RESTRICTED

PILOT'S HANDBOOK FOR MODEL J4F-1 AIRPLANE

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

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FOR

MODEL J4F-1 AIRPLANE

CONTRACT NO. Tcg 34026

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

FOREWORD

This handbook is prepared for the purpose of familiarizing flying personnel with the take-off, flying and landing characteristics of the Model J4F-1 airplane, the function of particular systems and installations, and the operation of the various automatic and manual controls.

For service and overhaul instructions refer to Erection and Maintenance Instructions Manual, Grumman Report No. 1740.

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I
COCKPIT ARRANGEMENT AND CONTROLS

The arrangement of the cockpit and the location of various controls are shown in the accompanying photographic illustrations

In general the name and direction of operation is indicated by a nameplate adjacent to the control knob or handle.

FLYING CONTROLS

Elevator & Aileron Controls

Standard column and throw-over wheel

Elevator Trimming Tab Control

Handcrank on L.H. side of pilot's upper control panel.
Turn clockwise - Airplane NOSE UP.

Rudder Controls

Standard over-hung pedals, adjustable in flight.
Removable rudder bar for co-pilot.

Rudder Trimming Tab Control

Handcrank on R.H. side of pilot's upper control panel.
Turn clockwise - Airplane NOSE RIGHT.

Wing Flaps Control

Valve with "thumb latch" on right hand side of pilot's upper panel. Upward - FLAPS UP.

LANDING GEAR CONTROLS

Landing Gear & Tail Wheel Retracting Controls

Valve lever with "latch" on L.H. side of pilot's upper control panel. Up - UP, Center - NEUTRAL, Down - DOWN.

Emergency Hand Hydraulic Pump

Pump handle is located at left of pilot's seat.

Tail Wheel Caster Lock Control

Lever on the L.H. side of the pilot's upper control panel.

Brake Controls

Toe bars attached to pilot's rudder pedals. Adjustable.

POWER PLANT CONTROLS

Carburetor Air Preheat Controls

Two push-pull "T" handles on left side of pilot's upper rear panel. PULL for heat, then rotate to lock.

Fire Extinguisher (CO_2) Controls

Control "T" handle and engine selector valve are located on the lower left hand side of the instrument panel.

Fuel Valve Controls

Three levers at right side of pilot's upper rear control panel. Right Tank, Tank Cross Flow and Left Tank. Levers up - OFF. Levers Down - ON. Valve must be closed on empty tank. At least two valves must be on simultaneously.

Ignition Switches

Single unit, double switch at center of pilot's upper control panel.

Master Switch

Lever at center of pilot's upper rear control panel. Right - ON, Left - OFF.

Mixture Controls

Two levers at center of pilot's upper rear control panel. FUEL CUT-OFF sectors painted red. Up - LEAN, Down - RICH.

Starter Controls

Two buttons on lower left side of pilot's Main Instrument Panel. PUSH to start engine.

Wobble Pump Controls

Lever at right and left side of pilot's upper rear control panel Right lever - Right Pump, Left Lever - Left Pump.

EQUIPMENT CONTROLS

Cabin Heat Controls

Two mixing control handles. Cockpit control to right and above the co-pilot, Cabin control to the left and above the pilot.

Pull - Hot Air
Push - Cold Air

The adjustable ventilating scoop in the cabin ceiling should normally be open except in very cold weather

An adjustable cockpit ventilator is provided on the left hand side, just above the cockpit window. The supply and direction of air is controlled by pulling and turning the disc type valve.

Electrical Switches & Rheostats

The following push-pull type switches are on the lower left of the pilot's main instrument panel:

Anchor Light
Navigation Light
Pitot Heat Switch
*Compass Light
*Cockpit Light
Generator Switch
Fuel Gage Switch
Landing Light

*These switches are combined with rheostats. The compass light switch also operates the lights in navigating instruments.

Radio Controls

In the R.H forward corner of the cabin, Directional antenna mounted in the cabin ceiling.

The installation of each of the foregoing items is further described in the Model J4F-1 Erection and Maintenance Manual.

1. VOLT AMMETER
2. PRIMER PUMP
3. FIRE EXTINGUISHER CONTROL
4. LANDING LIGHT SWITCH
5. VACUUM GAGE
6. DIRECTIONAL GYRO
7. ARTIFICIAL HORIZON
8. AIRSPEED INDICATOR
9. TURN & BANK INDICATOR
10. VERTICAL SPEED INDICATOR
11. ALTIMETER

12. FUEL PRESSURE GAGES
13. LANDING GEAR INDICATOR LIGHT
14. COMPASS
15. TACHOMETERS
16. CYLINDER HEAD TEMPERATURE GAGES
17. OIL PRESSURE GAGE
18. OIL TEMPERATURE GAGE
19. FUEL QUANTITY GAGE
20. CARBURETOR AIR TEMPERATURE GAGES
21. OUTSIDE AIR TEMPERATURE GAGES
22. CLOCK

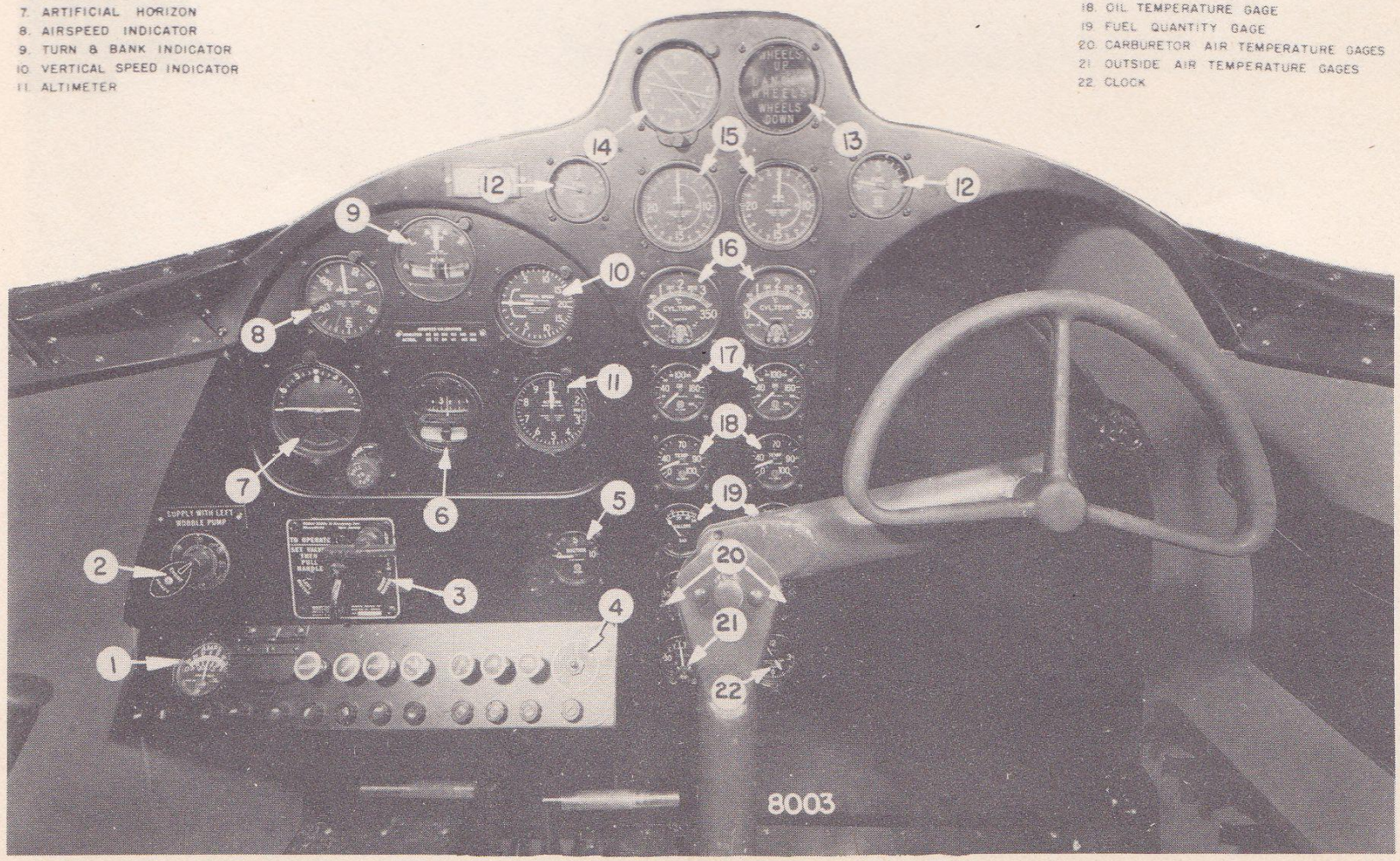

FIG. 1 - MAIN INSTRUMENT PANEL

1. VOLT AMMETER
2. PRIMER PUMP
3. FIRE EXTINGUISHER CONTROL
4. LANDING LIGHT SWITCH
5. VACUUM GAGE
6. DIRECTIONAL GYRO
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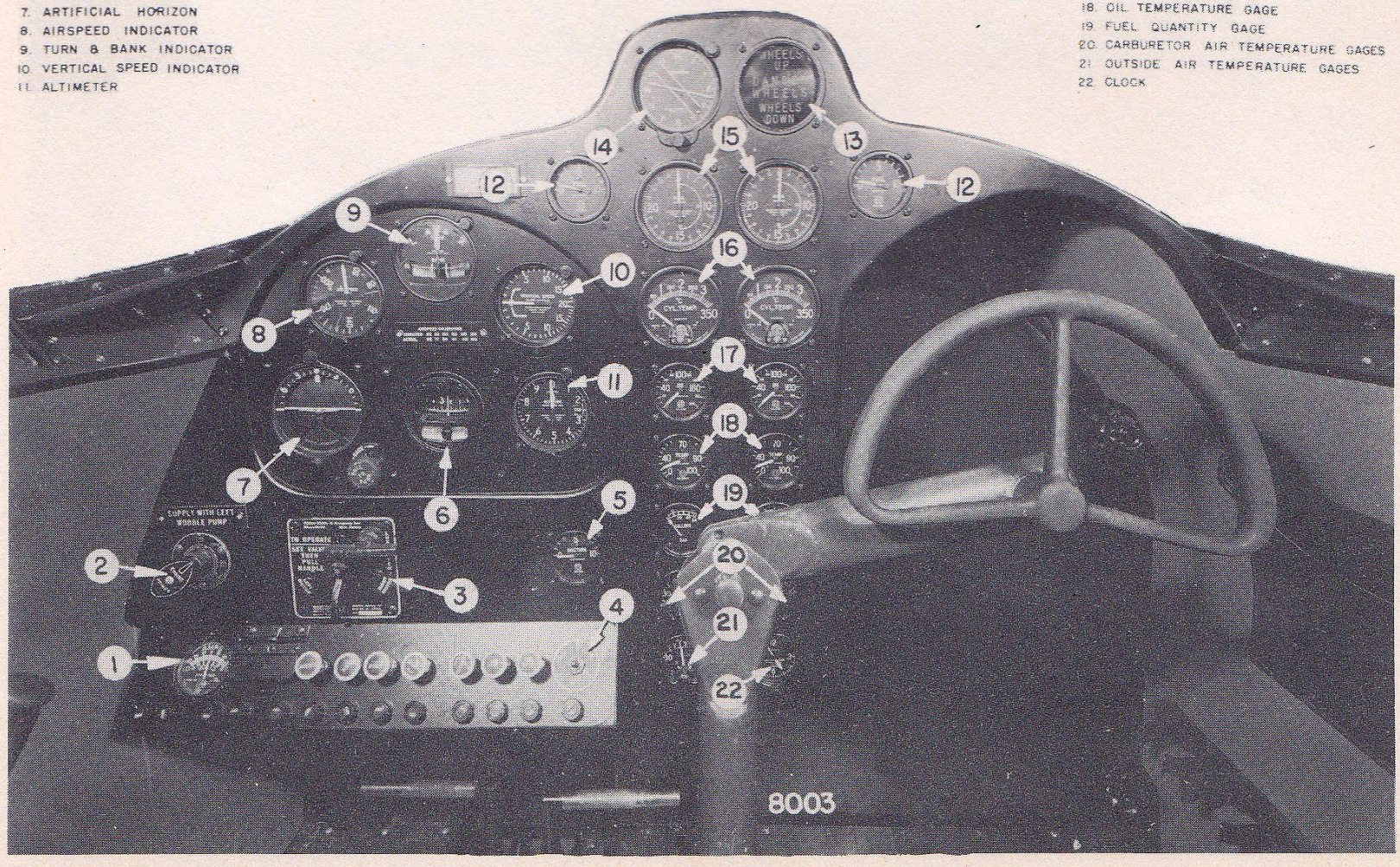


FIG. 1 - MAIN INSTRUMENT PANEL

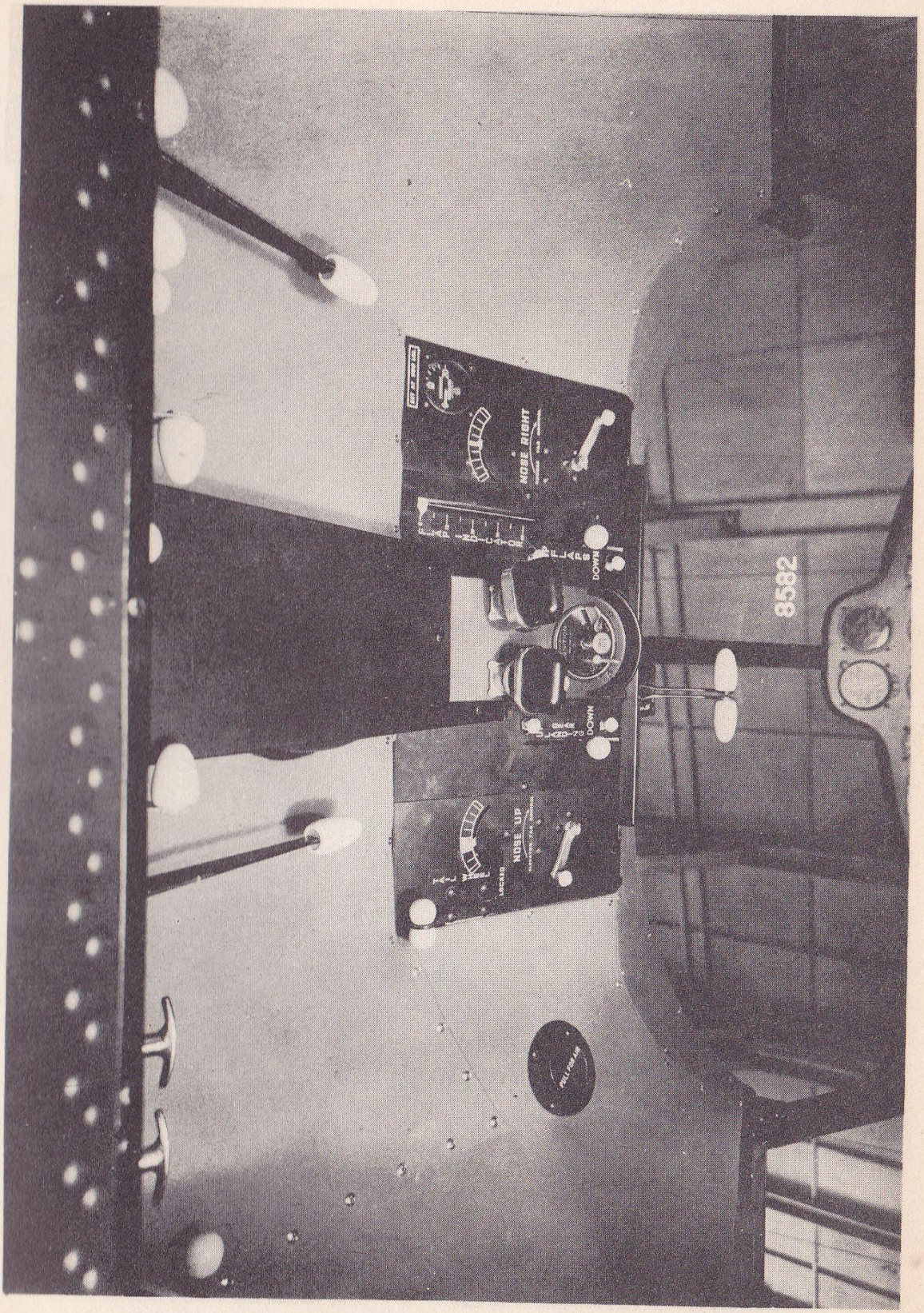
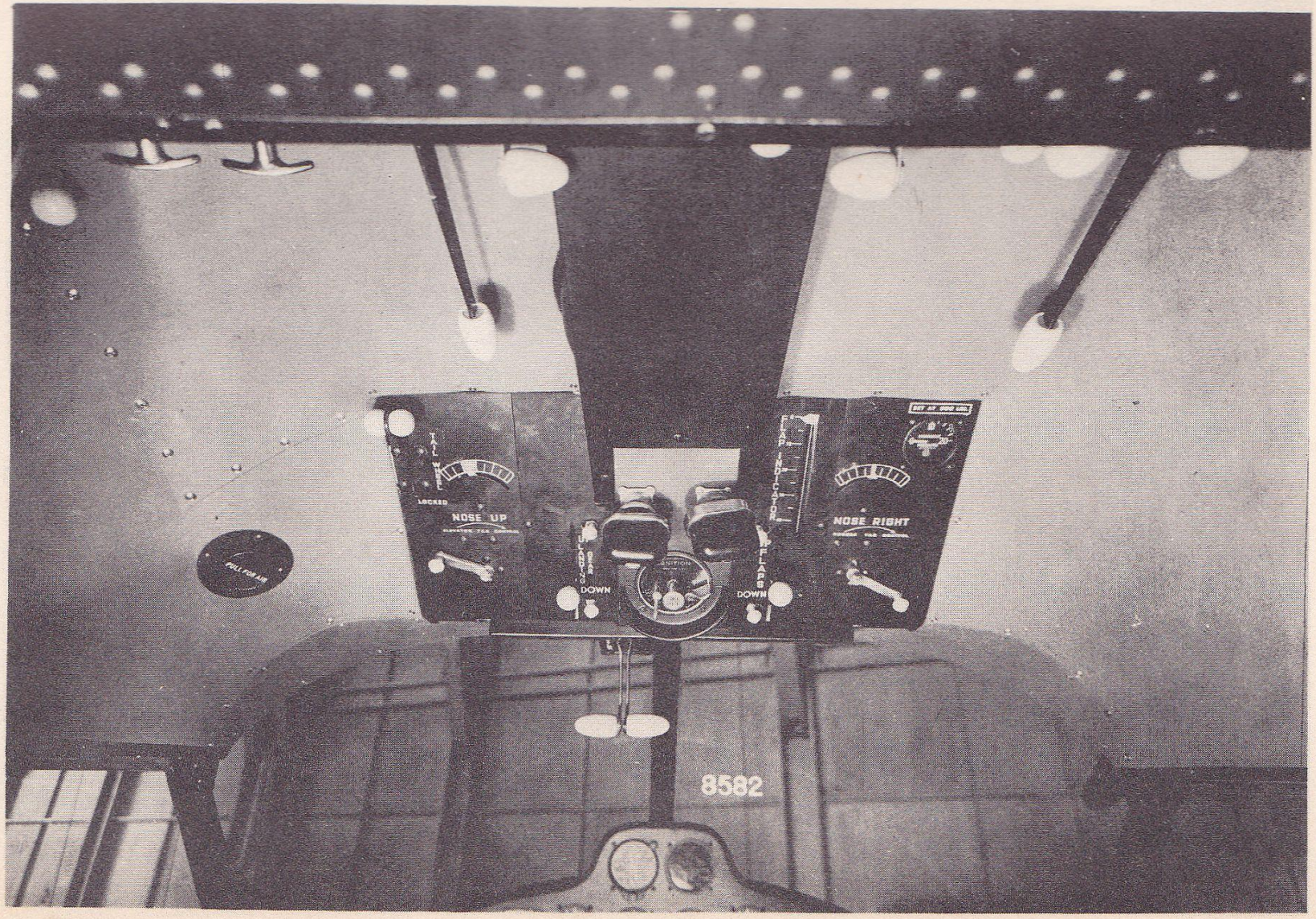


FIG. 2 - UPPER CONTROL PANEL



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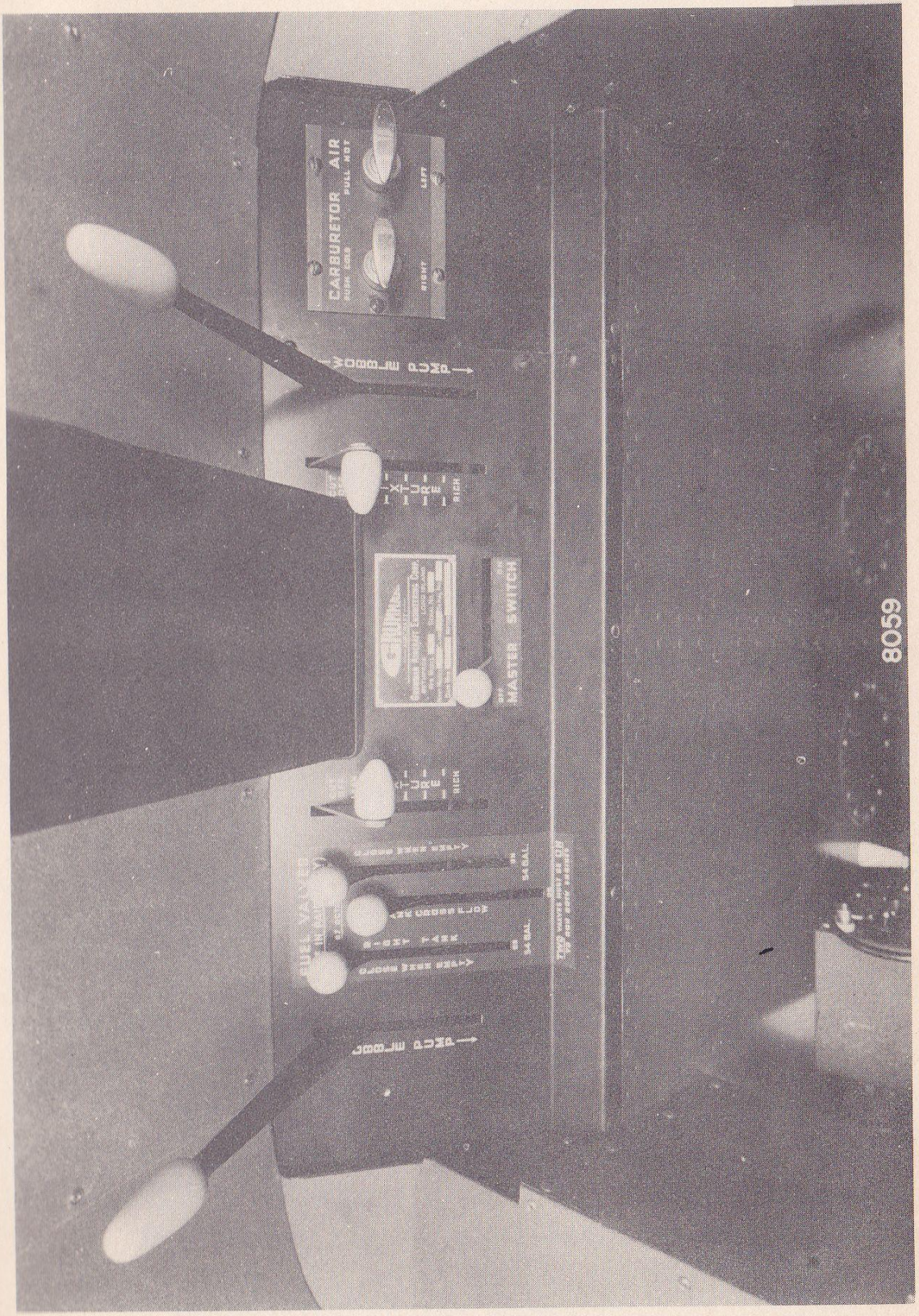


FIG. 3 - UPPER REAR CONTROL PANEL

FIG. 3 - UPPER REAR CONTROL PANEL

II

OPERATION INSTRUCTIONS

1. FLYING CONTROLS

(a) Aileron Controls

The aileron controls follow standard practice. Cables are led from the wheel mounted on the control column to the aileron horns With the wheels center spoke vertical the ailerons are in neutral.

The range of movement of the ailerons is 20° up to 20° down.

(b) Elevator Controls

The elevators are controlled by means of flexible cables leading from the control column in the cockpit to the elevator horns With the column approximately upright the elevators are in neutral

The range of movement of the elevators is from 23° up to 19° down.

The control column is fitted with adjustable stops, which are set at the factory.

(c) Elevator Tabs Controls

Trimming Tab

The tab on the left elevator is adjustable in flight from 10° up to 29° down, with respect to the center line of the elevator.

Control is accomplished by means of a hand-crank and pulley in the cockpit, through cables to a sprocket mounted at Sta. #32. The sprocket is attached to a rotating flexible shaft operating an actuator in the elevator.

For "NOSE UP" rotate crank clockwise.
For "NOSE DOWN" rotate crank counter-clockwise.

Position of the tab may be checked by the indicator located just above the handcrank. The average take-off position is indicated near the left of the scale.

Balance Tab

The tab on the right elevator is designed for downward movement only. It is actuated by a direct cable from the wing flap controls and is not adjustable in flight.

This tab automatically compensates for changes in trim produced by lowering the flaps.

It is important that the static balance tube on the upper surface is always firmly attached.

(d) Rudder Controls

The rudder controls follow standard practice; cables from a bellcrank are led aft to the rudder control horns.

Effective pedal position may be shortened two inches by a swinging pedal block, which is latched in either position.

The rudder movement is 27° either side of neutral.

(e) Rudder Tab Control

The tab is hinged near the trailing edge of the rudder and is adjustable in flight from 22° right to 23° left, with respect to the center line of the rudder. It will trim the airplane directionally with either engine shut-off at speeds above approximately 95 M.P.H.

Control is accomplished by means of a hand crank and pulley in the cockpit, through cables to a sprocket at Sta #32. The sprocket is attached to a rotating flexible shaft operating an actuator in the rudder.

For "Nose Right" rotate crank clockwise, for "Nose Left" rotate crank counter-clockwise.

Position of the tab may be checked by the indicator just above the handcrank.

Set the tab in neutral before taking off.

(f) Wing Flap Control

The flaps are hydraulically operated to the "Down" position and returned to normal or "Up" position by springs within the operating cylinders. They may be controlled from 0° to 40° down. This is accomplished by means of a lever in the pilot's cockpit. With this lever in central position, (neutral) there is no flap movement; with lever DOWN, the flap movement is downward. This movement may be stopped at any point by returning the lever to neutral, or continued until flaps are full down. A thumb latch just to the left of the flap control lever may be used to hold the lever temporarily in the "UP" position during the process of retraction.

The pressure for the hydraulic cylinders which operate the flaps "Down" is supplied by the Main Hydraulic System. Pressure for this system is supplied by an engine operated pump, or in the event the engine is not operating, by a hand-operated emergency pump, located to the left of the pilot's seat. Seven strokes are required to lower the flaps. To prevent rapid retraction of the flaps there is a restrictor in the hydraulic return line.

The hydraulic system is more fully discussed in the "Erection & Maintenance Instructions" furnished with this airplane.

2. LANDING GEAR CONTROLS

(a) Landing Gear & Tail Wheel Retracting Controls

The Landing Gear and Tail Wheel, which operate hydraulically, extend or retract simultaneously. The movement is controlled by a lever on the left center of the pilot's upper panel. If desired, this lever may be locked in either the "Up" or "Down" position by a knob just to the right of the control during the motion. It should be unlatched when the wheels are in place as otherwise the hydraulic system remains under continued pressure and the flap control would not work. The pressure to operate the hydraulic cylinders which extend and retract these mechanisms is supplied by the main hydraulic system of the airplane.

(b) Emergency Hand Hydraulic Pump

In case of failure of the engine driven hydraulic pump or if the left engine is not running, an emergency hand pump is provided at the left side of the pilot's seat. Approximately 24 strokes of this pump are required to raise, or lower the landing gear and tail wheel. Wheel position may be checked through small windows provided in the L.G. wheel pockets. The hinged top covers of the pockets may be raised for complete inspection.

(c) Landing Gear Position Indicator

Designed to help prevent inadvertent landings with the L.G. wheels in the incorrect position, a Position Indicator is provided on the top center of the pilot's main instrument panel. This signal lights when either engine is throttled below 1900 R.P.M.

In the event that the wheels are neither completely "Up" or "Down" - "DANGER WHEELS" is lighted, if the wheels are in a retracted position "WHEELS UP" is lighted and if they are down "WHEELS DOWN" is lighted.

(d) Tail Wheel Caster Lock Control

The tail wheel drag link is provided with a Lock Pin which locks the caster and wheel in a trailing position.

The locking pin is controlled by a lever on the left side of the pilot's upper control panel. The positions are plainly marked on the panel; Upward - "Unlocked", "downward - "Locked".

The tail wheel lock assists in taxiing cross wind and up and down steep ramps. It reduces the possibility of ground looping. The wheel is a 360° swivel type equipped with a spring loaded self-centering device.

(e) Brake Controls

The hydraulic brakes for each landing gear wheel may be operated individually by means of toe-bars attached to the rudder pedals.

It must be remembered that wet brakes may be ineffective; therefore, it is wise 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.

For "parking", either brake or both can be locked "ON" by means of lifting the knob located between the rudder pedals, then operating the brakes. Brakes may be adjusted by varying the length of adjustable rods attached to the toe-bars.

3. EQUIPMENT CONTROLS

(a) Electrical Switches & Rheostats

Included among the push-pull electrical switches on the main instrument panel are two labeled "Compass" and "Cockpit". These have rheostats incorporated with the switches and by turning may be used to dim the compass light and the Grifo-Ho lights respectively. The compass light switch also operates Navigation Instrument Lights. Fuses of the proper amperage are provided for each of the circuits. These are located just below the switch buttons.

Light Bulbs

Grifo-Ho (2)	3 c.p.	G.E. Mazda #89
Anchor	15 c.p.	G.E. Mazda #89
Tail	15 c.p.	G.E. Mazda #89
Cabin	21 c.p.	G.E. Mazda #89
Wing Tips (2)	21 c.p.	Grimes Model E
Compass	Pioneer	3 volt - Special
Artificial Horizon	Pioneer	3 volt - Special
Directional Gyro	Pioneer	3 volt - Special
Altimeter	Pioneer	3 volt - Special
Air Speed Indicator	Pioneer	3 volt - Special
Turn & Bank Indicator	Pioneer	3 volt - Special
Vertical Speed Indicator	Pioneer	3 volt - Special
Landing Light	315 c.p.	15 amp - Special
Position Indicator (L.G.) (3)	3 c.p.	Tung Sol G-4½

4. POWER PLANT CONTROLS

(a) Engine

This airplane is powered with two Ranger Model 6-440C-5, 6 cylinder in-line, inverted, air cooled, direct drive, engines which operate on 87 octane fuel. These engines are not supercharged. The combined engines are rated:

400 HP at 2450 RPM, with 28" Hg. Take-Off
300 HP at 2300 RPM, with 22" Hg. 4000' to 7000'
300 HP at 2350 RPM, with 21.5" Hg above 7000'

For power-output altitude table see page 34.

(b) Propellers

This airplane is equipped with Sensenich Model 82-RS-72 wooden, two blade, fixed pitch propellers.

Diameter	82"
Pitch (at 3/4 Radius)	72"

It should be remembered that temperature and humidity conditions affect wooden propellers, even after short periods without use. They sometimes warp slightly, and not alike on either side; thereby, changing the speed characteristics of their respective engines. This is the usual explanation if one engine does not turn up as fast as the other and does not normally indicate a power loss. Several hours of running may bring the propellers back to their former speed.

It is usual practice on twin-engine airplanes to synchronize the speed of the engines by their sound, even though the tachometer readings may be slightly different.

(c) Starting Engines

WARNING: It is recommended that the engines, after standing as long as over night, be "Pulled Through" three complete revolutions by hand before starting.

The engines are equipped with Eclipse Type E-80 starters. Starter buttons are located on the lower left hand side of the instrument panel.

It is suggested that the right hand engine be started first in order to avoid voltage drop (with generator inoperative), which is caused by the longer starter cable leading to left hand engine.

To start the engines, the best combination of fuel valves shall be turned on. NOTE: that at least two (2) valves must be on. Valve must be closed on empty tank. Proceed as follows:

Place the Master Switch to the "ON" position.

Set the mixture control to "Full Rich" position and operate the left wobble pump to obtain a fuel pressure of 2-1/2 to 3-1/2 pounds.

Prime the engine by pumping the throttle approximately 3 or 4 times, dependent on outside temperature. (Use of the priming pump is usually necessary only in cold weather as there is a tendency to overprime when using this unit.)

The selective primer is connected to the left fuel system. To assure filling the primer, operate the left wobble pump until pressure shows on the fuel pressure gage. The primer is more effective if the motor is being turned over while priming as the charge is immediately sucked into the cylinders.

With the throttle in the "Closed" position, push in master ignition switch marked "PULL-OFF", turn the individual switch on to the "Left" position as this magneto is equipped with an impulse unit.

Press the starter button and as soon as the engine starts, turn the individual ignition switch to the "Both" position and advance the throttle to about 800 RPM.

If the engine, after starting, shows any indication of missing or lean running, it will be necessary to pump the throttle at the closed position, using very short strokes.

If the engine is overprimed, as indicated by dripping of an excessive quantity of gasoline from the carburetor drain, the throttle should be opened wide and the engine turned backward several revolutions by hand with the ignition switch "OFF".

In extremely cold weather both engine and oil should be preheated.

If the engine fails to start after a reasonable number of attempts, consult the chapter on "Engine Troubles" in the INSTRUCTION BOOK for RANGER AIRCRAFT ENGINES.

(d) Warming Up Engines

As soon as the engine starts, check the oil pressure gage. If no pressure is indicated after 30 seconds running, the engine should be stopped and an investigation made. (See Chapter "Engine Troubles" INSTRUCTION BOOK for RANGER AIRCRAFT ENGINES.

Always be sure that the primer line is shut off after starting.

In cold weather, when the oil has not been preheated, keep the engine throttled as low as possible until some temperature is registered.

The warming-up period is important and should be carried out as follows:

After the oil gage indicates pressure, run the engine at 800 to 1000 RPM until the pressure is normal for this speed which will be a value between 50 and 70 lbs. This warm-up period should be extended for at least 5 minutes at which time the RPM should be increased to 1000.

It is recommended that these speeds not be exceeded until the oil temperature registers 100°F (38°C). A "Full Rich" mixture is used for all speeds when running on the ground near sea level.

The RPM check should be made as follows:

These engines are rated at sea level and, therefore, should be checked at full throttle. As cooling of the engine is insufficient while on the ground, any prolonged running at or near full throttle should be avoided. Check oil pressure and temperature and note drop in RPM when switching to one magneto at a time. Drop in RPM when operating on either magneto alone should not exceed 75 RPM.

Check for acceleration being sure that the mixture control is in "Full Rich" position.

(e) Take-Off

Set mixture control to full rich position. To reduce the spray, it is advisable to open the throttles smartly and hold the bow well up at the start (See page 42, "Spray Reduction") A take-off from water with full load under no wind conditions can be made in 27 seconds.

See notes on use of flaps, page 39.
See "Take-Off Check-Off", page 44.

The land take-off run is approximately 900' at Sea Level with gross load and no wind.

The pilot should brake both wheels after take-off and before retracting the landing gear to prevent excessive tire wear caused by rotation against the wheel well bumper pad.

(f) Climb

At full throttle, the engines operate at special rich settings. At slightly less than full throttle, the fuel consumption drops to the normal curve. Therefore, in order to avoid excess heating and engine wear, climbing should be done at full throttle or with power reduced to 75%.

Manifold Pressure 75% Power

S.L.	23.5" Hg.
2000 Ft.	23.0" Hg.
4000 Ft.	22.0" Hg.
6000 Ft.	22.0" Hg.
8000 Ft.	21.5" Hg.

(g) High Speed Level Flight

Recommended cruising power is 75% or less for all altitudes.

Mixture control is set at "Full Rich" below 4000 ft. and at "Smooth Operation" above 4000 ft. See page 28.

Maximum allowable RPM 2550.

(h) Cruising

Cruising economy will be obtained by conducting cruising operations in a range not to exceed 60% of the normal sea level H.P. See page 36 for values for manifold pressure and engine speed for various altitudes, which may be used as a guide in controlling engine operation. Maximum economy will be about 90 knots indicated Air Speed at full load - 4500#.

If roughness is experienced at high altitudes, the mixture control should be leaned out, the amount depending on the altitude and RPM.

The minimum cruising speed should not be less than 90 knots true indicated air speed at all altitudes.

(i) Landing

See Landing "Check-Off" list, page 44

The actual position of the wheels should be visually checked through the sight windows in the wheel pockets.

Another convenient check on wheel position, either lowering or raising, is the hydraulic system pressure gage on the right upper panel. When the landing gear and flap selector valves are not in use, the gage shows zero; as the landing gear is operated, the flow pressure shows about 100 lbs; when the landing gear has completed its motion and all three wheels are "Home", the gage jumps to the relief pressure of 900 lbs.

(j) Stopping Engines

Air cooled engines cool rapidly and should not be shut down too quickly except in extreme emergencies.

In stopping, the engine shall be allowed to turn over at 800 to 1000 RPM for a few minutes to allow the cylinders to cool properly. Then the mixture lever shall be pulled back to the Idle "Cut-Off" position.

Afterwards, shut-off the fuel valves and turn-off the ignition and master switches.

(k) Mixture Control

The following expressions are used in manual adjustment of the mixture control:

"Full Rich" is the setting of the mixture control lever in the position giving the maximum fuel flow.

"Best Power" is the setting of the mixture control lever which, with a given fixed throttle setting, results in the maximum engine RPM. At leanest fuel flow, further leaning of the mixture control would cause a decrease in the engine RPM.

"Smooth Operation". The setting for "Best Power is obtained and then the mixture enriched until the engine speed drops 20 or 30 RPM.

"Maximum Economy" is obtained by adjusting to "Best Power" and then leaning to obtain a decrease of 40 to 50 RPM.

IDLE "CUT-OFF"

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 full aft position on the mixture segment. This portion of the control unit is marked in RED.

(l) Cylinder Temperatures

There are two cylinder head temperature gages provided, one for each engine. A thermocouple is attached at the spark plug of cylinder #2.

Maximum allowable temperatures are:

Take Off and Climb	500°F.	(260°C.)
Continuous Operation	465°F.	(240°C.)

(m) Carburetor Air Pre-Heat Controls

The carburetor air preheat duct, mounted below the carburetor, is fitted with a mixing valve arrangement which is controlled by push-pull "T" handles on the pilot's upper rear panel. Pull for heat, then rotate to lock.

Hot or cold air, or any desired mixture of both, may be supplied to the carburetor. Temperatures of intake air at the carburetors are indicated at the pilot's instrument panel. A total heat rise of 60° is available at an outside air temperature of 30° F.

As shown by the fuel system diagram, page 32 the system is essentially a complete separate unit for each engine, and is normally used as such with each tank feeding its own engine directly.

Fuel should conform to A.S.T.M. Spec. for 87 Octane Fuel.

To drain the auxiliary tank, open the drain cock, accessible through the floor hand plate, and remove the outside red plug at the left chine.

5. FUEL SYSTEM

The fuel is carried in two integral wing tanks (54 gals. each) and an auxiliary tank (30 gals.) in the forward L.H. corner of the cabin. The auxiliary tank may be omitted.

Wing Tanks (54 gals. each)	108 gals.
Reserve Tank (Optional)	30 gals.
Total Fuel Capacity	138 gals.

An electric fuel quantity gage for each wing tank is provided on the pilot's instrument panel. They are controlled by a switch on the pilot's electrical panel.

A fuel strainer, wobble pump, and relief valve are mounted in each nacelle.

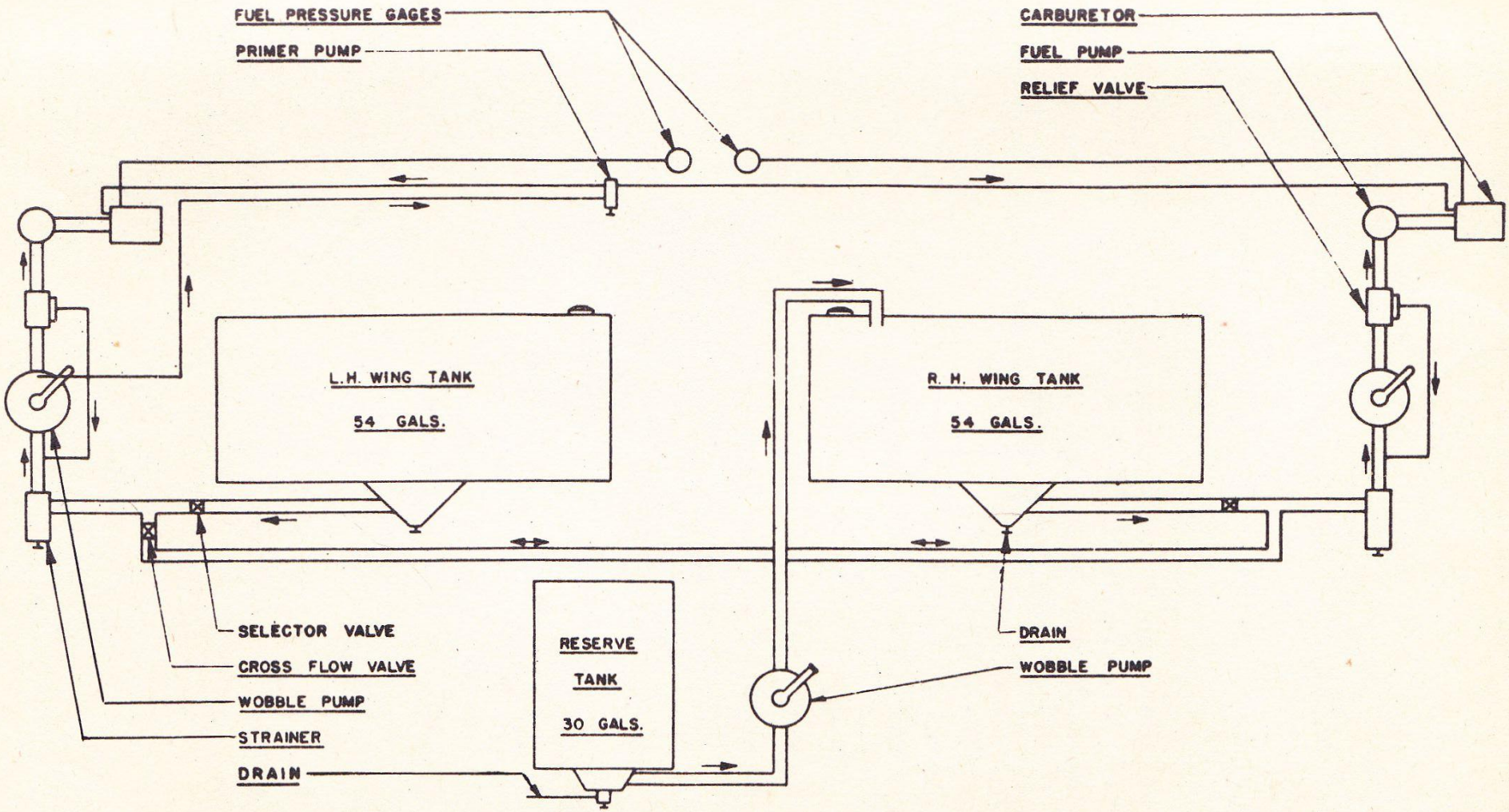
The wobble pumps are operated by remote control from the pilot's upper rear panel.

The auxiliary wobble pump for the reserve fuel tank is located under the co-pilot's seat.

NOTE: Reserve fuel must be pumped into the right wing tank before it can be utilized by the engines.

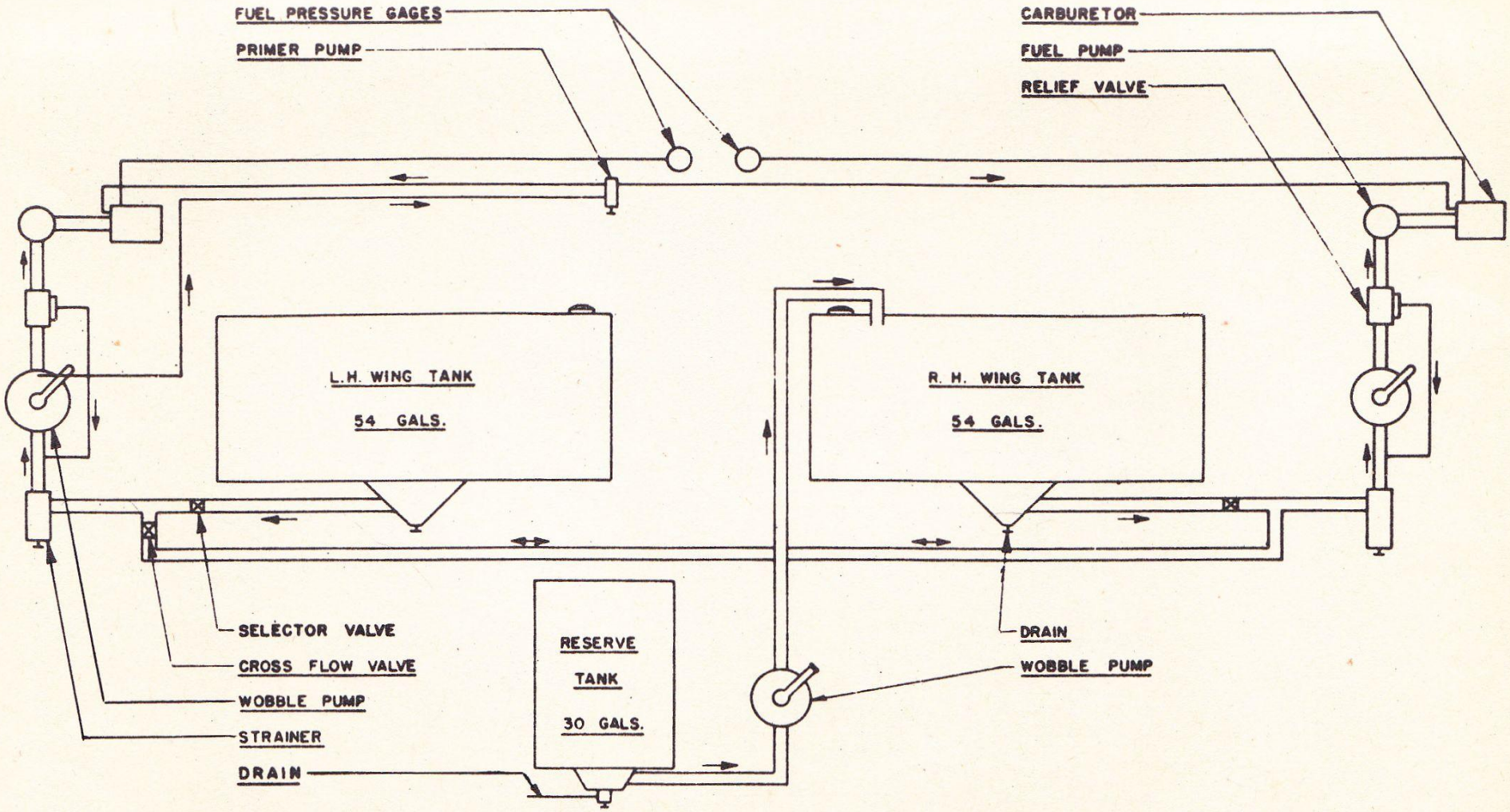
There is a cross-flow connection with a shut-off valve, enabling both engines to be run simultaneously from either tank. When using the shut-off valve, the valve on the tank not being used should be closed. If a tank should run dry when all three valves were open, air would enter both systems resulting in engine failure.

It should be remembered that for both engines to run, two valves must be on (down) and that three valves should not be on at once if the fuel is very low.



FUEL SYSTEM DIAGRAM
MODEL J4F-1

FIG. 4



FUEL SYSTEM DIAGRAM

MODEL J4F-1

FIG. 4

6. OIL SYSTEM

The oil for each engine is carried in a single tank, one in each engine nacelle, aft of the fire-wall. Tank capacity is $3\frac{1}{2}$ gals., plus 1 gal. foaming space.

Situated at the left side of each engine is a 5" dia. oil cooler with thermostatic oil temperature control. It maintains the "Oil In" temperature at approximately 140° F. (60°C.) to 170°F. (77°C.). The thermostatic control valve causes the oil to by-pass the cooler when the "Oil In" temperature is below approximately 120°F. (49°C.), returning the oil to the upper section of the tank.

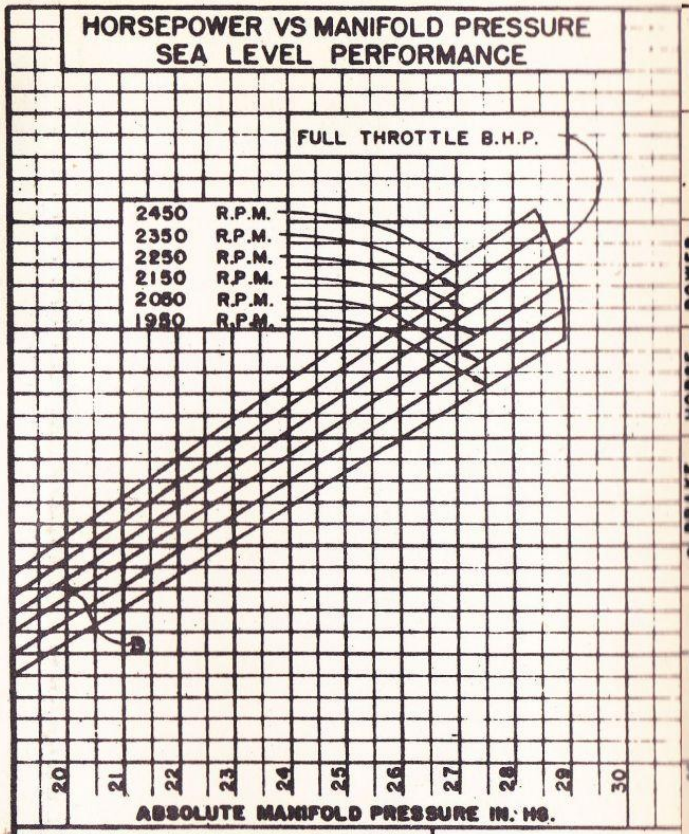
A vent line is provided between the top of the oil tank and the rear of the crankcase.

Temperatures	Desired	140°F (60°C) to 170°F (77°C)
	Maximum	200°F (93°C)
Pressures	Desired	60 p.s.i.
	Maximum	70 p.s.i.
	Minimum Cruising	50 p.s.i.
	Minimum Idling	15 p.s.i.

An oil drain valve is installed at the bottom of the tank.

Lubricating oils must conform to Army Spec. 1120.

HORSEPOWER VS MANIFOLD PRESSURE SEA LEVEL PERFORMANCE



TO FIND ACTUAL H.P., GIVEN DATA FOR: ALT., R.P.M., MAN. PRESS., & CARB. AIR TEMP.

1. LOCATE 'A' ON FULL THROTTLE ALT. CURVE FOR GIVEN R.P.M. & MAN. PRESS.
2. LOCATE 'B' ON SEA LEVEL CURVE FOR R.P.M. & MAN. PRESS. & TRANSFER TO 'C'.
3. CONNECT 'A' & 'C' BY STRAIGHT LINE AND READ H.P. AT GIVEN ALTITUDE 'D'.
4. MODIFY H.P. AT 'D' FOR VARIATION OF CARB. AIR TEMP. 'T' FROM STANDARD ALTITUDE TEMP. 'Ts' BY FORMULA:-

(APPROXIMATELY 1% CORRECTION FOR EACH 10° VARIATION FROM 'Ts'.)

EXAMPLE

ALTITUDE = 6,000 FT.
R.P.M. = 2,200
MAN. PRESS. = 20 IN. HG.
CARB. AIR TEMP. 'T' = 50 °F.
'Ts' AT 6000 FT. = 39 °F.
'B' H.P. = 115
'D' H.P. = 128

$$\text{'D' H.P.} \times \sqrt{\frac{460 + Ts}{460 + T}} =$$

ACTUAL H.P. = 122.5

HORSEPOWER & MANIFOLD PRESSURE ALTITUDE PERFORMANCE

RANGER 6-440-C5 ENGINE PERFORMANCE CURVES

COMPRESSION RATIO 7.5: 1
CARBURETOR NAR-48
FUEL 87 OCTANE

C-744

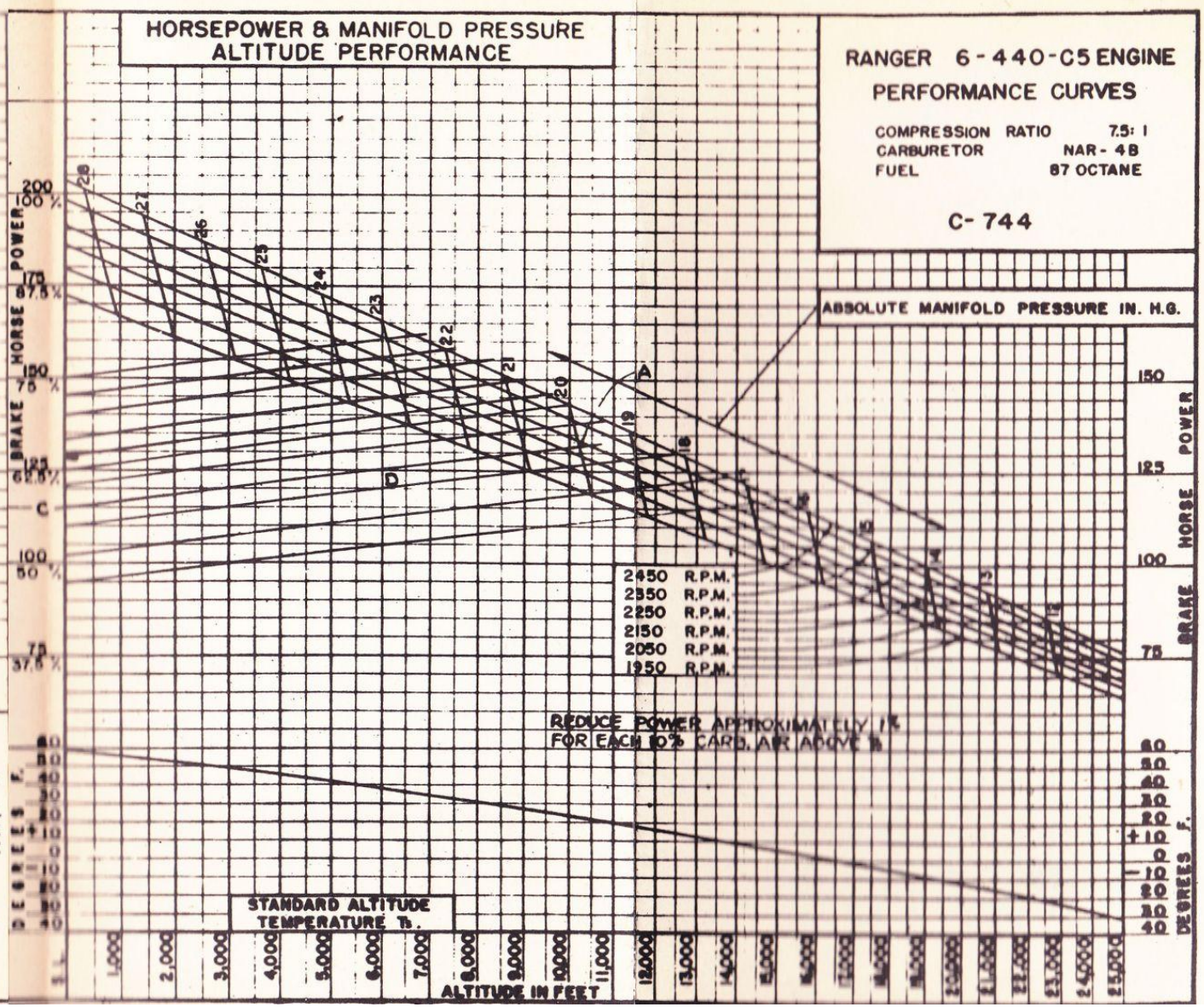


TABLE OF OPERATING CONDITIONS

Propeller Sensenich 82RS-72 Ranger Engine Model 6-440C-5

OPERATING CONDITIONS	ALTITUDE FEET	PERMISSIBLE R.P.M.	% RATED POWER	MAX. ABS. MAN. PRESS.	MAX. CYL. HEAD TEMP.	MIXTURE CONTROL
Starting	S.L.	800 to 1000	--	---	---	Full Rich
Take-Off	S.L.	2450	100	29.0" Hg.	500°F(260°C)	Full Rich
Cruising Max. Power	S.L.	2260	75	23.5" Hg.	465°F(240°C)	Best Power
	4000	2330	75	22.5" Hg.	465°F(240°C)	Best Power
	8000	2370	75	21.5" Hg.	465°F(240°C)	Best Power
Cruising Recommended	S.L.	2150	62½	22.0" Hg.	465°F(240°C)	Smooth Operation
	4000	2200	62½	21.0" Hg.	465°F(240°C)	Smooth Operation
	8000	2250	62½	20.0" Hg.	465°F(240°C)	Smooth Operation
Cruising Economical	S.L.	1975	50	19.5" Hg.	465°F(240°C)	Maximum Economy
	4000	2025	50	18.5" Hg.	465°F(240°C)	Maximum Economy
	8000	2075	50	17.5" Hg.	465°F(240°C)	Maximum Economy
Stopping	S.L.	800 to 1000	-	---	---	Idle Cut Off

Oil Pressure 50 to 70 p.s.i. except idling 15 p.s.i.
Oil Temperature 140°F(60°C) to 170°F(77°C) Maximum 200°F(93°C)
Fuel Pressure 2.5 to 3.5 p.s.i. Maximum Allowable R.P.M. 2550

FIG. 7

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FIG. 7

7. NORMAL INSTRUMENT READINGS

The following instrument readings were taken on a cruising flight at 500 ft. altitude.

RPM	2150 - 2150
Mixture	Smooth Operation
Fuel Pressure	3.0 p.s.i. - 3.2 p.s.i.
Oil Pressure	52 p.s.i.-48 p.s.i.
Oil Temperature	50°C - 50°C
Cylinder Temperature	170°C - 160°C
Carburetor Air Temperature	25°C - 27°C
Airspeed	112 knots
Outside Air Temperature	20°C

III

FLYING CHARACTERISTICS

1. BALANCE

Condition	Weight	C.G. Location	% M.A.C.
Empty	3211	17.65	20.42
Normal Utility	4500	18.30	21.42
Max. Forward	(Any Wt. Cond.)		15.77
Max. Rearward	(Any Wt., Cond.)		19.23

Note: The C.G. Locations are aft of the Datum line which is the L.E. of the wing at its root.

No disposable baggage should be carried in the bow compartment.

Refer to the Erection & Maintenance Instructions for this aeroplane for a complete weights breakdown.

2. MANEUVERS

Although this airplane, Class VJ Amphibian is not designed for combat work, its excellent maneuverability has been successfully demonstrated.

Flight characteristics and maneuverability have satisfactorily met the requirements of the C.A.A.

3. USE OF FLAPS

Deflection of the trailing edge flaps opens slots at their leading edge, thus obtaining the advantage of a relatively high lift and low drag at small angles. They are, therefore, much more effective than split flaps during such low speed operations as take-off, climb and single engine performance.

Best flap position for Take-Off:

Take-Off	20°
Climb	0° to 12°

4 SINGLE ENGINE FLIGHT

In the event of failure of one engine, the operating engine should be opened to full power and the plane retrimmed. The indicated air speed should be held to 90 MPH at 4000 ft or 95 MPH near sea level in order to best maintain altitude or achieve minimum rate of descent.

The ability to fly well on one engine improves rapidly as the load is decreased. At full gross load of 4500 pounds, single engine flight is seriously affected by turbulence, ragged flying, rain on the wings, etc. Unless the inoperative engine is rough, as from a mechanical failure, the throttle should be opened to permit maximum wind-milling rpm. However, in very cold weather, the congealing of the oil will eventually stop the engine.

Procedure for Single Engine Flight

1. Operating Engine
   Full Rich Mixture
   Full Throttle
   Zero or minimum carburetor heat.

2. Inoperative Engine
   If turning smoothly - Cut Switch - Full Throttle.

   If rough - Close Throttle - Cut Switch
   If desired to decrease load - Leave fuel valve on, unless danger of fire from spitting.

3. Trim with rudder tab

4. Assume 90 mph - 4000 ft or above
   Assume 95 mph - 1000 ft. or below

5. TAXIING

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 feet deep.

Following water maneuvering with wheels down, the use of the emergency hand hydraulic pump will be found convenient for retracting the gear after the engines are stopped.

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.

6. SPRAY REDUCTION

The durability of the propellers is greatly reduced if they are subjected to severe spray conditions. A little thought and attention by the pilot will eliminate a great deal of the spray thrown outward from the hull.

It will be noted that at all normal taxiing speeds, the bow wave lies flat and passes well below the propellers. As the speed increases, the point at which the bow wave leaves the chine moves rapidly rearward until it is soon entirely behind the propellers. However, the speed creates a feather of spray that strikes the tips for a moment before this point is reached. This can be clearly observed when the water is calm, though the pattern is distorted in rough water.

The pilot should reduce the spray-beating period by getting through it rapidly and by holding the bow as high as possible to get the spray well aft early in the run.

It is suggested that power be applied moderately as the plane accelerates to the spray point at which time the throttles should be fully advanced smartly and the wheel held full back.

Spray conditions are frequently less in rough or choppy waters because the stronger wind reduces the critical period. However, a little care in choice of time and position of take-off will avoid passing through higher than average waves at the critical conditions. For example, the pilot should clear his own waves after a downwind taxi before starting the take-off.

Adherence to these suggestions will decrease propeller deterioration.

As on any flying boat, the torque during take-off will cause a list to the left which may be disregarded. It is more noticeable under no-wind conditions. A very slight turn to the left during the start of the take-off will assist in raising the left float early.

CHECK-OFF LISTS

TAKE-OFF

1. Fuel ——— On
   Best Tank Combination
2. Mixture ——— Full Rich
3. Carburetor Heat ——— On Cold
4. Elevator Tab ——— Neutral
5. Rudder Tab ——— Neutral
6. Tail Wheel ——— Locked
7. Flaps ——— 20° or as desired

FLIGHT (Cruising)

1. Wheels ——— Retracted
2. Oil Pressure ——— 50 lbs. Min.
3. Oil Temperature ——— 200° F. Max.
4. Fuel Pressure ——— 2.5 to 3.5 p.s.i.
5. Carburetor Heat ——— Cold Unless Needed

LANDING

1. Landing Gear ——— Down-Land, Up-Water
2. Mixture ——— Full Rich
3. Fuel ——— Best Tank combination
4. Tail Wheel ——— Locked
5. Flaps ——— 40° or as desired