T. O. NO. 01-75F-1

PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODELS

P-38D through P-38G Series
F-4, F-4A and F-5A Series
AIRPLANES

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

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1 OCTOBER 1942
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WHAT'RE ALL THE GADGETS FOR?
Do you know?
Read this manual and find out!
KNOW YOUR AIRPLANE
BEFORE TAKING OFF

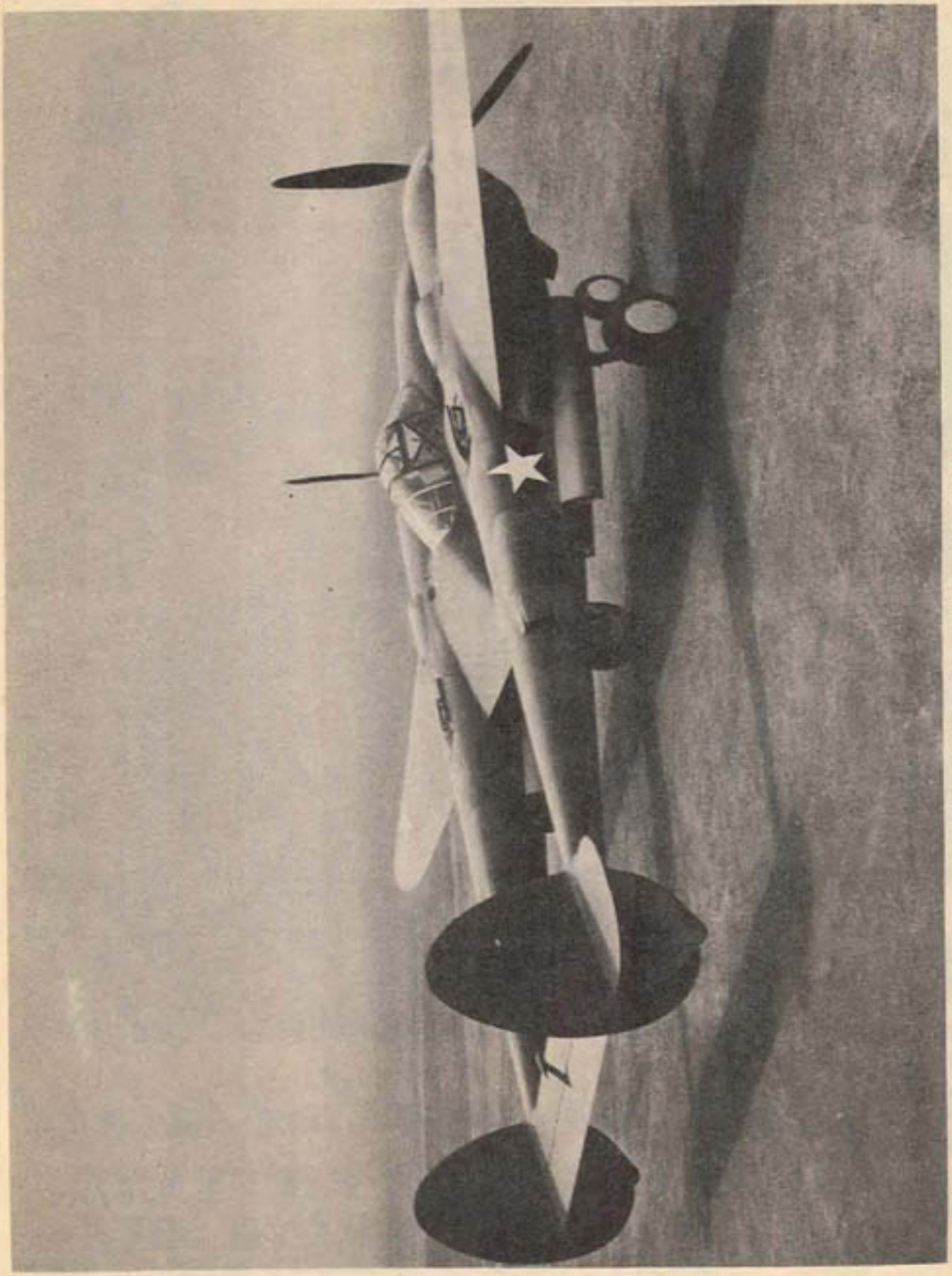


FIGURE 1—LOCKHEED P-38 FIGHTER AIRPLANE

FIGURE 2—LOCKHEED P-38 WITH DROPPABLE FUEL TANKS

SECTION I
DESCRIPTION

1. *GENERAL.*

This handbook covers the model RP-38D, RP-38E, P-38F, P-38F-1, P-38F-5, P-38F-13, P-38F-15, P-38G-1, P-38G-3, P-38G-5, P-38G-10, and P-38G-15 fighter airplanes, and the model F-4, F-4A, F-5A-1, F-5A-3, and F-5A-10 photographic airplanes. These airplanes are manufactured by Lockheed Aircraft Corporation, Burbank, California, under Contracts A-242, W535 ac 13205, W535 ac 15646, and W535 ac 21217.

They are tricycle geared, land monoplanes, powered with turbo-supercharged, twelve-cylinder, Allison, model V-1710-27 and -29, V-1710-49 and -53, or V-1710-51 and -55 engines.

Each engine drives a Curtiss electric, three-bladed, constant speed, full feathering propeller. Hydraulically operated flaps, landing gear, coolant shutters, cannon charger, and brakes are provided.

NOTE: The Hydraulic cannon charger has been deleted from airplanes serial No. 42-12567 and up, and serial No. 43-2035 and up.

The approximate overall dimensions are as follows:

Length	37 Ft. 9 1/8 In.
Height	9 Ft. 9 3/4 In.
Span	52 Ft. 0 In.

2. *FUEL, OIL, AND COOLANT.*

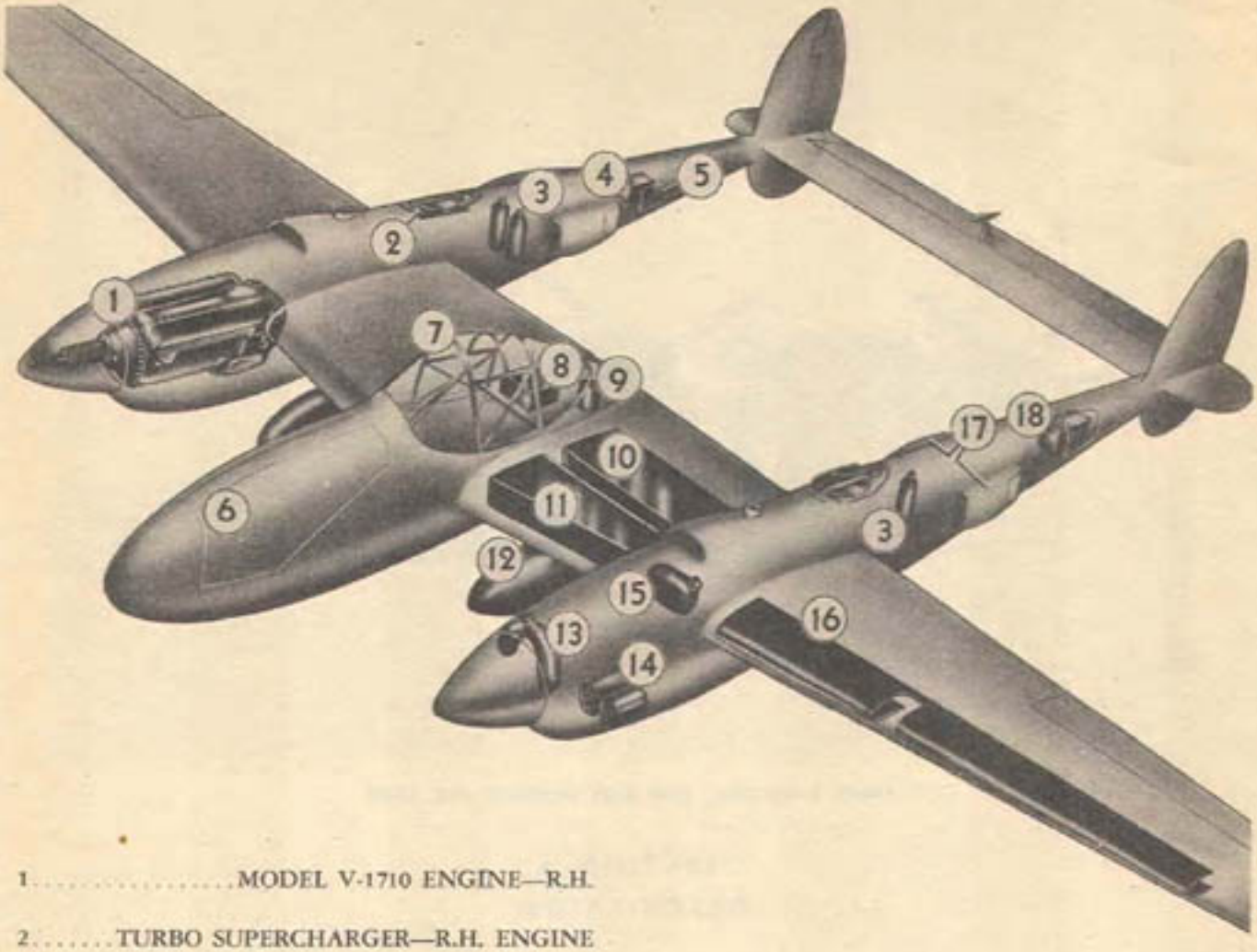
a. Fuel: ..... Specification—AN-VV-F-781
Octane—100

b. Oil: ..... Specification—AN-VV-O-446A
Vicosity—1120

c. COOLANT: ..... Specification—AN-E-2
Name—Ethylene Glycol

3. *PILOT PROTECTION.*

Front and rear armor is provided to protect the pilot from direct right angle .30 caliber fire originating within the shaded areas illustrated in Figure 12.



1 ..... MODEL V-1710 ENGINE—R.H.

2 ..... TURBO SUPERCHARGER—R.H. ENGINE

3 ..... OXYGEN CYLINDERS (Typical Installation)

4 ..... RECOGNITION RADIO

5 .... BAGGAGE COMPARTMENT (Located in L.H. Boom in Camera Airplanes)

6 ... ARMAMENT COMPARTMENT OR CAMERA COMPARTMENT

7 ..... COCKPIT

8 ..... RADIO EQUIPMENT

9 ..... HYDRAULIC RESERVOIR

10 ..... MAIN WING TANK—L.H.

11 ..... RESERVE WING TANK—L.H.

12 ... EXTERNAL DROPPABLE FUEL TANK—L.H.

13 ..... COOLANT TANK—L.H. ENGINE

14 ..... OIL RADIATORS—L.H. ENGINE

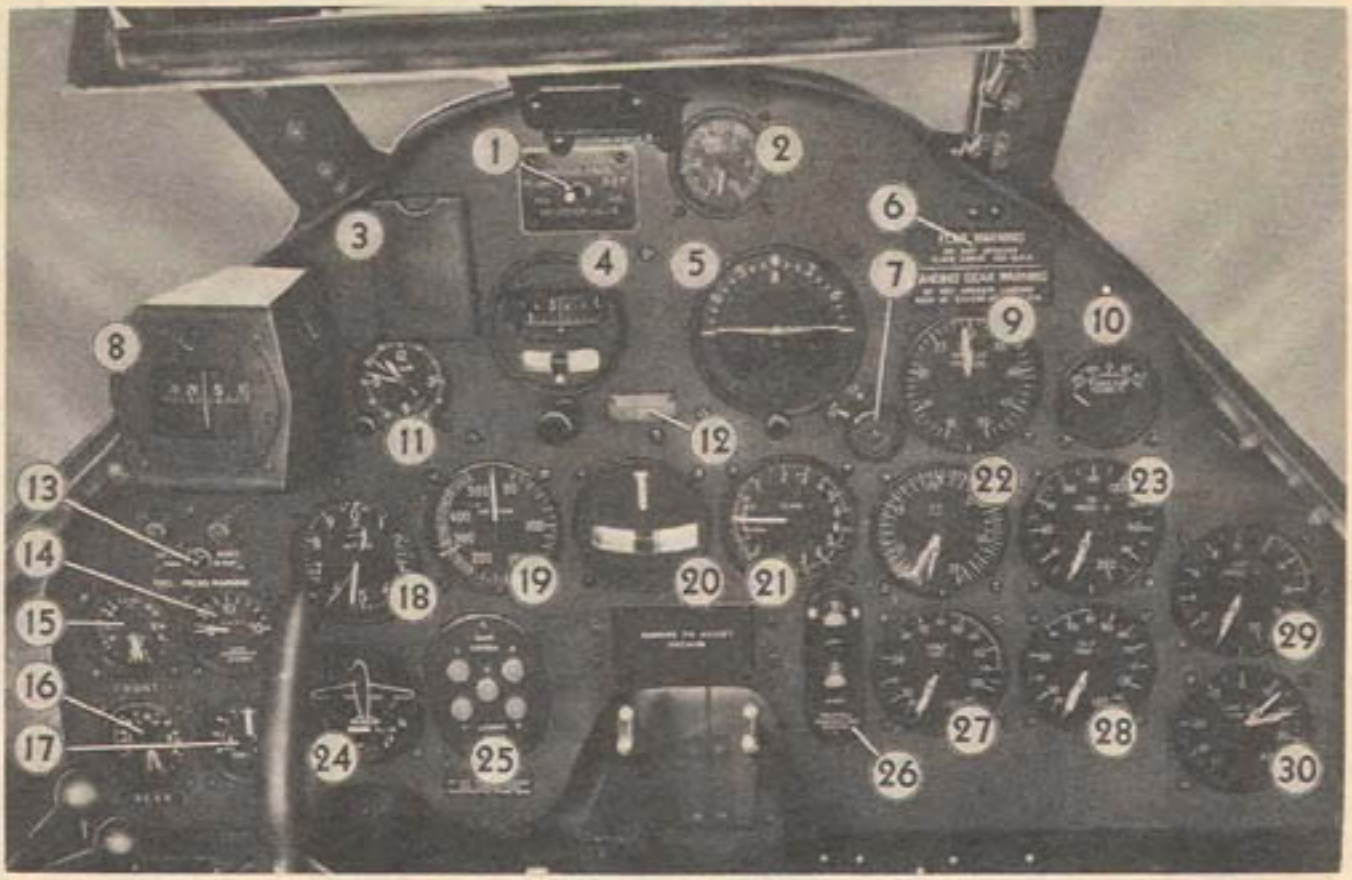
15 ..... OIL TANK—L.H. ENGINE

16 ..... INTERCOOLER—L.H. ENGINE

17 ..... COOLANT RADIATOR—L.H. ENGINE

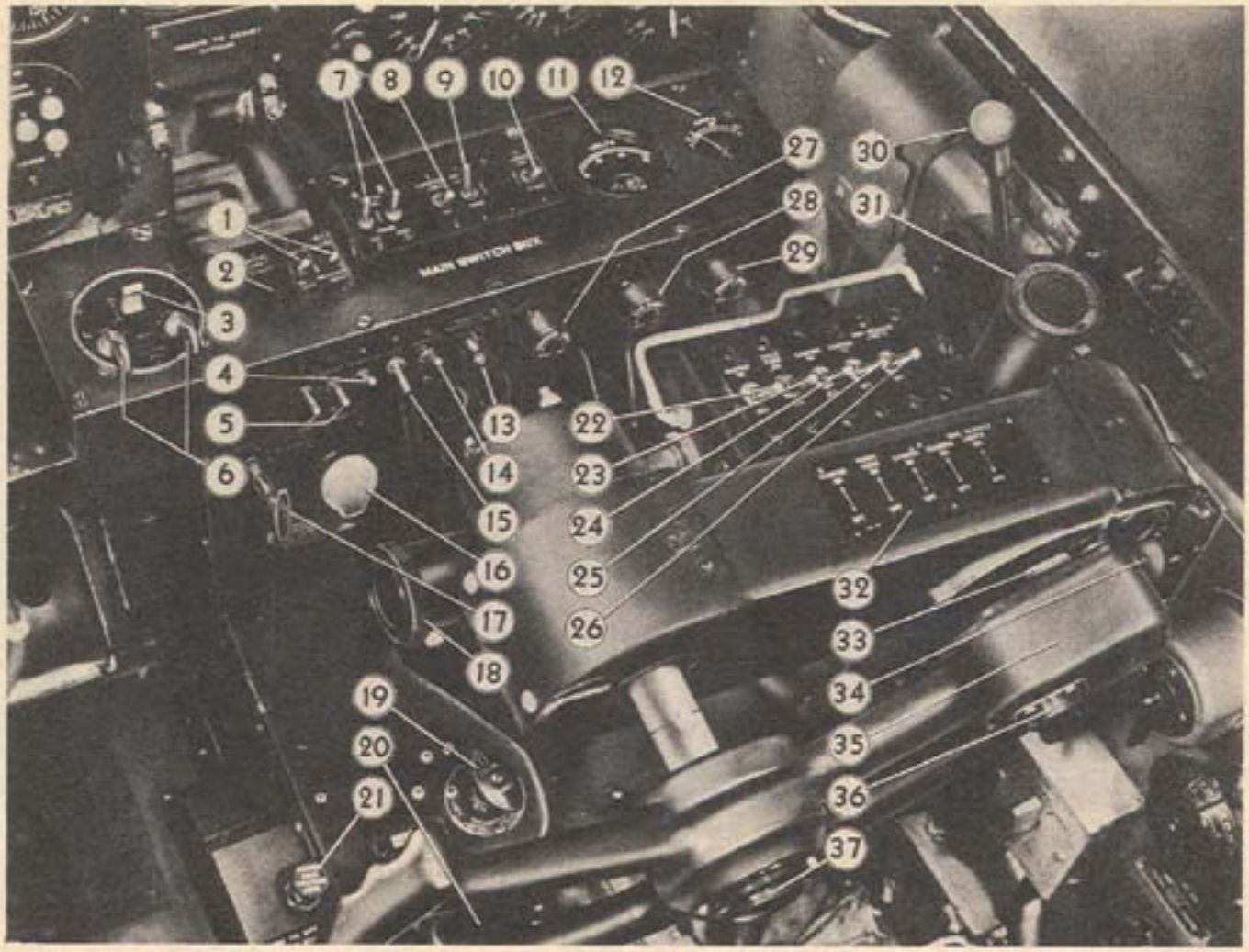
18 ..... BATTERY Located in Fuselage Nose in Camera Airplanes)

FIGURE 3—FUSELAGE CONTENTS ARRANGEMENT



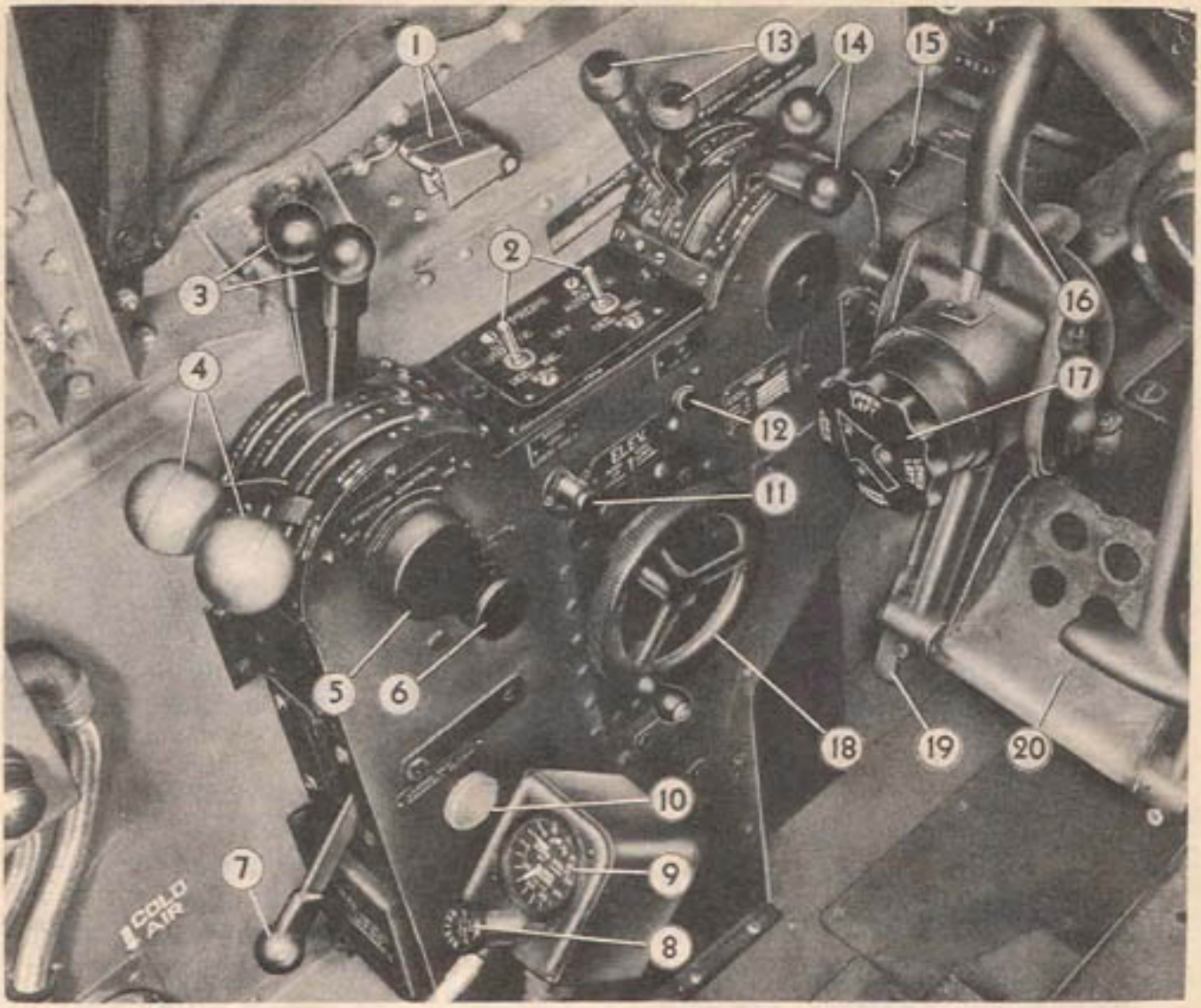
1. SUCTION GAGE SELECTOR VALVE
2. SUCTION GAGE
3. COMPASS CORRECTION CARD HOLDER
4. TURN INDICATOR
5. FLIGHT INDICATOR
6. FLAP AND LANDING GEAR PLACARD
7. FLIGHT INDICATOR CAGING KNOB
8. COMPASS
9. MANIFOLD PRESSURE GAGE (Right and Left Engines)
10. FREE AIR TEMPERATURE GAGE
11. CLOCK
12. RADIO CALL PLATE
13. FUEL PRESSURE WARNING LIGHTS (Right and Left Engines)
14. HYDRAULIC SYSTEM PRESSURE GAGE
15. FUEL QUANTITY INDICATOR (Front Tanks)
16. FUEL QUANTITY INDICATOR (Rear Tanks)
17. OIL COOLER FLAPS POSITION INDICATOR (Right and Left Engines)
18. ALTIMETER
19. AIRSPEED INDICATOR
20. BANK AND TURN INDICATOR
21. RATE OF CLIMB INDICATOR
22. TACHOMETER (Right and Left Engines)
23. OIL PRESSURE GAUGE (Right and Left Engines)
24. LANDING GEAR AND FLAP POSITION INDICATOR
25. MACHINE GUNS AND CANNON BLINKER LIGHTS
26. COOLANT TEMPERATURE WARNING LIGHTS (Right and Left Engines)
27. COOLANT TEMPERATURE INDICATOR (Right and Left Engines)
28. OIL TEMPERATURE INDICATOR (Right and Left Engines)
29. FUEL PRESSURE GAGE (Right and Left Engines)
30. CARBURETOR AIR TEMPERATURE (Right and Left Engines)

FIGURE 4—TYPICAL INSTRUMENT PANEL



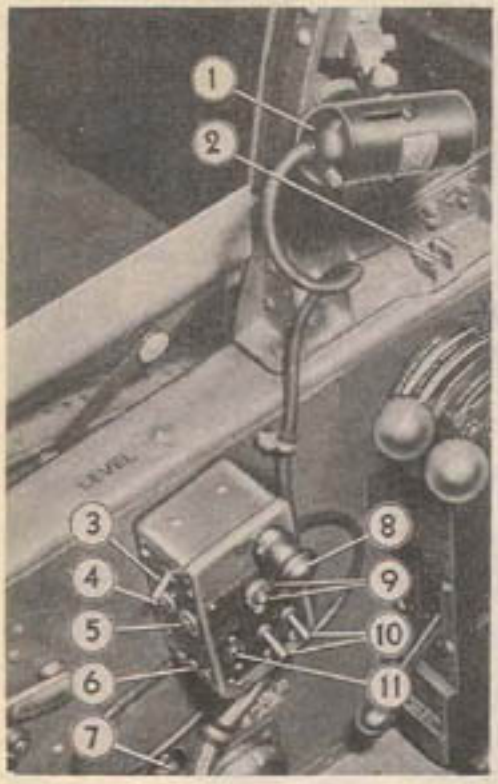
1. OIL DILUTION CONTROL SWITCHES (Left and Right)
2. SPARE INSTRUMENT LIGHT
3. AIRPLANE MASTER SWITCH
4. GENERATOR CONTROL SWITCH
5. OIL COOLERS FLAP CONTROL SWITCHES (Left and Right)
6. ENGINE IGNITION SWITCHES (Left and Right)
7. ENGINE STARTER CONTROL SWITCHES (Left and Right)
8. FLUORESCENT INSTRUMENT LIGHT CONTROL SWITCH
9. POSITION LIGHT SWITCH
10. LANDING LIGHT CONTROL SWITCH
11. VOLTMETER
12. AMMETER
13. INVERTER WARNING LIGHT
14. INVERTER SELECTOR SWITCH
15. PITOT HEAD HEATER SWITCH
16. CANNON CHARGER CONTROL
17. PARKING BRAKE CONTROL HANDLE
18. FLUORESCENT INSTRUMENT LIGHT
19. DUAL ENGINE PRIMER
20. RUDDER TAB CONTROL
21. CANNON CASE EJECTION DOOR CONTROL KNOB
22. ARMAMENT MASTER SWITCH
23. MACHINE GUNS CONTROL SWITCH
24. CANNON CONTROL SWITCH
25. GUN CAMERA CONTROL SWITCH
26. GUN BLINKER CONTROL SWITCH
27. COMPASS LIGHT RHEOSTAT SWITCH
28. GUN SIGHT LIGHT RHEOSTAT SWITCH
29. COCKPIT LIGHTS RHEOSTAT SWITCH
30. FLAP CONTROL LEVER
31. FLUORESCENT INSTRUMENT LIGHT
32. ARMAMENT SWITCHES INSTRUCTION PLATE
33. MACHINE GUNS TRIGGER BUTTON
34. AILERON TAB CONTROL
35. PILOTS CONTROL WHEEL
36. CANNON TRIGGER BUTTON
37. MICROPHONE BUTTON

FIGURE 5—COCKPIT (RIGHT FRONT)



1. PROPELLER FEATHERING SWITCHES—GUARDED (Left and Right)
2. PROPELLER SELECTOR SWITCHES—AUTOMATIC MANUAL (Left and Right)
3. PROPELLER GOVERNOR CONTROLS (Left and Right)
4. THROTTLES (Left and Right)
5. FRICTION CONTROL
6. PROPELLER PITCH VERNIER CONTROL (Right Engine)
7. LANDING GEAR CONTROL LEVER
8. OXYGEN CONTROL VALVE
9. OXYGEN CYLINDER PRESSURE AND FLOW INDICATOR
10. LANDING GEAR LEVER EMERGENCY RELEASE
11. LANDING GEAR UP WARNING LIGHT
12. LANDING GEAR WARNING HORN STOP BUTTON
13. MIXTURE CONTROLS (Left and Right)
14. COOLANT SHUTTER CONTROLS (Left and Right)
15. PROPELLER SAFETY SWITCHES (Left and Right)
16. MACHINE GUN CHARGER HANDLE
17. MACHINE GUN CHARGER SELECTOR
18. ELEVATOR TAB CONTROL WHEEL
19. RUDDER PEDAL ADJUSTMENT LOCK—LEFT
20. RUDDER PEDAL AND TOE BRAKE—LEFT

FIGURE 6—COCKPIT (LEFT FRONT)



1.....AUXILIARY COCKPIT SWIVEL LIGHT

2.....SURFACE CONTROL LOCK CLIP

3.....BOMB ARMING SWITCH

4....BOMBS ARMED INDICATOR LIGHT—RED

5....BOMBS SAFE INDICATOR LIGHT—GREEN

6....SPARE INDICATOR LIGHTS—RED, GREEN AND AMBER

7....ALTERNATE MOUNTING FOR AUXILIARY COCKPIT SWIVEL LIGHT

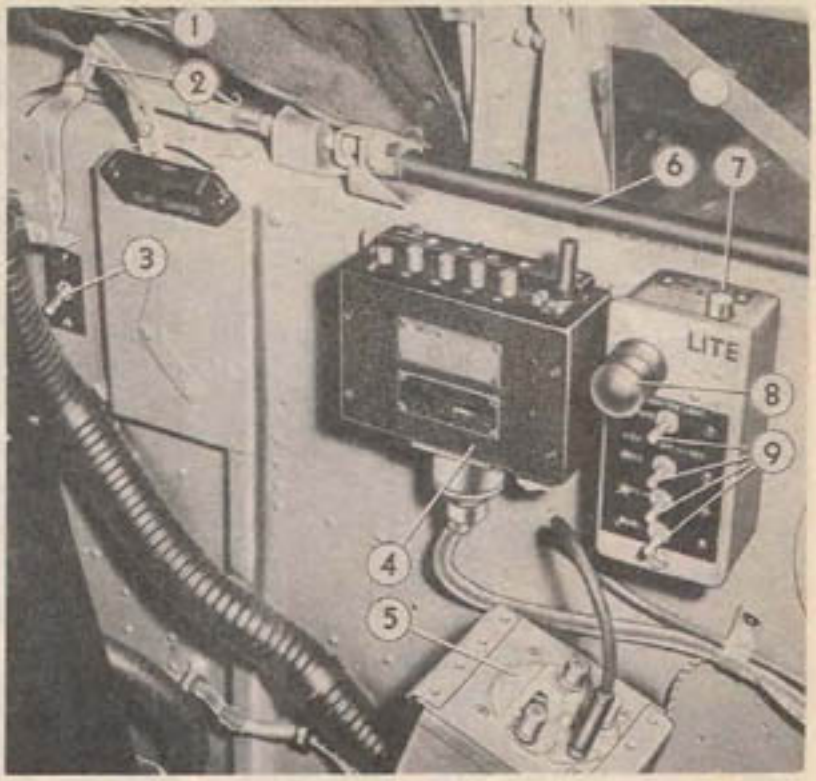
8.....AUXILIARY COCKPIT LIGHT (Left)

9.....BOMB OR DROPPABLE TANK SELECTOR SWITCH INDICATOR LIGHTS (Left and Right)

10.....BOMB OR DROPPABLE TANK SELECTOR SWITCHES (Left and Right)

11.....BOMB OR DROPPABLE TANK RELEASE BUTTON

FIGURE 7—COCKPIT (LEFT SIDE)



1.....FLAP CONTROL LEVER

2.....FLAP CONTROL LEVER TRIGGER

3.....INVERTER SWITCH

4.....SCR-522 RADIO CONTROLS

5.....RCA AVA-101

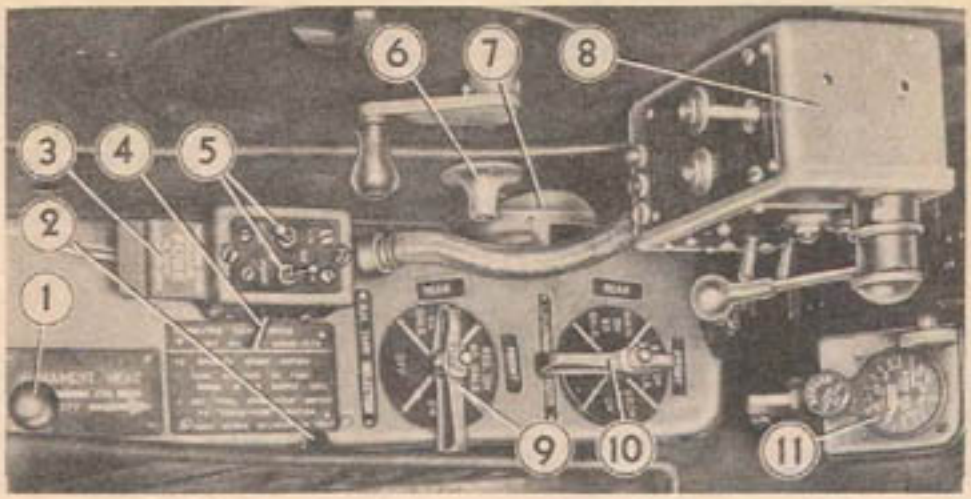
6.....SURFACE CONTROLS LOCK

7.....RECOGNITION LIGHTS KEYING SWITCH

8.....COCKPIT LIGHT

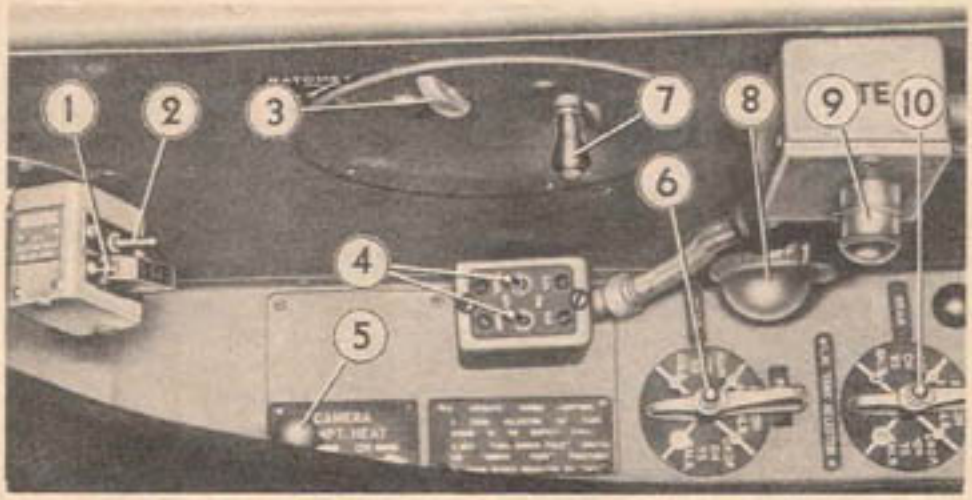
9..RECOGNITION LIGHTS SELECTOR SWITCHES

FIGURE 8—COCKPIT (RIGHT HAND)



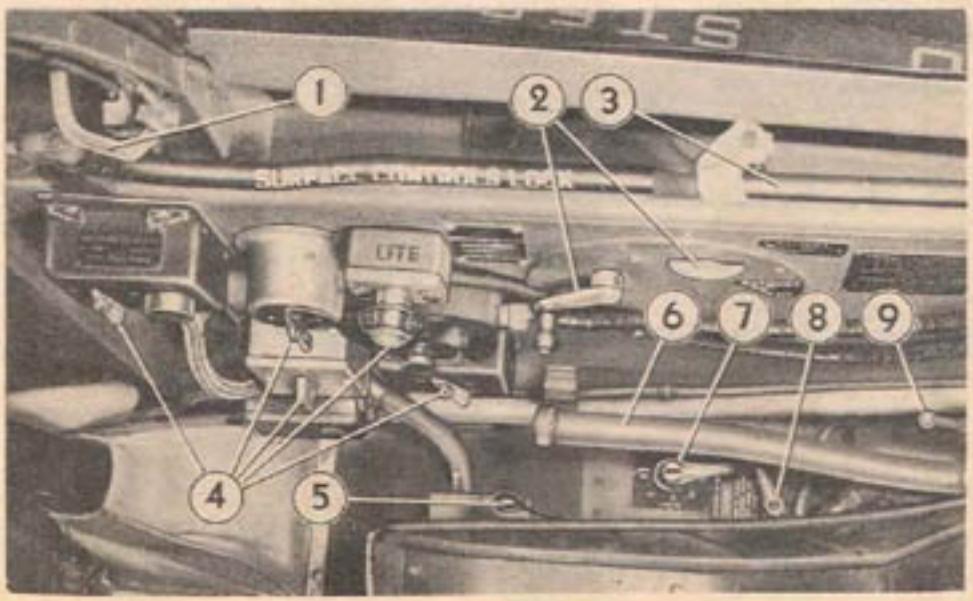
1. . .Armament Compartment Heat Control
2. .Shoulder Harness Release
3. . . . . .Tank or Bomb Fuse
4. . . .Cross-feed Valve Switch
5. .Fuel Boost Pump Switches
6. . . .Alternate Mounting for Auxiliary Cockpit Swivel Light
7. . . . . Cockpit Ventilator
8. . . .Tank and Bomb Switch Box
9. .R.H. Tank Selector Valve
10. . .L.H. Tank Selector Valve
11. . . . . Oxygen Regulator

FIG. 9—COCKPIT (LEFT REAR)



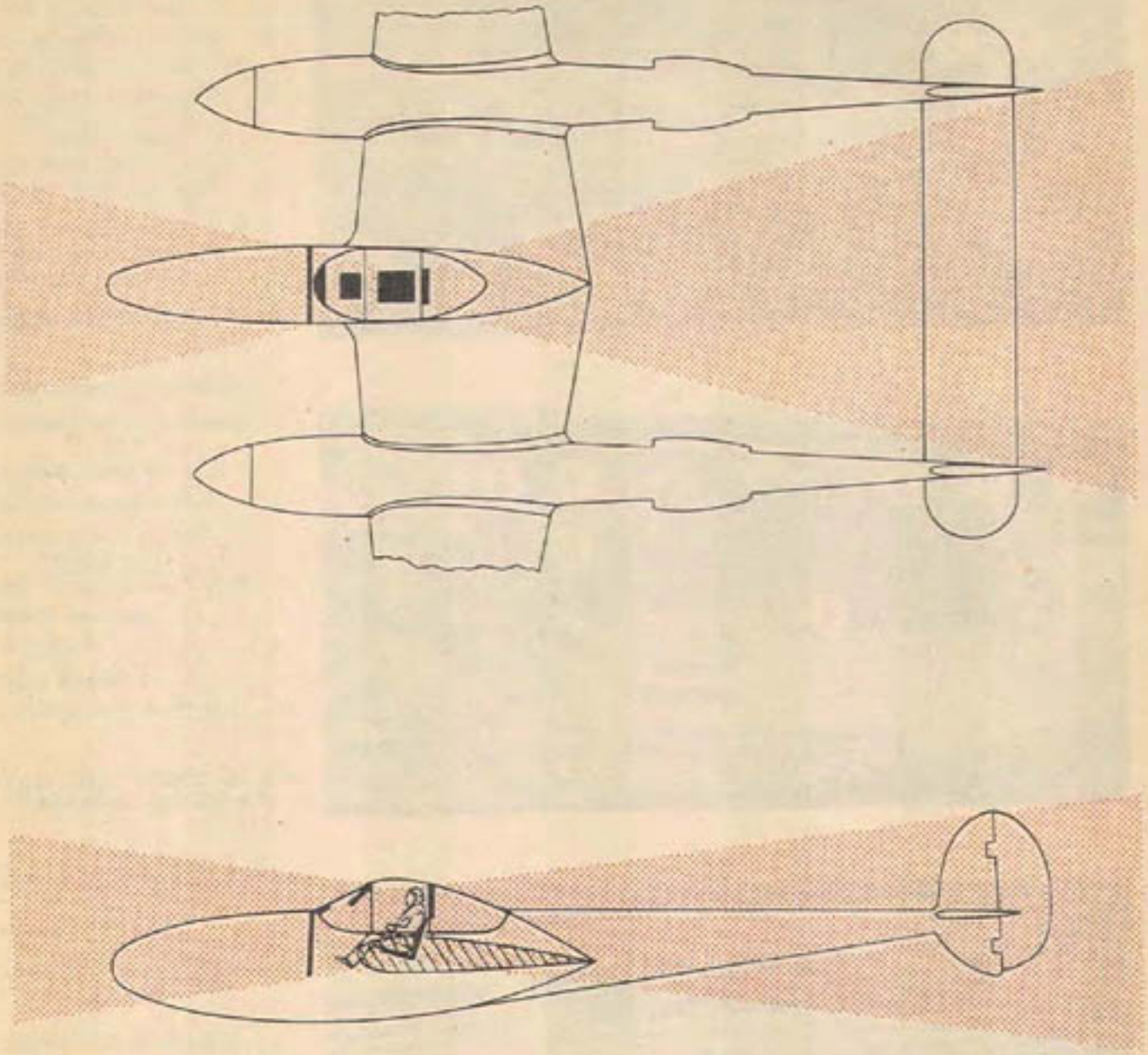
1. . .Tank Drop Switch—L.H.
2. .Crossfeed Valve Switch—L.H.
3. . . . . Window Ratchet
4. . . . . .Fuel Pump Switches
5. . . . . Camera Compartment Heat Control
6. .R.H. Tank Selector Valve
7. . . . . Window Crank
8. . . . . Ventilator
9. . . . . Cockpit Light
10. . .L.H. Tank Selector Valve

FIG 10—COCKPIT (LEFT REAR) (F-4 CAMERA AIRPLANES)



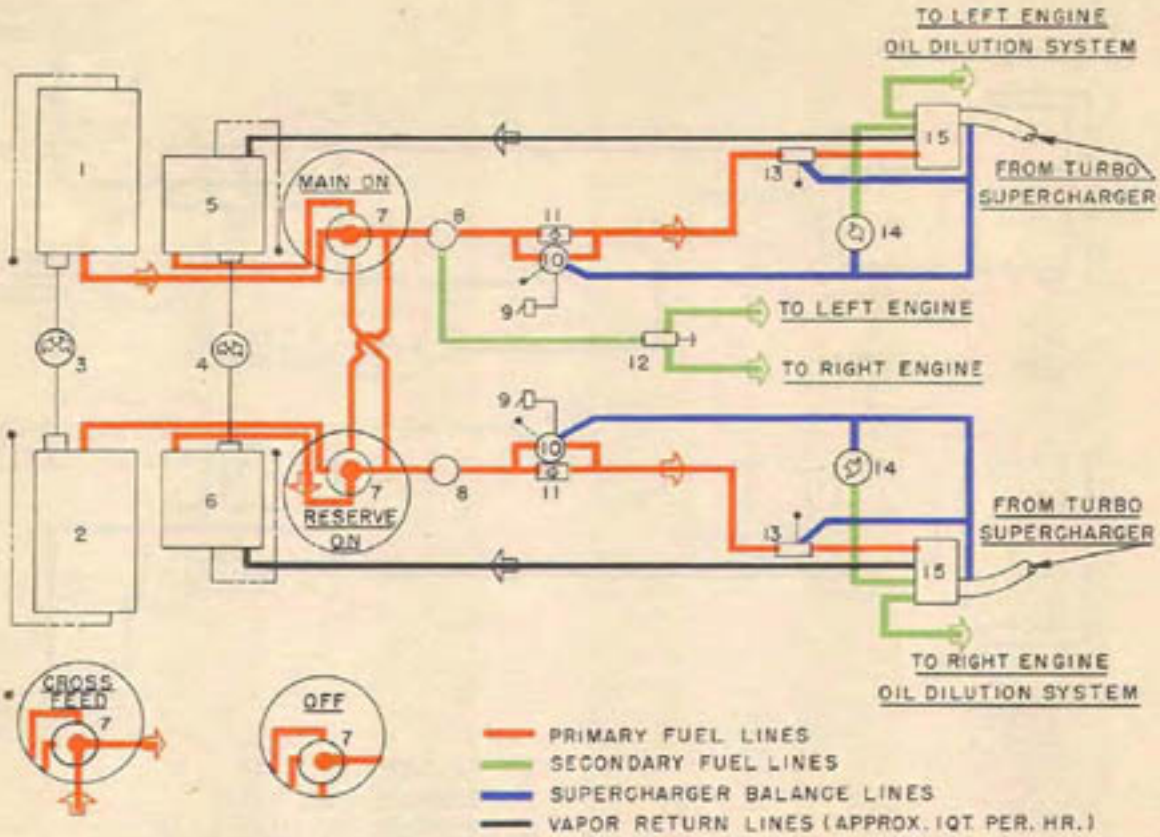
1. .Emergency Hatch Release
2. . . . . Window Controls
3. . .Surface Controls Lock—Stowed
4. . .SCR-283 Radio Controls
5. . . . .Seat Adjustment Lever
6. . . Hand Hydraulic Pump
7. . . . .Vacuum Pump Selector
8. . . . . By-pass Valve
9. . . . . .Oil Source Selector Valve Lever

FIG. 11—COCKPIT (RIGHT REAR)



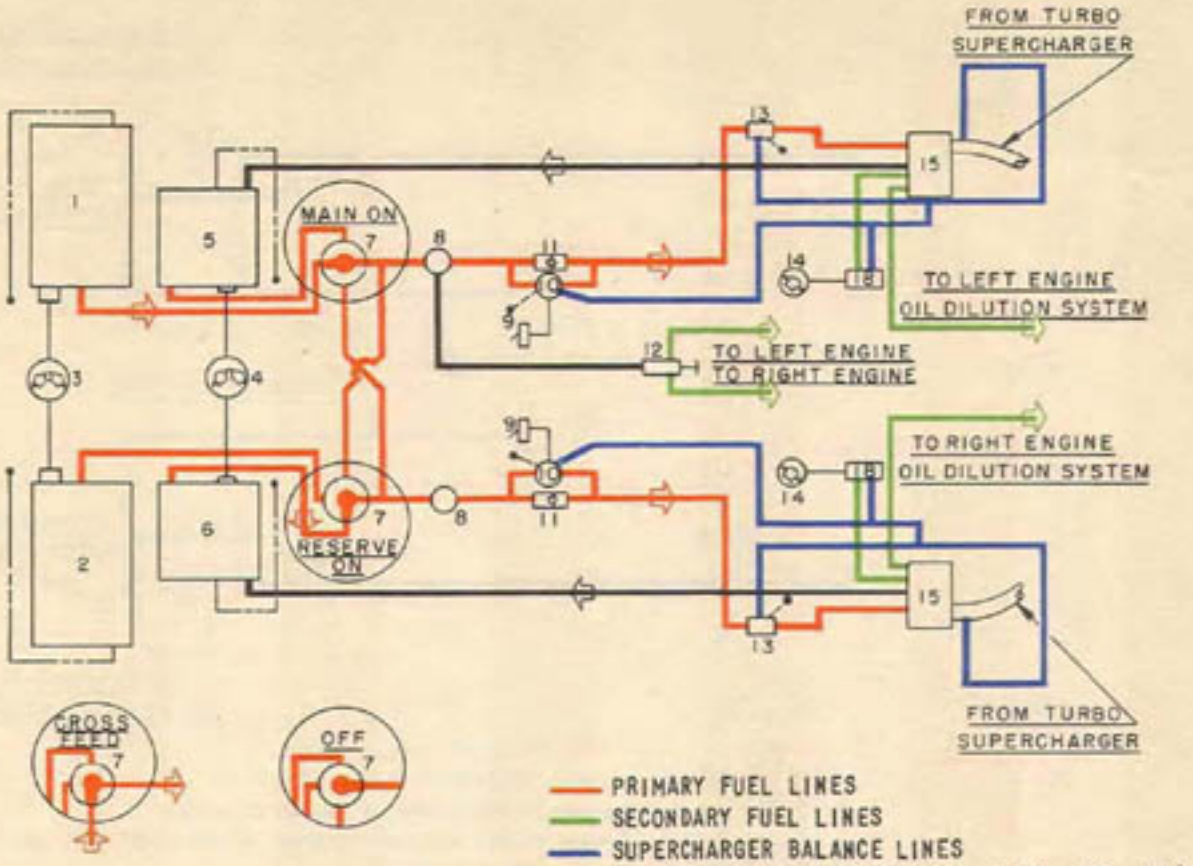
ARMOR PROTECTS PILOT FROM MACHINE GUN FIRE WITHIN SHADED AREA

FIGURE 12—ARMOR DIAGRAM



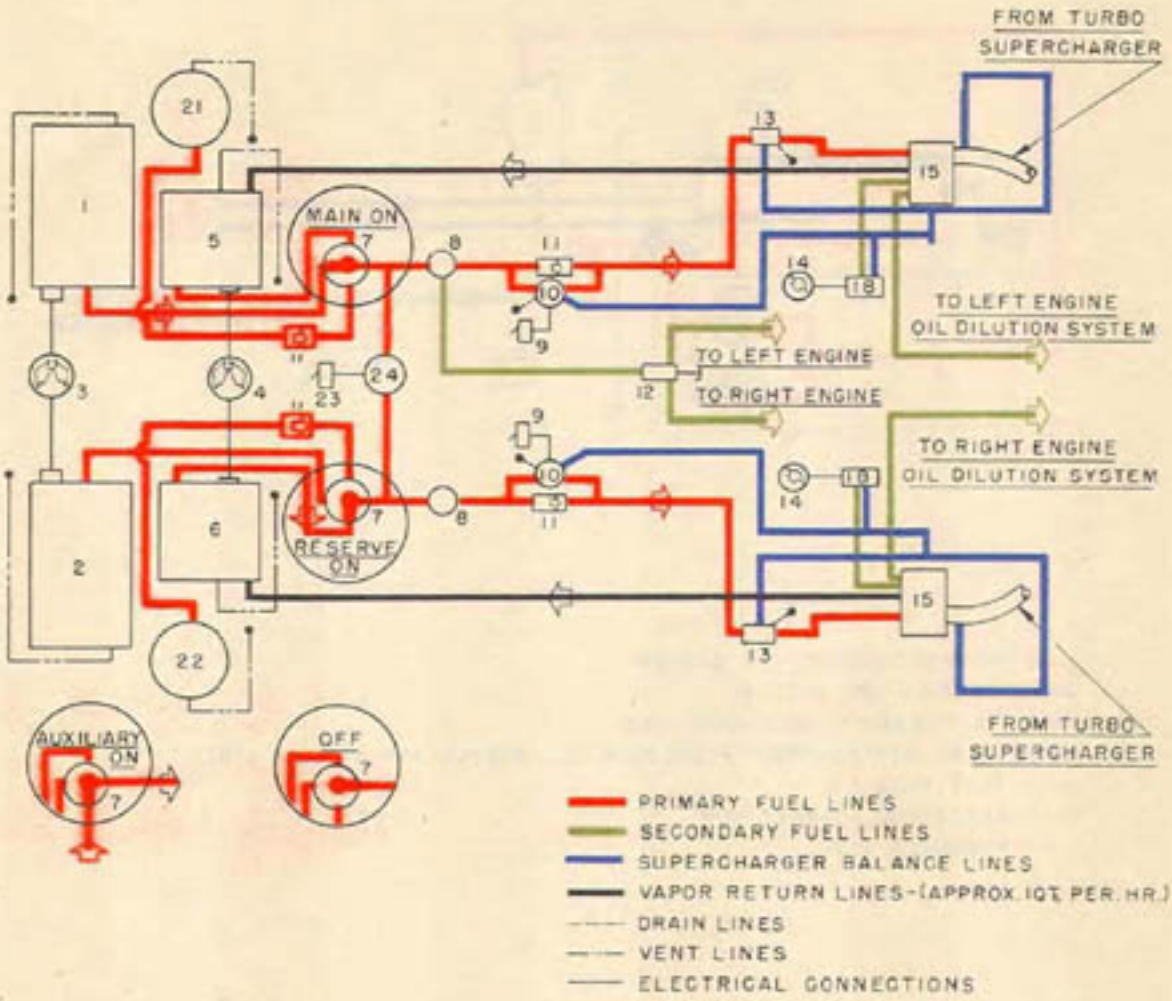
1 LEFT MAIN TANK – 93 U.S. GAL., 77 IMP. GAL.
2 RIGHT MAIN TANK – 93 U.S. GAL., 77 IMP. GAL.
3 REAR TANKS QUANTITY GAGE
4 FRONT TANKS QUANTITY GAGE
5 LEFT RESERVE TANK – 60 U.S. GAL., 50 IMP. GAL.
6 RIGHT RESERVE TANK – 60 U.S. GAL., 50 IMP. GAL.
7 TANK SELECTOR VALVE
8 FUEL STRAINER
9 ELECTRIC FUEL PUMP SWITCH
10 ELECTRIC FUEL PUMP
11 CHECK VALVE
12 PRIMER
13 ENGINE FUEL PUMP
14 FUEL PRESSURE GAGE
15 CARBURETOR

FIGURE 13—FUEL SYSTEM—P-38-D



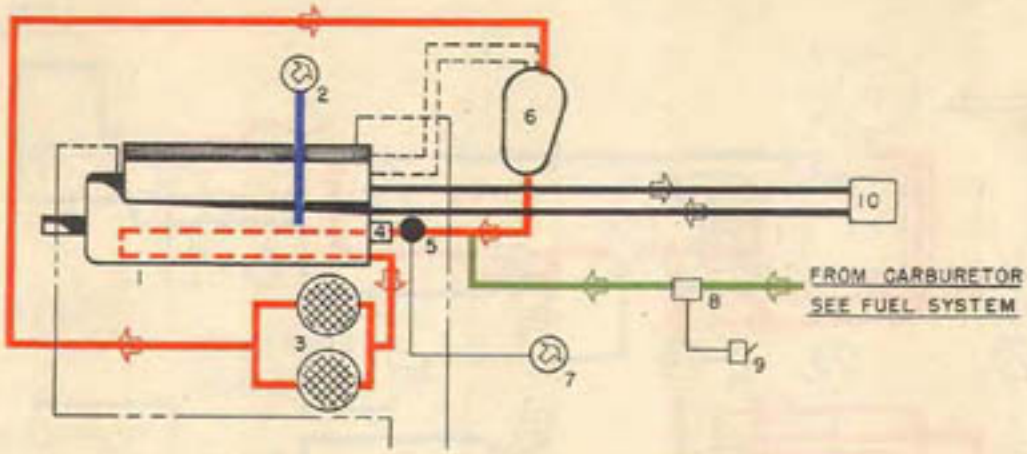
1 LEFT MAIN TANK-93 U.S. GAL., 77 IMP. GAL.
2 RIGHT MAIN TANK-93 U.S. GAL., 77 IMP. GAL.
3 REAR TANKS QUANTITY GAGE
4 FRONT TANKS QUANTITY GAGE
5 LEFT RESERVE TANK-60 U.S. GAL., 50 IMP. GAL.
6 RIGHT RESERVE TANK-60 U.S. GAL., 50 IMP. GAL.
7 TANK SELECTOR VALVE
8 FUEL STRAINER
9 ELECTRIC FUEL PUMP SWITCH
10 ELECTRIC FUEL PUMP
11 CHECK VALVE
12 PRIMER
13 ENGINE FUEL PUMP
14 FUEL PRESSURE GAGE
15 CARBURETOR
16 DELETED
17 DELETED
18 FUEL PRESSURE TRANSMITTER
19 DELETED
20 DELETED

FIGURE 14—FUEL SYSTEM—RP-38E, P-38F



1 LEFT MAIN TANK—93 U. S. GAL., 77 IMP. GAL.
2 RIGHT MAIN TANK—93 U. S. GAL., 77 IMP. GAL.
3 REAR TANKS QUANTITY GAGE
4 FRONT TANKS QUANTITY GAGE
5 LEFT RESERVE TANK—60 U. S. GAL., 50 IMP. GAL.
6 RIGHT RESERVE TANK—60 U. S. GAL., 50 IMP. GAL.
7 TANK SELECTOR VALVE
8 FUEL STRAINER
9 ELECTRIC FUEL PUMP SWITCH
10 ELECTRIC FUEL PUMP
11 CHECK VALVE
12 PRIMER
13 ENGINE FUEL PUMP
14 FUEL PRESSURE GAGE
15 CARBURETOR
16 DELETED
17 DELETED
18 FUEL PRESSURE TRANSMITTER
19 DELETED
20 DELETED
21 LEFT AUXILIARY TANK
22 RIGHT AUXILIARY TANK
23 CROSS SUCTION SOLENOID
24 CROSS SUCTION VALVE

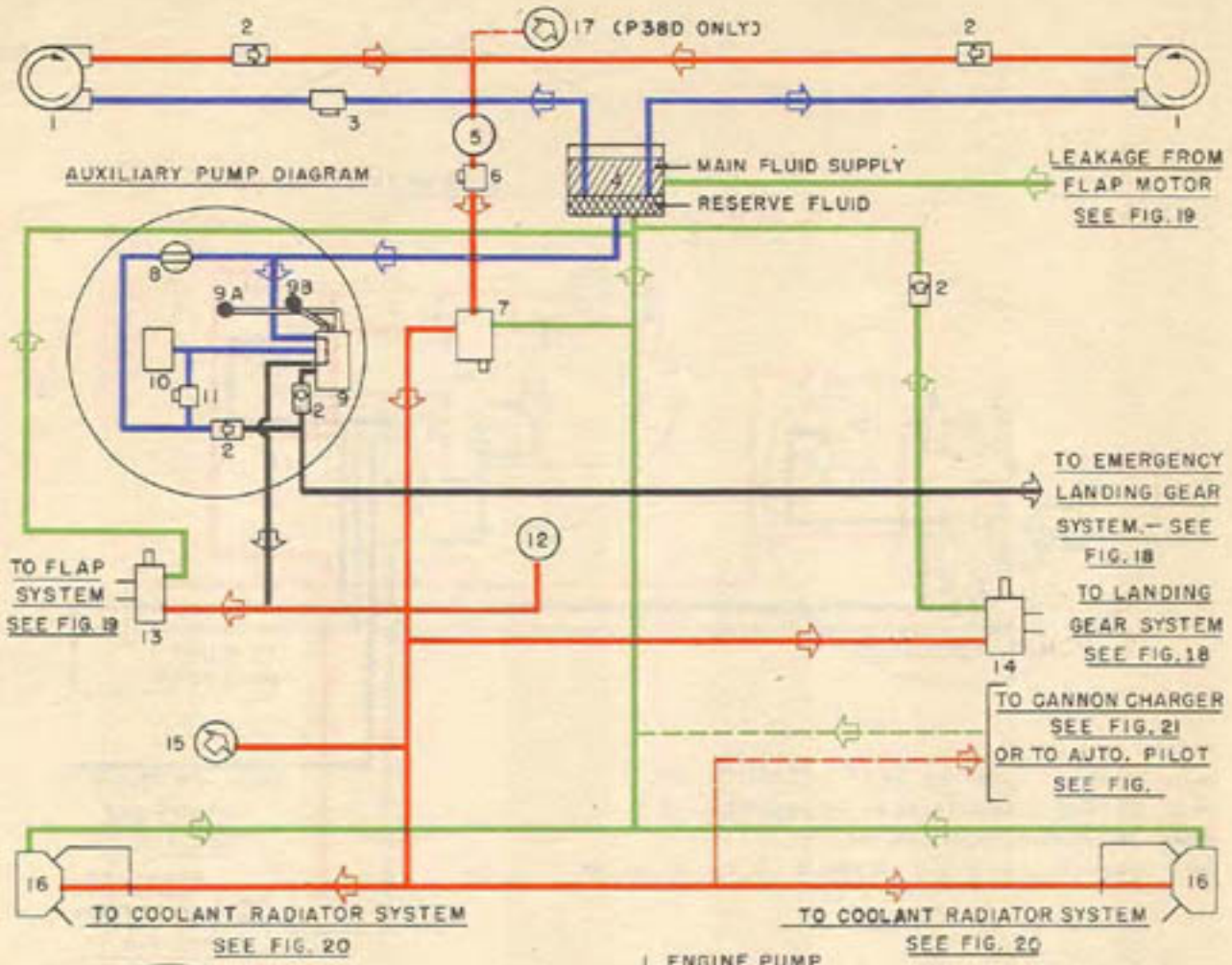
FIGURE 15—FUEL SYSTEM—AIRPLANES WITH DROPPABLE TANKS

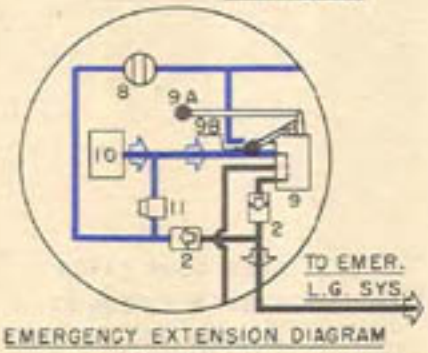


PRIMARY ENGINE OIL SYSTEM
OIL DILUTION SYSTEM
OIL PRESSURE INDICATOR LINE
TURBO SUPERCHARGER REGULATOR OIL SUPPLY AND RETURN LINES
VENT LINE
ELECTRICAL CONNECTION
BREATHER LINE

1 ENGINE
2 OIL PRESSURE INDICATOR
3 OIL RADIATORS
4 ENGINE OIL PUMP
5 OIL TEMPERATURE BULB
6 OIL RESERVOIR - 13 U.S. GAL, 11 IMP. GAL.
7 OIL TEMPERATURE INDICATOR
8 OIL DILUTION PUMP
9 OIL DILUTION PUMP SWITCH
10 TURBO SUPERCHARGER REGULATOR

FIGURE 16—OIL SYSTEM





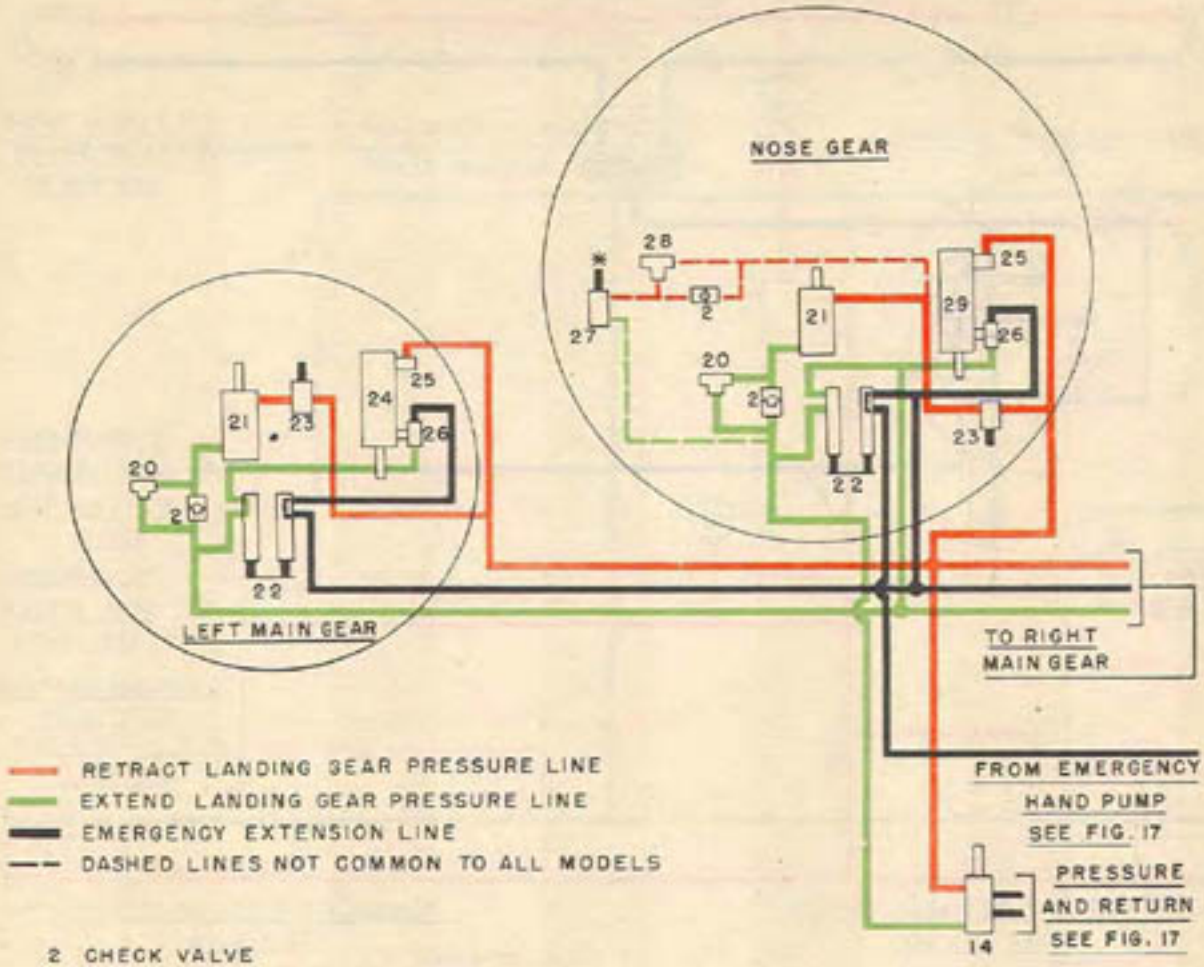
EMERGENCY EXTENSION DIAGRAM

- ENGINE PUMP PRESSURE LINES
- ENGINE PUMP AND HAND PUMP SUPPLY LINES
- RETURN TO RESERVOIR LINES
- HAND PUMP PRESSURE LINES- AUXILIARY OR EMERGENCY

DASHED- NOT COMMON TO ALL MODELS

1 ENGINE PUMP
2 CHECK VALVE
3 SUCTION GROUND TEST VALVE
4 MAIN RESERVOIR- 2.1 U.S. GAL., 1.7 IMP. GAL.
5 HYDRAULIC FILTER
6 PRESSURE TEST CHECK VALVE
7 PRESSURE REGULATOR
8 BY PASS VALVE
9 HAND PUMP WITH INTERGAL SELECTOR VALVE
9A PUMP HANDLE
9B VALVE CONTROL HANDLE
10 EMERGENCY EXTENSION HYDRAULIC RESERVOIR 1.4 U.S. GAL., 1.2 IMP. GAL.
11 RELIEF VALVE
12 ACCUMULATOR
13 FLAP CONTROL VALVE
14 LANDING GEAR CONTROL VALVE
15 HYDRAULIC PRESSURE GAGE
16 COOLANT RADIATOR EXIT FLAP CONTROL VALVE
17 PUMP PRESSURE GAGE

FIGURE 17—MAIN HYDRAULIC SYSTEM



2 CHECK VALVE
14 LANDING GEAR CONTROL VALVE
20 RELIEF VALVE – 250 PSI
21 DOOR ACTUATING CYLINDER
22 LANDING GEAR UP LOCK RELEASE
23 LANDING GEAR DOOR SEQUENCE VALVE (OPENED BY RETRACTED WHEEL)
24 MAIN LANDING GEAR ACTUATING CYLINDER
25 DOWN LANDING GEAR LOCK
26 EMERGENCY EXTENSION CHECK VALVE
27 NOSE DOOR LATCHING CYLINDER
28 RELIEF VALVE – 850 PSI
29 NOSE GEAR ACTUATING CYLINDER

* NOSE DOOR LATCH SYSTEM (ITEMS 27, 28 AND 2) ALL MODELS EXCEPT P38-D

FIGURE 18—LANDING GEAR HYDRAULIC SYSTEM

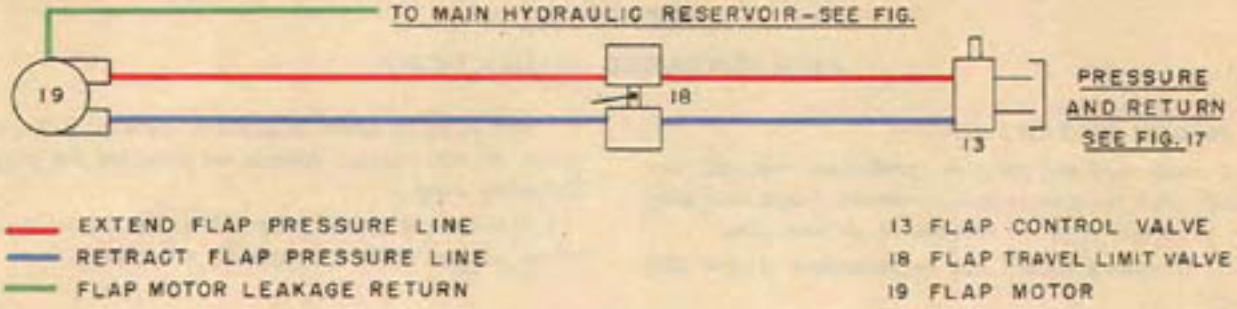


FIGURE 19—FLAP HYDRAULIC SYSTEM

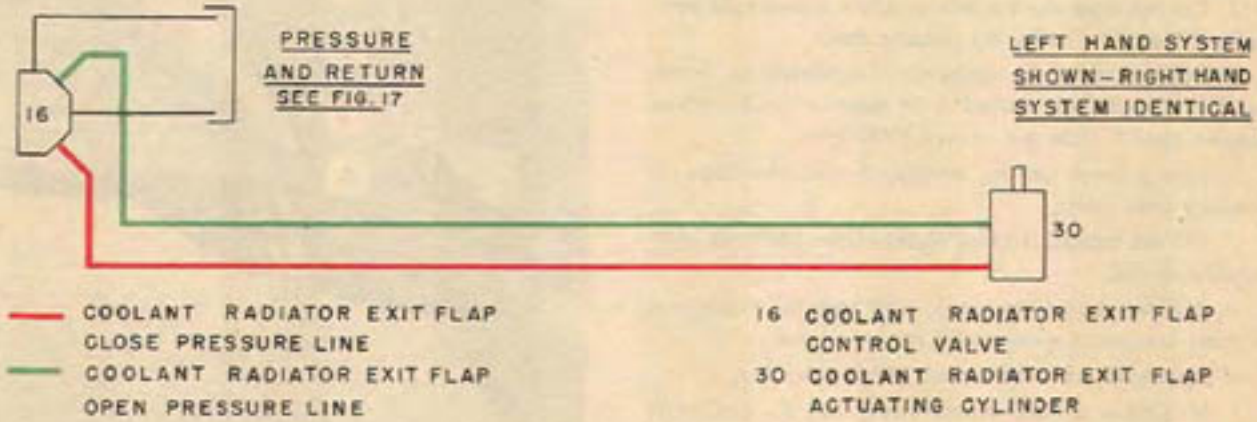


FIGURE 20—COOLANT RADIATOR EXIT FLAP HYDRAULIC SYSTEM

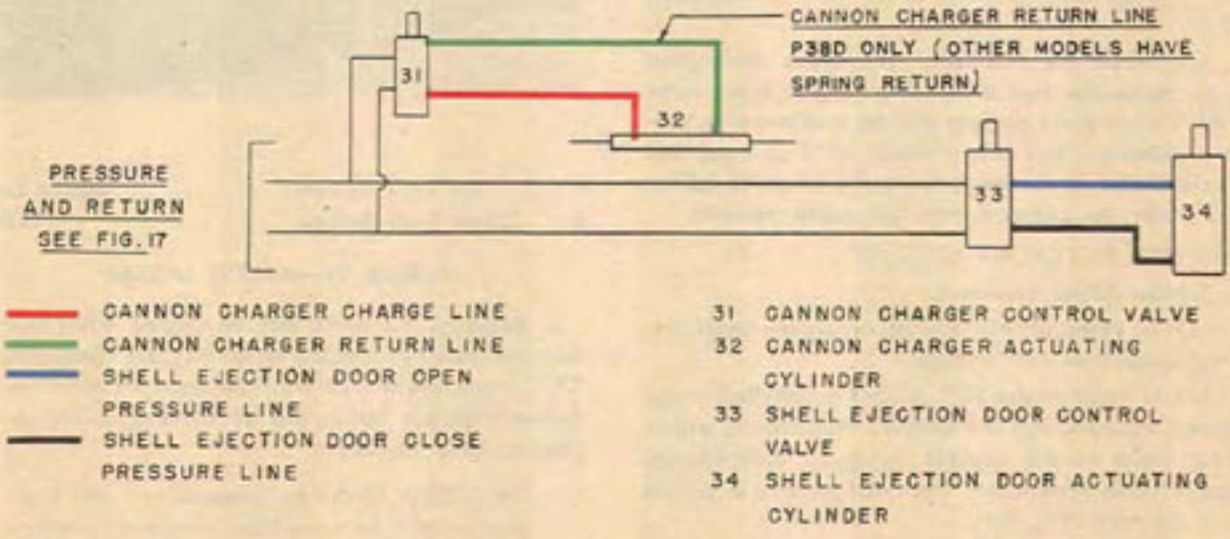


FIGURE 21—CANNON CHARGER HYDRAULIC SYSTEM

SECTION II
PILOT OPERATING INSTRUCTIONS

1. *FLIGHT RESTRICTIONS.*

a. Snap rolls and spins are prohibited with this airplane; such maneuvers as Immelmans, loops, and rolls are permitted with the exercise of extreme care.

b. Acrobatics should not be attempted at low altitudes.

c. Maneuvers involving prolonged inverted flight may cause complete loss of engine oil pressure, and are therefore restricted until such time as airplanes can be equipped with a device insuring continuous oil flow.

d. Do not close the throttle to allow a manifold pressure of less than 20 in. Hg. during dive.

e. Do not exceed the airspeeds of accelerations shown in Fig. 24; do not exceed 3.73 negative acceleration. Engine speeds must not exceed 3120 rpm.

f. Diving must not be attempted with the flaps or landing gear down.

g. Do not extend landing lights above 140 mph indicated airspeed.

h. Military maximum speed, 3000 rpm for 5 minutes; normal maximum speed, 2600 rpm; no limit.

i. Maximum oil temperature, 95°C. (203°F.).

j. Maximum coolant temperature, 125°C. (257°F.); minimum 85°C. (185°F.).

k. Manifold pressure: military maximum, 40.3 in. Hg. for 5 minutes only; normal maximum, 27 in. Hg. The military maximum is possible only with P-38D, P-38E, and F4.

l. To reduce the possibility of engines cutting-out due to insufficient fuel inlet pressures, the relief valve on all V-1710 series engines will be readjusted to provide a carburetor fuel inlet pressure of 17 ± 1 psi, and the relief valve on the boost fuel pump be set to deliver 1 psi under the engine-driven fuel pump pressure.

2. *BEFORE ENTERING COCKPIT.*

a. Obtain Flight Clearance.

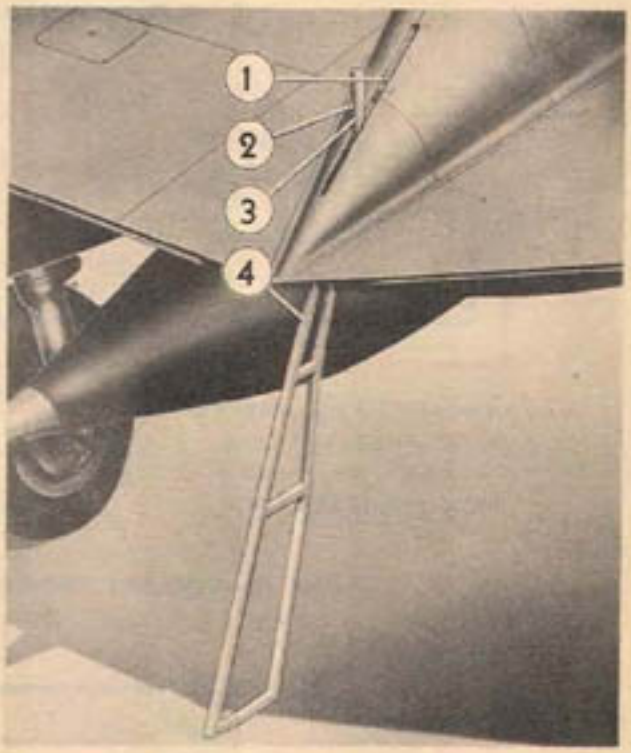
(1) In event of war operations, secure radio frequency assignment for the flight.

(2) If radio model SCR-AL-283 is installed in the airplane, ascertain that the assigned frequency is within tuning limits of the receiver "plug-in" coil. Change "plug-in" coils if necessary. The radio receiver is located aft of the pilot (Fig. 3-8).

(3) If radio model SCR-274N is installed in the airplane, be sure correct transmitter is installed and tuned for proper frequency.

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

b. Secure and check pilot safety equipment (parachute, oxygen mask, microphone, maps, etc.).



1 . . . . Up Lock Release
2 . . Down Lock Release
3 . . . . . Ladder Lever
4 . . . . . Ladder

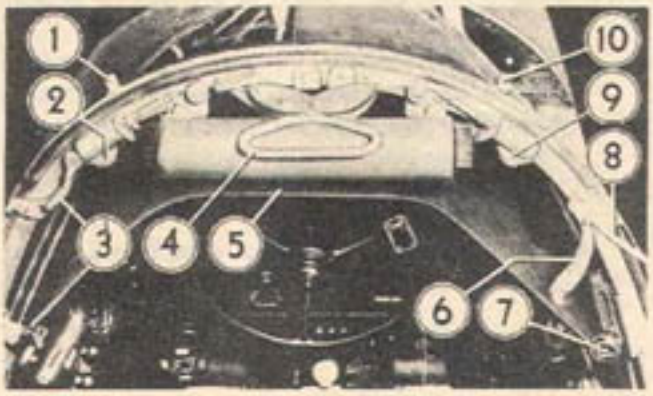
FIGURE 22—ACCESS LADDER

c. Baggage and tools may be carried when secured with the hold down straps in the baggage compartment. This compartment is in the right hand aft boom on the fighter airplanes and in the left hand aft boom on the photographic airplanes.

CAUTION: Under no circumstances will baggage or tools be carried that violate the instructions in Section III paragraph 1, as an excessively rearward center of gravity is likely to result.

d. To get on the wing, lower the folding ladder (Fig. 22-4) provided at the rear of the fuselage by pushing the ladder uplock lever (Fig. 22-1) and pulling the ladder operating handle (Fig. 22-3) to the vertical position. After climbing onto the wing stow the ladder by releasing the downlock lever (Fig. 22-2) and pushing the ladder operating handle *firmly* into the stowed position.

e. Enter the cockpit from the left by turning the handle on the top hatch allowing it to be raised and rotated about hinge pins on the right. On airplanes with serial numbers higher than 42-12767, turn the latch releases (Fig. 23-1 and 23-10) and rotate the top hatch backwards. The side panel may be lowered by turning the crank (Fig. 10-7) inside the cockpit.



1. Exterior Left Latch Handle Release
2. Left Latch Handle Release
3. Left Latch Handle—Locked Position
4. Emergency Hatch Release
5. Glare Shield
6. Right Latch Handle—Unlocked Position
7. Cockpit Heat Control
8. Open Hatch Brace
9. Right Latch Handle Release
10. Exterior Right Latch Handle Release

FIGURE 23—HATCH CONTROLS

3. *ON ENTERING THE COCKPIT.*

a. Special Check for Night Flying.

(1) Turn Battery Switch (on electrical panel) "ON".

(2) Turn airplane master switch (Fig. 5-3) "ON".

NOTE: On airplanes 43-13267 and up, airplane master switch becomes *Ignition* Master switch and need not be ON to operate the electrical equipment.

(3) Turn cockpit lights (Fig. 5-29) "ON"; in addition, a portable cockpit light (Fig. 7-1) with integral switch is provided on airplanes with serial numbers higher than 42-12567. An alternate location for this light is provided over the fuel selector valves (Fig. 7-7).

(4) Turn fluorescent instrument lights (Fig. 5-8) "ON".

(5) Test-operate compass light brilliancy by turning the rheostat control knob (Fig. 5-27).

(6) Test-operate landing light (or lights) for not over five seconds (Fig. 5-10). After the switch has been turned "ON", the lights will not glow until after the landing light mechanism has extended the lamp to its operating position. Return the switch to the "RETRACT" position and *leave it there.*

(7) Turn position lights (Fig. 5-9) "ON".

(8) Test-operate identification lights (Fig. 8-9). Airplanes with serial numbers above 42-12567 only.

b. Check for all Flights.

(1) Turn airplane master switch (Fig. 5-3) "ON".

(2) Ignition switches (Fig. 5-6) "OFF".

(3) Armament Master switch (Fig. 5-22) "OFF" and Cannon Charging Control (Fig. 5-16) "SAFE".

(4) Landing Gear Control Lever (Fig. 6-7) "DOWN".

(5) Flap Control Lever (Fig. 8-1) "CLOSED".

(6) Generator switch (Fig. 5-4) "OFF".

(7) Adjust rudder pedals (Fig. 6-20) for correct leg length by pushing the small spring loaded lever (Fig. 6-19) on the pedal and setting the pedals to the desired position. Release the lever, making sure that both pedals are adjusted equally and that full right and left movement of the rudder is available.

(8) Ascertain free movement of the flight control column and the aileron control wheel (Fig. 5-35) to the extremities of their operating range.

(9) Parking Brake (Fig. 5-17) "ON". To set parking brakes press both toe brake pedals and pull brake handle rearward.

(10) Adjust cockpit seat for correct height by first lifting the lock release handle (Fig. 11-5) on the right side of the pilot's seat and then raising or lowering the seat as desired. Lock the seat in position by releasing the locking handle, making sure that the spring loaded locking device has definitely engaged. Check adjustment of safety belt and of shoulder harness if installed. With

the shoulder harness on, it will be impossible to lean forward unless the lock release handle (Fig. 9-2) on the left side of the pilot's seat is raised. The mechanism is spring loaded so that if the locking handle is released the shoulder strap lock reengages when an upright position is resumed.

(11) Set Carburetor Air Filter lever "ON" when operating from a dusty field. This lever is located at the left, behind the pilot's seat and is installed on airplanes 42-12967 and up. On some earlier airplanes, carburetor air filters are installed which are "ON" when the landing gear is down and "OFF" when the gear is up.

(12) Test-operate gun sight light (Fig. 5-28).

(13) Check oxygen equipment as specified in Section IV, paragraph 1.

(14) Inspect cockpit generally to see that all components are in place and in good working order.

4. *STARTING ENGINES.*

a. With the airplane master switch (Fig. 5-3) "OFF" turn propeller over by hand two complete revolutions.

b. If a ground battery is being used turn "OFF" battery switch located on main switch box.

c. Turn airplane master switch (Fig. 5-3) "ON".

d. Check fuel quantity gauges (Fig. 4-15 and 4-16).

e. Set fuel tank selector valves (Fig. 9-9 and 9-10) to "RESERVE" if full.

f. Move the coolant shutter controls (Fig. 6-14) "REARWARD" to close and "FORWARD" to open. Leave in the "OFF" position unless the shutter position is being changed. "CLOSE" the shutters to hasten warm-up of cold engines and set as conditions require for warm engines.

(1) Airplanes 42-13167 and up have automatic coolant shutters which are in operation as long as the coolant override switches, located on the electrical panel, are "OFF". The automatic control is set to regulate between 101° C. (212° F.) (flaps closed) and 121° C. (250° F.) (flaps open).

(2) In the event of failure of the automatic mechanism, the shutters may be either fully opened or fully closed by operating the override switches. If hydraulic pressure fails, the flaps will assume a mid-position.

g. Move the oil shutter switches (Fig. 5-5) "UP" to close and "DOWN" to open. Leave in the "OFF" position unless shutter position is being changed. "CLOSE" the shutters to hasten the warm-up of cold engines and set as conditions require for warm engines.

(1) Airplanes 42-13067 and up have automatic oil shutters operated by switches having four positions: Automatic, Off, Open, and Close. The automatic control is set to regulate between 75° C. (167° F.) (flaps closed) and 95° C. (203° F.) (flaps open).

(2) Normally, these switches will be left in AUTOMATIC, however, the shutters may be operated manually in the event of failure of the regulator.

h. "PUSH" the propeller circuit breaker buttons to make certain the propeller circuit is closed. Turn propeller safety switches (Fig. 6-15) "ON" on airplanes not equipped with circuit breakers.

i. Set the propeller selector switches (Fig. 6-2) to "AUTOMATIC" and set the propeller governor controls (Fig. 6-3) "FORWARD" to the take-off position.

NOTE: The propeller warning lights located forward of the propeller feathering switches glow when the propeller circuit is open or when the propeller selector switches are not in "AUTOMATIC".

j. Set throttles (Fig. 6-4) to 800-1000 rpm position—approximately one-quarter inch forward of rear stop.

k. Set mixture controls (Fig. 6-13) to "IDLE CUT-OFF".

l. Flick fuel boost pumps (Fig. 9-5) "ON" and "OFF" to maintain 4 lbs. fuel pressure, then prime each engine with two strokes when warm, up to approximately four to six strokes of the dual primer (Fig. 5-19) when cold, as experience will indicate. Turn "OFF" the fuel boost pump before energizing the starter.

NOTE: Push down on primer and turn 90 degrees to operate.

WARNING: Because of the fire hazard, never use the fuel boost pump when the mixture control is out of "Idle Cut-off" unless the engine is definitely firing.

m. Turn ignition switch (Fig. 5-6) of left engine to "BOTH" position.

n. Move left hand starter switch (Fig. 5-7) to "START" position and hold until inertia flywheel sounds as though it had reached maximum rpm. Move the starter switch to the "ENGAGE" position (airplanes 42-12867 and up are equipped with separate START and ENGAGE switches). Leave the mixture control (Fig. 6-13) in "IDLE CUT-OFF" position and use the engine primer (Fig. 5-19) only, until the engine definitely fires,

at which time the mixture control should be moved immediately to the "AUTO RICH" position. The primer should be used as necessary during the time the engine is being turned over by the starter and when firing irregularly before obtaining the speed corresponding to the throttle setting. As soon as the engine starts it may be necessary to use the fuel boost pump to bring the fuel pressure to 17 ± 1 psi if the engine-driven fuel pump does not immediately furnish pressure. If the engine does not continue to run, return the mixture to "IDLE CUT-OFF," turn "OFF" the fuel boost pump, cut the ignition switch and reprime. Repeat the starting operations, taking care to prime in accordance with conditions. Stop the engine and investigate if the oil pressure (Fig. 4-23) does not register within 30 seconds after starting.

o. Start the right engine in the same manner, taking care to return the primer to the "OFF" position after the engines have been started.

5. *ENGINE WARM-UP.*

a. The engine should be idled between 500 and 800 rpm for at least 30 seconds after normal idling oil pressure is indicated on the gauge, after which the warm-up will be continued at not over 1400 rpm until the oil maintains without fluctuation not more than 75 lbs. sq. in. pressure, and the oil temperature gauge (Fig. 4-28) shows a definite increase in oil temperature.

b. Turn "ON" battery switch if ground battery was used for starting.

c. Set coolant radiator shutters and oil radiator shutters as the temperature requires. The coolant warning lights (Fig. 4-26) glow when the coolant temperature exceeds 120°C. (250°F.).

6. *EMERGENCY TAKE-OFF.*

Start engines in normal manner, then if the engine oil was properly diluted (refer to paragraph 21) when the engines were previously stopped, the oil pressure should quickly steady itself within the limits set forth on the "Specific Engine Operation Chart" in Section III. If the oil pressure is too high, or fluctuates, or falls back when the engine rpm is increased, the oil dilution system may be operated (turn switch (Fig. 5-1) "ON") to correct this condition; however, the oil pressure gauge (Fig. 4-23) should be watched carefully as over dilution and low oil pressure is likely to result under these conditions. The airplane may be flown as soon as there has been a definite rise (10°C.—20°F.) in the oil temperatures, the oil pressures are steady, and the engines are running smoothly.

7. *ENGINE AND ACCESSORIES GROUND TEST.*

a. After warm-up has been completed in accordance with paragraph 4, set the left propeller selector switch (Fig. 6-2) to "OFF" and advance throttle to obtain 2300 rpm.

(1) Test individual magnetos and spark plugs by moving left ignition switch (Fig. 5-6) to "R" and then "L." Note the loss of revolutions or manifold pressure when switched to one magneto at a time. Whenever an engine is operated on only one magneto, the manifold pressure must not exceed maximum cruising manifold pressure to avoid detonation when firing on only one set of spark plugs. It is important to switch back to "BOTH" and leave switch in that position until the engine has picked up the loss in rpm resulting from operating on one magneto before testing for rpm on the other magneto. The normal loss when operating on one magneto should not exceed 80 rpm. The difference in timing of the two magnetos results in loss of rpm or manifold pressure when operating on either magneto alone. This check should be made in as short a time as possible and should not exceed 15 seconds.

> *CAUTION:* On engines incorporating automatic boost control, it is necessary to observe the tachometer reading immediately after switching to single magneto operating before the automatic boost control has had time to compensate for the rpm drop.

(2) Check fuel and oil pressure, and oil and coolant temperatures (refer to "Specific Engine Operation Chart" in Section III for limits).

(3) Check generator operation (left engine only) with at least 1800 rpm by noting ammeter (Fig. 5-12) shows charge and voltmeter (Fig. 5-11) reads approximately 28 volts.

b. Return propeller selector switch (Fig. 6-2) to "AUTOMATIC." Pull propeller governor lever (Fig. 6-3) "REARWARD" until a reduction in rpm is observed (Fig. 4-22). Return propeller governor lever "FORWARD" to take-off position, noting that rpm again increases.

c. Open throttle to take-off power (Refer to "Specific Engine Operation Chart" in Section III) and then immediately cut down to idling speed.

> *NOTE:* This is the only possible ground check of turbo supercharger operation and is fully as important as the magneto check.

d. Repeat operation for right engine, omitting generator check.

e. Check vacuum system by turning vacuum selector valve (Fig. 11-7), if installed, to "LEFT ON," then "RIGHT ON," while noting reading on suction gauge (Fig. 4-2). Return selector valve to "BOTH ON."

f. Check hydraulic system by pulling flap control handle (Fig. 8-1) to "DOWN" position until indicator

(Fig. 4-24) shows flaps extended. Push flap control lever to "UP" position until flaps are retracted, then return lever to "CLOSED" position.

g. Refer to Section IV, paragraph 2 for complete instructions on operation of airplane's radio equipment.

h. For fighter airplanes refer to Section IV, paragraph 3 for complete instructions on operation of airplane's armament, or for photographic airplanes refer to Section IV, paragraph 4 for complete instructions on operation of airplane's cameras.

8. *TAXIING INSTRUCTIONS.*

The tricycle gear allows the airplane to roll very easily on the ground. Quick stops from high speed taxiing impose severe loads on the brakes. Steering can be accomplished easily in taxiing with power.

9. *TAKE-OFF.*

NOTE: To prevent possible siphoning from the reserve tank, take-off and flight will be made on reserve tank, until at least fifteen gallons are used, before switching to the main tanks.

a. Flaps Up. If a short take-off run is necessary, extend flaps ½ down by pulling flap control handle (Fig. 8-1) to the "DOWN" position until the indicator (Fig. 4-24) shows flaps down ½, then return flap control handle to "CLOSED" position. Flaps will remain in position until flap control handle is moved. Airplanes with serial numbers higher than 42-12667 and 43-2064 are equipped with maneuvering flaps (Reference paragraph 11) which are ½ down when the flap control lever is set to the "MANEUV" position. On these airplanes it is not necessary to return the flap control lever to the "CLOSED" position to keep the flaps ½ down.

WARNING: When using maneuvering flaps, leave the flap control lever at MANEUVERS. If the lever is moved even slightly forward and then returned to "MANEUVERS," the flaps will extend completely.

b. "OPEN" coolant radiator shutters (Fig. 6-14) and oil radiator shutters (Fig. 5-5).

c. Set rudder trim tabs (Fig. 5-20), elevator trim tab (Fig. 6-18), and aileron trim tabs (Fig. 5-34) to the "O" position.

d. If icing conditions exist turn pilot tube heater switch (Fig. 5-15) "ON."

e. The top hatch should be locked in place and the two side panels should be cranked (Fig. 10-7 and 11-2) "CLOSED" with the ratchet (Fig. 10-3 and 11-2) "ON" for take-off and all normal flight operations.

f. Turn selector switches (Fig. 7-10) "ON" if droppable fuel tanks or bombs are installed so that they may be dropped quickly in case of engine failure on take-off. Turn arming switch (Fig. 7-3) to "SAFE" if bombs are installed.

g. Refer to Take-off, Climb, and Landing Chart in Section III for take-off distance to be expected.

h. Set engine controls in accordance with "TAKE-OFF" settings listed in the "Specific Engine Flight Chart" in Section III.

i. Due to lag in the turbo supercharger boost, maximum performance take-offs require holding the airplane with brakes until engine power reaches the desired settings. During take-offs there is no operation of the controls necessary other than to keep the airplane straight until the take-off speed is reached. The exact speed depends upon the flap setting, the power used for take-off, and the gross weight of the airplane, and varies between approximately 90 mph for the normally loaded airplane to approximately 110 mph for the airplane with fully loaded 300 gallon droppable tanks.

j. Retract the landing gear as soon as practical after breaking ground by raising the landing gear lever (Fig. 6-7) to the "UP" position. An emergency release (Fig. 6-10) is provided to permit movement of the lever from the down position in the event that the safety device actuated by extension of the landing gear shock strut fails to function. This device prevents movement of the lever from the down position while the struts are compressed. Operate the release by turning in a counterclockwise direction with the left thumb. If the gear does not retract with the landing gear lever in the "UP" position, it is possible to retract the gear by operating the hand hydraulic pump (Fig. 11-6); however, it will take approximately 5 to 10 minutes to manually retract the gear and it is recommended that the airplane be landed and the difficulty corrected.

k. Retract the flaps by placing the flap control lever (Fig. 8-1) in the "UP" position. If the flaps fail to retract, operate the hand hydraulic pump (Fig. 11-6) if necessary to continue flight, otherwise land and investigate. When the flap indicator (Fig. 4-24) shows the flaps retracted return the flap control lever to the

"CLOSED" position. With flaps ½ down do not exceed 250 mph in airplanes equipped with maneuvering flaps, or 150 mph in other airplanes.

10. *ENGINE FAILURE DURING TAKE-OFF.*

a. Failure of one engine before take-off. If one engine fails while still on the ground, close both throttles immediately and apply the brakes. If it is impossible to stop within the airport boundary it may be desirable, if droppable tanks or bombs are not installed, to pull the landing gear lever (Fig. 6-7) to the "UP" position, causing the gear to collapse. With the airplane on the ground it will be necessary to rotate the emergency landing gear lever release (Fig. 6-10) counter-clockwise with the left thumb before the lever can be raised.

b. Failure of one engine immediately after take-off but before a safe speed has been reached. If one engine fails before a safe speed has been reached, close both throttles and land with the landing gear lever in the "UP" position so that the gear will collapse on landing, *unless* there is ample room ahead. Release the droppable fuel tanks or bombs, if installed, by pressing the release button (Fig. 7-11) on the F-5A and fighter airplanes, or by operating the droppable fuel tank release switches (Fig. 10-1) located on both sides of the cockpit on the F-4 and F-4A airplanes.

c. Failure of one engine after take-off when a safe speed has been reached.

(1) Immediate actions:

(a) Throttle the live engine, lead with rudder control, then apply necessary power.

CAUTION: Do not use full power on live engine under 120 mph. Apply corrective rudder action promptly so as to positively prevent the airplane from yawing excessively (skidding). Excessive yaw will result in stalling of the vertical tails, the rudder forces will reverse and it will be necessary to materially reduce the power of the operating engine and apply considerable rudder force to regain control. This situation can be prevented by keeping the airplane flying straight by means of prompt rudder action and necessary throttling of live engine.

(b) Pull the landing gear lever (Fig. 6-7) to the "UP" position.

(c) Release the droppable fuel tanks or bombs (see paragraph 9, *b* above).

Use some will power — Throttle the live engine until you straighten her out.

(d) Feather the propeller of the dead engine by pushing (forward) the applicable feathering switch (Fig. 6-1). Perform this operation deliberately so that the propeller of the live engine will not be feathered. There is one axiom concerning flight of *all* twin engine airplanes on one engine, that must be rigidly observed. *NEVER FLY ON ONE ENGINE WITH THE OTHER PROPELLER WINDMILLING IN LOW PITCH,* i.e. with the throttle closed and the propeller control in any position but full rearward. The reason for this is that a propeller windmilling at a speed in excess of 1000 rpm (Engine speed) causes so much drag on one side of the airplane that *rudder control is seriously affected* and *climbing performance materially reduced.* If circumstances do not permit feathering the propeller on the inoperative engine, at least *place the propeller control in the full high pitch position, "REARWARD"* as soon as the throttle is closed.

FEATHER THE WINDMILLING PROPELLER

(e) Gain as much speed as possible in level flight before attempting to climb.

(2) Subsequent actions:

(a) Push flap control lever (Fig. 8-1) "FORWARD" to retract flaps. When retracted pull lever back to "CLOSED".

(b) Trim the airplane, using rudder trim tab to off-set the single engine yawing effect.

(c) Reduce power of live engine to normal rated power as soon as practicable. (Reference "Specific Engine Flight Chart," Section III.) The airplane climbs well on one engine operating at normal power if the flaps and landing gear are retracted. The best speed for single engine climb is approximately 140 mph.

(d) Watch coolant temperature of live engine and adjust coolant shutters (Fig. 6-14) accordingly. *"CLOSE" coolant shutters of the dead engine.*

(e) Watch oil temperature of live engine and adjust oil shutter (Fig. 5-5) accordingly. *"CLOSE" oil shutter of the dead engine.*

(f) Turn "OFF" fuel tank selector valve (Fig. 9-9 or 9-10), fuel boost pump (Fig. 9-5), and ignition switch (Fig. 5-6) of dead engine.

(g) Climb to a safe height (1000 feet or more), then circle the airport and land (Reference paragraph 21.*j.* for landing instructions).

NOTE

Turns can be made safely in either direction as long as airspeed is held constant above critical single engine speed, and airplane is properly trimmed.

11. *CLIMB.*

a. Refer to the applicable "Take-off, Climb & Landing Chart" in Section III for the rpm, manifold pressures and best indicated airspeeds to be used during climb.

b. Set mixture controls (Fig. 6-13) to "AUTOMATIC RICH" at all times during climb.

c. Set coolant shutter controls (Fig. 6-14) and oil shutter controls (Fig. 5-5) so that the coolant and oil temperatures will not exceed the limits specified on the applicable "Specific Engine Flight Chart." The coolant warning lights (Fig. 4-26) glow when the coolant temperature exceeds 120° C. (250° F.).

12. *FLIGHT OPERATIONS.*

a. Plan all flight cruising conditions from the applicable "Flight Operation Instruction Chart" in Section III. Charts are provided for the operation of the airplane with 300 gallon, 150 gallon or droppable tank supports only installed. For operation of the airplane with 75 gallon tanks or 1100# or smaller bombs use the charts for the airplane with 150 gallon tanks installed. For operation of the clean airplane use the charts for the airplane with droppable tank supports only installed.

(1) Instructions for using the "Flight Operation Instruction Chart" are printed on top of each chart. Determine the correct chart to use by noting the type of droppable tanks or bombs suspended below the wing. Refer to Figs. 13, 14 or 15 for diagrams of the fuel system and fuel tank capacities, and Fig. 16 for diagram of the oil system and oil tank capacities.

(2) The indicated airspeed values shown on the "Flight Operation Instruction Charts" will give correct airplane airspeed indicator readings only when the pitot mast is located beneath the left outer wing panel. On airplanes with pitot mast located beneath the nose of the fuselage it will be necessary to correct the values shown on the "Flight Operation Instruction Charts" for pitot location error by referring to the table in paragraph 23. For example, if the instruction chart gives an indicated airspeed of 275 mph, on airplanes with nose pitot location the airplane airspeed should be set to read 264 mph. (See paragraph 23.)

(3) Example of the use of "Flight Operation Instruction Charts."

(a) Example: Find the correct rpm and ias (Indicated air speed) which should be used to fly 1150 miles at 15000 feet with a P-38E airplane equipped with a pitot mast under the nose, 150 gallon droppable tanks, and 550 gallons of gasoline.

(b) Solution:

1. Turn to the "Flight Operation Instruction Chart" for P-38E airplanes with 150 gallon droppable tanks.

2. Allowing 43 gallons for take-off and climb, and assuming for this flight 75 gallons reserve fuel, there are 432 gallons available for cruising.

3. Opposite next lower fuel quantity shown (420 gallons) locate air-miles (no wind) just beyond desired range (1180 statute air-miles).

4. Vertically below in cruising condition III and opposite desired cruising altitude (15000 feet) read optimum cruising rpm (2200 rpm) and indicated airspeed (215 mph). Note that light printing is used, hence the mixture should be set to AUTO LEAN.

5. Since the ias values shown on the chart are correct only when the pitot mast is located on the wing,

it will be necessary to correct the ias value given (215 mph) by reference to paragraph 23 *b*. By estimation between 200 and 225, this chart shows that 210 mph should be used.

b. Trim airplane for level flight.

(1) Rotate rudder tab control (Fig. 5-20) "CLOCKWISE" to turn nose of airplane to the RIGHT.

(2) Rotate elevator tab control (Fig. 6-18) "CLOCKWISE" to put nose DOWN.

(3) Rotate aileron tab control (Fig. 5-34) "CLOCKWISE" to put right wing DOWN.

c. To increase power during flight set the mixture controls to "AUTO RICH", adjust propellers to desired rpm, adjust the throttles to obtain the desired manifold pressure, and then readjust the mixture controls if necessary.

> *NOTE:* The throttle levers are inter-connected to the supercharger regulator, thereby eliminating supercharger regulator controls and their operation as a separate function by the pilot. The operation of the throttle is essentially the same as that for engines without turbine superchargers, except that throttle movement is relatively small for a given change in power compared to conventional airplanes. When operating in the range controlled through the supercharger regulator (approximately the last third of the throttle movement), the control is definitely sluggish and care must be exercised to avoid over-running the desired power setting. This is particularly true when power is applied suddenly, such as take-off and acrobatics.

d. To decrease power during flight, adjust the throttles to obtain the desired manifold pressure, adjust the propeller controls to obtain the desired rpm, readjust the throttles, if necessary, and then adjust the mixture controls, if necessary.

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

e. Operation of Propeller Controls.

(1) To change propeller rpm with selector switches (Fig. 6-2), set to "AUTOMATIC", adjust propeller governor control lever (Fig. 6-3) to obtain desired rpm. If the propeller circuit breakers, or safety switches (Fig. 6-15) throw out and will not remain in the "ON" position, the selector switches (Fig. 6-2) should be set to "OFF". When absolutely necessary it may be possible to change pitch by holding the circuit breaker button or safety switch "ON" while operating the inc-rpm, dec-rpm switch (Fig. 6-2). Refer to paragraph 20, *c* (1) for landing instructions with propeller in fixed pitch.

(2) To change propeller rpm manually, operate "inc-rpm, or dec-rpm" switch (Fig. 6-2) as required.

(3) Synchronize propeller by ear using the tachometers and the propeller vernier (Fig. 6-6) which allows fine adjustment of the right governor lever (Fig. 6-3).

(4) To feather propeller push applicable feathering switch (Fig. 6-1) to "FEATHER". To unfeather propeller and start engine, pull applicable feathering switch to "NORMAL" position and hold selector switch (Fig. 6-2) in "INC-RPM" position until tachometer shows at least 800 rpm with throttle cracked and mixture control "IDLE CUT-OFF". Turn fuel selector valve to tank containing fuel and turn "ON" fuel boost pump if fuel pressure doesn't come up. Turn ignition switch "ON", move mixture control to AUTO RICH and engine should start.

f. Operate engines from RESERVE tank for first 15 minutes of flight to allow room for the carburetor bleed back of approximately two quarts per hour. Then, if droppable tanks are installed, turn fuel selector valves (Fig. 9-9 and 9-10) to "DROP ON". As these tanks are not equipped with fuel gauges, their operating duration may be determined by dividing the cruising power gasoline consumption into the tank capacity. Gasoline consumption in U. S. gallons per hour are listed opposite each engine setting on the "Flight Operation Instruction Chart." (Refer to Fig. 15 for fuel tank capacities.)

g. To release droppable fuel tanks, (Flaps and Gear UP).

(1) Turn selector valves (Fig. 9-9 and 9-10) to either main or reserve tanks.

(2) Arming switch (Fig. 7-3) "ARM" or "SAFE".

(3) Raise the selector switches (Fig. 7-10) and press the release button (Fig. 7-11) on F-5A and fighter airplanes, or on F-4 and F-4A airplanes raise the switch guards and trip the toggle switches (Fig. 10-1) located on each side of the cockpit.

(4) Full tanks may be dropped at any indicated airspeed not exceeding 400 mph. Empty 75 or 150 gallon tanks must be dropped below 160 mph indicated airspeed with gear and flaps up.

WARNING: Empty 300 gallon tanks are to be dropped *only in an emergency*. The tanks may hit the airplane when dropped, consequently the airplane *must* be slowed down to 120 mph with gear and flaps up to avoid serious damage.

b. The fuel boost pumps (Fig. 9-5) should be turned "OFF" after take-off, and turned "ON" at altitude if the fuel pressure falls below 15 lbs. sq. in. or if the engine fuel pump fails. The fuel pressure warning lights (Fig. 4-13) glow when the fuel pressure falls below 12 lbs. sq. in.

i. Refer to Section IV for complete information and instructions on operating the airplane oxygen, radio, armament, and photographic equipment.

j. Carburetor heat. Carburetor air preheat is provided automatically by the turbo superchargers. It is possible, however, to encounter carburetor icing during extremely cold weather at low altitude when operating at low power. In such case, the power should be increased boldly and the airplane put into a rather steep climb. If descending for landing, put gear down, flaps ½ down and increase power. Both actions will increase the temperature of the carburetor air and clear away the carburetor ice. Carburetor air temperature (Fig. 4-30) which is measured ahead of the carburetor, should be kept below 50° C. (120° F.).

k. Oil temperature. Operate oil radiator shutter switches (Fig. 5-5) to keep shutters as nearly closed as possible while maintaining the oil temperature within the proper operating limits (See "Specific Engine Control Chart," Section III). During cold weather, or at altitude in warm weather, the oil can be easily overcooled with resultant congealing in the radiator cores. When congealing occurs, the oil temperature will increase and opening the shutters will not check the increase. When the temperature increases under congealing conditions (i.e. operation at cruising power when the air temperature is low), the shutters should be closed completely for a period of a few minutes. This will uncongeal the oil and re-establish normal flow through the radiators with the result that the oil temperature will decrease. As soon as a decrease in oil temperature is noticed, the shutters should be cracked open just enough to hold the temperature down around 80° C. (176° F.). At low power it will be necessary to keep the shutters closed longer than at high power. If the foregoing procedure does not result in the resumption of normal oil temperature, the engine should be throttled back and the procedure repeated while losing altitude. The oil pressure should be watched closely and the rpm and power reduced if it drops.

l. Maneuvering flaps. Airplanes with serial numbers higher than 42-12667 and 43-2064 are equipped with maneuvering flaps which may be used to increase the maneuverability of the airplane at speeds below 250 mph. To extend the flaps to the maneuvering position, pull the flap lever back to the stop at the "MANEUV" position. The flaps will then extend 50% to the maneuvering position and stop. Retract flaps in normal manner.

m. If inverter warning light (Fig. 5-13) goes on, turn inverter switch (Fig. 5-14) to other position. Airplanes later than 42-12567 have only one inverter with an on-off switch (Fig. 8-3).

WARNING: WHEN INVERTER WARNING LIGHT IS ON, TACHOMETER, AND PRESSURE AND TEMPERATURE INSTRUMENTS WITH CONCENTRIC POINTERS (DUAL AUTOSYN INSTRUMENTS) ARE NOT OPERATING AND THE POINTERS *DO NOT* RETURN TO ZERO.

n. The cockpit ventilator (Fig. 9-7) directs fresh air from the wing fuselage fillet to the cockpit and should be adjusted to suit conditions. An air vent, adjustable on the ground only, is provided aft of the radio (Fig. 3-8) on the left side. The cockpit heater control (Fig. 23-7) directs heated air from an intensifier tube in the exhaust system to the cockpit and inner surface of the windshield. On airplanes with serial numbers below 42-12569 the cockpit heater control is located on the floor in the right rear of the cockpit.

13. *GENERAL FLYING CHARACTERISTICS.*

a. This airplane is very stable laterally and directionally, and stable at all operating speeds longitudinally. Above placard speeds (see Fig. 24 for copy of placard) extreme nose heaviness may be encountered.

b. The trimming characteristics are normal for a twin-engined airplane. Rudder tabs (Fig. 5-20) should be neutral when the engines are supplying equal power. Aileron tabs (Fig. 5-34) normally require setting at the start of the flight only. Elevator tabs (Fig. 6-18) normally require only slight adjustments with variations in gross weight and speed.

14. *ENGINE FAILURE DURING FLIGHT.*

a. For single engine operation the pilot should be familiar with the variation in control characteristics of high performance twin-engine airplanes. Do not maneuver through large speed variations. Do not use full power on the live engine under 120 mph. When one

engine fails during climb, cruise, or descent, there is seldom need for emergency maximum power from the live engine.

b. Set the mixture control (Fig. 6-13) to "AUTO RICH", the propeller governor control (Fig. 6-3) to give 2600 rpm, and adjust the throttle to give a manifold pressure corresponding to "Maximum Continuous" on the "Specific Engine Flight Chart" in Section III.

c. Feather the propeller on the dead engine by pushing the feathering switch (Fig. 6-1) to "FEATHER", put mixture control (Fig. 6-13) in "IDLE CUT-OFF", turn fuel boost pump (Fig. 9-5) "OFF" and turn ignition switch (Fig. 5-6) "OFF".

d. Adjust oil shutters (Fig. 5-5) and coolant shutters (Fig. 6-14) of live engine to maintain desired temperatures and close oil and coolant shutters of dead engine.

e. Retract the flaps if extended.

f. Adjust trim tabs to give light stick forces.

Don't throw away fuel unless you're sure you won't need it.

g. Refer to the "Flight Operation Instruction Chart" for single engine operation in Section III, to determine rpm and IAS for range desired. If droppable tanks are installed and the maximum range shown on the instruction chart is not enough, retain the droppable tanks until empty before releasing them. Under these conditions draw fuel from the droppable tank on the *live engine side first*, and then from the droppable tank on the dead engine side. Release each tank as soon as it is empty. For maximum range operation with droppable tanks installed fly the airplane as low as safety permits and at the lowest power which will maintain an indicated airspeed of approximately 160 mph.

h. Turn fuel tank selector valve (Fig. 9-9 or 9-10) of dead engine to "OFF" except when operating cross suction, then proceed as follows:

(1) Airplanes equipped with provisions for droppable tanks.

(a) Set tank selector valve to tank which is to supply fuel.

(b) Turn cross suction switch (Fig. 9-4 or 10-2) "ON".

(c) Turn other tank selector valve to "OFF".

(2) Airplanes not equipped with provisions for droppable tanks.

(a) Set tank selector valve to tank which is to supply fuel.

(b) Set other tank selector valve to "CROSS SUCTION".

i. If the left engine has failed, the generator will not operate. To conserve the battery, operate the propeller in fixed pitch (propeller selector switch, Fig. 6-2, "OFF") and minimize operation of radio, lights and fuel boost pump. Turn generator switch (Fig. 5-4) "OFF".

15. *STALLS.*

a. The airplane stalls at the following indicated airspeeds at the following gross weights:

	15000#	17000#	19000#
Flaps and landing gear up.....	94	100	105
Flaps and landing gear down..	69	74	78

b. In either power on or power off stalls with flaps and landing gear up the airplane "mushes" considerably, but has a well controlled stall. With flaps and landing gear down there appears to be a slight tendency for a wing to drop; however, there is no tending to spin. Under this condition the nose also drops slightly, the speed increases, and the wing will come up. As stalling speed is approached, the center section stalls first with noticeable shaking of the airplane while the ailerons are still unstalled and effective.

c. The stall should be practiced in order that the pilot may know the feel of the controls near the stall, and the indicated stalling speed of the airplane.

16. *SPINS.*

Deliberate spinning is prohibited; however, if a spin occurs, rapid recover is made as follows: Neutral rudder, move the control column rapidly forward and hold until rotation stops. After two or three turns, the spin tends to flatten out and the controls reverse. Under these conditions engine power MUST be used to assist recovery, as it will be impossible to push the control column forward until power is applied.

17. *ACROBATICS.*

Although such maneuvers as loops, Immelmanns and rolls are permitted, the pilot is cautioned to exercise extreme care in acrobatic maneuvers of this airplane because of its ability to gain and lose altitude very rapidly. In general, acrobatics should not be attempted at low altitudes. Acrobatics should be started at not less than 10,000 feet until the pilot is thoroughly familiar with the airplane.

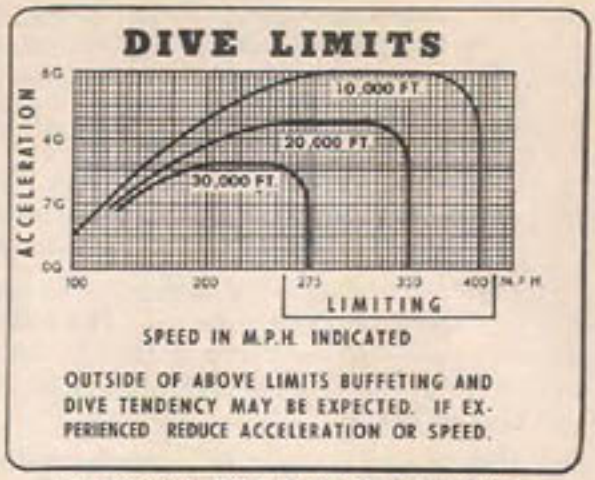
18. *DIVING.*

a. Do not exceed the speeds and accelerations shown on the placard, (Fig. 24). The airplane, if operated at combinations of acceleration and airspeed in excess of those contained on the placard, will be subject to severe buffeting and nose heaviness. The placard indicates the limits for three altitudes, 10,000 feet, 20,000 feet and 30,000 feet. To illustrate the use of the placard consider the following specific cases. At 30,000 feet if a pullout of over 3.3 g. is made at 225 mph indicated airspeed, buffeting will occur. To stop the buffeting reduce the acceleration slightly. However if a very steep dive is made in which an airspeed of approximately 300 mph is reached at 30,000 feet, the airplane will start to buffet and get extremely nose heavy simultaneously. If this occurs throttle the engines, and if the elevator force required to bring the nose up is excessive, use the elevator trim tab to assist. However, as soon as the speed or altitude has reduced; the buffeting will cease, the airplane will be tail heavy and it will be necessary to retrim with the elevator tab. Similarly if an acceleration of 4.5 g at 300 mph indicated airspeed is exceeded at 20,000 feet, buffeting will occur. This can be stopped by letting up on the stick and reducing acceleration. However, if an airspeed of approximately 385 mph is reached at 20,000 feet, the airplane will get nose heavy and buffet simultaneously, in which case it will be necessary to close the throttles and pull out of the dive, possibly using elevator tab to assist.

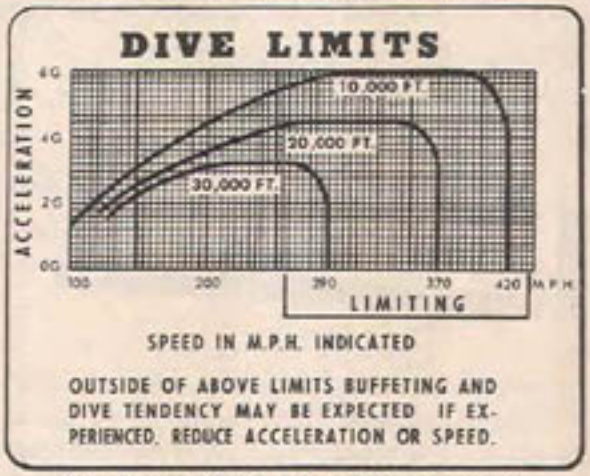
Observe the following rules:

(1) If buffeting occurs during accelerated maneuvers, i.e. dive pullouts or steep turns, it can be stopped by reducing the acceleration.

(2) If buffeting occurs due to excessively high speed in a steady dive, reduce airplane speed applying minimum acceleration as any acceleration will increase the buffeting. Closing the throttles is the first thing to do. Use elevator tab, if necessary, to assist recovery.



(Applicable With Nose Pitot Location)



(Applicable With Wing Pitot Location)

FIGURE 24—DIVE LIMIT PLACARD

NOTE: To decrease the possibility of the engines malfunctioning and missing considerably, upon opening of the throttle, after the pull out from POWER OFF DIVES the following precautions will be rigidly observed:

"DO NOT CLOSE THE THROTTLE TO ALLOW A MANIFOLD PRESSURE OF LESS THAN 20 INCH HG DURING DIVE."

(3) Chances of exceeding placard speeds are minimized by diving at low engine power.

b. Engine speeds must not exceed 3120 rpm.

c. Diving must not be attempted with the flaps or landing gear down.

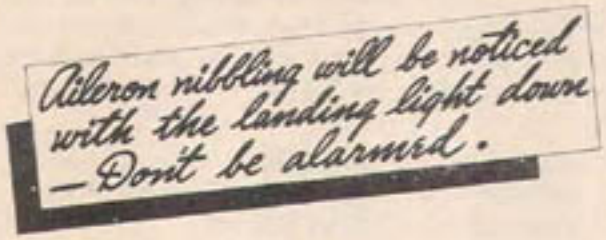
d. Trimming for dive.

Use the elevator tab to obtain comfortable control forces. At speeds within the placard, normal control forces exist.

19. *NIGHT FLYING.*

a. Refer to paragraph 2 *a* for instructions for turning on lights.

b. On airplanes later than 42-13067 and 43-2335 the landing lights (Fig. 5-10) may be turned "OFF" with the light extended. NEVER FLY ABOVE 150 MPH *UNLESS* THE LANDING LIGHT SWITCH IS IN THE "RETRACT" POSITION.



c. To operate identification lights if installed, turn the selector switch (Fig. 8-9) for the desired light to "STEADY", or to "KEY" and press the keying switch button (Fig. 8-7).

20. *EMERGENCY EXIT.*

In case of emergency, pull the emergency release handle (Fig. 11-1 or 23-4) or on P-38D airplanes rotate the RED handle on right side of the top hatch. This will disengage the pins securing the top hatch, allowing it to be carried away. Release the ratchet mechanism (Fig. 10-3 and 11-2) and push down the side windows, leaving the complete cockpit section open for egress.

21. *APPROACH, LANDING AND CROSS WIND LANDING.*

a. Turn the fuel boost pumps (Fig. 9-5) "ON".

b. Set mixture controls (Fig. 6-13) to "AUTO RICH".

c. Set propeller circuit breaker or propeller safety switches (Fig. 6-15) "ON". Set propeller selector switches (Fig. 6-2) to "AUTOMATIC". Set propeller governor levers (Fig. 6-3) to 2600 rpm position.

(1) If necessary to land with propellers in fixed pitch, set the propellers as follows. While flying not over 5000 feet above airport, operate inc-dec rpm switches (Fig. 6-2) and throttles to obtain 2600 rpm and a manifold pressure of 22 inches while flying at 180 mph. It will then be possible to apply take-off power without overspeeding the engine in case of a mislanding.

d. Adjust coolant radiator shutters (Fig. 6-14) and oil radiator shutters (Fig. 5-5) to prevent over cooling of the engine during approach.

e. Although the carburetors are inherently non-icing, it is possible for enough ice to accumulate on the throttles to cause them to stick. This is likely to occur in glides with the throttles almost closed when icing conditions exist. As a prevention, accelerate the engines at frequent intervals so that the throttles do not stay in one position long enough to accumulate ice.

f. Lower the landing gear when the indicated airspeed is at or below 175 mph by moving the landing gear control lever (Fig. 6-7) "DOWN". Watch the landing gear indicator (Fig. 4-24) and note that the warning horn does not blow and the landing gear warning light (Fig. 6-11) does not glow when the throttle is closed and the gear is down and locked. Check nose gear down by looking at mirror on inboard side of nacelles. Check hydraulic pressure at 1200—1400 psi.

(1) EMERGENCY OPERATION OF LANDING GEAR. There are two individual systems provided for extending the landing gear in case of emergency.

(a) Auxiliary System: With the landing gear control lever (Fig. 6-7) in the "DOWN" position operate the hand hydraulic pump (Fig. 11-6) until the gear is extended. This system uses the normal hydraulic lines and derives its hydraulic fluid from a reserve supply carried in the main hydraulic reservoir. (See Fig. 17.)

NOTE: If main hydraulic system fails, pump flaps ½ down before using auxiliary system to lower the landing gear (see Paragraph 20, *g* below).

(b) Emergency System: After having tried both systems described above, "CLOSE" the by-pass valve (Fig. 11-8) by turning it "CLOCKWISE", place the oil source selector valve lever (Fig. 11-9) in the "DOWN" position, and operate the hand pump until all three landing wheels are fully extended and locked. The emergency system is completely independent of the normal hydraulic system, having a separate oil tank and separate lines to the cylinders. The oil source selector valve lever (Fig. 11-9) is safetied in the "UP" position and directs oil to the hand pump from either the reserve supply in the main hydraulic tank or the emergency hydraulic tank. During normal operation some oil leaks from the main system into the emergency system. The by-pass valve (Fig. 11-8) allows this oil to flow back to the main hydraulic tank. This valve is safetied in the open position for normal operation. Refer to Fig. 18 for landing gear hydraulic diagram.

NOTE: The emergency extension system opens the landing gear doors by forcing them with the wheels; therefore after landing, the ground crew should be reminded to inspect the doors for damage and to service the emergency extension system.

CAUTION: Do not attempt to retract the landing gear by means of the emergency extension system.

g. Lower the flaps completely when the indicated airspeed is at or below 150 mph by moving the flap control lever (Fig. 8-1) to the "DOWN" position. Return the flap control lever to "CLOSED" when the flap indicator (Fig. 4-24) shows the flaps fully extended. On airplanes equipped with maneuvering flaps it will be necessary to move the flap control lever slightly forward of the "CLOSED" position and raise the trigger (Fig. 8-2) before the lever can be pulled back to the "DOWN" position.

(1) EMERGENCY OPERATION OF FLAPS: Extend the flaps ½ down by placing the flap control lever in the "DOWN" position and operating the hand hydraulic pump (Fig. 10-6). Lower the landing gear (see paragraph 20, *f*), then lower the flaps completely. If the landing gear emergency extension system [Reference paragraph 20, *f* (1) (b)] was used, raised the oil source selector valve lever (Fig. 10-9) to the "UP" position and *leave the by-pass valve (Fig. 10-8) in the "CLOSED" position.* This will maintain pressure on the landing gear cylinders, insuring that the landing gear down locks remain properly engaged.

h. Normal and power-on landings.

The normal approach is made at about 100-105 mph with 10 inches manifold pressure. Cut the throttle over the edge of the runway, flare the glide normally and make contact at about 75 mph. For the extremely short landing, use 15 inches manifold pressure and reduce approach speed to approximately 85-90 mph. Flare the glide, then close the throttle just as the airplane makes contact with the ground. After landing, hold the control column back for the first part of the landing roll. The brakes may be applied immediately, however, full braking will cause severe wear on the main wheel tires. Unless absolutely necessary, it is recommended that only moderate braking be used in the first part of the landing run. Extreme tail low landings with the flaps up may result in the fins striking the runway.

i. Cross wind landing.

Owing to the high landing speed and tricycle landing gear, this airplane may be safely landed in a cross wind. If the drift appears to be substantial, the effect of it may be reduced by banking to the windward side *until just before landing.*

j. Single engine landing.

When in good position for a *normal* approach and landing, lower the landing gear, then extend the flaps about twenty-five percent. Set rudder tabs to "O". Use the power of the live engine and the rest of the flap travel to regulate the gliding angle. Concentrate on the angle of glide, because, once committed to landing, it is impossible to go around again with both landing gear and flaps down. Glide straight into the airport, lower the flaps completely when sure of proper approach, flare the glide, close the throttle and land. *Remember, single engine approach requires but little power.*

k. After landing set propellet governor levers (Fig. 6-3) to take-off position, adjust coolant shutters and oil shutters as necessary, retract flaps, and taxi to the line in accordance with paragraph 7.

l. Emergency take-off if landing is not completed.

(1) Open the throttles to take-off manifold pressure, (see "Specific Engine Flight Chart" in Section III), and after propeller rpm has stabilized, increase rpm to 2800 by adjusting the propeller governor controls (Fig. 6-3).

CAUTION: Pull the airplane up in a climb sufficient to stay below 150 mph indicated air speed until the flaps are retracted.

(2) Retract the flaps and proceed in take-off technique as outlined in paragraph 8.

22. *STOPPING OF ENGINES.*

a. Apply toe brakes (Fig. 6-20) and pull parking brake handle (Fig. 5-17).

NOTE: Do not set the parking brake while the brake drums are hot.

b. Turn fuel boost pumps (Fig. 9-5) "OFF."

c. Idle the engine at 600-800 rpm until the oil and coolant temperatures are appreciably below cruising temperature. (Refer to "Specific Engine Flight Chart" in Section III.) Normally these temperatures will be obtained during the glide for landing and taxiing.

d. Oil Dilution Procedure.

(1) GENERAL.—Before stopping the engine when a cold-weather start is anticipated, set the throttle to between 800 to 1200 rpm and hold the oil dilution control in the "ON" position for a period of time, as follows:

Dilution Time in Minutes		
4.0° to -12°C (40° to 10°F)	-12° to -29°C (10° to -20°F)	-29° to -46°C (-20° to -50°F)
4 min	8 min	(See Note)

NOTE: A dilution period beyond 8 minutes, to provide the required dilution for extreme low temperatures, is excessive for this airplane. External heat is required in addition to the maximum permissible dilution. More dilution can be obtained by increasing the time period, but by doing so, excessive amounts of gasoline are added to the oil system which raises the oil temperature above 50°C (122°F), and also reduces the oil capacity.

The dilution of the engine while the oil temperatures are above 50°C (122°F) is not particularly effective. If oil dilution is to be accomplished and engine

oil temperatures are too high, stop the engine and after the oil has cooled to below 40°C (104°F), restart the engine and proceed with oil dilution. In some instances, particularly during sub-zero temperature where a long dilution period is required, the engine oil temperature may rise above the maximum desired values for oil dilution, 50°C (122°F). If this occurs, it may be necessary to dilute the oil in two or more short periods. Breaking up the oil dilution period into several short periods is neither detrimental nor beneficial to the general dilution procedure. If it is necessary to service the oil tank, the dilution procedure must be divided so that some dilution is accomplished before servicing the oil tank, and the remainder is accomplished after the oil tank is serviced. After dilution has been accomplished, shut off the engine in normal manner, continuing to hold dilution valve on until the engine stops.

(2) In starting the engine, a normal start should be made without regard to the oil dilution system. After starting the engine, if a heavy viscous oil is indicated by oil pressure that is too high, or by oil pressure that fluctuates or falls back when the engine rpm is increased, the dilution control may be pushed momentarily several times to decrease the viscosity of the oil as a means of correcting this condition. This procedure must be used with caution as it is possible to cause an engine failure by supplying the engine pump with pure gasoline in case the oil is sufficiently viscous or stopped by ice so as not to permit flow; the oil pressure gage may indicate sufficient pressure, due to the gasoline, to cause operating personnel to believe oil is flowing, which may not be the case. This method is suggested only if time and extreme temperature conditions do not permit engine warm-up in the normal manner.

(3) If desired, it is safe to make immediate take-offs, after oil dilution has been used, without the normal warm-up, provided there has been a rise in oil temperature, oil pressure is steady, and the engine is running smoothly. Cold oil properly diluted has the same viscosity as hot undiluted oil and, therefore, the same ability to circulate and properly lubricate the engine.

(4) When an engine oil scavenging arrangement is inadequate or critical, oil dilution may have an adverse effect. The term "over-dilution" has been used to indicate any amount of dilution which causes the engine scavenging system to break down and discharge oil through the engine breathers. This condition is serious, as it may be possible to completely lose all engine oil in a short period of time due to the break-down in the scavenging system. These difficulties will not normally occur if the outlined procedure, care, and judgment are exercised by the operating personnel. High percentages of dilution have no serious effect on engine bearings if the oil pressures remain normal. If oil discharge occurs under cold conditions, it may best be stopped by reducing power and rpm immediately. Consideration should be given to what has been found satisfactory dilution in the past by the operating personnel under similar conditions of engine and anticipated weather temperatures. Whenever engines have been previously diluted and have not been flown, the engines should not be given a full dilution until 30 minutes operating time with oil temperatures above 50°C (122°F) have been obtained.

NOTE: It is necessary to operate an aircraft engine at normal operating temperatures for approximately ½ hour to permit the fuel in the oil supply to evaporate and cause the oil to resume its normal viscosity. High temperatures will shorten this time period slightly.

(5) Engines which suddenly show a loss in oil pressure or throw oil out of the breathers during flight, will be checked upon landing to insure that the oil dilution valve is in the "CLOSED" position and fully seated. If equipped with an electrically operated valve, it may be momentarily turned "ON" and "OFF" in an attempt to complete the seating of the valve. The fuel pressure gage should drop when the switch is on. If dilution causes the loss of oil pressure, satisfactory operation will be resumed when the viscosity of the oil is restored by running the engine and evaporating the gasoline in the oil.

(6) When extreme cold is encountered and an airplane lay-over is necessary, the dilution procedure outlined above may be increased to provide reduced viscosity and safety in accordance with the experience of operating personnel. After several days lay-over, during which time the engine has been started and diluted several times, it is advisable to ground-run the engine for at least ½ hour at normal take-off to check the oil level which may have fallen considerably due to evaporation of gasoline. This will tend to eliminate any excess dilution which might otherwise cause oil discharge through the breathers or loss in oil pressure during high power take-off or operation.

e. Open throttles to obtain 1000 to 1200 rpm, then move mixture control levers (Figure 6-13) to "IDLE CUT-OFF" position and simultaneously open throttles.

f. When the propellers stop rotating, turn ignition switches (Fig. 5-6) "OFF". Leave mixture control levers in "IDLE CUT-OFF".

23. *BEFORE LEAVING COCKPIT.*

a. Turn fuel selector valves (Fig. 9-9 & 9-10) "OFF".

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

c. Turn airplane master switch (Fig. 5-3) "OFF".

d. If oxygen has been used during flight, turn regulator "OFF". (Refer to Section IV, paragraph 1.) Demand type regulators should be left with emergency knob (Fig. 27-7) "OFF" and the auto mix. lever (Fig. 27-3) "ON".

e. To set surface controls lock (Fig. 11-3), put rudders in neutral and place locking tube in clip provided (Fig.

oil temperatures are too high, stop the engine and after the oil has cooled to below 40°C (104°F), restart the engine and proceed with oil dilution. In some instances, particularly during sub-zero temperature where a long dilution period is required, the engine oil temperature may rise above the maximum desired values for oil dilution, 50°C (122°F). If this occurs, it may be necessary to dilute the oil in two or more short periods. Breaking up the oil dilution period into several short periods is neither detrimental nor beneficial to the general dilution procedure. If it is necessary to service the oil tank, the dilution procedure must be divided so that some dilution is accomplished before servicing the oil tank, and the remainder is accomplished after the oil tank is serviced. After dilution has been accomplished, shut off the engine in normal manner, continuing to hold dilution valve on until the engine stops.

(2) In starting the engine, a normal start should be made without regard to the oil dilution system. After starting the engine, if a heavy viscous oil is indicated by oil pressure that is too high, or by oil pressure that fluctuates or falls back when the engine rpm is increased, the dilution control may be pushed momentarily several times to decrease the viscosity of the oil as a means of correcting this condition. This procedure must be used with caution as it is possible to cause an engine failure by supplying the engine pump with pure gasoline in case the oil is sufficiently viscous or stopped by ice so as not to permit flow; the oil pressure gage may indicate sufficient pressure, due to the gasoline, to cause operating personnel to believe oil is flowing, which may not be the case. This method is suggested only if time and extreme temperature conditions do not permit engine warm-up in the normal manner.

(3) If desired, it is safe to make immediate take-offs, after oil dilution has been used, without the normal warm-up, provided there has been a rise in oil temperature, oil pressure is steady, and the engine is running smoothly. Cold oil properly diluted has the same viscosity as hot undiluted oil and, therefore, the same ability to circulate and properly lubricate the engine.

(4) When an engine oil scavenging arrangement is inadequate or critical, oil dilution may have an adverse effect. The term "over-dilution" has been used to indicate any amount of dilution which causes the engine scavenging system to break down and discharge oil through the engine breathers. This condition is serious, as it may be possible to completely lose all engine oil in a short period of time due to the break-down in the scavenging system. These difficulties will not normally occur if the outlined procedure, care, and judgment are exercised by the operating personnel. High percentages of dilution have no serious effect on engine bearings if the oil pressures remain normal. If oil discharge occurs under cold conditions, it may best be stopped by reducing power and rpm immediately. Consideration should be given to what has been found satisfactory dilution in the past by the operating personnel under similar conditions of engine and anticipated weather temperatures. Whenever engines have been previously diluted and have not been flown, the engines should not be given a full dilution until 30 minutes operating time with oil temperatures above 50°C (122°F) have been obtained.

NOTE: It is necessary to operate an aircraft engine at normal operating temperatures for approximately ½ hour to permit the fuel in the oil supply to evaporate and cause the oil to resume its normal viscosity. High temperatures will shorten this time period slightly.

(5) Engines which suddenly show a loss in oil pressure or throw oil out of the breathers during flight, will be checked upon landing to insure that the oil dilution valve is in the "CLOSED" position and fully seated. If equipped with an electrically operated valve, it may be momentarily turned "ON" and "OFF" in an attempt to complete the seating of the valve. The fuel pressure gage should drop when the switch is on. If dilution causes the loss of oil pressure, satisfactory operation will be resumed when the viscosity of the oil is restored by running the engine and evaporating the gasoline in the oil.

(6) When extreme cold is encountered and an airplane lay-over is necessary, the dilution procedure outlined above may be increased to provide reduced viscosity and safety in accordance with the experience of operating personnel. After several days lay-over, during which time the engine has been started and diluted several times, it is advisable to ground-run the engine for at least ½ hour at normal take-off to check the oil level which may have fallen considerably due to evaporation of gasoline. This will tend to eliminate any excess dilution which might otherwise cause oil discharge through the breathers or loss in oil pressure during high power take-off or operation.

e. Open throttles to obtain not over 1400 rpm, then move mixture control levers (Fig. 6-13) to "IDLE CUT-OFF" position, and slowly move the throttles fully open.

f. When the propellers stop rotating, turn ignition switches (Fig. 5-6) "OFF." Leave mixture control levers in "IDLE CUT-OFF".

23. *BEFORE LEAVING COCKPIT.*

a. Turn fuel selector valves (Fig. 9-9 & 9-10) "OFF".

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

c. Turn airplane master switch (Fig. 5-3) "OFF".

d. If oxygen has been used during flight, turn regulator "OFF". (Refer to Section IV, paragraph 1.) Demand type regulators should be left with emergency knob (Fig. 27-7) "OFF" and the auto mix. lever (Fig. 27-3) "ON".

e. To set surface controls lock (Fig. 11-3), put rudders in neutral and place locking tube in clip provided (Fig.

7-2) Strap control wheel to center of surface control lock.

f. Make out Form 1.

24. *AIR-SPEED CORRECTION TABLE.*

a. The airplanes described in this manual have the pitot mast located either under the left wing or under the fuselage nose. The "Flight Operation Instruction Charts" have been prepared for the wing pitot mast location. When flying an airplane with nose pitot location, correct indicated air speed value given on charts by using the following table:

b. Gear and Flaps UP—

Ship Reading mph Wing Pitot Location	125	150	175	200	225	250	275	300
Ship Reading mph Nose Pitot Location	131	154	176	197	218	240	264	289
Corrected Indicated Air Speed	136	158	180	200	220	242	265	290

c. Gear DOWN and Flaps UP—

Ship Reading mph Wing Pitot Location	100	110	120	130	140	150	160
Ship Reading mph Nose Pitot Location	101	110	119	128	137	146	155
Corrected Indicated Air Speed	115	123	132	140	149	158	166

d. Gear and Flaps DOWN—

Ship Reading mph Wing Pitot Location	80	90	100	110	120	130	140
Ship Reading mph Nose Pitot Location	80	85	94	102	110	119	128
Corrected Indicated Air Speed	94	100	108	116	124	132	140

7-2) Strap control wheel to center of surface control lock.

f. Make out Form 1.

24. *AIR-SPEED CORRECTION TABLE.*

a. The airplanes described in this manual have the pitot mast located either under the left wing or under the fuselage nose. The "Flight Operation Instruction Charts" have been prepared for the wing pitot mast location. When flying an airplane with nose pitot location, correct indicated air speed value given on charts by using the following table:

b. Gear and Flaps UP—

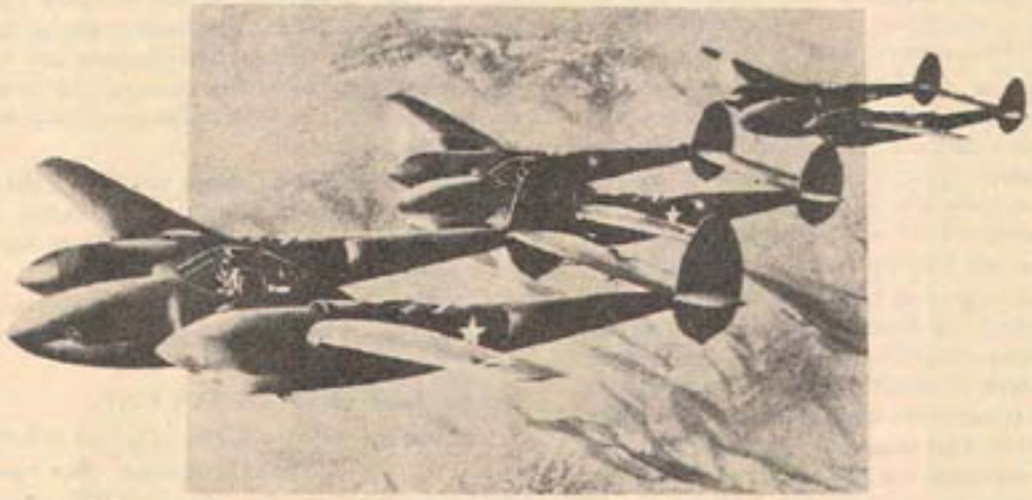
Ship Reading mph Wing Pitot Location	125	150	175	200	225	250	275	300
Ship Reading mph Nose Pitot Location	131	154	176	197	218	240	264	289
Corrected Indicated Air Speed	150	158	180	200	220	242	265	290

c. Gear DOWN and Flaps UP—

Ship Reading mph Wing Pitot Location	100	110	120	130	140	150	160
Ship Reading mph Nose Pitot Location	101	110	119	128	137	146	155
Corrected Indicated Air Speed	115	123	132	140	149	158	166

d. Gear and Flaps DOWN—

Ship Reading mph Wing Pitot Location	80	90	100	110	120	130	140
Ship Reading mph Nose Pitot Location	80	85	94	102	110	119	128
Corrected Indicated Air Speed	94	100	108	116	124	132	140



SECTION III
FLIGHT OPERATION DATA

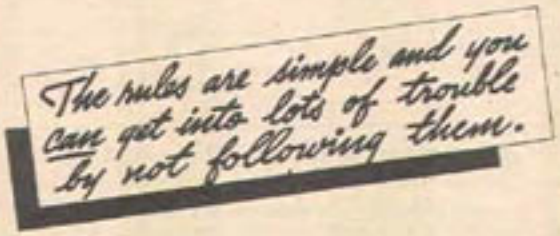
1. *WEIGHT AND BALANCE COMPUTATIONS.*

a. Refer to the "Weight and Balance Chart" in this section for the applicable model airplane, and check the listed 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 entered in the "pounds" column, and the "Alternate Items" whose weights are entered under the various loaded conditions in the "Alternate Loading" columns, the gross weight will be found listed at the bottom of the chart. If any items tabulated in the pounds column are omitted, or any items are added in computing the loading of the airplane, subtract or add the weight of the missing or added items from the "Gross Weight" and the answer will be the correct gross weight as the airplane is actually loaded.

b. The airplane balance is satisfactory for all alternate loading conditions shown in the "Weight and Balance Charts." As only a few changes in loading are possible, the following table will serve as a guide as to what items can be removed or added and what balance compensation is necessary.

REVISION	BALANCE COMPENSATION
Removal or use of external fuel.	None
Removal or use of main fuel (Rear wing tanks).	None
*Removal or use of reserve fuel (Front wing tanks).	None (If "Main" fuel burned first.)
Removal or use of ammunition.	None
Removal of armor.	None
Removal of *any* guns or *any* cameras.	Equivalent ballast *must be* securely strapped to the longerons in fuselage nose (see ballast chart on hood door).
Baggage—*not over the weight listed in the Weight and Balance Chart* for applicable model airplane under alternate load item.	None
Baggage—any amount over maximum allowable unballasted baggage.	14 lbs of ballast securely strapped to longerons in extreme fuselage nose for each additional 10 lbs. of baggage carried in the baggage compartment.
Any item of equipment added or removed which is located *not farther than 24 inches* forward or aft of the main wing beam. (Located immediately aft of pilot's seat.)	None
Any item of equipment added or removed which is located farther than 24 inches forward or aft of the main wing beam.	*Must be compensated* for with equivalent ballast. Check with squadron engineering officer for proper ballast.

*The fuel should be used in the following sequence: (1) Reserve wing tanks for fifteen minutes (see section II, para. 11f), (2) External tanks, (3) Main wing tanks, (4) Reserve wing tanks.



WEIGHT & BALANCE CHART

MAXIMUM*

AIRPLANE MODELS

P-38D

BALANCE (C.G.) LIMITS For any loading conditions

CONDITION	PERCENT M.A.C.
TAKE-OFF	20.0 % TO 28.5 %
LANDING	20.0 % TO 28.5 %

These limits are for gear down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	11,700
FIXED GUN INSTALLATION (S): (4) 50 CAL 280.00 LB. ( ) CAL. LB. GUN SIGHT 3.00 LB. FIXED CANNON INSTALLATION (S): (1) 37 MM 230.00 LB. ( ) MM LB.	
FLEXIBLE GUN INSTALLATION (S): ( ) CAL none LB. ( ) CAL LB. FLEXIBLE CANNON INSTALLATION (S): ( ) MM none LB. ( ) MM LB.	510.00
EQUIPMENT:- NAVIGATION none LB. PHOTOGRAPHIC none LB. OXYGEN 10.00 LB. PYROTECNICS (FLARES ETC.) none LB.	
Armor-plate and bullet-proof glass 220# (Alternate load item)	230.00
CREW 1 (200 LB. EA. INCLUDING PARACHUTES) 200.00 LB. OIL (17 U.S. GAL 14 IMP. GAL.) 130.00 LB.	330.00
TACTICAL WEIGHT EMPTY (@ 26.14 % M.A.C.)	12,800

ALTERNATE ITEMS	U.S. GAL.	(IMP. GAL.)	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL			
FUEL (6 LB. PER U.S. GAL. - 7.2 LB. PER IMPERIAL GALL.)						
Front Tanks	120	(100)	720.00			
Rear Tanks	180	(150)	1080.00			
		( )				
		( )				
		( )				
		( )				
EXTRA TANK (S) INSTALLATION None						
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9	(8)	70.00			
BOMB INSTALLATION (S): INTERNAL ( ) none LB. ( ) EXTERNAL none LB. OR ( ) EXTERNAL LB.						
TORPEDO INSTALLATION none						
AMMUNITION: 800 RDS. 50 CAL. RDS. CAL.			240.00			
15 RDS. 37 MM RDS. MM			30.00			
PASSENGERS none BAGGAGE (MAX.) none LB.						
GROSS WEIGHT			14,900.			
NOTE: 1% M.A.C. = .84 INCHES BALANCE (IN PERCENT M.A.C.)			25.88%			

*These limits must not be exceeded at any time during flight.

WEIGHT & BALANCE CHART

AIRPLANE MODELS

P-38E

MAXIMUM* BALANCE (C.G.) LIMITS For Any Loading Condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20.0% TO 28.5%
LANDING	20.0% TO 28.5%

These Limits are for Gear Down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	11,780
FIXED GUN INSTALLATION (S): (4) .50 CAL 292 LB. ( ) CAL LB. GUN SIGHT 3.0 LB. FIXED CANNON INSTALLATION (S): (1) 20 MM 206 LB. ( ) MM LB.	
FLEXIBLE GUN INSTALLATION (S): ( ) None CAL LB. ( ) CAL LB. FLEXIBLE CANNON INSTALLATION (S): ( ) None MM LB. ( ) MM LB.	510
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 5.0 LB. OXYGEN 10.5 LB. PYROTECNICS (FLARES ETC) None LB.	
Armor Plate & Bullet Proof Glass 235 Lb. (Alternate Load Item)	260
CREW 1 (200LB. EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL 14 IMP. GALL.) 128 LB.	350
TACTICAL WEIGHT EMPTY (C.G. 25.44% M.A.C.)	12,900

ALTERNATE ITEMS	U.S. GAL.	(IMP. GAL.)	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL			
FUEL (6 LB. PER U.S. GAL. - 7.2 LB. PER IMPERIAL GALL)						
Front Tanks	120	(100)	720.0			
Rear Tanks	180	(150)	1,080.0			
		( )				
		( )				
		( )				
		( )				
EXTRA TANK (S) INSTALLATION None						
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9 G.	(8 G.)	70			
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL LB. OR ( ) EXTERNAL LB.						
TORPEDO INSTALLATION						
None						
AMMUNITION: 2,000 RDS .50 CAL RDS. CAL			620.0			
150 RDS. 20 MM RDS. MM			100.0			
PASSENGERS None BAGGAGE (MAX.) None LB.						
GROSS WEIGHT			15,500			
NOTE: 1% M.A.C. = 84 INCHES BALANCE (IN PERCENT M.A.C.)			21.96%			

*These limits must not be exceeded at any time during flight.

WEIGHT & BALANCE CHART

AIRPLANE MODELS
P-38F

MAXIMUM* BALANCE (C.G.) LIMITS For any loading conditions

CONDITION	PERCENT M.A.C.
TAKE-OFF	20 % TO 28.5 %
LANDING	20 % TO 28.5 %

These limits are for geardown

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING:)	12,070
FIXED GUN INSTALLATION (S): (4) 50 CAL. 292.0 LB. ( ) CAL. LB. GUN SIGHT 3.0 LB. FIXED CANNON INSTALLATION (S): (1) 20 MM 206.0 LB. ( ) MM LB.	
FLEXIBLE GUN INSTALLATION (S): ( ) None CAL. LB. ( ) CAL. LB. FLEXIBLE CANNON INSTALLATION (S): ( ) None MM LB. ( ) MM LB.	510
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 5.00 LB. OXYGEN 10.00 LB. PYROTECNICS (FLARES ETC.) None LB.	
Armor-Plate and Bullet-Proof Glass - 235# (Alternate Load Item)	280
CREW 1 (200 LB. EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL. 14 IMP. GALL.) 128 LB.	340
TACTICAL WEIGHT EMPTY (C.G. 25.27 % M.A.C.)	13,200

ALTERNATE ITEMS	U.S. GAL.	(IMP. GALL.)	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL			
FUEL (6 LB. PER U.S. GAL. - 7.2 LB. PER IMPERIAL GALL.)						
Front Tanks	120	(100)	720			
Rear Tanks	180	(150)	1,080			
		( )				
		( )				
		( )				
		( )				
EXTRA TANK (S) INSTALLATION None						
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9 G.	(8 G.)	70			
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL None LB. OR ( ) EXTERNAL LB.						
TORPEDO INSTALLATION None						
AMMUNITION: 2000 RDS. 50 CAL. RDS. CAL. 150 RDS. 20 MM RDS. MM			620 110			
PASSENGERS None BAGGAGE (MAX.) None LB.						
GROSS WEIGHT			15,800			
NOTE: 1% M.A.C. = .84 INCHES BALANCE (IN PERCENT M.A.C.)			21.89%			

*These limits must not be exceeded at any time during flight.

WEIGHT & BALANCE CHART

AIRPLANE MODELS
P-38F-1-LO

MAXIMUM* BALANCE (C.G.) LIMITS For any loading condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20 % TO 28.5 %
LANDING	20 % TO 28.5 %

These limits are for Gear Down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	12,150
FIXED GUN INSTALLATION (S): (4) 50 CAL 292.0 LB. ( ) CAL LB. GUN SIGHT 2.0 LB. FIXED CANNON INSTALLATION (S): (1) 20 MM 206.0 LB. ( ) MM LB.	
FLEXIBLE GUN INSTALLATION (S): ( ) None CAL LB. ( ) CAL LB. FLEXIBLE CANNON INSTALLATION (S): (None MM LB. ( ) MM LB.	530
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 5 LB. OXYGEN 32.0 LB. PYROTECNICS (FLARES ETC) None LB. Armor-Plate and Bullet-Proof Glass - 234.72# (Alternate Load Item)	280
CREW 1 (200LB EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL 14 IMP GALL.) 128 LB.	340
TACTICAL WEIGHT EMPTY (C.G. 26.03 % M.A.C.)	13,300

ALTERNATE ITEMS	U.S. GAL.	(IMP GALL)	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL	Full Fuel 4150 Gal. Alt. Tanks	Full Fuel 4300 Gal. Alt. Tanks	
FUEL (6 LB. PER U.S. GAL - 72 LB. PER IMPERIAL GALL)						
Front Tanks	120	(100)	720	720	720	
Rear Tanks	180	(150)	1080	1080	1080	
Alternate Tanks	300	(250)		1800		
Alternate Tanks	600	(500)			3600	
		( )				
		( )				
EXTRA TANK (S) INSTALLATION				230	320	
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9 G	(8 G)	70	70	70	
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL None LB. OR ( ) EXTERNAL LB.						
TORPEDO INSTALLATION None						
AMMUNITION: 2000 RDS. 50 CAL			600	600	600	
150 RDS. 20 MM			90	90	90	
Radio Mast AN74 - 2#						
PASSENGERS None BAGGAGE (MAX.) None LB.						
GROSS WEIGHT			15,900	17,900	19,800	
NOTE: 1% M.A.C. = .84 INCHES BALANCE (IN PERCENT M.A.C.)			22.58%	23.98%	25.03%	

* These limits must not be exceeded at any time during flight.

WEIGHT & BALANCE CHART

AIRPLANE MODELS
P-38F-5-LO

MAXIMUM* BALANCE (C.G.) LIMITS For any loading condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20.0% TO 28.5%
LANDING	20.0% TO 28.5%

These limits are for Gear Down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	12,260
FIXED GUN INSTALLATION (S): (4) 50 CAL 290.15 LB. ( ) CAL LB. GUN SIGHT 2.80 LB. FIXED CANNON INSTALLATION (S): (1) 20 MM 192.20 LB. ( ) MM LB.	
FLEXIBLE GUN INSTALLATION (S): (None CAL LB. ( ) CAL LB. FLEXIBLE CANNON INSTALLATION (S): (None MM LB. ( ) MM LB.	500
EQUIPMENT:- NAVIGATION None LB PHOTOGRAPHIC 5 LB OXYGEN 32 LB PYROTECHNICS (FLARES ETC) None LB. Armor-Plate & Bullet-Proof Glass - 234.72# (Alternate Load Item)	280
CREW 1 (200 LB. EA. INCLUDING PARACHUTES) 200 LB OIL (17 U.S. GAL 14 IMP GALL) 128 LB.	330
TACTICAL WEIGHT EMPTY (C.G. 25.96% M.A.C.)	13,400

ALTERNATE ITEMS			ALTERNATE LOADING (POUNDS) MAXIMUM FUEL	Full Fuel & 150 Gal. Alt. Tanks	Full Fuel & 300 Gal. Alt. Tanks	
FUEL (6 LB. PER U.S. GAL. - 7.2 LB. PER IMPERIAL GALL)	U.S. GAL.	(IMP GALL)				
Front Tanks	120	(100)	720	720	720	
Rear Tanks	180	(150)	1080	1080	1080	
Alternate Tanks	300	(250)		1800		
Alternate Tanks	600	(500)			3600	
		( )				
		( )				
EXTRA TANK (S) INSTALLATION				230	320	
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9 G	(8 G)	70	70	70	
BOMB INSTALLATION (S): INTERNAL (None LB. ( ) EXTERNAL None LB. OR ( ) EXTERNAL LB.						
TORPEDO INSTALLATION None						
AMMUNITION: 2000 RDS 50 CAL RDS. CAL. 150 RDS. 20 MM RDS. MM			620 90	620 90	620 90	
PASSENGERS None BAGGAGE (MAX.) None LB.						
GROSS WEIGHT			16,000	18,000	19,900	
NOTE: 1% M.A.C. = .84 INCHES BALANCE (IN PERCENT M.A.C.)			22.33%	23.76%	24.83%	

* These limits must not be exceeded at any time during flight

WEIGHT & BALANCE CHART

AIRPLANE MODELS
P-38F-13-LO
P-38F-15-LO
P-38G-15-LO

MAXIMUM* BALANCE (C.G.) LIMITS For any loading condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20.0 % TO 28.5 %
LANDING	20.0 % TO 28.5 %

These limits are for Gear Down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	
FIXED GUN INSTALLATION (S): (4) 50 CAL. 273 LB. ( ) CAL. LB. GUN SIGHT 3.5 LB. FIXED CANNON INSTALLATION (S): (1) 20 MM 197 LB. ( ) MM LB.	12,200
FLEXIBLE GUN INSTALLATION (S): ( ) CAL. None LB. ( ) CAL. LB. FLEXIBLE CANNON INSTALLATION (S): ( ) MM None LB. ( ) MM LB.	460
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 5.00 LB. OXYGEN 41.50 LB. PYROTECNICS (FLARES ETC) None LB.	
Armor Plate & Bullet-Proof Glass - 290# (Alternate Load Item)	320
CREW 1 (200 LB. EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL 14 IMP. GALL.) 128 LB.	320
TACTICAL WEIGHT EMPTY (C.G. 28.82 % M.A.C.)	13,300

ALTERNATE ITEMS	U.S. GAL.	(IMP GALL)	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL	Full Fuel & 150 Gal. Alt. Tanks	Full Fuel & 300 Gal. Alt. Tanks	
FUEL (6 LB PER U.S. GAL. - 7.2 LB. PER IMPERIAL GALL)						
Front Tanks	120	(100)	720	720	720	
Rear Tanks	180	(150)	1080	1080	1080	
Alternate Tanks	300	(250)		1800		
Alternate Tanks	600	(500)			3600	
		( )				
		( )				
EXTRA TANK (S) INSTALLATION				230	320	
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN) 7 G. (6 G.)			50	50	50	
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL LB. OR ( ) EXTERNAL LB.						
TORPEDO INSTALLATION None						
AMMUNITION: 2000 RDS. 50 CAL. RDS. CAL. 150 RDS. 20 MM RDS. MM			620 100	620 100	620 100	
PASSENGERS None BAGGAGE (MAX.) 30 LB.			30	30	30	
GROSS WEIGHT			15,900	17,900	19,800	
NOTE: 1% M.A.C. = 84 INCHES BALANCE (IN PERCENT M.A.C.)			25.15%	26.26%	27.10%	

*These limits must not be exceeded at any time during flight

WEIGHT & BALANCE CHART

AIRPLANE MODELS
P-38G-1-LO
P-38G-3-LO
P-38G-5-LO
P-38G-10-LO

MAXIMUM* BALANCE (C.G.) LIMITS For any loading condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20 % TO 28.5%
LANDING	20 % TO 28.5%

These limits are for Gear Down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	12,190
FIXED GUN INSTALLATION(S): (4) 50 CAL 276.18 LB ( ) CAL LB. GUN SIGHT 2.8 LB. FIXED CANNON INSTALLATION(S): ( ) 20 MM 186.37 LB ( ) MM LB.	
FLEXIBLE GUN INSTALLATION(S): ( ) None CAL LB. ( ) CAL LB. FLEXIBLE CANNON INSTALLATION(S): ( ) None MM LB. ( ) MM LB.	460
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 5.00 LB. OXYGEN 10.75 LB. PYROTECNICS (FLARES ETC) None LB.	
Armor-Plate & Bullet-Proof Glass - 223.00 (Alternate Load Item)	220
CREW 1 (200 LB. EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL 14 IMP GALL.) 128 LB.	330
TACTICAL WEIGHT EMPTY (C.G. 25.46% M.A.C.)	13,200

ALTERNATE ITEMS	U.S. GAL.	IMP GALL.	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL	Full Fuel & 150 Gal. Drop. Tanks	Full Fuel & 300 Gal. Drop. Tanks	
FUEL (6 LB. PER U.S. GAL. - 7.2 LB. PER IMPERIAL GALL.)						
Front Tanks	120	(100)	720	720	720	
Rear Tanks	180	(150)	1080	1080	1080	
Alternate Tanks	300	(250)		1800		
Alternate Tanks	600	(500)			3600	
		( )				
		( )				
EXTRA TANK (S) INSTALLATION				230	320	
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9 G.	(8 G.)	70	70	70	
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL LB. OR ( ) EXTERNAL LB.						
TORPEDO INSTALLATION None						
AMMUNITION: 2000 RDS. 50 CAL RDS. CAL 150 RDS. 20 MM RDS. MM			620 90	620 90	620 90	
PASSENGERS None BAGGAGE (MAX.) None LB. Recognition Device - 3.50# Reflector Shade - 1#; Damped Rate Control - 2.50#:			10	10	10	
GROSS WEIGHT			15,800	17,800	19,700	
NOTE: 1% M.A.C. = .84 INCHES BALANCE (IN PERCENT M.A.C.)			21.89%	23.37%	24.49%	

* These limits must not be exceeded at any time during flight.

WEIGHT & BALANCE CHART

AIRPLANE MODELS

F-4

MAXIMUM*

BALANCE (C.G.) LIMITS
For any loading condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20.0% TO 28.5%
LANDING	20.0% TO 28.5%

These limits are for geardown

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	11,910
FIXED GUN INSTALLATION (S): ( ) None CAL ____ LB. ( ) ____ CAL ____ LB. GUN SIGHT None LB.	
FIXED CANNON INSTALLATION (S): ( ) None MM ____ LB. ( ) ____ MM ____ LB.	
FLEXIBLE GUN INSTALLATION (S): ( ) None CAL ____ LB. ( ) ____ CAL ____ LB.	
FLEXIBLE CANNON INSTALLATION (S): ( ) None MM ____ LB. ( ) ____ MM ____ LB.	
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 239.70 LB. OXYGEN 28.30 LB. PYROTECNICS (FLARES ETC) None LB.	
Armor Plate & Bullet-Proof Glass 219 Lbs. (Alternate Load Item)	490
CREW 1 (200LB. EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL 14 IMP GALL.) 128 LB.	300
TACTICAL WEIGHT EMPTY (C.G. 25.96% M.A.C.)	12,700

ALTERNATE ITEMS			ALTERNATE LOADING (POUNDS) MAXIMUM FUEL	Full Fuel &75 Gal. Drop. Tanks	Full Fuel &150 Gal. Drop. Tanks	Full Fuel &300 Gal. Drop. Tanks
FUEL (6 LB. PER U.S. GAL - 7.2 LB. PER IMPERIAL GALL.)	U.S. GAL	(IMP GALL)				
Front Tanks	120	(100)	720	720	720	720
Rear Tanks	180	(150)	1080	1080	1080	1080
Alternate Tanks	150	(125)		900		
Alternate Tanks	300	(250)			1800	
Alternate Tanks	600	(500)				3600
		( )				
EXTRA TANK (S) INSTALLATION				130	230	330
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9 G.	(8 G.)	70	70	70	70
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL ____ LB. OR ( ) EXTERNAL ____ LB.						
TORPEDO INSTALLATION None						
AMMUNITION: None RDS. ____ CAL ____ RDS. ____ CAL. None RDS. ____ MM ____ RDS. ____ MM						
PASSENGERS None BAGGAGE (MAX.) None LB.						
GROSS WEIGHT			14,500	15,600	16,600	18,500
NOTE: 1% M.A.C. = .84 INCHES BALANCE (IN PERCENT M.A.C.)			27.93%	28.39%	28.78%	29.42%

* These limits must not be exceeded at any time during flight.

WEIGHT & BALANCE CHART

AIRPLANE MODELS

F-4A

MAXIMUM* BALANCE (C.G.) LIMITS For any loading condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20.0% TO 28.5%
LANDING	20.0% TO 28.5%

These limits are for Gear Down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	11,990
FIXED GUN INSTALLATION (S): ( ) None CAL ____ LB. ( ) ____ CAL ____ LB. GUN SIGHT None LB. FIXED CANNON INSTALLATION (S): ( ) None MM ____ LB. ( ) ____ MM ____ LB.	
FLEXIBLE GUN INSTALLATION (S): ( ) None CAL ____ LB. ( ) ____ CAL. ____ LB. FLEXIBLE CANNON INSTALLATION (S): ( ) None MM ____ LB. ( ) ____ MM ____ LB.	
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 239.70 LB. OXYGEN 28.30 LB. PYROTECNICS (FLARES ETC) None LB. Armor-Plate & Bullet-Proof Glass - 219# (Alternate Load Item)	480
CREW 1 (200LB. EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL 14 IMP. GALL.) 128 LB.	330
TACTICAL WEIGHT EMPTY (C.G. 25.60% M.A.C.)	12,800

ALTERNATE ITEMS	U.S. GAL	(IMP. GAL)	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL	Full Fuel & 150 Gal. Drop. Tanks	Full Fuel & 300 Gal. Drop Tanks	
FUEL (6 LB. PER U.S. GAL. - 7.2 LB. PER IMPERIAL GALL)						
Front Tanks	120	(100)	720	720	720	
Rear Tanks	180	(150)	1080	1080	1080	
Alternate Tanks	300	(250)		1800		
Alternate Tanks	600	(500)			3600	
		( )				
		( )				
EXTRA TANK (S) INSTALLATION				230	320	
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9	(8)	70	70	70	
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL None LB. OR ( ) EXTERNAL ____ LB.						
TORPEDO INSTALLATION None						
AMMUNITION: None RDS. ____ CAL. ____ RDS. ____ CAL. None RDS. ____ MM ____ RDS. ____ MM						
PASSENGERS None BAGGAGE (MAX.) 30 LB.			30	30	30	
GROSS WEIGHT			14,700	16,700	18,600	
NOTE: 1% M.A.C. = 84 INCHES BALANCE (IN PERCENT M.A.C.)			28.06%	28.90%	29.52%	

* These limits must not be exceeded at any time during flight.

WEIGHT & BALANCE CHART

AIRPLANE MODELS

F-5A-1-LO

F-5A-3-LO

F-5A-10-LO

MAXIMUM* BALANCE (C.G.) LIMITS For any loading condition

CONDITION	PERCENT M.A.C.
TAKE-OFF	20.0 % TO 28.5 %
LANDING	20.0 % TO 28.5 %

These limits are for Gear Down

BASIC LOAD ITEMS	POUNDS
WEIGHT EMPTY, (INCLUDING)	12,200
FIXED GUN INSTALLATION (S): ( ) None CAL ____ LB. ( ) ____ CAL ____ LB. GUN SIGHT None LB.	
FIXED CANNON INSTALLATION (S): ( ) None MM ____ LB. ( ) ____ MM ____ LB.	
FLEXIBLE GUN INSTALLATION (S): ( ) None CAL ____ LB. ( ) ____ CAL ____ LB.	
FLEXIBLE CANNON INSTALLATION (S): ( ) None MM ____ LB. ( ) ____ MM ____ LB.	
EQUIPMENT:- NAVIGATION None LB. PHOTOGRAPHIC 315.70 LB. OXYGEN 29.30 LB. PYROTECNICS (FLARES ETC) None LB.	
Armor-Plate & Bullet-Proof Glass - 219# (Alternate Load Item)	560
CREW 1 (200LB EA. INCLUDING PARACHUTES) 200 LB. OIL (17 U.S. GAL 14 IMP GALL) 128 LB.	340
TACTICAL WEIGHT EMPTY (C.G. 24.66 % M.A.C.)	13,100

ALTERNATE ITEMS	U.S. GAL	(IMP GALL)	ALTERNATE LOADING (POUNDS) MAXIMUM FUEL	Full Fuel & 150 GAL. Alt. Tanks	Full Fuel & 300 GAL. Alt. Tanks	
FUEL (6 LB PER U.S. GAL - 72 LB. PER IMPERIAL GALL)						
Front Tanks	120	(100)	720	720	720	
Rear Tanks	180	(150)	1080	1080	1080	
Alternate tanks	300	(250)		1800		
Alternate tanks	600	(500)			3600	
		( )				
		( )				
EXTRA TANK (S) INSTALLATION				230	320	
EXTRA OIL (AS REQUIRED - MAXIMUM IS SHOWN)	9 G.	(8 G.)	70	70	70	
BOMB INSTALLATION (S): INTERNAL ( ) None LB. ( ) EXTERNAL ____ LB. OR ( ) EXTERNAL ____ LB.						
TORPEDO INSTALLATION None						
AMMUNITION: None RDS. ____ CAL. ____ RDS. ____ CAL. None RDS. ____ MM ____ RDS. ____ MM						
PASSENGERS None BAGGAGE (MAX) 30 LB.			30	30	30	
GROSS WEIGHT			15,000	17,000	18,900	
NOTE: 1% M.A.C. = .84 INCHES BALANCE (IN PERCENT M.A.C.)			27.19%	28.12%	28.82%	

* These limits must not be exceeded at any time during flight.

5-1-42

AIRPLANE MODELS
P-38D, P-38E
F-4

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS
V-1710-27 (R.H.)
V-1710-29 (L.H.)
(INTAKE PORT SCREEN NOT INSTALLED)

CONDITION	FUEL PRESSURE LB./SQ. IN.	OIL PRESSURE LB./SQ. IN.	OIL TEMP. °C	COOLANT TEMP. °C		
DESIRED	17±1	60-70	60-80	101-121		
MAXIMUM	18	85	95	125		
MINIMUM	12	55		85		
IDLING	10	15				

MAX. PERMISSIBLE DIVING R.P.M.

CONDITION	ALLOWABLE OIL CONSUMPTION	
"MAX CONTINUOUS"	22 IMP. PT./HR.	13 U.S. QT./HR.
"ECONOMICAL MAX."	15 IMP. PT./HR.	9 U.S. QT./HR.
"MIN. CRUISING"	12 IMP. PT./HR.	7 U.S. QT./HR.

OIL GRADE: (S) 1120 (W) 1120

SUPERCHARGER TYPE: EXHAUST TURBINE DRIVEN

FUEL OCTANE 100

OPERATING CONDITION	R.P.M.	MANIF. PRESS. (BOOST)	HORSE POWER	CRITICAL ALTITUDE (FEET)	BLOWER	USE LOW BLOWER BELOW	MIXTURE CONTROL POSITION	FUEL FLOW (GAL./HR./ENG.) U.S.	FUEL FLOW IMP.	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)	REMARKS
TAKE-OFF	3000	40.3	1150	25,000	SINGLE SPEED BLOWER	FT. ALT.	AUTO RICH	115	96	SEE COOLANT TEMPERATURE		5 MIN.	
EMERGENCY MAXIMUM	3000	40.3	1150	25,000		FT. ALT.	AUTO RICH	115	96			5 MIN.	REDUCE MANIFOLD PRESSURE 1 INCH PER 1000 FT ABOVE 25000 FT
MAXIMUM CONTINUOUS	2600	37	1000	28,000		FT. ALT.	AUTO RICH	90	75			NO LIMIT	REDUCE MANIFOLD PRESSURE 1 INCH PER 1000 FT ABOVE 28000 FT
ECONOMICAL MAXIMUM	2300	29	670	30,000		FT. ALT.	AUTO RICH OR LEAN	52 47	43 39			NO LIMIT	
TYPICAL CRUISING	2200	28	600	20,000		FT. ALT.	AUTO LEAN	42	35			NO LIMIT	
MINIMUM CRUISING	1600 1600 1650 2150 2300	20 21 22 21 23	325 350 380 450 535	SEA LEVEL 5,000 10,000 20,000 30,000		FT. ALT.	AUTO LEAN	26 28 30 37 43	22 23 25 31 36			NO LIMIT	

CONDITIONS TO AVOID: OPERATION BELOW 1600 RPM RESULTS IN INSUFFICIENT GENERATOR OUTPUT.
CAUTION: WHEN OPERATING ABOVE 2300 RPM, CRITICAL ALTITUDE IS REACHED AT PART THROTTLE DUE TO TURBO SPEED LIMITATIONS.

NOTE: CRITICAL ALTITUDE IS THE MAXIMUM TO WHICH THE POWER SHOWN CAN BE TAKEN.

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

FORM ASC-812

AIRPLANE MODELS
P-38F SERIES
F-4A

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS
V-1710-49 (R.H.)
V-1710-53 (L.H.)
(INTAKE PORT SCREENS NOT INSTALLED)

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F
DESIRED	17±1	60-70	60-80	140-176	101-121	214-250
MAXIMUM	18	85	95	203	125	257
MINIMUM	12	55			85	185
IDLING	10	15				

MAX. PERMISSIBLE DIVING RPM: 3120

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	13 U.S.QT/HR 22 IMP.PT/HR
MAX. CRUISE	9 U.S.QT/HR 15 IMP.PT/HR
MIN. SPECIFIC	7 U.S.QT/HR 12 IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1120

SUPERCHARGER TYPE: EXHAUST-DRIVEN TURBINE

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	44.5	1240	21,000		SINGLE SPEED		A.R.	135	112			5*
WAR EMERGENCY	NOT POSSIBLE ON THESE AIRPLANES												
MILITARY	3000	47.0	1325	15,000				A.R.	148	123			5**
MAXIMUM CONTINUOUS	2600	38	1000	27,000				A.R.	100	83			***
MAXIMUM CRUISE	2300	29	670	30,000				A.R. or LEAN	53 49	44 41			
MINIMUM SPECIFIC CONSUMPTION	1600 1600 1600 1870 2200	21 23 24 25 25	325 350 380 450 535	SEA LEVEL 5,000 10,000 20,000 30,000				AUTO LEAN	25 26 29 34 40	21 22 24 28 33			

REMARKS: * Use Military rated for War Emergency Take-off
** At 20,000 ft., use 47 in. M.P.; at 30,000 ft., use 35 in. M.P.; at 40,000 ft., use 20 in. M.P.
*** At 30,000 ft., use 47 in. M.P.; at 35,000 ft., use 30 in. M.P.; at 40,000 ft., use 20 in. M.P.

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

Form ASC-542

AIRPLANE MODELS
P-38G SERIES
F-5A SERIES

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS
V-1710-51 (R.H.)
V-1710-55(L.H.)
(INTAKE PORT SCREENS NOT INSTALLED)

CONDITION	FUEL PRESSURE (LB./SQ. IN.)	OIL PRESSURE (LB./SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	17±1	60-70	50-80	140-176	101-121	214-250		
MAXIMUM	18	85	95	203	125	257		
MINIMUM	12	55			85	185		
IDLING	10	15						

MAX. PERMISSIBLE DIVING RPM: ....3120.....

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	...13...U.S.QT/HR...22...IMP.PT/HR
MAX. CRUISE	....9...U.S.QT/HR...15...IMP.PT/HR
MIN. SPECIFIC	....7...U.S.QT/HR...12...IMP.PT/HR

OIL GRADE: (S)....1120.....(W)...1120.....

SUPERCHARGER TYPE: EXHAUST-DRIVEN TURBINE

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	44.5	1240	21,000				A.R.	135	112			5*
WAR EMERGENCY		NOT POSSIBLE ON						THESE AIRPLANES					
MILITARY	3000	51	1425	15,000		SINGLE SPEED		A.R.	150	132			**
MAXIMUM CONTINUOUS	2600	41	1100	24,000				A.R.	115	96			***
MAXIMUM CRUISE	2300	31	740	30,000				A.R. or LEAN	63 58	52 48			
MINIMUM SPECIFIC CONSUMPTION	1800 1800 1800 1870 2200	21 23 24 25 25	325 350 380 450 535	SEA LEVEL 5,000 10,000 20,000 30,000				AUTO LEAN	25 25 29 34 40	21 22 24 28 33			

REMARKS: * Use Military Rated for War Emergency Take-off.
** At 20,000 ft., use 47 in. M.P.; at 30,000 ft., use 35 in. M.P.; at 40,000 ft., use 20 in. M.P.
*** At 30,000 ft., use 35 in. M.P.; at 35,000 ft., use 30 in. M.P.; at 40,000 ft., use 20 in. M.P.

AIRPLANE MODELS: P-38D, P-38E, F4

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS: V-1710-27(RH), V-1710-29(LH)

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS)	HEAD WIND (MPH)	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.	
		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.
15000	0	1010	1680	1250	2090	1540	2570	1040	1730	1300	2160	1600	2665	1120	1860	1420	2360	1770	2950
	20	730	1220	910	1520	1150	1920	770	1280	960	1600	1190	1980	830	1380	1050	1750	1340	2230
	40	450	750	560	940	760	1260	490	810	600	1000	780	1300	540	900	690	1150	910	1520
17000	0	1350	2250	1690	2820	2080	3460	1390	2310	1760	2940	2160	3600	1520	2530	1970	3290	2430	4050
	20	1000	1660	1260	2100	1590	2650	1020	1700	1330	2220	1650	2750	1140	1900	1500	2500	1940	3240
	40	630	1050	840	1400	1100	1840	690	1150	910	1510	1160	1930	780	1300	1080	1800	1470	2450
19000	0	1750	2920	2210	3680	2760	4600	1820	3040	2310	3850	2920	4870	2040	3400	2640	4400	3120	5200
	20	1320	2200	1680	2800	2220	3700	1380	2300	1800	3000	2340	3900	1560	2600	2110	3520	2580	4300
	40	900	1500	1190	1980	1660	2760	940	1570	1290	2150	1760	2940	1080	1800	1560	2600	1950	3250

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

ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 40.3 IN. HG

CLIMB DATA

COMBAT MISSIONS USE *3000 RPM & 40.3 IN. HG

FERRY MISSIONS USE 2300 RPM & 29 IN. HG

GROSS WEIGHT (IN LBS)	TYPE OF CLIMB	S.L. TO 5,000 FT. ALT.			10,000 FT. ALT.				15,000 FT. ALT.				25,000 FT. ALT.				35,000 FT. ALT.				BLOWER CHANGE
		BEST I.A.S.	FT./MIN.	TIME FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	
15000	COMBAT	145	2900	2	140	2700	4	43	140	2100	6	51	130	1500	11	67	125	400	23	98	
	FERRY	145	1400	4	140	1300	8	42	140	1200	11	49	130	900	21	65	125	—	—	—	
17000	COMBAT	155	2300	3	150	2100	5	47	150	1600	8	56	140	1000	15	79	135	—	—	—	
	FERRY	155	1000	5	150	900	11	47	150	800	16	58	140	400	33	87	135	—	—	—	
19000	COMBAT	165	1900	3	160	1400	6	50	160	1200	10	62	150	600	21	97	145	—	—	—	
	FERRY	165	700	7	160	600	15	55	160	500	24	71	150	100	66	143	145	—	—	—	

NOTE: INCREASE ELAPSED CLIMBING TIME 5 % FOR EACH 10°C (20°F) ABOVE 0°C (32°F) FREE AIR TEMPERATURE. 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.	
		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
13000	100	2440	1280	2660	1400	2900	1530	2590	1430	2830	1570	3100	1730	4370	3210	4840	3580	5360	3990
14500	105	2660	1400	2900	1530	3170	1680	2820	1570	3090	1720	3380	1890	4810	3550	5330	3960	5910	4420

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

REMARKS

* FOR COMBAT CLIMB, REDUCE TO 2600 RPM AND 37.2 INCHES OF MANIFOLD PRESSURE WITHIN FIVE MINUTES. AND REDUCE MANIFOLD PRESSURE 1 INCH PER 1000 FEET ABOVE 28,000 FEET.

LEGEND

I.A.S. — INDICATED AIR SPEED

NOTE: ALL DISTANCES ARE AVERAGE, AND SUBJECT TO CONSIDERABLE VARIATIONS BECAUSE OF DIFFERENCES IN PILOT TECHNIQUE, LOAD, C.G., ETC.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

AIRPLANE MODELS

P-38F SERIES

F-4A

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS

V-1710-49(RH)

V-1710-53(LH)

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS)	HEAD WIND (MPH)	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.	
		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.
15,500	0	1090	1810	1360	2270	1670	2790	1120	1870	1410	2340	1750	2910	1230	2040	1540	2570	1950	3240
	20	790	1320	1010	1680	1260	2100	820	1360	1050	1740	1330	2210	890	1480	1140	1900	1480	2470
	40	490	810	640	1060	840	1390	500	840	670	1120	890	1480	550	920	730	1220	1020	1700
17,500	0	1440	2400	1830	3040	2230	3710	1500	2490	1900	3160	2320	3870	1650	2740	2120	3540	2660	4440
	20	1070	1790	1390	2310	1720	2860	1110	1850	1440	2390	1810	3010	1220	2030	1630	2710	2140	3560
	40	700	1150	940	1560	1190	1980	720	1200	960	1600	1290	2140	800	1330	1110	1840	1600	2660
19,500	0	1880	3130	2380	3970	2960	4930	1960	3260	2510	4180	3050	5080	2190	3640	2940	4900	3180	5300
	20	1420	2370	1860	3100	2420	4040	1480	2470	1980	3300	2510	4180	1680	2800	2400	4000	2650	4420
	40	950	1580	1330	2220	1870	3120	990	1650	1450	2410	1960	3260	1150	1920	1860	3100	2040	3400

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

ENGINE LIMITS FOR TAKE-OFF 2800 RPM & 44.5 IN. HG

CLIMB DATA

COMBAT MISSIONS USE *2800 RPM & 44.5 IN. HG

FERRY MISSIONS USE 2300 RPM & 29.3 IN. HG

GROSS WEIGHT (IN LBS)	TYPE OF CLIMB	S.L. TO 5000 FT. ALT.			10,000 FT. ALT.				15,000 FT. ALT.				25,000 FT. ALT.				35,000 FT. ALT.				BLOWER CHANGE
		BEST I.A.S.	FT./MIN.	TIME FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	
15,500	COMBAT	145	2900	2	145	2700	4	49	140	2000	6	57	135	1400	12	77	130	300	27	117	
	FERRY	145	1300	4	145	1300	8	47	140	1200	12	55	135	800	22	72	130	—	—	—	
17,500	COMBAT	155	2400	3	155	2200	5	52	150	1500	8	63	145	900	16	91	135	—	—	—	
	FERRY	155	900	6	155	900	11	53	150	700	17	65	145	400	37	100	135	—	—	—	
19,500	COMBAT	170	1900	3	165	1300	6	57	160	1100	10	71	155	600	22	112	145	—	—	—	
	FERRY	170	600	8	165	500	16	63	160	400	27	81	155	100	—	—	145	—	—	—	

NOTE: INCREASE ELAPSED CLIMBING TIME 5 % FOR EACH 10°C (20°F) ABOVE 0°C (32°F) FREE AIR TEMPERATURE. 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.	
		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
13,500	100	2510	1320	2740	1450	2990	1580	2660	1470	2920	1630	3190	1780	4520	3320	5000	3710	5550	4140
15,000	105	2730	1440	2980	1580	3260	1730	2900	1610	3170	1770	3480	1950	4950	3670	5490	4090	6100	4570

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

REMARKS

* FOR COMBAT CLIMB, REDUCE TO 2600 R.P.M. AND 38 INCHES OF MANIFOLD PRESSURE WITHIN FIVE MINUTES AND REDUCE MANIFOLD PRESSURE 1 INCH PER 1000 FEET ABOVE 27,000 FEET.

LEGEND

I.A.S. — INDICATED AIR SPEED

NOTE: ALL DISTANCES ARE AVERAGE, AND SUBJECT TO CONSIDERABLE VARIATIONS BECAUSE OF DIFFERENCES IN PILOT TECHNIQUE, LOAD, G.S., ETC.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

AIRPLANE MODELS

P-38G SERIES
F-5A SERIES

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS

V-1710-51(RH)
V-1710-55(LH)

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS)	HEAD WIND (MPH)	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.	
		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.
15,500	0	1090	1810	1360	2270	1670	2790	1120	1870	1410	2340	1750	2910	1230	2040	1540	2570	1950	3240
	20	790	1320	1010	1680	1260	2100	820	1360	1050	1740	1330	2210	890	1480	1140	1900	1480	2470
	40	490	810	640	1060	840	1390	500	840	670	1120	890	1480	550	920	730	1220	1020	1700
17,500	0	1440	2400	1830	3040	2230	3710	1500	2490	1900	3160	2320	3870	1650	2740	2120	3540	2660	4440
	20	1070	1790	1390	2310	1720	2860	1110	1850	1440	2390	1810	3010	1220	2030	1630	2710	2140	3560
	40	700	1150	940	1560	1190	1980	720	1200	960	1600	1290	2140	800	1330	1110	1840	1600	2660
19,500	0	1880	3130	2380	3970	2960	4930	1960	3260	2510	4180	3050	5080	2190	3640	2940	4900	3180	5300
	20	1420	2370	1860	3100	2420	4040	1480	2470	1980	3300	2510	4180	1680	2800	2400	4000	2650	4420
	40	950	1580	1330	2220	1870	3120	990	1650	1450	2410	1960	3260	1150	1920	1860	3100	2040	3400

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

ENGINE LIMITS FOR TAKE-OFF 2800 RPM & 44.5 IN. HG

CLIMB DATA

COMBAT MISSIONS USE *2800 RPM & 44.5 IN. HG

FERRY MISSIONS USE 2300 RPM & 38.2 IN. HG

GROSS WEIGHT (IN LBS)	TYPE OF CLIMB	S. L. TO 5000 FT. ALT.			10,000 FT. ALT.				15,000 FT. ALT.				25,000 FT. ALT.				35,000 FT. ALT.				BLOWER CHANGE
		BEST I.A.S.	FT./MIN.	TIME FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	
15,500	COMBAT	145	2900	2	145	2700	4	54	140	2200	6	62	135	1600	11	82	130	300	26	124	
	FERRY	145	1500	4	145	1500	7	52	140	1300	11	60	135	900	20	79	130	—	—	—	
17,500	COMBAT	155	2400	3	155	2200	5	57	150	1700	7	68	145	1000	15	96	135	—	—	—	
	FERRY	155	1100	5	155	1000	10	57	150	900	15	69	145	500	30	101	135	—	—	—	
19,500	COMBAT	170	1900	3	165	1500	6	62	160	1300	9	75	155	600	20	115	145	—	—	—	
	FERRY	170	800	7	165	700	13	65	160	600	21	82	155	100	56	156	145	—	—	—	

NOTE: INCREASE ELAPSED CLIMBING TIME 5 % FOR EACH 10°C (20°F) ABOVE 0°C (32°F) FREE AIR TEMPERATURE. 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.	
		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
13,500	100	2510	1320	2740	1450	2990	1580	2660	1470	2920	1630	3190	1780	4520	3320	5000	3710	5550	4140
15,000	105	2730	1440	2980	1580	3260	1730	2900	1610	3170	1770	3480	1950	4950	3670	5490	4090	6100	4570

NOTE: FOR GROUND TEMPERATURES ABOVE 15°C (59°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS

* FOR COMBAT CLIMB, REDUCE TO 2600 R.P.M. AND 41 INCHES OF MANIFOLD PRESSURE WITHIN FIVE MINUTES AND REDUCE MANIFOLD PRESSURE 1 INCH PER 1000 FEET ABOVE 24,000 FEET.

LEGEND

I.A.S. — INDICATED AIR SPEED

NOTE: ALL DISTANCES ARE AVERAGE, AND SUBJECT TO CONSIDERABLE VARIATIONS BECAUSE OF DIFFERENCES IN PILOT TECHNIQUE, LOAD, C.G., ETC.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

MODEL(S)
P-38D, P-38E
F-4

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 15,500 TO 13,200 POUNDS

SHEET 1 OF 12 SHEETS
EXTERNAL LOAD ITEMS
TANK SUPPORTS ONLY

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-27 (RH)
V-1710-29 (LH)
FOR ENGINE DATA SEE PAGES ____

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)-GALLONS PER HOUR (G.P.H.)-TRUE AIRSPEED (T. A. S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL PER HR) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
—	—	300	40 GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT										
450	390	260	630	550	760	660	810	700	860	750	260	870	760
410	360	240	590	510	700	610	750	650	790	690	240	800	700
380	330	220	540	470	640	560	680	590	730	630	220	740	640
340	300	200	490	420	580	500	620	540	660	570	200	670	580
310	270	180	440	380	520	450	560	490	600	520	180	600	520
280	240	160	390	340	460	400	500	430	530	460	160	530	460
240	210	140	340	300	410	350	430	380	460	400	140	460	400
210	180	120	290	250	350	300	370	320	400	350	120	400	350
170	150	100	240	210	290	250	310	270	330	290	100	330	290
140	120	80	190	170	230	200	250	220	260	230	80	260	230
100	90	60	150	130	170	150	190	160	200	170	60	200	170

MAXIMUM CONTINUOUS POWER R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.	DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS I R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	II R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	III R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	IV R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	166	385	30,000	2400	245	34	138	375	2300	225	30	108	350	2300	225	29	94	345	———					30,000	2300	195	23	87	310
2600	38	180	380	25,000	2400	255	33	134	365	2300	235	29	94	330	2300	235	29	94	330	2250	225	28	89	325	25,000	2250	195	25	90	285
2600	38	180	365	20,000	2350	260	32	125	340	2300	245	29	94	320	2250	240	29	91	315	2150	230	28	91	300	20,000	2150	190	21	73	260
2600	38	180	355	15,000	2300	265	32	118	320	2300	255	29	94	305	2200	240	28	84	290	2100	230	27	75	275	15,000	1900	190	21	66	240
2600	38	180	345	12,000	2300	270	31	114	310	2250	255	29	91	295	2150	240	28	81	280	2050	230	27	72	265	12,000	1700	190	22	61	230
2600	38	180	335	9,000	2300	270	30	109	295	2200	255	28	87	290	2150	240	27	78	270	2050	230	26	69	255	9,000	1600	190	22	58	220
2600	38	180	330	6,000	2300	270	29	94	280	2200	255	28	83	270	2100	240	27	74	255	2000	230	26	66	245	6,000	1600	190	21	56	210
2600	38	180	320	3,000	2300	275	29	94	275	2150	255	27	80	260	2050	240	26	71	245	2000	230	25	63	230	3,000	1600	190	20	54	200
2600	38	180	315	SEA LEVEL	2300	280	29	94	270	2100	260	27	77	250	2050	245	26	69	240	1950	230	25	60	220	SEA LEVEL	1600	190	20	52	190

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 40 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL
12 U.S. GAL EQUAL 10 IMP. GALL.
FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:-USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:-SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P. : MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H.-KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S) P-38D P-38E F-4

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 17500 TO 13200 POUNDS

SHEET 2 OF 12 SHEETS

EXTERNAL LOAD ITEMS
150 OR 75 GALLON TANKS
OR 1100# BOMBS

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-27
V-1710-29
FOR ENGINE DATA SEE PAGES _____

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.) – GALLONS PER HOUR (G.P.H.) – TRUE AIRSPEED (T. A. S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
—	—	613	43 GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT								613	—	—
920	800	570	1280	1110	1520	1320	1600	1390	1710	1480	570	1800	1570
840	730	520	1170	1020	1390	1210	1460	1270	1560	1350	520	1630	1420
760	660	470	1060	920	1260	1090	1320	1150	1410	1220	470	1460	1270
670	590	420	940	820	1120	970	1180	1020	1260	1090	420	1300	1130
590	520	370	830	720	990	860	1040	900	1110	960	370	1140	990
510	450	320	720	620	850	740	900	780	960	830	320	980	850
430	380	270	610	530	720	630	760	660	810	700	270	820	710
350	310	220	490	430	590	510	620	540	660	570	220	670	580
270	240	170	380	330	450	390	480	410	510	440	170	510	440
190	170	120	270	230	320	280	340	290	360	310	120	360	310
110	100	70	160	140	190	160	200	170	210	180	70	210	180

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS															DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
					I					II					III					IV						
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	166	350	30,000	2400	220	33	135	340	2300	190	29	94	305	2300	190	29	94	305						30,000	2300	185	25	92	293
2600	36	180	350	25,000	2400	230	33	132	330	2300	205	29	94	300	2300	205	29	94	300	2200	195	28	86	283	25,000	2250	180	24	85	270
2600	38	180	340	20,000	2300	235	33	124	310	2300	220	29	94	290	2250	215	29	92	285	2150	195	27	79	265	20,000	2150	180	23	78	260
2600	38	180	330	15,000	2300	245	32	118	298	2300	230	29	94	280	2200	215	28	84	260	2050	195	27	72	240	15,000	1900	180	23	70	250
2600	38	180	320	12,000	2300	245	31	112	280	2250	230	29	90	265	2150	215	28	80	250	2050	195	26	69	230	12,000	1700	180	23	65	240
2600	38	180	315	9,000	2300	245	30	108	270	2200	230	28	86	255	2100	215	27	77	240	2000	195	26	67	225	9,000	1600	180	23	61	210
2600	38	180	305	6,000	2300	245	29	94	260	2150	230	28	82	245	2100	220	27	74	230	2000	200	26	65	215	6,000	1600	180	22	55	200
2600	38	180	300	3,000	2300	250	29	94	255	2150	230	27	79	235	2050	220	27	72	225	1950	200	26	62	205	3,000	1600	180	22	57	190
2600	38	180	295	SEA LEVEL	2300	255	29	94	250	2100	235	27	76	225	2050	220	26	69	215	1950	200	25	60	200	SEA LEVEL	1600	180	21	55	180

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12000 FT. ALT.

*ALLOW 43 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL 12 U.S. GAL EQUAL TO IMP. GALL.

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
WITH TWO SPEED SUPERCHARGER:- USE HIGH BLOWER ABOVE HEAVY LINE ONLY
RED FIGURES ARE PRELIMINARY:- SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS

I.A.S.: INDICATED AIRSPEED
M.P. : MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H. – KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S): P-38 D, P-38 E, F-4

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 19,000 TO 13,200 POUNDS

SHEET 3 OF 12 SHEETS

EXTERNAL LOAD ITEMS
300 GALLON TANKS

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-27 (RH)
V-1710-29 (LH)
FOR ENGINE DATA SEE PAGES _____

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)–GALLONS PER HOUR (G.P.H.)–TRUE AIRSPEED (T.A.S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
—	—	938	48 GAL. TAKE OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT										
1360	1200	890	1910	1660	2250	1950	2350	2040			890	2640	2290
1250	1090	810	1740	1510	2050	1780	2140	1860			810	2380	2070
1130	980	730	1570	1360	1850	1600	1930	1680			730	2130	1850
1010	870	650	1400	1210	1640	1430	1720	1490			650	1880	1630
880	770	570	1230	1060	1440	1250	1510	1310			570	1630	1420
760	660	490	1050	920	1240	1080	1300	1130			490	1390	1210
630	550	410	880	770	1040	900	1080	940			410	1160	1000
510	440	330	710	620	830	720	870	760			330	920	800
390	340	250	540	470	630	550	660	570			250	690	600
260	230	170	370	320	430	370	450	390			170	470	410
140	120	90	190	170	230	200	240	210			90	240	210

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS																DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
					I					II					III					IV							
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	166	330	30,000	2400	205	34	136	325	→					→										30,000	2300	175	28	98	285
2600	38	180	335	25,000	2350	220	33	132	315	2300	185	29	94	275											25,000	2250	175	26	90	260
2600	38	180	325	20,000	2350	230	33	126	300	2300	205	29	94	270	2250	195	28	88	260						20,000	2150	175	25	82	240
2600	38	180	315	15,000	2300	235	32	118	280	2300	215	29	94	265	2200	200	28	84	250						15,000	1900	170	25	76	220
2600	38	180	310	12,000	2300	235	31	114	270	2250	220	29	91	255	2150	200	28	81	240						12,000	1700	170	25	63	210
2600	38	180	305	9,000	2300	235	30	109	260	2200	220	28	86	240	2100	195	27	76	225						9,000	1600	170	25	66	200
2600	38	180	300	6,000	2300	235	29	94	250	2150	215	28	82	230	2050	195	27	72	210						6,000	1600	170	24	63	190
2600	38	180	290	3,000	2300	240	29	94	245	2150	220	27	79	230	2050	200	26	70	205						3,000	1600	170	23	61	185
2600	38	180	285	SEA LEVEL	2300	250	29	94	240	2100	220	27	76	215	2050	200	26	68	200						SEA LEVEL	1600	170	23	59	175

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 48 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL 12 U.S. GAL EQUAL 10 IMP. GALL. FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:-SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS

I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H.-KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S)
P-38D, P-38E
F-4

FLIGHT OPERATION INSTRUCTION CHART
SINGLE ENGINE
WEIGHT 15,500 TO 13,700 POUNDS

SHEET 4 OF 12 SHEETS
EXTERNAL LOAD ITEMS
TANK SUPPORTS
DEAD PROPELLER FEATHERED

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-27 (RH)
V-1710-29 (LH)
FOR ENGINE DATA SEE PAGES ____

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.) – GALLONS PER HOUR (G.P.H.) – TRUE AIRSPEED (T.A.S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
670	580	300	750	650	810	700	840	730			300	940	820
620	540	275	690	600	740	640	770	670			275	860	750
560	490	250	630	550	670	580	700	610			250	780	680
500	430	225	560	490	600	520	630	550			225	700	610
450	390	200	500	430	540	470	560	490			200	630	550
390	340	175	440	380	470	410	490	430			175	550	480
340	300	150	380	330	400	350	420	370			150	470	410
280	240	125	310	270	340	300	350	300			125	390	340
220	190	100	250	220	270	230	280	240			100	310	270
170	150	75	190	170	200	170	210	180			75	240	210
110	100	50	130	110	130	110	140	120			50	160	140
60	50	25	60	50	70	60	70	60			25	80	70

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS																DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
					I					II					III					IV							
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
				30,000																					30,000				
				25,000																					25,000				
2600	37	90	240	20,000	2550	165	36	82	230																20,000				
2600	37	90	235	15,000	2500	175	36	80	220																15,000				
2600	37	90	230	12,000	2500	180	36	78	215	2350	160	34	66	195											12,000				
2600	37	90	230	9,000	2500	185	35	76	210	2350	170	34	66	195											9,000				
2600	37	90	225	6,000	2450	195	33	76	210	2350	180	34	66	195	2300	160	31	58	180						6,000				
2600	37	90	220	3,000	2450	200	33	74	205	2350	185	33	65	195	2300	170	31	58	180						3,000				
2600	37	90	215	SEA LEVEL	2450	200	34	72	200	2350	190	33	64	190	2300	180	31	58	180						SEA LEVEL	2250	155	29	46	160

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 6000 FT. ALT.

ALLOW ____ GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL 12 U.S. GAL EQUAL 10 IMP. GALL. FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:-SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P. : MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H. - KNOTS)
F.T.: FULL THROTTLE OPERATION

Don't try to take off with one engine

MODEL(S)
P-38F SERIES
F-4A

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 15,700 TO 13,500 POUNDS

SHEET 5 OF 12 SHEETS
EXTERNAL LOAD ITEMS
TANK SUPPORTS ONLY

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-49(RH)
V-1710-53(LH)
FOR ENGINE DATA SEE PAGES

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY.)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)–GALLONS PER HOUR (G.P.H.)–TRUE AIRSPEED (T.A.S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
		300	40 GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT.										
400	350	260	580	510	710	610	770	670	830	720	260	910	790
370	320	240	540	470	650	570	710	620	770	670	240	840	730
340	300	220	490	430	600	520	650	570	700	610	220	770	670
310	270	200	450	390	540	470	590	510	640	550	200	700	610
280	240	180	400	350	490	420	530	460	570	500	180	630	550
250	210	160	360	310	430	380	470	410	510	440	160	560	490
220	190	140	310	270	380	330	410	360	450	390	140	490	430
190	160	120	270	230	330	280	350	310	380	330	120	420	370
150	130	100	220	200	270	240	300	260	320	280	100	350	300
120	110	80	180	160	220	190	240	210	260	220	80	280	240
90	80	60	130	120	160	140	180	150	190	170	60	210	180

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS I					II					III					IV					DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	172	380	30,000	2400	240	34	149	370	2300	220	30	113	345	2300	220	29	101	345	2250	215	29	95	335	30,000	2200	195	25	80	310
2600	38	200	380	25,000	2350	255	33	143	360	2300	235	29	101	330	2300	235	29	101	330	2200	220	28	89	315	25,000	2050	195	25	73	285
2600	38	200	365	20,000	2300	260	33	135	340	2300	245	29	101	320	2250	235	29	94	310	2150	225	28	83	295	20,000	1850	190	25	67	260
2600	38	200	355	15,000	2300	265	32	128	330	2300	255	29	101	305	2200	240	28	89	290	2100	225	27	77	275	15,000	1700	190	25	62	240
2600	38	200	345	12,000	2300	270	31	123	310	2250	255	29	97	295	2150	240	28	84	275	2050	230	27	74	265	12,000	1600	190	25	59	230
2600	38	200	335	9,000	2300	270	31	118	295	2250	255	29	93	280	2150	240	27	81	265	2050	230	26	71	250	9,000	1600	190	24	56	220
2600	38	200	330	6,000	2300	270	30	113	280	2200	255	28	88	270	2100	245	27	78	255	2000	230	26	68	240	6,000	1600	190	23	54	210
2600	38	200	320	3,000	2300	275	29	101	275	2200	260	28	87	265	2100	245	27	75	245	2000	230	25	65	230	3,000	1600	190	22	51	200
2600	38	200	315	SEA LEVEL	2300	280	29	101	270	2150	260	28	83	250	2050	245	26	72	235	1950	230	25	62	220	SEA LEVEL	1600	190	21	48	190

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 40 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL 12 U.S. GAL EQUAL 10 IMP. GALL.
FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:– USE AUTO-RICH MIXTURE
LIGHT NUMBERS:– USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:– SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H.–KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S)
P-38F SERIES
F-4A

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 17,700 TO 13,500 POUNDS

SHEET 6 OF 12 SHEETS
EXTERNAL LOAD ITEMS
150 OR 75 GALLON TANKS
OR 1100 # BOMBS

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-49(RH)
V-1710-53(LH)
FOR ENGINE DATA SEE PAGES

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M. P.) - GALLONS PER HOUR (G.P.H.) - TRUE AIRSPEED (T. A. S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I. A. S. IS SUFFICIENT
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
—	—	613	43 GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT								613	TAKE OFF & CLIMB ALLOWANCE	
820	710	570	1170	1020	1410	1220	1520	1320	1640	1430	570	1870	1620
750	650	520	1070	930	1290	1120	1380	1200	1500	1300	520	1700	1470
680	590	470	970	840	1160	1010	1250	1090	1350	1180	470	1520	1320
600	530	420	870	750	1040	900	1120	970	1210	1050	420	1350	1170
530	460	370	760	660	920	800	990	860	1070	930	370	1180	1030
460	400	320	660	570	790	690	850	740	920	800	320	1020	890
390	340	270	560	480	670	580	720	620	780	680	270	850	740
320	270	220	450	390	540	470	590	510	630	550	220	690	600
240	210	170	350	300	420	360	450	390	490	430	170	530	460
170	150	120	250	210	300	260	320	280	350	300	120	370	320
100	90	70	140	130	170	150	190	160	200	180	70	220	190

ALTERNATE CRUISING CONDITIONS

MAXIMUM CONTINUOUS POWER R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.	DENSITY ALTITUDE FEET	I R.P.M.	I I.A.S.	I M.P.	I G.P.H.	I T.A.S.	II R.P.M.	II I.A.S.	II M.P.	II G.P.H.	II T.A.S.	III R.P.M.	III I.A.S.	III M.P.	III G.P.H.	III T.A.S.	IV R.P.M.	IV I.A.S.	IV M.P.	IV G.P.H.	IV T.A.S.	DENSITY ALTITUDE FEET	MAXIMUM RANGE - ENDURANCE R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	172	345	30,000	2350	210	33	144	330	2300	185	29	101	305	2300	185	29	101	305						30,000	2200	180	28	98	295
2600	38	200	350	25,000	2350	225	33	141	325	2300	205	29	101	295	2250	205	29	100	295						25,000	2050	180	28	90	270
2600	38	200	340	20,000	2300	235	33	134	305	2300	220	28	101	290	2250	215	29	96	280						20,000	1850	180	27	73	250
2600	38	200	325	15,000	2300	240	32	128	295	2300	230	29	101	290	2200	215	28	88	260	2050	195	27	75	240	15,000	1700	180	27	68	230
2600	38	200	320	12,000	2300	245	31	123	290	2250	230	29	97	285	2150	215	28	83	250	2000	195	27	72	230	12,000	1600	180	27	64	220
2600	38	200	315	9,000	2300	245	31	118	270	2200	230	30	98	285	2150	215	27	80	235	2000	195	26	68	205	9,000	1600	180	28	61	210
2600	38	200	305	6,000	2300	250	30	115	265	2200	235	28	90	250	2100	220	27	78	230	2000	195	26	66	210	6,000	1600	180	25	53	200
2600	38	200	300	3,000	2300	250	29	101	250	2200	235	28	86	235	2100	220	27	76	225	1950	195	25	64	205	3,000	1600	180	24	56	190
2600	38	200	295	SEA LEVEL	2300	255	29	104	245	2150	235	28	83	230	2050	225	27	73	215	1950	200	25	62	200	SEA LEVEL	1600	180	23	54	180

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 43 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND — 0-10% RESERVE FUEL
12 U.S. GAL EQUAL 10 IMP. GALL.
FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS: - USE AUTO-RICH MIXTURE
LIGHT NUMBERS: — USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY: - SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS

I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H. - KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S)
P-38 F SERIES
F-4A

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 19,500 TO 13,700 POUNDS

SHEET 7 OF 12 SHEETS
EXTERNAL LOAD ITEMS
300 GALLON TANKS

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-49 (RH)
V-1710-53 (LH)
FOR ENGINE DATA SEE PAGES ____

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.) - GALLONS PER HOUR (G.P.H.) - TRUE AIRSPEED (T. A. S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
		938	48 GALLON TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT.										
1230	1070	890	1750	1520	2070	1800	2210	1920			890	2640	2290
1120	980	810	1590	1380	1890	1640	2010	1750			810	2380	2070
1010	880	730	1430	1240	1700	1480	1810	1570			730	2130	1850
900	780	650	1270	1110	1510	1310	1610	1400			650	1880	1630
790	690	570	1120	970	1330	1150	1410	1230			570	1640	1420
680	590	490	960	830	1140	990	1220	1060			490	1390	1210
570	490	410	800	700	950	830	1020	880			410	1160	1000
460	400	330	650	560	770	670	820	710			330	920	800
350	300	250	490	430	580	510	620	540			250	690	600
240	200	170	330	290	400	340	420	370			170	470	410
120	110	90	160	150	210	180	220	190			90	250	210

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS															DENSITY ALTITUDE FEET	MAXIMUM RANGE - ENDURANCE				
					I					II					III					IV						
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	172	320	30,000	2350	190	33	142	310	2300	165	29	101	275	2250	155	29	95	260						30,000	2200	175	31	95	285
2600	38	200	330	25,000	2350	215	33	140	305	2300	180	29	101	270	2250	175	29	95	260						25,000	2050	175	30	97	260
2600	38	200	325	20,000	2300	225	33	135	295	2300	200	29	101	270	2250	190	29	93	255						20,000	1850	175	30	90	240
2600	38	200	315	15,000	2300	230	32	128	280	2300	215	29	101	260	2200	195	28	88	245						15,000	1700	170	29	74	220
2600	38	200	310	12,000	2300	230	31	123	270	2250	220	29	98	255	2200	200	28	88	235						12,000	1600	170	29	70	210
2600	38	200	305	9,000	2300	240	31	120	260	2250	220	29	93	240	2100	195	27	80	220						9,000	1600	170	28	67	200
2600	38	200	295	6,000	2300	240	30	118	255	2200	225	29	91	235	2100	200	27	79	220						6,000	1600	170	27	64	190
2600	38	200	290	3,000	2300	240	30	112	245	2200	225	28	88	230	2100	205	27	77	215						3,000	1600	170	26	61	185
2600	38	200	285	SEA LEVEL	2300	245	29	101	240	2150	225	28	85	220	2100	210	26	75	205						SEA LEVEL	1600	170	25	59	175

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 48 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND — 0-10% RESERVE FUEL 12 U.S. GAL EQUAL 10 IMP. GALL. FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:—USE AUTO-RICH MIXTURE
LIGHT NUMBERS:—USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:—SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H. - KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S)
P-38F-SERIES
F-4A

FLIGHT OPERATION INSTRUCTION CHART
SINGLE ENGINE
WEIGHT 15,700 TO 13,500 POUNDS

SHEET 8 OF 12 SHEETS
EXTERNAL LOAD ITEMS
TANK SUPPORTS
DEAD PROPELLER FEATHERED

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-49(RH)
V-1710-53(LH)
FOR ENGINE DATA SEE PAGES ____

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)–GALLONS PER HOUR (G.P.H.)–TRUE AIRSPEED (T. A. S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
600	520	300	670	580	730	630	760	660			300	880	760
550	480	275	610	530	670	580	700	610			275	810	700
500	430	250	560	490	610	530	640	560			250	740	640
450	390	225	500	430	550	480	570	500			225	660	570
400	350	200	450	390	490	430	510	440			200	590	510
350	300	175	390	340	430	370	450	390			175	510	440
300	260	150	330	290	370	320	380	330			150	440	380
250	220	125	280	240	310	270	320	280			125	370	320
200	170	100	220	190	240	210	250	220			100	290	250
150	130	75	170	150	180	160	190	170			75	220	190
100	90	50	110	100	120	100	130	110			50	150	130
50	40	25	60	50	60	50	60	50			25	70	60

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS I					II					III					IV					DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
				30,000																				30,000					
				25,000																				25,000					
2600	38	100	235	20,000	2500	160	36	90	220															20,000					
2600	38	100	230	15,000	2500	170	36	88	220															15,000					
2600	38	100	230	12,000	2500	175	36	87	215	2350	160	34	72	195										12,000					
2600	38	100	225	9,000	2500	180	36	85	210	2350	165	34	72	195										9,000					
2600	38	100	225	6,000	2450	190	36	85	210	2350	180	34	73	200	2300	160	33	64	180					6,000					
2600	38	100	220	3,000	2450	195	35	83	205	2350	180	33	71	195	2300	170	32	64	180					3,000					
2600	38	100	215	SEA LEVEL	2450	200	35	81	200	2350	190	33	70	190	2300	180	32	64	180					SEA LEVEL	2200	155	30	48	160

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 6000 FT. ALT.

%ALLOW ____ GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL
12 U.S. GAL EQUAL 10 IMP. GALL.
FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:- SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H.-KNOTS)
F.T.: FULL THROTTLE OPERATION

Don't try to take off with one engine

MODEL(S)
P-38G SERIES
F-5A SERIES

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 15,700 TO 13,500 POUNDS

SHEET 9 OF 12 SHEETS
EXTERNAL LOAD ITEMS
TANK SUPPORTS ONLY

5-I-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-51 (RH)
V-1710-55 (LH)
FOR ENGINE DATA SEE PAGES

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I.A.S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)-GALLONS PER HOUR (G.P.H.)-TRUE AIRSPEED (T.A.S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
—	—	300	40 GALLON TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT										
360	310	260	530	460	650	560	720	620	830	720	260	910	790
330	290	240	490	430	600	520	660	570	770	670	240	840	730
310	270	220	450	390	550	470	610	530	700	610	220	770	670
280	240	200	410	350	500	430	550	480	640	550	200	700	610
250	220	180	370	320	450	390	500	430	570	500	180	630	550
220	190	160	330	280	400	350	440	380	510	440	160	560	490
200	170	140	290	250	350	300	390	330	450	390	140	490	430
170	140	120	250	210	300	260	330	290	380	330	120	420	370
140	120	100	200	180	250	220	280	240	320	280	100	350	300
110	100	80	160	140	200	170	220	190	260	220	80	280	240
80	70	60	120	110	150	130	170	140	190	170	60	210	180

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS																DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
					I					II					III					IV							
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	172	380	30,000						2300	230	32	130	360	2300	230	31	115	355	2250	215	29	95	335	30,000	2200	195	25	90	310
2600	40	220	390	25,000	2350	260	36	163	370	2300	245	31	115	345	2250	240	31	112	345	2200	220	28	89	315	25,000	2050	195	23	73	285
2600	41	228	375	20,000	2300	270	35	156	355	2300	255	31	115	330	2200	250	31	106	325	2150	225	28	83	295	20,000	1850	190	25	67	260
2600	41	228	360	15,000	2300	280	34	147	335	2300	265	31	115	315	2200	250	30	99	305	2100	225	27	77	275	15,000	1700	190	25	62	240
2600	41	228	355	12,000	2300	280	33	141	320	2250	265	31	111	305	2150	255	29	95	290	2050	230	27	74	265	12,000	1600	190	25	59	230
2600	41	228	345	9,000	2300	280	33	136	310	2250	270	30	106	295	2150	255	29	91	280	2050	230	26	71	250	9,000	1600	190	24	56	220
2600	41	228	335	6,000	2300	280	32	131	295	2200	270	30	103	285	2150	255	28	88	270	2000	230	25	68	240	6,000	1600	190	23	54	210
2600	41	228	325	3,000	2300	285	32	126	285	2200	270	30	99	275	2100	260	28	85	260	2000	230	25	65	230	3,000	1600	190	22	51	200
2600	41	228	320	SEA LEVEL	2300	290	31	119	280	2150	270	30	95	260	2100	260	28	81	250	1950	230	23	62	220	SEA LEVEL	1600	190	21	49	190

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 40 GAL. FOR WARM-UP, TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL
12 U.S. GAL EQUAL 10 IMP. GALL.
FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION
WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:-SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS

I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H.-KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S)
P-38 G SERIES
F-5 A SERIES

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 17,700 TO 13,500 POUNDS

EXTERNAL LOAD ITEMS
150 OR 75 GALLON TANKS
OR 1100# BOMBS

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-51(RH)
V-1710-55(LH)
FOR ENGINE DATA SEE PAGES

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)-GALLONS PER HOUR (G.P.H.)-TRUE AIRSPEED (T. A. S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
		613	43 GAL TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT.								613	TAKE OFF & CLIMB ALLOWANCE	
740	640	570	1070	930	1290	1120	1430	1240	1650	1430	570	1870	1620
670	580	520	970	850	1180	1020	1300	1130	1500	1300	520	1700	1470
610	530	470	880	760	1070	930	1180	1020	1360	1180	470	1520	1320
540	470	420	790	683	950	830	1050	910	1210	1050	420	1350	1170
480	420	370	690	600	840	730	930	800	1070	930	370	1180	1030
410	360	320	600	520	730	630	800	700	920	800	320	1020	890
350	300	270	510	440	610	530	680	590	780	680	270	850	740
280	250	220	410	360	500	430	550	480	640	550	220	690	600
220	190	170	320	280	390	330	430	370	490	430	170	530	460
160	130	120	220	200	270	240	300	260	350	300	120	370	320
90	80	70	130	110	160	140	180	150	200	180	70	220	190

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS																DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
					I					II					III					IV							
R.P.M.	M.P (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	172	345	30,000						2300	200	32	126	330	2250	195	31	113	315	→					30,000	2200	180	28	88	295
2600	40	220	360	25,000	2350	235	35	162	335	2300	215	31	115	310	2250	215	31	110	305						25,000	2050	180	29	80	270
2600	41	228	350	20,000	2300	245	35	154	320	2300	230	31	113	300	2200	225	31	105	290						20,000	1850	180	27	73	250
2600	41	228	335	15,000	2300	255	34	147	305	2300	240	31	115	290	2200	225	30	99	275	2050	195	27	75	240	15,000	1700	180	27	68	230
2600	41	228	330	12,000	2300	255	33	142	295	2250	240	31	110	275	2150	230	30	95	260	2000	195	27	72	230	12,000	1600	180	27	64	220
2600	41	228	320	9,000	2300	260	33	138	285	2250	245	31	108	270	2150	230	29	91	255	2000	195	26	69	220	9,000	1600	180	26	61	210
2600	41	228	315	6,000	2300	265	32	133	275	2200	250	30	104	260	2150	230	28	88	245	2000	195	26	66	210	6,000	1600	180	25	59	200
2600	41	228	305	3,000	2300	265	32	128	265	2200	250	30	100	250	2100	235	28	85	235	1950	195	25	64	205	3,000	1600	180	24	56	190
2600	41	228	300	SEA LEVEL	2300	270	31	115	260	2200	250	29	96	240	2100	235	28	82	230	1950	200	25	62	200	SEA LEVEL	1600	180	23	54	180

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 43 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL. 12 U.S. GAL EQUAL 10 IMP. GALL. FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION. WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:- SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H. - KNOTS)
F.T.: FULL THROTTLE OPERATION

MODEL(S)
P-38G SERIES
F-5A SERIES

FLIGHT OPERATION INSTRUCTION CHART

WEIGHT 19,500 TO 13,700 POUNDS

SHEET 11 OF 12 SHEETS
EXTERNAL LOAD ITEMS
300 GALLON TANKS

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-51 (RH)
V-1710-55 (LH)
FOR ENGINE DATA SEE PAGE 5

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I. A. S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)–GALLONS PER HOUR (G.P.H.)–TRUE AIRSPEED (T. A. S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
		938	48 GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT										
1110	970	890	1600	1390	1920	1670	2100	1820			890	2640	2290
1010	880	810	1410	1260	1750	1520	1910	1660			810	2380	2070
910	790	730	1310	1140	1570	1370	1720	1490			730	2130	1850
810	710	650	1170	1010	1400	1220	1530	1330			650	1880	1630
710	620	570	1030	890	1230	1070	1340	1170			570	1640	1420
610	530	490	880	770	1060	920	1150	1000			490	1390	1210
510	450	410	740	640	880	770	970	840			410	1160	1000
410	360	330	590	520	710	620	780	680			330	920	800
310	270	250	450	390	540	470	590	510			250	690	600
210	180	170	310	270	370	320	400	350			170	470	410
110	100	90	160	140	190	170	210	180			90	250	210

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS																DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE				
					I					II					III					IV							
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
2600	35	172	320	30,000						2300	180	31	115	295											30,000	2200	175	31	95	285
2600	40	220	340	25,000	2350	225	35	160	320	2300	195	31	115	290	2250	190	31	107	280						25,000	2050	175	30	87	260
2600	41	228	335	20,000	2300	235	38	154	310	2300	215	31	115	285	2200	205	31	103	275						20,000	1850	175	30	80	240
2600	41	228	325	15,000	2300	245	34	147	295	2300	230	31	115	275	2200	210	30	99	260						15,000	1700	170	29	74	220
2600	41	228	315	12,000	2300	245	33	142	285	2250	235	31	112	270	2150	215	30	96	250						12,000	1600	170	29	70	210
2600	41	228	310	9,000	2300	250	33	138	275	2250	235	31	108	260	2150	215	29	91	240						9,000	1600	170	28	67	200
2600	41	228	305	6,000	2300	255	32	133	265	2200	240	31	105	250	2150	220	29	89	235						6,000	1600	170	27	64	190
2600	41	228	300	3,000	2300	255	32	129	260	2200	240	30	101	240	2100	220	28	84	225						3,000	1600	170	26	61	185
2600	41	228	290	SEA LEVEL	2300	260	31	115	250	2200	245	30	98	235	2100	225	28	84	220						SEA LEVEL	1600	170	25	59	175

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 12,000 FT. ALT.

*ALLOW 48 GAL. FOR WARM-UP TAKE-OFF ETC.

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL
12 U.S. GAL EQUAL TO IMP. GALL.
FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:- SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H.-KNOTS)
F.T.: FULL THROTTLE OPERATION

T. O. No. 01-75FB-1

MODEL(S)
P-38G-SERIES
F-5A-SERIES

FLIGHT OPERATION INSTRUCTION CHART
SINGLE ENGINE
WEIGHT 15,700 TO 13,500 POUNDS

EXTERNAL LOAD ITEMS
TANK SUPPORTS
DEAD PROPELLER FEATHERED

5-1-42

INSTRUCTIONS: (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS)

ENGINE MODEL(S)
V-1710-51 (RH)
V-1710-55 (LH)
FOR ENGINE DATA SEE PAGES ____

1. OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)
2. VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M. AND INDICATED AIRSPEED (I.A.S.)
3. MIXTURE CONTROL (AND BLOWER CONTROL IF ANY) ARE INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SECT. II PAR. 11)
4. MANIFOLD PRESSURE (M.P.)-GALLONS PER HOUR (G.P.H.)-TRUE AIRSPEED (T.A.S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE
5. USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION — HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.
6. TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.

STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	STATUTE AIR-MILES	NAUTICAL AIR-MILES	FUEL* GAL.	STATUTE AIR-MILES	NAUTICAL AIR-MILES
550	480	300	600	520	670	580	730	630	850	720	300	880	760
510	440	275	550	480	610	530	670	580	760	660	275	810	700
460	400	250	500	430	560	490	610	530	690	600	250	740	640
420	360	225	450	390	500	430	550	480	620	540	225	660	570
370	320	200	400	350	450	390	490	430	550	480	200	590	510
320	280	175	350	300	390	340	430	370	480	420	175	510	440
280	240	150	300	260	330	290	370	320	420	370	150	440	380
230	200	125	250	220	280	240	310	270	350	300	125	370	320
180	160	100	200	170	220	190	240	210	280	240	100	290	250
140	120	75	150	130	170	150	190	160	210	180	75	220	190
90	80	50	100	90	110	100	120	100	140	120	50	150	130
50	40	25	50	40	60	50	80	50	70	60	25	70	60

MAXIMUM CONTINUOUS POWER				DENSITY ALTITUDE FEET	ALTERNATE CRUISING CONDITIONS															DENSITY ALTITUDE FEET	MAXIMUM RANGE – ENDURANCE			
					I					II				III				IV							
R.P.M.	M.P. (IN. HG.)	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.	R.P.M.	I.A.S.	M.P.	G.P.H.	R.P.M.	I.A.S.	M.P.	G.P.H.	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.		R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
				30,000																			30,000					
				25,000																			25,000					
2600	41	114	255	20,000	2600	185	41	114	255	2400	160	37	90	220									20,000					
2600	41	114	250	15,000	2550	195	40	108	240	2400	170	37	98	230									15,000					
2600	41	114	245	12,000	2500	195	40	105	235	2400	175	37	97	235	2300	160	34	92	195					12,000					
2600	41	114	240	9,000	2500	200	39	106	230	2350	180	37	95	210	2300	165	34	92	195					9,000					
2600	41	114	235	6,000	2500	210	39	109	225	2350	190	36	95	210	2300	180	34	93	200	2300	155	31	87	175	6,000					
2600	41	114	230	3,000	2450	210	39	97	215	2350	195	36	93	205	2300	180	34	91	195	2300	165	31	89	175	3,000					
2600	41	114	225	SEA LEVEL	2450	220	38	93	210	2350	200	34	91	200	2300	190	34	90	190	2300	175	31	88	165	SEA LEVEL	2200	155	30	89	160

RANGE VALUES IN THIS COLUMN APPLY ONLY AT 6000 FT. ALT.

~~ALLOW GAL. FOR WARM-UP TAKE-OFF ETC.~~

ALL RANGE VALUES ARE BASED ON NO WIND – 0-10% RESERVE FUEL
12 U.S. GAL EQUAL 10 IMP. GALL.
FIGURES SHOWN ARE U.S. GALLONS

HEAVY NUMBERS:- USE AUTO-RICH MIXTURE
LIGHT NUMBERS:- USE AUTO-LEAN MIXTURE
I.A.S. VALUES ARE FOR WING PITOT LOCATION WITH NOSE PITOT CORRECT VALUES USING PAR. 23
RED FIGURES ARE PRELIMINARY:- SUBJECT TO REVISION AFTER FLIGHT CHECK

ABBREVIATIONS
I.A.S.: INDICATED AIRSPEED
M.P.: MANIFOLD PRESSURE (IN. HG.)
G.P.H.: GALLONS PER HOUR (TOTAL)
T.A.S.: TRUE AIRSPEED (M.P.H.-KNOTS)
F.T.: FULL THROTTLE OPERATION

Don't try to take off with one engine

SECTION IV
OPERATIONAL EQUIPMENT

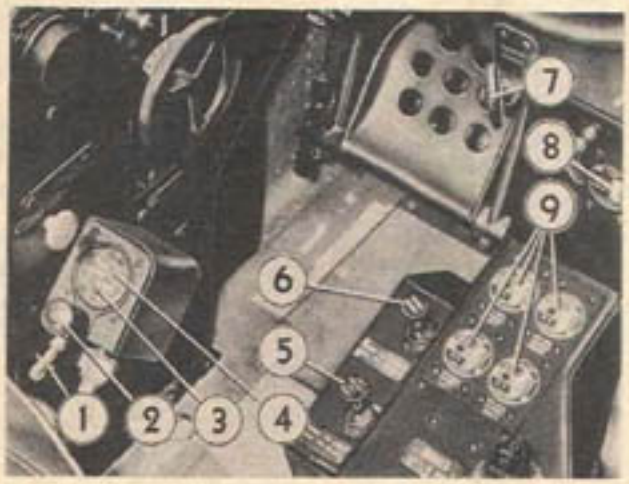
1. *OXYGEN SYSTEM* (Fig. 26).

a. Oxygen will be used when operating over 12,000 feet altitude except in emergency.

b. The airplanes described by this handbook are equipped with either a constant flow oxygen system, (see Fig. 25 for typical installation cockpit controls), or a demand type oxygen system (see Fig. 27 for typical installation of cockpit controls.)

c. Operation of Constant Flow Oxygen System:

(1) A rebreather type mask will be used. The mask should fit the face snugly, but not uncomfortably tight. Before flight the mask should be inspected for cleanness and deterioration with special attention given to the rebreather bag. Be absolutely sure the mask connector will fit the regulator output connector before starting airplane's engines.



1. . . . Oxygen Mask Tube Connection
2. . . . . Oxygen Regulator Valve
3. . . . . Oxygen Cylinder Pressure Indicator
4. Oxygen Flow Indicator
5. . . Cannon Case Ejector Door Control
6. . . . . Cannon Charger Control
7. Cannon Loader Handle
8. . . . . Cannon Rounds Counter
9. . Machine Gun Rounds Counters

FIGURE 25—CONTROLS—CONSTANT FLOW OXYGEN SYSTEM AND 37 MM CANNON

(2) Before take-off check the cylinder pressure gauge (Fig. 25-3) for sufficient oxygen supply (450 p.s.i. full).

(3) The oxygen supply to the pilot is controlled by the regulator valve (Fig. 25-2) and is adjusted for a flow corresponding to the ship's altitude on the flow indicator (Fig. 25-4).

(4) Some individuals require more oxygen than others and the flow should be increased if the pilot feels he is lacking sufficient oxygen.

> *CAUTION:* If the mask tube is pinched or anything restricts or prevents the flow of oxygen from the regulator to the mask, the flow indicator will show a flow greater than normal. Special care shall be exercised to keep mask tube free of bends.

d. Operation of Demand Type Oxygen System:

(1) A demand type mask shall be used. The mask *must fit snugly* without leakage to prevent air leaking between face and mask. To test mask pinch the mask tube and suck lightly. The mask will be drawn in without leaking if properly fitted. In flight the mask should be tested frequently.

(2) Before take-off check the cylinder pressure gauge (Fig. 27-4) for sufficient oxygen supply (400 pounds per square inch full).

(3) The mask tube should be clipped to clothing to prevent pulling mask away from face.

(4) The correct oxygen-air mixture is supplied automatically to the pilot as demanded by normal breathing, with the emergency knob (Fig. 27-7) "OFF" and the auto mix lever (Fig. 27-3) "ON."

(5) Lack of indication by the oxygen flow indicator (Fig. 27-6) may be caused by mask leakage, or regulator failure. If readjustment of the mask does not restore flow, the emergency knob shall be turned "ON," thus bypassing a continuous oxygen flow around the regulator.

(6) Indication by the supply pressure warning light (Fig. 27-5) occurs with approximately 100 p.s.i. oxygen supply remaining.

(7) With the Auto Mix lever (Fig. 27-3) "OFF" pure oxygen is furnished to the mask.

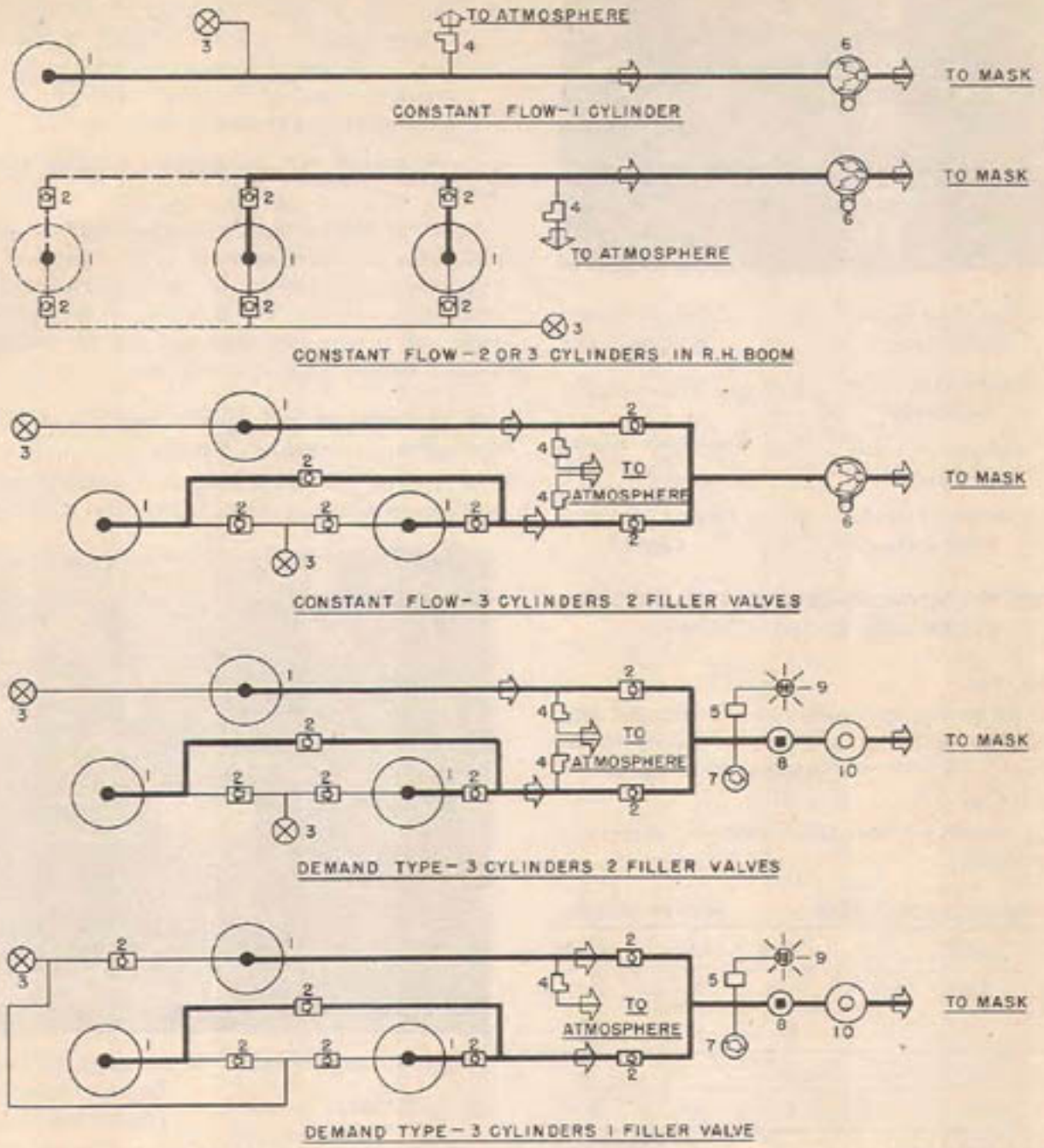
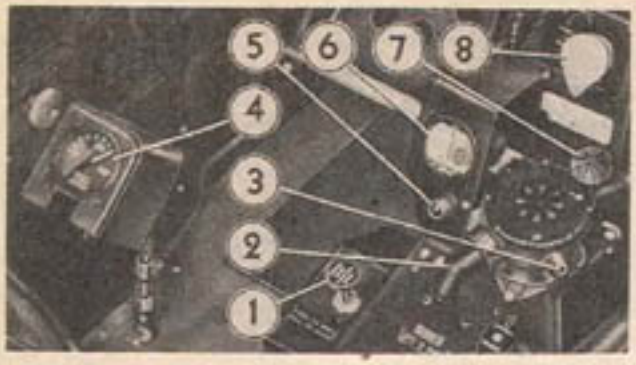


FIGURE 26—OXYGEN SYSTEMS



1. . . Cannon Case Ejector Door Control
2. . . . Oxygen Mask Tube Connection
3. . . . . Auto-mix Control Lever
4. . . . . Oxygen Cylinder Pressure Gauge
5. . . . . Oxygen Pressure Warning Light
6. Oxygen Flow Indicator
7. . . . Emergency By-pass Knob
8. . . . . Cannon Charging Control

FIGURE 27—CONTROLS—DEMAND TYPE OXYGEN SYSTEM AND 20 MM CANNON

e. Duration:

(1) Determine the number of cylinders and type of system installed. All cylinders are carried in the booms except in the P-38D where a cylinder is carried in the fuselage nose.

(2) Duration in Man Hours (400 p.s.i. initial cylinder pressure).

	CONSTANT FLOW SYSTEM			*DEMAND SYSTEM	
Altitude	1 Cyl.	2 Cyls.	3 Cyls.	2 Cyls.	3 Cyls.
15,000 Ft.	3.5	7.0	10.75	8.5	12.75
20,000 Ft.	3.0	6.0	9.0	6.0	9.0
25,000 Ft.	2.5	5.0	7.5	4.75	7.0
30,000 Ft.	2.0	4.25	6.5	4.0	6.25

*Pilot Inactive

NOTE: The duration time for an initial cylinder pressure less than 400 p.s.i. is reduced proportionately.

Example: The duration with one F-1 cylinder and a constant flow system at 30,000 ft. with 300 p.s.i. initial pressure is:

$$2 \text{ hrs. } x \frac{300}{400} = 1.5 \text{ hours.}$$

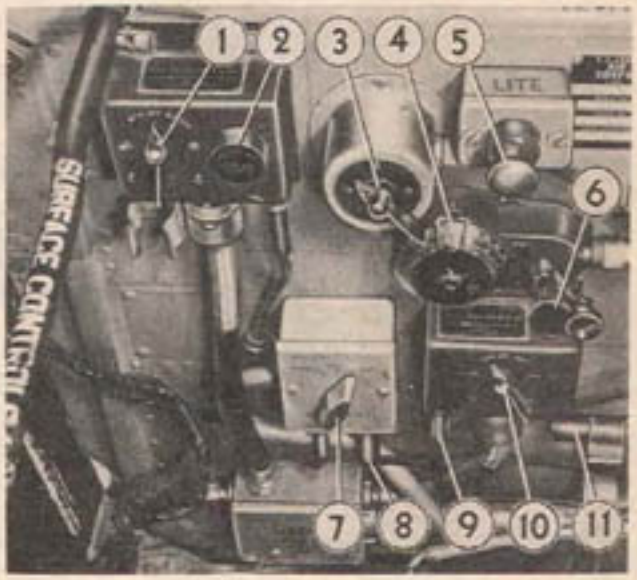
NOTE: The system of check valves as shown in Fig. 26 provide equal drain from all cylinders, and prevents exhausting of the entire oxygen supply if one or two cylinders are punctured. The pressure gauge will indicate the pressure of the highest charged cylinder if all cylinders are not at equal pressure.

2. OPERATION OF COMMUNICATIONS EQUIPMENT.

a. As the airplane may be equipped with one of several different combinations of radio equipment, the pilot should first identify the equipment installed by the cockpit controls. The operation of the individual radio sets is presented separately and the section or sections applicable should be employed.

b. Operation of SCR-AL-283 Radio Set (Without Microphone pre-amplifier, Fig. 28).

(1) The radio equipment is mounted under the rear canopy and the controls are installed on the right



1. Receiver Control Switch
2. . . . . Receiver Volume Control
3. . . . . Hi-Lo Frequency Selector Switch
4. Tuning Dial and Crank
5. . . . . Cockpit Light
6. . . . . Transmitter Key
7. . . Radio Range Switch
8. Headset Jack (Headset Extension Cord Plugged in)
9. . . . Microphone Jack (Microphone extension cord plugged in)
10. . . Transmitter Control Switch
11. . . . . Headset Extension cord jack (Stowed)

FIGURE 28—RADIO CONTROLS SCR283 RADIO SET

hand side of the cockpit. See Fig. 28.

(2) The airplane master switch (Fig. 5-3) must be "ON" to operate the radio equipment.

(3) Before take-off the pilot shall check with the radio maintenance personnel to determine that the receiver coil plugged in, covers the reception band desired and the transmitter is tuned for the proper frequency. An operational check of the equipment with the control tower or another airplane should also be made.

(4) Receiver Operation:

(a) By changing standard plug in coils receiver reception will cover the following ranges:

Frequency Range	Coil No.	Frequency Selector Switch Position	Tuning Dial Scale Used
201-398KC	C-270 Dual	LO	Front
4150-7700KC		HI	Rear
2500-4700KC	C-266 Single	Inoperative	Middle

(b) Plug headset into extension cord jack (Fig. 28-11).

(c) Turn receiver control switch (Fig. 28-1) to "MANUAL."

(d) For normal reception, set range selector switch (Fig. 28-7) to "BOTH." To receive radio range without voice interference, set selector switch to "RANGE." To receive voice without range interference, set selector switch to "VOICE."

NOTE: It is impossible to receive voice with selector switch in "Range" position.

(e) Set frequency selector switch (Fig. 28-3) to position indicated in paragraph 2 b. *(4) (a)* depending on coil installed.

(f) Tune receiver to desired frequency on tuning dial (Fig. 28-4) using scale indicated in paragraph 2 b. *(4) (a)*, and adjust volume control (Fig. 28-2) to desired level.

NOTE: The front and rear tuning dial scales are calibrated directly in kilocycles (KC). The middle scale is calibrated 0-100 and a placard is mounted on the top of the receiver, giving frequency vs 0-100 tuning dial setting.

(g) Automatic Volume control is available and may be used by turning the receiver control switch (Fig. 28-1) to "AUTO."

NOTE: This receiver is not capable of receiving straight CW.

(5) Transmitter Operation:

(a) The transmitter may be pre-tuned for any one transmission frequency between 2500-7700 KC.

(b) To turn on the transmitter, the receiver switch (Fig. 28-1) must be set to either "MANUAL" or "AUTO." Allow at least one minute for transmitter to warm up before attempting transmission.

(c) Plug microphone into jack (Fig. 28-9).

(d) To transmit voice turn transmitter control switch (Fig. 28-10) to "VOICE" and press key (Fig. 28-6) during transmission period. Speak slowly with clean, sharp, distinct words.

(e) To transmit code, turn transmitter control switch (Fig. 28-10) to "CW" and operate key (Fig. 28-6). When transmitting to receivers not capable of receiving straight CW, set transmitter control switch to "TONE" and operate as before. The key travel may be adjusted by regulating the thumb screw on the bottom of the transmitter box.

NOTE: The microphone button in the center of the control wheel is inoperative when this radio is installed.

(6) A clip is provided on the side of the pilot's seat to hold microphone and head set cords.

c. Operation of SCR-274-N Radio Set:

(1) The radio equipment is mounted under the rear canopy and the controls are installed on the right hand side of the cockpit. See Fig. 29.

(2) The airplane master switch (Fig. 5-3) must be "ON" to operate the radio equipment.

(3) Before take-off the pilot shall check that the transmitter is tuned for the desired frequencies and should make an operation check of the equipment with the control tower or another airplane.

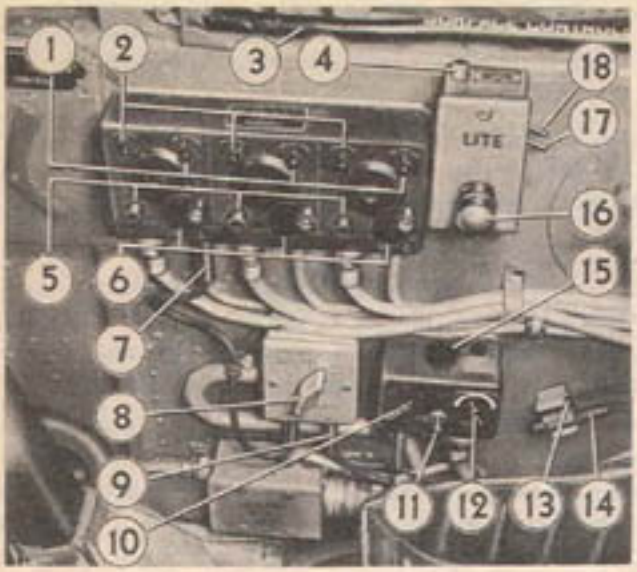
(4) Receiver Operation:

(a) Three separate receivers are installed covering 190-550 KC (kilocycles), 3-6 MC (Megacycles), and 6-9.1 MC frequency bands.

(b) Check receiver controls to be in their normal position, i.e., headset selector switches (Fig. 29-2) in intermediate position between "A" and "B," and receiver control switches (Fig. 29-1) "OFF."

(c) Plug headset into extension cord jack (Fig. 29-14).

(d) Select receiver tuning control (Fig. 29-6) covering desired reception frequency and turn corre-



1. . . . . Receiver Control Switches
2. Headset Selector Switch
3. . . . . Surface Controls Lock-Stowed
4. . . . Identification Light Keying Switch
5. . . . . Receiver Volume Controls
6. . Receiver Tuning Dial and Crank
7. . . Tel Plug—(plugged in "B" jack)
8. . Radio Range Selector Switch
9. . Headset Jack—headset Extension Cord plugged in
10. . . Transmitter Control Switch
11. . . . Transmitter Power Switch
12. . . Transmitter Selector, Switch
13. . . . Microphone Jack—Stowed
14. . . Headset—Extension Cord Jack—Stowed
15. . . . . Transmitter Key
16. . . . . Cockpit Light
17. . . Recognition Selector Switch (Top or Bottom)
18. . . Recognition Selector Switch (Both or Key)

FIGURE 29—RADIO CONTROLS SCR-274 RADIO SET

sponding receiver control switch (Fig. 29-1) to "MCW" for voice or (MCW) code, or to "CW" for straight (CW) code.

(e) For normal reception, set the range selector switch (Fig. 29-8) to "BOTH." To receive radio range without voice interference, set selector switch to "RANGE." To receive voice without range interference set selector switch to "VOICE."

NOTE: It is impossible to receive voice with selector switch in "RANGE" position.

(f) Note which jack, ("A" or "B"), the tel. plug (Fig. 29-7) is in and turn the head set selector switch (Fig. 29-2) of the receiver to be employed to the corresponding position ("A" or "B").

(g) Tune receiver to desired frequency on tuning dial (Fig. 29-6) and adjust corresponding volume control knob (Fig. 29-5).

(h) To turn off receiver volume return controls to normal position (paragraph 2 *c. (4) (b)*).

NOTE: More than one receiver may be heard simultaneously by turning the corresponding headset selector switches to "A" or "B" (reference paragraph 2 *c. (4) (f)*).

(5) Transmitter Operation:

(a) Two separate transmitters are installed providing a choice of two transmission frequencies. Any two of the three transmitters procurable with frequency ranges of 4.0-5.3 MC, 5.3-7.0 MC and 7.0-9.1 MC respectively may be installed.

(b) Turn transmitter power switch (Fig. 29-11) to "ON" and allow 15 seconds for transmitter to warm up.

(c) Plug microphone into extension cord jack (Fig. 29-13).

(d) Turn transmitter selector switch (Fig. 29-12) to desired transmitter.

(e) To transmit voice, turn transmitter control switch (Fig. 29-10) to "VOICE" and press microphone button in center of control wheel (Fig. 5-37) while speaking.

(f) To transmit code, turn transmitter control switch (Fig. 29-10) to "CW" and operate key (Fig. 29-15). When transmitting to receivers not capable of receiving straight CW set transmitter control switch to "TONE" and operate as above.

(g) Turn transmitter off by switching transmitter power switch (Fig. 29-11) to "OFF."

(6) A clip is provided on the side of the pilot's seat to hold microphone and headset cords.

d. Operation of SCR-522 Radio Set:

(1) The radio equipment is located under the rear canopy and the controls are installed on the right hand side of the cockpit (see Fig. 30). Transmission and reception on four pretuned channels between 100-156 MC (megacycles) is available.

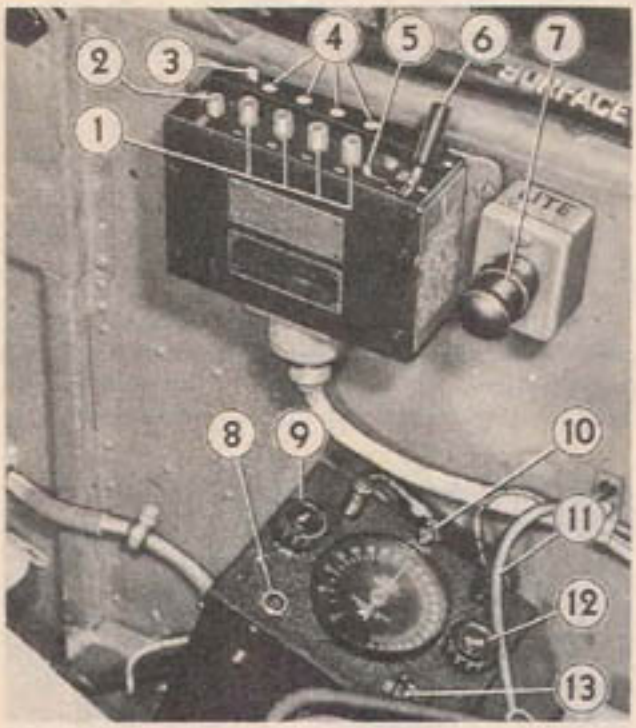
(2) The airplane master switch (Fig. 5-3) must be "ON" to operate the radio equipment.

(3) Before take-off the pilot shall check with the radio maintenance personnel to determine that the radio is tuned for the desired frequencies, and should make an operational check with the control tower or another airplane.

(4) Plug headset and microphone into jack. *NOTE:* A jack with microphone and headset combined or separate jacks may be installed, located on the right side of the cockpit.

(5) Reception:

(a) Turn on the radio equipment by pressing button "A," "B," "C" or "D" (Fig. 30-1) depending on which channel is to be used.



1.....Channel Buttons "A" "B" "C" and "D"
2......"OFF" Button
3...Dimmer Mask Lever
4.....Channel Indicator Lamps "A" "B" "C" and "D"
5.....Control Switch Locking Lever
6.....Control Switch
7.....Cockpit Light
8.....Headset Jack
9.....Volume Control
10. Antenna Tuning Knob
11.....Connection Cord
12.....Tuning Knob
13. .Receiver on-off switch

FIGURE 30—RADIO CONTROLS SCR522 RADIO SET AND TYPE 185 RECEIVER

(b) Place control switch (Fig. 30-6) in "R" position.

(6) Transmission:

(a) Turn radio equipment "ON" as in step (5) *(a)*.

(b) ALLOW ONE MINUTE FOR TRANSMITTER TO WARM UP.

(c) Place control switch (Fig. 30-6) in "T" position.

(d) While transmitting press microphone button (Fig. 5-37) in center of control wheel and speak clearly and slowly.

(7) Remote Operation:

(a) Turn radio equipment "ON" as in step (5) *(a)*.

(b) ALLOW ONE MINUTE FOR TRANSMITTER TO WARM UP.

(c) Place control switch (Fig. 30-6) in "REM" position.

(d) Under these conditions the receiver is normally in operation.

(e) To transmit press microphone switch in center of control wheel (Fig. 5-37) and speak slowly and clearly.

(8) To turn the radio equipment off, press "OFF" button (Fig. 30-2).

(9) A channel indicator lamp (Fig. 30-4) is lighted whenever the radio equipment is operating on the corresponding channel.

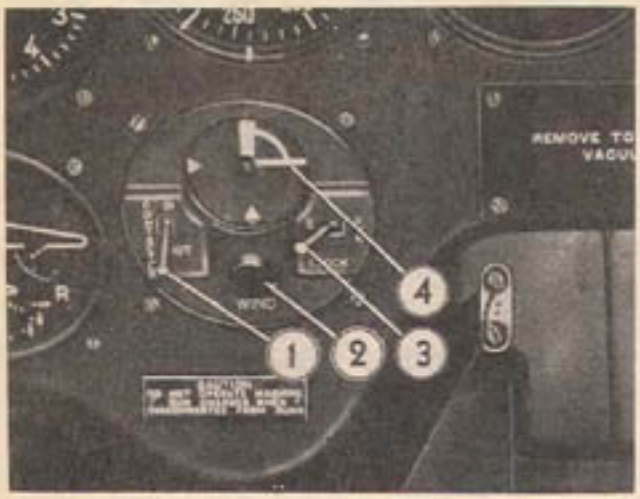
(10) The control switch indicator lamp (back of control switch in Fig. 30-6) is lighted whenever the receiver is operating, i.e., when the control switch (Fig. 30-6 is in the "R" position or reception is being obtained with the control switch in the "REM" position.

(11) The dimmer mask over the indicator lamps may be removed by pushing the dimmer mask lever (Fig. 30-3) "FORWARD."

(12) The switch locking lever (Fig. 30-5) when "ON" (rearward position) prevents throwing the control lever (Fig. 30-6) to the "REM" position and if put in "T" position the lever must be held in place or else it will spring back to the "R" position.

e. Operation of BC 608 Contactor:

(1) The contactor control (Fig. 31) is located on the instrument panel and controls automatic operation



1. Contactor in-out Switch
2. Clock Winding Knob
3. Clock Stop-Run Switch
4. Clock Indicator

FIGURE 31—BC 608 CONTACTOR

of the transmitter during 15 seconds of each minute.

(2) Before take-off check that the transmitter is tuned to the proper frequency. The automatic transmission frequency with a SCR-274N radio installed is the same as frequency number 1 or with a SCR-522 radio set is the same as channel "D."

(3) Wind clock (Fig. 31-2).

(4) For synchronizing the contactor with another contactor, the clock (Fig. 31-4) may be stopped at the 12 o'clock position by switching the Stop-Run lever (Fig. 31-3) to "STOP" position. To start the clock, turn Stop-Run lever to the "RUN" position.

(5) Turn airplane's radio transmitter "ON."

(6) To turn on automatic transmission, set the contactor switch (Fig. 31-1) to the "IN" position. Transmission will take place during the period the clock hand is between the 12 o'clock and 3 o'clock positions.

NOTE: Normal reception and transmission with the airplane's radio equipment is not possible during the 15 seconds of automatic transmission.

(7) To turn off automatic transmission, turn contactor switch (Fig. 31-1) to the "OUT" position.

(8) The contactor is provided with a thermostatically controlled heater. In early airplanes the heater is wired around the airplane's master switch and is "ON" at all times. Later airplanes are equipped with a contactor heat switch which should be turned "ON" before take-off if the contactor is to be used during the flight.

f. Operation of SCR-535 Radio:

(1) The radio control box is located on the left hand side of the cockpit. See Fig. 32.

(2) The sensitivity should be set and the detonator checked before each flight by the radio maintenance personnel.

(3) Turn the knob marked "V" (Fig. 32-3) to farthest counter-clockwise position.

(4) Turn On-Off switch (Fig. 32-4) to "ON."

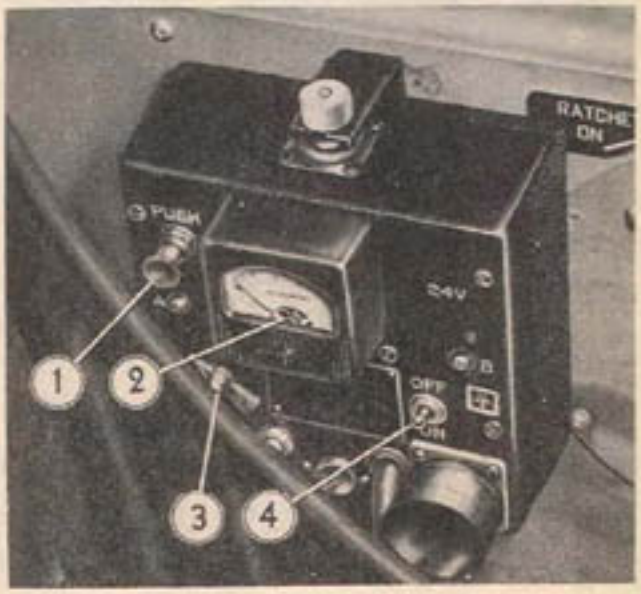
(5) Push button (Fig. 32-1) and turn knob "V" until the pointer on the meter (Fig. 32-2) points to the red line on the meter scale. This should be done with the engines running and the generator cut in.

NOTE: With models having two meters on the control box, adjust knob "V" as before, using voltmeter.

(6) Reset knob "V" while in flight every 15 minutes when possible.

(7) To turn radio off, turn on-off switch (Fig. 32-4) to "OFF."

(8) This radio is equipped with detonator which can be set off by a crash landing or by the pilot pressing the two buttons on the front end of the junction box directly below the radio control box simultaneously.



1. Push Button
2. Meter
3. "V" Control
4. On-Off Switch

FIGURE 32—RADIO CONTROL BOX SCR535

g. Operation of RCA AVR-100 or AVR-101 Receiver:

(1) This receiver is temporarily installed to supplement the SCR-522 radio installation with coverage of the 200-400 Kilocycle range. The AVR-100 also covers the broadcast band 550-1500 KC.

(2) The receiver is mounted on the right hand side of the cockpit. See Fig. 8-5.

(3) Reception is heard with the same headset connections used with the SCR-522 radio set.

(4) Set the antenna switch to the "ANT" position.

(5) On the AVR-100 set turn band selector switch to "BEACON" for 200-400 KC reception or to "BROADCAST" for 550-1500 KC reception. For reception on 278 KC turn band selector switch to "278" KC.

(6) Turn receiver "ON" and increase volume by turning volume control knob until a background noise is heard.

(7) Tune receiver to desired frequency with tuning knob.

(8) To turn receiver off, turn Volume control knob to "OFF."

h. Operation of Type 185 Receiver:

(1) This receiver is temporarily installed to supplement the SCR-522 radio installation with coverage of the 200-420 Kilocycle range.

(2) The receiver is mounted on the right hand side of the cockpit. See Fig. 30.

(3) Reception is heard with the same headset connections employed with the SCR-522 Radio Set, i.e., connection cord (Fig. 30-11) plugged into receiver jack (Fig. 30-8). If headset won't fit the SCR-522 radio jack, plug directly into the receiver jack (Fig. 30-8).

(4) Turn receiver switch (Fig. 30-13) to "ON."

(5) Turn volume control (Fig. 30-9) until a background noise is heard.

(6) Tune receiver to desired frequency with tuning knob (Fig. 30-12).

(7) For optimum performance, the antenna of the receiver should be tuned as follows:

(a) Tune receiver on a signal in the region of 950 KC, reducing volume until signal is just audible.

(b) Adjust antenna knob (Fig. 30-10) for loudest signal.

(c) Recheck operations *(a)* and *(b)*.

(d) The antenna will then be aligned for entire frequency band.

(8) To turn off receiver turn receiver switch (Fig. 30-13) to "OFF."

3. *OPERATION OF ARMAMENT.*

a. All models except the RP-38D and the camera airplanes carry four 50 caliber machine guns with a total of 2000 rounds, and a 20 mm. cannon with 150 rounds. The RP-38D carries 800 rounds of 50 caliber ammunition and a 37 mm. cannon with 15 rounds. The camera airplanes carry no armament.

b. Operation of Machine Guns:

(1) Charge machine guns as follows:

(a) Pull then turn selector knob (Fig. 6-17) to gun to be charged.

(b) Pull back charging handle (Fig. 6-16) and then push to forward position.

NOTE: Never attempt to change selector knob position EXCEPT when the charging handle is full forward.

(c) Strike selector knob with heel of the hand to release bolt. THIS OPERATION IS NECESSARY TO COMPLETE CHARGING OF GUN.

NOTE: Depending on position of first shell, it is sometimes necessary to charge a machine gun twice to insert the first live shell.

(d) Charge all machine guns to be fired as outlined in steps a, b, and c.

(2) Airplane master switch (Fig. 5-3) must be "ON."

(3) Turn armament master switch (Fig. 5-22) and machine gun switch (Fig. 5-23) "ON," or if airplane is equipped with camera-combat switch set to "COMBAT." The camera-combat switch is located in the control column switch box, if installed and replaces all other armament switches.

(4) To fire guns, press button on forward side of the control wheel (Fig. 5-33) during duration of salvo.

(5) After the first salvo the guns will not have to be charged again.

(6) Before landing, turn armament master and machine gun switches (Fig. 5-22 and 5-23) or camera-combat switch to "OFF."

c. Operation of 20 mm. cannon:

(1) Turn charging control (Fig. 26-8) to "COMBAT."

WARNING: The cannon is charged by the ground crew when loading the ammunition. NEVER PUSH CHARGING CONTROL TO CLEAR JAM IN FLIGHT BECAUSE OF THE DANGER OF AN INTERNAL EXPLOSION.

(2) Airplane master switch must be "ON."

(3) Turn armament master switch (Fig. 5-22) and cannon switch (Fig. 5-24) "ON"; or if airplane is equipped with a camera-combat switch turn it to "COMBAT."

(4) To fire cannon, press button on aft side of the control wheel (Fig. 5-36) during duration of salvo.

(5) To dispose of empty shells "PUSH" the ejection door control (Fig. 26-1) to open and "PULL" to close.

(6) Before landing, turn armament master and machine gun switches (Figs. 5-22 and 5-24) or camera-combat switch to "OFF."

d. Operation of 37 mm. Cannon (P-38D only):

(1) To charge cannon, "PUSH" cannon charger control (Fig. 25-6) for five seconds and then "PULL" control back.

(2) Pull loading handle (Fig. 25-7).

(3) Airplanes master switch must be "ON."

(4) Turn armament master switch (Fig. 5-22) and cannon switch (Fig. 5-24) to "ON."

(5) To fire cannon, press button on aft side of the control wheel (Fig. 5-36) during duration of the salvo.

(6) After the first salvo, the cannon will not have to be charged or loaded again.

(7) Before landing turn armament master and cannon switches (Figs. 5-22 and 5-24) to "OFF."

e. Airplanes before serial number 42-12567 are equipped with gun blinker lights (Fig. 4-25) which glow when the bolts are locked open. The blinker lights may be turned "ON" or "OFF" by the blinker light switch (Fig. 5-26).

f. Operation of Optical Gun Sight:

(1) Airplane's master switch must be "ON."

(2) Turn gun sight switch—rheostat (Fig. 5-28) "ON" and adjust brilliancy so that the "Bulls-eye" or "Cross-hair" appear on glass slide mounted in front of pilot's face.

(3) Sight target through "bulls-eye" in glass slide.

(4) Some sights are equipped with a sun shade which may be installed on top of the sight reflector or stowed in a box over the fuel selector valves.

g. Operation of Gun Camera:

(1) Airplane's master switch must be "ON."

(2) Turn armament switch (Fig. 5-22) and camera switch (Fig. 5-25) "ON" or if airplane is equipped with camera-combat switch turn it to "CAMERA."

(3) Camera will operate when cannon or machine gun button is pressed.

h. Turn armament compartment heat control (Fig. 9-1) "ON" if outside air temperature (Fig. 4-10) is below 0°C. (32°F.).

i. To Drop Bombs (Gear and Flaps Up):

(1) Turn arming switch (Fig. 7-3) to "ARM" or "SAFE." Indicator lights (Fig. 7-4 and 7-5) are provided to show the position of the arming switch.

(2) Turn selector switch (Fig. 7-10) "ON" for bombs to be dropped. Indicator lights (Fig. 7-9) are provided to show which selector switch is "ON."

(3) With the landing gear and flaps retracted and while flying at an angle not over 30° from the horizontal. Press the release button (Fig. 7-11) to drop bombs.

4. OPERATION OF PHOTOGRAPHIC EQUIPMENT.

a. The operation of the camera equipment in the F-4 series and F-5 series airplanes is similar. The cameras are installed in the fuselage nose with the following arrangements provided for:

F-4 OR F-4A AIRPLANE

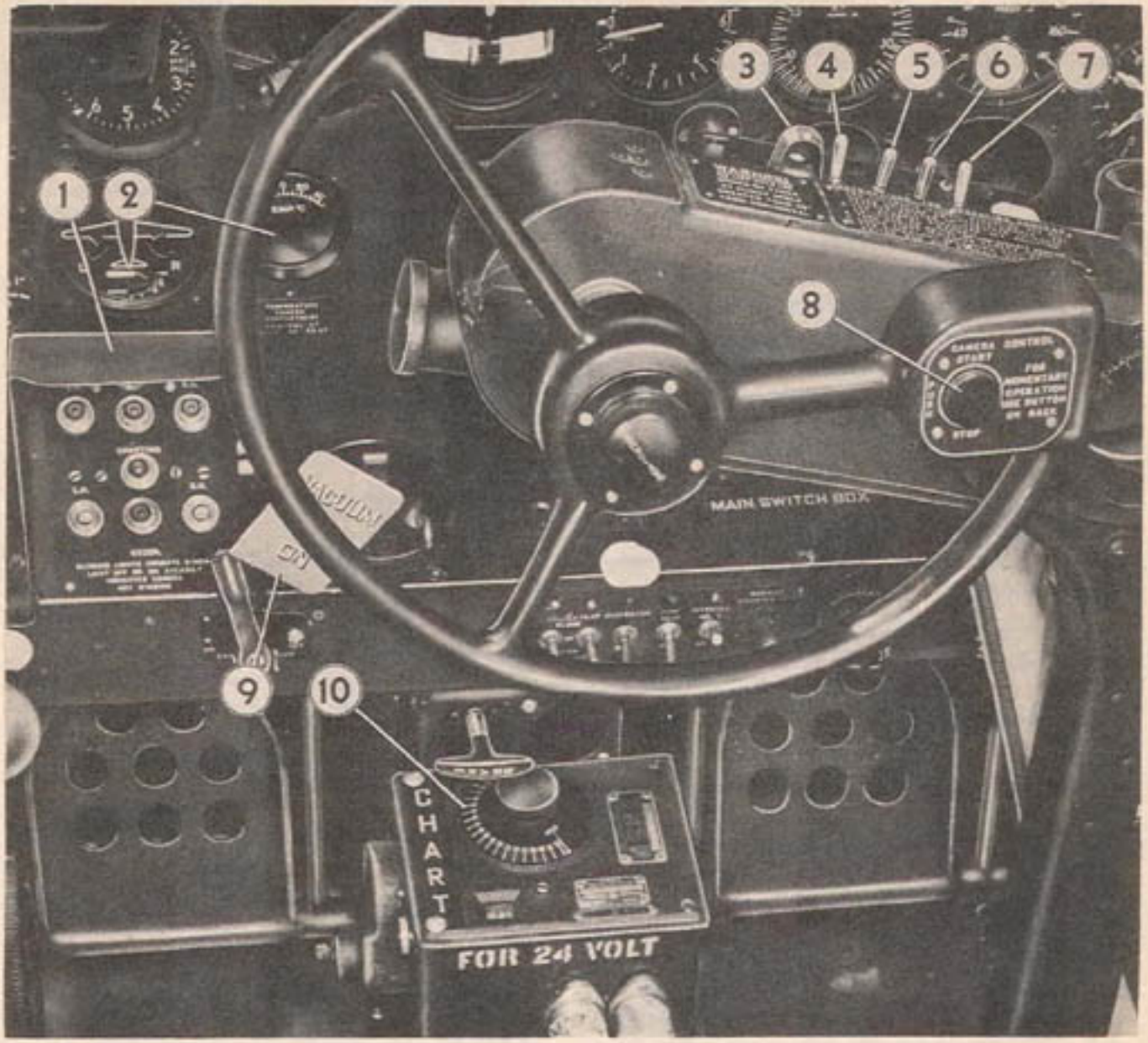
ARRANGEMENT	CHART CAMERAS	RECONNAISSANCE CAMERAS
Normal	3 Type K-17 (6 in.)	1 Type K-17 (24 in.)
Alternate	3 Type K-17 (6 in.)	1 Type K-17 (12 in.)

F-5A AIRPLANE

ARRANGEMENT	CHART CAMERAS	RECONNAISSANCE CAMERAS
Normal	3 Type K-17 (6 in.)	2 Type K-17 (24 in.)
Alternate	1 Type K-17 (6 in.)	3 Type K-17 (24 in.)
Alternate	1 Type K-17 (6 in.)	1 Type K-17 (12 in.) 2 Type K-17 (24 in.)
Alternate	1 Type K-17 (6 in.)	1 Type K-17 (24 in.) 1 Type K-18 (24 in.)
Alternate	1 Type K-17 (6 in.)	1 Type K-17 (12 in.) 1 Type K-18 (24 in.)
Alternate	3 Type K-17 (6 in.)	1 Type K-18 (24 in.)

b. Ground operations (for photographer):

(1) The photographer should be familiar with the normal operation of the K-17 and K-18 cameras.



1.....BLINKER LIGHT PANEL

2.....CAMERA COMPARTMENT TEMPERATURE GAUGE

3.....AMBER LIGHT

4.....PHOTOGRAPHIC EQUIPMENT—MASTER SWITCH

5.....CHART INTERVALOMETER SWITCH

6.....RECONNAISSANCE INTERVALOMETER SWITCH

7.....BLINKER LIGHT SWITCH

8.....CAMERA CONTROL BUTTON (Aft Side of Wheel Shown)

9.....VACUUM CONTROL LEVER

10.....INTERVALOMETER (Chart Shown)

FIGURE 33—PHOTOGRAPHIC EQUIPMENT CONTROLS (F-4 AIRPLANES)

(2) Owing to the limited space, the dark slides must be removed before installation of magazines. With this in mind, the entire daylight loading leader should not be rolled on the take-up spool thus preventing unnecessary fogging of the film and permitting sufficient exposures to check the operation of the camera controls without exposing film.

(3) Just prior to take-off, set correct shutter speeds and diaphragm openings, as the cameras are not accessible in flight. It is recommended that owing to the speed of the airplane, the highest possible shutter speed be used in all cases. Failure to do so may result in blurred negatives. It is also recommended that the diaphragm opening be set at one-half to one stop open from normal, for exposure on a clear sunshiny day. If the sky becomes overcast after take-off, a near normal exposure will be made. If it remains clear, the film will be slightly over-exposed which is far more desirable than under-exposed; for if over-exposed the film can be chemically reduced or under-developed and a normal print made therefrom.

(4) The camera windows in the bottom of the fuselage nose may have to be protected against spray from the nose wheel when taking off from muddy or wet or oily runways and the following expedient has been found satisfactory:

(a) Cut a piece of ordinary cardboard to the size of the visible glass area. Attach this over the glass with two pieces of masking or adhesive tape, one across the front side and one across the back. Before applying the front tape, run a stout cord along the edge of the window frame just ahead of the cardboard and run the tape over the cord. Tie a loop in the cord so as to cause it to encircle the tape. Tie the other end of the cord to the nose wheel strut, taking up all possible slack. This is repeated for the other window. Retraction of the nose wheel will pull off the front tapes, causing the cardboard covers to blow away.

(5) A piece of tape should be put over any inoperative blinker lights (Fig. 33-1) for the pilot's information.

(6) The photographer should fill out photographic data sheet "A" before the airplane takes off.

c. Camera Operation (for pilot):

(1) Before take-off the pilot shall ascertain which cameras are installed and that the ship is *properly balanced.* THIS IS IMPORTANT. See Section III.

(2) *Automatic Operation, Using Intervalometer:*

(a) Determine time interval from INTERVALOMETER SETTING TABLE (Fig. 34).

(b) Adjust chart and/or reconnaissance intervalometers by raising the time setting dial and turning to desired value. The "CHART" intervalometer is mounted between the pilot's legs (Fig. 33-10) and the "RECON" intervalometer is either on the left or right hand side of the pilot's seat.

(c) Throw chart toggle switch (Fig. 33-5 and/or Reconnaissance switch (Fig. 33-6) to "INTERVALOMETER."

(d) Throw blinker light toggle switch (Fig. 33-7) to "ON."

(e) Throw camera master switch (Fig. 33-4) to "ON."

(f) Turn vacuum control valve (Fig. 33-9) "ON."

**(g)* Check individual camera switches "ON" for operative cameras. The switches are installed on the blinker light panel adjacent to the corresponding blinker light.

(h) To start continuous automatic exposure press camera button (Fig. 33-8) on aft side of the wheel "IN AND RELEASE."

(i) Observe blinker lights (Fig. 33-1) to check camera operation.

**1.* Adjust lights to desired brightness by turning lens holders.

2. The clear lamps will light 3 seconds before an exposure is made. During this warning period, the pilot must steady the airplane.

3. The green blinker lights indicate that film is winding. Any lamp that is steadily "ON" or steadily "OFF" indicates that the corresponding camera is not operating. **Turn the individual camera switch of any camera not operating "OFF" to prevent possible camera damage.

(j) To stop continuous automatic exposures, press camera button (Fig. 33-8) on aft side of the wheel "IN AND RELEASE."

(3) *Manual Operation—single exposures or runaway operation:*

(a) Throw chart toggle switch (Fig. 33-5) and/or Reconnaissance switch (Fig. 33-6) to "MANUAL."

*Operations marked with asterisk (*) apply to F-5 series airplanes only.

(b) Throw blinker light toggle switch (Fig. 33-7) to "ON."

(c) Throw camera master switch (Fig. 33-4) to "ON."

NOTE: Pulling the emergency switch bar aft accomplishes steps a, b, and c, simultaneously.

(d) Turn vacuum control valve (Fig. 33-9) to "ON."

**(e)* Check individual camera switches "ON" for operative cameras.

(f) To make a single exposure, press button on forward side of the control wheel "IN AND RELEASE."

(g) For runaway operation, press camera button on forward side of wheel "IN AND HOLD" or press camera button on aft side of wheel (Fig. 33-8) "IN AND RELEASE."

(b) To stop runaway operation, release camera button on forward side of the wheel or press camera button on aft side of the wheel "IN AND RELEASE."

NOTE: Because the time to wind varies slightly with each camera, the cameras will not fire simultaneously after several exposures on runaway operation.

(4) The amber light (Fig. 33-3) is "ON" whenever a camera control button (Fig. 33-8) is "ON."

(5) Adjust the camera compartment temperature control (Fig. 10-5) so as to maintain a compartment temperature as close to 5°C. (40°F.) as possible on the compartment temperature indicator (Fig. 33-2).

(6) The pilot should fill out photographic Data Sheet "B" on completion of each photographic flight.

PHOTOGRAPHIC DATA SHEET "A"

_____ 19____

1._____Dark slide removed.
2._____Cameras properly secured in airplane.
3._____Shutter tested.
4._____Shutter speed. (set properly).
5._____Diaphragm opening. (set properly).
6._____Filter used.
7._____Lens tight.
8._____Magazine properly seated.
9._____Camera operations checked on Intervalometer and on Manual Trip Switches.
10._____Blinker lights and warning lights checked.
11._____Daylight loading trailer wound off supply spool.
12._____Camera windows clean.
13. Cameras used—

	A. Camera Serial No.	B. Magazine Serial No.
a. 6" vertical		
b. 24" vertical		
c. 12" vertical		
d. 6" oblique, right		
e. 6" oblique, left		
f. 24" oblique, right		
g. 24" oblique, left		

I certify that the above camera has been installed in aircraft No._____ under my supervision, this date, and is ready for use.

_____
Photographer

PHOTOGRAPHIC DATA SHEET "B"

1. Weather conditions_____
2. Altitude (true)_____
3. Exposures made_____
4. Approximate time_____
5. Area covered_____

_____
Pilot

Magazine taken up five (5) exposures_____

_____
Photographer

AIRPLANE'S AIRSPEED INDICATOR READING—MPH																	INTERVALOMETER SETTING—SEC.																CAMERA
Airplane's Altimeter Reading (1,000 Ft.)—Altimeter Set at 29.92" Hg.																	Altitude Above Ground—1,000 Ft.																
6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	
180	170	165	160	155	150	145	140	130	125								9	12	15	18	21	27	30	33	36	39	42	45	48	51	54	57	60	
210	200	195	185	180	170	165	160	150	145	140	135	125					9	12	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	
235	230	220	215	205	195	185	180	170	165	160	150	145	140	135	125		9	9	12	15	18	21	24	27	27	30	33	36	39	42	45	45	48	
260	255	245	240	230	225	215	205	195	190	180	170	165	160	150	145	140	6	9	12	15	15	18	21	24	27	27	30	33	36	36	39	42	45	6
285	275	270	260	250	245	235	230	220	210	200	190	180	175	170	160	155	6	9	12	12	15	18	18	21	24	27	27	30	33	33	36	39	42	Inch
310	300	290	280	275	265	260	250	240	230	220	215	205	195	185	180	170	6	9	9	12	15	15	19	21	21	24	27	27	30	33	33	36	36	Camera
330	320	310	300	295	285	280	270	260	250	240	230	225	215	205	195	190	5*	6	9	12	12	15	15	18	21	21	24	27	27	30	30	33	36	
355	345	335	325	315	310	300	290	280	270	260	250	240	230	225	215	205	5*	6	9	9	12	12	15	18	18	12	21	24	27	27	30	30	33	
380	370	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220	5*	6	9	9	12	12	15	15	18	18	21	21	24	27	27	30	30	
Airplane's Altimeter Reading (1,000 Ft.)—Altimeter Set at 29.92" Hg.																	Altitude Above Ground—1,000 Ft.																
6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	
180	170	165	160	155	150	145	140	130	125								5*	6	9	9	12	12	15	15	18	18	21	21	24	27	27	30	30	
210	200	195	185	180	170	165	160	150	145	140	135	125					4*	6	6	9	9	12	12	15	15	18	18	21	21	24	24	27	27	
235	230	220	215	205	195	185	180	170	165	160	150	145	140	135	125		4*	5*	6	9	9	9	12	12	15	15	18	18	18	21	21	24	24	
260	255	245	240	230	225	215	205	195	190	180	170	165	160	150	145	140	3"	5*	6	6	9	9	9	12	12	15	15	15	18	18	21	21	21	12
285	275	270	260	250	245	235	230	220	210	200	190	180	175	170	160	155	3"	4*	5*	6	6	9	9	12	12	12	15	15	15	18	18	18	21	Inch
310	300	290	280	275	265	260	250	240	230	220	215	205	195	185	180	170	3"	4*	5*	6	6	9	9	9	12	12	12	15	15	15	18	18	18	Camera
330	320	310	300	295	285	280	270	260	250	240	230	225	215	205	195	190	3"	4*	5*	5*	6	6	9	9	9	12	12	12	15	15	15	15	18	
355	345	335	325	315	310	300	290	280	270	260	250	240	230	225	215	205	3"	3"	4*	5*	6	6	9	9	9	9	12	12	12	15	15	15	15	
380	370	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220	2"	3"	4*	5*	5*	6	6	9	9	9	9	12	12	12	15	15	15	
Airplane's Altimeter Reading (1,000 Ft.)—Altimeter Set at 29.92" Hg.																	Altitude Above Ground—1,000 Ft.																
6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	
180	170	165	160	155	150	145	140	130	125								2"	3"	4*	5*	5*	6†	6†	9	9	9	9	12	12	12	15	15	15	
210	200	195	185	180	170	165	160	150	145	140	135	125					2"	3"	4*	4*	5*	6†	6†	6†	9	9	9	9	12	12	12	12	12	
235	230	220	215	205	195	185	180	170	165	160	150	145	140	135	125		2"	3"	3"	4*	4*	5*	6†	6†	6†	9	9	9	9	9	12	12	12	24
260	255	245	240	230	225	215	205	195	190	180	170	165	160	150	145	140	2"	2"	3"	3"	4*	5*	5*	6†	6†	6†	9	9	9	9	9	9	12	Inch
285	275	270	260	250	245	235	230	220	210	200	190	180	175	170	160	155	2"	2"	3"	3"	4*	4*	5*	5*	6†	6†	6†	6†	9	9	9	9	9	Camera
310	300	290	280	275	265	260	250	240	230	220	215	205	195	185	180	170	1"	2"	2"	3"	3"	4*	4*	5*	5*	6†	6†	6†	6†	9	9	9	9	
330	320	310	300	295	285	280	270	260	250	240	230	225	215	205	195	190	1"	2"	2"	3"	3"	4*	4*	5*	5*	5*	6†	6†	6†	6†	9	9	9	
355	345	335	325	315	310	300	290	280	270	260	250	240	230	225	215	205	1"	2"	2"	3"	3"	3"	4*	4*	5*	5*	5*	6†	6†	6†	6†	9	9	
380	370	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220	1"	1"	2"	2"	3"	3"	4*	4*	4*	5*	5*	5*	6†	6†	6†	6†	9	

To determine intervalometer setting: (1) Find airplane's altimeter reading in left hand side of table; (2) Follow down to first indicated airspeed higher than airplane's airspeed; (3) Follow across horizontal to intervalometer setting below distance above the ground.

Time intervals marked (*) are too short for type B-2 intervalometer use, but may be used on runaway operation.

Time intervals marked (") are too short even for runaway operation with K-17B camera.

Time intervals marked (†) are too short for runaway operation with K-18 camera.

FIGURE 34—INTERVALOMETER SETTING (60% Over Lap)

APPENDIX I

U.S.A. - BRITISH GLOSSARY OF NOMENCLATURE

U. S. A.	BRITISH
Accumulator (hydraulic)	Should not be confused with electrical accumulator or battery
Battery (electrical)	Electrical accumulator
Check valve (hydraulic)	Non-return valve
Cylinder (hydraulic)	Jack
Flight Indicator	Artificial horizon
Gross weight	All up weight
Gyro horizon	Artificial horizon
Gyro pilot	Automatic pilot
Manifold pressure	Boost
Outboard Panel	Outer plane
Propeller	Airscrew
Recticule (gun sight, etc.)	Graticule
Tachometer	Engine speed indicator
Turn indicator	Direction indicator
Valve (fuel or oil)	Cock
Weight empty	Tare