

NAVWEPS 01-40ALF-2

Handbook
Maintenance Instructions

NAVY MODELS

A-1H • A-1J

AIRCRAFT

SECTION VIII
RADIO AND RADAR
SYSTEMS

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SECTION VIII

RADIO AND RADAR SYSTEMS

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8-1. RADIO AND RADAR SYSTEMS.

8-2. GENERAL. The radio and radar systems installed on the A-1H and A-1J airplanes provide the pilot with the necessary information to complete a mission. This information is given aurally in the pilot's headset and visually by cockpit indicators. The radio and radar systems utilized to supply this information are as follows:

AN/ARC-1 VHF radio communication system
AN/ARC-27A VHF radio communication system
AN/ARA-25 automatic direction finder system
AN/ARN-6 radio compass system
AN/ARN-14E radio navigation system
AN/ARN-21 radio navigation system
AN/ARN-12 marker beacon radio navigation system
AN/APN-22 radar altimeter system
AN/APX-6 radar identification system
AN/APS-19C search radar system
AN/APA-89 coder group.

8-3. This section describes the electronic function, power requirements, installation, and interconnecting circuitry of components that comprise the radio and radar systems. In addition cleaning, ground testing, troubleshooting, and component removal and installation procedures are included. Systems in this section are divided into two categories:

Radio systems
Radar systems.

8-4. For descriptive information concerning a component of a radio or radar system refer to the Table of Contents preceding this section to determine location of specific information. The alphabetical index at the end of the handbook should be consulted to determine where specific information is contained within the handbook.

8-5. POWER REQUIREMENTS. The radio and radar systems power requirements are shown in the power loading tables in Section VII. Power sources and circuit protection provided for the radio and radar systems are itemized in tables 8-1 and 8-5C respectively. Power sources and interconnecting circuitry which connects the components that comprise the radio and radar systems with the airplane electrical distribution system are shown in Section X.

8-5A. CLEANING. The general cleaning instructions for electrical and electronic components, electrical leads, panels, and mechanical parts that comprise the electronic systems are as follows:

a. Clean dust, dirt, and foreign particles from fragile electrical and electronic components with a longhaired brush or wipe with a clean, soft, lint-free cloth.

WARNING

Observe safety precautions when handling cleaning agents. Make certain adequate ventilation is provided because prolonged inhalation of cleaning agents may create toxic conditions hazardous to personnel.

b. Brush dirt and grease with a firm, nonmetallic brush dipped in cleaning solvent (Fed. Spec. RD-680) or with a clean, lint-free cloth dampened with solvent.

CAUTION

Excessive use of cleaning solvent may damage fragile, precision built components and highly finished surfaces.

c. Absorb excess cleaning solvent with clean, lint-free cloth.

d. Dry with moisture-free compressed air (not in excess of 30-psi pressure) or allow adequate time for item to dry before installing or performing test procedures.

e. Clean enclosed areas with a vacuum, brush, or blow out with moisture-free compressed air.

8-5B. GROUND TESTING. For ground testing procedures refer to List of Tables preceding this section to determine where the specific table applicable for the system to be tested is contained within the handbook.

8-6. TROUBLESHOOTING. The following general troubleshooting steps should assist maintenance personnel in isolating the majority of trouble cases likely to occur in the interconnection of units that comprise the various radio and radar systems. Whenever troubleshooting information is required for a specific unit, reference should be made to the applicable technical publication.

a. Investigate report of trouble at its source, when possible, in an effort to determine conditions leading up to and under which trouble occurred. Also determine whether failure of another radio or radar system occurred simultaneously and whether trouble was constant or intermittent. (Information of this kind, when carefully analyzed, often indicates the nature and very often the location of the cause of trouble.)

b. Study wiring diagrams thoroughly. (A complete understanding of the interconnection and circuit function of components that comprise a radio or radar system is essential before troubleshooting can be effectively planned or applied.)

c. Check power supply circuits. If indications are that a radio or radar system is not receiving power, check for an overload or open power supply circuit; an overloaded circuit is indicated if the circuit breaker will not remain closed when power to the

to applicable wiring diagram (in section X) for information concerning proper matching of connections.

e. Install covers, shields, or other forms of protection provided for unit.

f. Ground test the radio or radar system.

8-6. TROUBLE SHOOTING. The following general trouble shooting steps should assist maintenance personnel in isolating the majority of trouble cases likely to occur in the interconnection of units that comprise the various radio and radar systems. Whenever trouble shooting information is required for a specific unit, reference should be made to the applicable technical publication.

a. *Investigate report of trouble* at its source, when possible, in an effort to determine conditions leading up

to and under which trouble occurred. Also determine whether failure of another radio or radar system occurred simultaneously and whether trouble was constant or intermittent. (Information of this kind, when carefully analyzed, often indicates the nature and very often the location of the cause of trouble.)

b. *Study wiring diagrams* thoroughly. (A complete understanding of the interconnection and circuit function of components that comprise a radio or radar system is essential before trouble shooting can be effectively planned or applied.)

c. *Check power supply circuits.* If indications are that a radio or radar system is not receiving power, check for an overload or open power supply circuit: an overloaded circuit is indicated if the circuit breaker will not

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circuit is applied. (This condition is usually caused by shorted power wires or an abnormal current drain within a unit of the system. Shorted power wires can be located by visual inspection or by disconnecting them, one at a time, at the main distribution point, until the overload condition is eliminated. Isolating the trouble within a circuit can be accomplished by disconnecting the wiring plugs from each unit until the overload condition is eliminated. The cause of an open power supply circuit can usually be attributed to broken wires, loose connections, or defective circuit breakers. The break in an open circuit can be located by performing a point-to-point continuity check on the circuit.)

d. Visually check circuitry of circuit(s) in question for defective relays, damaged wires, defective electrical connectors, and loose connections; pay particular attention to security of all ground connections.

e. Perform a power-on check only when it has been determined that power circuit is operating satisfactorily. With power on, perform ground operation test as outlined following descriptive test of applicable system: this procedure will confirm the report of trouble and will probably isolate the trouble to a particular unit or section of the circuit.

f. Replace inoperative equipment. Whenever a radio or radar system remains inoperative after it has been proven that all units are receiving proper power, replace units, one at a time, until trouble is eliminated. (This should be done only after the interconnecting circuitry has been thoroughly tested and found to be satisfactory.)

g. Test coaxial cables that interconnect receiver-transmitters to their respective antennas for high resistance shorts. (Coaxial cables that have been subjected to excessive moisture for long periods of time may develop high resistance shorts between the outer [shielded] and inner conductors. This condition will result in very weak or completely dead transmission and/or reception. High resistance shorts may be detected by disconnecting both ends of the cable and connecting a 500-volt megohmmeter [megger] across the inner and outer conductors. If a reading below 20 megohms is noted, the cable is defective and must be replaced.)

8-7. REMOVAL AND INSTALLATION PROCEDURES. (See figure 8-1.) The removal and installation procedures in figure 8-1 are of a general nature and will apply to most radio and radar equipment in the airplane. If a unit requires special handling, or if there is a possibility of injury to personnel or damage to equipment, specific removal and installation procedures are provided following the descriptive text of the unit concerned.

8-8. RADIO SYSTEMS.

8-9. DESCRIPTION. The radio systems provide a means of communication, automatic direction finding, homing, and navigation for the airplane. The radio systems installed in the airplane, their functions and power sources, are listed in table 8-1.

8-10. AN/ARC-1 VHF COMMUNICATION RADIO SYSTEM.

8-11. DESCRIPTION. (See figure 8-2.) Provisions are made in the A-1H and A-1J airplane for the installation of the AN/ARC-1 VHF radio communication system. The major components of the AN/ARC-1 system are as follows:

<u>Name</u>	<u>Location</u>
Circuit breaker, 20-amp, identified as VHF-UHF	Cockpit circuit-breaker panel
RT-18A/ARC-1 receiver-transmitter	Radio compt - lower shelf LH
C-865/ARC-1 control console, identified as VHF	RH control console
C-739/ARC-1 control panel, identified as MASTER	RH control console
AT-145B/A antenna	Fuselage top at sta 207
Communication radio microphone switch (Refer to para 8-36A)	Throttle control handle

8-12. The AN/ARC-1 VHF radio communication system provides for two-way voice communication between two or more aircraft and between aircraft and surface ships or ground stations. The system operates on any one of nine preset channels, plus one guard channel, within a frequency range of 100 to 156 megacycles. Channels are remotely selected at the VHF control console and radio volume is controlled at the MASTER control console. The microphone circuit to the receiver-transmitter is controlled by the communication radio microphone switch. For further information pertaining to the RT-18A/ARC-1 receiver-transmitter and the C-865/ARC-1 control panel, refer to Handbook of Maintenance Instructions for Aircraft Radio Equipment AN/ARC-1. A single, blade-type antenna serves for transmission and reception.

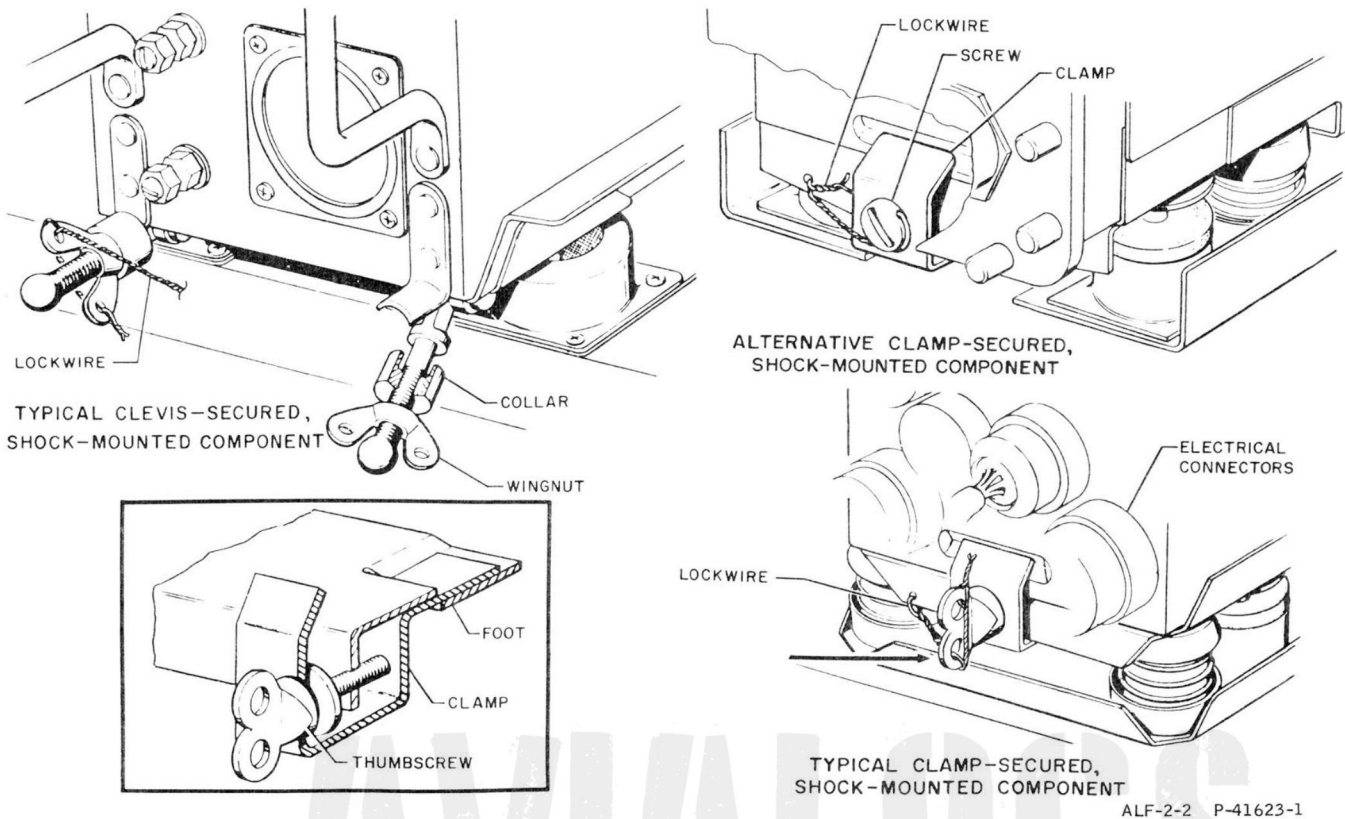
8-13. The AN/ARC-1 system operates on 28-volt dc power obtained from the radio bus through the circuit breaker. The system is energized when the circuit breaker is depressed and the MASTER RADIO switch is ON.

8-14. The AN/ARC-1 VHF radio communication system is an alternate installation for the AN/ARC-27A UHF radio communication system. Refer to table 8-1A for converting the airplane communication radio system from AN/ARC-1 system to AN/ARC-27A system.

8-15. GROUND TESTING. Refer to table 8-1B.

8-16. C-865/ARC-1 VHF CONTROL PANEL.

8-17. DESCRIPTION. (See figure 8-2.) The C-865/ARC-1 VHF control panel is installed in the cockpit center control console and is identified VHF. The control panel contains two rotary switches: one has three positions which are identified as GUARD T/R,



1. REMOVAL - CLEVIS TYPE MOUNTING.

- a. Verify that all electrical power switches are OFF, and that no external source of power is connected to airplane.
- b. Disconnect all wiring, bonding braid or mechanical linkage attached to unit.
- c. Back off wing nuts and/or collars to free clevises.
- d. Carefully pull unit clear of mounting rack.

NOTE

If unit is to remain out of airplane during subsequent flight, cover exposed wiring terminals with suitable insulating material. Secure loose wires or connectors to adjacent airplane structure.

2. INSTALLATION - CLEVIS TYPE MOUNTING.

- a. Verify that all electrical power switches are OFF, and that no external source of power is connected to airplane.
- b. Place unit in mounting rack, but do not secure it to mount.
- c. Apply antiseize compound (TT-A-580) sparingly to external threads of all threaded connectors.
- d. Connect electrical wiring and secure connectors with lockwire
- e. Shift unit into mounting position in rack.
- f. Lock unit in position by turning down collars and/or wing nuts.
- g. Secure nuts or collars with lockwire.

3. REMOVAL - CLAMP TYPE MOUNTING.

- a. Verify that all electrical power switches are OFF, and that no external power is connected to airplane.

- b. Disconnect all wiring, bonding braid or mechanical linkage attached to unit.
- c. Loosen clamp screw on front of mount and pull clamp out until it is disengaged from foot or detent on bottom of component case.
- d. Carefully pull unit clear of mounting rack.

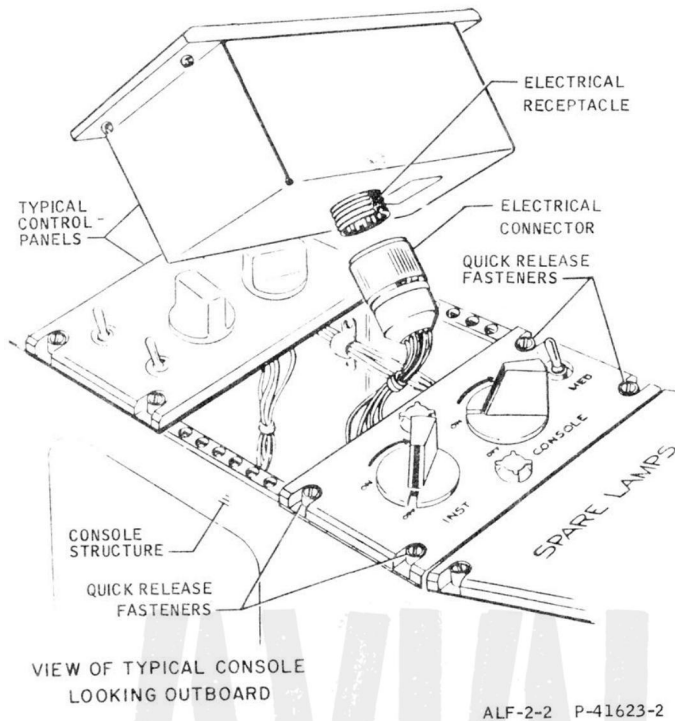
NOTE

If unit is to remain out of airplane during subsequent flight, cover exposed wiring with suitable insulating material. Secure loose wires or connectors to adjacent airplane structure.

4. INSTALLATION - CLAMP TYPE MOUNTING.

- a. Verify that all electrical power switches are OFF, and that no external power source is connected to airplane.
- b. Place unit in mounting rack, but do not secure it to mount.
- c. Apply antiseize compound (TT-A-580) sparingly to external threads of all threaded connectors.
- d. Connect electrical wiring and secure connectors with lockwire.
- e. Shift unit into mounting position in rack, at the same time pulling mounting clamp outward.
- f. Push mounting clamp back in its slot, making sure clamp engages foot or detent on bottom of component case.
- g. Lock clamp in place by turning down clamp screw.
- h. Secure screw with lockwire.

Figure 8-1. Typical Component Installation (Sheet 1)



5. REMOVAL—CONSOLE-MOUNTED CONTROL PANELS.

a. Verify that all electrical power switches are OFF and that no external electrical power is connected to airplane.

b. Release quick-release fasteners at edges of control panel face by using screwdriver to turn fasteners 1/4 turn counterclockwise.

c. Raise control panel to gain access to airplane wiring electrical connector(s).

d. Remove and stow airplane wiring electrical connector(s) from control panel electrical receptacle(s).

6. INSTALLATION—CONSOLE-MOUNTED CONTROL PANELS.

a. Verify that all electrical power switches are OFF and that no external power source is connected to airplane.

b. Apply antiseize compound (TT-A-580) sparingly to external threads of all threaded connector(s).

c. Connect airplane wiring electrical connector(s) to electrical receptacle(s) on control panel.

d. Place control panel into console and secure quick-release fasteners by using screwdriver to turn fasteners 1/4 turn clockwise.

Figure 8-1. Typical Component Installation
(Sheet 2)

TABLE 8-1. RADIO SYSTEMS POWER SOURCE AND CIRCUIT BREAKER IDENTIFICATION

System	Power Source	Circuit Breaker or Fuse	
		Identification	Rating
AN/ARC-1 VHF radio communication system	Secondary bus	MASTER RADIO	5 amperes
	Radio bus	VHF UHF	20 amperes
AN/ARC-27A UHF radio Communication system	Secondary bus	MASTER RADIO	5 amperes
	Radio bus	VHF UHF	20 amperes
AN/ARA-25 automatic direction finder system	Secondary bus	MASTER RADIO	5 amperes
	Radio bus	UHF ADF	5 amperes
	No. 1 inverter power transformer (26-volt ac)	ID-250 IND	3 ampere fuse
		ID-250 IND	3 ampere fuse
		COMP CARD	3 ampere fuse
AN/ARN-6 radio compass system	Secondary bus	MASTER RADIO	5 amperes
	Radio bus	LF ADF	5 amperes
	Essential bus	LF ADF	1 ampere fuse
	No. 1 inverter power transformer (26-volt ac)	ID-250 IND	3 ampere fuse
		COMP CARD	3 ampere fuse
	Electric tuning unit	F1	5 ampere fuse
AN/ARN-14E radio navigation system	Secondary bus	MASTER RADIO	5 amperes
	Radio bus	VOR	10 amperes
	Radio bus	VHF TEST	15 amperes
	No. 1 inverter power transformer (26-volt ac)	ID-250 IND	3 ampere fuse
		COMP CARD	3 ampere fuse
	Essential bus	VOR DME	1 ampere fuse
AN/ARN-21 radio navigation system	Secondary bus	MASTER RADIO	5 amperes
	Radio bus	VOR DME	5 amperes
	No. 1 inverter	ID-250 IND	3 ampere fuse
	Power transformer (26-volt ac)	COMP CARD	3 ampere fuse
		VOR DME	1 ampere fuse
AN/ARN-12 marker beacon radio navigation system	Secondary bus	MASTER RADIO	5 amperes
	Radio bus	MARKER BEACON	5 amperes

MAIN T/R & G REC, and MAIN T/R; the other is identified CHANNEL and has nine positions numbered 1 through 9. The three position switch performs the following functions at the following settings:

Switch Setting	Function
GUARD T/R	Places guard receiver and transmitter in operation and main receiver in standby.
MAIN T/R & G REC	Places main receiver and transmitter in operation and permits monitoring of guard channels through guard receiver.
MAIN T/R	Places main receiver and transmitter in operation and guard receiver in standby.

The channel selector switch permits the selection of any one of nine preset channels within the 100 to 156 megacycle range.

8-18. REMOVAL AND INSTALLATION. See figure 8-1 for console type installation.

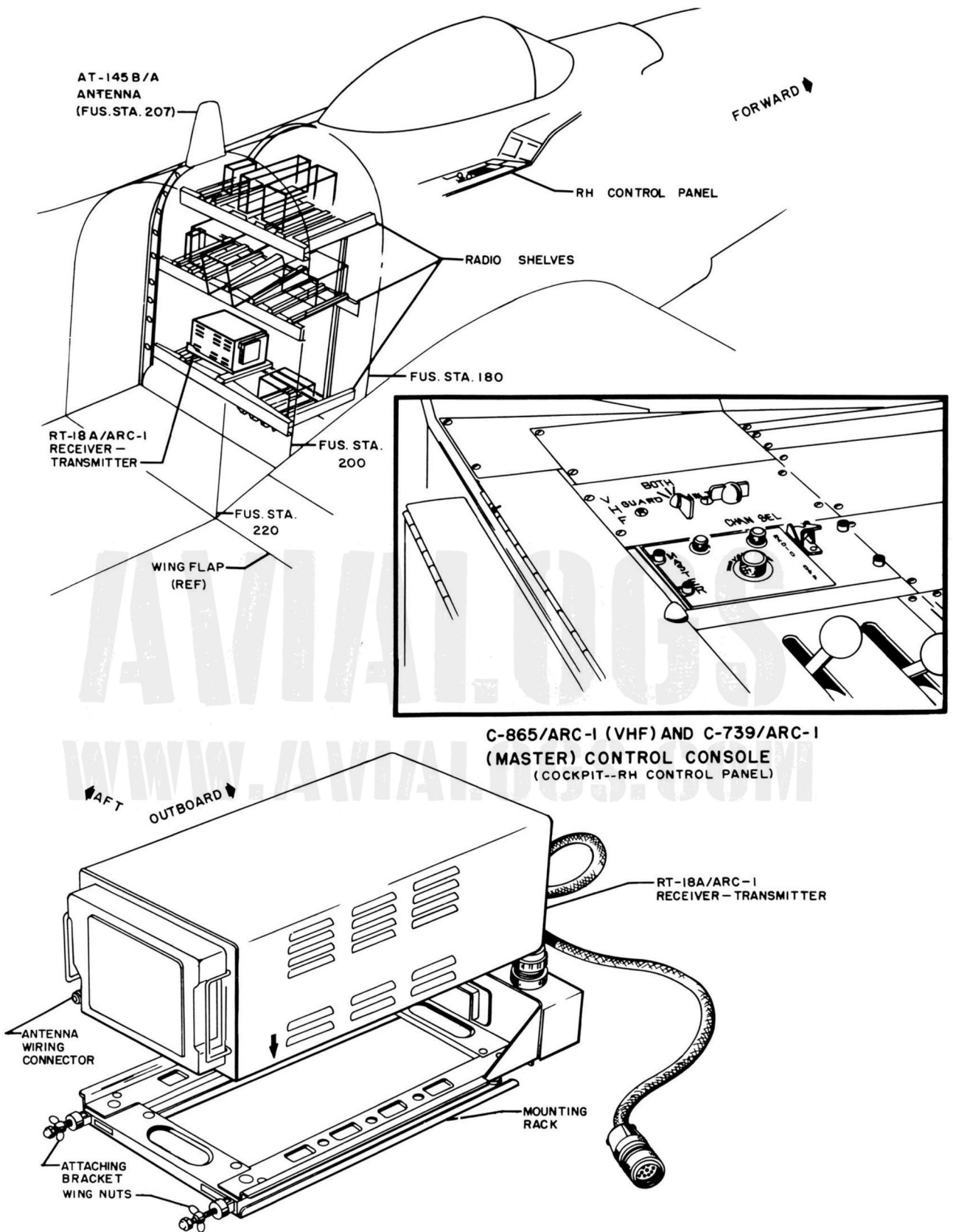
8-19. C-739/ARC CONTROL PANEL (MASTER).

8-20. DESCRIPTION. (See figure 8-2.) The AN/ARC-1 control panel, identified as MASTER, contains a control, identified as VOLUME, which controls the audio level for the communication and navigation radio systems. A toggle switch, identified as RADIO OFF, is also contained on the front panel, but is inactive since power to the radio systems is controlled by the master radio switch.

8-20A. REMOVAL AND INSTALLATION. See figure 8-1 for console type installation.

8-21. AT-145B/A ANTENNA.

8-22. DESCRIPTION. (See figure 8-2.) The AT-145B/A antenna is a broad-band, blade-type antenna



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Figure 8-2. AN/ARC-1 VHF Radio Communication System

TABLE 8-1A. AN/ARC-1 TO AN/ARC-27A CONFIGURATION
Equipment Removal and Installation Procedure

AN/ARC-1 VHF RADIO COMMUNICATION SYSTEM REMOVAL		
Component	Location	Procedure
AT-145B/A antenna	Fuselage top, station 207	<ol style="list-style-type: none"> Open radio compartment access door, bottom fuselage. Disconnect coaxial cable from antenna base. (Refer to installation AN/ARC-27A UHF radio communication system for coaxial cable connection.) Remove four attaching bolts and two attaching screws. Remove antenna.
RT-18A/ARC-1 receiver transmitter	Radio compartment – lower shelf LH	<ol style="list-style-type: none"> Disconnect coaxial cable from face of unit (J103). (Refer to installation AN/ARC-27A UHF radio communication system for coaxial cable connection.) Remove coaxial cable adapter (UG-83/U) and stow with dust cap at station 188 center radio shelf LH. Release unit from shock mounted support, and remove unit from airplane. Disconnect electrical connectors from shock mounted support and stow at station 188, center radio shelf LH. Remove hardware securing shock mounted support to radio shelf, and remove from airplane.
C-865/ARC-1 control panel	Cockpit – RH control console	<ol style="list-style-type: none"> Release fasteners and lift unit from control console. Disconnect electrical connector, and remove control panel. Stow electrical connector below RH control console.
C-739/ARC-1 control panel	Cockpit – RH control console	<ol style="list-style-type: none"> Release fasteners and lift unit from control console. Disconnect electrical connector, and remove control panel. Stow electrical connector below RH control console.
AN/ARC-27A UHF RADIO COMMUNICATION SYSTEM INSTALLATION		
Component	Location	Procedure
AT-141A/ARC antenna	Fuselage top, station 207	<ol style="list-style-type: none"> Open radio compartment access door, bottom fuselage. Place antenna into fuselage cutout, LEAD EDGE forward, secure with four attaching bolts, and two screws. Connect airplane wiring coaxial connector to coaxial receptacle on antenna base.
MT-822/ARC-27A or MT-822A/ARC-27 mounting support	Radio compartment – lower shelf LH	Install shock mounted support to radio shelf and secure with attaching hardware. (Provide adequate bonding between shock mounted support and radio shelf.)
RT-178/ARC-27A receiver-transmitter	Radio compartment – lower shelf LH	<ol style="list-style-type: none"> Install RT-178/ARC-27A receiver-transmitter on shock mounted support and secure. Remove electrical connectors from stowage at station 188 forward of RE-120/ARA-25 solenoid relay on airplanes BuNo. 134466-134637, 135223-135406, and 137492-137632. On airplanes BuNo. 139606-139821, and 142010-142081 stowage is located at station 180. Apply antiseize compound (Fed. Spec. TT-A-580) sparingly to external threads of all threaded connectors. Connect airplane wiring electrical connectors to electrical receptacles on face of receiver-transmitter.

TABLE 8-1A. AN/ARC-1 TO AN/ARC-27A CONFIGURATION (Continued)
Equipment Removal and Installation Procedure

AN/ARC-27A UHF RADIO COMMUNICATION SYSTEM INSTALLATION (Continued)		
Component	Location	Procedure
		e. Remove coaxial connector J304 from the RE-120/ARA-25 solenoid relay, and connect to electrical receptacle J1405 of receiver-transmitter. f. Connect airplane wiring coaxial connector from antenna to J314 of the RE-120/ARA-25 solenoid relay.
C-2459/ARC-27A UHF radio communication control panel	Cockpit - RH control console	a. Remove airplane wiring electrical connector from stowage below RH control console. b. Apply antiseize compound (Fed. Spec. TT-A-580) sparingly to external threads of control panel electrical receptacle. c. Connect airplane wiring electrical connector to electrical receptacle on control panel and secure. d. Place control panel into RH console and secure quick-release fasteners.
ID-572/ARC UHF remote channel indicator	Cockpit - RH control console	a. Remove airplane wiring electrical connector from stowage below RH control console. b. Apply antiseize compound (Fed. Spec. TT-A-580) sparingly to external threads of indicator electrical receptacle. c. Connect airplane wiring electrical connector to electrical receptacle on indicator and secure. d. Place indicator in support bracket and secure.

with a characteristic impedance of 50 ohms and is connected to the receiver-transmitter by a coaxial cable assembly.

AT-141A/ARC antenna Fuselage top at sta 207
 Communication radio Throttle control
 microphone switch

NOTE

If antenna is removed, make certain replacement antenna is installed with leading edge facing forward.

8-23 and 8-24 (Deleted).

8-25. AN/ARC-27A UHF RADIO COMMUNICATION SYSTEM.

8-26. DESCRIPTION. (See figure 8-2A.) The major components of the AN/ARC-27A UHF radio communication system are as follows:

Name	Location
Circuit breaker, 20-amp identified as VHF-UHF	Cockpit - circuit-breaker panel
RT-178/ARC-27 receiver-transmitter	Radio compt - lower shelf LH
C-2459/ARC-27A UHF control panel	Cockpit - RH control console
ID-572/ARC UHF remote channel indicator	Cockpit - RH control console
RE-120/ARA-25 solenoid relay. (Refer to paragraph 8-41.)	

8-27. The AN/ARC-27A UHF radio communication system provides for two-way voice communication between two or more aircraft and between aircraft and surface ships or ground stations. The system operates on any one of 20 preset channels, plus one guard channel, within a frequency range of 225 to 399.9 megacycles. Channels are remotely selected at the control console. A single antenna serves for transmission and reception. For further information pertaining to the RT-178/ARC-27 receiver-transmitter, refer to Handbook of Operating Instructions for Radio Set AN/ARC-27.

8-28. The AN/ARC-27A equipment operates on 28-volt dc power obtained from the radio bus through the VHF UHF circuit breaker. The system is energized when the circuit breaker is depressed and the MASTER RADIO switch is ON.

8-29. The AN/ARC-27A UHF radio communication system is an alternate installation for the AN/ARC-1 radio communication system. Refer to table 8-2 for converting the airplane radio communication system from AN/ARC-27A system to AN/ARC-1 system.

8-30. GROUND TESTING. Refer to table 8-2A.

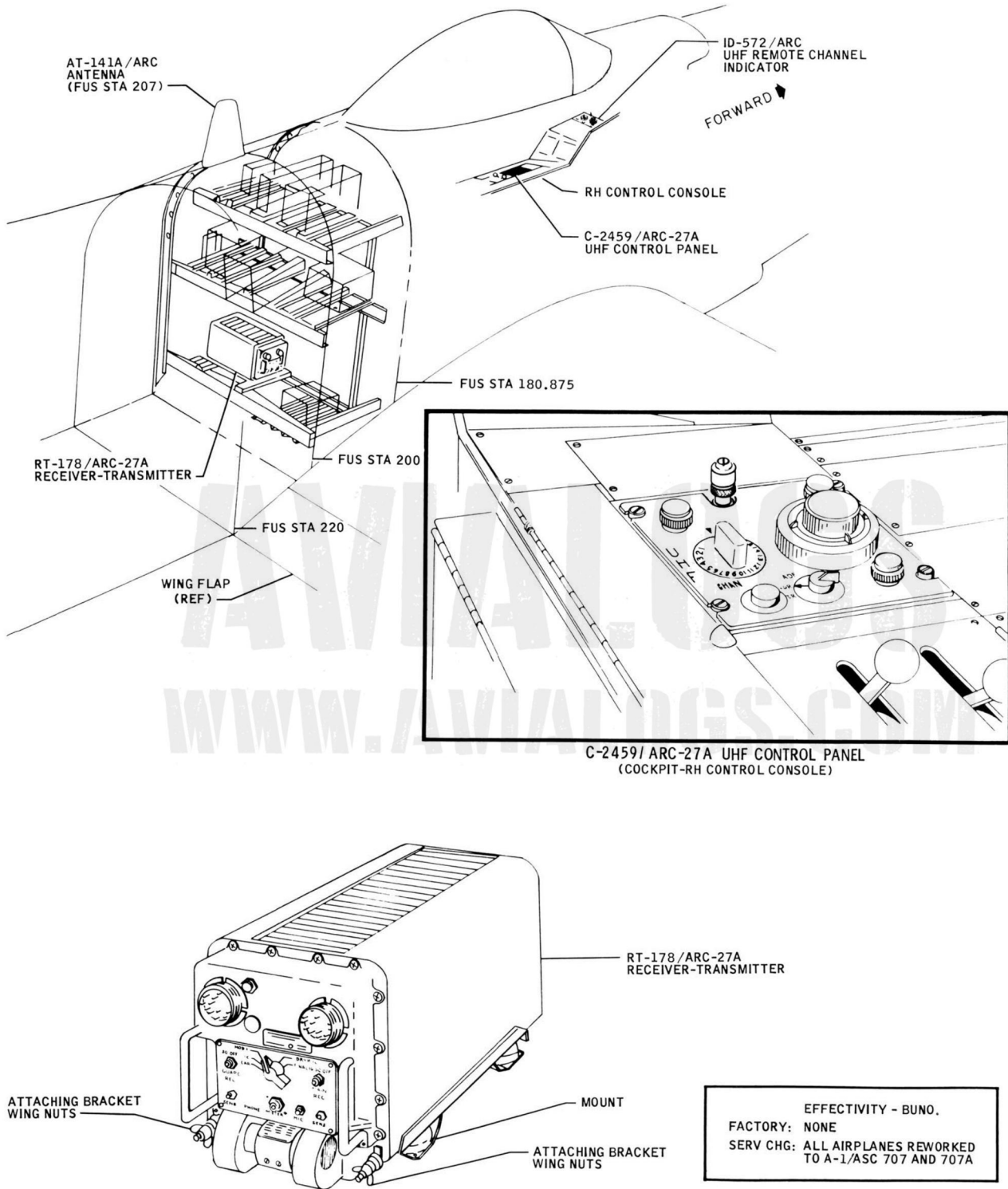


Figure 8-2A. AN/ARC-27A UHF Radio Communication System

TABLE 8-1B. GROUND TESTING AN/ARC-1 SYSTEM

Control Setting and/or Operation	Desired Result
Connect external source of 28-volt dc power	
MASTER RADIO and VHF UHF circuit breakers; depress	
MASTER RADIO switch: ON	
VOLUME control on MASTER control console: set at approximate midpoint	
Connect headset	
Control switch on VHF control console: BOTH	
CHAN SEL switch on VHF control console: set to ground station frequency (channels 1 to 9)	
Microphone switch: press and transmit to ground station	Ground station verifies transmission for proper quality and frequency. Reception from ground station satisfactory.
MASTER RADIO switch: OFF	

8-31. C-2459/ARC-27A UHF CONTROL PANEL.

8-32. DESCRIPTION. (See figure 8-2A.) The C-2459/ARC-27A UHF control panel is installed in the cockpit in the right-hand console. The control panel contains the switches, controls, and selectors needed to operate the AN/ARC-27A UHF radio communication system and the AN/ARA-25 automatic direction finder system. The controls provide for selection of frequency, mode of operation, adjustment of volume, and receiver sensitivity. The various controls and their respective functions are as follows:

Control	Function
OFF-T/R-T/R+G-ADF selector switch	Provides power control of UHF and ADJ systems; selects operation on indicated channel frequency, guard receiver, or ADF operation.
CHAN selector switch	Selects one of 20 preset frequencies, guard, or manual. Provides manual control of frequency selectors and provides CHAN information to ID-572/ARC UHF remote channel indicator.
Frequency selector	Provides selection of any frequency in operation

PUSH TO SET CHAN selector switch	Sets frequency in CHAN selector.
VOL control knob	Adjusts amplitude of signals delivered to headsets.
SENS control knob	Provides venier sensitivity adjustment.
Panel illumination lights (3)	Provides glare-free light for night operation.
PUSH TO SET CHAN indicating light	Provides indication that selected channel has been set in when light comes on.

8-33. Selection of operating frequency is provided by two dials. The right-hand (frequency) selector, consisting of three concentric dials, provides for direct selection of any one of the 1750 available frequencies while the left-hand CHAN selector may be set to make use of 21 preset frequencies. In setting up a channel in the CHAN selector, the frequency selector is adjusted to the desired frequency in megacycles. The outermost of the three concentric dials sets the first two digits of the frequency, the middle dial sets the third digit, and the inner dial sets the digit to the right of the decimal point. The CHAN selector is then rotated to the channel number to be associated with the selected frequency, and the PUSH TO SET CHAN button is unlocked (one-quarter turn clockwise), pressed firmly, and allowed to return. If the selected channel has been set into the C-2459/ARC-27A UHF control panel, the PUSH TO SET CHAN light will come on when the PUSH TO SET CHAN button is fully depressed. The frequency is related only to the number on the CHAN selector when the PUSH TO SET CHAN button returns to the original vertical position.

8-34. REMOVAL AND INSTALLATION. See figure 8-1 for console type installations.

8-34A. RESETTING AN/ARC-27A CHANNEL FREQUENCIES. Frequencies on all channels, including the guard channel, may be changed upon receipt of proper authority. When such authority is received, the following is the proper procedure for changing them:

- a. Set control switch to OFF.
- b. Set CHAN switch to desired channel.
- c. Set the three concentric FREQUENCY dials to new frequency.
- d. Rotate channel preset button one quarter turn clockwise and depress button firmly. (If button is not fully depressed on any one channel, other channels may also be improperly set.)

TABLE 8-2. AN/ARC-27A TO AN/ARC-1 CONFIGURATION
Equipment Removal and Installation Procedure

AN/ARC-27A UHF RADIO COMMUNICATION SYSTEM REMOVAL

Component	Location	Procedure
AT-141A/ARC antenna	Fuselage top, station 207	<ol style="list-style-type: none"> Open radio compartment access door, bottom fuselage. Disconnect coaxial cable from antenna base. (Refer to installation AN/ARC-1 VHF radio communication system for coaxial cable connection.) Remove four attaching bolts, and two attaching screws and remove antenna.
RT-178/ARC-27A receiver-transmitter	Radio compartment - lower shelf LH	<ol style="list-style-type: none"> Disconnect coaxial cable from face of unit (J1405). Disconnect coaxial cable from (J304) RE-120/ARA-25 solenoid relay. (Refer to installation AN/ARC-1 VHF radio communication system for coaxial cable connection.) Connect coaxial cable removed from J1405 of the receiver-transmitter to J304 of the RE-120/ARA-25 solenoid relay (stowage only). Disconnect electrical connectors from face of unit, and stow at station 188 forward of RE-120/ARA-25 solenoid relay on airplanes BuNo. 134466-134637, 135223-135406, and 137492-137632. On airplanes BuNo. 139606-139821, and 142010-142081, stow electrical connectors at station 180. Release unit from shock mounted support, and remove from airplane. Remove attaching hardware securing shock mounted support to radio shelf, and remove from airplane.
C-2459/ARC-27A UHF control panel	Cockpit - RH control console	<ol style="list-style-type: none"> Release quick-release fasteners and lift unit from control console. Disconnect electrical connector and remove unit. Stow electrical connector below RH control console.
ID-572/ARC UHF remote channel indicator	Cockpit - RH control console	<ol style="list-style-type: none"> Remove indicator from support bracket. Disconnect electrical connector from electrical receptacle on indicator and remove indicator from airplane. Stow airplane wiring electrical connector below RH control console.

AN ARC-1 VHF RADIO COMMUNICATION SYSTEM INSTALLATION

Component	Location	Procedure
AT-145B/A antenna	Fuselage top, station 207	<ol style="list-style-type: none"> Open radio compartment access door, bottom fuselage. Place antenna into fuselage cutout, LEAD EDGE forward, secure with four attaching bolts and two screws. Connect airplane wiring coaxial connector to coaxial receptacle on antenna base and secure.
MT-230A/ARC mounting support	Radio compartment - lower shelf LH	<ol style="list-style-type: none"> Install shock mounted support to radio shelf and secure with attaching hardware. (Provide adequate bonding between shock mounted support and radio shelf.) Remove airplane wiring electrical connectors from stowage at station 188, center radio shelf LH side. Apply antiseize compound (Fed. Spec. TT-A-580) sparingly to external threads on electrical receptacles on shock mounted support. Connect airplane wiring electrical connectors to shock mounted support and secure.
RT-18A/ARC-1 receiver-transmitter	Radio compartment - lower shelf LH	<ol style="list-style-type: none"> Install receiver-transmitter on shock mounted support and secure. Remove coaxial cable adapter (UG-83/U) from stowage at station 188, center radio shelf LH. Connect coaxial cable adapter (UG-83/U) to antenna coaxial cable, and connect to (J103) of unit.
C-865/ARC-1 control panel	Cockpit - RH control console	<ol style="list-style-type: none"> Remove electrical connector from stowage below RH control console. Apply antiseize compound (Fed. Spec. TT-A-580) sparingly to external threads on control panel electrical receptacle. Connect electrical connector to unit and secure. Place unit into RH control console and secure quick-release fasteners.
C-739/ARC-1 control panel	Cockpit - RH control console	<ol style="list-style-type: none"> Remove electrical connector from stowage below RH control console. Apply antiseize compound (Fed. Spec. TT-A-580) sparingly to external threads on control panel electrical receptacle. Connect electrical connector to unit and secure. Place unit into RH control console and secure quick-release fasteners.

TABLE 8-2A. GROUND TESTING AN/ARC-27A SYSTEM

Control Setting and/or Operation	Desired Result
Connect external source of 28-volt dc power	
MASTER RADIO and VHF UHF circuit breakers: depress	
MASTER RADIO switch: ON	
Connect headset	
Control switch on UHF control console: set to T/R + G REC	
CHAN switch on UHF control console: set to ground station frequency (channels 1 to 20)	
Microphone switch: press and transmit to ground station	
VOL control on UHF control console: set for satisfactory audio level	Ground station verifies transmission for proper quality and frequency. Reception from ground station satisfactory.
MASTER RADIO switch: OFF	

e. Release button. (Channel is now set to frequency shown on FREQUENCY selector dials.)

NOTE

The white line on the preset button must return to a vertical position when button is released. If this does not occur the channel is improperly set.

8-35. AT-141A/ARC ANTENNA.

8-36. DESCRIPTION. (See figure 8-2A.) The AT-141A/ARC antenna is an ultrahigh frequency, streamlined, broad band, omnidirectional antenna utilized for receiving and transmitting in the frequency range of 225 to 400 megacycles. Operating within this frequency range, the antenna has an impedance of 50 to 52 ohms, and a voltage standing wave ratio of less than 2 to 1. The antenna is installed on the upper surface of the fuselage just aft of the cockpit enclosure at station 207. Electrical connection of the antenna consists of a 50-ohm coaxial cable which

is connected to the RT-178/ARC-27A receiver-transmitter through the RE-120/ARA-25 solenoid relay. The receiver-transmitter function of the antenna is controlled by the microphone radio switch which applies a ground to the coil of the transmitter relay, located in the RT-178/ARC-27A receiver-transmitter.

8-36A. COMMUNICATION RADIO MICROPHONE SWITCH.

8-36B. DESCRIPTION. The communication radio microphone switch, identified as MIC, is a single-pole, single-throw, momentary contact, push-button type. When the switch is depressed the closed contacts connect the microphone circuit either to the RT-18A/ARC-1 receiver-transmitter or the RT-178/ARC-27A receiver-transmitter.

8-37. AN/ARA-25 AUTOMATIC DIRECTION FINDING SYSTEM.

8-38. DESCRIPTION. (See figures 8-3, 8-5, 8-6 and 8-7.) The major components of the AN/ARA-25 automatic direction finding system are as follows:

Name	Location
Circuit breaker, 5-amp, identified UHF ADF	Fwd equip. compt - circuit-breaker panel
AM-608/ARA-25 electronic control amplifier	Radio compartment - top shelf, LH
RE-120/ARA-25 solenoid relay	Radio compartment - center shelf, under side, RH
AS-578/ARA-25 antenna	Outboard wing, RH, near top
ID-250/ARN course indicator (Refer to section VI)	Instrument panel

ID-250 indicator relay (Refer to para 8-54L)	Terminal panel No. 17
--	-----------------------

ID-250 course indicator damping resistor (Refer to para 8-54N)	Fwd equip compt - station 110 right-hand side
--	---

8-39. The AN/ARA-25 automatic direction finding system operates in conjunction with the AN/ARC-27A UHF radio communication system to provide a continuous indication in degrees of the relative direction of arrival of amplitude modulated or unmodulated signals in the 225-to-400-megacycle signal band. The received signals are displayed on the ID-250 course indicator for the purpose of providing homing information with an accuracy within approximately 25 degrees. The ID-250/ARN course indicator of the G-2 or MA-1 compass system operates in conjunction with the AN/ARA-25 automatic direction finding system and the AN/ARN-6 or AN/ARN-14E or AN/ARN-21 systems. For further information pertaining to the ID-250/ARN course indicator, refer to section VI.

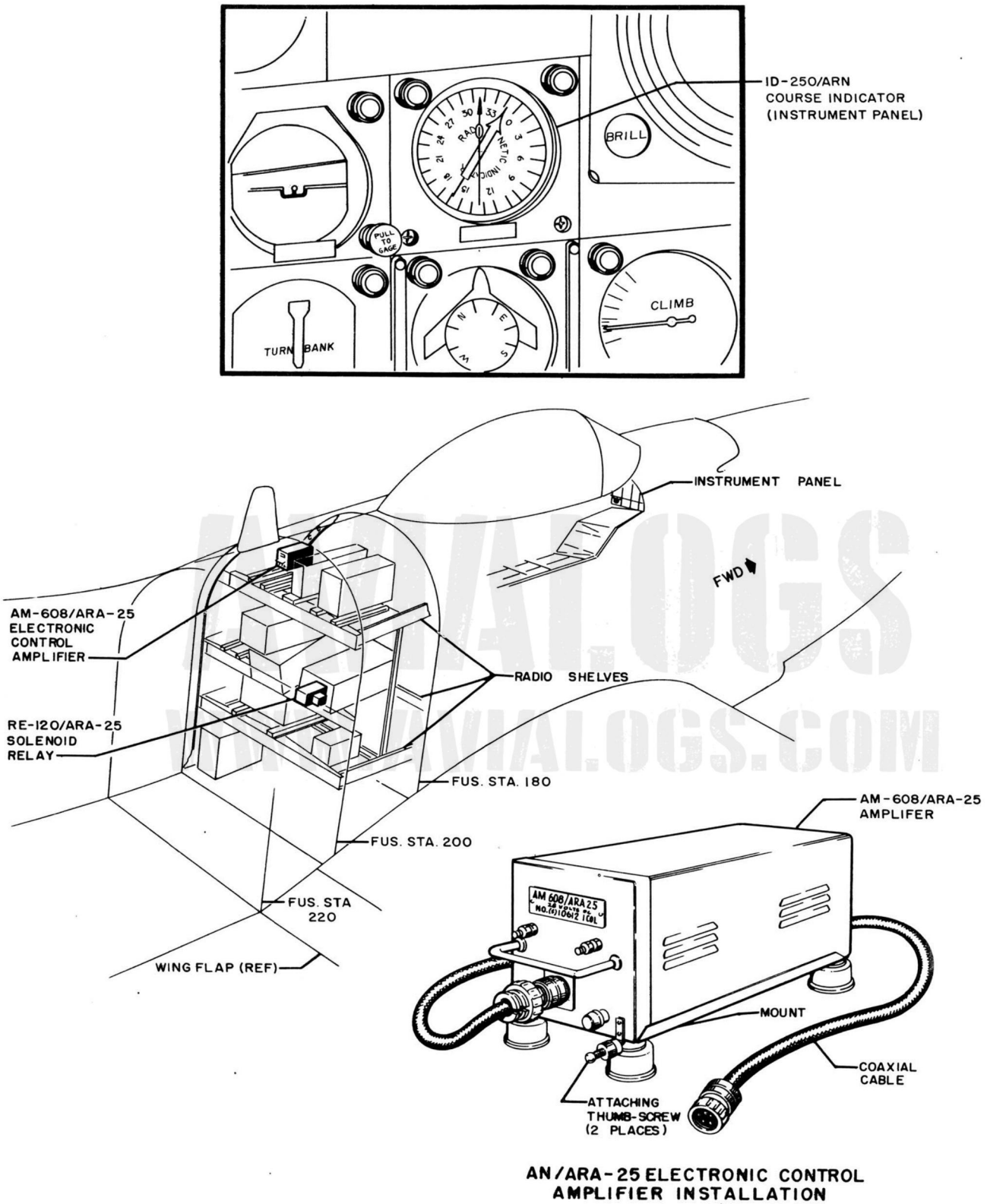
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8-40. The AN/ARA-25 automatic direction finding system receives operating power as follows: Tube filament and plate voltages are received from the AN/ARC-27A UHF radio communication system and the antenna motor circuit receives 28-volt dc power from the radio bus. The system is energized when the AN/ARC-27A UHF communication is energized and the UHF ADF circuit breaker is depressed and the MASTER RADIO switch is ON.

8-41. The system is placed in operation by setting the control switch on the C-2459/ARC-27A UHF control panel in the ADF position, thereby energizing the

coil of the RE-120/ARA-25 solenoid and the ID-250/ARN indicator relays. When the RE-120/ARA-25 solenoid relay coil is energized the closed contacts connect the AS-578/ARA-25 antenna and the RT-178/ARC-27A receiver-transmitter. When the ID-250/ARN indicator relay coil is energized the AS-578/ARA-25 antenna is connected to the pointer, identified as 2 on the ID-250/ARN course indicator. For detailed operation of the AN/ARA-25 system in conjunction with the AN/ARN-6 system, refer to figure 8-5. For detailed operation of the AN/ARA-25 system in conjunction with the AN/ARN-14E system, refer

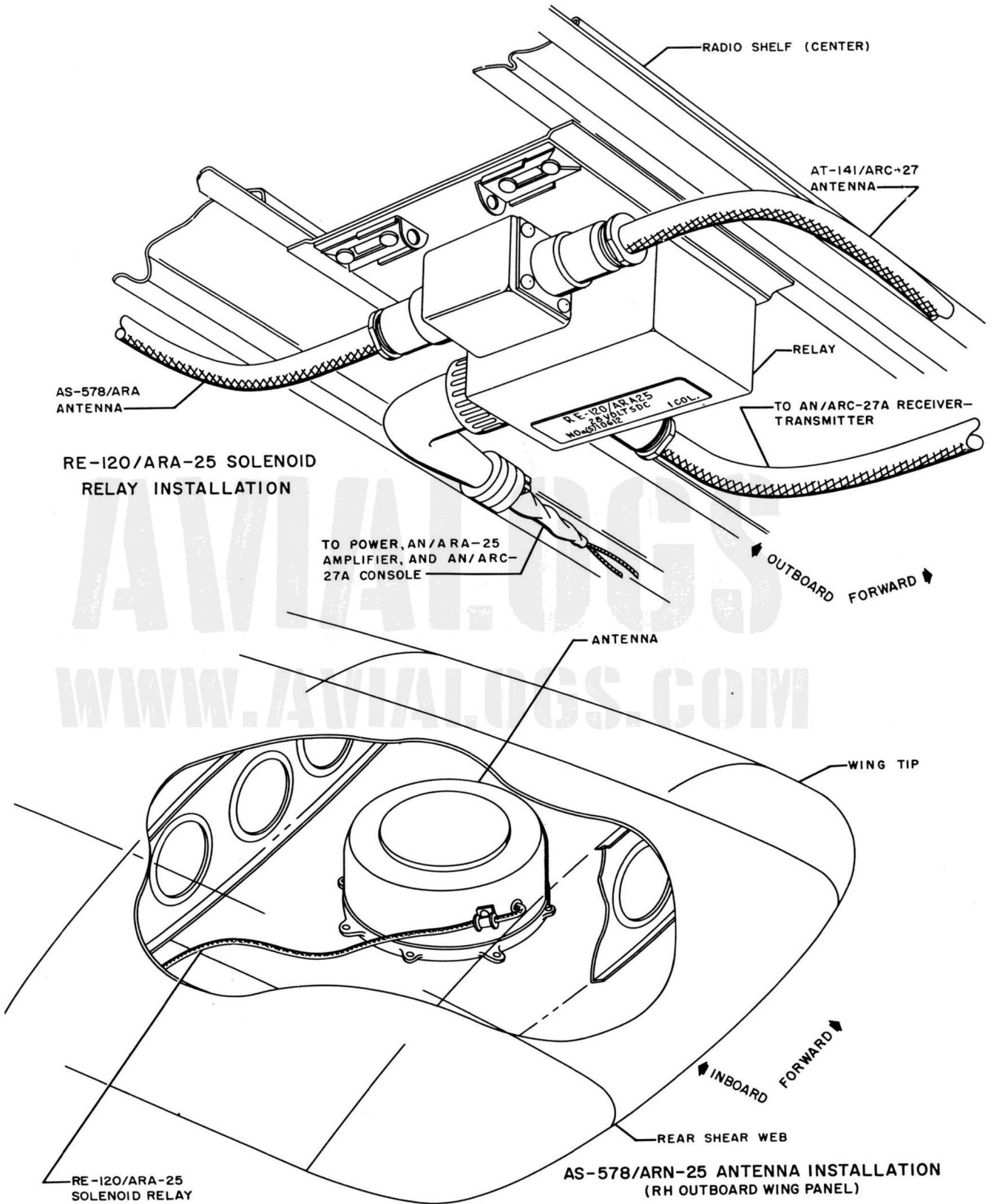
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AN/ARA-25 ELECTRONIC CONTROL AMPLIFIER INSTALLATION

P-3974-1A

Figure 8-3. AN/ARA-25 Automatic Direction Finding System (Sheet 1)



P-3974-2A

Figure 8-3. AN/ARA-25 Automatic Direction Finding System (Sheet 2)

TABLE 8-3. GROUND TESTING AN/ARA-25 SYSTEM

<i>Control Setting and/or Operation</i>	<i>Desired Result</i>
Connect external source of 28-volt d-c power	
MASTER RADIO, UHF-ADF circuit breakers: depress	
MASTER RADIO switch "ON" (right-hand control panel) allow five-minute warmup	
Connect headset	
Operate controls on UHF control console (right-hand control panel) as follows:	
VOL control: set at mid-point	
Operation selector switch: OFF-T/R-T/R + G REC-ADF switch set to "T/R"	
MANUAL—PRESET switch; set to "PRESET"	
PRESET selector switch: set to channel of transmitter of known position. Ascertain identification of transmitter	Reception clear from transmitter.
OFF-T/R-T/R + G REC-ADF switch set to "ADF"	Needle on RADIO MAGNETIC INDICATOR indicates approximate direction of arrival of signal from transmitter with respect to heading of airplane. (Bearing accuracy of better than 15 degrees cannot be expected when airplane is on ground.)
MASTER RADIO switch "OFF"	

to figure 8-6. For detailed operation of the AN/ARA-25 system in conjunction with the AN/ARN-21 system, refer to figure 8-7. For information pertaining to the AM-608/ARA-25 electronic control amplifier, RE-120/ARA-25 solenoid relay, and the AS-578/ARA-25 antenna, refer to Handbook of Operation Instructions for Direction Finder Group AN/ARA-25.

8-42. GROUND TESTING. Refer to table 8-3.

8-43. AN/ARN-6 RADIO COMPASS SYSTEM.

8-44. DESCRIPTION. (See figures 8-4 and 8-5.) The major components of the AN/ARN-6 radio compass system are as follows:

<i>Name</i>	<i>Location</i>
Circuit breaker, 5-amp, identified LF-ADF	Fwd. equip. compt—circuit-breaker panel
R-101/ARN-6 or R-101A/ARN-6 radio receiver	Radio compartment—top shelf, RH
C-1605/ARA-40 control console (Applies to airplanes BuNo. 135278-135406, 137492-137632, 139606-139821, and 142010-142081)	Cockpit—RH control panel
Douglas 5439090 electric tuning control (Applies to airplanes BuNo. 134466, 134520-134637, 135223-135277)	Cockpit—RH control panel

<i>Name</i>	<i>Location</i>
PD-41/ARA-40 tuning drive unit	Front panel, R-101/ARN-6 receiver
AS-313/ARN-6 or AS-313B/ARN-6 loop antenna	Fuselage top, sta 245
ID-250/ARN course indicator (Refer to section VI)	Instrument panel
ID-250 indicator relay (Refer to para 8-54L)	Terminal panel No. 17
ID-250 course indicator damping resistors (Refer to para 8-54N)	Fwd equip compt—station 110 right-hand side
AN/ARN-6 sense ("long-wire") antenna, or anti-precipitation antenna	Vertical stabilizer tip to fus sta 220
*AN/ARN-6 antenna filter	Radio Compt. (Sta 210—RH)

*Applies to airplanes BuNo. 139790-139821 and 142010 and subsequent.

8-45. The AN/ARN-6 radio compass system is a navigational aid which provides a means of taking bearings on certain transmitting stations. The system is also used for receiving aural flight information while in radio compass operation. The receiver and loop antenna are tuned electrically by the electric tuning unit, which is, in turn, controlled by the electric tuning control. Radio compass information is indicated on the ID-250/ARN course indicator. The ID-250/ARN course indicator of the G-2 or MA-1 compass systems operates in conjunction with the AN/ARA-25 automatic direction finding system and the AN/ARN-6 radio compass system. For further information pertaining to the ID-250/ARN course indicator, refer to section VI. For detailed operation of the AN/ARA-25 system in conjunction with the AN/ARN-6 system, refer to figure 8-5. For information pertaining to the R-101/ARN-6 or R-101A/ARN-6 receiver and AS-313/ARN-6 or AS-313B/ARN-6 antenna, refer to Handbook of Maintenance Instruction for Radio Compass AN/ARN-6. Refer to paragraph 8-50C for adjustment of the AS-313/ARN-6 or AS-313B/ARN-6 antenna.

8-46. The AN/ARN-6 system receives signals within a frequency range of 100 to 1750 kilocycles which is covered in four bands as follows:

Band one	100 to 200 kilocycles
Band two	200 to 410 kilocycles
Band three	410 to 850 kilocycles
Band four	850 to 1750 kilocycles

8-47. The AN/ARN-6 equipment operates on 28-volt d-c and 400-cycle, 115-volt a-c. D-c voltage is obtained from the radio bus through the LF ADF circuit breaker; a-c power is obtained from phase C of the constant frequency a-c supply through a 1-ampere fuse. The system is energized when the circuit breaker is depressed, the MASTER RADIO switch closed, and the OFF-ADF switch on the electric tuning control is in "ADF" position.

8-47A. The AN/ARN-6 radio compass system is an alternate installation for the AN/ARN-14E navigation

system on airplanes BuNo. 135278 through 135406 and 137492 through 137632 and also an alternate installation for the AN/ARN-21 navigational radio homing system on airplanes BuNo. 139606-139821, and 142010-142081. Refer to table 8-3A for converting the airplane AN/ARN-6 radio compass system to the AN/ARN-14E navigation system or the AN/ARN-21 navigational radio homing system.

8-48. On airplanes BuNo. 134466, 134520-134637 and 135223-135277, remote tuning of the R-101/ARN-6 receiver is accomplished by utilizing the Douglas 5439090 electric tuning control to position the PD-41/ARA-40 tuning drive unit attached to the front panel of the receiver.

8-49. On airplanes BuNo. 135278-135406, 137492-137632, 139606-139821, and 142010-142081, the C-1605/ARA-40 control console is installed to provide remote tuning of the R-101/ARN-6 receiver. In addition, the C-1605/ARN-6 control console incorporates a loop control switch to allow manual positioning of the AS-313/ARN-6 antenna.

8-49A. ANTI-PRECIPITATION STATIC ANTENNA.

8-49B. DESCRIPTION. (See figure 8-4A.) On air-

planes 139628-139821, 142010 and subsequent, and prior airplanes reworked per BuAer AD/SC No. 476, an anti-precipitation antenna is installed on the fuselage from station 220 to the tip of the vertical stabilizer. This insulated wire antenna is used as the sense antenna for the ARN-6 radio compass system.

8-49C. ARN-6 ANTENNA FILTER.

8-49D. DESCRIPTION. (See figure 8-4B.) On airplanes BuNo. 139790-139821, and 142010 and subsequent, a filter is located in the radio compartment on the right-hand side of the upper fuselage at station 207, and is identified ARN-6 ANT FILTER. It is connected between the coaxial cables that run from the ARN-6 sense antenna (or anti-precipitation antenna) to the R-101/ARN-6 radio receiver. The filter eliminates ARC-27 radio communication interference from the ARN-6 radio compass system.

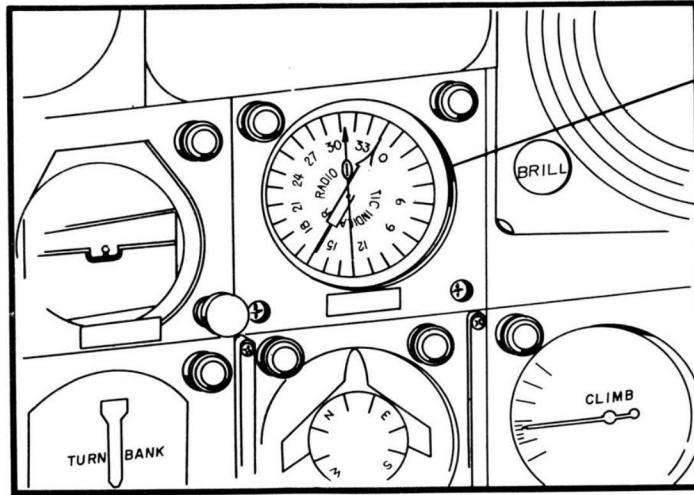
8-50. GROUND TESTING. Refer to tables 8-4 and 8-4A.

8-50A. AS-313/ARN-6 OR AS-313B/ARN-6 LOOP ANTENNA.

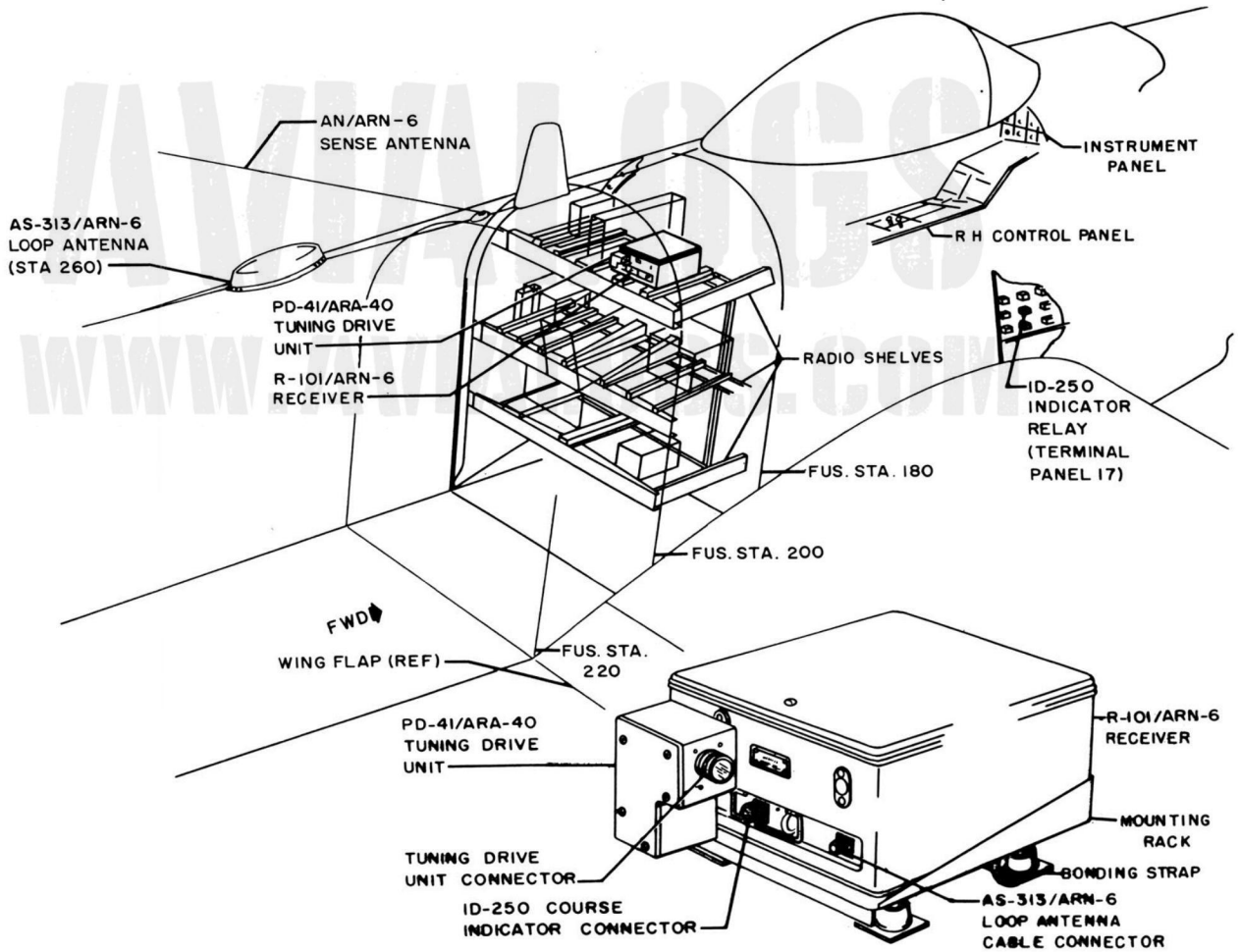
8-50B. DESCRIPTION. The AS-313/ARN-6 or AS-313B/ARN-6 loop antenna is an iron core, electrically

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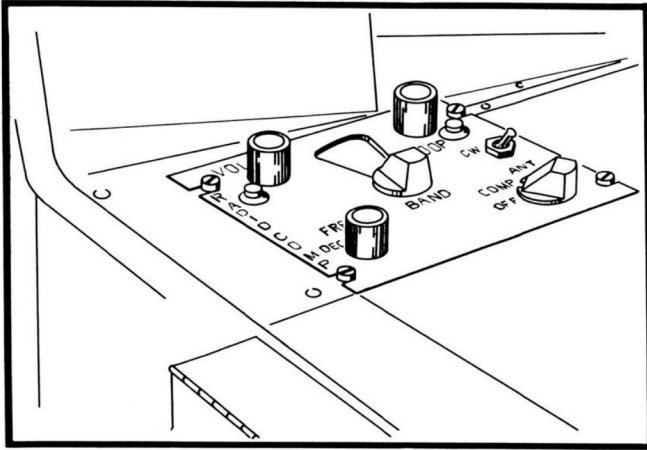


ID-250/ARN COURSE INDICATOR (INSTRUMENT PANEL)



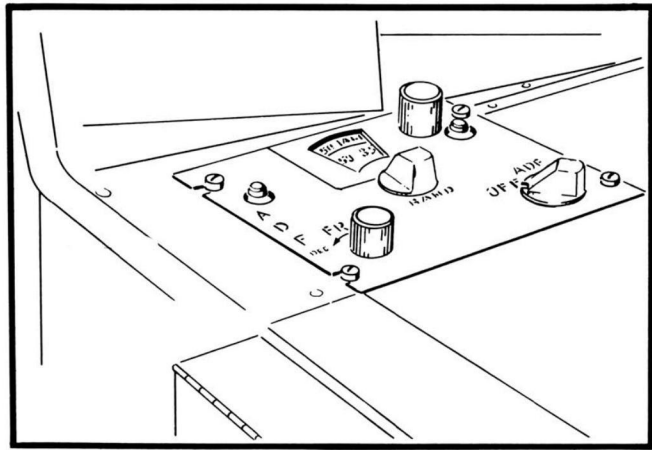
P-3976-1B

Figure 8-4. AN/ARN-6 Radio Compass System (Sheet 1)



C-1605/ARA-40 CONTROL CONSOLE
(COCKPIT - RH CONTROL PANEL)

APPLIES TO AIRPLANES BUNO. 135278 - 135406,
137492 - 137632, 139606 - 139821, AND
142010 - 142081



5439090 ELECTRIC TUNING CONTROL
(COCKPIT - RH CONTROL PANEL)

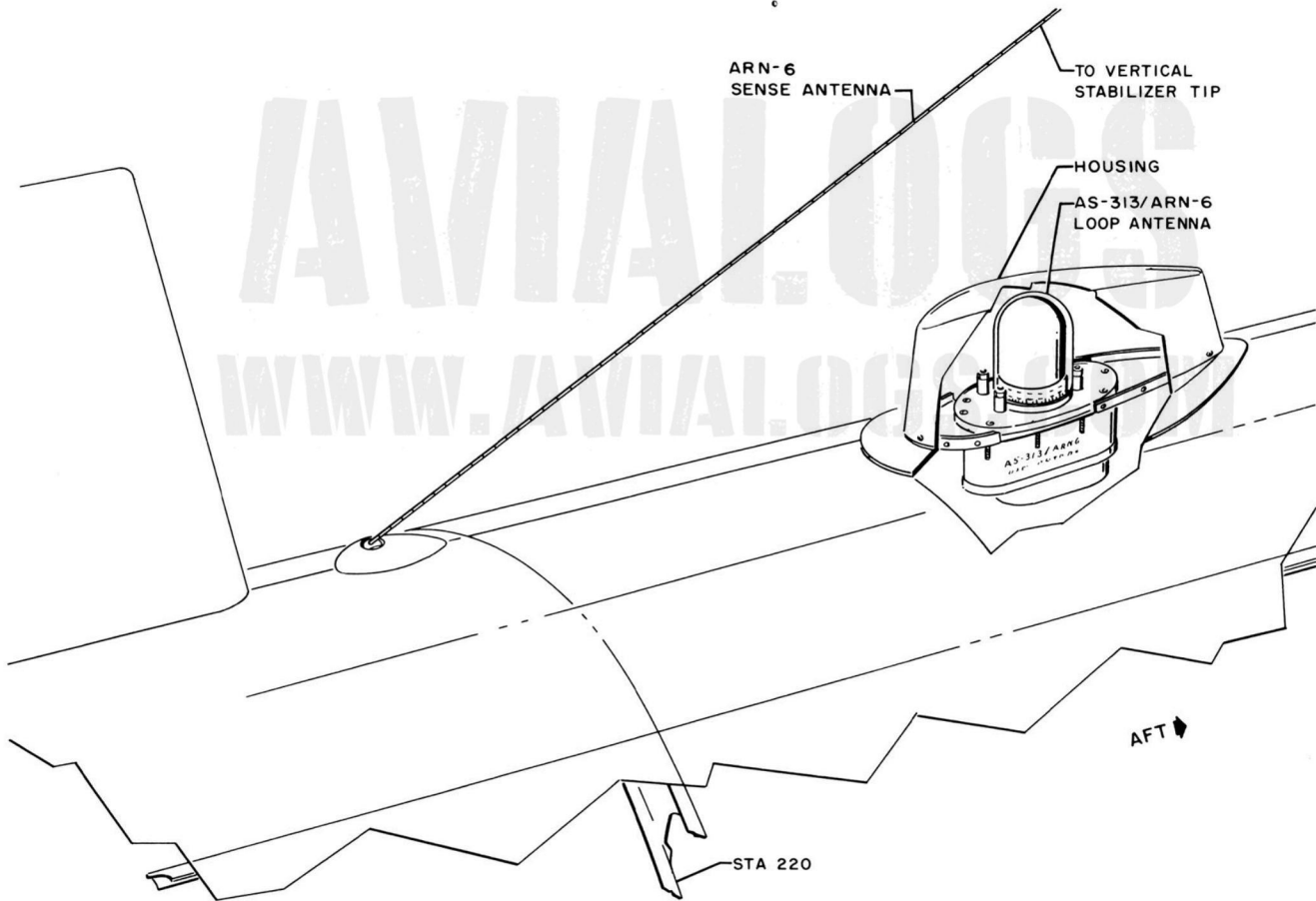
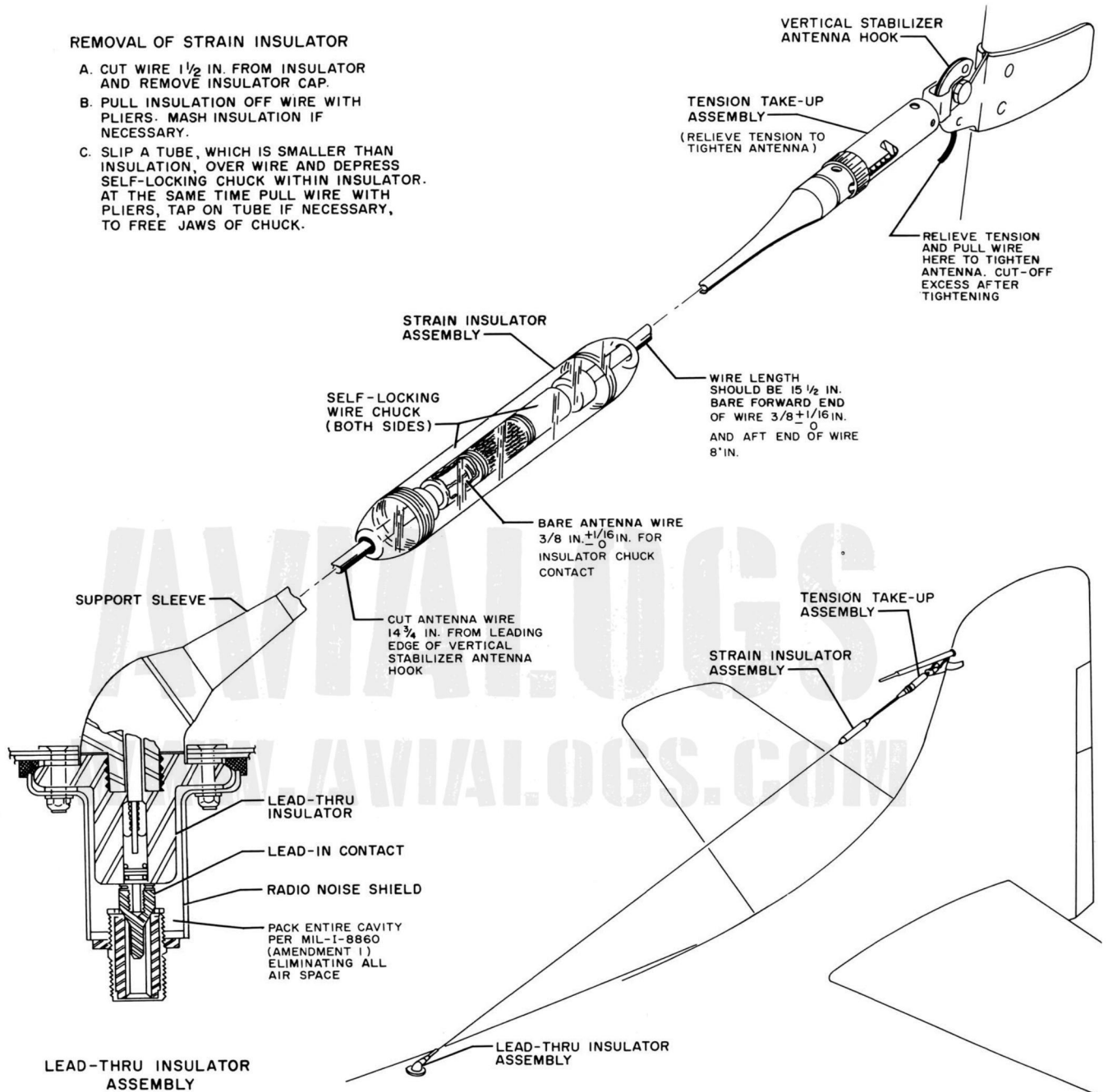


Figure 8-4. AN/ARN-6 Radio Compass System (Sheet 2)

REMOVAL OF STRAIN INSULATOR

- A. CUT WIRE 1 1/2 IN. FROM INSULATOR AND REMOVE INSULATOR CAP.
- B. PULL INSULATION OFF WIRE WITH PLIERS. MASH INSULATION IF NECESSARY.
- C. SLIP A TUBE, WHICH IS SMALLER THAN INSULATION, OVER WIRE AND DEPRESS SELF-LOCKING CHUCK WITHIN INSULATOR. AT THE SAME TIME PULL WIRE WITH PLIERS, TAP ON TUBE IF NECESSARY, TO FREE JAWS OF CHUCK.



ANTI-PRECIPITATION STATIC ANTENNA INSTALLATION

(STA. 217 TO VERTICAL STABILIZER TIP)

EFFECTIVITY-BUNO.
 FACTORY: 139628-139821, 142010 & SUBSEQUENT
 SERV CHG: 134466-134637, 135223-135406, 137492-137632, 139606-139627 REWORKED PER BUAER AD/SC NO.476

P9293-1A

Figure 8-4A. AN/ARN-6 Anti-Precipitation Antenna

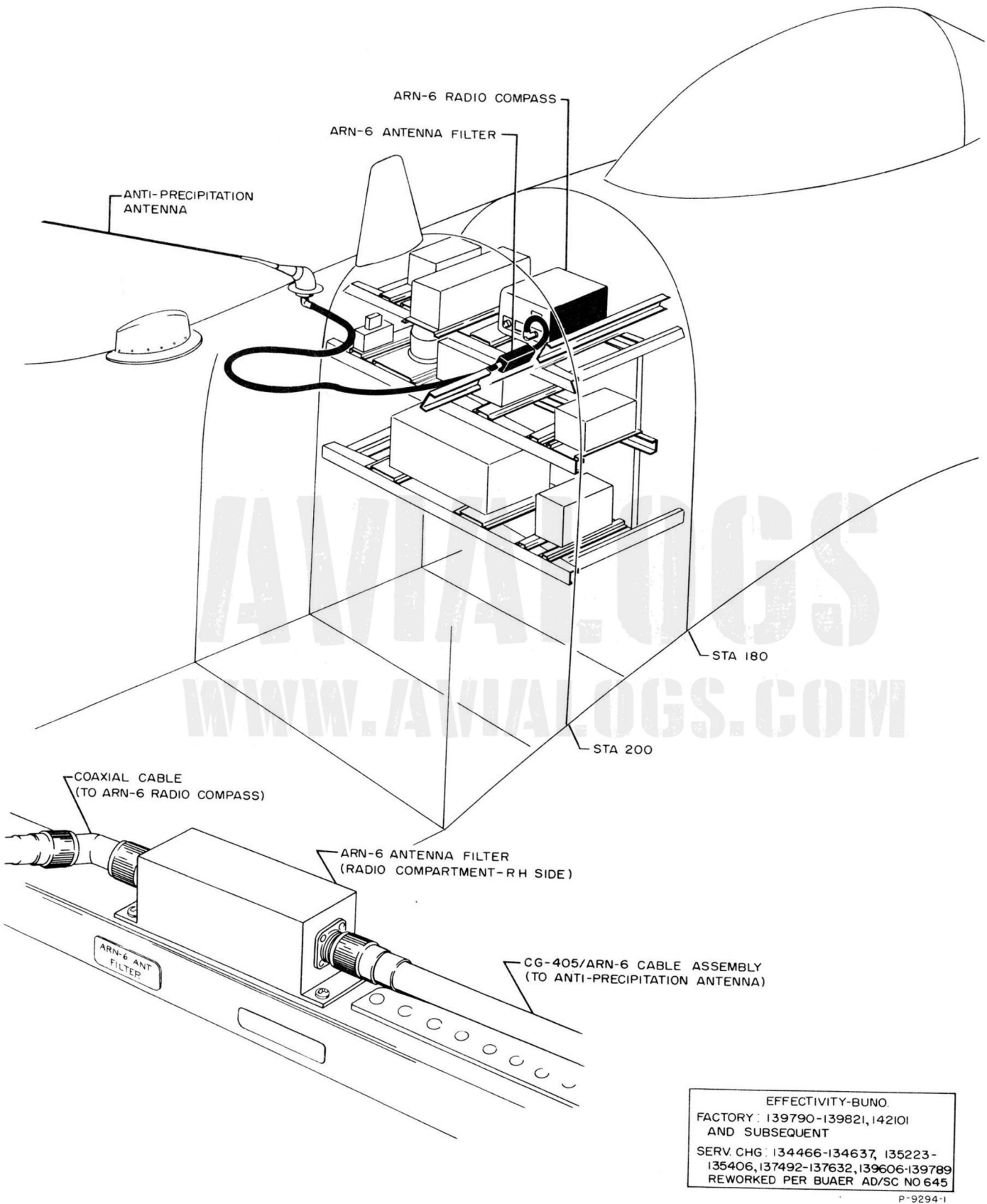


Figure 8-4B. AN/ARN-6 Filter Installation

**TABLE 8-3A. AN/ARN-6 TO AN/ARN-14E OR AN/ARN-21 CONFIGURATION
Equipment Removal and Installation Procedure**

AN/ARN-6 RADIO NAVIGATION SYSTEM REMOVAL

<i>Component</i>	<i>Location</i>	<i>Procedure</i>
AS-313/ARN-6 or AS-313B/ARN-6 antenna	Fuselage top station 245	<ol style="list-style-type: none"> Open radio compartment access door. Disconnect plugs from base of antenna and stow in dummy receptacles at station 257, fuselage top center line. (Identified ARN-6 CABLES STOWAGE.) Remove hardware attaching CU-141/ARN-6 antenna housing to base plate of antenna. Remove housing. Remove hardware attaching antenna to base plate. Remove antenna. Remove hardware attaching base plate to fuselage. Remove base plate.
R-101/ARN-6 or R-101A/ARN-6 receiver	Radio compartment, top shelf—RH side	<ol style="list-style-type: none"> Disconnect plugs from front of receiver. Stow in dummy receptacles at station 200, RH side. (Identified ARN-6 CABLES STOWAGE.) Release receiver from mounting rack. Remove receiver.
MT-274/ARN-6 mounting rack	Radio compartment, top shelf—RH side	<ol style="list-style-type: none"> Remove rack terminal strip cover plate. Disconnect wires, insulate, and secure to radio shelf. Remove hardware attaching shock-mounted rack to radio shelf. Remove rack.
C-1605/ARA-40 or Douglas 5439090 control console	Cockpit—RH control panel	Remove fasteners attaching console to control panel. Lift console out and disconnect plug at rear. Stow plug in dummy receptacle (identified ARN-6) in forward equipment compartment.

**AN/ARN-14E RADIO NAVIGATION SYSTEM INSTALLATION
Applies to Airplanes BuNo. 135278-135406, and 137492-137632**

<i>Component</i>	<i>Location</i>	<i>Procedure</i>
AT-172/ARN-14 antenna	Fuselage top station 245	<ol style="list-style-type: none"> At station 240, RH side, remove antenna adapter plate from beneath shelf on which R-540/ARN-14E receiver mounts. Install adapter plate over cut-out in top of fuselage at station 245. (Space formerly occupied by AS-313/ARN-6 antenna.) Attach antenna to adapter plate, connect coaxial cable stowed at station 257 fuselage top (identified as ARN-14 COAX STOW) to receptacle at base of antenna.
ID-251/ARN indicator	Radio compartment LH side—station 240	Install indicator in mounting bracket attached to the R-540/ARN-14E receiver support structure. Connect plug stowed at station 251 LH side (identified ID-251/ARN PLUG STOW) to receptacle at rear of indicator.
MT-627A/ARN-14 mounting rack	Radio compartment LH side—station 240	<ol style="list-style-type: none"> Install mounting rack on receiver support structure, making certain that bonding straps are attached. Interconnect plug at rear of rack and terminal panel No. 44. (Refer to applicable circuitry.)
R-540/ARN-14E receiver	Radio compartment LH side—station 240	Secure receiver to mounting rack. Connect plug stowed at station 240, LH side (identified as ARN-14 COAX STOW RCVR) to ANT receptacle on front of receiver.
MT-962/ARN-14E mounting rack and DY-84/ARN-14A dynamotor	Radio compartment top shelf—RH side	<ol style="list-style-type: none"> Install mounting rack on top radio shelf LH side, making certain that bonding straps are attached. Secure dynamotor to rack. Connect plug stowed at station 194, LH side (identified ARN-14 DYN STOW-AGE) to dynamotor receptacle.
C-760A/ARN control console	Cockpit—RH control panel	Connect plug stowed in forward equipment compartment, RH side (identified ARN-14) to receptacle at rear of control console. Position console on control panel and secure fasteners.

**TABLE 8-3A. AN/ARN-6 TO AN/ARN-14E OR AN/ARN-21 CONFIGURATION (Continued)
Equipment Installation Procedure**

**AN/ARN-21 NAVIGATION RADIO HOMING SYSTEM INSTALLATION
Applies to Airplanes BuNo. 139606-139821, and 142010-142081**

<i>Component</i>	<i>Location</i>	<i>Procedure</i>
AS-133/APX antenna	Fuselage top, station 245	<ol style="list-style-type: none"> Open radio compartment access door, bottom fuselage. Remove adapter plate from stowage at fuselage top, station 240. Install adapter plate on top of fuselage at station 245 and secure with attaching hardware. Install antenna on adapter plate, "LEAD EDGE" forward, and secure with attaching hardware. Remove coaxial cable from stowage at fuselage station 257 and connect to antenna.
MT-928/ARN-21 mounting support	Radio compartment—top shelf RH	<ol style="list-style-type: none"> Install shock mounted support on radio shelf and secure with attaching hardware. (Provide adequate bonding between shock mounted support and radio shelf.) Remove electrical connectors from stowage at terminal panel 39, fuselage station 180, and connect to shock mounted support.
RT-220/ARN-21 receiver-transmitter	Radio compartment—top shelf RH	<ol style="list-style-type: none"> Install unit on shock mounted support, and secure. Remove coaxial cable from stowage at fuselage station 200. Connect coaxial cable to face of unit, and secure.
ID-307/ARN-21 azimuth indicator	Radio compartment LH side—station 220	<ol style="list-style-type: none"> Install indicator on shock mounted support and secure with attaching hardware. Remove electrical connector from stowage forward of indicator. Connect electrical connector to indicator and secure.
CV-279/ARN-21 phase detecting network unit	Forward equipment compartment, front spar shear shelf RH side	<ol style="list-style-type: none"> Install unit on shear shelf and secure with attaching hardware. Remove electrical connector from stowage. Connect electrical connector to unit and secure.
ID-310/ARN-21 range indicator	Instrument console, cockpit floor, center line	<ol style="list-style-type: none"> Remove attaching hardware securing indicator lighting mask to console. Remove electrical connector from stowage. Connect electrical connector to indicator and secure. Install indicator in console, place lighting mask over face of indicator and secure indicator to console with attaching hardware.
ID-249/ARN course indicator	Instrument panel	<ol style="list-style-type: none"> Remove hardware securing adapter plate and lighting mask to instrument panel cut-out (below rate-of-climb indicator). Remove electrical connector from stowage at adapter plate, and remove adapter plate. Connect electrical connector to indicator and secure. Install indicator in instrument panel, place lighting mask over face of indicator, and secure both to instrument panel with attaching hardware.
C-866/ARN-21 control console	Cockpit—RH control panel	<ol style="list-style-type: none"> Remove electrical connector from stowage below RH control panel. Connect electrical connector to unit and secure. Place unit on RH control panel and secure fasteners.

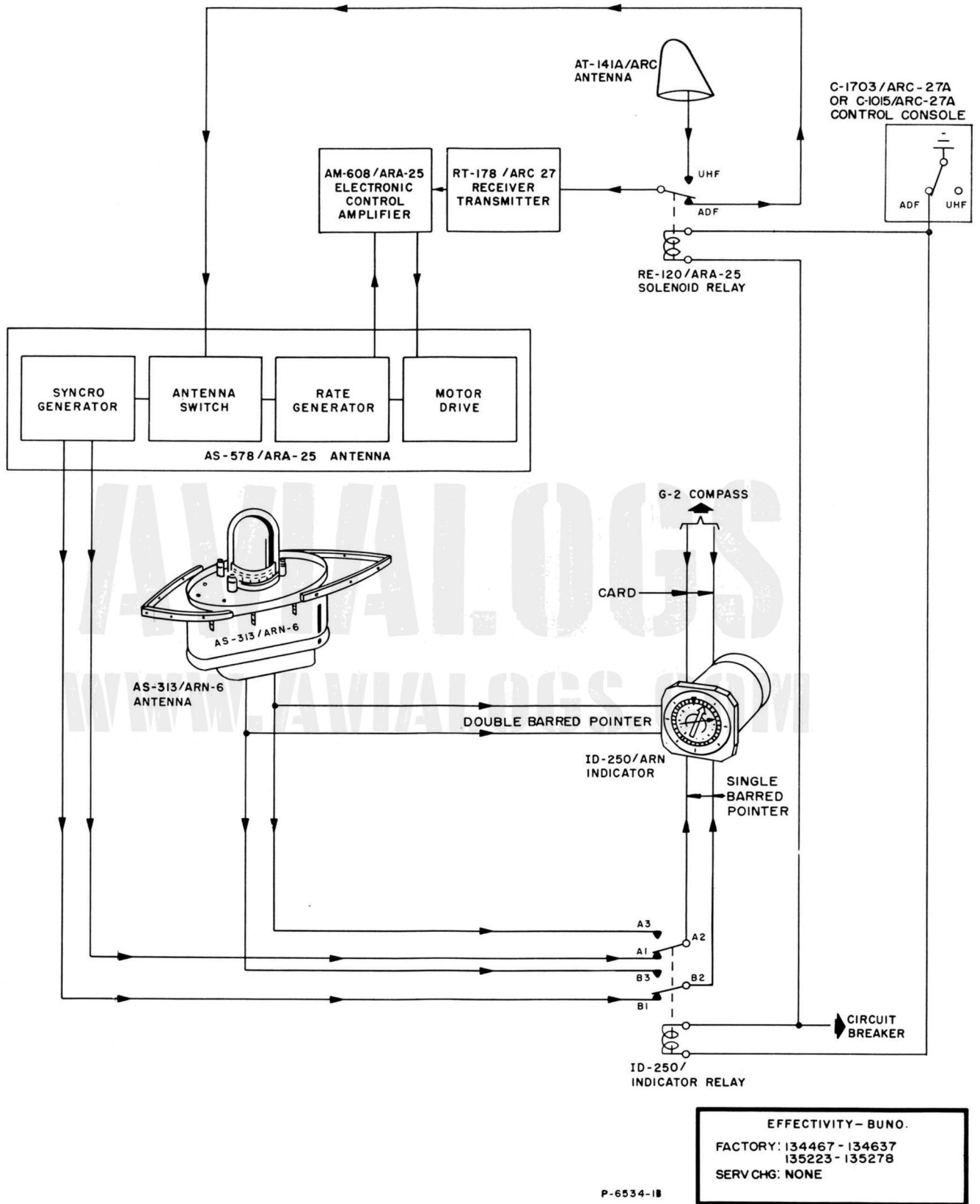


Figure 8-5. Direction Finding Radio Systems, Block Diagram for AN/ARC-27A, AN/ARA-25 and AN/ARN-6

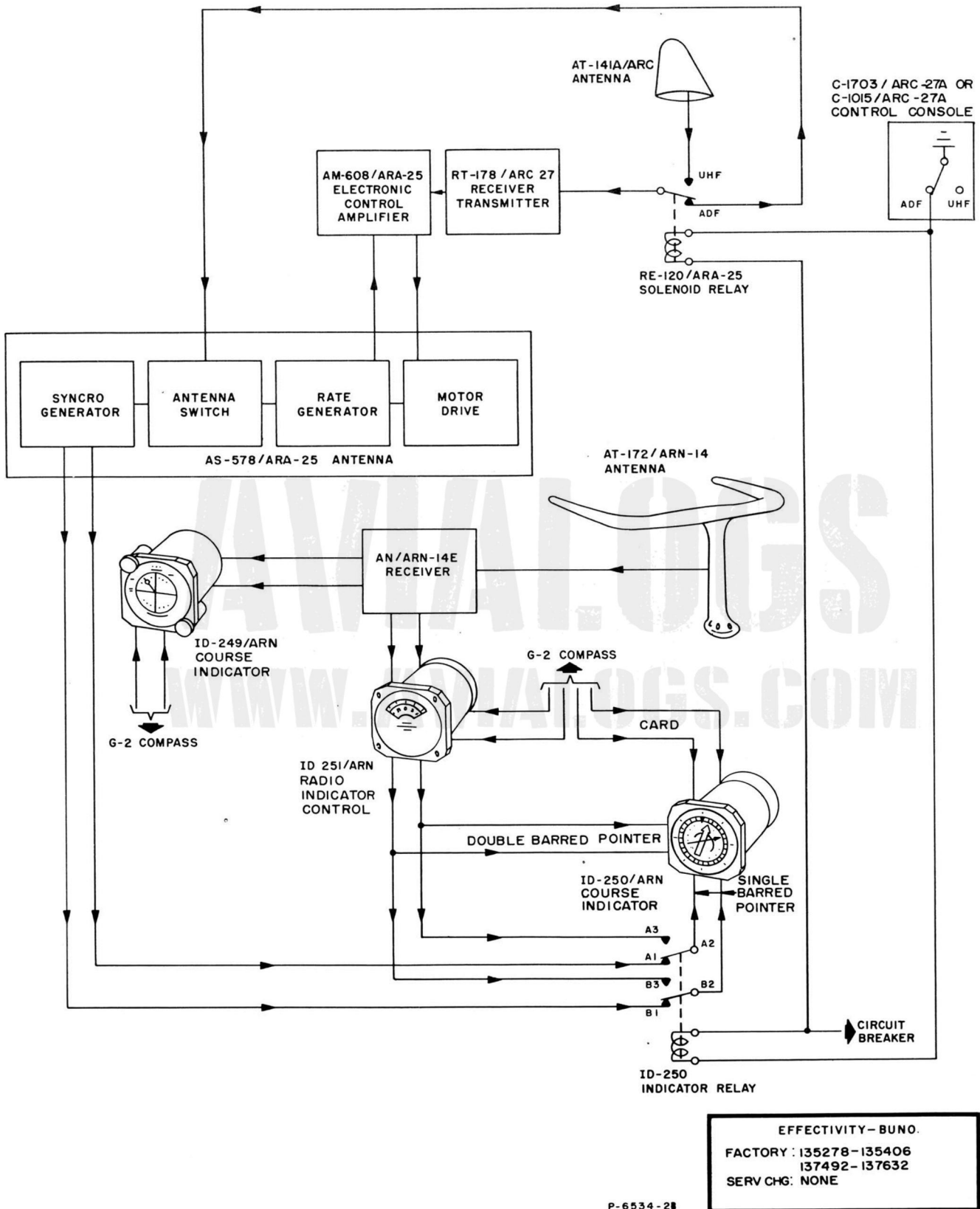


Figure 8-6. Direction Finding Radio Systems, Block Diagram for AN/ARC-27A, AN/ARA-25 and AN/ARN-14E

**TABLE 8-4. GROUND TESTING
AN/ARN-6 SYSTEM**

Preliminary Conditions:

- (1) External 28-volt dc power connected.
- (2) MASTER RADIO LF-ADF circuit breakers depressed.
- (3) MASTER RADIO switch ON. (Allow 5-minute warm-up.
- (4) Headset connected.
- (5) VOL control set at mid-point.

Control Setting and/or Operation	Desired Result
----------------------------------	----------------

(Applies to airplanes BuNo. 134466-135277)

- | | |
|--|---|
| a. Turn function switch to ANT. | Signals received on bands two, three, and four. |
| b. Turn function switch to ADF. Tune in stations on various bands. | Signals received on bands two, three, and four. Indicator moves smoothly to new bearings as new stations are tuned in. Indicated frequency and actual station frequency do not vary more than 2%. |
| c. Operate FREQ knob to rotate dial through entire range of calibration. | Dial moves smoothly. |
| d. Operate FREQ knob from neutral to maximum position of INC and DEC. | Speed of dial rotation increases as FREQ knob is operated. |

(Applies to airplanes BuNo. 135278-135406, 137492-137632, 139606-139821, and 142010-142081.)

- | | |
|--|--|
| a. Place function switch in ADI. | |
| b. Verify reception on all four bands. | Indicated frequency and station frequency do not vary more than 2%. |
| c. Set CW-VOICE switch in CW and check operation of beat frequency oscillator. | |
| d. Reset switch to VOICE. | |
| e. Place function switch in LOOP and verify reception on all four bands. | Indicated frequency and station frequency do not vary more than 2%. |
| f. Operate LOOP L-R switch. | Radio compass indicator responds smoothly in all directions selected. |
| g. If possible, tune within 200-400 kc band to station whose approximate direction is known. Rotate loop by LOOP-LR switch to obtain a sharp null. | (Note bearings on indicator.) |
| h. Displace loop approximately 90 degrees and place function switch in COMP. | As antenna returns to null, indicator returns to bearing obtained in step g. |

center-tapped antenna. The antenna is installed in the fuselage structure, above the radio compartment. The base of the antenna extends into the radio compartment, providing access to the compensator adjustment screws.

NOTE

All new and replacement antennas require bench adjustment prior to installation in the airplane. Refer to applicable technical publication and paragraph 8-50C.

8-50C. ADJUSTMENT.

a. Set function switch on ADF control console to ANT position.

b. Using black numbers, position O on loop scale, at loop scale index pointer; check that course indicator reads O plus or minus 2 degrees.

c. Remove circular cover plate from base of antenna by removing four small screws about the center, for access to the compensating adjustment screws. Note an adjustable screw opposite each number in column A.

d. To calibrate, position black numbers on loop scale at loop scale index pointer, in sequence, as given in column A. For each loop scale setting, adjust compensating screw opposite corresponding black number on compensating scale, so that course indicator reads as shown in column B.

CAUTION

Do not turn any one of the compensating screws more than three complete revolution at a time to avoid permanent damage to compensating assembly.

Black scale adjustment settings for loop antenna.

Column A	Column B	Column A	Column B
0	0	195	216
15	31	225	249
45	63	255	264
75	90	285	276
105	102	315	294
135	118	345	327
165	151		

8-51. AN/ARN-14E NAVIGATION SYSTEM.

8-52. DESCRIPTION. (See figures 8-6 and 8-8.) On airplanes not reworked to A-1/ASC 581 provisions are made for the installation of the AN/ARN-14E NAVIGATION SYSTEM. The major components of the system are:

Name	Location
R-540/ARN radio receiver	Top shelf radio compartment LH side

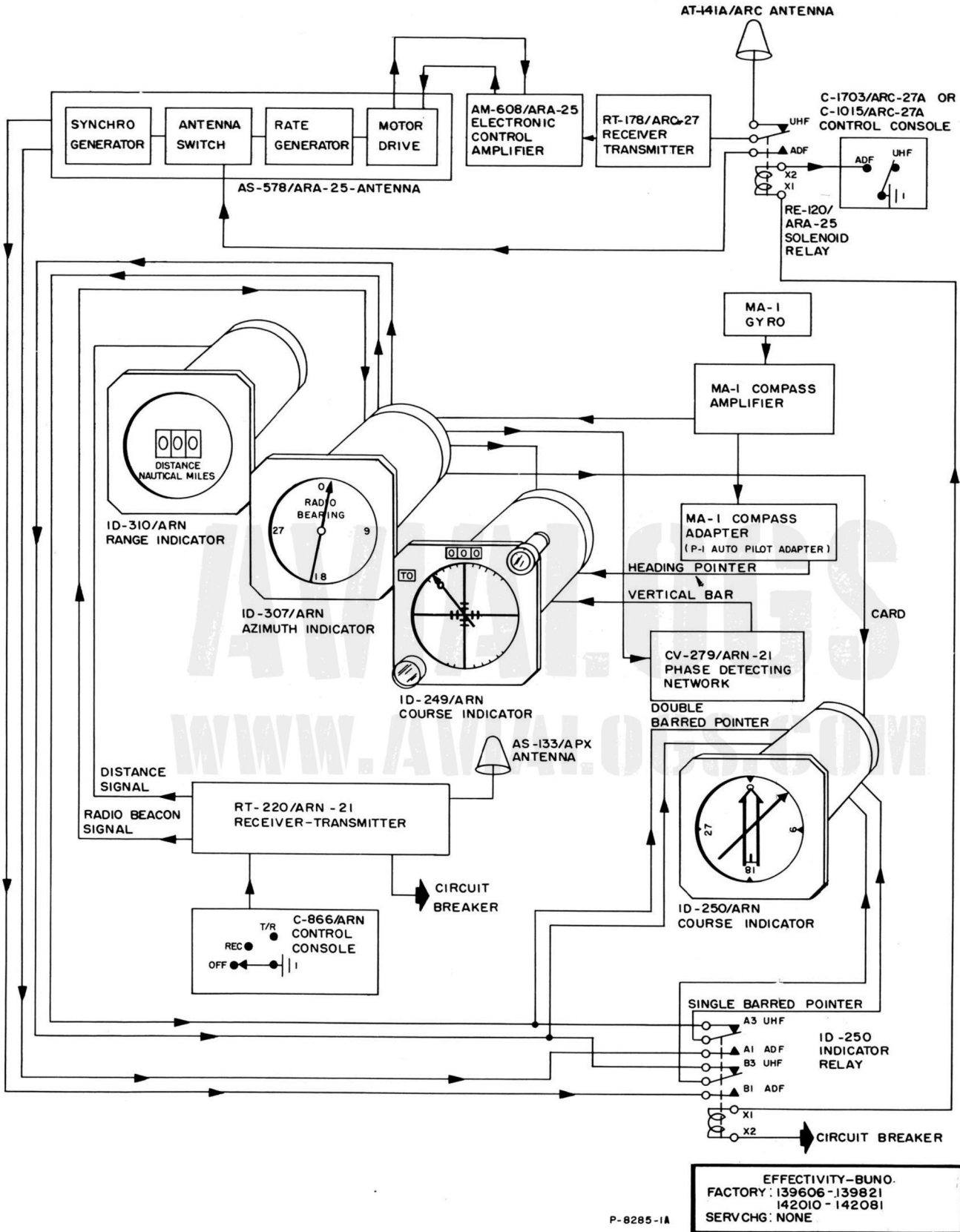


Figure 8-7. Direction Finding Radio Systems, Block Diagram for AN/ARC-27A, AN/ARA-25 and AN/ARN-21

Name	Location	Name	Location
DY-84/ARN dynamotor	Aft equipment compartment	AT-172/ARN antenna	Atop radio compartment at fuselage station 240,000
C-760B/A control console	RH control panel	AN/ARN-14 damping network	Terminal panel 44
ID-249/ARN course indicator	Instrument panel	ID-249 flag alarm resistor	Terminal panel No. 44
ID-250/ARN course indicator (Refer to section VI)	Instrument panel	ID-249 impedance matching resistor	Terminal panel No. 44
ID-251/ARN radio indicator control	Top shelf radio compartment LH side	ID-250 indicator relay (Refer to para 8-54L)	Terminal panel No. 17
		ID-250 course indicator damping resistors (Refer to para 8-54N)	Fwd equipmpt — station 110 right-hand side

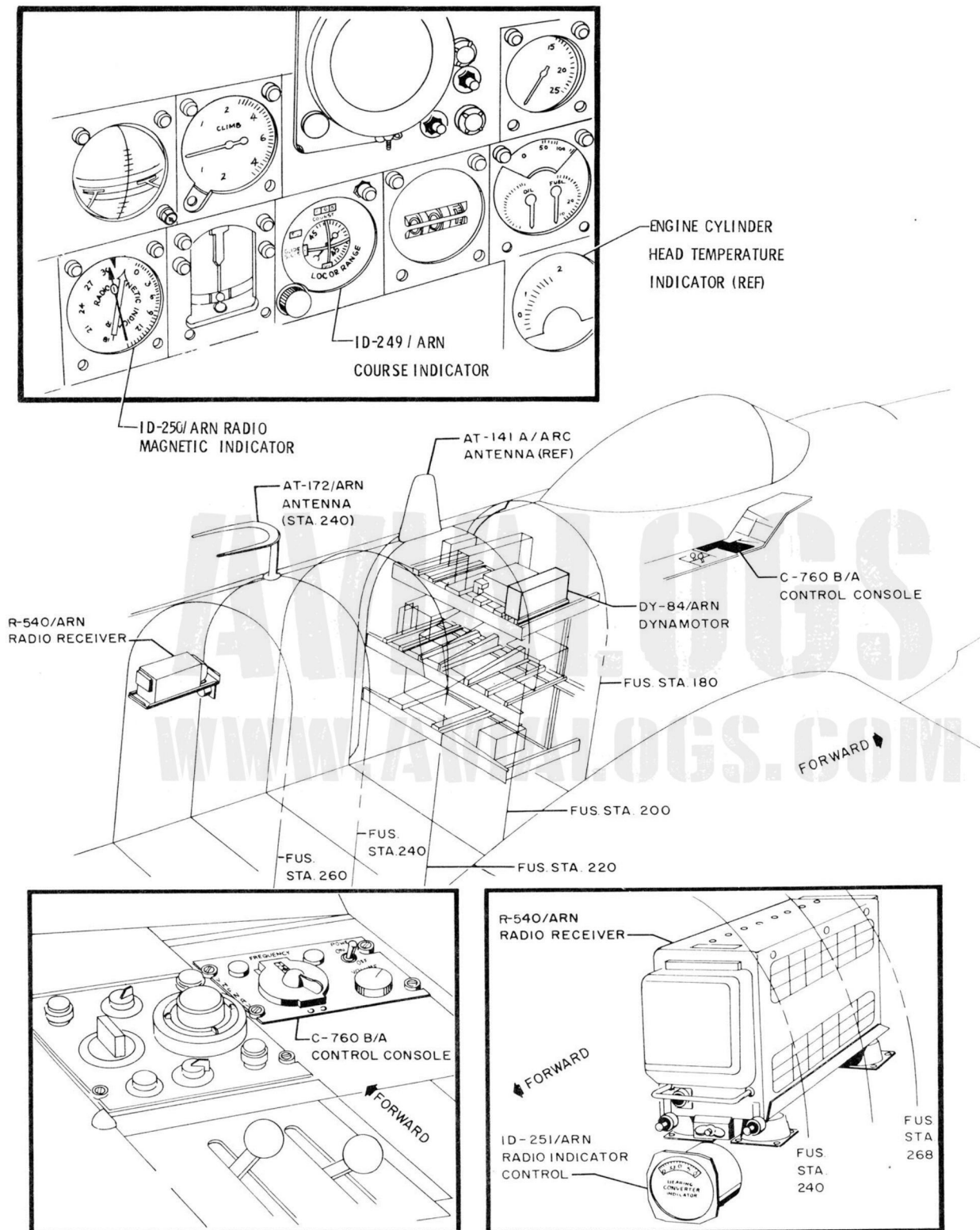
TABLE 8-4B. AN/ARN-14 TO AN/ARN-16 CONFIGURATION
Equipment Removal and Installation Procedure

AN/ARN-14E RADIO NAVIGATION SYSTEM REMOVAL
Applies to Airplanes BuNo. Not Reworked to A-1/ASC 581

Component	Location	Procedure
AT-172/ARN-14 antenna	Fuselage top, station 245	<ol style="list-style-type: none"> Disconnect coaxial cable plug from base of antenna. Stow in dummy receptacle at station 257 fuselage top (identified ARN-14 COAX STOW). Remove hardware attaching antenna to adapter plate. Remove antenna. Remove hardware attaching adapter plate to fuselage. Remove plate and stow beneath support structure for RT-540/ARN-14E receiver, station 240 RH side (identified as ARN-14 ADAPTER PLATE STOWAGE).
RT-540/ARN-14E receiver	Radio compartment LH side	<ol style="list-style-type: none"> Disconnect coaxial cable plug from ANT receptacle on front of receiver. Stow plug in dummy receptacle at station 240, LH side (identified ARN-14 COAX STOW RCVR). Release receiver from mounting rack and remove.
ID-251/ARN indicator	Radio compartment LH side—station 240	<ol style="list-style-type: none"> Disconnect plug at rear of indicator and stow in dummy receptacle at station 251, LH side (identified ID-251/ARN PLUG STOW). Remove hardware attaching indicator to mounting bracket. Remove indicator.
MT-627A/ARN-14 mounting rack	Radio compartment LH side—station 240	<ol style="list-style-type: none"> At terminal panel No. 44, remove wires interconnecting mounting rack to terminal panel. Remove hardware attaching mounting rack to support structure. Remove rack.
MT-962/ARN-14A mounting rack and DY-84/ARN-14A dynamotor	Radio compartment, top shelf RH side	<ol style="list-style-type: none"> Disconnect plug from dynamotor receptacle and stow in dummy receptacle at station 194, LH side (identified ARN-14 DYN STOWAGE). Release dynamotor from rack. Remove dynamotor. Remove hardware attaching mounting rack to radio shelf. Remove rack.
C-760A/ARN control console	Cockpit—RH control panel	Release fasteners and raise console. Disconnect plug at rear of console. Remove console. Stow plug in dummy receptacle in forward equipment compartment—RH side (identified ARN-14).

AN/ARN-6 RADIO NAVIGATION SYSTEM INSTALLATION

Component	Location	Procedure
AS-313/ARN-6 or AS-313B/ARN-6 antenna	Fuselage top, station 245	<ol style="list-style-type: none"> Install antenna base plate over cut-out in top of fuselage at station 245. Position antenna on base plate and install. Install CW-141/ARN-6 antenna housing by attaching housing to base plate. Connect plugs stowed in dummy receptacles at station 257 (identified ARN-6 CABLES STOWAGE) to receptacles in base of antenna.
MT-274-ARN mounting rack	Radio compartment, top shelf—RH side	<ol style="list-style-type: none"> Install mounting rack on top radio shelf, making certain that bonding straps are attached. Remove rack terminal strip cover plate and install wires. Replace cover plate.
R-101/ARN-6 or R-101A/ARN-6 receiver	Radio compartment, top shelf—RH side	Position receiver on mounting rack and secure. Connect plugs stowed in dummy receptacles at station 200, RH side (identified ARN-6 CABLES STOWAGE) to receptacles on receiver front panel.
C-1605/ARA-40 or Douglas 5439090 control console	Cockpit—RH control panel	Connect plug stowed in forward equipment compartment, RH side (identified ARN-6) to receptacle at rear of control console. Position console on control panel and secure fasteners.



C-760 B/A CONTROL CONSOLE

R-540/ARN RADIO RECEIVER AND ID-251/ARN RADIO INDICATOR CONTROL

ALF-2-2 P-6535-1B

Figure 8-8. AN/ARN-14E Navigation System

8-53. The AN/ARN-14E navigational system provides a means of receiving visual and aural flight information on all VHF omni-range, tone localizer, and voice facilities in the 108 to 136 megacycle signal band. The aural information is heard in the pilot's headset and the visual information is displayed on the ID-250/ARN, ID-249/ARN, ID-251/ARN, ID-307/ARN, and ID-310/ARN indicators. The ID-250/ARN course indicator of the G-2 or MA-1 compass systems operates in conjunction with the AN/ARA-25 automatic direction finding system and the AN/ARN-14E system. For further information pertaining to the ID-250/ARN course indicator, refer to section VI. For further information pertaining to the ID-249/ARN and ID-251/ARN course indicator, refer to Handbook of Operating Instructions for Radio Receiving Set AN/ARN-14C. For further information pertaining to the ID-307/ARN and ID-310/ARN indicators, refer to Handbook of Operating Instructions for Radio Set AN/ARN-21. The ARN-14 DAMPENING NETWORK is an impedance matching circuit, installed in the vertical bar circuit of the ID-249/ARN course indicator to prevent oscillation of the vertical bar. The dampening network consists of resistors and condensers. The ID-249 flag alarm resistor is installed in the vertical flag alarm circuit of the ID-249/ARN course indicator, to insure positive operation of the flag alarm. The ID-249 impedance matching resistor is connected between the ID-249/ARN course indicator and the 26-volt a-c power source.

8-54. The AN/ARN-14E operates on 28-volts direct current and 400-cycle, 115-volts alternating current. D-c voltage is obtained from the radio bus through the VOR circuit breaker; a-c voltage is obtained from phase A of the constant frequency a-c supply, through a one-ampere fuse.

8-54A. The system is placed in operation by setting the POWER switch on the C-760B/A control console to the ON position. For detailed operation of the AN/ARN-14E system in conjunction with the AN/ARA-25 system, refer to figure 8-6.

8-54B. The AN/ARN-14E navigation system is an alternate installation for the AN/ARN-6 radio compass system on airplanes not reworked to A-1/ASC 581. Refer to table 8-4B for converting the airplane AN/ARN-14E navigation system to the AN/ARN-6 radio compass system.

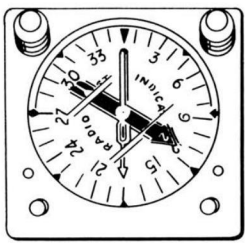
8-54C. GROUND TESTING. Refer to table 8-5. Ground testing of the AN/ARN-14E equipment as prescribed in table 8-8A requires the use of signal generator (AN type SG-66/ARM-5 or equivalent), a quarter-wave antenna (AT-172/ARN-14 or equivalent), and AN type RG-58/U coaxial cable with which to connect the antenna to the signal generator. During ground testing operations, place the signal generator in any convenient location while locating the antenna 20 to 50 feet from the airplane. Prior to operating the signal generator, refer to applicable technical publications.

8-54D. AN/ARN-21 NAVIGATIONAL RADIO HOMING SYSTEM.

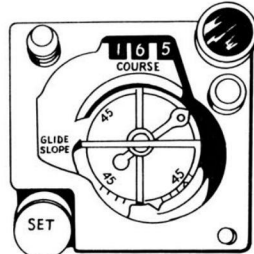
8-54E. DESCRIPTION. (See figures 8-7 and 8-9.) On airplanes BuNo. 139606-139821, and 142010-142081, and prior airplanes reworked to A-1/ASC 581 provisions are made for the installation of the AN/ARN-21 navigational radio homing system. Major components of the system are:

<u>Name</u>	<u>Location</u>
RT-220/ARN-21 receiver-transmitter	Radio compartment
CV-279/ARN-21 phase detecting network	Forward equipment compartment
ID-249/ARN course indicator	Instrument panel
ID-310/ARN range indicator	
ID-250/ARN course indicator	Instrument panel
ID-307/ARN azimuth indicator	Radio compartment
C-886/ARN-21 control console	Cockpit — RH control panel
ID-249/ARN flag impedance matching resistor	Terminal panel No. 39
ID-250 indicator relay	Terminal panel No. 17
ID-250 course indicator damping resistors	Fwd equip compt — station 110 right-hand side
AS-133/APX antenna	Fuselage top sta 220

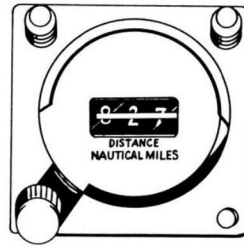
8-54F. The AN/ARN-21 navigational radio homing system operates in conjunction with a ground or shipboard AN/URN-3 radio beacon to provide aural and visual information. The aural information is heard in the pilot's headset and the visual information



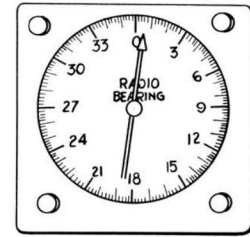
ID-250/ARN COURSE INDICATOR



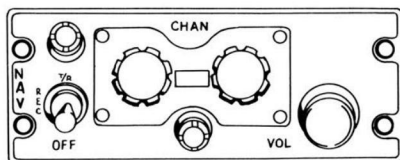
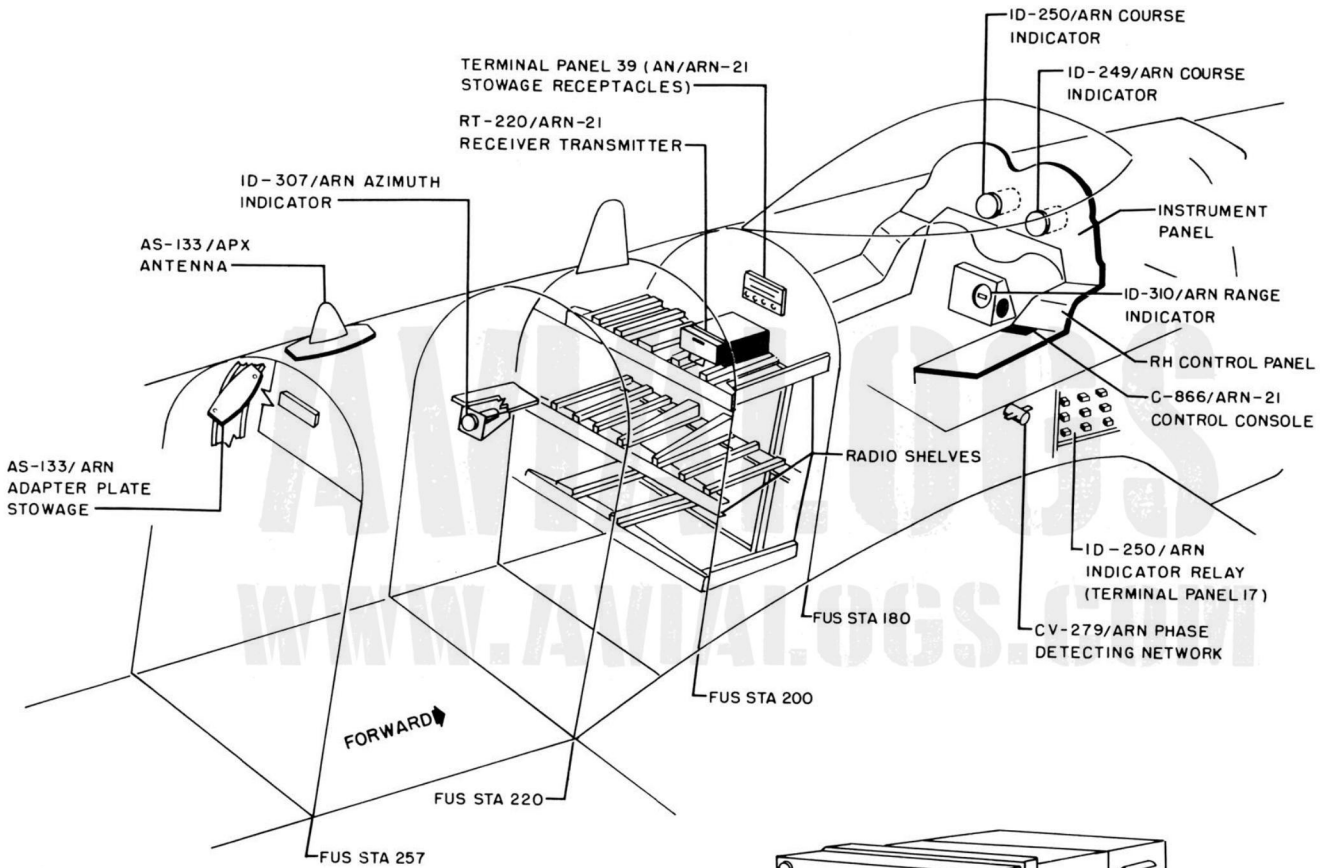
ID-249/ARN COURSE INDICATOR



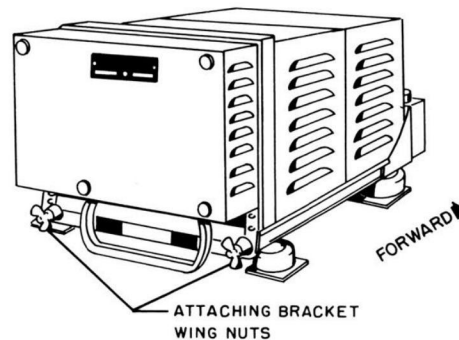
ID-310/ARN RANGE INDICATOR



ID-307/ARN AZIMUTH INDICATOR



C-866/ARN-21 CONTROL CONSOLE



RT-220/ARN-21 RECEIVER-TRANSMITTER

CAUTION
REFER TO PARAGRAPH 8-54L FOR
RT-220/ARN-21 REPLACEMENT.

P-8216-1A

Figure 8-9. AN/ARN-21 Navigational Radio Homing System

is displayed by the ID-249/ARN, ID-310/ARN, ID-250/ARN, and ID-307/ARN indicators. The ID-250/ARN course indicator of the G-2 or MA-1 compass systems operate in conjunction with the AN/ARA-25 automatic direction finding system and the AN/ARN-21 system. For further information pertaining to the ID-250/ARN course indicator, refer to section VI. For further information pertaining to the ID-307/ARN and ID-310/ARN indicators, RT-220/ARN-21 receiver-transmitter, CV-279/ARN-21 phase detecting network, and C-886/ARN-21 control console, refer to handbook of operating instructions for Radio Set AN/ARN-21. The ID-249/ARN flag impedance matching resistor is connected in the flag circuit of the vertical bar on the ID-249/ARN course indicator, to insure proper flag operation.

8-54G. The AN/ARN-21 equipment operates on 115 volts and 26 volts from phases A and B of the constant frequency a-c power supply system and 28 volts dc from the radio bus. The equipment is readied for operation by depressing the LF ADF circuit breaker.

8-54H. The system is placed in operation by placing the control switch on the C-866/ARN-21 control console in the REC position. For detailed operation of the AN/ARN-21 system in conjunction with the AN/ARA-25 system see figure 8-7.

8-54J. The AN/ARN-21 navigational radio homing system is an alternate installation for the AN/ARN-6 radio compass system on airplanes BuNo. 139606 through 139821, and 142010 through 142081. Refer to table 8-5A for information to convert the airplane AN/ARN-21 navigational radio homing system to the AN/ARN-6 radio compass system.

8-54K. GROUND TESTING. For testing refer to BUAER Preflight: Flight Test Instructions for Radio Set AN/ARN-21, ET-224, dated 1 October 1956.

8-54L. A modified RT-220/ARN-21 receiver-transmitter is installed on airplanes BuNo. 142010, and 142070 through 142081. The modified receiver-transmitter contains a pulse suppressor circuit. The only identifying difference between a modified and a non-modified receiver-transmitter is a J112 plug which has been added adjacent to the existing plug J804. A chain anchored, twist-on type dust cap is provided for the new J112 plug. By connecting a coaxial cable (Douglas 7438711-541) between

plug J112 and the input on the APX-6 receiver-transmitter marked SUP parasitic homing signals that trigger the oscillators in the AN/APX-6 system are trapped in the suppressor circuit and eliminated.

CAUTION

When replacing the RT-220/ARN-21 receiver-transmitters on airplanes BuNo. BuNo. 142010, and 142070 through 142081, DO NOT install receiver-transmitters that are not equipped with a J112 plug.

8-54M. ID-250 INDICATOR RELAY.

8-54N. DESCRIPTION. The ID-250 indicator relay is a double-pole, double-throw type relay which connects the pointers of the ID-250/ARN course indicator to the AN/ARA-25, AN/ARN-6, AN/ARN-14E, and AN/ARN-21 systems. The coil of the relay is energized when the control switch on the C-2459/ARC-27A UHF control panel is in ADF position. For detailed operation of the ID-250 indicator relay, see figures 8-5, 8-6, or 8-7. For further information pertaining to the ID-250/ARN course indicator, refer to section VI.

8-54P. ID-250 COURSE INDICATOR DAMPING RESISTOR.

8-54Q. DESCRIPTION. The ID-250 course indicator damping resistors are connected in series between the stator windings of the ID-250/ARN course indicator, and the electrical contacts of the ID-250 indicator relay. The ID-250 course indicator damping resistors prevent spinning and/or oscillation of the ID-250/ARN course indicator pointers when turning on the AN/ARA-25, AN/ARN-6, AN/ARN-14E, or AN/ARN-21 systems.

8-54R. ID-249/ARN COURSE INDICATOR.

8-54S. DESCRIPTION. The ID-249/ARN course indicator provides identical visual information when connected to either the AN/ARN-14E navigation system or the AN/ARN-21 navigation radio homing system. For further information pertaining to the ID-249/ARN course indicator, refer to handbook of operating instructions for Radio Receiving Set AN/ARN-14C.

**TABLE 8-5A. AN/ARN-21 TO AN/ARN-6 CONFIGURATION
Equipment Removal and Installation Procedure**

**AN/ARN-21 NAVIGATION RADIO HOMING SYSTEM REMOVAL
Applies to Airplanes BuNo. 139606-139821, and 142010-142081**

<i>Component</i>	<i>Location</i>	<i>Procedure</i>
AS-133/APX antenna	Fuselage top, station 245	<ol style="list-style-type: none"> Open radio compartment access door, bottom fuselage. Remove coaxial cable from antenna and stow at fuselage station 257. Remove hardware securing antenna to adapter plate. Remove antenna. Remove hardware securing adapter plate to fuselage. Remove adapter plate. Stow adapter plate at fuselage top, station 240.
RT-220/ARN-21 receiver-transmitter	Radio compartment— top shelf RH	<ol style="list-style-type: none"> Remove coaxial cables from face of unit, and stow at fuselage station 200. Release unit from shock mounted support, and remove unit from airplane. Disconnect electrical connectors from shock mounted support and stow at terminal panel 39, fuselage station 180. Remove hardware securing shock mounted support to radio shelf, and remove support from airplane.
ID-307/ARN-21 azimuth indicator	Radio compartment, LH side—station 220	<ol style="list-style-type: none"> Disconnect electrical connector and stow forward of indicator. Remove hardware securing indicator to shock mounted support, and remove indicator.
CV-279/ARN-21 phase detecting network unit	Forward equipment compartment, front spar shear shelf, RH side	<ol style="list-style-type: none"> Disconnect electrical connector and stow. Remove attaching hardware, and remove unit.
ID-310/ARN-21 range indicator	Instrument console, cockpit floor, center line	<ol style="list-style-type: none"> Disconnect electrical connector and stow forward of indicator. Remove hardware securing indicator to console, and remove indicator. Reinstall indicator lighting mask with attaching hardware, and secure.
ID-249/ARN course indicator	Instrument panel	<ol style="list-style-type: none"> Remove hardware securing indicator to instrument panel. Remove indicator and disconnect electrical connector. Connect electrical connector to receptacle on DAC 4545248 adapter plate, and install in vacated cut-out with attaching hardware.
C-866/ARN-21 control console	Cockpit—RH control panel	<ol style="list-style-type: none"> Release fasteners and lift unit from console. Disconnect electrical connector and remove unit. Stow electrical connector below RH control panel.

AN/ARN-6 RADIO COMPASS SYSTEM INSTALLATION

<i>Component</i>	<i>Location</i>	<i>Procedure</i>
AS-313/ARN-6 or AS-313B/ARN-6 antenna	Fuselage top, station 245	<ol style="list-style-type: none"> Install antenna base plate over cut-out in top of fuselage at station 245. Position antenna on base plate and install. Install CW-141/ARN-6 antenna housing by attaching housing to base plate. Connect plugs stowed in dummy receptacles at station 257 (identified ARN-6 CABLES STOWAGE) to receptacles in base of antenna.
MT-274/ARN mounting rack	Radio compartment, top shelf—RH side	<ol style="list-style-type: none"> Install mounting rack on top radio shelf, making certain that bonding straps are attached. Remove rack terminal strip cover plate and install wires. Replace cover plate.
R-101/ARN-6 or R-101A/ARN-6 receiver	Radio compartment, top shelf—RH side	Position receiver on mounting rack and secure. Connect plugs stowed in dummy receptacles at station 200, RH side (identified ARN-6 CABLES STOWAGE) to receptacles on receiver front panel.
C-1605/ARA-40 or Douglas 5439090 control console	Cockpit—RH control panel	Connect plug stowed in forward equipment compartment, RH side (identified ARN-6) to receptacle at rear of control console. Position console on control panel and secure fasteners.

Section VIII

AN 01-40ALF-2

Paragraphs 8-54V to 8-54X

audio switch is provided to permit the aural indication in the headset to be turned ON or OFF. On airplanes BuNo. 134466, 134520-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, the audio matching resistor is installed to establish a satisfactory audio output level from the R-122/ARN-12 receiver.

8-54W. The AN/ARN-12 equipment operates on 28-volt d-c power obtained from the radio bus through the MARKER BEACON circuit breaker. On airplanes BuNo. 134466, 134559 and subsequent, a radio noise filter is connected in series between the radio bus and the circuit breaker. The system is energized when the circuit breaker is depressed and the MASTER RADIO switch is "ON."

8-54X. GROUND TESTING. (Refer to table 8-5B.) Ground operation tests of the AN/ARN-12 equipment require the use of a BC376-H test oscillator (part of I-76 test set). The following is the correct procedure for using the oscillator:

a. Place oscillator on ground, 15 feet away from marker beacon antenna (left-hand wing tip).

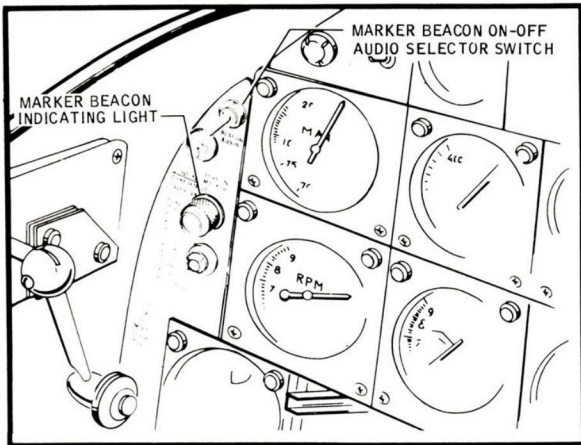
b. Fully extend telescopic antenna and move oscillator so that antenna is parallel with fore-and-aft axis of airplane.

c. Turn oscillator on and set modulation for 1300 cycles.

TABLE 8-5B. GROUND TESTING AN/ARN-12 SYSTEM

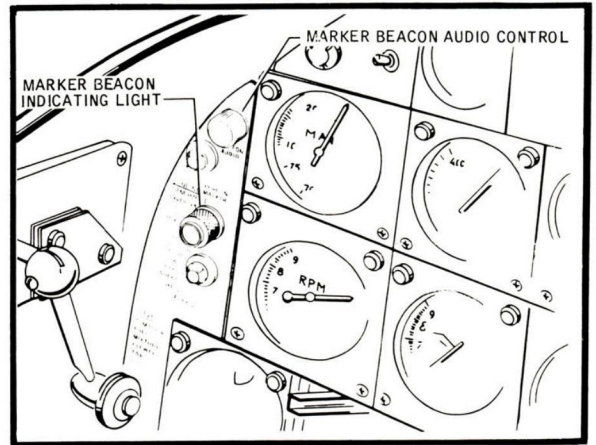
<i>Control Setting and/or Operation</i>	<i>Desired Result</i>
Connect external source of 28-volt d-c power	
Employ test oscillator as described in paragraph 8-56	
MASTER RADIO and MARKER BEACON circuit breakers: depress	
MASTER RADIO switch: "ON"	
Connect headset	Marker beacon indicating light on; 1300-cycle tone heard in headset.
MASTER RADIO switch: "OFF"	





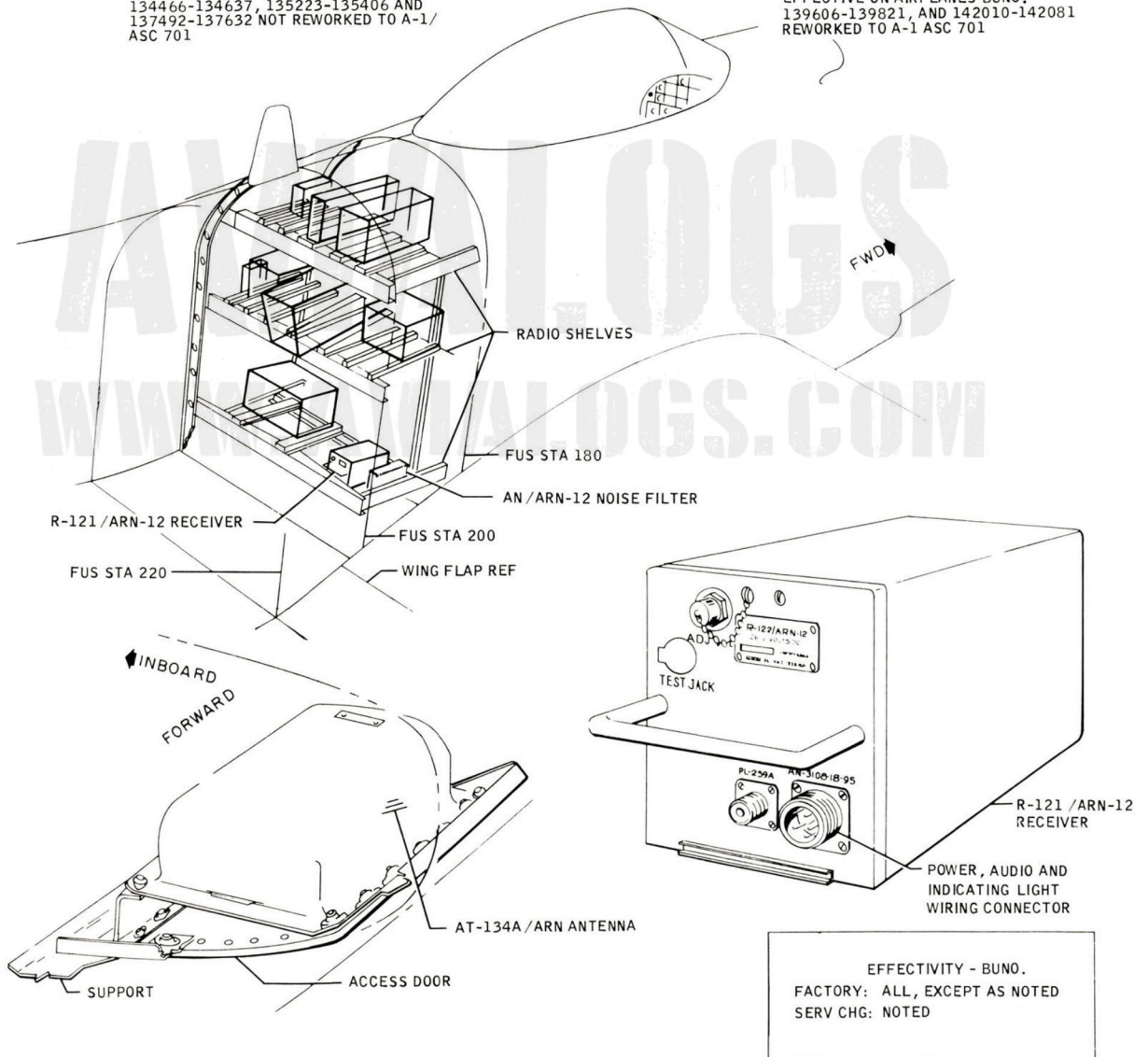
(INSTRUMENT PANEL)

EFFECTIVE ON AIRPLANES BUNO. 134466-134637, 135223-135406 AND 137492-137632 NOT REWORKED TO A-1/ASC 701



(INSTRUMENT PANEL)

EFFECTIVE ON AIRPLANES BUNO. 139606-139821, AND 142010-142081 REWORKED TO A-1 ASC 701



ALF-2 P-3979-1D

Figure 8-10. AN/ARN-12 Marker Beacon Radio Navigation System

Section VIII

Paragraphs 8-54T to 8-54AB

8-54T. AN/ARN-12 MARKER BEACON RADIO NAVIGATION SYSTEM.

8-54U. DESCRIPTION. (See figure 8-10.) A list of the major components of the AN/ARN-12 marker beacon radio navigation system are as follows:

<u>Name</u>	<u>Location</u>
Circuit breaker, 5-amp, identified MARKER BEACON	Cockpit—forward equipment compartment circuit breaker panel
R-122/ARN-12 receiver	Radio compartment—lower shelf, RH
Marker beacon indicating light	Cockpit—instrument panel, LH
AT-134/ARN antenna	Wing—LH wingtip, lower surface
AN/ARN-12 noise filter	Radio compartment—station 197, RH
Audio matching resistor	Terminal panel 23
Marker beacon audio control	Cockpit—instrument panel, LH

8-54V. The AN/ARN-12 marker beacon radio navigation system is an airborne navigational aid. Functionally, the system receives pulse modulated, 75-megacycle signal markers from ground based installations commonly referred to as marker beacon transmitters. The received signals are converted into aural and visual indications which provide a means of determining the relative position of the airplane with respect to specific marker beacon stations. The aural indication is heard in the headphones and the visual indication is observed on the marker beacon indicating light.

8-54W. The AN/ARN-12 equipment operates on 28-volt dc power obtained from the radio bus through a five-ampere circuit breaker. The circuit breaker is installed in the cockpit on the forward equipment compartment circuit breaker panel and is identified as MKR BEACON. The system is energized when the MASTER RADIO ON OFF selector switch is placed to the ON position.

8-54X. GROUND TESTING. (Refer to table 8-5B.) Ground operation tests of the AN/ARN-12 equipment requires the use of a BC376-H test oscillator (part of I-76 test set). The following is the correct procedure for using the oscillator.

a. Place oscillator on ground, 15 feet away from marker beacon antenna (left-hand wingtip).

b. Fully extend telescopic antenna and move oscillator so that antenna is parallel with the fore-and-aft axis of the airplane.

c. Turn oscillator on and set modulation for 1300 cycles.

TABLE 8-5B. GROUND TESTING AN/ARN-12 SYSTEM

<u>Control Setting and/or Operation</u>	<u>Desired Result</u>
Connect external source of 28-volt dc power	
Employ test oscillator as described in paragraph 8-54X.	
Connect headset MASTER RADIO and MARKER BEACON circuit breakers: depress MASTER RADIO ON OFF selector switch: ON	
Vary marker beacon audio control from fully counterclockwise position to fully clockwise position. MASTER RADIO OFF ON selector switch: OFF	1300 cycle tone heard in headset increases in intensity as control knob is varied.

8-54Y. R-122/ARN-12 RECEIVER.

8-54Z. DESCRIPTION. (See figure 8-10.) The R-122/ARN receiver is installed in the rear compartment on the left-hand side of the upper radio equipment shelf. The receiver receives a fixed frequency of 75 megacycles modulated by 400, 1300, or 3000 cycles. The signal, transmitted from the station transmitter, is fed into a superheterodyne-type circuit having a crystal controlled local oscillator, a mixer, two stages of audio frequency amplification, a push-pull output stage, an audio rectifier, and a dc amplifier for the visual indicator. The visual indicator (amber lens) is illuminated when the receiver receives a signal of sufficient amplitude (in the range of the beacon transmitter) to raise the plate voltage of the dc amplifier sufficiently to close the relay circuitry to the lamp. Simultaneously, the audio circuit detects, amplifies, and transfers the tone information to the headset.

8-54AA. MARKER BEACON INDICATING LIGHT.

8-54AB. DESCRIPTION. (See figure 8-10.) The marker beacon indicating light is installed in the

pilot's instrument panel and is identified as MARKER BEACON. The light provides visual indication of keyed or continuous marker beacon pulses. Pulses to the indicating light are controlled by the keying relay contained within the R-122/ARN-12 receiver. The indicating light is the press-to-test type and receives 28-volt dc power from the primary bus through a five-ampere WARNING LIGHT circuit breaker installed in the right-hand circuit breaker panel.

8-54AC. AT-134A/ARN ANTENNA.

8-54AD. DESCRIPTION. (See figure 8-10.) The AT-134A/ARN antenna is a resonant cavity type fabricated from aluminum alloy. The antenna is flush-mounted to the lower surface of the left-hand wing tip outboard of station 289. The resonant cavity contains a bent-channel receiving element and a temperature compensated fixed capacitor connected in parallel with a small variable capacitor. The receiving element is connected to the cavity and has a shaft which is slotted for screwdriver adjustment. The adjustment permits the sharp tuning at 75 megacycles. The antenna is coupled to the R-122A/ARN receiver by a section of coaxial cable with an impedance match of 52 ohms.

8-54AE. REMOVAL.

- Remove screws securing phenolic cover to underside of left-hand wingtip.
- Remove four antenna attaching screws.
- Disconnect coaxial connector from coaxial receptacle on antenna and remove antenna from airplane.

8-54AF. INSTALLATION.

- Position antenna and connect coaxial connector to coaxial receptacle on antenna.
- Install four antenna attaching screws.
- Install phenolic cover and secure with attaching screws.

8-54AG. AN/ARN-12 NOISE FILTER.

8-54AH. DESCRIPTION. (See figure 8-10.) The AN/ARN-12 noise filter is installed in the rear compartment on the left-hand side at station 200. As a part of the dc electrical circuit, the noise filter is connected in series between the radio bus and the R-122/ARN-12 receiver to prevent interference signals from being introduced into the AN/ARN-12 marker beacon radio navigation system.

8-54AJ. MARKER BEACON AUDIO CONTROL.

8-54AK. DESCRIPTION. (See figure 8-10.) The marker beacon audio control is installed on airplanes 139606-139821 and 142010-142081 reworked to A-1/ASC 701. The audio control identified MARKER BEACON AUDIO is located in the cockpit and is

installed on the upper left-hand corner of the pilot's instrument panel. The audio control is a 2500-ohm rheostat used to vary the amplitude of the marker beacon tone received in the pilot's headset.

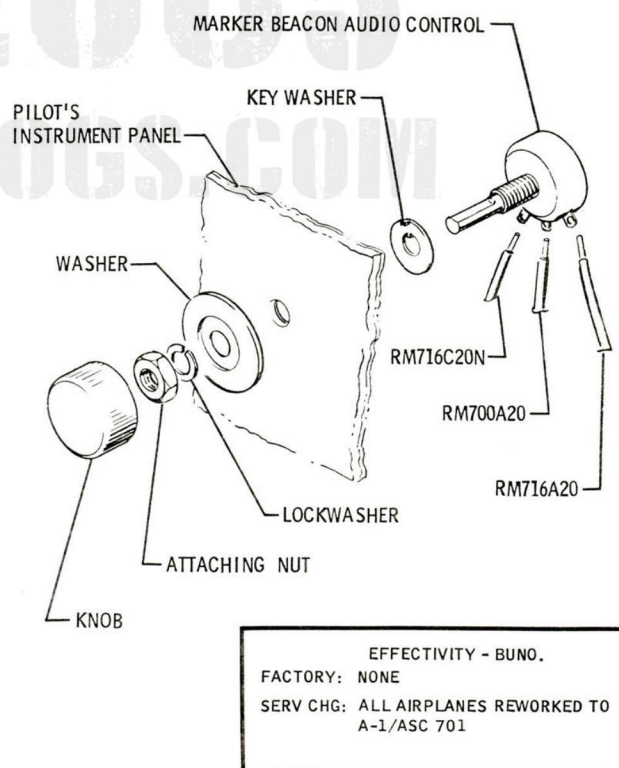
8-54AL. REMOVAL. See figure 8-10A.

- Verify that no external source of electrical power is connected to airplane.

CAUTION

Airplane external power input receptacle must be placarded to the effect that there are loose wires in the cockpit area.

- Place MASTER RADIO ON OFF selector switch in OFF position.
- Remove knob, attaching nut, and washers which secures marker beacon audio control to pilot's instrument panel.
- Push audio control through instrument panel and remove washer from audio control shaft.
- Unsolder wires from audio control electrical terminals.



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Figure 8-10A. Marker Beacon Audio Control Removal and Installation

f. Insulate all removed wires, and secure wire and loose hardware removed from audio control to the instrument panel.

g. Inspect stowed wires for safety and remove placard from electrical input receptacle.

8-54AM. INSTALLATION. See figure 8-10A.

a. Verify that no external source of electrical power is connected to airplane.

b. Remove replacement audio control from packing and inspect for cleanliness and condition of electrical connectors.

c. Solder wires with (Fed. Spec. QQ-S-571) solder to audio control. (See figure 8-10A.)

d. Place washer over shaft of audio control and insert shaft of audio control through mounting hole on pilot's instrument panel from aft side.

e. Place washers on shaft protruding through mounting hole and secure audio control to pilot's instrument panel with attaching nut.

f. Install knob on shaft of audio control.

8-55. RADAR SYSTEMS.

8-56. DESCRIPTION. The radar systems provide facilities for airplane altitude indication, aircraft identification, detection and location of targets, mapping and navigational information. The radar systems installed in the airplane, their functions and power sources, are listed in table 8-5C.

8-57. AN/APN-22 RADAR ALTIMETER SYSTEM.

8-58. DESCRIPTION. (See figure 8-11.) The major components of the AN/APN-22 radar altimeter system are as follows:

<u>Name</u>	<u>Location</u>
Circuit breaker, 5-amp, identified ALTM	Fwd equip compt — circuit-breaker panel
RT-160/APN-22 radar receiver-transmitter	Horizontal stabilizer
AM-291/APN-22 electronic control amplifier	Radio compartment
ID-257/APN height indicator	Instrument panel

8-59. The AN/APN-22 radar altimeter system provides an indication of airplane altitude above terrain. Altitude is indicated on the ID-257/APN height indicator. On all airplanes except BuNo. 134466-134484, inclusive, the AN/APS-19C search radar system is connected to the ID-257/APN height indicator to provide the later system with altitude information.

8-60. The AN/APN-22 equipment operates on 28-volt dc, 400-to-800-cycle, 115-volt ac, and 400-cycle, 115-volt ac power. D-c power is obtained from the radio bus through the ALTM circuit breaker; 400-to-800-cycle a-c is obtained from phase C of the a-c generator through a 1-ampere fuse; 400-cycle a-c is obtained from phase A of the No. 2 inverter through a 1-ampere fuse.

8-61. GROUND TESTING. Refer to table 8-6.

8-62. AN/APX-6 IDENTIFICATION RADAR (IFF) SYSTEM.

8-63. DESCRIPTION. (See figure 8-12.) The major components of the AN/APX-6 recognition radar identification set are as follows:

<u>Name</u>	<u>Location</u>
Circuit breaker, 1.5 amp, identified IFF CONT	Cockpit circuit-breaker panel
RT-82/APX-6 receiver-transmitter	Radio compartment—beneath lower shelf, LH
MT-362A/A mounting	Radio compartment—beneath lower shelf, LF
C-629/APX-6 control console	RH control panel
AS-133/APX antenna	Fuselage — sta 305, lower, center
Mode control relay	Terminal panel 17

8-64. The AN/APX-6 identification radar (IFF) system provides the airplane with a means of identifying itself when correctly challenged by surface of airborne radar equipment. The system also permits surface tracking and control of the airplane in which it is installed. Functionally, the AN/APX-6 system receives challenges and transmits replies for display with associated radar targets on the radar indicator.

8-65. The AN/APX-6 equipment operates on 400-to-800-cycle, 115-volt ac and 28-volt dc power. A-c power is obtained from phase A of the a-c generator through a

TABLE 8-5C. RADAR SYSTEMS

System	Para Ref	Function	Power Source	Circuit Breaker or Fuse	
				Amp	Ident
AN/APN-22	8-57	Radar altimeter system	Radio bus	5	ALTM
			Constant frequency a-c power supply	1	ALTM
			Variable frequency a-c power supply	1	ALTM
AN/APX-6	8-62	Identification radar (IFF) system	Secondary bus	5	IFF CONT
			Battery bus on airplanes BuNo. 134466-134637	10	IFF DESTR CANOPY JETTISON
			Variable frequency a-c power supply	1	IFF CONT
AN/APS-19C	8-72	Search radar system	Monitor bus	10	SEARCH RADAR
			Monitor bus	35	SEARCH RADAR
			Variable frequency a-c power supply	10	SEARCH RADAR

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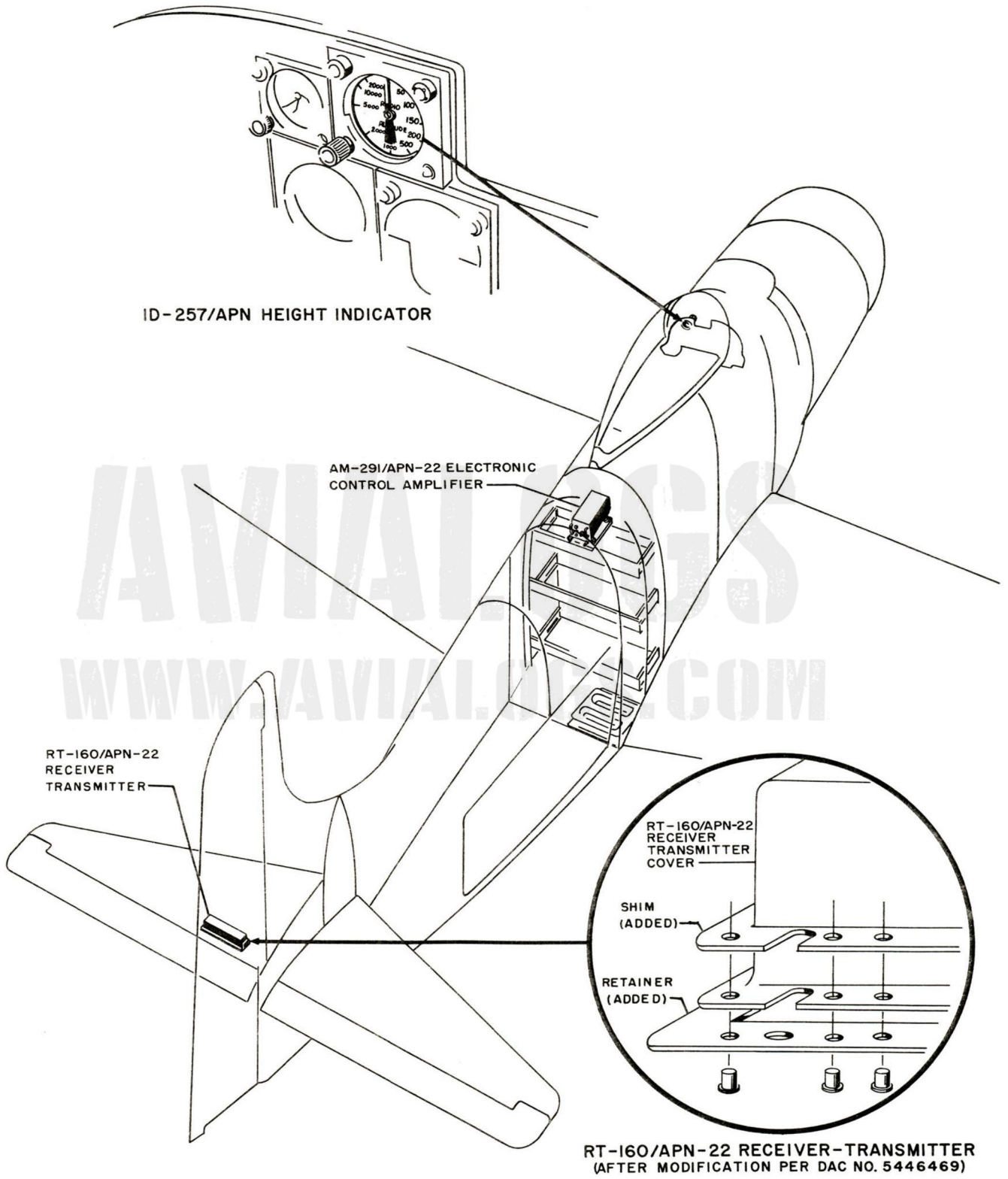


Figure 8-11. AN/APN-22 Radar Altimeter System

TABLE 8-6. GROUND TESTING AN/APN-22 SYSTEM

Note

Ground testing of the AN/APN-22 equipment requires the use of an AN/APM-66 radar test set. Operation of this test set as applied to the AN/APN-22 system equipment is described in the applicable technical publication (AN16-30/APM-66-1).

<i>Control Setting and/or Operation</i>	<i>Desired Result</i>
External source of 28-volt d-c power connected	
ON-LIMIT switch on RADIO ALTITUDE indicator: rotate clockwise. (Allow 30-minute warm-up)	
MX-1381/APM-66 delay line: place in position flush against face of receiver-transmitter	Radio altitude indicator ID-257/APN reads 157-173 feet less residual altitude (9.5 ft.).
With ID-257/APN indicating residual altitude, move limit "bug" to a point 15 feet above indicated altitude	Illumination of altitude warning light should occur.
Move limit "bug" to a point 15 feet below indicated altitude	Altitude warning light should be extinguished and remain off for all "bug" settings below 15 feet.
Remove MX-1381/APM-66 delay line from face of receiver-transmitter	
Place hand over either horn opening of antenna	Pointer of ID-257/APN indicator moves behind mask.

5-ampere fuse, and d-c power is obtained from the secondary bus through the circuit breaker. The system is energized when the circuit breaker is depressed and the MASTER switch on the IFF control console is set to the "NORM" position.

8-66. DELETED.

8-67. GROUND TESTING. All test procedure should be referred to the proper authority.

8-68. AN/APX-6 RECEIVER-TRANSMITTER.

8-69. DESCRIPTION. (See figure 8-12.) The AN/APX-6 receiver-transmitter is remotely controlled by the AN/APX-6 (C-629/APX-6) control console.

8-69A. On airplanes BuNo. 142010, and 142070 through 142081, a coaxial cable (Douglas 7438711-541) is connected between the input plug on the RT-82/APX-6 receiver-transmitter, marked "SUP," and the J112 plug on the RT-220/ARN-21 receiver-transmitter. This cable installation is provided to prevent the AN/ARN-21 navigational homing system from interfering with the identification radar system.



Should the receiver-transmitter require removal on airplanes BuNo. 134466 through 134637, make certain destructors are removed from their respective jacks immediately following removal procedure. Before installing receiver-transmitter, obtain a voltmeter capable of reading less than 0.1-volt d-c and measure voltage at destructor jacks. If no voltage is present, proceed with installation. However, if a voltage reading is noted, do not continue the installation until the voltage source is located and the condition remedied.

8-70. AN/APX-6 CONTROL CONSOLE.

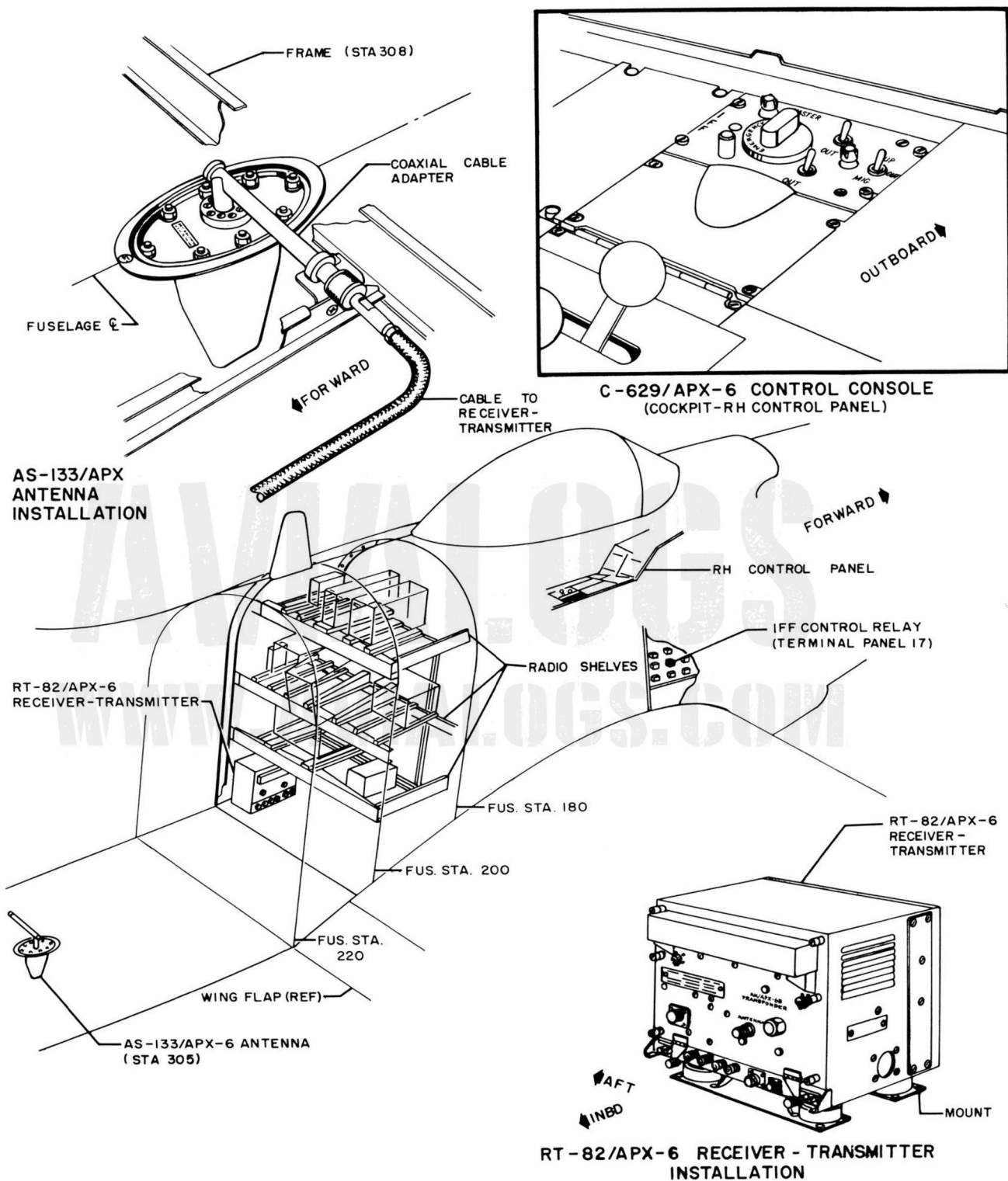
8-71. DESCRIPTION. (See figure 8-12.) The AN/APX-6 control console is identified as IFF. The unit contains a rotary selector switch, identified as MASTER, with five positions: "OFF," "STDBY," "LOW," "NORM," and "EMERGENCY"; and two MODE switches.

8-72. AN/APS-19C SEARCH RADAR SYSTEM.

8-73. DESCRIPTION. (See figure 8-13.) The major components of the AN/APS-19C search radar system are as follows:

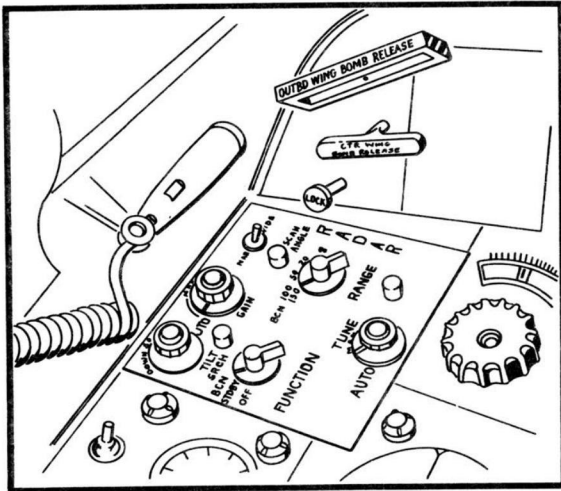
<i>Name</i>	<i>Location</i>
Circuit breakers, 10-amp (2), 35-amp, identified SEARCH RADAR	Fwd equip. compt—circuit-breaker panel
CW-144/APS-19C nacelle assembly	Center wing section LH side external stores rack—all airplanes, or wing outboard panel LH side external stores rack number 4—airplanes BuNo. 134603 and subsequent and prior airplanes reworked per BuAer AD/SC 543
ID-158/APS-19C indicator	Instrument panel
C-1184/APS-19C control console	Left-hand control panel
AN/APS-19C nacelle connector receptacle	Center wing section, inboard of LH external stores rack—all airplanes, or wing outboard panel LH side between external stores rack number 4 and 5—airplanes BuNo. 134603 and subsequent and prior airplanes reworked per BuAer AD/SC 543

8-74. On all airplanes except BuNo. 134466-134484, inclusive, the AN/APN-22 radar altimeter system is connected to the AN/APS-19C indicator to provide the latter system with altitude information.

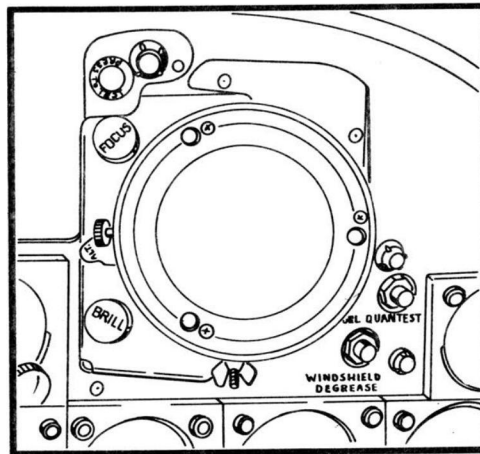


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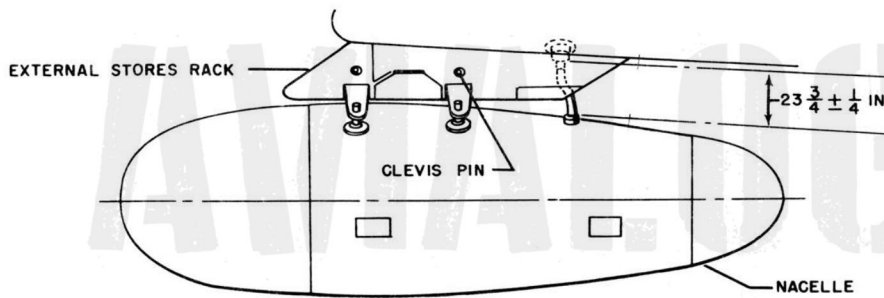
Figure 8-12. AN/APX-6 Recognition Radar System



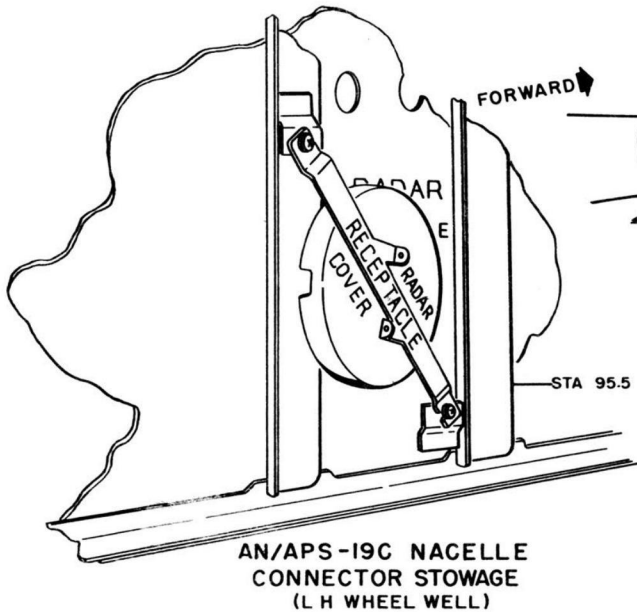
C-1184/APS-19C CONTROL CONSOLE
(COCKPIT-LH CONTROL PANEL)



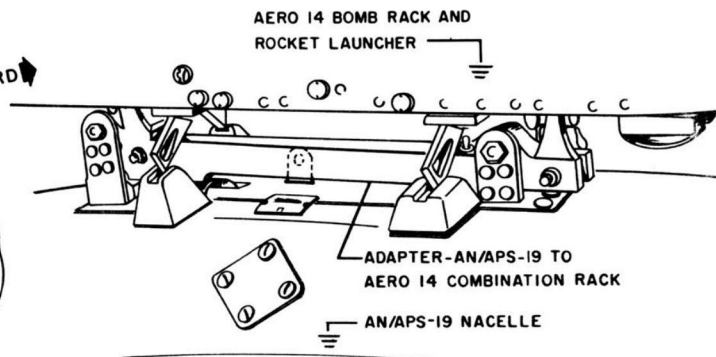
ID-158/APS-19C INDICATOR
(COCKPIT-INSTRUMENT PANEL)



CW-144/APS-19C NACELLE INSTALLATION
(LOOKING INBOARD AT LEFT-HAND EXTERNAL STORES STATION)



AN/APS-19C NACELLE CONNECTOR STORAGE
(LH WHEEL WELL)



AN/APS-19C NACELLE INSTALLATION
(LOOKING OUTBOARD AT LEFT-HAND OUTBOARD WING, EXTERNAL-STORES STATION NO. 4)

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Figure 8-13. AN/APS-19C Search Radar System

8-74A. All principal units of the AN/APS-19C system, except the control console and indicator, are contained within the nacelle assembly; a single, quick-release connector, installed adjacent to the unit, connects the equipment contained in the nacelle to the control console and the indicator.

8-75. The AN/APS-19C equipment operates on 28-volt d-c and 400-to-800-cycle, 115-volt a-c power. D-c voltage is obtained from the monitor bus through 35-ampere and 10-ampere SEARCH RADAR circuit breakers. A-c voltage is obtained from phase C of the a-c generator through a 10-ampere SEARCH RADAR circuit breaker.

8-76. GROUND TESTING. Refer to table 8-7.

TABLE 8-7. GROUND TESTING RADAR SET AN/APS-19C

<i>Control Setting and/or Operation</i>	<i>Desired Result</i>
Connect external source of 28 volts d-c and 115-volt 400-800 cycle a-c power	
Depress SEARCH RADAR circuit breakers	
Set FUNCTION switch on C-1184/APS-19C control console to STANDBY (allow 3-minute warm-up period). Set TUNE control to AUTO. Set GAIN control to AUTO. Set SCAN ANGLE to WIDE	Round spot appears in center of IF-158/APS-19C indicator in approximately 10 seconds. Within 30 seconds spot moves toward bottom of screen. Spot will then move smoothly from side to side.
Set FUNCTION switch to SRCH and operate BRILL and FOCUS controls	Vertical sweeps appear on indicator screen. Adjust to obtain sharp, medium brilliance, traces.
Observe vertical sweep	Vertical traces are not erratic or jittery.
Rotate TUNE control out of detent and adjust for best indicator presentation	Presentation substantially the same as in AUTO.
Rotate GAIN control out of detent and adjust for best indicator presentation	Presentation substantially the same as in AUTO. Excessive gain causes "grass" to appear in presentation.
Set SCAN ANGLE to NAR	Vertical sweep rate increases.
Return TUNE and GAIN controls to AUTO: SCAN ANGLE switch to WIDE	
Operate RANGE switch through all positions, step by step	Presentation size, brilliance and starting point on base line of vertical sweep substantially unchanged.
If suitable beacon stations are in range, set FUNCTION switch to BCN. Observe indicator presentation to determine satisfactory receiver operation	
Return FUNCTION switch to OFF	Equipment is secured.

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must observe safety regulations at all times. No attempt should be made to change tubes or to make internal adjustments on the equipment while it is operating. Under certain conditions, dangerous potentials, due to charges retained by capacitors, etc., may exist in circuits when power controls are off. It should be verified that all circuits are discharged before touching them.

8-76A. AN/APS-19C CONTROL CONSOLE.

8-76B. DESCRIPTION. (See figure 8-13.) To permit clearance between the electrical connectors and control cables, the AN/APS-19C control console is modified by relocating the two electrical connector receptacles, and reworking of the control console cover. The modification is accomplished per Douglas drawings 4446226 and 3446228.

8-76C. AN/APS-19C INDICATOR.

8-76D. DESCRIPTION. (See figure 8-13.) The AN/APS-19C indicator is modified by adding an electrical wiring "pigtail" and an electrical connector plug to adapt the indicator to the aircraft. On airplanes BuNo. 135223-135406, 137492-137632, 139606-139821, and 142010-142081, an additional modification is added by removing the grid coaxial cable from the electrical connector plug, and attaching it to the terminal board assembly thereby permitting isolation of the grid lead from the electrical cabling to reduce noise interference.

8-77. AN/APS-19C NACELLE ASSEMBLY.

8-78. DESCRIPTION. (See figure 8-13.) The AN/APS-19C nacelle assembly contains the following units:

- RT-100A/APS-19 receiver-transmitter, installed on MT-1111/APS-19B mounting base
- SN-51A/APS-19A synchronizer-power unit, installed on MT-438/APS-19 mounting base
- AS-630/APS-19C antenna
- J-494/APS-19B test panel
- CG-913/U waveguide assembly
- CU-129A/APS-19 directional coupler

Provisions are made for carrying the AN/APS-19C nacelle assembly on number four Aero 14 rack on airplanes BuNo. 134466, 134603-134605, 134609-134637, 135223-135406, 137492-137632, 139606-139821, 142010-142081, and airplanes BuNo. 134467-134602, 134606-134608 reworked per BuAer AD/SC No. 543. The additional nacelle connector receptacle is located between

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number four and number five Aero 14 racks. The nacelle assembly is jettisonable during flight by operating the external stores manual release system release mechanism; accidental jettisoning can be prevented by inserting a clevis pin in the rack mechanism. Electrical connections between the equipment in the nacelle and associated components in the airplane are made through the connector assembly. Hand grips in the sides of the nacelle facilitate handling.

8-78A. AN/APS-19 NACELLE ADJUSTMENT.

- a. Loosen cable clamp at nacelle.
- b. To obtain sufficient length of cable outside nacelle to reach wing connector, move cable clamp inside nacelle from left- to right-hand support on synchronizer-power unit.
- c. Pull cable out of nacelle or push cable into nacelle as needed to make connection with wing connector and obtain dimension shown in figure 8-9. Lock connector.
- d. Adjust position of wire clamp on cable so that release wires are taut.
- e. Tighten cable clamp.
- f. When necessary to prevent jettisoning of nacelle, install AN 394-39 clevis pin in hole in external stores rack.

8-79. REMOVAL.

- a. Pull downward on wing connector assembly; disengage locks and pull plug free of receptacle.
- b. Support nacelle and open stores-rack hooks. (Use manual release if remaining racks are empty; otherwise release hooks electrically.)

8-80. INSTALLATION.

- a. Install nacelle on stores rack.
- b. Adjust nacelle cable and release wires as shown in figure 8-13.

8-81. AN/APS-19C NACELLE CONNECTOR ASSEMBLY.

8-82. DESCRIPTION. (See figure 8-13.) The connector assembly consists of a receptacle and of a plug which is attached to a cable leading from the nacelle. The receptacle is installed in the wing lower plating inboard of the stores rack. On airplanes BuNo. 134603-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, a second receptacle is installed in the lower plating of the left-hand outboard wing between rocket launchers 4 and 5. This provides an alternate installation for the AN/APS-19 nacelle. The assembly incorporates a device that locks the plug and receptacle when connected, and automatically disconnects them when a downward pull is exerted on the plug. Further assurance of a quick, positive disconnect, should it become necessary to jettison the nacelle, is provided by two release wires attached to the cable clamp. Correct procedure for installing these wires is shown in figure 8-9. A protective cover for the receptacle, stowed in the LH wheel well and identified as APS-19 WING RECEPTACLE COVER STOWAGE, should be installed over the receptacle when the nacelle is not installed on the stores rack.

8-83. AN/APA-89 GROUP.

8-84. DESCRIPTION. Wiring and equipment mounting provisions for the AN/APA-89 group are installed in AD-6 airplanes BuNo. 135304 through 135333 inclusive, and BuNo. 135336-135406, 137492-137632, 139606-139821, and 142010-142081. Prior airplanes are reworked per BuAer AD/SC No. 585.