PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODEL

P-40N Series

BRITISH MODEL

KITTYHAWK IV

AIRPLANES

This Publication replaces T. O. No. 01-25CN-1 dated 10 April 1943.

This publication contains specific instructions for pilots and should be available for Transition Flying Training as contemplated in AAF Reg. 50-16.

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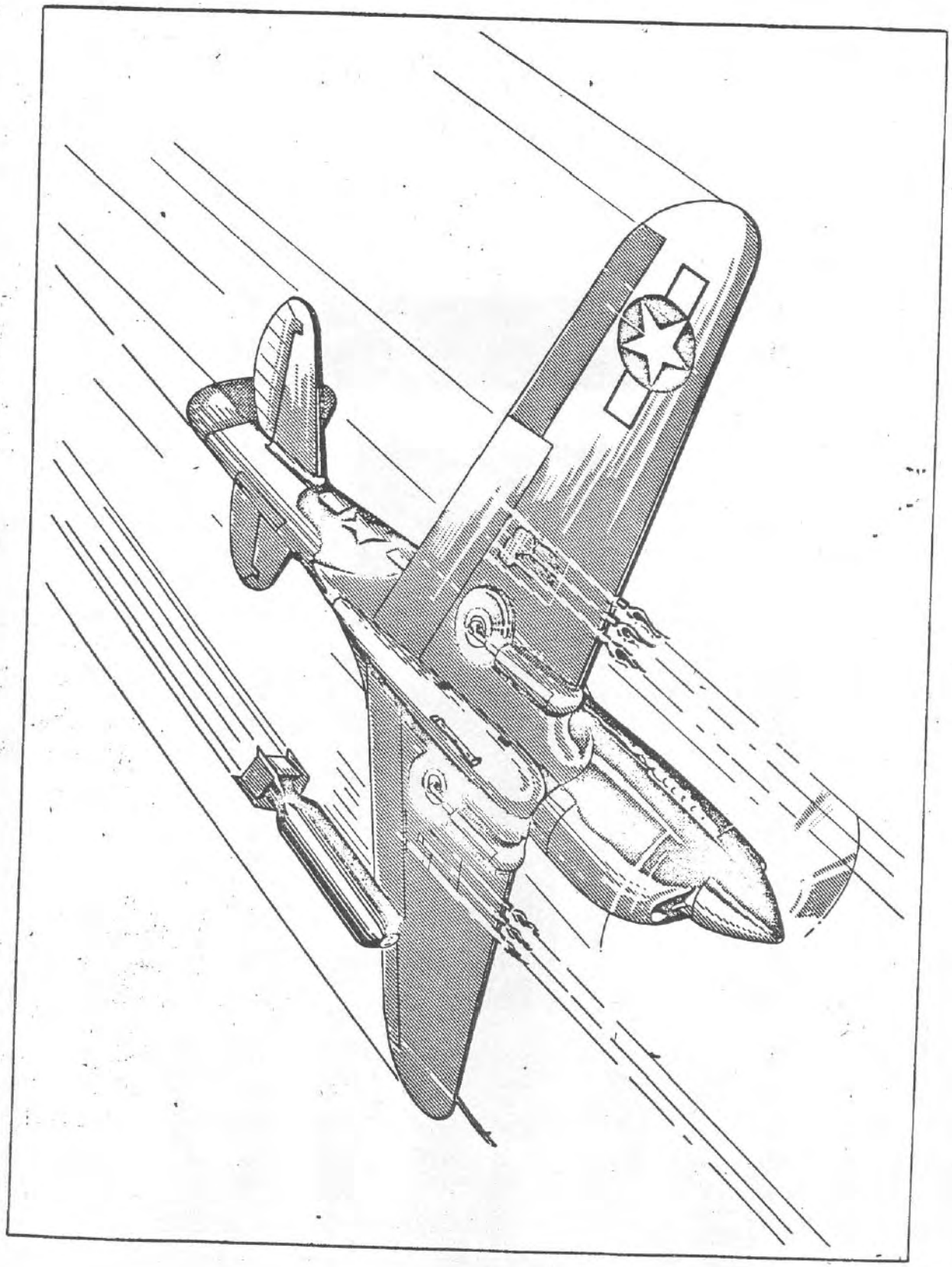


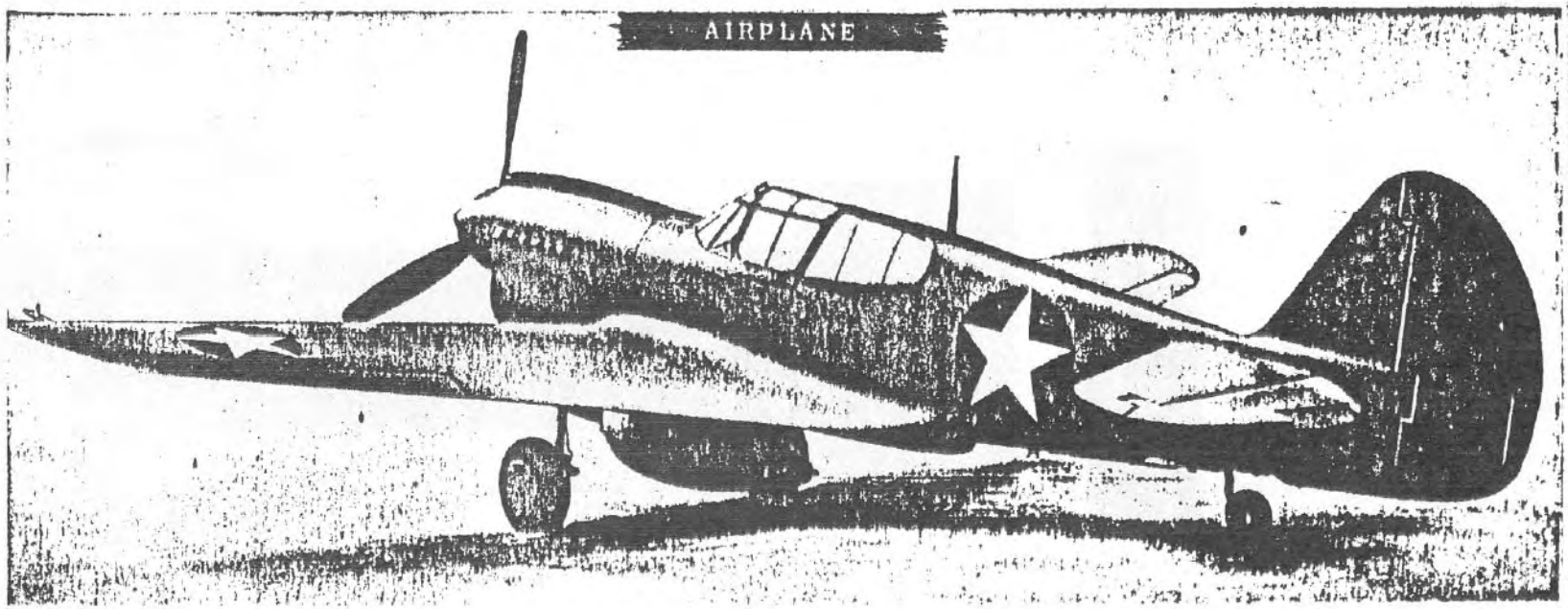


Figure 1

SECTION I
DESCRIPTION

1. AIRPLANE.

a. GENERAL.—The P-40N airplane is a single seat low wing monoplane designed for medium altitude pursuit and interception of hostile aircraft. It is powered with one twelve-cylinder type V-1710-81 Allison Engine for airplane AF42-104429 through airplane AF42-106405, and for airplane AF42-106406 and subsequent, it is powered with a type V-1710-99 Allison Engine. Its armament consists of six .50 calibre machine guns. All guns fire outside the propeller arc. It is equipped with a Curtiss electric constant-speed propeller, hydraulically operated landing gear, tail wheel, wing flaps, and brakes. The overall dimensions are:

Length	33 feet	3.72 inches
Height at Rest.....	12 feet	4.5 inches
Span	37 feet	3.5 inches

b. ACCESS TO THE AIRPLANE.—When the cabin is closed, access is gained by placing both hands on the side of the cabin canopy and pushing backward. If the canopy does not move, it is an indication that the lever "A" (detail "A" figure 21) is not perpendicular to the crank handle, allowing the crank handle pin to become engaged in a hole in the drum and locking the canopy in position. The crank will cause the frame to move to the desired forward and aft positions. This crank may be disengaged in an emergency by pulling the lever "A" to a horizontal position as shown in detail "A." The canopy can then be moved forward or aft by hand. The emergency canopy release "B" is located on the forward part of the upper beam in the canopy. (See detail "B"). The complete canopy may be released from the roller assemblies in flight by pulling the release tab "B" with a force of at least 40 pounds. This actuates the canopy release mechanism, breaking the lock wires as shown in detail "C", and releasing catch "D", freeing pin "C" (in the cabin release mechanism figure 21).

On airplane AF42-104429 through airplane AF42-104828, there is an escape panel which may be released (detail "D" of figure 20) by disengaging the escape panel from its locks. This will permit access to the cockpit, by lifting the panel, then pulling lever "A" (see detail "A") perpendicular to the crank handle, allowing the canopy to move.

c. FUEL, OIL AND COOLANT.

(1) FUEL.—Specification: AN-F-28, Grade 100/130. Specification AN-F-28. Grade 91 fuel can be used with a 10% decrease in manifold pressure.

(2) OIL.—Specification: AN-VV-0-446a. Grade 1120 (cold weather operation: Grade 1100).

(3) COOLANT.—Specification: AN-E-2, Name: Ethylene glycol, (inhibited with Na MBT).

d. PILOT PROTECTION.—Front and rear armor protects the pilot from direct .30 calibre fire originating within the shaded areas shown in figures 18 and 19. Deflector plates are provided to protect the pilot's arms while sustaining rear quarter attack (figure 19).

2. CONTROLS AND OPERATIONAL EQUIPMENT.

a. AIRPLANE CONTROLS.

(1) COCKPIT SEAT.—The height of the seat is adjustable. On airplanes AF42-104429 to AF42-104828 the adjustment control handle is located on the right side of the seat. On airplanes AF42-104829 and subsequent, the adjustment of the cockpit seat can only be made on the ground. To adjust: Remove the four bolts attaching the seat to the armor plate. Raise or lower the seat as desired. Replace the bolts. The seat is also provided with a B-11 safety belt and standard AAF shoulder harness. A control handle to permit movement when wearing the shoulder harness is installed on the left side of the seat on all airplanes.

(2) FLIGHT CONTROLS.—Conventional control stick equipped with a pistol grip controls the ailerons and elevators. Conventional pedals control the operation of the rudder.

(3) TRIM TAB CONTROLS.—The trim tab controls for the rudder trim tab and the elevator trim tabs are mounted on the left side of the cockpit just forward of station 4. Each control wheel is identified as to its use and direction of rotation. The aileron tab remains in a fixed position throughout each flight; an adjustment of the tab, when required, is accomplished by simply moving the tab up or down.

(4) LANDING GEAR CONTROL.—The landing gear and tail wheel are hydraulically operated, with an auxiliary hand pump for emergency operation.

(a) LANDING GEAR OPERATION.—The landing gear control handle marked "LANDING GEAR" is located at the left side of the seat (figure 2). To raise the landing gear, raise the handle to the "UP" position and operate the hydraulic pump by squeezing the trigger switch below the grip on the stick. To lower the landing gear, place the control handle in the "DOWN" position and squeeze the trigger switch as before.

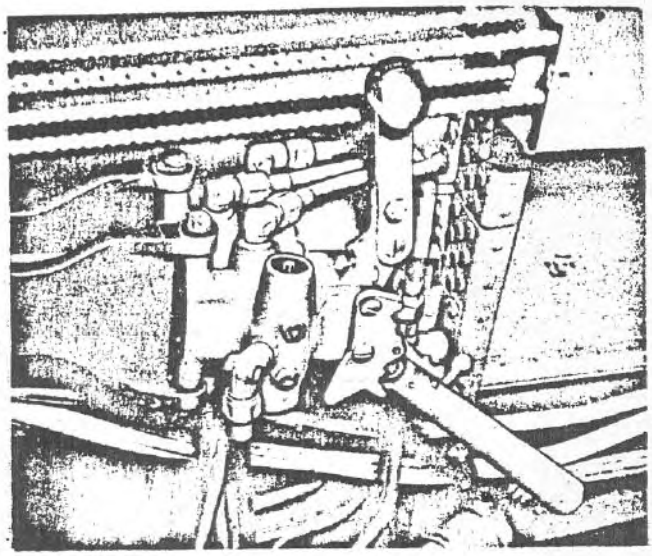


Figure 2—Hydraulic Selector Valve Assembly

NOTE

Landing gear control handle will be left in the "DOWN" position or returned to the "NEUTRAL" position when gear is down and locked. When the gear is up, the control handle should be returned to the "NEUTRAL" position.

CAUTION

Do not lower the landing gear above 175 mph IAS.

(b) LANDING GEAR POSITION INDICATOR.—The position indicator consists of a yellow rod mounted immediately above the oleo strut hinge on both left and right struts. It is mechanically linked to the oleo strut in such a manner that the rod protrudes conspicuously above the upper surface of the wing when the landing gear is in the extended position. The rod is flush with upper surface of the wing when the landing gear is retracted.

(c) LANDING GEAR WARNING LIGHT.—The warning light mounted on the instrument anti-glare shield (figure 15) flashes on whenever the engine is throttled to 1000 rpm or less, when landing gear is not locked down.

(d) EMERGENCY OPERATION.—In case of failure of the electrical system, or an inoperative hydraulic pump, the landing gear may be lowered manually. Place the control handle in the desired position, either up or down, and operate the auxiliary hand pump until it feels solid, and the yellow indicator pegs show the gear to be up or down.

(5) WING FLAP CONTROL.—The flap control is situated directly above the landing gear control, and is marked "FLAPS" (See figure 2).

(a) FLAPS UP AND DOWN.—To raise the flap, move the control to the rear "UP" position and squeeze the hydraulic pump trigger switch mounted below the pistol grip on the stick. To lower the flaps, move the control forward to the "DOWN" position and squeeze the trigger switch.

NOTE

The flaps may be operated manually by placing the control in the desired position and operating the hand pump.
Return the control to the "OFF" position after actuating the flaps.

(b) FLAP POSITION INDICATOR.—The wing flap position is indicated by a mechanically linked rod similar to the landing gear indicator, which rises from the top trailing edge of the left wing. The rod is extended when the flaps are lowered with color bands to indicate the degree of extension. Yellow = 15 degrees, yellow and green = 30 degrees, yellow, green and red = 45 degrees, or fully extended flaps.

(6) HEATING AND VENTILATING.—Hot air taken from the coolant radiator exit duct, and cold air taken from an opening in the leading edge of each panel provides hot and cold air for the cockpit. The control for cockpit heat is located below the main electrical panel. (See figure 34). Pull for "heat" and push for "cold". The control may also be set in any intermediate position. Also, there is a flexible cockpit heater tube extending from the coolant radiator exit duct through the fire wall to a spring clip on the left side of pilot's seat, from which it may be moved and placed in any desired position.

(7) WINDSHIELD DEFROSTER.—On P-40N airplanes, the defroster unit has been deleted. On airplanes AF42-105029 and subsequent, a spring clip is installed on top of the anti-glare shield to hold the flexible cockpit heater tube so it may be used to defrost the windshield.

(8) FUEL SYSTEM.—See figures 22 and 23 for diagrams of fuel system and tank capacities. For description of long range fuel system, refer to appendix II and figure 24.

(a) QUANTITY GAGES.—The fuel gage for the front wing tank is located on the cockpit floor to the right and forward of the control stick. The fuel gage for the rear wing tank is located on the cockpit floor, to the left of and aft of the control stick. (See figure 3). The fuselage fuel gage is mounted on the instrument panel. (See figure 15).

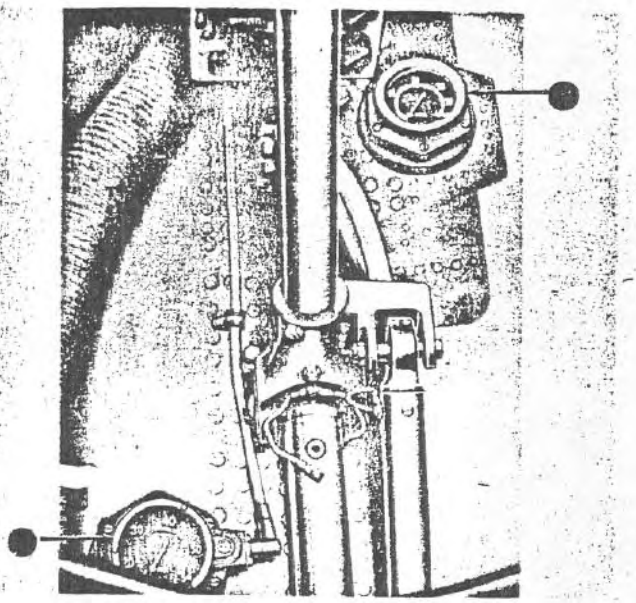


Figure 3—Wing Fuel Gages

1. **Front Wing Tank**
2. **Rear Wing Tank**

(b) FUEL SELECTOR VALVE.—The fuel selector valve is situated directly below the throttle control quadrant on the left side of the cockpit. The setting of the fuel selector valve should be determined by the "click" and "feel" method and not by the position of the control handle pointer.

CAUTION

Do not move the fuel selector control through "BELLY" if a belly tank is not installed.

(c) FUEL PUMPS.—Fuel is supplied by means of an engine driven fuel pump and an electrically operated boost pump. The electric boost pump is set in operation by turning the battery line switch on, and by turning the fuel boost pump switch on. (See figure 14). The fuel boost pump provides fuel pressure for starting the engine, for guarding against engine driven fuel pump failure, and for high altitude operation.

(9) OIL SYSTEM. (See figures 26 and 27).

(a) TANK.—The oil tank is located in the upper part of the fuselage just aft of the firewall. Access to the tank filler neck is gained by unbuttoning the Dzus fasteners on the access door. The access door is on the left top side of the fuselage, forward of the windshield. The oil tank capacity is 8 U. S. gallons (6.66 Imperial gallons).

(b) OIL PRESSURES.—During initial warm-up, keep the RPM below 1200 RPM so that the oil pressure does not exceed 120 pounds per square inch. If it is necessary, use oil dilution to maintain a pressure below this figure. Normal oil pressure should be between 60 and 70 pounds per square inch, with an oil temperature of 60° to 80° C (140° to 176°F).

(c) OIL DILUTION. — For cold weather starting operations, an oil dilution system is provided. On airplane AF42-104429 through AF42-105928, the system is operated by a switch mounted on the main switch panel. On airplane AF42-105929 and subsequent, a manual push button oil dilution control is provided (See figure 5). The travel of the button is approximately 3/32 of an inch. The control must be held "IN" all during the oil dilution period.

OIL DILUTION PROCEDURE:

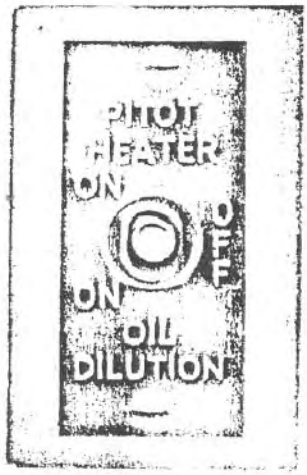
1. Operate engine at 800 rpm.

2. Maintain oil temperature of 5° to 50°C (41° to 122° F).

3. For ground temperature from 4° to –12° C (40° to 10°F), hold oil dilution control "IN" four minutes. Stop engine, release oil dilution control.

4. For temperature –12° to –29° C (10° to –20° F), hold oil dilution switch "IN" for eight minutes, stop engine, release oil dilution switch.

5. For temperatures below –29°C (–20°F), outside heat must be applied in addition to the maximum permissible dilution.



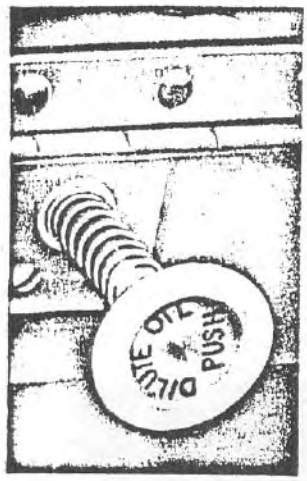


Figure 4—Oil Dilution Switch

Figure 5—Oil Dilution Control

(10) HYDRAULIC SYSTEM.—The hydraulic system is used for the operation of the landing gear and tail wheel, and the wing flaps. Pressure is derived from the electrically driven hydraulic pump or the auxiliary hand pump.

(a) BRAKE CONTROLS.—Each main wheel is equipped with hydraulic brakes and is individually operated by conventional toe brake controls integral with the rudder pedals. The braking action is obtained by applying toe pressure to the pedals. A parking brake is also provided as part of the brake system. To operate the parking brake, apply pressure to both toe pedals and pull out on the control knob being sure to release the toe pedal pressure before releasing the knob (figure 6) which is located just below the lower left corner of the instrument panel. To release the parking brake, depress both toe pedals.

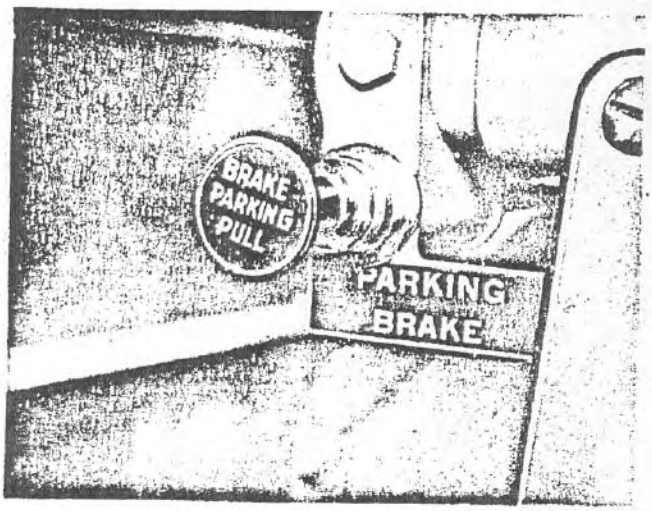


Figure 6—Parking Brake Control

(11) LIGHTS.

(a) COCKPIT LIGHTS.—Cockpit illumination is furnished by two incandescent spot lights. These lights are equipped with an amber lens. There is a rheostat (figure 14) on the main switch panel for controlling the intensity of the lights. To operate the lights, the control switch (figure 14) on the main switch panel should be turned to "ON" and the rheostat adjusted for any desired intensity.

There is a base provided for each light. On the left side of the cockpit, a base is on the station 4 bulkhead above the hydraulic selector valve; the other is on the right side on station 4 bulkhead, just forward of the map case. When the lamps are mounted, they may be aimed in any direction.

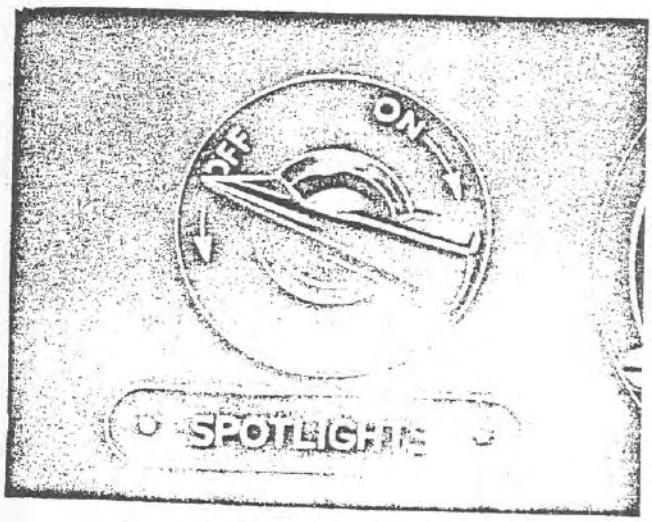


Figure 7—Cockpit Spotlight Control

(b) NAVIGATION LIGHTS. — Navigation lights are installed on the top and bottom surfaces of each wing tip, and on each side of the fin. The wing tip lights are operated by a switch (figure 8) on the main switch panel. The tail running lights are operated by a separate switch (figure 8). The running lights are also provided with fixed resistors so that the lights may be either bright or dim. With the use of the resistors, the running lights may be used for formation lights.

Figure 8—Navigation Lights Switch

Figure 9—Landing Light Switch

(c) INSTRUMENT LIGHTS.—The rear wing and front wing fuel gages are individually lighted. A switch is provided on the main switch panel for the fuel gage light. This switch also operates the compass light.

(d) SIGNAL LIGHTS.

1. An inter-aircraft signal light, B-2516 may be stowed in the clip mounted on the left side of the cockpit just below the trim tab control. This signal light is used for airplane to airplane, and airplane to ground communication.

2. An M-8 pyrotechnic pistol, (42B10666), for distress signaling, is stowed in the holster on the right side of the pilot's seat on airplanes AF43-23252 and subsequent. On previous airplanes of this series, the M-8 pyrotechnic pistol is mounted on match plate forward of the control stick.

3. Also used for signaling, are the recognition lights operated individually from a switch box on the lower right side of the cockpit (airplanes AF42-104829 and subsequent). By placing the switches in the down position, the code key on the switch box may be used for signaling. When being flashed, an amber light on the switchboard will indicate the signal. (The lights resume their regular function when the switches are placed in the up position). There are four recognition lights; one at the top of the airplane aft of the cockpit, and three in the belly of the airplane. The three belly recognition lights consist of (a) a red light in the underwing fairing, (b) a green light in the fuselage, midway between the underwing section and the landing gear, and (c) an amber light midway between the wing tip and the green light. At the top of the airplane aft of the canopy is a transparent light for airplane to airplane intercommunication.

(e) WARNING LIGHTS.—There is an oxygen supply warning light on the lower midsection of the panel switchboard, on a removable base which is screwed into the side of the gage. The landing gear warning light in the upper left corner of the instrument glare shield is controlled by a switch on the throttle bellcrank, which turns the light on when the throttle is brought back for landing. A switch in the landing gear fairing actuated by the RETRACTING strut, turns the light off when the gear is extended. The bulb may be replaced by lifting the glass.

(f) LANDING LIGHT.—A landing light is installed on the under side of the left outer panel on airplanes AF42-106029 and subsequent, and is located midway between the wing tip and left hand oleo strut. It is controlled by a switch on the winterization switch box on the left hand side of the cockpit. (See figure 9). When the switch is in "EXTEND" position, the landing light swings from the underside of the wing, throwing a beam of light ahead of the airplane to light the edge of the runway. The other two positions of the switch are "RETRACT" and "OFF".

(12) OXYGEN EQUIPMENT.

(a) OXYGEN CYLINDER.—A low pressure oxygen cylinder of 1000 cubic inch capacity is cradled in a support assembly aft of the fuselage access door just above the bottom of the fuselage. This installation is effective on airplanes AF42-104429 through AF42-105027. On airplanes AF42-105029 and subsequent, there are two low pressure oxygen cylinders of 500 cubic inches capacity. They are cradled by supports between stations 6 and 8, stationed on the same level as the aft portion of the cockpit canopy.

(b) OXYGEN REGULATOR (Figure 38.)—Oxygen flow to the pilot's oxygen mask is controlled by an A-12 demand regulator located on the right side of the cockpit between bulkheads at stations 3 and 4. A flow indicator is mounted on the instrument panel.

(13) FIRST AID KIT.—A first aid kit is buttoned on the side of the map case, adjacent to the seat. This applies to airplanes AF42-104429 through AF42-104828. On airplanes AF42-104829 and subsequent the first aid kit is handed to the pilot to be placed in

the duffle bag. The above locations apply to "fly-away" airplanes. On crated airplanes, the first aid kit is removed from the loose equipment container and placed in the duffle bag before the airplane goes into service.

(14) NAVIGATION EQUIPMENT.—A map case is provided on the right side of the cockpit aft of station 4.

(15) SPARE LAMPS.—Spare lamps are stowed on the left side of the cockpit, below the cockpit sill and forward of station 4.

(16) EMERGENCY EXIT CONTROL.—For instructions on emergency exit, refer to section IV, paragraph 1.

b. ENGINE CONTROLS.

(1) THROTTLE CONTROL. — The throttle control (figures 10 and 11) is located in the engine control quadrant, which is mounted on the left side of the cockpit. The throttle control is provided with a stop that limits the travel of the throttle to 52.0 inches of mercury manifold pressure. By pushing the throttle against the stop and releasing the step latch, a safety wire is broken permitting further forward travel to create "War Emergency Power". The rear position of the throttle is "CLOSED" and forward position is "OPEN".

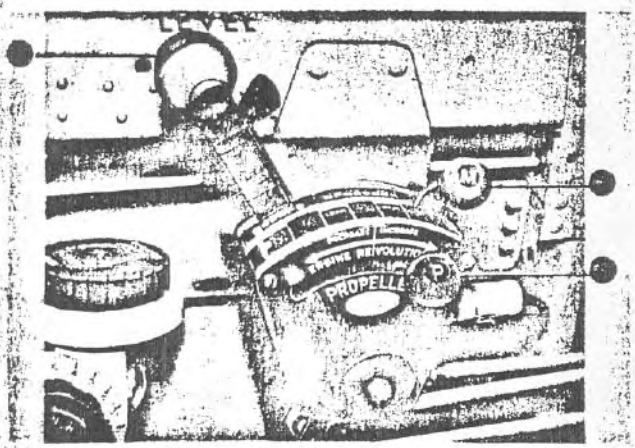


Figure 10—Engine Control Quadrant

AF 42-104429 through AF42-106405

1. Throttle *2. Mixture Control*

3. Propeller Control

(2) MIXTURE CONTROL.—The mixture control is also located on the control quadrant adjacent to the throttle. Reading from rear to forward, the mixture control has the following settings: "IDLE CUT-OFF", "AUTO-LEAN", "AUTO-RICH", and "FULL-RICH". Both the "FULL-RICH" and "IDLE CUT-OFF" positions are manually controlled. With the mixture control in the "AUTO-RICH" position, the carburetor adjusts automatically for power or altitude change. In "AUTO-LEAN", the mixture is also automatically adjusted, but must be used only for manifold pressure and engine speeds below those given for maximum cruising conditions. The engine should be stopped by moving the mixture control to "IDLE CUT-OFF" and slowly open the throttle when the engine stops firing, turn the ignition switch "OFF".

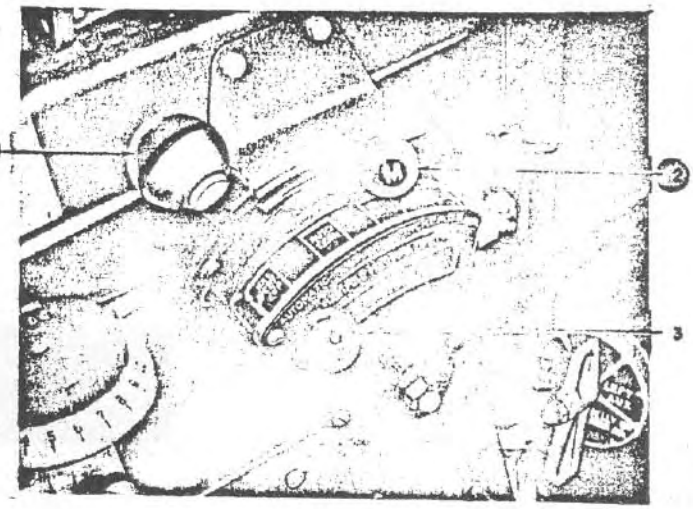


Figure 11—Engine Control Quadrant

AF42-106406 and Subsequent

1. Throttle *2. Mixture Control*

3. Manifold Pressure Modifier

NOTE

Whenever operating the engine at maximum cruising power, or above, the mixture should always be "AUTO-RICH".

To prevent inadvertent placing of mixture control in the "FULL RICH" position it is blocked off with a lockwire.

Breaking of the safety wire by the pilot in order to maintain proper engine operation, will indicate an unsatisfactory carburetor and an Unsatisfactory Report will be submitted outlining the difficulty in detail.

A friction control is located on the face of the quadrant to apply friction between the controls to keep them from "creeping".

(a) EMERGENCY OPERATION.—For emergency use, the mixture control may be used in manual lean positions. These positions are on either side of the "AUTO-LEAN" setting on the quadrant. At any point in this range of the mixture control, the automatic device is not in operation.

To regulate the fuel mixture to give a greater fuel economy, use the following procedure:

1. With the mixture control in "AUTO-RICH", obtain the cruising conditions desired.

2. Change propeller selector switch from "AUTO" to "MANUAL".

3. Lean out the mixture until a drop of 10 to 20 rpm is indicated. The position may possibly be between "AUTO-LEAN" and "IDLE CUT-OFF".

CAUTION

This procedure may cause detonation. If this does happen, immediately enrich the mixture.

4. Return the propeller switch to "AUTOMATIC".

NOTE

If any changes in cruising conditions or altitude are made, the mixture control setting should be checked by repeating the above operations.

(3) AUTOMATIC ENGINE CONTROL.

(a) FUNCTION.—The purpose of the automatic engine control is to maintain, within desirable limits, a selected manifold pressure from sea level up to critical altitudes of the supercharger.

(b) OPERATION.—The automatic manifold pressure regulator linkage is designed so that the pilot opens the throttle manually to the manifold pressure called for by the specific flight condition. The manifold pressure regulator will then maintain the selected manifold pressure. The propeller governor control will follow automatically and maintain the proper rpm for any given manifold pressure.

WARNING

CARBURETOR ICE.—The automatic engine control will show no indication of ice. If ice forms in the intake system, it will tend to reduce the manifold pressure, and the automatic engine control performing its function would open the carburetor throttle further in order to maintain the desired manifold pressure. The action of the automatic engine control is sufficiently smooth and automatic so that the pilot would probably have no warning until the automatic engine control has opened the throttle to the limit of its capacity and the manifold pressure would begin to drop, since the automatic engine control has already reached the limit of its capacity to adjust the throttle to a greater opening. It is, therefore, essential for the pilot to be on the alert to atmospheric conditions conducive to icing. If atmospheric conditions are such that icing conditions are apt to occur, carburetor air heat should be applied. If ice forms in the carburetor and the automatic engine control compensates for it by opening the carburetor throttle until nearly full throttle is obtained and the pilot is not aware of the icing condition, a heavy accumulation of ice may be formed which may be extremely difficult to remove by the application of carburetor air heat.

(c) DETECTION OF FAILURES.—The automatic engine control unit includes a Servo piston which operates from engine oil pressure to open or close the carburetor throttle automatically. The unit likewise includes an aneroid or evacuated bellows and a manifold pressure bellows. Indication of failures of the automatic engine control unit by the pilot can be detected through the following abnormal operations:

1. OIL PRESSURE FAILURE.—This is indicated when the manifold pressure is not compensated automatically with altitude. If it is necessary to adjust the cockpit throttle control manually to maintain a constant manifold pressure when climbing or descending, the engine control is probably not getting engine oil pressure.

2. ANEROID BELLOWS FAILURE.—A small crack in this bellows is indicated when the manifold pressure gradually increases while the airplane is in level flight. In the event the airplane has been standing on the ground after a small crack occurred, it would be impossible to run the engine at a low speed since the regulator would tend to adjust itself to atmospheric pressure, which would give approximately 30 inches of mercury manifold pressure. Aneroid bellows rupture, such as might be the result of a direct bullet hit, is indicated by a sudden increase in manifold pressure (above that selected by the pilot) an amount equal to atmospheric pressure; if this new pressure is within the supercharger limits. This increase will be approximately 13.8 inches of mercury at 20,000 feet, 20.5 inches of mercury at 10,000 feet, and 30 inches of mercury at sea level. In case of excessive damage to the internal parts of the regulator, it may become necessary to "cut" the ignition off when landing.

3. MANIFOLD PRESSURE BELLOWS FAILURE.—A small crack in this bellows is indicated when the manifold pressure gage shows the pressure to be increasing while climbing and decreasing while descending. This is contrary to the normal operation of the regulator. A complete rupture of the manifold pressure bellows, such as might be caused by a direct bullet hit, is indicated by either of two abnormal conditions.

a. If the manifold pressure was set at a pressure greater than atmospheric pressure, at the time of rupture, the engine control would suddenly open the carburetor throttle to full open, or nearly full open, and it would remain in this position.

b. If the manifold pressure was set at less than atmospheric pressure, the Servo piston of the engine control would move so as to close the carburetor throttle and it would be necessary to operate the cockpit throttle control to get the desired manifold pressure.

(4) IGNITION SWITCH.—The ignition switch (figure 35) is located on the main switch panel adjacent to the propeller selector switch. The switch has the following positions: "OFF", "L", "R", and "BOTH".

(5) ENGINE PRIMER.—An engine primer (figure 34) is installed in the small panel beneath the main switch panel. Unlock the pump by turning the handle counter-clockwise to the "ON" position. To lock the primer, push the handle in and turn clockwise to the "OFF" position.

(6) STARTING CONTROLS. — The engine installed in the P-40N airplane must be started by hand. A hand crank and crank extension are stowed on the side of the fuselage above the electrical junction box, directly opposite the fuselage access door. Access is gained to the engine starter through a small access door in the lower right rear section of the engine side cowl. Insert the crank through the support and engage the coupling on the starter housing. Crank the flywheel until the hand crank is rotating at least 60 rpm. Remove the hand crank and pull on the starter engage button located beside the hand crank support. This engages the starter and the engine, and also actuates the booster coil. If the starter has lost most of its momentum, and the engine has not fired, release the engaging button and bring the starter up to speed and then engage the engine again. This instruction applies to airplanes AF42-104429 through AF42-105639. On airplanes AF42-105640 and subsequent, there is an electric starter switch located on the winterization switch box on the left cockpit wall beneath the throttle quadrant. (Refer to section II, paragraph 5, for instructions on starting.)

NOTE

If no external "cart battery" is available, the airplane should be hand cranked. Access is gained to the engine starter through a small access door in the lower right rear section of the engine side cowl. The hand crank and hand crank extensions are stowed on the inside of the fuselage above the electrical junction box directly opposite the fuselage access door on airplanes AF42-104429 through AF42-105428. On airplanes AF42-104430 and subsequent, the hand crank is stowed inside the left fuselage wall forward of the fuselage access door. In an emergency, the electric starter may be used without the external "cart battery".

WARNING

It is imperative that the crank be removed before engaging the starter. Otherwise, if the engine kicks back, the crank will spring backwards.

(7) CARBURETOR AIR INTAKE CONTROL. —The carburetor has provisions for using either hot, cold, or filtered air. The cockpit control (figure 29) for the air intake is located on the right side of the cockpit just aft of the instrument panel. The control has three positions, "COLD", "HOT", and "FILTERED", and has a spring loaded handle which engages one of the three notches (for the three positions) on the quadrant sector. To operate the control, press "in" on the handle knob and move the control to the desired position. Release the handle and "jiggle" it to engage the notch in the quadrant sector.

(8) PROPELLER CONTROLS. — A circuit breaker (figure 12) and a selector switch (figure 12) are mounted on the left side of the main switch panel, and a propeller governor control handle (figure 10) is mounted on the throttle control quadrant. The circuit breaker must be "on" at all times when the airplane is in operation. The circuit breaker is to protect the propeller circuit against an overload. If the circuit breaker is opened by an excessive load, it

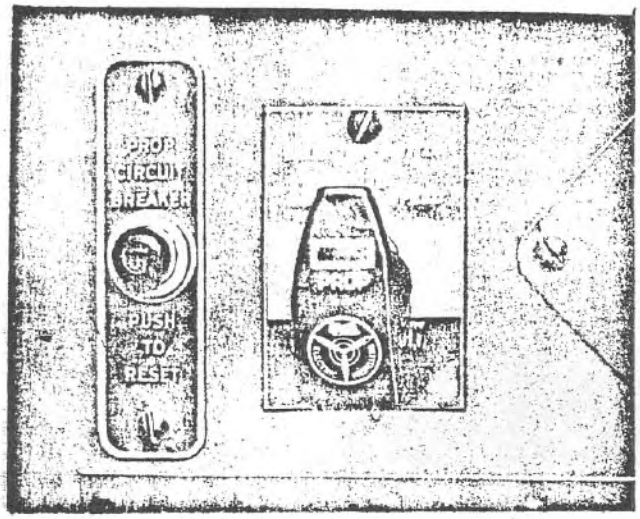


Figure 12—Propeller Control Switch

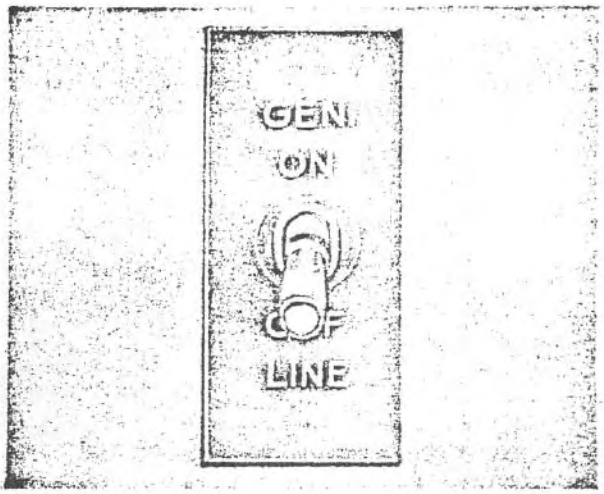


Figure 13—Generator Line Switch

may be reset by pressing the button. The selector switch has four positions, "AUTO CONSTANT SPEED", "FIXED PITCH", "DECREASE RPM", and "INCREASE RPM".

NOTE

On airplanes AF42-106406 and subsequent, the automatic engine control unit replaces the propeller governor control. The propeller governor control lever on the throttle quadrant (figure 11) is not used on airplanes AF42-106406 and subsequent, as indicated by the warning name plate on the throttle quadrant.

(9) GENERATOR LINE SWITCH.—The generator line switch (figure 13) is located on the main switch panel. The switch is to isolate the generator in the event of failure of the generator charging rate. The switch should be turned off in case of a forced landing, and whenever leaving the airplane.

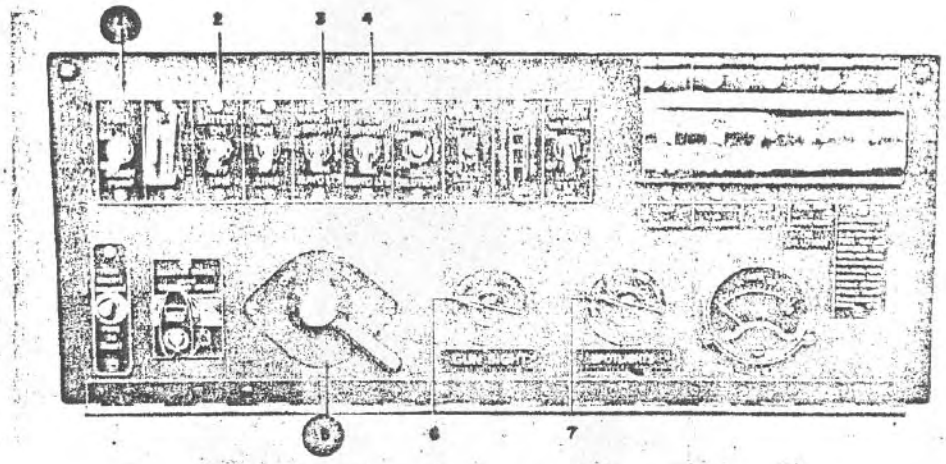


Figure 14—Main Switch Panel

1. Fuel Booster Pump
2. Battery Line Switch
3. Wing Tip Running Lights Switch
4. Tail Running Lights Switch
5. Ignition Switch
6. Gun Sight Rheostat
7. Cockpit Spotlight Rheostat

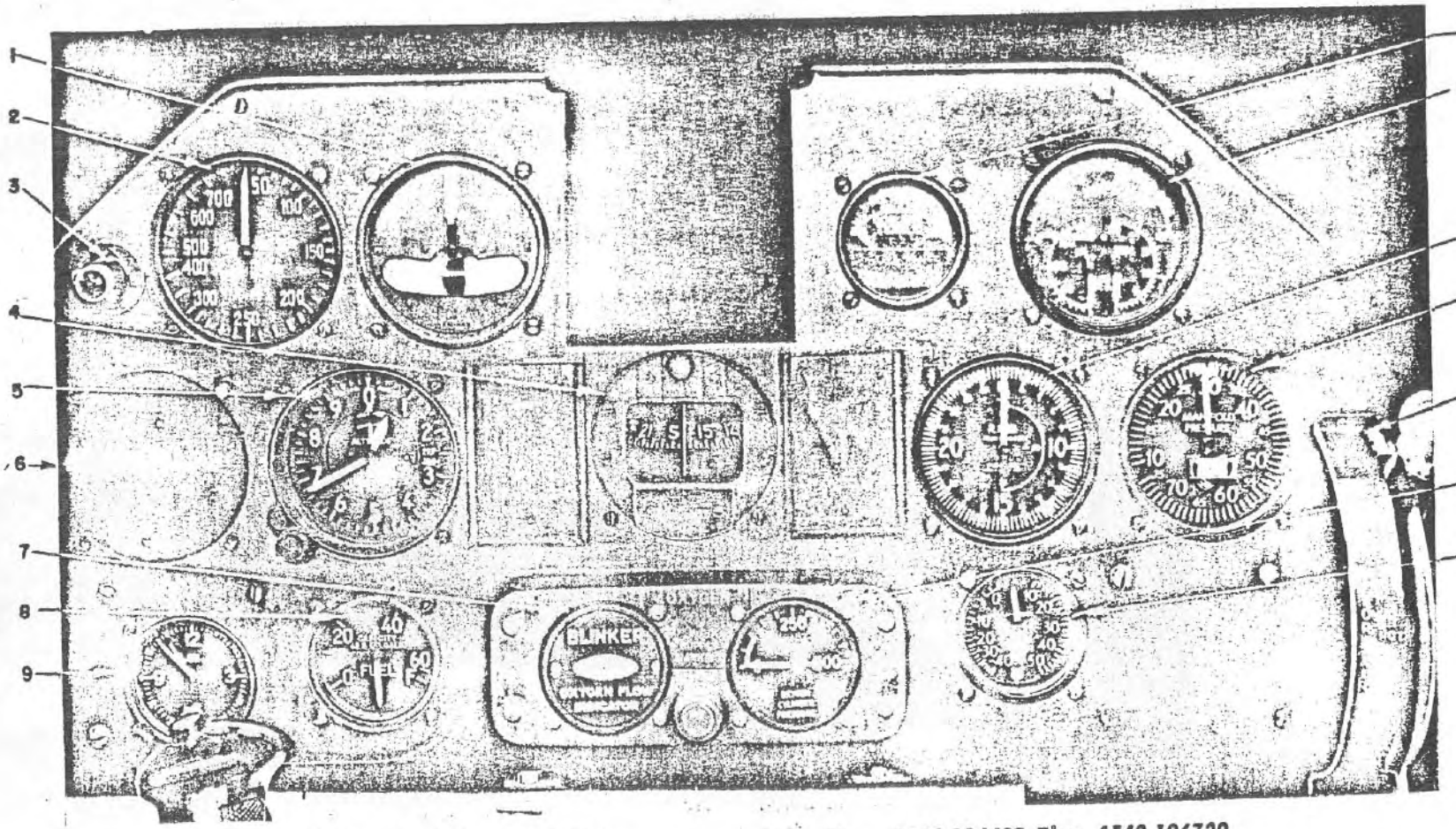


Figure 15—Instrument Panel

AF42-104429 Thru AF42-106729

1. Turn and Bank Indicator
2. Airspeed Indicator
3. Landing Gear Warning Light
4. Compass
5. Altimeter
6. Provision for Radio Contactor
7. Oxygen Flow Indicator
8. Fuselage Fuel Gage
9. Clock
10. Coolant Temperature Gage
11. Engine Gage Unit
12. Tachometer
13. Manifold Pressure Gage
14. Carburetor Air Control
15. Oxygen Cylinder Pressure Gage
16. Carburetor Air Temperature Gage

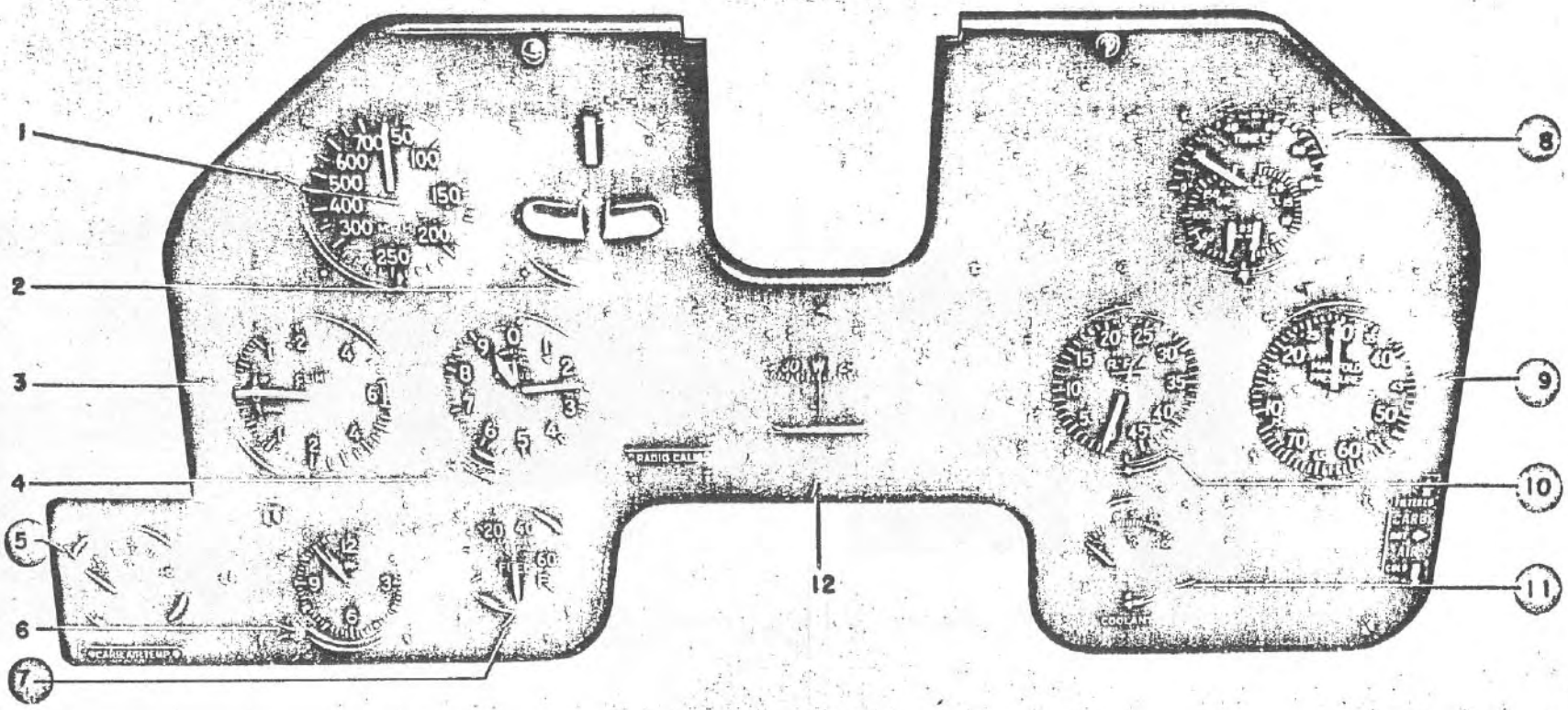


Figure 16—Instrument Panel *AF42-106729 to AF43-23751*

1. Airspeed Indicator
2. Turn and Bank Indicator
3. Rate of Climb Indicator
4. Altimeter
5. Carburetor Air Temperature
6. Clock
7. Fuselage Fuel Gage
8. Engine Gage Unit
9. Manifold Pressure Gage
10. Tachometer
11. Coolant Temperature Gage
12. Compass

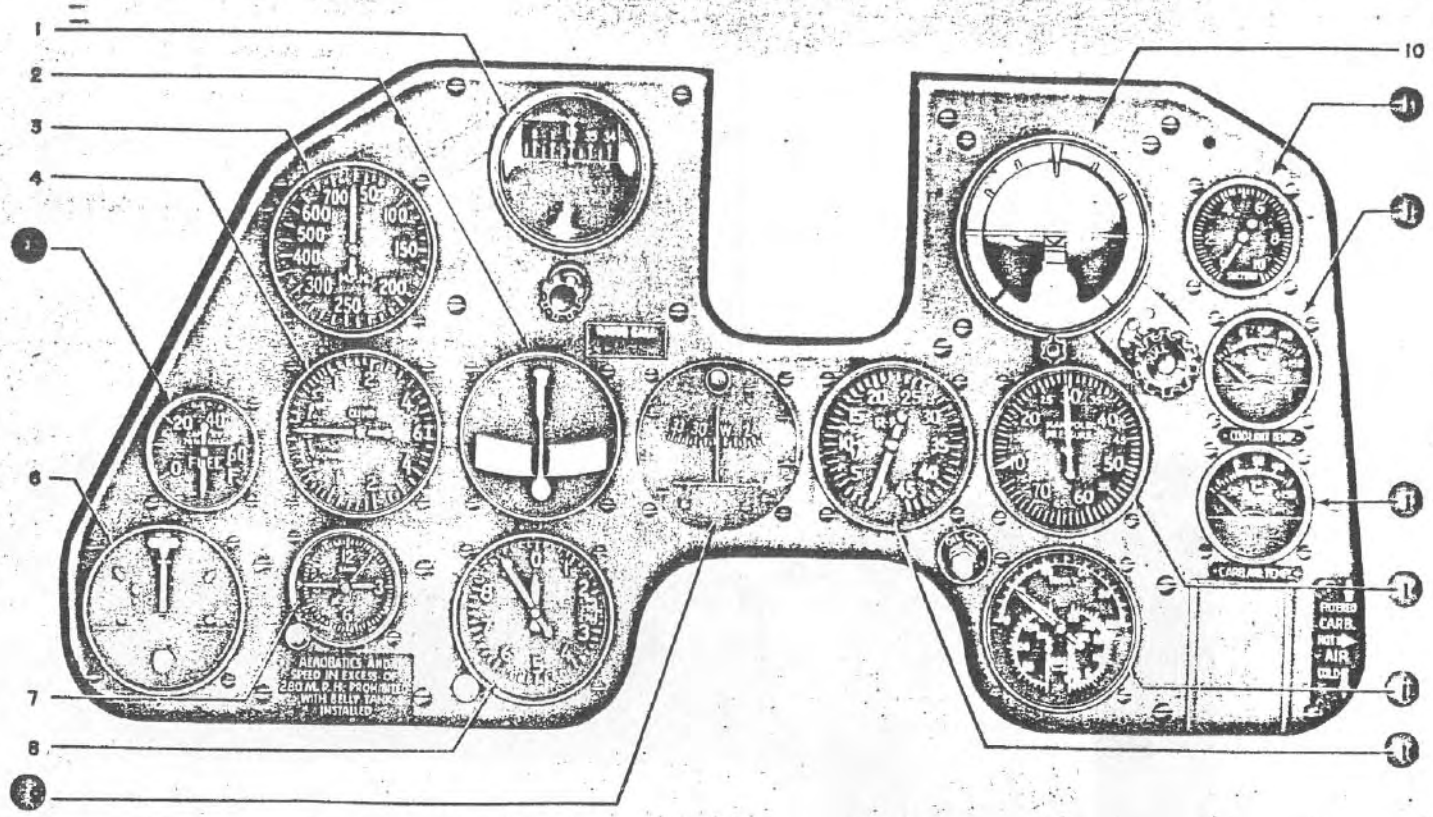


Figure 17—Instrument Panel *AF43-23752 and Subsequent*

1. Directional Gyro
2. Turn and Bank Indicator
3. Airspeed Indicator
4. Rate of Climb Indicator
5. Fuselage Fuel Gage
6. Radio Contactor
7. Clock
8. Altimeter
9. Compass
10. Gyro Horizon
11. Suction Indicator
12. Coolant Temperature Gage
13. Carburetor Air Temperature Gage
14. Manifold Pressure Gage
15. Engine Gage Unit
16. Tachometer

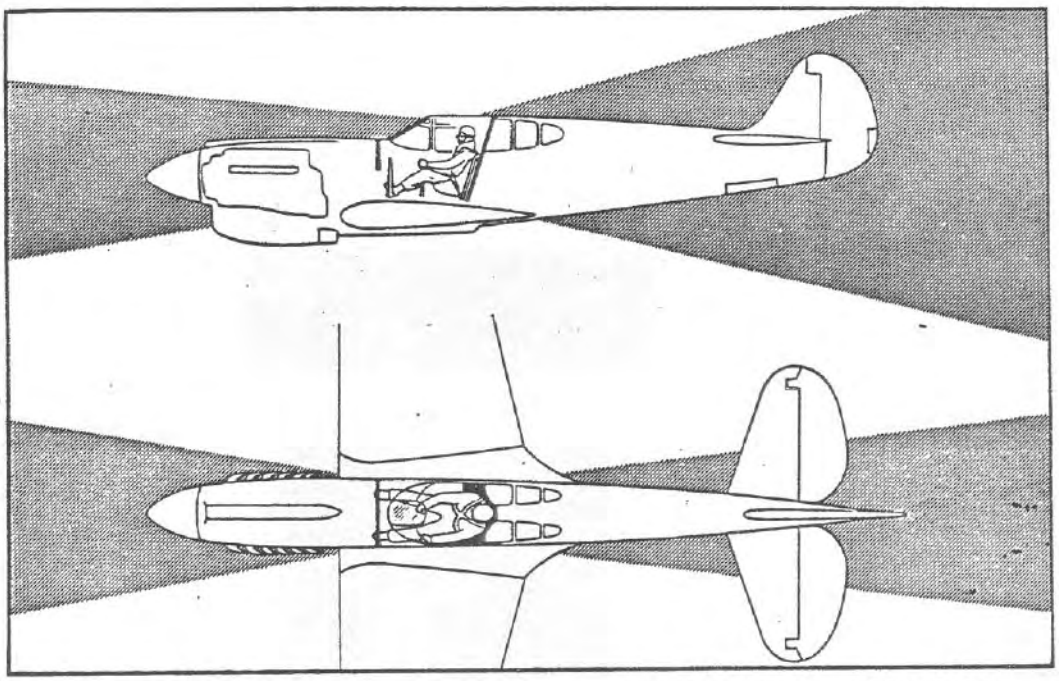


Figure 18—Angles of Armor Protection *AF42-104429 thru AF42-104828*

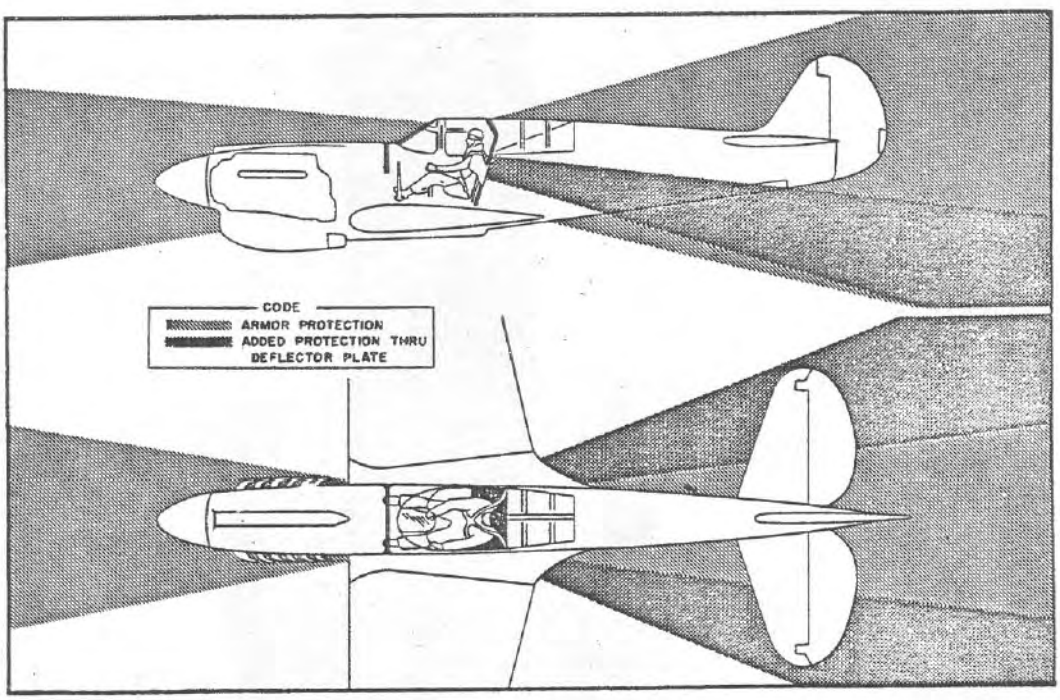


Figure 19—Angles of Armor Protection *AF42-104829 and Subsequent*

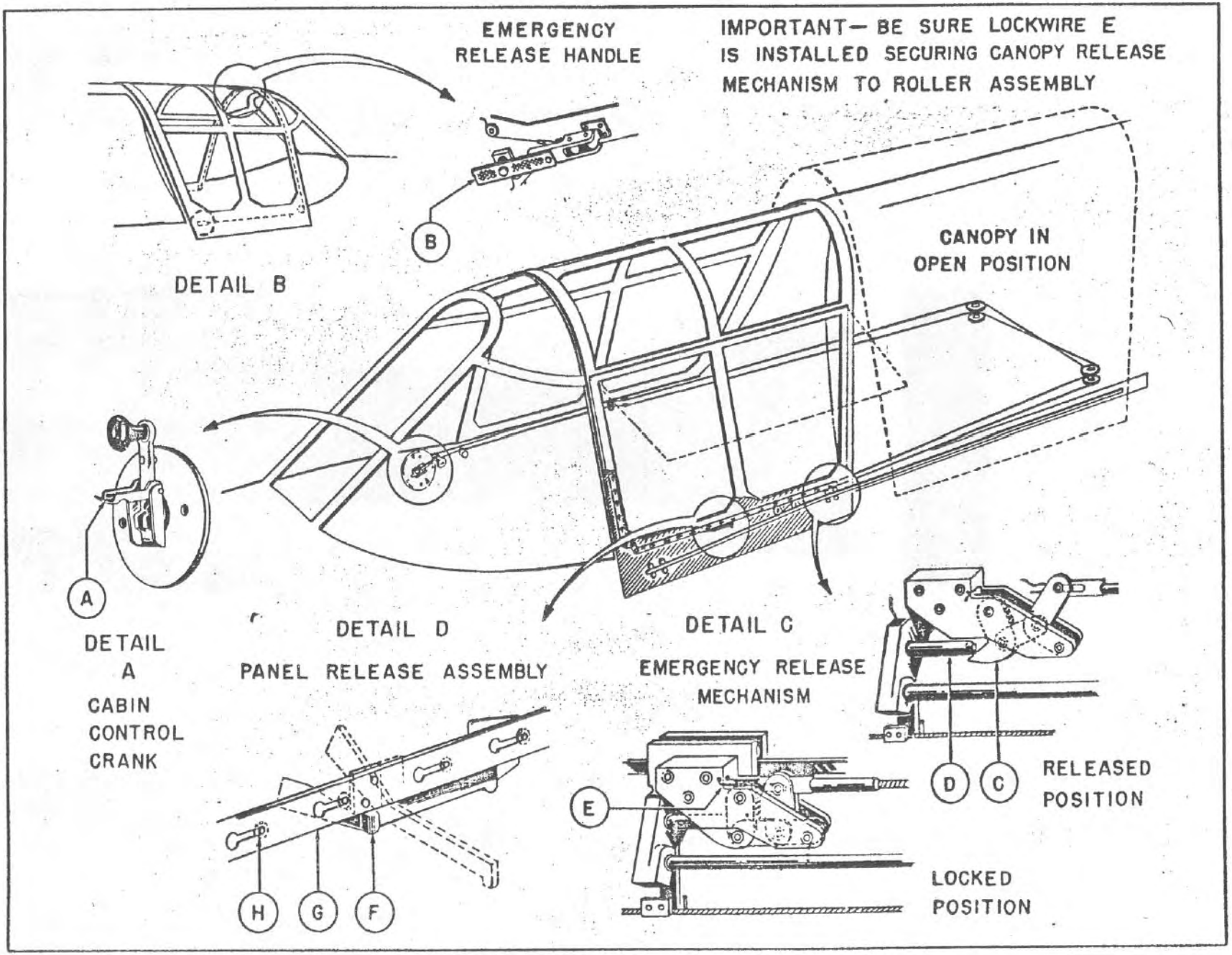


Figure 20—Detail of Cabin Operation, AF42-104429 to AF42-104828

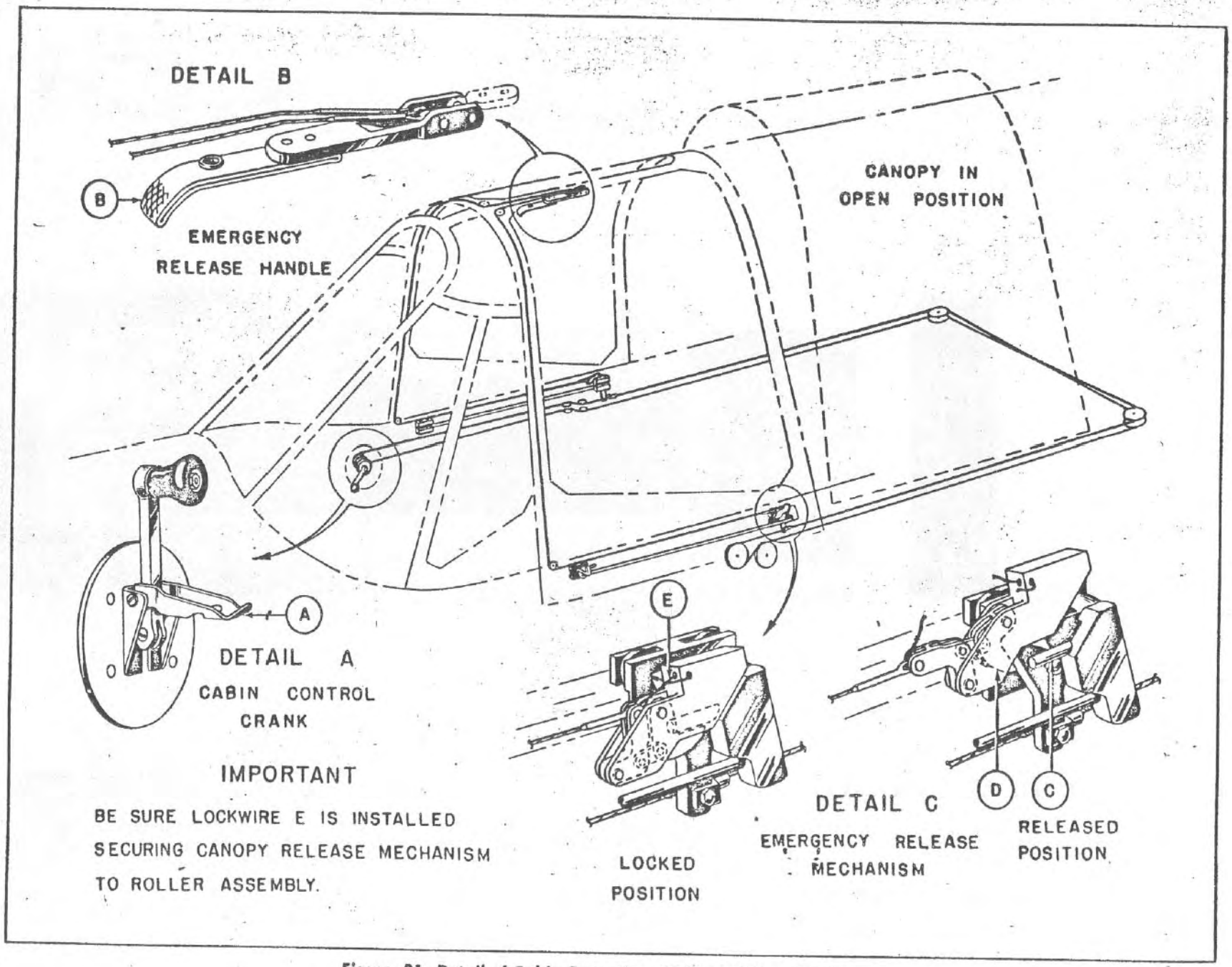
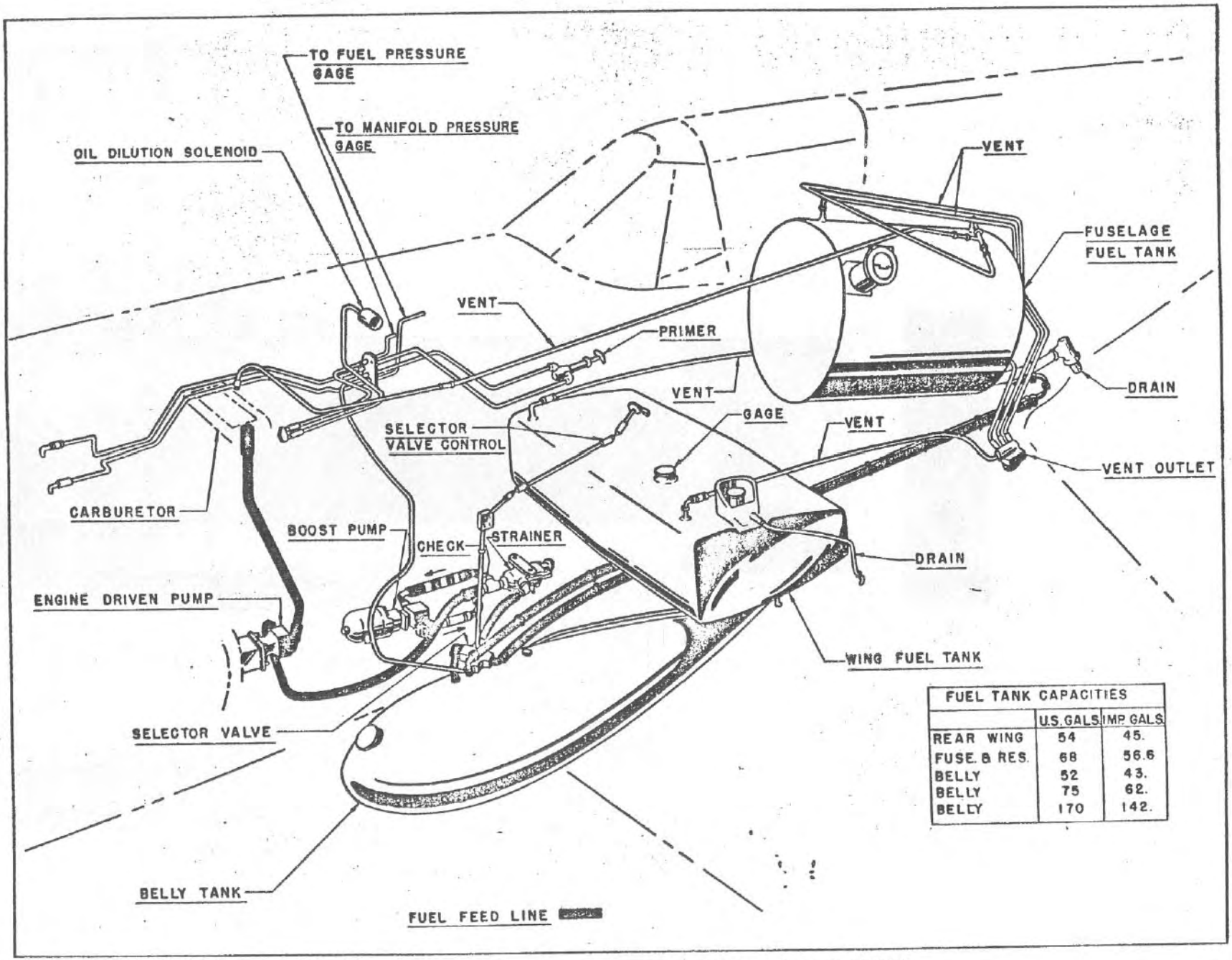


Figure 21—Detail of Cabin Operation, AF42-104829 and Subsequent



FUEL TANK CAPACITIES		
	U.S. GALS.	IMP. GALS.
REAR WING	54	45.
FUSE. & RES.	68	56.6
BELLY	52	43.
BELLY	75	62.
BELLY	170	142.

Figure 22—Fuel System AF42-104429 through AF42-104904

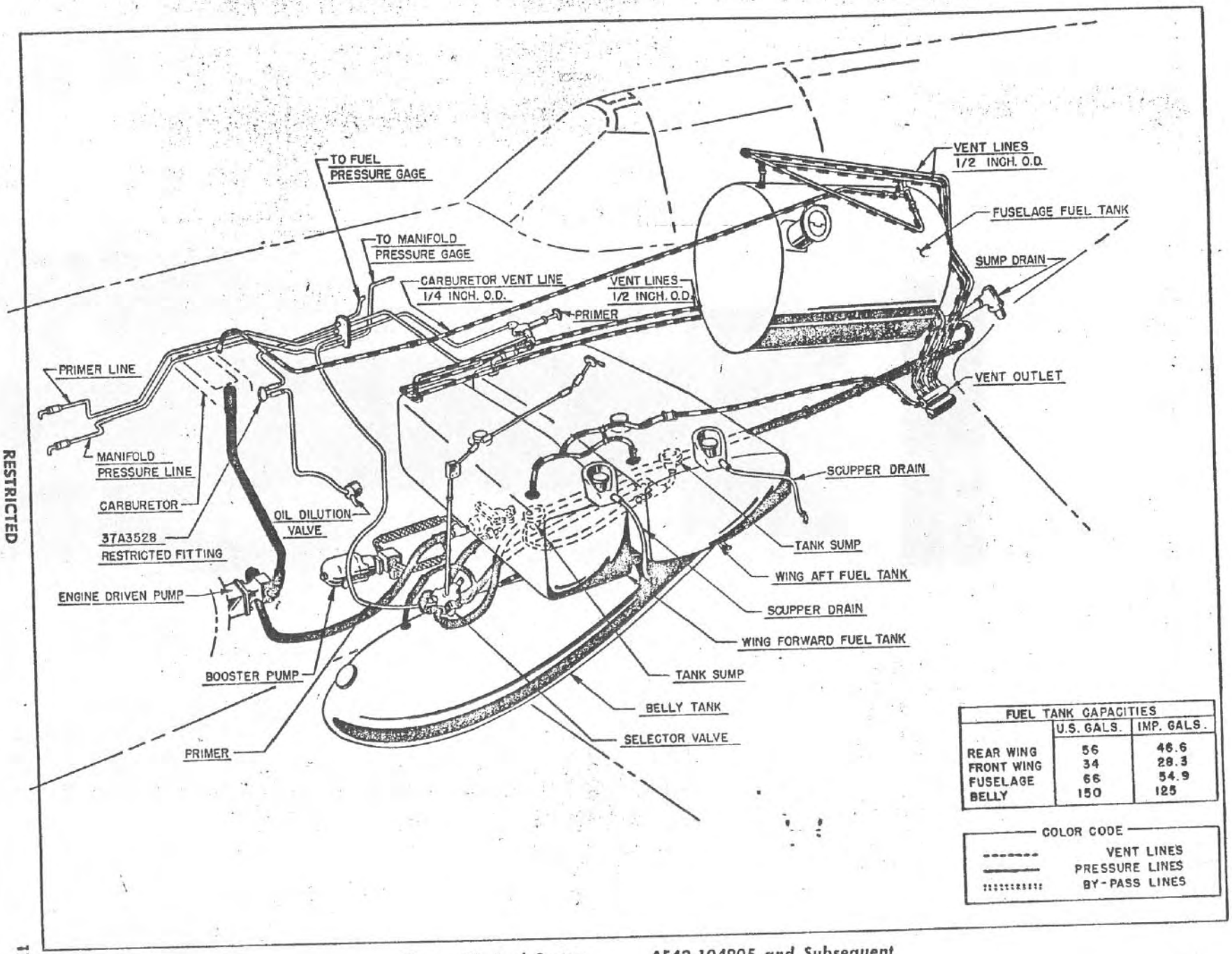


Figure 23—Fuel System *AF42-104905 and Subsequent*

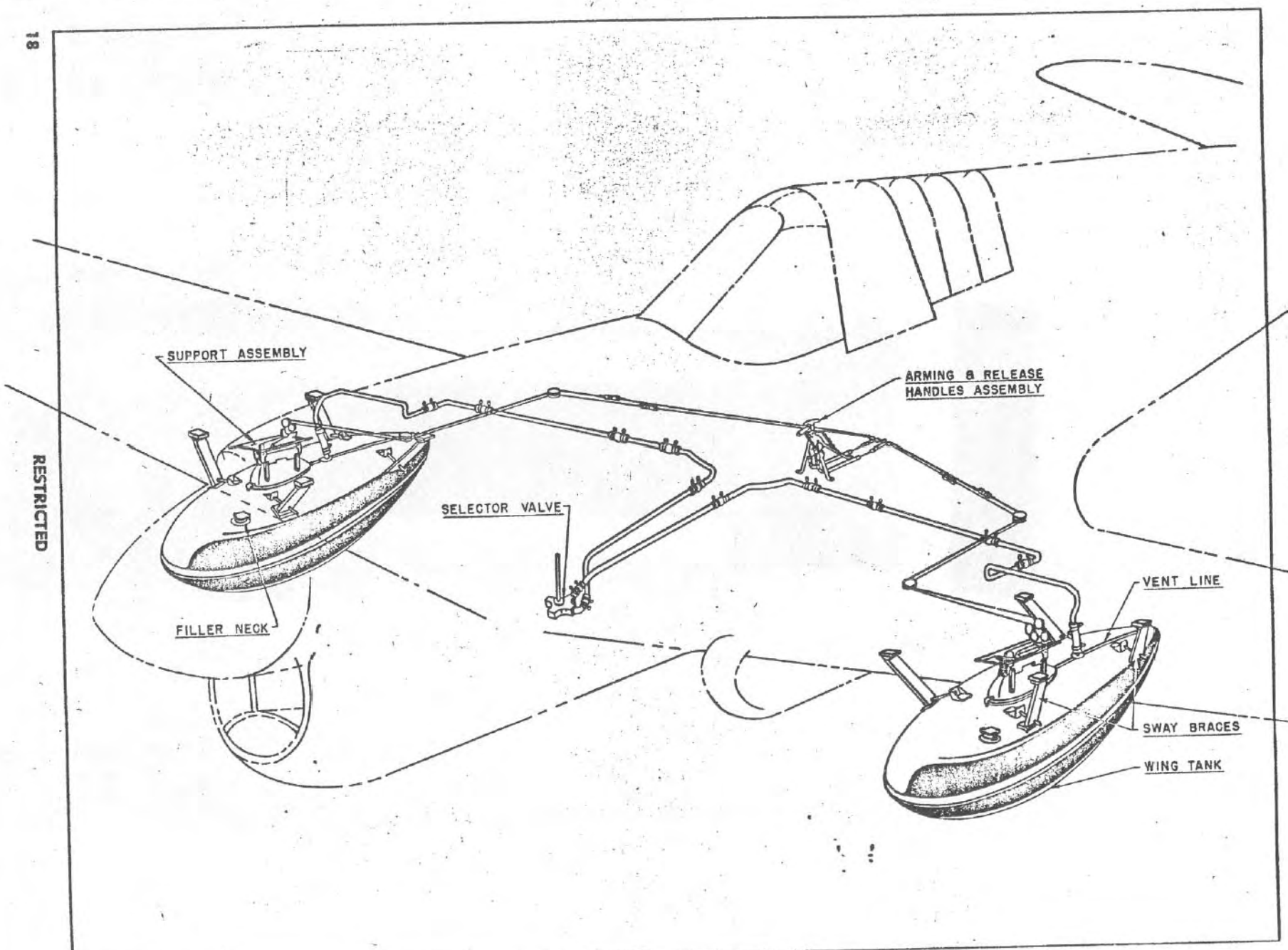


Figure 24—Long Range Fuel System *AF42-104829 and Subsequent*

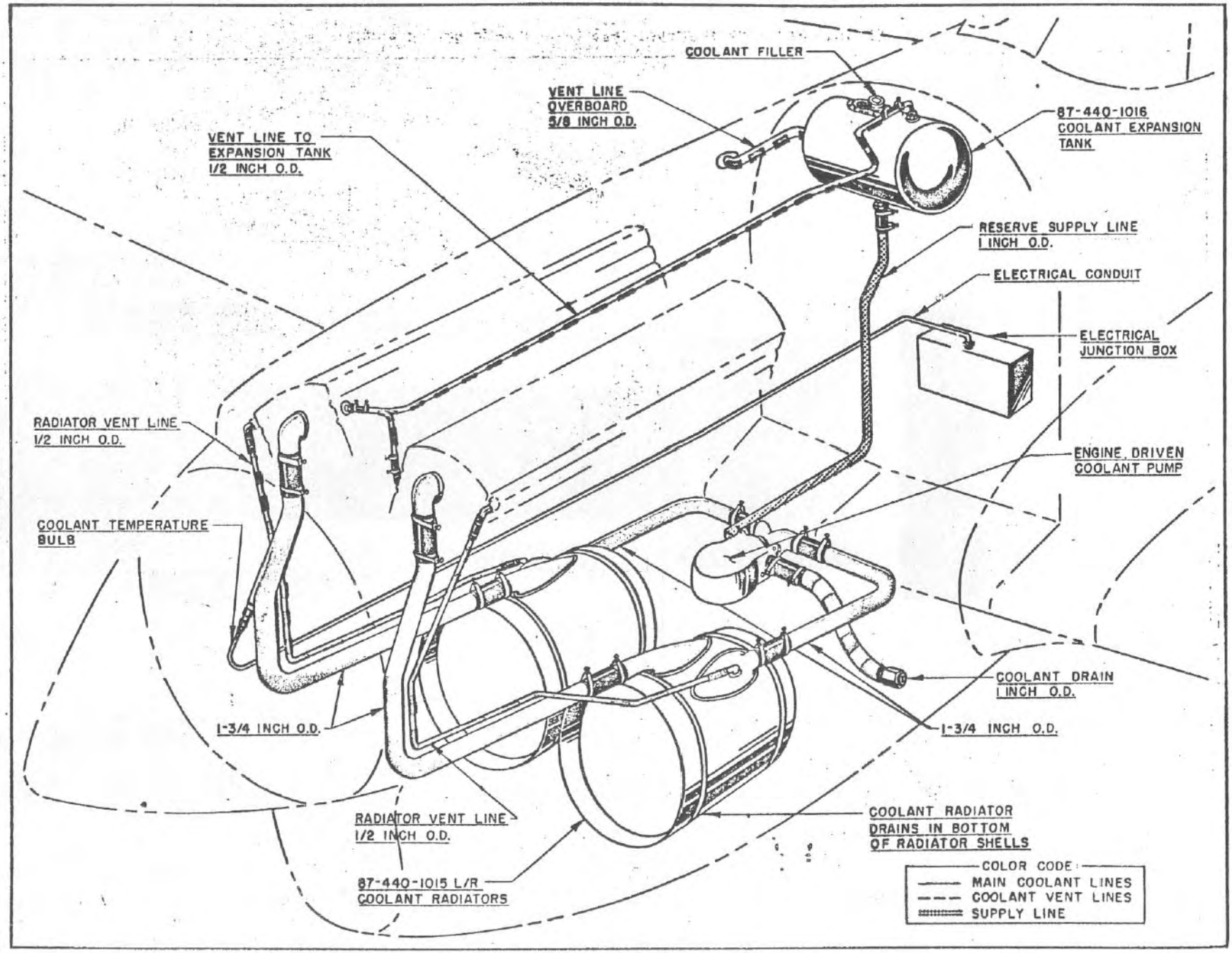


Figure 25—Coolant System

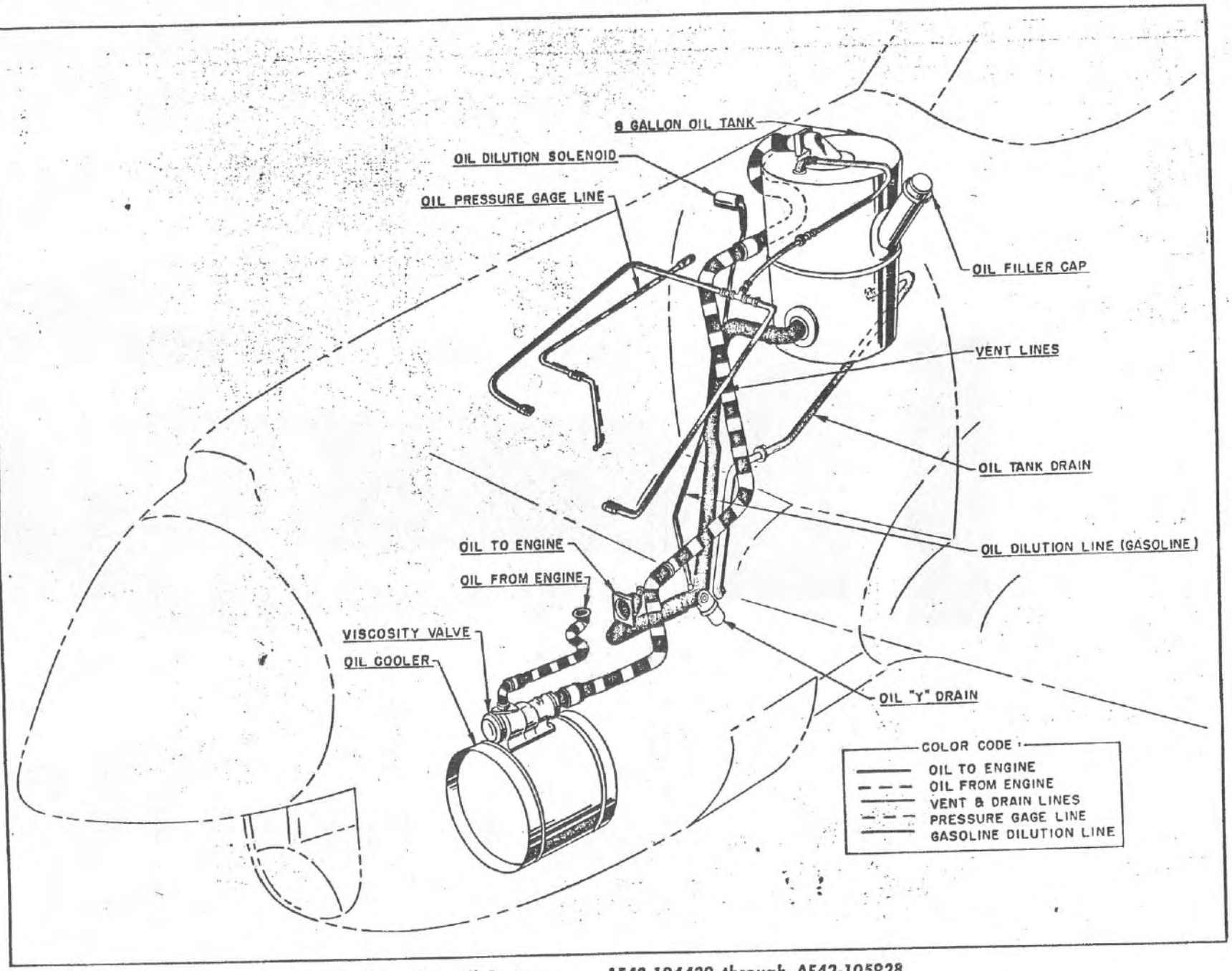


Figure 26—Oil System *AF42-104429 through AF42-105928*

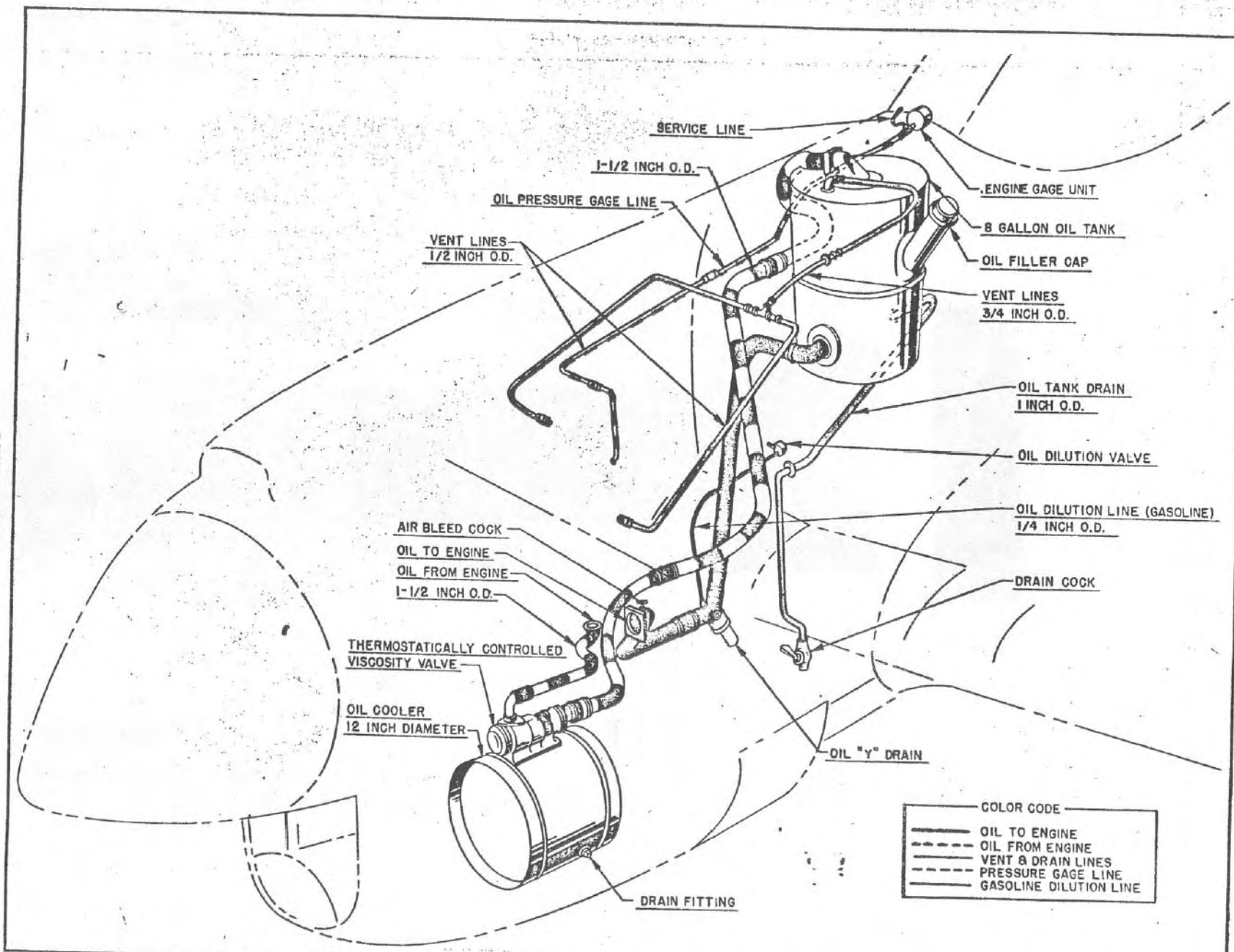


Figure 27—Oil System *AF42-105929 and Subsequent*

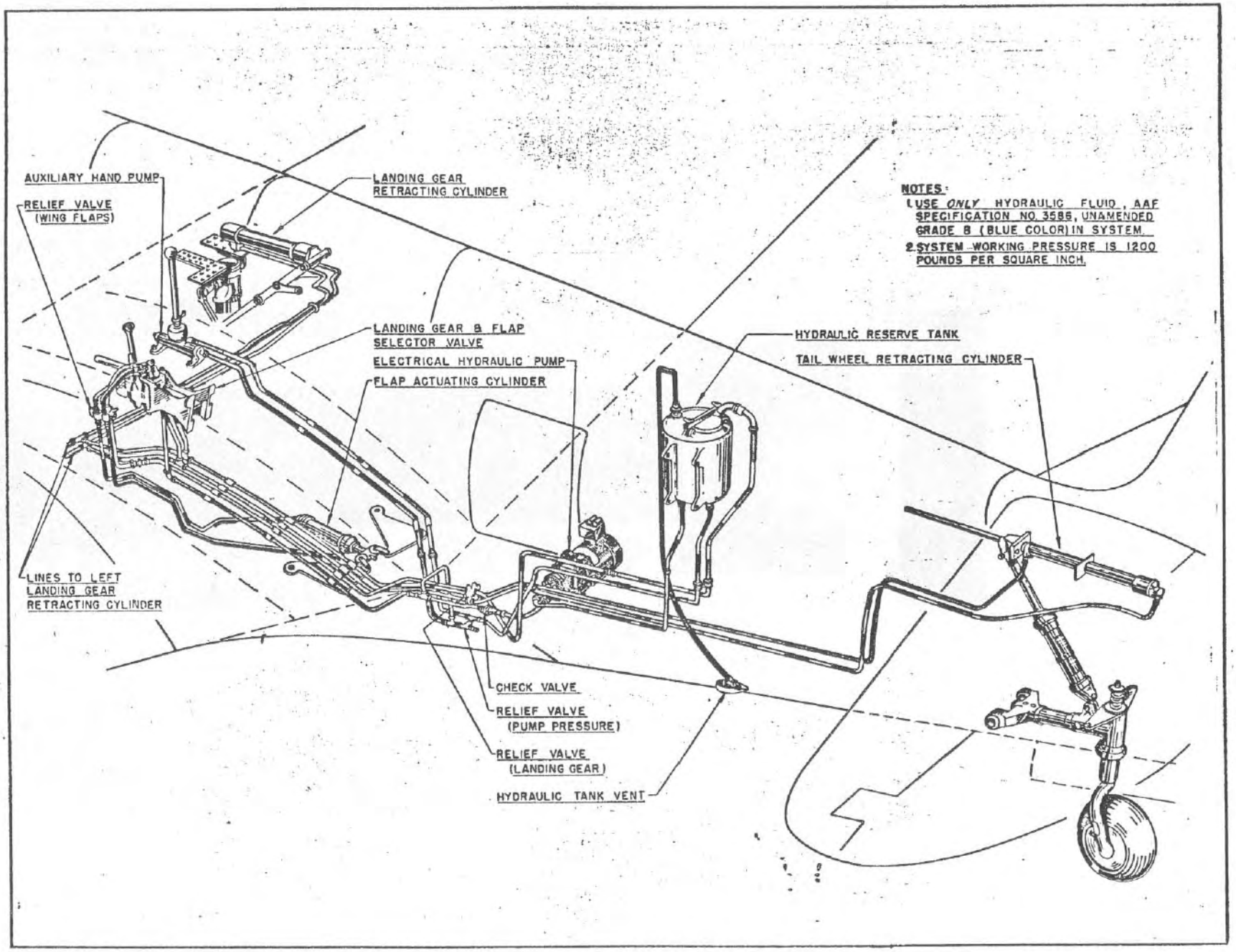


Figure 28—Hydraulic System

SECTION II
PILOT OPERATING INSTRUCTIONS

1. FLIGHT RESTRICTIONS.

a. The following maneuvers are prohibited:

Outside loop.
Inverted flight.
Inverted spin.
Snap roll at speed in excess of 140 MPH indicated.
Slow roll at speed in excess of 285 MPH indicated.
Spin of more than three turns.

Spin with baggage, auxiliary fuel or any other overload.

b. Observe the following airspeed restrictions:

Do not exceed 496 MPH indicated in dives.
Do not exceed 260 MPH indicated with auxiliary tanks installed.
Do not lower landing gear at speeds in excess of 175 MPH indicated.
Do not lower wing flaps at speeds in excess of 140 MPH indicated.

2. BEFORE ENTERING THE COCKPIT.

a. OBTAIN FLIGHT CLEARANCE.

(1) For war operation, secure radio frequency assignment for the flight.

(2) If the SCR-274N radio is installed in the airplane, be certain the correct transmitter is installed and tuned to the proper frequency.

(3) If radio model SCR-522-A is installed in the airplane, be sure the correct crystals are installed for the proper frequency range.

b. Check and secure pilot's safety equipment (parachute, safety belt, shoulder straps, oxygen mask, maps, cross country envelope, operation and flight handbook, seat cushion, first aid kit, etc.).

c. Baggage and tools may be carried in the duffle bag. Be sure the duffle bag is securely fastened with tie-down straps before each flight. Be sure that the engine hand starter crank and extension are securely mounted above the electrical junction box directly opposite the fuselage access door, (airplane AF42-104429 through airplane AF42-105428). On airplanes AF42-104429 and subsequent they are stowed in one piece inside the left fuselage wall forward of the fuselage access door. After completing the check, be sure the access door is closed and that both Dzus fasteners are fastened.

WARNING

Under no circumstances will baggage or tools be carried that exceed the gross loading of the airplane.

d. The cockpit canopy may be opened by placing the hands on the side of the canopy and pushing backwards. If the canopy fails to open, refer to section I, paragraph 1. *b.* Also see figures 20 and 21.

3. ON ENTERING THE COCKPIT.

a. SPECIAL CHECK FOR NIGHT FLYING.

(1) Turn battery line switch (figure 14) "ON".

(2) Turn cockpit spotlight rheostat "ON" and adjust it for desired intensity of light. (figure 14.)

(3) Test radio compass light on remote control unit for brilliancy, turning the rheostat control knob clockwise.

(4) Turn wing tank fuel gage lights "ON" (figure 14).

(5) Test running lights on "DIM" and "BRIGHT". (figure 14.)

(6) Test gun sight light, turning the gun sight rheostat (figure 14) clockwise to test intensity of the light.

(7) Test landing light switch (figure 9). Test "ON RETRACT", "LANDING GEAR DOWN" and "OFF" positions.

(8) Test signal lights. The recognition light switches are found on a control box on the right wall of the cockpit. (See figure 29). They may be tested for signaling by switching in the down position, at the same time operating the code key. (Maximum ground operating time is 10 seconds.) The inter-aircraft signal light at the left of the pilot may now be tested by operating the signaling trigger.

b. CHECK FOR ALL FLIGHTS.

(1) Ignition switch "OFF".

(2) Gun switch "OFF".

(3) Landing gear control handle "NEUTRAL" (figure 32). A small locking device projecting from the top side of the control handle must be held in its "forward" position to permit up movement of the control handle.

(4) Flap control handle "NEUTRAL".

(5) Wheel brakes on. Depress the brake treadles and pull out on the parking brake knob (figure 6).

(6) Adjust the rudder pedals to the desired position by pushing inboard on the spring loaded adjustment lock which will allow the rudder pedal to float free on its hinge. Move the pedal to the desired location and release the spring loaded lock. "Jiggle" the

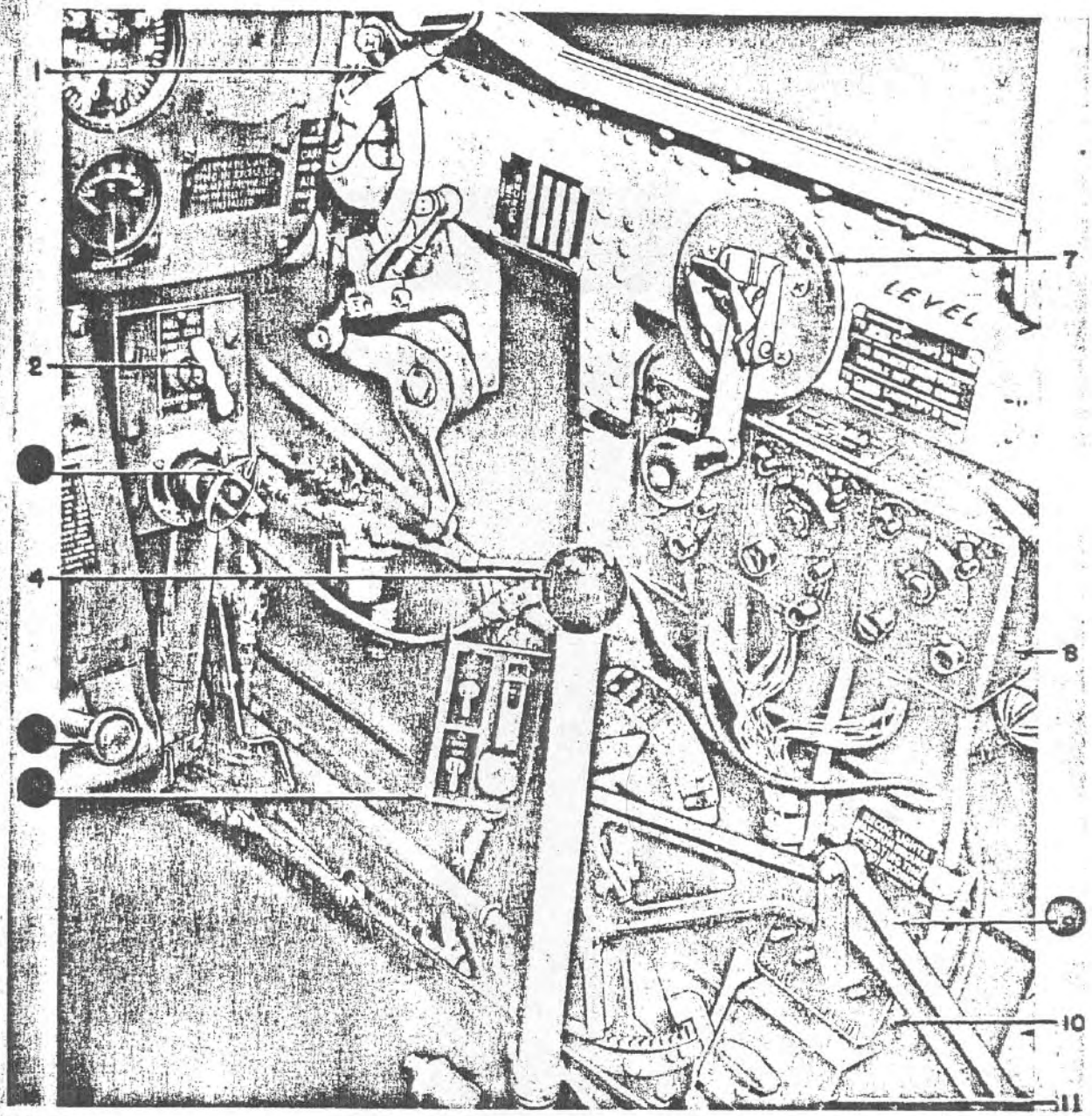


Figure 29—Cockpit—Right Side Front

1. Carburetor Heat Control
2. Cockpit Heat Control
3. Engine Primer
4. Auxiliary Hydraulic Pump Handle
5. Oil Dilution Control
6. IFF Radio
7. Cabin Canopy Control
8. Receiver Control (SCR-274-N Radio)
9. Cowl Shutter Control
10. Recognition Lights Switch Box
11. Radio Filter (SCR-274-N Radio)

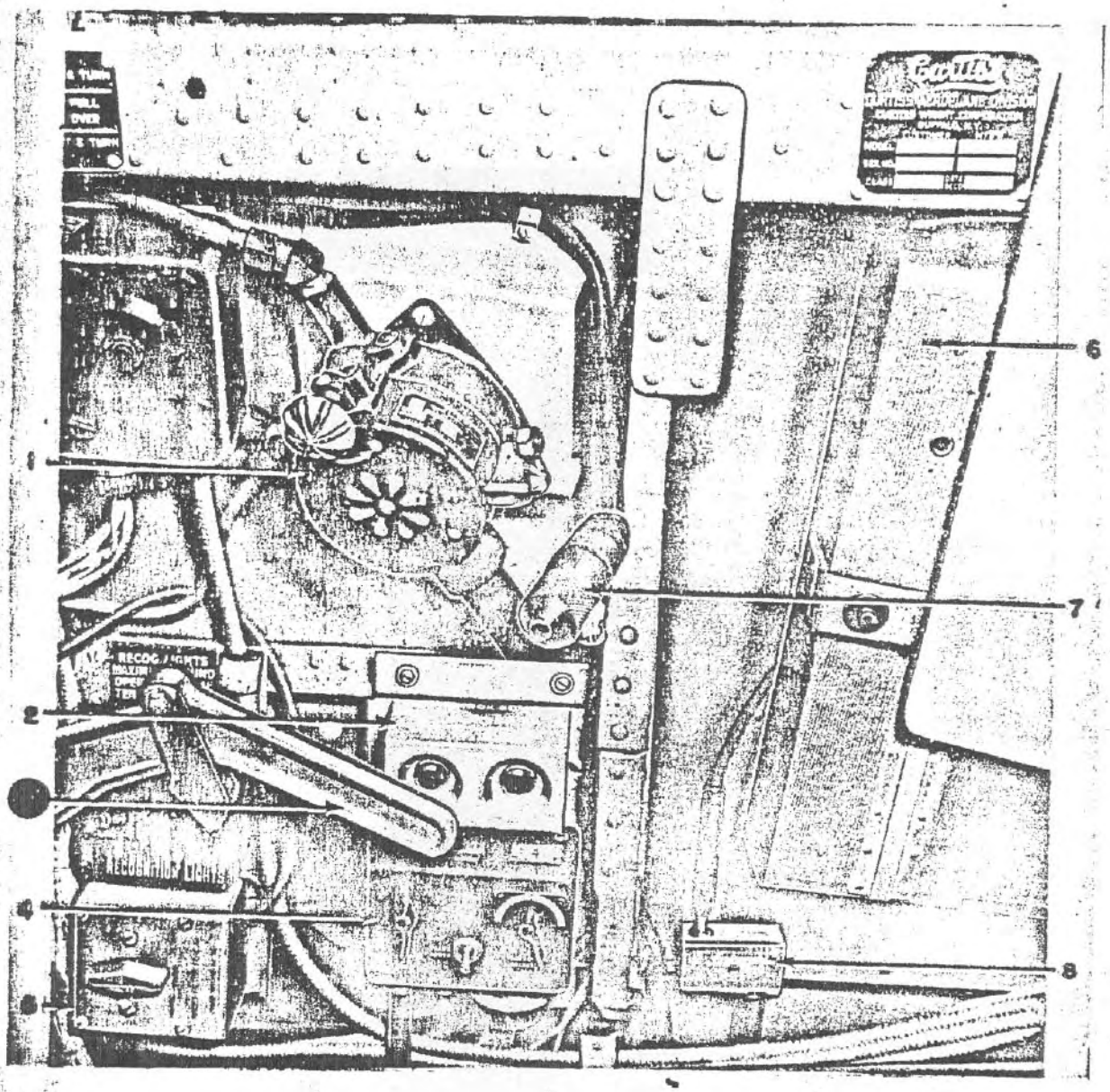


Figure 30—Cockpit—Right Side Rear

1. Oxygen Regulator
2. Detonator Switch Box
3. Cowl Shutter Control
4. Transmitter Control Box (SCR-274-N Radio)
5. Filter Switch Box (SCR-274-N Radio)
6. Map Case
7. Spot Light
8. Headset Adapter (SCR-274-N Radio)

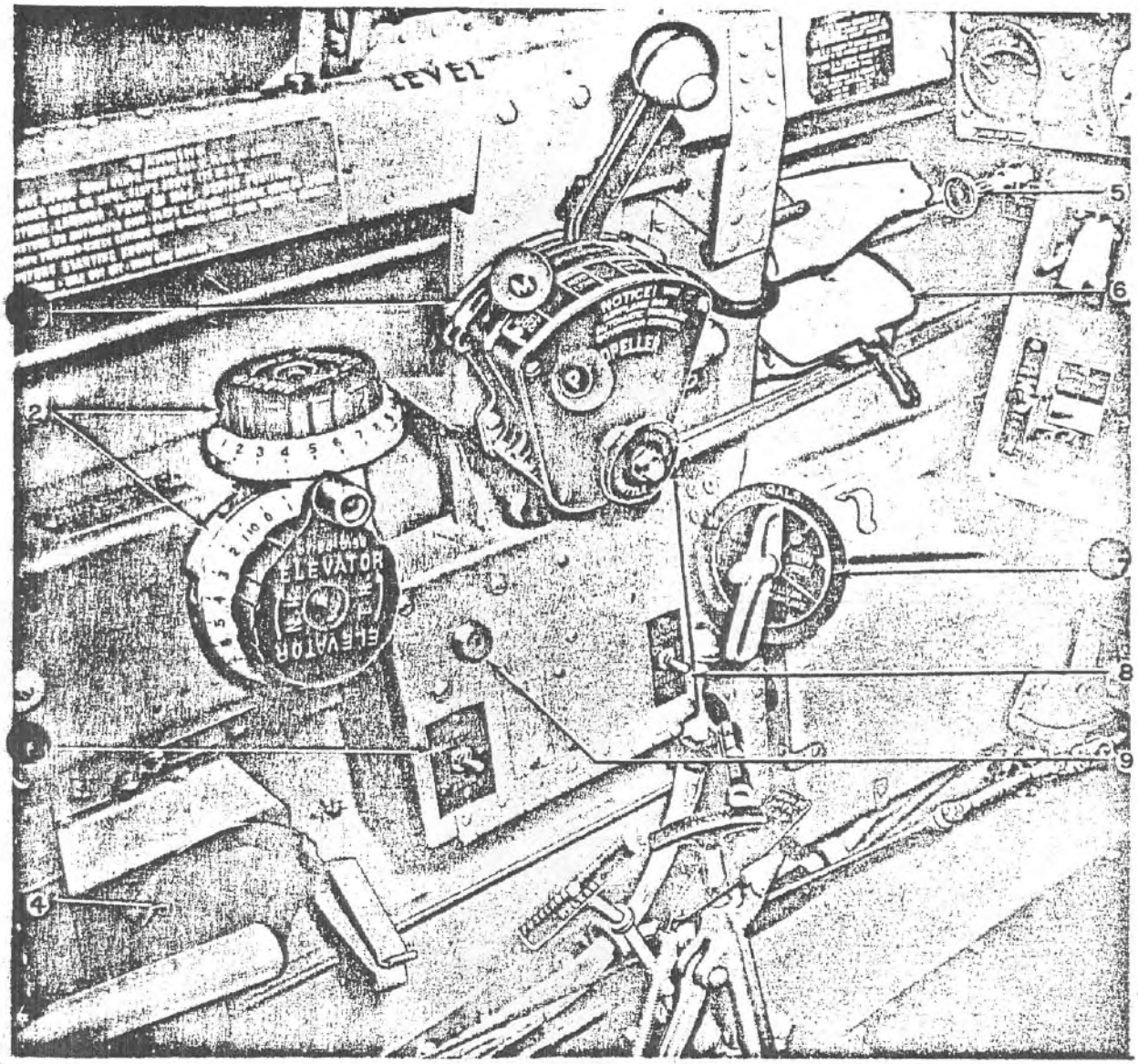


Figure 31—Cockpit—Left Side Front

1. Engine Control Quadrant
2. Trim Tab Controls
3. Starter Switch (AF42-105640 and Subsequent)
4. Inter-aircraft Signal Light Bracket
5. Parking Brake Control
6. Drop Message Bag
7. Fuel Selector
8. Landing Light Switch
9. Generator Circuit Protector Re-set

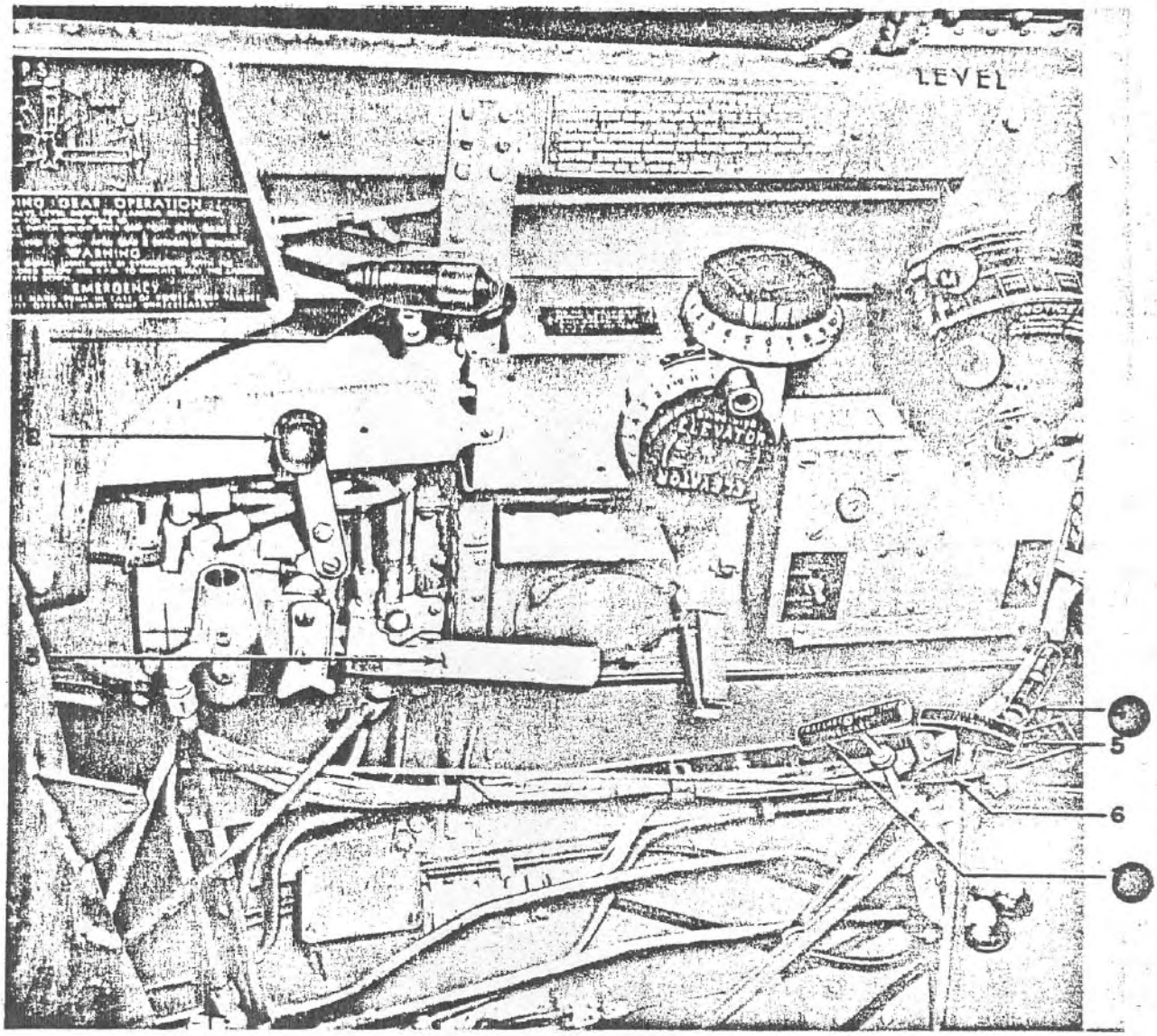


Figure 32—Cockpit—Left Side Rear

1. Spot Light
2. Flap Control Handle
3. Landing Gear Control Handle
4. Wing Bomb and Tank Release
5. Bomb Arming Handle
6. Bomb Safetying Lever
7. Fuselage Bomb and Tank Release

pedal slightly to allow the locking pin to snap into position. Adjust both pedals to the same length.

(7) Check for freedom of movement of the flight control stick and rudder pedals to the extremities of their operating range.

(8) Adjust the seat for the correct height by pushing forward on the release handle on the right side of the seat. Raise or lower the seat as desired and lock in position by releasing the handle. "Jiggle" the seat to make certain the spring loaded lock mechanism is definitely engaged. After adjusting the seat, check the rear view mirror to be certain it affords a clear view aft.

This instruction applies to airplane AF42-104429 through airplane AF42-104828 only. On airplanes AF42-104829 and subsequent, the seat is adjusted on the ground only, by removing four bolts in base of seat and adjusting.

(9) The two ends of the pilot's safety belt are anchored to the cockpit seat. The length of the safety belt may be adjusted to suit the pilot.

(10) The chest type shoulder strap is bolted to the bungee assembly on the back of the seat and the free ends are fastened to the safety belt and may be adjusted the same as the safety belt to fit the individual needs of the pilot.

The above applies to airplane AF42-104429 through airplane AF42-104828. On airplanes AF42-104829 and subsequent, the chest type shoulder strap is bolted to the cable back of the seat. The free ends are fastened to the safety belt and can be adjusted to fit the pilot.

(11) Push generator circuit breaker button (figure 33) "IN".

4. FUEL SYSTEM MANAGEMENT.

a. FUEL TANK SEQUENCE.

(1) Fuselage tank for starting take-off and climb.
(2) Alternate auxiliary wing tanks if installed.
(3) Belly tank if installed.
(4) Fuselage tank.
(5) Wing tank.

b. Electric booster pump should be on for all operation, except for checking the operation of the engine driven fuel pump on warm-up.

c. For normal landing have fuel cock on full tank.

d. For emergency landing fuel have fuel cock on "OFF" position.

If a belly tank is installed the fuel selector valve should be set at "BELLY" as soon as practical after take-off. As this tank is not equipped with a fuel gage, its operating limits may be determined by dividing the cruising power gasoline consumption into the tank capacity. Gasoline consumption in gallons per hour are listed opposite each engine setting on the Flight Operation Instruction Chart. (Refer to figures 22 and 23 for fuel tank capacities.)

5. STARTING THE ENGINE.

a. Have some member of ground crew stand by with carbon dioxide fire extinguisher bottle.

b. Be certain the ignition switch is "OFF".

c. If the engine has been idle for more than two hours, turn the propeller at least four complete revolutions by hand with the throttle open before using the starter.

d. Set the carburetor air control (figure 29) to "cold".

WARNING

When operating from a dusty field the carburetor air control should be set to "FILTERED".

e. Turn the battery line switch (figure 14) and the generator switch "ON".

f. Turn the propeller selector switch to "AUTO" and circuit breakers "ON".

g. Set the propeller governor control (figure 10) for 3000 rpm.

This applies to airplanes AF42-104429 through AF42-106405 only. On airplanes AF42-106406 and subsequent, the automatic engine control unit is installed and the propeller governor can no longer be manually operated from the cockpit. A "WARNING"

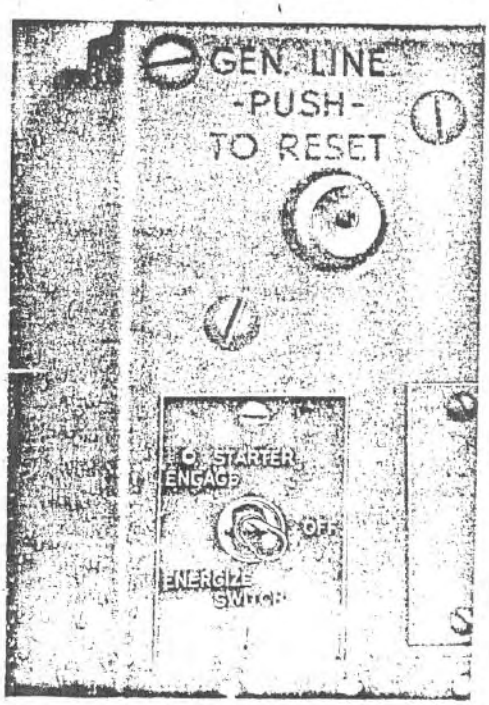


Figure 33—Starter Switch and Generator Circuit Breaker

nameplate on the throttle quadrant (figure 11) calls this to the attention of the pilot.

h. Set the mixture control (figure 10) to "IDLE CUT-OFF".

i. Set the throttle control about ¾ inch open.

j. Set the cowl flaps as required.

k. Turn the fuel selector to "FUSELAGE TANK". Never turn the valve pointer through "BELLY" when an auxiliary tank is not installed.

l. Operate the electrical booster pump (figure 14) to obtain from 16 to 18 pounds per square inch fuel pressure.

m. Prime the engine two to four strokes and turn the booster pump "OFF".

n. Turn the ignition switch to "BOTH".

o. After the starter has been hand cranked up to speed, and the engine begins to turn over, prime with a slow steady stroke. When the engine "catches", move the mixture control to "AUTO-RICH".

This applies to airplane AF42-104429 through airplane AF42-105639. On airplanes AF42-105640 and subsequent, there is an electric starter switch. The instructions for electric starting are as follows:

Under normal weather conditions, hold the starter switch in "ENERGIZE" position for 12 to 15 seconds (maximum), then move it to "ENGAGE" position. Move the mixture control to "AUTO-RICH" when the engine catches. Use the hand primer to prevent stalling. Pumping the throttle does not prime the engine. If the engine does not continue to fire, return mixture control to "IDLE CUT-OFF" immediately.

NOTES

Do not move the mixture control out of "IDLE CUT-OFF" while the starter is engaged.

Do not operate the electric booster pump with the mixture control out of "IDLE CUT-OFF" when the engine is not firing.

p. Close and lock the primer. (Figure 34)

q. If it is necessary to employ the hand inertia starter, on airplanes AF42-105640 and subsequent, the following procedure is used:

Open access door in lower rear section of the right engine cowl, making accessible the starter motor brush lift knob. Lift the starter brushes by sliding the brush lift knob on the aft side of the starter motor to "OFF" position. Access to the starter for cranking is gained through a small access door in the lower right rear section of the engine cowl. The crank is inserted through the support and the coupling on the starter housing is engaged. (Hand crank and hand crank extension are stowed inside of the left fuselage wall just forward of the fuselage access door, or across from door.) Crank the flywheel until the hand crank is rotating at least 60 rpm. Remove the crank and pull on the starter engage button located beside the hand crank support. This engages the starter with the engine. If the starter has lost most of its momentum, and the engine has not fired, release the engaging button and bring the starter up to speed and reengage the engine. Slide brush lift knob into "ON" position.

WARNINGS

If the engine quits after starting, return the mixture control to "IDLE CUT-OFF" immediately.

If the oil pressure is not established within 15 seconds after starting, stop the engine and investigate the oil pressure failure.

NOTE

If no external cart plug battery is available, the airplane should always be hand cranked unless an emergency condition exists.

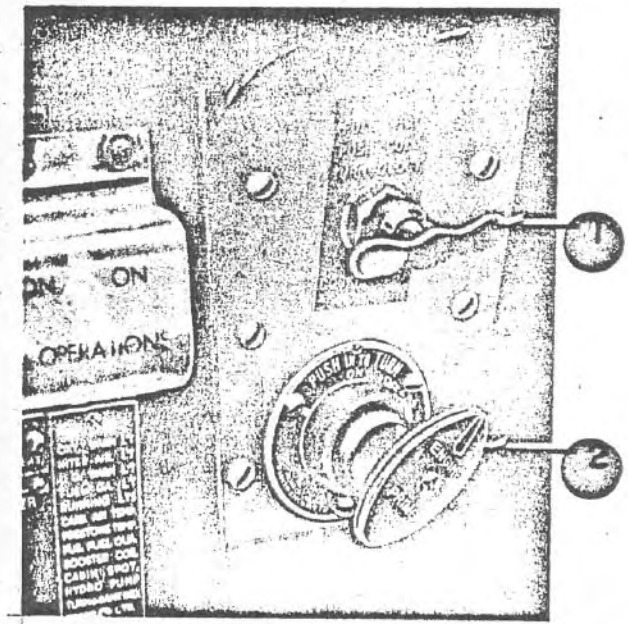


Figure 34—Engine Primer and Cockpit Heat Control

1. **Cockpit Heat Control**
2. **Primer**

6. ENGINE WARM-UP.

a. Start warming up the engine at 800 to 1000 rpm until the oil pressure stabilizes at 60 or 70 pounds per square inch pressure. When the oil pressure no longer fluctuates and the temperature begins to rise, gradually increase to approximately 1400. The minimum

oil temperature for 1400 rpm or over is 20°C (68°F). If known icing conditions exist, move the carburetor air control to "HOT". The maximum coolant temperature will be 125°C (257°F).

b. During warm-up the oil pressure should not exceed 120 pounds per square inch and the normal oil temperature should be 60°C to 80°C (140°F to 176°F) with a maximum of 95°C (203°F).

c. Fuel pressure for idling should be maintained at 10 pounds per square inch, and for operating, 16 to 18 pounds per square inch.

d. Avoid prolonged ground running of the engine.

e. Adjust the cockpit heating and ventilator control as desired (figure 34).

f. Set the cowl flaps as the temperature requires.

g. Set the carburetor heat control as required. Do not operate the engine with heat to the carburetor unless icing conditions prevail.

7. SCRAMBLE TAKE-OFF.

If the engine oil was properly diluted when previously stopped, no difficulty should be experienced in maintaining the oil pressure within the limits noted on the "Specific Engine Flight Chart," in section III. The engine, however, may be flown as soon as it will "take" the throttle with the oil dilution system in operation to overcome oil pressure in excess of the prescribed limits. Be careful not to overdilute the oil. Operate the oil dilution switch (figure 4) until the oil pressure gage indicates a stabilized pressure within the proper limits. Airplanes AF42-104429 through AF42-105928 are equipped with an oil dilution switch while airplanes AF42-105929 and subsequent are equipped with a manual control (figure 5). Procedure for operation is as follows:

Push the oil dilution control "IN" (figure 5), holding in this position until the oil pressure gage indicates a stabilized pressure within the proper limits.

8. ENGINE AND ACCESSORIES OPERATION GROUND TEST.

a. After warm-up has been completed in accordance with paragraph 4, set the propeller selector switch to "FIXED PITCH" and set the throttle to 28 inch Hg. Actuate the "Increase" or "Decrease" rpm switch to obtain 2200 rpm.

NOTE

On airplanes AF42-106406 and subsequent, the automatic engine control is installed. On these airplanes the following procedure is used:

After initial warm-up, advance the throttle to 28.5 inches of mercury. This manifold pressure setting should produce an engine speed of 2200 rpm with tolerance on this setting not exceeding 15 rpm.

(1) Test the dual magneto and the spark plugs by moving the ignition switch (figure 35) to "R" and note the loss in engine rpm. Return the switch to "BOTH" and when the original rpm is regained, move the switch to "L" and note the loss in engine rpm. The magneto check should be made in as short a time as possible, and should not exceed 15 seconds with a maximum permissible loss of 80 rpm.

NOTE

The magneto test must never be made at an engine speed exceeding 2200 rpm to avoid excessive detonation.

(2) Check the fuel and oil pressure, oil temperature, and coolant temperature. (Refer to section III, "Specific Engine Flight Chart" for limits.) Note the manifold pressure as a reference for checks in the future.

b. Return the propeller selector switch to "AUTO" and set the propeller governor control for take-off rpm. (On airplanes AF42-106406 and subsequent, as the propeller governor control is inoperative, simply return the selector to "AUTO".) Adjust the throttle control to obtain 2400 rpm. Note the manifold pressure. Vary the engine speed from 2400 to 2200 rpm by manually decreasing the rpm. The manifold pressure should remain constant within one inch of mercury.

(1) Ground test the automatic operation of the propeller by setting the throttle at ¾ take-off rpm and pulling back on the governor control (figure 10) until reduction of 100 rpm is noticed. Return the propeller governor control to take-off setting, noting that the original rpm is obtained. (On airplanes AF42-106406 and subsequent, as the propeller governor control is

inoperative, this procedure will not be used. Instead, the automatic operation of this propeller is ground tested by putting the propeller selector switch in "fixed pitch" and increasing the engine rpm with the throttle to 2100 rpm. Throw the propeller switch into "AUTO" and the rpm should drop to 1960.

c. The ammeter will show a charge, only when the generator is producing current in excess of that of the battery.

9. TAXYING INSTRUCTIONS.

a. Call the dispatcher for taxying clearance and altimeter setting. (In taxying, the engine should be kept turning at least 1000 rpm to prevent fouling the plugs.) If taking off from a field where no dispatcher is on duty, set the altimeter at the altitude listed on the flight map.

b. Refer to section V for complete information on operation of the armament.

c. Set the fuel selector valve to "FUSELAGE".

d. Wing flaps up.

e. Be sure all controls are free.

f. Open the cowl flaps.

g. If known icing conditions exist, throw the pitot tube heater switch (figure 14) "ON". If full horsepower is desired, set the carburetor heater control (figure 29) to "COLD" for the take-off.

h. Set the engine controls in accordance with "Take-Off" settings listed in "Flight Operation Instruction Chart" in appendix II.

i. Adjust the cockpit heating and ventilating control (figure 34) to the desired setting. Pull for "Heat" and push for "Cold". Closing the cowl flaps will increase the temperature of the heat entering the cockpit.

10. TAKE-OFF.

a. Fuel cock on full (FUSELAGE) tank.

b. Wing flaps up.

c. Controls free.

d. Propeller set "AUTO", 3000 rpm.

e. Mixture control on "AUTO-RICH".

f. If a belly bomb is carried the arming handle should be in the "SAFE" position so the bomb may be dropped in an emergency.

g. Electric booster pump "ON".

h. Manifold pressure 52.0 inches of mercury. (Maximum).

i. Immediately upon clearing all obstacles, reduce the throttle to not exceed 44.22 inches of mercury.

CAUTION

Climbs of 60 degrees or greater will be performed only with 1/3 or more of the maximum oil capacity.

j. Apply the brakes to stop the rotation of the wheels after the wheels are clear of the ground.

k. Retract the landing gear as soon as practicable after breaking ground.

l. If the flaps were used for take-off, do not raise below 500 feet. Wait until all ground obstacles have been cleared before raising the flaps."

11. ENGINE FAILURE DURING TAKE-OFF.

a. Release belly tank or bomb by pulling up on the "Bomb-Tank Release" handle.

b. Immediately depress the nose in order to maintain flying speed.

c. Make sure that the landing gear has started to come up; if only unlocked and on the way up, it will collapse on landing. Continue to retract the landing gear until the visual indicators show the wheels to be completely retracted.

d. Turn the fuel selector valve "OFF".

e. Turn ignition switch "OFF".

f. Lower the wing flaps.

g. Turn the battery line switch "OFF".

h. Land straight ahead.

12. CLIMB.

a. For combat missions climb for fifteen minutes at 3000 rpm 44.2" Hg. then reduce to 2600 rpm and 38.3" Hg.

b. On ferry missions climb at 2280 rpm 30.7" Hg.

c. For reference on best climbing speeds refer to take off, climb, and landing chart in Appendix II.

d. Set the engine cowl flap control lever in the "combat climb position."

e. See Section III for specific engine flight chart and engine performance.

13. GENERAL FLYING CHARACTERISTICS.

a. If a belly tank is installed, the fuel selector valve should be set at "BELLY" as soon as it is safe after take-off. As this tank is not equipped with a fuel gage its operating limits may be determined by dividing the cruising power gasoline consumption into the tank capacity. Gasoline consumption in gallons per hour is listed opposite each engine setting on the "Flight Operation Instruction Chart". (Refer to figures 22 and 23 for fuel tank capacities.) Use the fuel tanks in the following sequence:

(1) Fuselage tank for starting and take-off.

(2) Alternate auxiliary wing tanks if installed.

(3) Belly tank if installed.

(4) Fuselage tank.

(5) Wing tanks.

b. No fire prevention provisions are installed in this airplane.

c. Plan all flight operating conditions from the "Flight Operation Instruction Chart" in appendix II.

d. Normal engine operating conditions are adequately covered in the chart of section III, Specific Engine Flight.

e. Trim the airplane for level flight.

(1) Rotate the rudder tab control clockwise to turn the nose of the airplane to the right.

(2) Rotate the elevator tab control clockwise to put the nose of the airplane down.

(3) The aileron trim tab is adjusted previously to entering the cockpit and cannot be adjusted when in flight.

f. INCREASING OR DECREASING ENGINE POWER.

(1) To increase engine power during flight, place the mixture control in "AUTO-RICH", adjust the propeller control to give the desired rpm, set the throttle to give the manifold pressure desired, and if necessary, readjust the mixture control.

(2) To decrease engine power during flight, adjust the throttle for the manifold pressure desired, set the propeller control to obtain the rpm desired, and adjust the mixture control if it is necessary.

(3) For airplane AF42-106406 and subsequent, as the propeller governor is automatic, the above portion of paragraph 13. *f.* will not apply.

NOTE

Remember the rule: INCREASE RPM BEFORE INCREASING MANIFOLD PRESSURE. DECREASE MANIFOLD PRESSURE BEFORE DECREASING RPM.

g. OPERATION OF PROPELLER CONTROLS.

(1) "AUTO CONSTANT SPEED".—When the selector switch is in this position, the rpm is held constant by an engine driven propeller governor. When a certain rpm is desired, move the propeller governor control (figure 10) either to "decrease" rpm, or to "increase" rpm. When the control is moved to obtain the rpm desired, the engine driven governor will hold the propeller at a constant speed. For airplanes AF42-106406 and subsequent, this will not apply.

(2) "FIXED PITCH".—When the selector switch is in this position, the pitch of the propeller is fixed and cannot be varied except as specified below.

(3) "INCREASE—DECREASE RPM". — These two positions of the selector switch are used to increase or decrease the rpm when the propeller is being used in the manual "FIXED PITCH" position until the desired rpm is obtained, then return the switch to "FIXED PITCH" position. Hold the switch in either the "INCREASE RPM" or "DECREASE RPM" position until the desired rpm is obtained, then return the switch to "FIXED PITCH".

WARNING

If the circuit breaker throws out and will not remain on, place the selector switch in "FIXED PITCH". Change the pitch only when obsolutely necessary by holding the circuit breaker "on" and obtain the desired rpm as outlined in paragraph 13 g. (3) above.

(4) RATIO OF MANIFOLD PRESSURE AND ENGINE RPM.—If by reason of increased air loads,

such as auxiliary fuel tanks, it is desired to alter the ratio of manifold pressure to engine rpm, this may be done by setting the "propeller selector" switch in "FIXED PITCH" or "INCREASE RPM" position in order to obtain the cruising condition desired. At the option of the pilot the propeller selector switch may be returned to "AUTOMATIC" and the function of the propeller governor will resume its controlled relation to the manifold pressure. This will apply only on airplanes equipped with the automatic engine control unit (AF42-106406 and subsequent).

As previously stated, if the propeller governor control lever on the throttle quadrant is not used, this fact is emphasized by a Warning nameplate which states: "THIS AIRPLANE HAS AUTOMATIC PROPELLER GOVERNOR CONTROL". This control is locked in full rear position.

In alternating the ratio of manifold pressure to engine rpm on airplanes equipped with the automatic engine control, the following tolerances are used for various conditions of flight:

Manifold Pressure	*Allowable RPM Limits*
45.5	3000— ± 40
37.2	2600— ± 40
30.8	2280— ± 40
28.5	2190— ± 75
24	1950— ± 75

h. STABILITY.

At normal loadings the airplane is stable, but with the fuselage fuel tank full, instability and light stick loads under high acceleration may become apparent.

i. CHANGE OF TRIM.

With the landing gear extended the airplane is nose heavy. However, with retracting of the landing gear, this nose heavy condition is corrected and the airplane should be retrimmed. With the flaps down, there is no appreciable change in the trim. Do not open the cowl flaps at high speeds.

j. ENGINE FAILURE DURING FLIGHT.

(1) Release belly tank or bomb if attached.

(2) Maintain a glide of approximately 130 IAS until final approach.

(3) If in doubt, land with the landing gear retracted.

(4) Turn fuel boost pump and fuel selector valve "OFF".

(5) Turn the ignition switch "OFF".

(6) Lower flaps by squeezing the electric hydraulic pump switch on the control stick below the handgrip, until the visual indicator shows the flaps to be fully extended.

(7) Turn the battery switch "OFF".

(8) Open the cockpit enclosure by operating the control crank.

(9) Land at minimum safe speed.

(10) If extended glide is necessary, the propeller setting may be placed in "FULL DECREASE RPM", battery "ON". This reduces propeller windmilling drag.

14. STALLS

a. The stalling characteristics of the airplane are good and at normal operational load (8260 lbs.) the following are the approximate stalling speeds.

Landing gear up—flaps up.....88 mph
Landing gear down—flaps up.....90 mph
Landing gear up—flaps down.....78 mph
Landing gear down—flaps down.....79 mph

15. SPINS

Intentional spinning is prohibited. If a spin should develop, the normal methods of recovery must be employed at once and the importance of maintaining full opposite rudder is stressed. Crack the throttle open and at normal loadings and center of gravity positions apply full apposite rudder. Then after approximately one-half turn of the spin, push the control stick forward with a quick positive motion. This should effectively straighten out the airplane within two turns. The spin itself is usually extremely violent.

In recovering from a spin the pilot will generally have initial recovery in the form of a steep spiral. Even though his indicated airspeed may read 140 mph or more, he should attempt to level his wings and ease out gradually, making sure he has full control of the airplane before he fully recovers. Inadvertent spins can be avoided if the pilot will remember that the elevator condition as affected by center of gravity, and the rudder condition as affected by extreme yaw with power, both tend toward inadvertent spin entry. There is a shuddering of the airplane and a buffeting of the elevator at the verge of a stall. Pilots should always be on the alert for these spin warnings. It should also be remembered that it takes altitude to recover from a spin. If a pilot should inadvertently whip off into one turn he will require from 2000 to 2500 feet before re-

covery from the altitude at the start of the spin. Approximately 1000 feet altitude is lost in one turn of a spin. Recovery can be effected generally at a minimum of about 1500 feet loss of altitude.

16. ALLOWABLE AEROBATICS.

Any maneuver not specifically mentioned as a Flight Restriction may be executed.

WARNING

All aerobatics are prohibited with auxiliary tanks or bombs mounted.

17. DIVING.

As diving speed increases, the airplane tends to yaw to the right. Left rudder tab is required for correction. Stick loads during the early part of the recovery are inclined to be heavy. Elevator tab control is extremely sensitive and should not be used in recovery except in emergency.

a. Maximum permissible dive is 496 mph indicated.

b. Cowl flaps in combat and climb position.

c. POWER-OFF DIVES.—To decrease the possibility of the engine malfunctioning and missing considerably, upon opening the throttle after pull-out from POWER-OFF DIVES, the following precaution will be rigidly observed:

DO NOT MAKE A COMPLETE "POWER-OFF" DIVE. THE MINIMUM MANIFOLD PRESSURE DURING A DIVE IS 21 TO 23 INCHES MERCURY.

18. NIGHT FLYING.

a. Manually operated recognition lights are provided.

b. An inter-aircraft signal light is installed for identification purposes.

(1) The light is located forward of Station 4 bulkhead on the left hand side near the floor.

(2) The light is easily removed from the clip by grasping the handle and pulling inboard.

(3) A trigger is provided on the handle to turn the light "ON" and "OFF".

19. APPROACH, LANDING AND CROSS WIND LANDING.

a. Approach and landing of this airplane is normal. However, the view during a power approach is inclined to be poor owing to the flat angle of glide even with the flaps down. For this reason, extreme care must be exercised when approaching strange airports or emergency landing fields. When experience has been gained on the airplane, side-slip turns are recommended if the approach is to be made over obstacles. The position of the flaps will be governed by the wind velocity.

b. For preliminary approach, reduce the speed during the initial circuit to approximately 140 IAS and open the canopy.

(1) Ensure fuel cock is on full tank.

(2) Ensure mixture control is in "AUTO-RICH".

(3) Set throttle at 2000 rpm.

(4) Set carburetor air control at "COLD" for normal conditions, or at "FILTERED" for "dusty" conditions.

(5) Set landing gear control for "LANDING GEAR DOWN" position. When speed is below 175 mph operate switch on control stick.

(6) Lower cowl flaps as required. Do not lower them above 175 mph.

(7) Lower wing flaps, but not above 140 mph.

(8) With throttle closed, the landing gear warning lights will be off if the landing gear is locked down.

(9) For final approach it is recommended that an engine "OFF" approach be employed whenever possible, since with the engine "ON" the glide is very flat and the view of the landing area is obscured by the nose of the airplane. The following approach speeds are recommended:

Engine "ON" .....110 IAS

Engine "OFF" .....130 IAS

On approach of the boundary of the airport, the engine "ON" speed should be reduced to 100 IAS.

NOTE

Care should be exercised to prevent overcooling and loading up of engine when very low engine power is used during long glides.

WARNING

At full load with the center of gravity in the aft position, this airplane tends to swing to the right as soon as the wheels touch the ground. Therefore, care must be exercised to keep the airplane straight, both then and during the ensuing landing run. This swinging tendency is accentuated if, during landing with full load the airplane is flattened out too high, it is liable to drop a wing, often the left, and then swing sharply to the right. When taxying with a full load and the center of gravity in the aft position, it is possible to cause the tail wheel to swing through its steerable arc into the non-controllable condition, and as a result, difficulty may be encountered in controlling the airplane at low speeds. Extreme care must be exercised when such a swing develops and it is advisable to stop the airplane immediately by applying both brakes rather than to try to control the swing by application of opposite brake and rudder.

(10) Open the cowl flaps.

(11) At the conclusion of the landing run, fully retract the wing flaps.

NOTE

When landing at night, the angle of approach makes it difficult to see the landing area and extreme care must be exercised to land straight down the lighted path. For the same reason it is recommended that a minimum of engine be used when approaching for a night landing.

c. In a cross wind or in strong gusts, about half flaps are recommended with a tail high landing. Land with power "ON" providing sufficient runway is available, at 95 to 100 IAS.

d. If the initial approach is unsuccessful and the landing is not completed, increase the manifold pressure to 44.2 inches of mercury. Retract the flaps after gaining at least 500 feet altitude.

e. EMERGENCY OPERATION OF LANDING GEAR AND FLAPS.

If the electric hydraulic pump fails, the landing gear can be lowered by the use of the auxiliary hand pump. The control valve will be operated in the same manner as if the electric pump was in operation. The hand pump will also operate the flaps, and raise or lower the tail wheel.

20. STOPPING THE ENGINE.

a. Apply brake treadles and set the parking brake.

b. Place mixture control in "AUTO-RICH".

c. Move the throttle to obtain approximately 1300 rpm.

d. Operate the engine until the oil and coolant temperatures have fallen appreciably below cruising temperatures.

e. Set the mixture control in "Idle Cut-Off" at 1300 rpm, and slowly open the throttle.

f. Turn the ignition switch "OFF" when the propeller stops rotating.

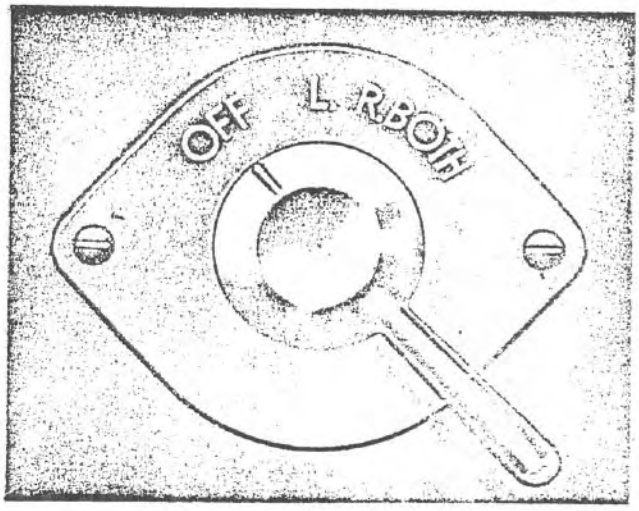


Figure 35—Ignition Switch

21. BEFORE LEAVING THE COCKPIT.

a. Turn the fuel selector valve "OFF".

b. Place all cockpit light switches, pitot heater switch, etc., in the "OFF" position.

c. Place the battery line switch in the "OFF" position.

d. Be sure that the control lever "A" (detail "A" figures 20 and 21) is in the position shown so that the canopy may be closed or opened from the outside by hand.

e. If it is windy, attach the parking harness to the flight controls to prevent damage to the control surfaces. The parking harness is carried in the duffle bag located just inside the fuselage access door. (See figures 36 and 37. Fuselage Contents Drawing.) To attach the parking harness: Move the rudder pedals to the full aft position, wrap the parking harness about the flight control stick and attach the cable assemblies to the eye-bolts provided on the rudder pedal tubes and the pilot's seat. To remove any slack in the cable, tighten the turnbuckles on the harness. On airplanes with adjustable seat raise the seat to remove any slack.

22. MOORING THE AIRPLANE.

Tie-down rings are located in the under surface of each wing between the outboard bulkhead and the removable wing tip. These rings are held in the retracted position in the wing by springs and are pulled down through the slots by small tabs which protrude from the bottom surface of the wing.

Decalcomanias, inscribed "TIE-DOWN" indicate the location of these tabs. The tail lifting bar may be passed through the left tube at the aft end of the fuselage to tie-down the aft portion of the airplane.

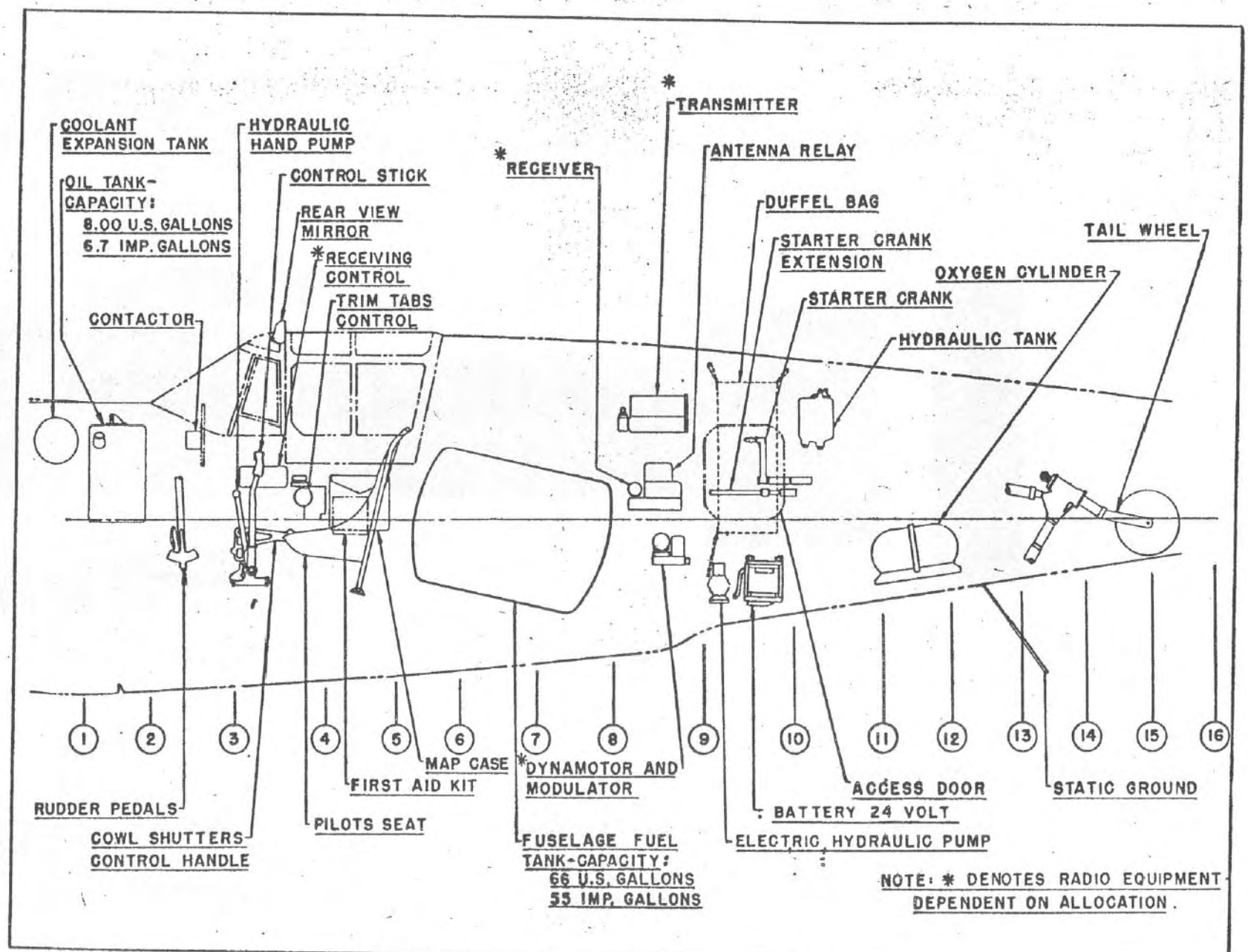


Figure 36—Fuselage Contents *AF42-104429 thru AF42-106028*

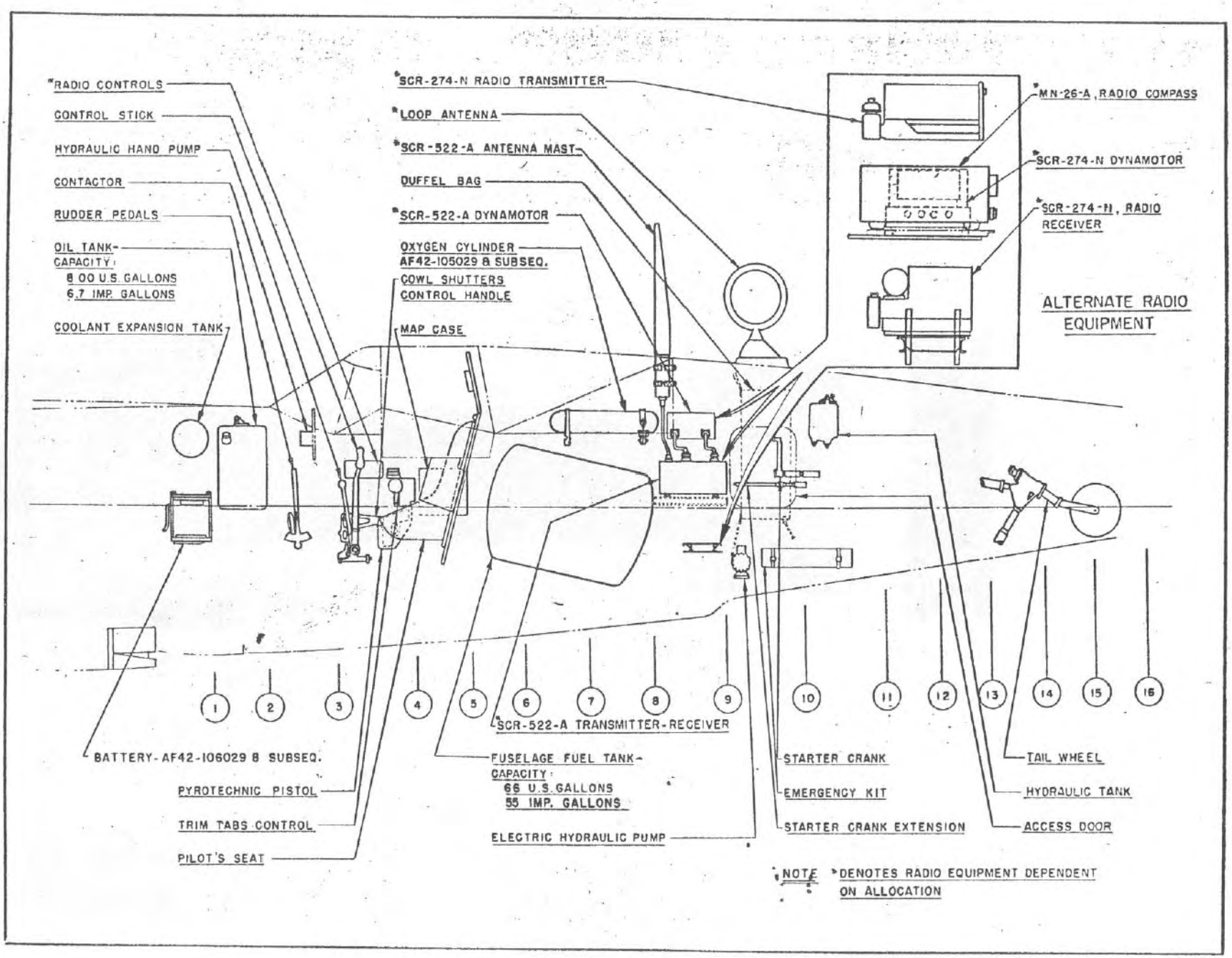


Figure 37—Fuselage Contents AF42-106029 and Subsequent

SECTION III
FLIGHT OPERATING DATA

1. AIRSPEED LIMITATIONS.

Do not extend wing flaps above 140 IAS.
Do not lower landing gear above 175 IAS.
Do not lower cowl flaps above 175 IAS.
Do not operate landing lights above 150 IAS.

2. AIRSPEED CORRECTION.

In order to obtain the flight duration, pilot's indicated air speed must be converted to true air speed and this true air speed divided into the air miles to be flown. True air speed may be obtained first by correcting pilot's indicated air speed for position error to obtain an approximate calibrated indicated air speed, then apply the pertinent altitude correction factor to this calibrated indicated air speed. The following table shows the approximate true air speed corresponding to pilot's indicated air speed on the P-40N series airplanes:

Pilot's	Altitudes			
IAS	5,000	10,000	15,000	20,000
	Approximate True Air Speeds			
150	165	180	190	210
200	220	240	260	280
250	270	300	320	350
300	330	360	390	415
350	390	420	450	480

IMPORTANT

The above instructions and following charts do not take into account the effect of wind. Adjustments to range values and flight duration to allow for wind may be made by any method familiar to the pilot such as the use of a flight calculator or a navigator's triangle of velocities.

3. AIRSPEED CORRECTION TABLE.

There is no appreciable error in airspeed indicator calibration when this airplane is in a glide with flaps or landing gear down.

4. WAR EMERGENCY RATING.

a. War emergency rating is established to make available to the pilot, in combat, the absolute maximum manifold pressure which the engine may be operated for a five-minute period.

b. War emergency is allowed only when all these conditions are met:

(1) In combat or pre-combat areas only when emergency conditions exist.

(2) While using Spec. No. AN-F-28 Grade 100/130 fuel.

(3) When the mixture control is in "AUTO-RICH".

(4) Propeller control set in automatic position to maintain 3000 rpm.

NOTE

The throttle break-thru seal will call to the attention of the crew chief as to whether the engine has been operated at war emergency rating or not.

c. For all normal operations, however, observe engine limitations as noted in Specific Engine Flight Chart which is on following page.

SPEC. AN-H-8
DEC. 18, 1942
FORM ASC-512

AIRPLANE MODELS: P-40N

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS: V-1710-81,-99,

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F
DESIRED	16 – 18	70	60 85	140 185	110 121	230 250
MAXIMUM	19	80	95	203	125	257
MINIMUM	14	60–55	40	104	85	185
IDLING	10	15				

MAX. PERMISSIBLE DIVING RPM:

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	13.3 U.S.QT/HR. 22 IMP.PT/HR
MAX. CRUISE	10 U.S.QT/HR. 17 IMP.PT/HR
MIN. SPECIFIC	5 – 7 U.S.QT/HR. 8 – 12 IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1100

SUPERCHARGER TYPE: 1 STAGE, 1 SPEED, MECH. DRIVEN CENTRIFUGAL

FUEL GRADE: 100/130 SPEC: AN-F-28

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.	FUEL FLOW (GAL/HR/ENG.) IMP.	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	52	1200	SEA LEVEL	SEA LEVEL			A. R.	148	123			5
WAR EMERGENCY *	3000	57	1480	10000	7500			A. R.	170	142			EMERGENCY ONLY
MILITARY	3000	44.2	1125	17000	15000			A. R.	135	109			15
MAXIMUM CONTINUOUS	2600	38	1000		14400			A. R.	110	92			
MAXIMUM CRUISE	2300	31	760		16600			A. L.	63	53			
MINIMUM SPECIFIC CONSUMPTION	1800	29	585		12200			A. L.	44	37			
	1800	24	480		17300			A. L.	36	30			

REMARKS: CRUISING BELOW 1800 RPM MAY RESULT IN INSUFFICIENT GENERATOR OUTPUT.
* TO BE USED IN PRE-COMBAT OR COMBAT ZONES *ONLY*.
FUEL FLOW ESTIMATED – ALLOW + 10% MARGIN FOR FLIGHT.
RED FIGURES HAVE NOT BEEN FLIGHT TESTED

WF-1-1-43-5M

SECTION IV
EMERGENCY OPERATING INSTRUCTIONS

1. EMERGENCY EXIT (See figures 18 and 19)

If the canopy cannot be wound back by use of the cabin control crank (detail "A"), it can be jettisoned by pulling down on the emergency release handle (detail "B").

Airplanes AF42-104429 through AF42-104828 are equipped with a kickout panel on the left side of the canopy which can be used for an exit in the event of a nose-over. This panel can be unlocked by pulling the release lever "F" located on the lower left inboard canopy frame. Slide frame "G" aft with the release handle "F" until the kickout panel can then be pushed outboard. This panel may also be opened from the outside by pulling out and aft on the release handle "F" when the kickout locks are disengaged. (See figure 20).

2. ENGINE FAILURE DURING TAKE-OFF.

a. Release belly tank or bomb by pulling up on the "Bomb Tank Release" handle.

b. Immediately depress the nose in order to maintain flying speed.

c. Make sure that the landing gear has started to come up; if only unlocked and on the way up, it will collapse on landing. Continue to retract the landing gear until the visual indicators show the wheels to be completely retracted.

d. Turn the fuel selector valve "OFF".

e. Turn ignition switch "OFF".

f. Lower the wing flaps.

g. Turn the battery line switch "OFF".

h. Land straight ahead.

3. ENGINE FAILURE DURING FLIGHT.

a. Release belly tank or bomb if attached.

b. Maintain an approximate 130 mph glide.

c. If in doubt about terrain, land with landing gear retracted.

d. Turn the fuel selector valve "OFF".

e. Turn the ignition switch "OFF".

f. Lower flaps by pushing flap valve control into the down position. Then squeeze the electric hydraulic pump switch on the control stick below the hand grip until the visual indicator shows the flaps to be fully extended.

g. Turn the battery switch "OFF".

h. Open and lock the cockpit enclosure by operating control crank.

i. Land at minimum safe speed.

4. EMERGENCY OPERATION OF THE HYDRAULIC SYSTEM.

If the electric hydraulic pump fails, the landing gear can be lowered by the use of the auxiliary hand pump. The control valve will be operated in the same manner as if the electric pump was in operation. The hand pump will also operate the flaps, and raise or lower the tail wheel. Approximately 80 strokes are required to lower and lock the landing gear, and about 17 strokes to lower the flaps.

5. FUEL SYSTEM FAILURE.

a. Change selector valve to tank that has known quantity of fuel.

b. Check to see if fuel boost pump is on. If it is off, it is an indication that engine driven pump has failed. Immediately switch boost pump on.

6. FIRES.

Inasmuch as this airplane has no fire extinguishing devices, the pilot's actions will be governed by the existing operational procedures as indicated by the operating unit.

7. ELECTRICAL SYSTEM FAILURE.

Immediately throw propeller control into fixed pitch. Switch the generator off. Allow time to use emergency hydraulic hand pump to lower landing gear if wheels-down landing is considered.

Pg 42 Blank

SECTION V
OPERATIONAL EQUIPMENT

1. OPERATION OF OXYGEN EQUIPMENT.

a. OXYGEN EQUIPMENT.

(1) DESCRIPTION.

(a) GENERAL.—The airplane is equipped with a low pressure oxygen DEMAND system operating at a working pressure of 400 pounds per square inch, and must be used when operating above 10,000′ pressure altitude, between 8,000′ and 10,000′ for flights of over 4 hours duration, and from ground up for all combat or tactical flights at night. The oxygen demand system is fully automatic and provides the pilot with the proper amount of oxygen at all altitudes and under all conditions. Every time the pilot inhales, a shot of oxygen in proper mixture with air is given to him. The demand regulator, which controls the proportion of air and oxygen in the breathing mixture flowing to the pilot, requires the pilot to wear a DEMAND mask.

The equipment which is incorporated in the airplane oxygen system consists of two D-2 oxygen cylinders of 500 cubic inch capacity each (airplanes AF42-105029 and subsequent). The cylinders are cradled beneath the upper deck. In the event that one cylinder is disabled, the other may still be used. Airplanes AF42-104429 through AF42-105028 are equipped with one F-2 oxygen cylinder of 1000 cubic inch capacity cradled aft of the fuselage access door just above the bottom of the fuselage on the center line. There is also a type K-1 oxygen cylinder pressure gage, a type G-1 signal assembly, a type A-3 oxygen flow indicator, and a type A-12 oxygen demand regulator. A system of check valves and oxygen flow lines completes the installation. Refer to figures 40 and 41 for the location of the equipment in the airplane.

(b) DEMAND REGULATOR.—The type A-12 demand regulator (figure 38) is essentially a diaphragm-operated flow valve which is opened by the suction of the pilot's inhalation and closes automatically when that suction ceases. The demand regulator supplies the flier with the proper mixture of air and oxygen at all altitudes every time he inhales, and then shuts off when he exhales. The percentage of oxygen delivered to the flier increases with increasing altitude, becoming 100 per cent at an altitude of approximately 30,000 feet. It is very essential that air is mixed with the oxygen at low altitudes, because it is unnecessary and very uneconomical to supply pure oxygen at low altitudes.

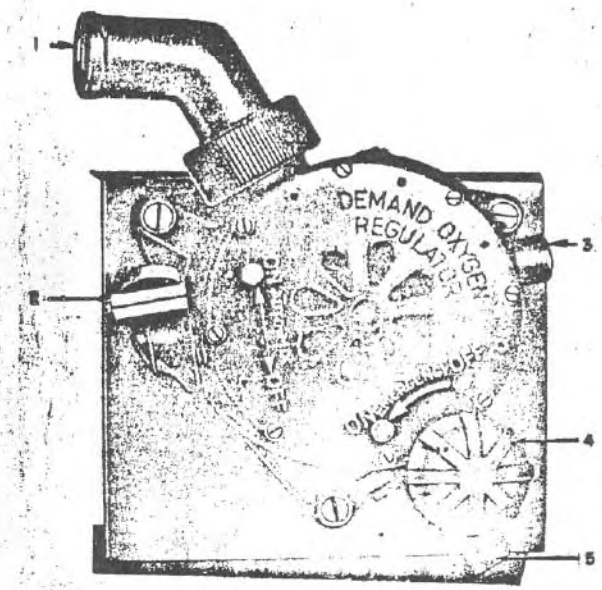


Figure 38—Oxygen Regulator

1. To Oxygen Mask
2. Automatic Mixture Control
3. To Flow Indicator
4. Emergency Control
5. Oxygen Intake

In normal use, the demand regulator is entirely automatic. Two manual controls are provided for use in special instances. One of these is labeled "AUTO-MIX" and the other "EMERGENCY". There are two positions for "AUTO-MIX" control; namely, "ON" and "OFF". The normal position is "ON". When the "AUTO-MIX" is "ON", the regulator automatically mixes the proper amount of air with the oxygen at all altitudes. When the "AUTO-MIX" is "OFF", the air port is closed and no air can enter the regulator. The regulator will then give PURE oxygen at all altitudes. Notice that when the "AUTO-MIX" is "ON", the radiant spot on the "AUTO-MIX" handle lines up approximately with the radiant spot on the regulator. When the "AUTO-MIX" is "OFF", the radiant spot on the handle is hidden.

At an altitude of 30,000 feet, the regulator is required to furnish more than 96 per cent of added oxygen. Therefore, at this altitude, it makes little difference whether the "AUTO-MIX" is "ON" or "OFF". However, if a flier turns the "AUTO-MIX" to "OFF"

position, he might descend to a lower altitude later and fly there for an extended period of time and forget to turn the "AUTO-MIX" on "ON" position again. He will waste his oxygen and might use up his supply before the mission is completed.

On extended flights at altitudes of 30,000 feet and higher, if the medical advice is to denitrogenate on the ground and use pure oxygen all the way up to avoid the effects of aero-embolism, then the "AUTO-MIX" must be turned "OFF" so that pure oxgyen will be furnished. When the "AUTO-MIX" is "OFF", the regulator is still a demand regulator and will automatically furnish oxygen on demand, but it will be PURE OXYGEN and will contain no air.

When the EMERGENCY valve is opened, the demand system is no longer in operation and the system automatically becomes a continuous or free flow system. The EMERGENCY valve should be opened only when the demand system fails to function. It is extremely wasteful if used when not needed.

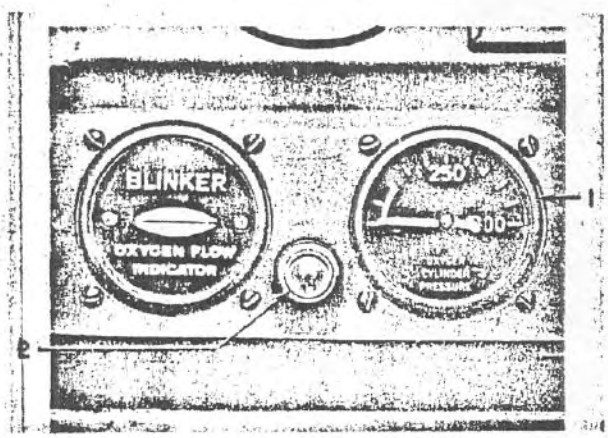


Figure 39—Oxygen Flow Indicator

1. Supply Warning Light
2. Pressure Gage

(c) OXYGEN FLOW INDICATOR. — The type A-3 flow indicator (figure 39) is used in conjunction with the type A-12 demand regulator. It gives a visual indication of the proper operation of the regulation unit by "blinking" at each inhalation of the pilot.

(d) OXYGEN CYLINDER PRESSURE GAGE AND SIGNAL LAMP.—The type K-1 pressure gage (figure 39) indicates the pressure of oxygen in the oxygen cylinders. The signal lamp is actuated by a type G-1 signal assembly in the supply line, and an amber light appears when the supply pressure falls below 100 pounds per square inch. When the light flashes, only one-seventh of the original supply remains and the pilot should descend. The supply should not be used when it decreases to less than 50 pounds per square inch, because no particular performance is required of the demand regulators below that pressure.

(e) OXYGEN MASK.—A type A-10 (revised) oxygen mask is available in four sizes: large, standard, small, and extra small. Only by individual fitting can the correct size be determined. The proper size for the face must be used. The size is marked on the chin of the mask. Since the demand regulator releases oxygen only in response to the suction of inhalation, the mask which is used with it must fit tightly to the face to insure an adequate supply at extreme altitudes. The mask consists of a face piece with an expiratory valve mounted in it, a connecting tube for oxygen supply, and straps for suspending it from the helmet, or a head harness.

(2) FILLING THE OXYGEN SYSTEM.—The oxygen cylinders may be filled without removing them from the airplane, by pushing the filler valve adapter from the recharging cylinders into the filler valve in the airplane. Push the adapter into the valve until it snaps in place. The filler valve is located just inside the fuselage access door. (See figures 40 and 41). Be sure the emergency valve on the regulator is closed tightly, and that no leaks exist in the system. Fill the oxygen cylinders to 425 pounds per square inch. DO NOT exceed 450 pounds per square inch. To disconnect the filler line from the filler valve assembly, trip the filler valve handle clockwise about ⅛ of a turn. Since pressure will blow the adapter out, securely hold the end of the hose near the filler valve before tripping the handle.

The airplane oxygen cylinders will become quite warm during the filling operation. After the cylinders cool to normal temperature, pressure in the airplane system will drop 20 to 30 pounds per square inch. After about one hour, pressure in the system will be approximately 400 pounds per square inch depending upon initial charging-pressure and atmospheric temperature.

CAUTION

Extreme caution must be exercised in the use of oxygen equipment to insure that none of it becomes contaminated with oil or grease. Fire or explosion may result when slight traces of oil and grease are in contact with oxygen under pressure. BE SURE THAT ALL LINES, FITTINGS, INSTRUMENTS, AND OTHER ITEMS ARE FREE FROM OIL, GREASE, AND OTHER FOREIGN MATTER.

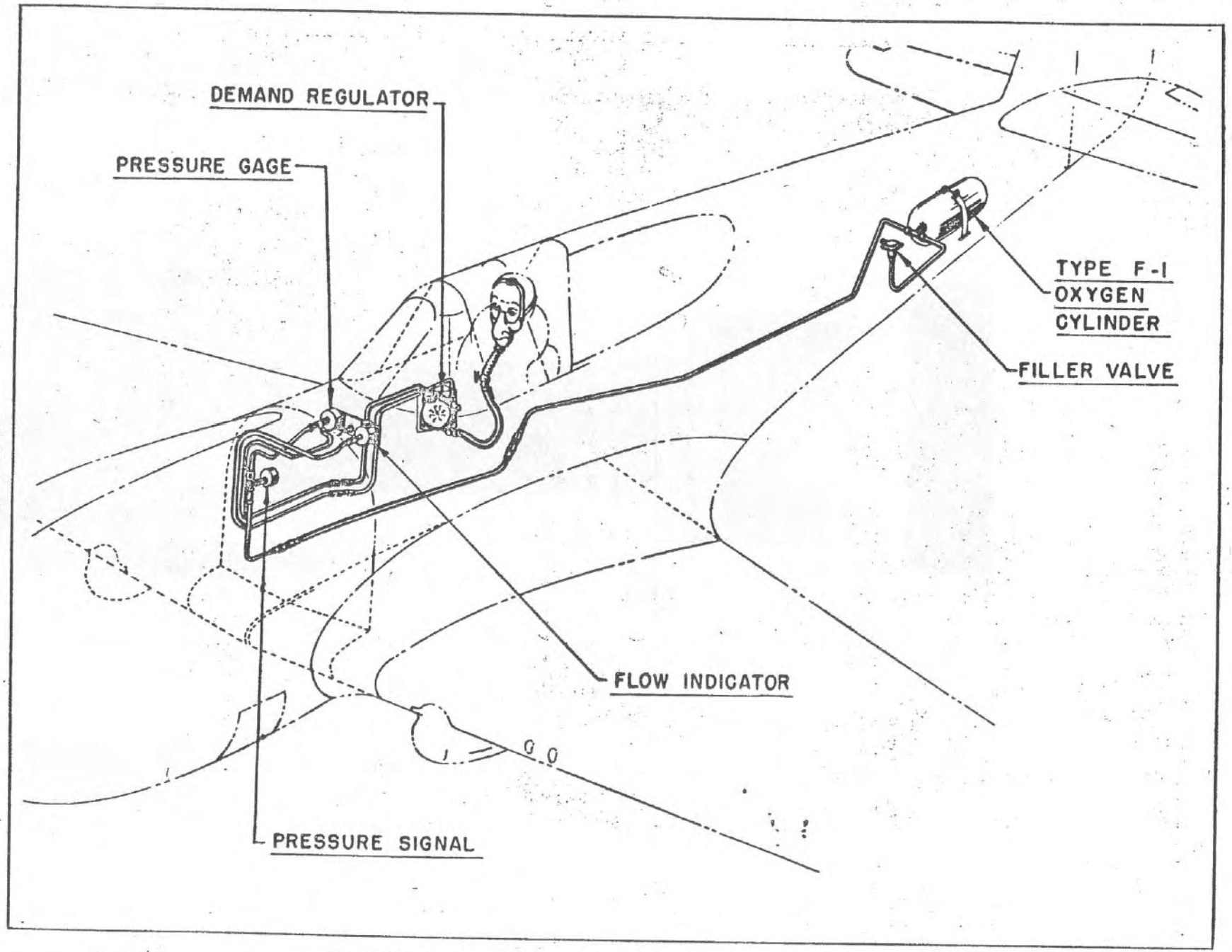


Figure 40—Oxygen System *AF42-104429 thru AF42-105028*

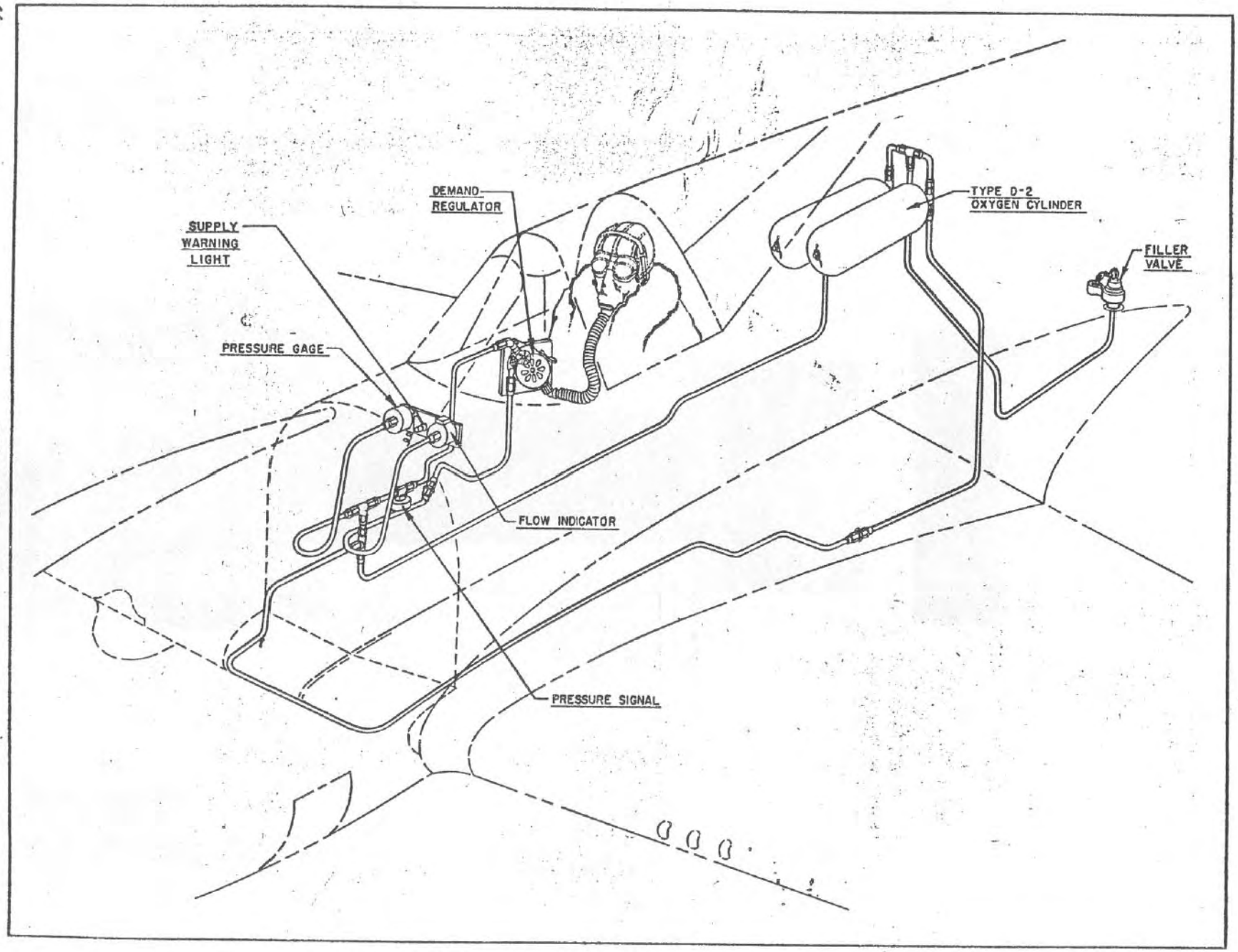


Figure 41—Oxygen System AF42-105029 and Subsequent

(3) USE OF THE OXYGEN EQUIPMENT.

(a) BEFORE FLIGHT.

1. Check pressure of the oxygen in the cylinders. It must not be less than 400 pounds per square inch.

2. Check the emergency flow to show that the lines are clear, and then close the "EMERGENCY" valve tightly.

3. Make sure that the knurled collar at the outlet end of the regulator is tight.

4. Be sure the male end of the rapid disconnect has its rubber gasket in place.

5. Be sure the male end of the rapid disconnect fit snugly into the female connection of the hose from the regulator. A pull of 10 pounds or more should be required to separate the two.

6. Have the mask adjusted for the particular helmet or headstrap to be used. The mask MUST be worn with a helmet. All helmets must be fitted with studs to which the mask is fastened.

CAUTION

A leak-proof fit is essential in a demand mask. A leak will dilute the necessary oxygen mixture with a possible result of unconsciousness and death at high altitudes. Be sure the mask you use is properly fitted at all times, and that an oxygen officer be contacted for assistance in determining the proper size required to accomplish a correct fit.

7. Clip the oxygen supply hose by means of the spring clip onto the clothing or parachute harness close enough to the face so that the tube of the mask will permit free movement of the head without kinking or pulling.

8. Be sure the "AUTO-MIX" is in the "ON" position except when the medical advice is to denitrogenate on the ground and use pure oxygen during the flight, then the "AUTO-MIX" should be in the "OFF" position.

(b) DURING FLIGHT.

1. Manipulate the mask to free it of ice at regular intervals when the temperature is low enough to cause ice formation in the mask.

2. Check the mask for leakage frequently during flight, by blockage and gentle inhalation.

CAUTION

In testing masks, it sometimes is the practice to close off the connecting tube to the mask by crimping it in the hand and judging the tightness of the mask by sharp inhalations. If the emergency knob is "ON" when the mask tubing is tested, the rubber diaphragm under the cover plate will rupture. It is VERY IMPORTANT to make sure that the knob is turned "OFF" at this time.

3. Should signs of impending anoxia appear, open the "EMERGENCY" valve of the regulator only if it is absolutely necessary.

4. Check the oxygen pressure gage frequently.

5. Check the oxygen flow indicator frequently.

NOTE

No provisions are made to prevent the oxygen regulator from freezing because of low temperature at high altitudes. While this is not likely to happen, it is advisable to keep the cockpit warm whenever oxygen is being used.

(c) AFTER FLIGHT.

1. Wipe mask dry, or better, wash with soap and water.

2. DO NOT lend your mask except in case of extreme emergency.

3. Inspect for cracks and leaks in the face piece of the mask.

4. Change the strap adjustment only to take up on natural stretch slack.

(4) OXYGEN DURATION.—For two type D-2 oxygen cylinders, or one type F-2 cylinder, filled to an initial pressure of 400 pounds per square inch, the oxygen duration is as follows:

Altitude	Duration in Hours
20,000′	2.2
30,000′	2.1

NOTE

The duration time for an initial cylinder pressure of less than 400 pounds per square inch is reduced proportionately.

Example:—The duration of two type D-2 cylinders, or one type F-2 cylinder, at 30,000 feet with 300 pounds per square inch initial pressure is:

$$2 \text{ hours} \times \frac{300}{400} = 1.5 \text{ hours}$$

NOTE

The system of check valves as shown on figures 40 and 41 provides equal drain from both cylinders, and prevents exhaustion of the entire oxygen supply if one of the cylinders is punctured. The pressure gage will indicate the pressure of the highest charged cylinder if both cylinders are not at equal pressure.

2. OPERATION OF COMMUNICATIONS EQUIPMENT.

a. GENERAL.—The radio equipment consists of two alternate radio sets, namely SCR-274-N and SCR-522-A. Since these two sets differ considerably, they will be described separately. All control units necessary for operating either radio are located on the right side of the cockpit where they are readily accessible to the pilot. The radio call plate is located on the instrument panel. The SCR-438 Detrola radio (figure 43) is a portable range receiver used with the SCR-522-A installation (figure 42). It covers the frequency range from 200 to 400 kilcycles (beacon and weather band).

CAUTION

Due to the fact that high voltages are present in this communications equipment, do not remove any wiring harness plugs while the set is turned on.

b. RADIO SET SCR-522-A. (Figures 42 and 43).

(1) DESCRIPTION.—This radio consists of a transmitter, receiver, and dynamotor mounted in the fuselage just forward of the baggage compartment. Control boxes for this radio are provided in the cockpit. One to four predetermined receiving channels and one to four predetermined transmitting channels are available. This radio is turned on and frequency selection is made by depressing one of the push-buttons marked "A", "B", "C", or "D" on the top of the main control box. The latter unit is located on the right side of the airplane immediately forward of the oxygen regulator.

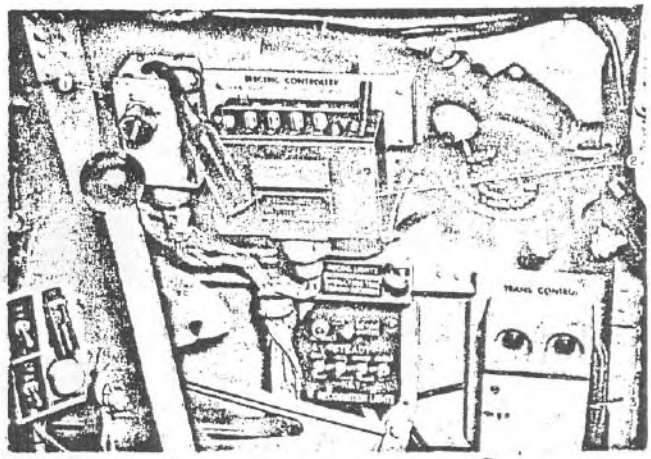


Figure 42—SCR-522-A Radio Controls

1. BC 629 Jack Box
2. Control Box
3. Microphone Adapter

(2) RECEIVING.—To operate the set as a receiver, first plug the headphones into the jack provided on the end of the headset-microphone extension cord. Next, select the desired receiving channel by depressing the corresponding push-button on the top of the control unit. (The toggle switch on the top of this control unit should remain lockwired in the "REM" position at all times.) After the set has been allowed to warm-up for about one minute, adjust the volume of the signal in the headset by manipulating the volume control on the jack box cover just forward of the control unit.

(3) TRANSMITTING.—To operate the set as a transmitter, plug the microphone into the jack provided in the end of the headset-microphone extension cord. Select the desired channel by use of the proper push-button on top of the control unit. After allowing approximately one minute for the tubes to warm-up, transmission can be made by depressing the "press-to-talk" button in the throttle-handle and speaking into the microphone. If the set is being used as a receiver, it is possible to start transmission immediately merely by pushing the throttle "press-to-talk" button and

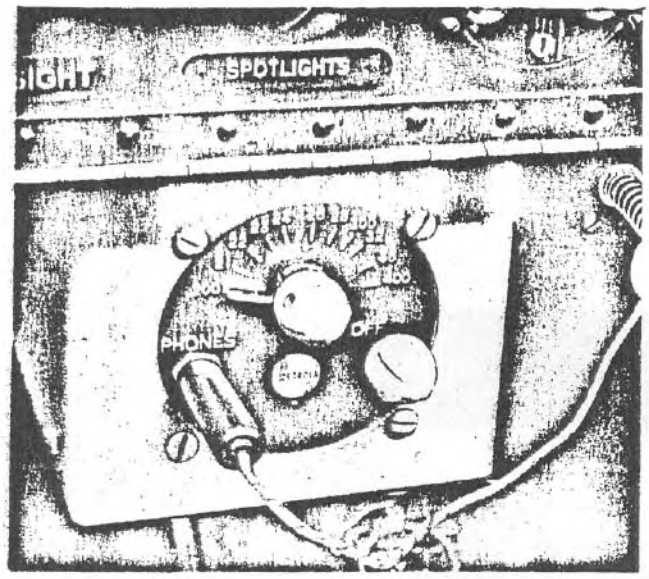


Figure 43—SCR-438 Radio Controls

speaking into the microphone since all the tubes in the set are sufficiently warmed-up. Also, the set may be switched from one channel to another as occasion demands while in either the "transmit" or "receive" condition, by pushing the desired channel push-button.

(4) Depressing the "OFF" push-button on top of the control box turns off both receiver and transmitter.

c. RADIO SET SCR-274-N (Figure 44).

(Alternate for SCR-522-A).

(1) DESCRIPTION. — This set consists of a transmitter, receiver, dynamotor, and antenna relay mounted in the fuselage forward of the baggage compartment. Controls for operating the radio are located in the cockpit.

(2) RECEIVING.—The receiver control box is located on the right side of the cockpit immediately below the longeron and forward of the oxygen regulator. Only one section of this control unit is used depending upon which receiver is installed.

(a) To operate the receiver, first plug the headphone extension cord into the jack on control box marked "A TEL." On airplanes AF42-106246 and subsequent, a type MC-385 headset adapter is provided to allow the use of low impedance type headsets. It is located aft of the transmitter control box. (The three position switch in the upper left corner of control section should always be in "A" position). Next turn the receiver power supply on by turning the switch at the upper right of the control section to the "CW" or "MCW" position. If voice transmission is to be received, the switch should be in "MCW" position, and for reception of code transmission, the switch should be in "CW" position. Adjust the FL-8 filter control for voice or range reception or both, as desired.

(b) After allowing the tubes in the receiver to warm up for about 15 seconds, select the frequency to be received by using the "TUNING" control. The volume of the signal in the headset can be regulated by use of the knob marked "INCREASE OUTPUT". To turn the receiver off, place the "CW-OFF-MCW" switch in the "OFF" position.

(3) TRANSMITTING. — The transmitter control box is located on the right side of the cockpit below the oxygen regulator. To operate the transmitter, first plug the microphone extension cord into the jack marked "MIC" on the control box. One transmitter only is installed and manipulation of the "selector switch" on the control unit is not necessary. Turn the transmitter power switch to the "ON" position and allow about 15 seconds for the transmitter tubes to warm up. (This switch will normally be left in the "ON" position throughout the flight to eliminate repetition of the warm-up period.)

(a) If voice transmission is desired, turn the "TONE-CW-VOICE" switch to "VOICE" position, depress the "press-to-talk" button in the throttle handle

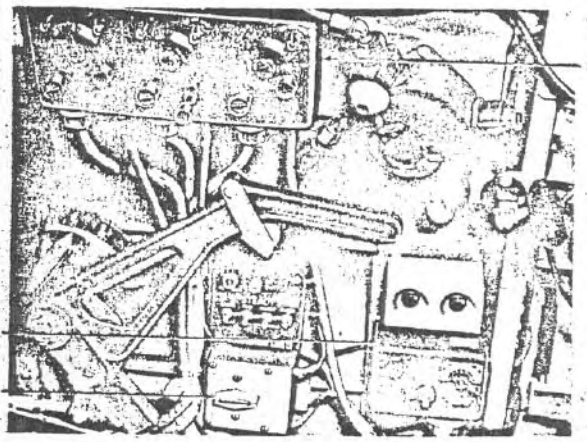


Figure 44—SCR-274-N Radio Controls

1. Transmitter Control Box
2. FL-8 Filter
3. Receiver Control

and speak into the microphone. If "TONE" or "CW" transmission is to be made, turn the switch to that position and "key" the transmitter, using the key on top of the control unit.

(b) To turn the transmitter off, it is necessary only to turn the transmitter power switch to the "OFF" position.

WARNING

Never leave the "TONE-CW-VOICE" switch in either "TONE" or "CW" position except when that particular type of transmission is being utilized. Failure to follow this precaution will result in excessive current drain on the airplane's electrical supply.

d. RADIO COMPASS MODEL MN-26( ). (Figure 45.)

(1) DESCRIPTION.—The radio compass equipment consists of a radio compass receiver, loop and sense antennae. Controls in the cockpit include a remote control unit located below the main switch panel, an azimuth control unit located on the right hand cockpit wall and a left-right indicator on the instrument panel.

(2) OPERATION OF CONTROLS. — Tuning the receiver is accomplished with a crank on the remote control unit. Above the tuning crank is a frequency band selector switch. Three frequency bands are available.

A four pole selector switch provides compass operation or use of either the vertical or loop antenna in connection with the receiving operation. The audio knob regulates the level of the audio signal in the headset when using compass operation. When the equipment functions as a receiver in either REC., ANT., or REC. LOOP positions, the audio knob controls the gain of the receiver permitting radio range reception. The knob entitled "COMPASS" regulates deflection in the left-right indicator.

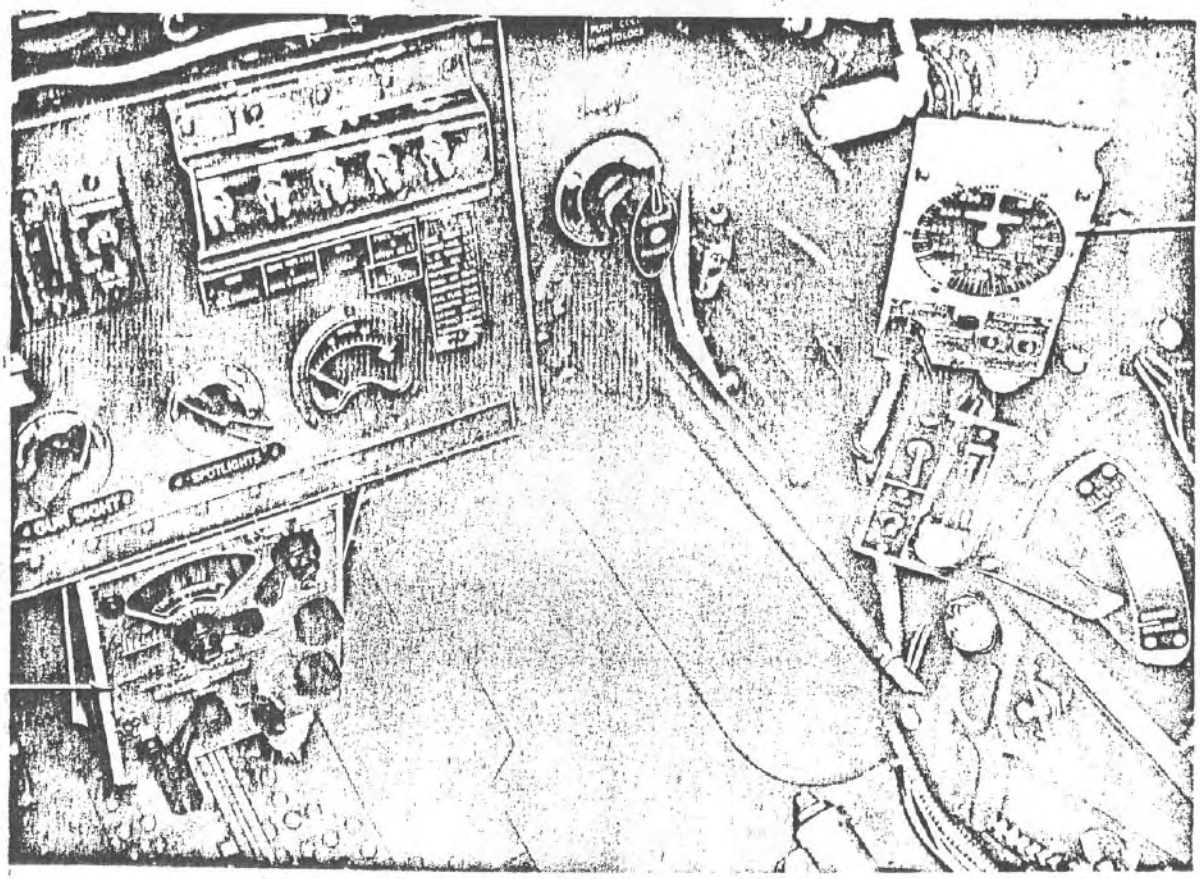


Figure 45—MN26 Radio Controls

1. Remote Control
2. Azimuth Control

The azimuth control unit has a dial indicating degrees of rotation of the loop antenna. When using compass operation, the crank on the unit is turned until zero deflection is registered on the left-right in-

dicator. This indicates "on-course" position. The compass circuits are arranged so that when flying in the direction of the transmitting station a course correction to the left causes the indicator needle to move toward the right. Likewise a course correction to the right causes the needle to move toward the left. If a course correction to the right or the left is accompanied by a deflection of the indicating needle in the same direction the station is aft.

3. OPERATION OF ARMAMENT.

a. WING GUN OPERATION.

(1) This airplane has provision for six .50 calibre machine guns. On airplanes AF42-104429 to AF42-104903 those allocated to beneficiary governments include six .50 calibre machine guns installed by the contractor. Airplanes in this group which were not allocated to beneficiary governments include four installed by the contractor and two sent as loose equipment. On airplanes AF42-104903 and subsequent, all airplanes are equipped with six .50 calibre machine guns installed by the contractor.

(2) The ammunition boxes carry 235 rounds of ammunition per gun as a normal load.

(3) Each gun must be charged manually with the ground charger assembly which is stowed on the inside of the gun access door on each wing panel. It is essential that all guns be charged before take-off as this operation cannot be accomplished in flight. Guns will not fire until charged. A manual charger is stowed on each gun bay door. Refer to the instructions on the gun bay door for procedure for charging the guns.

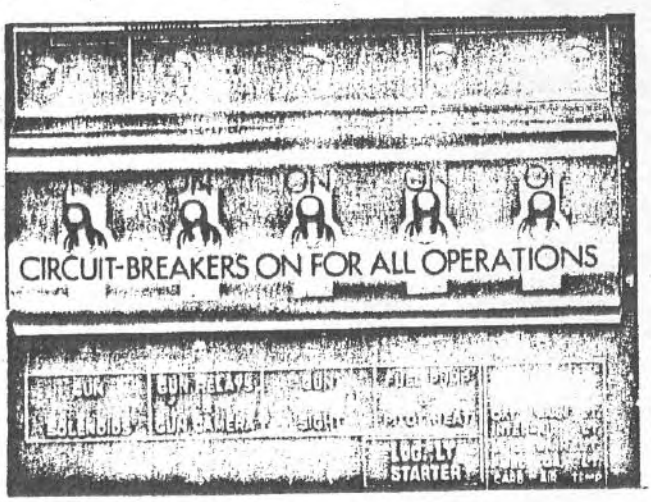


Figure 46—Armament Circuit Breakers

(4) Guns are fired by throwing the gun safety switch (figure 47) on the main switch panel to "All Guns On", and placing the gun circuit breakers (figure 46) in the "ON" position. Squeeze the trigger switch on the forward side of the control stick hand grip, for the desired burst.

b. GUN SIGHT OPERATION.

(1) The gun sight is a Type N-3B or N-3C located above the instrument panel, extending aft, on the centerline of the airplane. It is equipped with a sun screen which may be raised or lowered in front of the reflector glass by a lever on the left side of the sight. A crash pad is installed on the gun sight.

(2) To operate the gun sight, place the gun sight rheostat on the main switch panel (figure 14), in the "ON" position [the battery switch (figure 14), must be "ON"], and be sure the gun circuit breakers (figure 46) are "ON". A short circuit in the gun sight electrical system will cause the gun electrical circuit to become inoperative. In this case, turn off the gun sight rheostat (figure 14) and reset the circuit breakers (figure 46).

(3) On airplanes AF43-22752 and subsequent, a type A-1 bomb sight adapter is used with the type N-3B gun sight. It is a modified type of head with an adjustable reflector. A system of adjustable cam stops, which vary the angle of the reflector, makes possible a quick change from bombing to gunnery or vice versa. The first cam stop back of the dial is used to set in a gunnery position and the other ones may be preset for preselected sighting angles to be used in bombing.

c. BELLY AND WING BOMBS.

(1) Provision is made for loading several types of belly and wing bombs as an alternate load in place of the belly or wing tanks.

The maximum allowable bomb load which may be carried on P-40N aircraft is 2500 pounds. This may consist of two 1000-pound wing bombs and one 500-pound belly bomb.

The maximum allowable combination of fuel and bombs that can be installed externally is two 1000-pound wing bombs and one 75-gallon belly tank.

(2) The "Bomb-Tank Release" handles (figure 32) are mounted on a tripod with the arming control on the left side of the cockpit floor beneath the throttle quadrant.

(3) To release the bomb for an armed drop, pull the arming handle up as far as it will go and then pull the release handle. Never exceed a dive of 60 degrees when releasing a belly bomb or the bomb may not clear the propeller disc.

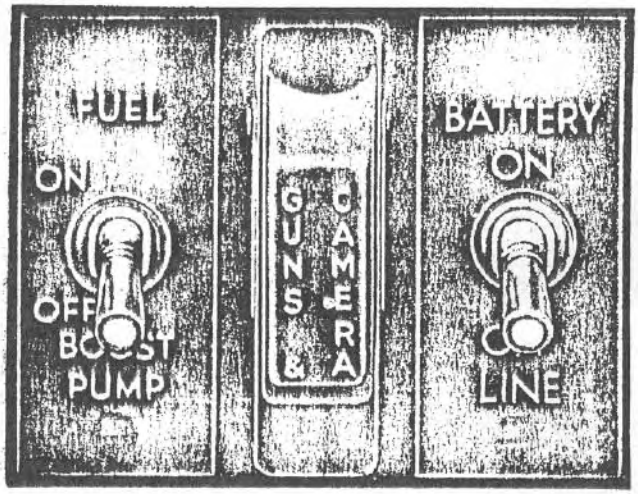


Figure 47—Gun Safety Switch

(4) To release the belly bomb for a safe drop, do not pull the arming handle up. If the arming handle has been pulled up for an armed drop, and the pilot decides not to drop the bomb, push down on the spring controlled lever in front of the tripod support and the arming handle will return to the "Safe" position.

WARNING

All aerobatics are prohibited when auxiliary tanks or bombs are installed.

d. GUN CAMERA.

A type N-2 or N-6 gun camera is mounted inside the right wing landing gear fairing. It is designed to start taking motion pictures simultaneously with the firing of the guns and will stop when firing ceases. The camera may not be used without placing the "GUN SAFETY SWITCH", (figure 47) in the "ON" position. To operate, throw on the "GUN SAFETY SWITCH", then squeeze the trigger switch on the flight control stick.

APPENDIX I
GLOSSARY OF NOMENCLATURE

U. S. A.	BRITISH
Airfield	Aerodrome
Airplane	Aircraft or Aeroplane
Auxiliary Tank	Slip or Drop Fuel Tank
Battery	Accumulator
Ceiling	Cloud Height
Course	Track Angle
Empennage	Tail Unit
Filter, Air	Air Cleaner
Flare	Signal Star or Signal Projectile
Fuel	Petrol
Fuel Gage	Fuel Contents Gage or Fuel Level Indicator
Generator	Dynamo
Glass, Bulletproof	Armour Glass
Gyro, Directional	Gyroscopic Turn Indicator
Gyro Horizon	Artificial Horizon
Heading	Course
Landing Gear	Undercarriage
Lean	Weak
Left	Port
(to) Level Off	(to) Flatten Out
Line, Mooring	Mooring Guy, Picketing Line
Manifold Pressure Regulator	Boost Control Unit
Mast, Radio	Rod, Aerial
Pressure, Manifold	Boost Pressure
Prime	Dope
Propeller	Air Screw (Obsolete)
Right	Starboard
Speed, Indicated Air	Air-Speed-Indicator Reading
Stabilizer	Tail Plane
Tab, Trim	Trimming Tab
Tachometer	Rev. Counter
Tube (Radio)	Valve
Weight (Empty)	Tare Weight
Windshield	Windscreen
Wing	Main Panel

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APPENDIX II
FLIGHT OPERATING CHARTS AND TABLES, AND CRUISING INSTRUCTIONS WITH EXTERNAL AUXILIARY (FERRYING) FUEL TANKS

TABLE I
CRUISING WITH AUXILIARY FUEL TANKS INSTALLED

No.	Tanks	Range	Take-Off Ground Run
A	1—170 US (142 Imp.) gal.	1700 miles	2500 ft.
B	2—170 US (142 Imp.) gal.	2200 miles	3800 ft.
C	2—225 US (187.2 Imp.) gal.	3100 miles	4500 ft.

WARNING

Aerobatics are prohibited with these tanks installed.

LOADING NOTES

All data contained herein is based on P-40N airplanes with 35 US (29.1 Imperial) gallons front wing tank installed. Decrease range 200 miles for airplanes without front wing tanks.

Ranges are also based on omission of ammunition load. In general, refrain from carrying load items not essential to ferrying operation where such items are available at destination.

1. TAKE-OFF.

Engine rpm.	3000
Manifold pressure	52 in. Hg.
Wing Flaps	See (a) below
Rudder Trim Tab	2 degrees right
Elevator Trim Tab	See (b) below
Take-Off Speed	135 mph indicated
Fuel	Fuselage tank
Mixture	Auto-rich

a. Set wing flaps between ¼ and ½ on cockpit control. This will give approximately 15 degrees down setting.

b. Set elevator trim tab one degree tail heavy.

c. Get speed to 145 mph as soon as practicable after take-off.

d. Get landing gear up as soon as possible after take-off.

e. Do not retract wing flaps below 160 mph.

f. Ship handles best with cowl flaps as nearly closed as possible while not exceeding coolant temperature of 120°C (248°F). Recommended two notches open from neutral for take-off.

g. NOTICE: Airplane may have a slight wallowing tendency in take-off and climb, particularly if cowl flaps are too far open. This should be no cause for alarm; the airplane is controllable in this condition.

h. EMERGENCY: In case of emergency immediately after take-off, DROP AUXILIARY TANKS BEFORE LANDING.

i. If shortest possible take-off distance is desired, set wing flaps at ½ on cockpit control. If ample distance is available, between ¼ and ½ gives better handling characteristics.

WARNING

SET WING FLAPS BY LOWERING THEM COMPLETELY, THEN BRING THEM UP TO DESIRED SETTING WHILE GROUND CREW APPLIES AN UP LOAD ON THE FLAPS. THIS ELIMINATES DANGER OF TAKING OFF WITH AIR IN FLAP ACTUATING CYLINDERS.

DO NOT TAKE OFF WITHOUT FLAPS. AFTER TAKE-OFF, RETRACT FLAPS GRADUALLY AND NOT UNDER 160 MPH.

2. CLIMB.

a. NORMAL CLIMB.—Climb at 160 mph at 2600 rpm and 30.5 inches manifold pressure, automatic rich.

b. CRUISING CLIMB.

(1) Climb at 160 mph at 2280 rpm and 30.8 inches manifold pressure, automatic rich.

NOTE

Cruising climb will be most economical of fuel and is recommended when conditions permit a long, slow climb to cruising altitude.

(2) Do not allow speed to drop below 145 mph in climb.

(3) Adjust cowl flaps to give 115° to 120°C (239° to 248°F) coolant temperature.

(4) Climb to cruising altitude on fuselage tank, and cruise on fuselage tank until 30 minutes after take-off.

3. CRUISING CONTROL.

The operating conditions given in table I have been set up as a simple and practical guide for maximum range cruising operation for the various tank installations.

4. CRUISING.

a. Follow cruising control charts and table for maximum range.

b. Mixture setting in automatic lean.

c. Cowl flaps set to give 115° to 120°C (239° to 248°F) coolant temperature.

d. Use fuselage tank for 30 minutes after take-off, internal wing tanks for 30 minutes, then switch to auxiliary tanks until empty. (Internal wing tanks are interconnected when two auxiliary tanks are installed.)

e. The recommended cruising altitude is 10,000 feet.

WARNING

DO NOT LAND WITH FULL AUXILIARY TANKS. DO NOT PERFORM AEROBATICS OR VIOLENT MANEUVERS OF ANY KIND WITH AUXILIARY TANKS INSTALLED.

5. EMERGENCY ONLY.

If it becomes necessary in an emergency to obtain the absolute maximum range:

a. DROP AUXILIARY TANKS AS SOON AS THEY ARE EMPTY.

b. If possible, reduce speed 10 mph below chart and rpm as low as practicable.

c. Lean out mixture by setting propeller in fixed pitch and leaning out the mixture control until 10 to 20 rpm decrease in engine speed is experienced. Return propeller to automatic. This operation must be done with caution because operating on too lean a mixture will cause engine damage and possible failure. Use only if absolutely necessary. If too close to idle cut-off, engine will stop; have sufficient altitude to recover.

Do not exceed 30 inches of manifold pressure in automatic lean.

Use fuel according to following schedule: (Internal wing tanks are interconnected for ferrying installation with two auxiliary tanks). It is important that the fuel valve settings are determined by the "click and feel" method, and not solely by the dial indication.

Fuselage tank	30 min. (from take-off)
Wing tanks	30 min.
Auxiliary tanks	Until empty, switching from left to right as necessary to trim ship if carrying two auxiliary tanks.
Fuselage tank	Until empty
Wing tanks	To completion of flight

WARNING

Do not land with full auxiliary tanks.

TABLE II
TRUE AIRSPEEDS

Indicated Airspeed	True Speeds at 5,000 ft.	10,000 ft.	15,000 ft.
Mph	Mph	Mph	Mph
180	200	216	233
177	196	212	229
174	193	208	226
171	190	205	222
167	185	200	217
164	182	197	213
160	178	192	208
157	175	189	204
154	171	185	200

6. GENERAL.

a. Do not dive or stunt with auxiliary tanks attached.

b. Do not exceed an indicated airspeed of 260 mph.

c. Do not be alarmed at slight wallowing tendencies of the airplane in flight.

d. Stalling speeds are higher than normal with the auxiliary tanks attached — always keep safe flying speed.

e. Do not exceed 30 inches manifold pressure in automatic lean.

f. WARNING: DROP AUXILIARY TANKS.

(1) If it is necessary to land and an appreciable amount of fuel remains in the tanks.

(2) If the absolute maximum range must be obtained after auxiliary tanks are empty.

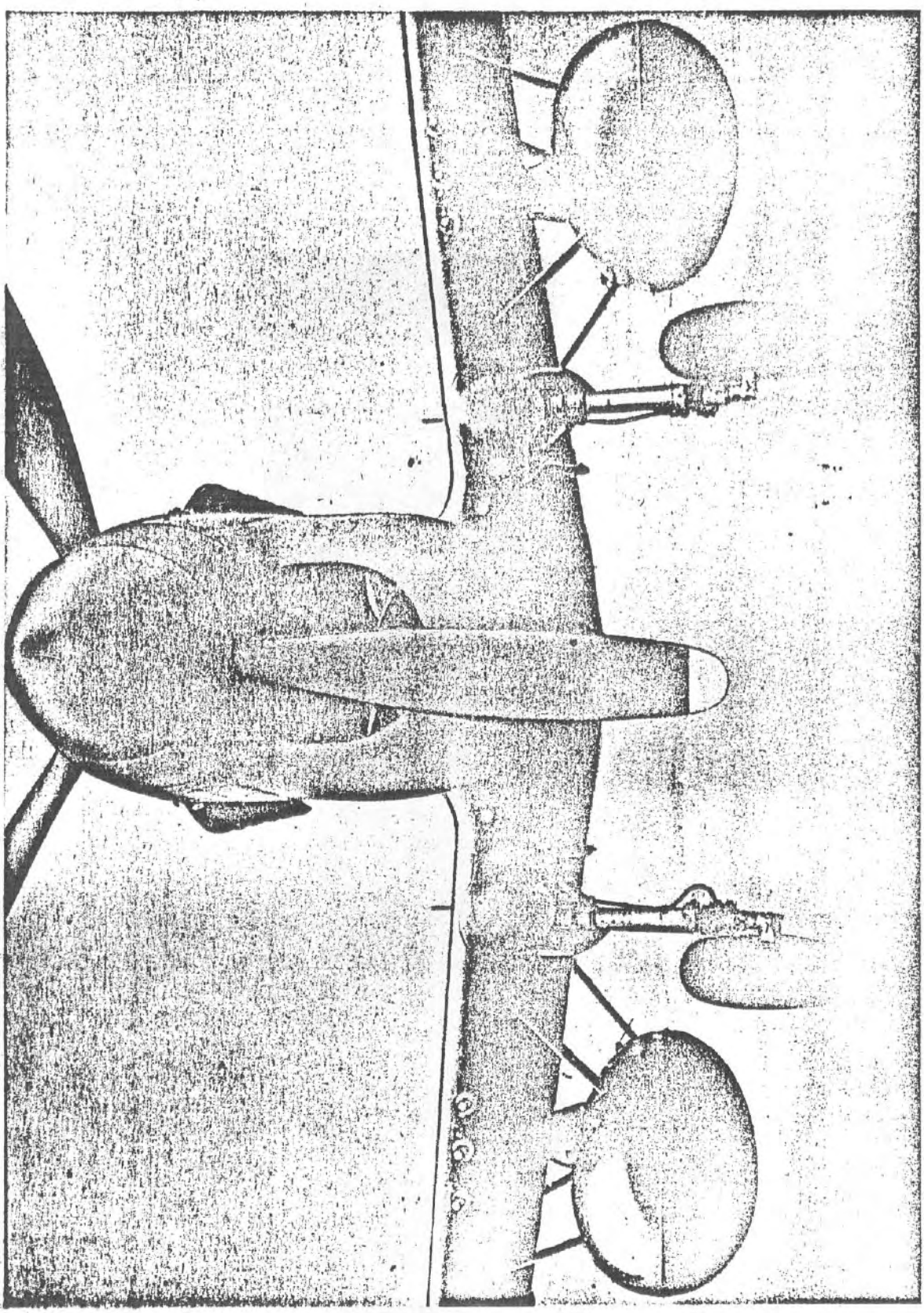

Figure 48—225 Gallon Auxiliary Wing Tank Installation

SPEC. AS-44-3 Dec. 15, 1942 FORM ASC-510

AIRPLANE MODELS
P-40N

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
ALLISON V-1710-81
ALLISON V-1710-99

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	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.
8400	0		1100	1850	1250	2100	1500	2650	1100	1850	1300	2150	1600	2600	1150	1900	1400	2250	1700	2750
	20		700	1250	800	1450	1000	1850	700	1300	850	1500	1050	1900	750	1300	900	1600	1100	1950
	40		350	850	400	950	600	1200	350	850	450	1000	600	1200	400	900	500	1050	650	1250
7800	0		950	1600	1100	1800	1300	2250	950	1600	1150	1850	1400	2150	1000	1650	1200	1950	1450	2350
	20		550	1050	700	1250	850	1550	550	1050	700	1250	850	1600	600	1100	750	1350	900	1650
	40		300	700	350	800	500	1000	300	700	350	800	500	1000	300	750	400	850	550	1050
7200	0		800	1350	900	1500	1100	1850	800	1350	950	1550	1150	1850	850	1400	1000	1600	1200	1900
	20		450	850	600	1050	700	1300	450	850	600	1050	700	1300	500	900	650	1100	750	1350
	40		250	550	300	650	400	850	250	550	300	650	400	850	250	600	350	700	450	850

NOTE: INCREASE DISTANCE 8 % FOR EACH 10°C ABOVE 0°C (9 % FOR EACH 20°F ABOVE 32°F)

ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 52 IN. HG

COMBAT MISSIONS USE 3000 RPM & 44.2 IN. HG

CLIMB DATA

FERRY MISSIONS USE 2280 RPM & 30.7 IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S. L. TO 3000 FT. ALT.				10,000 FT. ALT.					15,000 FT. ALT.					20,000 FT. ALT.					25,000 FT. ALT.					BLOWER CHANGE
		BEST I.A.S.		FT/MIN	TIME FROM S. L.	BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.	BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.	BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.	BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.	
		MPH	KNOTS			MPH	KNOTS			U. S. IMP.	MPH	KNOTS			U. S. IMP.	MPH	KNOTS			U.S. IMP.	MPH	KNOTS			U.S. IMP.	
8400	COMBAT	155		1900	1.6	150		2000	5.1	28	150		1800	7.7	34	145		1200	11.0	40	140		350	17.0	48	
	FERRY	145		750	4.0	145		800	12.4	30	145		850	17.9	38	140		650	24.0	46						
7800	COMBAT	150		2200	1.4	145		2300	4.5	27	145		2200	6.7	33	140		1550	9.4	38	140		850	13.5	45	
	FERRY	140		900	3.4	140		950	10.4	29	140		1000	15.5	37	135		850	21.0	44						
7200	COMBAT	140		2600	1.2	140		2700	3.8	26	140		2500	5.7	32	140		1850	8.0	36	135		1250	11.2	42	
	FERRY	135		1100	2.7	135		1150	9.0	28	135		1200	13.4	36	135		950	18.0	42						

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (6 % FOR EACH 20°F ABOVE 32°F) FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH		HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	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.	GROUND ROLL
8400	100		1750	1100	1850	1200	2000	1300	1850	1200	1950	1300	2100	1400	3100	2450	3350	2700	3650	2950
7200	95		1550	950	1700	1050	1800	1150	1650	1050	1800	1150	1900	1250	2800	2200	3000	2350	3250	2600

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS

USUAL
I.A.S.: Indicated Air Speed
M.P.H.: Miles Per Hour
S.L.: Sea Level
U.S.: U. S. Gallons
IMP.: Imperial Gallons
NOTE: All Distances are Average

W-1-1-43-3M

SPEC. AS-1000 Dec. 15, 1942 FORM AS2-510

AIRPLANE MODELS

P-40N WITH 75 GAL. BELLY TANK OR 500 LB. BOMB.

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS

ALLISON V-1710-81

ALLISON V-1710-99

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	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.
8900	0		1600	2650	1900	3200	2300	3800	1650	2750	1950	3200	2400	3900	1750	2850	2050	3350	2550	4050
	20		950	1900	1200	2250	1500	2700	1050	2000	1250	2300	1550	2750	1100	2100	1300	2350	1700	2900
	40		500	1200	650	1500	850	1800	550	1250	700	1550	950	1850	600	1300	750	1600	1000	1850
7900	0		1200	2000	1400	2350	1700	2800	1250	2100	1450	2350	1750	2850	1300	2150	1500	2450	1850	2950
	20		700	1400	900	1650	1100	2000	750	1450	900	1650	1100	2000	800	1550	950	1700	1200	2100
	40		400	850	500	1050	600	1300	400	900	500	1050	650	1300	450	950	550	1100	700	1300

NOTE: INCREASE DISTANCE 8 % FOR EACH 10°C ABOVE 0°C (9 % FOR EACH 20°F ABOVE 32°F)

ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 52 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 3000 RPM & 44.2 IN. HG

FERRY MISSIONS USE 2280 RPM & 30.7 IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S. L. TO 3000 FT. ALT.				10,000 FT. ALT.						15,000 FT. ALT.						20,000 FT. ALT.						25,000 FT. ALT.						BLOWER CHANGE
		BEST I.A.S.		FT/MIN	TIME FROM S.L.	BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		
		MPH	KNOTS			MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	
8900	COMBAT	140		1500	2.0	140		1600	6.5	32		145		1500	9.6	40		140		900	13.6	49								
	FERRY	135		500	5.9	135		550	18.5	34		135		600	26.7	47		130		300	37.4	57								
7900	COMBAT	135		2100	1.4	135		2200	4.7	28		140		2100	7.0	34		135		1450	9.8	39		130		750	14.5	46		
	FERRY	130		800	3.7	130		850	12.0	30		130		900	17.6	39		130		600	24.2	46								
	COMBAT																													
	FERRY																													

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (6 % FOR EACH 20°F ABOVE 32°F) FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH		HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	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.	GROUND ROLL
8400	105		1600	1050	1750	1150	1850	1250	1700	1150	1850	1250	1950	1350	2850	2300	3100	2500	3350	2750
7500	100		1450	950	1000	1000	1700	1100	1550	1050	1650	1100	1800	1200	2550	2050	2800	2250	3000	2400

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS

LEGEND
I.A.S.: Indicated Air Speed
M.P.H.: Miles Per Hour
S.L.: Sea Level
U.S.: U. S. Gallons
IMP.: Imperial Gallons
NOTE: All Distances are Average

WF-1-1-42-3M

MODEL (S)
P-40 N

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 3 SHEETS

GR. WT. 8400 TO 6600 POUNDS

EXTERNAL LOAD ITEMS
NONE

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION (IN MIN.)	U.S. G.P.H.	
TAKE-OFF	3000	52		A.R.	5	148	
MILITARY POWER	3000	44.2		A.R.	15	135	
ENGINE (S)	ALLISON V-1710-81						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns II, III, IV & V toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND) — ALTERNATE CRUISING CONDITIONS — (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
S.L.	12,000	S.L.	12,000	159									
375	330	325	290	130	545	470	640	560	690	600		770	670
350	305	300	265	120	500	435	590	515	635	550		710	615
320	280	275	245	110	460	400	545	475	585	505		650	565
290	255	250	220	100	420	365	495	430	530	460		590	515
260	230	225	200	90	375	325	445	385	475	415		535	460
230	205	200	180	80	335	290	395	345	425	370		475	410
205	180	175	155	70	290	255	345	300	370	320		415	360
175	155	150	135	60	250	220	295	260	320	275		355	310
145	130	125	110	50	210	180	245	215	265	230		295	255
115	100	100	90	40	165	145	195	170	210	185		240	205
85	75	75	65	30	125	110	150	130	160	140		180	155
60	50	50	45	20	85	75	100	85	105	90		120	105
30	25	25	20	10	40	35	50	45	55	45		60	50

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.
						30000																			30000						
2600	194	A.R.	F.T.	81	295	25000																			25000	2300	169	A.L.	F.T.	43	256
2600	223	A.R.	F.T.	102	312	20000	2600	220	A.R.	31	73	307							2250	198	A.L.	F.T.	52	276	20000	2000	179	A.L.	F.T.	42	249
2600	246	A.R.	F.T.	122	318	15000	2300	228	A.R.	31	70	294	2300	215	A.L.	29	56	277	2000	206	A.L.	F.T.	50	266	15000	1800	181	A.L.	25	39	232
2600	249	A.R.	38.3	120	308	12000	2300	230	A.R.	31	68	284	2300	216	A.L.	29	54	266	1900	206	A.L.	29	48	254	12000	1800	179	A.L.	25	37	220
2600	252	A.R.	38.3	116	297	9000	2300	232	A.R.	31	66	274	2300	218	A.L.	29	52	257	1850	206	A.L.	29	46	242	9000	1800	174	A.L.	24	34	203
2600	253	A.R.	38.3	107	287	6000	2300	234	A.R.	31	63	265	2300	218	A.L.	29	50	246	1850	206	A.L.	29	43	232	6000	1800	167	A.L.	24	32	188
2600	253	A.R.	38.3	98	274	3000	2300	234	A.R.	31	61	253	2300	217	A.L.	29	48	234	1850	204	A.L.	29	41	219	3000						
2600	253	A.R.	38.3	90	262	S.L.	2300	234	A.R.	31	58	241	2300	216	A.L.	29	45	222	1800	202	A.L.	29	39	207	S.L.						

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 29 U. S. GALS. FOR WARM UP

TAKE-OFF AND CLIMB TO 9000 FEET ALTITUDE

RETURN FUEL FLOWS TO TANK FUSELAGE

USE FUEL FROM TANKS IN THE FOLLOWING ORDER

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg.)
U.S.G.P.H.: U. S. Gallons Per Hour
T.A.S.: TRUE AIR SPEED
F.T.: Full Throttle

11-26-42

MODEL (S)
P-40N

FLIGHT OPERATION INSTRUCTION CHART

SHEET 2 OF 3 SHEETS

GR. WT. 8900 TO 7800 POUNDS

EXTERNAL LOAD ITEMS
ONE 75 GAL. AUXILIARY TANK OR
ONE 500 LB. BOMB

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	
TAKE-OFF	3000	52		A.R.	5	148	
MILITARY POWER	3000	44.2		A.R.	15	135	
ENGINE (S)	ALLISON V-1710-81						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND)

ALTERNATE CRUISING CONDITIONS

(NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
SL.	12,000	SL.	12,000	234			(34 GAL. FUEL NOT AVAILABLE IN FLIGHT)					OPERATION UNCERTAIN USE COLUMN IV UNTIL WEIGHT IS REDUCED TO 7800 LB.	
550	490	480	425	200	770	670	1010	875	1080	935			
495	440	430	385	180	695	600	910	790	970	845			
440	390	385	340	160	615	535	810	700	865	750			
385	345	335	300	140	540	465	710	615	755	655			
330	295	290	255	120	470	400	605	525	650	560			
275	245	240	215	100	385	335	505	440	540	470			
220	195	190	170	80	310	270	405	350	430	375			
165	145	145	130	60	230	200	305	260	325	280			
110	100	95	85	40	155	135	200	175	215	185			
55	50	50	45	20	75	65	100	90	110	95			

OPERATING DATA						(1) DENSITY ALT. IN FEET	II OPERATING DATA						III OPERATING DATA						IV OPERATING DATA						(1) DENSITY ALT. IN FEET	V OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.
						30000																			30000					
						25000																			25000					
2600	184	A.R.	F.T.	81	280	20000	2500	207	A.R.	30	75	289							2250	181	A.L.	F.T.	47	252	20000					
2600	212	A.R.	F.T.	102	296	15000	2250	215	A.R.	31	72	277	2300	197	A.L.	29	50	252	2000	189	A.L.	F.T.	45	243	15000					
2600	235	A.R.	F.T.	122	304	12000	2250	217	A.R.	31	70	268	2300	200	A.L.	29	49	246	1900	189	A.L.	29	43	233	12000					
2600	239	A.R.	38.3	120	296	9000	2250	218	A.R.	31	67	257	2250	200	A.L.	29	47	235	1850	189	A.L.	29	41	222	9000					
2600	241	A.R.	38.3	116	284	6000	2250	220	A.R.	31	64	248	2200	199	A.L.	29	44	224	1850	189	A.L.	29	39	212	6000					
2600	242	A.R.	38.3	107	274	3000	2250	220	A.R.	31	62	237	2150	199	A.L.	29	42	214	1850	187	A.L.	29	37	200	3000					
2600	242	A.R.	38.3	98	261	S.L.	2250	220	A.R.	31	59	227	2150	197	A.L.	29	40	202	1800	185	A.L.	29	35	189	S.L.					
2600	241	A.R.	38.3	90	249																									

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.
(2) ALLOW 34 U. S. GALS. FOR WARM UP
TAKE-OFF AND CLIMB TO 9000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK FUSELAGE
USE FUEL FROM TANKS IN THE FOLLOWING ORDER

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour
T.A.S. TRUE AIR SPEED
F.T.: Full throttle

MODEL (S)
P-40 N

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 3 SHEETS

GR. WT. 8400 TO 6600 POUNDS

EXTERNAL LOAD ITEMS
NONE

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION (IN MIN.)	U.S. G.P.H.	
TAKE-OFF	3000	52		A.R.	5	148	
MILITARY POWER	3000	44.2		A.R.	15	135	
ENGINE (S)	ALLISON V-1710-81						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns II, III, IV & V toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND) — ALTERNATE CRUISING CONDITIONS — (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
S.L.	12,000	S.L.	12,000	159									
375	330	325	290	130	545	470	640	560	690	600		770	670
350	305	300	265	120	500	435	590	515	635	550		710	615
320	280	275	245	110	460	400	545	475	585	505		650	565
290	255	250	220	100	420	365	495	430	530	460		590	515
260	230	225	200	90	375	325	445	385	475	415		535	460
230	205	200	180	80	335	290	395	345	425	370		475	410
205	180	175	155	70	290	255	345	300	370	320		415	360
175	155	150	135	60	250	220	295	260	320	275		355	310
145	130	125	110	50	210	180	245	215	265	230		295	255
115	100	100	90	40	165	145	195	170	210	185		240	205
85	75	75	65	30	125	110	150	130	160	140		180	155
60	50	50	45	20	85	75	100	85	105	90		120	105
30	25	25	20	10	40	35	50	45	55	45		60	50

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.
						30000																			30000						
2600	194	A.R.	F.T.	81	295	25000																			25000	2300	169	A.L.	F.T.	43	256
2600	223	A.R.	F.T.	102	312	20000	2600	220	A.R.	31	73	307							2250	198	A.L.	F.T.	52	276	20000	2000	179	A.L.	F.T.	42	249
2600	246	A.R.	F.T.	122	318	15000	2300	228	A.R.	31	70	294	2300	215	A.L.	29	56	277	2000	206	A.L.	F.T.	50	266	15000	1800	181	A.L.	25	39	232
2600	249	A.R.	38.3	120	308	12000	2300	230	A.R.	31	68	284	2300	216	A.L.	29	54	266	1900	206	A.L.	29	48	254	12000	1800	179	A.L.	25	37	220
2600	252	A.R.	38.3	116	297	9000	2300	232	A.R.	31	66	274	2300	218	A.L.	29	52	257	1850	206	A.L.	29	46	242	9000	1800	174	A.L.	24	34	203
2600	253	A.R.	38.3	107	287	6000	2300	234	A.R.	31	63	265	2300	218	A.L.	29	50	246	1850	206	A.L.	29	43	232	6000	1800	167	A.L.	24	32	188
2600	253	A.R.	38.3	98	274	3000	2300	234	A.R.	31	61	253	2300	217	A.L.	29	48	234	1850	204	A.L.	29	41	219	3000						
2600	253	A.R.	38.3	90	262	S.L.	2300	234	A.R.	31	58	241	2300	216	A.L.	29	45	222	1800	202	A.L.	29	39	207	S.L.						

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 29 U. S. GALS. FOR WARM UP

TAKE-OFF AND CLIMB TO 9000 FEET ALTITUDE

RETURN FUEL FLOWS TO TANK FUSELAGE

USE FUEL FROM TANKS IN THE FOLLOWING ORDER

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg.)
U.S.G.P.H.: U. S. Gallons Per Hour
T.A.S.: TRUE AIR SPEED
F.T.: Full Throttle

11-26-42

MODEL (S)
P-40N

FLIGHT OPERATION INSTRUCTION CHART

SHEET 2 OF 3 SHEETS

GR. WT. 8900 TO 7800 POUNDS

EXTERNAL LOAD ITEMS
ONE 75 GAL. AUXILIARY TANK OR
ONE 500 LB. BOMB

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	
TAKE-OFF	3000	52		A.R.	5	148	
MILITARY POWER	3000	44.2		A.R.	15	135	
ENGINE (S)	ALLISON V-1710-81						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND)

ALTERNATE CRUISING CONDITIONS

(NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
SL.	12,000	SL.	12,000	234			(34 GAL. FUEL NOT AVAILABLE IN FLIGHT)					OPERATION UNCERTAIN USE COLUMN IV UNTIL WEIGHT IS REDUCED TO 7800 LB.	
550	490	480	425	200	770	670	1010	875	1080	935			
495	440	430	385	180	695	600	910	790	970	845			
440	390	385	340	160	615	535	810	700	865	750			
385	345	335	300	140	540	465	710	615	755	655			
330	295	290	255	120	470	400	605	525	650	560			
275	245	240	215	100	385	335	505	440	540	470			
220	195	190	170	80	310	270	405	350	430	375			
165	145	145	130	60	230	200	305	260	325	280			
110	100	95	85	40	155	135	200	175	215	185			
55	50	50	45	20	75	65	100	90	110	95			

OPERATING DATA						(1) DENSITY ALT. IN FEET	II OPERATING DATA						III OPERATING DATA						IV OPERATING DATA						(1) DENSITY ALT. IN FEET	V OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S.
						30000																			30000					
						25000																			25000					
2600	184	A.R.	F.T.	81	280	20000	2500	207	A.R.	30	75	289							2250	181	A.L.	F.T.	47	252	20000					
2600	212	A.R.	F.T.	102	296	15000	2250	215	A.R.	31	72	277	2300	197	A.L.	29	50	252	2000	189	A.L.	F.T.	45	243	15000					
2600	235	A.R.	F.T.	122	304	12000	2250	217	A.R.	31	70	268	2300	200	A.L.	29	49	246	1900	189	A.L.	29	43	233	12000					
2600	239	A.R.	38.3	120	296	9000	2250	218	A.R.	31	67	257	2250	200	A.L.	29	47	235	1850	189	A.L.	29	41	222	9000					
2600	241	A.R.	38.3	116	284	6000	2250	220	A.R.	31	64	248	2200	199	A.L.	29	44	224	1850	189	A.L.	29	39	212	6000					
2600	242	A.R.	38.3	107	274	3000	2250	220	A.R.	31	62	237	2150	199	A.L.	29	42	214	1850	187	A.L.	29	37	200	3000					
2600	242	A.R.	38.3	98	261	S.L.	2250	220	A.R.	31	59	227	2150	197	A.L.	29	40	202	1800	185	A.L.	29	35	189	S.L.					
2600	241	A.R.	38.3	90	249																									

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.
(2) ALLOW 34 U. S. GALS. FOR WARM UP
TAKE-OFF AND CLIMB TO 9000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK FUSELAGE
USE FUEL FROM TANKS IN THE FOLLOWING ORDER

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour
T.A.S. TRUE AIR SPEED
F.T.: Full throttle

FLIGHT OPERATION INSTRUCTION CHART

SHEET 3 OF 3 SHEETS

MODEL (S) P-40N

GR. WT. 7800 TO 6600 POUNDS

EXTERNAL LOAD ITEMS: ONE 75 GAL. AUXILIARY TANK OR ONE 500 LB. BOMB

CONDITION	R.P.M.	M.P. (IN. HG)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.
TAKE-OFF	3000	52		A. R.	5	148
MILITARY POWER	3000	44.2		A. R	15	135

ENGINE (S): ALLISON V-1710-81

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. **NOTES:** (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U. S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
S.L.	12,000	S.L.	12,000			(30 GAL. FUEL NOT	AVAILABLE		IN FLIGHT)				
415	370	360	320	150	575	500	760	655	815	710		860	750
385	345	335	300	140	540	470	710	615	765	660		805	700
360	320	310	275	130	500	435	655	570	710	615		745	650
330	295	290	255	120	460	400	605	525	655	570		690	600
300	270	265	235	110	425	370	555	485	600	520		630	550
275	245	240	215	100	385	335	505	440	545	475		575	500
250	220	215	190	90	350	300	455	395	490	425		520	450
220	195	190	170	80	310	270	405	350	435	380		460	400
195	170	170	150	70	270	235	355	305	380	330		405	350
165	145	145	130	60	230	200	305	260	325	285		345	300
140	125	120	105	50	195	165	250	220	275	235		290	250
110	100	95	85	40	155	135	200	175	220	190		230	200
85	75	70	65	30	115	100	150	135	165	140		175	150
55	50	50	45	20	75	65	100	90	110	95		115	100
30	25	25	20	10	40	35	50	45	55	45		60	50

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	T.A.S.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	T.A.S.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. N. Hg	U.S. G. P. H.	T.A.S.
						30000																			30000					
2600	186	A.R.	F.T.	81	283	25000																			25000	2250	160	A.L.	F.T.	42	242
2600	215	A.R.	F.T.	102	300	20000	2600	211	A.R.	30	76	294							2250	186	A.L.	F.T.	48	259	20000	1950	167	A.L.	F.T.	40	232
2600	238	A.R.	F.T.	122	308	15000	2300	218	A.R.	31	73	281	2300	202	A.L.	29	52	260	2000	194	A.L.	F.T.	46	250	15000	1800	169	A.L.	24	38	217
2600	242	A.R.	38.3	120	299	12000	2300	220	A.R.	31	71	272	2300	203	A.L.	29	50	250	1900	194	A.L.	29	44	239	12000	1800	166	A.L.	24	36	204
2600	243	A.R.	38.3	116	287	9000	2300	221	A.R.	31	68	260	2300	204	A.L.	29	48	240	1850	194	A.L.	29	42	228	9000	1800	161	A.L.	24	33	188
2600	244	A.R.	38.3	107	276	6000	2300	222	A.R.	31	65	251	2250	204	A.L.	29	46	230	1850	194	A.L.	29	40	218	6000	1800	150	A.L.	23	29	167
2600	244	A.R.	38.3	98	264	3000	2300	223	A.R.	31	63	241	2250	203	A.L.	29	43	218	1850	192	A.L.	29	38	206	3000						
2600	243	A.R.	38.3	90	251	S.L.	2300	223	A.R.	31	60	230	2150	202	A.L.	29	41	207	1800	190	A.L.	29	36	194	S.L.						

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 30 U. S. GALS. FOR WARM UP

TAKE-OFF AND CLIMB TO 9000 FEET ALTITUDE

RETURN FUEL FLOWS TO TANK FUSELAGE

USE FUEL FROM TANKS IN THE FOLLOWING ORDER

WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour
T.A.S.: TRUE AIR SPEED
F.T.: Full Throttle

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.