Group 3 FLYING AIDS

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WARNING . . .

Voltages in excess of 100 volts either a.c. or d.c. can be dangerous under certain circumstances. Personnel should therefore ensure that the electrical system is electrically safe before any servicing is attempted. Where it is essential that tests or adjustments are to be made with the electrical power switched on the greatest care must be exercised.

DESCRIPTION

Introduction

1. This group contains brief descriptive notes on the operation of the items of notes on the operation of the items of equipment used in the flying aids installations and the functioning of the systems. The servicing notes, in this group, consist only of the checking of the power supplies to the installations as all the necessary information on the testing and servicing of the installations, together with detailed descriptions of the operation of the items of equipment used in the installations, is given in the relevant Air Publications. The Air Publication applicable to each system is given in the appropriate paragraphs.

A.R.I.18011—INSTRUMENT LANDING SYSTEM

Introduction

2. The instrument landing system enables the pilot to fly the aircraft in the correct glide angle, to the runway, and direction of flight to make a landing on the runway. Signals transmitted from a ground station are picked up by the aircraft aerials and fed, via receivers, to the pilots' indicators and marker lamps. The indicators have two pointers, one operated by the glide path signal and the other operated by the localizer signal. Thus the pilot has continuous indication of the exact position of the aircraft with respect to the required glide angle and direction of approach to the runway. For detailed information on the operation of the items of equipment reference should be made to A.P.2534E.

3. Signals from the system can be fed into the auto-pilot system from the junction box Type 164, via the auto-pilot approach coupling unit. See Sect. 5. Chap. 6, Group 2. Signals are also transmitted to the I/C system as soon as the I.L.S. switch, on the port quarter panel, is selected to ON, but these signals can be cut off by operating the pilots' I.L.S. volume control, mounted on the port coaming panel.

Localizer and Marker receiver, Type 1964

4. The unit, mounted in the radio crate, comprises the localizer and marker receivers in addition to the power supplies for them. The frequency of the localizer receiver is 108 to 118 Mc/s and the marker receiver operates on a fixed frequency of 75 Mc/s. The localizer signals are transmitted to the vertical pointer movements of the pilots' indicators. The marker signals are transmitted to the pilots' marker lamps which flash in accordance with the signals received from the various marker beacons.

Glide path receiver, Type R1965

5. The operating frequency range of the receiver is 329·6 to 335 Mc/s and the glide path signals are transmitted from the receiver to the horizontal pointer movements of the pilots' indicators, thereby indicating to the pilot the exact glide angle, to the runway, of the aircraft with respect to the required glide path.

Control unit, Type 705

6. The control unit mounted on the port quarter panel, besides providing the means for selecting the desired channel, enables the marker signals to be received independently. When the I.L.S./MARKER switch on the unit is selected to MARKER the localizer receiver and marker receiver are isolated from each other, the localizer receiver being switched off and the marker receiver being left operating to supply the signals to the pilots' marker lamps. A marker volume control is also fitted to the control unit.

Junction box, Type 157

7. The junction box, incorporated with the two receivers Types R1964 and R1965, provides for the connection of all the items of equipment to each other. Mounted inside the junction box is a change-over relay for isolating the marker and localizer receivers from one another when MARKER is selected on the control unit.

Indicators, Type 7

8. The indicators, mounted one in the port and one in the starboard instrument panel, have two pointers, the horizontal pointer being operated by the glide-path receiver and the vertical pointer operated by the localizer receiver. Flags are incorporated into the indicators and remain hidden from view all the time the system is functioning satisfactorily. Should the signal received by the indicator be below a certain value, the current will be insufficient to energize the flag movements. The flags will then appear and cover the ends of the pointers.

Marker Indicator lamps

9. Two marker lamps, one on the port and the other on the starboard instrument panel, indicate by flashing, the type of marker, inner, outer, or middle, over which the aircraft is passing.

Glide path and localizer aerials

10. Both aerials are suppressed and receive the signals from the ground station and feed them into their respective receivers. The glide path aerial is mounted in the starboard wing tip whilst the localizer aerial is mounted in the port wing tip.

Marker aerial

11. When the aerial, mounted in the bottom of the fuselage, is installed in the aircraft it must be tuned to resonate at exactly 75 Mc/s so a trimmer is fitted to the aerial. A di-electric cover is fitted over the aerial flush with the bottom of the fuselage.

Power supplies (post Mod. 2362 or 2446)

12. The 28 volts supply, for the system, is taken from the W/T No. 4 fuse on panel Z via the control switch, mounted on the port quarter panel. A voltage regulator Type VR.60, mounted in the radio crate, supplies the 19-volts for the valve heaters.

Note . . .

Pre-Mod 2632 *the* 28 *volts supply, for the system, is fed from fuse W/T No.* 2 *on panel Z to the control switch, via a* 10 *amp. circuit breaker, mounted on panel G.*

A.R.I.23051—RADIO COMPASS AD.7092D

Introduction

13. The installation provides: automatic relative bearing indication of a source of radio signals by panel mounted indicators; aural relative bearing determination by normal null signal method with remote control of the loop; aural reception of modulated or unmodulated radio signals, by use of either the loop or non-directional (sense) aerial; and radio range reception with simultaneous voice. The frequency coverage is 150 kc/s to 2,000 kc/s in four ranges: 150 to 300 kc/s: 300 to 580 kc/s; 580 to 1,100 kc/s; 1,100 to 2,000 kc/s.

14. For detailed information on the operation of the items of equipment used in the installation reference should be made to A.P.2883KD.

Receiver, Type AD.7092D

15. The receiver is mounted in the radio crate and by removing the quick-release side covers, access can be obtained to the valves and components which are built on to the sub-assemblies. A small rotary transformer, for H.T. supply, is mounted in the rear of the receiver case. The transformer is secured to its rubber-suspended mounting plate by two screws, connection to the receiver circuits being by means of spring contacts beneath. Control elements for driving the receiver tuning condensers and frequency range switch are mounted at the front of the unit and are accessible by removing covers on the front panel.

A.D.F. loop, Type 1324A

16. The A.D.F. loop is mounted in the roof of the compartment above the nosewheel bay and to reduce drag is contained in a shallow tray which is recessed into the aircraft fuselage, the aperture being covered with a di-electric which follows the contour of the fuselage so that there is no projection. The loop aerial is a nine turn coil wound on a bakelised paper former. Electrical connection to the loop is by means of slip rings on the shaft and brushes in holders attached to the chassis. A small two-phase a.c. motor drives the loop through a 394 : 1 reduction gear train. Provision is also made for the loop to be rotated manually. Elements for transmitting the loop bearing to the remote indicators are also contained in the main chassis.

Sense aerial

17. A centre-fed T-aerial supported on insulators is mounted in the line of flight on the nose undercarriage starboard door. It is connected to the sense amplifier Type 1628 which is mounted on the inside of the nose undercarriage starboard door.

Loop controller, Type 1342

18. The loop controller, mounted in the radio crate, provides for remote control of the loop when using the aural D.F. facility.

Receiver controller, Type 1274

19. Full remote control of the receiver is provided by this unit, mounted in the radio crate, which incorporates an illuminated tuning scale directly calibrated in frequency. The following controls are provided: system switch, frequency range switch, R.T./C.W. selectivity switch, tuning control, gain control and lamp switch. Two spare dial lamps are included in the unit. ◀ On some earlier aircraft an interim version of radio compass, revised by Mod. 2958, provides a Type 1276 controller mounted in the radio crate, whilst the Type 1274 controller is fitted to the control pedestal. ▶

Aerial transformer, Type 1343

20. This unit is secured to the receiver back plate and serves to match the impedance of the co-axial aerial cable to the input circuits of the receiver.

Power factor transformer, Type 1571

21. This unit is mounted at the top of the radio crate and connects the a.c. to the receiver when the system is operating. When the receiver is switched on, a 28-volt d.c. supply is connected to the operating coil of a relay in this unit. The relay contacts close and connect the a.c. supply to the receiver remote control circuit, via a transformer which provides the 26-volt a.c. required. A condenser connected across the primary of the transformer serves to improve the power factor.

Sense amplifier, Type 1628

22. The sense amplifier, mounted on the inside of the nose undercarriage starboard door, matches the input impedance of the sense aerial to the co-axial cable which connects the aerial to the receiver.

Bearing indicator, Type 1630

23. Two bearing indicators are fitted, one on the pilot's starboard instrument panel ◀ (pre Mod. 2218 starboard instrument panel) ▶ and the other in the radio crate at the navigator's position. The indicator contains separate movements for relative bearing and tuning indication. Relative bearing is by a single a.c. (Aysynn) movement.

Junction box, Type 1629

24. The junction box, mounted in the compartment above the nosewheel bay, provides the means for connecting the power supplies to the sense amplifier.

Power supplies

25. Power supplies of 28 volts d.c. and 115 volts, 400 c.p.s. single-phase a.c. are supplied to the system. The 28-volts d.c. supply is taken from a fuse on panel G to the voltage regulator Type 1555A via the RADIO COMPASS SUPPLIES switch mounted on the radio crate. The voltage regulator supplies an output of 19 volts for the valve heaters. The a.c. supply is fed from the power distribution box to the power factor transformer Type 1571, via a fuse in the power distribution box.

Table 1

A.R.I.23051—Radio Compass AD.7092D equipment

Item	Type or Ref. No.	No. Off	Location
A.D.F. receiver	A.D.7092D	1	Radio crate
Receiver back plate	1332	1	Radio crate
Receiver controller	1274	1	Radio crate
Aerial transformer	1343	1	Radio crate
Voltage regulator	1555A	1	Radio crate
Power factor transformer	1571	1	Radio crate
Loop controller	1342	1	Radio crate
Switch	5C/4184	1	Radio crate
Indicator	1630	2	Radio crate and pilots' starboard instrument panel
A.D.F. Loop	1324A	1	Compartment above nosewheel bay
Junction box	1629	1	Compartment above nosewheel bay
Sense amplifier	1628	1	Nose undercarriage starboard door
Sense aerial		1	Nose undercarriage starboard door
Voice/range filter	1275	1	Port quarter panel

Table 2

A.R.I.18011—Instrument landing system equipment

Item	Type or Ref. No.	No. off	Location
Voltage regulator	VR.60	1	Radio crate
Glide path receiver	10D/17819	1	Radio crate
Localizer and marker receiver	10D/17818	1	Radio crate
Junction box	157	1	Radio crate
Receivers and junction box mounting tray	10AJ/118	1	Radio crate
Glide path aerial	10B/16707	1	Starboard wing tip
Localizer aerial	10B/16708	1	Port wing tip
Marker aerial	10B/16706	1	Bottom of fuselage
Control unit	10L/263	1	Port quarter panel
Switch	5C/4184	1	Port quarter panel
Junction box	164	1	Behind centre instrument panel
Indicator	7	2	Port and starboard pilots' instrument panels
Lamps	5C/1553	2	Port and starboard pilots' instrument panels

3076 47764 5/61 625 A.Ltd. Gp. 420

SERVICING

WARNING . . .

Voltages in excess of 100 volts, either a.c. or d.c., can be dangerous under certain circumstances. Personnel should therefore ensure that the electrical system is electrically safe before any servicing is attempted. Where it is essential that tests or adjustments are to be made with the electrical power switched on the greatest care must be exercised.

Introduction

26. For detailed information on the servicing of items of equipment used in the various installations and the tests to be carried out on the installations, reference should be made to the relevant Air Publications.

27. Detailed descriptions of all the general tests to be applied to all aircraft electrical circuits can be found in the General Information group contained in Book 2 immediately after Section 5 marker card.

A.R.I.18011—Instrument landing system

28. Descriptions of all the tests to be carried out on the installation can be found in A.P.2534E, Vol. 1.

29. To check the power supply to the system proceed as follows:—

(1) Check the circuit fuse and connect a 28-volt d.c. supply to the aircraft external connection.

(2) Select the 24-VOLT BATTERY switch to ON.

(3) Connect a suitable voltmeter between the terminal with the WHITE SPOT on the regulator and earth.

(4) Select the I.L.S. CONTROL switch, on the port quarter panel, to ON and check that the voltmeter reads 26 volts approx. Disconnect the voltmeter and connect it between the terminal with the BROWN SPOT and earth and check that the reading is 19 volts.

(5) Select the I.L.S. CONTROL switch to OFF and check that the voltmeter reads zero.

(6) Disconnect the voltmeter.

A.R.I.23051—Radio compass AD.7092D

30. For detailed descriptions of all the tests to be applied to the system reference should be made to A.P.2883KD.

31. To check the power supply to the system proceed as follows:—

(1) Check the circuit fuses and connect 28-volt and 112-volt d.c. supplies to the aircraft external supply connection.

(2) Select the 24-VOLT and 96-VOLT BATTERY switches to ON.

(3) Disconnect the GREY and BLACK plug from the power distribution box.

(4) Switch on the No. 2 radar inverter Type 350.

(5) Connect a suitable voltmeter between pins A and B on the GREY/BLACK socket on the power distribution box and check that the voltage is 115 volts.

(6) Disconnect the socket EX from the voltage regulator and connect a suitable voltmeter between the pins of the socket, on the cable.

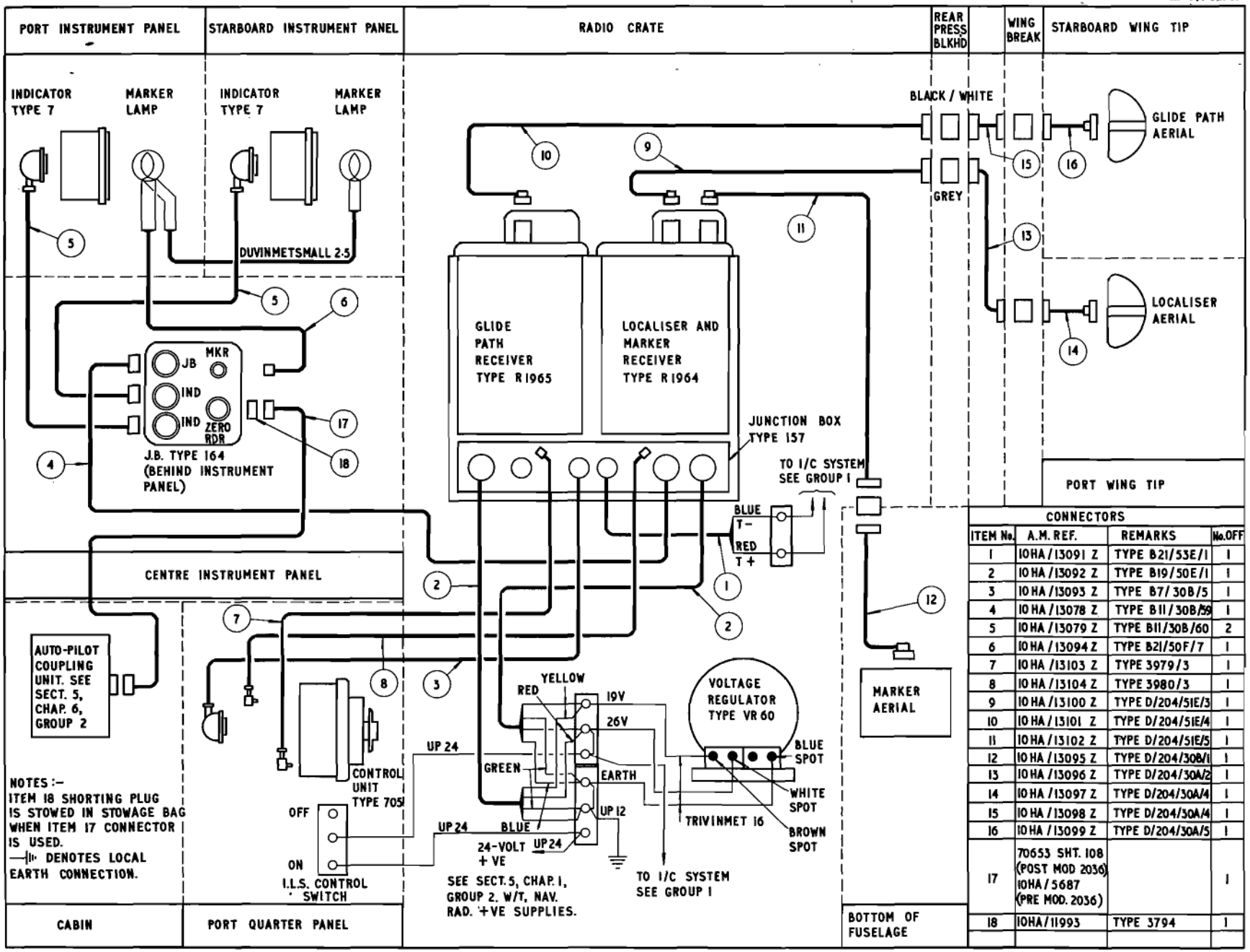
(7) Select the RADIO COMPASS switch to ON and check that the voltmeter reads 24 volts approx.

(8) Select the RADIO COMPASS switch to OFF. Disconnect the voltmeter, reconnect the socket EX and disconnect the plug DT, from the voltage regulator.

(9) Connect a suitable voltmeter between the pins of the socket DT, on the voltage regulator.

(10) Select the RADIO COMPASS switch to ON and check that the voltmeter reads 19 volts.

(11) Select the RADIO COMPASS switch to OFF. Switch off No. 2 inverter. Disconnect the voltmeter, and reconnect the plug and socket to the voltage regulator.



CONNECTORS			
ITEM No.	A.M. REF.	REMARKS	No.OFF
1	10HA/13091 Z	TYPE B21/53E/1	1
2	10HA/13092 Z	TYPE B19/50E/1	1
3	10HA/13093 Z	TYPE B7/30B/5	1
4	10HA/13078 Z	TYPE B11/30B/59	1
5	10HA/13079 Z	TYPE B11/30B/60	2
6	10HA/13094 Z	TYPE B21/50F/7	1
7	10HA/13103 Z	TYPE 3979/3	1
8	10HA/13104 Z	TYPE 3980/3	1
9	10HA/13100 Z	TYPE D/204/51E/3	1
10	10HA/13101 Z	TYPE D/204/51E/4	1
11	10HA/13102 Z	TYPE D/204/51E/5	1
12	10HA/13095 Z	TYPE D/204/30B/1	1
13	10HA/13096 Z	TYPE D/204/30A/2	1
14	10HA/13097 Z	TYPE D/204/30A/4	1
15	10HA/13098 Z	TYPE D/204/30A/4	1
16	10HA/13099 Z	TYPE D/204/30A/5	1
17	70653 SHT. 108 (POST MOD 2036) 10HA/5687 (PRE MOD. 2036)		1
18	10HA/11993	TYPE 3794	1

Fig. 1 A.R.I. 18011 Instrument landing system

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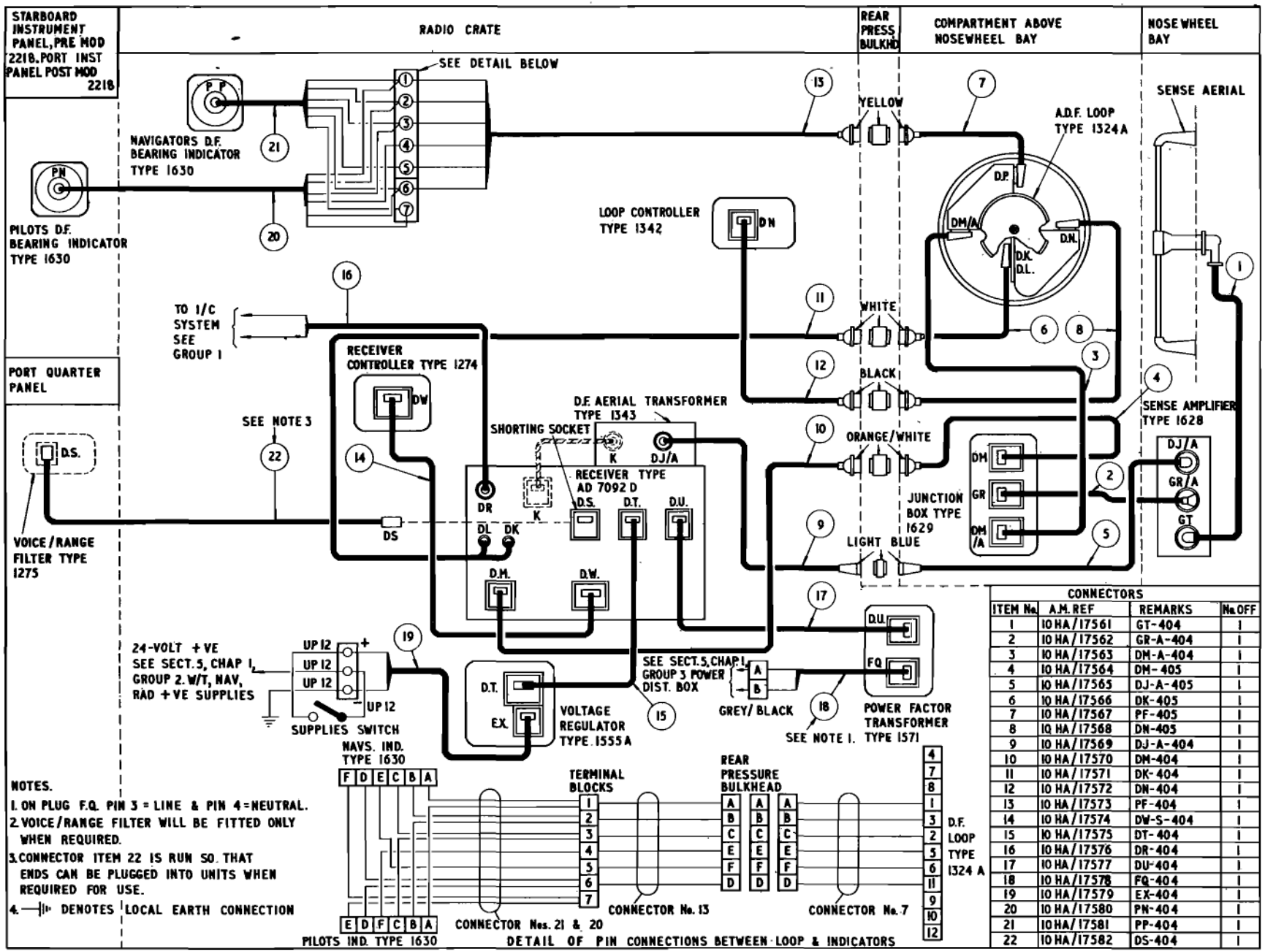


NOTES.

1. ON PLUG F.Q. PIN 3 = LINE & PIN 4 = NEUTRAL.
2. VOICE/RANGE FILTER WILL BE FITTED ONLY WHEN REQUIRED.
3. CONNECTOR ITEM 22 IS RUN SO THAT ENDS CAN BE PLUGGED INTO UNITS WHEN REQUIRED FOR USE.
4. —⏚— DENOTES LOCAL EARTH CONNECTION

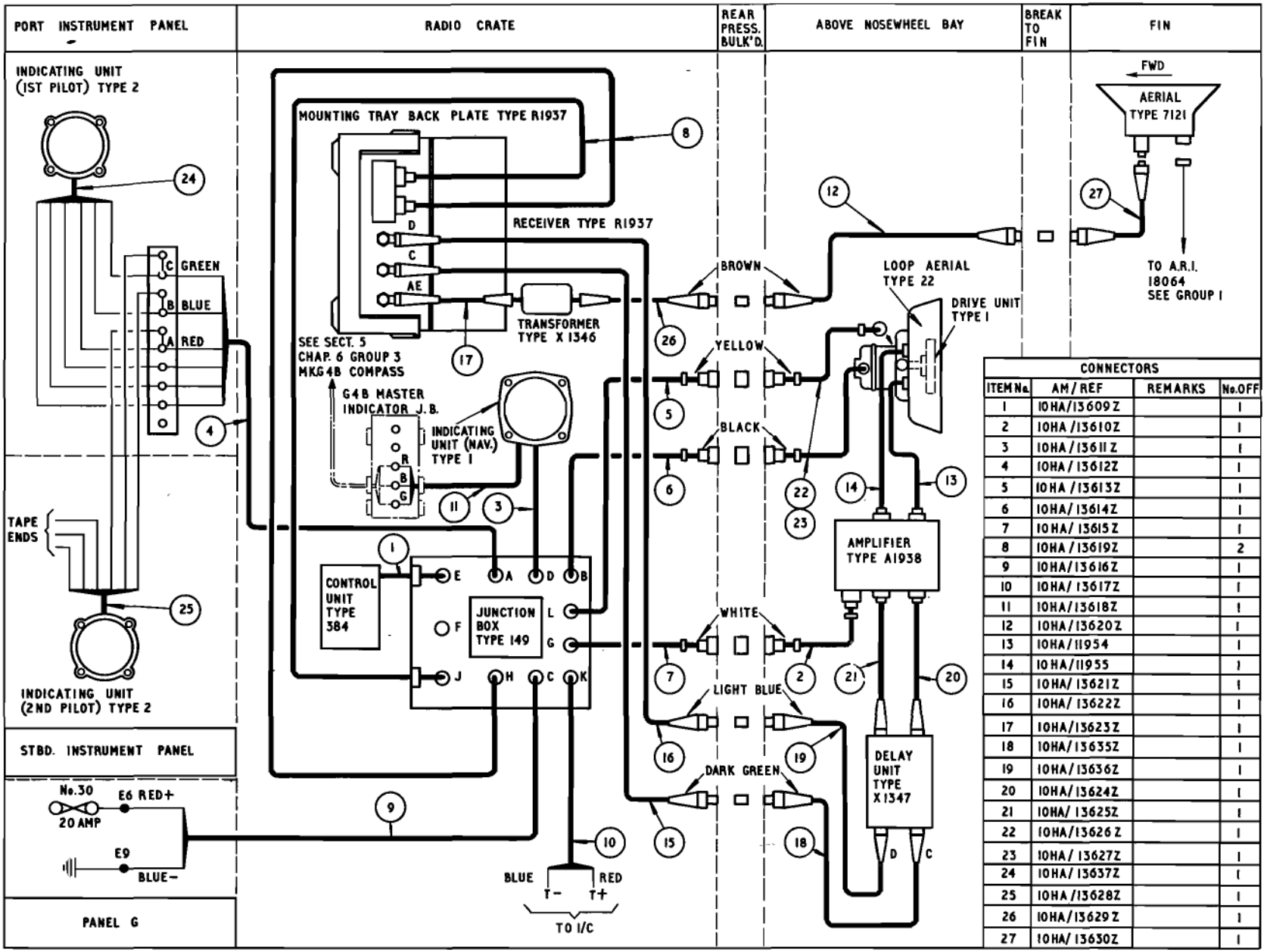
CONNECTORS

ITEM No.	A.M. REF	REMARKS	No. OFF
1	10 HA/17561	GT-404	1
2	10 HA/17562	GR-A-404	1
3	10 HA/17563	DM-A-404	1
4	10 HA/17564	DM-405	1
5	10 HA/17565	DJ-A-405	1
6	10 HA/17566	DK-405	1
7	10 HA/17567	PF-405	1
8	10 HA/17568	DN-405	1
9	10 HA/17569	DJ-A-404	1
10	10 HA/17570	DM-404	1
11	10 HA/17571	DK-404	1
12	10 HA/17572	DN-404	1
13	10 HA/17573	PF-404	1
14	10 HA/17574	DW-S-404	1
15	10 HA/17575	DT-404	1
16	10 HA/17576	DR-404	1
17	10 HA/17577	DU-404	1
18	10 HA/17578	FQ-404	1
19	10 HA/17579	EX-404	1
20	10 HA/17580	PN-404	1
21	10 HA/17581	PP-404	1
22	10 HA/17582	DS-404	1

Fig. 2. A.R.I. 23051 Radio compass A.D. 7092D installation (Mod. 1500)

RESTRICTED

70653 SHT. 49-D



CONNECTORS			
ITEM No.	AM/REF	REMARKS	No.OFF
1	10HA/13609Z		1
2	10HA/13610Z		1
3	10HA/13611Z		1
4	10HA/13612Z		1
5	10HA/13613Z		1
6	10HA/13614Z		1
7	10HA/13615Z		1
8	10HA/13619Z		2
9	10HA/13616Z		1
10	10HA/13617Z		1
11	10HA/13618Z		1
12	10HA/13620Z		1
13	10HA/11954		1
14	10HA/11955		1
15	10HA/13621Z		1
16	10HA/13622Z		1
17	10HA/13623Z		1
18	10HA/13635Z		1
19	10HA/13636Z		1
20	10HA/13624Z		1
21	10HA/13625Z		1
22	10HA/13626Z		1
23	10HA/13627Z		1
24	10HA/13637Z		1
25	10HA/13628Z		1
26	10HA/13629Z		1
27	10HA/13630Z		1

Fig. 3 A.R.I. 5428 Radio compass (pre Mod 1500 & 1382)

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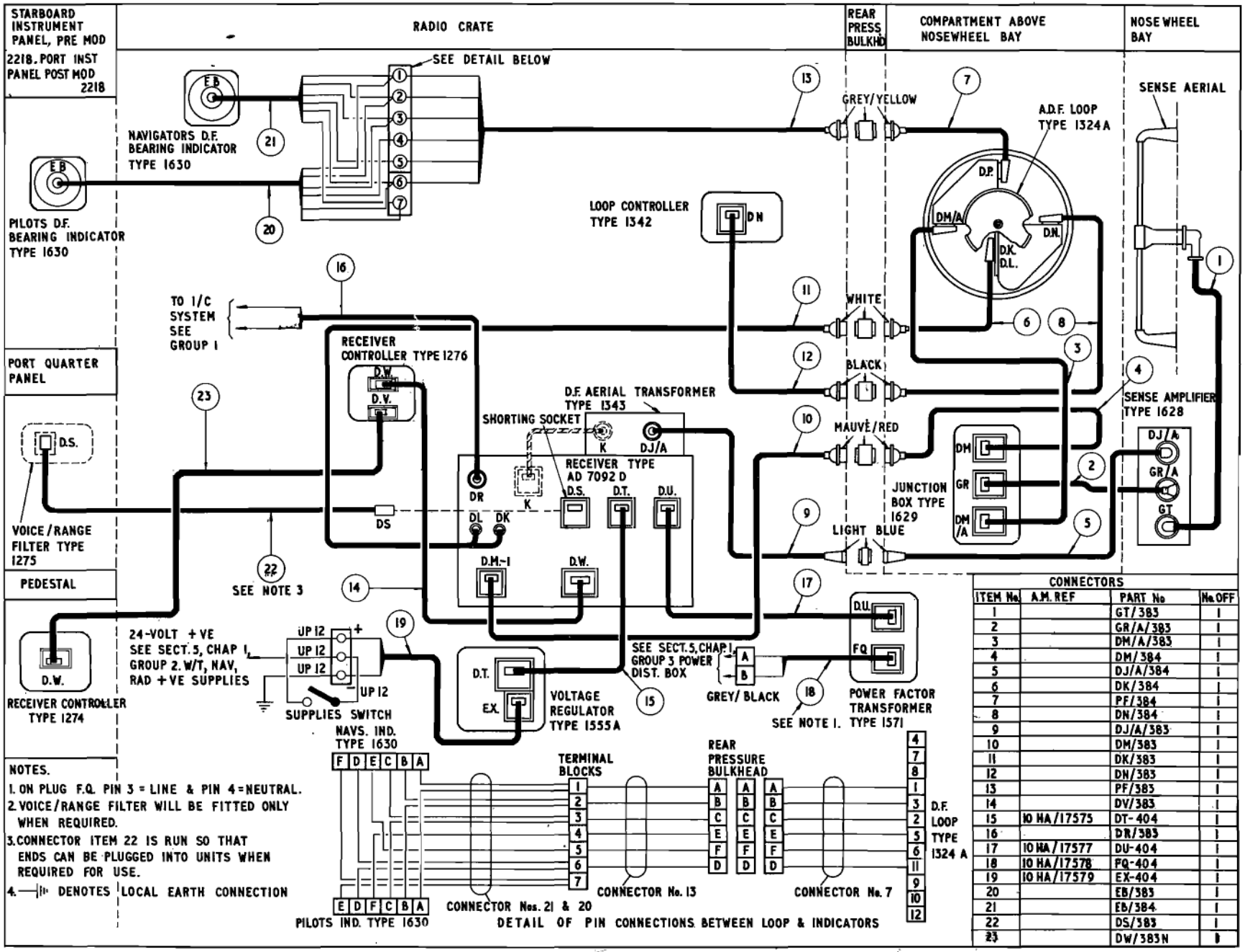

CONNECTORS			
ITEM No.	A.M. REF	PART No	No. OFF
1		GT/383	1
2		GR/A/383	1
3		DM/A/383	1
4		DM/384	1
5		DJ/A/384	1
6		DK/384	1
7		PF/384	1
8		DN/384	1
9		DJ/A/383	1
10		DM/383	1
11		DK/383	1
12		DN/383	1
13		PF/383	1
14		DV/383	1
15	10 HA/17575	DT-404	1
16		DR/383	1
17	10 HA/17577	DU-404	1
18	10 HA/17578	FQ-404	1
19	10 HA/17579	EX-404	1
20		EB/383	1
21		EB/384	1
22		DS/383	1
23		DW/383N	1

Fig 4. Interim version – Radio compass A.D 7092 (Mod 2958)

RESTRICTED

70653 SHT. 49-D

LIST OF APPENDICES

Appendix 1

ARI.18011—INSTRUMENT LANDING SYSTEM (POST MOD. 3032)

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LIST OF ILLUSTRATIONS

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Introduction

1. This appendix contains a brief description of the instrument landing system post Modification 3032, a pre-Modification description of the sytem being given in Group 3. A routeing diagram is included in this appendix to show circuit alterations whilst the disposition of equipment is shown in the Group 4 location diagrams.

DESCRIPTION AND OPERATION

Introduction

2. ARI.18011 is a landing approach aid which operates in conjunction with ground transmitting beacons to provide visual and aural indications of the aircraft's glide angle and flight direction relative to a runway. Signals transmitted from three ground beacons (localizer, glide path and marker) are picked up by aircraft aerials and fed via receivers to indicators, marker lamps and the I/C system (Group 1). Signals from the receiver are additionally fed into the auto-pilot system and post Mod. 2218 the zero reader flight director (Sect. 5, Chap. 6). The equipment comprising the installation is listed in Table 1 and together with the system principles involved is fully described in A.P.2543E, Vol. 1.

Localizer and Marker receiver, Type R1964

3. The unit is mounted in the radio crate and comprises a localizer receiver, marker receiver and H.T. power unit operating from a common d.c. power supply. The localizer receiver has a frequency coverage of 108–118 Mc/s, whilst the marker receiver operates on a fixed frequency of 75 Mc/s. Localizer signals are transmitted to the vertical pointer of the pilots' indicators and marker signals to the pilots' marker lamps, indicating the aircraft flight direction and position in respect of the runway.

Glide path receiver, Type R1965

4. The receiver is positioned adjacent to the Type R1964 receiver on a common mounting tray and has a frequency coverage of 326·6–335 Mc/s. Glide path signals transmitted from the receiver to the horizontal pointer of the pilots' indicators show the aircraft's glide angle.

Junction box, Type 157

5. The junction box forms the backplate of the two receivers, Type R1964 and Type R1965 and provides for interconnection of the installation.

Control unit, Type 705

6. The control unit is mounted on the pilot's port quarter panel and embodies a rotary switch for channel selection and a function lamp (red). 24 crystals, chosen to permit reception of beacon signals at particular airfields, are housed beneath a cover on the front face of the unit. The control unit is sole tuning control for the installation.

Indicators, Type 7

7. Two indicators are provided and mounted one in the port and one in the starboard instrument panel. Mod. 2218 replaced the port indicator with a zero reader flight director indicator (Sect. 5, Chap. 6). Mod. 3032 re-introduces the indicator at the position on the panel previously occupied by the 1st pilot's clock (Sect. 5, Chap. 6). The indicator, Type 7, is a crossed pointer instrument, the zero position of each pointer being along a vertical and horizontal line originating from a circle at the centre of the intrument face. The horizontal pointer is operated by glide path receiver signals and the vertical pointer by localizer receiver signals. The correct approach path is indicated when the pointers are crossed at the centre circle. The instrument incorporates two alarm flags, indicating serviceability of the complete system (including ground beacons), to prevent misleading conclusions being drawn from the pointer positions. The flags operate independently, to cover the localizer and glide path pointers when signal inputs are below a predetermined level.

Marker indicator lamps

8. Two marker lamps, mounted one in the port and one in the starboard instrument panel, are controlled by marker receiver outputs. As the aircraft passes over the marker beacons in the closing stages of a landing approach, the lamps are blinked in accordance with the keyed coding of the individual beacons.

Glide path and localizer aerial

9. The glide path aerial is installed in the starboard wing tip and the localizer aerial in the port wing tip. Both aerials are of the suppressed type and feed signals received from ground stations to their respective receiver units.

Marker aerial

10. The marker aerial is installed in the lower front fuselage skin beneath a di-electric cover, its co-axial connector being accessible from the rear of the bomb aimer's position. A trimmer is fitted to the aerial to facilitate adjustment, since the aerial must be tuned after installation to resonate at exactly 75 Mc/s. For access to the trimmer it is necessary to remove the di-electric cover.

Junction box, Type 164

11. Two junction boxes are located on the cross member forward of the centre instrument panel. One of the boxes connects the pilot's indicators and marker lamps into the system; the other box connects ILS signals to the autopilot and zero reader flight director systems (Sect. 5, Chap. 6).

Power supplies

12. The 28-volts supply for the system is taken from a fuse at panel Z and controlled by a master switch on the pilot's port quarter panel. With the switch selected to ON all three functions (localizer, glide path and marker) are switched on, a visible indication being provided by the red warning lamp on the control unit, Type 705. A voltage regulator, Type VR.60, mounted on the radio crate top, regulates the 28-volt supply at 19 volts for valve heaters.

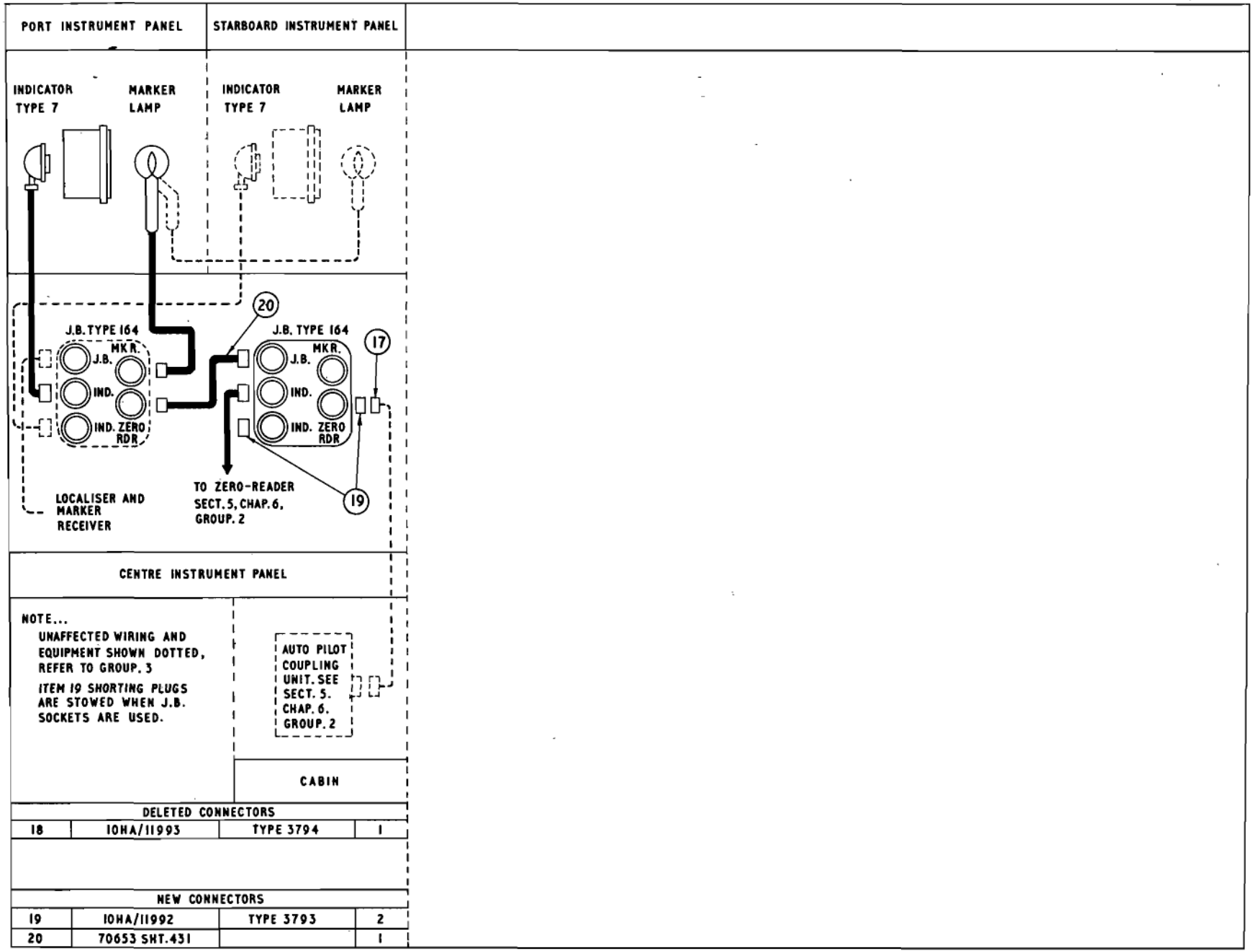
SERVICING

13. For a description of the tests to be carried out on the installation reference should be made to Group 3.

TABLE 1

ARI.18011—Instrument landing system equipment

Item	Type or Ref. No.	No. off	Location
Voltage regulator	VR.60	1	Radio crate
Glide path receiver	10D/17819	1	Radio crate
Localizer and marker receiver	10D/17818	1	Radio crate
Junction box	157	1	Radio crate
Receivers and junction box mounting tray	10AJ/118	1	Radio crate
Glide path aerial	10B/16707	1	Starboard wing tip
Localizer aerial	10B/16708	1	Port wing tip
Marker aerial	10B/16706	1	Bottom of fuselage
Control unit	10L/263	1	Port quarter panel
Switch	5C/4184	1	Port quarter panel
Junction box	164	2	Behind centre instrument panel
Indicator	7	2	Port and starboard pilots' instrument panels
Lamps	5C/1553	2	Port and starboard pilots' instrument panels



DELETED CONNECTORS			
18	10HA/11993	TYPE 3794	1

NEW CONNECTORS			
19	10HA/11992	TYPE 3793	2
20	70653 SHT.431		1

Fig.1. Alteration to Fig.1. in Group 3 (post Mod. 3032)