PILOT'S FLIGHT OPERATING INSTRUCTIONS FOR THE

Valiant

ARMY MODEL

BT-13, BT-13A, BT-13B & BT-15 AIRPLANES

NAVY MODEL

SNV-1 & SNV-2 AIRPLANES

APRIL 1, 1945

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INTRODUCTION

The purpose of this handbook is to convey information to operators of all models of Consolidated Vultee basic trainers, relative to a complete description of the airplanes, their flying characteristics and flight restrictions and limitations. Additional information relating to the precautionary emergency operations and equipment use is included, as well as various flight operating charts and tables, for the summary of flight operation procedures.

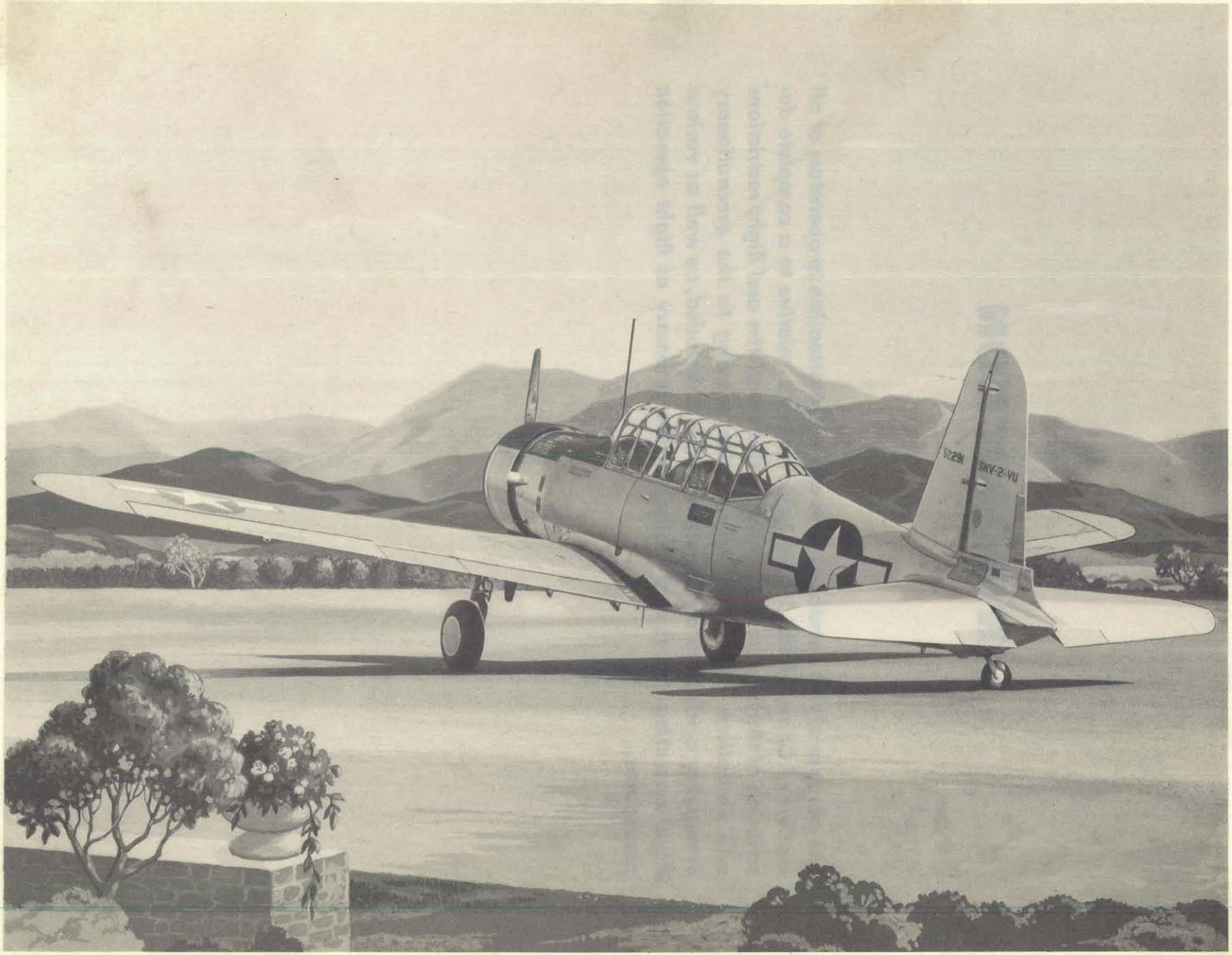


Figure 1—Rear Three-Quarter View of Complete Airplane

SECTION I
GENERAL DESCRIPTION

1. AIRPLANE.

All models of the Consolidated Vultee Basic Trainer Airplane are a two-place, low wing, land monoplane. These airplanes are equipped with a fixed landing gear, hydraulic wheel brakes, steerable tail wheel and manually operated slotted type wing flaps. Access to the airplane is provided by sliding enclosure sections. The overall dimensions are:

	BT-13	*BT-13A (SNV-1)*	*BT-13B (SNV-2)*	*BT-15*
Length	28′10″	28′10″	28′8½″	29′1″
Height	12′4⅜″	12′4⅜″	12′4⅜″	12′4⅜″
Span	42′0″	42′0″	42′2″	42′0″

Note

The BT-13A and SNV-1 airplanes are identical. Also, the BT-13B and SNV-2 airplanes are the same. All following data concerning BT-13A and BT-13B airplanes will apply to their respective SNV designations.

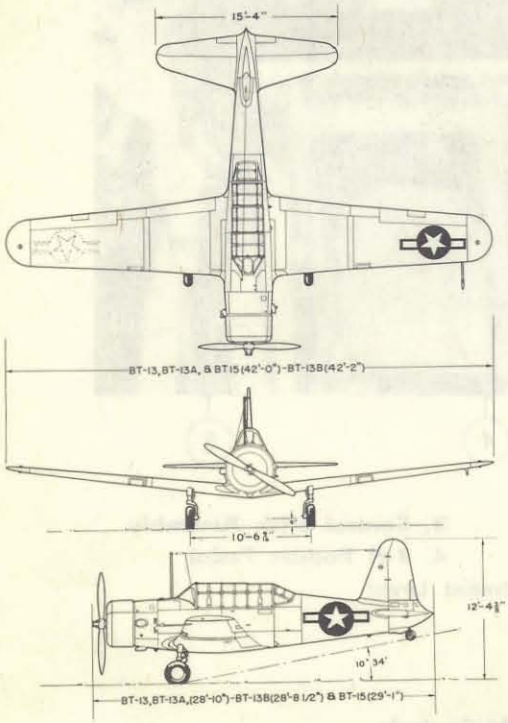


Figure 2—Airplane Three-View

2. ENGINES.

Refer to Section III for details on engines and propellers.

a. BT-13, BT-13A, BT-13B.—Pratt and Whitney R-985-25, R-985-AN-1 or AN-3.

b. BT-15.—Wright R-975-11.

3. ARRANGEMENT.

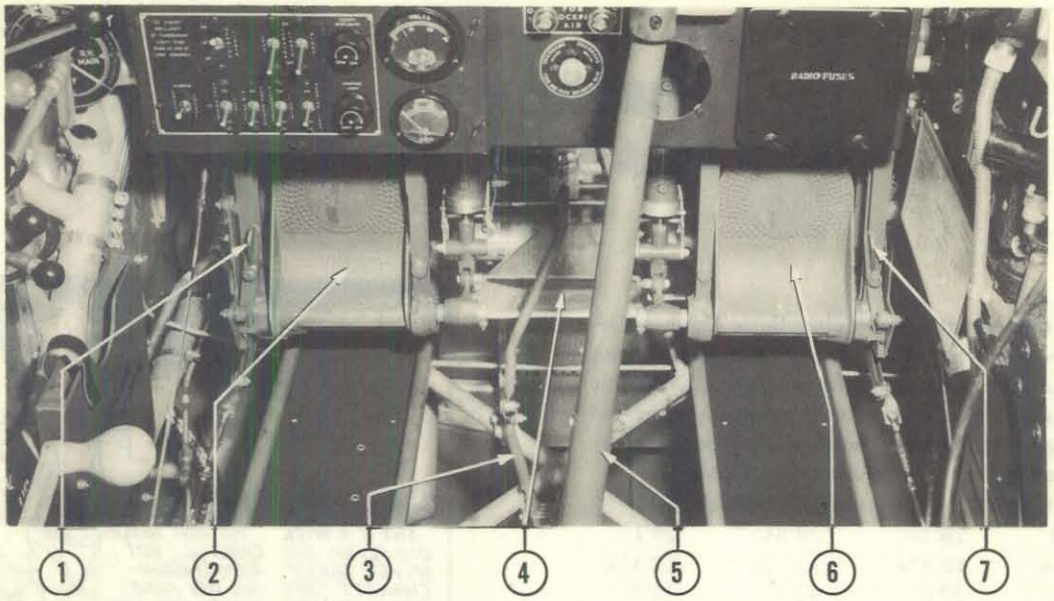
The Basic Trainer airplane is of the scout and training type and may be operated from either cockpit, although it is not entirely dual control. Complete command of the engine, electrical system, radio and surface control lock are *not* provided in the rear cockpit.

4. ELECTRICAL SYSTEM.

A 24-volt electrical system is used on all BT-13B airplanes, while all other models of the BT airplane use a 12-volt electrical system.

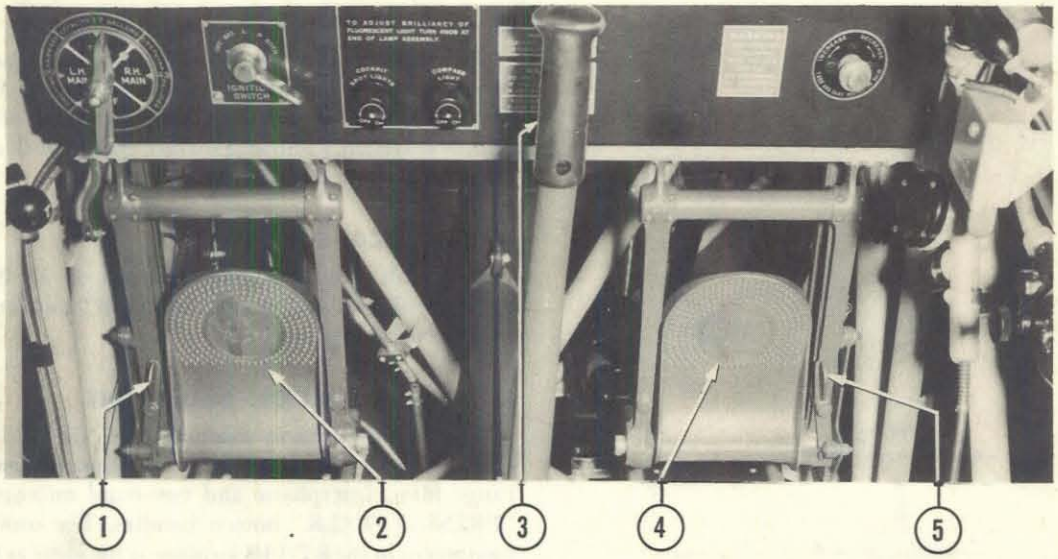
5. COMMUNICATION EQUIPMENT.

The communication equipment in all BT-13, BT-13A and BT-15 airplanes consists of a command set SCR-183, range filter, interphone and two-hand microphones with "PRESS-TO-TALK" button handles. The communication equipment in the BT-13B airplane is the same as listed above except that the command set is type SCR-274-N and a Marker Beacon Receiver and antenna has been added.



1. L-H Rudder Pedal Adjustment Lever
2. L-H Rudder Pedal
3. Surface Control Lock—Stowed
4. Cockpit Hot and Cold Air Diffuser
5. Control Stick Assembly
6. R-H Rudder Pedal
7. R-H Rudder Pedal Adjustment

Figure 3—Front Cockpit Flight Controls



1. L-H Rudder Pedal Adjustment Lever
2. L-H Rudder Pedal
3. Control Stick Assembly
4. R-H Rudder Pedal
5. R-H Rudder Pedal Adjustment Lever

Figure 4—Rear Cockpit Flight Controls

SECTION II
COCKPIT CONTROLS

1. SURFACE CONTROLS.

Complete dual flight controls in the form of conventional sticks and rudder pedals are provided. The rudder and elevators are provided with trim tabs controllable from either cockpit. The wing flaps are equipped with manual controls in the form of a handcrank in each cockpit.

a. RUDDER.—The rudder is controlled by conventional rudder pedals installed in both cockpits. The pedals in the front cockpit are interconnected with those in the rear cockpit and move together.

(1) RUDDER PEDAL ADJUSTMENT.—The rudder pedals in both cockpits are adjustable to meet the crew's convenience. To move the pedals to the desired length, kick the latch control lever (located on the outboard side of each pedal) free from the rudder pedal adjustment plates. This will release the pedals for fore-and-aft movement so that they can be adjusted to the proper stop holes in the adjustment plates. *(Figure 5.) PEDALS MUST BE ADJUSTED TO THE SAME LENGTH.* To apply brakes, use toe action on the pedals.

Figure 5—Rudder Pedal Adjustment

(2) RUDDER TRIM TAB.—The rudder trim tab is adjusted by the *outboard* wheel of the tab control unit, mounted to the left of the pilot in both cockpits. Rotate the wheel *forward* to nose the plane to the *right; aft* to nose the plane to the *left. (Figure 11-4.)*

b. ELEVATORS.—Conventional fore-and-aft movement of the control stick operates the elevators.

(1) ELEVATOR TRIM TABS.—Elevator trim tabs are adjusted by the *inboard* wheel of the tab control unit. Rotate the wheel *forward* for *nose-down; aft* for *nose-up. (Figure 11-6.)*

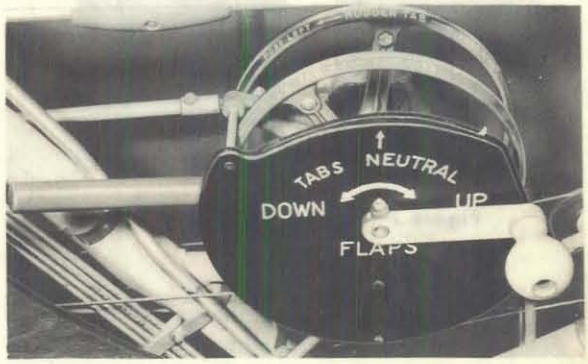


Figure 6—Trim Tab, Landing Flaps and Emergency Fuel Pump Control Unit

Note

During night flying, the position of rudder and elevator tabs may be determined by feeling the spoke bolts on respective tab wheels. If they are at the *top center* of the wheel arcs, the rudder and elevator tabs are in the "NEUTRAL" position.

c. AILERONS.—Conventional left-and-right movement of the control stick operates the ailerons.

(1) AILERON TRIM TABS.—Aileron trim tabs located on both the left and right wings are adjustable on the ground *only.* If the plane is left wing heavy, *raise* the left tab and *lower* the right tab *equal* amounts until proper lateral trim has been reached.

d. SURFACE CONTROL LOCK.—The surface control lock is located on the front cockpit floor just forward of the control stick. To lock the surface controls, *centralize* the rudder pedals and move the control stick to the forward

central position. Pull the lock arm free of its anchor clip and engage it to the control stick. To unlock the controls, release the lock arm from stick and *force* the arm into the *anchor clip. (Figures 7 & 8.)*

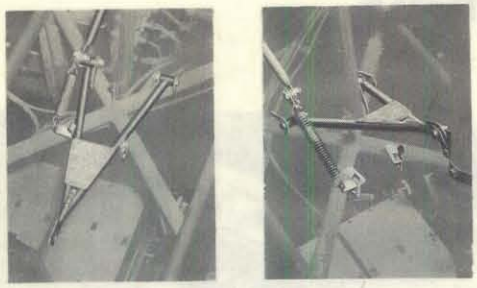


Figure 7—Surface Control Lock

CAUTION

In the UNLOCKED position the surface control lock yoke must be *securely* stowed in the anchor clips. If it is not anchored *firmly,* any severe jolt of the plane might throw the yoke up far enough to completely *freeze* the rudder controls.

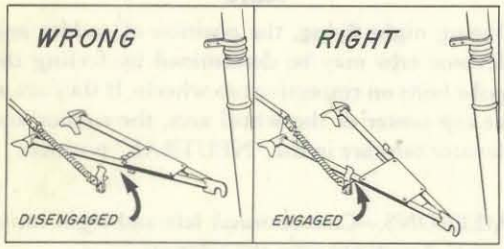


Figure 8—Proper Method of Stowing Surface Control Lock

e. WING FLAPS.—Wing flaps are controlled by a crank concentric with the trim tab unit at the left of each pilot's seat. To *raise* the flaps, rotate the operating crank clockwise (forward). To *lower* the flaps, rotate the crank counterclockwise (back). Use the double arrowed line as a guide to your "DOWN" and "UP" positions. *(Figure 11-7.)* The flap position pointer that indicates the degree of flaps you are using is operative when the flaps are more than 2 degrees open and will show full "UP" when the flaps are closed. One turn of the flap handle equals 2 degrees. DO NOT LOWER FLAPS AT SPEEDS ABOVE 120 MPH.

Note

Use of 20 to 30 degrees of flaps is recommended for take-offs. Length of take-off run will be less if flaps are used. The amount of flaps used for landing depends on size and condition of landing field, wind conditions or desire of the pilot.

2. POWER PLANT CONTROLS.

a. ENGINE CONTROL UNIT.—The engine control unit, located on the left side of both cockpits, houses the conventional throttle, mixture and propeller controls. *(Figure 9.)*

Figure 9—Engine Control Unit

(1) THROTTLE.—The throttle is on the *outboard* side of the engine control unit. Push forward to open throttle, and move aft to close throttle. *(Figure 11-8.)*

(2) MIXTURE CONTROL.—The mixture control, in *center* of engine control unit, has a ratchet lock on the FRONT cockpit unit which locks the mixture control lever in the full rich position. This lock must be disengaged in order to move the lever aft to lean the mixture, or to stop the engine by moving the lever to the extreme aft "IDLE CUT-OFF" position. This lock is installed so the mixture control lever is not moved to the "IDLE CUT-OFF" position by mistake. Thus *complete* command of the mixture control is provided in the *front cockpit only.* The mixture can be *enriched only* and not *leaned* in the rear cockpit. *(Figure 11-13.)*

Note

The engine should be stopped by moving the mixture control lever to the "IDLE CUT-OFF" position, and not by turning the ignition switch "OFF." The ignition switch is turned "OFF" *only* after the propeller has stopped turning.

(3) PROPELLER CONTROL.—The propeller control is located on the *inboard* side of the engine control unit. To "INCREASE" engine rpm (low pitch), move the propeller control *forward;* to "DECREASE" engine rpm (high pitch), move propeller control *aft. (Figure 10.)* The propeller is put in low pitch for take-offs, maximum climbs, approaches and landings. The high pitch position is used for slow climbs, cruising, high speed, and before stopping engine.

Figure 10—Close Up of Propeller Control

WARNING

Pilot is cautioned not to *mistake* the Mixture Control for the Propeller Control in changing from *low* to *high* pitch. If this error occurs the Mixture Control will be in the "IDLE CUT-OFF" position, causing the engine to *stop immediately.*

b. EMERGENCY FUEL PUMP.—The operating handle *(Figure 11-5)* is on the tab control unit to the left of the pilot in both cockpits. Move handle *"up"* and *"down"* to operate. This fuel pump is used to build up fuel pressure when starting the engine, and may be used in case of emergency, due to lack of fuel pressure, during flight.

CAUTION

Do *not* pump handle too *rapidly* or an air lock in the fuel line will result.

c. OIL COOLER AIR SCOOP CONTROL.—The air scoop is regulated by a lever forward and below the engine control unit on the left side of the cockpit. *(Figure 11-10.)*

(1) EARLY MODELS.—Both cockpits.

(2) LATER MODELS.—Front cockpit only.

(3) LATEST MODELS.—Not installed.

Note

To INCREASE oil temperature, move control lever *aft;* to DECREASE oil temperature, move lever *forward.*

d. CARBURETOR HEAT.—The carburetor heat is regulated by a lever forward and below the engine control unit on the left side of the front cockpit (both cockpits on Early Models). To INCREASE temperature of air entering the carburetor, move the lever *aft;* to DECREASE temperature of air, move the lever *forward. (Figure 11-12.)*

CAUTION

The lever should be set in the "COLD" position while starting the engine and during flight under normal weather conditions. However, if weather indicates danger of ice formation, the air heater should be partially opened. Watch the carburetor mixture gage to maintain the proper mixture as it is subject to rapid change during take-off. Rough engine, loss of power, and/or black smoke during flight may indicate ice is forming in the carburetor. In such an event, move the lever to "HOT" to remove ice, then move lever *forward* until proper mixture is indicated on carburetor mixture gage (+3°C.).

e. ENGINE PRIMER.—The engine primer is mounted on the upper right side of the trim panel in the *front* cockpit only. *(Figure 13-13.)*

(1) OPERATION.—Push handle of primer "IN" and turn counterclockwise to *unlock.* Build up fuel pressure with emergency fuel pump, and at the same time move primer back and forth until it is evident fuel is in the primer line.

(2) AMOUNT OF PRIME.—If both engine and weather are cold, four to six strokes of the primer will be necessary, while little or no prime will be needed for a hot engine.

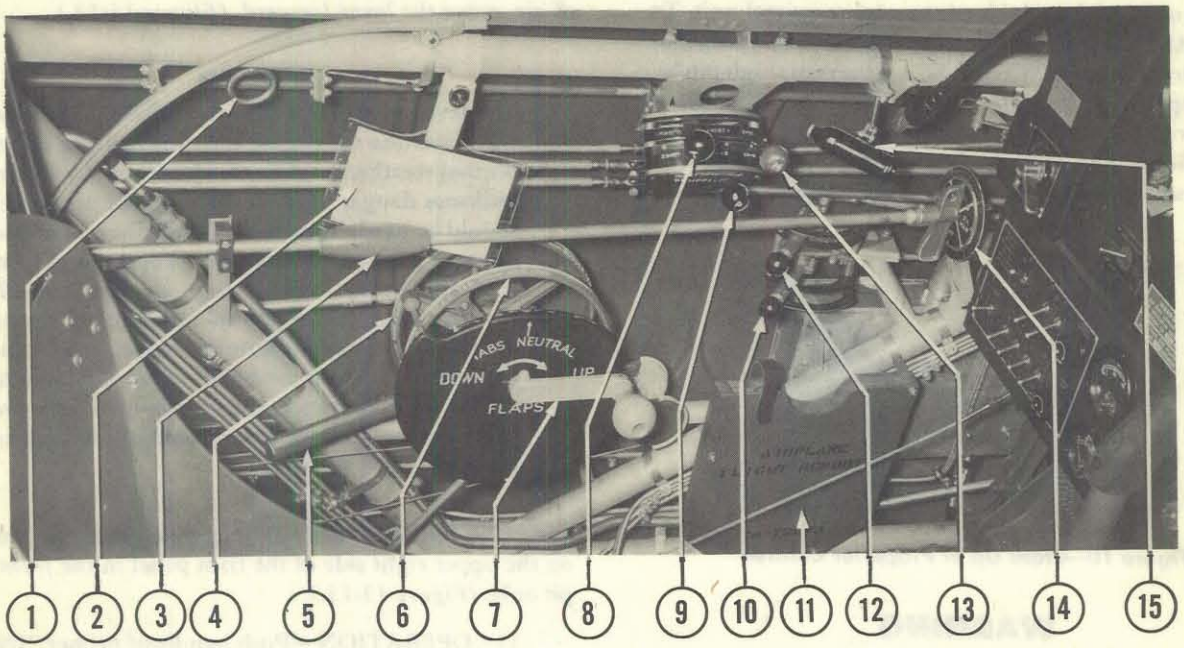
Note

The primer must be *closed* and *locked* after priming of engine is completed.

(3) OVER-PRIMING.—If engine is over-primed, place mixture control in "IDLE CUT-OFF," open throttle wide and turn the engine over several revolutions by hand with the ignition switch "OFF."

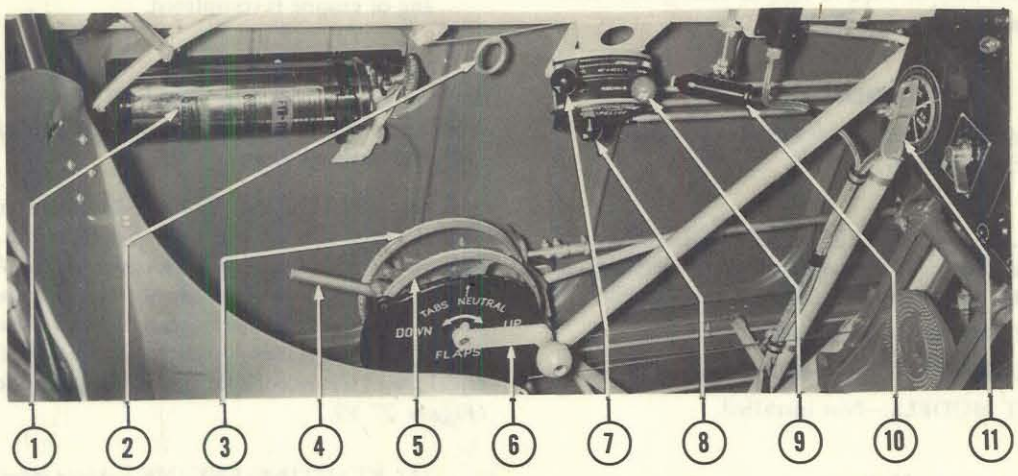
f. OIL DILUTION.—The oil dilution control is located on the right side of the trim panel in the front cockpit only in all BT-13 and BT-13A airplanes. *(Figure 13-27.)* This control is on the left side of the trim panel (front cockpit only) in the BT-15 airplanes. The oil dilution switch on the BT-13B airplanes is located on the left side of the electrical panel (front cockpit only) and is electrically operated. *(Figure 27-59.)*

(1) STARTING ENGINE.—After starting the engine and the weather is very cold, if a heavy viscous oil is indicated by excessive oil pressure, or by oil pressure that fluctuates or falls back when the engine rpm is increased, use the oil dilution control to dilute the oil to correct this condition. Over-dilution will result in a steady low pressure. Over-dilution is not considered serious, however, as there is a tendency for the diluting fuel to evaporate from the oil about as fast as it can be added, when dilution is beyond a reasonable amount.



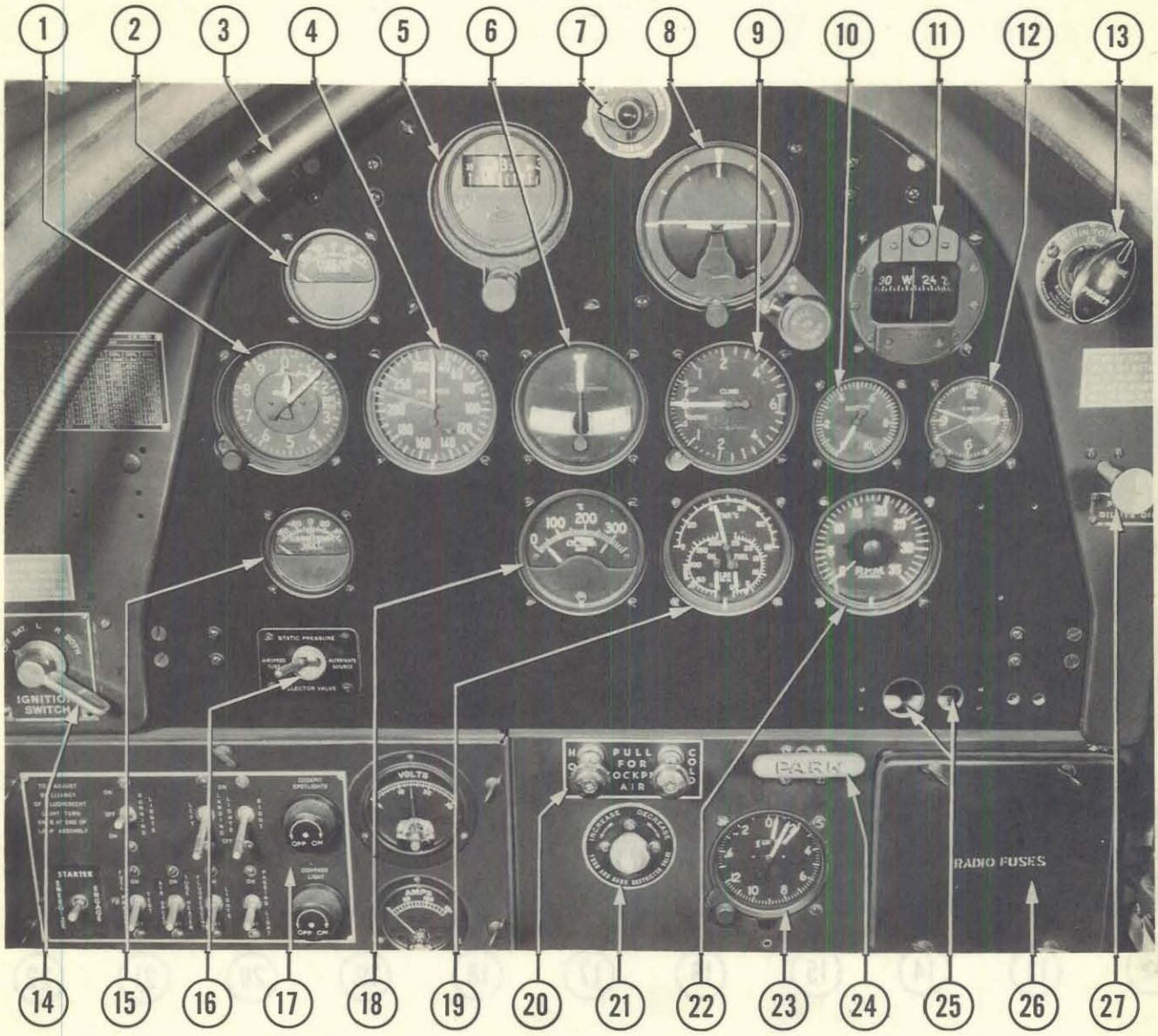
1. Blind Flying Hood Release
2. Pilot's Check List
3. Extension Handle-Fuel Selector Valve Control
4. Rudder Tab Control
5. Emergency Fuel Pump Lever
6. Elevator Tab Control
7. Wing Flaps Control Handle
8. Throttle Control
9. Propeller Pitch Control
10. Oil Cooler Shutter Control (if installed)
11. Flight Report Holder
12. Carburetor Air Control
13. Mixture Control
14. Fuel Tank Selector Valve Control
15. Cockpit Spotlight

Figure 11—Front Cockpit Arrangement and Controls—Left Side



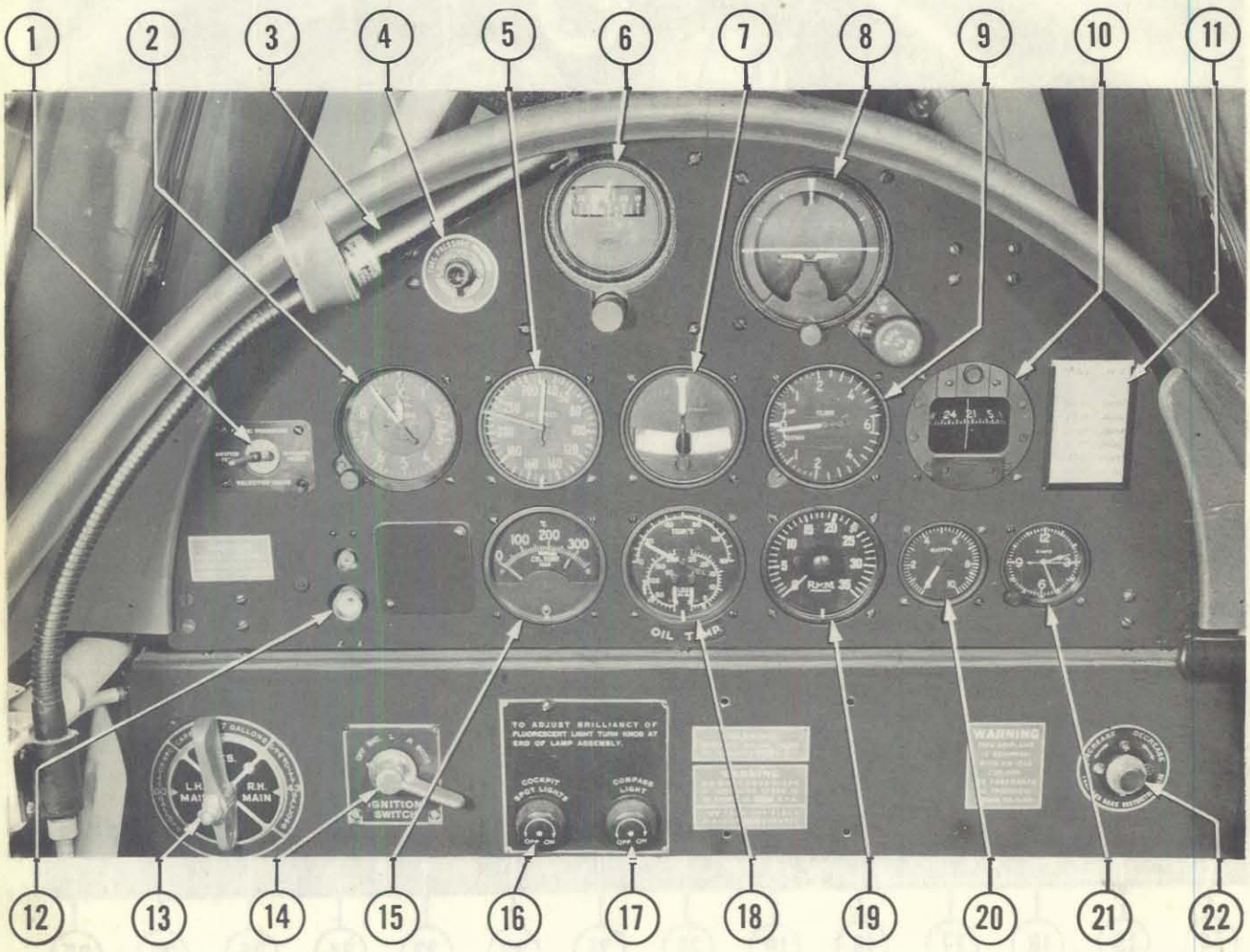
1. Fire Extinguisher
2. Blind Flying Hood Release
3. Rudder Tab Control
4. Emergency Fuel Pump Lever
5. Elevator Tab Control
6. Wing Flaps Control Handle
7. Throttle Control
8. Propeller Pitch Control
9. Mixture Control
10. Cockpit Spotlight
11. Fuel Tank Selector Valve Control

Figure 12—Rear Cockpit Arrangement and Controls—Left Side



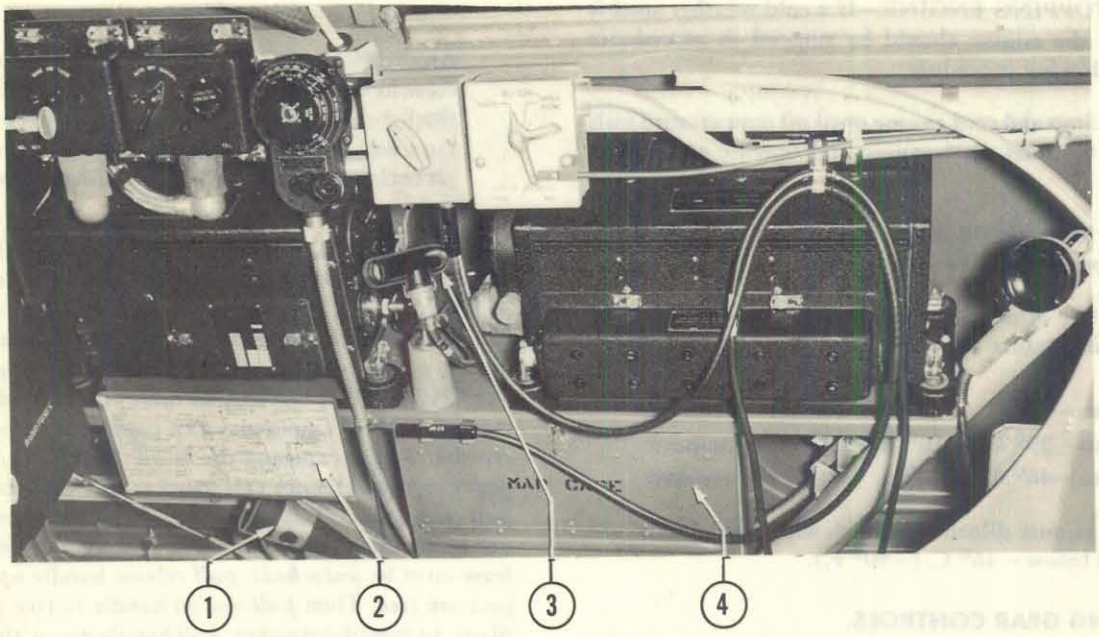
1. Altimeter
2. Free Air Temperature (if installed)
3. Fluorescent Lamp (if installed)
4. Air-Speed Indicator
5. Turn Indicator
6. Bank and Turn Indicator
7. Fuel Pressure Warning Lamp
8. Flight Indicator
9. Rate of Climb Indicator
10. Suction Gage
11. Compass
12. Clock
13. Engine Primer
14. Ignition Switch
15. Mixture Temperature
16. Static Pressure Valve (if installed)
17. Electrical Control Panel
18. Cylinder Head Temperature
19. Engine Gage Unit
20. Cockpit Hot and Cold Air Controls
21. Vacuum Restrictor Valve (various locations)
22. Tachometer
23. Accelerometer (if installed)
24. Parking Brake Handle
25. Spare Lamps (various locations)
26. Radio Fuse Box (early models)
27. Oil Dilution Control (left side on BT-15)

Figure 13—Front Cockpit Instrument Panel



1. Static Pressure Valve (if installed)
2. Altimeter
3. Fluorescent Lamp (if installed)
4. Fuel Pressure Warning Lamp
5. Air-Speed Indicator
6. Turn Indicator
7. Bank and Turn Indicator
8. Flight Indicator
9. Rate of Climb Indicator
10. Compass
11. Compass Correction Chart
12. Spare Lamps
13. Fuel Selector Valve Control
14. Ignition Switch
15. Cylinder Head Temperature
16. Cockpit Spotlight Rheostat
17. Compass Lamp Rheostat
18. Engine Gage Unit
19. Tachometer
20. Suction Gage
21. Clock
22. Vacuum Restrictor Valve (various locations)

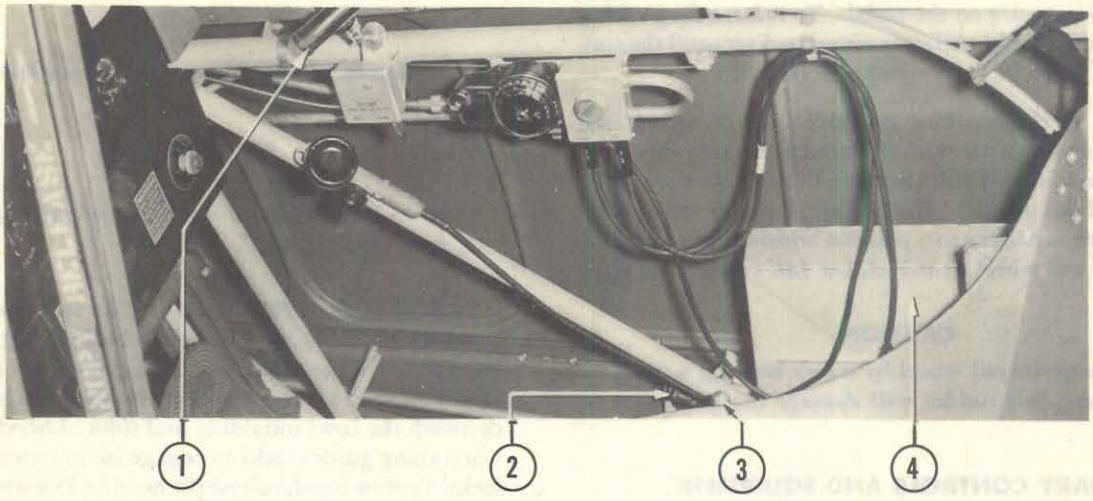
Figure 14—Rear Cockpit Instrument Panel



1. Relief Tube
2. Fuel System Diagram
3. Cockpit Spotlight
4. Map Case

Refer to Fig. 30 for Radio Information

Figure 15—Front Cockpit Arrangement and Controls—Right Side



1. Cockpit Spotlight
2. Relief Tube
3. Seat Height Adjustment Lever
4. Data Case

Refer to Fig. 31 for Radio Information

Figure 16—Rear Cockpit Arrangement and Controls—Right Side

(2) STOPPING ENGINE.—If a cold weather start is anticipated, the engine should be stopped in accordance with the following procedure.

(a) Stop and cool engine until oil temperature falls below 40° C.; then start engine and operate at 1000 to 1200 rpm.

(b) Maintain oil temperature below 50° C. (122° F.) and oil pressure above 15 psi.

(c) Use dilution control for a length of time indicated for temperature expected.

4° to −12° C. (40° to 10° F.)—3 minutes
−12° to −29° C. (10° to −20° F.)—6 minutes
−29° to −46° C. (−20° to −50° F.)—9 minutes

Add 1 minute dilution for each additional 5° C. (9° F.) below −46° C. (−50° F.).

3. LANDING GEAR CONTROLS.

All models of the BT airplane are equipped with a fixed landing gear.

a. WHEEL BRAKES.—Individual toe pedals on the rudder pedals control the hydraulic wheel brakes. The wheel brakes can be operated from *either* cockpit.

b. PARKING BRAKE.—The parking brake is controlled by the red painted handle marked "PARK" located on the upper right portion of the electrical control panel in the front cockpit *only. (Figure 13-24.)* To *lock* the parking brake, *pull* the control handle out, *press* both brake pedals, then *release* pressure on the pedals. To *release* the parking brake, *press* the brake pedals in either cockpit until the control handle snaps in; then release the pedals.

c. TAIL WHEEL.—The steerable, self-centering tail wheel is interconnected with the rudder through shock absorber springs and provides steering throughout the rudder arc. Beyond this arc, the wheel is free to swivel and will reengage when it returns to a position within the rudder arc. To free the tail wheel to swivel, use *full* rudder and *light* braking.

CAUTION

Releasing the tail wheel by *severe* braking without using *full* rudder will *damage* the mechanism.

4. AUXILIARY CONTROLS AND EQUIPMENT.

a. ACCESS TO AIRPLANE.—A step and hand grip are provided on the left side of the fuselage. To enter the front cockpit, turn the handle located on the upper forward edge of the front cockpit enclosure, freeing it to slide aft. Entrance to the rear cockpit is gained in the same manner except that the handle is located on the upper rear edge of the rear cockpit enclosure, freeing it to slide forward. The latch mechanisms can be operated from both the inside and the outside of the cockpit enclosures.

Note

An overturn structure is provided to protect the crew in case of a "nose-over." This inverted "V" shaped structure is a part of the steel tube fuselage, and extends upward to the top of the cockpit enclosure, between the front and rear cockpits.

b. EMERGENCY EXIT OR ACCESS TO AIRPLANE.—For emergency exit or access to the airplane, use the emergency exit panel release incorporated in both sides of the fore-and-aft cockpit enclosures. To *unlock* emergency exit panel, *push* locking cross bar *up,* covering the word "LOCKED." This can only be done on the inside of the enclosure. To *lock* emergency exit panel release *push* locking crossbar *down,* exposing the word "LOCKED." For emergency exit (emergency exit panel release must be *unlocked) pull* release handle *down* until latch pins are free, then *push out* on handle. To obtain access (emergency exit panel release must be *unlocked), pull* release handle *up* until latch pins are free. Then *pull out* on handle to free panels from plane. In case of nose-over, *pull* handle *down,* then *pull out.*

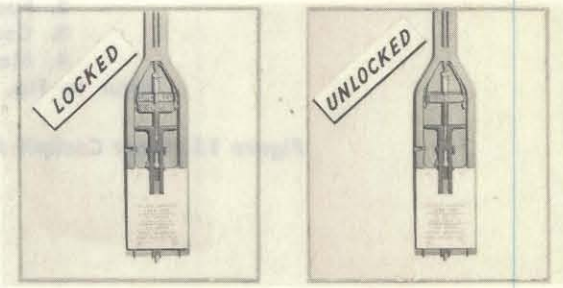


Figure 17—Emergency Exit Panel Release

WARNING

Always "UNLOCK" emergency exit panels before take-off.

c. BLIND FLYING HOOD.—This is stowed aft of the rear cockpit. To place the hood in blind flying position, release the stowage straps and swing hood up and forward on the guide tracks, until center of hood can be passed underneath the cowl moulding and sides of hood pushed forward along guide tracks to engage in the extended position locks. To stow hood, release the hood locks with the red pull-ring, located at the left side of both cockpits. *(Figure 11-1.)* After hood is released, slide bows to bottom of guide tracks and then *secure* with stowage straps.

d. SHOULDER HARNESS CONTROL.—A short lever at the left of each seat releases the shoulder harness for limited fore-and-aft movement. Pull the lever *up* to release harness for movement; push lever *down* to lock harness to the seat.

WARNING

If flying solo, check the rear cockpit to make sure that safety belt, blind flying hood, shoulder harness and headset cord are *securely stowed.* If they are not, a *fouling* of the control cables is possible.

e. COCKPIT SEAT ADJUSTMENT.—A short hand lever at the right side of each seat is the seat adjustment lock handle. To adjust the seat height, *pull* the handle *up,* thus releasing the seat lock; then raise or lower the seat to the desired height. To *lock* the seat in position, push the lock handle *down. (Figure 16-3.)*

f. HEATING AND VENTILATING SYSTEM.—Heating and ventilating control handles are in the upper center of the electrical and control panel, in the front cockpit only. Pull *out* on the control handles marked "HOT" and "COLD" to obtain quantity and temperature of air desired. *(Figure 13-20.)*

g. VACUUM RESTRICTOR VALVE.—A vacuum restrictor valve is installed in both cockpits. This valve allows adjustment of the TURN INDICATOR; thus the needle can be adjusted, by use of this valve, to give the proper rate of turn necessary in instrument flying.

WARNING

A static pressure selector valve and vacuum selector valve may be found on the instrument panels of early models. These alternate sources were not installed on later models. It should be assumed that these alternate sources are NOT in working order, if these valves are installed on the instrument panel, until a *careful* check of the systems proves otherwise.

h. EQUIPMENT.

(1) HAND FIRE EXTINGUISHER.—The hand fire extinguisher is located to the left of the seat in the rear cockpit *(Figure 12-1).* To *release* fire extinguisher from the metal holder, inside the cockpit, pull *up* on latch. The extinguisher is also accessible from outside the cockpit through a red painted door located just below the left rear panel of the rear canopy enclosure. Release fasteners from upper corners of the door and door will drop open.

Note

The hand fire extinguisher is provided for use on the ground. It is unsuitable for combating a fire outside the fuselage during flight. Read the directions for using the fire extinguisher so you will be able to handle it *efficiently* in case of fire.

(2) BAGGAGE COMPARTMENT.—The baggage compartment, located aft of the rear cockpit, is accessible through a door on the left side of the fuselage, just forward of the monocoque section. This compartment is to carry personal belongings, cushions, mooring equipment, engine cover, and the like.

CAUTION

Under *no* circumstances should containers, tools, or other objects, which have sharp edges or corners that may *pierce* the fabric, be carried in the baggage compartment unless they are *safely* and *securely* wrapped and tied down.

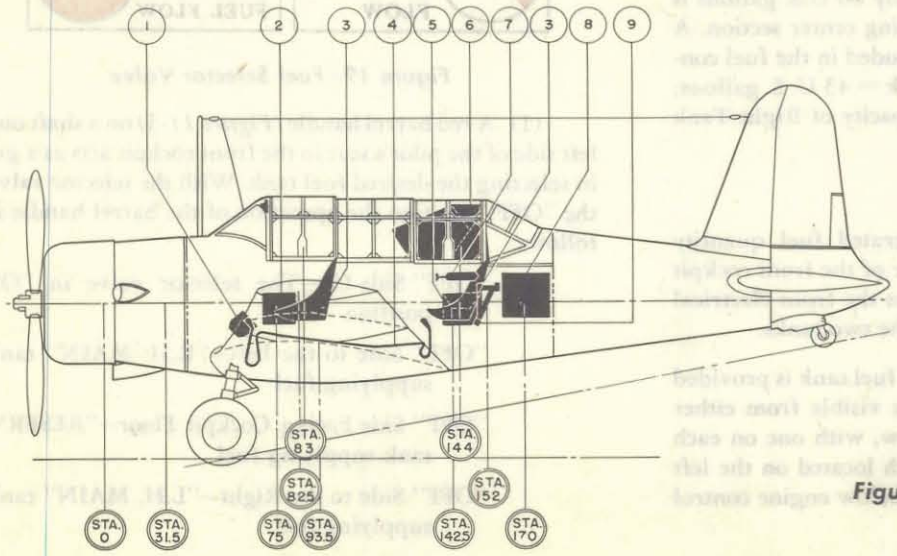
(3) RELIEF TUBES.—Pilot relief tubes are located to the right of the pilot in both cockpits. *(Figure 15-1.)*

(4) FLIGHT REPORT HOLDER.—The flight report holder is located at the left side of the front cockpit. *(Figure 11-11.)*

(5) MAP CASE.—A map case is provided at the right side of the front cockpit. *(Figure 15-4.)*

(6) DATA CASE.—A data case is provided at the right side of the rear cockpit. *(Figure 16-4.)*

(7) MOORING EQUIPMENT.—A type D-1 mooring kit and engine cover is stowed in the baggage compartment.



1. Flight Report Holder
2. Map Case
3. Cockpit Seats
4. Relief Tubes
5. Data Case
6. Blind Flying Hood
7. Fire Extinguisher
8. Baggage Compartment
9. Manual Starter Crank

Figure 18—Fuselage Contents Diagram

SECTION III

POWER PLANTS

1. ENGINES.

a. PRATT AND WHITNEY (R-985-25, R-985-AN-1 or AN-3).—BT-13, BT-13A and BT13B airplanes are powered by Pratt and Whitney R-985 nine-cylinder, radial, air-cooled, direct drive engines developing 450 HP at sea level with a compression ratio of 6:1 and impeller gear ratio of 10.12:1.

b. WRIGHT.—The B-15 airplane is powered by a Wright R-975-11, nine-cylinder, radial, air-cooled, direct drive engine developing 440 HP at sea level with a compression ratio of 6.3:1 and an impeller gear ratio of 10.15:1.

2. PROPELLERS.

a. METAL.—All metal propellers installed on BT airplanes are Hamilton Standard, two-blade, hydro-controllable, two-position type, nine feet in diameter.

b. WOODEN.—Wooden propellers are basically the same as the metal propeller, except the blades are wood.

3. FUEL AND OIL.

a. FUEL.—Specification AN-F-25.
Octane 87

b. OIL.—Specification AN-VV-0-446.
Viscosity 1120 (summer operation)
1100A (winter operation)

4. FUEL SYSTEM. *(Figures 20 & 21.)*

a. FUEL QUANTITIES.—Fuel is carried in two integral tanks having a total capacity of approximately 120 U.S. gallons. One fuel tank of approximately 60 U.S. gallons is an integral part of each side of the wing center section. A "RESERVE" of 17 U.S. gallons is included in the fuel content of the "RIGHT" tank (Right Tank = 43 U. S. gallons; Reserve = 17 U.S. gallons; Total Capacity of Right Tank = 60 U.S. gallons).

b. FUEL QUANTITY GAGES.

(1) BT-13.—An electrically operated fuel quantity gage is located in the lower left corner of the front cockpit instrument panel. A selector switch on the front electrical panel provides selective readings on the two tanks.

(2) BT-13A AND BT-15.—Each fuel tank is provided with a mechanical actuated fuel gage visible from either cockpit. These gages are located below, with one on each side of the front cockpit seat. A switch located on the left side of the front cockpit forward and below engine control unit provides gage illumination.

(3) BT-13B.—Each fuel tank is provided with a mechanical actuated fuel gage visible from either cockpit. These gages are located below with one on each side of the front cockpit seat. A switch on the electrical panel in the front cockpit provides gage illumination.

Note

Accurate readings are obtained *only* when the thrust line is *level.*

c. FUEL SELECTOR VALVE.—The fuel selector valve *(Figure 19)* permits fuel to be drawn selectively from either the left or right main tank or from the reserve tank. Its operation is controlled by a fuel selector valve handle located to the left of the instrument panel in both cockpits. The "pointer" end of the fuel selector valve handle should rest *flush* on the red tab marking of the desired tank for unrestricted fuel flow.

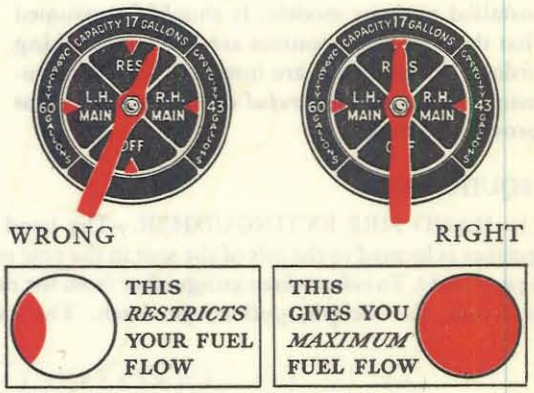


Figure 19—Fuel Selector Valve

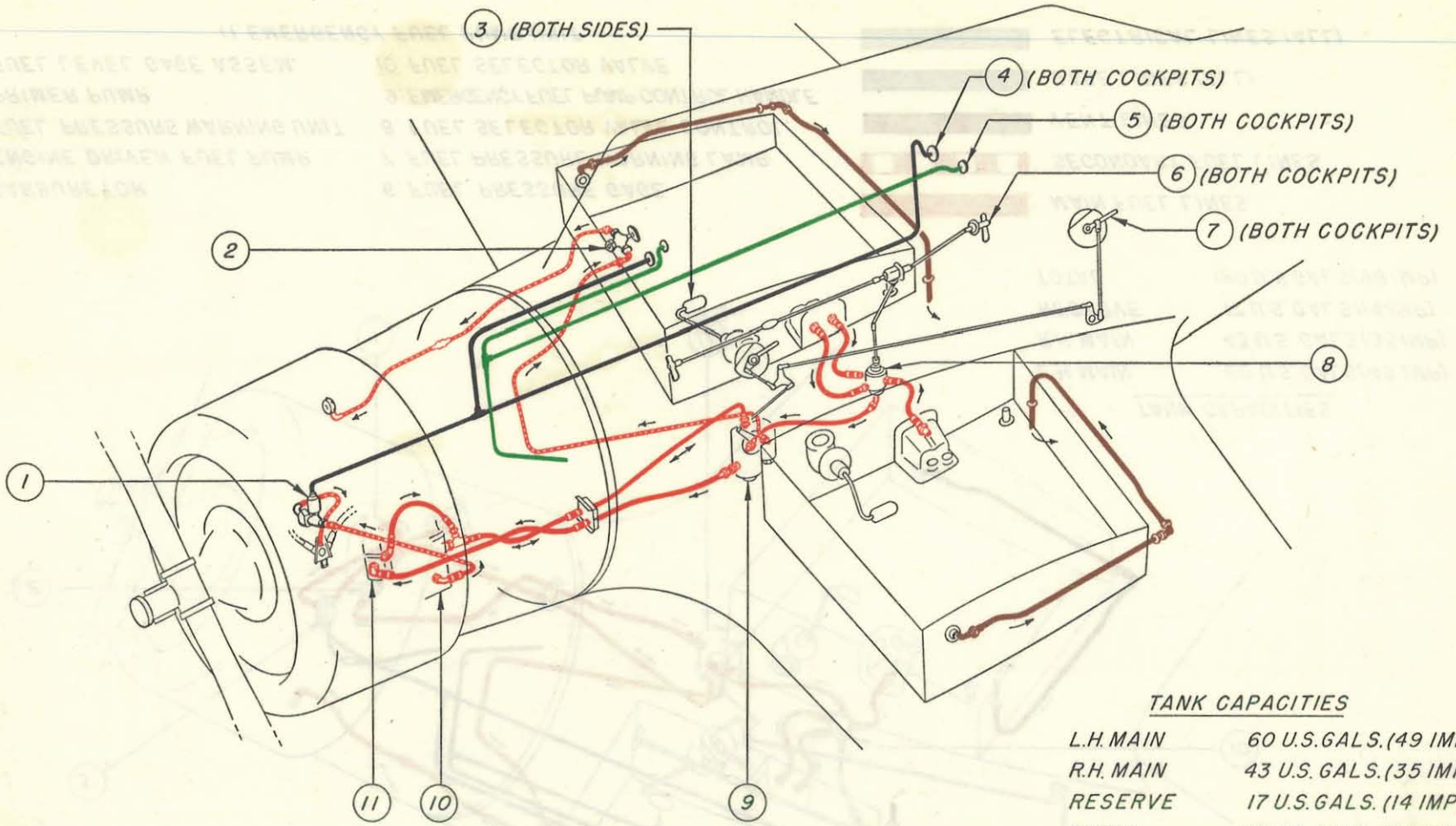
(1) A red barrel handle *(Figure 11-3)* on a shaft on the left side of the pilot's seat in the front cockpit acts as a guide in selecting the desired fuel tank. With the selector valve in the "OFF" position the operation of the barrel handle is as follows:

"OFF" Side Up—The selector valve in "OFF" position

"OFF" Side to the Left—"R.H. MAIN" tank supplying fuel

"OFF" Side Facing Cockpit Floor—"RESERVE" tank supplying fuel

"OFF" Side to the Right—"L.H. MAIN" tank supplying fuel



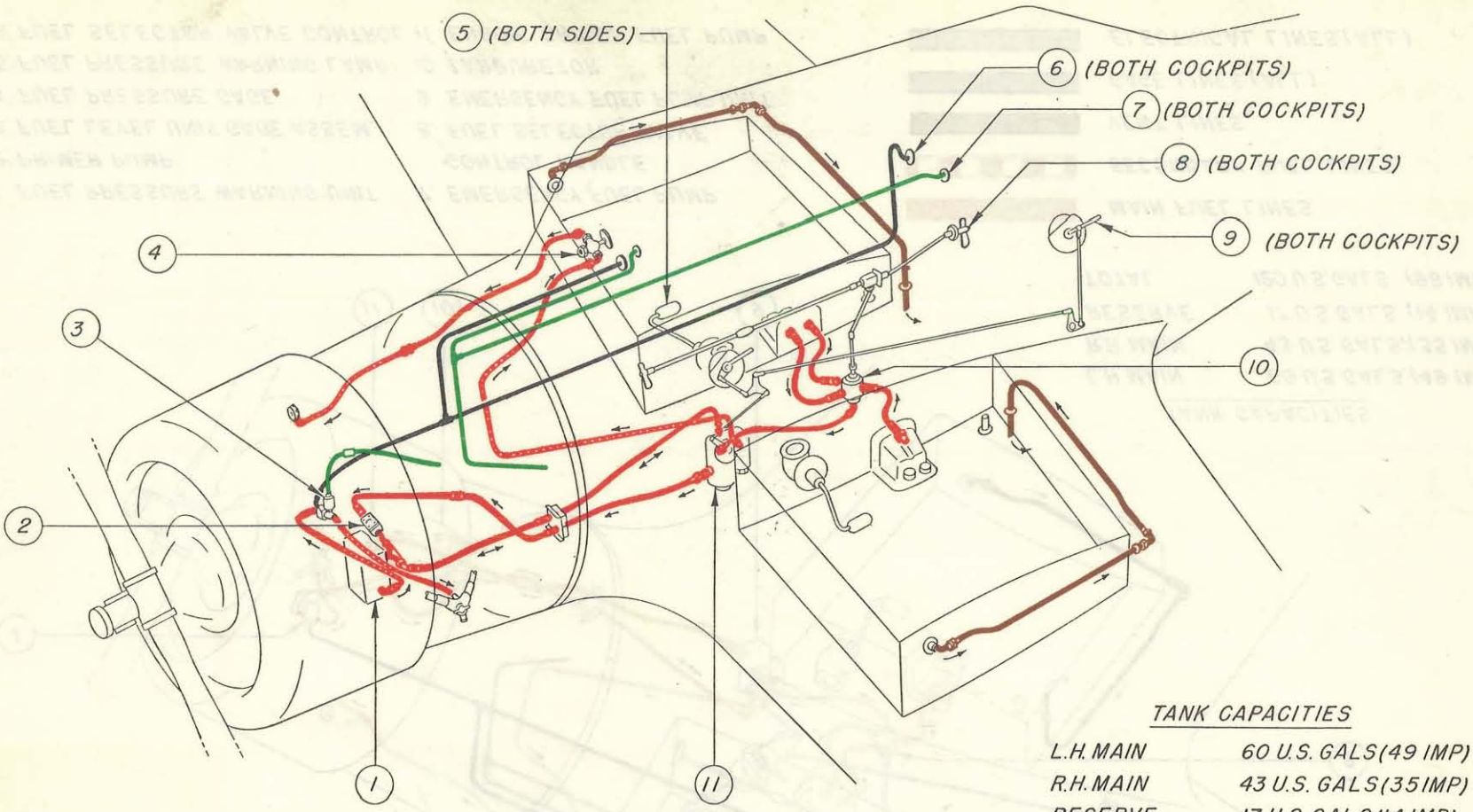
TANK CAPACITIES

L.H. MAIN	60 U.S. GALS. (49 IMP)
R.H. MAIN	43 U.S. GALS. (35 IMP)
RESERVE	17 U.S. GALS. (14 IMP)
TOTAL	120 U.S. GALS. (98 IMP)

1. FUEL PRESSURE WARNING UNIT.
2. PRIMER PUMP.
3. FUEL LEVEL UNIT GAGE ASSEM.
4. FUEL PRESSURE GAGE.
5. FUEL PRESSURE WARNING LAMP.
6. FUEL SELECTOR VALVE CONTROL.
7. EMERGENCY FUEL PUMP CONTROL HANDLE.
8. FUEL SELECTOR VALVE.
9. EMERGENCY FUEL PUMP UNIT.
10. CARBURETOR.
11. ENGINE DRIVEN FUEL PUMP.

MAIN FUEL LINES.
SECONDARY FUEL LINES.
VENT LINES.
GAGE LINES. (ALL)
ELECTRICAL LINES. (ALL)

Figure 20—Fuel System Diagram (BT-13, 13A & 13B)



TANK CAPACITIES

L.H. MAIN	60 U.S. GALS (49 IMP)
R.H. MAIN	43 U.S. GALS (35 IMP)
RESERVE	17 U.S. GALS (14 IMP)
TOTAL	120 U.S GALS (98 IMP)

1. CARBURETOR.
2. ENGINE DRIVEN FUEL PUMP.
3. FUEL PRESSURE WARNING UNIT.
4. PRIMER PUMP.
5. FUEL LEVEL GAGE ASSEM.
6. FUEL PRESSURE GAGE.
7. FUEL PRESSURE WARNING LAMP.
8. FUEL SELECTOR VALVE CONTROL.
9. EMERGENCY FUEL PUMP CONTROL HANDLE.
10. FUEL SELECTOR VALVE
11. EMERGENCY FUEL PUMP UNIT

MAIN FUEL LINES.
SECONDARY FUEL LINES.
VENT LINES.
GAGE LINES. (ALL)
ELECTRICAL LINES. (ALL)

Figure 21—Fuel System Diagram (BT-15)

Note

On later models the "OFF" side of the red barrel handle was *flat*, which aids materially in determining the position of the fuel selector valve.

In operating the barrel handle during day or night flying the "click" and "feel" method will tell the pilot the position of the fuel selector valve indicator.

WARNING

Be sure, in switching tanks, that the "pointer" end of the fuel selector valve handle is turned to the desired tank. If you are switching to "RESERVE," and use the wrong end of the "pointer," you will find the selector valve is actually in the "OFF" position, completely *cutting off* your fuel supply.

d. FUEL PRESSURE WARNING LIGHTS.—Fuel pressure warning lamps are located near the top of the instrument panel in both cockpits. These lamps glow if the fuel pressure drops below 2-1/4 pounds per square inch when the battery switch is "ON" or "BAT."

Note

Before flight, make sure the fuel pressure warning light is operating by turning the battery switch to "ON" or "BAT." (Lamp should *glow*.) During flight, operation of this light can be determined by use of the fuel pressure test switch located on the electrical panel.

Figure 22—Fuel Pressure Warning Lamp

e. FUEL SYSTEM MANAGEMENT.

(1) EMERGENCY FUEL PUMP.—The emergency fuel pump, mounted on the tab control unit to the left of the pilot in both cockpits, is used to maintain fuel pressure when starting engine. Refer to Section II, paragraph 2 *b.*, for proper operation.

(2) ENGINE PRIMER.—The primer, mounted on the right trim panel of the front cockpit, is used in starting a cold engine. Refer to Section II, paragraph 2 *e.*, for operating instructions.

(3) FUEL FLOW CHECK.—Before take-off check fuel flow from all tanks by switching the fuel valve to each tank long enough to insure that fuel has an opportunity to flow to the engine.

(4) CHANGING FUEL TANKS IN FLIGHT.

(a) When fuel becomes low in the tank being used, switch to a tank containing more fuel. Do *not* run a tank *dry* except in an emergency, and then fuel pressure gage must be watched *closely*.

(b) If engine misses after switching to new tank, *pause*, then several *slow* strokes of the hand fuel pump should correct this condition.

(c) If tank runs dry before changing over, proceed as follows:

1. Lower nose to maintain flying speed.

2. Switch to another tank.
3. *Close* throttle to high idling position.
4. *Pause*, then operate hand fuel pump *slowly*.
5. After engine starts, place throttle in desired position.

(5) TAKE-OFF AND LANDING.—Use either the "L.H. MAIN" or "RESERVE" tanks, whichever is the more nearly full.

(6) LEVEL FLIGHT.—Keep fuel in tanks within approximately ten gallons of each other to maintain lateral trim.

(7) EMERGENCY CONDITION.—Use hand fuel pump to maintain fuel pressure during flight if engine driven fuel pump should fail.

(8) FUEL SELECTOR ILLUMINATION.—Make sure the cockpit spotlight on the left side is placed in the correct position to properly illuminate the fuel selector control unit if night flying.

5. OIL SYSTEM. *(Figures 23 & 24.)*

The oil system consists of a 10.9 U.S. gallon supply tank, oil cooler with a thermostatic by-pass valve, oil separator, oil dilution, and drain cock. In addition to the above, an oil filter is incorporated in the BT-15 oil system.

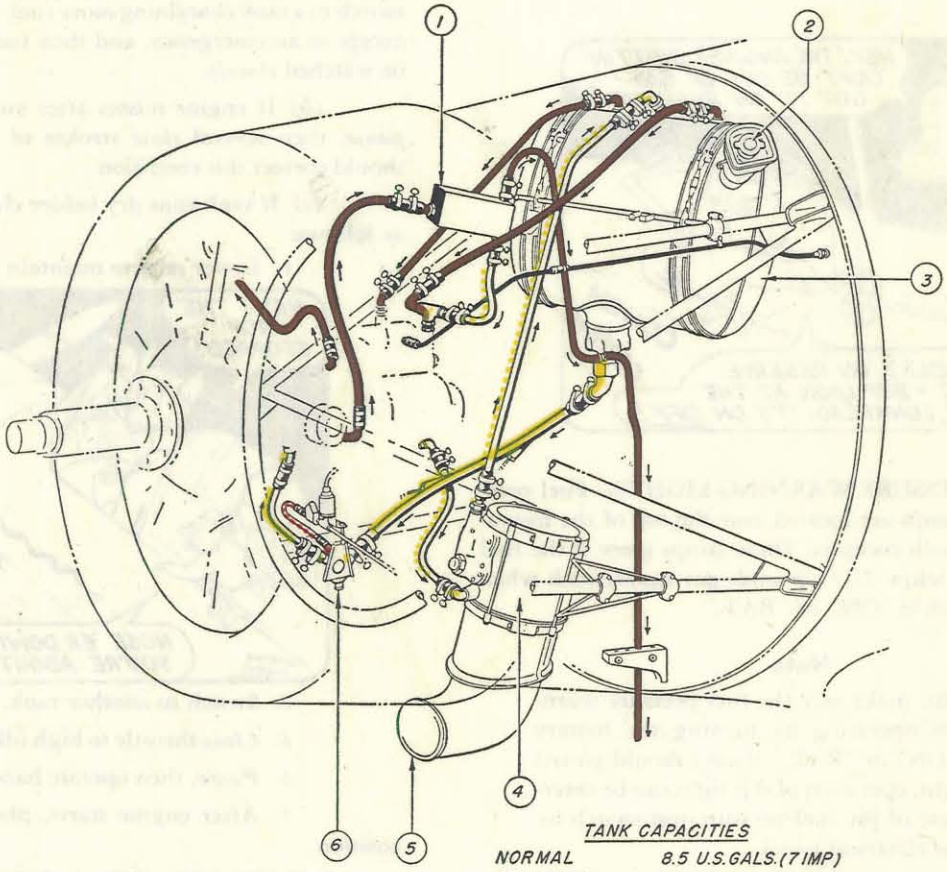
Note

Oil pressure and temperature readings are indicated on an engine gage unit (instrument) located on the instrument panel in both cockpits. *(Figures 13-19 & 14-18.)*

a. OIL PRESSURE AND TEMPERATURE.

(1) PRATT AND WHITNEY (R-985-25, AN-1, and AN-3.)

	Pressure	*Temperature*
Desired	75 to 90 psi	50° to 70° C. (122° to 158° F.)
Maximum	100 psi	95° C. (203° F.)
Minimum	60 psi	
Minimum Idling	15 psi	



TANK CAPACITIES
NORMAL 8.5 U.S.GALS.(7 IMP)
MAXIMUM 10.9 U.S.GALS.(9 IMP)

1. OIL SEPARATOR
2. OIL TANK FILLER CAP
3. OIL TANK
4. OIL COOLER
5. OIL COOLER AIR SCOOP
6. "Y" DRAIN & OIL DILUTION VALVE

SUPPLY LINES
RETURN LINES
OIL DILUTION LINES
GAGE LINES (ALL)
BREATHER, VENT AND PURGE LINES

Figure 23—Oil System Diagram (BT-13, 13A & 13B)

(2) WRIGHT (R-975-11).

	Pressure	*Temperature*
Desired	70 to 75 psi	50° to 70° C. (122° to 158° F.)
Maximum	80 psi	88° C. (190° F.)
Minimum	60 psi	
Minimum Idling	25 psi	

b. OIL DILUTION.—Refer to Section II, paragraph 2 *f.*, for location and operation of oil dilution control as used for cold weather starting and stopping of the engine.

c. OIL COOLER AIR SCOOP CONTROL.—Refer to Section II, paragraph 2 *c.*, for installation, location, and operation of the oil cooler air scoop.

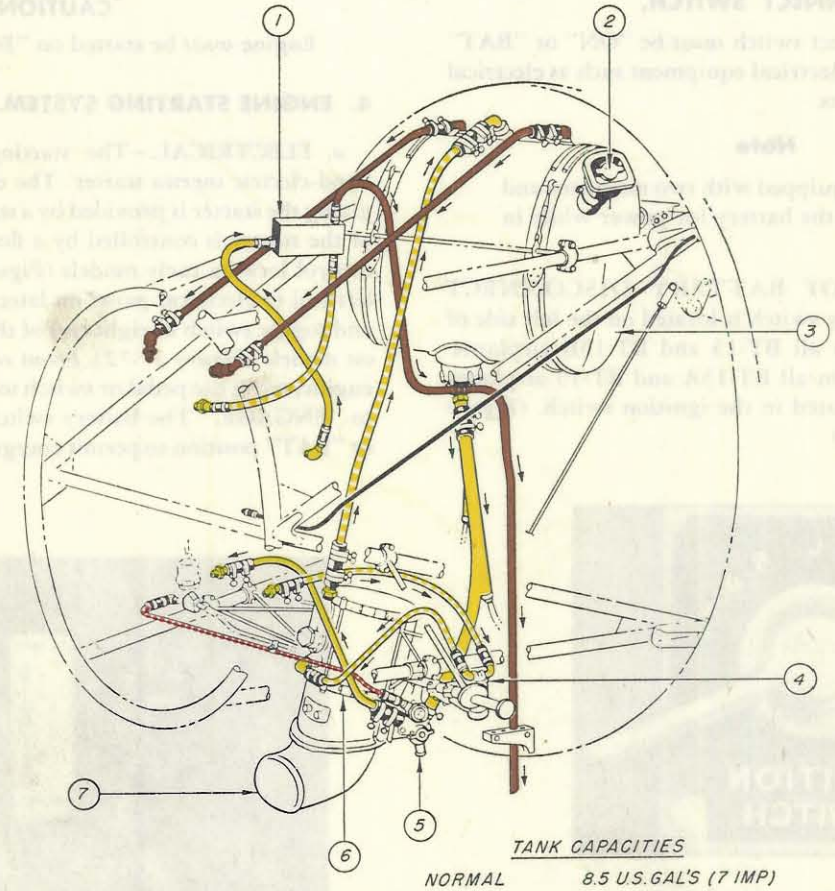


Figure 24—Oil System Diagram (BT-15)

SECTION IV
ELECTRICAL SYSTEM

1. GENERAL DESCRIPTION.

The electrical system principally consists of wiring and apparatus for the ignition, generator, and starter system; the landing, passing, and navigation lights; and the radio power supply.

2. BATTERY DISCONNECT SWITCH.

The battery disconnect switch *must* be "ON" or "BAT" when using any or all electrical equipment such as electrical starter, radio, and lights.

Note

The engines are equipped with two magnetos and do not depend on the battery for power while in operation.

a. LOCATIONS OF BATTERY DISCONNECT SWITCH.—The battery switch is located on the left side of the electrical panel on all BT-13 and BT-13B airplanes. *(Figure 27-1 & -69.)* On all BT-13A and BT-15 airplanes this switch is incorporated in the ignition switch. *(Figure 13-14, and Figure 25.)*

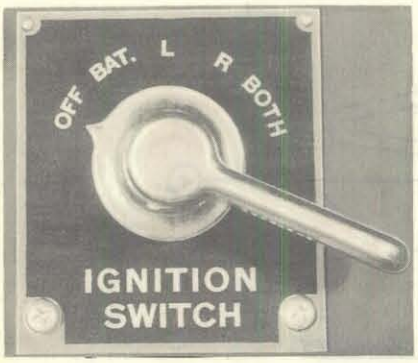


Figure 25—Ignition Switch

3. IGNITION SWITCH.

The ignition switch is located on the left side of the front cockpit instrument panel and on the left side of the electrical panel in the rear cockpit. *(Figures 13 & 14.)*

a. OPERATION.

OFF: Both magnetos grounded (off).

BAT: (BT-13A and BT-15) Electrical system energized. Both magnetos grounded.

L: Electrical system energized (BT-13A and BT-15). Left magneto "ON." (Right magneto grounded.)

R: Electrical system energized (BT-13A and BT-15). Right magneto "ON." (Left magneto grounded.)

BOTH: Electrical system energized (BT-13A and BT-15). Both magnetos "ON."

CAUTION

Engine *must* be started on "BOTH."

4. ENGINE STARTING SYSTEM.

a. ELECTRICAL.—The starting system consists of a hand-electric inertia starter. The electric current for energizing the starter is provided by a storage battery. Operation of the starter is controlled by a floor pedal forward of the control lock on early models *(Figure 26);* toggle switch at left end of electrical panel on later models *(Figure 27-34);* and toggle switch at right end of the electrical panel on latest models *(Figure 27-72). Front cockpit only.* To start the engine, move the pedal or switch to "ENERGIZE" and then to "ENGAGE." The battery switch *must* be in the "ON" or "BAT" position to permit energizing of the starter.

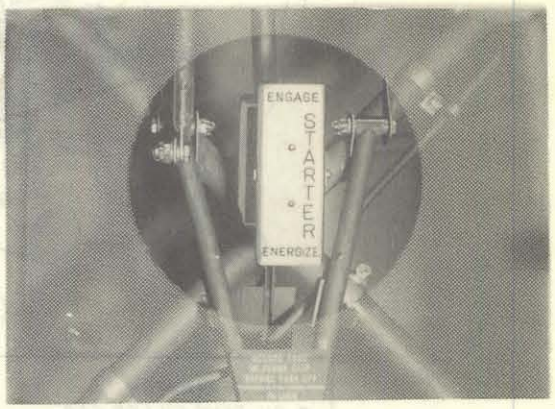


Figure 26—Floor Pedal Starter Control

Note

On the BT-13B airplane provision has been made for use of external power (cart battery) to energize the starter. This connection is located forward on the left side of the fuselage. If external power is used, remove before "ENGAGING" starter.

b. EMERGENCY MANUAL STARTER.—A hand crank is provided for energizing the starter in the event of failure of the electrical system. The hand crank and extension, stowed aft of the rear cockpit seat, are accessible from the baggage compartment. Insert the extension into the opening in the upper left side of the engine accessory compartment, and with the hand crank, energize the starter. A "pull" handle adjacent to the hand crank opening provides for manual engaging.

Note

Make sure that all unnecessary electrical equipment is turned OFF before energizing starter to prevent needless drain on the electrical system.

5. GENERATOR DISCONNECT SWITCH.

The generator disconnect switch *must* be "ON" to charge the battery. On early models this switch is located on the left side of the front cockpit forward and below engine control unit, while on the latest models it is located on the front electrical panel. *(Figure 27-62.)*

6. FUEL PRESSURE WARNING LIGHT.

Fuel pressure warning lights are located near the top of the instrument panel in both cockpits. Refer to Section III, paragraph 4 *d.*, for details.

7. FUEL GAGES.

The fuel gages on the BT-13 airplane are electrically operated. Refer to Section III, paragraph 4 *b.*

8. CARBURETOR MIXTURE TEMPERATURE GAGE.

This gage is located on the instrument panel of the front cockpit. *(Figure 13-15.)* The battery switch must be "ON" or "BAT" for operation. Refer to Section II, paragraph 2 *d.*, for operation during icing conditions.

9. PITOT HEATER SWITCH.

This switch is located on the electrical panel in the front cockpit only. This switch should be "ON" during flight in cold, wet weather.

10. FREE AIR TEMPERATURE GAGE.

On early models this gage is located on the front instrument panel *(Figure 13-2)* and is electrically operated. (Battery switch must be "ON" or "BAT.") On the latest planes the free air temperature gage is located on the front windshield and is not electrically operated.

11. OIL DILUTION.

On the latest planes (BT-13B) the oil dilution system is electrically operated. Refer to Section II, paragraph 2 *f.*, for proper operation.

12. MARKER BEACON INDICATOR.

Refer to Section V, paragraph 1 *f.*, for details.

13. SPARE LAMPS AND FUSES.

Spare lamps and fuses are provided in all BT airplanes. Spare lamps are located on the instrument panels. Spare fuses are clipped on the inside face of each fuse panel cover with the exception of the radio and recognition lamp fuses which are stowed within the recognition lamp box (radio fuse box on early models). *(Figure 13-25 & -26.)*

14. CIRCUIT BREAKERS.

Circuit breakers are provided on the latest airplanes (BT-13B). These breakers are located on the electrical panel and the main junction box located on the forward left side of the front cockpit. In case of a failure due to an overload, press the "PRESS-TO-RESET" button. *Do not hold button in.* If the overload condition still exists the button will pop back out—wait a few seconds and push the button in again. (The circuit breakers have taken the place of fuses.) *(Figure 27-70 & 73.)*

15. LIGHTING SYSTEM.

Battery switch *must* be "ON" or "BAT" for lights to operate.

a. LANDING LIGHTS.—A landing light is mounted in the leading edge of each outer wing panel. A switch for each landing light is located on the electrical panel in the front cockpit.

b. NAVIGATION LIGHTS.—All navigation lights ("running" lights) are controlled by switches on the electrical panel in the front cockpit only. On later airplanes a "BRIGHT" and "DIM" switch is provided.

c. PASSING LIGHT.—A red passing light is incorporated in the left wing panel landing light and is controlled by a switch located on the front cockpit electrical panel.

d. RECOGNITION LIGHTS.—There are three recognition lights installed in the aft lower portion of the fuselage directly below the baggage compartment. A single recognition light is installed on the upper forward portion of the monocoque. Switches for these lights are located in the front cockpit on the right side of the electrical panel. Individual lights may be operated in either the "STEADY" or "KEY" position. *(Figure 27-66 & 67.)*

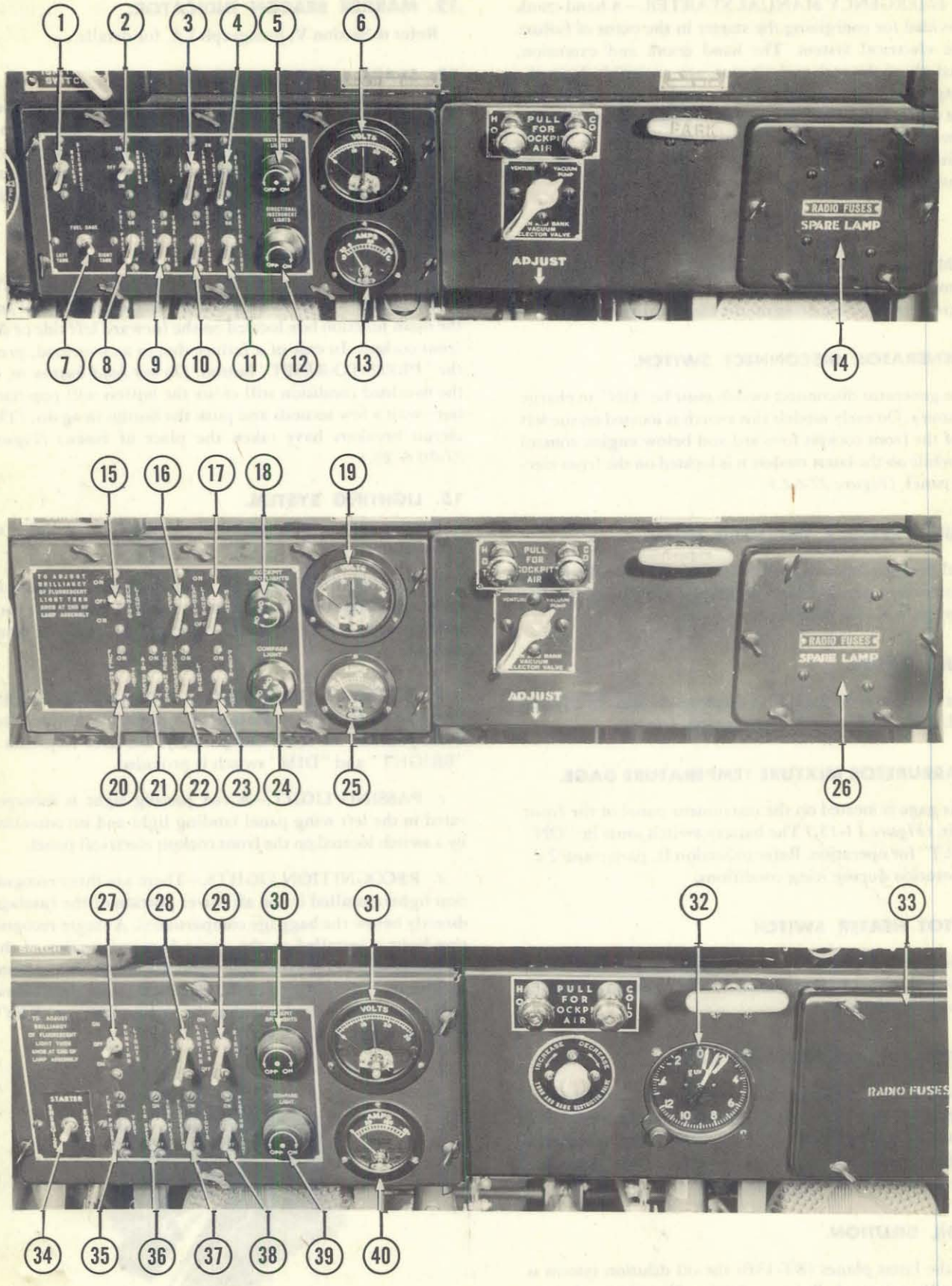
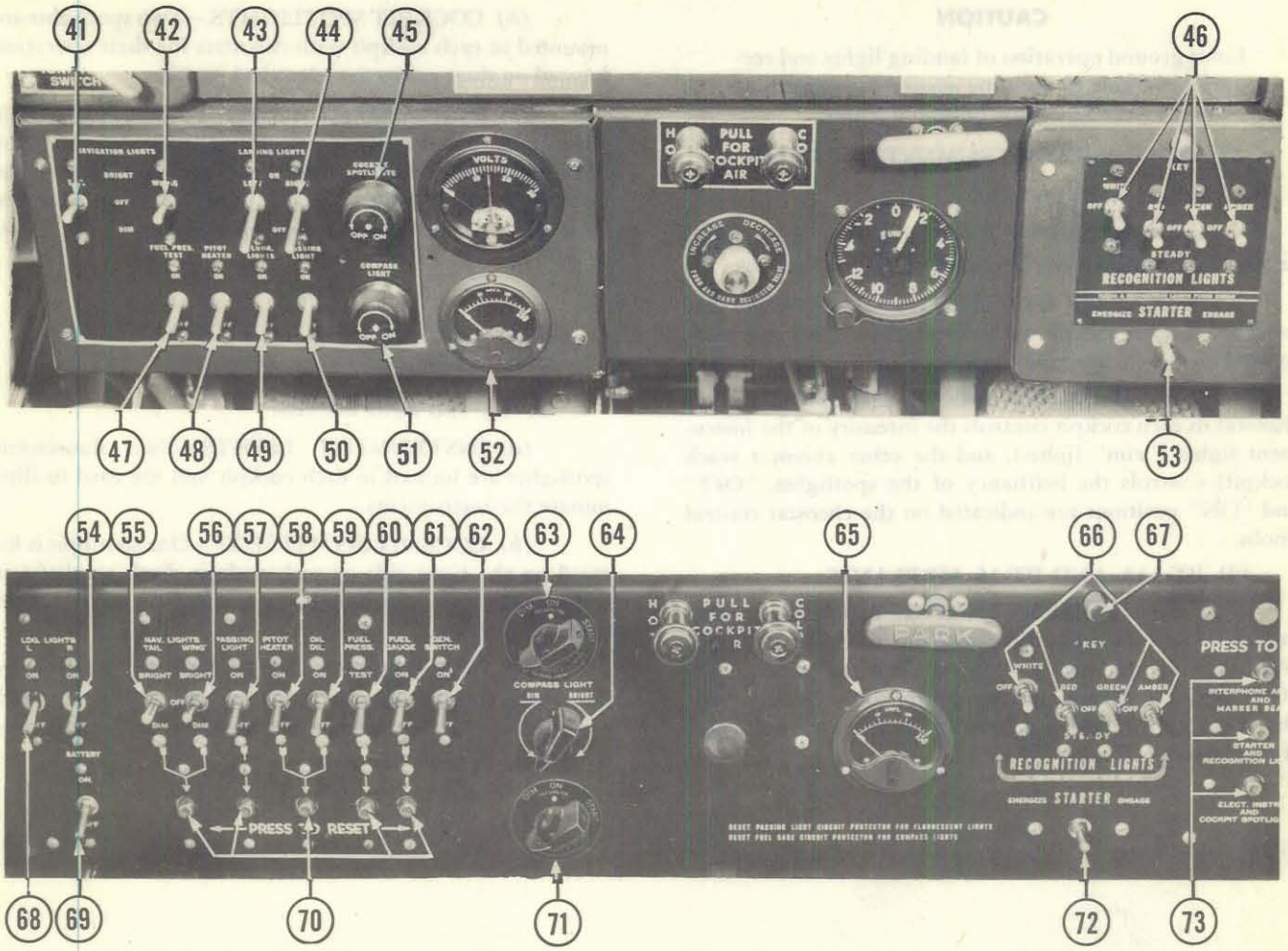


Figure 27—Electrical Control Panels (Sheet 1 of 2 Sheets)



1. Battery Disconnect
2. Navigation Lights
3. L-H Landing Light
4. R-H Landing Light
5. Non-Dir. Instr. Lights
6. Voltmeter
7. Fuel Gages Switch
8. Fuel Pressure Test
9. Pitot Heater
10. Cockpit Lights
11. Passing Light
12. Directional Instr. Lights
13. Ammeter
14. Radio Fuse Panel
15. Navigation Lights
16. L-H Landing Light
17. R-H Landing Light
18. Cockpit Spotlights
19. Voltmeter
20. Fuel Pressure Test
21. Pitot Heater
22. Fluorescent Lights
23. Passing Light
24. Compass Light
25. Ammeter
26. Radio Fuse Panel
27. Navigation Lights
28. L-H Landing Light
29. R-H Landing Light
30. Cockpit Spotlights
31. Voltmeter
32. Accelerometer (if installed)
33. Radio Fuse Panel
34. Starter
35. Fuel Pressure Test
36. Pitot Heater
37. Fluorescent Lights
38. Passing Light
39. Compass Light
40. Ammeter
41. Navigation Light—Tail
42. Navigation Lights—Wing
43. L-H Landing Light
44. R-H Landing Light
45. Cockpit Spotlights
46. Recognition Lights
47. Fuel Pressure Test
48. Pitot Heater
49. Fluorescent Lights
50. Passing Light
51. Compass Light
52. Ammeter
53. Starter
54. R-H Landing Light
55. Navigation Light—Tail
56. Navigation Lights—Wing
57. Passing Light
58. Pitot Heater
59. Oil Dilution
60. Fuel Pressure Test
61. Fuel Gage Illumination
62. Generator Disconnect
63. Fluorescent Light
64. Compass Light
65. Ammeter
66. Recognition Lights
67. Key for Recog. Lights
68. L-H Landing Light
69. Battery Disconnect
70. Circuit Breakers
71. Fluorescent Light
72. Starter
73. Circuit Breakers

Figure 27—Electrical Control Panels (Sheet 2 of 2 Sheets)

CAUTION

Limit ground operation of landing lights and recognition lights to the time *needed* for testing, as *excessive* heat may cause failure of lenses.

e. COCKPIT AND INSTRUMENT LIGHTING.

(1) BT-13 AIRPLANES.

(a) INSTRUMENT LIGHTS.—"Rim" type lights are used to illuminate the instruments in both cockpits.

(b) COCKPIT SPOTLIGHTS.—Two spotlights are mounted in each cockpit with rheostats for their operation located on their respective electrical panels.

(c) INSTRUMENT LIGHT RHEOSTATS.—One rheostat in each cockpit controls the intensity of the instrument lights ("rim" lights), and the other rheostat (each cockpit) controls the brilliancy of the spotlights. "OFF" and "ON" positions are indicated on the rheostat control knobs.

(2) BT-13A AND BT-15 AIRPLANES.

(a) INSTRUMENT LIGHTS.—A fluorescent lamp in each cockpit is used to illuminate the instruments. To operate these lamps, turn switch on electrical panel to the "ON" position. A rotating type shutter controlled from the end of the individual lamp housing regulates the brilliancy of each lamp. *(Figure 13-3.)*

(b) COCKPIT SPOTLIGHTS.—Two spotlights are mounted in each cockpit with rheostats for their operation located on their respective electrical panels.

(c) INSTRUMENT LIGHT RHEOSTATS.—One rheostat in each cockpit controls the intensity of the compass lighting, and the other rheostat (each cockpit) controls the intensity of the spotlights. "OFF" and "ON" positions are indicated on the rheostat control knobs. *(Figure 27-30 & -39.)*

Note

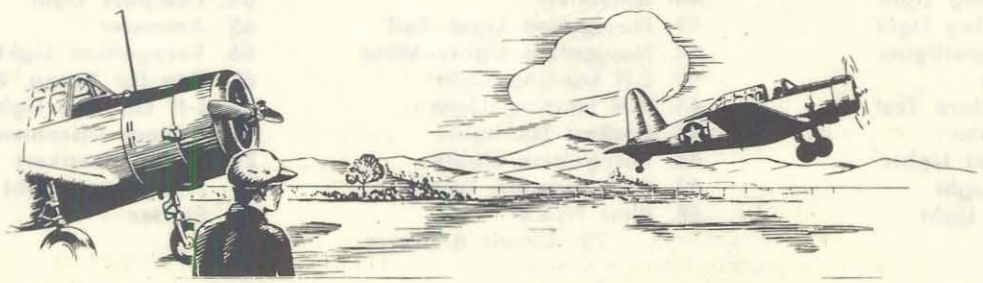
Fluorescent lamps must be turned "ON" before compass light circuits are energized.

(3) BT-13B AIRPLANES.

(a) INSTRUMENT LIGHTS.—Two fluorescent spotlights are located in each cockpit and are used to illuminate the instruments.

(b) COCKPIT SPOTLIGHTS.—One spotlight is located on the right side of each cockpit. Each spotlight is turned "ON" and its intensity regulated by a control on the light housing.

(c) INSTRUMENT LIGHT RHEOSTATS.—Each fluorescent spotlight has an individual rheostat to start and control its brilliancy. Also, a rheostat in each cockpit controls compass lighting.



SECTION V
COMMUNICATIONS EQUIPMENT

You'll want to be on the "receiving end" in case of trouble! Be able to receive or send a message on the fly by knowing how to operate your communications equipment.

1. BT-13B AIRPLANE.

a. GENERAL.—The communication equipment consists of a command set SCR-274-N, equipped with a range filter and two hand microphones with "PRESS-TO-TALK" button handles. All units of equipment exclusive of controls are located in the front compartment and are easily accessible for servicing. All controls for communication equipment are located in the front cockpit except a transmit-interphone switch which is located in the rear cockpit.

b. RADIO RECEIVER OPERATION.

(1) GENERAL.—The BC-496-A receiver control box consists of two entirely independent and complete receiver controls mounted in one case. The forward half controls the BC-453-A, low frequency receiver tuning from 190 to 550 kilocycles and the aft half controls the BC-454-A high frequency receiver tuning from 3 to 6 megacycles. A three-position CW-OFF-MCW switch is located in the upper right portion of each section. A three-position channel switch marked "A" and "B" is located on the left upper portion of each section. Headsets are connected only when the switch is in "A" position. Each section has its own volume control.

(a) The battery switch *must* be in the "ON" position.

(b) To receive U.S. Airway Radio Range (201 to 390 kc), or control tower (190 to 550 kc), or voice transmission on 3 to 6 mc band, set switches on the corresponding sections of control boxes to MCW and A. Greater accuracy of tuning may be obtained if the volume control adjustment is kept low after the desired signal is located.

(c) To receive modulated code transmission set switch on MCW.

(d) To receive unmodulated code transmission set switch on CW.

(2) RADIO RANGE FILTER (FL-8) OPERATION. *(Figure 28-8.)*

(a) For reception of airways radio range signals set switch on "RANGE."

(b) For reception of other types of transmission set switch on "VOICE."

(c) If simultaneous reception of radio range signals and other types of transmission is desired set switch on "BOTH."

CAUTION

The dynamotor DM-33-A on the modulator unit of this radio set generates 600 volts, D.C. This is sufficient to cause severe shock, or even death. Make *absolutely certain* that the dynamotor is not running before making any adjustment whatever except tuning up the transmitter.

c. RADIO TRANSMITTER OPERATION FROM THE FRONT COCKPIT.

(1) TO TRANSMIT VOICE SIGNALS.

(a) See that the battery switch is "ON."

(b) Set the "TRANSMITTER SELECTION" switch *(Figure 28-3)* to position "1."

(c) Set the emission switch to "VOICE." *(Figure 28-1.)*

(d) Set "TRANS. POWER" toggle switch *(Figure 28-10)* to "ON" and wait 15 seconds before further action. This warms up all transmitter tubes.

(e) Press the "PRESS-TO-TALK" button on the microphone and talk *clearly* and *distinctly* into the microphone. In the "VOICE" position the transmitting dynamotor will not start until the "PRESS-TO-TALK" button has been closed. Release the microphone button when you are through talking.

Note

The pilot in the rear cockpit may transmit voice signals by setting the INTERPHONE SWITCH on "RADIO" position, press the microphone button and proceed to speak, releasing the microphone button when conversation is completed.

(f) The "TRANS. POWER" toggle switch should be left "ON" throughout the flight in order to avoid repetition of the 15-second "warm-up" time.

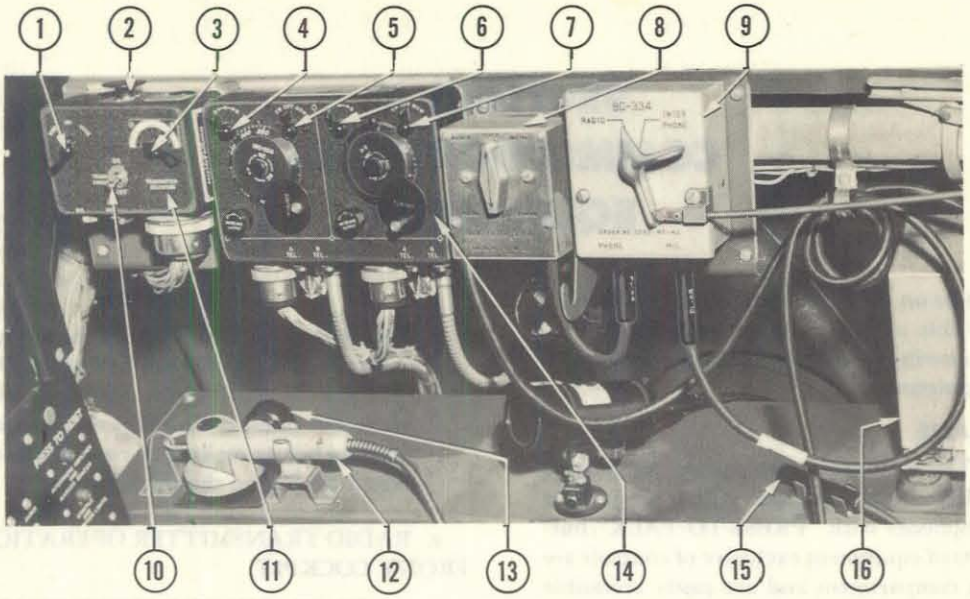
d. CODE TRANSMISSIONS.

(1) TONE (MCW).—Set transmitter emission selector switch *(Figure 28-1)* to "TONE" and operate transmitter key.

(2) CW.—Set transmitter emission selector switch to CW and operate transmitter key.

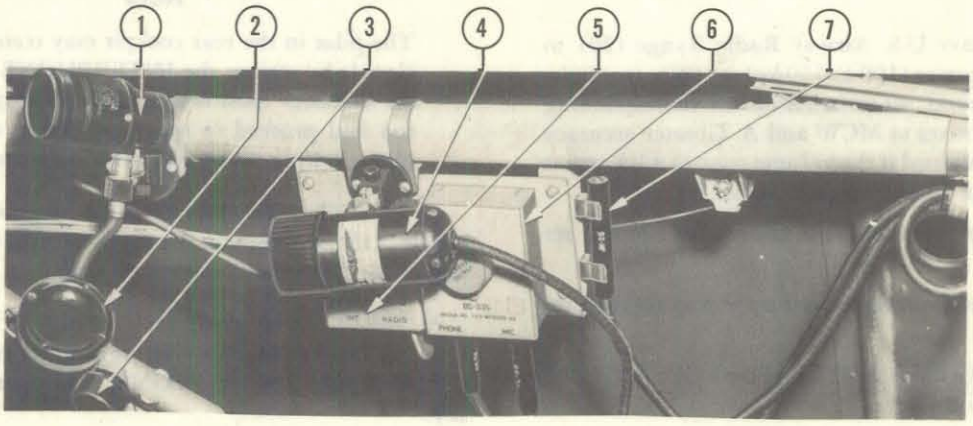
Note

The transmitter key located on top of the transmitter control box may be adjusted for travel by rotating the actuating button.



1. Emission Switch
2. Transmitter Key
3. Transmitter Selector Switch
4. Audio Output Switch (190-550 kc)
5. CW-OFF-MCW Switch (190-550 kc)
6. Audio Output Switch (3.0-6.0 mg)
7. CW-OFF-MCW Switch (3.0-6.0 mg)
8. Radio Filter Control
9. Interphone Control
10. Transmitter Power Switch
11. Transmitter Control Box
12. Microphone
13. Press-to-Talk Button
14. Receiver Control Box
15. Phone Jack Head Plug-In
16. Marker Beacon Receiver

Figure 28—Radio Controls—Front Cockpit (BT-13B)



1. Fluorescent Light
2. Microphone
3. Press-to-Talk Button
4. Cockpit Spotlight
5. Interphone Box (Remote)
6. Radio Control Box (Remote)
7. Phone Jack Head Plug-In

Figure 29—Radio Controls—Rear Cockpit (BT-13B)

CAUTION

To reduce battery drain and to increase dynamotor life, the emission selector should be left on "VOICE," unless continued use on "TONE" or "CW" is expected.

e. INTERPHONE OPERATION.—Interphone communications between front and rear cockpit are accomplished by means of an amplifier and dynamotor.

(1) OPERATION FROM FRONT COCKPIT.—Set the interphone switch *(Figure 28-9)* to interphone position, hold down the microphone button and proceed to speak, releasing button when conversation is completed.

(2) OPERATION FROM REAR COCKPIT.

(a) Set radio interphone switch to interphone. *(Figure 29-5.)*

(b) Hold down microphone switch and proceed to speak, releasing switch when conversation is completed.

f. MARKER BEACON.

(1) OPERATION.—The marker beacon radio receiver responds to 75 megacycle marker transmissions. These transmitters include Army Instrument Landing Type, the Cone of Silence and Fan Marker Types. The radio receiver's response to a signal will be indicated by the lighting of an indicator lamp located on the right trim panel in the front cockpit. The power for the marker beacon receiver is controlled by an ON-OFF switch under the indicator lamp.

The indicator lamp may be steady or flash regularly corresponding to the keying of the transmitter. There are four possible key sequences, either one, two, three, or four dashes. When the airplane is in a fan marker area the indicating lamp will flash. This tells the pilot the distance in miles to a designated location. When the airplane is directly over a Z marker transmitter, the lamp will remain "ON."

(2) PRECAUTIONS DURING OPERATION.—An irregularity which may occur is that the receiver may not follow the keying of strong marker transmitters with keyed modulation when flying through the strongest part of the beam at low altitudes. In this case the signal may be so strong that a slight ripple of the transmitter power supply causes sufficient modulation to operate the receiver.

g. OPERATION NOTES FOR THE PILOT.

(1) TRANSMITTING ETIQUETTE.—Before transmitting, adjust radio receiver to the frequency of the station you wish to talk to and "listen in" to be sure the operator is not talking to someone else. If the station is transmitting, take advantage of the opportunity to more accurately set the airplane receiver on the assigned frequency, and when the operator is through, proceed with your transmission.

(2) UNABLE TO RECEIVE.

(a) Make *sure* that receiver selector switch is "ON."

(b) Systematically check for secure connection in all cables and wires about the radio controls starting with the headset and ending at the receiver control box.

(c) Turn range filter switch pointer to all positions to be sure internal contact points are making good electrical connections; if not, set somewhere between positions.

(d) Turn volume control through its entire range to test for an intermittent short circuit or some isolated position where receiver is operative.

(3) UNABLE TO TRANSMIT.

(a) Make certain the receiver (and transmitter filament) selector switch is "ON."

(b) See that transmitter selector switch is placed on position "1."

(c) Carefully inspect microphone for evidence of damage caused by rough treatment.

(d) Systematically check for secure connections in all cables and wires about the radio controls starting with the microphone and ending at the transmitter control box.

(e) If the transmitter does not "come on" for voice transmission when the "PRESS-TO-TALK" button on the microphone handle is operated, hold the transmission key *"down"*; operate the "PRESS-TO-TALK" button if failure occurred on TONE or CW.

Note

The "KEY" or "PRESS-TO-TALK" button may be substituted for each other for any of three positions of the transmitter emission control.

2. ALL OTHER BT AIRPLANES.

a. GENERAL.—The communications equipment consists of a command set SCR-183 equipped with a range filter, interphone, and two hand microphones with "PRESS-TO-TALK" button handles. All controls for communications equipment are located in the front cockpit except a tuning dial, volume control, and transmit-interphone switch is also installed in the rear cockpit. A radio wiring diagram is supplied in the data case.

b. RADIO RECEIVER OPERATION.

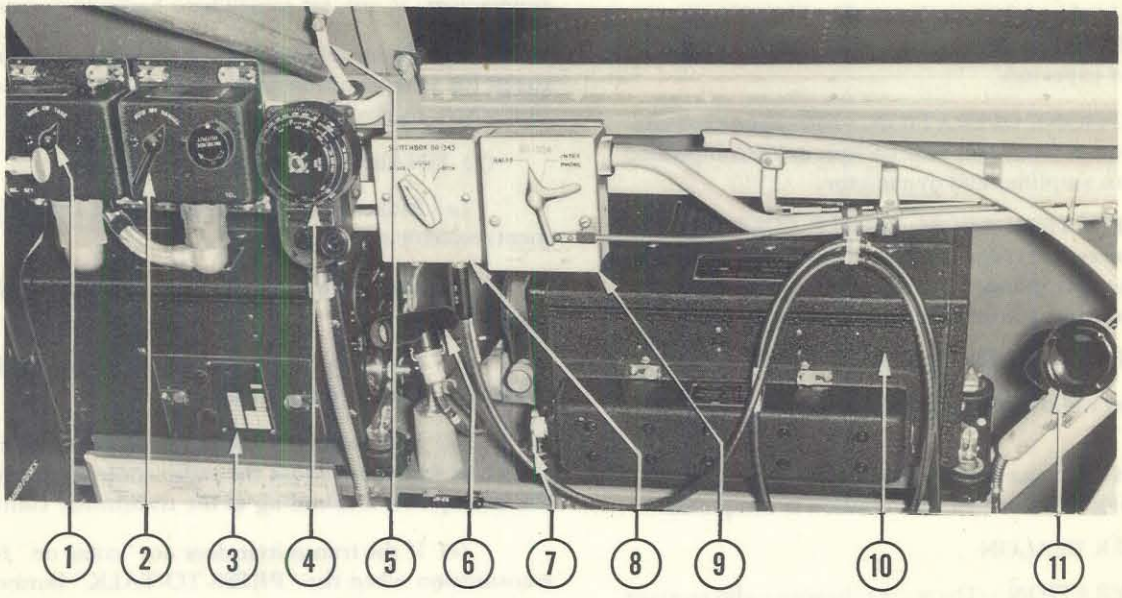
(1) GENERAL.—The receiver is calibrated and adjusted to receive the radio range frequencies between 201 and 398 kilocycles, and the tactical communication range between 2500 and 7700 kilocycles. Provision for receiving other frequencies can be installed by a radio technician.

(a) Battery disconnect switch *must* be "ON" or "BAT."

(b) Turn receiver control box selector switch *(Figure 30-2)* on "MANUAL" or "AUTO." Plug receiver phones in jack No. JK-26 and turn "INCREASE OUTPUT" control knob to the right until a frying noise or signal is heard in the receiver.

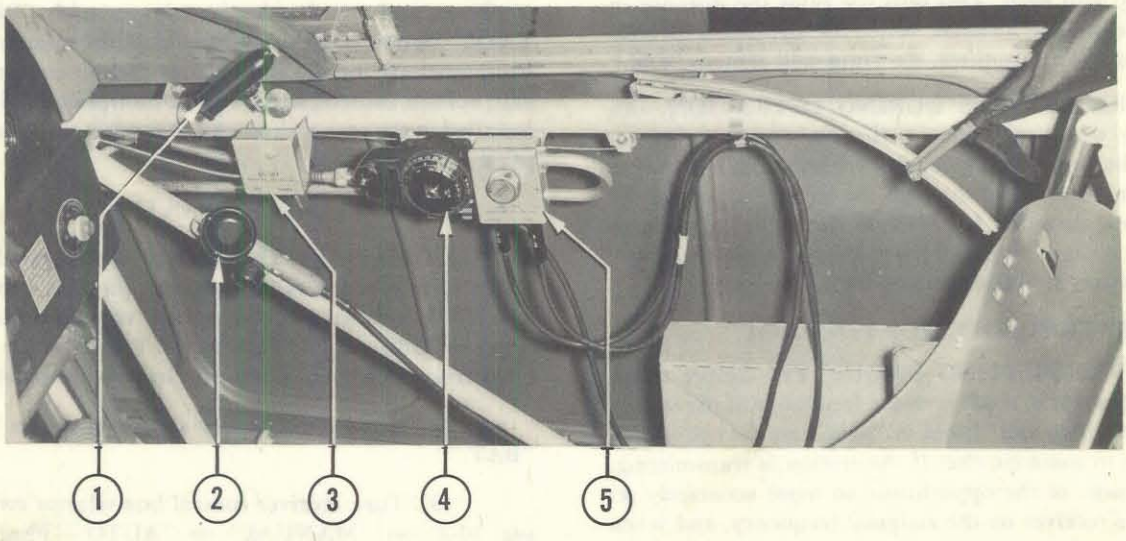
Note

Use the "MANUAL" position for *all* radio range flying.



1. Transmitter Control
2. Receiver Control
3. Radio Transmitter
4. Radio Receiver Tuning Control
5. Antenna Lead-In
6. Cockpit Spotlight
7. Hi-Lo Switch
8. Radio Filter Control
9. Interphone Control
10. Radio Receiver
11. Microphone

Figure 30—Radio Controls—Front Cockpit (BT-13, 13A & 15)



1. Cockpit Spotlight
2. Microphone
3. Interphone Box (Remote)
4. Receiver Tuning Control (Remote)
5. Radio Control Box (Remote)

Figure 31—Radio Controls—Rear Cockpit (BT-13, 13A & 15)

(c) To receive the radio ranges and control towers on 201 to 398 kilocycles, set the HI-LO selector switch *(Figure 30-7)* to "LO." Adjust tuning dial knob for desired frequency as calibrated on the inner scale of tuning dial.

Note

When tuning receiver for a definite frequency, always turn dial a little to each side of the frequency calibration mark to find the point where the signal is strongest. This procedure is to be followed when the receiver selector switch is on "MANUAL."

(d) To receive tactical frequencies, turn the HI-LO selector switch to "HI." Adjust tuning dial knob for desired frequency as calibrated on the outer scale of the tuning dial. The intermediate scale on the tuning dial (0-100 scale) is used only in special instances when special frequency ranges are being used, and require installation of special coils by radio maintenance personnel. In this case, there will be found a metal FREQUENCY IN KILOCYCLE calibration chart installed in every cockpit near the tuning dial.

Note

The HI-LO selector switch is connected to the receiver by a spring cable and must be operated by the "click-and-feel" method. Care must be taken to insure proper contact in either "HI" or "LO" position, since the position of the pointer does not accurately indicate the setting.

(e) Straight continuous wave signals (CW) cannot be heard on this receiver as it is not equipped with a beat frequency oscillator.

(f) Tone (MCW) signals may be heard by tuning in the same manner as for voice reception with the radio range filter selector switch set on "BOTH."

(g) The receiver (and transmitter filaments) may be turned off by placing the control box selector switch in its "OFF" position.

(2) RADIO RANGE FILTER OPERATION. *(Figure 30-8.)*

(a) For reception of airways radio range signals set switch on "RANGE."

(b) For reception of other types of transmission set switch on "VOICE."

(c) If simultaneous reception of radio range signals and other types of transmission is desired, set switch on "BOTH."

CAUTION

It is impossible to receive voice when this selector switch is set on "RANGE."

c. RADIO TRANSMITTER OPERATION FROM FRONT COCKPIT.—The transmitter operates on any frequency between 2500 and 7700 kilocycles for which it is set by a radio technician. It is capable of transmitting voice, modulated CW (MCW) or straight CW signals. The effective range of the transmitter for dependable voice transmission is approximately 25 miles.

(1) VOICE TRANSMISSION.

(a) Battery disconnect switch to "ON" or "BAT."

(b) Receiver control switch to "MANUAL" or "AUTO."

(c) Set transmitter emission selector *(Figure 30-1)* to "VOICE."

(d) Press the "PRESS-TO-TALK" button on the microphone and talk *clearly* and *distinctly* in a *normal* tone of voice into the microphone.

(e) Release the microphone button when you are through talking.

Note

The pilot in the rear cockpit may transmit voice signals by setting the INTERPHONE SWITCH *(Figure 31-3)* on "RADIO" position, press the microphone button and proceed to speak, releasing the microphone button when conversation is completed.

d. CODE TRANSMISSIONS.

(1) TONE (MCW).—Set transmitter emission selector switch *(Figure 30-1)* to "TONE" and operate transmitter key *(Figure 28-2.)*

(2) CW.—Set transmitter emission selector switch to "CW" and operate transmitter key.

Note

The transmitter key located on top of the transmitter control box may be adjusted for travel by rotating the actuating button.

e. INTERPHONE OPERATION.—Interphone communications between front and rear cockpits is accomplished by means of an amplifier and dynamotor.

(1) Set the interphone switch *(Figures 30-9 and 31-3)* to the interphone position, hold down the microphone button and proceed to speak, releasing button when conversation is completed.

f. OPERATION NOTES FOR PILOTS.

(1) TRANSMITTING ETIQUETTE.—Before transmitting, adjust radio receiver to the frequency of the station you wish to talk to and "listen in" to be sure the operator is not talking to someone else. If the station is transmitting, take advantage of the opportunity to more accurately set the airplane receiver on the assigned frequency. When the operator is through, proceed with your transmission.

(2) UNABLE TO RECEIVE.

(a) Make sure that receiver selector switch *(Figure 30-2)* is on "MANUAL" or "AUTO."

(b) Make sure the HI-LO switch *(Figure 30-7)* is in proper position and making good contact.

(c) Systematically check for secure connections in all cables and wires about the radio controls, starting with headset and ending at the receiver control box.

(d) Turn range filter switch pointer to all positions to be sure internal contact points are making good electric connection; or if not, set somewhere between positions.

(e) Turn volume control through its entire range to test for an intermittent short circuit or some isolated position where receiver is operative.

(3) UNABLE TO TRANSMIT.

(a) Make sure receiver (and transmitter filament) selector switch is set on "MANUAL" or "AUTO."

(b) See that the transmitter emission selector switch *(Figure 30-1)* is not placed between positions.

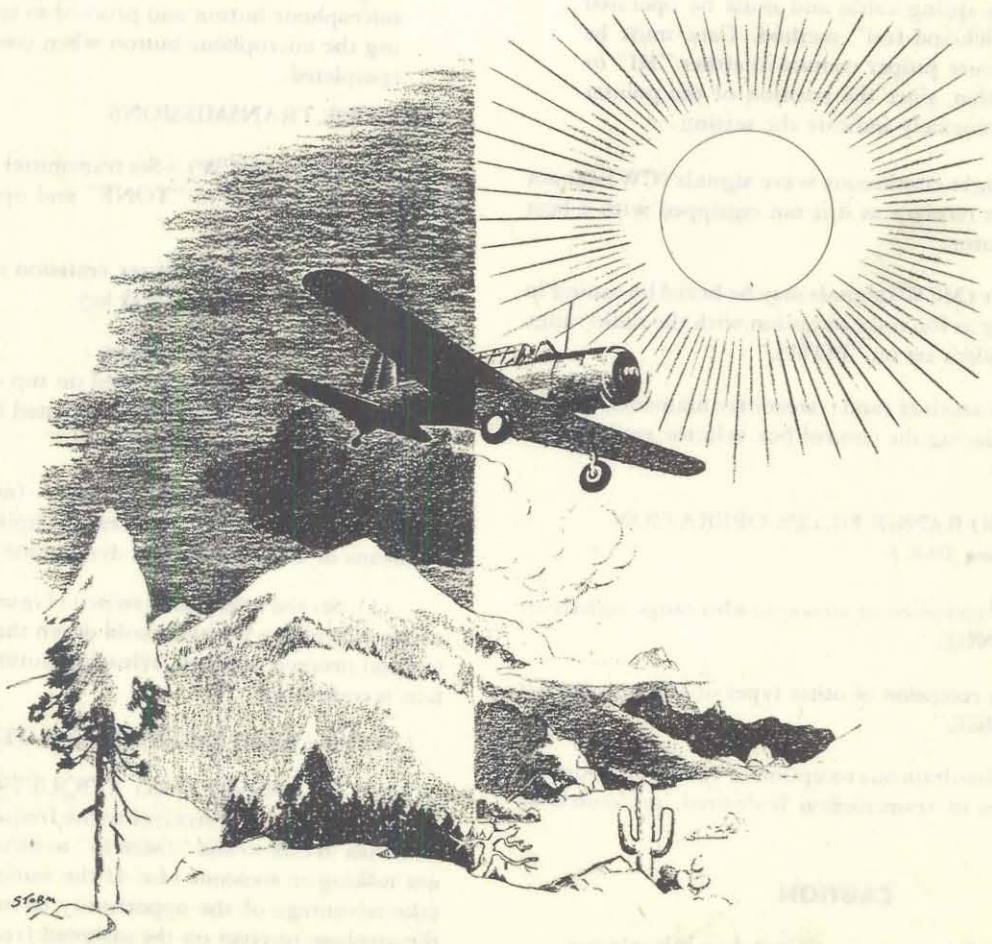
(c) Carefully inspect microphone for evidence of damage.

(d) Systematically check for secure connections in all cables and wires about the radio controls, starting with microphone and ending at the transmitter control box.

(e) If transmitter does not "come on" for voice transmission when the "PRESS-TO-TALK" button on microphone handle is operated, hold the transmitter key down; operate the "PRESS-TO-TALK" button if failure occurred on TONE or CW.

Note

The key or "PRESS-TO-TALK" button may be substituted for each other for any three positions of the transmitter emission control.



SECTION VI

PILOT OPERATING INSTRUCTIONS

1. FLYING CHARACTERISTICS.

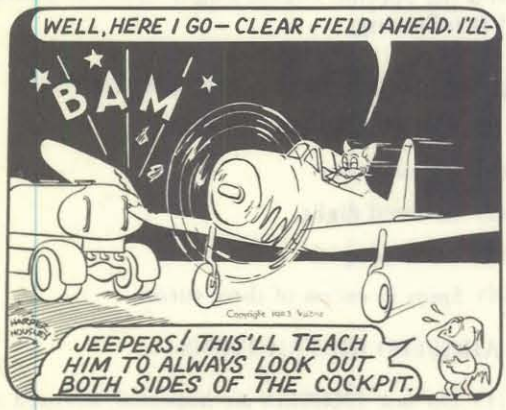
Note

The stability of the BT airplane is normal.

a. TAXIING.—The BT airplane is very stable and easy to control while taxiing due to the steerable tailwheel and efficient braking system.

(1) Freeing the tailwheel to swivel will be helpful for severe taxiing turns. Use *full* rudder before applying brakes to free tailwheel.

(2) Use of brakes is advisable in taxiing to assure a clear view ahead to avoid unseen obstacles.



b. TAKE-OFF.—Take-off characteristics are normal.

(1) Place rudder and elevator tab controls in "NEUTRAL," or as required within SAFE operating limits.

(2) Use of 20 to 30 degrees of flap is recommended to shorten take-off distance.

CAUTION

Be sure propeller is in "INCREASE" rpm (low pitch) for take-offs. With propeller in this position, acceleration is faster which shortens take-off run and gives highest rate of climb.

c. CLIMB.

(1) Best climbing speed is approximately 90 mph in "INCREASE" rpm at 2100 rpm with 20 degree flaps.

(2) Use trim tabs as needed. Use of rudder trim tab (nose-right) during climb will reduce the amount of rudder pressure that would otherwise be necessary.

d. LEVEL FLIGHT.—Level flight characteristics are normal. Adjust trim tabs to correct any nose or tail heaviness or directional instability.

(1) Put propeller in "DECREASE" rpm (high pitch) for cruising, high speed, or slow climb.

e. STALLS.

(1) WARNING CHARACTERISTICS.—The pilot is warned of an approaching stall by:

(a) Buffeting of the wings.

(b) Vibration of the aft portion of the fuselage.

(c) Loose action of all surface controls.

(2) STALLING SPEEDS.—Stalling speeds are approximately:

Flaps up —72 mph
30-degree flaps—65 mph
60-degree flaps—62 mph

(3) RECOVERY.—There is no unusual tendency to spin, and recovery is normal. *Push* stick *forward* to break the stall, then obtain adequate speed and *neutralize* rudder pedals before levelling out in order to avoid a re-stall. Do not be too hasty and jerk the airplane back to level position in recovering from the stall—LEVEL OFF GRADUALLY.

f. SPINS.

(1) GENERAL.—Spins in excess of three turns are prohibited. The spin is not a violent maneuver. A vibration during the spin is a normal characteristic of the airplane.

(2) RECOVERY.—When in a spin, *full* rudder should be held in the *direction* of the spin, and the elevator should be held in the *full up* position. *No* aileron should be used. The method of recovery is as follows:

(a) Briskly apply *full opposite* rudder.

(b) After spinning one-fourth to one-half turn more, briskly move the elevators to the *full down* position (*push* stick forward).

(c) Hold these positions of the controls until spinning motion is *stopped.* THEN NEUTRALIZE RUDDER.

(d) The resulting dive may be *steep,* so do *not* try to *jerk* the airplane back to level flight. LEVEL OFF GRADUALLY.

WARNING

If rudder is not NEUTRALIZED and stick should be *jerked* to recover from the dive after the spin has been stopped, it is quite likely the plane will go into another spin.

g. DIVES.—An increase in all surface control forces is noticeable during any diving maneuver.

(1) Do not EXCEED the maximum diving speed of 230 mph.

(2) In pulling out of a dive, LEVEL OFF GRADUALLY.

h. ACROBATICS.

(1) Normal acrobatics are permitted with the exception of those listed under "Maneuvers Prohibited"—paragraph 2a following.

(2) Gyro instruments *must* be caged when doing acrobatics.

i. APPROACH FOR LANDING.—Do not *lower* flaps above 120 mph.

(1) Use flaps as desired taking into consideration the condition of landing field. Do not use more than 20 to 30 degrees of flap if the landing strip is covered by water.

Note

The slotted flaps provide excellent flight characteristics at low air speeds. Use of these flaps does not introduce undesirable tendencies toward either nose or tail heaviness. The normal gliding angle with flaps down places the airplane in a fairly steep nose-down condition. This is due to the effective "braking" action of the flaps, necessitating a steep glide to maintain flying speed.

(2) Recommended gliding speed is 90 mph, POWER OFF; and 85 mph, POWER ON. If the approach is made *without* use of *flaps,* increase the approach speed.

(3) Do not let air speed drop below 85 mph in turns.

j. LANDING.

(1) When near the ground, *flare out* the glide to land. If a large amount of flap is being used, do *not* start flaring the glide until *close* to the ground.

(2) Use necessary braking. It is not advisable to use brakes excessively during landing roll.

(3) Due to the wide tread of the landing gear, there is no tendency to "ground-loop."

k. CROSS-WIND LANDING.—In approaching for a cross-wind landing, any one of the three methods of correcting for wind drift can be used, (1) crabbing into the wind, (2) side-slipping into the wind, and (3) a combination of the above two methods. This third method is easiest to use in a strong cross-wind.

Note

Refer to the Take-off, Climb, and Landing Chart and the Specific Engine Flight Chart in Section VII following.

2. FLIGHT RESTRICTIONS AND LIMITATIONS.

a. MANEUVERS PROHIBITED.

(1) Outside loop.

(2) Inverted flight.

(3) Inverted spin.

(4) Spins in excess of three turns.

b. AIRSPEED RESTRICTIONS.

(1) Do not EXCEED an indicated airspeed of 230 mph.

(2) Do not EXTEND the wing flaps at an indicated airspeed in EXCESS of 120 mph.

(3) Do not EXCEED 2500 rpm in a dive.

(4) Do not snap roll at an indicated airspeed in EXCESS of 115 mph.

(5) Do not slow roll at an indicated airspeed in EXCESS of 168 mph.

c. TEMPERATURE AND PRESSURE LIMITATIONS.

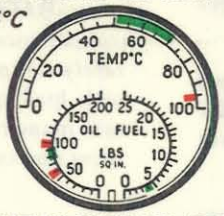
Refer to page 31, figures 32 and 33 for minimum, desired and maximum instrument dial readings.

Note

Refer to Section VII following for Specific Flight Charts summarizing the specific characteristics and limitations of the Pratt and Whitney or Wright Engines.

OPERATING RANGE
MAX OR MIN SAFE RANGE

OPERATING RANGE OIL TEMP 50-70
MAX 95°C



MAX IND
AIR SPEED 230 MPH

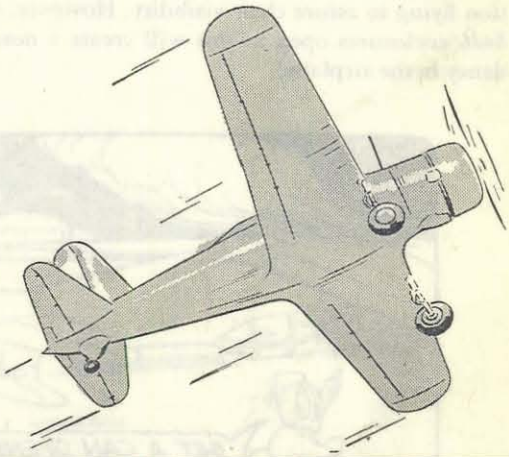
OPERATING RANGE OIL PRESS 75-90
MIN AND MAX OIL PRESS 60-100
OPERATING RANGE FUEL PRESS
3-4

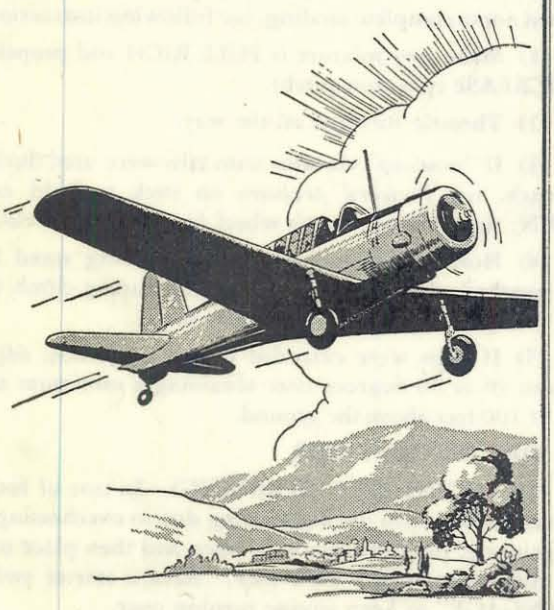
OPERATING RANGE
120°C-235°C
MAX 260°C
MIN 25°C

MAX CRUISING RPM
2000
MAX TAKE-OFF RPM
2300

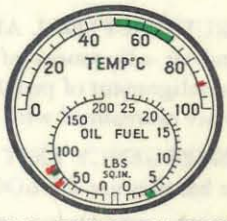
YOUR DIAL MARKINGS ARE YOUR GUIDE TO SAFE FLYING-
WATCH THEM CLOSELY!

Figure 32—Instrument Dial Markings
(BT-13, BT-13A & BT-13B)



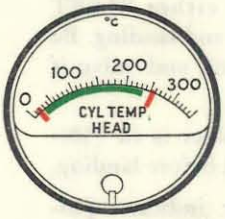


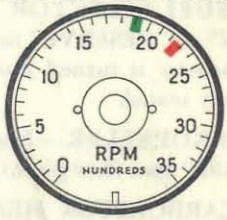
OPERATING RANGE
MAX OR MIN SAFE RANGE



MAX IND AIR SPEED
230 MPH

OPERATING RANGE OIL TEMP 50-70
MAX 88
OPERATING RANGE OIL PRESS 70-75
MIN AND MAX OIL PRESS 60-80
OPERATING RANGE FUEL PRESS 3-4





OPERATING RANGE
120°C-235°C
MAX 260°C
MIN 25°C

MAX CRUISING RPM
1900
MAX TAKE-OFF RPM
2250

YOUR DIAL MARKINGS ARE YOUR GUIDE TO SAFE FLYING.
DON'T EXCEED THEM!

Figure 33—Instrument Dial Markings (BT-15)

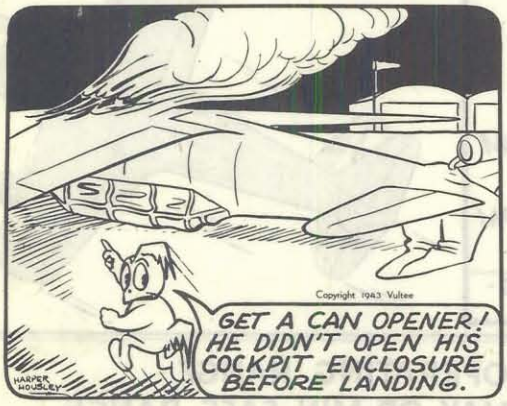
3. CAUTIONS.

The following "cautions" should be checked before take-off and during flight.

a. SURFACE CONTROL LOCK.—It is important that the lock be *securely* latched (in anchor clips) in the "UNLOCKED" (stowed) position before take-off.

b. FLYING SOLO.—If flying solo, check the rear cockpit to make sure that safety belt, blind flying hood, shoulder harness and headset cord are *securely stowed.* If they are not, a *fouling* of the control cables is possible.

c. COCKPIT ENCLOSURES.—The front cockpit enclosure should be open on the take-off, landing, and formation flying to assure clear visibility. However, do not leave *both* enclosures open as this will create a nose-heavy tendency in the airplane.



d. RUDDER PEDAL ADJUSTMENT.—The individual fore-and-aft adjustment of each rudder pedal makes possible misalignment of pedals and rudder. Make certain that pedals are *centralized* with rudder before take-off.

e. EMERGENCY EXIT LOCKS.—Make certain that all release handles are UNLOCKED before take-off.

f. FUEL PRESSURE WARNING LIGHT.—Operate "FUEL PRESSURE TEST" switch on electrical panel to ascertain that unit is working.

g. FUEL SELECTOR VALVE.—Use either "LEFT MAIN" or "RESERVE" tanks for take-off and landing. Be sure *pointer* is turned *flush* to desired tank and valve is properly *seated.*

h. PROPELLER.—Make sure propeller is in "INCREASE" rpm (low pitch) for take-off and before landing.

i. CARBURETOR HEAT.—If weather indicates possible icing, *carefully* check carburetor mixture temperature at take-off and during flight.

j. ICE ON WINGS.—Do *not* take off if there is the slightest amount of ice or frost on the wings as this condition changes the *lift* and increases the *stalling* characteristics of the airplane.

k. ENGINE WARM-UP IN HOT WEATHER.—To avoid excessive rise in cylinder head and oil temperature, do *not* warm up engine over an *extended* period. Also, *best* climbing speed for *hot* weather is 100 mph.

l. MICROPHONE.—Before doing acrobatics be sure microphone is stowed *securely.*

m. BAGGAGE COMPARTMENT.—Be sure baggage compartment is *not* overloaded and that all equipment is *safely wrapped* and *securely tied* down. The "G" value of such load components is materially increased during certain maneuvers and may result in failure of the compartment and consequent jamming of the surface controls.

WARNING

Do *not* put more than 150 pounds in the baggage compartment.

4. EMERGENCY OPERATIONS AND EQUIPMENT.

Emergency

An unforeseen combination of circumstances which calls for immediate action. Be prepared for "immediate action" by KNOWING WHAT TO DO.

a. ENGINE FAILURE DURING FLIGHT.

(1) Nose down.

(2) Fuel "OFF."

(3) Ignition "OFF."

(4) Lower flaps, but NOT until you are SURE of the field selected. Best gliding speed is 90 mph (using flaps).

(5) If at LOW altitude, land STRAIGHT AHEAD.

b. EMERGENCY TAKE-OFF IF LANDING IS NOT COMPLETED.—If proper procedure has been followed during "approach," mixture will be in FULL RICH and propeller in INCREASE rpm (low pitch). If decision is reached not to complete landing, use following instructions.

(1) Make *sure* mixture is FULL RICH and propeller in INCREASE rpm (low pitch).

(2) Throttle forward all the way.

(3) If "nose-up" elevator trim tabs were used during approach, use *forward pressure* on stick to hold nose DOWN; then move trim tab wheel *forward* to *neutral.*

(4) Hold plane *level* until *safe* climbing speed has been reached; then maintain this speed during climb (90 mph if flaps extended; 100 mph—no flaps).

(5) If flaps were extended during approach, adjust them to 20 or 30 degrees after obtaining a minimum altitude of 100 feet above the ground.

c. FIRE PRECAUTIONS.

(1) ENGINE FIRE (STARTING).—In case of fire in the induction system during starting due to overheating or overpriming, push throttle wide open and then place mixture control in "IDLE CUT-OFF." Return starter switch to "ENGAGE" to keep engine turning over.

(2) FIRE DURING FLIGHT.—When a fire is discovered while the airplane is in the air, parachutes should be in readiness for possible emergency. If flying low and condi-

tions permit, as much altitude as possible should be attained. If fire continues to burn, it must be left to the discretion of the pilot (if instructor is not along) whether a landing will be attempted or the airplane abandoned.

(a) ENGINE FIRE.—In case of engine fire during flight, and if altitude and other conditions permit, shut off the supply of gasoline to the engine and fully open throttle.

(b) WING FIRE.—In case of wing fires, turn all switches controlling landing or navigation lights to the "OFF" position. Attempt to extinguish the fire by sideslipping the airplane.

WARNING

Land as soon as possible, if the fire is extinguished, to determine and correct the cause of the fire.

(3) HAND FIRE EXTINGUISHER.—The hand fire extinguisher *(Figure 36-4)* is located to the left of the pilot's seat in the rear cockpit. To release extinguisher from metal holder, inside cockpit, pull *up* on latch. The extinguisher is also accessible from outside the cockpit through a RED painted door marked "Fire Extinguisher" located just below the left rear panel of the rear canopy enclosure. *Release* fasteners from upper corners of the door and door will drop open.

Note

The hand fire extinguisher is provided for use on the ground. It is unsuitable for combating a fire outside the fuselage during flight.

d. EMERGENCY EXIT PANEL RELEASE.—The Emergency Exit Panel Release *must be unlocked before take-off.* To unlock emergency exit panel release, push locking bar *up* to cover the word "LOCKED." *(Figures 34 & 36-1.)*

e. EMERGENCY EXIT IN FLIGHT.—Use cockpit sliding enclosures. In front cockpit, turn enclosure release handle and pull enclosure aft. In rear cockpit, turn enclosure release handle and push enclosure forward. If sliding enclosures should be jammed, use emergency exit panel release.

f. EMERGENCY EXIT ON GROUND.—In case of a crash landing when enclosure release mechanism is impaired and pilot is unable to slide cockpit enclosure open, the emergency exit panels should be used. To *release* panels in either cockpit, *pull* emergency exit panel release handle *down,* freeing latch pins. Then *push out* on handle. *(Figure 34.)*

g. EMERGENCY ACCESS TO AIRPLANE.—For emergency access to the cockpit, use the emergency exit panel release incorporated in the fore-and-aft sliding enclosures. To obtain access, *pull* release handle *up* until latch pins are free. Then pull *out* on handle to free panels from enclosures. In case of a nose-over, pull handle *down,* then pull *out* on handle. *(Figure 35.)*

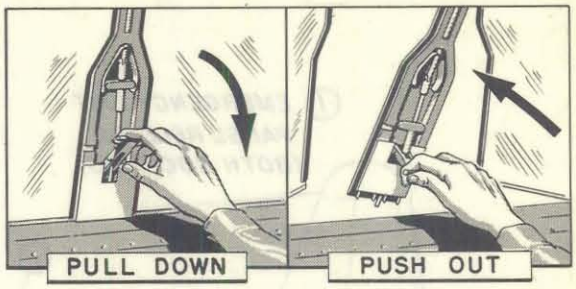


Figure 34—Operation of Panel Release—Emergency Exit on Ground

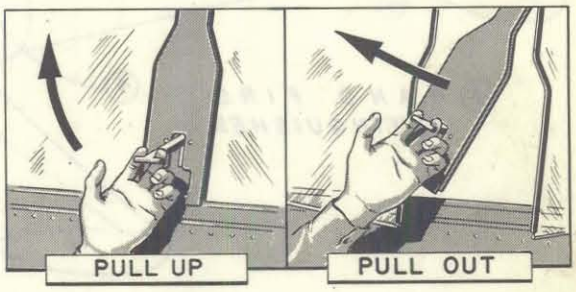


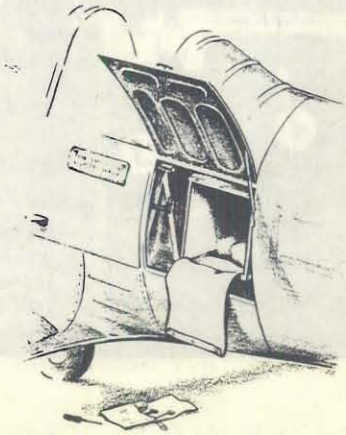
Figure 35—Operation of Panel Release—Emergency Access to Cockpit

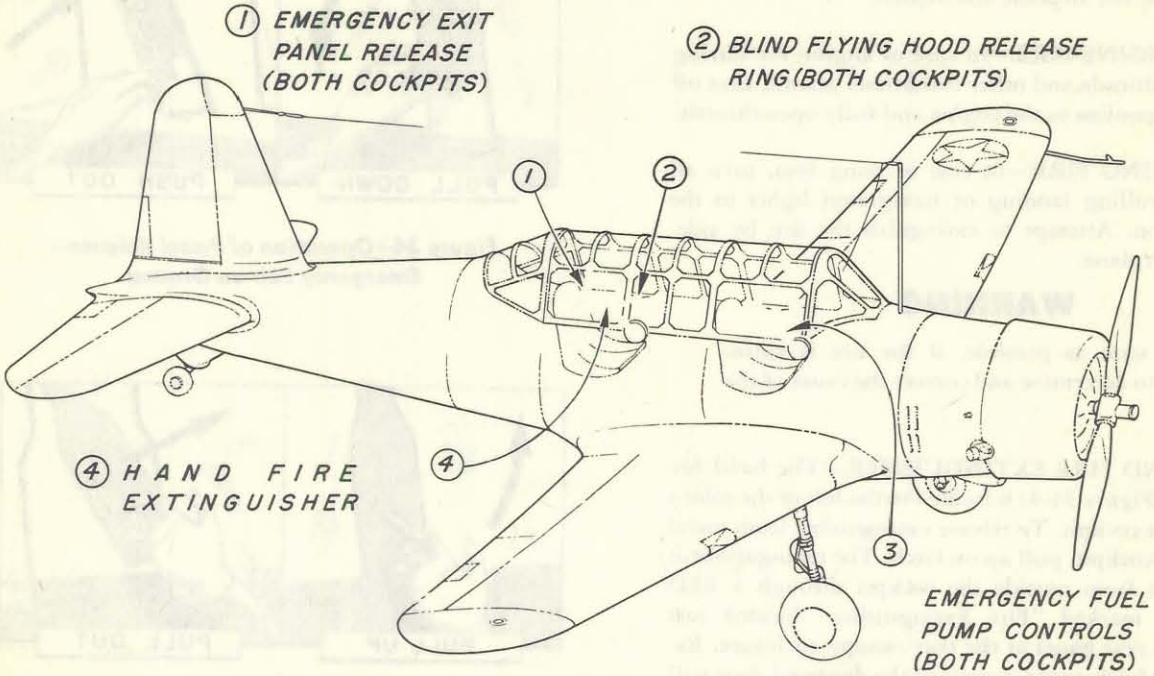
h. EMERGENCY FUEL PUMP.—If fuel pressure drops below 2¼ psi, use emergency fuel pump lever on the trim tab wheel unit at the left of the pilot in both cockpits. *(Figure 36-3.)*

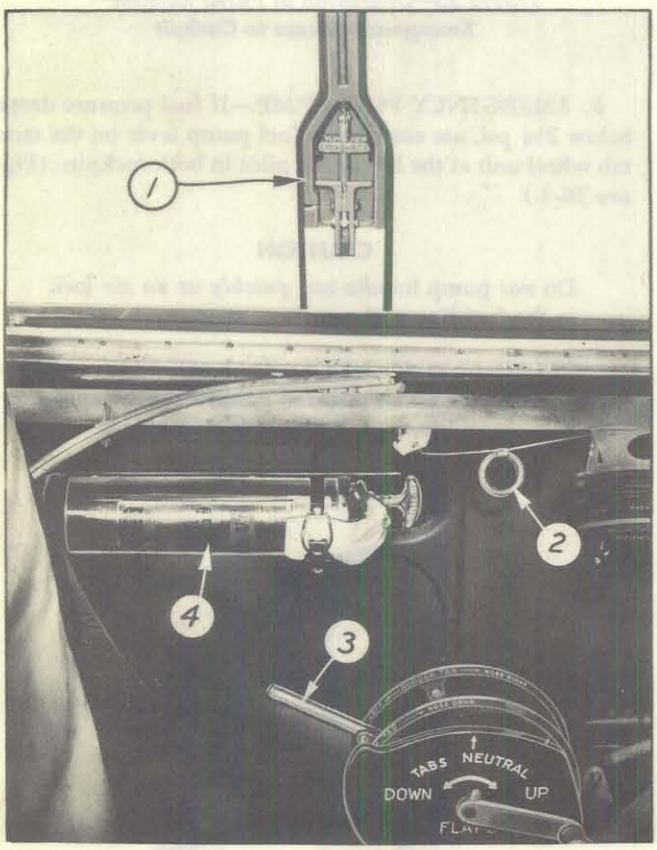
CAUTION

Do *not* pump handle too *quickly* or an air lock in the fuel line will result.

i. BLIND FLYING HOOD RELEASE RING.—To release blind flying hood, pull red painted release ring *(Figure 36-2)* located at the left side of both cockpits.







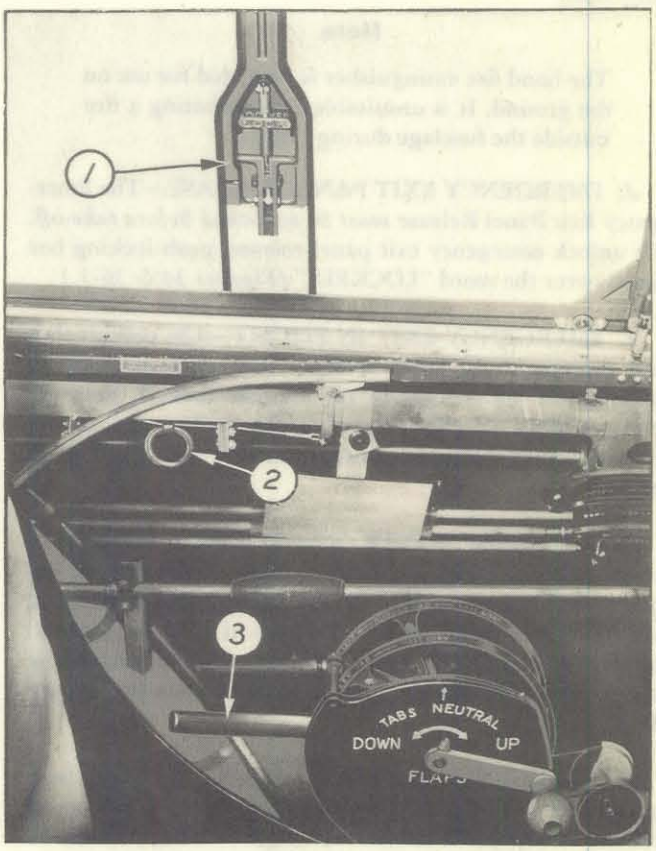


Figure 36—Emergency Equipment and Exits

5. FLIGHT PROCEDURE.

a. BEFORE ENTERING COCKPIT.

(1) Check gross weight and loading. *(Section VII following.)*

(2) Make sure pitot head cover has been removed.

(3) Open baggage compartment to make *sure* that ballast and equipment are safely wrapped and securely tied.

(4) Check fuel and oil.

(5) If flying solo, check the rear cockpit to make *sure* all equipment is securely stowed. *Close* rear cockpit enclosure.

b. ON ENTERING COCKPIT.

(1) Ignition switch "OFF" *(Figure 13-14).*

(2) Set parking brake *(Figure 13-24).*

(3) Check Form I (Flight Report) to make sure airplane has been inspected and pre-flighted.

(4) Unlock surface control lock and *stow securely* in anchor clips *(Figure 7).* Check for free movement of controls.

(5) Adjust and fasten safety belt and shoulder harness.

(6) Adjust seat to assure best visibility and full rudder movement. Use cushions if necessary.

(7) Adjust rudder pedals for full brake and rudder control. Be *sure* both pedals are adjusted to the same length *(Figure 5).*

(8) Flaps "UP."

(9) Set altimeter to field elevation or as required.

(10) "UNLOCK" emergency exits *(Figure 17).*

(11) Check that gyro instruments are uncaged.

Note

Any time the airplane is to be flown solo, and maneuvers which will exceed the operating limits of the gyro instruments are planned, the gyro instruments in the rear cockpit will be caged prior to take-off and uncaged immediately after the flight is completed. Under normal operations, the gyro instruments will be uncaged at all times except during maneuvers which exceed the operating limits of the instruments. If horizon bar of the gyro horizon indicator is not level after the engine is started, cage and immediately uncage the gyro at least 5 minutes before take-off.

(12) See Pilot's Check-Off List.

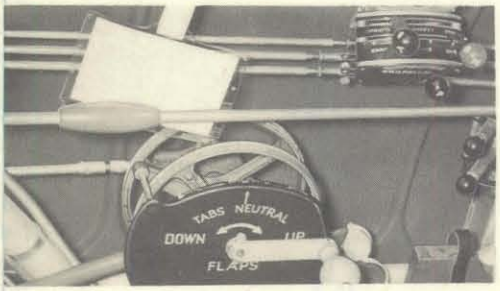


Figure 37—Pilot's Check-Off List Location

c. STARTING ENGINE.—Wheel chocks *should* be used when starting and running engine.

(1) If the engine has been idle for over two hours or overprimed, oil and fuel will collect in the lower cylinders and intake pipes. If the engine is cranked over with liquid in the combustion chamber, the link rod will *bend* and eventually *fail.* Consequently, it is very important that the engine be pulled through slowly by hand in direction of rotation. If there is any evidence of *excessive* compression during hand cranking, do *not* attempt to pull the engine past that point, but remove the front spark plugs from the three lower cylinders and then continue to crank the engine over by hand to remove all liquid. Dry the spark plugs and replace.

WARNING

Before pulling engine through by hand, be SURE ignition switch is "OFF."

(2) Set fuel selector valve *(Figure 11-14)* to "L.H. MAIN" or "RESERVE," whichever is the more nearly full.

(3) Mixture control *(Figure 11-13)* to "FULL RICH."

(4) Propeller control *(Figure 11-9)* in "DECREASE" rpm (high pitch).

(5) Carburetor heater control *(Figure 11-12)* to "COLD."

(6) Oil shutter control (if installed) to "OPEN" position *(Figure 11-10).*

(7) Check radio and other electrical equipment to make sure switches are "OFF."

(8) Turn generator disconnect switch to "ON."

(9) Set throttle approximately one inch open.

(10) With emergency fuel pump *(Figure 11-5)* bring fuel pressure to three or four pounds.

(11) Operate engine primer *(Figure 13-13)* as required. Refer to Section II, paragraph 2 *e* for detailed instructions.

CAUTION

If engine is overprimed turn ignition switch "OFF," place mixture control in "IDLE-CUT-OFF," open throttle wide, and turn the engine over several revolutions by hand. Ignition switch "OFF."

(12) Place battery disconnect switch *(Figure 27-1 & 69, & Figure 25)* to "ON" or "BAT." Fuel pressure warning light should glow.

(13) "ENERGIZE" starter *(Figure 27-34 & 53 & Figure 26.)*

(14) Turn ignition switch to "BOTH," then "ENGAGE" starter and operate emergency fuel pump to maintain fuel pressure as engine commences to run.

CAUTION

If engine does not start after second trial, do *not continue* cranking. Determine the trouble.

d. ENGINE WARM-UP AND ACCESSORY CHECK.

(1) After engine has started, idle at 800 to 1000 rpm until oil pressure is established. If oil pressure does *not* reach 40 pounds within 30 seconds, shut engine OFF and investigate.

(2) When oil pressure is sufficient to indicate that oil is circulating properly, shift propeller control to "INCREASE" rpm (low pitch) position, and continue engine warm-up at 1000 to 1100 rpm.

(3) Use oil shutters (if installed) as required.

(4) While engine and oil are warming, make the following accessory checks:

(a) Turn "ON" radio switches, attach headset cord to earphones, and check transmitter and receiver with control tower. Test interphone if flying dual.

(b) Test fuel pressure warning light by turning "ON" the Fuel Pressure Test switch located on electrical panel.

(c) Turn fuel selector valve to each tank long enough to ascertain fuel flow from *all* tanks to the engine.

Note

For night flights check cockpit lighting, landing lights, navigation and passing lights *(Figure 27.)*

(5) When oil temperature gage indicates that oil has started to warm up, increase engine rpm to approximately 1400.

(a) Shift propeller control from "INCREASE" rpm (low pitch) to "DECREASE" rpm (high pitch). There should be a drop of approximately 250 rpm at 1400 rpm if propeller is changing pitch properly. *Return propeller control* to "INCREASE" rpm (low pitch).

(6) Open throttle until engine is turning approximately 1700 rpm and check as follows:

CAUTION

As cooling of the cylinder heads and barrels is insufficient while on the ground, any *prolonged* running at or near *full* throttle must be *avoided.*

(a) Temperature and Pressure Indications.

		DESIRED	MINIMUM	MAXIMUM
P AND W ENGINE				
Oil Pressure	—	75 to 90 psi	60 psi	100 psi
Oil Temperature	—	50° to 70°C (122° to 158°F)		95°C (203°F)
Fuel Pressure	—	3 to 4 psi	3 psi	4 psi
Cylinder Head Temp.	—	120° to 235°C (248° to 455°F)	25°C (77°F)	260°C (500°F)
WRIGHT ENGINE				
Oil Pressure	—	70 to 75 psi	60 psi	80 psi
Oil Temperature	—	50° to 70°C (122° to 158°F)		88°C (190°F)
Fuel Pressure	—	3 to 4 psi	3 psi	4 psi
Cylinder Head Temp.	—	120° to 235°C (248° to 455°F)	25°C (77°F)	260°C (500°F)

(b) MAGNETO CHECK.—Turn ignition switch *(Figure 13-14)* to "R" momentarily and note any loss of rpm as indicated on tachometer. Return ignition switch to "BOTH" until engine picks up rpm, then turn ignition switch to "L" momentarily and note any loss of rpm. Return ignition switch to "BOTH." When switching to each magneto there should not be a drop of more than 100 rpm. This check must not EXCEED 15 seconds.

(c) GENERATOR CHECK.—Check ampere indicator to make sure generator is functioning. The amount of "charge" indicated will vary depending on the strength of the battery.

(7) MAXIMUM RPM CHECK.—Open throttle wide and note rpm as indicated on tachometer. Normal maximum rpm should be from 1900 to 2000. ENGINE SHOULD NOT BE FLOWN IF LESS THAN 1850 RPM AT FULL THROTTLE ON THE GROUND. This check should be limited to only a FEW seconds.

e. TAXIING INSTRUCTIONS.

(1) Get taxi clearance if required.

(2) Have chocks removed and release parking brake.

(3) Use *full* rudder and brakes as required to assure clear view ahead.

f. TAKE-OFF.—Check following:

(1) Check surface controls for free action.

(2) Set trim tabs at "NEUTRAL" or as required.

(3) Mixture control to "FULL RICH."

(4) Set carburetor air heater control to "COLD" position unless weather indicates icing conditions.

(5) Oil cooler shutters (if installed) to "OPEN."

(6) Propeller control forward to "INCREASE" rpm (low pitch).

(7) Fuel selector valve to "L.H. MAIN" or "RESERVE." Make sure valve is *seated* properly.

(8) Flap setting of 20 to 30 degrees is recommended.

(9) Clean out engine by opening throttle to 1700 rpm, then recheck magnetos, temperatures, and pressures.

CAUTION

Maximum rpm during take-off:

Pratt and Whitney Engine	—	2300 rpm
Wright Engine	—	2250 rpm

g. CLIMB.

(1) Throttle back, as soon as safe altitude has been reached, to 2100 rpm for continued climb in "INCREASE" rpm (low pitch).

(2) Best climbing speed is 90 mph with 20 degrees of flaps.

(3) Trim tabs as required.

h. CRUISE.

(1) Propeller control aft to "DECREASE" rpm (high pitch).

(2) Cruise rpm.

(a) Pratt and Whitney Engine—1950 to 2000 rpm.

(b) Wright Engine—1900 rpm.

(3) Trim tabs as required.

i. APPROACH AND LANDING.

(1) Mixture control to "FULL RICH."

(2) Fuel selector valve to "L.H. MAIN" or "RESERVE," whichever contains the more fuel. Be sure valve is *seated* properly.

(3) Propeller control forward to "INCREASE" rpm (low pitch).

Note

In changing from high to low pitch on approach, move the throttle *aft* to *decrease* engine rpm. *Then* move control to low pitch.

(4) Check carburetor mixture temperature.

(5) Use flaps as required. Do NOT lower flaps above 120 mph.

(6) Trim tabs as required.

(7) Recommended gliding speed is 90 mph, power-off; 85 mph, power-on.

(8) Press on brake pedals momentarily while on approach to check for hydraulic pressure.

(9) Do not use brakes excessively during landing roll.

(10) Raise flaps after airplane has stopped.

j. STOPPING ENGINE.

(1) For cold weather stopping, refer to OIL DILUTION, Section II, paragraph 2 *f*.

(2) Run engine at 1400 rpm, move propeller control aft to "DECREASE" rpm (high pitch) position, and note tachometer for an approximate decrease of 250 rpm to insure that propeller is in full high pitch.

(3) Throttle back and allow cylinder head temperature to drop well below cruising temperature, then set throttle for 1000 rpm and move mixture control to the "IDLE-CUT-OFF" position. As engine stops, move throttle wide open.

(4) Ignition switch to "OFF."

k. BEFORE LEAVING COCKPIT.

(1) All switches "OFF."

(2) Fuel selector valve "OFF."

(3) Set parking brake.

(4) "LOCK" surface controls.

l. TYING DOWN.

(1) Tail airplane into the wind, lock surface controls, set parking brake, and place wheel chocks in front and back of each wheel.

(2) Wing tie-down fittings are located on the lower surface of each outer wing panel, aft of the front spar and aft of the landing light.

(3) A fuselage tie-down fitting is located forward of the tailwheel.

(4) A mooring kit (D-1 type) and engine cover are stowed in the baggage compartment.

SECTION VII
FLIGHT OPERATING TABLES

1. FLIGHT PLANNING.

Plan all flight cruising conditions by use of the FLIGHT OPERATION INSTRUCTION CHARTS. Instructions for its use are printed at the top of the chart.

a. EXAMPLE.—The cruising conditions for a flight of 520 miles are desired. The flight is to be made at an altitude of 6000 feet with a total fuel supply of 120 U.S. gallons. We also decide, after considering special flight conditions such as terrain, weather, nearest alternate landing field and other factors, that a reserve range of 150 miles is desired.

b. SOLUTION.

(1) FUEL ALLOWANCE FOR TAKE-OFF AND CLIMB.—Looking at the lower left corner of chart (Pratt and Whitney Engine—Metal Propeller), we find that the allowance for take-off and climb is 10 U.S. gallons.

(2) FUEL ALLOWANCE FOR RESERVE RANGE.—Having decided that a reserve range of 150 miles is desired, we next wish to determine what the amount of our reserve fuel should be. We look at chart I under AIR-MILES directly below Section III, (this section is recommended for figuring reserve fuel) for a figure equal to or greater than 150. In this instance, the figure equal to 150 miles is found. Moving horizontally to the right or left from this figure, 150, we find under the column marked FUEL (GAL) the corresponding figure 30. In other words, 30 U.S. gallons of fuel are required for the desired 150 miles reserve range.

(3) FUEL FOR CRUISING.—The fuel available for cruising is the total supply (prior to starting the engine), minus the allowance for take-off and climb and reserve fuel.

Total fuel supply	U.S.
Prior to starting engine	120 gal.
Take-off, climb allowance	−10 gal.
Reserve fuel required	−30 gal.
Fuel available for cruising	80 gal.

(4) LOCATING DESIRED CRUISING CONDITION ON CHART.

(a) The next step is to find a figure in the FUEL column equal to or less than 80 U.S. gallons. In this particular case the equal figure 80 is found. We then locate horizontally to the right or left, under AIR-MILES (NO WIND), an amount equal to or greater than the desired flight range (520 miles). This is found to be 540 miles in the AIR-MILES column directly under Section IV.

(b) We have now reached the final step in determining the desired cruising conditions for a specific flight. Starting from the figure 540, we move vertically below to the lower portion of the chart and opposite the desired cruising altitude of 6000 feet. We there find the desired cruising conditions; engine speed, 1930 rpm and the fuel consumption, 18 gph. Note the use of light printing on the chart for the above figures, indicating that "MIXTURE" should be leaned to "Best Power."

2. SUMMARY OF FLIGHT OPERATION CHART PROCEDURE.

a. Determine the desired range and altitude for the flight, the reserve range, and the total fuel supply (prior to starting engine).

b. Determine the take-off and climb allowance. It is 10 U.S. gallons for the airplane.

c. Determine the reserve fuel required. To accomplish this, find the figure in the AIR-MILES column equal to or greater than the reserve range. Moving horizontally to the right or left of this figure, locate the amount of reserve fuel required for the reserve range.

d. Subtract the take-off and climb allowance, 10 U.S. gallons and also reserve fuel required, from the total fuel supply (prior to starting engine). This will give you the fuel available for cruising.

e. Find the figure in the right or left FUEL column equal to or less than the fuel available for cruising. Moving horizontally to the right or left, locate under an AIR-MILES column, the figure equal to or greater than the desired flight range.

f. Move vertically below the desired flight range figure to the lower portion of the chart, opposite the desired cruising altitude. This will give you the desired cruising conditions for the flight.

This stuff might seem kind of dry but it's pretty important. You'd better read it thoroughly if you want to understand how to get where you want to go.

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

FORM ASC-512

AIRPLANE MODELS

BT-13-VU, BT-13A-VU, BT-13B-VU.
METAL & WOOD PROPELLER

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS

R-985-25, R-985-AN-1
R-985-AN-3

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F
DESIRED	3-4	75-90	50-70			
MAXIMUM	4	100	95			
MINIMUM	3	60	40			
IDLING	2	15				

MAX. PERMISSIBLE DIVING RPM: 2500

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	10 U.S.QT/HR 6 IMP.PT/HR
MAX. CRUISE	8 U.S.QT/HR 5 IMP.PT/HR
MIN. SPECIFIC	5 U.S.QT/HR 3 IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1100A

SUPERCHARGER TYPE: SINGLE SPEED—SINGLE STAGE—GEAR DRIVEN

FUEL GRADE: 87 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	2300	FULL	450		S.L.	SINGLE SPEED BLOWER		FULL RICH	49	41	260	500	5
WAR EMERGENCY													
MILITARY	2300	FULL	450		S.L.			FULL RICH	49	41	260	500	5
MAXIMUM CONTINUOUS	2300	FULL	450		1000			FULL RICH	48	40	260	500	NO LIMIT
MAXIMUM CRUISE	2000	AS REQ'D	300					BEST POWER	25	21	235	455	NO LIMIT
MINIMUM SPECIFIC CONSUMPTION	1900 1950 2000 2000 1950 1850	AS REQ'D	280 270 260 250 230 200		SEA LEV. 3000 6000 9000 12000 15000			BEST POWER	22 21 20 19 18 17	18 18 17 16 15 14	235	455	NO LIMIT

REMARKS: CONDITIONS TO AVOID:
1400 TO 1500 RPM DUE TO UNDESIREABLE ROUGHNESS
OPERATION BELOW 1200 RPM RESULTS IN LOW GENERATOR OUTPUT.

Figure 38—Specific Engine Flight Chart (BT-13, BT-13A & BT-13B)

5-1-42

AIRPLANE MODELS: BT-15

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS: R-975-11

CONDITION	FUEL PRESSURE LB./SQ. IN.	OIL PRESSURE LB./SQ. IN.	OIL TEMP. °C	COOLANT TEMP. °C		
DESIRED	3-4	70-75	60			
MAXIMUM	4	80	88			
MINIMUM	3	60	40			
IDLING	2	25				

MAX. PERMISSIBLE DIVING R.P.M. 2500

CONDITION	ALLOWABLE OIL CONSUMPTION	
"MAX CONTINUOUS"	9.4 IMP. PT./HR.	5.6 U.S. QT./HR.
"ECONOMICAL MAX."	5.0 IMP. PT./HR.	3.0 U.S. QT./HR.
"MIN. SPECIFIC"	3.7 IMP. PT./HR.	2.2 U.S. QT./HR.

OIL GRADE: (S) 1120 (W) 1100 A

SUPERCHARGER TYPE: SINGLE SPEED—SINGLE STAGE—GEAR DRIVEN FUEL OCTANE 87

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	2250	FULL	440	S.L.	SINGLE SPEED BLOWER	———	FUL.L. RICH	49	41	260	490	5	
EMERGENCY MAXIMUM	2250	FULL	440	S.L.		———	FULL RICH	49	41	260	490	5	
MAXIMUM CONTINUOUS	2200	FULL	420	500		———	FULL RICH	44	37	235	455	NO LIMIT	LEAN SLIGHTLY ONLY IF NECESSARY TO ELIMINATE ROUGH ENGINE OPERATION
ECONOMICAL MAXIMUM	1860 1950	AS REQ'D	280 295	S.L. 3000		———	SMOOTH OPER.	22 27	19 23	205	400	NO LIMIT	AT FIXED THROT. ADJUST MIX. CONTROL TO OBTAIN MAX. RPM. THEN ENRICH MIX. UNTIL ENGINE SPEED DROPS 20 TO 30 RPM
MINIMUM SPECIFIC CONSUMPTION	1800 1760 1740 1710 1760	AS REQ'D	250 212 192 175 177	S.L. 3000 6000 9000 12000		———	MAX. ECONOMY	18 16 14 13 14	15 14 12 11 12	205	400	NO LIMIT	AT FIXED THROTTLE, ADJUST MIX. CONTROL TO OBTAIN MAX. RPM. THEN LEAN MIX. UNTIL ENGINE SPEED DROPS 40 TO 50 RPM.
MINIMUM CRUISING	1500	AS REQ'D	155	S.L.		———	MAX. ECONOMY	12	10	205	400	NO LIMIT	

CONDITIONS TO AVOID: 1350 TO 1450 RPM. DUE TO UNDESIREABLE ROUGHNESS
OPERATION BELOW 1200 RPM. RESULTS IN LOW GENERATOR OUTPUT.

NOTE: CRITICAL ALTITUDE IS THAT AT WHICH MAXIMUM POWER IS OBTAINED WITH FULL THROTTLE UNDER CONDITIONS SHOWN.

Figure 39—Specific Engine Flight Chart (BT-15)

AIRPLANE MODELS

BT-13, BT-13A
BT-13B & BT-15.

BALANCE (C.G.) LIMITS

(FOR ALL CONDITIONS OF FLIGHT)

FORWARD	14.51%	M.A.C.
REARWARD	32.00%	M.A.C.

LENGTH OF M.A.C. = 71.3 INCHES.
LEADING EDGE OF M.A.C. AFT OF "JIG POINT = 18.47 INCHES.

NOTE

"JIG POINT" IS IDENTIFIED BY THE LOWER FORWARD FACE OF THE FIREWALL AT THE ℄ OF AIRPLANE AND IS 37.5 INCHES AFT OF THE REFERENCE DATUM.

MAXIMUM RECOMMENDED FLYING WEIGHT---4745 LBS.

LOADING CONDITIONS

	I PRIMARY			II MOST FORWARD			III MOST REARWARD		
ITEMS	WT.	ARM.	MOM.	WT.	ARM.	MOM.	WT.	ARM.	MOM.
PILOT & CHUTE	200	82.5	16,500	200	82.5	16,500	200	82.5	16,500
CO-PILOT & CHUTE	200	142.5	28,500				200	142.5	28,500
FUEL-TRAPPED	6	93.5	561	6	93.5	561	6	93.5	561
-TANKS	552	93.5	51,612				720	93.5	67,320
OIL-TRAPPED	12	8.6	103	12	8.6	103	12	8.6	103
-TANKS	63	29.0	1,827	82	29.0	2,378	82	29.0	2,378
BAGGAGE							60	170.0	10,200
TOTALS	1033	95.9	99,103	300	65.1	19,542	1280	94.2	120,620

NOTE

1. ALL AIRPLANES AS DELIVERED FROM THE FACTORY WERE WELL WITHIN THE ABOVE SPECIFIED WEIGHT AND C.G. LIMITS WHEN LOADED IN ACCORDANCE WITH THE ABOVE.
2. EACH AIRPLANE SHOULD BE WEIGHED AND THE C.G. DETERMINED PRIOR TO MAJOR MODIFICATIONS IN ORDER THAT THE EFFECT OF THE REWORK CAN BE DETERMINED CORRECTLY.
3. A MAXIMUM WEIGHT OF 150 POUNDS CAN BE CARRIED IN THE BAGGAGE COMPARTMENT PROVIDED THE C.G. REMAINS WITHIN THE REAR LIMIT OF 32.00% M.A.C. AND THE GROSS WEIGHT DOES NOT EXCEED 4745 LBS.

Figure 40—Weight and Balance Chart

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

AIRPLANE MODELS
BT-13-VU, BT-13A-VU, BT-13B-VU.
METAL PROPELLER

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
R-985-25, R-985-AN-1,
R-985-AN-3

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
4600	0	0	750	1400	950	1750	1250	2250	800	1450	1050	1850	1350	2400	1000	1600	1250	2050	1700	2700
	17	15	450	900	550	1200	750	1550	500	950	600	1250	800	1650	550	1000	750	1350	1050	1850
	34	30	200	550	300	750	400	1000	250	600	350	800	450	1050	300	650	400	850	550	1150
	51	45	100	250	100	350	200	500	100	300	150	400	200	550	150	350	200	450	250	600
4100	0	0	600	1050	750	1350	950	1750	650	1100	800	1400	1000	1800	750	1200	900	1550	1200	2000
	17	15	350	700	450	950	550	1200	400	750	500	1000	600	1250	450	800	550	1000	700	1350
	34	30	150	400	200	550	300	700	200	450	250	600	350	750	250	500	300	650	400	850
	51	45	50	150	100	200	100	300	100	200	100	250	150	350	100	200	150	300	200	450
	0	0																		
	17	15																		
	34	30																		
	51	45																		

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

ENGINE LIMITS FOR TAKE-OFF 2300 RPM & F.T. IN. HG

COMBAT MISSIONS USE 2300 RPM & F.T. IN. HG

CLIMB DATA

FERRY MISSIONS USE 2000 RPM & IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S.L. TO 3000 FT. ALT.				6000 FT. ALT.						9000 FT. ALT.						12000 FT. ALT.						15000 FT. ALT.						BLOWER CHANGE
		BEST I.A.S.		FT/MIN	TIME FROM S.L.	BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S.L.	FUEL FROM S.L.		
		MPH	KNOTS			MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	
4600	COMBAT	90	78	1050	3	90	78	850	6	11	9.2	90	78	650	10	13	10.8	85	74	450	15.5	16	13.3	85	74	250	24	20	17	
	FERRY	80	70	550	5	80	70	400	11	11	9.2	80	70	250	21	14	11.7													
4100	COMBAT	90	78	1250	2.5	90	88	1000	5	10	8.3	90	78	800	8	12	10	85	74	600	12.5	14	11.7	85	74	400	18.5	17	14.2	
	FERRY	80	70	700	4	80	70	550	8.5	10	8.3	80	70	400	15	12	10													
	COMBAT																													
	FERRY																													

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

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH		HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL
4600	85	74	1300	650	1350	700	1450	750	1350	700	1450	750	1550	850	2150	1500	2300	1650	2500	1800
4100	85	74	1100	500	1150	550	1250	600	1150	550	1250	600	1300	650	1800	1200	1900	1300	2050	1400

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

REMARKS

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

Figure 41—Take-off, Climb and Landing Chart—Metal Propeller—
(BT-13, 13A & 13B)

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

AIRPLANE MODELS
BT-13-VU, BT-13A-VU, BT-13B-VU.

WOOD PROPELLER

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
R-985-25, R-985-AN-1,
R-985-AN-3.

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
4600	0	0	750	1450	1000	1800	1300	2300	850	1500	1100	1900	1400	2450	1050	1650	1300	2100	1750	2850
	17	15	450	1000	550	1250	750	1600	500	1050	600	1300	800	1700	550	1100	750	1400	1100	1900
	34	30	200	600	250	750	400	1050	250	650	300	800	450	1150	300	700	400	850	550	1250
	51	45	50	250	100	350	150	600	100	300	150	400	200	650	150	350	200	450	250	700
4100	0	0	600	1100	750	1400	1000	1800	650	1150	850	1450	1050	1850	750	1250	950	1600	1250	2050
	17	15	350	700	450	950	550	1250	400	750	500	1000	600	1300	450	800	550	1100	700	1400
	34	30	150	400	200	550	300	700	200	450	250	600	300	750	250	500	300	650	400	850
	51	45	50	150	100	200	100	300	100	200	100	250	150	350	100	200	150	300	200	400
	0	0																		
	17	15																		
	34	30																		
	51	45																		

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

ENGINE LIMITS FOR TAKE-OFF 2300 RPM & F. T. IN. HG

CLIMB DATA

COMBAT MISSIONS USE 2300 RPM & F.T. IN. HG

FERRY MISSIONS USE 2000 RPM & IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S. L. TO 3000 FT. ALT.				6000 FT. ALT.						9000 FT. ALT.						12000 FT. ALT.						15000 FT. ALT.						BLOWER CHANGE
		BEST I.A.S.		FT/MIN	TIME FROM S. L.	BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		
		MPH	KNOTS			MPH	KNOTS			U. S.	IMP.	MPH	KNOTS			U. S.	IMP.	MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	
4600	COMBAT	90	78	850	3.5	90	78	650	7.5	12	10	90	78	450	13	14	11.7	85	74	250	22	19	15.9							
	FERRY																													
4100	COMBAT	90	78	1000	3	90	78	800	6	11	9.2	90	78	600	10.5	13	10.8	85	74	400	16.5	16	13.3	85	74	200	27	22	18.4	
	FERRY																													
	COMBAT																													
	FERRY																													

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

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH		HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL
4600	85	74	1300	650	1350	700	1450	750	1350	700	1450	750	1550	850	2150	1500	2300	1650	2500	1800
3600	85	74	1100	650	1150	550	1250	600	1150	550	1250	600	1300	650	1800	1200	1900	1300	2050	1400

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

REMARKS

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

Figure 42—Take-off, Climb and Landing Chart—Wooden Propeller—
(BT-13, 13A & 13B)

5-1-42

AIRPLANE MODELS: BT-15

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS: R-975-11

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.
4600	0	750	1400	950	1750	1250	2250	800	1450	1050	1850	1350	2400	1000	1600	1250	2050	1700	2750
	20	400	850	500	1100	700	1450	450	900	550	1150	750	1550	500	950	700	1250	950	1700
	40	150	450	200	600	300	800	200	500	250	650	350	850	250	550	300	700	400	900
4100	0	600	1050	750	1350	950	1750	650	1100	800	1400	1000	1800	750	1200	900	1550	1200	2000
	20	300	650	400	850	500	1100	350	700	450	900	550	1150	400	750	500	950	650	1250
	40	100	300	150	400	200	550	150	350	200	450	250	600	200	400	250	500	300	650
	0																		
	20																		
	40																		

NOTE: INCREASE DISTANCE 10% FOR EACH 10°C (20°F) ABOVE 15°C (60°F)

ENGINE LIMITS FOR TAKE-OFF 2250 R.P.M. (MAX) & FULL THROTTLE

CLIMB DATA

COMBAT MISSIONS USE 2200 RPM (MAX), FULL THROTTLE & LOW PITCH

FERRY MISSIONS USE 1950 RPM, THROTTLE AS REQ. & LOW PITCH

GROSS WEIGHT (IN LBS)	TYPE OF CLIMB	S.L. TO FT. ALT.			FT. ALT.				FT. ALT.				FT. ALT.				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.	
4600	COMBAT	90	1050	3	90	850	6	11	90	650	10	13	85	450	15.5	16	85	250	24	20	
	FERRY	80	400	7	80	250	17	11													
4100	COMBAT	90	1250	2.5	90	1000	5	10	90	800	8	12	85	600	12.5	14	85	400	18.5	17	
	FERRY	80	550	5	80	400	12	11													
	COMBAT																				
	FERRY																				

NOTE: INCREASE ELAPSED CLIMBING TIME 10 % FOR EACH 10°C (20°F) ABOVE STANDARD 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
4600	85	1300	650	1350	700	1450	750	1350	700	1450	750	1550	850	2150	1500	2300	1650	2500	1800
3600	85	1100	500	1150	550	1250	600	1150	550	1250	600	1300	650	1800	1200	1900	1300	2050	1400

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

REMARKS

LEGEND

I.A.S. — INDICATED AIR SPEED

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

Figure 43—Take-off, Climb and Landing Chart (BT-15)

MODEL(S)

BT-13-VU, BT-13A-VU & BT-13B-VU

METAL PROPELLER

ENGINE(S): R-985-25, R-985-AN-1, R-985-AN-3

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 4600 TO 3600 POUNDS

EXTERNAL LOAD ITEMS

NONE

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.						
MILITARY POWER	2300	F.T.	S.L.	F.R.	5	49
NORMAL RATED	2300	F.T.	1000	F.R.	NO LIMIT	48

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I						FUEL	II						III						IV						FUEL	V	
RANGE IN AIR MILES						U. S.	RANGE IN AIR MILES						RANGE IN AIR MILES						RANGE IN AIR MILES						U. S.	RANGE IN AIR MILES	
STATUTE		NAUTICAL				GAL.	STATUTE		NAUTICAL				STATUTE		NAUTICAL				STATUTE		NAUTICAL				GAL.	STATUTE	NAUTICAL
						120	○ 10 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ○																		120		
340		300				110	450		390				550		480				740		640				110	790	690
310		270				100	410		360				500		430				680		590				100	720	630
270		230				90	360		310				450		390				610		530				90	650	570
240		210				80	320		280				400		350				540		470				80	580	500
210		180				70	280		240				350		300				470		410				70	500	430
180		160				60	240		210				300		260				410		360				60	430	370
150		130				50	200		170				250		220				340		300				50	360	310
120		100				40	160		140				200		170				270		230				40	290	250
90		80				30	120		100				150		130				200		170				30	220	190
60		50				20	80		70				100		90				140		120				20	140	120
30		25				10	40		30				50		40				70		60				10	70	60
MAXIMUM CONTINUOUS							OPERATING DATA						OPERATING DATA						OPERATING DATA							MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
2080	113	F.R.	F.T.	26	148	15000							2080	113	F.R.	F.T.	26	148							15000	1860	103	C.L.		16	136
2150	129	F.R.	F.T.	33	156	10000	2150	129	F.R.	F.T.	33	156	2040	122	F.R.	F.T.	27	148	1990	118	C.L.		19	143	10000	1800	102	C.L.		15	123
2200	145	F.R.	F.T.	44	163	5000	2110	139	F.R.	F.T.	35	156	2000	130	F.R.	F.T.	27	146	1900	123	C.L.		18	138	5000	1690	103	C.L.		14	116
2250	160	F.R.	F.T.	49	166	S.L.	2170	155	F.R.	F.T.	38	161	2040	145	F.R.	F.T.	28	151	1720	120	C.L.		16	125	S.L.	1540	101	C.L.		13	105

NOTES

○ ALLOW 10 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

EXAMPLE

AT 4600 LB. GROSS WT. WITH 100 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 10 GAL.) TO FLY 410 STAT. AIRMILES AT 5000 FT. ALT. MAINTAIN 2110 RPM AND 139 MPH IND. AIRSPEED WITH MIXTURE SET F.R.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

Figure 44—Flight Operation Instruction Chart—Metal Propeller—
(BT-13, 13A & 13B)

MODEL(S)

BT-13-VU, BT-13A-VU, BT-13B-VU
WOOD PROPELLER (HIGH PITCH 19.6)

ENGINE(S): R-985-25, R-985-AN-1, R-985-AN-3

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 4600 TO 3600 POUNDS

EXTERNAL LOAD ITEMS

NONE

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.						
MILITARY POWER	2300	F.T.	S.L.	F.R.	5	49
NORMAL RATED	2300	F.T.	1000	F.R.	NO LIMIT	48

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
			120	○ 10 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ○									120			
330	290		110	430	370		510	440		700	600		110	730	630	
300	260		100	390	340		470	410		640	550		100	670	570	
270	230		90	350	300		420	360		570	500		90	600	520	
240	200		80	310	270		370	320		510	440		80	530	460	
210	170		70	270	230		330	280		450	390		70	470	400	
180	150		60	230	200		280	240		380	330		60	400	350	
150	130		50	190	160		230	200		320	280		50	330	290	
120	100		40	150	130		180	150		250	220		40	260	220	
90	70		30	110	100		140	120		190	160		30	200	170	
60	50		20	80	70		90	80		120	100		20	130	110	
30	25		10	40	30		40	30		60	50		10	60	50	

MAXIMUM CONTINUOUS						ALT.	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT.	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
2080	108	F.R.	F.T.	26	141	15000							2080	108	F.R	F.T.	26	141							15000						
2150	124	F.R.	F.T.	33	150	10000	2150	124	F.R.	F.T.	33	150	2040	115	F.R.	F.T.	27	140	1990	112	C.L.		19	136	10000	1870	99	C.L.		16	120
2200	140	F.R.	F.T.	44	158	5000	2110	134	F.R.	F.T.	35	151	2000	126	F.R.	F.T.	27	141	1900	116	C.L.		18	130	5000	1760	100	C.L.		15	112
2250	156	F.R.	F.T.	49	162	S.L.	2170	151	F.R.	F.T.	38	157	2040	141	F.R.	F.T.	28	146	1720	114	C.L.		16	118	S.L.	1610	99	C.L.		14	103

NOTES

○ ALLOW 10 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

EXAMPLE

AT 4600 LB. GROSS WT. WITH 100 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 10 GAL.) TO FLY 390 STAT. AIRMILES AT 5000 FT. ALT. MAINTAIN 2110 RPM AND 134 MPH IND. AIRSPEED WITH MIXTURE SET F.R.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

Figure 45—Flight Operation Instruction Chart—Wooden Propeller—(BT-13, 13A & 13B)

MODEL(S)	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS	5-1-42
BT-15	WEIGHT 4600 TO 3600 POUNDS	NONE	

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

ENGINE MODEL(S): R-975-11

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.
3. MIXTURE CONTROL IS INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SPECIFIC ENGINE FLIGHT CHART)
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*
		120	10 GALLON TAKE-OFF ALLOWANCE, NOT AVAILABLE IN FLIGHT								120		
360	*310*	110	525	*455*	690	*595*	850	*735*			110	950	*825*
330	*285*	100	475	*410*	630	*545*	775	*670*			100	870	*755*
295	*255*	90	430	*370*	565	*490*	695	*600*			90	780	*675*
260	*225*	80	380	*330*	500	*430*	620	*535*			80	695	*600*
230	*200*	70	330	*285*	440	*380*	540	*465*			70	605	*525*
195	*165*	60	285	*245*	375	*325*	465	*400*			60	520	*450*
165	*140*	50	235	*200*	315	*270*	385	*330*			50	435	*375*
130	*110*	40	190	*165*	250	*215*	310	*265*			40	345	*295*
95	*80*	30	140	*120*	185	*160*	230	*195*			30	260	*225*
65	*55*	20	95	*80*	125	*105*	155	*130*			20	170	*145*
30	*25*	10	45	*35*	60	*50*	75	*65*			10	85	*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				
				20,000																				20,000				
1960	F.T.	26		15,000	*1950*			*26*																15,000				
2000	F.T.	30		12,000	*1950*			*27*		*1800*			*19*		*1800*			*16*						12,000				
2040	F.T.	34		9,000	*1950*			*27*		*1810*			*19*		*1800*			*16*						9,000	*1680*			*12*	
2080	F.T.	39		6,000	*1950*			*28*		*1840*			*20*		*1790*			*16*						6,000	*1610*			*12*	
2120	F.T.	43		3,000	*1950*			*27*		*1840*			*20*		*1770*			*16*						3,000	*1540*			*12*	
2150		43		SEA LEVEL	1950			27		*1820*			*20*		*1690*			*15*						SEA LEVEL	*1500*			*12*	

RANGE VALUES IN THIS COLUMN APPLY AT SEA LEVEL

*ALLOW 10 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. ALL FIGURES HAVE BEEN FLIGHT CHECKED.

HEAVY NUMBERS:-USE "FULL RICH" MIXTURE. LEAN SLIGHTLY IF NECESSARY TO ELIMINATE ROUGH ENGINE OPERATION.
HEAVY ITALICS:-USE "SMOOTH OPERATION" MIXTURE
LIGHT ITALICS:-USE "MAXIMUM ECONOMY" MIXTURE
(FOR DEFINITIONS SEE SPECIFIC ENGINE FLIGHT CHART)

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

Figure 46—Flight Operation Instruction Chart—(BT-15)