A. P. 2090A

PILOT'S HANDBOOK

MODEL JRF-6B AIRPLANE

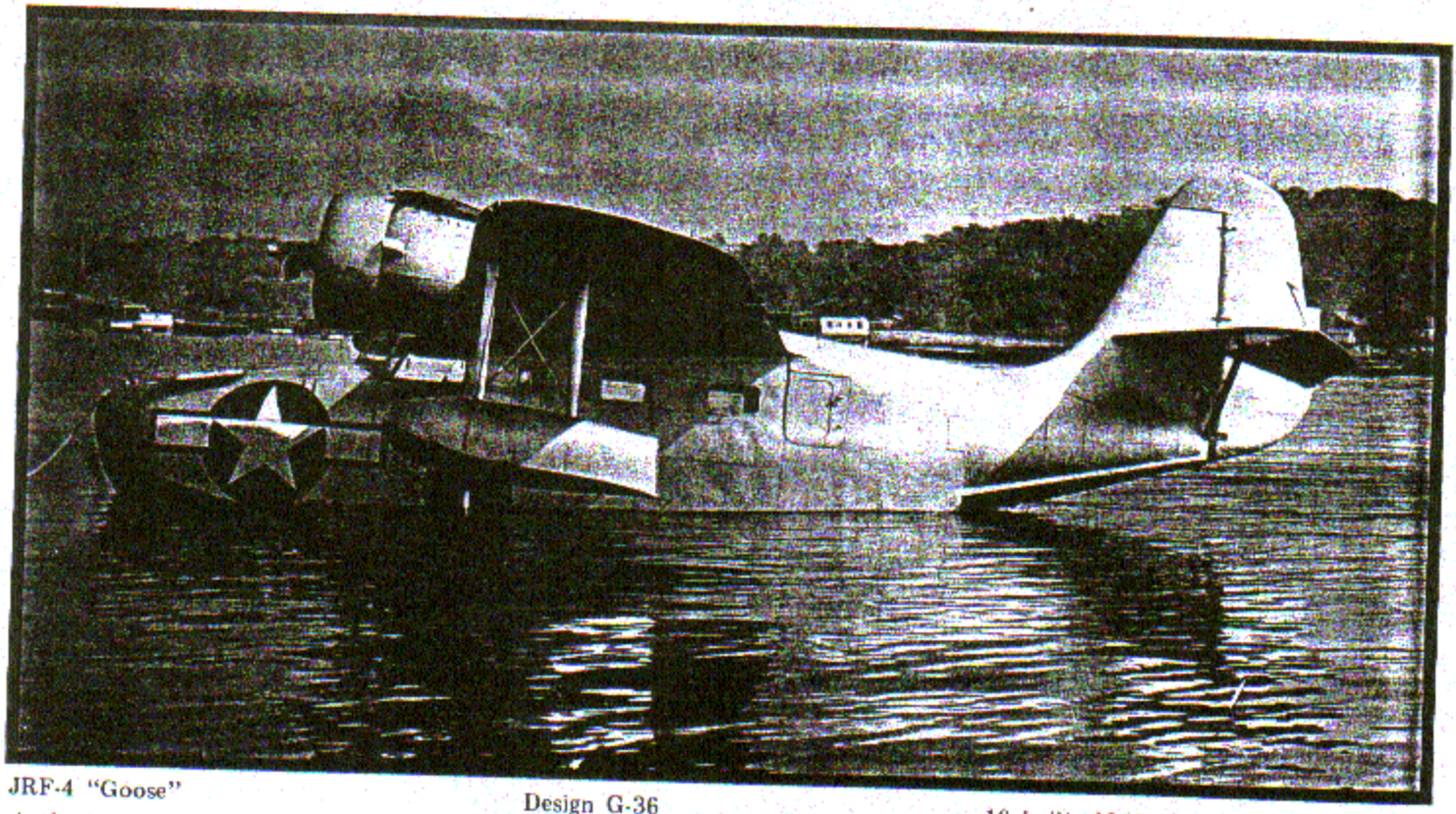
GOOSE IA

CONTRACT NO. 86447

PRATT & WHITNEY R-985-AN-6B ENGINES

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

BETHPAGE, L. I., N. Y.



-Grumman photo 7611

JRF-4 "Goose"

Design G-36

10 built, 1940-1941, 2 impressed 1942

Anti-submarine patrol duties became an important function of the Goose and the JRF-4 aircraft became a transitional aircraft between JRF-1 production and the JRF-5. The Navy ordered 25 additional JRF-1 with contract C-75686, however prior to delivery this was changed to call for 10 JRF-4 (c/n 1100-1109, BuAer 3846-3855). JRF-4 differed from the earlier JRF-1 only in having a "hardpoint" outboard of each engine capable of handling a 250 lb depth charge. Remaining 15 JRF-1 of this contract became JRF-5 and the contract the basis for initial JRF-5 orders. Photograph shows JRF-4 c/n 1108, BuAer 3854 in wartime markings and position of Goose in water. Deliveries of the JRF-4 began Dec 4, 1940 and ended April 14, 1941. Two civilian G-21A (c/n 1060, NC2786, BuAer 09767 and c/n 1188, NX1694, BuAer 35921) were impressed as JRF-4 and both returned to civilian operations. Only one JRF-4 (c/n 1109) survived to become VP-BAM and later N332D.

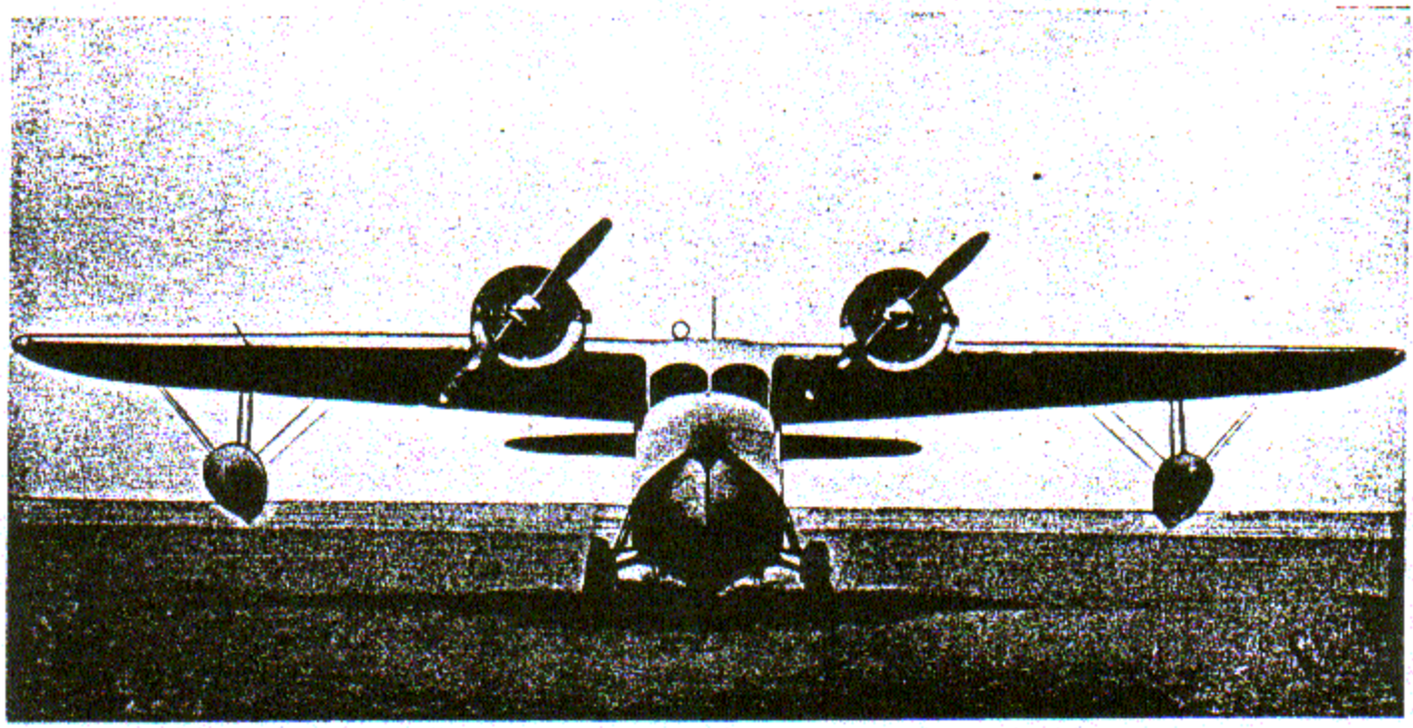
-Grumman

JRF-6B Goose

Design G-38

50 built, 1942-1943

Navy contract LL-86447 called for 50 JRF-6B (c/n 1125-1174, serial FP475-FP524) to be delivered to Great Britain. However only 44 were sent to the British and 38 of these were returned following World War II. Of the six not sent, five (c/n 1155-1160) were diverted to the U. S. AAC as OA-9-GR and one (c/n 1150) went to Bolivia and the corresponding British numbers were cancelled. Deliveries were from Jan 1942 through March 1943. Photo shows c/n 1147, FP497 on Feb 9, 1942. It is typical of most JRF-6B with the large "bubble" over the center cabin window. Although set up for navigational training with a compass in the bubble windows, they could carry one 100 or 325 lb bomb under each wing. Four JRF-6B (c/n 1146-1149) were equipped with special radios and interiors. Engines were R-985-AN-6B of 450 hp at 2300 rpm at sea level. "B" of JRF-6B was for "British".



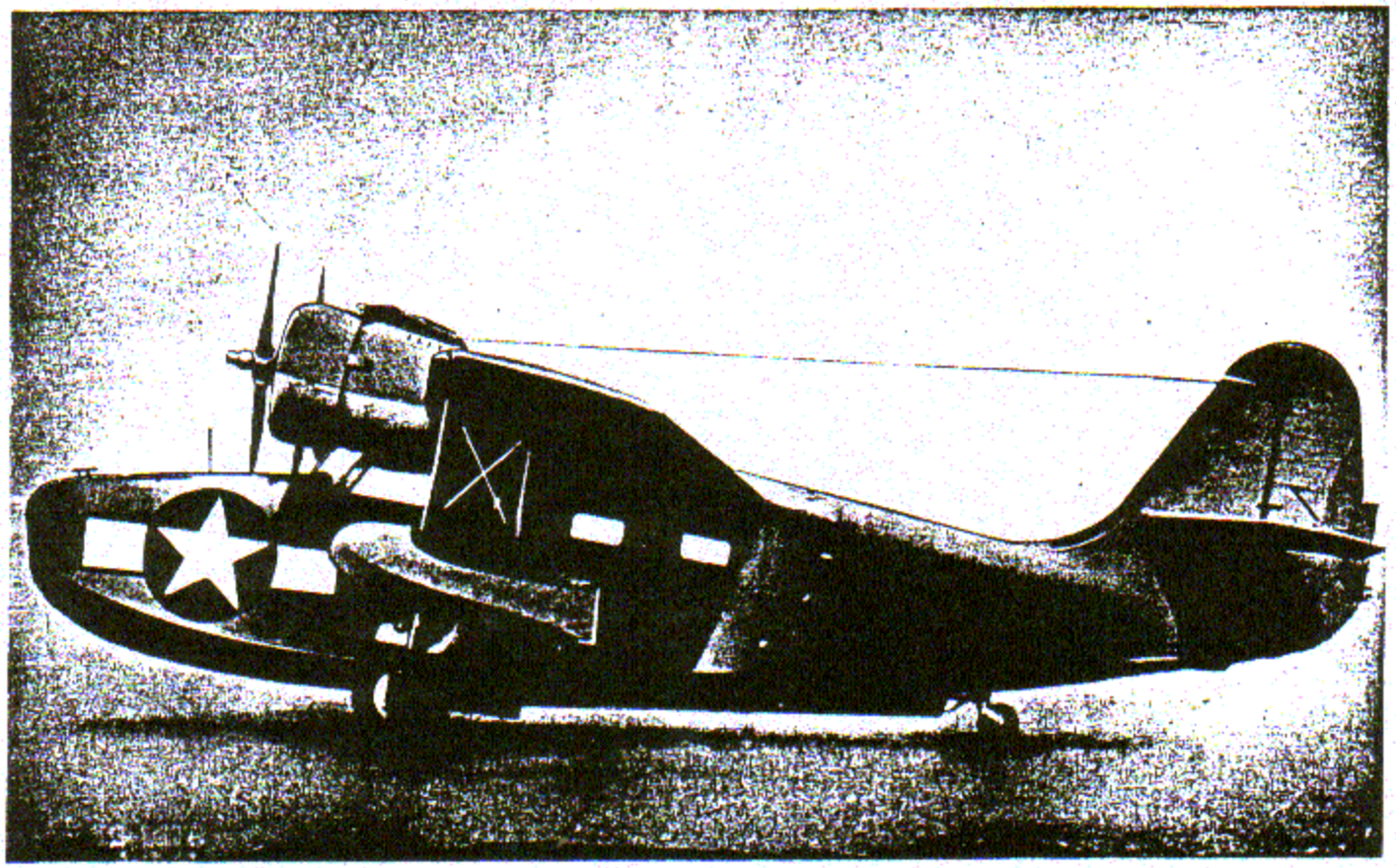


Figure 1—Front and Side View Airplane.

FOREWORD

This Handbook is prepared for the purpose of familiarizing flying personnel with the take-off, flying and landing characteristics of the Model JRF-6B airplane; the functions of particular systems and installations, and the operation of the various automatic and manual controls.

For service and overhaul instructions, refer to the Erection & Maintenance Instructions Manual, Grumman Report No. 1316, (A.P. 2090A).

The JRF-6B is a twin engine, six place, dual control, cantilever monoplane amphibian. It is designed for utility, patrol and observation use, and particularly as a navigators' and radio operators' training airplane.

The engines are Pratt & Whitney Wasp Model R-985-AN-6B, nine cylinder, air cooled radial, each rated 450 HP at 2300 RPM, at sea level, for take-off, and 400 HP at 2200 RPM from sea level to 5500 feet.

The hull is an integral part of the body. The wing center section includes the engine nacelles and the two built-in fuel tanks. Each tank has a capacity of 110 gallons (91.6 Imperial gallons). Each engine has a single oil tank with a capacity of 7.5 gallons (6.3 Imperial gallons) and .5 gallon (.4 Imperial gallon) foaming space.

The landing gear and tail wheel are retracted manually by the pilot and locked automatically in the UP and DOWN positions. The tail wheel assembly is of the self-aligning, full swivel type fitted with a controllable caster lock mechanism.

The split balanced type wing flaps are operated by vacuum. The control surfaces are statically and dynamically balanced.

Provision is made for the installation of radio and navigating equipment in the cabin. The cabin center windows are covered on the outside by plexiglass blisters each of which houses a compass. In addition, provision is made for the installation of compasses outside of the fuselage at the co-pilot's window and on the left and right cabin doors. A swinging horizontal compass is installed under the main instrument panel

Provision is made to carry one 100 or one 325 pound bomb under each outer wing panel.

Six seats are installed, for pilot, co-pilot and four (4) cabin seats; a special auxiliary seat is also installed. The cabin is heated and ventilated.

TABLE OF CONTENTS

SECTION I

SECTION III

LIST OF ILLUSTRATIONS

SECTION I
COCKPIT ARRANGEMENT
AND
CONTROLS

The arrangement of the cockpit and the locations of the various controls are shown on the accompanying photographic illustrations.

In general. the controls and their operation are indicated by adjacent name plates

1. FLYING CONTROLS

Aileron & Elevator Controls

Standard dual type column and wheel.

Elevator Trimming Tab Controls

Handcrank on right hand side of pilot's seat. See page 25.

CLOCKWISE - NOSE DOWN

Rudder Control

Standard over-hung dual pedals. Pilot's pedals are adjustable to three positions, by toe levers on the pedals. Co-pilot's pedals fold aft and into the floor when not in use. (See page 26)

Rudder Trimming Tab Control

Handwheel on pilot's left hand shelf. See page 25.

CLOCKWISE - NOSE RIGHT

Wing Flaps Control

Three position control lever on overhead instrument panel. See pages 26-27

FLAPS - UP, 30° DOWN and 60° DOWN.

CAUTION: DO NOT LOWER FLAPS WHEN CABIN DOOR IS OPEN.

2. LANDING GEAR CONTROLS

Retracting Control

Handcrank between pilot's and co-pilot's seat. Clockwise rotation lowers both landing gear and tail wheel - approximately 41 turns.

Main ratchet release controlled by the small lever to the left of the handcrank. Move ratchet lever UP to raise wheels and DOWN to lower.

IMPORTANT: Keep handle ratchet in the handle on the center position to lower or raise the wheels under normal circumstances. (See page 28).

Warning Indicator

Red jeweled warning light, with hinged night flap, on pilot's instrument panel, illuminates when the wheels are not fully extended and locked and either engine is throttled below 1200 RPM.

Tail Wheel Lock Control

Control lever on left hand side of pilot's instrument panel. When in the LOCK position, the tail wheel caster is locked in the trailing position and when UNLOCKED, the wheel can swivel through a radius of 360°.

Lock for take-off and landing and unlock for taxiing.

3. POWER PLANT CONTROLS

Carburetor Air Controls

Dual control levers on overhead instrument panel.

PUSH FORWARD - COLD AIR
PULL AFT - HOT AIR

Engine Primer

Prime engine by pumping throttle levers with mixture control in IDLE CUT-OFF position, red sector.

Fuel Tank Selector Valve

Standard dial and handle located on bulkhead behind co-pilot.

Pump Cross-Feed Valve

On upper center of bulkhead behind pilot. OFF for starting and checking fuel pressures and ON for take-off, flying and landing. See page 43.

Engine Fuel Cut-Off Valves

On the bulkhead behind the pilot. These valves shut-off the fuel supply to their respective engines.

Fire Extinguisher Control (CO_2)

Controls located on the right hand side of the main instrument panel. Set the selector valve to desired engine then pull the release handle to discharge the CO_2 into the engine compartment.

The CO_2 cylinder is equipped with an outboard discharge fitting on the right hand side of the hull. If the red disc is missing, the cylinder has been discharged and must be replaced with a fully charged cylinder.

NOTE: In warm climates, the red disc often shrinks; and is liable to fall out even though the cylinder is still fully charged.

Ignition Switches

Two switches and emergency switch knob located on overhead instrument panel. The emergency switch knob must be ON (full up position) for operating the engines.

Propeller Controls

Dual control levers on overhead instrument panel.

LOW PITCH forward and down to increase engine revolutions; HIGH PITCH up and aft to decrease engine revolutions.

Knurled knob at the left hand side of the propeller control levers adjusts the friction. See page 33.

Throttle & Mixture Controls

Dual unit engine control quadrant on overhead instrument panel. See page 32.

THROTTLE FORWARD - OPEN
THROTTLE AFT - CLOSED

MIXTURE CONTROL FULL AFT - AUTO LEAN
NEXT POSITION - AUTO RICH
NEXT POSITION FORWARD OF
"AUTO RICH" - LEAN
FULL FORWARD - IDLE CUT-OFF

Throttle & Mixture Friction Adjustment

Knurled knob, on left hand side of control quadrant, adjusts friction on levers.

Starter Controls

Control buttons on upper instrument panel. PUSH TO START ENGINE.

4. AUXILIARY CONTROLS

Brake Pedal Controls

The hydraulic brakes are operated by pressing on the upper part of the pilot's rudder pedals.

The parking brake lock arms are located forward of the pilot's pedals. Pull lock arms aft and hook over the top of the pedals to lock brakes for parking.

Heating & Ventilating

The two hot and cold air mixing valve control knobs are located above the pilot's left hand side window. The distributing valves are located at the upper rear section of the pilot's compartment.

To control the cabin air move the distributing valves in or out.

To control cockpit air turn the distributing valves to the right or left.

Electrical Controls

Switch Panel - Main Instrument Panel

Position lights switch
Anchor light switch
Pitot tube heater switch
Receptacle
Instrument panel light rheostat
Landing light switch

Overhead Instrument Panel

Instrument panel light's rheostat

Recognition Lights Switches

Located on switch box under pilot's left hand cabin rail. Contains the following:

Recognition lights switches (4)
Recognition lights keying switch

Navigator's Panel - Cabin

Navigator's panel light rheostat

Dome Lights

Two in cabin - switches on left hand side of the cabin and on forward bulkhead.

One in baggage compartment - switch on forward wall.

Aldis Signal Lamps - S.I.S. 1586

Located on upper right hand side of pilot's compartment.

Distribution Box

Located on bulkhead behind co-pilot contains the following:

Two battery switches
Generator switch
Generator circuit breaker
Volt-ammeter
Spare fuses and bulbs
Auxiliary switch

NOTE: The auxiliary switch must be ON in order for current to be supplied to the pitot heater and electrically operated instruments.

Static Pressure Selector Valve

Selector valve located on the center of the main instrument panel. Valve control handle UP - connected to airspeed tube; Valve control handle DOWN - connected to pilot's compartment, atmosphere vent.

Vacuum Pump Selector Valve

Selector valve control located on center of main instrument panel.

LEVER UP - LEFT ENGINE PUMP
LEVER DOWN - RIGHT ENGINE PUMP

Hatches, Doors & Emergency Exit

Water-tight doors between bow compartment and pilot's compartment, pilot's and cabin and cabin and baggage compartment. A lock is provided at the bottom of door to anchor compartment and baggage compartment.

The main cabin door and the emergency exit door at the rear of the cabin are released for immediate emergency exit by pulling the red painted tubular handle on the cabin ceiling adjacent to each door.

The bow compartment is equipped with double, outwardly hinged water-tight doors.

5. USEFUL LOAD CONTROLS

Chart Boards

Three chartboards are installed in the cabin, one at the forward left hand chair and one at each left and right aft chair.

Compasses

Provision is made for installing five British Type 0.2 compasses (S.I.S. 457) on external mounts; at the co-pilot's station, the left and right hand center cabin windows and the left and right hand cabin doors. A swinging horizontal compass is installed under the main instrument panel.

Bilge Pump & Boat Hook

Stowed in the bow compartment.

Anchor & Rope

A Northill 12 lb. folding anchor and 100 feet of anchor rope are stowed in the bow compartment.

Life Raft

A type "D" Mark 7 life raft is strapped to the right hand wall of the baggage compartment.

Boarding Ladder

Stowed in the baggage compartment.

Fire Extinguisher - Portable

A portable CO_2 (2# charge) hand fire extinguisher is located on the cabin floor aft of the rear left hand seat.

Emergency Covers

Two emergency covers for blister openings are stowed on right hand side of baggage compartment.

Pyrotechnics

a. Pistols & Ammunition

Provision is made to carry two British 1-1/2" Mark 2 pistols (S.I.S. 166); one on the upper left hand side of the pilot's compartment and the other above the right hand aft cabin window. Only the pilot's cockpit pistol is normally carried.

Two pistol ammunition containers with a total capacity of twelve rounds are located adjacent to the pistol in the pilot's compartment.

b. Flame Floats

Eight British flame floats, Mark 2 (S.I.S. 2118) four on the left hand side of the bow compartment and four on the left hand side of the baggage compartment.

c. Distress Signals

Six British distress signals, Mark 2 or Mark 3; two are stowed in the life raft and four on the aft wall of the cabin.

d. Sea Markers

Twelve British sea markers, Mark 1 or Mark 5 (S.I.S. 2142); at the right hand wall of the baggage compartment.

e. Smoke Floats

Two British smoke floats - Dinghy Distress Red (S.I.S. 1856) are stowed on the baggage compartment floor.

Emergency Rations

Six four pound ration packages are stowed in the life raft.

First Aid Kit

Located under auxiliary seat in forward left hand corner of cabin.

Bomb Controls

The bomb arming-release control is mounted above the left hand seat in the pilot's compartment.

Arm-Safe Lever

FORWARD - ARMED
AFT - SAFE

Release Lever

FORWARD - LOCK
AFT - RELEASE

SELECTIVE RIGHT - RIGHT BOMB
SELECTIVE LEFT - LEFT BOMB
CENTER - SALVO

Parachute Stowage

Racks for stowing parachutes are provided under each cabin seat. The instructor's parachute is stowed under the auxiliary seat. The pilot and co-pilot are provided with bucket type seats.

1 - TAIL WHEEL CASTER LOCK
2 - GYRO PILOT OIL SHUT-OFF VALVE
3 - DE-ICER PRESSURE GAGE
4 - ALTIMETER
5 - AIRSPEED INDICATOR
6 - TURN & BANK INDICATOR
7 - RATE OF CLIMB INDICATOR
8 - DIRECTIONAL GYRO
9 - ELAPSED TIME CLOCK
10 - GYRO PILOT CONTROL
11 - GYRO HORIZON
12 - LANDING GEAR WARNING LIGHT
13 - CAMERA SIGNAL LIGHT
14 - I.F.F. WARNING LIGHT
15 - GYRO PILOT VACUUM GAGE
16 - FIRE EXTINGUISHER CONTROLS
17 - ANTI-ICER CONTROL
18 - ELECTRICAL SWITCH PANEL
19 - GYRO PILOT OIL PRESSURE GAGE
20 - GYRO PILOT SERVO UNIT CONTROLS
21 - CHART BOARD
22 - I.F.F. KEY
23 - STATIC PRESSURE SELECTOR VALVE
24 - COMPASS

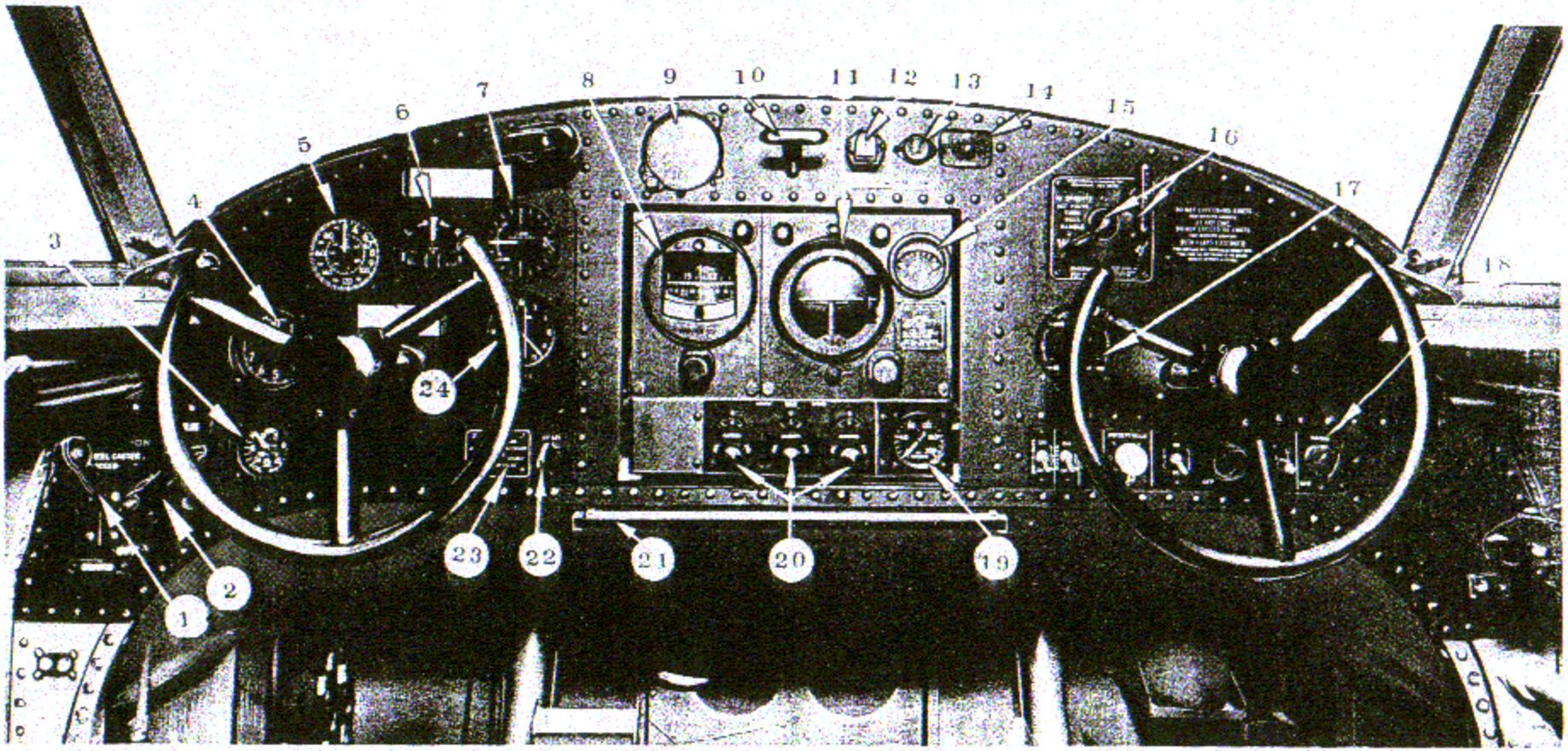
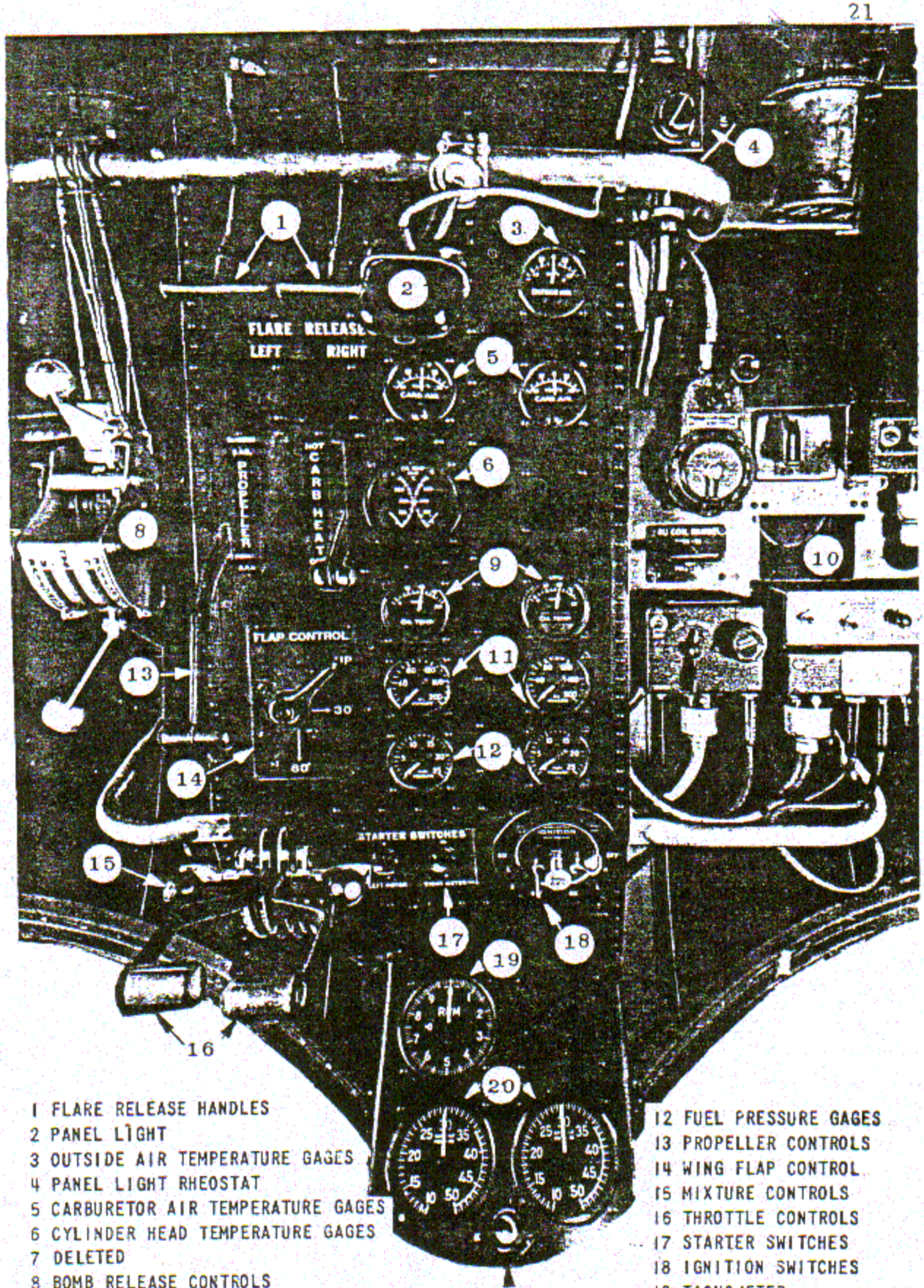


Figure 1 —Main Instrument Panel.



1 FLARE RELEASE HANDLES
2 PANEL LIGHT
3 OUTSIDE AIR TEMPERATURE GAGES
4 PANEL LIGHT RHEOSTAT
5 CARBURETOR AIR TEMPERATURE GAGES
6 CYLINDER HEAD TEMPERATURE GAGES
7 DELETED
8 BOMB RELEASE CONTROLS
9 OIL TEMPERATURE GAGES
10 RADIO CONTROL PANEL
11 OIL PRESSURE GAGES
12 FUEL PRESSURE GAGES
13 PROPELLER CONTROLS
14 WING FLAP CONTROL
15 MIXTURE CONTROLS
16 THROTTLE CONTROLS
17 STARTER SWITCHES
18 IGNITION SWITCHES
19 TACHOMETER
20 MANIFOLD PRESSURE GAGES
21 PANEL LIGHT

Figure 2—Overhead Instrument Panel

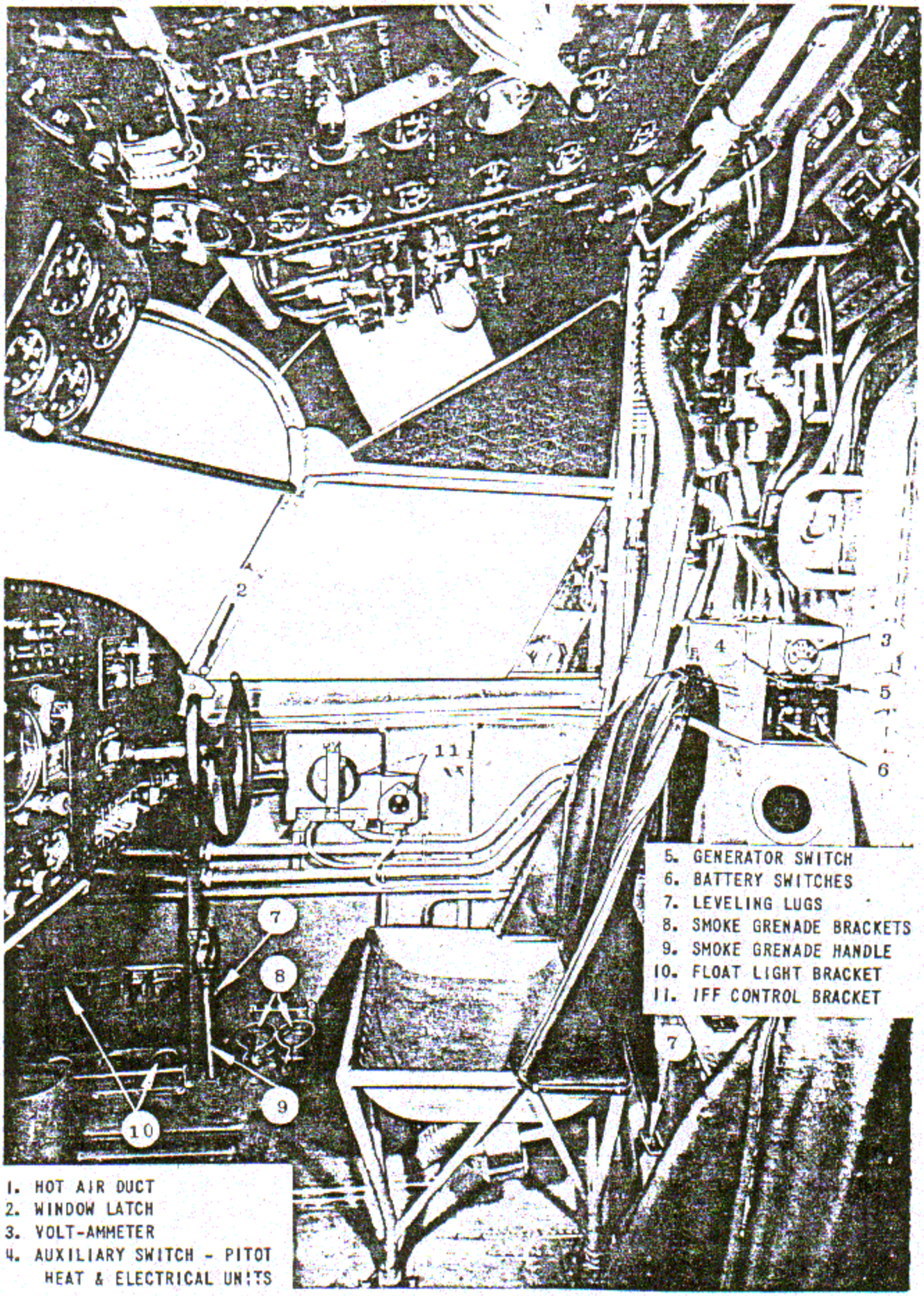


Figure 3—Pilot's Compartment—Right-hand Side

1. LANDING GEAR INSPECTION WINDOW
2. FUEL TANK SUMP DRAIN VALVE
3. SIGNAL PISTOL INSTALLATION
4. PISTOL AMMUNITION CONTAINERS
5. RECOGNITION LIGHTS CONTROL SWITCH
6. FILE BOX
7. RUDDER TAB CONTROL
8. GYRO PILOT HAND PUMP
9. GYRO PILOT DRAIN TANK & GAGE
10. HOT AIR DUCT
11. ELEVATOR TAB CONTROL

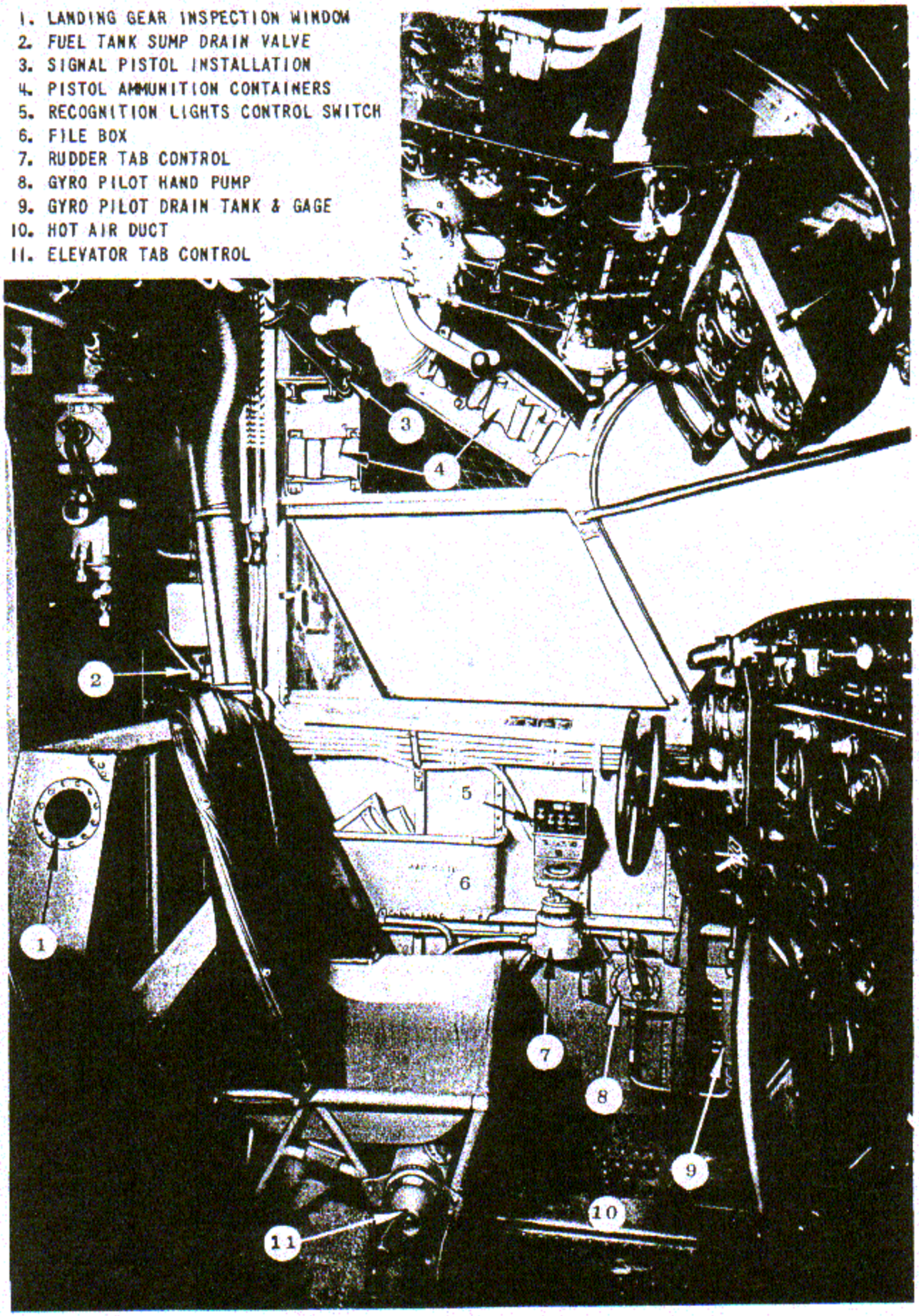
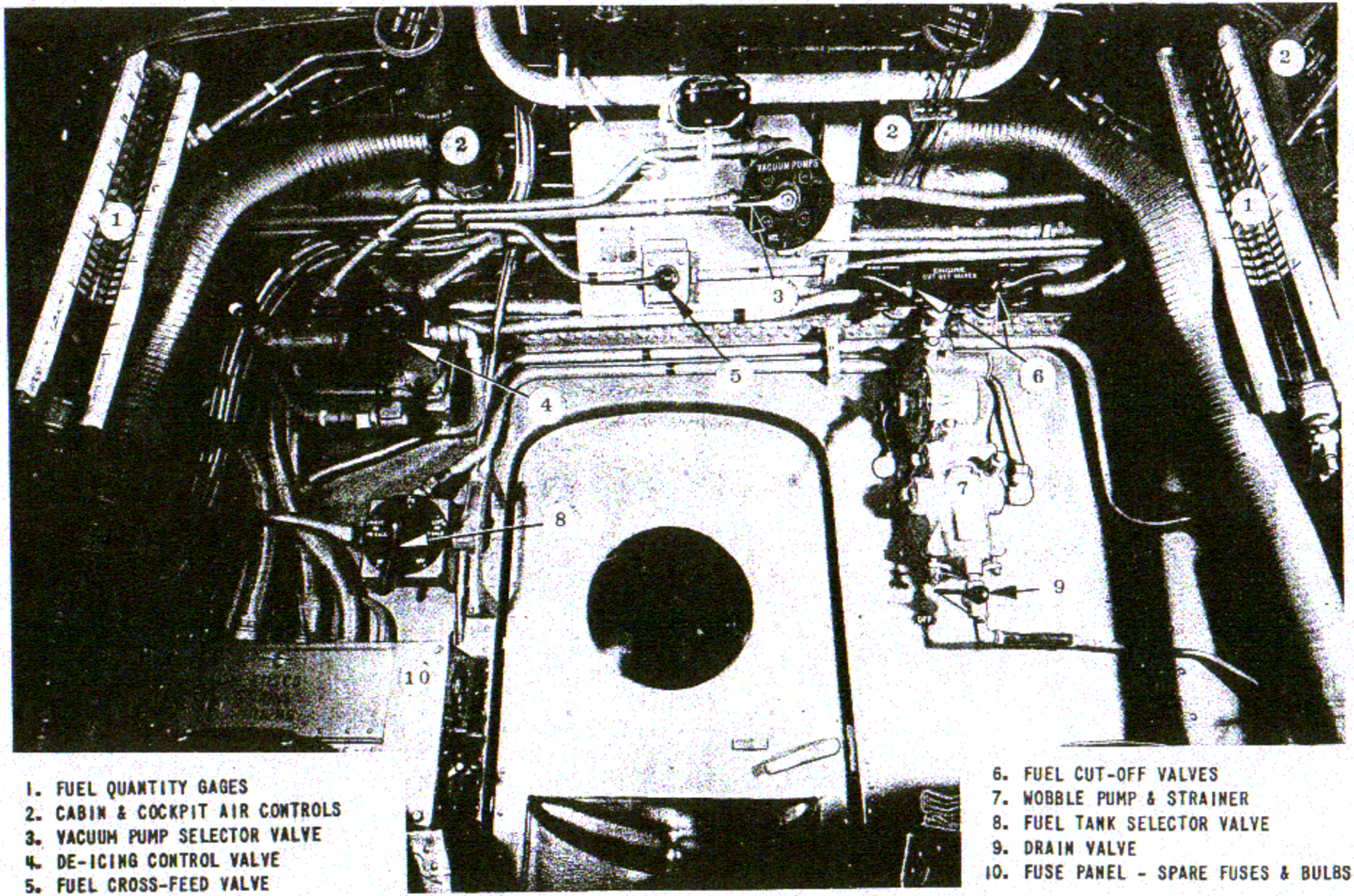


Figure 4—Pilot's Compartment—Left Hand Side.



1. FUEL QUANTITY GAGES
2. CABIN & COCKPIT AIR CONTROLS
3. VACUUM PUMP SELECTOR VALVE
4. DE-ICING CONTROL VALVE
5. FUEL CROSS-FEED VALVE
6. FUEL CUT-OFF VALVES
7. WOBBLE PUMP & STRAINER
8. FUEL TANK SELECTOR VALVE
9. DRAIN VALVE
10. FUSE PANEL - SPARE FUSES & BULBS

Figure 5 —Pilot's Compartment—Rear Bulkhead.

SECTION II

OPERATION INSTRUCTIONS

1. FLYING CONTROLS

a. Elevator Trimming Tab Control

The elevator trimming tabs are adjustable in flight from 10° up to 30° down with respect to the center line of the elevators.

The control is accomplished by means of a hand-crank and gear box on the right hand side of the pilot's seat, a flexible shaft to a drum under the pilot's floor; cables to a drum at the aft end of the hull, a flexible shaft, tab actuator and adjustable push rod to each tab.

TURN CLOCKWISE - NOSE DOWN
TURN COUNTER-CLOCKWISE - NOSE UP

When taking off with full load, the tab should be in neutral. The purpose of this tab is to maintain perfect longitudinal trim.

b. Rudder Trimming Tab Control

The rudder trimming tab is adjustable in flight from 25° left to 15° right with respect to the centerline of the rudder.

The control is accomplished by means of a hand-wheel to the left of the pilot's seat, a flexible shaft to a drum under the pilot's floor, cables to a drum at the aft end of the hull, a flexible shaft, tab actuator and adjustable push rod to the tab.

TURN CLOCKWISE - NOSE RIGHT
TURN COUNTER-CLOCKWISE - NOSE LEFT

Set the tab in neutral before taking off. The purpose of this device is to maintain perfect directional trim.

c. Rudder Pedal Adjustment

The pilot's rudder pedals are adjustable to three positions; FORWARD, NEUTRAL and AFT.

Adjustment is accomplished as follows: To move pedals forward away from the seat, depress the kick lever and push the pedals forward to the desired position. To bring pedals aft, nearer the seat, hook the toes under the pedals and pull aft to the desired position. The three positions of the ratchet can be felt as the pedal clicks in the ratchet. Check to see that each pedal has ratcheted past the same number of notches.

d. Wing Flaps Control

The wing flaps are vacuum operated and may be dropped to two positions, 30° and 60° down. The flap operating system consists of a vacuum tank located in the bow compartment, a control valve on the overhead instrument panel, a vacuum gage mounted beneath the main instrument panel on the cockpit forward bulkhead, check valves in the engine lines and two return springs and actuating cylinders located in the wings.

The source of vacuum supply is the engine intake manifold, the connection being in the carburetor adapting plate just above the carburetor.

Vacuum lines are fitted to both engines with individual check valves so that a vacuum supply is assured with either engine completely out of action. In addition, the vacuum tank is sufficiently large to operate the flap at least twice with both engines cut. The engine will produce vacuum with the throttle closed unless completely stopped even though the switch is cut.

There is no danger in opening the flap operating valve at high speed. The flaps will not come down at speeds in excess of approximately 110 MPH (95 Knots).

The operating force on the flaps is ample to hold the flaps down when the engines are idled. When power is applied the flaps will start to come up; and as more power is applied and the speed picks up, the flaps will gradually come up until, at about 110 MPH, the angle of droop will be approximately 20°. If the power is then removed the flaps will again return to the down position.

This feature is very helpful when it is necessary, for any reason, to go around again after approaching for a landing. The flaps can be left down until ample speed and height are obtained and if the valve is turned to the UP position there will be no sinking effect.

NOTE: With the vacuum system, the operating efficiency of the flaps will be reduced with the decreased atmospheric pressure at altitudes.

2. LANDING GEAR CONTROLS

a. Retracting Mechanism

The landing gear and tail wheel are retracted or extended simultaneously by means of the selective ratchet type handcrank unit located between pilot's and co-pilot's seats. Approximately 41 turns of the crank are required to raise or lower the gear. The crank is turned clockwise to lower and counter-clockwise to raise the gear.

The handcrank is automatically latched by the main ratchet within the housing, acting on the handcrank shaft while the wheels are being raised or lowered. The ratchet is reversed by operating the small knob just to the left of the handcrank. The knob has two positions, TO RAISE and TO LOWER. After reversing the ratchet the crank remains locked until pressure is exerted on the crank opposite to the desired rotation.

A handle ratchet is located in the crank handle and permits operation of the crank without the necessity of making complete revolutions. This unit has three positions; namely, to RAISE, to LOWER and NEUTRAL. In NEUTRAL the handle is engaged for rotation in either direction. For normal use, it is recommended that the handle ratchet be kept in NEUTRAL and used only as required when necessary to extend the landing gear in the water.

b. Wheel Lock

When the wheels are cranked to the DOWN position spring counterbalance units on compression links

come into action preventing all possibility of the wheels retracting during take-off and landing on ground. No control is necessary for these counterbalances, since they are so located and designed that they will always exert the proper force.

c. Warning Light

A red jewel landing gear warning light with hinged night shutter is located on the pilot's main instrument panel. The light is ON when the wheels are up and either throttle is closed below 1200 RPM and OFF under all other circumstances. This installation is intended to warn the pilot against inadvertently landing on land or on water with the wheels not in the proper position.

The wheel position may also be checked by looking through the small inspection windows.

d. Safety Bolts

The landing gear will not take any load unless it is in the fully down position. To save the operating mechanism from being damaged, in case load is inadvertently put on the gear by hitting bottom in shallow water while extending the gear or from any other cause there are three safety bolts at the top of each compression strut that will fail in shear. Six spare safety bolts #12646 should be carried in the airplane at all times, to be installed in case of such an emergency. Hand holes are provided to permit installation of these bolts, if necessary from the pilot's cockpit.

The bolt holes in the compression strut flange and the holes in the operating torque tube flange are so located that it is impossible to connect up the system out of synchronization.

Stress analysis investigations have shown that failures can occur to these safety bolts during landing or take-off only when there is an abnormal side load with no vertical component, or in the air when the pilot imposes a heavy load on the handcrank, which causes severe stress in the subject bolts. Some pilots give the handcrank a last hard pull to insure complete housing and locking of the wheels in the UP position. This can impose very severe stresses if the crank ends up in an advantageous position for an efficient pull. This last pull or jerk is detrimental and is not necessary to the proper securing of the gear in the UP position. Pilots are warned of the danger of using this method for completing the retraction of the landing gear.

Operating units are directed to inspect the three safety bolts in each landing gear during the 120 hour check. Bolts showing signs of wear or deformation should be replaced by new bolts.

e. Jacking

The axles serve as jacking points.

If the hull rests on the ground, the quickest and easiest method to put the airplane on its wheels is as follows:

1. Remove both wheels
2. Crank the gear all the way out
3. Jack up each side of the ship, under the

axles.

4. When just high enough, put the wheels back on.
5. Jack the ship down and remove the jacks.

f. Tail Wheel Caster Lock

The tail wheel drag link is provided with a lock-pin which locks the caster and wheel in the trailing position. The lock-pin is controlled by cable from a lever on the left hand side of pilot's instrument panel. The lock position is UP as plainly marked by the name plate. The primary purpose of this unit is to reduce the possibility of ground looping in landing.

It is essential for land operation that pilots lock the tail wheel immediately after taxiing into position for take-off. The tail wheel will then remain locked during flight and during landing. Check after take-off and before retracting wheels to see that lever is in the LOCKED position. It may be unlocked by the pilot after the landing run has been completed, in order to facilitate taxiing.

The tail wheel is 360° swivel type, equipped with a spring loaded self-centering device.

3. POWER PLANT

a. Engines

This airplane is powered with two Pratt & Whitney Wasp Junior Model R-985-AN-6B nine cylinder, radial, direct drive engines.

Rating

Take-off 450 BHP at 2300 RPM
Normal 400 BHP at 2200 RPM - S.L. to 5500'

Maximum Dive RPM 2860

Designed to operate on:

Fuel: 91 octane AN-VV-F-776
Oil : AN9532 Grade 1120

b. Mixture

The mixture selector control on the Stromberg Bendix carburetor NAR-9C-2 has four positions: FULL RICH, AUTOMATIC RICH, AUTOMATIC LEAN and IDLE CUT-OFF. These four positions are plainly marked on the mixture control quadrant.

FULL RICH is for emergency use only in the event of failure of the automatic features.

See Engine Operating Table on page 47, for mixture control positions to be used for the various operating conditions.

NOTE: For IDLE CUT-OFF place the mixture control lever in the full forward position, red sector.

Use AUTOMATIC RICH mixture for all operations above the line entitled Maximum Recommended cruising limits on the POWER ENGINE CURVES, page 48.

c. Propellers

The propellers are Hamilton Standard, two blade 8'6", constant speed controllable pitch, blade #6167A-12, hub #2D30-235 and governor unit Modol #1C2-A6.

The low pitch limit stop is set at 11° and the high pitch at 26° at the 42" station. The low pitch, INCREASE RPM or take-off position of the control handle is down and forward and the high pitch DECREASE RPM position is up and aft.

The operating range of the constant speed governor unit is between 1200 and 2700 RPM. The RPM adjustable stop is set for 2300 RPM.

d. Starters

The starters are Eclipse Type E-160 direct cranking electric equipped with booster coils and starter solenoids.

e. Starting Engine

If the engine has been standing idle for more than one hour, make sure the ignition emergency switch knob is OFF and rotate the engine four or five revolutions by pulling the propeller through by hand to expel oil from the lower cylinders. If necessary, remove a spark plug from each of the lower cylinders and drain.

To start the engines, the two engine fuel cut-off valves should be turned ON. The cross-feed valve OFF and the tank selector set for desired tank. With the mixture control in IDLE CUT-OFF position (red sector), operate the wobble pump to obtain a fuel pressure of 3 to 4 p.s.i. then prime the engine, which is to be started, by pumping the throttle. About eight strokes will be required when cold but over priming should be avoided. Place propeller control in DECREASE RPM position. Place ignition switch in ON position and engage engine starter. Place mixture control in AUTOMATIC RICH when engine fires.

f. Starting Check-Off

1.	Emergency Ignition Switch	OFF
2.	Mixture	IDLE CUT-OFF
3.	Rotate Engine Manually	4 or 5 revolutions
4.	Battery & Generator Switches	ON
5.	Carburetor Air	COLD
6.	Propeller Control	DECREASE RPM
7.	Tank Selector Valve	On Desired Tank
8.	Engine Fuel Cut-Off Valves	ON
9.	Fuel Cross-Feed Valve	OFF
10.	Wobble Pump	3 to 4 psi Fuel Pressure
11.	Prime Engine being Started	Pump Throttle approx. 4 strokes normal conditions -8 for cold weather starting.
12.	Throttle	500-600 RPM
13.	Emergency Ignition Switch	ON - Switch must be in extreme UP position.
14.	Ignition Switch	On BOTH for engine being started.
15.	Starter	ENGAGE
16.	Mixture Control	Place in AUTOMATIC RICH as soon as engine fires. Return to IDLE CUT-OFF if engine fails to continue running.

17. Idle ——————————— At 500-600 RPM or less for 30 seconds until oil pressure registers

If the oil pressure gage does not indicate pressure within 1/2 minute, the engine should be stopped and an investigation made.

To prevent damage to the oil pressure gages, avoid high oil pressure when engine is still cold by holding down engine RPM.

g. Engine Ground Test

During the warm up, the engines shall be run at approximately 800 to 1,000 RPM with the propellers in low pitch INCREASED RPM position, The change from high to low pitch should be made about one minute after starting.

Watch the oil pressure gage for a positive indication that pressure is being maintained in the engine. The oil inlet temperature should be brought up to at least 30°C in accordance with T.O. 24-41 before take-off. This temperature will be reached quite rapidly due to the action of the automatic oil temperature control unit located at the bottom of the tank.

Oil pressure will vary with RPM and need cause no alarm by falling as low as 25 p.s.i. at low RPM.

Ground Test Check-Off

1. Propeller ——————————— INCREASE RPM Low Pitch
2. Mixture ——————————— AUTOMATIC RICH

3.	Manifold Pressure	30" Hg.
4.	Maximum Cylinder Head Temp.	205°C(400°F)
5.	Oil Pressure	Min. - Idling 25 p.s.i. desired - 70-90 p.s.i.
6.	Oil Inlet Temperature	140 - 216°F (60 - 102°C) desired)
7.	Fuel Pressure	4-6 p.s.i.

h. Take-Off

Shoulder type throttle stops are provided on the control quadrant for limiting the throttle opening at sea level. The stop is set so that with the throttle lever opened to it, the manifold pressure will be 35.5" Hg. without requiring the pilot to watch the manifold pressure gage. Maximum allowable manifold pressure for take-off and initial climb is 35.5" Hg. Maximum allowable RPM is 2300. Maximum allowable duration is five minutes.

A take-off from water with full load, 8000 lbs., under no wind conditions can be made in approximately 15 seconds. The best trim angle for take-off can be readily determined with experience. To reduce the spray on take-off it is advisable to open the throttles gradually until the bow is well lifted. When full fuel is not carried it is recommended that the right tank carry 30 gallons more than the left tank to conteract engine take-off torque.

The take-off is excellent without the flaps but can be improved further by lowering the flaps to the 30° position.

On water take-offs pilots are cautioned to keep the windows closed to keep out the spray.

The average take-off runs as a landplane are given in the following table:

ALTITUDE	TAKE-OFF RUN IN FEET WIND VELOCITY - M.P.H			
FEET	0	10	15	20
Sea Level	650	510	415	345
2000	790	615	505	420
4000	955	745	610	505
6000	1150	900	735	610
8000	1390	1080	890	740

i. Climb

After take-off reduce power and climb in accordance with Engine Operating Table, page 47.

Climb with propeller control in either a high or intermediate RPM setting. For a rapid climb use an intermediate RPM setting and use a high RPM setting for a gradual climb. Cylinder head temperatures should be considered when deciding which method is most desirable.

Under conditions of maximum climb performance, it is preferable to maintain cold carburetor air. However, under icing conditions use 90°C carburetor heat.

j. High Speed Level Flight

Maximum allowable engine RPM is 2200, with propellers in high pitch and with manifold pressure as follows:

Sea Level to 3000 ft. - 33.5" Hg.

3000 to 5500 ft. - 32.5" Hg.
Do not exceed 32" Hg. above 5500 ft.

k. Cruising

Cruising operations may be conducted at any power below normal rated power. However, for maximum efficiency it is recommended that the conditions shown by the line titled Maximum Recommended Cruising Limits, page 48, not be exceeded. AUTOMATIC LEAN carburetor control setting may be used for cruising operation on or below the line titled Maximum Recommended Cruising Limits, page 48.

l. Manifold Pressures

The pilot's overhead instrument panel is provided with a manifold pressure gage for each engine. The manifold pressures and corresponding engine RPM for various flight conditions are given in the ENGINE OPERATING TABLE, page 47

m. Stopping Engine

In stopping, the propeller controls should be placed in the DECREASE RPM position and the engines allowed to turn over at 800 to 1000 RPM for a few minutes, especially after flying at full throttle, to allow the engines to cool down and the propeller to go high pitch. Then the mixture control levers shall be placed in the IDLE CUT-OFF position. The carburetors are fitted with IDLE FUEL CUT-OFFS which provide for stopping the flow of fuel to the carburetor jets when the mixture control levers are in the last 10 degrees of the mixture segment. This portion of the control unit is painted red. Afterwards shut off the fuel valve and turn

the emergency ignition switch to BOTH ENGINES OFF.

NOTE: Before stopping the engines, the propeller should be shifted to full high pitch, DECREASE RPM to empty the propeller cylinder of oil as any oil left in the cylinder is subject to congealing in cold weather.

n. Cylinder Temperatures

One thermocouple instrument for each engine is located on the overhead instrument panel and connected to cylinder head No. 5. These instruments are calibrated in degrees centigrade (°C).

Maximum Allowable Cylinder Head Temperatures

Ground Test	205°C (400°F)
Take-Off & Maximum Climb 5 mins. duration	260°C (500°F)
Continuous - Normal Rated Power	260°C (500°F)
Cruising - At or below Line of Maximum Recommended Cruising Limits	232°C (418°F)
Stopping - Cool Engine	140°C (284°F)

o. Carburetor Air Preheat Controls

The carburetor air preheat scoop, mounted below the carburetor, is fitted with a valve arrangement, consisting of two interconnected valves and levers, and is controlled from the lever

handles on the pilot's overhead instrument panel.

Hot air is taken from the exhaust manifold muffs and cold air through a duct on the outboard side of each nacelle.

Hot or cold air or any desired mixture of both may be supplied to the carburetor. The excess hot air is by-passed automatically to the atmosphere.

The thermometer bulbs are situated in the carburetor scoops and the carburetor air temperature gages are located on the overhead instrument panel.

For use of preheat see Bureau Aeronautics Manual 14-207.

p. Fuel System

The fuel is carried in two built-in wing tanks. The fuel supply is as follows:

Left Wing Tank - 110 U.S. gals., 91.6 Imperial gallons
Right Wing Tank - 110 U.S. gals., 91.6 Imperial gallons
91 Octane, Specification AN-VV-F-776

Each tank is fitted with a glass boiler type fuel gage located in the upper rear corners of the pilot's compartment. The gages are calibrated for the three-point position and level flight attitudes.

The normal operating fuel pressure is 4 to 6 p.s.i. The fuel pressure indicators are on the overhead instrument panel.

The fuel tank selector valve, located on the pilot's rear bulkhead, has five positions;

BOTH - ON
LEFT - ON
RIGHT - ON
OFF (2 POSITIONS)

Either of the two OFF positions turns BOTH TANKS OFF.

The AEL-1 fuel system unit and integral hand pump handle are located on the pilot's rear bulkhead. Drain this unit every day before flying then lock wire the valve in the closed position.

The engine fuel shut-off valves are located above the AEL-1 unit.

Each tank suction line is fitted with a fuel sump and drain valve located on the rear bulkhead. The lines, connected to each sump, empty just forward of the wheel wells through fuselage skin.

Pump Cross-Feed Valve

The pump cross-feed valve is located on a panel just aft of the overhead instrument panel. The cross feed line interconnects the two engine driven fuel pumps so that one pump may supply both engines if the other pump fails.

This valve should be in the ON position for take-off. However, in the remote event of fuel line failure near a pump, both pumps might discharge through the broken line resulting in failure of both engines. If so, the cross-feed valve should be turned OFF immediately.

At least once in each flight the cross-feed valve should be turned OFF momentarily to determine that both fuel pumps are operating satisfactorily.

The engine shut-off valve, leading to a damaged engine driven fuel pump or line, should be turned OFF as soon as practical.

Refer to Tech. Order No. 53-36 or Tech. Note No. 4-39.

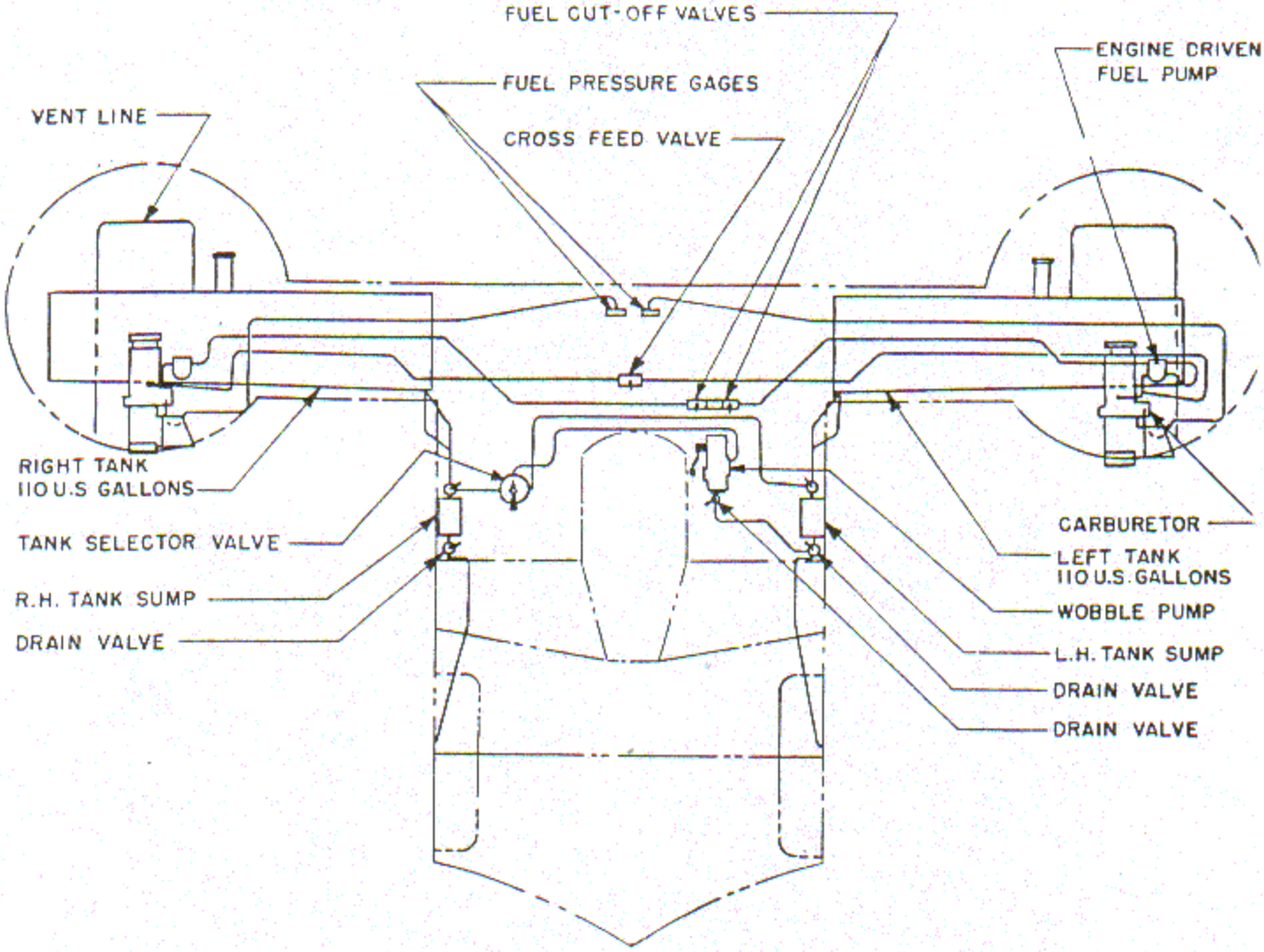


Figure 5—Fuel System Diagram.

q. Oil System

The oil for each engine is carried in a single tank located in the engine nacelle compartment. The tank capacity is as follows:

6 U.S. gals. (4.8 Imperial gals.) Normal
7-1/2 U.S. gals. (6.0 Imperial gals.)
Maximum
9-1/2 U.S. gals. (7.6 Imperial gals.) Tank Volume.

Each independent system incorporates an automatic oil temperature control and check valve attached to the bottom of the oil tank, which, in conjunction with the oil cooler, maintains the oil-in temperature at approximately 65°C (150°F) to 76°C (170°F). The control valve causes the oil to by-pass the cooler when the oil-in temperature is below approximately 65°C (150°F) directing the outlet oil from the engine back to the bottom of the oil tank in close proximity to the suction outlet. Consequently, the tank supply of oil is virtually by-passed when starting the engine until the oil-in temperature reaches approximately 65°C (150°F). The check valve unit prevents flow of oil into the engine from the tank back through the oil-out line from the engine to the control valve when the engine is not operating.

Each engine line at the bottom of the tank extends upward into the tank forming a sump. These risers prevent the circulation of 1/2 gallon of oil. The arrangement is such that all oil in the tank is drainable through the large drain valve.

Temperature - Desired 60° - 102°C
Pressure - Desired 70 - 90 p.s.i.
Idling - 25 p.s.i.

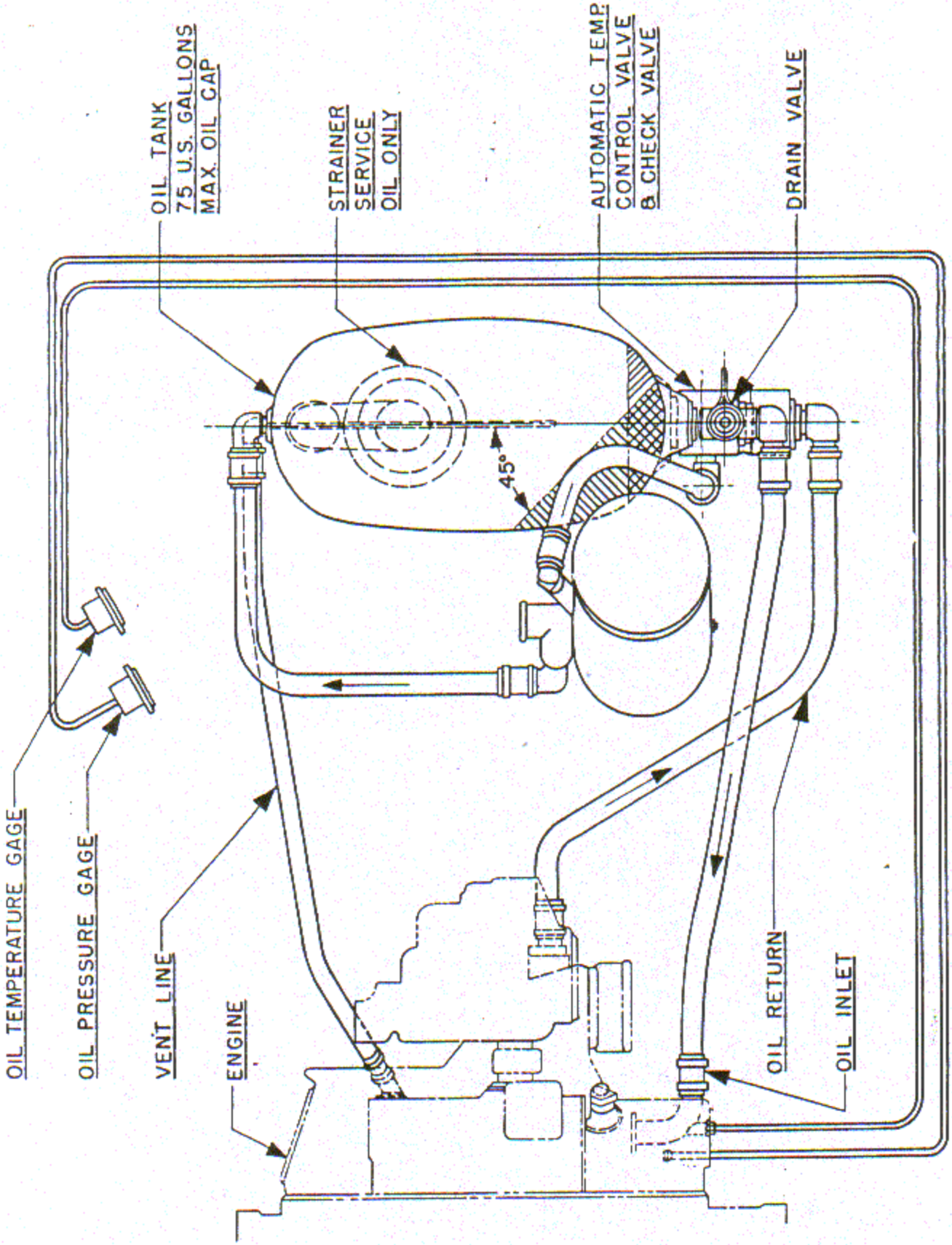


Figure 7 —Oil System Diagram

ENGINE OPERATING TABLE

DENSITY ALTITUDE (No Ram)	B.H.P. EACH ENGINE	MAXIMUM MANIFOLD PRESSURE	R.P.M.	PROPELLER	MIXTURE CONTROL
Take-off at Sea Level 5 minutes only	450	35.5" Hg.	2300	Increase RPM	Auto Rich
At Sea Level to 3000 ft.	400	33.5" Hg.	2200	Governing	Auto Rich
Climb 3000 to 5500 ft.	400	32.5" Hg.	2200	Governing	Auto Rich
Climb above 5500ft.*	-	Full Throttle	-	Governing	Auto Rich
Cruising	-	See Curve on pg. 48	-	Decrease RPM	Auto Lean for operation at or below Max. Recommended Cruising Limits Line, p. 46

*Do not exceed 32" Hg. above 5500 ft.

Oil Pressure - Desired 70 - 90 p.s.i.
Idling 25 p.s.i.
Oil Temperature - Desired 60° - 102°C
Fuel Pressure - Desired 4-6 p.s.i.

Fig. 8

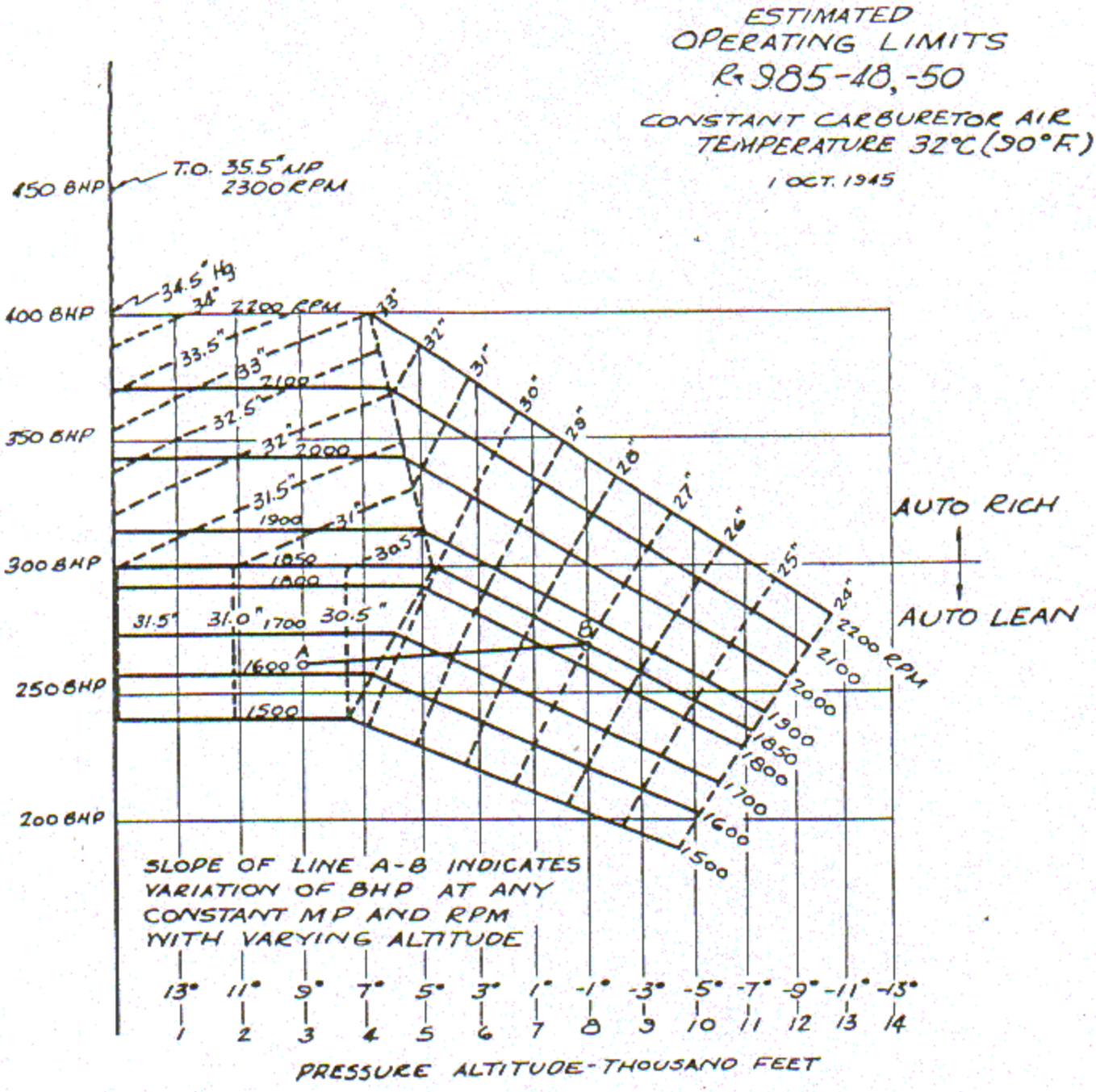


Figure 10—Engine Power Curve

r. Normal Instrument Readings

The following instrument readings were taken on a cruising flight at 5000 ft. altitude.

Propeller	GOVERNING
R.P.M.	1950
Manifold Pressure	27.5" Hg.
Cylinder Head Temp. (No. 5)	185°C.
Carburetor Air Temp.	32°C
Outside Air Temp.	25°C
Fuel Pressure	4 p.s.i.
Mixture	Best Power
Oil Pressure	70 p.s.i.
Oil Temperature	70°
Airspeed	146 MPH
Elevator Tab Setting	0°
Rudder Tab Setting	0°
Fuel Consumption	42 gals/hr.

SECTION III

FLYING CHARACTERISTICS

1. BALANCE

This airplane is designed to operate as a navigational trainer and when so loaded will balance satisfactorily without the use of ballast. When flown empty, carry 100 pounds of ballast in the rear baggage compartment.

The amount of elevator tab travel available will be found sufficient to maintain perfect balance in flight and to permit getting the tail down when landing in any of the permissible loading conditions.

The center of gravity location is as follows:

Airplane normal gross - 8000 lbs. - 24.7% M.A.C.

NOTE: The maximum permissible Gross Weight is 8700 lbs. provided that operations at Gross Weight in excess of 8000 lbs. shall be carried on only under favorable conditions. (Ref. T.O. 55-40)

2. MANEUVERS

Although this airplane, Class VJR amphibian is not designed for combat work, its excellent maneuverability has been successfully demonstrated. However, except in emergencies, maneuvers shall be limited to those permitted for Class VJR airplanes by existing Navy publications.

a. Take-Off

To reduce spray on take-off from the water, it is advisable to use maximum take-off manifold pressure by opening the throttle with a non-hesitating, smooth motion, at the same time holding the elevator control full back. With this technique, the airplane will get on the step with minimum delay. After getting on the step, take-off procedure is normal. See pages 37 and 38.

b. Glide & Landing

For pilots not familiar with this model airplane it is recommended that a gliding speed of 90 MPH be maintained. With practice the gliding speed will probably be reduced somewhat by each pilot. Even with the 90 MPH speed there is very little tendency to over-shoot because the high drag from the flaps give the airplane a steep gliding angle and practically eliminates any tendency to float. Attention is called to the fact that the forward deck of the airplane is just level when in the 3 point landing attitude, hence during a normal glide with flaps DOWN the airplane appears to be diving slightly. This attitude should be maintained until within a few feet of the ground, as speed is lost quickly when the nose is brought up.

It is recommended that the 30° flap setting be used for the first two or three landings on familiarization flights.

Since the flaps are extremely effective on this airplane, the use of full flaps produces an unusually steep glide unless part power is used. For land landings it is immaterial whether 30° or 60° flap setting is used provided a gliding

speed of at least 90 MPH is maintained until leveling off close to the ground. When leveling off from this approach speed, the actual landing will be found to occur at about 70 to 75 MPH. This applies to land as well as water operation.

The wing of this airplane is designed so that a stall occurs first in the center section of the wing and gradually spreads out along the wing toward the tips but the tips never stall. This airplane, therefore, will not fall-off if it is stalled but the nose will drop until speed is picked up. This is a very desirable characteristic but care should be taken that the airplane is not stalled too high off the ground when coming in for landings or it will tend to drop in on the wheels. When it is necessary to bring the airplane in slow for any reason it is recommended that a power-stall landing be made.

c. Water Landing

Always use 60° flap setting.

Use part throttle, about 15 inches manifold pressure, during the approach and until sound contact is made with water. Then throttle back completely.

If a bad bounce is made, use power to either recover to a normal position to land, or to go around for a new approach. This ship has sufficient power to recover from almost any position into which it might bounce.

By extending the landing gear wheels when taxiing on water, the maneuvering characteristics are improved; forward speed is reduced and sharper turns can be made; however, wheels should not be lowered in water less than 3 ft. deep.

When approaching a beach with the intention of taxiing out, it is considered good practice to come in slowly and at an oblique angle (not straight on) in order to determine if the surface is sufficiently firm to support the wheels.

It must be remembered that wet brakes may be ineffective; therefore, it is best to taxi cautiously immediately after leaving the water. If an immediate land landing is to be made after a water take-off, the brakes will dry more rapidly with the landing gear in the DOWN position.

3. CHECK-OFF LISTS

Take-Off

1. Propeller ——— INCREASE RPM, 2300
2. Carburetor Air Temp.— COLD (except when damp)
3. Mixture ——— AUTO RICH
4. Fuel Valve ——— BEST TANK
5. Manifold Pressure —— 35.5" HG.
6. Elev. Tab ——— NEUTRAL
7. Rudder Tab ——— NEUTRAL
8. Tail Wheel Caster —— LOCKED

Flight (Cruising)

1. Wheels ——— RETRACTED
2. Propeller ——— GOVERNING
3. R.P.M. ——— SEE ENGINE CHART
4. Mixture Control ——— AUTO RICH - 70% POWER OR LESS AUTO LEAN
5. Manifold Pressure —— SEE ENGINE CHART
6. Cyl. Head Temp. ——— 232°C MAX.
7. Oil Pressure ——— 70 P.S.I.
8. Oil-In Temp. ——— 70°C
9. Fuel Pressure ——— 4-6 P.S.I.
10. Carb. Air Temp. ——— AS REQUIRED

Landing

1. Wheels ——— DOWN (on land)UP(water)
2. Tail Wheel Caster —— LOCKED
3. Propeller ——— INCREASE RPM
4. Mixture —— ——— AUTO RICH
5. Fuel Valve ——— BEST TANK
6. Elevator Tab ——— TRIM AS REQUIRED
7. Flaps ——— DOWN - 30° or 60°

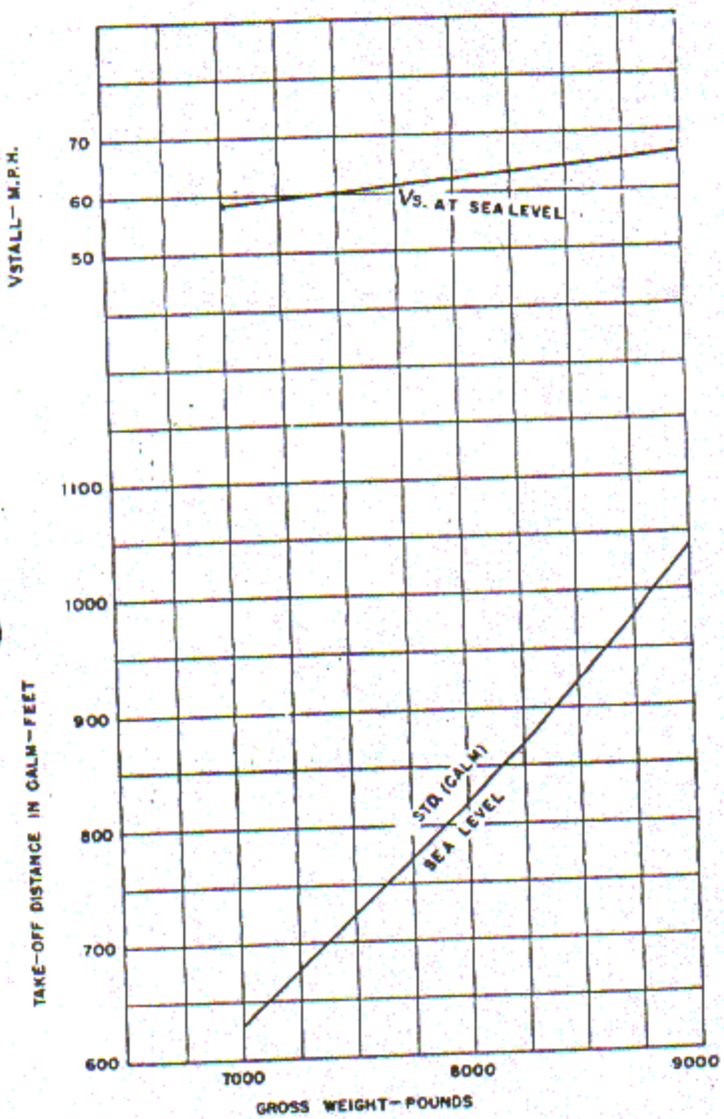


Figure 10—Take-off Run and Stalling Speed Chart.

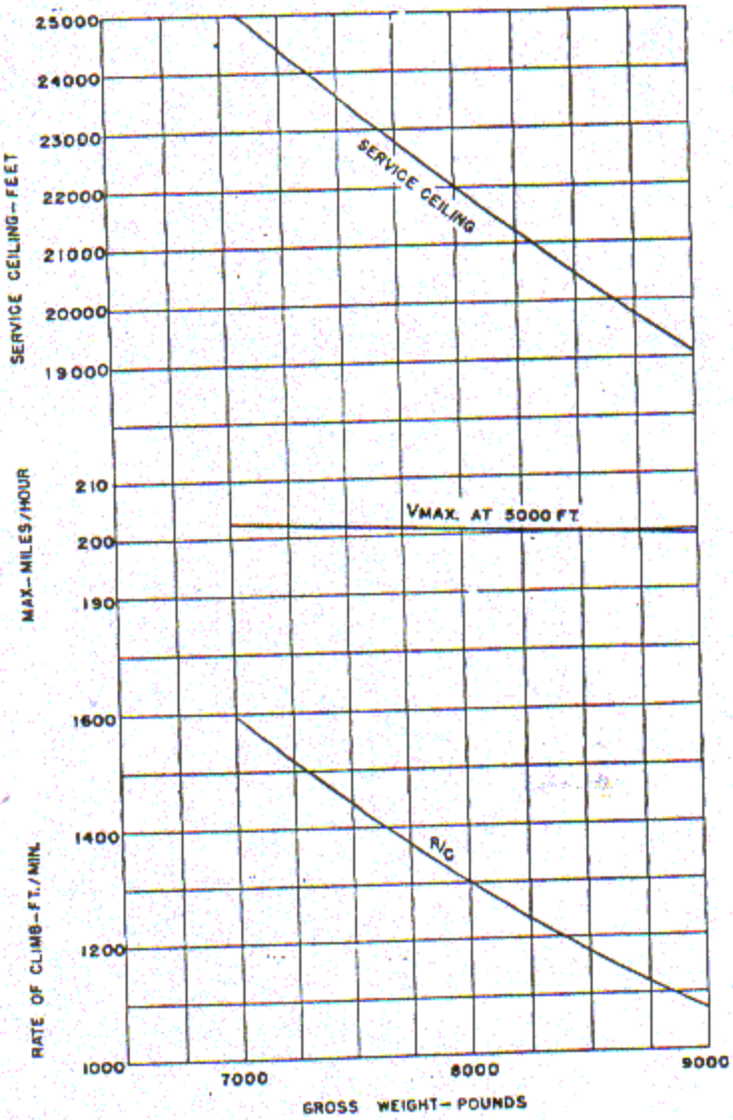


Figure 11—Climb, Speed, and Ceiling Chart.

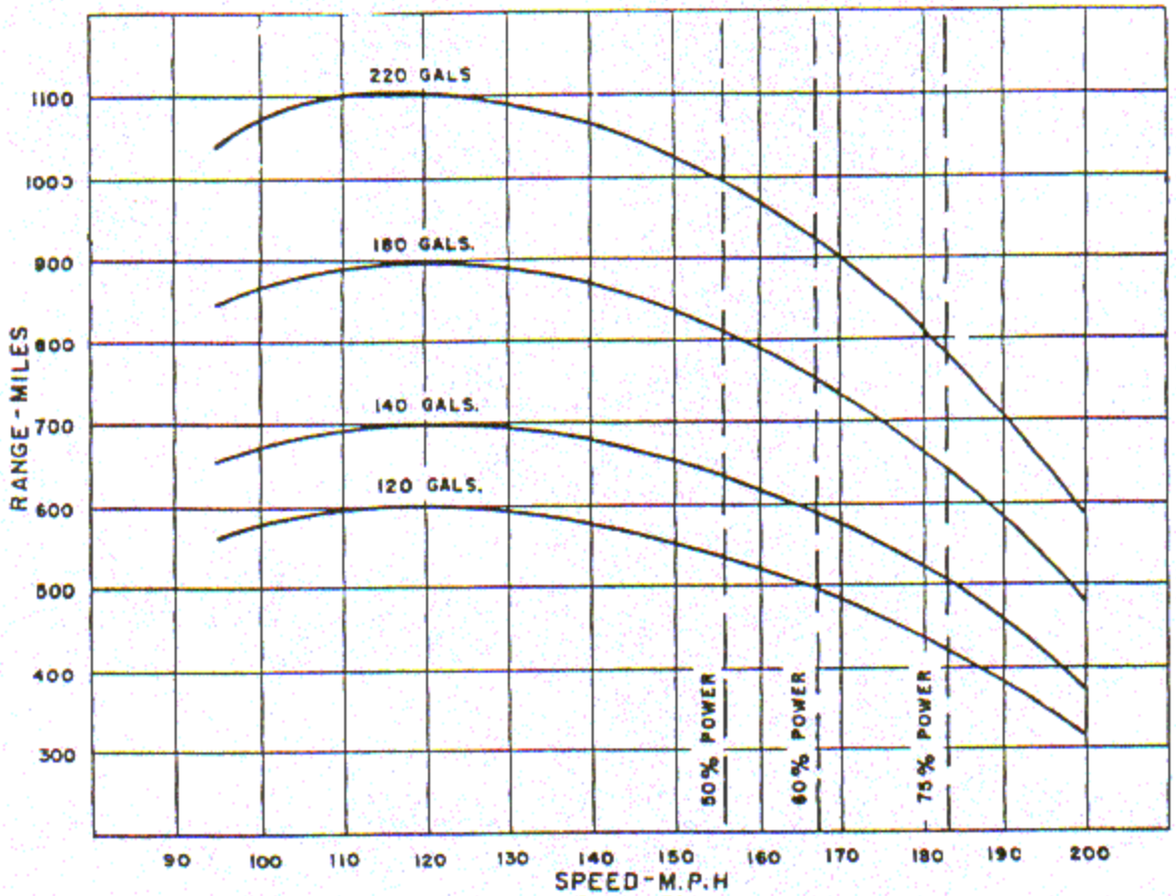


Figure 12—Range Chart.

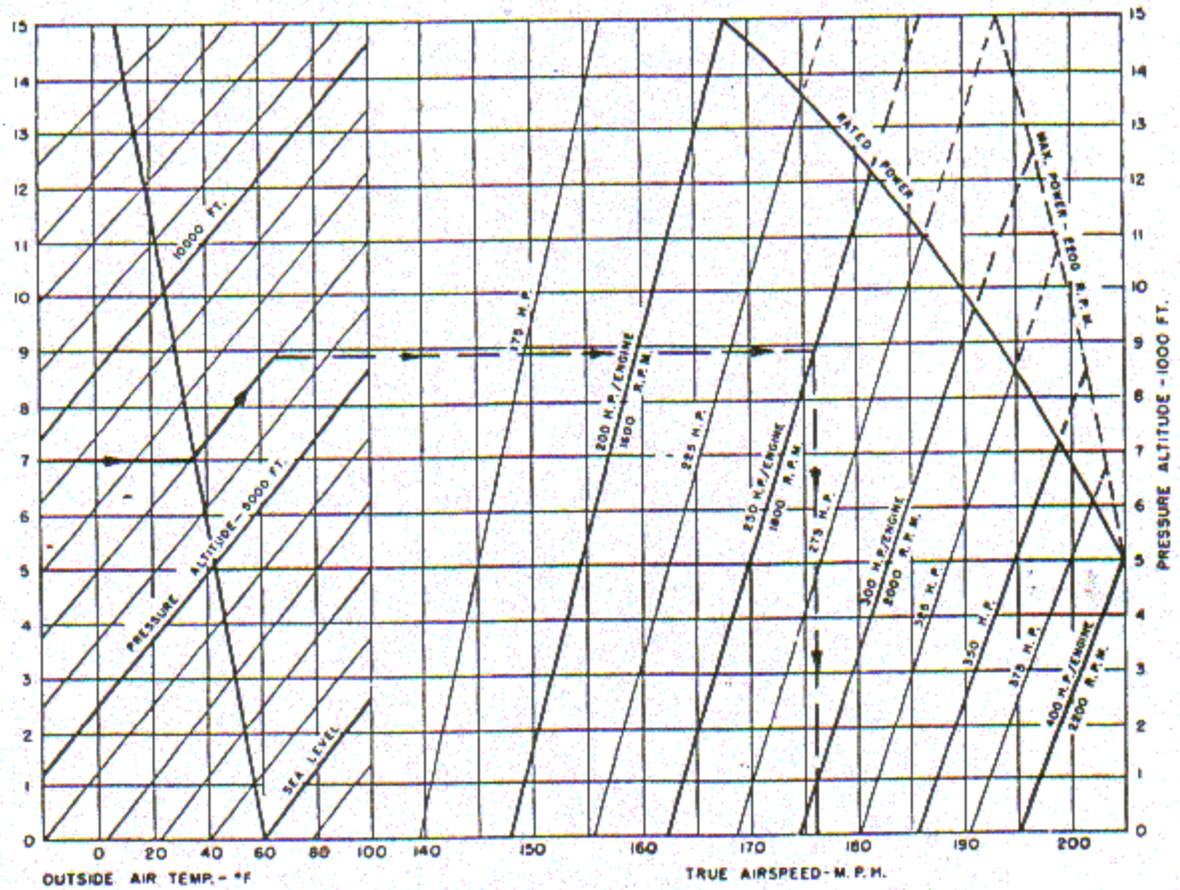


Figure —Cruising Chart.

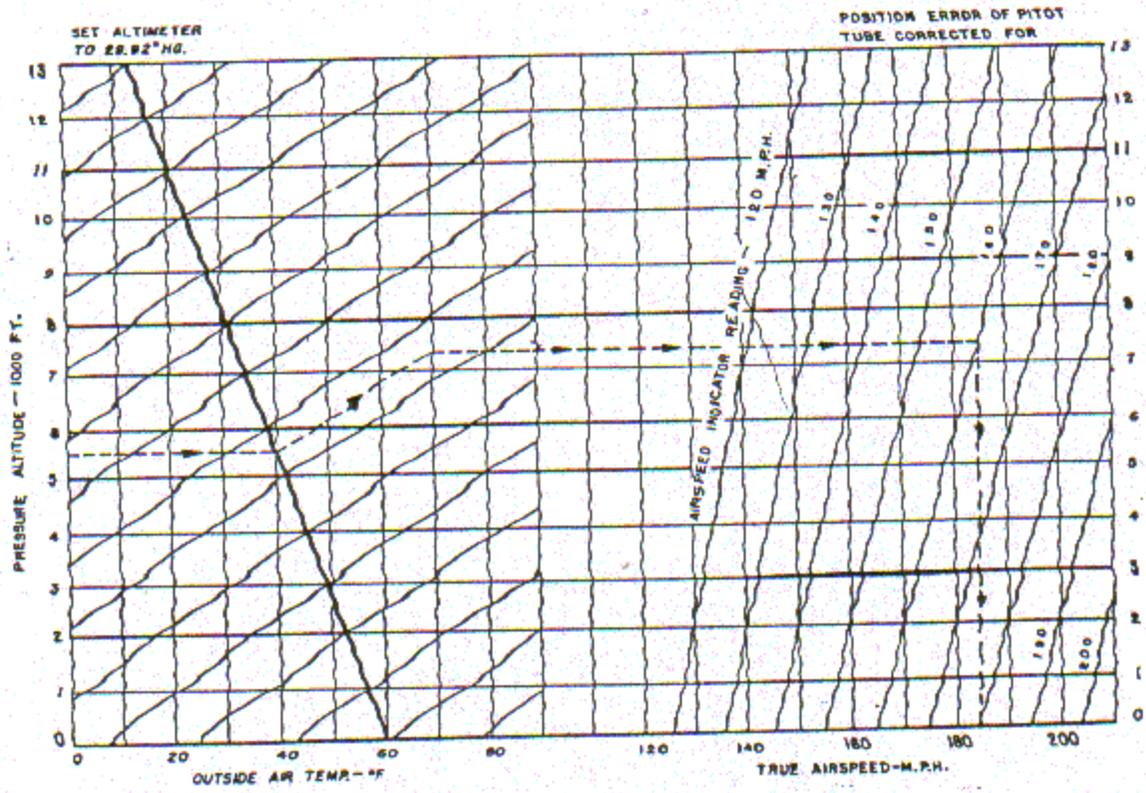


Figure 13—Airspeed Correction Chart.

RESTRICTED