RESTRICTED

HANDBOOK
OF
OPERATION & FLIGHT INSTRUCTIONS
FOR THE
MODEL B-26

PUBLISHED BY AUTHORITY
OF
THE CHIEF OF THE AIR CORPS

RESTRICTED

HANDBOOK
OF
OPERATION AND FLIGHT INSTRUCTIONS
FOR THE
MODEL B-26 BOMBARDMENT AIRPLANE

MANUFACTURED BY

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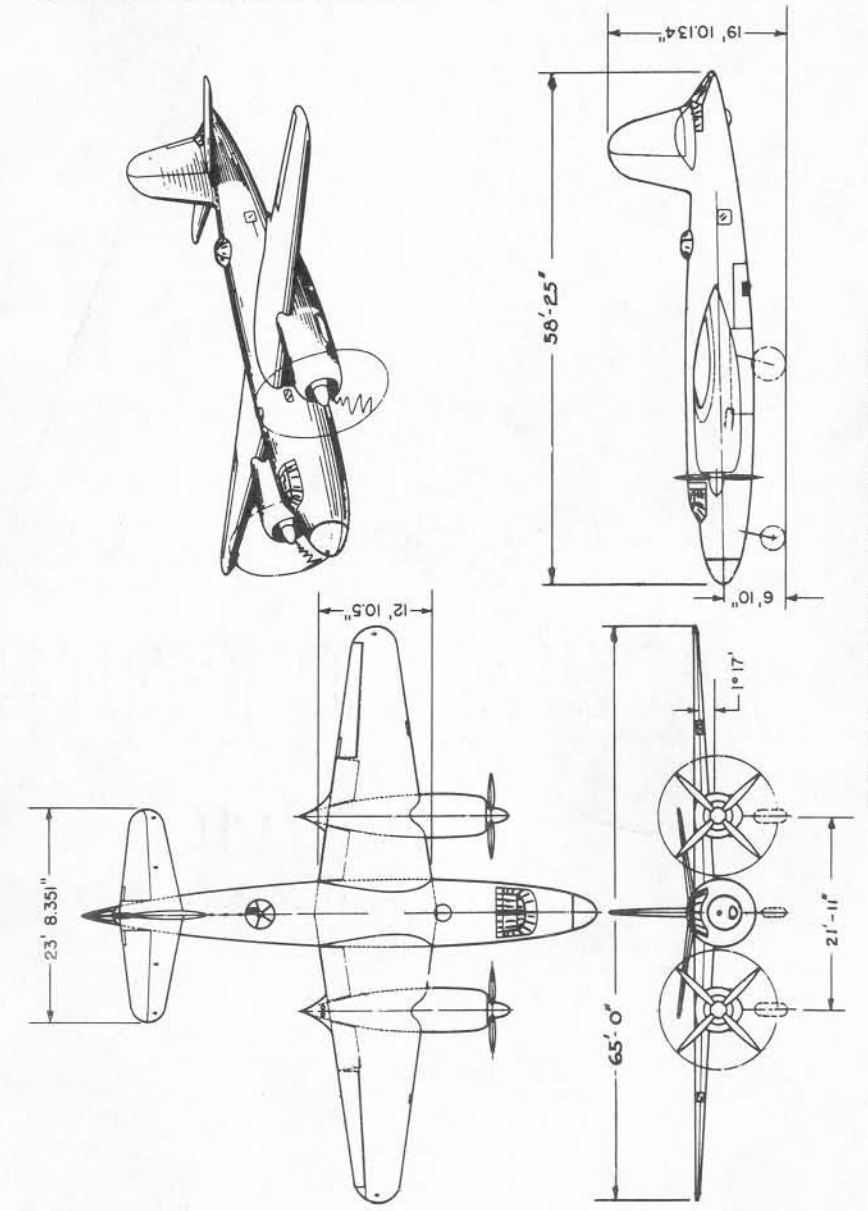


FIGURE 2 GENERAL ASSEMBLY - 3 VIEW

SECTION I

INTRODUCTION

1. This technical order is the operation and flight instructions for the model B-26 airplane. Pilots and other personnel who are required to understand the operation of this airplane will read and be familiar with the information contained herein.

2. One copy is being furnished to be carried in each airplane.

3. Reference has been made in this Handbook to the following Technical Orders and Handbooks which contain applicable data and instructions:

Technical Order No.	
00-20A	The Visual Inspection System for Airplanes
06-10-1	Aircraft Engine Lubricating Oil - Grade & Use
02-10GA-1	**Operation and Flight Instructions-R-2800-5 Engines
03-20BA-1	Handbook of Operation-Curtiss Electric Propellers

**Operation Instructions incorporated in this Handbook under Power Plant Section VI

SECTION II

DESCRIPTION AND OPERATION

1. Airplane

a. General Description:- The B-26 Airplane is a high-wing monoplane of all metal construction; incorporating a retractable main and nose landing gear, hydraulically operated brakes, wing flaps of the split trailing edge type, provisions for de-icer equipment (including complete propeller anti-icers) and sound-proofed pilot's and navigator's compartments. It is powered with two R-2800-5 ingines. There are no flotation provisions in the airplane.

b. Dimensions:- The overall dimensions of the airplane are:

Overall Span	65 ft. 0 in.
Overall Length	58 ft. 2.5 in.
Overall Height, Thrust Line Level, at rest	19 ft. 10.3 in.
Height, propeller hub, thrust line level, at rest	7 ft. 6 in.
Ground Clearance, propeller tip, thrust line level, at rest	9 in.
Fuselage Clearance, propeller tip	9 in.

2. Wings

a. General Description:- (1) The wing is built in three sections consisting of a center section integral with the fuselage, and two detachable outer panels of all metal, box type, aluminum alloy riveted construction. The outer panel tips are detachable. The engines are carried on the outer wing panels.

(2) Slotted flaps hydraulically operated,

extend from the side of the fuselage to the inboard side of the nacelle, and from the outboard side of the nacelle to the aileron.

(3) A cutout in the lower skin of each outer panel allows full retraction of the landing gear. The lower skin in the region of the fuel cells is removable. (Note:- These portions of the lower skin must not be removed unless the weight of the engines is relieved from the wing panels).

b. Ailerons:- Ailerons of torsion box construction extend from the end of the flaps to the wing tips. The spar ribs, leading and trailing edge, are of aluminum alloy and the area aft of the spar is fabric covered. Ailerons are equipped with trim tabs adjustable in flight.

c. Dimensions:-

(1) Wings

Airfoil Section, Root	NACA 0017-64
Airfoil Section, Tip	NACA 0010-64
Total Area including ailerons and section within fuselage	602 ft.^{2}
Chord, root	12 ft. 10.5 in.
Dihedral of Leading Edge	
Center Panel	0°
Outer Panels	1° 17'
Sweepback, leading edge	56 in.
Aspect Ratio	7.03:1
Taper Ratio	3:1
Incidence, Theoretical Chord Line	3° 30'

(2) Ailerons

Area to hinge center line, each aileron including tabs	18.42 sq. ft.
Area, each tab	118.42 sq. in.

3. Empennage

a. General Description:- (1) The empennage assembly consists of fixed cantilever type horizontal and vertical stabilizers, and elevator and rudder panels. The horizontal stabilizers of all metal construction are attached to two forged spars which are built into the aft section of the fuselage. The front spar is machined to receive the hinge fittings of the vertical stabilizer. The latter of all metal construction is further attached to the fuselage by means of $\frac{1}{4}$" screws around its contour. The elevators and rudder are of metal spar and rib construction, fabric covered. They are both statically and aerodynamically balanced and are fitted with combination balance and trim tabs of which the latter are adjustable in flight. The balance feature is set at the factory and should not be changed.

b. Dimensions:-

(1) Horizontal Stabilizer

Overall span	23 ft. 9 in.
Area including fuselage area and elevator balance	87.4 sq. ft.
Incidence	1/2°
Dihedral	8°

(2) Vertical Stabilizer

Area to hinge line	40.2 sq. ft.

(3) Rudder

Area to hinge centerline including tabs	26.2 sq. ft.
Area, tab.	250. sq. in.

(4) Elevators

Area to hinge centerline including tabs	41.1 sq. ft.
Area tabs.	262. sq. in.

4. Fuselage

a General Description:- (1) The fuselage is of aluminum alloy semi-monocoque construction. It is built in three sections, i.e.,

Forward Section	- Bomber Forward Gunner, Pilot and Co-pilot. Navigator and Radio Operator
Center Section	- Forward Bomb Bay, Aft Bomb Bay
Tail Section	- Rear Gunner, Turret Gunner, Floor Gunner, Tail Gunner

The Forward Section is provided with a removable transparent nose section of moulded one piece construction. The Aft Tail Section is provided with a tail cone fairing.

b. Entrance Doors: (1) Entrance to the forward section is through the main hatch door in the nose wheel well. It cannot be used when the nose wheel is retracted.

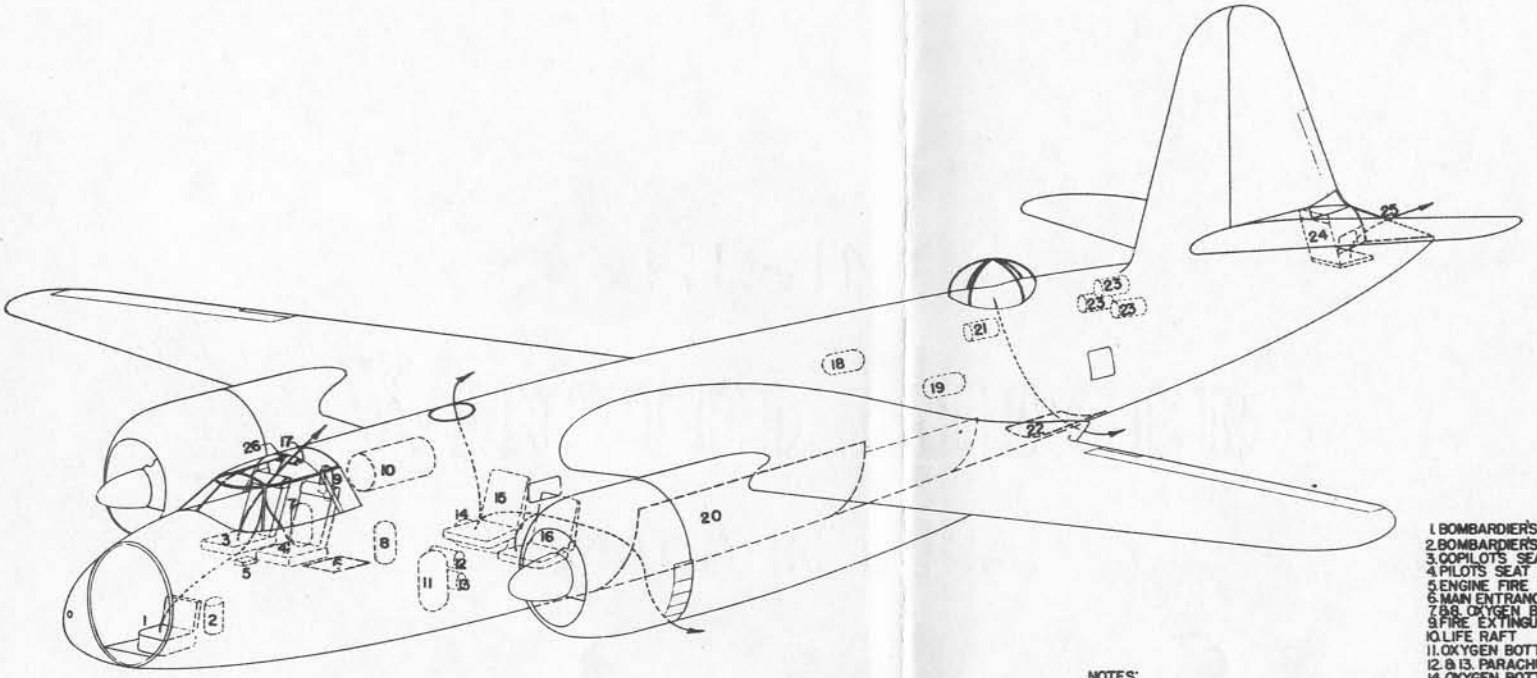
(2) Entrance to the aft section is through the camera door.

*

c. Emergency Exits:- are provided through (1) the top of the pilot's enclosure.
(2) the navigator's observation hatch
(3) the bomb bay doors
(4) the tail cone.

All doors and exits, except the bomb bay doors and tail cone, may be opened from either inside or outside. One key operates the locks of both main entrance doors.

*NOTE See page 12 for Exit Diagram.



NOTES:

ENTRANCE HATCH MAY BE USED AS AN ESCAPE IF NOSE WHEEL IS EXTENDED.

BOMB BAY MUST BE EMPTY BEFORE IT MAY BE USED AS AN EMERGENCY EXIT.

1. BOMBARDIER'S SEAT
2. BOMBARDIER'S PARACHUTE STOWAGE
3. COPILOTS SEAT
4. PILOTS SEAT
5. ENGINE FIRE EXTINGUISHER CONTROL
6. MAIN ENTRANCE HATCH
7. & 8. OXYGEN BOTTLES
9. FIRE EXTINGUISHER HAND CO_2
10. LIFE RAFT
11. OXYGEN BOTTLE
12. & 13. PARACHUTE STOWAGE
14. OXYGEN BOTTLE
15. NAVIGATORS SEAT
16. RADIO OPERATORS SEAT
17. EMERGENCY BOMB RELEASE
18. & 19. OXYGEN BOTTLES
20. FORWARD BOMB BAY
21. PARACHUTE STOWAGE
22. CAMERA HATCH
23. PARACHUTE STOWAGE
24. REAR GUNNERS SEAT
25. REAR GUNNERS EMERGENCY EXIT. HATCH
26. EMERGENCY BRAKE CONTROL

FIGURE 3 EMERGENCY EQUIPMENT & EXITS.

2-15-41

5. Landing Gear and Nose Wheel

a. General Description:- (1) The main landing gear consists of two independent units, one mounted under each nacelle and so arranged that they may be completely retracted into the nacelle. The nose gear consists of a single unit mounted under the nose of the fuselage and so arranged that it may be retracted into the bottom of the fuselage. Both main and nose gear are hydraulically operated, and are equipped with hydraulic shock absorber struts and hydraulic brakes. Hydraulically operated doors enclose all wheels in the retracted position.

(2) The main gear and nose gear are equipped with position locks as follows:

Downlocks - Direct type, spring loaded, hydraulic. Unlocked by hydraulic pressure and locked by spring loading.

Uplocks -By-pass type, spring loaded, hydraulic. Unlocked by hydraulic pressure and locked by spring loading.

b. Dimensions:

Main Gear

Tread	21 ft. 11 in.
Centerline of axle aft of leading edge	56.62 in.
Size of tire	SC. 47 in. Dia.

Nose Gear

Size of Tire	SC. 33 in. Dia.

c. Operation, Landing Gear: Tabulation and location of controls is given in Section III, Page 32. The operation of the Main Gear and the Nose Gear occurs simultaneously as follows:

(1) Normal operation is achieved by the retraction or extension of the hydraulic operating cylinders. Pressure is obtained in the hydraulic system by two engine driven pumps. In the event of failure of the engine driven pumps, pressure may be obtained by a hand pump. A lock is provided on the main control handle to prevent inadverdent retraction. The handle should remain down between landings and take-offs

(2) Emergency operation is achieved through shuttle valves and the emergency control valves, which allow the hand pump pressure to operate the doors and locks of the nose wheel, and the main gear through a separate isolated system. Using the nose wheel lever first, the hand pump pressure must be utilized to pump the nose wheel to "down" and locked position. Then using the main gear lever, the hand pump pressure need only open the doors and release the "up" lock where upon the gravity and air forces will then extend the gear to "down" and locked position. In the event that the main gear can not be released, landing with nose wheel extended will minimize the damage to the fuselage.

WARNING: Never put main gear down first as it may happen that the nose wheel may be out of commission, and therefore result in loss of ship and serious injury to personnel Therefore, if nose gear is tried first, and nose gear fails to operate, no attempt should be made to extend the main gear, thus requiring landing on bottom of fuselage The sequence of emergency operation is as follows:

Use emergency only after gage pressure drops below 130 lbs.

a) Landing Gear Lever Down

b) Emergency Nose Gear Lever Emergency (down)

c) Supply Pressure with Emergency Pump.
   1) Nose gear doors open.
   2) Nose gear uplocks are released.

d) Nose gear moves to down-locked position.

e) Return Nose Gear Emergency Lever to Neutral.

f) Emergency Main Gear Lever Emergency (down)

g) Supply Pressure with Emergency Pump.
   1) Main gear doors open.
   2) Main gear uplocks are released.

h) Main gear falls into place.

i) Put both emergency levers to normal.

j) Return landing gear lever to normal.

k) Hand pump for flaps and brakes

(3) Position indicator in the pilot's compartment indicates when the main and nose gears are in the extended position and the downlocks in place. A signal horn in the pilot's compartment warns when either gear is not in the extended and locked position.

d. Operation, Brakes: The Brakes are operated by toe pressure applied to the rudder brake pedals. Hydraulic pressure is transmitted to the brakes through the power brake control valve, each wheel operating independently of the other.

NOTE: WARNING: The high pressure brakes on this airplane generate heat rapidly at present and frequent brake landings in rapid succession will cause abnormal heat generation in the service brakes which is apt to cause leakage of dydraulic fluid after cooling. Therefore, pending receipt of further data from the Air Corps on service brake operation, a period of not less than 15 min. must elapse between brake landings except in emergency.

To set brakes for parking, proceed as follows: Set brakes firmly by depressing both brake pedals equally, pull back parking lever located on left side of control pedestal, remove pressure from pedals and release lever.

CAUTION: The hydraulic system pressure gage, located on the control pedestal must show at least 850 pounds per square inch pressure when the airplane is parked. This pressure can be obtained by running engines, prior to parking, which will allow the accumulator to charge to its full capacity and insure maximum fluid capacity for parking periods. Slight internal leaks may otherwise deplete a small supply and defeat the purpose of parking.

To release brakes from parked condition, depress both pedals equally and spring will release locking ratchets.

An intermittent pull on the emergency handle, located on the crown center between pilot and co-pilot, releases air pressure, through separate lines and shuttle valves, directly to the brake cylinders on each wheel, and applies the brake shoes. Brakes are released after emergency use by relieving air pressure in the lines through Emergency Brake Bleed valve in the pilot compartment above the door to the radio compartment. CAUTION: Emergency brake air bleed valve should not be opened until airplane is in charge of ground crew as sufficient pressure may not remain for taxiing control.

WARNING: Pilots of short stature are cautioned to adjust seat in the foremost position and check for full brake pedal travel and full application of brakes, before taking off.

6. Controls, (Flight)

a. General Description: (1) The airplane is equipped with dual controls of a type allowing the pilot and co-pilot to be seated side by side. Each has individual control column and set of rudder pedals which are interconnected respectively. Only the pilots station is equipped with brake pedals. The treads of the co-pilot's pedals can be stowed by pressing a small lever on the tread and rotating the tread rearward about 90 degrees until an engaging pin snaps into a hole. Adjustment for leg length is not provided directly on the rudder pedals but may be accomplished by adjusting the seats fore or aft to suit. Main control surface movement is as follows:

Left Aileron Down	15°	Right Aileron Down	15°
Right Aileron Up	18°	Left Aileron Up	18°
Right Rudder	25°	Elevator Down	12°
Left Rudder	25°	Elevator Up	20°

(2) The elevator trim tab control wheel is located on the left side of the control pedestal, convenient to the pilot. It can be reached by the co-pilot. The rudder and aileron tab controls consist of a combination concentric unit mounted on the ceiling and accessible to either pilot or co-pilot. A knob and a crank on this unit operate the aileron and rudder tabs respectively. Position indicators graduated in degrees for elevator, rudder and aileron tabs are incorporated in their respective cockpit control units. The relation between the rotation of the cockpit units and their corresponding surface movement is noted below:

Control	Rotation	Tab Motion	
Elevator Wheel	Forward and Down	Up	18½°
	Opposite	Down	35°
Rudder Crank	Clockwise	Left	15°
	Counter-clockwise	Right	15°
Aileron Knob	Clockwise	*Left Tab Up	11°
		*Right Tab Down	16°
	Counter-clockwise	*Left Tab Down	16°
		*Right Tab Up	11°

*NOTE: Taken from initial neutral setting of 5° Up

7. Hydraulic Pneumatic Systems

a. General Description: (1) The Hydraulic system of the Model B-26 Airplane is designed for use with a mineral oil conforming with Army Specification 3580-A, and for this reason, oil used should be bought from Army Approved sources.

(2) The system has been designed to avoid all sources of leakage. Under all normal conditions, no leakage should be evident in the system at zero to 1150 pounds per square inch pressure. The following is a tabulation of all hydraulic and pneumatic operating units:

UNIT	LOCATION	FUNCTION
Cylinder (2)	Nacelle	Oil Cooler Shutter Operation
Cylinder (2)	Nacelle	Cowl Flap Operation
Cylinder (2)	Nacelle	Landing Gear Door Operation
Cylinder (4)	Nacelle	Landing Gear Retraction
Cylinder (2)	Nacelle	Landing Gear Down Lock
Cylinder (2)	Nacelle	Landing Gear Up Lock
Valve (4)	Nacelle	Time Sequence - Main Gear
Pump (2)	Nacelle	Hydraulic Pressure
Filter (2)	Nacelle	Cleaning Fluid
Valve (2)	Nacelle(L.H. Only)	Test Outlet

UNIT	LOCATION	FUNCTION
Cylinder (1)	Pilot Compartment	Nose Wheel Operating
Cylinder (1)	Pilot Compartment	Nose Wheel Door Operating
Cylinder (1)	Pilot Compartment	Nose Wheel Down Lock
Cylinder (1)	Pilot Compartment	Nose Wheel Up Lock
Valve (2)	Pilot Compartment	Time Sequence - Nose Wheel
Valve (1)	Pilot Compartment	Brake Control
Valve (1)	Bombardier's Compartment	Bomb Door Operating
Valve (1)	Pilot Compartment	Wing & Cowl Flap Operating
Valve (1)	Pilot Compartment	Landing Gear Operating
Valve (1)	Pilot Compartment	Emergency Landing Gear
Pump (1)	Pilot Compartment	Emergency Hand
Valve (1)	Pilot Compartment	Relief
Valve (2)	Nacelle	Check
Valve (3)	Pilot Compartment	Check
Valve (8)	Pilot Compartment(3) Nacelle (2) Fore & Aft Bomb Bay (3)	Shuttle
Cylinder (2)	Forward Bomb Bay	Bomb Door Operating
Cylinder (1)	Aft. Bomb Bay	Bomb Door Operating
Reservoir (1)	Fwd. Bomb Bay	Fluid Supply
Accumulator (1)	Aft. Bomb Bay - (Fwd. Bomb Bay, 101st Airplane)	Pressure Equalizer
Gauge-(1)	Pilot Compartment	Hydraulic Pressure
Gauge-(3)	Nav.(1)Aft.B.B.(2)	Air Pressure
Cylinder (1)	Fwd. Bomb Bay	Wing Flap Operating
Air Release Valves (3)	Bomb Bay (For & Aft.)	Emergency Release
Regulator (1)	Aft. Bomb Bay	Pressure Regulation
Valve (1)	Aft. Bomb Bay	Relief
Valve & Restrictor (1)	Fwd. Bomb Bay	Retard Operation of wing flaps

UNIT	LOCATION	FUNCTION
Valve (1)	Pilot Compartment	Oil Cooler Flap Operating
Valve Restrictor (4)	Nacelle	Oil Cooler & Engine Cowl Flap
Valve Restrictor (3)	Pilot Compartment & Nacelle	Landing Gear Door
Valve-Engine(2)	Nacelle	Relief
	Pneumatic System	
Pneumatic Cylinder(1)	Aft Bomb Bay	Emergency Bomb Release System
Handle (1)	Pilot Compartment	Emergency Bomb Door & Bomb Release
Air Valves(2)	Aft Bomb Bay	Emergency Bomb Door & Bomb Release System
Handle (1)	Pilot Compartment	Emergency Air Brake System
Air Bottle(1)	Aft Bomb Bay	Emergency Bomb Door & Bomb Release System
Air Bottle(1)	Navigator's Compartment	Emergency Air Brake System
Bleed Valve(1)	Pilot Compartment	Emergency Air Brake System
Checking Valve (1)	Navigator's Compartment	Emergency Air Brake System

b. Operation: The B-26 hydraulic units should be operated frequently to preclude possibilities of drying or permanent set of seals. Check the performance of each unit prior to each flight, (except landing gear units).

In order to maintain a successfully operating hydraulic system all lines in the system must be free of air pockets. Therefore all lines and units should be bled every 50 hours of operation, and immediately prior to flight after the airplane or the hydraulic system has been inoperative for more than 36 hours.

Bleeder plugs are located at the highest point on each operating unit, and the lines can be freed of air by backing off these plugs a few turns and operating the handpump. The system should be bled whenever the reservoir is drained.

The accumulator should be charged to the recommended air pressure (400 lbs. per sq. in.) given on the nameplate on the accumulator. This air pressure should be checked prior to each flight. The oil in the reservoir should be maintained at its proper level.

8. Fuel System

a. General Description:- (1) The fuel system is of the simplified transfer type, incorporating self sealing Mareng cells, electrically driven booster pumps and transfer pump.

(2) Priming is accomplished by means of a solenoid operated priming valve for each engine. The switch button for the solenoid should be held in the "on" position as long as priming is required. Releasing the button automatically stops the priming operation. Fuel pressure must be available for all priming operations.

(3) Booster pumps, in this airplane, replace the coventional hand operated or "wobble" pump. They draw fuel from main (inboard) wing tanks only and deliver it to the engine driven fuel pumps on each engine. They are to be used for building up initial fuel pressure when starting engines, and for rapid climbs during warm weather, and for altitude operation with warm gasoline. They may be left on as a safeguard during take-off. At other times they should be inoperative

(4) The transfer pump is used to draw fuel from the auxiliary (outboard) wing tanks and bomb bay tank and deliver it to the main (inboard) wing tank.

(5) Fuel transfer valves located on the rear face of the forward bomb bay bulkhead show

clearly the flow of fuel between tanks. Do not turn transfer pump on with valves "OFF", or turn valves to "OFF" with pumps running.

b. Tanks:- (1) Mareng Cells:- The Mareng Cell fuel tanks are constructed of synthetic material which is designed to prevent loss of fuel in the event of damage due to gunfire. There are four such tanks; two main (inboard) enclosed within the wing between the fuselage and the nacelle, and between the front and rear spars; two auxiliary (outboard) enclosed within the wing, outboard of the nacelle and between the front and rear spars. Each inboard tank consists of three interconnected self sealing cells and each outboard tank consists of two interconnected self sealing cells.

(2) Bomb Bay Tank:- The bomb bay tank is of aluminum alloy construction and is carried in the left hand side of the forward bomb bay. It is droppable in flight by means of the normal and emergency bombing controls.

c. Tank Capacities:- (1) Capacities are as follows:

Tank	Capacity	Total
(2) Main (Inboard)	360 gal. ea.	720
(2) Auxiliary (Outboard)	121 gal. ea.	242
(1) Bomb Bay	250 gal.	250
		1212

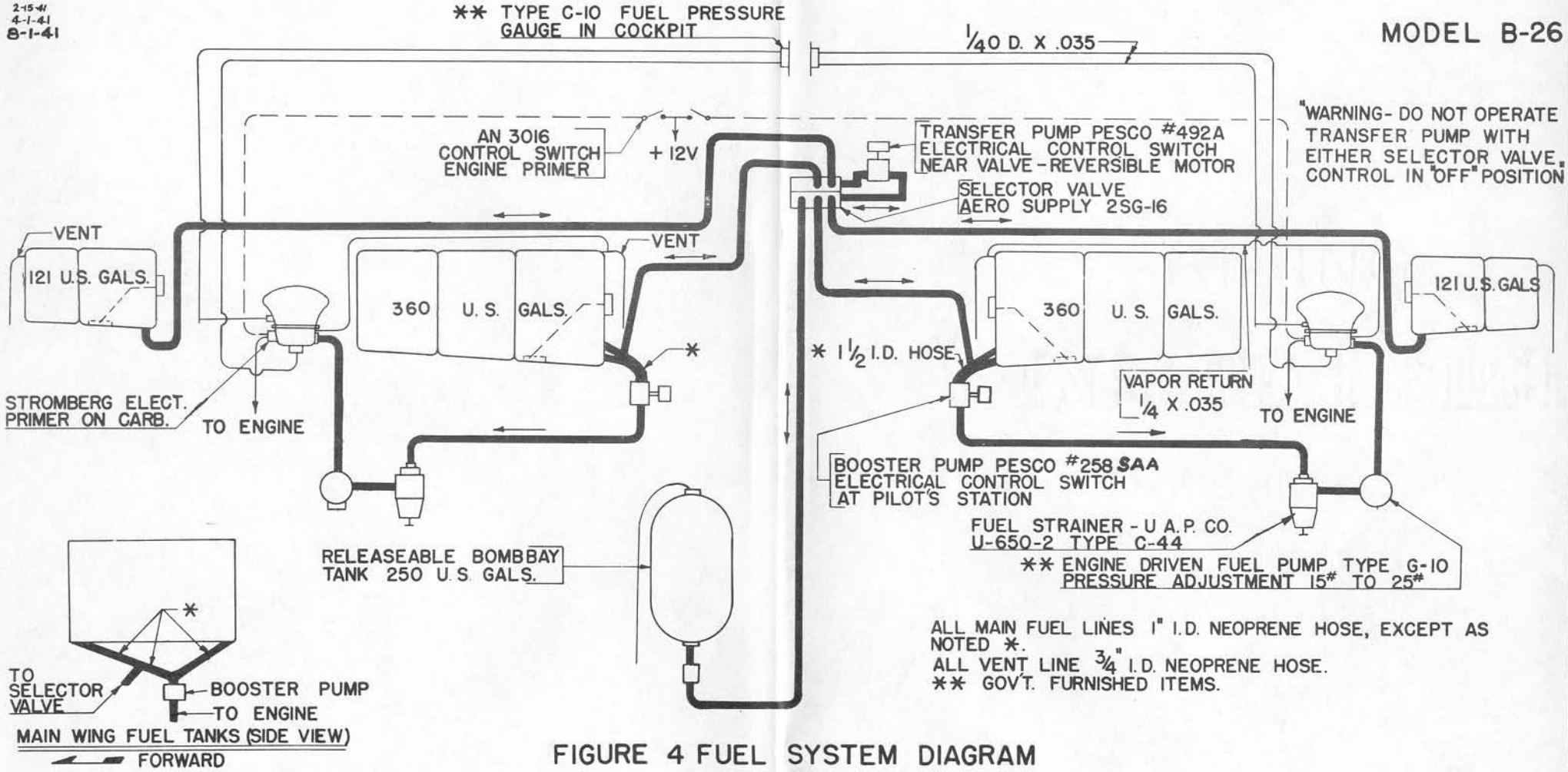


FIGURE 4 FUEL SYSTEM DIAGRAM

9. Oil System

a. General Description:- The engine oil system is of the conventional type with a tank for each engine mounted at the rear of, but removable with, each engine mount.

b. Tank Capacitys are as follows:

Each Tank	41.25 gal.
Total Capacity	82.5 gal.

c. Oil Radiators are supported below each engine mount with the "Y" drain valve adjacent. The inlet ducts to the radiators match the main ducts in the lower engine cowling. The outlet ducts are fitted with exit flaps hydraulically controlled by a valve conveniently located for the pilot. This exit flap supplements oil temperature control normally regulated by the Type D-5 thermostatic valve built into the oil radiators.

NOTE: The engine oil temperature bulb installation is in the engine, rather than the "Y" drain valve. Therefore, the temperature readings will be approximately 2° higher than recommended. This will have no deleterious effect on engine operation.

10. Fuselage Equipment

a. Seats and Cushions:-

Seat	Cushion
Pilot (1)	* 2
Copilot (1)	* 2
Bombardier (1)	** 2
Navigator (1)	* 2
Radio Operator (1)	* 2
Camera Operator (1)	** 1
Fatigue Position (3)	2 ea.*seat only
Tail Gunner (1)	** 2
	* mattress

* Life preserver type
** Non-life preserver type

Of the pairs of cushions provided at the pilot, co-pilot, radio operator and navigator seats, one of each pair may be removed to suit the type of parachute used.

b. Control Locks:- Provision is made for locking the control surfaces when moored. To lock aileron, elevator and rudder control surfaces, first obtain lock yoke from its stowage bag on the left forward side of Bulkhead 156½ just above the pilot's floor. Facing forward, rotate the pilot's control wheel counter-clockwise about 20° (left wing down) and place the yoke over the control wheel spoke. Secure yoke to pilot's control column by pressing it firmly to its seat in the base plate attached to the control column, turn key marked "Elevator" 90° clockwise and remove key. Take the "Elevator" and "Rudder" keys, which are connected together by a chain, to the tail of the ship. Open the inspection panel for the elevator quadrant on the left side of the ship. Neutralize the elevator quadrant with the 2 side fittings and insert the "Elevator" key all the way until the snap spring engages. Open the inspection panel for the rudder quadrant on the ceiling. Centralize the hole in the rudder quadrant with the hole in a lug on the stabilizer rear spar and insert the "Rudder" key all the way until the snap spring engages. The control surfaces and cockpit controls are now locked.

To disengage the locks from the surfaces and control column the above procedure is reversed.

CAUTION - Do not attempt to reverse "Elevator" key from lock yoke without first securing yoke to control wheel and column. Also, lock yoke cannot be removed from control wheel and column without first obtaining keys from elevator and rudder tail quadrants. Do not pry lock yoke free from control wheel and column by force.

c. Safety Belts:- Pilot's type safety belts are provided for the pilot, copilot, navigator, radio man, tail gunner and at each of the three fatigue seats. Gunner's type safety belts are provided for the bombardier where there are two support shackles, one for the bombardier and one for student bombardier, one at the tail gunner's station and one at the floor gunner's station. There is also a special type safety belt provided in the turret.

d. Relief Stations:- There are three relief stations, one at the forward end of the forward bomb bay on the left hand side, one on the left hand side of the rear bomb bay, and one in the tail compartment accessible to the tail gunner. A toilet with removable can is located under the deck turret structure on the right hand side of the aft compartment. The toilet paper container is on the bulkhead wall to the right of the toilet.

e. Flight Report Holder:- The airplane flight report holder and airplane data case containers are mounted on the left side of the ship near the pilot's shoulder.

f. Fire Extinguishers:- One CO_2 type fire extinguisher is installed in the pilot's compartment at the rear of the copilot. The Lux fire extinguisher system for the engines has its control in the floor between pilot and copilot. To operate, lift up the trap door to the selector valves and operating handle. See Power Plant for additional information.

g. Life Rafts:- The life raft is stowed in the navigator's compartment in the crown to the left of the centerline of the ship. After leaving the compartment the operator should reach in through the hatch door and pull the knob located on the forward edge of the door and container will fall to line up with the hatch opening. The life raft can then be pulled out.

h. Oxygen Equipment:- Oxygen equipment consists of one low pressure (350#) system. This system is filled from a central point located in Aft Bomb Bay. There are two small bottles located in the pilot's compartment; one back of the pilot and one back of the copilot. One large bottle is located under the navigator's table and one behind the navigator's seat.

There are two large bottles in the rear bomb bay, one the left hand side and one the right hand side. All of these are interconnected and fitted with check valves so that if one bottle is damaged it will not dump the entire system. The outlets, each provided with individual pressure regulators A.C. type A-9, are located as follows: Two in the bombardier's compartment - one right and one left, one for the pilot and one for the copilot, mounted on their respective sides of the instrument panel; one for the navigator mounted alongside the navigator's instrument panel; one for the radio man mounted on the radio panel with the radio compass; one for the turret gunner and one for the floor gunner or camera man and one for the tail gunner on the right side in the stub of the elevator.

i. Pyrotechnics:- There are no provisions for pyrotechnics on this airplane.

j. Photographic Equipment:- Provisions are made for the vertical installation of the multiple lens tactical mapping camera Type T-3A and for the K-7C and K-3B cameras in a combination retractable mount. The retractable mount is located in the rear compartment over the rear entrance door. In the stowed position the mount is located just aft of the door area. The mount is held in place in the stowed position by a latch on the rear center leg. To release - pull the lock handle on the left side of the ship at the edge of the camera door. The mount is spring loaded so that upon release the mount will slide down over the door opening. To bring the mount down to the horizontal position squeeze the latches on each of the forward legs. For moving the camera aft, raise the camera mount and pull the cable at the left hand side until the mount locks in the aft position. The view finder plate located on the forward side of the camera mount may be folded up for stowage. This must be folded out of the way when the mount is retracted, in order to close the camera doors. On the right hand side is located the electrical junction box for plugging in the camera and induction coil when needed. On the aft side of this box is a bracket affording stowage for the intervalometer.

Separate camera magazines may be stowed on the left hand side aft of the camera. In order to use the oblique cameras, the windows in the aft section should first be removed and the camera may then be aimed through them on either side of the plane.

k. Heating and Ventilating Equipment:- Heat is supplied to all crew stations by means of exhaust manifold heaters. Hot air is brought from the heaters through leading edge ducts to the mixing chamber located on the aft side of fuselage sta. 230 3/4. Cold air is brought through a leading edge duct from an inlet located inboard of the right hand nacelle only, to the same mixing chamber. Dampers in both hot and cold air ducts are operated independently, by controls in the navigator's compartment, for proper mixture in the mixing chamber. Heat is supplied from the mixing chamber as follows:

Caution:- If ship is attacked hot air should be bypassed overboard as bullet holes in manifold may cause crew to be gassed.

Crew Station or Compartment	Type of Outlet and Control
Navigator Compartment	Anemostat difuser and screw damper.
Aft Turret and Camera Station	Damper box with Aerofuse outlet and screw damper.
Tail Gunner	Duct outlet and sliding damper.
Pilot and Copilot	Duct outlet and sliding damper.
Bombardier	Duct outlet with sliding damper.
Pilot Windshield Defrosting	Duct outlet with butterfly damper.
Bombsight Defrosting	Flexible tube with thumb operated damper at nozzle.

NOTE: Heating or defrosting at any station may be improved by turning off other outlets.

l. Thermos Bottles:- One two-quart thermos bottle and cup container is located on the left hand side behind the pilot and one two-quart thermos bottle and cup container is located on the aft side of the Bulkhead #434 in the aft compartment.

m. Ladders:- The entrance ladders consist of a long ladder through the nose wheel well and a short ladder for access through the camera door to the aft compartment. These ladders are stowed in the aft compartment on the left side under the fin. For ease of stowage they are folded in the middle. To use these ladders the hooks on the ladder are fitted into the lugs provided at the doors. The engine working platform is an "A" ladder so arranged that the outer legs can be spread for support and the center portion extended to any desired height. The small platform on the center ladder is provided for tools. There is one of these engine ladders furnished for each airplane. For transportation from point to point this ladder may be stowed in the bomb bay lashed to the bomb racks.

n. Blind Flying Hood:- The blind flying hood, consisting of several pieces of fabric, stowed on the right side of the pilot's compartment, is provided with glove snaps to fasten the hood to the enclosure.

o. Sun Visors:- Adjustable sun visors, mounted on the windshield frame, are provided for the pilot and copilot.

p. Bomb Sight Stowage Box:- A removable bomb sight stowage box, fitted with lock and key, is provided in the Bombardier's Compartment.

q. Floor Gun Grate:- An easily removable bar, stowed in the gunner's step locker, is provided to place across aft bottom door opening to prevent accidental falling.

r. Cotton Container:- A cotton container is provided at each crew position.

s. Parachute Stowage:- Provision for stowage

of quick attachable type parachutes is at each of the following stations: Bombardier, Navigator, Radio Operator, plus four in the aft compartment. Seat or back parachutes may be used by the pilot, copilot, navigator, or radio operator by removing one of the seat cushions.

t. Curtains:- A curtain is provided between the pilot's and navigator's compartments. This is a split sliding curtain, and may be parted to either side for easy access. In the aft compartment, forward of the tail gunner's entrance, a zipper operated curtain is provided to help maintain better heating and ventilation.

u. Emergency Flotation:- There are no flotation provisions on this airplane.

11. De-icing Equipment (Provisions)

a. Wing De-icer provisions consist of tubing and branch fittings installed along the front spars and leading into the fuselage. At this point are brackets designed to mount a standard Air Corp distributing valve. Designs of shoes for wings, fin and stabilizers have been prepared especially for this airplane by the B.F.Goodrich Company.

b. Propeller De-icer provisions consist of standard slinger rings for the propellers, a five gallon fluid tank mounted on the rear of the front spar bulkhead in the forward bomb bay, mounting for an electric driven pump, and suitable interconnecting tubing. The rheostat for the pump may be mounted on either of the pilot's instrument panels, or in the cockpit.

c. Windshield De-frosting may be accomplished by:

(1) Interior hot air application (Refer to Paragraph 10, k above).

SECTION III

GENERAL INSTRUCTIONS

1. Pre-Flight Inspection

a. The pilot shall satisfy himself that the following inspection has been satisfactorily completed before takeoff.

Note:- This airplane is equipped with two Curtiss Electric Propellers, and two Pratt & Whitney R-2800-5 (S1A4-G) Single Stage, Two Speed Supercharger, Double Wasp Engines. The pilot shall be familiar with their operation before flying this airplane.

b. The following items shall be inspected in accordance with the provisions of Technical Order No. 00-20A, as general inspection for all airplanes:-

Crystals, Dials, Indicators, Installation Parts and Connections
Magneto Switches
Voltmeters
Ammeters
Thermometers, Oil Temperature
Tachometers
Fuel Level Gauges
Clocks
Flight Instruments
Navigation Instruments
Cockpits, Windows and Enclosures

c. The following items shall be in addition to T.O. No. 00-20A as applying specifically to this airplane:

(1) Hydraulic System Pressure must show a minimum of 750 lbs. in.^{2} Check the operation of each unit before flight. (except landing gear units) Check fluid level and air pressure of accumulator.

(2) See that flight controls are unlocked.

(3) See that all trim tab controls are in proper operating position.

(4) Check emergency air brake pressure at 1000 lbs. per sq. in.

2. Flight Instructions

a. Airplane:- (1) Propellers - The engines are fitted with Curtiss Electric Controllable Full Feathering Propellers. Refer to Curtiss Handbook of Operations. T.O. No. 03-20BA-1. Refer to *Pilot Takeoff Check, Section VII, Page 73.

b. Engines:- (1) Refer to Section VI, Power Plant, for complete operation and Page 72 for *Cruising Engine Operation.

*Note:- Copies of Check Lists are also in the airplane data case.

3. Location of Controls

a. Flight Controls:

Control	Type	Location
Elevators) Aileron)	Dual Control Column	Pilot Cockpit
Rudder	Dual Pedals	Pilot Cockpit
Tab-Elevator	Wheel	Left Side of Pedestal
Tab-Aileron	Knob	Cockpit Ceiling-Center
Tab-Rudder	Crank	Cockpit Ceiling-Center
Wing Flaps	Lever (Hydraulic Valve)	Pedestal Head-Rear Face, Left Center
Control	Wheel	Pedestal Head-Upper Center

b. Landing Gear Controls:

Control	Type	Location
Normal-Nose and Main	Lever	Pedestal Head-Rear Face Right Center
Emergency-Nose Gear	Lever	Pedestal Head-Rear Face Right Center
Emergency-Main Gear	Lever	Pedestal Head-Rear Face Extreme Right

c. Power Plant Controls

Control	Type	Location
Starter-Energize	Switch	(Pedestal-Forward Extreme Left Center
Starter-Mesh	Switch Top panel	(Pedestal-Forward Left Center
Ignition-Left and Right	Switches	(Pedestal-Forward Center
Throttles-Left and Right	Levers	Pedestal Head-Extreme Left
Mixture-Left and Right	Levers	Pedestall Head-Extreme Right
Propeller-Left and Right	Levers	Pedestal Head-Left and Right Center
Friction-Throttle Levers	Knob	Pedestal Head-Rear Left
Friction-Propeller Levers	Knob	Pedestal Head-Rear Center
Precessing (Pilot)	Switch	Pedestal Head-Rear Right
Precessing (Navigator)	Switch	Navigator Compartment-R.H.- Above Drift meter
Primer-Left and Right	Switches	Pedestal-Rear Center
Pump-Fuel Booster, L.&R.	Switches	Pedestal-Upper Rear Right

Control	Type	Location
Blower Ratio-Left and Right	Levers	Pedestal-Lower Rear Left
Oil Cooler-Left and Right	Levers	Pedestal-Lower Rear Center
Carburetor-Aux. Air	Levers	Pedestal-Lower Rear Right
Cowl Flap-Left and Right	Levers	Pedestal Head-Lower Rear Left
Pump-Fuel Transfer	Switch)	Rear face of Bulkhead between Navigator and Forward Bomb Bay-Left Side
Fuel Selector	Valve)	)
Propeller-Safety, Left	Switch	Pedestal-Forward lower Left Center
Propeller-Safety, Right	Switch	Pedestal-Forward Lower Right Center
Propeller-Auto. Man. Left	Switch	Pedestal-Forward Lower Extreme Left
Propeller-Auto. Man. Right	Switch	Pedestal-Forward Lower Extreme Right
Propeller-Feather, Left	Switch	Pedestal-Forward Lower Center
Propeller-Feather, Right	Switch	Pedestal-Forward Lower Center
Oil Dilution-Left and Right	Switch	Pedestal-Forward Middle Right
Fuel Level	Gauge	Pilot Instrument Panel
Fuel Flow (On AC 40-1361 only)	Meter	Right Hand Side of Copilot (not to be used for takeoff or climb.)

NOTE: Complete instructions for starting and stopping the engines are given in Section VI, Power Plant.

d. Armament Controls

Control	Type	Location
Bomb-Emergency	T-handle	Crown of fuselage

		between Pilot and Copilot
Bomb-Normal	Lever	Bombardier's Compartment Left hand side

e. Auxiliary Controls

Control	Type	Location
Brakes-Service	Pedals	Pilot rudder pedals
Brake-Emergency	T-handle	Forward center above pilot's instrument panel
Brake-Parking	Lever	Pedestal Head-Left Hand Face
Horn-Landing Gear Warning	Switch	Pedestal-Extreme Upper Forward Right
Battery-Master, Left & Right	Switches	Pedestal-Extreme Middle Right
Lights-Signal and Running	Switch	Pedestal-Forward Middle Right Center
Lights-Formation	Knob	Pedestal-Forward Middle Center
Light-Landing Left	Switch	(Pedestal-Forward Extreme
Light-Landing Right	Switch	(Middle Left
Light-Passing	Switch	Pedestal-Forward Middle Left Center
Lights-Instrument Panel	Switch	Pedestal-Forward Upper Middle Left
Lights-Interior	Switch	Pedestal-Forward Upper Middle Left
Light-Compass	Switch	Pedestal-Forward Upper Middle Left Center
Light-Pedestal	Switch	Pedestal-Forward Upper Middle Left Center
Bells-Alarm	Switch	(Pedestal-Forward Ex-
Heater-Pitot%	Switch	(treme Upper Right
		(Center
Control	Switches	Pedestal-Forward Extreme Upper Left

		and left Center
Oxygen Supply	Regulator	At each crew station
Heating and Ventilating	Controls	See detailed description under Section II
Seats-Pilot & Co-pilot	Levers	
	Fore & Aft	Outboard
	Height Adj.	Inboard
	Reclining	Inboard
Seats-Navig. Rad. Op.	Levers	
	Fore & Aft	Inboard
	Swivel	Inboard
De-icer Valve	Provision	R.H. of co-pilot
Drift Sight Door	Lever	R.H. & below Nav. Seat

4. Operation of Controls

a. Flight Controls

(1) Elevators, ailerons and rudder are operated conventionally by control column and pedals.

(2) Tabs are operated as follows:

Elevator Tab Wheel	Forward for Nose Down Rear for Nose Up
*Rudder Tab Crank	Clockwise for Nose Right Counter-clockwise for Nose left
Aileron Tab Knob	Clockwise for Right Wing Down Counter-clockwise for Left Wing Down

*NOTE: Airplane must be trimmed directionally after change from gear and flaps up to gear and flaps down condition, on approach for landing.

Wing Flap Levers	Up for Flaps Up Down for Flaps Down Flaps may be stopped at any degree of setting

by returning control lever to neutral. A catch holds the lever in neutral after use.

b. Landing Gear Controls

*Normal Lever	Down to Extend Gear - leave full down
	Up to Retract Gear - return to neutral
Emergency Levers	Normally Up
	Down for Emergency Operation

*Replace cap after use.

Always return hydraulic controls to neutral in normal flight so as to isolate circuits from one another and to thus minimize loss of operation due to a failure of one circuit. This does not apply to Bomb Door Valve Levers which must remain in "Door Closed" position in normal flight.

NOTE: See Section II for detailed operation of Landing Gear.

c. Power Plant Controls

(a) Engine Starters are controlled by two three-position electric switches, both having an "OFF" position in the center of their travel. Either starter may be energized separately by holding the energizing switch in one or the other extreme position until the inertia mechanism reaches adequate speed, after which the meshing switch is moved in the same direction to engage the starter dogs. It is permissible to allow the energizing switch to remain closed after the meshing switch

has been operated, in which case the starter will perform the function of a combined inertia and direct-cranking unit. The opposite starter is similarly controlled by moving both switches to the other extreme positions.

(b) Magneto Switches are combined in the conventional Type B-5 Unit, having provision for operation of either or both engines on either one or both magnetos, and in addition, incorporates the master off-on magneto and battery switch. All switch positions are clearly marked on the unit.

(c) Throttle operation is conventional, with open position farthest from pilot. An adjustable friction device is controlled by rotating a knob clockwise to increase friction, counter-clockwise to relieve friction.

(d) Carburetor Mixture control is operated by fore and aft movement of the lever. The lever is normally in one of four positions located by the carburetor mechanism and selected by the pilot, namely: Idle cut-off (extreme aft position), Automatic Lean, Automatic Rich, and Emergency Rich (extreme forward position). Operation of the carburetor mechanism is sufficiently positive that the control lever will remain in the desired position, and yet may be readily moved when it is desired to select another position.

(e) Propeller Governor control is operated by fore and aft movement of the lever. Take-off or maximum R.P.M. position is farthest from pilot. Friction adjustment is analogous to that provided on throttle control.

(f) Engine Priming is accomplished by holding the primer switches in the "On" (up) position for the desired period of time, after which the switch is released and will automatically return to the "Off" (down) position. Note that the fuel booster pumps must be in operation during the priming period to provide the necessary pressure to force

fuel into the cylinders. This operation should be done with care as it will take some experience to establish the proper length of time for the right amount of prime. Priming during cranking is good practice as tendencies toward overpriming are reduced and air turbulance facilitates starting.

(g) Fuel Booster Pumps are controlled by operation of conventional toggle switches, having their "ON" positions upward and their "OFF" positions downward.

(h) Blower Gear Ratio is selected by vertical movement of the levers provided. The levers should at all times, except during the shifting operation, remain at one end or the other of their travel, the lowest of which selects the low blower ratio and the higher, the high blower ratio. (See engine operating instructions Pages 60 and 61 for explanation of when and how to operate these control levers.)

(i) Oil Cooler Shutters are controlled by vertical movement of the levers provided, identical in operation to those controlling the cowl flaps. Keep in open (up) position for take-off and climb to prevent possible closure due to air loads, otherwise returning to neutral after use.

(j) Emergency Carburetor Air Intake control operates in a vertical plane, and normally remains in the "Cold" or locked position (higher end of lever travel). When the lever is moved to the "Hot", or alternate air intake (lower end of lever travel) position, the emergency air intake shutter is unlocked and will open automatically if the normal air duct or screens should become clogged by ice formation.

(k) Cowl Flaps are controlled by vertical movement of levers operating hydraulic valves. The neutral position of the lever is in the center of its travel. Opening the flaps is accomplished by moving the lever upward from neutral and holding in

the displaced position until the desired flap opening is obtained, after which the lever is returned to neutral. Closing the flaps is similarly accomplished by a downward movement of the lever. Keep in open (up) position for take-off and climb to prevent possible closure due to air loads. Otherwise return to neutral after use.

(l) Fuel Transfer Pump is controlled by a three-position electric switch having its "OFF" position in the center. Direction of flow is controlled by moving the switch lever either up or down, as required by the marking of the dial of the Fuel Transfer Selector Valve (Paragraph (m) following).

WARNING: Do not exceed "Full" guage reading on any tank when operating fuel transfer pump.

(m) Fuel Transfer Selector Valve controls only the transfer of fuel from one tank to another and in no way affects the flow from the main tanks to the engines, as indicated on the fuel system diagram, Page 23. It is also evident from the diagram that all fuel must pass through the main tanks, since they alone are connected through the booster pumps to the engines. The selector valve incorporates two separate controls with pointer handles and dial plates marked as follows, in clockwise rotation:

Aft dial - "Off", "Bomb Bay" "L.H.Main", "L.H. Aux."
Fwd. dial -"Off", "Bomb Bay", R.H.Main", "R.H. Aux."

The dial plates also bear the notation that with the Transfer Pump Switch (See Paragraph (l) above) in the "Up" position, the flow is from the tank selected on the aft dial to the tank selected on the forward dial and that with the switch in the "Down" position the direction of flow is reversed. It is thus possible to transfer fuel from

any tank marked on the aft dial to any tank marked on the forward dial and visa versa, and to transfer fuel between two tanks indicated on the same dial by first pumping into an intermediate tank. Note fuel quantity gages before attempting to transfer any fuel.

WARNING: Do not operate fuel transfer pump with either selector valve in "Off" position.

(n) Propellers are controlled by the following standard Curtiss switches, furnished in duplicate:

Safely Switch	- Curtiss 100602-2
Automatic - Manual Switch	- Curtiss 102911
Feathering Switch	- Curtiss 104029

The propeller circuits are energized by moving the safety switch levers forward to the "On" position. The propellers may then be made automatic governing by moving the selector switch forward to the position marked "Automatic" or may be manually adjusted by moving the selector toggle either to the right to the position marked "Increase RPM" or the left to "Decrease RPM". When the switch is centered to which position it will return automatically when released, the propeller will remain in fixed pitch. Feathering is accomplished by moving the feathering switch lever forward. This latter switch is protected from accidental operation by a hinged metal cover.

(o) Oil dilution is controlled by individual electric switches for each engine. The switches may be operated separately or simultaneously by holding the levers forward in the "On" position the required time for dilution. Switches will return to the "Off" position when released.

d. Armament Controls

Normal Salvo Bomb Release requires a pull of

about 50 lbs.

Emergency Bomb Release is effected by one vigorous pull straight forward on the emergency T-handle. A dog retains the control cable in the forward position, keeping the bomb bay doors open until tripped, when the doors will be closed by the hydraulic system.

NOTE: Bomb Bay doors may be walked on as the operating mechanism has a dead center which locks them. Be sure Bomb Bays are clear of personnel before operating controls.

e. Auxiliary Controls

Service Brakes are manipulated by toe pressure on the pilot rudder pedals.

Emergency Brakes are applied by an intermittent pull straight forward on the emergency T-handle. This control, if required, may be used at any point in the landing roll.

Parking Brake is used as directed in Section II.

Landing Gear Warning Horn is silenced by pushing toggle switch aft. The circuit is replaced in operation when the throttles are advanced.

Battery Master Switches close the circuits when moved forward.

Signal and Running Lights are operated as follows:

As Running Light: "On", in forward position
"Off", in middle position

As Signal Light: Momentary, in aft position

Formation Lights are "On" when knob is

turned clockwise.

Landing Lights are "On" when toggle switches are in forward position.

Passing Light is "On" when toggle switch is in forward position.

Instrument Panel, and Pedestal Lights are "On" when respective toggle switches are in forward positions.

Interior Lights are "On" when the toggle switch is in the forward position. They may be used for night signals.

Alarm Bells and Pitot Static Heater are "On" when respective toggle switches are in forward positions.

Compass Light is "Bright" with toggle switch in forward position, "Dim" in aft position.

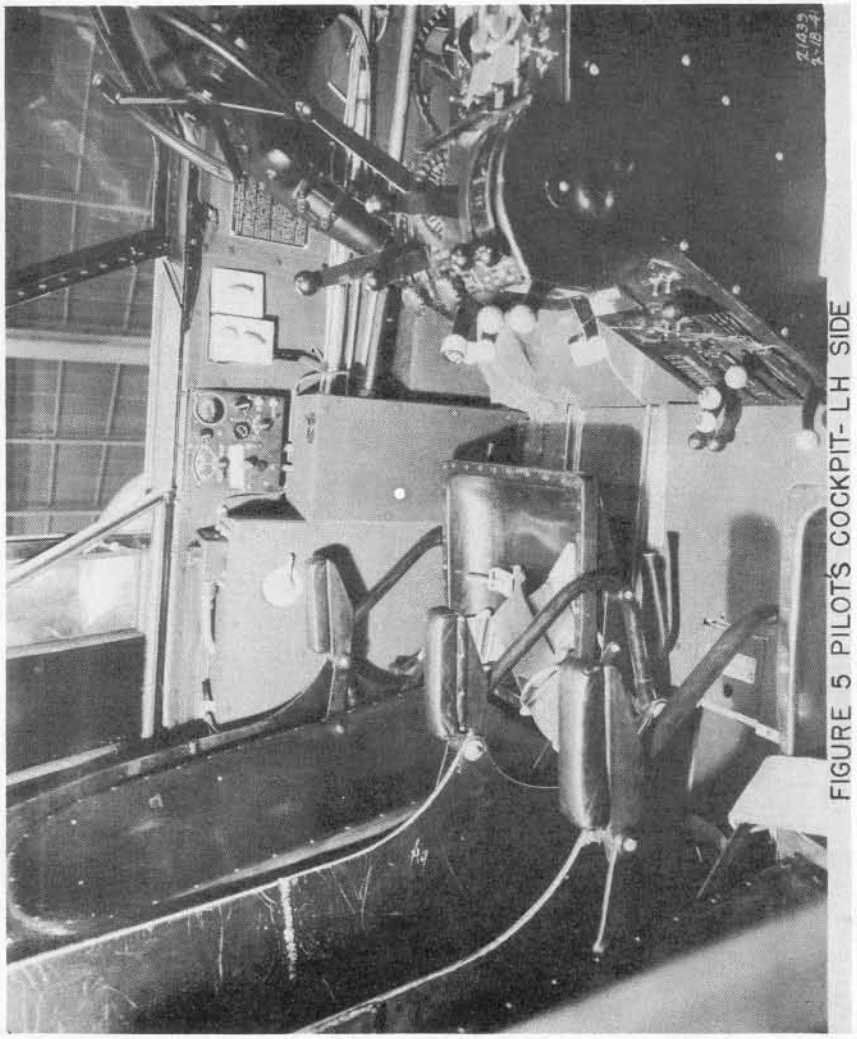


FIGURE 5 PILOT'S COCKPIT- LH SIDE

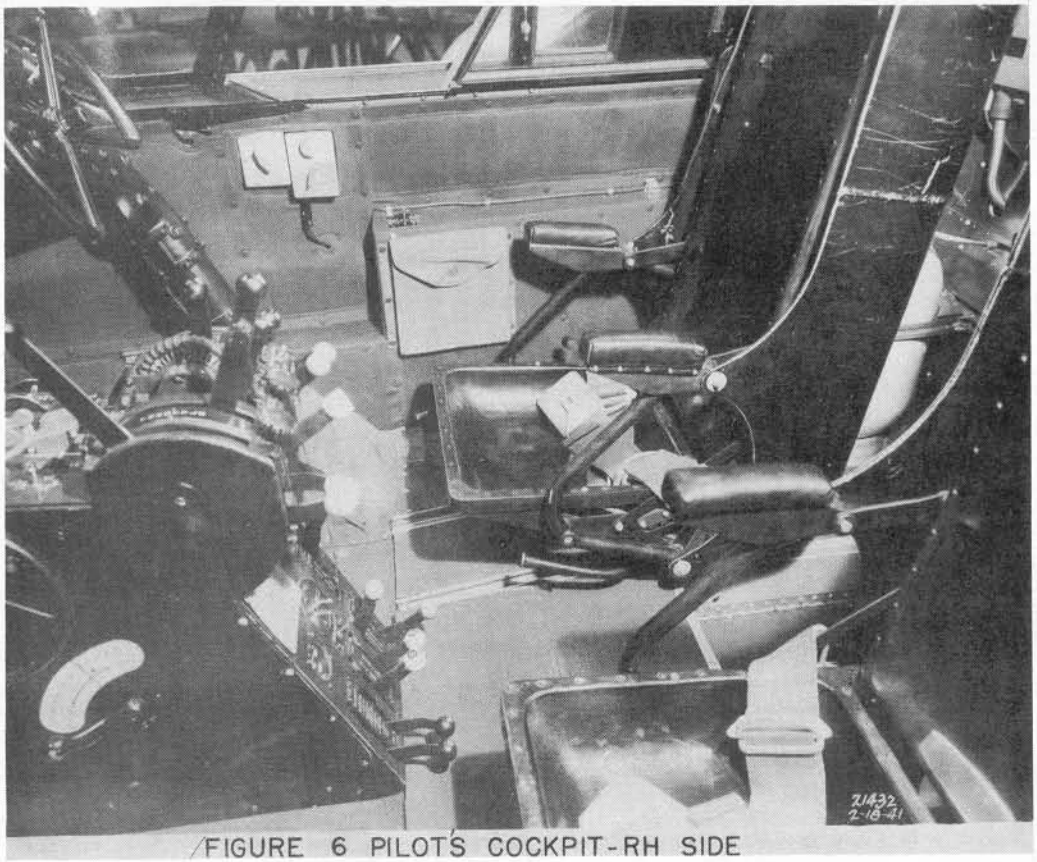


FIGURE 6 PILOTS COCKPIT-RH SIDE

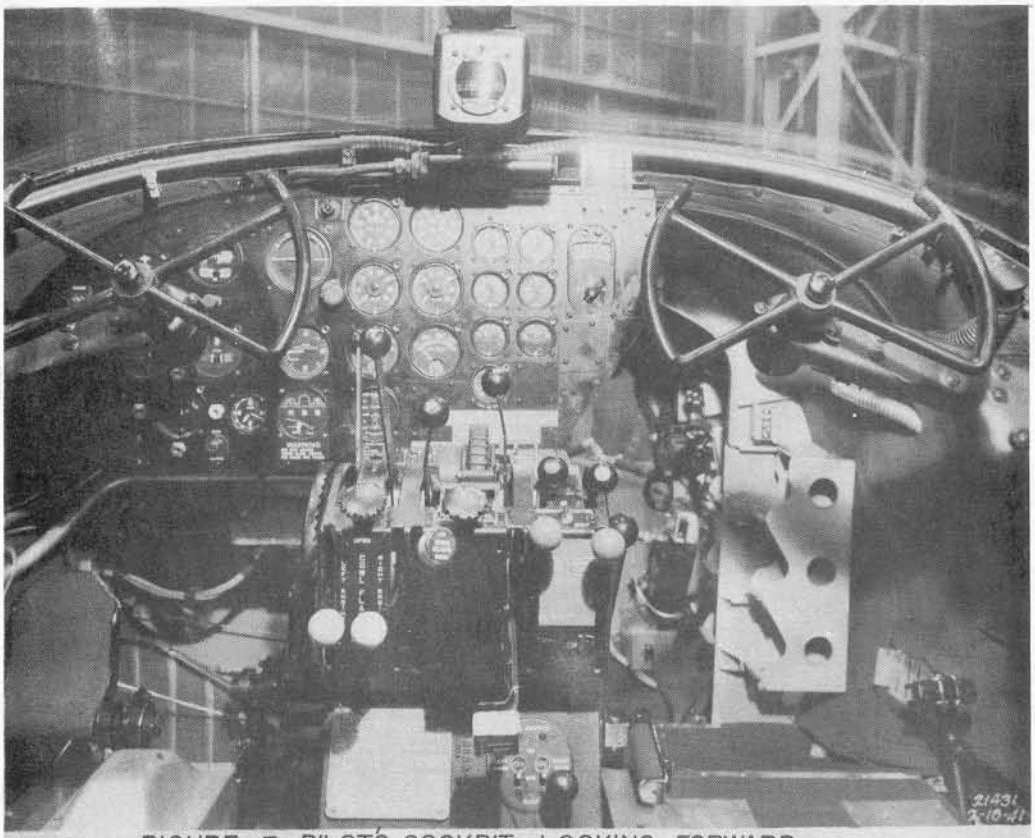


FIGURE 7 PILOT'S COCKPIT - LOOKING FORWARD

8-15-41

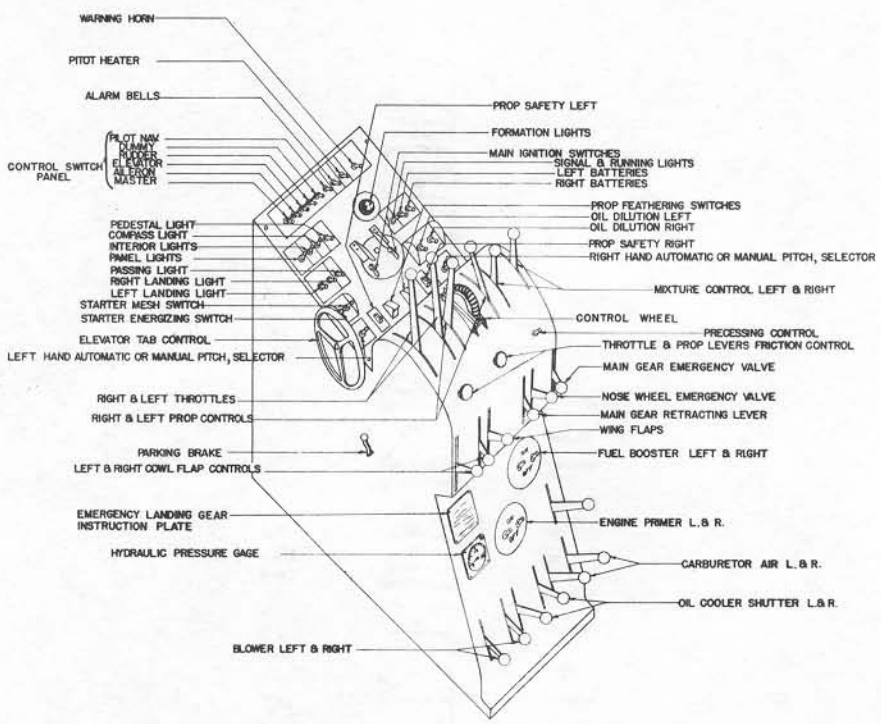


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FIGURE 8 CONTROL PEDESTAL PILOT'S COCKPIT

SECTION IV

FLIGHT CHARACTERISTICS

TAXIING:

The desirable characteristics of the tricycle type landing gear became increasingly apparent with increased familiarity with proper ground handling technique.

Certain differences will be noticed immediately in the taxiing technique required for a tricycle gear as compared to the conventional gear having a tail wheel. These differences are due, primarily, to two things: the swiveling of the nose wheel is limited to 45° each way, and the use of brakes or an increase of engine power tends to increase the load on the nose wheel.

If the directions given below are observed until such time that the pilot has become thoroughly familiar with the tricycle landing gear, no difficulty will be encountered.

To start the airplane rolling from a standstill, both THROTTLES should be OPENED slightly and evenly with the brakes off. As soon as the airplane moves, the direction in which the nose wheel is pointing becomes apparent. Permit the airplane to move or roll slowly when making turns or whenever a change in the angle of the nose wheel is desired. The airplane can be readily turned or controlled directionally by gentle use of the THROTTLES and brakes. Over use of the brakes should be avoided in order to prevent excessive heating.

As noted above, the nose wheel swivels through 45° each way, and this maximum angle of the nose wheel permits the airplane to turn while the inside main wheel is turning at a radius of about 8 1/2 feet. It is important therefore, that the inside main wheel should not be locked by the brake when making a sharp turn.

IMPORTANT: DO NOT ATTEMPT TO CHANGE THE ANGLE OF THE NOSE WHEEL UNLESS IT IS ROLLING. DO NOT MAKE A SHARP TURN BY LOCKING ONE MAIN WHEEL WITH THE BRAKE.

TAKE-OFF:

The WING FLAPS should be from 1/2 to 3/4 down.
ELEVATOR TABS should be approximately 8 degrees TAIL HEAVY.
RUDDER TAB and AILERON TABS should be neutral.
COWL FLAPS and OIL COOLER SHUTTERS should be full OPEN.

The airplane will be found to be very stable directionally while rolling on the ground at high speed. At the beginning of the take-off run and while the airplane is rolling along slowly, it will be necessary to hold a straight course by a normal use of the THROTTLES and rudder. If brakes are also required to maintain a straight run, they should be used as gently as possible thereby allowing the airplane to gain speed rapidly. The brakes are power-operated and are very positive.

The take-off is made at 2600 RPM (propeller control levers full forward) and with the maximum 49" of MANIFOLD PRESSURE.

With normal load, a comfortable pull-off can be made at about 110 MPH. To clear an obstacle in the minimum distance, the nose may be held up to maintain this pseed; however, if there is no space restriction it will be more comfortable to permit the speed to increase before starting the climb out of the field.

As soon as the airplane leaves the ground the LANDING GEAR retracting lever can be moved to the UP position. After take-off and within proper time limitations the engine power should be reduced from take-off power to rated power, or less as desired. Rated power is 2400RPM, and 38" of MANIFOLD PRESSURE. The COWL FLAPS can be CLOSED as long as engine CYLINDER TEMPERATURES do not exceed the maximum

permissible. The oil temperatures are regulated at the oil cooler and opening the OIL COOLER SHUTTER may not reduce the temperatures. THE OIL COOLER SHUTTERS should be opened only enough to keep the oil temperatures below maximum permissible.

Caution:

To reduce engine power: reduce MANIFOLD PRESSURE first and then reduce RPM. To increase engine power: increase RPM first and then increase MANIFOLD PRESSURE.

SINGLE-ENGINE FLIGHT:

There is ample rudder balance tab to trim out for operation on one engine at rated power at a climb speed of 140 MPH.

In event of failure of one engine, the propeller can be feathered and the engine stopped in approximately eight seconds merely by moving the feathering switch from NORMAL to FEATHER.

If single engine operation practice is desired, the engine should be stopped in the following manner:

1. Close THROTTLE to idle position.
2. Move feathering switch from NORMAL to FEATHER.
3. Move MIXTURE control to IDLE CUT-OFF position.

Note: If practice is done during cold weather, the oil should be diluted in the same manner as followed when stopping the engine on the ground in cold weather. The COWL FLAPS and OIL COOLER SHUTTERS should be CLOSED during the period of inoperation.

To start an engine in flight, the following sequence should be followed:

1. See that ignition switch is on.
2. Move feathering switch to NORMAL position.

3. Hold MANUAL operating switch in INCREASE RPM position until propeller wind mills.
4. Move MIXTURE control to AUTO. RICH position.
5. Hold MANUAL operating switch in INCREASE RPM position until engine is turning fast enough to build up oil pressure and then move to AUTOMATIC position.

Note: Care should be used in increasing power output of the engine until it is warmed up.

STALLS:

Stalls from normal flight under all clean and dirty conditions, power on and power off, will be found to be preceded by ample warning. In the landing condition, LANDING GEAR DOWN, WING FLAPS FULL DOWN, COWL FLAPS AND OIL COOLER SHUTTERS CLOSED, the stall speed is 98 MPH power off and 88 MPH power on.

LANDINGS:

A speed of 135 MPH is a comfortable and safe speed for the approach to a landing. At this speed with the FLAPS FULL DOWN, LANDING GEAR DOWN and with power off, the airplane has a rapid rate of descent but may be easily be leveled off for the landing close to the ground where the speed will decrease rapidly due to the drag of the flaps and landing gear. If it is desired to decrease the rate of descent, 3/4 WING FLAP and power may be used during the approach. The use of 3/4 WING FLAP will increase the landing speed only an insignificant amount. If engine power is used all the way into the field, it should be remembered that airplane speed will fall rapidly, immediately after the power is cut.

It is recommended that pilots not familiar with the airplane try 3/4 WING FLAP and some engine power

for the approach on their first few landings.

The sensation of a power-off approach is one of diving at the edge of the field. However, at 135 MPH, there is no difficulty in leveling off close to the ground. If it is necessary to shorten the approach distance, in order to prevent over shooting the landing, it is recommended that this be done by putting the nose down and increasing speed rather than holding the nose up to decrease speed in an effort to cause the airplane to settle. If the landing is passed up, no difficulty will be experienced in circling the field again for another try at landing provided that full take-off power is used, the LANDING GEAR raised and caution used in raising the WING FLAPS.

The actual touching down for landing, at approximately 105 MPH is quite conventional. The nose wheel may be held up to a stall landing or may be left low for what would be a wheel landing for an airplane equipped with a tail wheel type landing gear.

The nose wheel should not be permitted to strike the ground first. The nose wheel should not be slammed down hard after a normal landing by use of the elevators or brakes.

As soon as the landing is completed, the WING FLAPS should be raised and the COWL FLAPS and OIL COOLER SHUTTERS opened.

SECTION V

SPECIAL INSTRUCTIONS

1. Flight Limitations

(a) Maneuvers Prohibited

All acrobatic maneuvers including SIDE SLIPS, vertical banks and dives in excess of placarded dive speeds (345 MPH, 28800# normal gross weight and 325 MPH, 31800# max. gross weight.)

Indicated Airspeeds in excess of 345 M.P.H.

(b) Flight Restrictions

Do not fly airplane with flaps extended at indicated airspeed in excess of 185 M.P.H.

Do not fly airplane with landing gear extended at indicated airspeed in excess of 185 M.P.H.

Do not fly airplane with Bomb Doors open at indicated airspeeds in excess of 345.0 m.p.h.

Maneuvers or indicated speeds other than the above must be performed in accordance with Air Corps Circular 60-9 and 9b.

2. Emergency Limitations

(a) Never lower main gear before nose gear.

(b) If nose gear will not extend, do not attempt to extend main gear.

WARNING The fuel system of this airplane has no provision for Side Slip conditions. Therefore such a maneuver is Extremely Dangerous at low altitudes or landing approach, as the engine on the low wing is liable to cut out.

WARNING The limits of the c. g. position, as noted below, are determined by the strength of the airplane structure. However, the flying characteristics of the airplane are such that a c. g. position of not less than 12% M.A.C. should be maintained, regardless of gross weight. This applies particularly during take off and approach for landing.

Gross Weight	Maximum Fwd. C.G. Position (% M.A.C., Structural Determination)
21,000	4.5
22,000	6.0
23,000	7.5
24,000	8.8
25,000	10.0
26,000	11.3
*27,000	*12.5
28,000	13.5
28,800	14.3

* NOTE: If the airplane is operated at any time (such as flyaway delivery) without the deck turret or tail guns installed, the following ballast loading is required:

a. Airplane less deck turret and tail guns:

300 lbs. at Station 565
300 lbs. at Station 615

b. Airplane less tail guns:

100 lbs. at Station 565
300 lbs. at Station 615

Revised 5/7/41.
Revised 7/16/41.

SECTION VI

POWER PLANT

1. Specification Details

This airplane is powered with two R-2800-5 (S1A4-G), Single Stage, two Speed Supercharger engines, in accordance with Pratt and Whitney Specification No. A-8019-C revised as of 27 November 1939. Propeller gear reduction 2:1. See T.O. No. 02-10GA-1.

a. Ignition: Each engine is equipped with a Scintilla DF-3 magneto, two distributor type and thirty-six BG-321-LS spark plugs.

b. Fuel Metering: Each engine is equipped with one Stromberg Injection Carburetor, PT-13F1.

c. Priming System: Each engine is equipped with a Stromberg 12 volt Electric Primer.

d. Starting System: Each engine is equipped with a Type H-4 Combination Electric Inertia - Direct Cranking starter.

e. Propellers: Each engine drives a Curtiss, Full Feathering, Electrically Controlled propeller as follows:

(1) Hub - Curtiss Model C-543-S
(4) Blades - Curtiss Design 814-Co2
(1) Controls - Curtiss Specification C-5 dated 4 February 1940.

See T.O. No. 03-20BA-1

f. Controls: The engines are controlled by push pull rods and cables.

g. Air Intake: Each engine is provided with

two carburetor air scoop intake ducts incorporated in the cowling and alternate air intakes which may be unlocked and which open automatically when carburetor screens become severely iced.

h. Exhaust System: Each engine is provided with collector rings exhausting through propulsion jets at each side of the nacelle below the wings.

2. Operating Instructions

a. Pilot Check Chart: The instructions below follow in general the sequence of operating conditions shown on the "Pilot Check Chart" on page 73

b. Starting: (1) Turn the engine over four or six revolutions by pulling the propeller through by hand 2 or 3 revolutions to be sure the lower cylinders have not filled with oil or gasoline while the engine has stood idle. (It is advisable to remove the lower spark plugs before turning the engine over if there is any reason to suspect oil or gasoline in the cylinders. This is especially important where the exhaust collector may prevent drainage past the exhaust valve.)

(2) Be sure the cowl flaps are open.

(3) The blower ratio selector valve should be in the low blower position.

(4) Propeller control in "Take-Off", ("Low Pitch" or "High R.P.M.").

(5) Booster Pumps "On".

(6) Place the mixture control in the "Idle Cut-Off" position.

(7) For the first time after installation, filling of the carburetor is facilitated by tempo rary removal of 1/8" pipe plug just over and several inches in from the mixture control lever. With the mixture control lever in "Automatic Rich" (or Rich),

pump fuel with a pressure not over 2 to 3 lbs./sq. in. until gasoline appears at this hole. Replace and rewire the pipe plug. This portion of the carburetor has a small internal passage connecting with the permanent vent line that takes care of any small quantities of air that might collect during normal operation or periods that the engine does not run for several days. Large quantities of air in this portion of the carburetor interfere with the control of the mixture and usually result in hard starting, back firing, and ragged running for a short time after starting until the air can escape through the small vent passage.

(8) Bring fuel pressure up with booster pump. This will supply fuel to the primer.

(9) Open the solenoid switch to prime sufficiently. The longer the switch is held open, the greater the amount of fuel that will be furnished to the priming system. Care should be taken to see that the carburetor and fuel system are filled with gasoline, but that the induction system is not flooded. Prime sufficiently, but not excessively, having due regard to engine temperature. This will vary from no prime with a hot engine to approximately one minute with a very cold engine. Excessive priming will load the cylinders with raw gasoline, making it difficult to start the engine. Priming during cranking is good practice as tendencies toward overpriming are reduced and air turbulence facilitates the mixing of an explosive charge.

(10) In cold weather, the oil dilution valve should be opened as the engine is stopped and held open for approximately three to four minutes at 1000 RPM. In warmer weather, it will not be necessary to use the oil dilution system on stopping.

(11) (a) Warm Engines: Where engines are warm from previous running or where outside air temperatures are at 60°F. (15°C.) or above, priming may not be necessary.

1. Have the throttle lever in the nearly closed position or approximately 1/8 open (after the spring of the control system has been taken up).

2. Mixture control in the "Idle Cut-Off" position.

3. Maintain fuel pressure with the booster pump.

4. Maintaining fuel pressure engage starter, turn ignition to "Both On" after a revolution or two.

5. Leave mixture control in "Idle Cut-Off" until engine fires. The reason for this precaution is that if the mixture control is placed prematurely out of "Idle Cut-Off" and the engine fails to start for one reason or another considerable quantities of fuel is discharged into the engine and drained from the blower sections, creating a fire hazard.

6. If a start is not affected in a reasonable length of time, investigation should be made to ascertain the cause. Overloading will be indicated by a discharge of fuel from the drain located in the lower part of the engine blower. In this case, keep the mixture control in "Idle Cut-Off", and with no fuel pressure, open the throttle and turn the engine over with starter in order to clear it out. If the engine has been loaded and the ignition is left on, it is frequently possible to effect a start while clearing the engine out with the starter. In this case, it is necessary to be ready to immediately retard the throttle to prevent overspeeding. If the ignition switch is not left on during the clearing out procedure, a reasonable number of turns, such as 6 or 8 revolutions of the propeller, should be sufficient to clear, then repeat the starting procedure outlined above, starting with the mixture control in "Idle Cut-Off" and being careful about moving the mixture control out

of "Idle Cut-Off".

7. If no drainage of fuel is evident from the engine blower, the difficulty is probably not from overloading. In this case it is possible that the engine has not yet obtained sufficient prime. Repeat the starting procedure, increasing the prime.

8. If it is still not possible to start the engine, in all probability some part of the ignition system is not functioning, such as the booster coil, an investigation should be made. Protracted operation of the booster can sometimes overheat the coils so as to render the booster inoperative.

9. As soon as the engine starts, move the mixture control to "Automatic Rich", booster pump on, until the engine runs smoothly and automatically builds the fuel pressure to the desired 15 lbs/sq. in. Booster pump may then be turned off, unless take-off is to be made with hot gasoline. Pilots may prefer to retain booster pump operation durin take-off as a safety on the engine driven fuel pumps.

10. Adjust throttle control to hold the engine to as low a speed as possible for the first thirty seconds after starting and watch for an indication of oil pressure on the gauge.

CAUTION: If oil pressure does not register on the gauge almost immediately, (15 seconds) STOP and investigate.

11. After the first half-minute, adjust the throttle to about 1000 R. P. M.

(b) Cold Engines: When the engines are cold and have been exposed to outside air temperatures below 60°F. (15°C.), priming is necessary. The lower the temperature, the greater the amount of priming which will be required. Under the various

temperature conditions which may be encountered, experience will dictate how much priming is necessary to obtain good starting. (See Paragraph 9 Page 54 above for priming instructions.)

1. After the initial priming, the solenoid primer valve should be kept on as the engine is turned over with the starter in order to supply fuel directly to the cylinders since fuel from the primer system is vaporized by means of the primer nozzles.

NOTE: On cold engines, overloading is not necessarily indicated by a discharge of fuel from the engine blower but rather by the presence of raw gasoline in the exhaust collector, particularly in the stacks leading from the primed cylinders. In this case follow the procedure outlined for clearing out a warm engine when loaded.

2. If there is no evidence of raw gasoline in the exhaust collector, in all probability the engine has not been given sufficient prime, even though fuel may be draining from the blower. In cold weather considerable quantities of fuel may be discharged into the blower and pass out through the drain and still leave the engine underprimed. The reason for this is that fuel at low temperatures discharged into the blower is not sufficiently vaporized to be carried into the cylinders in mixture strengths necessary for combustion when the engine is turned over. For this reason, direct priming is required in cold weather to insure a satisfactory mixture at the intake ports of the cylinder. Care should be taken, however, not to flood the blower and cause a fire hazard from the drainage. On the other hand, in warm weather, both the fuel and the engine are at higher temperatures so that fuel discharged into the blower is vaporized sufficiently to be carried into the cylinders in mixture strengths necessary for combustion when the engine is turned over. When underpriming is suspected, additional priming should be made cautiously and the starting procedure repeated as outlined for warm engines.

c. Warm-up: (1) After the first half-minute, the warm-up should be made with the propeller, in the "Low Pitch" or "High R.P.M." position and at an engine speed of about 1000 R.P.M.

(2) Be sure the cowl flaps are open. Do not attempt to warm the engine up more quickly by closing the cowl flaps in extremely cold weather. This may cause overheating and damaging of the ignition system at the spark plug elbows.

(3) The oil pressure relief valve has been fitted with a temperature control that forces the oil when cold through the engine under high pressure, as much as 300 lbs./sq. in. when very cold. This extra high pressure is reduced when an oil-in temperature of about 40°C. (104°F.) is obtained.

(4) Always make certain that the solenoid primer switch is off after the engine is started.

(5) Long continued idling below 800 R.P.M. may result in fouled spark plugs.

d. Ground Test: (1) When the oil-in temperature has risen above 40°C., the throttle may be opened to approximately 30" Hg. manifold pressure with the propeller in "Low Pitch" or "High R.P.M." Do not attempt to operate above 1000 R.P.M. until the oil-in temperature has exceeded 40°C. Put propellers in "Manual" and note the loss of revolutions when switching to one magneto at a time. In switching from both magnetos to one, the normal drop-off is 50 to 75 R.P.M. and does not usually exceed 100 R.P.M. When switching from one magneto to the other, the change in R.P.M. should not be more than 30 or 40. It should be noted that the loss in R.P.M. when operating with one or two magnetos varies with different engine speeds. This check should be made in as short a time as practicable. Continued running on one magneto with manifold pressure as high as 25" to 30"Hg. absolute may cause serious detonation.

(2) In rare circumstances, even after the engine has been run a sufficient length of time to

give reasonable assurance that the spark plugs are cleared out, excessive R.P.M. drop or uneven engine operation may be experienced during the regular magneto check. In this case it is permissible to make a quick check of magnetos at 33" Hg. in low pitch in order to determine if the trouble lies in the magnetos themselves.

CAUTION: Operation of one magneto at this power output must be held to the shortest possible length of time because of the possiblility of serious damage from detonation.

(3) Check oil pressure, oil temperature, fuel pressure and other items at 2000 R.P.M.

(4) Oil pressure measure at the pressure gauge take-off on the upper left side of the engine rear cover case should be 75, ± 10 lbs./sq. in. at 2000 R.P.M. with 60°C. (140° F.) oil inlet temperature. If the low pressure oil system is checked it should show 30, ± 10 lbs./sq. in. Fuel pressure should be 16, ± 1 lb./sq. in.

(5) Oil pressures will vary with R.P.M. and temperature and need cause no alarm by falling to as low as 25 lbs./sq. in. with the engine idling, or if the pressure rises somewhat over 100 lbs./sq. in. with cool oil at take-off R.P.M. The pressures should not be set higher than 100 lbs/in.^{2} when the engine is operating under normal conditions with oil temperature 60 to 70°C. The fuel pressure at low idling speed may be as low as 8 or 10 lbs./sq. in. and still be satisfactory if the pressure comes up to the desired amount with 800 or 1000 R.P.M.

(6) On initial running after installation, if the oil pressure is not within the specified range, the oil pressure relief valve in the rear section should be adjusted to give the desired pressure and the low pressure system of the rear section should be checked and adjusted if necessary. The suctions and back pressures of the oil system in the airplane often are different from those of the test stand upon which the engine was run and have an ef-

fect upon the engine oil pressure. On subsequent running of the engine, any appreciable change in oil pressure under the same condition of R.P.M. and oil temperature may indicate trouble within the engine or oil system which should be investigated.

(7) Checking the blower ratio selector operations.

(a) Run the engine at 1400 to 1500 R.P.M. (60% normal speed) with the oil-in temperature about 60°C.

(b) Shift to "High" by moving the selector valve control without hesitation to the "High" position. The shift in the blower ratio should be accompanied by a slight rise of the manifold pressure when the high clutch is engaged. Prolonged fluctuation or loss in manifold pressure indicates improper high clutch engagement. In this event the selector control should be returned to the "Low" position and the operation repeated to assist in circulating warm oil through the mechanism.

(c) Important: When shifting from one speed to another, be sure to make the shift smoothly and positively without hesitation and without pausing between the two positions. Do not shift from one ratio to another in rapid succession. This is to avoid dragging and slipping of clutches with consequent abnormal heat generation.

(d) Be sure that the selector valve is in "Low" position, and that the carburetor is in automatic rich position and then proceed with take-off in the same manner as with a single speed engine.

(8) Cooling of the cylinder heads and barrels, and ignition harness is usually insufficient while on the ground for continued running above 1500 R.P.M. to 1600 RPM. Avoid prolonged running at power above this. It is recommended not to exceed 232°C. head temperature during ground operations if only one or two thermocouples are installed. For ground cooling tests with all heads and bases equipped with thermo-

couples, it is permissible to approach the maximum temperature of 260°C. on the hottest head.

e. Cowl Flaps: (1) The adjustable cowl flaps should be fully opened during all ground operations, and at least partially opened for take-off and climb. The cowl flaps should be adjusted to keep the cylinder temperatures under the limits specified on Page 72.

f. Flight - General: (1) General smoothness, engine speed, manifold pressure, carburetor air temperature, cylinder temperatures, oil temperatures, and the oil pressure give the most satisfactory indication of the performance of the power plant. If any of these appears irregular, the engine should be throttled and, if the cause is not apparent, a landing should be made to investigate and correct the trouble. For specific operating instructions, maximum limits, refer to Page 72. This information is shown on the Pilot's Check Chart in the map case on the back of the Pilot's seat for ready reference.

(2) Two Speed Blowers: (a) The manifold pressures below the critical altitudes are regulated by manually operating the engine throttle. Maximum engine performance will be obtained by remaining in low blower ratio until the critical altitude has been exceeded and the manifold pressure has dropped about 3 or 4 Hg. Then shift to high blower ratio by moving the control lever without hesitation to "High" position. Immediately before the selector valve control is shifted, the throttle should be partially closed in order to reduce the manifold pressure another 3 or 4" Hg. before the high speed ratio has engaged. Two or three trials will acquaint the pilot with the necessary throttle movement to prevent excessive manifold pressure after the high speed blower ratio engagement has been accomplished.

(b) With the blower in high ratio the engine may be operated essentially as any single speed engine. It is recommended that unduly high rates of change in engine speed be avoided if possible when in high blower ratio on account of the extra load on the

clutch and supercharger drive. Idling of the engine may not be entirely satisfactory because the idle adjustment of the carburetor has been made for the low blower ratio.

(3) Power Control: With controllable pitch propellers there are an infinite number of combinations of engine R.P.M. and manifold pressures obtainable for any desired value of engine power or airplane speed. However, there are also relations of engine R.P.M. and manifold pressure to desired engine power which will give maximum fuel economy, best over-all efficiency and will be conducive to most reliable engine operation and maximum engine life. The best possible operation will depend somewhat upon the desired conditions of flight such as climb and level flight and upon the airplane and propeller characteristics. The "Engine Characteristics" Pages 67 To 71 Incl., "Engine Check Chart" Page 72 "Cruising Control curves" Page 91 and "Cruising Engine Operating Instructions" Page 92 should be referred to for more detailed instructions.

g. Take-Off: - See Pilot's Check List, Page 73 and note the following:

(1) Cylinder head temperatures before the start of take-off must be low enough to ensure that the maximum limits are not exceeded during the use of take-off or emergency power. It is recommended that 205°C. not be exceeded prior to take-off.

(2) Throttle friction must be sufficient to prevent throttle creeping if hand is removed.

(3) Open throttle gradually, being careful not to exceed limiting manifold pressure. Airplane is sensitive to power application on take-off.

(4) As soon as clear of ground and obstructions, adjust the power to the normal climb conditions.

h. Climb: (1) The military services with their particular requirements often need the maximum

allowable power, having less regard for long life of the engine than for the immediate needs under conditions of emergency. For their purposes, military ratings comparable to take-off power may be usable in climb or level flight for five minutes.

(2) Adjust the cowl flaps to maintain cylinder temperatures somewhat less than the maximum permissible, preferably about the maximum permissible for cruising, i.e., 232°C.

(3) A material reduction in cylinder and/or oil temperatures can be obtained by climbing at an indicated air speed ten or twenty miles per hour higher than the speed for best climb without much loss in rate of climb. This will materially increase engine life by reducing ring sticking tendencies attendent with high head temperatures.

(4) A tendency for the oil to overheat can be checked the quickest by reducing the engine speed rather than by throttling alone.

i. Normal Maximum Rating - Climb and High Speed: - (1) The normal maximum rating is the maximum power at which the engine may be operated continously.

(2) The mixture given by the carburetor in "Automatic Rich" is expected to be rich enough to care for climbing operation. For maximum speed in level flight, even though the engine can be cooled, the mixture should not be set leaner than "Automatic Rich".

j. 75% Power:- (1) This is a power intermediate between the 100% Normal rated power and the maximum recommended cruising power. This again is primarily a military requirement.

k. Cruising Maximum:- (1) This is the maximum power recommended for continuous cruising operation. The engine will deliver dependable power for long periods between overhauls if the major portion of its operation is at or less than the cruising rating.

(2) After the airplane has leveled off and while attaining its approximate cruising speed, the engine should be given an opportunity to cool down after the climb, preferably even below the final cruising temperature, before auto lean is used. This permits the blower and rear sections, as well as the cylinders, to cool down. A well cooled engine will have little tendency to start detonation and overheating when the mixture is leaned.

(3) To aid in the cooling of the engine as outlined above, the cowl flaps should not be closed to the minimum position immediately after completion of the climb, but progressively as the airplane gathers speed.

l. Low Cruising Power:- Refer to "Range Chart" page 90, "Cruising Control Curves" page 91, and "Cruising Engine Operating Instructions" page 92.

Two Speed Blower: Better engine efficiency is obtained when operating in low blower than in high blower ratio if the low blower ratio is able to supply the necessary power. If it is desired to increase the power slightly at the full throttle altitude of a low R.P.M. in low blower ratio it is preferable to increase the engine speed up to 100 to 200 R.P.M. and remain in low blower rather than shift to high blower ratio and remain at the low R.P.M.

m. Cruising Descent:- (1) Under normal conditions of cross country flight it is general practice to start a descent at a distance from the destination of as much as 100 miles or more. This distance is determined as a function of the altitude of the airplane above the destination, the rate of descent desired and the time necessary for the descent, the wind velocity and direction and its effect upon the airplane speed, and the resulting speed of the airplane during the descent. Such a descent should be regarded as a cruising operation. Cruising R.P.M., power, and mixture should be maintained throughout the descent until the point is reached where the final glide or approach for landing is to be made.

n. Dive:- (1) The centrifugal or inertia loads on the master rod bearings increase as the square of the R.P.M. These loads, however, are in the opposite direction from the power impulse loads from the pistons. Therefore, high engine speeds with low manifold pressures impose the severest loads on the master rod bearings and should be avoided if possible. Where over-speeding of the engine is unavoidable in dives, it is recommended that the throttle be partially opened to give 12" to 15" Hg. if practicable. However, this may increase the speed of the engine somewhat; the maximum safe overspeed R.P.M. has been defined at 2880-R.P.M. for the R-2800-5.

(2) Since dives are usually accompanied by other maneuvers that may require full power of the engine, the mixture control must be in the "Automatic Rich" position.

(3) Two Speed Blower: The supercharger should be shifted into low blower ratio before any dives are made which might cause the engine to overspeed. This will prevent excessive wear of impeller shaft bearings and driving gears caused by unnecessarily high impeller speed during dives.

o. Glide:- (1) The paragraph on Dive has bearing upon the transition from high speed flight or cruising to the throttled condition of a glide or approach for landing. If the throttle is closed while the airplane has comparatively high speed the constant speed propeller will change pitch and maintain the R.P.M. for which the governor is set. When the governor is set for take-off R.P.M. and the throttle is closed while the airplane speed is high, the engine will "wing-mill" at high speed with manifold pressures of only one or two inches of mercury. This is not so at low airplane speeds. The propeller governor should be set for low cruising R.P.M. until the airplane has slowed down sufficiently to prevent high engine speeds when the governor setting is changed to the landing or take-off speed position. A convenient time to set the propeller governor preparatory to landing is while the landing gear and

wing flaps are being set for the landing.

(2) The mixture control should be checked at this time that it is in the "Automatic Rich" position, and check that the blower ratio selector valve or the turbine regulator control is in the position for take-off.

p. Approach for Landing:- (1) Set at Maximum Cruise (See T.O. 02-10GA-1

(2) It is advisable to partially open the cowl flaps. If emergency power is needed, further adjustment of the partially opened flaps can be made after having cared for more urgent duties.

(3) Before taxiing, have the cowl flaps fully open.

q. Stopping:- (1) Leave the propeller control in take-off position.

(2) If the Cylinders are hot due to hard taxiing, permit the engine to idle a short time to allow the cylinder temperatures to cool below 205°C.

(3) To stop the engine move the mixture control to the "Idle Cut-Off" position. This may be done with the engine turning at about 1,000 R.P.M. When the engine has stopped, turn all ignition switches to "Off".

(4) Leave the cowl flaps open after the engine stops to aid in circulation of air over the engine. This is to guard against residual heat of the power section and exhaust collector raising the temperatures of the spark plug elbows and other portions of the ignition system to values that are above the permissible limits (120°C, for the elbows) and cause damage.

(5) If "Idle Cut-Off" should not stop the engine, close the throttle, cut the ignition switch and slowly open the throttle wide as the engine stops. Have the "Idle Cut-Off" adjusted properly as

soon as possible.

(6) Leave the mixture control in "Idle Cut-Off" position at all times when the engine is not running.

3. Engine Ratings and Characteristics

a. Double Wasp R-2800-5 (S1A4-G) engine; single stage, two speed supercharger, 7.6:1 and 9.45:1 ratios; compression ratio 6.65:1; propeller reduction gear ratio 0.5000 (2:1); Stromberg, PT-13F1 Injection Carburetor with Automatic Mixture Control; Scintilla DF-3 Magneto, Fuel Spec. AN 9531, 100 Octane; Operating Curve, P&WA T-660. Rated:

See P. 92 Cruising Engine Operating Instructions

	BHP	RPM	ALT	BLOWER
Take-Off	1850	2600	o'	Low
Military(5Min.)	1850	2600	2700'	Low
Military(5Min.)	1850	2600	14000'	High
Normal Rated	1500	2400	7500'	Low
Normal Rated	1450	2400	13000'	High
Cruise	1000	2100	14000'	Low
Cruise	980	2100	17700'	High
Maximum Diving Speed		2880	(30 seconds)	Low

b. Take-Off:- (Available for Emergency Climb for 5 minutes)

Maximum Engine R.P.M	2600
Maximum Manifold Pressure	49.0" Hg.
Mixture Control	Auto Rich
Blower Ratio	Low

c. Military Rating - 5 Minutes

Low Blower - 0 - 9500 ft. (critical 3100 ft.)

Maximum Engine R.P.M.	2600
Maximum Manifold Pressure	47.5" Hg.
Mixture Control	Auto Rich

Blower Ratio	Low
Fuel Consumption (Approx.)	239 gal/hr.

High Blower 9500 ft. and up (critical 14,000 ft.)

Maximum Engine R.P.M.	2600
Maximum Manifold Pressure	40.5" Hg.
Mixture Control	Auto Rich
Blower Ratio	High
Fuel Consumption (Approx.)	180 gal/hr.

d. Normal Climb and High Speed Level Flight

Low Blower 0 - 9500 ft. (critical 8000 ft.)

Maximum Engine R.P.M.	2400
Maximum Manifold Pressure	38.0" Hg.
Mixture Control	Auto Rich
Blower Ratio	Low
Fuel Consumption (Approx.)	170 gal/hr.

High Blower 9500 ft. and up (critical 13,000 ft.)

Maximum Engine R.P.M.	2400
Maximum Manifold Pressure	40.0" Hg.
Mixture Control	Auto Rich
Blower Ratio	High
Fuel Consumption (Approx.)	176 gal/hr.

e. 75% Power Operation

Low Blower 0 - 14,000 ft. (critical 12,600 ft.)

Maximum Engine R.P.M.	2180
Maximum Manifold Pressure	30.0" Hg.
Mixture Control	Auto Rich
Blower Ratio	Low
Fuel Consumption (Approx.)	105 gal/hr.

High Blower 14,000 ft. and up (critical 17,600 ft)

Maximum Engine R.P.M.	2180
Maximum Manifold Pressure	31.0" Hg.
Mixture Control	Auto Rich
Blower Ratio	High
Fuel Consumption (Approx.)	109 gal/hr.

f. Cruising - Maximum

Low Blower 0 - 15,500 ft. (critical 14,300 ft.)

Maximum Engine R.P.M.	2100
Maximum Manifold Pressure	27.5" Hg.
Mixture Control	Auto Lean
Blower Ratio	Low
Fuel Consumption (Approx.)	79 gal/hr.

High Blower 15,500 ft. and up (critical 19,000 ft.)

Maximum Engine R.P.M.	2100
Maximum Manifold Pressure	28.2" Hg.
Mixture Control	Auto Lean
Blower Ratio	High
Fuel Consumption (Approx.)	83 gal/hr.

g. Cruising - Examples of Recommended Method for Low Power

Low Blower, 0 - 13,700 ft. (critical 12,000 ft.)

Maximum Engine R.P.M.	2000
Maximum Manifold Pressure	29.0" Hg.
Mixture Control	Auto Lean
Blower Ratio	Low
Fuel Consumption (Approx.)	76 gal/hr.

High Blower, 13,700 ft. and up (critical 17,500 ft.)

Maximum Engine R.P.M.	2000
Maximum Manifold Pressure	28.0" Hg.
Mixture Control	Auto Lean
Blower Ratio	High
Fuel Consumption (Approx.)	78 gal/hr.

Low Blower, 0 - 10,500 ft. (critical 8,800 ft.)

Engine R.P.M.	1600
Maximum Manifold Pressure	29.0" Hg.
Mixture Control	Auto Lean
Blower Ratio	Low
Fuel Consumption (Approx.)	58 gal/hr.

High Blower, 10,500 ft. and up (critical 13,300 ft.)

Engine R.P.M.	1600
Maximum Manifold Pressure	28.0" Hg.
Mixture Control	Auto Lean
Blower Ratio	High
Fuel Consumption (Approx.)	61 gal/hr.

h. Cylinder Temperatures - Maximum

	Heads* °C
At rated take-off and military power - (5 min.)	260
High speed and climb at normal rated power	260
Continuous operation at any power, except as above	232
Desired continuous operation	100-200

*Measured at point embedded in gasket of rear spark plug.

i. Oil Pressure

	Lbs./in.^{2}
Desired, at 2400 R.P.M. at 60°C	80, +5, -0
Desired, at 2000 R.P.M. at 60°C	75, +5, -0
Maximum	90
Minimum at rated R.P.M.	75
Minimum at cruising	60
Minimum at idling	25
Low pressure oil system	30, ±10

j. Oil Inlet Temperatures

	°C
Minimum for take-off and flight	40
Desired	60-75
Maximum, level flight	85
Maximum, climb	100

k. Fuel Pressure

	Lbs./in.^{2}
Desired	16, $\pm$1
Allowable Range	15 - 17

Fuel pressure is relative to the air pressure at the entrance of the carburetor.

ENGINE CHECK CHART P&W CURVE T-660, T-525-F

PRATT & WHITNEY DOUBLE WASP R-2800-5(S1A4-G), TWO SPEED BLOWER: PT-13F1; 100 OCTANE

OPERATING CONDITION	MAX. BHP	MAX. RPM	ALT. FT.	BLOW. RATIO	MAX. MAN. PRESS.	MIXTURE CONTROLS	FUEL PRESS.	OIL PRESS.	OIL TEMP. °C	MAX. CYL. HD. °C	COWL FLAPS	APPROX. FUEL CONS. GAL./HR.
PULL THRU	-	-	-	LOW	-	IDLE CUT-OFF	-	-	-	-	-	-
PRIME	-	-	-	LOW	-	IDLE CUT-OFF	6-10	-	-	-	OPEN	-
START	-	700	-	LOW	-	IDLE CUT-OFF & AUTO. RICH	6-10 15-17	(300)	-	-	OPEN	-
WARM-UP	-	1000	-	BOTH	-	AUTO. RICH	15-17	25-100	40-85	232	OPEN	-
GROUND TEST	-	*(LOW PITCH)	-	LOW	25-30"	AUTO. RICH	15-17	65-85	40-85	120-232	OPEN	-
TAKE-OFF	1850	2600	-	LOW	49.0"	AUTO. RICH	15-17	85-90	40-100	260	OPEN	239
MILITARY (5 MIN)	1850	2600	0 9500	LOW	49.0" 47.5"	AUTO. RICH	15-17	85-90	40-100	260	AS REQ'D	239
MILITARY (5 MIN)	1500	2600	9500 UP	HIGH	40.5"	AUTO. RICH	15-17	85-90	40-100	260	AS REQ'D	180
NORMAL RATED	1500	2400	0-9500	LOW	38.0"	AUTO. RICH	15-17	80-85	40-85 (100)	260	AS REQ'D	170
NORMAL RATED	1450	2400	9500 UP	HIGH	40.0"	AUTO. RICH	15-17	80-85	40-85 (100)	260	AS REQ'D	176
75% RATED	1125	2180	0-14000	LOW	30.0"	AUTO. RICH	15-17	80-85	40-85	232	CLOSED	105
75% RATED	1090	2180	14000 UP	HIGH	31.0"	AUTO. RICH	15-17	80-85	40-85	232	CLOSED	109
CRUISE - MAX.	1000	2100	0-15500	LOW	27.5"	AUTO. LEAN	15-17	60-80	60-75	232	CLOSED	79
CRUISE - MAX.	980	2100	15500 UP	HIGH	28.2"	AUTO. LEAN	15-17	60-80	60-75	232	CLOSED	83
CRUISE RECM'D.	-	SEE CRUISING CONTROL CHART FOR COMPLETE POWER					CONTROL		-			-
DIVE OR GLIDE	-	2880	-	LOW	-	AUTO. RICH	15-17	60-80	40-100	232	CLOSED	-
APPROACH	-	*2100	-	LOW	49.0"	AUTO. RICH	15-17	60-80	40-100	260	-	-
STOP	-	*(TAKE-OFF) 1000	-	LOW	-	IDLE CUT-OFF	-	(25)	-	205	OPEN	-

* (PROPELLER GOVERNOR SETTING)

SECTION VII

PILOT'S CHECK LIST

MODEL B-26 BOMBARDMENT AIRPLANE - R-2800-5 (S1A4-G) ENGINES
(See other side for complete Engine Check Chart)

Operating Limits

Cylinder Head Temperature
- Maximum (5 min.) 260° C
- Normal Cruising 100°-200° C

Oil Inlet Temperature
- Max. and Norm. Cruising 85°/60°
- Minimum for Take-off 40°C

Oil Pressure, Engine
- Max. and Min. Cruising 90/60 lbs./in.^{2}

Fuel Pressure - range 15-17 lbs./in.^{2}
Manifold Pressure - Maximum 49 in. Hg.
Hydraulic Pressure
- Maximum - 950 lbs./in.^{2}
- Minimum - 750 lbs./in.^{2}

Take-off Check

CHECK FLIGHT CONTROLS FOR FREE MOVEMENT

Fuel Pressure - 15-17 lbs./in.^{2}
Oil Temperature - Min. 40° C
Oil Pressure - 85-90 lbs./in.^{2}
Hydraulic Pressure - 750 lbs./in.^{2} Min.
Carburetor Heat Control - Cold
Mixture Control - Automatic Rich
Propeller Control - Low Pitch (High RPM)
Blower Ratio - Low
Cowl Flaps - Full Open
Oil Cooler Shutter - Full open except during extreme cold weather
Wing Flaps - Down 30°
Tab Controls - As required
Main Generator Switches - "ON"

Engine Operating Limits

	HP	RPM	IN. HG.
Military Power (Max. for 5 Min.)	1850	2600	49.0

Flight Check

Refer to Engine Check Chart, other side for instrument readings and control settings

Landing Check

Hydraulic Pressure - 750 lbs./in.^{2} Min.
Landing Gear - Extended

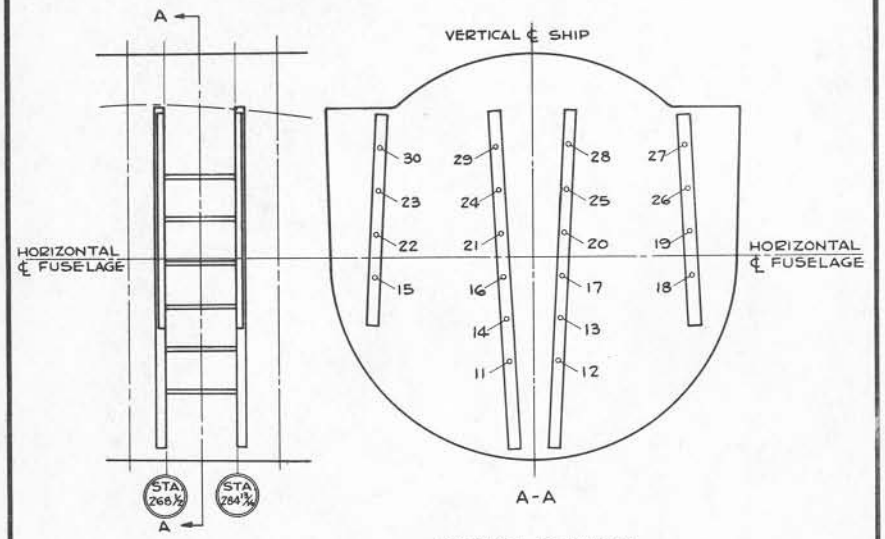
Mixture Control - Automatic Rich
Propeller Control - Automatic (High RPM)
Blower Ratio - Low
Cowl Flaps - As Required
Wing Flaps - Full Down
Tab Controls - As Required

WARNINGS

1. Cowl Flaps must be open for all ground operation except for warm-up during extremely cold weather.
2. Propeller blades must be in "Low Pitch" (High RPM) for Starting, Warm-up, and Take-off.
3. Wing Flaps must not be lowered at speeds above 185 MPH.
4. Landing Gear must not be extended at speeds above 185 MPH.
5. Lock pins of landing gear are indicated in place by indicators on Instrument Panel.
6. Warning horn sounds when gear is extended but not locked.
7. Maneuvers prohibited: All aerobatics including vertical banks, SIDE SLIPS, and dives above placarded maximum I.A.S.
8. Return Ldg. gear, Flap, oil cooler, and cowl flap controls to neutral when not in use.

Chg. A.

SECTION VIII WEIGHT DATA
BOMB LOADING SCHEDULE
FORWARD BOMB BAY



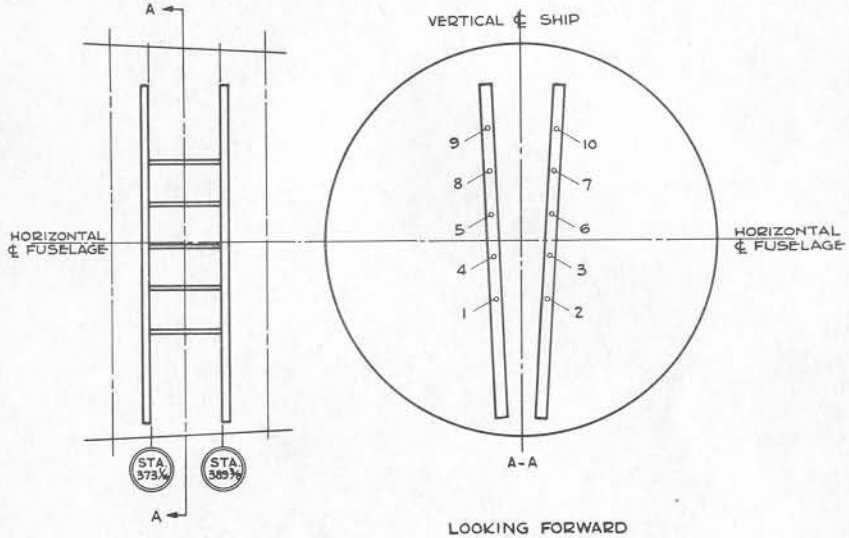
LOOKING FORWARD
BOMB DISTRIBUTION – FORWARD BAY

NORMAL LOAD	CARRIED AT STATIONS
1. BOMBER WITH 4-600# BOMBS	21, 14, 20 AND 13
2. BOMBER WITH 1-2000# BOMB	BETWEEN 23 & 24 or BETWEEN 25 & 26
3. BOMBER WITH 2-1100# BOMBS	16 AND 17
4. BOMBER WITH 8-300# BOMBS	15, 29, 21, 14, 28, 20, 13 & 18
5. BOMBER WITH 20-100# BOMBS	30, 23, 22, 15, 29, 24, 21, 16, 14, 11, 28, 25, 20, 17, 13, 12, 27, 26, 19 & 18

ALTERNATE LOAD	CARRIED AT STATIONS
6. BOMBERS WITH 2-2000# BOMBS	BETWEEN 23 & 24 & BETWEEN 25 & 26
7. BOMBER WITH 4-1100# BOMBS	29, 16, 28 & 17
8. BOMBER WITH 8-600# BOMBS (6 IN FWD. BAY)	29, 21, 14, 28, 20 & 13
9. BOMBER WITH 14-300# BOMBS (8 IN FWD. BAY)	15, 29, 21, 14, 28, 20, 13 & 18
10. BOMBER WITH 30-100# BOMBS (20 IN FWD. BAY)	30, 23, 22, 15, 29, 24, 21, 16, 14, 11, 28, 25, 20, 17, 13, 12, 27, 26, 19 & 18

NOTE: ADDITIONAL 300# BOMBS MAY BE LOADED AT STATIONS 23 & 26 BY MAKING 10 IN FORWARD BAY.
ROTATE FINS OF 100# & 300# BOMBS 30° COUNTER-CLOCKWISE WHEN INSTALLED AT STATION 15. ROTATE FINS OF 100# & 300# BOMBS 30° CLOCKWISE WHEN INSTALLED AT STATION 18.

BOMB LOADING SCHEDULE
AFT BOMB BAY



LOOKING FORWARD
BOMB DISTRIBUTION – AFT BAY

ALTERNATE LOAD	CARRIED AT STATIONS
8. BOMBER WITH 8-600# BOMBS (2 IN AFT BAY)	4 AND 3
9. BOMBER WITH 14-300# BOMBS (6 IN AFT BAY)	9, 5, 1, 10, 6 AND 2
10. BOMBER WITH 30-100# BOMBS (10 IN AFT BAY)	9, 8, 5, 4, 1, 10, 7, 6, 3 AND 2

BOMB LOAD TABLE

	Weight Lbs.	Arm Inches	Moment Inch-Lbs/1000
Forward Bay			
1 - 2000# bomb & shackles	2116	261.1	552.6
2 - 1100# bombs & shackles	2220	263.2	584.4
6 - 600# bombs & shackles	3776	264	996.8
8 - 300# bombs & shackles	2362	262.7	620.6
20 - 100# bombs & shackles	2438	263	641.3
Aft Bay			
2 - 600# bombs & shackles	1259	367.5	462.5
6 - 300# bombs & shackles	1772	367.2	650.4
10 - 100# bombs & shackles	1219	366.1	446.8

3. Center of Gravity and Cargo Loading Data

The Model B-26 airplane is stable when the center of gravity lies between 10% and 24% of the Mean Aerodynamic Chord. Aft of 24% MAC the airplane is controllable but not positively stable.

All normal and overload combinations of bombs

and fuel are within the desired limits of center of gravity location, with the crew at flight stations or at battle stations.

a. Light Landing Condition:

When all bombs, ammunition and fuel have been expended and the landing gear has been extended the center of gravity will be too far forward for ease of control in landing. Two members of the crew should be moved from their stations in the Pilot's or Navigator's compartment to the seats in the deck turret compartment. This will provide a landing center of gravity within the desired range.

NOTE: If 250 gallons or more fuel remain in the tanks it is unnecessary to move the crew.

b. Cargo Loading Data:

When using the airplane as a cargo or troop carrier or with a military load differing from one of the typical conditions shown on pages 78 and 79, it will be necessary to prepare a Loading Schedule. This schedule will list the weight and location of the items carried.

The Loading Data Table, pages 78 and 79 lists the weight and moment of the main items of removable weight empty and useful load. The location of any items not listed may be obtained approximately by scaling the Loading Diagram, page 81. The moment for any amount of fuel in the wing tanks may be obtained from the Fuel Capacity and Moment Graph, page 80. After summing up the weight and moment of all items carried on the flight the approximate center of gravity, in % MAC, may be determined by using the C. G. Grid, page 82. Sample loading schedules are shown on pages 83, 84, and 85.

LOADING DATA TABLE

Basic Useful Load	Weight Lbs.	Arm	Moment in.lbs./1000
Crew at Flight Positions	(950)	198	(188.3)
Pilot	200	97	19.4
Co-pilot	200	97	19.4
Radio Operator	200	184.5	36.9
Navigator	180	191	34.4
Turret Gunner	170	460	78.2
Moment for Crew at Battle Station			(+60.7)
Flexible Guns & Installation	(563.0)	(444.8)	(250.4)
Bow; 1-.30 cal., 600 rds.	73.5	28.9	2.1
Turret; 2-.50 cal.,400 rds.	270.0	451.3	121.8
Tunnel; 1-.30 cal.,600 rds.	76.5	484.8	37.1
Tail; 1-.50 cal., 200 rds.	143.0	625.8	89.4
Total Basic Useful Load	1513.0	289.95	438.7
Weight Empty L.G.Retracted	21375.0	234.39	5009.9
Moment for L.G.Extended			(-23.1)
Weight Empty & Basic U.L. L.G.Retracted	22888.0	238.05	5448.6

Removable Equipment Included in Weight Empty

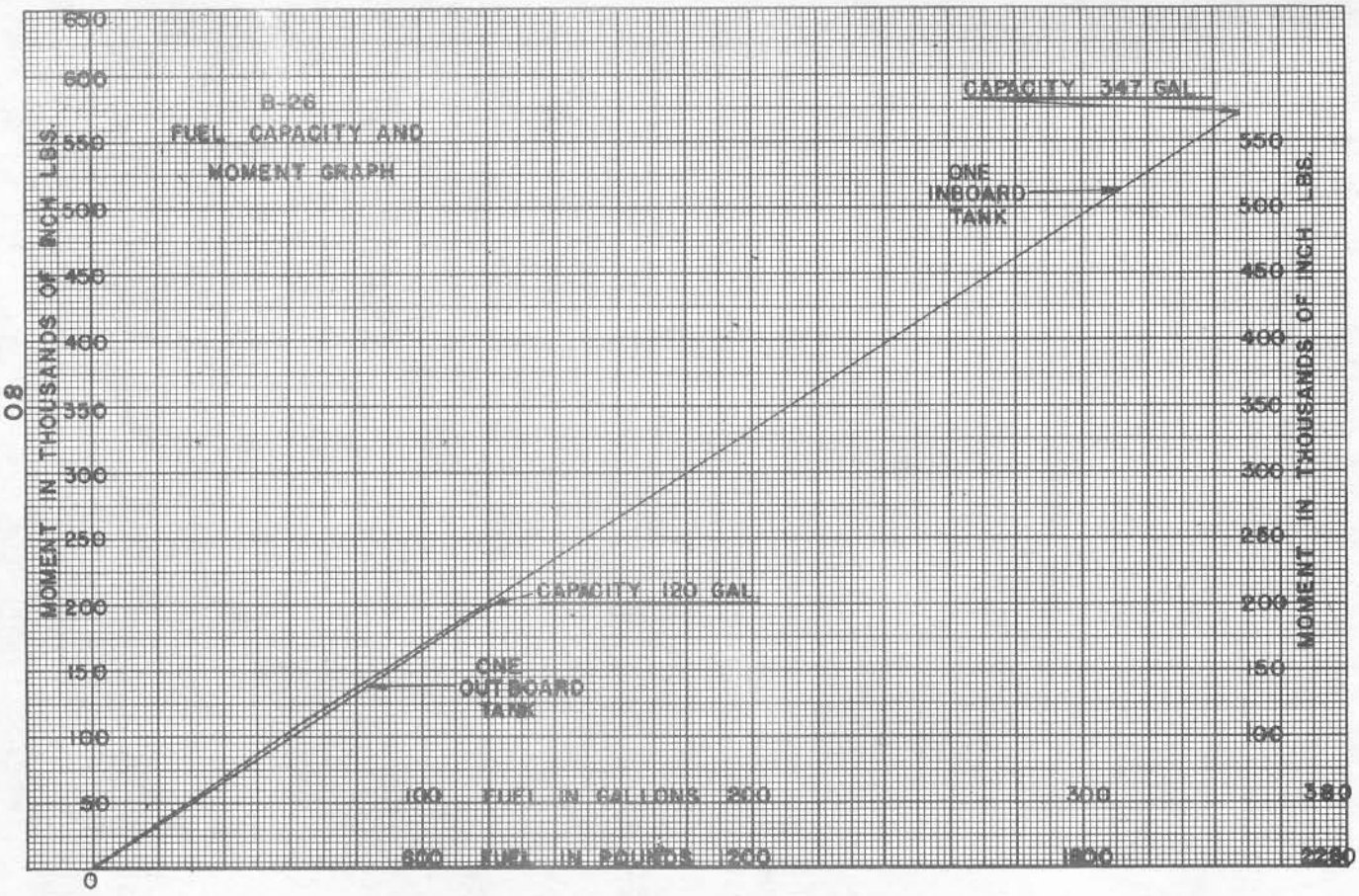
	Weight	Arm	Moment in.lbs./1000
Armor Plate	511	246.6	126.0
Oxygen Cylinders & Regulators	84.5	247.6	20.9
Upper Turret	331.5	445.1	147.5
Life Raft & Installation	68	167	11.4
Communication Equipment			
Command Set	53.2	153	8.1
Liaison Set	225.4	193.7	43.7
Radio Compass	77.7	149.8	11.6

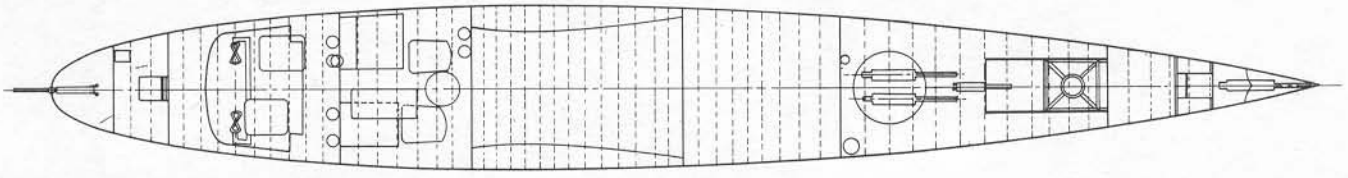
Center of Gravity Data:

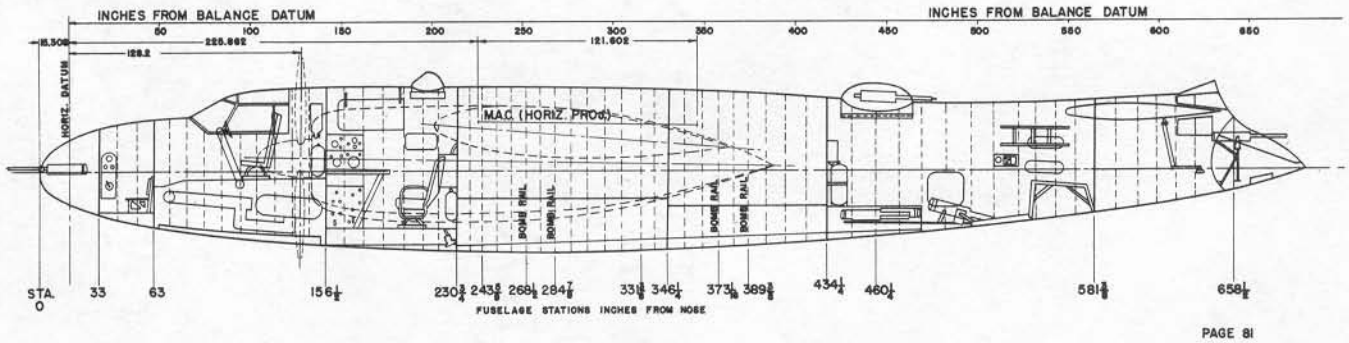
L.E. MAC From Bal. Datum = 225.86"
Length of MAC = 121.6 "

Balance in % MAC may be calculated or obtained graphically on the Center of Gravity Grid.

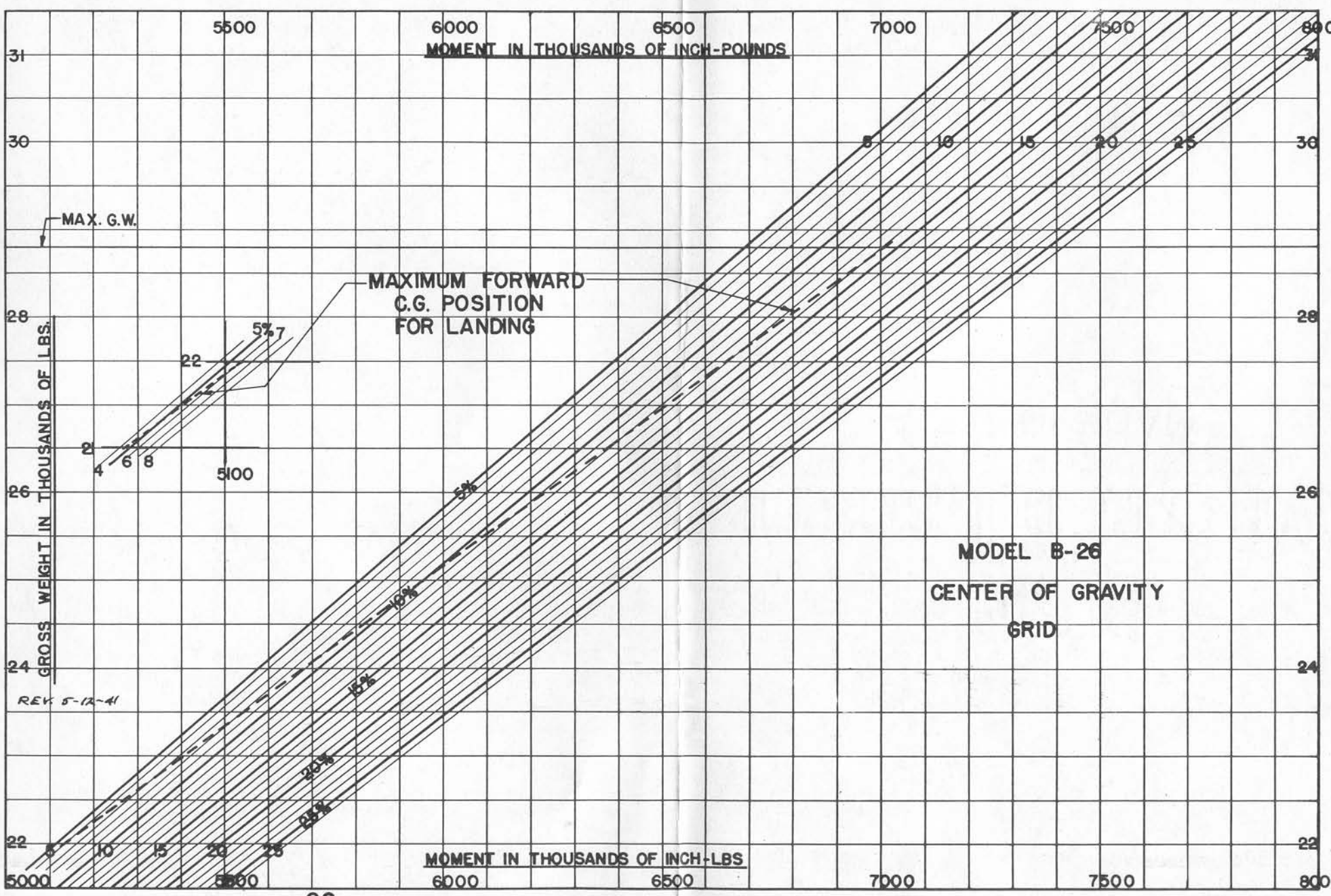
VARIABLE LOAD	NORMAL			MAX RANGE			MAX BOMB LOAD		
	Weight	Arm	Moment	Weight	Arm	Moment	Weight	Arm	Moment
Bombs & Shackles									
4 - 600# Fwd. Bay	2517	264	664.5				2517	264	664.5
2 - 600# Fwd. Bay							1259	264	332.3
Fuel at 6#/gal.	(465 gals. fuel)			(1184 gals. total fuel)			(465 gals. fuel)		
Inboard Tanks	2790	275.4	768.4	4164		1144.3	2790	275.4	768.4
Outboard Tanks				1440	274.5	395.3			
Bomb Bay Tank				1500	270	405.0			
Bomb Bay Tank Installation				178	270	48.1			
Oil at 7.5#/gal.	317	224.3	71.1	557	224.3	124.9	218	224.3	48.9
	(42 gals. oil)			(74 gals. oil)			(29 gals. oil)		
Total Variable Load	5624	267.4	1504	7839	270.1	2117.6	8043	283.1	2276.8
Weight Empty & Basic Useful Load L.G.Retracted	22888		5448.6	22888		5448.6	22888		5448.6
Gross Weight, L.G.Retracted	28512	243.8	6952.6	30727	246.2	7566.2	30931	249.8	7725.4
Crew at Flight Sta.		14.8% MAC			16.8% MAC			19.7% MAC	
Moment for Crew at Battle Sta.			+60.7			+60.7			+60.7
Gross Weight, L.G.Retracted	28512	246	7013.3	30727			30931		
Crew at Battle Sta.		16.5% MAC							
Overload Fuel	(930 gal. total fuel)			Special Variable					
Inboard Tanks	1374	273.6	375.9	Load (Not included above)					
Outboard Tanks	1416	274.6	388.8	Photographic Installation			159	548	87.1
Overload Oil	119	224.3	26.7	Extra Turret Ammunition					
Overload Gross Weight	31421	246.5	7744.0	(400 rds.)			100	456.5	45.6
L.G.Retracted, Crew at Flight Sta.		16.9% MAC							







LOADING DIAGRAM


5500
6000
6500
7000
7500
8000
MOMENT IN THOUSANDS OF INCH-POUNDS
31
30
28
26
24
22
MAX. G.W.
MAXIMUM FORWARD
C.G. POSITION
FOR LANDING
5%
7
22
2
4
6
8
5100
GROSS WEIGHT IN THOUSANDS OF LBS.
REV. 5-12-41
5%
10%
15%
20%
25%
5
10
15
20
25
MODEL B-26
CENTER OF GRAVITY
GRID
MOMENT IN THOUSANDS OF INCH-LBS
5000
5500
6000
6500
7000
7500
8000

CARGO LOADING DATA

Sample Loading Schedule #1

	Weight	Arm	Moment
Weight Empty L. G. Retracted	21375	234.39	5009.9
Basic Useful Load (Ref. page 78)	1513	289.9	438.7
Bombs & Shackles			
Fwd. Bay 20 - 100#	2438	263	641.3
Aft. Bay 10 - 100#	1219	366.1	446.8
Fuel 465 gal.	2790	275.4	768.4
Oil 42 gal.	317	224.3	71.1
Gross Weight L. G. Retracted	29652	248.76	7376.2

Center of Gravity = 248.76 - 225.86/121.6 = 18.8% MAC

Center of Gravity by intersection of weight and moment on C.G.Grid = 19% MAC.

CARGO LOADING DATA

Sample Loading Schedule #2

	Weight	Arm	Moment in.lbs./1000
A. Weight Empty. L.G. Retracted (Ref. Balance Table	21375		5009.9
Corrections to Weight Empty			
Less:			
Armor Plate	-511		-126.0
Deck Turret	-331.5		-147.5
Oxygen	- 84.5		- 20.9

B. Weight Empty corrected for Cargo Flight	20448		4715.5
Variable Load			
Crew			
Pilot & Co-Pilot	400	97	38.8
Radio-Navigator	200	184.5	36.9
Cargo			
Fwd. Bomb Bay	1500	264	396
Aft. Bomb Bay	1500	367	551
Navigator's Compartment	800	175	140
Total Weight, Less Fuel & Oil	24848		5878.2
Moment for L.G. Extended			-23.1
C. Total Weight, Less Fuel & Oil	24848	235.6	5855.1

Center of Gravity
=(235.6 - 225.86) /121.6 = 8% MAC

NOTE: This is too far forward, so it will be necessary to shift some of the cargo from Navigator's compartment to the turret compartment.

Cargo: 400# moved from 175" to 450" (400)		+275	+110
C' Total Weight Less Fuel & Oil L.G. Extended	24848	240.0	5965.1

Center of Gravity = 11.6% MAC

Moment for Landing Gear Retracted +23.1

CARGO LOADING DATA

Sample Loading Schedule (Cont'd) #2

	Weight	Arm	Moment in.lbs/1000
Total Weight Less Fuel & Oil L. G. Retracted	24848		5988.1
Fuel			
Inboard 2 at 347 gal. ea.	4164		1140.0
Outboard 2 at 120 gal. ea.	1440		395.0
Oil 58 gal.	436	224.3	97.8
D. Gross Weight L. G. Retracted	30888	246.7	7620.9

Center of Gravity
246.7 - 225.86/121.6 = 17.1% MAC

Center of Gravity by intersection of weight and moment on C. G. Grid = 17% MAC.

A. Gross Weight Data

1. Weight Empty 21,375 lbs.

2. Basic Useful Load

(a) Crew including parachutes: 950 lbs.

1. Pilot	200 lbs.
2. Co-pilot	200 lbs.
3. Radio Operator	200 lbs.
4. Navigator	180 lbs.
5. Gunner	170 lbs.

(b) Oxygen In.Wt.Empty

(c) Flexible Guns & Installation 563 lbs.

1. Bow; 1- .30 cal. incl. 600 rds.amm. 73.5
2. Turret; 2-.50 cal. incl.400rds.amm.270.0
3. Tunnel; 1-.30 cal. incl.600 rds.amm.76.5
4. Tail; 1-.50 cal. incl. 200 rds.amm.143.0

(d) Photographic Special overload

Total Basic Useful Load 1,513 lbs.

3. Variable Load

(a) Fuel (Normal 465 gals. total, inboard tanks) 2,790 lbs.

L.H. Inboard Tank	347 gals.	=	2,082 lbs.
R.H. Inboard Tank	347 gals.	=	2,082 lbs.
L.H. Outboard Tank	120 gals.	=	720 lbs.
R.H. Outboard Tank	120 gals.	=	720 lbs.
Bomb Bay Tank	250 gals.	=	1,500 lbs.
Bomb Bay Tank & inst.		=	178 lbs.
	1,184 gals.	=	7,282 lbs.

(b) Oil (Normal 42.3 gals. total) 317 lbs.

L.H. Tank 41.25 gals. = 309.5 lbs.
R.H. Tank 41.25 gals. = 309.5 lbs.
82.5 gals. = 619.0 lbs.

(c) Bombs, Including Shackles (Normal 4-600#) 2,517 lbs.

30 - 100# = 3,657 lbs.
14 - 300# = 4,134 lbs.
8 - 600# = 5,034 lbs.
4 -1100# = 4,441 lbs.
2 -2000# = 4,232 lbs.

(d) Photographic Equipment 146 lbs.
Mount 13 lbs.

(e) Overload Ammunition

Turret gun - 400 rds. 100 lbs.

Total Variable Load (Normal Gross Weight) 5,624 lbs.

4. Normal Gross Load Condition 28,512 lbs.

5. Maximum alternate Load Condition 31,421 lbs.

(Same as Normal Loading - except 930 gal. fuel and 58 gal. oil)

6. Flight Restrictions necessary when using Maximum Alternate Load.

Level flight not to exceed 325 m. p. h. indicated airspeed.

7. Tow Target Ballast Condition

If the Type C-5 Tow Target Winch is installed for Tow Target flight conditions, the following loading conditions will apply:

	Target Types		
Gross Weight Including:	A-6	A-7	B-14
Pilot, Co-pilot, Winch Operator			
Target Observer (Tail Position)			
Normal Fuel (465 gal.)			
Normal Oil (42.3 gal.)			
Power Turret (Less Guns & Ammunition)			
Ballast:			
At Camera Position (Sta. 565)	150	150	150
At Lower Gun Position (Sta. 475)	280	280	280
Total Gross Weight	26559	26426	26487
C.G.Position (%M.A.C.)	15.78	15.71	15.75

SECTION IX

PERFORMANCE DATA

1. General

a. This airplane may be expected to give approximately the following performance with normal load under standard atmospheric conditions.

2. Performance Data (Calculated)

High Speed Level Flight With Normal Power

Altitude Ft.	Speed MPH	Eng. RPM	M. P. (In.Hg.)	Blower Ratio
0	277.5	2400	38	Low
5000	296	2400	38	Low
9100	311	2400	38	Low
10600	307.5	2400	36.1	Low
14200	319.5	2400	40	High
20000	306	2400	Full Throttle	High
SC 24740	270	2400	Full Throttle	High

Climbing Flight With Normal Power
*Normal Gross Weight = 28512 lbs.

Altitude Ft.	Speed MPH	Eng. RPM	M. P. (In.Hg.)	Blower Ratio	Rate Climb FPM	Time Min.
0	154	2400	38	Low	1530	0
5000	167	2400	38	Low	1470	3.3
7900	174	2400	38	Low	1440	5.3
9400	178	2400	36.1	Low	1310	6.4
		2400	40	High	1310	6.4
13000	185	2400	40	High	1190	9.4
20000	202	2400	Full Throttle	High	460	18.4
SC 24740	205	2400	Full Throttle	High	100	31.1
AC 25740	207	2400	Full Throttle	High	0	

High Speed with Military Power Level Flight - 1850 H.P. at S.L., 4100 Ft; 1450 B.H.P. at 11000 Ft.
(Available for 5 minutes) 1500 H.P. at 15000 Ft.; *Normal Gross Weight 28,512
At sea level - 2600 r.p.m. - 47.5 in. manifold pressure Low Blower 307.0 m.p.h.
At 4100 ft. - 2600 r.p.m. - 47.5 in. manifold pressure Low Blower 318.0 m.p.h.
At 15000 ft. - 2600 r.p.m. - 47.5 in. manifold pressure High Blower 323.0 m.p.h.

Operating Speed Level Flight, Normal Gross Weight = 28512 lb. 75% Rated Power at Airplane Crit.Alt.(-1450 BHP/Eng. at 14,200')
At sea level - 259 m.p.h. - 37.0 in. manifold pressure Low Blower 1800 r.p.m.
At 10000 ft. - 278 m.p.h. - 31.5 in. manifold pressure Low Blower 2020 r.p.m.
At 15000 ft. - 286 m.p.h. - 32.2 in. manifold pressure High Blower 2030 r.p.m.

*Note- Gross Weight is in accordance with actual airplane and not original specification

Landing Speed - Wt. 28512 Lbs. Flaps up 124 m.p.h.
Flaps down 105 m.p.h.

Range and Endurance (at high speed with normal and *gross weight of 28,512 lbs. including 465 gals of fuel)

At 5000 ft.	-	Range 395 miles,	Endurance	-	1.32 hrs.
At 10000 ft.	-	Range 416 miles,	Endurance	-	1.33 hrs.
At 15000 ft.	-	Range 444 miles,	Endurance	-	1.38 hrs.

Range and Endurance (at operating speed with 28,512*gross weight including 465 gals. fuel)

At 5000 ft.	-	Range 835 miles,	Endurance	-	3.06 hrs.
At 10000 ft.	-	Range 855 miles,	Endurance	-	3.00 hrs.
At 15000 ft.	-	Range 806 miles,	Endurance	-	2.74 hrs.

Maximum Range for 30,725 lbs. gross weight including 1184 gals. fuel. Low Blower

Alt.Ft.	Speed-M.P.H.	Eng.R.P.M.	Man.Press in Hg.	Range-Mi.	Endurance-Hr.
5000	180	1350	27.2	2760	15.34
10000	200	1460	25.4	2775	13.87

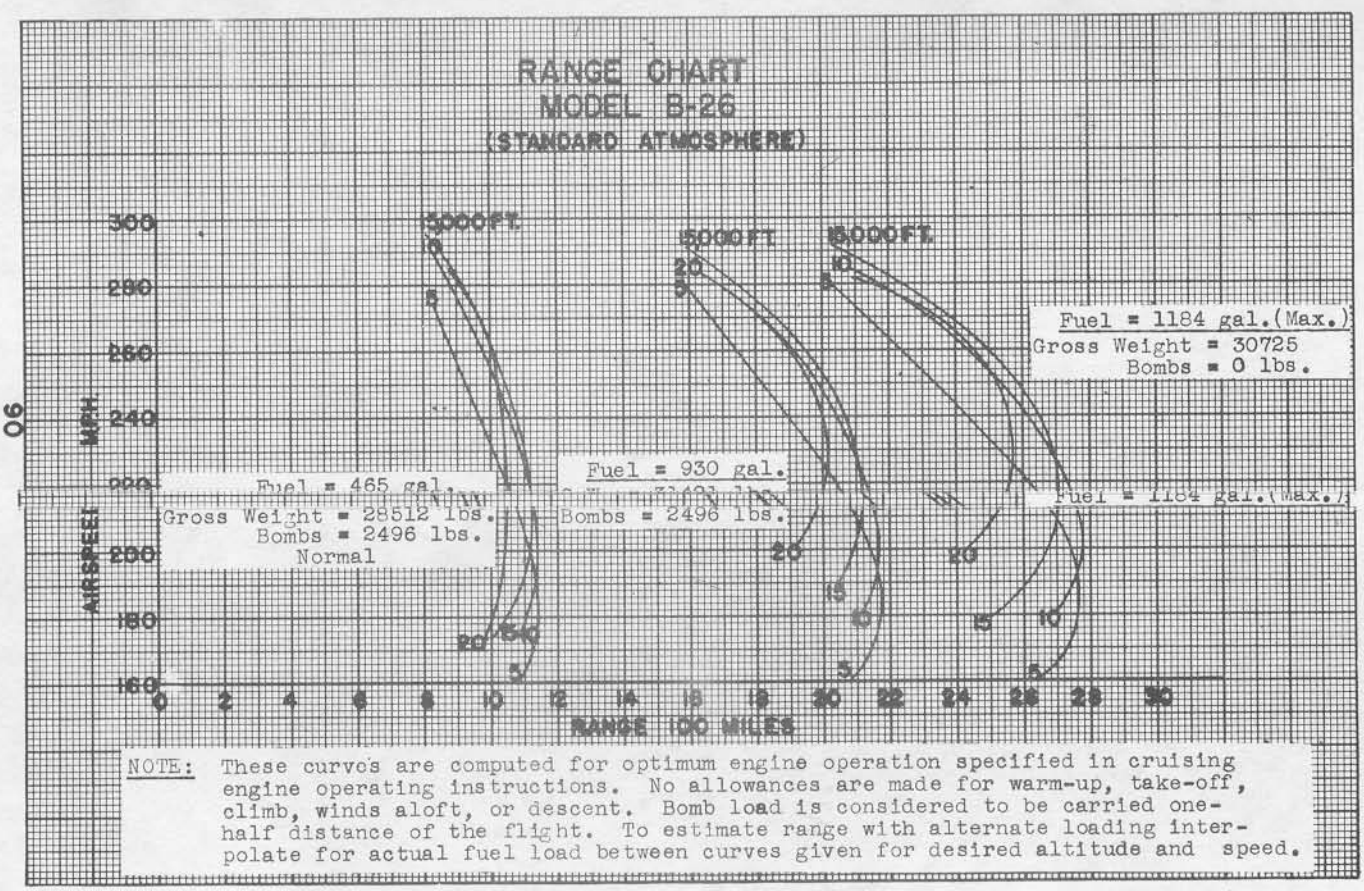
Take-Off Distance - 2720 ft. dry firm level sod field with full load*28,512 lbs. All take-offs will be made with carburetor mixture control in Automatic Rich position.

One Engine Dead - Will maintain altitude at full throttle, full load*28,512 lbs. at 10,000 ft. Feather propeller on dead engine to reduce drag and reduce pitch on good engine to increase h. p.

Stalling Speeds (Approximate), Power Off Condition.

Flaps and Gear Down	98 m.p.h. I.A.S.
Flaps and Gear Up	110 m.p.h. I.A.S.
45° Bank, Flaps and Gear Up	124 m.p.h. I.A.S.
60° Bank, Flaps and Gear Up	159 m.p.h. I.A.S.

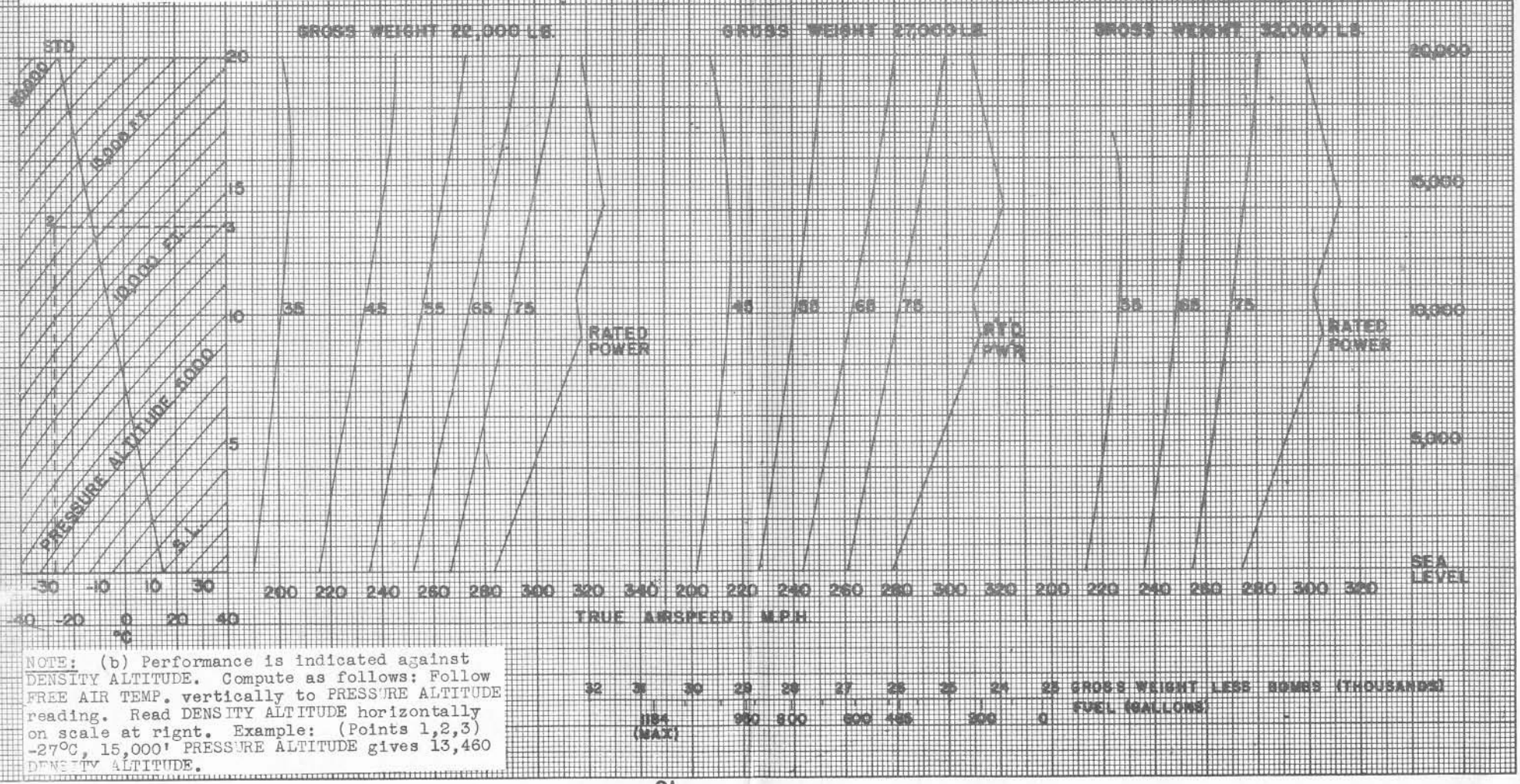
*Note- Gross Weight is in accordance with actual airplane and not original specification.


RANGE CHART
MODEL B-26
(STANDARD ATMOSPHERE)
AIRSPEED MPH
300
280
260
240
220
200
180
160
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
RANGE 100 MILES
5000 FT.
5000 FT.
15000 FT.
Fuel = 465 gal.
Gross Weight = 28512 lbs.
Bombs = 2496 lbs.
Normal
Fuel = 930 gal.
Bombs = 2496 lbs.
Fuel = 1184 gal.(Max.)
Gross Weight = 30725
Bombs = 0 lbs.
Fuel = 1184 gal.(Max.)
NOTE: These curves are computed for optimum engine operation specified in cruising engine operating instructions. No allowances are made for warm-up, take-off, climb, winds aloft, or descent. Bomb load is considered to be carried one-half distance of the flight. To estimate range with alternate loading interpolate for actual fuel load between curves given for desired altitude and speed.

MODEL B-26
CRUISING CONTROL CHART

NOTE: (a)

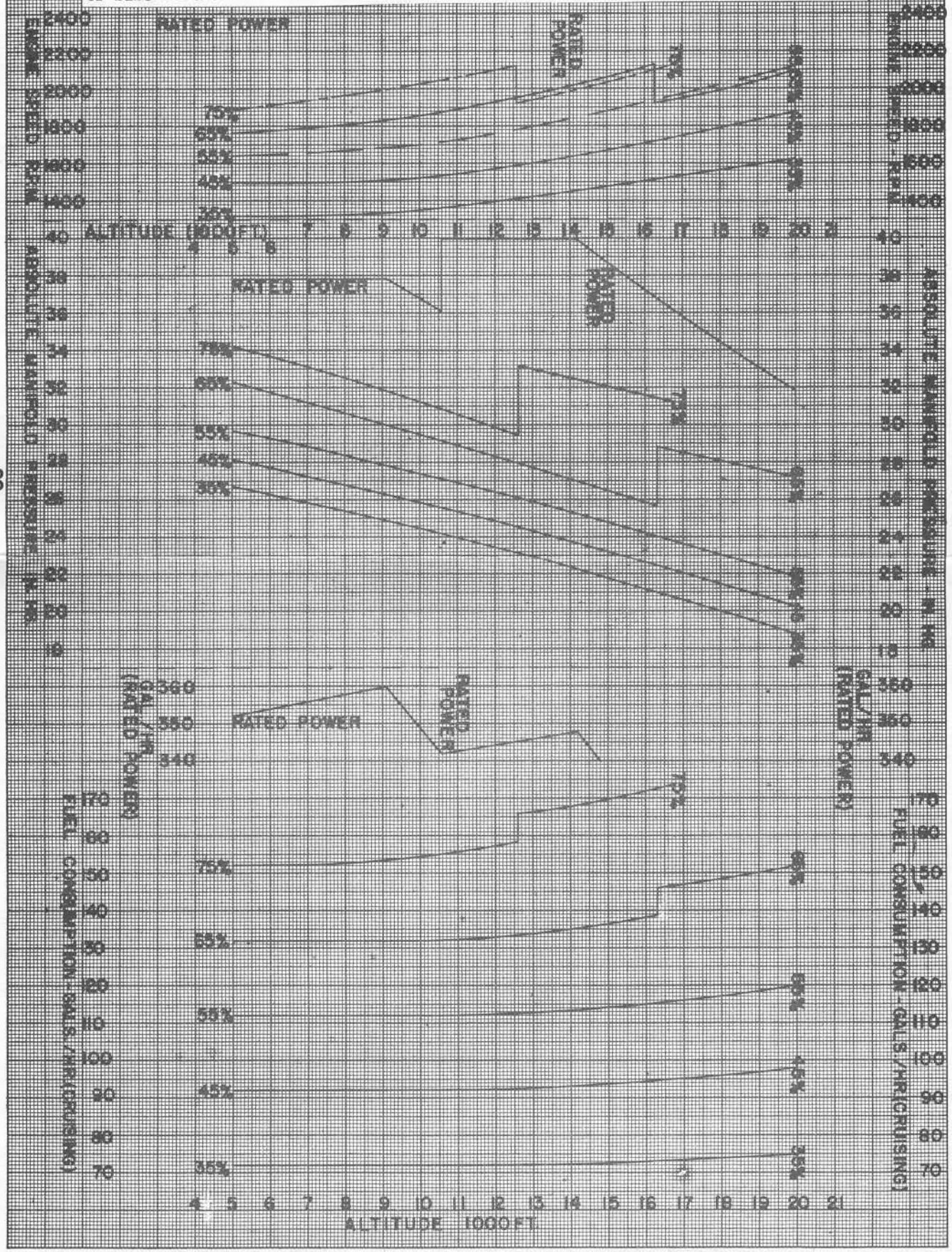
1. Powers given below are percentages of 2 x 1450 BHP, which is the normal rated power at airplane critical altitude.
2. For use in flight: Set manifold pressure and RPM to give the indicated airspeed equivalent to the true airspeed charted. (See Cruising Engine Operating Instructions). Do not exceed operating limits.
3. The fuel flows given in Cruising Engine Operating Instructions are the optimum; allowance for warm-up, take-off, climb, reserve, etc. must be made in flight plan.
4. For maximum range operation determine the percent power and altitude which gives the maximum miles per gallon (MPH divided by gallons per hour) for the existing gross weight of the airplane (see Cruising Engine Operating Instructions; use Range Chart as a guide). Consider each hour the effect of the weight decrease due to fuel consumption and on this basis revise speed and altitude; revise conditions when bombs are dropped; consider the effect of winds.

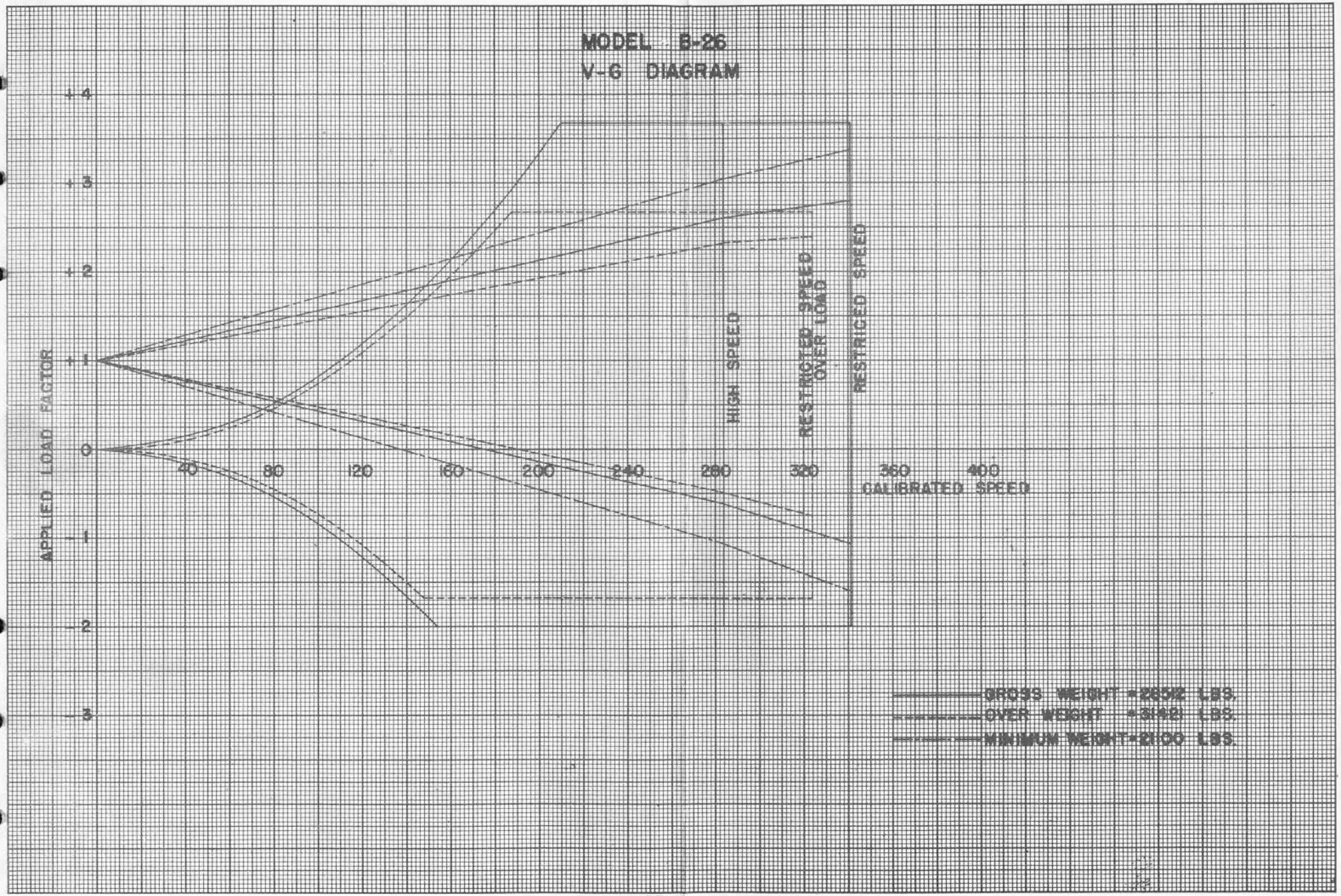


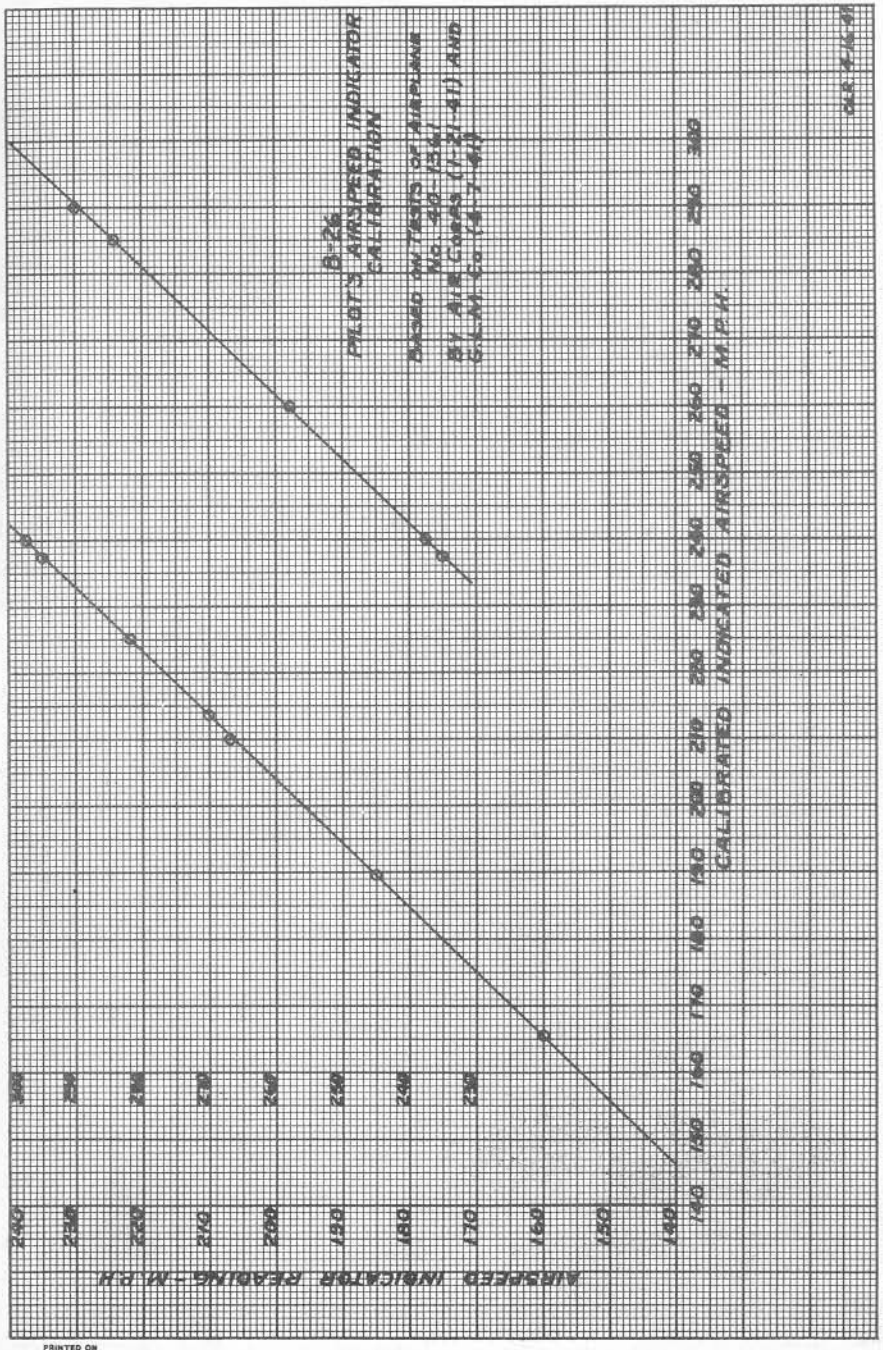
NOTE: (b) Performance is indicated against DENSITY ALTITUDE. Compute as follows: Follow FREE AIR TEMP. vertically to PRESSURE ALTITUDE reading. Read DENSITY ALTITUDE horizontally on scale at right. Example: (Points 1,2,3) -27°C, 15,000' PRESSURE ALTITUDE gives 13,460 DENSITY ALTITUDE.

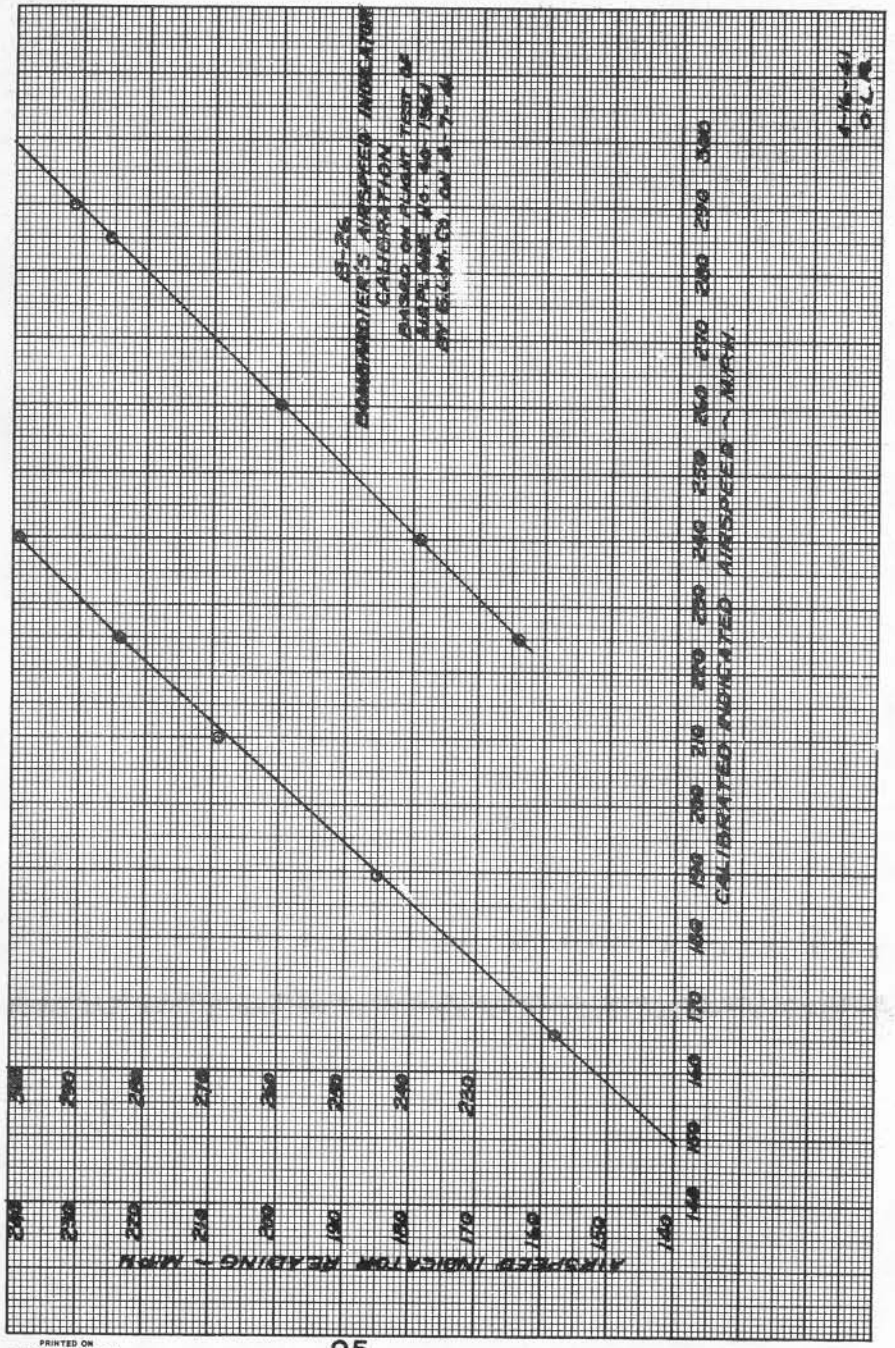
CRUISING ENGINE OPERATING INSTRUCTIONS
MODEL S-26
STANDARD ATMOSPHERE

These curves specify the optimum engine operating conditions required for use with the Cruising Control Chart.
(Percent powers given below are percentages of 2 x 1450 BHP which is the rated power at airplane critical altitude:
NOTE: Breaks in curves denote blower shift at maximum recommended cruising limit of 2125 R.P.M.




MODEL B-26
V-G DIAGRAM
APPLIED LOAD FACTOR
+4
+3
+2
+1
0
-1
-2
-3
40
80
120
160
200
240
280
320
360
400
CALIBRATED SPEED
HIGH SPEED
RESTRICTED SPEED OVER LOAD
RESTRICTED SPEED
GROSS WEIGHT =2650# LBS.
OVER WEIGHT =3442# LBS.
MINIMUM WEIGHT=2100 LBS.


B-26
PILOT'S AIRSPEED INDICATOR CALIBRATION
Based on Tests of Airplane No. 40-1394 by A.A.F. Comb. Flt. Sec. (1-22-41) and C.A.I. Co. (4-7-41)
CAL 4-16-41
AIRSPEED INDICATOR READING - M.P.H.
CALIBRATED INDICATED AIRSPEED - M.P.H.


B-26
PILOT'S AIRSPEED INDICATOR CALIBRATION
Based on Flight Tests by A.A.F. Comb. Flt. Sec. (1-22-41) and by G.I.M. Co. (4-7-41)
4-16-41
AIRSPEED INDICATOR READING - M.P.H.
CALIBRATED INDICATED AIRSPEED - M.P.H.