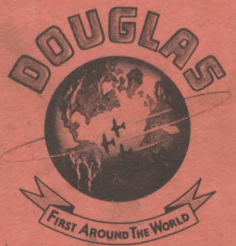
RESTRICTED

THE LOCKER PROVIDED FOR CLASSIFIED DATA IN THIS AIRPLANE GIVES CLASS "C" STOWAGE AS DEFINED BY ARTICLE 112 OF R.P.S.-6

PILOT'S HANDBOOK SBD-5 AND A-24B



DOUGLAS AIRCRAFT CO., INC.
EL SEGUNDO PLANT
EL SEGUNDO, CALIFORNIA

REVISIONS - May 20, 1943

Pages 28, 64, 68, 71, 77, 102, and 120 should be corrected to read as indicated below:

Page	Line	Correction
28	40	Add "41 - Recognition Light Switch"
64	26	20-1/2 degrees; positive high pitch setting 48-1/2 degrees. (Was 21-1/2 degrees)
68	24	pressure of 13 to 18 pounds. (Was 14 to 16 pounds)
71	17	Recommended 74° to 88° C. (167° to 189° F.). (Was 60° to 80° C. (140° to 176° F.))
71	23	Idling 30 lbs./sq.in. (min.). (Was 25 lbs./sq. in. (min.))
77	13	Throttle - Open to 45.5 inches Hg. (Was 46.5 inches Hg.)
77	21	Do not exceed 235 degrees C. (455°F.). (Was 253 degrees C. (489°F.))
102	27	Balance Chart (Page 116). (Was Balance Chart (Page 117))
120	30	Add "Automatic Pilot...47"

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Preliminary

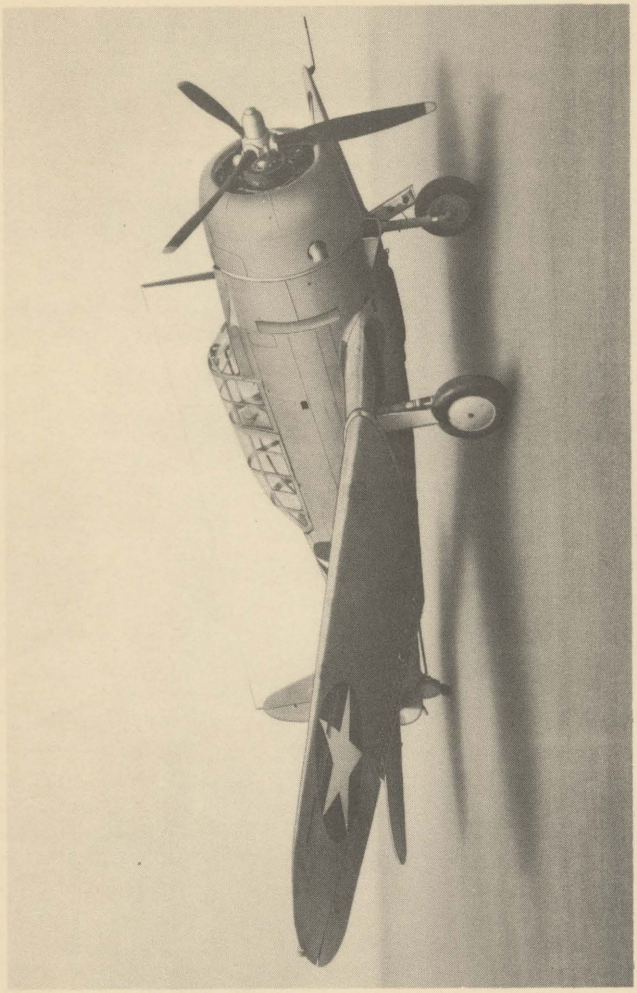
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1999-9-39/LC

Klotz, James A

DOUGLAS AIRCRAFT CO., INC.
EL SEGUNDO PLANT
EL SEGUNDO, CALIFORNIA

210583



Full View of SBD-5 Airplane

FOREWORD

This handbook has been compiled to acquaint the operating personnel assigned to the Douglas Dive Bomber, Model SBD-5, with its general characteristics, equipment, and method of operation.

The information contained herein is the result of factory and operators' experience and constitutes the generally accepted practice of operation for this particular airplane. The contents of this manual should be thoroughly studied before the pilot's first flight.

These instructions are furnished for the operator's information and without any warranty incident thereto. Furthermore, the Douglas Aircraft Company, Incorporated, reserves the right to revise or change the aforementioned information (approved by the Bureau of Aeronautics) whenever advanced methods of operation are introduced.

DOUGLAS AIRCRAFT COMPANY, INC.
El Segundo Plant
El Segundo, California

INTRODUCTION

In general, the Douglas Dive Bomber, Model SBD-5, is operated in the conventional manner and performs all ground and flight maneuvers with the normal characteristics of its type. The Model SBD-5 (Type VSB) is a single engine, two-place, full cantilever, low wing monoplane. As a landplane, it will take off from the ground, or from the deck of a carrier with or without the aid of a catapult. It will land on an ordinary landing field, or on a carrier deck with the aid of an arresting gear. This airplane is designed to complete the missions usually assigned to dive bombers, smoke layers, and scout airplanes.

All information concerning the proper operation of this airplane and its salient characteristics is given in this handbook.

The alphabetical index, found at the end of this manual, will provide a quick cross reference to information on individual items not readily found in the table of contents.

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SECTION I

COCKPIT ARRANGEMENT AND CONTROLS

GENERAL—The model SBD-5 Dive Bomber is designed to be flown from the pilot's cockpit. However, auxiliary controls in the rear compartment allow the airplane to be flown by the gunner. The controls are divided into four sections: Flight Controls; Power Plant Controls; Auxiliary Controls; and Useful Load Installation Controls. For the identification and arrangement of the various controls, refer to the illustrations included in the following pages.

FLIGHT CONTROLS—The airplane is equipped with tandem stick and pedal type controls for the pilot and gunner and are operated in the conventional manner. Controls for the aileron trim tab, elevator trim tabs, and rudder trim tab are located directly left of the pilot's seat. Individual tab movement is registered in degrees on an indicator beside each tab control. The control quadrant for the landing and diving flaps is located directly right of the pilot's seat. An indicator to the right of the control quadrant indicates the position of the flaps. Control surfaces may be locked in neutral when the airplane is parked or moored.

Control Stick (Item 7, Page 21).

A control stick of the conventional type is installed in the pilot's cockpit and the gunner's compartment. The gunner's control stick can be readily removed and stowed in the clips mounted on the left wall of the compartment (Item 12, Page 61).

The control stick provides lateral and longitudinal control of the airplane by means of the ailerons

and elevators. Side motion of the control stick operates the ailerons; fore and aft movement operates the elevators.

Incorporated in the handle of the pilot's control stick are trigger and bomb release switches. The trigger switch for firing the fixed guns is located on the forward side of the handle; the bomb release switch is a button on top of the handle.

Rudder Pedals (Item 10, Page 21).

Rudder pedals of the conventional type are installed in the pilot's cockpit and the gunner's compartment. The rudder pedals provide directional control of the airplane by means of the rudder. Actuation of either rudder pedal operates the rudder.

For adjustment of the rudder pedals, see Page 31.

Trim Tabs Controls.

The aileron trim tab control wheel (Item 6, Page 15) provides lateral trim of the airplane by means of a tab incorporated in the left aileron. Turn the control wheel right or left to obtain lateral trim.

The elevator tabs control wheel (Item 7, Page 15) provides longitudinal trim of the airplane by the action of a tab in each elevator. Rotate the control wheel fore or aft to obtain longitudinal control of the airplane.

The rudder tab control dial (Item 3, Page 15) provides directional trim of the airplane by means of a tab incorporated in the rudder. Turn the control dial right or left to obtain the desired directional trim.

Landing Flaps Control (Item 6, Page 7).

The landing flaps selector lever (black knob) controls the operation of the split-edge type landing

flaps. The landing flaps decrease the speed and increase the gliding angle of the airplane for landing, and are also used to shorten the take-off distance.

CAUTION:

Do not lower the landing flaps at an indicated airspeed in excess of 140 knots.

To **lower** the landing flaps, move the selector lever to the DOWN position and depress the engine pump control handle (Item 19, Page 7). Normally, 3 seconds are required for this operation.

CAUTION:

Before operating the landing flaps, the diving flaps selector lever must be in the CLOSED position, and the landing gear selector lever must be either full UP or full DOWN.

To **partially lower** the landing flaps: move the selector lever to the DOWN position; operate the hydraulic hand pump (Item 18, Page 7); when the flap indicator registers the desired position, return the selector lever to a neutral position (midway between UP and DOWN).

To **raise** the landing flaps, move the selector lever to the UP position and depress the engine pump control handle (Item 19, Page 7). Normally, 3 seconds are required for this operation.

NOTE:

In case of engine pump failure, use the hydraulic hand pump (Item 18, Page 7).

Normally, the landing flaps selector lever remains in the UP position when the flaps are raised. However, in case of hydraulic line failure, place the

selector lever in a neutral position to prevent the fluid in the reservoir from being pumped overboard.

CAUTION:

Place the landing flaps selector lever in the UP position when the airplane is parked. This allows any excessive hydraulic pressure, caused by temperature changes, to return to the reservoir.

When the landing flaps are in the DOWN position and it is necessary to flatten (or lengthen) the glide of the airplane in an emergency, place the selector lever in the UP position. This allows the force of the airstream to close the flaps to approximately 15 degrees.

CAUTION:

Air speed must be high enough to prevent inadvertent stall. (That is, if the flaps are to be retracted, it is advisable to have an airspeed of 10 knots higher than normal approach with flaps down.)

Diving Flaps Control (Item 4, Page 7).

The diving flaps selector lever (orange knob) controls the operation of the diving flaps. These flaps act as air brakes to retard the speed of the airplane in a dive.

CAUTION:

Do not operate the diving flaps unless the landing flaps selector lever is in the UP position.

To **open** the diving flaps, move the selector lever to the OPEN position and depress the engine pump

control handle (Item 19, Page 7). Normally, 5 seconds are required for this operation.

To **partially open** the diving flaps: move the selector lever to the OPEN position; depress the engine pump control handle (Item 19, Page 7); when the flap indicator registers the desired position, return the selector lever to a neutral position (midway between OPEN and CLOSED).

To **close** the diving flaps, move the selector lever to the CLOSED position (the flaps close to a "trailing" position), and depress the engine pump control handle (Item 19, Page 7) to completely close the flaps. Normally, 1 to 2 seconds are required for this operation.

> **NOTE:**
>
> In case of engine pump failure, use the hydraulic hand pump (Item 18, Page 7).

Normally, the diving flaps selector lever remains in the CLOSED position when the flaps are closed. However, in case of hydraulic line failure, place the selector lever in a neutral position to prevent the fluid in the reservoir from being pumped overboard.

> **CAUTION:**
>
> Place the diving flaps selector lever in the CLOSED position when the airplane is parked. This allows any excessive hydraulic pressure, caused by temperature changes, to return to the reservoir.

Surface Controls Lock (Item 9, Page 7).

The yoke-type surface controls lock, located on the floor forward of the pilot's control stick, locks the control surfaces in neutral.

PILOT'S COCKPIT—RIGHT SIDE

1 Hand Microphone

2 I.C.S. and Radio Switch Box

3 Control Box

4 Diving Flaps Selector Lever

5 Landing Gear Selector Lever

6 Landing Flaps Selector Lever

7 Hydraulic Fluid Reservoir Gage

8 Electrical Distribution Panel

9 Surface Controls Lock

10 Fixed Gun Trigger Switch

11 Bomb Release Button

12 ZB Control Box

13 Oxygen Canisters

14 Remote Tuner

15 Check-off List

16 Oxygen Rebreathing Apparatus

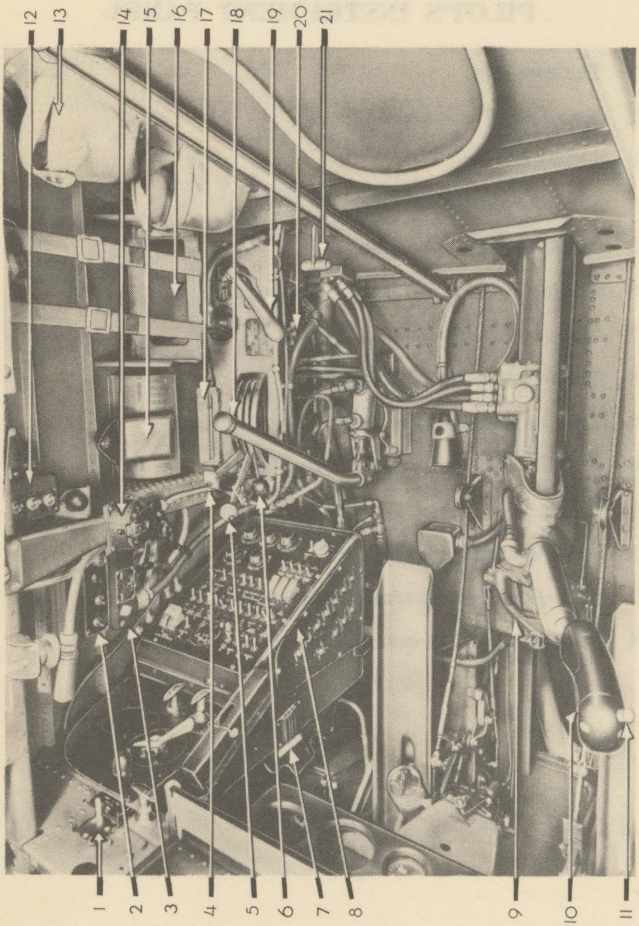
17 Flap Position Indicator

18 Hydraulic Hand Pump

19 Engine Pump Control

20 Landing Gear Emergency Relief Valve

21 Headrest Release



Pilot's Cockpit—Right Side

PILOT'S INSTRUMENT PANEL

1 Tachometer

2 Manifold Pressure Gage

3 Altimeter

4 Directional Gyro

5 Bank and Climb Gyro

6 Engine Gage Unit

7 Airspeed Indicator

8 Turn and Bank Indicator

9 Rate of Climb Indicator

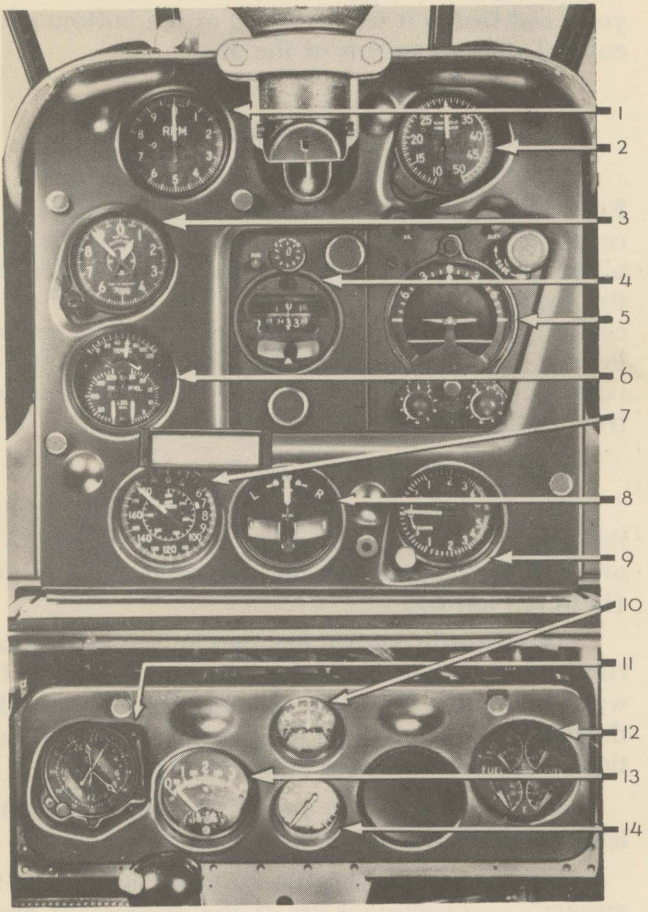
10 Outside Air Temperature Indicator

11 Clock

12 Fuel Quantity Gage

13 Cylinder Temperature Indicator

14 Auto Pilot Oil Pressure Gage



Pilot's Instrument Panel

To engage the lock: remove the pin which holds the yoke to the floor; place both rudder pedals in neutral (directly opposite each other); unbutton the boot around the base of the control stick; lift the yoke and fasten it to the fitting at the bottom of the control stick by means of the pin.

CAUTION:

Secure the surface controls lock to the floor during flight.

POWER PLANT CONTROLS—This section concerns the following controls: the throttle, propeller pitch, mixture, and supercharger controls located in the engine control quadrant on the left side of the cockpit forward of the pilot's seat; various controls located on the electrical distribution panel to the right of the pilot's cockpit; and miscellaneous controls installed in the pilot's cockpit.

Throttle Control (Item 10, Page 15).

The throttle control lever (metal knob) governs the intake manifold pressure of the engine. This pressure is measured by the manifold pressure gage (Item 2, Page 8).

The throttle control has two indicated positions, OPEN and CLOSED. Moving the control lever forward opens the throttle; aft motion closes it. The throttle guide is notched for the recommended position of the control lever at sea level take-off.

A small button on top of the throttle control lever operates the pilot's throat microphone.

An emergency throttle control, located in the gunner's compartment aft of the instrument panel, operates in the same manner as the pilot's throttle control. This is the only auxiliary power plant control installed in the gunner's compartment.

Propeller Pitch Control (Item 13, Page 15).

The propeller pitch control lever governs the rpm of the engine. This rpm is indicated on the tachometer (Item 1, Page 8).

To increase the rpm (propeller in lower pitch), move the propeller pitch control lever downward; to decrease the rpm (propeller in higher pitch), move the propeller pitch control lever upward.

NOTE:
Take-off rpm is the full down position.

A small knob for finer adjustment of the engine's rpm is attached to the outer edge of the propeller pitch control lever. To increase the rpm, rotate the knob counterclockwise; to decrease the rpm, rotate the knob clockwise.

Mixture Control (Item 12, Page 15).

The mixture control lever (red knob) regulates the correct fuel-air mixture in the carburetor. This control has three indicated positions:

Idle Cut-Off—

is the extreme aft position of the selector lever and cuts off the flow of fuel to the engine. It is indicated by a red stripe on the control guide.

Auto-Lean—

is the center position of the selector lever and may be used for economy when the airplane cruises below 70 percent of its normal rated power. It is indicated by a white stripe on the control guide.

Auto-Rich—

is the forward position of the selector lever and is required for take-offs, climbs, and during high speed level flight below 5800 feet altitude. It is required when the airplane operates above 70 per cent of its normal rated power.

Supercharger (Blower) Control (Item 9, Page 15).

The blower control lever (black knob) controls the two-speed supercharger (HIGH and LOW blower) which forces more fuel-air mixture into the cylinders. Higher altitude power rating is obtained by using the supercharger.

CAUTION:

LOW blower is to be used for all take-offs and landings.

Moving the control lever forward engages the HIGH blower which is used for operations at high altitudes. (See "Engine Operating Chart," Page 88). Moving the control lever aft engages the LOW blower which is used for normal operations.

CAUTION:

Change quickly from LOW blower to HIGH blower, or vice versa, to prevent generating undue heat during clutch engagement.

The blower control lever should be at either extreme of its travel (LOW or HIGH) at all times. This insures available rated power and prevents burning out the clutch. If the lever is in an intermediate position, the rated power output of the en-

gine is not available and constitutes a hazardous condition, particularly during take-off.

Carburetor Air Control (Item 13, Page 21).

The carburetor air control handle is located immediately above the electrical distribution panel. This control supplies DIRECT or ALTERNATE air to the carburetor. DIRECT air is obtained from the atmosphere by means of an air scoop, while ALTERNATE air is obtained from inside the cowling.

To obtain ALTERNATE air, rotate the control handle one quarter turn and pull out; to obtain DIRECT air, place the handle in the forward position.

> **CAUTION:**
> Place the carburetor air control in either the full DIRECT or full ALTERNATE positions at all times.

The carburetor air control should remain in the DIRECT position for normal operations. However, use ALTERNATE air when rain, snow, or icing conditions prevail.

> **CAUTION:**
> Place the carburetor air control in the DIRECT position for all diving operations.

Carburetor Air Filter Control (Item 5, Page 21).

The carburetor air filter control handle is located directly above the oil cooler scoop control. This control directs the carburetor air through, or past, the filters.

To use the carburetor air filter, pull out the control handle; when it is no longer desired, push in the handle.

PILOT'S COCKPIT—LEFT SIDE

1 Recognition Radio Control Box

2 Parachute Flare Controls

3 Rudder Tab Control

4 Fresh Water Container

5 Tail Wheel Lock

6 Aileron Tab Control

7 Elevator Tabs Control

8 Arresting Hook Control

9 Supercharger (Blower) Control

10 Throttle Control

11 Ignition Switch

12 Mixture Control

13 Propeller Pitch Control

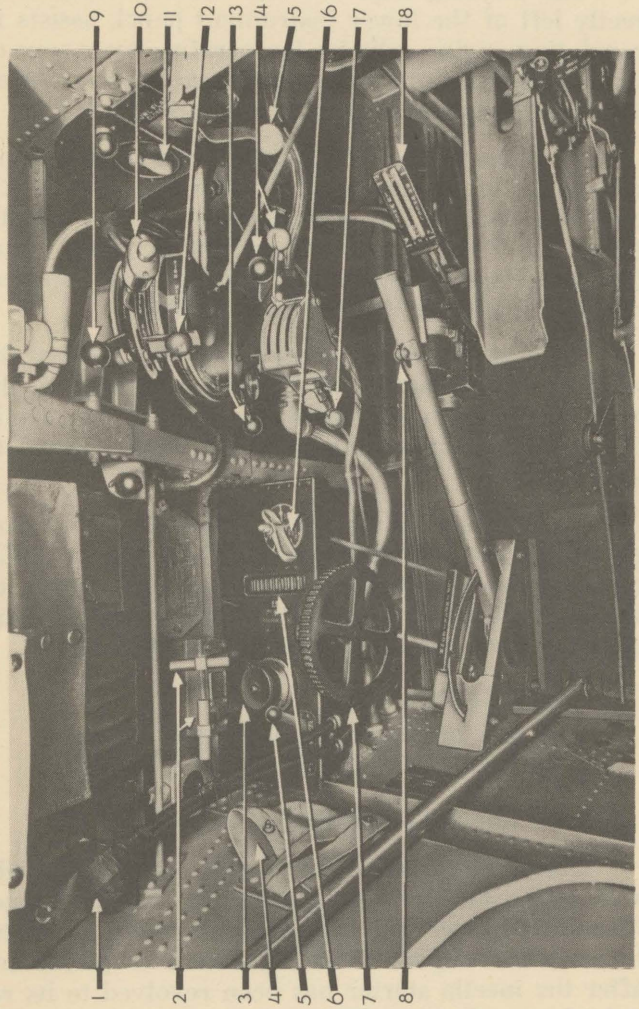
14 Bomb Selector Control

15 Cowling Flaps Control

16 Fuel Tank Selector Control

17 Manual Bomb Arming Control

18 Landing Gear Position Indicator



Pilot's Cockpit—Left Side

Cowling Flaps Control (Item 4, Page 21).

The cowling flaps selector control, located directly left of the lower instrument panel, assists in regulating engine cylinder temperature by means of the cowling flaps. This temperature is recorded on the cylinder temperature gage (Item 13, Page 9).

To **open** the cowling flaps (lower engine temperature): move the selector control to the OPEN position; depress the engine pump control handle (Item 19, Page 7), or the hydraulic hand pump (Item 18, Page 7); when the cowling flaps are opened, return the selector control to NEUTRAL.

To **partially open** the cowling flaps: move the selector control to the OPEN position; operate the hydraulic hand pump; when the cowling flaps are in the desired position, return the selector control to NEUTRAL.

To **close** the cowling flaps (increase engine temperature): move the selector control to the CLOSED position; depress the engine pump control handle, or the hydraulic hand pump; when the cowling flaps are closed, return the selector control to NEUTRAL.

CAUTION:

In case of engine pump failure, use the hydraulic hand pump (Item 18, Page 7).

Starter Control (Item 15, Page 21).

The starter control (outboard) located immediately above the electrical distribution panel, engages the inertia starter with the engine crankshaft in order to start the engine. This operation is performed after the inertia starter has been revolved to its required rate of speed (78 rpm) by the starter crank. (See Page 58).

To operate the starter control, pull out the control handle; hold it in place until the engine is started; then release and push in.

Ignition Switch (Item 11, Page 15).

The ignition switch lever, located directly forward of the engine control quadrant, selects the left magneto, right magneto, or both simultaneously.

NOTE:

The ignition switch also tests the proper operation of each magneto as well as the proper firing of each set (rear and forward) of spark plugs.

The ignition switch may select any of the four settings indicated below:

Left—operates the left magneto only, firing the rear spark plug in each cylinder.

Right—operates the right magneto only, firing the forward spark plug in each cylinder.

Both—is the setting for normal operations, firing both spark plugs in each cylinder.

Off—grounds both magnetos.

Engine Primer Switch (Item 3, Page 29).

The engine primer is operated by a switch on the upper left corner of the electrical distribution panel. The primer facilitates starting operations by supplying raw fuel to the cylinders.

To operate the engine primer hold the switch in the ON position for approximately 5 seconds. Release the switch to stop the engine primer.

CAUTION:

Raise the fuel pressure to approximately 15 pounds before using the engine primer.

Fuel Tank Selector Control (Item 16, Page 15).

The fuel tank selector control, located forward of the tabs controls, selects the tank from which fuel is to be withdrawn. This control is also used to shut off all fuel supply to the engine-driven fuel pump and the auxiliary fuel pump. The amount of fuel in each tank is registered on the fuel quantity gages (Item 12, Page 8) on the lower instrument panel.

Auxiliary Fuel Pump Control (Item 2, Page 29).

The auxiliary fuel pump is operated by a switch on the upper left corner of the electrical distribution panel. The necessary pressure required to supply fuel to the carburetor for starting and priming purposes is delivered by the auxiliary fuel pump. Engage the auxiliary fuel pump control during take-offs and landings as a precautionary measure against engine pump failure. If necessary, it is also used for high altitude flying to prevent vapor lock in the fuel system.

NOTE:

Substitute the auxiliary fuel pump if the engine pump fails during flight.

To operate the auxiliary fuel pump, place the switch in the **on** position. When it is no longer required, turn the switch OFF.

Oil Cooler Scoop Control (Item 9, Page 21).

The oil cooler scoop control is located directly forward of the control stick under the lower instru-

ment panel. This control assists in regulating engine oil temperature by opening and closing the scoop. The oil temperature is recorded on the oil temperature gage (Item 6, Page 9).

For normal operations, place the oil cooler scoop control in the CRUISE position. The control regulates the scoop as follows:

To **open** the scoop (cooling the oil), crank the control handle clockwise until the indicator registers the desired position.

To **close** the scoop (heating the oil), crank the control handle counterclockwise.

> **NOTE:**
> Lock the oil cooler scoop in any desired position by means of a small thumb screw on the left side of the control unit.

Oil Dilution Control (Item 21, Page 29).

The oil dilution control switch, located on the upper right corner of the electrical distribution panel, operates the oil dilution valve which allows raw fuel to enter the oil system. The diverter valve on the oil cooler then directs the flow of the diluted oil to the tank to facilitate quick starting operations.

> **NOTE:**
> Dilute the oil only when the temperature drops below −5 degrees C. (+23 degrees F.).

While the engine is running and before operating the oil dilution control switch, open the shut-off cock located above the "Y" drain valve. (The "Y" drain valve is located on the main oil supply line between the engine and the firewall.) This is accom-

PILOT'S COCKPIT—FRONT

1 Compass

2 Fixed Gun Sight

3 Windshield Heat Control

4 Cowling Flaps Control

5 Carburetor Air Filter Control

6 Brake Pedals

7 Control Stick

8 Brake Pedal Adjustment

9 Oil Cooler Scoop Control

10 Rudder Pedals

11 Rudder Pedal Adjustment

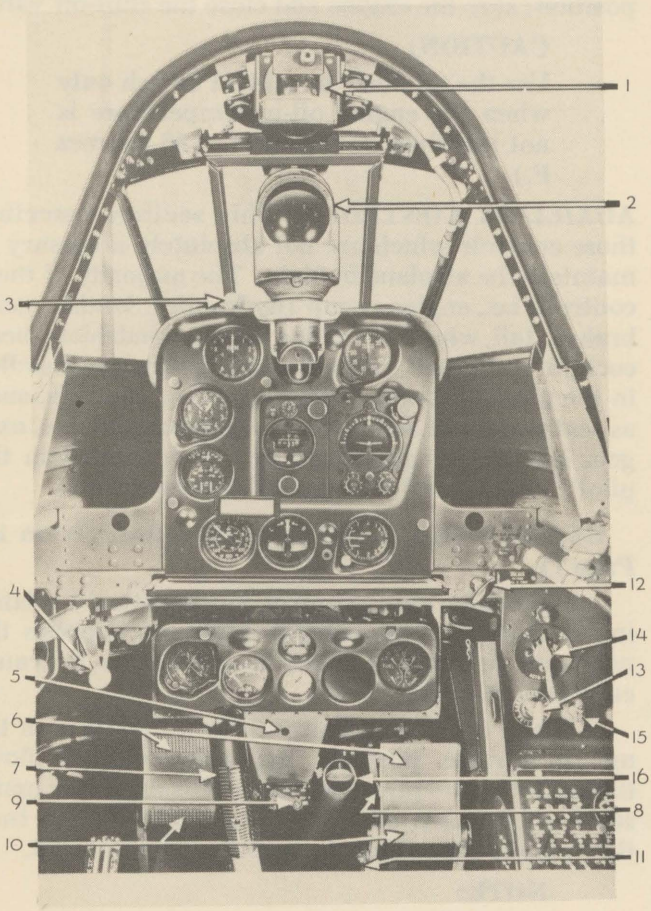
12 Parking Brakes Control

13 Carburetor Air Control

14 Auto Pilot Control

15 Starter Control

16 Cockpit Ventilator Control



Pilot's Cockpit—Front

plished by removing the left hand bottom panel of the accessory cowling. Then, turn on the control switch and hold in an UP position for approximately 2 minutes. Return the control switch to the OFF position; stop the engine and close the shut-off valve.

CAUTION:

Use the oil dilution control switch only when the engine oil-in temperature is not less than 30 degrees C. (86 degrees F.)

AUXILIARY CONTROLS—This section describes those controls which are not absolutely necessary to maintain the airplane in flight. The majority of these controls, i.e., engine pump (hydraulic), landing gear, brakes, tail wheel, arresting hook, windshield heat, cockpit ventilator, and automatic pilot, are installed in the pilot's cockpit. However, other controls, such as seat and pedal adjustments, enclosure latches, oxygen, and radio equipment, are incorporated in the pilot's cockpit and the gunner's compartment.

Engine Pump (Hydraulic) Control (Item 19, Page 7).

The engine pump control, located aft of the landing and diving flaps control quadrant, supplies the necessary pressure required to operate the hydraulically driven units.

When the engine pump control handle is in the **up,** or normal, position, hydraulic pressure flows through the auto pilot regulator. This regulator maintains a pressure of 120 pounds per square inch throughout the system to operate the auto pilot.

NOTE:

Depressing the engine pump control handle while the auto pilot is **on,** momentarily disrupts auto pilot operation.

When the engine pump control handle is depressed, the control valve maintains a pressure of approximately 1050 pounds per square inch throughout the system to operate the landing flaps, diving flaps, cowling flaps, and landing gear. The engine pump control handle automatically returns to its normal position in 9 to 12 seconds.

NOTE:

If the engine pump control handle does not automatically return to its normal position in approximately 15 seconds, return it manually.

Hydraulic Hand Pump (Item 18, Page 7).

The hydraulic hand pump, located to the right of the pilot's seat, supplies the necessary pressure to the hydraulic units when the engine pump is inoperative.

To build up pressure in the hydraulic system, pump the hydraulic hand pump fore and aft until a sufficient pressure is attained to operate the desired unit.

Landing Gear Control (Item 5, Page 7).

The landing gear selector lever, located in the landing and diving flaps control quadrant, governs the operation of the landing gear for take-off and landing.

CAUTION:

If the selector lever freezes, **force** the selector lever to the DOWN position and open the landing gear emergency relief valve.

The landing gear selector lever should remain in the full UP or full DOWN position at all times so that the safety latch, connected to the selector lever,

locks the gear in either the completely extended or retracted position. Immediately to the left of the left rudder pedal is an indicator which registers the position of the landing gear.

To **retract** the landing gear, move the selector lever to the UP position and depress the engine pump control handle. Normally, 6 seconds are required for this operation.

NOTE:

In case of engine pump failure, use the hydraulic hand pump (Item 18, Page 7).

To extend the landing gear, move the selector lever to the DOWN position. The gear should lower and lock within 6 seconds as registered on the indicator. A warning horn sounds until the landing gear is extended and locked, or when the throttle control lever is less than ⅛ open—14 to 16 inches Hg. manifold pressure.

CAUTION:

Do not extend the landing gear at an indicated air speed in excess of 140 knots.

EMERGENCY:

If one or both of the landing gear will not extend when the landing gear selector lever is moved to the DOWN position, apply pressure to the system by operation of the engine pump control handle.

If this does not actuate the landing gear, relieve pressure by shifting the cowling flap control to either the OPEN or the CLOSED position and then back to NEUTRAL. Reapply pressure to the system by operating the emergency hand pump.

If this sequence does not free the strut, move the selector lever to the UP position, apply pressure to the system to bring the gear to the fully retracted position and repeat the above emergency procedure to extend the landing gear. If this fails, continue as follows:

Bleed the landing gear hydraulic actuating system by breaking the safety wire and opening the emergency relief valve (Item 20, Page 7). Place landing gear selector lever in the DOWN position, executing maneuvers that develop negative accelerations of approximately two load factors.

If the above procedure does not free the strut, execute negative accelerations of approximately two load factors, followed immediately by a snap pullout of approximately five load factors.

NOTE:

Before other hydraulic units can function normally, close the emergency relief valve.

Landing Gear Emergency Relief Valve (Item 20, Page 7).

The landing gear emergency relief valve is located below the engine pump control handle. This

valve releases hydraulic pressure from the landing gear actuating cylinder, enabling the landing gear to extend by gravity and bungee action. Use this valve only when the landing gear does not extend as outlined above.

To open the landing gear emergency relief valve, turn the control handle counterclockwise. This permits the fluid to return to the reservoir. When the landing gear has been extended and locked, turn the control handle clockwise.

NOTE:

The landing gear emergency relief valve is safetied by means of a wire which must be broken by hand before the valve can be used.

Tail Wheel (Swivel) Lock (Item 5, Page 15).

This control is unlocked for all carrier operations except when the airplane is parked.

NOTE:

Lock the tail wheel for field landings and take-offs.

To unlock the tail wheel, move the lever forward to the RELEASED position; to lock the tail wheel, move the lever aft to the LOCKED position.

Arresting Hook Control (Item 8, Page 15).

The arresting hook control lever, located to the left of the pilot's seat, is used only for carrier deck landings.

NOTE:

Place the control lever in the full HOOK UP or full HOOK DOWN posi-

tion at all times so that the lever locks in either position.

To lower the arresting hook, move the control lever aft to the HOOK DOWN position; to stow the arresting hook, move the control lever forward to the HOOK UP position.

CAUTION:

Lock the control lever in the HOOK DOWN position prior to carrier landings.

Landing Light

The retractable landing light in the left wing is controlled by a switch (Item 11, Page 29) on the pilot's electrical distribution panel.

CAUTION:

Do not extend the landing light at an indicated airspeed in excess of 120 knots.

Operate the landing light as follows: to extend the landing light, place the switch in the DOWN position; to stop the light in an intermediate position, place the switch in the OFF position; to turn off the light, place the switch in the UP position.

NOTE:

The light automatically turns on and off when 10 degrees from the retracted position.

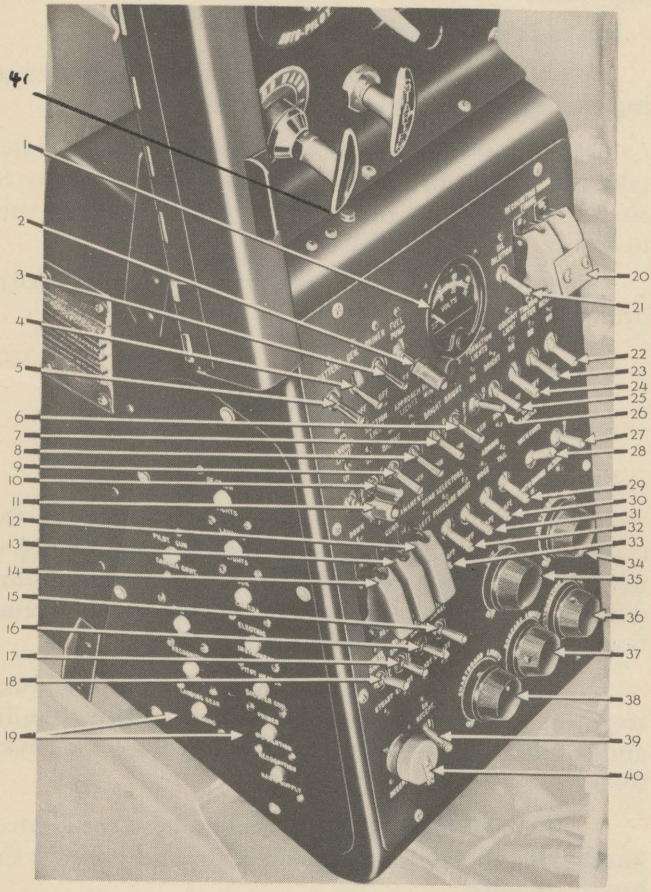
Approach Light

The Type 1-A approach light in the leading edge of the left wing operates in conjunction with the arresting hook.

When the arresting hook is extended, the approach light automatically illuminates and indicates

PILOT'S ELECTRICAL DISTRIBUTION PANEL

1	Voltammeter
2	Auxiliary Fuel Pump
3	Engine Primer
4	Generator
5	Battery
6	Running Tail Light
7	Running Wing Lights
8	Approach Light
9, 10	Section Light
11	Landing Light
12	Right Gun Selector
13	Left Gun Selector
14	Master Armament
15	Amber Recognition Signal
16	Green Recognition Signal
17	Red Recognition Signal
18	White Recognition Signal
19	Circuit Breakers
20	Recognition Radio Firing
21	Oil Dilution
22	Pitot Heater
23	Thermometer
24	Cockpit Light
25, 26	Formation Lights
27	Gun Sight
28	Gun Camera
29	Tail Arming
30	Nose Arming
31	Right Bomb Selector
32	Fuselage Bomb Selector
33	Left Bomb Selector
34	Instrument Lights Rheostat
35	Gun Sight Rheostat
36	Distribution Panel Light Rheostat
37	Compass Lights Rheostat
38	Chartboard Lights Rheostat
39	Receptacle Switch
40	Receptacle



Pilot's Electrical Distribution Panel

to the signal office the attitude of the airplane in regard to carrier landing as follows: red light, too low; green light, too high; amber light, correct approach.

Brakes (Item 6, Page 21).

Hydraulic wheel brakes are operated by depressing the upper portion of the rudder pedals.

Use these brakes for stopping the wheels after take-off, prior to retracting the landing gear; to check the speed of the airplane when landing; and to aid in ground maneuvers.

To operate the brakes, depress either, or both, brake treadles.

CAUTION:

Do not pump brakes except in emergencies.

Parking Brakes Control (Item 12, Page 21).

The parking brakes control is located to the right of the pilot's chartboard. This control, which is used to park the airplane and to check its motion during warm-up and take-off, operates in conjunction with the brake treadles as follows:

To apply the parking brakes, depress the brake treadles, pull out the parking brake control handle and rotate it one-quarter turn, then release the brake treadles.

To release the parking brakes, turn the control handle one-quarter turn, push it in, and depress the brake treadles.

CAUTION:

Do not pump brakes except in emergencies.

Rudder Pedal Adjustment (Item 11, Page 21).

Adjustment treadles, incorporated on the inboard edge of each rudder pedal, permit the pedals to be adjusted to the stature and comfort of the pilot or gunner.

To adjust the rudder pedals, apply downward toe pressure on the treadles to release the locks; then move the pedals fore and aft until they occupy the desired position.

Brake Pedal Adjustment (Item 8, Page 21).

Adjustment levers, incorporated on the inboard edge of each brake pedal, permit the pedals to be adjusted to the stature and comfort of the pilot.

To adjust the brake pedals, apply side foot pressure on the levers to release the locks; then move the pedals fore and aft until they occupy the desired position.

Pilot's Seat Adjustment (Item 3, Page 63).

The pilot's seat adjustment lever, attached to the upper right side of the seat, permits the adjustment of the seat to the proper height.

Lift and hold the adjusting lever while raising or lowering the seat with body weight; release the lever to lock the seat in place.

Gunner's Seat Adjustments

Adjust the gunner's seat for height, swivel, and tilt as follows:

The height adjustment lever (Item 4, Page 33), located forward of the left armor plate adjacent to the swivel track, permits the seat to be raised or lowered with body weight. Release the lever to lock the seat in position.

GUNNER'S COMPARTMENT—TOP

1 Left Armor Plate Lock Pin

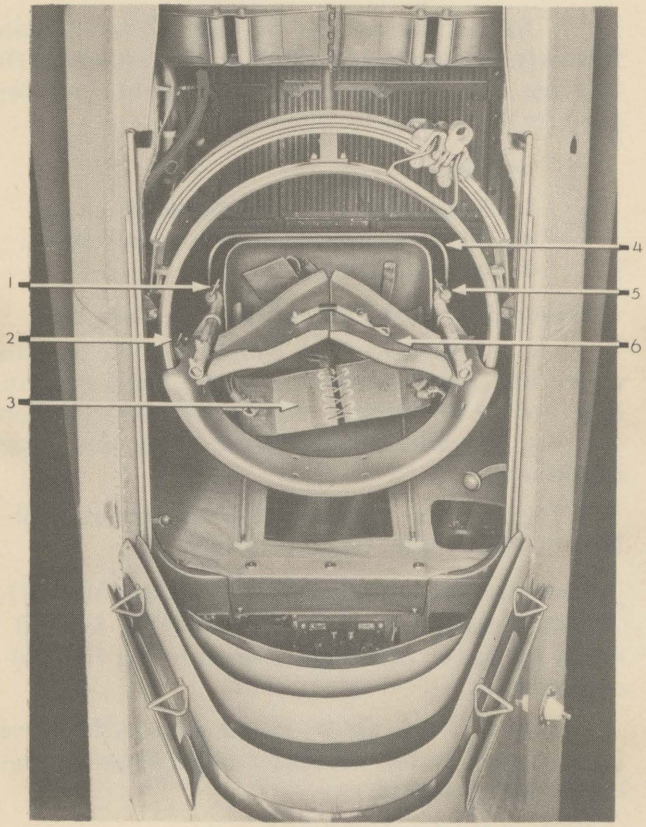
2 Seat Swivel Lock Pin

3 Safety Belt

4 Seat Height Adjustment Lever

5 Right Armor Plate Lock Pin

6 Chest Armor Plates



Gunner's Compartment—Top

The locking pin (Item 2, Page 33), located below the height adjustment lever, permits the seat to swivel or lock in a fore and aft position. To release the lock, depress and rotate the lever one-quarter turn.

Adjust the seat for tilt only when the gunner faces aft. Downward pressure on the foot pedal (Item 3, Page 55), located behind the right foot brace, permits the seat to be tilted.

NOTE:

Locking pins for the gunner's chest armor plate are located on either side of the seat fittings.

Windshield Heat Control (Item 3, Page 21).

The windshield heat control handle is located above the upper instrument panel. This control allows hot air to circulate over the windshield, thereby clearing the windshield during icing and fogging conditions.

To open the windshield heat control, pull out the control handle; push in to close it.

Cockpit Ventilator Control (Item 16, Page 21).

The cockpit ventilator control is located beneath the lower instrument panel to the right of the control stick.

Admit outside air by means of a butterfly valve incorporated in the ventilator tube; thumb pressure operates the control.

Cockpit Enclosure Latches.

The enclosure latches are operated from either inside or outside the cockpit.

The inside latch for the **pilot's enclosure** is on the upper right edge of the enclosure; the outside

latch is on the bottom right corner of the enclosure. Raising the outside lever or pulling down on the inside lever permits the enclosure to slide and lock in any of five positions.

The **gunner's** enclosure is divided into two sections:

Operate the forward enclosure, which has two positions, by means of a latch on the right side just below the enclosure track. It is also operated from the outside by a latch below the fore part of the section.

The aft section of the enclosure is released by a handle near the upper right inside corner. To slide the aft section forward, depress the handle, tilt the section, and slide it under the center enclosure. The latch, which is used to operate the forward section, also releases the aft section for replacement.

Oxygen Rebreathing Apparatus.

An oxygen rebreathing apparatus of the central supply type is installed in the pilot's cockpit and the gunner's compartment. This apparatus, which is used for breathing in high altitudes, consists of the following:

Oxygen Bottle—The oxygen supply for both rebreathers is located on the aft right side of the gunner's compartment (Item 10, Page 39). A valve on top of the bottle controls the supply of oxygen.

Rebreathers and Facepiece—The rebreathing unit incorporates a facepiece through which the wearer breathes. The pilot's rebreather (Item 16, Page 7) is stowed above the engine pump control; the gunner's rebreather (Item 9, Page 39) is above the oxygen bottle. Tubes leading from the oxygen bottle supply the necessary oxygen to both rebreathers.

Canisters—A holder on the left side of the rebreather case clamps the canisters in place and permits their easy replacement. The canisters, which purify exhaled air, are inserted only when they are to be used and after removing the tear-off caps. The pilot's two canisters are stowed in brackets (Item 13, Page 7) on the right side of the seat; one of the gunner's canisters is left of the rebreather while the other is stowed above the tail pipe valve (Item 6, Page 39).

NOTE:

Replace the canisters every two hours if the tear-off caps have been removed.

Automatic Pilot Control (Item 14, Page 21).

The control for the auto pilot is located above the electrical distribution panel. The auto pilot maintains the directional, longitudinal, and lateral stability of the airplane in flight.

CAUTION:

The auto pilot control must be either FULL ON or FULL OFF at all times.

Check auto pilot oil pressure gage (Item 14, Page 9); it should indicate approximately 120 pounds per square inch.

Proceed as follows before engaging the auto pilot:

Set lower, or directional, card on the directional gyro control unit to the magnetic compass reading by pushing in and turning the caging knob.

Uncage the directional gyro by pulling the caging knob straight out.

Turn the course-setting knob until upper, or reference, card coincides with the directional gyro.

Uncage the bank and climb gyro control unit by pulling out the caging knob and turning it counterclockwise as far as possible. (Push in the knob to lock in this position.)

Turn the aileron and elevator trim knobs on the bank and climb control unit until the pointers on the index dials register zero.

Trim the airplane for "hands off" condition.

Engage the auto pilot by turning the control ON. After it is in operation, the course-setting knob and the aileron and elevator trim knobs may be slightly adjusted, if necessary, to place the airplane in straight, level flight. Rapidity of control response is regulated by the knurled signal adjustment knobs.

NOTE:

For auto pilot ground and flight check lists, see Pages 81 and 82.

Before entering combat or aerobatics, place the auto pilot control in the OFF position, and cage the directional and the bank and climb control units.

Electrical Distribution Panels.

The pilot's electrical distribution panel (Item 8, Page 7), which is located on the lower right side of the cockpit, contains the following:

Voltammeter with selector switch; battery and generator switches; oil dilution, fuel pump, and engine primer switches; switches for the exterior, recognition, landing, approach, instrument and cockpit lights; thermometer and pitot heater control switches; rheostats for gun sight, instrument lights, distribution panel lights, and chartboard lights; gun, gun sight, bomb, camera, and arming switches; recognition radio firing switches; and a receptacle and switch.

GUNNER'S COMPARTMENT—RIGHT SIDE

1 Forward Enclosure Latch

2 Hand Microphone

3 Transmitter Key (forward position)

4 Control Box

5 Receiver Switch Box

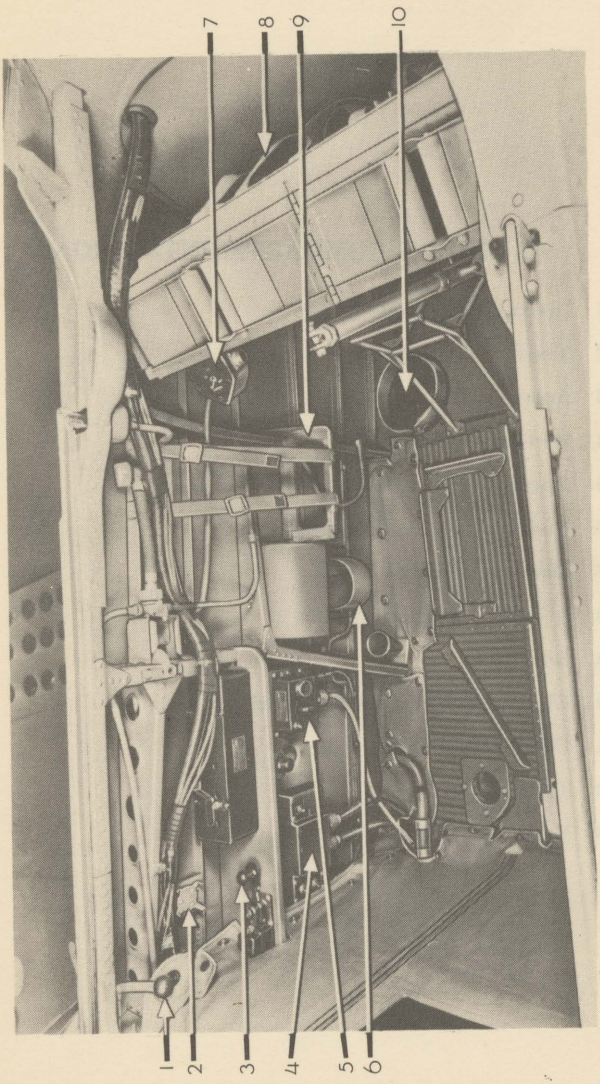
6 Oxygen Canister

7 Gun Camera Switch Box

8 Night Drift Signals

9 Oxygen Rebreathing Apparatus

10 Oxygen Bottle



Gunner's Compartment—Right Side

GUNNER'S COMPARTMENT—FRONT

1 Instrument Panel

2 Trailing Reel Antenna

3 Antenna Loading Coil

4 Rudder Pedals

5 Control Stick Socket

6 Rudder Pedal Adjustment

7 Homing Adapter

8 Cockpit Enclosure Latch

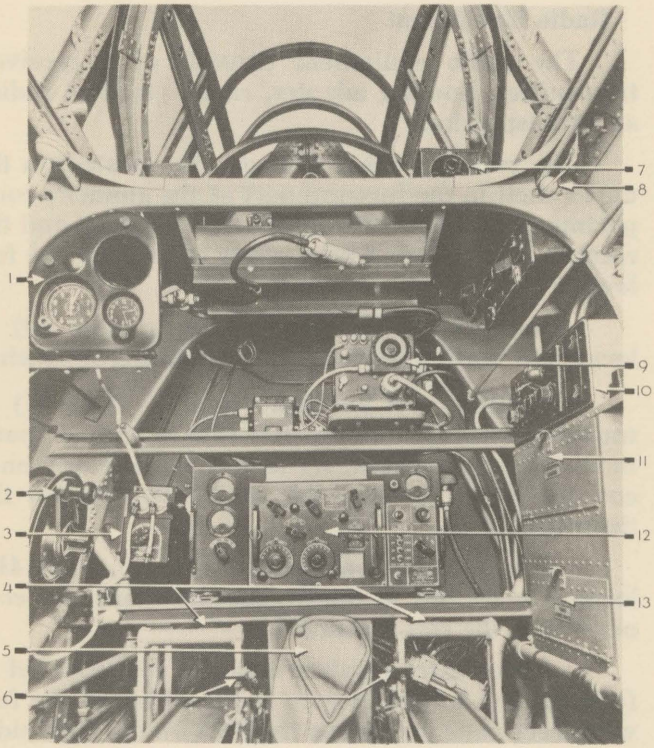
9 Receiver

10 Electrical Distribution Panel

11 Confidential Locker

12 Transmitter

13 Radio Spare Parts Locker



Gunner's Compartment—Front

The **gunner's** switch panel (Item 10, Page 41), located above the confidential locker on the right side of the compartment, contains the following:

Switches for instrument, compartment, and distribution panel rheostats; compartment lamp switch; and receptacles and power switches.

Radio Equipment

The radio equipment consists of a receiver, transmitter, homing adapter, radar (tactical radio) and transponder.

The **receiver** (Item 9, Page 41), located on the upper shelf in the forward part of the gunner's compartment, has controls on the receiver panel and the receiver switch box. The receiver consists of the following units:

Receiver switch box (Item 5, Page 39) is located forward of the oxygen rebreathing apparatus.

Trailing reel antenna (Item 2, Page 41) is mounted on a reel on the left side of the compartment. When released, its length is indicated on a counter (Item 13, Page 61) on the floor below the throttle control.

The **antenna loading coil** (Item 3, Page 41), located to the left of the transmitter, holds the connector for the reel antenna.

Three **extra receiver coil sets** are provided as follows: one is held in snap slides on top of the forward deck; one just below the deck on the right side; and one on the arm rest.

Remote tuner (Item 14, Page 7) is located above the pilot's control quadrant.

The **transmitter** (Item 12, Page 41) is located on the lower shelf in the forward part of the gunner's

compartment. All of the controls for the transmitter, except the ICS and Radio switches, are contained in the transmitter panel. The transmitter consists of the following units:

Gunner's control box (Item 4, Page 39), which incorporates the ICS and RADIO controls, is aft of the confidential locker.

Pilot's control box (Item 3, Page 7) is forward of the remote tuner.

Alternate tuning unit is stowed under the aft section of the gunner's compartment.

Antenna and the **antenna loading coil** conform to that described under "Receiver" above.

Microphones for the pilot and gunner are mounted in clips as follows: the gunner's microphone is aft of the electrical distribution panel (Item 2, Page 39); the pilot's microphone is right of the upper instrument panel (Item 1, Page 7). The pilot's throat microphone is operated by a button on the throttle control, while the gunner's throat microphone is operated by a button on top of the right gun spade grip.

Two **transmitting keys** are provided in the gunner's compartment; one operated while facing forward, the other while facing aft. The jack for the pilot's alternate transmitting key is provided in the bottom of the control box.

The **homing adapter** (Item 7, Page 41), located on the upper forward deck in the gunner's compartment, contains a tuning dial. Switches for the homing adapter are on the pilot's ZB control box (Item 12, Page 7), above the remote tuner.

Radar (Tactical Radio)—The indicator for the radar is located on the forward center deck of the

GUNNER'S ELECTRICAL DISTRIBUTION PANEL

1 Cockpit Light

2 Receptacle Switch

3 Receptacle

4 Instrument Lights Rheostat

5 Cockpit Lights Rheostat

6 Instrument Panel Light

7 Fuse and Spare Fuse Box

8 Switch Panel Lights Rheostat

(Photo to be Added)

Gunner's Electrical Distribution Panel

gunner's compartment. The control box (Item 10, Page 61) and the hydraulic controls (Item 11, Page 61) for operating the antennas are below the throttle control.

Recognition Radio (Transponder)—The control box for the recognition radio is aft of the pilot's data case (Item 1, Page 15). The recognition radio firing switches, located on the electrical distribution panel, fire the detonation cap to destroy the receiver unit in the baggage compartment.

Interphone—This communication is regulated as follows:

To use the interphone:

Place the switch on the receiver switch box in either the MANUAL or the AUTOMATIC position.

Place the I.C.S.-Radio switch on the transmitter control box in the I.C.S. position.

Depress the button on top of the microphone when speaking.

To operate the pilot's throat microphone:

Place the throat microphone plug in the mike jack at the bottom of the pilot's control box.

Depress the button on top of the throttle control when speaking.

To operate the gunner's throat microphone:

If cord switch is used, plug in the mike jack at the bottom of the gunner's control box.

If switch on left hand gun spade grip is desired (as for combat), remove the section of the microphone cord which contains the switch; replace with a plain cord; and plug in the mike jack at the bottom of the gunner's control box.

Unground the mike jack by twisting the knurled washer around the outside of the jack.

Unplug the transmitter key, and plug in the red plug leading from the electrical junction box.

Depress the button on top of the left hand gun spade grip when speaking.

USEFUL LOAD INSTALLATION CONTROLS— This section describes the following armament controls of the SBD-5 airplane and their location: The bombing controls installed in the pilot's cockpit; the fixed gun controls in the pilot's cockpit; the flexible gun controls in the gunner's compartment; the gun cameras which are included for the fixed and flexible guns; the parachute flare releases in the pilot's cockpit; and the smoke tank controls, signal pistol and night drift signals in the gunner's compartment.

Electrical Bombing Controls.

The three bomb racks are armed from the electrical distribution panel as follows; place the battery switch, or battery and generator switches in the ON position; place the master armament switch in the ON position; set the nose switch, tail switch, or both, in the ON position.

To release the bombs, place the left, fuselage, or right bomb selector switches in the ON position; depress the button on top of the control stick.

> **NOTE:**
> If it is desired to drop the three bombs simultaneously, place the three bomb selector switches in the ON position.

Manual Bombing Controls.

For manual bombing operations, the bombs must be electrically armed from the electrical distri-

bution panel as noted under "Electrical Bombing Controls" above.

To release the bombs: move the selector lever, located in the bomb control quadrant (Item 14, Page 15), to the R. (right) L. (left), or SALVO (center positions.

NOTE:

To release the three bombs simultaneously, place the selector lever in the SALVO position. However, if the bombs are to be released individually, drop the L. and R. bombs before the SALVO.

Fixed Gun Controls.

Two browning .50 calibre fixed guns are installed in the pilot's cockpit.

To prepare the guns for firing, the following switches on the electrical distribution panel must be placed in the ON position: the battery switch, or battery and generator switches; the master armament switch; the left, right, or both gun selector switches.

Grip the trigger switch (Item 10, Page 7), on the forward side of the control stick, to fire the guns.

To use the illuminated gun sight, located on the vertical centerline of the airplane beneath the compass, follow this procedure: adjust the pilot's seat for height; place the master armament switch in the ON position; place the gun sight switch in the ON position; adjust the rheostat knob (located on the electrical distribution panel) for desired intensity.

Flexible Gun Controls

The Browning twin flexible .30 calibre guns are located in the aft section of the gunner's compartment. The button incorporated on top of the left gun

spade grip operates the gun camera; the button on top of the right gun spade grip operates the gunner's throat microphone.

Prepare the guns for firing as follows:

Move the forward and after sections of the enclosure under the center section enclosure.

Push back the panels on either side of the gun tunnel doors.

Depress the pedal, located directly below the right foot brace, to open the gun tunnel doors.

Grasp the gun adapter spade grips and pull the gun back until it automatically locks in place.

Raise the bead and ring sights into position.

Depress the handle, located in the center of the gun truck, to allow the adapter to swivel on the gun ring.

To tilt the seat and guns, depress the lever immediately aft of the right foot brace.

Charge the guns by pulling back the two handles on the outboard side of the guns.

An illuminated gun sight, located on the aft end of the gun adapter, is controlled by the rheostat knob directly below the sight.

To fire the guns: set the safety lever, located between the trigger levers, in the FIRE position; grasp the gun spade grips and push the trigger levers with thumb pressure (either lever fires both guns).

Stow the guns as follows:

Set the safety lever in the SAFE position.

Place the gun truck in a center position.

Latch the ring and bead sights in a stowed position.

FLEXIBLE GUNS—STOWED POSITION

1 Interphone (Throat Microphone) Switch

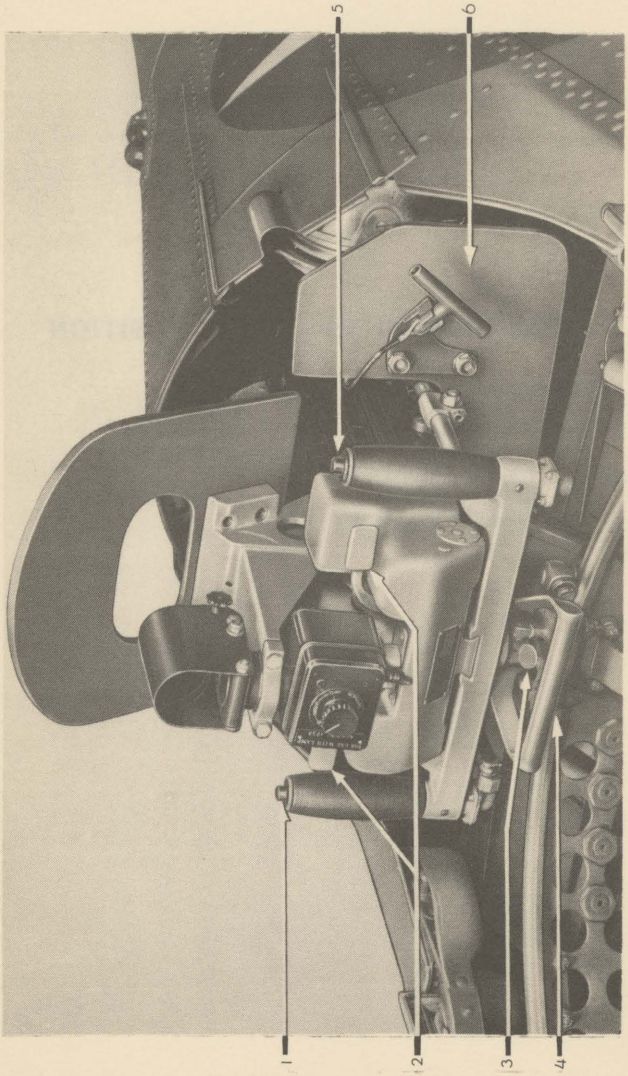
2 Gun Trigger Levers

3 Gun Adapter Release Lever

4 Gun Adapter Handle

5 Gun Camera Switch

6 Shoulder Armor Plate



Flexible Guns—Stowed Position

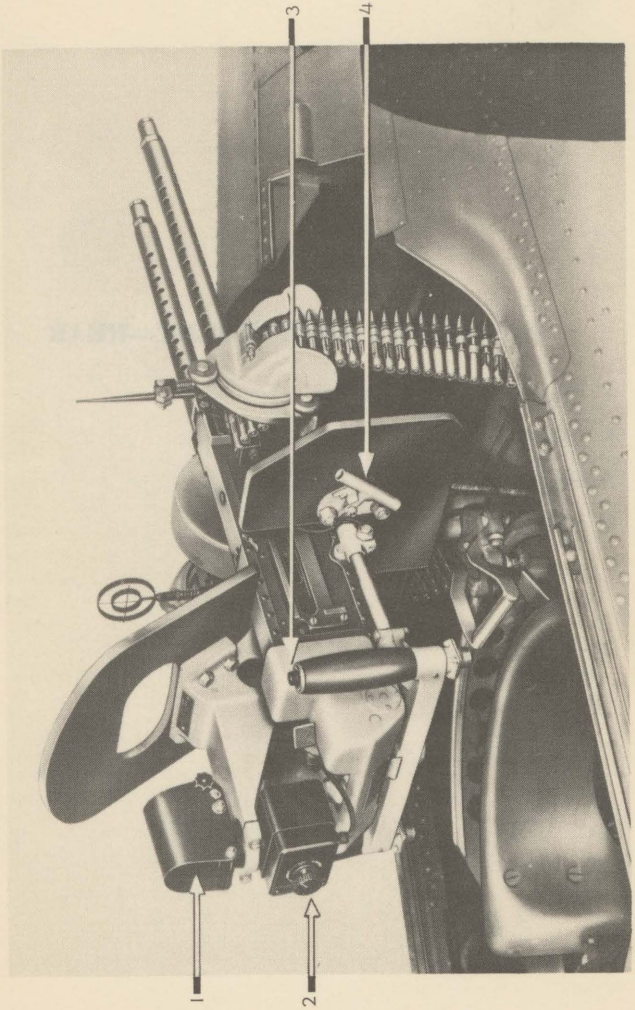
FLEXIBLE GUNS—FIRING POSITION

1 Illuminated Gun Sight

2 Gun Sight Rheostat

3 Gun Camera Switch

4 Gun Charger Control



Flexible Guns—Firing Position

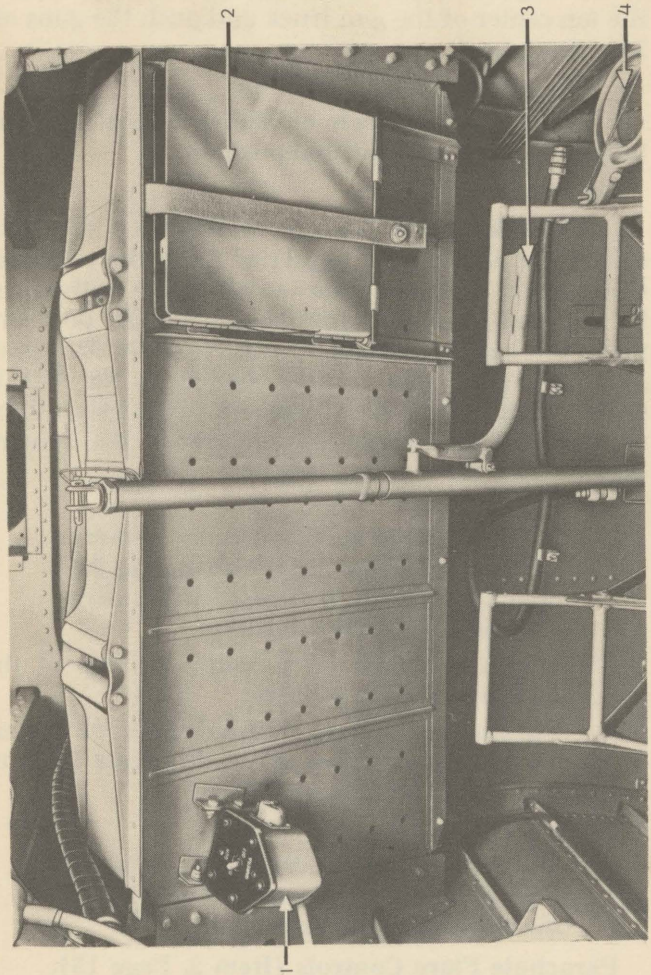
GUNNER'S COMPARTMENT—REAR

1 Gun Camera Switch Box

2 Data Case

3 Seat Tilt Control

4 CO_2 Bottle



Gunner's Compartment—Rear

Depress the pedal, located directly below the right foot brace, to open the gun tunnel doors.

Depress or lift the small lever, as required, on the top center of the gun truck and push the guns aft into the tunnel.

Lock the guns in position.

Return the panels on either side of the gun tunnel doors to their normal position.

Gun Cameras

The **pilot's** gun camera, mounted on the right side of the fuselage, is regulated from the electrical distribution panel as follows: place the battery, or battery and generator switches in the ON position; place the master armament switch in the ON position; place the gun camera switch in the WITH GUNS position. As the trigger switch is gripped, or the bomb release button is depressed the camera operates.

NOTE:
If it is desired to operate the camera without firing the guns or dropping the bombs, leave the gun and bomb switches in the OFF position.

The gunner's camera, mounted on top of the R.H. gun, is operated as follows:

Turn on the camera switch, located to the left of the gunner when facing aft, and depress the button on top of the left gun spade grip.

NOTE:
When mounted, the camera renders the R.H. gun inoperative and also prohibits the stowing of the guns.

Parachute Flare Controls (Item 2, Page 15).

Controls (painted red) for two parachute flares are located above the tail wheel lock.

Pulling up the control handle releases a flare which, if dropped from 2500 feet, illuminates an area of approximately 1½ miles for at least three minutes.

CAUTION:

To avoid ripping or catching the parachute flare on the tail wheel, decrease airspeed below 140 knots.

Smoke Tank Controls.

The smoke tank controls consist of the tail pipe control (Item 5, Page 61), the gate valve (Item 7, Page 61), and the CO_2 bottle located on the aft left side of the compartment.

To operate the smoke tank, lower the tail pipe control, so that the chemical flows away from the airplane; open the valve on the CO_2 bottle to build up pressure in the smoke tank; and raise the gate valve handle so that the chemical flows into the atmosphere.

To close the smoke tank control, depress the gate valve handle; raise the tail pipe control handle to the normal position; turn off the CO_2 valve handle.

NOTE:

It is not necessary for the CO_2 valve handle to be turned off if the gunner wishes to repeat the operation.

AN-M8 Signal Pistol (Item 1, Page 61).

The AN-M8 signal pistol, located on the aft left side of the gunner's compartment, is rigidly mounted to the structure. Twelve cartridges are located forward of the pistol in canvas containers.

To install a cartridge, break open the pistol.

Night Drift Signals (Item 8, Page 39).

The five night drift signals (float lights) are aft of the flexible gun ammunition box. These lights are principally used at night to check drift variations but may also be used during daylight.

By means of the smoke, or smoky light, released when the float strikes the water, the gunner computes the amount of drift.

MISCELLANEOUS EQUIPMENT — Miscellaneous equipment installed in the airplane consists of the life raft, pilot's chartboard, starter crank, hoisting sling, emergency rations and fresh water.

Life Raft.

The Type D life raft is stowed in a compartment in the aft left side of the fuselage. A latch is provided on the outside of the compartment to provide ready access to the raft.

The raft incorporates a handle which is pulled to allow the CO_2 gas to inflate it. If the handle fails to operate, inflate the raft by manual operation of the CO_2 cylinder attached to the raft.

Chartboard (Item 1, Page 63).

The pilot's chartboard, used for navigation calculations, is stowed under the instrument panel. To slide the chartboard from the stowed position, release the latch on the left side of the board.

Starter Crank.

The crank for energizing the engine starter is stowed in the baggage compartment. Access to the compartment is from the right side of the fuselage.

Hoisting Sling (Item 5, Page 63).

A single loop type hoisting sling is attached to the fuselage and stowed behind the pilot's seat. The hoisting sling holds the airplane at a specified angle of trim when loaded as a scout with no bombs and is also used for miscellaneous hoisting purposes.

Emergency Rations and Fresh Water.

Emergency rations and fresh water are stowed in a bag attached to the life raft. An additional water canteen of 1-quart capacity is stowed in the pilot's cockpit and gunner's compartment.

GUNNER'S COMPARTMENT—LEFT SIDE

1 Cut-out for AN-M8 Signal Pistol

2 Signal Flare Cartridge Containers

3 Transmitter Key (aft position)

4 Oxygen Canister

5 Tail Pipe Control

6 CO_2 Bottle

7 Gate Valve Control

8 Gun Tunnel Door Control Lever

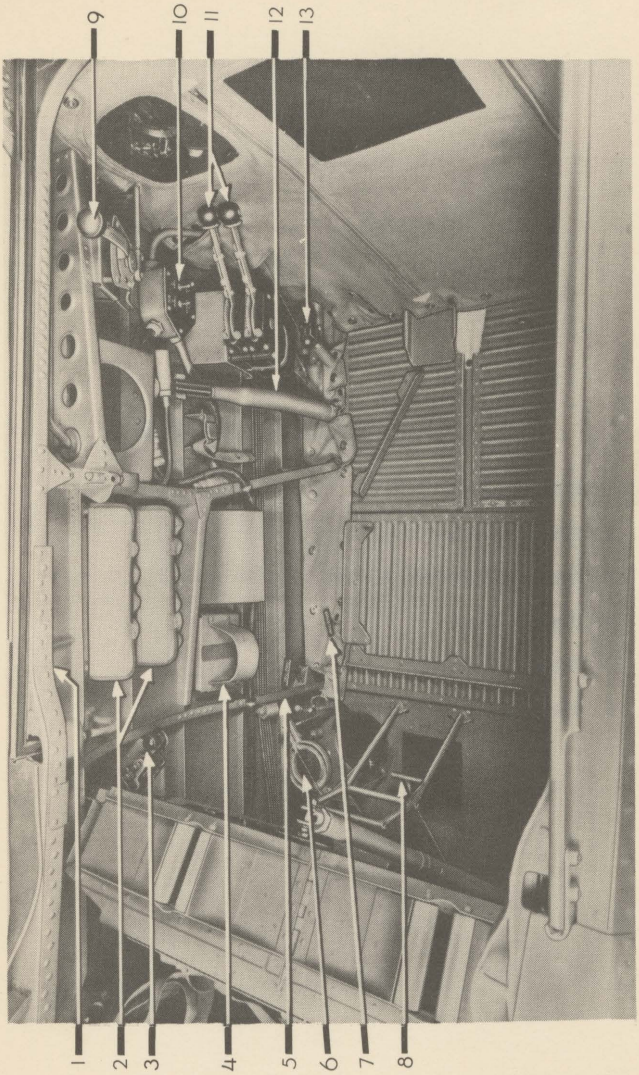
9 Throttle Control

10 Radar Control Box

11 Radar Controls

12 Control Stick (stowed position)

13 Counter for Trailing Reel Antenna



Gunner's Compartment—Left Side

PILOT'S COCKPIT—TOP

1 Chartboard

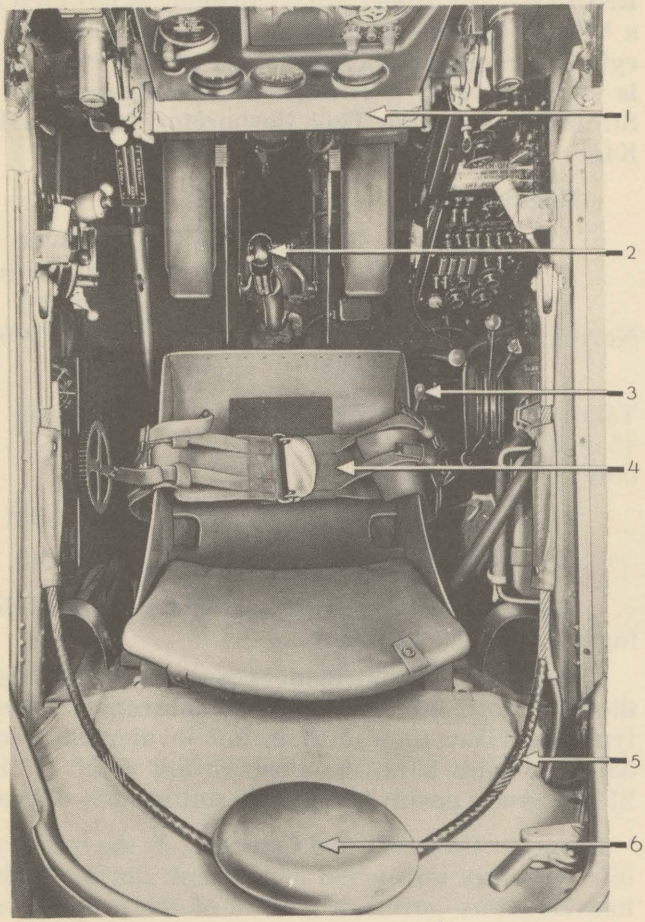
2 Control Stick

3 Seat Adjustment Lever

4 Safety Belt

5 Hoisting Sling

6 Headrest



Pilot's Cockpit—Top

SECTION II

POWER PLANT

ENGINE—The Model SBD-5 airplane is powered by a Wright Cyclone Engine, Model R-1820-60. The 9-cylinder, radial engine, air-cooled and geared 3 to 2, is equipped with a two-speed supercharger and a Stromberg Injection Type Carburetor, Model PD12-K4.

Engine Rating.

	BHP	RPM	BLOWER	Altitude (estimated, subject to revision)
Normal	1000	2300	Low	S.L.—4500
	900	2300	High	14,000
Take-off (5 minute only)	1200	2500	Low	Sea Level

Fuel—100 octane, Specification AN-VV-F-781.

Oil—Grade 1120, Specification AN-VV-C-446.

Maximum Diving RPM—3000 rpm (do all diving in LOW blower ratio).

Propeller—The airplane is equipped with a Hamilton Standard, three-blade hydromatic constant speed type propeller, 10 feet 10 inches in diameter; hub 33D50; blades 6511A-9. Positive low pitch setting 21½ degrees; positive high pitch setting 48½ degrees.

Propeller Governor and Controls—If the engine oil inlet becomes uncovered at the tank during a dive, unsatisfactory governor control of the propeller results, and oil pressure drops. However, to maintain constant oil pressure to the governor at all times, a hydraulic accumulator has been installed. This accumu-

lator stores up oil pressure during normal operation; when normal oil pressure fails, check valves permit the use of the accumulated oil pressure. For operation of the propeller governor control (pitch control), see Page 11.

Starter—The airplane is equipped with an Eclipse, Type 436, hand inertia starter. The starter crank is stowed on the floor of the baggage compartment and the crank socket for energizing the starter is on the right side of the cowling.

Carburetor Air Control—See Page 13.

Mixture Control—See Page 11.

Supercharger Control.

Do not, except in an emergency, shift the supercharger control more often than at five minute intervals; this permits heat to be dissipated from the clutches.

The control must be at the extremity of its travel (HIGH or LOW) at all times to prevent clutch slippage and insure available rated power.

The supercharger, equipped with a roller-type clutch, does not require a de-sludging operation.

Change from LOW to HIGH ratio as follows:

Place the mixture control in AUTO-RICH.

Close the throttle, as necessary, to avoid exceeding the desired manifold pressure in HIGH ratio.

Reduce rpm, if practicable (not below 1700 rpm).

Shift rapidly from LOW to HIGH.

Readjust rpm, throttle setting, and mixture control to obtain desired power.

Change from HIGH to LOW ratio as follows:

Place mixture control in AUTO-RICH.

Reduce rpm.

Shift rapidly from HIGH to LOW.

Readjust rpm, throttle setting, and mixture control to obtain desired power.

Changing Power Conditions—When changing power, **always** follow the procedure outlined below to prevent excessive pressures within the cylinders.

To Increase Engine Power:

Adjust the mixture control for the power condition specified in the "Engine Operating Chart," Page 88.

Adjust the propeller control for the desired rpm.

Adjust the throttle for the desired manifold pressure.

Decrease Engine Power:

Adjust the throttle for approximate desired manifold pressure.

Adjust the propeller control for the desired rpm.

Adjust the mixture control for the power condition specified in the "Engine Operating Chart," Page 88.

Readjust the throttle, if necessary.

Cowling Flaps Control—See Page 16.

Maximum Cylinder Head Temperatures — The

maximum cylinder head temperatures for the various operating conditions are indicated below:

Warm-up	205° C. (401° F.)
Take-off (5 min.)	260° C. (499° F.)
S.L. to 4500 (1 hr.)	235° C. (454° F.)
7500 - 14,000 (continuous)	218° C. (424° F.)
Maximum cruising	205° C. (401° F.)
Landing	205° C. (401° F.)
Stopping	150° C. (302° F.)

Fuel System—The fuel system incorporates two main fuel tanks, two auxiliary fuel tanks, a fuel tank selector valve, two sump selector valves, an engine-driven fuel pump, and an auxiliary fuel pump. See Diagram, Page 69.

The two main fuel tanks are located in the wing center section, and the two auxiliary tanks are located in each outer wing. Fuel tank capacities are indicated below:

	Capacity	
Fuel Tank	**With Liner**	**Without Liner**
R.H. Main	75 gal.	90 gal.
L.H. Main	75 gal.	90 gal.
R.H. Auxiliary	52 gal.	65 gal.
L.H. Auxiliary	52 gal.	65 gal.
Total	254 gal.	310 gal.

Since there are no interconnections between the tanks and each has individual supply lines to the tank selector valve, each must be filled and drained separately.

A fuel tank selector valve (Item 16, Page 15) selects from which tank fuel is to be withdrawn. It may also be adjusted to cut off the fuel supply to the engine-driven pump and the auxiliary fuel pump.

A sump selector valve, incorporated in the main fuel tanks, withdraws fuel from the sumps located in

the fore and aft corners of each tank. (The attitude of the airplane determines from which sump fuel is drawn.) This valve prevents air from entering the system through uncovered outlets. The auxiliary tanks, which are not equipped with sump selector valves, have only a single outlet.

CAUTION:

Do not take-off, land, or dive, with fuel supplied from the auxiliary fuel tanks. Use auxiliary tanks for level flight only.

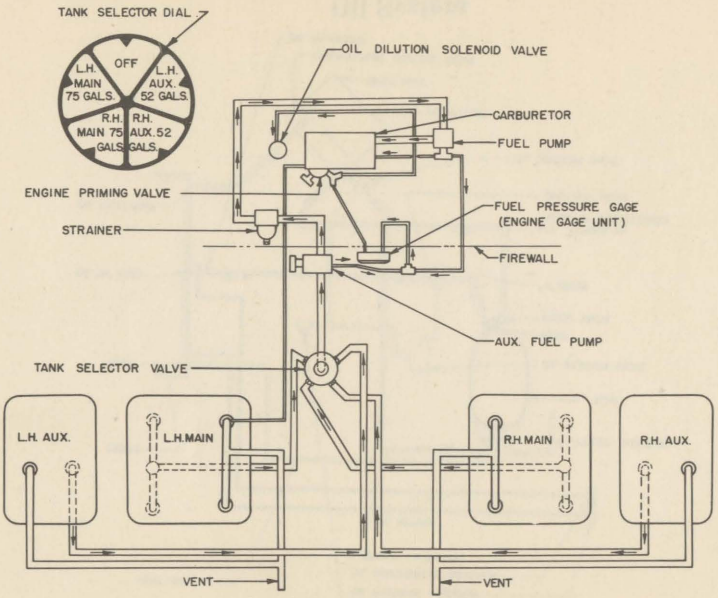
Fuel gage (Item 12, Page 9) located on the pilot's lower instrument panel, indicate in U.S. gallons the amount of fuel in the tanks during flight. When the airplane is at rest, the pilot may calculate the amount of fuel in the tanks by means of the gage calibration tables mounted on the left side of the electrical distribution panel.

The engine-driven fuel pump normally delivers fuel to the carburetor. However, to build up pressure for engine starting and to avoid vapor lock at high altitudes, use the auxiliary fuel pump. This pump, operated by a switch on the pilot's electrical distribution panel, assists in maintaining the required fuel pressure of 14 to 16 pounds.

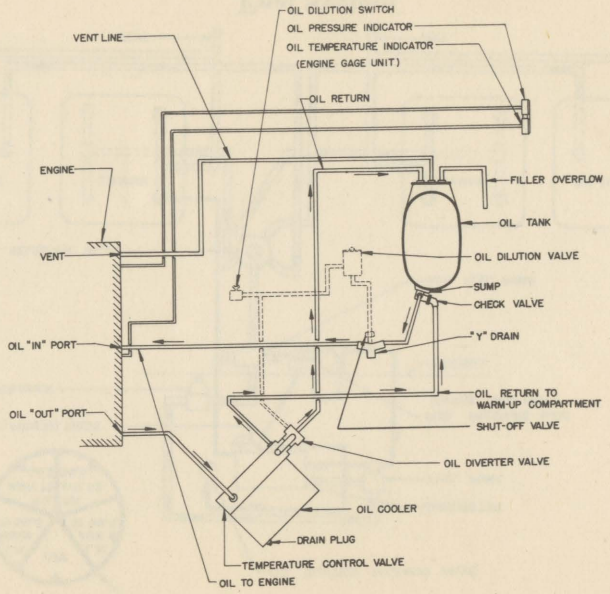
Oil System — The oil system incorporates an oil tank, an oil cooler, a temperature control valve, a diverter valve, an oil dilution valve and an oil return valve. See diagram, Page 70.

The oil tank, located directly forward of the firewall, has a "with liner" capacity of 16.5 gallons with a 3-gallon expansion space; "without liner" capacity is 19.5 gallons with a 3-gallon expansion space.

After the oil passes through the engine, it flows through an outlet to the rotary temperature control


TANK SELECTOR DIAL
OFF
L.H. MAIN 75 GALS.
L.H. AUX. 52 GALS.
R.H. MAIN 75 GALS.
R.H. AUX. 52 GALS.
OIL DILUTION SOLENOID VALVE
CARBURETOR
FUEL PUMP
ENGINE PRIMING VALVE
FUEL PRESSURE GAGE (ENGINE GAGE UNIT)
STRAINER
FIREWALL
AUX. FUEL PUMP
TANK SELECTOR VALVE
L.H. AUX.
L.H. MAIN
R.H. MAIN
R.H. AUX.
VENT
VENT

Fuel System


OIL DILUTION SWITCH
OIL PRESSURE INDICATOR
OIL TEMPERATURE INDICATOR
(ENGINE GAGE UNIT)
VENT LINE
OIL RETURN
ENGINE
FILLER OVERFLOW
OIL TANK
VENT
OIL DILUTION VALVE
SUMP
CHECK VALVE
"Y" DRAIN
OIL "IN" PORT
OIL RETURN TO
WARM-UP COMPARTMENT
OIL "OUT" PORT
SHUT-OFF VALVE
OIL DIVERTER VALVE
OIL COOLER
DRAIN PLUG
TEMPERATURE CONTROL VALVE
OIL TO ENGINE

Oil System

valve on the side of the oil cooler. The temperature control valve regulates the temperature of the oil being returned to the tank. At this point, cold oil is by-passed to the bottom of the tank; warm oil is directed through the cooler muff and the diverter valve to the top of the tank; hot oil is passed through the core of the cooler and the diverter valve to the top of the tank. A check valve, attached to the inlet connection at the bottom of the oil tank, allows the oil to enter the tank but does not permit it to flow out, thereby preventing oil from returning to the engine sump through the return line.

Oil temperature and oil pressure, recorded on the engine gage unit (Item 6, Page 9) located on the pilot's upper instrument panel, should be as follows:

Oil Temperature	
Recommended	60° to 80° C. (140° to 176° F.)
Emergency	102° C. (216° F.)
Minimum	30° C. (86° F.)
Oil Pressure	
Normal	65 to 75 lbs./sq. in. (desired operating range)
Idling	25 lbs./sq. in. (min.)

A retractable air scoop for the oil cooler is regulated from the pilot's cockpit by a control (Item 9, Page 21) directly forward of the control stick under the lower instrument panel. Normally, the control handle is set in the CRUISE position. However, when outside temperature warrants, it may be cranked clockwise to the OPEN position, or counterclockwise for the CLOSED position.

An oil dilution valve incorporated in the oil system facilitates engine starting. It is operated by an oil dilution switch on the pilot's electrical distribution panel. Raw fuel, which enters the oil system by means of the oil dilution valve, dilutes the oil.

Hydraulic System—The hydraulic system incorporates a reservoir, engine-driven pump, engine pump control valve, hydraulic hand pump, selector valves, sequence valve, booster cylinder, and auto pilot. See diagram, Page 73.

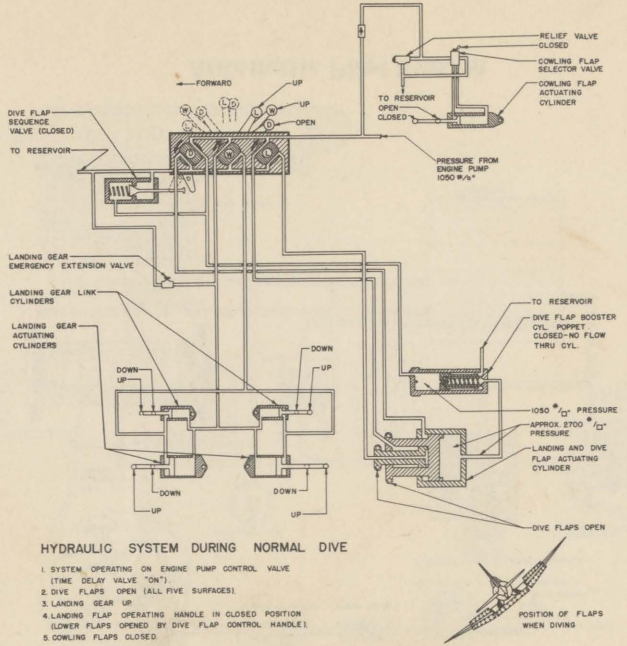
The reservoir, which is located on the right side of the pilot's cockpit aft of the firewall, has a hydraulic fluid capacity of 148 cubic inches. A sight gage (Item 7, Page 7) incorporated on the reservoir, indicates the hydraulic fluid level. The reservoir supplies hydraulic fluid to the engine-driven pump, the hydraulic hand pump, and the master brake cylinders.

Mounted on the engine is the engine-driven pump which directs fluid through a filter to the engine pump control valve (time delay valve). When the engine pump control handle is in the **up,** or normal, position, the fluid flows through a Sperry Relief valve. This valve directs a fluid pressure of 120 pounds per square inch to the auto pilot; excessive fluid returns to the reservoir.

The hydraulic hand pump is used in case of engine pump control failure. The hand pump, which supplies the necessary pressure to operate the actuating cylinders of the hydraulic units, is manually operated and is located to the right of the pilot's seat.

Incorporated in the selector valves are the control levers for the landing flaps, diving flaps, landing gear, and cowling flaps. To operate any of these units, set the lever in the desired position and depress the engine pump control handle.

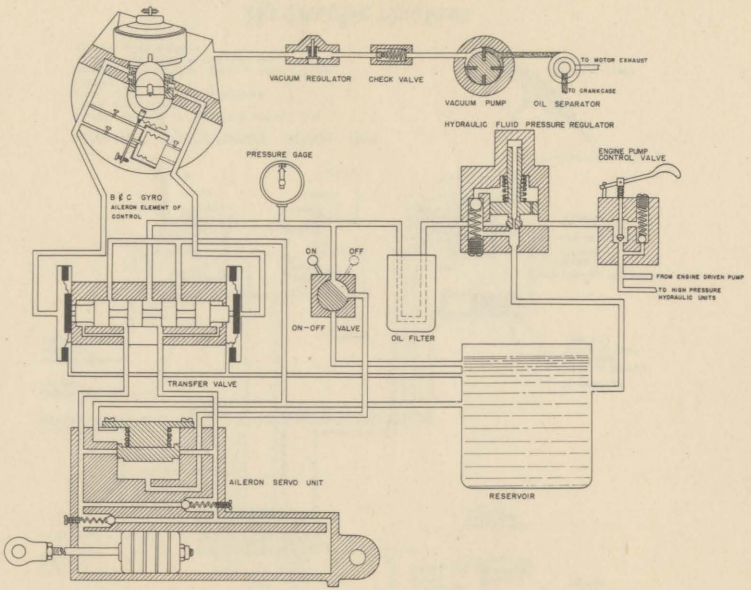
Attached to the diving flaps control lever is a sequence valve which permits immediate closing of the diving flaps to the trailing position. The booster cylinder, located between the selector valve and the diving flaps actuating cylinder, increases the normal



HYDRAULIC SYSTEM DURING NORMAL DIVE

1. SYSTEM OPERATING ON ENGINE PUMP CONTROL VALVE (TIME DELAY VALVE "ON").
2. DIVE FLAPS OPEN (ALL FIVE SURFACES).
3. LANDING GEAR UP.
4. LANDING FLAP OPERATING HANDLE IN CLOSED POSITION (LOWER FLAPS OPENED BY DIVE FLAP CONTROL HANDLE).
5. COWLING FLAPS CLOSED.

Hydraulic System



Automatic Pilot System

hydraulic system pressure by a ratio of 2.7 to 1, allowing for the opening of the diving flaps up to 200 knots indicated airspeed.

The auto pilot system is used to fly the airplane at a fixed attitude of flight by means of the directional gyro and the bank and climb gyro. Incorporated in the system are the Sperry Transfer valve and the Servo units which operate as follows:

The Sperry Transfer valve transforms the air impulses from the gyroscopic instruments to oil impulses which actuate the Servo units.

The Servo units receive the oil impulses and actuate the aileron, rudder, and elevator control cables.

Operating Instructions.

Starting.

Ignition switch—OFF.
Mixture control—IDLE CUT-OFF.
Rotate engine manually—4 or 5 revolutions.
Throttle—Set for 600 to 800 rpm.
Supercharger control—LOW.
Propeller control — TAKE-OFF rpm. (2500 rpm.)
Cowling flaps—OPEN.
Carburetor air—DIRECT (T.O. 44-40).
Battery and generator switches—ON.
Electric auxiliary fuel pump—ON.
Primer—ON (as necessary).
Ignition switch—BOTH (on).
Starter—Energize and engage.
Mixture control—Advance to AUTO-RICH as engine fires; if engine fails to continue running, return to IDLE CUT-OFF.
Primer—Operate intermittently, as necessary. *Do not pump the throttle.*

Idle—1000 rpm for 30 seconds. If oil pressure does not register, stop engine and investigate.

Engine Ground Test (Warm-up).

Carburetor air—DIRECT.

Cowling flaps—OPEN.

Mixture control—AUTO-RICH.

Propeller control—TAKE-OFF rpm.

Throttle—Operate at 1200 rpm until oil temperature reaches 30 degrees C. (86 degrees F.). See T.P. 24-41.

Check magnetos:

Set throttle at 30 inches Hg. maximum.

Operate on a single magneto for shortest possible time.

Return switch to BOTH between checks to allow engine to clear out.

Check supercharger:

Set propeller control to TAKE-OFF rpm.

Open throttle to 1700 rpm.

Shift rapidly from LOW to HIGH.

Open throttle to approximately 30 inches Hg.

Observe manifold pressure when rpm is stabilized.

Shift rapidly from HIGH to LOW. (*Do not move the throttle.*)

Sudden decrease in manifold pressure indicates proper operation.

CAUTION:

Do not exceed a cylinder head temperature of 205 degrees C. before take-off. (401°F.)

Check auxiliary fuel pump:

Turn control OFF.

Check fuel pressure (14-16 pounds).

Turn pump ON.

Take-off (5 Minutes).

Auxiliary fuel pump—ON.

Cowling flaps—OPEN.

Carburetor air — DIRECT. (See T.O. 44-40, T.N. 36-41).

Mixture control—AUTO-RICH.

Propeller control—TAKE-OFF rpm.

Supercharger—LOW.

Throttle—Open to 46.5 inches Hg.

Maximum cylinder temperature — 260 degrees C. (500° F.).

Rated Power Climb and Level Flight (2300 rpm) —Operate the engine according to the "Engine Operating Chart," Page 88, and the "Engine Operating Limits Chart," Page 87. The throttle and supercharger settings for this condition are given on the "Engine Operating Chart." **Do not exceed 253 degrees C. (489° F.) 1 hour, or 218 degrees C. (426° F.) continuous, cylinder head temperature.**

Altitude (No Ram)	Manifold Pressure Inches Hg.	Supercharger Ratio
S.L.	41.0	LOW
4500	40.0*	LOW
4500-7500	F.T. (Shift to HIGH when Manifold Pressure drops to 35.5 in. Hg.)	
7500	44.5	HIGH
12000	44.0	HIGH
14000	43.5*	HIGH
Above 14000	F.T.	HIGH

*NOTE:

The altitudes at which these manifold pressures can be obtained vary considerably with carburetor entrance conditions; the above values are for standard air and no ram.

Cruising.

Conduct cruising operations at any engine power below normal rated power. However, if minimum fuel consumption is of importance, and provided it is tactically feasible, conduct cruising operations in a range not exceeding 65 percent of normal rated power.

For cruising power operation, the engine should be operated in AUTO-LEAN as shown in the "Engine Operating Limits Chart," Page 87. Use AUTO-RICH if a cylinder head temperature of 205 degrees C. (401° F.) is exceeded while the cowling flaps are open.

Do **not** exceed the cruising manifold pressure-rpm relationships specified in the "Engine Operating Limits Chart," Page 87.

Diving.

Propeller control—1900-2200 rpm.
Maximum diving rpm—3000 rpm.
Cowling flaps—CLOSED.
Supercharger control—LOW.

NOTE:

This airplane is equipped with a propeller accumulator. (See T.O. 49-42).

Stopping.

Propeller control—TAKE-OFF rpm.

Throttle—800-1000 rpm.

Supercharger — No de-sludging operation needed.

Mixture control—IDLE CUT-OFF.

Ignition switch—OFF (when engine stops).

Battery and generator switches—OFF.

Fuel tank selector control—OFF.

SECTION III

OPERATION CHARTS AND DATA

ENGINE OPERATING LIMITS CHART—This chart is used to set operating conditions or to determine engine power at any operating condition within the recommended operating limits of the engine. The section to the left is for LOW blower operation; the section to the right for HIGH blower operation. The horizontal dot-dash line indicates the limit for AUTO-LEAN operation. When operating in the AUTO-RICH position, use the lines above the dot-dash line. Part throttle conditions are those to the left of the oblique heavy-dashed line in both the LOW and HIGH blower sections; full throttle conditions are to the right of these lines.

High Power—Auto-Rich (Part Throttle).

When a high-power climb is desired, operate along one of the constant manifold pressure-rpm lines (sloping lines labeled with manifold pressure and rpm). For a constant rated power climb, use 41 inches Hg. at sea level, decreasing to 40 inches Hg. at 4500 feet.

Select a level flight condition from a point on one of the designated lines. If an intermediate condition is desired, any manifold pressure-rpm combination represented in the full throttle portions of the chart can be used for part throttle operation.

Cruising Power—Auto-Lean (Part Throttle)—For power conditions below the dot-dash line, the maximum recommended manifold pressures are independent of rpm.

To Determine Horsepower (Any Power Condition).

When the rpm and manifold pressure are known, select the condition in the **full throttle** portion of the

section of the chart for the blower ratio in which the engine is operating.

Draw a line through the point determined, parallel to the constant manifold pressure-rpm lines shown; read the horsepower at the point where this line intersects the pressure altitude line.

Pressure Altitude.

Determine the amount of barometric pressure (altimeter window reading) above or below 29.92 inches Hg.

Add 100 feet for each 0.1 inch Hg. below 29.92 inches Hg.; subtract 100 feet for each 0.1 inch Hg. above 29.92 inches Hg.

AUTOMATIC PILOT GROUND CHECK—Check for the following:

Oil in Reservoir: Quantity—Normal.

Operation of Vacuum and Oil Pumps: Engine set at 600 to 700 rpm; note gage reading; use portable vacuum gage.

Oil Pressure: 4 to 5 inches Hg. and 115 to 125 pounds per square inch; auto pilot ON; engine running at 1000 rpm.

Air in Hydraulic System: Auto pilot ON; gyro trim knobs set at "0"; note sponginess in controls; should react as though locked under light control force.

To Bleed Air From System: Auto pilot OFF; gyro trim knobs one-half turn off "0"; hold controls at extreme positions each way for 30 seconds.

Airplane Controls: Note neutral position of controls; run engine at 1000 rpm; center airplane controls; uncage gyros; gyro trim knobs set at "0"; auto pilot ON.

Control Surfaces: Note direction and speed of movement; move gyro trim knobs back and forth; each control should move in proper direction and at approximately equal speed each way.

Turn aileron trim knob clockwise; right aileron up (control stick moves to the right).

Turn elevator trim knob clockwise; elevator down (control stick moves forward).

Turn course-setting knob clockwise; right rudder (right rudder pedal moves forward).

Operation of Servo Overpower Relief Valves.

Apply light pressure to the controls; simultaneously apply auto pilot force by means of the gyro trim knobs; controls should move against the light pressure.

Note force necessary to overpower the auto pilot; set Servo unit relief valve for 105 pounds per square inch pressure; auto pilot should be overpowered with the following approximate forces of the airplane controls:

Aileron .....28.5 pounds on stick
Elevator .....28.5 pounds on stick
Rudder .....103.0 pounds on rudder pedal

AUTOMATIC PILOT FLIGHT CHECK.

Use gyros as regular flight instruments and fly airplane to an altitude of 2000 feet.

Check oil pressure; 115 to 125 pounds per square inch.

Trim airplane for straight and level flight.

Turn auto pilot control valve ON slowly.

Overpower each control in each direction to assure overpowering of auto pilot.

Adjust auto pilot signal to maximum (clockwise) and slowly decrease as required to eliminate overcontrolling.

Fly airplane to altitude where varying air currents and rough air are present; check signal adjustments.

Climb to maximum ceiling at which auto pilot is used; check operation and required oil pressure.

Retard throttle to approximately 1000 rpm and check auto pilot in glide; note minimum rpm required for satisfactory operation.

Fly a straight course; use magnetic compass and check directional gyro at intervals; deviation of 3 degrees in 15 minutes is permissible.

Rotate rudder knob and make a slow 180-degree turn; check precision of gyros. Also check a slow 360-degree turn.

Check for return of artificial horizon to normal.

During severe maneuvers, cage auto pilot gyros.

CHECK-OFF LIST FOR TAKE-OFF

FUEL . . . . . L.H. MAIN

AUXILIARY FUEL PUMP . . . . . ON

MIXTURE . . . . . AUTO-RICH

SUPERCHARGER . . . . LOW BLOWER

PROPELLER PITCH . . . . . HIGH RPM

COWLING FLAPS . . . . . OPEN

CARBURETOR AIR . . . . . DIRECT

OIL COOLER SCOOP . . . . . OPEN

TRIM TABS . . . . . CHECK

TAIL WHEEL . . . (CARRIER) UNLOCKED

TAIL WHEEL . . . . . (FIELD) LOCKED

CHECK-OFF LIST FOR DIVING

FUEL	MAIN TANK
MIXTURE	AUTO-RICH
SUPERCHARGER	LOW BLOWER
PROPELLER PITCH	MAXIMUM CRUISING (2000-2100 RPM)
COWLING FLAPS	CLOSED
CARBURETOR AIR	DIRECT
OIL COOLER SCOOP	CLOSED
TRIM TABS	CHECK
DIVING FLAPS	OPEN

CHECK-OFF LIST FOR LANDING

TAIL WHEEL . . . (CARRIER) UNLOCKED

TAIL WHEEL . . . . . (FIELD) LOCKED

MIXTURE . . . . . AUTO-RICH

FUEL . . . . . MAIN TANK

AUXILIARY FUEL PUMP . . . . . ON

SUPERCHARGER . . . . . LOW BLOWER

CARBURETOR AIR . . . . . DIRECT

OIL COOLER SCOOP . . . . . OPEN

WHEELS (140 KNOTS MAXIMUM) . . DOWN

LANDING FLAPS . . . . . DOWN

COWLING FLAPS . . . . . CLOSED
(Check Head Temperature)

PROPELLER PITCH . . . . . HIGH RPM

TRIM TABS . . . . . CHECK

Engine Operating Limits Chart

AIRPLANE MODEL: SBD-5 ENGINE MODEL 1820-60

Operating Condition	B.H.P.	R.P.M.	Maximum Manifold Pressure (In. Hg.)	Altitude (Feet)	Super-Charger Position	Use Low Supercharger Below	Mixture Control Position	Maximum Cyl. Head Temperature °C.	Oil Inlet Temperature °C.	Oil Pressure Lb./Sq. In.
STARTING		800			LOW					25
WARM-UP		1000-1200			LOW HIGH		AUTO-RICH	205		60-70
TAKE-OFF (5 min.)	1200	2500	45.5	S.L.	LOW	USE LOW		260	74-88	65-75
NORMAL RATED	1000	2300	37.5	6,900	LOW	10,800	AUTO-RICH	235	74-88	65-75
100%	900	2300	40.0	15,200	HIGH					
MAX. CRUISE	750	2090	30.5	10,700	LOW	14,500	AUTO-RICH	218	74-88	65-75
75%	675	2090	31.7	18,700	HIGH					
DESIRED CRUISE	670	2015	28.4	11,900	LOW	15,800	AUTO-LEAN	205	74-88	65-75
67%	603	2015	29.2	19,900	HIGH					
DESIRED CRUISE	600	1940	26.6	13,100	LOW	17,200	AUTO-LEAN	205	74-88	65-75
60%	540	1940	26.8	21,000	HIGH					
DIVES		1900 to 2200			LOW		AUTO-RICH			65-75
LANDING		2300			LOW		AUTO-RICH	205		
STOPPING		1200 (30 sec.)			LOW		IDLE CUT-OFF	150		

ENGINE OPERATING CHART

Cruising Lean Fuel Consumption Chart

(Diagram to be added)

Mixture Ratio and Flow

(Diagram to be added)

Propeller Load Curve

(Diagram to be added)

Air Speed Correction Chart

(Diagram to be added)

Cruising Charts

(Diagram to be added)

Landing Speed Chart

(Diagram to be added)

Speed for Maximum Rate of Climb

(Diagram to be added)

Sea Level and Altitude Low Blower Characteristics

(Diagram to be added)

High Blower Altitude Characteristics

(Diagram to be added)

Maximum Permissible Operating Conditions
(1000-pound Bomber Condition)

(Diagram to be added)

Altitude in Terminal Velocity Dives
(SBD-5 1000-pound Bomber)

(Diagram to be added)

Sea Level — Low Gear, Brake Horsepower Manifold Pressure Curve

(Diagram to be added)

Maximum Permissible Operating Conditions

(Diagram to be added)

SECTION IV

AIRPLANE CHARACTERISTICS

The Model SBD-5 airplane, a single engine, low wing, monoplane, is designed for dive bombing, smoke laying, or scouting operations.

Check-off lists are provided in the pilot's cockpit, listing the operations which must be completed before take-off, landing, diving, or ground maneuvers.

It is recommended that the pilot study the following information in addition to the check-off lists.

Normal Instrument Readings.

Refer to "Engine Operating Limits Chart," Page 87.

Weight and Balance.

General.—The problem in maintaining Weight and Balance control is to keep the Gross Weight and Balance of the airplane always within the allowable limits for safe flying.

The Balance of an airplane refers to the position of the airplane's Center of Gravity, and is stated as a percentage of the Mean Aerodynamic Chord. The recommended Balance range (for this airplane) is from a forward limit of 20.0 percent M.A.C. to an aft limit of 32.0 percent M.A.C.

Procedure.—The procedure for determining the Gross Weight and Balance involves the use of the Balance Chart (Page 117) and a tabulation of the various index units (or Balance units) for the items comprising the various possible Gross Weights. The specified loading conditions are given on Page 110, and a number of special loading conditions are shown on Page 111.

First Step.—The operator must know the loading condition of the airplane. By this is meant that he must know what items of Useful Load will be on board the airplane and what items of Weight Empty (if any) will be missing from the airplane for the proposed flight.

Second Step.—Determine the Gross Weight and Total Index Units corresponding to the proposed flight loading condition. This is merely the summation of the Weights and Index Units of the items involved. It is suggested for this purpose that the operator tabulate a list of the items involved showing the Weight and Index Units for each item. The Weight and Index Units of the items likely to be encountered may be obtained from the tabulation of Weights and Index Units shown on the following pages.

Third Step.—Determine the balance or Center of Gravity position. This may be obtained from the graphical loading chart shown on Page .. by using the Gross Weight and Total Index Units found in the second step. The diagonal lines on the chart indicate balance or Center of Gravity position in percent of the Mean Aerodynamic Chord. The intersection of the abscissa for the Gross Weight and the ordinate for the Total Index Units establishes a point on the chart. The location of this point with respect to the diagonal percent lines gives the required balance figure.

Weight and Balance Checks for a Proposed Flight—

The following checks of Weight and Balance should be made for each flight.

1. Take-off Weight and Balance.
2. Estimated Landing Weight and Balance.

3. The most forward and the most aft Balance possible due to the expenditure of such items as fuel, oil. bombs, ammunition, etc.

If a check of the proposed flight shows that the Balance will fall outside of the recommended limits—namely 20 percent M.A.C. forward and 32 percent M.A.C. aft—the Center of Gravity may be shifted by any one or all of the following means:

1. Redistribution of the load.
2. Removing some of the load.
3. Adding ballast.

Loading Example.

Assume that it is desired to fly with the following expendable items:

Fuel, 100 gallons in the main or center section tanks.

Oil, 8 gallons.

Fixed gun ammunition 360 rounds.

Flexible gun ammunition 2000 rounds.

Bomb—1000-pound class.

Pyrotechnics.

From the tabulation of Weight and Index Units of the following pages we obtain the following:

1. Take-off Weight and Balance

Item	Wgt.	Index Units
Basic Weight	7550.0	77.9
Fuel—100 Gallons in main tanks	600.0	7.06
Oil—8 Gallons	60.0	0.32
Bomb—1000-pound Class..	1000.0	11.20

Item	Wgt.	Index Units
Pyrotechnics ..... Includes:	11.8	0.23
(1) Signal Pistol Amm. 12 rds.		
(2) Drift Signals—night AN-MK-4 (4)		
Flexible Guns ammunition and links (2).....	130.0	2.53
Fixed Guns ammunition and links (2).....	107.6	0.72
Gross Weight and Index Units	9459.4	100.0

From the chart on Page 117 the C.G. = 30 percent M.A.C.

2. Estimated Landing Weight and Balance

Item	Wgt.	Index Units
Total from (1) above.....	9459.4	100.0
Less:	—1837.6	—21.51
Fuel—100 Gallons in main tanks	600.0	7.06
Fixed Gun Ammun. (all)	107.6	0.72
Flexible Gun Ammun. (all)	130.0	2.53
Bomb—1000-pound Class	1000.0	11.20
Gross Weight and Index Units	7621.8	78.49

From the chart on Page 117 the C.G. = 27 percent M.A.C.

3. Most Forward Balance

Item	Wgt.	Index Units
Total from (1) above.....	9459.4	100.0
Less:	—1730.0	—20.79
Fuel—100 Gallons in main tanks	600.0	7.06
Flexible Gun Ammun. (all)	130.0	2.53
Bomb—1000-pound Class	1000.0	11.20
Gross Weight and Index Units	7729.4	79.21

From chart on Page 117 the C.G. = 27 percent M.A.C.

4. Most Aft Balance

Item	Wgt.	Index Units
Total from (1) above.....	9459.4	100.0
Less:	—107.6	—0.72
Fixed Gun Ammun. (all)	107.6	0.72
Gross Weight and Index Units	9351.8	99.28

From chart on Page 117 the C.G. = 31 percent M.A.C.

NOTE:

(a) When finding the Most Forward Balance, the expendable items aft of the Gross Weight C.G. (Ref. diagram Page 110) should be subtracted.

(b) When finding the Most Aft Balance, the expendable items forward of the Gross Weight C.G. (Ref. diagram Page 110) should be subtracted.

(c) The residual fuel and oil should not be considered as expendable items.

Take-off.

A load of 200 pounds (passenger or ballast) on the rear seat is advisable, but not essential, to maintain proper balance for take-off and landing.

Check the pilot's cockpit and gunner's compartment for any loose gear; also, check security of ammunition, life raft, and baggage compartment.

The pilot may set the control tabs to any deviation from neutral, provided he is thoroughly familiar with the airplane.

The airplane retains normal flying characteristics with either the landing or diving flaps in the closed, partially, or fully opened position. However, readjustment of the flight control tabs may be necessary to maintain proper trim at different airspeeds. Open the landing flaps to full DOWN position to assist in take-offs from carrier deck and small landing field.

Maneuvers.

This airplane has no peculiarities in carrying out permissible maneuvers on land, or in flight.

The maximum permissible rpm of the engine during prolonged vertical dives is 3000 rpm.

Close the oil cooler scoop and cowling flaps during dives; also, place the supercharger in LOW BLOWER ratio.

Landing.

The use of landing flaps is recommended for all landing operations as these flaps decrease the speed and increase the gliding angle of the airplane. However, fast landings without the use of the flaps are permissible on improved airports.

Arrested landings can be made with any combination of bomb loadings, provided the fuel load has been reduced to such an extent that the gross weight does not exceed the gross weight of the airplane in the fully loaded scout condition.

The indicated landing or stalling airspeed of the airplane increases with the weight, but does not increase with the altitude.

Trim the airplane for various conditions of flight in the normal manner.

Special Precautions.

There are no special precautions to be observed regarding this airplane. The only unusual characteristic is that the left wing tends to drop during a stall.

Recover from involuntary spins by neutralizing the controls. Various positions of flaps and gear have no effect on the recovery of the airplane from spins.

Taxying.

All taxying characteristics are normal and there is no advantage to be gained in taxying with the flaps down in a strong wind.

Basic Weight Chart

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Weight and Index Units for Use with Balance Chart

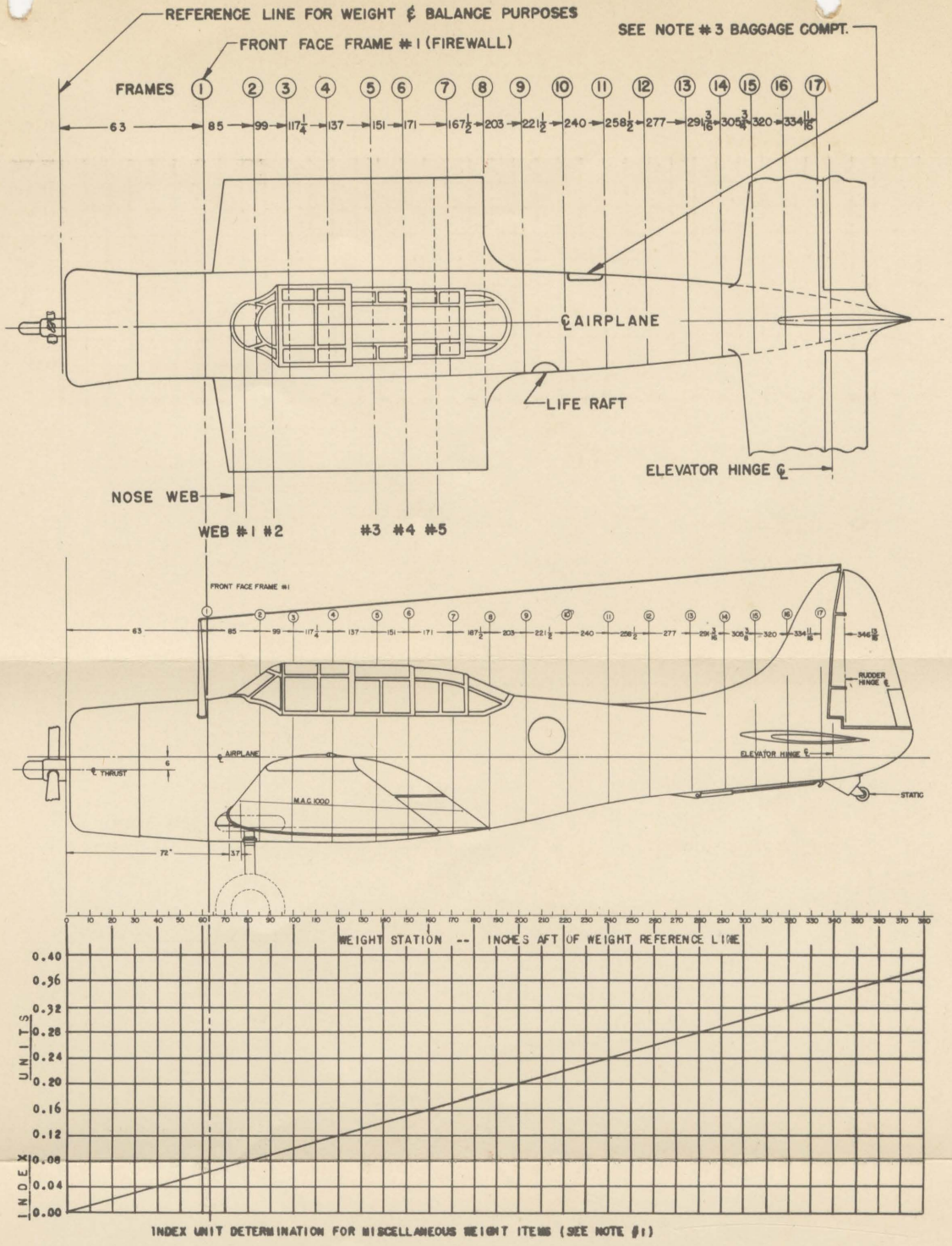
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Special Loads with Weight and Index Units

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Useful Load Items with Weight and Index Units

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INDEX UNIT DETERMINATION FOR MISCELLANEOUS WEIGHT ITEMS (SEE NOTE #1)

Loading Diagram for Miscellaneous Items

NOTES

(1) THIS CHART IS A DIRECT READING METHOD OF DERIVING INDEX UNITS FOR WEIGHT (IN 10# INCREMENTS) LOCATED ANYWHERE IN THE AIRPLANE. THE METHOD IS TO DETERMINE THE LOCATION OF THE WEIGHT TO BE ADDED ON THE PLAN OR SIDE VIEW OF THE AIRPLANE, PROJECT THIS POINT ON THE CURVE BELOW AND READ THE CORRESPONDING INDEX UNIT AT THE LEFT OF THE CHART. NEXT, MULTIPLY THE INDEX UNIT BY THE NUMBER OF 10# INCREMENTS IN THE WEIGHT TO BE ADDED.

EXAMPLE: IT IS DESIRED TO PLACE A 35# WEIGHT AT FRAME NUMBER 8. THE 35# EQUALS THREE AND ONE HALF, TEN POUND INCREMENTS. READING FROM THE CHART THE INDEX UNIT FOR AN INCREMENT OF 10# AT FRAME NUMBER 8 IS 0.19 INDEX UNIT. MULTIPLYING THE 0.19 INDEX UNIT BY THE 3.5 INCREMENTS GIVES AN ANSWER OF 0.665 INDEX UNITS FOR A WEIGHT OF 35# AT FRAME NUMBER 8.

(2) THE INDEX UNIT IS DERIVED BY THE FOLLOWING FORMULA:

$$\text{INDEX UNIT} = \frac{W \times D}{10{,}000}$$

"D" = 63 INCHES PLUS THE DISTANCE AFT OF FRAME NUMBER 1 (FIREWALL) IN INCHES. IF THE WEIGHT IS FORWARD OF THE FIREWALL SUBTRACT FROM 63.

"W" = WEIGHT IN POUNDS.

(3) THE MAXIMUM BALLAST ALLOWABLE IN THE BAGGAGE COMPARTMENT IS ESTIMATED TO BE 150 POUNDS FOR THE STANDARD LOADING CONDITIONS. IF THE GUNNER, FLEXIBLE GUN AMMUNITION, OR ANY OTHER ITEM LOCATED IN THE REAR COCKPIT AND INCLUDED IN THE STANDARD LOADING CONDITIONS ARE REMOVED FROM THE AIRPLANE, THE BALLAST MAY BE INCREASED BY APPROXIMATELY ONE HALF OF THE WEIGHT REMOVED. FROM A STRUCTURAL STANDPOINT, THE BALLAST SHOULD NEVER EXCEED 300 POUNDS WHEN THE RECOGNITION & RADAR RADIO ARE INSTALLED, OR 400 POUNDS WHEN THIS EQUIPMENT IS NOT INSTALLED.

Fuel Quantity Versus Index Unit

Oil Quantity Versus Index Unit

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SECTION V

ALPHABETICAL INDEX

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