NAVAER 01-35EH-501

Pilot's Handbook

for

NAVY MODEL

P4M-1

AIRCRAFT

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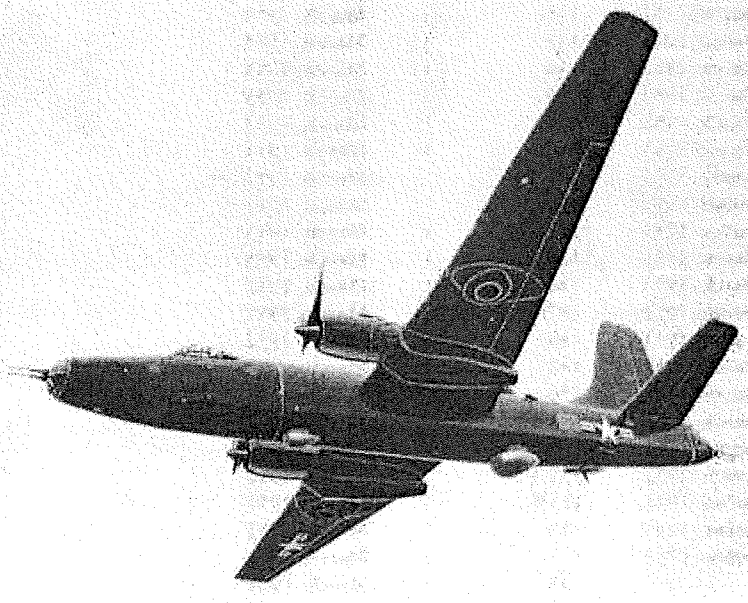

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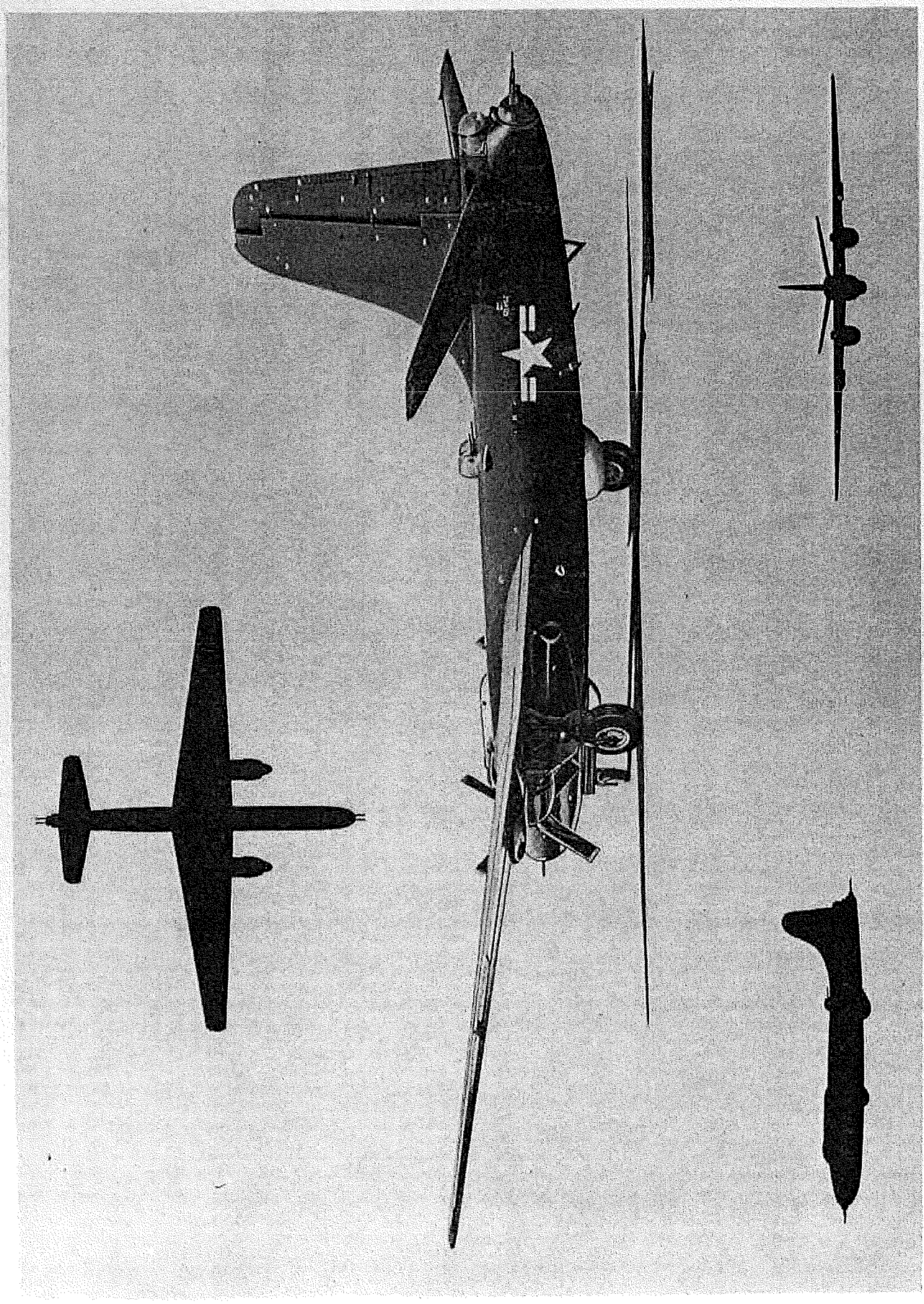


The P4M-1 Airplane

SECTION I

DESCRIPTION

1-1. GENERAL. The P4M-1 is a multi-engine nine place landplane for use as a land based long range patrol or mine laying airplane. This airplane is a development of the XP4M-1. Approximate overall dimensions and weights are as follows:

Length	85 feet, 2-7/8 inches
Height	29 feet, 9-5/16 inches
Span	114 feet
Weight Empty	51000 pounds
Normal Gross Weight	83200 pounds
Landing Weight	68900 pounds

1-2. FUSELAGE ARRANGEMENT. (See figure 1-1) The fuselage is made up of three main interconnected sections which contain the various compartments provided for accommodating nine crew members, equipment installations and bomb bay. Six of the crew members are located in the nose section which extends from the most forward point of the fuselage to the forward end of the bomb bay, while the remaining three are located in the other two sections which include the center section, extending the length of the bomb bay, and the tail section which extends from immediately aft of the bomb bay to complete the fuselage.

1-3. NOSE SECTION FUSELAGE. The nose section fuselage is compartmented to accommodate the bow gunner in a power operated turret in the extreme nose of the airplane; the bomber navigator whose station is located immediately aft of the bow turret compartment and extends to the bulkhead forward of the pilot's instrument panel; the pilot and co-pilot arranged side by side behind and above the bomber navigator station; and the radio operator and radar operator who are stationed in the compartment immediately aft of the pilot house. Since the pilot and co-pilot are located high in the bubble canopy, space is provided below the pilot house floor for radio and radar equipment. Space is also provided in the nose section for the wheel well into which the non-steerable nose wheel is retracted.

1-4. CENTER SECTION FUSELAGE. The center section fuselage is composed of the bomb bay, radar countermeasure operator's compartment, and ditching compartment. The bomb bay is entirely enclosed in the lower half of this fuselage section and is not accessible to the crew during flight. The upper portion of this fuselage section contain the radar countermeasure operator's compartment and ditching compartment, the countermeasure operator being located in the forward end immediately forward of the wing and the ditching compartment, containing two MK 7 Type D life raft installation is aft of the wing. A crawl-way over the wing center section is provided to allow access to the ditching compartment and tail section fuselage from the forward end of the airplane.

1-5. TAIL SECTION FUSELAGE. The tail section fuselage contains the power operated deck turret station, radar scanner, parachute flare release, and photographic equipment, and at the extreme end, a power operated tail turret. Also included in this section are the hot food galley and chemical toilet.

1-6. MOVEMENT OF FLIGHT PERSONNEL. A passageway extends from the bow turret to the tail turret being routed through all compartments so that movement of personnel throughout the airplane is possible except in the bomb bay.

1-7. ARMAMENT.

1-8. GUNNERY EQUIPMENT. Electrically operated turrets are located in the nose and upper deck in the waist compartment. An electro-hydraulic operated turret is located in the tail.

1-9. NOSE TURRET. The nose turret is a Model Aero 9A, twin, M-3, 20 mm gun turret equipped with a Mk 18 Mod. 6 lead computing sight. Ammunition cans are provided for 800 rounds of ammunition.

1-10. DECK TURRET. The deck turret is a Martin Model 250CE-324, twin .50 cal. gun turret equipped with a Mk 18 Mod. 6 lead computing sight. Ammunition cans are provided for 800 rounds of ammunition.

1-11. TAIL TURRET. The tail turret is a Model Aero 11B, twin, M-3, 20 mm gun turret equipped with a Mk 18 Mod. 6 lead computing sight. Ammunition cans are provided for 800 rounds of ammunition.

1-12. BOMBING EQUIPMENT. The airplane is equipped for carrying bombs, mines, torpedoes or auxiliary fuel tanks. All such stores are carried on bomb carriers, twelve of which are provided. Twenty six stations are provided for mounting the bomb carriers, their use dependent on the particular combination of stores to be carried.

1-13. BOMBER'S CONTROLS. Controls for normal hydraulic operation of the bomb bay doors as well as controls for bomb selection, bomb arming, and bomb release are provided for the bomber in addition to the AN/APA-5A radar bombing equipment.

1-14. PILOT AND CO-PILOT BOMBING CONTROLS. Controls for normal hydraulic operation of the bomb bay doors are available on the co-pilot's switch panel (See figure 1-5, reference 13) Bomb bay door position indicator lights are also provided on the co-pilot's switch panel. (See figure 1-5, reference 11) In addition, controls are provided so that either pilot may release bombs. An emergency bomb bay door switch and a bomb salvo switch are provided for the pilot (See figure 3-4, reference 7). The pilot is also provided with a Mk 9 optical sight.

1. Glare Shield
2. Windshield
3. Sun Visor
4. Co-Pilot's Seat
5. Pilot's Seat
6. Radio Operator's Station
7. Radar Operator's Station
8. Countermeasure Radar Operator's Station
9. Main Fuel Tanks
10. Life Raft
11. Main Ditching Station
12. Hot Food Galley
13. Anti-icing System Junction Box
14. Camera
15. Camera Operator's Station
16. Tail Gunner's Station
17. Toilet
18. Bomb Bay Fuel Tanks
19. External Power Receptacle
20. Battery
21. Battery Junction Box
22. Navigator's Table
23. Navigator Bomber Station
24. Bombardier's Floor Cushion

Figure 1-1. General Arrangement

1-15. FLIGHT CONTROLS.

1-16. RUDDER, AILERON AND ELEVATOR CONTROLS. Standard adjustable pedal type rudder controls are provided for pilot and co-pilot. Dual aileron and elevator controls are of the wheel and post type. A rudder force augmenter is installed to increase directional control force characteristics so that side slip angles corresponding to limit strength can be obtained only by application of at least 300 pounds rudder pedal force.

1-17. CONTROL LOCKS. Pins are provided for positively locking the ailerons, elevators and rudder in their neutral positions. These pins are operated by a handle located on the floor, aft of the pilot's left rudder pedal.

1-18. TABS. The rudder, ailerons and elevators are each fitted with a tab for combined trim and balance. To reduce pilot effort in moving the surfaces, the rudder and aileron tabs are spring loaded, the amount of spring load is not adjustable in flight. Pilot effort for moving the elevators is reduced by an additional spring tab, not adjustable in flight, on each elevator.

1-19. The combined trim and balance tabs are moved by electrically operated actuators controlled by momentary switches located on the pilot's pedestal (See figure 1-8 , references 18, 26 and 28). The elevator tab may be operated at two speeds as determined by the setting of the selector switch.

1-20. An emergency override switch, also located on the pilot's pedestal, is provided for the elevator tab control. (See figure 1-8 , reference 23). This switch overrides the normal momentary selector switch and energizes an entirely separate circuit between the pedestal and the elevator tab actuators.

1-21. Emergency manual tab controls are provided in addition to the electrical controls. For the rudder and elevator, they are located in the tail section of the airplane near the tail turret, while those for the ailerons are located in the ditching compartment.

1-22. WING FLAP CONTROLS. The wing flaps are powered by hydraulic pressure supplied to the actuating cylinders through a solenoid type control valve. This valve is controlled by a prepositioning system that is actuated by the flap control lever on the pilot's pedestal. (See figure 1-8 , reference 12) When the control lever is in the "UP" or "DOWN" position, pressure is being applied to the cylinder piston, thereby holding the flaps in the position selected. In any intermediate position of the control lever the ports of the valve are closed and the flaps are held in the selected position by a lock valve which traps fluid in the lines. The "TAKE-OFF" position of the control lever corresponds to the 20 degree down position of the flaps.

1-23. SPOILER AILERONS. A spoiler aileron is installed on each outer wing upper surface aft of the rear spar and just inboard of the ailerons. These spoiler ailerons are provided to increase the rate of roll of the airplane, particularly at or near stall speeds. They are actuated automatically by the aileron control system and cannot be operated independent of the ailerons.

1-24. In order for the spoiler to be actuated, the aileron has to be moved up three degrees. When an aileron has reached the three degree up position, the spoiler aileron on the same side automatically starts to open - the spoiler aileron on the opposite side will remain closed. The spoiler travel is proportional to aileron travel so that as the aileron is moved beyond a three degree up position, the spoiler will continue to open. As the aileron is brought back, the spoiler will close automatically, and when the aileron again reaches a three degree up position, the spoiler will be completely closed.

NOTE

Operation of the spoiler ailerons should be visually checked before take-off by moving first one aileron and then the other up at least three degrees.

1-25. AUTOMATIC PILOT.

1-26. The airplane is equipped with a P-1 automatic pilot. The auto-pilot is a system of automatic controls operating in conjunction with the co-pilot's master direction indicator, turn and bank indicator; and gyro horizon. While under automatic control, banked turns can be made, and the airplane can be made to climb or dive, by using the automatic pilot controller located on the pilot's pedestal (See figure 1-8 , reference 19). The system is also tied in to the AN/APA-5A radar bombing equipment allowing the bomber to take over directional control of the airplane when the bomb sight is being used.

1-27. Power is supplied to the automatic pilot and to the co-pilot's flight instruments by the automatic pilot inverter when the auto-pilot power switch located on the pilot's switch panel (See figure 1-4, reference 3) is turned to the "INSTRUMENT AND AUTO-PILOT" position. After a warm up period of approximately two minutes, the auto-pilot may be engaged by pushing in the automatic pilot clutch switch (See figure 1-4 reference 4).

NOTE

The automatic pilot cannot be engaged unless the gyroscopes in the co-pilot's flight instruments have been erected. This is done by caging and then uncaging before the automatic pilot is engaged.

1-28. No standby power for the automatic pilot is provided. Failure of the automatic pilot inverter renders the system inoperative. Standby power is provided for the pilot's and co-pilot's flight instruments.

NOTE

Monitoring the electrical system will disconnect power to the automatic pilot. Refer to paragraph 1-117 through 1-122.

1-29. An adapter on the AN/APA-5A radar bombing equipment allows the bomber to take over directional control of the automatic pilot when the bomb sight switch on the pilot's switch panel is in the "BOMBSIGHT" position. The elevators, however, continue to be controlled by the automatic pilot.

1-30. The automatic pilot is normally disengaged electrically by pulling out the auto-pilot clutch switch on the pilot's switch panel (See figure 1-4, reference 4) or by pushing in the clutch disconnect switch on either the pilot's or co-pilot's wheel. (See figure 1-6, reference 12A). Pushing in either the pilot's or co-pilot's clutch disconnect switch will automatically cause the automatic pilot clutch switch to pop out and has the same effect as pulling out the automatic pilot clutch switch.

1-31. Several other methods of electrically disengaging the automatic pilot may be used. Each will cause the automatic pilot clutch switch to pop out. These are listed as follows:

a. Caging the co-pilot's flight instrument gyros.

b. Turning the G-2 compass switch (See figure 1-4, reference 10) to "EMERGENCY".

c. Turning the co-pilot's flight instrument and auto-pilot switch (See figure 1-4 reference 3) to either "OFF", "INST. NORMAL" or "STANDY-BY".

1-32. The disconnect handle is attached by cables to the servo disconnects on the shafts of the three servos. As the servo pulleys are attached to the disconnects, pulling the handle loosens the grip of the disconnects on the servo shafts and the airplane control surfaces can no longer be moved by the servos. Pulling the handle has no effect on the electrical circuits of the automatic pilot. The servo disconnects cannot be re-engaged while the airplane is in flight.

1-33. POWER PLANT. This airplane is equipped with two reciprocating engines, Pratt & Whitney Model R-4360-20, and two turbo-jet engines, Allision J-33-A-10. The reciprocating engines with single stage variable speed superchargers, drive fifteen foot diameter, four blade, reversible pitch propellers at a ratio of .425:1. The turbo-jet engines are single stage, centrifugal compressor units incorporating fourteen burners arranged radially. Engine ratings are as follows:

Reciprocating Engines - 3250 BHP (Take-Off) each

Turbo-Jet Engines - 4600 pounds Thrust (Take-Off) each

1-34. RECIPROCATING ENGINE CONTROLS.

1-35. THROTTLE CONTROLS. (See figure 1-8, reference 13).

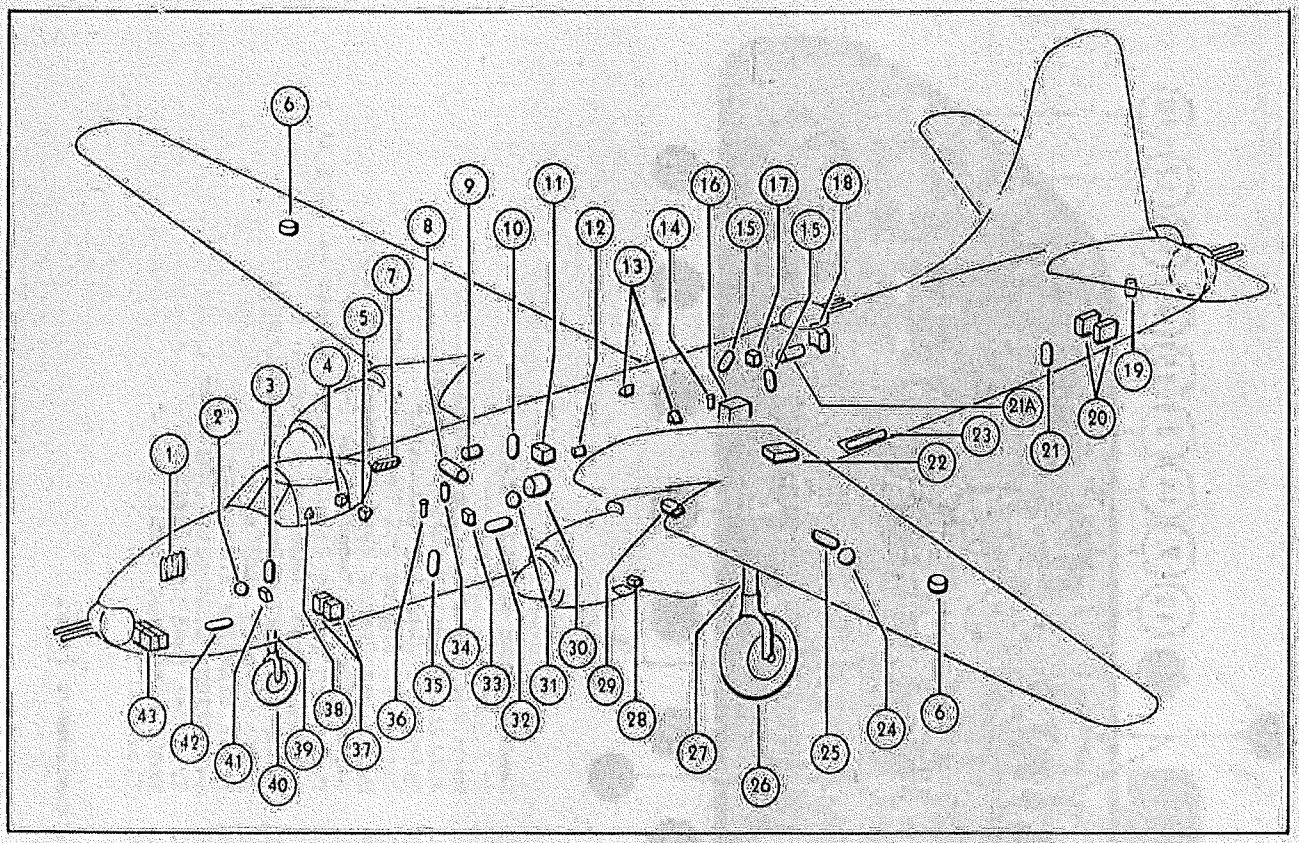
1-36. The regulation of manifold pressure and the control of impeller speed is accomplished through an automatic power control unit mounted on each engine. Military power is obtained by placing the throttle levers in full forward position. The use of the throttle lever to reverse propeller pitch is described in paragraph 1-42H and 1-42I.

1-37. Selection of a manifold pressure is made by movement of the throttle which, at the same time, operates the automatic power control unit. The automatic power control opens the carburetor throttle as required to maintain the desired manifold pressure until the critical altitude for low impeller ratio is reached. As the critical altitude for low impeller ratio is reached, the automatic power control begins to adjust the impeller speed, gradually changing from low to high ratio. There is a time lag in this operation which results in a decrease of manifold pressure, but as high impeller ratio is reached the manifold pressure will rise to its original setting. The decrease in manifold pressure diminishes as engine speed is reduced to 1700 rpm, however, at any power setting less than military power, it can be counteracted by advancing the throttle. When increasing the manifold pressure while in the variable speed range of the impeller, there will be a lag of several seconds before the impeller will be speeded up the required amount. Experience will determine the amount of throttle movement necessary for smooth control.

NOTE

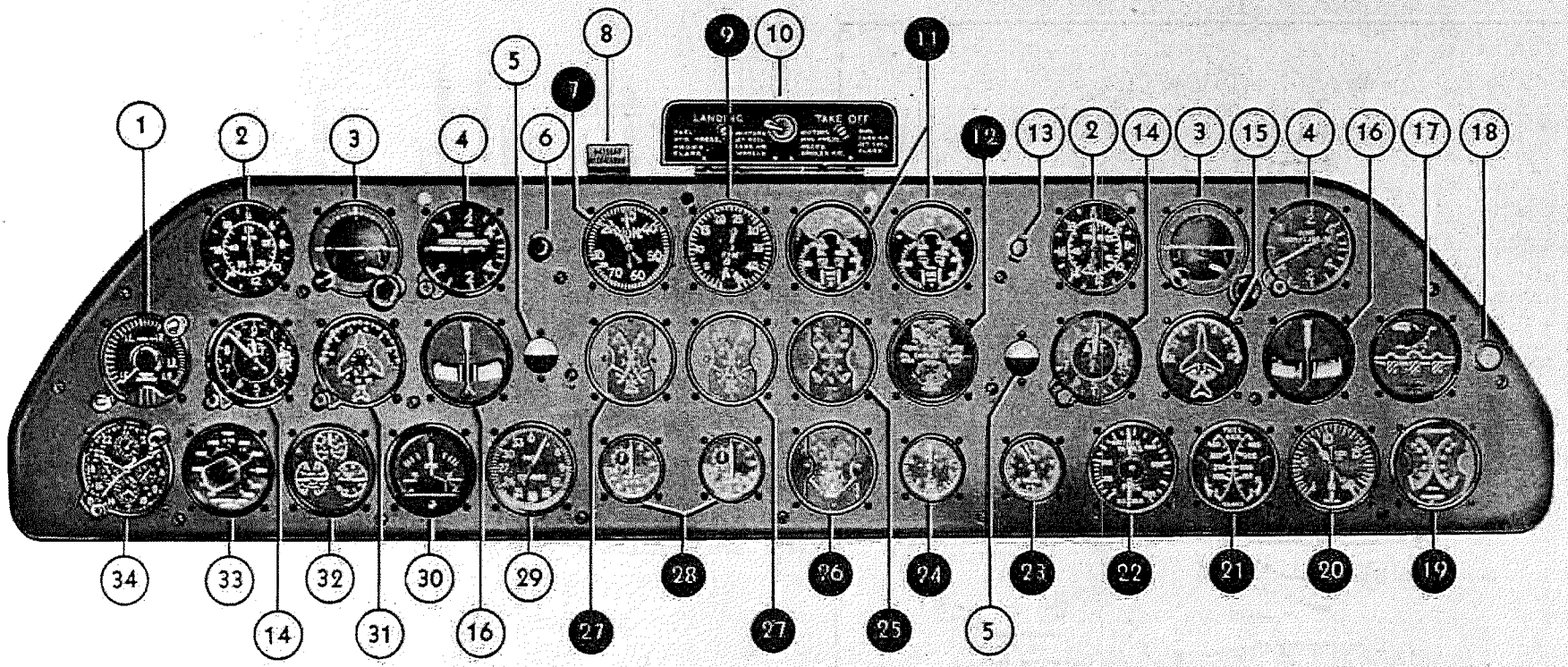
When operating near or below 1700 rpm and at an altitude for engagement of the high ratio coupling, an oscillation of manifold pressure may be encountered. This may be eliminated by a slight change in altitude, a small change of rpm, or a small change of manifold pressure.

1-38. In order to maintain operating limits and secure stable operation, it was necessary to incorporate manifold pressure "droop" in the automatic power control when operating in high impeller ratio. Until the full open position of the carburetor throttle is reached, when operating at less than military power, this "droop" can be overcome by advancing the throttle. However, when the carburetor throttle reaches full open the engine will act similiar to engines without this automatic control.



1. Night Drift Signals-Navigator's Compartment
2. Oxygen Bottles-Sta. 170 LH & RH
3. Brake Accumulator-Aft of Canted Bulkhead-RH Side
4. Radio Operator's Clock
5. Radar Operator's Clock
6. Outer Wing Auxiliary Tank Filler
7. Signal Pistol Cartridges-Radio Operator's Compartment
8. Water Breaker-Countermeasure Operator's Compartment
9. Emergency Hydraulic Reservoir
10. Fire Extinguisher Bottle-Countermeasure Compartment
11. Anti-icing Tank-Countermeasure Operator's Compartment
12. Bomb Bay Fuel Tanks No. 1 and 2 Filler
13. Main Fuel Tank Filler
14. Flashlight Sta. 597-3/4
15. Life Raft Ejector CO_2 Bottles-Ditching Station
16. Galley and Galley Accessories
17. First Aid Kit
18. Deck Turret Ammunition
19. Toilet and Toilet Accessories
20. Tail Turret Ammunition
21. Fire Extinguisher-Aft Fuselage
21A. Water Breaker-Galley Compartment
22. Bomb Bay Fuel Tanks No. 3 & 4 Filler-Left Center Wing Trailing Edge
23. Parachute Flare-Sta. 684 to 725
24. Spoiler Aileron Accumulator
25. Spoiler Aileron Air Bottle
26. Main Alighting Gear Tires
27. Main Alighting Gear Struts
28. Ignition Test Receptacles-Nacelle
29. Main Engine Oil Tank Filler
30. Main Hydraulic Reservoir-Sta. 386 to 408
31. Emergency Accumulator-Sta.
32. Emergency Air Bottle-Sta. 354
33. First Aid Kit-Radio Compartment
34. Paper Cups-Countermeasure Operator's Compartment
35. Fire Extinguisher-Radio Compartment
36. Flashlight-Radio Compartment
37. Batteries
38. Signal Light
39. Nose Alighting Gear Strut
40. Nose Alighting Gear Tire
41. Spare Bulb Box-On Canted Bulkhead
42. Fire Extinguisher-Navigators
43. Nose Turret Ammunition

Figure 1-2. Service Diagram



1. Radio Altimeter Indicator
2. Airspeed Indicator
3. Gyrohorizon Indicator
4. Rate of Climb Indicator
5. Power Failure Indicator
6. Low Altitude Warning Light
7. Manifold Pressure Indicator
8. Battery Discharge Warning Light
9. Main Engine Tachometer Indicator
10. Check-off List
11. Engine Gage Units
12. Cowl and Oil Cooler Flap Position Indicator
13. Marker Beacon Indicator
14. Altimeter
15. Master Direction Indicator For Automatic Pilot
16. Turn and Bank Indicator
17. Landing Gears and Flaps Position Indicator
18. Landing Gear Warning Light
19. Oil Quantity Indicator
20. Main Engines Fuel Flow Indicator
21. Auxiliary Fuel Quantity Indicator
22. Main Fuel Quantity Indicator
23. Turbo-Jet Engine Oil Pressure Indicator
24. Turbo-Jet Engine Fuel Pressure Indicator
25. Carburetor Air Temperature Indicator
26. Turbo-Jet Engine Exhaust Gas Temperature Indicator
27. Cylinder Head Temperature Indicator
28. Turbo-Jet Engine Tachometer Indicator
29. Radio Compass Indicator
30. Pilot Director Indicator
31. G-2 Master Direction Indicator
32. Trim Tab Position Indicator
33. Radio Altimeter Limit Switch
34. Clock

Figure 1-3. Pilot's and Co-Pilot's Instrument Panel

1-39. MIXTURE CONTROL. (See figure 1-8 , reference 17). The carburetor mixture control has three positions: "RICH", "NORMAL", and "IDLE CUT-OFF". The "RICH" position should be used for all ground operations, take-offs, landings, emergencies, and at other times when needed for adequate cooling. "NORMAL" position is used for all normal flight operations. "IDLE-CUT-OFF" is used to stop the engines and should be used when starting until the engine begins to fire (fuel for starting is provided by the primer).

1-40. Deleted

1-41. Deleted

1-42. Deleted

1-42A. PROPELLER CONTROLS.

1-42B. PROPELLER GOVERNOR CONTROLS. The propeller governors are controlled mechanically by conventional levers located on the pilot's pedestal. (See figure 1-8 , reference 4).

1-42C. PROPELLER FEATHERING AND UNFEATHERING CONTROLS.

1-42D. Propeller feathering controls consist of a push-pull switch for each propeller on the pedestal switch panel. (See figure 1-8 , reference 20). When the button on this switch is pushed in, a holding coil keeps it depressed and power is supplied to the feathering pump and timer motor. The pump will then build up oil pressure which is directed to the propeller piston, turning the blade toward the feathered position. After approximately 12 seconds the timer de-energizes the holding coil and stops operation of the system. The push button will then return to its neutral position. This normally allows ample time for the blades to feather. If the propeller should still be windmilling forward after the push button has returned to neutral, it may be pushed again to stop the windmilling. If after the button returns to neutral the propeller should windmill in reverse, the button may be pulled out momentarily to unfeather it enough to stop this condition. The button may be pulled out at any time to stop the feathering operation and return the blades to normal pitch.

1-42E. To unfeather the propeller the button must be pulled out and hold out until the engine is turning over approximately 600 rpm with the governor set at minimum speed position. With the button held out the pump will deliver oil pressure to the propeller piston moving the blades toward low pitch. When the blades move to the position for the governor to take over control the feathering circuits will be automatically de-energized. Releasing the feathering button will also de-energize the circuits.

1-42F. A total of seven breakers are installed in the feathering circuits. A feathering control breaker is provided adjacent to each feathering switch. (See figure 1-8 , reference 21). The other five circuit breakers are installed on the main circuit breaker panel and protect the following circuits: (See figure 1-13).

Left Feathering Control
Right Feathering Control
Left Feathering Pump Power
Right Feathering Pump Power
Timers

1-42G. PROPELLER REVERSING CONTROLS.

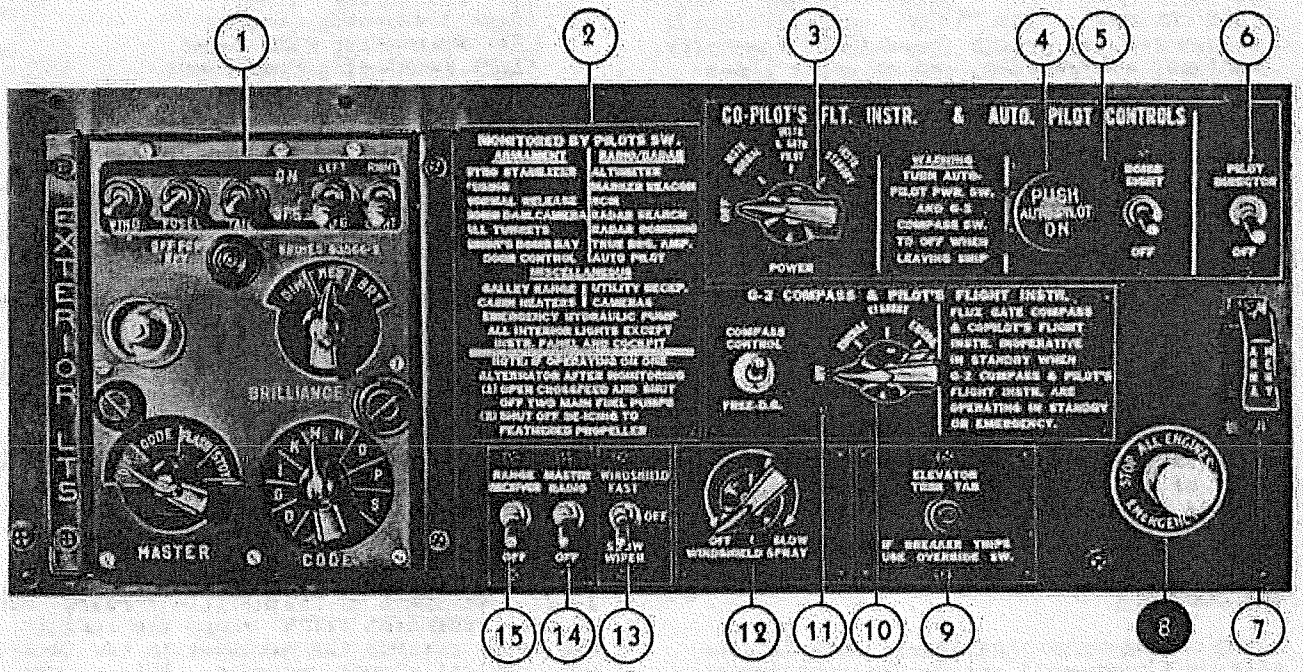
1-42H. The throttle levers are used to control the propeller reversing system. (See figure 1-8 , reference 13) Movement of the throttle aft to the "CLOSE" position, clear of the stop and then aft into the "REVERSE PITCH" range actuates switches in the reverse control box. This starts the timer and the feathering pump, then oil will be delivered to the propeller piston so as to reverse the pitch of the blades. After approximately three seconds the pump motor will be automatically de-energized by the timer as the propeller should be in reverse pitch by this time. The blades are held in reverse pitch by governor oil pressure. Further aft movement of the throttle increases power in reverse pitch.

1-42I. Movement of the throttle forward, out of the "REVERSING PITCH" range and through the stops returns the switches in the control box to their normal position. This causes the pump to start and supply oil to the propeller piston to turn the blades toward the normal pitch range. When the blades reach the governing range the pump will automatically stop and the governor will take over control.

1-42J. A breaker is installed on the main circuit breaker panel for the protection of the reversing control circuits. (See figure 1-13).

1-43. CARBURETOR AIR CONTROL. Ram air for the carburetor is normally supplied by the air scoop on top of the engine. If icing conditions exist the air scoop may be blocked and heated air taken from the engine accessory compartment. This prevents fouling and clogging of the induction system. Two carburetor air switches on the co-pilot's switch panel control the motors which position the carburetor air intake doors. (See figure 1-5, reference 2) In the "DIRECT" position the air duct between the air scoop and carburetor is open and in the "ALTERNATE" position the intake door blocks the air from the scoop and admits the heated air. When in the alternate position, the air intake door opens a back-fire door locking mechanism. This permits the back-fire door to swing open under the pressure of an engine back-fire, directing the flame to a safe area.

1-43A. CARBURETOR AIR CONTROL, VARIABLE ALTERNATE AIR SYSTEM. (Effective on all airplanes upon completion of the service change incorporating the variable alternate air system). Ram air for the carburetor is normally supplied by the air scoop on top of the engine. The variable alternate air system permits the flow of air through the air scoop and heated air taken from zone 1 or the power section to be mixed. The position of the carburetor air intake door, the power output



1. Exterior Light Controls
2. Montoring List
3. Automatic Pilot Power Switch
4. Automatic Pilot Clutch Switch
5. Automatic Pilot Bombsight Switch
6. Pilot Director Switch
7. Armament Switch
8. Master Ignition Switch
9. Elevator Trim Tab Circuit Breaker
10. G-2 Compass Power Switch
11. G-2 Compass Control Switch
12. Windshield Spray Switch
13. Windshield Wiper Switch
14. Master Radio Switch
15. Range Receiver Switch

Figure 1-4. Pilot's Switch Panel

of engine and the cowl flap position determines the mixture temperature. The primary function of the variable alternate air system is to prevent induction system icing. A secondary function is to supply a controllable heat to assist in vaporizing the fuel when operating under cold weather conditions. This in turn gives better engine operation. The two carburetor air control switches, each have three positions, the normal being "OFF", the "DIRECT" and "ALTERNATE" are moemntarily "ON". When the switches are held in the "DIRECT" position, the air intake door will be acuated in a direction to decrease the heated air flow from zone 1. If the switches are held in the "ALTERNATE" position, the air intake door will be actuated in a direction to decrease the flow of air through the air scoop. Thus the temperature of the air entering the carburetor is increased.

WARNING

In the event of an engine fire in the full "ALTERNATE" position, hold the carburetor air control switch in the "DIRECT" position for three seconds. The intake door should travel its limit, preventing fire from entering the carburetor.

1-43B. USE OF ALTERNATE AIR. The alternate air position shall be used when cruising under cold weather conditions (below 10°C) or when flying in any condition conducive to the formation of induction system ice. The shift to alternate air should be made before carburetor icing conditions are actually encountered. When making the shift to or from alternate air it is desirable to use "RICH" carburetor mixture during the shift. The manifold pressure lost in alternate air may be regained at low altitude by increased throttle opening. Loss of ram has no effect on airplane performance as long as the desired engine power can be maintained by increased throttle setting. Take-off in alternate air at ambient air temperatures below -30°C may be necessary for satisfactory engine operation.

1-43C. Never return from alternate air to direct for approach or landing under icing conditions. Take-off in alternate air is not recommended for ambient air temperatures above -20°C unless the take-off is made in actual icing conditions. Alternate air should not be used under hot day high power conditions.

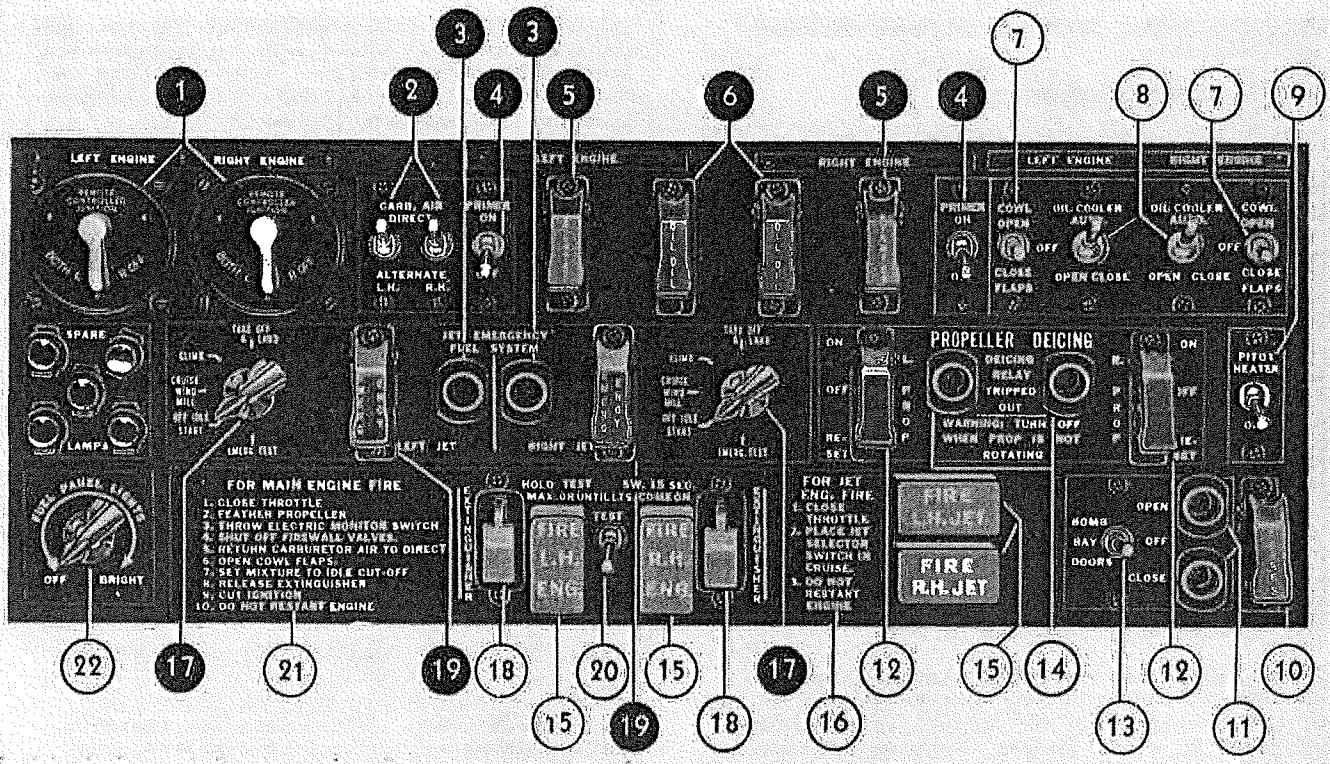
1-43D. Carburetor air temperature values to be maintained with the variable alternate air system are as follows: (After service change incorporates the alternate air system)

Carburetor Air Temperature °C

Condition	Minimum	Recommended Operating Range	Maximum
Icing	+5	+10 to +32	+38
Cold Weather Cruise		0 to +15	+38-Low Blower +15-High Blower
Cold Weather Take-off		0 to +15	+32

NOTE

Reduce maximum C.A.T. 5°C for each 2000 feet above low blower critical until 15°C is obtained.



1. Main Engine Ignition Switch
2. Carburetor Air Control Switch
3. Turbo-Jet Engine Emergency Fuel System Indicator Light
4. Primer Switch
5. Starter Switch
6. Oil Dilution Switch
7. Cowl Flaps Switch
8. Oil Cooler Flaps Switch
9. Pitot Heater Switch
10. Flare Release Switch
11. Bomb Bay Door Indicator Light
12. Propeller De-icer Switch
13. Bomb Bay Door Switch
14. Propeller De-icer Indicator Light
15. Fire Detector Indicator Light
16. Turbo-Jet Engine Fire Check List
17. Turbo-Jet Engine Fuel and Door Selector
18. Fire Extinguisher Switch
19. Turbo-Jet Engine Emergency Fuel System Switch
20. Fire Detector Test Switch
21. Main Engine Fire Check List
22. Fuel Panel Light Switch

Figure 1-5. Co-pilot's Switch Panel

1-44. COWL FLAP CONTROLS. The cowl flap switches located on the co-pilots switch panel control the cowl flap actuating motors. (See figure 1-5, reference 7) A motor, located in each nacelle, actuates the flaps in the direction selected.

1-45. OIL COOLER FLAP CONTROLS. A four-position selector switch is provided on the co-pilots switch panel to control each of the flap actuators. (See figure 1-5, reference 8) A thermostat in the actuator automatically controls the positioning of the flap when the switch is placed in the "AUTO" position. Manual control is obtained by placing the switch in the "OPEN" or "CLOSED" position as desired.

1-46. OIL DILUTION CONTROLS. Two switches on the co-pilot's switch panel control the oil dilution valves which permit the engine oil to be diluted with gasoline at the oil tank sequence valves. (See figure 1-5, reference 6) This permits easier starting when low temperatures are encountered.

NOTE

The manual shut-off cocks on the aft side of the firewall on the inboard side of each nacelle under the fuel strainer are always safetied shut and must be unsafetied and opened before dilution.

1-47. ENGINE PRIMING. Engine priming is accomplished by injecting fuel into engine blower section and is controlled by switches on the co-pilot's switch panel. (See figure 1-5, reference 4) These switches are operated simultaneously with the corresponding engine starter switches. If the engine is warm, priming should be done intermittently, otherwise continuously.

1-48. STARTER CONTROLS. A direct cranking electric motor type engine starter is mounted on each reciprocating engine. These starters automatically engage when energized and each is controlled by a starter switch on the co-pilot's switch panel. (See figure 1-5, reference 5) These switches have a momentary "ON" position and return to "OFF"

when released. No means of hand cranking is provided.

1-49. IGNITION CONTROLS.

1-50. The main engine ignition system is a remote controlled system consisting of a master ignition switch located on the pilot's switch panel (See figure 1-4, reference 8), two ignition switches, one for each main engine, located on the co-pilot's switch panel (See figure 1-5, reference 1), and an ignition control box mounted in each main engine nacelle. The remote control feature of the system is designed so that the cockpit ignition switches energize solenoids in the ignition control boxes which in turn ground or unground the magnetos. There is no direct connection between the cockpit switches and the magnetos. With this system, it is only possible to remotely control ignition if the circuit between the cockpit switches and the ignition control box is functioning properly. If the electrical system is interrupted causing the main engine ignition circuit breaker to pop out, the engines will continue to run.

1-51. When the master ignition switch is pushed in, the ignition system is controlled by the two ignition switches located on the co-pilot's switch panel. Pulling out the master ignition switch stops the main engines by grounding out all magnetos and also stops the jet engines by shutting off the fuel.

1-52. TURBO-JET ENGINE CONTROLS. Turbo-jet engines are controlled by a throttle control and door position selector for each engine. The operation of the turbo-jets is dependent on the positioning of both controls and various combinations of positions of each control are used under different circumstances.

1-53. TURBO-JET THROTTLE CONTROLS. A throttle lever is provided on the pedestal for each of the two engines (See figure 1-8, reference 24).

NOTE

For purpose of clarification, description of throttle lever operation assumes proper positioning of the jet door selector switch. Refer to paragraph 1-60 through 1-65, for jet door controls.

1-54. Four stops, "OFF", "CRANK", "START" and "IDLE", are provided for each throttle lever.

1-55. TURBO-JET THROTTLE "OFF" POSITION. This position of the throttle lever is used at all times when the jet is not used. Returning the lever to "OFF" stops the jets by turning off the jet fuel valve and automatically opens all electrical circuits connected with jet operation. The jet air door, however, will remain open for approximately 70 seconds after the throttle is moved to "OFF".

1-56. TURBO-JET THROTTLE "CRANK" POSITION. Moving the throttle from "OFF" to "CRANK", actuates switches which energize the electrical circuits for opening the jet air door, opening the fuel valve, turning on ignition, and turning the turbine. This position of the throttle is maintained until a turbine speed of 9.0 percent is reached.

1-57. TURBO-JET THROTTLE "START" POSITION. After a turbine speed of 9.0 percent is reached, the throttle is moved from the "CRANK" to "START" position. With the throttle in this position, the jet starting fuel sequence valve is opened. The starting fuel sequence valve allows fuel to enter burners number seven and fourteen. The emergency stand-by fuel pump supplements the main fuel pump during this period and its indicator light (See figure 1-5, reference 3) will come on indicating that the emergency pump is operating. As the jet turbine speed accelerates, the emergency pump and main pump will continue to supply fuel to all chambers through the starting fuel sequence valve until all burners are operating. When a turbine speed of approximately 17 percent is reached, the starter will automatically disengage and ignition will stop.

1-58. TURBO-JET THROTTLE "IDLE" POSITION. When the jet turbine speed reaches 23.8 percent the throttle is advanced to the "IDLE" position. This causes the starting fuel sequence valve to close and the main fuel valve in the engine to open. At the same time, the emergency fuel pump by-pass valve will open and the indicator light will go out. Further movement of the throttle beyond the "IDLE" position will increase fuel flow to the turbo-jet and increase turbine speed.

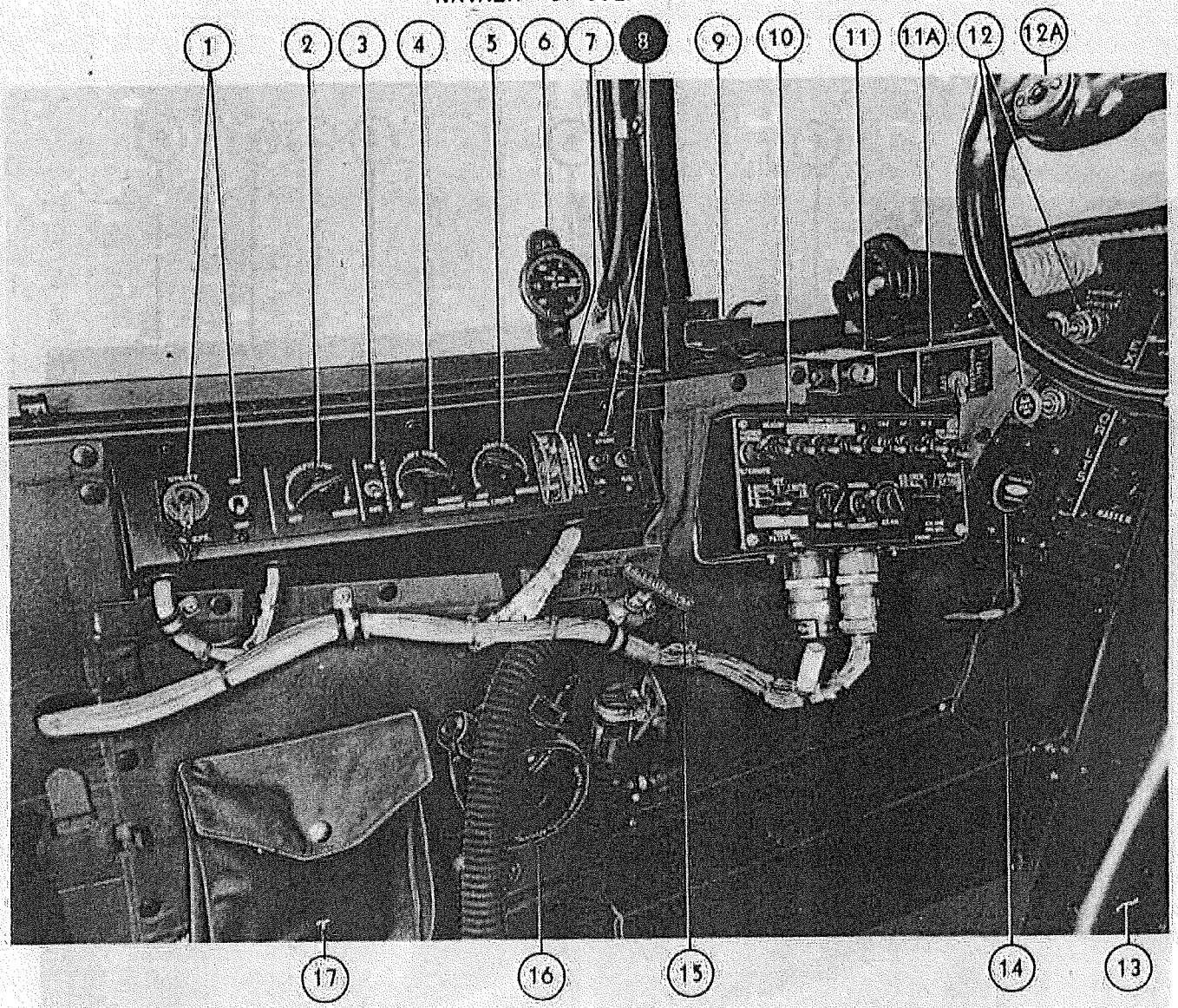
1-59. The turbo-jet may be stopped by moving the throttle to the "OFF" position, or, in an emergency, by pulling out the master ignition switch (See figure 1-4, reference 8).

WARNING

Pulling out the master ignition switch will stop all engines.

1-60. TURBO-JET ENGINE FUEL AND DOOR SELECTOR SWITCH. Two turbo-jet engine fuel and door selector switches are provided, one for each turbo-jet engine. These are located on the co-pilot's switch panel (See figure 1-5, reference 17) and are used to control the turbo-jet air door and fuel system in conjunction with the turbo-jet throttles. Each switch has five switch positions; "OFF-IDLE-START", "CRUISE-WINDMILL", "CLIMB", "TAKE-OFF AND LAND" and "EMERGENCY TEST".

1-61. SELECTOR SWITCH "OFF-IDLE-START" POSITION. The "OFF-IDLE-START" position of the switch should be selected when the turbo-jet is not running, is being shut down, or is being started (except for manual windmill starts). When the switch is in this position, the jet air doors will automatically open to the proper position for ground starts, or starts in flight, as the throttle lever is actuated. This switch position should be used for all ground checks and operation prior to take off. With the switch in this position, the door will automatically close after a 70 second delay,



1. Utility Receptacle and Switch
2. Cockpit Lights Switch
3. Auxiliary Panel Light Switch
4. Left Side Instrument Panel Light Switch
5. Center Instrument Panel Light Switch
6. Free Air Temperature Indicator
7. Master Interior Lights Switch
8. Turbo-Jet Engine Starter Circuit Breaker
9. Microphone Clip
10. Interphone Control Box (See figure 4-18)
11. Panel Light
11A. Pilot's Navigator Call Switch
12. Windshield Defroster Control
12A. Auto-Pilot Clutch Disconnect Switch
13. Control Column
14. Oxygen Flow Indicator
15. Emergency Automatic Pilot Disconnect
16. Oxygen Regulator
17. Oxygen Mask Bag

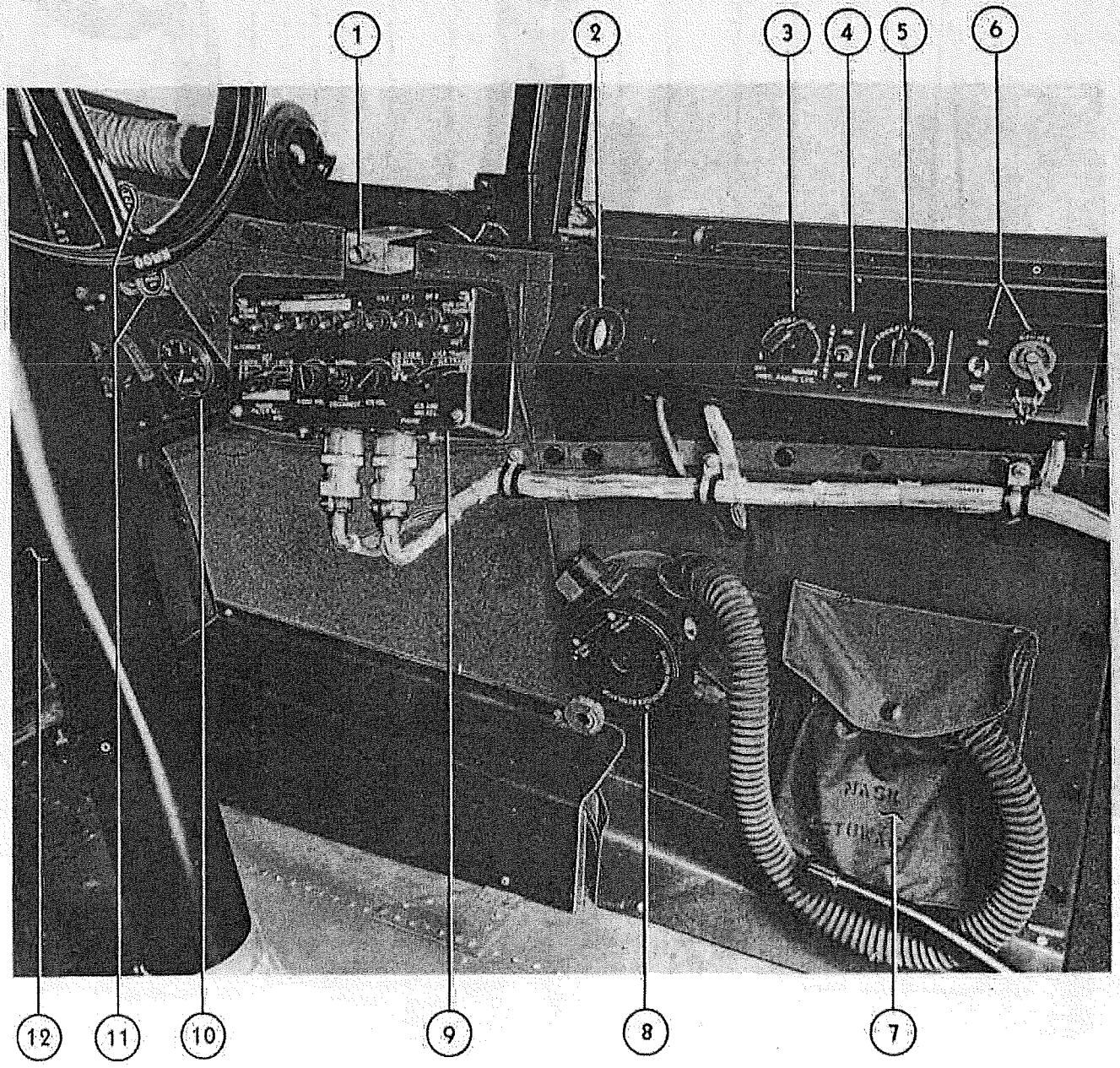
Figure 1-6. Left Side Of Flight Deck

when the turbo-jet is shut down by returning the throttle to the "OFF" position.

1-62. SELECTOR SWITCH "TAKE-OFF AND LAND" POSITION. The "TAKE-OFF AND LAND" position of the switch should be used at take-off after 90 percent power on jets. By the time this position of the switch is used, the turbo-jet engine should be running with the throttle in or beyond the "IDLE" range. This position of the switch supplies power to the door full open limit switch, and the door will remain full open as long as the switch is in this position. This position of the switch also completes a circuit through the fuel pressure switch which will allow the emergency fuel pump to automatically supply fuel to the turbo-jet in event of failure of the main fuel pump; should this happen, the indicator light on the co-pilot's switch panel will come on. (See figure 1-5, reference 3).

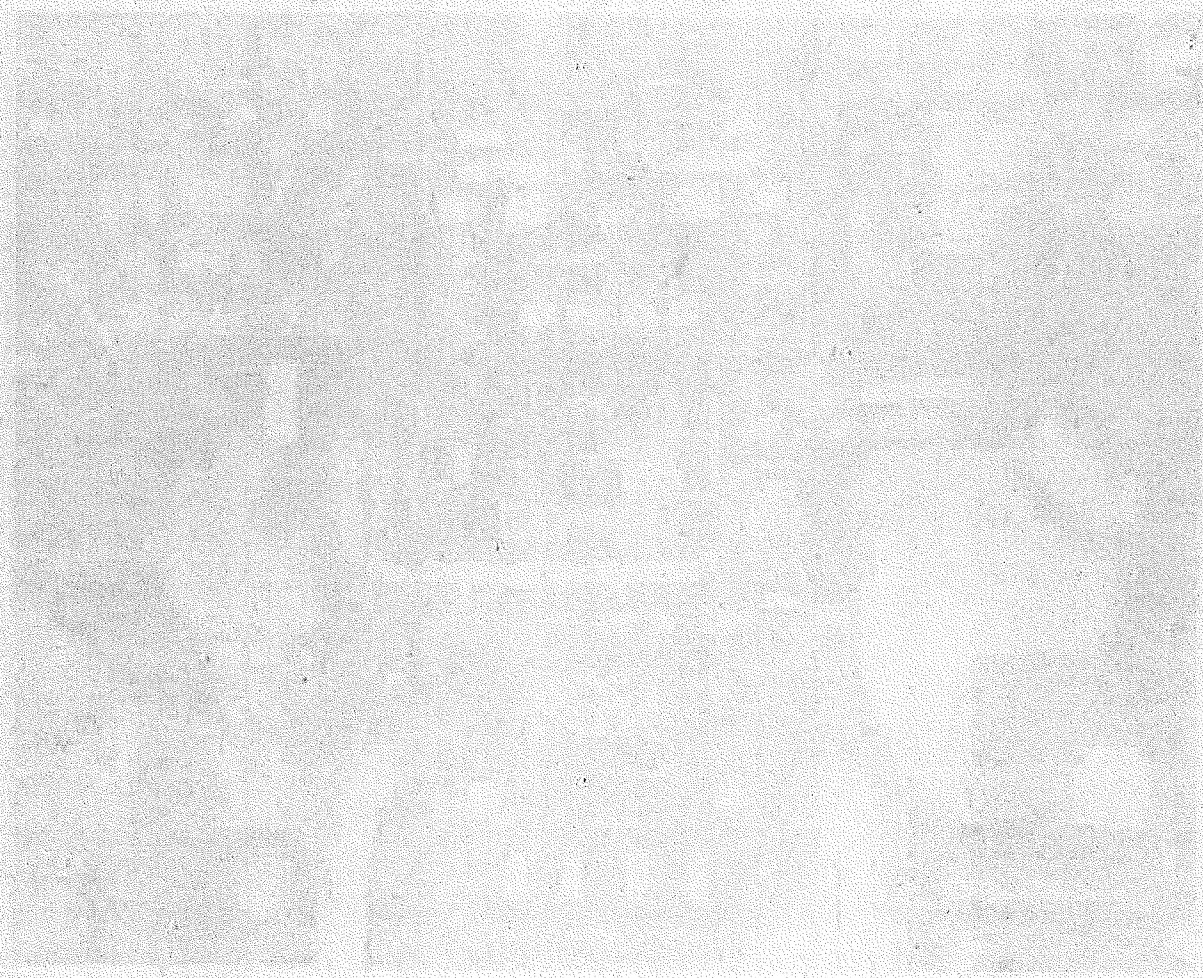
CAUTION

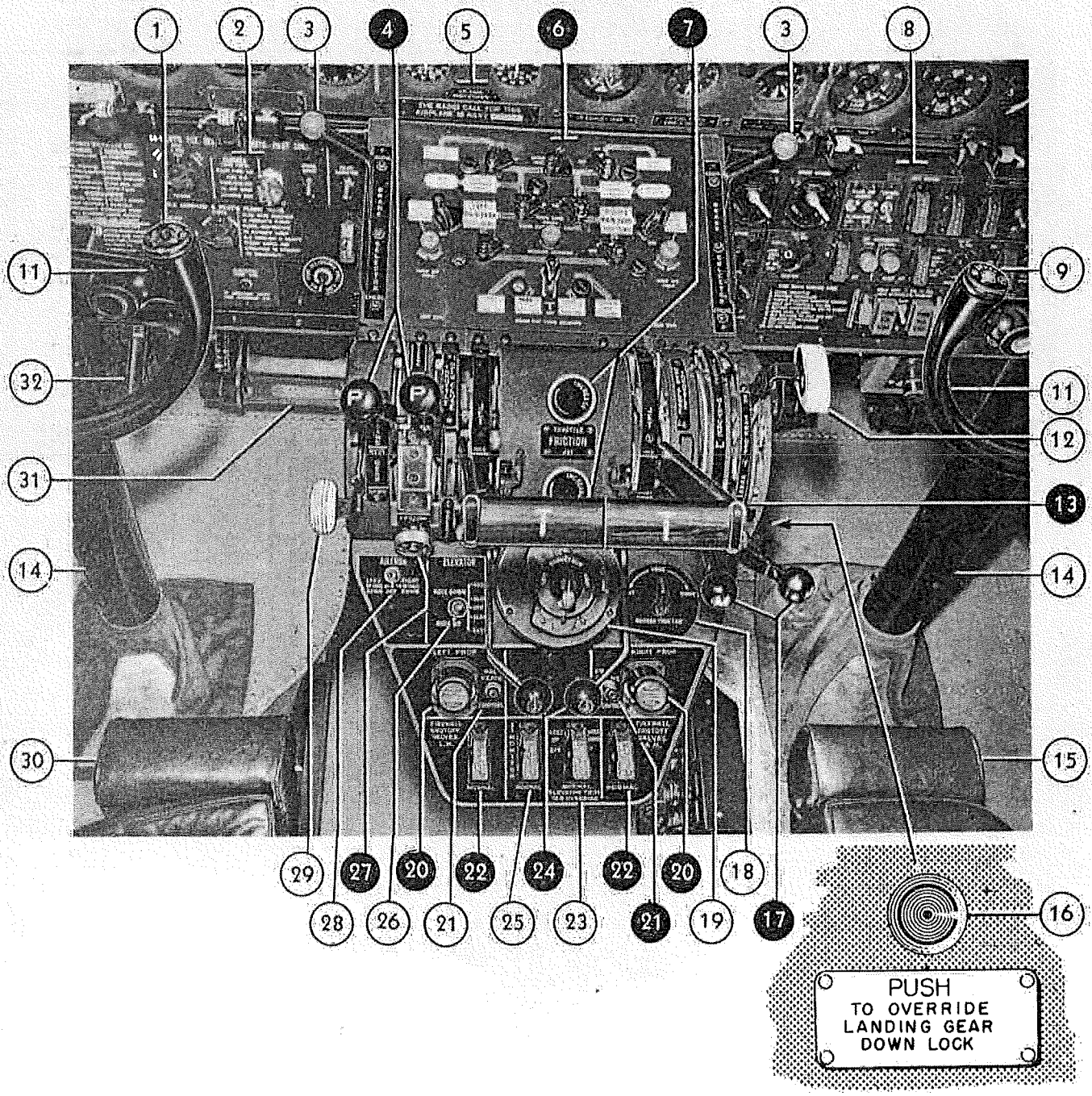
If an approach or landing is attempted with the turbo-jet engines operating and the jet door selector switch is in its "TAKE-OFF AND LAND" position, the turbo-jet engines will operate on the



1. Panel Light
2. Oxygen Flow Indicator
3. Right Side Instrument Panel Light Switch
4. Auxiliary Panel Light Switch
5. Cockpit Lights Switch
6. Utility Receptacle and Switch
7. Oxygen Mask Bag
8. Oxygen Regulator
9. Interphone Control Box
10. Hydraulic Pressure Gage
11. Windshield Defroster Control
12. Control Column

Figure 1-7. Right Side of Flight Deck





1. Microphone Switch
2. Pilot's Switch Panel (See Figure 1-4)
3. Brake Selector Lever
4. Propeller Control Lever
5. Pilot's and Co-pilot's Instrument Panel (See Figure 1-3)
6. Fuel Control Panel (See Figure 1-10)
7. Throttle Friction Adjustment Knobs
8. Co-pilot's Switch Panel (See Figure 1-5)
9. Bomb Release Switch
10. Deleted
11. Control Wheel
12. Flap Control Lever
13. Reciprocating Engine Throttle Control Lever
14. Control Column
15. Co-pilot's Seat
16. Landing Gear Down-Lock Override Button
17. Mixture Control Lever
18. Rudder Trim Tab Control Switch
19. Automatic Pilot Controller
20. Propeller Feathering Switch
21. Propeller Feathering Control Circuit Breaker
22. Firewall Shut-Off Valve Switch
23. Elevator Trim Tab Override Switch
24. Turbo-Jet Engine Throttle Control Lever
25. Monitor Switch
26. Elevator Tab Control Switch
27. Propeller Control Friction Adjustment Control Knob
28. Aileron Tab Control Switch
29. Landing Gear Control Lever
30. Pilot's Seat
31. Rudder Pedal
32. Parking Brake Handle

Figure 1-8. Pilot's Compartment-View Looking Forward

emergency fuel system as soon as the throttle is retarded below approximately 60 percent. In order to return to the normal fuel system after operating on the emergency system as referenced above, the throttle has to be advanced to a point above 85 to 90 percent rpm and then the selector switch moved from the "TAKE OFF AND LAND" position. The red indicator light will go out. The above condition can be eliminated if the switch is placed in any position except "TAKE OFF AND LAND" or "EMERGENCY TEST". In case of a main pump failure, emergency operation can be had by turning the guarded emergency fuel system switch to "EMERGENCY".

1-63. SELECTOR SWITCH "CLIMB" POSITION. The "CLIMB" position of the switch opens the door wide as in the case of the take off and land position. This position of the switch, however, does not allow an automatic switch over to the emergency fuel pump as in the case of the take-off and land position, and should not be used at low altitudes. This position should be used, after a safe altitude has been reached, for climbs, or when additional air is required for the turbo-jet intake.

1-64. SELECTOR SWITCH "CRUISE-WINDMILL" POSITION. When the switch is placed in the "CRUISE-WINDMILL" position, the door will close to the flight position. This position should be used after cruising altitude is reached and is the proper position for level flight cruising. No automatic switchover for the emergency fuel pump is provided with the switch in this position. This position of the switch should also be used for opening the jet air door on the ground. Moving the selector switch from "OFF-IDLE-START" to "CRUISE-WINDMILL" will allow the air door to be opened without moving the throttle from the "OFF" position. The system is arranged so that if the airplane is on the ground, with the landing gear down, the door will open wide, and while in flight with the landing retracted, the door will open to the flight position (half open). This position of the selector switch may therefore be used for opening the door on the ground without starting the turbo-jet, or for windmilling the turbine in flight.

1-65. SELECTOR SWITCH "EMERGENCY TEST" POSITION. The "EMERGENCY TEST" position is used for testing emergency fuel pump operation, and should only be used after a turbine speed of 90 percent has been reached. Switching to "EMERGENCY TEST" will open the jet air door wide and will allow the main fuel by-pass valve to open. As fuel pressure drops, the emergency pump by-pass valve will open and the emergency pump will supply fuel to the engine; proper operation of the emergency fuel pump will be indicated if the indicator light on the co-pilot's switch panel comes on. (See figure 1-5, reference 3). If the indicator light does not come on the system is not functioning properly.

CAUTION

The turbo-jets must not be started with the switch in "EMERGENCY TEST".

1-66. TURBO-JET ENGINE EMERGENCY FUEL SYSTEM SWITCH. Two switches and two indicator lights are provided on the co-pilot's switch panel. (See figure 1-5, reference 3 and reference 19) for switching to the jet engine emergency fuel pump in event of failure of the main fuel pump. The switches have two positions, "EMERGENCY" and normal, and are normally kept in the normal position. These switches are to be used when the jet fuel pressure drops to 60 to 70 psi, indicated on the turbo-jet fuel pressure indicator located on the co-pilot's instrument panel. (See figure 1-3, reference 24) If the fuel pressure drops to 60 to 70 psi, the switch should be moved to the "EMERGENCY" position. The engine will then run on the emergency fuel pump and the corresponding indicator light will come on indicating that the emergency fuel pump is operating.

1-67. FUEL SYSTEM. (See figure 1-9) The fuel used in this airplane must conform with specification MIL-F-5772 Grade 115/145 and is arranged in tanks as follows:

Tank	Usable Capacity (U.S. Gallons)	Total Usable Capacity (U.S. Gallons)
Main (2)	1000	2000
Auxiliary (2)	400	800
Bomb Bay (4)	350	1400
Total		4200

1-68. Fuel is supplied to the reciprocating engines and turbo-jet engines from two 1000 gallon self sealing main wing tanks, each containing two interconnected cells, which are located in the center wing section on either side of the airplane center line. Normally, the engines on the right side of the airplane are supplied fuel from the right hand tank, while those on the left are supplied from the left hand main tank. The fuel system does not provide for cross feed from one miin tank to the other, but it is possible to cross fuel from one main tank to the engines on the other side of the airplane. The system is arranged so that it is possible to feed all four engines, or any combination of the four, from either main tank should it be necessary.

1-69. Two 400 gallon self sealing auxiliary wing tanks, one located in each outer wing outboard of the wheel well, are connected to the main tanks. Each auxiliary tank automatically replenishes the main tank on its side of the airplane when the auxiliary tank transfer pump switch is "ON". Refer to paragraph 1-72. It is not possible to transfer fuel from an auxiliary tank to the main tank on the opposite side of the airplane. The transfer of fuel from auxiliary tank to main tank is automatic and is controlled by the fuel quantity transmitters in the main tanks. As the fuel level in the main tank drops to 700 gallons, the transfer pump in the auxiliary tank automatically starts and fuel is drawn from the auxiliary tank until the quantity in the main tank builds up to 900 gallons when the transfer pumps shut off automatically. Under normal cruising conditions, on reciprocating engines only, the transfer pump should run for 7 or 8 minutes befor it shuts off. This process is repeated automatically until the auxiliary tank is empty. A push to test warning light is provided on the pilot's fuel control panel for each auxiliary tank. (See figure 1-10, reference 5) The light is controlled by a pressure switch and comes on as soon as the tank is empty or the pump fails to pressurize the outlet line. The lights cannot be tested for bulb integrity unless the transfer pumps are running.

CAUTION

As soon as the warning light indicates that a tank is empty or that fuel is not being delivered the corresponding transfer pump must be turned off to prevent damage to the pump.

1-70. In addition to the main and auxiliary tanks, it is possible to increase the fuel load by carrying four, droppable, self sealing tanks in the bomb bay - each tank, as it is selected, automatically supplies fuel to the main wing tanks in the same manner as the auxiliary wing tanks. Fuel may be pumped from the selected bomb bay tank to either main tank individually or to both simultaneously. A push to test indicator light is provided on the pilot's fuel control panel which comes on when the selected tank has been emptied or when fuel is not being supplied to the main tank. The light cannot be tested for bulb integrity unless a transfer pump is running. Selection of another fuel tank turns off the light and stops the pump in the empty tank.

CAUTION

As soon as the warning light indicates that the tank has been emptied, another tank should be selected immediately to prevent damage to the pump in the empty tank.

1-71. FUEL QUANTITY INDICATORS. Fuel quantity indicators are provided on the

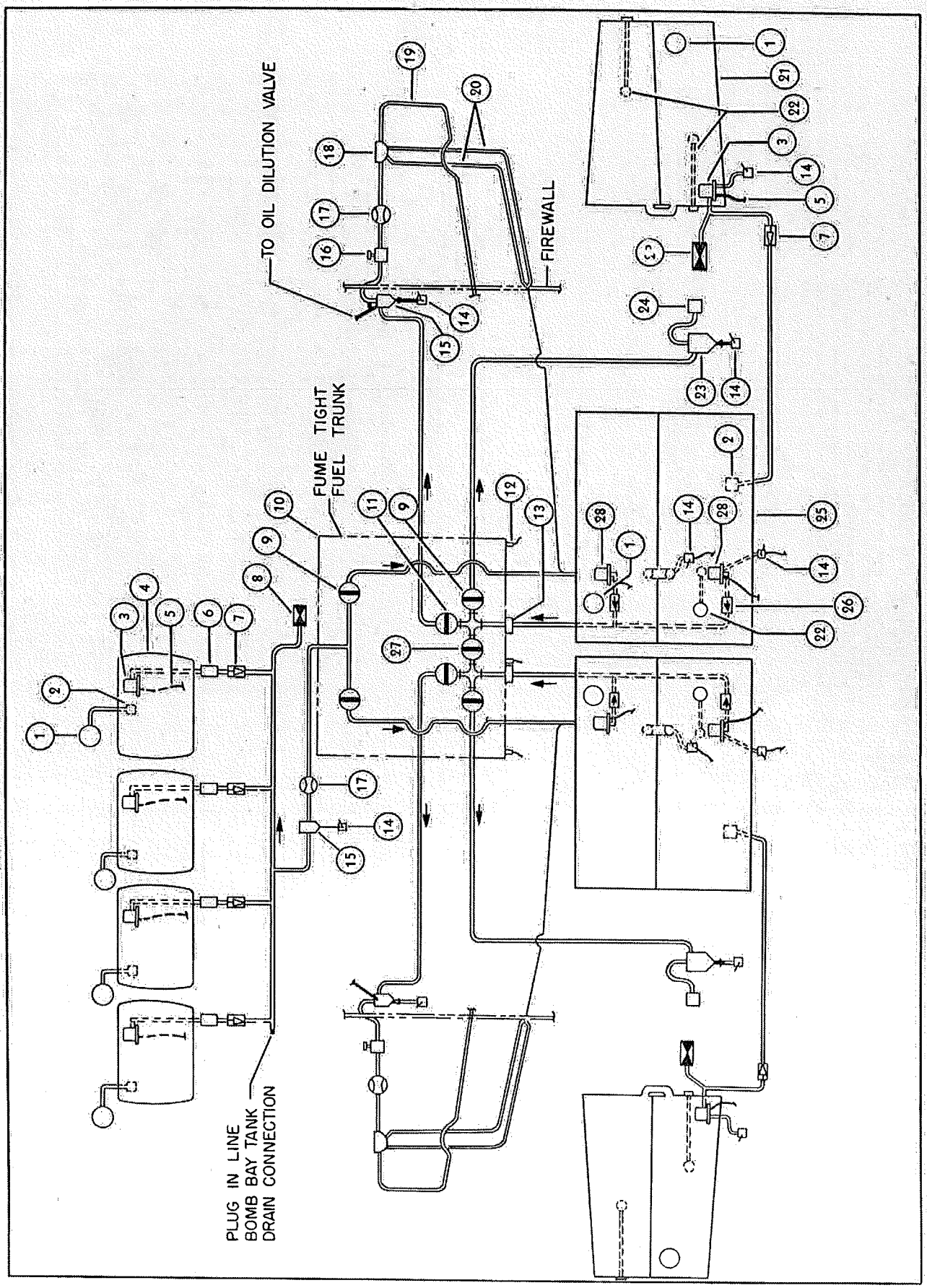


Figure 1-9. Fuel System Diagram

Key to Figure 1-9

1. Filler Cap
2. Constant Level Float
3. Transfer Pump
4. Self Sealing Auxiliary Droppable Bomb Bay Tank (350 gal.)
5. Pump Seal Drain
6. Breakable Union
7. Spring Loaded Check Valve
8. Pressure Warning Unit
9. Valve
10. Vent
11. Valve
12. Drain
13. Manual Gate Valve
14. Drain Valve
15. Strainer
16. Engine Driven Pump
17. Flowmeter
18. Engine Carburetor
19. Fuel Pressure Line
20. Vapor Return Line
21. Self Sealing Auxiliary Wing Tank (400 gal.)
22. Fuel Quantity Transmitter
23. Filler
24. Turbo-Jet Engine Inlet
25. Self Sealing Main Wing Tank (1000 gal.)
26. Springless Check Valve
27. Valve
28. Booster Pump
29. Pressure Warning Unit

co-pilot's instrument panel for the main tanks and auxiliary wing tanks only. (See figure 1-3, references 21 and 22) A counter above the navigator's table indicates the amount of fuel that has been transfered from the bomb bay tanks to the main tanks. (See figure 4-2, reference 12A)

NOTE

The bomb bay to main tank transfer counter must be manually reset to zero before each flight.

1-72. FUEL SYSTEM CONTROLS. A fuel panel which contains all controls necessary for normal operation of the fuel system, is located on the pilot's pedestal. (See figure 1-10) The panel is internally lighted so that a visual indication of fuel flow, appearing on the panel as unbroken red lines, is obtained. The segments of the switch knobs are colored to indicate in which position the switches must be placed to obtain a continuous line. If the switch knobs are positioned so that a continuous red line is indicated between fuel supply and engines, the fuel system should contact fuel as indicated by the panel. Turning a switch knob to a position which disrupts the continuity of the red line indicates that fuel flow will be stopped at the particular valve or pump controlled by the switch.

1-73. The fuel control panel contains ten switches which control the fuel system electrically operated valves and pumps, and three tank empty warning lights as follows:

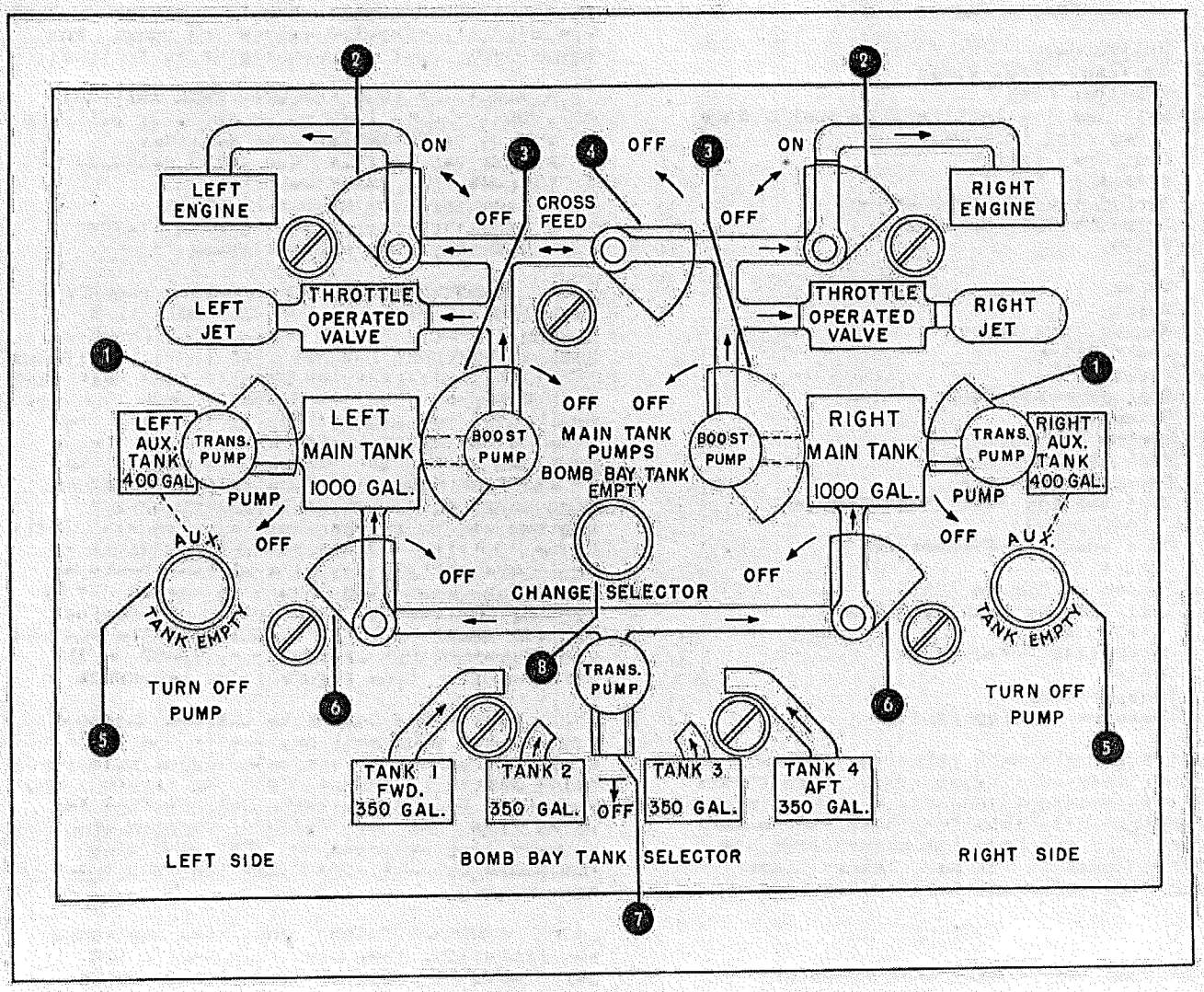
2 Auxiliary tank transfer pump switches
2 Main engine fuel valve selector switches
2 Main tank booster pump switches
2 Bomb bay to main tank valve switches
1 Cross feed valve switch
1 Bomb bay tank selector switch
2 Auxiliary tank empty warning lights
1 Bomb bay tank empty warning light

1-74. BOOSTER PUMPS. One booster pump is installed in each cell of each main tank, making a total of four pumps. The booster pump arrangement insures that in all attitudes of flight, at least one pump in each main tank is submerged. The two pumps in each tank are manifolded and supply fuel to the main fuel line in conjunction with each other. Each pump has sufficient capacity to supply fuel to all four engines. Booster pumps must be used under all conditions when turbo-jet engines are being operated, and for all conditions of flight on reciprocating engines except level flight cruising without heaters operating, when they should be turned off by turning the booster pump switch on the fuel control panel to "OFF" to maintain the desired fuel pressure and prevent enrichment of the carburetors. (See figure 1-10, reference 3)

1-75. The pumps cannot be started unless the booster pump switches are in the "ON" position and either the main engine selector valve switch is turned "ON" (See figure 1-10, reference 2), or the turbo-jet throttle is moved from "OFF" to "CRANK" Turning the booster pump switches to "OFF" will stop the pumps but will not close the fuel system valves.

1-76. BOMB BAY TANKS. When bomb bay tanks are installed, they are connected to the main tanks through two electrically operated valves - one for each main tank - located in the fuel trunk. These valves are controlled by the bomb bay to main tank fuel valve switches located on the pilot's fuel control panel. (See figure 1-10, reference 6)

1-77. A transfer pump is installed in each bomb bay tank. In order for the transfer pump to operate and pump fuel into the main tanks, the bomb bay to main tank valve switches must be "ON", the particular bomb bay tank pump must be selected. (See figure 1-10, reference 7), and the fuel level in either one or both main tanks must be below 700 gallons. When the fuel level in one main tank builds up to 900 gallons, the bomb bay to main tank fuel valve for that particular tank will automatically close stopping fuel flow to that tank; fuel will continue to flow into the other main tank until the fuel quantity builds up to 900 gallons when the valve for that tank will automatically close and the transfer pump will stop. The cycle



1. Auxiliary Tank Transfer Pump Switch
2. Main Engine Fuel Valve Selector Switch
3. Main Tank Booster Pump Switch
4. Cross-Feed Valve Switch
5. Auxiliary Tank Empty Warning Light
6. Bomb Bay to Main Tank Valve Switch
7. Bomb Bay Tank Selector Switch
8. Bomb Bay Tank Empty Warning Light

Figure 1-10. Fuel Control Panel

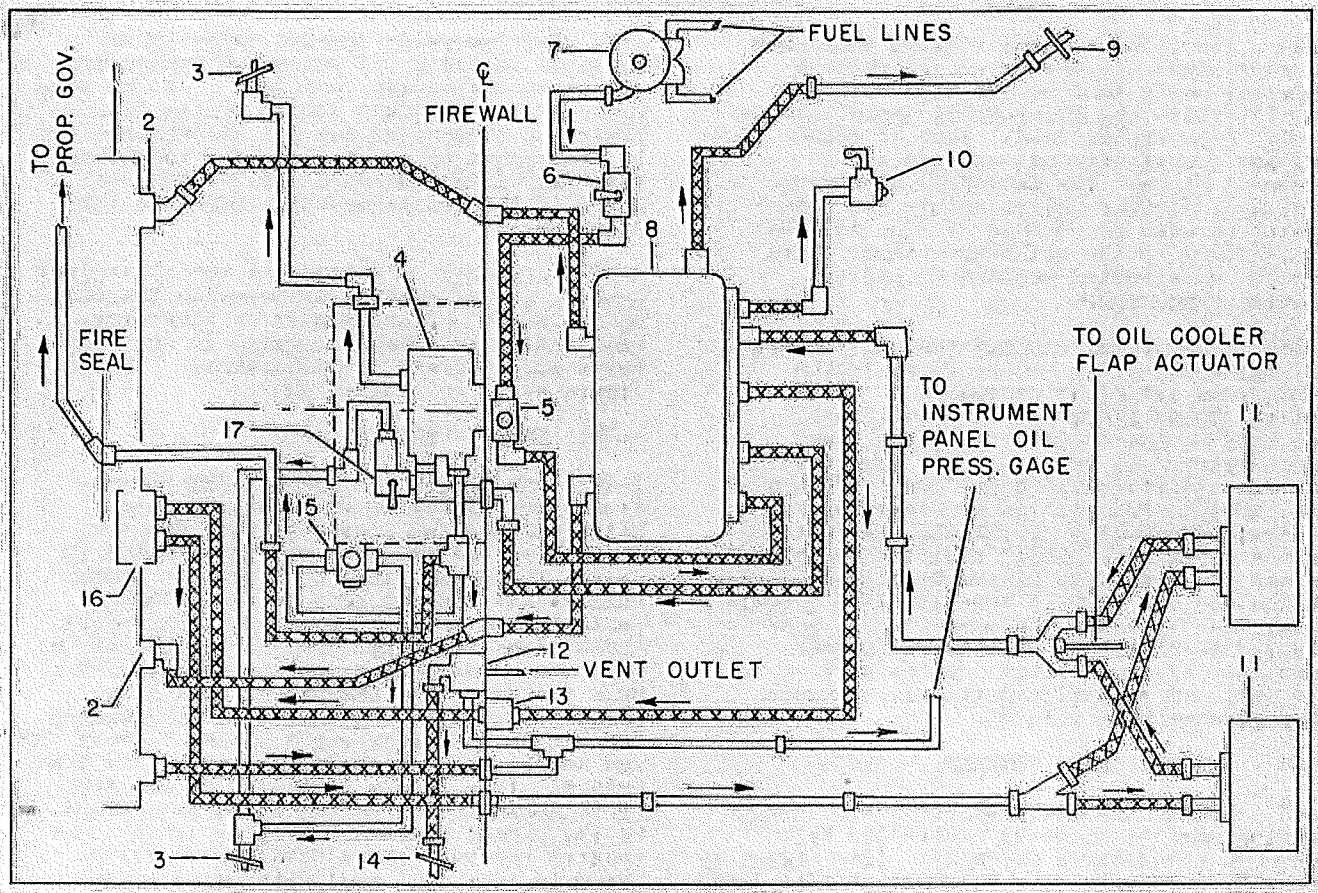
will be repeated automatically until the selected bomb bay tank is emptied and the warning light (See figure 1-10, reference 8) comes on.

CAUTION

The warning light is controlled by a pressure switch and indicates either that the tank is empty or that the transfer pump is not operating. As soon as the light comes on, another tank should be selected immediately to prevent damage to the transfer pump, if the tank is empty.

1-78. The bomb bay tanks may be jettisoned during flight by pressing the bomb salvo switch located on the bulkhead aft of the pilot's seat. (See figure 3-4, reference 7). Use of the bomb salvo switch will open the bomb bay doors and jettison all tanks. Individual tanks may be dropped by using the normal bomb release system.

1-79. CROSS FEED. The fuel system is arranged so that fuel may be fed to all engines or any combination of engines from either main tank. It is not possible to transfer fuel from one main tank to the other. Feeding from one main tank to engines on both sides of the airplane is accomplished by turning the cross feed valve switch "ON". (See figure 1-10, reference 4) When using cross feed, the booster pump switch (See figure 1-10, reference 3), auxiliary tank transfer pump switch (See figure 1-10, reference 1), and the bomb bay to main tank fuel valve switch (See figure 1-10, reference 6) for the main tank that is not to be used should be turned "OFF". This will allow fuel to be pumped from the selected main tank to any combination of



1. Reciprocating Engine
2. Vent Connection
3. Propeller Pump Drain
4. Propeller Feathering Pump
5. Oil Dilution Solenoid Valve
6. Shut-Off Valve
7. Fuel Strainer
8. Oil Tank
9. Scupper Drain
10. Drain Valve
11. Oil Cooler
12. Shut-Off Valve Pressure Switch
13. Oil and Hydraulic Fluid Shut-Off Valve
14. Pressure Switch Drain
15. Propeller Feathering Valve Drain
16. Engine Oil Pump
17. Shut-Off Valve

Figure 1-11. Reciprocating Engine Oil System Diagram

reciprocating or turbo-jet engines depending on the settings of the main engine fuel selector valve switches and turbo-jet throttles.

1-80. MANUAL CONTROL OF FUEL SYSTEM

1-80A. In event of failure of the automatic electrically operated system the fuel system may be controlled manually from the manual fuel panel located at the fuel trunk on the center wing front spar in the countermeasure operator's compartment. (See figure 3-3) The valves may be operated manually by pushing the handles in to disengage the motors, and turning the valve handles clockwise to close, and counterclockwise to open valves. Two override switches are provided on the panel which may be used to override the automatic operation of the auxiliary tank and bomb bay tank transfer pumps. Turning the switches "ON" starts the transfer pumps and fuel is pumped into the main tanks

CAUTION

When using the override switches for manual transfer, care should be taken to not over fill the main tanks.

1-180B. A manual fuel shut-off valve is installed in each of the main fuel supply lines. (See figure 1-9, reference 13) These valves are installed on the bottom of the fuel trunk. The applicable valve may be closed to prevent the line between the trunk and the unused tank from being pressurized during cross feed operation.

1-81. OIL SYSTEM CONTROLS

1-82. Each turbo-jet engine is equipped with a self contained oil system of 12 quarts capacity. This system must be serviced with oil, Specification No. MIL-O-6081, Grade 1010. No controls are provided in this system as its operation is entirely automatic.

1-83. The reciprocating engines each have an individual oil system of 105 gallons capacity which must be serviced with oil Specification No. MIL-O-6082, Grade 1100 or 1120. (See figure 1-11) Each of these systems contain two oil coolers and a sequence valve. The sequence valve automatically directs oil to either the main cavity or warm up chamber of the oil tank as dictated by the oil temperature. This process accelerates warming of oil to running temperature.

1-84. Flow of air through the oil coolers is regulated by oil cooler flaps in the lower wing skin just outboard of the nacelle. These flaps are controlled by switches on the co-pilot's switch panel. (See figure 1-5, reference 8) Each switch has four positions; "OFF", "OPEN", "CLOSE" and "AUTO". The oil cooler flaps may be controlled manually by placing the switch in the "OPEN" or "CLOSE" position as desired, or may be controlled automatically by placing the switch in "AUTO". When in "AUTO", position, the flaps are thermostatically controlled so that they will be fully open when the oil temperature reaches 82°C (180°F), and closed when the oil temperature reaches 67°C (153°F).

1-85. LANDING GEAR CONTROLS.

1-86. NORMAL LANDING GEAR CONTROLS. The landing gear is normally controlled by a lever on the pilot's pedestal. (See figure 1-8, reference 29) Movement of this lever to either the "UP" or "DOWN" position actuates the solenoid controlled valve which causes the nose and main alighting gears and the tail bumper to be hydraulically unlocked, moved to the selected position and relocked. A solenoid lock in the pilot's pedestal prevents the lever from being moved out of the "DOWN" position when the weight of the airplane is resting on the main alighting gears. This lock may be disengaged, in an emergency, by pushing in the red button on the right side of the pedestal. (See figure 1-8, reference 16) During the retraction cycle the main alighting gear brakes are automatically applied to reduce wear of the brush seals in the wheel wells. The landing gear lever should be returned to the "NEUT" position after the retraction cycle is completed in order to prevent loss of hydraulic fluid in case of damage to the hydraulic retraction lines. An indicator on the pilot's instrument panel indicates the position of the alighting gears. (See figure 1-3, reference 17) A warning light located to the right of this indicator is lighted at any time the alighting gears are not up and locked or down and locked. (See figure 1-3, reference 18)

1-87. EMERGENCY LANDING GEAR CONTROLS. The emergency landing gear handle, located on the bulkhead behind the pilot, serves to extend the alighting gears in event of failure of the hydraulic system. (See figure 3-4, reference 6) Pulling the handle unlocks the main gears permitting them to fall into the down position, and causes the nose gear emergency control valve to be actuated allowing the emergency hydraulic system to extend the nose gear. If the main gears do not indicate locked in the down position, compressed air may be released into the system by pulling the tee handle on the "MAIN GEAR EMERGENCY AIR BOTTLE" located in the countermeasure operation compartment.

1-88. In event of failure of the electrical system, it is possible to override the normal solenoid operated valve by operating the landing gear valve located in the countermeasure operator's compartment. (See figure 4-23, reference 43)

1-89. BRAKE CONTROLS.

1-90. The brakes are operated by conventional toe plates on the rudder pedals. Either of the two brake selector handles located on the pedestal may be actuated to select the brake lines to be used. These handles are usually kept in the "NORMAL" position and while in that position, allow conventional braking from the toe plates on the rudder pedals through the normal lines. When moved to the "EMERGENCY" position, brakes are applied by use of the toe plates through an emergency set of lines between the emergency brake selector valves and the brakes. (See figure 1-12) An accumulator is included in the system which is charged by the normal hydraulic system. This accumulator has sufficient capacity to allow three to four full applications of brakes. In event of failure of the normal brake hydraulic system, this accumulator may be recharged by the emergency hydraulic system by pulling the landing gear emergency release handle, located on the bulkhead behind the pilot. (See figure 3-4, reference 6)

NOTE

Pulling the landing gear emergency release handle locks the emergency nose gear selector valve in the "OPEN" position. The valve must be unlocked manually to close the emergency system before the landing gear can be retracted normally.

1-91. The parking brakes are controlled by a tee handle located just below the pilot's switch panel. The brakes are applied by first depressing the toe plates on the rudder pedals and then pulling out the tee handle. The brakes are released by depressing the toe plates on the rudder pedals.

1-92. HYDRAULIC SYSTEM.

1-93. A closed center, 3000 psi, hydraulic system is used to actuate the landing gear, brakes, turbo-jet engine air doors, bomb bay doors, wing flaps, and spoiler ailerons. The system has a capacity of 21.94 gallons and must be serviced with oil Specification No. MIL-O-5606. (See figure 1-12)

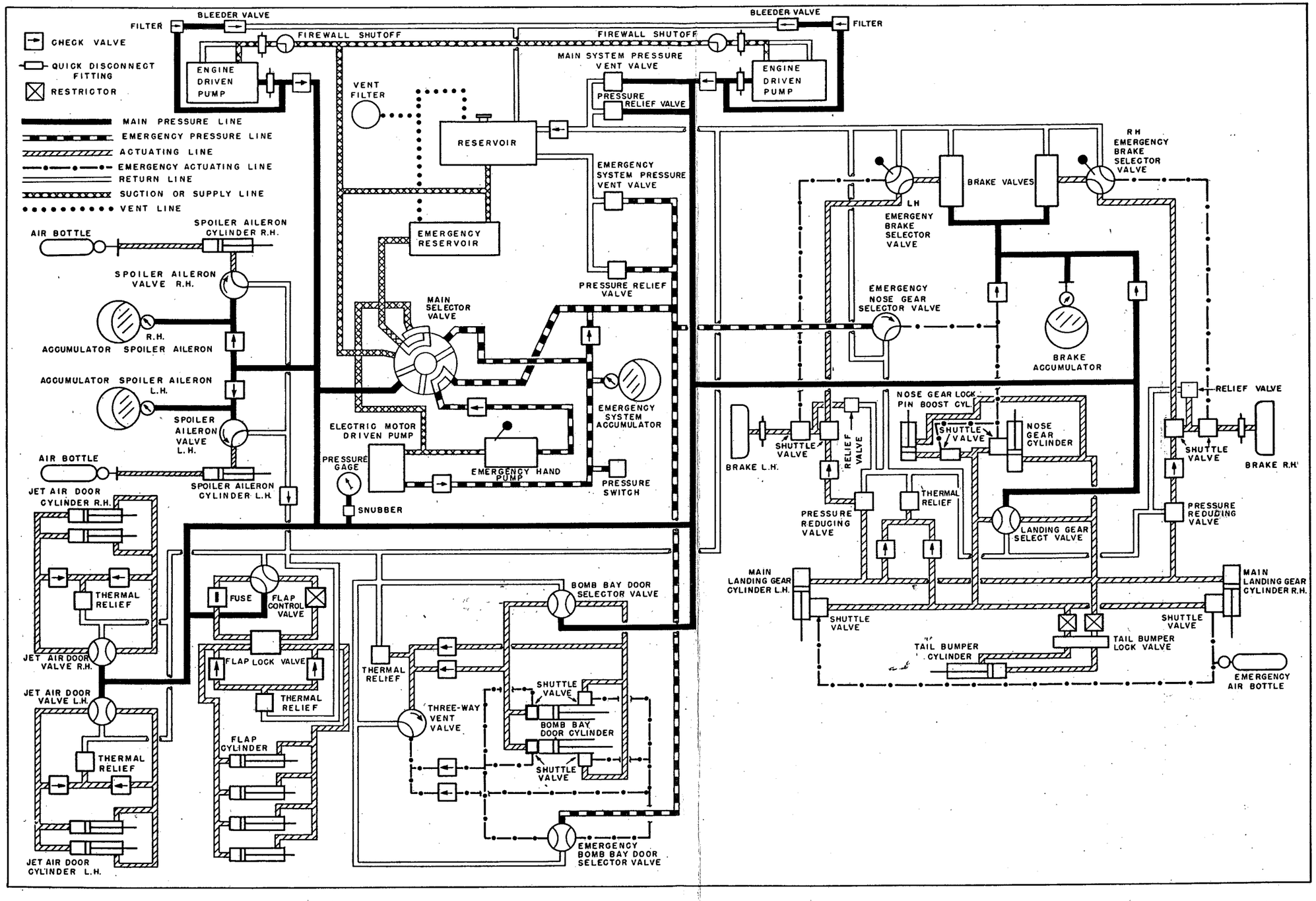


Figure 1-12. Hydraulic System Diagram

1-94. Main system pressure is supplied by two engine-driven hydraulic pumps - one pump mounted on each reciprocating engine. Check valves are provided in the outlet lines from the pumps so that in event of engine failure, the remaining pump will supply pressure to the system.

1-95. There is no main hydraulic accumulator provided for the main hydraulic system. Individual accumulators, each fitted with a pressure gage, are provided for the brake system, and one accumulator for each spoiler aileron. All other systems are actuated directly by pump pressure.

1-96. An emergency hydraulic system is provided for emergency release of the nose gear (the main gears fall into place automatically when released), emergency operation of the bomb bay doors, and for charging the brake accumulator in event of failure of the main hydraulic system. The emergency system is pressurized by an electric motor driven hydraulic pump controlled by a pressure switch. Pressure is maintained in the system by means of an accumulator, with pressure gage attached, charged by the electric motor driven pump. The system is arranged so that the motor driven pump will automatically start when the emergency system pressure drops to 2600 psi, and will automatically stop when the pressure reaches 3000 psi.

1-97. An emergency stand-by hand pump is provided in the emergency system for use in event of failure of the electric motor driven pump. This hand pump is installed on the floor of the countermeasure operator's compartment. (See figure 4-23, reference 34)

1-98. A selector valve is provided for the hydraulic system. This valve is located in the countermeasure compartment. (See figure 4-23, reference 30), and is used to select the source of supply for the hydraulic system. This valve has two positions, "POSITION FOR FLIGHT" and "GROUND OPERATION", and it should be safetied in the "POSITION FOR FLIGHT" for all hydraulic operations in flight. When in this position, the valve allows the emergency hydraulic system to be charged automatically by the electric motor-driven pump or, in case of failure of the motor driven pump, by the hand pump. The "GROUND OPERATION" position is used only for maintenance operations on the ground. When in this position, the electric motor-driven pump, or the hand pump, may be used to supply pressure to the main hydraulic system for checking hydraulic circuits on the ground without the necessity of using engine driven pumps or external hydraulic pumps.

1-99. Two pressure venting valves are provided in the hydraulic system. They are used to kill hydraulic pressure in the systems for which they are provided. These valves are normally used for reducing pressure in the hydraulic systems for maintenance operations or, in an emergency, to prevent the excessive loss of hydraulic fluid in event of a pressure line failure while in flight. Venting valves are provided for the main pressure system, and the emergency pressure system. The main pressure system venting valve is located on the left side of the countermeasure operator's compartment. Opening this valve will kill supply pressure to all normal hydraulic circuits but will not drain the spoiler aileron and brake system accumulators or the flap, turbo-jet air door or normal bomb bay door lines. These may only be drained by actuating the respective circuits. This valve is normally safetied in the closed position. The emergency system vent valve is located on the right forward side of the countermeasure operator's compartment. This valve vents the emergency hydraulic pressure and may be used to check operation of the emergency system motor driven pump. When the valve is opened, the pressure in the emergency system (indicated by the pressure gage on the emergency system accumulator) will drop and, if the system is operating properly, the pump will start when the pressure drops off to 2600 psi. Closing the valve when the system pressure drops below 2600 psi will allow pressure to build up to 3000 psi if the pump is operating properly.

1-100. Hydraulic pressure is indicated on the gage below and forward of the co-pilot's instrument panel and at each accumulator in the system. (See figure 1-7, reference 10) Accumulators are located as follows:

a. Brake system accumulator - located on the right side of the nose wheel well. Gage is not visible during flight.

b. Spoiler aileron accumulators - located in the main gear wheel wells. Gages are not visible during flight.

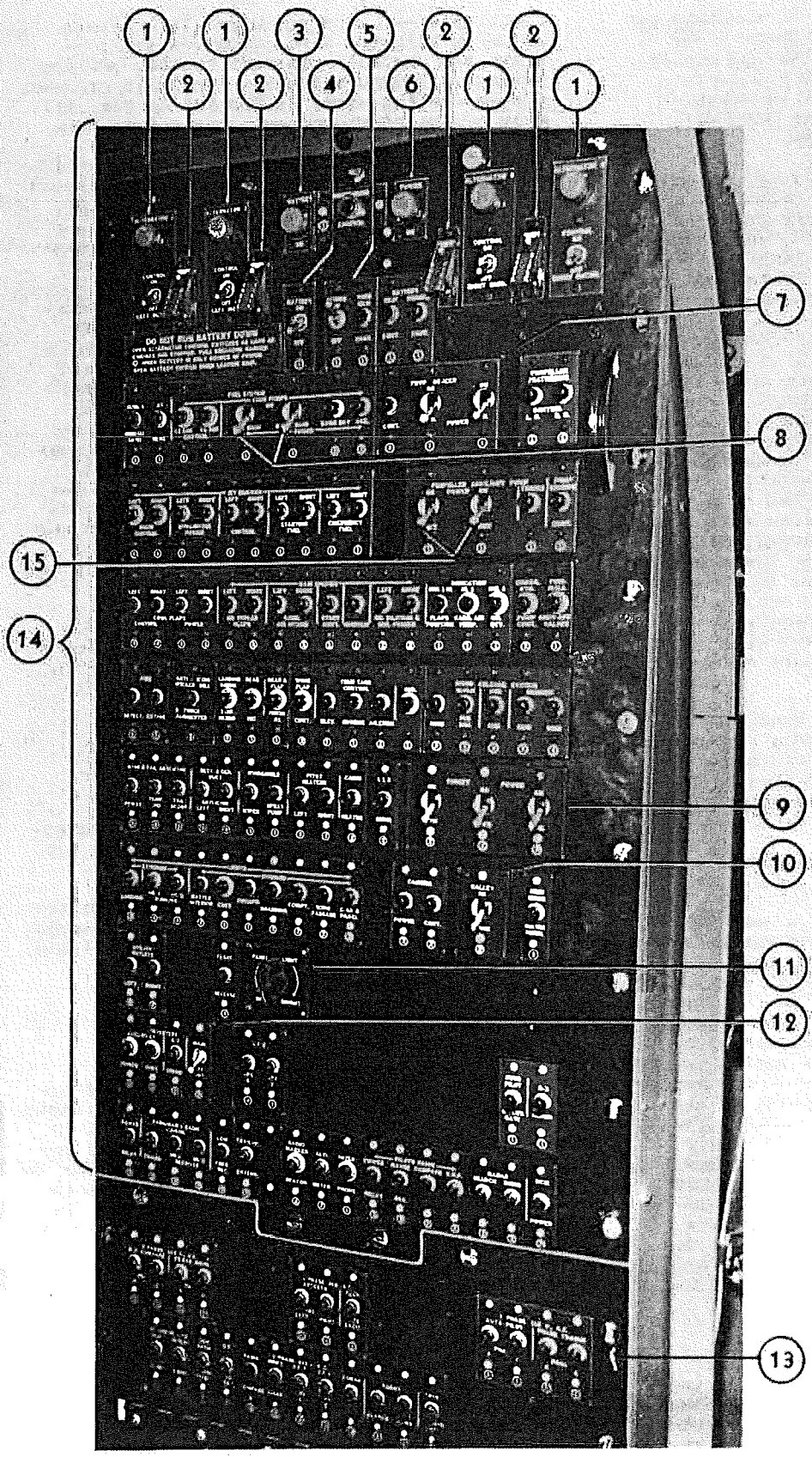
c. Emergency system accumulator - located in the countermeasure operator's compartment. Gage is visible in flight. (See figure 4-23, reference 33).

1-101. ELECTRICAL SYSTEM.

1-102. D-C ELECTRIC SYSTEM.

1-103. Electrical power is supplied by four A. C. generators, delivering 400 amperes each, and two 34 ampere hour batteries. Two A. C. generators are mounted on each reciprocating engine. The output of each A. C. generator is rectified into 28 volt d-c current by a separate rectifier for each A. C. generator. Each rectifier is protected by a 300 ampere reverse current circuit breaker, which is set to open automatically and de-energize the A. C. generator circuit when a reverse current of 300 amperes is applied.

1-104. An indicator light for each A. C. generator circuit and for the main bus is provided on the circuit breaker panel, which comes on when each A. C. generator is energized. The four A. C. generator lights indicate that each A. C. generator is functioning and the main bus light indicates that the main bus is energized. (See figure 1-13, references 1 and 6).



1. A. C. generator Control Switch and Indicator Light
2. Emergency A. C. generator Field Switch
3. Battery Indicator Light
4. Battery Switch
5. External Power Switch
6. Power Indicator Light
7. Propeller De-icer Controls
8. Fuel Pump Switches
9. Turret Power Switches
10. Galley Range Switch
11. Panel Light Rheostat
12. Inverter Control Switches
13. AC Circuit Breaker Panel
14. DC Circuit Breakers
15. Propeller Feathering Pump Power Circuit Breaker

Figure 1-13. Circuit Breaker Panel

1-105. The A. C. generator to main bus circuits are each controlled by an A. C. generator control switch - one switch for each A. C. generator circuit - located on the circuit breaker panel, which operates in conjunction with switches actuated by the mixture control levers. (See figure 1-13, reference 1) To get power to the main bus, it is necessary to turn the A. C. generator control switches "ON" and move the mixture control out of the "IDLE-CUT OFF" position. If the circuits are completed, the main bus indicator light will come on.

CAUTION

The A. C. generator control switches should be closed as soon as engine speed reaches 1000 rpm and should remain closed at all times except for short periods during A. C. generator voltage checks and during paralleling adjustment. Refer to paragraph 2-26.

1-106. An emergency field switch is provided on the circuit breaker panel for each A. C. generator. (See figure 1-13, reference 2) Placing the switch in the "OFF" position de-energizes the A. C. generator and the indicator light for the A. C. generator circuit will go out. These switches are normally closed and should only be turned "OFF" in event of failure of the A. C. generator circuit.

CAUTION

The emergency field switch must not be closed with the A. C. generator running. It must be closed before engines are started and must not be re-closed if it has been switched to "OFF" with the A. C. generator running. Otherwise, a flash across the rectifier will result which will burn out the rectifier.

1-107. A voltmeter is provided for each A. C. generator circuit which indicates the voltage output of the rectifier. These four voltmeters are located on the meter panel immediately forward of the circuit breaker panel. (See figure 4-22, reference 31) In addition to the four individual voltmeters, a master voltmeter is provided on the same panel, which may be used to check the voltage output of each rectifier, the batteries or bus. Selection of which rectifier voltage is to be checked is controlled through a master voltmeter selector switch. Turning this switch from "OFF" to any individual rectifier, battery or bus will allow the voltmeter to indicate the voltage in the selected circuit. (See figure 4-22, reference 28).

NOTE

The A. C. generator cannot be paralleled in flight, but they can be switched "ON" and "OFF" in flight. Paralleling requires the use of a sensitive voltmeter which is not part of the airplane equipment.

1-108. Five ammeters are provided on the meter panel. (See figure 4-22, references 25 and 30) One ammeter is provided for each A. C. generator to main bus circuit and indicates the current in each circuit. The fifth ammeter is in the battery to main bus circuit and indicates whether the battery is being charged or discharged.

1-109. The batteries are connected to the main bus through a battery relay controlled by the battery switch. The battery switch is located on the circuit breaker panel and must be "ON" to connect the batteries to the main bus.

1-110. A battery discharge warning light is located above the pilot's instrument panel. (See figure 1-3, reference 8) which comes on when more than approximately 100 amperes are being drawn from the battery circuit while the airplane is on the ground. When this warning light is on, the current indicated by the battery circuit ammeter is not indicative of the complete load being drawn from the batteries. The ammeter will only indicate a portion of the total load.

1-111. A battery relay open indicator light is provided on the radio rack. (See figure 4-20, reference 4) This light comes on when current in excess of 100 amperes is being drawn from the batteries or if battery switch is not closed, or if the battery circuit breaker trips. If current in excess of 100 amperes is drawn from the battery circuit, the battery relay will open disconnecting the batteries from the main bus, and the light will come on.

1-112. A push-to-test battery circuit indicator light is provided on the circuit breaker panel. (See figure 1-13, reference 3) This light is used to check battery circuit connection to the main bus and can only be turned on if the battery switch is "ON" and either main engine ignition switch is turned "ON". This push-to-test light provides also a means of checking whether the batteries are connected to the main engine ignition system.

CAUTION

Do not use batteries alone for starting engines except in an emergency when no external power is available.

1-113. Two external power receptacles are provided. External power is connected to the main bus through a relay controlled by the external power switch. (See figure 1-13, reference 5) The external power switch must be "ON" to connect the external power source to the main bus. While the external power source is connected to the main bus, it is possible to charge the airplane batteries by turning the battery switch to "ON". If the batteries are being charged, the battery circuit ammeter will so indicate.

1-114. A-C ELECTRICAL SYSTEM.

1-115. Five inverters, operating from the main d-c bus, with one exception, supply a-c power for operation of electronic equipment, automatic pilot, flight instruments, autosyn

engine instruments, and instrument lighting as follows:

NOTE

When the G-2 compass and pilot's instrument switch is in "EMERG", the standby inverter is operating from the battery rather than from the main d-c bus. This power source is available even though the batteries have been disconnected from the main bus. Refer to paragraph 1-111. The batteries have a duration of five hours under normal emergency conditions. Normal emergency conditions are defined as a 70 percent charged battery operating in a temperature range of 0 to 40°F.

Main Inverter - Supplies current for the radio compass, loran, IFF, instrument lights standby, and driftsight light and engine ignition analyzer.

G-2 Compass Inverter - Supplies current for the G-2 compass and pilot's flight instruments.

Automatic Pilot Inverter - Supplies current for the automatic pilot, co-pilot's flight instruments, flux gate compass, and autosyn engine instruments.

Standby Inverter - Supplies current to operate either the engine instruments, pilot's flight instruments and G-2 compass or engine instruments, co-pilot's flight instruments and flux gate compass. If the G-2 compass and pilot's instrument switch is in either "STANDBY" or "EMERG", power is supplied to the engine instruments, pilot's flight instruments and G-2 compass and not to the co-pilot's flight instruments and flux gate compass regardless of the position of the autopilot and co-pilot's instrument switch.

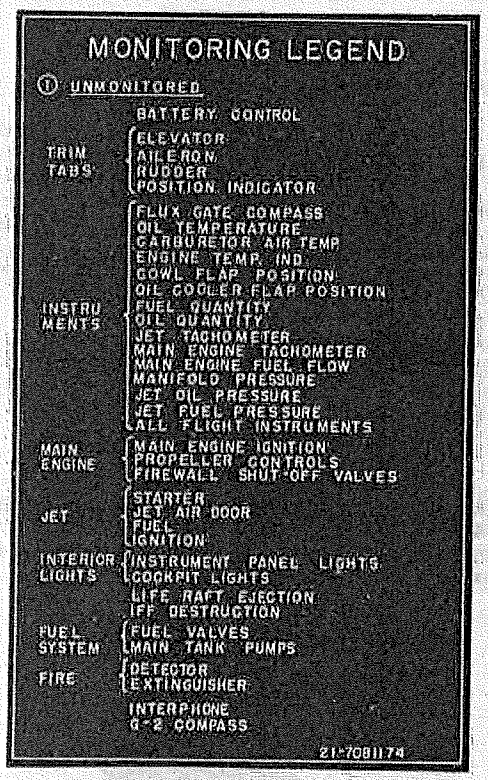
RCM Inverter - Refer to paragraph 4-133B.

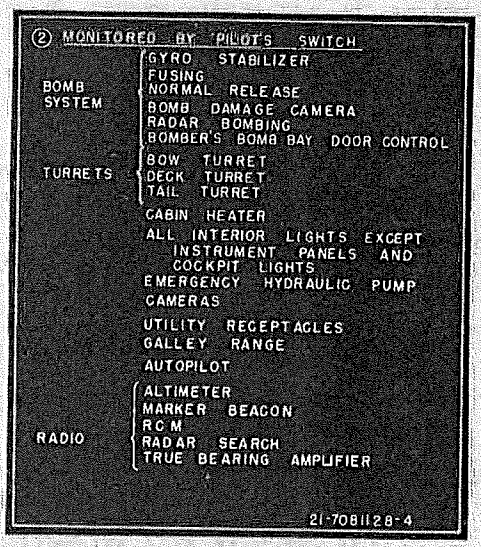
1-116. A circuit breaker switch is provided on the main circuit breaker panel for the main inverter and one on the RCM panel for the RCM inverter. (See figure 1-13, reference 12 and figure 4-23, reference 22) Turning "ON" the main inverter circuit breaker switch turns on the main inverter. The push-pull circuit breakers for the remaining three inverters located just forward of the main inverter switch, must be pushed in, but, the inverters will not come on until they are respectively selected by the co-pilot's instrument and auto pilot switch and/or the G-2 compass and pilots instrument switch, that are located on the pilot's switch panel. (See figure 1-4, reference 3 and 10). Refer to paragraph 4-48. For RCM power inverter refer to paragraph 4-133B.

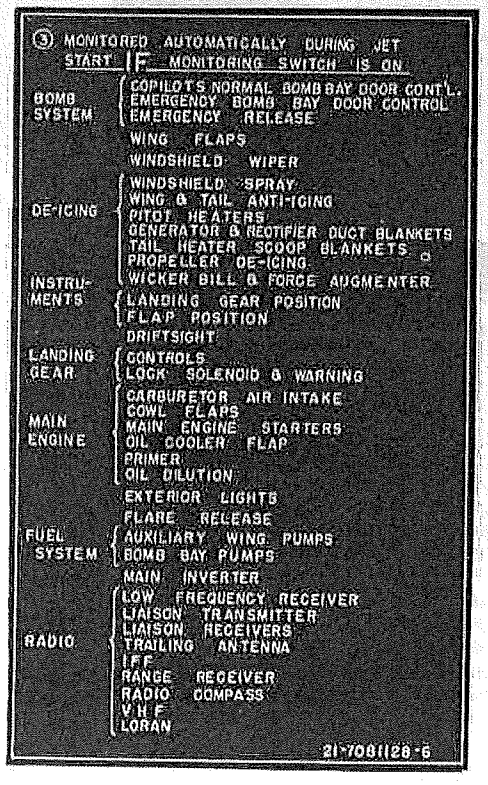
1-117. ELECTRICAL SYSTEM MONITORING.

1-118. A monitoring procedure for controlling the electrical system is provided for use in event of failure of two or more of the four A. C. generators. The electrical system is arranged so that the entire system will function on three A. C. generators. If two A. C. generators are disabled or cannot be used (for instance when one main engine is shut down), the electrical load on the remaining A. C. generators must be reduced, otherwise an overload on the operating A. C. generators will cause them to drop to zero voltage output. The battery circuit breaker will open and the airplane will be without electrical power.

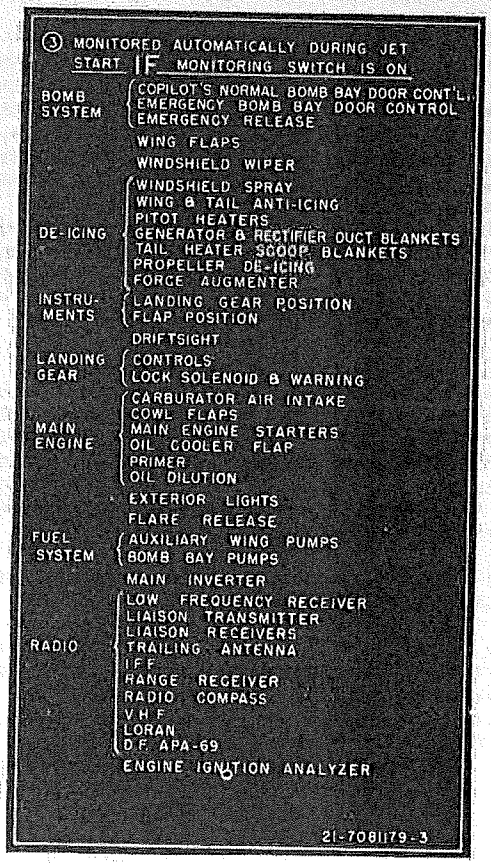
1-119. In event of one main engine failure, or otherwise, when only two A. C. generators are operating, the monitor switch on the pilot's pedestal (See figure 1-8A, reference 25) must be moved immediately to "MONITOR". Electrical circuits will be automatically con-







On airplane Nos. 122207, 122209 and 124362 through 124368 as delivered. See legend on R.H. side of page for service change.



On airplane No. 124373 as delivered and on airplane Nos. 122207, 122209, 124362 through 124368 after Service Change installation.

Figure 1-14. Monitoring Legend

trolled by the monitoring system in accordance with the monitoring legend (See figure 1-14), located on the circuit breaker panel as follows:

Code 1 - Circuits listed under code (1) are never automatically monitored. These circuits are considered essential for continuing flight.

Code 2 - Circuits listed under code (2) are automatically monitored when the monitoring switch is moved to "MONITOR". A list of circuits which are automatically disconnected by the monitoring switch is provided on pilot's switch panel. (See figure 1-4, reference 2).

Code 3 - If it is necessary to start turbo-jet engines while the electrical system is on "MONITOR", all code (3) circuits will automatically be disconnected until the turbo-jet engines are running. After the turbo-jet engines are running, all code (3) circuits, which were in use before starting the turbo-jet engines, will automatically be reconnected.

1-120. After the electrical system has been monitored, it may be necessary to reconnect some of the circuits which have been disconnected by the monitoring switch. This can be done by pulling circuit breakers, thereby reducing the load on the operating A. C. generator circuits to a point where the monitor switch may be turned "OFF". The desired circuits may then be reconnected at the circuit breaker panel while watching the ammeters to make sure that the operating A. C. generator circuits do not become overloaded.

1-121. In the event that only one A. C. generator is operating, extreme care must be taken to prevent overloading that circuit. The monitor switch must be moved immediately to "MONITOR" and additional circuits disconnected at the circuit breaker panel to cut down electrical load on the A. C. generator circuit.

1-122. There are no monitoring provisions for the battery circuit.

1-123. ENGINE FIRE DETECTION SYSTEM. An electrical fire detector system is provided for each engine compartment. Four fire warning lights are provided on the co-pilot's switch panel. (See figure 1-5, reference 15). A flashing light indicates the presence of fire in the particular engine compartment. A test switch (See figure 1-5, reference 20) is provided for testing the fire detection circuits. If the fire detector circuits are functioning properly, the warning light should come on when the test switch is moved to "ON". If all lights do not come on within 15 seconds the fire detection circuit is deficient.

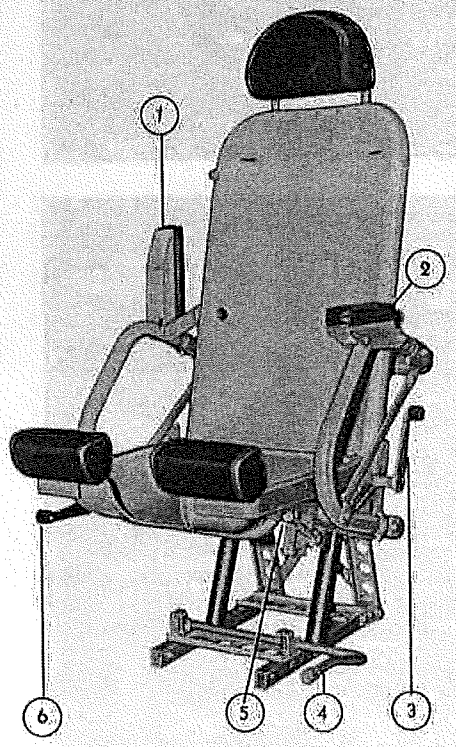
CAUTION

Do not hold test switch on for more than 15 seconds.

1-124. FIRE EXTINGUISHER SYSTEM. A carbon dioxide fire extinguishing system is provided for extinguishing fires in the main engine accessory section, carburetor air scoop and generator blast tubes. No fire extinguishers are provided for the turbo-jet engines. Two fire extinguisher switches are provided on the co-pilot's switch panel (See figure 1-5, reference 18). Lifting the switch guard and actuating the fire extinguisher switch operates a directional valve which directs CO_2 to the particular engine selected.

NOTE

The fire extinguisher system is a "one shot" system. The entire charge of carbon dioxide is expended when either switch is actuated.



1. Arm Rest (Raised Position)
2. Arm Rest
3. Recline Handle
4. Fore and Aft Adjusting Handle
5. Shoulder Harness Release
6. Vertical Adjusting Handle

Figure 1-15. Pilot's Seat

1-125. PILOT'S SEAT CONTROLS. (See figure 1-15). The pilot's and co-pilot's seats are adjustable for height, fore and aft location and tilt. The lever under the forward edge of the right side of the seat will

allow adjustment to any one of 13 heights when pulled up. The lever near the floor under the inboard side of the seat controls the location of the seat in any of seven fore and aft positions, pull up to release. The seat has five angles of tilt and one may be selected after the lever under the inboard arm rest is pushed forward. Push in the handle of the shoulder strap lever under the left side of the seat to move it to either the lower position (locked) or the upper position, (unlocked).

1-126. DELETED.

1-127. OPERATIONAL EQUIPMENT. Refer to Section IV for the operational equipment listed below:

Equipment	Section IV Paragraph No.
Armament	4-1
Photographic	4-36
Oxygen System	4-43
G-2 Compass	4-49
Electronic	4-56
Lighting	4-144
Heating and Ventilating System	4-149
Anti-Icing System	4-158
De-Icing, Propeller	4-171
De-Icing and Wipers, Windshield	4-174
De-Icing, Pitot Tube	4-177
Galley	4-180
Special Hatch Operations	4-183

Figure 1-16. DELETED

SECTION II

NORMAL OPERATING INSTRUCTIONS

2-1. BEFORE ENTERING THE AIRPLANE.

2-2. FLIGHT LIMITATIONS AND RESTRICTIONS.

a. Do not exceed 160 knots IAS with either flaps or landing gear extended.

b. There is no restriction on the speed at which the bomb bay door may be opened.

c. Do not operate the landing lights at airspeeds in excess of 175 knots.

d. Do not fly the airplane with the center of gravity aft of 28.4 or forward of 18.6 percent MAC.

e. At gross weights of 80,000 pounds or less the maximum permissible positive acceleration for symmetrical flight is 2.8g if the outer wing fuel tanks are full, or 2.6g if the outer wing tanks are empty. At gross weights in excess of 80,000 pounds these permissible accelerations, depending on condition of outer wing tanks, are reduced so as to maintain constant products of gross weight and acceleration. Acceleration in rolling maneuvers should not exceed 2.0g at any weight.

f. Do not exceed the speeds shown on the maximum speed curve in figure 2-1.

g. Full rudder pedal travel can be used up to speeds given by the full control speed limitation curve in figure 2-1. At speeds greater than shown on this curve, only the rudder required to produce 5 degrees of yaw or a maximum rudder pedal force of 300 pounds should be used.

h. Full wheel throw can be used up to speeds as indicated by the full control speed limitations curve in figure 2-1; 1/2 wheel throw should not be exceeded at speeds greater than indicated by the 1/2 wheel throw curve; and 1/4 wheel throw should not be exceeded at maximum speeds.

i. The maximum gross weight for landing on unimproved runways is 72,000 pounds. Landing at gross weights in excess of this should be made on smooth runways under controlled conditions.

j. The maximum permissible angle of bank is 60 degrees and intentional side slipping is not permitted at indicated airspeeds above 225 knots or the speed given by full control speed limitations, whichever are less. (See figure 2-1)

NOTE

These limitations and restrictions are subject to change, and latest service directives and orders must be consulted.

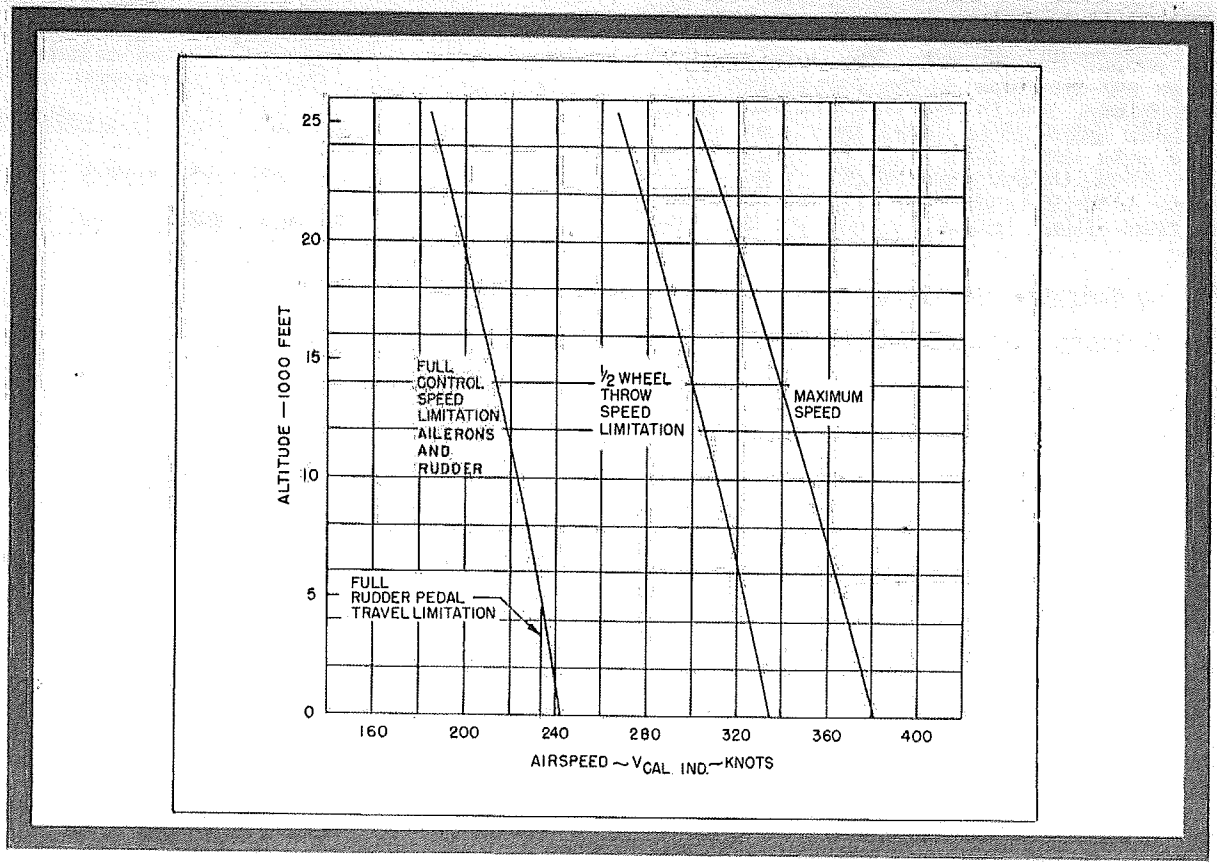


Figure 2-1. Speed Limitation Curve

2-3. WEIGHT AND BALANCE CHECK.

a. Obtain take-off and anticipated landing gross weight.

b. Use load adjuster to determine proper loading for best balance.

c. Refer to the Handbook of Weight and Balance, AN01-1B-40 for loading data.

2-4. EXTERIOR INSPECTION OF AIRPLANE.

a. See that the propellers are in low pitch and that there are no obstructions near the engines and propellers.

b. Check all cowling for security of installation.

c. See that the pitot head covers are removed.

d. Check general condition of landing gear tires and see that the wheels are chocked.

e. Check fuselage and surfaces for general condition and lack of obstructions.

f. Check for external leakage of fuel, oil and hydraulic fluid.

g. See that all access doors and inspection plates are closed and secured.

h. Check antennas for security and rig.

i. See that external power source is connected to airplane.

2-5. ACCESS TO AIRPLANE. Two entrance hatches are provided on the centerline of the airplane, one in the floor of the radio and radar operator's compartment just aft of the nose wheel well, and the other in the floor of the waist compartment. These hatches lock with the same key and are operable from either inside or outside the airplane.

2-6. ON ENTERING THE AIRPLANE.

2-7. STANDARD CHECK FOR ALL FLIGHTS.

a. Check interior of airplane for general condition, stowage of gear, and clearance and position of emergency controls.

b. Close external power switch on circuit breaker panel. Make sure circuit breaker is in.

c. Check circuit breaker panel to make sure all necessary circuit breakers and switches are in.

d. Check that all emergency switches in pilot's compartment are in the "NORMAL" position.

e. Check that the armament switch on the pilot's switch panel is "OFF".

f. Adjust seat and harness.

g. Unlock surface controls by lowering the control lock lever to a horizontal position, flush with the pilot's floor. The handle on the lever will lock the lever down.

h. Adjust rudder pedals.

i. Check surface controls for freedom of movement.

j. Check power plant controls for travel.

k. Test fire detector system.

l. Check fuel and oil loads.

m. Check operation of cowl and oil cooler flaps.

NOTE

Cowl flaps should stop at intermediate positions if switch is turned "OFF".

n. Check bomb loading.

o. Set up and check interphone and radio equipment. Refer to paragraph 4-69 through 4-71.

p. Check crew for satisfactory operation, or indication of operation, of their equipment. Check ammunition supply.

q. Check oxygen system. Refer to paragraph 4-46.

2-8. SPECIAL CHECK FOR NIGHT FLIGHTS.

a. Check operation of exterior lights and that proper colored lens is installed in fuselage light. Refer to paragraph 4-147.

b. Check operation of all interior lights.

c. Check that flares are stowed.

2-9. FUEL SYSTEM MANAGEMENT. (See figure 1-9)

NOTE

The bomb bay tank fuel should be used before using the auxiliary tank fuel in order to maintain the highest possible load factors.

2-10. The fuel control panel is equipped with internal lighting arranged so as to show the selected fuel flow as unbroken red lines on the panel. Turn on and adjust brilliance of fuel panel lights. (See figure 1-5, reference 22). All normal controls are located on this panel but in case of electrical failure the valves may be operated manually at the fuel trunk.

2-11. When starting the engines the crossfeed valve switch should be placed in the "OFF" position. If bomb bay tanks are being carried the bomb bay to main tank switches should be turned to the "ON" position, the bomb bay tank selector switch should be turned to the desired tank position and the

auxiliary tank transfer pump switches should be turned to "OFF". All other switches on the fuel control panel should be turned on. This will start the booster pumps and supply fuel to the main engines. The same procedure, followed by advancing of the turbo-jet engine throttles, will supply fuel to the turbo-jet engines. The main tank(s) will be automatically refilled from the bomb bay tank. It is recommended that bomb bay tanks be used in the order "4", "1", "3", "2", to maintain normal cg location. As soon as the bomb bay tank empty warning light comes on, switch to another tank. When all of the bomb bay tanks are empty return the bomb bay tank selector switch to "OFF".

CAUTION

The bomb bay tank empty warning light indicates either that the tank is empty, that the pump is not operating or fuel is not being delivered to main tank. When the warning light comes on, another tank should be selected immediately.

NOTE

Firewall shut-off valve switches must be in "NORMAL" position. (See figure 1-8, reference 22).

2-12. If bomb bay tanks are not being carried or if they have all been emptied, turn the bomb bay tank selector switch and the bomb bay to main tank valve switches to "OFF" and turn the auxiliary tank transfer pump switches to "ON". The main tanks will now be automatically refilled from the auxiliary tanks.

2-13. Lighting of the "AUX TANK EMPTY" warning light(s) on the fuel control panel indicates that the tank(s) contain only 12 gallons. As soon as a tank is empty turn the applicable transfer pump switch to "PUMP OFF" position.

CAUTION

The tank pumps should not be operated without fuel in the tanks. This is necessary to prevent damage to the pumps.

2-14. The crossfeed switch is normally kept in the "OFF" position. If it is desired to have either the left or right main tank supply fuel to all engines or any combination of engines, place the crossfeed switch in the "ON" position. When on crossfeed, turn "OFF" the auxiliary tank transfer pump switch, the bomb bay to main tank valve switch, and the booster pump switch for the main tank not being used.

NOTE

Fuel cannot be pumped from one main tank to the other main tank.

CAUTION

The tank pumps should not be operated without fuel in the tanks. This is necessary to prevent damage to the pumps.

2-15. OIL SYSTEM MANAGEMENT.

2-16. The turbo-jet engine oil system is integral with the engines and its operation is entirely automatic.

2-17. Automatic control of the main engine oil cooler flap is obtained by placing the oil cooler switch in the "AUTO" position. This maintains an oil temperature of approximately 72°C (162°F). The flap may also be controlled manually by placing the oil cooler switch in the "OPEN" or "CLOSE" position until desired setting is obtained, and then moving the switch to the "OFF" position. For cold weather operation refer to paragraph 5-8.

2-18. STARTING RECIPROCATING ENGINES.

a. Check that controls are in the following positions:

Ignition - "OFF"
Mixture - "IDLE CUT-OFF"
Engine Fuel Selector Switch - "OFF"
Cowl Flap Switches - "OFF" with flaps open
Oil Cooler Switches - "AUTO"
Propeller Control - Full "INCREASE"
Carburetor Air - "DIRECT"
Throttle - About 1/8 open

b. To clear engine, crank engine with starter four propeller revolutions. Remove lower spark plugs and drain oil if necessary.

c. Turn engine fuel selector switch to "ON".

d. Turn co-pilot's flight instrument and automatic pilot switch to "INSTRUMENT - NORMAL".

NOTE

Make sure inverter switches on the circuit breaker panel are turned on.

e. Push in master ignition switch.

f. Turn engine ignition switch to "BOTH".

CAUTION

Because of the intake pipe configuration, every possibility of liquid fuel collecting in the intake pipes must be avoided in order to insure against "hydraulicking". Operating personnel are advised against "wetting the blower" as a means of priming. All starts should be made by priming only, and the mixture control should be kept in "IDLE CUT-OFF" until the engine is firing on the prime.

g. Hold primer and starter switches in "ON" position.

NOTE

The primer switch should be used intermittently if the engine is hot, continuously if cold.

CAUTION

Do not hold switches "ON" for more than one minute. Allow starter to cool for one minute before second one minute cranking period.

h. When engine fires, move mixture control slowly to "Rich".

i. Adjust throttle to 1000 rpm or less.

j. Observe oil pressure rise.

CAUTION

If oil pressure gage does not register at least 50 psi within 30 seconds, stop engines and investigate.

k. If engine fires but does not continue to run, return the mixture control to "IDLE CUT-OFF" and continue cranking.

l. In case of fire follow the procedure outlined in paragraph 3-2.

2-19. RECIPROCATING ENGINE WARM-UP. Carefully warm up engine (not above 1000 rpm) until the oil temperature rises to 40°C (104°F).

2-20. GROUND CHECK (only reciprocating engines operating).

CAUTION

Avoid ground run up between 1700 and 2150 rpm.

NOTE

The following ground tests must be made with minimum oil temperature of 40°C (104°F) and with carburetor air switches in "DIRECT".

2-21. PROPELLER GROUND CHECK.

a. With the propeller governor control in full "INCREASE" position, set the throttle to give 1700 rpm.

b. Move the propeller governor control aft to give a 200 rpm drop and return to full "INCREASE".

c. Push in propeller feathering switch buttons. As soon as a drop in rpm is noted, pull out switch buttons to stop feathering operation.

2-21A. PROPELLER REVERSING GROUND CHECK. See paragraph 2-35.

CAUTION

If oil dilution has been used during engine warm-up, do not check out reversing of the propellers until the oil-in temperature has been maintained at 72°C (162°F) for at least ten minutes.

2-22. MAGNETO GROUND CHECK.

a. Advance throttle to obtain 30 inches hg. (atmospheric pressure) manifold pressure.

b. Delete.

c. Switch ignition from "BOTH" to "L" on to "BOTH" onto "R" then back to the original "BOTH".

d. The normal drop in either "R" or "L" is 60 to 80 rpm with an allowable maximum of 100 rpm. The maximum allowable difference in drop between "R" and "L" is 40 rpm.

2-23. IDLE MIXTURE GROUND CHECK.

a. At 450 to 500 rpm move mixture control from "RICH" to "IDLE CUT-OFF".

b. Check tachometer indicator for a momentary increase in rpm before the normal drop off. This increase should be between 20 and 30 rpm at 500 rpm engine speed.

c. Return mixture control to "RICH" as soon as engine speed drops back to 450 or 500 rpm.

2-24. AUTOMATIC POWER CONTROL GROUND CHECK.

NOTE

It is impossible to ground check the supercharger but the automatic power control can be checked in low impeller ratio operation.

a. With the propeller governor lever at full "INCREASE" position, advance the throttle to obtain 2300 rpm.

b. Observe manifold pressure.

c. Decrease propeller rpm to 2150.

d. Check that manifold pressure has remained constant.

e. Return controls to pre-check positions.

2-25. RECIPROCATING ENGINE GROUND CHECK AT 2000 RPM.

a. Oil pressure should be 80 to 85 psi when oil temperature is 75°C (167°F).

b. Fuel pressure should be between 24 and 26 psi.

2-26. ELECTRICAL SYSTEM GROUND CHECK.

a. Set engine speed at 1500 to 1700 rpm.

b. Open A.C. generator control switches one at a time. (See figure 1-13, reference 1).

CAUTION

The A.C. generator control switches should not be left open for more than the few seconds required to check the output voltage. Do not confuse the A.C. generator control switches with the emergency field switches. (See figure 1-13, reference 2) The emergency field switches must not be opened with the A.C. generator running except in an emergency. Refer to paragraph 1-106.

c. As each A.C. generator switch is opened, observe voltage at 27 to 28.5 volts for that rectifier.

NOTE

The generator system cannot be checked for parallel with the light electrical loads normally encountered on the ground, there may be as much as 100 amperes difference between the heaviest loaded and lightest loaded A.C. generator circuit. This does not indicate that the system is out of parallel as the electrical system must be checked for parallel with heavier electrical load.

2-27. AUTOMATIC PILOT GROUND CHECK.

a. Increase engine rpm to above 2150.

b. Turn co-pilot's flight instrument and automatic pilot switch to "INSTR AND AUTO PILOT".

c. Uncage gyros in co-pilot's flight instruments after waiting approximately two minutes for gyros to pick up speed.

d. Center indices on automatic pilot controller.

e. Push in the automatic pilot clutch switch.

f. Check movement of control surfaces by actuating the automatic pilot controller.

g. Disengage automatic pilot.

2-28. PROPELLER DE-ICING GROUND CHECK.

CAUTION

Propeller de-icing must not be checked unless engine is running, otherwise the propeller will be permanently damaged.

a. Check that both engines are running at 1600 rpm.

b. Reduce electrical loads to a minimum.

c. Disconnect external power and move the battery and three A. C. generator control switches to "OFF".

d. Observe load on ammeter for remaining A. C. generator circuit.

NOTE

If load on the remaining A. C. generator circuit is greater than 100 amperes use two A. C. generators for this check

e. Turn left propeller de-icing switch to "ON".

f. The ammeter reading should increase by approximately 120 amperes for 30 seconds, drop for 30 seconds and increase again by 120 amperes for 30 seconds if one A. C. generator is used. If two A. C. generators are operating an increase of 60 amperes should be noted on each ammeter.

g. Move the left propeller de-icing switch to "OFF" and move the right propeller de-icing switch to "ON".

h. Observe ammeter readings as in step f.

2-29. HYDRAULIC SYSTEM GROUND CHECK.

A. Check that hydraulic system selector valve is in "POSITION FOR FLIGHT" and safetied.

b. With both engine driven pumps running check that main hydraulic pressure gage on co-pilot's switch panel registers 2950 to 3050 psi.

c. Lower and raise wing glaps and note that pressure returns to 2950 to 3050 psi.

d. Crack open emergency hydraulic system pressure venting valve until the electrically-driven hydraulic pump starts.

e. Check pressure gage on emergency accumulator for emergency pressure reading at time electric pump cuts in (should be 2600 psi) and that pressure returns to 2950 to 3050 psi before electric pump cuts off.

f. Close emergency system pressure venting valve.

2-30. STARTING TURBO-JET ENGINES.

NOTE

When starting the turbo-jet engines without the aid of an outside power source, both main engines should be running at 1500 to 1700 rpm with all four A. C. generators operating. Use of turbo-jet engines on the ground should be delayed until the last possible instant because of high fuel consumption. Turbo-jet fuel consumption at idling speeds is aproximately 240 gallons per hour per engine.

CAUTION

A hot start is defined as a start during which the tail pipe temperature exceeds 1000°C (1832°F). Record each hot start on the flight report.

2-31. AUTOMATIC TURBO-JET ENGINE STARTING.

NOTE

Before attempting an air start glide down to 25,000 feet (at higher altitudes poor flame propagation makes air starts very uncertain).

NOTE

This method of starting is the normal procedure when starting on the ground or in the air. An automatic air start is conducted the same as an automatic ground start except that cranking rpm will be reached sooner during an air start as the airplane speed will assist in accelerating the turbine.

a. Check that master ignition switch is pushed in.

b. Check that circuit breakers on pilot"s lighting panel are in. (See figure 1-6, reference 8)

c. Check that turbo-jet emergency fuel system switch is in normal.

d. Check that booster pump switches on fuel control panel are "ON".

e. Set jet fuel and door switch to "OFF-IDLE-START".

f. Move throttle to "CRANK" position.

CAUTION

When starting jet engines a visual check must be made to make sure that jet air doors open when throttle is moved to"CRANK". Failure of doors to open will result in continuous operation of starter. If the doors fail to open the throttle should be returned to"OFF"position and a check of the jet starting system must be made.

NOTE

When making an air start, move throttle from "OFF" directly to "START" if turbine speed has already reached 9 .percent or more.

g. When engine speed reaches 9 percent or more, move throttle to "START".

NOTE

The jet emergency fuel system light will come on indicating that the emergency fuel pump is supplying fuel to the engine in conjunction with the normal fuel pump.

h. When turbine speed reaches approximately 23.8 percent, move throttle to "IDLE" range. The jet emergency fuel system light will go out.

CAUTION

When making an air start, the throttle should be moved to "IDLE" as soon as possible after the turbine has accelerated to approximately 23 to 25 percent or partial blow-out may occur.

2-32. MANUAL TURBO-JET ENGINE STARTING.

CAUTION

Manual starts are used as a secondary means of starting the turbo-jet engines, on the ground, and should not habitually be made. Careful manipulation of the throttle is required to prevent hot starts and over speeding.

NOTE

A manual air start is conducted the same as a manual ground start except that cranking RPM will be reached sooner during an air start as the airplane speed will assist in accelerating the turbine.

a. Check that master ignition switch is pushed in.

b. Check that circuit breakers on pilot's lighting panel are in. (See figure 1-6, reference 8).

c. Check that turbo-jet emergency fuel system switch is in "NORMAL".

d. Check that booster pump switches on fuel control panel are "ON".

e. Set jet fuel and door switch to "OFF-IDLE-START".

f. Move throttle to "CRANK" position.

g. When engine speed reaches 9 percent or more, move throttle to 1/3 to 1/2 open in the "IDLE" range completely by-passing the "START" position.

NOTE

The jet emergency fuel system light will not come on.

h. As soon as fuel pressure begins to rise from zero, return throttle to "IDLE" position. Adjust throttle as required to prevent exhaust gas temperature from exceeding 900°C (1652°F) while engine is accelerating to idling speed (approximately 34 percent).

2-33. WINDMILLING MANUAL TURBO-JET ENGINE STARTING.

NOTE

Windmilling manual starts cannot be made if the engine turbine is rotating faster than 12.7 percent since the ignition system cannot be energized above this speed.

CAUTION

Windmilling manual starts are to be used only in emergencies when other starting methods cannot be used as this type of start often results in failure of the starter mechanism. Careful manipulation of the throttle is required to prevent hot starts and over speeding.

a. Check that master ignition switch is pushed in.

b. Check that circuit breakers on pilot's lighting panel are in. (See figure 1-6, reference 8).

c. Check that turbo-jet emergency fuel system switch is in "NORMAL".

d. Check that booster pump switches on fuel control panel are "ON".

e. Set jet fuel and door switch to "CRUISE-WINDMILL".

f. When turbine speed reaches 9 percent, move throttle from "OFF" to approximately three-quarter open position by-passing the "CRANK" and "START" positions. As soon as the fuel manifold pressure begins to rise from zero, rapidly retard the throttle to idle or slightly below. Adjust throttle as required to keep exhaust gas temperature below 900°C (1652°F).

NOTE

The jet emergency fuel system light will not come on.

2-34. TAXIING INSTRUCTIONS. Steering must be accomplished by the engines with a minimum of braking as nose wheel steering is not provided. Be sure that the external power source is disconnected before moving the airplane.

NOTE

One engine must be operated above 800 rpm as much as possible during taxiing to supply the necessary electrical power. Otherwise the battery light may come on indicating that current in excess of 100 amperes is being used from the battery.

2-35. REVERSING AND UNREVERSING OF PROPELLERS.

a. To reverse the propeller(s) move the throttle(s) aft to the "CLOSE" position, clear of the stop, and aft to the "REVERSE PITCH" range. The position of the throttle in the "REVERSE PITCH" range determines the amount of reverse thrust provided.

b. To unreverse the propeller(s) move the throttle(s) forward from the "REVERSE PITCH" range, clear of the stop and forward through the "CLOSE" position.

2-36. BEFORE TAKE-OFF CHECK LIST.

a. Turn G-2 compass switch on the pilot's switch panel to "NORMAL".

b. Uncage gyros in pilot's and co-pilot's flight instruments.

c. Turbo-jet engines may be started at this time. Refer to paragraphs 2-30, 2-31 and 2-32.

NOTE

Do not start turbo-jet engines until just prior to take off to prevent excessive use of fuel.

d. With 30 inches hg. atmospheric manifold pressure check magnetos. Refer to paragraph 2-22.

NOTE

The parking brake will hold the airplane with full power on all engines.

e. With 23 to 25 inches hg. manifold pressure, not exceeding 200 rpm, check operation of propeller governors and check that automatic power control is holding the manifold pressure as rpm changes.

f. All hatches secured.

g. Check trim tab settings. Recommended settings for take-off are three degrees nose down for elevator, zero degrees for ailerons and two degrees nose right for rudder.

h. Mixture "RICH".

i. Check positioning of fuel flow panel switches.

j. Reciprocating engine fuel pressure 24 to 26 psi.

k. Hydraulic pressure 2950 to 3050 psi.

l. Carburetor air, "DIRECT".

m. Propeller control, full "INCREASE".

n. Turbo-jet engine fuel pressure, 38 to 180 psi.

o. Control locks disengaged and flight controls free. Visually check operation of spoiler ailerons.

p. Oil temperature, 40°C (104°F) to 80°C (176°F).

q. Oil pressure, reciprocating engines 65 to 100 psi; turbo-jet engines, 2 to 50 psi.

NOTE

Jet engine oil pressure of 90 psi is permissible on a scramble take-off.

r. Cowl flaps full open.

s. Oil cooler flaps switches, "AUTO".

t. Flap lever at "TAKE-OFF".

u. Turbo-jet engine exhaust gas temperature, below 655°C (1211°F).

2-37. TAKE-OFF.

2-38. NORMAL TAKE-OFF. (See figure A-5).

NOTE

Control tower should be advised that turbo-jet engines are operating and take-off clearance be given without delay.

a. With brakes on and the jet fuel and door switch in "TAKE-OFF AND LAND" position, advance jet throttles to develop 100 percent rpm. Be careful, in this operation, to keep exhaust gas temperatures in the safe operating range. Do not exceed 699°C (1290°F).

b. Release brakes.

c. Advance main engine throttles to full take-off power.

d. Maintain straight take-off path with rudder and unbalanced power from the main engines. Brakes should be used only as a last resort.

e. Pull the nose off the ground slightly when an airspeed of 90 knots has been reached and take-off without any further change.

2-39. RECIPROCATING ENGINE TAKE-OFF. (See figure A-5). Two engine take-off is achieved in the same manner as normal take-off. Take-off distance is approximately 50 percent greater than for normal take-off.

2-40. ENGINE FAILURE ON TAKE-OFF. Refer to paragraphs 3-7 to 3-11.

2-41. AFTER TAKE-OFF.

a. Raise landing gear after single-engine flight speed (120 knots) has been reached. They should retract in less than ten seconds.

b. Raise flaps as soon as a safe altitude has been reached but before attaining a speed of 160 knots.

c. Retrim to compensate for reduced drag.

NOTE

The electrically operated trim tabs must be used cautiously to prevent over-trimming. Quick flicks of the switch are recommended as an operating method.

d. Retard main engine throttle.

e. Adjust propeller to desired rpm.

f. Retard turbo-jet engines to 96 percent within five minutes after start of take-off.

g. Close cowl flaps as far as safe operating temperatures will allow.

2-42. CLIMB. High powered climbing should be done in accordance with all applicable charts in Appendix I except where such operation would cause the cylinder head temperature limits to be exceeded. Climbing for minimum fuel expenditure should be performed as slowly as permitted by the particular mission, i.e., A "Climb Cruise". Speeds should be maintained to satisfy the cruising and altitude conditions and as little additional power applied as necessary to reach the altitude as specified. The fuel consumed in this operation cannot be readily predicted but that amount of fuel used for climbing, excluding the fuel used for level flight, will be less than that used in high power climb in an increasing amount as the "Climb Cruise" condition is approached. Cowl flaps should be operated as necessary. When the turbo-jet engines are in use, the fuel and door selector must be turned to "climb".

2-43. STABILITY. This airplane is very stable at all loadings which keep the center of gravity between 18.6% M.A.C. and 28.4% M.A.C.

2-44. TRIM. This airplane is easily trimmed and requires only small changes during flight.

2-45. DURING FLIGHT.

2-46. Upon reaching cruising altitude the main engines should be adjusted to deliver the desired power. Turbo-jet engines may be stopped. Refer to paragraph 2-85.

2-47. While cruising on the two main engines only, the booster pumps in the main tanks may be turned off by turning the main tank booster pump switches on the pilot's control panel to "OFF". This is permissible only during level flight cruising on main engines. Booster pumps must be turned on for all other conditions of flight.

2-48. The Flight Operation Instruction Charts in Appendix I should be referred to when there are any changes in flight plan or operation. (See figures A-6 to A-15)

2-49. POWER CHANGES IN FLIGHT. Power changes will be made in the normal manner.

a. To increase power, increase rpm, then advance throttle.

b. To decrease power, retard throttle, then decrease rpm.

2-50. AUTOMATIC PILOT OPERATION.

2-51. TO ENGAGE THE AUTOMATIC PILOT IN FLIGHT.

CAUTION

Do not engage the automatic pilot while in a turn or while in climbs, dives or banks of more than 10 degrees. To do so may result in insufficient trim adjustment to return the airplane to level flight.

a. Make sure that the G-2 compass is not on "EMERGENCY".

b. Turn the co-pilot's flight instrument and automatic pilot switch to "INSTR AND AUTO PILOT". Allow two minutes for the electronic equipment to warm up.

c. Make sure that the gyroscopes in the co-pilot's flight instruments are erected.

d. Set indices on the automatic pilot controller.

e. Trim the airplane for the desired attitude.

f. Push in automatic pilot clutch switch.

2-52. TO DISENGAGE THE AUTOMATIC PILOT.

2-53. The automatic pilot is normally disengaged by pressing in the automatic pilot disconnect button on either the pilot's or co-pilot's control wheel, or by pulling out the automatic pilot clutch switch on the pilot's switch panel. Refer to paragraph 1-31 for other methods of disengaging the automatic pilot.

2-54. After the automatic pilot has been disengaged, turn the co-pilot's flight instrument and automatic pilot switch to "INSTR-NORMAL".

2-55. FLIGHT OPERATION OF THE AUTOMATIC PILOT.

2-56. The attitude of the airplane may be changed in flight through the automatic pilot controller. Turning the pitch wheel will make the airplane climb or dive or will trim the airplane longitudinally as desired. The bank trim knob may be used to trim the airplane laterally. Coordinated turns may be made by turning the turn control knob in the desired direction. The turn control knob must be centered to return the airplane to straight flight.

2-57. After any sudden change in load or change in speed, disengage the automatic pilot and retrim the airplane. The automatic pilot may then be re-engaged.

NOTE

It is best to retrim the airplane at least once every hour when flying on the automatic pilot.

WARNING

Do not adjust the trim tabs while the automatic pilot is engaged.

2-58. STALLS.

2-59. The calibrated stalling speeds are as follows:

Power On

Weight	Clean	Wheels and Flaps Down
55000 pounds	92 knots	73 knots
70000 pounds	104 knots	82 knots
85000 pounds	114 knots	91 knots

Power Off

Weight	Clean	Wheels and Flaps Down
55000 pounds	98 knots	79 knots
70000 pounds	110 knots	89 knots
85000 pounds	122 knots	98 knots

These stalling speeds will be increased approximately 25 knots in banks attained in normal traffic patterns.

2-60. As stalling speeds are approached, elevator buffeting is noticeable as follows:

Power On - Clean. A moderate buffet, approximately six knots before stalling speed.

Power On - Wheels and Flaps Down. A moderate buffet, approximately three knots before stalling speed is reached. Buffeting increases in forward C.G. position to the extent that at most forward C.G. position, elevators oscillate sufficiently to move control column approximately six inches.

Power Off - Clean. A moderate buffet approximately seven to nine knots before stalling speed is reached.

Power Off - Wheels and Flaps Down. A moderate to light buffet approximately five knots before stalling speed is reached.

2-61. Stalls are clean and straight except in the power on - landing gear and flaps down condition. In this condition, the airplane has a definite, but not violent, tendency to roll to the left. Recovery from all stalls is effected by application of down elevator which will make the airplane straighten out.

2-62. SPINS. All spins are prohibited. Avoid any flight attitude from which a spin may result. If the airplane goes into an inadvertent spin, use a normal recovery procedure.

2-63. PERMISSIBLE ACROBATICS. All acrobatics are prohibited in this airplane. Banks should not exceed 60 degrees.

2-64. DIVING. Do not exceed the restrictions as outlined in paragraph 2-2.

2-65. NIGHT FLIGHT.

2-66. EXTERIOR LIGHTS. All exterior lights are controlled from the pilot's switch panel (See figure 1-4, reference 11). These lights are controlled through a master selector switch for lighting under "CODE", "FLASH" or "STEADY". The master switch must be turned to one of the three positions before lights will come on. The brilliance of the lights can be adjusted by turning the brilliance knob to the desired setting.

2-67. EXTERIOR LIGHTS ON "CODE".

a. Turn master switch to "CODE".

b. Select desired code on code switch.

c. Turn "ON" wing, fuselage and tail lights: The fuselage light will blink the selected code and the wing and tail lights will be steady.

d. Adjust brilliance to "DIM", "MEDIUM" or "BRIGHT" as desired.

e. If landing lights are desired, they may be turned on by moving the landing light switches to "ON". When the landing light is extended 10 degrees, the light will come on. If it is desired to stop the light in any position between 10 degrees and fully extended, move switch toggle to center.

2-68. EXTERIOR LIGHTS ON FLASH.

a. Turn master switch to "FLASH".

b. Turn "ON" wing, fuselage and tail lights. The fuselage light will be steady, and the wing and white tail lights will flash together.

c. Adjust brilliance as desired.

d. Turn on landing lights if desired.

2-69. EXTERIOR LIGHTS ON "STEADY".

a. Turn master switch to "STEADY".

b. Turn "ON" wing, fuselage and tail lights. All lights will remain steady.

c. Adjust brilliance as desired.

d. Turn "ON" landing lights as desired.

2-70. MANUAL KEYING OF FUSELAGE LIGHTS.

a. Turn master switch to "STEADY".

b. Turn "ON" wing and tail lights leaving fuselage light switch in "OFF".

c. Adjust brilliance as desired.

d. Press keying switch on the pilot's switch panel. The fuselage light will come on each time the keying switch is pressed in and the indicator light on the switch panel will come on.

2-70A. SIGNAL LIGHT. (See figure 1-2, reference 37)

2-70B. The signal light, refer to paragraph 4-147A, may be used at night to signal other aircraft, a control tower or to check any of the outside parts of the airplane during flight.

2-71. INTERIOR LIGHTS. To turn "ON" interior lights:

a. Turn "ON" master interior light switch on pilot's lighting panel. (See figure 1-6, reference 7).

b. Select lights as desired, refer to paragraph 4-148 for light switches and locations.

2-72. APPROACH.

2-73. LANDING CHECK LIST.

a. Turn all radio and radar switches "OFF", except those required for airport communications.

b. Check fuel quantity and position of fuel system control switches. Booster pumps must be "ON".

c. Fuel pressure, 24 to 26 psi.

d. Mixture, "RICH".

e. Hydraulic pressure, 2950 to 3050 psi.

f. Propeller control, 2400 rpm.

g. Carburetor air, "DIRECT".

h. Cowl flaps, closed.

i. Oil cooler flaps switch, "AUTO".

j. Altimeter set to station pressure.

k. Crew secured for landing.

l. Tail turret locked in manual drive at zero elevation.

m. Trailing antenna in.

2-74. NORMAL APPROACH. This airplane is normally landed with main engines only. Use of jet power should be considered when making approaches at high gross weights in case the landing is not completed and it is necessary to climb out in a hurry.

a. Reduce air speed to 160 knots.

b. Lower landing gear. Check that it is down and locked.

c. Lower flaps to "TAKE-OFF" position.

d. Maintain airspeed above 120 knots.

e. On final approach, lower flaps to full "DOWN" position and trim airplane as necessary.

f. At an airspeed of 110 knots, begin flare-out when about 100 to 150 feet over runway.

2-75. LANDING.

2-76. DELETED.

2-77. NORMAL LANDING.

2-78. At 110 knots, 100 feet above the runway, a safe flare-out and landing can be made as the throttles are closed. Hold the airplane off the runway in a slightly nose high attitude so that the main alighting gears will touch first. After touching the runway, lower the nose and brake to a stop using reverse pitch of the propellers if desired.

2-79. To reverse the propeller pitch move the throttle levers to "CLOSE" lift over the mechanical stop and move back into the "REVERSE PITCH" range.

2-80. CROSSWIND LANDING. Normal procedures should be used for crosswind landings.

2-81. EMERGENCY LANDING. Refer to paragraph 3-14.

2-82. GO-AROUND.

a. Increase manifold pressure to 40 inches.

b. Move propeller governor control to full "INCREASE".

c. Increase manifold pressure to take-off power.

d. Increase power on turbo-jets if operating.

CAUTION

If an approach or landing is attempted with the turbo-jet engines operating and the jet door selector switch in the "TAKE-OFF AND LAND" position, the turbo-jet engines will operate on the emergency fuel system as soon as the throttle is retarded below approximately 60 percent. In order to return to the normal fuel system after operating on the emergency system as referenced above, the throttle has to be advanced to a point above 85 to 90 percent rpm and then the selector switch moved from the "TAKE-OFF AND LAND" position. The red indicator light will go out. The above condition can be eliminated if the switch is placed in any position except "TAKE-OFF AND LAND" or "EMERGENCY TEST". In case of a main pump failure, emergency operation can be had by turning the guarded emergency fuel system switch to "EMERGENCY".

e. Retract alighting gear.

f. Raise flaps carefully.

g. Adjust elevator tab as necessary.

2-83. AFTER LANDING CHECK LIST.

a. Cowl flaps-full open.

b. Propeller governor control-full "INCREASE".

c. Flaps lever, "UP".

d. Idle engines until cylinder head temperatures are below 177°C (350°F).

2-84. STOPPING OF ENGINES.

2-85. STOPPING TURBO-JET ENGINES.

a. Place the fuel and door selector switch in "OFF-IDLE-START" position.

b. Pull the throttle to its "OFF" position.

2-86. STOPPING RECIPROCATING ENGINES.

a. If engines are hot due to taxying, idle until the head temperature drops below 177°C (350°F).

b. Move propeller governor control to full "INCREASE".

c. Move mixture control to "IDLE-CUT-OFF".

d. Turn engine fuel selector switch to "OFF".

NOTE

This is a remote control ignition system. Power must be available on the d-c bus and the "MAIN ENGINE IGNITION" circuit breaker must be in before turning the ignition switch to "OFF" or ignition will still be energized.

e. If temperatures below 2°C (36°F) are forecast for the period before the next start, dilute the lubrication oil. Refer to paragraph 5-6.

2-87. BEFORE LEAVING THE AIRPLANE.

a. Mixture control, "IDLE CUT OFF".

b. Ignition switches, "OFF".

c. Turbo-jet throttles, "OFF".

d. Fuel switches, "OFF".

e. Flaps lever, "UP".

f. Wheels chocked or parking brake on.

g. Raise handle of control lock lever in the pilot's floor, locking the surface controls. Move wheel, column, and rudder pedals, as necessary for pins to engage.

h. Pilot's "MASTER RADIO" switch "OFF".

i. All transmitters and radar sets, "OFF".

j. Bomb "FUSING" and turret gun switches, "OFF".

k. All lights off.

l. Alternator control switches, "OFF".

m. Battery switch, "OFF".

n. External power switch, "OFF".

SECTION III

EMERGENCY OPERATING INSTRUCTIONS

3-1. FIRE

3-2. MAIN ENGINE FIRE WHEN STARTING. Some fires that occur when starting a reciprocating engine will extinguish if the throttle is pushed open quickly. If this doesn't extinguish the fire, a hand extinguisher should be used.

3-3. MAIN ENGINE FIRE IN FLIGHT. In the event of a fire in a main engine accessory section proceed as follows:

a. Close throttle and feather propeller. Refer to paragraph 3-26A.

b. Throw monitor switch to "MONITOR" position.

c. Close firewall shut-off valve using switch on pedestal.

d. Open cowl flaps.

e. Make sure carburetor air is "DIRECT".

f. Move mixture control to "IDLE CUT-OFF".

g. Actuate proper fire extinguisher.

h. Turn ignition "OFF".

i. DO NOT RESTART ENGINE.

NOTE

Operation of the engine fire extinguisher discharges the entire supply of carbon dioxide and none is available for successive engine fires.

3-4. DELETED.

3-5. TURBO-JET ENGINE FIRE. In the event of a fire in a turbo-jet engine;

a. Move throttle to "OFF".

b. Place jet air door selector switch in "CRUISE-WINDMILL".

3-6. PORTABLE FIRE EXTINGUISHERS. (See figure 3-1, reference 13). Three portable fire extinguishers are stowed as follows:

One five-pound extinguisher aft of the radar operator's seat.

One two-pound extinguisher below the navigator's table.

One two-pound extinguisher on the left side in the aft end of the waist compartment.

To break out, turn the latch to one side and lift.

3-7. ENGINE FAILURE.

3-8 MAIN ENGINE FAILURE BEFORE TAKE-OFF. If one main engine fails on the ground run of take-off, the airplane will swerve, so the other engines should be cut immediately and brakes applied as necessary to stop the airplane. DO NOT TRY TO CONTINUE TAKE-OFF.

3-9. MAIN ENGINE FAILURE - TURBO-JETS NOT RUNNING BEFORE SINGLE ENGINE FLYING SPEED (120 KNOTS) IS REACHED. In event of failure of a main engine before single engine flying speed is reached, land straight ahead.

3-10. MAIN ENGINE FAILURE - TURBO-JETS OPERATING OR SINGLE ENGINE FLYING SPEED (120 KNOTS) HAS BEEN REACHED. In event of failure of one main engine after single engine flying speed has been reached or with turbo-jets operating, proceed as follows:

a. Start turbo-jet engines, if necessary.

NOTE

Do not use the turbo-jet engines for extended flight as their high fuel consumption greatly reduces the range of the airplane.

b. Close the throttle of dead engine.

c. Feather propeller of dead engine. Refer to paragraph 3-26A.

d. Throw monitor switch to "MONITOR" position.

e. Apply necessary power to remaining engine or engines.

f. Raise landing gear, if extended.

g. Raise flaps carefully, if they are down.

h. Close cowl flaps on dead engine.

i. Consult the Flight Operation Instruction Charts for single-engine operation. (See figures A-12 to A-15)

j. Jettison loose gear as necessary to maintain altitude.

k. Land as soon as possible.

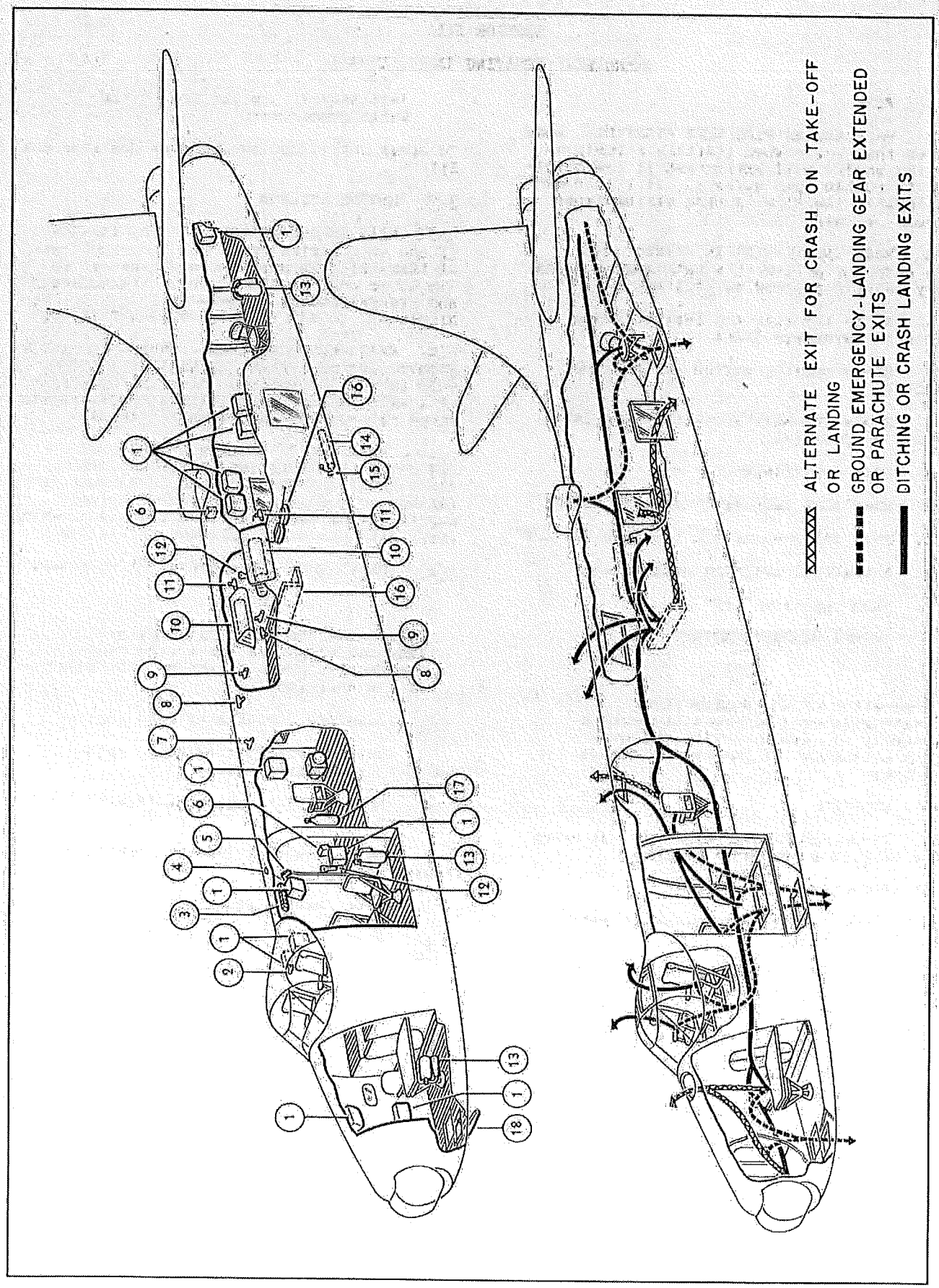


Figure 3-1 Emergency Equipment and Exits

KEY TO FIGURE 3-1

1. Parachutes (12)
2. Life Raft Release Handles, Pilot's Compartment (1)
3. Signal Pistol Cartridge Stowage
4. Signal Pistol Mount
5. Signal Pistol
6. First Aid Kits (2)
7. Life Raft Release Handle, Countermeasure Compartment (1)
8. Life Raft Release Handles, External (2)
9. Life Raft Release Handles, Ditching Stations (2)
10. Life Rafts (2)
11. Life Raft Release Handles (2)
12. Flashlights (2)
13. Portable Fire Extinguishers (3)
14. Parachute Flare
15. Flare Release Mechanism
16. Ditching Station
17. Engine Fire Extinguisher Cylinder
18. Hydroflap (See figure 3-2)

3-11. FAILURE OF BOTH MAIN ENGINES ON TAKE-OFF. If both main engines fail on take-off, attempt to maintain flight by dropping bomb bay stores, feathering propellers, turning on crossfeed, turning off one set of main boost pumps, and turning off all unnecessary electrical loads. The jet engines will operate without fuel boost. If speed, weight of aircraft and altitude preclude jet flight then land straight ahead.

3-12. PARACHUTE STOWAGE. (See figure 3-1, reference 1) There are 12 parachutes stowed in slings in the following locations:

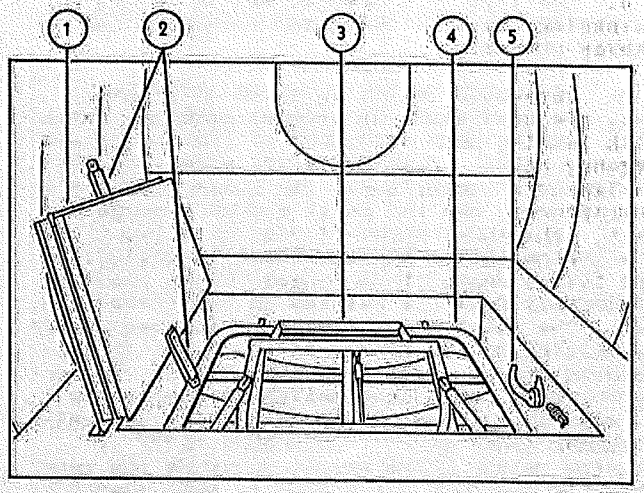
Two on the right side of the navigator-bomber compartment.
One on the radio rack.
One on the radar rack.
One aft of the radio operator.
One above the radar operator.
One aft of the countermeasure compartment escape hatch.
Two above each waist window.
One on the right side just forward of the tail turret.

3-13. BAIL OUT. (See figure 3-1). It is recommended that the crew members use the following parachute exits:

a. Bow gunner and navigator-bomber leave by the hydroflap hatch in the floor of the navigator-bomber compartment. (See figure 3-2) This is opened by raising the hinged floor section with strap handles and rotating the jettison handle, on the right side of the opening, up to a vertical position. If the hatch doesn't fall out, knock it out.

b. Pilot, co-pilot, radio operator, radar operator, and countermeasure operator, go out the main entrance hatch which is jettisoned by pushing down the jettison handle in the floor to the right of the hatch opening.

c. The deck turret operator, tail gunner, and cameraman, go out the aft entrance hatch which is jettisoned by pulling down the jettison handle on the right side of the frame at the hatch. If this hatch cannot be opened either waist window may be used; pull strap at upper edge of window to open.



1. Inner Hydro Hatch
2. Straps
3. Hydro Flap Handle
4. Hydro Flap
5. Hydro Flap Jettison Handles

Figure 3-2. Hydro Flap

3-14. FORCED LANDING.

3-15. FORCED LANDING PROCEDURE

a. Turn off all unnecessary electrical equipment.

b. Send crew to ditching stations. Refer to paragraph 3-18.

c. Just before landing, feather both propellers if landing gear is extended. Refer to paragraph 3-26A. Do not feather propellers for "wheels-up" landing. Turn battery to "OFF" and pull out master ignition switch.

d. Land in normal attitude, holding off as long as possible.

3-16. GROUND EMERGENCY EXITS. (See figure 3-1)

NOTE

Exits specified in steps "a" through "d" are used in the event of a crash landing. Parachute exits are used in the event of a ground emergency with landing gear extended.

a. The astrodome hatch in the top of the navigator-bomber compartment is opened by pulling four latches toward the center.

b. The top of the pilot's enclosure opens in two places: the left panel hinges up after the latch is released, the right panel will fall in and may be pushed out after it's rubber retainer is removed by pulling a strap at the forward edge.

c. There is an escape hatch in the top of the countermeasure compartment which can be opened from either inside or outside by turning the handle.

d. The life raft hatches may be opened by releasing the life rafts and unzipping the canvas covers.

e. Parachute exits, as shown in figure 3-1, are used also for ground emergency exits with landing gear extended, or for forced emergency exits. Such exits are made from the navigator's compartment, the radar operator's compartment, and the waist gunner's compartment. The inner hydro-flap door in the floor for the navigator's compartment is pulled up and folded where it is hinged in the center. "EMERGENCY EXIT" is painted on the floor carpet. The outer hydro-flap door is then opened by pulling on the handle to the right of the painted arrow. Exit from the pilot's, radar operator's, and countermeasure compartments is made by pulling on the handle for the main entrance inner door. "EMERGENCY EXIT" is painted on the floor carpet covering the door. The main entrance outer door is then opened from the inside by pulling the emergency pull handle to jettison the hatch. Markings on the outer skin of this door, for an emergency opening of the door, read "EXIT RELEASE TO OPEN PUSH PULL". The words "PUSH" and "PULL" are placed on each side of the latch. Exit from the waist gunner and tail gunner compartments is achieved through the rear entrance hatch. This door is opened from the inside, and jettisoned, by turning the jettison handle on the bulkhead at station 829-1/2 to the direction indicated by an arrow. This door is opened from the outside by following the markings on the outer skin which read "PUSH SPOT TURN HANDLE".

3-16A. FORCED EMERGENCY ENTRY OR EXIT, AND MARKINGS.

a. Five panels are provided for forced emergency entry or exit. Two panels are on the upper and lower left side of the nose section between stations 13-13/16 and 37-5/8. A third panel is on the right side of the aft section between stations 829-1/2 and 861-1/2. The fourth and fifth panels are between stations 892 and 922, one on the right side and one on the left side. On the inside of each panel, the corners are marked with color and the lettering reads "CUT HERE FOR EMERGENCY EXIT". On the outer skin of each panel, the corners are marked with color and the lettering reads "CUT HERE FOR EMERGENCY RESCUE".

b. A broken bank is painted in seven equally spaced places around the outer surface of the astro hatch between stations 90-3/4 and 117. Markings around the rim of the astro hatch read "CUT HERE FOR EMERGENCY RESCUE". Refer to paragraph 3-16, step a for ground emergency exit through the astro hatch.

c. Provisions for forced emergency entry are made for the pilot's and co-pilot's emergency escape hatches. Broken bands are painted at equal spaces around the border of these hatches and markings on each of the four sides read "CUT HERE FOR EMERGENCY RESCUE". Refer to paragraph 3-16, step b for emergency escape through these hatches.

d. A colored border is painted on the lining and on the inner flanges of frames and sills for the right and left windows in the waist gunner's compartment, and markings read "EMERGENCY EXIT PULL LOOPS REMOVE PANEL". Provisions are made for forced entry by a colored broken band painted at equal spaces around the exterior frame of the right and left windows for the waist gunner's compartment. The markings around these windows read "CUT HERE FOR EMERGENCY RESCUE".

3-17. DITCHING. (See figure 3-1)

3-18. DITCHING STATIONS. The pilot, copilot, radio operator, and radar operator remain in their seats as these seats have ditching cables. The other crew members are provided ditching stations in the ditching compartment just aft of the rear spar. These stations are equipped with safety belts and mattresses. The occupants of the ditching stations should strap themselves down and brace themselves against the bulkhead.

3-19. PREPARATION FOR DITCHING.

a. Notify crew of intention to ditch. Use "ICS EMG." position of "ICS AND MIC. SEL." switch on interphone control box.

b. Jettison all loose gear and stores except empty bomb bay tanks, which will provide buoyancy.

c. Order crew to ditching stations.

d. Radio operator and radar operator will slide seats all the way back, remove ditching hook from sling on seat back and insert in eye on structure, then slide seat forward and lock in track.

e. Before leaving the bow compartment the gunner or navigator-bomber will lower the hydro-flap by pulling up on the yoke on the outer hatch after opening the inner hatch. (See figure 3-2).

f. Pilot's and co-pilot's seat should be moved full aft and lowered, and the escape panels in pilot's enclosure opened. Refer to paragraph 3-16.

3-20. DITCHING PROCEDURE.

a. Lower flaps.

b. Approach with power on to flatten glide.

c. Feather propellers. Refer to paragraph 3-26A.

d. Turn battery switches "OFF".

e. Pull out master ignition switch.

f. If the wind is blowing across the swells, or lightly with the swells, ditch along the bottom of the swells.

g. If there is a high wind blowing with the swells, ditch into the wind toward the top of a swell.

h. Land as nearly level as possible.

3-21. DITCHING EXITS. (See figure 3-1) These exits are the same as the ground emergency exits specified in paragraphs 3-16 steps b through d.

3-22. After landing, release the life rafts and gather usable equipment, such as first aid kits, flashlights, signal pistol and parachutes. Refer to paragraph 3-23. Inflate life vests before entering the water and secure all equipment to the life rafts. The line which secures a raft to the airplane will break with a pull of 60 pounds.

3-23. Two Mark 7 type D life rafts are installed in the ditching compartment. (See figure 3-1, reference 10). Each raft is released automatically by submersion switches (one switch for each raft) located in the bomb bay. When the release system is actuated, the life raft hatch is ejected and the rafts are thrown clear of the airplane as they are being inflated. In addition to the automatic system, a manual release system is provided. When manually released, the life rafts are ejected in the same manner as by the submersion switches. Manual release handles are provided as follows:

a. On the bulkhead behind the pilot (See figure 3-4, reference 10 and figure 3-1, reference 2). When pulled, this handle releases both rafts simultaneously.

b. In the crown of the countermeasure operator's compartment (See figure 3-1 reference 7). This handle releases both rafts simultaneously.

c. On either side of the airplane at the ditching stations (See figure 3-1, reference 9). These two handles release individual rafts, each handle releasing the raft on the same side of the airplane as the handle.

d. On either side of the airplane at the aft end of the life raft (See figure 3-1 reference 11). These two handles release individual rafts, each handle releasing the raft on the same side of the airplane as the handle.

e. On the exterior of the airplane (See figure 3-1, reference 8). A release handle is provided at the forward end of the life raft hatch which may be used for releasing the raft from the outside of the airplane. These handles release individual rafts, each handle releasing the raft on the same side of the airplane as the handle.

3-24. STARTING TURBO-JET ENGINES ON EMERGENCY FUEL PUMP. This method of starting can be used for starting turbo-jet engines in the air in event of failure of the main fuel pump. Follow the same procedure as for automatic or manual start except that the jet emergency fuel pump switch is placed in "EMERGENCY". The jet emergency fuel system light will come on and stay on as long as switch is in "EMERGENCY".

3-25. PROPELLER FEATHERING AND UNFEATHERING.

3-26. Deleted

3-26A. PROPELLER FEATHERING PROCEDURE.

a. Close the throttle.

b. Push in feathering switch button.

c. Throw electrical system monitoring switch to "MONITOR" position.

d. Move firewall shut off switch to "SHUT-OFF".

e. Move mixture control to "IDLE CUT-OFF".

f. Turn "OFF" applicable fuel valve switch on the fuel control panel.

g. If after button returns to its neutral position, propeller is windmilling forward, push button again.

h. If after button returns to its neutral position, propeller is windmilling in reverse, the button should be pulled out momentarily to unfeather enough to stop this condition.

i. When the propeller stops turning, turn ignition switch "OFF".

j. Close cowl flaps and oil cooler door.

3-27. Deleted

3-27A. PROPELLER UNFEATHERING PROCEDURE.

a. Make sure fuel valve switch on the pilot fuel control panel is "OFF".

b. Mixture control in "IDLE CUT-OFF".

c. Firewall shut off switch on "NORMAL".

d. Turn ignition switch to "BOTH".

e. Open throttle to give approximately 1000 rpm.

f. Set propeller control in minimum rpm position.

g. Pull out propeller feathering switch button and hold until tachometer indicates approximately 600 rpm.

h. Turn fuel valve selector switch "ON" after propeller has turned four revolutions.

i. Move mixture control to "RICH"

j. Operate engine as near to 1000 rpm as possible until warmed up.

3-28. EMERGENCY OPERATION OF FUEL SYSTEM.

3-29. If any of the fuel valves fail to operate electrically when the proper switch is actuated, check the circuit breakers on the main circuit breaker panel. If the electrical fuel system has failed, the fuel system can be operated manually at the fuel trunk in the countermeasure operator's compartment. (See figure 3-3) Pushing the valve handles in will disengage the electric motors from the valves. Turning the valve handles (after they have been pushed in) clockwise will close the valves and counter clockwise will open them.

3-30. If a main tank fails to maintain its fuel level above 700 gallons when it is known that there is fuel in the auxiliary wing tanks or bomb bay tanks, fuel may be transferred manually by using the override switches on the fuel trunk panel after making sure that the valves are in the proper fuel flow positions. The override switches by-pass the automatic refueling feature of the fuel system and when actuated, start the transfer pumps in either the auxiliary tanks or bomb bay tanks.

CAUTION

When using the override switches, care should be taken to not overfill the main tank. The pump should run for approximately seven or eight minutes to transfer 200 gallons into the main tank. The main tank fuel quantity indicators should be carefully observed during manual transfer.

3-31. If any valve or pump fails causing starvation of an engine, the engine may be supplied fuel from the main tank on the opposite side of the airplane. This is done by turning either the cross-feed valve switch on the pilot's fuel control panel to "ON" or by opening the valve in the fuel trunk.

3-32. EMERGENCY ALIGHTING GEAR OPERATION.

3-33. EMERGENCY EXTENSION OF ALIGHTING GEAR. In event of failure of the hydraulic system, the alighting gear may be extended as follows:

a. Move landing gear lever to "DOWN" position.

b. Pull the emergency landing gear up lock release located on the bulkhead behind the pilot. (See figure 3-4, reference 6)

3-34. MANUAL OPERATION OF LANDING GEAR VALVE. If the electrical system is inoperative, the alighting gears may be extended by manually operating the solenoid operated valve. This may be done by moving the handle on the side of the landing gear valve (See figure 4-23, reference 43) located in the countermeasure operator's compartment. To raise the gears, turn the handle from the vertical position to the left while facing forward. To lower the gears, turn the handle from the vertical position to the right, while facing forward.

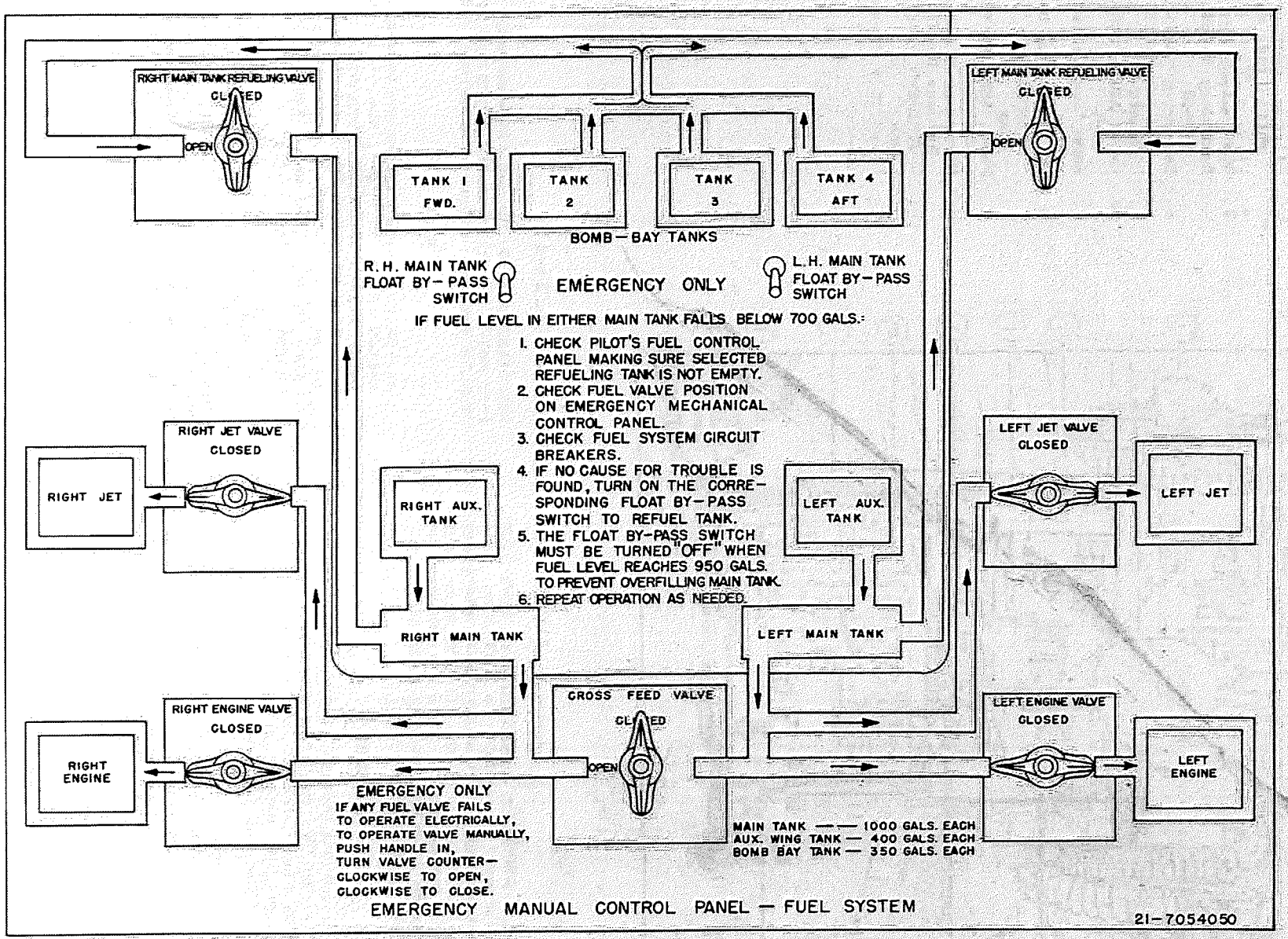
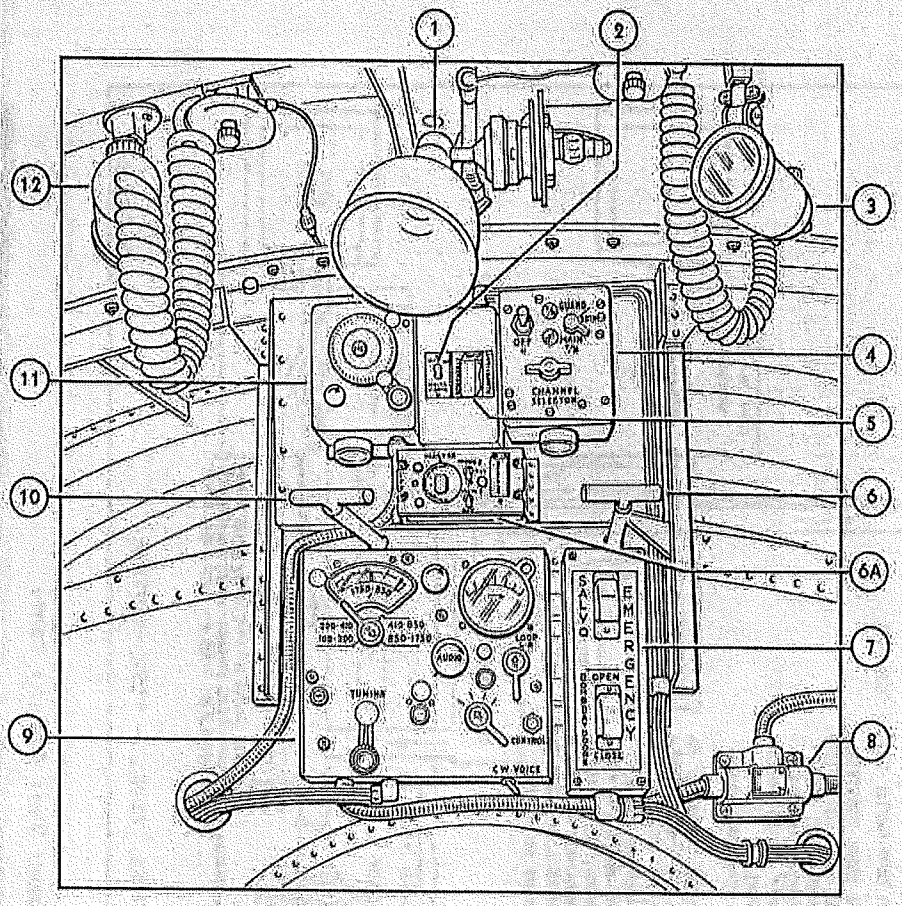


Figure 3-3. Emergency Manual Fuel Control Panel



1. Pilot's Emergency Flood Light
2. Pilot's Interior Red-White Light Switch
3. Pilot's Spot Light
4. VHF Control Box
5. Emergency Flood Light Switch
6. Emergency Landing Gear Up-Lock Release Handle
6A. C-544/APX-6 Control Unit
7. Bomb Control Switch Box
8. Radio Compass Tachometer Shaft Coupling
9. Radio Compass Control Box
10. Emergency Life Raft Release Handle
11. C-26/ARC-5 Control Box
12. Co-pilot's Spot Light

Figure 3-4. Flight Deck Aft Bulkhead

3-35. EMERGENCY ALIGHTING GEAR DOWN LOCK. If the main gears fail to lock down, pull the tee handle on the main gear emergency bottle located in the countermeasure operator's compartment. This will release air pressure into the landing gear actuating strut. (See figure 4-23)

WARNING

Do not return the landing gear lever to the "UP" position until the air has been released from the actuating strut, otherwise, the hydraulic reservoir may blow up.

3-36. EMERGENCY BRAKES. In event of failure the normal brake lines between the brake valve and the wheels, the emergency brake lines may be used by moving either brake selector handle on the pilot's pedestal to "EMERGENCY". (See figure 1-8, reference 3) The brake accumulator has sufficient capacity to allow three to four full applications of both brakes.

3-37. In the event of failure of the hydraulic system after a normal extension of the landing gear, pull the emergency up-lock release handle located on the bulkhead behind the pilot. (See figure 3-4, reference 6) This action will port pressure to the brake system through the emergency nose gear selector valve in the emergency hydraulic system. Refer to paragraph 1-96.

NOTE

If the electrical system monitoring switch is on "MONITOR", the electric motor-driven hydraulic pump will not operate. Decrease the electrical load so that the electric motor-driven pump can be turned on, refer to paragraphs 1-120 and 1-121.

3-38. EMERGENCY OPERATION OF WING FLAPS. If the electrical system is inoperative, the wing flap hydraulic valve may be operated manually by turning the handle under the valve located in the countermeasure operator's compartment. (See figure 4-23, reference 44) Turn the handle inboard to raise the flaps, and outboard to lower them. There are no provisions for lowering or raising flaps in event of hydraulic system failure.

3-39. EMERGENCY ARMAMENT CONTROLS.

3-40. EMERGENCY BOMB RELEASE. The emergency bomb salvo switch located on the bulkhead behind the pilot (See figure 3-4, reference 7) may be used in an emergency to release bombs or stores carried on the bomb

carriers. Actuating the switch will open the bomb bay doors and release all stores simultaneously. The doors will not close automatically. Refer to paragraph 3-41.

3-41. EMERGENCY BOMB BAY DOOR CONTROLS.

3-42. In event of failure of the main hydraulic system, the bomb bay doors may be opened or closed by means of the emergency hydraulic system. Moving the emergency bomb bay door switch, located on the bulkhead behind the pilot (See figure 3-4, reference 7) to "OPEN" will open the bomb bay doors.

CAUTION

Do not return switch to its neutral position as the doors have a tendency to close.

3-42A. In order to close the doors again, the electrically driven hydraulic pump must be operating, otherwise, there will be insufficient pressure in the accumulator for closing the doors. To close the doors, move the switch to "CLOSE" and hold in that position for a minimum of 10 seconds after light indicates that doors are closed. This is necessary for pressure to actuate mechanical up-lock.

NOTE

If the electrical system monitoring switch is in "MONITOR" the electric motor-driven hydraulic pump will not operate. Decrease the electrical load so that the pump can be turned on. Refer to paragraphs 1-120 through 1-121.

3-43. In event of failure of the electrical system, between the pilot's emergency switch and the solenoid on the emergency bomb bay door valve, the doors may be opened or closed by turning the handle on the side of the bomb bay door selector valve located in the countermeasure operator's compartment, while the pilot actuates the emergency switch in the cockpit. (See figure 4-23, reference 45). Turning the handle inboard will open the doors, turning the handle outboard will close them.

3-44. EMERGENCY HYDRAULIC SYSTEM OPERATION. If both reciprocating engines fail, causing the electrical system to become entirely inoperative, the electric motor-driven hydraulic pump cannot be operated. An emergency hand pump, located in the countermeasure operator's compartment, is provided for the emergency hydraulic system. (See figure 4-23, reference 34). The hand pump will supply pressure for emergency nose gear extension, for the brake system, and for operating the bomb bay doors.

3-45. EMERGENCY OPERATION OF JET AIR DOORS. In event of failure of the hydraulic system, the jet air doors may be opened by moving the jet air door selector switch to either the "TAKE-OFF AND LAND", "CRUISE-WINDMILL" or "CLIMB" position. The door actuating cylinders are spring loaded, the spring will open the doors approximately five degrees allowing the air stream to pull them open.

3-46. EMERGENCY OPERATION OF ELECTRICAL SYSTEM. Should two or more A. C. generators fail due to failure of one main engine or otherwise, the electrical system monitoring switch located on the pedestal, must be moved immediately to "MONITOR". (See figure 1-8, reference 25). When on "MONITOR", the use of electrical power should be carefully supervised. Refer to paragraph 1-117 through 1-122.

3-47. AUTOMATIC PILOT EMERGENCY RELEASE. A tee handle is provided, to the left of the pilot, for mechanically disengaging the automatic pilot. (See figure 1-6, reference 15).

The disconnect handle is attached by cables to the servo disconnect on the shafts of the three servos. As the servo pulleys are attached to the disconnects, pulling the handle loosens the grip of the disconnects on the servo shafts and the airplane control surfaces can no longer be moved by the servos. Pulling the handle has no effect on the electrical circuits of the automatic pilot. The servo disconnects cannot be re-engaged while the airplane is in flight.

3-48. EMERGENCY OPERATION OF TAB CONTROLS. The trim tab controls may be manually operated at the gear boxes by turning the handles in the desired direction as indicated on the dial. Refer to paragraph 1-21.

3-49. EMERGENCY OPERATION OF AN/APX-2 IFF EQUIPMENT.

3-50. The equipment installed permits the radar man to indicate that the airplane is in distress by means of an IFF response reserved for that purpose. To operate this feature of the equipment, tilt up the guard latch on the master control on the control unit, which is located to the left of the radar man (See figure 4-22, reference 11A) and rotate the switch to the "EMERGENCY" position.

3-51. Delete.

3-51A. EMERGENCY OPERATION OF AN/APX-6 IFF EQUIPMENT.

3-51B. To indicate an emergency or distress, press red dial stop on control unit and rotate "MASTER" selector to "EMERGENCY". (See figure 3-4, reference 6A).

3-51C. To explode destructors within the equipment, raise the switch guard labeled "DESTRUCT" and raise white switch handle to the "on" position. (See figure 3-4, reference 6A). If destructors were fired during flight, notify your commanding officer.

WARNING

Do not fire destructors unless the AN/APX-6 is in danger of falling into enemy hands. When in doubt about the area you are forced to land in fire the destructors.

3-52. EMERGENCY USE OF OXYGEN.

3-53. Should symptons occur suggestive of the onset of anoxia, or the regulator become inoperative, immediately turn on the emergency valve and descend below 10,000 feet.

3-54. Whenever excessive carbon monoxide or other noxious or irritating gas is present or suspected, then regardless of altitude, the air valve should be set to "100% OXYGEN" and undiluted oxygen used until danger is past or flight completed. Refer to paragraph 4-45.

3-55. Should brief removal of the mask from the face be necessary at high altitude, use the following procedure:

a. Take three or four deep breaths of "100% OXYGEN" (air valve lever at "100% OXYGEN" position).

b. Hold breath and remove mask from face.

c. As soon as practicable replace mask to face and take three or four deep breaths of "100% OXYGEN".

d. Reset air valve lever to "NORMAL OXYGEN" position.

3-56. MISCELLANEOUS EMERGENCY EQUIPMENT.

3-57. FIRST AID KITS AND FLASHLIGHTS. (See figure 3-1, references 6 and 12) A first aid kit and flashlight are stowed at the crown of the bulkhead forward of the deck turret and on the aft bulkhead of the radar compartment.

3-58. SIGNAL PISTOL. (See figure 3-1, references 3, 4 and 5) The signal pistol is installed in a socket in the crown of the fuselage aft of the radio operator, by inserting the muzzle and turning clockwise. The pistol is stowed in a holster beneath the socket and twelve cartridges are stowed just above the holster.

3-59. PARACHUTE FLARES. The flare release door, under the waist floor aft of the radome, handles one flare at a time and must be closed and reloaded manually. (See figure 3-1, reference 14) Normal release of flares is accomplished with a "FLARES" switch on the co-pilot's switch panel but a button on the control handle at the chute will also release them. (See figure 1-5, reference 10 and figure 3-1, reference 15) Two spare flares are stowed under the floor in the right forward corner of the waist compartment and are accessible through a door in the floor.

WARNING

Be sure that the tie down straps are tightened over flare and that door in flooring is closed and latched before releasing flare.

3-60. FOUL WEATHER PANELS.

3-61. DESCRIPTION OF FOUL WEATHER PANELS. A removable, transparent, foul weather panel is installed in each side of the pilot's enclosure. These panels are each secured in place by two hinges along the top, two latches along the bottom and a latch on the aft edge.

3-62. REMOVAL OF FOUL WEATHER PANELS.

a. Rotate each of the three latches to disengage panel.

b. Grasp handle on panel and move aft until the hinge pins disengage, freeing the panel.

WARNING

The clear vision panel is provided for emergency use only. Do not reinstall during flight.

3-63. PILOT'S COMPARTMENT SMOKE ELIMINATION. Use the following procedure to eliminate smoke entering the pilot's compartment from other compartments.

a. Close the door between the pilot's and navigator's compartment.

b. Open the pilot's and co-pilot's louvers (see figure 4-27, reference 2) and direct the nozzles toward the area between the pilot's face and the windshield.

c. Open the pilot's and co-pilot's heater outlets unless the smoke is issuing from them.

d. Open the manually-operated static ventilators located in the radio-radar compartment. See figure 4-20 reference 24 and figure 4-22 reference 20.

e. Close the curtain at the front spar, fuselage station 419.

SECTION IV

OPERATIONAL EQUIPMENT

4-1. ARMAMENT

4-2. BOMBING CONTROLS. The controls for bomber operation of the bomb bay doors, manual bomb release and K-25 camera are located on the bomber's switch panel. (See figure 4-3.)

4-3. BOMB BAY DOOR CONTROLS.

4-4. NORMAL OPERATION OF BOMB BAY DOORS. Bomb door control switches provided for both the bomber and co-pilot. (See figures 4-3 and 1-5, reference 13.)

a. Check that circuit breakers are in.

b. To open doors, move bomb bay door switch to "OPEN" and hold until doors are open as indicated by the indicator light.

NOTE

Limit switches on the doors prevent the release of stores until the doors are full open.

c. To close doors, move bomb bay door switch to "CLOSE".

4-5. EMERGENCY OPERATION OF BOMB BAY DOORS. (See figure 3-4, reference 7). Refer to paragraphs 3-39 and 3-43).

4-6. BOMB RELEASE CONTROLS.

4-7. MANUAL BOMB RELEASE.

a. Throw master switch on bomber's switch panel to "ON".

b. Close bombing circuit breakers.

c. Turn K-25 camera switch to "ON" and set camera timer.

d. Set intervalometer by turning the select train switch to the desired position.

e. If set at train, set the ground spacing and bombs to be released knobs.

f. Turn the indicator light switch on the bombers switch panel to "SELECTED".

g. Turn the switches on the bomber's switch panel for the stations to be released to "ON". Check to see that the corresponding indicator light is on.

NOTE

Bombs should be released alternately from either end of the bomb bay, to keep the remaining load balanced and the center of gravity reasonable constant. When releasing in "TRAIN" this is accomplished automatically.

h. Turn the manual switch on the bomber's switch panel to "ON".

NOTE

For either the pilot or co-pilot to release stores, the armament switch on the pilot's switch panel must be turned to "ON". (See figure 1-4, reference 7).

i. Hold the bomb bay door switch in "OPEN" position until indicator light comes on.

j. Throw fusing switch on bomber's switch panel.

k. Press firing key to release bombs or stores.

NOTE

If the intervalometer is set for "SELECT" release, a separate impulse is necessary to release each station.

l. If pictures other than those taken through the use of the K-25 camera are desired, set the camera auto-manual switch to "MANUAL".

m. After bombs or stores are released, close bomb bay doors by moving bomb bay door switch to "CLOSE".

n. Turn off all switches on bombers switch panel.

4-8. RADAR BOMB RELEASE. For releasing bombs or stores by means of the AN/APA-5A radar bomb sight refer to paragraphs 4-129 through 4-132.

4-9. TORPEDO RELEASE. Torpedoes may be released by the pilot, co-pilot or bomber. For sighting, the pilot uses a MK-9 illuminated sight which is stowed behind the co-pilot.

a. Mount sight in bracket on the left windshield frame and secure.

b. Connect electrical plug to sight.

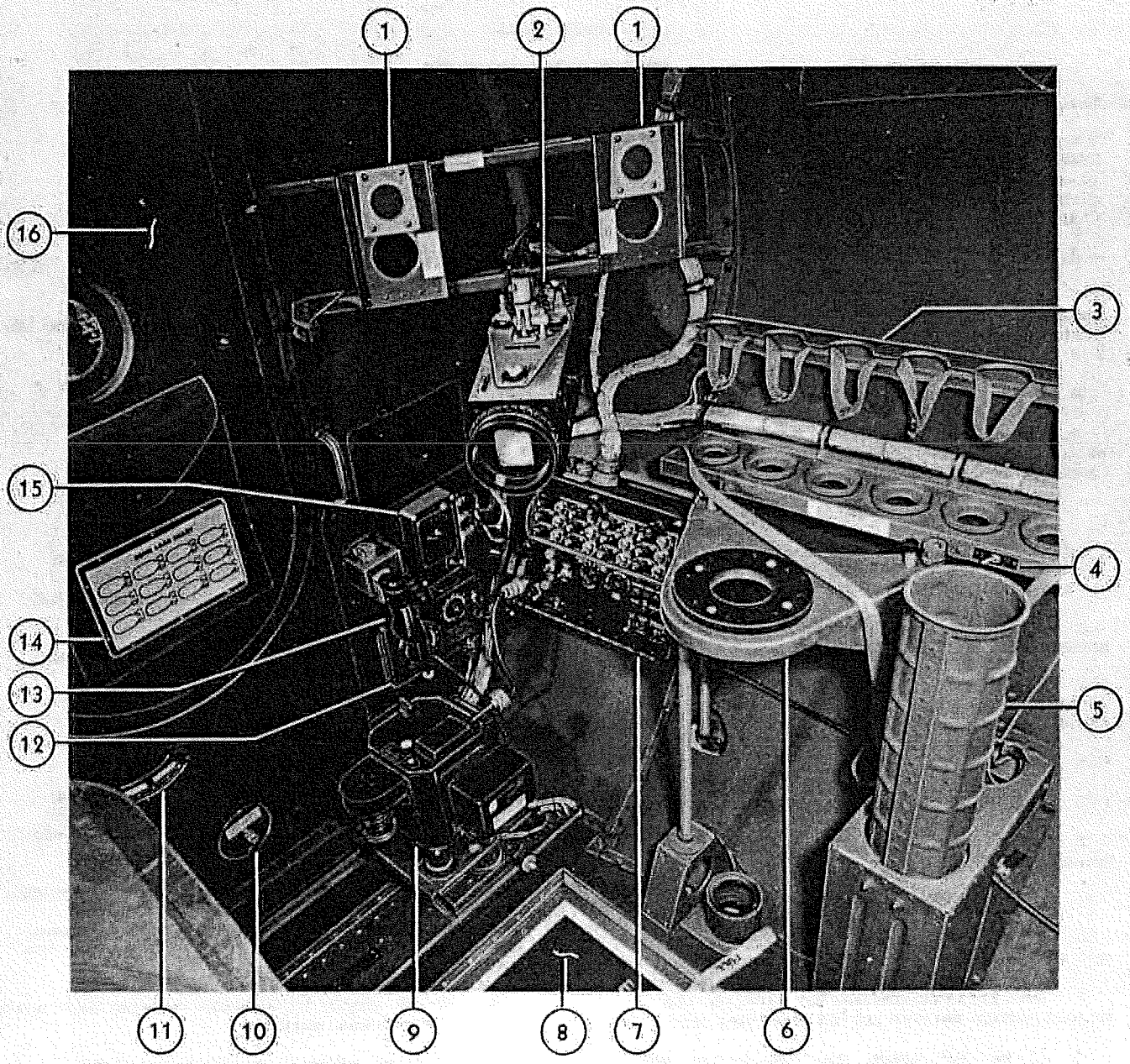
c. Turn and adjust brilliance of the pip and rings by means of the rheostat on the sight.

d. Adjust reflector for torpedoes.

e. Check that bomber has set up manual bomb release system.

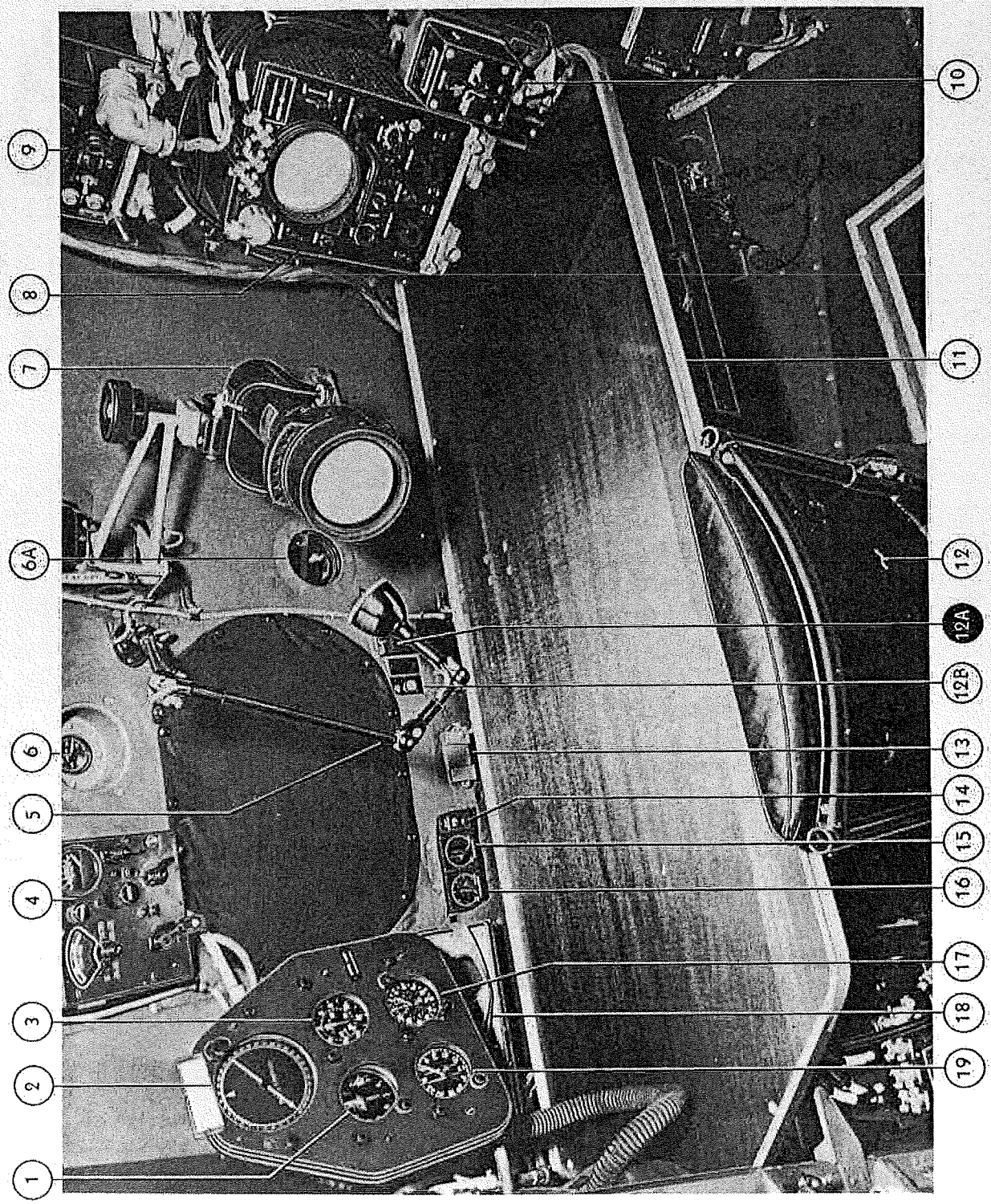
f. Turn armament switch on pilot's switch panel to "ON". (See figure 1-4, reference 7).

g. Open bomb bay doors by moving bomb bay door switch on co-pilot's switch panel to



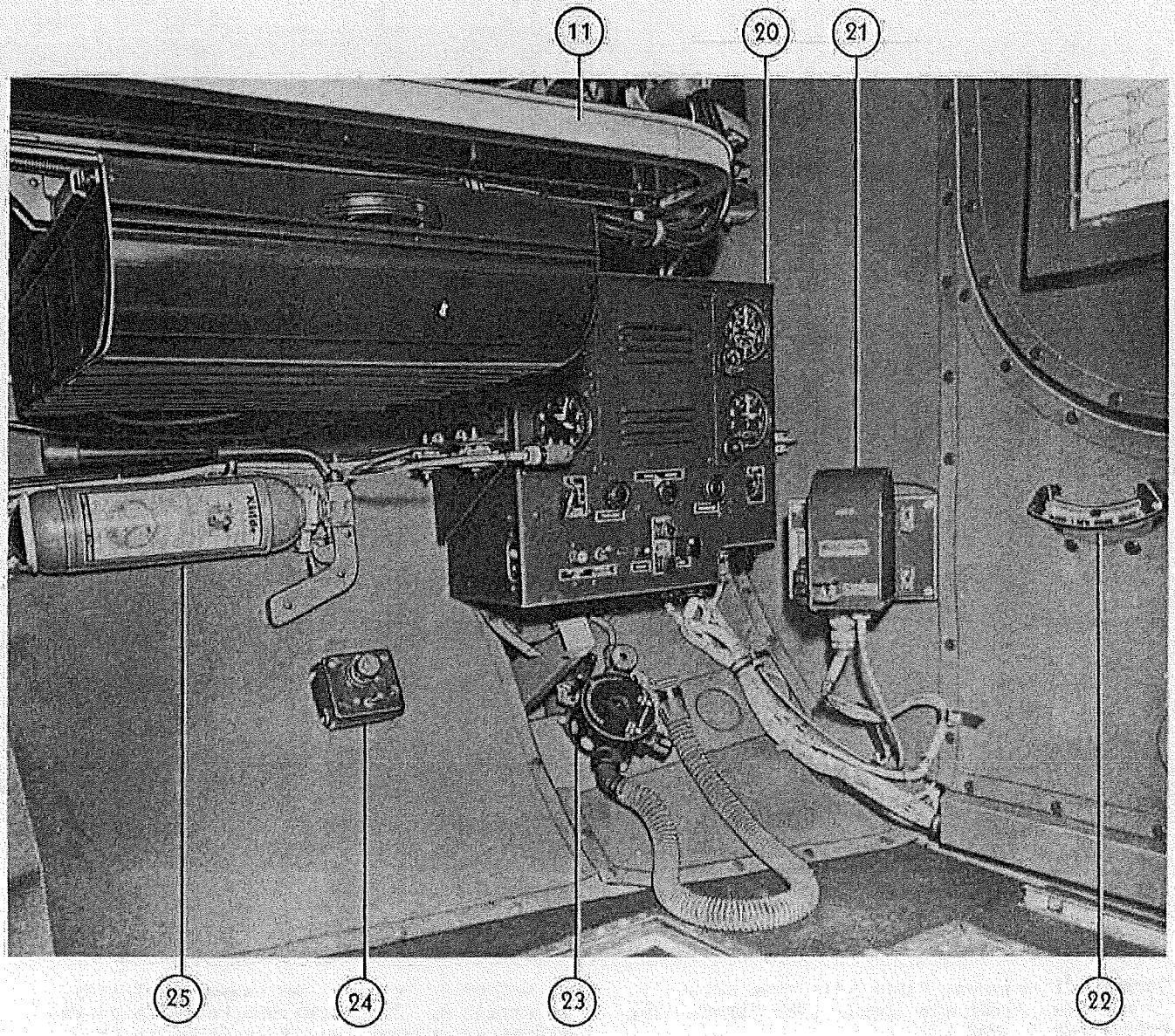
1. B3B Intervalometer Wedge Plate
2. AN/APA-5A Indicator
3. Drift Signal Stowage
4. Drift Meter Switch
5. Drift Flare Chute
6. Drift Meter Support
7. Bomber's Switch Panel (See figure 4-3)
8. Hydroflap (See Figure 3-2)
9. Gyro Stabilizer
10. Bow Turret Emergency Elevation Drive
11. Inclinometer
12. Intervalometer
13. Firing Key
14. Bomber's Data Case
15. Timing Control Unit
16. Door to Bow Turret

Figure 4-1. Bomber's Station



See Sheet 2 For Equipment Under Table

Figure 4-2 (Sheet 1 of 2 Sheets) - Navigator's Station



See Sheet 1 For Equipment Above Table

1. Altimeter
2. Radio Compass Indicator
3. Airspeed Indicator
4. Radio Compass Control Unit
5. Table Light
6. Free Air Thermometer
6A. Ventilator
7. AN/APS-33A Indicator
8. AN/APN-4 Loran Indicator
9. AN/ARR-31 Receiver
10. Interphone Station Box
11. Navigator's Table
12. Navigator's Seat
12A. Bomb Bay Tank Fuel Quantity Counter
12B. ICS Call Light *
13. Astro Compass Wedge Plate
14. Utility Receptacle Switch
15. Table Light Rheostat
16. Panel Light Switch
17. Elapsed Time Clock
18. Navigational Watch Stowage
19. Compass Repeater Indicator
20. AN/APA-5A Control Box
21. AN/APA-5A Range Tracking Unit
22. Inclinometer
23. Oxygen Regulator
24. Navigator's Extension Light
25. Fire Extinguisher

Figure 4-2 (Sheet 2 of 2 Sheets) - Navigator's Station

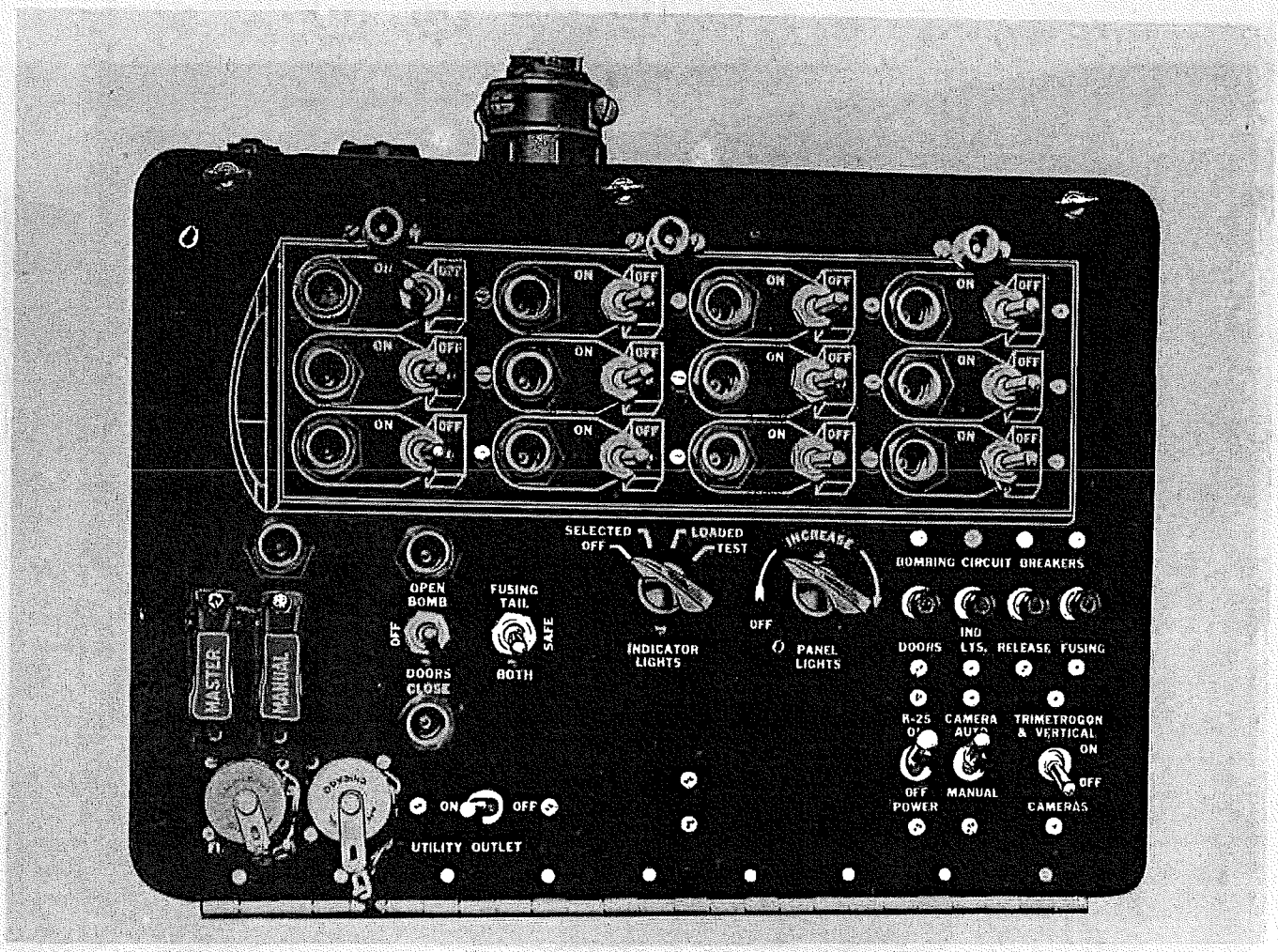


Figure 4-3. Bomber's Switch Panel

"OPEN". (Indicator light will come on at "OPEN" when doors are open) (See figure 1-5, references 11 and 13).

h. Release torpedoes by using firing switch on pilot's or co-pilot's control wheel.

i. After releasing torpedoes, close doors by moving switch to "CLOSE" position.

4-10. MINE LAYING. Mine laying procedure is the same as torpedo release, except that the sight reflector is set for mines. Refer to paragraph 4-9.

4-11. LOW LEVEL BOMBING. Low level bombing is accomplished through the same procedure as for releasing torpedoes except that the sight reflector is set for the angle, determined from low level bombing tables, for the altitude and speed at which bombs are to be released.

4-12. BOMB BAY TANK RELEASE.

4-13. Bomb bay tanks may be released selectively or in train as desired. When released in "TRAIN", the intervalometer should be set up to release the tanks as rapidly as possible. The tanks may be released by either the bomber, pilot or co-pilot as desired.

Bomb bay tanks are carried on bomb stations as follows:

Tanks	Bomb Stations
Tank Number 1 (forward tank)	Stations 1 and 3
Tank Number 2	Stations 7 and 9
Tank Number 3	Stations 10 and 12
Tank Number 4	Stations 4 and 6

4-14. Release of individual bomb bay tanks is accomplished by setting up the manual bomb release system. After the two bomb stations on which the bomb bay tank to be dropped have been selected on the bomber's switch panel, the intervalometer should be set on "TRAIN" and the interval dial adjusted to release tank as fast as possible.

4-15. Release of all bomb bay tanks consecutively in one operation is accomplished in the

same manner as for releasing an individual tank except that all bomb stations on which tanks are installed must be selected on the bomber's switch panel. For salvo release refer to paragraph 3-40.

NOTE

If one station fails to release the tank, the tank will still drop as only one end of the tank suspension sling need be loose to permit the tank to drop.

4-16. GUN TURRETS.

4-17. MARK 18 MOD. 6 TURRET GUN SIGHT.

4-18. DESCRIPTION OF MARK 18, MOD. 6 GUN SIGHT.

4-19. This gunsight is a lead computing gunsight, with which is combined an independent fixed sight. The lead-computing mechanism is an electro-magnetically controlled gyroscope and the computed lead is made visible in the gunner's field of view by an optical system which employs a reflection from the gyro mirror. The gunsight automatically computes and makes the necessary lead and windage allowances for accurately hitting the target when the gunner performs the following steps: sets into the instrument the correct range of target, the correct altitude and his own correct indicated air speed. The correct azimuth and elevation of the target relative to the gunner is automatically set in. The gunner must then accurately track the target.

4-20. The target is viewed by the gunner through a clear-glass reflector-plate, in which are reflected the images of two bright-line reticle patterns which are projected to infinity by two similar optical systems. The circle and/or cross reticle image seen by the left eye is fixed, and establishes a line of sight which is boresighted with the guns. The gyro reticle image seen by the right eye is the lead-computer image, consisting of six radially disposed diamond-shaped dots with a round dot in the center. The gunner may vary the distance of the diamond-shaped dots from the central dot in two ways, both of which may be used to obtain the range of his target; first, by setting the span handle to the known wing span of the target airplane; and second, by foot pedal range control. Depressing the pedal decreases range and allowing it to rise increases range. With increase in range the diamonds close in on the central dot; decreasing the range opens out the pattern of diamonds.

4-21. The gunner's objective is to bring the sight to bear on the target and to keep the inside points of the diamonds adjusted so that the distance, between opposite pairs, exactly equals the wing span of the target as the target comes within range and while it is being fired upon.

4-22. If the gunner has set into the instrument the correct values of altitude and indicated air speed for his own aircraft, and if he accurately tracks his target, the sight will automatically compute and compensate for the following factors necessary to make a hit:

a. Gunner's deflection and target deflection: based on range, altitude and relative angular velocity of the target. The gun must be pointed ahead of, or lead, the target.

b. Windage or bullet trail: based on range, altitude, indicated air speed, and gun azimuth and gun-elevation. The gunner must point the gun slightly towards his own bow in order to nullify the effects of windage on his bullets.

c. Gravity drops: based on range and gun-elevation. The gunner must point the gun slightly upward in order to nullify the effects of gravity on his bullets.

4-23. OPERATION OF MARK 18, MOD. 6 GUN SIGHT.

a. After the turret is operating and the sight on, set the dials on the control box to the airplane's altitude and airspeed.

b. Turn the selector switch to "FIXED AND GYRO" (or at night to "GYRO NIGHT").

c. Adjust the light with the "DIM-BRIGHT" control.

d. Raise the sun filter if necessary, with the lever on the right side of the sight.

e. When the target is sighted and identified, turn the span handle on the front of the sight to the target wing span.

f. If time allows, reset altitude and airspeed dials.

g. Bring the center pip to bear on the spot you wish to hit and with the ranging control, frame the target so that the imaginary ranging circle, formed by the inner points of the diamonds, touches the wing tip.

NOTE

Be sure you frame the target within a circle, not within a six sided figure formed by joining the dots with straight lines.

h. The ranging control is a pedal for the right foot, which changes from maximum range to minimum range when depressed. The gyroscope is caged when this pedal is released.

i. As the target gets closer and appears larger, keep the target framed by depressing the pedal. If a true view of the wing is not presented, ranging must be accomplished by using the fuselage.

j. As the target moves, operate the turret to keep the target framed.

k. Always keep the gyroscope caged when slewing the turret to prevent its tumbling.

l. When on the target, tracking must be smooth and deliberate and must be done for a short distance before firing to allow the computing mechanism to operate efficiently.

m. If the sight selector switch is turned to "FIXED", only the fixed reticle will appear.

n. It is usually best to set the selector switch at "FIXED AND GYRO" so that in the event of failure of the gyroscope or related equipment when a target is present, the fixed sight is there for continued action. If the two reflections confuse, the fixed reflection may be masked by depressing the lever on the left of the sight unit.

4-24. BOW TURRET MODEL AERO 9A. (See figure 4-4).

4-25. DESCRIPTION OF THE BOW TURRET.. The electrically operated spherical bow turret installed in the forward section of the airplane mounts two 20 mm guns and a MK-18, Mod. 6 lead computing sight. Four ammunition boxes are installed under the floor aft of the turret. Flexible chutes carry the ammunition through the boosters, in the crown of the airplane, to the guns which are electrically operated and pneumatically charged. All the drive components and the main junction box are located outside the turret but in the turret compartment.

4-26. NORMAL OPERATION OF BOW TURRET. (See figures 4-4 and 4-5).

WARNING

Do not occupy any turret during take-off and landing due to its exposed location in case of an accident. Before entering the turrets make sure that the master switch in the turret and the main power switch on the main junction box are turned to "OFF".

a. Open canvas and metal doors by means of the zipper and latches respectively.

b. Grasp the assist handles directly above the turret door and swing, feet first, into the seat with legs along the shelves, the left foot resting against the foot rest and the right foot resting on the gun sight range control pedal.

CAUTION

Do not use the sight, sight bracket or control handles as assist handles.

c. When secure in turret, establish contact with the crew and have the bow turret power switch on the circuit breaker panel turned to "ON".

d. Check to insure that the manual drive clutch levers are in "POWER" position.

e. Turn main power and master switches to "ON".

f. Grasp the control handles and depress one or both of the action switches. The turret will then operate as directed by movement of the handles.

g. To use the guns, place the gun selector switch in the desired position, usually "BOTH GUNS".

h. Turn gun heater switch to "ON" if required.

i. Turn camera switch to "ON" if required.

j. Turn sight switch to "ON". Refer to paragraph 4-17 through 4-23.

k. To charge the guns, press the gun charging buttons located just inboard of the guns behind the control handles.

l. When ready to fire, move the gun safety switch to the "FIRE" position.

m. Press the triggers in the control handles to fire the guns and operate the camera.

n. When approximately 200 rounds have been fired from each gun, level the guns,

rotate the turret into its extremes of travel in azimuth and dump the ejected cases and links into the airplane by pulling up the handle on the shelf.

NOTE

The ejected cases and links are retained in the airplane in flight to prevent them from fouling the turbo-jet engines. The capacity of the hoppers is only half that of the ammunition boxes, necessitating emptying them into the airplane after approximately 200 rounds have been fired from each gun. Hopper doors must be closed to prevent dumping cases and links on the fairing. If cases and links get between the turret and fairing it is necessary to remove the fairing, to remove them. This can only be done on the ground.

o. Before leaving the turret the guns should be emptied, leveled and pointed straight ahead and all switches should be turned off.

p. To leave the turret, open the doors, grasp the assist handle and swing out.

4-27. MANUAL OPERATION OF BOW TURRET.

a. To operate the turret manually move the manual drive clutch levers into the "MANUAL" position.

b. Use the crank located on the left side in the crown of the turret to move the turret in elevation and the crank located on the

right side in the crown of the airplane just aft of the turret to move the turret in azimuth (See figure 4-4, references 10 and 16)

c. The guns can also be moved in elevation from outside the turret by installing a crank on the shaft which extends from the drive motor, to under the step at the forward bulkhead in the bomber, navigator's compartment and turning as desired. In this case the elevation clutch lever within the turret must be left in the "POWER" position. This crank is stowed above the bombing controls when not in use.

4-28. DECK TURRET, MODEL 250 CE-324. (See figures 4-6 and 4-7).

4-29. DESCRIPTION OF THE DECK TURRET. This turret is a stabilized, self-contained, electrically operated, cylinderical unit installed in the upper surface of the waist compartment. Two .50 caliber machine guns are mounted. These guns are electrically operated but hand charged. A MK-18, Mod. 6 lead-computing gunsight is provided.

KEY TO FIGURE 4-4

1. 20 MM Guns
2. Compressor
3. Ammunition Boosters
4. Ammunition Chutes
5. Generator
6. Ammunition Boxes
7. Interphone Station Box
8. Main Junction Box
9. Foot Rest
10. Elevation Manual Drive
11. Feed Mechanism
12. Access Door
13. Hand Grip
14. Sighting Unit
15. Control Panel (See figure 4-5)
16. Azimuth Manual Drive
17. Range Control Pedal
18. Gun Charger Button
19. Canvas Door and Seat
20. Empty Case and Link Door Handle
21. Canvas Door Handles
22. Interrupter
23. Deflector
24. Drive Motors
25. Control Handles

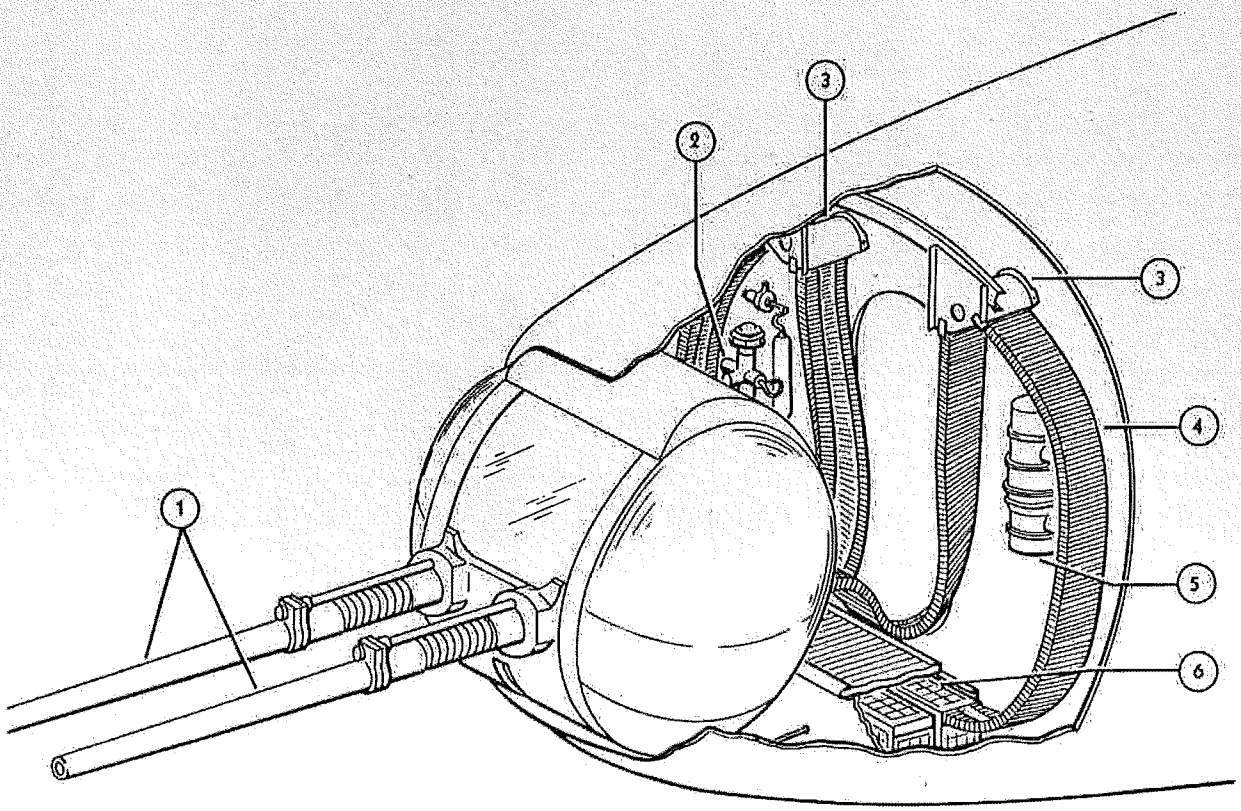


Figure 4-4 (Sheet 1 of 2 Sheets) - Bow Turret

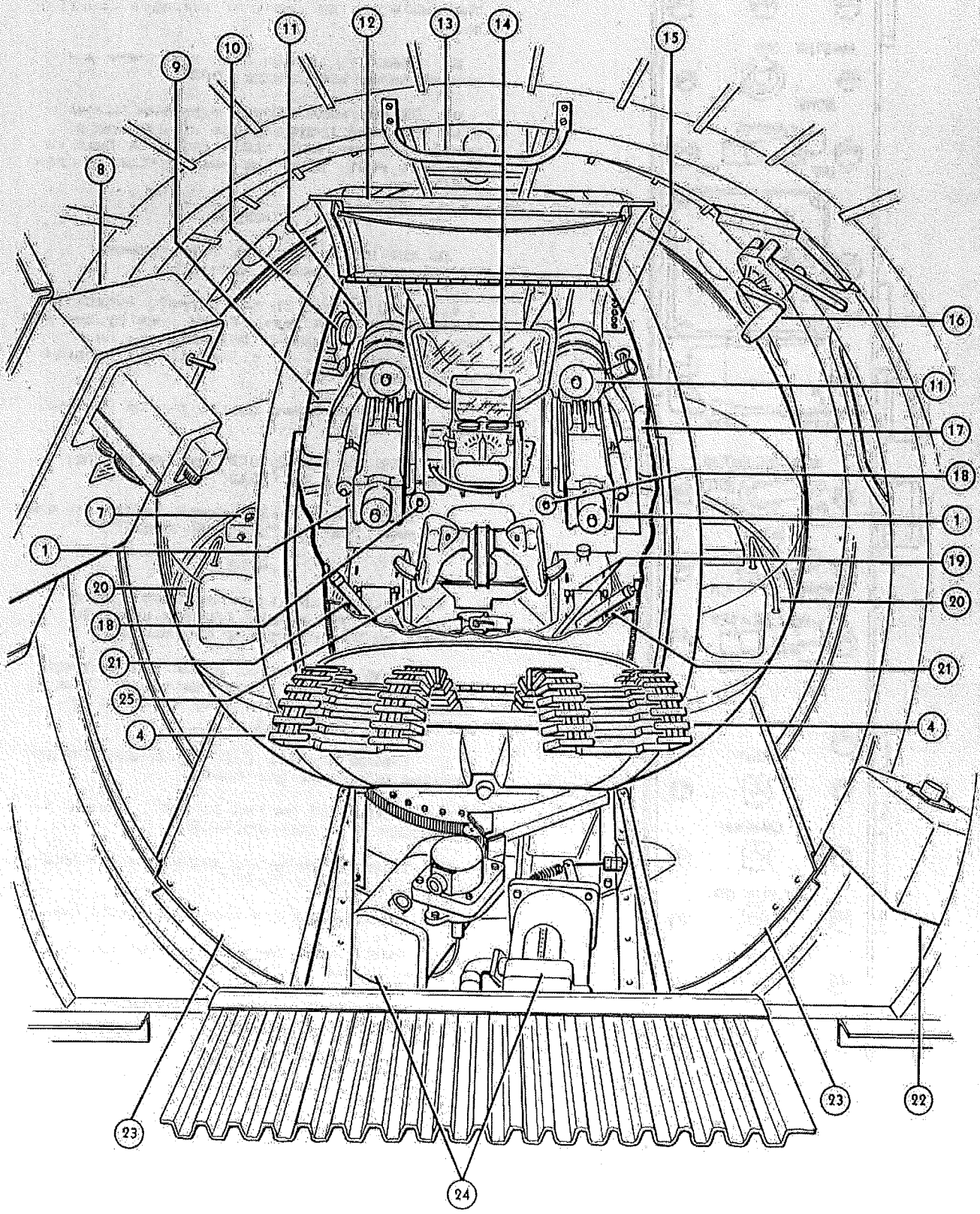


Figure 4-4 (Sheet 2 of 2 Sheets) - Bow Turret

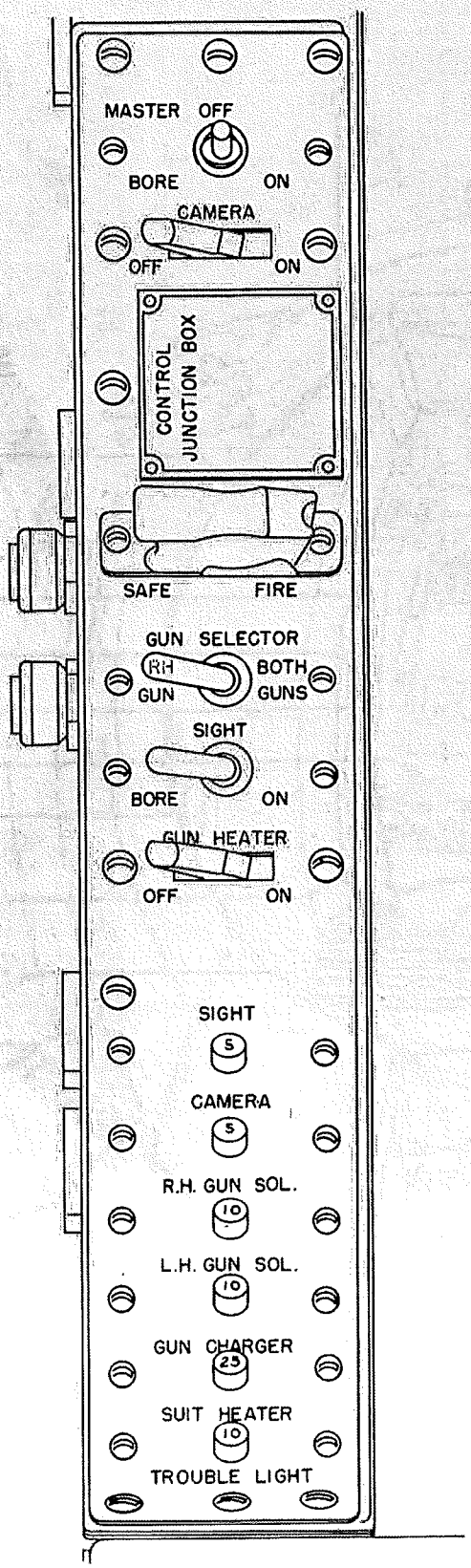


Figure 4-5. Bow Turret Control Panel

4-30. NORMAL OPERATION DECK TURRET. (See figure 4-6, 4-7 and 4-8).

a. Release the seat bottom by pulling on the cable at the front of the main junction box.

b. Check to insure that the power and gun switches are turned "OFF".

c. Climb, head first, into the turret. With one hand grasping one of the assist handles on the turn table and both feet on the foot rest, slam the seat bottom up into position.

CAUTION

Do not use any of the turret mechanism as an assist handle.

d. When secure in the turret, establish contact with the rest of the crew by use of the interphone system and have the deck turret power switch on the circuit breaker panel turned "ON".

e. Turn the power switch on the control panel to "ON".

f. Turn the "STAB-OFF" switch on the servo amplifier to "STAB".

g. Turn the inverter power switch on the servo amplifier to "INVERTER POWER".

NOTE

After the stabilizer has been turned on, wait one minute for the tubes to heat before operating the turret.

h. Grasp the control grips and depress one or both of the action switches. The turret will then operate as directed by movement of the grips.

i. Charge guns by pulling on gun charger handles under the gun butts.

j. Turn sight switch to "ON". Refer to paragraph 4-17 through 4-23.

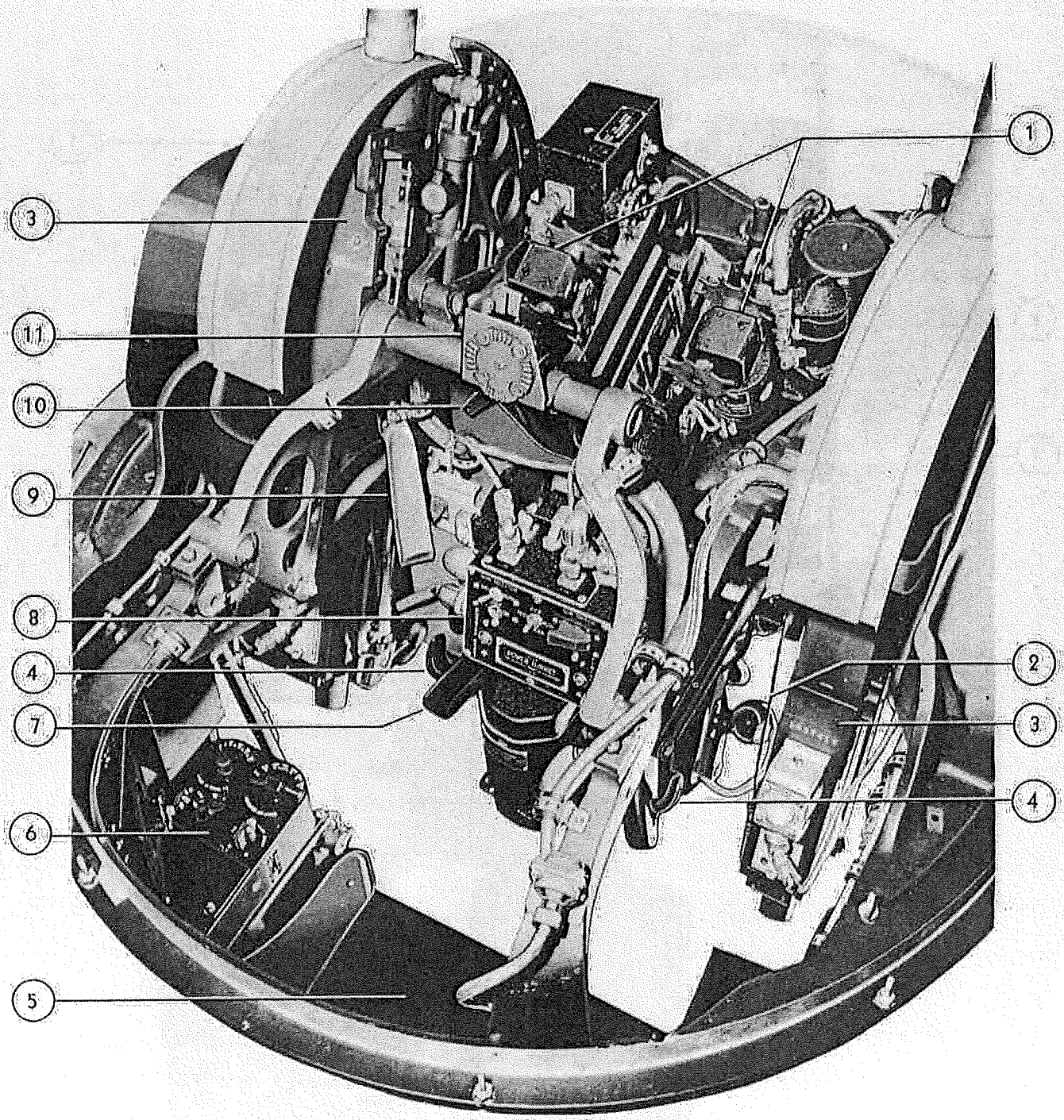
k. Turn gun selector switch to desired position, usually "BOTH".

l. Raise guard and turn gun switch on.

m. Turn camera switch to "RUN" if it is desired to use the camera.

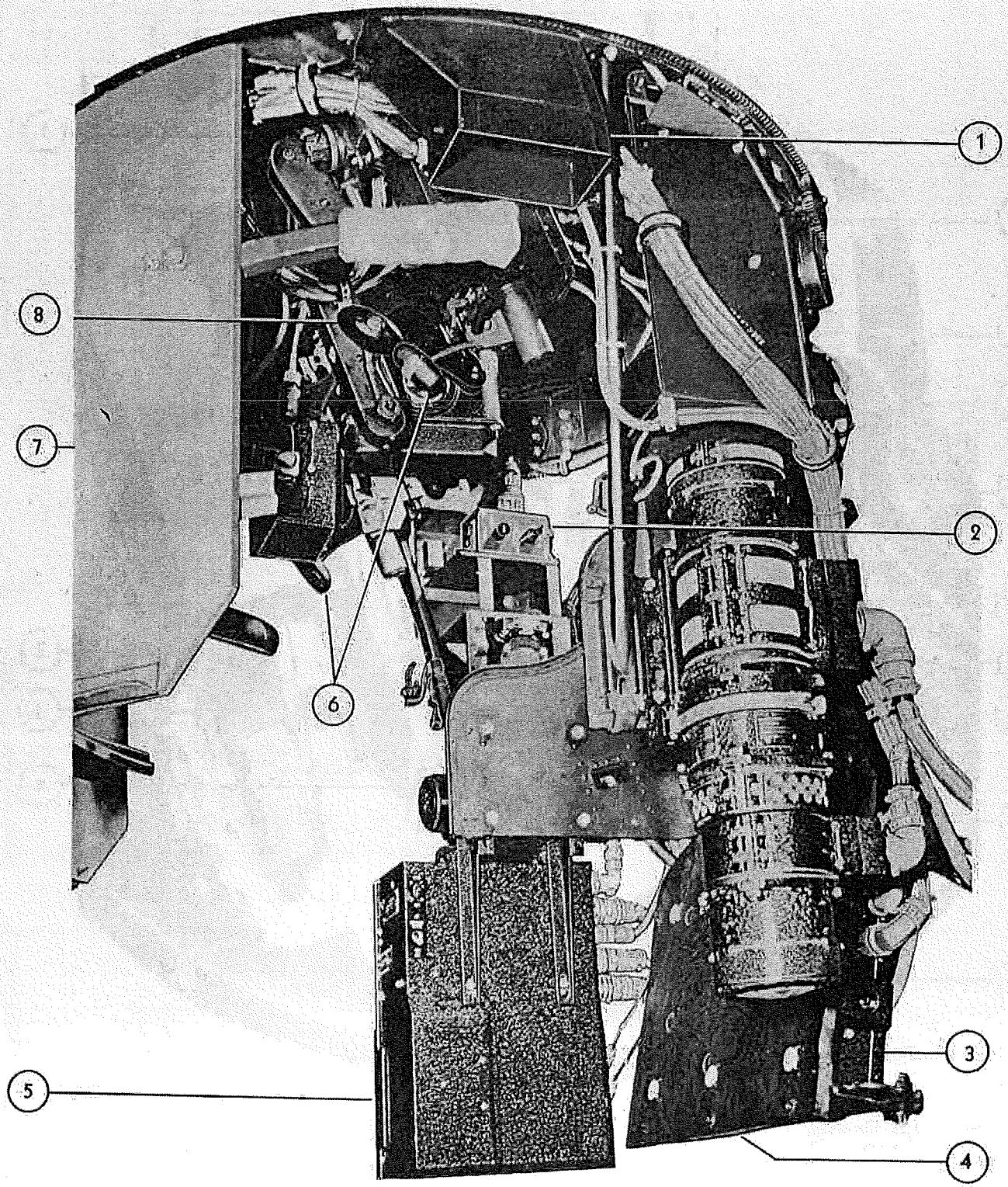
n. Depressing either or both of the triggers will cause the camera to operate and the guns to fire if the gun selector switch was turned to "BOTH". Either trigger will fire both guns and if placed in "IND" position each trigger will fire its respective gun.

o. Before leaving the turret, empty and level the guns and point aft. Make sure all switches are turned off.



1. Ammunition Booster
2. Azimuth Manual Drive
3. Machine Gun
4. Action Switch
5. Seat
6. Sight Control
7. Control Grip
8. Control Panel (See figure 4-8)
9. Assist Handle
10. Elevation Drive Clutch Release Handle
11. Sight Mount

Figure 4-6. Deck Turret - Upper View Without Sight



1. Ejected Case and Link Chute
2. Interphone Box
3. Main Junction Box
4. Seat (Open for Entrance)
5. Servo Amplifier
6. Gun Charging Handle
7. Armor Plate
8. Elevation Manual Drive

Figure 4-7. Deck Turret - Lower View

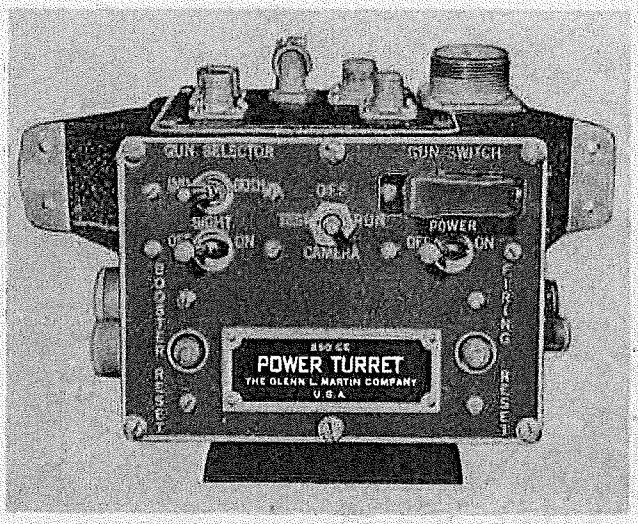


Figure 4-8. Deck Turret Control Panel

p. To leave the turret, place both feet on the foot rest, grasp one of the assist handles with one hand and release the seat bottom with the other.

CAUTION

Do not use any of the turret mechanism as an assist handle.

4-31. MANUAL OPERATION OF DECK TURRET.

a. Release the drive motor clutches by turning the clutch levers. The elevation clutch lever is located just inboard of the left gun, and the azimuth lever is located under the turntable behind the right hand manual drive handle. (See figure 4-6, reference 10).

b. Turn the left manual drive handle to move the turret in elevation and the right manual drive handle to move the turret in azimuth. (See figure 4-6, reference 2 and figure 4-7, reference 8).

c. To fire the guns when operating the turret manually, press the button in the right hand manual drive handle.

4-32. TAIL TURRET, AERO 11B. (See figure 4-9).

4-33. DESCRIPTION OF THE TAIL TURRET. The Aero 11B tail turret forms the entire fuselage, aft of the tail surfaces. It is made in two sections; a stationary forward section housing the gunner and all controls, and a movable aft sphere which houses the two 20 mm guns. Two ammunition boxes are installed near the turret with flexible chutes leading to the guns. The movable portion of the turret is powered by an electro-hydraulic unit, controlled by hand grips used in conjunction with a set of switches on a junction box. A MK-18, Mod 6 lead computing sight is used and the guns are electrically fired and hand charged.

KEY TO FIGURE 4-9

1. Span Handle
2. Trigger Switches
3. Assist Handles
4. Microphone Switches
5. Turret
6. Azimuth Manual Drive Handle
7. Action Switches
8. Control Grips
9. Hand Chargers
10. Seat
11. Range Control Pedal
12. Foot Rest
13. Junction Box
14. Ammunition Feeder Wrench
15. Hydraulic Pump Unit
16. Ammunition Boxes
17. Ammunition Chutes
18. Ammunition Booster
19. Arm Rests
20. Control Box
21. Elevation Manual Drive Handle
22. Back Rest
23. Interphone Control Box
24. Sight Control Box
25. Sighting Head

4-34. NORMAL OPERATION OF TAIL TURRET. (See figures 4-9 and 4-10).

WARNING

Do not occupy any turret during take-off and landing as this would place the occupant in an exposed position in case of an accident.

a. Before entering the turret be sure that the master switch is turned to "OFF".

b. To enter the turret, place the left foot on the step just in front of and to the left of the seat, grasp the two assist handles on the structure just forward of the sight, swing the right leg over all obstructions and slide into the seat placing the right foot on the range control pedal.

CAUTION

Do not use the control grips or sight bracket for assist handles and do not enter the turret from the right side.

c. When secured in the turret, establish contact with the rest of the crew using the interphone system and have the tail turret power switch on the circuit breaker panel turned to "ON".

d. Rotate each manual drive hand crank out of contact with the square end of its shaft and secure in the disengaged position with the strap provided.

e. Turn master switch to "ON".

NOTE

The master switch must be "ON" approximately 30 seconds before the hydraulic power unit will operate

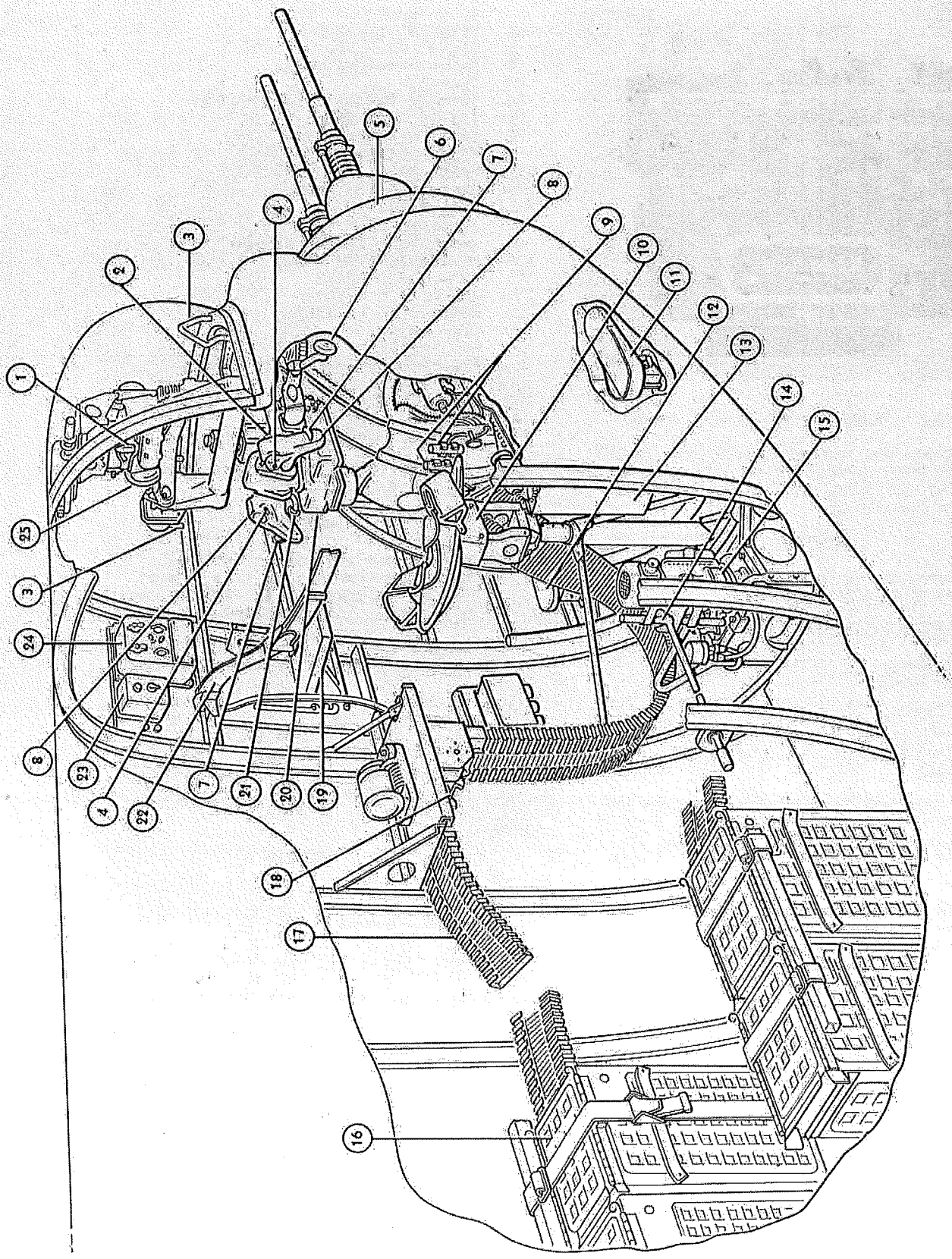


Figure 4-9. Tail Turret

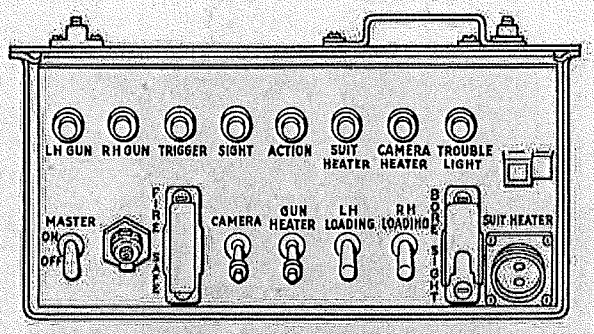


Figure 4-10. Tail Turret Switch Panel

due to a time delay feature of the electrical system.

f. Grasp the control grips and depress one or both of the action switches. The turret will then rotate as directed by movement of the control grips.

g. Charge the guns by sharply pulling the charger handles all of the way forward.

h. Turn the gun heater switch on if required.

i. Turn the camera switch on if required.

j. Raise guard and turn the gun safety switch to "FIRE". In addition to supplying power to the guns this will also turn on the sight. Refer to paragraphs 4-17 through 4-23.

k. The camera may now be operated and the guns fired by depressing the triggers on the control grips.

l. Before leaving the turret the guns should be emptied, leveled and pointed aft and all switches should be turned off.

4-35. MANUAL OPERATION OF THE TAIL TURRET.

NOTE

Make certain that the gun safety switch is on "SAFE" and master switches are off before operating the turret manually.

a. Release the desired hand crank from it's retainer strap.

b. Rotate the crank until it engages the squared end of the shaft.

c. Press the handcrank knob inboard to disengage the turret drive-motor clutch.

d. While holding the clutch disengaged, rotate the crank in the direction to produce the desired turret movement.

e. When finished, rotate the hand crank out of engagement with it's shaft and stow it with it's retainer strap.

4-36. PHOTOGRAPHIC EQUIPMENT. (See figure 4-11).

4-37. A K-25A Bomb damage assessment camera may be installed on the mount under the cameraman's seat. This camera is controlled by the bomber. Refer to paragraph 4-6. Stowage for this camera is provided on the left side of the crown of the fuselage above the vertical camera mount. A magazine stowage rack is provided in the crown opposite the camera stowage.

4-38. Other than the K-25A bomb damage camera, this airplane may have any combination of cameras installed on the vertical mount and tri-metrogon mount, located in the waist compartment, as listed below:

Vertical Mount

Quantity	Camera Type
1	K-17 (12 or 24 inch lens)
1	K-18
1	F-56 ($8\frac{1}{4}$ or 20 or 40 inch lens)
1	K-17 (12 inch lens)
1	K-17 (24 inch lens)
1	K-18
1	F-56 ($8\frac{1}{4}$ inch lens)
1	F-56 (20 inch lens)
1	F-56 (40 inch lens)

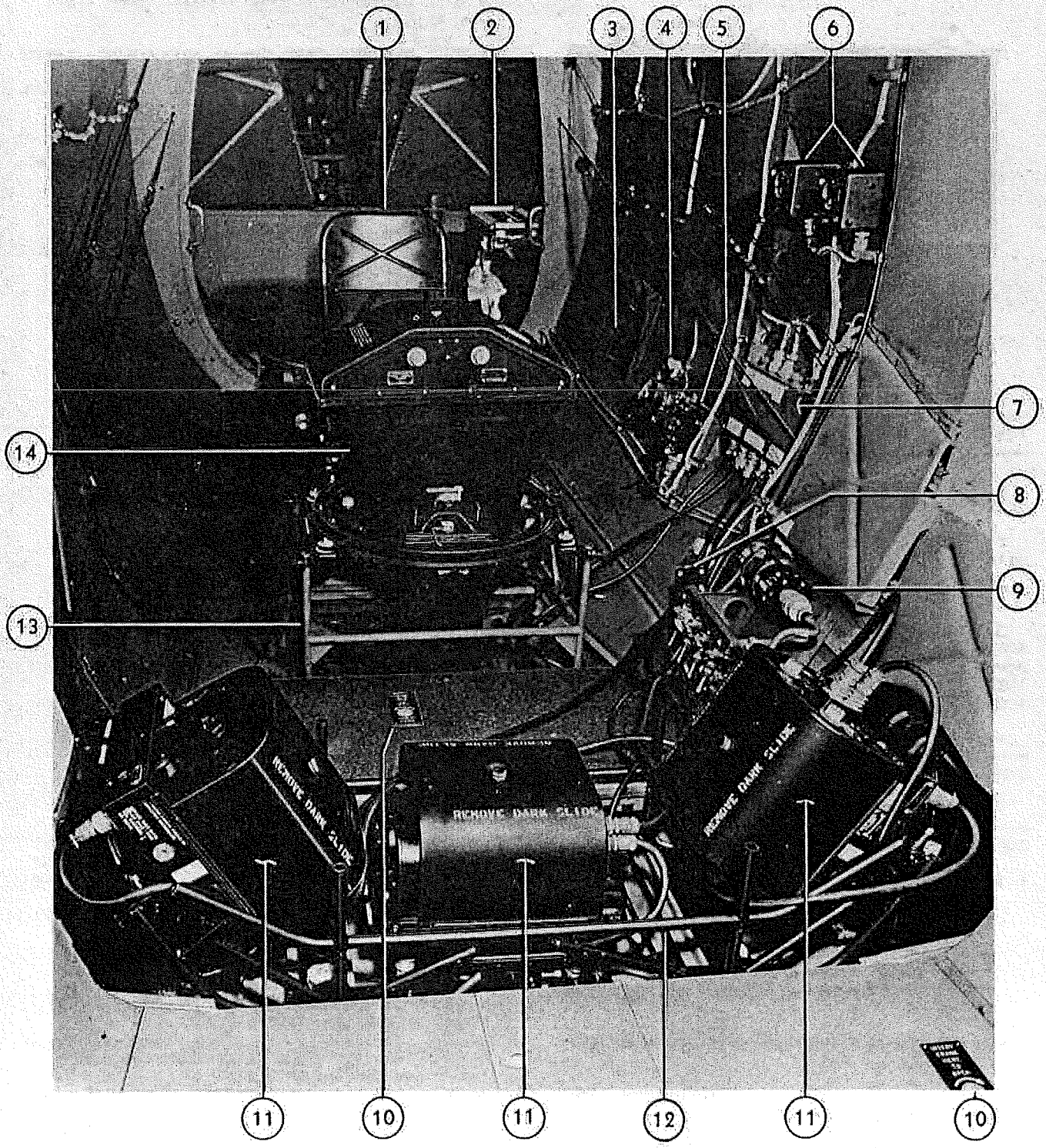
Tri-Metrogon Mount

Quantity	Camera Type
3	K-17 (6 inch lens)
1	K-17 (12 inch lens)
1	K-17 (24 inch lens)
1	K-18
1	F-56 ($8\frac{1}{4}$ inch lens)
1	F-56 (20 inch lens)
1	F-56 (40 inch lens)

4-39. After the desired cameras are installed their electrical leads must be connected to the applicable receptacles in the camera junction box which is located on the right side of the fuselage opposite the vertical camera. Each receptacle is identified by a decalcomania. The vacuum lines must also be connected.

4-40. A type A-2 view finder may be installed on the mount provided directly in front of the cameraman's seat.

4-41. Two type B-3B intervalometers are installed on the left side of airplane forward of the camerman's seat. One of these intervalometers is used to control the vertical camera and the other controls the three tri-metrogon cameras. Before using, the intervalometer electrical leads must be attached to the camera junction box at the proper receptacle. Each receptacle is identified by a decalcomania.



1. Cameraman's Seat
2. AN/APN-1 Transmitter-Receiver Mount
3. Oxygen Mask Stowage Bag
4. Oxygen Regulator
5. Interphone Station Box
6. Camera Intervalometer
7. Camera Junction Box
8. Suction Gage
9. Vacuum Pump
10. Camera Door Crank Socket
11. Camera
12. Tri-Metrogon Camera Mount
13. Vertical Camera Mount
14. Vertical Camera

Figure 4-11. Camera Station

4-42. OPERATION OF VERTICAL AND TRIMETROGON CAMERAS.

a. Check that cameras and intervalometers are installed and connected to the camera junction box and vacuum system.

b. Check that camera control and power circuit breakers on circuit breaker panel are pushed in.

c. Set intervalometers to desired camera shutter tripping interval.

d. Throw intervalometer power switch to "ON".

e. Throw either the switch on the camera junction box or the tri-metrogon and vertical camera switch on the bomber's switch panel to "ON".

f. The cameras will now operate at the selected intervals unless the extra picture switch or recycle knob on the intervalometer is operated. Operation of the extra picture switch causes an extra picture(s) to be taken without affecting the interval set up on the intervalometer. Operation of the recycle knob trips the camera(s) before the present interval is completed.

g. The cameras may be stopped by turning "OFF" their respective intervalometer switches or by turning "OFF" their power switches located on the camera junction box and the bomber's switch panel (both switches must be turned "OFF").

4-43. OXYGEN SYSTEM.

4-44. DESCRIPTION OF THE OXYGEN SYSTEM. The airplane is equipped with an eleven station, high pressure, diluter-demand oxygen system supplied by three 514 cubic inch bottles at 1800 psi. The diluter demand regulators are located at each station and in the bow and deck turrets. Each regulator automatically mixes the air and oxygen to meet the requirements for oxygen at the altitude the airplane is flying. Each regulator has a blinker flow indicator, a diluter valve and an emergency valve. (See figure 4-12) Turning the diluter valve to "NORMAL OXYGEN" allows air to be drawn into the breathing tube to be automatically mixed with oxygen from the oxygen supply to provide the total oxygen required up to approximately 30,000 feet altitude, 100 percent oxygen is delivered. Turning the diluter valve to "100 PERCENT OXYGEN" allows pure oxygen (not mixed with air) to be delivered at any altitude. While oxygen is being used, the blinker should be flashing on and off. In event of failure of the oxygen regulator, the emergency valve may be used. Turning this valve on (direction as indicated by arrow) allows pure oxygen to be supplied, directly to the mask, by completely by-passing the regulator, regardless of the position of the diluter valve.

WARNING

Should symptons occur suggestive of anoxia or if the regulator should become inoperative, immediately turn on the emergency valve and descend below 10,000 feet altitude. When used, the emergency valve should be opened slowly to obtain minimum flow required.

4-45. DURATION OF OXYGEN SUPPLY. Allowing for a drop in pressure from 1800 to 300 psi, the duration of the oxygen supply at various altitudes is as follows:

Altitude In Feet	Diluter Valve Normal Oxygen	Diluter Valve 100% Oxygen
5,000	22.5 Man hours	2.7 Man hours
10,000	27.0 Man hours	3.4 Man hours
15,000	25.5 Man hours	4.2 Man hours
20,000	20.7 Man hours	5.4 Man hours
25,000	12.3 Man hours	6.9 Man hours
30,000	9.3 Man hours	9.3 Man hours
35,000	12.6 Man hours	12.6 Man hours

4-46. PREFLIGHT CHECK OF OXYGEN SYSTEM. The following items must be checked prior to flight:

a. Check pressure gage for sufficient oxygen by opening cylinder valve and reading gage (1800 psi denotes full cylinder).

b. Put on oxygen mask and test for fit by placing thumb over end of breathing tube and inhaling lightly. If the mask adheres tightly to the face and resistance to inhalation is met, the mask does not leak. If mask leaks, tighten mask straps and/or adjust nose wire. If it still leaks obtain a new mask.

WARNING

Do not wear a mask that leaks.

c. Connect the oxygen mask to the oxygen supply being sure that disconnect couplings are fully engaged.

d. Breathe several times with diluter valve turned to "NORMAL OXYGEN" to check operation of regulator and "BLINKER". (Also check on "100 PERCENT OXYGEN")

e. Turn on emergency valve slowly until oxygen flow is indicated then close the valve tightly.

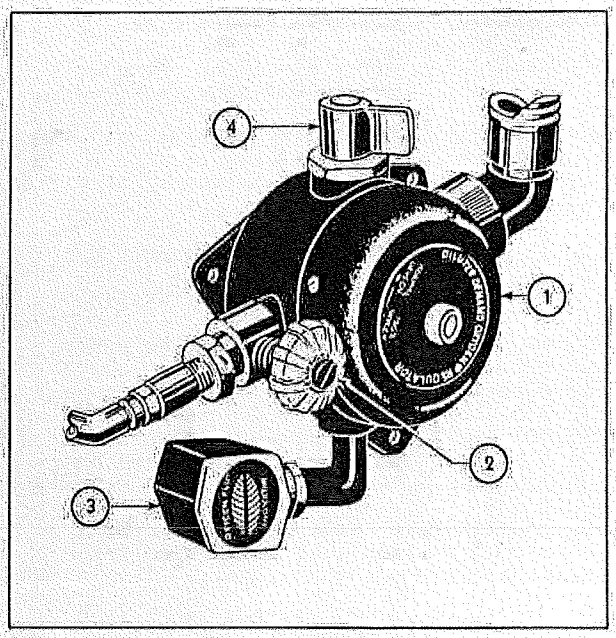
4-47. FLIGHT OPERATION OF OXYGEN SYSTEM. Oxygen shall be used constantly during flights when over 10,000 feet, during night flights when above 5,000 feet and when on combat missions and training missions simulating combat. During flight the following procedure must be followed:

a. Check pressure gage for presence of oxygen.

b. Put on mask and check for fit.

c. Attach clip of the oxygen breathing tube to the proximate strap of the shoulder harness sufficiently high on the chest to permit free movement of the head without stretching of the mask tube.

d. Turn diluter valve to "NORMAL OXYGEN". Refer to paragraph 4-44.



1. Diluter Demand Regulator
2. Emergency By-Pass Valve
3. Flow Indicator
4. Diluter Valve

Figure 4-12. Oxygen Regulator

e. While on oxygen, breathe normally and frequently check: (1) Cylinder pressure gage for oxygen supply; (2) Oxygen flow indicator for flow of oxygen through regulator; (3) Mask fit for leak tightness; and (4) Mask disconnect coupling to insure that it is fully engaged.

4-48. INSTRUMENT POWER. (See figures 4-13, 4-14, 4-15, 4-16, and 4-17). AC power for operation of the pilot's and co-pilot's flight instruments, engine autosyn instruments, G-2 compass and automatic pilot is furnished by three inverters. Refer to paragraph 1-115. Application of power from the inverters to the various instruments and the automatic pilot is controlled by the co-pilot's instrument and automatic pilot switch and/or the G-2 compass and pilot's instrument switch. (See figure 1-4, references 3 and 10). The circuit breaker switch, on the circuit breaker panel, for each of the three inverters must be turned "ON" before the inverters will run. Even though the circuit breaker is on, the inverters will not operate until they are selected by the co-pilot's instrument and autopilot switch and/or the G-2 compass and pilot's instrument switch. Indicators on the instrument panel will show yellow in the event of power failure to either the pilot's or co-pilot's flight instruments.

4-49. G-2 COMPASS SYSTEM.

4-50. DESCRIPTION OF G-2 COMPASS SYSTEM. This system is designed to provide an accurate stabilized indication of the heading of the aircraft in azimuth at all times. The parts of this system which must be observed and operated by the pilot are the master direction indicator, G-2 compass and pilot's instrument switch, and compass control switch. (See figure 1-3, reference 31 and figure 1-4, references 10 and 11).

4-51. NORMAL OPERATION OF G-2 COMPASS SYSTEM.

a. Turn G-2 compass switch on pilot's switch panel to "NORMAL". (See figure 1-4, reference 10)

NOTE

Make sure the G-2 compass inverter circuit breaker switch on the circuit breaker panel is on and that the G-2 compass control switch on the pilot's switch panel is on "COMPASS CONTROL". (See figure 1-4, reference 11)

b. Readings should not be taken before the gyro motor reaches full speed. For moderate temperatures, three minutes is sufficient for the gyro motor to reach full speed, but, at very low temperatures, it may take up to 15 minutes.

c. After the power supply has been turned on and the gyro motor has reached full speed the initial setting may be made. This is done by depressing the resetting knob on the face of the instrument, and setting the master direction indicator dial to the heading of the aircraft as indicated by the correspondence indicator in the center of the main dial. From this approximate heading, the master direction indicator will align itself to indicate the correct magnetic heading of the aircraft. This indication will become accurately stabilized in a short period, up to two minutes, depending on the accuracy of the initial setting.

NOTE

No caging or resetting of the gyro is necessary either before or after maneuvers. The system will operate satisfactorily through any of the maneuvers performed by the aircraft.

d. Once turned on and set to the approximate heading of the correspondence indicator the gyro requires no more attention, unless turned off.

e. The northerly turning errors encountered in a magnetic type of compass are not present in this system. Therefore, when making any type of turn from any magnetic heading of the aircraft, the indication of the master direction indicator is completely reliable.

4-52. OPERATION OF G-2 COMPASS ON "FREE GYRO".

4-53. Because of excessive dip of the earth-magnetic field near the magnetic poles, a magnetic compass becomes very erratic in those regions. For this reason, a free gyro type of indicator has advantages over a compass controlled type. The G-2 compass system may be changed to a free gyro system, when so desired, by moving the G-2 compass control switch located on the pilot's switch

POSITION OF		INVERTER			INSTRUMENTS									
					PILOT'S			CO-PILOT'S			ENGINE				AUTOMATIC PILOT
G-2 COMPASS AND PILOT'S INSTRUMENT SWITCH	AUTO PILOT AND CO-PILOT'S INSTRUMENT SWITCH	AUTO PILOT	G-2 COMPASS	STAND-BY	G-2 Compass	Gyro Horizon	Turn and Bank	Master Direction Ind.	Gyro Horizon	Turn and Bank	Manifold Pressure	Jet Oil Pressure	Jet Fuel Pressure	Fuel Flow Indicator	
Off	Off														
Off	Instr.Normal	On						On	On	On	On	On	On	On	
Off	Instr.Autopilot	On						On	On	On	On	On	On	On	On
Off	Instr.Standby			On				On	On	On	On	On	On	On	
Normal	Off		On		On	On	On								
Normal	Instr.Normal	On	On		On	On	On	On	On	On	On	On	On	On	
Normal	Instr.Autopilot	On	On		On	On	On	On	On	On	On	On	On	On	On
Normal	Instr.Standby		On	On	On	On	On	On	On	On	On	On	On	On	
Standby	Off			On	On	On	On								
Standby	Instr.Normal	On		On	On	On	On	On	On	On	On	On	On	On	
Standby	Instr.Autopilot	On		On	On	On	On	On	On	On	On	On	On	On	On
Standby	Instr.Standby			On	On	On	On				On	On	On	On	
Emerg.	Off			On	On	On	On				On	On	On	On	
Emerg.	Instr.Normal			On	On	On	On				On	On	On	On	
Emerg.	Instr. and Auto-pilot			On	On	On	On				On	On	On	On	
Emerg.	Instr.Standby			On	On	On	On				On	On	On	On	

NOTE: Blanks indicate that the particular inverter or equipment are "OFF".

Figure 4-13. Instrument Power

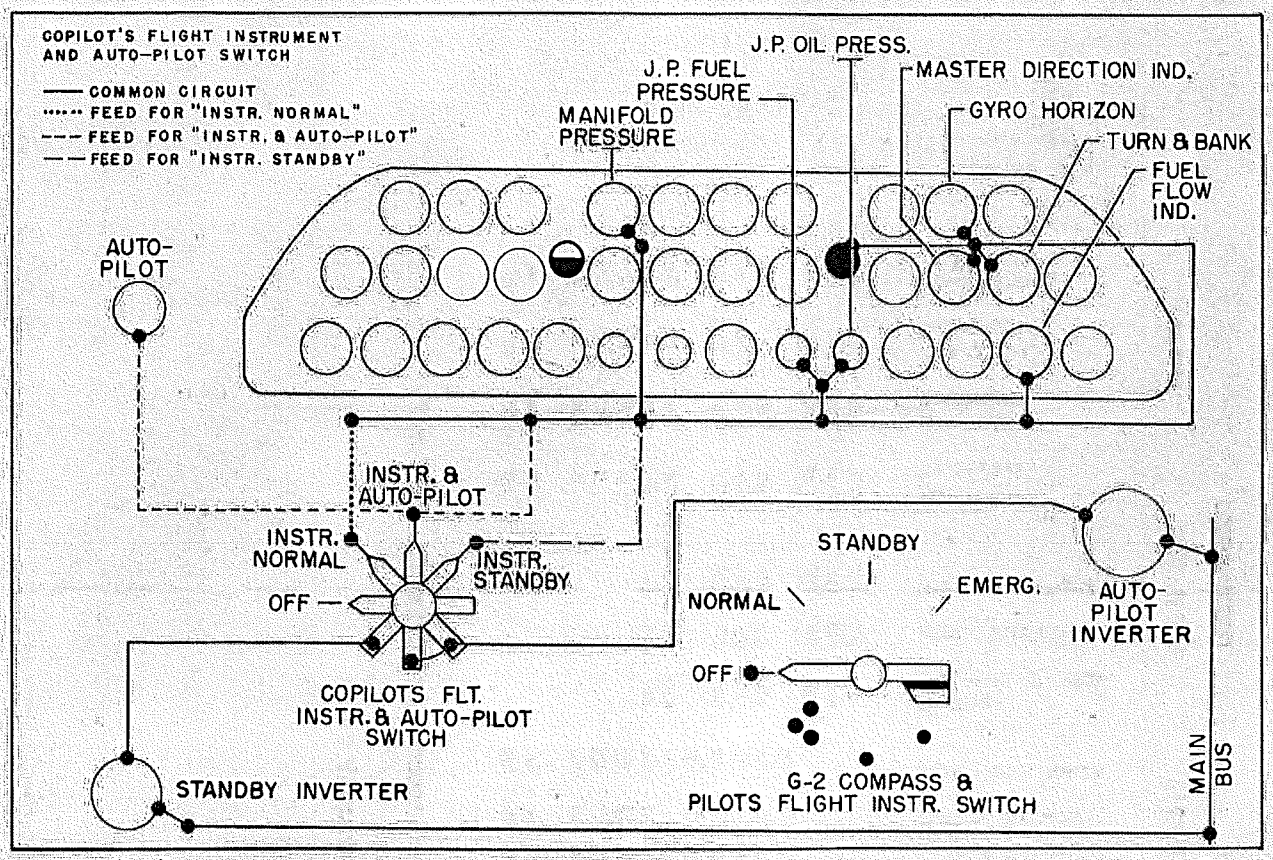


Figure 4-14. Instrument Power - G-2 Compass and Pilot's Flight Instrument Switch in "OFF"

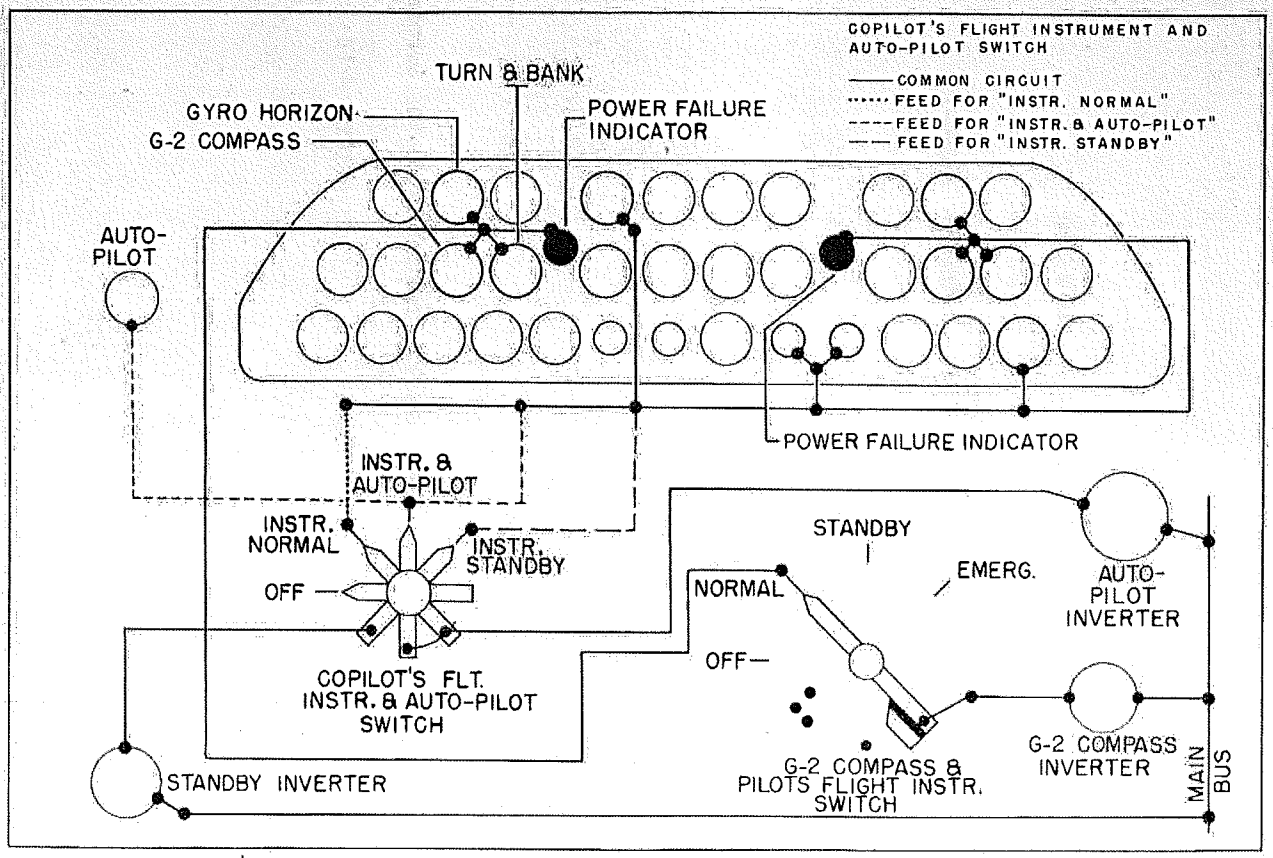


Figure 4-15. Instrument Power - G-2 Compass and Pilot's Flight Instrument Switch in "NORMAL"

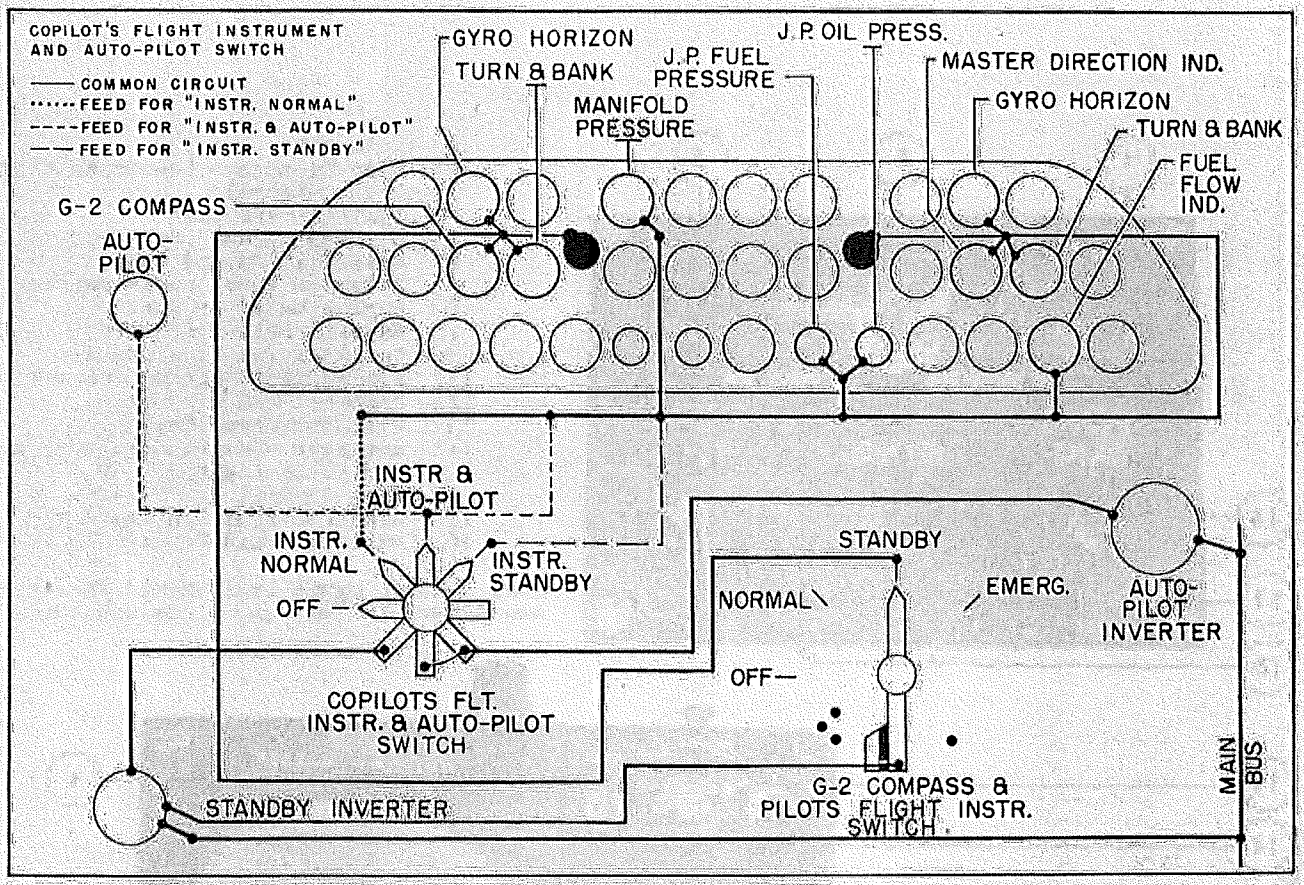


Figure 4-16. Instrument Power - G-2 Compass and Pilot's Flight Instrument Switch in "STANDBY"

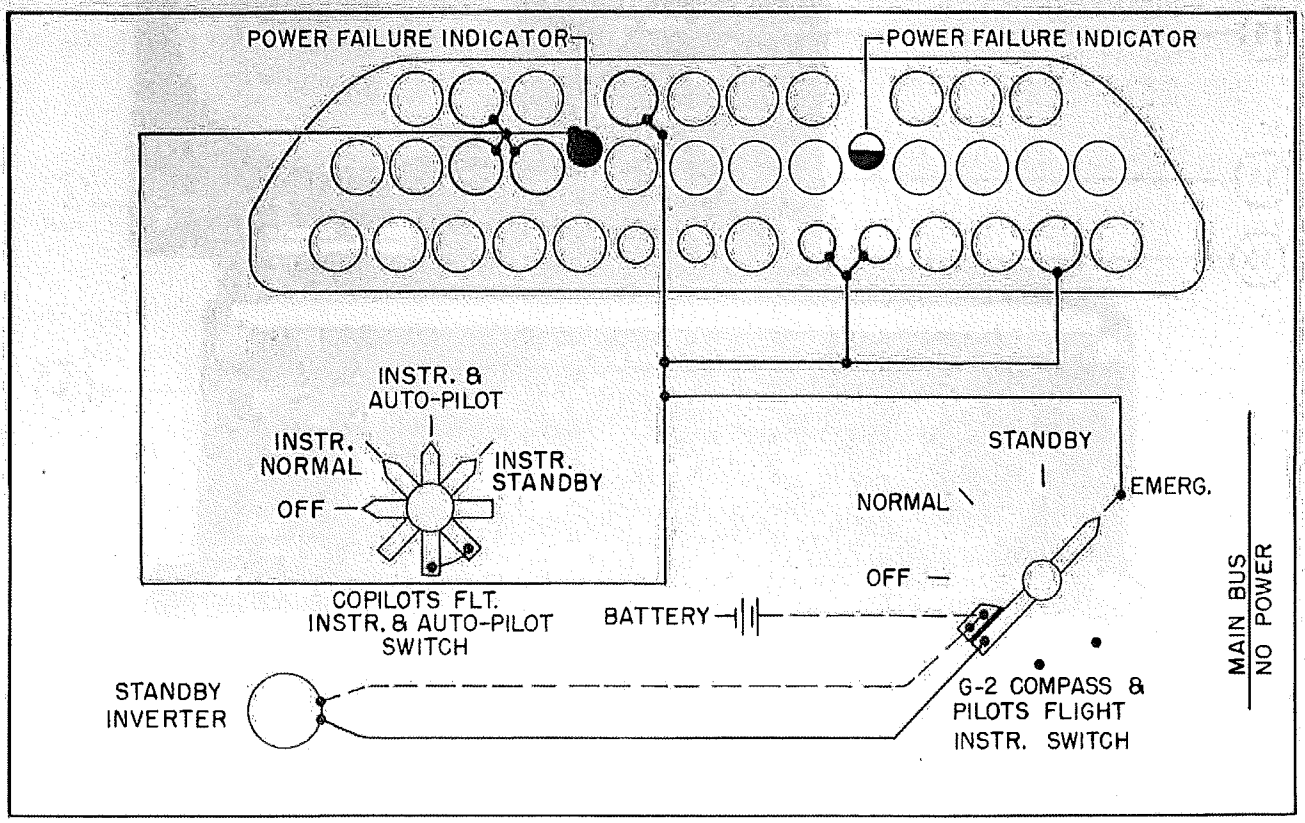
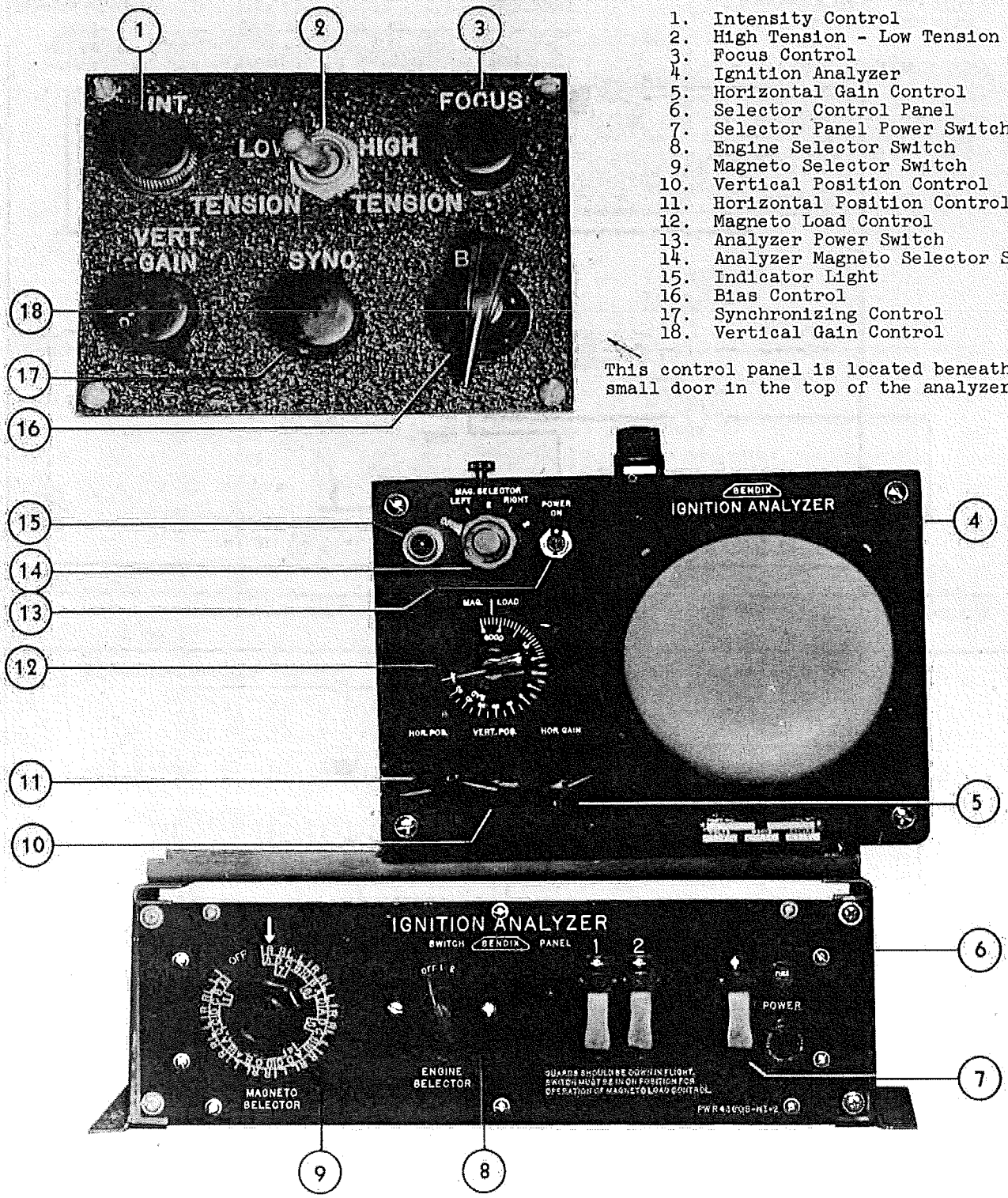


Figure 4-17. Instrument Power - G-2 Compass and Pilot's Flight Instrument Switch in "EMERG"



1. Intensity Control
2. High Tension - Low Tension Switch
3. Focus Control
4. Ignition Analyzer
5. Horizontal Gain Control
6. Selector Control Panel
7. Selector Panel Power Switch
8. Engine Selector Switch
9. Magneto Selector Switch
10. Vertical Position Control
11. Horizontal Position Control
12. Magneto Load Control
13. Analyzer Power Switch
14. Analyzer Magneto Selector Switch
15. Indicator Light
16. Bias Control
17. Synchronizing Control
18. Vertical Gain Control

This control panel is located beneath the small door in the top of the analyzer.

Figure 4-17A. Ignition Analyzer and Selector Panel Controls

panel to "FREE D.G." (See figure 1-4, reference 11). When operating as a free gyro, the instrument must be reset at intervals to correct for drift errors.

CAUTION

Indication of the correspondence indicator may be erratic under these conditions and should not be used. When used without compass control the indicator will not give a stabilized indication, but will give an indication subject to drift errors inherent in a free gyro. This means that after a long period the indication will become inaccurate and the gyro will require resetting.

4-54. To reset the G-2 compass master indicator when operating on "FREE GYRO" proceed as follows:

a. Depress reset knob on master direction indicator firmly and rotate dial to desired heading.

b. Keep knob depressed for at least five seconds.

c. Release knob straight out.

4-55. To return G-2 compass to compass controlled operation:

a. Move G-2 compass control switch on pilot's switch panel to "COMPASS CONTROL".

b. Depress reset knob and set master direction indicator to the heading indicated by the corresponding indicator.

c. Release knob straight out.

4-55A. ENGINE IGNITION ANALYZER SYSTEM.

NOTE

This equipment is installed on airplanes No. 121451, 121453, 121454, 122208, 124369 and subsequent at the factory and is to be installed on all other airplanes in service.

4-55B. DESCRIPTION OF THE ENGINE IGNITION ANALYZER SYSTEM. This system is designed to detect, locate and identify reciprocating engine abnormalities caused by the malfunctioning of the ignition system during engine operation. The units of this system which must be operated and observed by the designated operator are the ignition analyzer and the ignition analyzer selector panel assembly. These units are located on the right side of the crawlway in the center fuselage.

4-55C. DESCRIPTION OF THE ENGINE IGNITION ANALYZER. (See figure 4-17A, reference 4). This unit provides a picture of the condition of the ignition system during engine operation. The analyzer contains a cathode ray tube, the screen in the forward end of the tube is constructed of materials which cause it to fluoresce when struck by a stream of electrons. The variation of the voltages across the primary circuits of a magneto are shown on the fluorescent screen as wave forms. Ignition trouble is indicated by a change in the normal wave form as shown on the analyzer screen. Controls on the front of the analyzer and in the top right side of the analyzer adjust the analyzer so that the wave form is shown clear and vivid.

4-55D. DESCRIPTION OF THE ENGINE IGNITION ANALYZER SELECTOR CONTROL PANEL ASSEMBLY. (See figure 4-17A, reference 5). The analyzer selector control panel assembly provides a means whereby the operator may select and isolate the ignition circuit which he wishes to place under analysis and provides control over the power source to the analyzer.

4-55E. OPERATION OF THE ENGINE IGNITION ANALYZER SYSTEM. (See figure 4-17A).

NOTE

If the engine ignition analyzer is to be used to test the ignition circuits before take-off, the engines should be started in the normal manner, allowed to warm up and then brought to the conditions desired for the test. It is recommended that the analyzer tests be made at 1400 rpm or above to insure essentially stable fuel mixtures, temperatures and pressures.

a. Set the "POWER" switch (7) on the selector control panel to "ON".

b. Set the "MAG. LOAD" control (12) on the front panel of the analyzer to "OFF".

c. Set the "MAG. SELECTOR" switch (14) on the front panel of the analyzer to "LEFT 1" and turn the analyzer "POWER" switch (13) to "ON". The pilot light (15) on the front of the analyzer should now be on.

NOTE

"LEFT 1" position on the "MAG. SELECTOR" switch is the only one used in this system. The other positions are not energized.

d. A bright dot should appear on the analyzer screen after the tubes have warmed up. When the dot has stabilized in one position, adjust the "HOR. POS." (11) and "VER. POS." (10) dials, if necessary, so that the dot is in the center of the screen.

NOTE

The bright dot should not be held on any one position of the screen any longer than is necessary in order to avoid over rapid deterioration of the fluorescent qualities of the screen coating. If power is to be left on the analyzer for more than a minute or two without proceeding with the test, the dot should be shifted to the extreme periphery of the screen.

e. Turn the "ENGINE SELECTOR" switch (8) on the selector panel to select the engine desired for analysis.

f. Turn the "MAGNETO SELECTOR" switch (9) on the selector control panel to a position indicating the ignition circuit to be tested and a wave form will appear on the analyzer screen.

g. Check to insure that the "HIGH TENSION LOW TENSION" switch (2) located beneath the door on the upper part of the analyzer is in "HIGH TENSION".

h. The five controls located beneath the door on the upper part of the analyzer are used to adjust the instrument for lighting, interference or other variables inherent in the installation. They are seldom used. The "SYNC" control (17) varies the strength of the synchronizing pick up signal and is usually left on the full clockwise setting; the "BIAS" control (16) varies the effectiveness of an impulse of any given magnitude when applied to the sweep generator and is usually left on the full clockwise setting; the "INT" control (1) is used to adjust the intensity of the pattern to the degree of brightness desired; the "FOCUS" control (3) is used to adjust the pattern to a sharp, distinct outline; the "VERT. GAIN" control (18) enlarges the pattern in a vertical direction.

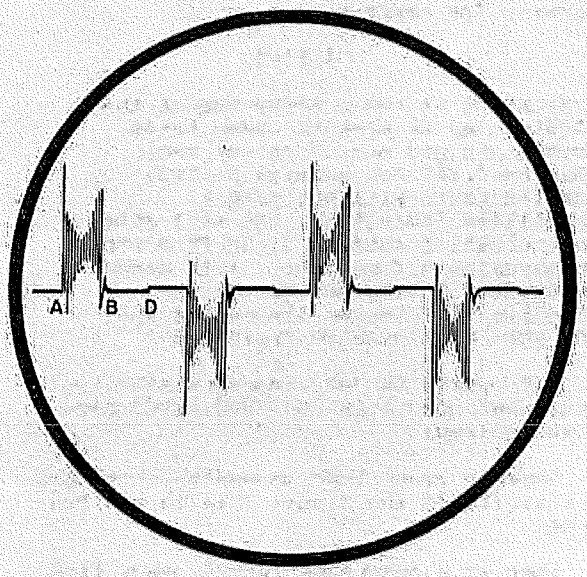
i. When it is desired to study the wave form for a particular cylinder in detail, the wave form is moved to the left or right of the screen by turning the "HOR. POS." control knob (11) and the wave form is enlarged in a horizontal direction by means of the "HOR. GAIN" control knob (5).

4-55F. INTERPRETATION OF THE IGNITION ANALYZER WAVE FORMS. (See figures 4-17B to 4-17H, inclusive).

4-55G. The exact size and shape of the wave forms, as viewed on the analyzer screen, may vary somewhat from the illustrations shown herein. This variance is due to the particular characteristics of the individual engine and ignition system on test and the setting of the analyzer controls. For this reason, the illustration should not be considered as infallible, but the explanation of the reason for the wave form appearing as it does will hold true and should be thoroughly understood before an attempt is made to interpret the wave forms as they actually appear on the analyzer screen.

NOTE

Single wave form illustrations are approximately as they appear when the analyzer controls, horizontal gain and vertical gain, are increased to make the wave form occupy the full screen.



1. Due to type of magneto ignition used (D4RN-2), wave forms for four firing cylinders appear on the analyzer screen. (Assuming analyzer controls are so set that this may be accomplished.)

2. The first wave form is that of the first cylinder to be fired by the magneto circuit under analysis. For example, if this is magneto #1-R, the wave forms as they appear, reading from left to right, are for cylinders D1, C1, B1 and A1, right spark plugs.

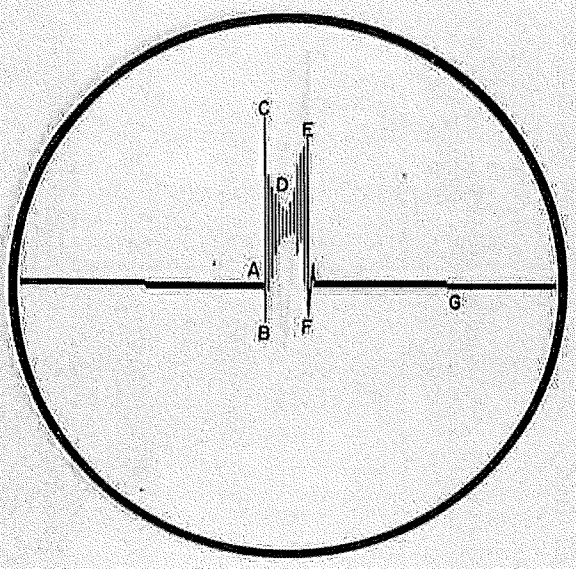
3. Point "A" in the above illustration designates the point at which the breaker opens in the magneto and the initial high voltage required to fire the spark plug begins.

4. Distance A-B represents the time required to accomplish the firing of the plug and to completely dissipate the energy in the magneto coil.

5. Point "D" represents the position at which the breaker points close to begin the next primary build up.

6. Distance A-D represents the breaker opening time.

Figure 4-17B. Wave Forms For One Ignition Circuit All Cylinders Firing Normally



1. When the breaker points open in a magneto, or distributor, the induced voltage in the secondary winding of the ignition coil rises rapidly until a value is reached sufficient to break down the gap in the spark plug. This is shown on the screen as the faint line, "AC". The analyzer is designed to suppress the magnitude of this line except under open circuit conditions.

2. Less voltage is needed to sustain the spark discharge once the gap is broken down. Hence, the voltage drops almost instantly to the point "B"

3. The energy from the ignition coil does not flow steadily in one direction across the spark plug gap. Instead, it is expended in a series of very rapid oscillations back and forth across the electrodes. These oscillations appear in the "pedestal" of the pattern at "D" and are referred to as "hash". The absence of this "hash" in a pattern is an indication that the cylinder is not firing.

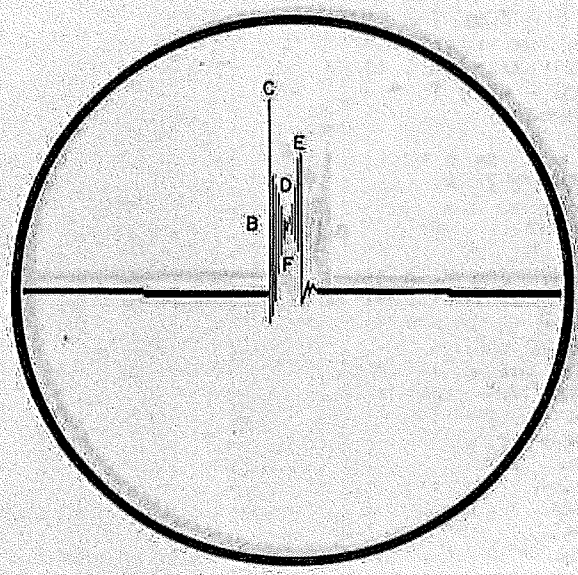
4. Note that the average voltage increases rather slowly to the point "E", where the spark can no longer be maintained.

5. The voltage then falls away with a few minor oscillations through the capacitance of the harness, leads, etc. until the breaker points close at "G", shorting the primary coil.

6. The time during which the spark occurs at the plug is represented by the distance between the two vertical lines "AC" and "EF".

7. The duration of the complete discharge, or the time between the breaker opening and the breaker closing, is the horizontal distance between "A" and "G".

Figure 4-17C. Single Wave Form of Cylinder Firing Normally.

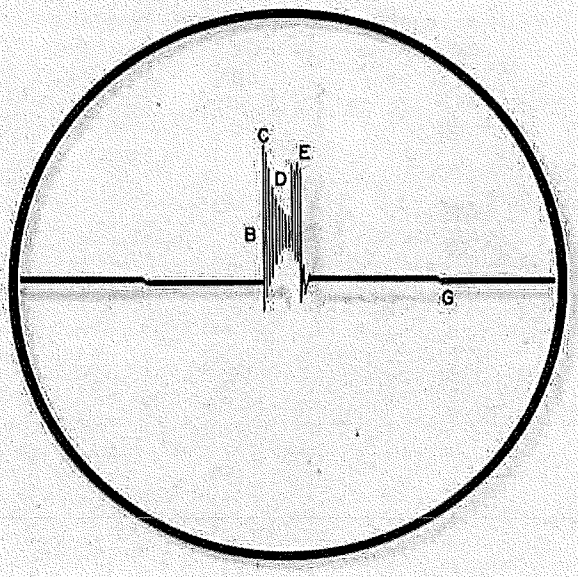


In comparison with the normal firing pattern note:

1. The shorter time (duration of the "hash" at "D").

2. The higher voltages, as shown by the greater distances from the base line of the points "B", "C" and "E".

Figure 4-17D. Wave Form Indicating High Voltage Discharge, Cylinder Firing. (Example: wide spark plug gap)

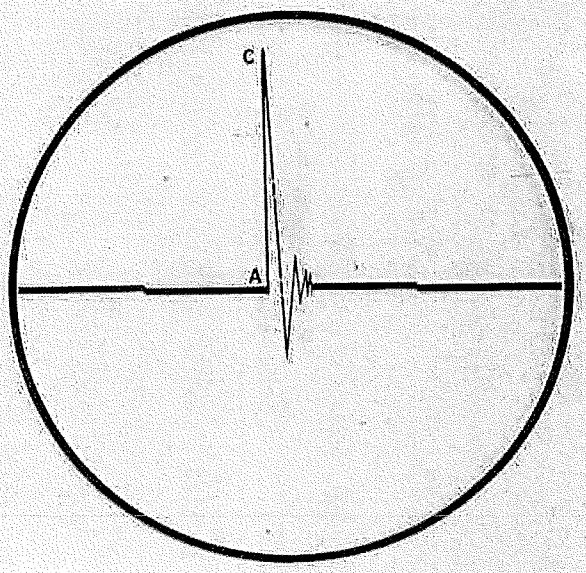


In comparison with the normal firing pattern note:

1. The longer time (duration of the hash at "D") during which the spark is sustained at the plug.

2. The lower voltages, as shown by the shorter distances from the base line of the points "B", "C" and "E".

Figure 4-17E. Wave Form Indicating Low Voltage Discharge, Cylinder Firing. (Example: narrow spark plug gap)



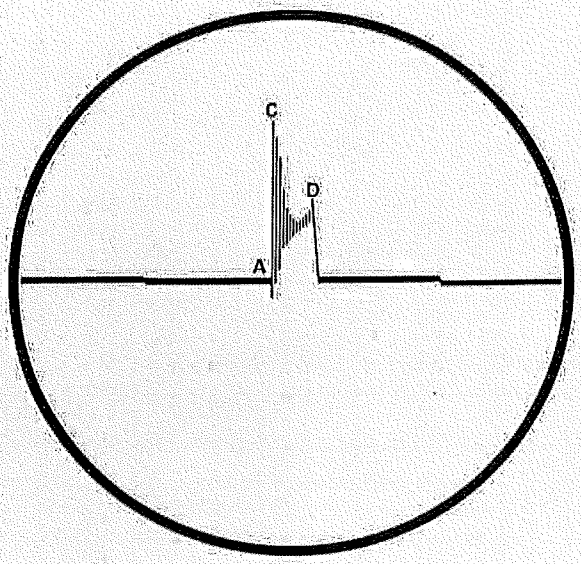
In the above pattern take note of the following characteristics:

1. No "hash", therefore no spark at the plug.

2. The energy is expended through the capacitance.

3. The line "AC" is distinct, higher, and its rise is less abrupt.

Figure 4-17F. Wave Form of Open Secondary Circuit, Cylinder Not Firing. (Example: spark plug gap very wide).

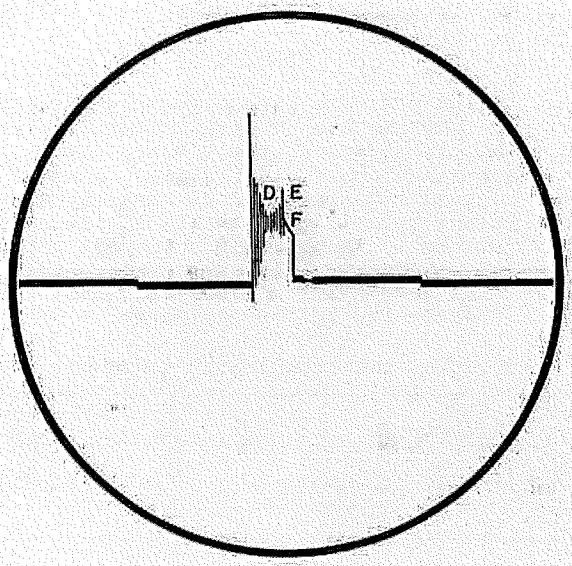


Note the following points pertaining to the above pattern:

1. No "hash" in the pedestal at "D".

2. Duration (width) and voltage (height) depend on the conditions prevailing.

Figure 4-17G. Wave Form of Shorted Secondary Circuit, Cylinder Not Firing (Example: fouled spark plug, ground or small air gap to ground).



In comparison with the normal firing pattern note:

1. The "hash" at "D" shows that the cylinder is firing.

2. The discharge at the spark plug, shown by the "hash" at "D", starts normally but instead of continuing in the usual pattern breaks off at "E". The voltage then drops along the curved line of "F", where the appearance again reverts to normal.

3. Unless the condition clears, or is corrected, the duration of the spark at the plug, shown by the "hash" at "D", will become steadily smaller until mis-firing occurs at which time the pattern will take the appearance of a full short.

Figure 4-17H. Wave Form of Partially Shorted Secondary, Cylinder Firing (Example: partially fouled spark plug).

4-56. ELECTRONIC EQUIPMENT

WARNING

Operation of electronic equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times, observe all safety regulations. Do not change tubes or make adjustments inside equipment with the power on. Do not operate the equipment unless the engine driven A.C. generators or external power sources are delivering power

4-57. The radio and radar equipment on this airplane consists of the following:

EQUIPMENT	PURPOSE	RANGE	PRIMARY OPERATOR	REFERENCE FIGURE
AN/AIC-5A Interphone	Inter communication	----------	Pilot Co-pilot Radioman	1-6 1-7 4-20
AN/ARC-1 VHF Command	Short range, two way voice communication	Line of Sight	Pilot	3-4
AN/ARC-5 Range Receiver	Radio range navigation	Unlimited	Pilot	1-4 3-4
AN/ARC-5 Low Frequency Liaison Receiver	Long range voice, CW reception	Unlimited	Radioman	4-20
AN/ART-13 LF-MF-HF Liaison Transmitter	Liaison Voice, MCW, CW Transmission	Variable	Radioman	4-20
AN/ARR-15 High Frequency Liaison Receiver	Two Units For Liaison Voice MCW & CW Reception	Variable	Radioman	4-20
LM-14 Frequency Meter	Frequency Checks	125 KC to 20,000 KC	Radioman	4-20
AN/ARN-7 Radio Compass	Position Finding and Homing	Variable	Pilot Navigator	1-3 3-4
AN/ARN-8 Marker Beacon	Radio navigation	Line of Sight	Pilot	1-3
AN/APN-1 Radio Altimeter	Indicate terrain clearance	4000 feet	Pilot	1-3
AN/APX-2 IFF	Identification	Line of Sight	Radarman	4-22
AN/APX-6 IFF	Identification	Line of Sight	Pilot Co-pilot	3-4
AN/APS-33A Search Radar	Search and Navigation	200 miles	Radarman	4-22
AN/APA-5A Indicator Equipment	Bombing run control and bomb release	30 miles	Bombardier	4-1
AN/APR-9 Search Receiver Installed on Airplane 124373 at the factory and all others when service change is incorporated	Receives and identifies radar signals	Line of Sight	Counter-measure Operator	4-23 A
AN/APA-69 Direction Finder group Installed on Airplane 124373 at the factory and all others when service change is incorporated	To determine the direction of signals received on AN/APR-4 and AN/APR-9 receiver sets	Line of Sight	Counter-measure Operator	4-23A

EQUIPMENT	PURPOSE	RANGE	PRIMARY OPERATION	REFERENCE FIGURE
AN/ARR-31 Radio Receiving Set	Sonobuoy Reception	----------	Navigator	4-2
AN/APN-4 Radio Set	(Loran) Long Range Navigation using special ground stations	300 Land, Day 700 Water, Day 1200 mi., Night	Navigator	4-2 4-4 4-5
AN/APR-4 Receiving Equipment	Receives and identifies radar signals	Line of sight	Counter-measure Operator	4-23
AN/APA-38 Panoramic Adapter	Shows signals within 10 mc. of tuned station	----------	Counter-measure Operator	4-23
AN/APA-64A Pulse Analyzer Group	Measures pulse characters	----------	Counter-measure Operator	4-23

4-58. AN/AIC-5A INTERCOMMUNICATION SYSTEM.

4-59. DESCRIPTION OF AN/AIC-5A INTERCOMMUNICATION SET. The AN/AIC-5A system provides general control of all radio equipment, in addition to providing a means of communication between crew members. The pilot, co-pilot and radio operator are furnished with control boxes and the remainder of the crew is furnished with station boxes. This interphone system is divided into two crew circuits, set up as follows:

FLIGHT CREW CIRCUIT	GUN CREW CIRCUIT
Pilot	Bow turret gunner
Co-pilot	Deck turret gunner
Radio Operator	Tail turret gunner
Radar Operator	Cameraman
Countermeasure operator	
Navigator-bomber	

After incorporation of service change an interphone station box will be located in the ditching station. This box is attached to the top of the bulkhead at station 597.

4-60. DESCRIPTION OF CONTROL BOX. (See figure 4-18).

4-61. There are eight switches labeled "COMMUNICATION" across the top of each box which control the audio circuit of the receivers for that particular station. These receivers will be operating at all times but will be heard only when their switches on one of these boxes are on. The "4", and "S.P. 2" switches are not used; the "BEACON" switch controls the audio signal from the AN/ARN-8 Marker Beacon receiver; the "1" and "2" switches control the two AN/ARR-15 high frequency receivers; and the "3" switch controls the low frequency AN/ARC-5 receiver operated by the radio operator and the "S.P. 1." switch controls sonobuoy receiver reception.

4-62. The "PHONES" switch is used in the event of an isolation amplifier failure. There are three isolation amplifiers, one for each of the three control boxes; if one of these amplifiers fails the switch must be thrown to "ALTERNATE". The pilot's alternate is the co-pilot's amplifier, the co-pilot's alternate is the radio operator's amplifier and the radio operator's alternate is the pilot's amplifier.

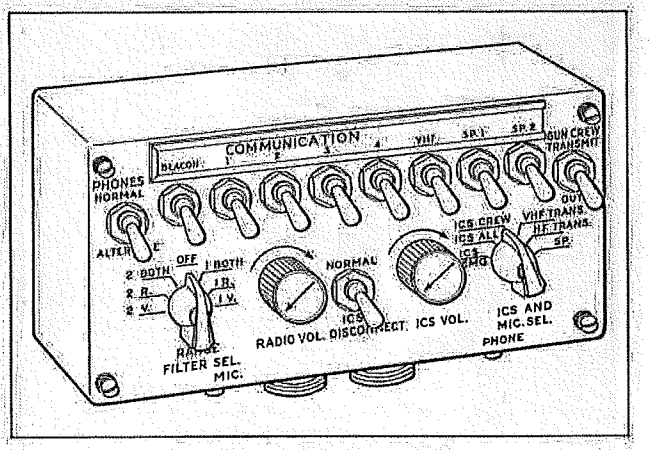


Figure 4-18. Interphone Control Box

4-63. The "RANGE FILTER SEL." switch governs the use of the AN/ARN-7 radio compass on the "1" or right side and the AN/ARC-5 range receiver on the "2" or left side.

4-64. The "NORMAL-ICS DISCONNECT" switch is operable by the pilot and radio operator only and is used to disconnect all interphone equipment for special radio reception. This condition is overriden by an emergency interphone transmission.

4-65. The "ICS AND MIC SEL" switch is used to select the desired transmitter; on the right side, the "SP" position is not used, the "HF TRANS" position is for the AN/ART-13 transmitter, and the "VHF TRANS" position is for the AN/ARC-1. On the left side, the "ICS CREW" position contacts only the flight crew, the "ICS ALL" position contacts the entire crew, and the "ICS EMG" position, which is not connected on the radio operators box, is used to override any switch position of all interphone boxes.

4-66. The "GUN CREW" switch will allow any member of the gun crew to transmit on VHF if it is desired.

4-67. DESCRIPTION OF STATION BOX. (See figure 4-19) The station boxes are provided with a "VOLUME" control and a "MIC. SEL." switch. The "MIC. SEL" switch has two positions for interphone use, "ICS CREW" and "ICS ALL", and a "TRANS. I" position which connects with the VHF transmitter receiver. A gun crew member may transmit if the "GUN CREW" switch on a control box is in the "TRANSMIT" position. A flight crew member may transmit at any time. The selector switch also has a fourth position, "RADIO", which is connected only for the navigator bomber, countermeasure operator, and radar operator.

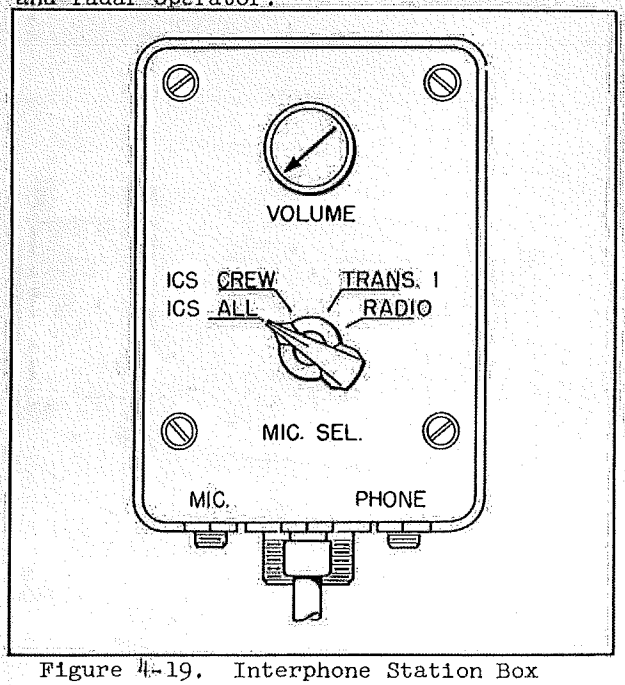


Figure 4-19. Interphone Station Box

4-68. PILOT'S AND CO-PILOT'S CONTROLS.

4-69. UPON ENTERING THE COCKPIT.

a. Plug the headset into the phone extension cord leading to the jack box and make certain that the microphone plug is fully engaged.

b. If a microphone other than a hand microphone is to be used, plug it into the microphone cord. This puts the control wheel microphone switch in the circuit.

4-70. RADIO POWER. With the reciprocating engines running and the A.C. generators delivering power, or with external power connected, the AN/AIC-5A interphone system and the AN/ARN-8 marker beacon are operating and the AN/APN-1 radio altimeter is supplied with power, provided the monitoring switch is in the "NORMAL" position. To power the rest of the pilot's radio equipment the "MASTER RADIO" switch on the pilot's switch panel must be thrown on and the "INVERTERS MAIN CONT." switch on the circuit breaker panel should be thrown on after the tubes in the equipment have warmed up. (See figure 1-4, reference 14 and 1-13, reference 12) This is based on an operating procedure which allows the switches on the individual pieces of equipment to be left "ON" when leaving the airplane.

4-71. INTERPHONE TEST.

a. Turn the "ICS AND MIC. SEL" switch to "ICS CREW" and with the microphone switch depressed, call the other stations, releasing the microphone switch while awaiting replies.

b. Check the "ICS EMG." position by having the crew operate the interphone to cut out your normal interphone transmission, then call with "ICS AND MIC. SEL" switch on "ICS EMG.". This should be heard over everything else.

4-72. RECEPTION. Any receiver or combination of receivers may be used without affecting the reception of others. Place the "COMMUNICATION" switches on the inter-phone box in the desired positions. The AN/ARC-1 VHF command set should be the first one set up as it has no volume control of its own; its output is adjusted by the "RADIO VOL" knob on the interphone control box. Other radio receivers can be adjusted by their own individual controls. The order of setting up the remaining sets is unimportant.

4-73. TRANSMISSION.

NOTE

Any instructions given in this publication on transmission are subject to local limitations regarding radio silence.

The "ICS AND MIC. SEL." switch selects the transmitter to be used and does not affect the use of other transmitters of other stations with the exception of the "ICS EMG" position. Control of the VHF transmitter may be given to gun crew members by throwing the "GUN CREW" switch to "TRANSMIT"

4-74. AN/ARC-1 VHF COMMAND RECEIVER-TRANSMITTER.

4-75. DESCRIPTION OF AN/ARC-1 VHF COMMAND RECEIVER-TRANSMITTER. The AN/ARC-1 radio set provides two-way voice communication between airplanes or between the airplane and ground on any of nine pre-arranged main channel communication frequencies or a guard-channel frequency. Incoming signals are received except for those intervals when transmission is desired. The change-over from receiving to transmitting, or the reverse, is accomplished by the microphone switch. Under normal conditions range is limited to line of sight distances, but under some atmospheric conditions signals may be heard at much greater distances.

4-76. OPERATION OF AN/ARC-1 VHF COMMAND RECEIVER-TRANSMITTER.

4-77. AN/ARC-1 CONTROLS. The control unit for the AN/ARC-1 equipment is located on the pilot's aft bulkhead. On it are located on "ON-OFF" switch, which is not connected, a channel selector switch, and a "GUARD-BOTH-MAIN T/R" selector switch which allows a choice between a selected main channel, or a guard channel, or operation on a main channel and monitoring on the guard channel. Windows on the control panel show the settings: the window adjacent to the "GUARD" setting shows either "OFF", or "R" for reception only or "T/R" for transmission and reception; the window adjacent to the "MAIN T/R" setting shows either "OFF" or the number "1" to "9", or the channel selected. The "VHF TRANS" switch on the interphone control box connects the AN/ARC-1 set to the airplane communication system.

4-78. AN/ARC-1 RECEPTION. With power supplied to the set, in the "VHF TRANS" position on interphone control box, and the tubes warmed up, set "GUARD-BOTH-MAIN T/R" switch to "BOTH" and rotate channel selector switch to desired channel; the incoming signals should now be received. Volume is controlled by the "RADIO VOL." knob on the interphone control box. If interference between the main channel and guard channel is present, turn to either "GUARD" or "MAIN T/R" position as desired to cut out interference. Whenever the selector switch is set to "GUARD", the system is blocked for about five seconds while the channel selector motor is realigning the circuits.

NOTE

Each time the set is turned on, allow at least 20 seconds for the tubes to reach operating temperature before actual reception or transmission is attempted.

4-79. AN/ARC-1 TRANSMISSION. To change from reception to transmission press the microphone button or control wheel switch and talk into the microphone. As soon as the transmission is complete, release the microphone button or control wheel switch to re-set the equipment for reception.

4-80, AN/ARC-5 RANGE RECEIVER.

4-81. DESCRIPTION OF AN/ARC-5 RANGE RECEIVERS. The AN/ARC-5 range receiver is remotely controlled by a control box on the pilot's aft bulkhead. This box has a tuning dial, a "CW-VOICE" switch, and an inoperative "SENSITIVITY" knob. Power for this equipment is provided by a "RANGE RECEIVER" switch on the pilot's switch panel. (See figure 1-4, reference 15) The volume is controlled by the "ARC-5 NAV. RECEIVER SENSITIVITY" control on the pilot's control column.

4-82. OPERATION OF AN/ARC-5 RANGE RECEIVER.

a. Turn "RANGE FILTER SEL." switch on interphone control box to the desired position on the "2" side.

b. Turn "CW-VOICE" switch to desired position, usually "VOICE".

c. Tune to desired frequency with dial and crank.

d. Adjust "ARC-5 NAV. RECEIVER SENSITIVITY" knob to the desired signal output.

e. Trim the receiver tuning for best signal.

f. Keep the "ARC-5 NAV. RECEIVER SENSITIVITY" control at a setting for the weakest usable signal. If the sensitivity is not kept low the course indications will be broad due to automatic volume control action.

4-83. AN/ARC-5 LIAISON RECEIVER. (See figure 4-20, reference 12).

4-83A. DESCRIPTION OF AN/ARC-5 LIAISON RECEIVER. The radioman's low-frequency receiver AN/ARC-5, mounted on the lower shelf of the forward radio rack, provides reliable reception of voice and CW signals on a frequency, 190 to 550 KC, which is below that covered by other communication receivers in the airplane. This receiver incorporates a control unit C-24/ARC-5 and is manually tuned by the radio operator using the controls on the face of the receiver. Two circuit breakers on the main circuit breaker panel protect this system.

4-83B. OPERATION OF AN/ARC-5 LIAISON RECEIVER.

a. Turn "3" switch on the radio operator's interphone control box on.

b. Turn the "CW-OFF-MCW" switch to the desired setting.

c. Adjust the "INCREASE OUTPUT" knob to the maximum tolerable noise level.

d. Tune the frequency desired by operating the crank beside the dial.

4-84. AN/ART-13 TRANSMITTER. (See figure 4-20, reference 52)

4-84A. DESCRIPTION OF AN/ART-13 TRANSMITTER. The AN/ART-13 LF-MF-HF transmitter having a frequency range of 2 MC to 18.1 MC and 200 KC to 600 KC, is used primarily for long distance airplane to ground communications. It is located on the radio operator's aft rack on the right side of the airplane and is tuned by the radio operator. The transmitter employs an autotune frequency change which is an electrically controlled mechanical system of positioning the transmitter tuning element. Manual frequency change, and tuning adjustments may be made without disturbing the autotune stop ring adjustments if the channel selector switch is placed in "MANUAL" position and the autotune system allowed to operate. Eleven autotune positions are available, ten positions permitting transmission in the 2 MC to 18.1 MC range, and one position permitting transmission in the 200 KC to 600 KC range. Power to the transmitter is supplied from a 28 volt d-c bus. Two circuit breakers on the main circuit breaker panel protect this system.

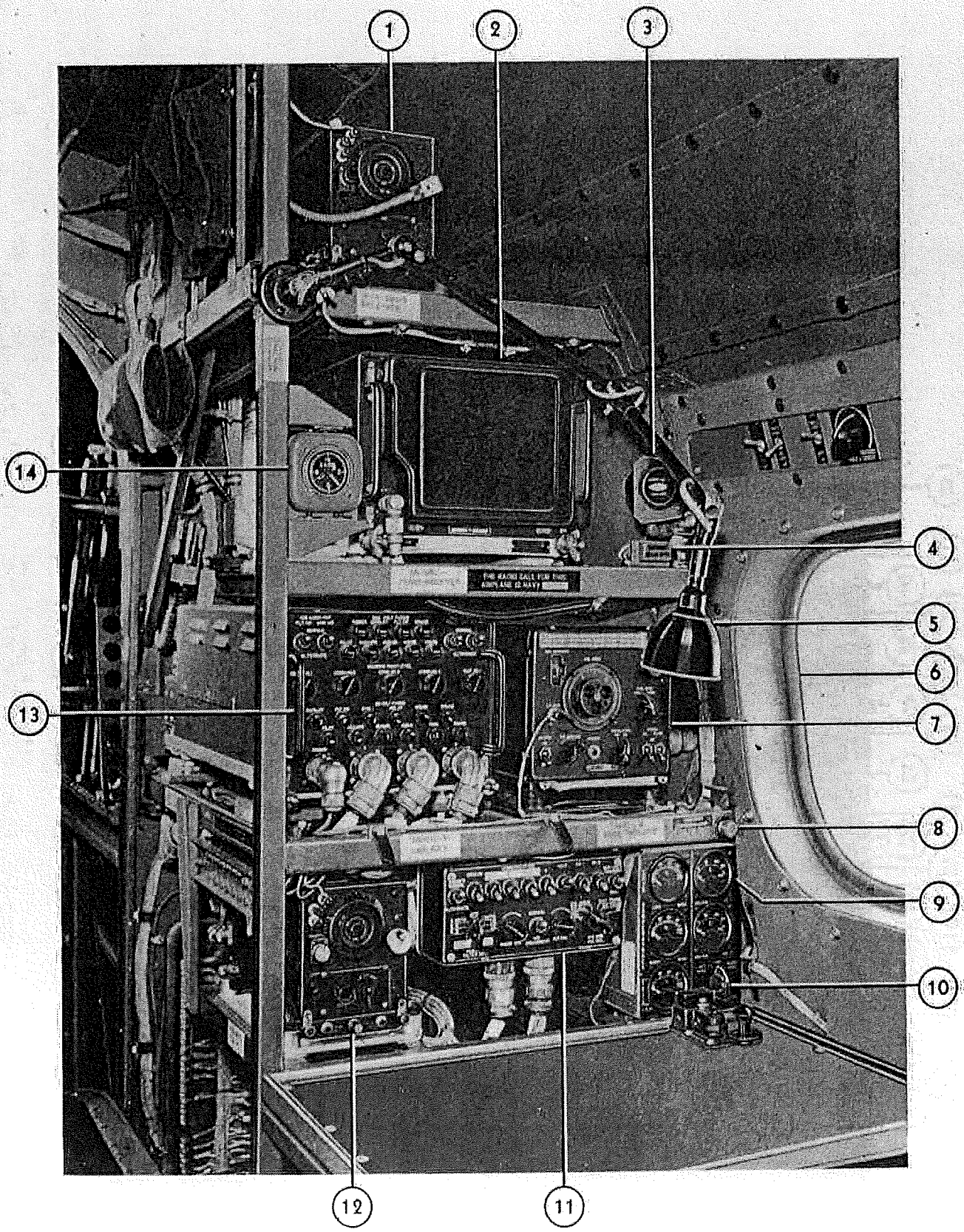
4-84B. OPERATION OF AN/ART-13 TRANSMITTER. On the transmitter panel, make certain that the "LOCAL-REMOTE" switch is on "LOCAL". Place the "EMISSION" selector switch on "VOICE", "CW" or "MCW", in accordance with the type of emission desired. Set the "CHANNEL" switch on the channel desired; the calibration card on the panel shows the frequencies corresponding to the "CHANNEL" switch positions. It takes about 25 seconds for the band shifting mechanism to complete the operation. For operation on low frequencies the trailing wire antenna must be used. Throw the knife switch on the patch panel to "TRANS-L.F.", turn the jumpers down and turn the antenna reel control to the "DOWN" position until the proper length, as determined for the frequency and transmitter adjustment, has been unreeled. The knife switch must be at "TRANS. REC. H.F." for any other use. Make certain that the "CALIBRATE-TUNE-OPERATE" power level switch is on "OPERATE". For voice operation from the radio operator's position, place the "ICS AND MIC. SEL" switch on the radio operator's interphone control box on "HF TRANS". Press the microphone press-to-talk switch and proceed with transmission. Sidetone will be heard through receiver channels. Code transmission is accomplished by means of the transmitter key.

CAUTION

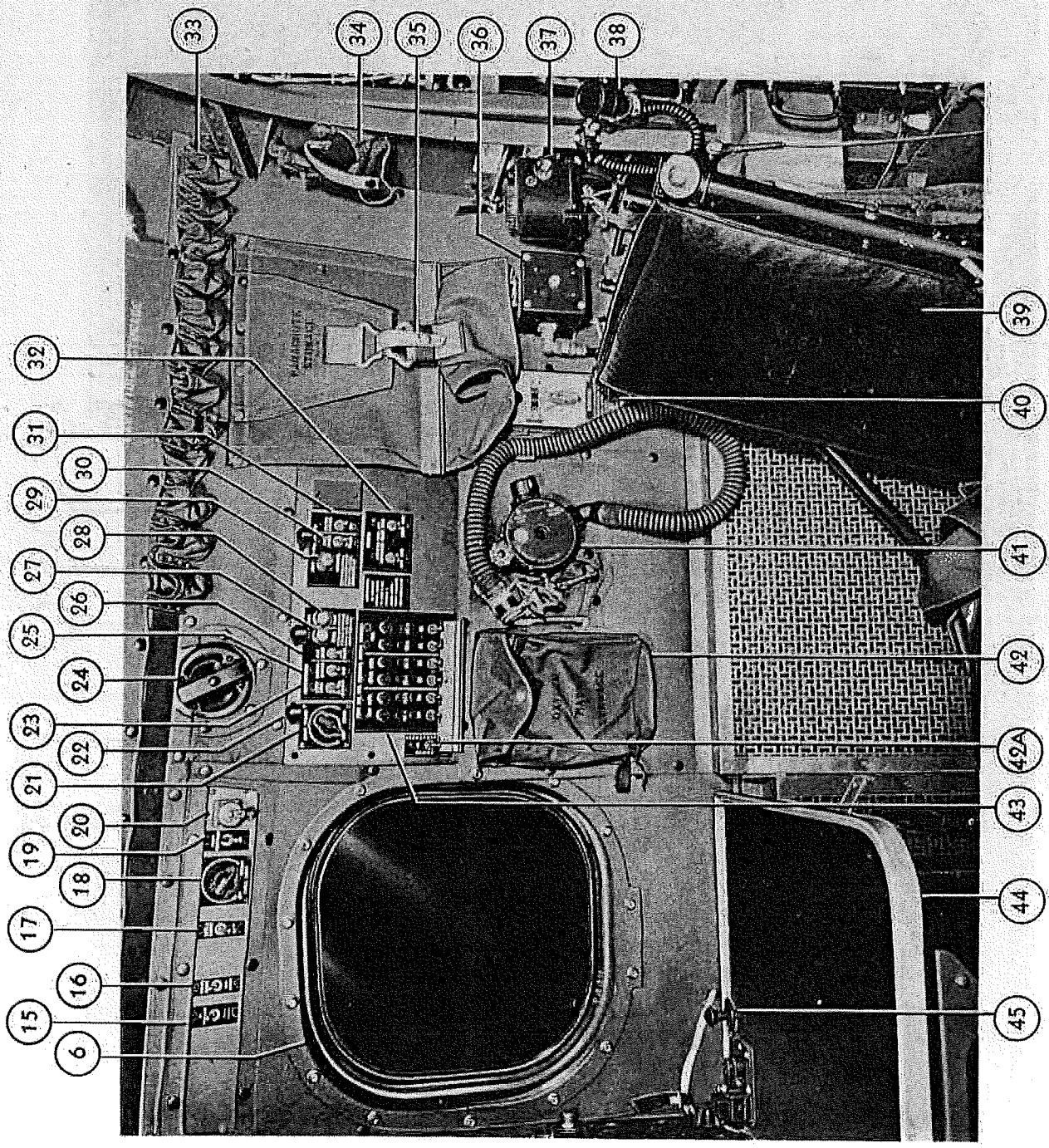
Continuous operation of antenna reel motor limited to one minute.

4-85. AN/ARR-15 LIAISON RECEIVERS.

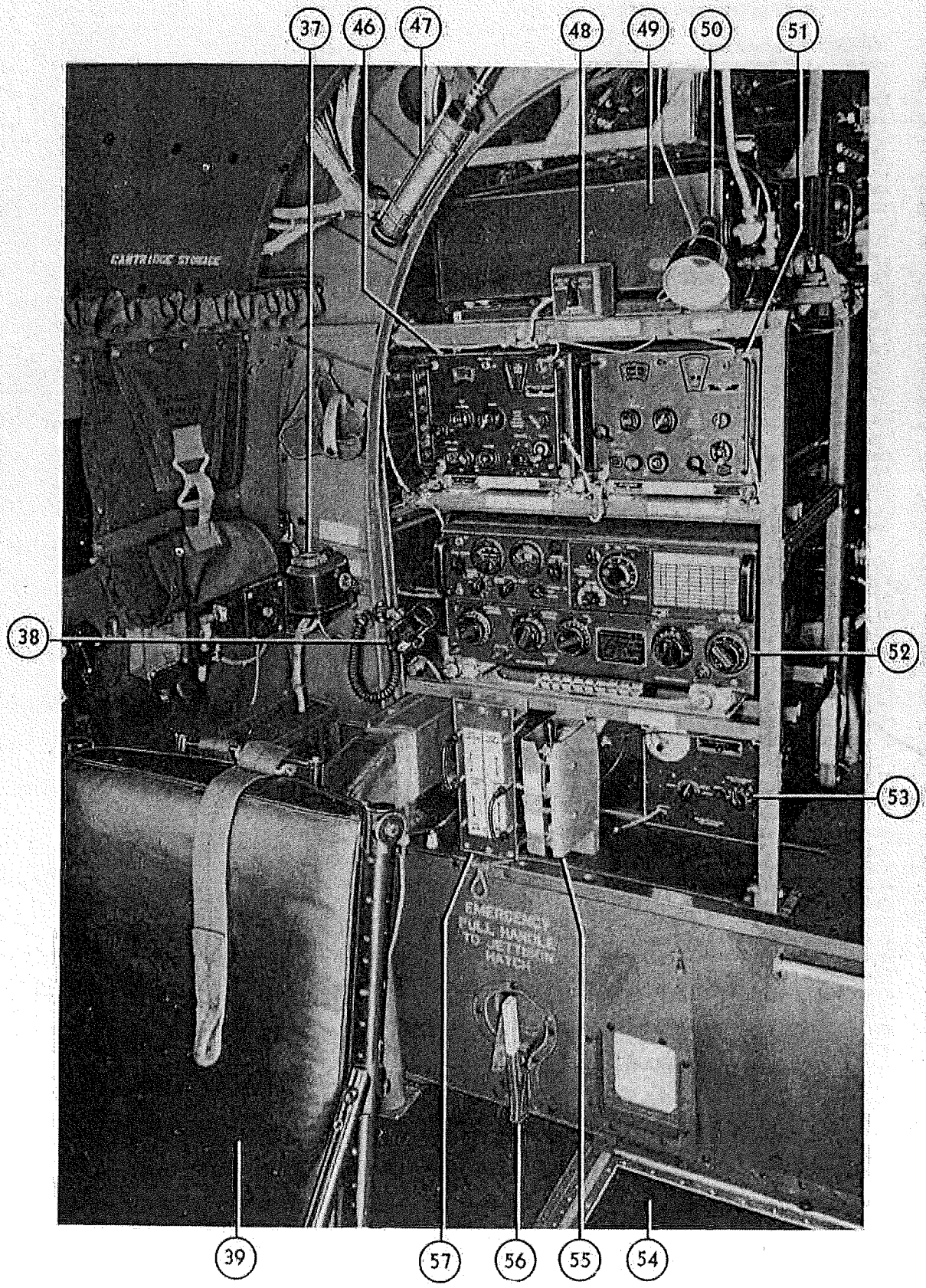
4-86. DESCRIPTION OF AN/ARR-15 LIAISON RECEIVER. The AN/ARR-15 liaison receiver provides preset multi-channel voice, CW, or MCW, radio operator controlled reception. Two sets, both radio operator tuned, are installed behind the radio operator. Ten frequencies may be selected and locked,



View Looking Forward
Figure 4-20 (Sheet 1 of 3 Sheets) - Radio Operator's Station



View to Right of Seat
Figure 4-20 (Sheet 2 of 3 Sheets) - Radio Operator's Station



View Looking Aft
Figure 4-20 (Sheet 3 of 3 Sheets) - Radio Operator's Station

Key to Figure 4-20

1. AN/ARC-5 Receiver
2. AN/ARC-1 Transmitter Receiver
3. Oxygen Flow Indicator
4. Battery Relay Open Indicator Light
5. Table Light
6. Radio Operator's Window
7. LM Frequency Meter
8. High Heat Warning Light
9. Skin Temperature Indicator
10. Skin Temperature Indicator Selector Switch
11. Interphone Control Box
12. AN/ARC-5 Receiver
13. AN/AIC-5A Amplifier
14. Clock
15. Radioman's Radio Power Switch
16. Dome Light Switch
17. Table Light Switch
18. Table Light Rheostat
19. Utility Receptacle Switch
20. Utility Receptacle
21. Panel Light Rheostat
22. Panel Light
23. Cabin Heater Temperature Selector Switch
24. Ventilator
25. Cabin Heater Master Switch
26. Cabin Heater Fuel Valve Switch
27. Cabin Heater Low Fuel Pressure Indicator Light
28. Cabin Heater Low Heat Indicator Light
29. Wing and Tail Heater Low Fuel Pressure Indicator Light
30. Wing and Tail Heater Fuel Valve Switch
31. Wing and Tail Heater Master Switch
32. Rectifier Duct and Alternator Blast Tube Heater Switches
33. Signal Pistol Cartridge Stowage
34. Signal Pistol Stowage
35. Parachute Stowage
36. Antenna Matching Unit
37. Impact Switch
38. Light
39. Radioman's Seat
40. Antenna Reel Control Box
41. Oxygen Regulator
42. Oxygen Mask Stowage

42A. Rudder Force Augmenter Heater Switch

43. Wing and Tail Anti-Icing Heater Control
44. Radioman's Table
45. Key
46. AN/ARR-15 Receiver No. 1
47. Radio Compass Loop Dehydrator
48. Receiver Antenna Selector Switch
49. AN/ARN-7 Receiver
50. Light
51. AN/ARR-15 Receiver No.2
52. AN/ART-13 Transmitter
53. AN/ART-13 Antenna Loading Coil
54. Forward Entrance Hatch
55. Antenna Transfer Switch
56. Forward Entrance Hatch Jettison Handle
57. AN/APN-4 - AN/ART-13 Antenna Changeover Panel

Figure 4-21 Deleted

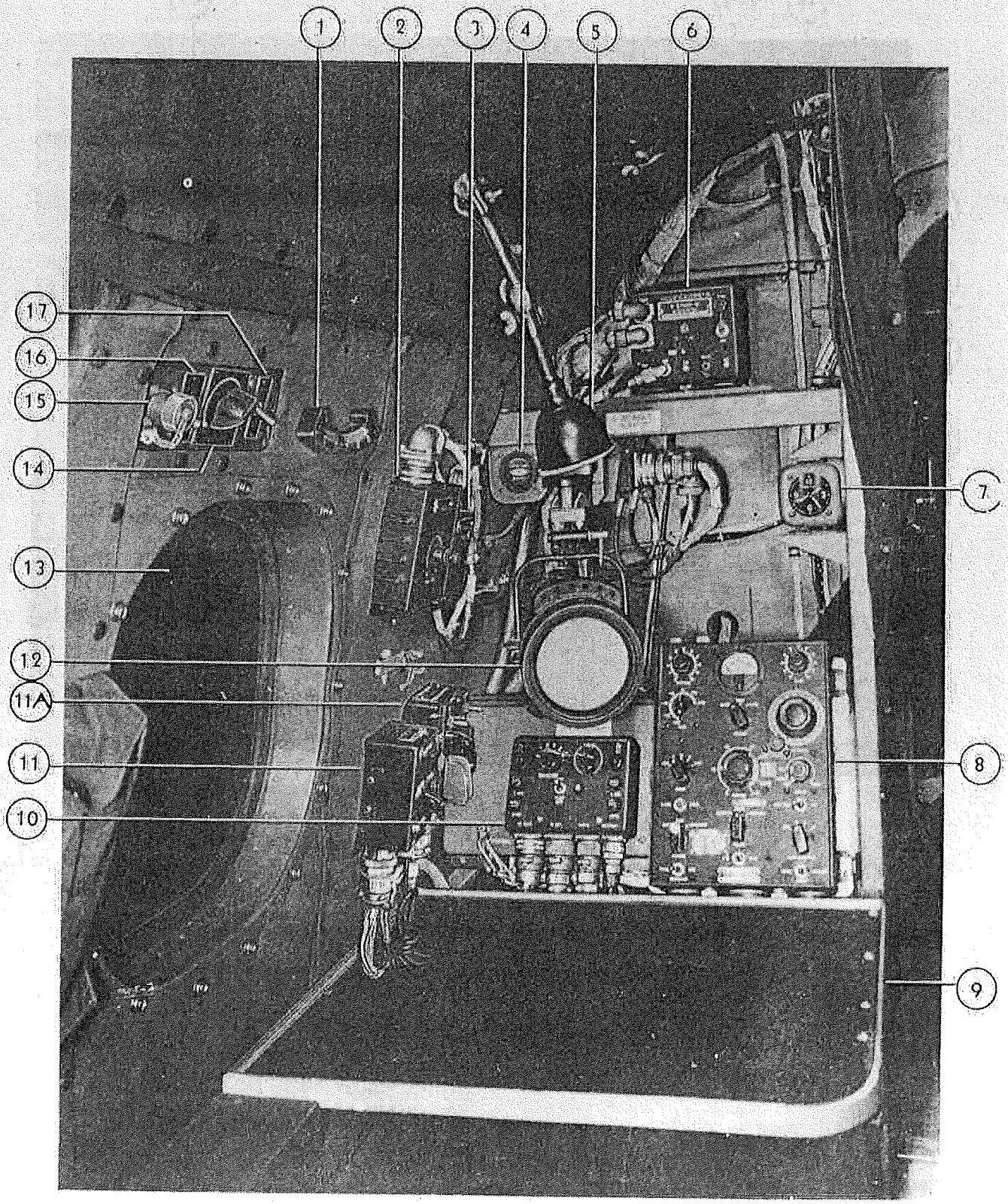
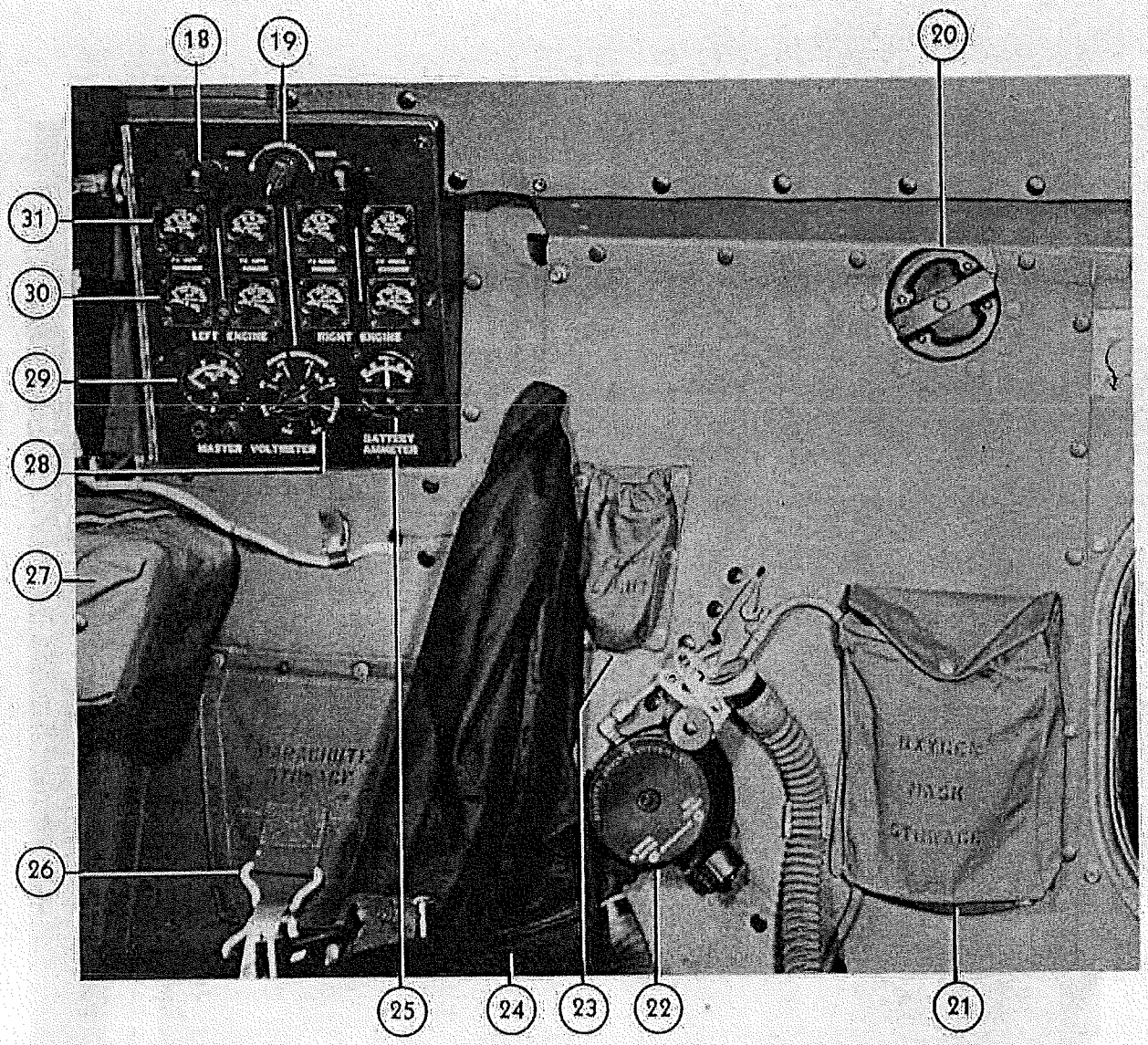


Figure 4-22 (Sheet 1 of 2 Sheets) - Radarman's Station



1. Inclinometer
2. AN/APS-33A Auto Transformer
3. AN/APS-33A Junction Box
4. Oxygen Flow Indicator
5. Table Light
6. AN/ARN-8 Receiver
7. Clock
8. AN/APS-33A Control Unit
9. Radarman's Table
10. AN/APX-2 Control Unit
11. Interphone Station Box
11A. AN/APX-2 Control Unit
12. AN/APS-33A Indicator
13. Radarman's Window
14. Table Light Rheostat
15. Utility Receptacle
16. Utility Receptacle Switch
17. Table Light Switch
18. Panel Light
19. Panel Light Rheostat
20. Ventilator
21. Oxygen Mask Stowage
22. Oxygen Regulator
23. Flashlight Stowage
24. Radarman's Seat
25. Battery Ammeter
26. Parachute Stowage
27. First Aid Kit
28. Voltmeter Selector Switch
29. Master Voltmeter
30. Ammeter
31. Voltmeter

Figure 4-22 (Sheet 2 of 2 Sheets) - Radarman's Station

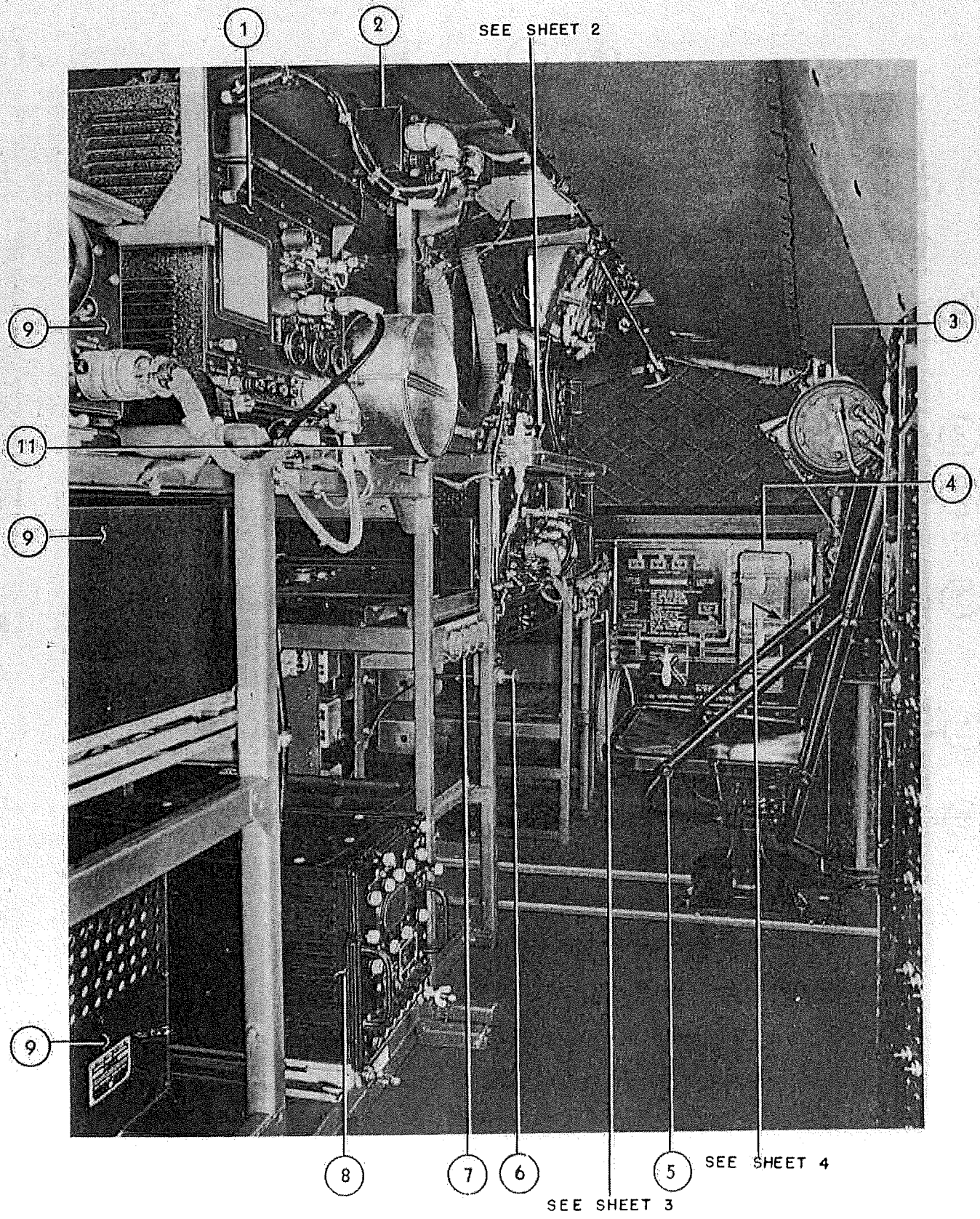


Figure 4-23 (Sheet 1 of 4 Sheets) - Radar Countermeasure Operator's Station

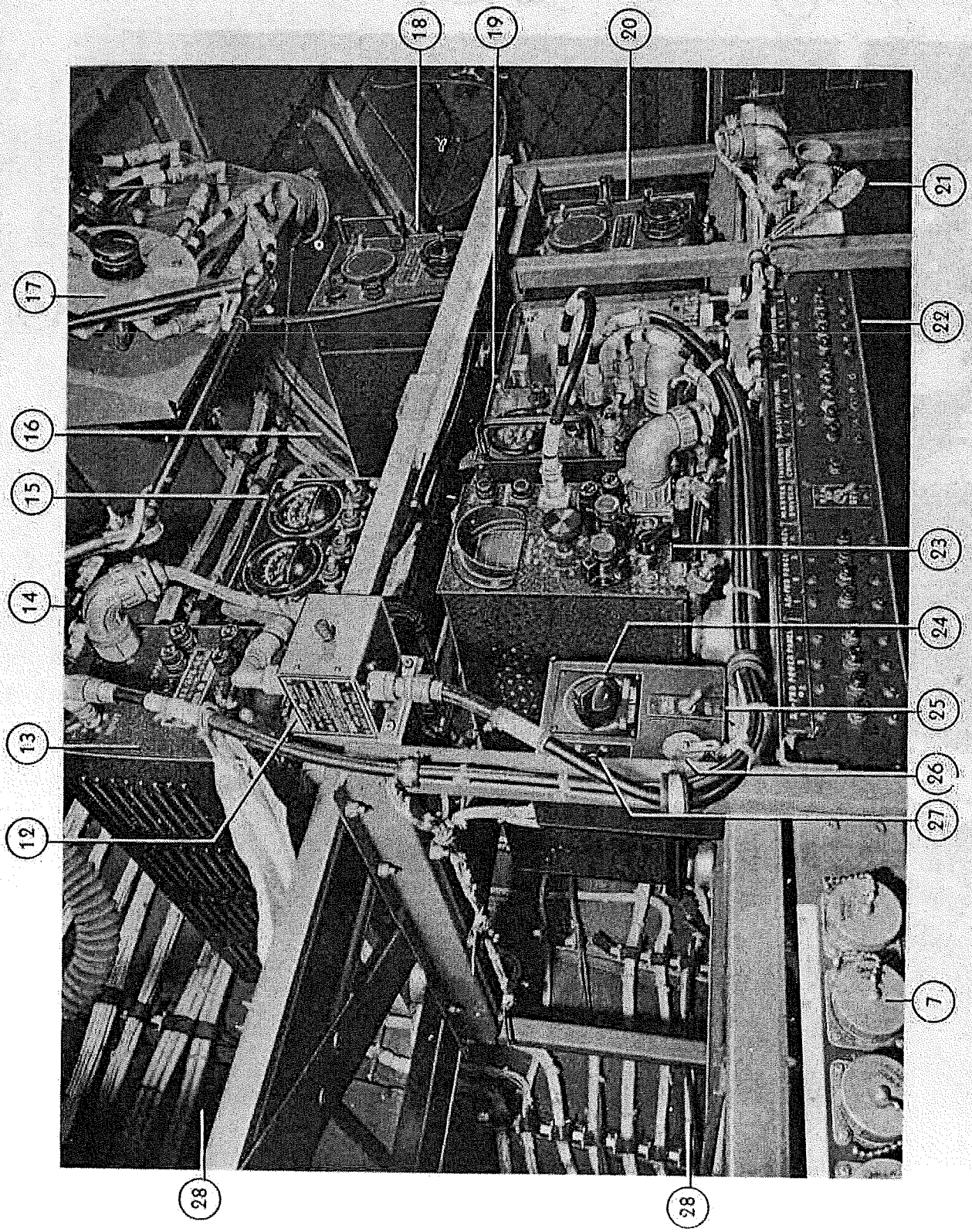


Figure 4-23 (Sheet 2 of 4 Sheets) - Radar Countermeasure Operator's Station

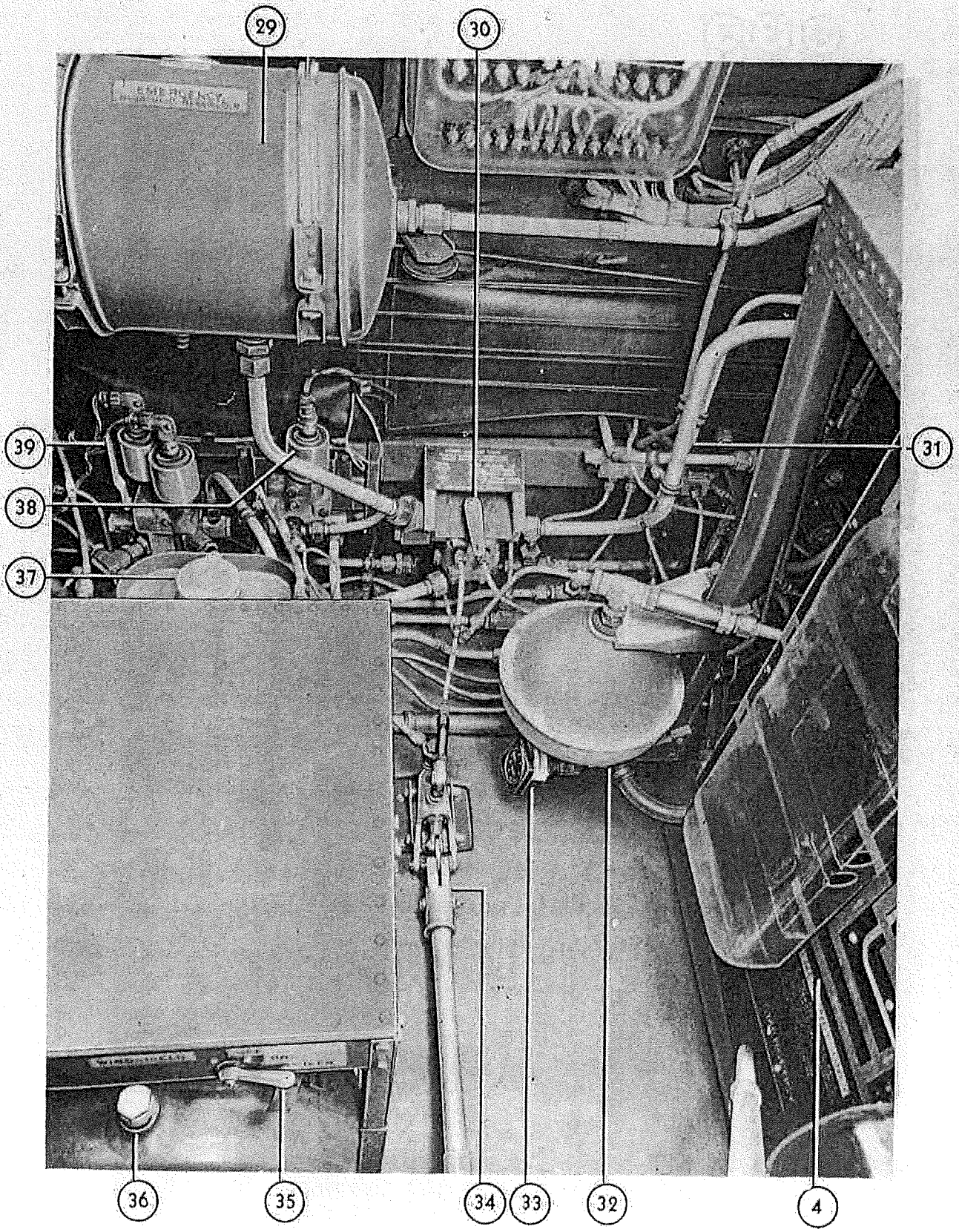


Figure 4-23 (Sheet 3 of 4 Sheets) - Radar Countermeasure Operator's Station

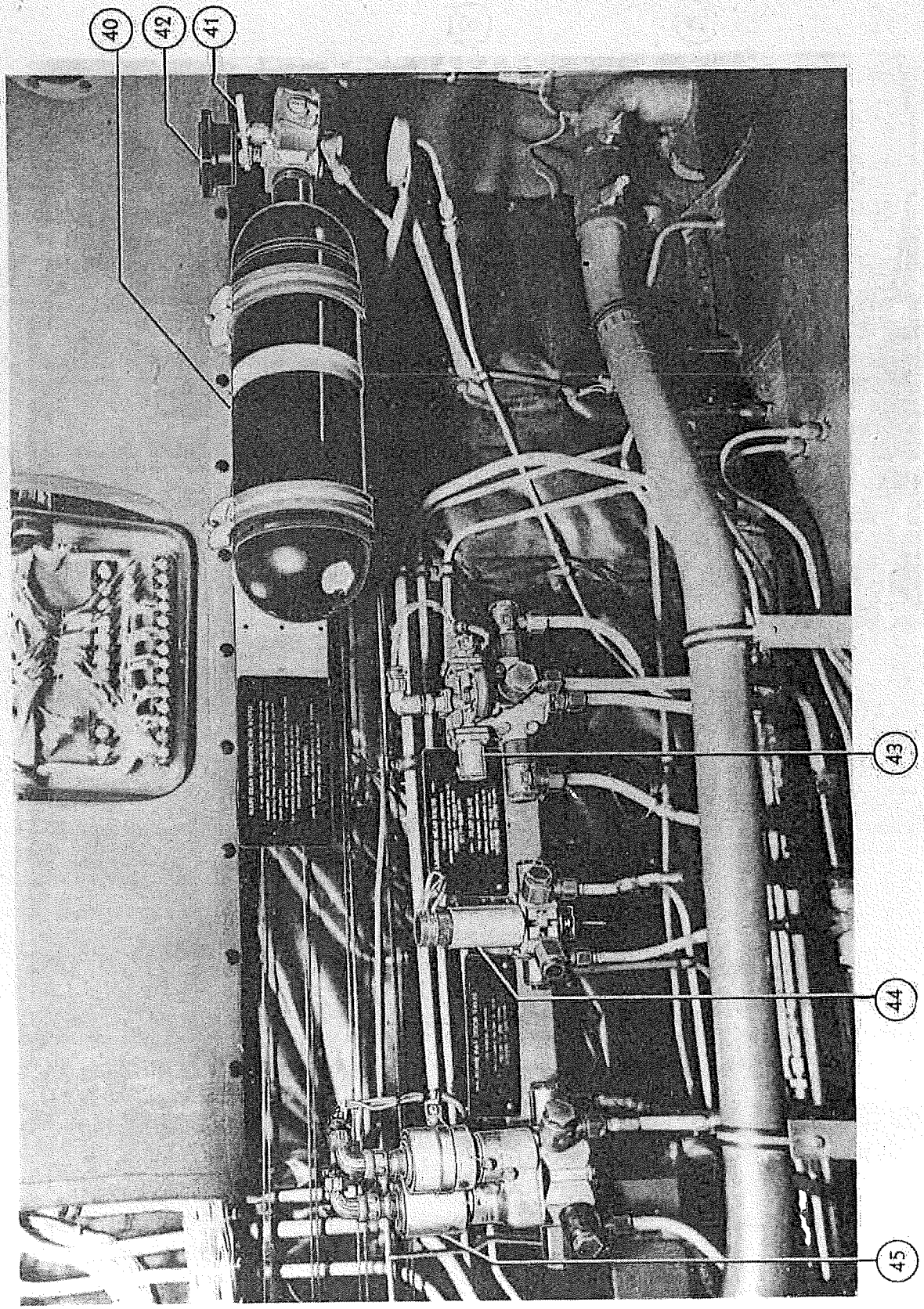


Figure 4-23 (Sheet 4 of 4 Sheets) - Radar Countermeasure Operator's Station

Key to Figure 4-23

1. RT-82/APX-6 Transponder
2. AN/APS-33 Relay Box
3. Hydraulic Reservoir
4. Emergency Manual Fuel Control Panel (See figure 3-3)
5. Radar Countermeasure Operator's Seat
6. Ventilator Control
7. Power Panel
8. AN/APS-33 Synchronizer
9. Radio Operator's Aft Rack (See figure 4-20, Sheet 3)
10. DELETED
11. Water Tank
12. F-27/UPR Stub Wave Trap
13. AN/APA-64A Pulse Analyzer
14. Interphone Station Box
15. AN/APA-64A Indicator Control
16. Space for AN/APA-17 Indicator
17. Radar Countermeasure Antenna Switch Panel
18. TN-17/APR-4 Tuning Unit
19. AN/APR-4 Receiver
20. TN-18/APR-4 Tuning Unit
21. Power Panel
22. Circuit Breaker Panel
23. AN/APA-38 Panoramic Adapter
24. Table Light Rheostat
25. Table Light Switch
26. Utility Receptacle
27. Utility Receptacle Switch
28. Spare Mount
29. Emergency Hydraulic Reservoir
30. Hydraulic System Selector Valve
31. Nose Gear Emergency Control Valve
32. Emergency Hydraulic System Accumulator
33. Emergency Hydraulic System Accumulator Pressure Gage
34. Hydraulic Hand Pump
35. Windshield Anti-Icing Fluid Valve
36. Windshield Anti-Icing System Tank
37. Windshield Anti-Icing System Tank Filler
38. Emergency Bomb Bay Vent Valve
39. Emergency Bomb Bay Control Valve
40. Main Landing Gear Emergency Air Bottle
41. Air Bottle Release Handle
42. Air Bottle Pressure Gage
43. Landing Gear Valve
44. Flap Valve
45. Bomb Bay Door Valve

The above items nos. 13, 15, 16, 17, 18, 20, 23 and 28 were installed on all airplanes except serial no. 124373 as delivered. See figure 4-23A for installation on airplane serial no. 124373 and all others when service change is incorporated.

Key to Figure 4-23A

1. RT-82/APX-6 Transponder
2. AN/APS-33 Relay Box
3. Hydraulic Reservoir
4. Emergency Manual Fuel Control Panel (See figure 3-3)
5. Aft Power Panel
6. Radar Countermeasure Operator's Seat
7. AM-256/APA-69 Amplifier-Power Supply
8. TN-16/APR-4 Tuning Unit
9. Ventilator Control
10. PP-336/APR-9 Power Supply
11. PP-337/APR-9 Auxiliary Power Supply
12. Fwd Power Panel
13. AN/APS-33 Synchronizer
14. TN-129/APR-9 Tuning Unit
15. Radio Operator's Aft Rack (See figure 4-20, Sheet 3)
16. TN-131/APR-9 Tuning Unit
17. Mounting Base for TN-130/APR-9 Tuning Unit
18. Mounting Base for TN-128/APR-9 Tuning Unit
19. Water Tank
20. SA-211/APR-9 RF Relay
21. CV-43/APR-9 Mixer-Amplifier
22. *C-527/APA-69 Direction Finder Control
23. ID-228A/APA-64 Indicator Control
24. Panel Light Rheostat for D/F Control Panel
25. ID-58/APA-38 Panoramic Adapter
26. RCM Operator's Interphone Station Box
27. ID-226/APR-9 Indicator
28. ID-36/APA-69 Azimuth Indicator
29. DELETED
30. C-426/APR-9 Control Unit (See figure 4-25A)
31. Engine Ignition Analyzer (See figure 4-17A)
32. TN-18/APR-4 Tuning Unit
33. TN-17/APR-4 Tuning Unit
34. RCM Circuit Breaker Panel
35. R-54/APR-4 Receiver
36. RF-38A/APA-64 Pulse Analyzer
37. Patch Panel
38. F-27/UPR Wave Trap

* (See figure 4-25G)

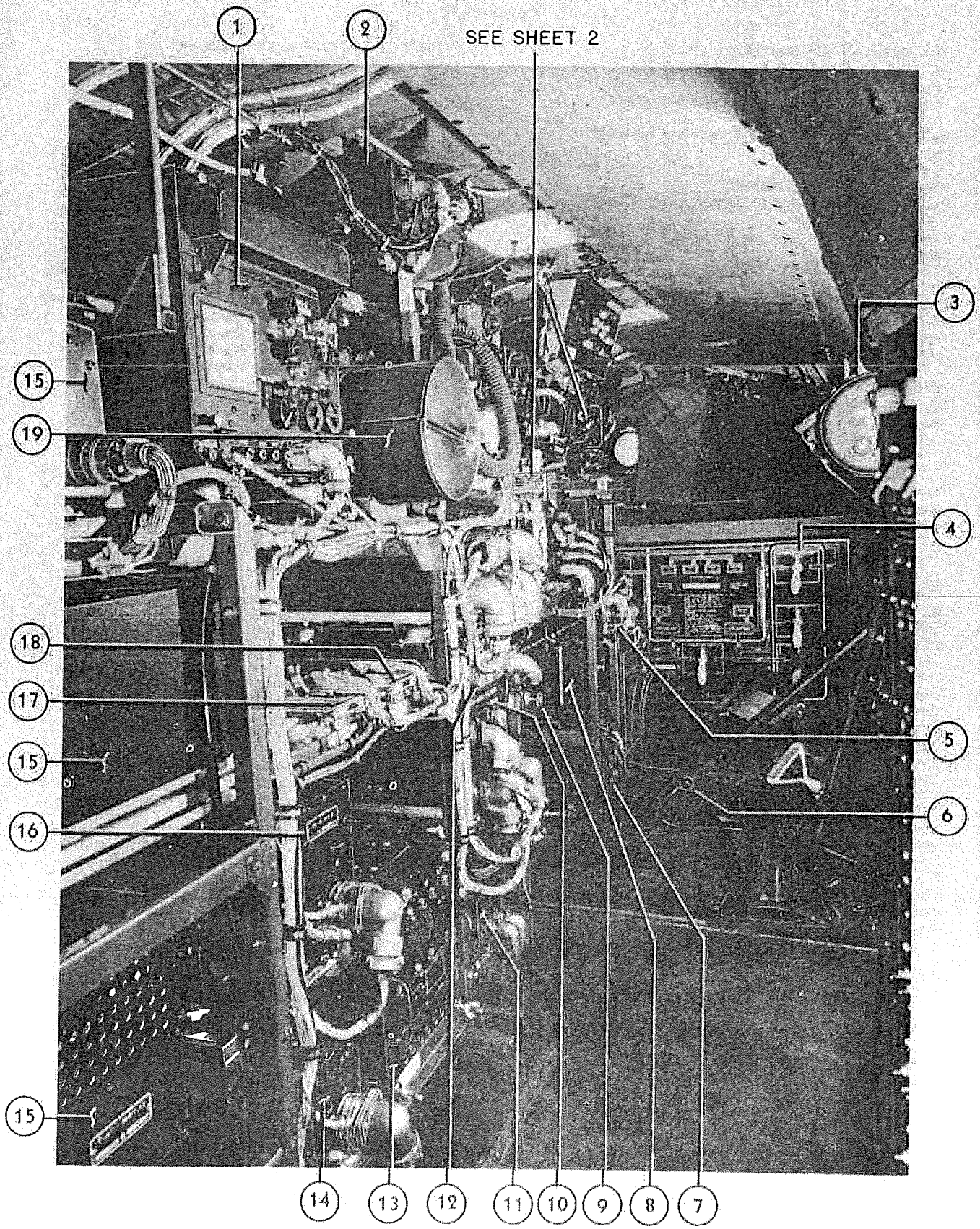


Figure 4-23A (Sheet 1 of 2 Sheets) - Radar Countermeasure Operator's Station

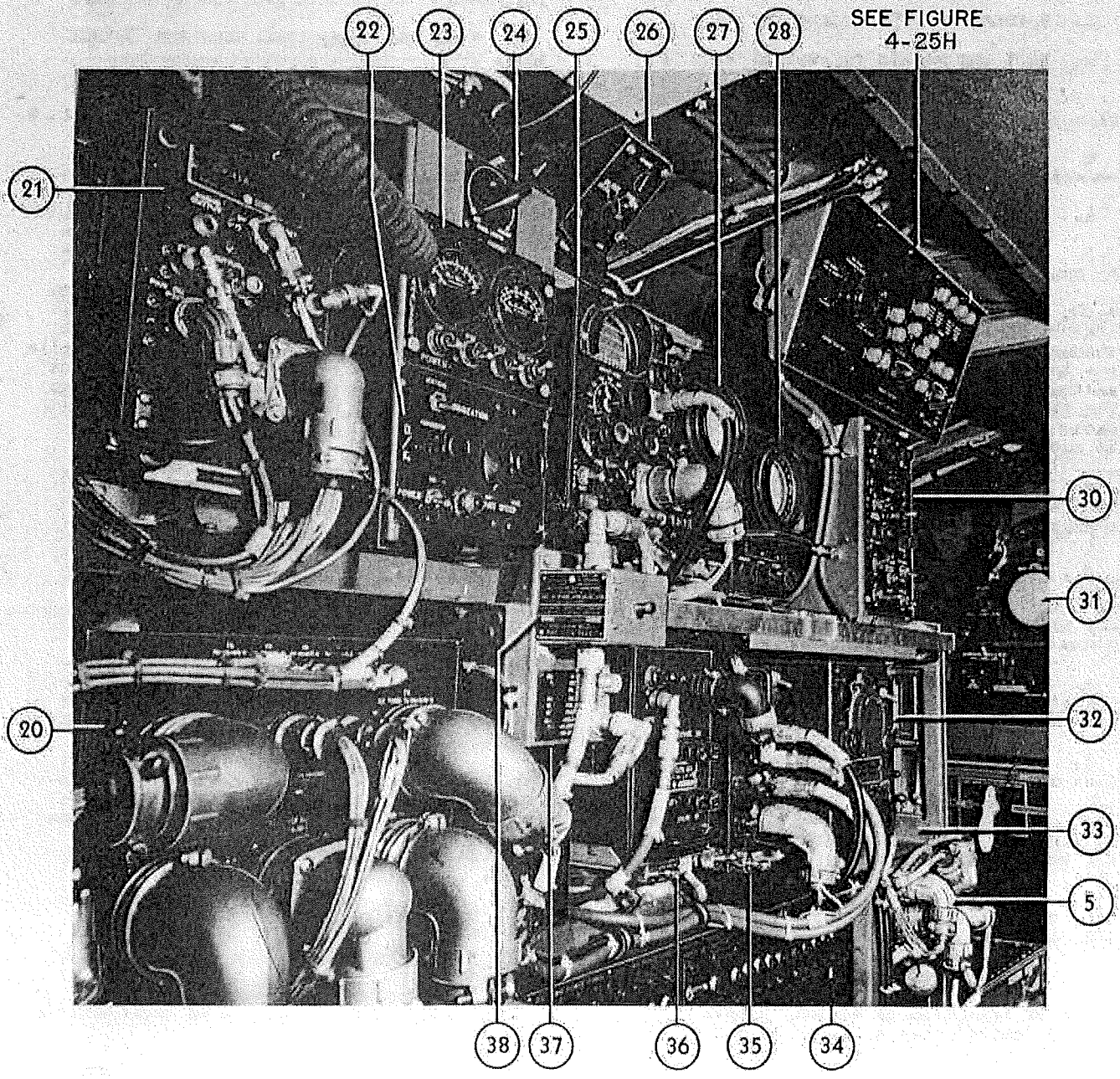


Figure 4-23A (Sheet 2 of 2 Sheets) - Radar Countermeasure Operator's Station

and then selected by the ten-point selector switch by the radio operator. Changing of the channels available may be accomplished by the receiver panel controls.

4-87. OPERATION OF AN/ARR-15 LIAISON RECEIVERS. The controls of the AN/ARR-15 receivers are on the panels of the receivers. No remote control of these units is used. The two receivers are located behind the radio man. (See figure 4-20, references 46 and 51)

a. Rotate "ON-OFF" switch to "ON".

b. Wait one minute for set to warm up.

c. Select desired channel with "CHANNEL" selector switch.

d. Set "CW-MCW-CAL" switch to desired reception.

e. Regulate volume with "VOLUME" control.

f. Press "ON-OFF" switch all the way in to shut off set.

4-88. TO CHANGE TO NEW SETTING OF AN/ARR-15 LIAISON RECEIVER. The controls used to change the frequency setting of the receiver for any position of the "CHANNEL" selector switch are located on the receiver panel. The two receivers are located behind the radio man. (See figure 4-20, references 46 and 51)

a. With set on, and warmed up, move "CHANNEL" selector switch to channel to be changed.

b. When cycle is completed, unlock "AUTO TUNE" stop rings by rotating the locking key on the "BAND" switch control, and the locking key above the "TUNING" control two revolutions in a counterclockwise direction.

c. Operate "BAND" switch to band that contains the desired frequency and set "CW-MCW-CAL" switch to "CAL.".

d. Rotate "TUNING" control until main dial shows desired frequency.

e. Rotate "BFO-CALIBRATE" control so that calibration dials show last two digits of the desired frequency.

f. While listening to the receiver output, rotate "TUNING" control until exact zero beat is obtained.

NOTE

If CW reception is wanted, rotate "CALIBRATE" dial a few divisions for peak audio output.

g. Carefully lock "AUTO TUNE" by rotating clockwise until tight.

h. Return the "CALIBRATE" control to "0".

i. Repeat for any other setting.

4-89. LM-14 FREQUENCY METER.

4-90. DESCRIPTION OF LM-14 FREQUENCY METER. The LM-14 frequency meter is used to measure radio signal frequencies and calibrate transmitters and receivers by setting up a correct frequency signal for comparison.

4-91. LM-14 FREQUENCY METER INSTRUMENT CORRECTION. The heterodyne oscillation must always be corrected to agree with the calibration through comparison with the crystal oscillator at the nearest crystal check point before making any frequency adjustments. To do this proceed as follows:

a. Plug the headphones into the "PHONES" jack.

b. Throw "CRYSTAL" and both "POWER" switches to "ON" and turn "MODULATION" switch to "OFF".

c. From the calibration book, ascertain the band and nearest crystal check point for the desired frequency. Turn the "FREQ. BAND" knob to proper setting and set the dial to agree with the crystal check point setting.

d. A signal or beat will be heard unless the heterodyne oscillator is either on calibration or so far off calibration that the sound is inaudible. Which condition prevails can be determined by turning the "CORRECTOR" knob to where the beat becomes audible, the pitch of the beat will identify its position compared with the crystal setting.

e. Rotate the "CORRECTOR" knob to the zero beat. Check this by turning beyond that setting to pick up the beat again.

4-92. TRANSMITTER CALIBRATION USING FREQUENCY METER.

a. Correct the instrument as described in paragraph 4-91.

b. Throw the "CRYSTAL" switch to "OFF".

c. Turn the frequency meter dial to the desired frequency, as given in the calibration book.

d. With the "RF. CPLG." loosely coupled to the transmitter output, tune the transmitter to give an audible beat in the phones.

e. Adjust the "RF. COUPLING" control to give a comfortable signal level.

f. Tune the transmitter to zero beat.

4-93. RECEIVER CALIBRATION USING FREQUENCY METER.

a. Correct the instrument as described in paragraph 4-91.

b. Throw the "CRYSTAL" switch to "OFF" and transfer the phones from the frequency meter to the receiver jack.

c. Turn the frequency meter dial to the desired frequency, as given in the calibration book.

d. If calibrating on MCW turn the

"MODULATION" switch to "ON", otherwise leave it at "OFF".

e. With the "RF. CPLG." loosely connected to the receiver antenna lead, tune the receiver to give an audible signal in the phones.

f. Adjust the "RF. COUPLING" control to give a comfortable signal level.

g. For CW calibration, adjust the receiver to that side of zero beat to give best reception according to the operator's desires. For MCW calibration, adjust the receiver for maximum response.

4-94. UNKNOWN FREQUENCY MEASUREMENT. To measure accurately a received signal frequency proceed as follows:

a. Using the frequency as read on the receiver, correct the instrument as described in paragraph 4-91.

b. Throw the "CRYSTAL" switch to "OFF" and transfer the phones from the frequency meter to the receiver jack.

c. With the "RF. CPLG." loosely connected to the receiver antenna, turn the meter dial until its signal is heard.

d. If the signal in question is CW, tune the receiver to zero beat and then tune the meter to zero beat with the receiver.

e. If the signal in question is MCW, turn the "MODULATION" switch to "ON" and adjust both receiver and meter to maximum response.

f. Take the resultant setting from the frequency meter dial and read the actual frequency from the calibration book.

4-95. AN/ARN-7 RADIO COMPASS.

4-96. PRELIMINARY TUNING OF AN/ARN-7 RADIO COMPASS.

a. Turn the "RANGE FILTER SEL." switch on the interphone control box to the desired position on the "1" side. The navigator bomber must turn the "MIC SEL." switch on the interphone station box to "RADIO".

b. On the radio compass control box turn the function selector switch to "ANT.". If the green light does not come on push in the "CONTROL" switch. This should turn on the green light indicating that this box has taken control of the equipment.

NOTE

Any one of the three positions on the function selector switch can be chosen, but in general best results will be obtained in preliminary tuning by using "ANT.".

c. Rotate the band switch to the frequency band desired.

d. Turn the "TUNING" crank to desired frequency, and rotate back and forth through resonance for maximum clockwise deflection of the tuning meter to determine exact setting of the dial. Listen for station identification to be sure that the correct station is being received.

NOTE

Aural identification of keyed CW stations may be obtained by switching to the "CW" position on the "CW-VOICE" switch on the bottom of the control box.

4-97. HOMING COMPASS OPERATION OF AN/ARN-7 RADIO COMPASS.

a. Switch the function switch to "COMP.".

b. Turn in the direction shown by the indicator pointer. When the indicator pointer is at zero, the airplane is headed toward the radio station to which the compass unit is tuned.

c. Adjust the "AUDIO" control for satisfactory headset level.

d. The airplane will ultimately arrive over the radio station antenna, but the path may be a curved line due to cross wind, and coordination with ground fixes or landing fields along the route may be either difficult or impossible. Consequently, it is often best to fly a straight line course by off-setting the heading of the airplane to compensate for wind drift.

4-98. POSITION FINDING WITH AN/ARN-7 RADIO COMPASS.

NOTE

The navigator will take control for position finding. To make the shift, the navigator sets the function switch on his radio compass control box to "COMP" or "ANT." and pushes in on his "CONTROL" switch. His green light will come on, and the pilot's will go out.

4-99. VISUAL METHOD OF POSITION FINDING WITH AN/ARN-7 RADIO COMPASS.

a. Set function switch to "COMP.".

b. Tune in the stations to be used, identify them, and log the dial readings. Greatest accuracy is obtained by taking several bearings in rapid succession.

c. Adjust "AUDIO" control to desired level.

d. Set the azimuth scale with the "VAR" knob so that the numerical value of the magnetic heading of the airplane is at the index.

e. Determine the magnetic variation for the locality over which the airplane is flying, and rotate the "VAR" knob for the required correction.

f. Record the bearings shown by the tail end of the bearing indicator pointer. This reading is the station-to-airplane bearing from north.

g. To obtain a fix, take bearings on three or more stations, 30 degrees or more from the line of direction of any one station, and plot them on a map. The intersection of the plotted lines is the position of the airplane at time of observation.

4-100. AURAL-NULL METHOD OF POSITION FINDING WITH AN/ARN-7 RADIO COMPASS.

NOTE

For aural reception of A-N signals, operate on "ANT" or "LOOP" because the AVC action on "COMP" will cause broad course indications.

a. Switch to "LOOP" and tune in the desired station. To obtain a good intelligible signal it may be necessary to rotate the loop to maximum signal position. It is also necessary to use "CW" operation in order to identify keyed CW station.

b. Adjust "AUDIO" control for the desired level.

NOTE

For aural reception of A-N signals on interphone, set the interphone volume control fully clockwise and use the "AUDIO" control on the radio compass control box to reduce headset volume. For best definition of A-N signals on "LOOP" or "ANT", set the "AUDIO" control to the lowest usable audio level and reduce it as A-N signals increase.

c. Use the "VAR" knob on the indicator and set the bearing scale so that the numerical value of the magnetic heading of the airplane is at the index mark.

d. Determine the magnetic variation for the locality, and rotate the "VAR" knob in the direction indicated by the arrows for the required correction.

e. Use the "LOOP L-R" switch and rotate the loop for minimum headset volume, and read the bearing indicator.

4-101. AN/ARN-7 RADIO COMPASS RECEIVER OPERATION.

4-102. AN/ARN-7 RADIO COMPASS ANTENNA RECEPTION.

a. Set the function switch to "ANT", tune in the desired station as for preliminary tuning and set "AUDIO" control at desired level.

b. Best definition of radio range signals will be received by setting interphone volume control fully clockwise, and adjusting "AUDIO" knob on radio compass control box for lowest usable headset volume.

4-103. AN/ARN-7 RADIO COMPASS LOOP RECEPTION.

a. Turn the function switch to "LOOP". Depress "LOOP L-R" and turn to "L" or "R", holding until maximum signal strength is obtained. Adjust the "AUDIO" knob for desired headset volume. To rotate loop at slow speed, do not depress "LOOP L-R" switch knob when turning it to "L" or "R".

b. For best definition of radio range signals, it is necessary to maintain the loop near the 90 or 270 degree position. Set the interphone control fully clockwise, and adjust the "AUDIO" knob for the lowest usable headset volume.

4-104. STOPPING AN/ARN-7 RADIO COMPASS. Turn the function switch to "OFF".

4-105. AN/ARN-8 MARKER BEACON RECEIVER. No adjustments of this receiver are necessary in flight. The receiver operates the marker beacon light on the pilot's instrument panel regardless of the position of the "BEACON" switch on the interphone control box. The audio signal from the receiver may be heard by turning on the interphone control box "BEACON" switch.

4-106. AN/APN-1 RADIO ALTIMETER.

4-107. DESCRIPTION OF AN/APN-1 RADIO ALTIMETER. The radio altimeter indicates actual altitude above terrain measured on an indicator which contains a 0-400 feet and a 0-4000 feet scale. (See figure 1-3, reference 1). A red light, indicates when the airplane gets closer to the terrain than the preset distance. (See figure 1-3, reference 6). This distance can be selected by the altimeter limit switch which has 11 positions for altitudes from 50 to 300 feet or 500 to 3000 feet depending upon the range of operation. (See figure 1-3, reference 33).

4-108. OPERATION OF AN/APN-1 RADIO ALTIMETER.

a. Turn the "ON" knob in the direction of the arrow as far as it will go.

b. Turn the "RANGE" knob to get the desired range.

WARNING

Use 0 to 400 scale when altimeter is used below 400 feet.

c. Turn the limit switch to the desired altitude. The red altitude limit indicator light will be on whenever the airplane is below the present altitude.

CAUTION

The altimeter may read high below 600 feet on the high range and should not be relied on below this altitude unless the particular installation is known to be accurate.

d. Turn off by turning the "ON" knob in the opposite direction from the arrow.

4-109. AN.APX-2 IFF EQUIPMENT.

4-110. This equipment is used for self-identification and is connected with the AN/APS-33A search radar so that targets

picked up on the search screen may be challenged for identification. There is a destructor circuit in the equipment and before take-off the "DESTRUCT" switch should be checked to make certain its guard is wired down. (See figure 4-22, reference 11A)

4-111. The main control box, C-57/APX-2, is to the left of the radarman and contains an "INT" switch, a "G BAND" switch, a function selector switch, a "DESTRUCT" switch and a "GAIN" control. (See figure 4-22, reference 11A.) The function selector switch has five positions; however, two of these positions, "A/G OFF" and "ROO", are usually used only by fighter aircraft. The "GAIN" control will govern the amplitude of the video signals so it is normally kept in the "REMOTE" position to enable the radarman to use the "GAIN" control on his C-56A/APX-2 control box. The "INT" switch is used to send a challenge to any sighted craft, either continuously or momentarily. Any response received from this challenge will show up on the AN/APS-33A radar screen. The "INT" switch on the radarman's IFF C-56A/APX-2 control box will accomplish the same results but it has only momentary contact. The "G BAND" is not generally used but it may be by actuating the switch.

4-112. The selection of response codes is done with the "SELECTOR" on the radarman's C-56A/APX-2 control box.

4-113. AN/APX-6 RADAR IDENTIFICATION SET.

4-113A. DESCRIPTION OF AN/APX-6 RADAR IDENTIFICATION SET.

4-113B. The radar identification set AN/APX-6 is an airborne transponder and is one of several equipments which may be operated together to provide a system of electronic identification and recognition. The purposes of the AN/APX-6 are:

a. To identify the airplane in which it is installed as friendly when correctly challenged by an interrogator -responsor associated with friendly shore, ship board and airborne radars.

b. To permit surface tracking and control of aircraft in which it is installed.

4-113C. Functionally the AN/APX-6 receives challenges, which are initiated by the interrogator-responsor, and transmits replies back to the interrogator-responsor where the replies are displayed, along with the associated radar targets, on the radar indicators. When the radar target is accompanied by a proper IFF reply, as transmitted by the AN/APX-6, the target is considered friendly.

4-113D. OPERATION OF AN/APX-6 RADAR IDENTIFICATION SET. All controls required for operation of the AN/APX-6 equipment are located on the radar set control C-544/APX-6. This unit is located on the forward side of the bulkhead directly aft of the pilot's seat. (See figure 3-4, reference 6A.) Operation is as follows:

a. To turn equipment on, rotate "MASTER" selector to "NORM".

b. To maintain the equipment ready for instant use by inoperative, rotate the "MASTER" selector to "STDBY".

c. The detent position labeled "LOW" on the "MASTER" selector should not be used except upon proper authorization.

d. The switches labeled "MODE 2" and "MODE 3" should be set to their "OUT" positions unless otherwise directed by proper authority.

e. To secure the equipment, rotate the "MASTER" selector to "OFF".

f. For emergency operation and destruction instructions, refer to paragraphs 3-51A.

4-113E. AN/ARR-31 SONOBUOY RECEIVER.

4-113F. DESCRIPTION OF AN/ARR-31 SONOBUOY RECEIVER.

4-113G. The AN/ARR-31 consists of an airborne receiver to receive the signals transmitted by the sonobuoy.

4-113H. Functionally the AN/ARR-31 is a superheterodyne F-M receiver. The receiver detects the R-F signal transmitted by the sonobuoy which in turn is transmitted through the interphone communication system to five members of the flight crew (pilot, co-pilot, navigator, radio operator and radar operator.)

4-113I. Controls for the operation of the AN/ARR-31 equipment are located as follows:

a. The "ON-OFF" switch is on the power unit located under the pilot's floor just aft of the control bulkhead.

b. DELETE

c. The interphone communication switches "SP 1" located on the control boxes of the flight crew.

d. Adjustment controls and navigator phone jacks on the R332/ARR-31 receiver. (See figure 4-2, reference 9).

e. Pilot's navigator call switch located on the pilot's window sill outboard of the instrument panel. (See figure 1-6, reference 11A). This switch controls the navigator's ICS call light located on the left hand side of the airplane above the navigator's table. (See figure 4-2, reference 12B).

4-113J. OPERATION OF AN/ARR-31 SONOBUOY RECEIVER.

a. To turn equipment on, move "ON-OFF" switch on power unit to "ON".

b. Plug headset H-3/ARR-3 into jacks on receiver.

c. DELETE

d. Adjust ICS gain control on receiver to comfortable level.

e. DELETE

f. To contact the navigator, the pilot presses the navigator call button located on the forward side of window sill. This flashes a light located just above the navigator's table. The navigator's microphone should remain plugged into the ICS station box so an immediate contact can be made with the pilot through the interphone system.

g. The flight crew (less RCM operator) can at their option listen to the sonobuoy output by setting the ICS control boxes to "SP 1" or the station boxes to "RADIO".

4-114. AN/APS-33A SEARCH RADAR EQUIPMENT.

4-115. DESCRIPTION OF AN/APS-33A RADAR EQUIPMENT. The AN/APS-33A radar set is designed to operate as a search and navigation instrument. It is also designed for beacon operation and is connected with the IFF equipment to show identification of targets. The radar bombing equipment also uses the AN/APS-33A antenna,

4-116. NORMAL SEARCH OPERATION WITH AN/APS-33A RADAR EQUIPMENT. With controls normally "OFF" ("DELAY" switch at "NORM" and "GYRO" switch at "CAGE") proceed as follows:

a. Turn "POWER" switch to "STANDBY", "SCAN" switch to "3" "METER" switch to "LINE" and "BEARING" switch to "REL".

b. The meter should indicate somewhere within the green area marked on the face. If it doesn't turn "POWER" and "SCAN" switches "OFF" and do not use.

c. Turn "METER" switch to "MAG." "PULSE" switch to "SHORT" and "POWER" switch to "RUN".

d. Check "MAG" current on meter, it should read between 5.5 and 7.0. Application of power to the magnetron is automatically delayed 3 minutes after "POWER" switch is first turned to "STANDBY".

CAUTION

The equipment should run for three minutes with these control settings after the magnetron current is indicated.

e. Turn "POWER" switch to "STANDBY" and "PULSE" switch to "LONG" then turn "POWER" switch back to "RUN"; the meter should read 135. If the magnetron current drops to zero; rotate the "MAG CUR" control on the autotransformer 1/4 turn toward "LO" and when the meter begins to indicate current adjust the "MAG CUR" control until the meter indicates 135.

NOTE

Check magnetron current frequently during flight to make sure it remains at proper value.

f. Adjust the brilliance of markers and signals and the sharpness of sweep line with the four controls on the indicator.

g. When the airplane is in level flight, move "GYRO" switch to "UNCAGE".

h. Adjust "TILT" and "GAIN" controls until signals appear best.

CAUTION

Setting RANGE control above 60 miles automatically gives long pulse operation, regardless of the PULSE switch setting.

i. Set "RANGE" control on "SEARCH 0-200" or on one of the other five search ranges as desired.

4-117. TARGET BEARING DETERMINATION WITH AN/APS-33A RADAR EQUIPMENT.

a. With the equipment set for normal search, move "BEARING" switch to "TRUE" for true bearing or leave at "REL" for relative bearing.

b. Rotate "MARKER" dial until azimuth marker line coincides with the vertical line on the indicator, if true bearing is desired, to ascertain bearing of airplane.

c. Rotate "MARKER" dial until the azimuth marker line bisects the target.

d. Relative bearing may be read directly from the dial. True bearing is the setting from step c minus the setting from step b. Add 360 to step c reading if necessary.

e. If the true bearing of the airplane is desired, take the reading from step b and subtract it from 360.

4-118. TARGET DISCRIMINATION WHILE USING AN/APS-33A RADAR EQUIPMENT. This form of operation is provided so that an amplified and expanded view of any object may be obtained. Target discrimination operation may be used with either normal search (long pulse), high definition search (short pulse) or beacon operation (beacon pulse) if range permits and with either sector scan or continuous rotation of the antenna. It should be noted that while objects are amplified or expanded in range, they are not expanded in azimuth and are therefore very distorted. The following is the procedure for target discrimination:

a. Set "ALT DEL-TD" switch in "TD" position.

b. Adjust "DELAY" control until the delay marker appears at the start of the area to be expanded.

c. Place "RANGE" switch in position "30 TD" or "5 TD", depending on degree of expansion desired.

d. Vary "DELAY" control toward "MIN." as the object is approached and disappears at the start of the sweep on the indicator screen.

4-119. ALTITUDE OPERATIONS OF AN/APS-33A RADAR EQUIPMENT. To determine the airplane's altitude above the terrain, set up the equipment for normal search and turn the "RANGE" switch to "5"; the wide luminous band which appears is the altitude mark, from which the approximate altitude is obtained by comparison with the range markers. To eliminate this circle which represents wasted screen area, place the "ALT DEL-TD" switch in the "ALT DEL" position and adjust the "DELAY" control between "MIN" and "MAX" until the altitude mark just appears.

4-120. SECTOR SCAN WITH AN/APS-33A SEARCH RADAR. For longer examination of a specific area or target a 60 degree sector may be scanned using the following procedure:

a. With the equipment set for normal search turn the "SCAN" switch to "2", throw the "SLOW-FAST" switch to "FAST" and turn the "MARKER" control until the desired area is scanned.

b. For even better definition throw the "BEARING" switch to "REL" and turn the "SCAN" switch to "1", this will depress the center of the sector. This presentation can only be used 45 degrees either side of the airplane's heading.

c. If the "BEARING" switch is thrown to "TRUE" when the "SCAN" switch is at "1" the depressed center sector returns to normal sector.

4-121. INTERFERENCE ELIMINATION ON THE AN/APS-33A RADAR SCREEN. Turn the "ANTI-CLUTTER" control to "A", "B" or "C" whichever eliminates the interference best.

4-122. STABILIZATION OF AN/APS-33A RADAR EQUIPMENT. When the "BEARING" switch is in "TRUE" position, magnetic north will always be at the top center of the screen and the presentation will not move as the airplane turns. The "TILT" control sets the antenna at the desired tilt for operation and gyroscope keeps it stabilized; however, during maneuvers involving roll or pitch of 60 degrees or more the "GYRO" switch should be at "CAGE".

4-123. HIGH DEFINITION SEARCH WITH AN/APS-33A RADAR EQUIPMENT. Follow the procedure for normal search operation then place "PULSE" switch in "SHORT" position, turn "SCAN" switch to "1" or "2" and move "SLOW-FAST" switch to "FAST". As target is approached adjust "TILT" and "GAIN" controls for best illumination and definition and adjust "RANGE" control to keep target near the center of the sector.

NOTE

High definition search operation is restricted to ranges below 60 miles.

4-124. BEACON OPERATION OF AN/APS-33A SEARCH RADAR. With equipment set for normal search turn "RANGE" control to "80-200 BEACON" and "PULSE" switch to "BEACON". When beacon signal has been located adjust "TILT" and "GAIN" controls for best definition.

NOTE

Beacon signals appear as spaced dashes on the screen, the number and spacing of the dashes identify the beacon station.

As the beacon signals approach the center of the screen or if there are none visible, turn the "RANGE" control to "120". Beacon signals less than 80 nautical miles distant cannot be seen with "RANGE" control in "80-200 BEACON" position.

NOTE

If beacon signals cannot be identified on long range, use target discrimination. (5TD or 30TD position).

4-125. TARGET IDENTIFICATION WITH IFF ON AN/APS-33A SCREEN. When the "INT" switch on the AN/APX-2 IFF equipment is "ON" any target on the screen which has answering IFF will show a coded signal in reply.

4-126. MANUAL TUNING OF AN/APS-33A SEARCH RADAR. Manual tuning is provided for use when the automatic frequency control circuit fails. Place "AFC-MAN" switch in "MAN" position and rotate "TUNING" control for maximum brilliance and clarity if signals disappear or fade.

4-127. RADAR BOMBING WITH AN/APS-33A RADAR EQUIPMENT. Rotate the "SCAN" control to "LAB" and operate a high definition search in coordination with the bomber.

4-128. TO STOP THE AN/APS-33A RADAR SET.

a. Throw "GYRO" switch to "CAGE".

b. Have "DELAY" switch at "NORM.".

c. Turn "SCAN" and "POWER" switches "OFF".

4-129. AN/APA-5A INDICATOR EQUIPMENT.

4-130. DESCRIPTION OF AN/APA-5A INDICATOR EQUIPMENT. This equipment is used in con-

junction with the AN/APS-33A search radar to permit accurate bombing of surface targets under conditions which preclude visual location and bombing of such targets. The release point of the bomb load is computed and as the bombing run is completed, the bomb release circuit is automatically energized, dropping the bombs at the predetermined release point.

4-131. AN/APA-5A RADAR BOMBING PROCEDURE. The AN/APA-5A radar bombing equipment is used for accurate blind bomb release. Its range is 30 miles in the high altitude range, which is used from 1000 feet to 35000 feet; and ten miles in the low altitude range, which is used from 100 feet to 3500 feet.

NOTE

The dial switches and "RANGE SELECTOR" should be set for the range of the anticipated release altitude before starting. For low altitude the vertical position is used, and for high altitudes the horizontal position is used giving ranges of one and ten miles at vertical and three and 30 miles at horizontal.

CAUTION

Always place the hands of the "TIME OF FALL" dial at zero before moving it's switch. This meter will be permanently damaged if this precaution is not observed.

a. Check that AN/APS-33A search radar is operating.

b. Turn the "POWER" switch "ON".

NOTE

A 30 minute warm-up period must be allowed.

c. If the bombs are to be dropped in train, set the appropriate amount of lead on the "LEAD AND TRAIL" dial.

d. Throw the "MASTER" switch on the bomber's panel "ON".

e. Check that "BOMBING CIRCUIT BREAKERS" are all in.

f. Throw the "K-25 CAMERA POWER" switch to "ON" and set the camera timer.

g. Set the intervalometer by putting the "SEL-TRAIN" switch in the desired position. If put in "TRAIN", set the ground spacing knob at the desired interval and turn the "BOMBS TO BE RELEASED" knob to the required number.

NOTE

The number used for the "BOMBS TO BE RELEASED" setting should be greater than the number of stations selected in order to give more impulses to any station which failed to release at the first impulse.

h. Turn the "INDICATOR LIGHTS" switch to "SELECTED" and throw "ON" the switches of the stations desired to be released. The indicator lights beside the selected switches will glow.

NOTE

Bombs should be released alternately from either end of the bomb bay to keep remaining load balanced and center of gravity reasonable constant. However, when releasing in train, the bomber has no control over sequence of release.

i. Turn "OFF" bomber panel "MASTER" switch.

j. When a target is sighted the pilot will head toward it and set up the automatic pilot for straight and level flight while the radar operator will turn the "SCAN" switch on the search radar to "LAB.". The pilot's "PILOT DIRECTOR" switch should be turned on.

NOTE

The drift pointer should be on zero with drift presetting handle locked, before radar operator turns "SCAN" switch to "LAB" position.

k. Level the gyro stabilizer and turn it's "POWER" and "P.D.I." switches "ON".

l. If doing high altitude bombing or bombing below 1000 feet set the corrected altitude, obtained from radio altimeter or pressure altimeter, on the "ALTITUDE" dial of the AN/APA-5A control box.

m. Set the calibrated airspeed value on the "CLOSING SPEED" dial.

n. From bombing tables obtain values for time of fall and trail and set on their respective dials.

o. If bombing in low altitude range, rotate the "OPR-CAL" switch to "CAL"; then pull out the "RELEASE-ZERO" knob and rotate until the green lamp on the indicator glows. Final adjustment should be clockwise until green lamp just lights. This adjustment is known as the edge of coincidence and is used on other controls.

p. Rotate "OPR-CAL" switch to "OPR".

q. When bombing in low altitude range above 1000 feet depress the "SET ALTITUDE" switch and increase reading of "ALTITUDE" dial until the green lamp is extinguished and just lights again on edge of coincidence.

r. When working in low altitude range below 1010 feet pull out the "TRACK-ZERO"

knob and rotate clockwise to the edge of coincidence.

s. When bombing at high altitudes depress the "SET ALTITUDE" switch and with it down pull out the "RELEASE-ZERO" knob and the "TRACK-ZERO" knob and adjust each to the edge of coincidence in succession.

t. Place tracking line on target with the locator knob on the range tracking unit.

u. Set "PDI" pointer on zero (use turn knob) unlock drift presetting handle and advise pilot to throw "BOMBSIGHT" switch on. This will give the bomber directional control of the automatic pilot through the gyro stabilizer.

v. Turn "RANGE SELECTOR" to "1" for low altitude work or to "3" for high altitude work.

w. Readjust locator knob until target is slightly above the tracking line.

x. As the target drifts down so that it's lower edge touches the tracking line throw the "TRACKING" switch "ON".

y. Correct any tendency of the target image to move horizontally from its position, bisected by the vertical line on the indicator, by adjustments of the gyro stabilizer turn and drift knobs.

z. Maintain the position of the target on the tracking line by turning the tracking knob on the range tracking unit.

CAUTION

Do not use the locator knob after the "TRACKING" switch has been turned "ON".

aa. Throw the "MASTER" switch to "ON".

ab. Open the bomb bay doors by holding the "BOMB DOORS" switch in the "OPEN" position.

NOTE

Limit switches on the bomb bay doors prevent release of the stores until the doors are full open.

ac. Throw the "FUSING" switch to "TAIL" or "BOTH" as required.

ad. Depress "ARM" switch on the AN/APA-5A control box, this will light the red light on the indicator.

ae. Continue tracking until the green lamp on the indicator glows, this indicates that the bombs have been released. After a few seconds both red and green lamps should go out indicating that the stores have gone.

af. Pilot should disengage the automatic pilot and throw the "BOMBSIGHT" switch "OFF".

ag. Close the bomb bay doors.

ah. Return all switches to their normal "OFF" position.

4-132. STOPPING AN/APA-5A INDICATOR EQUIPMENT. Throw "POWER" switch to "OFF".

4-133. AN/APN-4 LORAN EQUIPMENT. The AN/APN-4 Loran equipment is used by the navigator for position finding. Controls for the equipment are located in the nose section of the airplane at the bomber-navigator's station. The following procedure is used for operating the equipment.

a. Throw the "PWR" switch "ON". This switch is on the receiver, the other controls are on the indicator.

b. Set "SWEEP SPEED" switch at position "1".

c. Center "AMP. BALANCE" knob.

d. Set "STATION" selector switch at desired station.

e. Turn "GAIN" control slowly until pulses are visible on both A and B trace pattern. The pair of pulses (one on each trace) received from the selected stations will stand still or move very slowly.

f. Use "CRYSTAL PHASING" knob to correct drifting tendency of the selected pulses.

g. With the "LEFT-RIGHT" switch, position the "A" pulse on top of the left end of the pedestal. (See figure 4-24, reference a)

h. Turn "COARSE" control until lower pedestal is centered under the "B" pulse. Adjust "FINE" control until the extreme left end of the B-pedestal is under the B-pulse.

i. Adjust "AMP. BALANCE" and "GAIN" controls so that both pulses are approximately equal at a satisfactory height. Correct any resultant drifting with the "CRYSTAL PHASING" knob.

j. Turn "SWEEP SPEED" switch to position "2" and correct any drift with the "CRYSTAL PHASING" knob.

k. Turn "FINE" control unit until "B" pulse is directly below "A" pulse. (See figure 4-24, reference b)

l. Turn "SWEEP SPEED" switch to position "3".

m. With the "LEFT-RIGHT" switch or "CRYSTAL PHASING CONTROL" move the pulses to the center of the trace lines and with the "FINE" control, (See figure 4-24, reference c) position B-pulse directly under the A-pulse.

n. Turn "SWEEP SPEED" switch to position "4". Only one trace will appear.

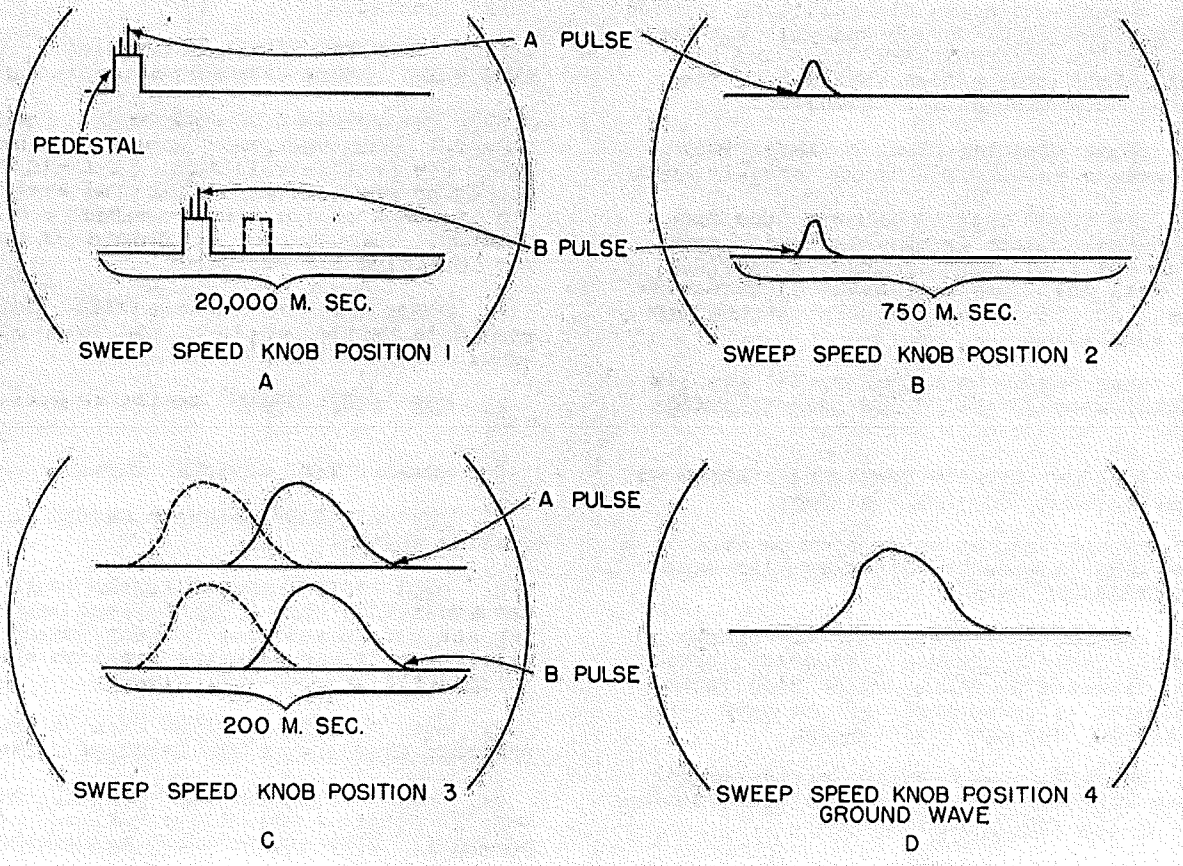


Figure 4-24. Loran Oscilloscope Wave Forms

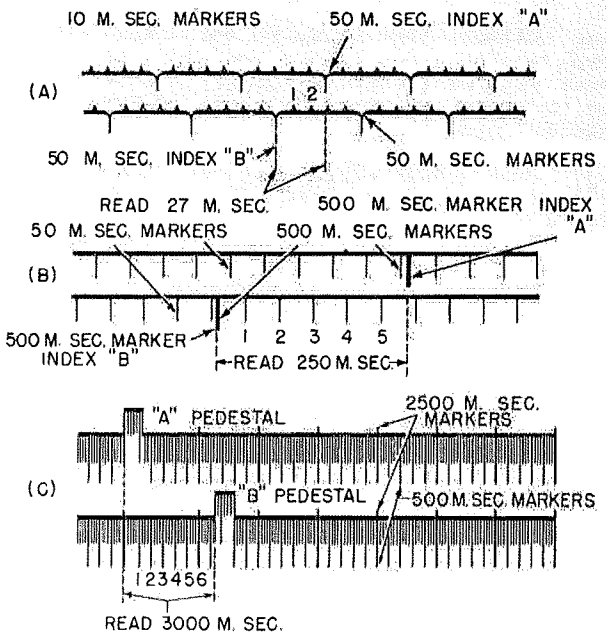


Figure 4-25 Loran Oscilloscope Patterns Showing Markers

o. Adjust "FINE" and "AMP. BALANCE" controls until leading edges of pulses are superimposed on the one trace and height is same. (See figure 4-24, reference d)

p. Turn "SWEEP SPEED" switch to position "5" and count the 10 microsecond spaces between a 50 microsecond marker on the lower trace, known as the index, the first 50 microsecond marker to the right of the index on the upper trace. (See figure 4-25)

q. Turn "SWEEP SPEED" switch to position "6" and repeat the preceeding step counting the 50 microsecond spaces between the 500 microsecond markers.

r. Turn "SWEEP SPEED" switch to position "7" and count the 500 microsecond spaces between the left edges of the "A" and "B" pedestal.

s. Total the results of steps p, q, and r while noting channel setting, PRR and station setting and see proper chart for the line of position.

t. If sky waves instead of ground waves were picked up to obtain this reading, a sky wave correction must be applied to get a correct line of position.

4-133A. RADAR COUNTERMEASURE (RCM) EQUIPMENT.

4-133B. RCM EQUIPMENT POWER SUPPLY. All units of the Radar Countermeasure Equipment except the azimuth indicator IP-36/APA-69, obtain their power from the RCM aft power panel located on the inboard side of the RCM rack. The indicator obtains its power from an a-c breaker on the main electrical circuit breaker panel marked "D.F. APA-69". The a-c power required to operate this equipment is supplied by a 2500 VA, 115 volts, single phase, 400 cycle inverter. The required d-c power (monitored) is brought from the 20 ampere RCM power breaker, in the main electrical circuit breaker panel, to the "RCM MASTER SWITCH" in the RCM circuit breaker panel. The "RCM MASTER SWITCH" serves to put 28 volts on all of the d-c breakers in the RCM circuit breaker panel. It serves further to start the RCM inverter by allowing 28 volts d-c to be fed through the "INVERTER CONTROL" breaker to the starting relay within the inverter. When the starting relay is operated, 28 volts d-c is fed from the RCM inverter bus and 200 ampere circuit limiter in the main electrical circuit breaker panel, to the input terminals of the inverter. The output from the inverter is fed to all the a-c breakers in the RCM circuit breaker panel. The forward and aft RCM power panels have a combined total of nine receptacles, eight of which are identical, and all contain both 115 volts a-c and 28 volts d-c. Protection against excessive current is provided for all receptacles by the use of 5-ampere breakers in the RCM circuit breaker panel. It is to these receptacles that the various units of RCM equipment are connected; however, caution must be observed when connecting the AN/APR-4 Receiver, as it must be connected only to the No. 1 receptacle in the aft panel.

4-134. AN/APR-4 SEARCH RECEIVER.

4-135. PRELIMINARY OPERATION OF AN/APR-4 RECEIVER.

a. Select tuning unit for desired frequency. Slide the tuning unit into position making sure it rests on tracks, and clamp in place. Tuning units cover the following ranges:

TN-16/APR-4	38 - 94 mc
TN-17/APR-4	74 - 320 mc
TN-18/APR-4	300 - 1000 mc

b. Turn antenna switch to proper antenna. Throw "POWER OFF" switch up to the on position, allow 30 seconds for warm-up unless temperature is below 0°F (-18°C), when ten minutes or more should be allowed. The gain switch should be at "AVC ON" and "W-N" switch at "N" for tuning units TN-16/APR-4 and TN-17/APR-4 or "W" for tuning unit TN-18/APR-4.

c. Advance "VOLUME" control until noise is heard. "HET-OFF" switch should be in the "OFF" position unless unmodulated CW signals are desired.

4-136. MANUAL TUNING OF AN/APR-4 RECEIVER.

a. Throw the "AUTOSWEEP-MANUAL" switch to the "MANUAL" position.

b. Rotate the gain control clockwise until the meter reads approximately 100 microamperes.

c. Rotate the manual tuning control until a tone is heard or an increased meter reading indicates a signal is being received.

d. Tune for maximum meter reading, adjust gain control if necessary to keep meter on scale.

e. A strong signal may appear at other places on the dial due to image frequencies, compare these for strength and, generally, the stronger signal is the true response. On the TN16/APR-4 and the TN17/APR-4 the image appears 60 megacycles below the true response and on the TN18/APR-4 it appears 60 megacycles above true response.

4-137. AUTOMATIC TUNING OF AN/APR-4 RECEIVER.

a. Throw "AUTOSWEEP-MANUAL" switch to the "AUTOSWEEP" position.

b. Adjust speed of sweep with the "SPEED" knob.

c. Set the frequency limits of the sector to be covered by removing the cover below the "FREQUENCY" dial and adjusting the two knurled screws to the ends of the frequency band to be covered. Replace the cover.

4-138. USE OF WAVE TRAP WITH AN/APR-4 RECEIVER. Until the signal is received the switch on the wave trap must be kept in the "OUT" position. When the carrier frequency of a signal is to be measured, the wave trap switch must be thrown to the "IN" position. Move the tuning slider to the right from the high frequency end of the stub until the first null is encountered, if this null is below 500 mc the frequency may be read directly on the fixed scale, if the first null is above 500 mc the sliding scales must be used by setting the zero reference point opposite the slider index then moving the slider to the right to the next null. Read the frequency on the sliding scale opposite the slider index. Below 300 mc it is possible to observe two nulls 30 mc apart when the TN-17 tuning unit is being used. The null to the right is the correct one.

4-139. OPERATION OF AN/APA-38 PANORAMIC ADAPTER.

4-140. With the receiver on and the receiver gain control at "6" proceed as follows:

a. Throw the adapter "POWER" switch "ON". The base line will appear in about 20 seconds.

b. Turn the adapter "GAIN" up about halfway.

c. Rotate the "SWEEP-P.R.F." control fully clockwise and the "PAN-P.R.F." switch to the "PAN" position.

4-141. When a station is tuned in on the receiver, it should show a deflection directly over the zero marker on the panoramic screen, if it is not centered proceed as follows:

a. Rotate the "SWEEP-P.R.F." control almost fully counterclockwise.

b. Center the spread out peak by manipulating the "CENTER FREQ." control.

c. Rotate the "SWEEP-P.R.F." control fully clockwise.

d. If the peak is not centered, rotate the "HOR POSITION" control until it is. The adapter is now ready for normal panoramic reception.

4-142. To use the adapter for pulse repetition frequency determination proceed as follows:

a. Set up adapter for panoramic reception.

b. Rotate "PAN-P.R.F." switch to "P.R.F. 1".

c. Slowly rotate "SWEEP-P.R.F." control until a steady pattern of pulses is obtained.

4-143. AN/APA-64A PULSE ANALYZER. The pulse analyzer is completely automatic in operation and will indicate the pulse width and pulse repetition frequency of successive

succeeding pulse trains or by manual operation of the "RESET" switch. To increase the accuracy of readings the meters are provided with overlapping ranges which multiply the indications of pulse width by one and four and of pulse repetition frequency by one, two and ten. To operate the equipment, set the "POWER" switch "ON" and the "PW" and "PRF" switches to the desired ranges; allow five minutes warm up and press the "RESET" switch. Careful adjustment of the receiver gain is necessary to prevent excessive noise from producing erroneous readings.

4-143A. AN/APR9 SEARCH RECEIVER. (See figure 4-23A).

NOTE

The following equipment was installed by the contractor in airplane 124373 and will be in all others when service change is incorporated.

4-143B. DESCRIPTION OF AN/APR9 SEARCH RECEIVER. This set is a superheterodyne radio and radar intercept receiver used to detect and determine the frequency of radar and radio signals within the frequency range from 1000 to 10,750 megacycles. This frequency range is covered by means of four RF tuners, only one of which can be used at a time. The signals received may be displayed on a cathode ray oscilloscope which displays a 20 mc band of frequencies and also may be heard through headphones.

4-143C. FUNCTION OF AN/APR-9 EQUIPMENT. The RF signals from the antenna is fed into the RF tuner, which contains a preselector, crystal mixer, local oscillator, and 160 mc IF preamplifier. The output of the RF tuner is fed into Mixer-Amplifier CV-43/APR-9 where further amplification and detection take place. The Mixer-Amplifier output is fed to Indicator ID-226/APR-9 in the form of narrow band video signals which are further amplified in the Indicator and are presented as the vertical deflection voltage for the oscilloscope. Video and audio outputs are also derived from Mixer-Amplifier. External power is supplied to the equipment through connections in Remote Control Unit C-426/APR-9 which also originates control circuits to operate the RF relay SA-211/APR-9 for the selection and tuning of the RF Tuners. The Remote Control Unit also operates the relays in the Mixer-Amplifier. The "Band Switch" on the Control Unit operates the RF relay SA-211/APR-9 which automatically selects the tuner desired and also operates two RF relay E-1797-2 that channel signals from an antenna to the tuner selected. The required a-c and d-c power is obtained through Power Supply PP-336/APR-9 and auxiliary Power Supply PP-337/APR-9.

4-143D. AN/APR9 SEARCH RECEIVER EQUIPMENT. This set consists of the following units:

a. Mixer-Amplifier CV-43/APR-9.

b. Indicator ID-226/APR-9.

c. Remote Control Unit C-426/APR-9.

d. Power Supply PP-336/APR-9.

e. Auxiliary Power Supply PP-337/APR-9.

f. RF Relay SA-211/APR-9.

g. Four RF tuners, only one of which can be tuned at a time.

TUNER	FREQUENCY RANGE
RF Tuner TN-128/APR-9	1000 to 2600 mc
RF Tuner TN-129/APR-9	2300 to 4450 mc
RF Tuner TN-130/APR-9	4300 to 7450 mc
RF Tuner TN-131/APR-9	7050 to 10750 mc

NOTE

All equipment is installed on RCM rack.

4-143E. LOCATION AND FUNCTION OF CONTROLS. Controls necessary for operation of AN/APR-9 equipment are located and function as follows:

a. REMOTE CONTROL UNIT C426/APR-9.

(1) "POWER OFF-ON" - Controls application of power to the entire equipment.

(2) "SECTOR SWEEP-MANUAL" - Permits selection of manual tuning or automatic sector-sweep tuning.

(a) "HIGH LIMIT" - Moves the upper pointer along the "KMC" dial to select the upper frequency limit for automatic sector-sweep tuning.

(b) "LOW LIMIT" - Moves the lower pointer along the "KMC" dial to select the lower frequency limit for automatic sector-sweep tuning.

(3) "MAN. TUNE RAISE-LOWER" - Manually controls the raising or lowering of the receiver tuned frequency.

(4) "BAND SWITCH" - Selects the proper frequency scale to agree with the RF tuner in use; also automatically selects the RF tuner covering the frequency bank by operating the RF Relay SA-211/APR-9.

(5) "IF ATT'N" - Varies the gain of the IF amplifier of the receiver. It is calibrated in approximate decibels (db) below maximum gain.

(6) "BAND WIDTH WIDE-NARROW" - Selects either "WIDE" band width and panoramic presentation, or "NARROW" band width which permits separation of closely spaced signals for direction finding or pulse analysis.

(7) "FIXED OSC.-OFF" - Turns the fixed oscillator on or "OFF". The fixed oscillator is used as an aid in accurate tuning, and as an attention directing device for

emphasizing the presence of a signal when searching.

(8) "CRYSTAL CURRENT METER" - Normally reads mixer crystal current (full scale reading is 4 max.).

(9) "PRESS FOR LINE VOLTS" - When pressed causes CRYSTAL CURRENT meter to read the a-c power line voltage.

(10) "AGC-OFF" - Turns the automatic gain control on or "OFF".

(11) "AUDIO GAIN" - Varies the audio output of the receiver.

(12) "PANEL LIGHTS" - Varies the brilliance of the lights on the panel, "KMC" dial and meter.

(13) "BFO-OFF" - Turns the beat frequency oscillator on or "OFF".

b. INDICATOR ID-226/APR-9.

(1) "H. GAIN" - Varies the gain of the horizontal deflection amplifier and hence the length of the trace on the cathode ray tube screen.

(2) "FOCUS" - Adjusts the focus of the trace on the screen.

(3) "V. CENT" - Adjusts the vertical centering of the trace.

(4) "H. CENT" - Adjusts the horizontal centering of the trace.

(5) "INTENSITY" - Adjusts the brightness of the trace on the screen.

(6) "INT. MOD" - Adjusts the amount by which signals brighten the brace.

(7) "KILOMEGACYCLES" - Provides a direct reading of the frequency to which the receiver is tuned.

(8) "PANEL LIGHT" - Adjusts the brilliance of the light which illuminates the "KILOMEGACYCLES" indicator.

(9) "RESET" - Located under the cover to the right of this panel marking are the RESET control, "COARSE-FINE" switch, and the synchronizing lamp, all of which provide means for proper alignment of the "KILOMEGACYCLES" counter with the RF tuner in use.

4-143F. PRELIMINARY CONTROL SETTINGS.

a. See that the controls on Remote Control Unit C-426/APR-9 are set as follows:

CONTROL	SETTING
POWER	OFF
SECTOR SWEEP-MANUAL	MANUAL
FIXED OSC.	OFF
IF ATT'N	Maximum Clockwise (0 DB)
BAND WIDTH	WIDE
BAND SWITCH	Set to Desired Frequency Range
AGC	OFF
AUDIO GAIN	Maximum Clockwise
PANEL LIGHTS	Maximum Clockwise
BFO	OFF

b. See that "PANEL LIGHT" control on Indicator ID-226/APR-9 is in its maximum (clockwise) position.

WARNING

The application of power to this equipment results in very high voltages which are dangerous to life. Personnel must observe safety regulations at all times.

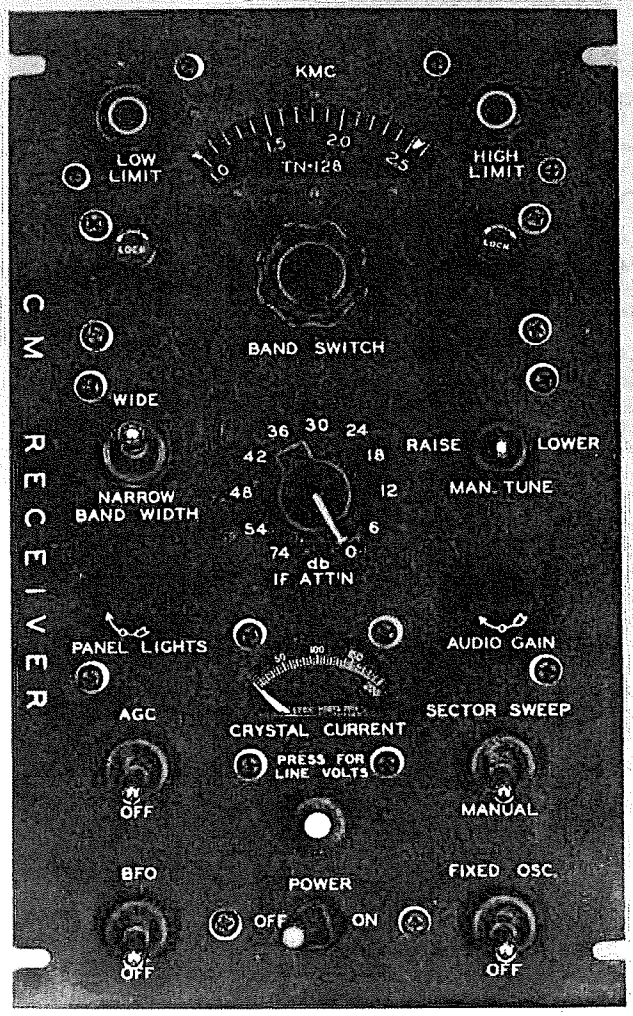


Figure 4-25A. Remote Control Unit C-426/APR-9

4-143G. STARTING THE EQUIPMENT. After setting the controls as indicated, throw the "POWER" switch to "ON". Allow about one minute for warm up time.

CAUTION

If the brightness of the trace on the scope is too high, turn the "INTENSITY" control counter-clockwise to prevent burning of the cathode ray tube screen.

4-143H. PREFLIGHT CHECKS. The operator should make the following preflight checks before placing the equipment in tactical operation:

a. Depress the "PRESS FOR LINE VOLTS" switch. The line voltage as indicated on the "CRYSTAL CURRENT" meter should be approximately 115 volts.

CAUTION

Do not use this meter as a standard for adjusting the a-c line voltage. A more accurate a-c voltmeter should be used for setting the line voltage at the correct value.

b. See that the "PANEL LIGHTS" on both Indicator ID-226/APR-9 and Remote Control C-426/APR-9 are lit. These lights in the Remote Control C-426/APR-9 indicate the presence of d-c supply voltages in the equipment, while the light in Indicator ID-226/APR-9 shows the presence of ac. Adjust the lights for the desired brilliance by means of the "PANEL LIGHTS" controls on each unit.

c. Throw toggle switch "AUDIO SELECTION" located on the aft end of the "ANTENNA SELECTION" switch panel to the "AN/APR-9" position. Turn switch on RCM operators interphone box to "RADIO" and check for the presence of noise. (Refer to paragraph 4-143X).

d. Turn the "AUDIO GAIN" control on Remote Control Unit C-426/APR-9 until the noise is at a satisfactory level.

e. About one minute after the application of power to the equipment, check for the presence of a trace on the oscilloscope.

f. Adjust the "INTENSITY" and "FOCUS" controls on the Indicator ID-226/APR-9 panel to obtain a well defined horizontal trace of reasonable brilliance.

g. Adjust the "V. CENT" control so that the oscilloscope trace is approximately 1/4 to about 1/2 inch below the center of the screen.

h. Adjust the "H. GAIN" and "H. CENT" controls until the oscilloscope trace occupies nearly the whole width of the tube and is centered in the tube.

i. Set the "BAND SWITCH" so that the range of frequencies exposed is correct for the RF Tuner in use.

j. Open the cover marked "RESET" on the Indicator ID-226/APR-9, and hold the "MAN. TUNE" switch of the Remote Control C-426/APR-9 in the "LOWER" position until the synchronizing lamp on Indicator ID-226/APR-9 lights.

k. Set the remote frequency indicator "KILOMEGACYCLES" to the proper reading as follows:

(1) Determine which of the four RF Tuners is in use and select the corresponding reset frequency from the following list:

RF Tuner	Frequency Range	Reset Frequency
TN-128/APR-9	1.00 to 2.60 kmc	1.00 kmc
TN-129/APR-9	2.30 to 4.45 kmc	2.30 kmc
TN-130/APR-9	4.30 to 7.35 kmc	4.30 kmc
TN-131/APR-9	7.05 to 10.75 kmc	7.05 kmc

(2) Hold the "RESET" switch in the "COARSE" position and rotate the "RESET" control until "KILOMEGACYCLES" dial indicates approximately the reset frequency selected. Then hold the "RESET" switch to the "FINE" position and rotate the "RESET" control until the dial indicates the reset frequency. Release the "RESET" switch, check the indication and close the "RESET" cover.

l. Hold the "MAN. TUNE" switch in the "RAISE" position and observe the "CRYSTAL CURRENT" meter reading as the receiver is continuously tuned over its tuning range. The meter indication should remain above 10 throughout the range.

m. Throw the "SECTOR SWEEP-MANUAL" switch to "SECTOR SWEEP" and, by watching the "KILOMEGACYCLES" indicator, check to see that the receiver frequency is swept back and forth approximately between the frequencies indicated by the pointers on the "KMC" dial.

n. Return the "SECTOR SWEEP-MANUAL" switch to "MANUAL".

o. Tune in a signal from an external source to check the operation of the antenna and preselector circuits. The equipment is now ready for operation.

NOTE

To stop the equipment at any time, throw the "POWER" switch on Remote Control C-426/APR-9 to "OFF".

4-143I. OPERATING THE EQUIPMENT.

4-143J. DISPLAY OF RECEIVED SIGNALS ON INDICATOR ID-226/APR-9. (See figure 4-25B). When the receiver is operated with the "BAND WIDTH" switch at "WIDE", the oscilloscope in Indicator ID-226/APR-9 provides a panoramic display. In a presentation of this type the distance along the horizontal trace represents the received signal frequency, and vertical deflections represent received signal amplitude. In Receiver AN/APR-9, the horizontal trace represents a band of frequencies 20 megacycles wide. The center of the trace is always at the frequency shown

on the "KILOMEGACYCLES" counter just below the scope; it is thus possible to detect the presence of all signals within 10 megacycles on either side of the frequency indicated on the counter. Figure 4-25B shows the appearance of a typical pulse modulated radar signal on the scope.

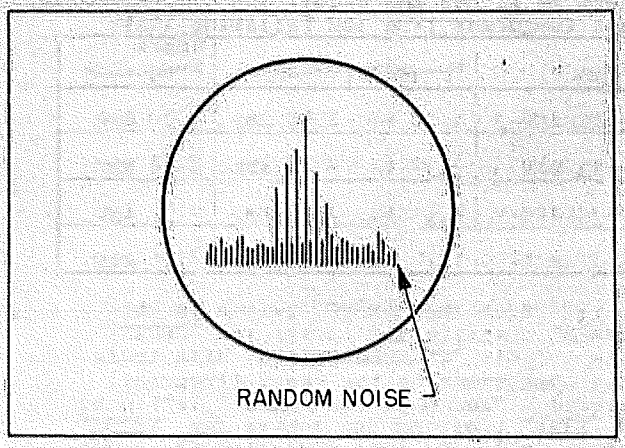


Figure 4-25B. Typical Radar Signal on Oscilloscope

4-143K. MANUAL TUNING AND SEARCHING. To search the frequency range covered by the RF Tuner in use for the presence of signals, proceed as follows:

a. Turn the "FIXED OSC.", "AGC", and "BFO" switches "OFF" and set the "BAND WIDTH" switch at "WIDE".

b. Turn the "IF ATT'N" control to a value such that at least 1/4 inch high grass appears on the scope, and adjust the "AUDIO GAIN" control so that the noise in the headphones is easily audible above the aircraft noise.

c. Throw the "SECTOR SWEEP-MANUAL" switch to "MANUAL" and operate the "MAN. TUNE" switch to "LOWER" until the "KILOMEGACYCLES" counter indicates the lowest frequency of the range it is desired to search.

d. Watch the Indicator ID-226/APR-9 screen and listen carefully with the headphones for the presence of a signal. (Sometimes a signal may be heard with the headphones before it is seen on the screen).

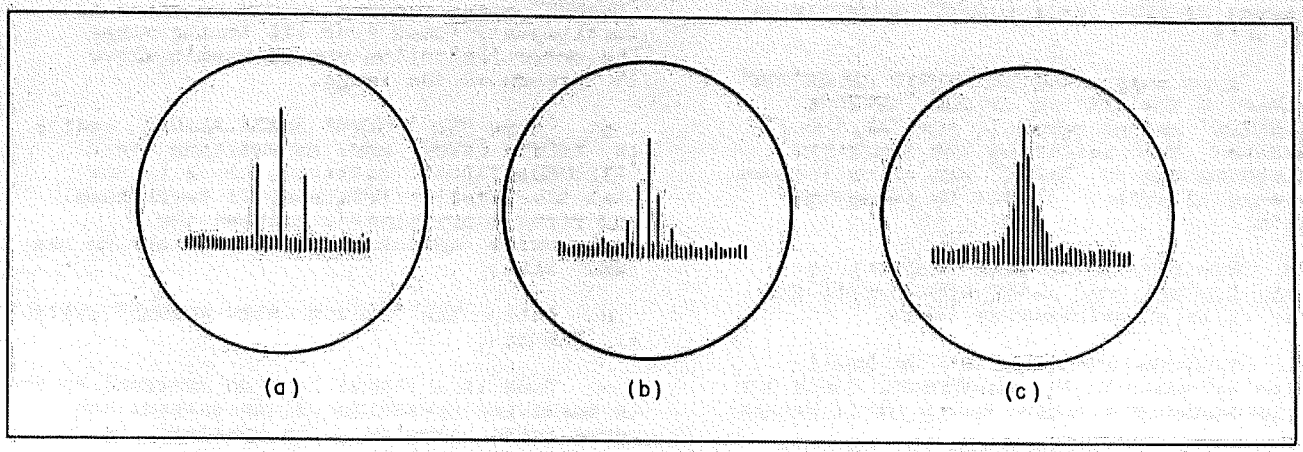


Figure 4-25C Appearance of Pulsed Radar Signals on Oscilloscope

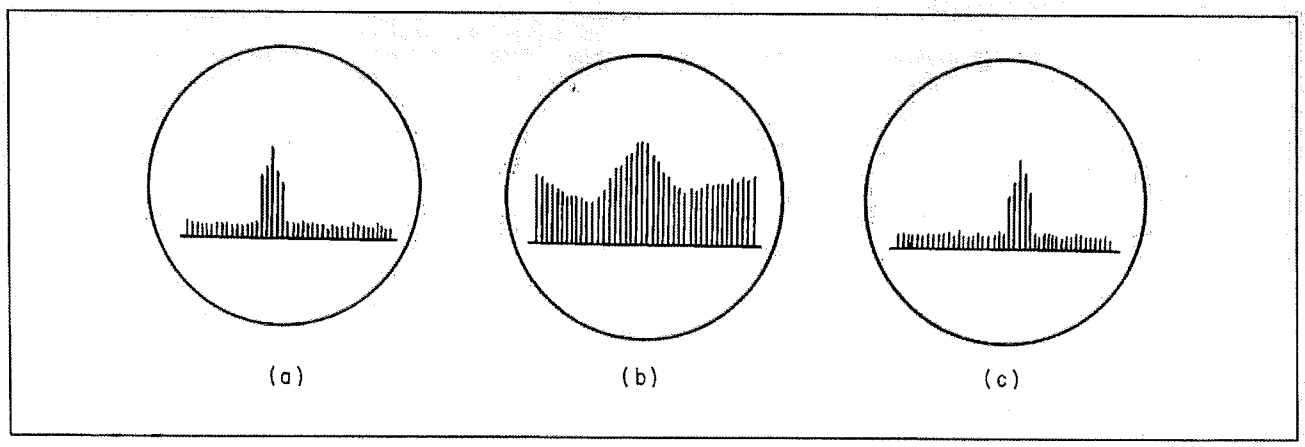


Figure 4-25D. Appearance of Radar Signals with Fixed Oscillator in Use

e. If no signal is immediately seen or heard, wait patiently for about a minute, before proceding. This is necessary because some radars sweep very slowly and their pulses may strike the receiver antenna only once a minute or so.

f. If no signal is detected after a reasonable time, operate the "MAN. TUNE" switch to "RAISE" until the "KILOMEGACYCLES" counter indicates a frequency 10 megacycles (0.01 kilomegacycles) higher than the original frequency.

g. Listen, watch, and wait as in steps d and e and, if no signal is detected, proceed to a new frequency setting as in step f. Continue in this manner until the desired frequency range is completely covered.

h. When a signal is seen on the screen, adjust the "MAN. TUNE" switch to bring the signal to the center of the trace on the screen. The pattern on the screen should normally move in the direction the "MAN. TUNE" switch is operated: to the right if the switch is operated to the right and to the left if the switch is operated to the left.

i. If the scope pattern of a signal moves in the opposite direction to the movement of the switch, an image signal is probably being received although the equipment responds to its image frequency only on extremely strong signals. The true signal, in this case, should be found at a point 320 megacycles higher in frequency for RF Tuners TN-128/APR-9 and TN-130/APR-9, and 320 megacycles lower in frequency for RF Tuners TN-129/APR-9 and TN-131/APR-9.

j. Set the "IF ATT'N" control so that the height of the signal is between 1/2 and 3/4 the height of the screen at the center, or as close to this as possible.

k. Adjust the "INTENSITY" and "INT. MOD." controls on Indicator ID-226/APR-9 so that the base line of the trace is clearly visible but the tops of the signal pulses are somewhat brighter. This adjustment makes it easier to locate weak signals.

l. Readjust the tuning, if necessary, to bring the signal to the center of the trace.

m. Record the reading of the counter dial under the screen. This reading is the frequency of the signal displayed.

n. Note how close together the signal pulses appear on the scope. In figure 4-25C (a), the pulses are spaced well apart, indicating that the signal has a low pulse repetition frequency (prf). Figure 4-25C (b) shows a medium prf and figure 4-25C (c) a high prf. To make accurate prf and pulse width measurements, switch the signal to the pulse analyzer AN/APA-64 by operating the "VIDEO SELECTION" switch on the "ANTENNA SELECTION" switch panel. (Refer to paragraph 4-143X).

o. As a check on the visual indication of prf, listen to the tone in the headphones. A low tone indicates a low prf; a medium tone, a medium prf; and a high tone, a high prf.

p. If the tone in the headphones is not steady, but seems to "warble" at a low rate, record this fact. A warbling is evidence that the radar whose signal is being received may be capable of very accurate tracking of targets and perhaps can control the firing of guns.

q. If the signal appears and disappears from the scope regularly, the radar is sweeping. Count the number of times the signal appears in one minute and record this rate of sweep.

r. If it is difficult to tune a sweeping signal exactly to the center of the trace because the signal is on the screen for such a short time during the sweep, proceed as follows:

(1) Tune the signal approximately to the center of the trace by the method outlined in the preceding steps.

(2) Throw the "FIXED OSC." switch on. If the signal is not exactly centered on the trace, the screen will appear the same as before. (See figure 4-25D (a).

(3) Continue tuning by means of the "MAN. TUNE" switch. When the signal is accurately tuned to the center of the scope, the entire scope screen will "bloom up" each time the sweeping signal comes in. It is much easier to observe this "blooming" for a sweeping radar signal than to estimate the exact center position. This "blooming" effect is shown in figure 4-25D. Figure (a) shows the tuning too high (signal too low). In figure (b) the tuning is just right; and in figure (c) the tuning is too low (signal too high).

s. When as in figure 4-25E, more than one radar signal appears in the 20 megacycle band displayed on the screen, analyze the signals by means of the following procedure:

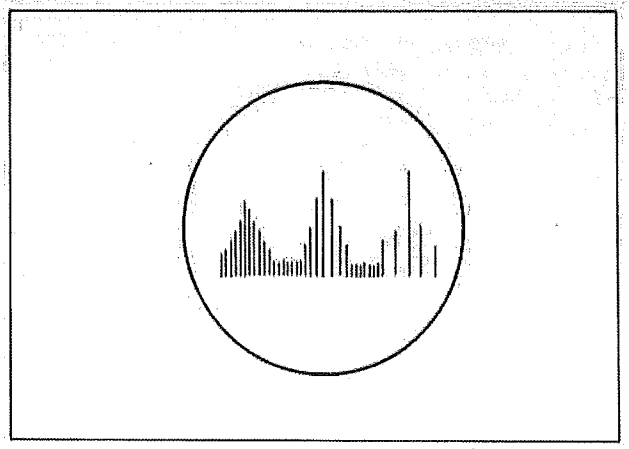


Figure 4-25E. Appearance of Three Radar Signals on Oscilloscope

(1) Tune one of the signals to the center of the screen and determine its frequency, sweep rate, and estimated prf as outlined in the preceding steps. The signal in the headphones during this step will be a combination of the three signals.

(2) To separate the signals in the headphones, or to separate the signals for analysis by the pulse analyzer AN/APA-64, tune the desired signal to the exact center of the scope, using the fixed oscillator as in step r of this section, then throw the "BAND WIDTH" switch to "NARROW." The trace on the scope will be reduced to a vertical line, and only the desired signal will produce audio or video outputs in the receiver. Signals more than about one megacycle apart may thus be separated for pulse analysis with AN/APA-64 or direction-finding with AN/APA-69 equipment. (Refer to paragraph 4-1430.)

(3) Throw the "AGC" switch to the "ON" position to avoid having to re-adjust the "IF ATT'N" control for each of several signals of varying strengths.

NOTE

With "AGC" on, the receiver sensitivity is reduced by the presence of strong signals, and weak signals may be missed. Do Not use "AGC" when searching for unknown signals.

(4) Check the estimated prf and listen for "warble" as in steps o and p of this section.

(5) When analysis of the individual signal has been completed, return the "BAND WIDTH" switch to "WIDE", and the "AGC" switch to "OFF", and successively tune the remaining signals to the center of the trace, analyzing each one as in preceding steps 1 through 4 above.

t. Use the "BFO" only when receiving cw or mcw signals, such as those from communications or some navigation equipments, The "BFO" is never used for the reception of pulsed signals.

4-143L. AUTOMATIC TUNING. Search Receiver AN/APR-9 can be made to tune automatically and continously over any desired part of the frequency range of the RF tuner in use. This mode of operation is useful in searching for radar signals that are likely to be continually beamed at the aircraft carrying the receiver, or for checking the presence of previously logged signals. However, automatic tuning is not recommended for general search purposes because the rate of tuning is too fast to be certain of intercepting al signals within the range of the receiver. To operate the equipment with automatic tuning proceed as follows:

a. With the controls initially set as for manual operation (paragraph 4-143K steps a and b), throw the "SECTOR SWEEP-MANUAL" switch to "SECTOR SWEEP." The tuned frequency of the receiver will then travel back and forth approximately between the fre - quency limits indicated by the upper limit and the lower limit pointers on the "KMC" dial. If the receiver tuning is initially outside these limits, the receiver will first tune into the frequency band between the limits, and then proceed to sweep back and forth between the limits. Thus the switch may be thrown to "SECTOR SWEEP" at any time, and proper operation will still result..

b. Set the upper limit pointer by means of the "HIGH LIMIT" control knob at the highest frequency in the range to be searched.

c. Set the lower limit pointer by means of the "LOW LIMIT" control knob at the lowest frequency in the range to be searched.

CAUTION

Check the actual frequency range being swept by noting the Indicator ID-226/APR-9 counter, and make slight limit adjustments as required. Automatic tuning should be used only over narrow limits (300 to 400 mc) and only then in bands where signals are known to exist. Use manual tuning when searching for new frequencies.

d. Observe the panoramic scope closely, and listen carefully with the headphones for the presence of signals.

e. When a signal is seen or heard, throw the "SECTOR SWEEP-MANUAL" switch immediately to "MANUAL." This operation stops the automatic tuning, and (if the switch was operated quickly enough) the signal will remain visible on the scope or audible in the phones.

f. If the signal does not remain visible on the scope or audible in the headphones after step above, operate the "MAN. TUNE" switch to "RAISE" or "LOWER", changing the frequency a few megacycles either way, until the signal is found.

g. If the signal is not found immediately, wait at least a minute before returning to automatic tuning, then continue the search a few megacycles on either side of the frequency at which automatic tuning was stooped. The signal may come from a radar which is sweeping slowly.

h. When the signal appears on the scope follow the procedure described in paragraph 4-143K, steps j through t to determine frequency, pulse width (pw), estimated prf, sweeping rate, and presence or absence of "warble."

4-143M. MCW OR CW OPERATION. The operation for the reception of mcw and cw is identical to the operation for pulsed signals except that the "BFO" switch may be turned on to assist in hearing the signal. Cw and mcw

signals should be observed with the sweep on. (See figure 4-25F). Code signals (interrupted cw) may be identified by the rapid appearance and disappearance of the signal on the screen. Such signals should not be confused with a sweeping cw radar.

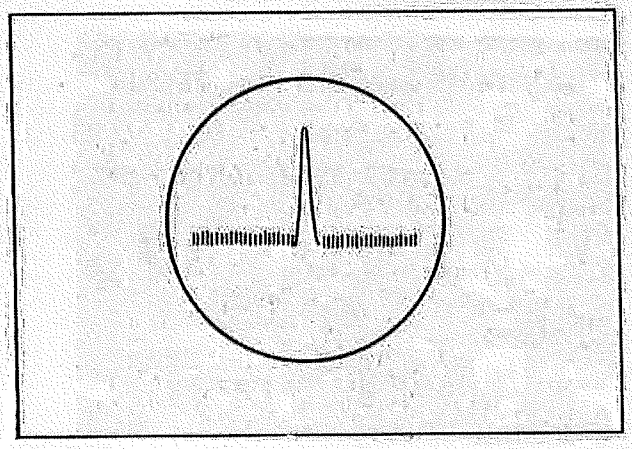


Figure 4-25F. APPEARANCE OF CW or MCW SIGNALS ON OSCILLOSCOPE

4-143N. SUMMARY OF OPERATION

a. Start the equipment by turning the "POWER" switch to "ON", and after about a minute of warm-up time, check all controls for normal functioning.

b. Search for signals in the desired frequency band, using either manual tuning or sector-sweep tuning.

c. When a signal is found, determine its frequency, pw, prf, sweeping rate, and "warbling".

d. To stop the equipment, throw the "POWER" switch on Remote Control C-426/APR-9 to "OFF"

4-143O. DIRECTION FINDER GROUP AN/APA-69 (See figure 4-23A).

4-143P. DIRECTION FINDER GROUP EQUIPMENT. Equipment for the AN/APA-69 group consists of the following units:

a. Amplifier Power Supply AM-256/APA-69 (RCM Rack).

b. Direction Finder Control C-527/APA-69 (RCM Rack).

c. Antenna Coupler CU-174/APA-69 to be used with antenna assemblies AS-434/APA-69 or AS-435/APA-69 when used. (Left bomb bay door.)

d. Azimuth Indicator IP-36/APA-69 (RCM Rack).

e. Antenna Drive Unit TG-8/APA-69 (Left bomb bay door.)

f. One of the following rotating antennas, only one of which can be installed at a time. (Left bomb bay door.)

Antenna	Frequency Range
Antenna Assembly AS-435/APA-69	180 to 1800 mc.
Antenna Assembly AS-434/APA-69	1000 to 5000 mc.
Antenna AS-436/APA-69 with Reflector AT-182/APA-69	4450 to 10,750 mc.

4-143Q. DESCRIPTION OF DIRECTION FINDER GROUP AN/APA-69. This group consists essentially of a video amplifier, three rotating antennas, a cathode-ray tube (CRT) indicator, a resolver and suitable circuits to reproduce the field pattern of the receiving antennas on the CRT screen. This antenna group must be used with receivers AN/APR-4 or AN/APR-9.

4-143R. FUNCTION OF DIRECTION FINDER GROUP AN/APA-69. The direction finder group antenna assemblies (only one of which can be installed at a time) cover a range between 140 mc and 10,750 mc. The antenna will pick up a radio or radar signal which is transferred, by the RCM Operator, to a tuning unit in either receiver depending on the frequency of the signal. In turn the signal is sent back to the azimuth indicator which gives a visual indication of the direction of the signal. A circular azimuth scale rotating around the outer rim of the screen and connected to the fluxgate compass system will give the true bearing of the signal source and the aircraft with respect to magnetic north. The power to operate this group is obtained from the main circuit breaker panel and the aft power panel on the RCM rack. (Refer to paragraph 4-133B.)

4-143S. FUNCTION OF OPERATING CONTROLS OF DIRECTION FINDER GROUP AN/APA-69. All controls necessary for the operation of this equipment are located on the front panels of direction finder control C-527/APA-69 and azimuth indicator IP-36/APA-69. Their panel markings and function are as follows:

a. DIRECTION FINDER CONTROL C-527/APA-69.

1. "POWER OFF-ON" - Controls primary power to the unit.

2. "ANT. SPEED" - "OFF-MAX" - Controls speed of antenna rotation. (0-300 rpm)

3. "POLARIZATION"

a. "VERTICAL" position - used to select vertical antenna on the two lower frequency antenna assemblies.

b. "HORIZONTAL" position - used to select horizontal antenna on the two lower frequency antenna assemblies and high frequency antenna.

4. "GAIN" Control - Controls the

length of the sweep on the cathode-ray screen.

5. Pilot Light - Glows when "POWER" switch is "ON".

b. AZIMUTH INDICATOR IP-36/APA-69.

1. "V. CENT". - Adjust the vertical centering of the trace.

2. "H. CENT". - Adjust the horizontal centering of the trace.

3. "INTENSITY" - Adjust the brightness of the trace on the scope.

4. "FOCUS" - Adjust the focus of the trace on the scope.

5. "INT. MOD". - Adjust the amount by which signals brighten the trace.

4-143T. PRELIMINARY STEPS BEFORE OPERATING DIRECTION FINDER GROUP AN/APA-69. The "DF" equipment is used to determine the direction to the source of the signal that is picked up by either the AN/APR-4 or AN/APR-9 receiver. The receiver being operated will pick up a signal through a fixed antenna selected by the switches on the "ANTENNA SELECTION" panel (refer to paragrpph 4-143X) according to which tuner is being operated. Assuming the signal received is within the range of the "DF" antenna installed, turn "ANTENNA SELECTION" switch to proper "DF" position. If the "DF90-1000 mc" antenna is to be used, both "ANTENNA SELECTION" switches will have to be turned to that position. The patch panel located below the wave trap houses two plugs. Either of these plugs when connected to the cable in front will feed the signal from AN/APR-4 or AN/APA-9 receiver back to the AN/APA-69 group where the direction may be determined by reading the azimuth indicator.

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES HIGH VOLTAGES WHICH MAY BE EXTREMELY DANGEROUS. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY PRECAUTIONS. USE SPECIAL CARE WHEN MAKING ANY ADJUSTMENTS ON AZIMUTH INDICATOR IP-36/APA-69.

4-143U. CONTROL SETTINGS FOR OPERATION OF DIRECTION FINDER GROUP AN/APA-69.

a. Circuit breaker "DF APA-69" located at the bottom of the main circuit breaker panel and "MASTER SWITCH" on "RCM" circuit breaker panel "ON".

b. See that controls on direction finder control C-527/APA-69 are set as follows:

Figure 4-25G. DIRECTION FINDER CONTROL C-527/APA-69

Control	Setting
POWER	ON
ANT. SPEED	Clockwise until rotator turns at desired rpm.
POLARIZATION	To correct position (Refer to step a3, paragraph 4-143S).
GAIN Control	Set for one inch long sweep on indicator screen.
Pilot Light	Glowing

c. Adjust "PANEL LIGHTS" - "OFF-BRIGHT" rheostat located at top of panel that houses "DF" controls, to get desired lighting on "DF" control unit panel.

d. Adjust azimuth indicator IP-36/APA-69 controls if necessary.

NOTE

Direction Finder Group AN/APA-69 is now ready to operate with either AN/APR-4 or AN/APR-9 equipment.

4-143V. OPERATION OF DIRECTION FINDER GROUP AN/APA-69. Operation of this equipment is remotely controlled from the "DF" control panel, except minor adjustments to the knobs on the azimuth indicator to obtain a clearer pattern on the screen. The pattern that appears on the screen, when the signal is intercepted, depends upon the characteristics of the antenna, polarization of signal, frequency, type of modulation and signal strength. Interpretation of these patterns is largely a matter of experience and study of known signals. For example, the receiver frequency and antenna polarization are known to the operator. Therefore, if a received pattern has no particular recognizable design, try switching the polarization. If the modulation cannot be determined, try changing the antenna rotating speed. If the picture has no partiuular shape and occupies a good portion of the screen, reduce the receiver gain. When high frequency antenna is used a very definite change in pattern may be observed due to altitude and distance with respect to signal source. Slow rotation is recommended for this antenna to produce a sharper picture.

4-143W. TURNING OFF AN/APA-69 EQUIPMENT.

a. Rotate "ANT. SPEED" control fully counter-clockwise.

b. Throw "POWER" switch to "OFF" position.

c. Pull out a-c circuit breaker "DF-APA-69" located at the bottom of the main circuit breaker panel.

4-143X. ANTENNA SELECTION SWITCH PANEL 21-7089006 (See figure 4-25H.)

4-143Y. FUNCTION OF EQUIPMENT ON ANTENNA SELECTION SWITCH PANEL.

a. Switches

1. "ANTENNA SELECTION" - SA-44A/APR is a rotary switch that selects the fixed and rotating low frequency antennas for the AN/APR-4 receiver set.

2. "ANTENNA SELECTION" - CH8918K533 is a three pole five position rotary switch that operates relays that channel signals from the fixed antennas to the AN/APR-9 receiver set and from the "DF" antennas to the AN/APR-4 or AN/APR-9.

3. "VIDEO SELECTION" - 217089802 is a two position rotary switch that operates a relay to channel signals from the AN/APR-4 or AN/APR-9 to the pulse analyzing equipment AN/APA-64.

4. "AUDIO SELECTION" - AN3022-1 is a two position toggle switch that channels either AN/APR-4 or AN/APR-9 signals to the RCM operator's interphone jack box.

b. Lights

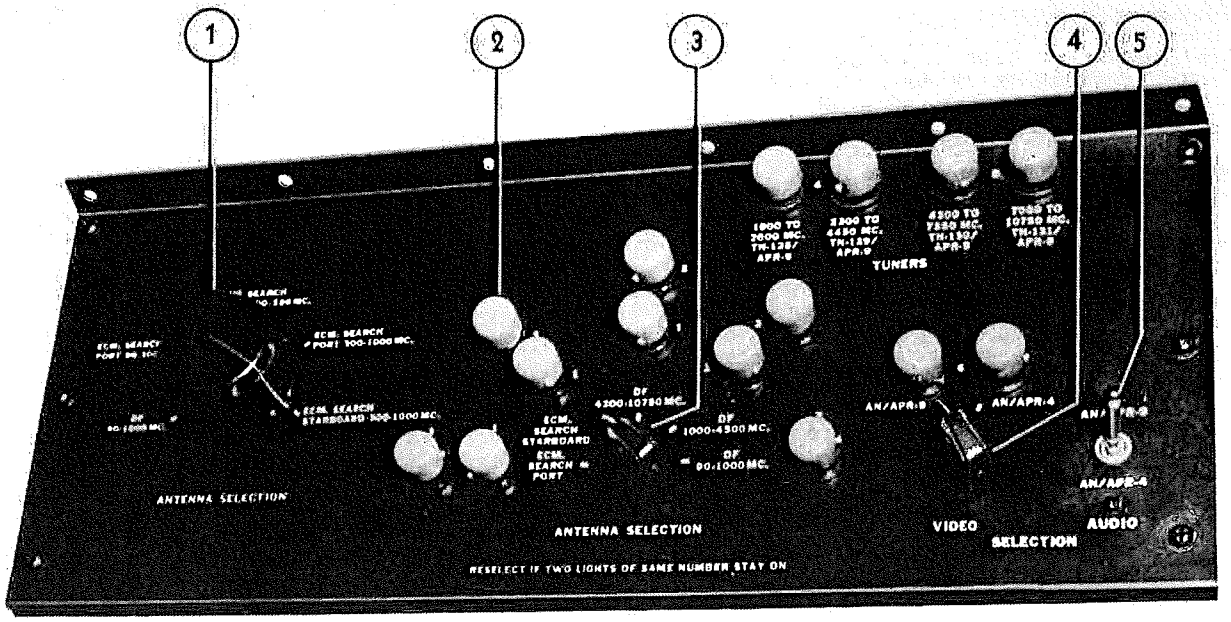
1. There are nine lights located around the center rotary "ANTENNA SELECTION" switch. These lights are to indicate that the relays are operating properly.

2. The two lights over the "VIDEO SELECTION" switch indicate the operation of the switching relay.

3. The four lights located in the upper right hand corner of the panel are to indicate which RF tuner is in operation.

NOTE

In some cases when switching relays, they will stick. If two lights of the same number



1. SA44A/APR - Switch
2. Indicator Lights
3. CH8918K533 - Switch
4. CH8918K516 - Switch
5. AN3022-1 - Switch

Figure 4-25H ANTENNA SELECTION SWITCH PANEL

stay on you may burn up the relay so, turn the knob to another position and then return to desired position.

4-143Z. ANTENNAS.

a. FIXED. - AN/APR-9 located on both sides of fuselage.

ANTENNA	FREQUENCY	LOCATION
21-7089032	1000 to 4450 mc	Station 344
AS-482/APR	4300 to 10,750mc	Station 306

b. FIXED. - AN/APR-4 located on both sides of fuselage.

ANTENNA	FREQUENCY	LOCATION
21-8089062	300 to 1000 mc	Station 700
*AT-121 (Stowed)	38 to 90 mc	L.H. Station 813
*AT-130	90 to 300 mc	Station 767

*Interchangeable

c. ROTATING - (Refer to paragraph - 4-143P.)

4-144. LIGHTING.

4-145. EXTERIOR LIGHTS.

4-146. Exterior lights are controlled from the pilot's switch panel. (See figure 1-4, reference 1). Power is supplied to all exterior lights from the main bus through circuit breakers located on the circuit breaker panel. Before exterior lights can be turned on, the circuit breakers must be in and the master switch must be turned to either "CODE", "FLASH", or "STEADY". Refer to paragraph 2-67 through 2-70 for operating instructions.

4-147. In addition to the white lens normally used in the bottom fuselage lights, colored lenses (red, green, and yellow) are stowed in the airplane for use on special assignments. These lenses can only be installed when the airplane is on the ground.

4-147A. SIGNAL LIGHT (See figure 1-2, reference 38) Refer to paragraph 2-70A.

4-147B. The signal light, AN3089-6, is a portable spot light that can be plugged into any utility receptacle on the airplane. It is stowed in a holder on the right hand side of the airplane on the forward side of the bulkhead at station 199 1/2 just behind the co-pilot's seat. The light is operated by a trigger on the handle and the beam may be directed by a small sight located on top of the light. The principal use of the light is to signal other aircraft or ground installations in case of radio failure or necessary radio silence. The light may also be used at night to check the outside parts of the airplane during flight.

4-148. INTERIOR LIGHTS. The cockpit and instrument panel lights are controlled by rheostats on the pilot's auxiliary switch panel. (See figure 1-6, reference 2,4, and 5). The master interior lights switch on the pilot's auxiliary switch panel must be turned to "ON" before any interior lights, except the cockpit and instrument lights, can be turned on. (See figure 1-6 reference 7). Power is supplied from the main bus through the master switch to the lights through circuit breakers located on the main circuit breaker panel. The pilot may turn off certain of the white lights and replace them with red dome lights by turning the switch located on the bulkhead behind the pilot from "WHITE" to "RED". (See figure 3-4, reference 2). Refer to figure 4-26 for the list of lights affected by the red-white switch and the location of the various interior light switches.

4-149. HEATING AND VENTILATING SYSTEM. (See figure 4-27.)

4-150. DESCRIPTION OF HEATING AND VENTILATING SYSTEM.

4-151. The cabin heating and ventilating system receives air from ram which is ducted to a combustion heater having a capacity of 100,000 BTU per hour. The heated or ventilating air is then supplied to the various crew stations forward of the wing through a system of ducts. Crew stations aft of the wing are not supplied heat except for the camerman's station which is supplied from the empennage anti-icing system. Refer to paragraph 4-160 through 4-164. Provisions have been made for attachment of a ground heater to the empennage system. No other provisions are made for ground heating. Push-pull damper controls are provided at the crew stations forward of the wing and a ventilating air intake damper marked "NORMAL", "MAXIMUM HEAT", and "CLOSED" is located on the floor outboard and aft of the radar operator's seat. (See figure 4-27, reference 4, and 8). Defroster nozzles for the pilot's and co-pilot's windshield may be operated by push-pull controls for defogging purposes. (See figure 4-27, reference 3).

4-152. Fuel for the cabin and anti-icing heaters is supplied from the main fuel tanks by the booster pumps. This fuel is diverted from the main fuel system through heater supply lines which tap into each of the main fuel supply lines in the fuel tank. Each of the heater supply lines is equipped with a manual shut-off valve which is located at the left side of the fuel trunk. These shut-off valves are normally lockwired open.

4-153. Each of the fuel supply lines continues from the manual shut-off valve through a solenoid operated shut-off valve to a pressure regulator. An equalizer line connects the two supply lines between the manual and solenoid operated shut-off valves. A cross feed line fitted with a manual shut-off valve connects the supply lines between the solenoid operated valves and the regulators. This manual shut-off valve is normally lockwired open. The cross feed line permits by-passing of a defective solenoid operated shut-off valve.

4-154. Fuel from one of the pressure regulators supplies the anti-icing system heaters. Refer to paragraph 4-164. The other regulator supplies the cabin heater. After

passing through the pressure regulator, cabin heater fuel is by-passed to a fuel pressure gage and to a fuel pressure switch which operates the low pressure warning light on the heater panel in the radio operator's compartment. The fuel pressure gage is located to the left of the main fuel trunk and should read 15 plus or minus 1/2 psi with heater operating.

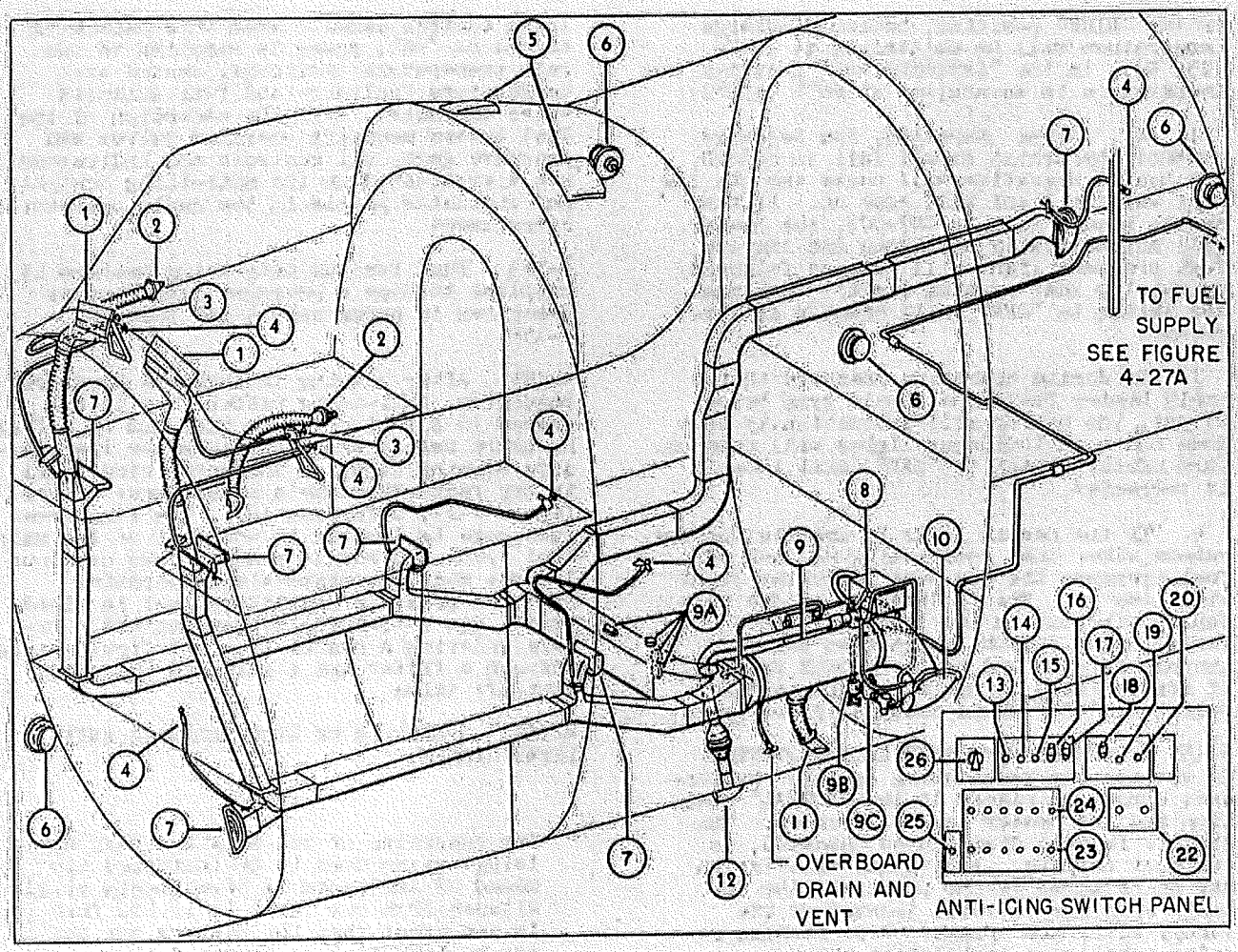
4-155. From the pressure regulator, cabin heater fuel is piped through a manual shut-off valve, solenoid operated shut-off valve, and a filter to the heater. The manual shut-off valve is normally lockwired open.

4-156. OPERATION OF HEATING SYSTEM. Controls for operating the heating system are located on the heater switch panel located in the radio operator's compartment. The cabin heater cannot be operated until the airplane is airborne as ram air is required to actuate a pressure switch before the system can be operated. The heating system is operated as follows:

a. Check that the manual fuel shut-off valves at the fuel trunk and heater are open.

LIGHT NAME	COLOR OF BULB	COLOR OF LENSE	CONTROLLING SWITCH	SWITCH LOCATION	CONTROLLED BY RED-WHITE SWITCH
Bomb Bay (12)	Clear	None	Inside Bomb Bay Lights Switch	Left Side-Fwd.Entranceway	No
			Bomb Bay Switch	In Bomb Bay - Station 280	
Aft Compt. Dome (4)	Silvered	White	Aft Boarding Lights Switch	Left Side - Station 862	No
			Fwd.Dome Light Switch	Left Side - Station 598	
Fwd. Radio Compt. Boarding	Clear (2)	Red (2)	Lower Boarding Lights Switch	Left Side - Fwd.Entranceway	No
			Upper Boarding Lights Switch	Centerline - Station 258	No
			Table Light Switch	Radar Operator's Switch Panel	Yes
			Dome Light Switch	Radio Operator's Switch Panel	Yes
			Table Light Switch	Radio Operator's Switch Panel	Yes
Aft Radio Compt. Boarding	Clear (1)	Red (1)	Same as for Fwd. Radio Compt. Boarding Light		
	Clear (1)	White (1)	Dome Light Switch	Radio Operator's Switch Panel	Yes
Radar Operator's Table	Clear	None	Table Lights Switch & Rheostat	Radar Operator's Switch Panel	Yes
Radio Operator's Table	Clear	None	Table Light Switch & Rheostat	Radio Operator's Switch Panel	Yes
Countermeasure Table	Clear	None	Table Light Switch & Rheostat	R.C.M. Operator's Switch Panel	Yes
Countermeasure Dome (Fwd. and Aft)	Clear	Red	Dome Light Switch	Near Fwd. Light	Yes
			Table Light Switch	R.C.M. Operator's Switch Panel	Yes
	Clear	White	Dome Light Switch	Near Fwd. Light	Yes
Pilot's Passageway	Clear	Red	Lower Boarding Lights Switch	Left Side-Fwd. Entranceway	No
			Upper Boarding Lights Switch	Centerline - Station 258	No
			Passageway Light Switch	Left Side - Station 155	Yes
	Clear	White	Passageway Light Switch	Left Side - Station 155	Yes
Radio Compt. C-4A (2)	Clear	Red or White	Rheostat	In Unit with Light	No
Circuit Breaker Panel Flood	Red	None	Panel Light Rheostat	Circuit Breaker Panel	No

Figure 4-26. Interior Light Controls



1. Defroster Nozzle
2. Louvre
3. Defroster Control Knob
4. Ventilating And Heating Control Knob
5. Vents
6. Ventilator
7. Ventilating And Heating Duct Outlet
8. Damper Control
9. Heater
9A. Thermoswitches
9B. Manual Shut-Off Valve
9C. Solenoid-Operated Shut-Off Valve
10. Ventilating Air Scoop
11. Heater Exhaust Stub
12. Combustion Air Scoop
13. Temperature Switch
14. Master Heater Switch
15. Fuel Valve Switch
16. Pressure Test Light
17. Heater Test Light
18. Anti-Icing Heater Low Fuel Pressure Indicator Light
19. Anti-Icing Heater Fuel Start Switch
20. Anti-Icing Heater Master Switch
21. Deleted
22. Rectifier And Alternator Blast Tube Heater Switch
23. Anti-Icing Heater Control Switch
24. Anti-Icing Heater Circuit Breaker
25. Rudder Force Augmenter Heater Switch
26. Panel Light Rheostat

Figure 4-27. Heating And Ventilating System

b. Check that cross feed valve located under the fuel tank is closed.

c. If the main tank booster pumps are not running, turn either pump switch on the fuel control panel to "ON".

d. Place the damper control in "NORMAL" position. Use "MAX HEAT" position for low ambient temperatures and/or when airplane indicated speed is 180 knots or greater. Open heating duct outlets, close ventilators, louvres and curtain at station 419.

e. Turn the heater master switch to "ON" when all circuit breakers for the cabin heating system have been closed. Low fuel pressure and low heat light will come on.

f. Hold the fuel valve switch at "START" position.

g. When the low pressure light goes out release fuel valve switch. The light should remain off.

NOTE

The low heat light will be lit and should go out in less than one minute after the low pressure light goes out.

h. Select either "HIGH" or "INTERMEDIATE" position of temperature switch to control heater outlet temperature. With the switch

in the "HIGH" position, heater discharge temperature will be maintained at 124°C (255°F). In the "INTERMEDIATE" position the temperature is maintained at 68°C (155°F).

i. If, during operation, the selected control thermostat should fail to CUT-ON, the heater operation will cease and the low heat warning light will come on. If the switch should fail to CUT-OUT, the heater will automatically shut-down and the low fuel pressure light will come on followed by the low heat warning light. Turn master switch to "OFF" until trouble is corrected.

j. If during operation pressure in the cabin heater fuel line should drop below 11 psi, the heater will automatically shut down and both indicator lights will come on. Turn master switch to "OFF" until trouble is corrected.

k. If the heater fails to operate for any reason other than overheating or lack of fuel pressure the low heat indicator light will come on. The failure may be due to a faulty vibrator in the ignition unit. Throw toggle switch on ignition box for second vibrator and heater should operate. If heater fails to operate, turn master switch to "OFF" until trouble is corrected.

4-157. OPERATION OF VENTILATING SYSTEM. To operate the ventilating system, the control damper is placed in the "NORMAL" position and the heater is not operated. The ram air is then distributed unheated, to the duct outlets. Additional ventilation may be obtained by the pilot and the co-pilot when the louvers, located on the canopy sill, are opened. Crew station receive additional ventilation through ventilators which are pushed out into the air stream. These ventilators may be positioned to act either as ram air inlets or cabin air exhausts. The curtain at station 419 should be open.

4-158. ANTI-ICING SYSTEM. (See figure 27A)

4-159. WING AND TAIL ANTI-ICING SYSTEM.

4-160. DESCRIPTION OF WING AND TAIL ANTI-ICING SYSTEM.

4-161. The thermal anti-icing system consists of a six 200,000 BTU per hour heaters and distributing ducts. Two heaters are installed in each outer wing and supply heat to the leading edge of their respective wings. The other two heaters are installed in the aft section of the fuselage and supply heat to the leading edge of the fin and stabilizer.

4-162. Basic operation of the system is governed by the master switch on the anti-icing control panel. When this switch is turned to "ON", power is supplied to the skin temperature indicator, heated air temperature indicator and fuel solenoid valve circuits. With the exception of the fuel system manually operated valves and pressure gage, all controls and indicators are also located on the anti-icing control and indicator panels in the radio operator's compartment.

4-163. Fuel for the anti-icing heaters is supplied through a pressure regulator as described in paragraphs 4-152 through 4-154.

4-164. After passing through the pressure regulator, anti-icing heater fuel is by-passed to a fuel pressure gage and to a fuel pressure switch which operates the low pressure warning light on the anti-icing panel in the radio operator's compartment. (See figure 4-27, reference 18). The fuel pressure gage is located to the left of the main fuel trunk and should read 15 plus or minus 1/2 psi when the heaters are operating. From the pressure regulator, fuel is piped to the six anti-icing system heaters. Before entering a heater the fuel first passes through a filter and a solenoid operated shut-off valve.

4-165. OPERATION OF WING AND TAIL ANTI-ICING SYSTEM.

CAUTION

The operation of the wing and tail anti-icing system down to an indicated air speed of 100 knots is permissable at altitudes from sea level to 10,000 feet. In the event that the heaters cut out due to insufficient airspeed it is necessary to increase the airspeed to 115 knots (IAS) in order to start the heater operating again.

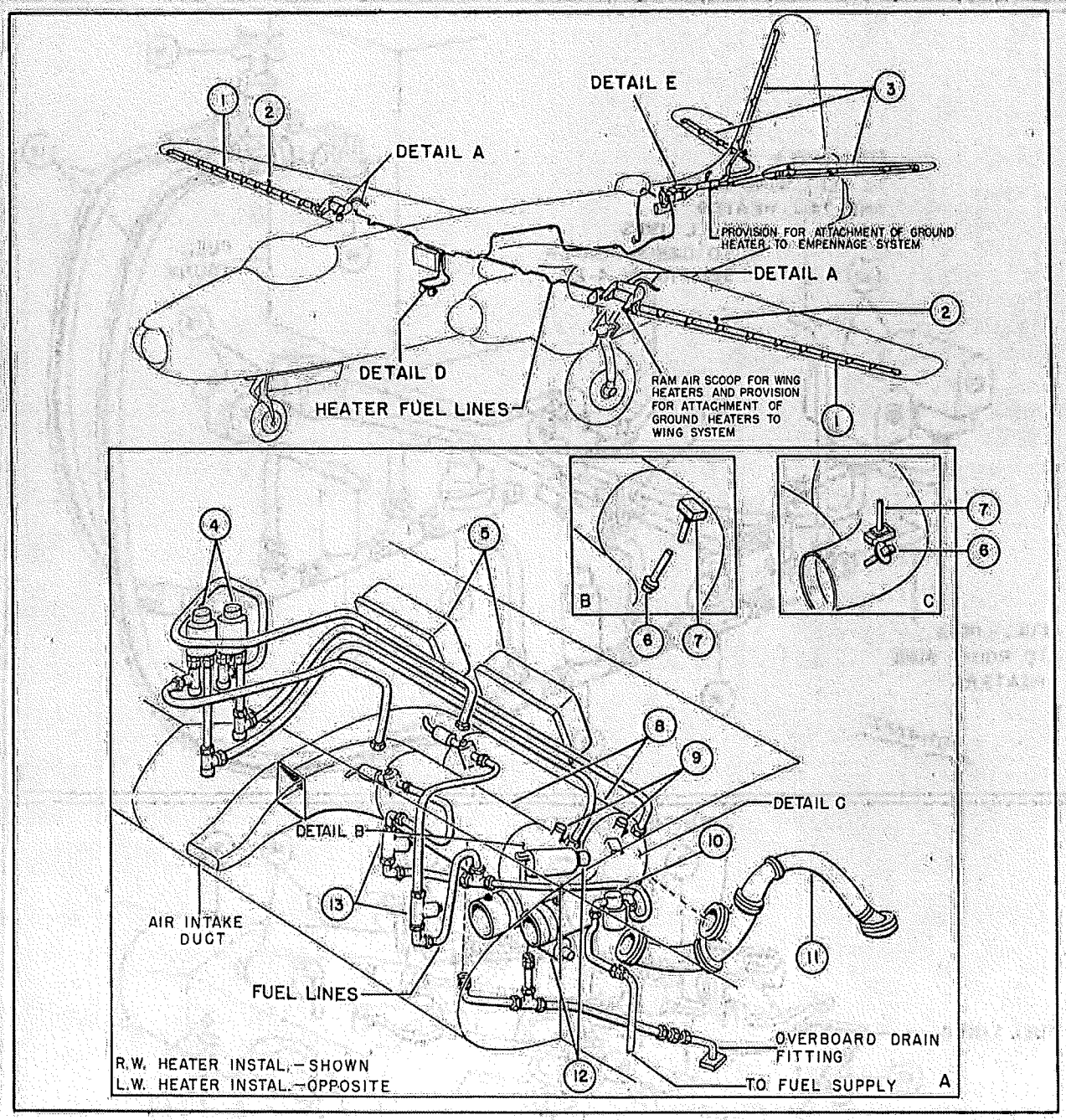
A minimum airspeed of 115 knots (IAS) must be maintained when operating the anti-icing system above an altitude of 10,000 feet.

a. Check that manual fuel shut-off valves, under emergency manual fuel control panel, are open.

b. Check that cross-feed valve, under emergency manual fuel control panel, is closed.

c. If main tank booster pumps are not running, turn either pump switch on fuel control panel to "ON".

d. Turn heater master switch to "ON" when all anti-icing system circuit breakers have been closed. Low fuel pressure indicator light come on.



1. Outer Wing Leading Edge Ducts
2. Skin Temperature Bulb
3. Empennage Ducts
4. Pressure Switch
5. Ignition Unit
6. High Heat Cut-Out Thermoswitch
7. Cycle Control Thermostat
8. Heater
9. Thermometer Bulb
10. Filter
11. Heater Exhaust
12. Control Motor
13. Solenoid Shut-Off Valve
14. Fuel Pressure Switch
15. Manual Fuel Shut-Off Valve
16. Manual Fuel Shut-Off Valve
17. Flexible Hose
18. Pressure Gage
19. Thermal System Fuel Pressure Throttling Valve
20. Empennage Air Intake Ducts
21. Damper Assembly

Figure 4-27A (Sheet 1 of 2 Sheets) Anti-Icing System

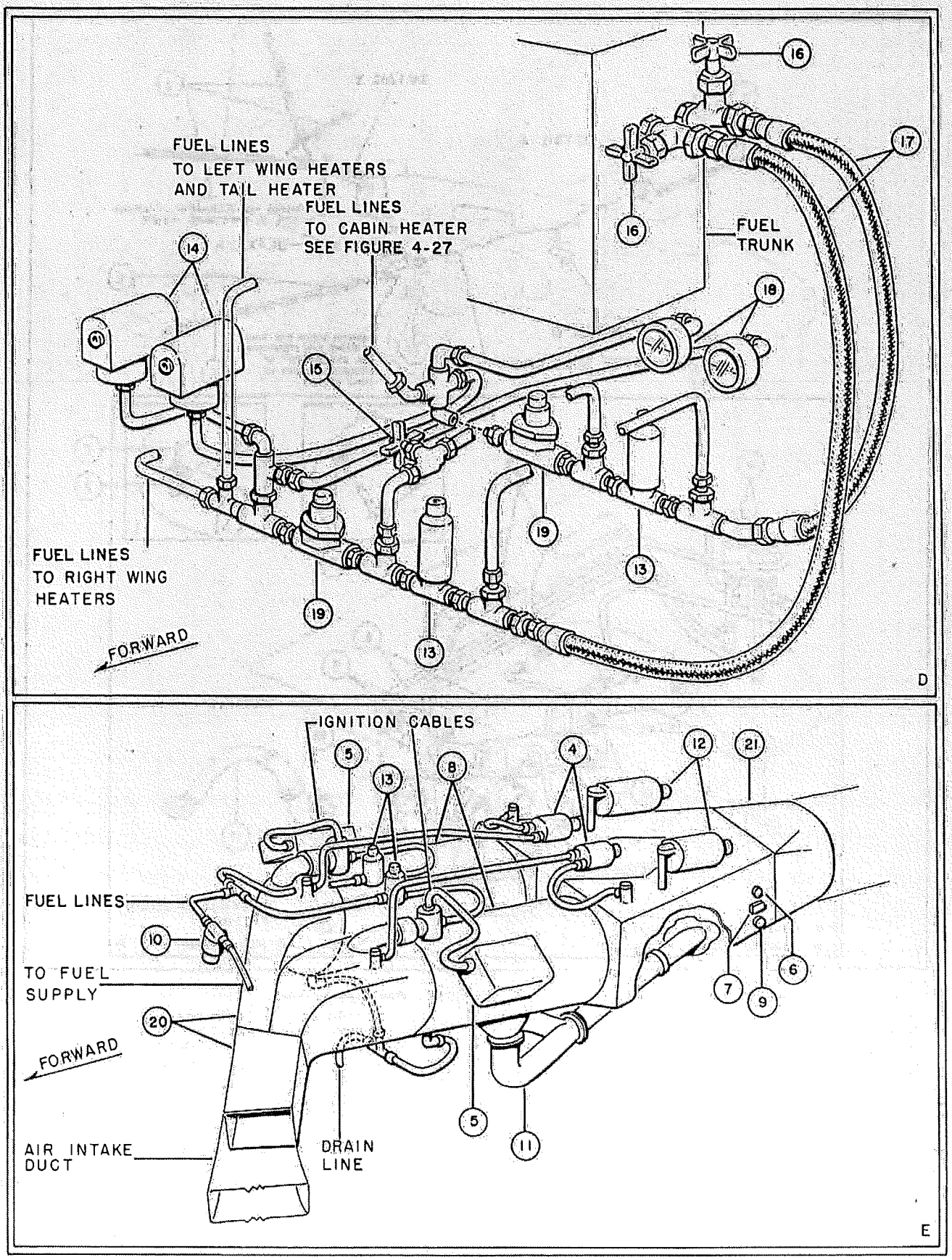


Figure 4-27A (Sheet 2 of 2 Sheets) Anti-Icing System

e. Hold the fuel valve switch in the "START" position until the low pressure indicator light goes out. Release the fuel valve switch. The light should remain "OFF"

f. Turn the six heater control switches or any desired combination thereof to "ON" when the circuit breakers for these switches have been closed.

NOTE

A thermostat maintains the heater discharge temperature at 177°C(350°F). If this thermostat should fail, the temperature will rise to 218°C(425°F), at which time the high heat warning light on the indicator panel will come on. If ignored the light will continue to blink or remain on and the high heat thermostat will act as a cycling control operating the heater.

g. If a skin temperature indicator should read abnormally low, or if the high heat warning light should come on, operate the heater selector switch on the indicator panel to determine which heater has failed.

h. After it is determined that a particular heater has failed, turn its control switch off.

i. To shut down the heaters, turn the six heater switches and the master switch to "OFF".

j. If a heater fails to operate after fuel pressure has been obtained and the heater selector switch has been turned to "ON", a vibrator in the ignition system may have failed. It will be impossible to rectify this situation in flight for the wing heaters, however, the empennage anti-icing ignition system is accessible in the fuselage. The second vibrator may be used by operating the toggle switch on the ignition box. If the heater still fails to operate, turn the heater selector switch to "OFF" until trouble is corrected.

k. The empennage air scoop lip and throat are protected from ice by electric blankets which automatically operate when this system is turned on. Periodic checks, to observe their operation, may be made on the ground by jumping the electrical relays involved. Feel blankets to observe operation. Do not allow blankets to operate above 71°C(160°F).

4-166. HEATING PROVISION FOR CAMERMAN'S STATION. Downstream of the empennage anti-icing heaters is a duct outlet, similar to those used in the cabin heating system, which is provided with a damper to allow discharge of the heated air in the region of the cameraman's station. The damper is operated by a knob which may be positioned to vary the amount of air discharge. To provide heat when anti-icing is not required, operate the system as outlined under paragraph 4-165 and select one heater in the tail to operate. Under no circumstances should two tail heaters be operated for cameraman's heat when the outside ambient temperature is above 0°C. (32°F).

4-167. GROUND HEAT PROVISIONS FOR ANTI-ICING SYSTEM. Provisions for ground heating by portable ground heaters have been made for the wing and empennage anti-icing system. Wing scoop adapters are furnished for the wings and a ground heat connection is provided in a duct downstream of the empennage heaters.

4-167A. RUDDER FORCE AUGMENTER ANTI-ICING SYSTEM.

4-167B. DESCRIPTION OF RUDDER FORCE AUGMENTER ANTI-ICING SYSTEM. An electric heater is provided for the rudder force augmenter air intake. A switch is provided for this heater. This switch is located on the anti-icing switch panel. (See figure 4-27) A breaker is installed on the main circuit breaker panel to protect the heater circuit.

4-167C. OPERATION OF RUDDER FORCE AUGMENTER ANTI-ICING SYSTEM.

a. To start heater, check that circuit breaker is pushed in and close switch.

b. To shut-down heater, open switch.

4-167D. DESCRIPTION OF RUDDER FORCE AUGMENTER ANTI-ICING SYSTEM. (Effective on all airplanes upon completion of service change incorporating the automatic ground shut-off for the rudder force augmenter anti-icing heater.) An electric heater is provided for the rudder force augmenter air intake. The empennage anti-icing system controls the relay that operates the rudder force augmenter and tail scoop heaters. A breaker is installed on the main circuit breaker panel to protect the rudder force augmenter and the tail scoop heaters.

4-167E. OPERATION OF RUDDER FORCE AUGMENTER ANTI-ICING SYSTEM. (Effective on all aircraft upon completion of service change incorporating the automatic ground shut-off for the rudder force augmenter anti-icing heater) To start heater, check that the rudder force augmenter and tail scoop heater circuit breaker is pushed in. The heater will operate only when the empennage anti-icing system is operating.

4-168. RECTIFIER AND A.C. GENERATOR AIR DUCT ANTI-ICING SYSTEM.

4-169. DESCRIPTION OF RECTIFIER AND A.C. GENERATOR AIR DUCT ANTI-ICING SYSTEM. An electric blanket is provided for the anti-icing of each of the retifier and A.C. Generator air ducts in the leading edge of the wing. These blankets are controlled by two switches, one for the blankets on each wing. These switches are located on the anti-icing control panel.

4-170. OPERATION OF RECTIFIER AND A.C. GENERATOR AIR DUCT ANTI-ICING SYSTEM.

CAUTION

Do not operate the anti-icing blankets on the ground unless the engines are running. This is necessary to prevent overheating and possible permanent damage to the blankets.

a. To start operation of the blankets, throw switch(es) to "ON".

b. To stop operation of blankets, throw switch(es) to "OFF".

4-171. PROPELLER DE-ICING SYSTEM.

4-172. DESCRIPTION OF PROPELLER DE-ICING SYSTEM. The leading edge of each propeller blade is equipped with an electric heating element inside the leading edge of the blade. Opposite blade heaters on each propeller are wired in paralled. A timer energizes these four pairs of blankets in rotation. The system is started and stopped by two switches, one for each propeller. These switches are located on the co-pilot's switch panel. (See figure 1-5, reference 12).

4-173. OPERATION OF PROPELLER DE-ICING SYSTEM.

a. To start system, throw propeller de-icer switch(es) to "ON".

CAUTION

Do not operate the system unless the propeller(s) are rotating or permanent damage to the propeller may result.

NOTE

If during operation, the push-to-test indicator lights, located between the two propeller de-icing switches, should come on, the de-icer relay(s) have tripped as a result of the malfunctioning of a heater.

b. If the indicator lights come on, push the light to determine which propeller has caused the indication.

c. Hold the applicable propeller de-icer switch in "RESET" position momentarily.

d. If the indicator lights again come on, the circuit is definitely in fault. Place the applicable propeller de-icer switch in "OFF" position.

e. To stop system, return the propeller de-icer switch(es) to "OFF".

4-174. WINDSHIELD DE-ICING SYSTEM AND WIPER.

4-175. DESCRIPTION OF WINDSHIELD DE-ICING SYSTEM AND WIPER. De-icing fluid is carried in a tank which is located on the floor just aft of the countermeasure rack. This fluid is pumped to the windshield where it is sprayed to aid in de-icing. The windshield wipers must be used in conjunction with the spray to clean the windshield. The rheostat which controls the de-icing fluid pump and thereby the intensity of the spray is located on the pilot's switch panel. (See figure 1-4, reference 12.) The windshield wiper is controlled by a switch located next to the rheostat. (See figure 1-4, reference 13.)

4-176. OPERATION OF WINDSHIELD DE-ICING SYSTEM AND WIPER.

a. Turn windshield spray rheostat away from the "OFF" position until the desired spray intensity is obtained.

b. After ice has been softened by the spray, throw windshield wiper switch to either "FAST" or "SLOW"

CAUTION

Do not operate the wiper on a dry windshield.

c. To stop the spray turn the windshield spray rheostat to "OFF".

d. To stop the wiper turn the windshield wiper switch to "OFF".

4-177. PITOT TUBE DE-ICING SYSTEM.

4-178. DESCRIPTION OF PITOT TUBE DE-ICER SYSTEM. Each of the two pitot tubes contains an electrical heating element. These heating elements are controlled by a switch on the co-pilot's switch panel. (See figure 1-5, reference 9.)

4-179. OPERATION OF PITOT TUBE DE-ICER SYSTEM.

a. To start system, throw pitot heater switch to "ON".

b. To stop system, return pitot heater switch to its off position.

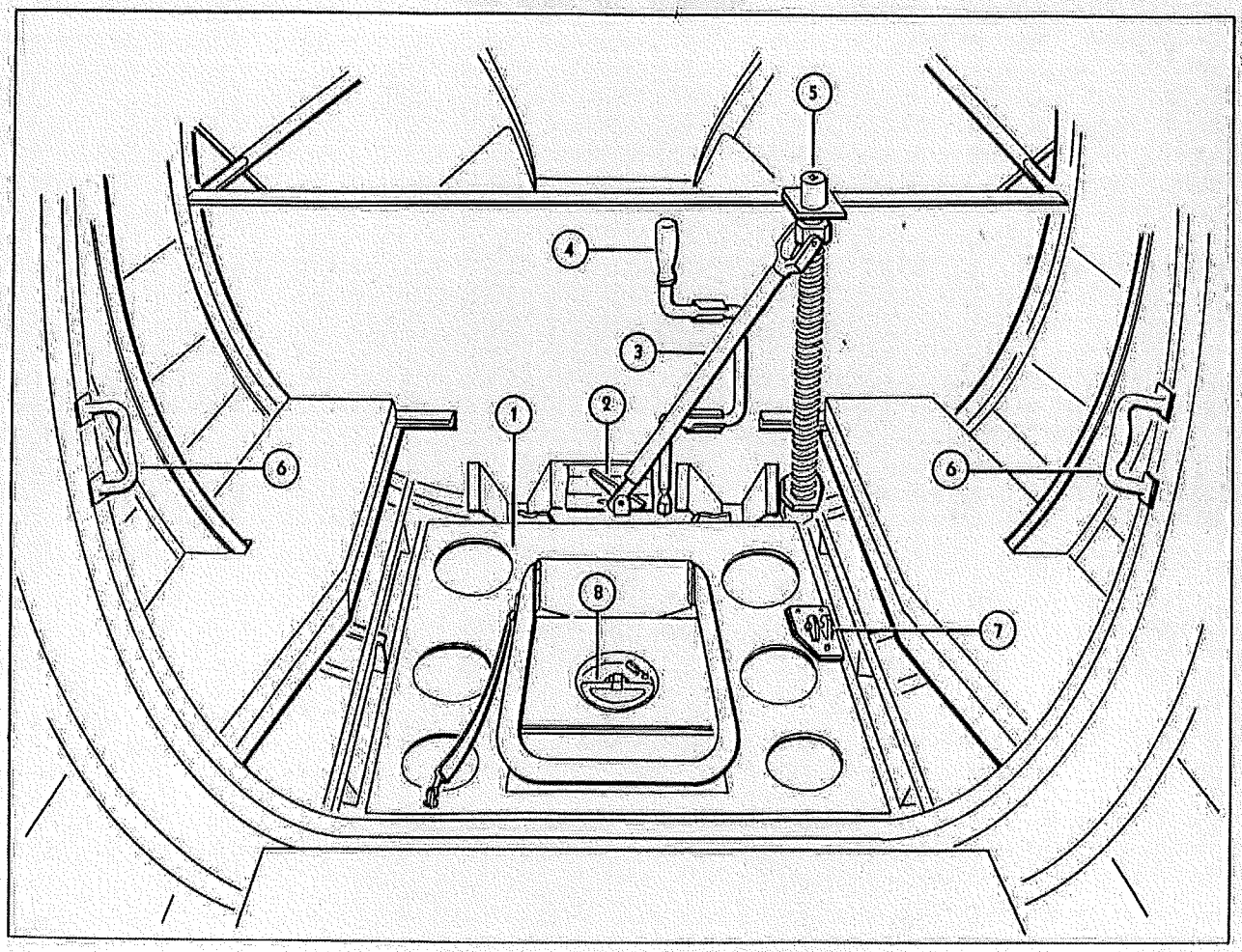
4-179A. RELIEF TUBE ANTI-ICING SYSTEM (Effective on all airplanes upon completion of service change revising the relief tube.)

4-179B. DESCRIPTION OF RELIEF TUBE ANTI-ICING SYSTEM. (Effective on all airplanes upon completion of service change revising the relief tube.) A venturi heater is installed on the aft underside of the fuselage. It is provided for the outlet of the relief tube. The heater is operated in conjunction with the cabin heating system. A circuit breaker is installed on the main circuit breaker panel to protect the heater circuit.

4-179C. OPERATION OF RELIEF TUBE ANTI-ICING SYSTEM. (Effective on all airplanes upon completion of service change revising the relief tube.) To start venturi heater check that circuit breaker is pushed in and follow with the procedure for operating the cabin heater. The venturi heater will then automatically operate with the cabin heater.

4-180. GALLEY.

4-181. A galley range is located at the forward bulkhead of the waist compartment. Two heating elements are set in recessed bowls on the top. These elements are controlled by four-position switches. Red indicator lights glow when the elements are on. Two 24 volt outlets are provided adjacent to the switches for attachment of a percolator, toaster, etc.



1. Hatch
2. Link Locking Lever
3. Hatch Operating Link
4. Screw Jack Crank
5. Screw Jack
6. Assist Handle
7. Link Attaching Bracket For Link
8. Latch Handle

Figure 4-28. Aft Entrance Hatch

NOTE

The "GALLEY RANGE" switch on the circuit breaker panel must be "ON" before the range will operate.

4-182. Cooking utensils are stored in the cabinet and a drawer beneath contains service for 12.

4-183. SPECIAL HATCH OPERATIONS.

4-184. HYDRO-FLAP AS LOADING DOOR. The hydro-flap may be used as a loading door by disconnecting the actuating mechanism.

a. Disengage the operating mechanism from the structure by pulling the cable outboard by means of the cable disc-handle.

b. Secure the disconnected actuator arms to the flaps by means of the fabric strap attached to the flap.

4-185. AFT HATCH AS A LIFE RAFT DOOR. (See figure 4-28) The aft entrance hatch is provided with a means of opening in flight to allow a life raft to be dropped during rescue operations. The mechanism is mounted on the bulkhead at the aft end of the hatch.

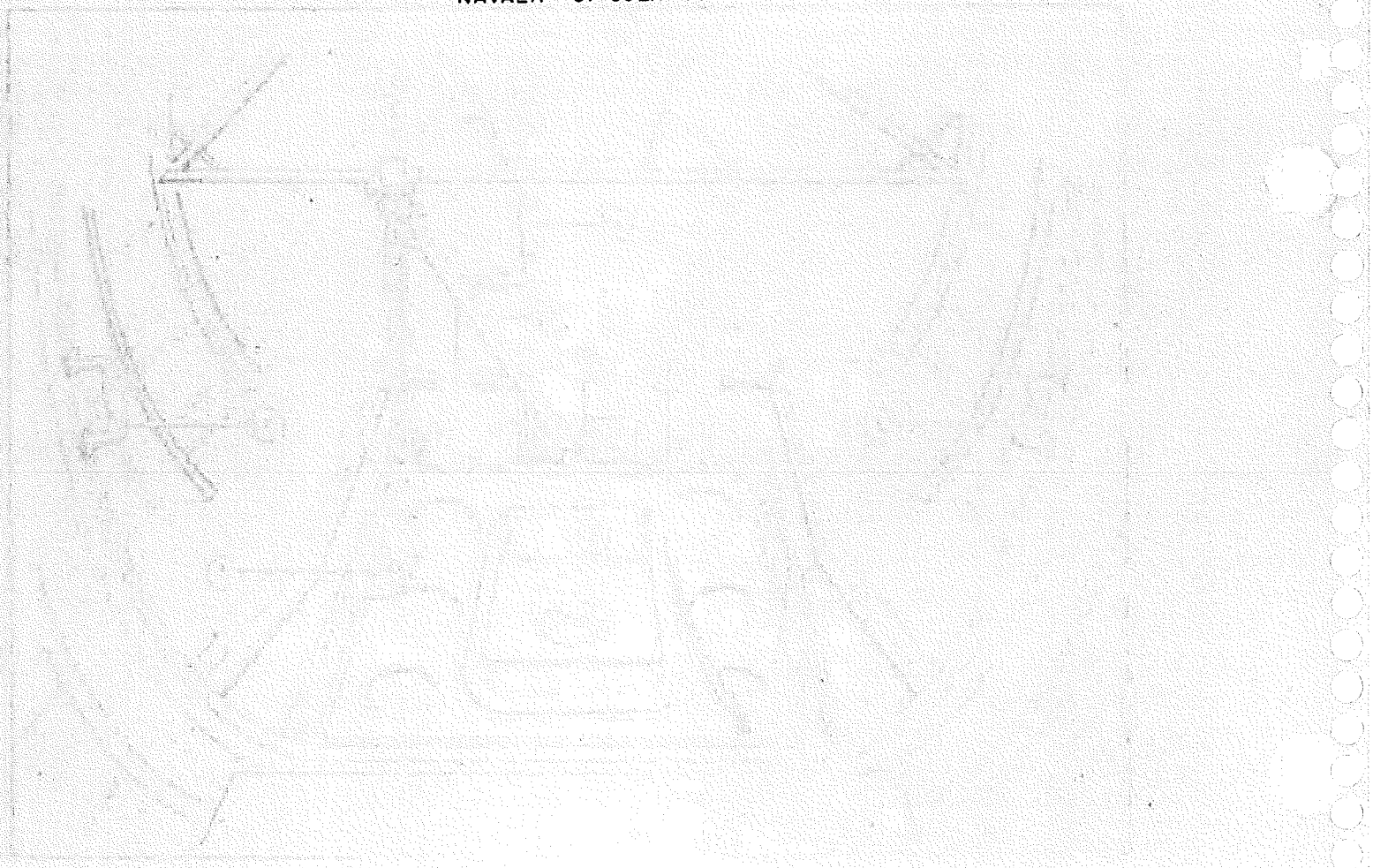
a. Disengage drag link from the stowage bracket by pushing down on the lever and lifting the link up.

b. Engage this link with the bracket on the hatch as indicated by the decalcomania.

c. Remove the crank on the bulkhead and insert the end in the socket of the screw jack.

d. Unlatch the hatch and turn the crank until the hatch is opened.

e. Reverse this procedure to secure.



SECTION V

EXTREME WEATHER OPERATION

5-1. GROUND ANTI-ICING EQUIPMENT.

5-2. DESCRIPTION OF GROUND ANTI-ICING EQUIPMENT. Provisions for supplying heat to the wing and tail anti-icing system from ground heaters are installed. These provisions permit a ground heater duct to slide into the wing heater air intake duct in the leading edge of each outer wing. Removal of an access cover in the bottom of the fuselage aft of the empennage heater permits attachment of another heater for the tail surface anti-icing on the ground.

5-3. OPERATION OF GROUND ANTI-ICING EQUIPMENT.

a. Attach ground heater ducts to airplane.

b. Operate switches on panel at radio operators station to cause ventilation air damper valve motors to close ducts.

c. Close anemostat outlet at camera station.

5-4. OIL DILUTION SYSTEM.

5-5. DESCRIPTION OF OIL DILUTION SYSTEM.

Two momentary switches on the co-pilot's switch panel control the oil dilution valves which permit the engine oil to be diluted with gasoline at the oil tank sequence valves. (See figure 1-5, reference 6) This permits easier starting when low temperatures are encountered.

NOTE

The manual shut-off cocks on the aft side of the firewall on the inboard side of each nacelle under the oil tank are always safetied shut and must be unsafetied and opened before dilution.

5-6. OPERATION OF OIL DILUTION SYSTEM.

CAUTION

When oil dilution is used during engine warm-up, do not reverse propellors until the oil-in temperature has been maintained at 72°C (162°F) for at least ten minutes.

a. Stop the engines.

b. Unsafety and open the manual oil dilution shut-off cocks, aft of the firewall under the oil tank.

c. Start the engines.

NOTE

To prevent vaporization of the fuel, the oil temperature should be held to 60°C or below if possible.

d. Hold engine speed at 1100 RPM with propeller governor lever in full "INCREASE".

e. Hold the oil dilution switch in the "ON" position for four minutes. During the last few seconds, move the mixture lever to "IDLE CUT-OFF".

CAUTION

If the oil pressure falls below 25 psi before the oil dilution period is ended, release the oil dilution switch immediately and move the mixture lever to "IDLE CUT-OFF".

f. Release the oil dilution switch when the engine stops firing.

g. Turn the ignition switch "OFF" after propeller stops turning.

h. Close and safety shut-off cock when oil dilution is complete.

5-7. LONG RANGE CRUISE OPERATION IN EXTREMELY COLD WEATHER. A higher carburetor air temperature, than that obtained with the standard alternate air configuration, is desired for long range cruise operation in extreme cold weather to prevent erratic engine operation. This is accomplished by securing the carburetor airscoop backfire door in the open position and bolting closed the shutters which normally allow Zone 2 air to be used for alternate air.

WARNING

In the event of an engine fire when the backfire door is secured in the open position, move carburetor air control switch to "DIRECT" to prevent the fire from entering the carburetor and to complete the fire seal.

5-7A. LONG RANGE CRUISE OPERATION IN EXTREMELY COLD WEATHER. (Effective on all airplanes upon completion of service change incorporating the variable alternate air system.) Smoother engine performance is obtained if variable alternate air is used to assist in vaporizing the fuel. Refer to paragraph 1-43A and 1-43D.

5-8. OIL COOLER SYSTEM OPERATION IN EXTREMELY COLD WEATHER. Operation of the oil cooler flap at low ambient temperatures should be done manually to preclude possible congealing of oil within the cooler. Maintaining an oil in temperature a few degrees higher than normal will assure flow through the cooler.

APPENDIX I

A-1. AIRSPEED INSTALLATION CORRECTION TABLE. The following table lists the air speed indicator installation errors. To obtain calibrated airspeed subtract the correction shown in the center of right column as applicable from the applicable indicated airspeed listed in the left column. The following tabulation is based on flight data obtained on P4M-1 airplane no. 121452.

Instrument Indicated Airspeed*	Correction 80,000 lb. Gross Weight
Flaps Retracted	
110 knots	Subtract 9.5 knots
125 knots	Subtract 5 knots
150 knots	Subtract 2 knots
200 knots	Add 0.5 knots
250 knots	Add 1.5 knots
300 knots	Add 2 knots
Flaps Extended 40°	
100 knots	Subtract 10.5 knots
110 knots	Subtract 6.5 knots
120 knots	Subtract 4 knots
130 knots	Subtract 2.5 knots
140 knots	Subtract 1.5 knots
150 knots	Subtract 1 knot
160 knots	Subtract 0.5 knots

* Corrected for instrument error

A-2. POWER PLANT CHARTS. (See figure A-1 and A-2) Operating characteristics and limitations of the engines, with which this airplane is powered, are listed for ready reference in the power plant charts.

A-3. ENGINE OPERATING LIMITS CURVE. (See figures A-3)

A-4. These curves can be used to set operating conditions to determine engine power within the recommended limits of the engine. Partial throttle conditions up to a limiting BMEP located on the left side of the curve. Full throttle conditions with high impeller ratio are those to the right of the "MINIMUM SLIP HIGH GEAR" line, and the space between are generally those with the impeller in the variable speed. Each speed is shown with the APC unit at a constant setting.

A-5. Deleted

A-6. A maximum manifold pressure setting of 61.5 inches is recommended for sea-level take-off, regardless of outside air temperature. This manifold pressure is required

POWER PLANT CHART

AIRCRAFT MODEL(S): P4M-1

PROPELLER(S): Aero Products Model No. A644-FN-A1, Blade No. C40G1-216-36 or Hamilton Standard Model No. 24260-79, Blade No. 2J17C-24 AG

ENGINE MODEL(S): R-4360-20

GAUGE READING	FUEL PRESS.	OIL PRESS.	OIL TEMP.	COOLANT TEMP.		OIL(1) CONS.
DESIRED MAXIMUM	24-26 28	65-100 100	60-75 85 (6)			
MINIMUM IDLING	21 14	65 25	40 (5)			

MAXIMUM PERMISSABLE DIVING RPM: 3060
MINIMUM RECOMMENDED CRUISE RPM: 1200

OIL GRADE : 1100(s)-1065(W) Spec. MIL-O-6082A
FUEL GRADE: 115/145 Spec. MIL-F-5572

WAR EMERGENCY (COMBAT EMERGENCY)			MILITARY POWER (NON-COMBAT EMERGENCY)			OPERATING CONDITION			NORMAL RATED (MAXIMUM CONTINUOUS)			MAXIMUM CRUISE (NORMAL OPERATION)		
MINUTES			Thirty (30) MINUTES			TIME LIMIT			UNLIMITED			UNLIMITED		
			250°C			MAX. CYL. HD. TEMP.			232°C			218°C		
			Normal (8)			MIXTURE			Normal (8)			Normal (8)		
			2700			R. P. M.			2550			2000		
MANIF. PRESS.	SUPER-CHARGER	FUEL(2) Gal/Min	MANIF. PRESS.	SUPER-CHARGER	FUEL(2) Gal/Min	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH (3)	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH (3)
						-55.0 -55.0 -55.0	40,000 FT. 38,000 FT. 36,000 FT.	-67.0 -67.0 -67.0						
						-52.4 -48.4 -44.4	34,000 FT. 32,000 FT. 30,000 FT.	-62.3 -55.1 -48.0						
						-40.5 -36.5 -32.5	28,000 FT. 26,000 FT. 24,000 FT.	-40.9 -33.7 -26.5						
			55		5.9	-28.6 -24.6 -20.7	22,000 FT. 20,000 FT. 18,000 FT.	-19.4 -12.3 - 5.2	48.5		344	37		136
			57 58 58		6.1 6.3 6.6	-16.7 -12.7 - 8.8	16,000 FT. 14,000 FT. 12,000 FT.	2.0 9.1 16.2	48 48 48.5		350 354 357	40 40 40		148 148 146
			58.5 58.5 58.5		6.9 7.2 7.3	- 4.8 - 0.8 3.1	10,000 FT. 8,000 FT. 6,000 FT.	23.4 30.5 37.6	48.5 49 49.5		357 354 351	40.5 40.5 41		143 142 141
			59 60.1 60.1		7.5 7.6 7.6	7.1 11.0 15.0	4,000 FT. 2,000 FT. SEA LEVEL	44.7 51.8 59.0	49.5 49 49		345 338 332	41 41 41		140 139 138

GENERAL NOTES

(1) OIL CONSUMPTION: MAXIMUM U.S. QUART PER HOUR PER ENGINE.
(2) *Gal/Min:* APPROXIMATE U.S. GALLON PER *MINUTE* PER ENGINE
(3) GPH: APPROXIMATE U.S. GALLON PER HOUR PER ENGINE.

FOR COMPLETE CRUISING DATA SEE APPENDIX I

TAKE-OFF CONDITIONS: 61.5 "Hg. MANIFOLD PRESSURE
"RICH" MIXTURE
2700 RPM, CYL. TEMP. 250°C.

CONDITIONS TO AVOID:

SPECIAL NOTES

(4) Automatic Power Control Installed.
(5) Minimum Oil Temperature For Take-Off.
(6) Maximum Allowed For Take-Off and Climb is 102°C.
(7) Maximum Cruise Is Defined As The Maximum Power That Can Be Used And Still Have The Carburetor Meter At The Most Economical Fuel-Air Ratios. Higher Powers Up Through Normal Rated Power May Be Used For Continuous Cruising But The Fuel-Air Ratio Becomes Progressively Richer Resulting In Greatly Increased Fuel Consumption And Consequently A Marked Reduction In Range.
(8) If Cylinder Temperature Limits Cannot Be Maintained Move Mixture To Rich.
(9) The Following Power Settings Are Approved Recommended Limits When Operating On Grade 100/130 Fuel:

T.O. & Mil. Power	2700 RPM	58 in. Hg.	Rich Mixture
Normal Rated Power	2550 RPM	46 in. Hg.	Normal Mixture
Max. Cruise Power	2000 RPM	35 in. Hg.	Normal Mixture

DATA AS OF 1-30-52 BASED ON GLM Engineering Report 3247 Appendix "C"

AAFMC-526 8-1-52

Figure A-1. Power Plant Chart - R4360-20 Engine

TURBO-JET ENGINE CHART

AIRCRAFT MODEL
P4M-1

ENGINE MODEL
J33-A-10

GAGE READING	FUEL PRESSURE (PSI)	OIL PRESSURE (PSI)	TAIL PIPE TEMPERATURE (°C)	OPERATING CONDITION	RPM (%)	TAIL PIPE TEMPERATURE MAX. (°C)	TIME LIMIT
DESIRED		12-38		TAKE-OFF	100	700	5 MINUTES
MAX.	180	50	700	NORMAL	96	655	UNLIMITED
MIN.	38	7	315	CRUISE	96-65	655	UNLIMITED
IDLE		2-10	600	IDLE	34	600	UNLIMITED

FUEL: SPECIFICATION MIL-F-5572, GRADE 115/145
OIL: SPECIFICATION MIL-O-6081A, GRADE 1010

PRESSURE ALTITUDE	STANDARD TEMPERATURE °F	STANDARD TEMPERATURE °C	FUEL CONSUMPTION - GALLONS/HOUR 100% (11750) RPM	96% (11250) RPM
40,000	-67.0	-55.0	270 at 350 knots	225 at 300 knots
35,000	-65.8	-54.3	340 at 350 knots	290 at 300 knots
30,000	-48.0	-44.0	410 at 350 knots	345 at 300 knots
25,000	-30.2	-34.5	485 at 350 knots	410 at 300 knots
20,000	-12.3	-24.6	580 at 350 knots	480 at 300 knots
15,000	5.5	-14.7	680 at 350 knots	545 at 300 knots
10,000	23.4	- 4.8	780 at 350 knots	610 at 300 knots
5,000	41.2	5.1	890 at 350 knots	680 at 300 knots
SEA LEVEL	59.0	15.0	1000 at 350 knots, 910 at 100 knots	750 at 300 knots

SOURCE: ALLISON SPECIFICATION 258D

Figure A-2. Power Plant Chart - J33-A-10 Engine

to obtain take-off power (3150 BHP) when the outside air temperature is 33°C (91.4°F) at sea level pressure altitude. Any further increase in manifold pressure may result in serious detonation. As noted 61.5 inches are required to obtain 3250 BHP under standard conditions.

A-7. "NORMAL" mixture may be used for all powers in flight provided cylinder head temperatures are held within limits.

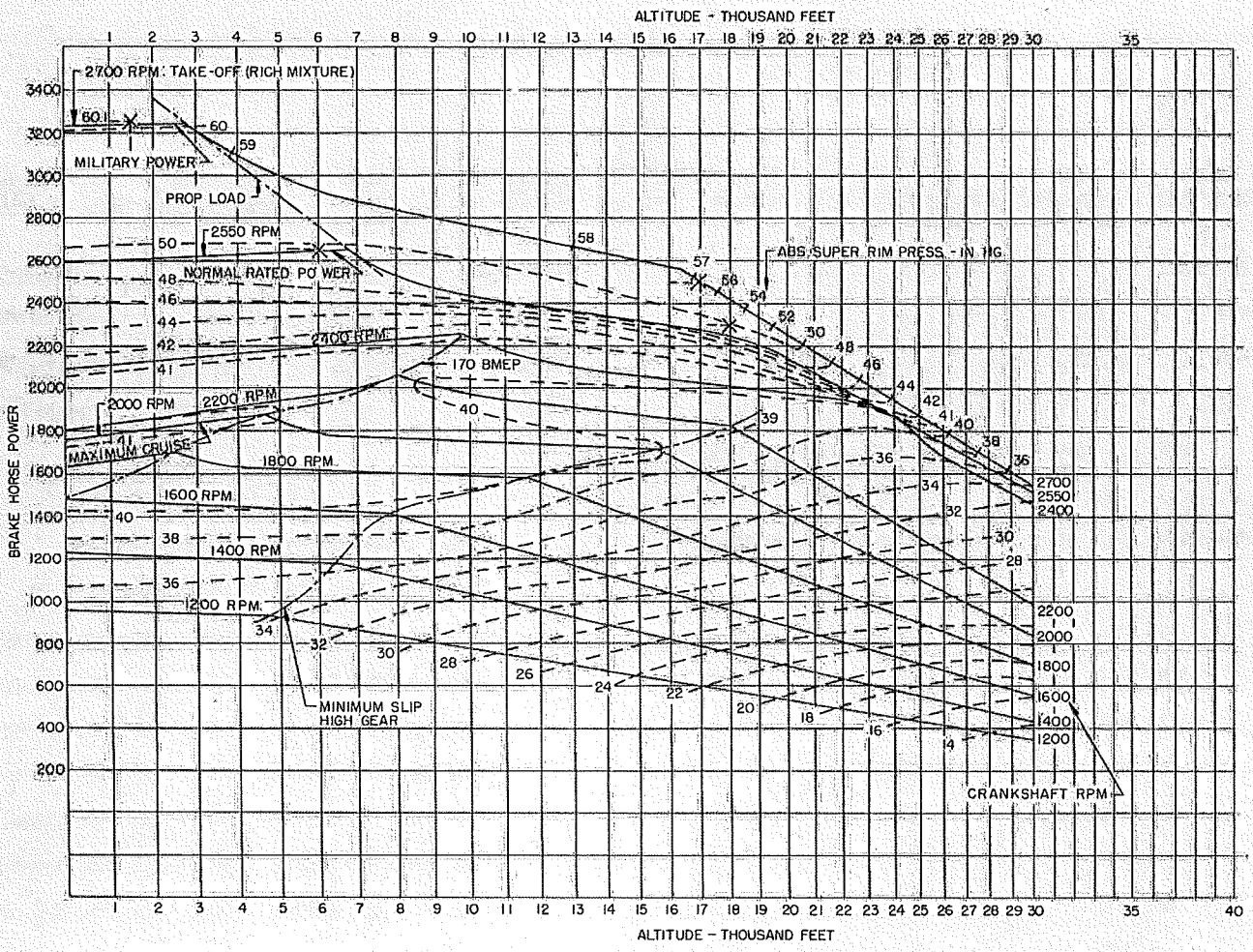
A-8. "RICH" mixture must be used for all ground operations, taxiing, take-off, and whenever cylinder head temperatures exceed 232°C in "NORMAL".

A-9. FLIGHT OPERATION DATA. The following flight operation data is presented to acquaint the pilot with the operation and performance of the airplane. Adherence to the operating instructions given on the charts will result in the attainment of best possible performance under each required condition.

A-10. TAKE-OFF, CLIMB, AND LANDING CHARTS. (See figures A-5).

A-11. The take-off table lists the ground run distance and the distance to clear a 50-foot obstacle for various gross weights. This chart is based on zero head wind and operation from a hard surfaced runway. The distances shown are for average service conditions. With precision flying, distances of 80 percent of values shown may be obtained.

A-12. The climb data table gives the best climb speed, rate of climb, time to climb, and the fuel used for climb to various altitudes with normal rated power. It is imperative that the cowl flaps and oil cooler shutters be kept as near closed as



X MANUFACTURER'S GUARANTEED CRITICAL

NOTE: DO NOT INCREASE MP ABOVE THESE CHARTERED VALUES TO CORRECT BMEP FOR HIGHER THAN STANDARD CARBURETOR AIR TEMPERATURE, OR INCIPIENT DETONATION AND/OR VALVE TROUBLES MAY RESULT.

OPERATING LIMITS R-4360
NORMAL CARBURETOR SETTING
(EXCEPT WHERE NOTED)
ALTITUDE CHARACTERISTICS WITH MANIFOLD PRESSURE
REGULATOR UNIT
GRADE 115/145 FUEL (SEE FIGURE A-1 FOR LIMITS WHEN USING 100/130 FUEL)
DATA AS OF 30 JANUARY 1952 BASED ON: GLM ENGINEERING REPORT 3247 APPENDIX "G"

Figure A-3. Engine Calibration Curve - R4360-20 Engine

possible without exceeding engine temperature limits. An allowance of 130 gallons of fuel is shown in the sea level column for warm-up and take-off, and the same allowance is contained in the fuel values shown on this chart to climb to other altitudes.

A-13. The landing distance table lists the run distance as well as the total distance required to land over the 50 foot obstacle for various gross weights and altitudes. The best indicated approach speed gives safe air speeds for approaching the landing area with flaps deflected full down. The landing distances given are for average service conditions. With precision flying landing distances of 80 percent of values shown can be obtained.

A-14. FLIGHT OPERATION INSTRUCTION CHARTS. (See figures A-6 to A-15)

A-15. In making up a flight plan, the available fuel for the mission is obtained by subtracting the allowances for warm up taxiing, take off and climb from the total fuel load. The remaining fuel is available for cruising and reserve. From gross weight, range required, altitude desired, and available fuel figures, the engine operation and cruising speed can be chosen to meet the requirement. The fuel required and the flying time for a given mission depends largely upon the speed desired. With all

other factors remaining equal in the airplane, speed is obtained with a sacrifice in range and conversely, range is obtained with a sacrifice in speed. The speed is usually determined after considering the urgency of the flight and the range obtainable at various speeds. The time of take-off is adjusted to have the flight arrive at it's destination at the predetermined time.

A-16. Included are charts for two engine and single engine operation using the R-4360-20 reciprocating engines and operated with "NORMAL" mixture. The two engine charts also include range data (in Column I only) for operation at Normal Rated Power on all four engines (the two reciprocating and two turbo-jet engines).

A-17. For determination of fuel load to be carried, it is recommended that the two engine charts be used for the first half of the mission and single engine charts for the remainder of the mission. In case of engine failure this procedure will provide enough fuel for the airplane to reach its destination.

A-18. The charted ranges make no allowance for warm-up, take-off and climb. Fuel consumed during these operations should be obtained from the Take-Off Climb and Landing Chart (figure A-5). Similarly no account is taken of the improved miles per gallon realized during descent. Neglect of this factor is recommended to balance the fuel required for landing operations.

A-19. The operating data included on any one chart should be used only when the gross weight is within the limits specified in the title block. When diminishing fuel load causes the gross weight to decrease to a value included in the weight limits of the next chart, the operating data included in the corresponding column of that chart should be used. This is essential, as ranges have been computed on this basis.

A-20. All data is based on the maximum weight for which the chart is applicable. When gross weight is within the chart weight limits and less than the maximum due to lighter initial weight or diminished fuel load, the air speed will be slightly greater than that listed on the chart. In order to maintain the chart in simplified form, no account has been taken of this factor.

A-21. Experience has shown that fuel consumption should be increased fifteen percent above specification fuel flows to take account of variation in service airplanes and operating techniques. These allowances have been made on the Flight Operation Instruction Charts. No allowance has been made for wind, navigational error, combat, formation flight, or other contingencies. Appropriate allowances for these items should be dictated by local doctrine. The fuel quantity used in entering the chart, therefore, should be the fuel available after reaching flight altitude less allowances appropriate for the mission.

A-22. For planning a flight proceed as follows:

a. Select the Flight Operating Instruction Chart for the initial gross weight.

b. Locate the largest figure entered under GPH (gallon per hour) in the column applicable to the flight plan on the lower half of the chart.

c. Multiply this figure by the number of hours desired for reserve fuel.

d. Add the resulting figure to the number of gallons required for starting, warm-up, and take-off (normally 130 gallons unless additional allowance is required for delays in take-off or climbing).

e. Subtract this figure from the number of gallons of fuel in the airplane before the engines were started. The result represents the amount of fuel available for cruising.

f. Select the figure in the fuel column equal to, or just below the amount of fuel determined in the preceding paragraphs.

g. Read horizontally to the right or left and select the range in air miles figure equal to, or just above the number of air miles, with no wind, to be flown.

h. Reading vertically downward in the column in which this figure appears will give the highest cruising speed (TAS, true air speed) possible for the range desired together with the optimum engine setting. The airplane may be flown using values contained in any column of a higher range with the flight plan being completed at a sacrifice of air speed but an increase in fuel economy. The airplane and engine operating values listed in any single column are calculated to give approximately constant miles per gallon at all altitudes listed. Therefore, the airplane may be operated at any altitude with the corresponding conditions given, as long as they are in the same column listing the range desired.

A-23. For operating and planning during flight, proceed as follows:

a. When the gross weight becomes less than the minimum limit specified on the flight operation instruction chart used for take-off, read the operating data from the same column on the chart of the next lowest gross weight.

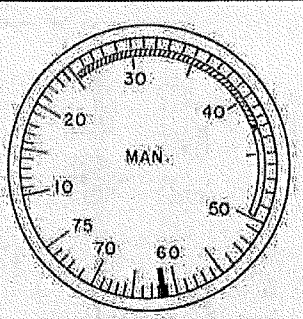
b. The time in hours during flight, when this transition occurs, can be found by dividing the difference between the take-off gross weight and the minimum weight on the chart by six times the gallon per hour fuel consumption.

c. If the flight is of long duration make the change in operating data several times, i.e., as soon as the airplane gross weight falls in the next weight range.

d. The flight plan may be changed readily at any time enroute, and the chart will show the balance of range at various cruising

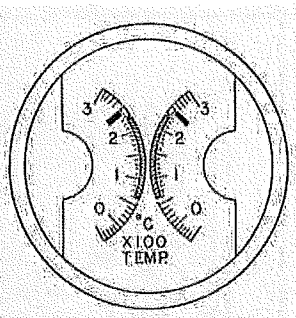
powers by following the instructions printed on each chart. If the flight indicates a mission requiring changes in engine power, air speed, gross weight, or if one engine fails in flight; break down the total flight into a series of short flights, compute each individually, then add them together to determine the total flight and its requirements.

A-24. The highest operating efficiency of an airplane is obtained under conditions which give the maximum miles per gallon of fuel. Since the airplane is composed of the airframe and the power plant, peak efficiency results from the best operating combination of both. The Flight Operation Instruction Charts are computed to give optimum engine settings for each airplane condition shown, with maximum range being obtained in column V. In addition to following the charts precisely the operating efficiency can be increased by reducing unnecessary drag items and by choosing the optimum altitude.



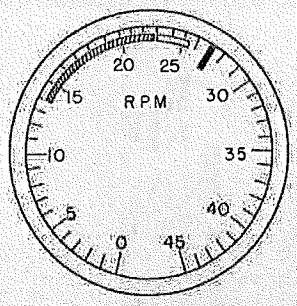
MANIFOLD PRESSURE

BLUE 25 (MINIMUM PERMISSIBLE IN FLIGHT)
BLUE 25 TO 43 (NORMAL)
GREEN 43 TO 50 (RICH)
RED 61 ½ (MAXIMUM)



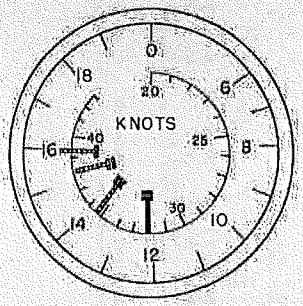
CYLINDER HEAD TEMP

BLUE 60° TO 232° NORMAL
GREEN 232° TO 249° RICH
RED 249° MAXIMUM



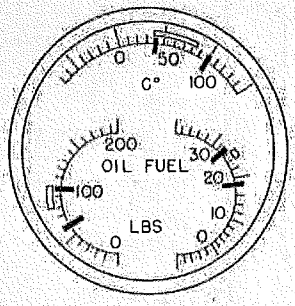
TACHOMETER

BLUE 1400 TO 2300 NORMAL
GREEN 2300 TO 2550 RICH
RED 2700 MAXIMUM



AIRSPEED INDICATOR

YELLOW 160K (FLAP AND GEAR PLACARD SPEED)
RED 320K (LIMIT SPEED AT 20,000 FT.)
YELLOW 351K (LIMIT SPEED AT 10,000 FT)
BLUE 380K (LIMIT SPEED AT SEA LEVEL)

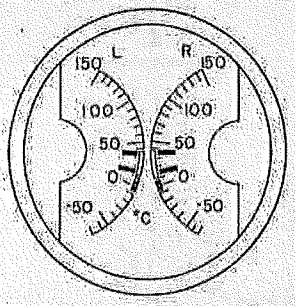


ENGINE GAGE

OIL IN TEMPERATURE
- GREEN ARC 40° TO 85° (CONTINUOUS OPERATION)
- RED 98° (MAXIMUM CLIMB)
- RED 40° (MINIMUM TAKE OFF)

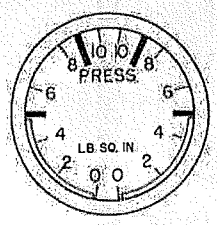
OIL PRESSURE
- GREEN 80 TO 100 (CONTINUOUS OPERATION)
- RED 100 (MAX FLIGHT)
- RED 60 (MINIMUM FLIGHT)

FUEL PRESSURE
- GREEN 24 TO 26 (CONTINUOUS OPERATION)
- RED 27 ½ (MAXIMUM)
- RED 19 (MINIMUM FLIGHT)



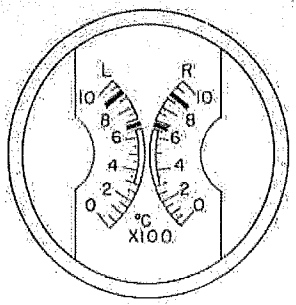
CARBURETOR AIR TEMPERATURE

GREEN 10° TO 38° (NORMAL)
YELLOW -5° TO +10° (DANGER OF ICING)
RED 38° (MAX PRE-HEAT-LOW BLOWER)
RED 15° (MAX PRE-HEAT-HIGH BLOWER)



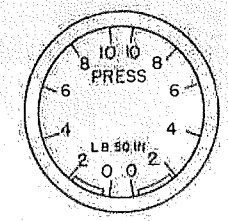
OIL PRESSURE (JET)

GREEN 2 TO 50 PSI
RED 50 PSI
RED 90 PSI



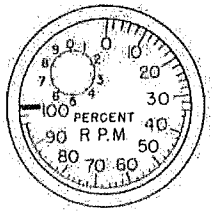
EXHAUST TEMPERATURE (JET)

GREEN 315° TO 655° (CONTINUOUS OPERATION)
SHORT RED 699° (MAX. FLIGHT)
LONG RED 900° (MAX. START AND ACCELERATION)



LOW PRESSURE FUEL (JET)

GREEN 38 TO 180 PSI



TACHOMETER (JET)

GREEN 34% TO 96% NORMAL
RED 100% MAXIMUM

COLOR LEGEND

- RED
- GREEN
- BLUE
- YELLOW

Figure A-4. Instrument Limitations Chart

AAFMC-527 4-1-48

AIRCRAFT MODEL(S)

P4M-1/1Q

TAKE-OFF, CLIMB & LANDING CHART

MAIN ENGINES ONLY OPERATING

TAKE-OFF DISTANCE FEET

ENGINE MODEL(S)

(2) R-4360-20

(2) J-33-A-10

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
60000	0	0	2485	3715																
65000	0	0	2760	4055																
70000	0	0	3125	4485																
75000	0	0	3530	4975																
80000	0	0	3975	5510																
85000	0	0	4455	6090																
88000	0	0	4780	6500																

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

OPTIMUM TAKE-OFF WITH 2700 RPM, 61.5 IN.HG. & 20 DEG. FLAP IS 80% OF CHART VALUES

DATA AS OF 30 Jan. 1952 BASED ON: GLM Engineering Report 3247 Appendix "C"

CLIMB DATA (NORMAL RATED POWER)

GROSS WEIGHT LB.	AT SEA LEVEL				AT 2000 FEET					AT 4000 FEET					AT 6000 FEET					AT 8000 FEET					AT 10,000 FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED
60000	140	121	1330	130	140	121	1310	1.5	147	141	122	1260	3.1	165	143	124	1250	4.7	184	142	123	1160	6.4	203	140	121	1100	8.1	224
65000	143	124	1170	130	142	123	1150	1.7	149	143	124	1090	3.5	169	144	125	1080	5.3	191	143	124	980	7.3	214	142	123	940	9.4	238
70000	146	127	1000	130	145	126	980	2.0	152	145	126	920	4.1	176	146	127	910	6.3	202	146	127	810	8.6	229	144	125	760	11.2	259
75000	149	129	870	130	148	128	850	2.3	156	148	128	780	4.8	184	150	130	770	7.4	214	149	129	670	10.1	246	147	127	630	13.2	283
80000	151	131	740	130	150	130	710	2.7	161	150	130	640	5.7	194	151	131	630	8.8	231	151	131	540	12.2	271	150	130	500	16.1	317
85000	153	133	630	130	153	133	600	3.2	166	153	133	530	6.8	206	154	134	520	10.4	249	154	134	420	14.6	298	152	132	380	19.6	357
88000	156	135	560	130	155	134	530	3.7	171	156	135	460	7.7	217	157	136	450	12.0	267	156	135	360	16.9	325	155	134	320	22.9	395

POWER PLANT SETTINGS: (DETAILS ON FIG. A-1 SECTION 1 FT):

DATA AS OF 30 Jan. 1952 BASED ON: GLM Engineering Report 3247 Appendix "C"

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
55000	128	106	117	101	1350	2590																
70000	138	120	132	114	1710	3160																
80000	147	127	141	122	1950	3590																

DATA AS OF 1 July 1949 BASED ON: GLM Engineering Report 3247

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS: Time Minutes In Climb Data Does Not Include Time Required For Take-Off

LEGEND

I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure A-5. (Sheet 1 of 2 Sheets) Take-Off, Climb, and Landing Chart

AAFNC-527
4-1-44

AIRCRAFT MODEL(S)
P4M-1/1Q

TAKE-OFF, CLIMB & LANDING CHART

ENGINES AND JETS OPERATING

ENGINE MODEL(S)
(2) R-4360-20
(2) J-33-A-10

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
60000			1175	1785																
65000			1345	1995																
70000			1555	2245																
75000			1800	2525																
80000			2055	2825																
85000			2335	3145																
88000			2515	3350																

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 60%

DATA AS OF 30 Jan. 1952 BASED ON: GLM Engineering Report 3247 Appendix "C"

OPTIMUM TAKE-OFF WITH 2700 RPM, 61.5 IN. HG. & 20 DEG. FLAP IS 80% OF CHART VALUES
Jet at 100% RPM (11750)

CLIMB DATA (NORMAL RATED POWER)

GROSS WEIGHT LB.	AT SEA LEVEL				AT 2000 FEET					AT 4000 FEET					AT 6000 FEET					AT 8000 FEET					AT 10000 FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED
60000	182	158	3580	130	182	158	3400	.6	153	182	158	3240	1.2	176	182	158	3080	1.8	199	181	157	2890	2.5	223	181	157	2700	3.2	247
65000	183	159	3310	130	183	159	3140	.6	155	185	160	2980	1.3	180	185	160	2830	2.0	206	182	158	2640	2.7	231	182	158	2450	3.5	258
70000	186	161	3040	130	185	160	2880	.7	157	186	161	2720	1.4	185	187	162	2560	2.1	213	186	161	2380	2.9	242	185	160	2200	3.8	271
75000	188	163	2830	130	186	161	2670	.7	159	186	161	2510	1.5	189	188	163	2360	2.3	219	188	163	2190	3.1	249	186	161	2000	4.1	281
80000	190	165	2630	130	188	163	2470	.8	162	188	163	2310	1.6	194	188	163	2160	2.5	228	189	164	1990	3.5	262	187	162	1810	4.5	297
85000	190	165	2460	130	190	165	2300	.8	164	190	165	2150	1.7	199	190	165	1990	2.7	235	190	165	1830	3.8	272	190	165	1650	4.9	311
88000	191	166	2350	130	190	165	2200	.9	166	193	167	2050	1.8	201	193	167	1900	2.8	239	193	167	1730	3.9	278	191	166	1560	5.1	319

POWER PLANT SETTINGS: (DETAILS ON FIG. A-1):

DATA AS OF 30 Jan 1952 BASED ON: GLM Engineering Report 3247 Appendix "C"

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
55000	122	106	117	101	1350	2590																
70000	138	120	132	114	1710	3160																
80000	147	127	141	122	1950	3530																

DATA AS OF 1 July 1949 BASED ON: GLM Engineering Report 3247

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS: Time Minutes in Climb Data Does Not Include Time Required For Take-Off

LEGEND
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure A-5. (Sheet 2 of 2 Sheets) Take-Off, Climb, and Landing Chart

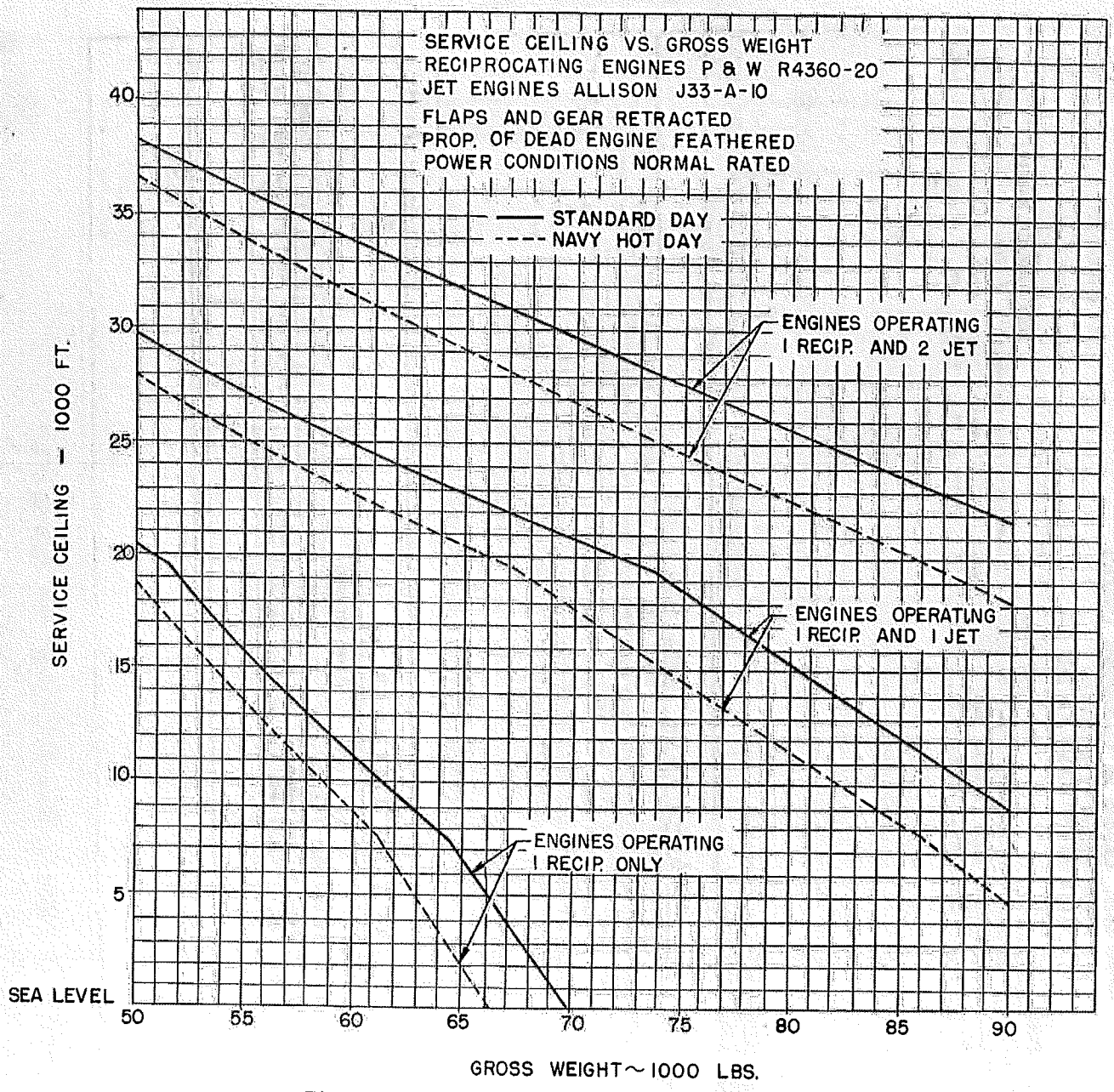


Figure A-5A Service Ceiling vs Gross Weight

GROSS WEIGHT AND CLIMB SPEED FOR SERVICE CEILING OF SEA LEVEL, ONE RECIPROCATING ENGINE OPERATING AT MILITARY POWER. JET ENGINES INOPERATIVE.

Condition	Standard Day	Navy Hot Day
Propeller of Dead Engine Feathered, Flaps 20°, Gear Down		
Gross Weight	66,300 lb.	62,800 lb.
Climb Speed	87 knots	86 knots
Propeller of Dead Engine Feathered, Flaps Up, Gear Up		
Gross Weight	81,000 lb.	77,700 lb.
Climb Speed	127 knots	128 knots
Propeller of Dead Engine Windmilling, Flaps Up, Gear Up		
Gross Weight	73,400 lb.	70,350 lb.
Climb Speed	123 knots	123 knots

Approximate correction to Gross Weight for Service Ceiling at Various Altitudes and Engine Operating Condition for non-standard Atmospheric Conditions.
GW/°F = 200 lb/°F

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AIRCRAFT MODEL(S) P4M-1/1Q (HAMILTON PROPELLERS: MODEL NO. 24260-79 STANDARD)

ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 88000 TO 85000 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO(3)

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO.	NORMAL	30 MIN.	250°	912
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES (3) A TWO ENG. OPERATION STAT.	A TWO ENG. OPERATION NAUT.	B 2ENG+2JET OPERATION STAT.	B 2ENG+2JET OPERATION NAUT.	FUEL U.S. 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 U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
							SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)						
1581	1372	617	536	4200			2389	2074	2793	2425	4200	3198	2776
1503	1305	588	510	4000			2261	1963	2640	2292	4000	3018	2620
1349	1171	529	459	3600			2004	1740	2332	2024	3600	2658	2307
1197	1039	469	407	3200			1760	1528	2042	1773	3200	2322	2016
1045	907	410	356	2800			1521	1320	1759	1527	2800	1996	1733
893	775	353	306	2400			1284	1115	1480	1285	2400	1676	1455
743	645	294	255	2000			1060	920	1218	1057	2000	1376	1194
593	515	235	204	1600			834	724	955	829	1600	1075	933
444	385	175	152	1200			620	538	708	615	1200	796	691
296	257	116	101	800			410	356	468	406	800	524	455
148	128	58	51	400			202	175	229	199	400	257	223

MAXIMUM CONTINUOUS R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(.505 STAT. (.438 NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(.574 STAT. (.498 NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	.642 MAXIMUM AIR RANGE .557 R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
2550	48.5		714	263	228	10000							2400	41		489	247	214	2330	40		413	238	206	10000	2190	40		335	215	187
2550	49		708	261	227	8000							2480	43.5		497	251	218	2290	41		410	236	204	8000	2110	40.5		334	214	186
2550	49.5		702	259	225	6000							2440	43		482	243	211	2380	40.5		407	234	203	6000	2300	39.5		340	218	189
2550	49.5		690	254	221	4000							2460	43		476	240	209	2370	41		400	229	199	4000	2270	40		340	218	189
2550	49		676	249	216	2000							2460	43		469	237	205	2370	41		391	224	194	2000	2240	40		332	213	185
2550	49		664	245	213	S.L.							2460	43		458	231	201	2380	41		382	219	190	S.L.	2250	40		320	205	178

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off and Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as required.
(2) Use Normal Mixture for all Power Conditions.
(3) All Figures are for (2) R-4360-20 Engines excepting the Ranges Under Column B which are for (2) R-4360-20 Eng. @ N.R.P. and (2) J33-A-10 Jets @ 96% RPM. At Sea Level (Worst Condition) The GPH (2 Eng. + 2 Jets) = 2281 and The TAS (2 Eng. + 2 Jets) = 336 MPH = 292 Knots.
(4) Adjust Power as Necessary To Obtain The Charted True Airspeed. Maintain the Designated RPM and Adjust the Manifold Pressure as Required up To The Limits Given In Figure A-3.

EXAMPLE

AT 86000 LB. GROSS WEIGHT WITH 1600 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 278 GAL.) TO FLY 955 STAT. AIRMILES AT 8000 FT. ALTITUDE MAINTAIN 2290 RPM AND 41 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G L M ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-5B. Flight Operation Instruction Chart - Two Engine - 88000 to 85000 Pounds

AAFMC-528 4-1-48

AIRCRAFT MODEL(S) P4M-1/1Q (HAMILTON PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 85000 TO 79000 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO (3)

LIMITS	RPM.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO.	NORMAL	30 Min	250°	912	
MILITARY POWER J-33-A-10	100%						1820	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I — RANGE IN AIRMILES (3)				FUEL U.S. GAL.	COLUMN II — RANGE IN AIRMILES		COLUMN III — RANGE IN AIRMILES		COLUMN IV — RANGE IN AIRMILES		FUEL U.S. GAL.	COLUMN V — RANGE IN AIRMILES	
A TWO ENG. OPERATION		B 2ENG+2JET OPERATION			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
STAT.	NAUT.	STAT.	NAUT.										
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
1590	1380	621	539	4200			2470	2144	2910	2526	4200	3350	2908
1511	1312	591	513	4000			2331	2023	2738	2377	4000	3147	2732
1357	1178	532	462	3600			2072	1799	2430	2109	3600	2788	2420
1204	1045	473	411	3200			1817	1577	2122	1842	3200	2427	2107
1051	912	413	358	2800			1568	1361	1826	1585	2800	2064	1809
899	780	354	307	2400			1328	1153	1544	1340	2400	1758	1526
746	648	295	256	2000			1089	945	1260	1094	2000	1431	1242
597	518	236	205	1600			863	749	996	865	1600	1130	981
446	387	177	154	1200			638	554	734	637	1200	829	720
297	258	118	102	800			421	365	482	418	800	544	472
149	129	59	51	400			210	182	241	209	400	272	236

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.)						(.525 STAT. (.456 NAUT.) MI./GAL.)						(.602 STAT. .523 NAUT.) MI./GAL.)						PRESS ALT. FEET	.680 MAXIMUM AIR RANGE .590					
R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
2550	48.5		714	265	230	10000							2380	40.5		472	248	215	2300	40		395	238	207	10000	2050	39		290	197	171
2550	49		708	263	228	8000							2440	42		474	249	216	2290	41		397	239	208	8000	2080	40.5		315	214	186
2550	49.5		702	261	226	6000							2430	42.5		463	244	211	2360	40		385	232	201	6000	2270	40		320	217	189
2550	49.5		690	256	222	4000							2450	42.5		457	240	208	2340	40.5		378	228	198	4000	2190	40		313	213	185
2550	49		676	251	218	2000							2440	42.5		446	235	204	2340	40.5		369	223	193	2000	2150	39.5		308	209	182
2550	49		664	246	214	S.L.							2440	42.5		437	230	199	2340	41		361	218	189	S.L.	2210	39.5		297	202	176

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off and Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as required.
(2) Use Normal Mixture for all Power Conditions.
(3) All Figures are for (2) R-4360-20 Engines excepting the Ranges Under Column 1B Which are for (2) R-4360-20 Eng. @ N.R.P. and (2) J33-A-10 Jets @ 96% RPM. At Sea Level (Worst Condition) The GPH (2 Eng. + 2 Jets) = 2281 and The TAS (2 Eng. + 2 Jets) = 336 MPH = 292 Knots.
(4) Adjust Power as Necessary To Obtain The Charted True Airspeed. Maintain the Designated RPM and Adjust the Manifold Pressure as Required up To The Limits Given In Figure A-3.

EXAMPLE

AT 80000 LB. GROSS WEIGHT WITH 3600 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 297 GAL.) TO FLY 2072 STAT. AIRMILES AT 10000 FT. ALTITUDE MAINTAIN 2380 RPM AND 40.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G L M ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-6. Flight Operation Instruction Chart - Two Engine - 85000 to 79000 Pounds

AAFMC-528 4-1-48

AIRCRAFT MODEL(S) P4M-1/1Q (HAMILTON PROPELLERS: MODEL NO. 24260-79 STANDARD)

ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 79000 TO 73000 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO (3)

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO	NORMAL	30 MIN.	250°	912	
MILITARY POWER J-33-A-10	100%						1820	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[4] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I — RANGE IN AIRMILES (3)				FUEL U.S. GAL.	COLUMN II — RANGE IN AIRMILES		COLUMN III — RANGE IN AIRMILES		COLUMN IV — RANGE IN AIRMILES		FUEL U.S. GAL.	COLUMN V — RANGE IN AIRMILES	
A 2 ENG. OPERATION		B 2 ENGINES + 2 JETS			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
STAT.	NAUT.	STAT.	NAUT.										
							SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						
1608	1396	623	541	4200			2660	2309	3184	2764	4200	3709	3220
1530	1328	593	515	4000			2507	2176	2994	2599	4000	3481	3022
1374	1193	533	463	3600			2226	1932	2651	2301	3600	3076	2670
1219	1058	474	411	3200			1945	1688	2307	2003	3200	2670	2318
1063	923	415	360	2800			1676	1455	1981	1720	2800	2288	1986
910	790	355	308	2400			1419	1232	1674	1453	2400	1927	1673
756	656	296	257	2000			1162	1009	1365	1185	2000	1568	1361
604	524	237	206	1600			923	801	1082	939	1600	1241	1077
452	392	178	154	1200			683	593	799	694	1200	915	794
301	261	118	102	800			450	391	525	456	800	601	522
150	130	59	51	400			226	196	263	228	400	301	261

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.)						(.563 STAT. (.489 NAUT.) MI./GAL.)						(.658 STAT. (.571 NAUT.) MI./GAL.)						PRESS ALT. FEET	.751 MAXIMUM AIR RANGE .652					
R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2550	48.5		714	268	232	10000							2390	41		450	254	220	2260	40		367	241	210	10000	2040	39		286	215	187
2550	49		708	266	231	8000							2350	41		441	248	215	2170	41		360	237	206	8000	1990	40		281	211	183
2550	49.5		702	264	229	6000							2410	41.5		435	245	213	2330	40		353	232	201	6000	1970	39.5		275	207	179
2550	49.5		690	259	225	4000							2420	41.5		427	241	209	2290	40		347	228	198	4000	1960	38.5		264	198	172
2550	49		676	254	220	2000							2410	41.5		415	234	203	2260	40		337	222	193	2000	1880	38		256	192	167
2550	49		664	249	217	S.L.							2410	41.5		405	228	198	2280	40		327	215	187	S.L.	1950	37.5		255	192	167

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off and Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as required.
(2) Use Normal Mixture for all Power Conditions.
(3) All Figures are for (2) R-4360-20 Engines excepting the Ranges Under Column II Which are for (2) R-4360-20 Eng. @ M.R.P. and (2) J33-A-10 Jets @ 96% RPM. At Sea Level (Worst Condition) The GPH (2 Eng. + 2 Jets) = 2281 and The TAS (2 Eng. + 2 Jets) = 337 MPH = 293 Knots.
(4) Adjust Power as Necessary To Obtain The Charted True Airspeed. Maintain the Designated RPM and Adjust the Manifold Pressure as Required up To The Limits Given In Figure A-3.

EXAMPLE

AT 78000 LB. GROSS WEIGHT WITH 400 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 162 GAL.) TO FLY 301 STAT. AIRMILES AT 2000 FT. ALTITUDE MAINTAIN 1880 RPM AND 38 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G L M ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-7. Flight Operation Instruction Chart - Two Engine - 79000 to 73000 Pounds

AAFMC-526 4-1-48

AIRCRAFT MODEL(S) P4M-1/1Q (HAMILTON PROPELLERS: MODEL NO. 24260-79 STANDARD)

ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 73000 TO 67000 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO (3)

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO	NORMAL	30 MIN.	250°	912
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES A 2 ENG. OPERATION STAT.	COLUMN I RANGE IN AIRMILES A 2 ENG. OPERATION NAUT.	COLUMN I RANGE IN AIRMILES B 2 ENGINES + 2 JETS STAT.	COLUMN I RANGE IN AIRMILES B 2 ENGINES + 2 JETS NAUT.	FUEL U.S. 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[1]	COLUMN IV RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING								
1388	1205	535	464	3600			2402	2085	2908	2524	3600	3413	2963
1233	1070	475	412	3200			2097	1820	2526	2193	3200	2958	2568
1076	934	415	360	2800			1803	1565	2165	1879	2800	2527	2194
920	799	356	309	2400			1523	1322	1821	1581	2400	2122	1842
765	664	296	257	2000			1242	1078	1475	1283	2000	1716	1490
611	530	237	206	1600			984	854	1169	1015	1600	1357	1178
457	397	178	154	1200			728	632	862	748	1200	996	865
304	264	118	102	800			479	416	566	491	800	653	567
152	132	59	51	400			240	208	283	246	400	327	284

MAXIMUM CONTINUOUS R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(.599 STAT. (.520 NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S.	(.707 STAT. (.614 NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	.817 MAXIMUM AIR RANGE .709 R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	48.5		714	271	235	10000							2340	40		424	254	220	2200	39.5		341	242	209	10000	1920	37.5		259	211	183
2550	49		708	269	234	8000							2400	41.5		426	255	221	2130	41		336	238	206	8000	1860	37		250	205	178
2550	49.5		702	267	232	6000							2390	41		412	247	214	2290	40		330	233	202	6000	1820	36.5		245	200	173
2550	49.5		690	262	228	4000							2380	41		400	240	208	2230	40		322	228	198	4000	1780	35.5		237	193	168
2550	49		676	257	223	2000							2370	41		391	234	203	2180	40		314	223	193	2000	1660	38		221	180	156
2550	49		664	252	219	S.L.							2370	41		379	228	197	2230	40		305	216	187	S.L.	1730	37		230	188	163

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off and Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as required.
(2) Use Normal Mixture for all Power Conditions.
(3) All Figures are for (2) R-4360-20 Engines excepting the Ranges Under Column 1B Which are for (2) R-4360-20 Eng. @ N.R.P. and (2) J33-A-10 Jets @ 96% RPM. At Sea Level (Worst Condition) The GPH (2 Eng. + 2 Jets) = 2281 and The TAS (2 Eng. + 2 Jets) = 339 MPH = 294 Knots.
(4) Adjust Power as Necessary To Obtain The Charted True Airspeed Maintain the Designated RPM and Adjust the Manifold Pressure as Required up To The Limits Given In Figure A-3.

EXAMPLE

AT 68000 LB. GROSS WEIGHT WITH 1600 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 185 GAL.) TO FLY 611 STAT. AIRMILES AT 4000 FT. ALTITUDE MAINTAIN 2550 RPM AND 49.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: GLM ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-8. Flight Operation Instruction Chart - Two Engine -73000 to 67000 Pounds

AAFMC-526 6-1-44

AIRCRAFT MODEL(S)
P4M-1/1Q (HAMILTON
PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 67000 TO 61000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: (3) TWO

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO	NORMAL	30 MIN.	250°	912
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.) MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I — RANGE IN AIRMILES				FUEL U.S. GAL.	COLUMN II — RANGE IN AIRMILES		COLUMN III — RANGE IN AIRMILES		COLUMN IV — RANGE IN AIRMILES		FUEL U.S. GAL.	COLUMN V — RANGE IN AIRMILES	
A 2 ENG. OPERATION		B 2 ENGINES + 2 JETS			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
STAT.	NAUT.	STAT.	NAUT.										
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
1086		416	362	2800			1956	1698	2390	2075	2800	2824	2451
931		357	310	2400			1650	1432	2009	1744	2400	2369	2056
774		297	258	2000			1344	1167	1629	1414	2000	1913	1661
619		237	206	1600			1063	923	1286	1116	1600	1508	1309
463		178	155	1200			782	679	942	818	1200	1102	957
308		119	103	800			514	446	616	535	800	720	625
154		59	51	400			257	223	309	268	400	359	312

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.)						(.643 STAT. (.558 NAUT.) MI./GAL.)						(.771 STAT. (.669 NAUT.) MI./GAL.)						PRESS ALT. FEET	.900 MAXIMUM AIR RANGE .781					
R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2550	48.5		714	274	238	10000							2310	40		400	257	223	2120	39.5		312	241	209	10000	1770	34		224	202	175
2550	49		708	272	237	8000							2270	41		394	253	220	2070	40.5		306	236	205	8000	1720	35		225	202	176
2550	49.5		702	271	235	6000							2350	40		383	246	214	2180	40		301	232	201	6000	1640	35.5		216	194	169
2550	49.5		690	266	231	4000							2350	40.5		375	241	209	2120	39.5		293	226	196	4000	1590	36		210	189	164
2550	49		676	260	226	2000							2340	40.5		366	235	204	2040	40.5		286	220	191	2000	1510	37		201	181	157
2550	49		664	256	222	S.L.							2340	41		356	229	199	2140	39		278	215	186	S.L.	1580	35.5		207	187	162

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off and Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as required.
(2) Use Normal Mixture for all Power Conditions.
(3) All Figures are for (2) R-4360-20 Engines excepting the Ranges Under Column 1B Which are for (2) R-4360-20 Eng. @ N.R.F. and (2) J33-A-10 Jets @ 96% RPM. At Sea Level (Worst Condition) The GPH (2 Eng. + 2 Jets) = 2281 and The TAS (2 Eng. + 2 Jets) = 340 MPH = 295 Knots.
(4) Adjust Power as Necessary To Obtain The Charted True Airspeed. Maintain the Designated RPM and Adjust the Manifold Pressure as Required up To The Limits Given In Figure A-3.

EXAMPLE

AT 66000 LB. GROSS WEIGHT WITH 400 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 157 GAL.) TO FLY 154 STAT. AIRMILES AT 2000 FT. ALTITUDE MAINTAIN 2550 RPM AND 49 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G L M ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-9. Flight Operation Instruction Chart - Two Engine - 67000 to 61000 Pounds

AAFMC-5-28 4-1-48

AIRCRAFT MODEL(S) P4M-1/1Q (HAMILTON PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 61000 TO 55000 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO (3)

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO.	NORMAL	30 MIN.	250°	912	
MILITARY POWER J-33-A-10	100%						1820	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND) (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S.GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I — RANGE IN AIRMILES (3) A 2 ENG. OPERATION STAT.	A 2 ENG. OPERATION NAUT.	B 2 ENGINES + 2 JETS STAT	B 2 ENGINES + 2 JETS NAUT.	FUEL U.S. GAL.	COLUMN II — RANGE IN AIRMILES STATUTE	COLUMN II NAUTICAL	COLUMN III — RANGE IN AIRMILES STATUTE	COLUMN III NAUTICAL	COLUMN IV — RANGE IN AIRMILES STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V — RANGE IN AIRMILES STATUTE	COLUMN V NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)								
702	609	268	232	1800			1313	1140	1620	1406	1800	1924	1670
623	541	239	208	1600			1160	1007	1430	1241	1600	1697	1473
546	474	209	181	1400			1007	874	1238	1075	1400	1469	1275
468	406	179	155	1200			855	742	1048	910	1200	1242	1078
390	338	149	129	1000			702	609	858	745	1000	1014	880
311	270	119	103	800			561	487	687	596	800	811	704
234	203	89	77	600			421	365	515	447	600	608	528
156	135	60	52	400			281	244	343	298	400	406	352
78	68	30	26	200			139	121	172	149	200	203	176

MAXIMUM CONTINUOUS R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(702 STAT. (609 NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(858 STAT. (745 NAUT.) MI./GAL.) R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	1.014 MAXIMUM AIR RANGE .880 R.P.M. (4)	M.P. INCHES (4)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2550	48.5		714	278	241	10000							2270	40		369	259	225	2030	39		281	241	209	10000	1500	31		185	188	163
2550	49		708	276	239	8000							2160	41		358	252	219	1960	39.5		272	234	203	8000	1500	32		187	190	165
2550	49.5		702	274	238	6000							2320	39.5		352	247	214	1920	38.5		265	228	198	6000	1500	32.5		185	188	163
2550	49.5		690	269	233	4000							2300	40		345	242	210	1920	37.5		258	221	192	4000	1500	32.5		180	183	159
2550	49		676	263	229	2000							2260	40		334	235	204	1850	37.5		250	215	187	2000	1500	34		179	182	158
2550	49		664	259	224	S.L.							2270	40		324	228	197	1840	37.5		245	210	182	S.L.	1500	31.5		173	176	152

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off and Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as required.
(2) Use Normal Mixture for all Power Conditions.
(3) All Figures are for (2) R-4360-20 Engines excepting the Ranges Under Column 1B Which are for (2) R-4360-20 Eng. @ N.R.P. and (2) J33-A-10 Jets @ 96% RPM. At Sea Level (Worst Condition) The GPH (2 Eng. + 2 Jets) = 2281 and The TAS (2 Eng. + 2 Jets) = 341 MPH = 296 Knots.
(4) Adjust Power as Necessary To Obtain The Charted True Airspeed. Maintain the Designated RPM and Adjust the Manifold Pressure as Required up To The Limits Given In Figure A-3.

EXAMPLE

AT 58000 LB. GROSS WEIGHT WITH 1000 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 247 GAL.)
TO FLY 1014 STAT. AIRMILES AT 10000 FT. ALTITUDE
MAINTAIN 1500 RPM AND 31 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. = PRESSURE ALTITUDE
M.P. = MANIFOLD PRESSURE
GPH = U.S. GAL. PER HOUR
TAS = TRUE AIRSPEED
KTS. = KNOTS
S.L. = SEA LEVEL
F.R. = FULL RICH
A.R. = AUTO-RICH
A.L. = AUTO-LEAN
C.L. = CRUISING LEAN
M.L. = MANUAL LEAN
F.T. = FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G.L.M. ENGINEERING REPORT 3247 APPENDIX "C" RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-10. Flight Operation Instruction Chart - Two Engine - 61000 to 55000 Pounds

AAFMC-528 4-1-48

AIRCRAFT MODEL(S)
P4M-1/1Q (HAMILTON
PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2) J33-A-10JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55000 TO DOWN POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: TWO (3)

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO	NORMAL	30 MIN	250°	912
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I — RANGE IN AIRMILES (3)				FUEL	COLUMN II — RANGE IN AIRMILES		COLUMN III — RANGE IN AIRMILES		COLUMN IV — RANGE IN AIRMILES		FUEL	COLUMN V — RANGE IN AIRMILES	
A 2 ENG. OPERATION		B 2 ENGINES + 2 JETS		U.S.							U.S.		
STAT.	NAUT.	STAT.	NAUT.	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
312	271	119	103	800			612	531	761	661	800	910	790
273	237	105	91	700			535	464	666	578	700	797	692
234	203	90	78	600			458	398	571	496	600	683	593
196	170	75	65	500			382	332	476	413	500	569	494
157	136	60	52	400			305	265	380	330	400	455	395
118	102	45	39	300			229	199	286	248	300	341	296
78	68	30	26	200			153	133	190	165	200	228	198
39	34	15	13	100			76	66	96	83	100	114	99

MAXIMUM CONTINUOUS						PRESS	(STAT. (NAUT.) MI./GAL.)						(.765 STAT. (.664 NAUT.) MI./GAL.)						(.952 STAT. (.826 NAUT.) MI./GAL.)						PRESS	1.138 MAXIMUM AIR RANGE .988					
R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M. (4)	M.P. INCHES (4)	MIX-TURE (2)	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	48.5		714	278	242	10000							2190	39.5		339	259	225	1860	36		247	235	204	10000	1500	29.5		171	195	169
2550	49		708	277	240	8000							2130	41		332	255	221	1810	36		241	229	199	8000	1500	28.5		162	184	160
2550	49.5		702	275	238	6000							2270	39.5		323	247	214	1740	36		232	221	192	6000	1500	29		161	183	159
2550	49.5		690	270	234	4000							2230	40		315	241	209	1690	36		226	215	186	4000	1500	26		158	180	156
2550	49		676	264	229	2000							2130	40		306	234	203	1630	38		218	208	180	2000	1500	29		157	179	155
2550	49		664	259	225	S.L.							2210	39.5		297	227	197	1640	36		217	206	179	S.L.	1500	29		155	177	154

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off and Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as required.
(2) Use Normal Mixture for all Power Conditions.
(3) All Figures are for (2) R-4360-20 Engines excepting the Ranges Under Column 1B Which are for (2) R-4360-20 Eng. @ N.R.P. and (2) J33-A-10 Jets @ 96% RPM. At Sea Level (Worst Condition) The GPH (2 Eng. + 2 Jets) = 2281 and The TAS (2 Eng. + 2 Jets) = 342 MPH = 297 Knots.
(4) Adjust Power as Necessary To Obtain The Charted True Airspeed. Maintain the Designated RPM and Adjust the Manifold Pressure as Required up To The Limits Given In Figure A-3.

EXAMPLE

AT 55000 LB. GROSS WEIGHT WITH 200 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 153 GAL.) TO FLY 190 STAT. AIRMILES AT 2000 FT. ALTITUDE MAINTAIN 1630 RPM AND 38 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT.	: PRESSURE ALTITUDE	F.R.	: FULL RICH
M.P.	: MANIFOLD PRESSURE	A.R.	: AUTO-RICH
GPH	: U.S. GAL. PER HOUR	A.L.	: AUTO-LEAN
TAS	: TRUE AIRSPEED	C.L.	: CRUISING LEAN
KTS.	: KNOTS	M.L.	: MANUAL LEAN
S.L.	: SEA LEVEL	F.T.	: FULL THROTTLE

DATA AS OF 30 JANUARY '52 BASED ON: GLM ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-11. Flight Operation Instruction Chart - Two Engine - 55000 Pounds and Down

AAFMC-528 4-1-RN

AIRCRAFT MODEL(S)
P4M-1/1Q (HAMILTON PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 73000 TO 70000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO.	NORMAL	30 MIN.	250°	456
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STAUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
1949 1837	1692 1595	3800 3600		SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]					3800 3600		
1618 1400 1185	1405 1216 1029	3200 2800 2400							3200 2800 2400		
976 768 570	848 667 495	2000 1600 1200							2000 1600 1200		
374 182	325 158	800 400							800 400		

.455 MAXIMUM CONTINUOUS .395

R.P.M. (3)	M.P. INCHES (3)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET
						40000 35000 30000
						10000 8000 6000
2550	49		332	151	131	4000 2000 S.L.

(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.

PRESS ALT. FEET	MAXIMUM AIR RANGE					
	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
40000 35000 30000						
10000 8000 6000						
4000 2000 S.L.						

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off & Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as Required.
(2) Use Normal Mixture For All Power Conditions.
(3) Adjust Power As Necessary To Obtain The Charted True Airspeed. Maintain the Designated R.P.M. And Adjust The Manifold Pressure As Required Up To The Limits Given In Figure A-3.

EXAMPLE

AT 71000 LB. GROSS WEIGHT WITH 2800 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 0 GAL.) TO FLY 1400 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 2550 RPM AND 49 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT.	PRESSURE ALTITUDE	F.R.	FULL RICH
M.P.	MANIFOLD PRESSURE	A.R.	AUTO-RICH
GPH	U.S. GAL. PER HOUR	A.L.	AUTO-LEAN
TAS	TRUE AIRSPEED	C.L.	CRUISING LEAN
KTS.	KNOTS	M.L.	MANUAL LEAN
S.L.	SEA LEVEL	F.T.	FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G.L.M. ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA. SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-11A. Flight Operation Instruction Chart - One Engine - 73000 to 70000 Pounds

AAFMC-528 4-1-48

AIRCRAFT MODEL(S)
P4M-1/1Q (HAMILTON
PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 70000 TO 64000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO.	NORMAL	30 MIN.	250°	456
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN (1) 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STAUTE	COLUMN I RANGE IN AIRMILES NAUTICAL	FUEL U.S. 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 U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)							
1776	1542	3400							3400		
1665	1445	3200							3200		
1445	1254	2800							2800		
1227	1065	2400							2400		
1009	876	2000							2000		
801	695	1600							1600		
592	514	1200							1200		
391	339	800							800		
196	170	400							400		

.488 MAXIMUM CONTINUOUS .424

R.P.M. (3)	M.P. INCHES (3)	MIXTURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																				40000						
						35000																				35000						
						30000																				30000						
						10000																				10000						
						8000																				8000						
						6000																				6000						
2550	49.5		345	159	138	4000																				4000						
2550	49		338	160	139	2000																				2000						
2550	49		332	162	141	S.L.																				S.L.						

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off & Climb (See Fig. A-5) Plus Allowance For Wind, Reserve and Combat as Required.
(2) Use Normal Mixture For All Power Conditions.
(3) Adjust Power As Necessary To Obtain The Charted True Airspeed. Maintain the Designated R.P.M. And Adjust The Manifold Pressure As Required Up To The Limits Given In Figure A-3.

EXAMPLE

AT 68000 LB. GROSS WEIGHT WITH 1200 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 0 GAL.)
TO FLY 592 STAT. AIRMILES AT 4000 FT. ALTITUDE
MAINTAIN 2550 RPM AND 49.5 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G L M ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-12. Flight Operation Instruction Chart - One Engine - 70000 to 64000 Pounds

AAFMC-528 8-1-48

AIRCRAFT MODEL(S) P4M-1/1Q (HAMILTON
PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 64000 **TO** 58000 **POUNDS**

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO.	NORMAL	30 MIN.	250°	456
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN (1) 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. (1) RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STAUTE	COLUMN I RANGE IN AIRMILES NAUTICAL	FUEL U.S. 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 U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)							
1288	1118	2400							2400	1501	1303
1066	925	2000							2000	1213	1053
848	736	1600							1600	939	815
630	547	1200							1200	665	577
417	362	800							800	422	366
209	181	400							400	211	183

.521 MAXIMUM CONTINUOUS .452 — .528 MAXIMUM AIR RANGE .458

PRESS ALT. FEET	R.P.M. (3)	M.P. INCHES (3)	MIXTURE (2)	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	PRESS ALT. FEET	R.P.M. (3)	M.P. INCHES (3)	MIXTURE (2)	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
40000																									40000						
35000																									35000						
30000																									30000						
10000																									10000						
8000	2550	49		354	170	148																			8000	2510	45		293	155	134
6000	2550	49.5		351	177	154																			6000	2490	46		308	163	141
4000	2550	49.5		345	177	154																			4000	2510	46		312	165	143
2000	2550	49		338	175	152																			2000	2505	45.5		310	164	142
S.L.	2550	49		332	174	151																			S.I.	2510	46		308	163	141

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off & Climb (See Fig. A-5) Plus Allowance For Wind, Reserve And Combat As Required.
(2) Use Normal Mixture For All Power Conditions.
(3) Adjust Power As Necessary To Obtain The Charted True Airspeed. Maintain the Designated R.P.M. And Adjust The Manifold Pressure As Required Up To The Limits Given In Figure A-3.

EXAMPLE

AT 64000 LB. GROSS WEIGHT WITH 2000 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 0 GAL.) TO FLY 1066 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 2550 RPM AND 49 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G L M ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-13. Flight Operation Instruction Chart - One Engine - 64000 to 58000 Pounds

AAFMC-528 8-1-48

AIRCRAFT MODEL(S)
P4M-1/1Q (HAMILTON
PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 58000 TO 55000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20 ENGINE	2700	60.5	AUTO.	NORMAL	30 MIN	250°	456
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STAUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
772	671	1400					936	813	1400	991	860
661	574	1200					800	695	1200	847	735
550	478	1000					665	577	1000	703	610
439	382	800					529	460	800	559	485
328	285	600					393	342	600	415	360
218	189	400					260	226	400	274	238
109	95	200					130	113	200	137	119

.545 MAXIMUM CONTINUOUS .473						PRESS	(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						(651 STAT. (565 NAUT.) MI./GAL.)						PRESS	.685 MAXIMUM AIR RANGE .595					
R.P.M. (3)	M.P. INCHES (3)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M. (3)	M.P. INCHES (3)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M. (3)	M.P. INCHES (3)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	48.5		357	179	155	10000													2450	43		260	170	147	10000	2380	40.5		225	155	134
2550	49		354	185	161	8000													2490	44		269	175	152	8000	2440	42		245	168	146
2550	49.5		351	189	164	6000													2470	44.5		267	174	151	6000	2440	43		245	168	146
2550	49.5		345	187	162	4000													2470	43.5		262	171	148	4000	2460	43.5		244	167	145
2550	49		338	184	160	2000													2480	44		260	170	147	2000	2450	43		242	165	144
2550	49		332	181	157	S.L.													2480	44		257	167	145	S.L.	2470	43.5		239	163	142

SPECIAL NOTES

(1) Make Allowance For Warm-up, Take-off & Climb (See Fig. A-5) Plus Allowance For Wind, Reserve And Combat As Required.
(2) Use Normal Mixture For All Power Conditions.
(3) Adjust Power As Necessary To Obtain The Charted True Airspeed. Maintain the Designated R.P.M. And Adjust The Manifold Pressure As Required Up To The Limits Given In Figure A-3.

EXAMPLE

AT 56000 LB. GROSS WEIGHT WITH 1000 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 0 GAL.)
TO FLY 665 STAT. AIRMILES AT 10000 FT. ALTITUDE
MAINTAIN 2450 RPM AND 43 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT.	PRESSURE ALTITUDE	F.R.	FULL RICH
M.P.	MANIFOLD PRESSURE	A.R.	AUTO-RICH
GPH	U.S. GAL. PER HOUR	A.L.	AUTO-LEAN
TAS	TRUE AIRSPEED	C.L.	CRUISING LEAN
KTS.	KNOTS	M.L.	MANUAL LEAN
S.L.	SEA LEVEL	F.T.	FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G L M ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-14. Flight Operation Instruction Chart - One Engine - 58000 to 55000 Pounds

AAFMC-52B 4-1-48

AIRCRAFT MODEL(S)
P4M-1/1Q (HAMILTON
PROPELLERS: MODEL NO. 24260-79 STANDARD)
ENGINE(S): (2)R-4360-20+(2)J33-A-10 JETS

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55000 TO DOWN POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
MILITARY POWER R-4360-20	2700	60.5	AUTO.	NORMAL	30 MIN.	250°	456
MILITARY POWER J-33-A-10	100%						1820

FOR DETAILS SEE POWER PLANT CHART (FIG. A-1)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) 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 VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(2) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STAUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
445	386	800					543	471	800	576	500
333	289	600					407	353	600	432	375
222	193	400					272	236	400	288	250
111	96	200					136	118	200	144	125

.555 MAXIMUM CONTINUOUS .482						PRESS	(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						(.576 STAT. (.589 NAUT.) MI./GAL.)						PRESS	.720 MAXIMUM AIR RANGE .625					
R.P.M. (3)	M.P. INCHES (3)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M. (3)	M.P. INCHES (3)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M. (3)	M.P. INCHES (3)	MIX-TURE (2)	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	48.5		357	187	162	10000													2400	41		255	173	150	10000	2330	40		232	167	145
2550	49		354	192	167	8000													2460	42		261	177	154	8000	2380	41		238	172	149
2550	49.5		351	192	167	6000													2440	43		259	176	153	6000	2410	41.5		237	170	148
2550	49.5		345	191	166	4000													2450	42.5		256	174	151	4000	2430	42		234	168	146
2550	49		338	188	163	2000													2450	43		253	172	149	2000	2420	42		230	166	144
2550	49		332	183	159	S.L.													2450	43		250	169	147	S.L.	2450	42.5		227	164	142

SPECIAL NOTES

(1) Make Allowance For Warm-Up, Take-Off & Climb (See Fig. A-5) Plus Allowance For Wind, Reserve And Combat As Required.
(2) Use Normal Mixture For All Power Conditions.
(3) Adjust Power As Necessary To Obtain The Charted True Airspeed. Maintain the Designated R.P.M. And Adjust The Manifold Pressure As Required Up To The Limits Given In Figure A-3.

EXAMPLE

AT 54000 LB. GROSS WEIGHT WITH 600 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 0 GAL.) TO FLY 432 STAT. AIRMILES AT 4000 FT. ALTITUDE MAINTAIN 2430 RPM AND 42 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL MIXTURE

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 30 JANUARY 1952 BASED ON: G.L.M. ENGINEERING REPORT 3247 APPENDIX "C"

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-15. Flight Operation Instruction Chart -One Engine -55000 Pounds and Down