TM 55-1510-202-10

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S AND CREW MEMBER'S
INSTRUCTIONS

ARMY MODEL L–19A
L–19E, TL–19A
TL–19D, TL–19E
AIRPLANES
(CESSNA)

Note: This manual rescinds TM 1–1L–19A–1, 11 Feb 57, C1, 5 Dec 57, C2, 8 Apr 58; TM 1–1L– 19A–5, 26 Mar 57, C1, 23 Jul 57, C2, 2 Dec 57; TM 1–1L–19(T)D–1, 6 Feb 57, C1, 27 May 57, C2, 20 Jan 58, C3 23 May 59; TM 1–1L–19(T)D–5, 14 Feb 57, C1, 24 Sep 58, C2, 22 May 59.

HEADQUARTERS, DEPARTMENT OF THE ARMY

APRIL 1961

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SECTION I | CHAPTER 1

SCOPE

1-1. This manual is the official document for Army Models L-19A, L-19E, TL-19A, TL-19E and TL-19D aircraft, serial numbers 50-1327 through 57-6277. The purpose of the manual is to supply operators and crew members with the latest information and performance data derived from flight test program and operational experiences. The study and use of this manual will enable you to perform the assigned missions and duties with maximum efficiency and safety.

1-2. Your ability and experience is recognized, and it is not the function of this manual to teach the pilot how to fly; therefore, basic flight principles and elementary instructions have been avoided. The contents of this manual will provide you with a general knowledge of Army Models L-19A, L-19E, TL-19A, TL-19E and TL-19D aircraft, its flight characteristics, and specific normal and emergency operating procedures. Recommendations and comments pertaining to content of this manual should be submitted to the Commanding General, U. S. Army Transportation Materiel Command, P. O. Box 209, Main Office, St. Louis 66, Mo., ATTN: TCMAC-E.

CODE	AIRCRAFT
1	L-19A
2	L-19E
3	TL-19A
4	TL-19E
5	TL-19D

SECTION II | CHAPTER 1

GENERAL

2-1. The Operator and Crew Members Manual is divided into five different chapters, each used for a specific purpose, as follows:

2-2. CHAPTER I - INTRODUCTION. The primary function of this chapter is to give a brief summary of the contents of each chapter, plus reference to and a description of the Repair Parts Appendices and a list of maintenance forms required for use by pilot and crew members.

2-3. CHAPTER II - PILOT'S FLIGHT INFORMATION. This chapter of the manual describes the aircraft, its equipment, systems, operational limitations and characteristics in sufficient detail to familiarize the Flight Crew with the aircraft. This chapter also contains information regarding the behavior of the aircraft in normal, emergency and all weather conditions of flight and ground operations, which are peculiar to the aircraft, in order that a Flight Crew of minimum experience can intelligently, safely and efficiently accomplish a complete flight. Section X of this chapter contains the necessary performance charts for preflight and inflight mission planning. Full use of these charts for mission planning will result in obtaining maximum performance and efficiency from the aircraft. Information, quoted on the performance charts, is consistant with the techniques set forth elsewhere in this manual.

2-4. CHAPTER III - WEIGHT AND BALANCE DATA. This chapter contains the necessary information for weight and balance control data pertinent to the proper operation, loading and maintenance of the aircraft which must be exercised to maintain the center of gravity limitations of the aircraft. Information is also supplied for the proper preparation and use in completing the standard balance control forms.

2-5. CHAPTER IV - CARGO LOADING. This Chapter not applicable to this aircraft.

2-6. CHAPTER V - AIRCRAFT INVENTORY MASTER GUIDE. The purpose of this chapter is to provide using activities with information regarding use of the 780 series forms, entitled, "Aircraft Inventory Record Master Guide". These forms are used to furnish using activities with a guide indicating inventoriable items of installed and/or loose equipment, authorized or required, which are installed on the aircraft.

2-7. APPENDIX I. This appendix contains a list of applicable references that are available to the operator.

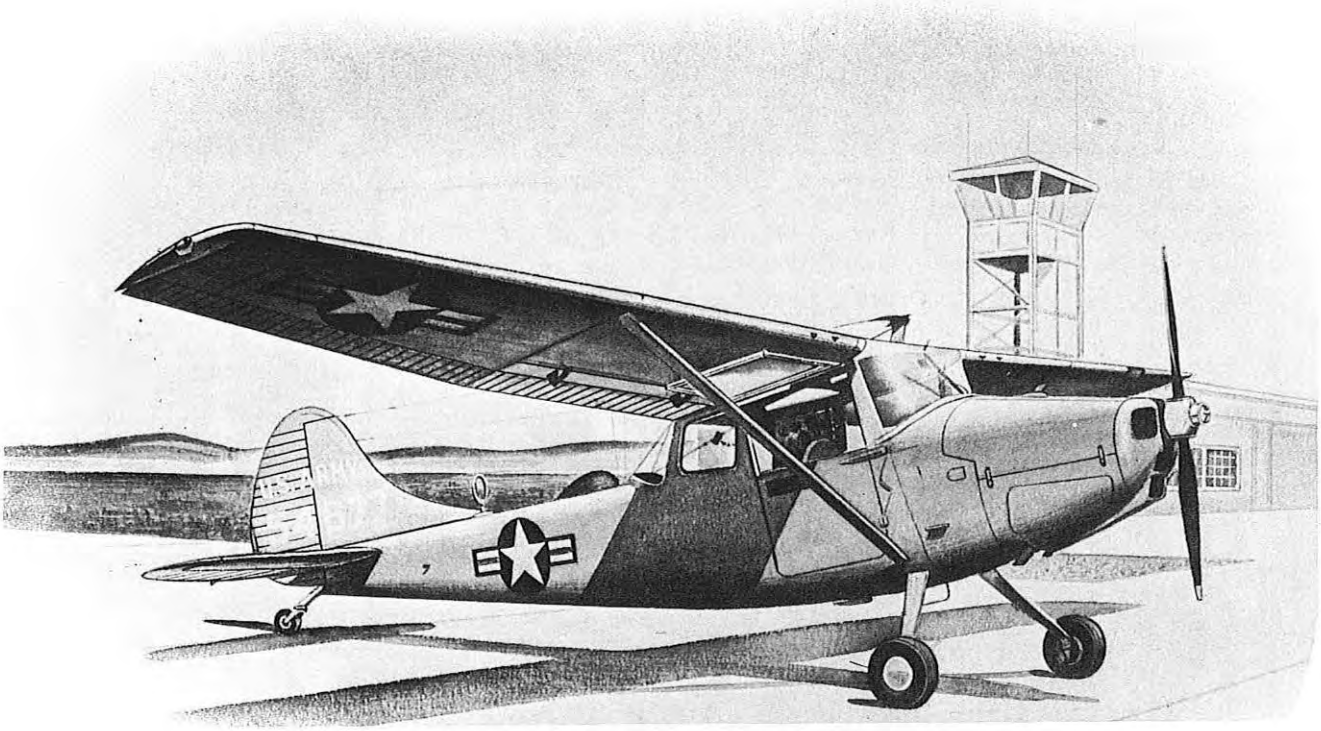
2-8. APPENDIX II. This appendix is a reference to the maintenance allocation chart which is found only in TM 55-1510-202-20.

2-9. The following comprises a list of maintenance forms required for use by personnel in the performance of prescribed operations:

FORM	DESCRIPTION
DD Form 780-1	Aircraft Inventory Record Inventory List
DD Form 780-2	Aircraft Inventory Record Shortages
DD Form 780-3	Aircraft Inventory Record Certification and Record of Transfers
DD Form 781-1	Aircraft Flight Report and Maintenance Record
DD Form 781-2	Aircraft Flight Report and Maintenance Record - Aircraft Inspection and Maintenance
DD Form 781-3	Aircraft Flight Report and Maintenance Record - Delayed Correction and Discrepancy List
DD Form 781-4	Aircraft Flight Report and Maintenance Record - Aircraft General Data

DD Form 781-5	Aircraft Flight Report and Maintenance Record - Accessories Data
DD Form 781-6	Aircraft Flight Report and Maintenance Record - Aircraft Summary
DD Form 781-7	Aircraft Flight Report and Maintenance Record - General Mission Classifications - Mission Symbols
DD Form 829	Historical Record for Aeronautical Equipment
DD Form 829-1	Historical Record - Technical Instructions Compliance Record
DD Form 829-2	Historical Record - Significant Historical Data

THE AIRCRAFT ■ ■ ■



L-19A, L-19E, TL-19A, TL-19E, TL-19D

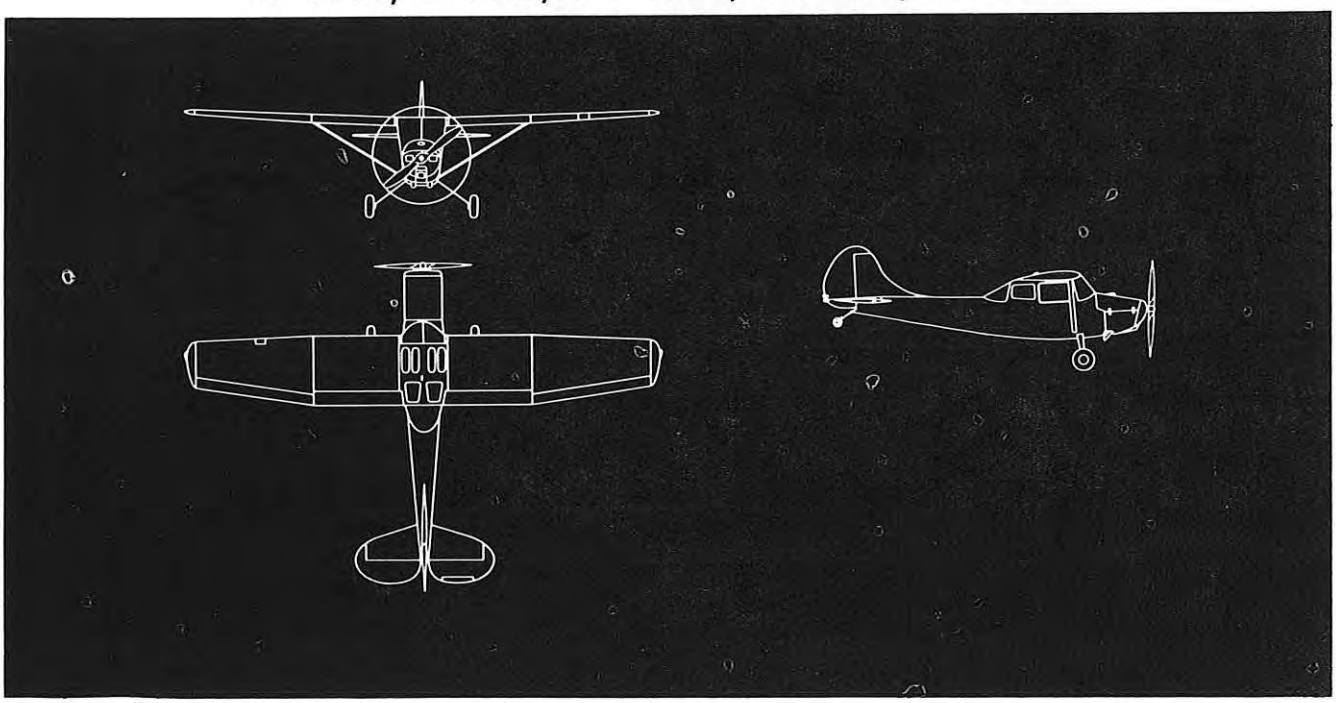


Figure 1-1.

SECTION I CHAPTER 2

DESCRIPTION

1-1. THE AIRCRAFT.

1-2. The aircraft, manufactured by Cessna Aircraft Company, is an all metal high wing, two place (tandem) monoplane. The aircraft is powered by a Continental six cylinder, horizontally opposed, air cooled engine. It is a multi-purpose aircraft used primarily for reconnaissance-observation, as a primary and advanced trainer and for instrument training. Although basically designed as a landplane, the aircraft can be converted to a seaplane with the installation of floats and seaplane fins.

1-3. TRAINER VERSIONS.

1-4. The IT L-19A ▲1 and the TL-19D ▲5 aircraft are specifically designed for use as instrument trainers. In addition to the complete set of controls and instruments within the pilot's compartment, the student's compartment provides adequate controls and a complement of instruments necessary for the various phases of instrument flight instruction. All TL-19A ▲3 and TL-19E ▲4 aircraft are designated as primary and advance trainers and are modified versions of L-19A ▲1 and L-19E ▲2 aircraft. The modification includes the relocation and addition of equipment in both the front and rear compartments to improve the flight training capabilities.

1-5. DIMENSIONS.

1-6. The overall dimensions of the aircraft under normal conditions of gross weight and tire inflation are as follows:

Wing Span	36 feet
Over-all length	25 feet 9 1/2 inches
Height to top of cabin	7 feet 6 inches

1-7. GROSS WEIGHT.

1-8. The normal gross weight of the aircraft is as follows: aircraft ▲1 and ▲3 normal gross weight is 2100 pounds, aircraft ▲2 and ▲4 normal gross weight is 2165 pounds and aircraft ▲5 normal gross weight is 2400 pounds.

1-9. SPECIAL FEATURES.

1-10. The special features of this aircraft are: one piece spring steel landing gear struts that minimize ground looping tendencies, a simple control lock that locks the rudder, elevators and ailerons in neutral and also applies the parking brake, a flush retracting lift handle (figure 1-3) in the tailcone that can be extended for hoisting or retracted flush with the fuselage skin when not in use. On aircraft ▲1 ▲2 ▲5, the rear rudder pedals are hinged and can be folded flat against the cabin floor when not in use. Brake action on these pedals is transmitted mechanically to the forward brake pedals and thereby down to the main wheel brakes. On aircraft ▲3 ▲4, the rear pedals do not fold, and are equipped with separate hydraulic brake cylinders. Air-

MAIN DIFFERENCE TABLE

ITEM	L-19A	L-19E	TL-19A	TL-19E	TL-19D
WING FLAPS	Manually operated on aircraft † and electrically operated on aircraft ‡	Electrically Operated	Electrically Operated	Electrically Operated	Electrically Operated
CIRCUIT BREAKER PANEL	Lower right in instrument panel and on right side of voltage regulator cover	Lower left side under front side window	Lower right in instrument panel and on right side of voltage regulator cover	Lower left side under front side window	Lower left side under front side window
PROPELLER	Fix Pitch	Fix Pitch	Fix Pitch	Fix Pitch	Constant Speed

† AIRCRAFT 50-1327 THRU 53-8067 EXCEPT AIRCRAFT MODIFIED PER TM1-1L-19A-247
‡ AIRCRAFT 53-8068 AND ON AND AIRCRAFT MODIFIED PER TM1-1L-19A-247

Figure 1-2.

GENERAL ARRANGEMENT AND SERVICING DIAGRAM

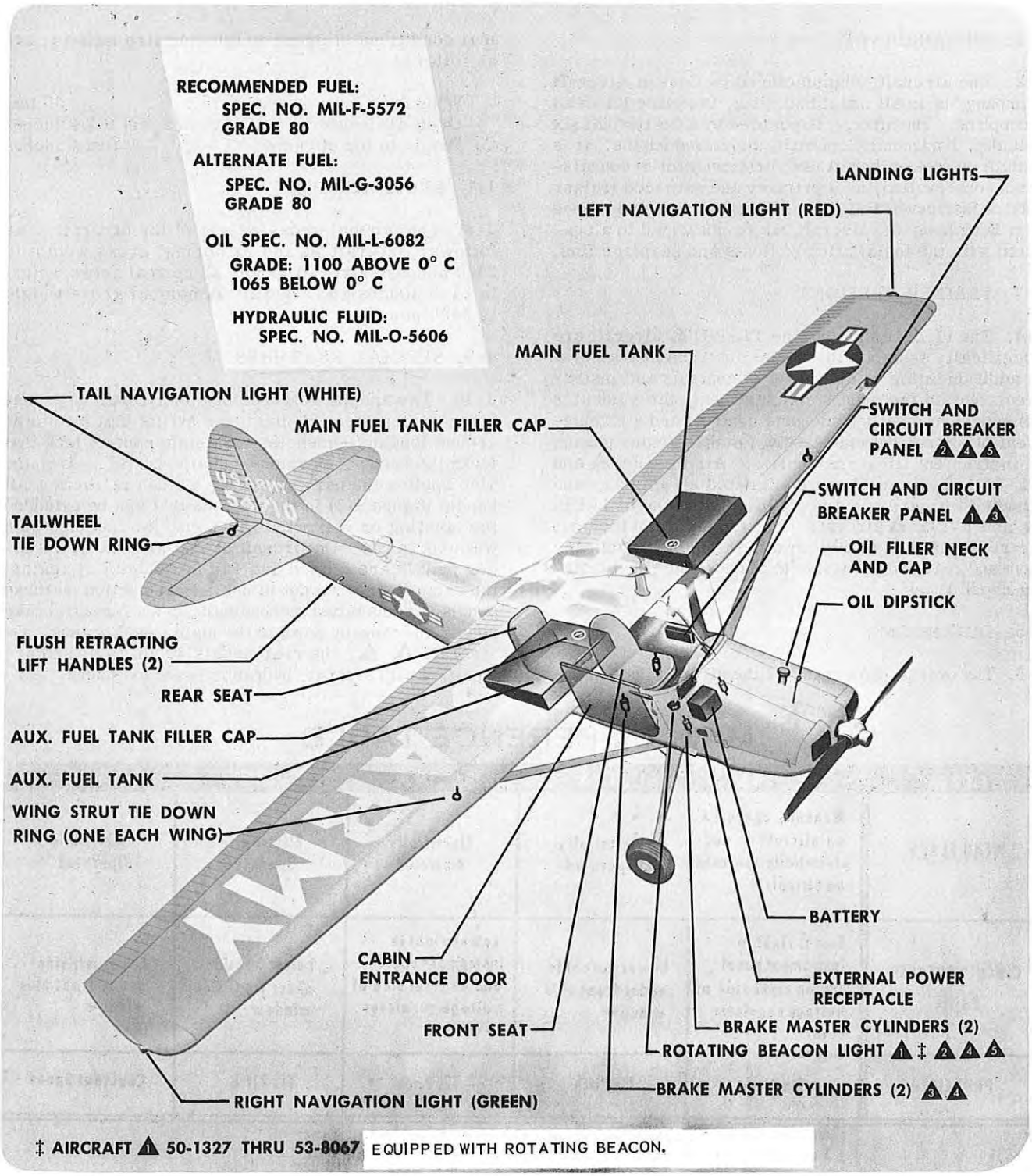


Figure 1-3.

craft ⑤ is equipped with a constant speed propeller.

1-11. MAIN DIFFERENCES TABLE.

1-12. The main differences between series of aircraft presented in this manual are shown in figure 1-2.

1-13. ENGINE.

1-14. The aircraft is powered with a Continental six cylinder, horizontally opposed, air-cooled engine. The model designation on aircraft ① ② ③ ④ is O-470-11 and on aircraft ⑤ is O-470-15. Approximate standard sea level maximum horsepower rating for both engines is 213 horsepower at takeoff power. The engine controls consisting of throttle, mixture control lever and carburetor air control lever, are mounted on two quadrants (figure 1-4). The front quadrant is located on the left side of the fuselage slightly forward of the front seat. The rear quadrant is located in a like position just forward of the rear seat. These quadrants are mechanically inter-connected between the front and rear stations to provide simultaneous movement of the engine controls.

1-15. THROTTLE.

1-16. The throttle (figure 1-4) is the outboard lever in each quadrant and is mechanically connected to the carburetor by a flexible push-pull type control. The full forward position of the throttle is OPEN and the full aft position is CLOSED. On aircraft ③ ④ ⑤, each throttle incorporates two radio switches within the handle, one for interphone communication and one for radio transmission.

1-17. CARBURETOR.

1-18. The carburetor is mounted to the intake manifold on the underside of the engine. It is an updraft, single-barrel, pressure-injection type carburetor that incorporates a manually operated mixture valve. The basic purpose of the carburetor is to meter fuel accurately in proportion to the amount of air being consumed by the engine.

1-19. MIXTURE CONTROL LEVER.

1-20. The mixture control lever (2, figure 1-4) on each quadrant enables the front or rear crew member to regulate the fuel-air mixture to the engine to obtain efficient engine operation and maximum fuel economy. Positions for each mixture control lever are RICH and LEAN. The RICH position is full forward, full aft is LEAN and manual leaning is accomplished by placing the control between the RICH and LEAN position. The front mixture control lever is equipped with a spring-loaded lock. When either the front or rear mixture control lever is moved forward, the lock is automatically released. However, before the mixture control lever can be moved aft toward LEAN, the lock must be released by pressing forward on the lock lever of the front mixture control lever. The mixture control lever, when pulled full aft, shuts off all fuel flow at the carburetor to stop the engine.

1-21. CARBURETOR AIR CONTROL LEVER.

1-22. The inboard lever on each engine control quadrant is the carburetor air control lever (4, figure 1-4). On aircraft ① ② the carburetor air lever positions are labeled RAM FILTERED AIR (forward position) and HEAT (aft position). On aircraft ③ ④ ⑤, the carburetor air lever positions are labeled RAM FILTERED AIR (forward position) and ALTERNATE AIR (aft position). The lever enables either the front or rear crew member to control the temperature of air entering the carburetor thereby maintaining efficient engine operation under all flying conditions. When the lever is in the RAM FILTERED AIR position, ram air is admitted to the carburetor through the air intake scoop on the front lower side of the cowl (see figure 1-5). When the lever is moved to the HEAT position on aircraft ① ② or to the ALTERNATE AIR position on aircraft ③ ④ ⑤ a gate valve closes off the ram-air intake opening from the carburetor. With the gate valve closed, a partial vacuum is created in the carburetor air box, causing a spring-loaded valve to open automatically. Thereby allowing the hot air surrounding the engine cylinders to enter the carburetor.

CAUTION

The carburetor air control lever should be set only in the RAM FILTERED AIR or HEAT position on aircraft ① ② or ALTERNATE AIR position on aircraft ③ ④ ⑤. Do not use any intermediate positions. With the lever in any intermediate position, the gate valve in the carburetor air box is partially closed, restricting the entrance of ram filtered air into the carburetor. However unless the gate valve is completely closed, the partial vacuum produced in the carburetor air box is not adequate to open the spring-loaded valve which permits the entrance of heated air into the air induction system. This results in the engine putting out less power because it is not getting its normal air supply.

1-23. ENGINE COOLING.

1-24. Air for engine cooling enters through an opening located in the upper part of the nose cowling. The cooling air passes over the engine and exits through an opening in the aft portion of the lower cowling. The vented areas are always open and can not be controlled from the cockpit.

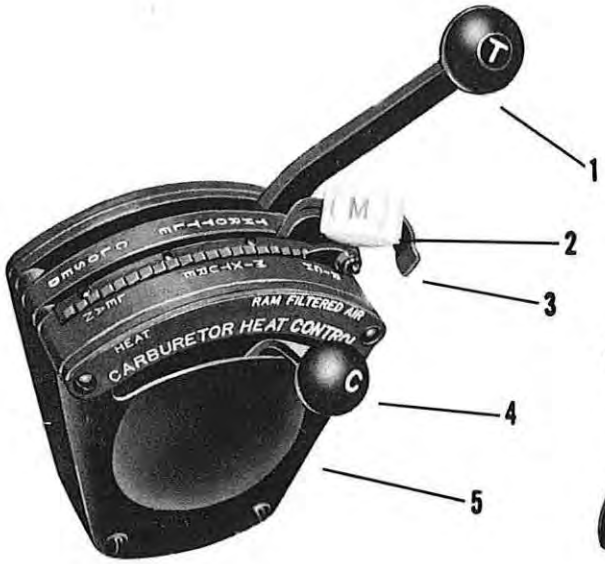
1-25. IGNITION SYSTEM.

1-26. The engine is equipped with a high-tension, dual ignition system firing two spark plugs in each cylinder. The high voltage required to ignite the fuel air mixture is supplied by two engine driven Bendix Scintella magnetos. Control of the magnetic circuit is obtained by use of a conventional rotary type magneto switch mounted on the front instrument panel.

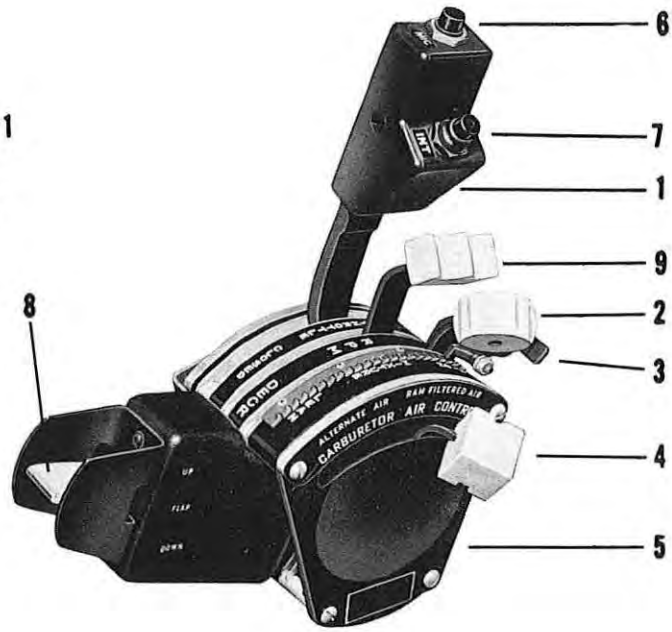
1-27. IGNITION SWITCH.

1-28. The engine ignition switch (22, figure 1-7), controls the dual (magneto) ignition system. There are four switch positions designated counterclockwise: BOTH, L, R, and OFF. The engine is started and

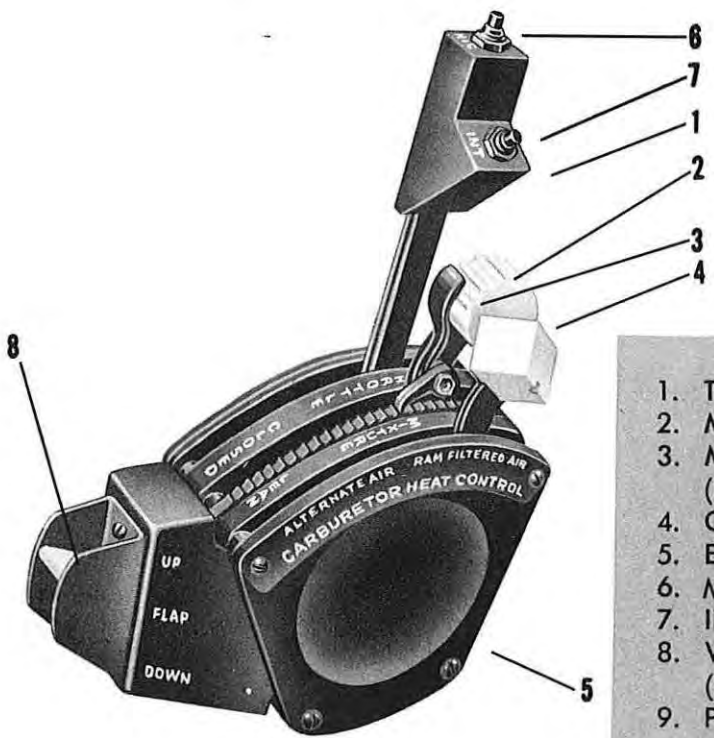
ENGINE CONTROL QUADRANT ■ ■ ■



AIRCRAFT ▲1 ▲2



AIRCRAFT ▲5



AIRCRAFT ▲3 ▲4

1. THROTTLE
2. MIXTURE CONTROL LEVER
3. MIXTURE CONTROL LEVER LOCK (PILOT'S QUADRANT ONLY)
4. CARBURETOR AIR CONTROL LEVER
5. ENGINE CONTROL QUADRANT
6. MICROPHONE SWITCH
7. INTERPHONE SWITCH
8. WING FLAP SWITCH (PILOT'S QUADRANT ONLY AIRCRAFT ▲3 ▲4)
9. PROPELLER CONTROL LEVER

Figure 1-4.

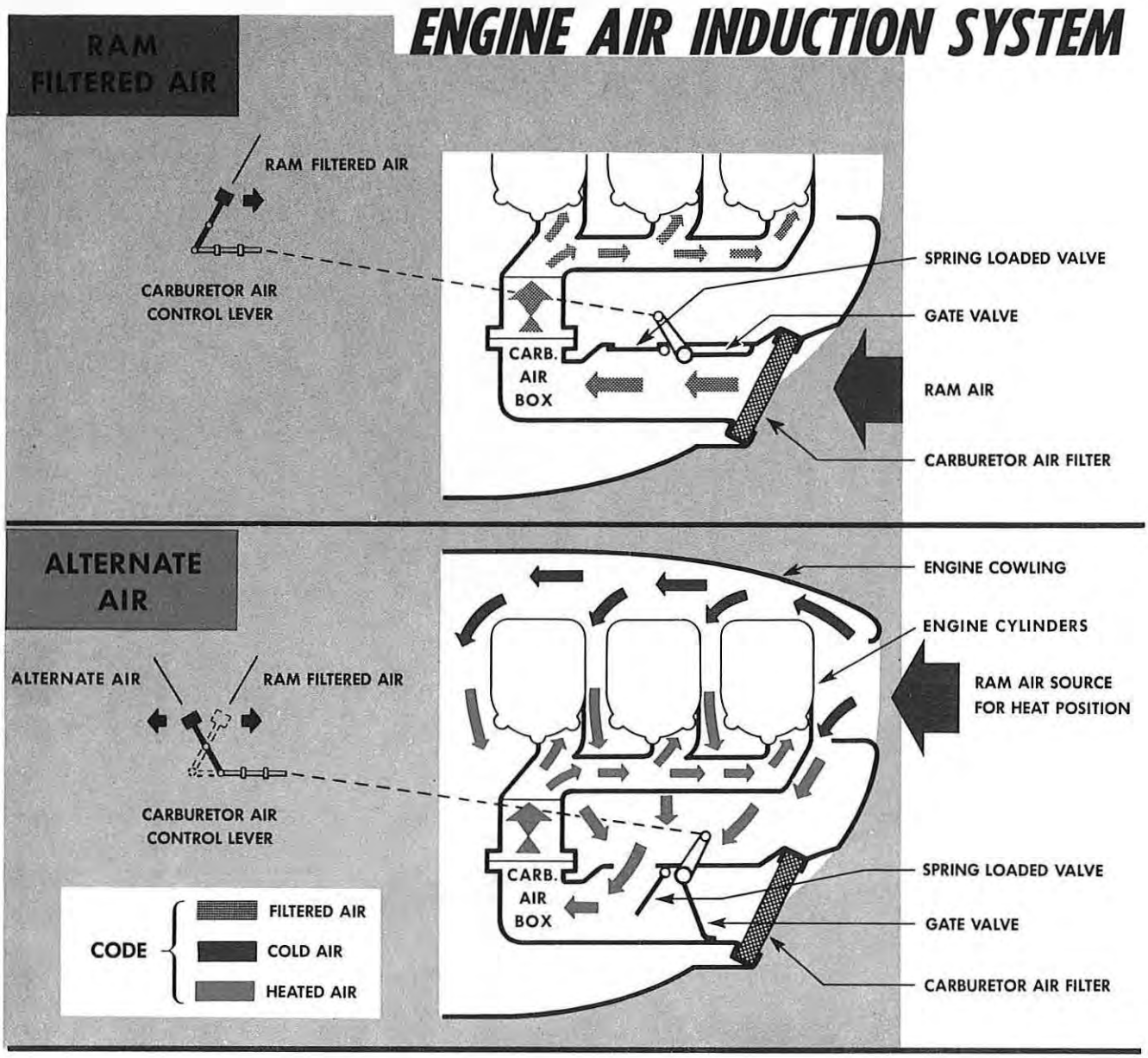


Figure 1-5.

operated in the BOTH position. The L and R positions are for checking purposes only.

1-29. EMERGENCY MAGNETO SWITCH ▲3▲.

1-30. An emergency magneto switch (21, figure 1-17) is mounted on the cabin ceiling just forward of the fuselage rear spar for use by the instructor in the rear seat of primary and advanced trainers. The switch, labeled EMERGENCY MAG, is ON in the rearward position and OFF in the forward position, and may be used to switch both magnetos OFF, regardless of the position of the ignition switch on the instrument panel. The switch is equipped with a guard which prevents it from being placed in the OFF position when the guard is closed.

CAUTION

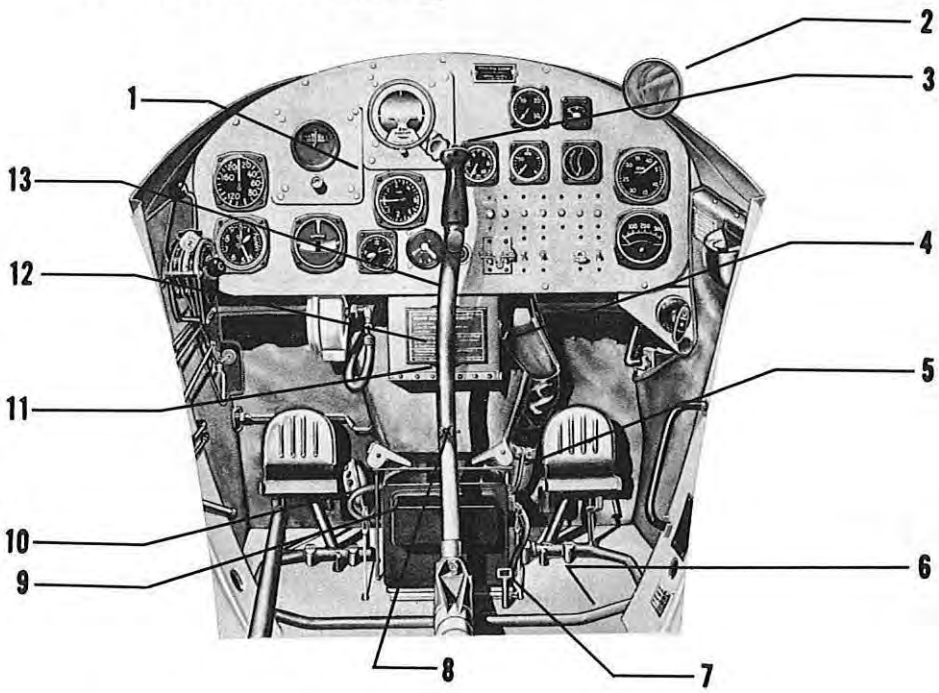
Do not place either the ignition switch or the emergency magneto switch in the OFF position unless stopping the engine is desired. The OFF position of either switch will ground the magnetos, thus stopping the engine.

1-31. ENGINE PRIMER SYSTEM.

1-32. The engine primer system is provided as a means of supplying fuel directly to the cylinders to aid in engine starting.

CABIN FORWARD VIEW

AIRCRAFT ▲1 ▲3



AIRCRAFT ▲2 ▲4

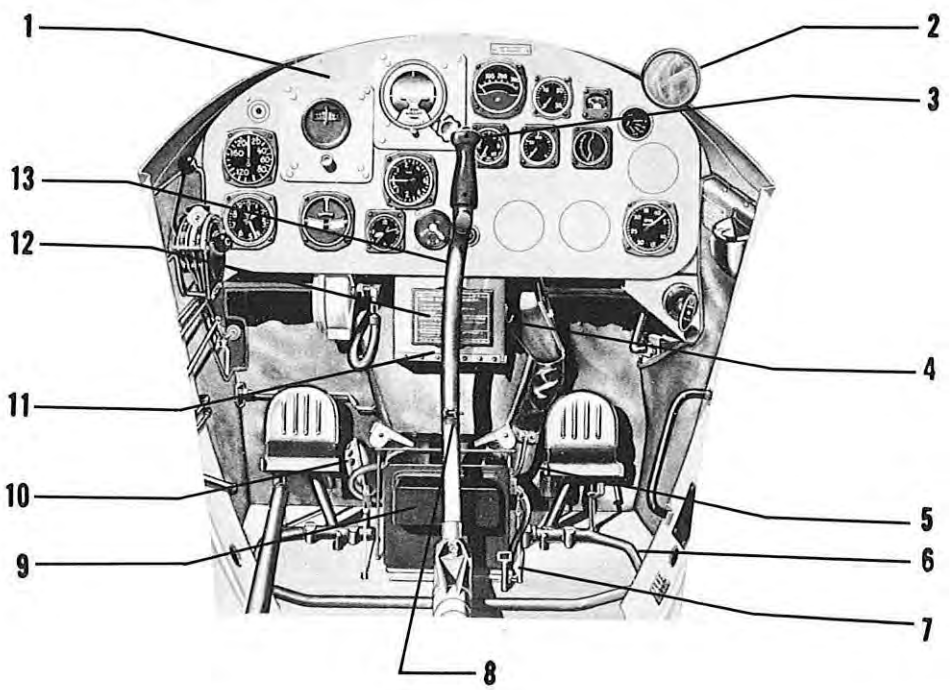
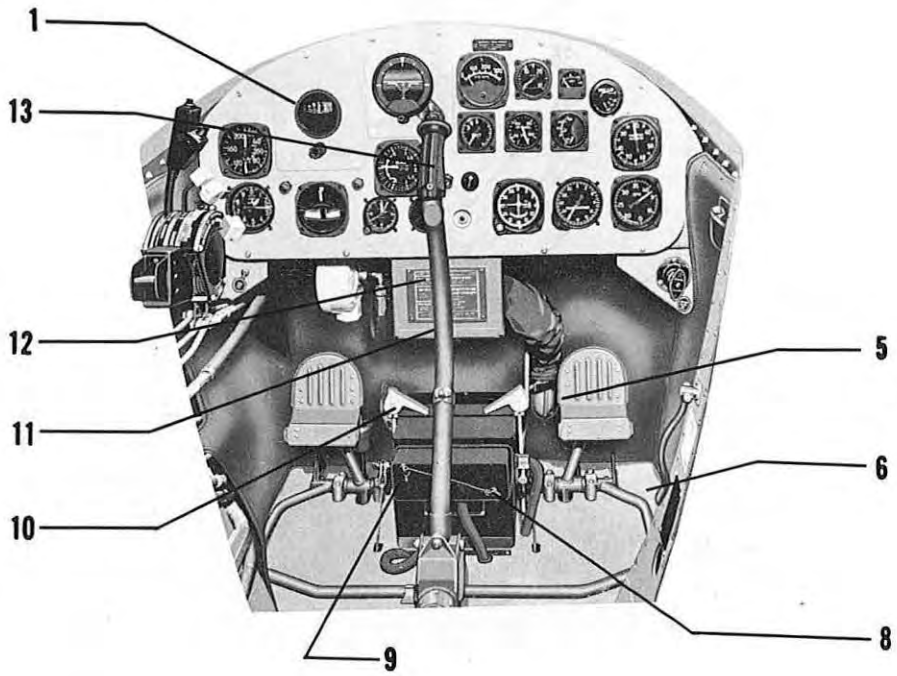


Figure 1-6. (Sheet 1 of 2)

CABIN FORWARD VIEW



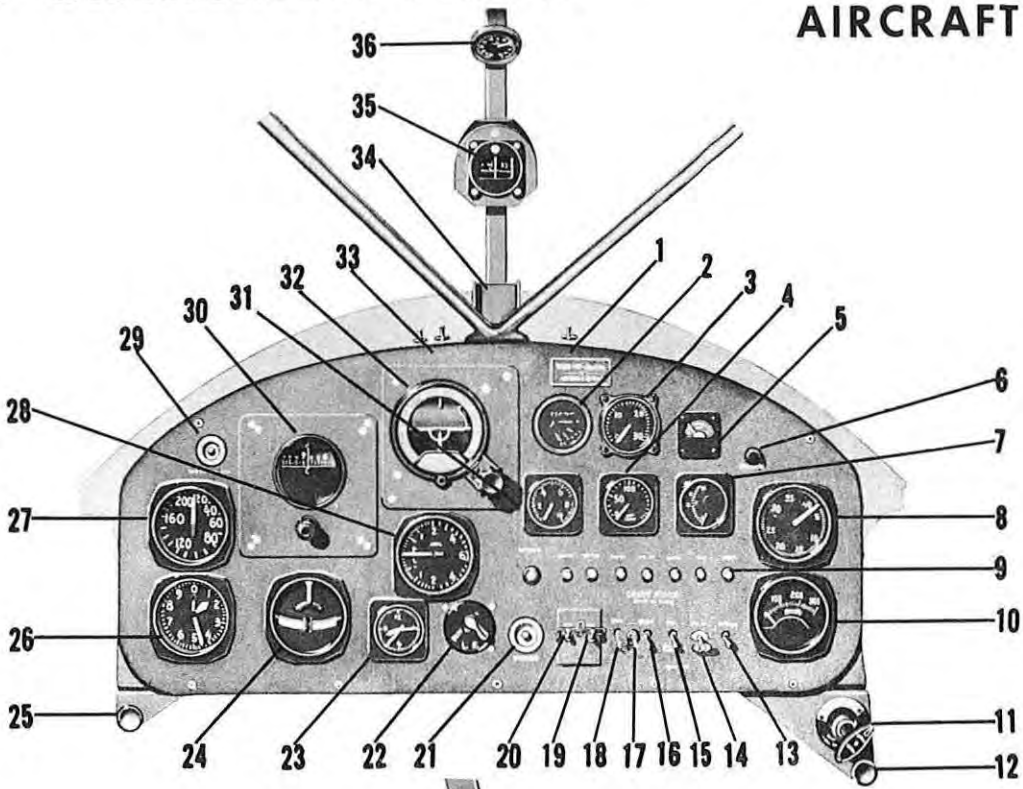
AIRCRAFT ▲5

1. INSTRUMENT PANEL
2. REAR VIEW MIRROR ▲3 ▲4
3. MICROPHONE SWITCH ▲1 ▲2
4. WATER RUDDER RETRACTION HANDLE HOOK (FLOAT PLANES ONLY) ▲1 ▲2
5. RIGHT CABIN HEATER OUTLET
6. CONTROL LOCK
7. WATER RUDDER RETRACTION HANDLE (FLOAT PLANES ONLY) ▲1 ▲2
8. CONTROL LOCK ENGAGING PIN
9. BATTERY
10. LEFT CABIN HEATER OUTLET
11. VOLTAGE REGULATOR RHEOSTAT (BEHIND CHECK LIST)
12. CHECK LIST
13. CONTROL STICK

Figure 1-6. (Sheet 2 of 2)

FRONT INSTRUMENT PANEL

AIRCRAFT ▲1 ▲3



AIRCRAFT ▲5

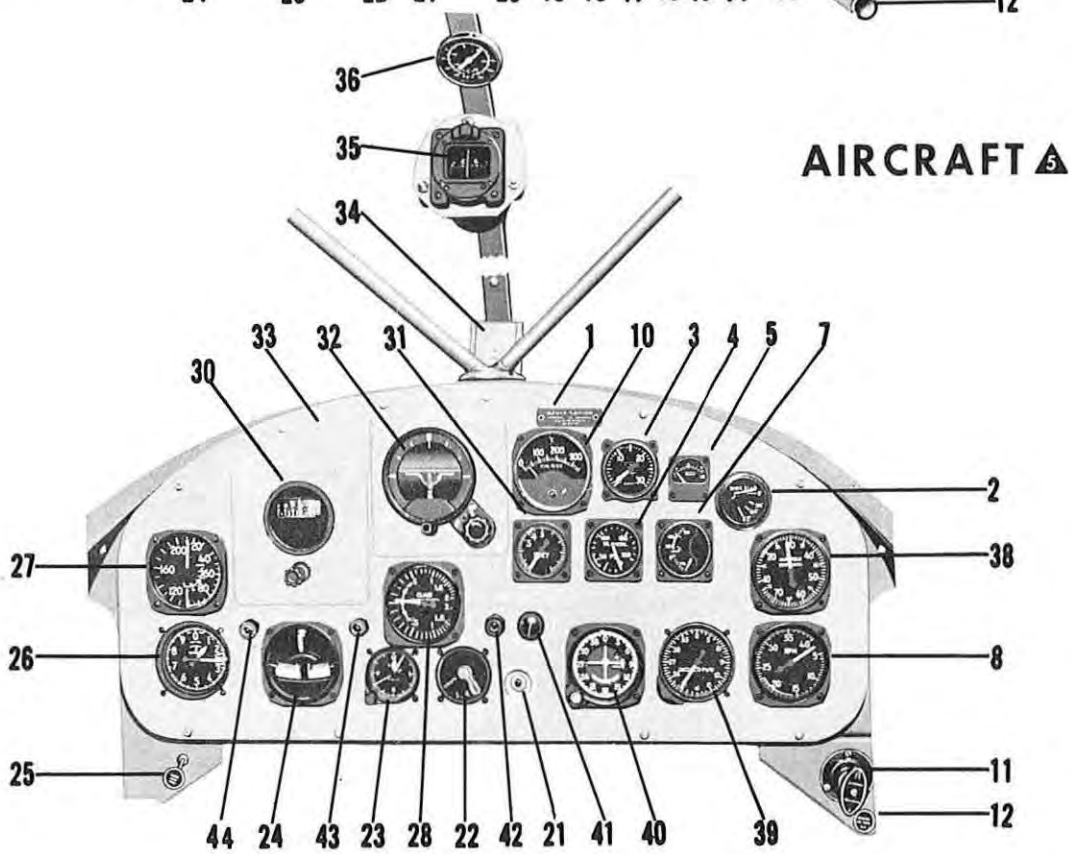
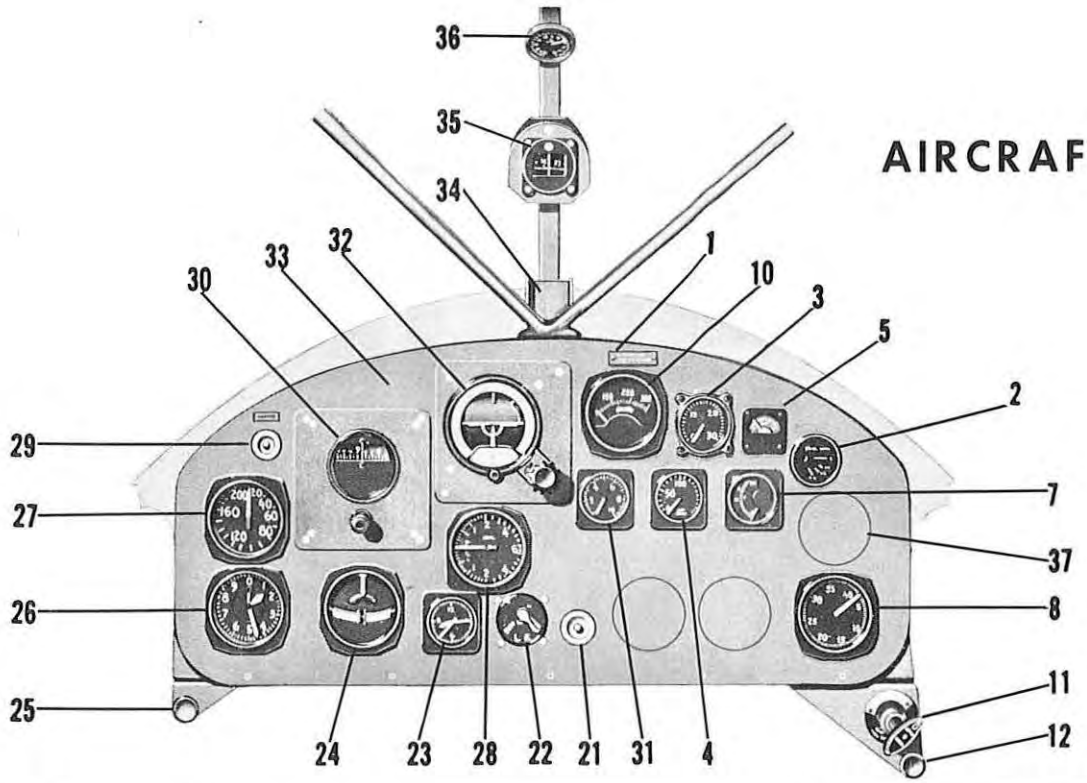


Figure 1-7. (Sheet 1 of 2)

AIRCRAFT▲2 ▲4



1. RADIO CALL PLATE
2. WING FLAP POSITION INDICATOR
3. FUEL PRESSURE GAGE
4. OIL PRESSURE GAGE
5. LOADMETER
6. COMPASS LIGHT RHEOSTAT SWITCH
7. OIL TEMP. INDICATOR
8. TACHOMETER
9. CIRCUIT BREAKERS
10. CYLINDER HEAD TEMP. GAGE
11. ENGINE PRIMER HANDLE
12. DEFROSTER & PILOT HEAT KNOB
13. FUEL PUMP SWITCH
14. LANDING LIGHT SWITCH
15. NAVIGATION LIGHT FLASHER SWITCH
16. NAVIGATION LIGHTS SWITCH
17. ROTATING BEACON LIGHT SWITCH. ▲1 ‡
18. PITOT HEAT SWITCH
19. BATTERY SWITCH
20. GENERATOR SWITCH
21. STARTER BUTTON
22. IGNITION SWITCH
23. CLOCK
24. TURN AND SLIP INDICATOR
25. CABIN HEAT KNOB
26. ALTIMETER
27. AIRSPEED INDICATOR
28. VERTICAL VELOCITY INDICATOR
29. DROP SHACKLE EMERGENCY SALVO SWITCH
30. DIRECTIONAL INDICATOR
31. SUCTION GAGE
32. ATTITUDE INDICATOR
33. PILOT'S INSTRUMENT PANEL
34. COMPASS CARD HOLDER
35. STANDBY COMPASS
36. FREE AIR TEMP. GAGE
37. COVER PLATE
38. MANIFOLD PRESSURE GAGE
39. AZIMUTH INDICATOR
40. COURSE INDICATOR
41. MARKER BEACON POWER SWITCH AND VOLUME CONTROL
42. MARKER BEACON INDICATOR LIGHT
43. NAV. RADIO CONTROL SWITCH LIGHT
44. COMM. RADIO CONTROL SWITCH-LIGHT

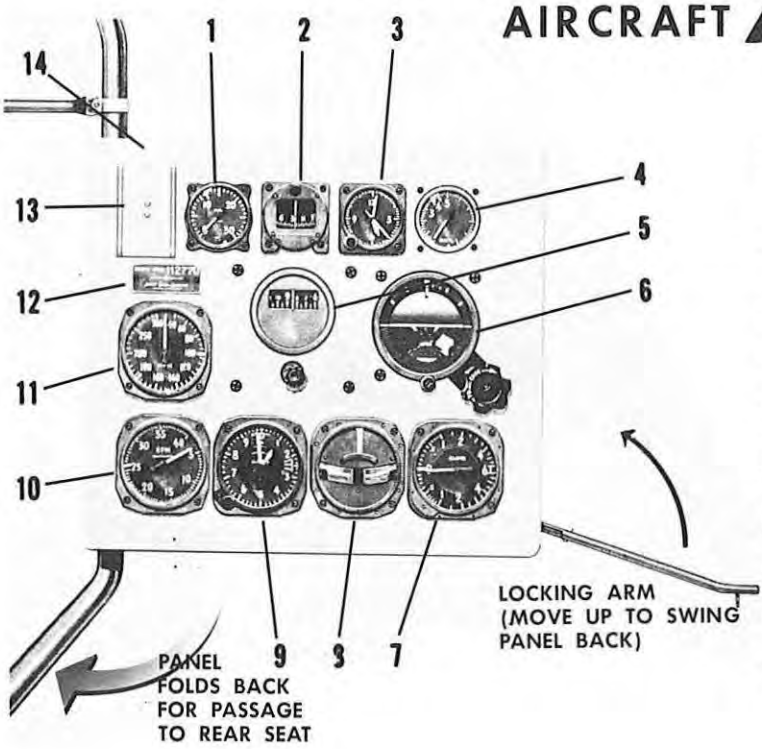
‡ **AIRCRAFT 50-1327 THRU 53-8067**

EQUIPPED WITH ROTATING BEACON.

Figure 1-7. (Sheet 2 of 2)

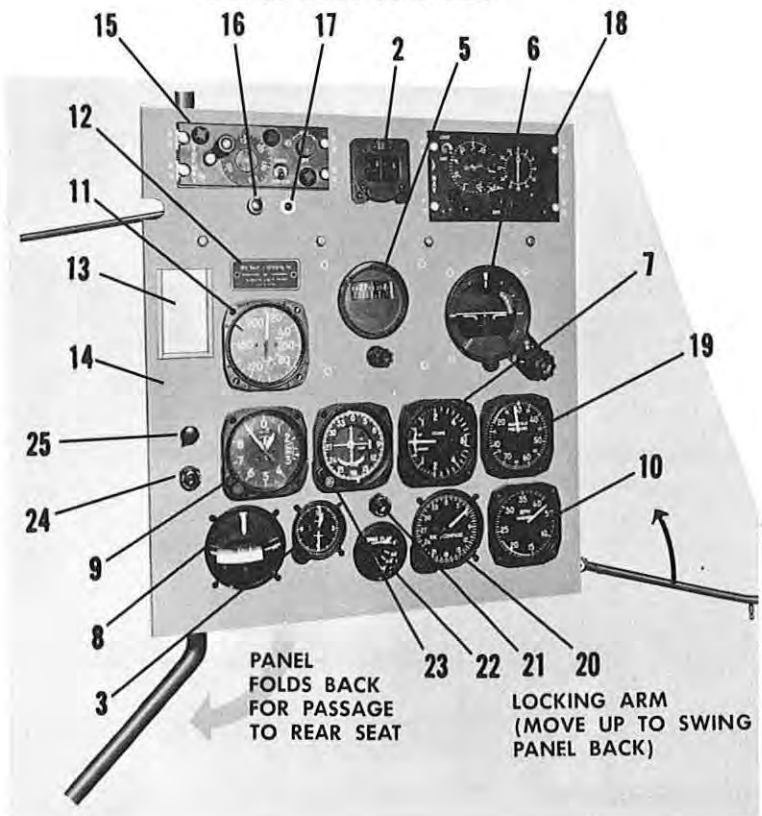
REAR INSTRUMENT PANEL

AIRCRAFT 1



1. FUEL PRESSURE GAGE
2. COMPASS
3. CLOCK
4. SUCTION GAGE
5. DIRECTIONAL INDICATOR
6. ATTITUDE INDICATOR
7. VERTICAL VELOCITY INDICATOR
8. TURN AND SLIP INDICATOR
9. ALTIMETER
10. TACHOMETER
11. AIRSPEED INDICATOR
12. RADIO CALL PLATE
13. COMPASS CARD HOLDER
14. REAR INSTRUMENT PANEL
15. VHF NAVIGATION CONTROL PANEL
16. COMM RADIO CONTROL SWITCH-LIGHT
17. NAV RADIO CONTROL SWITCH-LIGHT

AIRCRAFT 5



18. LF AND MANUAL LOOP CONTROL PANEL OR LF NAVIGATION (ADF RADIO COMPASS) CONTROL PANEL.
19. MANIFOLD PRESSURE GAGE
20. AZIMUTH INDICATOR
21. FUEL LOW PRESSURE WARNING LIGHT
22. WING FLAP POSITION INDICATOR
23. COURSE INDICATOR
24. MARKER BEACON INDICATOR LIGHT
25. VOLUME CONTROL MARKER BEACON

Figure 1-8.

1-33. ENGINE PRIMER.

1-34. The engine primer is a manual, plunger type primer. A fore and aft movement of the engine primer handle (11, figure 1-7) pumps raw fuel into the six cylinders. The handle is normally FULL IN and LOCKED. The handle is turned counterclockwise to unlock or clockwise to lock.

1-35. STARTER SYSTEM.

1-36. A starting system, operating on 28 volt dc current from the bus is provided for the engine. The starting system consists of a starter button and a direct drive starting motor located on the accessory section of the engine. An external power source should normally be used for starting the engine although the aircraft battery may be capable of starting the engine, depending on its state of charge, etc.

1-37. STARTER BUTTON.

1-38. A press type starter button (21, figure 1-7) energizes the electric starter motor. The starter button, mounted on the lower center portion of the instrument panel, is housed within a circular recessed cup to prevent inadvertent operation. When the starter button is pressed, a solenoid connects the starter to the 28 volt dc bus. Electrical power for energizing the starter may be supplied by the aircraft battery, but an external power source should be connected for the purpose, whenever possible, to conserve battery life. The starter button is protected by a circuit breaker (figure 1-11).

1-39. TACHOMETER.

1-40. An electric tachometer (8, figure 1-7) showing engine rpm, located on the front instrument panel, is a self-generating instrument and requires no power from the aircraft electrical system. Aircraft ▲1 ▲5 have an additional tachometer (10, figure 1-8) provided on the rear instrument panel.

1-41. CYLINDER HEAD TEMPERATURE GAGE.

1-42. The cylinder head temperature gage (10, figure 1-7), located on the front instrument panel, is calibrated in degrees centigrade, with a range of 0°C to 350°C in 50° increments. It is an electrical instrument; however, its sole source of power is generated by a thermocouple mounted on number four engine cylinder and therefor requires no power from the aircraft electrical system.

1-43. MANIFOLD PRESSURE GAGE. Aircraft ▲5.

1-44. Manifold pressure gages (38, figure 1-7; 19, figure 1-8) are located on the extreme right hand side of both the front and rear instrument panels directly above the tachometer and are calibrated in inches of mercury.

1-45. PROPELLER. Aircraft ▲1 ▲2 ▲3 ▲4 .

1-46. The aircraft is equipped with a McCauley two-blade fixed pitch, all metal propeller. No propeller controls or indicators are provided for this installation.

1-47. PROPELLER. Aircraft ▲5 .

1-48. The engine drives a two blade constant speed, controllable pitch, all metal McCauley propeller. A propeller governor, controlled from either compartment, maintains a selected rpm, regardless of varying air loads or flight attitude. The governor increases the propeller blade angle by directing pressurized engine oil to a piston in the propeller hub. The aerodynamic force on the propeller blades is utilized to pull the blades into low pitch. The governor assembly, containing a gear driven oil pump, is mounted on the rear section of the engine. With a fixed throttle setting, the propeller has a governing range (full increase to full decrease) of from approximately 2600 rpm to 2100 rpm.

1-49. PROPELLER CONTROL LEVER. Aircraft ▲5 .

1-50. Engine rpm is determined by the setting of the propeller control lever (9, figure 1-4) on the throttle quadrant in each compartment. The quadrant is labeled RPM with marked positions; DECR aft position and INCR forward position. The position of the propeller control lever determines the setting of the propeller governor by mechanical linkage.

1-51. OIL SUPPLY SYSTEM.

1-52. Oil for engine lubrication and on aircraft ▲5 propeller governor operation is supplied from a sump mounted on the bottom of the engine. Oil is picked up by the engine driven pressure pump, forced through the oil thermostat, oil cooler, and then through the engine and on aircraft ▲5 the engine driven propeller governor. When the oil is below 72°C the thermostat will cause the oil to bypass the oil cooler. Oil from the engine and on aircraft ▲5 propeller governor return to the sump by gravity flow. The oil filler neck is located on the left rear side of the engine (figure 1-3). Ten U.S. quarts are required to fill the sump and an additional one half quart is required for the oil cooler and connecting lines. The oil supply is measured by a dip stick (figure 1-3) located just forward of the oil filler neck on the left side of the engine. No oil system controls are required on the aircraft. See figure 1-3 for oil specification and grade.

1-53. OIL PRESSURE GAGE.

1-54. An oil pressure gage (4, figure 1-7) is installed on the front instrument panel and indicates oil pressure to the engine in pounds per square inch and is a direct pressure operated gage.

1-55. OIL TEMPERATURE INDICATOR.

1-56. The electrical, resistance type, oil temperature indicator (7, figure 1-7) mounted on the front instrument panel is calibrated in degrees Centigrade and ranges in increments of 10°, from - 70°C to + 150°C. The indicator receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

1-57. FUEL SUPPLY SYSTEM.

1-58. Fuel is supplied to the engine from two aluminum

FUEL QUANTITY DATA (U. S. GALLONS)

TANKS	NO.	USABLE FUEL-EACH	FULLY SERVICED-EACH	EXPANSION SPACE-EACH	TOTAL VOL. EACH
MAIN	1	20.5	21.0	0.5	21.5
AUX.	1	20.5	21.0	0.5	21.5

Figure 1-9.

fuel tanks, a main fuel tank located in the inboard end of the left wing, and an auxiliary fuel tank similarly located in the right wing (see figure 1-3). From these tanks, fuel flows through a fuel selector valve, an auxiliary fuel pump, a fuel strainer and an engine driven fuel pump to the carburetor. A vapor return line from the carburetor carries excess fuel and vapor back through the rear half of the fuel selector valve to the tank being used. A drain valve is incorporated in the fuel strainer and in each fuel tank to drain any water or sediment that may collect in the system. The auxiliary fuel pump is provided with a drain which opens to the outside surface of the cabin skin just forward of the auxiliary fuel pump. In event of pump seal failure, any fuel escaping through the seal will flow overboard instead of entering the pump motor where it would create a fire hazard. Recommended and alternate fuel specifications and grades are noted on figure 1-3.

1-59. FUEL SELECTOR VALVE.

1-60. A rotary type fuel selector valve is incorporated in the fuel system. The fuel selector valve handle (2, figure 1-15), which controls through mechanical linkage the fuel selector valve, has three positions: MAIN TANK, AUX. TANK and FUEL OFF. The MAIN TANK and AUX. TANK positions allow fuel to flow from the main tank and auxiliary tank respectively to the engine. The FUEL OFF position seals both tanks off from the rest of the fuel system and allows no fuel to pass beyond the selector valve. The valve is designed so that the fuel flowing through the vapor return line is routed back into the fuel tank from which fuel is being used. The fuel selector valve is located on the left side of the fuselage at the wing root and is accessible from either the front or rear seat.

1-61. AUXILIARY FUEL PUMP SWITCH.

1-62. An auxiliary fuel pump switch (13, figure 1-7), on aircraft ▲ ▲3 is located in the lower right section of the front instrument panel and on aircraft ▲2 ▲4 ▲5 the switch (8, figure 1-12), is located on the switch and circuit breaker panel below the left front window. The switch is labled FUEL PUMP and has two positions: ON (up position) and OFF (down position). On aircraft ▲ ▲5 an additional auxiliary fuel pump switch (9, figure 1-17) is provided in the rear compartment. This switch is located just forward of the rear shoulder harness lock handle. The switch is labled FUEL PUMP and has two positions; ON (forward position) and OFF (aft position), and operates the auxiliary fuel pump in exactly the same manner as the switch in the front compartment. The auxiliary fuel pump is used to build up pressure in the carburetor before starting the engine and during takeoff and landing. It is also used as an emergency source of fuel pressure if the engine driven fuel pump fails. When the auxiliary fuel pump is not in operation, fuel is bypassed around the pump through a bypass located in its base. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

1-63. FUEL DRAIN VALVES.

1-64. Three, self-locking drain valves are provided in the fuel system. (see figure 1-10.) A valve is located in the bottom of each wing tank and labeled "FUEL TANK DRAIN". One valve is incorporated in the fuel filter and is labeled "FUEL FILTER DRAIN". These valves are used to drain water and sediment from the fuel system.

1-65. FUEL QUANTITY INDICATORS.

1-66. A direct-reading, mechanically-actuated float-type fuel quantity indicator (3, figure 1-15; 5, figures 1-16) is mounted in each fuel tank at the wing root. Each indicator shows, in relation to a full tank, the amount of fuel remaining in its respective fuel tank. The indicator is marked E, 1/4, 1/2, 3/4 and F. A red arc is painted on the face of each indicator and is labeled NO TAKE-OFF to warn the pilot that the respective fuel tank is almost empty.

1-67. FUEL PRESSURE GAGE.

1-68. A fuel pressure gage (3, figure 1-7) for the engine is located on the front instrument panel and indicates fuel pressure to the engine in pounds per square inch. On aircraft ▲ a fuel pressure gage (1, figure 1-8) is also located on the rear instrument panel.

1-69. FUEL LOW PRESSURE WARNING LIGHT. Aircraft ▲5.

1-70. A fuel low pressure warning light (21, figure 1-8) is installed on the rear instrument panel, and will illuminate to warn the student in the event fuel pressure drops to 10psi or below. The warning light, which is located on the lower portion of the instrument panel, is normally OFF. The light is a press-to-test type and may be checked for continuity of the circuit by pressing the light in. The light receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

AIRCRAFT FUEL SYSTEM

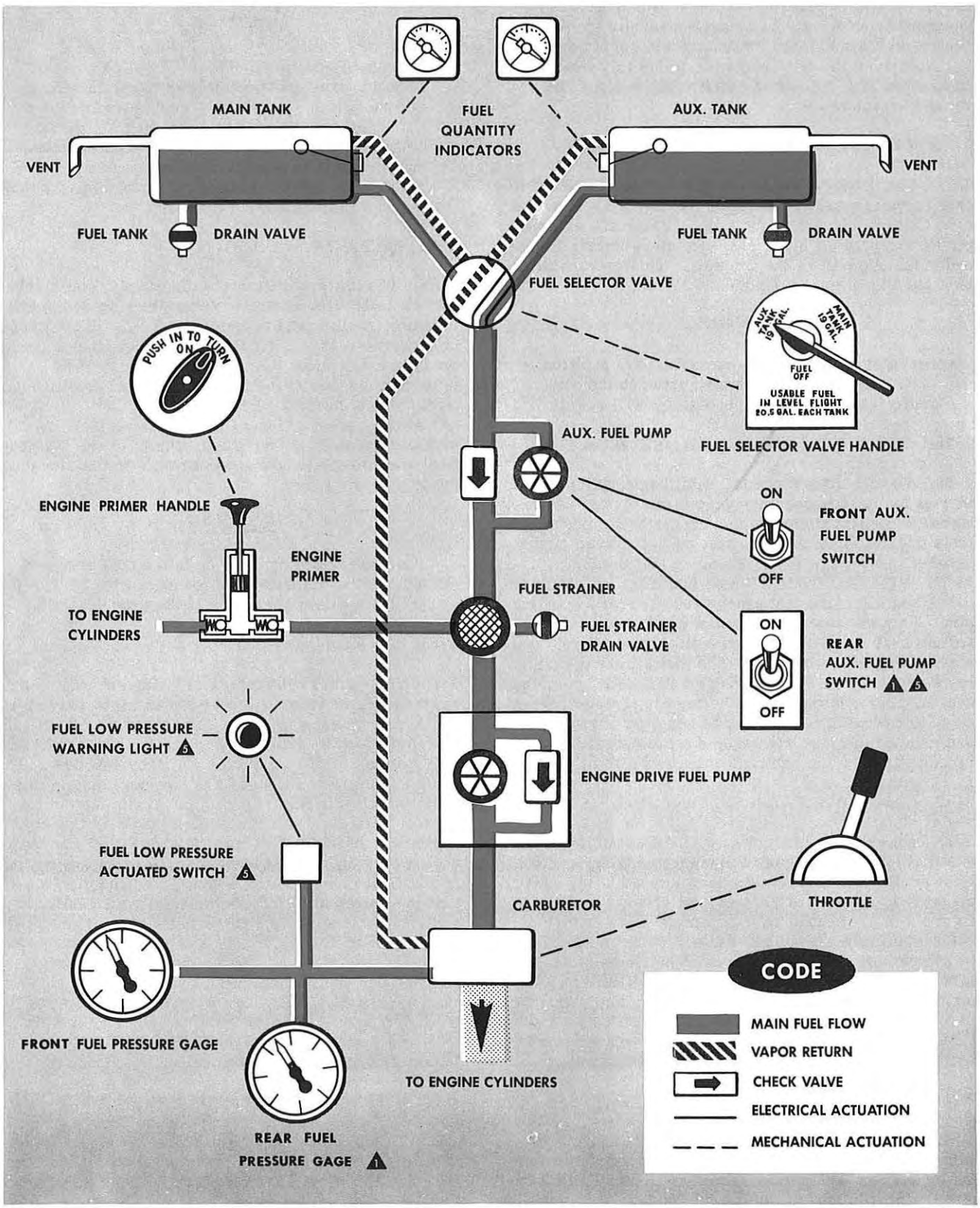


Figure 1-10.

1-71. ELECTRICAL POWER SUPPLY SYSTEM.

1-72. The aircraft is equipped with a 28 volt direct current electrical power supply system (figure 1-11). The dc system is powered by a 50 ampere engine driven generator. A 24 volt, 11 ampere-hour storage battery serves as a stand by power source to supply current to the dc system when the generator is inoperative or when generator voltage is insufficient to close the reverse current relay.

1-73. EXTERNAL POWER RECEPTACLE.

1-74. The dc power supply system can be connected to external power source for engine starting, or for ground checking the electrical system, through the external power receptacle (figure 1-3) located on the right side of the fuselage aft of the firewall. This receptacle is protected by a spring-loaded door.

CAUTION

The battery switch must be in the OFF position when external power is connected to the aircraft, as damage to the battery will result.

1-75. CIRCUIT BREAKERS. Aircraft ▲1 ▲3.

1-76. All electrical circuits, with the exception of the starter and oil temperature gage circuits, and the external drop load circuit (some aircraft) are protected from overloads by manual reset push-pull type circuit breakers (9, figure 1-7). These circuit breakers, labeled "PUSH TO RESET" have luminous tips and are located on the instrument panel directly above the switch row. Should an overload occur in a circuit, the resulting heat rise will cause the circuit breaker to pop out and break the circuit. The circuit breaker may be pushed in to re-energize the circuit. However, the circuit breaker should not be held in if it opens the circuit a second time. Automatic reset circuit breakers are provided for the starter and oil temperature gage circuits and for the external drop load circuit.

1-77. CIRCUIT BREAKERS. Aircraft ▲2 ▲4.

1-78. All electrical circuits, with the exception of the external drop load circuit, are protected from overload by manual reset circuit breakers located in the lower aft portion of the switch and circuit breaker panel (see figure 1-12). Should an overload occur in a circuit, the resulting heat rise will cause the circuit breaker to pop out and break the circuit. The circuit breaker, labeled "PUSH TO RESET, PULL TO BREAK", may be pushed in to re-energize the circuit. However, the circuit breaker should not be held in if it opens the circuit a second time. An automatic reset circuit breaker is provided for the external drop load circuit.

1-79. CIRCUIT BREAKERS. Aircraft ▲5.

1-80. All electrical circuits, are protected from overload by push-to-reset circuit breakers located in the lower rear portion of the switch and circuit breaker panel (figure 1-12). Should an overload occur in a circuit the resulting heat rise will cause the circuit breaker to pop out and break the circuit. The circuit breaker may be pushed in to re-energize the circuit. However, the circuit breaker should not be held in if it opens the circuit a second time. The circuit breakers are labeled "PUSH TO RESET, PULL TO BREAK".

CAUTION

Circuit breakers should not be pulled or reset without a thorough understanding of all the effects and results. Use of the circuit breakers can eliminate from the system some related warning system or interlocking circuit. A circuit breaker that continues to pop out after being reset, could result in an electrical fire and further attempts to reset it should be discontinued.

1-81. BATTERY SWITCH.

1-82. The battery switch (19, figure 1-7) on aircraft ▲1 ▲3 is located on the lower right side of the front instrument panel and on aircraft ▲2 ▲4 ▲5 the switch (10, figure 1-12), is located on the switch and circuit breaker panel under the left front window. The switch is used to disconnect the battery from the aircraft electrical supply system. The switch is marked BAT and has two positions, ON and OFF, which controls the circuit accordingly. When the switch is in the ON position, the battery is connected directly to the 28 volt dc bus.

CAUTION

The battery switch must be in the OFF position when external power is connected to the aircraft, as damage to the battery will result.

1-83. GENERATOR SWITCH.

1-84. The generator switch (20, figure 1-7) on aircraft ▲1 ▲3 is located on the lower right side of the front instrument panel and on aircraft ▲2 ▲4 ▲5 the switch (9, figure 1-12) is located on the switch and circuit breaker panel under the left front window. The switch is marked GEN and has two positions, ON and OFF, and functions to control generator output to the 28 volt dc bus. With the switch ON, and the engine operating at 1200-1250 rpm or above, the generator will supply direct current to the 28 volt dc bus, thus relieving the drain on the battery. For normal operation the switch is in the ON position at all times. The switch is protected by a circuit breaker (figure 1-11).

Note

On aircraft ▲1 ▲3 a bar is installed across the battery and generator switchs. This provision enables the switches to be turned off simultaneously or operated individually.

1-85. VOLTAGE REGULATOR RHEOSTAT.

1-86. The voltage regulator is pre-set by the ground crew and ordinarily the pilot has no occasion to adjust it. However, the regulator can be adjusted in flight by means of a rheostat knob on the regulator. The regulator rheostat knob (11, figure 1-6) which can be reached from the front cockpit is on the left side of

ELECTRICAL POWER SUPPLY SYSTEM

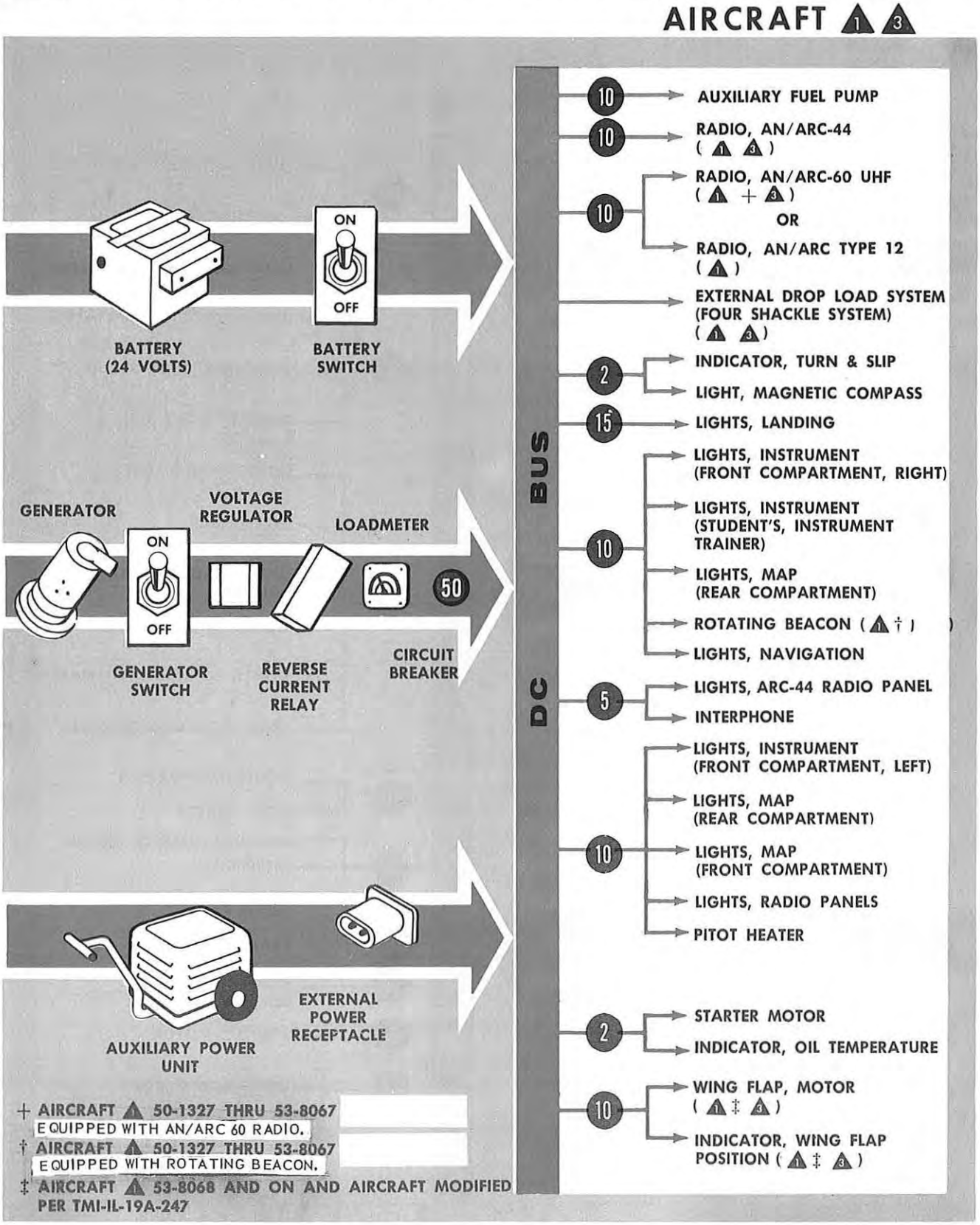
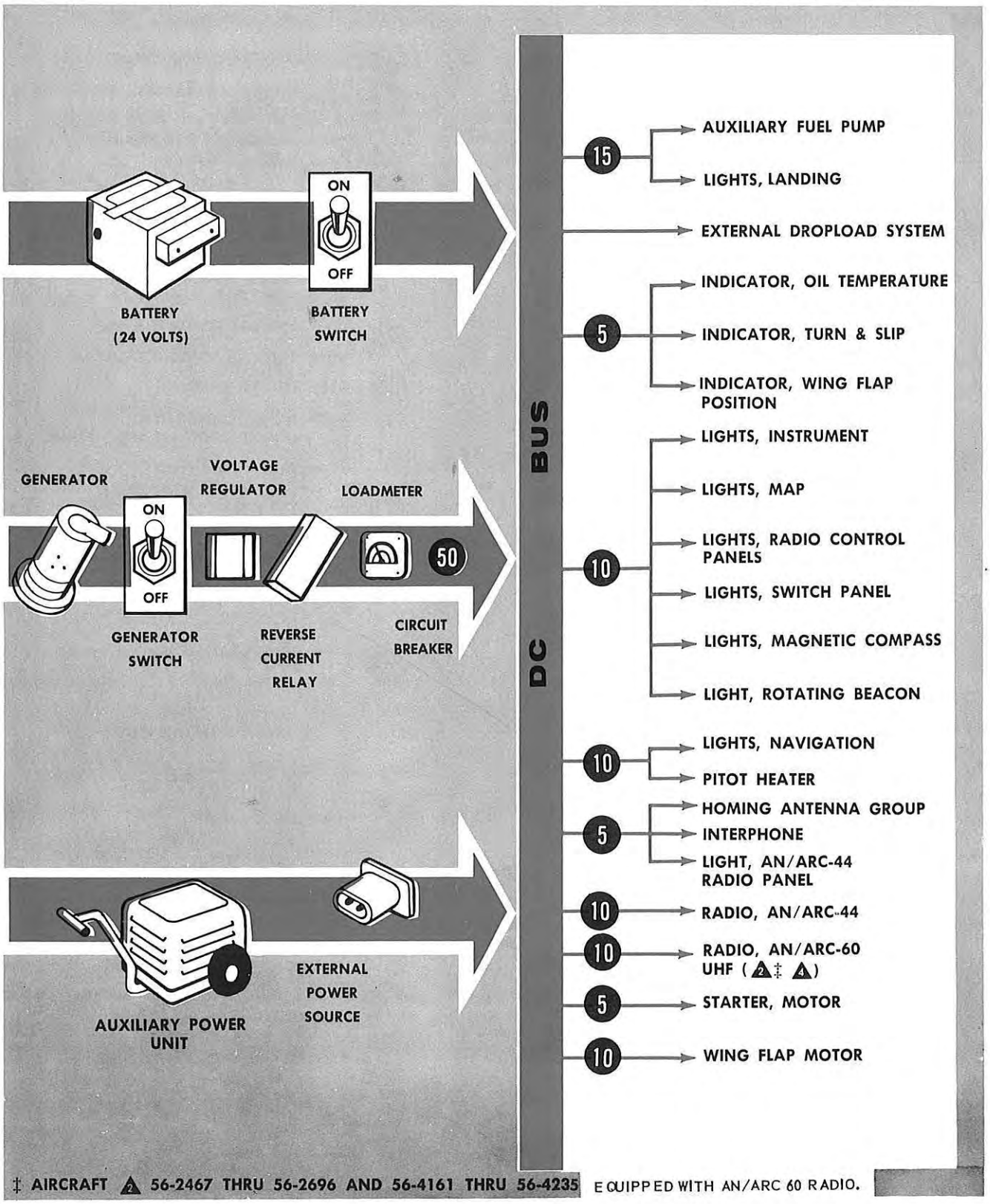


Figure 1-11. (Sheet 1 of 3)

ELECTRICAL POWER SUPPLY SYSTEM

AIRCRAFT ▲2 ▲4



‡ AIRCRAFT ▲2 56-2467 THRU 56-2696 AND 56-4161 THRU 56-4235 EQUIPPED WITH AN/ARC 60 RADIO.

Figure 1-11. (Sheet 2 of 3)

ELECTRICAL POWER SUPPLY SYSTEM

AIRCRAFT 5

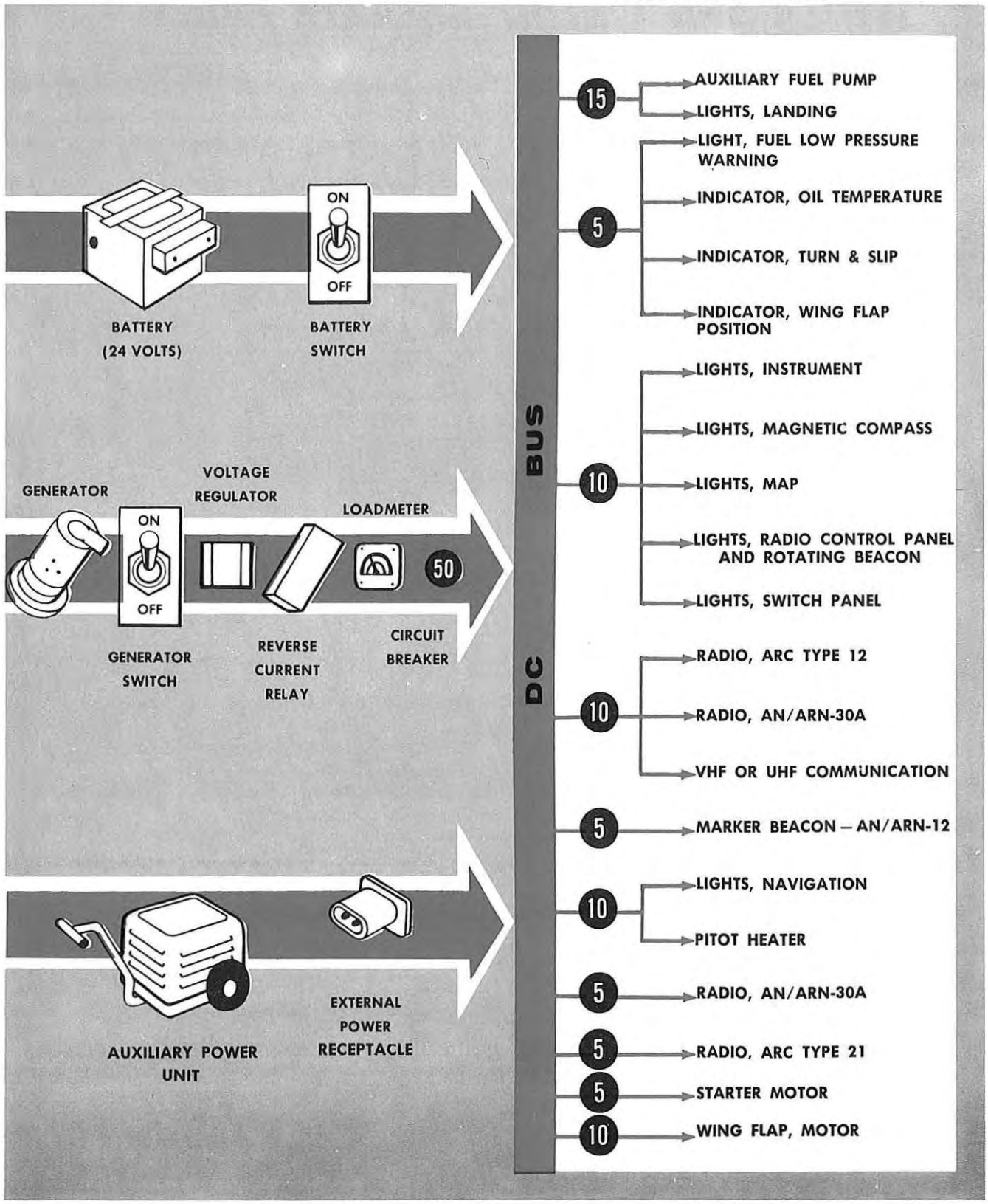
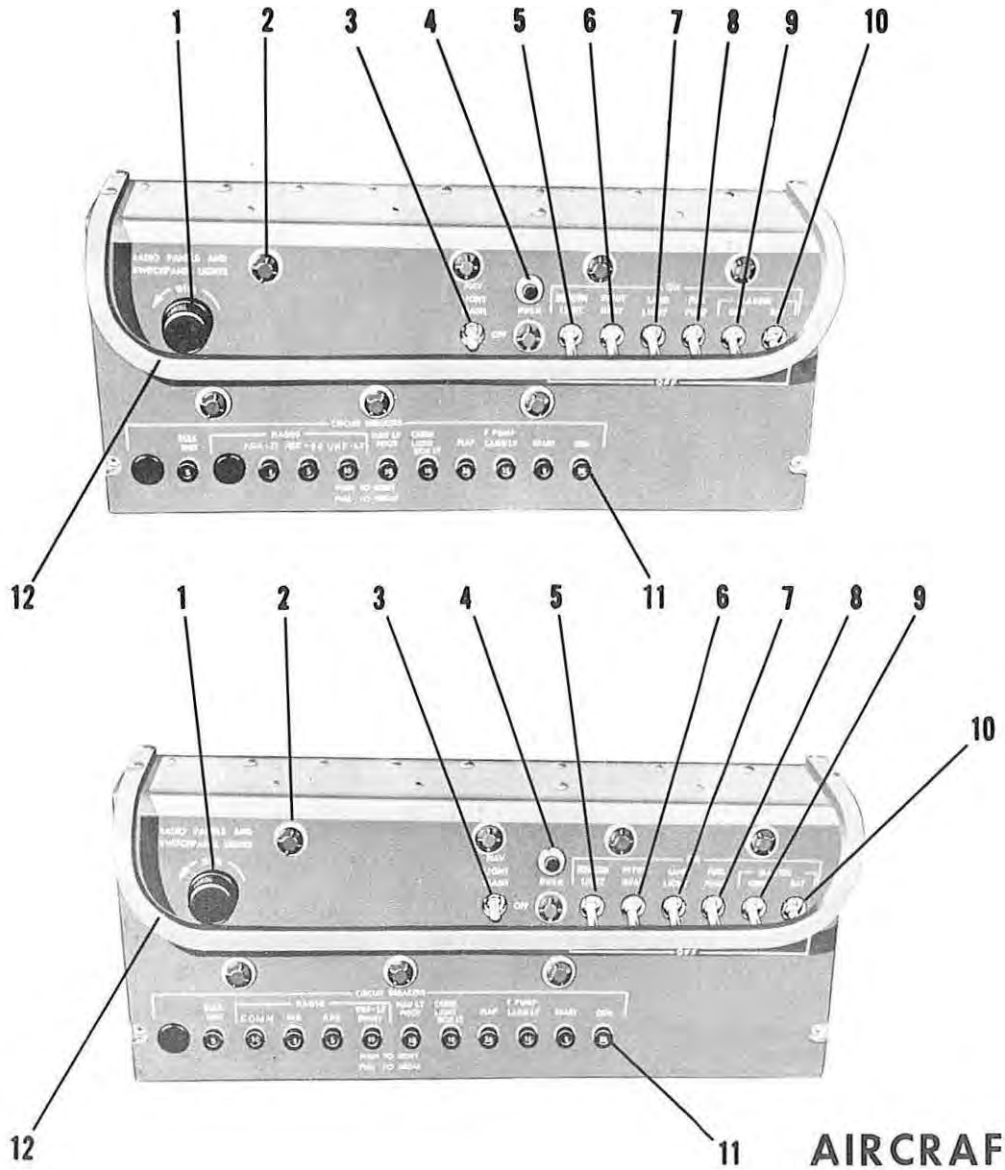


Figure 1-11. (Sheet 3 of 3)

SWITCH AND CIRCUIT BREAKER PANEL

AIRCRAFT 2 4



1. COMPASS, SWITCH AND CIRCUIT BREAKER PANEL AND RADIO PANELS RHEOSTAT SWITCH.
2. PANEL EDGE LIGHTS
3. NAVIGATION LIGHTS SWITCH
4. RADIO CONTROL SWITCH 2 4 5
5. ROTATING BEACON LIGHT SWITCH
6. PITOT HEAT SWITCH
7. LANDING LIGHT SWITCH
8. AUXILIARY FUEL PUMP SWITCH
9. GENERATOR SWITCH
10. BATTERY SWITCH
11. CIRCUIT BREAKERS
12. SWITCH GUARD

Figure 1-12.

the voltage regulator. Clockwise rotation of the knob increases voltage, counterclockwise rotation decreases it.

1-87. LOADMETER.

1-88. The loadmeter (5, figure 1-7) is located on the upper right portion of the front instrument panel. The loadmeter which consists of an ammeter, on which the scale has been calibrated to read from -0.1 to 1.25 times the generator related output, to indicate that proportion of generator rated output being used.

1-89. FLIGHT CONTROL SYSTEM.

1-90. Conventional stick and rudder pedal controls are provided in both the front and rear compartments to operate, by mechanical linkage, the primary flight control surfaces (ailerons, rudder and elevators). The flight-adjustable trim tab on the right elevator is mechanically actuated by manual operation of the elevator trim tab control wheel. A trim tab control wheel is provided on the left cabin wall adjacent to the front seat in all aircraft. A rear compartment trim tab control wheel is provided on aircraft ▲1 ▲5. The rudder and aileron trim tabs are adjustable on the ground only. When desired, the rear control stick can be removed and stowed on the rear compartment cabin wall. On aircraft ▲1 ▲2 ▲5, the rear rudder pedals, when not in use, can be folded flat against the floor.

1-91. CONTROL STICKS.

1-92. Aileron and elevator control is maintained by dual control sticks on individual yokes, interconnected to permit control of the aircraft using either control stick. The front control stick (13, figure 1-6) on aircraft ▲1 ▲2 houses a microphone switch (3 figure 1-6) within the control stick grip. The rear control stick (14, figure 1-17) is removable by pulling out the control stick release knob and lifting the control stick from its socket. On aircraft ▲1 ▲2 a stowage strap and clip for storage of the rear control stick, when not in use, are provided on the left cabin wall of the rear compartment. On aircraft ▲3 ▲4 ▲5 a similar stowage strap and clip are provided on the right cabin wall of the rear compartment.

Note

When installing the aft control stick in its socket, be sure to have the slot in the base of the control slick facing aft.

1-93. RUDDER PEDALS.

1-94. Two sets of rudder pedals are provided to mechanically operate the rudder and the steerable tailwheel. The front pedals are located just aft of the firewall adjacent to the cabin floor, and are equipped with brake master cylinders. The rear pedals are located just aft of the front seat. On aircraft ▲1 ▲2 ▲5, the rear pedals can be folded flat against the floor by pulling up on the locking pin of each pedal and pushing the pedal down and aft (see figure 1-13). The pedals in this position do not interfere with the normal operation of the front rudder pedals. The pedals can be raised to the operating position by pulling them up and forward. Toe pressure on these pedals for brake operation is mechanically transmitted to the front pedals which in turn hydraulically actuate the main wheel brakes. On aircraft ▲3 ▲4 the rear pedals do not fold and they are equipped with separate brake master cylinders.

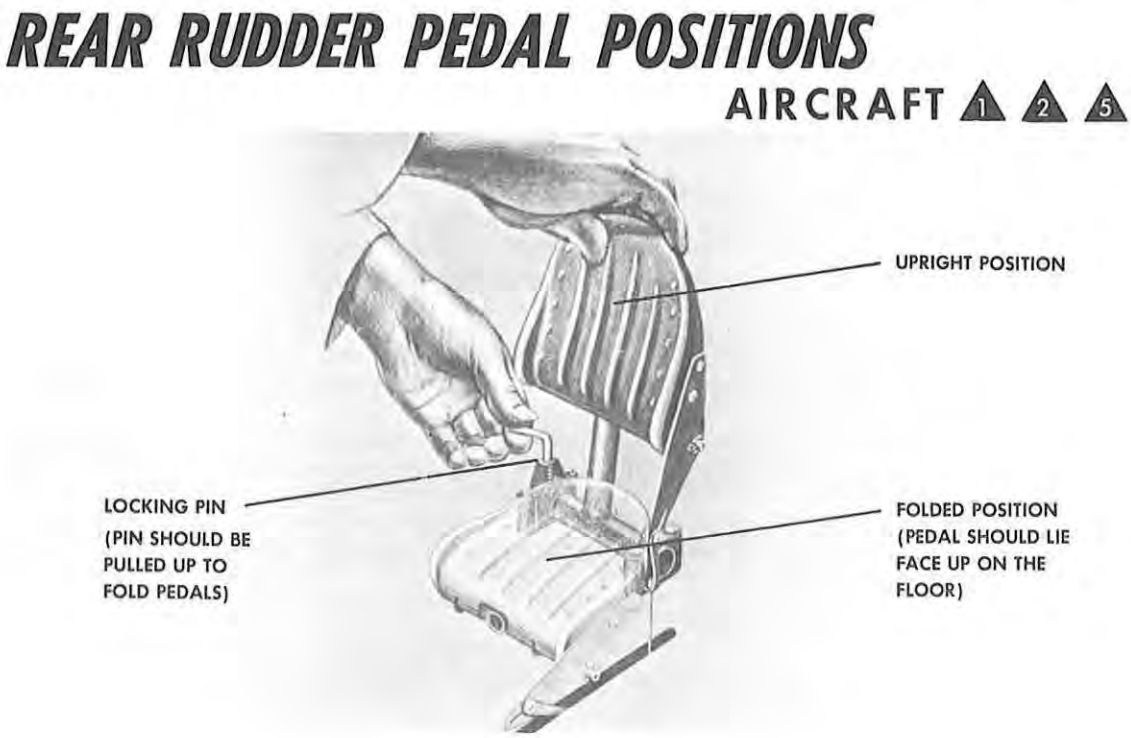


Figure 1-13.

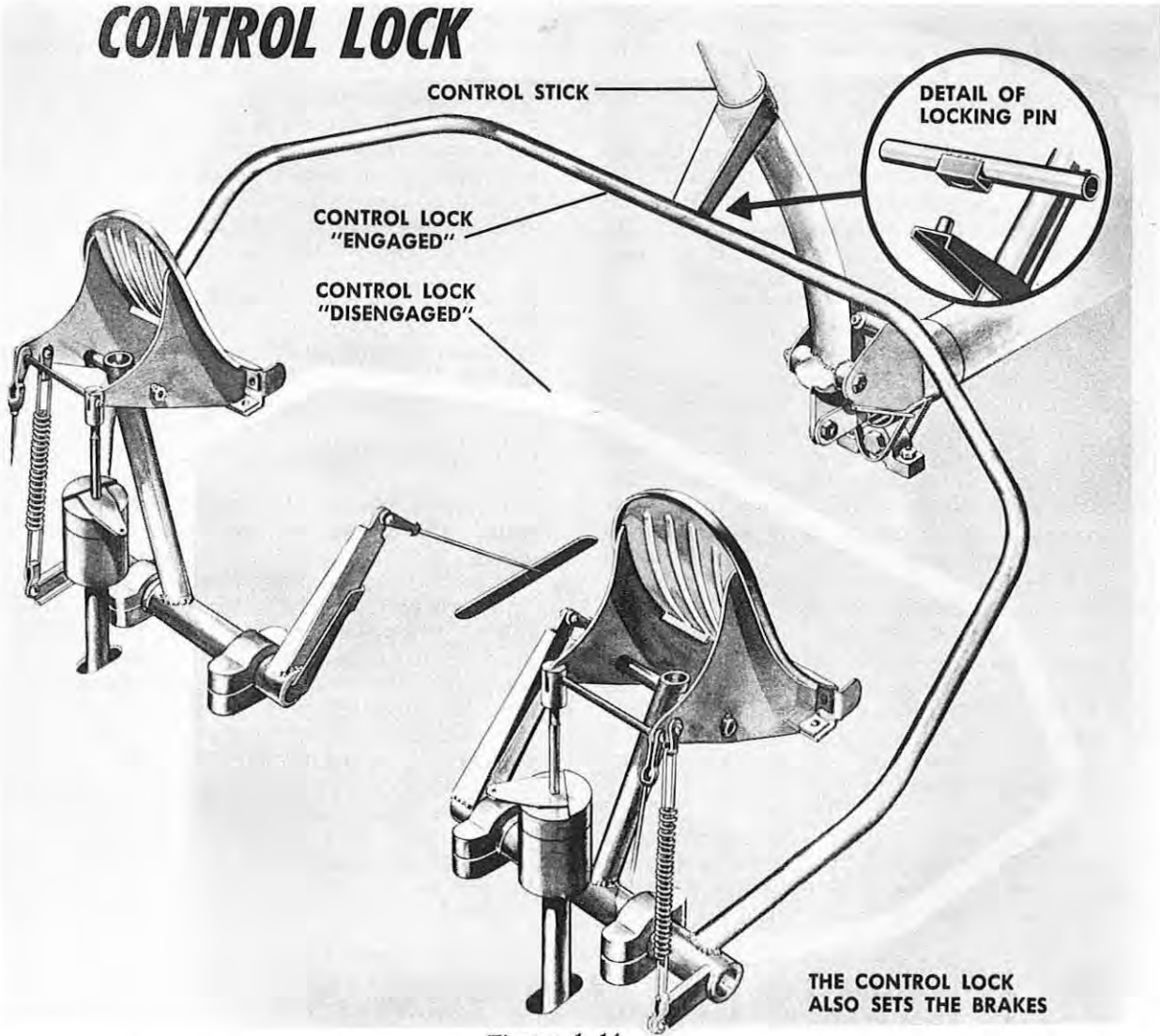


Figure 1-14.

1-95. ELEVATOR TRIM TAB CONTROL WHEEL.

1-96. An elevator trim tab control wheel (16, figure 1-15) is located on the left cabin wall in all aircraft and is accessible from the front seat; an additional trim tab control wheel (16, figure 1-17) is located on the left cabin wall of the rear compartment on aircraft ▲ 5 equipped and designated as instrument trainers. The rear compartment trim tab control wheel is mechanically interconnected with the forward trim tab control wheel and operates in exactly the same manner. The trim tab control wheel is mechanically connected to the elevator trim tab by chains, cables and a screw-jack tab actuator. A trim tab position indicator is in each trim tab control wheel mechanism indicating the nose attitude of the aircraft. The labeled indicator positions are NOSE UP, NOSE DOWN and TAKEOFF.

1-97. CONTROL LOCK.

1-98. A simple positive control lock (figure 1-14) for rudder, elevators and ailerons, is located on the cabin floor in front of the forward control stick. The lock is a welded "U" shaped tube that pivots inside the front rudder pedal torque tubes. Locking and unlocking of the controls is accomplished by a single operation. The controls can be LOCKED by lifting the lock from the floor and engaging it with the steel pin attached to the forward control stick. The controls can be UNLOCKED by disengaging the control lock from the pin and lowering the lock to the floor. The control lock also sets the parking brakes.

1-99. WING FLAPS. Aircraft ▲ 50-1327 thru 53-8067 except aircraft modified per TM1-1L-19A-247.

1-100. The wing flaps are partial span, single-slotted trailing edge type and extend from the aileron to the fuselage on each wing. The wing flaps are manually operated by a wing flap lever mounted on the cabin floor adjacent to the left cabin wall. Manual operation of the lever to the selected setting actuates the wing flaps to the desired degree of extension.

1-101. WING FLAP LEVER. Aircraft ▲ 50-1327 thru 53-8067 except aircraft modified per TM1-1L-19A-247.

1-102. The wing flaps are controlled by a wing flap lever (13, figure 1-15) mounted on the floor between

the front seat and left cabin wall. The manual operated lever is mechanically connected to the wing flaps by a flexible control cable. The lever is operated by depressing a thumb button on the lever and moving the lever to the desired flap setting. By releasing the thumb button, the flap lever can be locked to provide 0, 30, 45 and 60 degree flap position.

1-103. WING FLAPS. Aircraft 1 53-8068 and on and aircraft modified per TM1-1L-19A-247 and aircraft 2 3 4 5 .

1-104. The wing flaps are partial span, single-slotted trailing edge type and extend from the aileron to the fuselage on each wing. The wing flaps are electrically operated by a wing flap switch to any setting between zero and 60 degrees. A flap position indicator on the instrument panel shows the position of the wing flaps at all times. No emergency system is provided for operating the flaps. The wing flaps receive their electrical power from the 28 volt dc bus and the system is protected by a circuit breaker (figure 1-11).

1-105. WING FLAP SWITCHES. Aircraft 1 53-8068 and on, and aircraft modified per TM1-1L-19A-247 and aircraft 2 3 4 5 .

1-106. On modified 1 aircraft and all aircraft 2 , the wing flaps are electrically operated by means of a three-position, spring-loaded wing flap switch (10, figure 1-15) mounted on the window sill adjacent to the front engine control quadrant. The switch has two marked positions, FLAPS UP and FLAPS DOWN. The center position of the switch is the OFF position. The wing flaps can be lowered electrically to any setting, between zero and 60 degrees, and locked at that position by releasing the switch and allowing it to return to the center OFF position. When the flap limits are reached, either up or down, the electrical actuator motor is automatically turned off by the limit switches. On aircraft 3 4 5 , the wing flaps are electrically operated by either of two spring-loaded, three position switches. One switch (8, figure 1-4) is mounted on the aft side of the front engine control quadrant for use by the front occupant. The switch is labeled FLAP and has two marked positions, UP and DOWN. The center position of the switch is OFF. On aircraft 3 4 , a switch (20, figure 1-17) is provided in the rear compartment on the left window sill for use by the rear occupant. The switch has two marked positions, FLAPS UP and FLAPS DOWN and overrides the front flap switch. The center position of the switch is OFF. On aircraft 5 , the rear compartment flap switch (26, figure 1-17) is mounted on the left side of the rear engine control quadrant. The switch is spring-loaded and is labeled FLAP with two marked positions UP and DOWN with the center position being OFF. On aircraft 5 , the front and rear flap switches are identical in operation being momentarily on in both the UP or DOWN position, however, the front wing flap switch will override the rear flap switch. The time required to lower the wing flaps from zero to 60 degrees is approximately seven and a half seconds; the time required to raise the flaps from 60 to zero degrees is approximately six and a half seconds. The wing flap switches receive their electrical power from the 28 volt dc bus and are protected by a circuit breaker (figure 1-11).

1-107. WING FLAP POSITION INDICATOR. Aircraft 1 53-8068 and on and aircraft modified per TM1-1L-19A-247 and aircraft 2 3 4 5 .

1-108. An electrically operated wing flap position indicator (2, figure 1-7) is provided on the front instrument panel. On aircraft 5 an additional flap position indicator (22, figure 1-8) is also provided for the student. The indicators are calibrated in degrees and show the position of the wing flaps at all times. The indicators receive their electrical power from the 28 volt dc bus and are protected by a circuit breaker (figure 1-11).

1-109. LANDING GEAR SYSTEM.

1-110. The landing gear system consists of a fixed main landing gear and a steerable tailwheel. The main landing gear incorporates a single tapered spring-steel leaf supporting each main wheel. The tailwheel is supported by a multileaf spring. The tailwheel steering arms are connected to the rudder by flexible cables and springs, and steering is controlled through normal operation of the rudder pedals. No landing gear controls or indicators are required for this system. To permit smoother and safer landing and takeoff operation on extremely rough, soft and sandy fields, which are impractical for standard-gear-equipped aircraft, a tandem gear may be installed.

1-111. LANDING GEAR SYSTEM (SEAPLANE). Aircraft 1 2

1-112. When the aircraft is used as a seaplane, floats are attached to fittings on the fuselage, and seaplane fins are installed at the tips of the horizontal stabilizer. Retractable water rudders on the floats are connected to the rudder bellcrank to permit steering during taxiing.

1-113. STEERING SYSTEM.

1-114. Steering during operations is made possible by operation of the rudder pedals. The tailwheel steering arms are connected to the rudder by flexible cables and springs. The tailwheel is steerable through an arc of 16 degrees each side of neutral. Beyond this travel, the tailwheel becomes free-swiveling.

1-115. STEERING SYSTEM (SEAPLANE). Aircraft 1 2 .

1-116. WATER RUDDERS.

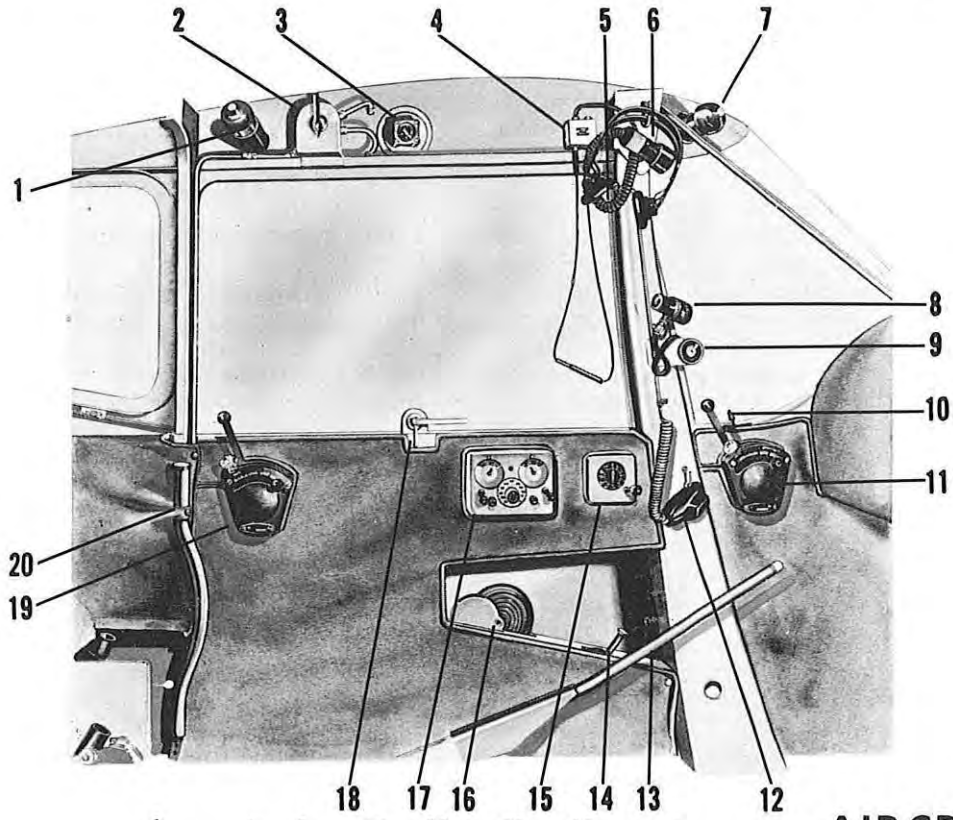
1-117. Retractable water rudders are mounted at the aft end of each float to provide steering during seaplane taxiing. The water rudders are connected by a system of cables to the rudder bellcrank; thus, normal operation of the rudder pedals operates the water rudders.

1-118. WATER RUDDER RETRACTION HANDLE.

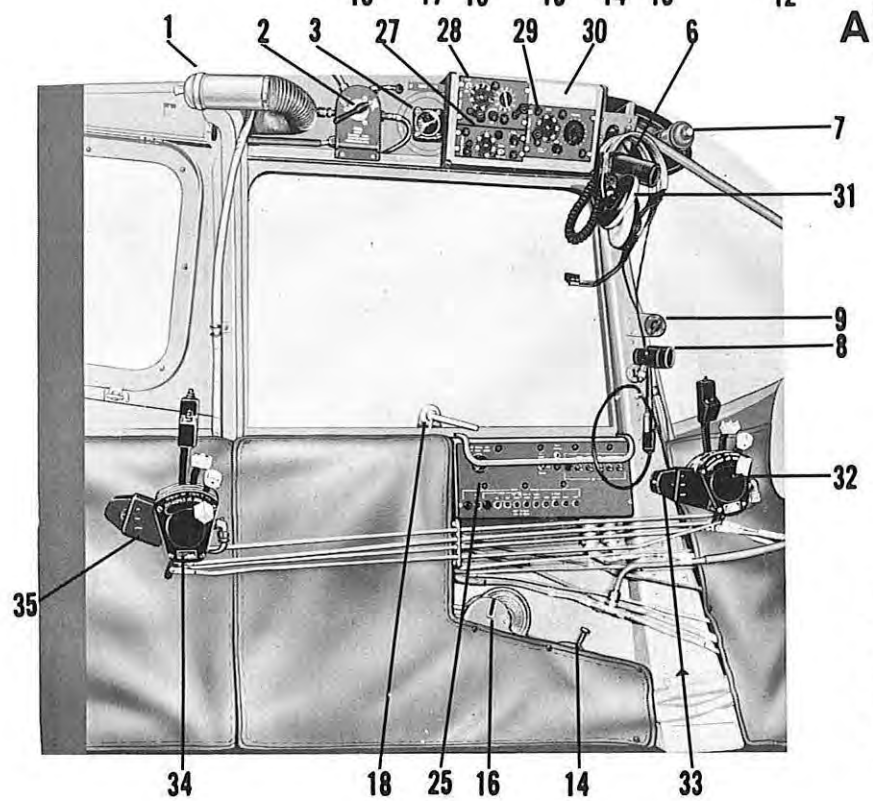
1-119. A water rudder retraction handle (7, figure 1-6), located slightly to the right and in front of the forward control stick, is provided to manually raise and lower the water rudders. Flexible steel cables connect the water rudders to the water rudder retraction handle. The retraction handle is normally hooked

FRONT COMPARTMENT ... LEFT SIDE

AIRCRAFT 1 3

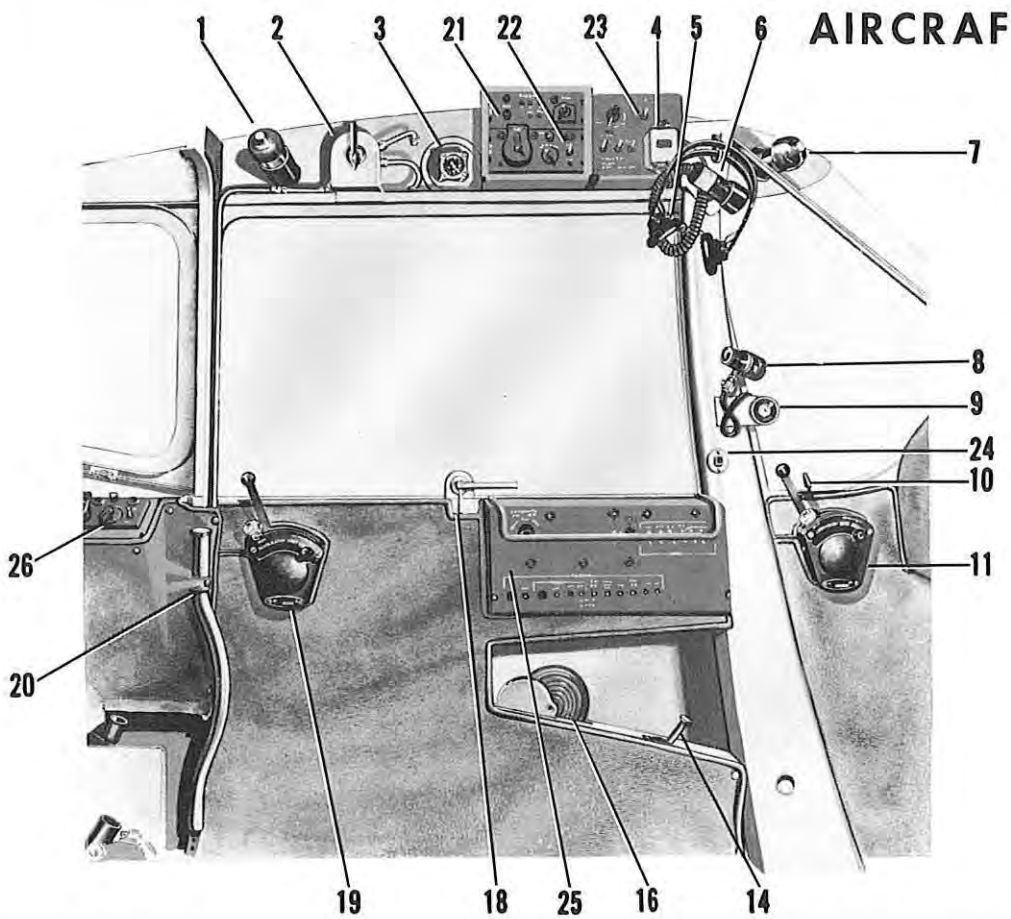


AIRCRAFT 5



NOTE
On aircraft IT 1 and aircraft 2, the rear instrument panel has been removed for clarity

Figure 1-15. (Sheet 1 of 2)



1. REAR COMPARTMENT VENTILATOR
2. FUEL SELECTOR VALVE HANDLE
3. MAIN FUEL TANK QUANTITY INDICATOR
4. RADIO JACK BOX
5. HEADSET
6. MAP LIGHT
7. FRONT COMPARTMENT VENTILATOR
8. INSTRUMENT LIGHT
9. INSTRUMENT LIGHT RHEOSTAT SWITCH
10. WING FLAP SWITCH (1‡ 2)
11. FRONT ENGINE CONTROL QUADRANT (1 AND 2 SHOWN)
12. MICROPHONE
13. WING FLAP LEVER (1 †)
14. SHOULDER HARNESS INERTIA REEL LOCK LEVER
15. MANUAL LOOP CONTROL
16. ELEVATOR TRIM TAB CONTROL WHEEL
17. RADIO CONTROL PANEL
18. WINDOW HANDLE
19. REAR ENGINE CONTROL QUADRANT (1 AND 2 SHOWN)
20. CONTROL STICK STOWAGE STRAP (1 AND 2)
21. ARC-44 RADIO DISTRIBUTION PANEL
22. FRONT ARC-44 RADIO CONTROL PANEL
23. RADIO SWITCH PANEL
24. AUXILIARY LIGHT MOUNTING BRACKET
25. SWITCH AND CIRCUIT BREAKER PANEL
26. REAR ARC-44 RADIO CONTROL PANEL
27. VHF NAVIGATION CONTROL PANEL
28. LF AND MANUAL LOOP CONTROL PANEL OR LF NAVIGATION (ADF RADIO COMPASS) CONTROL PANEL
29. VHF OR UHF COMMUNICATION CONTROL PANEL
30. TRANSMITTER FREQUENCY CHART
31. HEADSET - MICROPHONE
32. FRONT ENGINE CONTROL QUADRANT
33. WING FLAP SWITCH (3 1 AND 5)
34. REAR ENGINE CONTROL QUADRANT
35. WING FLAP SWITCH

† AIRCRAFT 1 50-1327 THRU 53-8067 EXCEPT AIRCRAFT MODIFIED PER TM1-1L-19A-247
‡ AIRCRAFT 1 53-8068 AND ON AND AIRCRAFT MODIFIED PER TM1-1L-19A-247

Figure 1-15. (Sheet 2 of 2)

FRONT COMPARTMENT RIGHT SIDE

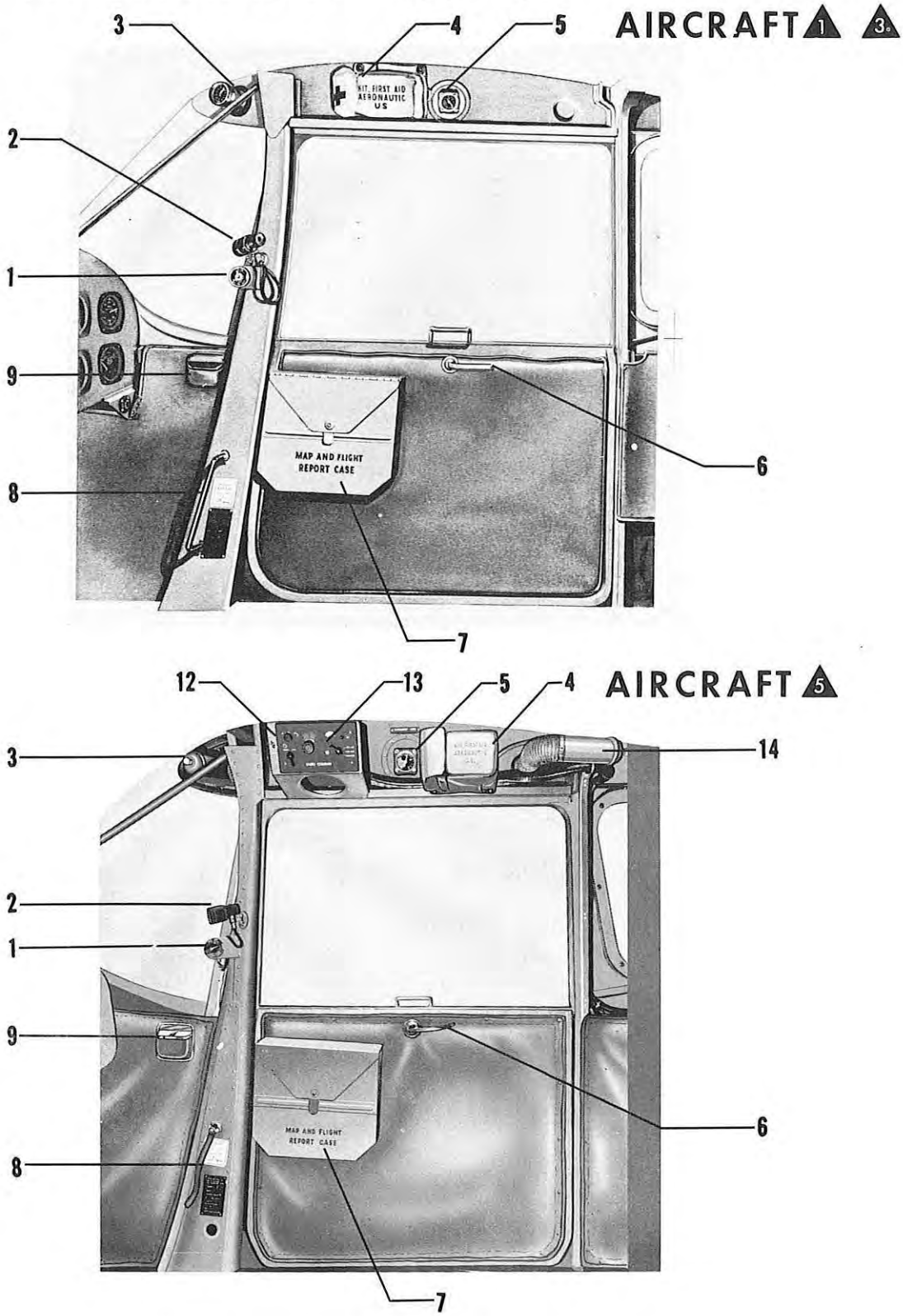
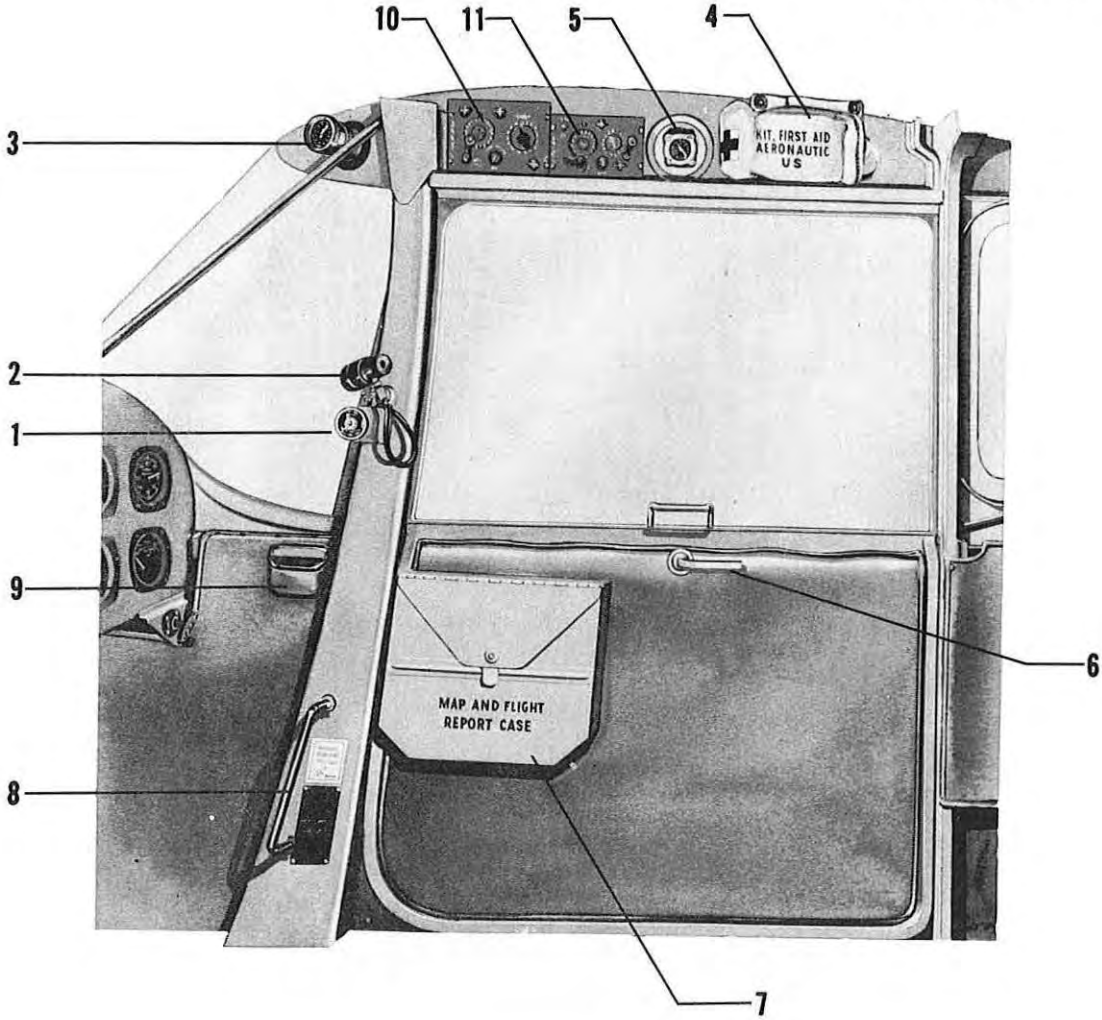


Figure 1-16. (Sheet 1 of 2)

AIRCRAFT 2 4



1. INSTRUMENT LIGHT RHEOSTAT SWITCH
2. INSTRUMENT LIGHT
3. FRONT COMPARTMENT VENTILATOR
4. FIRST AID KIT
5. AUXILIARY FUEL TANK QUANTITY INDICATOR
6. DOOR HANDLE
7. MAP AND FLIGHT REPORT CASE
8. DOOR EMERGENCY RELEASE HANDLE
9. ASH TRAY
10. UHF RADIO CONTROL PANEL
11. LF AND MANUAL LOOP CONTROL PANEL
12. ADF POWER SWITCH
13. ADF RADIO CONTROL PANEL
14. REAR COMPARTMENT VENTILATOR

Figure 1-16. (Sheet 2 of 2)

REAR COMPARTMENT... LEFT SIDE

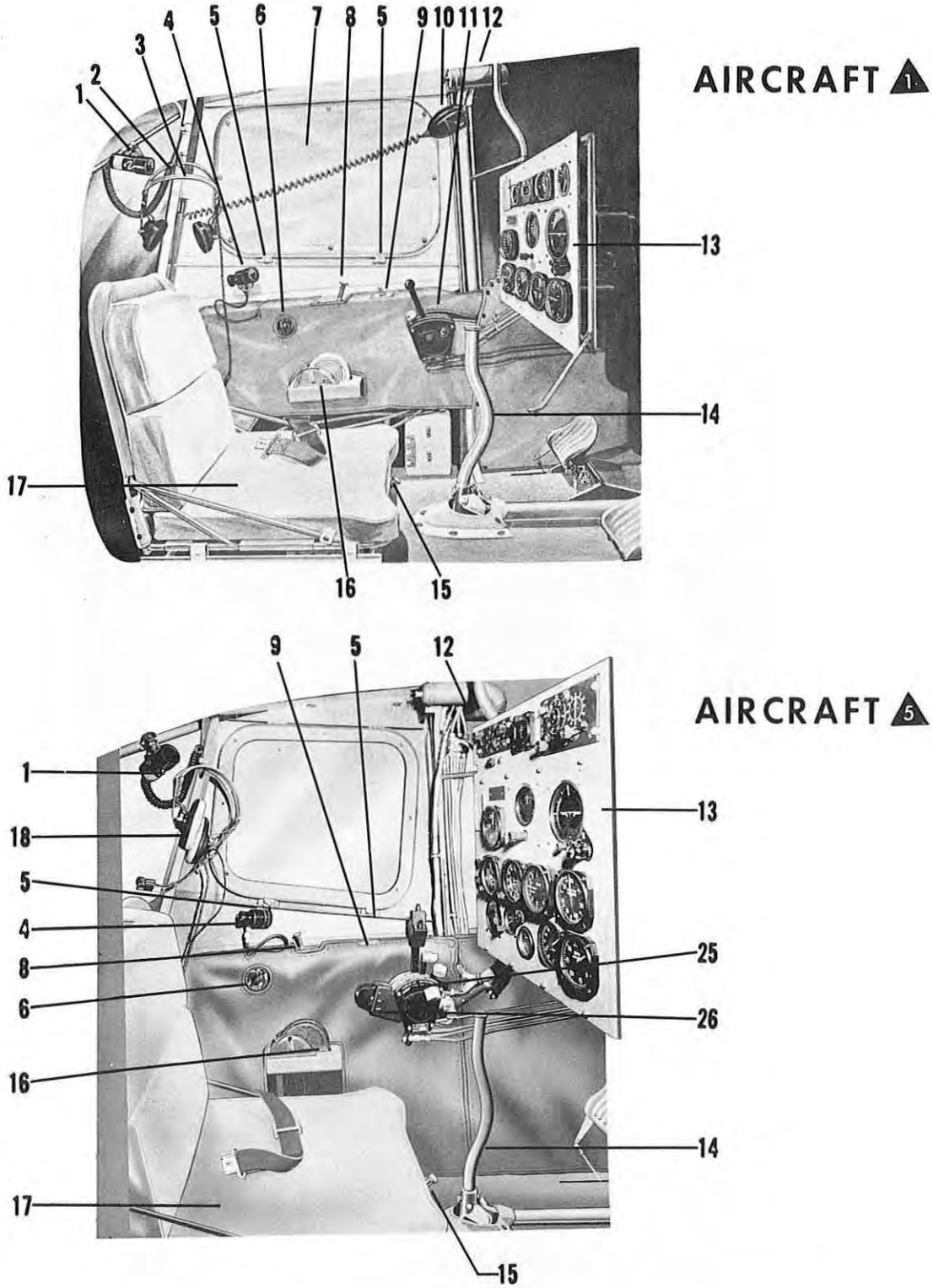
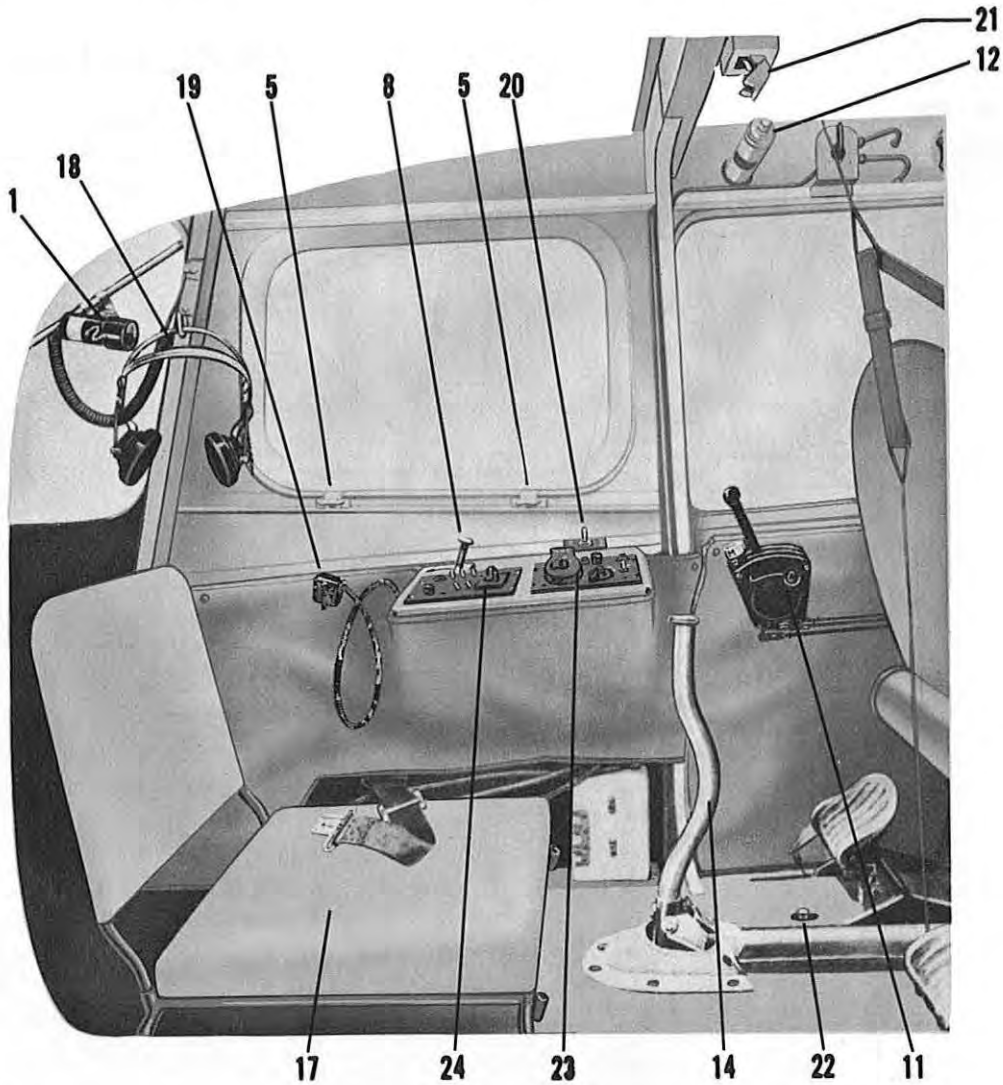


Figure 1-17. (Sheet 1 of 2)

AIRCRAFT ▲2 ▲3 ▲4



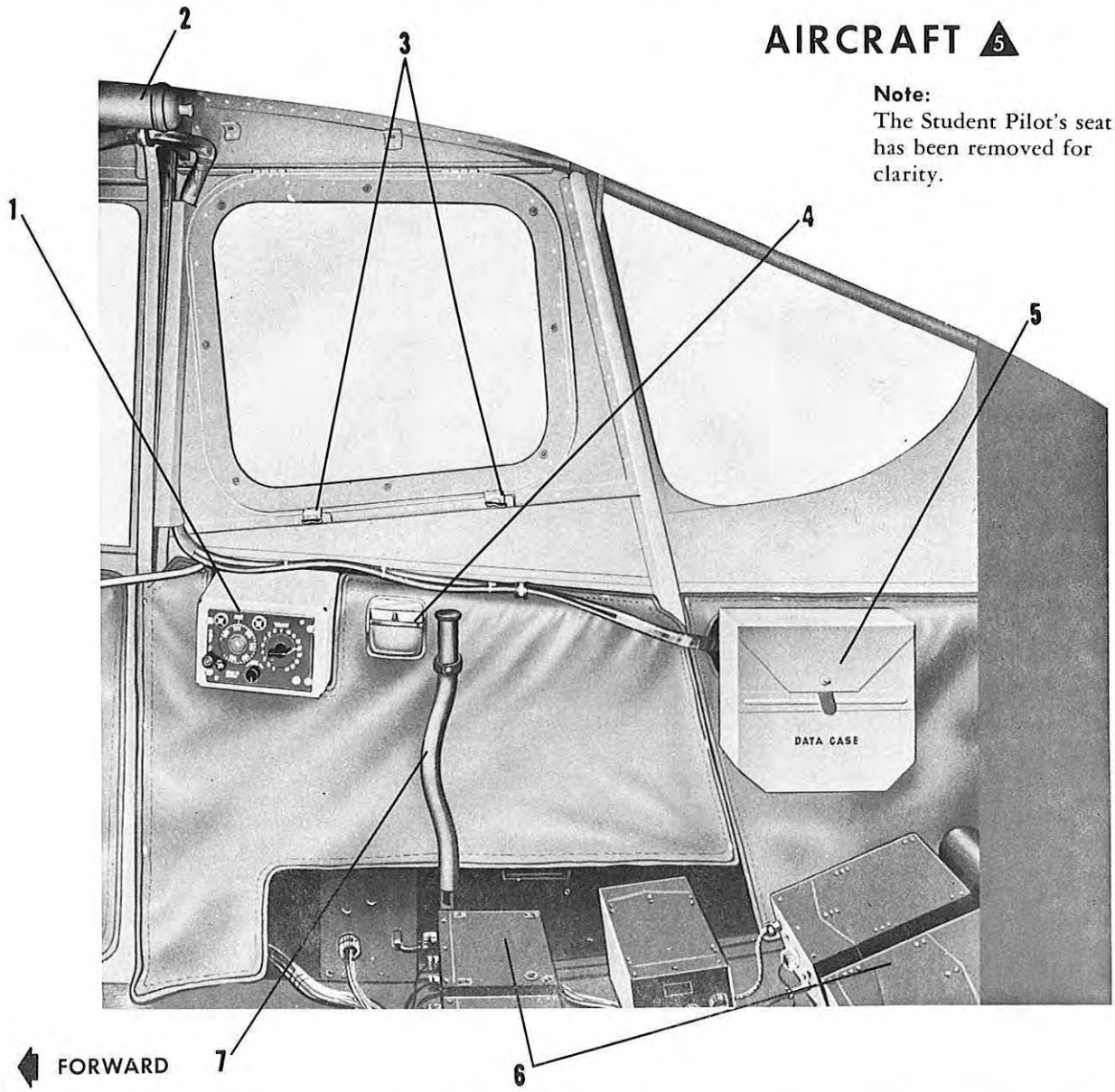
1. MAP LIGHT
2. HEADSET
3. RADIO JACK BOX
4. INSTRUMENT LIGHT
5. SIDE WINDOW LATCH
6. INSTRUMENT LIGHT RHEOSTAT SWITCH
7. BLIND FLIGHT CURTAIN
8. SHOULDER HARNESS INERTIA REEL LOCK LEVER
9. AUXILIARY FUEL PUMP SWITCH
10. MICROPHONE
11. ENGINE CONTROL QUADRANT (▲1 AND ▲2 SHOWN)
12. REAR COMPARTMENT VENTILATOR
13. INSTRUMENT PANEL
14. CONTROL STICK
15. SEAT ADJUSTMENT LEVEL
16. ELEVATOR TRIM TAB CONTROL WHEEL
17. REAR SEAT
18. HEADSET-MICROPHONE
19. MICROPHONE SWITCH ▲2
20. WING FLAP SWITCH ▲3 ▲4
21. EMERGENCY MAGNETO SWITCH ▲3 ▲4
22. FOOT-OPERATED MICROPHONE SWITCH ▲2
23. ARC-44 RADIO CONTROL PANEL
24. ARC-44 RADIO DISTRIBUTION PANEL
25. ENGINE CONTROL QUADRANT
26. WING FLAP SWITCH

Figure 1-17. (Sheet 2 of 2)

REAR COMPARTMENT ... RIGHT SIDE

AIRCRAFT 5

Note:
The Student Pilot's seat has been removed for clarity.



1. VHF OR UHF COMMUNICATION CONTROL PANEL
2. REAR COMPARTMENT VENTILATOR
3. SIDE WINDOW LATCHES
4. ASH TRAY
5. DATA CASE
6. ELECTRONIC EQUIPMENT
7. CONTROL STICK STOWAGE

Figure 1-18.

to the water rudder retraction handle hook (4, figure 1-6) during flight. The water rudders are UP when the retraction handle is in this position. By manually lowering the retraction handle to the cabin floor the water rudders are lowered to their operating position.

1-120. BRAKE SYSTEM.

1-121. Single disc hydraulic brakes on the main wheels are conventionally operated by applying toe pressure to either the front or rear rudder pedals. Rotation of the pedals actuates the hydraulic brake cylinders, resulting in a braking action on the main landing gear wheels. The parking brake is set by engagement of the control lock. No emergency braking provisions are provided on the aircraft.

1-122. BRAKE PEDALS.

1-123. Conventional toe-type pedals consist of the upper part of the front and rear rudder pedals. A hydraulic brake master cylinder is mounted directly on each of the front brake pedals. On aircraft ▲1 ▲2 ▲5, the rear brake pedals are connected by flexible steel cables to the front brake pedals; thus, pressure applied to the rear pedals is mechanically transmitted to the master cylinders on the front pedals and pressure is applied at the wheel brakes. On aircraft ▲3 ▲4 the rear brake pedals are equipped with brake master cylinders, and pressure applied to the pedals is transmitted directly to the main wheel brakes by the hydraulic system.

1-124. INSTRUMENTS.

1-125. This paragraph covers only those instruments which cannot be considered to be part of complete systems, such as fuel system, engine etc. For information regarding instruments that are an integral part of a particular system, refer to applicable paragraphs in this Section.

1-126. FRONT COMPARTMENT INSTRUMENTS.

1-127. The flight and engine instruments are mounted on a shock mounted instrument panel in the front compartment with the exception of a free air temperature gage and a magnetic compass. The free air temperature gage is mounted on the windshield centerstrip. The magnetic compass is mounted on a bracket attached to the windshield centerstrip just below the free air temperature gage.

1-128. REAR COMPARTMENT INSTRUMENTS. Aircraft IT ▲1 and aircraft ▲5.

1-129. All instruments necessary for instrument training are mounted on the rear instrument panel. The panel does not include the full complement of instruments provided on the front instrument panel; however, the instruments on the rear panel are identical to corresponding instruments on the front instrument panel. On aircraft ▲5 a fuel pressure warning light, rather than a fuel pressure gage, is installed on the rear panel to minimize the presence of raw fuel and to eliminate a fire hazard in the cabin area. The rear panel, on which all the instruments are located, is positioned just aft of the front seat. The panel is shock-mounted on a tubuler framework and is hinged at the left to allow the instrument panel to be swung aside for passage to the rear compartment. A locking arm (see figure 1-8) on the lower right corner of the panel engages in the right sidewall to hold the panel in flight position. When the arm is disengaged the panel may be swung aside. When the panel is swung all the way to the left to the stowed position, a spring clip holds it in place against the left sidewall.

WARNING

Do not operate aircraft with rear instrument panel in the stowed position as it may interfere with operation of the engine controls.

1-130. ELECTRICALLY-OPERATED INSTRUMENTS. Aircraft ▲1 ▲2 ▲3 ▲4.

1-131. Instruments operating on power from the aircraft 28 volt direct current electrical system include the turn-and-slip indicator, the wing flap position indicator (aircraft ▲1 ▲ and aircraft ▲2 ▲3 ▲4, and the oil temperature gage. These instruments (figure 1-7 and 1-8) will operate when the battery switch is ON, or when generator output is sufficient when the generator switch is ON. The tachometer and cylinder head temperature gage systems are self-generating type and do not require power from the aircraft electrical power supply system.

1-132. ELECTRICALLY OPERATED INSTRUMENTS Aircraft ▲5.

1-133. Instruments operating on power from the aircraft 28 volt direct current electrical system includes turn and bank indicator, wing flaps position indicator, marker beacon indicator light, radio compass azimuth indicator, and course indicator on both front and rear instrument panels. The oil temperature gage will operate when the battery switch is ON, or, with the generator charging, when the generator switch is ON. With the battery switch ON, the marker beacon indicator lights may be tested for continuity of their circuits by pressing the lights in. On early model aircraft ▲5, both radio compass azimuth indicators are operative after turning on the battery switch and the ADF power switch which is located adjacent to the ADF control panel on the right fuselage root rib and is accessible to the pilot. On later model aircraft ▲5, the radio compass azimuth indicators are operative after turning on the battery switch and the ON-OFF volume control knob located on the ADF control panel on the front and rear instrument panels. The course indicator on each panel is operative after turning on the battery switch and the OMNI control panel power switch. The front OMNI control panel (27, figure 1-15) is the lower rear panel on the left fuselage root rib. The rear OMNI control panel (15, figure 1-8) is mounted in the upper left hand corner of the rear instrument panel. The tachometer and cylinder head temperature gage systems are self-generating type and do not require power from the aircraft electrical power supply system.

1-134. VACUUM OPERATED INSTRUMENTS.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

1-135. Vacuum operated instruments provided in the aircraft are the attitude indicator and directional indicator. An attitude indicator (32, figure 1-7) and a directional indicator (30, figure 1-7) are mounted on the front instrument panel of all aircraft; and on aircraft IT ▲ and aircraft ▲5 an attitude indicator (6, figure 1-8) and a directional indicator (5, figure 1-8) are mounted on the rear instrument panel. A suction gage (31, figure 1-7) is provided on the front instrument panel to indicate the amount of vacuum being developed by the engine-driven vacuum pump. No suction gage is provided on the rear instrument panel on aircraft ▲ ▲5.

1-136. PITOT STATIC SYSTEM.

1-137. The airspeed indicator (27, figure 1-7; 11, figure 1-8), calibrated in mph, is located on the front instrument panel; this indicator utilizes the difference between impact and static air pressure. The altimeter (26, figure 1-7; 9, figure 1-8) is calibrated in feet and incorporates a knollsman window. A vertical velocity indicator (28, figure 1-7; 7, figure 1-8) is calibrated in feet per minute. These instruments are located on the front instrument panel. These instruments utilize static air pressure obtained from static ports mounted on each side of the fuselage aft section. The pitot tube is mounted on the under side of the left wing. On aircraft IT ▲ and aircraft ▲5 there is an additional airspeed indicator, altimeter and vertical velocity indicator mounted on the rear instrument panel.

1-138. STANDBY COMPASS.

1-139. The standby compass (35, figure 1-7) mounted on the windshield centerstrip is a standard type magnetic compass to be used as a check on the directional indicator, or in the event of an emergency. Readings should be taken only during level flight since error may be introduced by turning or acceleration. A compass correction card is provided in the compass card holder (34, figure 1-7), indicating deviation, and is located directly below the compass.

1-140. CLOCK.

1-141. An eight day, stem wound, clock (23, figure 1-7) is located on the front instrument panel. On aircraft ▲ and aircraft ▲5 a clock (3, figure 1-8) of the same type is located on the rear instrument panel.

1-142. EMERGENCY EQUIPMENT.

1-143. DOOR EMERGENCY RELEASE HANDLE.

1-144. A door emergency release handle (8, figure 1-16) is located just forward of the door on the right side of the cabin. The entire lower section of the cabin door can be jettisoned by disengaging the bottom end of the door emergency release handle and turning it clockwise.

1-145. HAND-OPERATED FIRE EXTINQUISHER.

1-146. A hand operated, carbon-tetrachloride, fire extinquisher (figure 1-19) is secured within a bracket on the back of the lower frame of the front seat.

1-147. FIRST-AID KIT.

1-148. A first aid kit (4, figure 1-16) is located on the fuselage right root rib. On aircraft ▲ ▲5 the first aid kit is secured to snap studs located forward of the auxiliary fuel tank quantity indicator. On aircraft ▲2 ▲4 ▲5 the first aid kit is located aft of the auxiliary fuel tank quantity indicator.

1-149. CABIN DOOR.

1-150. A cabin door is provided on the right side of the aircraft for entrance and exit. The door is composed of two sections, the lower door section which is jettisonable in flight, and the upper door section which is a window hinged on the top edge and opens out and up. The lower section is hinged along the forward edge and opens like a conventional door. Handles are provided on both the inside and outside of the lower door section. To open the window section of the door, rotate the handle down approximately 60 degrees until the window swings free. The window can be held open by swinging it up until it engages a retaining stud located on the under surface of the wing. To open the door lower section, continue rotating the handle down until the door is unlatched.

CAUTION

Do not exceed the maximum allowable speed with the window section of the door open. See Section V for limitation.

1-151. SEATS.

1-152. FRONT SEAT.

1-153. The front seat (figure 1-19) is mounted on two rails in the front part of the cabin. A seat adjustment lever (figure 1-19) is provided on the right side of the seat. The front seat may be adjusted fore and aft by raising the lever and sliding the seat to the desired position. To lock the seat in this position, release the lever and move the seat fore and aft a short distance until the seat locking pins engage in holes in the seat rails. On aircraft ▲3 ▲4, a seat emergency release pedal (figure 1-19) is incorporated on the front seat adjustment mechanism. The pedal positioned on the back right side of the front seat frame, enables the occupant in the rear seat to release the seat lock and push the seat forward as an aid to leaving the rear compartment. Toe pressure on the top of the pedal actuates the lock release mechanism. The front seat framework is constructed of welded steel tubing and an aluminum seat pan. Moisture resistant cloth material covers the seat back. A sponge rubber seat pad is attached to the seat with snap fasteners.

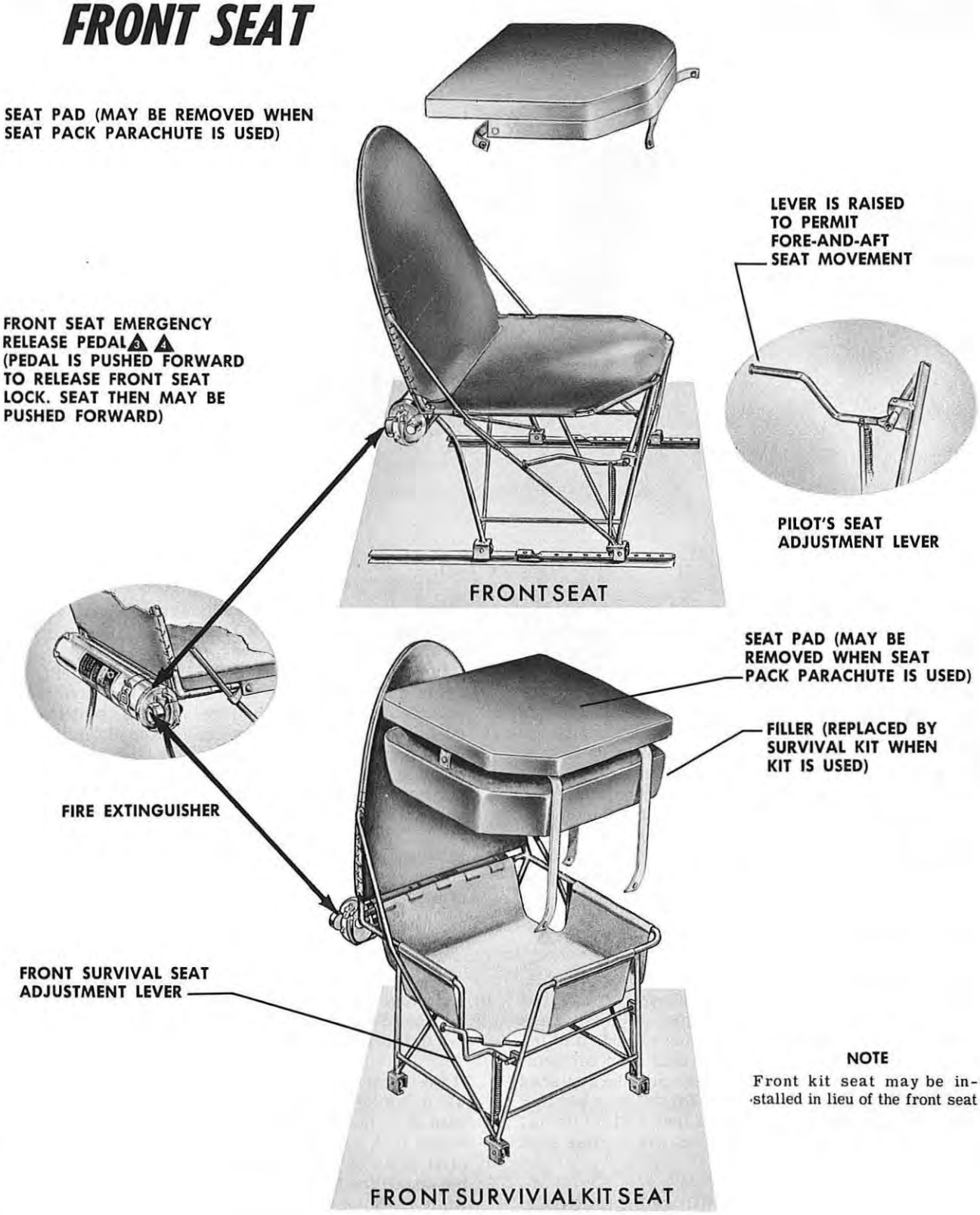
1-154. SURVIVAL KIT SEAT AIRCRAFT ▲ ▲2 ▲3 ▲4.

1-155. The regular front seat may be replaced with a seat using the same general framework, but equipped to accommodate a survival kit in the seat bottom.

1-156. REAR SEAT. Aircraft IT ▲ and ▲5.

1-157. A rear seat (figure 1-20), mounted on two rails

FRONT SEAT



NOTE

Front kit seat may be installed in lieu of the front seat

Figure 1-19.

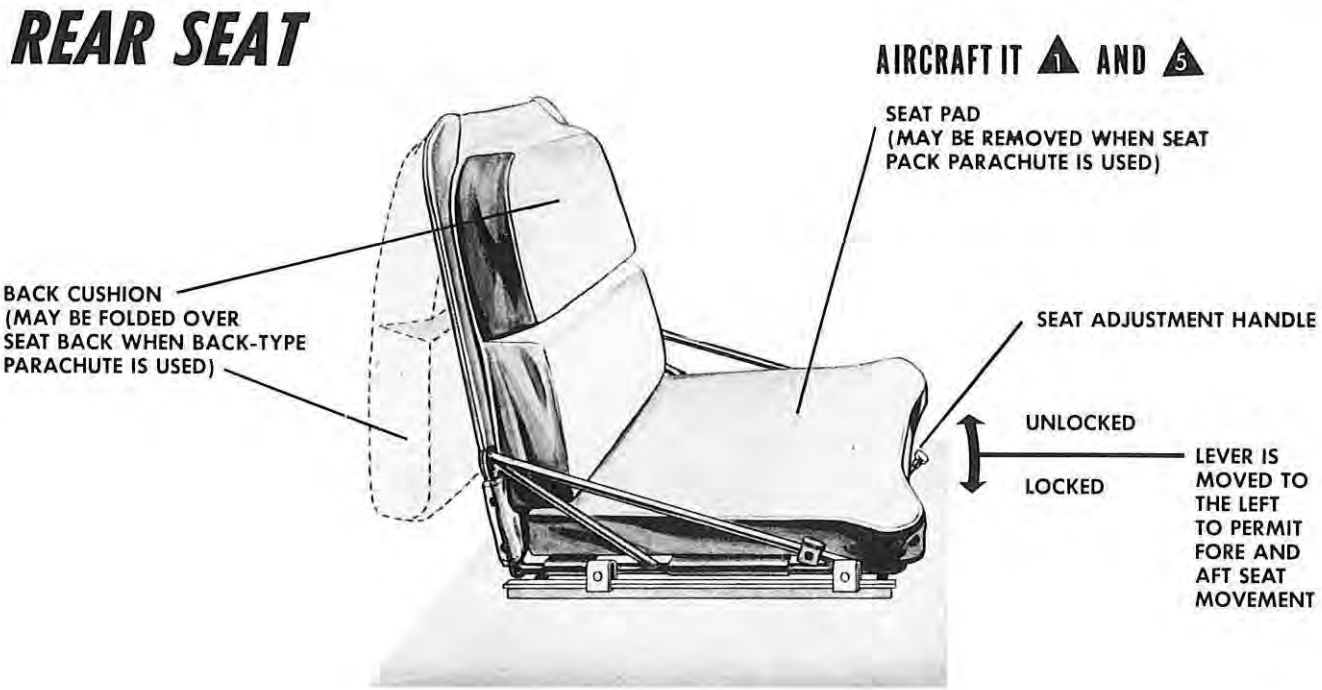


Figure 1-20.

to permit seat adjustment, is located in the rear compartment. A seat adjustment lever (15, figure 1-17) is located centrally along the front of the seat framework. The rear seat may be adjusted fore and aft by pushing the adjustment lever to the left and sliding the seat to the desired position. The seat is locked in this position by pulling the seat adjustment lever to the right as far as it will go, and at the same time moving the seat fore or aft a short distance until the seat locking pins engage in the bracket holes beneath the seat. The seat framework is constructed of welded steel tubing and an aluminum seat pan. The seat back is covered with moisture-resistant cloth material. Sponge rubber filled pads cushion the seat back and seat pan.

1-158. REAR SEAT. Aircraft IT 1 and 2 3 4.

1-159. The rear seat (figure 1-21) is not adjustable. Sockets for installing the seat back are provided at each corner of the seat bottom frame. The seat back can be lifted from the rear retaining sockets and installed in the front sockets if the rear seat occupant desires to sit facing aft. The seat may be replaced with a survival kit seat (figure 1-21) which is similar to the regular rear seat, except that a sheet-metal pan to hold a survival kit replaces the regular seat bottom.

1-160. SAFETY BELTS AND SHOULDER HARNESS.

1-161. A safety belt and shoulder harness, with associated inertia reel, is provided for each crew member. The safety belts are bolted to brackets on the fuselage structure. The inertia reels are mounted under the floor aft of each seat. A two-position (LOCK and UNLOCK) shoulder harness inertia reel lock lever (14, figure 1-15 and 8, figure 1-17) is located on the left cabin wall adjacent to each seat. A positive latch is provided for retaining the lever at either position of the quadrant. By pressing down on the top of the lever, the latch is released and the lever may be moved from one position to another. In addition to locking the shoulder harness manually the inertia reel will lock automatically under a 2 to 3 G load applied to the aircraft, as in a crash landing. Therefore, it is necessary to lock the harness manually only during maneuvers and flight in rough air, or as an added safety precaution in event of a forced landing.

CAUTION

Before a forced landing, all switches not readily accessible with the shoulder harness locked should be turned off before moving the lock lever to the LOCK position.

If the harness is locked while the pilot is leaning forward, as he straightens up, the harness will retract with him, moving into successive locked position as he moves back against his seat. To unlock the harness, the pilot must be able to lean back enough to relieve the tension on the lock. Therefore, if the harness is locked while the pilot is leaning back hard against the seat he may not be able to unlock the harness without first releasing it momentarily at the safety belt (or by releasing the harness buckles, if desired). After automatic locking of the harness, it will remain locked until the lock

lever is moved to the LOCK position and back to UNLOCK.

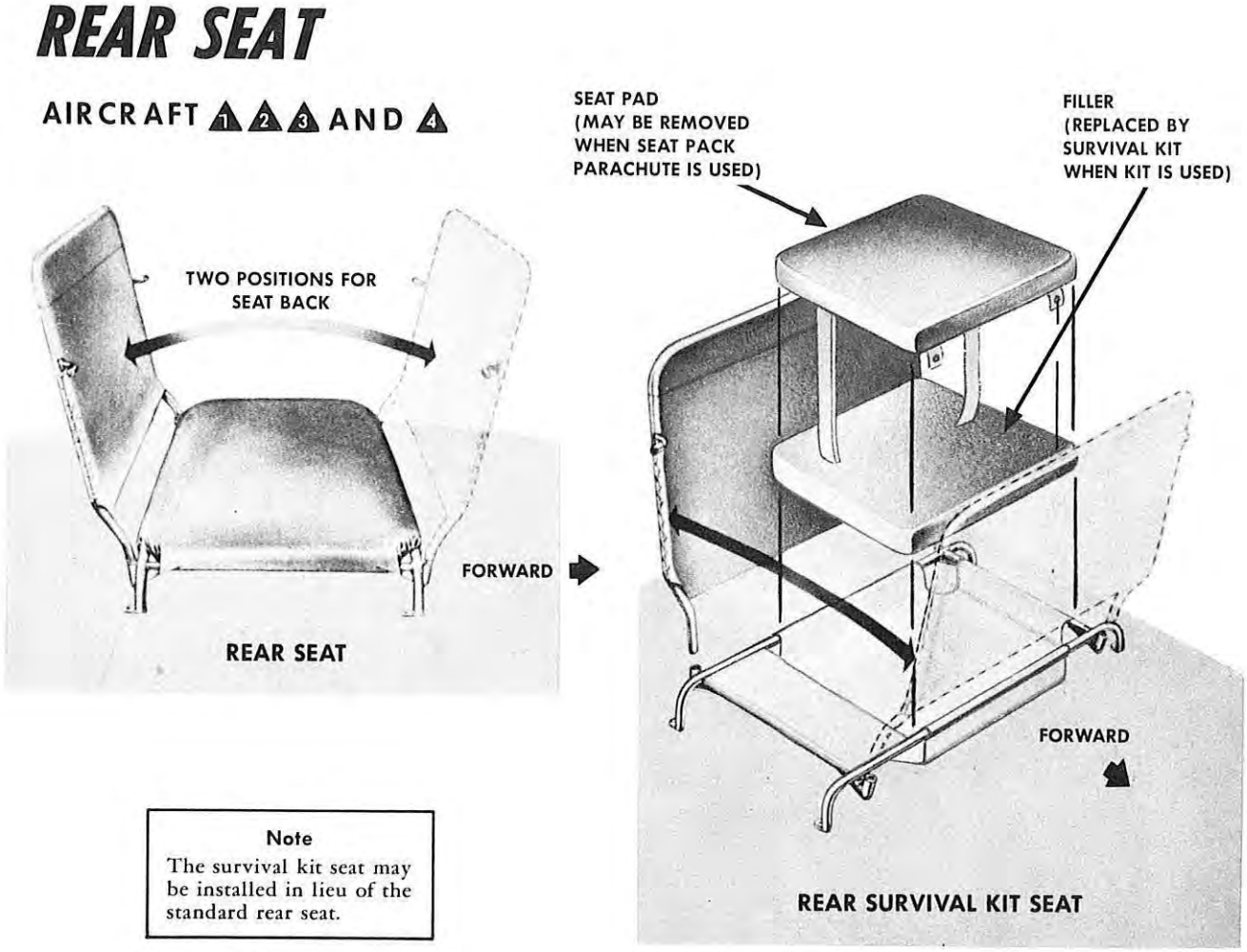
1-162. AUXILIARY EQUIPMENT.

1-163. Information concerning the following equipment is supplied in Section IV: heating and windshield defroster system, pitot heater, ventilation system, lighting equipment, and miscellaneous equipment.

1-164. DESTRUCTION OF AIRCRAFT.

1-165. In the event the aircraft must be abandoned by the crew due to enemy action, accomplish destruction, sufficient to deny use or technical intelligence to the enemy, as follows:

1. Break fuel line.
2. Puncture fuel tank.
3. From a safe distance, ignite fuel.



Note
The survival kit seat may be installed in lieu of the standard rear seat.

Figure 1-21.

SECTION II | CHAPTER 2

NORMAL PROCEDURES

2-1. BEFORE ENTERING THE AIRCRAFT.

2-2. FLIGHT RESTRICTIONS.

2-3. Refer to Section V Operating Limitations, of this chapter for the operating restrictions and limitations imposed on the aircraft.

2-4. CRUISE CONTROL.

2-5. Determine cruise control data such as, required fuel, airspeed, power setting, etc. from operating data contained in Section X of this chapter.

2-6. WEIGHT AND BALANCE.

2-7. Check weight of fuel, oil and passenger and CG location when computing takeoff and anticipated landing gross weight. Consult Weight and Balance chapter and DD Form 365F (WEIGHT AND BALANCE CLEARANCE FORM F, TACTICAL) for detail weight and balance information. Check Section V, Operating Limitations, for gross weight limits.

2-8. CHECK LISTS.

2-9. BEFORE STARTING ENGINE.

Aircraft ▲1 ▲2 ▲3 ▲4	Aircraft ▲5
1. DD Form 781	1. DD Form 781
2. Control lock	2. Control lock
3. Fuel quantity and selector	3. Fuel quantity and selector
4. Carburetor heat	4. Carburetor alternate air

2-10. ENGINE RUN-UP.

Aircraft ▲1 ▲2 ▲3 ▲4	Aircraft ▲5
1. Instruments	1. Propeller
2. Generator	2. Instruments
	3. Generator

2-11. BEFORE TAKEOFF.

Aircraft ▲1 ▲2 ▲3 ▲4	Aircraft ▲5
1. Elevator trim tab	1. Elevator trim tab
2. Mixture	2. Mixture
3. Flight controls	3. Carburetor alternate air
	4. Flight controls

2-12. BEFORE INSTRUMENT OR NIGHT TAKEOFF.

Aircraft ▲1 ▲2 ▲3 ▲4	Aircraft ▲5
1. Lights	1. Lights
2. Pitot heat	2. Pitot heat
3. Vacuum	3. Vacuum
4. Instruments	4. Instruments
5. Radio	5. Radio
6. Flashlights	6. Flashlights
7. Flight controls	

2-13. BEFORE LANDING.

Aircraft ▲1 ▲2 ▲3 ▲4	Aircraft ▲5
1. Fuel selector	1. Fuel selector
2. Mixture	2. Propeller
3. Instruments	3. Mixture
	4. Carburetor alternate air

2-14. EXTERIOR INSPECTION.

2-15. Check DD Form 781 for status of aircraft and perform the following checks in accordance with figure 2-1.

A. Nose Section (Right Side).

1. Cowling for oil leaks and security.
2. Windshield for cleanliness.
3. Drain small quantity of fuel from filter (first flight of the day).
4. Right exhaust stack and battery drain tube for proper clearance from each other.
5. Right landing gear tire for cuts, bruises, proper inflation (30 psi). Chock properly in place.

B. Right Wing.

1. Check quantity of fuel in auxiliary fuel tank. Filler cap for security.
2. Right wing strut for dents, cracks, security. Wing skin for damage.
3. Navigation light for condition.
4. Aileron and flap hinges for security, freedom of movement.

C. Fuselage Aft Section (Right Side).

1. Fuselage for skin damage.
2. Rotating beacon light for condition. ▲1 ▲2 ▲4 ▲5
3. Antennas for security.
4. Right static pressure source for dirt or obstructions.
5. Right lift handle retracted.

D. Empennage and Tailwheel.

1. Empennage for skin damage.
2. Rudder, elevator and elevator tab for condition and security. Check elevator trim tab for proper setting (takeoff).
3. Navigation light for condition.

EXTERIOR INSPECTION

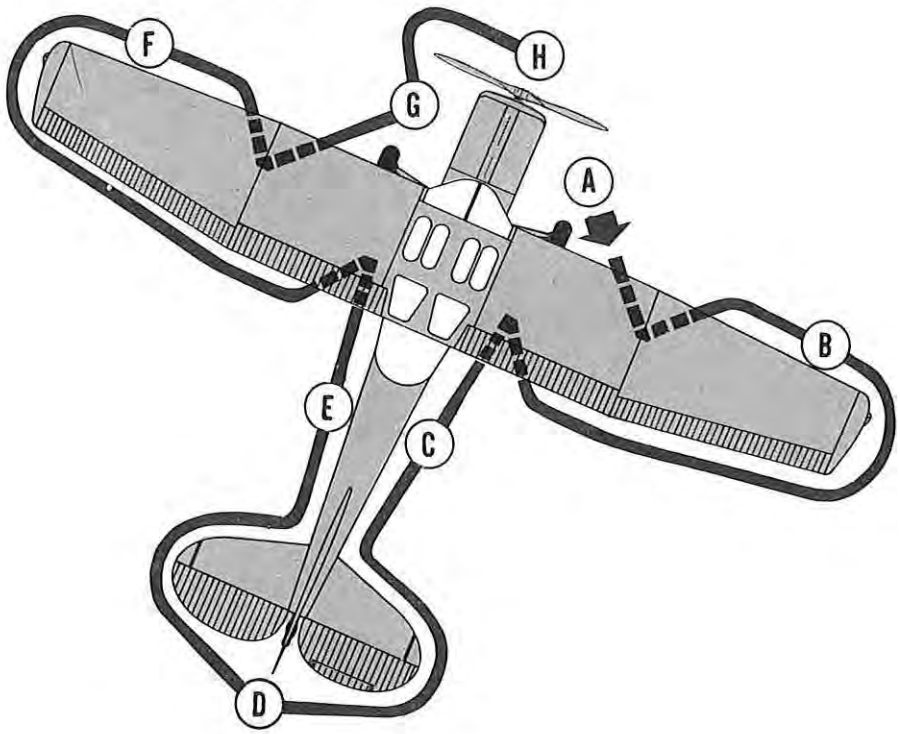


Figure 2-1.

4. Tailwheel linkage for condition. Tailwheel for condition and proper inflation (35 psi).

E. Fuselage Aft Section (Left Side).

1. Left lift handle retracted.
2. Left static pressure source for dirt, or obstructions.
3. Fuselage for skin damage.

F. Left Wing.

1. Aileron and flap hinges for security, freedom of movement.
2. Navigation light and landing light for condition.
3. Left wing strut for dents, cracks, security. Wing skin for damage.
4. Remove pitot tube cover, check pitot tube for obstructions.
5. Check quantity of fuel in main fuel tank. Filler cap for security.

G. Nose Section (Left Side).

1. Left landing gear tire for cuts, bruises, proper inflation (30 psi). Chock properly in place.
2. Auxiliary fuel pump drain for obstructions.
3. Cowling for oil leaks and security. Cowling air intake openings for obstruction.

H. Propeller.

1. Propeller for nicks, cracks and security of mounting.

2-16. ON ENTERING THE AIRCRAFT.

2-17. INTERIOR CHECK (all flights).

1. First aid kit-Installed.
2. Fire extinquisher-Installed and secured.
3. Rear instrument panel-Flight position. Locking arm engaged (aircraft IT ⚠ and ⚠).

Note

When rear seat is to be occupied, this check shall be accomplished after occupant is aboard.

4. Controls and parking brake - UNLOCKED.
5. Seat - Adjust.
6. Safety belt and shoulder harness - Condition, secure and shoulder harness UNLOCKED.
7. Flight Controls - Check rudder, ailerons and elevators for free and correct movement.
8. Fuel tank selector valve handle - Turn fuel selector valve handle to fullest tank.
9. Elevator trim tab control wheel - TAKEOFF.
10. Radio panels and switch edge panel lights rheostat

switch - OFF, turn rheostat counterclockwise.
11. Navigation lights switch - OFF.
12. Rotating beacon light switch - OFF. ▲ ▲▲ ▲.
13. Pitot heat switch - OFF.
14. Landing light switch - OFF.
15. Auxiliary fuel pump switch - OFF.
16. Generator switch - ON.
17. Battery switch - OFF. If auxiliary power is used, leave battery switch OFF.

CAUTION

The battery switch must be turned OFF when auxiliary power is being used to start engine as damage to the battery will result.

18. Circuit breakers - Check (push to reset).
19. Cabin heat knob - Adjust as desired for heat.
20. Altimeter - SET to field elevation or barometric pressure.
21. Clock - SET.
22. Directional gyro - Cage.
23. Attitude gyro - Cage.
24. Defroster and pilot heat knob - Adjust as desired.

2-18. INTERIOR CHECK (night flights).

2-19. The following checks are to be performed in addition to all flight checks when night flight is anticipated or planned.
1. Battery switch - ON.
2. Interior and exterior lights - Test.
3. Battery switch - OFF.
4. Flashlight - Check, make sure it is on board and in usable condition.

2-20. BEFORE STARTING ENGINE.

2-21. Refer to Section V for normal operating limitations and figure 1-3 for recommended or alternate fuel, and oil.
1. Mixture control lever - FULL RICH.
2. Carburetor air control lever - RAM FILTERED AIR.
3. Propeller control lever - INCREASE RPM ▲.
4. Communication and navigation equipment power switch - OFF.
5. Battery switch - OFF, if auxiliary power is used.

CAUTION

The battery switch must be turned OFF when auxiliary power is being used to start the engine or damage to the battery may result.

6. Auxiliary power - Connect if available.

2-22. STARTING ENGINE.

1. Propeller area - Check, be sure propeller area is clear of personnel.
2. Throttle - OPEN (1/4 inch).
3. Ignition switch - BOTH.

Note

On aircraft ▲ ▲, both the ignition switch and emergency magneto switch must be ON before the engine will start.

4. Auxiliary fuel pump switch - ON, until fuel pressure gage shows a rise, then OFF.

Note

In warm weather when starting a warm engine, the use of the auxiliary fuel pump is not always necessary.

5. Brake pedals - Depress if wheels are not chocked.
6. Starter button - PRESS.

CAUTION

Limit the starter energized time to 30 seconds. If engine fails to start, release the starter button and allow starter to cool for 30 seconds before attempting another start.

7. Throttle - 800 rpm, after engine starts.

CAUTION

If oil pressure gage fails to show a rise within 30 seconds after starting a warm engine, shut down engine and have it investigated.

Note

If engine runs rough, indicating too rich a mixture, briskly move mixture control lever through its full range of travel several times. This action should cause the engine to run smoothly. Occasionally dirt may become lodged under the mixture poppet valve in the carburetor causing an excessively rich mixture.

CAUTION

Refer to Engine Fire During Start, Section III for procedure to follow in case of fire during starting engine.

2-23. ENGINE GROUND OPERATION.

1. Throttle - 800 rpm. Warm up engine for at least one minute.
2. Throttle - 1200 rpm, continue warm-up until engine accelerates smoothly.

Note

Warm-up the engine while taxiing to takeoff position to reduce engine time.

3. Auxiliary power - Disconnect (if used).
4. Battery switch - ON.

CAUTION

Do not turn battery switch ON until auxiliary

aircraft ② ③ ④ ⑤. Wing flap lever - Down (aircraft ① ■), flap setting 0°.
2. Line up aircraft with runway.
3. Throttle - OPEN, advance throttle slowly.
4. Brakes - Released, avoid dragging brakes by keeping heels on floor.
5. Maintain a tail-low attitude throughout the takeoff to avoid bouncing on rough fields.
6. Fly aircraft off at approximately 55 mph, IAS.

2-34. NORMAL TAKEOFF (SEAPLANE).

1. Water rudder retraction handle - UP and hooked.
2. Throttle - Full OPEN.

Note

Apply full up elevator and get seaplane on float step by releasing stick back pressure after primary bow wave moves aft of wing strut. Allow seaplane to accelerate to takeoff speed on step and to fly itself off.

2-35. MINIMUM RUN TAKEOFF (LANDPLANE).

1. Wing flap switch - FLAPS DOWN (aircraft ① ▲ and aircraft ② ③ ④ ⑤). Wing flap lever - UP (aircraft ① ■) flaps extended 30°.

WARNING

On aircraft ① ▲ and ② ③ ④ ⑤ when extending or retracting the flaps visually observe the flaps for symmetrical operation at all times. If other than normal flap operation is noticed do not takeoff.

2. Line up aircraft with runway.
3. Brakes - Hold.
4. Throttle - OPEN, advance throttle slowly.
5. Brakes - Release.
6. Maintain a tail low attitude and let aircraft fly itself off at takeoff IAS, shown in Takeoff Chart in Section X of this chapter.

2-36. MINIMUM RUN TAKEOFF (SEAPLANE).

1. Water rudder retraction handle - UP and hooked.
2. Wing flap switch - FLAP DOWN (aircraft ① ▲ and ②). Wing flap lever - UP (aircraft ① ■). Flaps extended 30°.
3. Throttle - OPEN.

WARNING

On aircraft ① ▲ and ② when extending or retracting the flaps visually observe the flaps for symmetrical operation at all times. If other than normal flap operation is noticed do not takeoff.

Note

Apply full up elevator and get seaplane on float step by releasing stick back pressure after primary bow wave moves aft of wing strut. Pull seaplane off rather abruptly after minimum flying speed is obtained on step.

2-37. OBSTACLE CLEARANCE TAKEOFF.

1. Wing flap switch - FLAPS DOWN (aircraft ① ▲ and aircraft ② ③ ④ ⑤). Wing flap lever - UP (aircraft ① ■) flaps extended 30°.

WARNING

On aircraft ① ▲ and aircraft ② ③ ④ ⑤ when extending or retracting the flaps visually observe the flaps for symmetrical operation at all times. If other than normal flap operation is noticed do not takeoff.

2. Line up aircraft with runway.
3. Brakes - Hold.
4. Throttle - OPEN.
5. Brakes - Released.
6. Maintain a tail-low attitude and let aircraft fly itself off at takeoff IAS shown on Takeoff Chart in Section X of this chapter.
7. Climb at IAS shown on Climb Charts in Section X of this chapter until obstacle is cleared.

2-38. OBSTACLE CLEARANCE TAKEOFF (SEAPLANE).

2-39. Execute a minimum run takeoff and climb at 60 mph IAS until obstacle is clear.

2-40. CROSSWIND TAKEOFF.

1. Wing flap switch - FLAPS UP (aircraft ① ▲ and ② ③ ④ ⑤). Wing flap lever - Down (aircraft ① ■) or use minimum flap setting necessary for field length.

WARNING

On aircraft ① ▲ and all ② ③ ④ ⑤ when extending or retracting the flaps visually observe the flaps for symmetrical operation at all times. If other than normal flap operation is noticed, do not takeoff.

2. Throttle - OPEN. Advance throttle slowly.
3. Maintain a tail-high attitude to keep the aircraft on the ground until an airspeed well above takeoff airspeed of approximately 55 mph IAS is reached.
4. Pull aircraft off abruptly to avoid settling to the ground while drifting.

2-41. NIGHT TAKEOFF (LANDPLANE).

2-42. Execute a night takeoff in the same manner as a normal takeoff except for the following:
1. Directional and attitude gyros - UNCAGE, adjust after aircraft is aligned for takeoff.
2. Landing light switch - ON (if desired).
3. Landing light switch - OFF (if used) after a safe altitude and airspeed are reached.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247
■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

2-43. NIGHT TAKEOFF (SEAPLANE).

2-44. Execute a normal takeoff with the addition of the following steps:
1. Landing light switch - ON (if desired).
2. Landing light switch - OFF (if used) after a safe altitude and airspeed are reached.

2-45. AFTER TAKEOFF.

1. Throttle - Retard, 2300 rpm or less (aircraft ▲1 ▲2 ▲3 ▲4). 24 inches manifold pressure or less (aircraft ▲5).
2. Propeller control lever - DECREASE, 2300 rpm or less (aircraft ▲5).
3. Wing flap switch - FLAPS UP (aircraft ▲1 ▲ and ▲2 ▲3 ▲4 ▲5). Wing flap lever - Down (aircraft ▲1 ■) (if used), after a safe altitude and airspeed have been reached.

WARNING

On aircraft ▲1 ▲ and aircraft ▲2 ▲3 ▲4 ▲5, when extending or retracting the flaps, visually observe the flaps for symmetrical operation at all times. If other than normal flap operation is noticed, land as soon as possible.

4. Elevator trim tab control wheel - Adjust. Trim aircraft for climb attitude.
5. Auxiliary fuel pump switch - OFF.

2-46. CLIMB. Aircraft ▲1 ▲2 ▲3 ▲4 .

2-47. The speed for best rate of climb is 65 mph IAS when the engine speed is limited to 2300 rpm. However, normal climbs at 80 mph IAS and 2300 rpm are recommended for best engine cooling. The speed for best angle of climb is approximately 60 mph IAS at full throttle. For additional climb data, see Climb Chart in Section X of this chapter.

2-48. CLIMB. Aircraft ▲5 .

2-49. If maximum climb performance is desired, use full throttle, 2300 rpm, and 83 mph IAS at sea level, decreasing speed to 77 mph IAS at 10,000 feet. However normal climbs at 90 mph IAS, 24 inches of manifold pressure and 2300 rpm are recommended for best engine cooling. The speed for best angle of climb is approximately 60 mph IAS at full throttle. For additional climb data, see Climb Chart in Section X of this chapter.

2-50. CRUISE CHECK.

1. Power setting - Select. See data in Section X.
2. Mixture control lever - LEAN. Lean mixture in accordance with procedure listed in Section VII.

2-51. FLIGHT CHARACTERISTICS.

2-52. Refer to Section VI for information on aircraft flight characteristics.

2-53. SYSTEM OPERATION.

2-54. Refer to Section VII for additional information regarding the operation of aircraft systems.

2-55. DESCENT AND PRE-LANDING CHECK.

1. Mixture control lever - RICH (before starting descent).
2. Propeller control lever - INCREASE RPM. ▲5
3. Carburetor air control lever - HEAT (ALTERNATE AIR on aircraft ▲3 ▲4 ▲5) if icing conditions exist.
4. Throttle - CLOSED.
5. Elevator trim tab control wheel - NOSE UP, establish normal glide at 80 mph IAS and trim.
6. Throttle - OPEN then CLOSED, clear engine every 30 seconds.

Note

Opening and closing of the throttle during descent prevents the engine from loading up and fouling the spark plugs.

7. Fuel selector valve handle - Fullest tank.
8. Shoulder harness and seat belt - Check.

2-56. TRAFFIC PATTERN CHECK.

1. Auxiliary fuel pump switch - ON.
2. Propeller control lever - INCREASE RPM, check ▲5 .
3. Carburetor air control lever - HEAT (ALTERNATE AIR on aircraft ▲3 ▲4 ▲5), check.

2-57. LANDING.

2-58. NORMAL LANDING (LANDPLANE).

2-59. The normal landing technique as listed below will produce the results as stated in the Landing Charts in Section X of this chapter. Sideslips can be safely executed during approach with the wing flaps down and either a wheel or three point landing may be executed. Refer to figure 2-3 for typical landing pattern and recommended procedures. Refer to Section III for emergency landing procedures.

WARNING

Use caution when operating the brakes from the rear seat if the rear pedals are not equipped with locking pins. (See figure 1-13.) On aircraft ▲1 not equipped with the locking pins, the rudder pedals are held in upward position only by the rudder return springs. Hard toe pressure downward on the pedals, especially if the pedals are out of the neutral position when the brakes are applied, may cause folding of the pedals to the stowed position.

CAUTION

The control stick should be held full back at all times when using brakes to avoid nosing over.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

TYPICAL
LANDING PATTERN

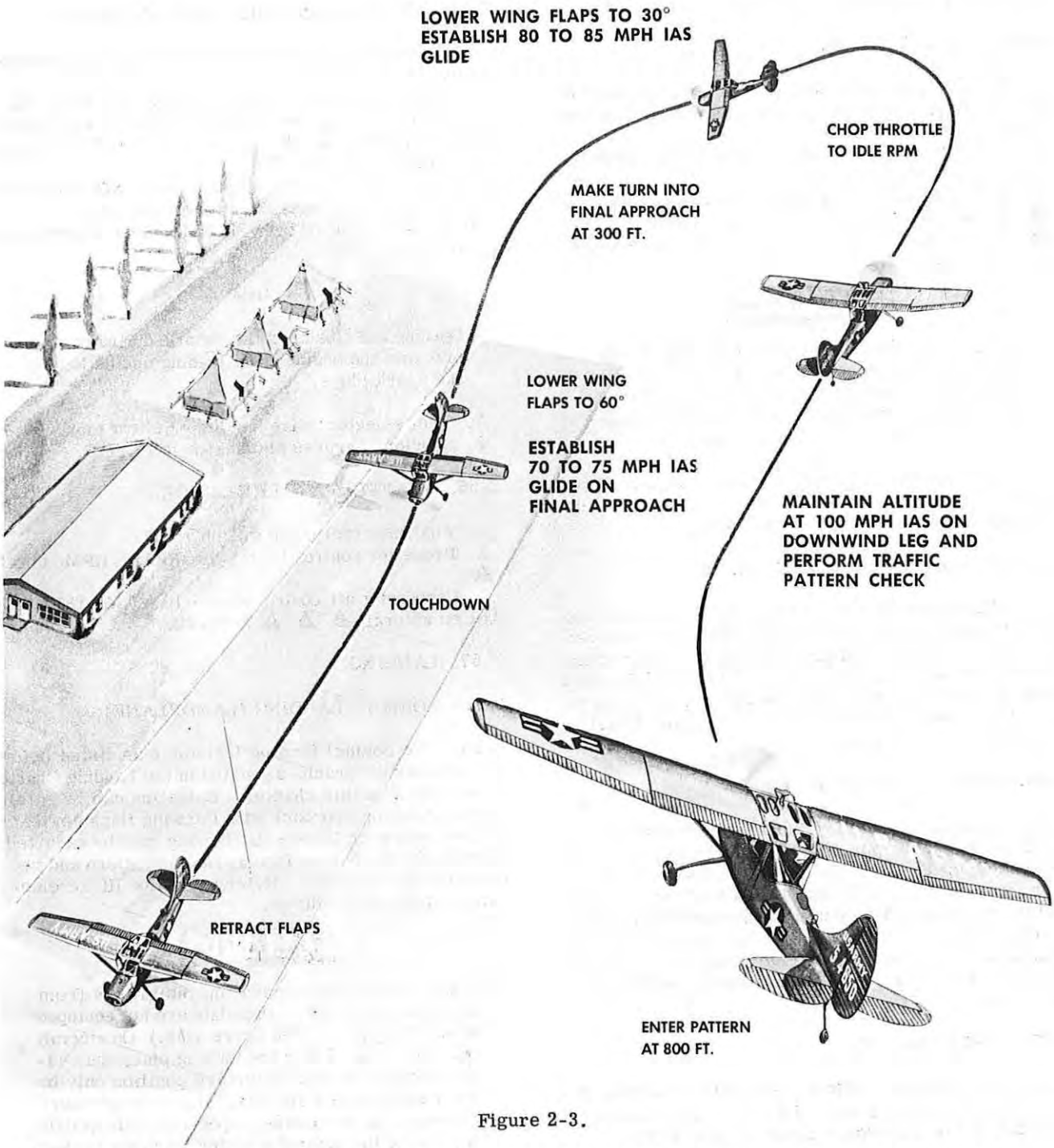


Figure 2-3.

1. Wing flaps switch - FLAPS DOWN (aircraft ▲ ▲, and aircraft ▲ ▲ ▲ ▲). Wing flaps lever - UP (aircraft ▲ ■). Extend flaps 30° prior to turning on final approach. Use 60° wing flaps or as desired and hold a 75 mph IAS glide on final approach.

WARNING

On aircraft ▲ ▲ and aircraft ▲ ▲ ▲ ▲, when extending or retracting flaps, visually observe the flaps for symmetrical operation.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

CAUTION

Do not exceed maximum recommended airspeed limit for flap extension.

2. Execute a three-point landing.
3. Turn off runway before performing after landing check.

2-60. NORMAL LANDING (SEAPLANE).

2-61. Enter the landing pattern at 800 feet. Maintain altitude at 100 mph IAS on the downwind leg, then close the throttle to idle rpm when entering the base leg. On the base leg, lower wing flaps to 30° and establish an 80 mph IAS glide. Make a turn into the final approach at 300 feet. Use wing flaps as desired and establish a 70 mph IAS glide on the final approach. Execute a tail-low landing.

2-62. CROSS WIND LANDING.

1. Wing flaps switch - FLAPS DOWN (aircraft 1 ▲ and aircraft 2 3 4 5). Wing flap lever - UP (aircraft 1 ■). Use minimum flap setting for field length.

WARNING

On aircraft 1 ▲ and aircraft 2 3 5 4 , when extending or retracting the flaps, visually observe the flaps for symmetrical operation. operation.

2. Use either wing-low, crab, or combination method of drift correction.
3. Either a three-point or wheel landing may be used.
4. Turn off runway before performing after landing check.

2-63. MINIMUM RUN LANDING (LANDPLANE).

1. Wing flaps switch - FLAPS DOWN (aircraft 1 ▲, and 2 3 4 5). Wing flaps lever - Up (aircraft 1 ■). Extend flaps to 60°.

WARNING

On aircraft 1 ▲ and aircraft 2 3 4 5 , when extending or retracting the flaps visually observe the flaps for symmeterical operation.

2. Maintain power-off glide speed as shown on Landing Chart in Section X of this chapter.
3. Begin flare at approximately six feet and execute a three-point landing.
4. Upon contact with the ground apply heavy braking, releasing brakes gradually as speed decreases.
5. Turn off runway before performing after landing check.

2-64. MINIMUM RUN LANDING (SEAPLANE).

1. Wing flaps switch - FLAPS DOWN (aircraft 1 ▲ 2). Wing flaps lever - Up (aircraft 1 ■). Use full wing flaps with power off.

WARNING

On aircraft 1 ▲ and aircraft 2 , when extending or retracting the flaps, visually observe the flaps for symmetrical operation.

Note

- Keep glide speed at 70 mph IAS until obstacle is cleared. Begin flare at approximately six feet and execute a tail-low landing. Upon contact with water, hold full up elevator.
- Under calm water condition, a low rate-of-descent should be established and the seaplane flown into the water.

2-65. NIGHT LANDING (LANDPLANE).

1. Approach with power to reduce the rate of descent.
2. Landing light switch - ON (if desired).
3. Wing flap switch - FLAP DOWN (aircraft 1 ▲ and aircraft 2 3 4 5). Wing flap lever - Up (aircraft 1 ■). Use minimum flap setting for field length.
4. Establish glide at 70-80 mph IAS.
5. Execute either three-point or wheel landing, closing the throttle upon contact with the ground.

Note

If landing is being performed without landing light, a wheel landing will allow a lesser rate of closure with the ground and improved visibility.

6. Clear runway before performing after landing check.

2-66. NIGHT LANDING (SEAPLANE).

1. Landing light switch - ON (if desired).
2. Wing flap switch - FLAPS DOWN (aircraft 1 ▲ and aircraft 2 3 4 5). Wing flap lever - Up (aircraft 1 ■). Use 0° to 45° flaps as desired.

Note

Use a power approach at 75 to 80 mph IAS and execute a slightly tail-low landing. Close the throttle upon contact with the water.

2-67. AFTER LANDING.

1. Wing flaps switch - FLAPS UP (aircraft 1 ▲ and aircraft 2 3 4 5). Wing flaps lever - Down (aircraft 1 ■).
2. Carburetor air lever - RAM FILTERED AIR.
3. Auxiliary fuel pump switch - OFF.

2-68. POST FLIGHT ENGINE CHECK.

2-69. After the last flight of the day, make the follow-

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

ing engine checks and enter any discrepancies on DD Form 781.

1. Brakes - Hold.
2. Throttle - 1700 rpm.
3. Ignition system - Check. Move the ignition switch from BOTH to L and observe drop in rpm, move switch back to BOTH until rpm returns to 1700 and move switch to R and observe drop in rpm and return switch to BOTH. (Maximum allowable rpm drop is 100 rpm).

CAUTION

The ignition system check will not be reliable if magneto ground trouble exists.

4. Ignition switch - Check. At 700 rpm turn ignition switch to OFF position momentarily (as rapidly as possible) and observe that engine completely ceases firing. On aircraft ⚠ ⚠ with engine operating at 700 rpm, turn emergency magneto switch OFF momentarily and observe that engine completely ceases firing. Return switch to ON.
5. Throttle - CLOSED. The engine should idle at approximately 500 rpm.

2-70. STOPPING ENGINE.

1. Radio and pitot heat switches - OFF.
2. Throttle - 900 rpm, for one to three minutes to cool engine.)
3. Throttle - 1300 rpm.
4. Mixture control lever - IDLE CUT-OFF.
5. Ignition switch - OFF.
6. Battery switch - OFF, (after engine stops).
7. Fuel tank selector valve handle - FUEL OFF.

2-71. BEFORE LEAVING THE AIRCRAFT.

1. Switches - OFF, (except generator switch).
2. Control and parking brake lock - LOCKED.

Note

The controls lock will lock the rudder, ailerons, and elevator in neutral position and also applies the parking brake.

3. Carburetor air control lever - RAM FILTERED AIR.
4. Directional and attitude indicator - CAGE.
5. DD Form 781 - Comments, (if any).

CAUTION

Make appropriate entries in the DD Form 781 covering any limits in the Manual that have been exceeded during the flight. Entries must also be made when in the pilot's judgement the aircraft has been exposed to unusual or excessive operations such as hard landings, excessive braking action during aborted takeoffs, long and fast landings and long taxi runs at high speeds, etc.

6. Windows and door - CLOSED.
7. Pitot tube cover - Installed.
8. Wheels - Chocked. Tie-down aircraft if necessary.

SECTION III | CHAPTER 2

EMERGENCY PROCEDURES

3-1. ENGINE FAILURE.

3-2. Engine failures fall into two main catagories; those occurring instantly, and those with ample indication prior to failure. The instant failure is rare and usually occurs only if ignition or fuel flow fails completely. Most engine failures are gradual and afford the alert pilot ample indication that he may expect a failure. An extremely rough-running engine, loss of oil pressure, excessive cylinder head temperature under normal flight conditions, and fluctuating rpm are indications that a failure is imminent. When indications point to an engine failure, the pilot should make a landing immediately.

3-3. ENGINE FAILURE DURING TAKEOFF.

If malfunction occurs when the remaining runway is insufficient for stopping, and the nature of malfunction will permit flight, continue takeoff, circle field and land immediately. If malfunction occurs when there is sufficient runway for stopping or is of such a nature as to make flight impossible, proceed as follows:

1. Throttle - CLOSED.
2. Brakes - Apply.
3. Mixture control lever - IDLE CUT-OFF.
4. Ignition switch - OFF.
5. Battery switch - OFF.
6. Ground loop to avoid obstacles.
7. Get clear immediately when aircraft has come to a stop.

3-4. ENGINE FAILURE AFTER TAKEOFF.

If engine fails immediately after takeoff, proceed as follows:

1. Nose down quickly to maintain a 75 mph IAS glide.
2. Mixture control lever - IDLE CUT-OFF.
3. Fuel selector valve handle - FUEL OFF.
4. Battery switch - OFF (unless wing flaps, lights or radio are needed).

WARNING

Land straight ahead, changing direction only enough to miss obstacles. Don't try to turn back to the field; making a crash landing straight ahead with the aircraft under control is much better than turning back and taking a chance of an uncontrolled roll into the ground.

3-5. ENGINE FAILURE DURING FLIGHT.

If the engine fails during flight:

1. Lower nose as speed drops to establish a 75 mph IAS glide.
2. Select best possible area for landing.
3. Fuel selector valve handle - Fullest tank.
4. Mixture control lever - RICH.
5. Propeller control lever - INCREASE RPM. ⚠5
6. Auxiliary fuel pump switch - ON.

If the above corrective action has been taken and the engine does not restart, shutdown as follows and make a forced landing if possible; otherwise, bailout.

1. Auxiliary fuel pump switch - OFF.
2. Mixture control lever - IDLE CUT-OFF.
3. Throttle - CLOSED.
4. Propeller control lever - DECREASE RPM. ⚠5
5. Ignition switch - OFF.
6. Generator switch - OFF.
7. Fuel selector valve handle - FUEL OFF.
8. Battery switch - OFF. (Unless wing flaps, lights or radio are required.)

3-6. ENGINE RESTART DURING FLIGHT.

If the source of trouble has been determined and corrective action has been taken and there is still sufficient altitude to restart the engine, proceed as follows:

CAUTION

The engine should not be restarted unless it can be determined that it will be reasonably safe to do so.

1. Lower nose and establish normal glide, 75 mph IAS.
2. Mixture control lever - IDLE CUT-OFF.
3. Throttle - OPEN (for a few seconds to clear engine).
4. Throttle - OPEN (1/4 inch).
5. Propeller control lever - INCREASE RPM. ⚠5
6. Mixture control lever - RICH.
7. Battery switch - ON.
8. Auxiliary fuel pump switch - ON.

Note

If propeller is not windmilling, attempt restart by engaging starter while losing altitude down to approximately 500 feet.

Should this procedure fail to restart the engine, shut down as follows:

1. Auxiliary fuel pump switch - OFF.
2. Mixture control lever - IDLE CUT-OFF.
3. Throttle - CLOSED.
4. Propeller control lever - DECREASE rpm. ⚠5
5. Ignition switch - OFF.
6. Generator switch - OFF.
7. Fuel selector valve handle - FUEL OFF.
8. Battery switch - OFF. (Unless wing flaps, lights

or radio are required.)

3-7. MAXIMUM GLIDE.

If the engine fails during flight, maximum gliding distance can be obtained by maintaining the airspeed shown on figure 3-1. To establish maximum glide path, proceed as follows:

1. Wing flaps switch - FLAPS UP (aircraft 1▲ and aircraft 2 3 4 5). Wing flaps lever - Down (aircraft 1■).
2. Propeller control lever - DECREASE RPM 5.
3. Establish a 75 mph IAS glide. Do not attempt to stop propeller from windmilling. The altitude lost trying to stop the propeller more than offsets the additional performance gained with the propeller stopped.
4. Trim aircraft to maintain optimum glide speed.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

3-8. LANDING WITH ENGINE INOPERATIVE.

3-9. A full wing flaps, three-point landing is recommended on rough ground.

3-10. PROPELLER FAILURE. Aircraft 1▲ 2 3 4▲.

1. Throttle - CLOSED.
2. Mixture control lever - IDLE CUT-OFF.

Note

At a safe altitude, nose up to decrease speed quickly, thereby stopping propeller rotation and vibration. Establish normal glide and follow instructions for engine failure in flight procedure.

3-11. PROPELLER FAILURE. Aircraft 5.

If the linkage of the propeller governor fails, a spring

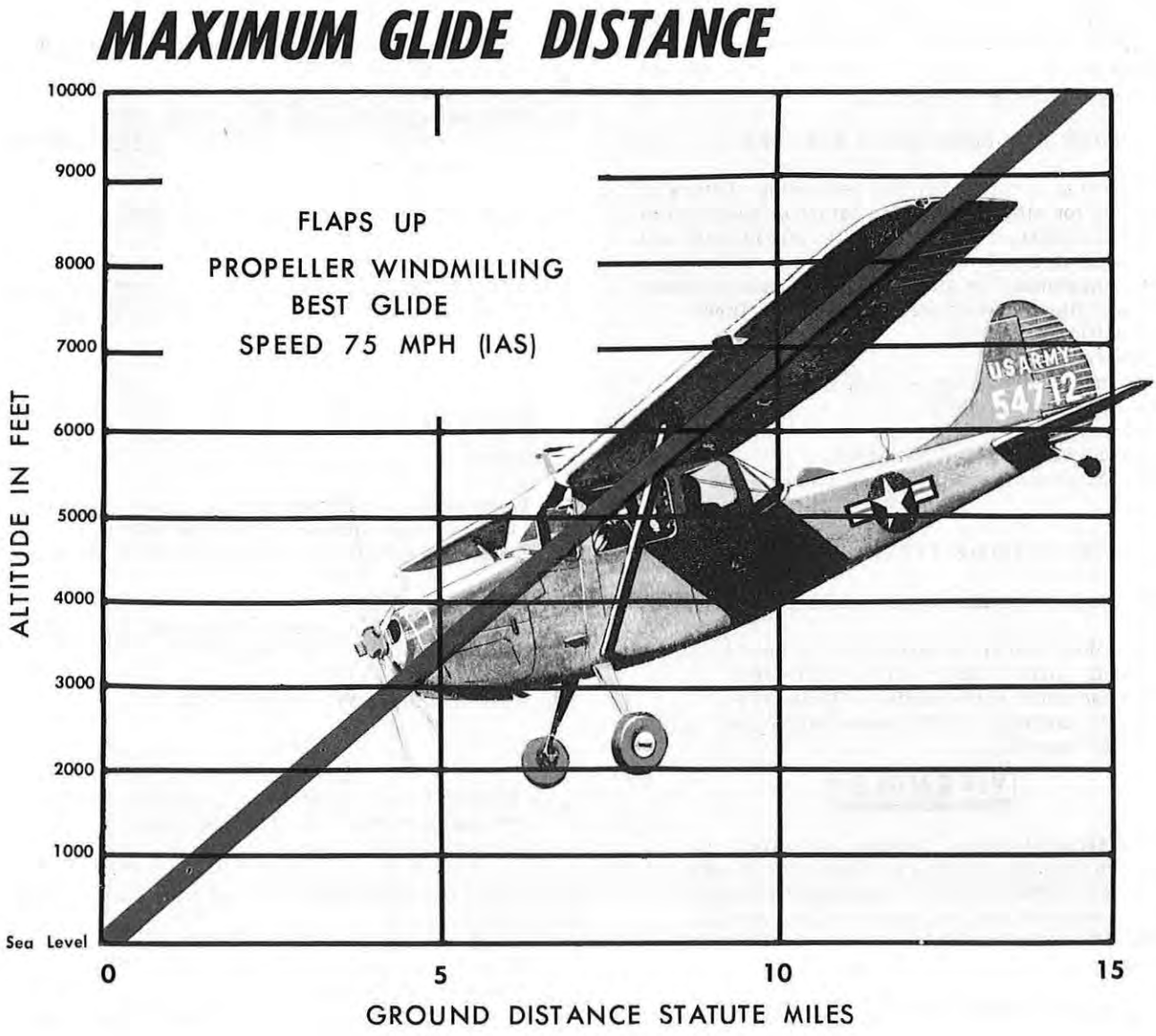


Figure 3-1.

on the governor automatically sets the governor to control the propeller in full INCREASE RPM (2600 rpm). If a failure of the propeller governor occurs and the propeller goes into low pitch (high rpm), resulting in a runaway propeller, proceed as follows:

CAUTION

Prompt corrective action is essential.

1. Throttle - CLOSED, to maintain rpm within limits (2600 rpm).
2. Pull aircraft up into climb to decrease airspeed and increase load on propeller.
3. Propeller control lever - Manipulate in an attempt to restore governing.
4. If governing cannot be restored, sufficient power is available to maintain flight.

Propeller governor failure resulting in the propeller going into high pitch (low rpm) is rare, however, if this type of failure occurs proceed as follows:

1. Throttle - CLOSED. Adjust to the lowest manifold pressure which will sustain flight.
2. Wing flap switch - FLAPS UP (aircraft 1▲ and aircraft 2 3 4 5), wing flap lever - Down (aircraft 1 ■). Sufficient power is available at low altitudes to maintain flight with flaps retracted.
3. Land as soon as practical.

3-12. FIRE.

3-13. ENGINE FIRE DURING START.

If fire is located in the air induction system during ground operation proceed as follows:

1. Throttle - OPEN.
2. Continue engine cranking. The fire may be sucked through the engine and extinguished.
3. If fire is not extinguished, move mixture control lever to IDLE CUT-OFF.
4. Auxiliary fuel pump switch - OFF.
5. Fuel selector valve handle - FUEL OFF.
6. Ignition switch - OFF.
7. Battery switch - OFF.
8. Exit from aircraft and attempt to extinguish fire with hand fire extinguisher.

3-14. ENGINE FIRE DURING FLIGHT.

1. Cabin heat control knobs - IN (to prevent smoke from entering cabin).
2. Mixture control lever - IDLE CUT-OFF.
3. Fuel selector valve handle - FUEL OFF.
4. Ignition switch - OFF.
5. Battery switch - OFF.
6. Do not attempt to restart engine after fire goes out.
7. Make an emergency landing or bailout.

3-15. FUSELAGE FIRE.

1. Battery switch - OFF.
2. All ventilators - CLOSED (to eliminate drafts).
3. Use hand fire extinguisher if possible.
4. If fire cannot be extinguished, land as soon as possible or bailout.

WARNING

When using fire extinguisher in closed cabin ventilate cabin immediately after fire has been extinguished.

3-16. WING FIRE.

1. Landing light switch - OFF.
2. Navigation light switch - OFF.
3. Pitot heat switch - OFF.
4. Slip aircraft away from burning wing in effort to extinguish flames.
5. Land as soon as possible or bailout.

3-17. ELECTRICAL FIRE.

Circuit breakers isolate most electrical circuits and automatically interrupt power to prevent a fire when a "short" occurs. If necessary, however, turn generator and battery switches OFF to remove power from all electrical equipment and land as soon as possible. If electrical power is essential, as during instrument flight, an attempt to identify and isolate the shorted circuit may be feasible. This can be accomplished as follows:

1. Battery switch - OFF.
2. Generator switch - OFF, turn off all remaining switches (except ignition).
3. Generator switch - ON, if generator circuit is shorted return switch to OFF.
4. Battery switch - ON.
5. Individually turn each circuit on again, allowing a short period of time before proceeding to the next, until the shorted circuit is identified.

3-18. SMOKE AND FUME ELIMINATION.

1. Make sure fire is either extinguished or will not be aggravated by draft.
2. Cabin heat control knob - IN.
3. Defroster and pilot heat control knob - IN.
4. Open pilot's window (under 120 mph).
5. If smoke remains dense enough to impair further flight, land as soon as possible or bailout.

3-19. LANDING EMERGENCIES (except ditching).

3-20. LANDING ON ROUGH TERRAIN.

1. Open windows and crack door open slightly.
2. Rear instrument panel - Flight position (aircraft IT 1 and 5).
3. Safety belt and shoulder harness - Fastened.
4. Shoulder harness inertia lock lever - LOCKED.

CAUTION

Before locking shoulder harness, turn off all switches not readily accessible with harness locked.

5. Wing flap switch - FLAPS DOWN (aircraft 1 ▲ and aircraft 2 3 4 5). Wing flap lever - Up (aircraft 1 ■). Fully extended flaps.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

6. Battery switch - OFF (on approach).
7. Throttle - CLOSED.
8. Mixture control lever - IDLE CUT-OFF.
9. Fuel selector valve handle - FUEL OFF.
10. Land fully stalled, tail low.
11. Fold rear instrument panel back against left side and latch locking arm to side (aircraft IT ▲ and aircraft ▲5).

Note

Rear seat crew member should exit through the door first or use side window. It is easier to exit out the door from the rear compartment with the front seat forward. After the rear seat crew member exits, the front crew member can slide his seat aft to exit. If door is jammed shut, turn door emergency release handle clockwise and push door outward. If this is impracticable, exit through the side windows. On aircraft ▲3 ▲4 the crew member in the front seat should exit through the door first. The crew member in the rear seat can then kick the seat emergency release pedal to unlock the front seat, push the seat forward, and exit through the door.

3-21. LANDING WITH FLAT TIRE.

If a tire is flat at the time of landing or if a blowout occurs during the landing roll, be alert for possible ground loop toward side having flat tire and proceed as follows:

1. Wing flaps switch - FLAPS DOWN (aircraft ▲1 ▲ and aircraft ▲2 ▲3 ▲4 ▲5). Wing flaps lever - Up (aircraft ▲1 ■). Fully extended flaps.
2. Land on good wheel, side of the flat tire.
3. Maintain directional control with steerable tail wheel and with braking action on good wheel.
4. Shut down engine as a fire precaution in case of a ground loop.

3-21. EMERGENCY ENTRANCE.

3-22. To gain emergency entrance into the cabin, turn door handle to release door and window. If unsuccessful, entrance can also be gained by kicking in any of the cabin windows. (See figure 3-2.)

3-23. DITCHING.

The aircraft should be ditched only as a last resort. Since all emergency equipment is carried by the crew members, there is no advantage in riding the aircraft down. However, if ditching is unavoidable, proceed as follows:

1. Follow radio distress procedures.
2. See that no equipment will foul you when you leave the aircraft. Remove radio head set.
3. Rear instrument panel - STOWED (if crew member is aboard), otherwise secure panel in flight position.
4. Unbuckle parachute, but make sure that the life raft is still fastened to you; tighten and lock safety belt and shoulder harness.

CAUTION

Before locking shoulder harness, turn off all switches not readily accessible with harness locked.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247
■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

EMERGENCY EXITS, ENTRANCES, AND EQUIPMENT

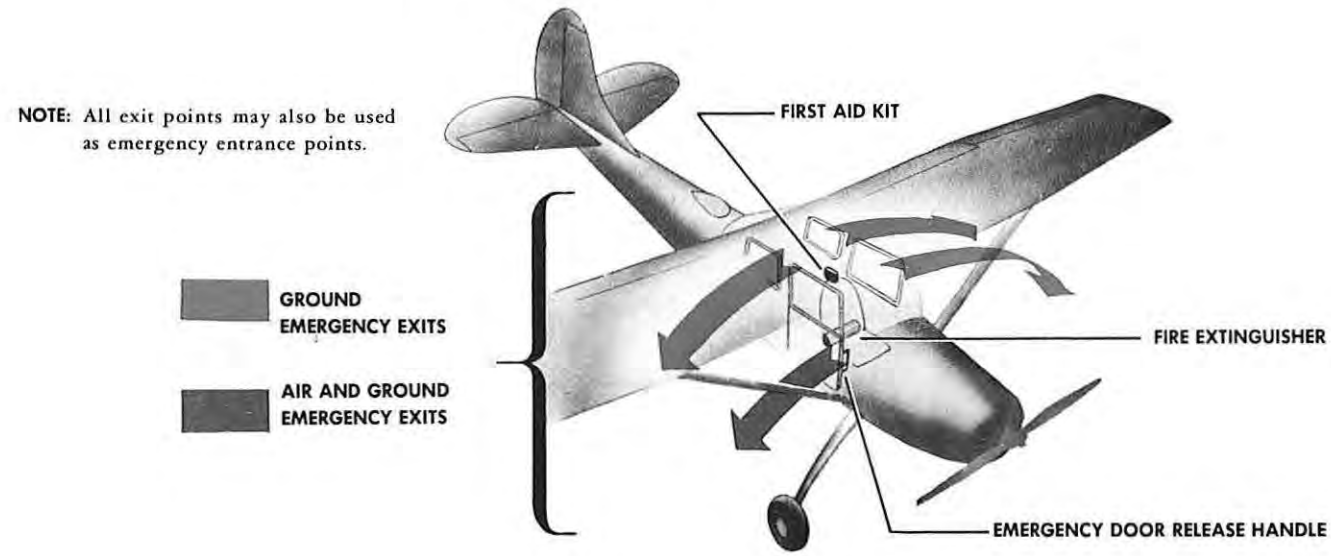


Figure 3-2.

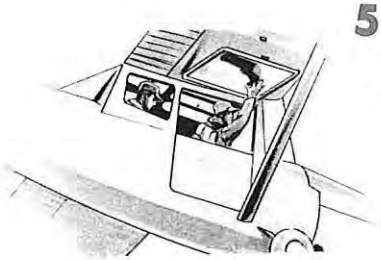
BAIL-OUT

1 REDUCE SPEED AS MUCH AS POSSIBLE AND TRIM AIRCRAFT TO FLY HANDS-OFF TO UNINHABITED AREAS.

2 SAFETY BELTS AND SHOULDER HARNESS— UNFASTEN.

3 RADIO HEADSET— REMOVE.

4 REAR INSTRUMENT PANEL—STOWED POSITION (IF REAR COMPARTMENT IS OCCUPIED, AIRCRAFT ▲1 AND ▲5).



5 DOOR WINDOW— OPEN. ENGAGE IN RETAINING STUD ON UNDER SIDE OF WING.

6 EMERGENCY DOOR RELEASE HANDLE— TURN CLOCKWISE. KICK DOOR OUT.

CAUTION

Only back style parachutes should be worn on flights in this type of aircraft. If back style parachute assemblies, Part No. 50C7024-11 or-12 only are available, bailout must be accomplished at a minimum altitude of 750 ft. Above the terrain.

7 ON AIRCRAFT ▲1 ▲2 ▲5 REAR SEAT CREW MEMBERS SHOULD EXIT FIRST BY DIVING OUT AND DOWN THROUGH DOOR OPENING.

8 THE FRONT SEAT CREW MEMBER SHOULD SLIDE SEAT BACK AND EXIT BY DIVING OUT AND DOWN.

NOTE

It is easier to exit out the door from the rear compartment with the front seat forward. After the rear seat crew member exits, the front seat crew member can slide his seat aft to exit.

9 ON AIRCRAFT ▲3 ▲4 THE CREW MEMBER OCCUPING THE FRONT SEAT SHOULD EXIT FIRST DURING BAILOUT. THE REAR CREW MEMBER CAN THEN KICK THE FRONT SEAT EMERGENCY RELEASE PEDAL. TO UNLOCK THE FRONT SEAT, PUSH THE SEAT FORWARD, AND EXIT BY DIVING OUT AND DOWN THROUGH THE DOOR OPENING.

Figure 3-3.

5. Door window and pilot side window - OPEN. Engage windows in retaining studs on under side of wing.
6. Aft side windows - OPEN (if rear crew member is aboard).
7. Wing flaps switch - FLAPS DOWN (aircraft ▲ and aircraft ▲ ▲ ▲ ▲). Wing flaps lever - Up (aircraft ▲ ■). Fully extended flaps.
8. Battery switch - OFF.
9. Make normal approach with power, if possible, and flare out to normal landing attitude. Touchdown just above stalling speed with tail low. Unless wind is high or sea is rough, plan approach heading parallel to any uniform swell pattern and try to touch down along wave crest or just after crest passes. If wind is as high as 25 knots or surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of wave.
10. Just before impact, turn ignition switch - OFF.
11. Make an immediate exit through the window as aircraft may sink rapidly.

3-24. BAILOUT.

3-25. Refer to figure 3-3 for bailout procedures.

3-26. FUEL SYSTEM FAILURE.

3-27. In event of engine fuel pump failure, turn auxiliary fuel pump switch ON. The pump will develop normal fuel pressure. A landing should be made at the nearest base.

3-28. ELECTRICAL POWER FAILURE.

3-29. If a complete electrical failure occurs, or if it becomes necessary to turn the battery and generator off, a landing should be made as soon as practical. The auxiliary fuel pump, wing flaps on aircraft ▲ and aircraft ▲ ▲ ▲ ▲, fuel low pressure warning light on aircraft ▲ and oil temperature gage will be inoperative. Instrument flying will be dangerous, as all radio communication equipment will be inoperative.

3-30. GENERATOR FAILURE.

3-31. If the generator is inoperative, the battery is supplying all the current to the electrical system. Conserve the battery by immediately turning off all non-essential equipment and check generator circuit breaker. Land as soon as possible and have system checked.

3-32. FLIGHT CONTROL SYSTEM FAILURE. Aircraft ▲ and ▲ ▲ ▲ ▲.

3-33. If other than normal flap operation is noticed during operation of flaps, immediately release the wing flap switch, which is spring-loaded to the neutral or OFF position. Attempt to equalize the flap setting and land at nearest available airfield as soon as possible.

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

SECTION III.1 | CHAPTER 2

SIGNAL ELECTRONIC EQUIPMENT CONFIGURATION

3.1-1. GENERAL.

3.1-2. This section of the manual describes the standard signal electronic equipment configuration installed in Army Models L-19A, L-19E, TL-19A, TL-19E and TL-19D aircraft; Serial number 50-1327 through 57-6277. It includes a description of the signal electronic equipment included in the configuration, their technical characteristics, capabilities and location, operation under normal and emergency conditions, and pilot's pre-flight and post flight checks.

3.1-3. FORMS AND RECORDS.

3.1-4. The following list of forms and records are required for use by personnel in the performance of prescribed operations.

1. Unsatisfactory Equipment and Electronic Failure Reports.
   a. Fill out and forward DD Form 787-1 (Electronic Failure Report) to the Commanding Officer, U.S. Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700-39. DD Form 787-1 will be used only to report failures of Radio Set AN/ARC-44 and Direction Finder Set AN/ARN-59. All other signal equipments will be reported on DD Form 468.
   b. For all signal equipments except those specified above, fill out and forward DD Form 468 (Unsatisfactory Equipment Report) to the Commanding Officer, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700-38.
2. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-38.
3. Maintenance Forms.
   a. Periodic inspection check sheet. Fill out the Periodic-Inspection Check Sheet in accordance with the instructions on the check sheet.
   b. Work Order Form DA-811. Fill out Work Order Form DA-811 in accordance with instructions on the form. (The maintenance officer or his representative will enter on the work order the items to be removed for bench tests and alignment.)
   c. DD Form 781-2. On completion of the periodic inspection, fill out DD Form 781-2 (Aircraft Flight Report and Maintenance Record) in the aircraft record book.
4. DD Form 780-1 Aircraft Inventory Record Inventory List
5. DD Form 780-2 Aircraft Inventory Record Shortages
6. DD Form 780-3 Aircraft Inventory Record Certification and Record of Transfers
7. DD Form 781-1 Aircraft Flight Report and Maintenance Record
8. DD Form 781-3 Aircraft Flight Report and Maintenance Record - Delayed Correction and Discrepancy List
9. DD Form 781-4 Aircraft Flight Report and Maintenance Record - Aircraft General Data
10. DD Form 781-5 Aircraft Flight Report and Maintenance Record - Accessories Data
11. DD Form 781-6 Aircraft Flight Report and Maintenance Record - Aircraft Summary
12. DD Form 781-7 Aircraft Flight Report and Maintenance Record - General Mission Classifications - Mission Symbols
13. DD Form 829 Historical Record for Aeronautical Equipment
14. DD Form 829-1 Historical Record - Technical Instructions Compliance Record
15. DD Form 829-2 Historical Record - Significant Historical Data

3.1-5. RADIO SET AN/ARC-60. Applicable to L-19 AIRCRAFT HAVING AN/ARC 60 RADIO SET AN/ARC 60. RADIO installed.

3.1-6. PURPOSE AND USE.

3.1-7. Radio set AN/ARC-60 has a line-of-sight range of approximately 55 to 60 miles at 5000 feet and is used for ground-to-air and air-to-air voice communication. It provides crystal-controlled, amplitude-modulated (AM) transmission on a maximum of 16 channels; the receiver can be tuned to the transmitting frequency. The frequency range is 228 to 258 megacycles.

3.1-8. TECHNICAL CHARACTERISTICS.

Frequency range	228 to 258 megacycle.
Transmitting channels	16(8 per transverter).
Crystal holder	Type HC-6/U.
Type of modulation	Amplitude.
Type of transmission	Voice.
Distance Range:	
Transmitting	55 to 60 miles at 5000 feet altitude.
Receiving	Line-of-sight distance.
Transmitting power output	1/2 watt.
Receiving sensitivity	7 microvolts for 10 mw output with 10 db signal-plus-noise to noise ratio.
Antenna	Quarter-wave, base-fed, inverted-L whip
Power required	6.8 amperes.

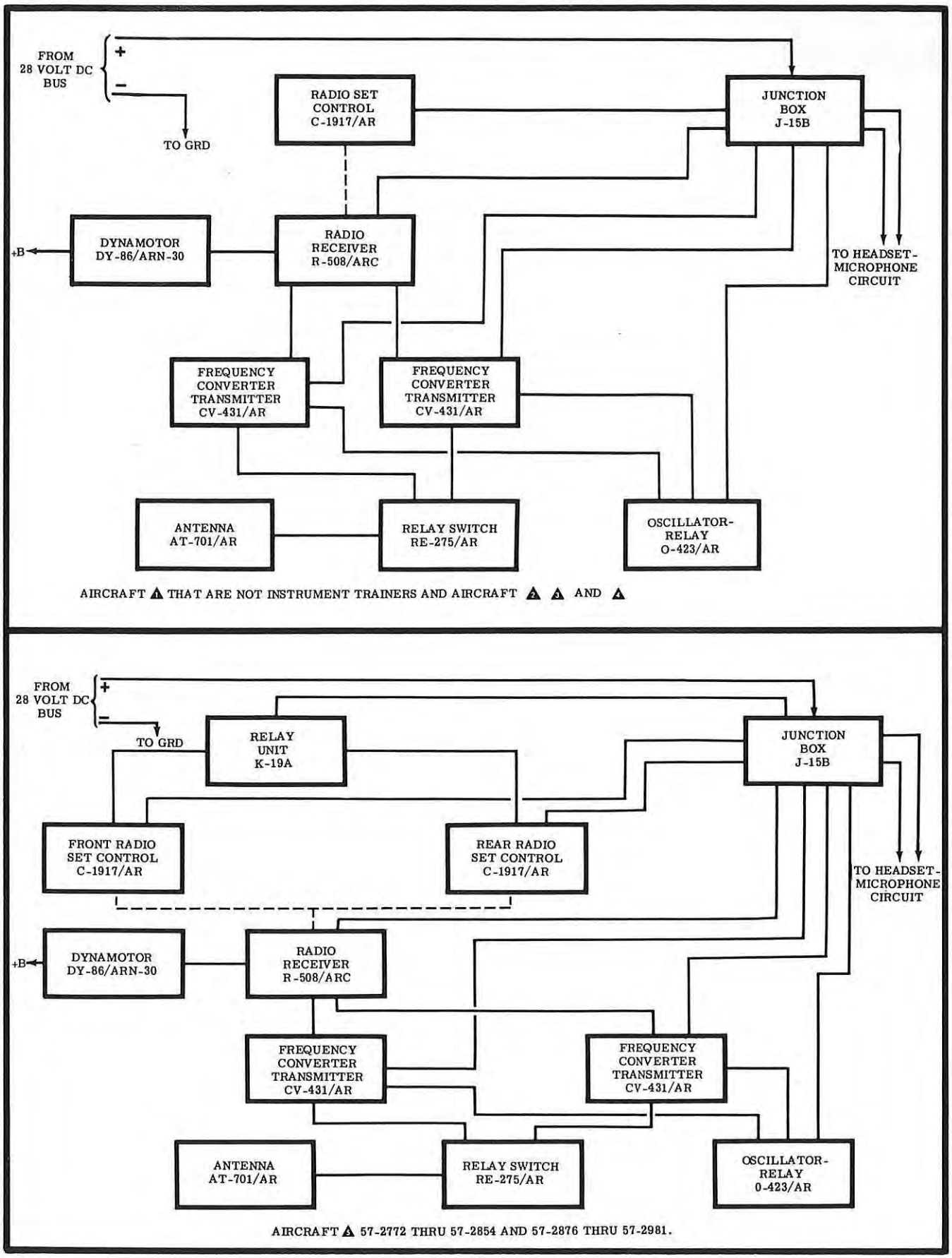


Figure 3.1-1. Radio Set AN/ARC-60 Block Diagram

3.1-9. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common Name
Radio Set AN/ARC-60	Radio set.
Frequency Converter-Transmitter CV-431/AR	Transverter
Radio Receiver R-508/ARC	Receiver
Radio Set Control C-1917/AR . . .	Control unit
Oscillator-Relay O-423/AR	Oscillator-relay
Dynamotor DY-86/ARN-30	Dynamotor
Relay-Switch RE-275/AR.	Antenna relay
Relay unit ARC Type K-19A ▲	Control unit relay
Electrical Equipment Rack MT-1140/ARC . .	Equipment rack
Mounting MT-1677/AR .	Mounting
Antenna AT-701/AR . .	Antenna
Mounting ARC Type M-20 ▲	Relay mounting

3.1-10. COMPONENTS OF RADIO SET AN/ARC-60.

3.1-11. Refer to figure 3.1-2 for location of the Radio Set AN/ARC-60 components within the aircraft.

Quantity	Items
1	Radio Receiver R-508/ARC; includes Dynamotor DY-86/ARN-30
2	Frequency Converter-Transmitter CV-431/AR
1*	Radio Set Control C-1917/AR
1	Oscillator-Relay O-423/AR
1	Relay-Switch RE-275/AR
1	Antenna AT-701/AR
3	Electrical Equipment Rack MT-1140/ARC
1	Mounting MT-1677/AR
7	Crystal ARC-17142
1▲	Relay Unit ARC Type K-19A
1▲	Mounting ARC Type M-20

*On aircraft ▲ two control units, C-1917/AR, are required.

3.1-12. DESCRIPTION OF RADIO SET AN/ARC-60.

3.1-13. The two transverters permits selection of a maximum of 16 transmitting frequencies; each transverter provides eight crystal-controlled frequencies. Selection of the proper transverter is made automatically when the transmitter channel selector switch, labeled TRAN, on the control unit is set to the desired channel. The receiver is continuously tunable; it is tuned by turning a crank on the control unit. Because the receiver accepts only frequencies from 118 megacycles to 148 megacycles, it is necessary to convert the received signals which range from 228 megacycles to 258 megacycles. This is done in the transverters. High voltage for all components is supplied by the dynamotor which is part of the receiver. To permit the receiver to be tuned to the same frequency as the transmitter, whistle-through tuning is provided. If the tuning crank is pressed in while it is being turned, a whistle will be heard; the whistle is loudest when the receiver is accurately tuned to the transmitting frequency.

3.1-14. DESCRIPTION OF MAJOR COMPONENTS.

3.1-15. FREQUENCY CONVERTER-TRANSMITTER CV-431/AR.

3.1-16. The frequency converter-transmitter CV-431/AR (10, figure 3.1-2) is a combined transmitter and receiver-converter. The five-tube transmitter section is an independent transmitter operating from 228 to 258 megacycles. The converter section uses one tube and a crystal divide to convert received signals from the 228 to 258 megacycle range to the 118 to 148 megacycle range. The transmitter section of each transverter contains eight crystal - controlled channels, providing a total of 16 usable frequencies. The eight transmitting channels may be located in one four megacycles band or they may be divided between two bands, each four megacycles wide, with at least a two megacycle separation between the bands. Although the two transverters are identical, they are designated as No. 1 and No. 2. The No. 1 transverter is aligned to operate on a lower set of frequencies than the No. 2 transverter. The radio frequency (rf) and oscillator sections are factory-aligned for the frequencies listed below. When other flight frequencies are to be used, the radio frequency section must be aligned by depot personnel.

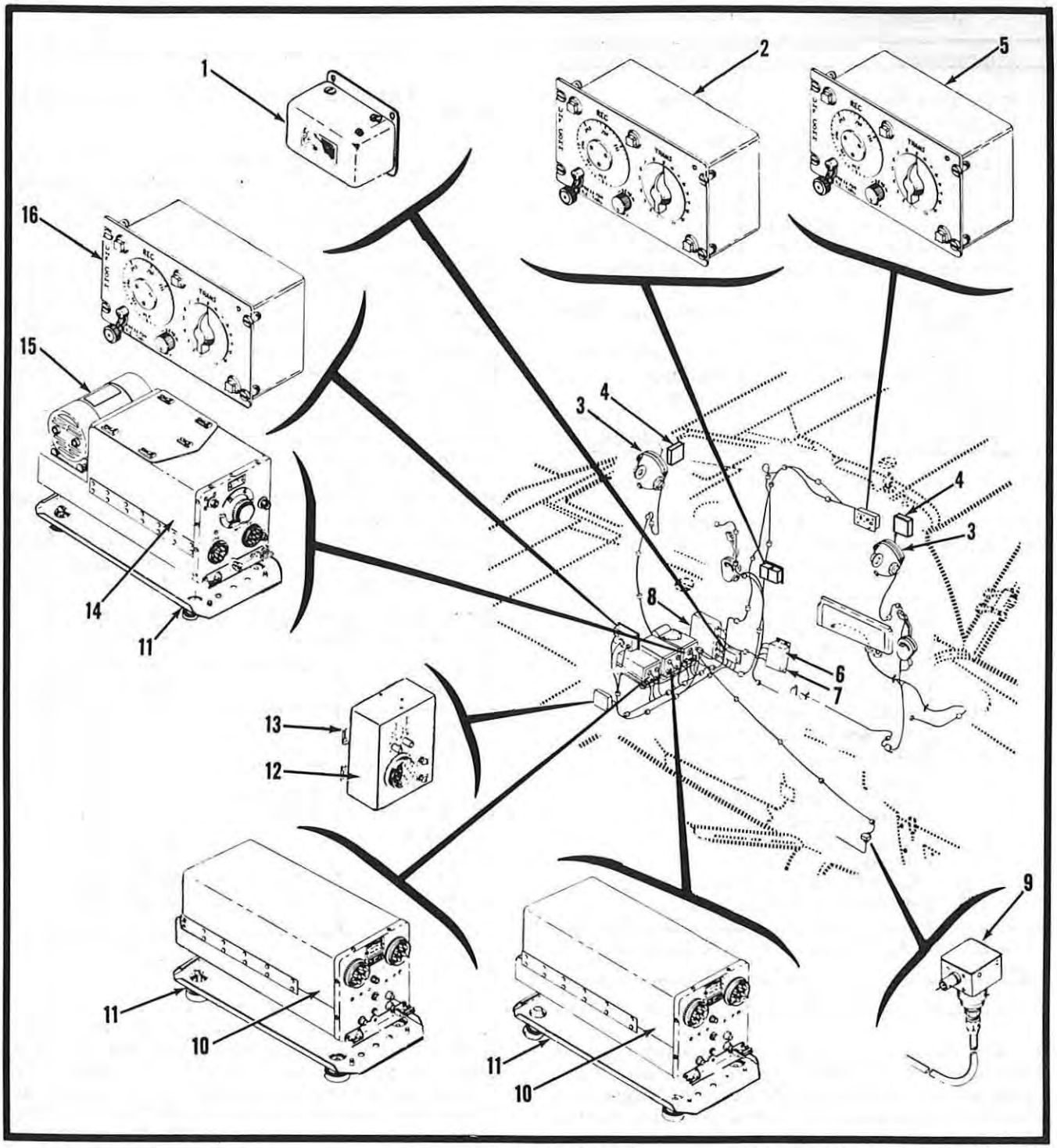
NO. 1 TRANSVERTER			
Operating Freq. (mc)	Channel No.	Crystal Freq. (mc)	Crystal Socket
233.8	3	9.74	3
236.6	6	9.85	6
NO. 2 TRANSVERTER			
242.4	9	10.1	1
243	11	10.12	3
255.4	13	10.64	5
255.8	15	10.65	7
257.8	16	10.74	8

3.1-17. RADIO RECEIVER R-508/ARC.

3.1-18. The radio receiver R-508/ARC (14, figure 3.1-2) is a nine-tube superheterodyne continuously tunable from 118 to 148 megacycles. Mounted at the rear of the receiver is the dynamotor (15, figure 3.1-2). Circuits between the dynamotor and the receiver are completed by mating connectors on the base of the dynamotor and the receiver chassis. All other connections are made to the receiver on the front panel. The receiver is remotely controlled by the radio control unit. The receiver is located on the floor aft of the rear seat.

3.1-19. RADIO SET CONTROL C-1917/AR.

3.1-20. The front panel of the radio set control C-1917/AR (2, 5, 16, figure 3.1-2) is lighted by three panel edge lights (1, figure 3.1-3). The frequency dial (2, figure 3.1-3), labeled REC, is calibrated in megacycles. The tuning crank (5, figure 3.1-3), labeled PRESS TO WHISTLE, turns the REC dial and also operates a mechanical linkage that is connected to the re-



1. Relay-Switch RE-275/AR
2. Radio Set Control C-1917/AR†
3. Headset-Microphone H-101/U ▲1 ▲2 ▲3 ▲4 ; H-46A/UR ▲5
4. Jack Box J-10 ▲1 ▲2 ▲3 ▲4
5. Front Radio Set Control C-1917/AR‡
6. Relay Unit K-19A‡
7. Mounting ARC Type M-20‡
8. Junction Box ARC Type J-15B
9. Antenna AT-701/AR
10. Transverter CV431/AR
11. Electrical Equipment Rack MT-1140/ARC
12. Oscillator-Relay O-423/AR
13. Mounting MT-1677/AR
14. Radio Receiver R-508/ARC
15. Dynamotor DY 86/ARN-30
16. Rear Radio Set Control C-1917/AR‡

†Aircraft ▲1 EQUIPPED WITH AN/ARC 60 RADIO ; all aircraft ▲3 EQUIPPED WITH AN/ARC 60 RADIO ; all aircraft ▲2 ▲4 .
‡Aircraft ▲5 57-2772 thru 57-2854 and 57-2876 thru 57-2981.

Figure 3.1-2. Radio Set ARC-60 Major, Minor and Installation Items Locations Diagram

ceiver. As the REC dial is turned, the receiver is tuned to the frequency indicated by the dial. The transmitter channel selector switch (3, figure 3.1-3), labeled TRANS, has 17 positions. Position one thru 16 are the transmitting channels; the 17 position is not connected for use in radio set AN/ARC-60. The panel edge lights that illuminate the front panel are installed in red filters. They are controlled by the aircraft panel edge light rheostat switch. Electrical and mechanical connections are made at the rear of the control unit.

3.1-21. OSCILLATOR-RELAY O-423/AR.

3.1-22. The oscillator-relay O-423/AR (12, figure 3.1-2) includes a 1000-cycle, neon-tube oscillator to provide the tone for whistle-through tuning. It also includes relays that operate, when the tuning crank on the control unit is pressed, to set up the receiver and the transverter that is in use for whistle-through tuning. It is housed in a metal box, on top of which are mounted the necessary connectors and two whistle level adjustments, UHF and VHF.

3.1-23. RELAY-SWITCH RE-275/AR.

3.1-24. The antenna relay RE-275/AR (1, figure 3.1-2) is a coaxial switch operated by a relay. It automatically connects the antenna to the transverter that is in operation as selected by the transmitter channel selector switch on the control panel. It is mounted in a metal box and has three coaxial connectors and one connector for supplying power to the relay.

3.1-25. ANTENNA AT-701/AR.

3.1-26. The antenna AT-701/AR (9, figure 3.1-2) is a quarter-wave, base-fed, inverted-L type. It consists of a 1/4 inch, stainless steel rod, L-shaped and mounted on a small aluminum box that contains a receptacle for coupling to a 52-ohm coaxial transmission line.

3.1-27. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-28. ELECTRICAL EQUIPMENT RACK MT-1140/ARC.

3.1-29. Electrical equipment rack MT-1140/ARC (11, figure 3.1-2) is a shockproof and vibration-proof mounting. One is used for the receiver and one is used for each transverter. The components are secured by snapslides that engage grooved studs on the equipment racks. Copper strips, on the underside, ground the equipment racks.

3.1-30. MOUNTING MT-1677/AR.

3.1-31. Mounting MT-1677/AR (13, figure 3.1-2) is a plate that is used to fasten the oscillator-relay in place. Disk-type springs on top of the plate provide mounting tensions. The plate is mounted on the lower right cabin wall behind the rear seat.

3.1-32. RELAY UNIT ARC TYPE K-19A. Aircraft ▲5.

3.1-33. The relay unit ARC Type K-19A (6, figure 3.1-2) is mounted on the left side of the fuselage in front of the J-15B junction box. The relay supplies power to the communication system and transfers operation between the front and rear control unit.

3.1-34. MOUNTING ARC TYPE M-20. Aircraft ▲5.

3.1-35. Mounting ARC Type M-20 (7, figure 3.1-2) is a plate that is used to fasten the K-19A relay unit in place. The plate is mounted on the lower left cabin wall adjacent to the rear seat.

3.1-36. JUNCTION BOX ARC TYPE J-15B.

3.1-37. The junction box ARC Type J-15B (8, figure 3.1-2) is located on the left side of the fuselage directly below the rear compartment window. This junction box is the center of operation for radio communication and navigation systems. The junction box contains 56 terminals and the power and sidetone relays.

3.1-38. JACK BOX ARC TYPE J-10. Aircraft ▲1 ▲2 ▲3 ▲4.

3.1-39. The jack box ARC Type J-10 (4, figure 3.1-2) provides a microphone input jack, a telephone input jack, and two collet-type openings for wiring connections into and out of the box. The front jack box is mounted on the left root rib adjacent to the front seat. The rear jack box is mounted on a bulkhead on the left side of the cabin behind the rear seat.

3.1-40. HEADSET-MICROPHONE H-101/U. Aircraft ▲1 ▲2 ▲3 ▲4.

3.1-41. The headset-microphone H-101/U (3, figure 3.1-2) provides hand-free, low-noise communication. It consists of a close-talking, noise-cancelling microphone mounted on a two-phone headset. These phones are connected in parallel and are pressure compensated to provide a frequency response that is practically independent of altitude. A pair of neoprene-covered earphone cushions are designed for the right and left ear and are marked R and L on the rear outer surface of the cushion. A polyethylene moisture barrier is fitted over the mouthpiece of the microphone and a black nylon guard protects its thin membrane from abuse. The moisture barrier and guard should be in place when the microphone is in use. The microphone is mounted on a swivel arm and can be positioned directly in front of the lips during transmission.

3.1-42. HEADSET-MICROPHONE H-46A/UR, Aircraft ▲5.

3.1-43. Headset-microphone H-46A/UR (3, figure 3.1-2) consists of headset HS-33A and microphone assembly M-3A/A. Headset HS-33A includes an adjustable headband, two low-impedance earphones (300 ohm's each), two earphone cushions, and a cord and plug. Microphone M-3A/A is a boom-type, noise-cancelling carbon microphone. It includes a 100 ohm microphone unit held to the boom with a microphone unit-holding bracket, adjustable cord guide, and a cord and plug. The microphone unit is covered with a plastic frost and wind blast shield.

3.1-44. DIFFERENCES IN MODELS.

3.1-45. Refer to figures 3.1-30 for differences between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

3.1-46. OPERATING CONTROLS AND USE.

3.1-47. VOLUME CONTROL KNOB.

3.1-48. The volume control knob (4, figure 3.1-3) labeled VOL, controls the audio level of the radio set and also turns the set on or off.

3.1-49. TRANSMITTER CHANNEL SELECTOR SWITCH.

3.1-50. The transmitter channel selector switch (3, figure 3.1-3) labeled TRANS selects the desired radio set transmitting frequency. The frequency corresponding to the transmitter channel selector number is listed on a frequency chart located near the radio set control.

3.1-51. TUNING CRANK.

3.1-52. The tuning crank (5, figure 3.1-3) labeled PRESS TO WHISTLE, turns the frequency dial (2, figure 3.1-3) labeled REC and also operates a mechanical linkage that is connected to the receiver, which permits the receiver to be tuned to any desired frequency as indicated on the frequency dial. The crank also provides a means of setting the receiver precisely to the frequency selected on the transmitter. By pressing in on the crank while tuning, an oscillation is heard in the headset when the receiver is tuned across the transmitter frequency. The frequency dial indicates frequencies from 228 to 257 megacycles in one megacycle increments.

3.1-53. RADIO CONTROL SWITCH. Aircraft ⚠5 .

3.1-54. Each instrument panel has a radio control switch and indicator light (44, figure 1-7; 16, figure 1-8). The switches, labeled COMM, transfer operation of the radio set between the front and rear radio control unit. The indicator light within each switch designated whether the front or rear occupant has control of the radio set. Operation of the radio set may be obtained by the front or rear occupant by pressing the radio control switch.

Note

Control of the radio set always reverts to the front control unit when the battery switch is turned OFF and then ON. The rear control unit will become operative again only after the radio control switch is pressed.

3.1-55. MICROPHONE SWITCH BUTTON. Aircraft ⚠1 ⚠2 .

3.1-56. A microphone switch button (figure 4-2) is mounted on top of the front control stick grip. The switch button is effective only when a throat microphone is used by the pilot. When a conventional hand microphone, incorporating and integral switch is utilized, the control stick microphone switch button is ineffective and does not interfere with the operation of the hand microphone's integral switch.

3.1-57. MICROPHONE SWITCH BUTTON. Aircraft ⚠3 ⚠4 ⚠5 .

3.1-58. A microphone switch button (figure 1-4) is mounted on both the front and rear throttle. The switch is labeled MIC, and is used for transmitting communication.

3.1-59. INTERPHONE SWITCH BUTTON. Aircraft ⚠3 ⚠4 ⚠5 .

3.1-60. A interphone switch button (figure 1-4) is mounted on both the front and rear throttle. The switch is labeled INT, and is used for transmitting communication between the front and rear compartments.

Control	Function
VOL Control . .	Controls the volume of signals heard in the headset. Includes a switch for turning the radio set on and off.
TRANS Switch .	Permits selection of any one of 16 transmitting channels. Position 17 is not used.
PRESS TO WHISTLE Crank . .	Tunes receiver and turns REC dial to indicate receiver frequency. When pressed, produces whistle in headset. Whistle is loudest when receiver is tuned to the selected transmitting frequency.
COMM Switch ⚠5 .	Transfer operation of the radio set between the front and rear radio control set. An indicator light within each switch shows which radio control set has control of the radio set.
MIC Switch . .	Used for transmitting communication.
INT Switch ⚠3⚠4⚠5	Used for transmitting communication between front and rear compartments.

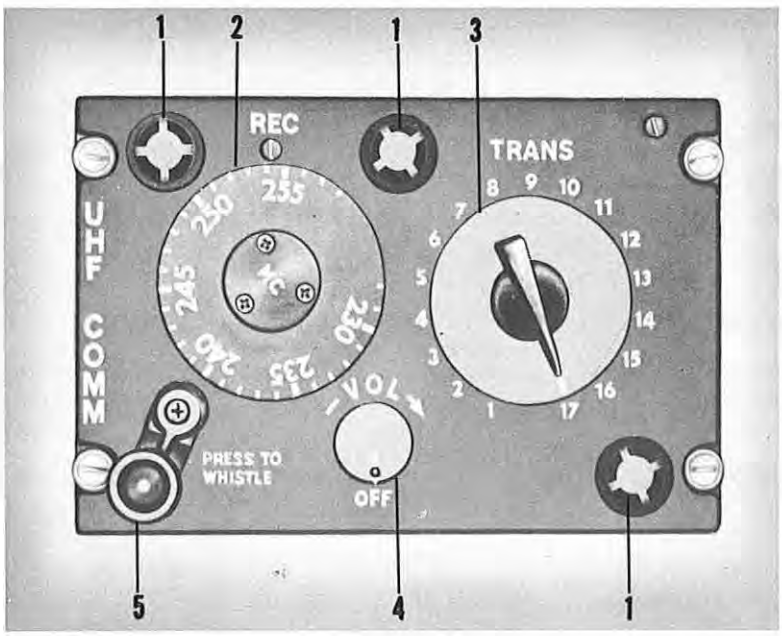
3.1-61. TYPES OF OPERATION FACILITIES.

3.1-62. Refer to figure 3.1-30 for operating facilities.

3.1-63. OPERATING INSTRUCTIONS.

1. Turn the volume control knob, labeled VOL, full clockwise. Allow approximately a three minute warm-up period.
2. Turn the transmitter channel selector switch, labeled TRANS, to an assigned channel.
3. Radio control switch, labeled COMM - Press for control ⚠5 .
4. Tuning crank - Press, turn until the whistle heard in the headset is loudest. Adjust the volume control

RADIO SET CONTROL C-1917/AR



1. Panel Edge Light
2. Frequency Dial
3. Transmitter Channel Selector Switch
4. Volume Control Knob
5. Tuning Crank

Figure 3.1-3

for a comfortable listening level. Reception of stations operating on the selected channel will be possible.

Note

If receiving and transmitting frequencies are to be the same, select the transmitting channel first, then depress and adjust the tuning crank for maximum whistle.

5. To transmit, press the microphone button and speak into the microphone. Release the button as soon as the transmission has ended.
6. To turn off the radio set, turn the volume full counterclockwise.

Note

Enter any equipment malfunction or failure in flight report.

3.1-64. INTERPHONE OPERATING INSTRUCTIONS. Aircraft ▲5 .

1. Turn the volume control knob, labeled VOL, full clockwise. Allow approximately a three minute warm-up period.
2. Interphone switch - Press and speak directly into microphone.
3. To turn unit off turn volume control knob counter-clockwise.

3.1-65. DUAL OPERATING CONTROL. Aircraft ▲5.

3.1-66. Refer to paragraph 3.1-53, "Radio Control Switch".

3.1-67. EMERGENCY OPERATION.

3.1-68. If generator failure occurs during flight, radio operation will be limited to the life of the battery, therefore radio operation should be limited to conserve the battery. For frequencies reserved for emergency operation, refer to the frequency chart located near the radio set control.

Note

- No transmission will be made on emergency (distress) frequency channels except for emergency purpose. For test, demonstration, or drill purpose, the radio equipment will be in a shielded room to prevent transmission of messages that could be construed as actual emergency messages.

- On aircraft ▲1 ▲2 ▲3 ▲4 if failure of radio set AN/ARC-60 occurs operation of the FM radio set can still be maintained.

3.1-69. PREFLIGHT INSPECTION.

3.1-70. The following paragraphs describe the operational procedures performed on radio set AN/ARC-60 equipment at the time indicated in Section II Normal Procedures.

3.1-71. POWER OFF INSPECTION.

3.1-72. EXTERIOR INSPECTION.

3.1-73. The following check is an extension to the Exterior Inspection in Section II.

1. Antenna - Check for secure antenna mounting and condition.

3.1-74. INTERIOR INSPECTION.

1. Antenna and antenna relay - Check for secure antenna lead-in connections to antenna and antenna relay.
2. Frequency converter transmitters - Check for secure wire and plug connections. Tighten plug connectors rings hand tight.
3. Radio receiver - Check for secure plug and wire connections. Check and hand tighten plug connector rings and mechanical linkage nut.
4. Oscillator relay - Check for secure plug connections. Hand tighten plug connector rings.
5. Junction box - Check that all wire connections and terminal nuts are secure.
6. Radio control unit - Check to see that all plugs are secure. Hand tighten plug connector rings, and mechanical linkage nut. Set TRANS switch to desired operating channel.
7. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-75. POWER ON.

Note

When an auxiliary power unit is used to start the engine the operational checks, as listed below, will be performed while the auxiliary power unit is connected to the aircraft prior to starting the engine. If an auxiliary power unit is not available, the operational checks will be performed during engine warm-up.

1. Volume control knob - Turn maximum clockwise. Dynamotor should start running and noise should be heard in headset.
2. Transmitter channel selector switch - To desired channel. Press the PRESS TO WHISTLE tuning crank and tune the receiver to the transverter frequency. Whistle audible in headset should be heard.
3. Establish two-way communication with tower - Press MIC button and speak into microphone. Release MIC button to receive. Two-way communication should be possible.

3.1-76. POST FLIGHT CHECK.

1. Volume control knob - Turn maximum counterclockwise to turn radio set off.
2. All discrepancies noted on Form DA-781-1 and the crew-chief should be notified.

3.1-77. RADIO SET ARC TYPE 12. Aircraft ▲1 except Aircraft EQUIPPED WITH AN/ARC 60 RADIO; all aircraft ▲3 except aircraft EQUIPPED WITH AN/ARC 60 RADIO and aircraft ▲5 55-4649 thru 55-4748 and 57-2855 thru 57-2875.

3.1-78. PURPOSE AND USE.

3.1-79. Radio set ARC Type 12 has a line-of-sight range of approximately 30 miles at 3000 feet, and 60 miles at 6000 feet with some variation according to terrain and atmospheric conditions, and is used for ground-to-air and air-to-air voice communication. It provides crystal controlled, amplitude-modulated (am) transmission on a maximum of 10 channels on aircraft ▲1 ▲3 and 15 channels on aircraft ▲5, the receiver can be tuned to the transmitting frequency. The frequency range is 118 to 148 megacycles.

3.1-80. TECHNICAL CHARACTERISTICS.

Frequency range	118 to 148 megacycles.
Transmitting channels aircraft ▲1 and ▲3	10 (5 per transmitter).
Transmitting channels aircraft ▲5	15 (5 per transmitter).
Type of modulation	Amplitude.
Type of transmission	Voice.
Distance range:	
Transmitting	30 miles at 3000 feet, 60 miles at 6000 feet.
Receiving	Line-of-sight.
Transmitting power output	2 watts.
Receiving sensitivity	7 microvolt for 10 mw output with 10 db signal-plus-noise to noise ratio.
Antenna ▲5	Quarter wave, base-fed, inverted-L whip.
Antenna ▲1 ▲3	Quarter wave, base-fed, 25 inches long.
Power required ▲1 ▲3	4.0 amperes.
Power required ▲5	5.25 amperes.

3.1-81. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common Name
Radio Set ARC Type 12	Radio set
Radio Transmitter T-363/ARC and T-366/ARC	Transmitter
Radio Receiver R-508/ARC	Receiver
Radio Set Control C-1117/ARC ▲1 ▲3	Control unit
Radio Set Control C-1341/ARC ▲5	Control unit
Oscillator Relay O-423/AR ▲5	Oscillator relay
Control Unit ARC Type C-47 ▲1	Control selector
Dynamotor DY-86/ARN-30	Dynamotor
Relay Unit ARC Type K-12 ▲1 ▲5 *	Control relay
Relay Unit ARC Type K-19A ▲5 *	Control relay
Muting Relay ARC Type K-11 ▲5 *	Muting relay
Relay Unit ARC Type K-17 ▲5 *	Relay unit
Electrical Equipment Rack MT-1140/ARC	Equipment rack
Mounting ARC Type M-11A	Transmitter mount
Mounting MT-1677/AR ▲5	Relay mount
Mounting Type M-20 ▲1 ▲3	Control relay mount
Antenna ARC Type A-15 ▲5	Antenna
Antenna Type A-12 ▲1 ▲3	Antenna

* Aircraft ▲5 55-4649 thru 55-4748.
* Aircraft ▲5 55-2855 thru 57-2875.

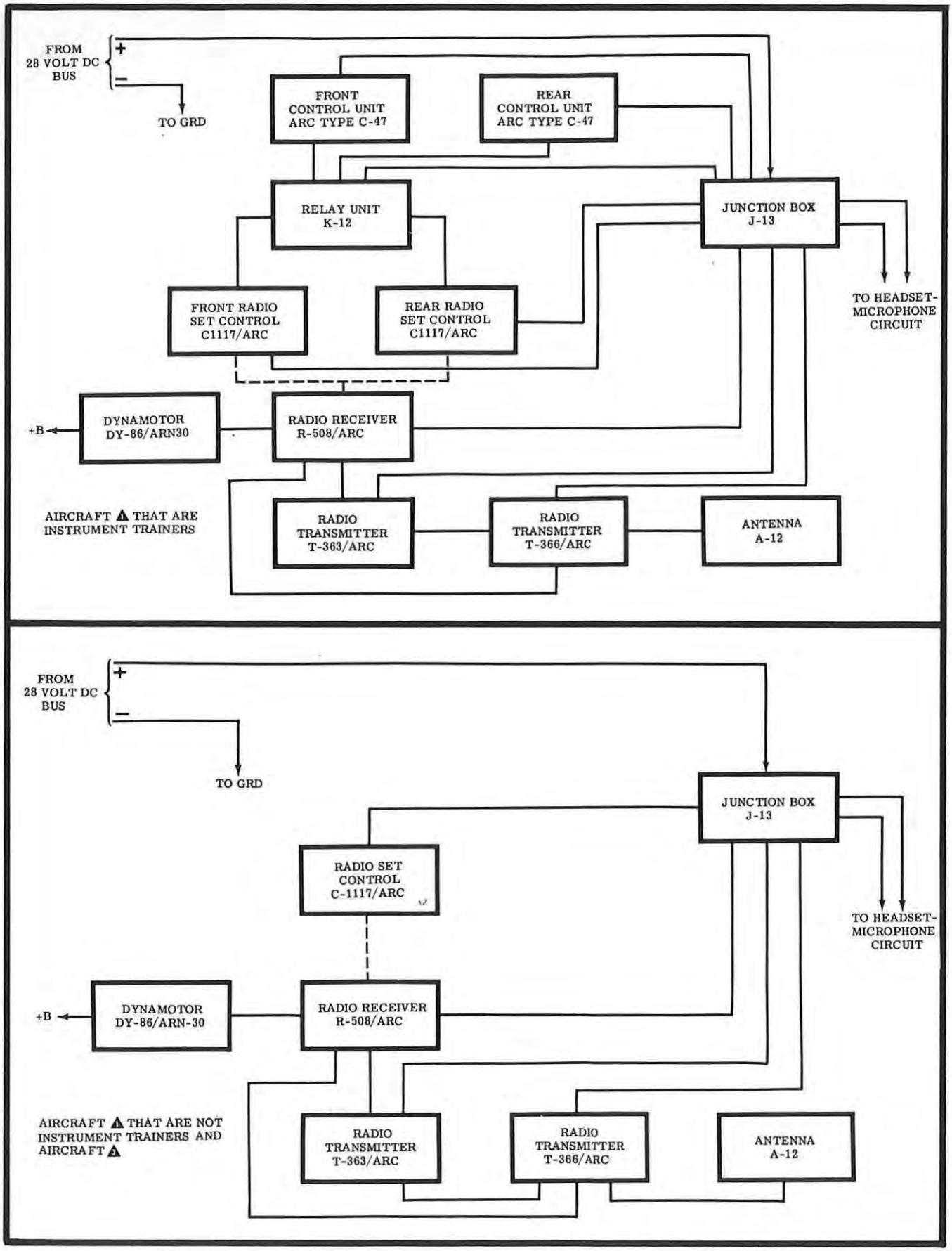
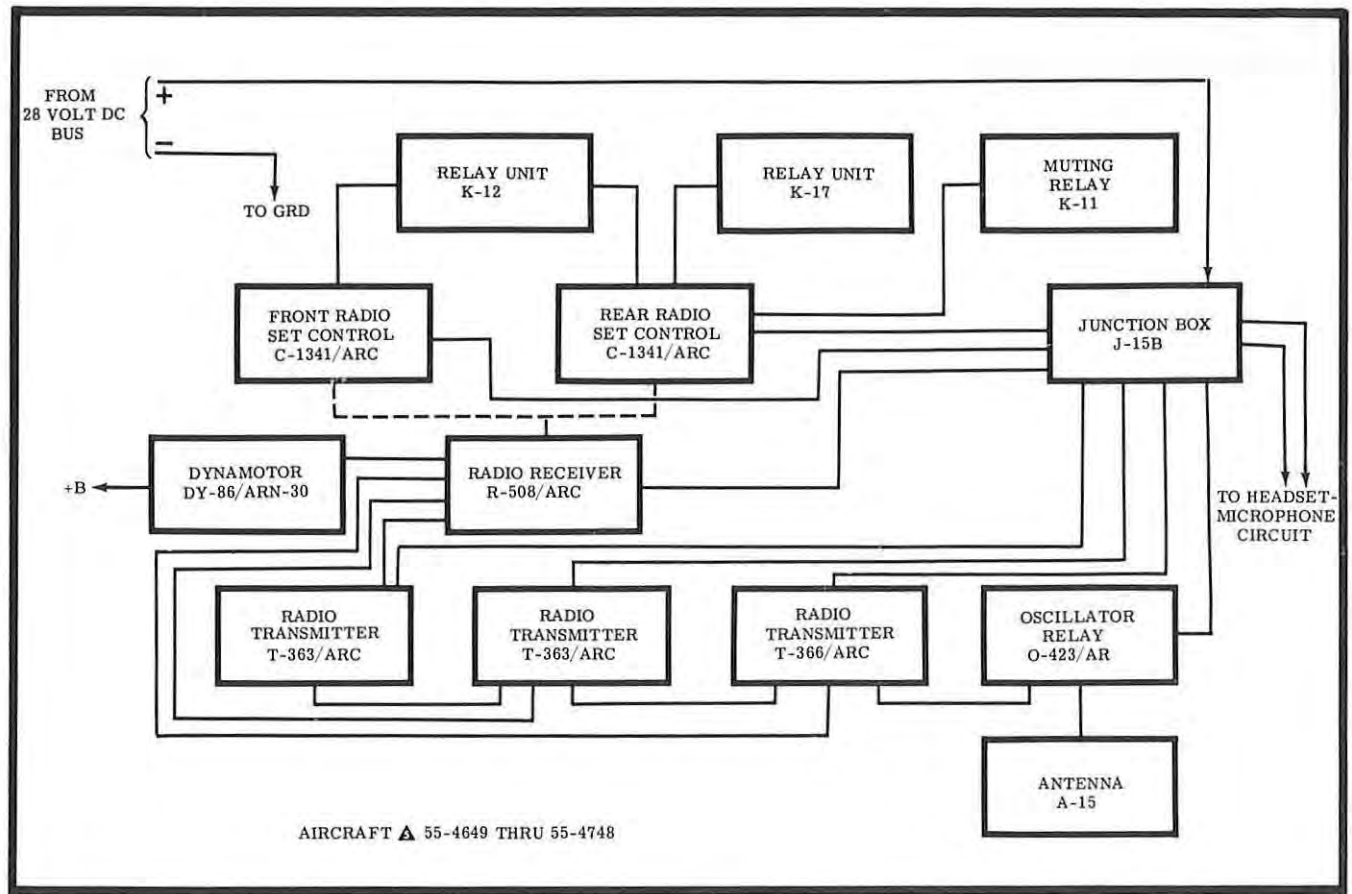


Figure 3.1-4. Radio Set ARC Type 12 Block Diagram (Sheet 1 of 2)



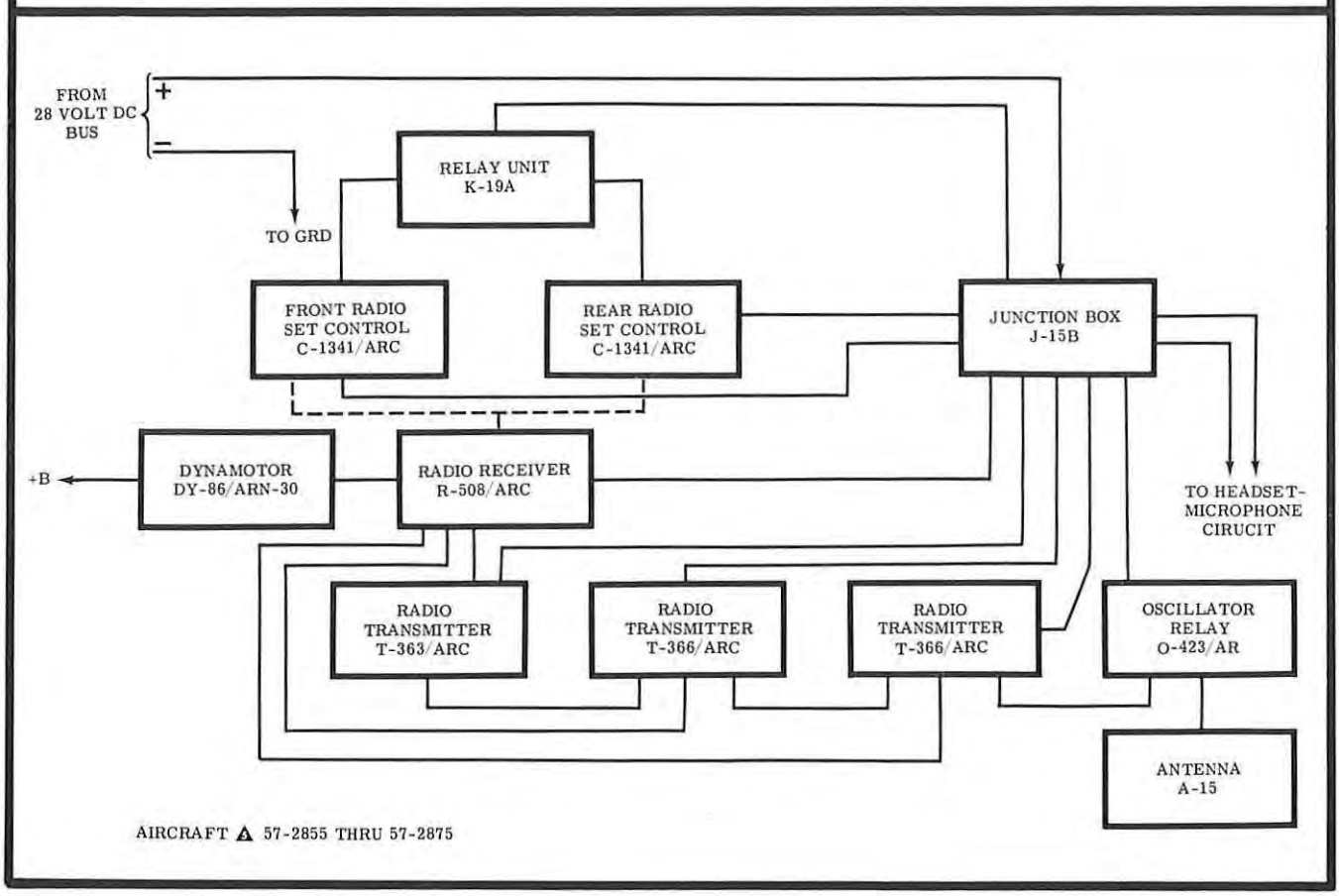


Figure 3.1-4. Radio Set ARC Type 12 Block Diagram (Sheet 2 of 2)

3.1-82. COMPONENTS OF RADIO SET ARC TYPE 12. Aircraft ▲1 ▲3 .

3.1-83. Refer to figure 3.1-5 for location of the radio set ARC Type 12, components within the aircraft.

Quantity	Items
1	Radio Receiver R-508/ARC; includes Dynamotor DY-86/ARN-30
1	Radio Transmitter T-363/ARC
1	Radio Transmitter T-366/ARC
2*	Control Selector ARC Type C-47
1*	Radio Set Control C-1117/ARC
1	Antenna ARC Type A-12
1*	Relay Unit ARC Type K-12
1	Electrical Equipment Rack MT-1140/ARC
2	Mounting ARC Type M-11A
1*	Mounting ARC Type M-20
1	Antenna ARC Type A-12

* Aircraft ▲1 instrument trainers, two radio control units are required.
* Aircraft ▲1 instrument trainers only.

3.1-84. COMPONENTS OF RADIO SET ARC TYPE 12. Aircraft ▲5 .

3.1-85. Refer to figure 3.1-5 for location of the radio set ARC Type 12 components within the aircraft.

Quantity	Items
1	Radio Receiver R-508/ARC; includes Dynamotor DY-86/ARN-30
2*	Radio Transmitter T-363/ARC
1*	Radio Transmitter T-366/ARC
1*	Radio Transmitter T-363/ARC
2*	Radio Transmitter T-366/ARC
2	Radio Set Control C-1341/ARC
1	Antenna ARC Type A-15
1	Oscillator Relay O-423/AR
1*	Relay Unit ARC Type K-12
1*	Relay Unit ARC Type K-19A
1*	Muting Relay ARC Type K-11
1*	Relay Unit ARC Type K-17
1	Electrical Equipment Rack MT-1140/ARC
3	Mounting ARC Type M-11A
1	Mounting MT-1677/AR
1	Mounting ARC Type M-20

* Aircraft ▲5 55-4649 thru 55-4748.
* Aircraft ▲5 57-2855 thru 57-2875.

3.1-86. DESCRIPTION OF RADIO SET ARC TYPE 12.

3.1-87. Two transmitters on aircraft ▲1 ▲3 permits selection of a maximum of 10 transmitting frequencies; on aircraft ▲5 three transmitters permits selection of a maximum of 15 transmitting frequencies; each transmitter provides five transmitting crystal-controlled frequencies. Selection of the proper transmitter is made automatically when the transmitter channel selector switch labeled TRAN on the control unit is set to the desired channel. The receiver is continuously tunable in the frequency range of 118 to 148 megacycle; it is tuned by turning a crank on the control unit. High voltage for all components is supplied by the dynamotor which is part of the receiver. On aircraft ▲5 to permit the receiver to be tuned to the same frequency as the transmitter, whistle-through tuning is provided. If the tuning crank is pressed in while it is being turned, a whistle will be heard; the whistle is loudest when the receiver is accurately tuned to the transmitting frequency.

3.1-88. DESCRIPTION OF MAJOR COMPONENTS.

3.1-89. RADIO TRANSMITTER T-363/ARC.

3.1-90. Radio transmitter T-363/ARC (20, figure 3.1-5) is a four-tube, five-channel transmitter designed to operate in any two megacycle band located between 118-132 megacycles. Because of the narrow band, only one set of tuned circuits is required. High voltage for the transmitter is obtained from the receiver dynamotor. The interconnections between the transmitter and receiver are arranged so that when the microphone button is closed, in preparation for transmission, a single-pole double-throw relay in the transmitter is actuated, switching the high voltage from the receiver to the transmitter. When two or more transmitters are installed, relays of the transmitters not in use, serve to patch the power and antenna input connection to the relays of the operating transmitter. The transmitter is located on the floor aft of the rear seat.

3.1-91. RADIO TRANSMITTER T-366/ARC.

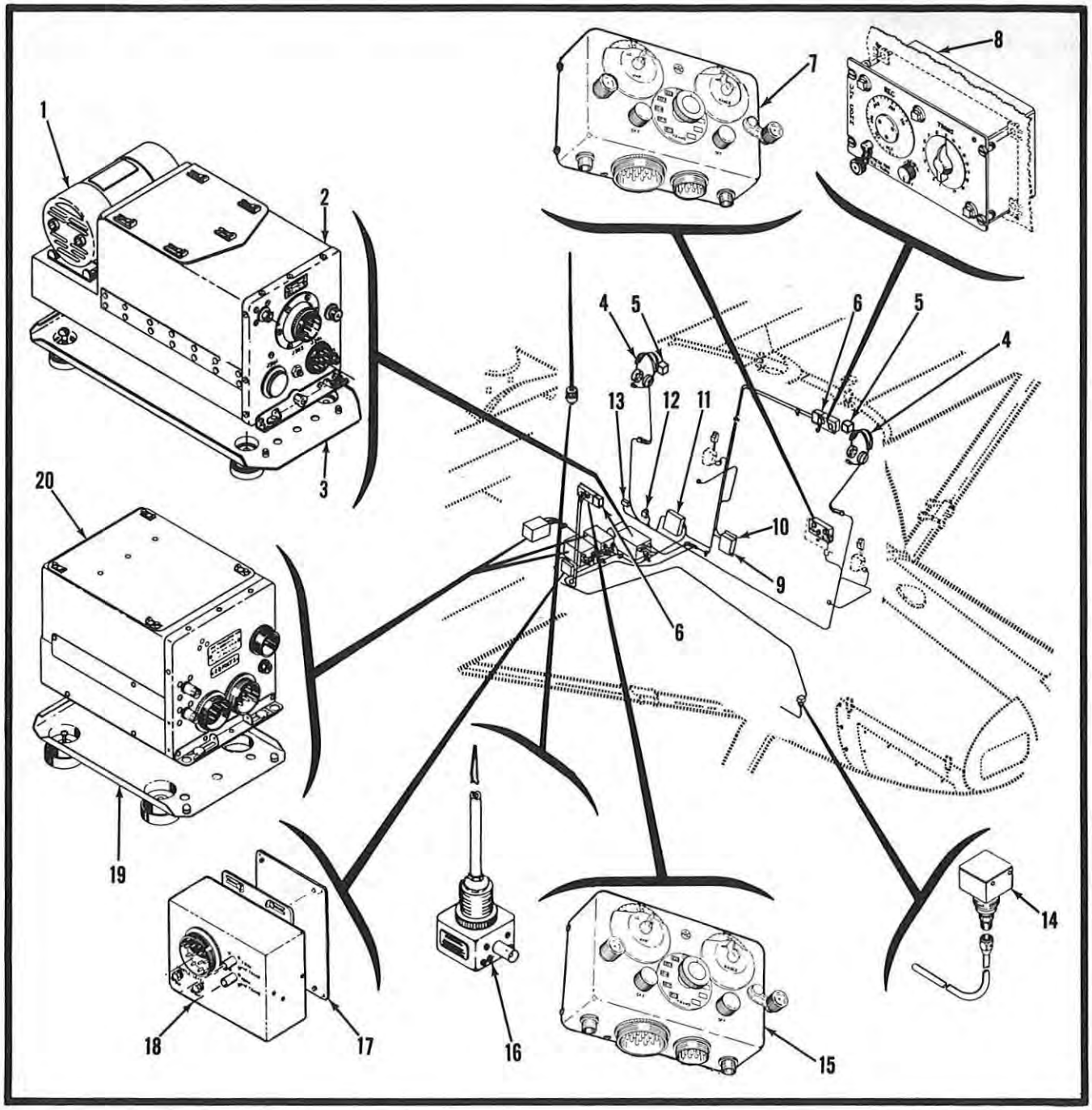
3.1-92. Radio transmitter T-366/ARC (20, figure 3.1-5) is similar to radio transmitter T-366/ARC, except for the frequency range, which is designed to operate in any two megacycle band located between 132-148 megacycles. The transmitter is located on the floor aft of the rear seat.

3.1-93. RADIO RECEIVER R-508/ARC.

3.1-94. The radio receiver (2, figure 3.1-5) is a nine-tube superheterodyne continuously tunable from 118 to 148 megacycles. Mounted at the rear of the receiver is the dynamotor (1, figure 3.1-5). Circuits between the dynamotor and the receiver are completed by mating connectors on the base of the dynamotor and the receiver chassis. All other connections are made to the receiver on the front panel. The receiver is remotely controlled by the radio set control. The receiver is located on the floor aft of the rear seat.

3.1-95. RADIO SET CONTROL C-1117/ARC. Aircraft ▲1 and ▲3 .

3.1-96. Radio set control C-1117/ARC (7, 15, figure 3.1-5) is designed for remote control of the receiver and transmitters. The frequency dial (12, figure 3.1-6), is calibrated in megacycles. The tuning crank (7, figure 3.1-6), turns the frequency dial and also operates a mechanical linkage that is connected to the receiver. As the frequency dial is turned, the receiver is tuned to the frequency indicated by the dial. The transmitter channel selector switch (5, figure 3.1-6) labeled TRANS has 11 positions. Ten of the positions are usable for selecting the desired transmitting frequency. Illumination of the panel is provided by a light (13, figure 3.1-



1. Dynamotor DY86/ARN-30
2. Radio Receiver R-508/ARC
3. Electrical Equipment Rack MT-1140/ARC
4. Headset-Microphone H-101/U ▲1 ▲3 ; H-46A/UR ▲5
5. Jack Box ARC Type J-10 ▲1 ▲3
6. Radio Control Selector Unit ARC Type C-47 ▲1
7. Radio Set Control C-1117/ARC ▲1 ▲3
8. Front Radio Set Control C-1341/ARC ▲5
9. Mounting ARC Type M-20 ▲1 ▲5
10. Relay Unit ARC Type K-12 ▲1 ▲3† Type K-19A ▲5‡
11. Junction Box ARC Type J-13 ▲1 ▲3 ARC Type J-15B ▲5
12. Muting Relay ARC Type K-11 ▲3†
13. Relay Unit ARC Type K-17 ▲5†
14. Antenna ARC Type A-15 ▲5
15. Rear Radio Set Control C-1117/ARC ▲1; C-1341/ARC ▲5
16. Antenna ARC Type A-12 ▲1 ▲3
17. Mounting MT-1677/AR ▲5
18. Oscillator-Relay O-423/AR ▲5
19. Mounting ARC Type M-11A
20. Transmitter T-363/ARC and T-366/ARC

† Aircraft ▲5 55-4649 thru 55-4748
‡ Aircraft ▲5 57-2855 thru 57-2875

Figure 3.1-5. Radio Set ARC Type 12 Major, Minor and Installation Items Location Diagram

6). Electrical and mechanical connections are made at the bottom of the control unit.

3.1-97. RADIO SET CONTROL C-1341/ARC. Aircraft 5 .

3.1-98. The front panel of the radio set control (8, 15, figure 3.1-5) is lighted by three panel edge lights (2, figure 3.1-7). The frequency dial (3, figure 3.1-7) labeled REC is calibrated in megacycles. The tuning crank (1, figure 3.1-7) labeled PRESS TO WHISTLE, turns the REC dial and also operates a mechanical linkage that is connected to the receiver. As the REC dial is turned the receiver is tuned to the frequency indicated by the dial. The transmitter channel selector switch (5, figure 3.1-7) labeled TRANS has 17 positions. Positions one thru 15 are the transmitting channels; the 16 and 17 positions are not connected for use in radio set ARC Type 12. The panel edge lights that illuminate the front panel are installed in red filters. They are controlled by the aircraft panel edge light rheostat switch. Electrical and mechanical connections are made at the rear of the control unit.

3.1-99. OSCILLATOR-RELAY O-423/AR. Aircraft 5 .

3.1-100. The oscillator-relay O-423/AR (18, figure 3.1-5) is described in paragraph 3.1-21.

3.1-101. ANTENNA ARC TYPE A-12. Aircraft 1 and 3 .

3.1-102. The antenna ARC Type A-12 (16, figure 3.1-5) is a vertical, quarter-wave base-fed antenna. It consists of a 21 7/8 inches high beryllium copper rod mounted on a small aluminum box that contains a receptacle for a 52 ohm coaxial transmission line.

3.1-103. ANTENNA ARC TYPE A-15. Aircraft 5 .

3.1-104. The antenna ARC Type A-15 (14, figure 3.1-5) is a quarterwave, base-fed inverted L-antenna. It consists of a 1/4 inch, stainless steel rod, L-shaped and mounted on a small aluminum box that contains a receptacle for coupling to a coaxial transmission line.

3.1-105. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-106. ELECTRICAL EQUIPMENT RACK MT-1140/ARC.

3.1-107. Electrical Equipment Rack MT-1140/ARC (3, figure 3.1-5) is described in paragraph 3.1-28.

3.1-108. MOUNTING ARC TYPE M-11A.

3.1-109. Mounting ARC Type M-11A (19, figure 3.1-5) is a shockproof and vibration proof mounting used for mounting the transmitters. The components are secured by snapslides that engage ground studs on the mount. Copper strips on the underside ground the mounting.

3.1-110. MOUNTING MT-1677/AR. Aircraft 5 .

3.1-111. Mounting MT-1677/AR. (17, figure 3.1-5) is described in paragraph 3.1-30.

3.1-112. RADIO CONTROL SELECTOR UNIT ARC TYPE C-47. Aircraft 1 that are instrument trainers.

3.1-113. A radio control selector unit ARC Type C-47 (9, figure 3.1-6) is located to the left of each control unit. The radio control selector unit permits electrical control of the system to be transferred from one operator to the other. System control is transferred by means of the K-12 relay unit, which is controlled by the PUSH FOR CONTROL non-locking push button switch. A red-lens indicating lamp illuminates when control has been transferred to the operator closing the switch.

3.1-114. RELAY UNIT ARC TYPE K-12. Aircraft 1 that are instrument trainers and aircraft 5 55-4649 thru 55-4748.

3.1-115. Relay Unit ARC Type K-12 (10, figure 3.1-5) is mounted on the left side of the fuselage in front of the junction box. The relay supplies power to the communication system and transfers operation between the front and rear control unit.

3.1-116. RELAY UNIT ARC TYPE K-19A. Aircraft 5 57-2855 thru 57-2875.

3.1-117. Relay unit K-19A (10, figure 3.1-5), is described in paragraph 3.1-32.

3.1-118. MOUNTING ARC TYPE M-20. Aircraft 1 that are instrument trainers and aircraft 5 .

3.1-119. Mounting ARC Type M-20 (9, figure 3.1-5) is a plate that is used to fasten the K-12 or K-19A relay unit in place. The plate is mounted on the lower left cabin wall adjacent to the rear seat.

3.1-120. MUTING RELAY ARC TYPE K-11. Aircraft 5 55-4649 thru 55-4748.

3.1-121. The muting relay ARC Type K-11 (12, figure 3.1-5) is installed to mute out all signals, except sidetone during transmitter operation.

3.1-122. RELAY UNIT ARC TYPE K-17. Aircraft 5 55-4649 thru 55-4748.

3.1-123. Relay unit ARC Type K-17 (13, figure 3.1-5) transfers the transmitter selection and keying between the front and rear compartment.

3.1-124. JUNCTION BOX ARC TYPE J-13. Aircraft 1 and 3 .

3.1-125. The junction box ARC Type J-13 (11, figure 3.1-5) is located on the left side of the fuselage directly below the rear compartment window. The junction box is the center of operation for radio communication and navigation system. The junction box contains 30 terminals plus four ground terminals, a single-pole, double-throw relay, and three 20-ampere fuse for receiver protection.

3.1-126. JUNCTION BOX ARC TYPE J-15B. Aircraft 5 .

3.1-127. Junction box ARC Type J-15B (11, figure

3.1-5) is described in paragraph 3.1-36.

3.1-128. JACK BOX ARC TYPE J-10. Aircraft ▲1 and ▲3.

3.1-129. Jack box ARC Type J-10 (5, figure 3.1-5) is described in paragraph 3.1-38.

3.1-130. HEADSET-MICROPHONE H-101/U. Aircraft ▲1 and ▲3.

3.1-131. Headset-microphone H-101/U (4, figure 3.1-5) is described in paragraph 3.1-40.

3.1-132. HEADSET-MICROPHONE H-46A/UR. Aircraft ▲5.

3.1-133. Headset-microphone H-46A/UR (4, figure 3.1-5) is described in paragraph 3.1-42.

3.1-134. DIFFERENCES IN MODELS.

3.1-135. Refer to figures 3.1-30 for differences between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

3.1-136. OPERATING CONTROLS AND USE.

3.1-137. VOLUME CONTROL KNOB.

3.1-138. The volume control knob (6, figure 3.1-6; 4, figure 3.1-7), labeled VOL, controls the audio level of the radio set and also turns the set on and off.

3.1-139. TRANSMITTER CHANNEL SELECTOR SWITCH.

3.1-140. The transmitter channel selector switch (5, figure 3.1-6; 5, figure 3.1-7) labeled TRANS selects the desired radio set transmitting frequency. The frequency corresponding to the transmitter channel selector switch is indicated by small tabs on the selector switch plate.

3.1-141. TUNING CRANK. Aircraft ▲1 and ▲3.

3.1-142. The tuning crank (7, figure 3.1-6) turns the frequency dial (12, figure 3.1-6) and also operates a mechanical linkage that is connected to the receiver, which permits the receiver to be tuned to any desired frequency on the frequency dial. The frequency dial indicates frequencies from 118 to 148 in one megacycle increments.

3.1-143. TUNING CRANK. Aircraft ▲5.

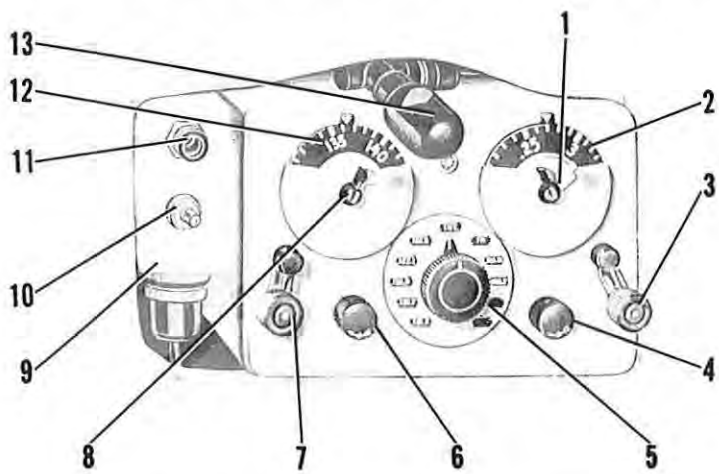
3.1-144. The tuning crank (1, figure 3.1-7) labeled PRESS TO WHISTLE, turns the frequency dial (3, figure 3.1-7) labeled REC and also operates a mechanical linkage that is connected to the receiver, which permits the receiver to be tuned to any desired frequency as indicated on the frequency dial. The crank also provides a means for setting the receiver precisely to the frequency selected on the transmitter. By pressing in on the crank while tuning, an oscillation is heard in the headset when the receiver is tuned across the transmitter frequency. The frequency dial indicates frequencies from 118 to 148 megacycles in one megacycle increments.

3.1-145. SENSITIVITY SWITCH. Aircraft ▲1 and ▲3.

3.1-146. The sensitivity switch (8, figure 3.1-6) selects the audio level of reception. The switch is set at LO to

RADIO SET CONTROL C-1117/AR

Aircraft ▲1 except aircraft EQUIPPED WITH AN/ARC 60 RADIO and Instrument Trainer.
Aircraft ▲3 except aircraft EQUIPPED WITH AN/ARC 60 RADIO.



† Aircraft ▲1 that are instrument trainers.

1. Antenna Selector Lever
2. Frequency Dial
3. Range Tuning Crank
4. Range Volume Control Knob
5. Transmitter Channel Selector Switch
6. VHF Volume Control Knob
7. VHF Tuning Crank
8. VHF Sensitivity Switch
9. Radio Control Selector Unit (▲1 †)
10. Radio Control Switch (▲1 †)
11. Control Indicator Light (▲1 †)
12. Frequency Dial
13. Radio Control Panel Light

Figure 3.1-6

pick up strong signals, and at HI to pick up faint signals.

3.1-147. RADIO CONTROL SWITCH. Aircraft ▲1 that are instrument trainers.

3.1-148. A radio control switch (10, figure 3.1-6) located on each radio control selector unit (9, figure 3.1-6) is labeled PUSH FOR CONTROL, and transfers operation of the radio set between the front and rear control unit. The indicator light (11, figure 3.1-6) above the control switch, designates whether the front or rear occupant has control of the radio set. Operation of the radio set may be obtained by the front or rear occupant by pressing the radio control switch.

Note

Control of the radio set, always reverts to the rear control unit when the battery switch is turned OFF and then ON. The front control unit will become operative again only after the front radio control switch is pressed.

3.1-149. RADIO CONTROL SWITCH. Aircraft ▲5.

3.1-150. On aircraft ▲5 ▲ the front radio control switch (4, figure 1-12) is located on the switch and circuit breaker panel. On aircraft ▲5 ■ the front radio control switch (44, figure 1-7) is located on the front instrument panel. A radio control switch (16, figure 1-8) is also located on the rear instrument panel. The switches labeled COMM, transfer operation of the radio set between the front and rear radio control unit. On aircraft ▲5 ▲ an indicator light is installed on the front and rear instrument panel and on aircraft ▲5 ■ the indicator light is located within each switch. The indicator light designates whether the front or rear occupant has control of the radio set. Operation of the radio set may be obtained by the front or rear occupant by pressing the radio control switch.

Note

Control of the radio set always reverts to the front control unit when the battery switch is turned OFF and then ON. The rear control unit will become operative again only after the radio control switch is pressed.

3.1-151. MICROPHONE SWITCH BUTTON. Aircraft ▲1.

3.1-152. Refer to paragraph 3.1-55 for description of microphone switch button.

3.1-153. MICROPHONE SWITCH BUTTON. Aircraft ▲3 and ▲5.

3.1-154. Refer to paragraph 3.1-57 for description of microphone switch button.

3.1-155. INTERPHONE SWITCH BUTTON. Aircraft ▲3 and ▲5.

3.1-156. Refer to paragraph 3.1-59 for description of interphone switch button.

▲ Aircraft 55-4649 thru 55-4749
■ Aircraft 57-2772 and on

Control	Function
VOL Control	Controls the volume of signals heard in the headset. Includes a switch for turning radio set on and off.
TRANS Switch	Permits selection of any of the transmitting channels.
Tuning Crank	Tunes receiver and turns the frequency dial to indicate receiver frequency.
PRESS TO WHISTLE Crank ▲5	Tunes receiver and turns REC dial to indicate receiver frequency. When pressed, produces whistle in headset. Whistle is loudest when receiver is tuned to the selected transmitting frequency.
HI-LO Sensitivity Switch ▲1 ▲3	Selects the audio level for reception.
PUSH FOR CONTROL Switch ▲1 or COMM Switch Switch ▲5	Transfer operation of the radio set between the front and rear radio control set. An indicator light in each compartment shows which radio control set has control of the radio set.
Microphone Switch Button	Used for transmitting communication.
Interphone Switch Button ▲3 ▲5	Used for transmitting communication between front and rear compartment.

3.1-157. TYPES OF OPERATION FACILITIES.

3.1-158. Refer to figure 3.1-30 for operating facilities.

3.1-159. OPERATING INSTRUCTIONS.

1. Turn the volume control, labeled VOL, full clockwise. Allow approximately a three minute warmup period.
2. Turn the transmitter channel selector switch, labeled TRANS to an assigned channel.
3. Radio control switch labeled PRESS FOR CONTROL on aircraft ▲1 and COMM on aircraft ▲5 - Press for control.
4. Tuning crank aircraft ▲1 - Turn to the frequency upon which a reply is expected.
5. Tuning crank aircraft ▲5 - Press, turn until the whistle heard in the headset is loudest. Adjust the volume control for a comfortable listening level. Reception of stations operating on the selected channel will be possible.

Note

If receiving and transmitting frequencies are to be the same, select the transmitting channel

RADIO SET CONTROL C-1341/ARC

Aircraft ▲ 55-4649 thru 55-4748 and 57-2855 thru 57-2875

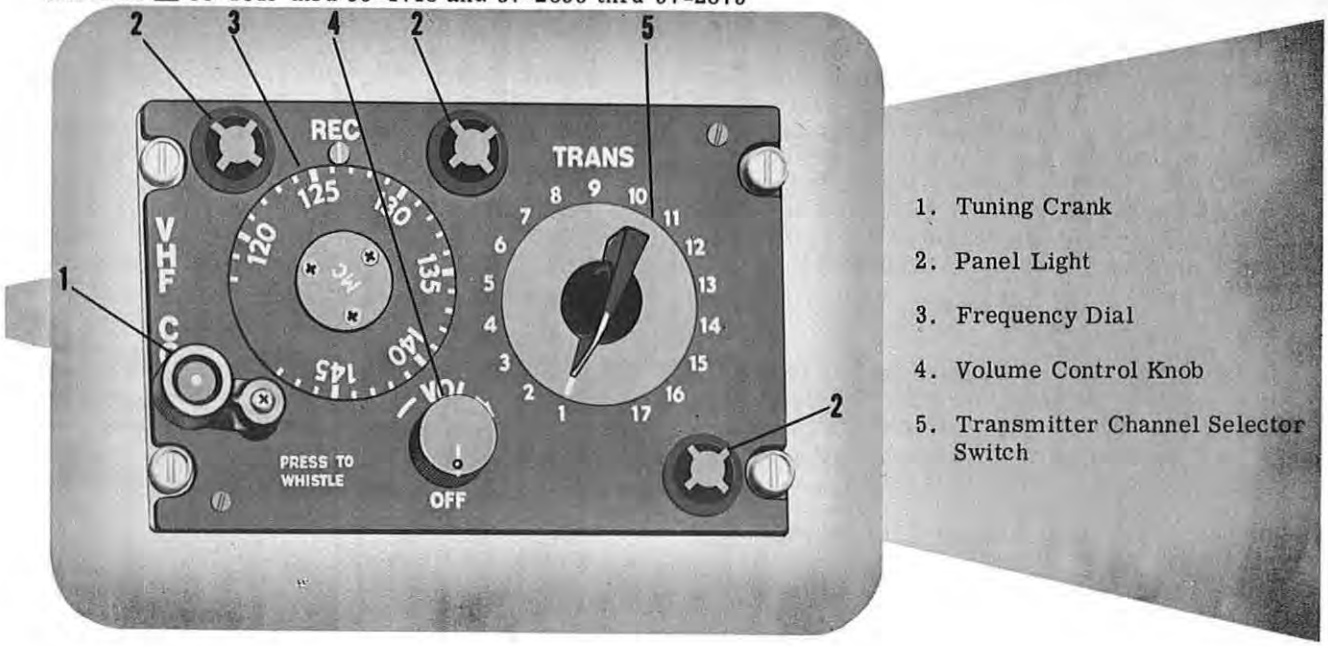


Figure 3.1-7

first, then adjust the tuning crank for maximum whistle.

6. To transmit, press the microphone button and speak into the microphone. Release the button as soon as the transmission has ended.
7. To turn off the radio set, turn the volume control full counterclockwise.

Note

Enter any equipment malfunction or failure in flight report.

3.1-160. INTERPHONE OPERATING INSTRUCTIONS.

1. Turn the volume control, labeled VOL full clockwise. Allow approximately a three minute warmup period.

Note

The interphone volume is pre-set and does not require adjustment.

2. On aircraft ▲1 and ▲3 transmitter channel selection switch - INT position.
3. Depress microphone switch button aircraft ▲1 and ▲3 or interphone switch button on aircraft ▲2 to operate.
4. To turn unit off rotate volume control knob counterclockwise.

3.1-161. DUAL OPERATING CONTROL. Aircraft ▲1 that are instrument trainer and aircraft ▲3 .

3.1-162. Refer to paragraphs 3.1-147 and 3.1-149, "Radio Control Switch".

3.1-163. EMERGENCY OPERATION.

3.1-164. If generator failure occurs during flight, radio operation will be limited to the life of the battery, therefore radio operation should be limited to conserve the battery. For frequencies reserves for emergency operation, refer to the frequency chart located near the radio set control.

Note

- No transmission will be made on emergency (distress) frequency channels except for emergency purpose. For test, demonstration or drill purpose, the radio equipment will be in a shielded room to prevent transmission of messages that could be construed as actual emergency messages.
- On aircraft ▲1 ▲2 ▲3 ▲4 if failure of the radio set ARC Type 12 occurs operation of the FM radio set can still be maintained.

3.1-165. PREFLIGHT INSPECTION.

3.1-166. The following paragraphs describe the operational procedures performed on radio set ARC Type 12 equipment at the time indicated in Section II Normal Procedures.

3.1-167. POWER OFF INSPECTION.

3.1-168. EXTERIOR INSPECTION.

3.1-169. The following check is an extension to the

Exterior Inspection in Section II.

1. Antenna - Check for secure antenna mounting and condition.

3.1-170. INTERIOR INSPECTION.

1. Antenna - Check for secure antenna lead-in connections to antenna.
2. Transmitters - Check for secure wire and plug connections. Tighten plug connector rings hand tight.
3. Radio receiver - Check for secure plug and wire connections. Check and hand tighten plug connector rings and mechanical linkage nut.
4. Oscillator relay on aircraft ▲ - Check for secure plug connections. Hand tighten plug connector rings.
5. Junction box - Check that all wire connections and terminal nuts are secure.
6. Radio control unit - Check to see that all plugs are secure. Hand tighten plug connector rings and mechanical linkage nut. Set transmitter channel selector switch to desired operating channel.
7. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-171. POWER ON.

Note

When an auxiliary power unit is used to start the engine the operational checks as listed below, will be performed while the auxiliary power unit is connected to the aircraft prior to starting the engine. If an auxiliary power unit is not available, the operational checks will be performed during engine warm-up.

1. Volume control knob - Turn maximum clockwise. Dynamotor should be running and noise should be near in headset.
2. Transmitter channel selector - Set to desired channel. On aircraft ▲ and ▲ turn tuning crank and tune receiver. On aircraft ▲ press the PRESS TO WHISTLE, tuning crank and tune the receiver to the transmitter frequency. A whistle in the headset should be audible.
3. Establish two-way communication with tower - Press MIC button and speak into microphone. Release MIC button to receive. Two-way communication should be possible.

3.1-172. POSTFLIGHT CHECK.

1. Volume control knob - Turn maximum counterclockwise to turn radio set off.
2. All discrepancies noted on Form DA-781-1 and the crew chief should be notified.

3.1-173. MARKER BEACON RECEIVING SET AN/ARN-12. Aircraft ▲ 55-4649 thru 55-4748 and 57-2772 and on.

3.1-174. PURPOSE AND USE.

3.1-175. Marker beacon receiving set AN/ARN-12 is an airborne radio navigation aid. Its function is to receive signals transmitted by a ground beacon transmitter and deliver an aural and visual indication of the received signal to the occupants of the aircraft.

3.1-176. TECHNICAL CHARACTERISTICS.

Frequency range .	Reception frequency fixed at 75 megacycles.
Type of reception .	Receiver signals A-M modulated at 400, 1300 or 3000 cps signals.
Sensitivity . . .	Sensitivity of the receiver is 500 microvolts in the "HI" position on the sensitivity and 150 microvolts in the LOW position.
Selectivity . . .	When the carries is 30 percent modulated by a 400-cycle signal, the bandwidth of the receiving set is not less than 125 kc at points 6 db down from resonance; at points 60 db down from resonance the bandwidth is not greater than 600 kc.
Audio Output . .	Audio output power, developed across a 150 ohm load is 180 milliwatts.
Visual output . .	Two remotely located visual indicators are controlled by a relay within the receiver. The relay is actuated by a current proportional to the audio modulation signal amplitude.
Antenna	A horizontally-polarized antenna for receiving the 75 megacycle marker beacon signal.
Power required . .	1.50 amperes at 26.5 volts dc.

3.1-177. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common Name
Marker Beacon Receiver R-122A/ARN-12 . .	Marker Beacon
Mounting MT-589A/ARN-12	Mounting
Antenna AS-215/ARN .	Antenna

3.1-178. COMPONENTS OF MARKER BEACON RECEIVER SET AN/ARN-12.

3.1-179. Refer to figure 3.1-9 for location of marker beacon receiver set AN/ARN-12 components within the aircraft.

Quantity	Items
1	Marker Beacon Receiver
1	Mounting MT-589A/ARN-12
1	Antenna AS-215/ARN
2	Signal Light
1	Power Switch and Volume Control
1	Volume Control
1	Crystal Unit CR-24/U

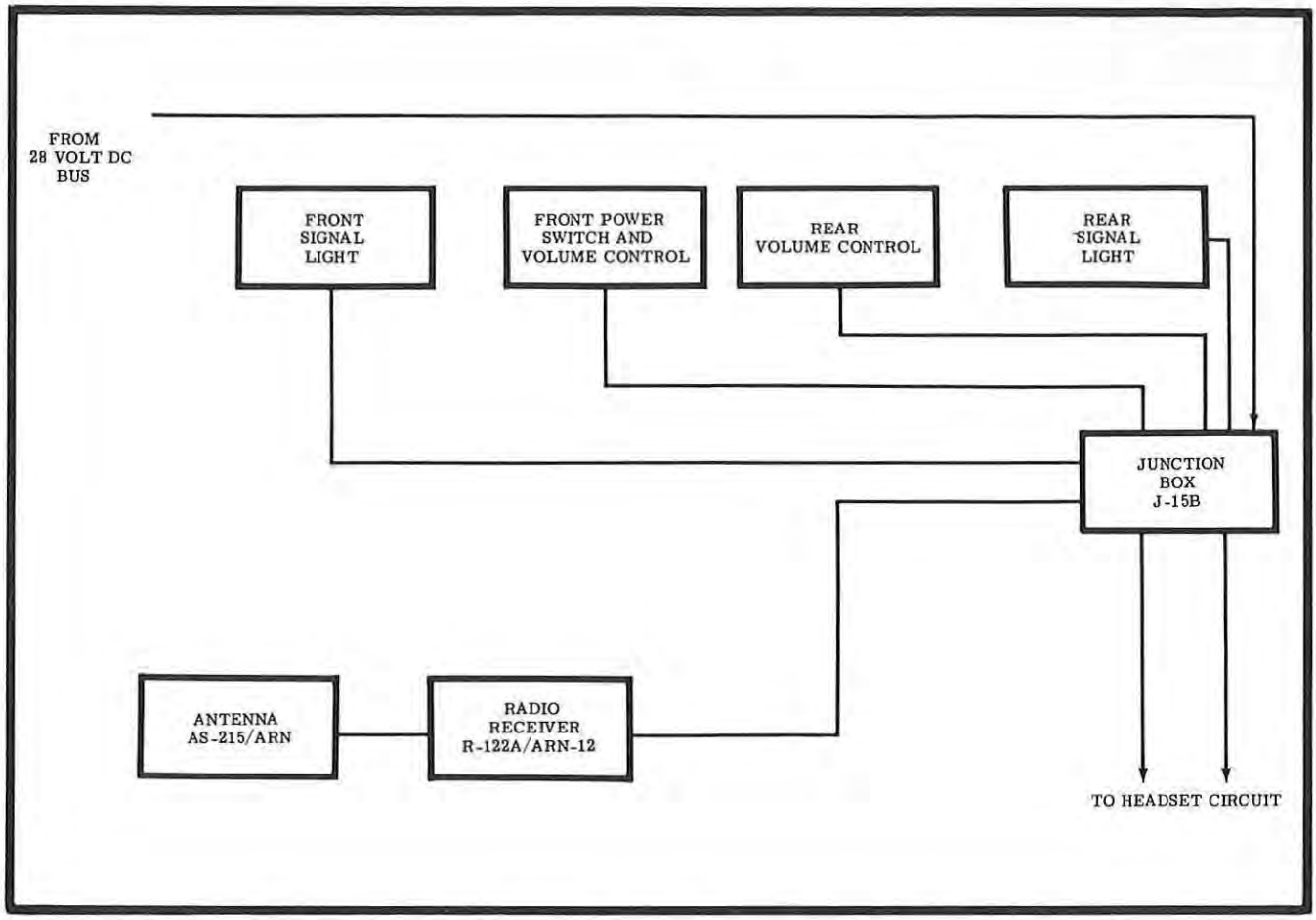


Figure 3.1-8. Marker Beacon Receiver Set AN/ARN-12 Block Diagram

3.1-180. DESCRIPTION OF MARKER BEACON RECEIVER SET AN/ARN-12.

3.1-181. The marker beacon receiver is automatically set in operation whenever the power switch and volume control, labeled MARKER BEACON, is turned on. The receiver is designed to receive a fixed frequency of 75 megacycles modulated by 400, 1300, or 3000 cycles. An amber signal light located on the instrument panel of either compartment gives a visual indication when the aircraft is passing over a 75 megacycle marker beacon station. An "expansion" circuit in the receiver narrows the cone of reception over a marker beacon station and gives a sharp definition to the tone edges; it squelches the receiver output when the aircraft is not over a marker signal. Marker beacon receiver audio level is controlled from either compartment by a volume control located on the instrument panel.

3.1-182. DESCRIPTION OF MAJOR COMPONENTS.

3.1-183. MARKER BEACON RECEIVER R-122A/ARN-12.

3.1-184. The marker beacon receiver R-122A/ARN-12 (2, figure 3.1-9) is a nine tube receiver utilizing a superheterodyne type circuit designed to receive a fixed frequency of 75 megacycle modulated by 400, 1300 or 3000 cycles. The receiver also consists of an indicator control circuit, and audio output components mounted on one metal chassis behind the rear seat.

3.1-185. ANTENNA AS-215/ARN.

3.1-186. The antenna AS-215/ARN (10, figure 3.1-9) is a horizontally-polarized antenna for receiving the 75 megacycle marker beacon signal. Impedance is 52 ohms into unbalance line.

3.1-187. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-188. MOUNTING MT-589/ARN-12.

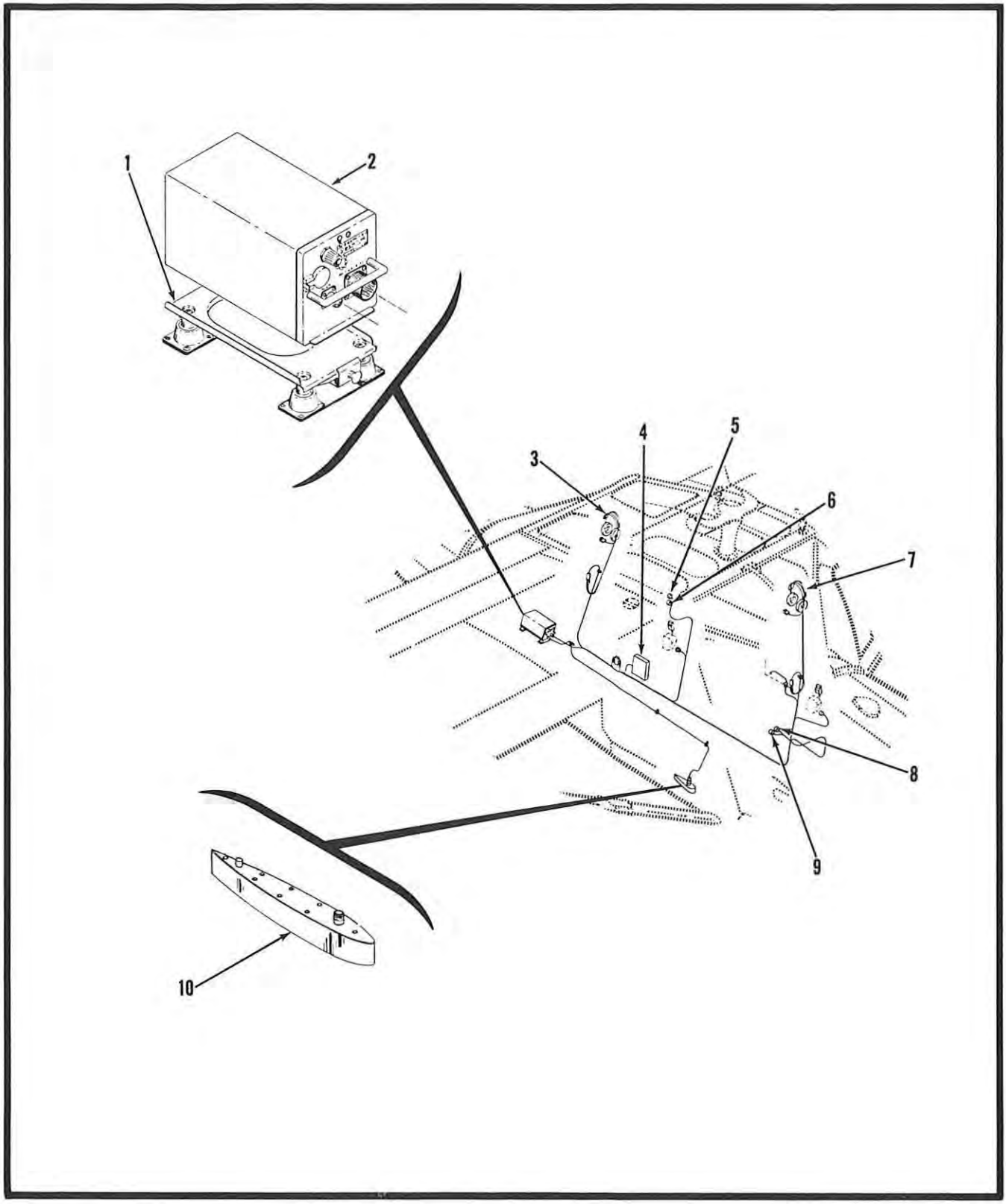
3.1-189. Mounting MT-589/ARN-12 (1, figure 3.1-9) is a shockproof and vibration proof mounting used for mounting of the receiver. The receiver is secured to the mount by a clamp located on the forward end of the mount.

3.1-190. DIFFERENCE IN MODELS.

3.1-191. Refer to figure 3.1-30 for differences between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

3.1-192. OPERATING CONTROLS AND USE.

3.1-193. MARKER BEACON VOLUME CONTROL.



1. Mounting MT-589A/ARN-12
2. Radio Receiver R-122A/ARN-12
3. Rear Headset-Microphone H-46A/UR
4. Junction Box ARC Type J-15B
5. Rear Volume Control
6. Rear Indicator Light
7. Front Headset-Microphone H-46A/UR
8. Front Power Switch and Volume Control
9. Front Indicator Light
10. Antenna AS-215/ARN

Figure 3.1-9. Marker Beacon Receiver Set AN/ARN-12 Major, Minor and Installation Items Location Diagram

3.1-194. A marker beacon volume control knob (41, figure 1-7; 25, figure 1-8) is provided on each instrument panel adjacent to the marker beacon indicator light. The front volume control incorporates an ON-OFF power switch. The volume control knob on each instrument panel gives the crew member in that compartment a degree of control of the volume of the aural signal reception heard in his headset. Clockwise rotation of the control knob increases the volume of the signals received, and counterclockwise rotation decreases the volume. Full counterclockwise rotation of the front volume control knob turns off the marker beacon equipment.

3.1-195. MARKER BEACON INDICATOR LIGHTS.

3.1-196. A marker beacon indicator light (42, figure 1-7; 24, figure 1-8) is provided on both the front and rear instrument panels. The lights provide visual indication of the presence of a marker beacon by coming on as a ground beacon transmitter is approached. Both lights are the press-to-test type, and their condition may be checked by pressing the lens portion of the lights.

Control	Function
Volume control . .	Controls the volume of signal heard in the headset. The front volume control incorporates a switch for tuning the receiver set on and off.
Indicator light . .	Gives a visual indication when a ground beacon transmitter is approached.

3.1-197. TYPE OF OPERATION FACILITIES.

3.1-198. Refer to figure 3.1-30 for operating facilities.

3.1-199. OPERATING INSTRUCTIONS.

1. The marker beacon receiver is set in operation when the battery switch is turned ON and the volume control knob on the front instrument panel is turned clockwise.

3.1-200. EMERGENCY OPERATION.

3.1-201. Since the equipment has but one mode of operation, there is no alternative type of operation which can be used. The equipment, however supplies its information in several ways, each of which may be used independently. Should the audio signal alone fail, the visual indicator may be utilized to receive the marker signals. Should the visual indicator alone fail, the audio signal may be utilized to receive the marker-beacon signals.

3.1-202. PREFLIGHT INSPECTION.

3.1-203. The following paragraphs describe the operational procedures performed on marker beacon receiver set AN/ARN-12.

3.1-204. POWER OFF INSPECTION.

3.1-205. EXTERIOR INSPECTION.

3.1-206. The following check is an extension to the Exterior Inspection in Section II.

1. Antenna - Check for secure antenna mounting and condition.

3.1-207. INTERIOR CHECK.

1. Antenna - Check for secure antenna lead-in connection to antenna.
2. Marker beacon receiver - Check for secure plug and wire connections. Check and hand tighten plug connector rings.
3. Junction box - Check that all wire connection and terminal nuts are secure.
4. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-208. POWER ON.

1. Marker beacon indicator light - Press-to-test light should come on.

3.1-209. POST FLIGHT CHECK.

1. Front volume control switch - Turn maximum counterclockwise to turn receiver off.
2. All discrepancies noted on Form DA-781-1 and the crew chief should be notified.

3.1-210. RADIO RECEIVING SET AN/ARN-30A. Aircraft ▲ 55-4649 thru 55-4748 and 57-2772 and on.

3.1-211. PURPOSE AND USE.

3.1-212. Radio receiving set AN/ARN-30A, is an airborne radio receiving set with a frequency range of 108 to 135 megacycles designed to receive the following VHF radio airway facilities: VHF omni directional range (VOR); visual-aural range (VAR); 90/150 cps runway localizer (LOC); voice reception on the complete band of frequencies covered within the range of 108 to 135 megacycles, simultaneously with the available navigation facilities, if desired.

3.1-213. TECHNICAL CHARACTERISTICS.

Frequency range . . .	108 to 135 megacycles.
Type of modulation . .	Amplitude.
Distance range . . .	Approximately 120 miles at 10,000 feet.
Sensitivity . . .	Two microvolts or better throughout the frequency range for 10 milliwatts with 30% modulation at 400 cps, into a 300-ohm load.
Selectivity . . .	Total bandwidth 100 kilocycles for 6 db, 350 kilocycles for 60 db.
Antenna . . .	Ramshorm, V-type.
Power required . . .	2.9 amperes.

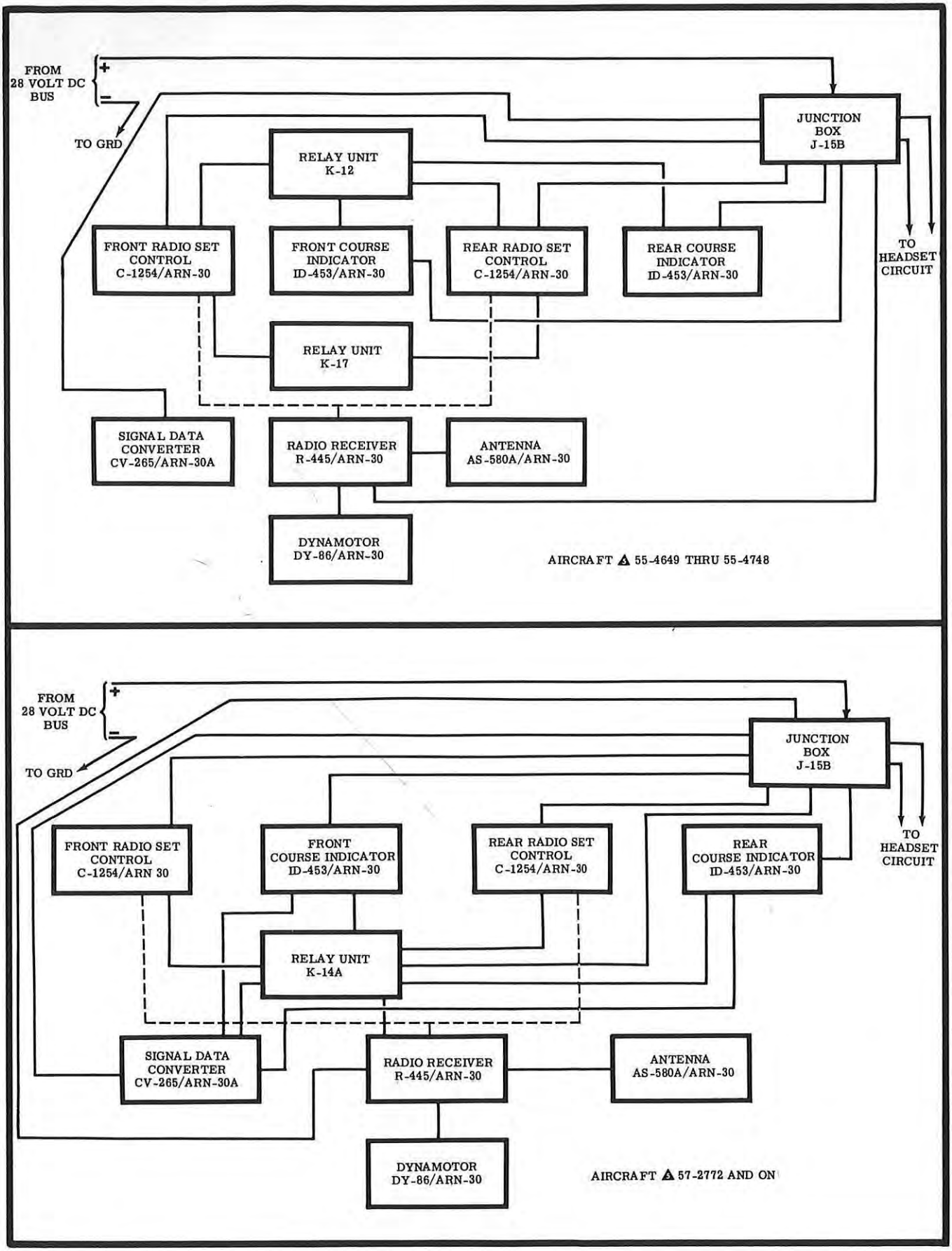


Figure 3.1-10. Radio Receiver Set AN/ARN-30A Block Diagram

3.1-214. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common Name
Radio Receiving Set AN/ARN-30A . . .	Radio receiving set
Radio Receiver R-445/ARN-30	Receiver
Dynamotor DY86/ARN-30 .	Dynamotor
Signal Data Converter CV-265/ARN-30A . .	Converter
Radio Set Control C-1254/ARN-30 . . .	Control unit
Course Indicator ID-453/ARN-30 . . .	Course Indicator
Antenna AS-580A/ARN-30 .	Antenna
Mounting MT-1175/ARN-30A	Mounting
Mounting MT-1174/ARN-30A	Mounting
Relay Unit ARC Type K-12. *	Relay Unit
Relay Unit ARC Type K-17. *	Relay Unit
Relay Unit ARC Type K-14A *	Relay Unit

* Aircraft ▲ 55-4649 thru 55-4748.
* Aircraft ▲ 57-2772 and on.

3.1-215. COMPONENTS OF RADIO RECEIVING SET AN/ARN-30A.

3.1-216. Refer to figure 3.1-11 for location of the radio receiving set AN/ARN-30A components within the aircraft.

Quantity	Items
1	Radio Receiver R-445/ARN-30; includes Dynamotor DY-86/ARN-30
1	Signal Data Converter CV-265/ARN-30A
2	Radio Set Control C-1254/ARN-30
2	Course Indicator ID-453/ARN-30
1	Antenna AS-580A/ARN-30
1	Mounting MT-1175/ARN-30A
1	Mounting MT-1174/ARN-30A
1 *	Relay Unit ARC Type K-12
1 *	Relay Unit ARC Type K-17
1 *	Relay Unit ARC Type K-14A

* Aircraft ▲ 55-4649 thru 55-4748.
* Aircraft ▲ 57-2772 and on.

3.1-217. DESCRIPTION OF RADIO RECEIVING SET AN/ARN-30A.

3.1-218. With radio receiving set AN/ARN-30A receiver tuned to an incoming signal by the tuning crank on the control unit, the signal picked up by the antenna is fed to the input circuit of the receiver. The type of signal reception desired is selected by the OMNI-VAR LOC selector switch on the control unit. With the switch in the OMNI position, the navigation portion of a VOR signal is fed to the omni circuit of the converter. Here, the intelligence is converted into visual track information for presentation on the course indicator. With the switch in the VAR LOC position a relay feeds the navigation portion of the VAR or localizer signal to the VAR and localizer circuits of the converter, which converts it for visual presentation on the course indicator. If the OMNI-VAR LOC selector switch is set incorrectly for the type of signal being received, the vertical-pointer flag-alarm on the course indicator will show. In either position of the selector switch, the audio portion of the received signal is routed to the control unit where its level may be adjusted, by the volume control knob. High voltage for the radio receiving set is provided by the dynamotor which is part of the receiver and receives its power from the aircraft 28 volt dc bus.

3.1-219. DESCRIPTION OF MAJOR COMPONENTS.

3.1-220. RADIO RECEIVER R-445/ARN-30.

3.1-221. Radio receiver R-445/ARN-30 (10, figure 3.1-11) is a nine-tube superheterodyne receiver capable of being tuned to any amplitude-modulated signal with a frequency range between 108 and 135 megacycles. The receiver provides aural output for headset operation, as well as a navigation signal which is used to feed the converter. The receiver is designed to be tuned remotely by the control unit. Mounted at the rear of the receiver is the dynamotor (13, figure 3.1-11). Circuits between the dynamotor and the receiver are completed by mating connectors on the base of the dynamotor and the receiver chassis. The receiver is located on the floor aft of the rear seat.

3.1-222. SIGNAL DATA CONVERTER CV-265/ARN-30A.

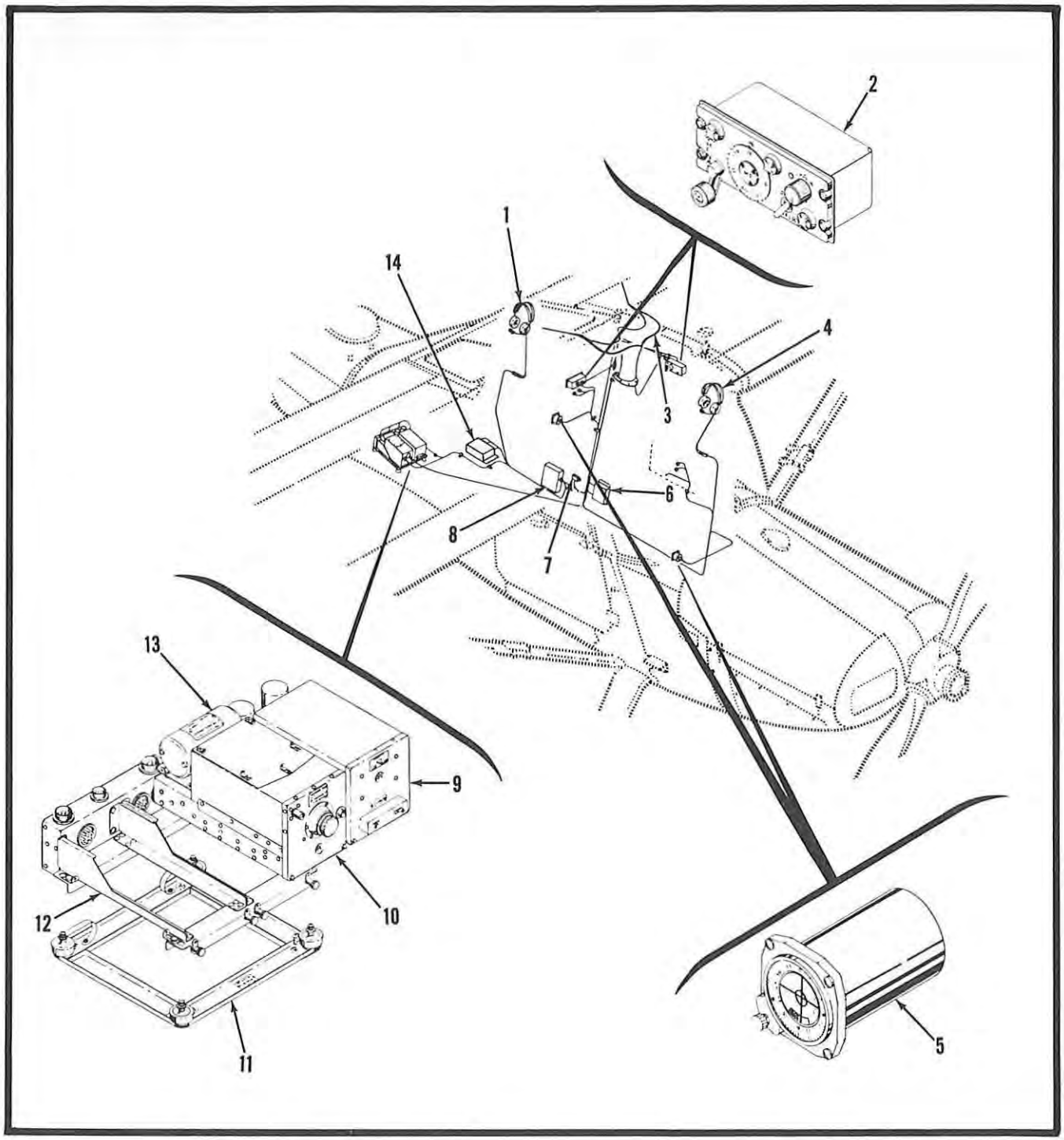
3.1-223. The signal data converter CV-265/ARN-30A (9, figure 3.1-11) is a five-tube receiver designed to accept the VOR, VAR, and localizer information delivered by the receiver and convert it to a form which is presented visually by the course indicator. The converter contains no operating or tuning controls. Input and output connectors are located on the rear of the chassis and mate with connectors on mounting MT-1175/ARN-30A. The converter is located on the floor aft of the rear seat.

3.1-224. ANTENNA AS-580A/ARN-30.

3.1-225. Antenna AS-580A/ARN-30 (3, figure 3.1-11), functions as the receiving antenna for radio receiving set AN/ARN-30A. The antenna is a "ramshorn" V-type incorporating two broad-band antennas. The forward dipole antenna is used for glide-slope signal reception, which is not used on this aircraft. The angular rear dipole antenna is used for the reception of VOR, VAR and localizer signals in conjunction with the other units of the set. The dipoles are set in a rubber block, which in turn is fastened to an aluminum pedestal support. The antenna is located on top of the cabin.

3.1-226. RADIO SET CONTROL C-1254/ARN-30.

3.1-227. Radio set control C-1254/ARN-30 (2, figure 3.1-11) is an edge lighted plastic console control unit, designed for remote control of the receiver. Edge-lighting is provided by three midget flange-base lamps installed in red-filter light assemblies (1, figure 3.1-12) located on the front panel and controlled by the aircraft rheostat switch. Power control is accomplished by means of an off-on volume control knob (4, figure 3.1-12), which turns the set on and off and controls the audio level of the received signal. Remote control tuning of the receiver is provided by the tuning crank



1. Rear headset-microphone H-46A/UR
2. Radio Set Controls C-1254/ARN-30
3. Antenna AS-580A/ARN-30
4. Front headset-microphone H-46A/UR
5. Course Indicators ID-453/ARN-30
6. Relay Unit ARC Type K-12‡
7. Relay Unit ARC Type K-17‡
8. Junction Box ARC Type J-15B
9. Signal Data Converter CV-265/ARN-30A
10. Radio Receiver R-445/ARN-30
11. Mounting MT-1174/ARN-30A
12. Mounting MT-1175/ARN-30A
13. Dynamotor DY-86/ARN-30
14. Relay Unit ARC Type K-14A†

‡ Aircraft ▲ 55-4649 thru 55-4748
† Aircraft ▲ 57-2772 and on

Figure 3.1-11. Radio Receiver Set AN/ARN-30 Major, Minor and Installation Items Location Diagram

(2, figure 3.1-12), which mechanically tunes the receiver and turns the frequency dial (3, figure 3.1-12). As the frequency dial, calibrated in megacycles, is turned the receiver is tuned to the frequency indicated by the dial. The OMNI-VAR LOC selector switch (5, figure 3.1-12) is used for selecting the desired type of reception, VOR, VAR and localizer signals. Electrical and mechanical connections are made at the rear of the control unit.

3.1-228. COURSE INDICATOR ID-453/ARN-30.

3.1-229. Course indicator ID-453/ARN-30 (5, figure 3.1-11) is a combined cross-pointer meter and course selector TO-FROM instrument. The cross-pointer meter section of the course indicator is a special type of micrometer containing two pointer mechanisms, and two flag-alarm mechanism for indicating the operating or non-operating conditions of the pointer mechanisms. The vertical pointer visually indicates the VOR, VAR, or localizer information received from the converter. The vertical pointer is pivoted at the top and moves left or right to supply a visual indication of the lateral position of the aircraft with respect to the on-course signal of the omni or localizer beam. The horizontal pointer is not used in this aircraft. Fluorescent blue and yellow sectors are included for flying the visual courses of VAR. A red flag-alarm warning is associated with each pointer to indicate the relative operating strength of a received signal. The flag-alarm associated with the vertical pointer, in confirmation with the TO-FROM meter, serves to indicate the presence or absence of proper output signals from the converter. The course selector dial is graduated in a compass scale of 360 degrees. An arrowhead is used for the true-course indicator and a ball as the reciprocal indicator on the indicator scale. The TO-FROM meter is a zero center d-c instrument which provides the sense information required to resolve any ambiguity in the reading of the course indicator scale. The TO-FROM meter will show to when the indicated bearing on the course selector is the magnetic bearing to the station. The meter will show FROM when the bearing on the course selector is the magnetic bearing from the station.

3.1-230. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-231. MOUNTING MT-1175/ARN-30.

3.1-232. Mounting MT-1175/ARN-30A (12, figure 3.1-11) is a mounting rack for the receiver and converter and serves as a terminal junction box for all units of the receiver set. The receiver and converter are mounted in separate stalls secured by means of nut-and-link arrangements which engage the tapered studs located on the front of the units. All connectors are contained in an enclosure located at the rear of the mount.

3.1-233. MOUNTING MT-1174/ARN-30.

3.1-234. Mounting MT-1174/ARN-30 (11, figure 3.1-11) is provided for mounting, mounting MT-1175/ARN-30, which in turn mounts the receiver and converter. Vibration mounts are located in each corner of the mount. Mounting MT-1175/ARN-30A is secured by means of four snapslides engaging the grooved studs. Two ground straps, fastened from the two rear vibration mounts to the channel frame, provide ground connections across the vibration mounts.

3.1-235. RELAY UNIT ARC TYPE K-12. Aircraft ▲5 55-4649 thru 55-4748.

3.1-236. Relay unit ARC Type K-12 (6, figure 3.1-11) is described in paragraph 3.1-114.

3.1-237. RELAY UNIT ARC TYPE K-17. Aircraft ▲5 57-2772 and on.

3.1-238. Relay unit ARC Type K-17 (7, figure 3.1-11), located on the lower left side of the fuselage transfers the operation of the radio receiver set between the

RADIO SET CONTROL C-1254/ARN-30

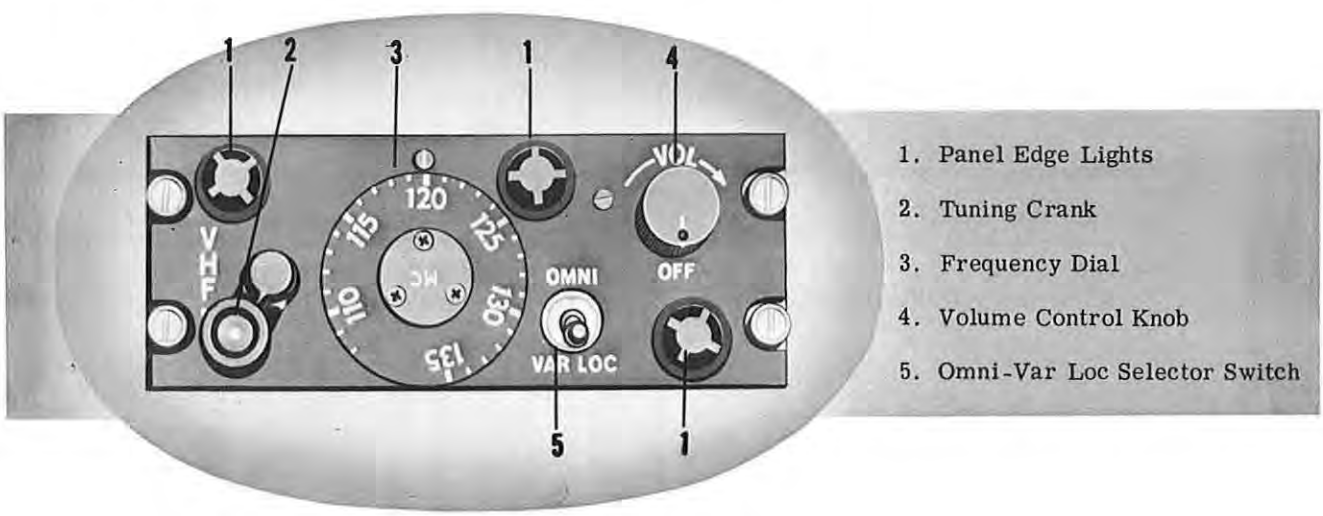


Figure 3.1-12

front and rear compartments. One set of contacts transfers the OMNI-VAR LOC selector switching and the other contacts transfers the volume control.

3.1-239. RELAY UNIT ARC TYPE K-14A. Aircraft ▲ 57-2772 and on.

3.1-240. Relay unit ARC Type K-14A (14, figure 3.1-11) is mounted on the floor just aft of the rear seat. The relay transfers the operation of the navigation system between the front and rear control units.

3.1-241. HEADSET-MICROPHONE H-46A/UR.

3.1-242. Headset-microphone H-46A/UR (1, 4, figure 3.1-11) is described in paragraph 3.1-42.

3.1-243. JUNCTION BOX ARC TYPE J-15B.

3.1-244. Junction box ARC Type J-15B (8, figure 3.1-11) is described in paragraph 3.1-36.

3.1-245. DIFFERENCES IN MODELS.

3.1-246. Refer to figure 3.1-30 for difference between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

3.1-247. OPERATING CONTROLS AND USE.

3.1-248. RADIO SET CONTROL C-1254/ARN-30.

3.1-249. VOLUME CONTROL KNOB.

3.1-250. The volume control knob (4, figure 3.1-12) labeled VOL and OFF, incorporates a switch that controls power to the radio receiver set. Clockwise rotation of the knob turns the system on and increases the audio level.

3.1-251. OMNI-VAR LOC SELECTOR.

3.1-252. Omni, visual-aural ranges or localizer operation may be selected by the OMNI-VAR LOC selector switch (5, figure 3.1-12). When the switch is positioned to OMNI, the heading to or from the station is presented on the vertical needle of the course indicator. When placed in the VAR LOC position, visual-aural range or runway localizer signals will actuate the vertical needle of the course indicator.

3.1-253. TUNING CRANK.

3.1-254. The tuning crank (2, figure 3.1-12), turns the frequency dial (3, figure 3.1-12) and also operates a mechanical linkage that is connected to the receiver, which permits the receiver to be tuned to any desired frequency as indicated on the frequency dial.

3.1-255. COURSE INDICATOR ID-453/ARN-30. See figure 3.1-13.

3.1-256. COURSE SELECTOR KNOB.

3.1-257. The course selector knob located on the lower right hand corner of the course indicator permits selection or determination of the magnetic bearing of the aircraft from the VOR station being received.

Component	Control	Function
Radio Set Control C-1254/ ARN-30	Volume Control knob	Combination on-off switch and volume control. Controls application of power to the set, rotation clockwise (direction of arrow) turning power on. Further clockwise rotation increases the audio level of the radio receiver.
	OMNI-VAR LOC Selector Switch	Function selector switch. In OMNI position, the equipment provides track information, as chosen by the operator, when tuned to the selected VOR ground station. In VAR LOC position, the equipment is set up for operation with either VAR or localizer signals.
	Tuning Crank .	Turns the frequency dial and through the interconnection of mechanical linkage, remotely tunes the receiver.
Course Indicator ID-453/ ARN-30	Course Selector Knob .	Permits selection or determination of the magnetic bearing of the aircraft from the VOR station being received.
	NAV Switch .	Transfers operation of the receiver set between the front and rear radio control set. An indicator light in each compartment shows which radio control set has control of the receiver set.

3.1-258. RADIO CONTROL SWITCH.

3.1-259. On aircraft ▲ ▲ the front radio control switch (4, figure 1-12) is located on the switch and circuit breaker panel. On aircraft ▲ ■ the front radio control switch (43, figure 1-7) is located on the front instrument panel. A radio control switch (17, figure 1-8) is also located on the rear instrument panel. The switch labeled NAV, transfers operation of the radio set between the front and rear radio control unit. On aircraft ▲ ▲ an indicator light is installed on the front and rear instrument panels and on aircraft ▲ ■ the indicator light is located

▲ Aircraft 55-4649 thru 55-4749
■ Aircraft 57-2772 and on

within each switch. The indicator lights designates whether the front or rear occupant has control of the radio set. Operation of the radio set may be obtained by the front or rear occupant by pressing the radio control switch.

Note

Control of the radio set always reverts to the front control unit when the battery switch is turned OFF and then ON. The rear control unit will become operative again only after the radio control switch is pressed.

COURSE INDICATOR ID-453 ARN-30

Figure 3.1-13

3.1-260. TYPE OF OPERATION FACILITIES.

3.1-261. Refer to figure 3.1-30 for operating facilities.

3.1-262. OPERATING INSTRUCTION.

3.1-263. The following paragraphs describe the operating instructions for the various modes of operation. The radio set can be used for voice reception on all frequencies covered by the receiver.

3.1-264. VHF OMNI DIRECTIONAL RANGE (VOR) STEERING INSTRUCTIONS.

3.1-265. When using the course selector for on-course, set the indicator so that the TO-FROM meter indicates TO, going to a station and in FROM, when going from a station. The following steering rule to get back on course is:

1. When crosspointer moves LEFT, steer left.
2. When crosspointer moves RIGHT, steer right.

This is referred to as, "steering into the needle" and is the same rule which should be followed on normal runway approaches on the localizer. It does not necessarily apply to flying the simultaneous visual-aural ranges.

3.1-266. VHF OMNI DIRECTIONAL RANGE (VOR) OPERATING INSTRUCTION.

1. Turn the volume control, labeled VOL, full clockwise. Allow approximately a three minute warmup period.
2. NAV radio control switch - Press for control.
3. OMNI-VAR LOC selector switch - OMNI position.
4. Tuning crank - Tune desired omni station. Make certain that the OFF "flap alarm" on the vertical crosspointer meter is out of sight.
5. Volume control knob - Readjust to comfortable listening level.

Note

Visual indication are independent of audio circuits and are not affected by the position of the volume control. Volume should be maintained at a high enough level to prevent navigating by a wrong station.

6. Course indicator - To fly a desired course, set the heading by rotating the course indicator knob. Keep in mind whether course is to or from the station. To obtain a bearing from an omni station, rotate the knob until vertical needle centers and the TO-FROM meter indicates FROM.

Note

When tuning a station in, the flag-alarm at the base of the vertical needle will disappear. If the flag does not disappear the signal is not strong enough for navigation purposes.

7. Volume control knob - Full counterclockwise to turn radio receiver set off.

3.1-267. VISUAL AURAL RANGE (VAR)OPERATING INSTRUCTIONS.

1. Turn the volume control, labeled VOL, full clockwise. Allow approximately a three minute warmup period.
2. NAV radio control switch - Press for control.
3. OMNI - VAR LOC selector switch - VAR LOC position.
4. Tuning crank - Tune in desired station. Make certain that the OFF "flag-alarm" on the vertical crosspointer is out of sight.
5. Volume control knob - Readjust to comfortable listening level.
6. Course indicator - The "flag-alarm" on the vertical crosspointer meter will disappear when the station is tuned in properly and the signal is of sufficient strength for navigation. The vertical crosspointer meter will give a right or left indication.
7. Determine position with respect to on-course by deflection of crosspointer needle on the course indicator and by the character of the audio signal; determine quadrant by noting whether needle is in blue or yellow area and whether off-course component of audio signal is A or N.
8. Volume control knob - FULL counterclockwise to

turn radio receiver off.

3.1-268. LOCALIZER (LOC) STEERING INSTRUCTIONS.

3.1-269. On making a normal runway approach, a reading of the crosspointer meter to the left or right of center indicates that the pilot must steer left or right respectively to bring the meter back to on-course-center, that is steer into the needle.

Note

During an approach from the back side of a localizer, the needle deflections will be opposite from normal indications.

3.1-270. LOCALIZER (LOC) OPERATING INSTRUCTIONS.

1. Turn the volume control, labeled VOL, full clockwise. Allow approximately a three minute warmup period.
2. NAV radio control switch - Press for control.
3. OMNI - VAR LOC selector switch - VAR LOC position.
4. Tuning crank - Tune in desired station. Make certain that the OFF "flag-alarm" on the vertical crosspointer meter is out of sight.
5. Fly the approach by steering in the direction the needle deflects to correct the approach patch.

Note

During approaches from the back side of the localizer, needle deflections will be opposite from normal indications.

6. Volume control knob - Full counterclockwise to turn radio receiver off.

Note

Enter any equipment malfunction or failure in flight report.

3.1-271. DUAL OPERATING CONTROL.

3.1-272. Refer to Paragraph 3.1-258, "Radio control switch".

3.1-273. EMERGENCY OPERATION.

3.1-274. If generator failure occurs during flight, radio operation will be limited to the life of the battery, therefore radio operation should be limited to conserve the battery.

Note

Except for the possible substitution of the use of VOR facilities for VAR or localizer signals (or vice versa) to complete a desired navigation maneuver, there are no emergency methods of operation in case of circuit failure during flight. However, if the voice portion of the receiver is operable, it may be possible to use GCA facilities.

3.1-275. PREFLIGHT INSPECTION.

3.1-276. The following paragraphs describe the operational procedures performed on radio receiver set AN/ARN-30A equipment at the time indicated in Section II Normal Procedures.

3.1-277. POWER OFF INSPECTION.

3.1-278. EXTERIOR INSPECTION.

3.1-279. The following check is an extension to the Exterior Inspection in Section II.
1. Antenna - Check for secure antenna mounting.

3.1-280. INTERIOR INSPECTION.

1. Antenna - Check for secure antenna leadin connection to antenna.
2. Radio receiver - Check for secure mounting and plug connection. Tighten plug connector rings and mechanical linkage nut.
3. Converter check for secure mounting.
4. Mounting - Check for secure wire and plug connections. Tighten plug connector rings hand tight.
5. Junction box - Check that all wire connections and terminal nuts are secure.
6. Radio set controls - Check for secure mounting.
7. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-281. FLIGHT CHECK

3.1-282. A flight check is more satisfactory than a pre-flight power on check and should be performed in accordance with paragraph 3.1-262.

3.1-283. POST FLIGHT CHECK.

1. Volume control knob - Full counterclockwise to turn radio receiver set off.
2. All discrepancies noted on Form DA-781-1 and the crew chief should be notified.

3.1-284. RADIO SET AN/ARC-44. All aircraft ▲ except 51-12711 thru 51-12714, 51-12724 thru 51-12759 and 51-12763 thru 51-12791 and all aircraft ▲ ▲ ▲.

3.1-285. PURPOSE AND USE.

3.1-286. Radio set AN/ARC-44 is a subminiature airborne frequency-modulated radio receiver-transmitter set operating in a frequency range of 24.0 to 51.9 megacycles. Its primary function is to provide two-way communication between aircraft or between aircraft and ground stations. An auxiliary function enables the operator to use the equipment to home on any signal within its frequency range. The effective receiving and transmitting range of the radio set is limited by line-of-sight consideration to approximately 50 miles.

3.1-287. TECHNICAL CHARACTERISTICS.

Frequency range	.	280 preset channels - 24.0 to 51.9 megacycles. Channel separation; 100 kilocycles.
Use		Air-ground liaison communi-

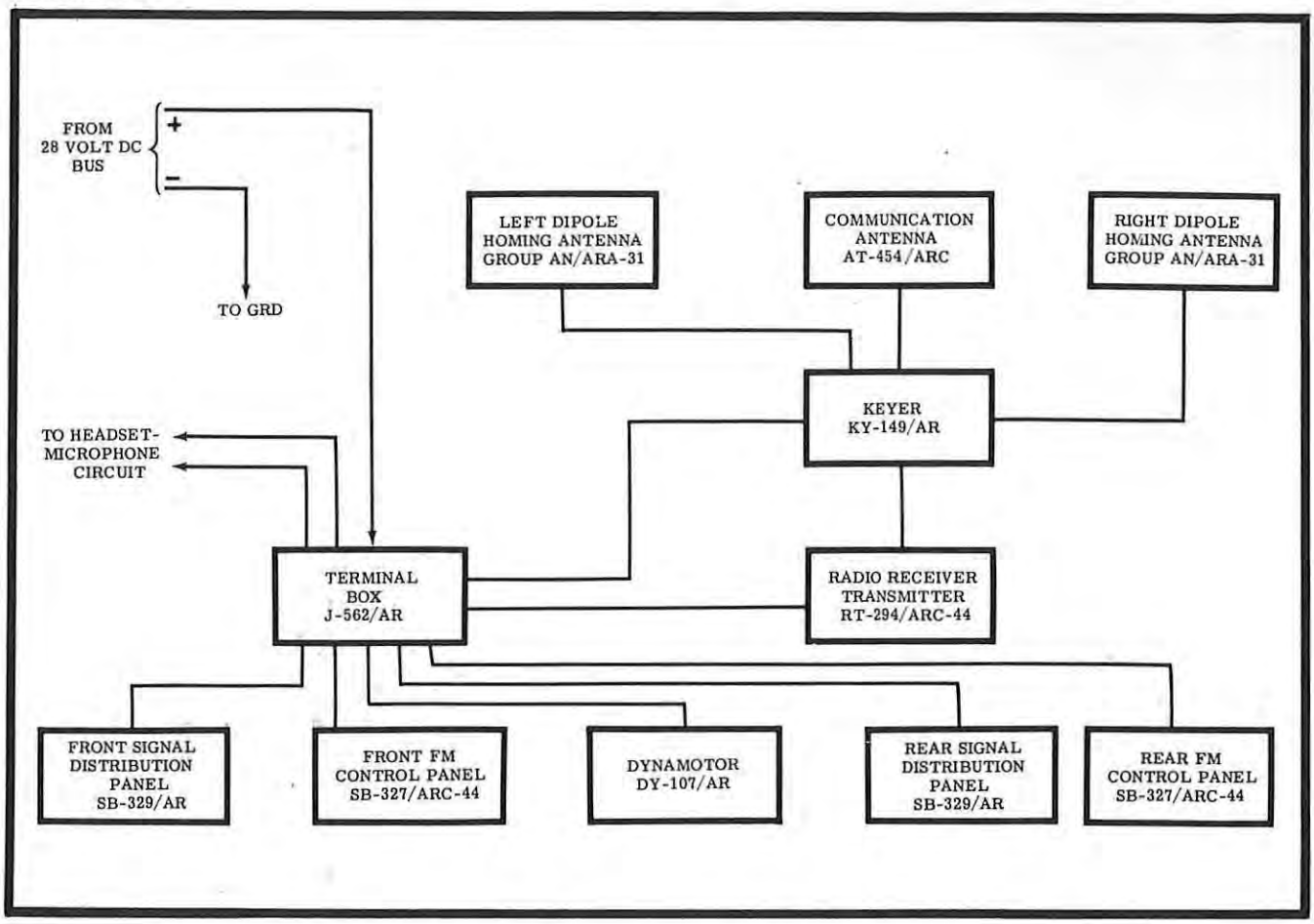
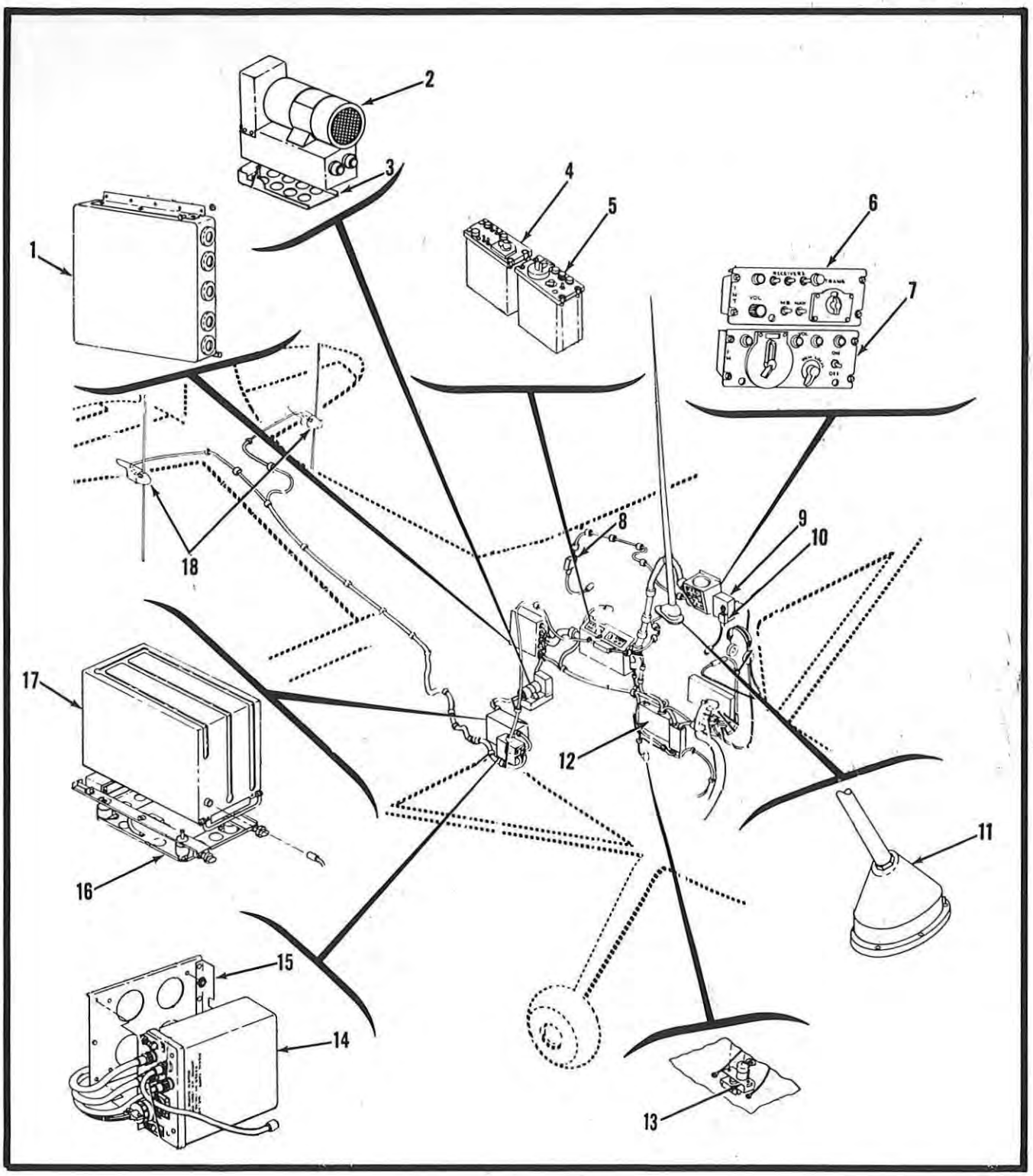


Figure 3.1-14. Radio Set AN/ARC-44 Block Diagram

	cation.
Type of modulation .	Frequency modulation, derived from reactance tube modulation.
Type of transmission	Voice.
Distance range . .	50 miles.
Transmitter power output . . .	6 watts, 52-ohm resistive load.
Receiver type . .	Double-Conversion superheterodyne.
Type of signals that can be received .	Fm voice, squelch control. When used as homing receiver, keyed unmodulated signals or keyed cw signals.
Receiver audio power output . . .	50 mw across 150 ohm.
Receiver sensitivity .	1 microvolt for 10 db signal plus noise-to-noise; 10 microvolts for 40 db signal plus noise-to-noise, using 52 ohm signal generator.
Homing sensitivity .	2 microvolts for 10 db signal plus noise-to-noise output of 50 mw across 150 ohms.
Antenna . . .	Whip transmitting and receiving.
Antenna . . .	Phase sensitive dipoles (2) for D-U sector coding.

3.1-288. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common Name
Radio Set AN/ARN-44 . .	Radio set
Radio Receiver-Transmitter RT-294/ARC-44. . .	Rt unit
Mounting MT-1268/AR .	Mounting
Control Panel SB-327/ARC-44 . . .	Control panel
Dynamotor DY-107/AR .	Dynamotor
Mounting MT-1267/AR .	Mounting
Radio Signal Distribution Panel SB-329/AR . .	Distribution panel
Terminal Box J-562/AR .	Terminal box
Antenna AT-454/ARC . .	Communication antenna
Headset-Microphone H-101/U	Headset-microphone
Antenna Group AN/ARA-31 . . .	Antenna group
Keyer KY-149/AR . .	Keyer
Mounting MT-1620/AR .	Mounting
Impedance Matching Network CU-459/AR .	Bullet } Homing antenna
Antenna Element AT-624/AR . . .	Element } Homing antenna



1. Terminal Box J-562/AR
2. Dynamotor DY-107/AR
3. Mounting MT-1267/AR
4. Rear Radio Signal Distribution Panel SB-329/AR
5. Rear Control Panel SB-327/ARC-44
6. Front Radio Signal Distribution Panel SB-329/AR
7. Front Control Panel SB-327/ARC-44
8. Rear Jack Box ARC Type J-10
9. Radio Switch Panel
10. Front Jack Box ARC Type J-10
11. Antenna AT-454/ARC
12. Junction Box ARC Type J-15B
13. Rear Microphone Switch
14. Keyer KY-149/AR
15. Mounting MT-1620/AR
16. Mounting MT-1268/AR
17. Radio Receiver-Transmitter RT-294/ARC-44
18. Homing Antenna Group AN/ARA-31

Figure 3.1-15. Radio Set AN/ARC-44 Major, Minor and Installation Items Location Diagram

3.1-289. COMPONENTS OF RADIO SET AN/ARC-44.

3.1-290. Refer to figure 3.1-15 for location of the radio set AN/ARC-44 components within the aircraft.

Quantity	Items
1	Radio receiver-transmitter RT-294/ARC-44.
1	Mounting MT-1268
2	Control Panel SB-327/ARC-44
1	Dynamotor DY-107/AR
1	Mounting MT-1267/AR
2	Radio Signal Distribution Panel SB-329/AR
1	Terminal Box J-562/AR
1	Antenna AT-454/ARC
2	Headset-Microphone H-101/U
2	Antenna Group AN/ARA-31
1	Keyer KY-149/AR
1	Mounting MT-1620/AR
2	Impedance Matching Network CU-459/AR
4	Antenna Element AT-624/AR

3.1-291. DESCRIPTION OF RADIO SET AN/ARC-44.

3.1-292. Radio set AN/ARC-44, receiver and transmitter circuits are contained in the receiver-transmitter unit, which is remotely tuned by whole-and 1/10 megacycle selector on the control panel. The signal distribution panel provides switching facilities for selecting the receiver-transmitter unit or other equipment in the aircraft. It also contains preamplification for the microphone and audio output amplification for the headset. Power for the complete equipment is obtained from the dynamotor which receives its power from the aircraft power source. When the FM Squelch switch on the radio switch panel is in the COMM position, the antenna lead from the receiver-transmitter unit is connected through the homing keyer to the communication antenna. When the FM Squelch switch is in the HOMING position, the antenna lead from the receiver-transmitter unit is connected to the homing antennas through the homing keyer, which keys the incoming signals of the homing antennas at D and U rate.

3.1-293. DESCRIPTION OF MAJOR COMPONENTS.

3.1-294. RADIO-RECEIVER-TRANSMITTER RT-294/ARC-44.

Radio receiver-transmitter RT-294/ARC-44 (17, figure 3.1-15) located under the rear seat contains the receiver and transmitter circuits for Radio Set AN/ARC-44. The receiver-transmitter unit tuning drive mechanism, which is remotely controlled by the control panel, automatically tunes the receiver stage and transmitter stages to the frequency selected at the control panel. The receiver is a double-conversion superhetrodyne type. Included with the receiver circuits are the homing circuits for detection of the D-U signals which are coded in the homing antenna group. An external switch is used to energize the homing circuits.

3.1-295. CONTROL PANEL SB-327/ARC-44.

3.1-296. Control panel SB-327/ARC-44 (5, 7, figure 3.1-15) is a separately housed unit containing the receiver-transmitter unit frequency selectors, the power switch, and the volume control. It also provides a choice of remote or local operation. All controls are located on the front panel. The frequency selectors levers (6, 7, figure 3.1-16) are mounted on consecutive shafts which also mounts the corresponding hole-and 1/10 megacycle re-entrant switch sections. The selected frequency appears in a frequency window (2, figure 3.1-16), labeled FREQ, directly above the 1/10 megacycle lever. Three panel lights (1, figure 3.1-16) located across the top of the panel, are covered by red translucent plastic covers and are controlled by the aircraft panel edge light rheostat switch. All external connections are made to the rear of the panel. The front panel is located on the left root rib and the rear panel is located on a bracket on the left cabin wall below the rear side window.

3.1-297. RADIO SIGNAL DISTRIBUTION PANEL SB-329/AR.

3.1-298. Radio signal distribution panel SB-329/AR (4, 6, figure 3.1-15) is a separately housed unit which permits the occupants of the aircraft to monitor other receivers or to apply audio to other transmitters in the aircraft. Two panel lamps, (1, figure 3.1-17) located across the top of the panel are covered by red translucent plastic covers and are controlled by the aircraft panel edge lights rheostat switch. All external connections are made to the rear of the panel. The distribution panels are in the same location as the control panels.

3.1-299. DYNAMOTOR DY-107/AR.

3.1-300. Dynamotor DY-107/AR (2, figure 3.1-15) located aft of the rear seat, supplies the high-voltage dc power and 400 cycle ac power for operation of the radio set AN/ARC-44.

3.1-301. ANTENNA AT-454/ARC.

3.1-302. Antenna AT-454/ARC (11, figure 3.1-15) located on the forward center cabin top, is the communication antenna for radio set AN/ARC-44. The antenna is a tapered whip approximately seven and one-half feet long and is made of fiberglass reinforced plastic with six copper wires molded within the fiberglass whip and spaced equally around the circumference. A corona discharge restrictor is built into the tip of the whip. The antenna base is tilted aft at a 15 degree angle.

3.1-303. HEADSET-MICROPHONE H-101/U.

3.1-304. Headset-microphone H-101/U is described in paragraph 3.1-40.

3.1-305. ANTENNA GROUP AN/ARA-31.

3.1-306. Antenna group AN/ARN-31 (18, figure 3.1-15) consists of keyer KY-149/AR (14, figure 3.1-15), mounting MT-1620/AR (15, figure 3.1-15) and four antenna elements at -624/AR. Two antenna elements and one impedance matching network make up a homing antenna. There are two identical homing antennas: one is located on either side of the stabilizer.

3.1-307. KEYER KY-149/AR.

3.1-308. Keyer KY-149/AR (14, figure 3.1-15) is mounted on the right cabin wall near the floor just aft of the door post. It is enclosed by a sliding cover which is held in place by a single spring lock fastener on the rear of the cover. The front panel of the keyer contains four coaxial connectors and a two-pin connector for a 27.5 volt power input. One coaxial connector is for the antenna cable from the receiver-transmitter unit, one for the communication antenna cable and two for the homing antenna cables. The keyer contains an antenna switching relay, a lobe switching relay, and a lobe switching motor.

3.1-309. IMPEDANCE MATCHING NETWORK CU-459/AR.

3.1-310. Impedance matching network CU-459/AR has a bullet-shaped black nylon shell. Two antenna connectors are mounted on the outer surface of the bullet, one on each side. The bullet contains the circuity for impedance matching between the receiver-transmitter and the antennas.

3.1-311. TERMINAL BOX J-562/AR.

3.1-312. Terminal box J-562/AR (1, figure 3.1-15) located behind the rear seat on the left cabin wall, is a rectangular case which contains four mounted terminal board strips and 80 terminal posts.

3.1-313. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-314. MOUNTING MT-1267/AR.

3.1-315. Mounting MT-1267/AR (3, figure 3.1-15) is a shockproof and vibration proof mounting used to mount the dynamotor. The dynamotor is secured by mounting screws that engage in mounting screw inserts.

3.1-316. JACK BOX ARC TYPE J-10.

3.1-317. Jack box ARC Type J-10 (8, 10, figure 3.1-15) is described in paragraph 3.1-38.

3.1-318. JUNCTION BOX ARC TYPE J-15B.

3.1-319. Junction box ARC Type J-15B (12, figure 3.1-15) is described in paragraph 3.1-36.

3.1-320. MOUNTING MT-1620/AR.

3.1-321. Mounting MT-1620/AR (15, figure 3.1-15) is a plate used for mounting the keyer in place. The plate is mounted on the right cabin wall near the floor just aft of the door post.

3.1-322. MOUNTING MT-1268/AR.

3.1-323. Mounting MT-1268/AR (16, figure 3.1-15) is a shock proof and vibration proof mounting used to mount the receiver-transmitter unit. The receiver-transmitter unit is secured by mounting screws that engage in mounting screw blocks.

3.1-324. DIFFERENCES IN MODELS.

3.1-325. Refer to figure 3.1-30 for difference between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

CONTROL PANEL SB-327/ARC-44

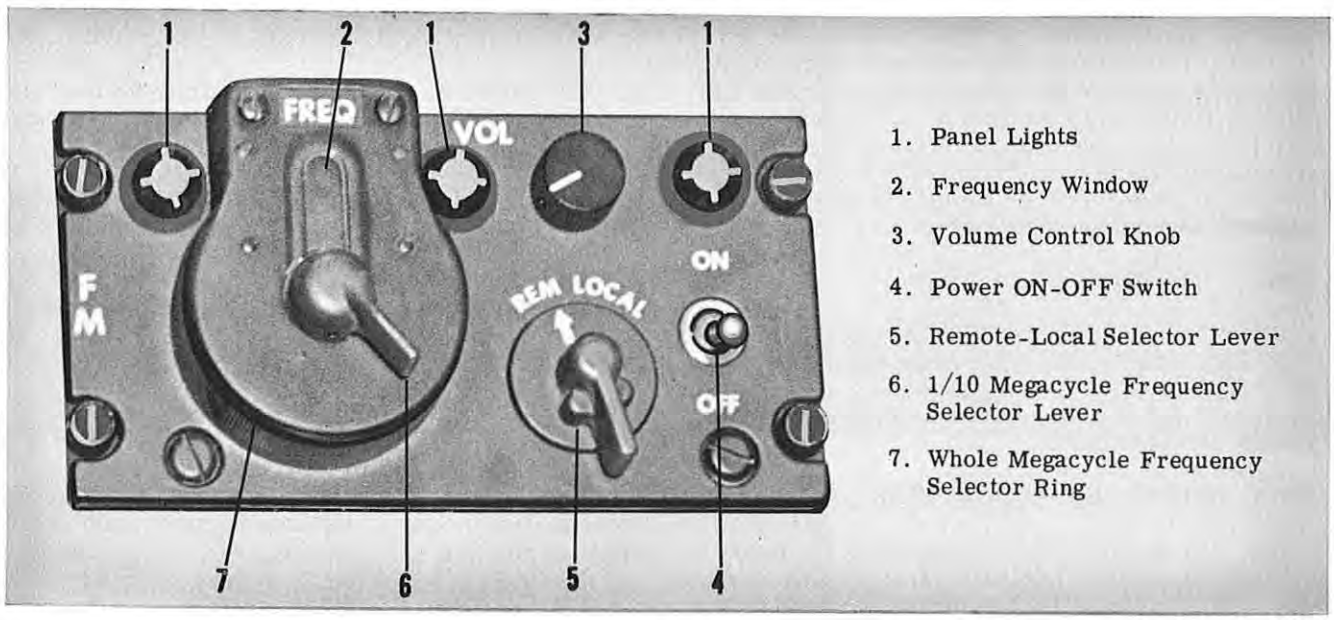


Figure 3.1-16

3.1-326. OPERATING CONTROLS AND USE.

3.1-327. CONTROL PANEL SB-327/ARC-44.

3.1-328. The following paragraphs describes the controls on the control panel (figure 3.1-16) and indicates their functions.

3.1-329. POWER ON-OFF SWITCH.

3.1-330. The power ON-OFF switch (4, figure 3.1-16) controls the electrical power to the receiver-transmitter from the dynamotor and INTERPHONE POWER switch (6, figure 3.1-18).

Note

The INTERPHONE POWER switch must be on before the power ON-OFF switch will turn on the receiver-transmitter unit. The power ON-OFF switches on the control panels are connected in parallel so that both switches must be OFF to turn off the receiver-transmitter unit.

3.1-331. FREQUENCY SELECTOR RING AND LEVER.

3.1-332. The operating frequency of the receiver-transmitter is controlled by the frequency selector ring and lever. The whole-megacycle frequency selector ring (7, figure 3.1-16) provides both receiver and transmitter operating frequency tuning in 28 selections spaced at one megacycle intervals in the frequency range between 24.0 and 51.9 megacycles. Rotation of the ring sets up the upper two digits in the FREQ window, which represent the first two whole-megacycle portion of the three digit operating frequency. The 1/10 megacycle frequency selector lever (6, figure 3.1-16) changes the frequency of each whole megacycle selector setting in 1/10 megacycle intervals. Since there are 28 whole megacycle selector positions, 280 channels can be selected by the whole and 1/10 megacycle frequency selectors. Rotating the 1/10 megacycle selector lever sets up the lower digit in the FREQ window and represents the 1/10 megacycle portion of the three digit operating frequency. The selector levers actuate an electrical tuning drive mechanism in the receiver-transmitter. When the tuning drive is in operation a continuous 400 cycle tone is audible in the headsets. The operator should wait for the tone to cease before beginning transmission of messages.

3.1-333. VOLUME CONTROL KNOB.

3.1-334. The volume control knob (3, figure 3.1-16) labeled VOL, controls the audio output level from the receiver-transmitter. Clockwise rotation of the knob increases the audio level, and counterclockwise rotation decreases the audio level.

3.1-335. REMOTE-LOCAL SELECTOR LEVER.

3.1-336. The remote-local selector lever (5, figure 3.1-16), labeled REM-LOCAL, transfers frequency selector and volume control between the front and rear control panels. When the lever on either control panel is placed in the LOCAL positions, it trips the lever on the other control panel to REM and blocks out its frequency indications. The control panel which is placed in the LOCAL position will govern the operation of the radio set.

Note

- It is possible to manually set both levers in the REM position. THIS IS AN IMPROPER OPERATING CONDITION, which will cut off all radio set facilities. To remedy, merely rotate either selector lever to LOCAL.
- Either station may transmit and receive on the receiver-transmitter unit regardless of the position of the selector lever. Only frequency control and receiver-volume control are lost by the control panel with its selector lever in the REM position.

Control	Function
Power ON-OFF Switch	Turns power on.
Whole Megacycle Frequency Selector Ring	Selects first two numbers of receiver and transmitter operating frequency.
1/10 Megacycle Frequency Selector Lever	Selector third number of receiver and transmitter opating frequency.
Remote-Local Selector Lever. . . .	Provides remote-local frequency control and receiver audio volume of the receiver-transmitter unit.
Volume Control Knob	Provides volume control for the receiver-transmitter unit receiver audio output. Turn clockwise to increase the audio output.

3.1-337. SIGNAL DISTRIBUTION PANEL SB-329/AR.

3.1-338. The following paragraphs describe the controls on the signal distribution panel (figure 3.1-17) and indicate their function.

3.1-339. HEADSET AMPLIFIER VOLUME CONTROL KNOB.

3.1-340. The headset amplifier volume control knob (8, figure 3.1-17) labeled VOL controls the audio signal level fed to the corresponding headset. Turning the control knob clockwise increases the audio level.

3.1-341. RECEIVER 1 SWITCH LEVER.

3.1-342. The receivers 1 switch (2, figure 3.1-17) connects the audio output of the AN/ARC-44 radio set receiver-transmitter to the headset. The switch is on in the up position.

3.1-343. RECEIVER 2 SWITCH LEVER.

3.1-344. The receivers 2 switch (3, figure 3.1-17)

SIGNAL DISTRIBUTION PANEL SB-329/AR

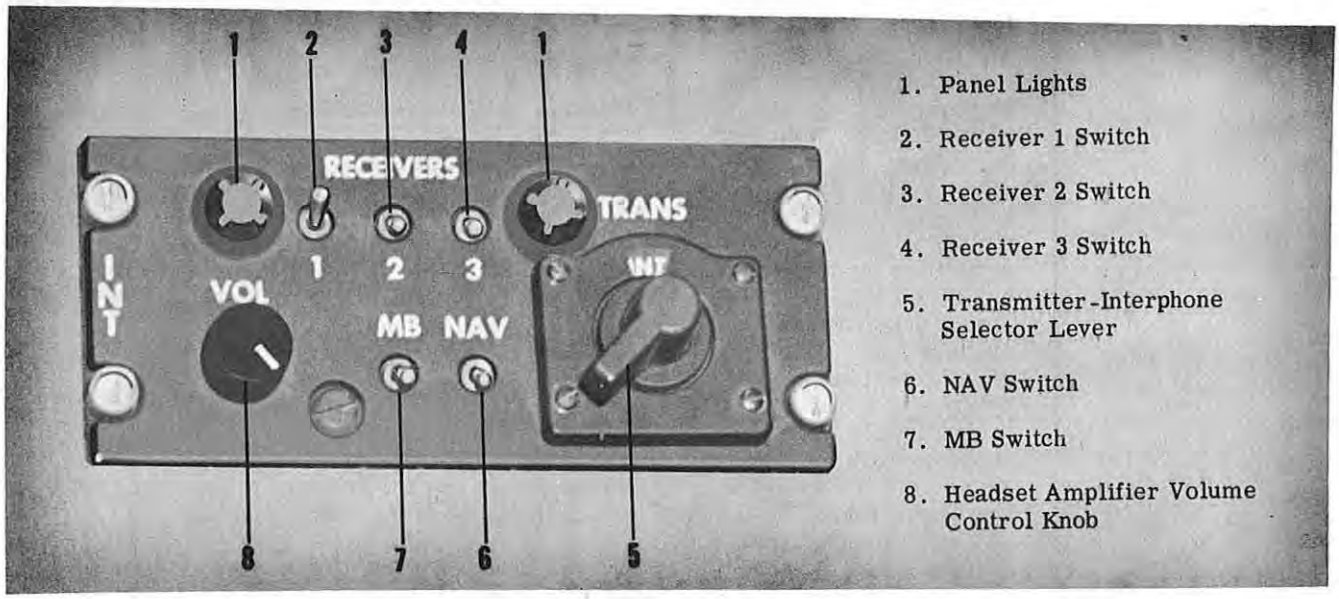


Figure 3.1-17

allows the audio from the UHF or VHF system to be heard in the headset when the switch is in the up position.

3.1-345. NAV SWITCH.

3.1-346. The NAV switch (6, figure 3.1-17) allows the audio from the LF system to be heard in the headsets when the switch is in the up position.

3.1-347. RECEIVER 3 and MB SWITCHES.

3.1-348. The receivers 3 switch (4, figure 3.1-17) and MB switch (7, figure 3.1-17) are not used in this installation.

3.1-349. TRANSMITTER-INTERPHONE SELECTOR LEVER.

3.1-350. The transmitter-interphone selector lever (5, figure 3.1-17) labeled TRANS, is used to select one of two transmitters; position 1 (FM Communication) and position 2 (UHF or VHF Communication). INT. (Interphone) is also a position selected by the lever.

Note

The audio output from the receiver-transmitter unit is connected to the headset through two parallel paths as follows: through the RECEIVERS 1 switch when it is in the up position and through the transmitter. Interphone selector lever when in position 1. If the RECEIVERS 1 switch is in the down position, while the transmitter-interphone selector lever is in any position other than 1 the receiver-transmitter unit audio output cannot be heard in the headset.

Control	Function
RECEIVERS 1 Switch . . .	When the switch is in the up position, the FM system receiver audio output is connected to the operator's headset. In its down position, it disconnects the audio signal from the operator's headset. If the transmitter-interphone selector switch is in position 1, however, the receiver-transmitter unit audio can still be heard.
RECEIVERS 2 Switch . . .	When the switch is in the up position, it connects the audio output of the UHF or VHF radio set to the operator's headset. In its down position, it disconnects the audio signal from the operator's headset unless the transmitter-interphone selector lever is in position 2.
RECEIVERS 3 and MB Switch . .	Not used in this installation.
NAV Switch . . .	When the switch is in the up position, the LF receiver audio output is connected to the operator's headset. In its down position, it disconnects the audio signal from the operator's headset.

Transmitter-Interphone Selector Switch . . .	Position 1 allows operator to transmit on the FM system and at the same time the audio output of the FM system is heard by the operator. This is true regardless of the position of the RECEIVER 1 listening switch. Position 2 allows operator to transmit on the UHF or VHF system and at the same time the audio output of the UHF or VHF system is heard by the operator. The INT position connects the front and rear distribution panels for interphone operation. At the same time the operator hears his own transmission as a sidetone signal on his headset.
Headset Amplifier Volume Control Knob	Adjust the input level to the headset in the distribution panel.

3.1-351. RADIO SWITCH PANEL.

3.1-352. The following paragraphs describes the controls on the radio switch panel (figure 3.1-18) and indicates their functions.

3.1-353. INTERPHONE-POWER SWITCH.

3.1-354. The INTERPHONE-POWER switch (6, figure 3.1-18) controls power for all components of radio set AN/ARC-44. When the switch is in the ON position, the dynamotor is started and power is supplied to the power ON-OFF switch on the FM control panels. Power is also supplied to the signal distribution panels for interphone operation.

3.1-355. SQUELCH SWITCH.

3.1-356. The SQUELCH switch (5, figure 3.1-18) controls squelch action in the receiver circuits of the radio set AN/ARC-44 receiver-transmitter unit. The squelch circuit automatically suppresses background noise during no signal periods and opens to allow full amplification when signals are received.

3.1-357. HOMING-COMM SWITCH.

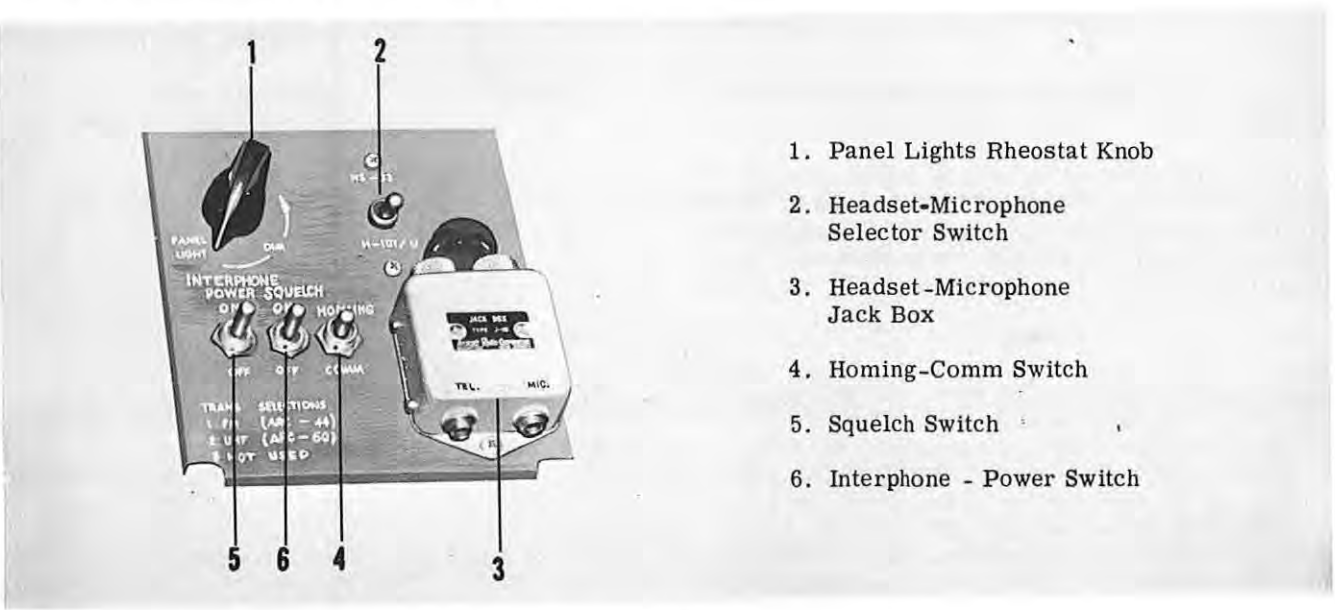
3.1-358. The HOMING-COMM switch (4, figure 3.1-18) when placed in the HOMING position converts the radio set AN/ARC-44 receiver to homing operation. The equipment is returned to normal operation when the switch is placed in the COMM position.

3.1-359. HEADSET-MICROPHONE SELECTOR SWITCH.

3.1-360. The headset-microphone selector switch (2, figure 3.1-18), labeled HS-33 and H-101/U, permits either HS-33 or H-101/U headset microphones to be used in the aircraft. The H-101/U headset-microphones are provided with radio set AN/ARC-44. If the radio set AN/ARC-44 radio is removed, the H-101/U headset-microphone must be replaced with HS-33 headsets and carbon microphones.

3.1-361. PANEL LIGHTS RHEOSTAT KNOB.

3.1-362. The panel lights rheostat knob (1, figure 3.1-



1. Panel Lights Rheostat Knob
2. Headset-Microphone Selector Switch
3. Headset-Microphone Jack Box
4. Homing-Comm Switch
5. Squelch Switch
6. Interphone - Power Switch

Figure 3.1-18

18) labeled PANEL LIGHTS, controls edge lighting for the radio control panels.

3.1-363. MICROPHONE SWITCH BUTTON.

3.1-364. Refer to paragraphs 3.1-55 and 3.1-57 for description of microphone switch button.

3.1-365. REAR MICROPHONE SWITCH BUTTON. Aircraft ▲1 ▲2 .

3.1-366. A microphone switch button (13, figure 3.1-15) is mounted on the floorboard of the rear compartment and used for transmitting communication.

3.1-367. INTERPHONE SWITCH BUTTON. Aircraft ▲3 ▲4 ▲5 .

3.1-368. Refer to paragraph 3.1-59 for description of interphone switch button.

Control	Function
INTERPHONE POWER Switch. .	Controls power for radio set AN/ARC-44. With switch in the ON position, starts the dynamotor and supplies power to FM control panels and signal distribution panel.
SQUELCH Switch .	Controls squelch action in radio set AN/ARC-44 receiver.
HOMING-COMM Switch . . .	In the HOMING position, the switch energizes the homing circuit in radio set AN/ARC-44, disconnects the communications antenna, connects the homing antennas through keyer KY-149/AR to the receiver-transmitter unit receiver input and disables the microphone switch. In the COMM position, the homing operation becomes disabled, allowing the radio set to return to normal operation.
Headset-Microphone Selector Switch .	Permits either HS-33 or H-101/U headset microphone to be used in the aircraft. The H-101/U headset microphone must be used when radio set AN/ARC-44 is installed.
Panel Light Rheostat Knob . .	Control edge lighting for the radio control panels.
MIC Switch Button .	Used for transmitting communication.
INT Switch Button .	Used for transmitting communication between front and rear compartments.

3.1-369. TYPES OF OPERATION FACILITIES.

3.1-370. Refer to figure 3.1-30 for operating facilities.

3.1-371. PRELIMINARY STARTING PROCEDURES.

3.1-372. Perform the preliminary operations listed below before starting the radio set.

Note

Unless otherwise stated the following instructions apply to both the front and rear control panels and the signal distribution panels.

3.1-373. CONTROL PANEL PRELIMINARY STARTING PROCEDURES.

1. Power ON-OFF switch - OFF.
2. Volume control knob - Full counterclockwise position.
3. Front Remote - local selector lever - LOCAL.

Note

When the power ON-OFF switch is turned to the ON position the control panel, not selected for LOCAL position automatically switches to REM.

3.1-374. RADIO SIGNAL DISTRIBUTION PANEL PRELIMINARY STARTING PROCEDURES.

1. RECEIVERS 1 switch - ON (up position).
2. RECEIVERS 2 and NAV switch - OFF (down position).
3. Transmitter-interphone selector lever - Rotate so that INT shows in the indicator window.
4. Headset amplifier volume control knob - Full counterclockwise position.

3.1-375. RADIO SWITCH PANEL PRELIMINARY STARTING PROCEDURES.

3.1-376. Position all switches on the switch panel to their down position.

3.1-377. OPERATING INSTRUCTIONS.

Note

Unless otherwise stated the following instructions apply to both the front and rear control panels and signal distribution panels.

3.1-378. RADIO SWITCH PANEL OPERATING INSTRUCTIONS.

1. INTERPHONE-POWER Switch-ON, the dynamotor should start operating.
2. SQUELCH switch - ON.
3. HOMING-COMM switch, COMM position - Check.
4. Headset-microphone switch - H-101/U.

3.1-379. RADIO SIGNAL DISTRIBUTION PANEL OPERATING INSTRUCTIONS.

1. Headset amplifier volume control knob - Turn

clockwise until either a slight amount of noise or intercommunications signal is heard at a comfortable listening level in the headset.

2. Transmitter-interphone selector lever - Rotate, so that 1 shows in the indicator window.

3.1-380. CONTROL PANEL OPERATING INSTRUCTIONS.

1. Power ON-OFF switch-ON, wait approximately one minute for receiver transmitter unit to warmup; more time may be required in very cold weather.

Note

The equipment may start to cycle when power is turned on and will be indicated by a continuous 400 cycle tone in the headset. This merely indicates that the selected frequency setting is different from the setting that the frequency selectors were adjusted to when the power was last turned off. Cycling, however, should not continue longer than approximately six seconds.

2. Whole-and 1/10-megacycle selectors - Rotate to the desired operating frequency (as shown in the FREQ window).

3. Volume control knob - Rotate approximately one half turn clockwise.

CAUTION

Do not manually position the remote-local switch to REM after the power is turned on. Although this will not in any way physically damage the equipment, the receiver-transmitter unit will no longer operate properly into the associate equipment. To remedy, merely return the selector to its LOCAL position.

3.1-381. RADIO SIGNAL DISTRIBUTION PANEL.

1. Headset amplifier volume control. Rotate clockwise until either a slight amount of noise or a communications signal is heard in the headset at a comfortable listening level.

Note

- If the signal is too weak to break the squelch on the receiver, turn the SQUELCH switch on the radio switch panel to OFF.

- After the operating frequency has been selected and the equipment is started, as instructed in the above steps, it operates as an FM communications receiver. To operate as a transmitter merely press the microphone switch button in either compartment and talk into the microphone.

3.1-382. HOMING RECEIVER OPERATING INSTRUCTIONS.

3.1-383. For use as an FM homing receiver, the radio set AN/ARC-44 operated as just described, but with the HOMING-COMM switch on the radio switch panel in the HOMING position and the whole-and 1/10 megacycles selectors on the control panels tuned to the desired frequency. The coded D and U signals or steady 400 cycle on-course tone should be present in both the front and rear headset. Three types of signals that are heard when using the homing facility are given below:

Signals	Meaning
A keyed 400 cycle per second tone with the code character D (-..) predominant. .	The transmitting station to which tuned is on the left (port side) of the course heading. A turn to the left must be made until headset signal changes to a steady 400 cycle per second tone.
A keyed 400 cycle per second tone with the code character U (. . -) predominant. .	The transmitting stations to which tuned is on the right (starboard) of the course heading. A turn to the right must be made until headset signal changes to a steady 400 cycle per second tone.
A steady 400 cycle per second tone. . .	Heading directly toward the transmitting station tuned to.

Note

It is possible, when a steady 400 cycle tone is heard, the aircraft is heading directly away from the station. By flying to the right or left of the on-course heading the error will be automatically corrected by following the directions for reception of D and U signals.

3.1-384. INTERPHONE OPERATING INSTRUCTIONS.

3.1-385. Either operator may talk over the interphone channel during any mode of operations. The operator desiring to talk on the interphone should proceed as follows:

1. Transmitter-interphone selector lever Aircraft ▲1 ▲2 - Rotate to the INT positions.

2. Interphone switch button aircraft ▲3 ▲4 ▲5, or microphone switch button aircraft ▲1 ▲2 - Press and talk into microphone.

Note

On aircraft ▲1 ▲2 the resulting interphone audio signal is present in both headset. It is not necessary for the other operator to rotate his transmitter-interphone selector lever to INT to hear interphone messages, because all information on the interphone channel is present in both headsets during all modes of operations. If both

operators want to talk over the interphone, both transmitter-interphone selector lever must be rotated to their INT positions.

3.1-386. STOPPING PROCEDURE.

3.1-387. The following procedures should be followed for shuting down radio set AN/ARC-44.

1. HOMING-COMM Switch - COMM if radio set was operated as a homing receiver to remove power from the keyer.
2. Power ON-OFF Switch - OFF.

Note

The power ON-OFF switch on both control panels must be in the OFF position.

3. INTERPHONE-POWER switch - OFF.

3.1-388. DUAL OPERATING CONTROLS.

3.1-389. Refer to paragraph 3.1-371, "Preliminary Starting Procedures" and 3.1-377 "Operating Instructions".

3.1-390. EMERGENCY OPERATIONS.

3.1-391. If generator failure occurs during flight radio operation will be limited to the life of the battery, therefore radio operation should be limited to conserve the battery. For frequencies reserves for emergency operation, refer to the frequency chart located near the radio set control panel.

Note

If failure of the radio set AN/ARC-44 occurs, operation of the VHF or UHF and LF radio sets can still be maintained.

3.1-392. PREFLIGHT INSPECTION.

3.1-393. The following paragraphs describe the operational procedures performed on radio set AN/ARC-44 equipment at the time indicated in Section II Normal Procedures.

3.1-394. POWER OFF INSPECTION.

3.1-395. EXTERIOR INSPECTION.

3.1-396. The following check is an extension to the exterior inspection in Section II.

1. Communication and homing antennas - Check for secure antenna mounting and condition.

3.1-397. INTERIOR INSPECTION.

1. Antennas - Check for secure antenna leadin connections to keyer.
2. Receiver-transmitter unit - Check for secure wire and plug connections and mounting.
3. Dynamotor - Check for secure wire and plug connections and mounting.
4. Keyer - Check for secure wire and plug connections and mounting.
5. Terminal box - Check that all wire connections and terminal nuts are secure.
6. Control panels and signal distribution panels - Check that all plugs are secure.
7. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-398. POWER ON.

3.1-399. The power on procedures will be performed in accordance with paragraph 3.1-377, "Operating Instructions", with the addition of the following:

Note

When an auxiliary power unit is used to start the engine the operational checks, as listed below, will be performed while the auxiliary power unit is connected to the aircraft prior to starting the engine. If an auxiliary power unit is not available, the operational checks will be performed during engines warmup.

1. Establish two-way communication with tower - Press MIC button and speak into microphone. Release MIC button to receive. Two-way communication should be possible.

3.1-400. POST FLIGHT CHECK.

3.1-401. The postflight check will be performed in accordance with paragraph 3.1-386, "Stopping Procedures", with the addition of the following:

1. All discrepancies noted in Form DA-781-1 and the crew-chief should be notified.

3.1-402. LOW FREQUENCY NAVIGATION AND RECEIVER SET ARC TYPE 12. Aircraft ▲1 ▲2 ▲3 ▲4 and ▲5 55-4649 thru 55-4748.

3.1-403. PURPOSE AND USE.

3.1-404. Low frequency navigation and receiver set ARC Type 12 has a range of approximately 200 miles and operates in the frequency range of 190-550 kilocycles. The receiver set is used for reception of low-frequency radio range stations and for homing or direction-finding.

3.1-405. TECHNICAL CHARACTERISTIC.

Frequency range	190 to 550 kilocycles
Type of modulation	Amplitude
Distance range	200 miles
Antenna	Bidirectional, manual loop antenna 9 inches in diameter.
Antenna	Wire antenna
Power required	1.5 amperes

3.1-406. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common Name
Low Frequency Navigation and Receiver Set ARC Type 12 Radio Receiver	Receiver set

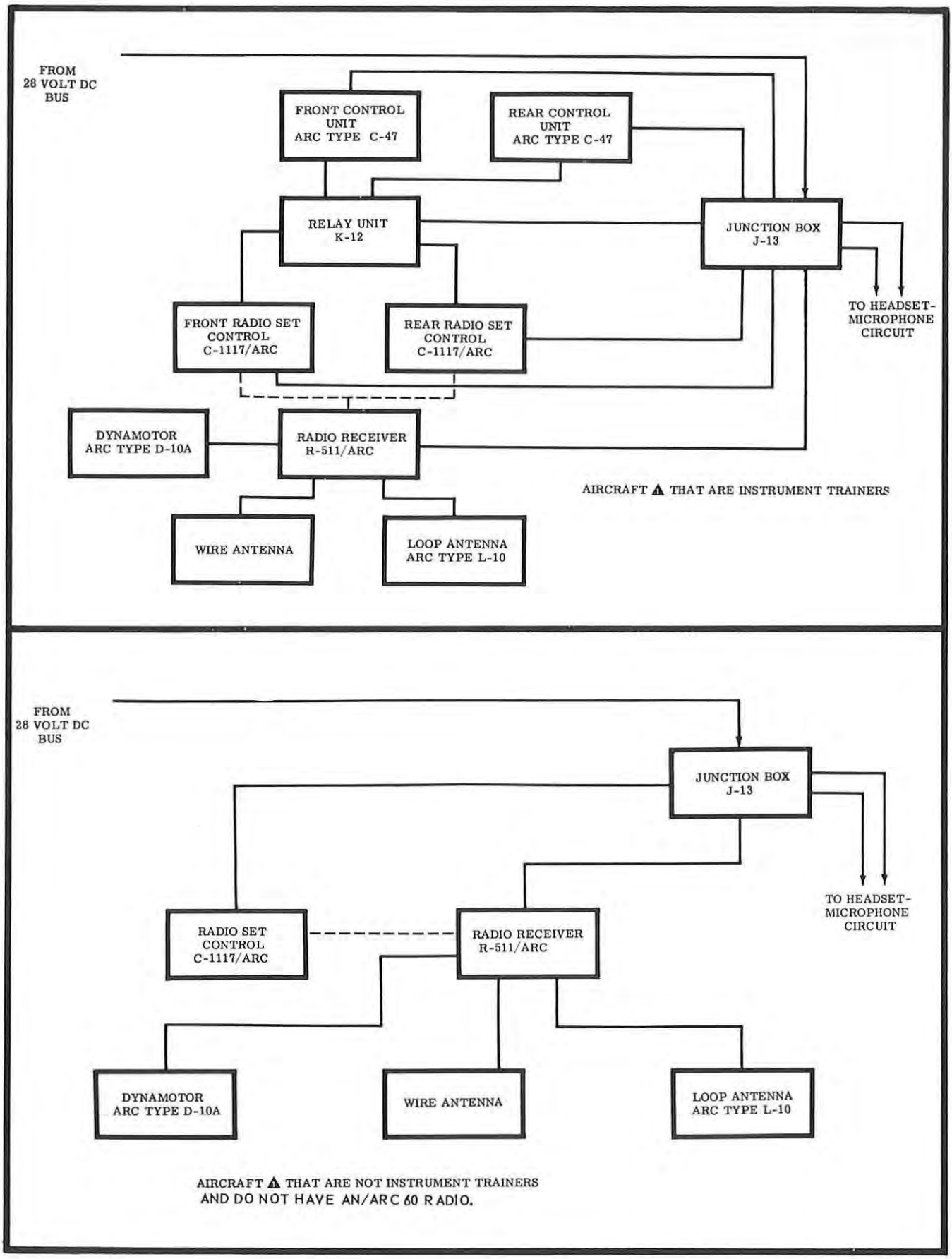
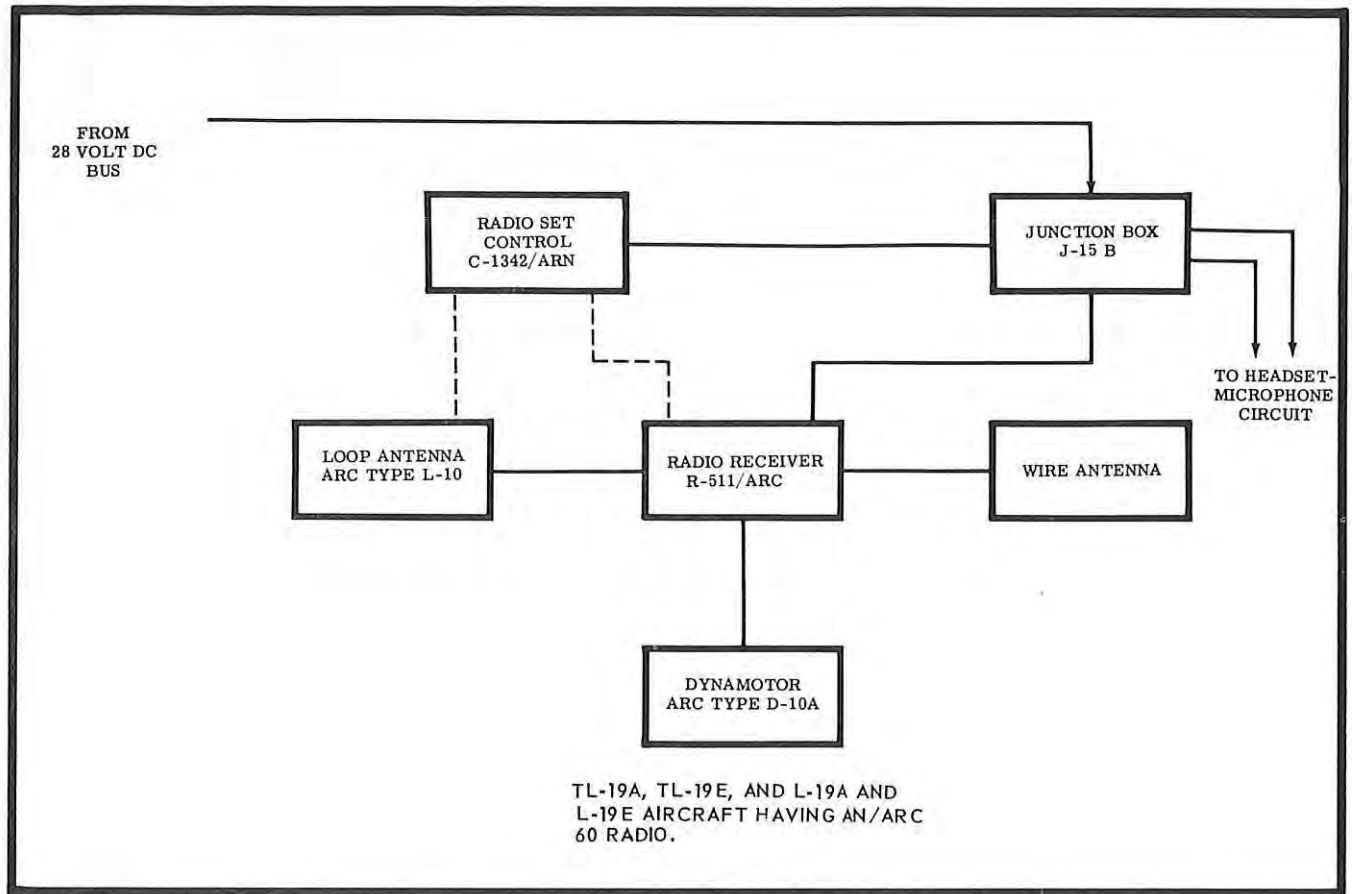


Figure 3.1-19. Low Frequency Navigation and Receiver Set ARC Type 12 Block Diagram (Sheet 1 of 2)



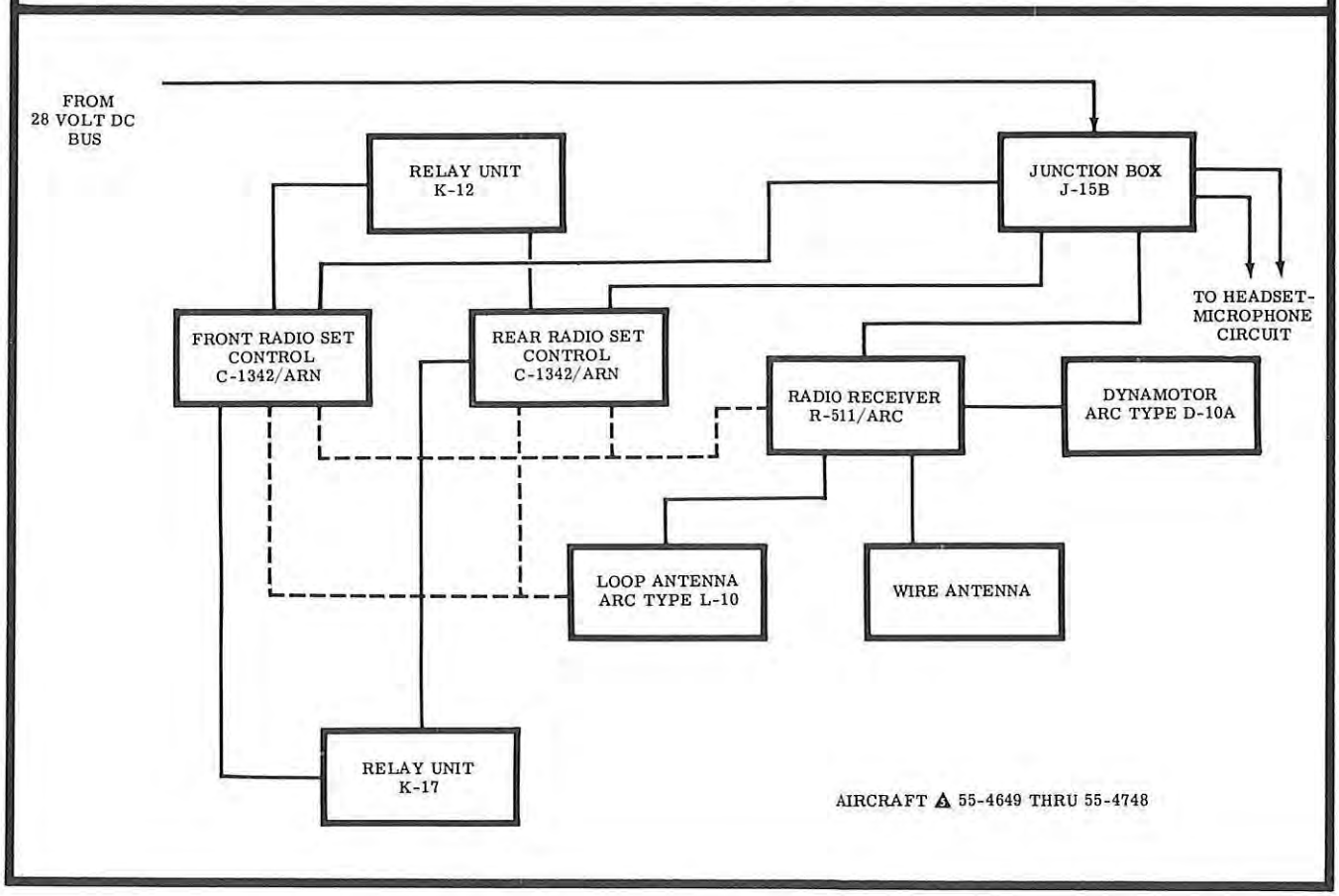
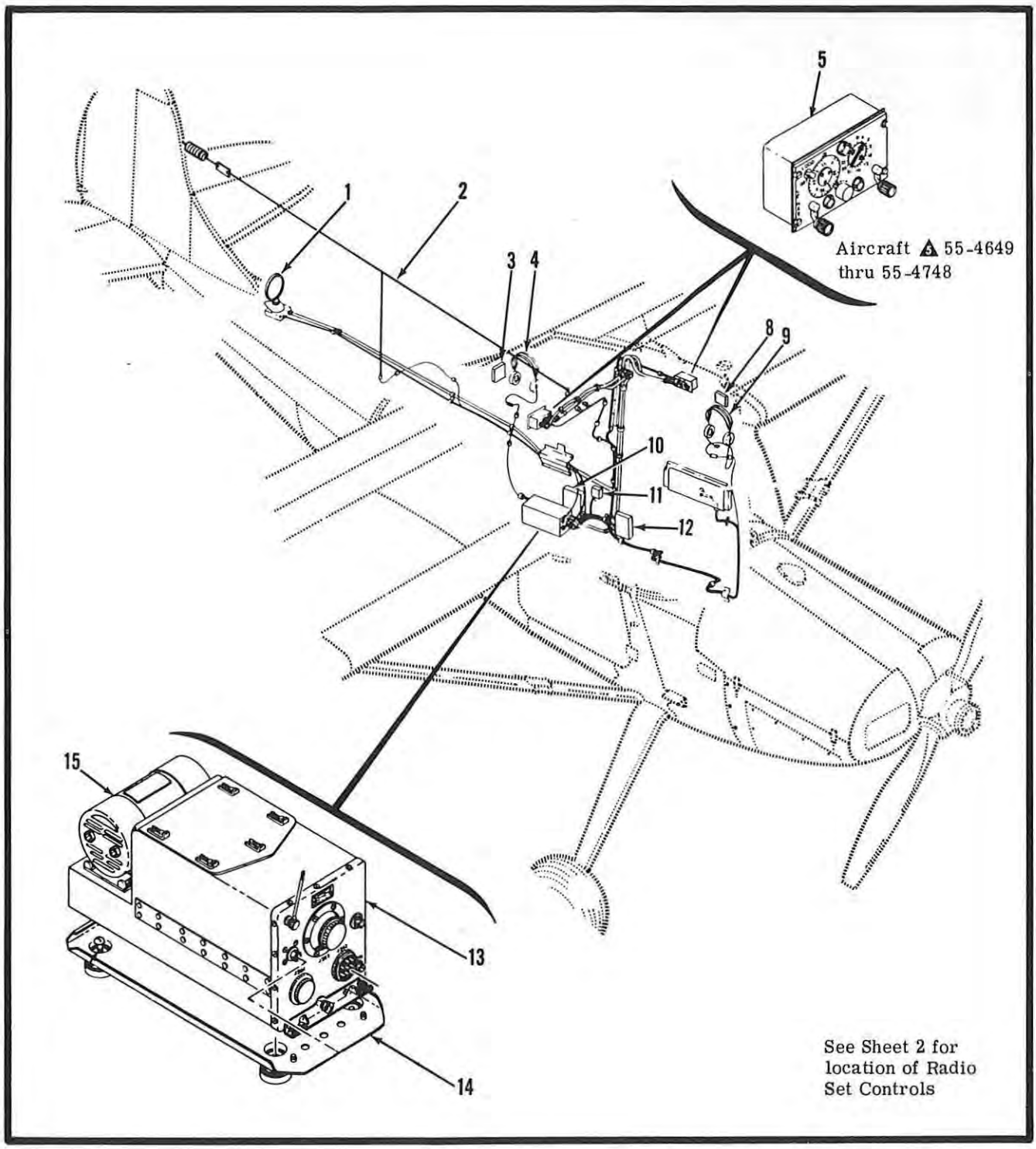


Figure 3.1-19. Low Frequency Navigation and Receiver Set ARC Type 12 Block Diagram (Sheet 2 of 2)



1. Loop Antenna ARC Type L-10
2. Wire Antenna
3. Rear Jack Box ARC Type J-10 ①②③④
4. Rear Headset-Microphone H-46A/UR ⑤ H-101/U ①②③④
5. Radio Set Control C-1342/ARN
6. Radio Set Control C-1117/ARC
7. Control Unit C-1113/ARC ①③
8. Front Jack Box ARC Type J-10 ①②③④
9. Front Headset-Microphone H-46A/UR ⑤ H-101/U ①②③④
10. Junction Box J-15B ②④ ⑤ J-13 ①③
11. Relay Unit ARC Type K-17 ⑤
12. Relay Unit ARC Type K-12 ⑤ and ① Instrument Trainer
13. Radio Receiver R-511/ARC
14. Electrical Equipment Rack MT-1140/ARC
15. Dynamotor ARC Type D-10A

Figure 3.1-20. Low Frequency Navigation and Receiver Set ARC Type 12, Major, Minor and Installation Items Location Diagram (Sheet 1 of 2)

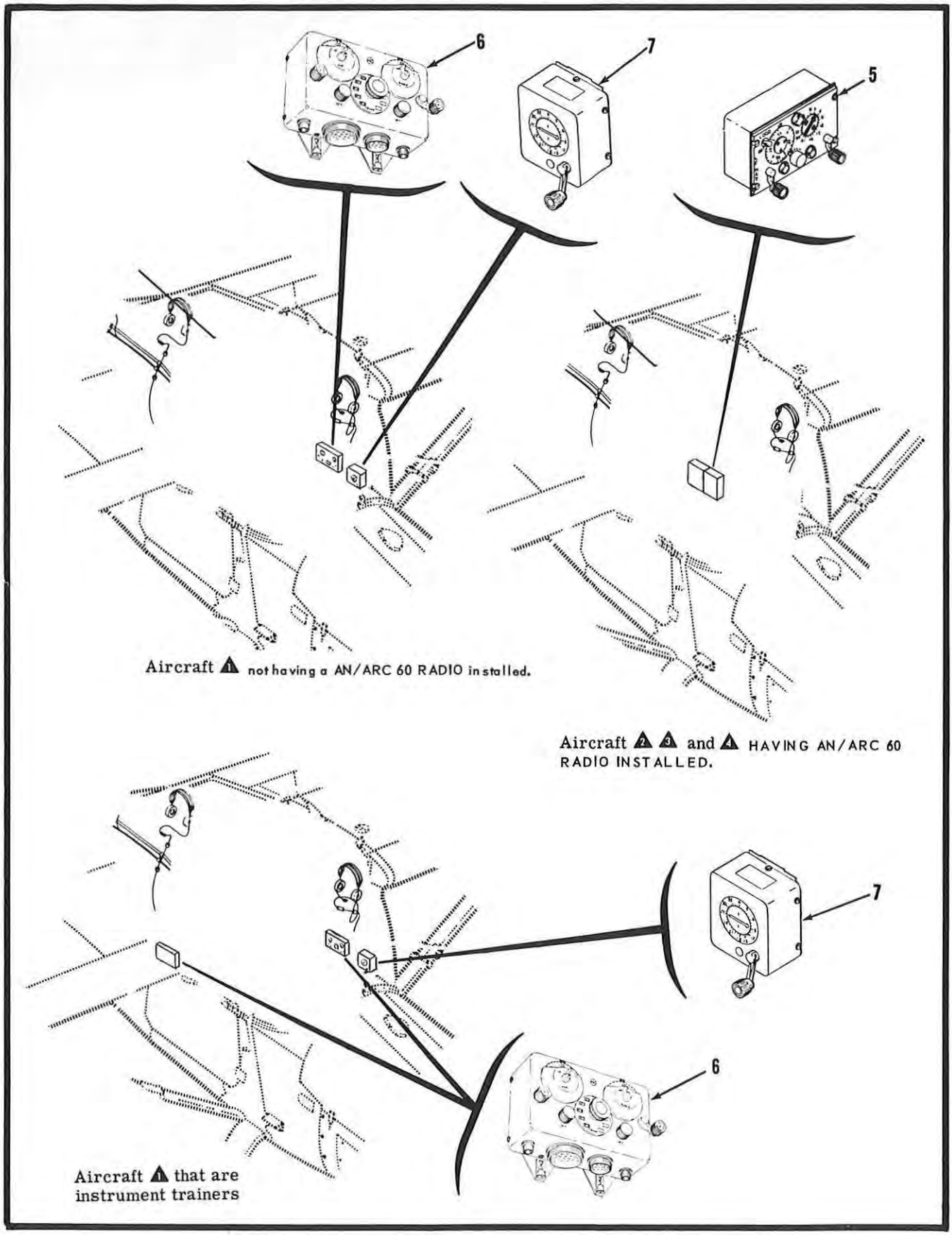


Figure 3.1-20. Low Frequency Navigation and Receiver Set ARC Type 12, Major, Minor and Installation Items Location Diagram (Sheet 2 of 2)

R-511/ARC . . .	Receiver
Radio Set Control C-1117/ARC . . .	Control unit
Radio Set Control C-1342/ARN . . .	Control unit
Dynamotor ARC Type D-10A	Dynamotor
Control unit ARC Type C-1113/ARC . . .	Loop antenna control
Electrical Equipment Rack MT-1140/ARC . . .	Equipment rack
Loop antenna ARC Type L-10 . . .	Loop antenna
Wire antenna . . .	Wire antenna
Radio Control Selector Unit ARC Type C-47 . .	Control selector

3.1-407. COMPONENTS OF LOW FREQUENCY NAVIGATION AND RECEIVER SET ARC TYPE 12. Aircraft ▲1 ▲3 not having a AN/ARC 60 RADIO installed.

3.1-408. Refer to figure 3.1-20 for location of the receiver set ARC Type 12 components within the aircraft.

Quantity	Items
1	Radio receiver R-511/ARC including Dynamotor ARC Type D-10A
1*	Radio Set Control C-1117/ARC
2*	Radio Control Selector Unit ARC Type C-47
1*	Relay Unit ARC Type K-12
1	Loop Antenna ARC Type L-10
1	Wire Antenna
1	Control Unit ARC Type C-1113/ARC
1	Electrical Equipment Rack MT-1140/ARC

* On aircraft ▲1 instrument trainers, two are required.
* On aircraft ▲1 instrument trainers only.

3.1-409. COMPONENTS OF LOW FREQUENCY NAVIGATION AND RECEIVER SET ARC TYPE 12. Aircraft ▲1 EQUIPPED WITH AN/ARC 60 RADIO except instrument trainers; Aircraft ▲3 EQUIPPED WITH AN/ARC 60 RADIO; Aircraft ▲2, ▲4 and ▲5 55-4649 thru 55-4748.

3.1-410. Refer to figure 3.1-20 for location of the receiver set ARC Type 12 components within the aircraft.

Quantity	Items
1	Radio Receiver R-511/ARC including Dynamotor ARC Type D-10A
1*	Radio Set Control C-1342/ARN
1*	Relay Unit ARC Type K-12
1	Loop Antenna ARC Type L-10
1	Wire Antenna
1*	Relay Unit Type K-17
1	Electrical Equipment Rack MT-1140/ARC

* On aircraft ▲5 two are required.
* On aircraft ▲5 only.

3.1-411. DESCRIPTION OF LOW FREQUENCY NAVIGATION AND RECEIVER SET ARC TYPE 12.

3.1-412. The low frequency navigation and receiver set ARC Type 12 receiver is continuously tunable in the frequency range of 190 to 550 kilocycles; it is mechanically tuned by a tuning crank on the control unit. The loop antenna used for homing or direction-finding, is mechanically controlled by a crank on the control unit. The antenna position is indicated on a position indicator which is mechanically controlled by the tuning crank. The antenna selector switch, located on the control unit permits the selection of either the loop or the wire antenna, depending on the type of signal reception desired. Power for the complete equipment is obtained from the dynamotor which receives its power from the aircraft power source.

3.1-413. DESCRIPTION OF MAJOR COMPONENTS.

3.1-414. RADIO RECEIVER R-511/ARC.

3.1-415. Radio receiver R-511/ARC (13, figure 3.1-20) is a six tube superheterodyne, continuously tunable from 190 to 550 kilocycles. Mounted at the rear of the receiver is the dynamotor (15, figure 3.1-20). Circuits between the dynamotor and the receiver are completed by mating connectors on the base of the dynamotor and the receiver chassis. All other connections are made to the receiver on the front panel. The receiver is remotely controlled by the radio set control. The receiver is located on the floor aft of the rear seat.

3.1-416. RADIO SET CONTROL C-1117/ARC. Aircraft ▲1 and ▲3.

3.1-417. Radio set control C-1117/ARC (6, figure 3.1-20) is designed for remote control of the receiver. The frequency dial (2, figure 3.1-6), is calibrated in megacycles. The tuning crank (3, figure 3.1-6) turns the frequency dial and also operates a mechanical linkage that is connected to the receiver. As the frequency dial is turned, the receiver is tuned to the frequency indicated by the dial. An antenna selector lever (1, figure 3.1-6) is provided on the control unit for selection of either the wire or loop antenna. Refer to paragraph 3.1-95, for additional information of the radio set control.

3.1-418. RADIO SET CONTROL C-1113/ARC. Aircraft ▲1 and ▲3.

3.1-419. Radio set control C-1113/ARC (7, figure 3.1-20) provides for remote control of the orientation of the loop antenna through the use of a crank (2, figure 3.1-21) and an indicator (1, figure 3.1-21). The indicator is calibrated to indicate rotation of the loop antenna from zero to 360 degrees.

3.1-420. RADIO SET CONTROL C-1342/ARN. Aircraft ▲1 ▲2 ▲3 ▲4 ▲5.

3.1-421. Radio set control C-1342/ARN (5, figure 3.1-20) is an edge-lighted panel, console-mounted component designed to control the receiver and the loop antenna. The control consists of a tuning crank (7, figure 3.1-22) for tuning the receiver to the desired frequency, a volume control (6, figure 3.1-22) to control the application of power and to adjust the receiver audio level, a antenna selector switch (1, figure 3.1-22) for selecting either the wire antenna or the loop antenna

for reception, and a loop position crank (5, figure 3.1-22) for controlling the orientation of the loop antenna, as indicated on the loop position indicator (4, figure 3.1-22). Edge-lighting is provided by three midget flange base lamps (3, figure 3.1-22) and are controlled by the aircraft panel edge light rheostat switch. Electrical and mechanical connections are made at the rear of the control.

3.1-422. LOOP ANTENNA ARC TYPE L-10.

3.1-423. Loop antenna ARC Type L-10 (1, figure 3.1-20) is a nine-inch diameter rotating antenna, remotely controlled. The antenna located on top of the fuselage, forward of the fin is used for aural direction-finding or homing reception. The greasebox and antenna cable receptacle are located in a box at the base of the antenna.

3.1-424. WIRE ANTENNA.

3.1-425. The wire antenna (2, figure 3.1-20) is provided for radio range reception. The antenna is strung between the fin and cabin top. A leadin wire enters the fuselage just aft of the rear window.

3.1-426. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-427. ELECTRICAL EQUIPMENT RACK MT-1140/ARC.

3.1-428. Electrical equipment rack MT-1140/ARC (14, figure 3.1-20) is a shockproof and vibration-proof mounting. The equipment rack is used for mounting of the receiver. The receiver is secured by snapslides that engage grooved studs on the equipment rack. Copper strips on the underside ground the equipment rack.

3.1-429. RADIO CONTROL SELECTOR UNIT ARC TYPE C-47. Aircraft ▲1 that are instrument trainers.

3.1-430. Radio Control Selector Unit ARC Type C-47 (9, figure 3.1-6) is described in paragraph 3.1-112.

3.1-431. RELAY UNIT ARC TYPE K-12. Aircraft ▲1 that are instrument trainers and ▲5.

3.1-432. Relay unit ARC Type K-12 (12, figure 3.1-20) is described in paragraph 3.1-114.

3.1-433. RELAY UNIT ARC TYPE K-17. Aircraft ▲5.

3.1-434. Relay unit ARC Type K-17 (11, figure 3.1-20) transfers the operation of the receiver between the front and rear compartment. One set of contacts transfers the switching between the wire antenna and the loop antenna, and the other contacts transfer the volume control.

3.1-435. JUNCTION BOX ARC TYPE J-13. Aircraft ▲1 and ▲3.

3.1-436. Junction box ARC Type J-13 (10, figure 3.1-20) is described in paragraph 3.1-124.

3.1-437. JUNCTION BOX ARC TYPE J-15B. Aircraft ▲2 ▲4 ▲5.

3.1-438. Junction box ARC Type J-15B (10, figure 3.1-20) is described in paragraph 3.1-126.

3.1-439. JACK BOX ARC TYPE J-10. Aircraft ▲1 ▲2 ▲3 ▲4.

3.1-440. Jack box ARC Type J-10 (3, 8, figure 3.1-20) is described in paragraph 3.1-38.

3.1-441. HEADSET-MICROPHONE H-101/U. Aircraft ▲1 ▲2 ▲3 ▲4.

3.1-442. Headset-microphone H-101/U (4, 9, figure 3.1-20) is described in paragraph 3.1-40.

3.1-443. HEADSET-MICROPHONE H-46A/UR. Aircraft ▲5.

3.1-444. Headset-microphone H-46A/UR (4, 9, figure 3.1-20) is described in paragraph 3.1-42.

3.1-445. DIFFERENCES IN MODELS.

3.1-446. Refer to figure 3.1-30 for differences between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

3.1-447. OPERATING CONTROLS AND USE.

3.1-448. RADIO SET CONTROL C-1117/ARC.

3.1-449. RANGE VOLUME CONTROL KNOB.

3.1-450. The range volume control knob (4, figure 3.1-6) labeled VOL, control the audio level of the receiver and also turns the set on and off.

3.1-451. ANTENNA SELECTOR LEVER.

3.1-452. The antenna selector lever (1, figure 3.1-6) labeled RANGE with positions ANT and LOOP, permits the selection of either the wire or loop antenna, depending on mode of operation desired. The selector lever when placed in the ANT position, connects the wire antenna to the receiver for normal radio range reception. When the selector lever is positioned to LOOP, the wire antenna is disconnected and the loop antenna is connected to the receiver for homing or direction finding.

3.1-453. RANGE TUNING CRANK.

3.1-454. The range tuning crank (3, figure 3.1-6) turns the frequency dial (2, figure 3.1-6) and also operates a mechanical linkage that is connected to the receiver which permits the receiver to be tuned to any desired frequency as indicated on the frequency dial.

3.1-455. CONTROL UNIT ARC TYPE C-1113/ARC. Aircraft ▲1 and ▲3.

3.1-456. LOOP POSITION CRANK.

3.1-457. The loop position crank (2, figure 3.1-21), turns the loop position indicator (1, figure 3.1-21) and also operates a mechanical linkage that is connected to

the loop antenna, which controls the rotation of the antenna. The position of the antenna is indicated on the position indicator, which is calibrated for 360 degrees of rotation in 10 degrees increments.

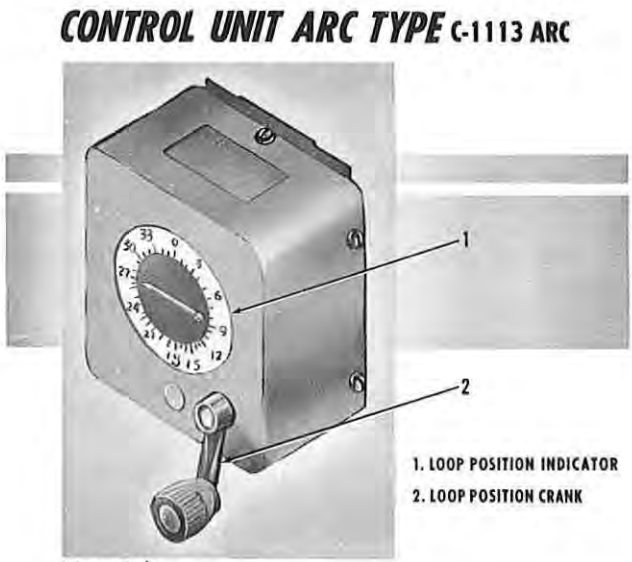


Figure 3.1-21

3.1-458. RADIO CONTROL SET C-1342/ARN.

3.1-459. VOLUME CONTROL KNOB.

3.1-460. The volume control knob (6, figure 3.1-22) labeled SENS - OFF, controls the audio level of the receiver and also turns the set on and off.

3.1-461. ANTENNA SELECTOR SWITCH.

3.1-462. The antenna selector switch (1, figure 3.1-22) with positions ANT and LOOP, permits the selection of either the wire or loop antenna, depending on the mode of operation desired. The selector switch when placed in the ANT position connects the wire antenna to the receiver for normal radio range reception. When the selector switch is positioned to LOOP, the wire antenna is disconnected and the loop antenna is connected to the receiver for homing or direction-finding.

3.1-463. TUNING CRANK.

3.1-464. The tuning crank (7, figure 3.1-22) turns the frequency dial (2, figure 3.1-22) and also operates a mechanical linkage that is connected to the receiver which permits the receiver to be tuned to any desired frequency as indicated on the frequency dial.

3.1-465. LOOP POSITION CRANK.

3.1-466. The loop position crank (5, figure 3.1-22) turns the loop position indicator (4, figure 3.1-22) and also operates a mechanical linkage that is connected to the loop antenna, which controls the rotation of the antenna. The position of the antenna is indicated on the position indicator which is calibrated for 360 degrees of rotation in 10 degree increments.

3.1-467. RADIO CONTROL SWITCH. Aircraft ▲ that are instrument trainers.

3.1-468. Refer to paragraph 3.1-147, "Radio Control Switch".

3.1-469. RADIO CONTROL SWITCH. Aircraft ▲

3.1-470. Refer to paragraph 3.1-149, "Radio Control Switch".

Control	Function
Volume Control Knob	Controls the volume of signal heard in the headset. Includes a switch for turning the radio set on and off.
Antenna Selector Switch . . .	Permits the selection of either the wire or loop antenna, depending on mode of operation desired.
Tuning Crank . .	Tunes receiver and turns the frequency dial to indicate receiver frequency.
Loop Position Crank. . . .	Turns loop antenna and turns loop position indicator to indicate position of antenna.
PUSH FOR CONTROL Switch ▲ or COMM Switch ▲ .	Transfers operation of the receiver set between the front and rear control set. An indicator light in each compartment shows which radio control set has control of the receiver set.

3.1-471. TYPES OF OPERATION FACILITIES.

3.1-472. Refer to figure 3.1-30 for operating facilities.

3.1-473. OPERATING INSTRUCTIONS.

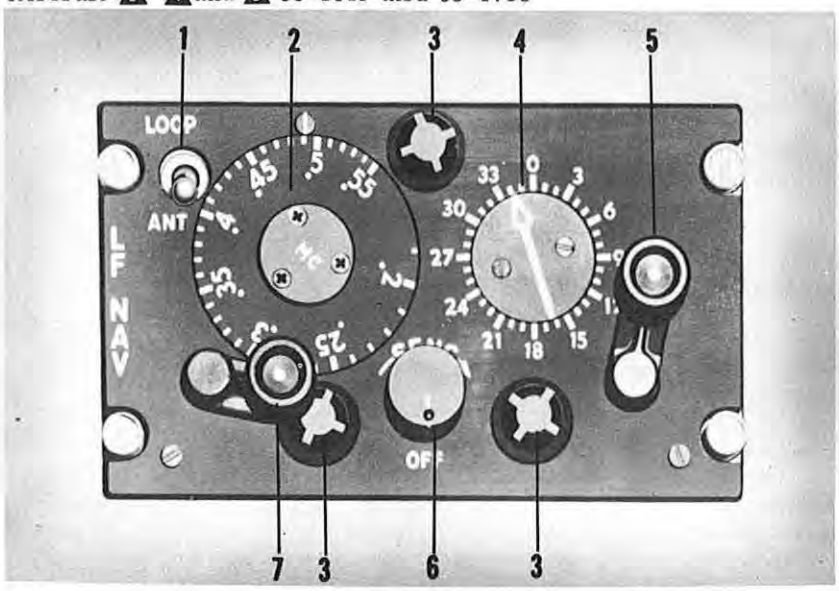
3.1-474. The following paragraphs describe the operating instructions for various modes of operation. The receiver set can be used for voice reception on all frequencies covered by the receiver.

3.1-475. OPERATION AS LF COMMUNICATION RECEIVER.

1. Volume control knob - Full clockwise. Allow approximately a three minute warmup period.
2. Antenna selector switch - ANT position.
3. Tuning crank - Tune receiver to desired frequency as indicated on the frequency dial.
4. Volume control knob - Reduce signal to a comfortable listening level and wait for station identification.
5. Tuning crank - Slightly clockwise from the position corresponding to optimum range reception to receive

RADIO SET CONTROL C-1342/ARN

Aircraft ▲1 EQUIPPED WITH AN/ARC 60 RADIO except instrument trainers.
Aircraft ▲3
Aircraft ▲2 ▲4 and ▲5 55-4649 thru 55-4748



1. Antenna Selector Switch
2. Frequency Dial
3. Panel Light
4. Loop Position Indicator
5. Loop Position Crank
6. Volume Control Knob
7. Tuning Crank

Figure 3.1-22

voice signals from a station which is simultaneously transmitting range signals. This operation eliminates the requirement for a range filter.

6. Volume control knob - Full counterclockwise to turn receiver set off.

3.1-476. OPERATION AS MANUAL LOOP RECEIVER.

1. Volume control knob - Full clockwise. Allow approximately a three minute warmup period.
2. Antenna selector switch - LOOP position.
3. Loop position crank - Rotate as required to receive a null from the station desired (Note the position of the loop position indicator).
4. To turn off the receiver set, turn the volume control knob full counterclockwise.

Note

Enter any equipment malfunction or failure in flight report.

3.1-477. DUAL OPERATING CONTROL. Aircraft ▲1 instrument trainers and ▲5.

3.1-478. Refer to paragraph 3.1-147 and 3.1-149. "Radio Control Switch".

3.1-479. EMERGENCY OPERATION.

3.1-480. If generator failure occurs during flight radio operation will be limited to the life of the battery, therefore radio operation should be limited to conserve the battery. Other than the above, there are no other emergency operation.

3.1-481. PREFLIGHT INSPECTION.

3.1-482. The following paragraphs describe the operational procedures performed on the low frequency navigation and receiver set ARC Type 12 equipment at the time indicated in Section II, Normal Procedures.

3.1-483. POWER OFF INSPECTION.

3.1-484. EXTERIOR INSPECTION.

3.1-485. The following check is an extension to the Exterior Inspection in Section II.

1. Wire antenna - Check for secure antenna mounting and check leadin wire.
2. Loop antenna - Check for secure antenna mounting and check for free rotation by turning loop antenna crank.

3.1-486. INTERIOR INSPECTION.

1. Radio receiver - Check for secure plug and wire connections. Check and hand tighten plug connector rings and mechanical linkage nut.
2. Junction box - Check that all wire connections and terminal nuts are secure.

3. Radio control unit - Check to see that all plugs are secure. Hand tighten plug connector rings and mechanical linkage nuts.
4. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-487. POWER ON.

Note

When an auxiliary power unit is used to start the engine the operational check as listed below, will be performed while the auxiliary power unit is connected to the aircraft prior to starting the engine. If an auxiliary power unit is not available, the operational checks will be performed during engine warmup.

1. Volume control knob - Turn maximum clockwise. Dynamotor should start running and noise should be heard in headset.
2. Antenna selector switch - To ANT or LOOP position, depending on type of reception desired.
3. Volume control knob (if operation as LF communication receiver is desired) - Reduce signal to comfortable listening level and wait for station identification.
4. Loop position crank (if operation as manual loop receiver is desired) - Rotate as required to receive a null from the station desired. (Note the position of the loop position indicator.)

3.1-488. POST FLIGHT CHECK.

1. Volume control knob - Turn maximum counterclockwise to turn receiver set off.
2. All discrepancies noted on Form DA-781-1 and the crew chief should be notified.

3.1-489. DIRECTION FINDERS RECEIVER SET AN/ARN-59. Aircraft ▲ 57-2772 and on.

3.1-490. PURPOSE AND USE.

3.1-491. Direction finder receiver set AN/ARN-59 is an airborne radio compass system designed to provide automatically, a visual indication of the direction from which an incoming radio - frequency (RF) signal is received. It provides for aural reception of amplitude modulated signals in the 190 to 1750 kilocycle frequency range. It may also be used for aircraft homing and position fixing.

3.1-492. TECHNICAL CHARACTERISTICS.

Frequency range:	
Band 1	190 to 400 kilocycle
Band 2	400 to 840 kilocycle
Band 3	840 to 1750 kilocycle
Band switching	Electrical
Tuning	Remote-controlled by control unit with interconnecting mechanical linkage.
Type of modulation	Amplitude
Sensitivity of receiver with function switch in:	
ANT position:	
Mcw	4 to 10 uv in series with 50-micro-micro-farad capacitance through 100 micro-micro-farad cable with 6 db signal plus noise-to-noise output ratio.
Cw	2 to 6 uv in series with 50-micro-micro-farad capacitance through 100 micro-micro-farad cable with 10 db signal plus noise-to-noise output ratio.
LOOP position:	
Mcw	50-200 uv/meter for 6 db signal plus noise-to-noise ratio at max signal pick-up of loop antenna.
Cw	20 to 100 uv/meter for 10 db signal plus noise-to-noise ratio at max signal pick-up of loop antenna.
COMP position	10 to 25 mv/meter for maximum 2° error, and ±2° jitter.
Image rejection:	
At 190 kilocycles	over 110 db.
At 379 kilocycles	over 100 db.
At 1750 kilocycles	over 70 db.
Intermediate-frequency rejection:	
At 190 kilocycles	over 85 db.
At 1750 kilocycles	over 100 db.
Bandwidth (measured with 30 percent modulation at 400 cps).	
At 6 db	1.6 to 2.8 kilocycles at resonance between 190 and 1750 kilocycles.
At 60 db	4.2 to 8.5 kilocycles at resonance between 190 and 1750 kilocycles.
Audio-frequency output	300 mw into 300 ohms.
Power required	2.8 amperes.

3.1-493. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common name
Direction Finder Receiver Set AN/ARN-59	Direction finder set
Antenna AT-780/ARN	Loop antenna
Azimuth Indicator ID-637/ARN	Indicator
Dynamotor DY-150/ARN	Dynamotor
Mounting MT-1912/ARN	Receiver mounting
Mounting MT-1913/ARN	Dynamotor mounting
Radio Receiver R-836/ARN	Receiver
Radio Set Control C-2275/ARN	Control unit
Sense Antenna	Sense antenna

3.1-494. COMPONENTS OF DIRECTION FINDER RECEIVER SET AN/ARN-59.

3.1-495. Refer to figure 3.1-24 for location of the

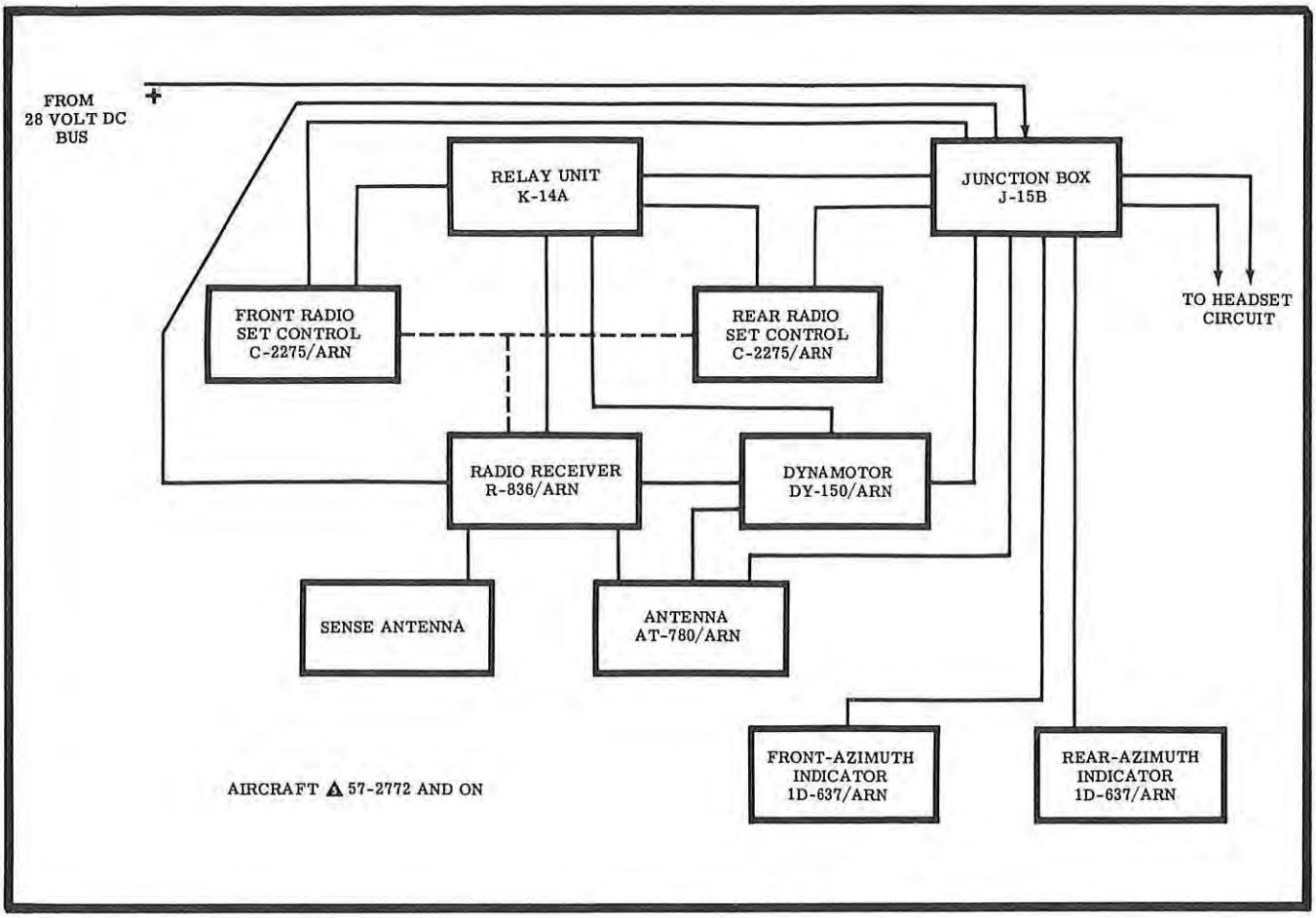


Figure 3.1-23. Direction Finder Receiver Set AN/ARN-59 Block Diagram

direction finder receiver set AN/ARN-59 components within the aircraft.

Quantity	Items
1	Antenna AT-780/ARN
2	Azimuth Indicator ID-637/ARN
1	Dynamotor DY-150/ARN
1	Mounting MT-1912/ARN
1	Mounting MT-1913/ARN
1	Radio Receiver R-836/ARN
2	Radio Set Control C-2275/ARN
1	Sense Antenna
1	Relay Unit ARC Type K-14B

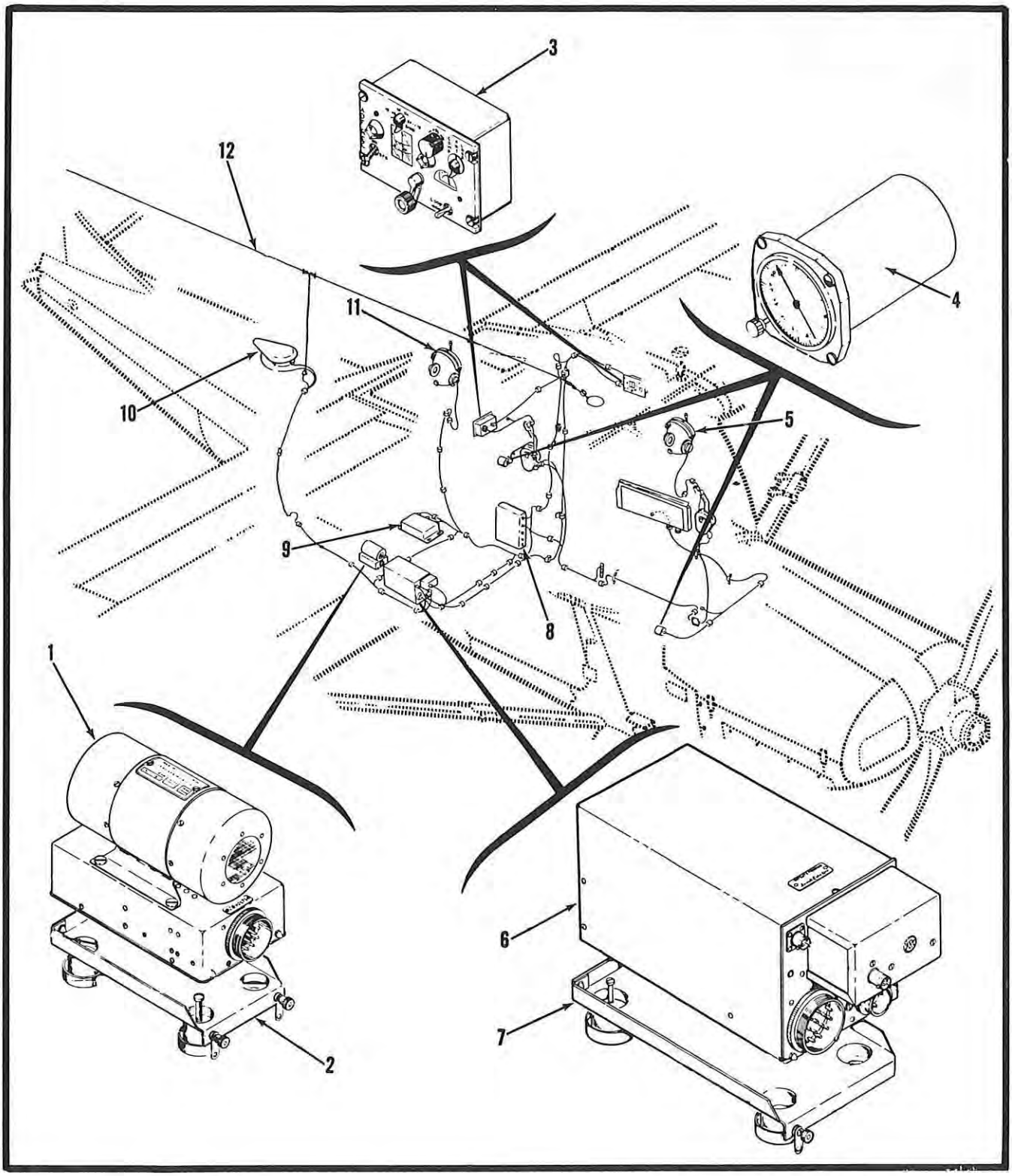
3.1-496. DESCRIPTION OF DIRECTION FINDER RECEIVER SET AN/ARN-59.

3.1-497. Direction finder receiver set AN/ARN-59 contains a low frequency receiver which is continuously tunable in the frequency range of 190 to 1750 kilocycles; it is mechanically tuned by a tuning crank on the radio set controls. The receiver may be operated as a low frequency receiver; an automatic direction finder or a non-automatic direction finder. The pointer of the azimuth indicator shows the relative, magnetic, or true bearing of the transmitting station with respect to the heading of the aircraft, depending on the position of the azimuth scale with relation to the heading index, as set by the east, west variation knob. The beat frequency oscillator in the receiver permits identification of keyed continuous wave (CW) stations and may be used to obtain improved indications of an aural null during loop-only operation. Power for the complete equipment is obtained from the dynamotor which receives its power from the aircraft power supply.

3.1-498. DESCRIPTION OF MAJOR COMPONENTS.

3.1-499. RADIO RECEIVER R-836/ARN.

3.1-500. Radio receiver R-836/ARN (6, figure 3.1-24), located under the rear seat, is a three-band superheterodyne receiver covering the frequency range of 190 to 1750 kilocycles. The desired band is selected through remote control of a band-switching motor operated by a switch located on the control units. Remote tuning of the receiver is accomplished through a flexible mechanical linkage that interconnects the receiver and control units. For automatic direction finding, the receiver uses both the sense and loop antenna. For other functions, the receiver uses either antenna alone. Identification of keyed continuous wave stations is accomplished by use of a beat frequency oscillator (BFO) which is included in the receiver. High voltage required for operation of the receiver is obtained from the dynamotor. All electrical and mechanical connections to the receiver are made through receptacles on the front panel.



1. Dynamotor DY-150/ARN
2. Mounting MT-1913/ARN
3. Radio Set Controls C-2275/ARN
4. Azimuth Indicator ID-637/ARN
5. Front Headset-Microphone H-46A/UR
6. Radio Receiver R-836/ARN
7. Mounting MT-1912/ARN
8. Junction Box ARC Type J-15B
9. Relay Unit ARC Type K-14A
10. Antenna AT-780/ARN
11. Rear Headset-Microphone H-46A/UR
12. Sense Antenna

Figure 3.1-24. Direction Finder Receiver Set AN/ARN-59, Major, Minor and Installation Items Location Diagram

3.1-501. RADIO SET CONTROL C-2275/ARN.

3.1-502. Radio set control C-2275/ARN (3, figure 3.1-24) is an edge lighted plastic panel, console-type control assembly. It includes a tuning crank, a tuning meter, a primary power on-off switch and volume control, a band selector switch, a function selector switch, a switch for controlling loop rotation, and a beat frequency oscillator switch. The two panel edge lights (1, figure 3.1-25) located on the panel, are covered by red translucent plastic covers and are controlled by the aircraft panel edge light rheostat switch. All external connections are made at the rear of the panel. The front panel is located on the left root rib and the rear panel is located on the upper right hand corner of the rear instrument panel.

3.1-503. DYNAMOTOR DY-150/ARN.

3.1-504. Dynamotor DY-150/ARN (1, figure 3.1-24) supplies power to operate the receiver, receiver loop motor and loop synchro system. The dynamotor is a separately housed unit located aft of the rear seat, with all input and output connections made through a single connector mounted on the base.

3.1-505. AZIMUTH INDICATOR ID-637/ARN.

3.1-506. The azimuth indicator ID-637/ARN (4, figure 3.1-24) is a hermetically sealed, synchro-drive instrument. The indicator pointer shows the angular position of the synchro transmitter in the loop, which is the bearing of the incoming signal relative to the aircraft heading. The indicator is indexed every 45 degrees near the rim of the azimuth scale, with an oversize index mark at the zero degree (heading) position. The azimuth scale of the indicator is graduated every two degrees with major graduation lines every 10 degrees and with every 30 degrees graduation indicated by a numeral. The scale may be positioned manually by rotating the east-west variation knob, labeled (VAR) on the front of the indicator. The index marks, azimuth scale numerals, 10 degree graduation lines, and pointer are coated with green phosphorescent material. An indicator is located on both the front and rear instrument panel.

3.1-507. ANTENNA. AT-780/ARN.

3.1-508. Antenna AT-780/ARN (10, figure 3.1-24), located on top of the fuselage, is a hermetically sealed unit consisting of a loop antenna, a two-phase drive motor, a synchro transmitter, and an adjustable compensating mechanism. The compensating mechanism, corrects for bearing errors caused by the aircraft structure. The antenna portion of the loop is a coil of several widely spaced turns of wire wound on a flat ferrite core. The loop antenna is driven by a miniature, two-phase induction motor; its relative bearing is synchro-transmitted to the azimuth indicator. The loop housing is fabricated of anti-precipitation static material to increase loop effectiveness.

3.1-509. SENSE ANTENNA.

3.1-510. The sense antenna (12, figure 3.1-24) is provided for low-frequency range reception and when used in conjunction with the loop antenna, the receiver set functions as an automatic direction finder. The antenna is strung between the fin and cabin top. A lead in wire enters the fuselage just aft of the rear window.

3.1-511. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-512. MOUNTING MT-1913/ARN.

3.1-513. Mounting MT-1913/ARN (2, figure 3.1-24) is a shockproof, vibration-mount type and is used to mount the dynamotor. The mounting has two knurled thumb nuts and two links to engage two conical studs on the receiver. Two flexible grounding straps are located on the underside of the mounting.

3.1-514. MOUNTING MT-1912/ARN.

3.1-515. Mounting MT-1912/ARN (7, figure 3.1-24) is a shockproof, vibration-mount type and is used to mount the receiver. The mounting has two knurled thumb nuts and two links to engage two conical studs on the receiver. Two flexible grounding straps are located on the underside of the mounting.

3.1-516. RELAY UNIT ARC TYPE K-14A.

3.1-517. Relay unit ARC Type K-14A (9, figure 3.1-24) is described in paragraph 3.1-239.

3.1-518. JUNCTION BOX ARC TYPE J-15B.

3.1-519. Junction box ARC Type J-15B (8, figure 3.1-24) is described in paragraph 3.1-36.

3.1-520. HEADSET-MICROPHONE H-46A/UR.

3.1-521. Headset-microphone H-46A/UR (11, 5, figure 3.1-24) is described in paragraph 3.1-42.

3.1-522. DIFFERENCE IN MODELS.

3.1-523. Refer to figure 3.1-30 for differences between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

3.1-524. OPERATING CONTROLS AND USE.

3.1-525. RADIO SET CONTROL C-2275/ARN.

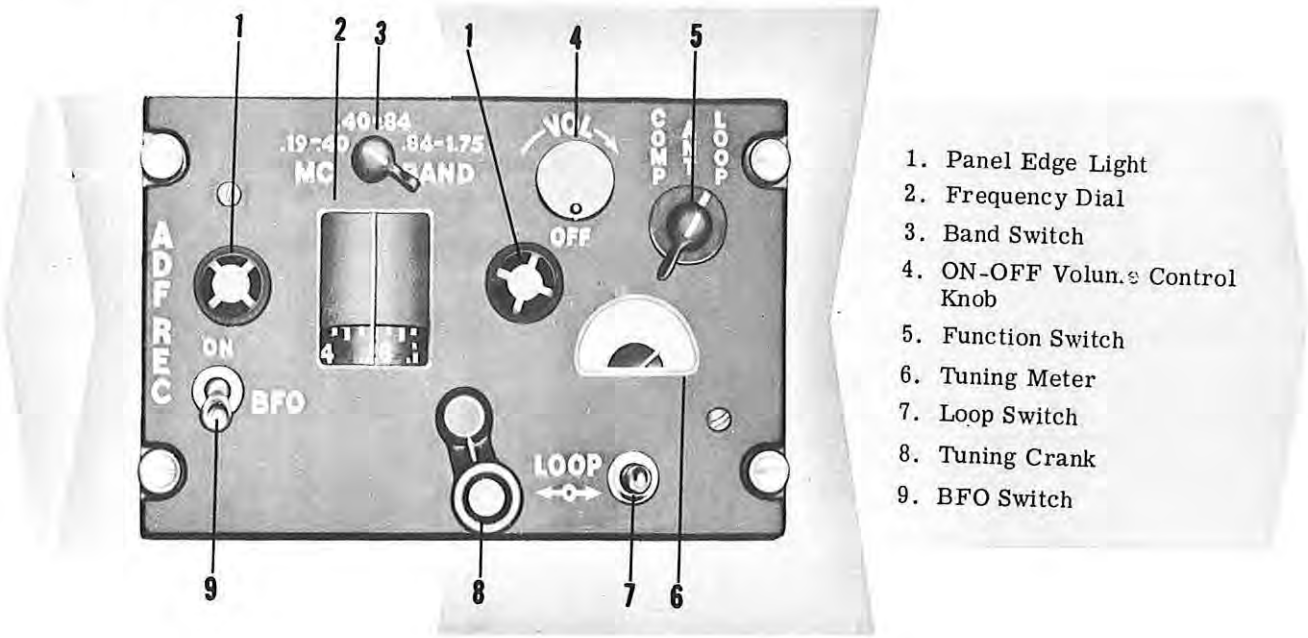
3.1-526. VOLUME CONTROL KNOB.

3.1-527. A volume control knob (4, figure 3.1-25) labeled VOL and OFF turns the radio receiver set on and off. Adjust receiver audio level when function switch is in COMP position. Adjust receiver RF sensitivity when function switch is in ANT or LOOP position.

3.1-528. BAND SWITCH.

3.1-529. The band switch (3, figure 3.1-25) labeled MC BAND, actuates a mashing drum which surrounds the frequency dial drum allowing only the desired frequency band to be visible.

RADIO SET CONTROL C-2275/ARN



1. Panel Edge Light
2. Frequency Dial
3. Band Switch
4. ON-OFF Volume Control Knob
5. Function Switch
6. Tuning Meter
7. Loop Switch
8. Tuning Crank
9. BFO Switch

Figure 3.1-25

3.1-530. TUNING CRANK.

3.1-531. The tuning crank (8, figure 3.1-25), tunes the receiver to the frequency of the received signal. Low frequency radio range stations may be received on the 190 to 400 kilocycle band. Commercial broadcast stations may be received on the two higher bands.

3.1-532. TUNING METER.

3.1-533. To facilitate accurate tuning of the receiver the tuning meter (6, figure 3.1-25), provides a visual indication of the accuracy of the tuning. A signal is properly tuned in when the meter indicates the furthest clockwise deflections.

3.1-534. FUNCTION SWITCH.

3.1-535. The function switch (5, figure 3.1-25), labeled COMP-ANT-LOOP, is a three-position rotary switch. With the switch in COMP position, both the loop and sense antenna are used and the radio set functions as a radio compass. When the switch is in the ANT position, only the sense antenna is used and the receiver functions as a low-frequency range receiver. The LOOP position of the switch is used when it is desired to use only the loop antenna for reception. This position permits the receiver set to be used as a manual direction finder, or allows the loop antenna to be used instead of the sense antenna for radio range reception during heavy static conditions.

3.1-536. LOOP SWITCH.

3.1-537. The loop switch (7, figure 3.1-25), labeled LOOP is used to electrically position the loop antenna when the function switch is in the LOOP position. When the function switch is in the COMP position, the loop switch is used to determine whether the indicator reading is produced by a reliable signal. The loop switch is a spring-loaded, double-throw, center-off toggle switch. When actuated, a test voltage is applied to the loop amplifier of the receiver to drive the loop in the direction in which the switch is held (left or right). This test voltage override the signal circuit, so that when the loop switch is held to the left or right, the loop and azimuth indicator pointer are rotated independent of the received signal. To check whether the indicator reading is reliable, the loop switch is held in either position to rotate the loop antenna away from its original bearing. When the loop switch is released, the loop antenna and azimuth indicator pointer will return to their original position if the receiver signal is adequate and the indicator reading reliable. The test assures the operator that the automatic direction finder is operating properly, and that the received signal is strong enough to duplicate the indicator reading whether approach from a clockwise or counterclockwise direction.

3.1-538. BEAT FREQUENCY OSCILLATOR SWITCH.

3.1-539. The beat frequency oscillator switch (9, figure 3.1-25) is labeled BFO and controls the operation of the beat frequency oscillator in the receiver. When the switch is in the ON position, it places the beat frequency oscillator in operation to permit identification of keyed continuous stations. With the switch in the OFF position, power is received from the oscillator and only voice or tone-modulated signals may be identified.

AZIMUTH INDICATOR ID-637 ARN

Figure 3.1-26

3.1-540. AZIMUTH INDICATOR ID-637/ARN. See figure 3.1-26.

3.1-541. EAST-WEST VARIATION KNOB.

3.1-542. The east-west variation knob, labeled E-W, VAR is located on the lower left hand corner of the azimuth indicator. The knob rotates the azimuth scale so that zero (heading index) on the scale is in the direction of the desired heading. Also compensates for east-west variation.

3.1-543. RADIO CONTROL SWITCH.

3.1-544. A radio control switch (43, figure 1-7; 17, figure 1-8) labeled NAV, is located on the front and rear instrument panel. The switches transfer operation of the radio set between the front and rear radio control unit. An indicator light is located within each switch, and designates whether the front or rear occupant has control of the radio set. Operation of the receiver set may be obtained by the front or rear occupant by pressing the radio control switch.

Note

Control of the receiver set always reverts to the front control unit when the battery switch is turned OFF and then ON. The rear control unit will become operative again only after the radio control switch is pressed.

Component	Control	Function
Radio Set Control C-2275/ARN	Band Switch	Selects the desired frequency band.
	Volume Control Knob .	Turns direction finder receiver set on and off. Adjust receiver audio level when function switch is in COMP position. Adjust receiver RF sensitivity when function switch is in ANT or LOOP position.
	Function Switch .	COMP position - Receiver operates on combined loop and sense antenna as a radio compass. ANT position - Receiver operates with loop antenna. LOOP position - Receiver operates with loop antenna.
	Loop Switch .	Positions the loop antenna when function switch is in either COMP or LOOP position.
	Tuning Crank .	Tunes the receiver to the frequency of the received signal.
	Tuning Meter .	Facilitates accurate tuning of the receiver.
	Beat Frequency Oscillator Switch .	Turn beat frequency oscillator on or off.
Azimuth Indicator ID-637/AR	East-West Variation Knob .	Rotates the azimuth scale so that zero (reading index) on the scale is in the direction of the desired heading. Also, compensates for east-west variation.

3.1-545. TYPE OF OPERATION FACILITIES.

3.1-546. Refer to figure 3.1-30 for operating facilities.

3.1-547. OPERATING INSTRUCTIONS.

3.1-548. The following paragraphs describe the operating instructions for various modes of operation. The receiver set can be used for audio reception on all frequencies covered by the receiver.

3.1-549. OPERATION AS AUTOMATIC DIRECTION FINDER.

1. Volume control knob - Full clockwise to turn equipment on and allow approximately 30 seconds for equipment to warmup.
2. Radio control switch - Press for control.
3. Band switch - Switch to the desired frequency band.
4. Function switch - COMP position.

5. Tuning crank - Turn to desired frequency and slowly tune for a maximum indication on the tuning meter.
6. Volume control knob - Reduce volume by turning knob counterclockwise until the desired audio level is obtained.
7. Check for station identification to be sure that the desired station is received. If the signal strength is too weak for easy identification when the function switch is at COMP, temporarily switch to ANT to increase the signal to noise ratio and permit a more accurate station identification.
8. To find whether the relative bearing obtained on the indicator is accurate when the function switch is at COMP, move the loop switch to the right and observe that the pointer rotates clockwise. After the pointer has traveled 10 to 20 degrees, release the switch and note the action of the indicator pointer. If the operation is normal and a reliable signal is being received, the pointer will immediately return to the original reading automatically. This procedure can be repeated by moving the loop switch to the left, in which case the pointer will rotate counterclockwise.
9. Volume control knob - Full counterclockwise to turn receiver set off.

3.1-550. OPERATION AS LOW-FREQUENCY RECEIVER.

1. Volume control knob - Full clockwise to turn equipment on and allow approximately 30 seconds for equipment to warmup.
2. Radio control switch - Press for control.
3. Band switch - Switch to the desired frequency band.
4. Function switch - ANT position.
5. Tuning crank - Turn to desired frequency and slowly tune for a maximum indication on the tuning meter.
6. Volume control knob - Reduce volume by turning knob counterclockwise until the desired audio level is obtained.
7. Volume control knob - Full counterclockwise to turn receiver set off.

3.1-551. OPERATION AS NON-AUTOMATIC DIRECTION FINDER.

1. Volume control knob - Full clockwise to turn equipment on and allow approximately 30 seconds for equipment warmup.
2. Radio control switch - Press for control.
3. Band switch - Switch to the desired frequency band.
4. Function switch - LOOP position.
5. Tuning crank - Turn to desired frequency and slowly tune for a maximum indication on the tuning meter.
6. Volume control - Reduce volume by turning knob counterclockwise until the desired audio level is obtained.
7. Loop switch - Rotate indicator needle to desired bearing.
8. Volume control knob - Full counterclockwise to turn receiver set off.

Note

Enter any equipment malfunction or failure in flight report.

3.1-552. BEAT FREQUENCY OSCILLATOR OPERATION.

3.1-553. The beat frequency oscillator (BFO) permits identifying continuous wave (CW) transmission that is frequently used in the 200 to 1700 kilocycles band in areas outside of the United States. The bfo is also used as an aid in the determination of aural nulls, with the function switch in the LOOP position.

3.1-554. LOOP OPERATION WITH BFO.

3.1-555. Turn beat frequency oscillator switch ON. With unmodulated, or voice-modulated signals, the bfo can be used to produce a steady beat not with the frequency being received. When the loop is rotated, the received signal will change in amplitude, going sharply to zero at each loop null thereby giving accurate determination of the angular positions of the nulls. In this application, with the function switch at LOOP, tune the receiver to get an audio beat signal with the desired received signal, with the dial turned toward the lower frequency end of the zero beat position. Then press the loop switch and rotate the loop until the tone drops to minimum, and read the relative bearing of the transmitting station on the azimuth indicator.

Note

The bfo may be used as a tuning aid with the function switch in the LOOP or ANT position, but the tuning meter should always be used when tuning in the COMP position.

3.1-556. DUAL OPERATING CONTROL.

3.1-557. Refer to paragraph 3.1-543, "Radio control switch".

3.1-558. EMERGENCY OPERATION.

3.1-559. If generator failure occurs during flight, radio operation will be limited to the life of the battery, therefore radio operation should be limited to conserve the battery. Other than the above there are no other emergency operations.

3.1-560. PREFLIGHT INSPECTION.

3.1-561. The following paragraphs describe the operational procedures performed on direction finder receiver set AN/ARN-59 at the time indicated in Section II, Normal Procedures.

3.1-562. POWER OFF INSPECTION.

3.1-563. EXTERIOR INSPECTION.

1. Sense antenna - Check for secure antenna mounting and check leadin wire.
2. Loop antenna - Check for secure antenna cover.

3.1-564. INTERIOR CHECK.

1. Radio receiver - Check for secure plug and wire

connections. Check and tighten plug connector rings and mechanical linkage nuts.

2. Dynamotor - Check for secure plug connection. Check and hand tighten plug connector ring.

3. Radio control units - Check to see that all plugs are secure. Hand tighten plug connector rings and mechanical linkage nut.

4. Junction box - Check that all wire connections and terminal nuts are secure.

5. Relay unit - Check that all plugs are secure. Hand tighten plug connector rings.

6. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-565. POWER ON.

Note

When an auxiliary power unit is used to start the engine, the operational check as listed below, will be performed while the auxiliary power unit is connected to the aircraft prior to starting the engine. If an auxiliary power unit is not available, the operational checks will be performed during engine warmup.

1. Volume control knob - Turn full clockwise, dynamotor should begin running.

2. Tuning crank - Tune receiver to desired frequency within the band selected. A maximum indication should be given on the tuning meter at the received signal frequency.

3. Beat frequency oscillator switch - ON, a heterodyne beat note should be obtained.

4. Function switch in LOOP position and loop switch positioned to right, then to left - A aural null should be obtained when the loop antenna is in direction of received station, and azimuth indicator pointer should move in proportion with the loop antenna.

5. Function switch - ANT position, audio signals should be heard on all bands.

6. With function switch in the COMP position and tuned to a signal and the loop switch positioned to the right, the azimuth indicator pointer should turn clockwise, When loop switch is released azimuth indicator pointer should turn counterclockwise to original position.

3.1-566. POST FLIGHT CHECK.

1. Volume control knob - Turn maximum counterclockwise to turn receiver set off.

2. All discrepancies noted on Form DA-781-1 and the crew chief should be notified.

3.1-567. DIRECTION FINDER RECEIVER SET AN/ARN-42. Aircraft ▲ 55-4649 thru 55-4748.

3.1-568. PURPOSE AND USE.

3.1-569. Direction finder receiver set AN/ARN-42 is a combination communication receiver and automatic direction finder. It operates in the range of 190 through 1725 kilocycles covered in three bands. It is primarily a navigational device, locating the direction from which radio signals are received in order to give the operator a bearing, which is displayed in degrees of azimuth on the azimuth indicators. It may be used for both aircraft homing and position fixing, using any type of transmitted radio signal in its frequency range, whether modulated or unmodulated. When used as a communications receiver it is capable of receiving amplitude modulated and unmodulated radio signals in its frequency range. The equipment can also be used to receive radio range signals.

3.1-570. TECHNICAL CHARACTERISTICS.

Frequency range:	
Band 1	190 to 430 kilocycles
Band 2	480 to 1025 kilocycles
Band 3	1025 to 1725 kilocycles
Intermediate frequency	465 kilocycles
Audio output impedance	3.2 ohms
Type of reception:	
Communications receiver	Telegraph and voice
Automatic direction finder	Telegraph and voice
Power required	3.7 amperes

3.1-571. NOMENCLATURE AND COMMON NAMES.

Nomenclature	Common name
Direction Finder Receiver Set AN/ARN-42	Direction finder set
Radio Receiver 702398-02	Receiver
Electronic Control Amplifier 702377-04	Control amplifier
Loop Antenna 700939-01	Loop antenna
Sense Antenna	Sense antenna
Azimuth Indicator ID-91B/ARN-6	Azimuth indicator
Mounting 96556	Control amplifier mounting

3.1-572. COMPONENTS OF DIRECTION FINDER RECEIVER SET AN/ARN-59.

3.1-573. Refer to figure 3.1-28 for location of the direction finder receiver set AN/ARN-42 components within the aircraft.

Quantity	Items
1	Radio Receiver 702398-02
1	Electronic Control Amplifier 702377-04
1	Loop Antenna 700939-01
1	Sense Antenna
2	Azimuth Indicator ID-91B/ARN-6
1	Mounting

3.1-574. DESCRIPTION OF DIRECTION FINDER RECEIVER SET AN/ARN-42.

3.1-575. Direction finder receiver set AN/ARN-42 contains a low frequency receiver which is continuously tunable in the frequency range of 190 to 1725 kilocycles. The operating controls of the receiver set are located on the front panel of the radio receiver. The receiver may be operated as a low frequency receiver or an automatic direction finder. The pointer, of the azimuth indicators show the relative, magnetic or true bearing of the transmitting stations with respect to the heading of the aircraft depending on the position of the azimuth scale with relation to the heading index, as set by the

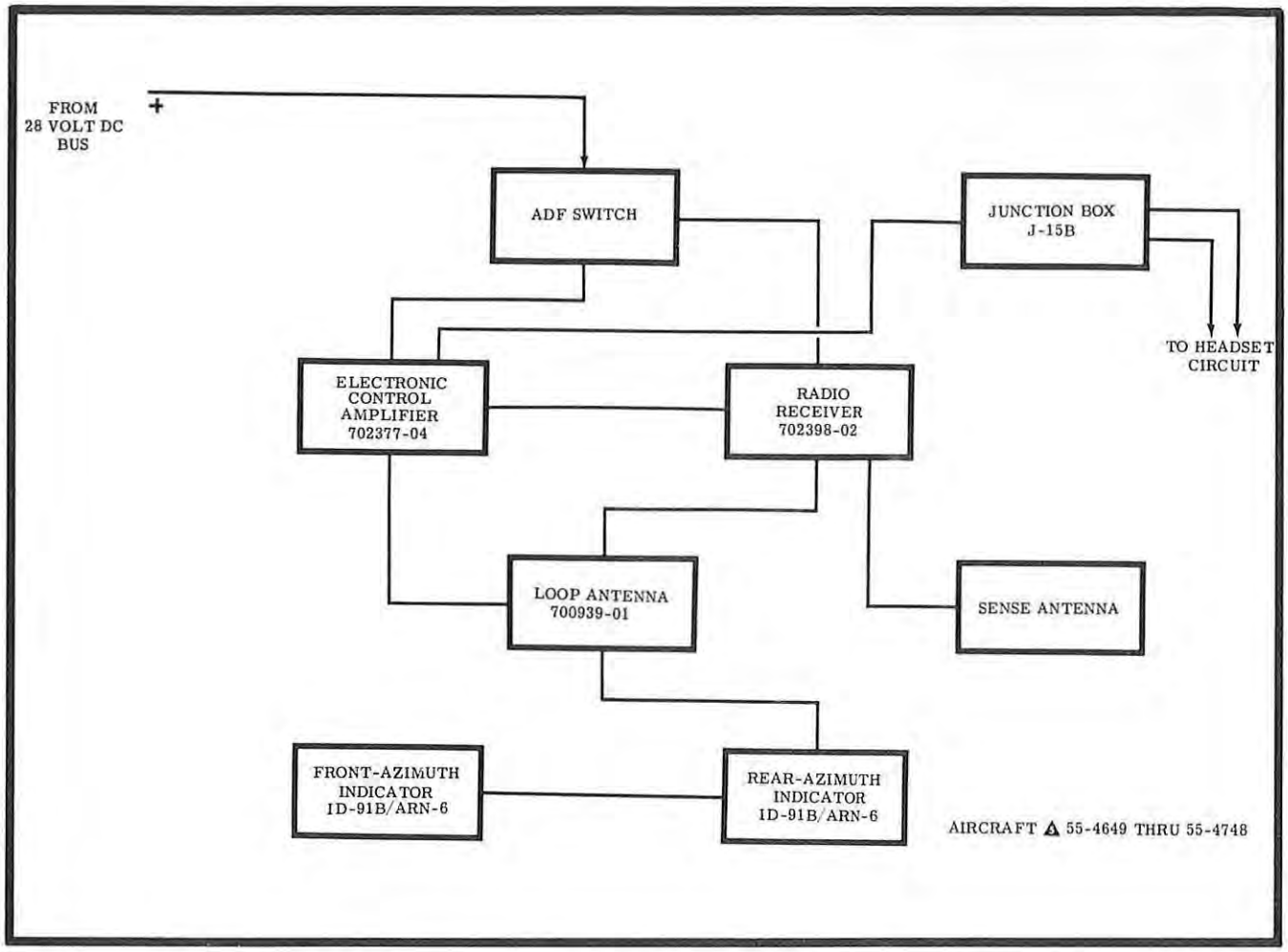


Figure 3.1-27. Direction Finder Receiver Set AN/ARN/42 Block Diagram

east-west variation knob. The beat frequency oscillator in the receiver permits identification of keyed continuous wave (CW) station or for use as a tuning aid on weak signals. The control amplifier contains circuit elements necessary to position the loop by controlling the loop motor, as well as amplifying circuits which provide audio output to the headsets.

3.1-576. DESCRIPTION OF MAJOR COMPONENTS.

3.1-577. RADIO RECEIVER 702398-02.

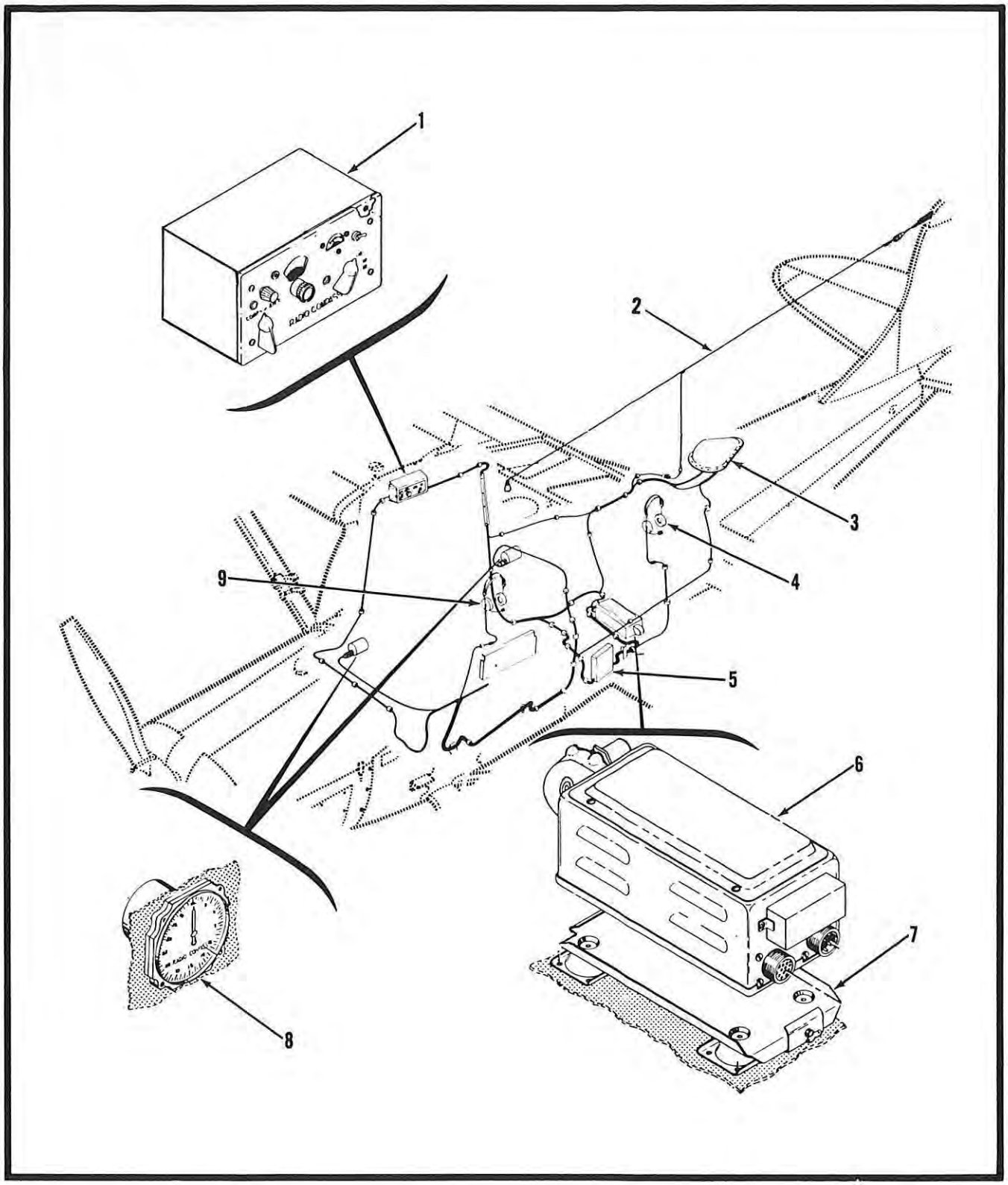
3.1-578. Radio receiver 702398-02 (1, figure 3.1-28) located on the right root rib adjacent to the front seat is a three-band superheterodyne receiver covering the frequency range of 190 to 1725 kilocycles. The desired band is selected by the band switch located on the front panel of the receiver. Tuning of the receiver to the desired frequency within each band is accomplished by the tuning knob. For automatic direction finding, the receiver uses both the sense and loop antenna. For use as a low frequency range receiver only the sense antenna is used. Identification of keyed continuous wave stations is accomplished by use of a beat frequency which is included in the receiver. Amplification and special modification of the receiver signals for operation of the automatic control circuits are provided by the control amplifier which is electrically connected to the receiver.

3.1-579. ELECTRONIC CONTROL AMPLIFIER 702377-04.

3.1-580. The electronic control amplifier 702377-04 (6, figure 3.1-28) contains the circuits and components associated with i-f amplifier, demodulator, audio and power amplifiers, azimuth amplifier, and the automatic control function. The rear of the amplifier also houses the power supply components. The amplifier has no controls on its panel. It contains the necessary receptacles for electrically connecting the amplifier to the other components. The control amplifier is located on the floor aft of the rear seat.

3.1-581. LOOP ANTENNA 700939-01.

3.1-582. The loop antenna 700939-01 (3, figure 3.1-28) located on top of the tailcone is a hermetically sealed unit consisting of a loop antenna, a drive motor, a synchro transmitter, and a corrector strip. The function of the corrector strip is to minimize bearing inaccuracies caused by quadrantal error. The antenna portion of the loop is a coil of several widely spaced turns of wire wound on a flat ferrite core. The loop antenna is driven by a miniature drive motor; its relative bearing is synchro-transmitted to the azimuth indicators. The loop housing is fabricated of antiprecipitation static



1. Radio Receiver 702398-02
2. Sense Antenna
3. Loop Antenna 700939-01
4. Rear Headset-Microphone H-46A/UR
5. Junction Box ARC Type J-15B
6. Electronic Control Amplifier 702377-04
7. Mounting 96556
8. Azimuth Indicator ID-91B/ARN-6
9. Front Headset-Microphone H-46A/UR

Figure 3.1-28. Direction Finder Receiver Set AN/ARN-42 Major, Minor and Installation Items Location Diagram

material to increase loop effectiveness.

3.1-583. SENSE ANTENNA.

3.1-584. The sense antenna (2, figure 3.1-28) is provided for low frequency range reception; and when used in conjunction with the loop antenna, the receiver set functions as an automatic direction finder. The antenna is strung between the fin and cabin top. A lead in wire enters the fuselage just aft of the rear window.

3.1-585. AZIMUTH INDICATOR ID-91B/ARN-6.

3.1-586. The azimuth indicator ID-91B/ARN-6 (8, figure 3.1-28) is a hermetically sealed, synchro-drive instrument. The indicator pointer shows the angular position of the synchro transmitter in the loop antenna, which is the bearing of the incoming signal, relative to the aircraft heading. The indicator has an index mark at the zero degree (heading) position. The azimuth scale of the indicator is graduated every two degrees with major graduation every ten degrees and with every 30 degrees graduation indicated by a numeral. The scale may be positioned manually by rotating the east-west variation knob (labeled VAR) on the front of the indicator. The index mark, azimuth scale numerals, 10 degree graduation lines, and pointer are coated with green phosphorescent material. An indicator is located on both the front and rear instrument panel.

3.1-587. DESCRIPTION OF MINOR COMPONENTS AND INSTALLATION ITEMS.

3.1-588. MOUNTING 96556.

3.1-589. Mounting 96556 (7, figure 3.1-28) is a shock-proof, vibration-mount type and is used to mount the control amplifier. A flexible grounding strap is located on the underside of the mounting.

3.1-590. JUNCTION BOX ARC TYPE J-15B.

3.1-591. Junction box ARC Type J-15B (5, figure 3.1-28) is described in paragraph 3.1-36.

3.1-592. HEADSET-MICROPHONE H-46A/UR.

3.1-593. Headset-microphone (4, 9, figure 3.1-28) is described in paragraph 3.1-42.

3.1-594. DIFFERENCE IN MODELS.

3.1-595. Refer to figure 3.1-30 for differences between the signal electronic equipment configuration in aircraft bearing the same model designation and between models of the same aircraft.

3.1-596. OPERATING CONTROLS AND USE.

3.1-597. RADIO RECEIVER 702398-02.

3.1-598. ADF RADIO SWITCH.

3.1-599. The ADF radio switch (1, figure 3.1-29), labeled ON and OFF provides power to the receiver set. The switch is ON in the up position and OFF in the down position.

3.1-600. VOLUME CONTROL KNOB.

3.1-601. The volume control knob (2, figure 3.1-29) controls the volume of the signal reception heard in the headsets. Clockwise rotation of the knob increases the volume of the signals received, and counterclockwise rotation decreases the volume.

3.1-602. TUNING KNOB.

3.1-603. The tuning knob (4, figure 3.1-29), tunes the receiver to the frequency of the received signal. Low frequency radio range stations may be received on the 190 to 430 kilocycle band. Commercial broadcast station may be received on the two higher bands.

3.1-604. TUNING METER.

3.1-605. To facilitate accurate tuning of the receiver, the tuning meter (5, figure 3.1-29), provides a visual indication of the accuracy of the tuning. A signal is properly tuned in when the meter indicates the furthest clockwise deflections.

3.1-606. BEAT FREQUENCY OSCILLATOR SWITCH.

3.1-607. The beat frequency oscillator switch (6, figure 3.1-29) labeled CW is used to control the operation of the beat frequency oscillator in the receiver. When the switch is in the ON position, it places the beat frequency oscillator in operation to permit identification of keyed continuous wave stations. With the switch in the OFF position, power is removed from the oscillator and only voice or tone-modulated signals may be identified.

3.1-608. BAND SWITCH.

3.1-609. The band switch (7, figure 3.1-29) is provided to select the operating frequency band on which operation is desired.

3.1-610. FUNCTION SWITCH.

3.1-611. The function switch (8, figure 3.1-29) controls the two receiving components of the receiver set. The switch positions are COMP and ANT. With the switch in COMP position, the equipment serves as an automatic direction finder, making use of both loop and sense antennas. The heading of the aircraft, in degrees, relative to the direction of the location of the station being received is automatically indicated by both azimuth indicators. The ANT position of the switch allows the equipment to function as a standard low frequency receiver set, operating on signals picked up on the sense antenna only.

3.1-612. AZIMUTH INDICATOR ID-91B/ARN-6.

3.1-613. EAST-WEST VARIATION KNOB.

3.1-614. The east-west variation knob, labeled E-W VAR is located on the lower left hand corner of the azimuth indicator. The knob rotates the azimuth scale so that zero (heading index) on the scale is in the direction of the desired heading. Also compensates for east-west variation.

Component	Control	Function
Radio Receiver 702398-02	ADF Radio Switch .	Turns direction finder receiver set on and off.
	Volume Control knob.	Controls audio output to headsets.
	Tuning Knob .	Tunes the receiver set to desired frequency within each band.
	Tuning Meter .	Facilitates accurate tuning of the receiver.
	Beat frequency Oscillator Switch .	Turns beat frequency oscillator on and off.
	Band Switch .	Selects frequency band on which operation is desired.
	Function Switch .	COMP position - Places the receiver set in automatic direction finder operation. INT position - Places the receiver set in communication receiver operation.
Azimuth Ind. ID-91B/ARN	East-West Variation Knob .	Rotates the azimuth scale so that zero, (heading index) on the scale is in the direction of the desired heading. Also compensates for east-west variation.

3.1-615. TYPES OF OPERATION FACILITIES.

3.1-616. Refer to figure 3.1-30 for operating facilities.

3.1-617. OPERATING INSTRUCTIONS.

3.1-618. The following paragraphs describe the operating instructions for various modes of operation. The receiver set can be used for audio reception on all frequencies covered by the receiver.

3.1-619. OPERATION AS AUTOMATIC DIRECTION FINDER.

1. ADF radio switch - ON, to turn equipment on and allow approximately 30 seconds for equipment to warmup.
2. Band switch - Switch to the desired frequency band.
3. Function switch - ANT.

Note

Normally the function switch must be in COMP position when equipment is operating as an automatic direction finder. However, maximum sensitivity is attained during initial adjustment if the station is first tuned in and identified with the function switch in the ANT position.

4. Volume control knob - Adjust to a comfortable listening level.
5. Function switch - COMP position after station is selected and identified.
6. Tuning knob - Tune exactly to the center of the signal from the transmitting station. Tune for maximum deflection on tuning meter. In case of extremely weak station, turn CW switch ON and tune for a zero beat (the point at which the pitch of the station whistle decreases until the whistle disappears).
7. ADF radio switch - OFF, to turn receiver set off.

3.1-620. OPERATION AS LOW FREQUENCY RECEIVER.

1. ADF radio switch - ON, to turn equipment on and allow approximately 30 seconds for equipment to warm up.
2. Band switch - Switch to the desired frequency band.
3. Function switch - ANT.

WARNING

Never use the receiver set in automatic direction finder operation (function switch in COMP position) when flying radio ranges. Always turn the function switch to ANT, or serious course broadening may result.

4. Volume control knob - Adjust to a comfortable listening level.
5. Tuning knob - Tune in station observing the frequency dial to select the proper frequency. Tune for maximum deflection on tuning meter.
6. Volume control knob - Readjust for comfortable listening level.
7. ADF radio switch - OFF, to turn receiver set off.

Note

Enter any equipment malfunction or failure in flight report.

3.1-621. BEAT FREQUENCY OSCILLATOR OPERATION.

3.1-622. The beat frequency oscillator permits identifying continuous wave (CW) transmission that are frequently used in the 200 to 1700 kilocycles based in areas outside of the United States.

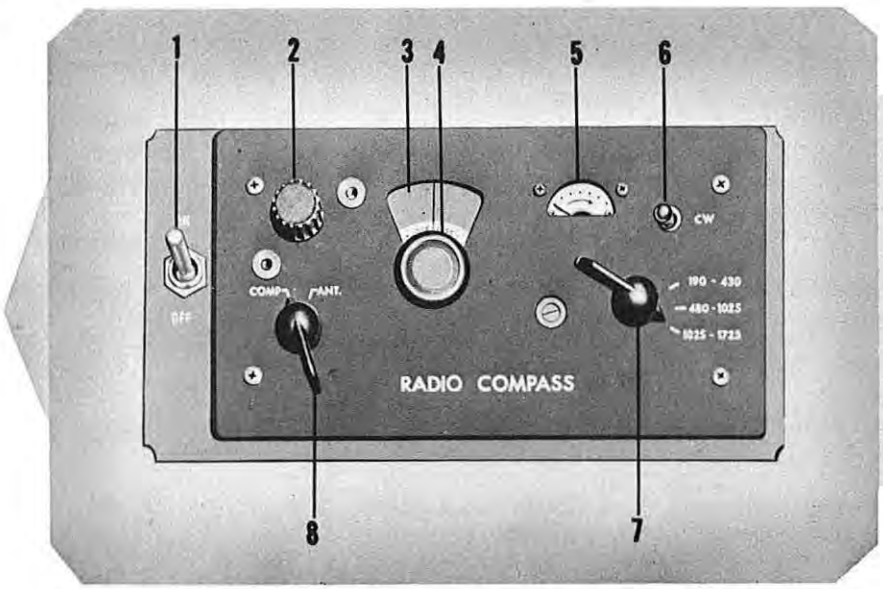
3.1-623. EMERGENCY OPERATION.

3.1-624. If generator failure occurs during flight, radio operation will be limited to the life of the battery, therefore radio operation should be limited to conserve the battery. Other than the above there are no other emergency operations.

3.1-625. PREFLIGHT INSPECTION.

3.1-626. The following paragraphs describe the opera-

RADIO RECEIVER 702398-02



1. ADF Radio Switch
2. Volume Control Knob
3. Frequency Dial
4. Tuning Knob
5. Tuning Meter
6. CW Switch
7. Band Switch
8. Function Switch

Figure 3.1-29

tional procedures performed on direction finder receiver set AN/ARN-42 at the time indicated in Section II Normal Procedures.

3.1-627. POWER OFF INSPECTION.

3.1-628. EXTERIOR INSPECTION.

1. Sense Antenna - Check for secure antenna mounting and check leadin wire.
2. Loop Antenna - Check for secure antenna cover.

3.1-629. INTERIOR CHECK.

1. Radio receiver - Check for secure plug and wire connections. Check and hand tighten plug connector rings.
2. Control amplifier - Check for secure plug and wire connections. Check and hand tighten plug connector rings.
3. Junction box - Check that all wire connections and terminal nuts are secure.
4. Headset-microphone - Check that headset-microphone cord is plugged in.

3.1-630. POWER ON INSPECTION.

Note

When an auxiliary power unit is used to start the engine the operational check as listed below, will be performed while the auxiliary power unit is connected to the aircraft prior to starting the engine. If an auxiliary power unit is not available, the operational check will be performed during engine warmup.

1. ADF radio switch - ON, blower on control amplifier should operate.
2. Tuning knob - Tune receiver to desired frequency within the band selected. A maximum indication should be given on the tuning meter at the receiver signal frequency.
3. CW switch - ON, a heterodyne beat note should be obtained.
4. Function switch - COMP position, direction of all stations tuned in should properly be shown on azimuth indicators. Operation of azimuth indicator is rapied on fairly strong stations, with little hunting. A hum in the headset should be heard along with broadcast intelligence.
5. Function switch - ANT position, audio signal should be heard on all bands.

3.1-631. POST FLIGHT CHECK.

1. ADF radio switch - OFF position, to turn receiver set off.
2. All discrepancies noted on Form DA-781-1 and the crew chief should be notified.

SIGNAL ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	USE	RANGE	OPERATOR	LOCATION of CONTROL
UHF COMMUNICATION	AN/ARC-60	AIRCRAFT-TO-AIRCRAFT AIRCRAFT-TO-GROUND COMMUNICATION	LINE-OF-SIGHT	FRONT OR REAR ▲5 OCCUPANT	RIGHT ROOT RIB ▲1▲2▲3▲4 LEFT ROOT RIB AND BELOW RIGHT REAR WINDOW ▲5
VHF COMMUNICATION	ARC TYPE 12	AIRCRAFT-TO-AIRCRAFT AIRCRAFT-TO-GROUND COMMUNICATION	LINE-OF-SIGHT	FRONT OR REAR ▲5 OCCUPANT	LEFT CABIN WALL ▲1▲3 LEFT ROOT RIB AND REAR COMPARTMENT RIGHT WALL ▲5
MARKER BEACON	AN/ARN-12	RECEIVE MARKER BEACON SIGNALS	UP TO 6,000 FEET	FRONT OR REAR OCCUPANT	FRONT AND REAR INSTRUMENT PANELS
VISUAL OMNI RANGE RECEIVER	AN/ARN-30A	VOR VAR NAVIGATION VOICE RECEPTION LOCALIZER	LINE-OF-SIGHT	FRONT OR REAR OCCUPANT	LEFT ROOT RIB AND REAR INSTRUMENT
FM RADIO	AN/ARC-44 INCLUDING AN/ARA-31 HOMING GROUP	AIRCRAFT-TO-AIRCRAFT AIRCRAFT-TO-GROUND COMMUNICATION AND ALLOWS PILOT TO HOME ON SIGNAL	APPROXIMATELY 50 MILES	FRONT OR REAR OCCUPANT	LEFT ROOT RIB AND LOWER LEFT SIDE OF REAR WINDOW
L F RECEIVER AND MANUAL LOOP NAVIGATION	ARC TYPE 12	RANGE RECEIVING AND DIRECTION FINDING	APPROXIMATELY 200 MILES	FRONT OR REAR ▲1 ▲5 OCCUPANT	LEFT CABIN WALL ▲1 RIGHT ROOT RIB ▲2▲3▲4 LEFT ROOT RIB AND REAR INSTRUMENT PANEL ▲5
RADIO COMPASS	AN/ARN-59	DIRECTION FINDING AND HOMING	APPROXIMATELY 200 MILES	FRONT OR REAR OCCUPANT	LEFT ROOT RIB AND REAR INSTRUMENT PANEL
RADIO COMPASS	AN/ARN-42	DIRECTION FINDING AND HOMING	APPROXIMATELY 200 MILES	FRONT OCCUPANT	RIGHT ROOT RIB

Figure 3.1-30

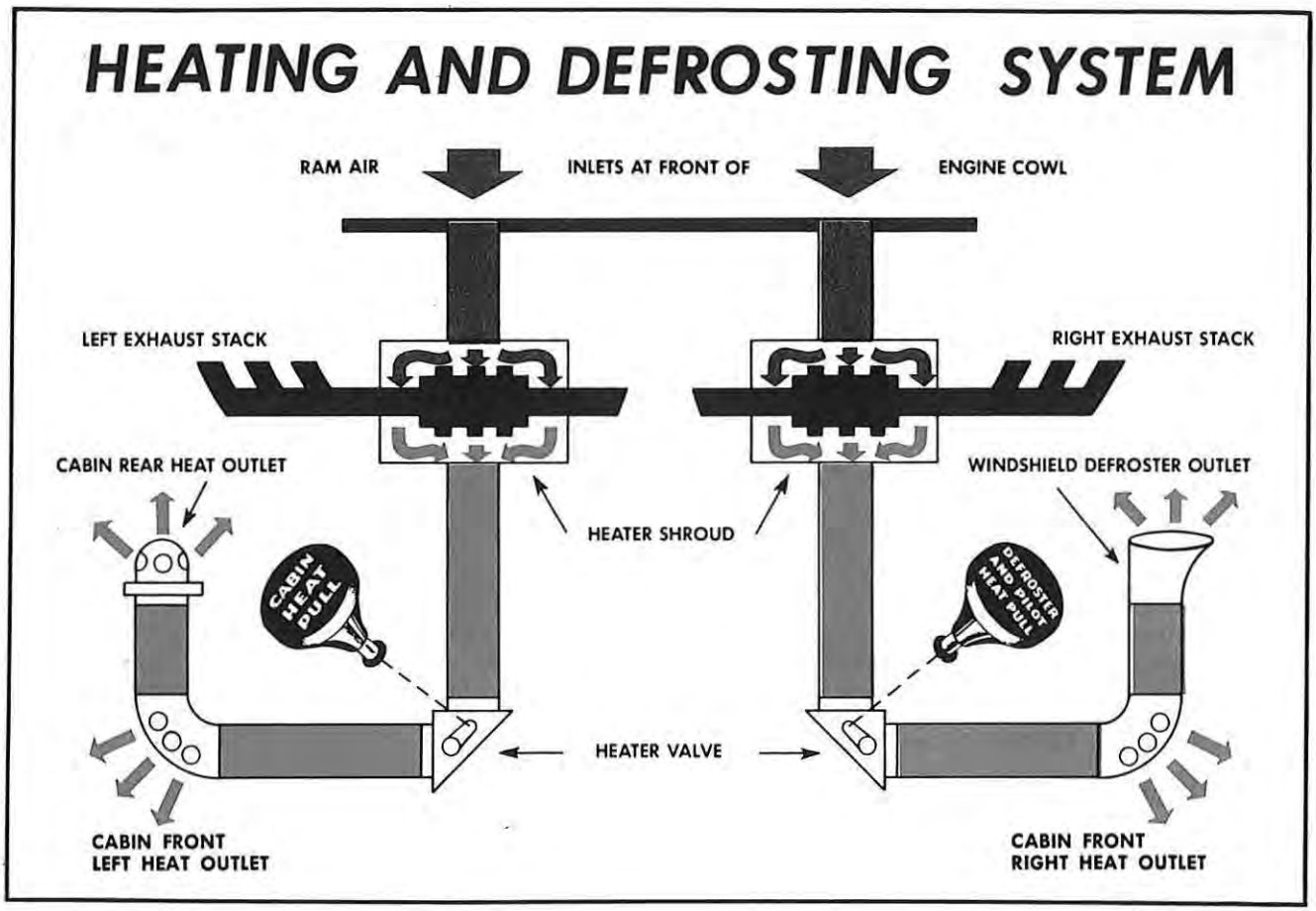


Figure 4-1.

4-18. The pitot heater is controlled by a two position switch. On aircraft 1 3 the switch (18, figure 1-7) is located on the lower center portion of the instrument panel. On aircraft 2 4 5 the switch (6, figure 1-12) is located on the switch and circuit breaker panel on the left forward cabin wall. The switch is labeled PITOT HEAT and has two position ON and OFF. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

4-19. LIGHTING EQUIPMENT.

4-20. All exterior and interior lighting receive their power from the 28 volt dc bus and are protected by circuit breakers (figure 1-11) which can be controlled from within the cabin.

4-21. EXTERIOR LIGHTING.

4-22. Exterior lighting consist of two landing lights, three navigation lights and on aircraft 1 and aircraft 2 4 5 a rotating beacon light. The landing lights are mounted in the leading edge of the left wing. The navigation lights consist of a red light on the left wing tip, a green light on the right wing tip and a white light on the lower trailing edge of the rudder. The rotating beacon light, containing a large red lens, is mounted on the bottom of the fuselage slightly aft of the main landing gear.

4-23. LANDING LIGHT SWITCH.

4-24. The landing light switch (14, figure 1-7) on aircraft 1 3 is located on the instrument panel. On aircraft 2 4 5 the landing light switch (7, figure 1-12) is located on the switch and circuit breaker panel. The switch is labeled LAND LIGHT and has two positions; ON and OFF. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

4-25. NAVIGATION LIGHTS SWITCH. Aircraft 1 3.

4-26. The navigation lights switch (16, figure 1-7) located on the instrument panel is labeled NAV LT with two positions; ON and OFF. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

4-27. NAVIGATION LIGHTS FLASHER SWITCH. Aircraft 1 3.

4-28. A navigation light flasher switch (15, figure 1-7) is located beside the navigation light switch on the in-

strument panel. The switch controls the flasher and permits the selection of either steady or flashing operation of the navigation lights. The switch has two marked positions; FLASHER and STEADY. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

4-29. NAVIGATION LIGHTS SWITCH. Aircraft 2 4 5.

4-30. The navigation lights switch (3, figure 1-12) is labeled NAV LT and is located on the switch and circuit breaker panel. It has three positions; FLASH, OFF and STEADY. A flasher unit is incorporated in the system and causes the navigation lights to flash intermittently when the navigation light switch is in the FLASH position. When the switch is in the STEADY position, the navigation lights shine continuously. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

4-31. ROTATING BEACON LIGHT SWITCH. Aircraft 1 and 2 4 5.

4-32. The rotating beacon light switch (17, figure 1-7) on aircraft 1 is located on the instrument panel. On aircraft 2 4 5 the rotating beacon light switch (5, figure 1-12) is located on the switch and circuit breaker panel on the forward left side of the cabin. The switch is labeled BEACON LIGHT and has two marked positions; ON and OFF. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

Note

The rotating beacon light should be turned OFF during flight through actual instrument conditions. With the light on during instrument conditions, the pilot could experience vertigo as a result of the rotating reflections of the light against the clouds. In addition, the light would be ineffective as an anti-collision light during instrument conditions since it could not be observed by pilots of other aircraft.

4-33. INTERIOR LIGHTING. Aircraft 1 3.

4-34. The interior lights consist of two ultraviolet, fluorescent instrument lights, two map lights, and a compass light. One instrument light is mounted on the fuselage structure between the windshield and the front side window on each side of the cabin. In the instrument trainer version of aircraft 1, an additional flourescent instrument light (4, figure 1-17), controlled by a rheostat, is located to the left of the rear seat. The lights are mounted on swivel type brackets and may be turned to illuminate any area of the instrument panel. The front map light (6, figure 1-15) is located above the left front window just forward of the left wing fuel quantity gage. The rear map light (1, figure 1-17) is located on the left rear window brace, above the rear seat. The map lights are equipped with red plastic filters and are mounted on swivel type mounting brackets. The lights can be adjusted to shine in any direction or can be pulled from their stowage brackets and used as hand lights. The compass dial is illuminated by a compass light mounted in the top of the compass.

4-35. INTERIOR LIGHTING. Aircraft 2 4 5.

4-36. The interior lights consist of two ultraviolet fluorescent instrument lights and three map lights on aircraft 2 4. Three ultraviolet fluorescent instrument lights and two map lights on aircraft 5, a compass light, switch and circuit breaker panel lights and radio control panel lights. The two forward instrument lights (8, figure 1-15; 2, figure 1-16) are mounted on the fuselage structure between the windshield and the front side window on each side of the cabin. On aircraft 5 an instrument light (4, figure 1-17) is located on the left side of the rear compartment below the rear side window. These instrument lights are mounted on swivel type brackets and may be turned to illuminate any area of the instrument panel. The front map light (6, figure 1-15) is located directly above and forward of the front left window. The rear map light (1, figure 1-17) is located on the left rear window brace, over the rear seat. On aircraft 2 4 a third map light is located on the cabin top forward of the rear spar. The map lights are equipped with red plastic filters and are mounted on swivel type mounting brackets. The lights can be adjusted to shine in any direction or can be pulled from their stowage brackets and used as handlights. The compass dial is illuminated by a compass light mounted in the compass (35, figure 1-7). Switch and circuit breaker panel lights (2, figure 1-12) are mounted on the face of the panel as are radio control panel lights mounted on the face of each control panel.

4-37. INSTRUMENT LIGHT RHEOSTAT SWITCH.

4-38. Instrument light rheostat switch (9, figure 1-15; 1, figure 1-16) are mounted directly below the light they control. In the instrument trainer version of aircraft 1 and all aircraft 5 the additional instrument light provided in the rear compartment is controlled by a rheostat switch (6, figure 1-17) mounted in the left side wall, below the light. The switch positions are OFF, DIM, ON and START. To turn an instrument light on, turn the switch clockwise to START, then turn the switch counterclockwise to ON or DIM, depending on the amount of illumination desired. To turn the light off move the switch counterclockwise to OFF. The switches receive their power from the 28 volt dc bus and are protected by a circuit breaker (figure 1-11).

4-39. MAP LIGHT SWITCH.

4-40. An integral, knob type switch is contained in each map light. The map light and switch receive power from the 28 volt dc bus and protected by a circuit breaker (figure 1-11).

4-41. COMPASS LIGHT RHEOSTAT SWITCH. Aircraft 1 3.

4-42. A rheostat switch (6, figure 1-7) is installed in the instrument panel to control the compass light. To turn the compass light on, rotate the switch clockwise until the desired illumination is attained. To turn the

compass light off, turn the switch counterclockwise as far as it will go. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

4-43. COMPASS, SWITCH AND CIRCUIT BREAKER PANEL AND RADIO PANEL RHEOSTAT SWITCH. Aircraft 2 1 5 .

4-44. A rheostat switch (1, figure 1-12) is mounted on the switch and circuit breaker panel and controls the compass light switch and circuit breaker panel and radio edge panel lights simultaneously. Clockwise rotation of the rheostat increases the intensity of the light while counterclockwise rotating dims them. Rotating the rheostat to the full counterclockwise position turns the lights off. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

4-45. FOUR-SHACKLE SYSTEM. Aircraft 1 2 3 4 .

4-46. Aircraft equipped with a front control stick grip incorporating a master drop-load shackle release switch (see figure 4-2) have provisions for the installation of four electrically-operated drop-load shackles, two on the underside of each wing. Switches mounted in the drop-load switch panel (see figure 4-3) permit the selection and arming of any combination of loads to be dropped. This drop-load switch panel is mounted in the cabin ceiling adjacent to the left wing root. The selected loads are dropped when the master drop-load shackle release switch (see figure 4-2) is pressed. For emergency use, an emergency drop-load salvo switch (29, figure 1-7) on the instrument panel jettisons all drop loads simultaneously. The battery switch (19, figure 1-7; 10, figure 1-12) must be "ON" for normal operation of the drop-load system, but the emergency drop-load salvo switch is operative at all times, regardless of the battery switch position.

4-47. FOUR-SHACKLE SYSTEM SWITCHES.

4-48. SHACKLE ARMING SWITCHES.

4-49. The four shackle arming switches, (see figure 4-3) located just below the indication lights on the drop load shackle switch panel, have two positions, ON and OFF. The ON position operates the "arming" mechanism of the corresponding drop shackle.

4-50. SHACKLE SELECTOR SWITCHES.

4-51. The drop-load shackle selector switches (see figure 4-3) on the drop-load panel are equipped with switch guards which make it impossible for the switches to be in the ON position with the guards closed. Thus, closing the guards prevents accidental release of external loads in the event that the master release switch (see figure 4-2) is pressed accidentally in flight. Placing the individual shackle selector switches in the ON position causes the shackles to release when the master drop-load shackle switch is pressed. With all shackle selector switches in the OFF position, the shackle releasing mechanism will not operate except through the use of the emergency drop-load salvo switch (29, figure 1-7) on the instrument panel.

Figure 4-2.

4-52. MASTER DROP-LOAD SHACKLE RELEASE SWITCH.

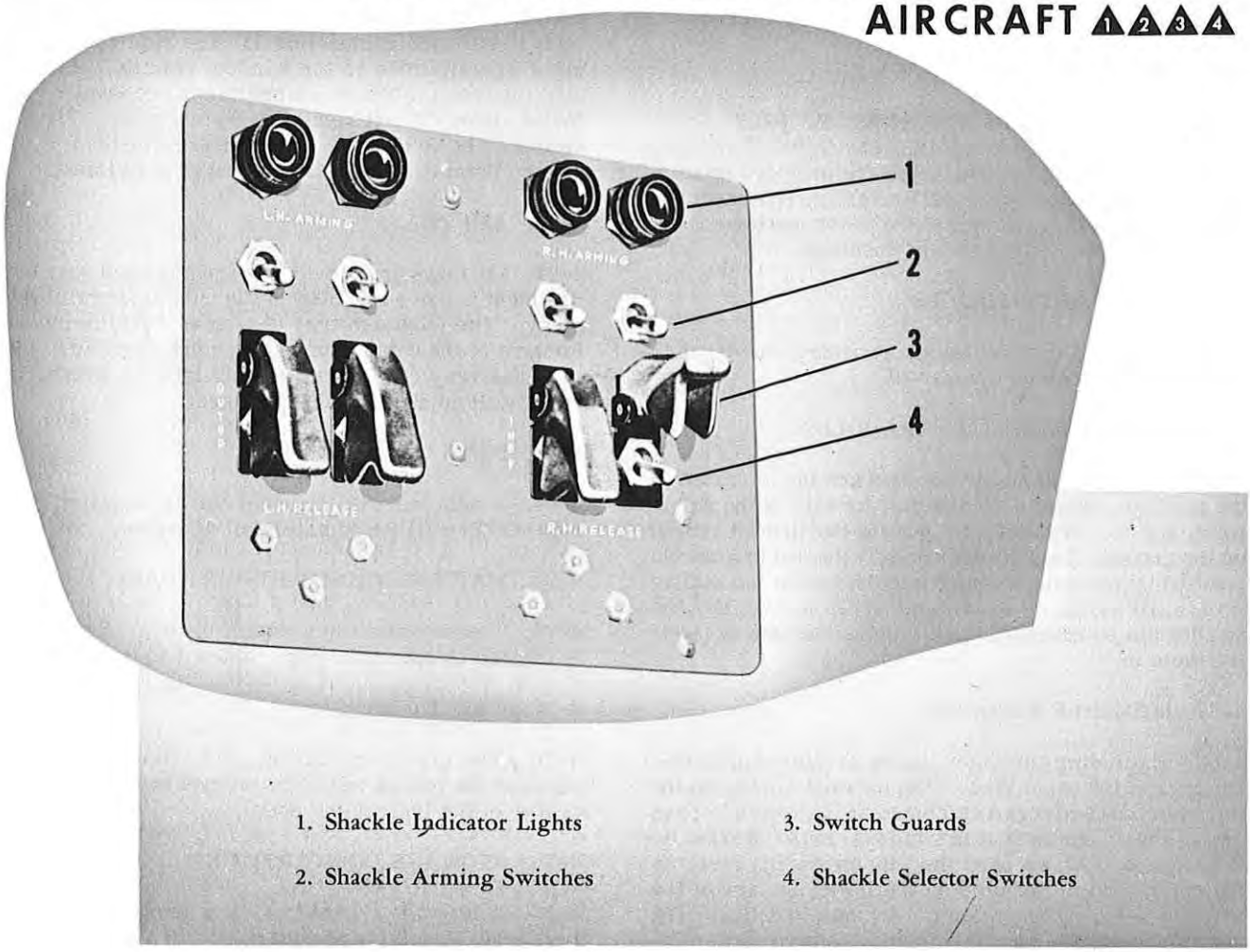
4-53. The master drop-load shackle release switch (see figure 4-2) is located on the front control stick grip. This trigger-type switch is wired in series to the shackle selector switches. Pressing the master drop-load shackle release switch drops all loads selected by the shackle selector switches. It is impossible to drop any load unless at least one of the individual shackle selector switches is "ON".

4-54. EMERGENCY DROP-LOAD SALVO SWITCH.

4-55. The emergency drop-load salvo switch (29, figure 1-7) is located on the instrument panel and is housed in a recessed mounting to prevent accidental release

DROP LOAD SWITCH PANEL FOUR SHACKLE SYSTEM

AIRCRAFT 1 2 3 4



1. Shackle Indicator Lights
2. Shackle Arming Switches
3. Switch Guards
4. Shackle Selector Switches

Figure 4-3.

of the external loads. Pressing the salvo switch causes all four drop-load shackles to open simultaneously. The salvo circuit is wired directly to the battery, making it possible to jettison all external loads by the use of the salvo switch at any time, regardless of the position of the battery and drop-load switches. The salvo switch will drop loads "unarmed" only.

4-56. SHACKLE INDICATOR LIGHTS.

4-57. Four shackle indicator lights (see figure 4-3) are located in a row at the top of the drop-load switch panel. These lights are wired in series with the individual shackles and light up when the shackles are loaded. When the load is dropped, the lights go out.

4-58. NORMAL OPERATION OF THE FOUR-SHACKLE SYSTEM.

1. Battery switch - ON.
2. If the external load is to be "armed" prior to dropping, place the respective arming switches in ARM position.
3. Select the combination of loads to be dropped by placing the respective shackle selector switches "ON".
4. Press the master drop-load shackle release switch to drop the selected loads.

Note

Return the shackle selector and arming switches to OFF position after the load is dropped to prevent useless operation of the drop-load circuits in the event that the master drop-load shackle release switch is pressed accidentally in flight.

4-59. EMERGENCY OPERATION OF THE FOUR-SHACKLE SYSTEM.

1. Press the emergency drop-load release salvo

switch.

Note

All external loads will be jettisoned "unarmed" when the salvo switch is pressed, regardless of the position of battery and drop-load switches.

4-60. MISCELLANEOUS EQUIPMENT.

4-61. FUELING STEPS AND ASSIST HANDLE.

4-62. To facilitate fueling, steps are provided on each wing strut and on each side of the fuselage front section. An assist handle is mounted at the lower juncture of the windshield center strip and the fuselage.

4-63. MOORING PROVISIONS.

4-64. Three tie-down rings are provided, one on each wing strut and one on the tail-wheel.

4-65. RETRACTABLE LIFT HANDLES.

4-66. Two retractable lift handles are incorporated in the fuselage, one on each side just forward of the stabilizer, and are very useful for pushing the aircraft around on the ground. Each handle can be extended to a usable position by inserting a finger into the handle and pulling it outward as far as it will go. When not in use, the handles can be retracted flush with the fuselage by pushing them in.

4-67. MOVABLE WINDOWS.

4-68. Excluding the door, there are three movable windows in the cabin area. The forward window on the left side of the aircraft is hinged at the top and opens out and up. To open this window, raise the handle (18, figure 1-15) up until the window swings free. A retaining stud is mounted on the lower surface of the wing for securing the window in the open position. The rear side windows open in and up. To open these windows, turn the latch (5, figure 1-17; 3, figure 1-18) in each window frame a half turn counterclockwise. Two canvas straps hang from the cabin ceiling to hold the windows open. Both the rear windows may be open at the same time.

CAUTION

Do not exceed the maximum allowable speed when the rear windows are open. (See Section V.)

4-69. REMOVABLE BLIND FLIGHT CURTAINS. Aircraft IT ▲1 and aircraft ▲5.

4-70. Removable blind-flight curtains (7, figure 1-17) may be installed to enclose the rear compartment. All side, front, and rear curtains are of opaque material. The top curtain is of white canvas which admits light to the compartment. The side window curtains are attached to the window frames, making it possible for the rear compartment occupant to open the windows without removing the curtains. The curtains may be removed by unsnapping the fasteners which secure them to the interior of the compartment.

4-71. ASH TRAYS.

4-72. Ash trays are provided in the front and rear compartment and are mounted in the cabin sidewall upholstery. The front ash tray (9, figure 1-16) is mounted forward of the cabin door on the right cabin wall. The rear ash tray (4, figure 1-18) is located on the right cabin wall adjacent to the rear seat.

4-73. DATA CASE.

4-74. A data case (5, figure 1-18) is installed on the right cabin wall immediately aft of the rear seat.

4-75. MAP AND FLIGHT REPORT CASE.

4-76. The map and flight report case (7, figure 1-16) is located on the cabin door adjacent to the front seat.

4-77. CHECK LISTS.

4-78. The pilot's check list, (12, figure 1-6) is located on the voltage regulator bracket directly below the center of the instrument panel.

4-79. STOWAGE COMPARTMENT.

4-80. A stowage compartment is provided aft of the rear seat, measuring approximately 23 x 24 x 29 inches. If increased space is required, the rear seat, radio sets, and rear control stick are easily removed, and the rear rudder pedals on aircraft ▲1 ▲2 ▲5 can be folded flat on the floor. This provides a cargo compartment approximately 59 inches long.

4-81. REARVIEW MIRROR. Aircraft ▲3 ▲4.

4-82. A rearview mirror (2, figure 1-6) is located on the right hand side of the front compartment on top of the instrument panel.

SECTION V | CHAPTER 2

OPERATING LIMITATIONS

5-1. INTRODUCTION.

5-2. Cognizance must be taken of the instrument markings since they represent limitations which are not necessarily repeated in the text. In some cases further explanation of the instrument markings will be found in the text under the appropriate paragraph headings.

5-3. MINIMUM CREW REQUIREMENTS.

5-4. The minimum crew required for this aircraft is one pilot in the front seat. An additional crew member, as required, will be added at the discretion of the Commanding Officer.

5-5. INSTRUMENT MARKINGS.

5-6. The operating ranges and limitation for both the aircraft and the engine are shown in figure 5-1.

5-7. ENGINE LIMITATIONS.

5-8. All normal engine limitations are shown in figure 5-1. The maximum allowable engine speed is 2600 rpm for five minutes.

WARNING

Whenever engine speed exceeds the operating limits, the aircraft should be landed immediately at the nearest base. The reason for the overspeed (if known), the maximum rpm and duration will be entered in the DD Form 781 and reported to the Maintenance Officer. Overspeed between 3400 and 3600 rpm will necessitate an inspection of the engine before further flight. If engine speed exceeds 3600 rpm, the engine must be removed for overhaul.

5-9. PROPELLER LIMITATIONS.

5-10. The maximum propeller speed is 2600 rpm.

5-11. AIRSPEED LIMITATIONS.

5-12. The airspeed limitations listed below are based on the maximum gross weight of the aircraft.

Configuration	Maximum IAS
Flaps up	2 4 190 mph
	5 190 mph
	1 3 179 mph
Flaps down	100 mph
Front side window open	1 2 3 4 120 mph
	118 mph
Rear side window open	1 2 3 4 145 mph
	5 142 mph
Maneuvering speed	2 4 134 mph
	5 131 mph
	1 3 119 mph

5-13. Refer to Prohibited Maneuvers in this Section, for recommended entry speeds for all approved acrobatic maneuvers.

5-14. PROHIBITED MANEUVERS.

1. Inverted spins are prohibited.
2. When gross weight exceeds 2100 pounds on aircraft 1 3, 2165 pounds on aircraft 2 4 and 2400 pounds on aircraft 5, all acrobatics are prohibited.
3. When gross weight is less than 2100 pounds on aircraft 1 3, 2165 pounds on aircraft 2 4 and 2400 pounds on aircraft 5, all acrobatics are prohibited except the following:

Maneuvers	Recommended entry Speed
Steep turns	2 4 134 mph
	5 131 mph
	1 3 119 mph
Chandells	2 4 134 mph
	5 131 mph
	1 3 119 mph
Lazy eights	2 4 134 mph
	5 131 mph
	1 3 119 mph
Spins	1 2 3 4 60 mph

Note

On aircraft 5, practice spins shall not be accomplished until such time as the aircraft is approved for spins.

5-15. ACCELERATION LIMITATIONS.

5-16. The maximum maneuvering load factors for maximum gross weight are as follows:

Flaps up	4.4 G's
Flaps down	3.5 G's

5-17. CENTER OF GRAVITY LIMITATIONS.

5-18. The aircraft recommended weight or C.G limits cannot be exceeded by loading arrangements normally employed in training or liaison operations. Refer to Chapter 3 Weight and Balance Data, for weight control data.

5-19. WEIGHT LIMITATIONS. Aircraft 1 3.

5-20. The maximum recommended gross weight of

INSTRUMENT MARKINGS

FUEL GRADE 80

MANIFOLD PRESSURE AIRCRAFT 5

- 15" Hg-24" Hg Continuous Operation
- 24" Hg Maximum Continuous (Operation above this pressure limited to 5 minutes)
- 30" Maximum (Limited to 5 minutes)

AIRSPEED INDICATOR

100 mph	Full Flaps
190 mph	Maximum Diving 2 4
190 mph	Maximum Diving 5
179 mph	Maximum Diving 1 3

OIL PRESSURE

30 psi	Minimum For Flight
40-60 psi	Normal
95 psi	Maximum

OIL TEMPERATURES

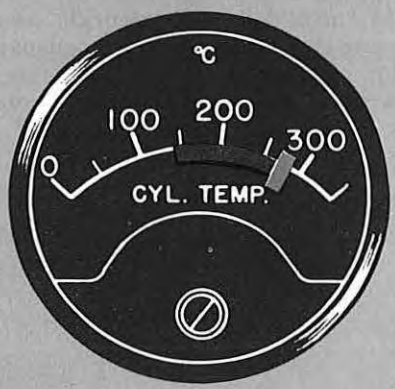
24°C	Minimum For Flight
38°-108°C	Continuous Operation
108°C	Maximum

Figure 5-1. (Sheet 1 of 2)

FUEL GRADE 80

TACHOMETER

- 1600 - 2300 rpm Continuous Operation ▲1 ▲2 ▲3 ▲4
- 1800 - 2300 rpm Continuous Operation ▲5
- 2300 rpm Maximum Continuous (Operation above this rpm limited to 5 minutes)
- 2600 rpm Maximum For Takeoff



CYLINDER HEAD TEMPERATURE

149° - 274° C	Continuous Operation
274° C	Maximum

SUCTION

3.75 In. Hg	Minimum For Flight
3.75 - 4.25 In. Hg.	Continuous Operation
4.25 In. Hg	Maximum

FUEL PRESSURE

11 psi	Minimum For Flight
11-13 psi	Normal
15 psi	Maximum

Figure 5-1. (Sheet 2 of 2)

TM55-1510-202-10
FIG. NO. 5-1 Sh2
PAGE NO. 5-3
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this aircraft is 2100 pounds. This weight consists of an aircraft with main fuel tank and oil fully serviced, and loaded with full crew and baggage or miscellaneous equipment necessary to bring the aircraft up to gross weight. All operations and maneuvers listed in the general flight restrictions paragraph are approved up to this maximum recommended gross weight. At 2100 pounds gross weight, the aircraft is approved for flight load factors up to 4.4 and landing load factors up to 4.0. Operation of this aircraft above 2100 pounds gross weight is not recommended and, based on mission requirements, may be exceeded only as deemed necessary by the base commander. The maximum gross weight for the floatplane configuration is 2400 pounds.

5-21. WEIGHT LIMITATIONS. Aircraft ▲2 ▲.

5-22. The maximum recommended gross weight of this aircraft for combat missions is 2165 pounds. This weight consists of an aircraft with main fuel tank and oil fully serviced, and loaded with full crew and no baggage. The maximum mission gross weight is 2400 pounds. This weight consists of an aircraft with both fuel tanks and oil fully serviced, and loaded with full crew and baggage or miscellaneous equipment necessary to bring the aircraft up to gross weight. At 2400 pounds gross weight, the aircraft may be operated for flight load factors up to 4.4 and landing load factors up to 4.0. Loadings above 2400 pounds are not recommended and, based on the mission requirements, may be exceeded only as deemed necessary by the base commander. The maximum gross weight for the floatplane configuration is also 2400 pounds.

5-23. WEIGHT LIMITATIONS. Aircraft ▲.

5-24. The maximum gross weight of this aircraft is 2400 pounds. This weight consists of an aircraft fully serviced with fuel and oil, and loaded with full crew. All operations and maneuvers listed above are approved up to this maximum recommended gross weight. At 2400 pounds gross weight, the aircraft is approved for load factors up to 4.4. The aircraft has not been structurally investigated above 2400 pounds. Based on the mission requirements, the maximum recommended gross weight may be exceeded only as deemed necessary by the base commander.

SECTION VI | CHAPTER 2

FLIGHT CHARACTERISTICS

6-1. FLIGHT CHARACTERISTICS.

6-2. All control forces are normal, requiring only gentle pressure to execute any maneuver. Stability around all axes is excellent. Control is positive down to very low speeds.

6-3. STALLS.

6-4. NORMAL STALL CHARACTERISTICS.

6-5. The normal stall characteristics of the aircraft are conventional and very mild. Stall warning is characterized by loss in effectiveness of the controls (large increases in control movements required) and increasing elevator stick force. The aircraft pitch is very gentle when stall occurs, with no tendency to roll providing the wings are level upon entry. Slight elevator buffeting may occur just before and after the stall with flaps down.

Note

Wing flaps have little effect on stall characteristics.

6-6. ACCELERATED STALL CHARACTERISTICS.

6-7. Stalls in accelerated flight are characterized by a heavy, low frequency, longitudinal buffeting that provides unmistakable warning to the pilot. Structural limitations of the aircraft will be exceeded if accelerated stalls are performed above 119 mph IAS on aircraft ▲1 ▲3, 131 mph IAS on aircraft ▲5 and 134 mph on aircraft ▲2 ▲4.

6-8. PRACTICE STALLS.

6-9. Practice stalls should include power-on and power-off stalls in straight and turning flight with recovery initiated both prior to and following the downward pitch of the nose. Retard throttle smoothly for power-off stalls; use low cruise power settings for power-on stalls. With power-off, the aircraft may be stalled in an approximate landing attitude with no roll or yaw tendency, providing the wings are level upon entry. With power on, the aircraft is normally stalled with the nose about 40° above the horizon. Characteristics of the power-on stall are identical with those of the power-off stall except for an increase in pitching motion and yaw.

6-10. PRACTICE STALL - POWER OFF, STRAIGHT AHEAD.

1. Retard throttle smoothly to closed position.
2. Raise nose to a landing attitude and hold until stall occurs.
3. Execute a stall recovery immediately with full throttle and aircraft nose slightly lower than that at stall. The aircraft accelerates rapidly with full power and diving the aircraft is not necessary.

Note

In stalls with full wing flaps, the flaps should be retracted slowly at a safe airspeed after recovery to level flight.

6-11. PRACTICE STALL - POWER ON, STRAIGHT AHEAD.

1. Retard throttle smoothly to approximately 1/3 open position.
2. Raise nose approximately 40° above the horizon.
3. Execute a stall recovery by lowering the nose slightly to climb attitude or lower while applying full throttle and keeping the nose straight ahead.

Note

In stalls with full wing flaps, the flaps should be retracted slowly at a safe airspeed after recovery to level flight.

6-12. PRACTICE STALL - POWER ON, 20° BANK.

1. Retard throttle smoothly to approximately 1/3 open position.
2. Establish a coordinated climbing turn with about 20° of bank.
3. While turning, steadily raise the nose approximately 40° above the horizon.
4. As the stall occurs, lower the nose slightly, apply full throttle, and level aircraft after regaining speed.

6-13. PRACTICE STALL - POWER OFF, 40° BANK.

1. Retard throttle smoothly to closed position.
2. After excess speed is dissipated in straight flight, roll into a slightly nose-high gliding turn with about 40° of bank.
3. While turning, steadily raise the nose slightly above the horizon until the stall occurs.
4. Make a stall recovery with full throttle, holding the nose straight ahead and level aircraft after regaining speed.

6-14. STALL SPEEDS.

6-15. Refer to figure 6-1 and 6-2, for stall speeds.

AIRCRAFT ▲1 ▲2 ▲3 ▲4 STALLING SPEEDS

POWER OFF, MPH IAS CONFIGURATION		0° FLAPS			30° FLAPS			60° FLAPS		
GROSS WT (LBS)		1800	2100	2400	1800	2100	2400	1800	2100	2400
	LEVEL FLIGHT	47	54	59	44	51	56	41	48	54
	20° BANK	50	56	61	47	54	59	45	51	57
	40° BANK	58	64	69	55	61	65	54	59	63
	60° BANK	74	81	87	70	76	81	69	74	80

Figure 6-1.

6-16. STALL RECOVERY.

6-17. The intended mission of this aircraft dictates slow flight, approach, and climb-out speeds that are very close to actual stalling speeds and for these reasons the stall recovery should be made with a minimum loss in altitude. The aircraft can readily be flown out of the stall in nearly the same attitude as that at stall by using a slight amount of forward stick with throttle required to accelerate the aircraft in level flight. Raise wing flaps slowly as aircraft accelerates. An excessive amount of altitude will be lost if the stick is moved quickly forward in an attempt to dive the aircraft to regain flying speed.

6-18. SPINS.

6-19. PRACTICE SPINS. Aircraft ▲5.

6-20. Practice spins shall not be accomplished until such time as the aircraft is approved for spins.

6-21. SPIN CHARACTERISTICS.

6-22. The aircraft does not exhibit any dangerous spin characteristics when spun in the clean, power-off configuration. The spins are very mild except for the rapid rate of rotation. Altitude lost per turn is approximately 200 to 300 feet. The rate of descent is approximately 125 feet per second.

WARNING

- Do not spin the aircraft with wing flaps down because of structural limitations of the flaps.
- Since the aircraft is not stressed for inverted maneuvers, inverted spins are prohibited.

6-23. SPIN RECOVERY.

6-24. Spin recovery is accomplished by reversing the rudder immediately; after 1/2 turn, return elevator briskly to approximately neutral; hold ailerons neutral throughout the entire recovery procedure. After rotation ceases, return rudder to neutral. All control forces are light to moderate during recovery. The aircraft recovers rapidly and shows no tendency to spin in the opposite direction. Altitude required for pull-out after rotation is approximately 300 to 400 feet.

6-25. FLIGHT CONTROLS.

6-26. Aileron, rudder and elevator control forces are moderately light in all configurations. Elevator stick forces are somewhat less for the 60° flap deflection and rear C.G. loading combination. Elevator trim is effective throughout the range of flight speeds. With full flaps, nose-down trim may be used in gliding flight to increase elevator effectiveness for the landing flare-out. On aircraft ▲1 ▲ and aircraft ▲2 ▲3 ▲4 ▲5, the rate of retraction of the flaps with the electric motor provides smooth transition from the takeoff to the climb configuration.

6-27. LEVEL FLIGHT CHARACTERISTICS UNDER VARIOUS SPEED CONDITIONS.

6-28. The aircraft is conventional in all ways throughout

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

the level flight speed range. Slow flying is easily accomplished with wing flaps up or down. No special technique is required.

6-29. MANEUVERING FLIGHT.

6-30. The aircraft is conventional in every respect throughout the range of maneuvering flight including steep turns, chandelles and lazy eights.

6-31. DIVING.

6-32. Dives shall be limited to the maximum diving airspeed marked on the airspeed indicator. The trim changes and other characteristics are conventional in dives. Recovery from any dive should be made gradually, since the structural load on the aircraft increases in direct relation to abruptness of pull-out.

CAUTION

Do not exceed the maximum recommended engine speed.

6-33. FLIGHT WITH EXTERNAL LOADS. Aircraft ▲1 ▲2 ▲3 ▲4.

6-34. No special technique is required for flying with external loads.

6-35. FLIGHT WITH EXTERNAL LOADS. Aircraft ▲5.

6-36. This aircraft does not incorporate provisions for carrying external loads.

AIRCRAFT ▲5 STALLING SPEEDS

POWER OFF, MPH IAS CONFIGURATION		0° FLAPS			30° FLAPS			60° FLAPS		
GROSS WT (LBS)		2000	2200	2400	2000	2200	2400	2000	2200	2400
	LEVEL FLIGHT	46	51	56	40	47	51	40	47	51
	20° BANK	49	54	59	44	50	54	44	50	54
	40° BANK	59	63	68	55	59	63	55	59	63
	60° BANK	78	82	87	71	75	79	71	75	79

Figure 6-2.

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SECTION VII | CHAPTER 2

SYSTEM OPERATIONS

7-1. ENGINE OPERATION IN FLIGHT.

1. For normal operation under 5000 feet, use RICH mixture.
2. For maximum range, LEAN mixture to obtain best power. The procedure for leaning the mixture is to pull the mixture control lever back until engine becomes rough, then enrichen mixture slightly beyond this point. Any changes in altitude, power or carburetor heat will require a change in the lean mixture settings. For cruise data, refer to Section X of this chapter.

WARNING

If engine should suddenly start running rough, indicating too rich a mixture, briskly move mixture control lever through its full range of travel several times. Ocassionally dirt may become lodged under the mixture control poppet valve in the carburetor causing an excessively rich mixture to result. Fore and aft movement of the mixture control lever dislodges this dirt and resumes normal engine operation.

3. Under low power conditions, a momentary engine overspeed to a maximum of 3000 rpm may occur without damage to engine.

7-2. FUEL SYSTEM OPERATION IN FLIGHT.

1. The fuel selector valve handle should be set on the fullest tank for all operations.
2. Auxiliary fuel pump switch should be ON as a safety precaution during the takeoff and landing, but should be turned OFF for normal operation. If fuel pressure begins to fluctuate return switch to ON.

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SECTION VIII | CHAPTER 2

CREW DUTIES

This section is not applicable to the aircraft as the crew consists of only the pilot, whose duties have already been outlined in the preceding sections.

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SECTION IX | CHAPTER 2

ALL WEATHER OPERATION

9-1. INTRODUCTION.

9-2. Except where repetition may be necessary for emphasis or continuity of thought, this Section contains only those procedures and technique that differ or are in addition to the normal operating instructions covered in Section II. Any discussions related to system operation are covered in Section VII.

9-3. NIGHT FLYING.

9-4. Be thoroughly familiar with the lighting equipment of the aircraft, know the location of all switches in the cockpit, and carry a flashlight. Before a night takeoff, complete the "Before Takeoff" check list in Section II. In addition, check all lights for proper operation. Leave the navigation and required cockpit lights on. During night weather flight, place the navigation lights switch in the STEADY position and on aircraft ▲1 and aircraft ▲2 ▲3 ▲4 place the rotating beacon switch in the OFF position to prevent any distraction created by cloud reflections. To penetrate an electrical storm at night, turn the cockpit lights on to full bright after removing the red filters. This will prevent a momentary blindness from lightning. During normal VFR flight, unfiltered lights should be used sparingly.

Note

When making VFR takeoffs in areas of limited horizon references, reference to the flight instruments is recommended to avoid flying back to the ground after takeoff.

9-5. INSTRUMENT FLIGHT.

9-6. Although this aircraft is adequately equipped for instrument training, it is not designed for complete all weather operation. The lack of de-icing equipment imposes a serious handicap when flying in precipitation. Other limitations are the light wing loading which makes control more difficult in severe turbulence, a lack of alternate sources of vacuum and electrical power for gyro instruments and radio equipment, and insufficient radio frequencies for safe operation in dense traffic areas. Extremely low approaches are not feasible since complete ILS equipment is not supplied. With a competent instrument pilot and copilot aboard, the aircraft is capable of being operated in limited instrument weather into terminals having average traffic. The weather should be free of precipitation, heavy turbulence, and thunderstorm activity. Instrument approaches should be avoided in ceilings of less than 500-1000 feet depending upon available navigation aids, terrain, visibility, pilot's skill and his familiarity with the area. Range is adversely affected during instrument flight in turbulence due to the airspeed reduction caused by frequent skidding and slipping. Average pilot technique under these conditions would reduce the available range approximately 5%.

Note

On aircraft ▲1 and aircraft ▲2 ▲3 ▲4, the rotating beacon light should be turned off during flight through actual instrument conditions. With the light on during instrument conditions, the pilot could experience vertigo as a result of the rotating reflection of the light against the clouds. In addition, the light would be ineffective as an anti-collision light during instrument conditions, since it could not be observed by pilots of other aircraft.

9-7. INSTRUMENT TAKEOFF.

1. Align aircraft with runway.
2. Directional indicator - SET, to runway number or compass reading.
3. Attitude indicator - ADJUST, for proper relative position with the miniature aircraft.
4. Throttle - OPEN, advance throttle slowly to minimize torque effect.
5. Directional and attitude indicators - Maintain original indication until the aircraft is airborne.
6. Climb out at 90 mph IAS with wing flaps up or at 80 mph IAS with 30 degrees of flaps on aircraft ▲5 using 24 inches of manifold pressure and 2300 rpm, on aircraft ▲1 ▲2 ▲3 ▲4 using 2300 rpm.
7. Wing flaps switch - UP (aircraft ▲1 ▲ and aircraft ▲2 ▲3 ▲4 ▲5). Wing flaps lever - DOWN (aircraft ▲1 ■) (if used), retract the flaps slowly above 400 feet.
8. Elevator trim tab control wheel - ADJUST, trim for a flaps up climb at 90 mph IAS.

9-8. INSTRUMENT CLIMB.

9-9. Normal climb procedures and power settings, are given in Section II. Climbing turns may be safely executed with as much as a two-needle width turn (30° angle of bank) above 1000 feet.

9-10. INSTRUMENT CRUISING FLIGHT.

9-11. The aircraft has satisfactory instrument characteristics at normal cruising speed. If turbulence is encountered, these speeds should be reduced to the values

▲ Aircraft 53-8068 and on and aircraft modified per TMI-1L-19A-247

■ Aircraft 50-1327 thru 53-8067 except aircraft modified per TMI-1L-19A-247

shown in the turbulence and thunderstorms paragraph in this section. Fatigue can be decreased during long flights in smooth air by maintaining headings through rudder action alone. The excellent longitudinal and lateral stability of the aircraft make control stick attention unnecessary unless the air is turbulent. A second crew member is normally required to assist in the extensive dead reckoning, radio navigation, and position reporting procedures associated with instrument flight plans.

9-12. SPEED RANGE.

9-13. Instrument flight characteristics at high speed are identical to those at low speed. However, inaccuracies are magnified at high speed because the aircraft deviates a greater amount in a given time interval. For this reason a precise flight path can be maintained more easily at a reduced speed.

9-14. RADIO AND NAVIGATION EQUIPMENT.

9-15. The radio equipment in the aircraft is normally reliable; however, a continuous cross check of all radio and navigational equipment in flight will insure safe operation in the event of the failure of one piece of equipment.

9-16. DESCENT. Aircraft ▲1 ▲2 ▲3 ▲4.

9-17. Normal enroute descents or radar controlled descents to traffic pattern altitude are made with wing flaps up at 100 mph IAS using 1800 rpm to maintain the desired rate of descent. A maximum rate descent of 1000 feet per minute is obtained at 100 mph IAS with wing flaps up and power off. Flight characteristics are conventional in descents with any combination of power and airspeed in the normal operating range. Limit banks to 15 degrees if rate of descent is more than 500 feet per minute.

9-18. DESCENT. Aircraft ▲5.

9-19. Normal enroute descents or radar controlled descents to traffic pattern altitude are made with wing flaps up at 120 mph IAS using 2000 rpm and the manifold pressure required to maintain the desired rate of descent. A maximum rate of descent of 1750 feet per minute is obtained at 120 mph IAS with wing flaps up and power off. Flight characteristics are conven-

TYPICAL *RADIO RANGE APPROACH*

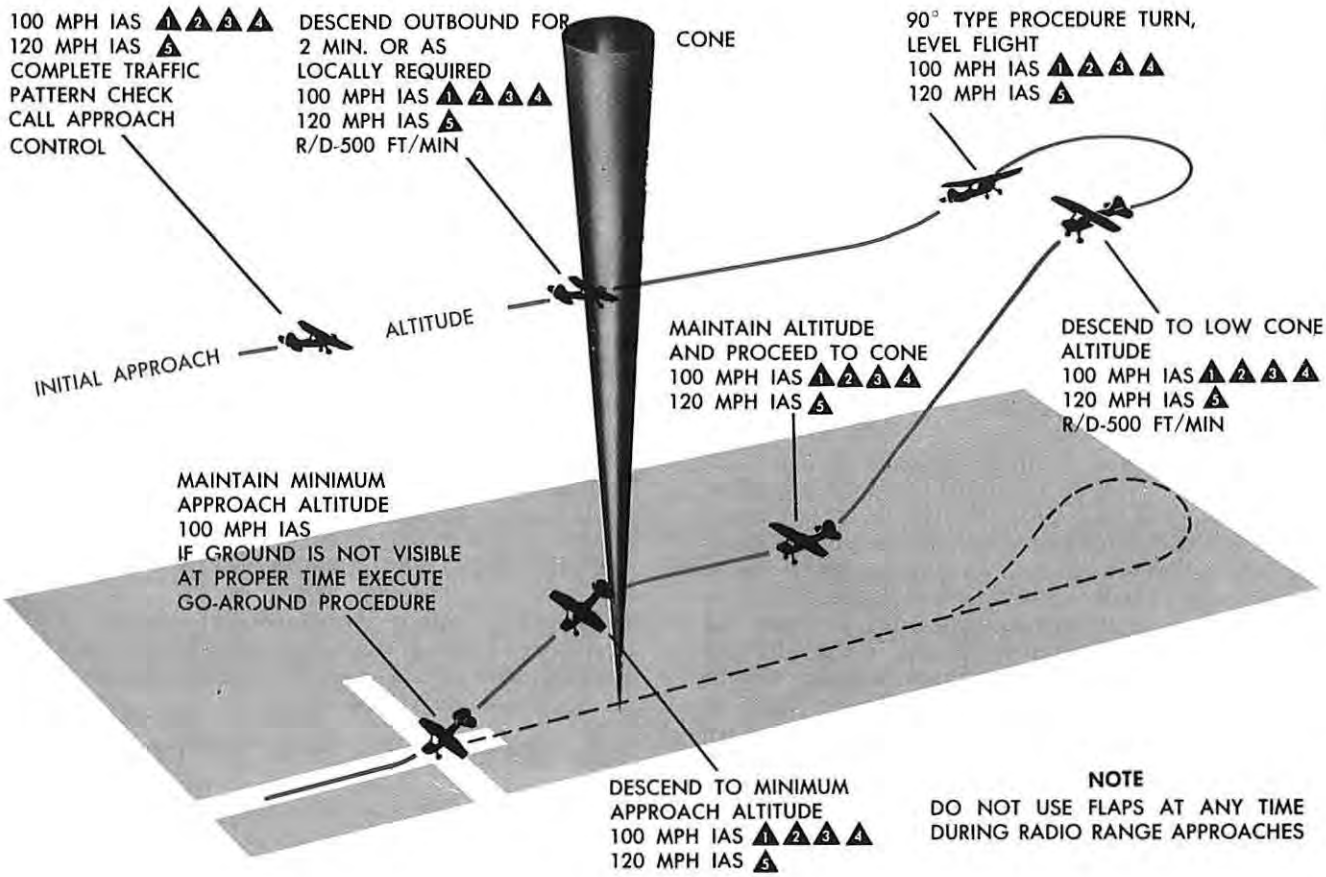
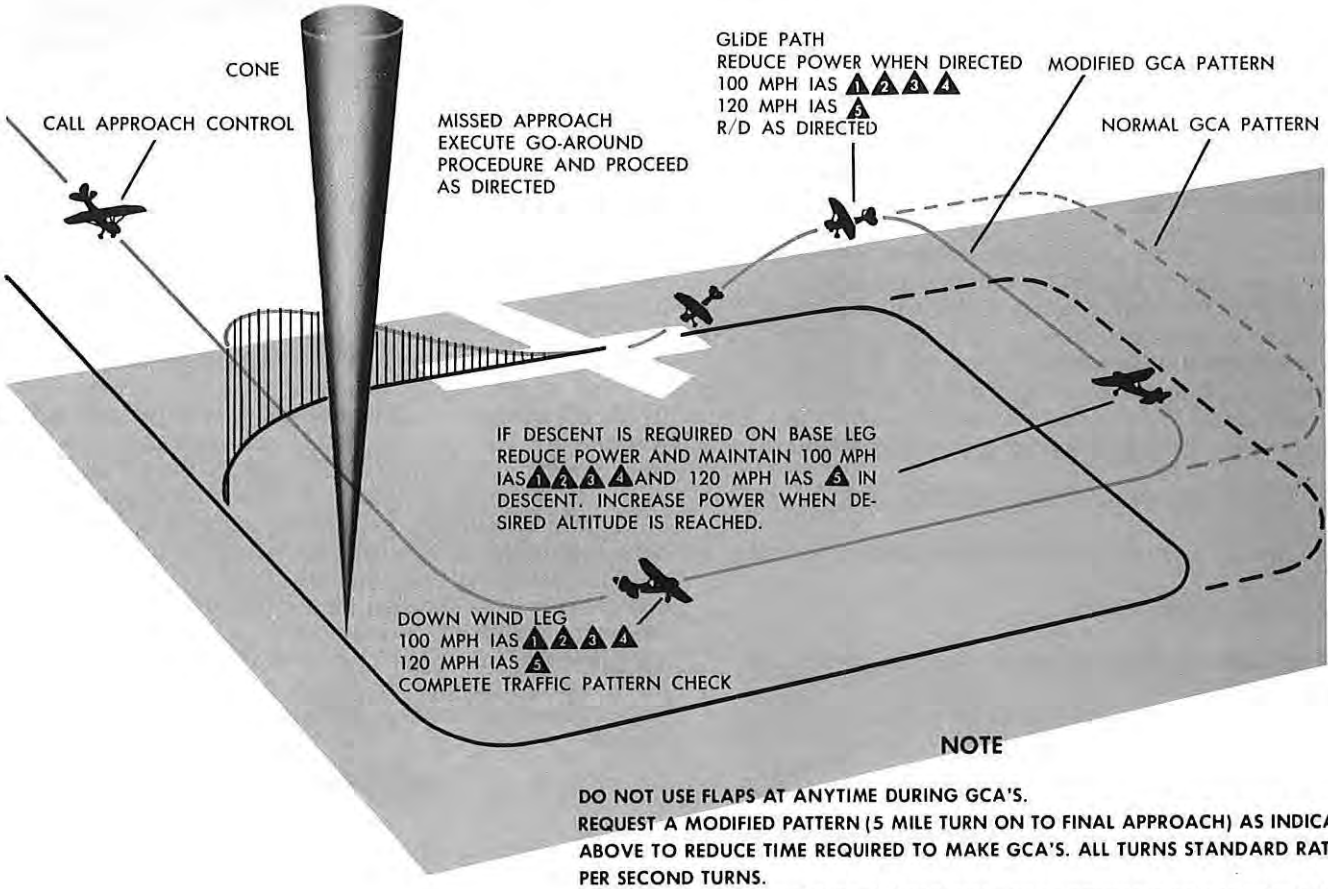


Figure 9-1.

TYPICAL GROUND CONTROL APPROACH



NOTE

DO NOT USE FLAPS AT ANYTIME DURING GCA'S.
REQUEST A MODIFIED PATTERN (5 MILE TURN ON TO FINAL APPROACH) AS INDICATED ABOVE TO REDUCE TIME REQUIRED TO MAKE GCA'S. ALL TURNS STANDARD RATE 3° PER SECOND TURNS.
GCA'S DURING HEAVY PRECIPITATION PRESENT SOME DIFFICULTY FOR GCA OPERATORS TO KEEP THE AIRCRAFT VISIBLE BECAUSE OF THE PRECIPITATION CLUTTER ON THE RADAR SCOPE. THIS MAY REQUIRE THE EXECUTION OF A GO-AROUND PROCEDURE.

Figure 9-2.

tional in descents with any combination of power and airspeed in the normal operating range. Limit banks to 15 degrees if rate of descent is more than 500 feet per minute.

9-20. HOLDING.

9-21. Holding in this aircraft normally presents no problem concerning fuel consumption regardless of altitude; however, holding at low airspeeds may present a problem if the winds are strong at holding altitude. Enter the holding pattern and maintain recommended instrument cruising airspeed of 100 mph IAS, unless there is considerable delay or the fuel reserve is low, then reduce power to maximum range.

9-22. INSTRUMENT APPROACHES.

9-23. Preparations for instrument approaches should include a thorough study of approach charts and obstacles in the let down area, determination of the rate of descent required at 100 mph IAS on aircraft 1 2 3 4 and 120 mph IAS on aircraft 5 to follow the prescribed glide path into the field, selection of a minimum altitude and a study of the go around procedure. In addition, all instruments and radio equipment should be carefully checked for proper operation and the Before Landing Check in Section II should be accomplished.

9-24. RADIO RANGE LET-DOWN.

9-25. It is recommended that radio range let-down procedures be reviewed as a part of preflight planning by reference to the Pilot's Handbook using the technique shown on figure 9-1.

9-26. GROUND CONTROL APPROACH (GCA).

9-27. The procedures shown on figure 9-2 should be used when making GCA's to provide better handling qualities and to reduce the time required to complete an approach. GCA's should be made with flaps up and at an airspeed of 100 mph IAS on aircraft 1 2 3 4 and at 120 mph IAS on aircraft 5. Even at these speeds, it presents quite a traffic control problem due to its relatively slow speed compared to normal

air traffic. Therefore, the GCA operator should be notified of the aircraft speed and that a base leg five miles out is requested.

Note

- A modified pattern will decrease GCA time approximately five minutes.
- All turns should be standard rate three degrees per second (approximately 15 degrees angle of bank).
- GCA's during heavy precipitation present some difficulty for the GCA operators to keep the aircraft visible because of the precipitation clutter on the radar scope. This may require the execution of a missed approach. Forward visibility is distorted or obscured by precipitation; however, limited forward visibility is possible out the side portion of the windshield.

9-28. INSTRUMENT LANDING SYSTEM (ILS).

9-29. An ILS cannot be accomplished in this aircraft.

9-30. ICE, SNOW, RAIN.

9-31. A takeoff should not be attempted if the aircraft is covered with frost, sleet or snow because the takeoff distance would be greatly increased. Rime and clear icing can be expected at all altitudes. Because of the lack of anti or de-icing equipment, ice will normally adhere to the leading edge of wings, empennage, struts, propeller, antennas and the windshield; however, the windshield defrosters will partially remove windshield ice during moderate icing conditions. Flight controls become sluggish and the cruising speed is decreased as ice is accumulated. If icing conditions cannot be avoided, turn the pitot heat switch ON and move the carburetor air control lever to HEAT (ALTERNATE AIR on aircraft ▲3 ▲4 ▲5) position.

Note

Icing within the carburetor might occur. If so it will be indicated by an unaccountable drop in rpm and on aircraft ▲3 in manifold pressure. Placing the carburetor air control lever in the HEAT (ALTERNATER AIR aircraft ▲3 ▲4 ▲5) position provides warm air from the engine compartment. Should the carburetor air filter become obstructed by ice, a valve in the carburetor air box will open, automatically providing an alternate air source.

9-32. If rough engine operation persists due to propeller ice, increase and decrease engine rpm to attempt to remove some of the ice. During flight, ice may accumulate between the outboard portion of the stabilizer and the overhanging aerodynamic balance of the elevator. This accumulation will restrict normal elevator operation if left undisturbed; therefore, occasional abrupt fore and aft movements of the elevator control should be made. Descend or climb to a warmer altitude if possible. If a landing is to be made with ice on the aircraft, make a power on approach at a higher than normal airspeed.

CAUTION

The stalling speed will be increased due to frost or icing.

9-33. No special precautions are required during flight in rain or snow other than keeping constantly alert for icing conditions and remembering that visibility is reduced considerably. If a landing is to be made on a field covered in spots by water, or soft sod is suspected, a full stall tail-low landing should be made to preclude the possibility of nosing over. A tail-low takeoff should also be made when these conditions exist.

9-34. TURBULENT AIR AND THUNDERSTORMS.

9-35. If turbulence is encountered, it is recommended that the aircraft be flown at or near 100 mph IAS to improve flying qualities. Because of the aircraft's relatively slow speed and the difficulty of handling the aircraft in turbulence, thunderstorm flying is not recommended. Make a thorough analysis of the general weather situation to determine thunderstorm areas, and prepare a flight plan that will avoid these areas whenever possible. Power setting and pitch attitude are the keys to proper flight technique in turbulent air. Desired penetration speed should be established before entering storm and maintained throughout the storm.

CAUTION

Thunderstorm flying demands considerable instrument experience and should be intentionally undertaken only by a pilot who is qualified. However, many flight operations require a certain amount of thunderstorm flying, since it is not always possible to avoid storm areas. A pilot, using modern equipment and possessing a combination of proper experience, common sense, and instrument flying proficiency, can safely fly thunderstorms.

Note

Proximity to thunderstorm activity can be determined by visual inspection (build-ups in the day time, lightning at night) and by "crash static" on radio equipment. If thunderstorms are detected, alter course to avoid them. If thunderstorms are accidentally encountered, fly as low as possible considering local terrain. If a landing is anticipated, be aware of the high winds accompanying thunderstorm activity.

9-36. APPROACHING THE STORM.

9-37. If thunderstorms cannot be avoided, prepare the aircraft as follows:

1. Mixture control lever - RICH.
2. Pitot heat switch - ON.
3. Carburetor air control lever - As required.
4. Throttle - Adjust as necessary to obtain penetration speed.

5. Suction gage - Desired range.
6. Directional and attitude indicators - Proper settings.
7. All loose equipment - Secured.
8. Safety belt - Tightened.
9. Shoulder harness inertia reel lock lever - LOCKED.
10. Turn off any radio equipment rendered useless by static.
11. At night, turn cockpit lights full bright to minimize blinding effect of lightning.

CAUTION

Do not lower wing flaps because maximum recommended airspeed for flap extension may be inadvertantly exceeded in heavy turbulence.

9-38. IN THE STORM.

1. Maintain power setting and pitch attitude (established before entering the storm) throughout the storm. Hold these constant, and your airspeed will be constant, regardless of airspeed indicator.
2. Devote all attention to flying the aircraft.
3. Expect turbulence, precipitation, and lightning, and don't allow them to cause undue concern.
4. Maintain attitude, concentrate principally on holding a level attitude by reference to the artificial horizon.
5. Maintain original heading. Do not make turns unless absolutely necessary.
6. Don't chase the airspeed indicator, since doing so will result in extreme attitudes. If a sudden gust should be encountered while the aircraft is nose high, a stall might result.
7. Use as little elevator control as possible to maintain your attitude in order to minimize the stresses imposed on the aircraft.
8. The altimeter may be unreliable in thunderstorms because of differential barometric pressure within the storm. A large gain or loss in altitude may be expected. Make allowance for this error in determining minimum safe altitude.

Note

Normally, the least-turbulent area in the thunderstorm will be at altitudes from zero to 6000 feet above the terrain. Altitudes between 10,000 and 20,000 feet are usually the most turbulent.

9-39. TURBULENT AIR PENETRATION SPEEDS.

9-40. The heaviest turbulence normally occurs between 10,000 and 20,000 feet. If a penetration must be made, a safe, most comfortable airspeed can be found by adding 70 mph to the power-on stall speed for the weight and the configuration being flown.

9-41. COLD WEATHER PROCEDURES.

9-42. The success of low temperature operation depends primarily upon the preparations made during the post flight inspection in anticipation of the requirements for operation on the following day. In order to expedite preflight inspection and insure satisfactory operation for the next flight, normal operating procedures outlined in Section II, should be adhered to with the following additions and exceptions.

9-43. BEFORE ENTERING THE AIRCRAFT.

1. Remove protective cover from cockpit and pitot head.
2. Remove snow and ice from control surfaces, wings, control hinges, fuel tank vents, pitot static sources, and auxiliary fuel pump drain opening.
3. Perform exterior inspection.
4. Preheat engine compartment by using portable ground heater with engine cover in place.
5. Fill oil tank with preheated oil. Specification MIL-L-6082, Grade 1065 to which one quart of gasoline has been added.
6. Remove engine cover.
7. With ignition switch OFF, pull propeller through several revolutions by hand.

9-44. ON ENTERING THE AIRCRAFT.

9-45. Actuate controls through a complete cycle of movement to ascertain that there are no obstructions and particularly to find if any controls are frozen. To conserve the battery, use external power to operate all electrical and radio equipment. Refer to Section II and perform Interior Inspection.

9-46. BEFORE STARTING ENGINE.

9-47. Refer to Section V of this chapter for normal engine operating limitations.

9-48. STARTING ENGINE.

1. Set all controls as for normal start.
2. Battery switch - OFF.

CAUTION

Battery switch must be OFF when using external power as damage to the battery will result.

3. Mixture control lever - RICH.
4. Auxiliary fuel pump switch - ON.
5. Ignition switch - BOTH. On ③ ⚠ aircraft, also turn emergency magneto switch ON if not already ON.

Note

On ③ ⚠ aircraft, both the ignition switch and emergency magneto switch must be ON before the engine will start.

6. Prime two to three strokes.
7. Starter button - Press.
8. Continue to prime until engine runs smoothly.
9. Auxiliary fuel pump switch - OFF (when engine runs smoothly).
10. Carburetor air control lever - HEAT (ALTERNATE AIR on aircraft ③ ⚠ ⑤. Leave in this position for warmup period.
11. After engine is running, cabin heater may be used for cabin heating and windshield defrosting as required.
12. External power source - Disconnect.
13. Battery switch - ON.

Note

Use utmost care to avoid engine stoppage as this will cause moisture to condense on spark plug points, making a restart difficult.

9-49. WARM-UP AND GROUND TESTS.

9-50. Maintain engine rpm between 800-1000 rpm until engine accelerates smoothly and oil pressure remains steady as throttle is advanced. Taxiing to the takeoff point will help to warm up the engine and should be used to reduce the ground time.

9-51. TAXIING INSTRUCTIONS.

9-52. Avoid taxiing in deep snow, as taxiing and steering are extremely difficult and frozen brakes are likely to result. The wheels should be visually checked to make sure they are turning. Use only essential electrical equipment to preserve battery life while taxiing at low engine speeds. Increase space between aircraft while taxiing to provide safe stopping distance. Taxi speed should be reduced when taxiing on slippery surfaces to avoid skidding. Keep control stick back when taxiing through snow. Taxiing in a strong crosswind on ice is not recommended.

WARNING

In cold weather, make sure all instruments have warmed up sufficiently to insure normal operation. Check for sluggish instruments during taxiing.

9-53. BEFORE TAKEOFF.

1. Check all controls carefully for free and correct movement.
2. Hold brakes and run engine at 1700 rpm until spark plugs have burned clean and engine is operating smoothly.
3. Carburetor air control lever - RAM FILTERED AIR.
4. Ignition system - Check at 1700 rpm (maximum allowable drop is 100 rpm).

CAUTION

The ignition system check will not be reliable if magneto ground trouble exists.

5. Generator - Check (See that generator cuts in at approximately 1200 to 1250 rpm).
6. Brakes - Check that brakes are free for takeoff run.
7. Flight controls - Check controls for free movement and correct response.

9-54. TAKEOFF.

9-55. Carburetor heat may be used as required during takeoff.

WARNING

Do not takeoff if there is any frost on the wings because this condition reduces the wing lift, and affects the stalling characteristics of the aircraft.

9-56. AFTER TAKEOFF.

9-57. If takeoff from a snow or slush-covered field is made the brakes should be operated several times to expel wet snow or slush and during VFR conditions the flaps should be operated through several cycles to prevent their freezing in the retracted position. If takeoff is made under IFR condition, delay raising the flaps to allow as much slush and water to drain off as possible.

CAUTION

Do not exceed the flaps down limit airspeed during this operation.

9-58. CLIMB.

9-59. Climb performance will be improved during cold weather operation at low altitude. Follow recommended climb speeds as given in the climb chart in Section X of this Chapter.

9-60. DURING FLIGHT.

9-61. Under extreme conditions, carburetor icing might occur. This will be indicated by an unaccountable drop in rpm and on aircraft ▲ a drop in manifold pressure. Operation of the carburetor air control lever provides a heated air source. Should the carburetor air filter be obstructed by ice, a valve in the carburetor air system automatically provides an alternate air source.

CAUTION

The carburetor air control lever should not be positioned to any intermediate position.

9-62. On aircraft ▲ under extreme conditions, exercise the propeller control lever between INCREASE RPM and DECREASE RPM periodically to cycle the oil in the propeller housing. This will prevent the propeller from becoming inoperative due to the oil congealing in the propeller housing.

9-63. DESCENT.

9-64. Use power in let-downs to maintain proper engine temperatures. Alternate air may be used if engine roughness develops during the let-down, and the mixture control lever should be in the RICH position.

9-65. APPROACH TO PATTERN.

1. Avoid engine over cooling in the approach.
2. Carburetor air control lever - HEAT (ALTERNATE AIR on aircraft ▲ ▲ ▲).

9-66. LANDING.

9-67. Avoid landing in snow unless the depth and conditions of the snow are known. After landing, apply brakes intermittently and carefully.

9-68. STOPPING ENGINE.

9-69. Use normal shutdown procedure as described in Section II of this Chapter.

9-70. BEFORE LEAVING THE AIRCRAFT.

1. Carburetor air control lever - RAM FILTERED AIR.
2. When parking aircraft on snow or ice, always place a layer of fabric, straw or other insulation under the wheels to keep them from freezing to the surface.
3. Control lock - UNLOCKED. (To keep brakes from freezing.)
4. Chock wheels and secure ailerons, elevators, and rudder with external locks.
5. Drain fuel drains of condensate.
6. Inspect fuel and oil vents and remove ice.
7. Clean dirt and ice from brake discs.
8. Drain oil.
9. Fill fuel tanks to avoid condensation in tanks.
10. If the engine is expected to be idle for several days, the battery should be removed.

CAUTION

Battery should be kept fully charged at all times in cold climates.

11. Install protective covers.

CAUTION

When reinstalling cabin cover, avoid scratching the plexiglas with metal fasteners on the cover or with other hard objects.

9-71. HOT WEATHER PROCEDURES.

9-72. Operation when outside air temperatures are above standard day conditions, does not require any special handling technique or procedures.

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SECTION X | CHAPTER 2

PERFORMANCE DATA

10-1. INTRODUCTION.

10-2. The information and charts in this section provides the pilot with performance data for all normal flight conditions and shows how to obtain the maximum performance from the aircraft. By utilizing the data in this section, the pilot will be able to fly each mission in an efficient manner with ample margin of safety. By using the recommended power settings and airspeeds, the pilot will be able to fly a greater distance at better cruising speed and arrive at a given destination with more reserve fuel. A careful study of the data will show the pilot the extensive range of operating conditions included and the potential usefulness of the charts. A description of each chart follows.

10-3. AIRSPEED INSTALLATION CORRECTION TABLE.

10-4. An airspeed installation correction table (figure 10-2) shows installation error as a function of airspeed for flap configurations of 0° and 30-60°. In using the chart, the installation error is added to or subtracted from the indicated airspeed (corrected for instrument error) to obtain calibrated airspeed (CAS). With this value of CAS and the free air temperature at a given pressure altitude, the true airspeed (TAS) can be found by means of a Type D-4 or a Type G-1 airspeed computer, or a Type AN5835-1 dead reckoning computer.

10-5. COMBAT ALLOWANCE CHART.

10-6. The combat allowance chart (figure 10-3), presents fuel flow values in gallons per hour for maximum continuous (normal) power at altitudes from sea level to 15,000 feet for standard day temperatures.

10-7. TAKEOFF CHART.

10-8. The takeoff chart (figure 10-4) shows minimum takeoff performance from a sod runway using takeoff rpm, full throttle and 30° flaps. Distances are shown for pressure altitude from sea level to 5000 feet and for ambient temperatures from -5° to +55°C. Effects of a 30 knot headwind are included and effects of other wind conditions may be found by interpolation. The distances shown are based on the minimum ground run and distance to clear a 50 foot obstacle technique. Performance for normal technique, as outlined in Section II, may be obtained by increasing the minimum distances as explained on the chart. Seaplane takeoff distances are shown for sea level standard conditions and minimum distance technique. Distances for normal seaplane technique may also be found by the method explained on the chart.

10-9. CLIMB CHART.

10-10. Distances during a climb, time to climb, and fuel used in a climb can be determined from the climb chart (figure 10-5). Climb performance may be obtained for both climbs from sea level and in flight climbs between any altitudes. The data shown is based on normal power (2300 rpm), flaps up, and airspeed for maximum rate of climb as noted.

10-11. LANDING CHART.

10-12. The landing chart (figure 10-6) shows the total distance required to clear a 50 foot obstacle and minimum landing ground roll for a sod runway with 60° flaps at altitudes from sea level to 6000 feet. Approach speeds for the minimum distance technique are contained in the chart, however, correction factors to obtain distances using the normal techniques as outlined in Section II may be obtained by increasing the minimum distances as explained on the chart. Seaplane water run and total distances are shown for a normal technique with 45° flaps.

10-13. FLIGHT OPERATION INSTRUCTION CHARTS.

10-14. The flight operation instruction charts (figure 10-7, 10-8 and 10-9) show the range that can be obtained with various quantities of fuel on board at various cruise speeds and altitudes. Power settings required to attain the desired range are shown for various altitudes. The charts contain instruction for use as well as a sample problem.

10-15. MAXIMUM ENDURANCE CHART.

10-16. The maximum endurance chart (figure 10-10) presents the power settings and speeds that result in minimum fuel flow, and maximum time airborne. Data is presented for altitudes from sea level to 15,000 feet for standard day conditions.

10-17. SAMPLE PROBLEM.

10-18. This mission planning problem is included as an additional aid in the application of the data presented in Section X. A typical navigation mission will be planned in the succeeding paragraphs and each of the charts will be used in the progress of the flight. Although TL-19D data is used in the problem, the method is applicable to all aircraft covered in this manual.

a. This mission shall consist of a flight to a check point 150 nautical miles west of home base, simulated combat for 15 minutes at 5000 feet at this point and return to the home base. It is desired to have sufficient reserve fuel for 30 minutes loiter at sea level at the

end of the return leg. A cruise altitude of 5000 feet has been selected.

b. The weather report over the intended route includes a 30 knot wind from the south at 5000 feet.

CONDITIONS.

a. Gross weight (Full fuel and crew of two) . . 2400 lb.
b. Runway air temperature . . . 15°C.
c. Pressure altitude . . . . . 1000 ft.
d. Wind . . . . . South at 10 kt.
e. Runway 18, 1200 feet long, a sod runway is the active runway.

PLANNING THE MISSION. (Takeoff)

The first step is to check the takeoff and landing distances to determine the technique required for the prevailing conditions.

a. From figure 10-4, the minimum takeoff distances to clear a 50 foot obstacle are:
No wind . . . . . 848 ft.
30 knot wind . . . . . 275 ft.
b. Difference (848-275) . . . . . 573 ft.

To compute the takeoff distance for the 10 knot prevailing wind, a linear interpolation is made between the no-wind and 30 knot wind distances. This is done by subtracting 1/3 of the difference from the no-wind value (or adding 2/3 of the difference to the 30 knot value).

a. (573 ÷ 1/3) . . . . . 191 ft.
b. The minimum takeoff distances to clear a 50 foot obstacle is then:
(848-191) . . . . . 657 ft.

The distance using normal technique is 1.5 times the minimum distance (as explained in the remarks).

a. The distance to clear a 50 foot obstacle using normal technique is then:
(1.5 x 657) . . . . . 989 ft.

The normal technique is ample for the prevailing conditions.

CRUISING FUEL.

The fuel available for cruising is found by taking the total useable fuel and subtracting the allowances for takeoff and climb, combat and reserve.

a. Fuel for takeoff and climb.
(From figure 10-5) . . . . 2.8 gal.

Fuel for 15 minutes combat is computed from figure 10-3 and is simply the fuel flow (gal/hr) times combat time (hrs).

b. Fuel for combat.
(12.4 x .25) . . . . . 3.1 gal.

Reserve for 30 minutes loiter is taken from figure 10-10 and is again fuel flow times loiter time.

c. Fuel for loiter at sea level.
(5.7 x .50) . . . . . 2.9 gal.

In order to compute wind allowance, it is necessary to establish an approximate cruise speed from the flight operation instruction charts (figure 10-7, 10-8 and 10-9).

The cruise fuel available is found as follows:

a. Total fuel . . . . . 41 gal.
b. Fuel used in takeoff and climb to 5000 feet . . . . . 2.8 gal.
c. Fuel used in combat . . . . 3.1 gal.
d. Fuel reserve for loiter . . . 2.9 gal.
e. Total fuel for takeoff and climb, combat and loiter (2.8 + 3.1 + 2.9) . 8.8 gal.
f. Fuel available for cruise (41 - 8.8) . . . . . 32.2 gal.

From figure 10-8, column III with 30 gallons of cruise fuel, 360 nautical air miles are available at a cruise speed of 120 knots TAS and a power setting of 1900 rpm and 24" hg. The wind is accounted for by computing the air distance necessary to fly the 300 nautical miles ground distance assumed in the problem.

The air distance is found by:

$$\text{Air distance} = \text{ground distance} \times \frac{\text{average true airspeed}}{\text{ground speed}}$$

The ground speed in the assumed problem is 116 knots for both the outbound and return legs.

a. The air distance is then:
(300 x 120 ÷ 116) . . 310 nautical miles

The power setting of 1900 rpm and 24" hg will result in approximately 380 nautical miles with 32 gallons of fuel which is sufficient for the sample problem.

LANDING.

The gross weight at landing is found by subtracting the weight of the fuel used during the mission from the takeoff weight.

Fuel used is 6.0 lb/gal.

a. Takeoff and climb
(2.8 x 6.0) . . . . . 17 lb.
b. Cruise.
(30 x 6.0) . . . . . 180 lb.
c. Combat
(3.1 x 6.0) . . . . . 19 lb.
d. Loiter
(2.9 x 6.0) . . . . . 17 lb.
e. Total pounds of fuel consumed during mission.
(17 + 180 + 19 + 17) . . . . 233 lb.
f. Landing gross weight.
(2400-233) . . . . . 2167 lb.

To find the minimum landing distance to clear a 50 foot obstacle for a gross weight of 2167 pounds and pressure altitude of 1000 feet, it is necessary to interpolate for both altitude and gross weight effects from figure 10-6.

a. Landing distance at sea level for 2400

pounds gross weight . . . . 660 ft.

b. Landing distance at 2000 foot pressure altitude for 2400 pounds gross weight. 680 ft.

c. Landing distance at sea level for 2000 pounds gross weight . . . . 580 ft.

d. Landing distance at 2000 foot pressure altitude for 2000 pounds gross weight. 600 ft.

e. Gross weight difference (2400-2000) . . . . . 400 lb.

f. Landing distance difference at sea level (660-580) . . . . . 80 ft.

g. Landing distance difference at 2000 foot pressure altitude. (680-600) . . 80 ft.

h. Difference between 200 pounds gross weight and actual landing gross weight. (2167-2000) . . . . . 167 lb.

i. Landing distance for 2167 pounds gross weight at sea level. (80 x 167 - 400 = 33 ft.) (580 + 33) . . . . . 613 ft.

j. Landing distance for 2167 pound gross weight at pressure altitude of 2000 foot (80 x 167 ÷ 400 = 33 ft.) (600 + 33) . . . . . 633 ft.

k. Landing distance for 2167 pound gross weight at pressure altitude of 1000 foot for minimum distance technique. (613 + 633 ÷ 2) . . . . . 623 ft.

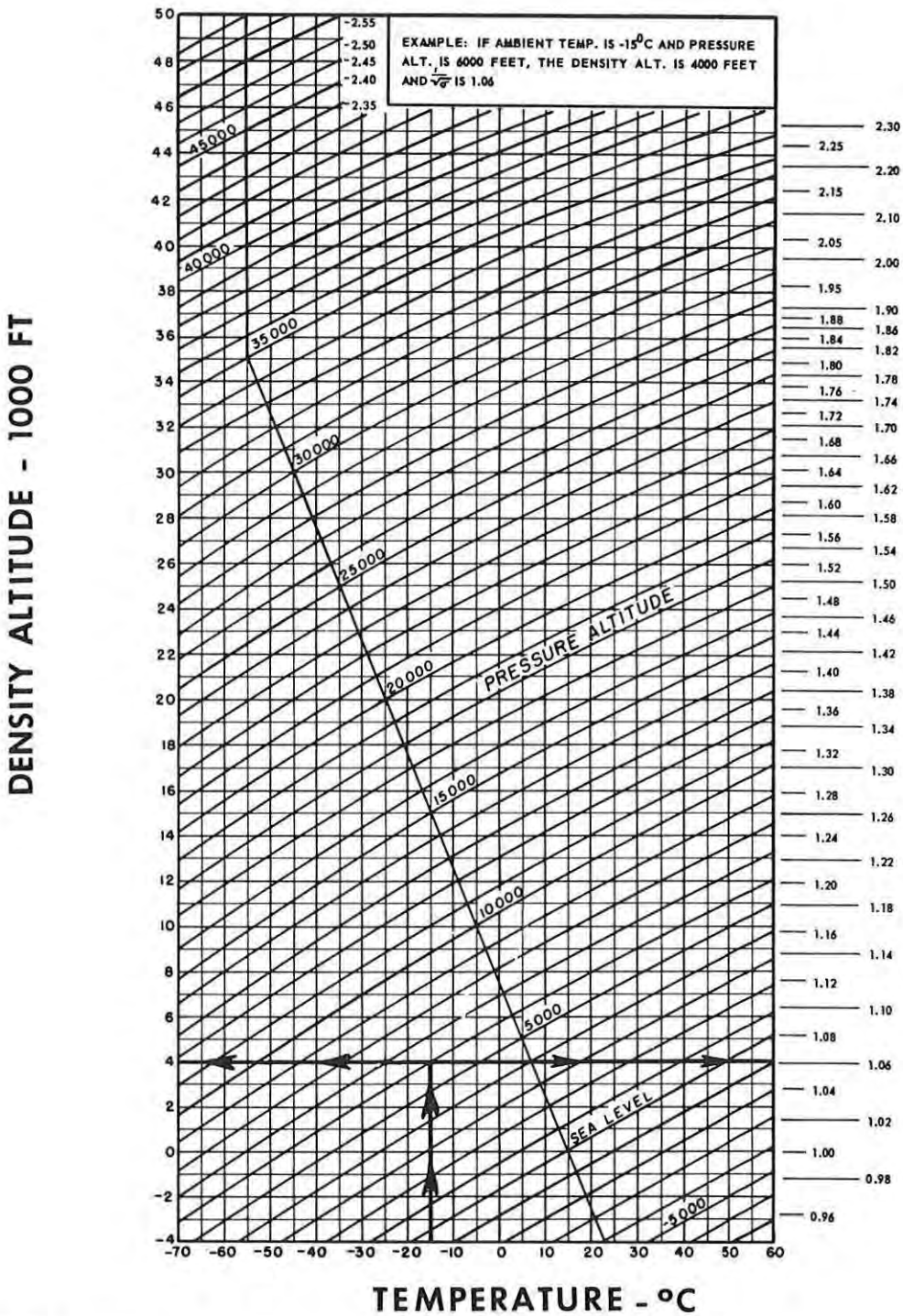
No wind distance using normal technique is found by increasing the minimum distance by 65%.

a. Landing distance for normal technique. (1.65 x 623 ft) . . . . . 1030 ft.

Winds are accounted for by substracting 20% of the no-wind distance for each 10 knots of headwind.

a. With the assumed wind of 10 knots the normal landing distance is then: (1030 x 80%) . . . . . 825 ft. and the normal landing technique may be used.

DENSITY ALTITUDE CHART



WADC Form 241V
(11 June 51)

Figure 10-1.

AIRSPEED INSTALLATION CORRECTION TABLE

ADD CORRECTION TO CORRECTED INSTRUMENT READING (IAS) TO OBTAIN CALIBRATED AIRSPEED

MODELS: L-19A ▲1, L-19E ▲2 TL-19A ▲3, TL-19E ▲4				ENGINE: (1) O-470-11			
FLAPS UP		FLAPS DOWN 30°—60°		FLAPS UP		FLAPS DOWN 30°—60°	
IAS (MPH)	CORRECTION (MPH)	IAS (MPH)	CORRECTION (MPH)	IAS (MPH)	CORRECTION (MPH)	IAS (MPH)	CORRECTION (MPH)
40	+12	40	+11	40	+12	40	+10
50	+10	50	+6	50	+7	50	+5
60	+7	60	+4	60	+4	60	+2
70	+5	70	+3	70	+2	70	+1
80	+4	80	+2	80	+1	80	0
90	+3	90	+2	90	+1	90	0
100	+2	100	+2	100	+1	100	0
120	0			120	+2		
140	-1			140	+3		
160	-2			160	+4		

MODEL: TL-19D ▲5	ENGINE: (1) O-470-15

REMARKS:

DATA BASIS: FLIGHT TEST

DATA AS OF: ▲1 ▲2 ▲3 ▲4 15 APRIL 1957: ▲5 15 MARCH 1956

Figure 10-2.

COMBAT ALLOWANCE CHART

NORMAL POWER STANDARD DAY

MODELS: L-19A ①, L-19E ②
TL-19A ③TL-19E ④, TL-19D ⑤

ENGINE:
①②③④(1) O-470-11
⑤(1) O-470-15

MODEL	PRESSURE ALTITUDE	RPM	M.P. INCHES-HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT MIN.	LIMIT CYLINDER TEMP.°C	FUEL FLOW GAL/HR.
①②③④	SL	2300	N/A	N/A	M.L.	Continuous	274	1.0
	5000	2300	N/A	N/A	M.L.	Continuous	274	8.7
	10000	2300	N/A	N/A	M.L.	Continuous	274	7.8
	15000	2300	N/A	N/A	M.L.	Continuous	274	7.3
⑤	SL	2300	F.T.	N/A	M.L.	Continuous	274	14.6
	5000	2300	F.T.	N/A	M.L.	Continuous	274	12.4
	10000	2300	F.T.	N/A	M.L.	Continuous	274	10.8
	15000	2300	F.T.	N/A	M.L.	Continuous	274	9.3
①② SEA PLANE	SL	2300	N/A	N/A	M.L.	Continuous	274	9.6
	5000	2300	N/A	N/A	M.L.	Continuous	274	8.6
	10000	2300	N/A	N/A	M.L.	Continuous	274	8.0

REMARKS:

LEGEND

F. T. : Full Throttle
M. L. : Manual Lean
N/A: Not Applicable

DATA BASIS: FLIGHT TEST
DATA AS OF: ①②③④15 APRIL 1957; ⑤15 MARCH 1956

FUEL GRADE: 80
FUEL DENSITY: 6.0 LBS/GAL

Figure 10-3.

TAKE-OFF DISTANCES – FEET

MODELS: L-19A[1], L-19E[2], TL 19A[3], TL-19E[4], TL-19D[5]

30° FLAPS, SOD RUNWAY

ENGINES: [1][2][3][4] (1) O-470-11; [5] (1) O-470-15

CONFIGURATION, MODEL AND GROSS WEIGHT	PRESSURE ALTITUDE	−5 DEG. CENT.				+15 DEG. CENT.				+35 DEG. CENT.				+55 DEG. CENT.			
		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND	
		GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.
LANDPLANE [1] -2100 LB [3] -2100 LB	SL	265	430	40	100	355	580	59	147	500	830	95	237	670	1125	143	381
	1,000	295	480	46	110	390	640	68	170	565	940	113	282	780	1330	174	465
	2,000	325	530	53	125	455	750	84	210	620	1035	128	320	870	1500	202	540
	3,000	355	580	59	145	505	835	96	240	720	1220	156	390	985	1740	236	630
	4,000	400	655	70	170	565	940	113	282	810	1390	184	460	1095	1990	270	720
	5,000	455	750	84	210	640	1070	133	332	910	1590	214	535	1175	2200	294	785
LANDPLANE [2] -2165 LB [4] -2165 LB	SL	284	474	44	110	380	634	66	165	535	891	105	263	716	1205	156	390
	1,000	315	525	50	125	417	695	74	185	605	1010	123	308	835	1440	190	475
	2,000	348	580	58	145	477	795	90	225	663	1115	140	350	930	1630	220	560
	3,000	380	634	65	163	540	900	106	265	770	1310	171	427	1055	1890	258	670
	4,000	428	715	77	193	605	1010	123	308	866	1490	202	505	1170	2190	294	780
	5,000	486	810	92	230	685	1150	146	365	974	1710	232	600	1255	2450	322	870
LANDPLANE [5] -2400 LB	SL	332	690	50	200	375	772	63	235	420	857	76	278	465	940	90	317
	1,000	365	760	59	230	415	848	75	275	465	942	90	317	515	1038	103	350
	2,000	392	810	68	260	450	915	86	305	510	1027	102	355	568	1135	116	385
	3,000	442	900	83	295	500	1010	100	345	560	1120	114	385	622	1238	130	425
	4,000	482	975	95	330	550	1100	112	375	617	1230	128	422	682	1352	143	460
	5,000	533	1070	108	365	607	1210	125	415	680	1350	142	460	750	1480	160	505
SEAPLANE [1] -2400 LB [2] -2400 LB	SL					590	1660	425	590								
	1,000																
	2,000																
	3,000																
	4,000																
	5,000																

REMARKS: Distances shown are minimum for normal technique, as outlined in Section II, increase distances shown approximately 50%.

DATA BASIS: FLIGHT TEST

DATA AS OF: [1][2][3][4] 15 APRIL 1957; [5] 15 MARCH 1956

FUEL GRADE: 80

FUEL DENSITY: 6.0 LB/GAL

Figure 10-4.

CLIMB CHART FOR NORMAL POWER

STANDARD DAY

MODELS: L-19A[1], L-19E[2], TL-19A[3], TL-19E[4], TL-19D[5]

ENGINES: [1][2][3][4](1) 0-470-11
[5](1) 0-470-15

CONFIGURATION: LANDPLANE
WEIGHT: [1] 2100 LB [2][3][4][5] 2100 LB

APPROXIMATE				M.P.	CAS	PRESSURE ALTITUDE	CAS	M.P.	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL			IN. Hg.	MPH	FEET	MPH	IN. Hg.	FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL						FUEL	TIME	DIST.	
1290	0	0	1.5	N/A	65	SL	65	N/A	1.5	0	0	1230
1010	4	4	2.4	N/A	65	5000	65	N/A	2.5	4	5	955
725	11	10	3.8	N/A	65	10000	65	N/A	3.9	10	11	680
445	21	18	5.7	N/A	65	15000	65	N/A	6.0	20	22	400
275	32	26	7.2	N/A	65	18000	65	N/A	7.6	28	35	240
160	42	34	8.7	N/A	65	20000	65	N/A	9.2	37	46	125

CONFIGURATION: LANDPLANE
WEIGHT: [5] 2400 LB

CONFIGURATION: SEAPLANE
WEIGHT: [1] 2400 LB [2][3][4] 2400 LB

APPROXIMATE				M.P.	CAS	PRESSURE ALTITUDE	CAS	M.P.	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL			IN. Hg.	MPH	FEET	MPH	IN. Hg.	FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL						FUEL	TIME	DIST.	
1140	0	0	1.5	F.T.	83	SL	64	N/A	1.5	0	0	960
880	6	5	2.8	F.T.	80	5000	61	N/A	3.0	5	7	680
625	16	12	4.4	F.T.	77	10000	57	N/A	5.5	15	16	390
370	29	22	6.5	F.T.	74	15000	52	N/A	9.7	36	38	100
220	43	32	8.2	F.T.	72	18000						
115	59	43	10.2	F.T.	70	20000						

REMARKS:
1. Climb at 2300 RPM.
2. Climb at recommended CAS.
3. 1.5 gallons used for warm-up, taxi and takeoff.
4. Rich mixture.

LEGEND
Rate-of-climb: Feet per min
Distance: Nautical miles
Time: Minutes
Fuel: Gallons
CAS: Calibrated Airspeed
M.P.: Manifold Pressure
F.T.: Full Throttle
M.P.H.: Miles Per Hour

FUEL GRADE: 80
FUEL DENSITY: 6.0 LBS/GAL

DATA BASIS: FLIGHT TEST
DATA AS OF: [1][2][3][4]15 APRIL 1957; [5]15 MARCH 1956

Figure 10-5.

LANDING DISTANCE - FEET

LANDPLANE STANDARD DAY

MODELS: L-19A[1], L-19E[2], TL-19A[3], TL-19E[4], TL-19D[5]

ENGINES: [1][2][3][4](1) O-470-11 [5](1) O-470-15

MODEL GROSS WEIGHT		BEST CAS FOR APPROACH		60° FLAPS - SOD SURFACE - NO WIND - POWER OFF							
		POWER ON	POWER OFF	AT SEA LEVEL		AT 2000 FT.		AT 4000 FT.		AT 6000 FT.	
		KNOTS	KNOTS	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.
[1][2]	1800 LB	58	58	260	550	295	590	335	630	380	680
[3][4]	2100 LB	62	62	305	605	350	650	390	690	450	760
[5]	2000 LB	65	65	250	580	257	600	265	630	297	650
	2400 LB	71	71	300	660	308	680	318	710	353	740

LANDING DISTANCE - FEET

SEAPLANE 45° Flaps

MODELS: L-19A[1] L-19E[2]

[1][2]	2000 LB	68	68	560	1200						
	2400 LB	74	74	645	1310						

REMARKS: 1. Distances shown are minimum. For normal technique, as outlined in Section II, increase distance shown approximately 65%.
2. Subtract 20% of the distance shown for each 10 knots of headwind.

DATA BASIS: FLIGHT TEST

DATA AS OF: [1][2][3][4] 15 APRIL 1957 : [5] 15 MARCH 1956

Figure 10-6.

AIRCRAFT MODELS: L-19A [1], L-19E [2], TL-19A [3], TL-19E [1]

ENGINE: (1) O-470-11

FLIGHT OPERATION INSTRUCTION CHART

LANDPLANE - STANDARD DAY

CHART WEIGHT LIMITS: 2165 TO 1800 POUNDS

EXTERNAL LOAD ITEMS: NONE

NUMBER OF ENGINES OPERATING: 1

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite values nearest desired cruising altitude (ALT.) read R.P.M. manifold pressure (M.P.) and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high speed cruising only, Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Air miles per gal (MI./GAL) (no wind), gal per hr. (GPH) and true airspeed (T.A.S.) are approximate values for reference. Range values are for an average airplane flying alone (no wind).

COLUMN I		FUEL[1] GAL	COLUMN II		COLUMN III		COLUMN IV		FUEL[1] GAL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
491	426	42	580	505	630	547	676	588	42	690	600
351	305	30	414	360	449	390	483	420	30	495	430
234	203	20	276	240	299	260	322	280	20	329	286
117	102	10	138	120	150	130	161	140	10	165	143

MAXIMUM CONTINUOUS						PRESS ALT. FEET	13.8 STAT. 12 NAUT. MI./GAL						15 STAT. 13 NAUT. MI./GAL						16.1 STAT. 14 NAUT. MI./GAL						PRESS ALT. FEET	16.5 STAT. 14.3 NAUT. MI./GAL					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
2300	N/A	ML	7.3	116	101	15000													2250	N/A	ML	6.9	112	97	15000	2150	N/A	ML	6.4	105	92
2300	N/A	ML	7.8	117	101	10000							2300	N/A	ML	7.8	116	101							10000						
2300	N/A	ML	8.7	116	101	5000	2250	N/A	ML	8.2	113	99	2075	N/A	ML	6.8	102	89							5000						
2300	N/A	ML	10	115	100	S.L.	2100	N/A	ML	7.6	104	91													S.L.						

REMARKS:

1. Make allowance for warm-up, take-off and climb (see fig. 10-5) plus allowances for wind, reserve and combat as required.

EXAMPLE

At 2165 lb. gross weight with 30 gal of fuel (after deducting total allowances of 12 gal) to fly 449 statute air miles at 5000 ft, maintain 2075 rpm with mixture set M. L.

LEGEND

N/A: Not Applicable
M.P.: Manifold Pressure
GPH: Fuel flow per hour
TAS: True Airspeed
KN.: Knots
M.L.: Manual Lean
F.T.: Full Throttle
S.L.: Sea Level
M.P.H.: Miles Per Hour

DATA BASIS: FLIGHT TEST
DATA AS OF: 15 APRIL 1957

FUEL GRADE: 80
FUEL DENSITY: 6.0 LBS/GAL

Figure 10-7

AIRCRAFT MODEL (S): TL-19D ▲	FLIGHT OPERATION INSTRUCTION CHART STANDARD DAY	EXTERNAL LOAD ITEMS: NONE
ENGINE: (1) O-470-15	CHART WEIGHT LIMITS: 2400 TO 2000 POUNDS	NUMBER OF ENGINES OPERATING: 1

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite values nearest desired cruising altitude (ALT.) read R.P.M. manifold pressure (M.P.) and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high speed cruising only, Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Air miles per gal (MI./GAL) (no wind), gal per hr. (GPH) and true airspeed (T.A.S.) are approximate values for reference. Range values are for an average airplane flying alone (no wind).

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I RANGE IN AIRMILES NAUTICAL	FUEL[1] GAL	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II RANGE IN AIRMILES NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III RANGE IN AIRMILES NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV RANGE IN AIRMILES NAUTICAL	FUEL[1] GAL	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]											
649 464	564 403	42 30	484 346	420 300	580 414	505 360	676 483	588 420	42 30	764 556	664 474
308 154	268 134	20 10	230 115	200 100	276 138	240 120	322 161	280 140	20 10	363 182	316 158

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	PRESS ALT. FEET	11.5 STAT. 10 NAUT. MI./GAL R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	13.8 STAT. 12 NAUT. MI./GAL R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	16.1 STAT. 14 NAUT. MI./GAL R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	PRESS ALT. FEET	18.2 STAT. 15.8 NAUT. MI./GAL R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN
						40000 35000 30000																			40000 35000 30000						
2300	16	ML	9.0	139	121	25000 20000 15000													2200	16	ML	8.6	139	121	25000 20000 15000	1900	15	ML	6.7	122	106
2300	20	ML	10.5	145	126	10000							2300	20	ML	10.5	145	126	1950	20	ML	8.4	135	118	10000								
2300	24	ML	12.2	149	129	5000							1900	24	ML	10	138	120	1900	20	ML	7.7	124	108	5000								
2300	28	ML	14.2	150	130	S.L.	2300	25.5	ML	12.3	142	123	1900	24	ML	9.3	128	111	1900	19	ML	7.0	112	97	S.L.								

REMARKS:

1. Make allowance for warm-up, take-off and climb (see fig.10-7) plus allowances for wind, reserve and combat as required.

EXAMPLE

At 2400 lb. gross weight with 30 gallons of fuel (after deducting total allowances of 12 gallons) to fly 556 statute air miles at 15,000 ft. altitude, maintain 1900 rpm and 15 in. manifold pressure with mixture set M.L.

LEGEND

N/A: Not Applicable
M.P.: Manifold Pressure
GPH: Fuel flow per hour
TAS: True Airspeed
KN.: Knots
M.L.: Manual Lean
F.T.: Full Throttle
S.L.: Sea Level
M.P.H.: Miles Per Hour

DATA BASIS: FLIGHT TEST
DATA AS OF: 15 MARCH 1956

FUEL GRADE: 80
FUEL DENSITY: 6.0 LBS/GAL

Figure 10-8.

AIRCRAFT MODELS:
L-19A, ▲L-19E▲
SEAPLANE

ENGINE: (1) 0-470-11

FLIGHT OPERATION INSTRUCTION CHART
STANDARD DAY

CHART WEIGHT LIMITS: 2400 TO 2000 POUNDS

EXTERNAL LOAD ITEMS:
NONE

NUMBER OF ENGINES OPERATING: 1

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite values nearest desired cruising altitude (ALT.) read R.P.M. manifold pressure (M.P.) and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high speed cruising only, Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Air miles per gal (MI./GAL) (no wind), gal per hr. (GPH) and true airspeed (T.A.S.) are approximate values for reference. Range values are for an average airplane flying alone (no wind).

COLUMN I		FUEL[1]	COLUMN II		COLUMN III		COLUMN IV		FUEL[1]	COLUMN V	
RANGE IN AIRMILES		GAL	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		GAL	RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
546	475	42	532	462	555	483	581	505	42	590	513
390	339	30	380	330	397	345	414	360	30	421	366
260	226	20	253	220	264	230	276	240	20	280	244
130	113	10	127	110	132	115	138	120	10	140	122

MAXIMUM CONTINUOUS						PRESS ALT. FEET	12.7 STAT. 11 NAUT. MI./GAL						13.2 STAT. 11.5 NAUT. MI./GAL						13.8 STAT. 12 NAUT. MI./GAL						PRESS ALT. FEET	14 STAT. 12.2 NAUT. MI./GAL					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN		R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN	R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN		R.P.M.	M.P. INCHES	MIXTURE	APPROX. GAL/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KN
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
						15000																			15000						
2300	N/A	ML	8.2	106	92	10000							2275	N/A	ML	7.9	104	91	2150	N/A	ML	7.1	98	85	10000						
2300	N/A	ML	8.7	109	95	5000	2300	N/A	ML	8.5	107	94	2250	N/A	ML	8.0	105	92	2100	N/A	ML	7.1	98	85	5000						
2300	N/A	ML	9.8	112	98	S.L.	2175	N/A	ML	8.3	104	91	2125	N/A	ML	7.5	99	86	1975	N/A	ML	6.7	93	81	S.L.	1900	N/A	ML	6.3	89	77

REMARKS:

1. Make allowance for warm-up, take-off and climb (see fig10-7) plus allowances for wind, reserve and combat as required.

EXAMPLE

At 2400 lb. gross weight with 30 gal of fuel (after deducting total allowances of 12 gal) to fly 380 statute miles at sea level maintain 2175 rpm with mixture set M.L.

LEGEND

N/A: Not Applicable
M.P.: Manifold Pressure
GPH: Fuel flow per hour
TAS: True Airspeed
KN.: Knots
M.L.: Manual Lean
F.T.: Full Throttle
S.L.: Sea Level
M.P.H.: Miles Per Hour

DATA BASIS: FLIGHT TEST
DATA AS OF: 15 APRIL 1957

FUEL GRADE: 80
FUEL DENSITY: 6.0 LBS/GAL

Figure 10-9.

MAXIMUM ENDURANCE

MODELS: L-19A[1], L-19E[2], TL-19A[4], TL-19E[4], TL-19D[5]

STANDARD DAY

ENGINES: [1][2][3][4](1) O-470-11
[5](1) O-470-15

CONFIGURATION: LANDPLANE
WEIGHT: [1] 2100 LB [2]2100 LB

APPROXIMATE				CAS	PRESSURE ALTITUDE	CAS	APPROXIMATE			
GAL/HR	MIX.	RPM	M.P. IN. Hg.	KNOTS	FEET	KNOTS	M.P. IN. Hg.	RPM	MIX.	GAL/HR
5.8	M.L.	1800	N/A	84	SL	85	N/A	1820	M.L.	5.9
5.6	M.L.	1800	N/A	77	5000	79	N/A	1825	M.L.	5.7
5.7	M.L.	1900	N/A	76	10000	77	N/A	1940	M.L.	5.8
5.8	M.L.	2000	N/A	75	15000	76	N/A	2050	M.L.	5.9

CONFIGURATION: LANDPLANE
WEIGHT: [3] 2400 LB

CONFIGURATION: SEAPLANE
WEIGHT: [1] 2400 LB [2]2400 LB

APPROXIMATE				CAS	PRESSURE ALTITUDE	CAS	APPROXIMATE			
GAL/HR	MIX.	RPM	M.P. IN. Hg.	KNOTS	FEET	KNOTS	M.P. IN. Hg.	RPM	MIX.	GAL/HR
5.7	M.L.	1900	15	85	SL	81	N/A	1800	M.L.	5.9
5.9	M.L.	1900	15	85	5000	76	N/A	1900	M.L.	6.0
6.0	M.L.	1900	14	85	10000	76	N/A	2000	M.L.	6.4
6.4	M.L.	1900	14	85	15000					

REMARKS:

LEGEND:

N/A: Not Applicable
M.L.: Manual Lean

DATA BASIS: FLIGHT TEST
DATA AS OF: [1][2][3][4]15 APRIL 1957; [5]15 MARCH 1956

FUEL GRADE: 80
FUEL DENSITY: 6.0 LBS/GAL

Figure 10-10.

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SECTION I | CHAPTER 3

INTRODUCTION

The data covered by this chapter is intended to assist the using activities in complying with aircraft weight and balance requirements necessary for the proper operation, loading and maintenance of the L-19A, L-19E, TL-19A, TL-19E and TL-19D aircraft.

SECTION II | CHAPTER 3

GENERAL LOADING INSTRUCTIONS

2-1. INSTRUCTIONS FOR USE OF CHART "E".

2-2. The loading data on Chart "E" is intended to provide information necessary to work a loading problem for the aircraft to which this manual is applicable. From the loading tables, weight and moment/constant are obtained for all variable load items and are added arithmetically to the current basic weight and moment/constant to obtain the gross weight and moment. The CG of the loaded aircraft is represented by a moment figure on the tables. If the aircraft is loaded within the forward and aft CG limits, the moment figure will fall numerically between the limiting moments. The effect on the CG of the expenditure in flight such as fuel maybe checked by subtracting the weight and moments of the items from the takeoff gross weight and moment and checking the new moment with the CG table. This check should be made to determine whether or not the CG will remain within limits during the entire flight.

2-3. CHART A - BASIC WEIGHT CHECK LIST FORM 365A.

2-4. GENERAL.

2-5. The Basic Weight Check list is a tabulation of all operating equipment that is or may be installed and for which provision or fixed stowage has been made in a definite location in the aircraft. When check marks are entered in the "IN AIRCRAFT" column, it serves as the inventory of equipment included in the basic weight and moment/constant.

2-6. Inventories should be made periodically, but are required specifically when:

1. The aircraft undergoes modification, major overhaul or repair.
2. The aircraft is received at a new base.
3. Changes in equipment are made for a different type of operation or mission.
4. The aircraft is reweighed.
5. The pilot reports unsatisfactory flight characteristics (tail or nose heaviness).

2-7. INSTRUCTION FOR USE.

2-8. The manufactures of the aircraft placed check marks in the "DELIVERY EQUIPMENT" column to identify the items of equipment in the aircraft for the delivery condition.

2-9. Subsequent check list inventories shall be carried on as follows:

1. Inspect the aircraft for equipment actually installed, placing check marks in the next unused "IN AIRCRAFT" column. A check (✓) in the column headed "IN AIRCRAFT" indicates the presence of the item in the aircraft on the date at the head of the column, and a zero (0) indicates its absence. Items should not be checked unless they are installed. During this inventory, note whether any new items of equipment have been installed, and if so enter item number and the name or description, together with other data required through column "moment/constant", including the date in parentheses following the description.
2. Compare this inventory with that under the last "CHECK" heading, noting any changes in the items of equipment installed in the aircraft.
3. Check marks are made only at the time of a complete inventory. Never change the check marks or add new ones under a previously accomplished check heading. Use the next "CHECK" column. When an inventory is included as part of a weighing, the procedure outlined in the preceding paragraph should not be omitted since this correction makes possible the comparison of calculated and actual weight figures.

SECTION III | CHAPTER 3

CHART "E", LOADING DATA

3-1. WEIGHING AND MEASURING PROCEDURE. Aircraft ▲ ▲2 ▲3 ▲4 ▲5 and ▲ Instrument Trainer.

a. Aircraft Condition.

The aircraft is weighed with tires inflated to recommended operating tire pressure and in level attitude with brakes off.

b. Fuel and Oil Draining.

1. Defuel in three-point through the wing tank drain valves. Drain oil at quick drain valve. The fuel and oil remaining aboard after defueling is the "trapped" fuel and oil included in aircraft basic weight (refer to Chart A, for quantity).

c. Leveling.

1. Place scales under each main wheel and tailwheel. A screw jack is used on the tailwheel scale to raise the tail to obtain a level attitude.

2. To level, place a level on the top of the horizontal control stick torque tube (refer to pages 3-2, 3-10 and 3-15) and raise the screw jack until a level attitude is reached.

d. Weighing.

1. When a level attitude is obtained, record the weights on each scale and the amount of tare from the total weight to obtain "as weighed" condition.

e. Measuring.

1. Stretch a line between the center of each main wheel.

2. Drop a plumb bob from the center line of the aircraft so that it is in the vertical plane of the line stretched between the center of the main wheels.

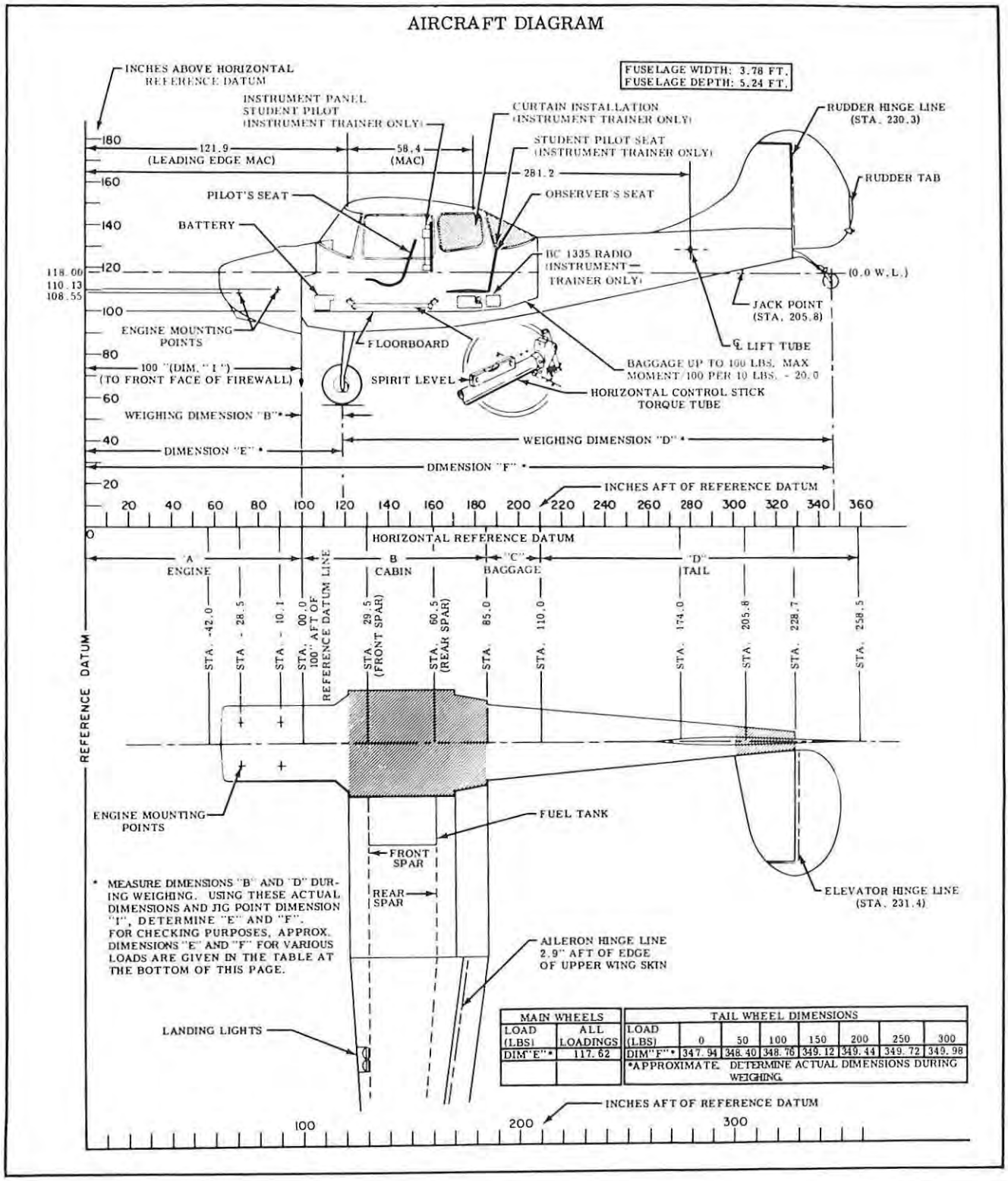
3. Drop another plumb bob from the front face of the firewall at the center line of the aircraft.

4. Drop another plumb bob from the center of the tailwheel.

5. With the use of a measuring tape in a level attitude, record the measurements "B" and "D" (refer to pages 3-2, 3-10 and 3-15).

CHART E, LOADING DATA L-19A, TL-19A, L-19A INSTRUMENT TRAINER

AIRCRAFT DIAGRAM



MAIN WHEELS	
LOAD (LBS)	ALL LOADINGS
DIM "E"*	117.62

TAIL WHEEL DIMENSIONS							
LOAD (LBS)	0	50	100	150	200	250	300
DIM "F"*	347.94	348.40	348.76	349.12	349.44	349.72	349.98
*APPROXIMATE. DETERMINE ACTUAL DIMENSIONS DURING WEIGHING.							

NOTE
Moment/100 is used in lieu of Moment/1000.

*FUEL LOADING TABLE/TANK		
GALLONS	WEIGHT (LBS)	MOMENT /100 (WING TANK ARM 144.0)
1	6	9
2	12	17
3	18	26
4	24	34
5	30	43
6	36	52
7	42	60
8	48	69
9	54	78
10	60	86
11	66	95
12	72	104
13	78	112
14	84	121
15	90	130
16	96	138
17	102	147
18	108	156
19	114	164
20	120	173
21	126	181

CAPACITIES	
TANK	GALLONS
Main (Left Wing)	21
Auxiliary (Right Wing)	21

OIL LOADING TABLE		
GALLONS	WEIGHT (LBS)	MOMENT /100 ARM 85.0
1.0	8	7
2.0	15	13
2.5	19	16

CAPACITIES	
TANK	GALLONS
Engine	2.5

*Full tanks with Specification MIL-F-5572 gasoline at 6.0 lbs/gal.

NOTE

Moment/100 is used in lieu of Moment/1000.

CARGO LOADING TABLE-OBSERVERS SEAT	
WEIGHT (LBS)	MOMENT /100 (ARM 176.0)
10	17.6
20	35.2
30	52.8
40	70.4
50	88.0
60	105.6
70	123.2
80	140.8
90	158.4
100	176.0
110	193.6
120	211.2
130	228.8
140	246.4
150	264.0
160	281.6
170	299.2
180	316.8
190	334.4
200	352.0

CARGO LOADING TABLE - STUDENT PILOT'S SEAT (L-19A INSTRUMENT TRAINER)	
WEIGHT (LBS)	MOMENT/100 (ARM 182)
10	18.2
20	36.4
30	54.6
40	72.8
50	91.0
60	109.2
70	127.4
80	145.6
90	163.8
100	182.0
110	200.2
120	218.4
130	236.6
140	254.8
150	273.0
160	291.2
170	309.4
180	327.6
190	345.8
200	364.0

BAGGAGE LOADING TABLE	
WEIGHT (LBS)	MOMENT /100 (ARM 200.0)
5	10
10	20
15	30
20	40
25	50
30	60
35	70
40	80
45	90
50	100
55	110
60	120
65	130
70	140
75	150
80	160
85	170
90	180
95	190
100	200

CREW LOADING TABLE, L-19A AND TL-19A			
	WEIGHT (LBS)	ARM (in. aft datum)	MOMENT/100
Pilot	200	136	272
Observer	200	176	352

CREW LOADING TABLE, L-19A INSTRUMENT TRAINER			
	WEIGHT (LBS)	ARM (in. aft datum)	MOMENT/100
Pilot	200	136	272
Student Pilot	200	182	364

DROP LOAD TABLE (One Wing Only)	
WEIGHT (LBS)	MOMENT /100 (ARM 145.0)
10	14.5
20	29.0
30	43.5
40	58.0
50	72.5
60	87.0
70	101.5
80	116.0
90	130.5
100	145.0
110	159.5
120	174.0
130	188.5
140	203.0
150	217.5
160	232.0
170	246.5
180	261.0
190	275.5
200	290.0
210	304.5
220	319.0
230	333.5
240	348.0
250	362.5

NOTE

Moment /100 is used in lieu of Moment /1000.

CENTER OF GRAVITY TABLE L-19A AND TL-19A

Sheet 1 of 2 — MOMENT / 100

Gross Weight lbs.)	18.3% MAC (132.6)	18.6% MAC (132.8)	19.0% MAC (133.0)	19.3% MAC (133.2)	19.6% MAC (133.4)	20.0% MAC (133.6)	20.3% MAC (133.8)	20.6% MAC (134.0)	21.0% MAC (134.2)	21.3% MAC (134.4)	21.7% MAC (134.6)	22.0% MAC (134.8)	22.3% MAC (134.9)	22.7% MAC (135.1)
1500	1989	1992	1995	1998	2001	2004	2007	2010	2013	2016	2019	2022	2024	2026
1510	2002	2005	2008	2011	2014	2017	2020	2023	2026	2029	2032	2035	2037	2040
1520	2016	2018	2022	2025	2028	2031	2034	2037	2040	2043	2046	2049	2050	2054
1530	2029	2032	2035	2038	2041	2044	2047	2050	2053	2056	2059	2062	2064	2067
1540	2042	2045	2048	2051	2054	2057	2060	2064	2067	2070	2073	2076	2077	2080
1550	2055	2058	2062	2065	2068	2071	2074	2077	2080	2083	2086	2089	2091	2094
1560	2068	2072	2075	2078	2081	2084	2087	2090	2094	2097	2100	2103	2104	2108
1570	2082	2085	2088	2091	2094	2098	2101	2104	2107	2110	2113	2116	2118	2121
1580	2095	2098	2101	2104	2108	2111	2114	2117	2120	2124	2127	2130	2131	2134
1590	2108	2112	2115	2118	2121	2124	2127	2131	2134	2137	2140	2143	2145	2148
1600	2122	2125	2128	2131	2134	2138	2141	2144	2147	2150	2154	2157	2158	2162
1610	2135	2138	2141	2144	2148	2151	2154	2157	2161	2164	2167	2170	2172	2175
1620	2148	2151	2155	2158	2161	2164	2168	2171	2174	2177	2180	2184	2185	2189
1630	2161	2165	2168	2171	2174	2178	2181	2184	2187	2191	2194	2197	2199	2202
1640	2175	2178	2181	2184	2188	2191	2194	2198	2201	2204	2207	2211	2212	2216
1650	2188	2191	2194	2198	2201	2204	2208	2211	2214	2218	2221	2224	2226	2229
1660	2201	2204	2208	2211	2214	2218	2221	2224	2228	2231	2234	2238	2239	2243
1670	2214	2218	2221	2224	2228	2231	2234	2238	2241	2244	2248	2251	2253	2256
1680	2228	2231	2234	2238	2241	2244	2248	2251	2254	2258	2261	2265	2266	2270
1690	2241	2244	2248	2251	2254	2258	2261	2265	2268	2271	2275	2278	2280	2283
1700	2254	2258	2261	2264	2268	2271	2275	2278	2281	2285	2288	2292	2293	2297
1710	2267	2271	2274	2278	2281	2284	2288	2291	2295	2298	2302	2305	2307	2310
1720	2281	2284	2288	2291	2294	2298	2302	2305	2308	2312	2315	2318	2320	2324
1730	2294	2297	2301	2304	2308	2311	2315	2318	2322	2325	2328	2332	2334	2337
1740	2307	2311	2314	2318	2321	2325	2328	2332	2335	2339	2342	2346	2347	2351
1750	2320	2324	2328	2331	2334	2338	2342	2345	2348	2352	2356	2359	2361	2364
1760	2334	2337	2341	2344	2348	2351	2355	2358	2362	2365	2369	2372	2374	2378
1770	2347	2350	2354	2358	2362	2365	2368	2372	2375	2379	2382	2386	2388	2391
1780	2360	2364	2367	2371	2374	2378	2381	2385	2389	2392	2396	2399	2401	2404
1790	2374	2377	2381	2384	2388	2391	2395	2399	2402	2406	2409	2413	2415	2418
1800	2387	2390	2394	2398	2401	2405	2408	2412	2416	2419	2423	2426	2428	2432
1810	2400	2404	2407	2411	2414	2418	2422	2425	2429	2433	2436	2440	2442	2445
1820	2413	2417	2421	2424	2428	2432	2435	2439	2442	2446	2450	2453	2455	2459
1830	2426	2430	2434	2438	2441	2445	2448	2452	2456	2460	2463	2467	2468	2472
1840	2440	2444	2447	2451	2454	2458	2462	2466	2469	2473	2477	2480	2482	2486
1850	2453	2457	2461	2464	2468	2472	2475	2479	2483	2487	2490	2494	2496	2500
1860	2466	2470	2474	2478	2481	2485	2489	2492	2496	2500	2504	2507	2509	2513
1870	2480	2483	2487	2491	2494	2498	2502	2506	2510	2513	2517	2521	2523	2526
1880	2493	2497	2500	2504	2508	2512	2515	2519	2523	2527	2530	2534	2536	2540
1890		2510	2514	2517	2521	2525	2529	2533	2536	2540	2544	2548	2550	2553
1900			2527	2531	2535	2538	2542	2546	2550	2554	2557	2561	2563	2567
1910				2544	2548	2552	2556	2559	2563	2567	2571	2575	2576	2580
1920					2561	2565	2569	2573	2577	2580	2584	2588	2590	2594
1930						2578	2582	2586	2590	2594	2598	2602	2603	2607
1940							2596	2600	2603	2607	2611	2615	2617	2621
1950								2613	2617	2621	2625	2629	2630	2634
1960									2630	2634	2638	2642	2644	2648
1970										2648	2652	2656	2658	2661
1980											2665	2669	2671	2675
1990												2682	2684	2688
2000													2698	2702
2010														2715
2020														
2030														
2040														
2050														
2060														
2070														
2080														

NOTE

Moment /100 is used in lieu of Moment /1000.

Blank spaces are beyond approved CG limits.

CENTER OF GRAVITY TABLE L-19A and TL-19A (CONT)

Sheet 2 of 2	MOMENT / 100											
Gross Weight (Lbs.)	23.0% MAC (135.3)	23.3% MAC (135.5)	23.7% MAC (135.7)	24.0% MAC (135.9)	24.3% MAC (136.1)	24.7% MAC (136.3)	25.0% MAC (136.5)	25.3% MAC (136.7)	25.7% MAC (136.9)	28% MAC (138.2)	30.5% MAC (139.7)	
1500	2030	2032	2036	2038	2042	2044	2048	2050	2054	2073	2096	
1510	2043	2046	2049	2052	2055	2058	2061	2064	2067	2087	2109	
1520	2056	2060	2063	2066	2069	2072	2075	2078	2081	2107	2123	
1530	2070	2073	2076	2079	2082	2085	2088	2092	2094	2114	2137	
1540	2084	2087	2090	2093	2096	2099	2102	2105	2108	2128	2151	
1550	2097	2100	2103	2106	2110	2113	2116	2119	2122	2142	2165	
1560	2111	2114	2117	2120	2123	2126	2129	2132	2136	2156	2179	
1570	2124	2127	2130	2134	2137	2140	2143	2146	2149	2170	2193	
1580	2138	2141	2144	2147	2150	2154	2157	2160	2163	2184	2207	
1590	2152	2154	2158	2161	2164	2167	2170	2174	2177	2197	2221	
1600	2165	2168	2171	2174	2178	2181	2184	2187	2190	2211	2235	
1610	2178	2182	2185	2188	2191	2194	2198	2201	2204	2225	2249	
1620	2192	2195	2198	2202	2205	2208	2211	2214	2218	2239	2263	
1630	2205	2209	2212	2215	2218	2222	2225	2228	2231	2253	2277	
1640	2219	2222	2225	2229	2232	2235	2239	2242	2245	2266	2291	
1650	2232	2236	2239	2242	2246	2249	2252	2256	2259	2280	2305	
1660	2246	2249	2253	2256	2259	2263	2266	2269	2272	2294	2319	
1670	2260	2263	2266	2270	2273	2276	2280	2283	2286	2308	2333	
1680	2273	2276	2280	2283	2286	2290	2293	2296	2300	2322	2347	
1690	2286	2290	2293	2297	2300	2303	2307	2310	2314	2336	2361	
1700	2300	2304	2307	2310	2314	2317	2320	2324	2327	2349	2375	
1710	2314	2317	2320	2324	2327	2331	2334	2338	2341	2363	2389	
1720	2327	2330	2334	2337	2341	2344	2348	2352	2355	2377	2403	
1730	2341	2344	2348	2351	2354	2358	2361	2365	2368	2391	2417	
1740	2354	2358	2361	2365	2368	2372	2375	2379	2382	2405	2431	
1750	2368	2371	2375	2378	2382	2385	2389	2392	2396	2418	2445	
1760	2381	2385	2388	2392	2395	2399	2402	2406	2409	2432	2459	
1770	2395	2398	2402	2405	2409	2412	2416	2420	2423	2446	2473	
1780	2408	2412	2415	2419	2422	2426	2430	2433	2437	2460	2487	
1790	2422	2425	2429	2433	2436	2440	2443	2447	2450	2474	2500	
1800	2435	2439	2443	2446	2450	2453	2457	2460	2464	2487	2515	
1810	2450	2452	2456	2460	2463	2467	2471	2474	2478	2501	2528	
1820	2462	2466	2470	2473	2477	2481	2484	2488	2492	2515	2542	
1830	2476	2480	2483	2487	2491	2494	2498	2502	2505	2529	2556	
1840	2490	2493	2497	2500	2504	2508	2512	2515	2519	2543	2570	
1850	2503	2507	2510	2514	2518	2522	2525	2529	2533	2557	2584	
1860	2516	2520	2524	2528	2531	2535	2539	2543	2546	2571	2598	
1870	2530	2534	2538	2541	2545	2549	2552	2556	2560	2584	2612	
1880	2544	2547	2551	2555	2559	2562	2566	2570	2574	2598	2626	
1890	2557	2561	2565	2568	2572	2576	2580	2584	2587	2612	2640	
1900	2571	2574	2578	2582	2586	2590	2594	2597	2601	2626	2654	
1910	2584	2588	2592	2596	2600	2603	2607	2611	2615	2640	2668	
1920	2598	2602	2605	2609	2613	2617	2621	2625	2628	2653	2682	
1930	2611	2615	2619	2623	2627	2631	2634	2638	2642	2667	2696	
1940	2625	2629	2632	2636	2640	2644	2648	2652	2656	2681	2710	
1950	2638	2642	2646	2650	2654	2658	2662	2666	2670	2695	2724	
1960	2652	2656	2660	2664	2668	2671	2675	2679	2683	2709	2738	
1970	2665	2669	2673	2677	2681	2685	2689	2693	2697	2722	2752	
1980	2679	2683	2687	2690	2695	2699	2703	2707	2711	2736	2766	
1990	2692	2696	2700	2704	2708	2712	2716	2720	2724	2750	2780	
2000	2706	2710	2714	2718	2722	2726	2730	2734	2738	2764	2794	
2010	2720	2724	2728	2732	2736	2740	2744	2748	2752	2778	2808	
2020	2733	2737	2741	2745	2749	2753	2757	2761	2765	2792	2822	
2030		2751	2755	2759	2763	2767	2771	2775	2779	2805	2836	
2040			2768	2772	2776	2780	2785	2789	2793	2819	2850	
2050				2786	2790	2794	2798	2802	2806	2833	2864	
2060	NOTE				2803	2808	2812	2816	2820	2847	2878	
2070	Moment/100 is					2821	2826	2830	2834	2861	2892	
2080	used in lieu of Moment/1000						2839	2843	2848	2874	2906	
2090	Blank spaces are							2857	2861	2888	2920	
2100	beyond approved CG limits.								2875	2902	2934	

TYPICAL SERVICE LOAD CONDITIONS, L-19A									
ITEMS	ARM	NORMAL LIAISON		FERRYING		DROP LOADS		INSTR. TRAINER	
		WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100
Weight Empty (L-19A)	133.1	1502	1999	1502	1999	1502	1999		
Weight Empty (Instr. Trainer)	134.31							1575.5	2116
Weight Drop Load Instl. (approx.)	145					40	58		
Pilot & Chute	136	200	272	200	272	200	272	200	272
Observer & Chute	176	200	352	200	352				
Student Pilot & Chute	182							200	364
Fuel									
Normal									
L-19A (21 Gal)	144	126	181			126	181		
Instr. Trainer (16.9 Gal)	144							101.5	146
Trapped (.17 Gal)	144	1	1	1	1	1	1	1	1
Max. (42 Gal)	144			252	363				
Oil									
Engine	85	19	16	19	16	19	16	19	16
Trapped	85	3	3	3	3	3	3	3	3
Drop Loads	145					300	435		
Baggage	200	49	98						
TOTALS		2100	2922	2177	3006	2191	2965	2100	2918
		ARM 139.1		ARM 138.1		ARM 135.3		ARM 138.95	

NOTE

Moment/100 is used in lieu of Moment/1000.

TYPICAL SERVICE LOAD CONDITIONS, TL-19A

ITEMS	ARM	TRAINING		MAX. MISSION		DROP LOADS		FERRYING	
		WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100
Weight Empty (L-19A Trainer)	132.8	1524	2024	1524	2024	1524	2024	1524	2024
						40	58		
Student Pilot & Chute	136	200	272	200	272	200	272	200	272
Instructor & Chute	176	200	352	200	352				
Fuel									
Normal L-19A Trainer (21 Gal)	144	126	181			126	181		
Trapped (.17 Gal)	144	1	1			1	1		
Maximum L-19A Trainer (42 Gal)	144			252	363			252	363
Trapped (.34 Gal)	144			2	3			2	3
Oil									
Engine	85	19	16	19	16	19	16	19	16
Trapped	85	3	3	3	3	3	3	3	3
Drop Loads	145					300	435		
Baggage	200	27	54					100	200
TOTALS		2100	2903	2200	3033	2214	2991	2100	2881
		ARM 138.2		ARM 137.9		ARM 135.1		ARM 137.2	

NOTE

Moment/100 is used in lieu of Moment/1000.

ADDITIONAL RADIO EQUIPMENT LOADING TABLE L-19A, TL-19A, L-19A Instrument Trainers			
BACK OF PILOTS SEAT		BENEATH OBSERVERS SEAT	
WEIGHT	MOMENT/100 (ARM 150.0)	WEIGHT	MOMENT/100 (ARM 171.0)
2	3	2	3.4
4	6	4	6.8
6	9	6	10.3
8	12	8	13.7
10	15	10	17.1
12	18	12	20.5
14	21	14	23.9
16	24	16	27.4
18	27	18	30.8
20	30	20	34.2
22	33	22	37.6
24	36	24	41.0
26	39	26	44.5
28	42	28	47.9
30	45	30	51.3
32	48		
34	51		
36	54		
38	57		
40	60		

MISCELLANEOUS DATA

General Dimensions

Wing Span	432 in. (36 ft. 0 in.)
Length	300 in. (25 ft. 0 in.)
Height (Max.)	90 in. (7 ft. 6 iin.)
Wheel Base	234.6 in. (19 ft. 6.6 in.)
Tread (at gross weight)	90.5 in. (7 ft. 6.5 in.)

Centroids of Load Items (Inches Aft Datum)	L-19A	TL-19A	INSTRUMENT TRAINER
Pilot	136	176	136
Observer	176		
Student Pilot		136	182
Oil	85	85	85
Fuel	144	144	144
Drop Loads	145	145	145
Baggage	200	200	200
Basic Weight	1502 lbs.	1528 lbs.	1575.5 lbs.

Distance Aft of Datum Line (Inches)

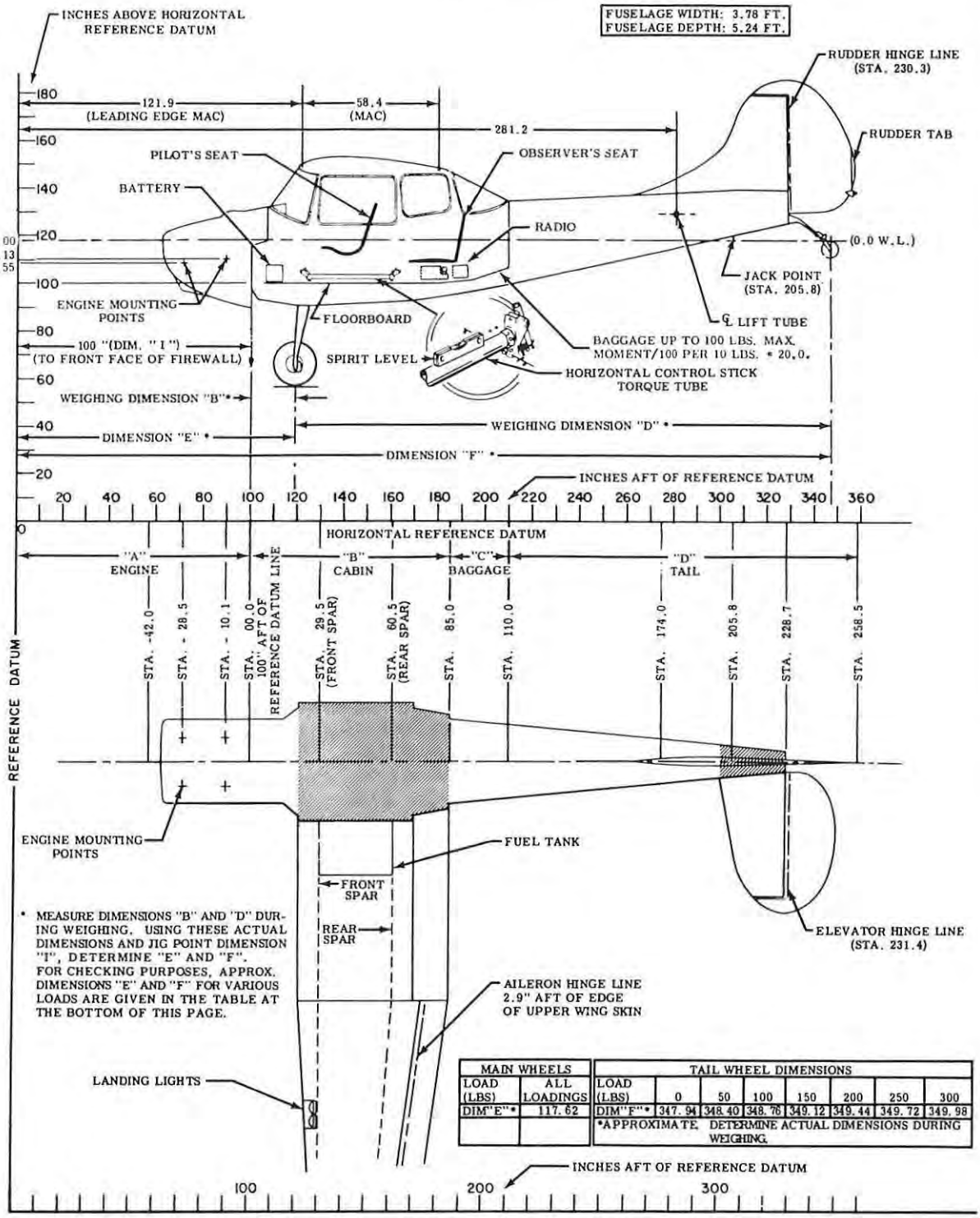
Center of Gravity at Basic Weight	133.0	132.7	134.2
Center Line of Main Wheels at Basic Weight	117.5	117.5	117.5
Center Line of Tail Wheel At Basic Weight	347.3	347.3	347.3

(Weight and dimensions are approximate)

NOTE
Moment/100 is used in lieu of Moment/1000.

CHART E, LOADING DATA L-19E AND TL-19E

AIRCRAFT DIAGRAM



MAIN WHEELS	
LOAD (LBS)	ALL LOADINGS
DIM"E"*	117.62

TAIL WHEEL DIMENSIONS							
LOAD (LBS)	0	50	100	150	200	250	300
DIM"F"*	347.94	348.40	348.76	349.12	349.44	349.72	349.98
*APPROXIMATE. DETERMINE ACTUAL DIMENSIONS DURING WEIGHING.							

NOTE
Moment/100 is used in lieu of Moment/1000

*FUEL LOADING TABLE/TANK		
GALLONS	WEIGHT (LBS)	MOMENT/100 (WING TANK ARM 144.0)
1	6	9
2	12	17
3	18	26
4	24	35
5	30	43
6	36	52
7	42	60
8	48	69
9	54	78
10	60	86
11	66	95
12	72	104
13	78	112
14	84	121
15	90	130
16	96	138
17	102	147
18	108	156
19	114	164
20	120	173
21	126	181

CAPACITIES		
TANK		GALLONS
MAIN	(Left Wing)	21
AUXILIARY	(Right Wing)	21

OIL LOADING TABLE		
GALLONS	WEIGHT (LBS)	MOMENT/100 ARM 85.0
1.0	8	7
2.0	15	13
2.5	19	16

CAPACITIES	
TANK	GALLONS
Engine	2.5

CARGO LOADING TABLE OBSERVER'S SEAT	
WEIGHT (LBS)	MOMENT/100 (ARM 177)
10	17.7
20	35.4
30	53.1
40	70.8
50	88.5
60	106.2
70	123.9
80	141.6
90	159.3
100	177.0
110	194.7
120	212.4
130	230.1
140	247.8
150	265.5
160	283.2
170	300.9
180	318.6
190	336.3
200	354.0

CREW LOADING TABLE			
	WEIGHT (LBS)	ARM (in. aft datum)	MOMENT/100
Pilot	200	136	272
Observer	200	177	354

*Full tanks with specification MIL-F-5572 gasoline at 6.0 lbs./gal.

NOTE
Moment/100 is used in lieu of Moment/1000

CENTER OF GRAVITY TABLE, L-19E AND TL-19E

Sheet 1 of 2 — Moment/100

Gross Weight (lbs.)	18.3% MAC (132.6)	19.0% MAC (133.0)	19.9% MAC (133.5)	20.7% MAC (134.0)	21.6% MAC (134.5)	22.4% MAC (135.0)	23.3% MAC (135.5)	24.1% MAC (136.0)
1700	2254	2261	2270	2278	2287	2295	2304	2312
1720	2281	2288	2296	2305	2313	2322	2331	2339
1740	2307	2314	2323	2332	2340	2349	2358	2366
1760	2334	2341	2350	2358	2367	2376	2385	2394
1780	2360	2367	2376	2385	2394	2403	2412	2421
1800	2387	2394	2403	2412	2421	2430	2439	2448
1820	2413	2421	2430	2439	2448	2457	2466	2475
1840	2440	2447	2456	2466	2475	2484	2493	2502
1860	2466	2474	2483	2492	2502	2511	2520	2530
1880	2493	2500	2510	2519	2529	2538	2547	2557
1900		2527	2537	2546	2556	2565	2575	2584
1920		2554	2563	2573	2582	2592	2602	2611
1940		2580	2590	2600	2609	2619	2629	2638
1960			2617	2626	2636	2646	2656	2666
1980			2643	2653	2663	2673	2683	2693
2000			2670	2680	2690	2700	2710	2720
2020				2707	2717	2727	2737	2747
2040				2734	2744	2754	2764	2774
2060				2760	2771	2781	2791	2802
2080					2798	2808	2818	2829
2100		Fwd C. G. Limits →			2825	2835	2846	2856
2120					2851	2862	2873	2883
2140						2889	2900	2910
2160						2916	2927	2938
2165						2923	2934	2944
2180							2954	2965
2200							2981	2992
2220							3008	3019
2240								3046
2260								3074
2280								3101

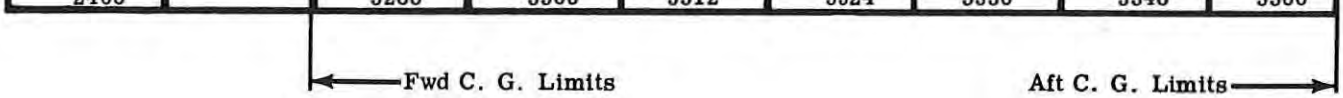
NOTE

Moment/100 is used in lieu of Moment/1000

Blank spaces are beyond approved C.G. limits.

CENTER OF GRAVITY TABLE L-19E AND TL-19E (CONT)

Sheet 2 of 2	Moment/100							
Gross Weight (lbs.)	25.0% MAC (136.5)	25.9% MAC (137.0)	26.7% MAC (137.5)	27.6% MAC (138.0)	28.4% MAC (138.5)	29.3% MAC (139.0)	30.2% MAC (139.5)	31.0% MAC (140.0)
1700	2321	2329	2338	2346	2355	2363	2372	2380
1720	2348	2356	2365	2374	2382	2391	2399	2408
1740	2375	2384	2393	2401	2410	2419	2427	2436
1760	2402	2411	2420	2429	2438	2446	2455	2464
1780	2430	2439	2448	2456	2465	2474	2483	2492
1800	2457	2466	2475	2484	2493	2502	2511	2520
1820	2484	2493	2503	2512	2521	2530	2539	2548
1840	2512	2521	2530	2539	2548	2558	2567	2576
1860	2539	2548	2558	2567	2576	2585	2595	2604
1880	2566	2576	2585	2594	2604	2613	2623	2632
1900	2594	2603	2613	2622	2632	2641	2651	2660
1920	2621	2630	2640	2650	2659	2669	2678	2688
1940	2648	2658	2668	2677	2687	2697	2706	2716
1960	2675	2685	2695	2705	2715	2724	2734	2744
1980	2703	2713	2723	2732	2742	2752	2762	2772
2000	2730	2740	2750	2760	2770	2780	2790	2800
2020	2757	2767	2778	2788	2798	2808	2818	2828
2040	2785	2795	2805	2815	2825	2836	2846	2856
2060	2812	2822	2833	2843	2853	2863	2874	2884
2080	2839	2850	2860	2870	2881	2891	2902	2912
2100	2867	2877	2888	2898	2909	2919	2930	2940
2120	2894	2904	2915	2926	2936	2947	2957	2968
2140	2921	2932	2943	2953	2964	2975	2985	2996
2160	2948	2959	2970	2981	2992	3002	3013	3024
2165	2955	2966	2977	2988	2999	3009	3020	3031
2180	2976	2987	2998	3008	3019	3030	3041	3052
2200	3003	3014	3025	3036	3047	3058	3069	3080
2220	3030	3041	3052	3064	3075	3086	3097	3108
2240	3058	3069	3080	3091	3102	3114	3125	3136
2260	3085	3096	3108	3119	3130	3141	3153	3164
2280	3112	3124	3135	3146	3158	3169	3181	3192
2300	3140	3151	3162	3174	3186	3197	3208	3220
2320	3167	3178	3190	3202	3213	3225	3236	3248
2340	3194	3206	3218	3229	3241	3253	3264	3276
2360		3233	3245	3257	3269	3280	3292	3304
2380		3261	3272	3284	3296	3308	3320	3332
2400		3288	3300	3312	3324	3336	3348	3360



NOTE

Moment/100 is used in lieu of Moment/1000.

Blank spaces are beyond approved C.G. limits.

TYPICAL SERVICE LOAD CONDITIONS, L-19E

ITEMS	ARM	TRAINING		FERRYING		MAXIMUM MISSION	
		WT	MOMENT/100	WT	MOMENT/100	WT	MOMENT/100
Weight Empty (L-19E)	134.0	1614	2163	1614	2163	1614	2163
Pilot & Chute	136	200	272	200	272	200	272
Observer	177	200	354			200	354
Fuel							
Normal							
L-19E (21 Gal)	144	126	181				
Trapped (.17Gal)(Norm.)	142	1	1				
Trapped (.34Gal)(Max.)	142			2	3	2	3
Max. (42 Gal)	144			252	363	252	363
Oil							
Engine	85	19	16	19	16	19	16
Trapped	85	3	3	3	3	3	3
Cargo	165					100	165
Misc.	165					10	17
TOTALS		2163	2990	2090	2820	2400	3356
		ARM	138.2	ARM	134.9	ARM	139.8

NOTE
Moment/100 is used in lieu of Moment/1000

TYPICAL SERVICE LOAD CONDITIONS, TL-19E

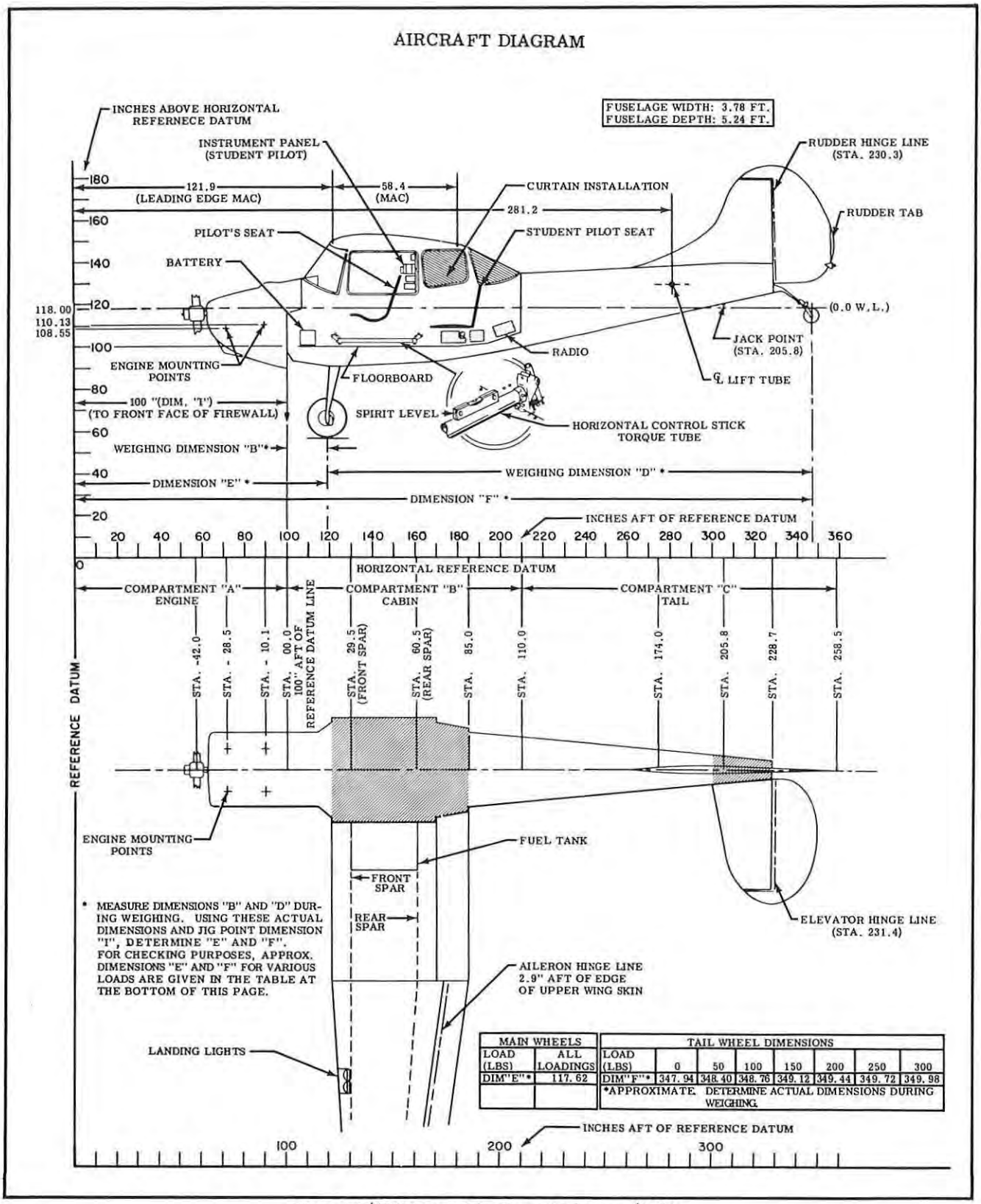
ITEMS	ARM	TRAINING		FERRYING		MAXIMUM MISSION	
		WT	MOMENT/100	WT	MOMENT/100	WT	MOMENT/100
Weight-Empty (TL-19E)	133.8	1629	2179	1629	2179	1629	2179
Student Pilot & Chute	136	200	272	200	272	200	272
Instructor & Chute	177	200	354			200	354
Fuel							
Normal							
(18.83 Gal)	144		113	163			
Trapped (.17 Gal)	142		1	1			
Maximum(42 Gal)	144			252	363	252	363
Trapped (.34 Gal)	142			2	3	2	3
Oil							
Engine	185	19	16	19	16	19	16
Trapped	185	3	3	3	3	3	3
Cargo	165					95	157
TOTALS		2165	2988	2105	2836	2400	3347
		ARM	138.0	ARM	134.7	ARM	139.5

NOTE

In training mission, TL-19E fuel load is limited to 18.83 gallons.

CHART E, LOADING DATA TL-19D

AIRCRAFT DIAGRAM



MAIN WHEELS	
LOAD (LBS)	ALL LOADINGS
DIM"E"*	117.62

TAIL WHEEL DIMENSIONS							
LOAD (LBS)	0	50	100	150	200	250	300
DIM"F"*	347.94	348.40	348.76	349.12	349.44	349.72	349.98
*APPROXIMATE. DETERMINE ACTUAL DIMENSIONS DURING WEIGHING.							

Moment/100 is used in lieu of Moment/1000

*FUEL LOADING TABLE/TANK		
GALLONS	WEIGHT (LBS)	MOMENT/100 (WING TANK ARM 144.0)
1	6	9
2	12	17
3	18	26
4	24	34
5	30	43
6	36	52
7	42	60
8	48	69
9	54	78
10	60	86
11	66	95
12	72	104
13	78	112
14	84	121
15	90	130
16	96	138
17	102	147
18	108	156
19	114	164
20	120	173
21	126	181

CAPACITIES		
TANK		GALLONS
MAIN	(Left Wing)	21
AUXILIARY	(Right Wing)	21

OIL LOADING TABLE		
GALLONS	WEIGHT (LBS.)	MOMENT/100 ARM 85.0
1.0	8	7
2.0	15	13
2.5	19	16

CAPACITIES	
TANK	GALLONS
Engine	2.5

CARGO LOADING TABLE - STUDENT PILOT'S SEAT	
WEIGHT (LBS)	MOMENT/100 (ARM 182)
10	18.2
20	36.4
30	54.6
40	72.8
50	91.0
60	109.2
70	127.4
80	145.6
90	163.8
100	182.0
110	200.2
120	218.4
130	236.6
140	254.8
150	273.0
160	291.2
170	309.4
180	327.6
190	345.8
200	364.0

CREW LOADING TABLE			
	WEIGHT (LBS)	ARM (in. aft datum)	MOMENT/100
Pilot	200	136	272
Student Pilot	200	182	364

*Full tanks with specification MIL-F-5572 gasoline at 6.0 lbs./gal.

NOTE
Moment/100 is used in lieu of Moment/1000

CENTER OF GRAVITY TABLE TL-19D

Sheet 1 of 2	Moment/100							
Gross Weight (lbs.)	21.6% MAC (134.5)	21.7% MAC (134.6)	22.1% MAC (134.8)	22.4% MAC (135.0)	22.8% MAC (135.2)	23.1% MAC (135.4)	23.8% MAC (135.8)	24.1% MAC (136.0)
1700	2286	2288	2292	2295	2298	2302	2309	2312
1720	2313	2315	2319	2322	2325	2329	2336	2339
1740	2340	2342	2346	2349	2352	2356	2363	2366
1760	2367	2369	2372	2376	2380	2383	2390	2394
1780	2394	2396	2399	2403	2407	2410	2417	2421
1800	2421	2423	2426	2430	2434	2437	2444	2448
1820	2448	2450	2453	2457	2461	2464	2472	2475
1840	2475	2477	2480	2484	2488	2491	2499	2502
1860	2502	2504	2507	2511	2515	2518	2526	2530
1880	2529	2530	2534	2538	2542	2546	2553	2557
1900	2555	2557	2561	2565	2569	2573	2580	2584
1920	2582	2584	2588	2592	2596	2600	2607	2611
1940	2609	2611	2615	2619	2623	2627	2635	2638
1960	2636	2638	2642	2646	2650	2654	2662	2666
1980	2663	2665	2669	2673	2677	2681	2689	2693
2000	2690	2692	2696	2700	2704	2708	2716	2720
2020	2717	2719	2723	2727	2731	2735	2743	2747
2040	2744	2746	2750	2754	2758	2762	2770	2774
2060	2771	2773	2777	2781	2785	2789	2797	2802
2080	2798	2800	2804	2808	2812	2816	2825	2829
2100	2824	2827	2831	2835	2839	2843	2852	2856
2120		2854	2858	2862	2866	2870	2879	2883
2140			2885	2889	2893	2898	2906	2910
2160				2916	2920	2925	2933	2938
2180				2943	2947	2952	2960	2965
2200					2974	2979	2988	2992
2220					3001	3006	3015	3019
2240						3033	3042	3046
2260							3069	3074
2280							3096	3101
2300								3128
2320								
2330								
2340								
2360								
2380								
2400								

NOTE
Moment/100 is used in lieu of Moment/1000

Blank spaces are beyond approved C.G. limits

CENTER OF GRAVITY TABLE TL-19D (CONT)

Sheet 2 of 2	Moment/100							
Gross Weight (lbs.)	24.5% MAC (136.2)	25.2% MAC (136.6)	25.9% MAC (137.0)	26.7% MAC (137.5)	27.6% MAC (138.0)	28.4% MAC (138.5)	29.3% MAC (139.0)	31.0% MAC (140.0)
1700	2315	2322	2329	2338	2346	2354	2363	2380
1720	2343	2350	2356	2365	2374	2382	2391	2408
1740	2370	2377	2384	2393	2401	2410	2419	2436
1760	2397	2404	2411	2420	2429	2438	2446	2464
1780	2424	2431	2439	2448	2456	2465	2474	2492
1800	2452	2459	2466	2475	2484	2493	2502	2520
1820	2479	2486	2493	2503	2512	2521	2530	2548
1840	2506	2513	2521	2530	2539	2548	2558	2576
1860	2533	2541	2548	2558	2567	2576	2585	2604
1880	2561	2568	2576	2585	2594	2604	2613	2632
1900	2588	2595	2603	2613	2622	2631	2641	2660
1920	2615	2623	2630	2640	2650	2659	2669	2688
1940	2642	2650	2658	2668	2677	2687	2697	2716
1960	2670	2677	2685	2695	2705	2715	2724	2744
1980	2697	2705	2713	2723	2732	2742	2752	2772
2000	2724	2732	2740	2750	2760	2770	2780	2800
2020	2751	2759	2767	2778	2788	2798	2808	2828
2040	2778	2787	2795	2805	2815	2825	2836	2856
2060	2806	2814	2822	2833	2843	2853	2863	2884
2080	2833	2841	2850	2860	2870	2881	2891	2912
2100	2860	2869	2877	2888	2898	2908	2919	2940
2120	2887	2896	2904	2915	2926	2936	2947	2968
2140	2915	2923	2932	2943	2953	2964	2975	2996
2160	2942	2951	2959	2970	2981	2992	3002	3024
2180	2969	2978	2987	2998	3008	3019	3030	3052
2200	2996	3005	3014	3025	3036	3047	3058	3080
2220	3024	3033	3041	3053	3064	3075	3086	3108
2240	3051	3060	3069	3080	3091	3102	3114	3136
2260	3078	3087	3096	3108	3119	3130	3141	3164
2280	3105	3114	3124	3135	3146	3158	3169	3192
2300	3133	3142	3151	3163	3174	3185	3197	3220
2320	3160	3169	3178	3190	3202	3213	3225	3248
2330	3173	3183	3192	3204	3215	3227	3239	3262
2340		3196	3206	3218	3229	3241	3253	3276
2360		3224	3233	3245	3257	3269	3280	3304
2380			3261	3273	3284	3296	3308	3332
2400			3288	3300	3312	3324	3336	3360

NOTE
Moment/100 is used in lieu of Moment/1000

Blank spaces are beyond approved C.G. limits

TYPICAL SERVICE LOAD CONDITIONS, TL-19D					
ITEMS	ARM	TRAINING		FERRYING	
		WEIGHT	MOMENT/100	WEIGHT	MOMENT/100
Weight Empty (TL-19D)	135.4	1703	2306	1703	2306
Pilot & Chute	136	200	272	200	272
Student Pilot & Chute	182	200	364		
Fuel					
Normal					
TL-19D (21 Gal)	144	126	181		
Trapped (.17 Gal)	144	1	1	1	1
Max. (42 Gal)	144			252	363
Oil					
Engine	85	19	16	19	16
Trapped	85	3	3	3	3
TOTALS		2252	3143	2178	2961
		ARM	139.6	ARM	135.95

NOTE
Moment/100 is used in lieu of moment / 1000

MISCELLANEOUS DATA

General Dimensions

Wing Span	432 in. (36.0 ft. 0 in.)
Length	309.5 in. (25 ft. 9.5 in.)
Height (Max.)	90 in. (7 ft. 6 in.)
Wheel Base	234.6 in. (19 ft. 6.6 in.)
Tread (at gross weight)	90.5 in. (7 ft. 6.5 in.)

Centroids of Load Items (Inches Aft Datum)

Pilot	136
Student Pilot	182
Oil	85
Fuel	144

Basic Weight . . . . . 1707 lbs.

Distance Aft of Datum Line (Inches)

Center of Gravity at Basic Weight	135.4
Center-Line of Main Wheels at Basic Weight	117.5
Center-Line of Tail Wheel At Basic Weight (Weight and dimensions are approximate)	347.3

SECTION IV | CHAPTER 3

CHART "A", FORM DD-365A, BASIC WEIGHT CHECK LIST

The sample Basic Weight Check Lists contained herein are to be used ONLY AS A GUIDE in preparing check lists for individual aircraft of these series. If no other basic weight check list is available, a complete inventory of all equipment in the aircraft must be made and a check mark placed in the proper column on a new set of basic weight check list pages.

CHART A—BASIC WEIGHT CHECK LIST

PAGE 1 OF 3 PAGES | AIRPLANE MODEL L-19A and TL-19A | SERIAL NUMBER (Sample Only) | DELIVERY DATE

FOR USE IN AN 01-1B-40
RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT	DELIVERY EQUIPMENT	CHECK 1		2		3		4		5		6		7		8	
						IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY
A	Engine Compartment (0" - 100")																				
A-1	Trapped Oil	3	82	2.5																	
B	Cabin Compartment (100" - 185")																				
B-1	Battery AN3154-1A	34	110	37.4																	
B-2	Pilot's Headset (HS-33)	3	135	4.0																	
B-3	Pilot's Seat (Student's Seat, TL-19A)	10	139	13.9																	
B-4	First Aid Kit	2	139	2.8																	
B-5	Pilot's Safety Belt (B-14)(Student's, TL-19A)	2	140	2.8																	
B-6	Pilot's Shoulder Harness (G-1)(Student's, TL-19A)	3	144	4.3																	
B-7	Trapped Fuel	1	144	1.4																	
B-8	Fire Extinguisher (A-20)	7	145	10.2																	
B-9	Handbooks	10	145	14.5																	
B-10	*Radio SCR300 (With Batteries)	38	150	57.0																	
B-11	Observer's Engine Controls	2	156	3.1																	
B-11	Instructor's Engine Controls, TL-19A	2	166	3.3																	
B-12	**Radio BC-1335 (SCR619)	24	171	41.0																	
B-13	Receiver (ARC type R-11A)	7	177	12.4																	
B-14	Receiver (ARC type R-19)	6	177	10.6																	
B-15	***Receiver (ARC type R-15)	8	177	14.2																	
B-16	Observer's Seat (Instructor's Seat, TL-19A)	8	176	14.1																	
B-17	Observer's Safety Belt (B-14)(Instructor's, TL-19A)	2	180	3.6																	
	*Optional Equipment																				
	**Installed on overseas aircraft ***Installed in place of R-19 Receiver on overseas aircraft																				

1/ Enter constant used below line.

NOTE: Moment/100 is used throughout in lieu of Moment/1000

CHART A—BASIC WEIGHT CHECK LIST

PAGE 2 OF 3 PAGES | AIRPLANE MODEL L-19A and TL-19A | SERIAL NUMBER (Sample Only)

DELIVERY DATE

FOR USE IN AN 01-1B-40
RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1 IN AIRPLANE	CHECK 1 CHART C ENTRY	CHECK 2 IN AIRPLANE	CHECK 2 CHART C ENTRY	CHECK 3 IN AIRPLANE	CHECK 3 CHART C ENTRY	CHECK 4 IN AIRPLANE	CHECK 4 CHART C ENTRY	CHECK 5 IN AIRPLANE	CHECK 5 CHART C ENTRY	CHECK 6 IN AIRPLANE	CHECK 6 CHART C ENTRY	CHECK 7 IN AIRPLANE	CHECK 7 CHART C ENTRY	CHECK 8 IN AIRPLANE	CHECK 8 CHART C ENTRY
B-18	Dynamotor (ARC type D-10)	2	181	3.6																	
B-19	Dynamotor (ARC type D-10A)	2	181	3.6																	
B-20	Transmitter (ARC type T-11A)	3	183	5.5																	
B-21	Transmitter (ARC type T-13)	3	183	5.5																	
B-22	+Transmitter (ARC type T-11A)	3	183	5.5																	
C	Baggage Compartment (185"-210")																				
C-1	Observer's Headset (HS-33)(Instructor's TL-19A)	3	186	5.6																	
C-2	Observer's Shoulder Harness (G-1)	3	198	5.9																	
C-2	Instructor's Shoulder Harness (TL-19A)	3	198	5.9																	
C-3	Tool Kit (Includes Jack Point)	4	200	8.0																	
C-4	Fuselage Cabin Cover	11	200	22.0																	
C-5	Engine Compartment Cover	10	200	20.0																	
C-6	Mooring Kit	11	200	22.0																	
D	Tailcone Compartment (210" - 328")																				
	None																				
E	Empennage																				
	None																				
	+Installed in place of Transmitter T-13, on overseas aircraft.																				

1/ Enter constant used below line.

NOTE: Moment/100 is used throughout in lieu of Moment/1000

CHART A—BASIC WEIGHT CHECK LIST

PAGE 3 OF 3 PAGES | AIRPLANE MODEL L-19A and TL-19A | SERIAL NUMBER (Sample Only) | DELIVERY DATE

FOR USE IN AN 01-1B-40
RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1 IN AIRPLANE	CHECK 1 CHART C ENTRY	CHECK 2 IN AIRPLANE	CHECK 2 CHART C ENTRY	CHECK 3 IN AIRPLANE	CHECK 3 CHART C ENTRY	CHECK 4 IN AIRPLANE	CHECK 4 CHART C ENTRY	CHECK 5 IN AIRPLANE	CHECK 5 CHART C ENTRY	CHECK 6 IN AIRPLANE	CHECK 6 CHART C ENTRY	CHECK 7 IN AIRPLANE	CHECK 7 CHART C ENTRY	CHECK 8 IN AIRPLANE	CHECK 8 CHART C ENTRY
R	Outside Fuselage																				
R-1	Ski-Left (Federal A-2500)	26	113	29.4																	
R-2	Ski -Right (Federal A-2500)	26	113	29.4																	
R-3	Axle & Bolts - Left	2	118	2.4																	
R-4	Axle & Bolts - Right	2	118	2.4																	
R-5	Wheel Assembly - Left	18	118	21.2																	
R-6	Wheel Assembly - Right	18	118	21.2																	
R-7	Spring - Main Gear - Left	33	122	40.3																	
R-8	Spring - Main Gear - Right	33	122	40.3																	
R-9	Float Gear - Complete Instl.																				
	Edo Model 44-2425	325	140	455.0																	
R-10	Bomb Rack - Type S-2 - Left	7	145	10.2																	
R-11	Bomb Rack - Type S-2 - Right	7	145	10.2																	
R-12	Antenna - Loop (ARC Type L-10)	2	240	4.8																	
R-13	Auxiliary Fins - Seaplane	8	328	26.2																	
R-14	Tail Wheel Spring & Yoke	9	339	30.5																	
R-15	Ski - Tail (Federal AT-1500A)	4	345	14.2																	
R-16	Tail Wheel & Tire	4	348	13.9																	
W	Wing																				
	None																				

1/ Enter constant used below line.

NOTE: Moment/100 is used throughout in lieu of Moment/1000

CHART A - BASIC WEIGHT CHECK LIST

PAGE 1 OF 3 PAGES | AIRPLANE MODEL L-19A Instrument Trainer | SERIAL NUMBER (Sample Only) | DELIVERY DATE

FOR USE IN AN 01-1B-40

RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	MOMENT 1/ 100	DELIVERY EQUIPMENT	CHECK 1		2		3		4		5		6		7		8	
						IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY
A	Engine Compartment (0" - 100")																				
A-1	Trapped Oil	3	82	2.5																	
B	Cabin Compartment (100" - 185")																				
B-1	Battery AN3154-1A	34	110	37.4																	
B-2	Pilot's Headset (HS-33)	3	135	4.0																	
B-3	Pilot's Microphone (T-17B)	2	135	2.7																	
B-4	Pilot's Seat	10	139	13.9																	
B-5	First Aid Kit	1	139	1.4																	
B-6	Pilot's Safety Belt (B-14)	2	140	2.8																	
B-7	Pilot's Shoulder Harness (G-1)	3	144	4.3																	
B-8	Trapped Fuel	1	144	1.4																	
B-9	Fire Extinguisher (A-20)	7	145	10.2																	
B-10	Handbooks	10	145	14.5																	
B-11	Student Pilot's Instr. Panel Instl.	21	158	33.2																	
B-12	Air Filter	2	158	3.2																	
B-13	Student Pilot's Engine Controls	4	166	6.6																	
B-14	Student Pilot's Trim Tab Instl.	1	177	1.8																	
B-15	Receiver (ARC Type R-11A)	7	177	12.4																	
B-16	Receiver (ARC Type R-19)	6	177	10.6																	
B-17	Dynamotor (ARC Type D-10)	2	181	3.6																	
B-18	Dynamotor (ARC Type D-10A)	2	181	3.6																	

1/ Enter constant used below line.

CHART A - BASIC WEIGHT CHECK LIST

PAGE 2 OF 3 PAGES | AIRPLANE MODEL L-19A Instrument Trainer | SERIAL NUMBER (Sample Only) | DELIVERY DATE

FOR USE IN AN 01-1B-40

RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1 IN AIRPLANE	CHECK 1 CHART C ENTRY	CHECK 2 IN AIRPLANE	CHECK 2 CHART C ENTRY	CHECK 3 IN AIRPLANE	CHECK 3 CHART C ENTRY	CHECK 4 IN AIRPLANE	CHECK 4 CHART C ENTRY	CHECK 5 IN AIRPLANE	CHECK 5 CHART C ENTRY	CHECK 6 IN AIRPLANE	CHECK 6 CHART C ENTRY	CHECK 7 IN AIRPLANE	CHECK 7 CHART C ENTRY	CHECK 8 IN AIRPLANE	CHECK 8 CHART C ENTRY
B-19	Student Pilot's Seat	17	182	30.9																	
B-20	Student Pilot's Safety Belt (B-14)	2	183	3.7																	
B-21	Transmitter (ARC Type T-11A)	3	183	5.5																	
B-22	Transmitter (ARC Type T-13)	3	183	5.5																	
C	Baggage Compartment (185" - 210")																				
C-1	Curtain Installation	4	186	7.4																	
C-2	Student Pilot's Headset (HS-33)	3	186	5.6																	
C-3	Student Pilot's Microphone (T-17B)	2	186	3.7																	
C-4	Student Pilot's Shoulder Harness (G-1)	3	198	5.9																	
C-5	Tool Kit (Includes Jack Point)	4	200	8.0																	
C-6	Fuselage Cabin Cover	11	200	22.0																	
C-7	Engine Compartment Cover	10	200	20.0																	
C-8	Mooring Kit	11	200	22.0																	
C-9	Radio - BC-1335 (SCR619)	24	202	48.5																	
D	Tailcone Compartment (210" - 328")																				
	None																				
E	Empennage																				
	None																				

1/ Enter constant used below line.

CHART A - BASIC WEIGHT CHECK LIST

PAGE 3 OF 3 PAGES | AIRPLANE MODEL L-19A Instrument Trainer | SERIAL NUMBER (Sample Only) | DELIVERY DATE

FOR USE IN AN 01-1B-40

RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1 IN AIRPLANE	CHECK 1 CHART C ENTRY	CHECK 2 IN AIRPLANE	CHECK 2 CHART C ENTRY	CHECK 3 IN AIRPLANE	CHECK 3 CHART C ENTRY	CHECK 4 IN AIRPLANE	CHECK 4 CHART C ENTRY	CHECK 5 IN AIRPLANE	CHECK 5 CHART C ENTRY	CHECK 6 IN AIRPLANE	CHECK 6 CHART C ENTRY	CHECK 7 IN AIRPLANE	CHECK 7 CHART C ENTRY	CHECK 8 IN AIRPLANE	CHECK 8 CHART C ENTRY
R	Outside Fuselage																				
R-1	Ski - Left (Federal A-2500)	26	113	29.4																	
R-2	Ski - Right (Federal A-2500)	26	113	29.4																	
R-3	Axle & Bolts - Left	2	118	2.4																	
R-4	Axle & Bolts - Right	2	118	2.4																	
R-5	Wheel Assembly - Left	18	118	21.2																	
R-6	Wheel Assembly - Right	18	118	21.2																	
R-7	Spring - Main Gear - Left	33	122	40.3																	
R-8	Spring - Main Gear - Right	33	122	40.3																	
R-9	Float Gear - Complete Instl. Edo Model 44-2425	325	140	455.0																	
R-10	Bomb Rack - Type S-2 - Left	7	145	10.2																	
R-11	Bomb Rack - Type S-2 - Right	7	145	10.2																	
R-12	Antenna - Loop (ARC Type L-10)	2	215	4.3																	
R-13	Auxiliary Fins - Seaplane	8	328	26.2																	
R-14	Tailwheel Spring & Yoke	9	339	30.5																	
R-15	Ski - Tail (Federal AT-1500A)	4	345	14.2																	
R-16	Tailwheel & Tire	4	348	13.9																	
W	Wing																				
	None																				

1/ Enter constant used below line.

CHART A—BASIC WEIGHT CHECK LIST

PAGE 1 OF 2 PAGES | AIRPLANE MODEL: L-19E and TL-19E | SERIAL NUMBER: (Sample Only) | DELIVERY DATE

FOR USE IN AN 01-1B-40
RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1 IN AIRPLANE	CHECK 1 CHART C ENTRY	CHECK 2 IN AIRPLANE	CHECK 2 CHART C ENTRY	CHECK 3 IN AIRPLANE	CHECK 3 CHART C ENTRY	CHECK 4 IN AIRPLANE	CHECK 4 CHART C ENTRY	CHECK 5 IN AIRPLANE	CHECK 5 CHART C ENTRY	CHECK 6 IN AIRPLANE	CHECK 6 CHART C ENTRY	CHECK 7 IN AIRPLANE	CHECK 7 CHART C ENTRY	CHECK 8 IN AIRPLANE	CHECK 8 CHART C ENTRY
A	Engine Compartment (0" - 100")																				
A-1	Trapped Oil	3	85	2.6																	
B	Cabin Compartment (100" - 185")																				
B-1	Battery	34	110	37.4																	
B-2	Pilot's Seat (Student's, TL-19E)	10	139	13.9																	
B-3	Pilot's Safety Belt (MD-1)(Student's, TL-19E)	2	140	2.8																	
B-4	Control Panel (SB-327)	2	141	2.8																	
B-5	Signal Distribution Panel (SB-329)	2	141	2.8																	
B-6	Pilot's Shoulder Harness (G-1)(Student's, TL-19E)	2	144	2.9																	
B-7	Trapped Fuel	2	142	2.8																	
B-8	Fire Extinguisher (A-20)	7	145	10.2																	
B-9	Handbooks	4	145	5.8																	
B-10	Control Panel (SB-327)	2	168	3.4																	
B-11	Junction Box (J-15A)	3	173	5.2																	
B-12	Signal Distribution Panel (SB-329)	2	175	3.5																	
B-13	Receiver - Transmitter (RT-294)	14	175	24.5																	
B-14	Copilot's Seat (Instructor's, TL-19E)	8	176	14.1																	
B-15	Copilot's Safety Belt (MD-1)(Instructor's, TL-19E)	2	178	3.6																	
B-16	Keyer Unit (KY-149)	2	177	3.5																	
B-17	Receiver (R-19)	6	178	10.7																	
B-18	Receiver (R-11A)	6	178	10.7																	
B-19	Transverter (TV-10)	5	178	8.9																	
B-20	Copilot's Shoulder Harness (G-1)(Instructor's, TL-19E)	2	183	3.7																	

1/ Enter constant used below line.

NOTE: Moment/100 is used throughout in lieu of Moment/1000

CHART A - BASIC WEIGHT CHECK LIST

PAGE 2 OF 2 PAGES | AIRPLANE MODEL L-19E AND TL-19E | SERIAL NUMBER (Sample Only) | DELIVERY DATE

FOR USE IN T.O 1-1B-40 & AN 01-1B-40

RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1	CHECK 2	CHECK 3	CHECK 4	CHECK 5	CHECK 6	CHECK 7	CHECK 8
						IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY
C	Baggage Compartment (185" - 210")												
C-1	Dynamotor (DY-107)	6	187	11.2									
C-2	Transverter (TV-10)	5	189	9.5									
C-3	Curtain Installation	3	210	6.3									
D	Tailcone Compartment (210" - 328")												
D-1	Antenna (L-10)	2	240	4.8									
E	Empennage												
	None												
R	Outside Fuselage												
	None												
T	Outside Tailcone												
	None												
W	Wing												
	None												

1/ Enter constant used below line.

CHART A—BASIC WEIGHT CHECK LIST

PAGE 1 OF 3 PAGES | AIRPLANE MODEL: TL-19D | SERIAL NUMBER: (Sample Only)

DELIVERY DATE

FOR USE IN AN 01-1B-40
RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1		2		3		4		5		6		7		8	
						IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY
A	Engine Compartment (0" -100")																				
A																					
A-1	Trapped Oil	3	85	2.6																	
B	Cabin Compartment (100" -210")																				
B-1	Battery (AN3154-1A)	34	110	37.4																	
B-2	ID 453/ARN-30 Indicator	3	115	3.4																	
B-3	AN580A/ARN-30 Antenna	4	133	5.3																	
B-4	Control (C-1917)	2	135	2.7																	
B-5	Control (C-1341A)	2	135	2.7																	
B-6	Pilot's Seat	10	139	13.9																	
B-7	Pilot's Safety Belt (B-14 or MD-1)	2	140	2.8																	
B-8	Control (C-59A)	2	140	2.8																	
B-9	Pilot's Shoulder Harness (G-1)	2	144	2.9																	
B-10	Fire Extinguisher (A-20)	6	145	8.7																	
B-11	Tuner AN/ARN-42	5.5	140	6.2																	
B-12	Handbooks	4	145	5.8																	
B-13	Control (C-59A)	2	161	3.2																	
B-14	ID 453/ARN-30 Indicator	3	161	4.8																	
B-15	Student Pilot's Instr. Panel Installation	26	165	42.9																	
B-16	Student Pilot's Engine Controls	2	166	3.3																	
B-17	Control (C-1917)	2	169	3.4																	
B-18	Control (C-1341A)	2	169	3.4																	
B-19	Junction Box (J-13)	2	174	3.5																	
B-20	Receiver (R-11A)	6	176	10.6																	

1/ Enter constant used below line.

NOTE: Moment/100 is used throughout in lieu of Moment/1000

CHART A—BASIC WEIGHT CHECK LIST

PAGE 2 OF 3 PAGES | AIRPLANE MODEL TL-19D | SERIAL NUMBER (Sample Only) | DELIVERY DATE

FOR USE IN AN 01-1B-40
RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1 IN AIRPLANE	CHECK 1 CHART C ENTRY	CHECK 2 IN AIRPLANE	CHECK 2 CHART C ENTRY	CHECK 3 IN AIRPLANE	CHECK 3 CHART C ENTRY	CHECK 4 IN AIRPLANE	CHECK 4 CHART C ENTRY	CHECK 5 IN AIRPLANE	CHECK 5 CHART C ENTRY	CHECK 6 IN AIRPLANE	CHECK 6 CHART C ENTRY	CHECK 7 IN AIRPLANE	CHECK 7 CHART C ENTRY	CHECK 8 IN AIRPLANE	CHECK 8 CHART C ENTRY
B-21	Receiver (R-19)	6	176	10.6																	
B-22	Student Pilot's Seat	9	176	15.8																	
B-23	Junction Box (J-15)	3	174	5.2																	
B-24	Receiver (R-508)	6	177	10.6																	
B-25	Student Pilot's Safety Belt (B-14) or (MD-1)	2	178	3.6																	
B-26	Converter (CV-431)	5	178	8.9																	
B-27	Converter (CV-431)	5	178	8.9																	
B-28	Receiver (R-30A)	7	180	12.6																	
B-29	Dynamotor (D-10A)	3	182	5.5																	
B-30	Dynamotor (D-10A)	3	182	5.5																	
B-31	Transmitter (T-13)	3	182	5.5																	
B-32	Transmitter (T-13)	3	182	5.5																	
B-33	Dynamotor (DY-86)	3	182	5.5																	
B-34	Student Pilot's Shoulder Harness (GI)	2	183	3.7																	
B-35	Curtain Installation	3	185	5.5																	
B-36	Amplifier (702377-04)	11	191	21.0																	
B-37	Power Unit (P-14A)	5	191	9.6																	
B-38	Transmitter (T-11A)	3	192	5.8																	
B-39	Transmitter (T-13)	3	192	5.8																	
B-40	Converter (CB-266)	6	201	12.1																	
B-41	Receiver (R-445)	6	201	12.1																	
B-42	Mounting (MT-1175)	3	202	6.1																	
B-43	Receiver (R-13B)	6	202	12.2																	
B-44	Receiver (R-12)	7	203	14.2																	
B-45	Converter (B-13)	6	204	12.2																	
B-46	Mount (1175)	3	204	6.1																	

1/ Enter constant used below line.

NOTE: Moment/100 is used throughout in lieu of Moment/1000

CHART A—BASIC WEIGHT CHECK LIST

PAGE 3 OF 3 PAGES | AIRPLANE MODEL: TL-19D | SERIAL NUMBER: (Sample Only)

DELIVERY DATE

FOR USE IN AN 01-1B-40
RECORD OF CHECKING (Enter date)

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1		2		3		4		5		6		7		8	
						IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY	IN AIRPLANE	CHART C ENTRY
B-47	Receiver (R-122)	7	204	14.3																	
B-48	Dynamotor (DY-86)	3	206	6.2																	
B-49	Dynamotor (DY-86)	3	207	6.2																	
C	Tailcone Compartment (210" -328")																				
C-1	Loop Installation	3	221	6.6																	
C-2	Loop Antenna Installation (L-11)	4	222	8.9																	
E	Empennage																				
	None																				
R	Outside Fuselage																				
R-1	Antenna (580-A)	4	130	5.2																	
T	Outside Tailcone																				
T-1	Antenna (L-10)	2	257	5.1																	
W	Wing																				
	None																				

1/ Enter constant used below line.

NOTE: Moment/100 is used throughout in lieu of Moment/1000

SECTION V | CHAPTER 3

CHART "C", FORM DD-365C, BASIC WEIGHT AND BALANCE RECORD

This section not applicable.

CHAPTER 4

CARGO LOADING

This chapter not applicable.

SECTION I | CHAPTER 5

PURPOSE

The purpose of this chapter is to provide using activities with information regarding use of DD Form 780, 780-1, 780-2 and 780-3 entitled "Aircraft Inventory Record Master Guide". These forms are intended to standardize present inventory procedures and to furnish using activities with a guide indicating inventoriable items of installed and/or loose equipment, authorized and required, which are installed in the aircraft.

SECTION II | CHAPTER 5

DESCRIPTION

2-1. Each form in the 780 series is explained and the purpose for which it is used is stated in the following paragraphs.

2-2. DD FORM 780 AIRCRAFT I INVENTORY RECORD. (See figures 2-1 and 2-2.)

2-3. This portion of the DD Form 780 provides a general identification of the subject aircraft and a sectional breakdown diagram, showing specific station and compartments wherein inventoriable items are contained.

2-4. DD FORM 780-1, AIRCRAFT INVENTORY RECORD EQUIPMENT LIST. (See figure 2-3.)

2-5. This portion of the DD Form 780 provides an inventory record list of quantity, nomenclature, location and equipment checks of installed items.

2-6. DD FORM 780-2 AIRCRAFT INVENTORY RECORD SHORTAGES. (See figure 2-4.)

2-7. This portion of the DD Form 780 provides a record list of quantity, nomenclature, and authority or reason for shortage of inventoriable items.

2-8. DD FORM 780-3, AIRCRAFT INVENTORY RECORD CERTIFICATION AND RECORD OF TRANSFERS. (See figure 2-5.)

2-9. This portion of the DD Form 780 provides a space to indicate compliance with the inventory of property installed in subject aircraft and acceptance of responsibility of property.

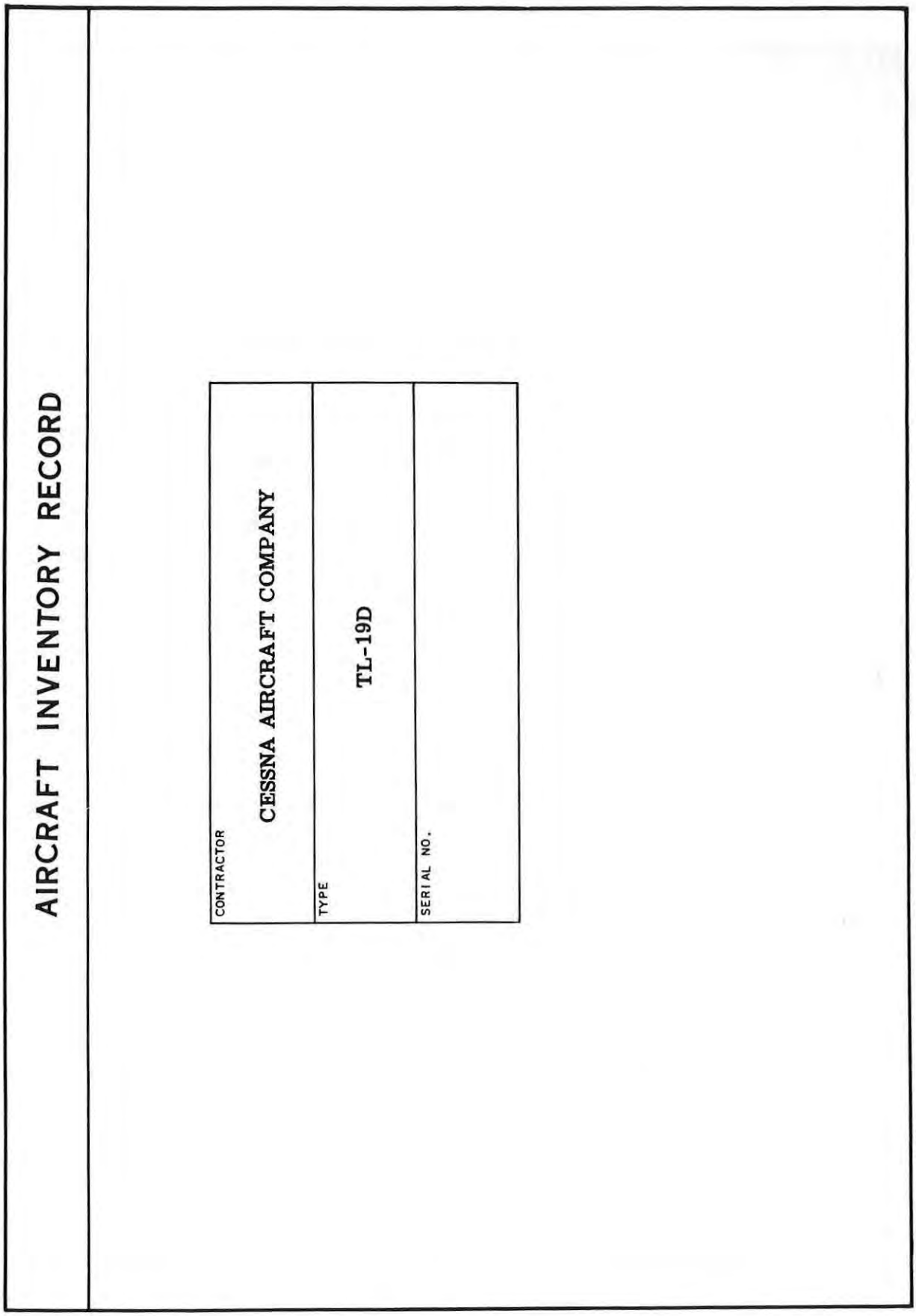

AIRCRAFT INVENTORY RECORD
CONTRACTOR
CESSNA AIRCRAFT COMPANY
TYPE
TL-19D
SERIAL NO.
DD FORM 1 JUN 54 780
REPLACES AF FORM 263C SERIES, 1 APR 45, WHICH ARE OBSOLETE.

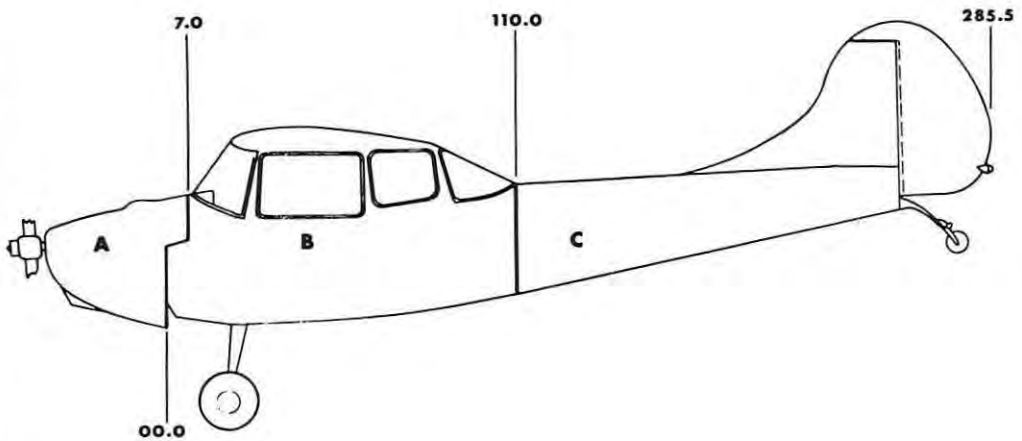
Figure 2-1.

AIRCRAFT TYPE	SERIAL NO.	CONTRACT NO.	PRIME CONTRACTOR	ACCEPTANCE DATE
TL-19D		AF33(600)-34476	Cessna Aircraft Company	

EXPLANATION

SYMBOL	LOCATION	STA.
A	Nose Compartment	-24 to 00.0
B	Pilot's and Student's Compartment	00.0 to 110.0
C	Aft Fuselage Section	110.0 to 285.5
R	Fuselage Exterior	

SECTIONAL BREAKDOWN DIAGRAM



MISCELLANEOUS DATA

Sections A and C do not contain applicable equipment.

Figure 2-2.

U. S. GOVERNMENT PRINTING OFFICE : 1954 O —305319

AIRCRAFT INVENTORY RECORD EQUIPMENT LIST		SECTION B Cabin Section		GOVERNMENT SERIAL NO.		AIRCRAFT TYPE TL-19D		PAGE 1 OF 7 PAGES
ITEM NO. A	NOMENCLATURE, TYPE AND MODEL B	REQUIRED HERE C	EQUIPMENT CHECKS[1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 D					LOCATION OR REMARKS E
B-1	Clock - Type A-11	1						Instrument Panel
B-2	Headset - Microphone H-46A/UR	1						Above Left Pilot's Window - Forward
B-3	Cushion - Seat	1						On Pilot's Seat
B-4	Kit - First Aid	1						Right Root Rib
B-5	DD Form 781	1						Map & Flight Report Case
B-6	Flight Handbook OPERATORS HANDBOOK TM- 55-1510-202-10	1						In Map & Flight Report Case
B-7	USAF Radio Facility Charts & Supplementary Information LF/MF Edition	1						In Map & Flight Report Case

CHECK 1 BY	CHECK 7 BY	CHECK 13 BY	CHECK 19 BY
CHECK 2 BY	CHECK 8 BY	CHECK 14 BY	CHECK 20 BY
CHECK 3 BY	CHECK 9 BY	CHECK 15 BY	CHECK 21 BY
CHECK 4 BY	CHECK 10 BY	CHECK 16 BY	CHECK 22 BY
CHECK 5 BY	CHECK 11 BY	CHECK 17 BY	CHECK 23 BY
CHECK 6 BY	CHECK 12 BY	CHECK 18 BY	CHECK 24 BY

[1] *Verify each equipment check by entering the signature of the person performing the inventory.*

DD FORM 1 JUN 54 780-1 REPLACES AF FORM 263C SERIES, 1 APR 45, WHICH ARE OBSOLETE.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1954 O – 305318

Figure 2-3.

AIRCRAFT INVENTORY RECORD SHORTAGES		GOVERNMENT SERIAL NO.	AIRCRAFT TYPE TL-19D	PAGE 1 OF 1 PAGES
ITEM NO. A	NOMENCLATURE, TYPE AND MODEL B	QUANTITY SHORT C	AUTHORITY OR REASON FOR SHORTAGE D	REMARKS E
B-10	USAF Pilot's Handbook,	1	TCSM-EA-452(EAR) OCMTI	
	US - East		Letter 1st Ind. 25 Oct. 56	
B-11	USAF Pilot's Handbook,	1	TCSM-EA-452(EAR) OCMTI	
	US - West		Letter 1st Ind. 25 Oct. 56	
B-21	SE 44 INVOICE	1	AR 715-232	

DD FORM 1 JUN 54 780-2 REPLACES AF FORM 263C SERIES, 1 APR 45, WHICH ARE OBSOLETE.

U. S. GOVERNMENT PRINTING OFFICE : 1955 O - 352067

Figure 2-4.

AIRCRAFT INVENTORY RECORD
CERTIFICATION AND RECORD OF TRANSFERS

PAGE 1 OF 1 PAGES

NAME OF PRIME CONTRACTOR	GOVERNMENT SERIAL NO.	CONTRACT NO.	AIRCRAFT TYPE
Cessna Aircraft Company		AF33(600)34476	TL-19D

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF DELIVERY, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	TRANSFERRED FROM	DATE TRANSFERRED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION
1	Cessna Aircraft Company		

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF RECEIPT, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	RECEIVED BY	DATE CERTIFIED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION
2			

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF DELIVERY, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	TRANSFERRED FROM	DATE TRANSFERRED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF RECEIPT, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	RECEIVED BY	DATE CERTIFIED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF DELIVERY, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	TRANSFERRED FROM	DATE TRANSFERRED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF RECEIPT, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	RECEIVED BY	DATE CERTIFIED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF DELIVERY, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	TRANSFERRED FROM	DATE TRANSFERRED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION

I CERTIFY THAT THIS AIRCRAFT, AT TIME OF RECEIPT, WAS EQUIPPED WITH THE ITEMS LISTED IN PRECEDING PAGES OF THE AIRCRAFT INVENTORY RECORD WITH THE EXCEPTIONS OF THOSE NOTED ON DD FORM 780-2, "SHORTAGES".

CERTIFICATE NO.	RECEIVED BY	DATE CERTIFIED	SIGNATURE OF GOVERNMENT REPRESENTATIVE OR AUTHORIZED AGENT OFFICIAL DESIGNATION AND ORGANIZATION

DD FORM 1 JUN 54 780-3 REPLACES AF FORM 263C SERIES, 1 APR 45, WHICH ARE OBSOLETE.

U S GOVERNMENT PRINTING OFFICE 1954 O—316808

Figure 2-5.

ALPHABETICAL INDEX

Asterisk*preceding page number denotes illustration or chart.

Asterisk*preceding page number denotes illustration or chart.

E

Asterisk*preceding page number denotes illustration or chart.

Asterisk*preceding page number denotes illustration or chart.

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Asterisk*preceding page number denotes illustration or chart.

Asterisk*preceding page number denotes illustration or chart.

Asterisk*preceding page number denotes illustration or chart.

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

Distribution:
Active Army:
To be distributed in accordance with DA Form 12-5 requirements for Operator's and Crew Member's Instructions for L-19 Aircraft.

* U.S. GOVERNMENT PRINTING OFFICE : 1961 O—591821