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PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODEL
P-40F and P-40L

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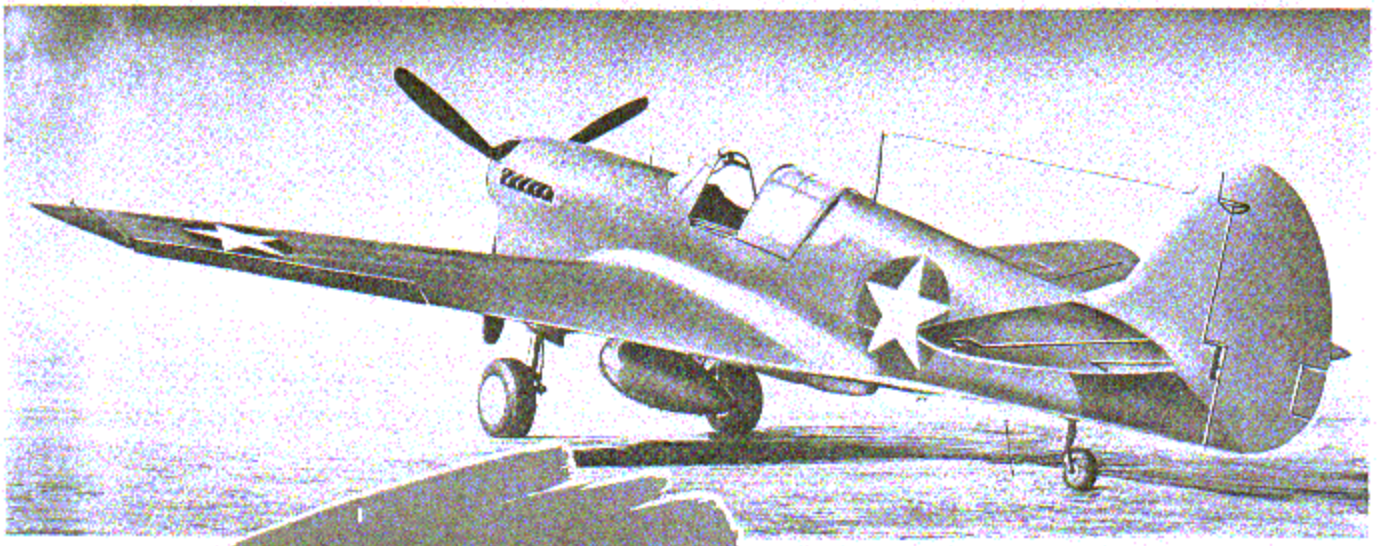
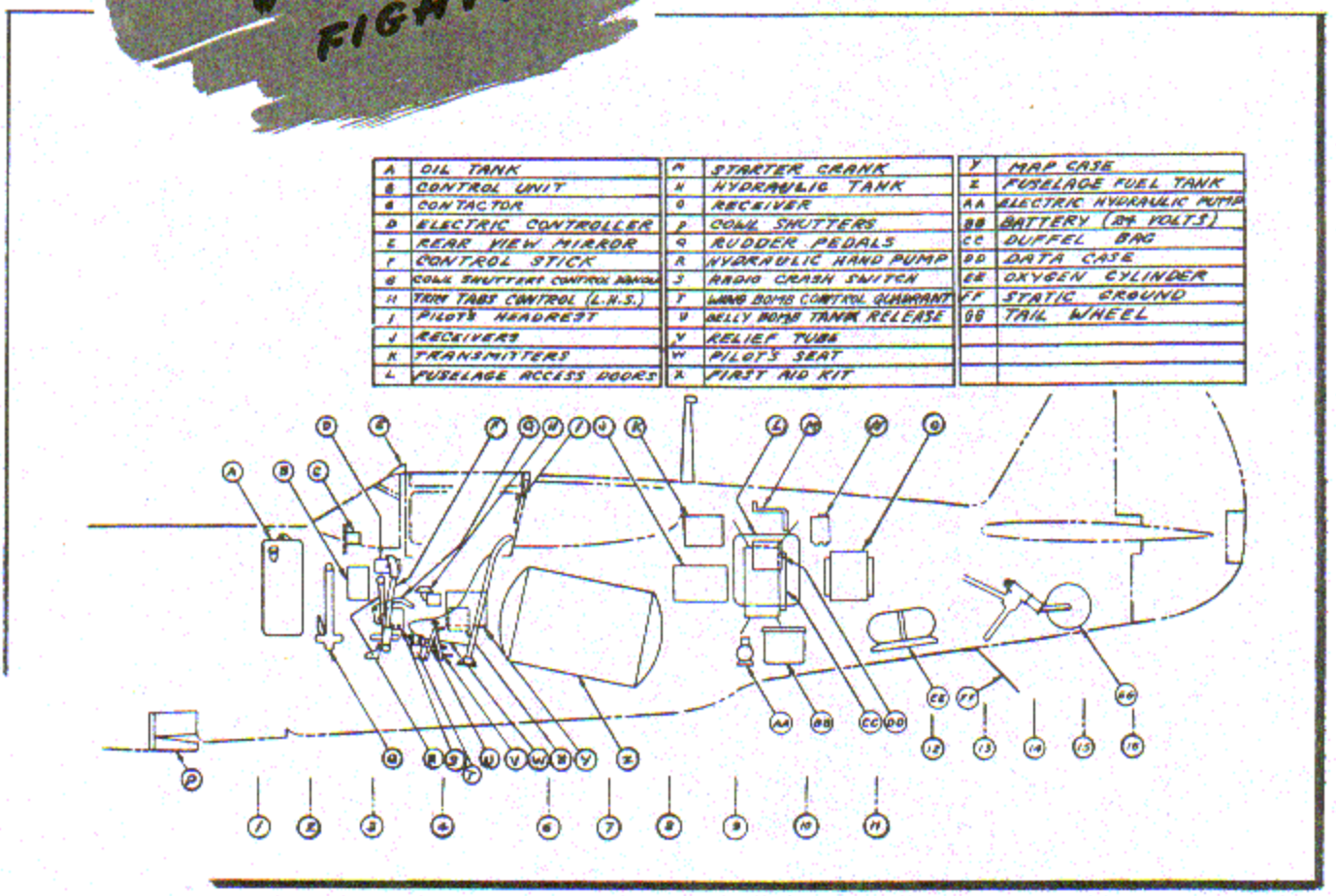


P-40 FIGHTER

Figure 1 - Three-Quarter Rear View Complete Airplane

Figure 2 - Fuselage Contents



SECTION I

DESCRIPTION

1. AIRPLANE.

a. GENERAL DESCRIPTION. - The P-40F Airplane is a single place, low wing monoplane. (See figure 1.) The over-all dimensions for airplanes AC-41-13600 through AC-41-14299 are: span 37 feet, 3-1/2 inches; length 31 feet, 7-23/32 inches; and height at rest 10 feet, 7-25/32 inches.

For P-40F airplanes AC-41-14300 and subsequent and all P-40L airplanes, the over-all dimensions are: span 37 feet, 3-1/2 inches; length 33 feet, 3-23/32 inches; and height at rest 10 feet, 7-25/32 inches.

b. WING.

(1) GENERAL. - The wing is of the stressed-skin type, consisting of two panels joined at the center line of the airplane. The area where the wing panels are joined is so constructed that in the event of a landing with the main landing gear retracted, the possibility of damage to the primary structure and injury to the pilot is minimized.

The wing tips are detachable.

(2) AILERONS. - The fabric-covered ailerons are dynamically and aerodynamically balanced. The left aileron is equipped with an electrically controlled trim tab, which can be adjusted, while the airplane is in flight, by operating the respective momentary contact toggle switch in the cockpit. The right aileron is equipped with a fixed position trim tab which can be adjusted only while the airplane is on the ground.

(3) WING FLAPS. - The wing flaps are of the split-trailing edge type, extending from the inboard end of the ailerons to near the center line of the airplane and are attached to each wing panel by a piano-type hinge. The flaps are normally operated by the electrically driven hydraulic pump or, in the event of electrical hydraulic pump failure, by the auxiliary hydraulic hand pump.

(a) P-40F. - The position of the flaps can be determined by the "Flap" pointer in the wheel and flap position indicator, located on the instrument panel.

(b) P-40L. - The flap position indicator consists of a peg which rises from the top trailing edge of the left wing. This peg is fully extended from the wing when the flaps are full down. Colored bands on the peg indicate the degree of extension of the flaps as follows:

Yellow	- 15 degrees
Yellow and Green	- 30 degrees
Green and Red	- 45 degrees

c. EMPENNAGE. - The horizontal and vertical stabilizers are of all-metal construction attached in fixed alignment to the fuselage. The metal construction, fabric-covered, rudder and elevators are dynamically balanced, and are equipped with metal-covered, flush-type trim tabs which are manually controlled from the cockpit.

d. FUSELAGE. - The fuselage is of semimonocoque-type construction, fabricated of aluminum-alloy sheet. The engine mount is constructed of steel tubes which are attached, by steel forgings, to the fuselage. The fuselage structure just aft of the pilot's seat is of sufficient strength to support the airplane in turn-over position. The fuselage access door is on the left side of the fuselage just forward of the horizontal stabilizer.

e. LANDING GEAR.

(1) GENERAL. - The landing gear is fully retractable. Each of the two main landing gear assemblies, and the tail gear assembly is equipped with an oleo-pneumatic shock absorber strut and a retracting mechanism which is operated hydraulically. During the retraction of the main landing gear, the wheels and the struts are drawn aft and up, rotating about bevel gears until the wheels, in retracted position, lie flush within the wheel pockets within the lower surface of the wing. When the tail gear is retracted, it is completely enclosed within the aft part of the fuselage by two hinged doors which are operated by the tail gear retracting mechanism. The operation of the landing gear is controlled by the landing gear control handle on the hydraulic selector valve which is located at the left of the pilot.

(2) MAIN LANDING GEAR. - The main landing gear is locked automatically in both the extended and retracted positions by hydraulically operated positive-type mechanical locks.

(a) P-40F. - A warning horn signal switch, which is operated by a cam on the throttle control rod when the throttle is retarded to approximately 1000 rpm or less, sounds a warning horn when the main landing gear is not locked "DOWN" in the safe landing position. The warning horn is located in the upper left side of the fuselage just aft of the turn-over bulkhead at station No. 5.

(b) P-40L. - A landing gear warning light located in the upper left of the instrument panel, lights if the throttle is closed when the landing gear is not locked down. There is no warning horn installed on P-40L airplanes.

(3) TAIL GEAR. - The tail gear is locked automatically in the extended position by the hydraulically operated positive mechanical locks. It is held in the retracted position by hydraulic pressure in the retracting cylinder. The tail wheel is steerable by the rudder pedals throughout the range of rudder pedal travel. The steering horn is automatically disengaged from the tail wheel knuckle at approximately 30 degrees from either side of the longitudinal axis, and the wheel and knuckle are free to swivel throughout the remainder of the 360 degrees.

(4) WHEEL POSITION INDICATOR.

(a) P-40F. - A wheel and flap position indicator is mounted on the left side of the instrument panel. Three tabs in the indicator show the relative position of the main landing gear wheels and the tail wheel, and a pointer indicates the position of the wing flaps. When the main landing gear is locked in the extended position, the indicator tabs will suddenly jump to the full "DOWN" position, indicating that the locks have been positively engaged.

(b) Indicator consists of a yellow peg which rises directly above the oleo strut hinge on both right and left landing gears when the gear is down.

(5) WHEELS AND BRAKES. - The main landing gear wheels are of special design, equipped with eight-ply, 30-inch outside diameter, smooth-contour type casings. The brakes are hydraulically operated and are of conventional design. The tail wheel is equipped with a 12.5-inch outside diameter, smooth-contour type casing. A control is provided for locking the brakes when the airplane is parked.

2. POWER PLANT.

a. ENGINE.

(1) GENERAL. - The airplane is powered by the model V-1650-1 Rolls Royce engine manufactured by the Packard Motor Car Company. The engine is a liquid cooled, 12-cylinder, 60-degree "vee" type having a bore of 5.4 inches, a stroke of 6 inches, and a total piston displacement of 1649 cubic inches. The compression ratio is 6.0 to 1. The engine incorporates spur-type reduction gears which drive the propeller at a ratio of .477 to 1 crankshaft speed. The supercharger is a single stage two-speed centrifugal unit having a 10.25-inch diameter impeller which is driven at a ratio of 1.151 to 1 crankshaft speed when the engine is operating in "LOW" blower, and a ratio of 9.490 to 1 crankshaft speed when operating in "HIGH" blower. The carburetion is furnished by model PD-16-A-1 incorporating automatic altitude mixture control and idle cut-off. The engine also incorporates an automatic manifold pressure regulator (boost control) which limits the manifold pressure to a maximum of 48.24 inches Hg absolute, when operating below full throttle height. It maintains the pressure at any predetermined figure within the limits of the regulator for any given position of the pilot's throttle lever. The action of the unit superimposes an automatic control upon that of the hand-operated throttle lever, thereby relieving the pilot of the necessity of adjusting the throttle position to maintain the desired manifold pressure.

(2) WAR EMERGENCY.

(a) For emergency use in combat or precombat areas in cases of extreme emergency an emergency manifold pressure may be obtained by moving the emergency manifold control lever provided in the pilot's cockpit to the "OUT" position. When using the War Emergency Rating, low blower should always be used below 8000 feet altitude and high blower should be used above 8000 feet. War Emergency Ratings are given in section III, "Specific Engine Flight Chart"; however, all engines will have to be campaigned for modification of the boost control before the maximum manifold pressure of 61 inches Hg may be obtained.

(b) After use of the War Emergency Rating the crew chief should be notified as to the length of time the rating has been used so that he may take the necessary action.

(3) ENGINE PERFORMANCE.

Normal Rated Power - 9,500-foot altitude

Rated Power	1080 brake hp
Rated Speed	2650 rpm
Blower Gear Ratio	Low
Manifold Pressure	44.2 in Hg abs (+ 7 lb/sq in.)

Rated Take-off Performance

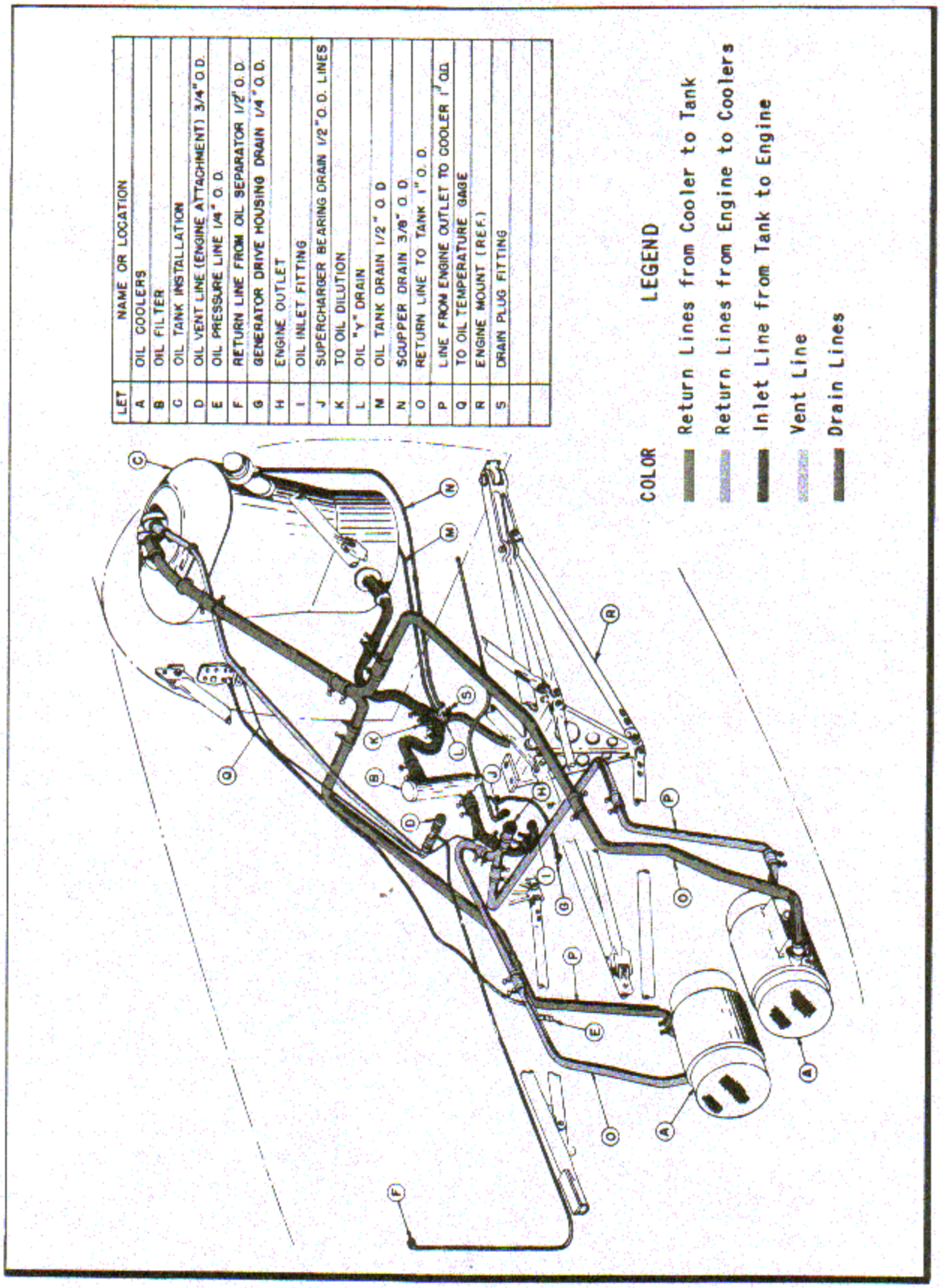
Rated Power	1300 brake hp
Rated Speed	3000 rpm
Blower Gear Ratio	Low
Manifold Pressure	54.3 in Hg abs (+ 12 lb/sq in.)

Military Rating Low Blower Gear Ratio

Rated Power	1240 brake hp
Rated Speed	3000 rpm
Altitude	11,500 ft
Manifold Pressure	48.24 in Hg abs (+ 9 lb/sq in.)

Military Rating High Blower Gear Ratio

Rated Power	1120 brake hp
Rated Speed	3000 rpm
Altitude	18,500 ft
Manifold Pressure	48.24 in Hg abs (+ 9 lb/sq in.)



LET	NAME OR LOCATION
A	OIL COOLERS
B	OIL FILTER
C	OIL TANK INSTALLATION
D	OIL VENT LINE (ENGINE ATTACHMENT) 3/4" O.D.
E	OIL PRESSURE LINE 1/4" O. D.
F	RETURN LINE FROM OIL SEPARATOR 1/2" O.D.
G	GENERATOR DRIVE HOUSING DRAIN 1/4" O.D.
H	ENGINE OUTLET
I	OIL INLET FITTING
J	SUPERCHARGER BEARING DRAIN 1/2" O.D. LINES
K	TO OIL DILUTION
L	OIL "Y" DRAIN
M	OIL TANK DRAIN 1/2" O.D
N	SCUPPER DRAIN 3/8" O.D
O	RETURN LINE TO TANK 1" O. D.
P	LINE FROM ENGINE OUTLET TO COOLER 1" OD
Q	TO OIL TEMPERATURE GAGE
R	ENGINE MOUNT (REF.)
S	DRAIN PLUG FITTING

Figure 3 - Oil System

b. PROPELLER. - The propeller is a Curtiss three-blade 11-foot diameter electrically controlled multiposition and / or constant-speed type. The propeller blade pitch angle setting is controlled by a reversible electric motor which is mounted on the front face of the propeller hub. The propeller motor is operated from the airplane electrical power supply and will adjust the blade pitch angle to any setting within the operating range of the propeller, while the airplane is in flight or on the ground, in either automatic constant-speed or manual selective control. Automatic constant-speed control is accomplished by the engine-driven governor which regulates the current flow to the propeller motor. Manual selective control is accomplished by a selector switch which provides direct control of the current to the propeller motor.

(1) When the propeller is operated in the automatic constant-speed control the propeller governor automatically directs the current flow to the propeller motor thus adjusting the blade pitch angle setting to "increase" or "decrease" pitch to correct for the varying conditions of flight; thereby, the engine speed will be held constant. The propeller governor can be regulated by the propeller governor control lever located on the engine control unit in the cockpit.

(2) When the propeller is operated in the manual selective control, the propeller selector switch will permit the operation of the propeller in fixed pitch position or the selection of any pitch angle setting to obtain any combination of engine rpm and manifold pressure within the operating range of the propeller and engine. Manual selective control is completely independent of the engine-driven propeller governor.

(3) The propeller controls may be regulated at any time during flight or ground operation whether the propeller is operating in automatic constant speed or manual selective fixed pitch control.

(4) For winterized airplanes, an anti-icing system is provided for the propeller. The system consists of a 2.25 U. S. (1.9 Imperial) gallon supply tank mounted above the fuselage fuel tank. The supply tank is filled with anti-icing fluid, Specification No. 3585, which is composed of 15 percent glycerine, 4 percent methyl (wood alcohol, and the remainder is ethyl (grain) alcohol (190 proof). This anti-icing fluid is pumped to the propeller slinger ring, where it is then thrown onto the leading edge of the blade by centrifugal force. The pump for the propeller anti-icer is located just aft of bulkhead station No. 5 and above the fuselage fuel tank.

(5) When the rheostat, beneath the throttle quadrant, is placed in the "NORMAL" position, the fluid rate of discharge is 1 pint of fluid every 6 minutes. At this rate, a full tank is adequate for 1 hour and 45 minutes. When the pump rheostat is set for maximum flow, the fluid will last approximately 1/2 hour.

(6) The recommended procedure for operating is to set the pump for maximum flow for the first minute of operation and then return to "NORMAL." To determine if icing conditions exist, the pilot should watch the leading edge of the wing. If conditions warrant the use of the wing de-icer, the propeller anti-icer should also be used.

c. OIL SYSTEM.

(1) The oil system consists of an oil supply tank and piping to convey the oil from the tank to the engine and from the engine back to the tank. Incorporated in the oil return piping from the engine to the tank are two oil coolers each equipped with a fully automatic temperature regulator incorporating a bypass valve which regulates the direction of oil flow either through the core of the oil cooler or through the bypass jacket of the oil cooler back to the oil supply tank. The oil tank is located aft of the fire wall and forward of the instrument panel. The normal capacity of oil in the tank and lines is approximately 18 gallons. The normal oil level in the oil tank is determined by the rivet which passes completely through the filler neck. The system should be filled to a level of approximately two (2) inches below the pin level before flight. The maximum oil level is determined by the filler opening. The oil outlet from the tank to the engine is through a pendulum-type valve which allows dives of 90 degrees, climbs of 60 degrees or 10-second inverted flight which should be performed only with one-third or more of the maximum oil capacity in the oil tank.

(2) There is also incorporated in the oil system, provision for oil dilution in order to facilitate starting. This system is used before stopping the engine when a cold weather start is anticipated. Dilution is obtained by the controlled addition of engine fuel into the oil inlet line at the "Y" drain cock. The fuel is supplied from a restricted fitting in the fuel pressure gage line. The fuel flow is controlled by a momentary-contact-type toggle switch in the cockpit. This switch energizes the solenoid which operates the oil dilution valve.

d. FUEL SYSTEM. - The fuel is carried in two wing tanks, a fuselage tank, and an auxiliary belly tank. Each of the two wing tanks, (front wing and rear wing) and the fuselage tank consist of a multi-ply, self-sealing fuel cell contained in an aluminum-alloy shell. This construction minimizes the hazard of fuel leaking from the tanks if punctured by gunfire.

(1) The front wing and rear wing tanks are located in the center of the wing panel, beneath the cockpit floor. The filler necks are accessible through doors in the left wing fillet; the fuel gages protrude through the cockpit floor. The front wing tank gage is forward and to the right of the control stick, and the rear wing tank gage is aft and to the left of the control stick.

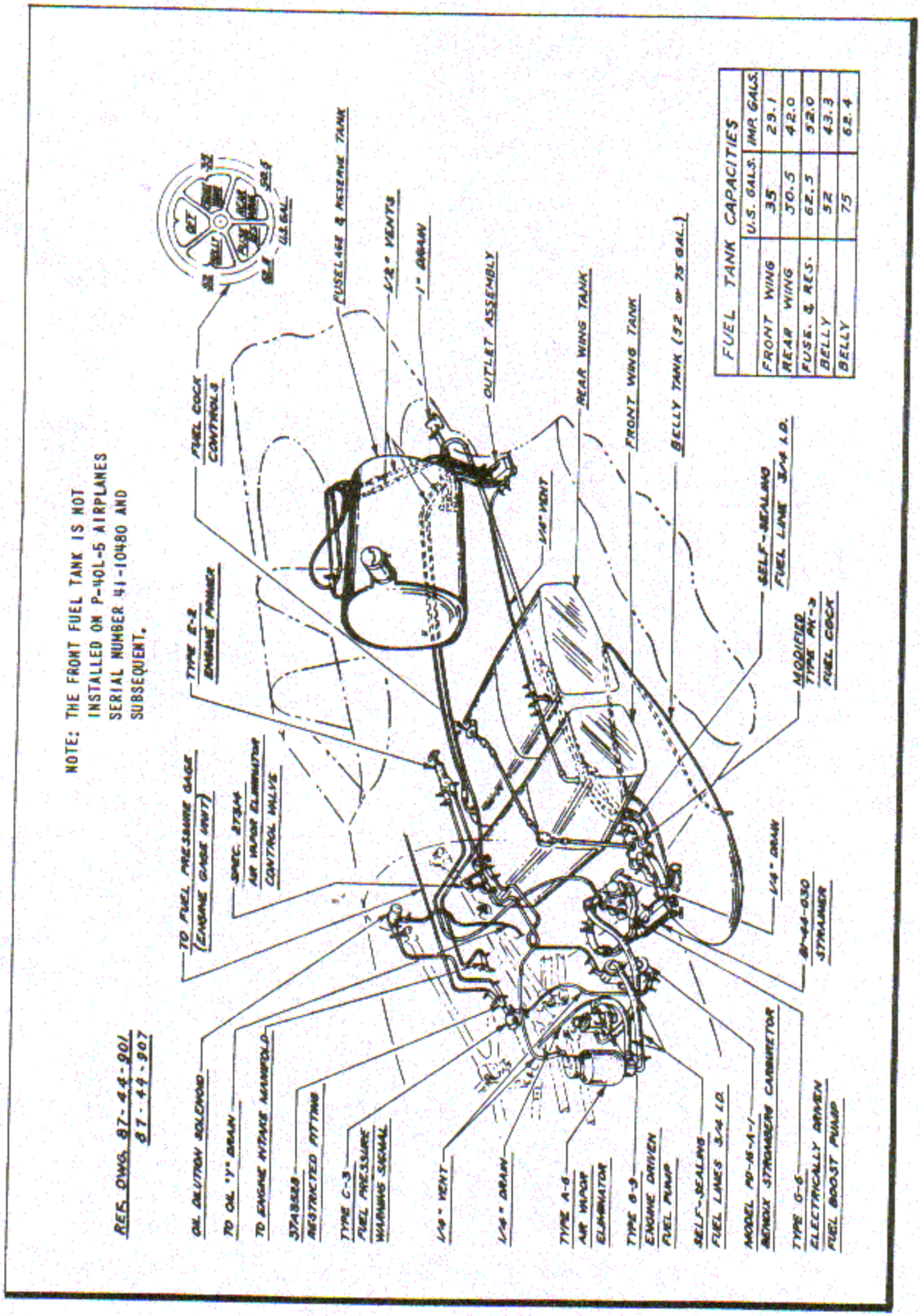


Figure 4 - Fuel System Diagram

NOTE

On P-40L-5 airplanes, serial No. 41-10480 and up, the front wing tank installation has been eliminated.

(2) The fuselage tank is located aft of the armor plate at station No. 5, and carries part of the main fuel and 35 U. S. (29 Imperial) gallons reserve fuel. There is no division or standpipe within the fuselage tank for the purpose of trapping reserve fuel, but instead, the reserve fuel is calibrated between the 0- and 35-gallon marks on the fuel quantity gage which is located on the instrument panel. The fuselage tank filler neck, is accessible on the left side of the fuselage, below the rear-vision window. The fuselage tank is referred to as the "Fuselage and Reserve" tank.

(3) The belly tank is supported by the bomb shackle assembly which is installed below the wing panel on the airplane center line. Either a 52 U. S. (43 Imperial) gallon, 75 U. S. (62 Imperial) gallon, or 150 U. S. (125 Imperial) gallon belly tank may be installed. The belly tank may be dropped while in flight by pulling up on the bomb-tank release handle which is located within easy reach of the pilot on the left side of the cockpit.

(4) The fuel tank capacities are given on the Fuel System Diagram. (See figure 4.)

(5) Fuel is supplied to the carburetor by an engine-driven fuel pump, and an electrically driven fuel boost pump. The boost pump, which is controlled by a switch on the main switch panel, must be turned "ON" whenever the engine is running. If the fuel pressure should drop below 12 pounds per square inch, a fuel pressure warning signal light, located on the upper left side of the instrument panel, will flash on. A test switch for checking the fuel pressure warning light is provided on the main switch panel.

(6) Fuel may be used from any of the four tanks by turning the fuel selector valve to the desired position. The fuel should be drawn from the "FRONT WING" tank in starting the engine, for warm-up, and for take-off. (Where front tank is not installed use rear wing tank instead.) After reaching a safe altitude, the fuel should be used from the tanks in the following order: (1) "BELLY," (2) "FUSE. - RESERVE" (Leave 35 U. S. (29 Imperial) gallons reserve fuel) (3) "FRONT WING," (4) "REAR WING," (5) "FUSE. - RESERVE" (35 U. S. (29 Imperial) gallons reserve fuel). If the belly tank is not installed, use fuel from the tanks in the order of (2), (3), (4), and (5).

NOTE

Do not turn the fuel selector valve through "BELLY" if the belly tank is not installed.

e. COOLING SYSTEM.

(1) GENERAL. - The engine is cooled with a mixture of 70 percent water and 30 percent ethylene glycol (by volume) when the ground temperatures are above 3°F (-16°C). A mixture of 35 percent water and 65 percent ethylene glycol (by volume) is used when the ground temperatures are below 3°F (-16°C). The coolant is circulated through the engine cooling system by a centrifugal-type pump mounted on the bottom of the accessory housing at the rear of the engine. The coolant flows from the engine to the header tank, then through the radiator and back to the pump. An automatic thermostatic bypass valve is located in the piping from the coolant header tank to the coolant radiator. Whenever the coolant temperature is below 85°C (185°F) the valve will automatically bypass the coolant through the engine until the coolant temperature has reached 85°C (185°F) when the valve will partially open, permitting the coolant to flow through the coolant radiator. Full opening of the valve occurs when the coolant temperature reaches 105°C (221°F) permitting full flow of the coolant through the coolant radiator. The coolant overflow projects through the right side of the fuselage just below the front exhaust stack. The recommended operating temperatures for the Packard-Built Rolls Royce engine are: 100°C (212°F) maximum cooling temperature for cruising, and 121°C (250°F) for all out operations. A signal lamp located on the upper right side of the instrument panel glows as a warning when the coolant reaches a temperature of 121°C (250°F). A momentary-contact-type toggle switch located on the main electrical control switch panel is used to test this signal lamp installation.

(2) COWL FLAPS.

(a) P-40F AC-41-13600 through AC-41-14422. The airplane is equipped with electrically operated automatic cowl flaps which are installed aft of the radiator and oil cooler exit duct. The cowl flaps regulate the flow of air through the radiator and oil cooler exit duct and consequently help to maintain normal oil and coolant temperatures. The cowl flaps are operated by a reversible electric motor which is automatically controlled by the Fulton-Sylphon Modulating Cowl Flap Control System when the toggle switch in the cowl flap control box in the cockpit is in the "AUTO" position. Normally, the cowl flaps will not require any attention from the pilot.

(b) P-40F airplanes AC-41-14423 and subsequent, and all P-40L airplanes have a manual cowl flap control. The control is mounted on the right side of the cockpit adjacent to the pilot's seat. The handle is raised or lowered to get the desired cowl flap setting. The settings are shown by an indicator plate attached to the control.

3. EQUIPMENT.

a. FLIGHT CONTROLS. - Conventional control stick and pedals control the ailerons, elevators, and the rudder.

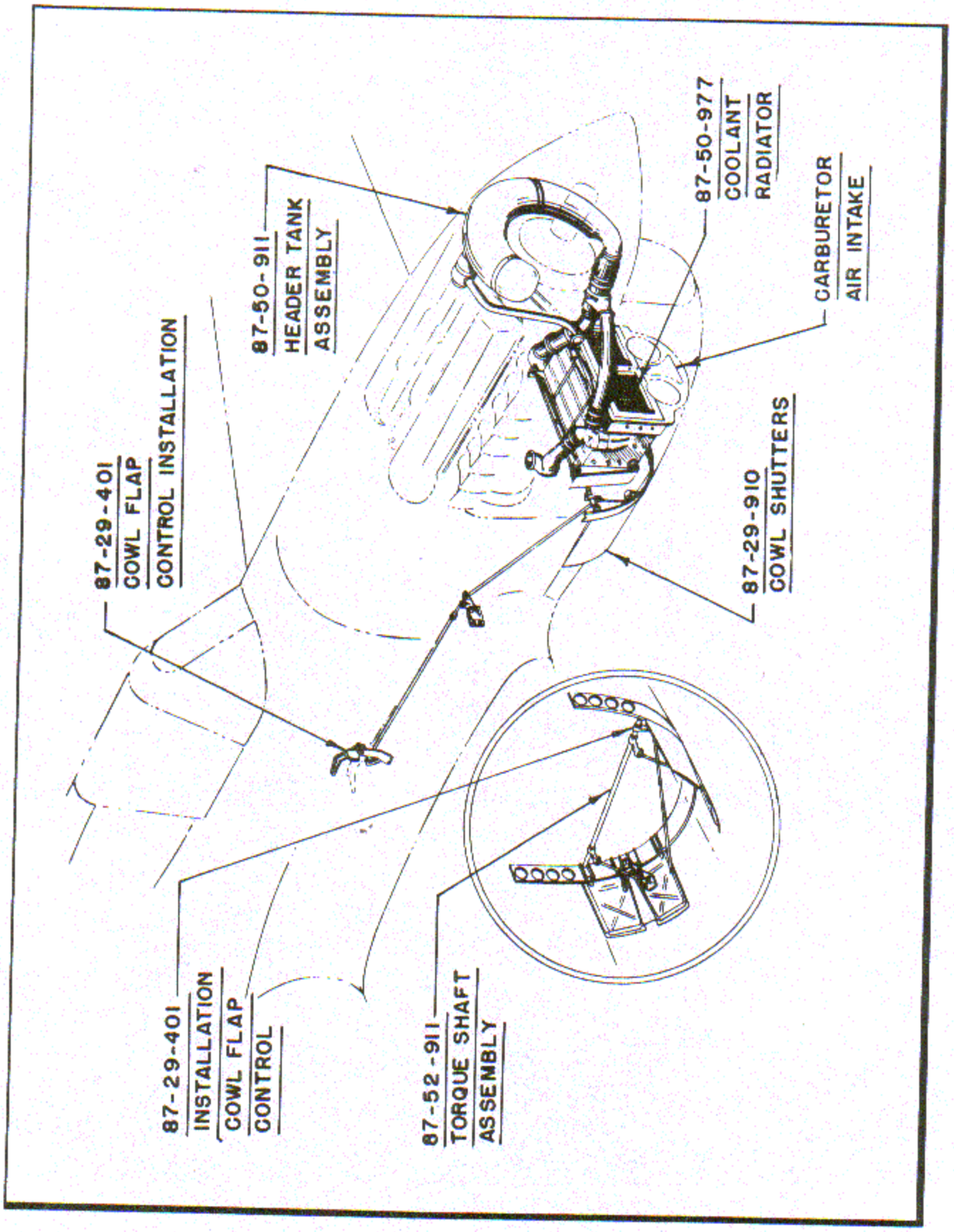


Figure 5 - Cooling System Diagram

(1) BRAKE PEDALS. - The brake pedals are pivoted on the rudder pedal assembly.

(2) TRIM TAB CONTROLS. - The left aileron trim tab is operated by an electric motor which is controlled by a toggle-type switch located on the main electrical control switch panel. The elevator and rudder trim tabs are controlled by the conventional-type control knobs, chains, and cables.

b. FUSELAGE EQUIPMENT.

(1) COCKPIT ENCLOSURE.

(a) WINDSHIELD. - (AC-41-13600 through AC-41-14523.) The windshield center section is comprised of two panes of laminated plate glass. The front pane is three-ply having a total thickness of 5/16 of an inch. The rear pane is five-ply plate glass having a total thickness of 1-1/2 inches. A 5/32-inch space is provided between the panels to permit the circulation of warm air from the duct aft of the coolant radiator to defrost the windshield. The two side sections of the windshield are curved, nonshatterable, three-ply plate glass having a total thickness of 3/8 of an inch. A rear-vision mirror is mounted on the forward top left side of the windshield. The defroster air is controllable from the cockpit. The tube for the glycol spray is mounted at the bottom of the windshield and the glycol spray pump is located within the cockpit.

1. The windshield center section on P-40F airplanes AC-41-14524 and subsequent, and all P-40L airplanes is a single pane of plate glass 1-1/2 inches thick.

2. On P-40F airplanes AC-41-14500 and subsequent, and all P-40L airplanes, the windshield defroster is on the inside, and at the base of the center section.

3. Incorporated in the windshield of P-40F airplanes AC-41-14600 and subsequent and all P-40L airplanes, is a clear-vision panel. A section of the left side of the cockpit enclosure is hinged and swings "IN" when the spring-loaded catch assembly is raised up.

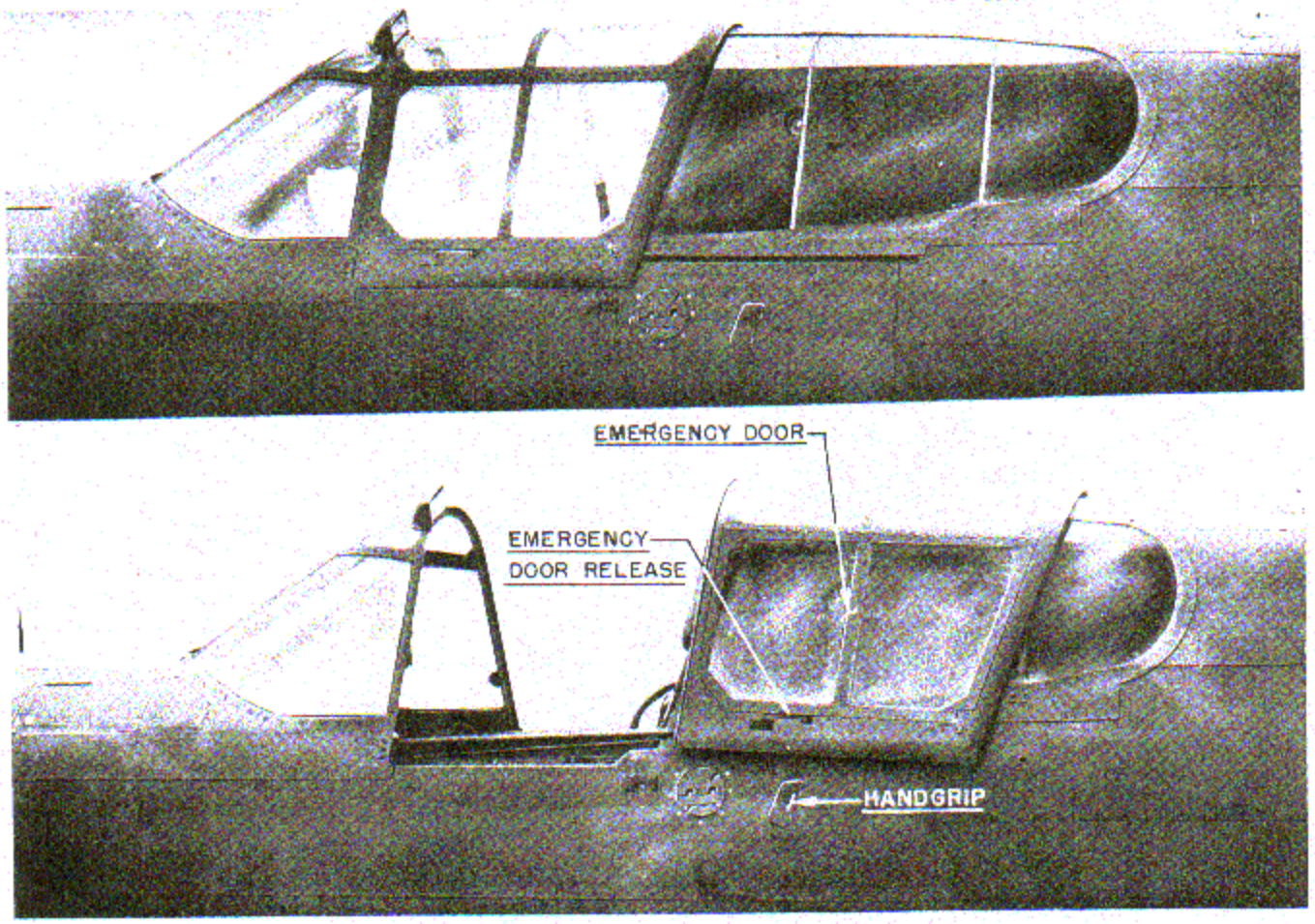


Figure 6 - Cockpit - Open and Closed

4. For P-40F airplanes AC-41-14500 and subsequent, and all P-40L airplanes, the windshield glycol spray assembly has been removed.

(b) CABIN ASSEMBLY. - The cabin assembly can be opened, closed, or adjusted to any intermediate position, and locked at any time by operating the crank-type regulator mounted on the right side of the cockpit. The window panels are of transparent plastic material.

1. Provision is made for instant release of the cabin assembly in event of an emergency exit while the airplane is in flight. (See section II, paragraph 10.)

2. A hinged panel in the left side of the cabin assembly is provided to permit exit from the cockpit should the airplane be turned over.

(2) INSTRUMENT FLYING HOOD. - There are provisions for installing an instrument flying hood.

(3) ARMOR PLATE. - The armor plate installation comprises a 3/8-inch nonmagnetic plate mounted forward of the instrument panel at station No. 2, a 5/16-inch plate mounted forward of, and completely covering the bulkhead at station No. 5 and a 5/16-inch plate mounted on the forward side of the armor plate at station No. 5, immediately aft of the pilot's headrest.

(4) MISCELLANEOUS. - A standard Army Air Force type pilot's seat, safety belt, chest-type safety belt, relief tube, map case, data case, mooring kit, and duffel bag are provided. The data case, duffel bag including tool kit for engine and airplane tools are accessible through the access door on the left side of the fuselage.

c. HYDRAULIC SYSTEM. - The main landing gear retracting cylinders and tail gear retracting cylinder, the wing flaps (and the gun charging mechanism which is installed on airplanes AC-41-13600 to AC-41-13994, inclusive, and airplane AC-41-13998) are operated hydraulically. The hydraulic pressure is supplied to the main hydraulic system by an electrically driven hydraulic pump located in the rear of the fuselage. The pump is controlled by a switch located near the base of the handgrip on the flight control stick. An auxiliary hydraulic hand pump for operating the complete main hydraulic system in case of electrical pump failure, is located on the right side of the cockpit. An emergency hydraulic system is provided which is completely self-contained and separate from the main hydraulic system. The emergency hydraulic system is comprised of an emergency hydraulic reserve tank mounted on the forward side of the fire wall, separate lines, and an emergency hydraulic hand pump. The emergency hydraulic hand pump is located inboard of, and is identical to the main hydraulic system auxiliary hydraulic hand pump. The emergency hydraulic system is used to actuate the hydraulic cylinders to extend the main landing gear only, in event of failure of the electrically driven hydraulic pump, or failure of the auxiliary hydraulic hand pump, or other damage to the main hydraulic system. The emergency hydraulic system is not in any way connected to the hydraulic lines of the wing flaps, tail gear, or gun charging mechanism.

NOTE

The emergency hydraulic system has been removed from P-40F airplanes AC-41-14600 and subsequent, and all P-40L airplanes.

d. HEATING AND VENTILATING EQUIPMENT. The cockpit heating and ventilating system consists of a duct extending from near the rear of the coolant radiator to carry warm air to the cockpit and a duct from an opening near the fuselage in the leading edge of each wing panel, which carries cold air to the cockpit. The hot or cold air enters the cockpit through openings in the fire wall at the floor line. The flow of hot or cold air to the cockpit can be regulated by operating the plainly marked control which is mounted on the small panel below the main electrical control switch panel in the cockpit.

(1) For winterized airplanes, the capacity of the cockpit heating system has been increased by the addition of a cockpit heat intensifier tube. This tube is flexible, and long enough to be moved about the cockpit to any area where more heat is desired. It may also be used as an aid in defrosting the windshield or side panels. If the cockpit becomes too warm, the cap on the end of the tube may be turned to shut off the additional warm air.

(2) Hot air is carried by separate ducts from the rear of the coolant radiator to the gun compartment on each wing panel. The flow of hot air to the gun compartment is constant and can not be controlled except by the position of the cowl flaps.

e. OXYGEN SYSTEM. - Refer to "Operation of the Oxygen Equipment" in section IV.

f. COMMUNICATIONS EQUIPMENT. - The airplane is equipped with an alternate installation of either the SCR-522-A transmitter and receiver or the SCR-274-N transmitter and receiver and the SCR-515-A and / or the SCR-535 receiver units. This equipment provides for two-way communication. The radio controls, microphone and the earphones are located on the right side of the cockpit. A radio crash switch is mounted on a bracket below the radio controls. The crash switch is used to set off a detonator which will destroy the SCR-535 radio if there is danger of its falling into enemy hands. A contactor is located on the left side of the instrument panel.

g. ARMAMENT. - Refer to "Operation of Armament" in section VI.

REF LET.	PART NO.	NAME
A	87-33-503	HYDRAULIC CONTROL VALVE
B	87-33-504	HYDRAULIC HAND PUMP
C	87-31-505	LANDING GEAR RETRACTING STRUT
D	87-64-004	FLAP ACTUATING CYLINDER
E		ELECTRICAL HYDRAULIC PUMP ELIPSE TYPE 809 MODEL
F	87-33-018-10	HYDRAULIC TANK ASSEMBLY
G	87-37-905	TAIL WHEEL RETRACTING STRUT
H		HYDRAULIC TANK VENT
I	87-33-071	CHECK VALVE
J	87-33-025	VALVE
K	87-33-069	VALVE
L	87-31-505	LANDING GEAR RETRACTING STRUT

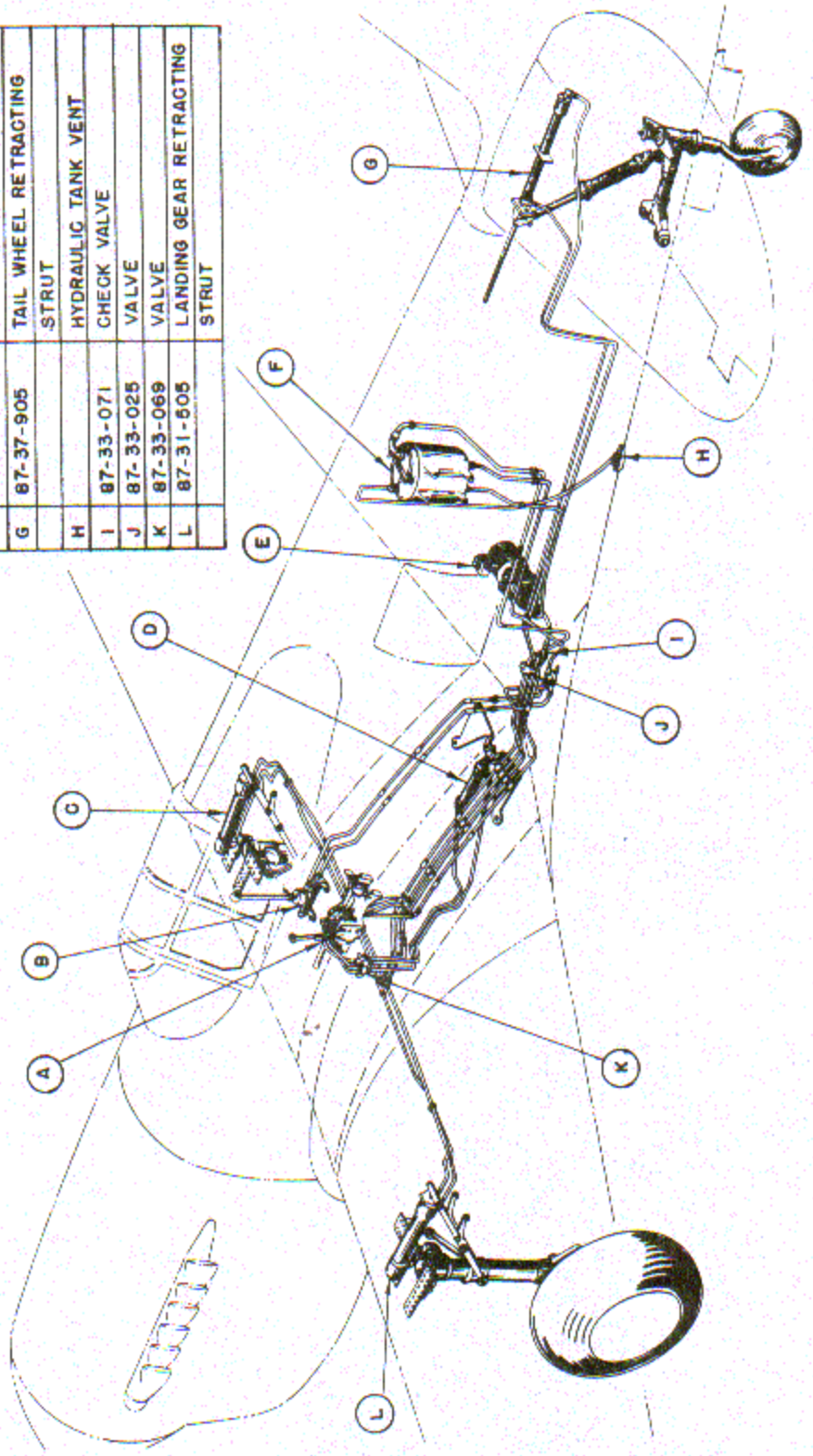


Figure 7 - Hydraulic System

h. BATTERY. - The AC Specification No. 32234 - type G-1, 34-ampere-hour battery is located within the fuselage between station No. 9 and station No. 10 and it is accessible through the fuselage access door.

i. ELECTRICAL SYSTEM. - A 24-volt electrical system is employed to operate the various instruments, motors, and lights in the airplane. The power is supplied to the airplane electrical system by either the 50-ampere modified type M-2 generator which is installed on airplanes AC-41-13600 to AC-41-13749, inclusive, or the 100-ampere type 0-2 generator which is installed on airplanes AC-41-13750 and up. The switches for the various circuits, the rheostats, and the circuit breakers are located on the electrical control switch panel below the instrument panel.

j. FLUORESCENT SPOTLIGHTS. - Cockpit illumination is furnished by two self-contained fluorescent spotlights which emit either visible or ultraviolet light by rotating the knurled cap which contains the lens, 90 degrees. Each light is controlled by a separate switch, integral with a rheostat, located on the main electrical control switch panel. The fluorescent spotlight assembly is detachable from its base, and so it may serve as a utility cockpit light. A spotlight base is attached to bulkhead No. 4, just below the radio transmitter control box, on the right-hand side of the cockpit; a second base is attached to the longeron just aft of bulkhead No. 4 on the left-hand side of the cockpit. In addition, a spotlight base is provided on each side of the windshield side panel frame. When the lamp is mounted on the base, it may be readily aimed in any direction. The instrument dials and the pointer markings are painted with a fluorescent-type paint which is activated by the ultraviolet light emitted from the fluorescent lamp, making them luminous.

k. RECOGNITION LIGHTS. - For airplanes AC-41-13800 and up, there are two recognition lights, containing a green, and an amber lens which are installed in the bottom of the fuselage aft of station No. 10 and station No. 11, respectively. The two lights are located slightly to the left of the airplane center line. A recognition light having a red lens is installed in the rear keel fairing along the airplane center line just aft of station No. 8. A recognition light having a clear lens is installed slightly to the left of the airplane center line and forward of station No. 9 at the top of the fuselage. The four recognition lights are controlled by the recognition lights keying switch which is located below the radio controls in the cockpit.

l. LANDING LIGHT. - A landing light is located on the under side of the left wing panel. The light is extended and retracted electrically.

m. WALKWAYS. - A partial walkway of 1/16-inch green "Aero-Floor" is provided on the trailing edge of the left wing to prevent slipping when stepping on or off the wing.

n. PARKING BRAKE. - The brakes may be held in the engaged position when the airplane is parked by operating the parking brake control provided in the cockpit.

o. PARKING HARNESS. - The surface controls may be locked when the airplane is parked by attaching the parking harness, which is stowed in a stowage bag below the pilot's headrest. An instruction plate for its use is located on the right side of the armor plate at station No. 5.

p. MOORING. - Mooring rings are permanently attached to the under side of each wing panel near the wing tip. These mooring rings are held in a retracted position within the wing panel by springs.

KEY TO ILLUSTRATION

1 Contactor Clock Winding Knob
2 Contactor "In" - "Out" Switch
3 Radio Contactor
4 Clock "Stop" - "Run" Switch
5 Fuel Pressure Warning Signal
6 Air-Speed Indicator
7 Turn Indicator
8 Caging Knob - Turn Indicator
9 Turn and Bank Indicator
10 Rate-of-Climb Indicator
11 Zero Pitch Adjustment Knob - Flight Indicator
12 Flight Indicator
13 Caging Knob - Flight Indicator
14 Coolant Temperature Warning Light
15 Coolant Temperature Gage
16 Wheel and Flap Position Indicator (P-40F only)
17 Clock "Wind" and "Set" Knob
18 Clock
19 Fuselage Tank Fuel Gage
20 Zero Setting Adjustment Knob - Altimeter
21 Altimeter
22 Altimeter Correction Card Holder
23 Compass
24 Compass Correction Card Holder
25 Tachometer
26 Manifold Pressure Gage
27 Suction Gage
28 Engine Gage Unit
a. Oil Temperature (top)
b. Oil Pressure (left side)
c. Fuel Pressure (right side)

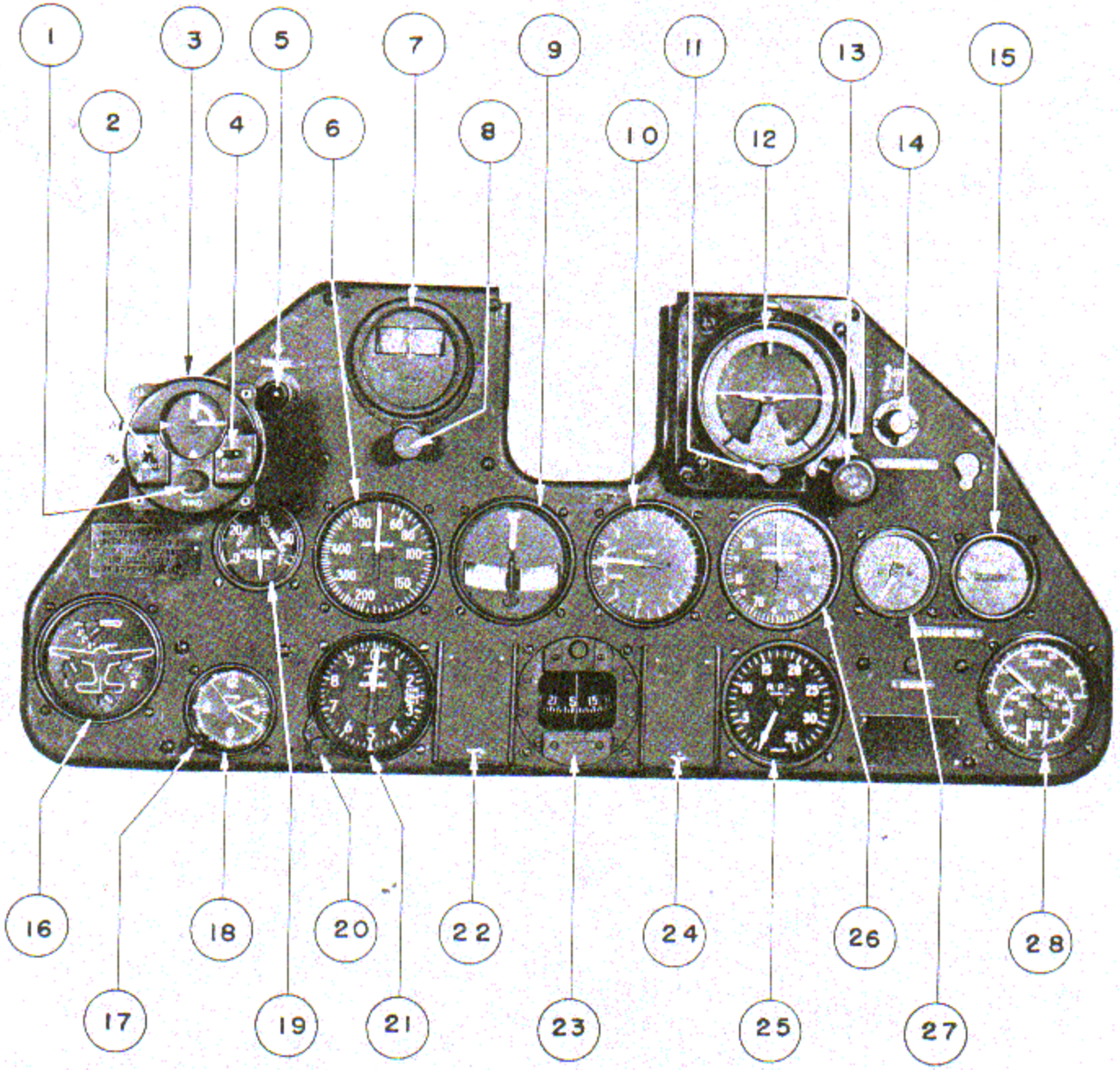


Figure 8 - Instrument Panel

KEY TO ILLUSTRATION

31 Parking Brake Control
32 Electric Fuel Pump Switch
33 Gun Safety Switch
34 Propeller Warning Light
35 Bomb Safety Switch
36 Gun Camera Switch
37 Oil Dilution Switch
38 Aileron Trim Tab Switch
39 Pitot Tube Heater Switch
40 Coolant Temperature and Fuel Pressure Warning Lights Switch
41 Wing Tip Running Lights Switch (AC41-13950 and up)
42 Generator Line Switch
43 Fuel Gage Lights Switch
44 Landing Light Switch
45 Battery Line Switch (AC41-13710 and up)
46 Tail Running Lights Switch (AC41-13950 and up)
47 Ammeter
48 Gun Sight Rheostat Switch
49 Armament Circuit Breakers
50 Miscellaneous Circuit Breakers
51 Carburetor Air Heat Control
52 Propeller Circuit Breaker
53 Propeller Selector Switch
54 Rudder Pedal - Left
55 Ignition Switch
56 Fluorescent Spotlight Rheostat Switch - Left Side
57 Fluorescent Spotlight Rheostat Switch - Right Side
58 Compass Light Rheostat Switch
59 Oxygen Regulator
60 Carburetor Air Filter Control
61 Engine Primer
62 Windshield Glycol Pump
63 Cockpit Heater
64 Front Wing Tank Fuel Gage
65 Rudder Pedal - Right

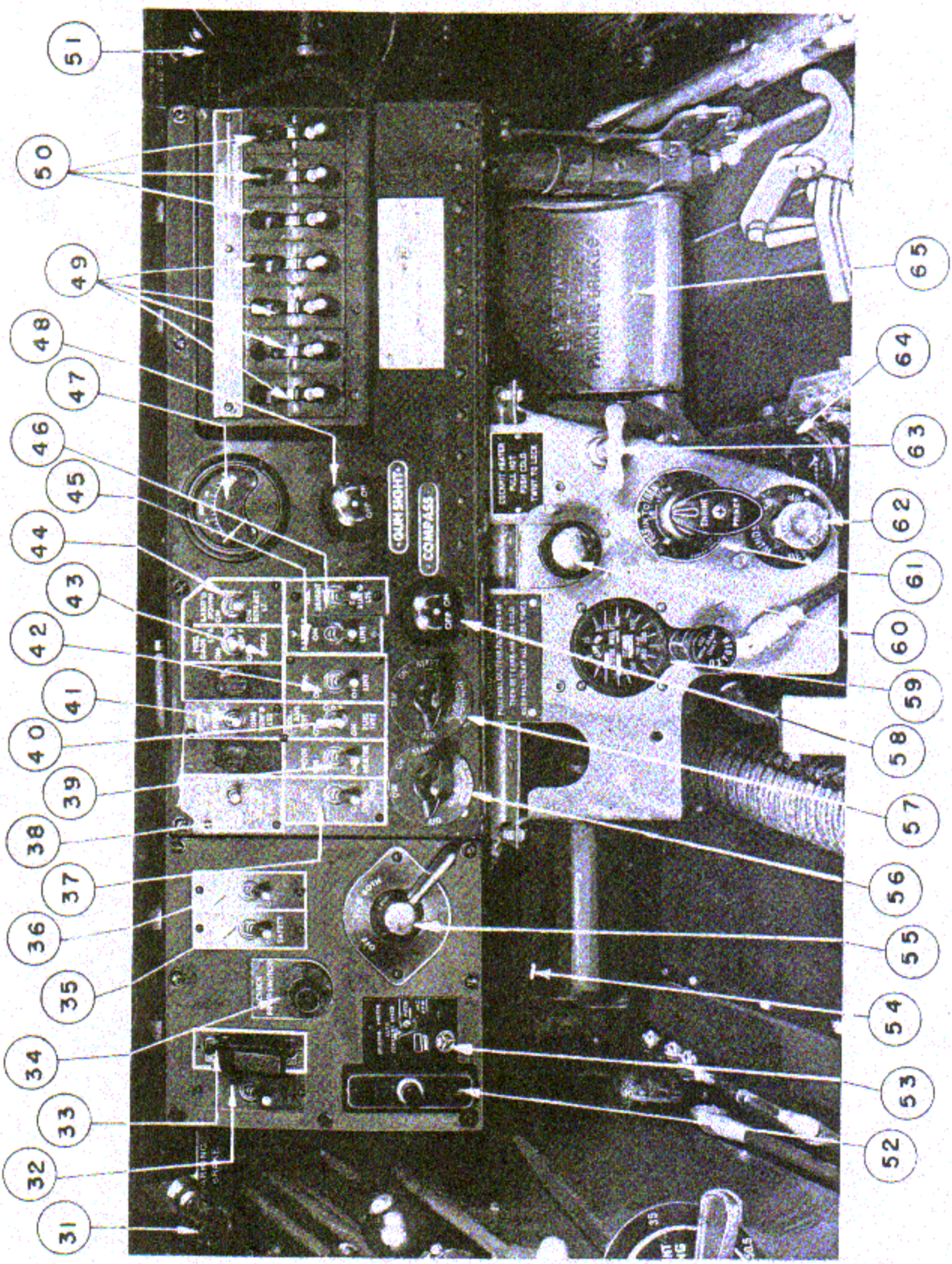


Figure 9 - Main Electrical Switch Panel

KEY TO ILLUSTRATION

70 Flap Control Valve Handle
71 Spotlight
72 Spare Bulbs
73 Elevator Trim Tab Control
74 Rudder Trim Tab Control
75 Aileron Trim Tab Control Switch
76 Shoulder Straps
77 Pilot's Seat
78 Hydraulic Control Valve
78A Landing Gear Safety Latch
79 Landing Gear Control Valve Handle
80 Safety Belt
81 Wing Bomb Release Control
82 Belly Bomb Arming Handle
83 Belly Bomb-Tank Release Handle
84 Wing Bomb Arming Handle

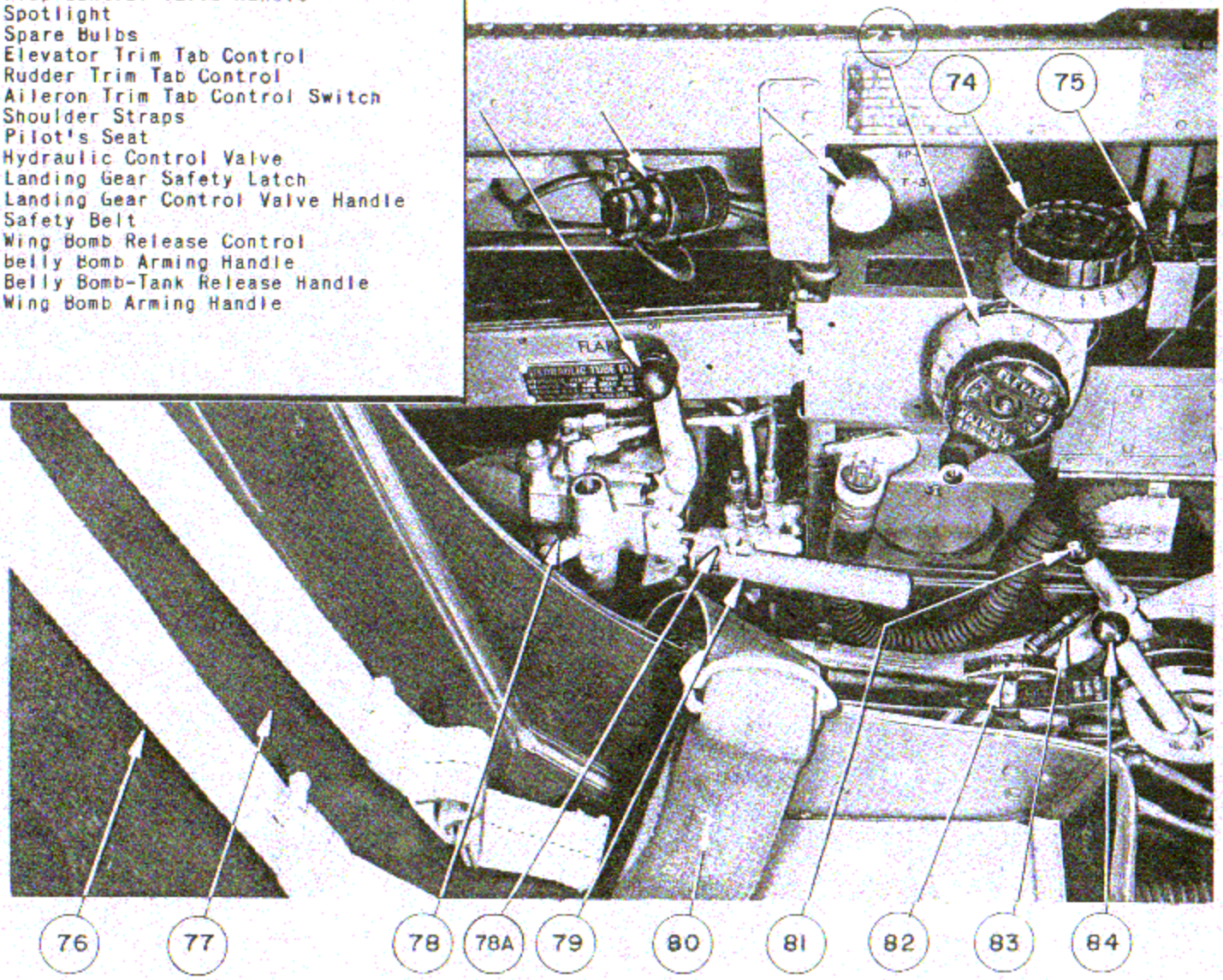


Figure 10 - Cockpit - Left Side - Rear

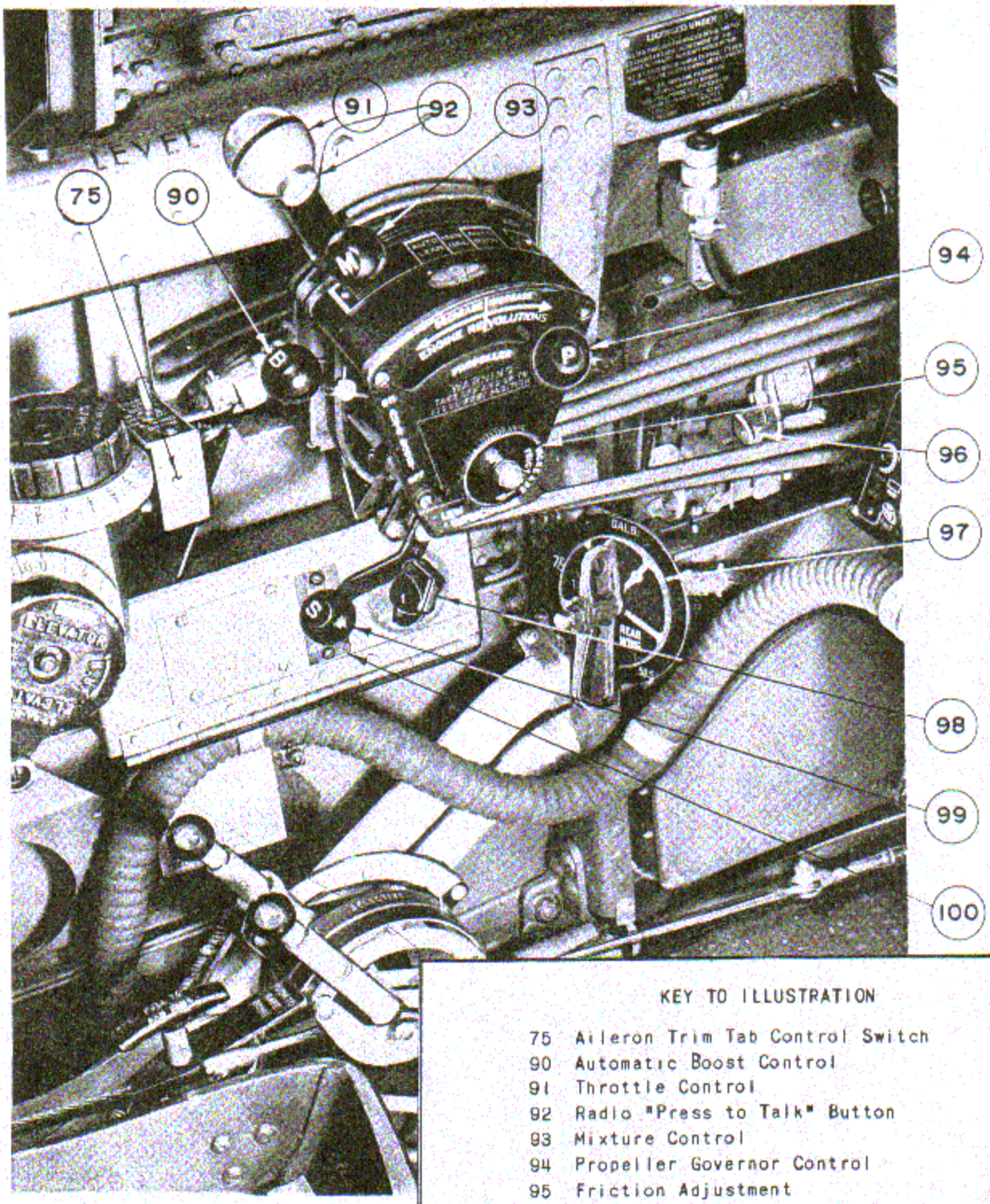


Figure 11 -
Cockpit - Left Side - Foreward

KEY TO ILLUSTRATION

75	Aileron Trim Tab Control Switch
90	Automatic Boost Control
91	Throttle Control
92	Radio "Press to Talk" Button
93	Mixture Control
94	Propeller Governor Control
95	Friction Adjustment
96	Throttle Rod Cam - Landing Gear Warning Light Switch
97	Fuel Selector Valve Control
98	Propeller Anti-icer Pump Control
99	Supercharger Control
100	Wing De-icer Control Switch

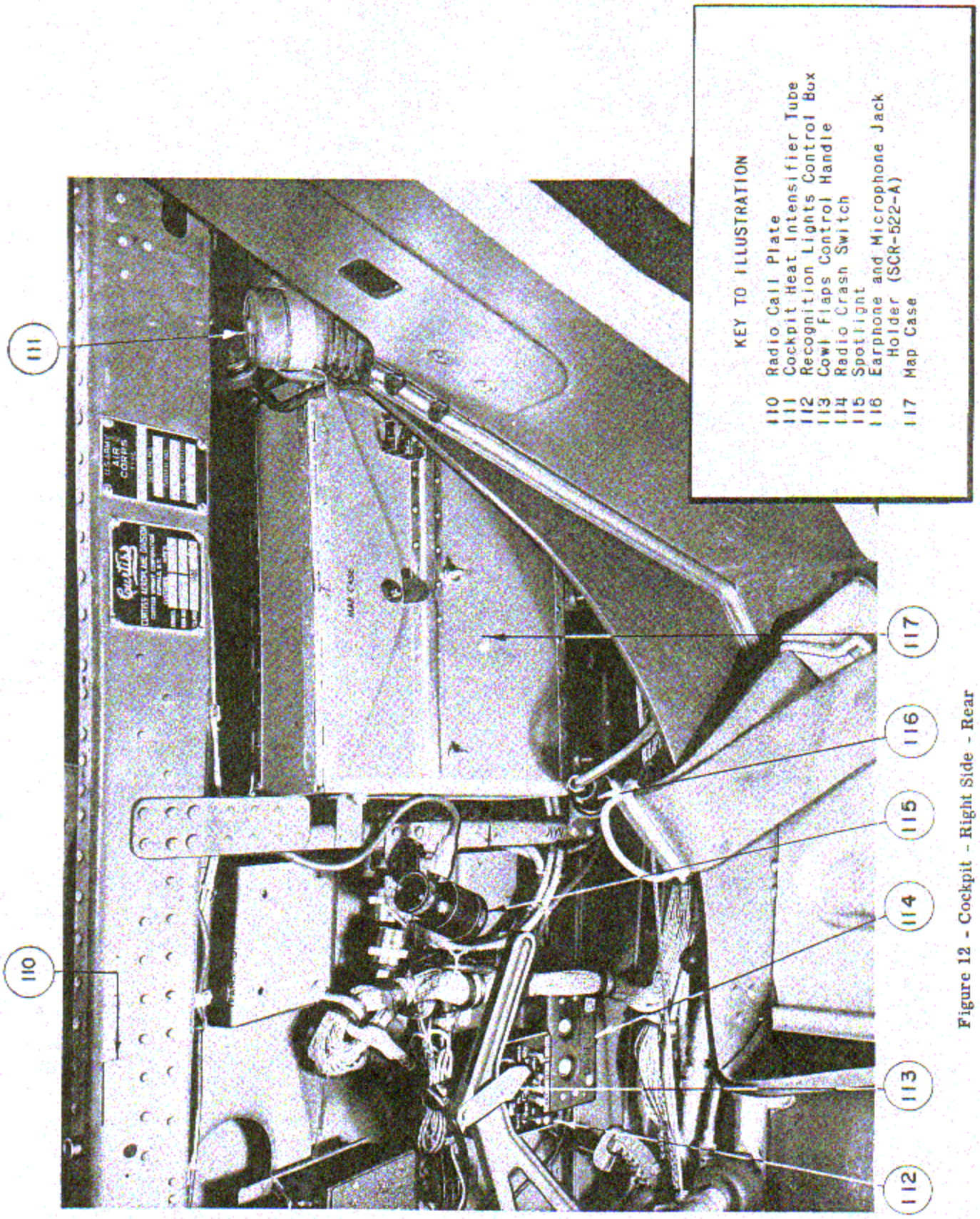
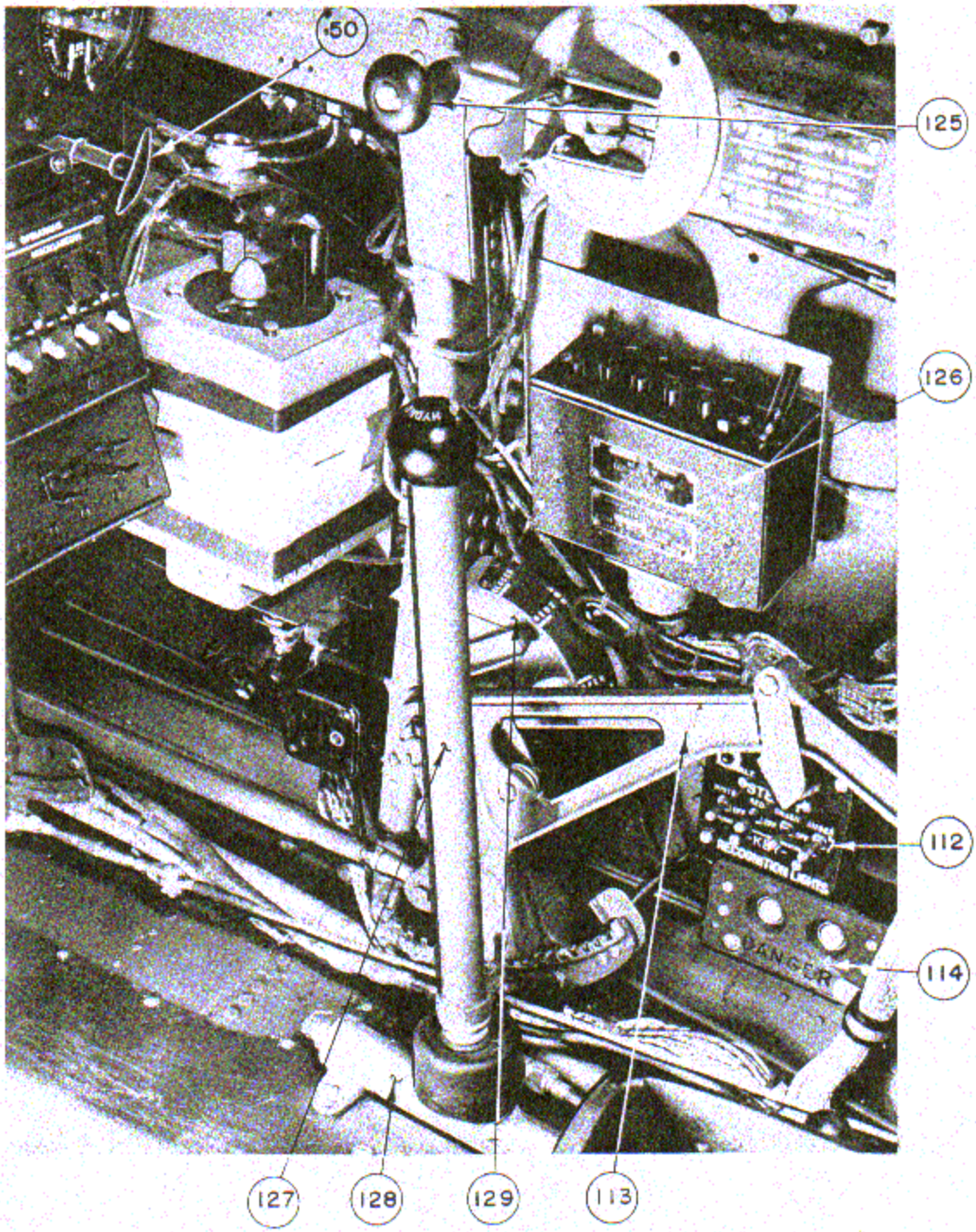


Figure 12 - Cockpit - Right Side - Rear



KEY TO ILLUSTRATION

50 Carburetor Air Heat Control
112 Recognition Light Control Box
113 Cowl Flaps Control Handle
114 Radio Crash Switch
125 Cabin Control
126 Control Box Radio Set (SCR-522-A)
127 Hydraulic Hand-Pump Handle
128 Hydraulic Hand-Pump
129 Cowl Flap Control Position Indicator

Figure 13 - Cockpit - Right Side - Foreward

SECTION II

PILOT'S OPERATING INSTRUCTIONS

1. BEFORE ENTERING THE COCKPIT.

a. OBTAIN FLIGHT CLEARANCE.

(1) For combat operations, secure the correct radio frequency assignment for the flight.

(2) Be certain that the assigned frequency is within the tuning limits of the receiver. Every receiver has its frequency range stamped on its dial face. If it is necessary, change the receiver to obtain the assigned frequency. The radio receivers are accessible through the fuselage access door. Refer to section V for complete instructions on communications equipment.

b. Check and secure the pilot's safety equipment (parachutes, safety belt, shoulder straps, oxygen mask, maps, cross country envelope, Operation and Flight Instruction Handbook, pilot's seat cushion, emergency kit, etc.).

c. Baggage, tools, and desert equipment may be carried in the duffel bag. Be sure the duffel bag is secured with tie-down straps in the baggage compartment 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. It is important that the starter crank be carried in the airplane at all times so that the engine may be started by hand in the event of battery or other electrical failures. Check the data case on the inboard side of the access door to make certain the Handbook of Service Instructions is a part of the contents. After checking the duffel bag and starter crank for security be certain that the fuselage access door is locked shut and that the handle is flush with the fuselage skin.

CAUTION

Under no circumstances will baggage or tools be carried in excess of the gross loading of the airplane approved in the "WEIGHT AND BALANCE CHART."

d. The cockpit canopy may be opened by placing the hands on the side of the canopy and applying a backward pressure. If it is impossible to move the canopy back it is evident that the lever "G" (detail "B," figure 14) is not perpendicular to the crank handle allowing the crank handle pin to become engaged in a hole on the drum and locking the canopy in position. If this has happened, pull the release handle "A" (detail "C") out and pull aft disengaging the escape panel from its locks. Pull the escape panel open and reach into the cockpit. Pull lever "G" (detail "B") out perpendicular to the crank handle and push the canopy aft.

NOTE

Whenever a pilot or service personnel leaves the cockpit of this airplane they should be sure that the lever "G" (detail "B") is in the position shown (horizontal) so that the canopy may be closed and opened by hand from the outside.

2. ON ENTERING THE COCKPIT.

a. SPECIAL CHECK FOR NIGHT FLYING.

(1) Turn battery line switch (figure 9) "ON."

(2) Turn the two cockpit spotlight control knobs on the main switch panel to "START" and hold them in this position for a few seconds until the lights illuminate. Then turn the knobs to the left until the desired intensity of illumination is obtained. The knurled caps which contain the lenses, control the emittance of either visible or ultraviolet light by each 90-degree rotation. The spotlight bases are located as follows:

(a) On the right side, at station No. 4 bulkhead just below the radio transmitter control box and on the right side of the windshield side panel frame. On the left side, one base is located on the longeron just aft of station No. 4 bulkhead and the other on the windshield side panel frame.

(b) A spare bulb for the spotlights is stowed with a spare bulb for the coolant and fuel warning lights on the left side of the cockpit below the longeron, just forward of station No. 4 bulkhead.

(3) Test operate the compass light's brilliancy by turning the rheostat control knob (figure 9) clockwise.

(4) Turn the wing tank fuel gage lights "ON." (See figure 9.)

(5) Test operate the running lights.

(a) For airplanes AC-41-13600 to AC-41-13949 inclusive: Throw the toggle of the running lights switch, located on the main control switch panel, in the up "ON" position for steady illumination, and in the down "ON" position for signal.

(b) For airplanes AC-41-13950 and up: Test operate the wing tip running lights switch (figure 9), and the tail running lights switch (figure 9) on "DIM" and on "BRIGHT."

(6) Test operate the landing light for not over 5 seconds. (See figure 9.) When the switch is turned "ON" the light will not glow until after the landing light mechanism has extended the lamp to its operating position.

(7) Test operate the gun sight light. (See figure 9.) Turn the gun sight rheostat clockwise to test the intensity of the light.

(8) A damped rate control handle is located on the right of the cockpit floor between the two hydraulic hand pumps. This handle controls the automatic recognition device mounted in the top of the fuselage forward of station No. 10 bulkhead. When the damped rate control handle is pulled up and then released, the automatic recognition device will eject a flare through an opening in the fuselage skin. The automatic recognition device contains six flares.

CAUTION

Under no circumstances will the damped rate control handle be operated while the airplane is on the ground.

NOTE

On P-40F airplanes AC-41-14480 and subsequent, the damped rate control has been removed.

(9) For airplanes AC-41-13800 and up: Test operate the three recognition lights on the under side of the fuselage and the one recognition light on the top of the fuselage. Throw the four individual light switches located on the side of the recognition light switch box (figure 12) on "STEADY," and note if all four recognition lights illuminate. Throw the four individual light switches on "KEY" and test operate the keying switch on the top of the recognition light switch box.

b. CHECK FOR ALL FLIGHTS.

(1) Ignition switch "OFF." (See figure 9.)

(2) Battery line switch "ON." (See figure 9.)

(3) Gun safety switch "OFF." (See figure 9.)

(4) Test the cooling system warning light. (See figure 9.) Hold the toggle of the warning light test switch (figure 9) to the up "ON" position and observe if the warning light illuminates.

(5) Test the fuel pressure warning light. (See figure 9.) When the battery line switch is "ON," the warning light should be illuminated. With the mixture control (figure 11) in "IDLE CUT-OFF" operate the electric fuel pump switch (figure 9) and note if the warning light is extinguished when the fuel pressure exceeds approximately 12 pounds per square inch.

(6) Test operate the cowl flap control box. Throw the circuit breaker located in the top of the control box to "ON." Hold the toggle of the four-position selector switch in the "MAN, OPEN" or the "MAN, CLOSE" position to operate the cowl flaps and note the position of the cowl flaps on the position indicator in the control box. Check the cowl flap position against the position shown on the indicator.

NOTE

P-40F airplanes AC-41-14423 and subsequent and all P-40L airplanes have a manual cowl flap control in lieu of the electric control.

(7) For airplanes AC-41-13600 to AC-41-13944, inclusive, and for airplane AC-41-13998: gun charger valve handles matched with the red markers on the panel and in their out position.

(8) Landing gear control handle "NEUTRAL." (See figure 10.) A small locking device (figure 10) projecting from the top side of the control handle must be held in its "FORWARD" position to permit movement of the control handle upward. The handle can be moved downward without operating the locking device.

(9) Flap control handle "NEUTRAL." (See figure 10.)

(10) Wheel brakes on. Depress the brake treadles and pull out on the parking brake knob. (See figure 9.)

(11) A general observation of the cockpit must indicate all component parts in place and in perfect operating order.

(12) Check for freedom of movement of the flight control stick and rudder pedals (figure 9) to the extremities of their operating range.

(13) Adjust the rudder pedals to the desired position by pushing inboard on the spring-loaded adjustment lock (figure 9) 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. "Juggle" the pedal slightly to allow the locking pin to snap into position. Adjust both pedals to the same length.

(14) The cockpit seat may be adjusted for height by lifting the lock release handle on the right side of the seat and raising or lowering the seat as desired. To lock the seat in position, release the locking handle and "juggle" the seat slightly in a vertical direction until the spring-loaded locking device definitely snaps into position. After the seat has been properly adjusted check to be sure that the rear-view mirror at the top of the windshield frame affords a clear view aft. The mirror in the fairing may be adjusted by simply tilting it by hand to the correct angle.

(15) The two ends of the pilot's safety belt (figure 10) are anchored to the cockpit seat and will not require readjustment if the seat is moved. The

length of the safety belt may be adjusted to suit the individual needs of the pilot.

(16) The chest type shoulder strap (figure 10) 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 raising or lowering of the pilot's seat will not affect the adjustment of the shoulder straps.

(17) Check to see if the two spare bulbs forward of station No. 4 bulkhead are secure in place. The top spare bulb is a replacement for the fuel pressure or coolant warning light on the instrument panel or the propeller warning light located on the left of the main control switch panel. The lower bulb is a spare for the cockpit spotlights.

(18) Be sure the emergency canopy release mechanism is properly lockwired to prevent accidental release during flight. (See detail "A" of figure 14.)

3. STARTING THE ENGINE.

a. Be certain that the ignition switch (figure 9) is "OFF."

b. If the engine has been idle for more than 2 hours turn the propeller at least four complete revolutions by hand with the throttle (figure 10) open before using the starter. (See figure 9.)

c. Be certain the carburetor air heat control (figure 9) is pushed all the way in and locked in the cold air position to avoid possible damage to the induction system if the engine should backfire.

d. Throw the toggle of the battery line switch "ON." (See figure 9.)

e. Throw the propeller circuit breaker "ON." (See figure 9.) The circuit breaker must be on at all times when the engine is being operated.

f. Throw the toggle of the four-position propeller selector switch (figure 9) to "AUTO" (constant speed).

g. Set the propeller governor control (figure 11) for 3000 rpm.

h. Set the mixture control (figure 11) in "IDLE CUT-OFF."

i. Set the throttle control (figure 11) for 800 to 1000 rpm. (approximately one-tenth open).

j. Set the supercharger speed change control (figure 11) in "LOW" gear.

k. Operate the cowl flaps as required. (See figure 12.)

l. Turn the fuel selector valve (figure 11) to a full tank. The front wing tank is preferred. Never turn the valve pointer through the "BELLY" position when the belly tank is not installed.

m. Operate the electric fuel pump to obtain 12 to 16 pounds per square inch fuel pressure. (See figure 9.)

n. Prime a cold engine three strokes and a warm engine one stroke (figure 9), and turn the fuel pump "OFF."

o. Turn the ignition switch (figure 9) to "BOTH." With the mixture control (figure 11) in "IDLE CUT-OFF," engage the starter. (See figure 9.) Hold the starter pedal depressed in the engaged position until the engine is definitely running in order to keep the booster circuit closed during this period.

p. When the engine starts firing, move the mixture control (figure 11) to "AUTO-RICH."

NOTES

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

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

3. Prime the engine to keep it from stalling; pumping the throttle does not prime the engine.

4. Use ONLY the primer system until the engine is definitely firing. When the engine "catches" the electric fuel pump may be turned "ON."

CAUTIONS

1. If the engine ceases to fire return the mixture control to "IDLE CUT-OFF" immediately.

2. If the oil pressure is not at least 75 pounds per square inch within 1/2 minute after starting, the engine should be stopped and investigated.

3. For winterized airplanes, an external propane priming system is provided to facilitate cold weather starting. The propane intake is mounted on the engine mount on the left side of the airplane.

4. When using the propane system, use extreme caution to avoid any possibility of fire, as propane is extremely inflammable. Have adequate fire fighting equipment available whenever using propane. Fasten the propane cylinder supply line to the intake fitting on the

engine mount. Open the propane control for about 1 second before engaging the engine, and keep it open until the engine fires regularly. Release the propane control, and the engine will draw propane from the cylinder automatically. When the engine is running smoothly, move the mixture control to the "AUTO-RICH" position. As soon as the engine warms up slightly, this will cause too rich a mixture; therefore, disconnect the propane system. The plug must then be replaced immediately, or air will be sucked into the intake system through the priming line. This will "lean out" the mixture and cause the engine to "quit."

g. RECOMMENDED PROCEDURE. - Cold weather engine starting without the use of propane.

(1) Make sure the battery has a full charge. It is advisable to use an external electrical supply such as a battery cart, whenever and wherever such equipment is available.

(2) Ignition switch "OFF." (See figure 9.)

(3) Carburetor air on "COLD." (See figure 9.)

(4) Mixture control should be in "IDLE CUT-OFF." (See figure 11.)

(5) Throttle (figure 11) should be about 3/4 inch open.

(6) Pull the propeller through about eight complete turns.

(7) Throw battery line switch "ON." (See figure 9.)

(8) Propeller circuit breaker "ON." (See figure 9.)

(9) Set propeller selector switch to "AUTO." (See figure 9.)

(10) Set propeller governor control (figure 11) for 3000 rpm.

(11) Supercharger control should be set to "LOW." (See figure 11.)

(12) Cowl flaps control (figure 10) set to "CLOSED."

(13) Operate the electric fuel pump (figure 9) to obtain 14 to 16 pounds per square inch fuel pressure, then turn the pump off.

(14) Move the mixture control from "IDLE CUT-OFF" to "FULL RICH" to "IDLE CUT-OFF." This move must be done rapidly and not extended over a period of seconds.

(15) Resume operation of the electric fuel pump, and pull the fuel primer pump (figure 9) full "OUT."

(16) Turn the ignition to "BOTH" and engage the starter. Operate the primer slowly as soon as the engine begins to rotate. At this stage the operation of the primer is more important than the movement of the mixture control to the "AUTO-RICH" position. With a little experience it will be possible to start the engine quite readily with the priming charge. The operator must be able to tell whether the start is successful before moving the mixture control to "AUTO-RICH." Do not operate the electric fuel pump with the mixture control out of "IDLE CUT-OFF," and the engine not firing. If the mixture control is advanced before the engine "catches" on the priming charge, the operator is likely to temporarily "drown" the engine.

NOTE

The operator will find it helpful to allow the engine to commence to rotate before moving the ignition switch to "BOTH." This procedure will lessen the possibility of "kick-backs."

4. ENGINE WARM-UP.

a. Be sure that the mixture control (figure 11) and the propeller governor control (figure 11) are set in the take-off position. The engine should first be idled at 600 to 800 rpm until a steady oil pressure is obtained. This speed range is selected to reach a reasonable coolant pump efficiency as the header tank valve does not permit coolant circulation at less than 800 rpm. The engine speed should then be increased to 1200 or 1500 rpm and running continued until the temperature of the oil inlet is at least 15°C (59°F) and that of the coolant outlet reaches 60°C (140°F).

NOTE

AFTER OIL PRESSURE IS OBTAINED, ENGINES WILL NOT BE IDLED BELOW 1300 RPM.

CAUTION

Running at reduction gear and crankshaft synchronous periods of 820, 1135, and about 1200 rpm should be avoided.

b. During warm-up, the oil pressure should never exceed 120 pounds per square inch, and the oil temperature should never exceed 90°C (194°F). The minimum oil pressure is 60 pounds per square inch and the minimum oil temperature is 15°C (59°F). The normal oil pressure is 75 to 95 pounds per square inch, and the normal oil temperature is 60°C to 80°C (140°F to 176°F).

c. During warm-up, the coolant temperature should not exceed the maximum of 121°C (250°F). The normal

coolant temperature range is from 95°C (203°F) to 120°C (248°F).

d. The fuel pressure for idling should be maintained at 10 pounds per square inch and for operating at 14 to 15 pounds per square inch.

e. Avoid prolonged ground running of the engine.

f. Adjust the cockpit heater and ventilator control as desired. (See figure 9.)

g. The cowl flaps are controlled automatically and normally will not require any attention from the pilot.

See paragraph 2.b.(6) of this section.

h. Set the carburetor heat control as required. (See figure 9.) If known icing conditions exist, set the carburetor heat control to "FULL HOT" and lock the handle in that position by turning it to the right 90 degrees. Do not operate the engine with heat to the carburetor unless icing conditions prevail.

5. EMERGENCY TAKE-OFF.

The engine may be used for an emergency take-off as soon as it will properly "take" the throttle.

6. GROUND TEST.

a. After warm-up has been completed in accordance with paragraph 4. above, throw the toggle of the propeller selector switch (figure 9) in "MANUAL," and advance the throttle (figure 11) to obtain a manifold pressure of 30 inches Hg. Hold the toggle of the propeller selector switch in the "INC.-RPM" or the "DEC.-RPM" position as required to obtain an engine speed of 2300 rpm.

(1) To test each magneto and the spark plugs, move the ignition switch (figure 9) to "R" and note the loss in engine rpm. Return the switch to "BOTH," and when the original rpm is regained, move the ignition switch to "L" and note the loss in engine rpm. Return the switch to "BOTH" after the test. The maximum drop in rpm when operating the engine on one magneto must not exceed 150 rpm. The magneto check should be made in as short a time as possible, and should not exceed 15 seconds.

(2) With the propeller selector switch in "AUTO" ground test the automatic operation of the propeller by setting the throttle at three-fourths take-off rpm and pulling back on the propeller governor control (figure 11) until approximately 100 rpm reduction in engine speed is observed. Return the propeller governor control to take-off position noting that the original rpm is obtained.

b. Test operate the propeller switch check warning light. (See figure 9.)

(1) When the propeller circuit breaker (figure 9) is "OFF," or when the propeller selector switch (figure 9) is out of "AUTO" position, the warning light will flash on.

(2) If the propeller blade angle is at the full increase or decrease pitch, the propeller motor circuit is opened and the warning light will not flash on.

(3) The engine must be running before the warning light will illuminate.

c. To check the operation of the mixture control, hold the toggle of the propeller selector switch in the "INC.-RPM" position to obtain maximum low pitch. Keep the selector switch in "MANUAL," open the throttle to 37.5 inches Hg manifold pressure, and move the mixture control from "AUTO-RICH" to "AUTO-LEAN" position. There should be a slight drop in rpm, but never an increase.

d. To check the supercharger and manifold pressure regulator, set the mixture control in "AUTO-RICH," open the throttle to obtain 44.2 inches Hg manifold pressure, and adjust the propeller pitch setting to obtain 2650 rpm. Retain the propeller selector switch in "MANUAL." Observe the engine speed, then shift the supercharger control (figure 11) from "LOW" to "HIGH" blower. An appreciable drop in rpm should follow, but the original manifold pressure should prevail within 1 inch Hg. By shifting back to low gear, the original rpm should be restored. Make the shift from one gear to the other as quickly as possible to avoid unnecessary dragging and slipping of clutches.

e. Check the "OFF" position of the ignition switch to assure the proper connection of the ground wires. Make this check at the end of the engine warm-up period with the propeller in full low pitch and the engine turning over at approximately 700 rpm. Turn the ignition switch to "OFF" momentarily and note whether or not the engine stops firing. Two or three seconds is ample time for making this check. Return the ignition switch to "BOTH" immediately after the test.

CAUTION

Prolonged idling of the engine should be avoided since this will tend to cause fuel to condense in the supercharger volute and cause spark plugs to foul.

f. Check the operation of the engine on each fuel tank. Turn the fuel selector valve control handle (figure 11) from "FRONT WING" to "REAR WING" and then to "FUSE. - RESERVE." If the belly tank is installed, turn to "BELLY." Operate the engine for approximately 1 minute with the fuel selector valve control handle in each position, and then return to "FRONT WING."

NOTE

Be sure the fuel selector valve is opened to the tank indicated on the dial. It is important that the fuel valve settings are determined by the "click and feel" method, and not solely by the position of the valve control handle on the dial.

g. Check the fuel and oil pressure and the oil and coolant temperatures when the engine is operating at 2300 rpm at 30 inches Hg manifold pressure. See paragraph 4., "Engine Warm-up," for normal operating temperatures.

h. The ammeter (figure 9) will show a charge only when the battery is taking current. If the battery is fully charged, an automatic relay grounds the generator field and no charge will be indicated.

i. TAXYING INSTRUCTIONS.

(1) All taxying will be done with the propeller setting in the high rpm (low pitch) position.

(2) The view ahead is poor when taxying; it is therefore necessary to keep swinging the airplane from side to side for visibility directly ahead.

CAUTION

Avoid taxying through mud holes and tall grass as the propeller can easily be damaged by small stones, mud clots, or hidden pieces of foreign material. DO NOT TAXI WITH FLAPS EXTENDED.

7. PREFLIGHT.

a. Call the dispatcher for taxying clearance and Kollsman air altitude. If taking off from a field where no dispatcher is on duty, set the Kollsman at the altitude listed on the flight map. Refer to section V for complete instructions for the operation of the airplane's radio equipment.

b. Refer to section VI for complete information on operation of the airplane's armament.

c. Set the fuel selector valve on "FRONT WING."

d. Wing flaps up.

e. Be sure all controls are free.

f. Adjust the trim tabs to the take-off setting. (See figure 10.)

g. Set the trim tab on the left aileron flush with the trailing edge. The right aileron trim tab cannot be adjusted from the cockpit. When the electric trim tab toggle switch is moved up the left wing raises, and when the switch is moved down the left wing lowers. The switch automatically returns to neutral when released and the tab will remain fixed at its last setting.

h. The cowl flaps are controlled automatically.

i. If known icing conditions exist, set the carburetor heater control to "FUEL HEAT" (figure 9) and throw the pitot tube heater switch "ON." (See figure 9.)

j. Set the engine controls in accordance with "Take-off" settings listed on the "Flight Operation Instruction Chart" in section III.

k. Adjust the cockpit heating and ventilating control (figure 9) to the desired setting. Pull for "heat" and push for "cold." The control may be set for any intermediate position. Closing the cowl flaps will increase the temperature of the heat entering the cockpit.

8. TAKE-OFF.

a. Place the supercharger gear control (figure 11) in "LOW" blower ratio, mixture control (figure 11) in "AUTO-RICH," the propeller selector switch (figure 11) in "AUTO," and the propeller governor control (figure 11) in the full forward "INCREASE" rpm position. Move the throttle (figure 11) to the extreme forward position THROUGH THE CROSS-OVER GATE to obtain 54.3 inches Hg manifold pressure. This take-off throttle position overrides the automatic manifold pressure regulator and provides uncontrolled pressure of about 54.3 inches Hg absolute.

CAUTION

This extreme throttle position should be used only until all obstructions are cleared, after which the throttle must be pulled back to the gate for normal climbing speed and manifold pressure. THE THROTTLE SHOULD NEVER BE MOVED PAST THE GATE EXCEPT FOR TAKE-OFF.

NOTE

The supercharger gear control must be in the low gear position for take-off and up to 13,000 feet.

b. Immediately upon clearing all obstacles, reduce the throttle to not exceed 48.2 inches Hg.

CAUTION

Climbs of 60 degrees or greater will be performed only with one-third or more of the maximum oil capacity.

c. Refer to the "Flight Operation Instruction Chart" section III, for all flight data. It is generally safer to take this type airplane off by first lifting the tail before gathering flying speed. Taking off from a

three-point position is extremely dangerous if the engine should cut out during take-off. In this condition it would be almost impossible to keep from whipping off on one wing. Ten- to twenty-degree flaps will aid in shortening the take-off distance but is generally not necessary with this type airplane.

WARNING

The artificial horizon is fitted with a caging device. Check to ensure that the instrument is uncaged if required for immediate use.

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

(1) Apply the brakes to stop the rotation of the wheels just after the wheels are clear of the ground.

(2) To retract the landing gear, pull the safety latch (figure 10) on the landing gear control handle forward, and raise the handle to the "UP" position. (See figure 10.) Squeeze the hydraulic electric motor switch on the front of the control stick until the Flap and Wheel Position Indicator on the instrument panel, or the visual indicators in the wing, whichever installation is used, shows the gear to be fully retracted. If the switch on the control stick fails to raise the gear the necessary hydraulic pressure may be produced by actuating the auxiliary hydraulic hand pump (outboard pump, figure 13) until the gear is locked in the "UP" position. If the electric hydraulic pump is used to raise the landing gear, actuate the switch for a few seconds after the indicator shows the wheels to be retracted so that the mechanical locks in the retracting cylinder will be positively engaged to lock the gear in the retracted position. After the electric pump switch has been released actuate the auxiliary hydraulic hand pump a few strokes as a final safety check. If a high load is required to move the pump handle it is an indication that the locks are engaged and the gear properly secured in the retracted position. Return the landing gear control handle to "NEUTRAL" after the gear is retracted.

(3) For all airplanes equipped with hydraulic gun chargers: BE SURE ALL GUN CHARGING VALVES ARE IN THEIR "OUT" POSITION WHEN OPERATING THE LANDING GEAR.

e. If the flaps were used for take-off, do not raise them below 500 feet altitude.

f. ENGINE FAILURE DURING TAKE-OFF.

(1) If the engine stops for no apparent reason, the carburetor air intake may be plugged, or its butterfly valve may have failed. Apply carburetor heat to provide an alternate source of air. If the fuel pressure drops, causing engine failure, try switching to another fuel tank.

(2) If the engine does not respond, move the mixture control to "IDLE CUT-OFF," put the nose of the airplane down and maintain flying speed.

(3) DO NOT ATTEMPT TO LOWER THE LANDING GEAR. Be sure that the landing gear has commenced to retract and continue to hold the electric hydraulic pump switch until the landing gear has fully retracted.

(4) Lower the wing flaps to the full "DOWN" position.

(5) If the airplane is carrying a belly tank or bomb, be sure that the bomb arming handle is in the "SAFE" position and release the tank or bomb by pulling up on the "BOMB-TANK RELEASE" handle.

(6) If the airplane is carrying wing bombs, be sure that the arming lever on the bomb release quadrant is in the "SAFE" position (fully aft), and throw the bomb release lever to the "SALVO" position (fully forward.) All wing bombs will be released simultaneously.

(7) Turn ignition switch "OFF."

(8) Turn battery line switch "OFF," only when the landing gear is fully retracted and the wing flaps are fully down.

(9) Land straight ahead.

CAUTION

The elevator control at 110 mph with a dead engine is considerably slower than during a normal landing with an idling engine, and will require a greater movement to obtain a normal response.

9. FLIGHT.

a. FIRE PREVENTION. - No fire prevention equipment is installed in this airplane.

b. Plan all flight cruising conditions from the "Tactical Range Chart" and "Flight Operation Instruction Chart" in section III. Instructions for using these charts are printed on the bottom of the "Tactical Range Chart." See figure 4 for a diagram of the fuel system and capacity of the tanks. The airplane's oil supply is more than sufficient for the maximum fuel capacity.

c. Trim the airplane for level flight.

(1) Rotate the rudder tab control clockwise to turn the nose of the airplane to the right. (See figure 10.)

(2) Rotate the elevator tab control clockwise to put the nose of the airplane down. (See figure 10.) The elevator tab control has a crank handle for rapid adjustment.

(3) Move the electric aileron trim tab switch "UP" to lift the left wing, and "DOWN" to lower the left wing. (See figure 10.)

d. The engine rpm oil temperature and pressure and coolant temperature give the most satisfactory indications of engine performance. If any of these appears irregular, the engine should be throttled, and if the trouble cannot be eliminated, a landing should be made to investigate and remove the trouble. Refer to paragraphs 4.b. and c. of this section for normal operating temperatures and pressures.

e. To prevent excessive cylinder pressures when changing the power conditions, the following procedure will always be followed whether in flight or during ground operations.

(1) To increase the engine power set the mixture control in "AUTO-RICH," adjust the propeller control for the required rpm and the throttle to obtain the desired manifold pressure and then readjust the mixture control if necessary. After all controls are adjusted properly they may be locked in place by tightening the knurled knob on the inboard side of the quadrant. (See figure 11.)

(2) To decrease the engine power, adjust the throttle for the desired manifold pressure, adjust the propeller control to obtain the required rpm and then readjust the mixture control if necessary. Lock the controls at the desired setting with the knurled knob on the face of the quadrant. (See figure 11.)

f. TWO-SPEED BLOWERS.

(1) Maximum engine performance will be obtained by remaining in low blower ratio until the critical altitude has been exceeded and the manifold pressure has dropped about 3 or 4 inches Hg. Then shift to high blower ratio by moving the supercharger gear control (figure 11) without hesitation to the "HIGH" position. The supercharger gear control may be shifted from low blower gear ratio to high blower gear ratio or vice versa at any speed or boost condition without throttling back.

(2) Better engine efficiency is obtained when operating in low blower than in high blower ratio if the low blower ratio is able to supply the necessary power. Supposing a full throttle altitude at low rpm has been reached and a slight increase in power is desired, it is preferable to increase the engine speed by 100 to 200 rpm and remain in low blower than to shift to high blower and remain in the lower engine speed.

(3) Unless in actual combat, reduce the engine power to approximately 20 inches manifold pressure and 2000 rpm prior to shift. This procedure will lengthen the life of the supercharger clutch.

g. TO CHANGE THE ENGINE RPM.

(1) When the propeller is operating automatically, the propeller selector switch (figure 9) is in "AUTO." To change the engine rpm, move the propeller governor control (figure 11) in the "INCREASE" or "DECREASE" direction as required to obtain the desired rpm.

(2) When the propeller is operating in fixed pitch, the propeller selector switch (figure 9) is in "MANUAL" or the central position. To change the engine rpm, hold the toggle of the propeller selector switch in the "INC.-RPM" or the "DEC.-RPM" position as required until the desired engine rpm is obtained.

NOTE

If the circuit breaker switch (figure 9) throws out and will not remain in the "ON" position, place the propeller selector switch in "MANUAL." Change the propeller pitch only if it is absolutely necessary. To change the propeller pitch, hold the circuit breaker "ON," and obtain the desired rpm according to the procedure given in paragrapn g.(2).

h. Do not operate the landing light control switch (figure 9) at indicated air speeds in excess of 175 mph and avoid burning the light longer than 3 minutes.

i. Do not start to open the cowl flaps at indicated air speeds in excess of 400 mph.

j. If icing conditions exist and the windshield is frosting over, both heat and glycol spray may be administered to the panels to clear the windshield. To allow heat to pass between the two windshield panels, pull the handle on the left side of the windshield frame "OUT" to release heat from the defrosting housing in the oil tank compartment. If it is desired to release a glycol spray on the windshield, pump the glycol spray control handle (figure 9) which will eject a spray of glycol from the jet tube along the periphery of the fuselage.

(1) On P-40F airplanes AC-41-14500 and subsequent and all P-40L airplanes, the windshield glycol spray has been removed.

(2) The windshield defroster for P-40F airplanes AC-41-14500 and subsequent, and all P-40L airplanes is inside the cockpit. It is located at the base of windshield center section.

k. The cockpit may be heated and ventilated by the heating and ventilating system controlled by the handle (figure 9) at the right of the small panel below the main switch panel. Pull the handle for hot air and push for cold. A mixture of both can be obtained by pulling the handle partially out and locking. To lock the handle in any position, turn approximately 90

degrees clockwise. For additional heat in winterized airplanes, the long flexible tube in the cockpit should be used. This additional heat tube may also be used as a defroster.

l. If a belly tank is installed, the fuel selector valve (figure 11) should be set at "BELLY" as soon as practicable 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." (See figure 4 for fuel tank capacities.)

CAUTION

Never allow a fuel tank to run dry during flight as detonation and engine failure may result. The fuel pressure warning light (figure 8) will flash on whenever the pressure drops below 12 pounds per square inch. This warning light has a red jewel lens.

(1) To change over from one tank to another, hold the airplane in a level flying position, throttle position unchanged, mixture control on "FULL RICH" and turn the fuel selector valve to the desired position.

(2) Fuel selector valve settings must be determined by the "CLICK and FEEL" method and not solely by the position of the pointer on the dial in the cockpit. If this precaution is not taken, fuel may flow between tanks creating a very dangerous fire hazard.

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

WARNING

(On P-40F airplanes that do not have extended fuselage.) If a full left rudder is applied during climbs at high engine power a reversal of the rudder load may be experienced. This condition will not be encountered in normal maneuvers. However, should such a condition develop, immediate action should be taken to retard the throttle. With the engine power reduced, no further difficulty should be experienced in centralizing the rudder.

n. Use the fuel from the tanks in the following order:

Without Belly Tank	With Belly Tank
1. Front Wing (starting and take-off)	1. Front Wing (starting and take-off)
2. Fuselage (leave 35 U.S. gallons (29 Imperial gallons) reserve)	2. Belly
3. Front Wing	3. Fuselage (leave 35 U.S. gallons (29 Imperial gallons) reserve)
4. Rear Wing	4. Front Wing
5. Fuselage (reserve)	5. Rear Wing
	6. Fuselage (reserve)

A vapor vent line passes vapor and a small quantity of fuel back to the front wing tank in flight. Therefore, this tank should always be used for starting, take-off, and during flight until a safe flying altitude is reached to make room for the returning fuel. When extreme range is required, the small quantity of fuel returned may be used by turning the selector valve back to "FRONT WING" towards the end of the flight.

NOTE

On P-40L-5 airplanes serial No. 41-10480 and up, the front wing tank installation is eliminated.

o. CHANGE OF TRIM. - With the landing gear extended, the airplane is nose heavy. However, with the 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.

p. STALLING. - The stalling characteristics of the airplane are good and at normal operational loads the following are the approximate stalling speeds.

Landing gear up - flaps up	92 IAS
Landing gear down - flaps up	94 IAS
Landing gear up - flaps down	80 IAS
Landing gear down - flaps down	82 IAS

q. SPINNING.

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

(2) In recovering from a spin the pilot will generally have initial recovery in the form of a steep spiral. Even though his indicated air speed 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 C.G. 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 recovery from the altitude at which he first whipped off. Approximately 1000 feet altitude is lost per turn of a spin. Recovery can be effected generally at a minimum of about 1500 feet loss of altitude during recovery.

r. DIVING.

(1) Dives of 90 degrees will be performed only with one-third or more of the maximum oil capacity.

(2) Do not fully close the throttle in dives. One-quarter throttle opening, which will give about 20 inches Hg manifold pressure is recommended. Do not make sudden changes in throttle opening during dives as large changes in directional and lateral trim will result and might throw the airplane into a yawed attitude which would be dangerous at high speeds because of the type of air loads imposed.

(3) When going into a dive always retard the throttle first and then advance the throttle gradually. The propeller controls may be set in the maximum increase rpm position during the dive, but in most cases the maximum diving speed will be obtained with the propeller controls set for approximately 2600 rpm. The supercharger gear control (figure 11) should be moved to low blower before entering the dive if the pilot intends to continue below 13,000 feet.

(4) As diving speed increases the airplane tends to yaw to the right and left rudder trim 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 an emergency.

CAUTION

Do not exceed the maximum permissible engine overspeed of 3180 rpm. At 3180 rpm the manifold pressure must not be less than 20 inches Hg. Do not exceed an air speed of 480 mph indicated.

(5) 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 CLOSE THE THROTTLE TO ALLOW A MANIFOLD PRESSURE OF LESS THAN 20 INCHES HG DURING DIVE."

s. AEROBATICS. - Subject to any current restrictions any normal aerobatics may be executed in this airplane. However, the following are prohibited:

(1) Outside loop.

(2) Inverted flight.

(3) Inverted spin.

(4) Snap roll at speed in excess of 140 mph indicated.

(5) Slow roll at speed in excess of 285 mph indicated.

(6) Spin of more than three turns.

(7) Spin with baggage, auxiliary fuel, or any other overload.

CAUTION

It has been found that it is possible to cause locking of the rudder in the full left position on these airplanes if the airplanes are skidded with almost full left rudder at fairly low speed and power is then suddenly applied. This causes air loading on the rudder to be reversed and the more that power is applied the more the left rudder tends to remain locked in the left position. This condition is believed to have caused fatal spins. All pilots should be cautioned that the throttle should be cut immediately if the airplane is inadvertently stalled or spun. When power is reduced the airplane will respond to normal recovery control.

WARNING

It is extremely important to maintain ample altitude for recovery from any maneuver as acceleration during the dive is rapid and at high speeds the initial pull-out is inclined to be heavy. All aerobatics are prohibited with a belly tank installed or a belly bomb loaded.

SPECIAL NOTES

1. Do not exceed a maneuver acceleration of $8.02g$ positive or $3.6g$ negative with a normal gross weight of 8500 pounds.

2. Do not exceed a maneuver acceleration of $7.0g$ positive or $3.3g$ negative when the airplane is loaded above the normal gross weight.

3. The turn indicator (figure 8) and the flight indicator (figure 8) must be caged before doing aerobatics.

t. Refer to section VI for complete information on angles of protection for the pilot against .30-caliber gun fire.

u. POWER FAILURE DURING FLIGHT.

(1) Move the mixture control to "IDLE CUT-OFF" and turn the ignition switch "OFF."

(2) Drop the nose of the airplane sufficiently to maintain an approximate 110 mph glide.

(3) If the airplane is equipped with a belly tank, pull the "BOMB-TANK RELEASE" handle (figure 10) and drop the tank immediately.

(4) If a belly bomb load is carried, be sure that the bomb arming handle is in the "SAFE" position and pull the "BOMB-TANK RELEASE" handle for a "SAFE" drop.

(5) If a wing bomb load is carried, place the arming lever on the bomb control quadrant (figure 10)

in the "SAFE" position and throw the release lever (figure 10) to the "SALVO" position. This will release all bombs for a "SAFE" drop simultaneously.

(6) Turn the fuel selector valve "OFF." (See figure 11.)

(7) Move the flap control handle (figure 10) to the forward position and operate the auxiliary hydraulic hand pump (figure 13) until the flap and wheel indicator on the instrument board (figure 8) (or the visual flap indicator pegs, in the wings) shows the flaps fully extended. Return the flap control handle to "NEUTRAL." Increase the glide angle sufficiently to maintain an approximate 110 mph indicated air speed.

(8) Open the cockpit enclosure by operating the control crank. (See figure 14.)

(9) If a suitable landing field is available the landing gear may be lowered. Place the control handle in the "DOWN" position and squeeze the switch on the control stick, below the handgrip. Hold the switch depressed a few seconds after the indicator shows the landing gear down. Close the throttle and if the landing gear warning horn sounds, the landing gear is not locked down. If the warning horn sounds, operate the auxiliary hydraulic hand pump (figure 13) until the horn is quiet. Return the control handle to the "NEUTRAL" position. If both the main hydraulic system and auxiliary system fail, lower the landing gear, by removing the handle from the auxiliary hand pump by depressing the latch at the bottom of the stick and pulling the handle up until it is free of the pump, and replace the handle on the emergency hand pump. (See figure 13.) Open the two shut-off valves, one on the right and the other on the left cockpit floor. The emergency hand pump will lower the main landing gear only, with the control handle in any position. The tail gear will not lower with the operation of the emergency hand pump, LAND TAIL HIGH. If a suitable landing field is not available for a normal landing, keep the landing gear retracted and land the airplane on its belly.

NOTE

For P-40F airplanes AC-41-14600 and subsequent, and all P-40L airplanes, the emergency hydraulic system has been removed.

(10) Turn the battery switch "OFF" (figure 9) except when lights are needed.

v. EMERGENCY CONDITIONS OF FLIGHT.

(1) For emergency use below 10,000 feet, an increase in level flight and climbing performance may be obtained from the "emergency" manifold pressure control. (See figure 11.) When this control is operated with the throttle lever AT THE GATE, the maximum "regulated" manifold pressure of 54.3 inches Hg is available. THIS CONTROL SHOULD NEVER BE USED WITH HIGH BLOWER RATIO OR WITH THE THROTTLE THROUGH THE GATE.

(2) When it becomes expedient to use the emergency manifold pressure control, throttle back slightly, pull out the control and open the throttle. To return to normal manifold pressure, throttle back slightly, close the control and adjust the throttle and the propeller control to the power desired.

CAUTION

If the increased manifold pressure is used during climb, the engine speed must not be less than 2600 rpm. Use of this control is limited to 5 minutes.

NOTE

The emergency manifold pressure control (figure 11) is sealed with lock wire in the "ON" position. When the seal is broken, the engine must be rechecked and the control resealed.

10. EMERGENCY PILOT EXIT.

In the event of an emergency during flight, pull the emergency release handle "D" at the top forward frame of the cockpit enclosure and the entire canopy will be torn off by the slip stream. (See figure 14, detail "A.") After a turn over on the ground, pull the release handle "A" located on the left lower canopy frame, inboard, to unlock the emergency exit frame "B." Slide frame "B" aft with the release handle "A" until the kick-out panel on the left side of the canopy can be pushed open. This panel can also be opened from the outside by pulling out the handle on the lower frame (painted red) and pushing back until the panel locks are disengaged.

11. APPROACH FOR LANDING.

a. Approach and landing of this airplane is normal. However, the view during the final glide 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. Landing must always be made with the flaps down.

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

(1) Set the fuel selector valve control (figure 11) on full tank.

(2) Be sure that the mixture control is in "AUTO-RICH" and that the supercharger is set in low blower ratio.

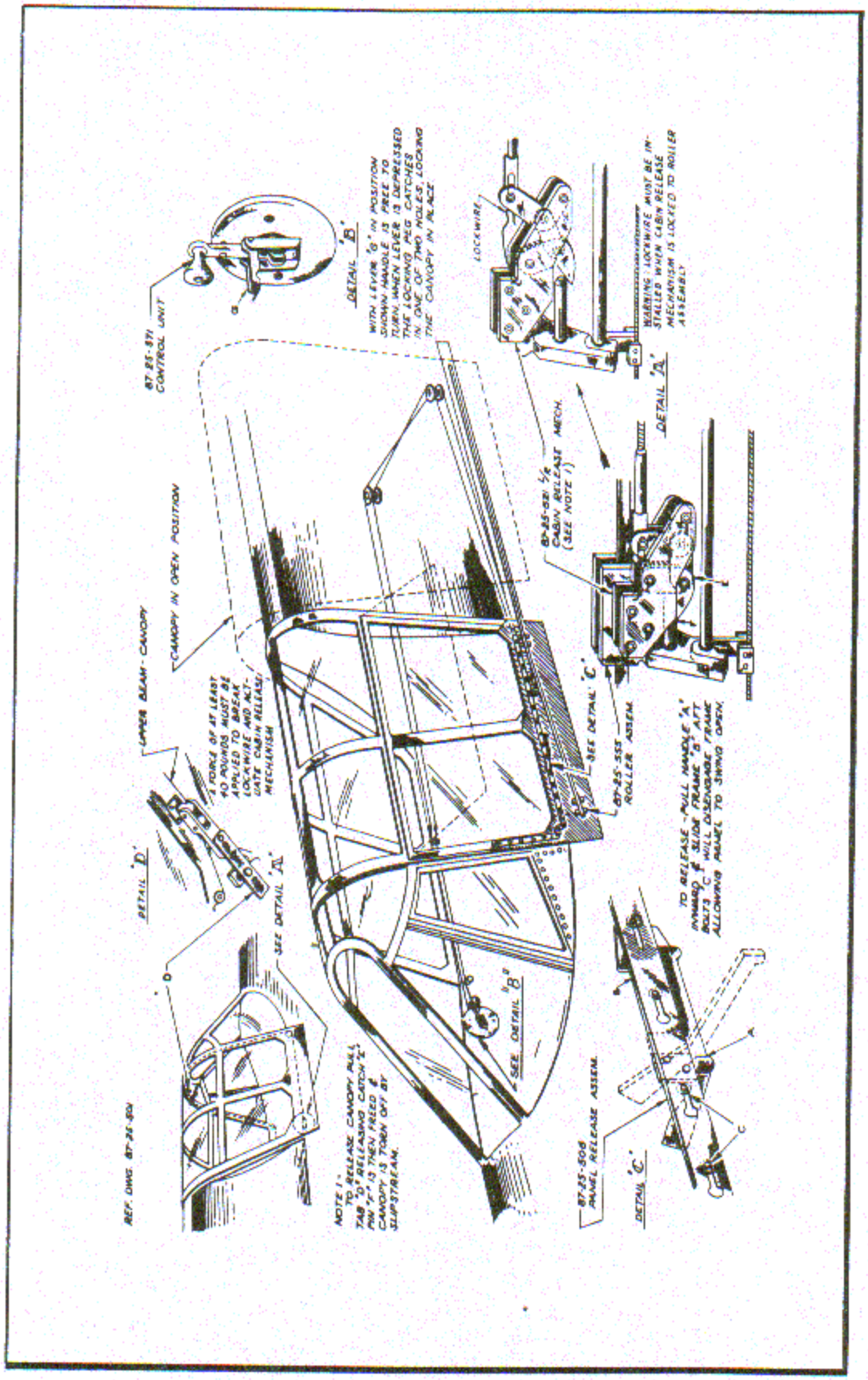


Figure 14 - Detail Operation of Cabin Controls

(3) Push the carburetor air control (figure 9) in and lock in the "FULL COLD" position.

(4) Set the propeller for 2650 rpm and check the propeller switches.

(5) Set the cowl flaps to prevent overcooling the engine during long glides.

(6) Be certain the gun safety switch (figure 9) is "OFF" before extending the landing gear or the wing flaps. This will prevent the guns from being fired accidentally, if the gun trigger switch on the flight control stick handgrip is depressed instead of the electric hydraulic pump switch which is located just below the handgrip.

(7) For airplanes AC-41-13600 to AC-41-13994, inclusive, and airplane AC-41-13998: The gun charger valves must be in the "OUT" position before operating the landing gear. (See section V, paragraph f.)

(8) Lower the landing gear by placing the control handle in the "DOWN" position and squeezing the electric hydraulic pump switch on the control stick below the handgrip. Operate the switch a few seconds after the position indicator and warning horn show the gear to be down and the locks in place. As a final check actuate the auxiliary hydraulic hand pump and if a high load is required to move the handle the locks are definitely engaged. The landing gear must not be lowered when the air speed is in excess of 175 mph, IAS.

(9) When the indicated air speed is 140 mph or less, fully extend the flaps by moving the flap control handle forward and squeezing the electric hydraulic pump switch on the control stick below the handgrip. Hold the switch on until the indicator shows the flaps to be fully extended. Return the flap control handle to "NEUTRAL." (See figure 10.)

(10) For the 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"	- 95 - 105 IAS

Once the boundry of the airport has been crossed, the engine "ON" speed may be reduced to 100 IAS. (The airplane stalls at approximately 82 IAS with landing gear and flaps down.) This stalling speed is subject to plus or minus 2 mph depending on the load.

(11) The airplane has a high angle of attack when on the ground and as the tail comes down the whole area ahead is obscured by the nose.

NOTE

In a cross wind or in strong gusts about half flaps are recommended with a tail high landing.

WARNING

At full load with the C.G. 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 a 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 C.G. in the aft position, it is possible to cause the tail wheel to travel through its steerable arc into the nonsteerable 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 the application of both brakes rather than to try and control the swing by the application of opposite brake and rudder.

(12) At the conclusion of the landing run raise the flaps by placing the control handle in the "UP" position and squeezing the electric hydraulic pump switch on the control stick below the handgrip, until the indicator shows the flaps to be fully retracted.

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 also recommended that the minimum of engine power be used when approaching for a night landing. The retractable landing light may be used by throwing the switch on the panel (figure 9) to the "DOWN" position. The light will automatically illuminate when it is extended. Throw the landing light switch to the "UP" position immediately after landing. Never burn the landing light longer than 3 minutes or the reflector will become smoked.

12. FORCED LANDINGS.

In the event of a forced landing, the pilot must decide whether or not it is advisable to lower the landing gear or whether the landing should be made with the landing gear retracted.

a. If in doubt, land with the landing gear retracted.

b. Turn the fuel selector valve "OFF."

c. Turn the ignition switch "OFF."

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

e. Turn the battery switch "OFF."

f. Land with as high an angle of attack as possible.

g. In the event of a forced landing on water, be sure the landing gear is retracted, canopy open, parachute harness released, safety belt and shoulder straps secured, but ready for instant release after landing. Due to the violent stop when landing on water the safety belt and shoulder straps should never be released until after the landing is completed.

13. FLYING IN THE RAIN OR BAD VISIBILITY.

a. Flying in the rain or bad visibility should be done at approximately 120 to 130 mph indicated and the following should be observed.

(1) Canopy open.

(2) Flaps one-fourth DOWN. Place the flap control lever in the "DOWN" position and operate the auxiliary hand pump until the indicator shows the flaps to be in the correct position.

(3) Propeller control should be set to give 2600 rpm.

14. EMERGENCY OPERATION OF THE LANDING GEAR.

If the electric hydraulic pump and the auxiliary hand pump fail, the landing gear can be lowered by transferring the pump handle from the auxiliary hand pump (outboard) to the emergency hand pump (inboard). Open both left and right shut-off valves. The landing gear can be lowered with the control valve handle in any position. The tail wheel will not lower with the operation of the emergency hand pump. LAND TAIL HIGH.

NOTE

For P-40F airplanes AC-41-14600 and subsequent, and all P-40L airplanes, the emergency hydraulic system has been removed.

15. EMERGENCY OPERATION OF THE FLAPS.

If the hydraulic electric pump fails to extend the flaps, manually pump them down with the auxiliary hand pump (outboard pump).

NOTE

The flaps cannot be extended with the emergency hand pump (inboard pump).

16. EMERGENCY TAKE-OFF IF LANDING IS NOT COMPLETED.

a. Open the throttle to 35 inches Hg and after the propeller rpm has been stabilized, increase the rpm to 3000 by adjustment of the propeller control. (See figure 11.) Then increase the manifold pressure to 54 inches Hg.

CAUTION

Pull the airplane up in a climb not to exceed 140 mph indicated air speed until the flaps are retracted.

b. Retract the flaps and proceed in the take-off technique as outlined in paragraph 8.

17. STOPPING THE ENGINE.

a. Apply brake treadles (figure 9) and set the parking brake. (See figure 9.)

b. Place the mixture control (figure 11) in "FULL RICH."

c. Move the throttle (figure 11) to obtain approximately 1300 rpm.

d. Set the propeller controls in the high rpm (low pitch) position.

NOTE

All taxying will be done with the propeller setting in the high rpm (low pitch) position.

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

f. When the outside temperature is below 0°C (32°F) or when a cold weather start is anticipated, the engine oil shall be diluted before stopping the engine. Operate the engine at approximately 1000 rpm, and hold the oil dilution switch "ON" (figure 9) for about 4 minutes before stopping the engine.

NOTE

If the oil temperature is above 70°C (158°F), stop the engine until the oil has cooled to 40° to 50°C (104° to 122°F). Restart the engine and proceed with the oil dilution as described above.

g. Open the throttle and move the mixture control to "IDLE CUT-OFF."

h. When the propeller stops rotating, turn the ignition switch "OFF."

18. BEFORE LEAVING THE COCKPIT.

a. Turn the fuel selector valve "OFF." (See figure 11.)

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

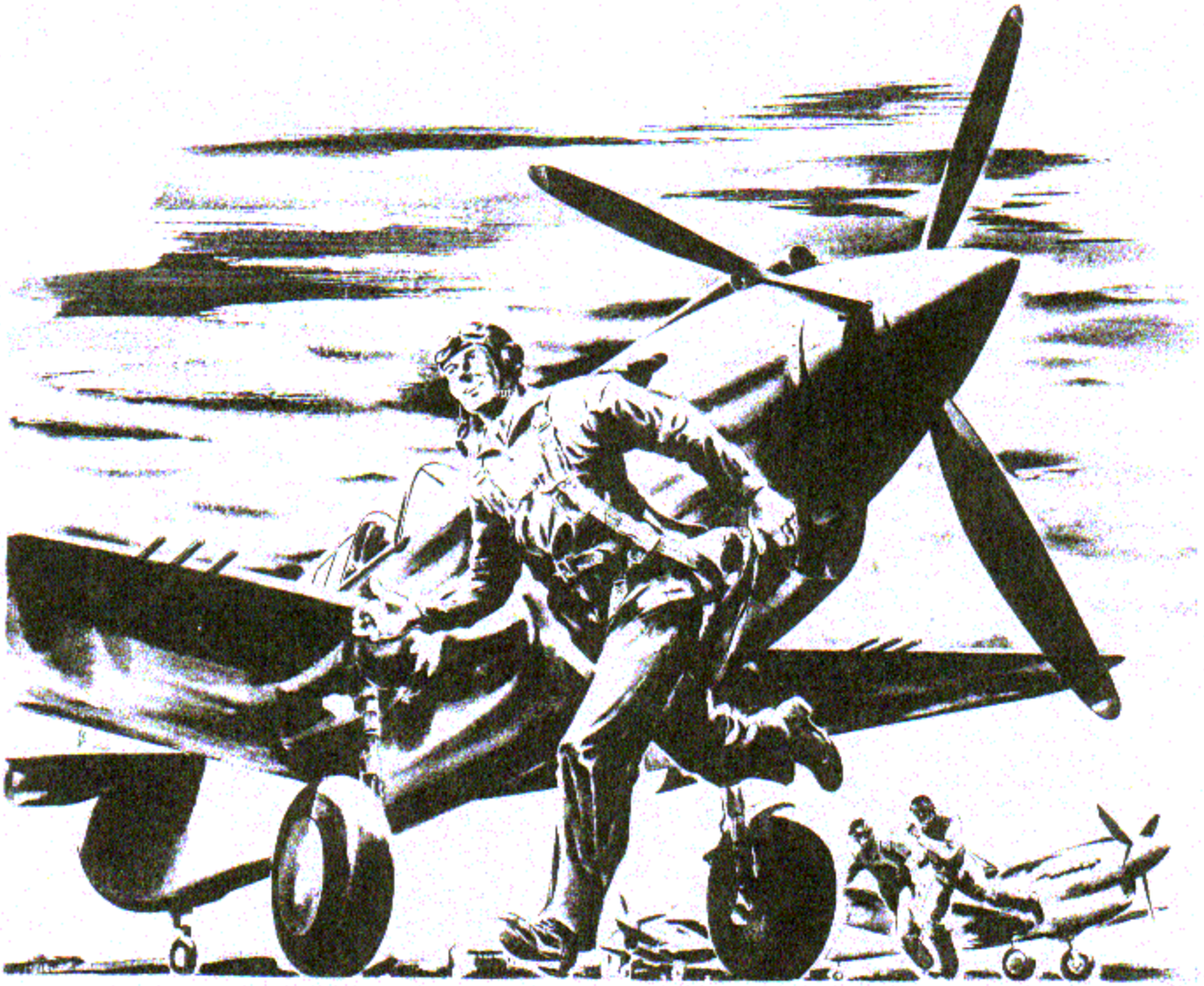
c. Place the battery line switch in the "OFF" position. (See figure 9.)

d. Cage flight indicator.

e. If oxygen has been used during flight, be sure that the oxygen regulator (figure 9) is turned off to prevent leakage.

f. Be sure that the control lever "G" (detail "B," figure 14) is in the position shown so that the canopy may be closed and opened by hand from the outside.

g. Fill out Form 1.



SECTION III

FLIGHT OPERATION DATA

1. DETERMINING GROSS WEIGHT

a. To determine the gross weight of the airplane, refer to the WEIGHT AND BALANCE CHART and check the basic and alternate tabulated items against those loaded in the airplane. If the airplane is loaded in accordance with the "BASIC LOAD ITEMS" whose weights are listed in the "POUNDS" column and the "ALTERNATE ITEMS" whose weights are entered under four loading conditions in the "ALTERNATE LOADING (POUNDS)" column, the gross weight will be listed at the bottom of the chart. If any items tabulated in the "POUNDS" columns are omitted in the loading of the airplane, deduct the weight of the missing items from the "GROSS WEIGHT" and the answer will be the correct gross weight as the airplane is actually loaded.

2. FLIGHT PLANNING.

a. The following outline may be used as a guide to aid personnel in the use of the FLIGHT OPERATION INSTRUCTION CHART for flight planning purposes.

b. If the flight plan calls for continuous flight where the desired cruising power and air speed are reasonably constant after take-off and climb to 5000 feet, the fuel required and flight time may be computed as a "single section flight."

(1) Within the airplane's limits, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in the airplane, speed is gained at a sacrifice of range, and range is gained at a sacrifice of speed. The speed is usually determined by considering the urgency of the flight plotted against the required range. The time of take-off is arranged so the flight will arrive at its destination at the predetermined time.

(2) Select the FLIGHT OPERATION INSTRUCTION CHART for the gross weight of the airplane at take-off. Locate the largest figure entered under the G.P.H. (gallons per hour) in column I in the lower left-hand corner of the chart. Multiply this figure by the number and/or fraction of hours desired for reserve fuel. Add the resulting figure to the number of gallons set forth in footnote No. 2 and subtract the total from the number of gallons of gasoline in the airplane prior to starting the engine. The figure resulting from the computation will represent the amount of fuel available and applicable for flight planning purposes on the RANGE IN AIR MILES SECTION of the FLIGHT OPERATION INSTRUCTION CHART.

(3) Select a figure in the fuel column equal to, or the next entry less than, the available amount of fuel in the airplane as determined in paragraph 2.a.(2). Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the air miles (with no wind) to be flown. Operating values contained in the column number in which this figure appears represent the highest cruising speed possible at the range desired: however, the airplane may be flown in accordance with values contained under OPERATING DATA in any column of a higher number with the flight plan being completed at a sacrifice of speed but at an increase in fuel economy.

(4) Using the same column number as selected by applying the instructions in preceding paragraph, determine the indicated air speed (in mph) and gallons per hour listed at sea level in the lower section of the chart under OPERATING DATA. Divide this "IAS" into the air miles to be flown and obtain the calculated flight duration in minutes, which can be converted into hours and minutes. Subtract the flight duration time from the desired time of arrival at destination in order to obtain the time of take-off (without consideration for wind). To allow for wind, use the above "IAS" as ground speed and calculate a new corrected ground speed with the aid of a flight calculator or by a navigator's triangle of velocities.

(5) The airplane and engine operating values listed below OPERATING DATA in any single numbered column are computed to give constant miles per gallon at any altitude listed. Therefore, the airplane may be flown at any altitude and at the corresponding set of values given as long as they are in the same column listing the desired range.

(6) The flight plan may be changed at any time enroute, and the chart will show the balance of range at various cruising powers by following the "INSTRUCTIONS FOR USING CHART," printed at the top of each page.

c. If the original flight plan calls for a mission requiring changes in power, speed, gross load, or external load items in accordance with "GR. WT." or "EXTERNAL LOAD ITEMS" increments shown on the series of "FLIGHT OPERATION INSTRUCTION CHARTS," the complete flight should be broken down into a series of "single section flights" each calculated as outlined in 2.a. in its entirety, and then added together to make up the total flight and its requirements.

SPEC. AN-H-8
DEC. 18, 1942

FORM ASC-513

WEIGHT & BALANCE CHART

AIRPLANE MODELS: P-40F & P-40L

CG LIMITS (IN INCHES) AFT OF REFERENCE DATUM LINE

CONDITION	F'W'D	AFT
TAKE-OFF		
LANDING		

BASIC WEIGHT ITEMS	POUNDS
WEIGHT EMPTY (INCLUDING TRAPPED FUEL AND OIL) AND RADIO	6537
EQUIPMENT:	
NAVIGATION ____ LB. PHOTOGRAPHIC ____ LB. OXYGEN 15 LB.	15
PYROTECHNICS (FLARES, ETC.) ____ LB.	
ARMAMENT:	
FIXED GUN INSTALLATION(S): (6) .50 CAL. 471 LB.; ( ) ____ CAL. ____ LB.; GUN SIGHT 4 LB.	475
FLEXIBLE GUN INSTALLATION(S): ( ) ____ CAL. ____ LB.; ( ) ____ CAL. ____ LB.	
CANNON INSTALLATION(S): ( ) ____ MM. ____ LB.; ( ) ____ MM. ____ LB.	
RADIO: MODEL(S) ____	
TOTAL BASIC WEIGHT (CG ____ INCHES AFT OF REFERENCE DATUM LINE)	7027

ITEMS OF USEFUL LOAD		ALTERNATE LOADINGS (POUNDS)			
		MAXIMUM FUEL	DESIGN LOAD	FULL INTERNAL	GROUND ATTACK
PILOT (200 LB. INCLUDING PARACHUTE)		200	200	200	200
CREW (200 LB. EACH INCLUDING PARACHUTE)					
PASSENGERS (200 LB. EACH INCLUDING PARACHUTES)					
BAGGAGE (____ LB. MAXIMUM)					
FUEL (6 LB. U.S. GAL. OR 7.2 LB. IMP. GAL.):	U.S. GAL. (IMP. GAL.)				
FRONT WING TANK	37 (31)	222		222	222
REAR WING TANK	54 (45)	324	324	324	324
FUSELAGE TANK	65 (55)	396	396	396	396
EXTERNAL TANK	52 (43)	312			
	( )				
	( )				
OIL (7.5 LB. U.S. GAL. OR 9 LB./IMP. GAL.):	18 (15)	135	135	135	135
EXTRA	3 (2.5)	23		23	23
EXTRA TANK(S) INSTALLATION		54			
BOMB INSTALLATION(S): ( ) INTERNAL AT ____ LB. EACH					
(1) EXTERNAL AT 500 LB. EACH					514
TORPEDO INSTALLATION					
AMMUNITION					
(1410) RD. OF .50 CAL.; ( ) RD. OF ____ CAL.		423	423		
( ) RD. OF ____ MM.; ( ) RD. OF ____ MM.					
1686 RD. OF .50 CAL.				506	506
EXTRA RADIO - 2 RECEIVERS AND 1 TRANSMITTER (SCR-274N)				27	
GROSS WEIGHT		9,116	8,505	8,860	9,347
DISTANCE (IN INCHES) THAT CG IS AFT OF REFERENCE DATUM LINE					

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

AIRPLANE MODELS P-40F & P-40L

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS V-1650-1

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	12-16	70-80	75		90			
MAXIMUM	16	90	85		121			
MINIMUM	12	60	15		60			
IDLING	9	15						

MAX. PERMISSIBLE DIVING RPM: 3180

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	14 U.S.QT/HR 23 IMP.PT/HR
MAX. CRUISE	10 U.S.QT/HR 17 IMP.PT/HR
MIN. SPECIFIC	5.6-9.4 U.S.QT/HR 9-16 IMP.PT/HR

OIL GRADE: (S) 1100 (W)

SUPERCHARGER TYPE: INTEGRAL, SINGLE STAGE, TWO SPEED, CENTRIFUGAL

FUEL GRADE: 100 OCTANE

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	54.3	1300			L		A.R.	133	111			
WAR EMERGENCY	3000	61.0	1300	4,600		L		A.R.					*
	3000	61.0	1300	12,000		H		A.R.					
MILITARY	3000	48.2	1240	11,500		L	15,000	A.R.	123	102			5
	3000	48.2	1120	18,500		H		A.R.	120	100			
MAXIMUM CONTINUOUS	2650	44.2	1080	9,500		L	12,000	A.R.	98	82			CONT.
	2650	44.2	1010	16,000		H		A.R.	93	77			
MAXIMUM CRUISE	2320	37.3	810	9,500		L	12,000	A.R.	87	72			CONT.
	2320	36.0	758	16,000		H		A.L.	65	54			
								A.R.	70	58			
								A.L.	53	52			
MINIMUM SPECIFIC CONSUMPTION	1850	37.5	650	S.L.		L	26,000	A.L.	57	47			CONT.
	2100	34.0	700	10,000		L		A.L.	65	54			
	2650	28.0	725	20,000		L		A.L.	78	65			
	2650	25.0	580	30,000		H		A.L.	55	46			

REMARKS: *To be used in pre-combat or combat zones ONLY. EMERGENCY ONLY.

SPEC. AN-H-9 Dec. 18, 1942 FORM ASC-510

AIRPLANE MODELS P-40F&L

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS V-1650-1

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND MPH	HEAD WIND KNOTS	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3,000 FT. GROUND RUN	HARD SURFACE RUNWAY AT 3,000 FT. TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6,000 FT. GROUND RUN	HARD SURFACE RUNWAY AT 6,000 FT. TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3,000 FT. GROUND RUN	SOD-TURF RUNWAY AT 3,000 FT. TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6,000 FT. GROUND RUN	SOD-TURF RUNWAY AT 6,000 FT. TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ	SOFT SURFACE RUNWAY AT 3,000 FT. GROUND RUN	SOFT SURFACE RUNWAY AT 3,000 FT. TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6,000 FT. GROUND RUN	SOFT SURFACE RUNWAY AT 6,000 FT. TO CLEAR 50' OBJ.
8500 *	0	0	1700	2950	2200	3850	2900	5200	1750	3000	2300	3900	3050	5300	1900	3150	2500	4100	3350	5500
	20	17	1100	2100	1450	2750	1950	3800	1100	2100	1500	2800	2000	3850	1200	2200	1600	2850	2200	4050
	40	35	600	1350	800	1850	1150	2600	600	1350	850	1850	1150	2600	650	1400	900	1950	1300	2750
9300 *	0	0	2250	3950	2950	5300	4100	7600	2350	4050	3050	5400	4250	7800	2550	4250	3350	5550	4800	8300
	20	17	1450	2850	1950	3850	2750	5700	1500	2900	2000	3950	2900	5800	1650	3000	2200	4150	3250	6150
	40	35	850	1900	1150	2600	1650	4000	850	1900	1200	2650	1750	4050	900	2000	1300	2800	1950	4250
	0	0																		
	20	17																		
	40	35																		

NOTE: INCREASE DISTANCE % FOR EACH 10°C ABOVE 0°C (% FOR EACH 20°F ABOVE 32°F) ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 54 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 3000 RPM & 48.2 IN. HG*

FERRY MISSIONS USE 2300 RPM & 37 IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S.L. TO 5000 FT. ALT. BEST I.A.S. MPH	BEST I.A.S. KNOTS	FT/MIN	TIME FROM S.L.	10000 FT. ALT. BEST I.A.S. MPH	BEST I.A.S. KNOTS	FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.	FUEL FROM S.L. IMP.	15000 FT. ALT. BEST I.A.S. MPH	BEST I.A.S. KNOTS	FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.	FUEL FROM S.L. IMP.	20000 FT. ALT. BEST I.A.S. MPH	BEST I.A.S. KNOTS	FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.	FUEL FROM S.L. IMP.	25000 FT. ALT. BEST I.A.S. MPH	BEST I.A.S. KNOTS	FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.	FUEL FROM S.L. IMP.	BLOWER CHANGE
9300 *	COMBAT	145	125	1900	2.6	140	121	1200	5.3	30	25	150	30	900	10.5	39	32.4	145	125	550	17.5	51	42.4	140	121	200	29.4	69	57.4	
	FERRY	140	121	750	6.7	145	125	600	13.6	35	29.1	145	125	400	20.2	49	40.8	140	121	100	43.7	75	62.4							
8500 *	COMBAT	140	121	2250	2.2	135	116	2400	4.4	28	23.3	130	113	1250	5.4	34	28.3	150	130	800	12.8	43	35.8	140	121	400	21.4	56	46.6	
	FERRY	135	116	900	5.9	140	121	700	11.9	33	27.5	140	121	600	19.4	43	35.8	140	121	300	30.0	57	47.4							
	COMBAT																													
	FERRY																													

NOTE: INCREASED ELAPSED CLIMBING TIME % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (% 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 MPH	BEST I. A. S. APPROACH KNOTS	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT 3,000 FT. TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3,000 FT. GROUND ROLL	HARD DRY SURFACE AT 6,000 FT. TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6,000 FT. GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT 3,000 FT. TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3,000 FT. GROUND ROLL	FIRM DRY SOD AT 6,000 FT. TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6,000 FT. GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT 3,000 FT. TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3,000 FT. GROUND ROLL	WET OR SLIPPERY AT 6,000 FT. TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6,000 FT. GROUND ROLL
7500 *			1450	950	1550	1000	1700	1100	1550	1000	1650	1100	1750	1200	2550	2050	2800	2250	3000	2450
8500 *			1600	1050	1750	1150	1850	1250	1700	1150	1850	1250	1950	1350	2850	2300	3100	2500	3350	2750

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

REMARKS * 52 OR 75 GAL. BELLY TANK OR 500 LB. BOMB INSTALLED

* FOR 5 MINUTES DURATION ONLY, THEN USE 2650 R.P.M. & 44.2 IN. HG.

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
RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

RESTRICTED

SPEC. AN-H-8 Dec. 18, 1942 FORM ASC-510

AIRPLANE MODELS P-40F & L

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS V-1650-1

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.
7500	0	0	1100	1850	1350	2300	1750	2900	1150	1850	1400	2300	1800	2950	1200	1950	1500	2400	1950	3100
	20	17	700	1250	850	1600	1100	2050	700	1300	900	1600	1150	2100	750	1300	950	1650	1250	2200
	40	35	360	800	450	1000	600	1350	350	800	450	1000	650	1350	400	800	500	1050	700	1400
8500	0	0	1550	2600	1950	3300	2500	4250	1600	2600	2000	3350	2600	4300	1700	2750	2200	3500	2850	4550
	20	17	1000	1800	1250	2350	1650	3050	1000	1850	1300	2400	1700	3100	1100	1900	1400	2500	1900	3300
	40	35	550	1150	700	1550	950	2050	550	1150	750	1550	1000	2100	600	1200	800	1600	1100	2200
9300	0	0	2000	3350	2500	4300	3350	5750	2050	3400	2600	4350	3450	5850	2200	3600	2850	4600	3850	6250
	20	17	1300	2400	1650	3100	2250	4250	1350	2400	1700	3150	2350	4350	1450	2500	1800	3300	2600	4600
	40	35	750	1550	1000	2100	1350	2960	750	1600	1000	2150	1400	3000	800	1650	1100	2200	1600	3150

NOTE: INCREASE DISTANCE % FOR EACH 10°C ABOVE 0°C (% FOR EACH 20°F ABOVE 32°F) ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 54 IN. HG

COMBAT MISSIONS USE 3000 RPM & 48.2 IN. HG*

CLIMB DATA

FERRY MISSIONS USE 2300 RPM & 37 IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S. L. TO 5000 FT. ALT.				10000 FT. ALT.						15000 FT. ALT.						20000 FT. ALT.						25000 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.	
9300	COMBAT	150	130	2050	2.4	145	125	2200	4.7	28	23.3	155	135	1160	8.3	35	29.1	155	135	790	13.3	44	36.6	155	135	350	22.1	57	47.4	
	FERRY	145	125	850	5.9	150	130	700	12.2	34	28.3	150	130	600	19.9	44	36.6	145	125	250	31.7	60	50							
8500	COMBAT	150	130	2350	2.1	145	125	2500	4.2	27	22.5	155	135	1450	6.8	32	26.6	150	130	1000	10.6	39	32.4	150	130	550	17.1	49	40.8	
	FERRY	140	121	1050	4.8	150	130	800	9.9	30	25	150	130	700	16.2	39	32.4	145	125	450	24.9	51	42.4							
7500	COMBAT	145	125	2850	1.8	135	117	2950	3.5	26	21.7	130	113	2600	5.4	30	25	150	130	1350	8.2	35	29.1	145	125	670	12.7	41	34.1	
	FERRY	140	121	1350	3.7	145	125	1200	7.7	27	22.5	150	130	1000	12.2	33	27.5	145	125	700	18.1	41	34.1			300	28.1	53	44.1	

NOTE: INCREASED ELAPSED CLIMBING TIME % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (% 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
7500			1550	950	1700	1050	1800	1150	1650	1050	1800	1150	1900	1250	2800	2200	3000	2400	3250	2600
8500			1750	1100	1850	1200	2000	1300	1850	1200	1950	1300	2100	1400	3100	2500	3350	2700	3650	2950

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

REMARKS * FOR 5 MINUTES DURATION ONLY, THEN USE 2650 R.P.M. & 44.2 IN. HG.

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
RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

SPEC. AN-H-8 DEC. 18, 1942 FORM 45C-511

MODEL (S) P-40F & P-40L

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 1 SHEETS

GR. WT. 8,900 TO 7,300 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.	IMP. G.P.H.
TAKE-OFF	3000	54.3	LOW	A. R.	TO CLEAR OBSTACLES	133	111
MILITARY POWER	3000	48.2	LOW	A. R.	5	123	102

ENGINE (S): V-1650-1

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) Statute at S.L.	I Statute at 12,000	I Nautical at S.L.	I Nautical at 12,000	FUEL U.S. GALS. (2)	II Statute	II Nautical	III Statute	III Nautical	IV Statute	IV Nautical	FUEL IMP. GALS. (2)	V (MAX. RANGE) Statute	V Nautical
				157	27 U.S. (22.5 IMP.) GALLONS NOT AVAILABLE IN FLIGHT						130.5		
	380		330	130	430	370	600	520	650	565	108	700	610
	355		305	120	395	345	550	480	600	520	100	650	565
	325		280	110	360	315	505	440	550	480	92	595	515
	295		255	100	330	285	460	400	500	435	83	540	470
	265		230	90	295	260	415	360	450	390	75	485	420
	235		205	80	265	230	370	320	400	345	67	430	375
	205		180	70	230	200	320	280	350	305	58	380	330
	175		155	60	200	170	275	240	300	260	50	325	280
	145		130	50	165	145	230	200	250	215	42	270	245
	115		100	40	130	115	185	160	200	175	33	215	190
	90		75	30	100	85	140	120	150	130	25	160	140
	60		50	20	65	55	90	80	100	85	17	110	95
	30		25	10	35	30	45	40	50	45	8	55	50

OPERATING DATA

DENSITY ALT. IN FEET (1)	I R.P.M.	I I.A.S. M.P.H.	I I.A.S. KNOTS	I M.P. IN. Hg	I U.S. G.P.H.	I IMP. G.P.H.	II R.P.M.	II I.A.S. M.P.H.	II I.A.S. KNOTS	II M.P. IN. Hg	II U.S. G.P.H.	II IMP. G.P.H.	III R.P.M.	III I.A.S. M.P.H.	III I.A.S. KNOTS	III M.P. IN. Hg	III U.S. G.P.H.	III IMP. G.P.H.	IV R.P.M.	IV I.A.S. M.P.H.	IV I.A.S. KNOTS	IV M.P. IN. Hg	IV U.S. G.P.H.	IV IMP. G.P.H.	V R.P.M.	V I.A.S. M.P.H.	V I.A.S. KNOTS	V M.P. IN. Hg	V U.S. G.P.H.	V IMP. G.P.H.
30000																														
25000																														
20000							2650	234	203	39	101	84							2300	186	162	29	54	45	2250	174	151	23	47	38
15000	2650	256	222	44.2	112	93	2500	241	209	40	96	79	2300	218	189	35	60	50	2300	210	182	29	56	47	2050	186	162	26	46	37
12000	2650	260	226	44.2	109	91	2600	254	221	39	96	79	2300	230	200	34	62	52	2100	214	186	31	54	45	1550	185	162	27	44	36
9000	2650	274	238	44.2	111	92	2400	254	221	39	92	77	2200	234	203	36	61	51	1950	213	185	32	51	42	1900	188	163	28	42	34
6000	2650	277	240	44.2	108	90	2400	254	221	39	88	73	2050	237	206	37	59	49	1900	214	186	33	49	40	1900	182	158	27	39	32
3000	2650	279	242	44.2	106	88	2400	254	221	39	84	70	2000	236	205	37	56	47	1900	212	184	33	47	38	1900	174	151	26	36	29
S.L.	2650	282	245	44.2	103	86	2400	254	221	39	81	67	1950	233	202	37	53	44	1900	210	182	32	44	36	1900	170	148	26	33	27

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.
(2) ALLOW 27 U. S. GALS. 22.5 IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK FRONT WING
USE FUEL FROM TANKS IN THE FOLLOWING ORDER (1) FUS. TO 35 GAL. (2) FRONT WING (3) REAR WING (4) FUS. RES. -35 GAL.

BOLD NUMBERS: Use Auto-Rich
LIGHT NUMBERS: Use Auto-Lean
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
IMP.G.P.H.: Imperial Gallons Per Hour
F.T.: Full Throttle
S.L.: Sea Level

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

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AA-H-H DEC. 38, 1942 | FORM ASC-511

MODEL (S) P-40F & P-40L

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 2 SHEETS

GR. WT. 9,300 TO 8,300 POUNDS

EXTERNAL LOAD ITEMS

(1) 52 OR 75 GAL. TANK
OR (1) 500 LB. BOMB

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	IMP. G.P.H.
TAKE-OFF	3000	54.3	LOW	A.R.	TO CLEAR OBSTACLES	133	111
MILITARY POWER	3000	48.2	LOW	A.R.	5	123	102
ENGINE (S)	V-1650-1						

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 STATUTE AT S.L.	I STATUTE AT 12,000	I NAUTICAL AT S.L.	I NAUTICAL AT 12,000	FUEL U.S. GALS. (2)	II RANGE IN AIR MILES STATUTE	II NAUTICAL	III RANGE IN AIR MILES STATUTE	III NAUTICAL	IV RANGE IN AIR MILES STATUTE	IV NAUTICAL	FUEL IMP. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES STATUTE	V NAUTICAL
				232	32 U.S. (27 IMP.) GALLONS NOT AVAILABLE IN FLIGHT.						194		
	545		480	200	640	555	820	710	910	790	167	990	860
	520		455	190	610	530	780	675	865	750	158	940	815
	490		430	180	575	500	740	640	820	710	150	890	775
	465		405	170	545	470	695	605	775	670	142	840	730
	440		380	160	510	445	655	570	725	630	133	790	690
	410		360	150	480	415	615	535	680	595	125	740	645
	385		335	140	450	390	575	500	635	555	117	695	600
	355		310	130	415	360	535	465	590	515	108	645	560
	330		285	120	385	335	490	425	545	475	100	595	515
	300		260	110	350	305	450	390	500	435	92	545	475
	275		240	100	320	280	410	355	455	395	83	495	430
	245		215	90	290	250	370	320	410	355	75	445	385
	220		190	80	255	220	330	285	365	315	67	395	345
	190		165	70	225	195	285	260	320	275	58	345	300

OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	(1) DENSITY ALT. IN FEET	II OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	III OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	IV OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	(1) DENSITY ALT. IN FEET	V OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.
						30000																			30000						
						25000	2650	189	164	32	93	77													25000						
2650	217	189	39	100	83	20000	2650	215	187	38	96	79							2200	170	148	29	54	44	20000	2200	154	134	23	46	37
2650	238	207	44.2	112	93	15000	2450	216	188	39	89	74							2300	196	170	30	57	47	15000	2050	173	150	27	47	38
2650	240	208	44.2	109	91	12000	2500	228	198	38	89	74	2300	215	185	34	65	54	2150	200	174	32	59	47	12000	1900	174	151	28	45	37
2650	257	223	44.2	111	92	9000	2300	228	198	39	86	72	2250	223	194	37	65	54	2000	203	176	34	54	45	9000	1900	186	144	27	41	34
2650	258	224	44.2	108	90	6000	2300	230	200	39	82	68	2250	223	194	37	62	52	1900	204	177	35	52	43	6000	1900	158	137	26	37	31
2650	260	226	44.2	106	88	3000	2300	231	201	39	79	66	2200	225	195	37	60	50	1900	202	175	34	49	40	3000	1900	155	135	27	35	29
2650	262	228	44.2	103	86	S.L.	2300	231	201	39	76	63	2100	220	191	37	56	47	1900	196	169	33	45	37	S.L.	1900	155	135	27	33	27

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 32 U. S. GALS., 27 IMP. GALS. FOR WARM UP, TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE

RETURN FUEL FLOWS TO TANK FRONT WING

USE FUEL FROM TANKS IN THE FOLLOWING ORDER (1) BELLY (2) FUS.-RES. TO 35 GAL. (3) FRONT WING (4) REAR WING (5) FUS.-RES. 35 GAL.

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

BOLD NUMBERS: Use Auto-Rich
LIGHT NUMBERS. Use Auto-Lean
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
IMP.G.P.H.: Imperial Gallons Per Hour
F.T.: Full Throttle
S.L.: Sea Level

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-H-8 DEC. 18, 1942 — NAVY AER-511

MODEL (S)

P-40F & P-40L

FLIGHT OPERATION INSTRUCTION CHART

SHEET 2 OF 2 SHEETS

GR. WT. 8,300 TO 7,300 POUNDS

EXTERNAL LOAD ITEMS
(1) 52 OR 75 GAL. TANK
OR (1) 500 LB. BOMB

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	IMP. G.P.H.
TAKE-OFF	3000	54.3	LOW	A.R.	TO CLEAR OBSTACLES	133	111
MILITARY POWER	3000	48.2	LOW	A.R.	5	123	102
ENGINE (S)	V-1650-1						

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 STATUTE AT S.L.	I (MAX. CONT. POWER) RANGE IN AIR MILES STATUTE AT 13,000	I (MAX. CONT. POWER) RANGE IN AIR MILES NAUTICAL AT S.L.	I (MAX. CONT. POWER) RANGE IN AIR MILES NAUTICAL AT 12,000	FUEL U.S. GALS. (2)	II RANGE IN AIR MILES STATUTE	II RANGE IN AIR MILES NAUTICAL	III RANGE IN AIR MILES STATUTE	III RANGE IN AIR MILES NAUTICAL	IV RANGE IN AIR MILES STATUTE	IV RANGE IN AIR MILES NAUTICAL	FUEL IMP. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES STATUTE	V (MAX. RANGE) RANGE IN AIR MILES NAUTICAL
				157		27 U.S. (22.5 IMP.) GALLONS NOT AVAILABLE IN FLIGHT					130.5		
	355		310	130	415	360	535	465	610	530	108	675	585
	330		285	120	385	335	490	425	565	490	100	625	540
	300		260	110	350	305	450	390	515	450	92	570	495
	275		240	100	320	280	410	355	470	410	83	520	460
	245		215	90	290	250	370	320	423	370	75	470	405
	220		190	80	255	220	330	285	375	325	67	415	360
	190		165	70	225	195	285	250	330	285	58	365	315
	165		145	60	190	165	245	215	280	245	50	310	270
	135		120	50	160	140	205	180	235	205	42	260	225
	110		95	40	130	110	165	140	190	165	33	210	180
	80		70	30	95	85	125	105	140	120	25	155	135
	55		50	20	65	55	80	70	95	80	17	105	90
	25		22	10	30	25	40	35	45	40	8	50	45

OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	I.A.S. KNOTS	M.P. IN. Hg	U.S. G.P.H.	IMP. G.P.H.
						30000																			30000						
						25000																			25000						
2650	220	191	39	100	83	20000	2650	218	189	39	96	82							2300	177	154	29	53	46	20000	2250	159	147	24	47	38
2650	240	208	44.2	112	93	15000	2650	228	198	36	94	78							2300	200	174	33	57	47	15000	2000	179	152	26	45	37
2650	243	211	44.2	109	91	12000	2550	235	204	38	92	77	2300	216	188	34	52	55	2100	201	175	31	54	45	12000	1900	176	153	27	43	36
2650	256	222	44.2	111	92	9000	2350	235	204	39	88	73	2300	227	197	37	67	55	1950	202	176	33	52	43	9000	1900	172	149	26	40	33
2650	259	225	44.2	108	90	6000	2300	233	202	38	83	69	2300	228	198	37	54	55	1900	205	178	34	50	42	6000	1900	169	147	26	38	32
2650	261	226	44.2	106	88	3000	2300	234	203	38	80	67	2300	229	199	37	61	51	1900	200	174	33	47	38	3000	1900	167	145	26	35	29
2650	263	228	44.2	103	86	S.L.	2300	234	203	38	77	64	2150	226	196	37	58	48	1900	199	173	32	45	37	S.L.	1900	167	145	26	32	27

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 27 U.S. GALS 22.5 IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK FRONT WING
USE FUEL FROM TANKS IN THE FOLLOWING ORDER (1) BELLY (2) FUS. RES. TO 35 GAL. (3) FRONT WING (4) REAR WING (5) FUS.-RES. 35 GAL.

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

BOLD NUMBERS: Use Auto-Rich
LIGHT NUMBERS: Use Auto-Lean
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
IMP.G.P.H. - Imperial Gallons Per Hour
F.A. - Full Throttle
S.L. - Sea Level

RED FIGURES ARE PRELIMINARY. SUBJECT TO REVISION AFTER FLIGHT CHECK

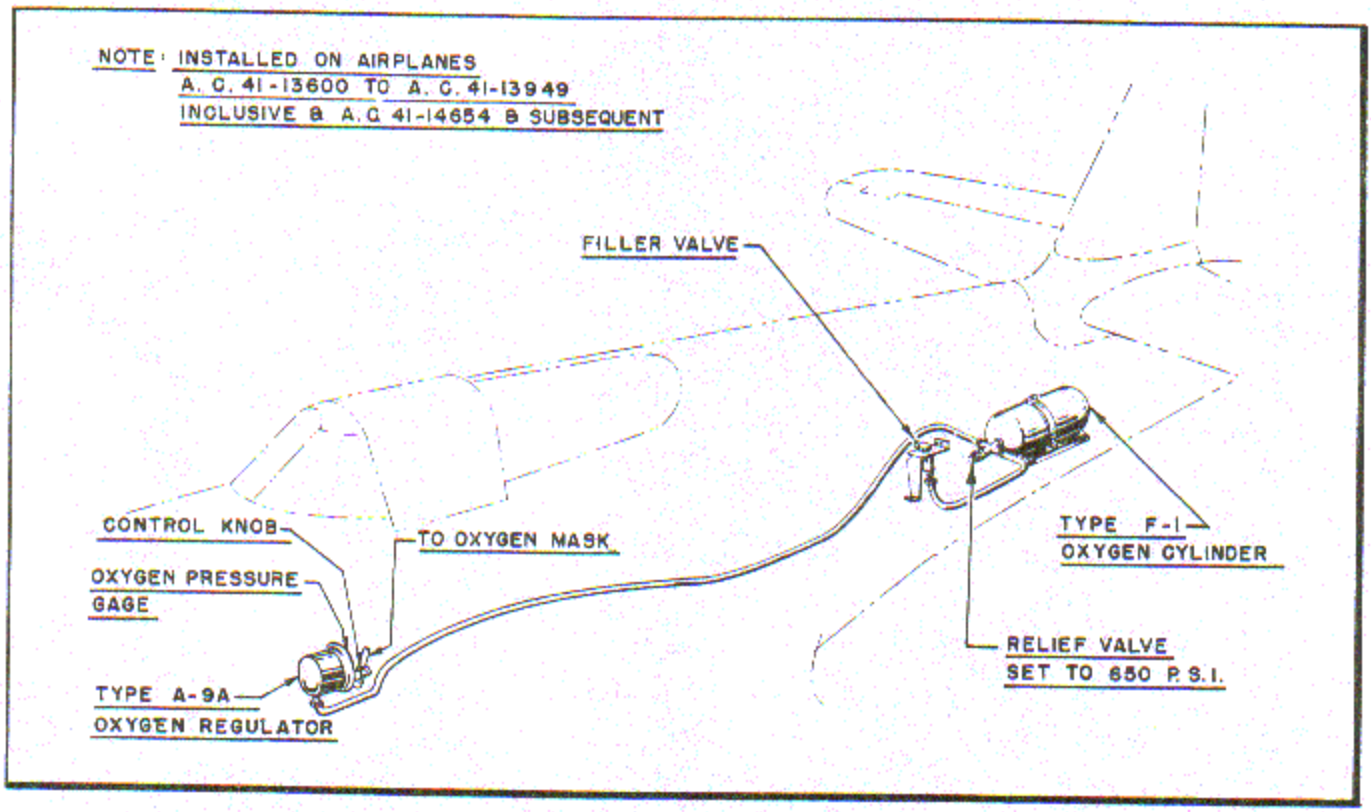


Figure 15 - Oxygen System

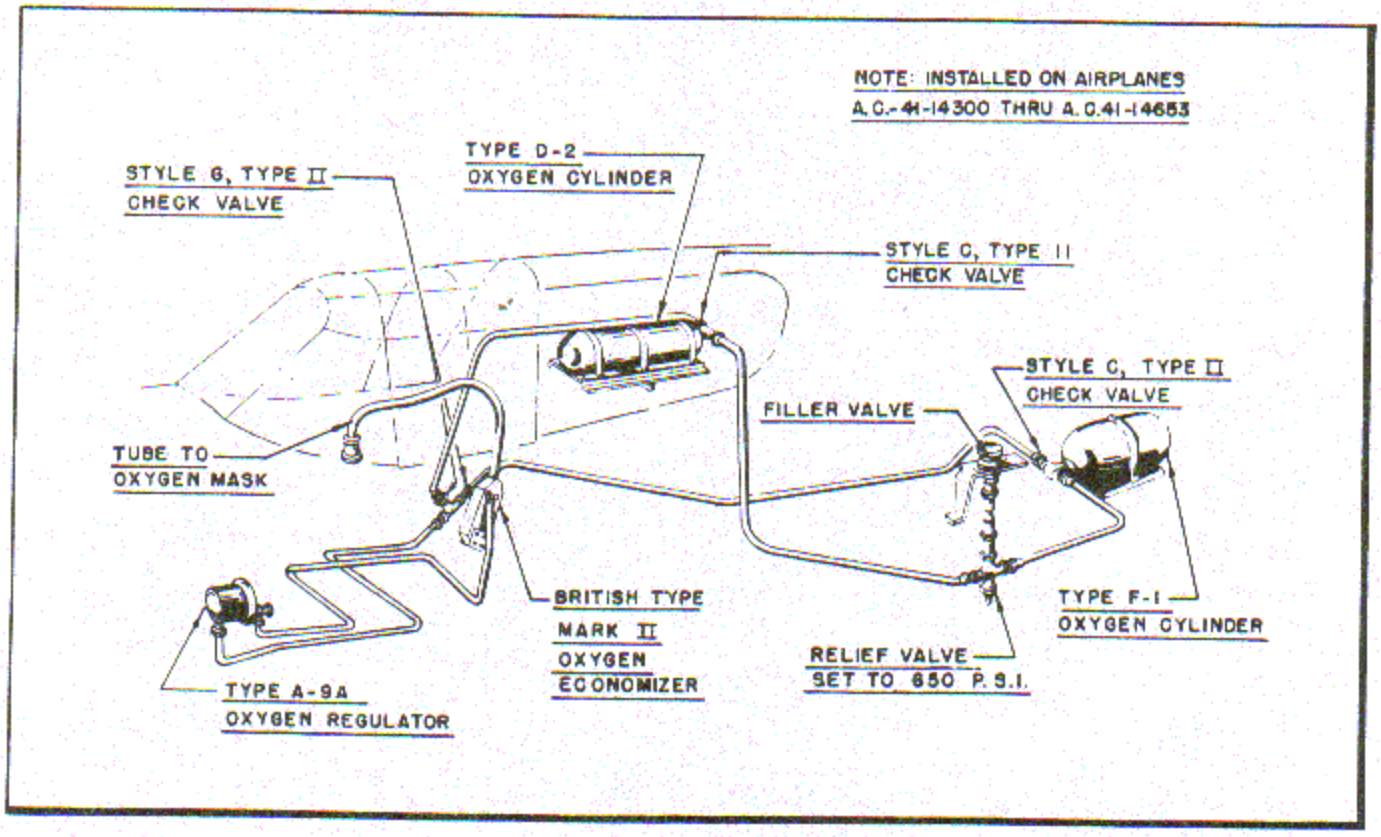


Figure 16 - Oxygen System

SECTION IV

OPERATION OF THE OXYGEN EQUIPMENT

1. OPERATION.

Oxygen will be used when operating above 12,000 feet pressure altitude.

a. The pilot's oxygen mask hose has a rubber bayonet connector to attach the mask hose to the oxygen regulator. Be sure that the mask hose connection will fit the regulator output connection before starting the airplane's engine.

b. The airplane is equipped with a low-pressure oxygen system operating at a working pressure of 400 pounds per square inch. The following oxygen cylinders are installed:

(1) For airplanes AC-41-13600 to AC-41-13949 inclusive and AC-41-14654 and subsequent: The type F-1 oxygen cylinder having an internal volume of 1000 cubic inches is secured in a support installation in the aft part of the fuselage. (See figure 15.)

(2) For airplanes AC-41-14300 through AC-41-14653: Two oxygen cylinders, a type F-1 and a type D-2, are installed. The type F-1 oxygen cylinder is installed in the aft part of the fuselage as in paragraph b.(1). The type D-2 oxygen cylinder having an internal volume of 500 cubic inches is secured in a support installation above the fuselage fuel tank. (See figure 16.)

(3) The oxygen cylinders may be filled without removing them from the airplane by attaching a master cylinder to the filler valve located just inside the lower aft corner of the fuselage access door. Be sure that the oxygen cylinders have been filled before each flight.

c. Oxygen flow to the pilot's oxygen mask is controlled by a type A-9A regulator. (See figure 9.) A small knurled knob is provided for adjustment and a gage calibrated in thousands of feet to indicate the oxygen flow. When oxygen is being used by the pilot, the regulator should be adjusted so that the gage registers an equal amount of pressure to the altitude of the airplane. Some pilots may require more oxygen than others and the flow of oxygen should be increased if the pilot feels any extremity of his body, such as the lobes of his ears, feet or fingers lacking in sensitiveness or experiencing a "tingling" sensation.

2. OXYGEN DURATION.

a. The single type F-1 oxygen cylinder when filled to 400 pounds per square inch will supply oxygen to one man for approximately 2 hours and 15 minutes at 25,000 feet altitude with the type A-9A regulator.

b. The two oxygen cylinders, type F-1 and D-2, when filled to 400 pounds per square inch, will supply oxygen to one man for approximately 3 hours and 20 minutes at 25,000 feet altitude with the type A-9A regulator.

NOTE

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

3. CONSTANT FLOW TYPE.

a. PREFLIGHT CHECK.

(1) GENERAL. - Before using this equipment, be sure you are familiar with the complete oxygen system. Consult your oxygen officer and refer to the applicable Technical Orders, the Lithograph Instruction Charts and Training Films on oxygen equipment. Thoroughly understand the operation, use and purpose of each instrument and item. Give each part the care and consideration it requires for its proper functioning.

(2) MASK.

(a) The mask must be properly fitted. Check all parts of the mask to see if it is in good shape and ready for instant use. Particular attention should be paid to the condition of the bag. The mask must be clean and free of all foreign matter.

(b) Be sure that the component parts of the mask are securely held together with wire or tape. Be sure that the plug at the bottom of the bag and the sponge rubber valves are properly in position.

(c) If flight is under freezing conditions, have the plastic connector between facepiece and bag sticking up inside the facepiece above the lower surface so that moisture will not readily drain into the connector and bag. Protective shields, for the sponge rubber valves should be used.

(d) Be sure that the bayonet fitting at the end of the mask hose has its rubber gasket and that proper connection can be made with the outlet fitting on the regulator.

(3) REGULATOR.

(a) Check the cylinder or system pressure as shown on the regulator gage. It must be at least 400 pounds per square inch.

(b) Turn the needle valve knob on the see that there is no restriction to flow. This adjustment knob should not be too loose. If it is, tighten the gland packing which is on the same shaft.

(c) Check the regulator for proper flow with the ground flow check meter, Specification No. 40400.

b. IN FLIGHT.

(1) Oxygen will always be used when operating above 12,000 feet altitude.

(2) Be sure to set the regulator to the proper altitude.

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

(4) Be sure that your mask hose does not become kinked or twisted.

(5) Be sure that your mask retains its proper fit.

(6) Check the oxygen pressure gage on the regulator frequently.

(7) Above 30,000 feet the bag should never be completely collapsed during inhalation. If it is, the adjustment knob on the regulator should be opened further, no matter what the flow indicator setting is.

(8) When activity is required, the flow should be also increased so that the bag does not completely collapse.

c. AFTER FLIGHT.

(1) Be sure that the regulator adjustment knob is tightly closed so that there is no leakage.

(2) Be sure all the oxygen equipment is in proper condition before leaving the airplane. If any difficulties developed during flight take necessary steps to have these corrected.

(3) Wash the mask with mild soap and water, dry thoroughly and leave in a clean, airy place out of the sunlight.

(4) At all times, be sure the mask is in good condition and properly fitted for instant use.

4. DEMAND TYPE SYSTEM.

a. PREFLIGHT CHECK.

(1) GENERAL. - Before using this equipment be sure you are familiar with the complete oxygen demand system. Consult your oxygen officer and refer to the applicable Technical Orders, the Lithograph Instruction Charts and Training Films on oxygen equipment. Thoroughly understand the operation, use, and purpose of each instrument and item. Give each part the care and consideration it requires for its proper functioning.

(2) MASK.

(a) The mask must be properly fitted and checked for leakage by the oxygen officer. Flights over 30,000 feet must not be made when the mask leak is greater than 6 percent.

(b) Check all parts of the mask to see if it is in good shape and ready for instant use. The mask must be clean and free of all foreign matter.

(c) Try the mask on in the airplane and check for leaks by holding the thumb over the corrugated hose fitting and inhaling normally.

(3) QUICK DISCONNECT FITTING. - Insert the male fitting (see that the gasket is in place) of the mask into the female end of the tubing from the regulator. Be sure the fit is snug and that a pull of at least 10 pounds is required to separate the two.

(4) MASK-REGULATOR TUBING.

(a) Inspect the mask-regulator tubing for any damages such as tears, holes, and kinks. Be sure all clamps are firmly in place.

(b) Attach the tubing, by means of the spring clip on the female fitting, to the clothing or parachute harness high up on the chest. It may be desirable to sew on a tab of fabric or webbing to the clothing to accommodate the clip. Be sure that the attachment is high enough so that there is free movement of the head without kinking of the mask hose. Be sure that the mask hose does not become kinked or twisted in flight.

(5) REGULATOR AND INDICATING INSTRUMENTS.

(a) Be sure that the knurled collar at the outlet end of the regulator is tight. Examine the top diaphragm to see that it is not ruptured or distorted.

(b) Turn on the "Emergency" valve and see that you get a large flow. Observe the pressure gage. There should be no perceptible pressure drop. Turn off the "Emergency" valve tightly; be sure it does not leak. Leave it in this position.

(c) Turn the "Auto-Mix" to the "OFF" position. Notice that on inhalation the top diaphragm goes down and that you get nearly 100 percent oxygen which will be indicated on the flow indicator. Turn the "Auto-Mix" to the "ON" position. Notice that on inhalation you get almost pure air and that there is little or no indication of oxygen flow on the flow indicator. Leave it in this position.

(d) Check the pressure of the system. It must not be less than 400 pounds per square inch.

b. IN FLIGHT.

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

(2) Be sure that your mask hose does not become kinked or twisted.

(3) Be sure that your mask does not lose its leakproof characteristics.

(4) If for any reason you feel you are suffering from lack of oxygen, if your mask should suddenly leak, if the demand mechanism fails, or if no oxygen flow is indicated by the flow indicator, immediately turn on the "Emergency" control on the regulator.

(5) Check the oxygen pressure gage frequently.

(6) Check the flow indicator frequently.

(7) In any flights over 30,000 feet pay particular attention to your oxygen equipment. Be sure all items and instruments are functioning perfectly before attempting flight to these extreme altitudes. Any failure of the equipment may be fatal.

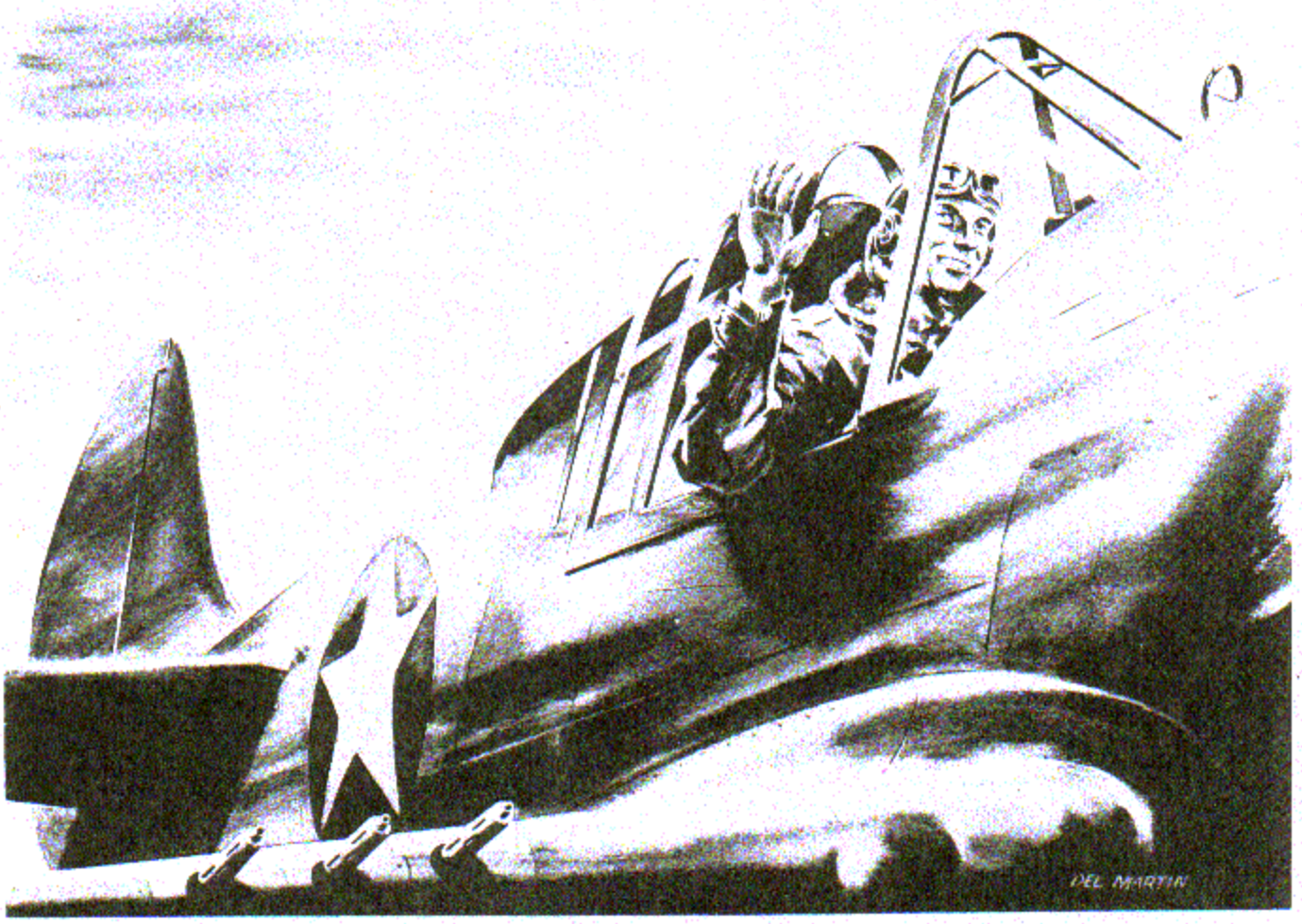
c. AFTER FLIGHT.

(1) Be sure all the oxygen equipment is in proper condition before leaving the airplane. If any difficulties developed during flight, take necessary steps to have these corrected.

(2) If your pressure is less that 100 pounds per square inch, observe that the supply warning light is on. Occasionally, at the end of a flight, when the pressure is slightly above 100 pounds per square inch bleed the oxygen out of the system by opening the "Emergency" on the regulator and see that the supply warming light goes on at about 100 pounds per square inch. Then turn the "Emergency" off.

(3) Wash the mask with mild soap and water, dry thoroughly and leave in a clean, airy place out of the sunlight.

(4) At all times, be sure the mask is in good condition and properly fitted for instant use.



SECTION V

OPERATION OF THE COMMUNICATION EQUIPMENT

1. RADIO OPERATION.

a. The SCR-274-N radio receivers and transmitters are located in the aft part of the fuselage and are accessible through the fuselage access door. (See figure 2.) All tuning dials, switches and controls including the radio filter and relay box, are grouped together on the right side of the cockpit. The radio contactor is located on the left side of the instrument panel. (See figure 8.)

b. This radio installation incorporates a control box composed of individual controls for three separate receiver units of various ranges: from 3 to 6 M.C., from 190 to 550 K.C., and from 6 to 9.1 M.C. To operate these receivers, move the battery switch from "OFF" to the "CW" (Continuous Wave) or the "MCW" (Modulated Continuous Wave) positions. Place the "TEL" switch to either "A" or "B" to correspond to the jack used for the headset plug. Set the filter switch box control to "RANGE," "VOICE," or "BOTH," as desired. Tuning is accomplished with the large "TUNING" knob while adjusting for suitable volume with the "INCREASE OUTPUT" control knob. The radio call letter plate is attached to the right longeron aft of the cabin control handle assembly. (See figure 12.)

c. Two transmitters are installed, only one being used at a time, and are preset with the different frequencies recorded on the "WRITE IN" space on the transmitter control. When transmitting, move the "TRANSMITTER SELECTION" switch to the frequency desired. Set the "TRANSMITTER POWER" toggle switch to "ON." It requires 15 seconds to warm up the transmitter tubes. Set the emission switch to "TONE," "CW," or "VOICE," as required. Be sure that the radio contactor on the instrument panel (figure 8) is properly adjusted.

Set the clock switch (figure 8) to the "RUN" position and the contactor switch (figure 8) on the radio contactor to the "IN" position and leave these switches set in these positions throughout the entire flight. The purpose of this contactor is to automatically cut in the No.1 transmitter for approximately 13 seconds at every revolution of the clock hand. While the clock hand is inside the angle marked on the clock face all sets are cut out except the No. 1 transmitter. If the pilot is transmitting a message he should observe the contactor clock hand at all times to determine when he is "ON" and "OFF" the air. If the emission switch is on "VOICE," press the "PRESS-TO-TALK" button on the throttle control and talk clearly and distinctly into the microphone. In the "VOICE" position the transmitter dynamotor will not start until the "PRESS-TO-TALK" button has been closed. Side tone should be heard distinctly whenever transmitting. With the emission switch on "TONE" or "CW," the dynamotor will be running continuously but the transmitter will not be "ON THE AIR" until the transmitter key is pressed.

d. The "TRANSMITTER POWER" toggle switch should be left "ON" throughout the flight to avoid repetition of the 15-second "WARM-UP" period.

e. To reduce battery drain and increase dynamotor life, the emission selector switch should remain on "VOICE," unless continued use on "TONE" or "CW" is anticipated.

WARNING

The dynamotor generates 600 volts, dc. Before attempting to connect or disconnect a transmitter or a power plug, TOUCH the dynamotor to determine that it is not running. If no vibration is felt, it is not running.

f. While tuning up the antenna circuit of the transmitters, do NOT touch the antenna when the power is "ON."

g. The radio crash switches (figure 12) provided on the right side of the cockpit are employed by the pilot to destroy the identification radio when there is danger of this confidential radio falling into the hands of the enemy. The detonator installed in the radio destroys all wiring when set off by either the automatic device or the switches in the cockpit. The automatic device is set off by acceleration during a crash landing. To destroy the radio during or after a regular landing, the pilot must push both button switches simultaneously. Pressing one push button will not set off the detonator. The automatic unit is a separate device and is located adjacent to the radio it protects.

WARNING

Never actuate the two push buttons unless it is desired to destroy the radio equipment. The push button bracket is painted red with "DANGER" lettered on it for quick identification.

2. RADIO SET SCR-522-A.

a. GENERAL. - Some airplanes are equipped with the SCR-522-A radio; this equipment is an ultra high-frequency command set for voice communication.

The radio waves from this equipment travel in straight lines, like beams of light, and do not follow

the curvature of the earth. Because of this fact, in order to receive ground station signals, it is necessary for the airplane to be above a certain altitude. The altitude varies, and is determined by the distance from the ground station to the airplane.

If the airplane is between 35 and 50 miles away from the ground station it must be above 1000 feet altitude before reception is possible.

If the airplane is between 80 and 100 miles from the ground station, it must be above 5000 feet for reception of signals.

If the airplane is between 120 and 160 miles from the ground station, it must be above 10,000 feet before reception is possible.

NOTE

If the distances vary from any of the above figures, the altitude will vary proportionately.

b. ACCESSORIES.

(1) If British type microphone is provided for use with Radio Set SCR-522-A, make sure microphone cord is plugged into its jack and that microphone "ON-OFF" switch is in "ON" position.

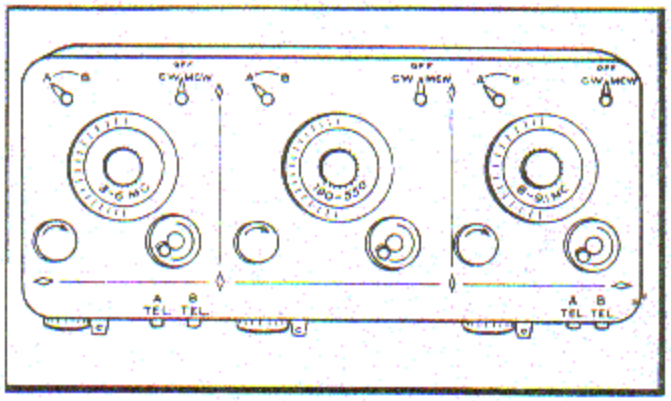


Figure 16A - Receiver Control Box BC-450-A

NOTE

A later type microphone does not include this switch.

(2) A microphone adapter M-299 has been installed in certain type P-40F airplanes to permit carbon throat microphone T-30 or carbon mask microphone T-42 to be used interchangeably with the mask magnetic T-34 or T-44 (British) microphones. The adapter M-299 is permanently connected into the circuit and differences in the construction of plugs for carbon and magnetic type microphones eliminate the possibility of errors in their use.

NOTE

To use mask magnetic microphone T-34 or T-44, insert plug PL-179 in jack JK-49, and remove microphone T-30 or T-42 from jack JK-48 and stow. Remove headset HS-18 or HS-23 from JK-26 on cord CO-219, and insert it in jack JK-26 located above the Vee of cord CO-287. To use carbon throat microphone T-30, remove plug PL-179 from jack JK-49, and stow magnetic type mask microphone with cord CO-287. While Radio Set SCR-522-A will function with both type microphones plugged in simultaneously, optimum performance is secured by disconnecting the one not in use.

(3) The "T-R-REM" switch located on lower part of radio control box BC-602-A will be kept in the

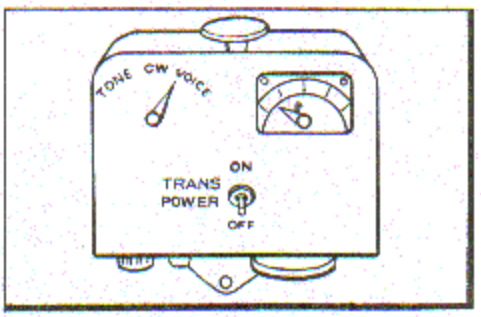


Figure 16B - Transmitter Control Box BC-451-A

"REM" position as the "T" and "R" positions are used only in installations not employing a "PRESS-TO-Talk" button. When out of the "REM" position, it is necessary to lift the switch locking lever directly above the switch before it can be thrown to "REM" position. With switch in "REM" position, indicator lamp opposite it will glow when reception takes place and is dark when transmission takes place.

NOTE

The indicator lamps on the cockpit control box have a dimmer mask which should be used to prevent glare during night operation. To raise and lower the dimmer mask, operate the dimmer mask lever just above channel "A" indicator lamp.

(4) The airplanes are equipped with a contactor to be used in conjunction with the radio. The purpose of the contactor is to cut in the "D" channel and produce a "MCW" tone.

Set the clock switch to the "RUN" position and the contactor switch to the "IN" position, and leave the switches "set" throughout the entire night.

With the contactor in operation, the pilot should watch the clock at all times when transmitting, to determine when he is on and off the air. Whenever the clock hands swing through the angle marked off on the clock face, the pilot is off the air. He cannot begin to transmit again until the hand swings by the section marked on the contactor face.

3. OPERATION.

a. RECEPTION AND TRANSMISSION.

(1) To start equipment, press button "A," "B," "C," or "D," depending on channel to be used.

(2) Allow approximately 1 minute for vacuum tubes to warm up.

(3) Place "T-R-REM" switch in "REM" position if it is in "T" or "R" position.

(4) No other operations are required for reception.

(5) To transmit, press "PRESS-TO-TRANSMIT" button on throttle.

NOTE

During remote operating conditions, the receiver is in operation except when the pilot closes the switches and speaks into the microphone.

b. TO STOP THE EQUIPMENT. - To stop the equipment, press the "OFF" button.

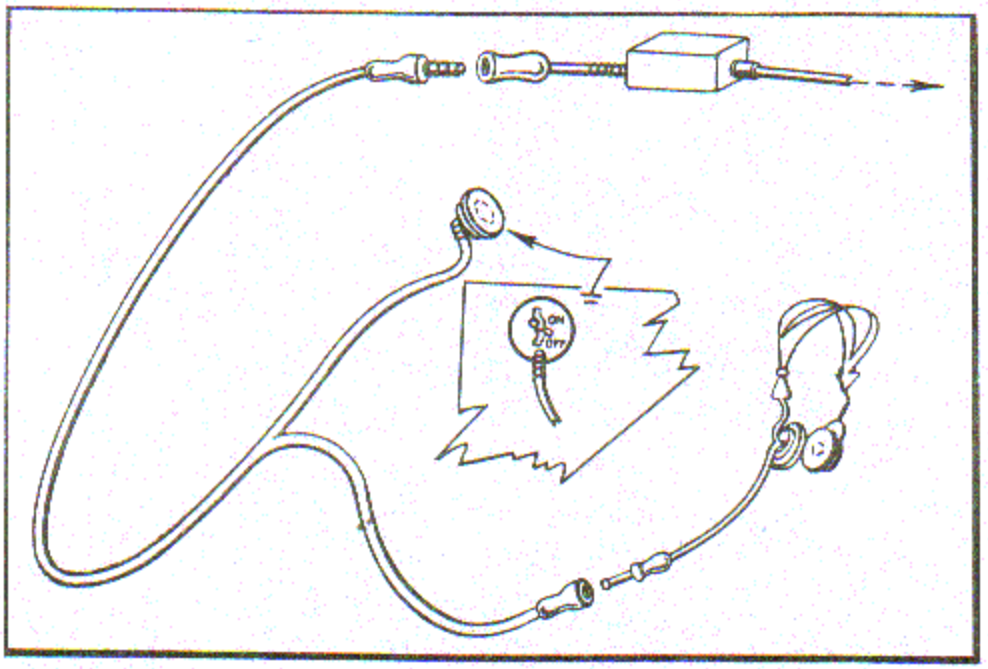


Figure 16C - Detail of VHF SCR-522 Command Set
British Type Microphone and Head-Set

SECTION VI

OPERATION OF ARMAMENT

1. WING GUN OPERATION.

a. This airplane is equipped with six .50-caliber machine guns (three in each wing panel) outboard of the landing gear. The guns fire clear of the propeller.

b. The ammunition boxes carry 235 rounds of ammunition per gun as normal load.

c. For airplanes AC-41-13600 to AC-41-13994, inclusive, and for airplane AC-41-13998: The guns are charged hydraulically by three gun charging valves mounted below the main switch panel in the cockpit. The right-hand charger valve charges the center and inboard guns in the right wing while the upper left-hand charger valve charges the center and inboard guns in the left wing panel. The lower charger valve charges the outboard guns in each wing panel.

To charge the guns proceed as follows:

(1) Turn all valve handles clockwise 140 degrees from the red markers on the panel.

(2) Actuate only ONE charger valve at a time.

(3) Push the charger valve handle all the way in.

(4) Actuate the hydraulic electric motor switch on the control stick below the handgrip until the valve handle pops out.

(5) Repeat these operations on the remaining charger valves and all guns are charged.

(6) The guns may now be fired by following the procedure outlined in d., following.

NOTE

For airplanes AC-41-13995, AC-41-13996, AC-41-13997, and AC-41-13999 and up. The guns are charged manually by the ground charger assembly which is stowed on the inside of the gun access door in each wing panel. The guns cannot be charged while the airplane is in flight. An instruction plate for ground charging the guns is mounted on the inside of the gun access door in each wing panel.

WARNING

When the guns are charged and the gun switch "ON" be careful not to pull the trigger switch when actuating the hydraulic electric motor switch.

d. The guns are fired by throwing the gun switch (figure 9) on the main switch panel to "ALL GUNS ON" and placing the gun circuit breakers in the "ON" position. (See figure 9.) After the guns are charged depress the trigger switch on the forward side of the handgrip for the desired burst. If one of the gun circuit breakers "kick out" causing some of the guns to be inoperative, reset the circuit breaker. If the breaker continues to "kick out" after resetting several times it is an indication of a short circuit and the circuit breaker should be left "OFF." The gun circuit should be thoroughly checked upon landing and the faulty operation corrected before the airplane is used again.

e. For airplanes AC-41-13600 to AC-41-13994 inclusive, and for airplane AC-41-13998: After a firing mission it is desirable to lock the guns rearward so that they will not accidentally be fired when approaching for a landing. To lock the guns rearward proceed as follows:

(1) Match the red points on the valve handles with the red markers on the panel.

(2) Actuate ONE charger valve at a time.

(3) Push the charger valve all the way in.

(4) Actuate the electric hydraulic motor switch on the control stick below the handgrip until the valve pops out.

(5) Repeat this operation on the remaining valves and all guns are locked in their rearward position.

(6) If it is desired to charge the guns again after they have been locked in their rearward position, turn the valve handles 140 degrees clockwise from the red markers on the panel and the guns are charged and ready to fire.

2. GUN SIGHT OPERATION.

a. The gun sight extends aft above the instrument panel on the center line of the airplane. The gun sight on airplanes AC-41-14100 and up, is equipped with a sun screen which can be raised or lowered in front of the reflector assembly by a lever on the left side of the sight; also, provision is made on the reflector assembly for attaching the crash pad.

b. To operate the gun sight place the gun sight rheostat switch in the "ON" position (the battery switch must be "ON") and be sure the gun circuit breakers are "ON." The reticle image, when viewed on the reflector glass and superimposed on a target approxi-

mately 500 yards distance, should not change in relation to the target as the head is moved over the field of vision.

3. GUN CAMERA OPERATION.

a. The type N-2 gun sight aiming point camera, is mounted on the rear of the type N-3A gun sight on airplanes AC-41-13600 to AC-41-14099 inclusive. The camera is installed in the leading edge of the right outboard landing gear fairing assembly on airplanes AC-41-14100 and up.

b. The gun camera is controlled by the gun camera switch on the main switch panel (figure 9) and the trigger switch on the handgrip.

c. The overrun control is a separate unit mounted on a bracket on the left side of the cockpit, outboard of the landing gear control handle. The gun camera may be operated independently of the overrun control when the toggle switch on the overrun control is in the "OFF" position. The overrun control permits the gun camera to continue taking pictures for a predetermined period of time after the electrical circuit normally controlling the gun camera motor has been interrupted. The overrun time interval is variable from 1/4 to 3 seconds of increments of 1/4 of a second and the time internal is set by moving the pointer to the desired position on the dial of the overrun control assembly.

(1) To operate the gun camera without the overrun: Place the toggle switch on the overrun control in the "OFF" position. Throw the toggle of the camera safety switch "ON," and squeeze the trigger switch on the flight control stick.

(2) To operate the gun camera with the overrun control: Throw the toggle switch of the overrun control "ON." Set the time interval for the desired overrun. Throw the toggle of the camera safety switch "ON," and squeeze the trigger switch on the flight control stick.

NOTE

On P-40F airplanes AC-41-14550 and subsequent, the gun camera overrun control has been removed.

d. The camera accommodates the Eastman kodak 16-mm magazine.

4. OPERATION OF THE WING BOMB CONTROLS.

a. This airplane is equipped with a type Q-2 bomb rack in each wing panel, outboard of the wing guns.

b. The wing bombs are released and armed by a type L-21A control quadrant on the left cockpit floor. (See figure 10.)

c. The wing bombs may be dropped selectively or in valvo by the following procedure:

(1) To drop the bomb selectively, place the arming control handle in the "ARM" position (fully forward) and the release control handle in "SELECTIVE" (center position). (See figure 10.) Throw the circuit breakers and bomb switch on the main switch panel "ON." (See figure 9.) Press the bomb release switch on top of the handgrip and two bombs will be released (one from each rack). With the control handle in the "SELECTIVE" position the button on the top of the handgrip must be pressed three times to drop the wing bomb load.

(2) To drop the bombs in salvo, place the arming control handle (figure 10) in the armed position, and the release control handle (figure 10) in the salvo position. The bombs will be dropped immediately in salvo.

(3) In case of an emergency the wing bomb load may be dropped unarmed by placing the arming control handle in the "SAFE" position and placing the release control handle in the "SALVO" position.

CAUTION

The release handle should always be in the "LOCK" position and the arming handle in the "SAFE" position except when approaching a bombing objective.

5. BELLY BOMBS.

a. Provision is made to load several types of belly bombs as an alternate load in place of the belly tank, one bomb being loaded at a time.

b. The belly bomb control handles are located as follows:

(1) For airplanes AC-41-13600 to AC-41-14069, inclusive: The "BOMB-TANK RELEASE" handle is attached to the aft side of the bulkhead at station No. 3 on the left side of the cockpit.

(2) For airplanes AC-41-14070 and up: The "BOMB-TANK RELEASE" handle is mounted on the aft side of the L-21A bomb release quadrant. (See figure 10.)

(3) The belly bomb arming handle is supported by a tripod at the left of the pilot's seat. (See figure 10.)

c. 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 up also. Never exceed a dive of 60 degrees when releasing a belly bomb or the bomb may not clear the propeller.

d. To release the bomb for a safe drop, be sure that the arming handle is down. If the arming handle has been pulled up for an armed drop and the pilot then decides to return the arming handle to the "SAFE" position, push down on the spring controlled lever on the

front of the tripod support assembly and the arming handle will automatically return to the "SAFE" (down) position. Pull the release handle and the belly bomb will drop unarmed.

WARNING

All aerobatics are prohibited when a belly bomb or tank is installed.

6. PILOT'S PROTECTION.

a. The pilot is protected from .30-caliber gunfire both for and aft by armor plate and bullet-resistant windshield glass.

b. An installation of nonmagnetic armor plate is located at station No. 2 forward of the instrument panel. Another installation of armor plate covers station No. 5 bulkhead immediately aft of the seat. A smaller piece of armor plate is bolted to the large installation and affords double protection immediately back of the pilot's headrest.

c. The areas of protection for the pilot are shown in figures 17 and 18.

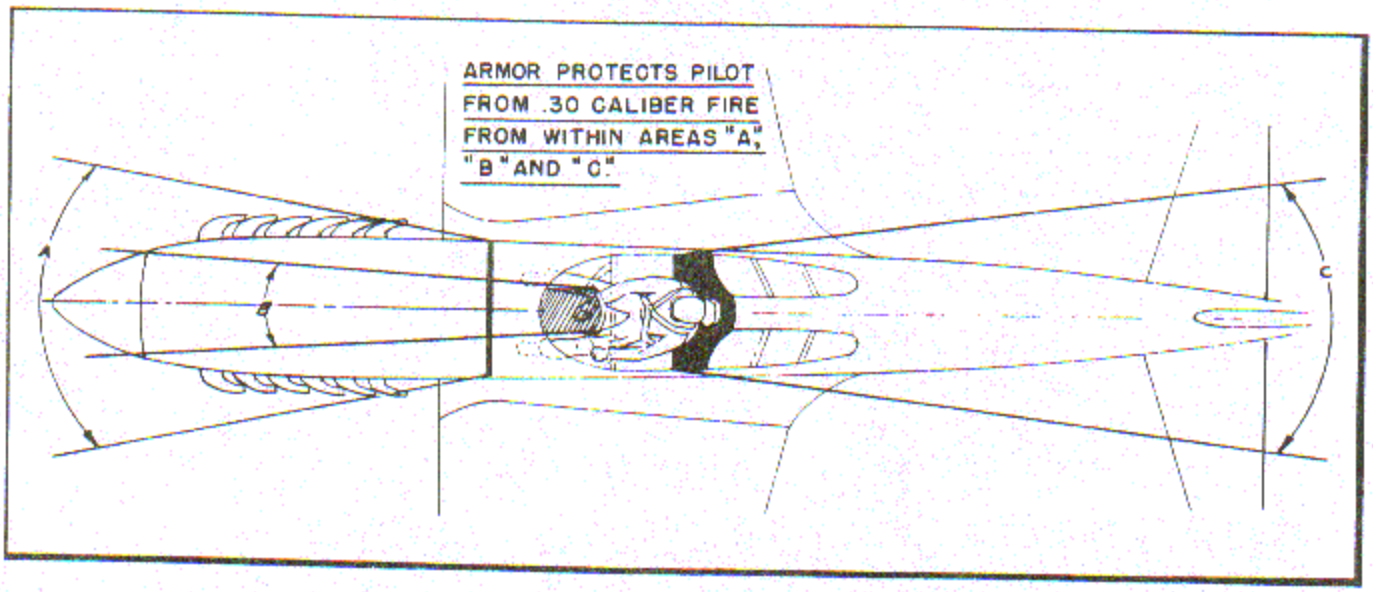


Figure 17 - Angles of Armor Protection - Top View

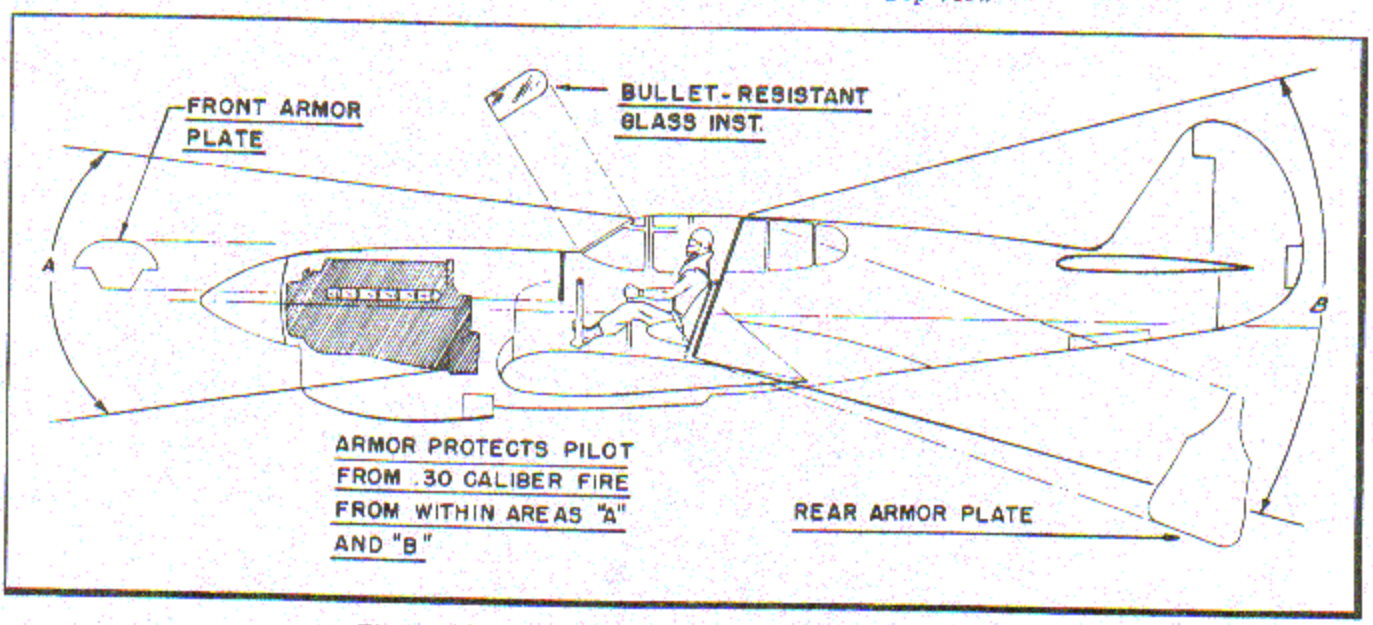


Figure 18 - Angles of Armor Protection - Side View

APPENDIX I

PILOT'S CRUISING INSTRUCTIONS WITH ONE 170-GALLON AUXILIARY FUEL TANK - P-40F

1. TAKE-OFF.

a. Take-off Distance - 2200-foot ground run in zero wind, standard conditions.

Engine rpm	3000 rpm
Manifold pressure	54.3 inches
Wing flaps	See (1)
Rudder trim tab	2 degrees right
Elevator trim tab	See (2)
Take-off speed	130 mph indicated
Fuel	Front wing tank
Mixture	Full rich

(1) Set wing flaps between 1/4 and 1/2 on cockpit control. This will give approximately 15 degrees down setting.

(2) Set elevator trim tab 1 degree tail heavy ("T. O." (Take-off) setting on dial).

(3) Get speed to 145 mph as soon as practicable after take-off.

(4) Get landing gear up as soon as possible after take-off.

(5) Do not retract wing flaps below 160 mph.

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

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.

EMERGENCY

In case of emergency immediately after take-off, DROP BELLY TANK BEFORE LANDING.

(7) If shortest possible take-off distance is desired, set wing flaps at 1/2 on cockpit control. If ample distance is available, between 1/4 and 1/2 gives better handling characteristics.

IMPORTANT

SET WING FLAPS BY LOWERING THEM COMPLETELY; THEN BRING THEM UP TO DESIRED SETTING WHILE GROUND CREW APPLIES AN UP LOAD ON THE FLAPS.

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 2650 rpm and 44.2 inches manifold pressure, automatic rich.

b. CRUISING CLIMB. - Climb at 160 mph at 2300 rpm and 30.0 inches manifold pressure, automatic lean.

NOTE

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

c. Do not allow speed to drop below 145 mph in climb.

d. Adjust cowl flaps to give 115 to 120 degrees Prestone temperature.

e. Climb to cruising altitude on front wing tank, and cruise on front wing tank until 30 minutes after take-off.

3. CRUISING CONTROL.

The operating conditions given in table 1 or figure 1 have been set up as a simple and practical guide for maximum range cruising operation.

Figure 2 gives the exact conditions from which figure 1 and table 1 were derived, and includes complete information on the essential operating conditions at any weight. Range and operating conditions for less than full fuel load may be predicted from the chart.

4. CRUISING.

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

b. Mixture setting in automatic lean.

c. Cruise in low supercharger gear ratio.

d. Cowl flaps set to give 115 to 120 degrees Prestone temperature.

e. Use front wing tank for 30 minutes after take-off, fuselage tank for 15 minutes and rear wing tank for 15 minutes; then switch to belly tank until empty.

WARNING

DO NOT LAND WITH FULL BELLY TANK.

The recommended cruising altitude is 10,000 feet.

5. EMERGENCY ONLY.

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

a. DROP BELLY TANK AS SOON AS IT IS EMPTY.

b. If possible, reduce speed 10 mph below chart.

c. Lean out mixture by setting propeller in fixed pitch and leaning out the mixture control until 10-20 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.

6. GENERAL.

a. Do not dive or stunt with belly tank attached.

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

c. Stalling speeds are higher than normal with the belly tank attached; always keep safe flying speed.

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

e. DROP BELLY TANK (1) if it is necessary to land and an appreciable amount of fuel remains in the tank, or, (2) if the absolute maximum range must be obtained after belly tank is empty.

TABLE 1 - CRUISING CONTROL

TIME	INDICATED AIR SPEED	ENGINE RPM
0 - 1:30	177 mph	2000
1:30 - 3:00	173 mph	1950
3:00 - End	168 mph	1900

Set engine rpm and adjust throttle to give the indicated air speed as shown in table. Use low blower.

Under the given operating conditions, the belly tank fuel will last from 4 to 4-1/2 hours if it is the 170-gallon type (plastic tank), or 3-1/2 to 4 hours if 150-gallon type (metal tank).

Use fuel as follows: Belly Tank (after first hour from take-off)
Front Wing
Rear Wing
Fuselage

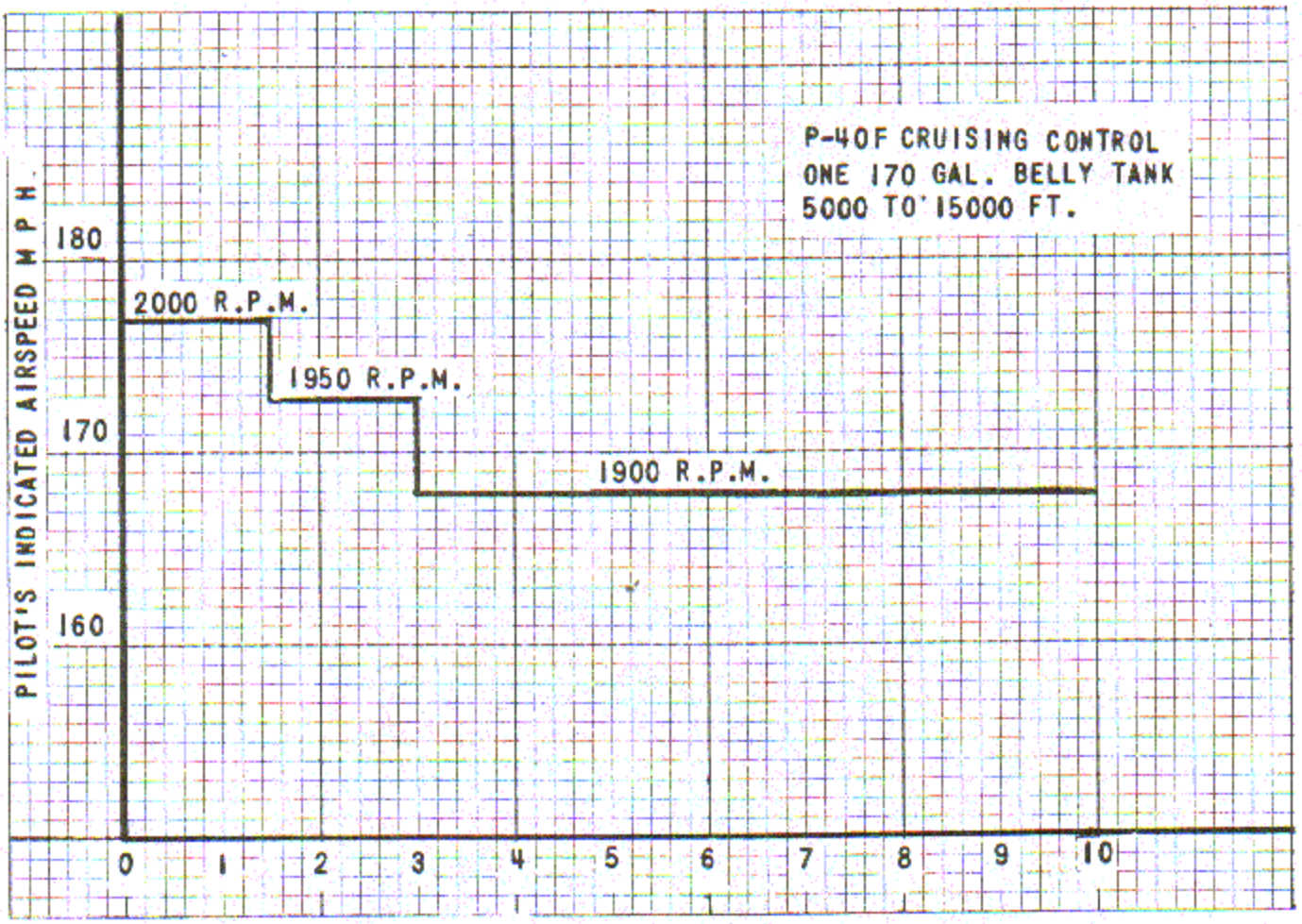
TABLE 2 - TRUE AIR SPEEDS

INDICATED AIR SPEED	TRUE SPEEDS AT 5000 Ft	10,000 Ft	15,000 Ft
MPH	MPH	MPH	MPH
177	196	212	229
173	192	207	224
168	186	201	218

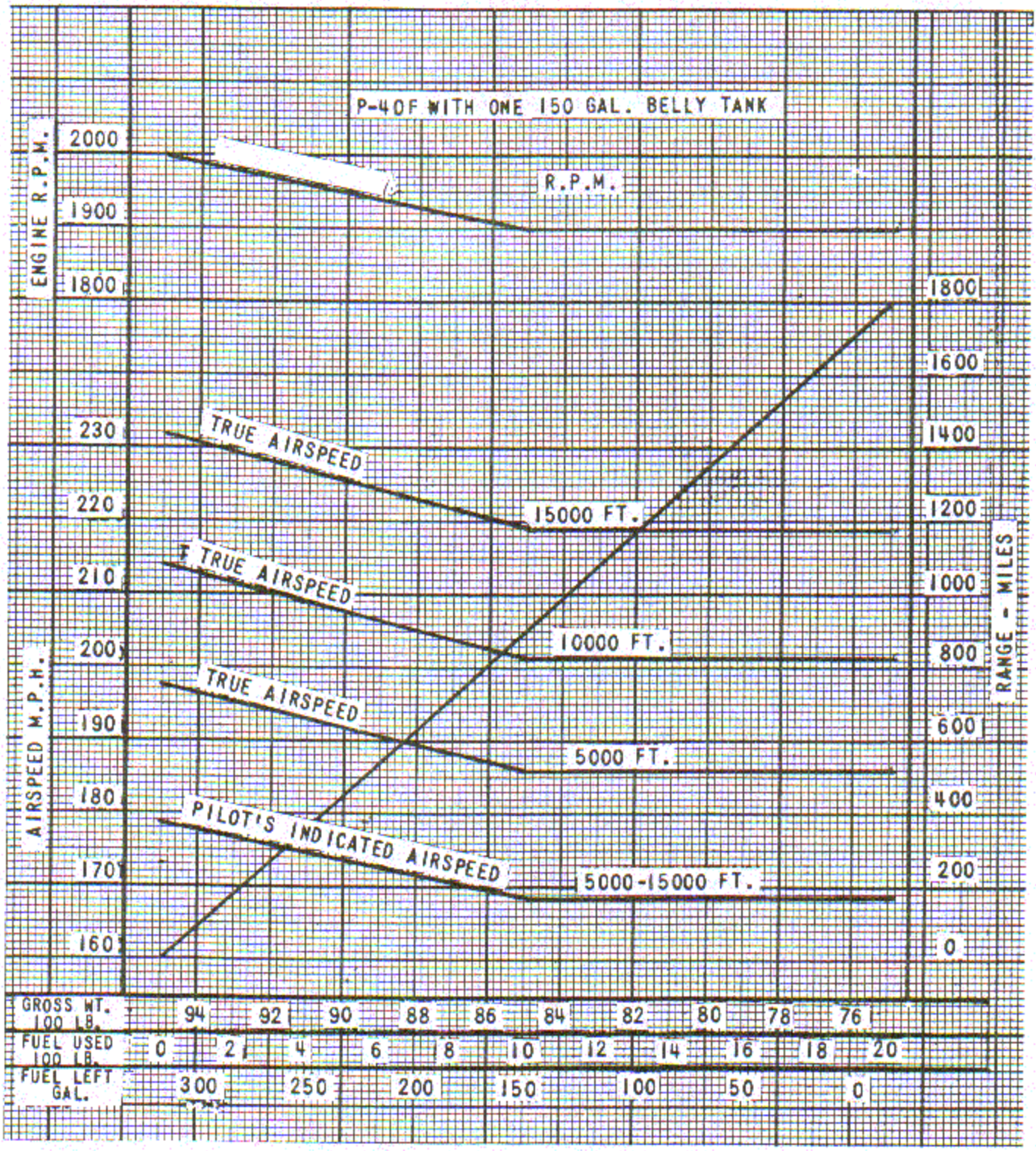
TABLE 3 - FUEL AND RANGE CHECK FOR 170-GALLON BELLY TANK

	5000 Ft		10,000 Ft		15,000 Ft	
Time Hrs.	Range Miles	Fuel Gal	Range Miles	Fuel Gal	Range Miles	Fuel Gal
0	0	318	0	318	0	318
1	190	273	200	268	200	263
2	383	236	409	228	426	220
3	575	200	616	189	650	178
4	761	165	817	151	868	137
5	947	130	1018	114	1086	97
6	1133	96	1219	77	1304	57
7	1319	62	1420	41	1522	18
8	1505	28	1621	5		
End	1658	0	1649	0	1622	0

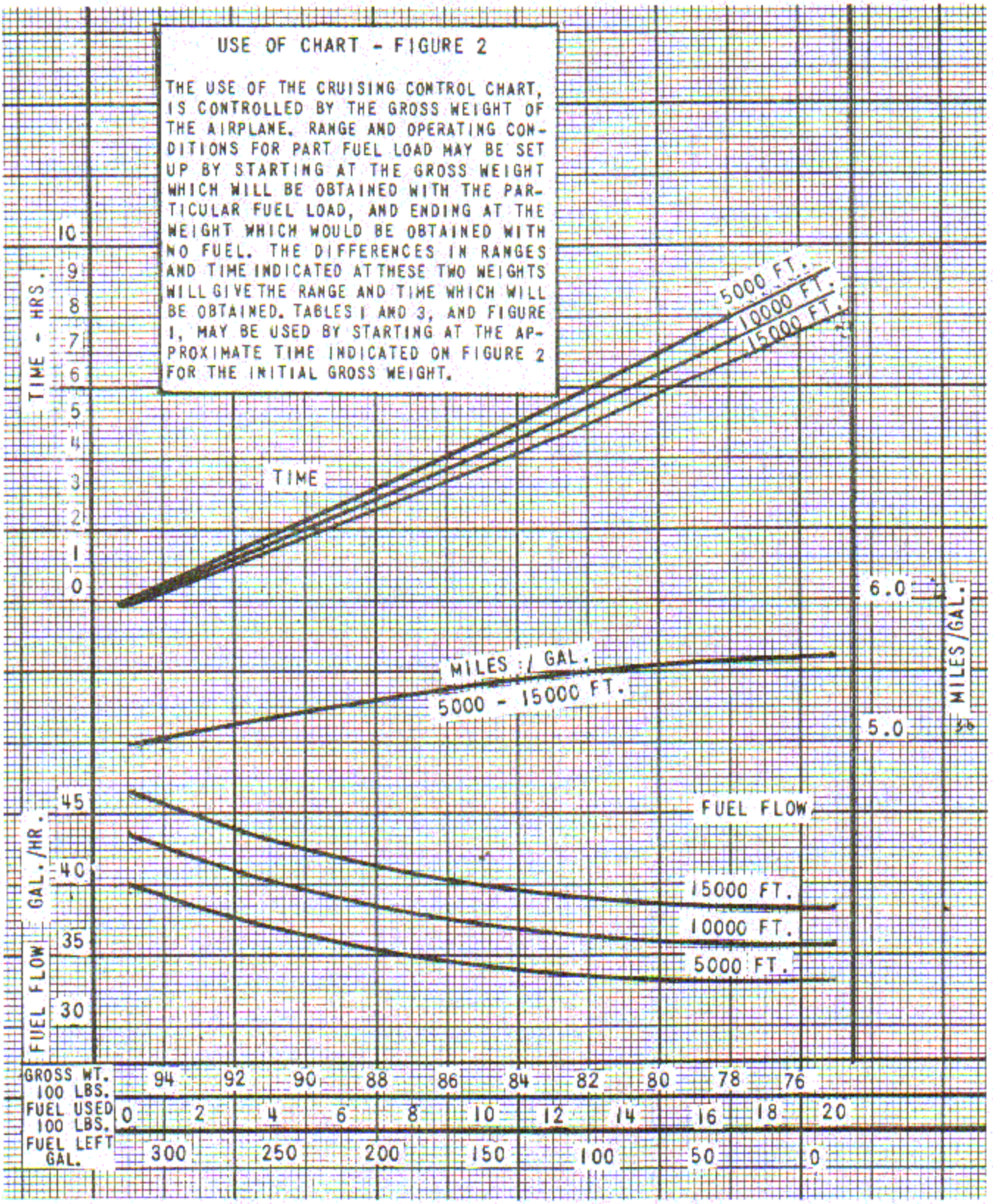
(Allowance is made for fuel used in climb.)



Air-speed and RPM Chart



Cruising Control Chart



Cruising Control Chart (Continued)

APPENDIX II

U.S.A. - BRITISH GLOSSARY OF NOMENCLATURE

U. S. A.	BRITISH
Accumulator	Pressure reservoir
Battery	Accumulator
Check valve	Non-return valve
Cotter pin	Split pin
Inverter	Motor generator (AC to DC)
Lean mixture	Weak mixture
Lift raft	Dinghy
Lock washer	Spring washer
Manifold pressure	Boost
(inches of mercury above zero)	(pounds per square inch from 0 at sea level)
Change of 2.036 inches	Change of 1 pound boost
29.92 inches Hg	0 pound boost
50.2 inches Hg	10 pounds boost
Oleo strut	Compression leg
Piston pin	Gudgeon pin
Propeller	Airscrew
Low pitch	Fine pitch
High pitch	Coarse pitch
Radio mast	Rod aerial
Reticle (gun sight)	Graticule
Snap roll	Flick roll
Stabilizer	Tail plane
Tachometer	Revolution counter
Tow target	Drouge target
Wrench	Spanner