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ARROW 1 SERVICE DATA

SECTION 41

ELECTRONICS

RADIO COMPASS AN/ARN-6

(This data supersedes previous issue dated 28 May 57)

15 JUN 58

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ELECTRONICS

RADIO COMPASS AN/ARN-6

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DESCRIPTION

GENERAL

1 The Radio Compass System AN/ARN-6 automatically, or manually, determines the bearing, relative to the aircraft, of radio broadcast and radio range stations. The bearing information can be used as a navigational aid or for homing purposes. In addition, the system can be used as a radio communications receiver for the reception of weather reports or other flight information.

2 The system consists of the following component units:

- (a) Receiver R-101A/ARN-6 (Modified to Avro Dwg. 7-1354-162).
- (b) Receiver Mounting MT273E/ARN-6 (Modified to Avro Dwg. 7-1354-105).
- (c) Control Panel Type C1513/A (2).
- (d) Loop Antenna Bendix No. LPA-6A.
- (e) Sense Antenna.
- (f) Sense Antenna Susceptiformer (Avro Part No. 7-1362-47).
- (g) Course Indicator (DUAL) RM1 Type 1D-250/ARN (2).
- (h) Tuning Drive and Amplifier ED400A.

3 The frequency range of the system is 100 Kc/s to 1750 Kc/s, covered in four bands as follows:

Band 1,	100-200 Kc/s
Band 2,	200-410 Kc/s
Band 3,	410-850 Kc/s
Band 4,	850-1750 Kc/s

RECEIVER R-101A/ARN-6

4 The radio compass receiver, located on the electronic equipment bay centre access

door, is a conventional superheterodyne receiver with additional circuit elements which permit the reception of CW transmissions. The input coil (L103) of the receiver is modified to facilitate sense antenna impedance matching. Circuitry is incorporated in the receiver to orient the loop antenna during automatic compass operation. A recess in the front panel houses receptacles for the loop and sense antennas, a ground connector and the tuning drive coupling. The circuit wiring is brought out to the contacts of a male connector strip fitted to a recess in the rear panel. Plate voltage is provided by a vibrator circuit and a spare vibrator is attached to the top cover of the receiver.

RECEIVER MOUNTING MT273E/ARN-6

5 The receiver is mounted on a shock absorbing mounting which serves also as a junction box. A female connector strip fitted at the rear of the mounting mates with the male connector on the receiver when the receiver is installed. Terminal strips in the base of the mounting facilitate the interconnection of the receiver with the other components of the system. The mounting is modified to facilitate sense antenna impedance matching on all frequency bands. Wiring alterations introduced by the modification are shown on a label located under the terminal strips. A relay incorporated in the mounting permits control of the system to be transferred from one to the other of two control panels, one of which is located in each cockpit.

CONTROL PANELS C1513/A (Fig 2)

6 Each control panel incorporates a five-position function selector switch, a loop switch, a CW/VOICE switch, a waveband switch, a tuning control and a volume control.

7 The function selector switch is marked OFF-COMP-ANT-LOOP-CONT. Control of the system is gained by selecting the switch to the spring-loaded CONT (control) position. This energizes the transfer relay in the receiver mounting which transfers the control circuits onto the selected panel. The illumination of the control panel dial light indicates that the panel is operative.

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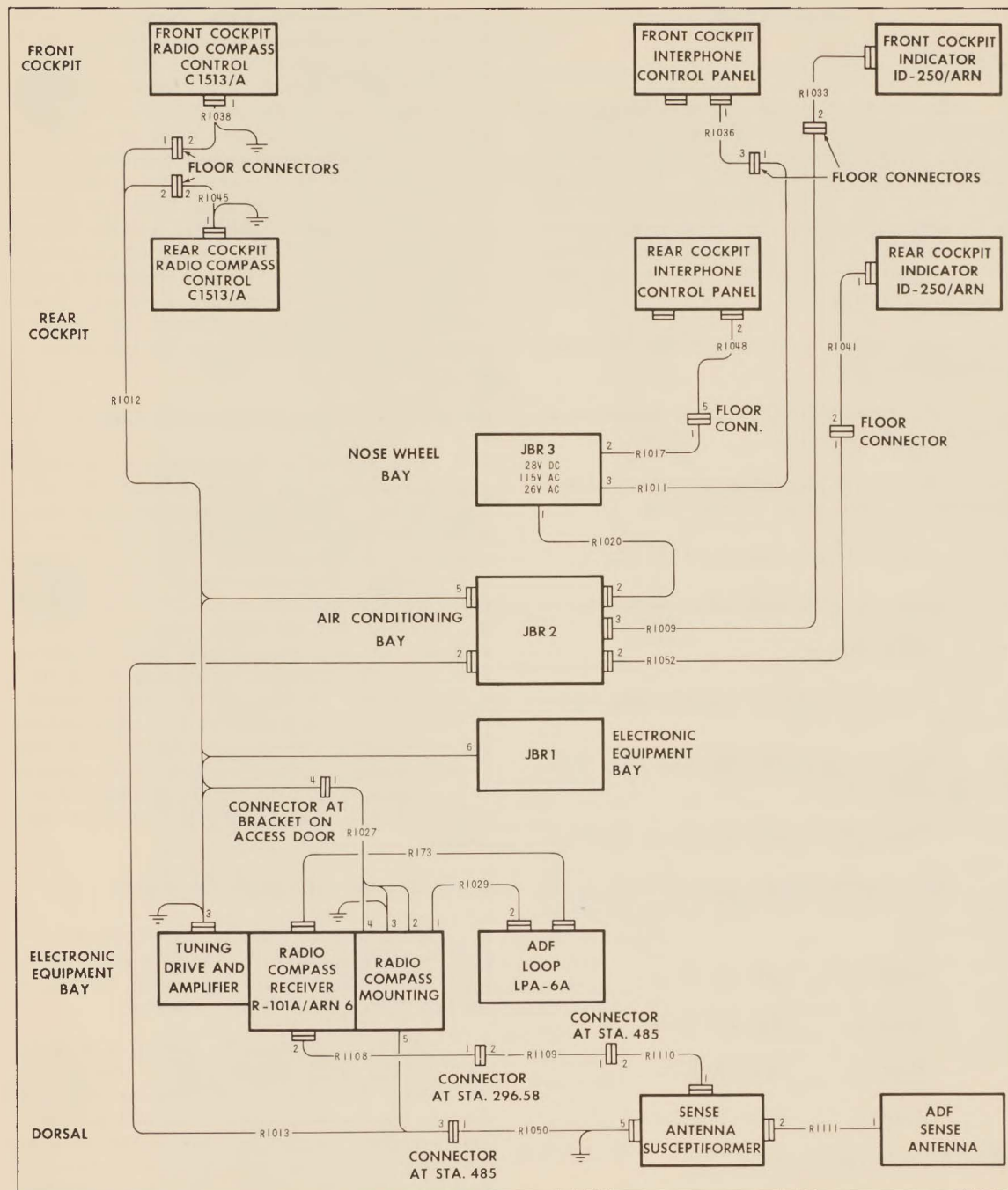
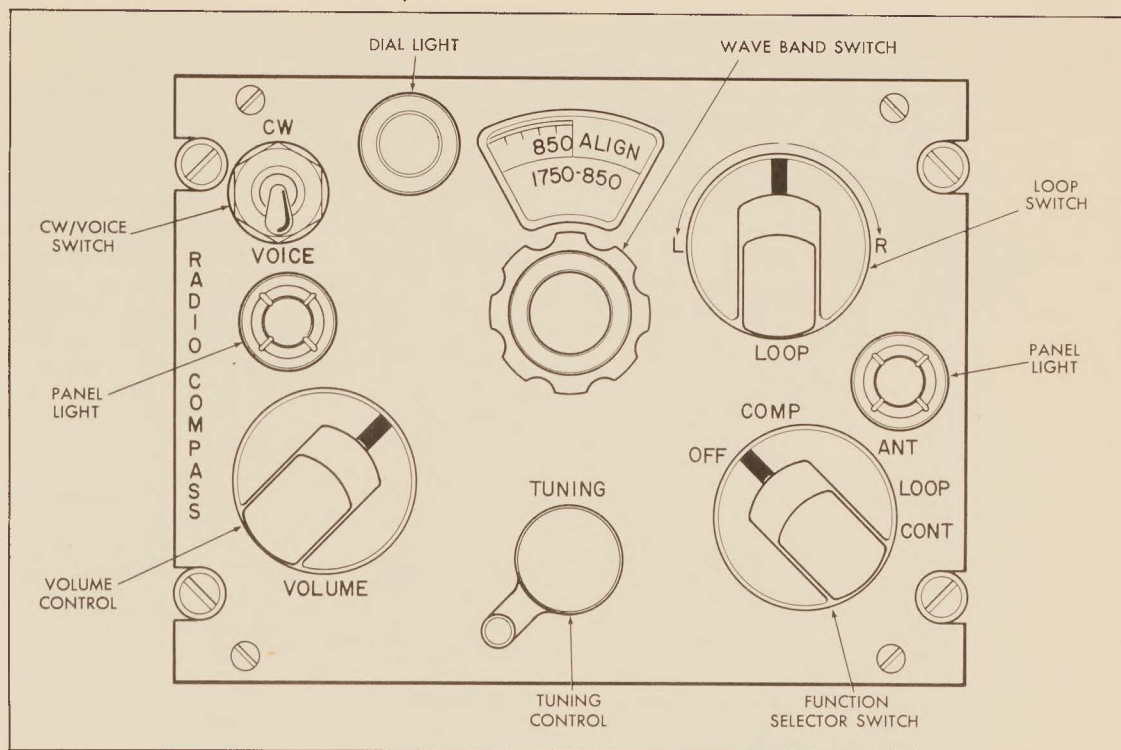


FIG. 1 RADIO COMPASS SYSTEM AN/ARN-6 - GENERAL ARRANGEMENT

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FIG. 2 CONTROL PANEL C1513/A

8 When the function selector switch is selected to the COMP (compass) position the bearing, relative to the aircraft, of the selected transmission point is indicated automatically and continuously on two course indicators, one of which is located in each cockpit. When the ANT (antenna) position is selected, broadcast transmissions can be received in the headsets provided that the COMP mixing switch on the interphone control panel is selected on. Selecting the LOOP position permits the orientation of the loop antenna using the loop switch which is marked L-R (left-right). This enables bearings to be determined aurally. The orientation of the loop is indicated on the course indicators.

9 The CW/VOICE switch when selected to CW completes circuitry which permits the reception of CW transmissions.

10 The four-position waveband switch, when operated, energizes a motor in the receiver

which positions a bandswitch mechanism to the selected frequency band. Remote tuning of the receiver is accomplished by means of a tuning drive and amplifier type ED400A fitted on the receiver.

TUNING DRIVE AND AMPLIFIER ED400A (Fig 3)

11 The tuning drive and amplifier unit consists of an electromechanical servo system which positions the receiver tuning capacitor to correspond with the dial position set manually by means of the tuning control on the radio compass control panel.

12 The unit consists of a DC motor with split field control, a potentiometer balancing network and an electronic amplifier.

13 The DC motor rotates the radio compass receiver tuning capacitor and, via a

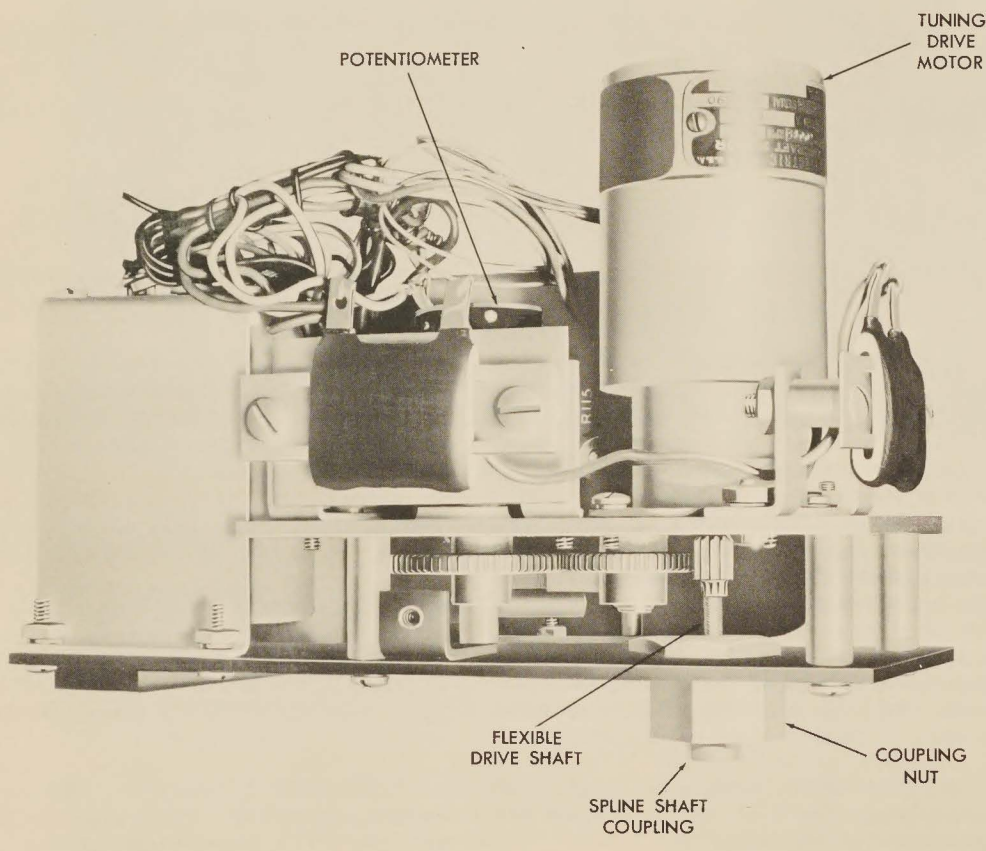
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reduction gearing, the wiper arm of a potentiometer in the tuning drive. The potentiometer forms one segment of a balancing network and a similar potentiometer in the control panel forms the other segment of the balancing network. The wiper arm of the control panel potentiometer is mechanically coupled through gearing to the tuning control crank, and electrically connected to the input of the first amplifier circuit in the tuning drive amplifier. When the wiper arms of both potentiometers are in the same angular position, the balancing network will be in balance.

14 Operating the tuning control crank

upsets the balance of the network. This results in a signal appearing at the input to the first amplifier circuit. The signal is amplified and passes through a phase sensitive demodulator circuit to a power amplifier circuit, the output of which is fed to the field windings of the tuning motor. The resultant differential field current causes the motor to rotate in a direction corresponding with the phase of the input signal so driving the wiper arm of the potentiometer at the receiver. This action restores the balance of the circuit and the motor ceases to rotate, at which point the tuning capacitor is aligned with the tuning point set manually on the control panel.

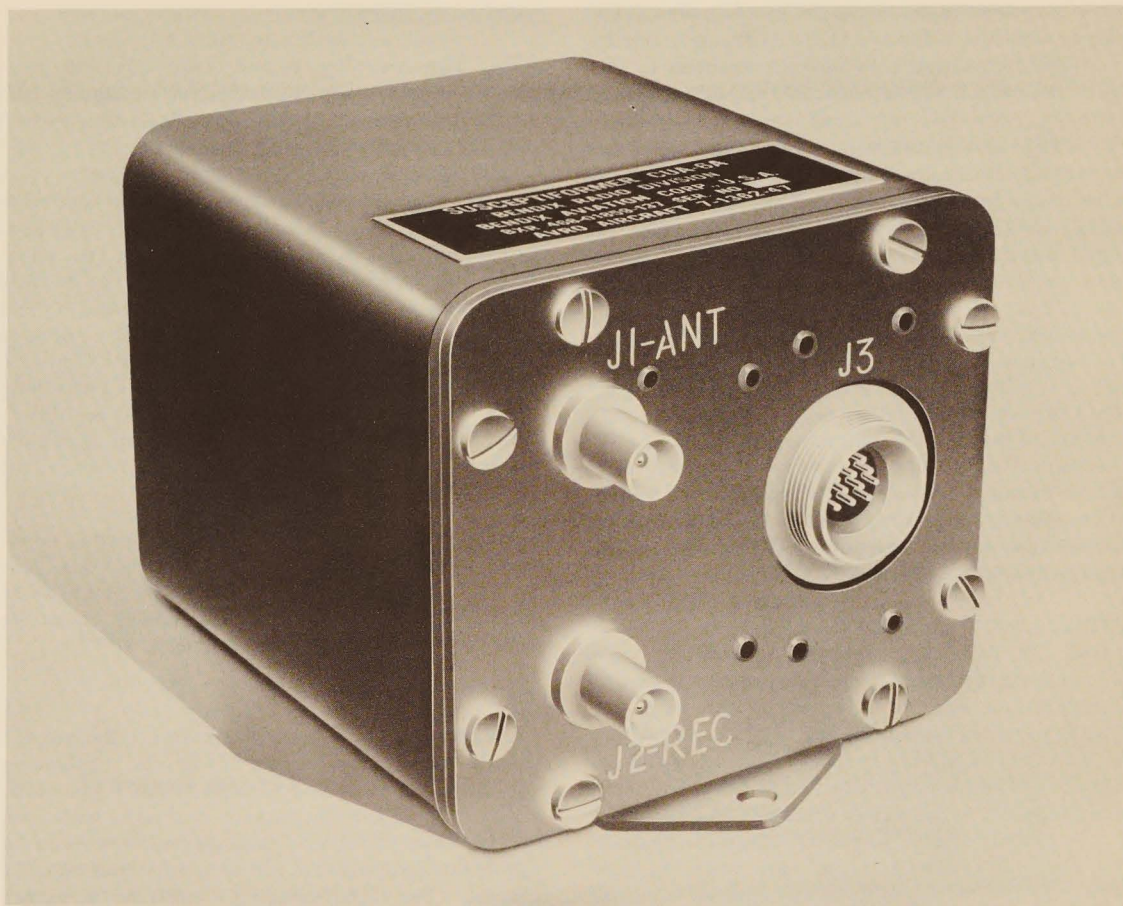


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FIG. 3 TUNING DRIVE AND AMPLIFIER ED400A

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FIG. 4 SENSE ANTENNA SUSCEPTIFORMER

LOOP ANTENNA LPA-6A AND SENSE ANTENNA

15 Two antennas are provided for the system, a loop antenna which is directional and a sense antenna which is non-directional. The antennas are used separately or in conjunction with each other depending upon the type of operation selected.

16 The loop antenna, flush mounted in the electronic equipment bay centre access door, is used for aural directional reception i.e. LOOP operation. The sense antenna which is a flat plate type antenna located in the aft dorsal fairing, is used for normal radio

communications reception i.e. ANT operation. Both antennas are used for automatic compass (COMP) operation i.e. continuous bearing indication of a selected transmission point.

17 Correction for quadrantal error, i.e. errors which could be introduced due to the distortion of the radio waves by the metallic structure of the aircraft, is achieved by adjusting the length of ferrite bars in the loop assembly. The correct length of the bars is determined experimentally and once set should not require further adjustment.

18 Due to the greater than normal length of cable necessary to connect the sense antenna

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to the receiver input, a sense antenna suscepti-former which is effective on all frequency bands, is provided to match the sense antenna to the input impedance of the radio compass receiver.

19 The suscepti-former consists of four impedance matching transformers one of which is provided for each waveband, a bandswitching relay, a dummy sense antenna and a dummy sense antenna switching relay. The radio compass receiver and mounting are modified to provide proper termination for the matching transformer secondaries and to incorporate the components into the bandswitching circuit. The modification to the receiver also disconnects the existing dummy sense antenna and IF trap from the receiver sense antenna channel. The dummy sense antenna in the suscepti-former unit is brought into circuit by the dummy sense antenna switching relay which is actuated when the function selector switch on the control panel is selected to LOOP.

AUTOMATIC COMPASS OPERATION

20 Continuous bearing indication of a selected transmission point is obtained by selecting the COMP position on the function selector switch of the control panel in use. This results in signal voltages from the transmission point being induced in the sense antenna, and the loop if it is not orientated to the transmission point. The voltage induced in the loop will, in that event, be out of phase with the voltage induced in the sense antenna and will lead or lag according to which side of the loop is nearer to the transmission point. This effect is used to activate the loop drive motor which will rotate the loop until it is orientated to the transmission point. In this position, the voltage induced in the loop is zero, and the drive motor becomes inactive.

21 The orientation of the loop coil is relayed to course indicators by an autosyn transmitter connected to the loop coil. The radio magnetic course indicators type ID-250/ARN, one of which is provided in each cockpit, are dual reading instruments with two indicating needles. The narrow needle operates in conjunction with the Radio Compass system and the broad needle operates in conjunction with the UHF Homer system.

LOOP OPERATION

22 The bearing of the transmission point can be determined aurally, by selecting the LOOP position on the function selector switch and rotating the loop by means of the spring-loaded LOOP L/R switch to a null point, i.e. a position where minimum signals are received. If the loop is rotated through 360 degrees, minimum signals will be received at two positions 180 degrees apart. Selecting the system to automatic compass operation will determine which of these is the true null point as opposed to the reciprocal. Re-selecting the function selector switch to LOOP and rotating the loop enables a more accurate bearing to be determined. The orientation of the loop is transmitted continuously to the remote indicators.

23 Selecting the function selector switch to LOOP prevents operation of the automatic compass and cuts out the sense antenna signals. The COMP mixing switch on the interphone system AN/AIC-10 control panel must be selected on for aural reception.

ANTENNA OPERATION

24 Antenna operation provides for the reception of radio communication signals. Selecting the function selector switch to ANT prevents operation of the automatic compass and cuts out the loop circuits. Signals are received by the sense antenna and fed to a superheterodyne circuit. The COMP mixing switch on the interphone system AN/AIC-10 control panel must be switched on for aural reception.

SYSTEM POWER REQUIREMENTS

25 The radio compass system operates on 27.5 volts DC with an input current of 4 amps, and 115 volts 400 cps AC at 0.5 amps. The course indicators and the loop antenna require a 26 volts 400 cps AC supply.

TESTING AND SERVICING

GENERAL

26 Function testing of the AN/ARN-6 radio compass system should be carried out at the periods specified in the Maintenance Schedule, and after replacing or repairing any part of the system.

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27 Special items of test equipment are not required to carry out the function test.

28 To provide data for assessing the performance of the equipment, a log should be kept of frequencies, signal strength and time of receipt, and the identity of transmitting stations on which bearings are taken during function testing.

ALIGNMENT OF RADIO COMPASS RECEIVER AND TUNING DRIVE

29 The radio compass receiver tuning mechanism is aligned prior to installing the equipment in the aircraft. If the system requires re-alignment, the receiver and tuning drive must be removed from the aircraft. The alignment procedure following is provided for reference:

- (a) Detach the tuning drive amplifier from the radio compass receiver.
- (b) Remove the cover from the receiver.
- (c) Manually rotate the receiver tuning capacitor fully counterclockwise and check that the capacitor vanes are fully meshed.
- (d) Refit the cover to the receiver.
- (e) Connect the electrical cable assembly between a spare control panel and the tuning drive amplifier.
- (f) Switch on the power supply and set the tuning dial on the control panel to the ALIGN mark on the 850 Kc/s to 1750 Kc/s (band 4) tuning scale. The shaft of the tuning drive motor will correctly position itself with respect to the ALIGN mark during this operation.
- (g) Switch off the power supply.
- (h) Remove the cover of the tuning drive amplifier.
- (j) Attach the tuning drive amplifier to the receiver, coupling the shaft of the tuning drive motor to the tuning capacitor drive spindle.
- (k) Refit the cover to the tuning drive amplifier.

(m) Switch on the power supplies.

(n) Tune in a station of known frequency, approaching the known frequency from both the right and the left side of the dial, and compare the dial reading with the frequency of the known station.

(p) Check dial alignment by tuning-in two other stations of known frequency. Repeat this check on more than one waveband.

(q) Refit the equipment in the aircraft.

PREPARATION FOR TESTING

30 Prior to carrying out function tests proceed as follows:

(a) Position the aircraft at a distance of at least 500 feet from buildings, power lines, railroad tracks and other sources of interference or distortion.

(b) Connect an external 115V AC three phase power supply to the aircraft.

FUNCTION TESTING PROCEDURE

31 As the system is a dual installation, two operators, one in each cockpit, will facilitate testing. The procedure is as follows:

- (a) Select to ON the master electrical switch in the front cockpit.
- (b) Plug a headset type H-70/AIC and a microphone M-33/AIC-10, or equivalents, into the quick-release connector on each cockpit seat.
- (c) Switch on the COMP mixing switch on the interphone control panel in each cockpit and set the volume control on each panel to the 12 o'clock position.
- (d) Select the function selector switch on the radio compass control panel in the rear cockpit to COMP.
- (e) Check that control of the system is on this panel by observing that the dial light is illuminated. If the dial light is not illuminated

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select the function selector switch to the CONT position to gain control of the system. The dial light should illuminate.

(f) Allow at least two minutes for the equipment to warm up.

(g) Select the function selector switch to ANT, the CW/VOICE switch to VOICE and turn the volume control fully clockwise.

(h) Tune in a station of known frequency, approaching the known frequency from both the right and the left side of the dial; compare the dial reading with the frequency of the known station.

(j) Check dial alignment by tuning-in two other stations of known frequency. Repeat this check on more than one waveband.

(k) Transfer control to the radio compass control panel in the front cockpit and repeat operations (g), (h) and (j). Check that both tuning dials agree.

(m) Transfer control to the radio compass control panel in the rear cockpit.

(n) Tune in at least two stations on each waveband, in turn. Check the operation of the waveband switch, volume control and tuning crank.

(p) Select the CW/VOICE switch to CW and check that an audio tone is heard which varies in frequency as a station is tuned in. Check the operation of the CW/VOICE switch several times.

(q) Select the function selector switch to COMP, and check that the narrow needle of the indicator type 1D-250 in each cockpit indicates a definite bearing when two or three stations are tuned in. Check that the indicator in the front cockpit agrees within $\pm 2-1/2$ degrees with the indicator in the rear cockpit.

(r) Select the CW/VOICE switch to CW and check that a 900 cps tone is heard which does not vary with tuning.

(s) Tune in a station of known bearing relative to the aircraft and check that the indicators register the direction of the transmission point within $\pm 2-1/2$ degrees. Check that the indicator needle does not oscillate more than 4 degrees about the bearing position.

(t) Select the function selector switch to LOOP and tune in at least two stations on each waveband in turn. Operate the LOOP L/R switch to turn the loop for aural directional reception. Check that minimum signals are heard when the indicator is on the bearing of the transmission point. Rotate the loop using the LOOP L/R switch and check that the indicator in each cockpit follows the movement of the loop smoothly.

(u) Check that the LOOP L/R switch rotates the loop through 175 degrees in less than seven seconds with the switch held fully over to one side, and in approximately one minute with a small movement of the switch.

(v) Rotate the loop to the loop scale bearings shown in the deviation correction calibration chart for the aircraft and check that for each bearing the rear cockpit indicator agrees within $\pm 2-1/2$ degrees with the compensator corrected bearing shown in the chart.

(w) Check that the indicator in the front cockpit agrees with the indicator in the rear cockpit within $\pm 2-1/2$ degrees at each bearing.

(x) Transfer control to the radio compass control panel in the front cockpit and repeat operations (n) through (w).

(y) Switch off the equipment.

REMOVAL AND INSTALLATION

GENERAL

32 The majority of the units comprising the Radio Compass System AN/ARN-6 are removed by disconnecting cables and unscrewing mounting or securing bolts. Where it is considered necessary, the procedure for removal and installation of various units is described in more detail.

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33 The radio compass receiver is mounted on the electronic equipment bay centre access door which is hinged at the aft end to open outwards and is secured by 33 camloc fasteners. One fastener, clearly marked, must be released last and secured first. The door is raised and lowered by means of an electric motor actuator which is controlled by a switch located adjacent to the door. Access to the switch is gained by releasing two camloc fasteners securing an access flap.

RADIO COMPASS RECEIVER AND TUNING DRIVE - REMOVAL

34 Note that neither the radio compass receiver nor the tuning drive should be removed from the aircraft individually, but they must be removed and installed together. To remove the radio compass receiver and tuning drive proceed as follows:

- (a) Disconnect the loop antenna cable assembly R173 and the sense antenna cable assembly R1108-2 from the receiver.
- (b) Disconnect the ground wire from the receiver.
- (c) Disconnect cable assembly R1012-3 from the tuning drive and amplifier unit.
- (d) Slacken off and release the two knurled fasteners which secure the receiver to the mounting.
- (e) Carefully pull the receiver forward on its mounting until it is free of the connector strip at the rear of the mounting and lift the receiver complete with tuning drive and amplifier from the mounting.

RADIO COMPASS RECEIVER AND TUNING DRIVE - INSTALLATION

35 Prior to installation, the radio compass receiver and tuning drive must be aligned. See alignment procedure described in Testing and Servicing paragraph 29. The procedure for installing the radio compass receiver and tuning drive is the reverse of that given for removal.

RADIO COMPASS RECEIVER MOUNTING - REMOVAL

36 To remove the radio compass receiver mounting from the electronic equipment bay access door proceed as follows:

- (a) Disconnect cable assembly R1027-1 from the receptacle on the bracket on the access door.
- (b) Disconnect the ground wire from the airframe.
- (c) Loosen the cable clamps holding cable assemblies R1027-2, R1027-3 and R1027-4 adjacent to the mounting.
- (d) Disconnect the circuit wiring in the cable assemblies R1013-5 and R1029-1 from the connector strip on the mounting.
- (e) Remove 16 screws securing the mounting to the access door and lift the mounting and attached wiring clear of the door.

RADIO COMPASS RECEIVER MOUNTING - INSTALLATION

37 The procedure for installing the radio compass receiver mounting is the reverse of that given for removal.

LOOP ANTENNA - REMOVAL

38 The radio compass loop antenna is mounted on the electronic equipment bay centre access door, flush with the skin. Access to the unit is gained by removing a fibreglas panel secured to the outside of the door by 76 screws.

39 To remove the loop antenna proceed as follows:

- (a) Remove the loop antenna fibreglas access panel from the electronic equipment bay centre access door by removing 76 attachment screws.
- (b) Disconnect cable assemblies R1029-2 and R173 from the loop antenna.
- (c) Remove eight mounting screws and detach the loop antenna from the access panel.

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LOOP ANTENNA - INSTALLATION

40 The procedure for installing the loop antenna is the reverse of that given for removal.

SENSE ANTENNA - REMOVAL

41 Access to the sense antenna attached to the aft dorsal fibreglas fairing is gained by removing six latches which secure the fairing in position.

42 To remove the sense antenna proceed as follows:

(a) Remove the sense antenna connector access panel in the aft dorsal fairing by releasing six camloc fasteners.

(b) Disconnect the sense antenna cable assembly R1111-2 at the susceptiformer.

(c) Remove the aft dorsal fairing complete with sense antenna by unfastening six latches.

SENSE ANTENNA - INSTALLATION

43 The procedure for installing the sense antenna is the reverse of that given for removal.

SENSE ANTENNA SUSCEPTIFORMER - REMOVAL

44 Access to the sense antenna susceptiformer mounted on the dorsal electronic equipment area, is gained by removing the aft dorsal fairing.

45 To remove the sense antenna susceptiformer proceed as follows:

(a) Remove the sense antenna connector access panel in the aft dorsal fairing by releasing six camloc fasteners.

(b) Disconnect the sense antenna cable assembly R1111-2 at the susceptiformer.

(c) Remove the aft dorsal fairing by releasing six latches.

(d) Disconnect cable assembly R1050-5 and the sense antenna cable assembly R1110-1 from the susceptiformer.

(e) Remove three mounting bolts and lift the susceptiformer clear.

SENSE ANTENNA SUSCEPTIFORMER - INSTALLATION

46 The procedure for installing the sense antenna susceptiformer is the reverse of that given for removal.

CONTROL PANEL (FRONT COCKPIT AND REAR COCKPIT) - REMOVAL

47 Access to the radio compass control panel in the front cockpit and in the rear cockpit is unobstructed.

48 To remove the control panel from the RH console in the front cockpit or the RH console in the rear cockpit proceed as follows:

(a) Release four dzus fasteners holding the panel to the console.

(b) Withdraw the panel from the console and disconnect cable assembly R1038-1 in the front cockpit or R1045-1 in the rear cockpit from the rear of the control panel.

CONTROL PANEL (FRONT COCKPIT AND REAR COCKPIT) - INSTALLATION

49 The procedure for installing the control panels is the reverse of that given for removal.

COURSE INDICATOR (FRONT COCKPIT AND REAR COCKPIT) - REMOVAL

50 To remove the course indicator from the main instrument panel in the front cockpit or from the main instrument panel in the rear cockpit proceed as follows:

(a) Remove four mounting screws and withdraw the indicator from the instrument panel.

(b) Disconnect the cable assembly at the rear of the indicator, R1033-1 in the front cockpit or R1041-1 in the rear cockpit.

COURSE INDICATOR (FRONT COCKPIT AND REAR COCKPIT) - INSTALLATION

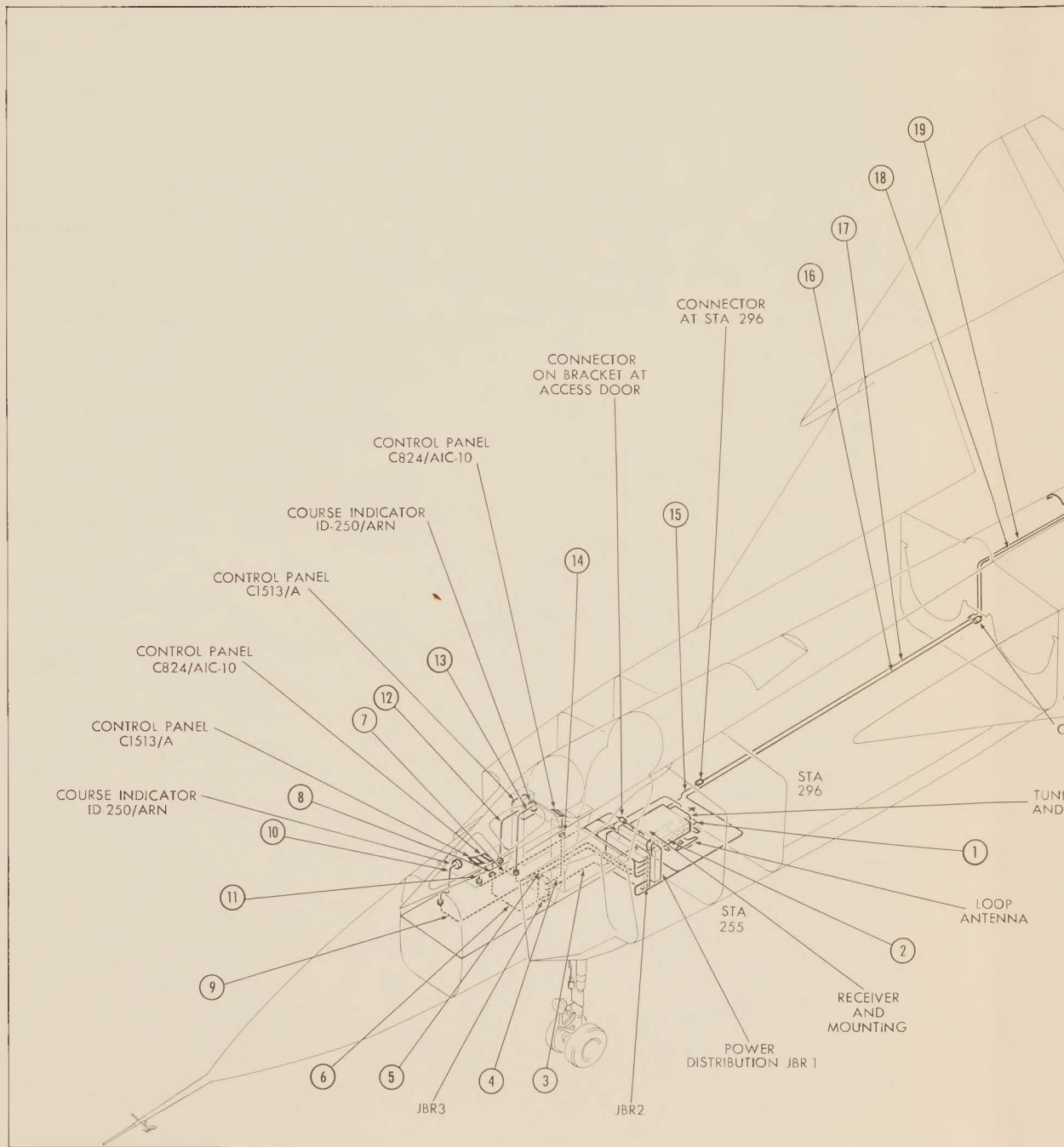
51 The procedure for installing the course indicators is the reverse of that given for removal.

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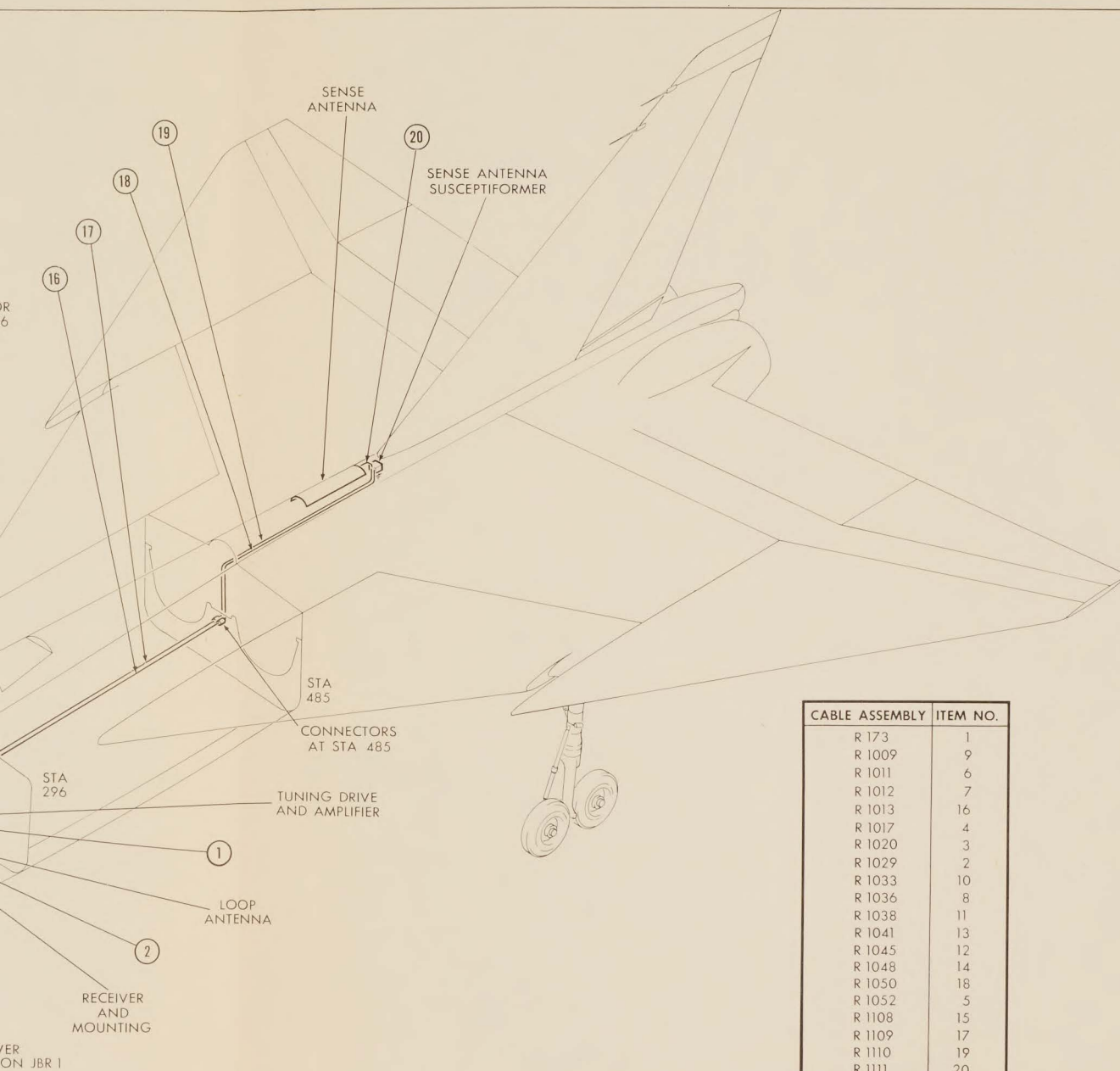
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EQUIPMENT LIST

PART NO.	MANUFACTURER	NOMENCLATURE	UNITS PER ASSEMBLY
MT273E/ARN-6	GFE	Mounting, Radio Compass Receiver	1
R-101A/ARN-6	GFE	Radio Compass Receiver	1
ED400A	GFE	Tuning Drive and Amplifier	1
LPA-6A	GFE	Loop Antenna	1
C1513/A	GFE	Control Panel	2
7-1362-47	Aviation Electric	Sense Antenna Susceptiformer	1
	Avro Aircraft Limited	Sense Antenna	1
CG-131/ARN-6		Loop Antenna Cable	1
ID-250/ARN	GFE	Course Indicator (See also section 43)	2



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CABLE ASSEMBLY	ITEM NO.
R 173	1
R 1009	9
R 1011	6
R 1012	7
R 1013	16
R 1017	4
R 1020	3
R 1029	2
R 1033	10
R 1036	8
R 1038	11
R 1041	13
R 1045	12
R 1048	14
R 1050	18
R 1052	5
R 1108	15
R 1109	17
R 1110	19
R 1111	20

SEE ALSO POWER
DISTRIBUTION SYSTEM -
SECTION 40

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