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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**

*This handbook of pilot's flight operating instructions is an unrestricted publication by the Service Department, Vultee Field Division of Consolidated Vultee Aircraft Corporation.*

*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.*

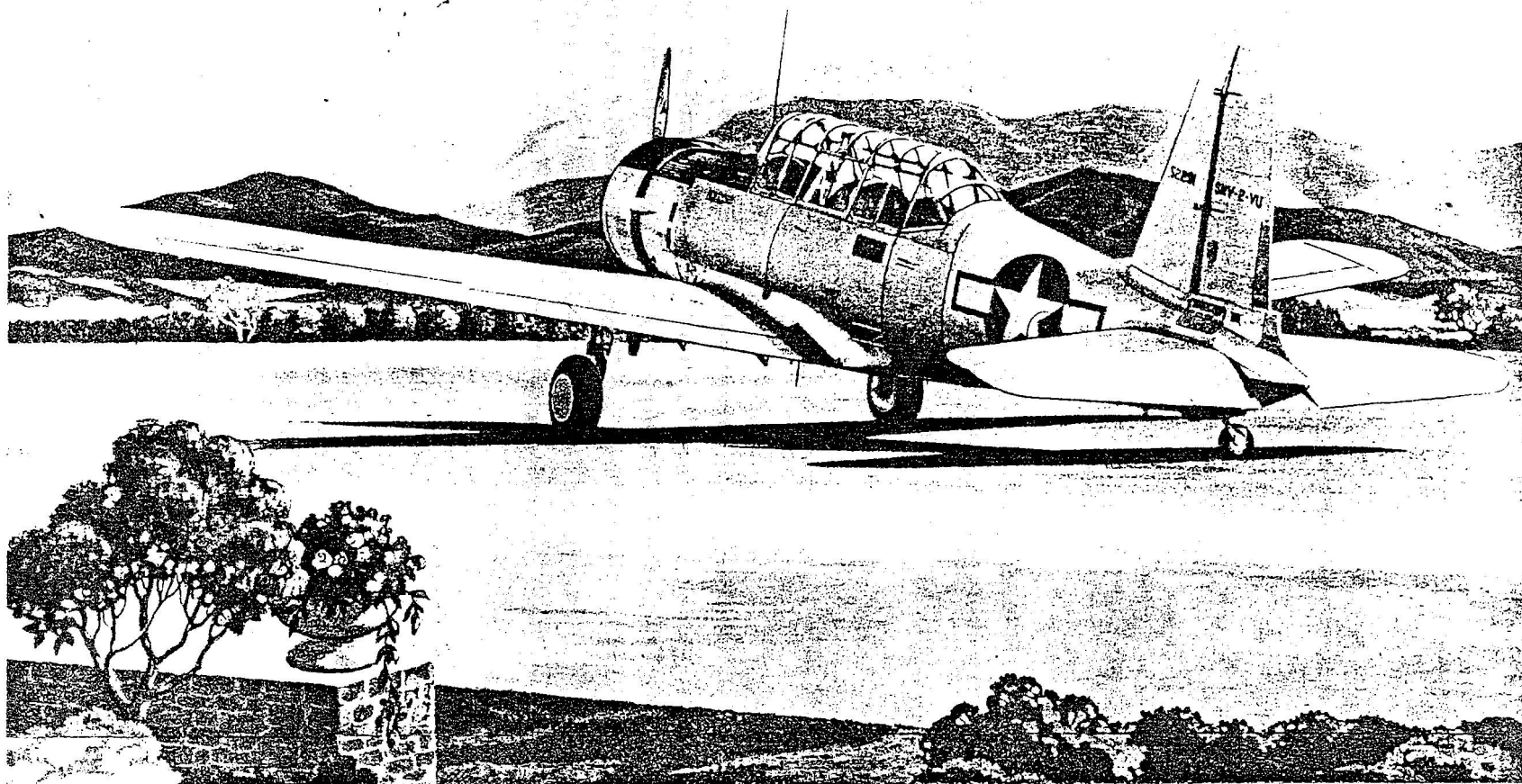


Figure 1—Rear Three-Quarter View of Complete Airplane

## 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	12'4¾"	12'4¾"	12'4¾"	12'4¾"
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.

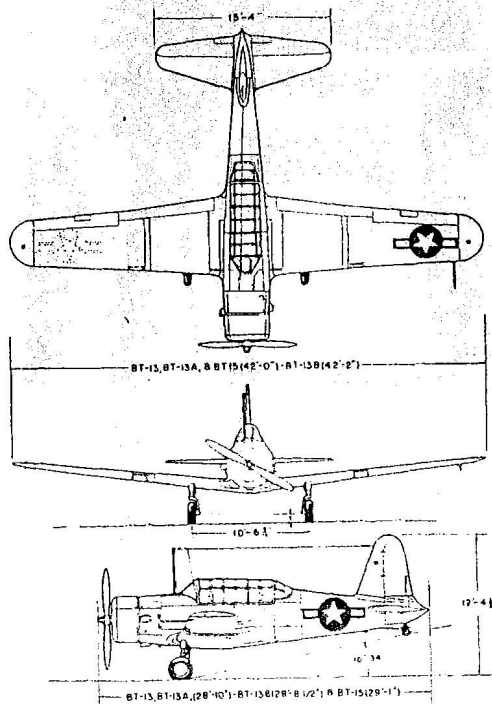
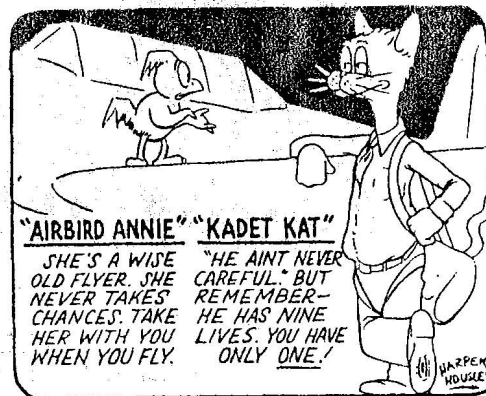


Figure 2—Airplane Three-View



### 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.

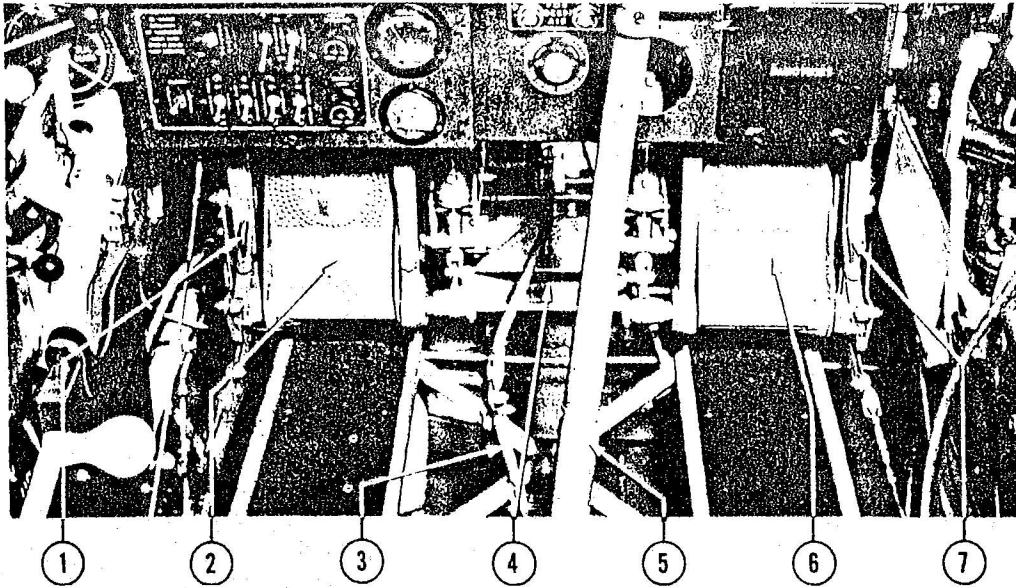
### 4. ELECTRICAL SYSTEM.

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.

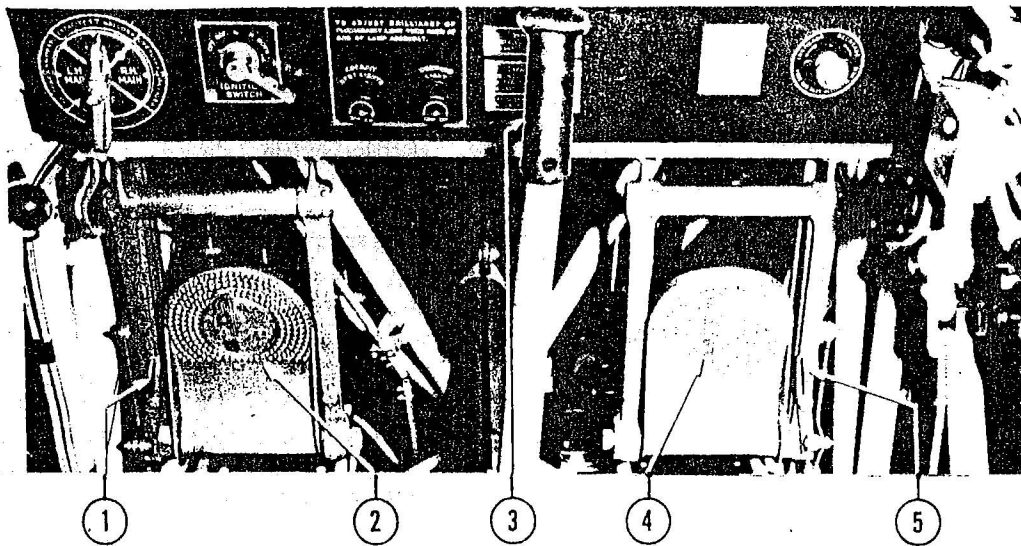
The communication equipment in all BT-13, BT-13A and BT-15 airplanes consists of a command set SCR-183; range filter, interphone and two-hand microphones with "PRESS-TO-TALK" button handles. The communication equipment in the BT-13B airplane is the same as listed above except that the command set is 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 controllible 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.

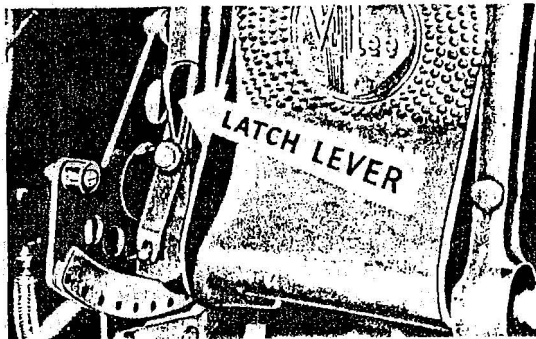


Figure 5—Rudder Pedal Adjustment

(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*; *ast* 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*; *ast* for *nose-up*. (Figure 11-6.)

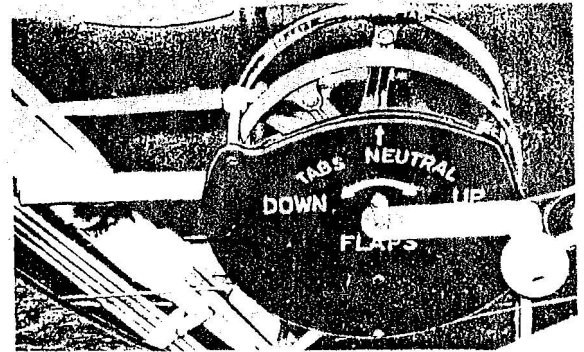


Figure 6—Trim Tab, Landing Flaps and Emergency Fuel Pump Control Unit

#### 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



Section II  
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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.)

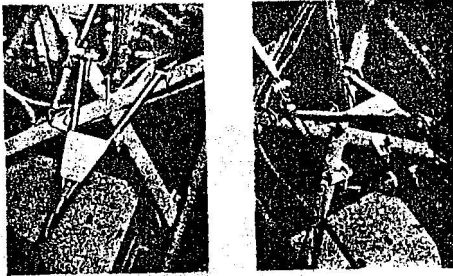


Figure 7—Surface Control Lock

**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 control.

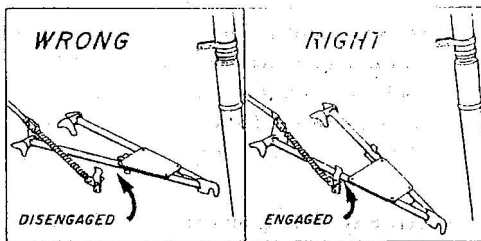
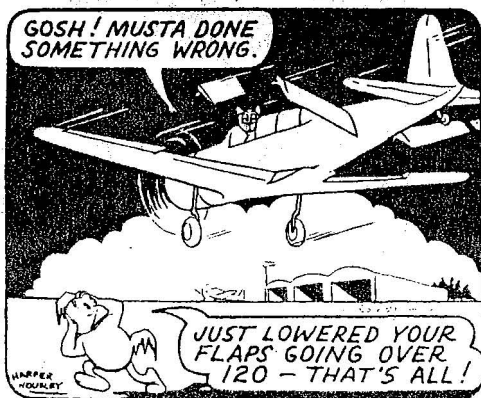


Figure 8—Proper Method of Stowing Surface Control Lock

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.)

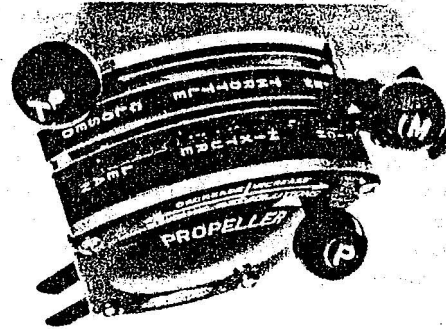


Figure 9—Engine Control Unit

(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.

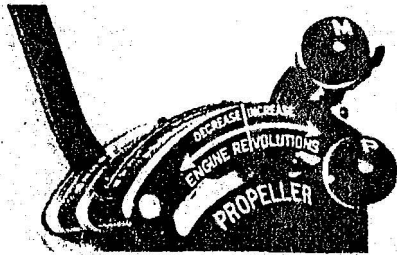


Figure 10—Close Up of Propeller Control

### 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.

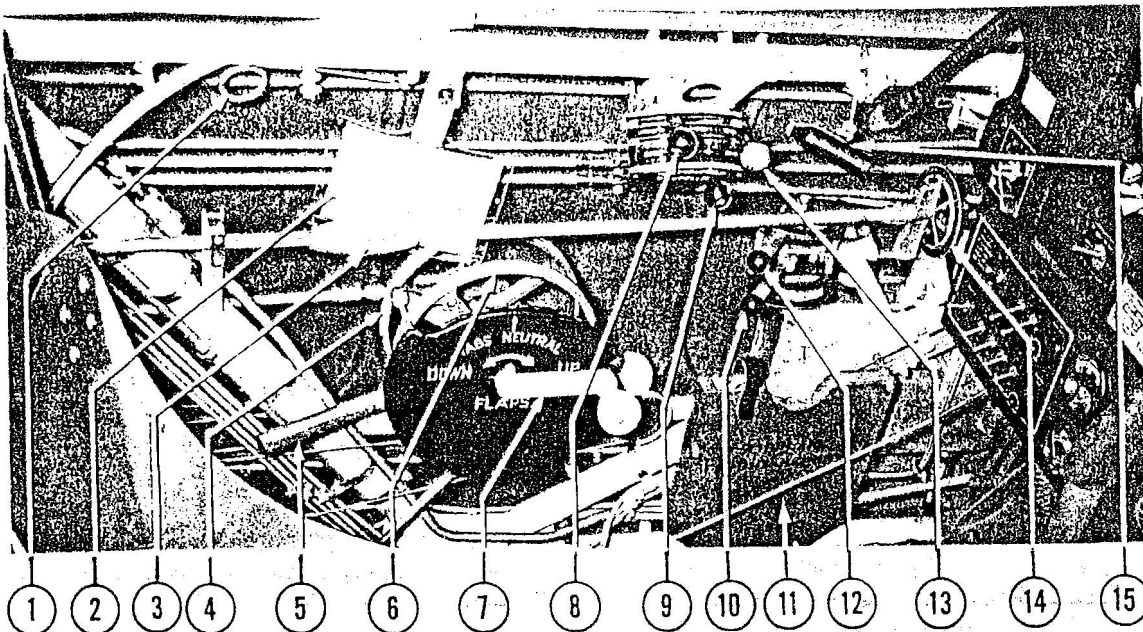
### Note

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."

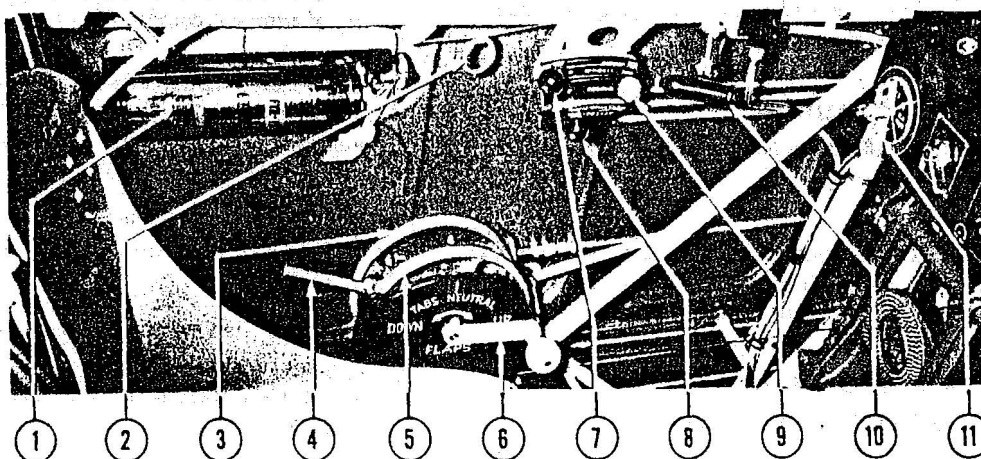
f. OIL DILUTION.—The oil dilution control is located on the right side of the trim panel in the front cockpit only in all BT-13 and BT-13A airplanes. (Figure 13-27.) This control is on the left side of the trim panel (front cockpit only) in the BT-15 airplanes. The oil dilution switch on the BT-13B airplanes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



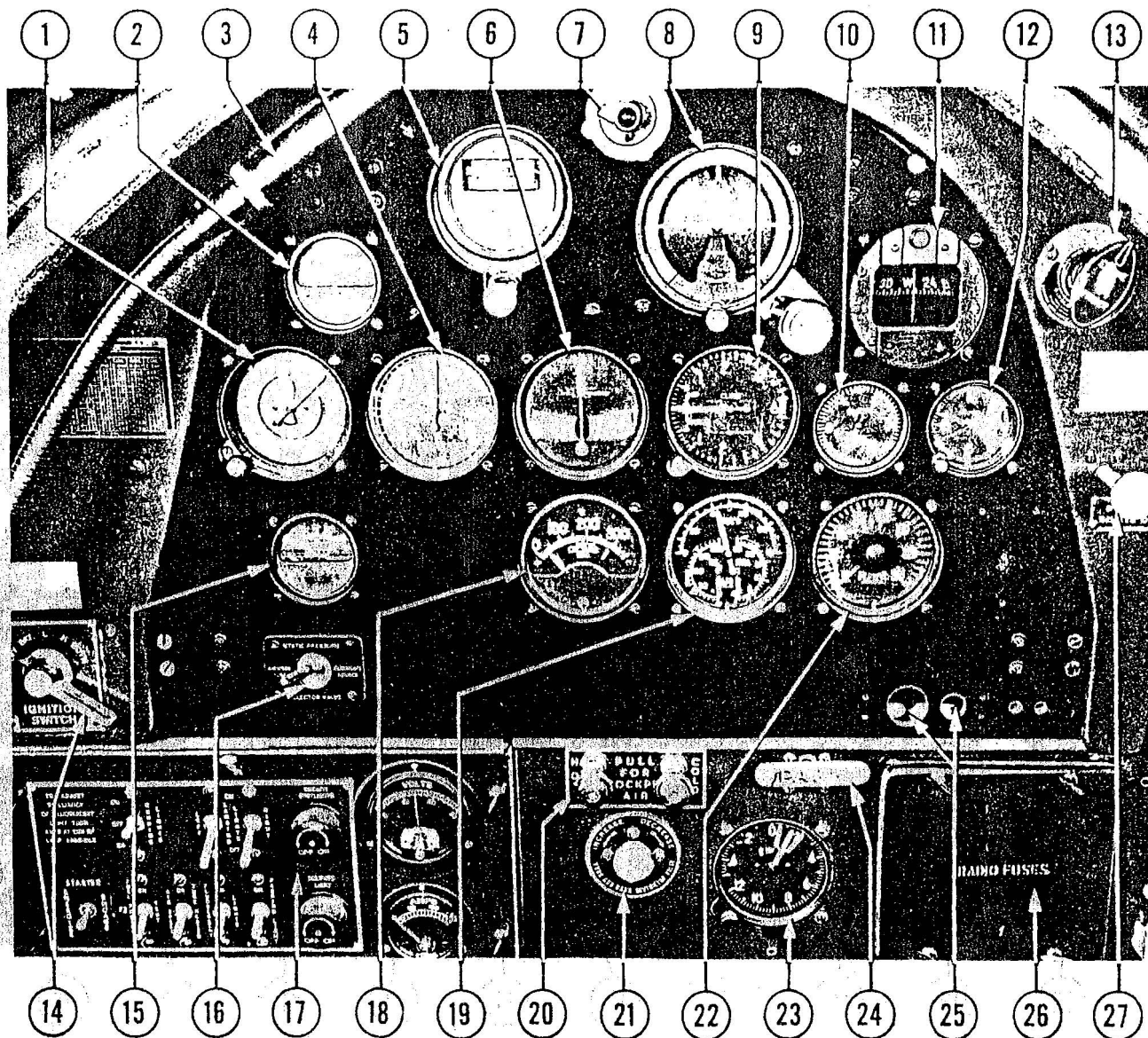
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|---|---|
| 1. Blind Flying Hood Release                    | 8. Throttle Control                           |
| 2. Pilot's Check List                           | 9. Propeller Pitch Control                    |
| 3. Extension Handle-Fuel Selector Valve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

Figure 11—Front Cockpit Arrangement and Controls—Left Side



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

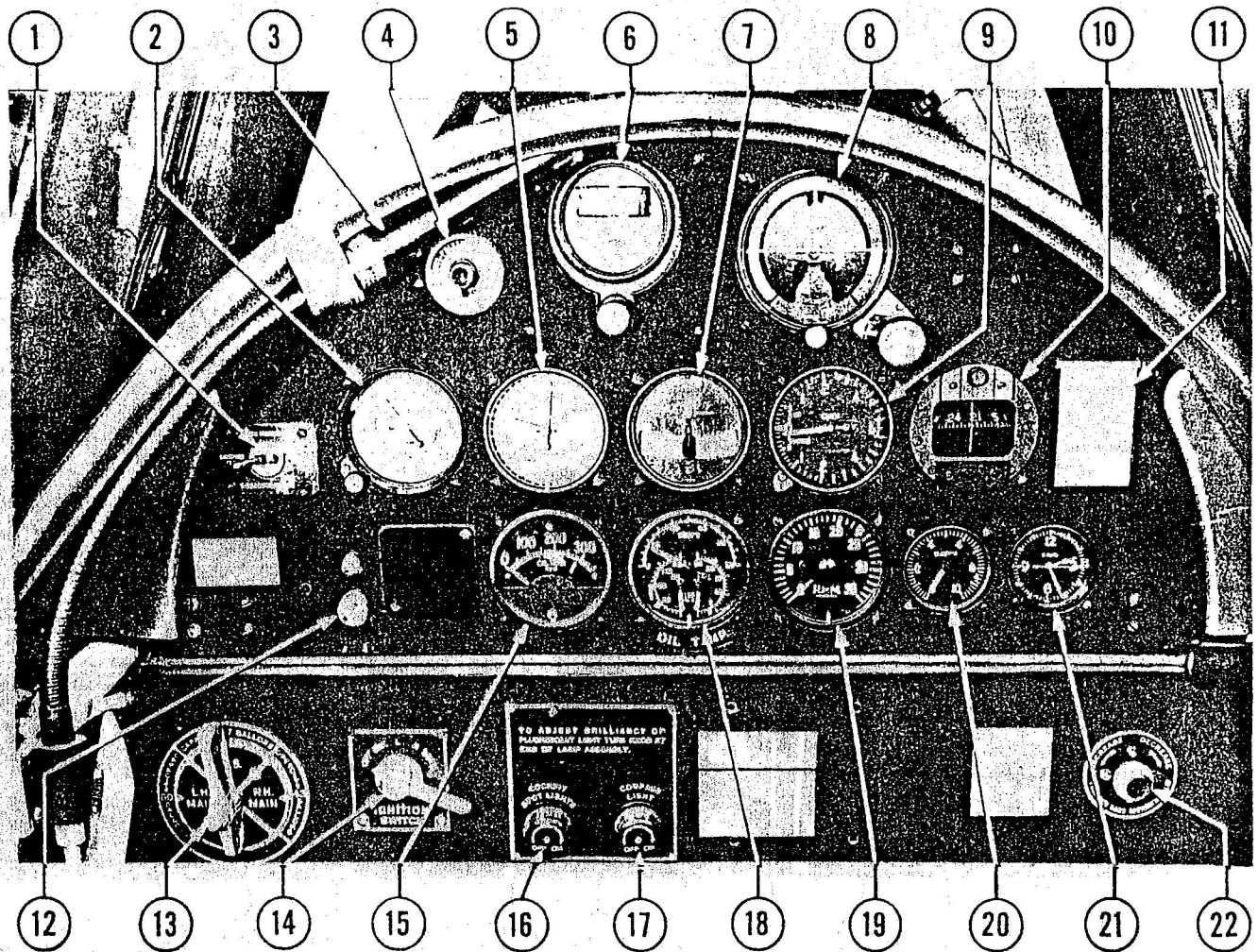
Figure 12—Rear Cockpit Arrangement and Controls—Left Side



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

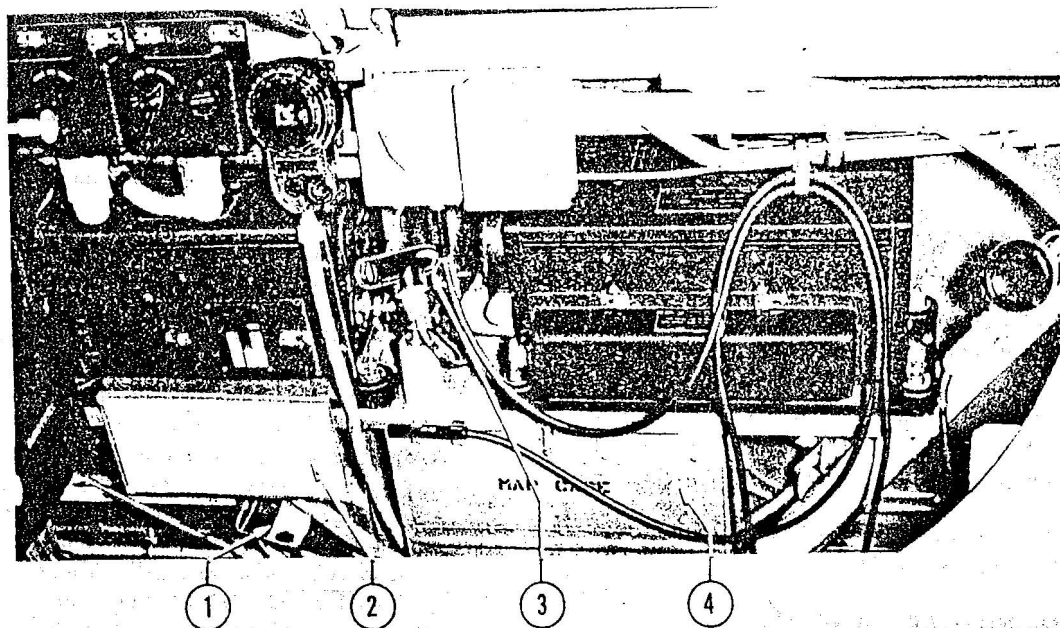
Figure 13—Front Cockpit Instrument Panel





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

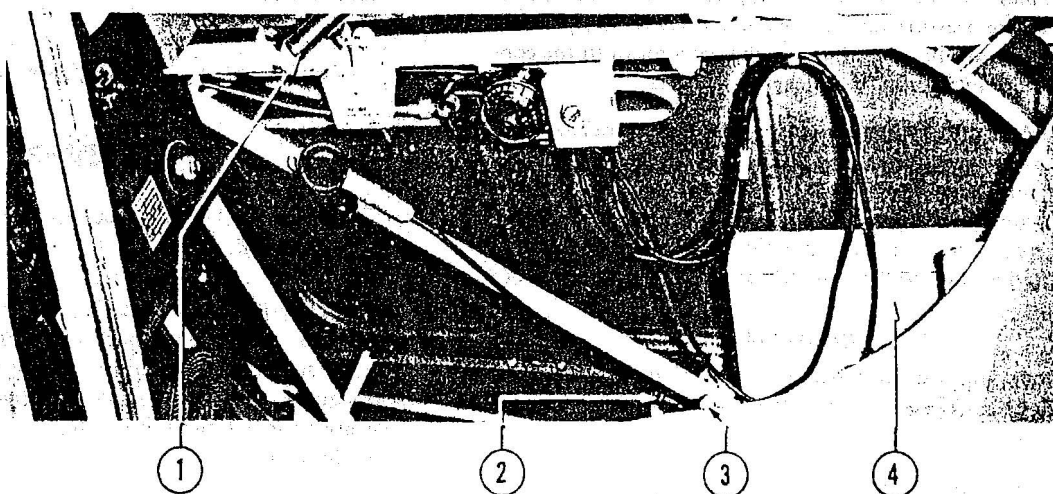
Figure 14—Rear Cockpit Instrument Panel



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

Section II  
Par. 2-4

(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 re-engage 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*.

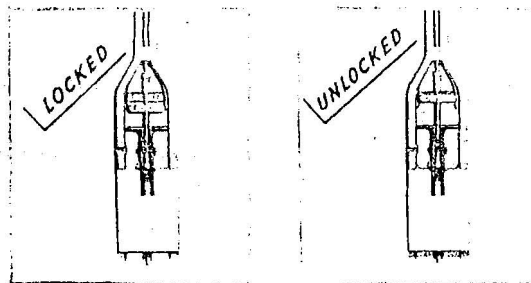


Figure 17—Emergency Exit Panel Release

#### 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.

b. 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 extin-

guisher 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.

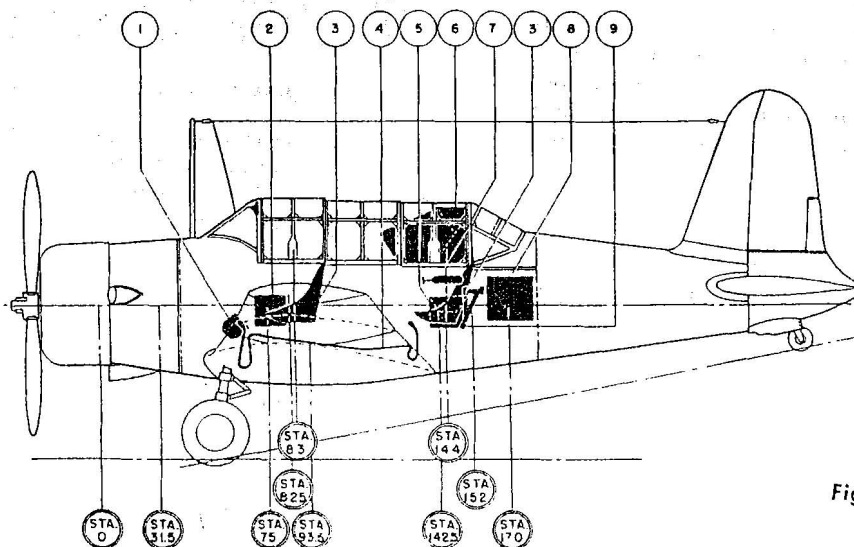
(3) RELIEF TUBES.—Pilot relief tubes are located to the right of the pilot in both cockpits. (Figure 15-1.)

(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 BT-13B 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-controlable, 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-33  
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.

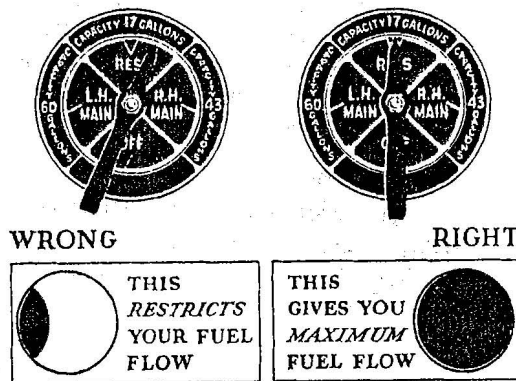
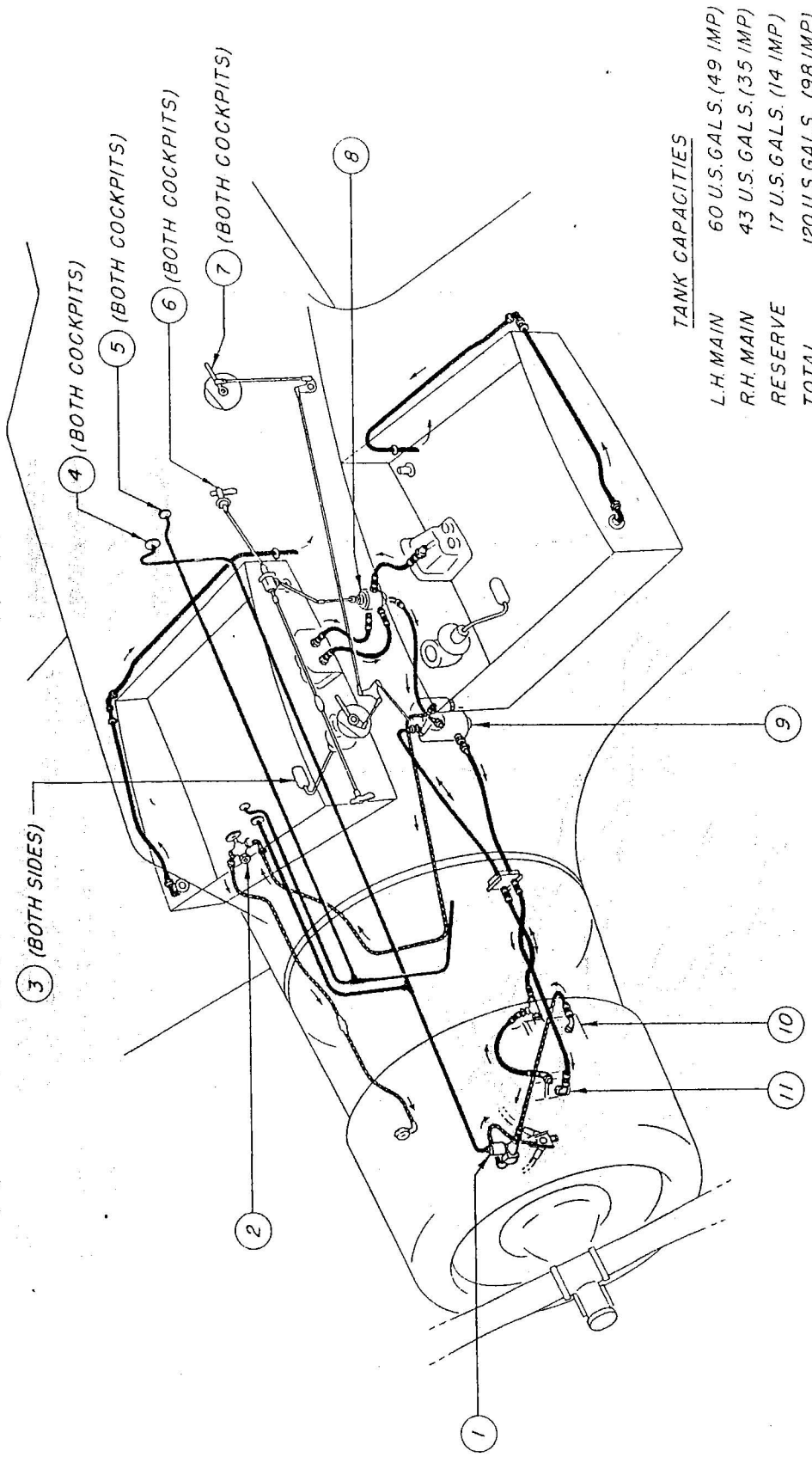


Figure 19—Fuel Selector Valve

(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



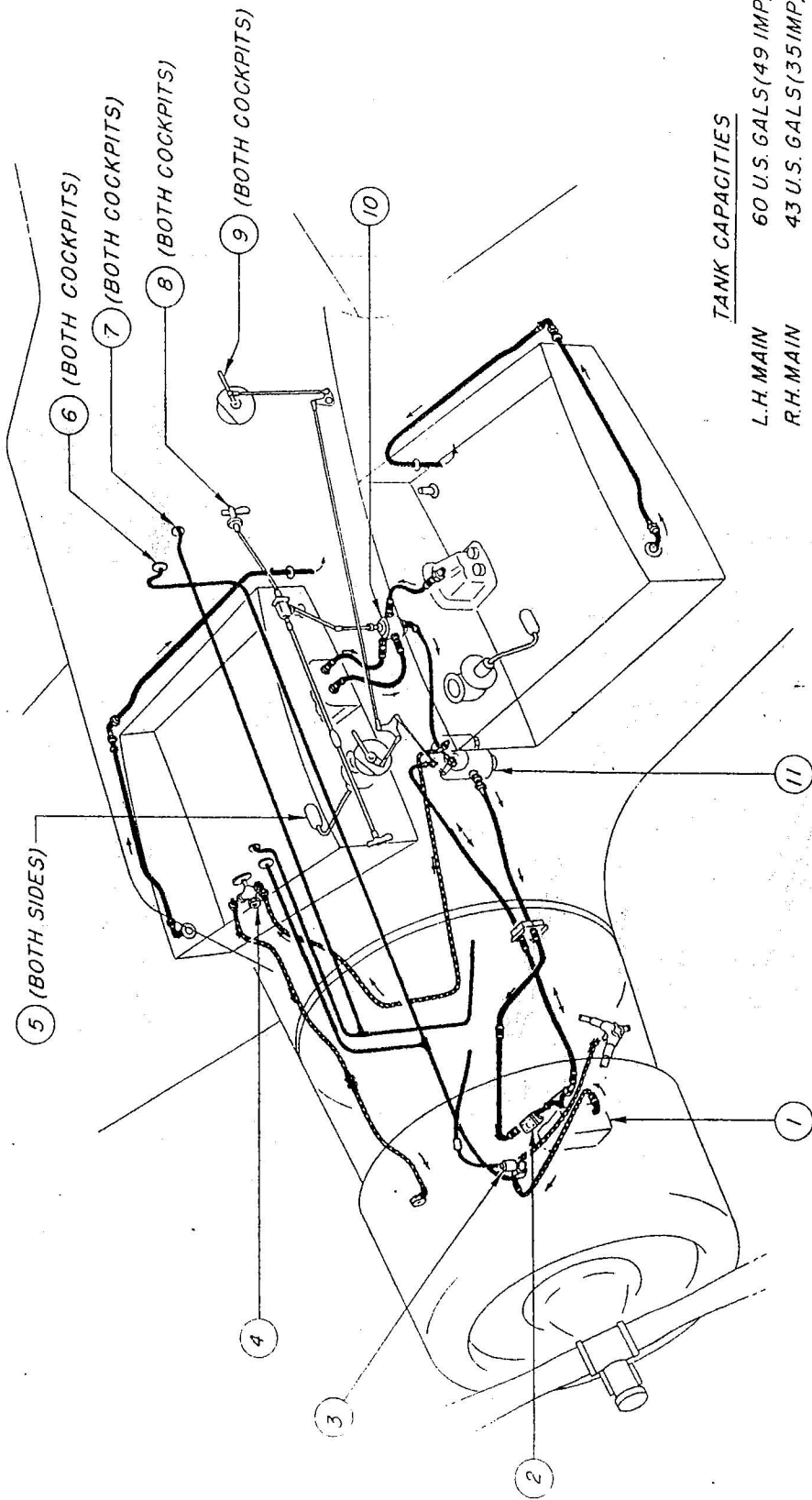
TANK CAPACITIES

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)

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

- 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. CARBURATOR.
- 11. ENGINE DRIVEN FUEL PUMP.

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)

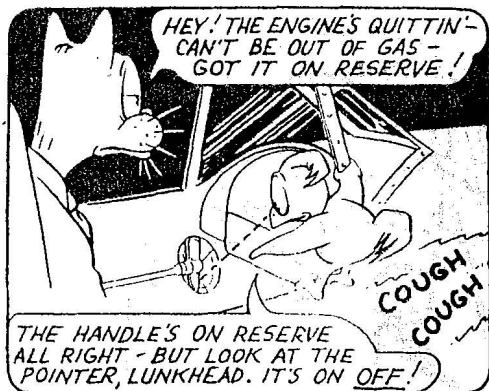
**Note**

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.

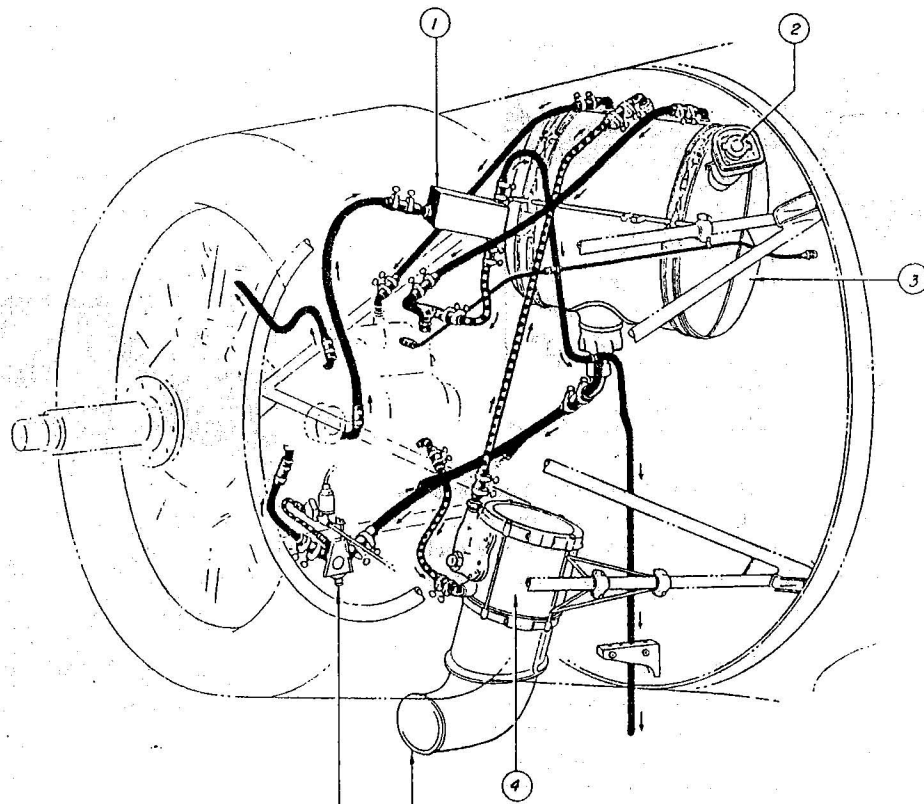
**Note**

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

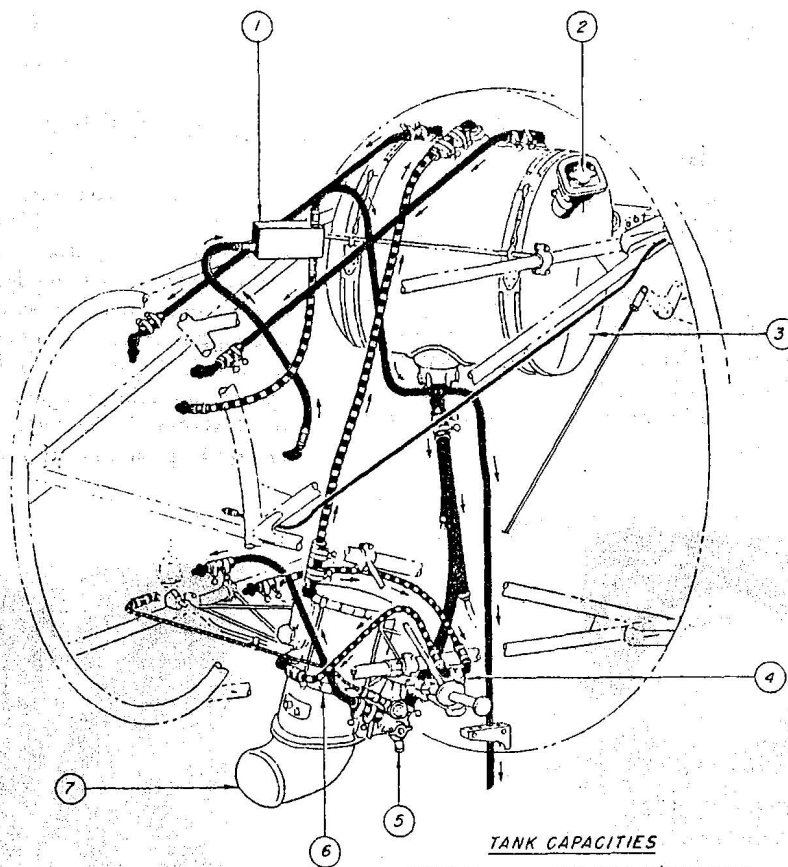
Figure 23—Oil System Diagram (BT-13, 13A & 13B)

(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.



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

**TANK CAPACITIES**

NORMAL	8.5 U.S. GAL'S (7 IMP)
MAXIMUM	10.9 U.S. GAL'S (9 IMP)

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

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.)

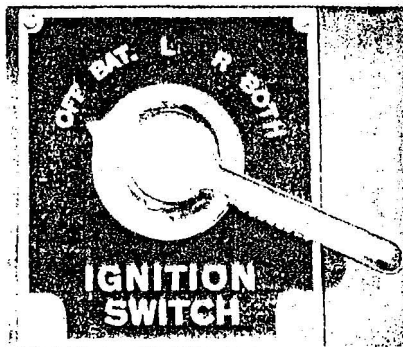


Figure 25—Ignition Switch

### 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.

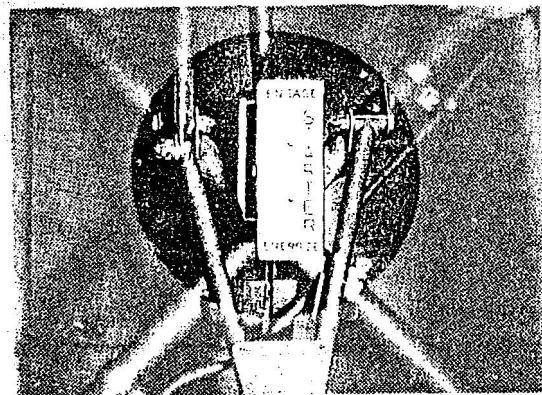


Figure 26—Floor Pedal Starter Control

#### 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.**

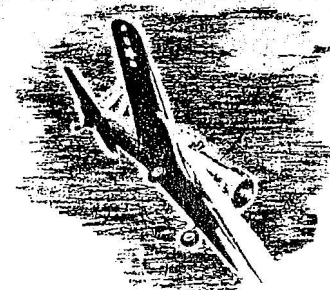
Battery switch *must* be "ON" or "BAT" for lights to operate.

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.)





Section IV

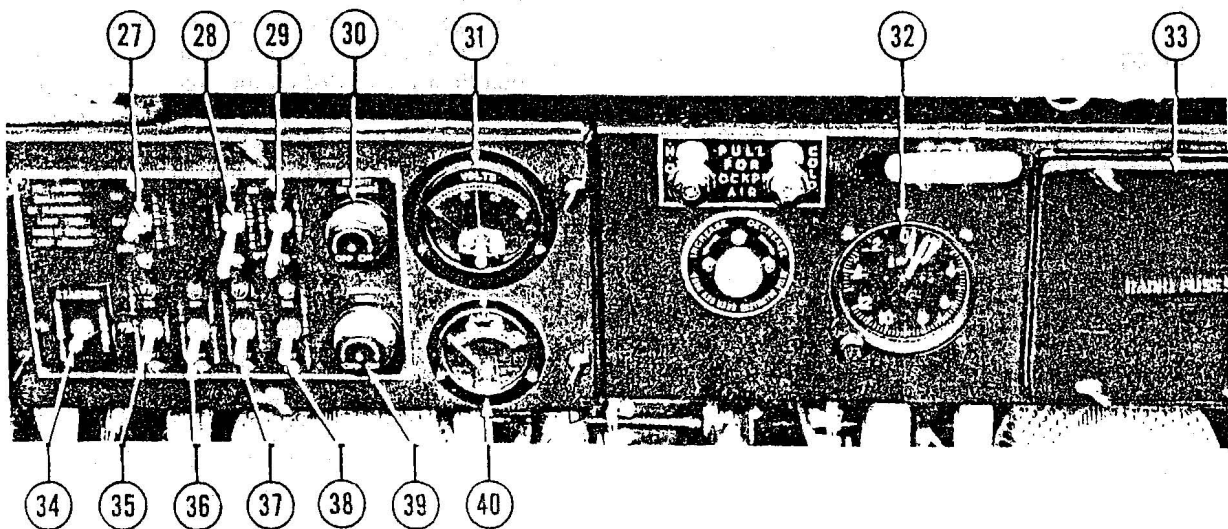
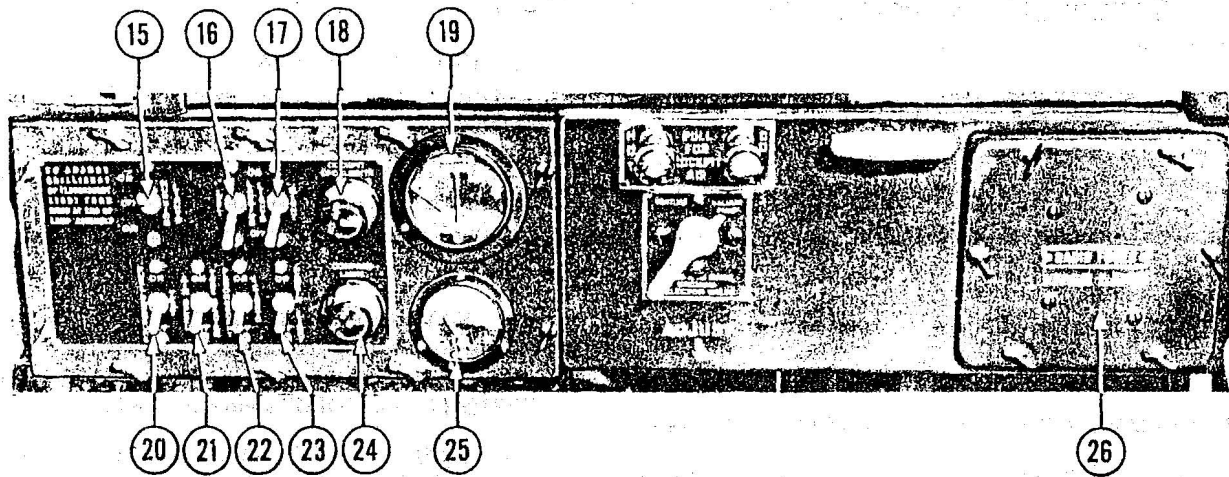
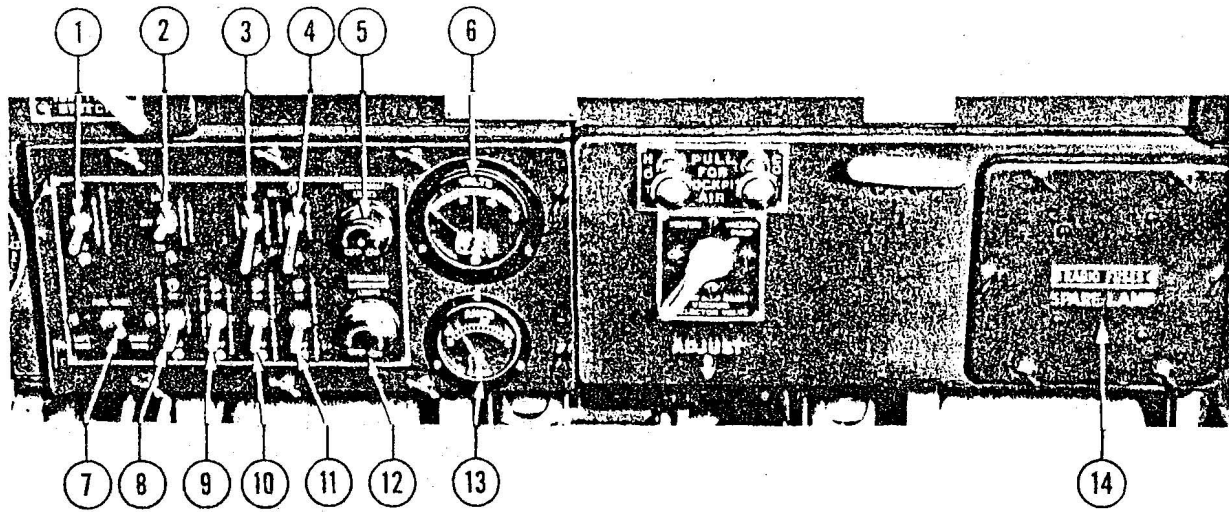
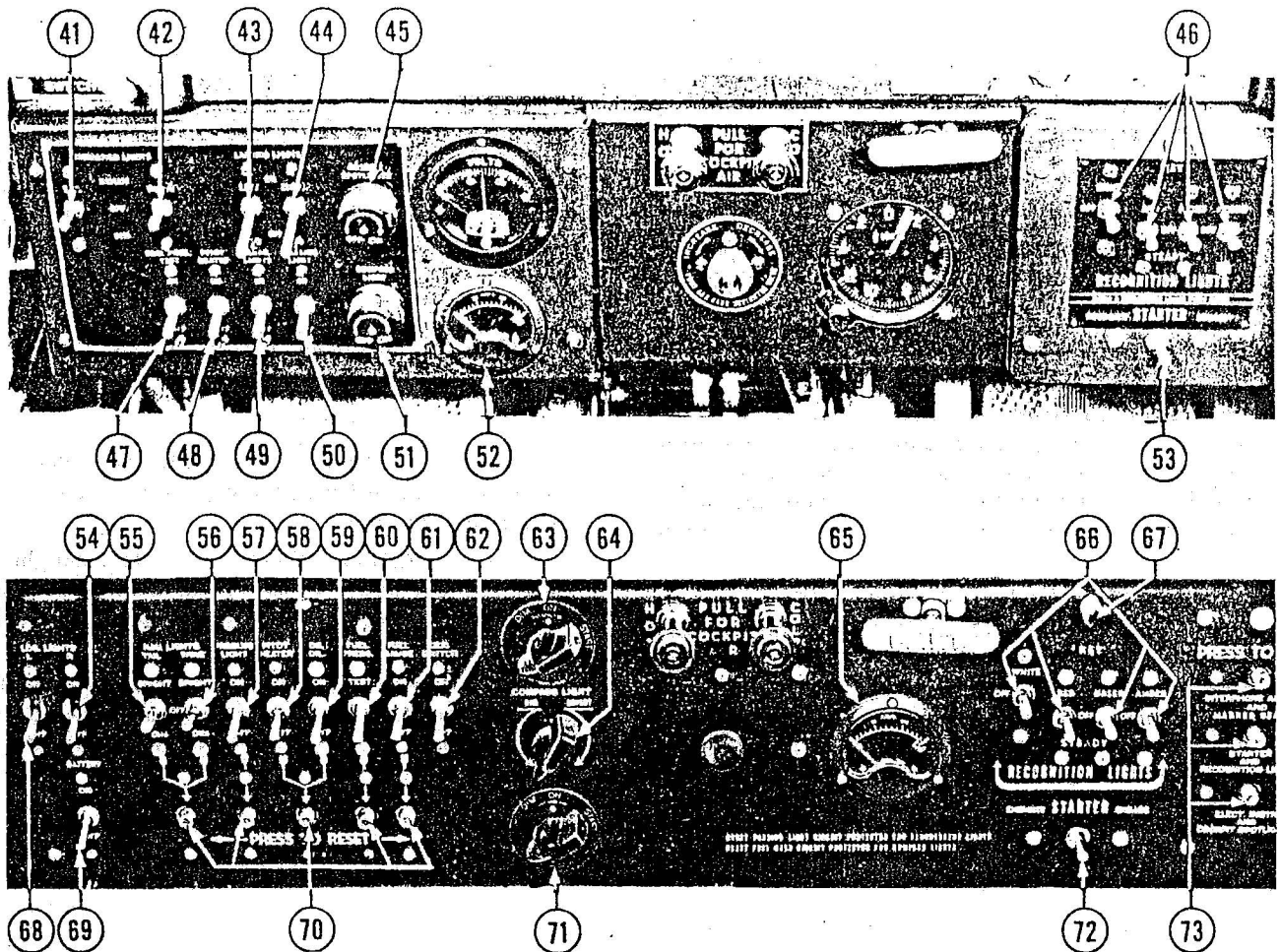


Figure 27—Electrical Control Panels (Sheet 1 of 2 Sheets)



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

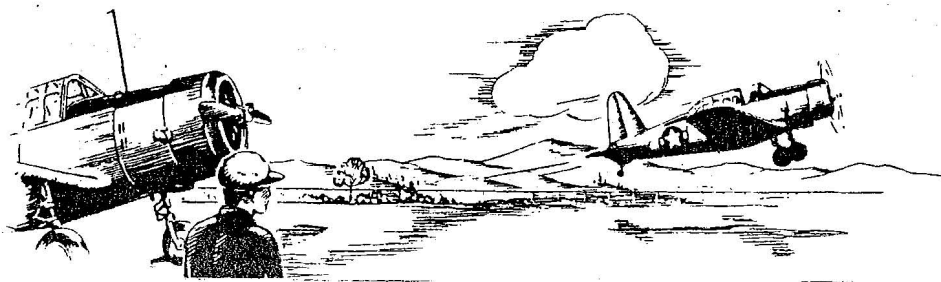
Fluorescent lamps must be turned "ON" before compass light circuits are energized.

(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.

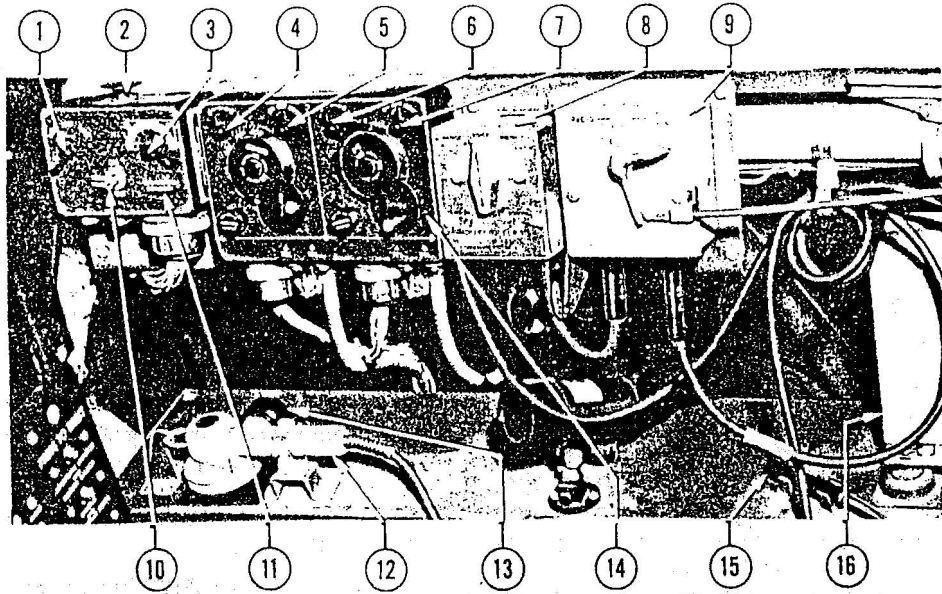
#### *d.* CODE TRANSMISSIONS.

(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.

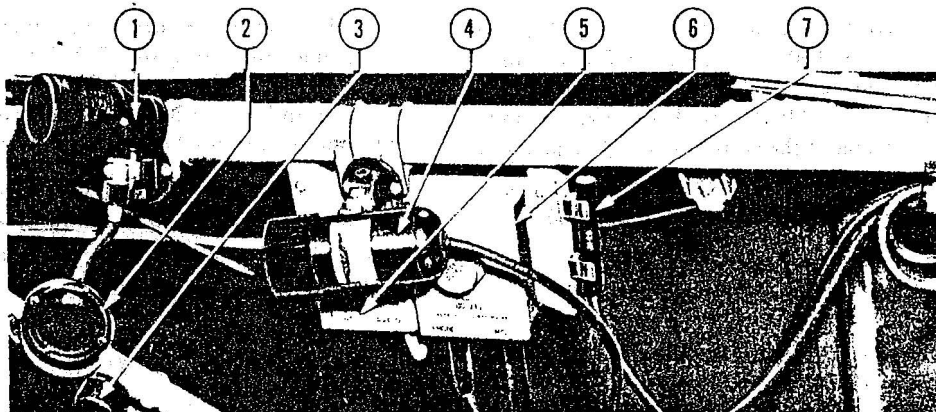
### Note

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



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

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



- |                            |                               |
|----------------------------|-------------------------------|
| 1. Fluorescent Light       | 4. Cockpit Spotlight          |
| 2. Microphone              | 5. Interphone Box (Remote)    |
| 3. Press-to-Talk Button    | 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.

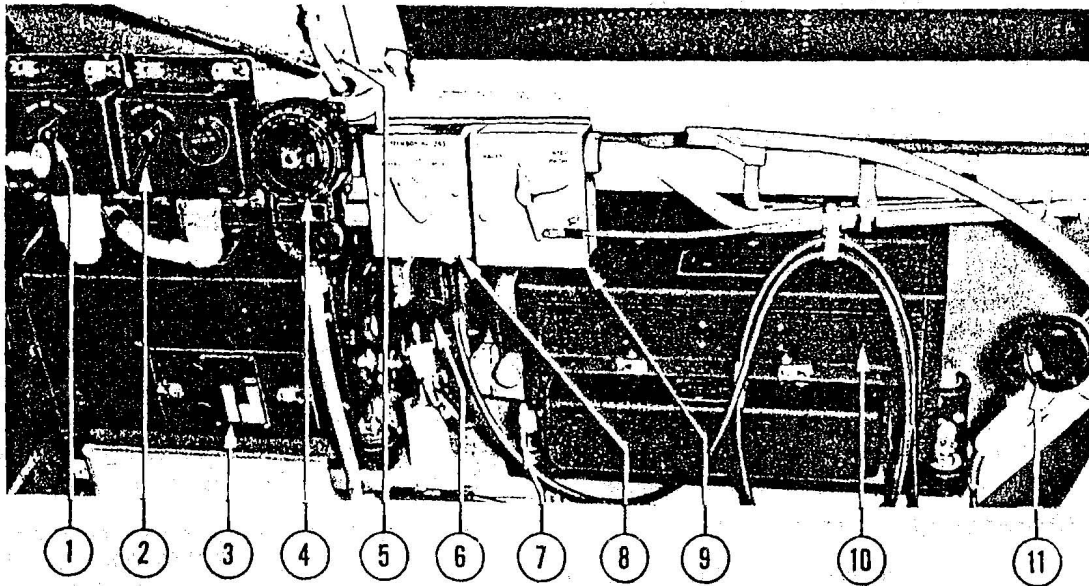
(1) GENERAL.—The receiver is calibrated and adjusted to receive the radio range frequencies between 201 and 398 kilocycles, and the tactical communication range between 2500 and 7700 kilocycles. Provision for receiving other frequencies can be installed by a radio technician.

(*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.

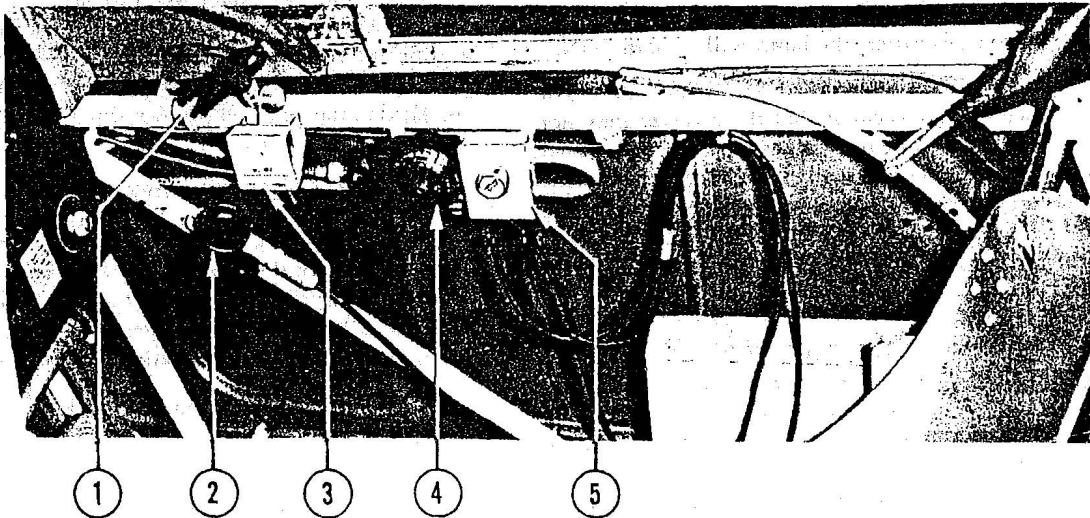
#### Note

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



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

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



- |                               |                                     |
|-------------------------------|-------------------------------------|
| 1. Cockpit Spotlight          | 3. Interphone Box (Remote)          |
| 2. Microphone                 | 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.



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(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.

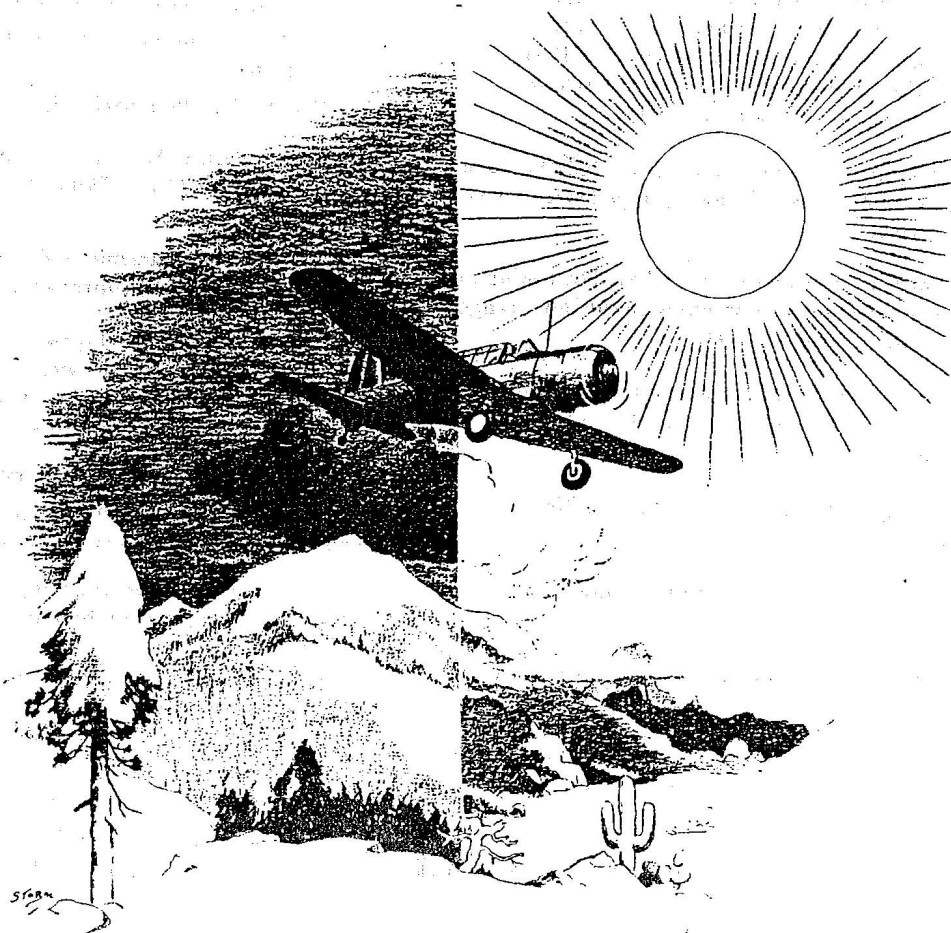
(c) Carefully inspect microphone for evidence of damage.

(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.

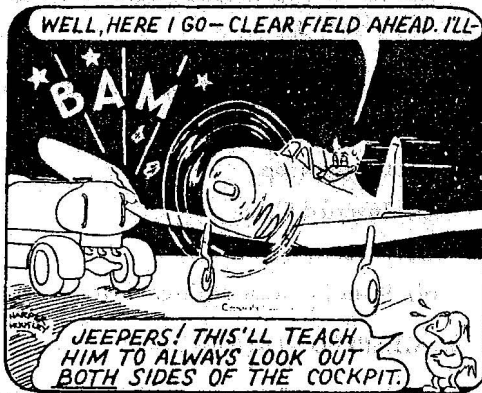
#### Note

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.

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(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.



### b. 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.

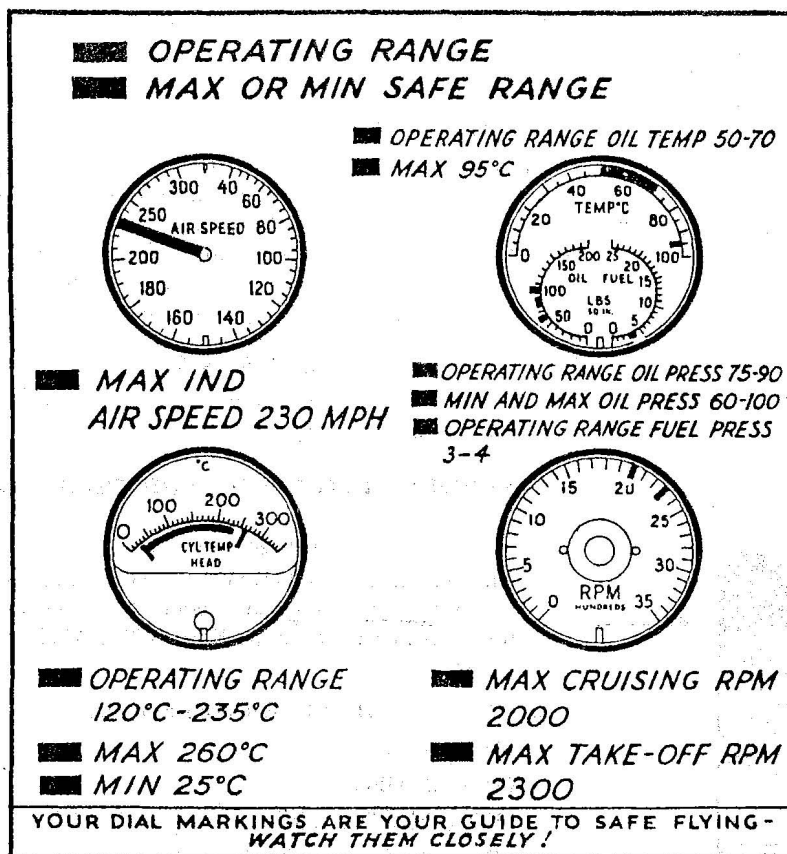


Figure 32—Instrument Dial Markings (BT-13, BT-13A & BT-13B)

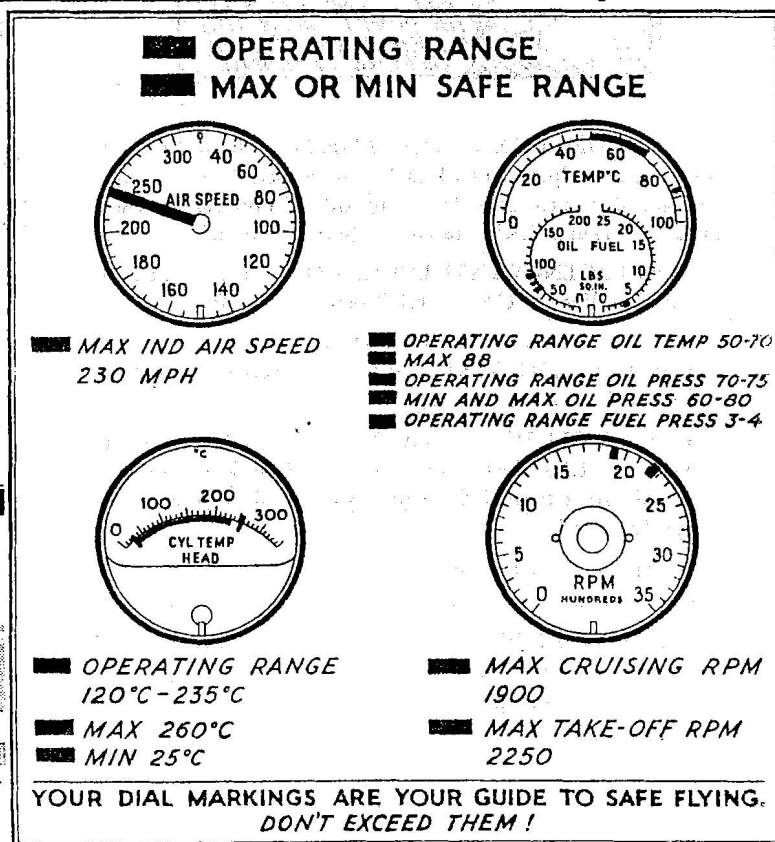
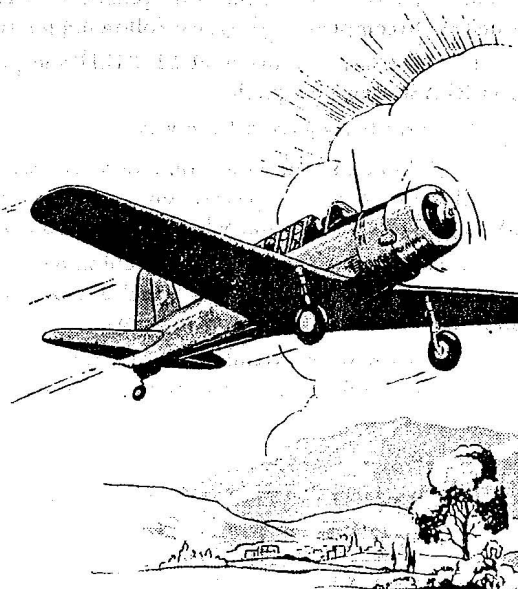
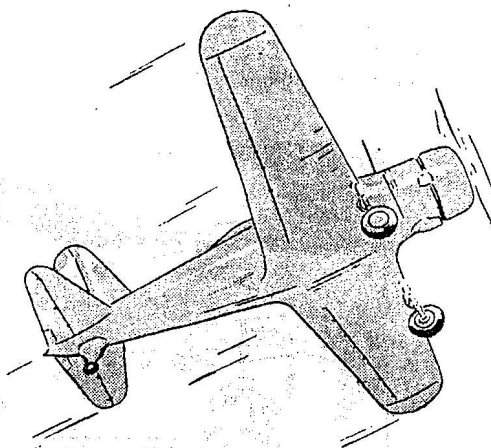


Figure 33—Instrument Dial Markings (BT-15)

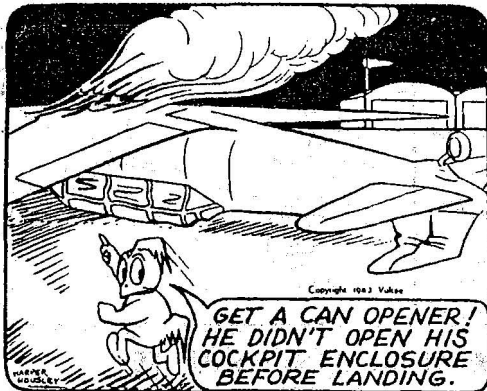
### 3. CAUTIONS.

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 side-slipping 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.)

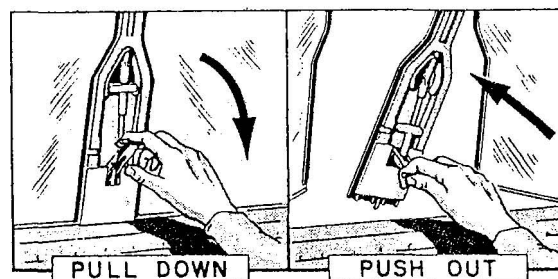


Figure 34—Operation of Panel Release—  
Emergency Exit on Ground

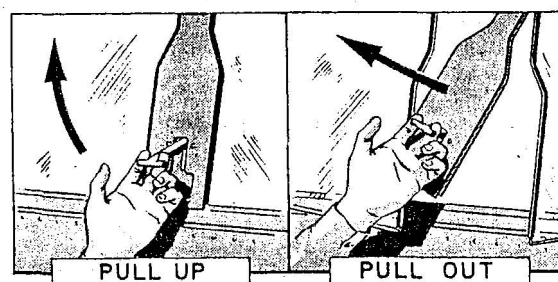


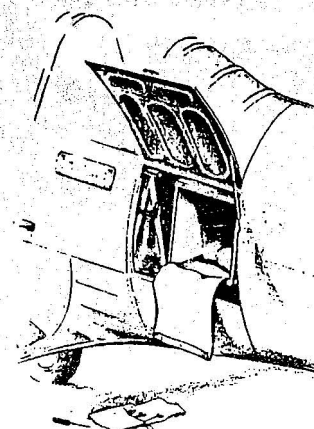
Figure 35—Operation of Panel Release—  
Emergency Access to Cockpit

b. 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.





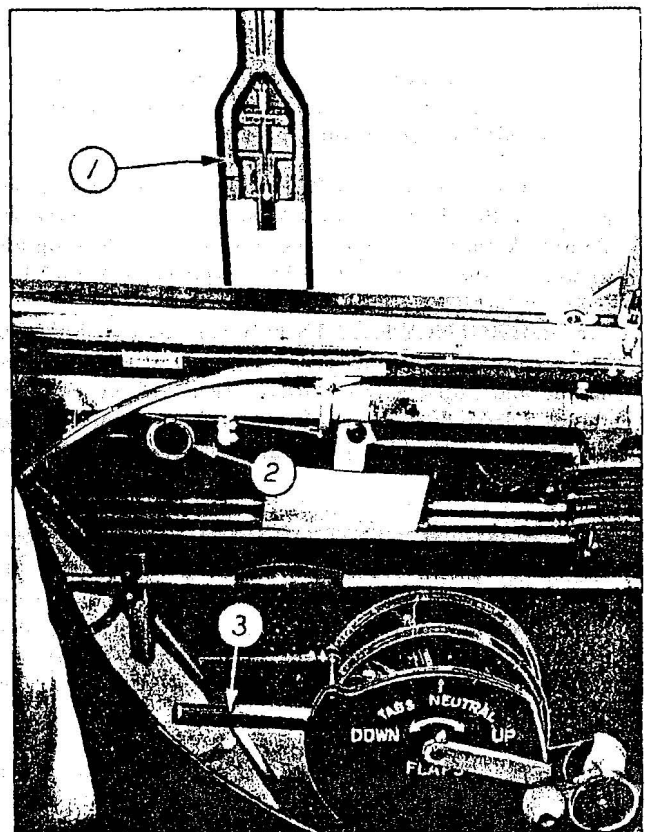
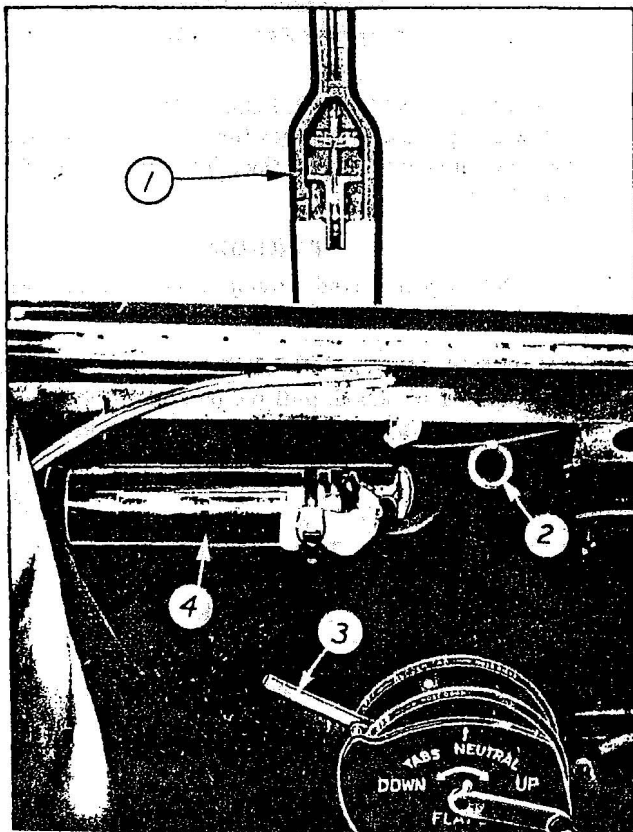
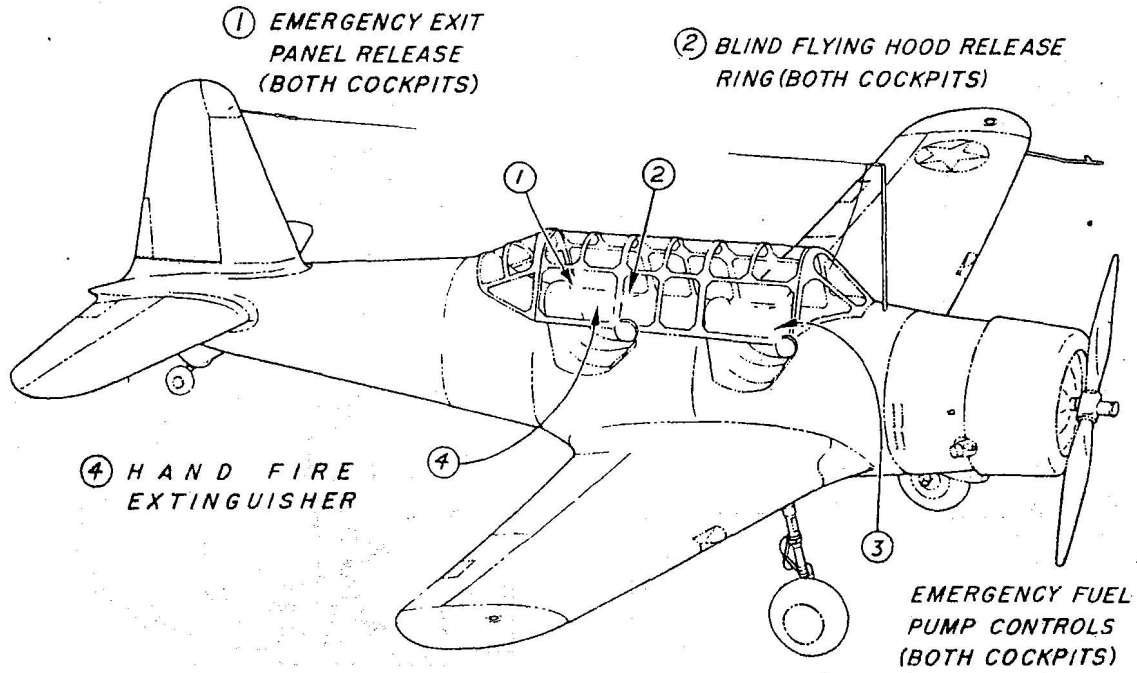


Figure 36—Emergency Equipment and Exits

## 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.

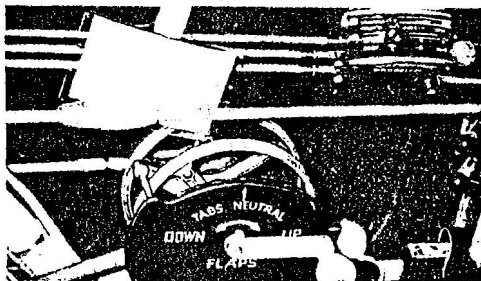


Figure 37—Pilot's Check-Off List Location

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.

Section VI  
Par. 5

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
<b>P AND W ENGINE</b>				
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)
<b>WRIGHT ENGINE</b>				
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.

## 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.*

**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.

**b. 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.

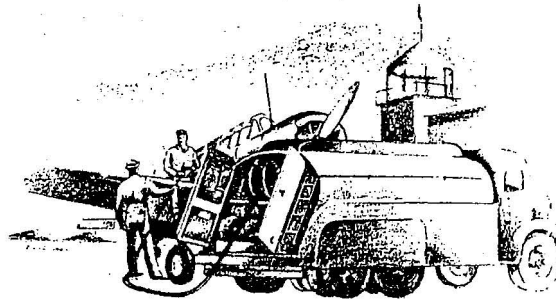
**l. TYING DOWN.**

(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.



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.		COOLANT TEMP.		MAX. PERMISSIBLE DIVING RPM: 2500.....
			°C	°F	°C	°F	
DESIRED	3-4	75-90	50-70				CONDITION
MAXIMUM	4	100	95				ALLOWABLE OIL CONSUMPTION
MINIMUM	3	60	40				MAX. CONT. ... 10 ... U.S.QT./HR. ... 6 ... IMP.PT./HR
IDLING	2	15					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		BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL./HR./ENG.)		MAXIMUM CYL. TEMP.		MAXIMUM DURATION (MINUTES)	
				WITH RAM	NO RAM				U.S.	IMP.	°C	°F		
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)



AIRPLANE MODELS		SPECIFIC ENGINE				ENGINE MODELS							
BT-15		FLIGHT CHART				R-975-J1							
CONDITION	FUEL PRESSURE LB./SQ. IN.	OIL PRESSURE LB./SQ. IN.	OIL TEMP. °C	COOLANT TEMP. °C						MAX. PERMISSIBLE DIVING R.P.M. 2500			
	DESIRED	3-4	70-75	60						CONDITION	ALLOWABLE OIL CONSUMPTION		
	MAXIMUM	4	80	88						"MAX CONTINUOUS"	9.4 IMP. PT./HR. 5.6 U.S. QT./HR.		
	MINIMUM	3	60	40						"ECONOMICAL MAX"	5.0 IMP. PT./HR. 3.0 U.S. QT./HR.		
	IDLING	2	25							"MIN. SPECIFIC"	3.7 IMP. PT./HR. 2.2 U.S. QT./HR.		
										OIL GRADE: (S) 1120 (W) 1100A			
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.)		MAXIMUM CYL. TEMP.		MAXIMUM DURATION (MINUTES)	REMARKS
								U.S.	IMP.	°C	°F		
TAKE-OFF	2250	FULL	440	S.L.	SINGLE SPEED BLOWER	—	FULL 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	AS REQ'D	280	S.L.		—	SMOOTH OPER.	22	19	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.
	1950	REQ'D	295	3000				27	23				
MINIMUM SPECIFIC CONSUMPTION	1800	AS REQ'D	250	S.L.		—	MAX. ECONOMY	18	15	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.
	1760		212	3000				16	14				
	1740		192	6000	14			12					
	1710		175	9000	13			11					
1760	177	12000	14	12									
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  $\text{C}$  OF AIRPLANE AND IS 37.5 INCHES AFT OF THE REFERENCE DATUM.

MAXIMUM RECOMMENDED FLYING WEIGHT---4745 LBS.

LOADING CONDITIONS

ITEMS	I PRIMARY			II MOST FORWARD			III MOST REARWARD		
	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-1-B Dec. 11, 1942 FORM 430-530	AIRPLANE MODELS BT-13-VU, BT-13A-VU, BT-13B-VU. <b>TAKE-OFF, CLIMB &amp; LANDING CHART</b>														ENGINE MODELS R-985-25, R-985-AN-1, R-985-AN-3																																					
	<b>METAL PROPELLER</b>														<b>TAKE-OFF DISTANCE (IN FEET)</b>																																					
	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.	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	13	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	13	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	13																																																		
	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 & F.T. 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.		TIME FROM S.L.		BEST I.A.S.		TIME FROM S.L.		BEST I.A.S.		TIME FROM S.L.		BEST I.A.S.		TIME FROM S.L.		BEST I.A.S.		TIME FROM S.L.		BEST I.A.S.		TIME FROM S.L.		BEST I.A.S.		TIME FROM S.L.		BEST I.A.S.		TIME FROM S.L.																				
		MPH	KNOTS	FT/MIN	U.S.	IMP.	MPH	KNOTS	FT/MIN	U.S.	IMP.	MPH	KNOTS	FT/MIN	U.S.	IMP.	MPH	KNOTS	FT/MIN	U.S.	IMP.	MPH	KNOTS	FT/MIN	U.S.	IMP.	MPH	KNOTS	FT/MIN	U.S.	IMP.																					
4600	COMBAT FERRY	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																							
		80	70	550	5	80	70	400	11	11	9.2	80	70	250	21	14	11.7																																			
4100	COMBAT FERRY	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																							
		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.																																	
			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																		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)

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.	
				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

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	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 FERRY	90	78	850	3.5	90	78	650	7.5	12	10	90	78	450	13	14	11.7	85	74	250	2.2	19	15.9						
4100	COMBAT FERRY	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
	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

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	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

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)

AIRPLANE MODELS										ENGINE MODELS													
BT-15										R-975-11													
TAKE-OFF, CLIMB & LANDING CHART																							
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.	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 RPM (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.				BLOWER CHANGE					
		BEST I.A.S.	FT./MIN.	TIME FROM SL.	FUEL FROM SL.	BEST I.A.S.	FT./MIN.	TIME FROM SL.	FUEL FROM SL.	BEST I.A.S.	FT./MIN.	TIME FROM SL.	FUEL FROM SL.	BEST I.A.S.	FT./MIN.	TIME FROM SL.	FUEL FROM SL.						
4600	COMBAT FERRY	90	1050	3		90	850	6	11	90	650	10	13	85	460	15.5	16	85	250	24	20		
		80	400	7		80	250	17	11														
4100	COMBAT FERRY	90	1250	2.5		90	1000	5	10	90	800	8	12	85	600	12.5	14	85	400	18.5	17		
		80	560	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	1300	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										<b>LEGEND</b> 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							FLIGHT OPERATION INSTRUCTION CHART							EXTERNAL LOAD ITEMS NONE																				
ENGINE(S): R-985-25, R-985-AN-1, R-985-AN-3							CHART WEIGHT LIMITS: 4600 TO 3600 POUNDS																											
LIMITS	R. P. M.	M. P. (IN. HG.)	BLDWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.	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.																				
WAR MAX.																																		
MILITARY POWER	2300	F.T.	S.L.	F.R.	5	49																												
NORMAL RATED	2300	F.T.	1000	F.R.	NO LIMIT	48																												
I		FUEL		II		III		IV		FUEL		V																						
RANGE IN AIR MILES		U. S. GAL.		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		U. S. GAL.		RANGE IN AIR MILES																						
STATUTE	NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL																					
340	300	120		450	390	550	480	740	640	120		790	690																					
310	270	110		410	360	500	430	680	590	110		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									
						15000	2080	113	F.R.	F.T.	26	148	15000	2080	113	F.R.	F.T.	26	148	1990	118	C.L.		19	143	10000	1800	102	C.L.		15	123		
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	1900	123	C.L.		18	138	5000	1690	103	C.L.		14	116			
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	1720	120	C.L.		16	125	S.L.	1540	101	C.L.		13	105			
2250	160	F.R.	F.T.	49	166	S.L.	2170	155	F.R.	F.T.	38	181	2040	145	F.R.	F.T.	28	151																

**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)							FLIGHT OPERATION INSTRUCTION CHART							EXTERNAL LOAD ITEMS NONE																
ENGINE(S): R-985-25, R-985-AN-1, R-985-AN-3							CHART WEIGHT LIMITS: 4600 TO 3600 POUNDS																							
LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.	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.																
WAR MAX.																														
MILITARY POWER	2300	F.T.	S.L.	F.R.	5	49																								
NORMAL RATED	2300	F.T.	1000	F.R.	NO LIMIT	48																								
I		FUEL	II				III				IV				FUEL	V														
RANGE IN AIR MILES		U. S. GAL.	RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		U. S. GAL.	RANGE IN AIR MILES		U. S. GAL.	RANGE IN AIR MILES															
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL														
○ 10 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ○																														
330	290	120	430	370	510	440	700	600	120	730	630																			
300	260	110	390	340	470	410	640	550	110	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						OPERATING DATA						OPERATING DATA						OPERATING DATA						MAXIMUM RANGE						
R. P. M.	I. A. S.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																								
						35000																								
						30000																								
						25000																								
						20000																								
						15000																								
2080	108	F.R.	F.T.	26	141		2080	108	F.R.	F.T.	26	141																		
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	
<b>NOTES</b>						<b>EXAMPLE</b>						<b>LEGEND</b>																		
○ ALLOW 10 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.						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.						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)

MODELS)		FLIGHT OPERATION INSTRUCTION CHART										EXTERNAL LOAD ITEMS									
BT-15		WEIGHT 4600 TO 3600 POUNDS										NONE									
<b>INSTRUCTIONS:</b> (THIS CHART APPLIES ONLY TO THE ABOVE MODELS WHILE WITHIN THE ABOVE WEIGHT LIMITS WITH ABOVE ITEMS) <ol style="list-style-type: none"> <li>OPPOSITE FUEL TO BE USED LOCATE AIR MILES (RANGE) DESIRED (AVOID CRUISING WITH "MAXIMUM CONTINUOUS POWER" EXCEPT IN EMERGENCY)</li> <li>VERTICALLY BELOW AND OPPOSITE DESIRED CRUISING ALTITUDE READ OPTIMUM CRUISING R.P.M.</li> <li>MIXTURE CONTROL IS INDICATED IN LOWER HALF OF CHART (FOR DETAILED INSTRUCTIONS SEE SPECIFIC ENGINE FLIGHT CHART)</li> <li>MANIFOLD PRESSURE (M.P.)-GALLONS PER HOUR (G.P.H.)-TRUE AIRSPEED (T.A.S.) ARE APPROX. MAXIMUM VALUES FOR REFERENCE</li> <li>USE CARE IN INITIAL ADJUSTMENT OF ENGINE CONTROLS THEN AVOID MANIPULATION - HOURLY RE-ESTABLISHMENT OF I.A.S. IS SUFFICIENT.</li> <li>TO DETERMINE ENDURANCE IN HOURS: DIVIDE GAL OF FUEL AVAILABLE BY G.P.H. (GAL. PER HR.) FOR THE CONDITIONS SELECTED.</li> </ol>																					
ENGINE MODEL(S)																					
R-975-11																					
FOR ENGINE DATA SEE PAGES																					
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								
10 GALLON TAKE-OFF ALLOWANCE, NOT AVAILABLE IN FLIGHT																					
360	310	120	525	455	690	595	850	735			120	950	825								
330	285	110	475	410	630	545	775	670			110	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				ALTERNATE CRUISING CONDITIONS										MAXIMUM RANGE - ENDURANCE							
RPM	M.P. (IN. HG.)	G.P.H.	T.A.S.	I			II			III			IV			DENSITY ALTITUDE FEET	R.P.M.	I.A.S.	M.P.	G.P.H.	T.A.S.
				RPM	I.A.S.	M.P.	G.P.H.	T.A.S.	RPM	I.A.S.	M.P.	G.P.H.	T.A.S.	RPM	I.A.S.						
1960	F.T.	26		15,000	1950		26														
2000	F.T.	30		12,000	1950		27	1800	19	1800		16									
2040	F.T.	34		9,000	1950		27	1810	19	1800		16									
2080	F.T.	39		6,000	1950		28	1840	20	1790		16									
2120	F.T.	43		3,000	1950		27	1840	20	1770		16									
2150		43		SEA LEVEL	1950		27	1820	20	1690		15									
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)