PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODELS

B-24G, H, J, L and M

NAVY MODEL

PB4Y-1

BRITISH MODEL

LIBERATOR

GRVI and BVI

AIRPLANES

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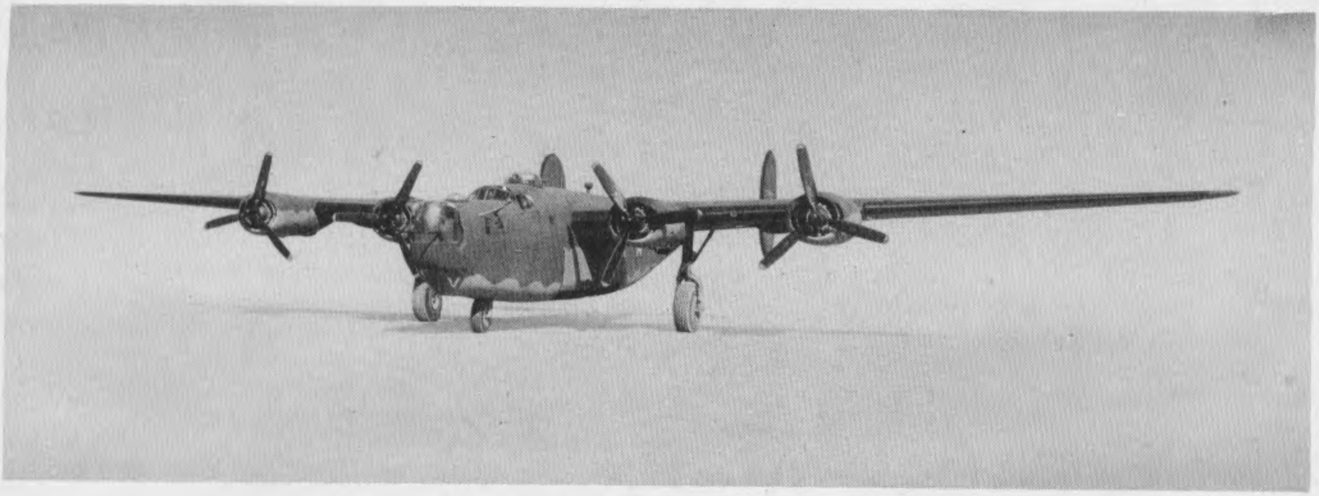


Figure 1—Three-Quarter Front View Showing Type A-15 Nose Turret

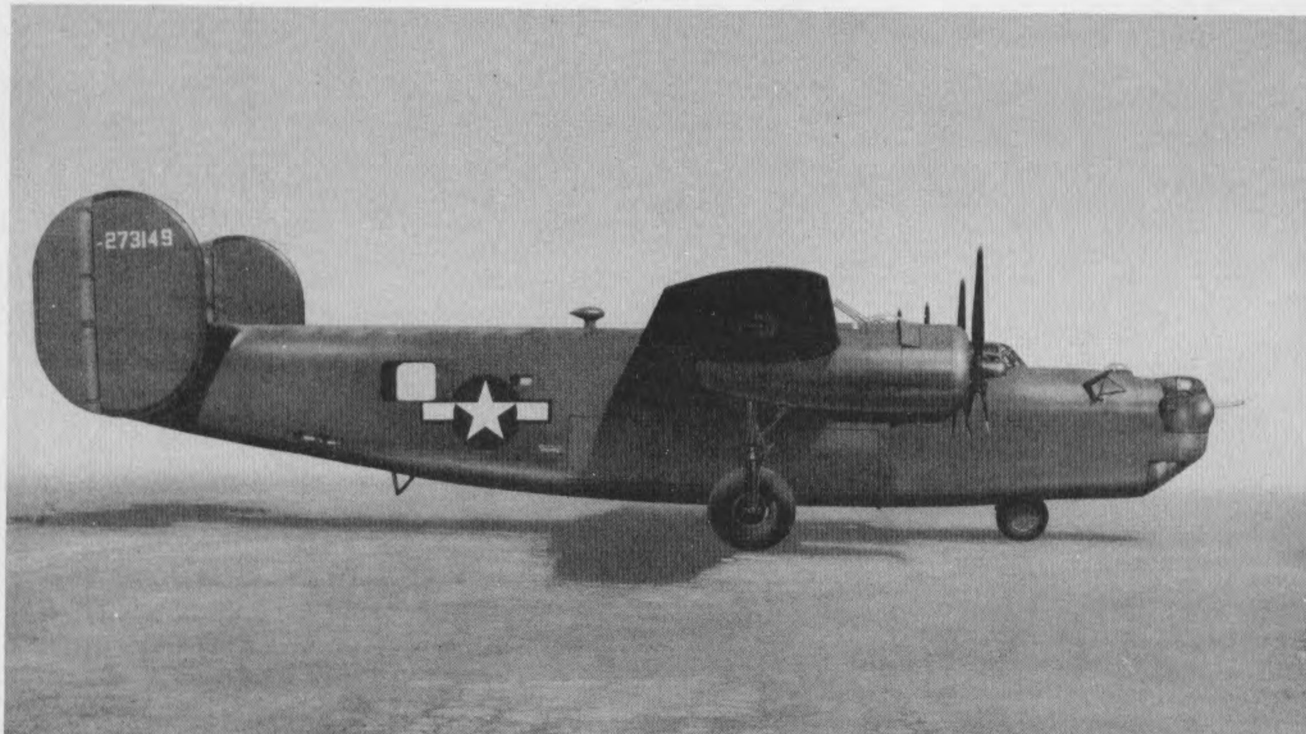


Figure 2—Side View Showing Motor Products A-6B Turret

SECTION I
DESCRIPTION

1. AIRPLANE.

a. GENERAL.

(1) B-24G, H and J (Navy PB4Y-1) heavy bombardment airplanes are high-wing land monoplanes manufactured by Consolidated Vultee Aircraft Corporation, Ford Motor Company, Douglas Aircraft Corporation, and North American Aviation, Incorporated. These airplanes will be referred to hereafter as "Group I," "Group II," and "Group III."

This group designation system is necessary due to conversion of the "G" and "H" lines to a "J" model which is the basic "G" or "H" with the C-1 Autopilot and M-7 bomb sight replacing the A-5 automatic pilot and S-1 bomb sight. Thus the fuel, armament, and other equipment differs from the original "J" models (Group III) in that the equipment is as in the "G" or "H."

GROUP DESIGNATION CHART

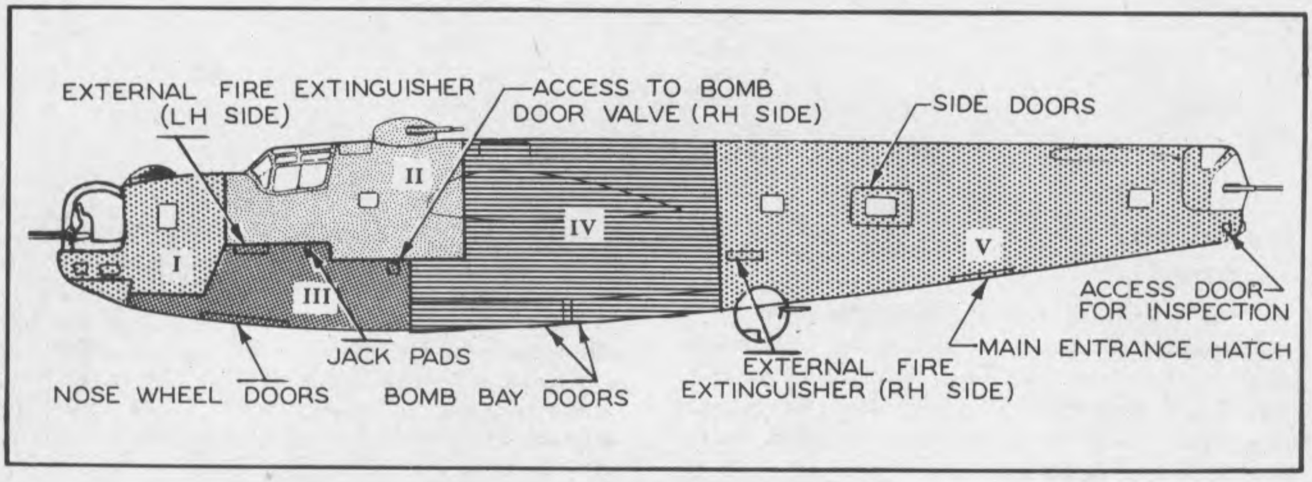
Group	*Block*	*Serial No.*
I	B-24G-1NT to B-24G-15NT	42-78045 to 42-78474
	B-24J-1NT to	42-78475 to 42-78794
II	B-24H-1CF	41-29116 to 41-29608
	to	42-64432 to 42-64501
	B-24H-30CF	42-50277 to 42-50451
	B-24J-401CF	42-50452 to 42-50508
	B-24H-1FO	42-7465 to 42-7769
	to	42-50277 to 42-52776
	B-24H-30FO	42-94729 to 42-95503
	B-24J-1FO	42-95504 to 42-95628 42-50509 to 42-51067

Group	*Block*	*Serial No.*
II (Cont'd)	B-24H-1DT	41-28574 to 41-29008
	to B-24H-30DT	42-51077 to 42-51225
	B-24J-1DT to B-24J-5DT	42-51226 to 42-51430
III	B-24J-1CO	42-72964 to 42-73514
	to	42-99936 to 42-100435
	B-24J-200CO	42-109789 to 42-110188
		44-40049 to 44-41248
	B-24J-1CF	42-64047 to 42-64349
	to B-24J-65CF	42-99736 to 42-99935
		44-10253 to 44-10603

CO—Consolidated-Vultee, San Diego
FO—Ford Motor Company, Willow Run
NT—North American Aviation, Dallas
CF—Consolidated-Vultee, Fort Worth
DT—Douglas Aircraft, Tulsa

Approximate over-all dimensions are: length 67 feet, 2 inches; height 17 feet, 11 inches; span 110 feet. The fuselage is divided into compartments as shown in figure 3.

Referring to figure 3, the compartment numbered I is the bombardier-navigator's compartment, containing navigational equipment, bomb sight, bomb controls, and nose turret. The compartment numbered II is the flight deck, containing the pilot's and copilot's seats and controls, radio operator's station, and the top gun turret. On some later Group III airplanes the navigator's station is located on the flight deck instead of in the bombardier's compartment. The compartment numbered III is the nose wheel compartment, containing the nose landing gear, auxiliary power unit, liaison antenna reel, amplidyne



I. NAVIGATOR-BOMBARDIER'S COMPARTMENT
II. FLIGHT DECK
III. NOSE WHEEL COMPARTMENT
IV. BOMB BAYS
V. REAR FUSELAGE COMPARTMENT

Figure 3—Fuselage Compartments Diagram

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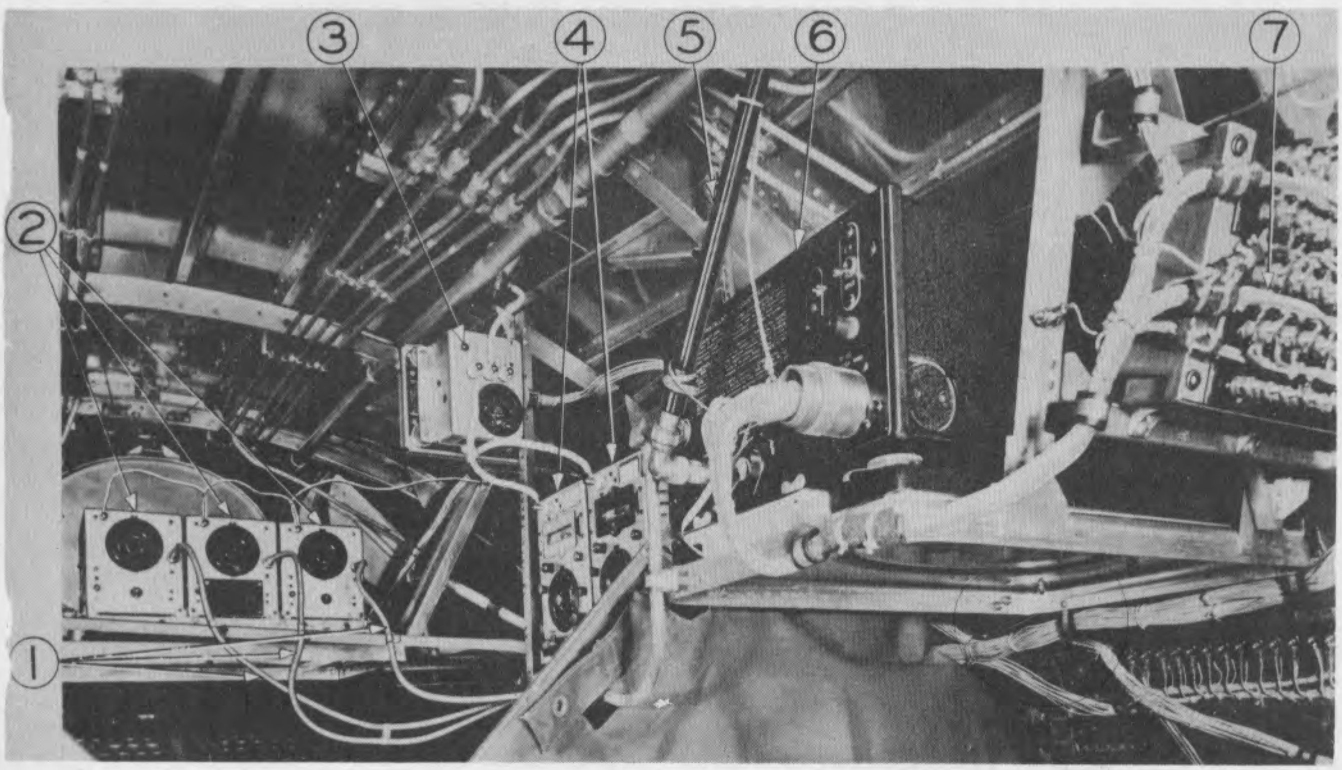
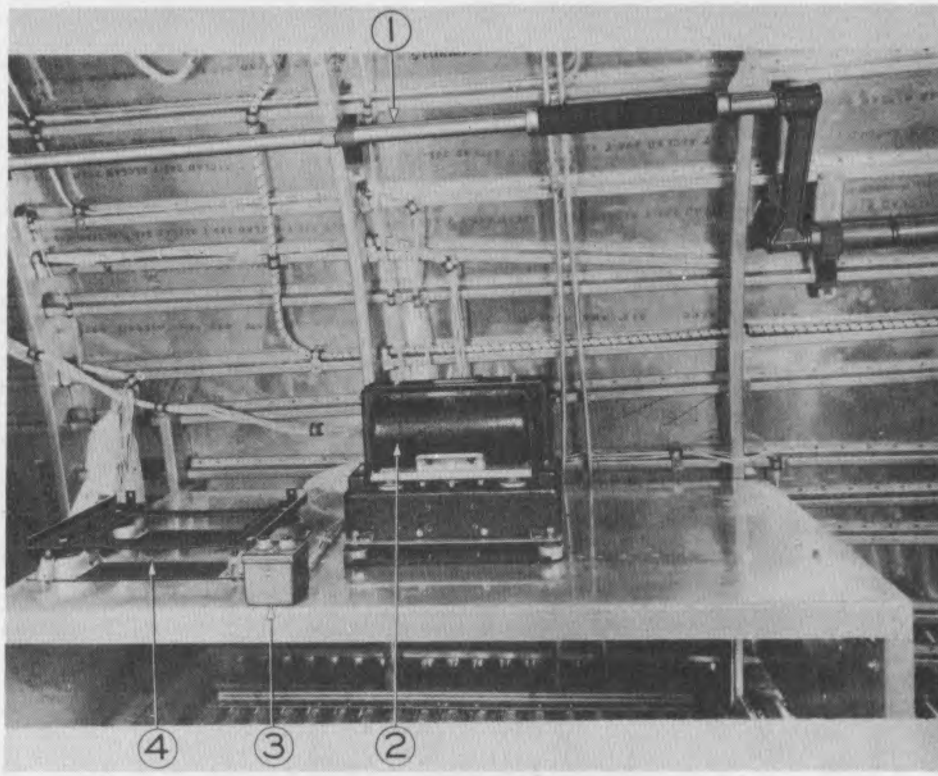


1. Tuning Shafts
2. Command Receivers (BC 453, BC 454, BC 442)
3. Antenna Relay (BC 442)
4. Command Transmitters (BC 458, BC 459)
5. Shaft to Loop Antenna
6. Radio Compass Receiver (BC 433)
7. BK 22 Relay

Figure 4—Radio Equipment, Command Deck, Right Side, Forward View



1. Engine Crank
2. Command Dynamotor and Modulator (BC 456)
3. Indicator Box (for SCR 695 Equipment)
4. Mounting-Base for SCR 695

Figure 5— Radio Equipment Command Deck, Right Side, Aft View

units (on Groups I, II and III airplanes equipped with electric nose turrets) storage battery, a-c power inverters, voltage regulators, hydraulic system accumulators, and various other items. The compartment numbered IV contains the bomb bays, the electric auxiliary hydraulic pump, the main hydraulic fluid reservoir, the platform over the wing center sections (known as the command deck), see figures 4 and 5, radio equipment, oxygen storage tanks, and other items. The compartment numbered V contains the retractable ball turret, side guns, photographic equipment, additional oxygen storage tanks, tail turret or gun mount, and miscellaneous equipment.

(2) The airplane is designed to carry a combat crew of nine men; located as follows:

Compartment I — Nose turret gunner
Bombardier-navigator

Compartment II — Pilot
Copilot
Radio operator—top gunner

Compartment V — Bottom turret gunner
Two side gunners
Tail turret gunner

Movement of the crew members between the nose compartment (Compartment I) and the flight deck (Compartment II) or the after part of the ship (Compartments IV and V) is by way of a passageway through the nose wheel compartment, (Compartment III) around the right side of the nose landing gear. Movement of personnel between the flight deck (Compartment II) and the rear fuselage compartment (Compartment V) is by way of a narrow catwalk through the bomb bays (Compartment IV).

(3) Access to the nose compartment (Compartment I) from outside the airplane is by way of the nose wheel doors. Access to the rest of the airplane from outside is either through the bomb bay doors or through the entrance hatch in the bottom of the rear fuselage compartment (Compartment V). When the bomb bay doors are closed, they may be opened from the outside by pulling the handle which operates the bomb door emergency and utility valve. This handle is located on the right side of the nose portion of the fuselage, and is accessible through the same opening which provides access to the battery cart plug connectors.

(4) Armor plate protection for all earlier Groups I, II and III airplanes is as shown in figures 68 and 69. Later production airplanes and some airplanes modified by service activities will have flexible steel "flak" curtains behind the pilots' seats, in lieu of armor plate.

b. FLIGHT CONTROLS.

(1) Flettner trim tabs which may be controlled from the pilots' pedestal *(see figure 17, detail B)* are

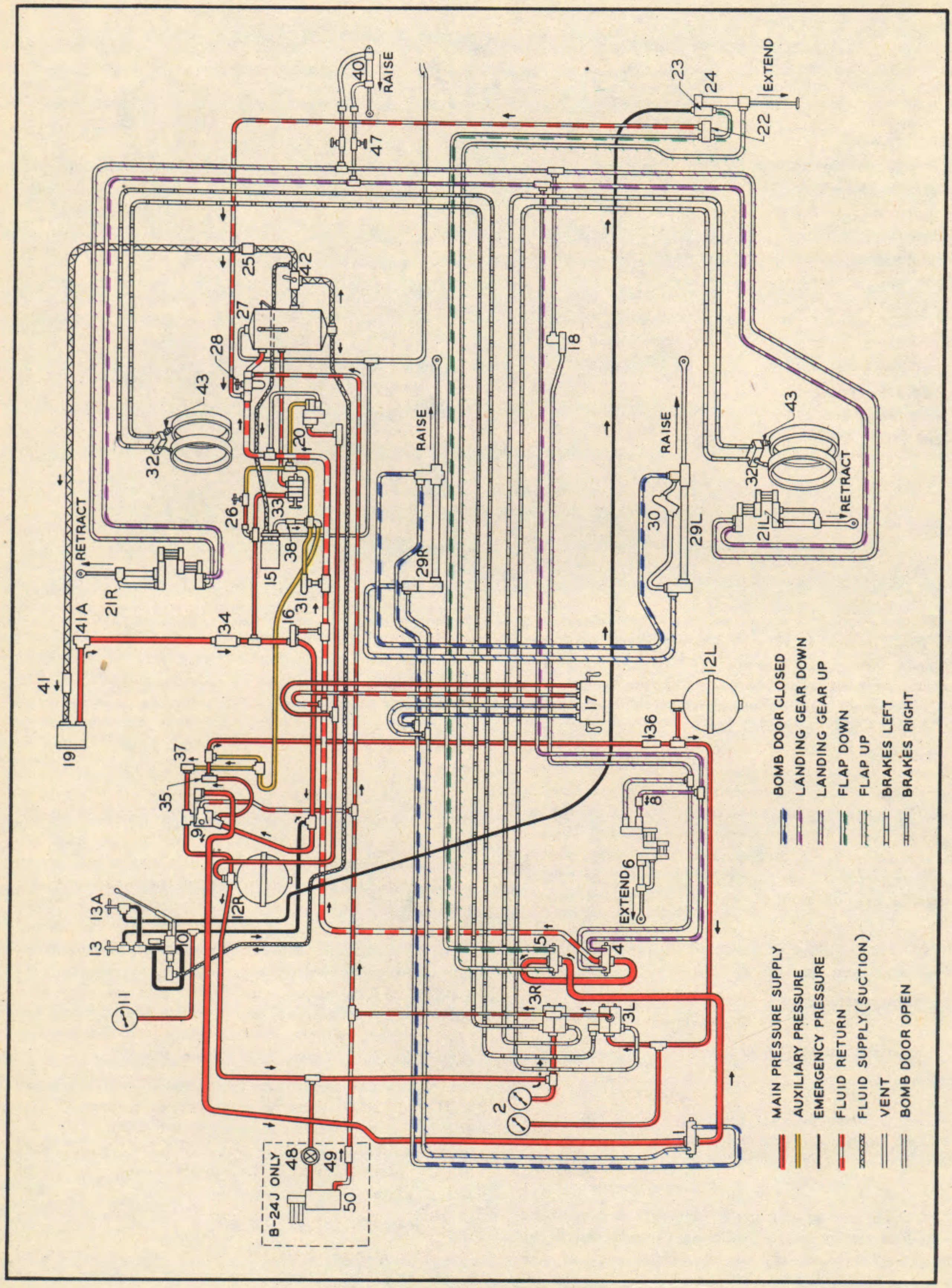


Figure 6—Hydraulic System Schematic Diagram

installed on the rudder, elevator, and (on early Groups I, II and III airplanes) the right aileron. Later Group III airplanes have trim tabs on both ailerons.

(2) Fowler-type wing flaps, which are retracted and extended hydraulically, are installed on the wing trailing edge, inboard of the ailerons. The flap control lever is on the right side of the pilots' pedestal. *(See figure 17, item 72.)* The flap position indicator is on the right side of the main instrument panel. *(See figure 17, item 16.)*

(3) Two types of electrically operated automatic flight controlled equipment are installed on the airplanes. The A-5 automatic pilot on early Group 1, 11 airplanes. The C-1 automatic pilot is used on later Group 1 and 11 and all Group 111 airplanes.

(4) The flight controls are locked by means of a lever at the base of the pilots' pedestal, on the right-hand side. On later airplanes the lever is shortened, and a "T" handle is attached to the lever to permit obtaining a better grip on the lock control. Instructions for locking the flight controls are given in Section II.

c. LANDING GEAR.

(1) The main landing gear retracts into the wings and is hydraulically operated. The retracting mechanism is controlled simultaneously with the nose gear mechanism by a lever on the left side of the pilots' pedestal. *(See figure 17, Detail B.)* An emergency cable system is provided for lowering the main wheels if the hydraulic system fails. Emergency operating instructions are given in Section IV.

(2) The nose wheel retracts into the bottom of the nose of the fuselage. The nose wheel compartment is No. III in figure 3. The hydraulic mechanism is controlled simultaneously with the main gear hydraulic mechanism by means of the same lever which controls the main landing gear. Emergency nose gear lowering instructions are given in Section IV.

(3) When the engine-driven hydraulic pump on No. 3 engine is functioning, the brake hydraulic accumulator is charged from this pump. When the engine-driven pump is not functioning, the electrically-driven auxiliary hydraulic pump furnishes the necessary pressure. Brakes are controlled by pedals which form the upper portions of the pilot's and copilot's rudder pedals. Inboard and outboard pressure gages are on the auxiliary instrument panel to the left of the pilot's control column. A parking brake control handle is located at the bottom of the pilots' control pedestal on the left side. *(See figure 17, item 52.)*

(4) A solenoid-operated locking pin in the pilots' pedestal prevents the landing gear operating handle from being pushed forward accidentally while the airplane is on the ground. The solenoid is energized and the locking pin released by pressing the button in the top of the landing gear operating lever. *(See figure 17, item 53.)*

(5) The landing gear warning signal is a light on the pilots' instrument panel, which glows when the landing gear is "DOWN" and locked. *(See item 15 of figure 17.)*

d. HYDRAULIC SYSTEM. *(See figure 6.)*

(1) The main hydraulic system operates the landing gear, wing flaps, bomb bay doors, and nose turret (in cases where nose turrets are not all electric)

Key List for Figure 6

1. Bomb Bay Door Selector Valve
2. Brake Pressure Gages
3. (L & R) Brake Control Valves
4. Landing Gear Selector Valve
5. Flap Selector Valve
6. Nose Wheel Actuating Cylinder
8. Nose Wheel Restrictor
9. Unloading Valve
10. Hand Pump
11. Hydraulic System Pressure Gage
12. (L & R) Accumulators
13. Hand Pump System Valve
13A. Hand Pump Flap Valve
15. Auxiliary Electric Pump
16. Relief Valve
17. Bomb Door Emergency and Utility Control Valve
18. Main Landing Gear Restrictor
19. Engine Driven Pump
20. Pressure Switch
21. (L & R) Main Landing Gear Actuating Cylinder
22. Relief Valve
23. Shuttle Valve
24. Flap Actuating Cylinder
25. Suction Line Check Valve
26. Auxiliary Cross-over Valve
27. Fluid Reservoir
28. Filter
29. (L & R) Bomb Bay Doors Actuating Cylinder
30. Bomb Door Cylinder Relief Valve
31. Auxiliary System Relief Valve
32. (L & R) Brake Bleeder Valve
33. Test Stand Connections
34. Engine Pump Check Valve
35. Check Valve
36. Left Accumulator Check Valve (Spring Removed)
37. Right Accumulator Check Valve
38. Auxiliary Pump Check Valve
40. Tail Bumper Actuating Cylinder
41. Automatic Seal Coupling
41A. Automatic Seal Coupling
42. Emergency Switch-over Valve
43. Brake Disconnect Coupling
47. Tail Bumper Shut-Off Valves
48. Nose Turret Shut-Off Valve
49. Nose Turret Check Valve
50. Nose Turret Swivel Valve

by means of fluid under pressure from the engine-driven pump or auxiliary electric pump. Pressure built up in two accumulators provides parking brake pressure and an emergency source of pressure for operating the bomb bay doors. The main system and accumulator system are connected through check valves, so that either may operate independently in case the other fails.

(2) The engine-driven hydraulic pump is located on No. 3 engine. When this engine is not operating, pressure must be supplied by either the electric auxiliary pump or the hand pump.

(3) The hand pump, located on the floor to the right of the copilot's seat, will furnish pressure to lower the flaps if both engine-driven and electric hydraulic pumps fail.

(4) The main hydraulic system gage and the two brake pressure gages (inboard and outboard) are on the auxiliary instrument panel to the left of the pilot's control column.

e. ELECTRICAL SYSTEM.

(1) The electrical system draws its power from four engine-driven generators, two storage batteries and/or an auxiliary power plant. The system distributes 24 volts direct current to operate the engine starters, fuel booster pumps, auxiliary hydraulic pump, propeller feathering pumps, lighting, cowl flap motors, intercooler shutter motors, engine primers, oil dilution solenoids, communications equipment, bombing equipment, and the gun turrets. The direct current system also furnishes power to two a-c inverters, either one of which supplies a-c current for the electronic amplifier tubes of the automatic flight control systems and the electronic turbo regulators. The a-c inverters also furnish current for the autosyn instruments.

(2) The main generator switches, ammeters, and voltmeter, with its selector switch are on the power control panel on the forward face of the bulkhead at the rear of the flight deck. *(See figure 7.)* The a-c power switch controlling the inverters is on the pilots' pedestal. *(See figure 17, item 55.)* The airplane master switch is on the ignition switch panel. *(See figure 17, item 51.)* The main battery switches are directly above the master switch.

(3) Figures 8 and 9 show locations of the main fuse boxes and circuit breakers.

(4) All fuse boxes are located in the fuselage, and are accessible during flight. *(See figures 8 and 9.)*

(5) A gasoline-driven auxiliary power plant is located in the nose wheel compartment. It may be used either inside or outside the airplane when the airplane is on the ground.

(6) A receptacle for plugging in an outside source of power when the airplane is on the ground is located on the right side of the fuselage, forward of the bomb bays.

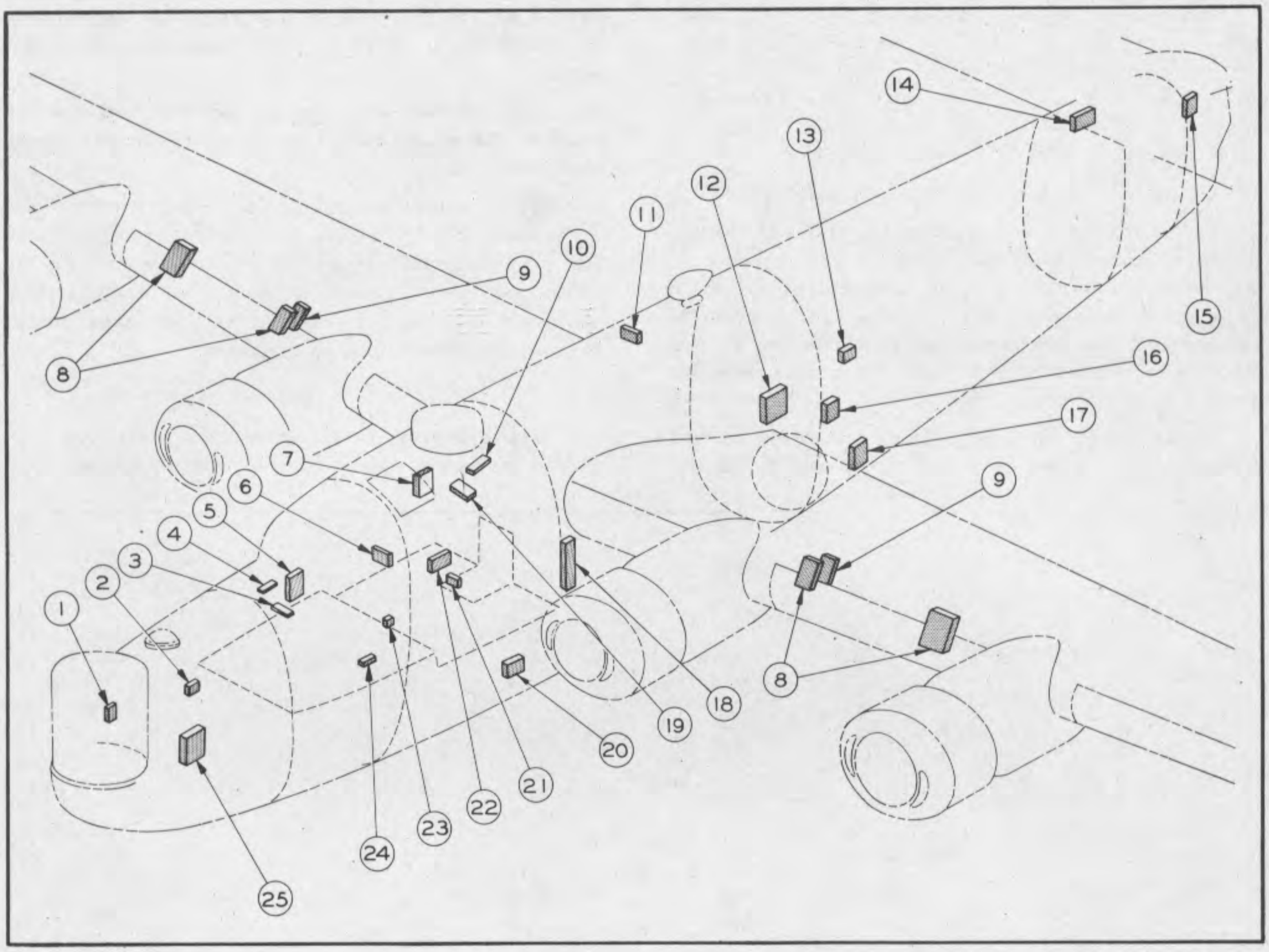
(7) Receptacles and controlling rheostats for electrically heated flying suits are located at each crew station, and also at the fuel transfer station in the forward bomb bay.

2. POWER PLANT.

a. ENGINES.—These airplanes are equipped with R-1830-43 or R-1830-65 radial air-cooled engines having a 16:9 propeller gear ratio. These engines are equipped with single-stage, single-speed engine-driven integral superchargers having a 7.15:1 gear ratio.

b. FUEL AND OIL SPECIFICATIONS. — All charts and performance figures in this handbook are based on the use of fuel, grade 100/130, Specification No. AN-F-28. For training and other non-combat purposes, the use of fuel, grade 91/96, Specification

Figure 7—Generator Control Panel



1. Nose Turret Junction Box
2. Heater Fuse Box
3. Propellers Feathering Circuit Breakers
4. Battery Circuit Breaker Switches
5. Copilot's Fuse Box
6. Liaison Junction Box
7. Radio Fuse and Junction Box
8. Reverse Current Relay Boxes
9. Landing Light Relay Boxes
10. Right Power Bus
11. Radio Compass Relay Panel
12. Inverter Relay Junction Box
13. Station 6.1 Fuse Box
14. Tail Turret Power Switch Box
15. Tail Turret Junction Box
16. Ball Turret Switch Box
17. Ball Turret Junction Box
18. Left Power Bus
19. Top Turret Junction Box
20. Battery Power Panel
21. Station 4.0 Fuse Box
22. Station 3.1 Fuse Box
23. Landing Gear Lock Down Relay Box
24. Pilot's Fuse Box
25. Bomber's Switch Panel

Figure 8—Current Limiter Fuse and Circuit Breaker Location Chart, Groups I & II Airplanes

No. AN-F-26, is permissible, but only if engines are operated at a maximum manifold pressure of 44 inches mercury for take-off and power settings for all other conditions are reduced proportionately.

The engines use oil, Specification No. AN-VV-O-446A.The grade of oil used depends on operating conditions.

The recommended operating temperature ranges in the table below are for guidance in selecting the most suitable grade of oil to be used under various conditions. The overlap of ground temperatures is intentionally allowed to avoid setting up a requirement for changing from one grade to another unnecessarily, particularly when frequent temperature changes occur locally.

Grade Oil	*Air Temperature At Ground*
1120	4°C (40°F) and above
1100	—7° to +27°C (20° to 80°F)
1080	10°C (50°F) and below

Safe Maximum "Oil-in" Temp.	*Safe Minimum "Oil-in" Temp.*
95°C (203°F)	20°C (68°F)
85°C (185°F)	10°C (50°F)
75°C (167°F)	0°C (32°F)

Since these airplanes employ oil dilution to facilitate starting in cold weather, the engines can operate in temperature conditions above 4°C (40°F) with grade 1120 oil. However, with ground temperature below 4°C (40°F) use grade 1100. Oil lighter than grade 1100 should never be required.

c. FUEL SYSTEM. *(See figures 10 and 11.)*

(1) The main fuel system has 12 self-sealing fuel cells installed in the wing center sections so connected as to create four separate tanks, each having three interconnected cells. Four booster pumps are installed on the lower wing structure at the bottom of the four inboard cells. Four main selector valves are mounted as follows:

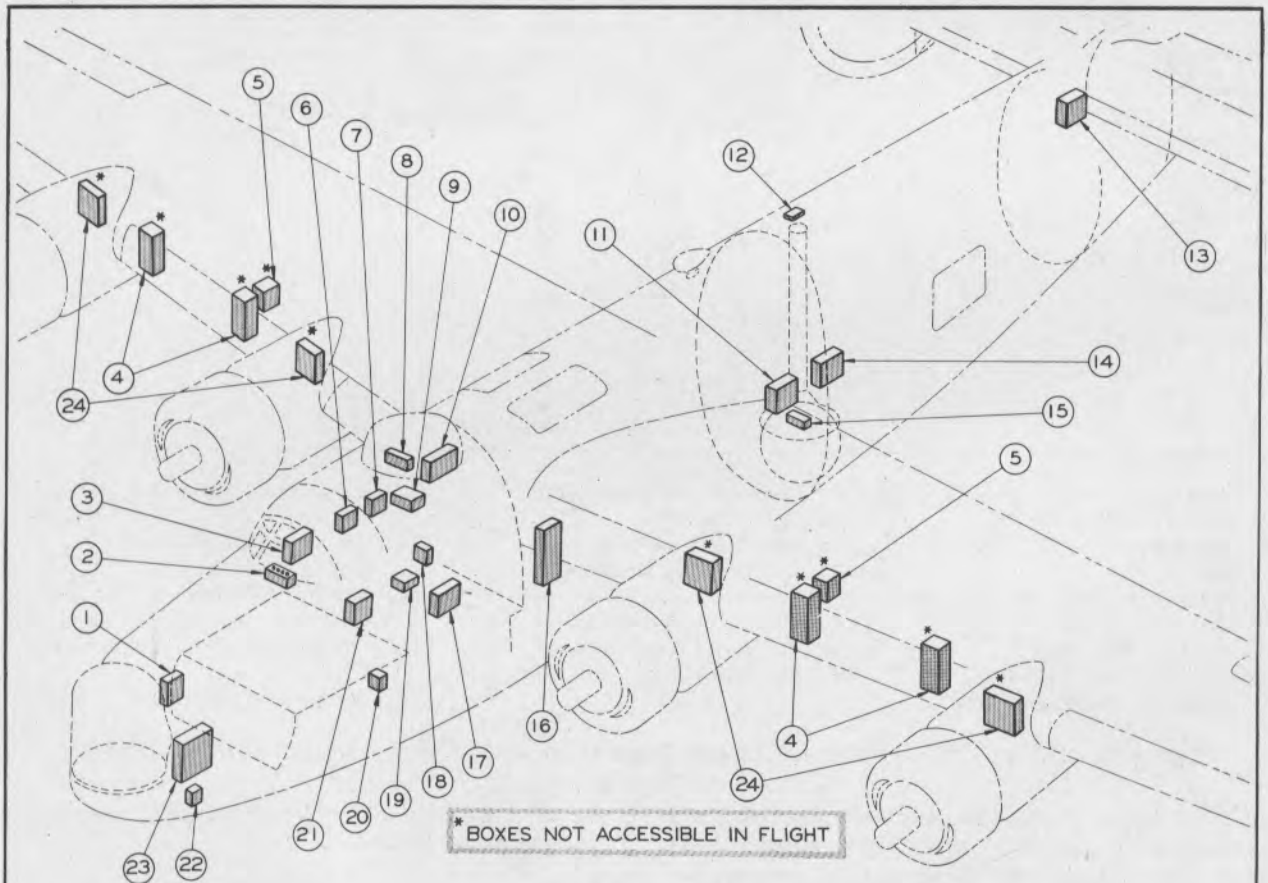
(a) Airplanes Groups I and III: forward end of bomb bay. (Valves for tanks No. 1 and No. 2 are located on the left side of the airplanes and valves for tanks No. 3 and No. 4 are located on the right side.)

(b) Airplane Group II: Central fuel control panel on the aft bulkhead of the radio compartment. *(See figure 12.)*

(2) A cross-feed manifold connects with each of the four selector valves, thereby permitting operation of any or all engines on fuel from any or all tanks, and also provides a means for transferring fuel from the bomb bay tanks to any main tanks, or from one main tank to another.

Note

In the Group II airplanes, the auxiliary wing tank transfer line is routed through



1. HEATER FUSE BOX
2. FAST FEATHERING CIRCUIT BREAKERS
3. COPILOTS FUSE BOX
*4. REVERSE CURRENT RELAY BOXES (GENERATOR FUSES)
*5. LANDING LIGHT RELAY BOX
6. LIAISON JUNCTION BOX
7. FUSE & TERMINAL BOX (SCR 695 POWER)
8. TOP TURRET CONTROL UNIT
9. TOP TURRET JUNCTION BOX
10. RIGHT HAND POWER PANEL
11. STATION 5.4 FUSE BOX
12. BOTTOM TURRET CURRENT LIMITER
13. TAIL TURRET FUSE BOX
14. STATION 6.1 FUSE BOX
15. BOTTOM TURRET SWITCH BOX
16. LEFT HAND POWER PANEL
17. STATION 3.1 FUSE BOX
18. STATION 4.1 FUSE BOX
19. INVERTER RELAY BOX
20. BATTERY LIMITER BOX
21. PILOT'S FUSE BOX
22. NOSE TURRET FUSE BOX
23. BOMBARDIER'S PANEL
*24. NACELLE JUNCTION BOX

Figure 9—Current Limiter Fuse and Circuit Breaker Location Chart, Group III Airplanes

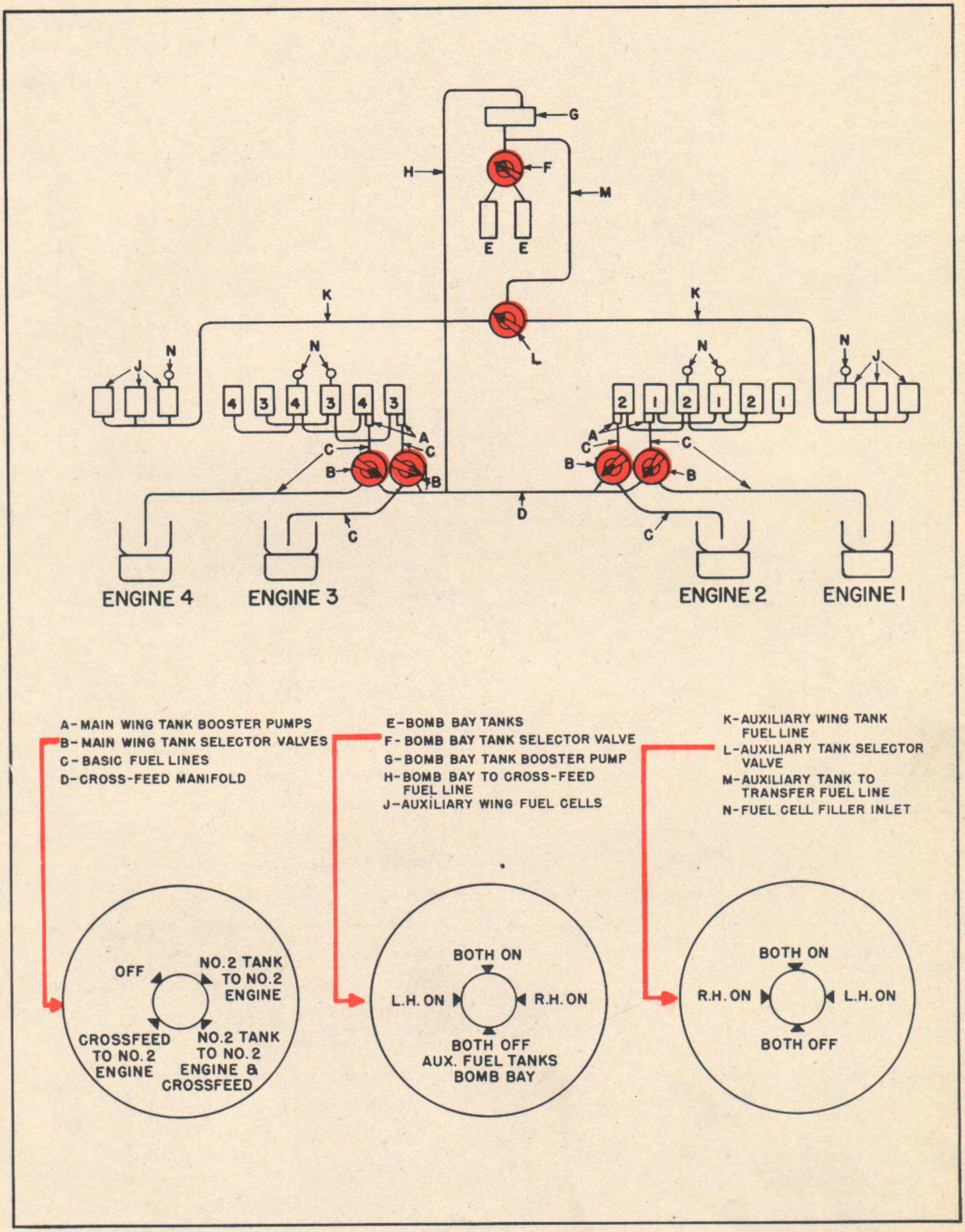


Figure 10—Fuel System Diagram, Group II Airplanes

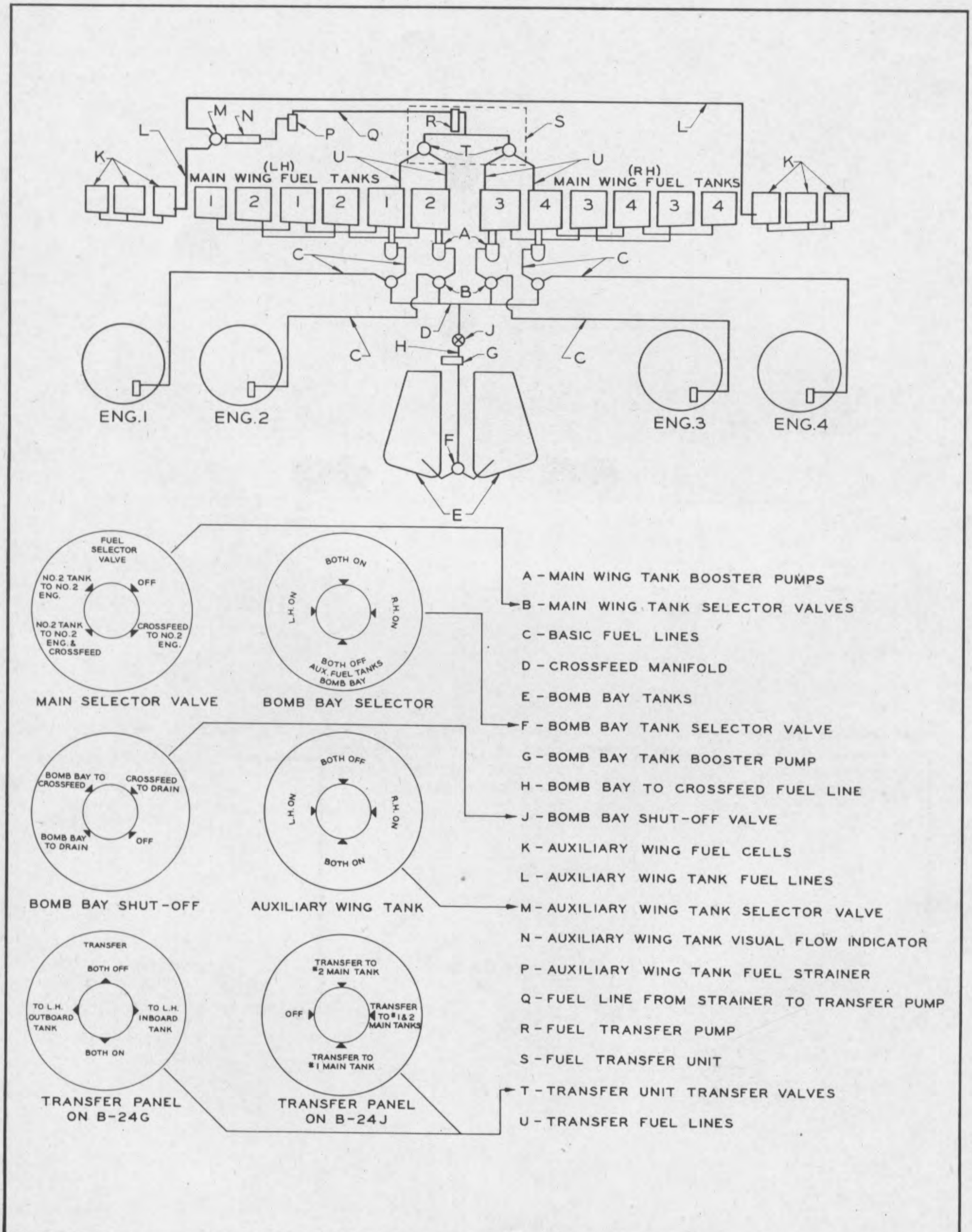


Figure 11—Fuel System Diagram, Groups I and III Airplanes

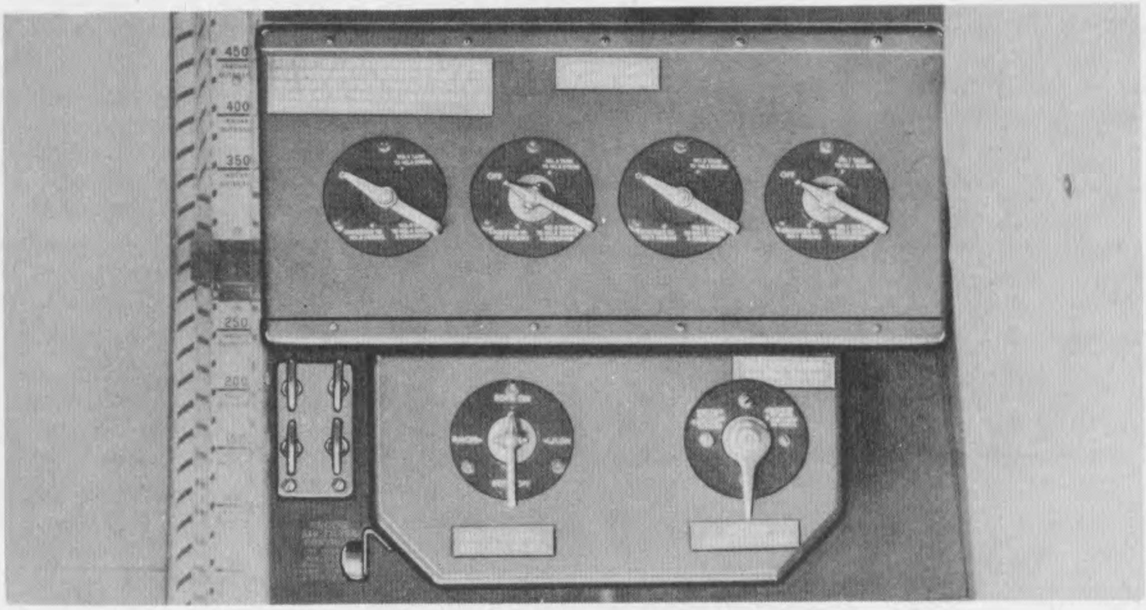
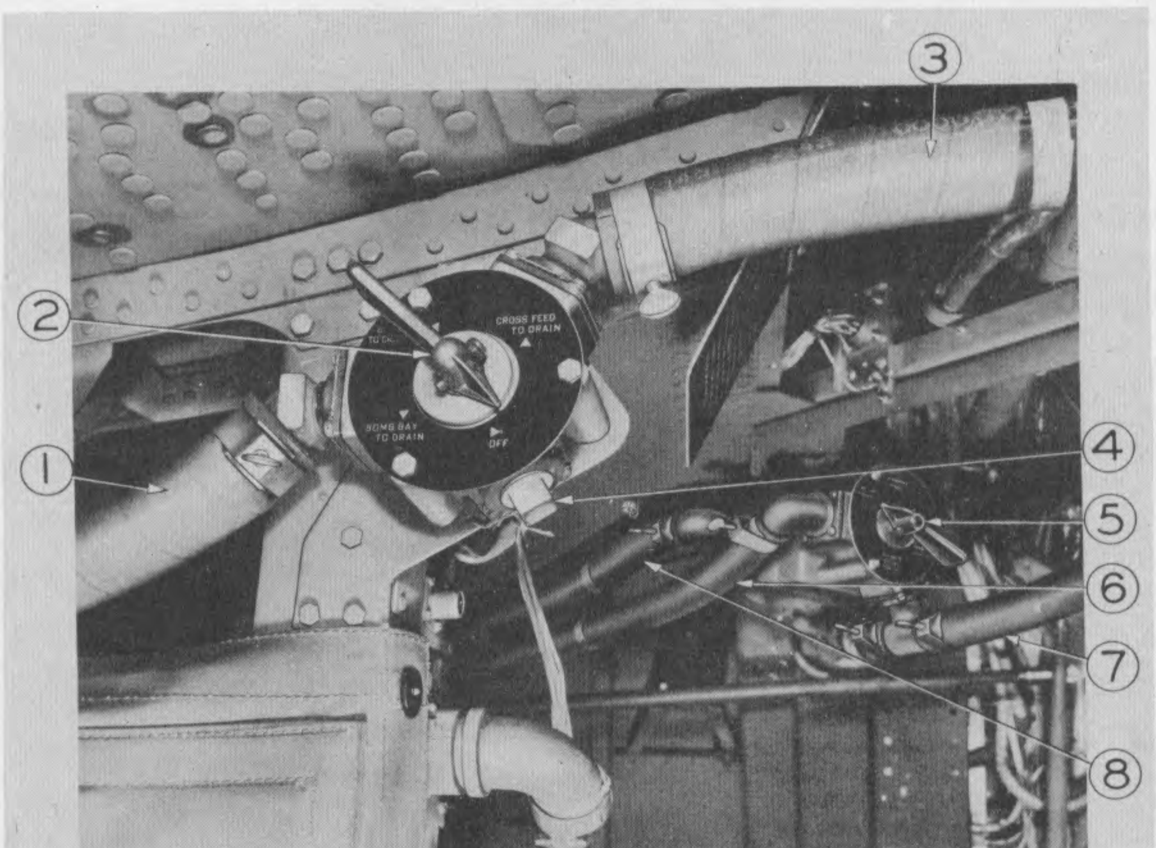


Figure 12—Centralized Fuel Selector Valve Panel, Group I Airplanes



1. Fuel Line from Bomb Bay Tanks
2. Bomb Bay Shut-Off Valve Handle
3. Fuel Line to Cross-Feed Manifold
4. Bomb Bay Shut-Off Valve Drain Plug
5. No. 2 Main Selector Valve Handle
6. Fuel Line from No. 2 Main Tank to No. 2 Main Selector Valve
7. Cross-Feed Manifold
8. Fuel Line from No. 1 Main Tank to No. 1 Main Selector Valve

Figure 13—Bomb Bay Shut-Off Valve, Groups I and III Airplanes

the bomb bay booster pump to the cross-feed line, so that the cross-feed is used in making fuel transfers from the auxiliary wing tanks to the main wing tanks. (For transfer procedures, see Section II, paragraph 4.)

(3) The bomb bay tanks are connected with a bomb bay selector valve and a bomb bay booster pump located on the catwalk in the middle of the bomb bay. A fuel line connects the pump with the cross-feed manifold. A bomb bay shut-off valve is installed in the fuel line between the pump and the cross-feed manifold. It may be used as a drain valve for the fuel system by removing the plug and installing a drain hose in the outlet. *(See figure 13.)*

Note

The shut-off valve is not installed in early Group I airplanes.

Provisions have been incorporated on late airplanes so that the bomb bay fuel tanks may be dropped, if a cable release system is installed.

(4) Three self-sealing auxiliary fuel cells are installed in the wing outboard of the wheel well on the left and right sides of the airplane. The cells are connected to form the left and right auxiliary wing tanks.

(5) On Groups I and III airplanes, the auxiliary wing tanks are connected to the auxiliary wing tank selector valve located on the left side of the aft bomb bay above the rear spar of the wing *(see figure 14)*. The valve is connected to a visual flow indicator and a strainer. The strainer is connected with the inlet port of the fuel transfer pump, which is installed in the auxiliary fuel transfer unit located above the wing forward of the strainer. Two transfer valves are mounted on the transfer unit panel and are connected to the four main tanks *(see figure 15)*. The auxiliary fuel transfer panel is used only for transfers from the auxiliary wing tanks to the main wing tanks.

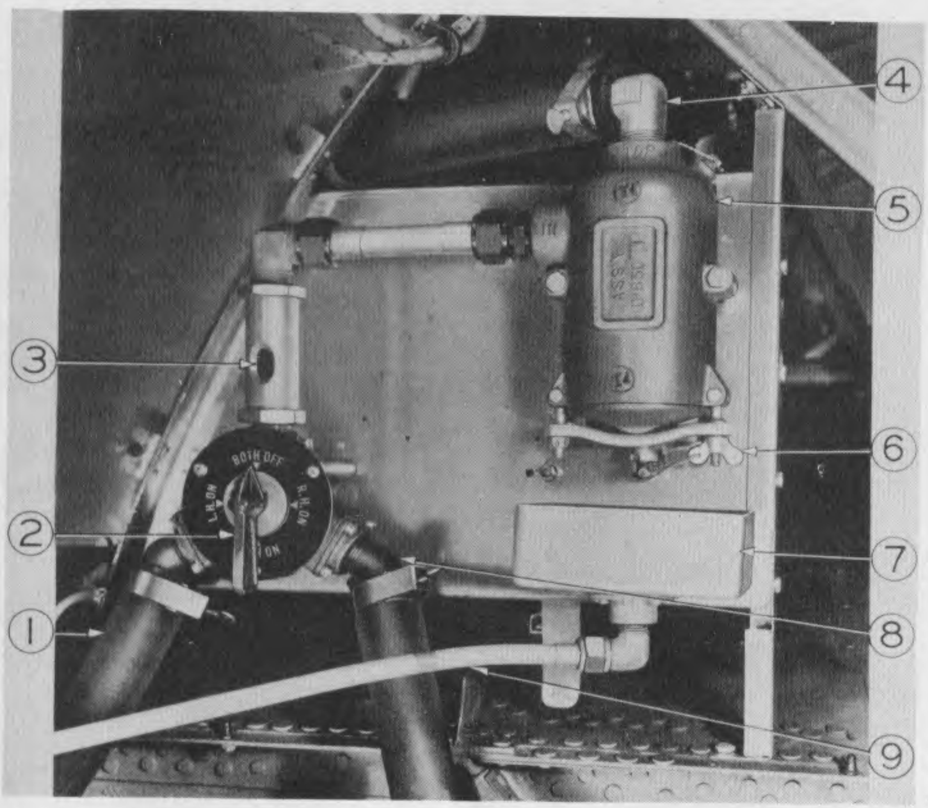
(6) On Group II airplanes, the left and right auxiliary wing tanks are connected to the auxiliary wing tank selector valve, which is mounted on the central fuel control panel on the rear bulkhead in the radio compartment. The valve is connected by a line running through the bomb bay booster pump to the cross-feed manifold. The bomb bay selector valve must be in the "OFF" position during the transfer of fuel from the auxiliary wing tanks to the main tanks.

(7) Capacities of the fuel tanks are as follows:

MAIN FUEL SYSTEM

Nos. 1 & 4 tanks—611 U.S. (509 Imperial) gallons each.

Nos. 2 & 3 tanks—571 U.S. (475 Imperial) gallons each.



1. Fuel Line from Left Auxiliary Wing Tank
2. Auxiliary Wing Tank Selector Valve Handle
3. Visual Fuel Flow Indicator
4. Connection for Fuel Line to Transfer Unit Pump
5. Auxiliary Wing Tank Fuel Strainer
6. Wing Nut for Use in Opening Strainer
7. Drip Pan
8. Connection, Fuel Line from Right Auxiliary Wing Tank
9. Strainer Drain

Figure 14—Auxiliary Wing Tank Selector Valve, Groups I and III Airplanes

AUXILIARY WING TANK SYSTEM

Left Tank—225 U.S. (187.5 Imperial) gallons.
Right Tank—225 U.S. (187.5 Imperial) gallons.

BOMB BAY SYSTEM

Left Tank—390 U.S. (325 Imperial) gallons.
Right Tank—390 U.S. (325 Imperial) gallons.

Total Capacity of Main Fuel System — 2364 U.S. (1968 Imperial) gallons.

Total Capacity of all Systems — 3594 U. S. (2993 Imperial) gallons.

d. OIL SYSTEM. *(See figure 16.)*

(1) Each engine nacelle contains its independent oil system, consisting of a hopper-type, self-sealing tank 32.9 U.S. (27.3 Imperial) gallons, temperature regulator, engine pump, and propeller feathering pump.

(2) Engine oil systems provide oil for operation of the propeller feathering system. On early airplanes the feathering pump draws its oil supply from the "oil-in" line to the engine. On late airplanes the feathering pump draws its oil supply from the sump at the bottom of the oil tank.

On early Groups I, II and III airplanes the supercharger waste gate regulator, Eclipse Type A-13, is actuated by engine oil pressure. On later Group I, II and III airplanes the oil regulator is replaced by the electronic regulators.

(3) The oil dilution valve for each engine is controlled by a switch located on the copilot's switch panel *(see figure 17, item 32)*.

(4) Engine oil may be heated by externally powered neck-type immersion heaters.

(5) On some airplanes, larger oil tanks, having a capacity of 42 U.S. (34.9 Imperial) gallons, have been installed.

1. Transfer Instruction Plaque
2. Fuel Line from Strainer to Transfer Pump
3. Connection, Line from Pump to Transfer Valve
4. Transfer Valve Handle, No. 1 and No. 2 Main Tanks
5. Transfer Pump Switch
6. Transfer Valve Handle, No. 3 and No. 4 Main Tanks
7. Connection, Line from Pump to Transfer Valve
8. Transfer Lines from Valves to Four Main Tanks

Figure 15—Auxiliary Wing Selector Tank Transfer Unit, Group III Airplanes

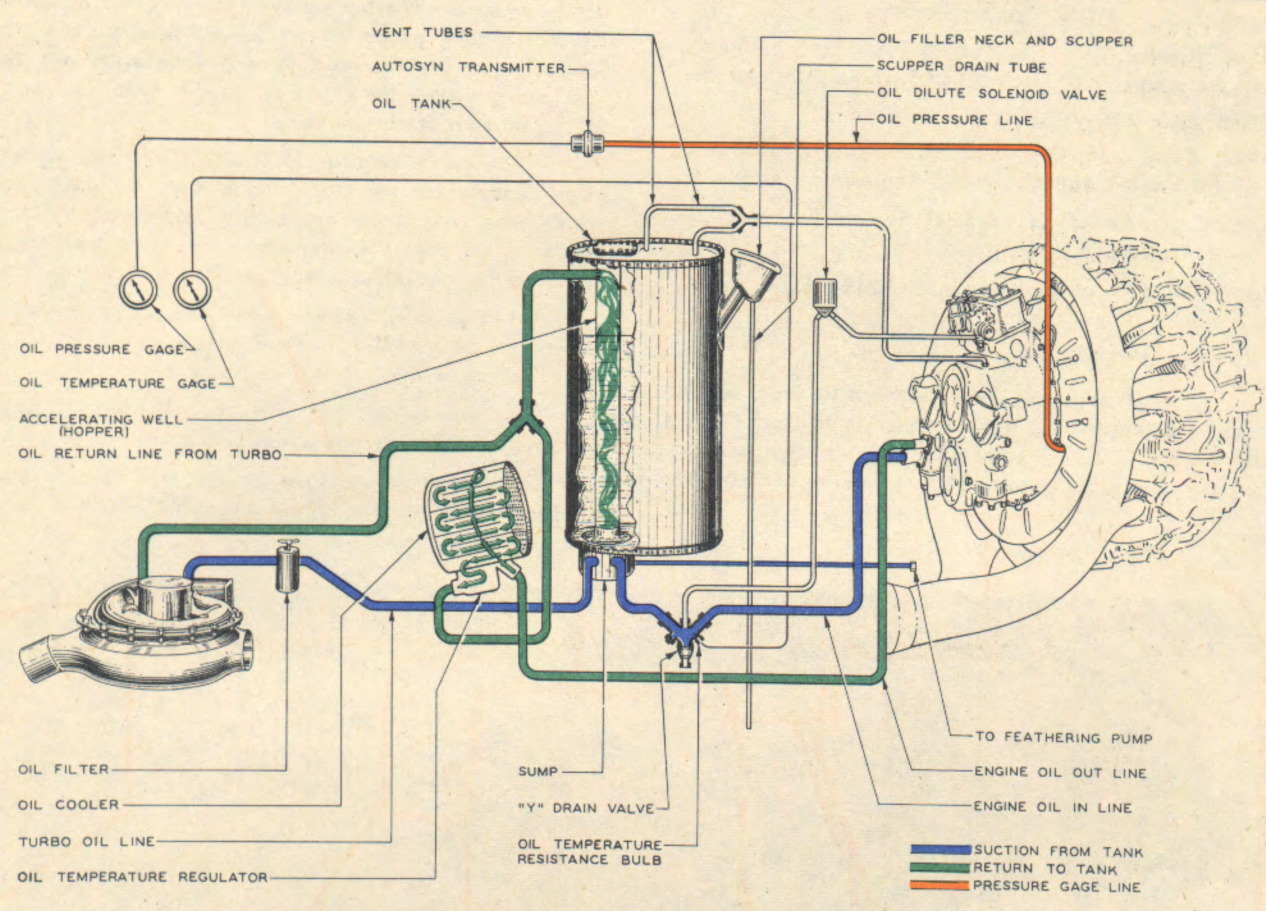


Figure 16—Oil System Schematic Diagram

Keys to Figure 17
Nos. 1 to 37

1. Propeller Feathering Switches
2. Remote Indicating Compass
3. Magnetic Compass
4. Clock
5. Manifold Pressure Gages
6. Tachometers
7. Bomb Doors Indicator
8. Bomb Release Indicator
9. Fuel Pressure Gages
10. Supercharger Warning Plate
11. Cylinder Temperature Gages
12. Oil Temperature Gages
13. Oil Pressure Gages
14. Free Air Temperature Gage
15. Landing Gear Indicator Light
16. Flap Position Indicator
17. Marker Beacon Indicator
18. Pilot Director Indicator
19. Directional Gyro
20. Gyro Horizon
21. Gyro Horizon Control Knob
22. Radio Compass Bearing Indicator
23. C-1 Autopilot
24. Altimeter
25. Airspeed Indicator
26. Turn and Bank Indicator
27. Rate of Climb Indicator
28. Propeller Governor Limit Lights
29. Bomb Bay Fuel Transfer Switch
30. Engine Starter Switches
31. Booster Pump Switches
32. Oil Dilution Switches
33. Primer Switches
34. SCR 595 Power Switch
35. SCR 595 Emergency Switch
36. De-Icer Control
37. Defroster Control

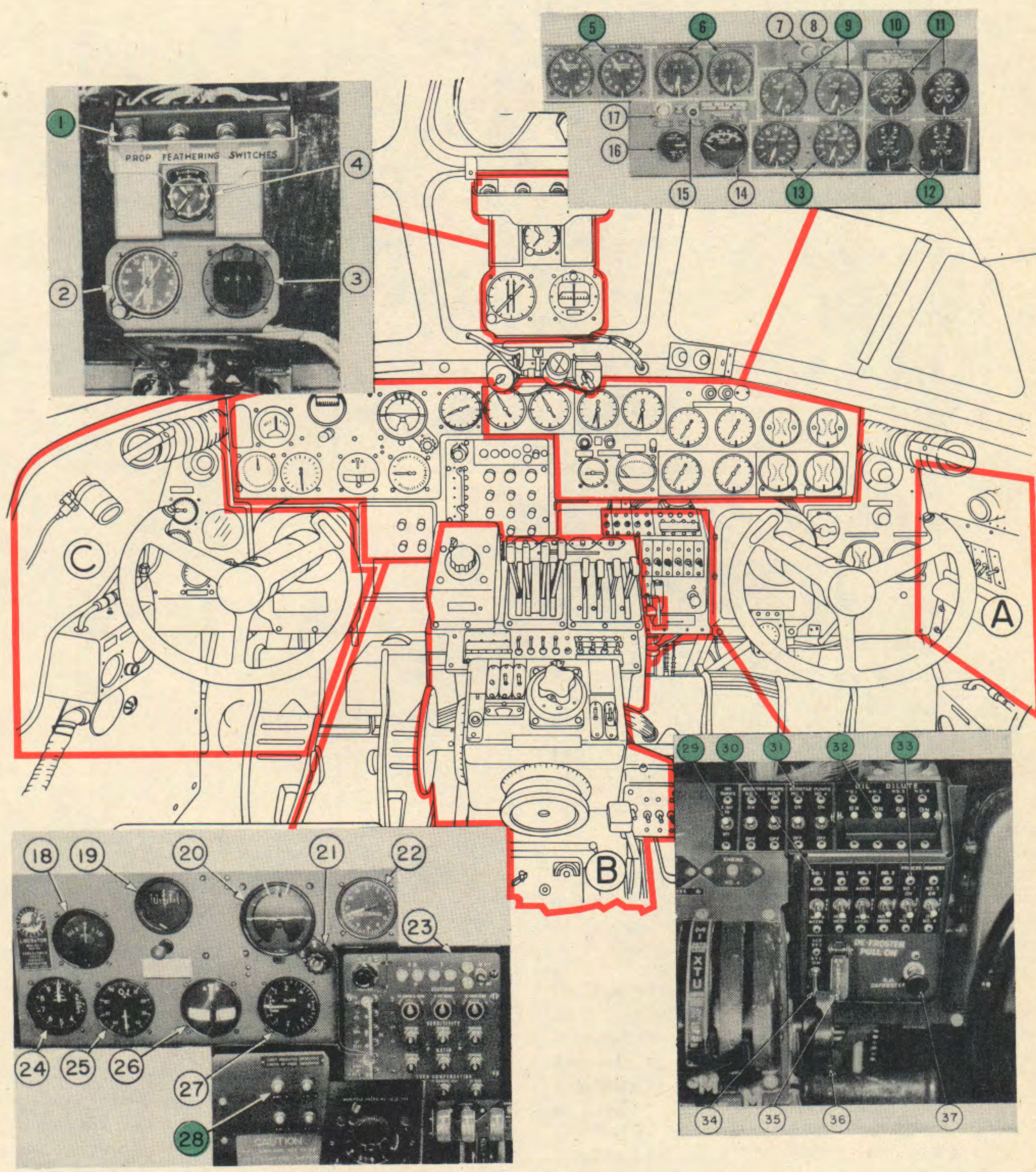
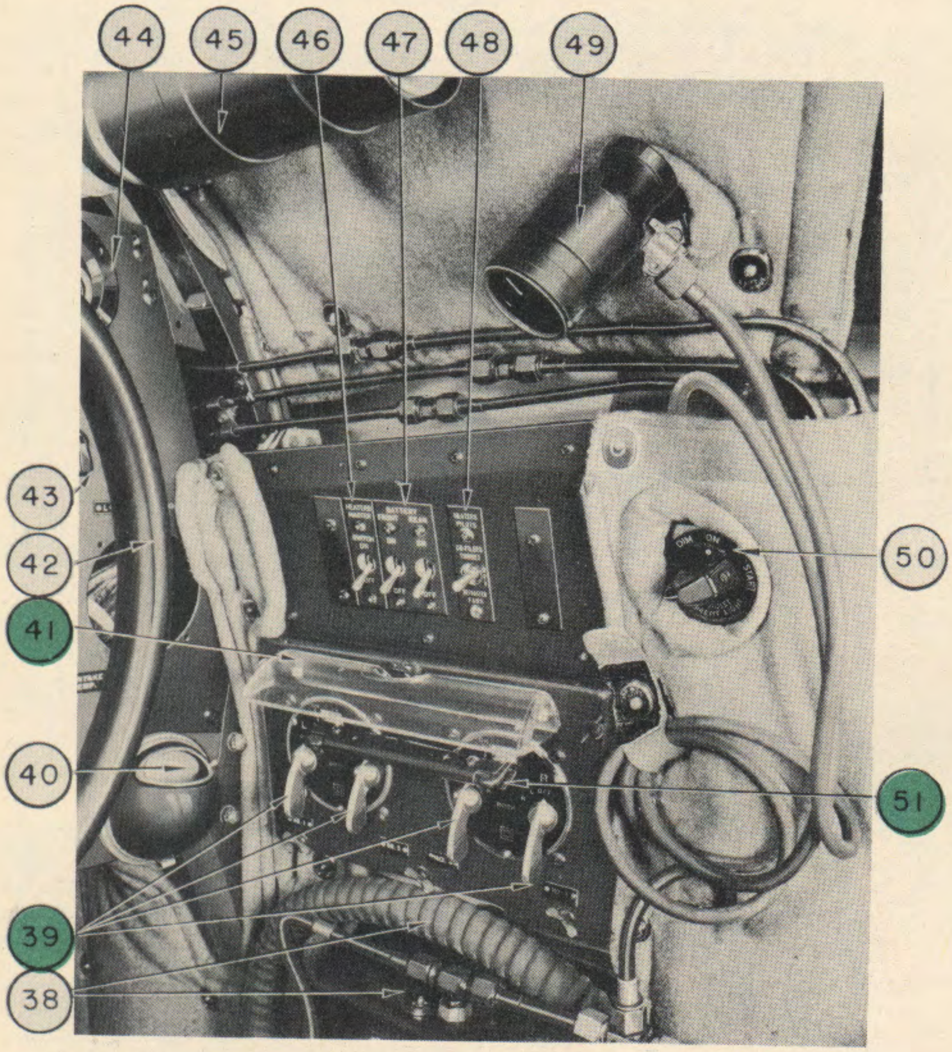


Figure 17—Pilots' Instruments and Controls, Group III Airplanes

(See following pages for Details A, B, and C.)



38. Copilot's Oxygen Panel
39. Ignition Switches
40. Ash Receptacle
41. Switch Guard
42. Copilot's Wheel
43. Formation Light Rheostat
44. Ventilator
45. Defroster Duct
46. Master Heater Switch
47. Main Storage Battery Switch
48. Defroster Fan Switch
49. 24 Volt D-C Fluorescent Light
50. Fluorescent Light Switch
51. Emergency Ignition Switch Bar

Figure 17—Detail "A"

e. AUTOMATIC THROTTLE CONTROL.—Throttle controls are spring-loaded so that they will move to approximately 65 per cent power in the event of a break in the throttle control system.

f. MIXTURE CONTROL. — Automatic mixture controls are provided, which keep the fuel-air ratio constant for a given setting of the mixture control levers, when the levers are in either of the two "automatic" positions. The mixture control quadrant *(see figure 17, item 65)* on the pilots' pedestal is marked, reading from the rear forward, as follows: "FULL RICH - EMERGENCY," "AUTO - RICH," "AUTO-LEAN," and "IDLE CUT-OFF."

Note

The "FULL RICH-EMERGENCY" position is safety-wired, but the safety wire may be broken by a strong pressure on the control lever.

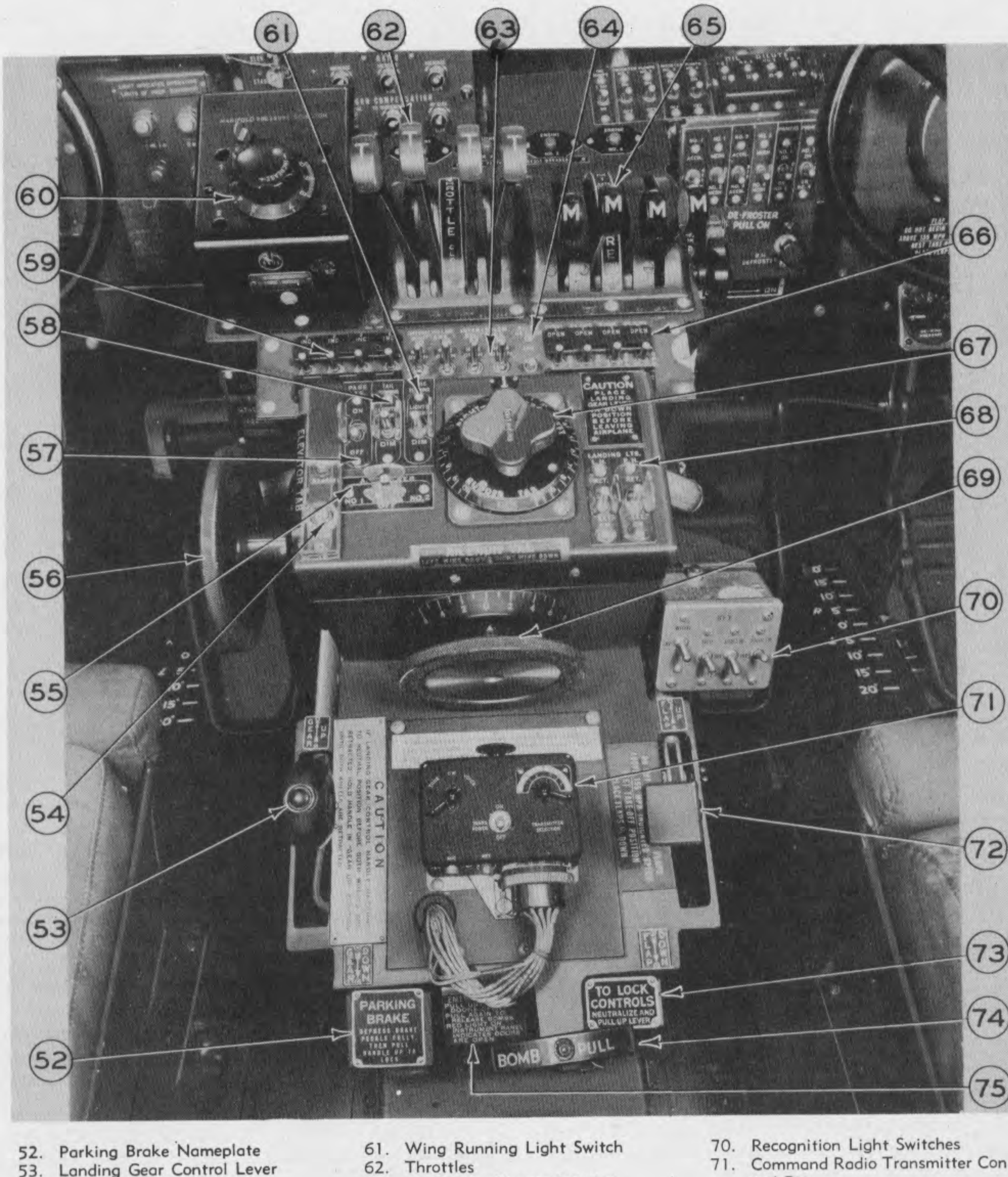
g. PROPELLER CONTROL.
(See figure 17, item 59.)

(1) These airplanes are equipped with Hamilton-Standard hydromatic, fast-feathering, three-blade propellers.

(2) Propellers are controlled by four toggle switches on the pilots' control pedestal. To increase rpm, push switches forward; to decrease rpm, pull them aft. When released, switches return to the inoperative position. Propeller governor limit indicator lights glow when the governors reach extreme limit of travel in either direction.

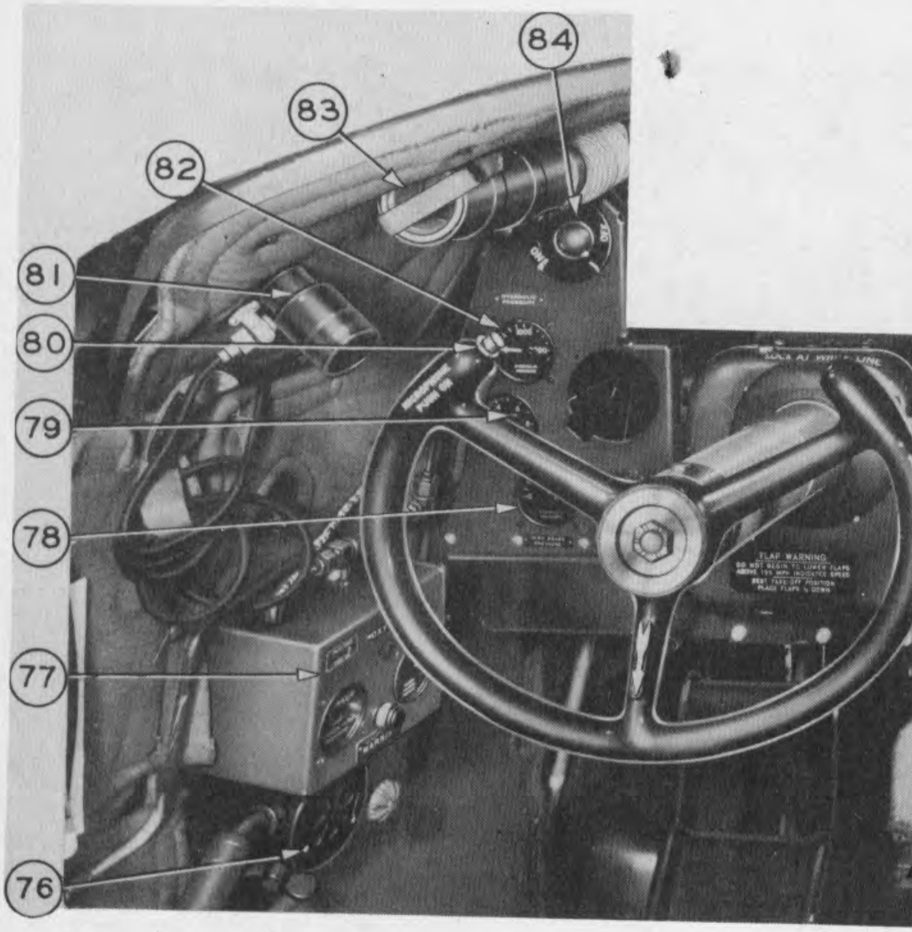
(3) Four fast-feathering switches are located above the compass at the top of the windshield.

h. CARBURETOR AIR TEMPERATURE CONTROL.—Temperature of the carburetor intake air is regulated by motor-actuated shutters at the rear of the intercooler. The switches controlling the inter-



52. Parking Brake Nameplate
53. Landing Gear Control Lever
54. Alarm Button
55. A-C Inverter Switch
56. Elevator Tab Control Wheel
57. Passing Lights Switch
58. Tail Running Lights Switch
59. Propeller Control Switches
60. Turbo Boost Selector
61. Wing Running Light Switch
62. Throttles
63. Intercooler Shutter Switches
64. Pitot Heater Switch
65. Mixture Controls
66. Cowl Flap Switches
67. Rudder Tab Control Knob
68. Landing Light Switches
69. Aileron Tab Control Wheel
70. Recognition Light Switches
71. Command Radio Transmitter Control Box
72. Wing Flap Control Lever
73. Controls Lock Nameplate
74. Pilot's Emergency Bomb Release Handle
75. Emergency Bomb Release Instruction Plate

Figure 17—Detail "B"



76. Demand Flow Oxygen Regulator
77. Flow Indicator
78. Inboard Brake Pressure Gage
79. Suction Gage
80. Push-To-Talk Microphone Switch
81. Fluorescent Light
82. Main System Hydraulic Pressure Gage
83. Defroster Duct
84. Ventilator Duct

Figure 17—Detail "C"

cooler shutter motors are located on the pilots' pedestal. *(See figure 17, item 63.)* The carburetor air temperature gage is on the auxiliary panel to the right of the main instrument panel. The maximum recommended carburetor air temperature limit is 38°C (100.4°F).

i. CARBURETOR AIR FILTER CONTROL.—The gate in the carburetor air duct which cuts the carburetor air filter in and out is controlled by means of handles on a panel located on the flight deck. This panel is on the forward face of the aft bulkhead of the flight deck, on the left-hand side of the airplane.

j. TURBOSUPERCHARGERS. — An exhaust-driven turbosupercharger is installed behind each engine mount support below the lower surface of the wing. On early Groups I, II and III airplanes the turbosupercharger is type B-2. On all later airplanes the turbosupercharger is type B-22. The two types are almost identical in appearance, but the type B-22 Supercharger has a higher maximum rpm and consequently, a higher critical altitude. The turbo regulating device is either a hydraulically actuated system or an electronic control system (later Groups I, II and III airplanes.) The hydraulically actuated system uses engine oil under pressure supplied by the engine lubricating pump. The pilot controls the oil regulator by means of levers on the pilots' pedestal. Power to operate the system is supplied from the 115-volt, 400-cycle inverters. The pilot controls the electronic regulator by means of a turbo boost selector on the pilots' pedestal *(see figure 17, item 60)*.

k. OTHER POWER PLANT CONTROLS.—The engine starter, magneto, primer, cowl flap, and fuel booster pump switches are all at the copilot's position. *(See figure 17.)*

★ ★ ★

SECTION II
PILOTS' OPERATING INSTRUCTIONS

1. FLIGHT RESTRICTIONS.

a. MANEUVERS PROHIBITED.

Do not attempt the following maneuvers:

Loop	Inverted flying
Roll	Immelmann
Spin	Vertical bank

WARNING

During taxying, take-off and landing, there is considerable pitching movement at all gross weights. For this reason no member of the crew should be aft of the side gunner's station. On no account should anyone be in the nose wheel compartment, because of the danger of injury if the nose wheel gear should collapse. On airplanes from which the turrets have been removed and/or on which special equipment has been installed, the center of gravity at the end of the flight may fall at, or in front of, the permissible forward limit for landing. For landing under these conditions, all members of the crew except the pilot and radio operator must move aft to the side gunner's station, but not beyond it.

For emergency landings at full load or for landings at any loading at which, at the start of the flight, the center of gravity was at, or near, the aft limit, no member of the crew should be aft of the rear bomb compartment.

b. AIR-SPEED LIMITATIONS.

(1) Do not exceed an indicated air speed of 155 mph with the flaps fully extended, or 180 mph with the flaps extended 10 degrees.

(2) Do not lower the landing gear at speeds in excess of 155 mph.

(3) Slow down to 150 mph when flying in extremely turbulent air.

(4) Do not operate the automatic pilot when flying at less than an indicated air speed of 155 mph.

(5) Do not exceed an indicated air speed of 356 mph with 41,000 or more pounds gross weight.

(6) Do not exceed an indicated air speed of 275 mph with 56,000 or more pounds gross weight.

(7) Do not attempt other than normal flight with maximum gross weight of 56,000 pounds:

Permissible flight factor 2.67
Permissible ground landing factor...... 2.25

(8) Do not attempt other than normal flight with emergency maximum gross weight of 64,000 pounds:

Flight factor 2.3
Landing factor 2.0

CAUTION

When loaded to maximum emergency gross weight, operate only from smooth fields and do not exceed cruising speed until sufficient load has been expended to reduce gross weight to 56,000 pounds. No dives, short turns, or flight in turbulent air should be attempted.

2. BEFORE ENTERING THE PILOTS' COMPARTMENT.

a. Check Form 1 and Form 1-A.

b. Check and sign Form F, in the Handbook of Weight and Balance Data, AN 01-1B-40.

c. Check to see that the pitot head covers have been removed.

d. Inspect the landing gear at the point where it joins the wing. If any break in the wing skin is noted, indicating an excessively hard landing on a previous flight, the airplane will not be flown until it has been properly repaired.

e. Inspect the horizontal stabilizer and tail assembly for wrinkles or any sign of buckling.

3. ON ENTERING THE PILOTS' COMPARTMENT.

a. Enter the airplane through the bomb bay doors. The bomb bay doors may be opened by pulling the handle of the bomb door utility valve. This handle is located on the right-hand side of the nose section. A hinged cover plate covers the opening in the fuselage skin. The cover is identified by stencilling. While in the bomb bays, and before going to the flight deck, check the fuel selector valves to see that each is set to direct fuel from its respective tank to the engine having a corresponding number (Tank No. 1 to Engine No. 1, etc.).

WARNING

See that none of the valves is set to the "ENGINE AND CROSSFEED" position. This setting is dangerous during take-off.

b. On entering the flight deck, check the fuel sight gages, near the aft bulkhead door, to see that the proper quantity of fuel is aboard.

c. BEFORE STARTING ENGINES.
(Standard Check For All Flights.)

(1) Form No. 1, loading and passenger list.

(2) Engineer's report (Form 1A).

(3) Parking brakes—On.

(4) Wheel chocks—In place.

(5) Pitot head covers—Off.

(6) Control check.

(7) Generators—"OFF."

(8) Fuel valves—On.

(9) Autopilot—"OFF."

(10) De-Icers (wing), anti-icers propeller)—"OFF."

(11) Intercoolers—"OPEN."

(12) Main line switch—"ON." Battery switches—"ON" (if the battery cart is not being used).

(13) Auxiliary power unit—On (if the battery cart is not being used).

(14) A-c power—"ON."

(15) Auxiliary hydraulic pump—"ON."

(16) Cowl flaps—"OPEN."

(17) Turbo controls—"OFF."

(18) Propellers—high rpm.

(19) Mixture control—"IDLE CUT-OFF."

(20) Gyro instruments—uncaged.

(21) Carburetor air filter—as required.

d. AMPLIFIED CHECK LIST. — The amplified check list is a complete and detailed explanation of every item on the check list furnished in the airplane. In order that the airplane check list may be intelligently and successfully used, it is imperative that the pilot be completely indoctrinated with the material contained in this amplified check list. The amplified check list will never be used as a check list in the airplane, inasmuch as the airplane check list is complete unto itself and if followed implicitly will result in safe operation at all times. The amplified check list is designed to assist pilots comparatively inexperienced on the B-24 airplane in operating the engines and accessories as the airplane check list indicates they are to be handled, and to elaborate sufficiently upon the airplane check list to insure standardized pilot-copilot procedures. The copilot will call out items on the airplane check list, and the pilot will answer when the check has been made.

(1) FORM 1 AND FORM 1A.—The pilot replies "Checked" to these items to indicate that inspection has been accomplished.

(2) LOADING.—The pilot will reply "Checked" to indicate that inspection of loading has been accomplished.

(3) WHEEL CHOCKS.—Pilots look and reply "In place."

(4) PITOT COVERS.—Engineer calls out "Removed"; pilot looks out the left side and replies "Removed left"; copilot looks out right side and replies "Removed right."

(5) FUEL TANK CAPS.—The engineer replies "Checked" to this item. Enough emphasis cannot be placed upon the importance of properly securing the caps. In a few minutes several hundred gallons of fuel may be syphoned out, much of which will run back through the wing into the bomb bay, creating a fire hazard.

(6) FLIGHT CONTROLS. — This is a visual check and the engineer, with his head out of the hatch, reports the position of the control surfaces as the pilot moves them for full travel. The pilot calls out each set of controls as he works them; such as, when checking the elevators, he calls out "Elevators" and moves the control fully fore and aft, waiting each time for a reply from the engineer. After all controls have been checked, the pilot replies "Checked visually" to signify completion of the check.

(7) FUEL TANK VALVES AND AMOUNT.—Engineer replies "Checked" and the amount of fuel aboard. It is well also to question the engineer regarding the amount of oil if there is any reason to believe it might be low.

(8) GENERATORS. — Engineer replies "OFF" and copilot looks back at the switches and notes same. Generator switches are kept "OFF" to prevent drain of the battery back to the generator in case of faulty reverse current relay, and because the generators will not charge unless rpm is 1700 or more.

(9) CARBURETOR AIR FILTERS.—Engineer sets these as directed for local conditions and replies "As required."

(10) MAIN LINE AND BATTERY SWITCHES.—Copilot turns on the main line and the battery selector switches and replies "ON." He will check each battery selector separately to determine the battery condition. In starting engines with the battery carts, use only the main line and leave the battery selectors "OFF"; this permits the current from the battery cart to pass through the main line bus and prevents a drain of the airplane's batteries.

(11) AUXILIARY POWER UNIT AND HYDRAULIC PUMP.—Engineer starts the power unit, then turns on the auxiliary hydraulic pump. The pump builds up pressure in the brake accumulators immediately. When the pressure reaches 1140 to 1180 pounds per square inch the pressure switch will stop the pump. When the pressure drops 130 to 230 pounds the pressure switch will start the pump again.

(12) BRAKE PRESSURE AND PARKING BRAKE.—Pilot applies the brakes and notes any change of pressure. Then while holding pedals down, raises the parking brake handle and releases the foot brakes. This handle must not be forced either up or down as this will snap the brake pedal lock pin. After

the parking brake is set he replies, "Checked and on."

(13) GYROS. — Pilot uncages the gyros and replies "Uncaged." This will give the flight indicator a chance to right itself when the engine starts—a good check of the righting mechanism. Some instruments will not normally erect themselves, and require momentary caging to assist erection.

(14) AUTOPILOT.—Pilot checks to see that all switches are "OFF" and replies "OFF."

(15) TURBOSUPERCHARGERS.—Pilot checks them in the "OFF" position and replies "OFF." Superchargers should be off from the previous stopping of the engines so that the waste gate is open to keep backfiring on starting from damaging the waste gate.

(16) PROPELLERS. — Copilot checks for full high "RPM" position and notes the governor limit lights. He then replies "High rpm." Be sure the toggle switches are toward "INCREASE RPM" inasmuch as lights also come on in full low "RPM" position.

(17) A-C POWER SWITCH.—Copilot switches the A-C power switch to "No. 1" and checks. Check may be made by switching on one booster pump and noting whether or not the autosyn fuel pressure gage for the engine affected indicates. The copilot then switches to "No. 2" being careful to pause at least 5 seconds in the neutral position to avoid arcing the points of the inverter and blowing out a fuse. He then switches to the inverter he desires to use. It is suggested that No. 1 inverter be considered the normal inverter and that No. 2 inverter be considered an alternate inverter. It is believed that if this procedure is followed it will be highly unlikely that both inverters will fail on any one flight.

(18) INTERCOOLERS. — Copilot checks for "OPEN" position and replies "Open." Open is the normal position. Nothing is gained by closing them as no heat is available. Operation may be checked by listening to each motor as the switch is moved.

(19) PITOT HEATER. — Copilot flicks the switch on and off while looking back at the voltmeter for a flicker indicating current drain. The engineer replies "Checked."

Note

Voltmeter checked shows drain but an accurate check is obtained only by feeling the pitot heat itself. Engineer should check on preflight by feel.

(20) COWL FLAPS. — Copilot will open the cowl flaps. Pilot will check to see that the cowl flaps on the left side are open. Copilot will check to see that cowl flaps on the right side are open.

(21) MIXTURE CONTROL. — Copilot will check for "Idle Cut-off" position and reply "Idle cut-off." This prevents flooding when the booster pumps are turned on.

(22) WING FLAPS.—Copilot will check the handle for neutral and the flap position indicator to see that the flaps are up.

(23) ICE ELIMINATION EQUIPMENT. — If shoe type wing De-Icers are installed, the copilot will check to see that the de-icing system is off. If exhaust heat anti-icing is installed, the cabin heat or anti-icing switches may be left "ON" if desired.

CAUTION

If both No. 2 and No. 3 switches are on, be sure that the "EMPENN. ANTI-ICING" switch is also on.

Check to see that the propeller anti-icer rheostat is turned off.

4. FUEL SYSTEM MANAGEMENT.

WARNING

In any fuel transfer requiring use of the cross-feed manifold, do not attempt to fill more than one main wing tank at a time. Any engines connected to the cross-feed manifold will stop running when the tank, or tanks, being drained are completely empty and air is introduced into the system. When an engine stops, set its main selector valve to "TANK TO ENG." and start the engine.

a. TO TRANSFER FROM BOMB BAY TO MAIN WING TANKS. *(See figure 18.)*

CAUTION

FILL ONLY ONE MAIN TANK AT A TIME. Open the bomb bay door six or eight inches before starting the transfer to prevent accumulation of fuel vapor. Do not remove the bomb bay tank filler cap during the transfer. If fuel overflows, stop the transfer and inspect.

(1) Set the bomb bay selector valve to "L.H. ON," "R.H. ON," or "BOTH ON."

(2) Set main selector for the tank to be filled to "TANK TO ENG. and CROSS-FEED."

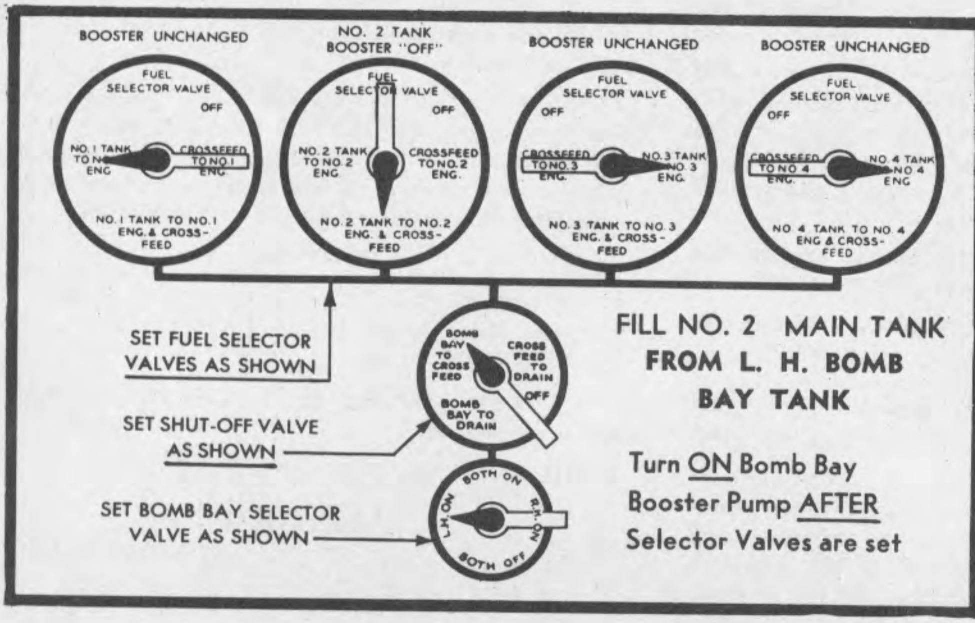
(3) Set the other three main selector valves to "TANK TO ENG."

(4) Set the bomb bay shut-off valve (if installed) to "BOMB BAY TO CROSS-FEED."

(5) Turn "ON" the bomb bay booster pump switch.

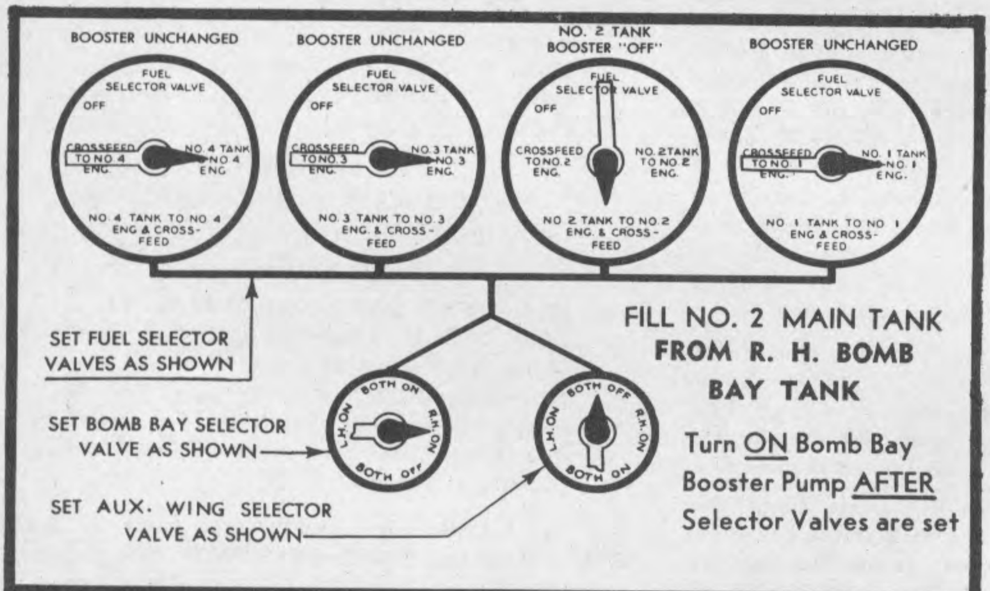
(6) Turn "OFF" the booster pump switch of the tank to be filled.

(7) When the main tank is within 50 gallons of full, or when the bomb bay tanks are empty: Turn "OFF" the bomb bay booster switch; turn the bomb



GROUPS I & III AIRPLANES

Figure 18—Fuel Transfer From Bomb Bay Tanks To Main Tanks



GROUP II AIRPLANES

bay selector valve to "BOTH OFF"; turn the bomb bay shut-off valve to "OFF."

Reset the selector valve of the filled tank to "TANK TO ENG."

Note

On Group I airplanes, and on Group II airplanes, the bomb bay shut-off valve is not included in the system; therefore, instruction (4) will be omitted from this procedure. In the Group II centralized system, be sure the auxiliary wing tank selector valve is in the "BOTH OFF" position before attempting the transfer from bomb bay tanks.

b. TO TRANSFER FROM ONE MAIN TANK TO ANOTHER. *(See figure 19.)*

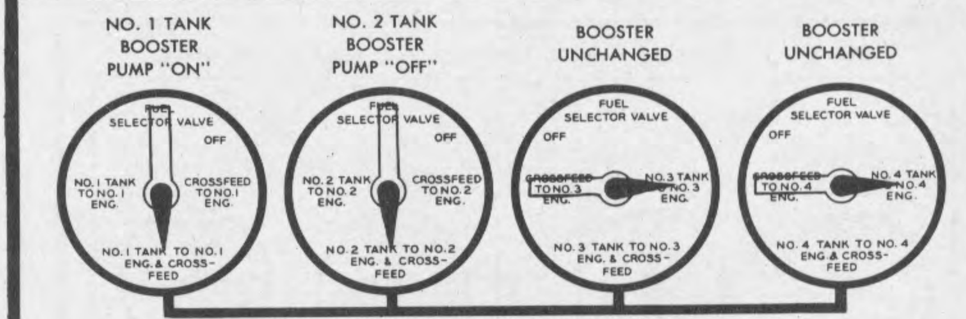
CAUTION

FILL ONLY ONE MAIN TANK at a time.

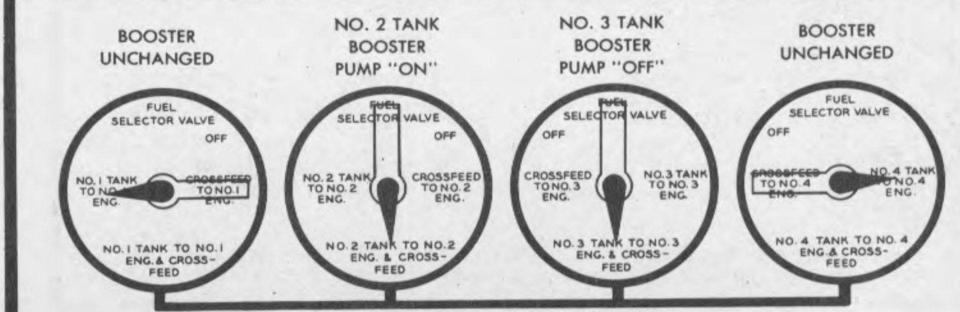
(1) Set the main selector valves of the valves of the tank to be filled and of the tank to be drained to "TANK TO ENG. and CROSS-FEED."

(2) Set the other two main selector valves to "TANK TO ENG."

Figure 19— Fuel Transfer From One Main Tank To Another

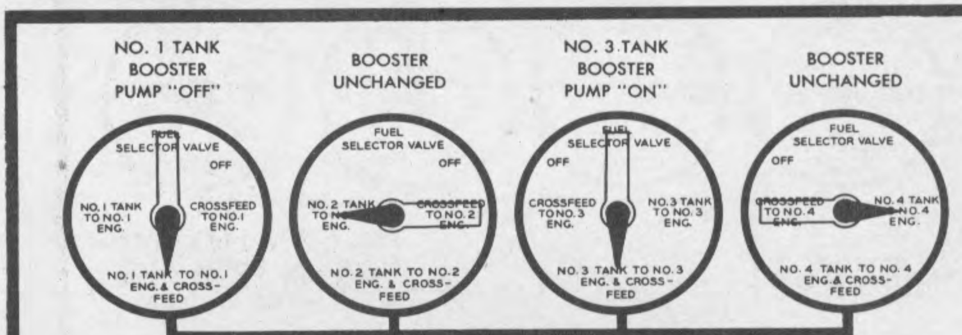


SET SELECTOR VALVES AS INDICATED TO TRANSFER FUEL FROM NO. 1 MAIN WING TANK TO NO. 2 MAIN WING TANK



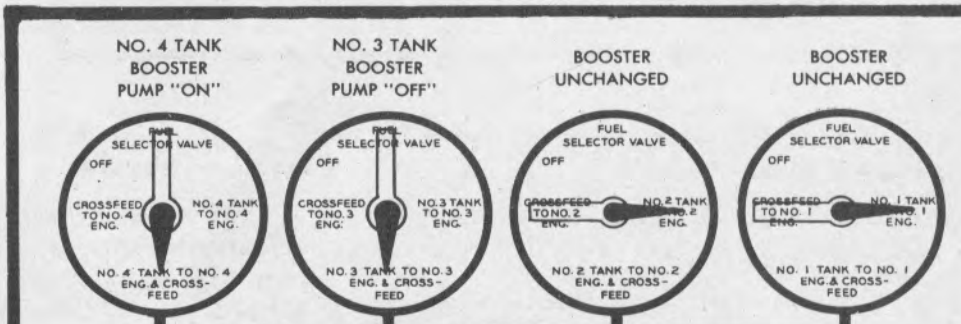
SET SELECTOR VALVES AS INDICATED TO TRANSFER FUEL FROM NO. 2 MAIN WING TANK TO NO. 3 MAIN WING TANK

GROUPS I & III AIRPLANES

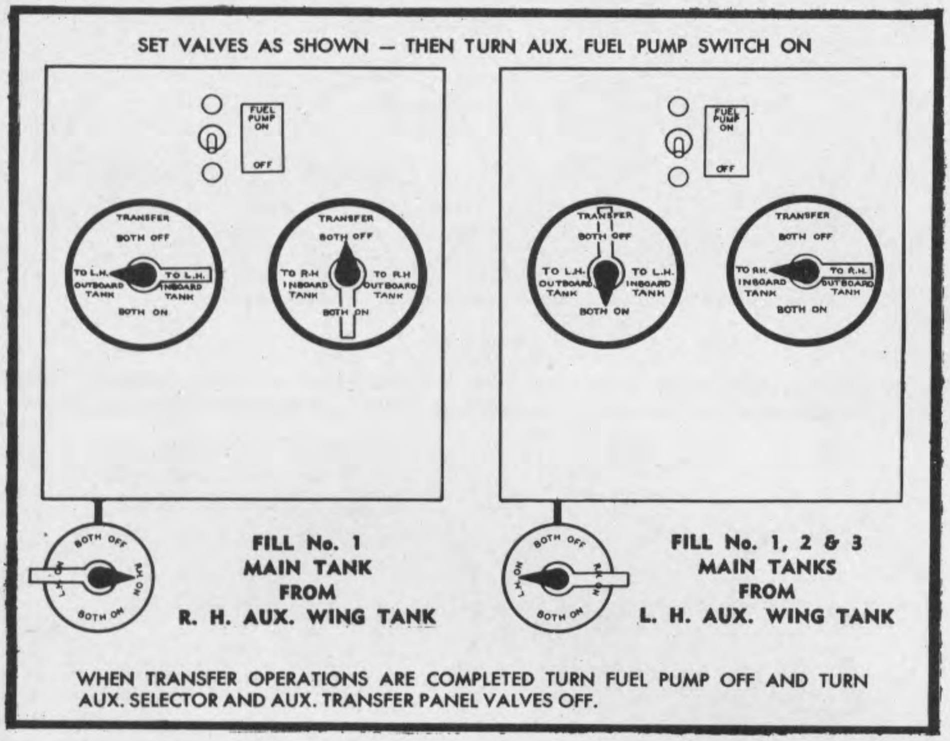


SET SELECTOR VALVES AS INDICATED TO TRANSFER FUEL FROM NO. 3 MAIN WING TANK TO NO. 1 MAIN WING TANK

GROUP II AIRPLANES

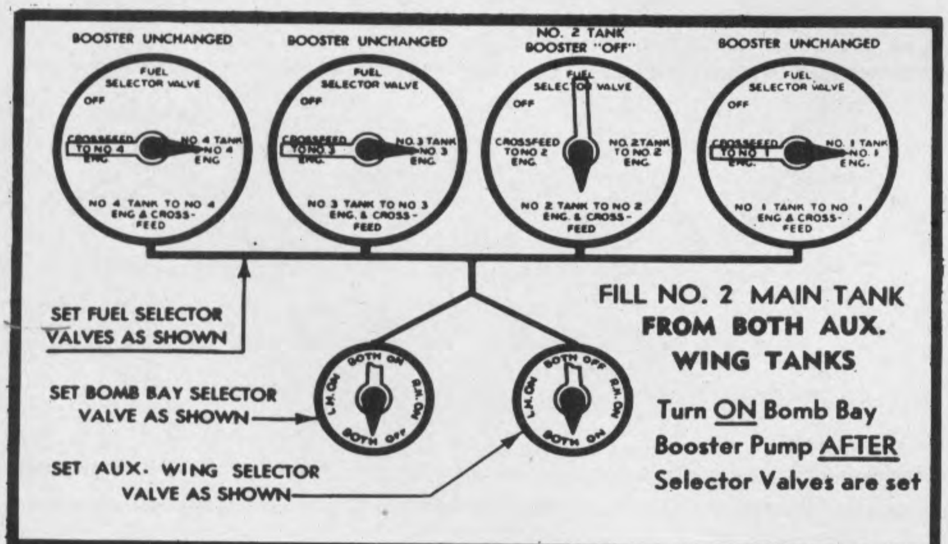


SET SELECTOR VALVES AS INDICATED TO TRANSFER FUEL FROM NO. 4 MAIN WING TANK TO NO. 3 MAIN WING TANK



GROUP I
AIRPLANES

Figure 20—
(Sheet 1 of 2 Sheets)
Fuel Transfer
From
Auxiliary Wing Tanks
To Main Tanks



GROUP II
AIRPLANES

(3) Turn "OFF" the booster pump switch for the tank to be filled.

(4) Turn "ON" the booster pump switch for the tank to be drained.

(5) When the tank being filled is within 50 gallons of full:

(a) Reset its selector valve and that of the tank being drained to "TANK TO ENG."

(b) Turn "OFF" the booster switch of the tank being drained.

(6) When any main tank is completely empty, reset its selector valve to "CROSS-FEED TO ENG."; reset the other three main selector valves to "TANK TO ENG. and CROSS-FEED."

(7) If fuel is low in all main tanks, reset all the main selector valves to "TANK TO ENG. and CROSS-FEED."

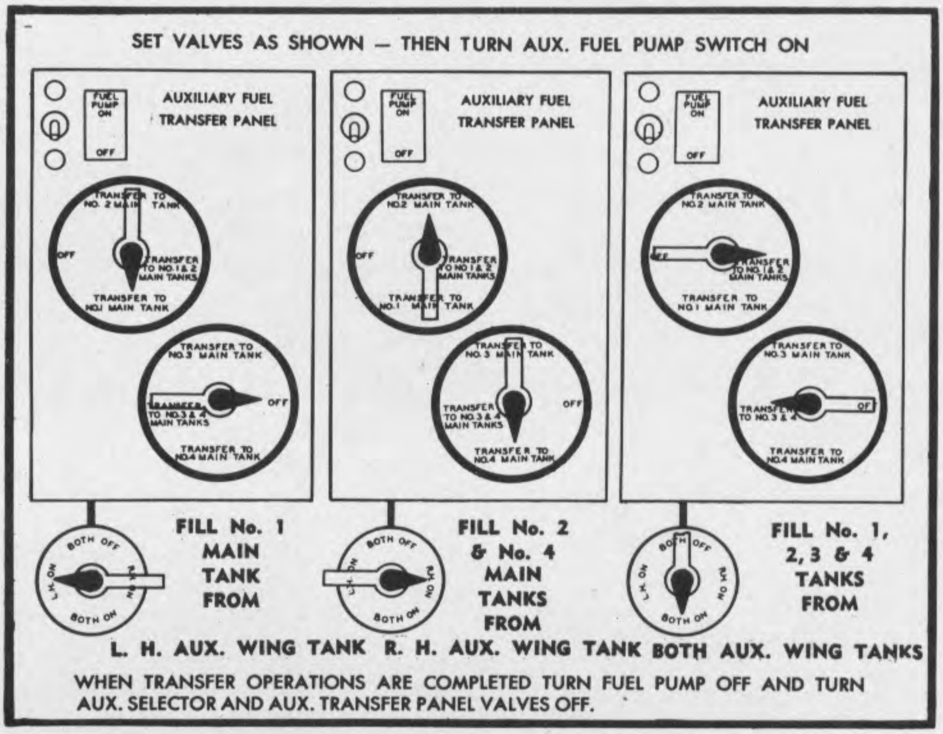


Figure 20— (Sheet 2 of 2 Sheets) Fuel Transfer From Auxiliary Wing Tanks To Main Tanks

GROUP III AIRPLANES

c. TO TRANSFER FROM AUXILIARY WING TANKS TO MAIN TANKS ON GROUPS I AND III AIRPLANES. *(See figure 20.)*

Note

Transfers may be made from either or both auxiliary wing tanks to any or all main tanks in a single operation.

(1) Set the auxiliary wing selector valve to "L.H. ON," "R.H. ON," or "BOTH ON."

(2) Set either or both of the transfer valves on the panel to any desired transfer position.

(3) Turn "ON" the auxiliary fuel pump switch (on panel).

(4) When the main tank or tanks are within 50 gallons of full, or when the auxiliary wing tank or tanks are empty:

(a) Switch "OFF" the fuel pump.

(b) Turn the auxiliary wing selector valve "OFF."

(c) Turn "OFF" both transfer panel valves.

CAUTION

Do not change any of the valve settings while the fuel pump is on. Be sure the auxiliary selector and the transfer panel valves are turned off after the transfers are completed.

d. TO TRANSFER FROM AUXILIARY WING TANKS TO MAIN TANKS ON GROUP II AIRPLANES.

CAUTION

FILL ONLY ONE MAIN TANK AT A TIME.

(1) Set the auxiliary wing selector valve to "L.H. ON," "R.H. ON," or "BOTH ON."

(2) Set the main selector valve for the tank to be filled to "TANK TO ENG. and CROSS-FEED."

(3) Set the other three main selector valves to "TANK TO ENG."

(4) Be sure the bomb bay tank selector valve is in "BOTH OFF" position.

(5) Turn "ON" the bomb bay booster pump switch.

(6) Turn "OFF" the booster pump switch of the tank to be filled.

(7) When the main tank is within 50 gallons of full, or when the auxiliary wing tank or tanks are empty:

(a) Turn "OFF" the bomb bay booster pump switch.

(b) Reset the main tank selector valve to "TANK TO ENG."

(c) Turn the auxiliary selector valve to "BOTH OFF."

PILOT — COPILOT

5. STARTING ENGINES.

a. CONDENSED CHECK LIST.

(1) Fire guard.

(2) Ignition switches—"ON."

(3) Booster Pumps—"ON."

(4) Start engines.

(5) Flight indicator—Check operation.

b. AMPLIFIED CHECK LIST.

Pilot:

(1) Call "Clear."

(3) THROTTLES.—Crack all throttles. This prevents backfiring and/or overspeeding of the engine on starting.

(7) When the engine starts, bring the mixture control back to "AUTO-RICH" and leave it there.

Copilot:

(1) Call "Clear."

Check to see that the fire guard is posted. Signal to start No. 3 engine first. The engines will be started 3, 4, 2, 1. This is to protect the fire guard from danger of the outboard propeller in case of fire. Also, the hydraulic pump is on No. 3 engine. (When using the crank or external energizer, start engines 1, 2, 3, 4.)

(2) IGNITION SWITCHES.—Turn all ignition switches "ON."

(4) BOOSTER PUMPS.—Do not turn the booster pump switch "ON" until the engine is to be started. Turn "OFF" after the engine is started. Booster pumps must be on to supply fuel pressure for priming.

(5) PRIME.—Prime the engine when the fuel pressure is up above four pounds. The engine will be primed by depressing the switch for one second and then releasing it. The number of one-second shots necessary may best be determined by experience but normally will not be less than three or more than six.

(6) START ENGINES.—Energize the starter, then mesh, holding the mesh until the engine is definitely started. The reason for this is that the induction vibrator is energized by the meshing switch.

PILOT

COPILOT

(8) Watch the oil pressure gage and call "Oil pressure coming up" if it is coming up. If the oil pressure does not come up within 30 seconds, put the mixture control in "IDLE CUT-OFF" and stop the engine. When the engine starts, turn "OFF" the booster pump switch. During all subsequent operation on the ground, the engines will be idled at 1000 rpm when not actually taxying.

FLIGHT ENGINEER

(9) GENERATOR SWITCH.—Turn the generator switch to "ON" position.

(10) FLIGHT INDICATOR.—Note the rapidity with which the flight indicator rights itself as the engine which is supplying the vacuum starts. If the righting is sluggish, the instrument needs repair.

(11) ENGINE FIRE.—In case of engine fire, move the mixture control to "IDLE CUT-OFF" and turn the ignition switch for the burning engine off. If the other engine on the same side is running, stop that engine also. Use fire extinguishers. Do not start the engines again until thorough inspection is made and cause of the fire is determined.

6. ENGINE WARM-UP AND ACCESSORY CHECK.

a. CONDENSED CHECK LIST.

(1) Check all instruments.

(2) Check the vacuum pressures.

(3) Check the altimeter.

b. AMPLIFIED CHECK LIST.

(1) ALL INSTRUMENTS.—Spin the directional gyro, then pull out to uncage it. If the gyro stops spinning, it may be considered in good working condition. Try it both ways, left and right. The flight indicator has already been checked if it has righted itself. Check the engine instruments: Oil pressure, oil temperature, head temperature fuel pressure, carburetor air temperature, tachometers and manifold pressure. Check the free air temperature gage, hydraulic pressure gages, compass and the gear warning light.

FLIGHT ENGINEER

(2) VACUUM.—Call out the number of the engine supplying the vacuum. The pilot will check his gage and reply "Check" if the vacuum is between 3.5 and 5 inches of mercury. The engineer will then turn the selector valve and the procedure will be repeated at 1000 rpm on the other engine.

PILOT

(3) RADIO, ALTIMETER AND TIME.—Call the tower for radio check, altimeter setting and time. Set altimeter and note how far off it is by the difference between altimeter reading and the actual altitude of field. The maximum error permissible is 75 feet. Check the interphone communication among the members of crew.

(4) WHEEL CHOCKS.—Check removal left.

COPILOT

(4) WHEEL CHOCKS.—Check removal right.

7. EMERGENCY TAKE-OFF.

a. If oil dilution has been used before stopping the engines at the end of previous flight, a normal take-off may be made as soon as the oil pressures steady down on all engines. Be on the alert for failure of cold engines. (See Section IV, paragraph 2.)

b. Safe minimum "Oil-in" temperatures when the oil has not been diluted are:

Grade Oil	*Air Temperature At Ground*	*Oil Temperature Gage Reading*
1120	4°C (40°F) and above	20°C (68°F)
1100	–7° to 27°C (20° to 80°F)	10°C (50°F)
1080	10°C (50°F) and below	0°C (32°F)

8. ENGINE AND ACCESSORY OPERATING GROUND TEST.

a. CONDENSED CHECK LIST.

(1) Exercise the turbos, wing flaps and propellers.

(2) Run up engines.

b. AMPLIFIED CHECK LIST.

(1) TRIM TABS.—Set the trim tabs as desired. (Normally rudder two to three degrees right rudder, elevators one to two degrees nose up, and aileron zero degrees) and replies "Set for take-off."

(2) MIXTURE CONTROLS. — Copilot puts them all in "AUTO-RICH" and replies "AUTO-RICH."

(3) EXERCISE THE PROPELLERS AND TURBOSUPERCHARGERS.—Pilot sets the throttles for 1400 rpm. Then as the copilot changes the propeller governors from high rpm to low rpm and back, the pilot advances the superchargers slowly and retards them slowly several times.

(See Note on next page.)

PILOT

Note

Electronically regulated superchargers need not be exercised. The turbosupercharger control system is automatically energized whenever the inverter is running.

(5) RUN UP ENGINES.—Engines will be run up in the following order: 4, 3, 2, 1. Advance No. 4 throttle to 2000 rpm.

Move the supercharger control handle forward nearly to stop. As the manifold pressure climbs, then stops, move supercharger lever slowly forward until desired manifold pressure is obtained. On airplanes having electronic turbo regulators, set the turbo boost selector dial to "8."

(8) GYROS. — Pilot gives final check, noting any precession since taxying from the line, and resets for the take-off.

(10) FLIGHT CONTROLS.—Check the flight controls for freedom of movement.

COPILOT

(4) PROPELLERS.—Check for high rpm and governor limit lights.

(6) Check the magnetos at signal from the pilot. Switch to the left magneto first, then back to both magnetos, and then to right magneto. Normal drop from both to one magneto is 50 to 75 rpm. The maximum drop should not be more than 100 rpm. When switching from left to right magneto the difference in the speeds should not be more than 30 or 40 rpm. Magneto check should be made in as short a time as possible. Adjust the hydraulic turbo regulator by advancing the throttle fully open and holding it there.

(7) TURBOSUPERCHARGERS.—Set the lock so that the levers may be moved but will not creep. It should be remembered that the throttle and supercharger "LOCKS" are in reality friction brakes and should be treated as such.

(9) WING FLAPS.—Check the flaps for 20-degree position.

FLIGHT ENGINEER

(11) DOORS AND HATCHES. — Close the doors and hatches.

FLIGHT ENGINEER

(12) AUXILIARY POWER UNIT.—Turn auxiliary power unit to "OFF" position and reply "OFF."

(13) Deleted in revision, dated 25 March 1945.

PILOT

COPILOT

(14) COWL FLAPS.—Close the cowl flaps to trail position (10 degrees). Be careful to see that all are closed the same. If open too much, they will cause a loss of lift and increased drag. Beyond five degrees of cowl flap opening one mile per hour loss of air speed will result from each additional degree. In flight no added cooling will be gained above 12½ degrees.

(15) BOOSTER PUMPS. — Turn all booster pump switches "ON." This builds up a differential of eight pounds pressure in the self-sealing hose lines to the engine to keep them from collapsing. It is also a safety precaution in case of engine pump failure.

9. TAXYING INSTRUCTIONS.

When taxying it is imperative that application of the brakes, rudder and throttle be coordinated in such a manner as to keep the plane taxying in a straight line, not in excess of 15 miles per hour and without excessive use of the throttle at any time. Except in cases of emergency, use of the throttle in excess of 1400 rpm is unnecessary. For all ground operation the cowl flaps must be wide open. The mixture control must be in "AUTO-RICH" and the engine temperature limits strictly observed.

At all times try to taxi without using the brakes. Use the outboard engines and rudder, rather than the brakes to keep on course.

CAUTION

Avoid sudden application of power while the nose wheel is turned in a direction not parallel to the line of travel. When the forward motion of one main wheel is retarded the nose wheel will turn in the direction of the restricted wheel. Forward surges will then impose high shear loads which could cause failure of the nose gear strut.

REMEMBER, use only one outboard engine at a time, and be sure to cut back all throttles when braking the plane to a complete stop.

The following suggestions will serve as a guide to successful taxiing operations:

a. Keep the field control tower posted as to your movements.

b. Post the flight engineer on lookout at the pilot's escape hatch.

c. Have the copilot closely watch right side of plane.

d. Be sure the supercharger switches are in "LOW," booster pumps off, mixture controls in "AUTO-RICH," and the cowl flap full open.

e. Never at any time spin the plane on the inside landing wheel on turns. This will tear rubber off the tire.

f. Do not cock the nose wheel more than 30 degrees at any time.

g. When braking to a complete stop, and the nose wheel starts to turn, release the pressure on the brake on side to which the nose is turning and catch with the opposite brake.

h. Refrain from using excessive amounts of outboard throttle when taxying, as this will necessitate constant "jockeying" of the airplane.

i. One of the main points to consider in taxying tricycle gear installations is to avoid starting movement contrary to the direction in which the nose wheel is turned. Pilots should note the position of the nose wheel before entering the airplane. If it is turned sidewise over 30 degrees or caught in a rut, the wheel should be straightened with a towbar before attempting to taxi. If turned only a small amount the pilot should begin his taxying in the direction the nose wheel points using unsymmetrical power rather than brakes in order to start the wheel castering. After the nose wheel has begun to caster, the plane may be turned to the desired direction.

j. Pilots should start taxying with no more than the minimum amount of throttle required to start motion. Hold the brakes and turn the engines up to about 1000 rpm. Release the brakes and keep the engines at 1000 rpm using the outboard engines for steering.

k. Bounding of the nose section on a smooth runway is due to excessive use of brakes, and is a sure indication of an inexperienced pilot.

l. Use the carburetor air filter if dust conditions are bad. There will be about two inches loss of manifold pressure when the filter is used, but this loss should not be made up by advancing the throttle unless absolutely necessary. Ground operation should always be carried on at the lowest possible rpm.

10. TAKE-OFF.

a. NORMAL TAKE-OFF.—On clearance from the control tower, taxi into the take-off position on the assigned runway. The engines will be idled at a minimum of 1000 rpm and the airplane held with the brakes. When the instruments and controls have been given a final check by both the pilot and the copilot, the brakes will be released and the take-off roll started by advancing the throttle slowly and steadily.

(1) Directional control will be maintained by use of the throttles and rudder and not by use of brakes.

(2) The copilot will follow the pilot through on the throttles and will adjust the friction knob on the pedestal to give only sufficient friction to prevent creeping.

(3) The copilot will keep his eyes on the instrument panel throughout the take-off roll, alert for excessive manifold pressure or rpm and ready for instant action.

(4) The pilot will retain control of the throttles until a safe altitude has been reached.

(5) The flight engineer will maintain a constant visual check on the engines, watching for turbo torching, evidence of fire, or any other irregularities. If noted, the pilot will be informed immediately.

(6) High wind conditions require a large amount of rudder control and a large amount of differential throttling on the take-off roll.

(7) Climbing conditions directly after the take-off in a high wind require as much as 10 miles per hour faster air speed than calm or moderate wind conditions require.

(8) Take-off power settings (fuel, Specification No. AN-F-28, grade 100/130 only):

Manifold pressure .... 49 inches Hg.
RPM 2700
Mixture control .... "AUTO RICH"

Do not hold take-off power setting longer than five minutes. If an electronic turbosupercharger regulator is installed, be sure the turbo boost selector dial is set at "8."

(9) At the beginning of the take-off roll the flight engineer will watch the ammeters on the generator control panel for indication of excessive load on any one generator. Switch off any generator carrying excessive load. Do not switch back on again until other generators show signs of sharing the load.

b. NO FLAP TAKE-OFF.

(1) Take-off settings, position, and clearance the same as for normal take-off, except for the flaps being all the way up.

(2) Take-off the same as normal take-off, except that plane requires longer run, higher take-off speed. The take-off speed should be at least 130 miles per hour indicated. A slightly higher nose-up attitude at the initial take-off is needed. Climb at 150 miles per hour for remainder of the take-off, the same as for the normal take-off.

c. FULL FLAP (40°) TAKE-OFF.

In case it is necessary to take off from an exceptionally short field and to clear rather high obstructions close to the field, a full flap take-off should be used. It will place the airplane in the air faster with a shorter run than any other method. It must be noted, however, that the airplane is flying at such a low airspeed that sufficient rudder control is not available in case of outboard engine failure. When using this method it is recommended that the airplane be made as light as possible. A full flap take-off differs from the conventional half flap take-off in the following manner:

(1) Start the take-off run with half flaps. As soon as the throttles are set and tightened, drop the flaps full down (40°).

(2) Momentarily exceed the take-off power limits if necessary, to reach a speed of 90 to 100 miles per hour indicated. A hard pull on the elevators will be necessary at this speed. Assist with the trim tabs.

(3) Hold 100 miles per hour climb to 200 or 300 feet to clear obstructions. Nose over gradually, holding your altitude and pick up speed to 127 miles per hour indicated.

(4) Raise the flaps up to half (20°). Retract the wheels, and proceed the same as for normal take-off.

d. THREE-ENGINE TAKE-OFF.

(1) Operate the two symmetrical good engines in the same manner as for a normal take-off.

(2) Adjust the rudder tab to give the maximum possible force to counteract the unsymmetrical thrust.

(3) During the take-off run, hold the rudder over as far as possible and increase the power of the odd engine as the force on the tail becomes greater, thus keeping the ship straight.

(4) It has been found that with an outboard engine stopped, and its propeller feathered, the other outboard engine may be allowed to develop about 750 horsepower (2500 rpm and 30 inches Hg) at take-off. In case an inboard engine is dead, the other inboard can be allowed to develop partially full take-off power by the end of the take-off run. Tests show that, with an outboard engine dead, the take-off run is from 2¾ to 3 times as long as when using all four engines. With an inboard engine dead, the run will be 2 to 2¼ times as long as that required when all four engines are used.

(5) If time and shop facilities permit, remove the propeller of the dead engine and close the front of the engine with a securely fastened disc of plywood or sheet metal, to reduce drag.

e. ALTITUDE TAKE-OFF.—The ground run for the take-off increases with altitude (See Take-off, Climb and Landing Charts, Appendix II). For a supercharged engine this increase is approximately 3.5 percent per 1,000 feet increase in altitude, up to the rated altitude. The path angle of climb also decreases with altitude. In all take-offs at high altitude, allowance must be made for the increased ground run and reduced path angle of climb.

11. ENGINE FAILURE DURING TAKE-OFF.

Refer to "ENGINE FAILURES," in Section IV, paragraph 2.

12. CLIMB.

a. CONDENSED CHECK LIST.

(1) Wheels.

(2) Power reduction.

(3) Wing flaps.

b. AMPLIFIED CHECK LIST.

(1) WHEELS.—The copilot will raise the gear on signal from pilot. The pilot will apply the brakes to stop rotation of wheels.

Note

Do not raise the gear until at a safe altitude.

(2) TURBOSUPERCHARGERS. — The pilot will make a power reduction with the superchargers and set them for climb.

(3) THROTTLES.—If the manifold pressure is still higher than desired for climbing, retard the throttles.

(4) PROPELLERS. — The copilot will reduce the rpm to 2550 when ordered to do so by the pilot.

(5) WING FLAPS.—The copilot will raise the wing flaps when ordered to do so by pilot. The flaps should not be raised at air speeds less than 140 miles per hour. It is desirable to climb with flaps up and at highest air speed possible to maintain desired rate of climb (usually 150 to 160 MPH.)

Note

Raising of the flaps changes the trim and attitude of the airplane. Bring the nose up gradually as the flaps are raised. Be sure that the airplane is at a safe altitude before raising the flaps.

(6) BOOSTER PUMPS.—Above 1,000 feet, the copilot switches the booster pump switches "OFF" one at a time, noting any drop in pressure, indicating malfunctioning of the engine-driven pumps. The booster pumps will be used at high altitudes wherever necessary to maintain pressure and prevent vapor lock.

(7) COWL FLAPS.—The cowl flaps should normally be set at trail for climb.

CAUTION

On running take-off, watch the cylinder head temperatures and open the cowl flaps if necessary.

13. GENERAL FLYING CHARACTERISTICS.

a. Power settings and engine limits for various flight conditions are given in the Specific Engine Flight charts in Section III of this handbook.

WARNING

When changing the power settings during flight, advance or retard the throttles slowly. AVOID ABRUPT OR JERKY MOVEMENTS. Sudden movement of the throttle levers may cause the engines to backfire or to stop.

b. Effect on airplane performance due to changes of the gross load during flight, such as consumption of fuel and dropping of bombs, is shown on the Flight Operation Instruction charts in Appendix II of this handbook.

c. OPERATION OF ELECTRONIC TURBO-SUPERCHARGER REGULATOR.

(1) BEFORE STARTING ENGINES.—Set the turbo boost selector (figure 17, item 60) at "0." Turn on the auxiliary power unit.

(2) SYSTEM AUTOMATICALLY ENERGIZED BY INVERTERS.—After turning on the airplane's

battery switches, master switch, and the inverter switch, allow two minutes for the amplifiers to warm up. The control system will then respond to the setting of the turbo boost selector.

Note

Never turn inverter off while the engines are running, due to the fact that the control system is dependent on the a-c power for operation.

(3) TAXYING. — Set the dial at "0" unless turbo boost is needed.

(4) BEFORE TAKE-OFF.—Set the propeller governors for take-off rpm and check the manifold pressure on each engine separately by advancing the throttle to full-open position and then turning the dial of the turbo boost selector clockwise to "8." If the manifold pressure on any engine fails to come up to within one inch of the take-off pressure with full rpm, turn the dial to "0" and check the engine rpm and manifold pressure without the turbo boost. This will show whether the low manifold pressure is caused by faulty engine operation or by insufficient turbo boost. Also check the d-c voltage on the voltmeter, with the generators on.

(5) TAKE-OFF.—Turn the dial to "8" and then open the throttles.

Note

Be sure the generator switches are "ON" and operating during the take-off.

(6) CLIMBING.—After the take-off, turn the knob counterclockwise until the desired manifold pressure is reached. Decrease the rpm to desired value. Reset the manifold pressure with the turbo boost selector if necessary. Adjust the intercooler shutters to maintain the proper carburetor air temperature. For climbing, after cruising, increase the rpm first; then advance the throttles and increase the manifold pressure to the desired value by turning the turbo boost selector clockwise.

(7) CRUISING.—Use the dial to select the manifold pressure. If the manifold pressure cannot be lowered sufficiently with the knob, pull back on the throttles. Decrease the rpm to the desired value, and then if necessary reset the manifold pressure with the throttles and dial.

Note

If the atmospheric conditions are such that carburetor icing may occur, maintain at least four inches of turbo boost and adjust the intercoolers to maintain the proper carburetor air temperatures. If the engine operation does not require this amount of boost, reduce the manifold pressure four inches by retarding the throttles and bring the manifold pressure back up four inches by increasing the dial setting.

(8) FORMATION FLYING.—The throttles, the turbo boost selector knob, or the throttles and the knob combined, may be used in formation flying, depending on the tightness of the formation, the position of the plane in the formation, and the altitude. In all cases, the setting of the turbo boost selector must be such that the manifold pressure will not exceed the recommended limit for the rpm being used, even with throttles full open. At altitudes in the turbo overspeed range (where governor limits rpm of turbosupercharger) the turbo boost selector should be held to a setting below the point where the overspeed control begins to "cut in" on any engine, and the throttles should then be used to vary the power. Below 6,000 feet, the throttles must be used, as the effective range of the control system is limited at low altitudes.

(9) DESCENDING. — Maintain some turbo boost. Use the dial to select manifold pressure until the throttle range is reached. For further reduction, use the throttles.

(10) LANDING.—Set the propellers at maximum cruising rpm. Set dial for the maximum cruise manifold pressure. Pull back on the throttles.

(11) STOPPING ENGINES. — When stopping the engines, turn the dial of the turbo boost selector to "0" before turning off the inverter.

Note

In emergencies, where the electronic supercharger regulator fails to hold the manifold pressures within the required limits, retard the throttles to prevent excessive manifold pressures.

d. AUTOMATIC FLIGHT CONTROL OPERATING INSTRUCTIONS. *(See figure 21.)*

(1) TYPE C-1 AUTOPILOT. — Operation of the type C-1 Autopilot installation in the airplane is conventional. Standard instructions and check list are placarded in the pilot's compartment.

(2) TYPE A-5 AUTOMATIC PILOT.

(a) BEFORE TAKE-OFF.

1. Check freedom of all three controls for hard-over position.

2. If equipment has been repaired or changed since last flight, turn "ON" the automatic pilot and check alignment of the meter needles and the proper operation of controls. Press the emergency release button and check that all controls are freed. Turn all switches "OFF." *(See figure 22.)*

(b) AFTER TAKE-OFF.

1. Turn the master control switch clockwise to position "1" and leave for about 20 seconds.

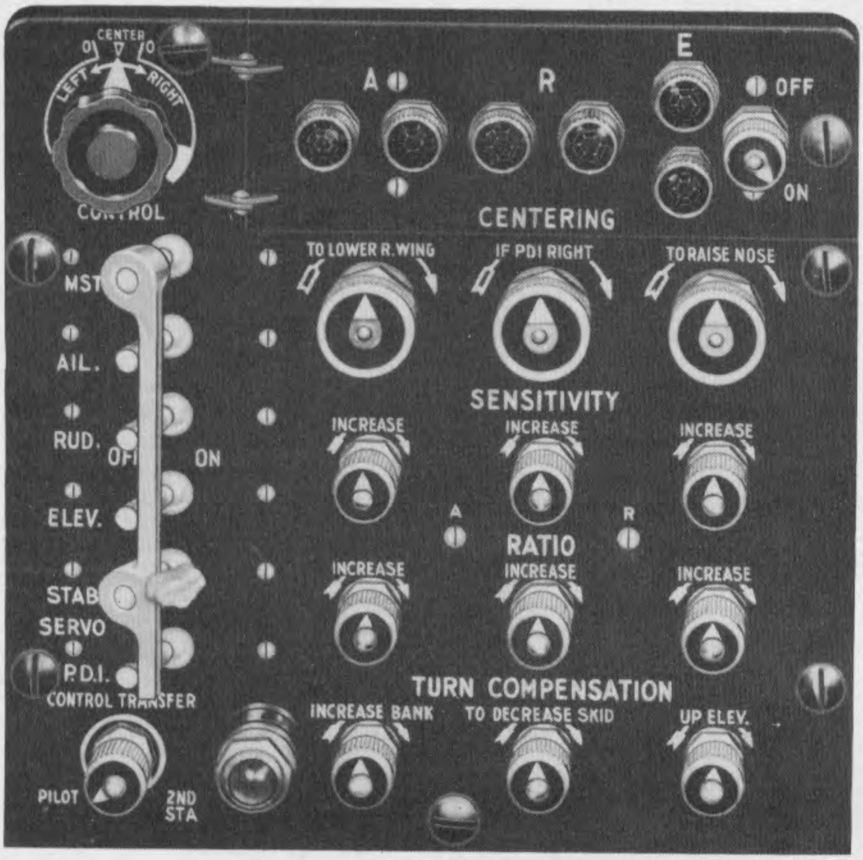
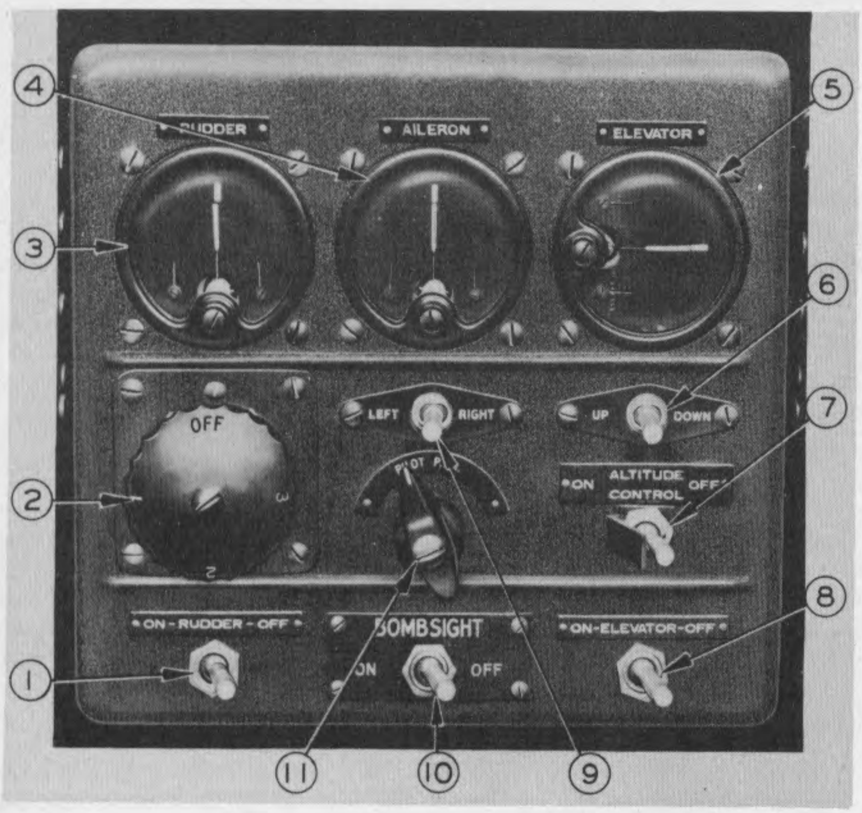


**Figure 21—
Type C-1 Autopilot
Control Panel**



1. Rudder Switch
2. Master Control Switch
3. Rudder Meter
4. Aileron Meter
5. Elevator Meter
6. Elevator Aligning Switch
7. Aileron Aligning Switch
10. Bomb Sight Switch
11. Station Selector Switch

**Figure 22—
Type A-5 Automatic Pilot
Control Panel**

2. Turn clockwise to position "2" and leave for three to five minutes for the gyros to come up to speed.

3. Turn the station selector switch to "PILOT."

4. Be sure that the "RUDDER," "BOMBSIGHT," "ELEVATOR," and "ALTITUDE CONTROL" switches are all "OFF."

5. Check the voltage and frequency, 110 to 120 volts, 380 to 420 cycles. METERS SHOULD NOT FLUCTUATE.

6. Trim the airplane for "hands-off" straight and level flight.

Note

Since the meters indicate only three degrees airplane movement to either side of the index, it is difficult in rough air to control the airplane so that the meter is exactly centered. It is permissible to turn any control "ON," even though the meter is not exactly centered.

7. Center the needle of "AILERON" meter approximately by holding the aileron aligning switch "LEFT" or "RIGHT," and immediately turn the master control switch clockwise to position "3." If necessary, level the airplane laterally by moving aileron aligning switch "LEFT" or "RIGHT."

8. Center the needle of the "ELEVATOR" meter approximately, by holding elevator aligning switch "UP" or "DOWN," and immediately turn the "ELEVATOR" switch "ON." If necessary, level the airplane longitudinally by holding the elevator aligning switch "UP" or "DOWN."

9. Center the needle of the "RUDDER" meter approximately:

a. If the meter needle shows left deflection, turn the rudder alignment knob (Center knob on A-5, turn and bank control) clockwise until the meter needle is centered *(see figure 23)*.

b. If the meter needle shows right deflection, turn the rudder alignment knob counterclockwise until the meter needle is centered. Immediately turn the "RUDDER" switch "ON."

CAUTION

If the direction of the meter needle movement does not correspond to the movement of the rudder alignment knob, continue to turn the aligning knob until the needle approaches center in the same direction in which the aligning knob is rotated.

10. Turn the "ELEVATOR TAB" switch "ON."

11. AIRPLANE TRIMMING CONTROL.—When the automatic pilot is in operation, any out-of-trim condition of the airplane is indicated by a tendency of the meter needles to remain on one side. This may be corrected by trimming the airplane manually with the airplane's trim controls while the automatic pilot is in operation.

12. DIRECTIONAL CONTROL. — The pilot may make course corrections or turns by use of the turn controller. The pilot's turn control knob is turned right or left for the desired direction turn. The ball inclinometer is kept centered by changing the angle of bank with the bank adjustment knob on the turn controller. The airplane is returned to straight and level flight by turning the pilot's turn control knob to center.

13. LATERAL CONTROL. — The human pilot may have lateral control by operating the aileron aligning switch "LEFT" or "RIGHT."

14. LONGITUDINAL CONTROL.—Longitudinal control through the automatic pilot may be accomplished by operating the elevator aligning switch "UP" or "DOWN."

15. PILOT DIRECTOR INDICATOR. — To put the pilot director indicator in operation, turn the station selector switch to "P.D.I." By reference to this unit the human pilot can maintain a predetermined heading from the directional gyro when flying manually.

16. To disengage the automatic pilot, turn the master control switch clockwise to "OFF" or, if the automatic pilot is to be temporarily disengaged, turn the master control switch counterclockwise to position No. "2"; then, turn the "RUDDER" and "ELEVATOR" switches "OFF."

Figure 23—Type A-5 Bank and Turn Control

e. CRUISING.

(1) Always approach the cruising level from higher altitude and the cruising speed from higher speed; NEVER FROM LOWER ALTITUDE OR SPEED. The speed gained in descent to cruising altitude from above will insure a proper flight attitude for economical cruising. If the power is reduced before the airplane has picked up full momentum for cruising, it will "mush" along in a high-attack, high-drag attitude and waste fuel.

(2) A visual check of the cowl flaps and nacelles should be made every half hour. The cowl flaps should be at trail for cruising.

(3) Check the actual fuel consumption with sight gages every hour. Set up a form and keep records. Compare with Flight Operation Instruction Charts (see Appendix II).

(4) On long flights at high altitudes, exercise the propellers about every half hour, to prevent stiffening of oil in the propeller dome. Always put the mixture control in "AUTO RICH" and reduce the manifold pressure before increasing the propeller pitch (i.e. decreasing rpm).

14. STALLS.

a. As the flap angle is changed, the stalling speed of the airplane is changed. Therefore the airplane should have considerable excess speed before the flaps are raised.

b. When under automatic pilot control, do not fly at near-stalling speeds.

c. Maintain the indicated air speeds higher than 155 miles an hour with gross weight loadings of 41,000 pounds or more.

d. STALLING SPEEDS.

Power	Gross Weight	Wing Flaps and L. G. Retracted	Wing Flaps 40° L. G. Extended
Zero	45,000 lb	110 mph	91 mph
Zero	56,000 lb	123 mph	101 mph
Zero	64,000 lb	132 mph	109 mph
40%	45,000 lb	103 mph	71 mph
40%	56,000 lb	114 mph	80 mph
40%	64,000 lb	123 mph	85 mph

Note

Variations to the above results may be caused by variations in operating technique and the condition of the wing surfaces as to paint and dirt.

15. SPINS.

a. Intentional spins with this airplane are prohibited.

b. Lowering of the landing gear will assist recovery from early stages of spins. If a spin has not progressed too far, recovery may be assisted by increasing the power of the engines on the inside of the turn and decreasing the power of the engines on the outside of the turn, as well as by applying the usual nose-down and opposite aileron and rudder controls. In recovery from a spin, there must be no abrupt movement of the controls.

16. ACROBATICS.

All acrobatics with this type of aircraft are prohibited.

17. DIVING.

a. Refer to paragraph 1., *b.* of this section for the maximum permissible air speeds.

b. Do not exceed 3060 rpm during rapid descents.

18. NIGHT FLYING.

When approaching a lighted field at night, start a turn from the base leg into the runway approach at the moment when the runway lights appear to separate and become two rows of lights instead of one row.

19. APPROACH AND LANDING.

a. BEFORE LANDING—CONDENSED CHECK LIST.

(1) Radio and altimeter.
(2) Crew positions.
(3) Autopilot—"OFF."
(4) Booster pumps—"ON."
(5) Mixture—"AUTO RICH."
(6) Intercoolers—open.
(7) Wing De-Icers (shoe type)—"OFF."
(8) Auxiliary power unit—as required.
(9) Landing gear.
(a) Pressure.
(b) Visual check of locks.
(c) Indicator light.
(d) Control handle.
(10) Electric hydraulic pump—"ON."
(11) Brake pressure.
(12) RPM.
(13) Wing flap setting.
(14) Heaters off. (Stewart-Warner)

b. BEFORE LANDING—AMPLIFIED CHECK LIST.

(1) ALTIMETER SETTING. — Before coming back into traffic, call tower for altimeter setting and landing instructions.

(2) CREW TO STATION.—See that the nose section is clear of personnel. Retract the ball turret and trailing antenna.

(3) AUXILIARY HYDRAULIC PUMP. — The engineer starts back to turn the auxiliary hydraulic pump switch "ON," signals "ON," and continues back to check the main gear locks when the gear is started down.

(4) BRAKE PRESSURE AND PARKING BRAKES.—The pilot presses the pedals, notes pressure, and checks the parking brake handle for "OFF."

(5) AUTOPILOT. — The pilot checks all switches for "OFF" positions.

(6) GEAR HANDLE.—With indicated air speed no greater than 155 miles per hour, the copilot puts the gear handle momentarily "UP" then "DOWN."

(7) MIXTURE.—The copilot puts the mixture controls in "AUTO RICH."

(8) PROPELLERS.—The copilot sets the rpm at 2400 to give greater flexibility of power range.

(9) INTERCOOLERS.—Unless icing conditions exist, the copilot checks the intercoolers for open.

(10) COWL FLAPS.—The copilot checks the cowl flaps for required position.

(11) BOOSTER PUMPS.—The copilot turns all booster pump switches "ON."

(12) WING DE-ICERS (SHOE TYPE).—The copilot checks the De-Icers, making sure they are turned "OFF." With the heat anti-icing system installed in later Group III airplanes, it is not necessary to turn "OFF" the control switches until after landing.

(13) WHEELS.—The pilot and copilot look out on their respective sides to see if both wheels are down. Pilot checks to see that the indicator light is "ON" and that the landing gear control handle has returned to neutral. The engineer makes visual check of the gear to see that it is locked and notifies pilot. After the engineer has checked the main gear through the waist gun window, he will proceed forward to check the nose gear and report to the pilot. *(See figure 24.)*

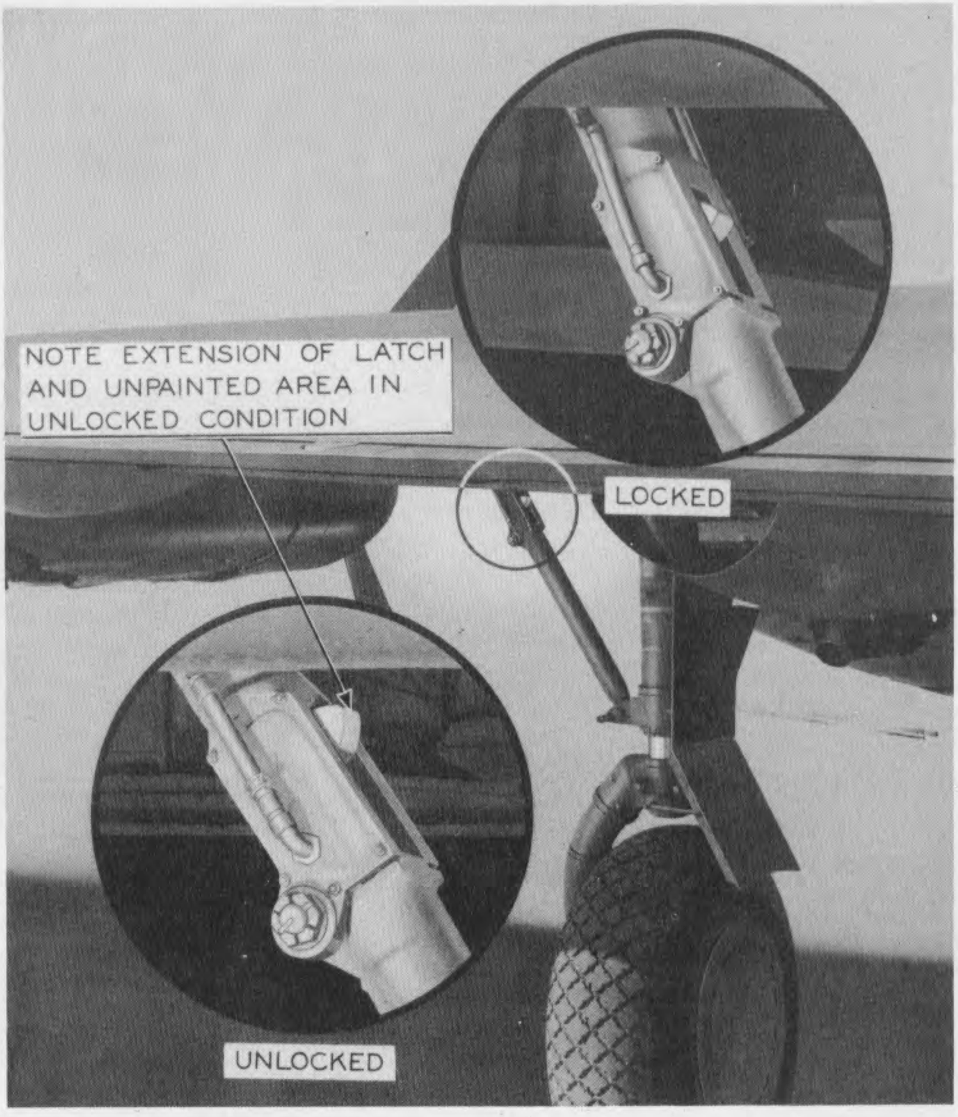


Figure 24—Main Landing Gear Down Lock Visual Check

(14) BALL TURRET AND TRAILING ANTENNA.—At the same time the engineer goes forward to make the nose gear check, he will check the ball turret to make sure it is retracted and check the trailing antenna to make sure it is in. He will report to the pilot that the ball turret and trailing antenna are retracted.

(15) WING FLAPS.—The copilot lowers the flaps 10 degrees. At normal approach speed (150 miles per hour) this will increase the drag very little, but will increase the lift and will give the airplane a more level flight attitude, provide better visibility, and lower the stalling speed. Lower the flaps to half while turning on the final approach.

c. FINAL APPROACH—CONDENSED CHECK LIST.

(1) TURBO CONTROLS.

(2) FLAP SETTING.

(3) AIR SPEED CALL-OUT.

d. FINAL APPROACH—AMPLIFIED CHECK LIST.

(1) POWER SETTING.—Reduce the manifold pressure below 25 inches mercury. Set the propellers for 2400 rpm to give greater flexibility of the power range.

CAUTION

Pull back the throttles SLOWLY.

(2) TURBOSUPERCHARGERS.—On airplanes which have the hydraulically actuated regulators, the pilot will set the supercharger control levers one finger's width from the take-off position. On airplanes having electronic regulators, set the turbo boost selector for 35 inches Hg manifold pressure (dial setting of "6" should give this manifold pressure).

(3) WING FLAPS.—The pilot calls for full flaps (40 degrees) when the air speed is down to 135 miles per hour. The copilot lowers the flaps.

(4) AIR SPEED CALL-OUT.—The copilot will call out the air speed to the pilot during approach.

e. RUNNING TAKE-OFF.

(1) WING FLAPS.—The copilot will raise the wing flaps to 20 degrees for take-off.

(2) TRIM TABS.—After bringing the flaps up to 20 degrees and returning the control handle to the neutral position, the copilot will roll the elevator tab forward to the normal take-off position.

Note

On running take-off, the cylinder head temperatures should be watched carefully, and the cowl flaps opened if engines show a tendency to overheat.

f. GO-AROUND.

(1) POWER.—The pilot opens the throttle until the take-off manifold pressure is obtained.

(2) AIR SPEED.—The copilot will watch the air speed indicator and notify the pilot if the air speed should be increased.

(3) WHEELS.—Copilot will raise the wheels.

(4) WING FLAPS.—After wheels are up, and safe speed (approximately 120 MPH), and altitude is obtained, milk flaps to 20 degrees.

CAUTION

Be prepared to use trim tabs to counter-act heavy control loads caused by raising wheels and flaps.

g. END OF LANDING ROLL—CONDENSED CHECK LIST.

(1) Wing flaps—"UP."

(2) Turbos—"OFF."

(3) High rpm.

(4) "AUTO RICH."

(5) Booster pumps—"OFF."

(6) Trim tabs—reset.

h. END OF LANDING ROLL—AMPLIFIED CHECK LIST.

(1) TURBOSUPERCHARGERS.—Shut "OFF" while taxying.

(2) BOOSTER PUMPS.—The copilot will switch the booster pump switches "OFF."

(3) Deleted in revision, dated 25 March 1945.

(4) WING FLAPS.—The copilot will raise the wing flaps.

(5) COWL FLAPS.—The copilot will "OPEN" the cowl flaps fully.

(6) AUXILIARY POWER UNIT.—The auxiliary power unit will normally be on during all taxying.

(7) BRAKE PRESSURE. — The copilot will check the brake pressure at this time and will continue to check the brake pressure frequently until the airplane is parked. If at any time the brake pressure falls below 800 pounds, the pilot will bring the airplane to a stop carefully, and will not move it again until the trouble has been corrected, or until the ground personnel have come to tow the airplane in.

20. STOPPING ENGINES.

a. THROTTLES.—The pilot will open the throttles until the engines reach 1000 rpm.

b. MIXTURE CONTROL.—The copilot will put the mixture control levers in "IDLE CUT-OFF." The pilot will then open the throttles, slowly, leaving them fully open.

c. SWITCHES OFF.—Copilot turns all switches to "OFF" position. Magneto switches first, then radio; then (when the autosyn instruments, such as fuel and oil pressure gages have returned to zero) a-c power switch; then lights, battery selectors. Engineer turns off generator switches.

21. BEFORE LEAVING THE PILOT'S COMPARTMENT.

a. SECURING AIRPLANE—CONDENSED CHECK LIST.

(1) Engines.

(2) Radio.

(3) Switches.

(4) Chocks.

(5) Gear lever.

(6) Controls locked.

b. SECURING AIRPLANE—AMPLIFIED CHECK LIST.

(1) ENGINES—OIL DILUTION.—If low temperatures make oil dilution necessary, dilute the engine oil as follows:

(a) Operate the engines at 1100 to 1300 rpm.

(b) Maintain the oil temperature below 50°C (122°F).

(c) For expected ambient temperatures prior to next engine start of 4°C to —12°C (39.2°F to 10.4°F) engage dilution switches 2 minutes. For expected temperatures between —12°C and —29°C (10.4°F and —20.2°F) engage switches 4 minutes. For temperatures —29°C to —46°C (—20.2°F to —50.8°F) engage switches 7 minutes.

(d) During the last few seconds of the dilution period increase the engine speed to 1600 rpm and move the propeller control to work diluted oil into the propeller dome. Also depress feathering switches to obtain a 400 rpm drop. Repeat the feathering cycle twice.

(e) It is important to leave the dilution switches engaged until the engines stop so that undiluted oil will not be drawn into the oil inlet line.

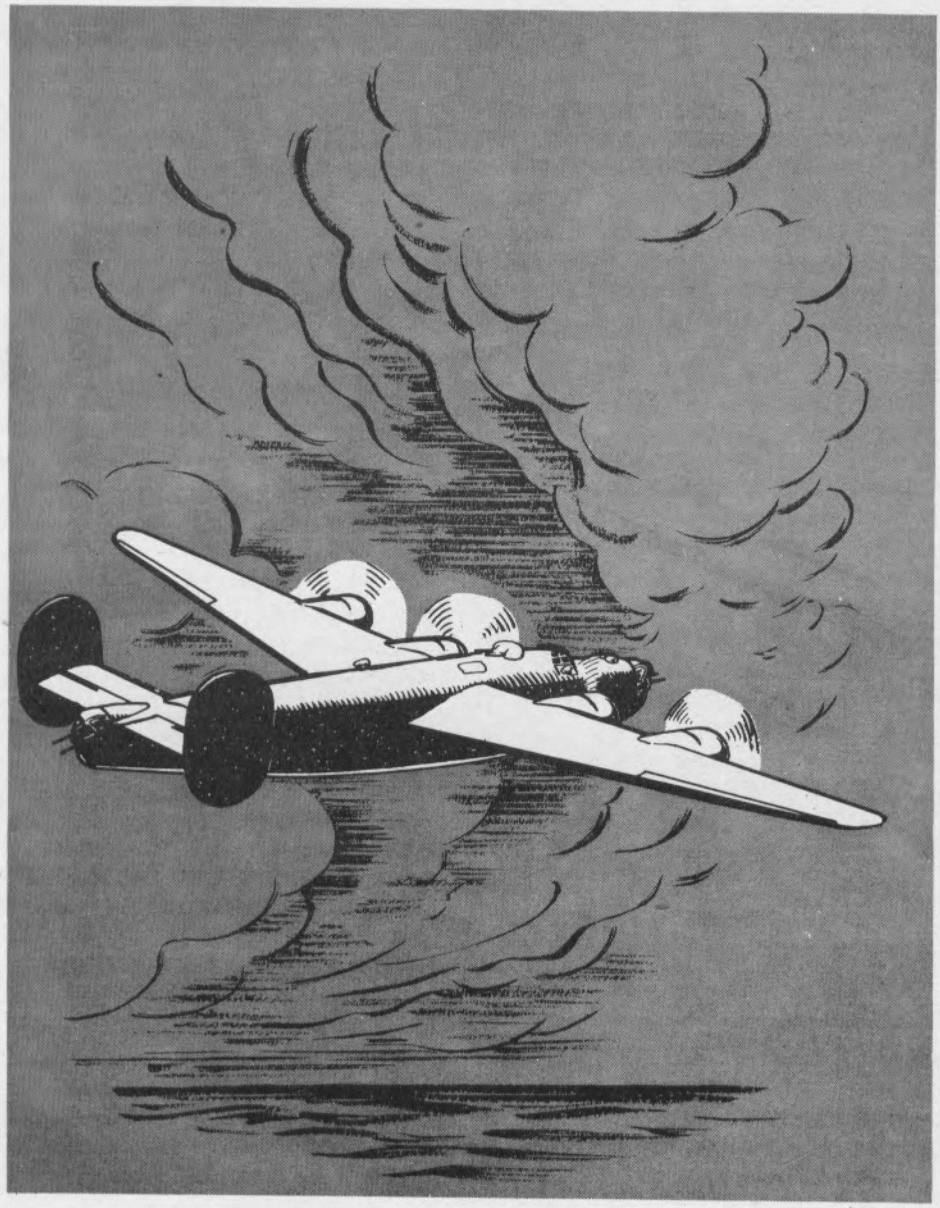
(2) WHEEL CHOCKS.—Put the wheel chocks in place, then release the brakes. The brakes should be released because the heat generated when stopping the landing roll of the airplane may cause over-expansion and overheating of the expander tubes.

(3) GEAR HANDLE.—The copilot will put the landing gear lever "DOWN."

(4) FLIGHT CONTROLS.—The copilot will lock the flight controls while the pilot loosens the strap. In locking the controls, remember to lock the rudders first by holding the rudder near neutral and slowly moving the pedals either way while a slight tension is applied to the locking handle. Next, lock the elevators by pushing the wheel in until the white line on the column is flush with the collar. Next, engage the aileron lockpin by slowly rotating the wheel either side of neutral. Now place the hook in the handle and draw the strap up.

CAUTION

Do not force the handle.



SECTION III
FLIGHT OPERATING DATA

1. POWER PLANT CHART.

(See figures 25 and 26.)

The definition of the engine power ratings shown on the chart are as follows:

a. TAKE-OFF.—Maximum recommended for take-off under the specified time limit.

b. MILITARY.—Maximum recommended for operation limited to five minutes duration, unless otherwise specified.

c. NORMAL RATED.—Maximum recommended for operation limited to 60 minutes duration, unless otherwise specified.

d. MAXIMUM CONTINUOUS.—Maximum recommended for unlimited operation with rich mixture.

e. MAXIMUM CRUISE.—Maximum recommended for operation with lean mixture.

f. MINIMUM SPECIFIC CONSUMPTION.—The power at which greatest range can be obtained.

CAUTION

ALL POWER SETTINGS GIVEN IN THIS HANDBOOK ARE BASED ON GRADE 100/130 FUEL, SPECIFICATION NO. AN-F-28.

g. CYLINDER HEAD TEMPERATURE. — The high gross weights necessary to achieve combat efficiency have imposed a heavier load on R-1830 engines. This has caused a limited number of airplanes, in relatively hot areas, to operate at temperatures in excess of the cylinder head temperature limits of 232°C (450°F) and 260°C (500°F). Under abnormal conditions, it is permissible to operate at temperatures of 248°C (478°F) and 270°C (518°F). The instruments on some airplanes are marked accordingly. The foregoing must not be interpreted to permit operation of those airplanes, which experience has shown can be operated within cylinder head temperature limits of 232°C (450°F) and 260°C (500°F), at temperatures beyond those limits. Only those installations in overseas service, which cannot be operated within the low limits will make use of the latitude permitted. The lower limits will be found on the Power Plant Charts.

2. AIR-SPEED CORRECTION TABLE

a. TYPE D-1 PITOT STATIC TUBES.

IAS Instrument Reading MPH	*IAS Corrected MPH*		
	Wing Flaps Retracted	*Wing Flaps Extended 20° Down*	*Wing Flaps Extended Full Down*
90	—	—	85
100	—	—	96
110	—	105	107
120	—	116	118
130	127	127	130
140	137	142	139
150	147	150	148
160	158	161	—
170	169	—	—
180	179	—	—
190	190	—	—
200	200	—	—
210	211	—	—
220	221	—	—
230	—	—	—
240	—	—	—
250	—	—	—

b. TYPE G-2 PITOT HEADS AND FLUSH-TYPE STATIC HEADS.

IAS Instrument Reading	*IAS Corrected MPH*		
	Wing Flaps Retracted	*Wing Flaps Extended 20°*	*Wing Flaps Full Down*
90	—	—	80
100	—	—	95
110	—	109	108
120	—	118	119
130	127	128	129
140	138	139	140
150	148	149	150
160	158	159	—
170	168	—	—
180	179	—	—
190	189	—	—
200	199	—	—
210	209	—	—
220	219	—	—
230	230	—	—
240	240	—	—

POWER PLANT CHART

AIRCRAFT MODEL(S)	PROPELLER(S)	ENGINE MODEL(S)
B-24 G, H & J NAVY PB4Y-1	HAMILTON STANDARD HYDROMATIC FULL FEATHERING CONSTANT SPEED THREE BLADED (NO.6477A-0)	R-1830-43 (BENDIX-STROMBERG CARB.)

GAGE READING	FUEL PRESS.	OIL PRESS.	OIL TEMP.	COOLANT TEMP.	CARB. AIR TEMP.	OIL[1] CONS.
DESIRED	17	85	60-75	-	-	-
MAXIMUM	18	105	100	-	38	18
MINIMUM	16	80				
IDLING	7	15				

MAXIMUM PERMISSABLE DIVING RPM: 3000
MINIMUM RECOMMENDED CRUISE RPM: 1500
MAXIMUM RECOMMENDED TURBO RPM: SEE NOTES

OIL GRADE: (S) 1120 (W) 1100
FUEL GRADE: 100/130 SPEC.ANF-28

MILITARY POWER (NON-COMBAT EMERGENCY)			NORMAL RATED			OPERATING CONDITION			MAXIMUM CONTINUOUS			MAXIMUM CRUISE (NORMAL OPERATION)		
5 MINUTES			60 MINUTES			TIME LIMIT			UNLIMITED			UNLIMITED		
260°C*			260°C*			MAX. CYL. HD. TEMP.			260°C*			232°C*		
AUTO-RICH			AUTO-RICH			MIXTURE			AUTO-RICH			AUTO-LEAN		
2700			2550			R. P. M.			2325			2200		
MANIF. PRESS.	SUPER-CHARGER	FUEL[2] Gal/Min	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH[3]	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH[3]	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH[3]
						-55.0	40,000 FT.	-67.0						71
						-55.0	38,000 FT.	-67.0				32	B-22	
						-55.0	36,000 FT.	-67.0	35.5	B-22	104		B-2	70
						-52.4	34,000 FT.	-62.3		B-2	103			68
49	B-22	2.85	46	B-22	151	-48.4	32,000 FT.	-55.1			102			67
		2.85			150	-44.4	30,000 FT.	-48.0			101			66
		2.80			149	-40.5	28,000 FT.	-40.9			101			66
	B-2	2.80		B-2	149	-36.5	26,000 FT.	-33.7			100			66
		2.80			148	-32.5	24,000 FT.	-26.5			100			65
		2.75			148	-28.6	22,000 FT.	-19.4			99			64
		2.75			147	-24.6	20,000 FT.	-12.3			99			63
		2.75			146	-20.7	18,000 FT.	- 5.2			98			63
		2.70			146	-16.7	16,000 FT.	2.0			98			63
		2.70			146	-12.7	14,000 FT.	9.1			98			63
		2.70			145	- 8.8	12,000 FT.	16.2			97			63
		2.65			145	- 4.8	10,000 FT.	23.4			97			63
		2.65			145	- 0.8	8,000 FT.	30.5			97			63
		2.65			145	3.1	6,000 FT.	37.6			96			63
		2.65			144	7.1	4,000 FT.	44.7			96			63
		2.60			144	11.0	2,000 FT.	51.8			96			62
49	B-2 B-22	2.60	46	B-2 B-22	144	15.0	SEA LEVEL	59.0	35.5	B-2 B-22	96	32	B-2 B-22	62

GENERAL NOTES

(1) OIL CONSUMPTION: MAXIMUM U.S. QUART PER HOUR PER ENGINE.
(2) *Gal/Min:* APPROXIMATE U.S. GALLON PER *MINUTE* PER ENGINE
(3) GPH: APPROXIMATE U.S. GALLON PER HOUR PER ENGINE.
F.T.: MEANS FULL THROTTLE OPERATION.
VALUES ARE FOR LEVEL FLIGHT WITH RAM.

FOR COMPLETE CRUISING DATA SEE APPENDIX II
NOTE: TO DETERMINE CONSUMPTION IN BRITISH IMPERIAL UNITS, MULTIPLY BY 10 THEN DIVIDE BY 12. RED FIGURES ARE PRELIMINARY SUBJECT TO REVISION AFTER FLIGHT CHECK.

TAKE-OFF CONDITIONS: 1200 BHP PER ENGINE
2700 RPM/49 IN.Hg. MANIF.PRESS./AUTO-RICH

CONDITIONS TO AVOID:

SPECIAL NOTES

CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14.
MAXIMUM RECOMMENDED TURBO RPM: B-2 TURBO 22,400 (5 MINUTES)
21,300 (CONTINUOUS)
B-22 TURBO 26,400 (5 MINUTES)
24,000 (CONTINUOUS)

* UNDER ABNORMAL CONDITIONS CYLINDER HEAD TEMPERATURE LIMITS OF 270°C AND 248°C, RESPECTIVELY, ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

DATA AS OF AUG. 1944 BASED ON FLIGHT TEST DATA

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Figure 25—Power Plant Chart R1830-43 Engines

POWER PLANT CHART

AIRCRAFT MODEL(S)	PROPELLER(S)	ENGINE MODEL(S)
B-24 G, H & J NAVY PB4Y-1	HAMILTON STANDARD HYDROMATIC FULL FEATHERING CONSTANT SPEED THREE BLADED (NO.6477A-0)	R-1830-65 (CECO CARBURETOR)

GAGE READING	FUEL PRESS.	OIL PRESS.	OIL TEMP.	COOLANT TEMP.	CARB. AIR TEMP.	OIL(1) CONS.
DESIRED	17	85	60-75	-	-	-
MAXIMUM	18	105	100	-	38	18
MINIMUM	16	80				
IDLING	7	15				

MAXIMUM PERMISSABLE DIVING RPM: 3000
MINIMUM RECOMMENDED CRUISE RPM: 1500
MAXIMUM RECOMMENDED TURBO RPM: SEE NOTES

OIL GRADE: (S) 1120 (W) 1100
FUEL GRADE: 100/130 SPEC.ANF-28

MILITARY POWER (NON-COMBAT EMERGENCY)			NORMAL RATED			OPERATING CONDITION			MAXIMUM CONTINUOUS			MAXIMUM CRUISE (NORMAL OPERATION)		
5 MINUTES			60 MINUTES			TIME LIMIT			UNLIMITED			UNLIMITED		
260°C*			260°C*			MAX. CYL. HD. TEMP.			232°C*			232°C*		
AUTO-RICH			AUTO-RICH			MIXTURE			AUTO-RICH			AUTO-LEAN		
2700			2550			R. P. M.			2325			2200		
MANIF. PRESS.	SUPER-CHARGER	FUEL (2) Gal/Min	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH (3)	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH (3)	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH (3)
						-55.0	40,000 FT.	-67.0						
						-55.0	38,000 FT.	-67.0				32	B-22	69
						-55.0	36,000 FT.	-67.0	35.5	B-22	99		B-2	68
						-52.4	34,000 FT.	-62.3		B-2	97			67
49	B-22	3.01	46	B-22	157	-48.4	32,000 FT.	-55.1			96			65
		3.00			155	-44.4	30,000 FT.	-48.0			95			65
		2.95			153	-40.5	28,000 FT.	-40.9			94			64
	B-2	2.90		B-2	152	-36.5	26,000 FT.	-33.7			93			63
		2.90			151	-32.5	24,000 FT.	-26.5			92			63
		2.85			150	-28.6	22,000 FT.	-19.4			92			63
		2.85			149	-24.6	20,000 FT.	-12.3			91			62
		2.80			148	-20.7	18,000 FT.	- 5.2			90			62
		2.80			147	-16.7	16,000 FT.	2.0			90			62
		2.80			146	-12.7	14,000 FT.	9.1			91			62
		2.75			146	- 8.8	12,000 FT.	16.2			91			63
		2.75			146	- 4.8	10,000 FT.	23.4			91			63
		2.75			146	- 0.8	8,000 FT.	30.5			92			64
		2.75			146	3.1	6,000 FT.	37.6			93			65
		2.75			146	7.1	4,000 FT.	44.7			95			67
		2.75			148	11.0	2,000 FT.	51.8			97			70
49	B-2 B-22	2.80	46	B-2 B-22	150	15.0	SEA LEVEL	59.0	35.5	B-2 B-22	100	32	B-2 B-22	75

GENERAL NOTES

(1) OIL CONSUMPTION: MAXIMUM U.S. QUART PER HOUR PER ENGINE.
(2) *Gal/Min:* APPROXIMATE U.S. GALLON PER *MINUTE* PER ENGINE
(3) GPH: APPROXIMATE U.S. GALLON PER HOUR PER ENGINE.
F.T.: MEANS FULL THROTTLE OPERATION.
VALUES ARE FOR LEVEL FLIGHT WITH RAM.

FOR COMPLETE CRUISING DATA SEE APPENDIX II
NOTE: TO DETERMINE CONSUMPTION IN BRITISH IMPERIAL UNITS, MULTIPLY BY 10 THEN DIVIDE BY 12. RED FIGURES ARE PRELIMINARY SUBJECT TO REVISION AFTER FLIGHT CHECK.

TAKE-OFF CONDITIONS:	CONDITIONS TO AVOID:
1200 GPH PER ENGINE 2700 RPM/49 IN.Hg. MANIF.PRESS./AUTO-RICH	

SPECIAL NOTES

CECO CARBURETOR SETTING 700-C-3.
MAXIMUM RECOMMENDED TURBO RPM: B-2 TURBO 22,400 (5 MINUTES)
21,300 (CONTINUOUS)
B-22 TURBO 26,400 (5 MINUTES)
24,000 (CONTINUOUS)

* UNDER ABNORMAL CONDITIONS CYLINDER HEAD TEMPERATURE LIMITS OF 270°C, AND 248°C, RESPECTIVELY, ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

DATA AS OF AUG. 1944 BASED ON FLIGHT TEST DATA

AAFMC-526
8-1-44

Figure 26—Power Plant Chart R1830-65 Engines

OPERATING LIMITS USING GRADE 91 FUEL

AIRPLANE MODELS: B-24 G, H, J, L & M

ENGINE MODELS: R-1830-43, R-1830-65

FUEL: GRADE 91/96 SPEC. AN-F-26

OPERATING CONDITIONS	MANIFOLD PRESSURE (MAX. IN. HG)	R. P. M. (MAX.)	HORSE POWER	MIXTURE CONTROL POSITION	ALTITUDE	MAXIMUM DURATION (MIN.)
TAKE-OFF	44.0	2700	1125	AUTO-RICH	S.L.-3500	1
	43.0	2700	1100	AUTO-RICH	S.L.-3500	5
NORMAL RATED	43.0	2550	1000	AUTO-RICH	S.L.	60 *
	38.0	2550	1000	AUTO-RICH	10,000	60 *
MAXIMUM CRUISING	36.0	2230	825	AUTO-RICH	S.L.	CONTINUOUS
	35.0	2230	825	AUTO-RICH	7500	CONTINUOUS
DESIRED CRUISING	32.5	2230	735	AUTO-RICH	S.L.	CONTINUOUS
	31.5	2230	735	AUTO-RICH	11,000	CONTINUOUS

REMARKS:
* CONTINUOUS IF CYLINDER HEAD TEMPERATURE DOES NOT EXCEED 248°C
REDUCED TAKE-OFF POWER INCREASES THE TAKE-OFF DISTANCE; THE TAKE-OFF GROSS WEIGHT SHOULD BE LIMITED IN ACCORDANCE WITH THE INCREASED DISTANCE.
FUEL CONSUMPTION AND CRUISING POWER OPERATION UP TO MAXIMUM CRUISING ARE NOT AFFECTED; FIGURES GIVEN ON CHARTS IN APPENDIX II MAY BE USED PROVIDED THE VALUES GIVEN ON THIS CHART ARE NEVER EXCEEDED.

Figure 26A

SECTION IV
EMERGENCY OPERATING INSTRUCTIONS

1. EMERGENCY EXITS.

Emergency exits are provided as illustrated in figure 27, and should be used as follows:

a. MAIN ENTRANCE DOOR. — The main entrance door *(see figure 28)* is located on the bottom of the fuselage in the aft section of the rear fuselage compartment. There is an outside and inside latch on the left center of the door. The door swings inward on a side hinge and is fastened in the extreme open position on the right with a catch attached to the right side of the fuselage. This door may only be used while the airplane is on the ground, or as an emergency exit when the airplane is in the air. This door must be closed in the event of a forced descent on water (DITCHING).

b. SIDE GUN WINDOWS.—The side gun windows *(see figure 29)* are located in the rear fuselage compartment, left and right sides. There is an outside and inside latch on the bottom center of each window. These windows swing inward and upward and may be fastened in the full open position by a catch attached to the fuselage. These windows may be used as emergency exits on the ground, in flight, or in the event of a forced descent on water (DITCHING).

c. BOMB BAY DOORS.—The bomb bay doors may be opened hydraulically by placing the bomb door selector valve handle on the quadrant (in the bombardier-navigator's compartment, left side) in the "BOMB DOORS OPEN" position. The doors may also be opened by pulling the pilot's emergency bomb release handle (which jettisons all bombs), or by pushing on the emergency and utility valve handle (just forward and to the right of the door between the forward bomb bay and the nose wheel compartment).

The bomb bay doors may be opened manually by placing the bomb door selector valve handle on the bomb quadrant in the "BOMB DOORS OPEN" position, or by pushing and holding outboard on the emergency and utility valve handle (throughout the entire operation) and operating the hand cranks located between the two bomb bays. The bomb bay doors may be used as an emergency exit while the airplane is on the ground, or during flight. These doors must be kept closed during any landing or forced descent on water (DITCHING).

d. PILOTS' EMERGENCY EXIT. — The pilots' emergency exit *(see figure 30)* is located on the top of the fuselage to the left of the centerline at the forward end of the radio operator's compartment. It is opened by pulling the latch handle downward and inboard. It may be fastened open by means of a strap attached to the side of the fuselage, and fitted with a "lift the dot fastener." It may be removed by opening it and sliding it aft on the hinge pins. This emergency exit is to be used only when the airplane is on the ground or in the event of a crash landing or forced descent on water (DITCHING), and only when the engines are stopped.

e. NOSE WHEEL DOOR.—The nose wheel door provides an emergency exit, during flight, from the bombardier-navigator's compartment and the nose turret. It is opened by pulling down on the red nose wheel door emergency release handle (or handles) located on the top of the bulkhead just forward of the nose wheel door. These doors must be kept closed during a crash landing or emergency descent on water (DITCHING).

f. ASTRODOME. — The astrodome *(see figure 31)*, located in the top of the fuselage in the bombardier-navigator's compartment, may be removed by loosening the latch aft of it, then pulling downward on the astrodome and lifting it off the hinge points. This emergency exit is used only, when the airplane is on the ground, in the event of a crash landing, or a forced descent on water, and only when the engines are stopped. This exit is for extreme emergencies only, as there should be no one forward of the flight compartment during a crash landing or forced descent on water (DITCHING).

2. ENGINE FAILURE.

WARNING

In flying the airplane with one or more engines useless, all maneuvers should be made carefully in order to avoid any attitude from which recovery would be impossible.

a. GENERAL. *(See figure 32.)*

(1) When an engine fails on take-off, action taken by the pilot must vary, depending upon terrain, weather, load, and other factors. There is sufficient power available in three engines to climb the airplane, and all of this power should be used. When sufficient altitude has been gained to insure safety, reduce power to amount required to safely sustain flight and proceed in a normal manner.

(2) Loss of either INBOARD ENGINE is of negligible consequence to flight characteristics. There

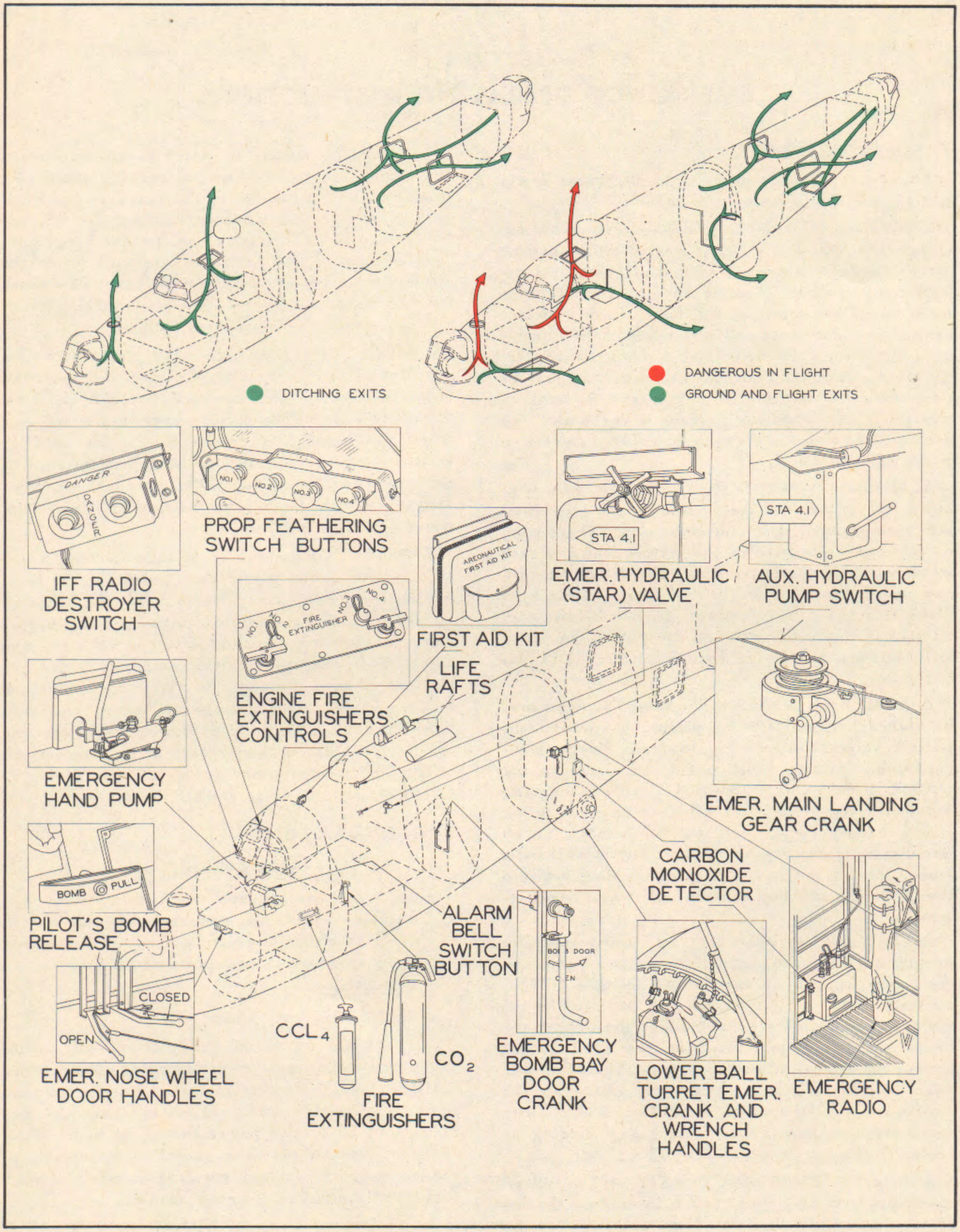


Figure 27—Emergency Exits and Equipment

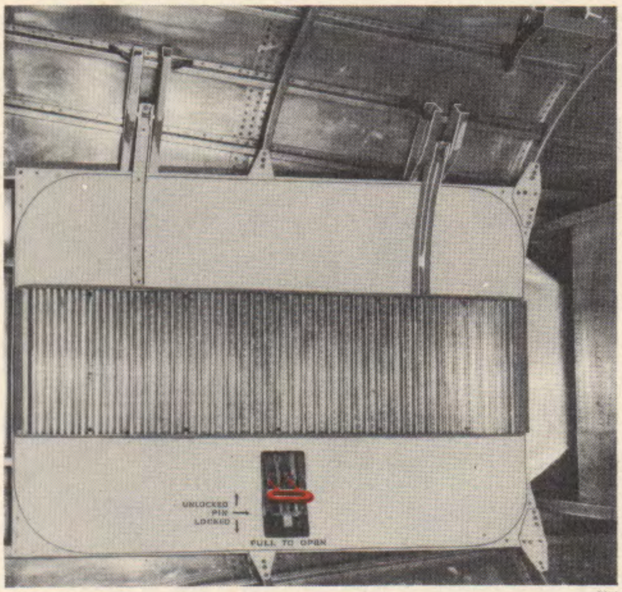


Figure 28—Main Entrance Door

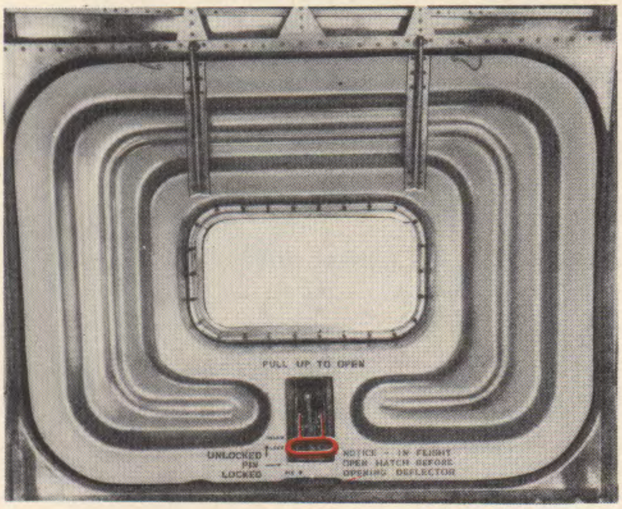


Figure 29—Side Gun Window

will be a slight loss of air speed. The control forces are easily trimmed out with the tab adjustment.

(3) An OUTBOARD ENGINE failure causes a more serious thrust unbalance, and can be counteracted only by immediate and vigorous use of the controls.

(4) Maintain an air speed which will allow full control of the airplane. With an OUTBOARD OR TWO ENGINES ON A SIDE DEAD, control varies directly with air speed. As the air speed drops below that required for adequate control, the airplane will develop a yaw toward the dead engine or engines. To recover, the air speed must be increased. The preferable method is to nose the airplane down and increase the power on the live engines.

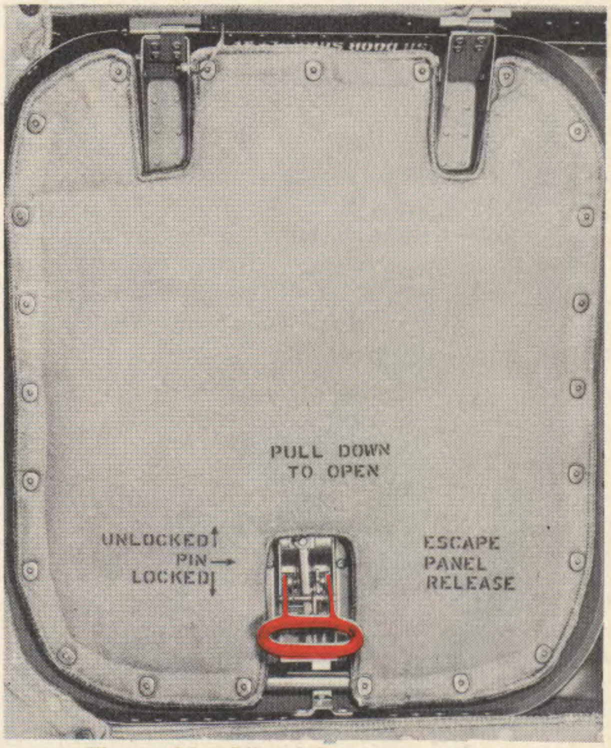


Figure 30—Pilots' Emergency Exits

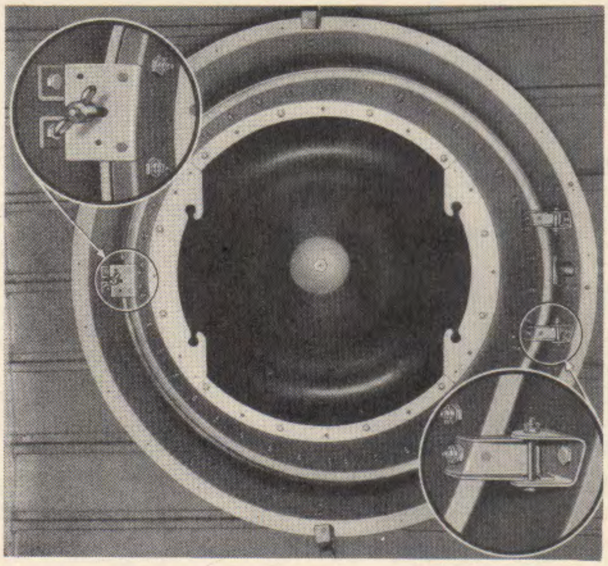


Figure 31—Navigator's Dome (Astrodome)

(5) Unbalanced power will aid in trimming the airplane after the tab limits have been reached.

(6) If an engine failure occurs while flying on the automatic pilot, shut off the automatic pilot until the airplane has been trimmed, then the automatic pilot may be set to that trim.

b. ENGINE FAILURE ON TAKE-OFF.—In case of engine failure before the landing gear is up, at

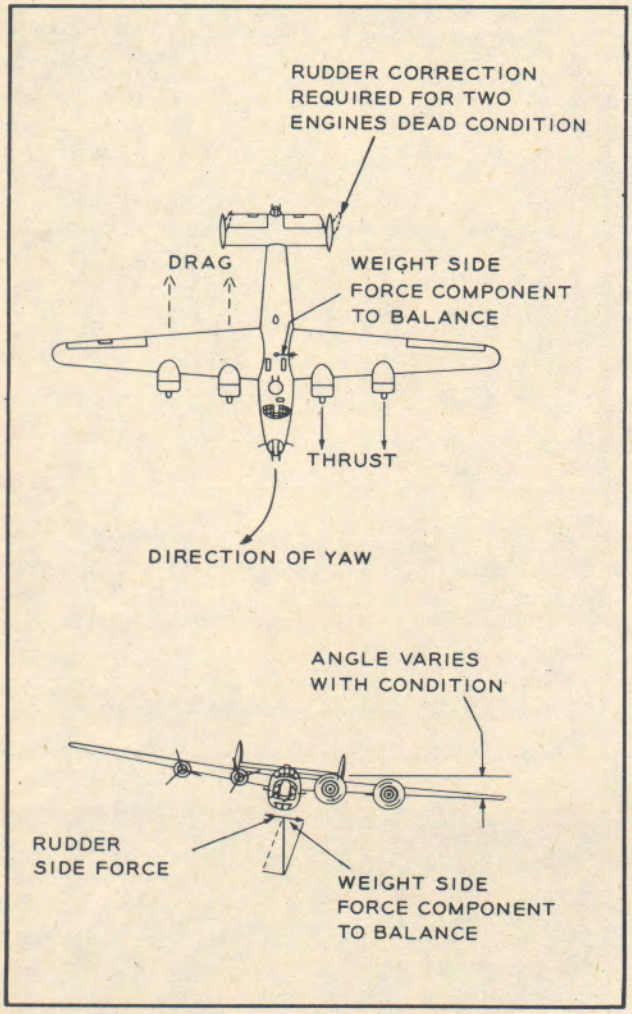


Figure 32—Dead Engine Operation

low air speed and low altitude, the pilot must immediately choose between two alternatives:

(1) Throttling the remaining engines and landing straight ahead with the gear DOWN and LOCKED, if possible, taking care to lower the nose sufficiently to maintain the air speed above stalling. Power should be used, if available, as it materially reduces the stalling speed of the airplane and will aid in making a safe landing.

CAUTION

In the event of an emergency landing, use full flaps and sufficient air speed to avoid a high rate of sink.

(2) Retracting the landing gear, carefully building up speed and altitude until a safe landing can be made.

(a) Fly the airplane by getting the nose down to the minimum angle of climb required to safely clear any hazards or obstructions.

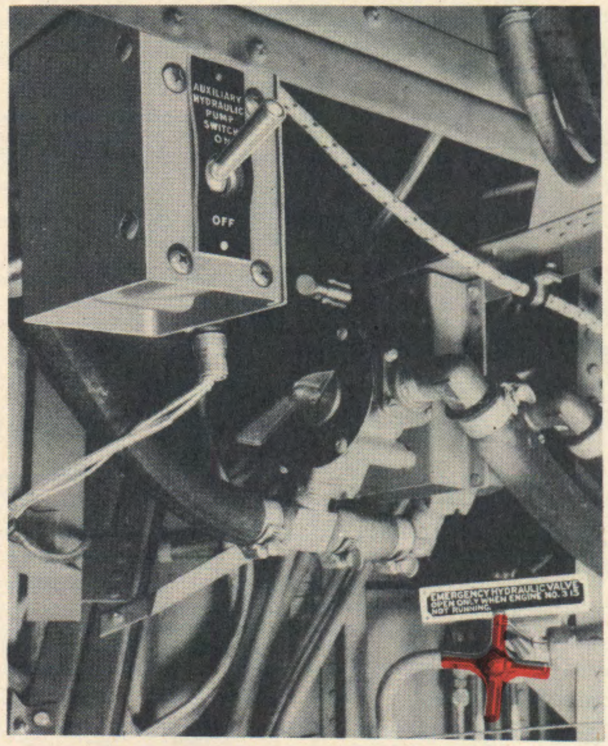


Figure 33—Emergency Hydraulic Valve, Auxiliary Hydraulic Pump Switch

(b) Trim the airplane with the rudder first, to relieve yaw; and with the ailerons second, for as good "hands off" condition as possible.

Note

If No. 1 engine is out, full rudder pedal must be used; if No. 4 engine is out, nearly full rudder pedal is required. If No. 2 or No. 3 engine is out, the trim tab only is required.

(c) The landing gear should be raised as soon as practicable to reduce drag.

(d) Apply the trim tab to relieve the physical effort required on the controls.

(e) Determine which engine is at fault by observing engine temperature, manifold pressure, rpm, and yaw of the airplane.

(f) Feather the propeller and at a safe altitude raise the wing flaps by small amounts (three to four degrees at a time), to avoid high rates of sink. The airplane will handle better if approximately eight degrees of flaps is retained at low speeds.

(g) Close the cowl flaps.

(h) To start a dead engine during flight, see 3. *b.*, following.

PRECAUTIONS

Do not draw excessive power from the remaining engines for a longer period than necessary to get the airplane under safe control.

Do not fail to use sufficient rudder in trimming the airplane. Carry the dead engine wing high only the amount necessary to make directional control possible.

Insufficient rudder and too much aileron will cause a forward slip, making it impossible to attain a safe air speed.

Do not apply the trim tabs while applying the rudder and aileron. First, introduce the required amount of rudder and aileron; hold it, then relieve the strain with tabs.

Do not forget that it is always desirable to keep dead engines high on all turns. Never make steep turns with the dead engine down. Approximately 152 mph is the minimum safe speed at which a turn can be made.

Do not fail to attain and hold a safe air speed: A minimum of 135 mph with 20 degrees of flap and approximately 152 mph with a zero to eight degree flap setting under normal load conditions.

Avoid rapid changes in speed or power. If the speed falls below the minimum for control, regain speed by losing altitude at reduced power instead of applying additional power. Over-heating and detonation caused by use of more than rated power may result in damage to, if not complete failure of, the remaining engines.

Avoid violent maneuvers.

An engine that is being started after being stopped in flight for any length of time, should be run at reduced power and rpm, until the oil and cylinder head temperatures indicate that it is warmed up sufficiently for safe operation.

c. FAILURE OF ENGINES NO. 1 AND NO. 2 ON AIRPLANES EQUIPPED WITH RUBBER DE-ICER SHOES.—The same as for other engines except that the vacuum pumps are located on engines No. 1 and No. 2 and the vacuum selector valve located on the rear bulkhead in the radio operator's compartment, left side, must be turned to live engine to keep the gyro flight instruments or rubber De-Icer shoes in operation.

Note

Airplanes equipped with heat anti-icing do not have a manual vacuum selector valve, but are equipped with automatic vacuum check valves.

d. FAILURE OF ENGINE NO. 3.—Same as for other engines except that the engine-driven hydraulic pump is located on engine No. 3. In the event of failure of this engine, turn "ON" the auxiliary electric hydraulic pump switch, located to the right of the forward entrance to the bomb bay, and "OPEN" the emergency hydraulic (star) valve, located outboard of the pump switch. *(See figure 33.)*

e. FAILURE OF TWO ENGINES IN FLIGHT.

(1) With two engines on one side inoperative, it is possible to fly the airplane in all normal maneuvers within the engine power limits.

(2) When the two operating engines are delivering rated power, it is desirable to bank the airplane (dead engines high) to reduce the rudder pressure required for straight flight. The use of full rudder tab greatly relieves the rudder pedal pressure required to maintain straight flight.

(3) Handle the controls of the dead engines as outlined for single engine failure.

(4) Make all turns with the dead engines on the outside of the turn.

(5) The service ceiling with left engines running, and both right engines dead and propellers feathered, will be slightly higher than the ceiling with the right engines running, left engines dead. In all cases the ceiling with any two engines dead and a gross weight of 41,000 pounds is above 10,000 feet.

(6) Airplanes with one engine out will generally maintain altitude with the landing gear down, but will do so, much more readily with landing gear retracted. When only two engines are useful, the airplane cannot be expected to maintain altitude with both landing gear and flaps extended.

f. LANDING WITH ONE OUTBOARD ENGINE INOPERATIVE.

(1) Keep the dead engine high on all turns near the ground.

(2) Fly the traffic pattern at least 500 feet higher than customary.

(3) Fly the base leg close enough so that a minimum amount of power is required on the final approach. At the point power reduction is required, instead of partially reducing power on all three active engines together, reduce power on the active outboard engine to about 12 inches manifold pressure. Then, use the inboard engines for power. Just before landing, close both the throttle for the active outboard engine and the throttles for the inboard engines. If the above procedure is used, the check list for landing can be followed closely in regard to flap settings, landing gear, high rpm, etc. Also on the final approach, a normal tab setting is possible.

WARNING

Avoid high rates of sink on the final approach because of the reduced available power. If runway length permits, use five to 10 mph higher air speed than is customary on the final approach.

g. LANDING WITH TWO ENGINES INOPERATIVE ON ONE SIDE.—Approach the traffic pattern high enough to permit the pattern to be flown with a minimum amount of power and a semi-glide condition all the way in to the actual landing, reducing power on the active outboard engine first. Proceed the same as for landing with one outboard engine inoperative, but have more altitude in the traffic pattern. This is necessary due to the lack of available power and the unbalanced power condition which makes it undesirable to pull a high amount of power from the active outboard engine.

h. LANDING WITH ONE ENGINE INOPERATIVE ON EACH SIDE.—Use the same method as landing with two engines inoperative on one side, even though the inoperative engines should be an inboard on one side and an outboard on the other. This condition is easier to control because of power available on each side.

Note

When flying across country with one or more engines inoperative, it is necessary to maintain sufficient air speed to properly fly the airplane. Under normal load conditions a minimum of 150 mph with no flaps and 145 mph with eight degrees of flap is recommended.

3. EMERGENCY OPERATION OF PROPELLERS.

a. FEATHERING IN FLIGHT.

CAUTION

Do not feather the wrong propeller. A drop in cylinder head temperature and yaw of the airplane may be the only indication of the necessity to feather. Feather the propeller on a useless engine as soon as possible.

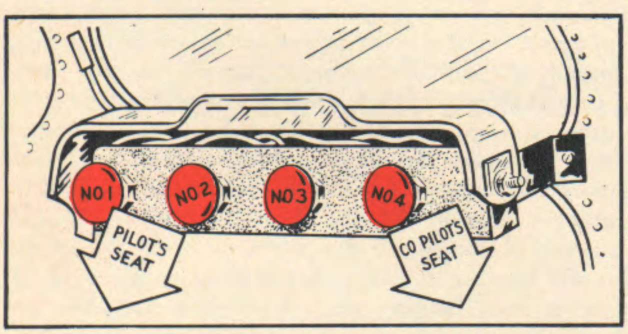


Figure 34—Propeller Feathering Switch Buttons

Do not attempt to feather more than one propeller at a time except in an emergency as this uses excessive amounts of electrical power.

(1) Press the feathering switch button. *(See figure 34.)*

Note

The feathering switch button should kick out when the propeller is feathered. If the switch button does not kick out, the propeller will unfeather. In this case, pull the switch button out and press it in again and pull it out as soon as the propeller is feathered. If the propeller does not feather, reset the circuit breaker switch by pushing it in, and press the feathering switch button again. If the propeller still will not feather, set the propeller governor to full "DECREASE RPM," to reduce drag and windmilling.

(2) Shut "OFF" the turbosupercharger. *(See figure 17, item 60.)*

(3) Close the throttle. *(See figure 17, item 62.)*

(4) Move the mixture control to the "IDLE CUT-OFF" position. *(See figure 17, item 65.)*

(5) Turn "OFF" the fuel booster pump switch, *(see figure 17, item 31)*, and shut "OFF" the fuel selector valve for the dead engine.

(6) Shut "OFF" the ignition switch as soon as the propeller stops turning. *(See figure 17, item 39.)*

(7) Close the cowl flaps. *(See figure 17, item 66.)*

(8) Turn the generator switch "OFF." *(See figure 7.)*

Note

If the dead engine fuel tank is supplying the cross-feed line leave the fuel booster pump and selector valve on, provided there is no fire hazard, and if the engine will not be operated again during flight, transfer the remaining fuel to other tanks as soon as possible. If there is a fire hazard, switch the cross-feed line to another tank and turn "OFF" the dead engine fuel selector valve and fuel booster pump switch.

b. UNFEATHERING IN FLIGHT.

(1) See that throttle for the "Dead" engine is "CLOSED" and mixture control is in "IDLE CUT-OFF" position.

(2) Be sure the turbosupercharger control is in the "OFF" position.

(3) Turn "ON" the fuel selector valve and fuel booster pump switch.

(4) Set the propeller governor for "DECREASE RPM."

(5) Press the propeller feathering switch button and hold it in until the tachometer indicates 800 rpm, then pull it out.

(6) Turn the ignition switch "ON."

(7) Move the mixture control momentarily from "IDLE CUT-OFF" to "AUTO-RICH." If the engine fails to fire, repeat this operation as quickly and smoothly as possible. When the engine fires, move the mixture control to "AUTO-RICH," and allow it to remain at this setting.

(8) Open the cowl flaps.

(9) Maintain 800 rpm until the oil temperature has exceeded 40°C (104°F) and the cylinder head temperature has reached at least 120°C (248°F). (A faster warm-up of the engine may be accomplished if mixture control is placed in "AUTO-LEAN" after the engine is running smoothly. However, care must be exercised to prevent the cylinder head temperature from exceeding 248°C (479°F)).

(10) Then open the throttle gradually until the rpm is increased to the operating speed of the other engines.

c. RUNAWAY PROPELLERS.—In the event of a runaway propeller and it is necessary to continue take-off or if in flight:

(1) Reduce and hold the rpm by intermittent use of the feathering switch button.

(2) Reduce the power with the throttle if necessary.

(3) If feathering cannot be accomplished, place the mixture control in "IDLE CUT-OFF," turn the ignition switch and fuel selector valve "OFF."

Note

Do not confuse a runaway propeller with one that is only slightly overspeeding. An overspeeding propeller can many times be brought within limits with the propeller governor control.

4. FIRE.

a. FIRE EXTINGUISHERS.

(1) There are two portable type carbon tetrachloride fire extinguishers in the airplane. One is located on the left side of the nose wheel compartment and is accessible only through the door on the outside of the airplane. The other is located just forward and to the right of the lower ball turret. It is accessible from the door on the outside of the airplane and from the inside by opening a zipper on the canvas cover. *(See figure 35.)*

Figure 35—Carbon Tetrachloride Fire Extinguisher

WARNING

If any carbon tetrachloride odor is detected during flight, open all windows and ventilators, correct the cause at once, or jettison the fluid, or extinguisher, overboard if the leak cannot be stopped. Small amounts of the fumes may produce drowsiness, sleep, nausea.

(2) A carbon dioxide fire extinguisher is located on the forward bulkhead, left side, of the radio operator's compartment.

Note

Two types of portable carbon dioxide fire extinguishers *(see figure 36)* are installed in these airplanes; one type has a pistol grip and a trigger release, the other type releases the carbon dioxide when the horn is unclamped from the cylinder and extended.

(3) Some airplanes are equipped with an engine fire extinguisher system, the controls for which are located on the floor to the right of the copilot. *(See figure 37.)*

b. FIRE IN FLIGHT.

(1) WHEN FIRE IS DISCOVERED. — Notify all the crew members to be sure their parachutes are attached and to stand by for further orders. If flying low, and conditions permit, gain as much altitude as possible. Attempt to control the fire as soon as possible.

(2) ENGINE FIRES.

(a) Shut "OFF" the fuel supply to the burning nacelle to prevent feeding the fire.

(b) "OPEN" the throttle of the engine affected, and place the mixture control in "AUTO-RICH" position to consume fuel in the carburetor as rapidly as possible.

Figure 36—Carbon Dioxide Fire Extinguisher

Figure 37—Engine Fire Extinguisher System Controls

(c) Set the vacuum selector valve, located on the rear bulkhead of the radio operator's compartment, left side, so the vacuum operated instruments will not be affected when the propeller is feathered (if the fire is in No. 1 or No. 2 nacelle). Alternate operation of instruments and De-Icer shoes will be required when icing conditions prevail.

Note

Airplanes equipped with heat anti-icing have automatic vacuum check valves, and the manual vacuum selector valve has been deleted.

(d) Feather the propeller. Delay in feathering may result in a burned feathering pump oil line and subsequent inability to feather.

(e) Close the cowl flaps to reduce airflow through the nacelle. The retaining of all possible products of combustion in the nacelle will tend to smother the fire and keep the temperature down.

(f) Retard the speed of the airplane to reduce the airflow through the nacelle.

(g) If engine fire extinguishers are installed, set the control valve *(see figure 37)*, in the pilots' compartment, to the desired position, and be sure the other valve is "OFF," and pull either handle. If the contents of one cylinder does not extinguish the fire, the second cylinder may be used by pulling the other handle. DO NOT ATTEMPT TO USE THE SYSTEM TO EXTINGUISH TWO FIRES AT THE SAME TIME. If fire occurs in two nacelles at the same time and it is desired to use the fire extiguisher system for both nacelles, operate the system as directed for one nacelle, pulling only one handle; when the contents of the cylinder are completely discharged, reset the valves and pull the other handle.

CAUTION

Do not attempt to change the selector valve setting during the discharge of a cylinder, as it may render the system useless. Once a release handle is pulled, complete emptying of that cylinder cannot be prevented. Premature discharge of a cylinder is indicated by the rupture of a small red disc on the outside of the fuselage aft of the nose wheel door about half way up on the right side. The only positive way to determine the contents of a cylinder, is by its weight.

(h) Open all emergency exits to provide for escape in the event the fire cannot be controlled.

(i) If the No. 3 nacelle is on fire, *before attempting to land*, open the emergency hydraulic (star) valve, located in the forward bomb bay at the right of the entrance to the flight compartment, and turn "ON" the electric, auxiliary hydraulic pump switch, located inboard of the valve.

CAUTION

Do not turn this pump "ON" with the star valve open until the necessity for hydraulic pressure arises, and then turn the pump "OFF" as soon as possible. This pump motor is designed for intermittent, rather than constant, action; if used too soon it will burn out before the landing is accomplished.

(3) FUSELAGE FIRES.

(a) USE OF CARBON DIOXIDE FIRE EXTINGUISHER.—Remove the extinguisher by pulling out on the release strap handle and by lifting it from the bracket. Stand close to the fire; raise the horn, and direct the gas toward the base of the fire. To shut off the extinguisher, return the horn to the clip on the side of the cylinder. The cylinder must be recharged after each use.

CAUTION

Avoid frost bite. Do not grasp the horn with the hands. The white discharge is dry ice.

(b) USE OF CARBON TETRACHLORIDE FIRE EXTINGUISHER. — Release the extinguisher from its bracket by pulling out on the retainer strap handle. Stand in a well ventilated place, preferably in another compartment, and as far from the fire as possible. Turn the handle and pump, maintaining a steady, full stream. To shut it off, push the handle down, and turn it until the sealing plunger is depressed.

WARNING

Carbon tetrachloride fumes are poisonous, and when sprayed on a fire generate phosgene gas. This gas is harmful even in small amounts, and if inhaled may prove fatal. *Do not use carbon tetrachloride in a confined area. Do not stand near the fire. Open windows and ventilators as soon as the fire is extinguished.*

(4) WING FIRES.

(a) Turn all navigation and landing-light switches "OFF." *(See figure 17, items 57, 58, 61 and 68.)*

(b) Open all emergency exits.

(c) Try to extinguish the fire by maneuvering the airplane if possible.

(d) If the fire continues to burn, the pilot will determine whether to attempt a landing or abandon the airplane.

c. FIRE SUBDUED OR EXTINGUISHED.

(1) If an engine fire is subdued and a landing attempted, do not open the cowl flaps or start the engine. Make the landing in accordance with instructions for three-engine operation.

(2) If a fire is extinguished, land as soon as possible. Determine the cause of the fire and make any necessary repairs before continuing the flight.

5. ALARM BELLS.

Emergency alarm bells in the nose turret, navigator-bombardier's compartment, rear fuselage compartment, and tail gun turret are controlled by a switch on the pilots' control pedestal. *(See figure 17, item 54.)*

6. EMERGENCY BAILING OUT PROCEDURE OVER LAND.

a. GENERAL.—If an emergency develops in flight and it is necessary to bail out, there is no time for confusion or guessing; the procedure must be automatic. Figure 27 shows the emergency exits that crew members should use in leaving the airplane. Whenever possible, jump from the aft end of the exit. When the order is given over the interphone, or by some other prearranged signal, to "Prepare to Abandon Airplane," each crew member will make sure that his parachute harness is securely attached.

b. ORDER OF BAILING OUT.

(1) Clear the bomb bay of bombs by using the emergency release handle. Control the airplane as well as possible during abandonment. Reduce air speed, if possible. Hold the airplane level. Set up the C-1 autopilot, if possible.

(2) The navigator, then the bombardier, then the nose turret gunner will exit through the nose wheel door. Pull the two emergency levers (one lever on Group II and later Group III airplanes) at the top of the compartment.

(3) The lower ball-turret gunner and right side gunner will exit through the aft end of the bomb bay, or through the main entrance door.

(4) The tail gunner and the left side gunner will exit through the main entrance door, or the aft end of the bomb bay.

(5) The flight engineer, radio operator, copilot and pilot will exit through the forward end of the bomb bay in the order named.

c. COPILOT'S DUTIES.

(1) To assist the pilot as directed.

(2) To direct the radio operator to send a distress message which shall include all pertinent information.

(3) To stand by to abandon the airplane by way of the bomb bay.

d. RADIO OPERATOR'S DUTIES.

(1) To find out the exact position of the airplane from the navigator.

(2) To send a distress call.

(3) To stand by to leave by way of the bomb bay.

e. ENGINEER'S DUTIES.

(1) To assist the crew in preparing to abandon the airplane.

(2) To assist the pilot as directed.

(3) To stand by to leave by way of the bomb bay.

f. NAVIGATOR'S DUTIES.

(1) To give the radio operator the position report.

(2) To stand by the emergency exit in the nose of the airplane; or, if stationed in the flight compartment, to exit through the bomb bay.

g. BOMBARDIER'S DUTIES.

(1) To assist the pilot in releasing the bombs, if necessary.

(2) To stand by the emergency exit in the nose of the airplane.

h. NOSE GUNNER'S DUTIES.—To stand by the emergency exit in the nose of the airplane.

i. ALL OTHER CREW MEMBERS OR PASSENGERS will leave by way of the main entrance hatch or the aft end of the bomb bay.

7. EMERGENCY FUEL DUMPING.

a. EMERGENCY FUEL SHUT-OFF. — The four main selector valves may be turned to the "OFF" positions if it is advisable to cut off the flow of fuel from the four main tanks. These valves are located on the right and left sides of the forward bomb bay, overhead. Before making a "Forced Landing," turn "OFF" the fuel sight-gage valves and wing compartment drain-line valves, located in the forward bomb bay on the lower wing surface near the booster pumps. It is also recommended that the four sight-gage sump lines, located in the forward bomb bay on the left side panel, be drained before landing.

b. BOMB BAY FUEL TANK EMERGENCY RELEASE.—On airplanes equipped with droppable bomb bay fuel tanks, make sure that the fuel selector valve (located on the catwalk between the two bomb bays) is "OFF." Open the bomb bay doors, release the fuel tanks, and close the bomb bay doors.

c. DELIBERATE WASTE OF FUEL TO REDUCE WEIGHT IN EMERGENCY.—No fuel dump valves are provided on the airplane. Occasions may arise which call for a rapid reduction in weight. One way to reduce weight is to set the engine controls to waste fuel. If, at the same time, high speed is objectionable, increase the drag of the airplane as much as possible. In such cases, the following procedure may be used without damage to the engines:

(1) Set the mixture controls as rich as possible but without causing excessive engine roughness or the emission of black smoke from exhaust.

(2) Increase rpm to 2700.

(3) Set manifold pressure to 30 inches Hg.

(4) Open the bomb bay doors and emergency exits (if temperature permits). This will increase drag.

(5) Extend the landing gear.

(6) The pilot may, at his discretion, extend the flaps, if further reduction of speed is desired. DO NOT EXCEED 155 MILES PER HOUR WITH FLAPS FULL DOWN, OR LANDING GEAR DOWN.

8. EMERGENCY OPERATION OF POWER-DRIVEN GUN TURRETS.

a. CONSOLIDATED NOSE AND TAIL TURRETS, (Group III).

(1) Unlock elevation and azimuth locks, if not already unlocked.

(2) Close the shut-off valve (red handle).

(3) Open the release valve under the seat.

(4) Open the bypass valves by lowering the linkage bar at the left of control handles.

(5) Remove the cranks from the clips on the turret cabin wall.

(6) Snap one crank in place on the emergency rotating system shaft located on the right cabin wall; snap the other crank in place on the emergency elevation system shaft located on the left cabin wall of the turret.

(7) To charge the guns manually, elevate the guns to approximately 30 degrees. Pull the charging cable handles. Pull the left handle with the right hand and right handle with the left hand. Pull each cable handle as far as possible and let go.

(8) To fire the guns, disengage the foot firing safety latch on the control valve support plate. The guns may now be fired by foot pressure on the pedals, while the turret and guns are operated by the hand cranks.

(9) To remove a casualty from the nose turret, grasp the loop of cable which is safety wired to the turret base ring. Break the safety wiring with a quick jerk and put the cable loop over the crank handle and the drum of the winch located on the arched member below the turret compartment doors. Winding the cable on the winch will release the bypass valve under the gunner's seat. Continued cranking will pull the turret around to where the turret rear doors are accessible and may be opened to remove the casualty.

IMPORTANT

Close the "HYDRAULIC SHUT-OFF VALVE TO NOSE TURRET," located on the right side of the bombardier-navigator's compartment, before winding the emergency cable on the drum. Otherwise, the hydraulic pressure in the airplane hydraulic system will be reduced.

(10) To remove a casualty from the tail turret, grasp the handle of the emergency control cord (lower portion of the turret on the center line of the airplane) and pull until the turret doors are in position to open. The first movement of the emergency control cord will move the azimuth dump valve to the "OFF" position, and bypass the hydraulic fluid in the azimuth pressure line, thus permitting free rotation of the turret. Continued movement of the emergency cord will rotate the turret until the doors are in a position to be opened. Open the doors and remove the casualty.

b. MOTOR PRODUCTS NOSE AND TAIL TURRETS (Group III).

Note

Letters (A) through (G) called out in the text are stenciled on the inside of the turret cabin walls with luminous paint.

(1) If not already removed: Remove the safety lock (A) from the elevation system and stow at (B) on the bulkhead to gunner's left. Remove the safety lock (C) from the azimuth system and stow it at (D) on the bulkhead to the gunner's right.

(2) Snap the hand crank in place on the emergency rotating shaft located on the bulkhead to the gunner's right.

(3) Snap the hand crank in place on the emergency elevation shaft located on the bulkhead at gunner's left.

(4) Close the shut-off valve (E) located at the left side of the control valve.

(5) Raise the handle on the azimuth (rotation) dump valve under the seat to the "OFF" position.

(6) Raise the handle on the elevation dump valve (F) located below the control valve to "OFF" position. The turret is now ready for manual rotation or manual elevation of the guns.

(7) FOOT FIRING INSTRUCTIONS. — Push the safety lock (G) located on the bulkhead to gunner's right from the "SAFE" to "FIRE" position. Depress the foot pedals. Either pedal will fire both guns.

(8) Procedure for removal of a casualty from this turret is the same as for the other hydraulic nose or tail turrets (see above) except that some installations have a separate pull handle at the bottom of the turret to release the bypass valve. In this case the handle must be pulled before the turret can be pulled around by the winch.

c. EMERSON ELECTRIC NOSE TURRET (Groups I and III).

(1) MANUAL OPERATION OF TURRET FROM INSIDE.

(a) The turret need not be connected to an electric power source when both turret and guns are to be manually operated. Simply engage the two hand cranks by pushing the manual control clutch index plates to one side. These index plates are located on the two brackets which extend back toward the gunner's hands from the structural member in front of the control column. The azimuth index plate is on the left side. The elevation index plate is on the right side. Shifting of both clutches simultaneously causes disengagement of the power drive and engagement of the manual control handle assembly (the hand crank). Turn the hand cranks to move the turret and the guns as desired.

Note

Electrically operated limit controls will not be functioning. Do not attempt to force movements beyond their mechanical limitations.

(b) To release the hand cranks and re-engage the power drives, push the two manual control shifting levers forward into their "LOCKED" positions.

(c) Should an emergency permit the manual operation of either the turret or guns while the power operations of the unaffected movement is to be continued, proceed as follows:

1. Open the drive switch that controls the amplidyne motor of the damaged system.

2. Engage the hand crank of the same system by pushing to one side the manual control clutch index plate that operates the clutch of the drive motor in the system.

3. Use the hand crank in place of the disengaged drive motor while continuing electrically to operate the unaffected movement by means of the control handles, as usual.

(2) EMERGENCY AZIMUTH OPERATION—FROM OUTSIDE OF THE TURRET.—To rotate the turret from within the airplane fuselage.

(a) Open the external power switch, located outside the turret, on the fuselage, right side.

(b) Disengage the azimuth emergency clutch by pulling on the "T" handle attached to the emergency release cable, which hangs from the gunner's floor assembly beneath the turret. This cable is accessible from the bombardier-navigator's compartment.

(c) While holding the cable to keep the clutch disengaged, rotate the turret by hand.

(3) FOOT TRIGGER OPERATION.

(a) In firing the guns by means of the foot trigger, the turret electrical system need not be in operation if only a short length of the belt is loaded into each gun. However, if the length of belt for either gun is longer than would be required to reach the floor of the turret, then all switches must be closed. This is necessary so that boosters will operate to assist the self-feeding action of the guns.

(b) There is a lever assembly affixed to each gun, back of the solenoid on the butt of the gun. This assembly holds an actuator cam aligned with the solenoid plunger. One, or both guns, may be prepared for foot firing by rotating the firing plungers to project into the rear of the firing solenoids.

(c) The foot trigger is located directly below the control column, within easy reach of the gunner's feet. Both guns will fire so long as the foot trigger is held down. When finished with the foot firing mechanism, turn the cams back into their inoperative (safety) positions.

d. MARTIN UPPER GUN TURRET
(Groups I, II and III).

(1) The manual drive is provided for auxiliary operation in the event the electric drive becomes inoperative. The manual drive is located below the electric control unit and is controlled by two cranks. The left crank controls the elevation movement of the two guns, and the right crank, incorporating a gun firing switch, button type, controls the azimuth movement of the turret.

(2) The manual drive is placed in operation, first by disengaging the elevation and azimuth electric motor drive clutches, then by rotating both right and left cranks in either direction. This automatically engages the manual drive. To change from manual to the electric drive operation, place both crank handles in the "UP" position and disengage by lifting the engaging pin on both cranks in disengaged position. Then engage the elevation and azimuth electric drive clutches.

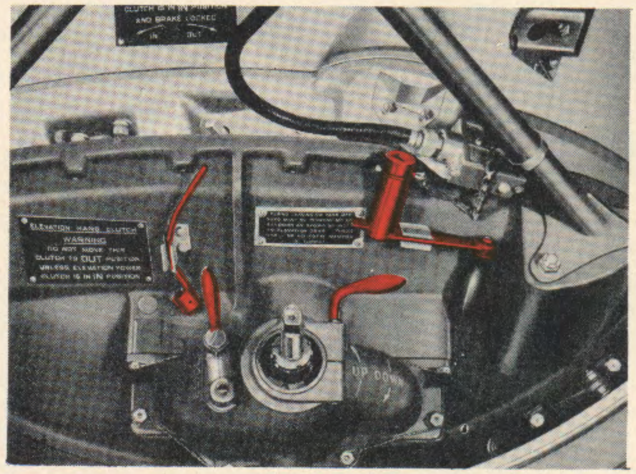


Figure 38—Lower Ball Turret Emergency Crank and Wrench Handles

WARNING

Disengage the manual drive before operating the turret electrically. Failure to do this will cause the crank handles to spin, endangering the turret gunner.

e. LOWER BALL TURRET
(Groups I, II and III).

(1) Shut off the power switch located on the left side of the fuselage, opposite the turret.

(2) Release the azimuth and elevation power clutches. The azimuth clutch release is directly below the azimuth gear shaft. The elevation clutch release is hidden by the elevation hand crank gear case.

(3) Remove the hand cranks from the stowage clips above gunner's head. Place the cranks upon their respective gear shafts. Elevation crank goes on elevation pinion shaft at gunner's left. Azimuth hand crank goes on the azimuth gear shaft, to the gunner's right.

(4) With the two hand cranks, the turret may be rotated until the guns point aft and the guns depressed to the angle which permits raising the turret into the airplane.

(5) If the hydraulic retracting mechanism is disabled, the turret may be retracted by means of the two bomb hoists above the turret. *(See figure 85, item 4.)*

(6) Emergency crank and wrench handles (red) are stowed in clips on the outside of the lower ball turret, and are accessible from inside the airplane. *(See figure 38.)*

(7) Two retaining pins for the hoist cable hooks are provided on the retraction cylinder guide flange for emergency retraction. The hoisting gear is stowed with the hooks in place. The turret must be lifted evenly by both hoists.

(8) Be sure that the hydraulic retraction release valve is open, to allow fluid to flow from above the retraction cylinder.

9. EMERGENCY BOMB BAY DOOR OPERATION.

This material is now covered in paragraph "18. HYDRAULIC SYSTEM FAILURES" of this section.

10. EMERGENCY BOMB RELEASE.

This material is now covered in paragraph "18. HYDRAULIC SYSTEM FAILURES" of this section.

11. EMERGENCY WING FLAP LOWERING.

This material is now covered in paragraph "18. HYDRAULIC SYSTEM FAILURES" of this section.

12. EMERGENCY LANDING GEAR OPERATION.

a. MAIN GEAR. — If the engine-driven, electrically driven, and hand hydraulic pumps fail (complete hydraulic failure), the following manual operation procedure must be followed:

(1) Place the landing gear control lever on the pilots' control pedestal in the "DOWN" position. *(See figure 17, item 53.)*

(2) Turn the emergency hand crank *(figure 43)* clockwise until the main gear is down and locked. (Approximately 30 turns are required.) This crank is located on the forward side of the front spar and may be reached while standing on the extreme forward end of the bomb bay catwalk.

(3) Check the landing gear position indicator light on the pilots' instrument panel *(see figure 17, item 15)*. As an added precaution, check both gears visually to determine that they are down and locked.

(4) Return the landing gear control lever to neutral.

Note

To reset the emergency lowering system after completion of above procedure, turn emergency hand crank approximately 30 turns counterclockwise to normal position. Avoid cranking too far and allowing the cable to jump off the drums. Resafety.

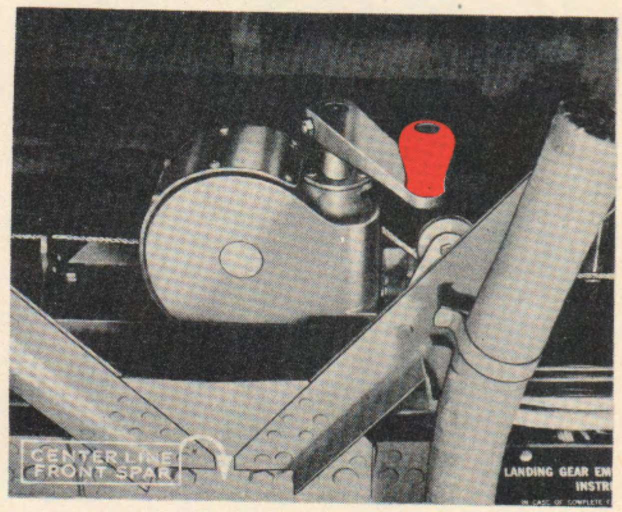


Figure 43—Main Landing Gear Emergency Lowering Crank

b. NOSE GEAR. — The emergency procedure for lowering the nose landing gear in the event of hydraulic system failure is illustrated in figure 44.

CAUTION

Be sure to lower the main landing gear first by mechanical means.

c. EMERGENCY BRAKE OPERATION.—Should the engine-driven hydraulic pump fail, open the emergency hydraulic (star) valve located at the right of the door to the flight compartment and at the forward end of the bomb bay, and then turn "ON" the emergency hydraulic pump switch, located inboard of the emergency hydraulic valve. *(See figure 33.)* The electrically-driven hydraulic pump will then furnish pressure for the brakes through the main hydraulic system. If both pumps fail, braking pressure can be built up by means of the hand pump at the copilot's right, and the emergency flap lowering valves; forward valve open, and aft valve closed.

d. MAIN LANDING GEAR FAILURES.

(1) GEAR DOWN-LOCK FAILS TO HOLD.—Hold the landing gear control lever in the "DOWN" position. If this fails to lock the gear, raise the gear and try the emergency method described in paragraph 12. *a.*, preceding.

(2) GEAR JAMS WHILE LOWERING.—Attempt to lower the gear with the emergency procedure described in paragraph 12. *a.*, preceding.

(3) GEAR JAMS WHILE RETRACTING.—Lower the gear and attempt normal retraction again. If this fails, lower the gear and land.

(4) GEAR FAILS TO LOCK IN THE "UP" POSITION.

(a) Place the landing gear control lever in the "UP" position and hold it there manually until the gear locks.

(b) If the gear fails to lock after repeated attempts, it will be necessary to rely on the hydraulic pressure to keep the gear up. This will necessitate putting the control lever in the "UP" position frequently to prevent the gear from slipping down. This is not recommended on long flights, but may be used while the airplane is gaining sufficient altitude for a proper approach and landing.

(5) ONE GEAR STICKS UP AND WILL NOT LOWER.—Raise the lowered gear by the normal method and attempt to lower both gears by the emergency procedure described in paragraph *a.*, preceding.

(6) GEAR FAILS TO RETRACT (NO. 3 ENGINE OR ENGINE-DRIVEN HYDRAULIC PUMP FAILS ON TAKE-OFF).

(a) Open the emergency hydraulic (star) valve to the right of the door to the flight compartment in the forward bomb bay. *(See figure 33.)*

(b) Check to be sure the switch for the auxiliary electrically driven hydraulic pump is "ON." The switch is located inboard of the emergency hydraulic (star) valve.

(c) If this pump fails, pressure can be built up by means of the emergency hand pump at copilot's right and operating the emergency flap lowering valves; the forward valve "OPEN" and the aft valve "CLOSED." See paragraph *c.*, preceding.

e. NOSE LANDING GEAR FAILURES.

(1) GEAR FAILS TO RETRACT (NO. 3 ENGINE OR ENGINE-DRIVEN HYDRAULIC PUMP FAILS ON TAKE-OFF).—Follow the same procedure as paragraph *d.*, (6), preceding.

(2) GEAR FAILS TO LOWER.—This may be due to premature kick-out of the landing gear selector valve. Overpower the control lever until operation is completed.

f. EMERGENCY NOSE-WHEEL DOORS OPERATION.

Pull the red emergency handles as illustrated in figure 45, (single handle on Group II and later Group I and III airplanes) full length of travel DOWN with sufficient force to break the safety wiring. Location: Bombardier-navigator's compartment, at top of fuselage, aft end. *(See figures 46, and 47.)*

g. LANDING WITH MAIN WHEELS RETRACTED AND NOSE WHEEL EXTENDED.—Turn off the fuel sight gage valves and drain the lines; turn off the wing compartment drain line valve located in forward bomb bay on the lower wing surface, near the fuel booster pump. Choose a smooth concrete runway, if possible. Hard sod would be the next preference. Make a full flap landing in a normal attitude with enough air speed on the approach to effect a smooth "flare-out" with minimum sink just before contact. At this point place the mixture controls for the outboard engines (No. 1 and No. 4) in "IDLE CUT-OFF" position.

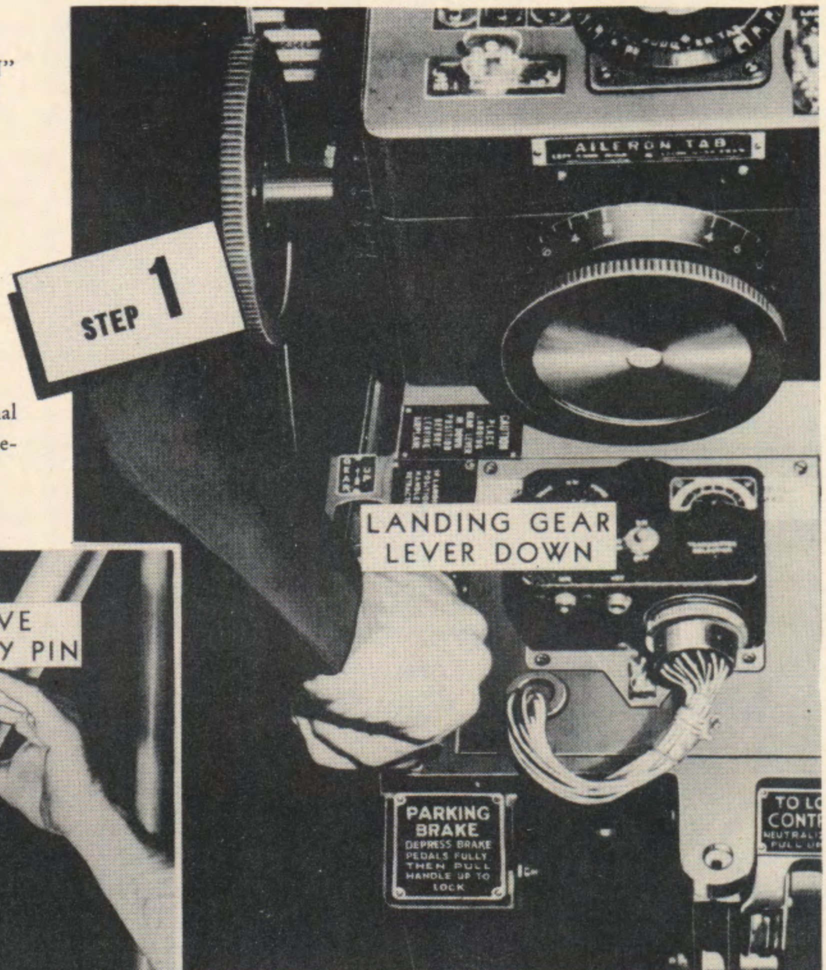
h. LANDING WITH FLAT MAIN WHEEL TIRE.—After landing, put the nose wheel firmly on the ground. Use the engines on the side on which the tire is blown, concentrating on the outboard engine, and use enough brake on the good tire to keep the airplane rolling straight. It may be necessary to blow the good tire out.

i. LANDING WITH A FLAT NOSE WHEEL TIRE, FAULTY SHIMMY DAMPERS, OR UNEXTENDED NOSE WHEEL WITH MAIN GEAR DOWN AND LOCKED.—Slow the airplane down to 150 to 155 miles per hour. At this air speed, shift the load so that the airplane flies approximately 1½ degrees tail heavy. Normally this requires one crew member in the extreme rear of the rear fuselage compartment and seven crew members just aft of the entrance into the rear fuselage compartment. On the final approach trim the airplane for a normal landing, put the propellers in full high rpm and land on the main gear, nose slightly higher than

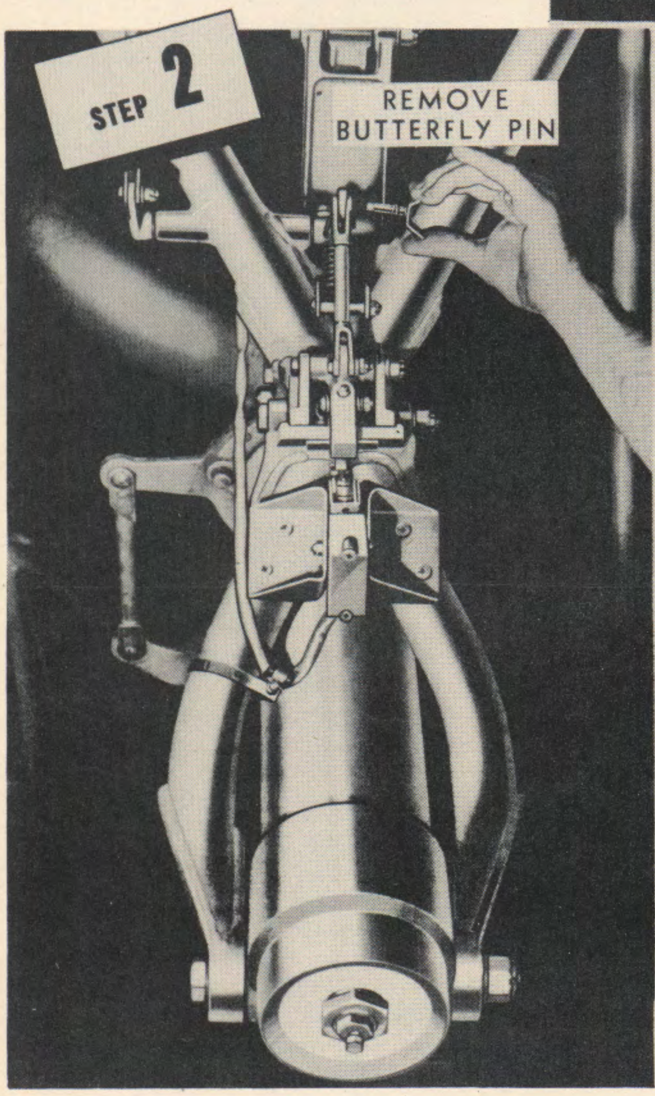
1. Place landing gear lever in the "DOWN" position.

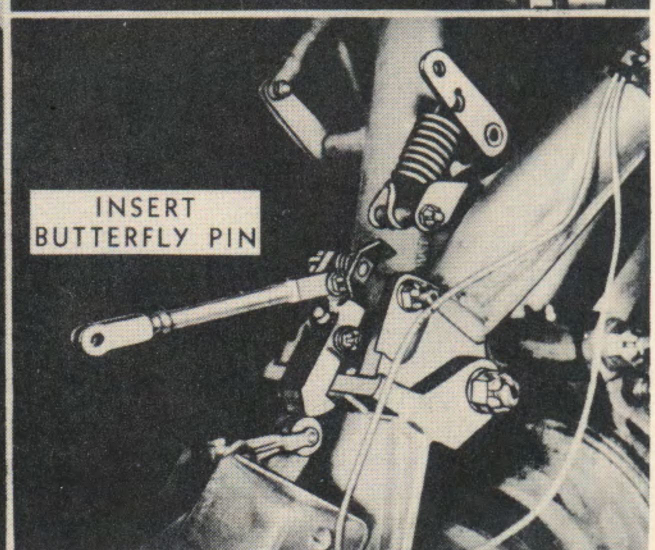
Note

On entering nose wheel compartment it may be necessary in some airplanes to remove the draft curtain to get access to the nose gear.



2. Remove the butterfly pin from its normal position and insert in latch slot as shown in detail "A."

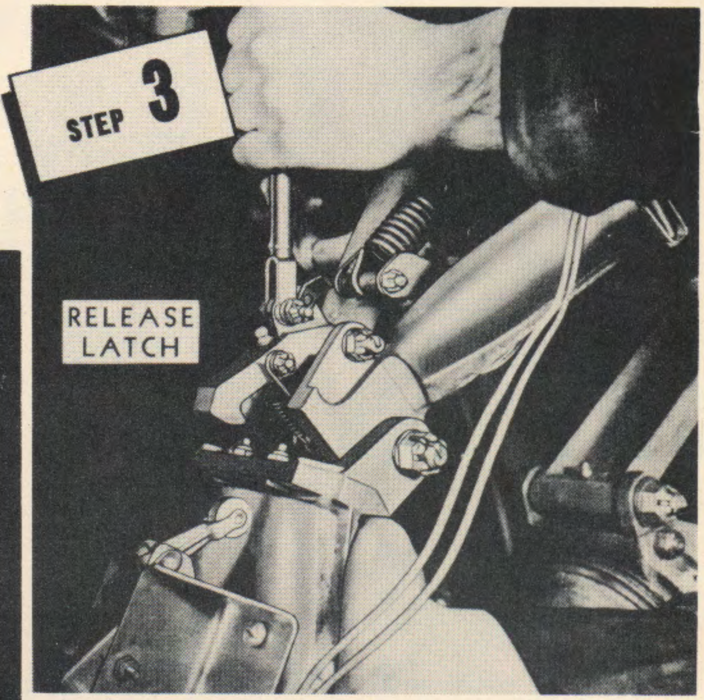


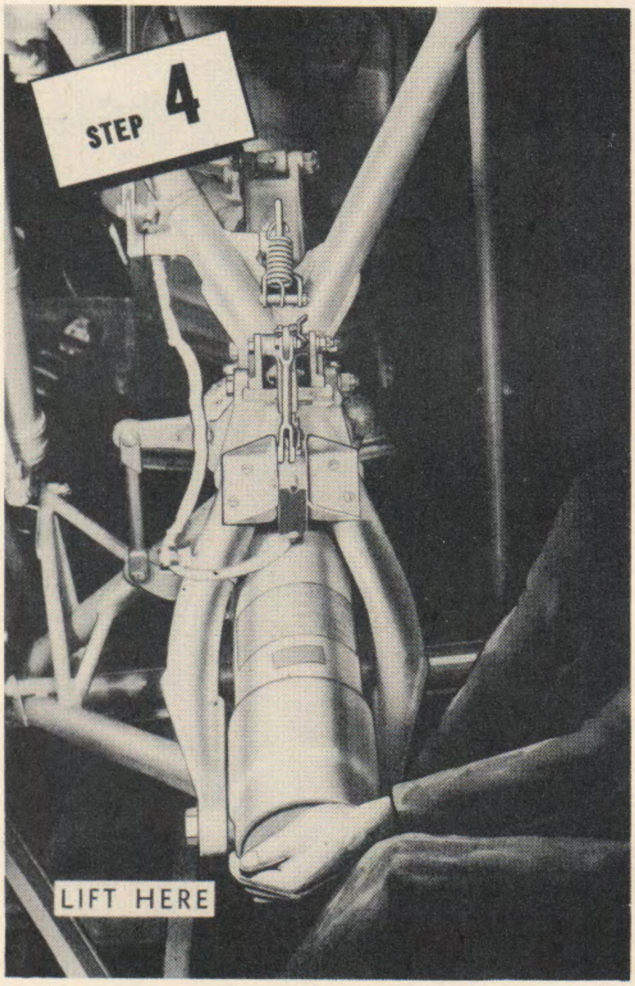


DETAIL "A"

Figure 44—Emergency Lowering of Nose Landing Gear (Sheet 1 of 2 Sheets)

3. Release the nose gear latch by pulling on latch link while pushing up on the drag link as shown.





4. Take a sitting position near the top of the shock strut. Grasp the top of the shock strut with both hands and lift upward to force the gear into the extended position.

Note

It may be necessary to rock the gear two or three times to gain momentum.

5. After the gear falls, make certain the lock is securely latched. If the lock is not securely latched, push upward on the aft drag link as shown to force the lock into the latched position.

CAUTION

Replace the butterfly pin as soon as possible after landing. If the linkage holes do not align to permit insertion of the butterfly pin, place the landing gear lever in the "DOWN" position and apply hydraulic pressure to the system.

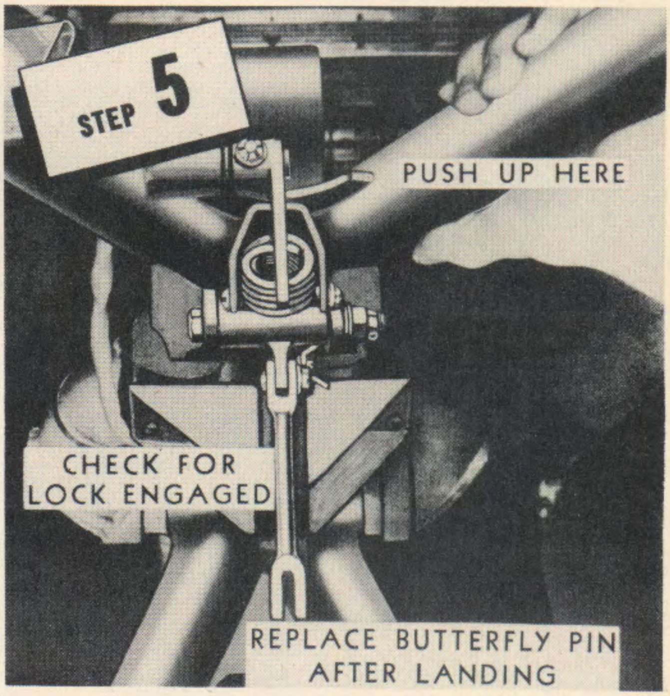


Figure 44—Emergency Lowering of Nose Landing Gear (Sheet 2 of 2 Sheets)

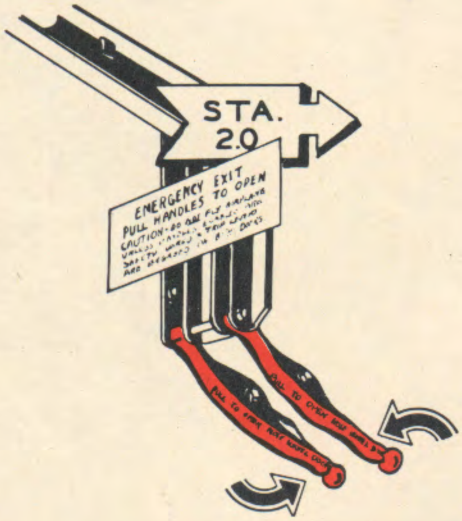


Figure 45—Emergency Nose Wheel Doors Operating Handles

normal, at the lowest safe air speed: Do not land on the retractable tail bumper gear.

The throttles must be fully closed after landing to obtain full propeller braking effect.

Some additional braking effect may be obtained by placing the No. 2 and No. 3 engine mixture controls in the "IDLE CUT-OFF" position, leaving the outboard engines (No. 1 and No. 4) available for ground looping, if necessary. Always choose the longest runway. Touching the tail bumper gear on the landing roll is permissible, but severe impacts must be avoided. Use of the brakes is not recommended, but if they are to be used at all, they should be used only on the initial part of the landing roll, as application later will result in the nose being forced down onto the runway. On the landing roll the control column will be held back as far as possible, but not so far that the tail will fall and damage the tail bumper gear.

As the speed decreases on the landing roll, more men from immediately aft of the bomb bay should move to the extreme rear, one man going aft for each prearranged signal on the alarm bell. Usually, seven men should be in the extreme aft position when the landing roll speed has decreased to approximately 20 miles per hour. Normally, the weight of seven men in the extreme rear will hold the nose wheel off the ground when the airplane comes to rest. As a safety precaution, the eighth man should be sent aft, and all should remain there until the nose wheel repair can be made, or until the nose of the airplane can be jacked.

13. EMERGENCY LANDING ON LAND.

a. LANDING WITH NOSE GEAR DAMAGED OR RETRACTED.

(1) Station at least six members of the crew at station 6.0 (the rear bulkhead of the bomb bay) so that upon a predetermined signal they may individually go to the extreme rear of the airplane.

(2) Make a normal approach and a normal landing, nose high.

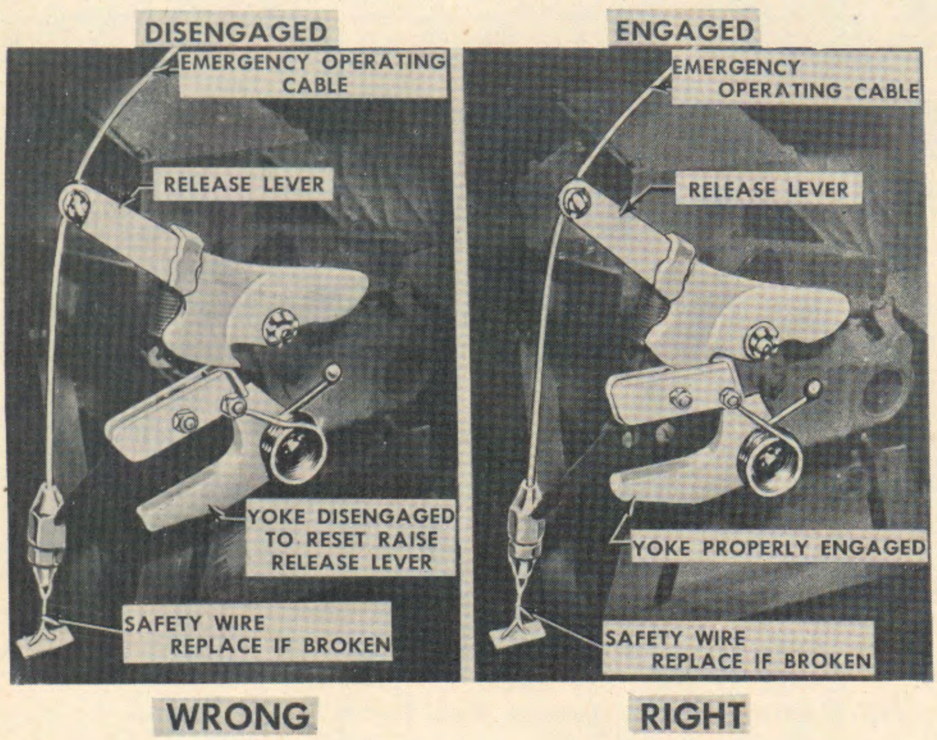


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Figure 46—Resetting the Nose Wheel Doors Latch (Groups I and II Airplanes)

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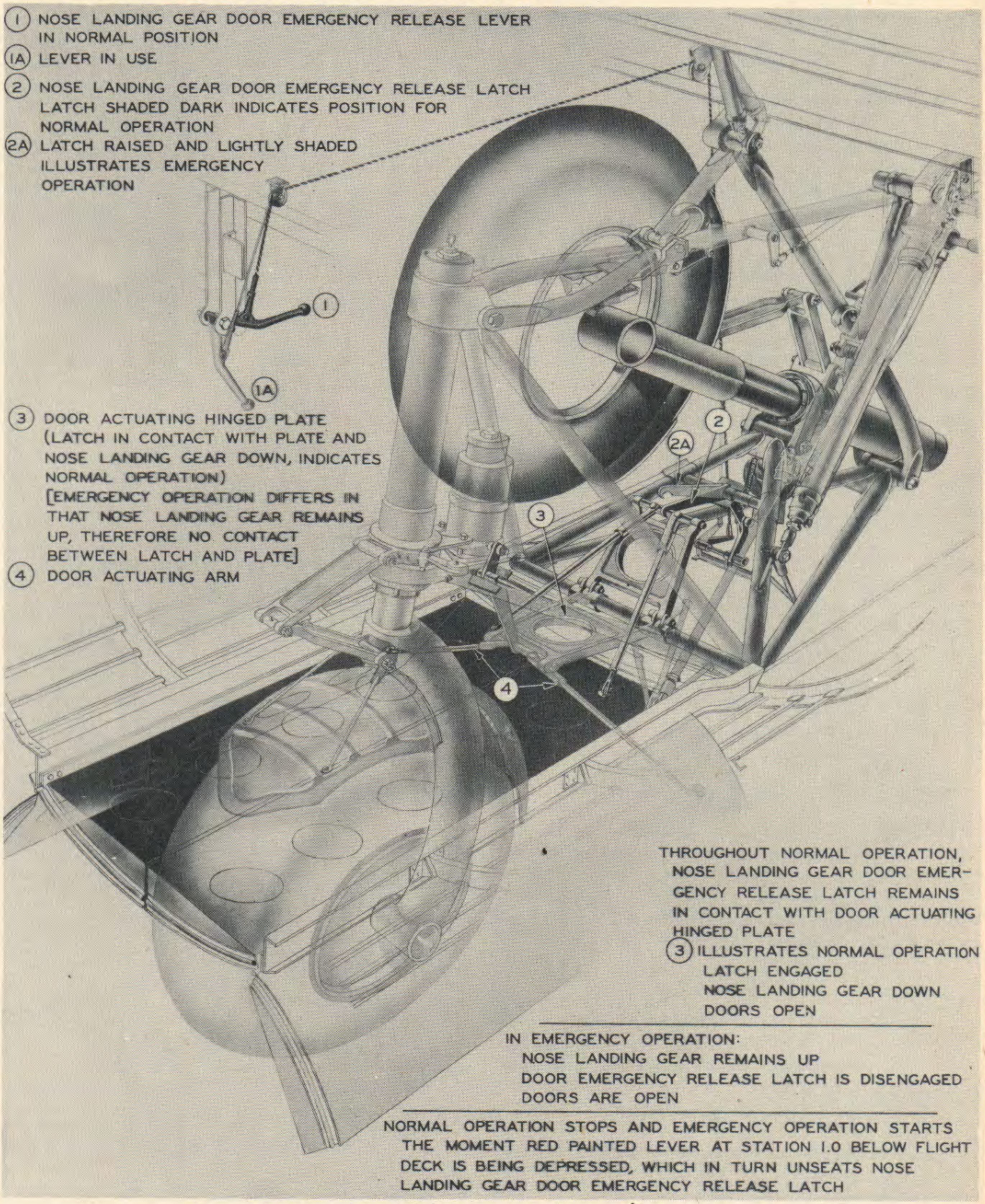


Figure 47—Nose Wheel Doors, Normal and Emergency Operation, (Groups II and Later Groups I and II! Airplanes)

(3) Land as short as possible to utilize all of the available runway.

(4) The pilot will use the alarm bell to signal the crew at station 6.0 to move aft; one person will move as far aft as possible with each ring of the bell.

(5) The copilot will cut the ignition switches and mixture controls on the inboard engines. Keep the outboard engines running in case a ground loop is necessary at the end of the landing roll.

CAUTION

All crew members in the rear of the airplane will remain there until the pilot gives them authority to leave. Do not use brakes if the nose gear is retracted or damaged. Do not land on the tail skid.

b. LANDING WITH NO BRAKES. — Landings with no brakes are accomplished the same as landings with nose gear retracted.

c. LANDING WITH NOSE WHEEL TIRE FLAT, OR SHIMMY DAMPER INOPERATIVE. — Landing is made as described above in "Landings with Nose Gear Damaged or Retracted," in this paragraph.

d. LANDING WITH ONE MAIN GEAR TIRE BLOWN.

(1) Station all crew members as designated below in "Procedure Preceding Crash Landing on Land."

(2) Make a normal approach and landing.

(3) When contact is made, put the nose wheel firmly on the ground.

(4) Maintain directional control by using the outboard engine on the side with the tire blown. Use sufficient brake on the good tire to keep the airplane straight.

e. LANDING WITH NO FLAPS.

(1) Make certain that the airplane is loaded properly (shift crew to locate center of gravity within limits).

(2) Make a fast, power-on approach with an air speed of approximately 140 mph.

(3) Level off just above the runway with an air speed of approximately 130 mph.

(4) After contact, place the nose wheel firmly on the ground.

(5) Apply the brakes (auxiliary hydraulic pump "ON").

(6) Cut the ignition switches and mixture controls on the inboard engines. Keep the outboard engines running to provide power if ground looping becomes necessary at the end of the landing roll.

f. PROCEDURE PRECEDING CRASH LANDING ON LAND.—Procedure cannot be established to fit all cases. The following is a summary of the

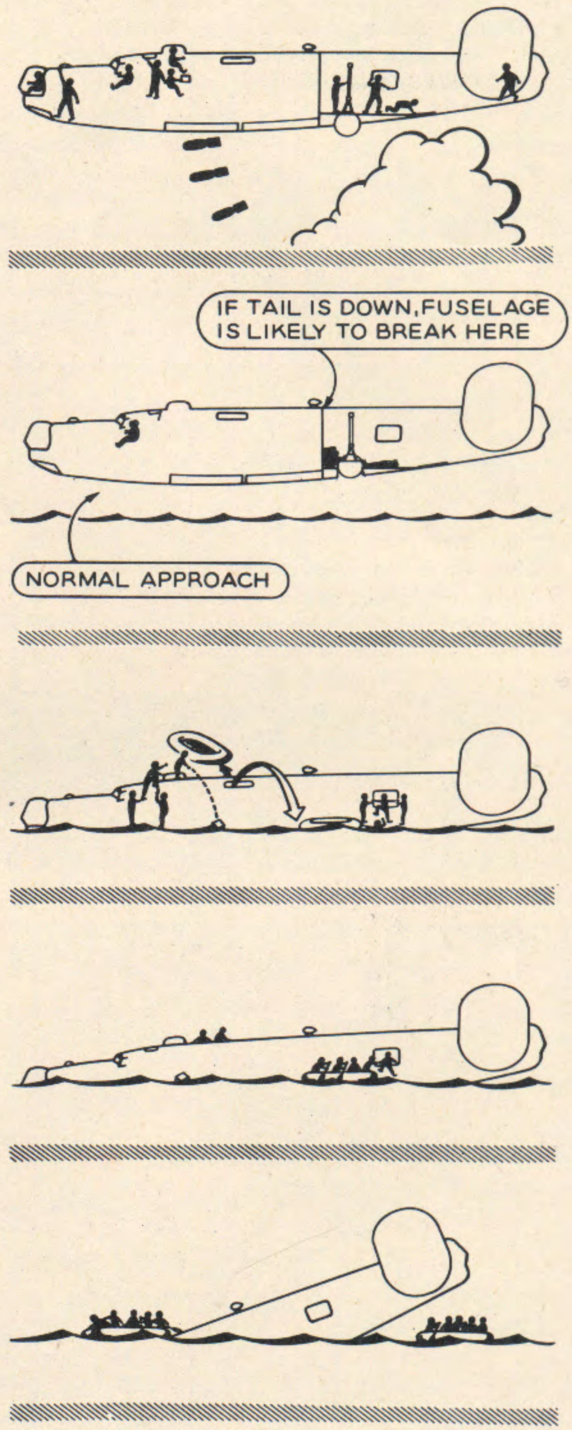


Figure 48—Forced Descent on Water (Ditching)

steps to be taken if time permits. The pilot may alter this procedure wherever necessary.

(1) THE PILOT WILL:

(a) Notify crew by interphone or oral communication between crew members that crash landing is to be made.

(b) Notify bombardier to release bombs; if possible, to drop them in uninhabited or enemy territory. The bomb bay doors will be closed. All emergency hatch covers will be removed and placed in bomb bay.

(c) Make a normal slow landing with flaps and landing gear down.

(2) THE COPILOT WILL:

(a) After impact, put the mixtures in "IDLE CUT-OFF."

(b) Turn off the battery switches after operation of necessary electrical equipment.

(c) Assist the pilot as directed.

(3) THE BOMBARDIER WILL:

(a) Check with the pilot to determine if the bombs are to be dropped.

(b) Release the bombs. Close the bomb bay doors.

(c) Proceed to the rear compartment.

(4) THE ENGINEER WILL:

(a) See that the crew is in the rear compartment and properly disposed to withstand impact.

(b) See that the doors at the fore and aft ends of the bomb bay are locked in an open position.

(c) See that all emergency exit doors are removed and placed in the bomb bay. (A door that is cast free may damage the control surfaces.)

(d) Turn off and drain the fuel sight gages.

(e) Turn the wing drains off.

(f) Turn the generators to the "OFF" position after the impact.

(5) THE NAVIGATOR WILL:

(a) Definitely determine the position of the airplane if time permits.

(b) Direct the radio operator to send distress message giving pertinent information.

(c) Proceed to the rear compartment.

(6) THE RADIO OPERATOR WILL:

(a) Obtain the position from the navigator and send distress message if time permits.

(b) Proceed to the rear compartment.

(7) ABANDONING AIRCRAFT FOLLOWING CRASH LANDING ON LAND.

(a) All preparation for abandoning ship has been made during approach. After landing little can be done, except to leave the airplane as quickly as possible.

(b) Crew members will take fire extinguishers with them, if available, for use in fire fighting and in the rescue of personnel trapped in the airplane.

14. EMERGENCY LANDING ON WATER (DITCHING).

a. PREPARATION FOR DITCHING. *(See figure 48.)*

(1) In the event of a forced descent on water, every precaution must be taken to keep the airplane under control by not allowing the airplane speed to go below 115 mph. At this speed there is little danger of the airplane stalling, and the pilot should be able to execute a belly landing without difficulty.

(2) The pilot warns the crew to prepare for ditching using the interphone set at "CALL" or by some other prearranged signal, giving the altitude and the approximate number of minutes before the impact. This should be acknowledged by each member of the crew using the words, "Navigator Ditching," "Side Gunner Ditching," etc. Immediately, all crew members should loosen shirt collars, and remove oxygen masks unless above 12,000 feet in which case oxygen continues to be used until notification by the pilot.

(3) If existing orders permit, the pilot radios on the command transmitter to contact other airplanes, surface craft, or nearby shore stations.

(4) The copilot helps pilot with the controls.

(5) The bombardier will jettison the bombs, or the bomb bay fuel tanks, and close the bomb bay doors. If there is not sufficient time to release the bombs and close the doors, ascertain that the bombs are "SAFE" and leave the doors closed.

WARNING

If the fuse arming switch is "ON," the bombs will be released armed.

(6) The navigator will determine the position, course, speed and estimated position of ditching and inform both the pilot and radio operator. He will prepare to take with him the instruments necessary to make simple computations while in the life rafts.

(7) If orders permit, the radio operator turns IFF radio to distress, switches on the liaison transmitter (tuned to MF DF frequency) to contact more distant stations (ship and shore), sending distress signals, including time and position signals. He also transmits the course, altitude, ground speed, and estimated position of ditching. On order from the pilot he clamps down the code transmitter key, and hinges up the radio table. The radio operator's "ditching station" should be as near as possible to his flight position.

(8) Crew members hoist the lower ball turret, if extended, and jettison all possible ammunition and equipment.

(9) Crew members will open all EMERGENCY EXITS for ditching, (refer to paragraph 1., preceding), and see that the nose wheel doors, bomb bay doors, and the main entrance door are tightly closed.

WARNING

Emergency exits must be opened prior to landing, as the impact on striking the water may jam them if they are closed.

(10) The pilot, copilot, navigator, radio operator, gunners and any other personnel make sure that safety belts and shoulder harness are secure, and parachute straps unfastened.

(11) The pilot should operate the warning bell switch on the pilots' control pedestal before landing, to give the crew members a chance to make necessary preparations.

(12) DITCHING POSITIONS.—It is difficult to specify the exact ditching positions for each crew member because the location and types of equipment will vary. There are two suitable general locations, the flight compartment, and the rear fuselage compartment forward of the side windows. The rear fuselage compartment is one of the best ditching positions in the airplane and as many crew members as possible should lie there with feet braced forward against the bulkhead just aft of the lower ball turret, protected with coats and cushions against sharp edges.

Lying down with the feet braced forward is the best position for ditching. If in a sitting position with the back braced against a solid surface, head should be clasped in hands to hold it against the snap of impact.

Usually those in the flight compartment will include the pilot and copilot. Those in the rear fuselage compartment usually will include the bombardier, navigator, flight engineer or upper turret gunner, radio operator, the two side gunners, lower turret gunner, and the tail gunner.

b. PREPARATION FOR DITCHING AT NIGHT.

(1) Same procedure as for day except:

(2) Turn on all lights. They may assist in landing, or in attracting searching parties, and they will assist in abandoning the airplane.

(3) Judgment of height over water at night is difficult. One way of telling how high the airplane is above the water is to lower the trailing antenna. Instruct the radio operator to clamp the transmission key down and to watch the ammeter. The current will drop as soon as the antenna touches the water. The radio operator should inform the pilot as soon as this happens.

WARNING

Do not throw the emergency radio transmitter (SCR-578-A or SCR-578-B) overboard before landing. Have the radio operator or some other crew member take it along when leaving the airplane.

c. USE OF POWER.

(1) If only two or three engines are available, power should be used to flatten the approach; but the engines should not be used to such an extent that, at any time prior to the stall, the airplane cannot be turned against any unbalanced power condition with the margin of rudder power available. Under no circumstances should the engines be "opened up" during the final stage of landing.

(2) The value of power in landing on water is so great that the pilot should always land before the fuel is completely exhausted when it is certain that shore cannot be reached.

WARNING

The ditching command must, if possible, be given while the fuel supply is still sufficient for 15 minutes of flight. The chances for a successful landing are much greater if power is used.

d. APPROACH AND LANDING ON WATER.

(1) The landing gear must be RETRACTED.

(2) If the wind is blowing across the swell, a cross sea is created with the waves (which are moving down wind) running on the swell. Under these conditions the pilot must choose the direction along the swell which will make the approach as nearly into the wind as possible.

(3) A normal glide approach speed should be used, since this will insure control and a margin of speed after flattening out to allow the pilot to choose the best point for landing on a swell. The pilot should hold off until he loses all excess speed above the stall, and strike the sea with a normal landing attitude.

(4) Before the actual landing, the flaps should be lowered to reduce the speed at which the airplane can approach a landing position. It is better to use a medium setting rather than a full down setting, since little, if any, further reduction of speed is obtained, while the rate of descent is increased and the airplane approaches more nose down. A steep nose down descent is dangerous if the sea is met sooner than was expected, and also because more altitude is required to flatten out from such a position.

(5) IN ANY SEA. — It is IMPORTANT to avoid a high rate of sink. Get the airplane slowed down before starting the glide and control the sink with power if available. Glide with half flaps, and bring full flaps down to slow the speed when flaring out above the water, and avoid a high rate of sink that will bring the airplane crashing down into the water. As far as possible, slide the airplane onto the water the same as in a belly landing on concrete (even though this necessitates a somewhat faster landing). Make a normal approach, and attempt to touch the water first with the portion of the airplane just forward of the bomb bay doors. DO NOT attempt to land tail low because this puts too much strain on the bulkhead between the aft bomb bay and the rear fuselage compartments. DO NOT drop the airplane in or it will collapse the bomb bay doors and force water against the bulkhead between the aft bomb bay and the rear fuselage compartments. The landing recommended above is based on service experience.

(a) LANDING ON A CALM SEA.—If the surface is calm without a definite wave formation and white caps have not appeared, land upwind.

(b) LANDING ON A SWELL.—If the surface is spotted with white caps but foam is not yet being blown into spray, land along the top and parallel with the swell.

(c) LANDING IN HIGH WAVES.—If foam is whipped into spray, the wind velocity is too great to land cross wind. Land upwind in a heavy sea.

CAUTION

There may be more than one impact. Warn the crew to hold their positions until the airplane comes to rest.

e. PROCEDURES AFTER LANDING. — Usually the airplane will remain afloat from one to ten minutes. As soon as the airplane comes to rest, the life raft release will be pulled. Exits will be made as fast as possible with all necessary equipment as follows:

(1) EXITS THROUGH THE PILOTS' EMERGENCY EXIT.—Each crew member inflates his life vest after clearing the exit. Copilot first, receives the emergency radio set (if stored in the radio compartment), ration box, water and other supplies from the pilot, and goes to the right raft, takes command; pilot second, hands out water and other supplies to the copilot and goes to left raft and takes command.

(2) EXITS FROM REAR FUSELAGE COMPARTMENT.—The life vests should be inflated after individuals are clear of the side windows so the vests will not interfere with escape if the exits are under water. Right side gunner first, through the right side window to the right raft, carrying water or other supplies; lower ball turret gunner second, through the right side window to the right raft; bombardier third, through the right window to the right raft; flight engineer or upper turret gunner, fourth, through the right window to the right raft. Left side gunner first, through the left window to the left raft, holding onto the ration box rope; tail gunner second, through the left side window; radio operator third, after throwing out the emergency radio set (if in his charge) holding tightly to the rope attached to it, to the left raft; navigator fourth, through the left side window to the left raft.

Note

If time and circumstances permit, take the frequency meter along when leaving the airplane. Be sure to keep it dry. By attaching the antenna from the emergency radio to the frequency meter, it can be operated as an efficient receiver to provide two-way communication for several hours.

(3) The TIME ELEMENT. — Speed is important but so is procedure. Give first attention to injured persons. Do not leave necessary equipment behind or you will face starvation and have no means of signaling for help.

f. LIFE RAFTS.—Two type A-3 life rafts are carried in the fuselage above the wing. To release either raft from inside the airplane, pull the "T" handle located just aft of the pilots' emergency exit. The pull cable releases the lock pins which hold the life raft doors closed and allows the spring bungee to throw the rafts out, clear of the fuselage. A rip cord attached to the life raft cradles automatically opens the valve which controls the raft inflation from the CO_2 cylinder. To release either raft from outside the airplane, the lever flush in the fuselage aft of each door should be lifted and twisted 90 degrees. This action pulls the same cable and releases the raft in the same manner as described above. Do not release the life rafts until the airplane is at rest on the water.

g. OPERATION OF PORTABLE EMERGENCY RADIO SET SCR-578-A or SCR-578-B.

(1) GENERAL.

(a) A complete, self-contained emergency transmitter provides for operation anywhere away from the airplane. *(See figures 49 and 50.)* Primarily designed for use in a small boat or life raft, it may be placed in operation anywhere. The unit is equipped with a small parachute to permit dropping from the airplane in the event of an emergency. It is stowed on the aft left side of the command deck.

Note

The emergency radio set carried in the airplane may be either SCR-578-A or SCR-578-B.

(b) When operated, the transmitter emits an MCW signal and is pretuned to the international distress frequency of 500 kc. Automatic transmission of a predetermined signal is provided. Any searching party can home on the signal with the aid of a radio compass.

(c) No receiver is provided.

(2) REMOVAL FROM AIRPLANE.

(a) If the airplane has made an emergency landing on water, the emergency set should be removed at the same time that the life rafts are released. The set is waterproof and will float, and therefore, it is not necessary to take any precautions in keeping the equipment out of the water. Be sure that it does not float out of reach.

(b) The only time the emergency set is to be dropped from the airplane (with attached parachute) is in rescue work or when abandoning the airplane in flight. The altitude of the airplane when dropping the equipment should be between 300 and 500 feet. To drop the equipment, the following steps should be observed:

1. Tie the loose end of the parachute static line to any solid metal structure of the airplane.

CAUTION

Be sure the static line clears the airplane and will not foul.

2. Throw the emergency set out through a convenient opening in the airplane. The parachute will be opened by static line.

CAUTION

DO NOT attach static line to any part of one's body when throwing the equipment overboard.

h. PYROTECHNICS. — When craft are in a position to see signals, fire life raft pistol or any available pyrotechnics. A Very pistol is stowed on the left side of the aft bulkhead in the radio operator's compartment, and should be taken along when leaving the airplane, if possible. An M-8 flare signal pistol mount is located in the top of the fuselage, over the inboard end of the radio operator's table. The M-8 flare signal pistol must be placed in this mount, prior to being fired from within the airplane. *(See figure 51.)*

i. ABANDONING AIRPLANE BY PARACHUTE OVER WATER.

(1) The pilot will determine when this is advisable, and will warn the crew members, using the interphone set at "CALL," or by some other prearranged signal, and will operate the warning bells.

(2) If existing orders permit, the pilot and radio operator will follow the same procedure as in Preparation for Ditching.

(3) Each crew member will remove the individual seat-type life raft and chest-type parachute from their respective positions near his station, and snap them onto his QAC harness. A life vest should be worn under the QAC harness on all overwater flights. The lanyard on the seat-type life raft should be snapped onto the D-ring of the life vest.

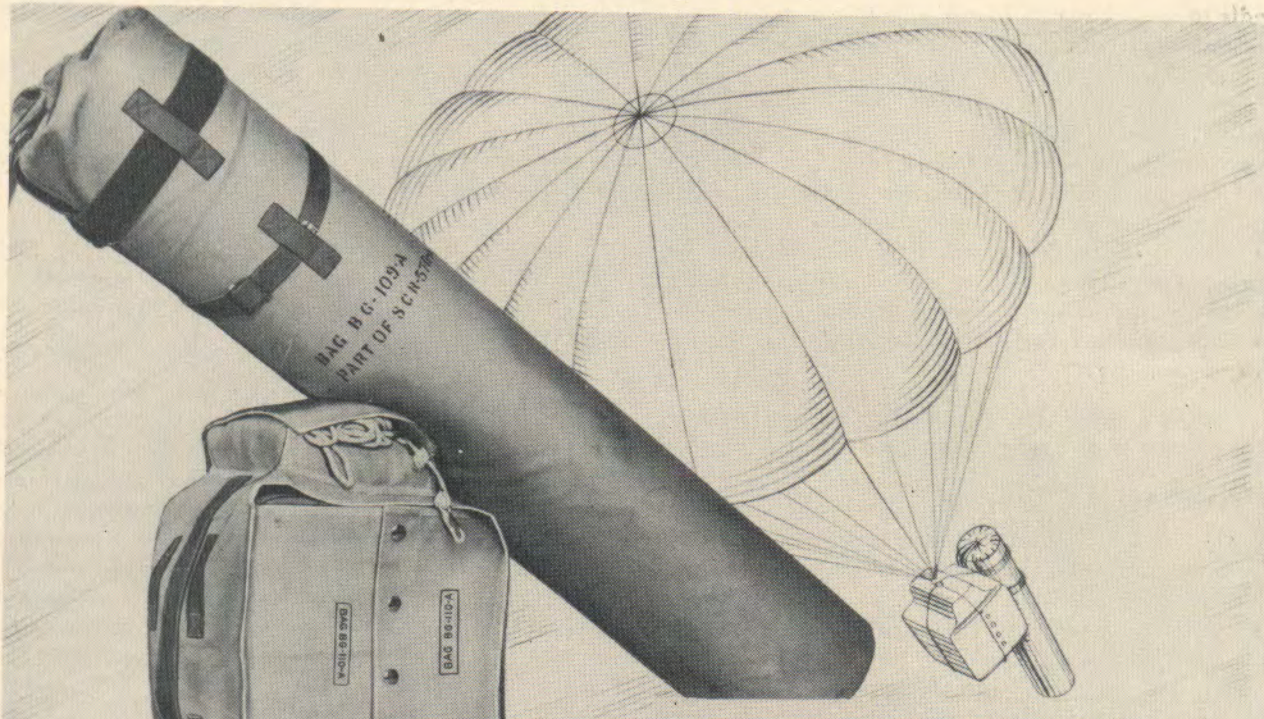
(4) All emergency exits will be opened.

(5) Personnel will bail out over water only in the event surface craft are nearby to assist in rescue.

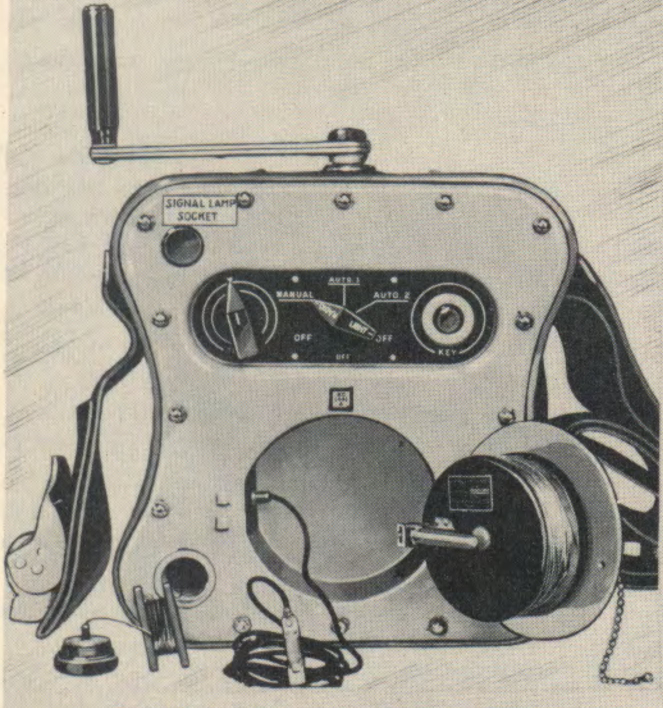
(6) The emergency transmitter (SCR-578-A or SCR-578-B) will have its parachute removed from its stowage pocket, prepared, and the set thrown overboard.

(7) Personnel will leave the airplane as instructed by the pilot.

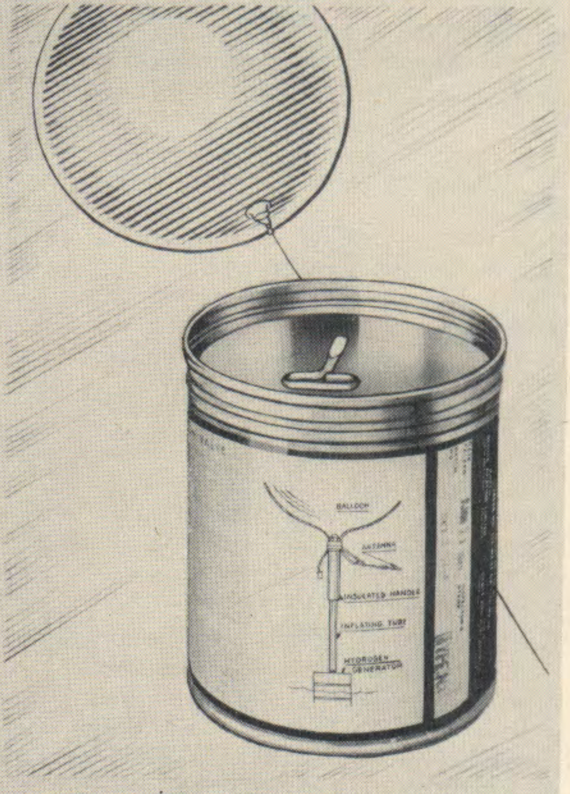
(8) When approaching the water, straighten the body with the feet together. When the feet touch the water, release the parachute harness, inflate the life vest, and pinch the nostrils together. Keep the elbows close to the sides. Land with the back toward the direction of travel.



PARACHUTE M-267-A PACKED WITH BG-110-A
AND ACCESSORY BAG BG-109-A



RADIO TRANSMITTER BC-778-A AND
HAND CRANK GC-18-A



BALLOON M-278-A INFLATED WITH ANTENNA
ATTACHED. CONTAINER ALSO SHOWN

Figure 49—Emergency Radio Set SCR-578-A (Sheet 1 of 2 Sheets)

KITE M-277-A UNASSEMBLED AND ASSEMBLED WITH ANTENNA ATTACHED

SIGNAL LAMP M-308-A AND SPARE ROLL OF ANTENNA WIRE W-148

INSTRUCTIONS FOR OPERATING RADIO SET

GENERATORS M-315-A HYDROGEN AND INFLATING TUBES UNASSEMBLED (above) AND ASSEMBLED (right)

Figure 49—Emergency Radio Set SCR-578-A (Sheet 2 of 2 Sheets)

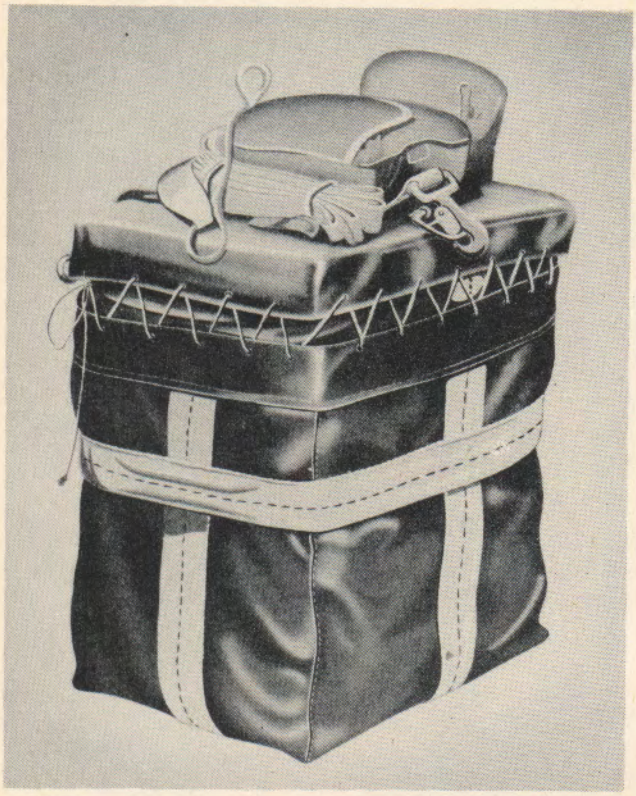


Figure 50—Emergency Radio Set SCR-578-B

j. EMERGENCY SUSTENANCE KITS. — There are numerous emergency sustenance kits provided for specific operations and these should be considered when an airplane has been assigned to perform a definite mission other than routine.

LIFE SAVERS

(1) Frequently inspect your life rafts and their equipment. *(See figures 52 and 53.)*

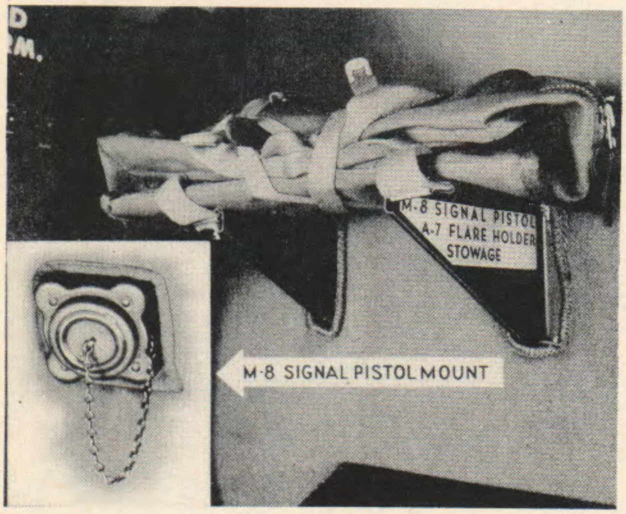


Figure 51—M-8 Flare Signal (Very) Pistol and Mount

(2) Learn the location of all the life rafts, how to release and inflate them and the purpose of every piece of equipment. (Read and know the instructions on each piece of equipment.)

(3) Learn where everything in the airplane is located and be able to reach for it without hesitation, even in the dark.

(4) Decide what extras you will need, stow them, and know where they are.

Wisdom

The only place where something you may vitally need will do you any good is aboard the life rafts and it is not going to be there, unless you put it there!

(5) Drill, drill as a team to get the life rafts away complete with all equipment and all of the crew. Drill so that if someone is injured, the others can do his job in addition to their own and get him away with them.

(6) Practice in the daylight, practice in the dark, practice until you do the right thing instinctively.

(7) If it is lack of fuel that is causing the forced landing, do not wait until the engines "sputter," but land while you have power available to assist you in selecting your landing spot.

(8) Leave the life rafts and other equipment in the stowed position until the airplane has come to rest on the water (loose equipment may be damaged by impact).

(9) Never inflate the life vests inside the airplane.

(10) Keep the pockets in the raft buttoned, except when actually removing an article.

(11) Once in the life raft, LASH OR TIE DOWN ALL EQUIPMENT! "Loose equipment is as good as lost."

15. EMERGENCY OPERATION OF RADIO EQUIPMENT.

a. INTERPHONE FAILURE. — The audio frequency section of the command radio can be substituted for the regular interphone amplifier. The pilot will place his command transmitter channel selector switch in either the "3" or "4" position, and the various interphone jack box selector switches will be set at "COMMAND." In this position it is not possible to communicate with ground stations or other aircraft.

Note

To resume normal command set operation, the pilots' channel selector switch must be placed back in the "1" or the "2" position.

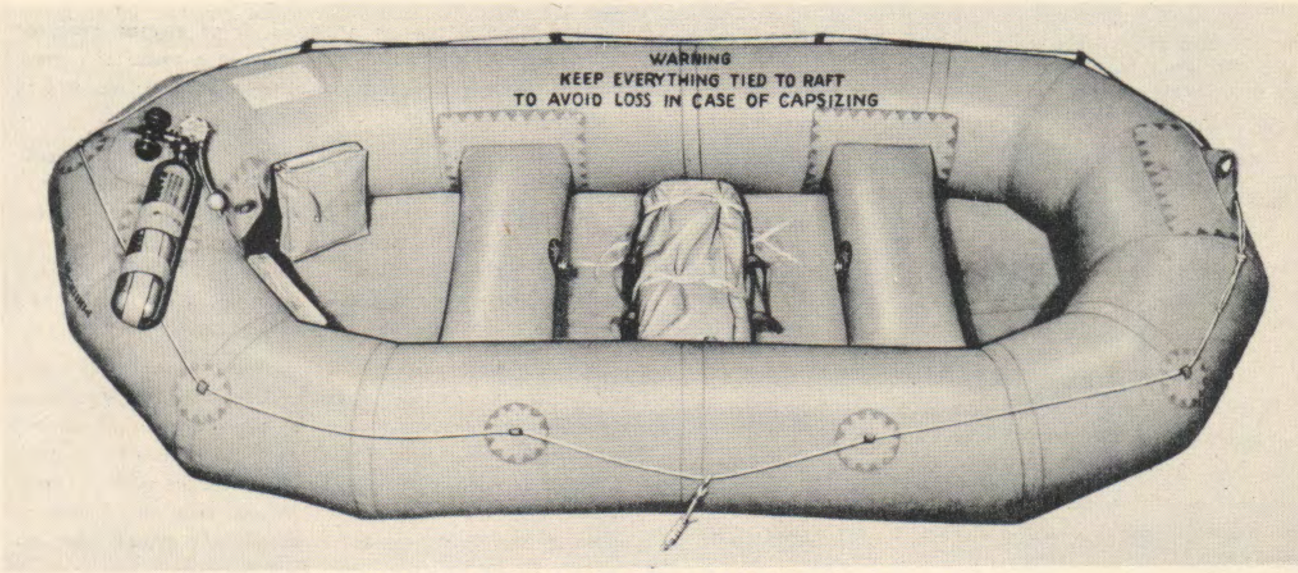
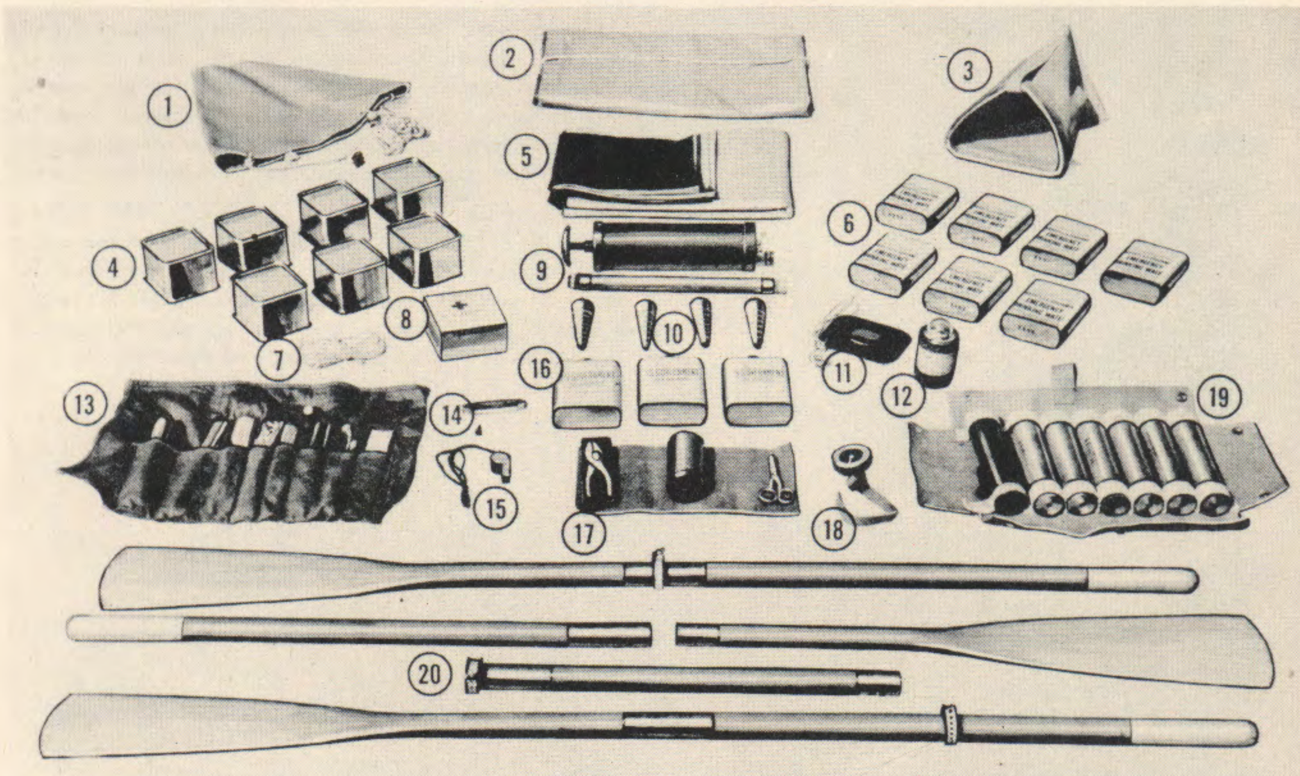


Figure 52—Type A-3 Life Raft



1. Sea anchor
2. Tarpaulin (Shade and Camouflage)
3. Bailing Bucket
4. Ration, Type A
5. Sail (Also Camouflage and Signal Cloth)
6. Emergency Drinking Water
7. Line
8. First Aid Kit
9. Inflating Pump
10. Puncture Plugs
11. Signaling Mirror
12. Flashlight
13. Fishing Tackle
14. Jackknife
15. Whistle
16. Sea Markers
17. Repair Patch Kit
18. Compass
19. Very Pistol
20. Oars

Items Not Illustrated but Also Included in Life Raft Kit are Mast, Water Container, Sun Ointment, Cellulose Sponge, and Religious Pamphlets

Figure 53—Life Raft Kit (Open)

b. COMMAND SET RECEIVER FAILURE.—The radio compass or liaison receivers can be substituted for the command set receiver.

Note

When substituting one receiver for another, such as the compass receiver for the command receiver, the pilot must move the interphone selector switch to "COMMAND" or "LIAISON" in order to transmit, and must switch back to the position of the receiver being used.

c. COMMAND SET TRANSMITTER FAILURE.—In case of failure of the command set transmitter, the liaison transmitter may be substituted.

d. IFF RADIO DESTROYER SWITCH. — The copilot has the necesary controls and is responsible for destroying the radio receiver if necessary. *(See figure 54.)*

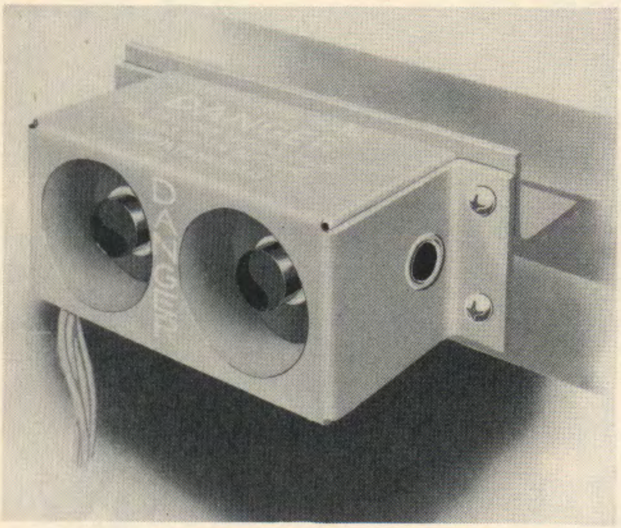


Figure 54—IFF Radio Destroyer Switch

Note

The IFF radio destroyer switch is paralleled by an inertia-type switch which is automatically energized by a crash landing.

16. EMERGENCY OPERATION OF TURBOSUPERCHARGER REGULATORS.

a. ELECTRONIC TURBOSUPERCHARGER REGULATOR.

(1) The pilot can, at any time, reduce the manifold pressure on one or more engines by retarding the corresponding throttle or throttles without changing the Turbo Boost Selector dial setting (Manifold Pressure Selector on some airplanes).

(2) In the event of electric power failure in the electronic turbosupercharger regulator system, the waste gate motor will hold the waste gate in whatever position it is in when the power failure occurs. An increase of throttle or of engine rpm, or a decrease in altitude will result in a manifold pressure increase which may be erroneously attributed to waste gate creepage.

(3) If, however, either of the two discriminator (7C5) tubes in the amplifier fails, leaving the other in operation, the movement of the waste gate motor and, consequently, of the waste gate will be in one direction only. Whether the waste gate moves toward the open or closed position will be indicated by the manifold pressure gage of the engine affected.

(4) Failure of inverter power, which will cause failure of the electronic turbosupercharger regulator system, may be recognized by the "freezing" of the autosyn instruments (fuel and oil pressure gages) or their remaining in a "fixed" position without any "hunting," or movement. When this condition is noticed, the pilot should immediately check the inverter power by turning a fuel booster pump switch to another position and noticing whether or not the corresponding fuel pressure gage reacts accordingly. If the inverter power has thus proved to have failed, the pilot should then switch to the other inverter, allowing approximately two minutes for the amplifiers to warm up. The same check should then be made by changing a booster pump switch setting to be sure that the second inverter is delivering power.

b. EMERGENCY OPERATION OF THE ELECTRONIC TURBO BOOST SELECTOR.—In the event of an extreme emergency, additional power may be secured by increasing the rpm to MAXIMUM, pressing the dial stop release, and turning the dial toward "10." This is emergency power and must not be used more than five minutes. *(See figure 55.)*

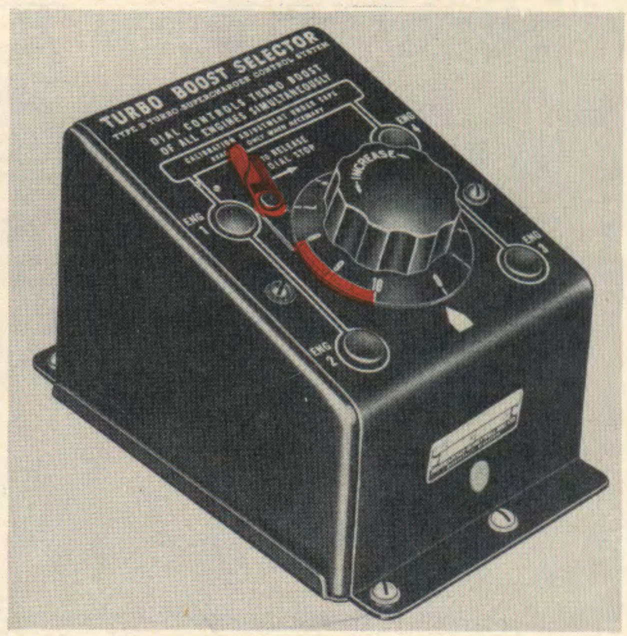
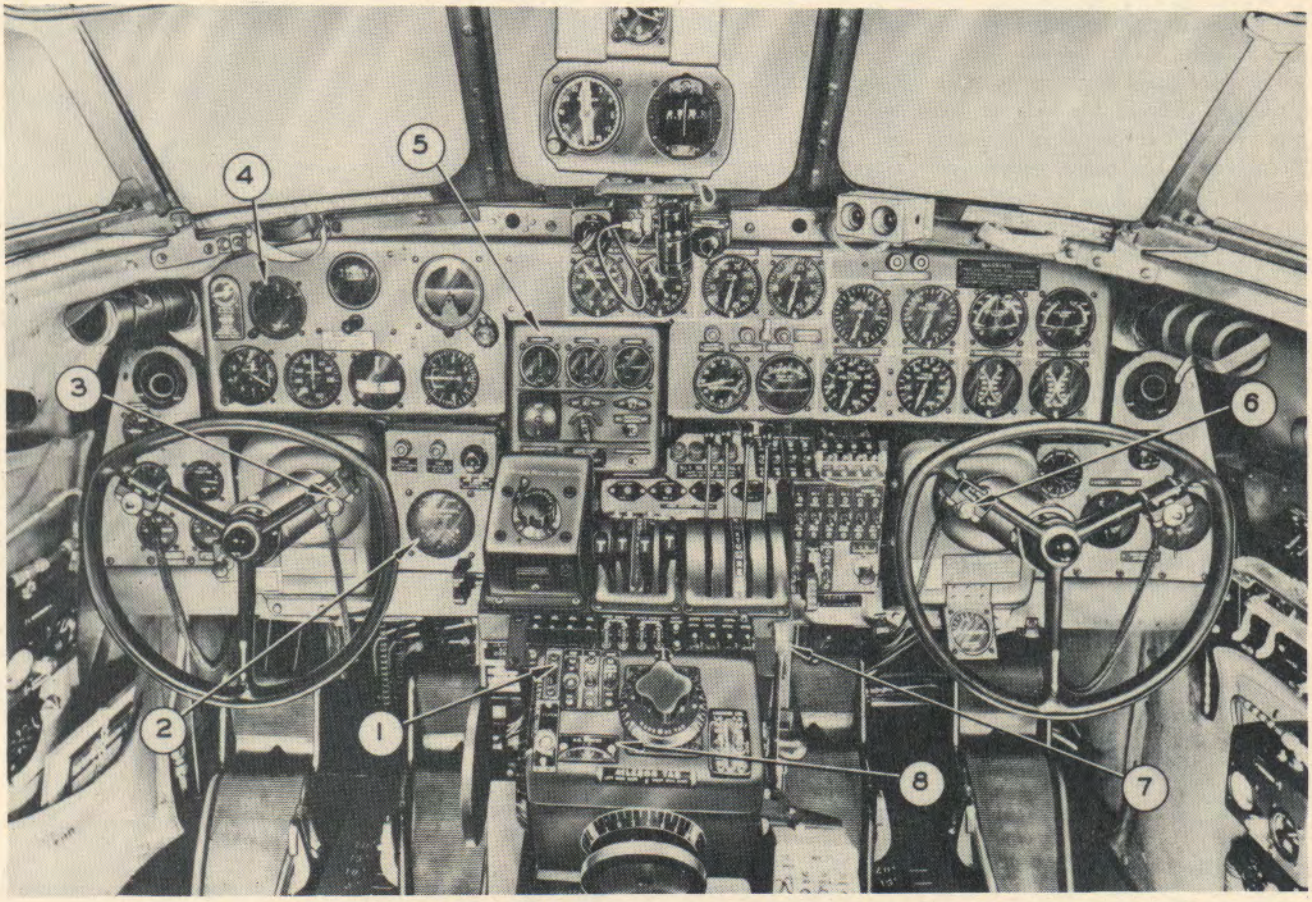


Figure 55—Turbo Boost Selector (Manifold Pressure Selector)



1. Number Three Inverter Switch
2. Banked Turn Control
3. A-5 Emergency Release Switch
4. Pilot Director Indicator
5. Automatic Pilot Control Unit
6. A-5 Emergency Release Switch
7. A-5 Emergency Release Handle
8. AC Power Inverter Switch

Figure 56—Pilots' Instruments and Controls (Groups I and II Airplanes)

CAUTION

The regulator dial must not be turned past "8" unless fuel, grade 100/130, Specification No. AN-F-28 is being used.

c. **OVERSPEEDING OF OIL PRESSURE REGULATED TURBOSUPERCHARGER.**

(1) Retard the throttle on the engine affected.

(2) Move the turbo regulator control lever to "OFF."

(3) Try to maintain the desired power with the throttle.

(4) Attempt to reset the turbosupercharger control regulator so that the turbosupercharger will not overspeed, by selecting a control lever position at which the turbosupercharger will stay within the operating limits.

(5) Maintain directional control with the rudder. Do not retard the throttle on an "opposite" engine to maintain control unless full rudder will not hold the airplane on a straight course.

(*6*) On take-off, do not feather the propeller for an engine if the turbosupercharger or propeller can be brought under control.

17. EMERGENCY RELEASE OF A-5 AUTOMATIC PILOT (Groups I and II).

a. **To release the A-5 automatic pilot temporarily, press the emergency release button on the pilot's or copilot's control wheel. *(See figure 56, item 6.)* To re-engage the system after pressing either button, turn the master control switch back to position "2" and repeat the procedure for turning on the A-5 automatic pilot. [See Section II, paragraph 13., *d.*, (2), *(b)*.] The master control switch may also be used in an emergency, by turning it "OFF" in the normal manner. *(See figure 22.)***

b. **If an emergency requires a rapid release of the A-5 automatic pilot for the remainder of a flight,**

pull the emergency release handle for the A-5 automatic pilot. *(See figure 56, item 7.)* This handle is located on the right side of the pilots' control pedestal. After this release handle has been pulled, the system cannot be re-engaged until the units have been reset by hand, when the airplane is on the ground.

18. HYDRAULIC SYSTEM FAILURES.

a. HYDRAULIC RESERVOIR EMERGENCY VALVE.—The hydraulic reservoir emergency valve provides an emergency supply of hydraulic fluid when the fluid level in the reservoir drops below the level of the hydraulic reservoir emergency valve. This valve is located on the hydraulic suction line, just aft of the hydraulic reservoir, and must be set in accordance with the following instructions:

(1) Keep the valve in the horizontal position for normal operation of the system (safety wired in the horizontal position).

(2) Turn the handle to the vertical position to make the reserve supply of fluid available when the fluid level (as indicated in the reservoir sight gage) in the reservoir drops below the level of the valve due to one of the following reasons ONLY:

(a) Slow leakage.

(b) Negligence in filling the tank.

(c) Damage or leak in the system which has been located and repaired.

WARNING

Turning the valve handle to the vertical position when there is a leak or damage in the system will cause the loss of the reserve supply of fluid in flight and make the operation of the entire hydraulic system impossible.

b. FAILURE OF NO. 3 ENGINE, OR ENGINE-DRIVEN PUMP.

(1) ON TAKE-OFF.

(a) Turn the auxiliary hydraulic pump to the "ON" position.

(b) Open the star valve.

(c) Place the landing gear selector valve handle in the "UP" position.

(d) After the landing gear selector valve kicks out, raise the flaps up to 8 degrees in slow steps.

(e) Close the star valve.

(2) IN FLIGHT.—Turn the auxiliary hydraulic pump to the "ON" position. The star valve must be fully closed (to charge the accumulators, for operation of the nose turret and the bomb bay doors).

(3) BEFORE LANDING. — When ready to lower the gear:

(a) Turn the auxiliary hydraulic pump to the "ON" position.

(b) Open the star valve (after the accumulators are charged).

(c) Extend the gear and flaps; then close the star valve and make a normal landing. (If there is any unusual delay between lowering of the gear and flaps, the switch should be turned off temporarily.)

(d) Engineer will stand by to open the star valve, in case of a "go around," to permit raising of the gears and flaps. Then the star valve will be closed.

c. FAILURE OF ENGINE-DRIVEN PUMP AND AUXILIARY HYDRAULIC PUMP.

(1) Place the selector valve in the desired position.

(2) Pump the hand pump (leaving the forward needle valve open and the aft needle valve closed).

d. SUCTION LINE BREAK BETWEEN TANK AND ENGINE PUMP, OR PRESSURE LINE BREAK BETWEEN ENGINE-DRIVEN PUMP AND PRESSURE CHECK VALVE.—Symptoms: Complete loss of open center system pressure, chattering of valves, or fluctuating pressure.

(1) Feather No. 3 engine if possible.

(2) Disconnect the line above the suction line check valve at station 5.1.

(3) If desired to save the engine-driven pump, leave No. 3 engine feathered. If power is needed, start No. 3 engine.

(4) Turn the three-way valve to vertical.

(5) Use the auxiliary hydraulic systems as if No. 3 engine were feathered.

e. COMPLETE FAILURE OF OPEN CENTER SYSTEM. — Symptoms: Loss of fluid, loss of open center system pressure. To correct: Use manual or emergency lowering methods.

Note

If break occurs in the return line from the landing gear selector valve to the tank, use steps (1), (2), (3), (4) and (5) in subparagraph *d.* above. (Returning fluid from the opposite side of actuating cylinder will be lost.)

f. ACCUMULATOR FAILURE.

(1) BREAK IN RIGHT ACCUMULATOR, OR RIGHT ACCUMULATOR LINE.

(a) The unloading valve goes to charging position, causing the loss of the open center system.

(b) Disconnect the line from the accumulator, or at break. Make a 3-inch crimp in the line and wrap with safety wire.

(2) BREAK IN LEFT ACCUMULATOR, OR LEFT ACCUMULATOR LINE.

(a) Fluid will flow out of break resulting in failure of the open center system.

(b) Crimp the left accumulator line for 3 inches and wrap with safety wire.

Note

Loss of the right accumulator results in failure of the inboard brakes, bomb bay doors, utility valve, and nose turret. Loss of the aft accumulator results in failure of the outboard brakes.

g. LANDING GEAR SYSTEM FAILURE.

(1) BROKEN LINE, SELECTOR VALVE TO ACTUATING CYLINDER.

(a) LANDING GEAR UP LINE, OPEN CENTER SYSTEM OPERATING. — The gear may be lowered hydraulically, but cannot be raised.

(b) LANDING GEAR DOWN LINE, OPEN CENTER SYSTEM OPERATING.

1. The gear may be raised hydraulically.

2. The gear must be lowered by manual methods.

h. MAIN LANDING GEAR FAILURES.

(1) LANDING GEAR FAILS TO LOCK IN THE "DOWN" POSITION.

(a) Check the selector valve kick-out pressure. Adjust if necessary.

(b) Hold the landing gear selector valve handle down. If this fails, hold the selector valve in the "DOWN" position and crank the manual lowering device clockwise (while facing aft) until the gear locks down.

(2) LANDING GEAR FAILS TO LOCK IN THE "UP" POSITION.

(a) Check the selector valve kick-out pressure. Adjust if necessary.

(b) Hold the selector valve handle in the "UP" position for a brief period. If this fails, check the manual lowering cables for tension. The cables may not be unwound sufficiently and may be holding the up-locks open.

(c) If neither of the above is successful, frequent placing of the selector valve handle in the "UP" position will keep the gear up because of hydraulic pressure. This is not recommended for long flights.

(3) LANDING GEAR FAILS TO RETRACT.

(a) Check for loss of hydraulic pressure.

(b) Unloading valve stuck in charging position. (1250 pounds per square inch brake pressure.) Tap the unloading valve lightly with a mallet.

(c) Check the manual lowering device. It may not be reset.

(d) If the above check out satisfactorily, check the kick-out pressure and override the selector valve.

(e) Latch linkage failure. Check the downlocks and land the airplane.

(4) LANDING GEAR FAILS TO LOWER.

(a) Check for loss of hydraulic pressure.

(b) Unloading valve stuck in the charging position (1250 pounds per square inch brake pressure.) Tap the valve lightly with mallet.

(c) Check the kick-out pressure; override the selector valve.

(d) Remove the pressure from the open center system (by feathering No. 3 engine; star valve closed). Lower the gear manually.

(5) ONE MAIN GEAR STICKS IN UP POSITION.

(a) Override the selector valve. If this fails:

1. Retract all gear.

2. Remove the pressure from the open center system. (Feather No. 3 engine, star valve closed.)

3. Hold the selector valve handle in the "DOWN" position.

4. Lower the gear by manual means.

(6) ONE GEAR JAMS WHILE OPERATING.

(a) Check the kick-out pressure.

(b) Override the selector valve. If this fails, lower the gear manually and land.

i. NOSE GEAR FAILURES.

(1) Fails to rise (failure of No. 3 engine or pump).

(a) Turn the auxiliary electric pump to the "ON" position.

(b) Open the star valve.

(c) Place the selector valve handle in the "UP" position.

(2) FAILS TO RAISE OR LOWER (LOCK FAILURE).

(a) Release the lock with screw driver.

(b) Override the selector valve.

(3) FAILS TO OPERATE (TOO LOW KICK-OUT PRESSURE).—Adjust the selector valve kick-out pressure.

(4) COMPLETE FAILURE (LINE BROKEN).

(a) Up line; gear will not retract.

(b) Down line; lower by manual method.

j. TAIL SKID FAILS TO LOWER.

(1) Hold the landing gear selector valve handle down.

(2) Remove the flooring and access door over the tail skid compartment.

(3) Push the tail skid out with the engine crank.

(4) Close the tail skid valves, right side of bomb bay, station 5.2.

k. FLAP SYSTEM FAILURE.

(1) COMPLETE FAILURE (EMERGENCY LOWERING).
(See figure 56A.)

(a) Close the forward needle valve.

(b) Open the aft needle valve.

(c) Hold the flap handle down.

(d) Operate the hand pump until it locks.

(e) Return the handle to neutral.

Note

If an intermediate flap setting is desired, close the aft needle valve to hold the flaps at the desired setting.

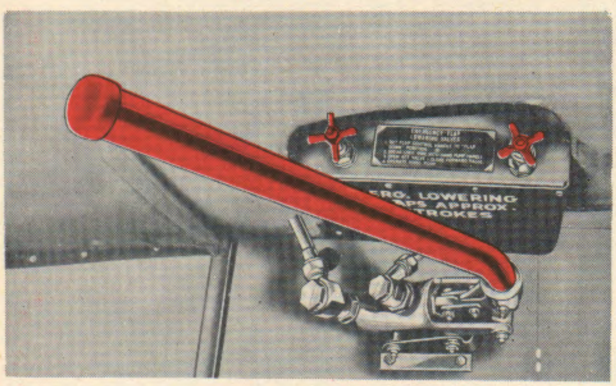


Figure 56A—Emergency Hydraulic Hand Pump and Emergency Flap Lowering Valves

(2) TO RETURN FLAPS AFTER EMERGENCY LOWERING, OR IF FLAPS REFUSE TO COME UP IN FLIGHT.

(a) PREFERRED METHOD.

1. Close the aft needle valve.

2. Open the forward needle valve.

3. Loosen (slightly) the union in the flap emergency line at station 3.1 on the diagonal beam under the flight deck.

4. Put the flap handle down momentarily and bleed off the fluid in the flap emergency line. (Return the shuttle valve to normal.)

5. Tighten the union.

6. Flaps may be raised by the open center system.

(b) ALTERNATE METHOD. (NO. 3 ENGINE FEATHERED, STAR VALVE CLOSED.)

1. Open both needle valves for approximately one minute.

2. Close the aft valve. Forward valve is open.

3. Raise the flaps with either the open center system pressure from engine-driven pump or the auxiliary hydraulic pump.

(3) FAILURE OF ENGINE-DRIVEN PUMP.

(a) Turn the auxiliary hydraulic pump to the "ON" position.

(b) Open the star valve (after accumulator is charged).

(c) Operate the flaps.

(4) FAILURE OF ENGINE-DRIVEN PUMP AND AUXILIARY HYDRAULIC PUMP.

(a) Leave the needle valves in normal position.

(b) Place the flap handle in the desired position.

(c) Operate the hand pump.

(5) HANDLE KICKS OUT BEFORE FULL FLAP TRAVEL, OR FLAPS STICK IN ONE POSITION.

(a) Flap kick-out setting too low. Adjust if necessary.

(b) Override the selector valve.

(6) ALTERNATE METHOD FLAP LOWERING. — Extreme emergency; no hydraulic pressure available; line intact from the landing gear and flap selector valves to the actuating cylinders.

(a) Disconnect or break the open center system pressure line between the flap selector valve and the bomb bay door selector valve in nose.

(b) Place the flap selector and landing gear selector valves in the "UP" position.

(c) Crank the landing gear down manually.

(d) When flaps reach full down, put the flap selector valve in neutral to lock in place.

l. BOMB DOOR SYSTEM FAILURE.

(1) COMPLETE FAILURE.

(a) Move the bombardier's or utility selector valve handle to the desired position. *(See figure 56B.)*

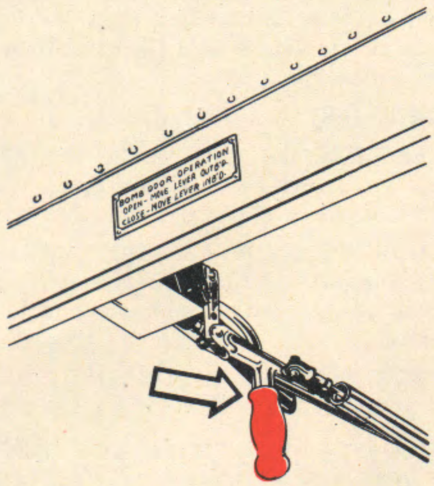


Figure 56B—Bomb Door Emergency and Utility Valve Handle

(*b*) Crank the doors to desired positions with the cranks at station 5.0. One crank is for the right hand doors and a second is for the left hand doors. Turn the cranks in the direction of arrows for desired position. *(See figure 56C.)*

(*c*) If cranking to close the bomb bay doors, the open locks must be disengaged manually.

(2) FAILURE OF OPEN CENTER SYSTEM.

Use the bomb bay utility valve under the flight deck.

CAUTION

If unable to recharge the accumulators, do not use the bomb door utility valve. Save for the brakes.

(3) FAILURE OF ENGINE-DRIVEN PUMP AND AUXILIARY HYDRAULIC PUMP.

(*a*) Use the bombardier's selector valve.

(*b*) Operate the hand pump.

(4) DOORS STOP PART WAY, OR SELECTOR VALVE KICKS OUT PREMATURELY.

(*a*) Check the selector valve kick-out pressure. Adjust if necessary.

(*b*) Check the tracks for obstructions.

(5) EMERGENCY BOMB RELEASE.

(*a*) BY PILOT.

1. If it is desired to release an armed salvo, order the bombardier to set the "NOSE FUSE" switch to "ARM" position.

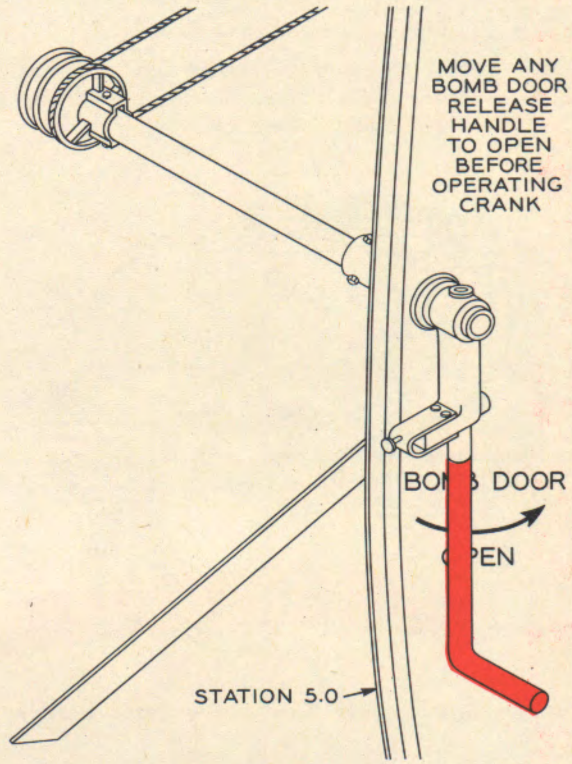


Figure 56C—Emergency Bomb Bay Door Hand Crank

2. Pull the "BOMB PULL," emergency bomb release (red) handle, at the rear of the pilots' pedestal *(see figure 56D)*. Pull upward on the handle until motion is stopped. Keep the handle pulled upward under tension. As soon as the bomb doors are fully opened, a further upward pull will be possible which will release the bombs.

CAUTION

After an emergency release of bombs by the pilot, the emergency bomb door cam (located on the right side of the nose wheel compartment) must be reset; and the locking pin (located on the left side of the nose wheel compartment) must be replaced in the slip rod assembly, in order to reset the bomb release system.

(*b*) BY BOMBARDIER.

1. Open the bomb bay doors by moving the "BOMB DOORS" selector valve handle to the "OPEN" position.

2. If an armed salvo is desired, set the "NOSE FUSE" switch to the "ARM" position.

3. Release the bombs by moving the "BOMB RELEASE" handle to the "SALVO" position.

(*c*) MANUALLY, IN THE BOMB BAY.

1. Open the bomb bay doors.

2. With a screw driver or similar tool, force the release lever of each bomb shackle past the hinged ear of the bomb rack release unit.

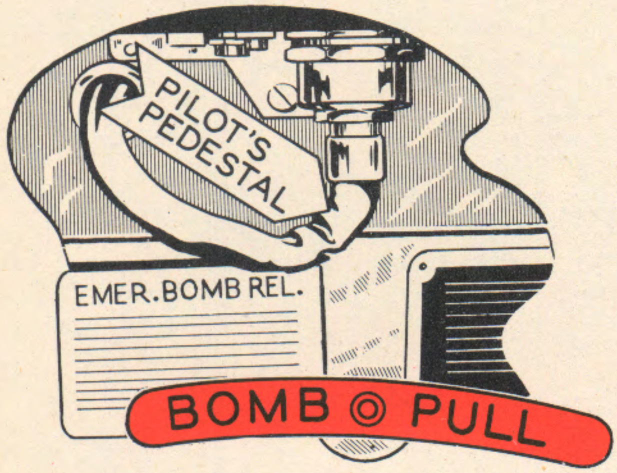


Figure 56D—Pilots' Emergency Bomb Release

(6) BOMB DOOR CREEPAGE. — Operate the bomb doors twice before leaving open for the bomb run, or have the navigator hold the bomb door utility valve open on the run.

m. BRAKE SYSTEM FAILURES.

(1) FAILURE OF ENGINE PUMP.—Maintain the accumulators with the auxiliary hydraulic pump in the "ON" position. Star valve closed.

(2) LOSS OF ENGINE-DRIVEN PUMP AND AUXILIARY HYDRAULIC PUMP. — Maintain the accumulator charge with the hand pump. Needle valves normal.

(3) LOSS OF ALL HYDRAULIC SYSTEMS (ACCUMULATORS CHARGED).

(*a*) Do not discharge the accumulators by use of the bomb door utility valve, nose turret or by checking brakes.

(*b*) Apply the brakes once and hold, after landing. Do not pump the brakes.

(4) BROKEN EXPANDER TUBE OR BRAKE LINE.—Loss of one-half brake efficiency.

(5) NO BRAKE PRESSURE.—See "Emergency Landing on Land," paragraph 13.

SECTION V
OPERATIONAL EQUIPMENT

(See figure 57.)

1. HEATING AND VENTILATING.

a. HEATING SYSTEMS.

Note

Groups I, II and early Group III airplanes are heated by Stewart-Warner combustion-type spot heaters. Later Group III airplanes utilize engine exhaust heat.

(1) COMBUSTION SPOT HEATERS.

(a) The flight deck and bombardier-navigator's compartment are heated by six Stewart-Warner, combustion-type spot heaters, controlled by switches at the right of the copilot and on the bombardier's control panel.

(b) There is a solenoid-operated shut-off valve in each heater fuel line. Manual shut-off valves forward of the front spar in the bomb bay permit shutting off the fuel supply to the heater in case of solenoid valve failure.

(c) If the manifold pressure on either No. 2 or No. 3 engine is reduced below 15 inches Hg, heaters will be extinguished by lack of fuel.

CAUTION

If heaters start smoking after being shut off, reduce manifold pressure on No. 2 and No. 3 engines to 15 inches Hg and turn on heaters until smoking stops. Then turn heaters off and resume manifold pressure.

(2) EXHAUST HEAT SYSTEM. *(See figure 58.)*—The flight deck and bombardier-navigator's compartment are heated indirectly by means of engine exhaust heat. Temperature of the air in the system is controlled automatically by a valve which admits cold air to the ducts when the temperature rises above certain preset limits.

Heat exchangers in the exhaust tail pipes in the two inboard engine nacelles warm the air for the system. The heating system is controlled by switches on the pilots' pedestal *(figure 59)*, by manually operated registers in the duct outlets *(figure 60)*, and by manually operated damper valves in the ducts.

Note

An electrically operated carbon monoxide detector system with a warning light and alarm reset button on the pilots' pedestal warns of the presence of an excess amount of carbon monoxide in the system. This condition may be caused by a leak in one of the heat exchangers. The cabin heat switches must be turned "OFF" immediately if the warning light shows. It is dangerous to operate the cabin heat system if the carbon monoxide detector is not installed or has not been tested and certified to be functioning properly.

(3) FLYING SUIT HEATER RECEPTACLES.—Each crew station has a receptacle for plugging in an electric suit heater.

(4) OPERATION OF HEAT ANTI-ICING AND CABIN HEATING SYSTEM.

(a) PILOTS' SWITCHES. *(See figure 59.)*—Ordinarily, only one cabin heat switch need be turned on for cabin heating. To increase the heat to the cabin with either the No. 2 or No. 3 switch on, the empennage anti-icing switch may be turned off if no icing conditions exist. This procedure will cut off hot air to the tail and direct more to the cabin.

CAUTION

Do not turn the empennage anti-icing switch off if both the No. 2 and No. 3 heating system switches are on.

To prevent formation of ice on wings, tail and windshield, turn on all cabin heat and anti-icing switches, including the empennage anti-icing switch, as soon as icing conditions are anticipated and before ice starts to form.

(b) MANUALLY CONTROLLED DAMPERS.

1. The damper controlling the two windshield ducts is over the forward end of the radio operator's table on the aft face of the armor plate behind the copilot's seat. This damper should be closed except to prevent the formation of ice or frost on the windshield.

2. The damper controlling the main heater duct, on the lower left side of the cabin, is located on the forward bulkhead of the left bomb bay near the top. The damper controlling the main heater duct, on the right side of the cabin, is located on the aft bulkhead of the radio operator's compartment near the floor on the right side. These dampers should not be closed except to divert more hot air to windshield defrosters. Cabin air heat should be controlled exclusively by the outlet shutters in the ducts and by switches No. 2 and No. 3.

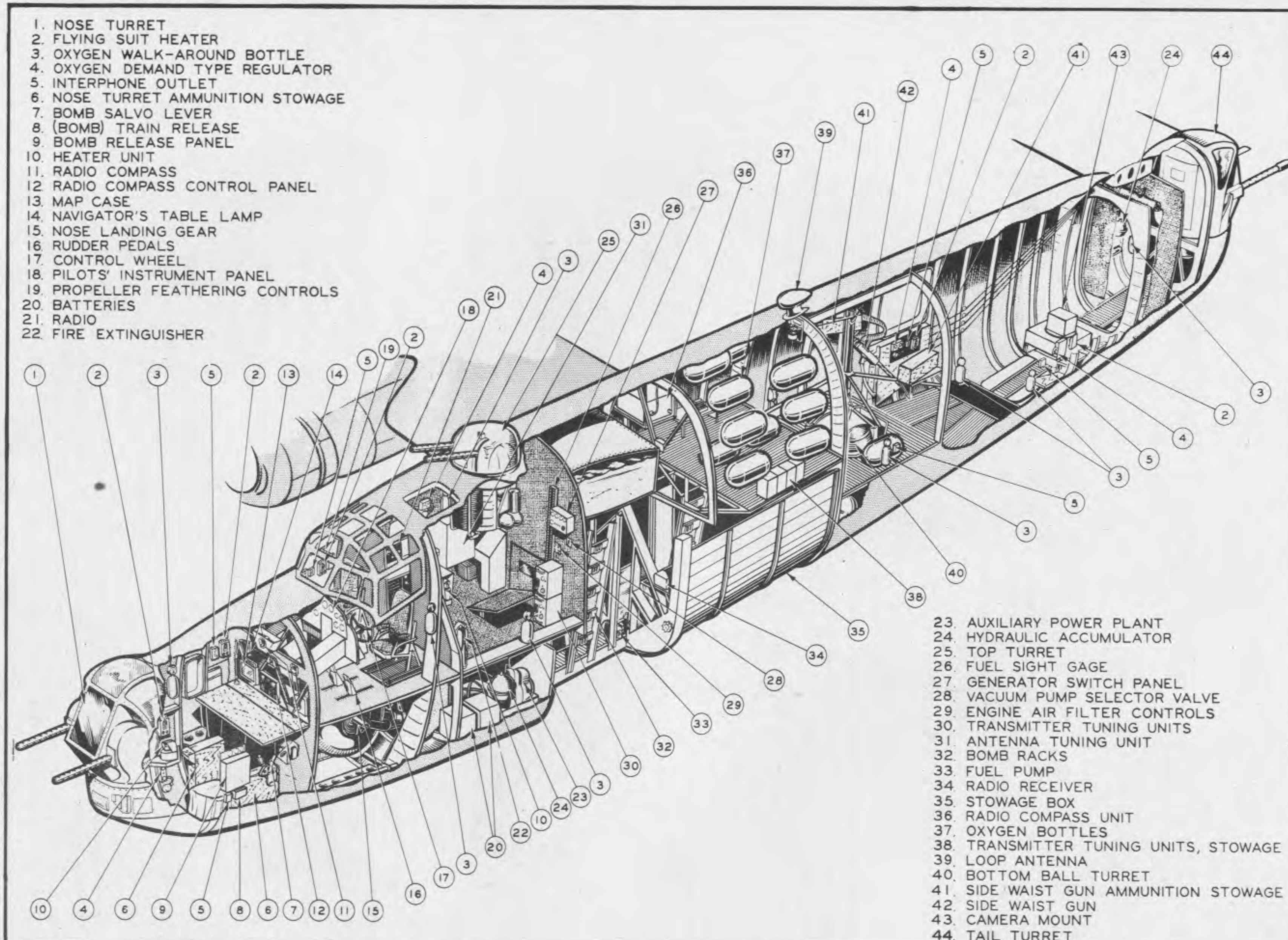


Figure 57—Fuselage Contents Diagram

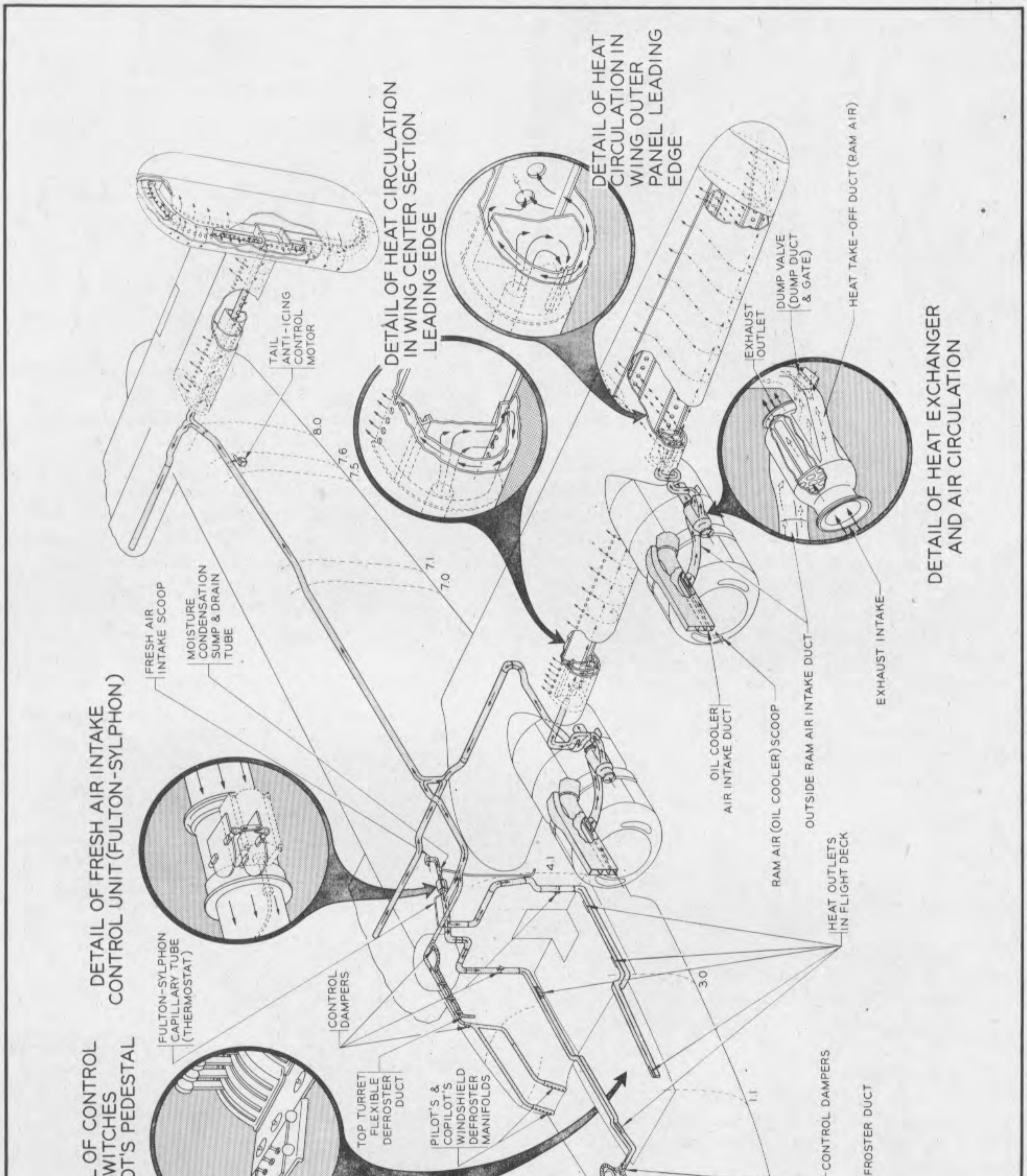


Figure 58—Exhaust Heat System for Interior Heating, Defrosting and Anti-Icing (B-24J)

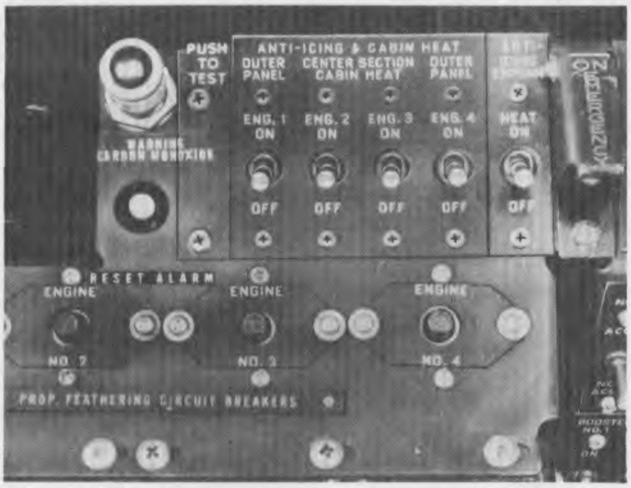


Figure 59—Heater System Switches (B-24J)

3. The damper controlling the top turret

3. The damper controlling the top turret defroster is located on the aft bulkhead of the radio operator's compartment above the main right duct control damper. Do not open the defroster damper except when necessary to defrost the top turret or compartment side windows.

4. The dampers controlling the ducts in the bombardier's compartment are located on the forward end of the copilot's heater duct in the nose compartment near the navigator's table. Do not open these dampers except when necessary for heating or defrosting in the bombardier's compartment.

(c) CARBON MONOXIDE DETECTOR.—A warning light on the pilots' pedestal will indicate the presence of carbon monoxide in the cabin air in the event of a leak in one of the heat exchangers. A button near the warning light resets the warning light relay when the danger of carbon monoxide is no longer present.

After the instrument is turned on, a warm-up period of 15 minutes must be allowed before an accurate indication may be obtained from the carbon monoxide detector. During this time the warning light may come on but it is not necessarily an indication that there is carbon monoxide present in the heating system. At the end of the warm-up period, press the reset button on the pilot's pedestal. If the warning light is not immediately extinguished, turn the cabin heat controls to the "OFF" position immediately

CAUTION

Turn all cabin heat controls to the "OFF" position during actual combat. The heating system may be turned on again after enemy action has ceased, if it has been definitely determined that no damage has been done to the system.

b. VENTILATING SYSTEM.—Pilot and copilot obtain fresh air through ducts leading to the outboard ends of the instrument panel where ball-and-socket outlets control the air intake. Fresh air is supplied to the radio operator's compartment by two ventilating ducts, one on each side wall.

2. DEMAND OXYGEN SYSTEM.

(See figure 61.)

a. GENERAL.—The demand oxygen system provides the user with the proper amount of oxygen at all altitudes and under all conditions. The percentage of oxygen delivered increases with altitude up to 100 per cent at approximately 30,000 feet. The operation is completely automatic and requires no adjustment on the part of the user.

(1) The demand-type oxygen system consists of 26 type G-1 cylinders and a regulator panel at each crew station. A blinker flow indicator and a pressure gage are mounted on each panel. This is a low pressure system. Portable "walk-around" cylinders, which can be replenished from the main system at any regulator, are stowed in clips on the fuselage, but in an emergency they may be removed and carried to any position on the airplane. The demand regulator automatically delivers the proper air-oxygen mixture required at high altitudes. A manual valve marked "AUTO-MIX" is provided to shut off the air when pure oxygen is required. The emergency valve permits a steady flow of oxygen when desired.

(2) The system filler valve is on the left side of the airplane aft of the bomb bays and it is accessible from the outside.

b. REGULATOR. — A demand regulator is installed as a permanent fixture at each crew station in the airplane. Two manual controls are provided for use in special instances as required. *(See figures 62 and 63.)*

Figure 60—Heat Registers in Radio Compartment (B-24J)

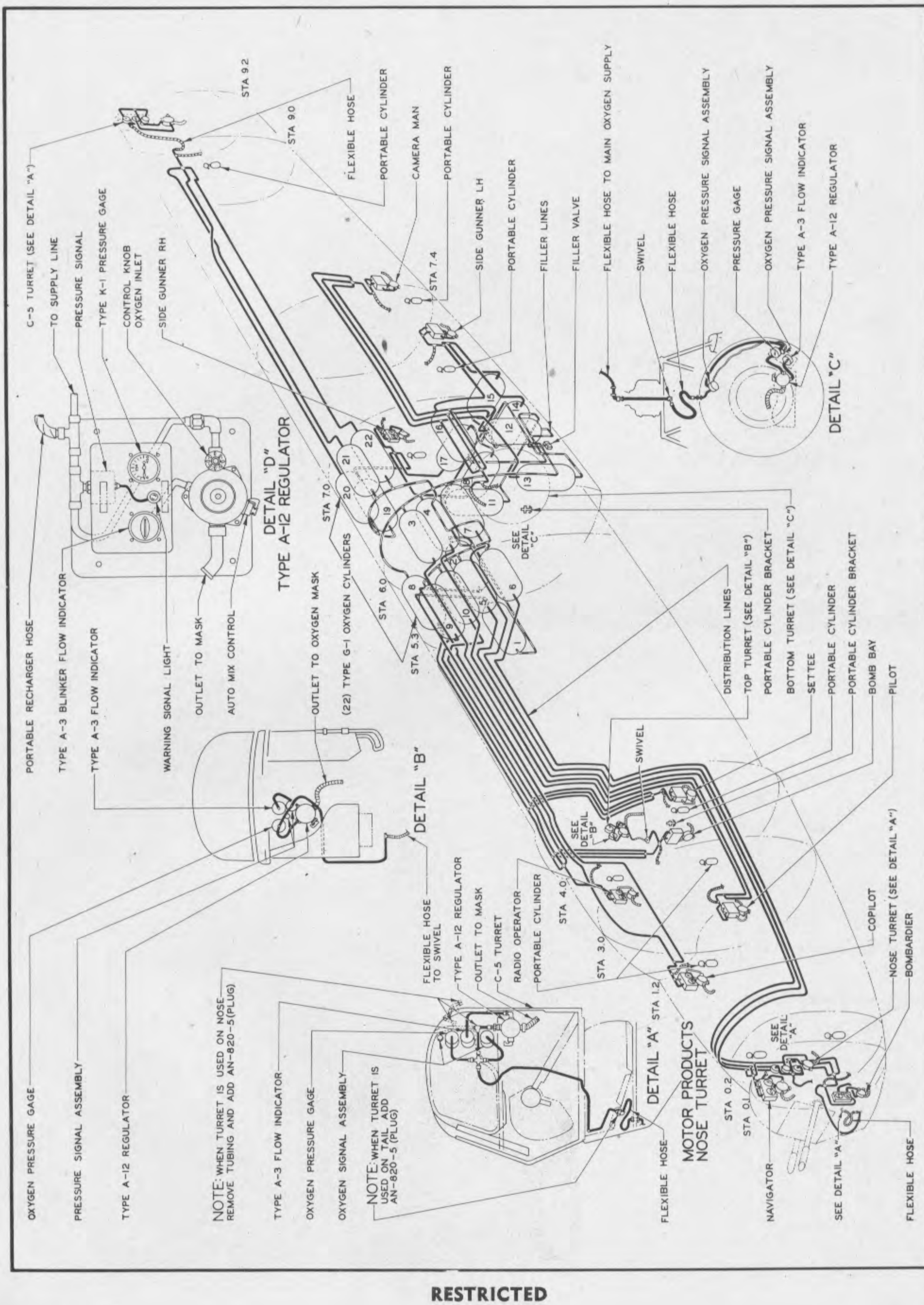


Figure 61—Demand Oxygen System

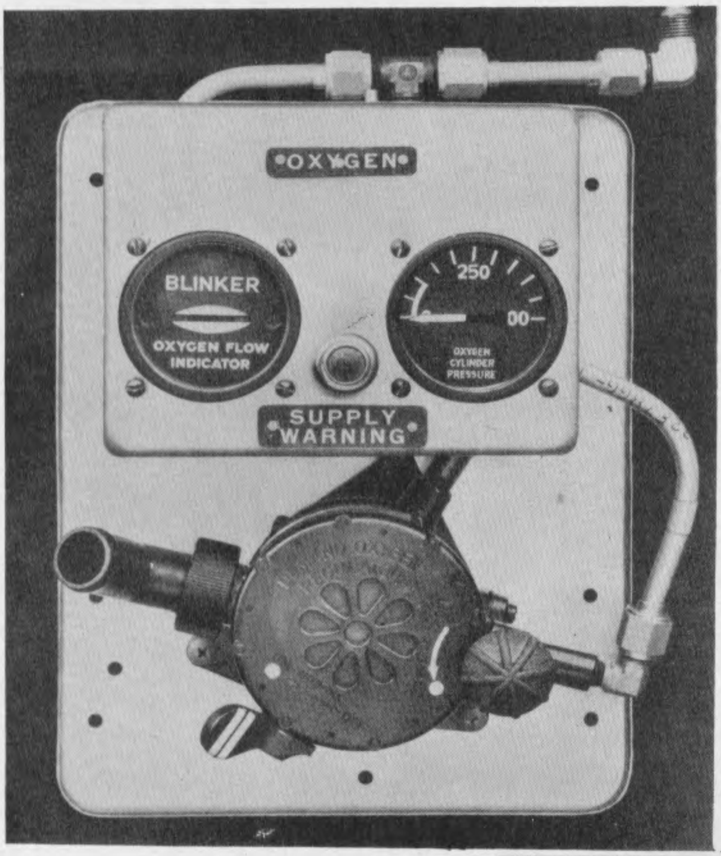


Figure 62—Oxygen Panel, "Aro" Type A-12 Regulator

Figure 63—Oxygen Panel, "Pioneer" Type A-12 Demand Regulator

MAN HOURS OF AVAILABLE OXYGEN

AIRCO REGULATORS (A-12)

PILOT—COPILOT (2 G-1 Cylinders Each)

Gage Pres. / Alt. Ft.	400	350	300	250	200	150	100	50
40,000	16.6 / 16.6	14.3 / 14.3	11.8 / 11.8	9.5 / 9.5	7.1 / 7.1	4.8 / 4.8	2.3 / 2.3	E
35,000	11.8 / 11.8	10.1 / 10.1	8.4 / 8.4	6.7 / 6.7	5.1 / 5.1	3.4 / 3.4	1.7 / 1.7	M
30,000	8.6 / 8.8	7.4 / 7.6	6.1 / 6.2	4.9 / 5.0	3.7 / 3.8	2.5 / 2.5	1.2 / 1.2	E
25,000	6.6 / 8.4	5.6 / 7.2	4.6 / 6.0	3.7 / 4.8	2.8 / 3.6	1.9 / 2.4	0.9 / 1.2	R
20,000	5.2 / 9.4	4.5 / 8.1	3.7 / 6.7	3.0 / 5.3	2.2 / 4.0	1.5 / 2.7	0.7 / 1.3	G
15,000	4.0 / 11.4	3.4 / 9.8	2.8 / 8.1	2.3 / 6.5	1.7 / 4.9	1.2 / 3.3	0.6 / 1.6	E
10,000	3.2 / 19.4	2.7 / 16.7	2.3 / 13.8	1.8 / 11.0	1.4 / 8.3	0.9 / 5.6	0.4 / 2.7	N
5,000	2.6 / —	2.2 / —	1.8 / —	1.5 / —	1.1 / —	0.7 / —	0.4 / —	C
S. L.	2.2 / —	1.9 / —	1.6 / —	1.2 / —	0.9 / —	0.6 / —	0.3 / —	Y

OTHER CREW MEMBERS (3 G-1 Cylinders Each)

Gage Pres. / Alt. Ft.	400	350	300	250	200	150	100	50
40,000	24.9 / 24.9	21.4 / 21.4	17.7 / 17.7	14.2 / 14.2	10.7 / 10.7	7.2 / 7.2	3.5 / 3.5	E
35,000	17.7 / 17.7	15.2 / 15.2	12.5 / 12.5	10.1 / 10.1	7.6 / 7.6	5.1 / 5.1	2.5 / 2.5	M
30,000	12.9 / 13.2	11.1 / 11.3	9.1 / 9.4	7.3 / 7.5	5.5 / 5.7	3.7 / 3.8	1.8 / 1.8	E
25,000	9.9 / 12.6	8.4 / 10.8	6.9 / 8.9	5.6 / 7.2	4.2 / 5.4	2.8 / 3.6	1.4 / 1.7	R
20,000	7.8 / 14.1	6.8 / 12.1	5.5 / 10.0	4.4 / 8.0	3.3 / 6.1	2.2 / 4.1	1.1 / 1.9	G
15,000	6.0 / 17.1	5.2 / 14.7	4.3 / 12.1	3.4 / 9.7	2.6 / 7.3	1.7 / 4.9	0.8 / 2.4	E
10,000	4.8 / 29.1	4.1 / 25.0	3.4 / 20.5	2.7 / 16.6	2.1 / 12.3	1.4 / 8.4	0.7 / 4.0	N
5,000	3.9 / —	3.3 / —	2.8 / —	2.1 / —	1.7 / —	1.1 / —	0.6 / —	C
S. L.	3.3 / —	2.8 / —	2.3 / —	1.9 / —	1.4 / —	0.9 / —	0.4 / —	Y

TOP TURRET GUNNER (2 D-2 Cylinders)

Gage Pres. / Alt. Ft.	400	350	300	250	200	150	100	50
40,000	4.0 / 3.8	3.4 / 3.3	2.8 / 2.3	2.2 / 2.2	1.8 / 1.6	1.2 / 1.1	0.6 / 0.5	E
35,000	2.8 / 2.8	2.4 / 2.4	2.0 / 2.0	1.6 / 1.6	1.2 / 1.2	0.8 / 0.8	0.4 / 0.4	M
30,000	2.2 / 2.2	1.8 / 1.9	1.6 / 1.6	1.2 / 1.2	1.0 / 0.9	0.6 / 0.6	0.4 / 0.3	E
25,000	1.6 / 2.0	1.4 / 1.7	1.2 / 1.4	1.0 / 1.1	0.6 / 0.9	0.4 / 0.6	0.2 / 0.3	R
20,000	1.2 / 2.4	1.0 / 2.0	0.8 / 1.7	0.6 / 1.4	0.6 / 1.0	0.4 / 0.7	0.16 / 0.3	G
15,000	1.0 / 2.8	0.8 / 2.4	0.8 / 2.0	0.6 / 1.6	0.4 / 1.2	0.2 / 0.8	0.12 / 0.4	E
10,000	0.8 / 4.8	0.6 / 4.1	0.5 / 3.4	0.4 / 2.7	0.3 / 2.0	0.2 / 1.3	0.3 / 0.6	N
5,000	0.6 / —	0.4 / —	0.4 / —	0.3 / —	0.2 / —	0.1 / —	0.1 / —	C
S. L.	0.4 / —	0.4 / —	0.2 / —	0.2 / —	0.1 / —	0.1 / —	0.1 / —	Y

PIONEER REGULATORS (A-12)

PILOT—COPILOT (2 G-1 Cylinders Each)

Gage Pres. / Alt. Ft.	400	350	300	250	200	150	100	50
40,000	16.6 / 16.6	14.3 / 14.3	11.8 / 11.8	9.5 / 9.5	7.1 / 7.1	4.8 / 4.8	2.3 / 2.3	E
35,000	11.8 / 12.0	10.1 / 10.3	8.4 / 9.5	6.7 / 6.8	5.1 / 5.2	3.4 / 3.5	1.7 / 1.7	M
30,000	8.6 / 9.0	7.4 / 7.7	6.1 / 6.4	4.9 / 5.1	3.7 / 3.8	2.5 / 2.6	1.2 / 1.3	E
25,000	6.6 / 8.8	5.6 / 7.4	4.6 / 6.2	3.7 / 5.0	2.8 / 3.8	1.9 / 3.5	0.9 / 1.2	R
20,000	5.2 / 15.6	4.5 / 13.4	3.7 / 11.1	3.0 / 8.9	2.2 / 6.7	1.5 / 4.5	0.7 / 2.2	G
15,000	4.0 / 15.2	3.4 / 13.1	2.8 / 10.8	2.3 / 8.6	1.7 / 6.5	1.2 / 4.4	0.6 / 2.1	E
10,000	3.2 / 15.0	2.7 / 12.9	2.3 / 10.6	1.8 / 8.5	1.4 / 6.4	0.9 / 4.3	0.4 / 2.1	N
5,000	2.6 / 11.4	2.2 / 9.8	1.8 / 8.1	1.5 / 6.5	1.1 / 4.9	0.7 / 3.3	0.4 / 1.6	C
S. L.	2.2 / 12.0	1.9 / 10.3	1.6 / 8.5	1.2 / 6.8	0.9 / 5.2	0.6 / 3.5	0.3 / 1.7	Y

OTHER CREW MEMBERS (3 G-1 Cylinders Each)

Gage Pres. / Alt. Ft.	400	350	300	250	200	150	100	50
40,000	24.9 / 24.9	21.4 / 21.4	17.7 / 17.7	14.2 / 14.2	10.7 / 10.7	7.2 / 7.2	3.5 / 3.5	E
35,000	17.7 / 18.0	15.2 / 15.5	12.5 / 12.8	10.1 / 10.3	7.6 / 7.7	5.1 / 5.2	2.5 / 2.5	M
30,000	12.9 / 13.5	11.1 / 11.6	9.1 / 9.6	7.3 / 7.7	5.5 / 5.8	3.7 / 3.9	1.8 / 1.9	E
25,000	9.9 / 13.2	8.4 / 11.0	6.9 / 9.4	5.6 / 7.5	4.2 / 5.7	2.8 / 3.8	1.4 / 1.8	R
20,000	7.8 / 23.4	6.8 / 20.1	5.5 / 16.6	4.4 / 13.3	3.3 / 10.0	2.2 / 6.8	1.1 / 3.3	G
15,000	6.0 / 22.8	5.2 / 19.6	4.3 / 16.2	3.4 / 13.0	2.6 / 9.8	1.7 / 6.6	0.8 / 3.2	E
10,000	4.8 / 22.5	4.1 / 19.3	3.4 / 16.0	2.7 / 12.8	2.1 / 9.7	1.4 / 6.5	0.7 / 3.1	N
5,000	3.9 / 16.1	3.3 / 14.7	2.8 / 12.1	2.1 / 9.7	1.7 / 7.3	1.1 / 4.9	0.6 / 2.3	C
S. L.	3.3 / 18.0	2.8 / 15.5	2.3 / 12.8	1.9 / 10.3	1.4 / 7.7	0.9 / 5.2	0.4 / 2.5	Y

TOP TURRET GUNNER (2 D-2 Cylinders)

Gage Pres. / Alt. Ft.	400	350	300	250	200	150	100	50
40,000	4.0 / 3.8	3.4 / 3.3	2.8 / 2.7	2.2 / 2.2	1.8 / 1.6	1.2 / 1.1	0.6 / 0.5	E
35,000	2.8 / 2.9	2.4 / 2.5	2.0 / 2.0	1.6 / 1.6	1.2 / 1.2	0.8 / 0.8	0.4 / 0.4	M
30,000	2.2 / 2.2	1.8 / 1.9	1.6 / 1.6	1.2 / 1.3	1.0 / 0.9	0.6 / 0.2	0.4 / 1.0	E
25,000	1.6 / 2.3	1.4 / 2.0	1.2 / 1.6	1.0 / 1.3	0.6 / 1.0	0.4 / 0.6	0.2 / 0.3	R
20,000	1.2 / 3.7	1.0 / 3.2	0.8 / 2.6	0.6 / 2.3	0.6 / 1.6	0.4 / 1.0	0.16 / 0.5	G
15,000	1.0 / 3.5	0.8 / 3.0	0.8 / 2.5	0.6 / 2.0	0.4 / 1.5	0.2 / 1.0	0.12 / 0.5	E
10,000	0.8 / 3.5	0.6 / 3.0	0.6 / 2.5	0.4 / 1.6	0.4 / 1.3	0.2 / 1.0	0.12 / 0.5	N
5,000	0.6 / 2.8	0.4 / 2.4	0.4 / 2.0	0.4 / 1.6	0.2 / 1.2	0.18 / 0.8	0.10 / 0.4	C
S. L.	0.4 / 2.9	0.4 / 2.5	0.2 / 2.0	0.2 / 1.6	0.14 / 1.2	0.12 / 0.8	0.06 / 0.4	Y

BLACK FIGURES INDICATE AUTO-MIX "ON"—RED FIGURES INDICATE AUTO-MIX "OFF"

USE OXYGEN INTELLIGENTLY

USE OXYGEN ABOVE 10,000 FEET ON ALL FLIGHTS.

USE OXYGEN FROM THE GROUND UP, AT NIGHT, OR ON RAPID ASCENTS TO HIGH ALTITUDE.

BREATHE NORMALLY.

ADJUST YOUR MASK CAREFULLY AND ELIMINATE LEAKS BEFORE TAKE-OFF.

★ BE FAMILIAR WITH YOUR OXYGEN EQUIPMENT AND ITS USE. ★

REPORT FAULTY FUNCTION OF OXYGEN EQUIPMENT PROMPTLY AND INSURE CORRECTION.

CHECK YOUR OXYGEN EQUIPMENT FREQUENTLY DURING FLIGHT.

DON'T FAIL TO CHECK ALL OXYGEN EQUIPMENT BEFORE TAKE-OFF.

DON'T FAIL TO INSURE FULL CYLINDER PRESSURE AND AN ADEQUATE SUPPLY OF OXYGEN FOR YOUR MISSION.

★ DON'T FAIL TO USE YOUR OWN FITTED MASK AND NECESSARY CONNECTING TUBING. ★

DON'T LEAVE YOUR WALK-AROUND AND BAIL-OUT OXYGEN BOTTLES IN YOUR LOCKER. YOU MAY NEED THEM.

DON'T WASTE YOUR OXYGEN SUPPLY BY EXCESSIVE AND NEEDLESSLY HIGH FLOWS.

DON'T TAKE LIBERTIES AT HIGH ALTITUDE BY WALKING ABOUT THE AIRCRAFT WITHOUT PORTABLE OXYGEN BOTTLES, OR BY NOT TURNING ON THE OXYGEN SUPPLY IN TIME.

CAUTION

EXTREME CAUTION MUST BE EXERCISED TO INSURE THAT OXYGEN EQUIPMENT DOES NOT BECOME CONTAMINATED WITH OIL OR GREASE. FIRE OR EXPLOSION MAY RESULT WHEN EVEN SLIGHT TRACES OF OIL AND GREASE COME IN CONTACT WITH OXYGEN UNDER PRESSURE.

(1) AUTO-MIX.—The normal position of the auto-mix control is "ON" (the luminous spot on the auto-mix handle lined up approximately with the radiant spot on the regulator). In this position the regulator automatically mixes the proper amount of air with the oxygen at all altitudes. When the auto-mix is "OFF" (the spot on the handle hidden), the air port is shut off and the regulator will then give pure oxygen at all altitudes. When the auto-mix is "OFF," the regulator is still a demand regulator and will automatically furnish oxygen on demand, but it will furnish pure oxygen.

(2) When the ARO demand regulator is used, the AUTO-MIX control must be turned "OFF" before the emergency valve is turned "ON"; otherwise, oxygen will escape through the AUTO-MIX valve.

_c._ EMERGENCY VALVE. — Opening the emergency valve converts the demand system to free flow, and is an emergency device to be used only if the demand system fails to function. It is extremely wasteful of the oxygen if it is used when it is not needed.

d. FLOW INDICATOR.—Two types of flow indicators are used. Early airplanes have type A-1 indicators which register flow of oxygen by rise and fall of a ball in a glass tube. Later airplanes have type A-3 indicators in which the flow of oxygen is indicated by movement of luminous "blinker" shutters seen through a glass window *(see figure 62).* When the A-3 indicators are connected to type A-12 (ARO) regulators, they operate on a negative pressure created by inhalation, and "blink" shut. When connected to type A-12 (Pioneer) regulators, the indicators operate on a positive pressure and "blink" open with each inhalation.

The flow indicator may show that no oxygen is flowing from the regulator when the airplane is on the ground or at low altitude and the auto-mix is "ON." The regulator does not necessarily function to add any oxygen at low altitudes.

e. PRESSURE GAGE. — The pressure gage shows the pressure in the supply cylinders for that station.

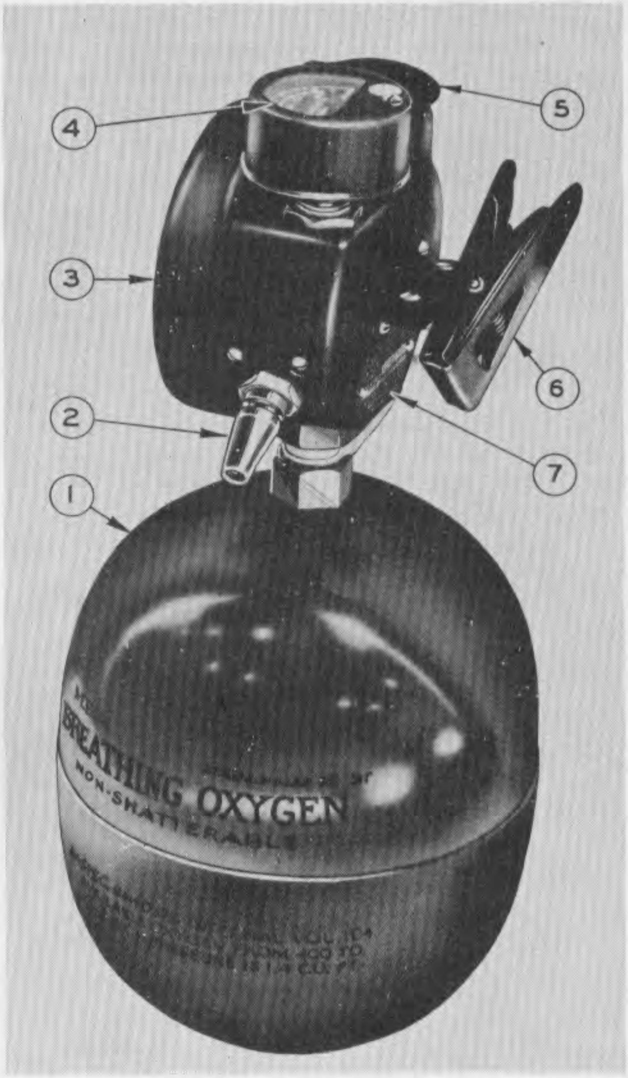
3. PORTABLE OXYGEN EQUIPMENT.

(See figure 64.)

Portable "walk-around" oxygen cylinders, which may be refilled at any regulator, are provided to permit the crew to move about safely during flight.

a. Check to see that there is a "walk-around" cylinder at each station, filled to 425 (minimum), 450 (maximum) pounds per square inch and in working order.

b. In flight above 10,000 feet, always use a "walk-around" unit when moving from one station to another.



1. A-4 Cylinder
2. Filler Valve
3. Case
4. Pressure Gage
5. Oxygen Mask Hose Outlet Connection
6. Clothing Clip
7. Name Plate

Figure 64—Walk-Around Oxygen Cylinder and Regulator

4. COMMUNICATIONS EQUIPMENT.

Note

This airplane is equipped with head-set adapters which require the use of low impedence head sets, HS-33 or HS-38.

a. DESCRIPTION.—Groups I, II and III airplanes are equipped with interphone and radio systems for performance of various functions. These functions include intercommunication between crew members, intercommunication between the airplane and ground stations or other airplanes, and reception of directional, marker beacon and ground identification signals.

The following sets are installed on the airplane:

INTERPHONE.—Stations are installed for the nose turret gunner, bombardier, navigator, pilot, co-pilot, radio operator, top turret gunner, bottom turret gunner, right side gunner, left side gunner, camera operator and tail gunner. An interphone station is also located at station 5.0.

COMMAND RADIO.—The transmitter control box is on the aft end of the pilots' pedestal. The receiver control box is overhead above the pilots' pedestal. *(See figures 66 and 67.)*

LIAISON RADIO.—The transmitter is on the floor beneath the radio operator's table, and the receiver is on the forward end of the table.

RADIO COMPASS.—The pilot's control box is overhead in the flight compartment and the navigator's control box is above the navigator's table.

MARKER BEACON.—The indicator light is on the instrument panel to the right of the automatic flight controls.

IFF.—The control boxes are on the right side wall of the radio compartment.

EMERGENCY RADIO SET.—Radio set SCR-578-A or SCR-578-B is stowed in a compact unit for emergency use, on the command deck.

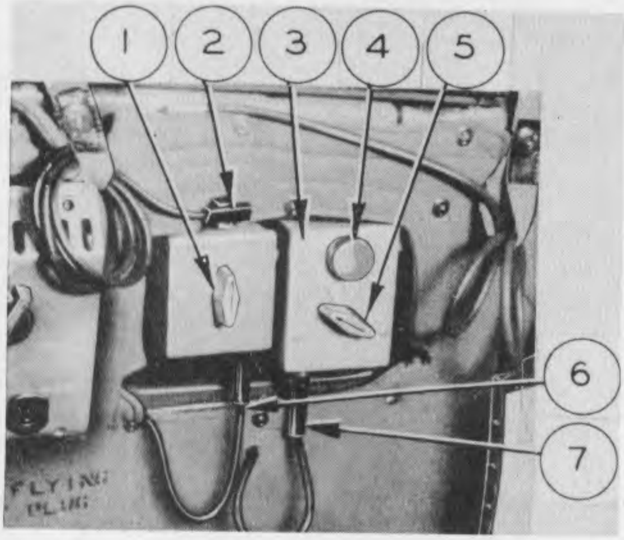
b. GENERAL OPERATING INSTRUCTIONS.

(1) Plug the head set into the head-set disconnector cord (the cord must be plugged into the interphone jack-box "PHONES" jack) and plug the throat microphone into its jack. *(See figure 65.)* At the radio operator's position, plug the microphone into the microphone disconnector cord (the cord must be plugged into the microphone jack-box "MIC" jack).

(2) Set the interphone jack-box selector switch on the applicable position and turn the "INCREASE OUTPUT" knob fully clockwise. If listening to radio sets having operating controls at other positions, the head-set volume can be regulated with "INCREASE OUTPUT" knob.

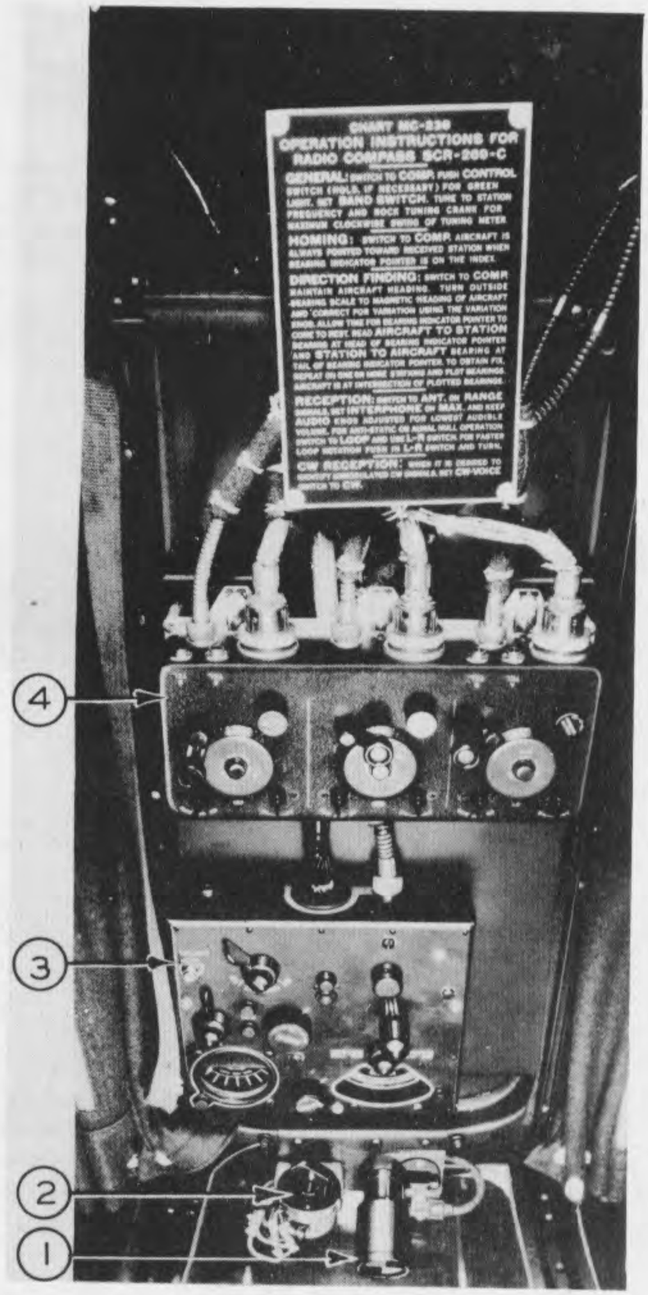
(3) If the airplane is not in flight, start the auxiliary power equipment and turn on the battery switches and the master ignition switch. When operation of communication equipment is complete, turn off these switches and stop the auxiliary power unit.

c. COMMAND RADIO.—Can be controlled only at pilot's position, but may be operated from any interphone jack box after adjustment has been made by the pilot.



1. BC-345 Switch Box (Range, Voice, CW)
2. Head-Set Plug
3. Interphone Control Box
4. Interphone Volume Control Rheostat
5. Interphone Selector Knob
6. Headphone Plug-In
7. Microphone Plug-In

Figure 65—Filter Switch Box and Interphone Jack Box



1. Fluorescent Light
2. Fluorescent Light Rheostat
3. Pilot's Radio Compass Control Box (BC-434)
4. Command Radio Receiver Control Box (BC-450)

Figure 66—Radio Controls in Top of Pilots' Compartment

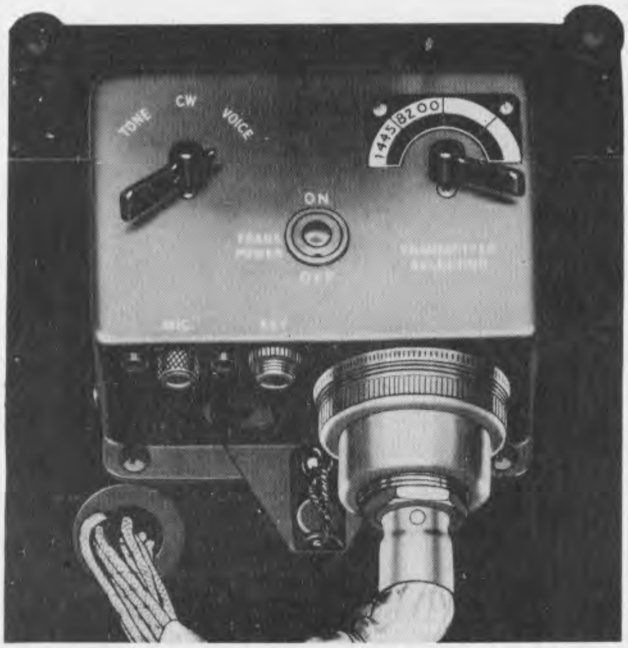


Figure 67—Command Transmitter Control Box

(1) COMMAND RADIO (SCR-274-N).—Set the interphone jack box on "COMMAND," then receive and transmit by conventional use of headset and throat microphone.

(2) COMMAND RADIO (SCR-522).—Audio output only is available on the "COMMAND" position of the interphone jack box.

d. LIAISON RADIO (SCR-287). *(See figures 72 and 73.)*—This equipment can be controlled only at the radio operator's position, but it may be operated by the pilot or copilot after the necessary operating adjustments have been made by the radio operator. Audio output only is available at all other stations with the interphone jack box on "LIAISON." Cutting in on liaison signals being used by radio operator will affect his head-set volume.

Note

The following instructions include only sufficient information to operate the liaison radio. More efficient operation, based on an extensive knowledge of the equipment, can be attained by the radio operator. An abbreviated set of instructions, based on flight operating tests with the installation in each particular airplane, should be available to personnel who may be required to operate this equipment.

(1) RECEIVER BC-348.

(a) Turn the "AVC-OFF-MVC" switch on the liaison receiver *(figure 72)* to "MVC."

(b) Turn the "CW-OSC" switch to "ON" for "CW," turn to "OFF" for modulated reception.

(c) Turn the "BEAT FREQ" control until the arrow on the knob is pointing upward, if "CW" is being received.

(d) Turn the "CRYSTAL" "OUT-IN" switch to "OUT."

(e) Turn the "DIAL LIGHTS" control clockwise.

(f) Turn the "INCREASE VOL" control clockwise until a sufficiently strong background is heard.

(g) Turn the "BAND SWITCH" to the band coverage desired. The bands are indicated on the dial above the switch.

(h) Tune the receiver to the desired frequency by means of the "TUNING" crank.

Note

If the liaison receiver has a low frequency band, check by tuning to a signal nearest 500 kilocycles.

(i) Tune the "ANT. ALIGN" control for maximum signal, indicated by head-set volume.

(j) To receive a modulated signal, turn "CW-OSC" "ON-OFF" switch to "OFF." Tune in the desired signal by means of the band change switch, tuning crank, and volume control.

(k) If a "CW" signal is being received, the signal pitch may be adjusted by the "BEAT FREQ" control.

(l) The automatic volume control may be employed after a signal is tuned in by turning the "AVC-OFF-MVC" switch to "AVC."

(m) To reduce noise and interfering signals, turn the "CRYSTAL" "OUT-IN" to "IN" and make any necessary tuning adjustments.

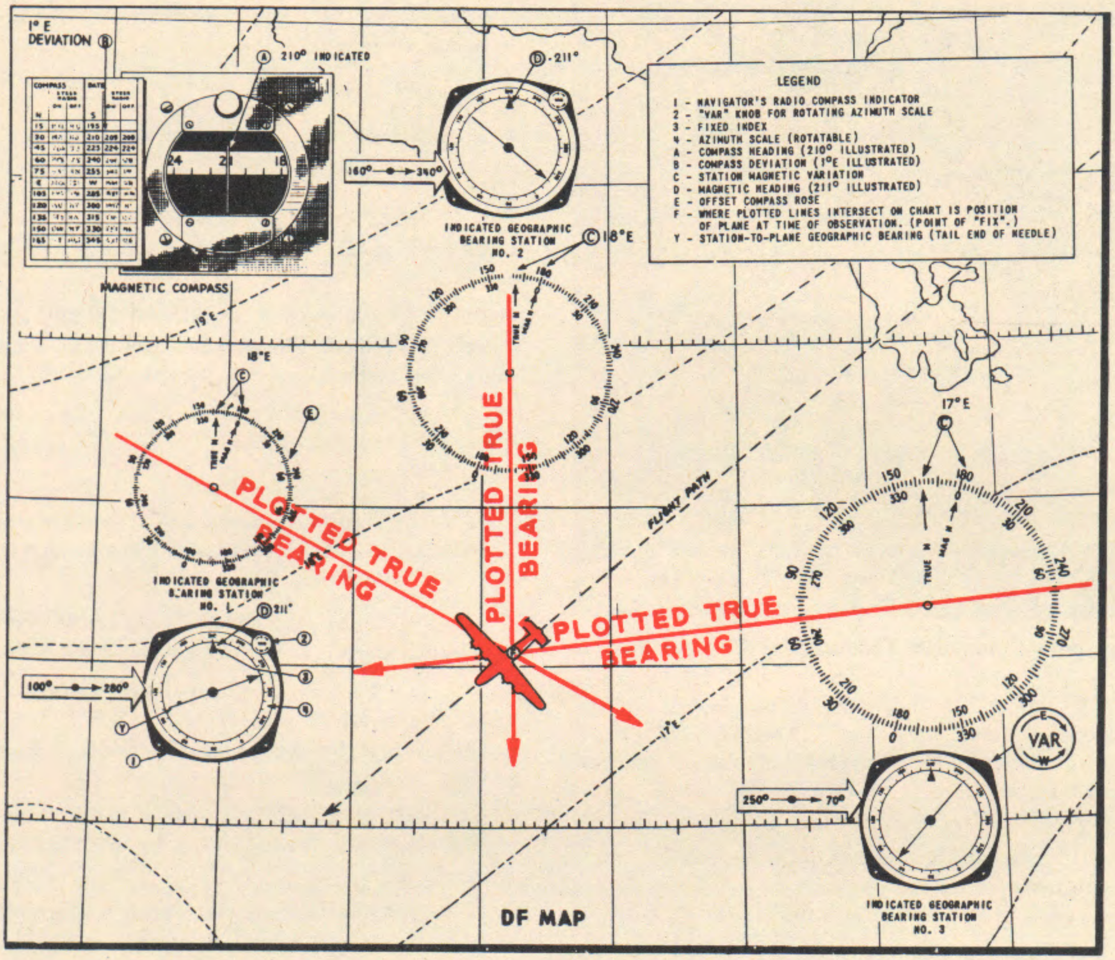
(n) Auxiliary headset jacks, marked "TEL," are provided on the receiver.

(o) To turn off the receiver, turn the "AVC-OFF-MVC" switch to "OFF."

(2) TRANSMITTING COMPONENTS.

Note

The transmitter will give satisfactory service on CW at all altitudes up to 27,000 feet. On TONE and VOICE, insulation breakdown may be experienced above 25,000 feet with the transmitter tuning unit TU-8-B (6,200-7,700 kilocycles), and above 19,000 feet with tuning unit TU-9-B (7,700-10,000 kilocycles). These limitations may be exceeded slightly by care in tuning and by guarding against accumulation of dust and other foreign matter in the equipment. Effective operation on CW alone is assured between 6,200 and 10,000 kilocycles at



OPERATIONS NECESSARY TO PLOT A TRUE BEARING

I Tune in previously logged and identified station.

II Turn "VAR" knob to place compass heading A at index 3.

III Turn "VAR" knob to correct azimuth scale 4 for compass deviation B. (A ± B) (Add east deviation; subtract west.)

IV Read station-to-plane true bearing Y on azimuth scale indicated by tail end of pointer. When using DF maps, the sharp end of pointer can be read and the outer scale of magnetic compass rose used for plotting. The outer scale is the reciprocal of inner scale and will give the same results as "tail-end" of pointer reading Y when using sectional or regional charts.

V Plot station-to-plane bearing from station compass rose.

Note

When maps without offset compass roses are used azimuth scale must be corrected for each bearing taken (add east variation; subtract west).

OPERATIONS NECESSARY TO ESTABLISH A FIX

I Rapidly obtain true bearings on three radio stations while maintaining same line of flight and flight attitude.

II Plot the bearings (usually three). Average of points (due to elapsed flying time and distance traversed between observations) of intersection is approximate fix F.

Figure 68—Plotting Radio Compass Bearings to Obtain A Fix

altitudes between 19,000 and 27,000 feet. With the transmitter tuning unit TU-26-B, the transmitter will give satisfactory service at all altitudes up to 15,000 feet.

(a) TO OPERATE LIAISON TRANSMITTER ON FREQUENCIES ABOVE 800 KILOCYCLES.

1. Monitor the desired frequency before effecting transmission (refer to paragraph (1), preceding).

2. Insert the transmitter tuning unit covering the desired frequency in the transmitter.

3. Set the "BAND CHANGE SWITCH" on the position indicated on the "CALIBRATION CHART" located on the front of the transmitter tuning unit *(figure 55)* for the desired frequency.

4. Set the "M.O. TUNING" control on the dial calibration (last two figures indicated on vernier) corresponding to the desired frequency on the calibration chart.

5. Set the "P.A. TUNING" control dial on the calibration corresponding to the desired frequency on the calibration chart.

6. Set the "ANT. COUPLING SWITCH" on "2."

7. Set the "ANT. IND. TUNING" control on "ZERO."

8. Set the "ANT. CIRCUIT SWITCH" on "2."

9. Set the "ANT. CAP TUNING" control on "50."

10. Set the "ANT. IND. SWITCH" on "1."

11. Set the selector switch on the antenna tuning unit on "1."

12. Set the antenna switch in the open-circuit position.

13. Set the "TONE-CW-VOICE" switch for the transmission desired.

14. Set the "CW. FIL.-MOD. FIL." switch to "CW FIL." for the code and the "MOD. FIL." for voice.

15. If the airplane is in flight, request the pilot's permission to reel out the antenna.

Note

The trailing antenna must be in before the bomb bay doors are opened, when landing, when in formation and when the antenna is not in use. Under icing conditions, the antenna weight should be released two or three inches before icing begins to prevent it from freezing to the fair-lead.

16. If the trailing wire antenna control box indicator *(figure 55, reference 5)* does not read "000" with the antenna in, set the indicator at "000" by means of the reset.

17. Turn the "OFF-IN-OUT" switch to "OUT," and reel out the proper length of antenna.

RECOMMENDED ANTENNA LENGTHS IN FEET

kc	¼ *Wave Lengths*	¾ *Wave Lengths*
2,000	123	—
3,000	82	—
4,000	62	—
5,000	49	147
6,000	41	123
7,000	35	105
8,000	31	93
9,000	27	81
10,000	24	73

For frequencies below 800 kilocycles, use the full length of the trailing antenna.

18. Turn the "ON-OFF" switch to "ON" and note the filament voltage indicated on the "FIL. VOLTAGE" meter. The pointer should fall on the red line; if it does not, remove the tube shield and make sure that the "24-28.5 VOLT" switch is in the "28.5V" position, and that the "AC-DC" switch is in the "DC" position.

CAUTION

Do not change tubes or make adjustments inside the transmitter with the test key, microphone switch, or the hand key depressed. Do not operate any equipment with the tube shield removed.

19. Press the "TEST KEY" and tune the "P.A. TUNING" control to obtain the minimum value of the plate current indicated on the "TOTAL PL. CURRENT" meter.

Note

If total plate current exceeds 100 milliamperes with antenna circuit open, the transmitter should not be operated until the defect is corrected by maintenance personnel. Always release the "TEST KEY" while changing switch positions. When tuning, avoid pressing the test key any more than necessary.

20. Place the antenna switch on the trailing wire position. If it is impossible to use the trailing wire antenna, the fixed antenna may be used though with less efficient results.

21. Rotate the "ANT. IND. TUNING" control to obtain the maximum value of the total plate current.

Note

Resonance will also be indicated by the maximum value of the antenna current indicated on the "ANT. CURRENT" meter. If no deflection of the plate current meter pointer is indicated, or if the maximum plate current is less than 210-220 milliamperes, increase the "ANT. COUPLING SWITCH" and repeat this tuning operation as necessary.

22. It may be necessary to change the position of the "ANT. CAP TUNING" control or the length of the antenna and to repeat operation *u.* before a satisfactory plate loading of 210-220 milliamperes is obtained.

23. The final tuning operation is to move the "P.A. TUNING" control to determine if a decrease in plate current, indicated on the total plate current meter, can be produced. If the movement of the control producing the lowest value of plate current exceeds 2 to 3 dial divisions, or if the decrease in plate current exceeds 5 to 10 milliamperes, the antenna coupling or antenna tuning adjustments are in error and the operations *19.* through *23.* should be repeated.

Note

For more comprehensive instructions, refer to T.O. No. 08-10-66.

24. Transmit with hand key.

25. To transmit tone or voice modulated signals, turn the "TONE-CW-VOICE" switch to the applicable position and transmit with hand key or microphone.

26. Each time the frequency is changed, the transmitter must be retuned.

(b) TO OPERATE THE LIAISON TRANSMITTER ON FREQUENCIES BELOW 800 KILOCYCLES.

1. Complete the operations (a) 1. through 21. and the operation (a) 23., except that in operations 6. and 8. position "4" should be substituted for position "2."

2. If it is impossible to resonate the antenna, set the "ANT. IND. SWITCH" on "2," "3," "4," and "5," successively, attempting to resonate the antenna on each position by use of the "ANT. IND. TUNING" control.

3. If the preceding operation does not permit resonating the antenna, set the "ANT. IND. TUNING" control and the "ANT. IND. SWITCH" on their maximum positions; set the antenna tuning unit selector switch on "2," "3," "4," and "5," successively, and attempt to resonate the antenna by tuning the "ANT. VARIOMETER" on each position.

4. Make sure in the preceding operat that sufficient antenna coupling is used and plate loading does not exceed 220 milliamperes.

5. Transmission on CW may now be effe by use of the hand key, or transmission of ton voice modulated signals may be accomplished.

6. To turn off the transmitter, turn "ON-OFF" switch to "OFF."

Note

The maximum continuous running time for the transmitter dynamotor is 30 minutes.

7. Reel in the trailing antenna when munications are completed.

e. RADIO COMPASS. *(See figure 76.)*—The compass may be controlled from either the pilot the navigator's station. Audio output only is a able on the "COMP" position of the interphone box at all other stations. To operate the compa a direction finder for the purpose of establishi fix, proceed as follows:

(1) GENERAL.

(a) At least three station bearings shoul used for a fix of location. A set of stations bearings spaced at approximately equal inte throughout 360 degrees will give the best accu Prior to making fix determinations, stations t used should be located on the map, tuned in, id fied, and their dial readings logged.

(b) Bearings should be taken in rapid cession, thereby eliminating error caused by the tance traveled between bearing observations. ings cannot be accurate unless the airplane is on a steady heading.

(c) When close to a station, accurate ings cannot be taken with the airplane in a bank, especially during the reception of signals instrument landing trucks.

(d) Only head-on bearings are entirely pendable. If side bearings are taken, keep the w horizontal.

(e) In compensating for magnetic vari (declination), the variation indicated on the graphic compass rose of the radio station is the fi normally used. If the magnetic variation of locality over which the airplane is flying is kn and is used, the station compass rose variation fi should be excluded. In obtaining bearings for ting on radio direction-finding maps, the azi scale should not be compensated for variation, the compass roses on these charts are offset to pensate for magnetic variations.

(2) AUTOMATIC VISUAL DIRECTION FINDING.

(a) Set the selector switch on the "CO position.

(b) Push the "CONTROL" button if the control indicator lamp does not indicate position control.

(c) Compensate the radio compass indicator azimuth scale *(figure 77, item 8)* for magnetic compass headings and magnetic compass deviation by means of the "VAR" knob.

(d) Further compensate the azimuth scale for magnetic variation.

(e) Tune in the desired, preferably a clear channel, station.

(f) Regulate the head-set volume with the "AUDIO" knob.

(g) Record the station-to-airplane bearing, indicated on the azimuth scale by the tail end of the radio compass indicator pointer.

(h) Rapidly repeat operations *(d)*, *(e)* and *(g)* to obtain two additional station-to-airplane bearings.

(i) Plot the three station-to-airplane bearings on a map to obtain the fix. *(See figure 68.)*

(j) To turn off the radio compass, turn the selector switch on the radio compass control box to "OFF."

(3) AURAL NULL DIRECTION FINDING.

(a) Set the selector switch on "LOOP."

(b) Push the "CONTROL" button if the control indicator lamp does not indicate position control.

(c) Compensate the radio compass indicator azimuth scale for magnetic compass heading and magnetic compass deviation by means of the "VAR" knob.

(d) Further compensate the azimuth scale for magnetic variation.

(e) Tune in desired, preferably a clear channel, station.

(f) Turn the "AUDIO" control fully clockwise. Depress the "LOOP LR" knob and turn it "L" or "R" to the position indicated by minimum head-set signal volume or tuning meter dip. Release the knob and make a final adjustment of the loop position at slow speed.

(g) Record the station-to-airplane bearing, indicated on the azimuth scale by tail end of radio compass indicator pointer.

(h) Rapidly repeat operations *(d)*, *(e)*, *(f)* and *(g)* to obtain two additional station-to-airplane bearings.

(i) Plot the bearings on a map to obtain a fix.

Note

Bearings obtained by the aural-null method are subject to a 180-degree ambiguity. When this exists, bearing lines plotted on the map will fail to intersect. If this ambiguity is clearly evident, the reciprocal bearing may be plotted. In cases of doubtful correctness the bearing should be retaken.

f. IFF RADIO.—The IFF radio can be adjusted only at the radio operator's station. An "ON-OFF" control is provided on the copilot's switch panel.

(1) TO OPERATE SCR-535, IF INSTALLED.

(a) Turn on local "ON-OFF" switch on the control box and allow the radio set to warm up for at least five minutes.

(b) SENSITIVITY ADJUSTMENT.

1. Turn knob "V" clockwise until the pointer of the voltmeter face of the control box points to the triangular marking on the voltmeter scale.

CAUTION

Voltage must be adjusted with a 28.5-volt input.

2. With a screw driver which fits the adjusting screw, turn both "A" and "B" controls on the face of the control box counterclockwise until the adjustment strikes the stop.

3. Starting with "A" adjustment, plug the head set into the jack on control box BC-648-A, and listen while gradually turning "A" control clockwise.

4. There will be crackling sounds, which grow stronger, as the "A" control is turned clockwise. Determine the first position of the control at which a steady tone of higher pitch can be heard. This tone is usually on for seconds, then off for several seconds. This sequence continues as long as the control is kept in the same position. For this reason it will be necessary to pause at each notch of the "A" adjustment to determine whether or not the steady tone will be heard at that point.

Note

Until the operator gains some experience at this adjustment it is advisable to pause for as long as 20 or 30 seconds on each notch.

5. Next turn control "A" counterclockwise until the even tone changes to the crackling noise. This first notch on detent, below (counterclockwise from) the point where the even tone is first heard, is called the point of maximum sensitivity.

6. To allow for possible variations in the sensitivity of radio receiver BC-647-A, especially when unattended, control "A" is turned counterclockwise two notches from the point of maximum sensitivity. If the operator is on hand continuously, it is permissible to maintain a more sensitive setting so long as the setting is kept below the point where the even tone is first heard. In such cases, the setting should be checked every 15 minutes.

7. Repeat the above procedure for "B" adjustment.

(2) TO OPERATE IFF RADIO SET, SCR-595.

(a) If installed, this equipment will replace either radio set SCR-695 or radio set SCR-535. The location of the set components will be similar for all models.

(b) Turn on the local "ON-OFF" switch on the control box.

(c) Set the selector switch on the control box on the numbered position designated by tactical orders.

(d) If "EMERGENCY" operation is desired, place the "EMERGENCY" switch on the control box "ON."

(e) To turn off the equipment, turn the local and remote "ON-OFF" switches to "OFF."

Note

Both the remote and the local "ON-OFF" switches must be "OFF" to turn the set off since they are wired in parallel. On later B-24 airplanes, the remote "ON-OFF" and "EMERGENCY" switches are marked "F."

(3) DESTRUCTOR COMPONENTS.—The copilot has the necessary controls and is responsible for destroying the radio receiver if necessary. *(See figure 54.)*

(4) To turn off equipment, turn the local "ON-OFF" switch to the "OFF" position.

Note

The pilot's remote "ON-OFF" switch, if installed, must also be "OFF."

(a) Turn on the local "ON-OFF" switch on the control box.

(b) Set the selector switch on the control box on the numbered position designated by tactical orders.

5. ICE ELIMINATION.

a. CARBURETOR ICE ELIMINATION.—Detection of icing may be difficult, since it is questionable whether the momentary drop in manifold pressure will be noticed until it is too late. The following procedure is recommended for elimination of ice:

(1) Increase rpm.

(2) Open throttles wide.

(3) Close the air filters and intercoolers.

(4) Add four inches turbo boost.

(5) Change altitude (if possible).

b. PROPELLER ANTI-ICING. — Propeller ice is not usually dangerous, since uneven ice formation on the blades will cause vibration and the ice will be thrown off. The following procedure is recommended:

(1) Increase rpm.

(2) Switch the propeller anti-icer to the full "ON" position.

(3) As soon as all ice is removed from the propellers (indicated by decrease in vibration) turn the anti-icer control to the lowest flow capable of keeping the propellers clear of ice.

c. PROPELLER ANTI-ICING EQUIPMENT.

(1) Groups I and III airplanes are equipped with an anti-icer fluid tank with a capacity of 21 US (17.5 Imperial) gallons.

(2) On early Group II airplanes, the fluid supply tank capacity is six US (five Imperial) gallons. On late Group II airplanes the capacity is 16.9 US (14.1 Imperial) gallons.

(3) The pumps are controlled simultaneously by a rheotsat located on the instrument panel (copilot's side). When icing conditions are encountered, the rheostat should be turned to the "FULL ON" position for three minutes, then back to the minimum rate of flow necessary to keep the propellers ice-free.

d. WINDSHIELD ANTI-ICING SPRAY.—Group II and early Group III airplanes have provisions for spraying the pilot's windshield and the bomb sight window with fluid from the propeller anti-icing fluid tank. Hand primer-type pumps are located at the copilot's and bombardier's stations to supply pressure for the sprays.

e. DEFROSTING PROVISIONS.—Airplanes having the spot-heater system defrost windows, turrets, astrodome, and bomb sight pane by means of flexible tubes leading from the nearby Stewart-Warner heater unit. The tube nozzles are held in the hand and the warm air is directed toward the surface to be defrosted. When not in use, the flexible tubes are secured by clips or straps with dot fasteners.

On airplanes where cabin heat is supplied from heat exchangers in the exhaust system, the same type of flexible tubing is connected to the hot air ducts. Flow of hot air is turned on or off by means of manually operated dampers.

Airplanes having the exhaust heat system are also provided with double plate glass windshields. For defrosting the windshield, warm air is introduced between the two sheets of glass from manifolds on their inboard edges. Since the inner sheets of glass are removable, stowage space is provided on the left side of the radio compartment.

f. PITOT HEAD HEATERS.—The switch for the pitot head heaters is on the pilots' pedestal. *(See figure 17, item 64.)*

g. WING AND TAIL ICE ELIMINATION.

(1) Wing ice may form with outside air temperature between +2° to —20° C (+35.6° to —4° F). Best means of prevention is to stay out of clouds if wing ice is starting to form. The following other preventive measures are recommended:

(a) Turn on the pitot heat.

(b) Get out of the clouds.

(c) Gain altitude if clear ice is forming.

(d) Turn all anti-icer switches on the pilots' pedestal to the "ON" position.

(2) DE-ICER SHOES. — On Groups I and III airplanes, De-Icing of wing and tail surfaces is accomplished by means of rubber-and-fabric De-Icer shoes. These shoes are on the leading edges of the wings and the vertical and horizontal stabilizers, and are alternately inflated and deflated by pressure and suction furnished by vacuum pumps on the two left-hand engines. A lever at the left of the copilot, immediately below the instrument panel, controls the system. Either the No. 1 or the No. 2 engine-driven vacuum pump may be selected for operating De-Icers (or gyro instruments, as desired) by means of a valve located on the left forward face of the rear flight compartment wall.

CAUTION

A loose De-Icer shoe may cause failure of the airfoil skin. If the shoes ripple in flight, with the De-Icer system shut off, especially at high speeds and when pulling out of dives, the shoes should be inspected upon landing and replaced if necessary.

(3) EXHAUST HEAT SYSTEM. — Heat for anti-icing the leading edges of the wing center section and empennage is furnished by heat exchangers in the inboard nacelles. Heat for anti-icing outer panel leading edges and wing tips is furnished by heat exchangers in the outboard nacelles. Control switches are on the same panel as the cabin heat switches. *(See figure 59.)*

6. ARMAMENT.

a. GUNNERY EQUIPMENT. — The airplane is equipped with four power-driven turrets each mounting two .50-calibre machine guns. A turret is located in the nose, in the tail, on top of the fuselage forward of the wing, and at the bottom of the fuselage aft of the wing. One .50-calibre machine gun is also located at each side window in the waist. *(See figure 69.)*

b. ARMOR PLATE PROTECTION. *(See figures 69, 69A and 70.)*—In later Group III airplanes, flak curtains will be installed in lieu of armor plate behind the pilot's and copilot's seats.

c. BOMBING EQUIPMENT.—Refer to paragraphs 12 and 13 of this section.

7. PHOTOGRAPHIC EQUIPMENT.

Photographic equipment consists of a camera mount, and electrical and vacuum connections for the use of either a Type D-18 or K-17 aircraft camera at the rear fuselage entrance hatch. When not in use the camera and mount are raised and stowed aft of the hatch.

a. CAMERA OPERATION WITH B-3 INTERVALOMETER.

(1) Push the stop button, then turn the camera master switch "ON" (after take-off).

(2) When approaching the target area, determine the exposure interval. Set interval on dial.

(3) When over beginning of target area, push the start button. Push the stop button when over end of target area.

(4) Turn the camera master switch "OFF" prior to landing.

b. WITH B-2 INTERVALOMETER (24-VOLT).

(1) Turn dial to "STOP." Then turn camera master switch "ON" (after take-off).

(2) When approaching the target area, determine the exposure interval.

(3) Set the interval on the dial when over beginning of the target area.

(4) Turn the dial to "STOP" when over the end of the target area.

(5) Turn the camera master switch "OFF" prior to landing.

8. AUXILIARY POWER UNIT.

A gasoline engine-driven generator unit is installed in the nose wheel compartment of some airplanes. Operating controls are on the unit mount under the generator. *(See figure 71.)*

a. STARTING GENERATOR UNIT.

(1) See that the fuel container is filled with a mixture of one-half pint of lubricating oil, Specification No. AN-VV-O-446, grade 62, to each gallon of gasoline (grade 98/130 or 100/130).

(2) Turn the shut-off valve on top of the fuel container to "ON."

(3) To choke, pull the plunger button on the priming pump all the way up (on top of air cleaner) and release. In cold weather, operate the plunger five to eight times; in mild weather, two or three times.

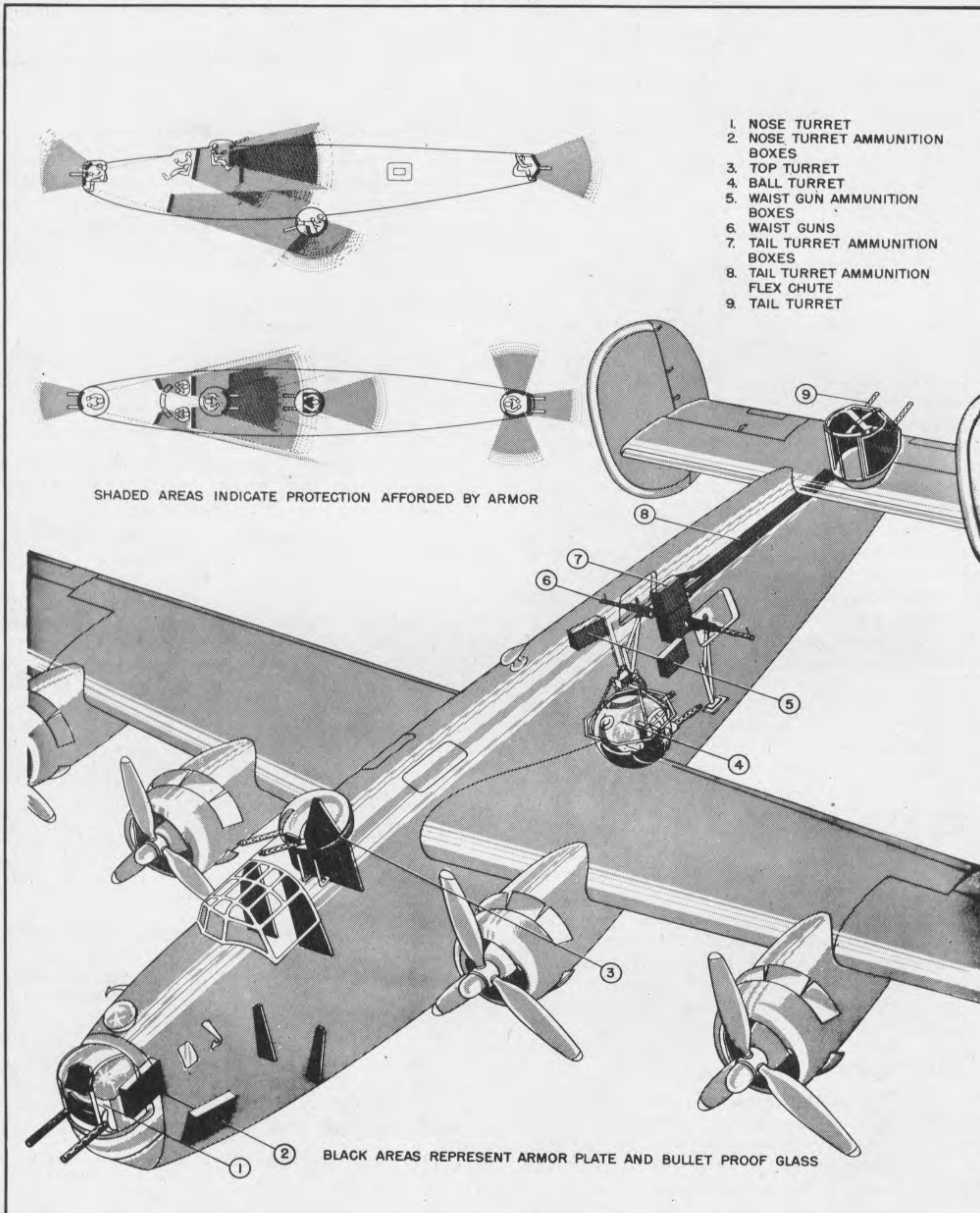


Figure 69—Angles of Armor Protection, Group I Airplanes

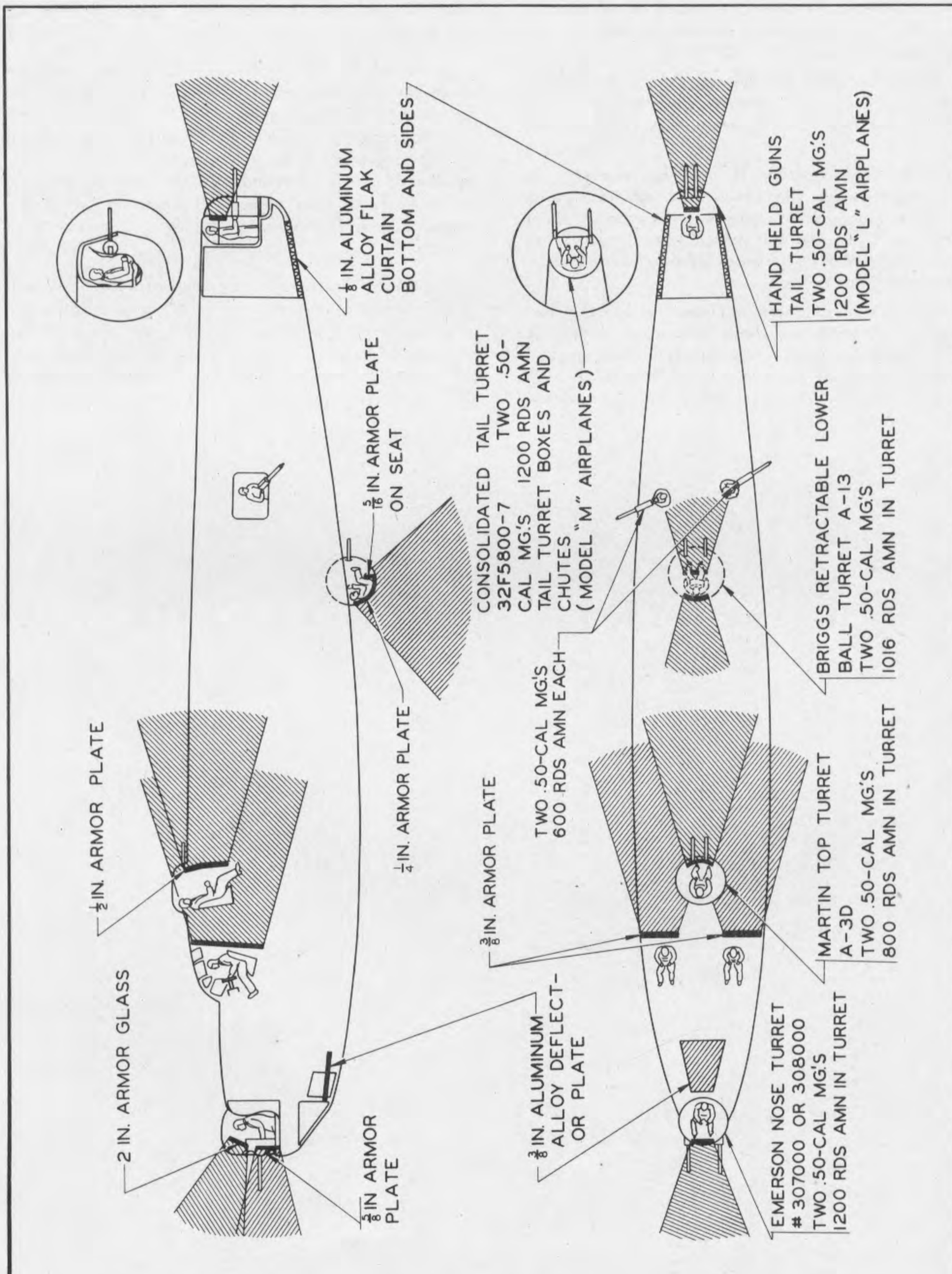


Figure 69A—Defensive Armament and Angles of Armor Protection (B-24L and M Airplanes)

(4) See that the equalizer switch on the control box is "OFF" unless the main engines are running and the generator switches are "ON."

(5) Turn "ON" the emergency ignition switch (copilot's switch panel). Depress the starting switch on the control box and release as soon as the engine starts.

(6) In cold weather it may be necessary to repeat operation of the carburetor priming pump after the engine starts. Operate the pump at short intervals until the engine is sufficiently warmed up to run smoothly. The warm-up process should take approximately one minute.

(7) If the engine does not start within five seconds after following the above procedure, it may be flooded. Open the drain cock on the crankcase and turn over the engine for a few seconds by depressing the starter switch. This procedure should expel the raw gas. Close the drain cock and repeat the starting procedure.

b. MANUAL STARTING. — If the batteries are dead, the generator unit engine can be started manually by following instructions (1), (3), and (4) in paragraph 8., *a.* Then wind the starting rope on the starting plate in the direction of the arrow; brace one hand on the unit and pull the rope to give the engine a quick spin. Repeat, if necessary, until the engine starts. If necessary, follow (6) and (7) in paragraph 8., *a.*

c. OPERATION. — Turn the equalizer switch "ON" to charge the batteries in parallel with the airplane engine generators while the engines are running. If the airplane engines are not running, keep the equalizer switch "OFF." In normal operation, the auxiliary power unit voltmeter will register

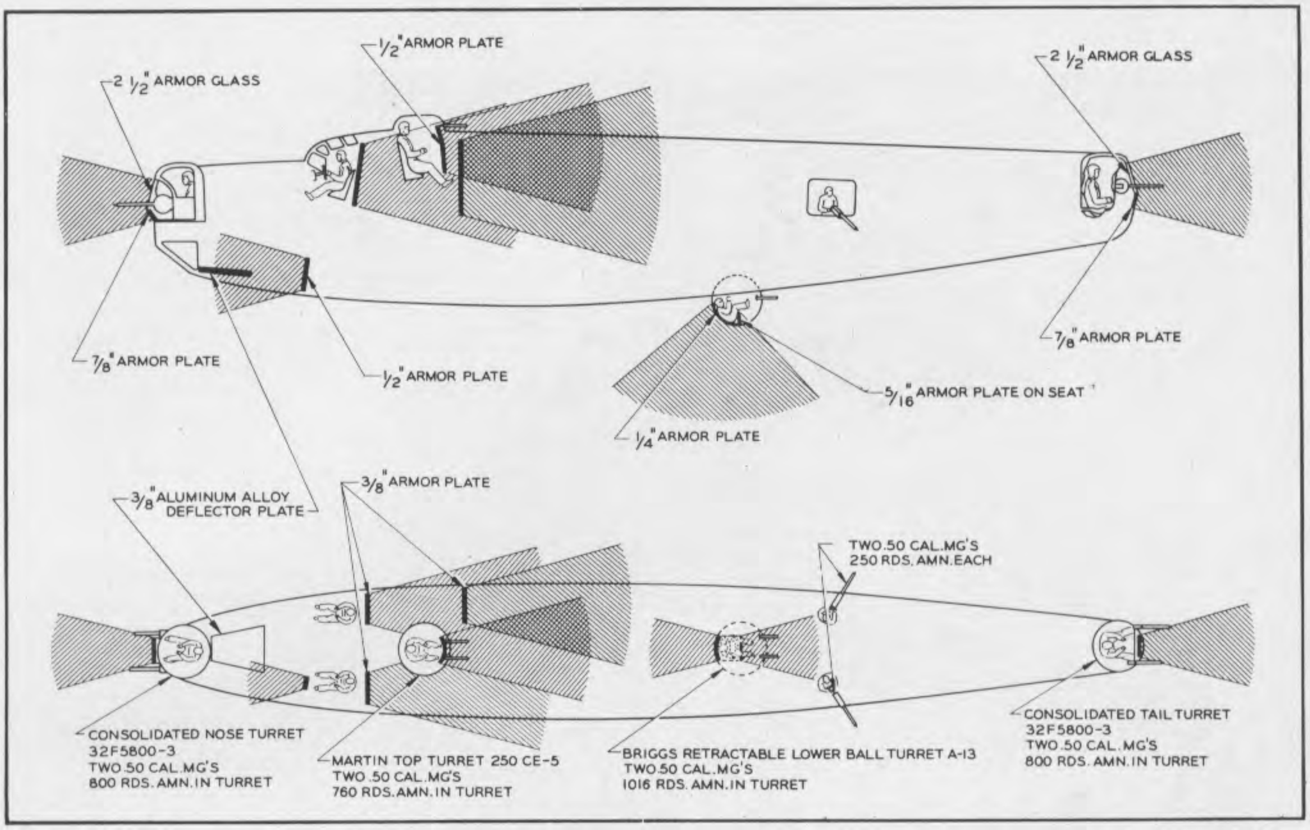


Figure 70—Angles of Armor Protection, Groups II and III Airplanes

approximately 28.5 volts, but if the batteries are under a heavy load, the reading will be lower.

d. STOPPING AUXILIARY POWER UNIT.

(1) Turn "OFF" the shut-off valve on top of the fuel container. The unit will continue to run for approximately one-half minute.

(2) For emergency stopping, or if the generator unit engine is to be restarted soon, press the red "STOP" button on the magneto starter plate and hold it until the engine stops.

9. PILOTS' COMPARTMENT.

a. OXYGEN EQUIPMENT.—The pilot and copilot are each provided with oxygen panels comprising demand regulators, flow indicators, pressure gages and supply warning lights as described in paragraph 2. See paragraph 3. for pilot's portable oxygen equipment.

b. HEATING, VENTILATING AND ICE ELIMINATION EQUIPMENT.—Refer to paragraphs 1. and 5.

c. PILOT'S COMMUNICATING EQUIPMENT.—The pilot has control of the command set and the radio compass and may use the liaison set for communication (radio operator must adjust frequency). Refer to paragraph 4. for operation instructions.

d. SEATS.—The pilot's and copilot's seats are adjustable fore and aft, vertically, and for tilt.

e. LOAD ADJUSTER.—A load adjuster for determining the correct distribution of weight will be found on a hook adjacent to the data case.

CAUTION

The index number entered on the carrying case is correct only for the airplane the serial number of which appears directly above.

10. RADIO OPERATOR'S COMPARTMENT.

(See figures 72 and 73.)

Refer to paragraph 4., COMMUNICATIONS EQUIPMENT.

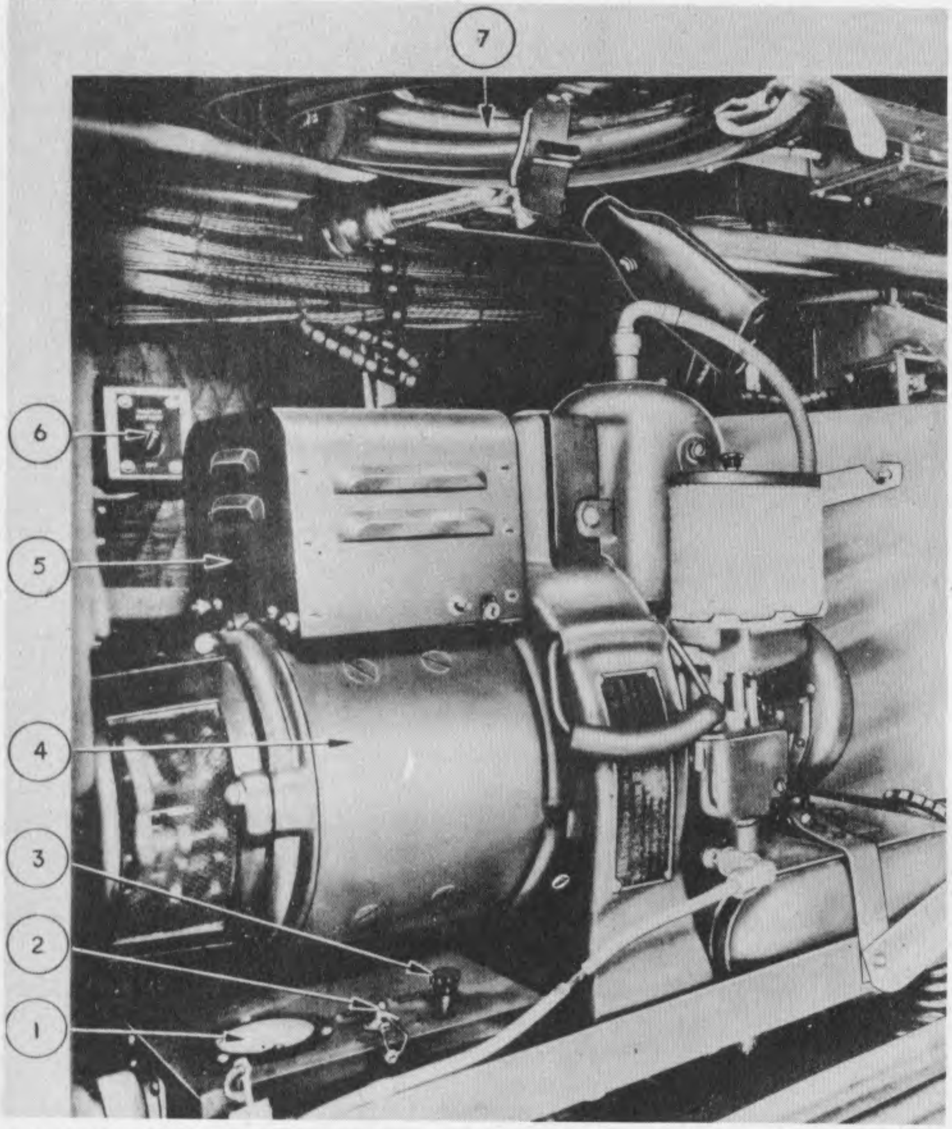
In addition to communications equipment, the radio operator's compartment contains the generator switch panel on which are located the ammeters, the voltmeter, the voltmeter selector, and the generator line switches. *(See figure 7.)*

11. NAVIGATOR'S COMPARTMENT.

Refer to paragraph 12. *b.*, following.

12. BOMBARDIER'S COMPARTMENT.

a. BOMBING CONTROLS. — Normal bombing



1. Auxiliary Power Unit Voltmeter
2. Equalizer Switch
3. Starter Switch
4. Auxiliary Power Unit Generator
5. Auxiliary Power Unit Voltage Regulator
6. Master Battery Switch
7. Extension Cord

★

Figure 71—Auxiliary Power Plant

★

controls combine electrical and manual operation. Emergency controls are manual.

(1) BOMB QUADRANT. *(See figure 74.)*—The bomb quadrant located on the left side of the nose compartment has two lever handles.

(a) BOMB RELEASE HANDLE.—This handle controls the cam system which positions the bomb rack release unit salvo couplers. It has three positions:

1. "SAFE."—The release units are locked against the release of bombs.

2. "SELECT."—The release units are unlocked so that the bombs can be released either electrically or manually.

3. "SALVO." — The release units actuate release levers of bomb shackles, releasing all bombs.

Note

Salvoing of the bombs is completely a manual operation.

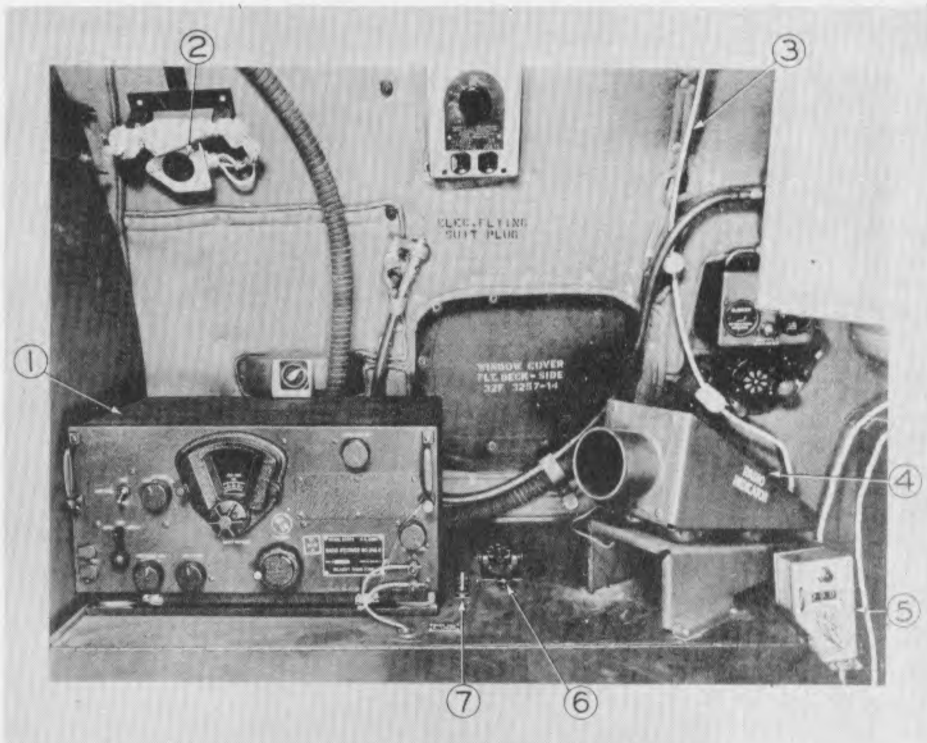
(b) BOMB DOORS HANDLE.—This handle controls the bomb bay doors. After being moved to the "OPEN" or "CLOSED" position, the handle will return to the "NEUTRAL" position. The doors open or close in approximately five seconds.

Note

The bomb bay doors may also be opened by the emergency and utility valve handle located under the right side of the radio compartment, and accessible from the forward doorway to the bomb bay. In case of failure of the hydraulic system, the doors can be opened by engaging and turning the two emergency hand cranks. There is one on each side of the catwalk in the center of the bomb bay.

(2) ELECTRICAL CONTROL PANELS (GROUP III).
(See figure 76.)

★



1. Liaison Receiver (BC348-R)
2. S0158 Plug (For SCR-695 Equipment)
3. Transmission Line to Liaison Antenna
4. Indicator Mounting Bracket (For SCR-518 Equipment)
5. Antenna Reel Control Box (RL461)
6. Transmitting Key
7. Monitor Switch

Figure 72—Radio Operator's Table and Equipment, Early Group III Airplanes

(a) INTERVAL CONTROL, TYPES B-2, B-2A, OR B-3.—The interval control, located in the left forward corner of the nose compartment below the bombardier's control panel, has the following switch and dials:

1. "SELECTIVE - TRAIN" switch. This switch sets up the circuits for either selective or train bombing.

2. COUNTER DIAL (WITH COUNTER KNOB AND POINTER).—The pointer setting determines the number of bombs to be released in train bombing.

3. INTERVAL SELECTOR DIALS. — The interval selector has two concentric dials with a knob to turn the inner dial. The relative setting of the two dials determines the distances in feet between successive impacts of bombs in train bombing. A movable cap is provided to black out the indicator light when desired.

(b) BOMBARDIER'S CONTROL PANEL.—The control panel has the following apparatus:

1. Bomb rack loading indicators which show the class of bombs being carried in each bomb rack.

2. Bomb position indicator lights which show the bomb rack positions having release units cocked.

3. Bomb rack station indicator light switch.

4. Panel light and rheostat.

5. BOMB BAY DOORS OPEN indicator light.

6. Four 2000-pound bomb selector release switches.

7. Switch for bomb formation signal light with "OFF," "DIM," and "BRIGHT" positions.

8. Bomb formation signal light.

9. Switch for BOMB RELEASED light with "OFF," "DIM," and "BRIGHT" positions.

10. BOMB RELEASED indicator light.

11. Four bomb bay selector switches for B-7 bomb racks.

12. Bomb release controls switch with positions for D-6 bomb racks and B-7 bomb racks.

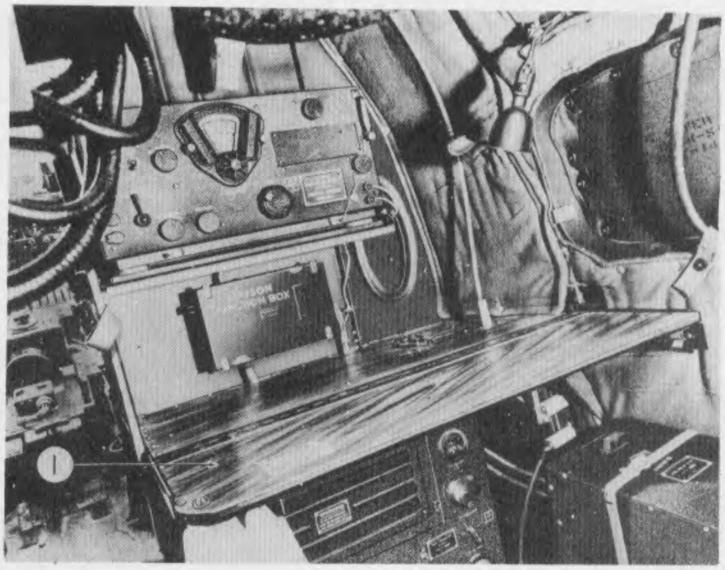
13. Nose fuse switch with positions for "ARM" and "SAFE."

14. Nose fuse indicator light.

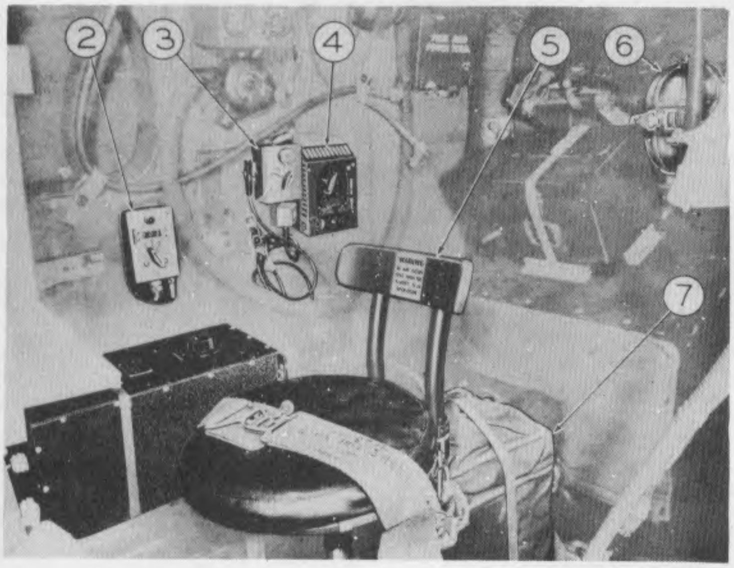
15. Switch for bombardier's and radio operator's heaters.

16. The bomb control box contains fuses for the bombing circuits. Fuse positions are marked, indicating the circuit and size of fuse.

(3) ELECTRICAL CONTROL PANEL (GROUPS I AND II).—The bombardier's control panel is divided into three sections. *(See figure 75.)*



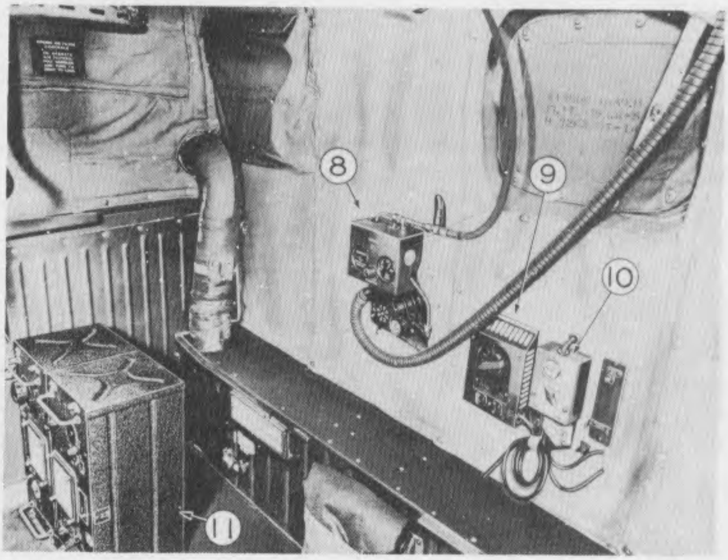
(Right)—
Right Side, Forward View



(Left)—
Outboard, Right Side, Aft View

1. Radio Operator's Table
2. Antenna Reel Control Box
3. Interphone Jack Box
4. Flying Suit Heater Receptacle
5. Radio Operator's Seat
6. Portable Walk-Around Oxygen Cylinder
7. Frequency Meter
8. Oxygen Regulator Panel
9. Flying Suit Heater Receptacle
10. Interphone Jack Box
11. Spare Tuning Units

Figure 73—Radio Operator's Compartment, Groups I, II and Later Group III Airplanes



(Right)—
Outboard, Left Side, Aft View

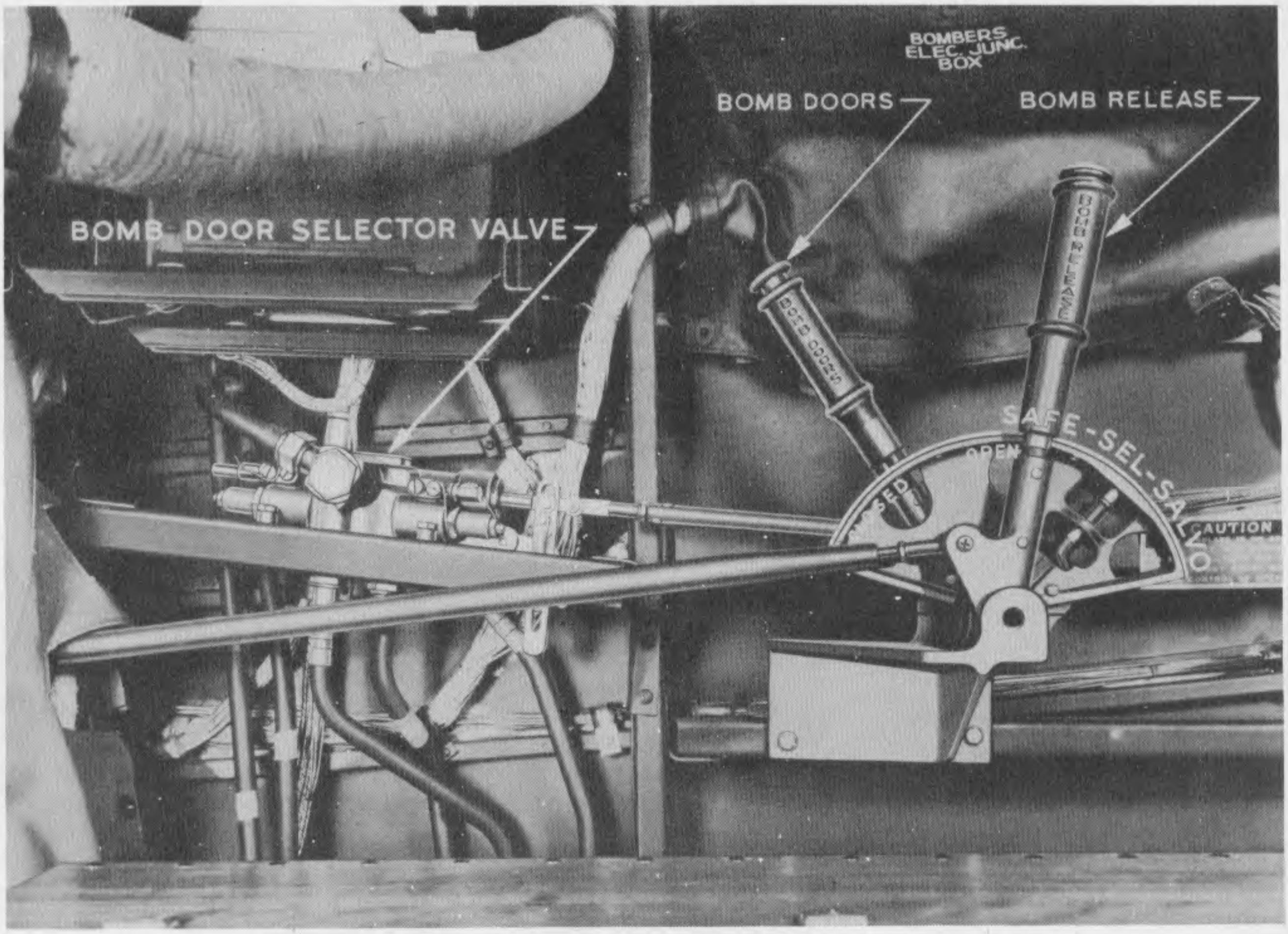


Figure 74—Bombardier's Control Quadrant

(a) BOMB RELEASE CONTROL PANEL.—The bomb release control panel contains the following:

1. Panel light and rheostat.

2. Switches for bomb release, bomb nose fusing, formation lights, bomb indicator lights, and bombardier compartment heaters.

3. Indicator lights for bomb formation lights, nose fusing, and open bomb bay doors.

4. Indicator lights for bomb rack positions (four columns of lights, one for each position).

(b) INTERVAL CONTROL. — The interval control has a "TRAIN-SELECTIVE" switch and two dials. One counter dial is for selecting the number of bombs to be released in train bombing. One bomb interval dial is for setting the distance in feet between successive impacts of bombs in train bombing.

(c) FLIGHT INSTRUMENTS. — An airspeed indicator, remote compass indicator and altimeter are mounted on the bombardier's flight instrument panel.

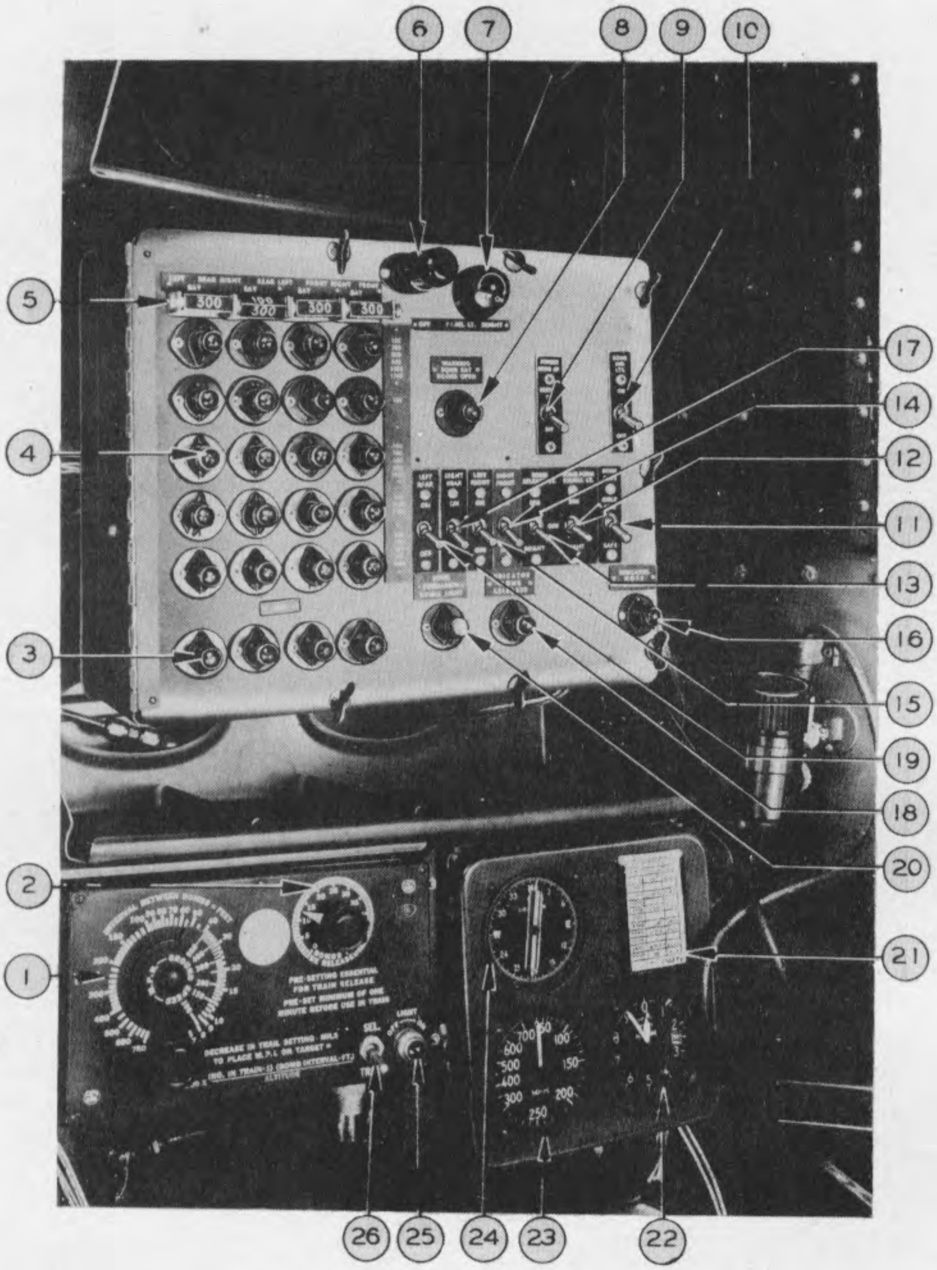
Note

When bomb bay doors are open and bomb formation signal light switch is on, a white light in the tail of the fuselage is on. When a bomb is released, if bomb release light switch is on, the white light goes out for approximately five seconds and a red light is on for approximately five seconds.

(4) BOMB SIGHT.—The bomb sight is mounted on a bracket at the left front of the nose compartment.

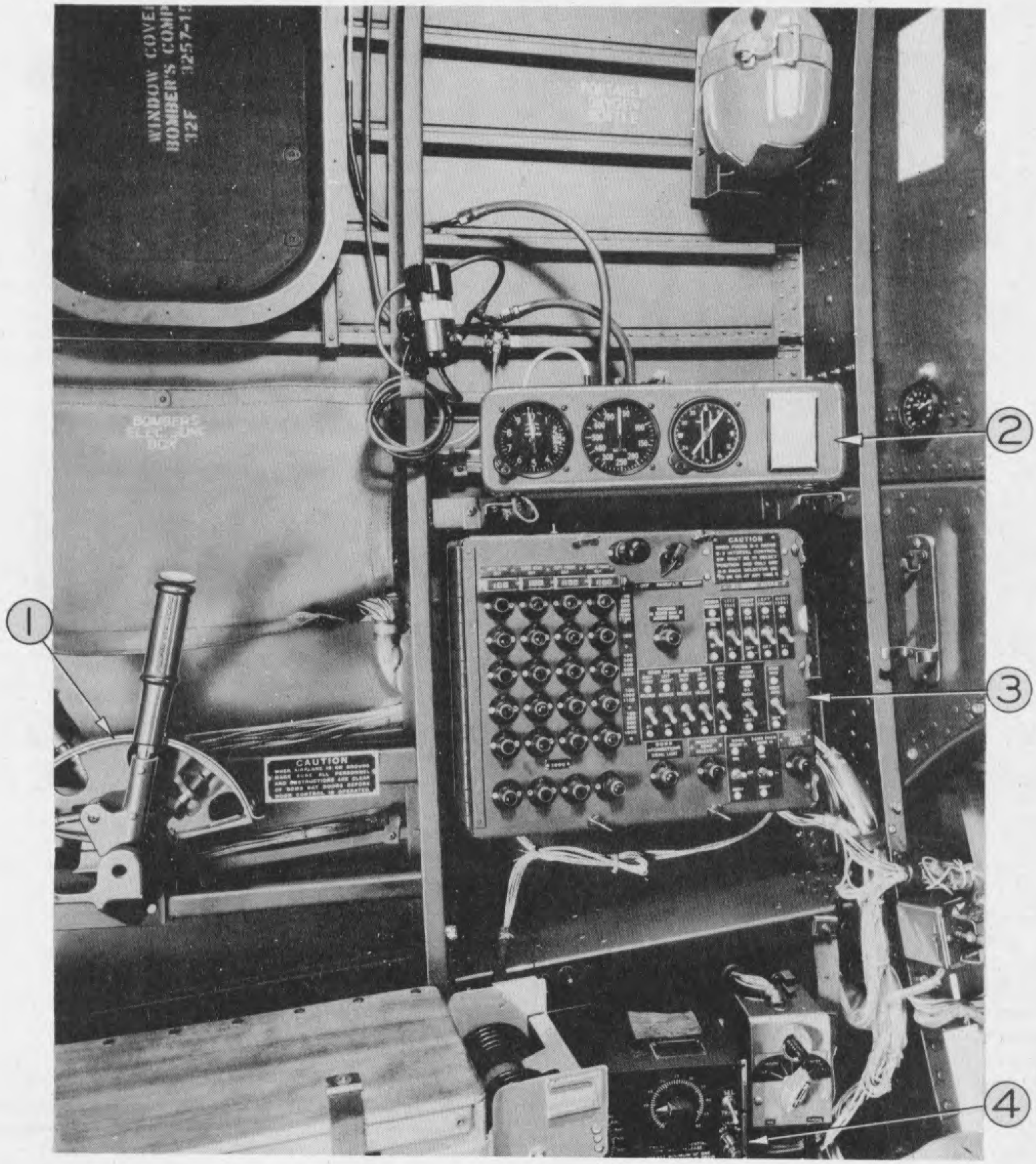
(5) FIRING SWITCH. — The firing switch is mounted in the left forward corner of the nose compartment forward of the bombardier's control panel. This is a momentary contact type switch. A single pressure on the switch will actuate the interval control to start the release of a train of bombs. A separate pressure on the switch is required for the release of each bomb in selective bombing.

b. NAVIGATIONAL EQUIPMENT. — The navigator is provided with navigation and flight instru-



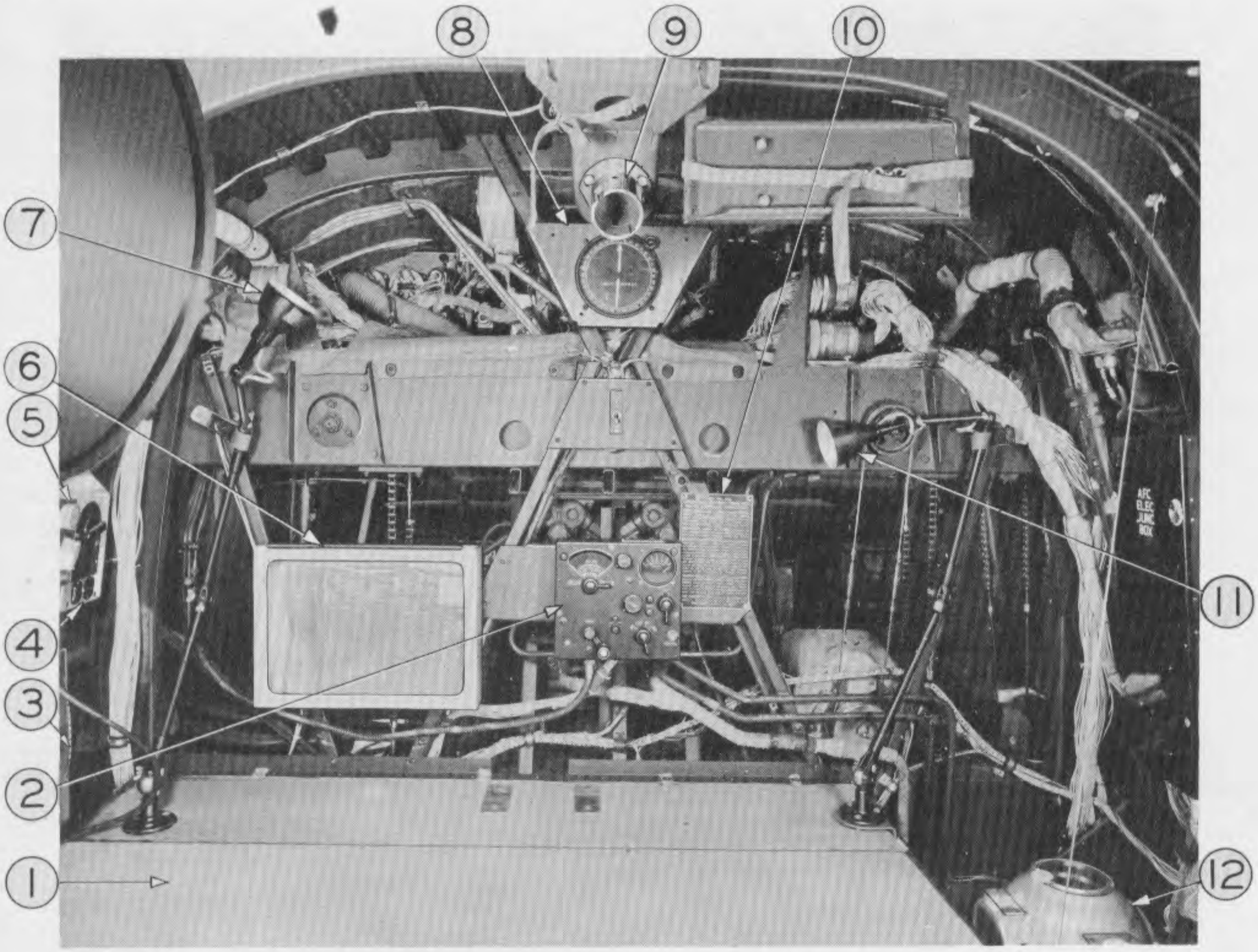
1. Interval Selector Dial
2. Bomb Counter Dial
3. Four 2000 Pound Bomb Rack Position Indicator Lights
4. Twenty Main Rack Bomb Position Indicator Lights
5. Four Bomb Size Indicators
6. Panel Light
7. Panel Light Rheostat
8. Bomb Bay Doors Open Indicator Light
9. Bombardier's and Radio Operator's Heaters Switch
10. Bomb Indicator Lights Switch
11. Nose Fuse Only Switch
12. Bomb Formation Signal Light Switch
13. Bomb Release Light Switch
14. Right Front Bomb Rack Selector Switch
15. Left Front Bomb Rack Selector Switch
16. Nose Fused Indicator Light
17. Right Rear Bomb Rack Selector Switch
18. Bomb Release Indicator Light
19. Left Rear Bomb Rack Selector Switch
20. Bomb Formation Signal Light
21. Scale Correction Card
22. Altimeter
23. Air-Speed Indicator
24. Remote Compass Indicator
25. Signal Light
26. Interval Control Switch

Figure 75—Bombardier's Instruments, Groups I and II Airplanes



1. Bomb Quadrant
2. Instrument Panel
3. Control Panel
4. Interval Control B-3

Figure 76—Bombardier's Instruments, Group III Airplanes



1. Navigator's Table
2. Radio Compass Control Panel
3. Bombardier's Map Case
4. Flying Suit Receptacles and Rheostat
5. Interphone Station Box
6. Bombardier's Chart Stowage
7. Extension Light
8. Radio Compass Bearing Indicator
9. Astrocompass Mounting Bracket
10. Radio Compass Instruction Plate
11. Extension Light
12. AFCE Gyro Case

Figure 77—Navigator's Station, Looking Aft

ments, including astrodome, sextant, drift meter, radio compass indicator, drift recorder, astrograph and astro compass. *(See figure 77.)* In some later model airplanes the astrodome is replaced with a flat panel hatch. A drawing board, with drafting machine attached, is stowed in the navigator's compartment. Racks and containers are provided for maps and charts.

13. BOMB BAY COMPARTMENT.

a. BOMB RACKS.

(1) The 100-pound to 1600-pound bombs are carried in four vertical bomb racks (two in each bomb bay) designated as follows:

No. 1 .... Left rear
No. 2 .... Right rear
No. 3 .... Left front
No. 4 .... Right front

Each rack has five bomb stations. The bomb racks and the bombardier's control panel are marked to indicate the bombs by weight which can be carried at each station. Bombs of one weight only can be carried in any one bomb rack at one time. The bomb racks have auxiliary boxes permanently attached, which receive the terminals of the electrical wires carrying the circuits to the bomb rack release units. Bomb rack release units type A-2 are attached to the bomb rack stations on which bombs are to be carried. A bomb arming control box type A-1 is attached to each bomb rack station for the purpose of controlling the arming of nose fuses.

Note

The bomb racks from which bombs are to be released are controlled by bomb bay selector switches. Bombs are released in layers. The lowest bomb from each rack is selected in order, then the next lowest bomb from each rack is selected, and so on. The order of release is No. 1 rack, No. 2 rack, No. 3 rack and No. 4 rack. If one or more racks are not selected, bombs are released from selected racks without "idle" pauses for the racks not selected.

Early Group I airplanes are equipped with B-7 bomb shackles. However, on later Group I airplanes, twelve stations are supplied with B-10 shackles in lieu of B-7 shackles.

(2) 2000-pound bombs are carried internally on four special horizontal racks, one to a rack, suspended by D-6 shackles. These racks are installed only for a mission on which 2000-pound bombs are to be used. When a 2000-pound bomb is carried in a bomb bay section, no other smaller bombs are loaded in that bomb bay section. There are four switches on the control panel for selecting the 2000-pound bombs.

CAUTION

When firing D-6 racks, the B-3 interval control must be in "SELECTIVE" position, and only one D-6 rack selector switch is to be on at any one time.

(3) Except for Group I airplanes, for which there are no provisions but structural reinforcement, 4000-pound bombs are carried in special external racks with D-7 shackles, one under the left wing and one under the right wing. The parts for the 4000-pound bomb installation are put up in kits for use when an airplane is to be modified to carry 4000-pound bombs. The 1000-pound, 1600-pound or 2000-pound bombs can be carried in these racks, if desired, using appropriate bomb chocks and shackles. Bombs can also be carried in the internal racks at the same time that bombs are being carried in the external racks. A bombardier's auxiliary panel is installed in the bombardier's compartment immediately above the bombardier's control panel. The auxiliary panel has indicator lights for the two 4000-pound bomb rack release units, and it has three switches:

(a) A double-pole double-throw switch with positions "EXTERNAL - INTERNAL RACKS" and "EXTERNAL RACKS." The "EXTERNAL-INTERNAL RACKS" position permits release of bombs from both external and internal racks. The "EXTERNAL RACKS" position permits release of bombs from external racks only.

(b) A single-pole double-throw switch with positions "WING RACKS LEFT SELECT" and "OFF." The "WING RACKS LEFT SELECT" position permits the release of the left-hand 4000-pound bomb.

(c) A single-pole double-throw switch with positions "WING RACKS RIGHT SELECT" and "OFF." The "WING RACKS RIGHT SELECT" position permits the release of the right-hand 4000-pound bomb.

(d) No switch is provided for the indicator lights as they are connected to the load side of the five-ampere indicator light fuse in the bombardier's panel box.

(e) The bomb release electrical impulse is routed from the firing switch to the interval control, then to the bombardier's auxiliary panel and the 4000-pound racks, and then through the bombardier's control panel and the rack selectors to the internal 100 to 1600-pound bomb racks. If the 2000-pound internal racks are installed, the electrical impulse for their release does not go through the rack selectors, and the precautions given in paragraph (2), preceding, must be observed.

Note

Release may be either "TRAIN" or "SELECTIVE" except when releasing 2000-pound bombs from internal racks.

(f) With both wing rack selector switches on, and the double-pole double-throw switch in the "EXTERNAL-INTERNAL RACKS" position, the order of release of bombs is:

1. Left 4000-pound bomb,

2. Right 4000-pound bomb,

3. Internal racks, as selected by bomb release controls switch and bomb bay selector switches.

b. OPERATION.

(1) ARMING.

(a) BY A-2 RELEASE UNIT.—The arming wire of the tail fuse is attached to the tail fuse and bomb shackle bar. When the firing switch is operated, the wire is automatically locked to the shackle, thus pulling the pin from the tail fuse and arming it when the bomb falls free. When bombs are released in salvo, locking does not occur and the bombs fall in safe condition.

(b) BY A-1 FUSING UNIT (BOMB ARMING CONTROL BOX A-1).—The arming of the nose fuse operates electrically and is controlled by the nose fuse switch on the bombardier's control panel. The arming wire is attached to the nose fuse and to the fusing unit of the Bomb Control Box A-1. Bombs may be released in salvo with nose fuses armed.

(c) 2000 AND 4000-POUND BOMBS.—The operation of arming the fuses is the same as in *(a)* and *(b)* preceding when these bombs are specially installed in the airplane.

(2) RELEASE.

(a) 100 TO 1600-POUND BOMBS.

1. For Group II: The bombardier instructs the pilot to turn on the "BOMB SIGHT" switch.

2. Turn on the following switches if the lights which they control are desired:

a. Panel light rheostat.

b. Bomb position indicator light switch.

c. Bomb formation signal light switch.

d. Bomb released light switch.

3. Open the bomb bay doors by moving the "BOMB DOORS" handle to the "DOORS OPEN" position. Place the handle in the "DOORS OPEN" position immediately before releasing the bombs to insure that the doors are completely raised.

4. Unlock the bomb rack release units A-2 by moving the "BOMB RELEASE" handle to the "SELECT" position.

5. Set the "TRAIN-SELECTIVE" switch on interval control for the desired method of release. If set for train, set the counter for the number of bombs to be released and set the interval selector dial for the bomb spacing desired. The interval control must be in operation for at least one minute before the start of train bombing.

6. Move the bomb release controls switch to the "B-7 RACKS" position.

7. Turn on the bomb bay selector switches for the racks from which bombs are to be released.

8. Turn the nose fuse switch to the "ARM" position.

9. Operate the firing switch once to initiate the release of a train of bombs, or once for each bomb to be released selectively.

10. After the bombs are released close the bomb bay doors and turn off all switches.

(b) 2000-POUND BOMBS.

Note

On later Group I airplanes, the 2000-pound bomb release switches have been deleted and the circuit paralleled with the bottom position of each rack.

1. For Group II: The bombardier instructs the pilot to turn on the "BOMB SIGHT" switch.

2. Turn on the following switches, if the lights which they control are desired:

a. Panel light rheostat.

b. Bomb station indicator light switch.

c. Bomb formation signal lights switch.

d. Bomb released light switch.

3. Open the bomb bay doors by moving the "BOMB DOORS" handle to the "DOORS OPEN" position. Place handle in the "DOORS OPEN" position immediately before releasing bombs to insure that the doors are completely raised.

4. Unlock the bomb rack release units A-2 by moving the "BOMB RELEASE" handle to the "SELECT" position.

5. Set the "TRAIN-SELECTIVE" switch on interval control to "SELECTIVE."

6. Move the bomb release controls switch to the "D-6 RACKS" position.

7. Turn on the 2000-pound bomb selector release switch for the rack from which the bomb is to be released. ONLY ONE OF THESE SWITCHES IS TO BE ON AT A TIME.

8. Turn the nose fuse switch to the "ARM" position.

9. Operate the firing switch.

10. For each additional bomb to be released, turn on its 2000-pound bomb selector release switch and operate firing switch.

11. After the bombs are released, close the bomb bay doors and turn off all switches.

(c) 4000-POUND BOMBS.

1. EXTERNAL RACKS ONLY.

a. Turn on the following switches, if the lights which they control are desired:

Panel light rheostat.
Bomb formation signal light switch.
Bomb release light switch.

b. Unlock the bomb rack release units A-2 by moving the "BOMB RELEASE" handle to the "SELECT" position.

c. Set the "TRAIN-SELECTIVE" switch on the interval control for the desired method of release. If set for "TRAIN," set the counter for the number of bombs to be released and set the interval selector dial for the bomb spacing desired. The interval control must be in operation for at least one minute before the start of train bombing.

d. Set the "EXTERNAL INTERNAL RACKS-EXTERNAL RACKS" switch on the bombardier's auxiliary panel to the "EXTERNAL RACKS" position.

e. Turn on either or both of the "WING RACK SELECTOR" switches on the bombardier's auxiliary panel for the bomb or bombs to be released.

f. Set the nose fuse switch to the "ARM" position.

g. Operate the firing switch, once to initiate the release of a train of bombs, or once for each bomb to be released selectively.

h. After the bombs are released, turn off all switches.

2. EXTERNAL AND INTERNAL RACKS.

a. 100 TO 1600-POUND BOMBS IN INTERNAL RACKS.—The procedure is the same as that described in paragraph 13. *b.* (2) *(a)*, preceding, except that the following settings of switches on the bombardier's auxiliary panel must be made:

The "EXTERNAL INTERNAL RACKS—EXTERNAL RACKS" switch to be in the "EXTERNAL INTERNAL RACKS" position.

The "WING RACK SELECTOR" switches are to be on for the bomb or bombs to be released.

Note

The interval control may be set for either train or selective bombing. In either setting, the 4000-pound bomb or bombs will be released before release of bombs in internal racks.

b. 2000-POUND BOMBS IN INTERNAL RACKS.—The procedure is the same as that described in paragraph 13. *b.* (2) *(b)*, preceding, except that, the following settings of switches on the bombardier's auxiliary panel must be made:

The "EXTERNAL INTERNAL RACKS-EXTERNAL RACKS" switch to be in the "EXTERNAL INTERNAL RACKS" position.

The "WING RACK SELECTOR" switches are to be on for the bombs or bombs to be released.

Note

The interval control must be set for "SELECTIVE" bombing. The 4000-pound bomb or bombs will be released before release of bombs in the internal racks.

(3) SALVO RELEASE.

(a) BY PILOT.—See Section IV, paragraph 10., "EMERGENCY BOMB RELEASE."

(b) BY BOMBARDIER.

1. Open the bomb doors by moving the "BOMB DOORS" handle to the "DOORS OPEN" position.

2. If an armed salvo is desired, set the nose fuse switch to the "ARM" position.

3. Release the bombs by moving the "BOMB RELEASE" handle to the "SALVO" position.

c. FUEL SELECTOR VALVES.—Refer to Section II, paragraph 4. *(See figure 78.)*

d. HYDRAULIC CONTROLS. — The hydraulic reservoir is located on the right side in the center of the bomb bay compartment. The emergency hydraulic valve and the auxiliary electric hydraulic pump switch are located in the forward end of the bomb bay compartment on the right side. *(See figure 78.)*

14. NOSE TURRET.

Group I and II airplanes have the Emerson nose turret. Group III airplanes have Consolidated or Motor Products nose turret, except the later Group III airplanes which have the Emerson nose turret.

WARNING

Do not occupy the nose turret or the nose compartment during take-off or landing.

a. EMERSON NOSE TURRET. *(See figure 79.)*

(1) DESCRIPTION. — The Emerson turret mounting two .50-calibre machine guns is rotated, and the guns are elevated and depressed by electric motors. Manual movement of the turret is accomplished by two cranks, one rotating the turret in azimuth and the other elevating the guns. The turret can be rotated manually from outside the turret by pulling on an emergency release cable which extends outside the turret. The gunner and the turret mechanism are protected by sections of 5/8-inch and 3/8-inch armor plate and bullet-resistant glass.

(2) TURRET OPERATING INSTRUCTIONS. *(See figures 80 and 81.)*

(a) GENERAL.—Gun firing is by standard type G-11 solenoids. One trigger switch is located on each control handle grip. The trigger switches are wired in parallel, so that either switch fires both guns.

1. Turn "ON" the master switch.

2. Adjust the sight rheostat to the desired intensity. The "dead man" grips must be held "CLOSED."

3. Turn "ON" the elevation drive switch. Wait 10 seconds.

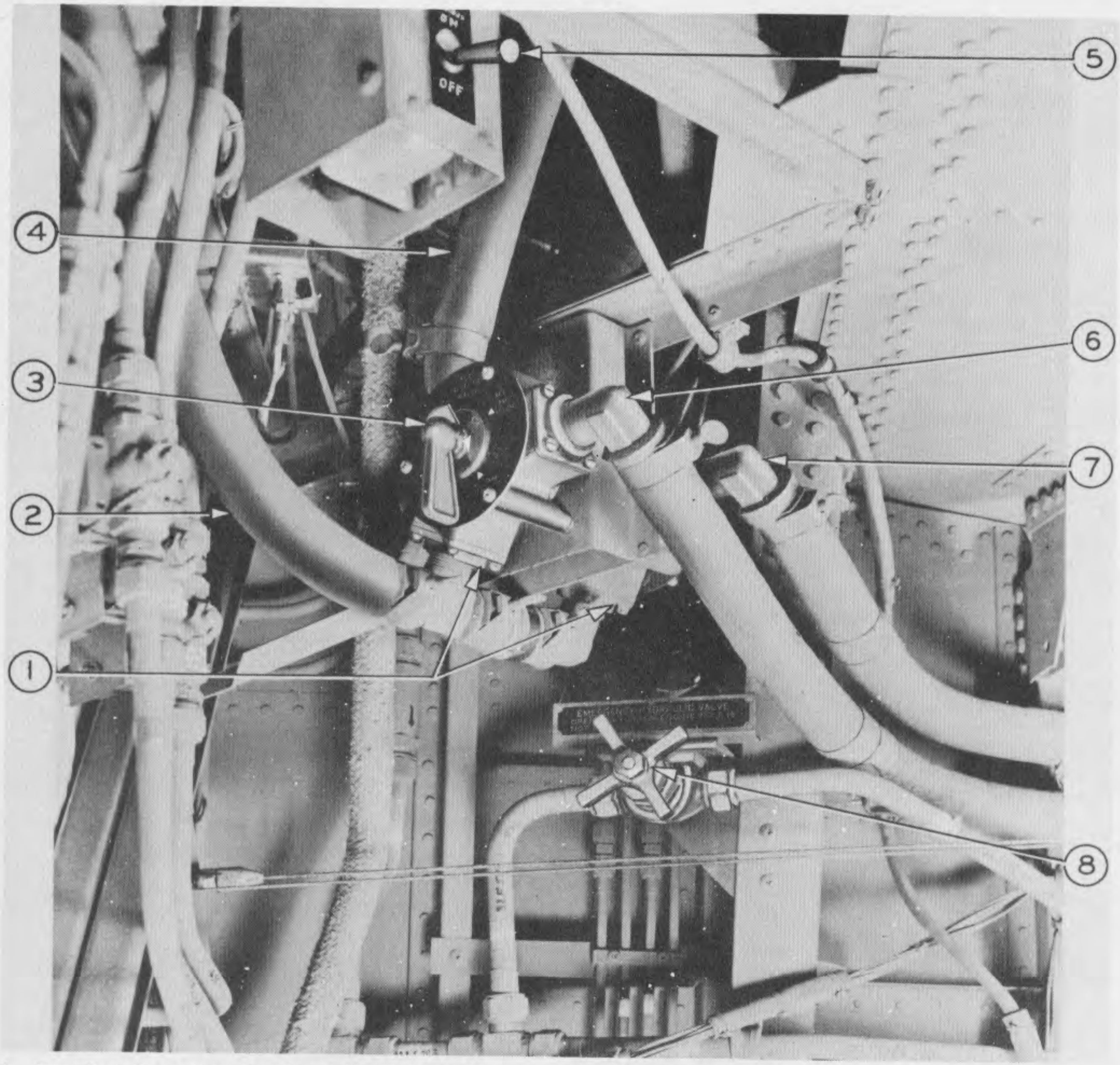
4. Turn "ON" the azimuth drive switch.

5. Turn "ON" the gun ready switch.

6. Check the charging handles for stowed position.

7. Check the manual controls for stowed position.

(b) PREPARATION FOR POWER OPERATION.—The turret is made ready for combat operation by starting the two amplidyne motors installed outside the turret and by energizing the two drive



1. Cross-Feed Connections No. 3 and No. 4 Main Selector Valves
2. Cross-Feed Manifold Line
3. No. 3 Selector Valve Handle
4. Main Fuel Line to No. 3 Engine
5. Switch for Electric Motor, Hydraulic System Pump
6. Connection Main Fuel Line from No. 3 Main Tank to No. 3 Selector
7. Connection Main Fuel Line from No. 4 Main Tank to No. 4 Selector
8. Emergency Shut-Off Valve, Hydraulic System

Figure 78—Fuel and Hydraulic System Controls in Bomb Bay

motor fields. To accomplish this operation, close the following switches in the order of their listing below:

1. EXTERNAL POWER SWITCH. — Located on top of the amplidyne junction box in the airplane fuselage beside the nose wheel installation. This switch controls all current to the turret and to the supplementary units located in the airplane fuselage. It serves as an external emergency control. It may be left closed at all times except when the turret power must be cut off.

2. MASTER SWITCH. — Located on the turret switch box. Closing this switch energizes both drive motor fields.

3. ELEVATION AND AZIMUTH DRIVING SWITCHES.—Located on the turret switch box adjacent to the master switch. Closing these switches

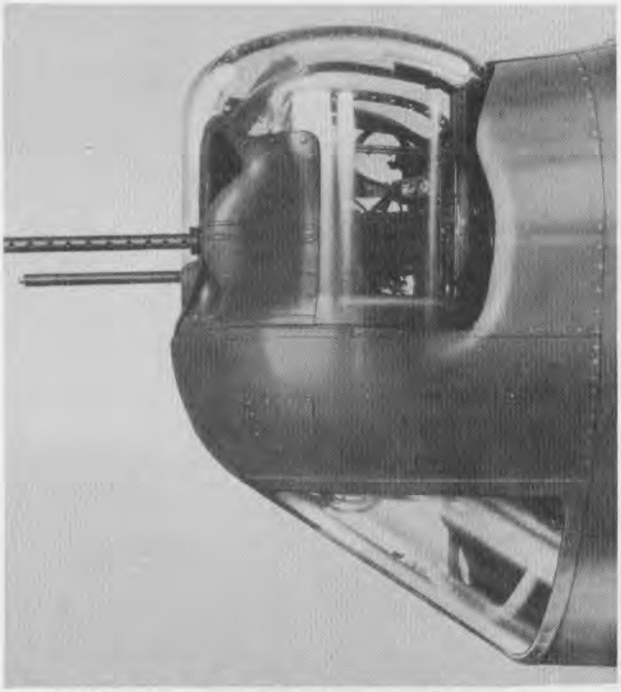


Figure 79—Type A-15 (Emerson) Nose Turret

starts the elevation and the azimuth amplidyne motors, respectively.

4. GUN READY SWITCH. — Located on the turret switch box, protected by a red guard. This switch controls the circuits to the firing solenoids.

(c) ACTUAL POWER OPERATION OF TURRET.—When the turret has been prepared for operation, the actual operation is controlled entirely by the control handles and their component switches.

1. Hold one or both of the "dead man" safety switches "CLOSED." These switches are mounted on the control handle grips on the side toward the gunner. Holding on to either of these grips will depress one of these switches to the "CLOSED" position.

2. Movement of the turret or guns corresponds to movement of the control handles. One or both of the safety switches must be held "CLOSED" during all movement. The speed of movement in any direction will be proportional to the movement of the control handles in the same direction.

3. Hold the high-speed switch "CLOSED" for high-speed operation. A push-button type switch is located at top front of the right control handle grip, convenient for operation by the gunner's thumb. It must be held "CLOSED." It will open when released.

4. Two circuit breaker switches, one for the elevation drive motor and one for the azimuth drive motor, are located on the amplidyne junction box outside the turret. These switches protect the turret circuits from current overloads.

(3) OPERATION OF GUNS.

(a) TRIGGER SWITCH OPERATION.—The turret must be made ready for operation as described in *a.*, (2) preceding. If these steps are completed and the guns are fully charged, the closing of either trigger switch, mounted on the control handle grips on the side away from the gunner, will fire both guns. The switch must be held closed for so long as it is desired to have the guns continue firing.

(b) GUN CHARGERS.—Gun charger handles are located below and inboard of the guns forward of the gunner's knees. To charge the guns, pull the gun charger handles to the end of the stroke and release. Repeat the operation to be sure that the guns are charged.

b. CONSOLIDATED NOSE TURRET.

(1) DESCRIPTION. *(See figure 82.)*—The turret mounts two .50-calibre machine guns. The turret is the same as the Consolidated tail turret. Instead of an independent hydraulic system, the nose turret hydraulic system is connected to the airplane hydraulic system on right side of fuselage beneath the flight deck. A fuse box for turret electrical circuits, located on the left side of the nose compartment, contains a 20-ampere fuse for nose turret power, a 20-ampere fuse for flying-suit heater, and a 2-ampere fuse for the oxygen indicator.

(2) NORMAL OPERATION. — Normal operation is hydraulic for movement of the turret in azimuth, for movement of the guns in elevation, and for charging the guns. The guns are fired electrically. A gun trigger switch, which controls the circuits to both firing solenoids, is mounted on the right side of the turret cabin. A circuit breaker push button for each solenoid circuit is mounted above the switch. A firing trigger controlling both firing solenoids is mounted on the right control grip. Emergency manual operation is provided for as described in Section IV, paragraph 8.

Note

For normal operation of the turret, the airplane hydraulic system must be in operation.

(a) Before entering the turret, open the hydraulic valve on the right side of the fuselage at the rear of the bombardier's compartment.

(b) Visually check the azimuth lock on the right side of the elevation lock on the left side of the turret. The turret must be in the "LOCKED" position at all times when unoccupied.

(c) Reach into the turret and check the hydraulic shut-off valve (red handle). The valve must be in the "OFF" position. *(See figure 83.)*

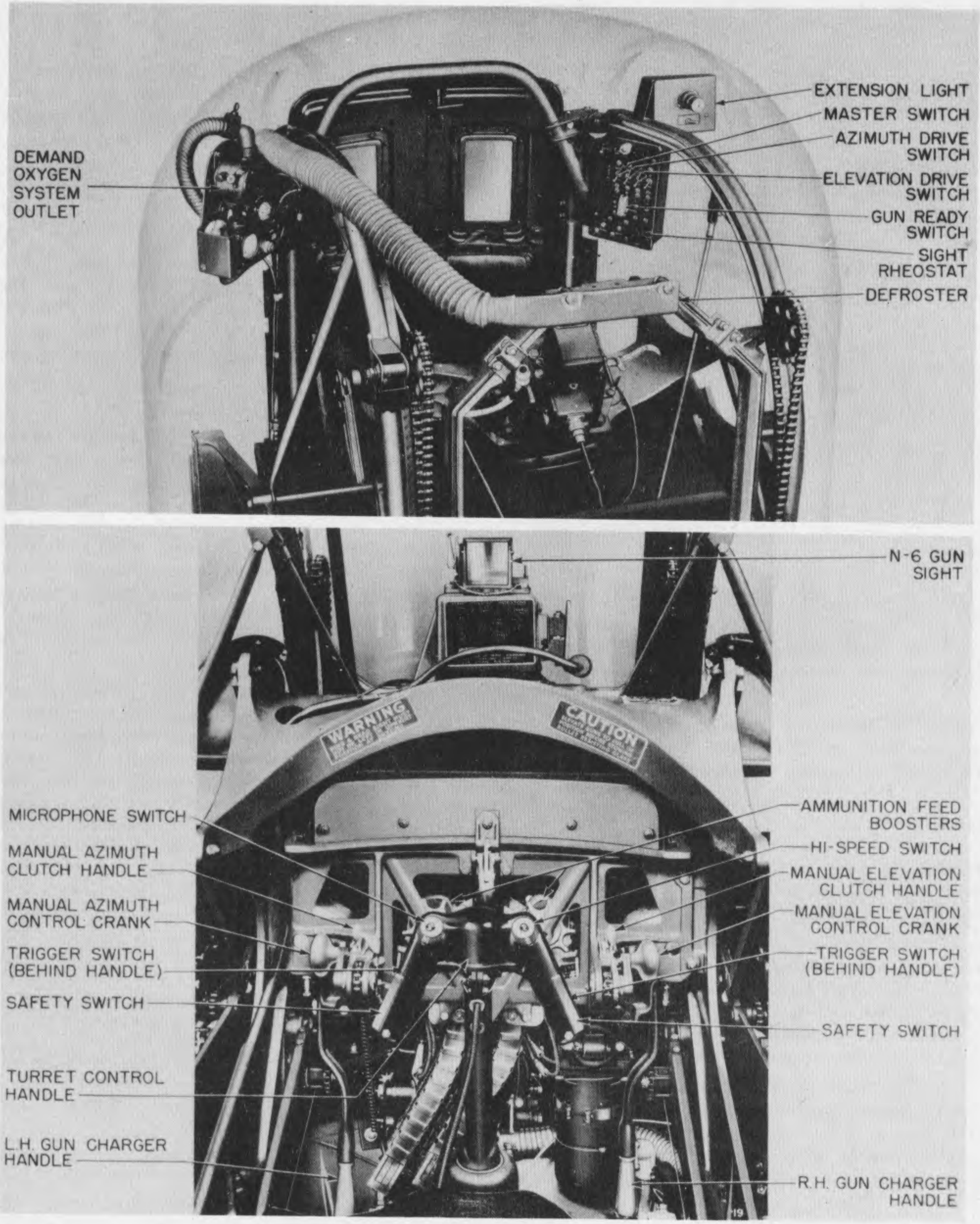


Figure 80—Type A-15 Turret Controls

Figure 81—Type A-15 Turret Control Panel

CAUTION

Use the hand grips inside the turret above the door as an aid in entering. Do not use the sight control bar for this purpose.

(*d*) Enter the turret. Close and secure the doors.

(*e*) To adjust the seat to the proper eye level for sight, push down on the two adjusting knobs under the seat, raise or lower the seat as required, and pull up on the knobs.

(*f*) Unlock and stow the elevation lock on the left side of the turret.

(*g*) Unlock and secure the azimuth lock on the right side of the turret, simultaneously turning on the hydraulic valve (red handle) located below the control handles.

WARNING

Attempts to actuate turret with azimuth or elevation lock in position may result in serious damage to turret or injury to operator.

(*h*) Adjust intensity of sight illumination.

(*i*) Check to determine that the magazines are properly filled and that the belts are fed to guns ready for charging. As soon as orders permit, check the operation of charging guns and firing.

(*j*) Check control handles to determine that the turret and the guns operate properly.

(*k*) Check the oxygen supply and equipment.

(*l*) Check the flying-suit heater circuit.

(*m*) Check the interphone operation.

(*n*) Before leaving the turret, bring the guns to horizontal and straight forward position.

(*o*) Unload the guns by raising the gun cover plates and removing the belts. Operate the gun chargers twice and press the firing trigger.

(*p*) Engage the elevation lock. Engage the azimuth lock and simultaneously shut off the hydraulic valve. Remove hands from the control handles as soon as the azimuth lock is engaged.

(*q*) After leaving the turret, close the hydraulic valve at the rear of the bombardier-navigator's compartment.

c. MOTOR PRODUCTS NOSE TURRET.

(1) DESCRIPTION.—The turret mounts two .50-calibre machine guns. The turret does not have built-in magazines. Two ammunition boxes are installed in the bombardier's compartment. Flexible ammunition chutes lead from the boxes to the bottom of the turret. The turret has a firing trigger switch on each hand grip (wired in parallel), with trigger selector switches which permit either or both guns to be fired. A manual gun charging mechanism is provided. The turret hydraulic system is connected

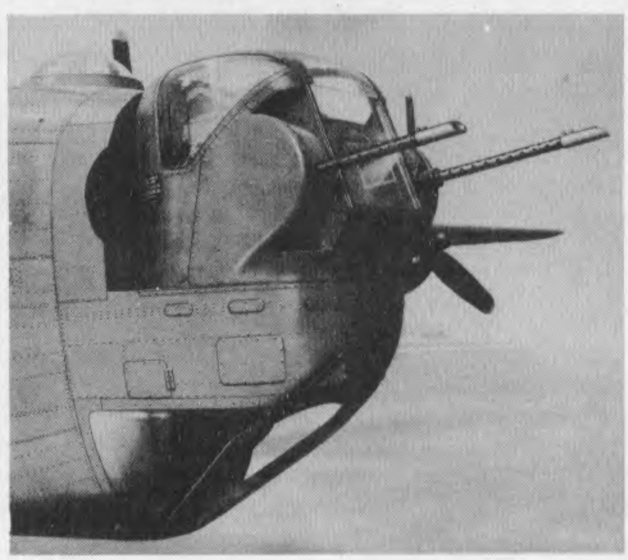
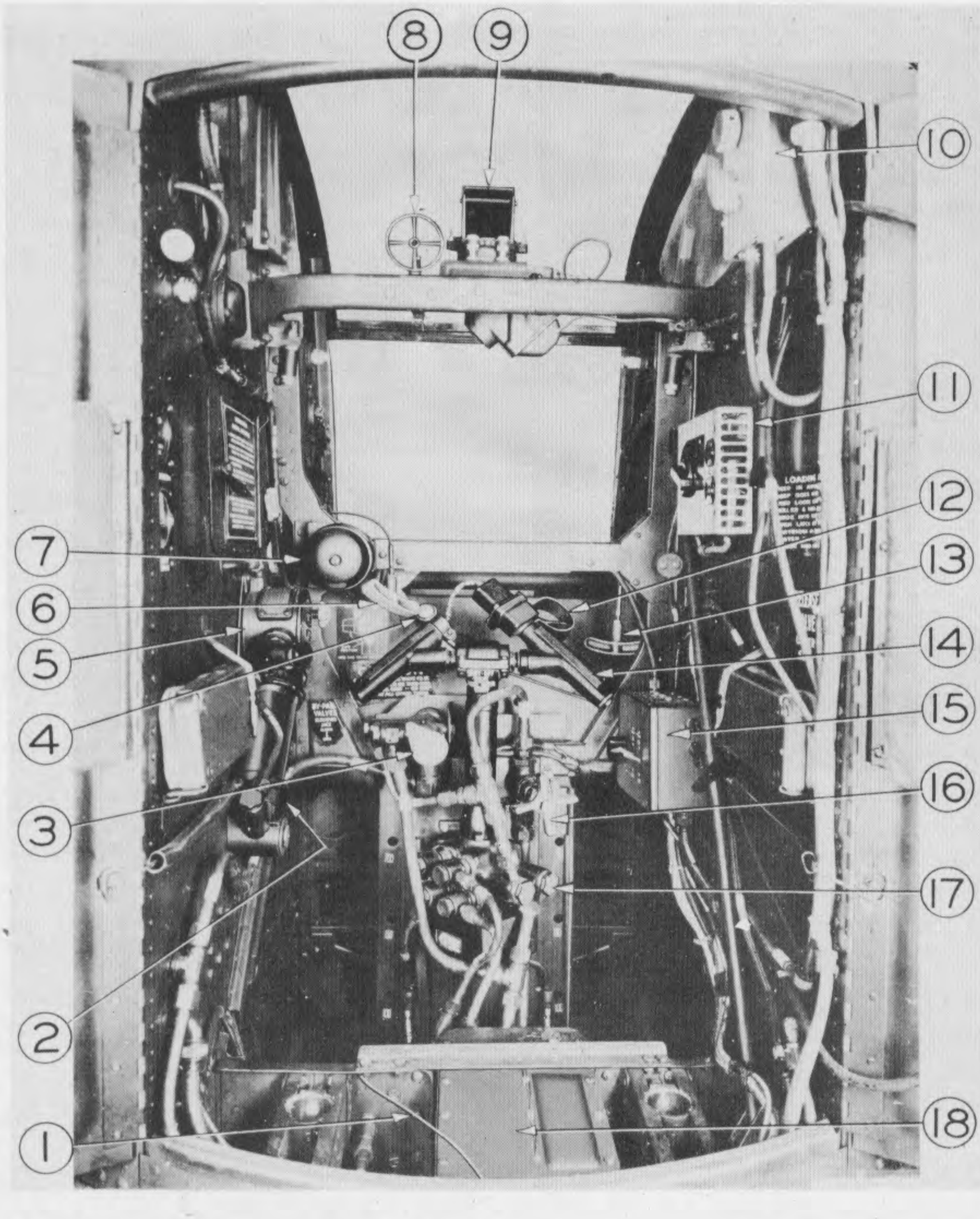


Figure 82—Type A6A (Consolidated) Turret Mounted in Nose



1. Emergency Control Cord
2. Hydraulic Elevation Jack
3. Hydraulic Charging Valve
4. Microphone Switch Button
5. Oxygen Regulator
6. Manual Charging Handle
7. Alarm Bell
8. Ring and Bead Sight
9. Illuminated Sight
10. Interphone Station Box
11. Flying Suit Heater Receptacle
12. Firing Trigger
13. Manual Charging Handle
14. Control Grips
15. Switch Box
16. Shut-Off Valve
17. Clarke Control Valve
18. Seat Cushion Removed

Figure 83—Interior of Type A6A Turret

to the airplane hydraulic system. The valve mounted on the right side of the fuselage beneath the flight deck in the turret pressure line must be "ON" for hydraulic turret operation. The fuse box contains a 20-ampere fuse for nose turret power, a 20-ampere fuse for flying-suit heater, and a 2-ampere fuse for the oxygen indicator. The turret armor plate is $\frac{3}{8}$-inch thick. (A few of the early turrets had $\frac{7}{8}$-inch armor plate.)

(2) NORMAL OPERATING INSTRUCTIONS.

(a) LOADING.

1. Feed the ammunition (end with single loop goes into magazine) from the ammunition boxes into the tracks.

2. Pull the ammunition down through the tracks and up into the turret.

3. Engage the clutches on the booster motors. Feed the belt over the sprocket, then under the booster limit switch up into the ammunition guide and through opening in a disk to gun.

4. Open the latch on the gun and insert the first cartridge over the pawl in the shell receiver.

5. Fasten the gun latch securely.

(b) PROCEDURE FOR ENTERING TURRET DURING FLIGHT.

1. Be sure that the hydraulic valve marked "HYDRAULIC SHUT-OFF VALVE TO NOSE TURRET," located on right side of the nose compartment, is turned "ON."

2. Open the entrance doors.

3. Make certain that the azimuth manual control is securely locked.

4. Make certain that the main hydraulic supply valve in the turret is closed.

5. Make certain that both the azimuth and the elevation bypass valves are closed.

6. Enter turret by grasping the two handles located inside (above doors).

7. Place both feet on seat.

8. Slide feet forward and down into turret tub (straddling controls).

(c) ON ENTERING TURRET.

Note

Items (A), (B), (C), etc. below are identified in the turret by large letters in luminous paint.

1. Close and secure the doors.

2. Adjust the seat to the proper eye level for sight.

3. Remove the safety lock (A) from the elevation system and stow at (B) on bulkhead to the gunner's left.

4. Remove the safety lock (C) from the azimuth system and stow at (D) on bulkhead to the gunner's right.

5. Open the shut-off valve (E) located at gunner's left side of control valve.

6. Push down handle on the elevation dump valve located below the control valve to the "ON" position.

7. Push down handle on the azimuth dump valve, located under the seat, to the "ON" position.

8. Adjust intensity of sight illumination.

9. Turn on the booster switches and the trigger switch.

WARNING

The booster motor clutch (J) located at the end of the motor must be engaged except when the gun jams. If the gun jams, disengage the clutch to reverse the rotation of the sprockets.

10. As soon as orders permit, charge the guns by pulling the charging handles (H) located on the right and the left bulkheads to full length of the cable. Give a quick release. Check operation of the firing triggers and the solenoids.

11. Check the control handles to determine that turret and guns operate properly.

12. Check the oxygen supply and apparatus.

13. Check the flying-suit heater circuit.

14. Check interphone operation.

(d) BEFORE LEAVING TURRET.

1. Unload the guns and operate the firing trigger to be sure that no live rounds remain in the guns.

2. Turn off the gun sight rheostat, booster switches, and trigger switch.

3. Bring the guns to the horizontal position and in line with the center line of the airplane.

4. Place the safety lock (A) on the elevation system.

5. Place the safety lock (C) on the azimuth system.

6. Close the shut-off valve (E) located at the gunner's left side of control valve.

(e) AFTER LEAVING NOSE TURRET.—Close the hydraulic valve marked "HYDRAULIC SHUT-OFF VALVE TO NOSE TURRET."

15. UPPER GUN TURRET (GROUPS I, II, AND III).

(See figure 84.)

a. DESCRIPTION.—An electrically operated Martin turret with twin .50-calibre machine guns is mounted in the top of the fuselage forward of the wing. An N-6 illuminated gun sight is installed. In some later airplanes the N-6 illuminated sight is replaced with a Sperry K-13 compensating sight. The sight light bulb is controlled by a combination switch and rheostat located on the control unit panel. A camera switch is located on the front of the control unit to control the operation of the camera. A microphone switch is located on the left firing grip within easy reach of the thumb. This switch is depressed when it is desired to connect the microphone to the airplane interphone system. When oxygen is required, connect the face mask to the fitting provided at the right side of the gunner's seat. The heated flying-suit rheostat is mounted at the left side of the gunner's seat.

b. NORMAL OPERATION.

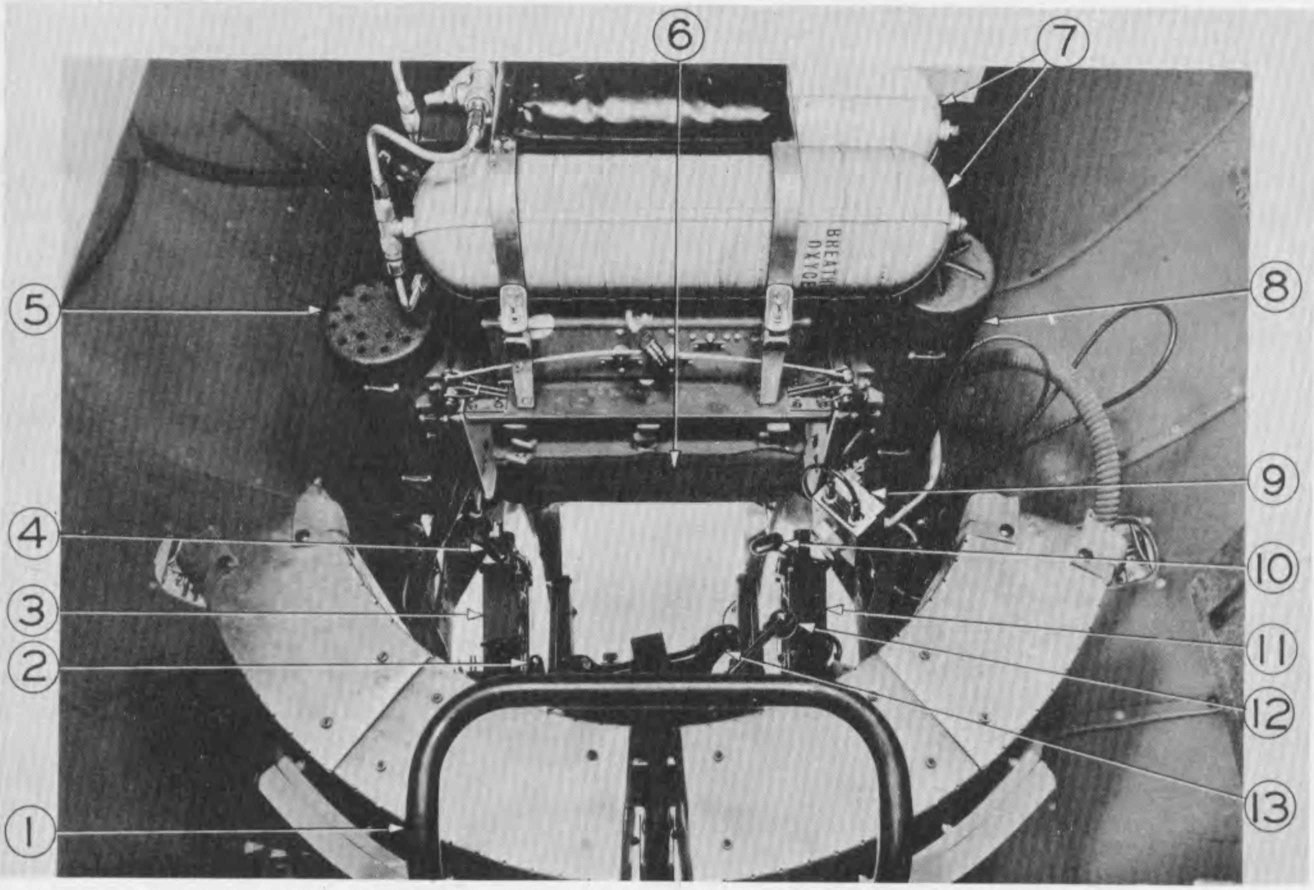
(1) Turn on the two turret power switches located on the under side of the turret supporting structure immediately forward of turret, left and right side.

(2) After being strapped in place, the gunner must reach under the front edge of the seat and close the master switch to the right side of the junction box.

(3) Charge the guns by pulling the gun charging handles to the full extent of their travel and then releasing.

(4) Turn on the guns switch located on the front of the control unit. This switch is covered by a guard which must be raised before it can be turned on.

(5) Place both hands on the firing grips, thereby depressing the side levers and thus closing the safety switches and starting the motor generators. Unless



1. Foot Rest
2. Manual Elevation Crank
3. L-H Gun
4. Gun Charger Handle
5. Elevation Amplidyne Motor Generator
6. Gunner's Seat
7. Turret Oxygen Supply
8. Azimuth Amplidyne Motor Generator
9. Interphone Station Box
10. Gun Charger Handle
11. R-H Gun
12. Manual Azimuth Crank
13. Control Handle

Figure 84—Type A-C3 (Martin) Upper Gun Turret

at least one of the safety switches is closed the turret will not operate.

(6) The guns may now be elevated or lowered by turning the grips about the horizontal shaft on which they are mounted. To rotate the turret, the grips are rotated about the vertical axis between them, the direction of rotation depending upon the direction in which the grips are turned. The speed at which the turret or guns move depends upon the displacement of the grips from the center position. All motion is stopped by returning the grips to the center position or by releasing both side levers.

(7) At any position of the firing grips, the speed of rotation can be increased approximately 250 percent in azimuth and 150 percent in elevation by pressing the high speed switch, which is located on the right grip within easy reach of the thumb. However, the turret will not exceed a speed of 45 degrees per second in azimuth, or 30 degrees per second in elevation.

(8) The operation of the firing triggers is controlled by the selector switch located on the front of the control unit next to the gun switch. When the selector switch is in the "DOWN" position, either trigger will fire both guns, and when it is in the "UP" position the right-hand trigger will fire the right-hand gun and the left-hand trigger will fire the left-hand gun. The firing triggers are located in the control grips, one in each grip. The G.S.A.P. camera N-2 is also interconnected with the left trigger.

c. OVERLOAD PROTECTION.—This protection is provided in the power circuits to the amplidynes, in the gun circuit, the booster circuit, and the control and auxiliary circuits by using thermal overload circuit breakers. In the case of a short circuit or an excessive overload in these circuits, the breakers will snap open after a short time. After a few seconds, they can be reclosed by pushing the "reset" buttons, but they will open again if the overload condition still exists.

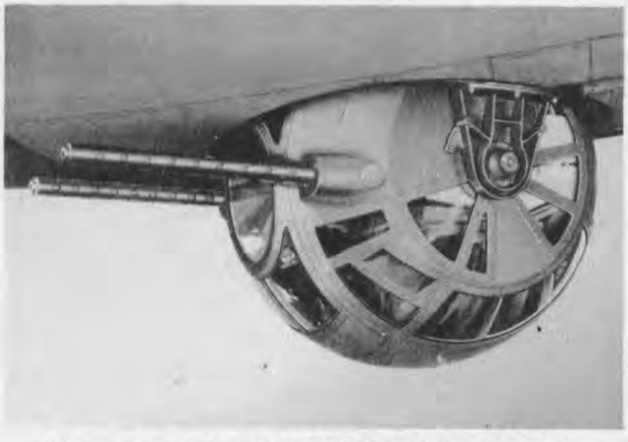


Figure 85—Type A-13 (Briggs) Retractable Lower Ball Turret

16. RETRACTABLE LOWER BALL TURRET.

(See figure 85.)

a. DESCRIPTION. — A Briggs retractable ball turret is mounted in the rear fuselage compartment immediately aft of the bomb bays. It may be aimed in practically any direction in a hemisphere below the airplane fuselage. The turret itself houses all necessary equipment for the two .50-calibre machine guns which are mounted. A Sperry automatic computing sight is provided. This sight automatically calculates the prediction and ballistic deflections. The turret carries 1016 rounds of ammunition. The turret is provided with a demand oxygen regulator mounted under the turret operator's seat. A push-to-talk type interphone switch box is installed at the turret operator's right foot. Later model ball turrets have the gunner's seat lowered to accommodate modified type B-8 parachutes.

b. OPERATING INSTRUCTIONS.

(1) PREFLIGHT OPERATION CHECK. — A preflight operation check is recommended to insure the satisfactory operation of the turrets during combat.

(a) Check the oil level in the hydraulic breather tank.

(b) See that all hand cranks and clutch levers are secured in clips.

(c) Turn the power switch and the sight switch "ON."

(d) Check the response of power and the control mechanisms by manipulating the hand controls, being careful not to cause the guns to strike the ground.

(e) Adjust the reticle light on the sight to the desired brilliance.

(f) Determine that the reticles respond to the foot range control.

(g) Check the alignment of the sight and guns by boresighting.

(h) Operate the oxygen system. Be sure that the blinker flow indicator shows oxygen supply through the regulator and that the pressure remains adequate.

(i) Operate the heated suit to be sure that it is functioning properly.

(j) Operate the interphone system, depressing the foot switch to use the microphone.

(k) Load the ammunition boxes and push the ammunition down to the guns. Lift each gun cover plate and pull the ammunition down. Feed the first shell into the gun magazine by hand. Close the gun cover plates. A hook bent from iron wire may be useful.

(2) TO EXTEND TURRET.

(a) Close the hydraulic retraction release valve. This valve is above the forward end of the turret on the right side of the airplane.

(b) Use the hand pump to the right of the turret on the fuselage to lift the turret enough to release the retraction safety hooks.

(c) Move the retraction safety hooks to the open position. These hooks are mounted at the base of the retraction cylinder.

(d) Open the hydraulic retraction release valve and the turret will move to its extended position.

(e) Be sure that the turret is properly seated at its lowest position.

(3) PROCEDURE FOR ENTERING TURRET. *(See figure 86.)*

(a) When entering the turret, maintain a firm grasp on the tubular supporting structure until sure that the turret will not move.

(b) When inside the turret, fasten the safety belt and close the door securely. Be sure that the door latches are completely closed.

(c) Remove the elevation hand crank from the retainer clip on the trunnion ring support and place it on the vertical shaft projecting from the hand elevation drive unit.

(d) Holding the crank firmly, release the elevation brake and move the elevation power clutch to the "OUT" position by means of the handle provided in the retainer clip on the trunnion ring support.

(e) Remove the clutch handle and replace in the retainer clip.

(f) Crank the turret in elevation to minus 90 degrees (guns down). Holding the crank firmly, open the turret door, and move the elevation power clutch into the "IN" position. Move the hand crank if necessary. Be sure the clutch is engaged.

(g) The turret is now held in the elevation position by power gearing. Remove the outside hand crank and place in clip on the trunnion ring support.

(4) IN FLIGHT OPERATION.

(a) Enter the turret according to instructions *b.* (3), preceding.

(b) Turn "ON" the power switch on the switch box.

(c) Turn "ON" the sight switch on the gun sight.

(d) Plug the heated suit into receptacle beneath the seat.

(e) Connect the oxygen mask to the hose from the regulator beneath the seat.

(f) Connect the microphone and the head set into the jacks on the cords from the switch box.

(g) Charge the guns twice.

(h) Turn "ON" the gun selector switches on the switch box.

(i) At high altitudes or low temperatures, operate the power unit frequently to keep the oil warm and thinned out.

(j) When the target is observed, set the target dimension dial on the sight.

(k) Operate the turret so that the reticles stay on the target ("tracking" target).

(l) Operate the foot range pedal to frame the target with the sight reticles.

(m) Fire the guns with either hand-grip button.

(n) If ammunition is used up, charge the guns twice to insure that no live rounds are left in the guns.

(o) Turn the gun selector switches "OFF."

(p) Leave the turret.

WARNING

During landing or take-off, the turret must be retracted with the guns at minus 22 degrees in elevation and pointing aft. There must be no crew member in the turret.

(5) TO LEAVE TURRET.

(a) Drive the turret to the low limit in elevation (minus 90 degrees).

(b) Turn the power and sight switches "OFF."

(c) Disengage the azimuth power clutch only.

(d) Open the door, unfasten the safety belt, and leave the turret.

(e) Attach the elevation hand crank.

(f) While holding the hand crank firmly, disengage the elevation power clutch within the turret.

(g) Tighten the elevation hand brake.

(h) Close and latch the turret door.

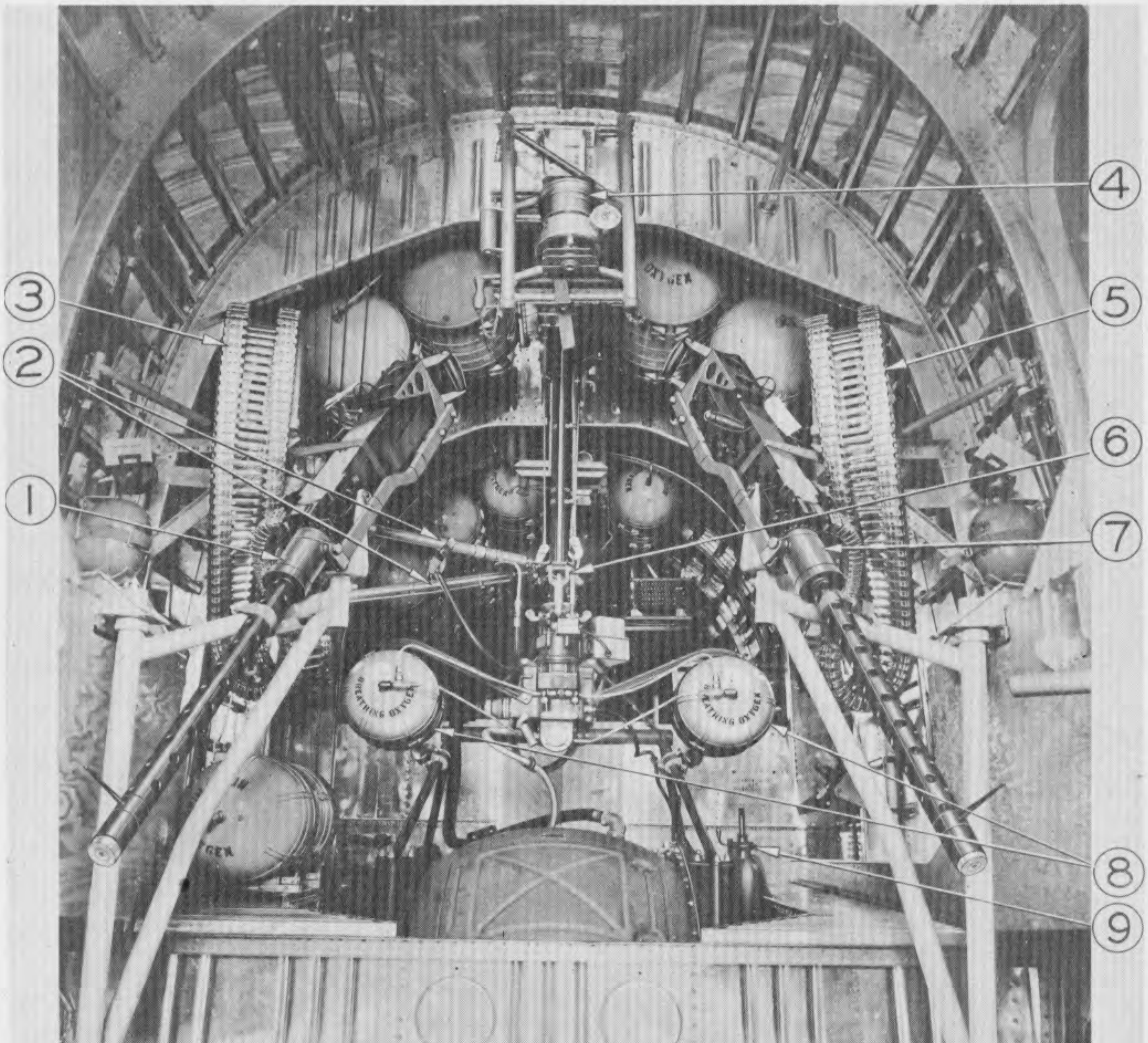
(i) Retract the turret.

(6) TO RETRACT TURRET.

(a) Upon leaving the turret, the guns will be down (minus 90 degrees in elevation).

(b) Close the hydraulic retraction release valve.

(c) Operate the hand pump to raise the turret until the retraction safety hooks may be closed.



1. Left Side Gun in Stowed Position
2. Turret Tie Rods
3. Left Side Gun Ammunition Feed
4. Rear Bomb Hoist in Position for Emergency Turret Retraction
5. Right Side Gun Ammunition Feed
6. Retraction Safety Hook
7. Right Side Gun in Stowed Position
8. Turret Oxygen Bottles
9. Elevation Hand Brake

Figure 86—Lower Ball Turret, Retracted View from Inside Fuselage

(d) Close the retraction safety hooks to retain the turret securely.

(e) Move the turret by hand in azimuth to 180 degrees as marked on the trunnion ring support (guns pointing directly toward tail of airplane). Engage the azimuth power clutch to secure the turret.

(f) Crank the turret in elevation to minus 22 degrees, at which point the cam will close the elevation retraction position switch.

(g) Engage the outside elevation power clutch, using the handle in the retainer clip on the trunnion ring support. Replace the handle in the clip.

(h) Tighten the elevation hand brake. Replace the hand crank in the clip.

c. SAFETY DEVICES.

(1) Two bomb hoists are mounted on the turret support beam. They are available for use in retracting the turret in the event of failure of the hydraulic retracting system.

(2) A spare current limiter is mounted at the top of the fuselage above the ball turret.

(3) On late Group III airplanes, an external master switch marked "BOTTOM TURRET ON-OFF" is installed in the turret power circuit. This switch is mounted on the right side of the turret support beam. The switch does not take the place of the power switch inside the turret. The external master switch may be left "ON" at all times except when an emergency requires that all power to the turret be cut off.

17. SIDE GUNS.

a. GROUPS I, II, AND III AIRPLANES.
(See figure 87.)

Two flexible .50-calibre machine guns are mounted, one in the left rear fuselage window and one in the right rear fuselage window. Each gun is provided with 250 rounds of ammunition in flexible belts stowed in ammunition boxes located on the side walls of fuselage just forward of windows.

The guns are mounted on arm assemblies which are swung inboard and secured to the inside of the fuselage when stowed. When brought up to firing position, the arm assemblies are locked to the firing posts by firing-post lockpins. Proceed as follows to secure the guns in the firing position:

(1) Swing the gun-and-mount assembly over to the firing post at the sill of the waist gun window.

(2) Engage the firing-post lockpin by lifting up on the lockpin handle. Secure the handle by rotating it a quarter of a turn to the right.

(3) On some airplanes, a small safety pin is provided which may be inserted in a hole in the lockpin and the lockpin socket. When inserted, this safety pin prevents the firing-post lockpin from slipping out of place while the gun is being fired. On airplanes which have this safety pin, *be sure to insert the safety pin before firing.*

b. LATER GROUP III AIRPLANES.

(1) DESCRIPTION.—The side guns in the later Group III airplanes are semipermanently mounted in the universal swivels designed to allow the side-hatch windows to remain in place when the machine guns are in operation. Provisions are made to stow 1200 rounds of ammunition (600 rounds per gun) on the half-deck and to feed this ammunition to the machine guns by booster motors. These motors are controlled by switches located on the fuselage wall forward of each gun.

Each gun is equipped with an N-8A sight, which is controlled by a three-position toggle switch on the side of the sight, and by a rheostat mounted on the fuselage wall to the left of the machine gun (facing outboard). The sight contains a two-filament light; if one filament fails, operation may be restored by reversing the toggle switch. The volume of light is controlled by the rheostat.

The sights are equipped with auxiliary ring-and-bead sights for use in the event of power failure.

For cold weather operation, the guns are equipped with heaters that are set in operation by connecting the heater wires to the plug below the gun mount.

Both the machine guns and the ammunition storage boxes can be jettisoned in an emergency.

(2) OPERATION.—Since the operation of these machine guns is standard, no detailed instructions are required.

18. TAIL GUN TURRET.

a. CONSOLIDATED TAIL TURRET (Early Group I and Group III Airplanes).
(See figure 88.)

(1) DESCRIPTION. — The consolidated tail turret is installed in the extreme rear of the fuselage. Two .50-calibre machine guns are mounted in the turret and eight hundred rounds of ammunition are normally carried. The hydraulic system for operation of the turret is an independent unit. It consists of an electrically driven pump, a check valve, pressure switch, relief valve, accumulator, oil filter, oil reservoir, and required pressure lines. This equipment is located outside the turret on the right side of the fuselage.

(2) NORMAL OPERATION. — Hydraulic energy is used for moving the turret in azimuth, for moving the guns in elevation, and for charging the guns. The guns are fired electrically. A gun trigger switch, which controls the circuits to the firing trigger, is mounted on the right side of the turret cabin. A circuit-breaker push button for each firing solenoid circuit is mounted above the switch. A firing trigger, controlling both firing solenoid circuits, is mounted on the right-hand grip control. Emergency manual operation is provided for as described in section IV, paragraph 8.

WARNING

Do not occupy the turret or remain in the tail of the airplane during take-off or landing.

(a) Before entering the turret, turn on the actuating system switch on the right side of the fuselage outside of the turret.

(b) Release the securing straps or the locking pin (if installed) underneath the turret ring.

(c) Visually check the azimuth lock (if installed) on the right side of the turret. Visually check the elevation lock on the left side of the turret. The turret must be in the locked position at all times when unoccupied.

(d) Reach into the turret and check the hydraulic shut-off valve (red handle). This valve must be in the "OFF" position.

CAUTION

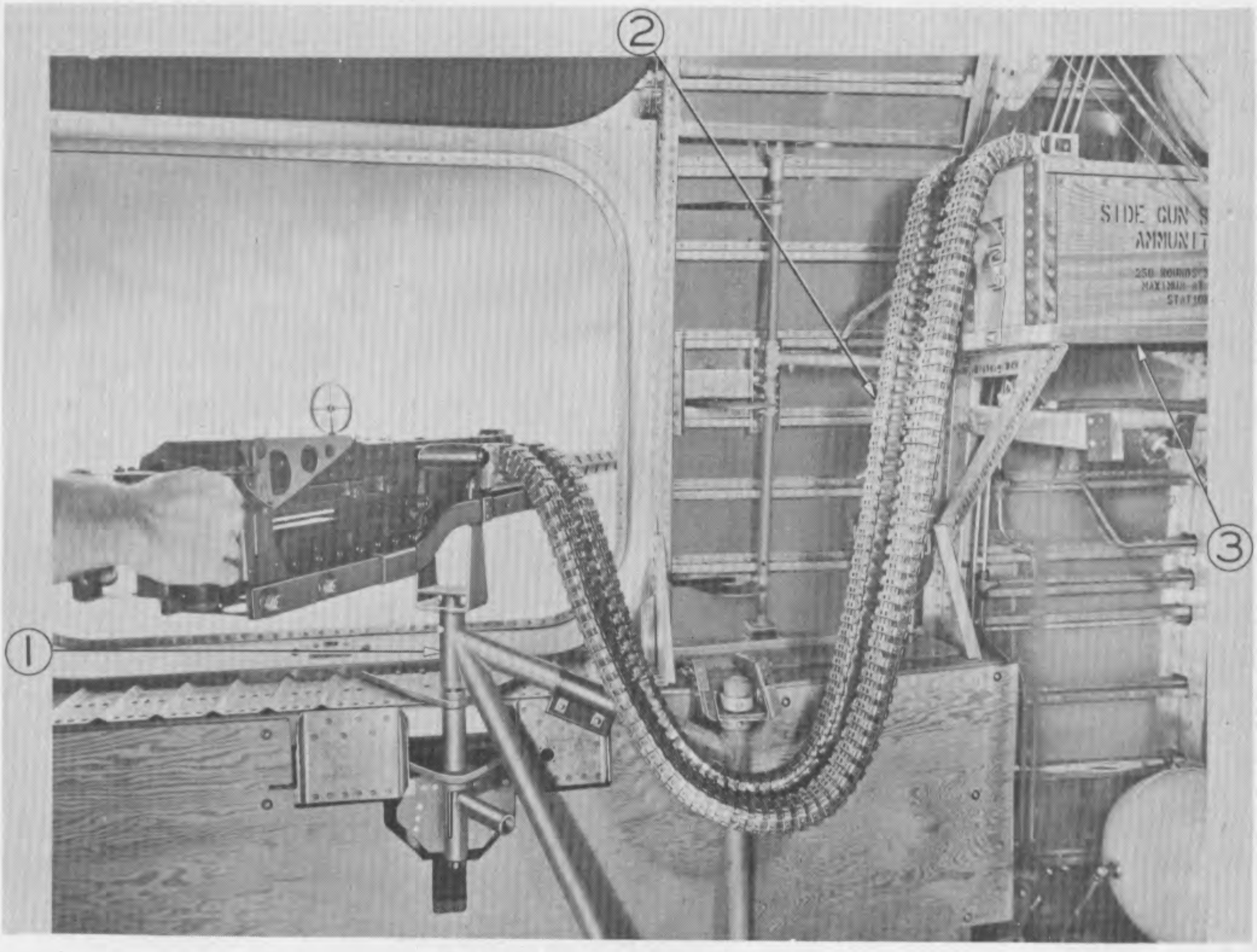
Use the hand grips inside the turret above the door as an aid in entering the turret. Do not use the sight control bar for this purpose.

(e) Enter the turret, then close and secure the doors.

(f) To adjust the seat to the proper level for sighting, push down on the two adjusting knobs under the seat, raise or lower the seat as required, and pull up on the knobs.

(g) Unlock and stow the elevation lock on the left side of the turret.

(h) If the azimuth lock is installed, unlock and secure it, and simultaneously turn on the hydraulic valve (red handle) located below the control handles. If the azimuth lock is not installed, turn on the hydraulic valve.



1. Gun Mount in Firing Position
2. Flexible Ammunition Feed
3. Left Side Gun Ammunition Box

Figure 87—Left Side Gun, Looking Outboard

WARNING

Attempts to actuate the turret with the azimuth or the elevation lock in position may result in serious damage to the turret or in injury to the operator.

(i) Adjust intensity of sight illumination.

(j) Check to determine that the magazines are properly filled and that the belts are fed to the guns ready for charging. As soon as orders permit, check the operation of charging the guns and firing.

(k) Check the control handles to determine that the turret and the guns operate properly.

(l) Check the oxygen supply and equipment.

(m) Check the flying-suit heater circuit.

(n) Check interphone operation.

(o) Before leaving the turret, bring the guns to the horizontal and straight aft position.

(p) Unload the guns by raising the cover plates and removing the belts. Operate the gun charger twice and press the firing trigger.

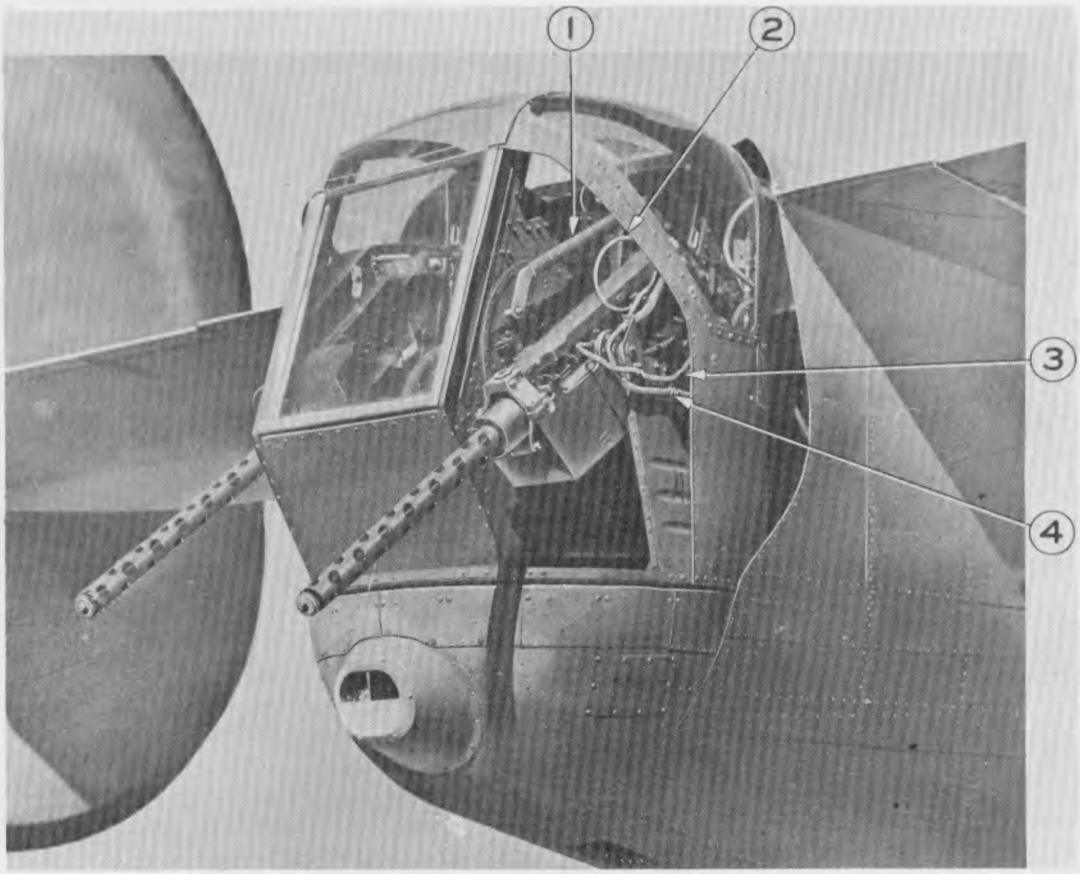
(q) Engage the elevation lock. Engage the azimuth lock and simultaneously shut off the hydraulic valve. Remove the hands from the control handles as soon as the azimuth lock is engaged.

(r) If the azimuth lock is not installed, after leaving the turret, fasten the securing straps or locking pin underneath the turret ring.

(s) Turn "OFF" the actuating system switch on the right side of the fuselage outside the turret.

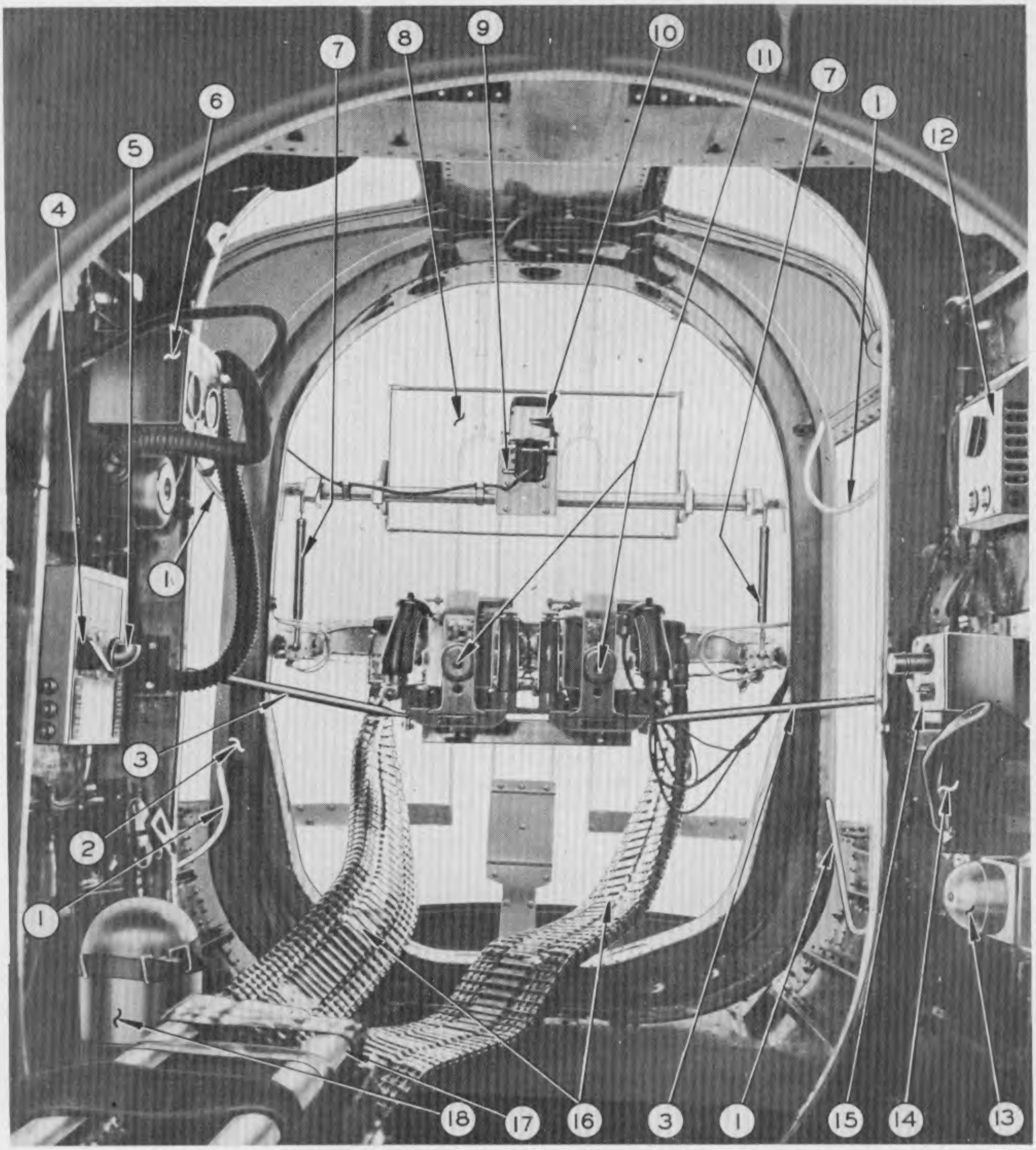
b. MOTOR PRODUCTS TAIL TURRET (On Some Group II and Late Group III Airplanes).

(1) DESCRIPTION.—The Motor Products tail turret installed is identical to the Motor Products nose turret except for differences in the connections to the hydraulic power supply and in the airplane installation supporting the turret. The hydraulic system for operation of the Motor Products tail turret is independent of the main hydraulic system. It consists of an electrically driven pump, a check valve, pressure switch, relief valve, and the required pressure lines, all of which are located outside the turret on the right side of the fuselage. On some airplanes, the pressure switch is replaced by an unloading valve. A switch marked, "TURRET POWER ON-OFF," is mounted on the rear end of the tail turret fuse box,



1. Sight Linkage Bar
2. Foot Firing Cable
3. Electrical Circuit to Firing Solenoid
4. Hydraulic Line to Gun Charger

Figure 88—Type A6A (Consolidated) Turret Mounted in Tail



1. Azimuth Travel Check Cord
2. Draft Curtains
3. Stowage Links
4. Master Switch
5. Sight Light Rheostat
6. Oxygen Outlet
7. Elevation Harmonizing Links
8. Bullet-Resistant Glass
9. Sight Light Toggle Switch
10. Gun Sight, Type N-8A
11. Machine Gun Mount and Mount Assemblies
12. Machine Gun and Flying Suit Heater Panel
13. Warning Bell
14. Oxygen Mask Stowage
15. Extension Light
16. Flexible Ammunition Chutes
17. Rigid Ammunition Chutes
18. Walk-Around Oxygen Cylinder, Type A-4

Figure 88A—Tail Turret, Hand-Held Guns Assembly and Equipment

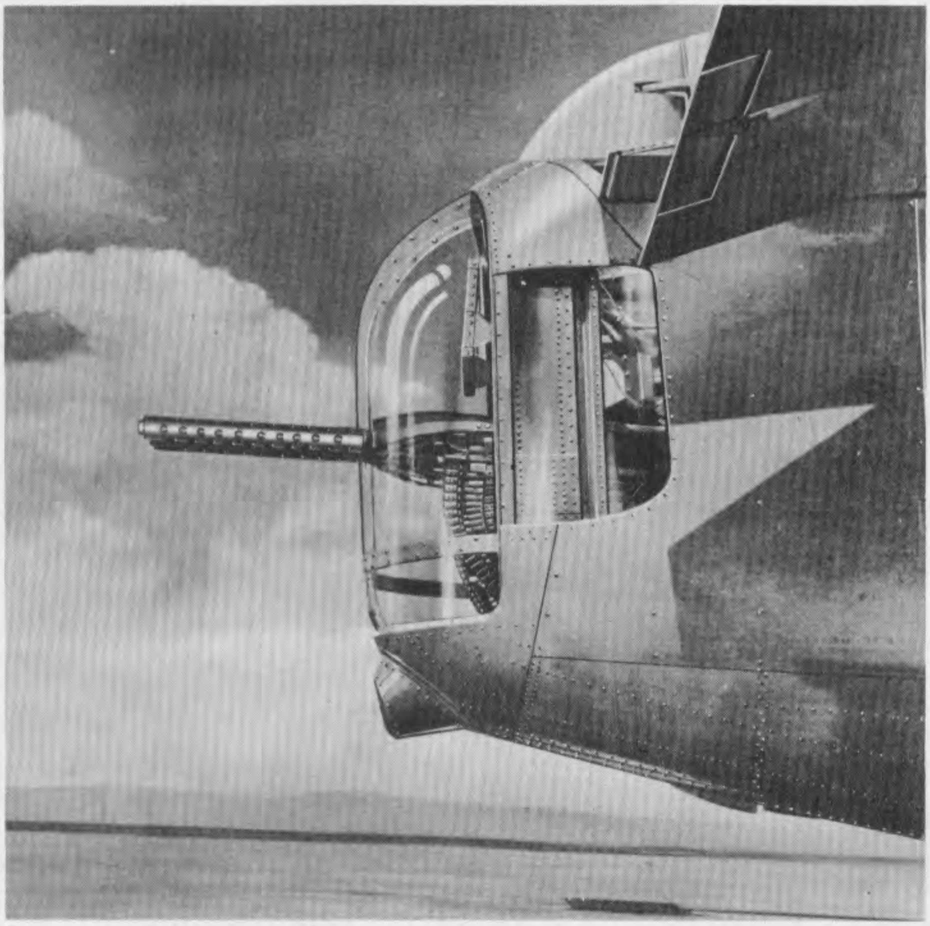


Figure 88B—Side View, Hand-Held Guns Tail Turret

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located on the right side of fuselage outside of the turret. This switch is in series with the pressure switch located in the hydraulic unit and must be "ON" to supply power to the electrically driven pump.

(2) OPERATING INSTRUCTIONS. — Before entering the tail turret, check to determine that the ammunition boxes are properly filled and that the belts are fed into the turret properly. Be sure that the "TURRET POWER" switch is turned "ON." Operation of the turret itself is identical with that of the nose turret. See paragraph 14 *c* (2). After leaving the turret, turn "OFF" the "TURRET POWER" switch.

c. HANDHELD MACHINE GUNS TAIL TURRET (MODEL "L" AIRPLANES).

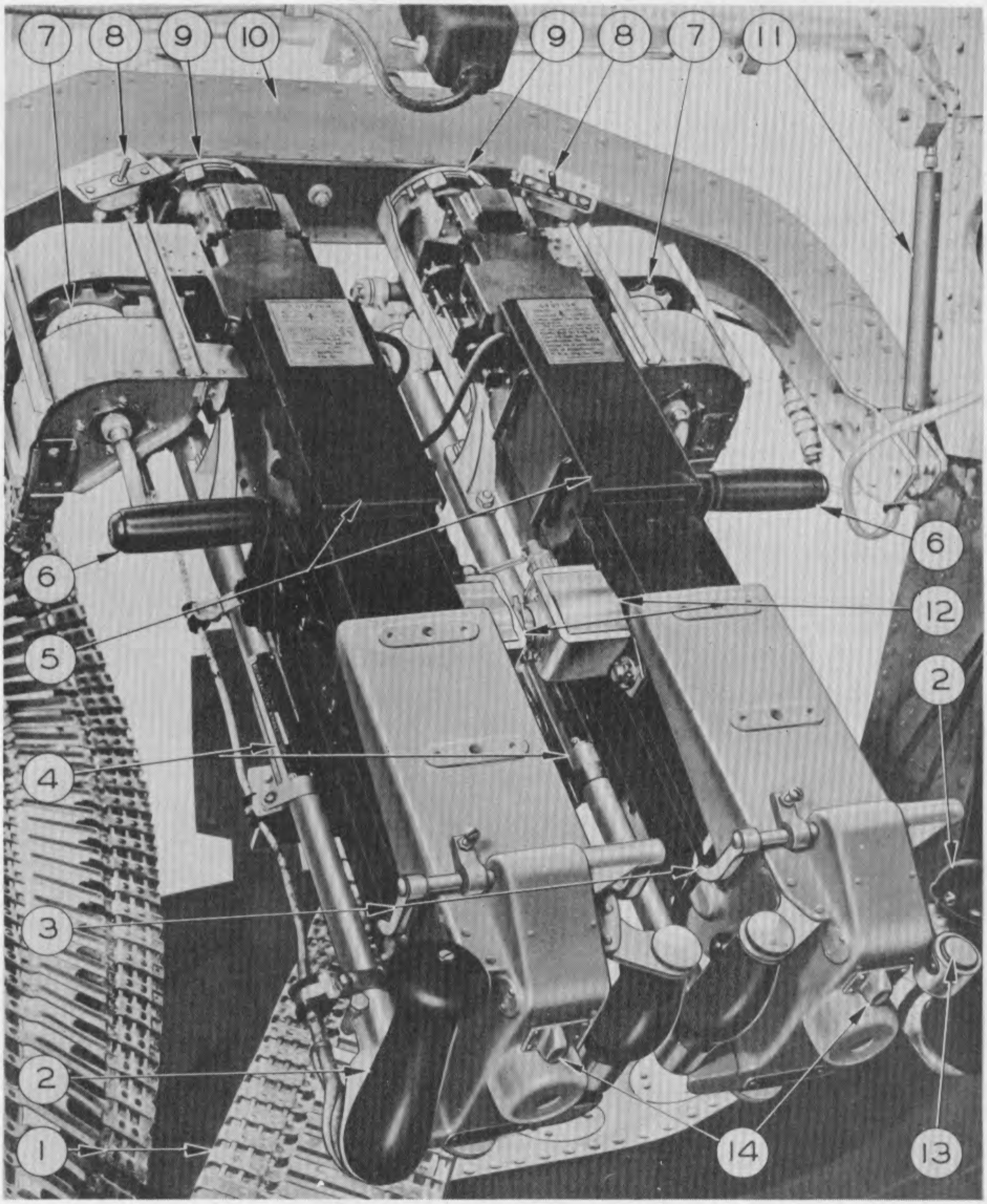
(1) DESCRIPTION. *(See figures 88A and 88B.)* —This hand-held machine gun turret is installed on Model B-24L airplanes. The machine guns, which are hand-held and hand-powered, have an azimuth movement of 60 degrees on either side of the center line, a depression of 50 degrees below the horizontal, and an elevation of 50 degrees above.

(a) MACHINE GUNS. *(See figure 88C.)*— The turret mounts two Type M-2, .50-calibre machine guns. These are parallel mounted in combination Type E-11 and Type C-19 mount adapters. The Type E-11 adapters are modified to mount a firing handle with an electric trigger on the outboard side of each mount. Each machine gun is equipped with a Type J-4 heater and a Type G-9 firing solenoid. The heaters connect into the flying-suit heater rheostat panel. In the event of power failure, the guns may be charged and fired by hand.

(b) SIGHT. *(See figure 88A.)*—The turret is equipped with an N-8A gun sight. This sight is controlled by a three-position toggle switch on the side of the sight and by a rheostat mounted on the master switch panel. The sight contains a two-filament light; if the light fails with the tog‸ : switch in one position, the switch may be reversed to restore operation. The volume of light is controlled by the rheostat on the master switch panel.

The sight is equipped with a bead-and-ring auxiliary sight for use in the event of power failure.

(c) AMMUNITION. — Stowage boxes for 1200 rounds of ammunition (600 rounds for each gun) are provided immediately aft of the right side-gunner's hatch. This ammunition is fed through fixed ammunition chutes to station 9.0. From station 9.0 aft, the ammunition is fed through flexible chutes.



1. Flexible Ammunition Chutes
2. Firing Handle
3. Manual Firing Trigger
4. Mount Adapters, Type E-11
5. Gun Heaters
6. Charging Handles
7. Booster Motors
8. Booster Motor Switches
9. Mount Adapters, Type C-19
10. Gun Yoke
11. Elevation Harmonizing Link
12. Firing Solenoids
13. Throat Microphone Button
14. Machine Gun Safeties

Figure 88C—Machine Gun and Mount Adapter Assembly

Four Model H-1 Hughes booster motors are used to feed the ammunition to the guns. These motors are controlled by the master switch and by two switches mounted outboard of the guns on the mounting yoke.

(d) GUNNER'S EQUIPMENT. *(See figure 88A.)*—The following equipment is located immediately forward of the turret assembly for the gunner's use:

1. WARNING BELL.—This bell is located near the bottom of the fuselage on the left wall.

2. EXTENSION LIGHT. — The extension light is located above the warning bell on the left fuselage wall.

3. OXYGEN MASK STOWAGE CASE. — This stowage case is located immediately forward of, and below, the extension light.

4. FLYING SUIT HEATER PANEL.—This panel is located above the extension light near the top of the left fuselage wall.

5. WALK-AROUND OXYGEN BOTTLE. —The walk-around bottle is secured to a mount near the bottom right fuselage wall, just forward of the turret.

6. OXYGEN OUTLET.—The oxygen outlet equipment is located near the top of the fuselage wall above the oxygen walk-around bottle.

(2) STOWAGE. *(See figure 88D.)*—When not in use, the machine guns may be secured by means of two rods connected to the beltframe at station 9.2. These links attach to toggle bolts beneath the machine gun firing handles when the guns are secured. When not in use, these rods are held out of the way by clamps on the lower portion of the beltframe at station 9.2.

(3) OPERATION. — To place this turret in operation, observe the following procedure:

(a) Turn "ON" the turret master switch.

(b) Turn "ON" the sight rheostat and sight toggle switch.

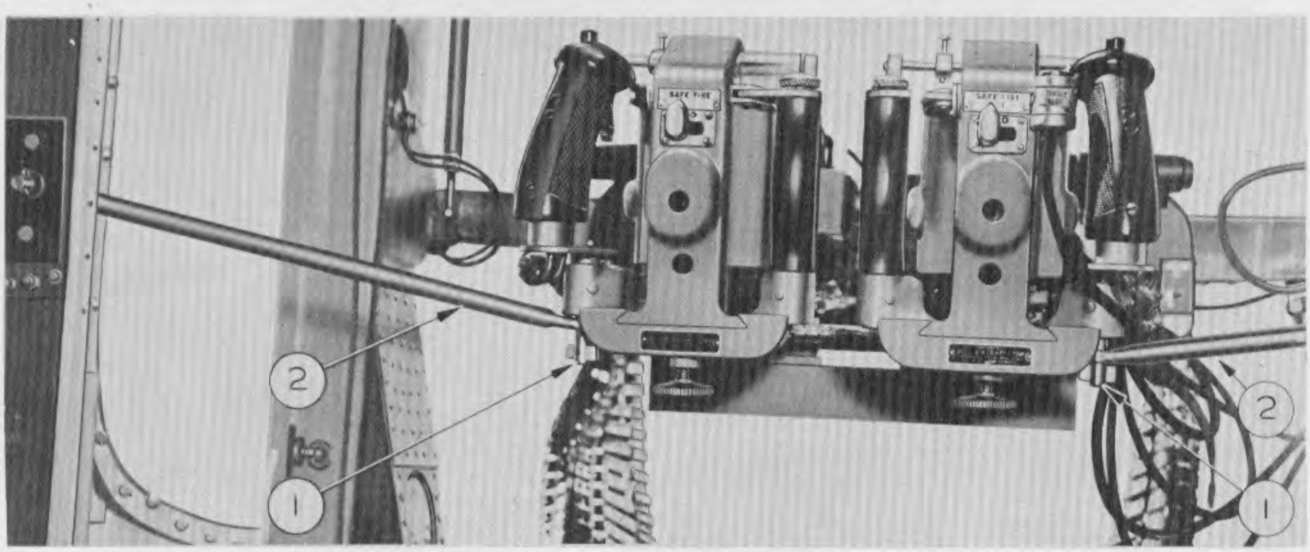
(c) Turn "ON" the two booster motor switches.

(d) Charge the machine guns, using the hand-charging handles.

(e) Remove the securing rods from the machine guns.

(f) Release the machine gun safety.

d. CONSOLIDATED TAIL TURRET 32F5800-7 (MODEL "M" AIRPLANES). *(See figure 69A.)*—This turret is similar to the turret described in paragraph 18 *a*, preceding, in all particulars except armor plating. All armor plate and bullet-resistant glass have been removed from this turret.



1. Toggle Bolts   2. Stowage Links

Figure 88D—Hand-Held Guns, Stowed

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U. S. A.—BRITISH GLOSSARY

United States	*British*
A	
Accumulator	Pressure reservoir (do not confuse with electric accumulator or storage battery)
Acrobatics	Aerobatics
Airfoil	Aerofoil
Airplane	Aeroplane
Airport	Aerodrome
Angle of attack	True angle of incidence or angle of attack
Angle of incidence or angle of wing setting	Angle of wing setting
Angle of stabilizer setting	Tail-setting angle
Antenna	Aerial
Antenna, loop	Loop aerial
Appendix	Neck
Axis, vertical	Normal axis
B	
Ball bearing or roller bearing	Antifriction bearing
Battery, storage	Accumulator or storage battery
Beacon, radio range	Radio track beacon
Beam, landing	Approach beam
Blade back	Suction face
Bombardier	Bomb aimer
Bureau, weather	Meteorological office
C	
Cam	Cam or snail
Carburetor	Carburettor
Ceiling	Cloud height
Chord	Chord line
Clevis	Fork joint or knuckle joint end
Command set	Pilot controller set
Commutator	Invertor
Cone, split, or split wedge	Collet
Controls	Flying controls
Converter	Motor generator (A.C. to D.C.) or converter
Copilot	Second pilot
Cord	String
Course	Track angle
Cylinder, hydraulic	Hydraulic jack
D	
Distance, take-off	Take-off run
Drift	Drift-angle
Duct	Interconnecting sleeve or trousers
E	
Empennage or airplane tail	Tail unit
Engine or power plant	Aero-engine
Engine section	Power plant or power egg
Exit	Egress
F	
Feathering	Differential pitch control
Field, landing	Landing ground
Filter, air	Air cleaner
Flare	Signal star or signal projectile
Flight indicator	Artificial horizon
Fuel	Petrol or fuel
Fuel gage	Fuel contents gage or fuel level indicator
G	
Gage, fuel, or fuel-level gage	Fuel contents gauge or fuel level indicator
Gasket	Joint, washer, or gasket
Gasoline, "gas," or fuel	Petrol or fuel
Gear, retractable landing	Alighting gear, undercarriage, retractable undercarriage, retractile undercarriage, or chassis
Generator	Dynamo
Glass, bulletproof, or bullet-resisting glass	Armour glass
Gross weight	All-up weight
H	
Head, air speed	Pressure head
Course	Heading
I	
Interphone	Inter-communication
Inverter	Motor generator (D.C. to A.C.)
L	
Land	Alight
Lean mixture	Weak mixture
Left	Port
Level off	Flatten out
Lights, position	Navigation lights
Longeron	Stringer
Loop, antenna	Loop, aerial
M	
Manifold pressure	Boost
Mast, radio	Rod aerial
Meter, drift	Drift sight
Meter, frequency	Wavemeter

United States	British
N	
Navigation, air	Avigation
O	
Oleo strut	Oleo leg
Operator, radio	Wireless operator
P	
Panel, center section	Center section plane
Panel, inboard	Center section plane or center section
Panel, outboard wing	Outer plane
Plug, spark	Sparking plug
Post, binding	Terminal
Pressure, manifold	Boost pressure or boost
Prime	Prime or dope
Propeller	Air screw, propeller, or propellor
Propeller, controllable	Controllable pitch propeller
R	
Radio	Wireless
Raft, life	Dinghy
Regulator, manifold pressure	Boost control unit
Right	Starboard
Ring, lock	Circlip
Rings, mooring	Picketing rings
Rod, link	Auxiliary connecting rod
S	
Set, command radio	Pilot controller set
Set, liaison radio	General purpose set
Shield, electrical	Screen
Shield, ignition	Ignition harness
Speed, rated engine	Maximum RPM for continuous cruising
Stabilizer	Tail plane
Strut, oleo	Compression leg, shock absorber leg or oleo leg
T	
Tab, trim	Trimming tab
Tachometer	Engine speed indicator, or revolution indicator
Test, block	Test after overhaul
Tie down fittings	Picketing rings
Tube	Valve
Tube, static	Static-pressure tube
Turn indicator	Direction indicator
V	
Valve	Valve or cock
Valve, check	Non-return valve or check valve
Vise	Vice
W	
Wall, fire	Fireproof bulkhead
Washer, lock	Spring washer
Windshield	Windscreen
Wing	Main plane

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APPENDIX II
FLIGHT OPERATING CHARTS

1. USE OF FLIGHT OPERATION INSTRUCTION CHARTS.

Flight Operation Instruction Charts include information concerning range attainable and recommended power plant control settings for various combinations of gross weight, fuel load, altitude and air speed. To avoid misuse or misinterpretation of the charts, cognizance should be taken of the following items:

a. The charted ranges make no allowance for starting warm-up, take-off, and climb. Fuel consumed during these operations should be obtained from Take-off, Climb, and Landing Charts. *(See figures 89 and 90.)* The horizontal miles flown in climbing to altitude have not been added to the range and similarly, no account is taken of the improved mileage per gallon obtained during descent. Neglect of this latter factor is recommeded to balance the fuel required for the landing operation.

b. The operating data included on any one chart should be used only when the gross weight is within the limits specified in the title block. THIS IS ESENTIAL, AS RANGES HAVE BEEN COMPUTED ON THIS BASIS. Ranges shown on the three-engine charts listing one propeller feathered as an external load item are based on the conservative assumption that the feathered propeller is Number 1 (left outboard), and is carried the entire distance.

c. All data have been based on the maximum weight for which the chart is applicable. When gross weight is within the chart weight limits and less than the maximum (because of lighter initial weight or diminished fuel load), the air speed should be slightly greater than that listed on the chart. To be conservative, no account has been taken of this factor.

d. Experience has indicated that it is necessary to reduce reliable flight test range data by 10 percent to take account of variations in service airplanes and operating technique. These allowances have been made on the Flight Operation Instruction Chart. NO ALLOWANCE HAS BEEN MADE FOR WIND, NAVIGATIONAL ERROR, OR OTHER CONTINGENCIES. NO ALLOWANCE HAS BEEN MADE FOR COMBAT OR FORMATION FLIGHT. APPROPRIATE ALLOWANCES FOR THESE ITEMS SHOULD BE DICTATED BY LOCAL DOCTRINE. The fuel quantity used in entering the chart, therefore, should be the fuel available after reaching flight altitude less allowances appropriate for the mission.

2. FLIGHT PLANNING.

a. The following outline may be used as a guide to assist personnel in the use of the Flight Operation Instruction Chart for flight planning purposes:

(1) Select the Flight Operation Instruction Chart with the gross weight limits specified which corresponds most nearly to the gross weight of the airplane at take-off.

(2) Locate largest figure entered under "G.P.H." (gallons per hour) in column I ("Normal Rated") on lower half of chart.

(3) Multiply this figure by the number of hours desired for reserve fuel.

(4) Add the resulting figure to the number of gallons of gasoline required for starting, warm-up, take-off, and climb to desired altitude. *(See Take-off, Climb, and Landing Charts, figures 89 and 90.)*

(5) Subtract the above total from the number of gallons of fuel in the airplane before starting the engines. The figure obtained as a result of this computation will represent the amount of gasoline available for flight planning purposes in the column headed "FUEL" on the "RANGE IN AIR MILES" section of the Flight Operation Instruction Chart.

(6) Select a figure listed in the fuel column equal to (or the next entry less than) the amount of available fuel as determined above.

(7) Read horizontally to the right or left, and select a range figure equal to (or greater than) the number of air miles (with no wind) to be flown. To convert for wind, determine what percent the wind velocity is of the true air speed for the "no wind" condition and reduce or increase the range by the same percentage.

(8) Read the operating data ("R.P.M.," "M.P.," "MIXTURE," "G.P.H.," and "M.P.H." or "KTS.") vertically below and opposite the desired pressure altitude in the SAME NUMBERED COLUMN in which the above range figure appears. Operating values contained in the column in which the range figure appears will give the highest cruising speed possible at the desired range. However, the airplane may be flown using the operating data in any column of a higher range (higher column number), completing the flight plan at a sacrifice of speed, but with an increase in fuel economy.

Note

The conditions having been picked off, the rpm is set first, then manifold pressure is varied to give the desired air speed. At charted air speed and rpm the manifold pressure will be high in hot weather and low in cold weather, when compared to listed values. DO NOT INCREASE MANIFOLD PRESSURE MORE THAN TWO INCHES ABOVE THE TABULATED VALUE WITHOUT RAISING RPM.

(9) The airplane and engine operating data tabulated below the "RANGE IN AIR MILES" figures in columns II, III, or IV, are calculated to give constant miles per gallon at any altitude listed and at any gross weight. Ranges given in column I ("NORMAL RATED") are correct only at the highest altitude listed for the operating values. The range figures given in column V ("MAXIMUM AIR RANGE") are based upon the altitude which gives the fewest miles per gallon.

(10) As the flight progresses and fuel is used, the airplane becomes lighter. WHEN THE GROSS WEIGHT BECOMES LESS THAN THE MINIMUM LIMIT SPECIFIED ON THE CHART, READ THE OPERATING DATA FROM THE SAME NUMBERED COLUMN ON THE CHART OF THE NEXT LOWEST WEIGHTS. The approximate time (in hours) after take-off, when this transition occurs, can be found by taking the difference between the take-off gross weight and the minimum weight specified on the operation chart and dividing by six times the gallons per hour. This information is listed with the operating data in the same numbered column selected, and at the altitude the flight is to be made. When a more accurate calculation is desired, the weight of fuel used in climb (6 times the number of gallons) should be subtracted from the take-off gross weight, and the time to climb added to determine the transition point after take-off. If the flight is of great duration, make this change in operating data several additional times; that is, as soon as the gross weight of the airplane falls into the next weight region. However, the total distance flown is the range first chosen.

(11) To approximate the flight duration in hours (no wind), divide the chosen air miles by an average of the true air speeds at which the flight is to be made. To allow for wind, change the above true air speeds to true ground speeds with the aid of a flight calculator or a navigator's triangle of velocities, divide the air miles by an average of the true ground speeds to get the duration in hours.

(12) Within the limits of the airplane, the fuel required and the flying time for a given mission depend largely on the speed desired. With all other factors remaining equal, speed is obtained at a range sacrifice and range is obtained at a speed sacrifice. The speed is usually determined after considering the urgency of the flight plotted as against the range required. The calculated flight duration in hours is deducted from the desired arrival time to obtain the take-off time so as to have the flight arrive at its destination at the predetermined time.

b. If the flight plan calls for a continuous flight, with the desired cruising power and air speed reasonably constant after take-off and climb, the fuel required and flight time may be computed as a "single section flight."

c. If the original flight plan calls for a mission requiring changes in altitude, power, speed, and gross weight, or if one engine fails in flight, break down the total flight into a series of sections; then, put them together to make up the total flight and its requirements. Figures 93 and 94 are charts for three-engine operation.

Note

The Three-Engine Take-Off, Climb, and Landing Chart is based upon a maximum gross weight of 55,000 pounds while the Three-Engine Flight Operation Instruction Charts are based upon a maximum gross weight of 65,000 pounds. This discrepancy is due to the fact that three-engine take-offs with gross weights in excess of 55,000 pounds are not recommended, and therefore, flight planning involving three-engine operation for the entire distance should be limited to this gross weight. However, the Flight Operation Instruction Charts for gross weights higher than 55,000 pounds are applicable in cases where take-off has been made with four engines, but one engine has failed during flight.

3. EXAMPLE.

a. Given Conditions:

Gross weight at take-off = 63,000 pounds

Gallons of fuel in the airplane = 2600 gallons

Bomb load = 6,000 pounds

Total Range = 1,000 statute miles (assume bombs dropped at halfway mark)

Altitude = 5,000 feet

Reserve fuel = 1½ hours at normal rated power

Engines = R-1830-43 (Bendix-Stromberg carburetor)

(1) Select the Flight Operation Instruction Chart with "CHART WEIGHT LIMITS: 65,000 to 60,000 POUNDS" for airplanes with the R-1830-43 engines (Bendix-Stromberg carburetors). *(See figure 91, sheet 1.)*

(2) The largest figure entered under "G.P.H." in column I is 588 gallons per hour.

(3) Multiply 588 by 1.5 to obtain 822 (use 880) gallons for reserve fuel.

(4) Refer to the Four-Engine Take-Off, Climb, and Landing Chart, figure 89, and pick out 185 gallons of fuel used for starting, warm-up, take-off, and climb to 5,000 feet altitude. Add 185 to 880 to obtain 1065 gallons.

Note

The Take-Off, Climb, and Landing Charts list data for three variations of gross weight loading. Data for intermediate gross weights may be obtained by interpolation, but the heavier weight given should be used for conservatism.

(5) Subtract 1065 gallons from 2600 gallons to otbain 1535 gallons of fuel available for flight planning.

(6) In the column headed "FUEL," select 1500 as the figure to be used for obtaining the range desired.

(7) Move horizontally to the right and read 1150 statute (1000 nautical) miles in column III for the range figure nearest the desired range of 1000 statute miles.

(8) Read vertically below and opposite 5000 feet altitude the operating data in turn to be 2100 RPM, 31.5 M.P., A.L. Mixture, 212 GPH, and 182 MPH or 158 KTS.

(9) Determine when the operating data should be changed to conform with that given on the chart of the next lowest weight limits (60,000 to 55,000 pounds, figure 91, sheet 2) by subtracting the weight of fuel used to climb (6 lb/gal $\times$ 185 gal $=$ 1110 lb) from the take-off gross weight to obtain 61,890 pounds. Subtract 60,000 pounds from 61,890 pounds and divide the difference of 1890 pounds by 6 times the fuel flow to obtain 1890 $\div$ 6 $\times$ 212 $=$ 1.49 hours or 1 hour, 29 minutes. Add the time to climb of 9 minutes to obtain 1 hour 38 minutes, or 1.6 hours, for the transition point time.

(10) Go to the chart of the next lowest gross weight limits (60,000 to 55,000 pounds) and under column III opposite 5,000 feet altitude read in turn 2150 RPM, 31.5 M.P., A.L. Mixture, 218 GPH, and 189 MPH or 164 KTS.

(11) The same procedure as outlined above is followed until the flight plan has been completed. For this example, a 6000-pound bomb load is dropped at the halfway mark. Cognizance must be taken of this in planning the return flight, as the loss in weight of 6000 pounds may necessitate skipping one chart of gross weight limits. Thus, neglecting wind, the average true air speed is 185.5 mph, and dividing 500 miles by 185.5 gives 2.7 hours, or 2 hours 42 minutes, for the approximate length of time of the flight. At this point, the bombs are dropped. To calculate the new gross weight, first determine the weight of fuel consumed from the time the transition was made to the new chart by subtracting 1.6 hours from 2.7 hours, and multiplying the difference by 6 times the fuel flow to obtain (2.7 —1.6) $\times$ 6 $\times$ 218 $=$ 1439 pounds. Then add this amount to the weight of bombs dropped to obtain 7439 pounds and subtract the total from 60,000 pounds to obtain 52,561 pounds for the new gross weight. Go to the chart with "CHART WEIGHT LIMITS: 55,000 to 50,000 POUNDS," figures 91, sheet 3, and under column III opposite 5,000 feet read in turn 2200 RPM, 32.0 M.P., A.L. Mixture, 226 GPH, 195 MPH or 169 KTS. for the operation data to make the return trip.

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Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-527
8-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

FOUR-ENGINE
TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
R-1830-43 (BENDIX-STROMBERG CARB.)
R-1830-65 (CECO CARBURETOR)

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
45,000	0	0	1600	2290	1810	2550	2100	2920	1740	2430	2000*	2740	2360	3180	2000	2690	2450	3190	3000	3820
	15	13	1200	1800	1360	1990	1580	2280	1310	1910	1480	2110	1780	2480	1480	2080	1860	2490	2350	3050
	30	26	880	1360	950	1440	1110	1700	900	1380	1030	1550	1260	1850	1030	1510	1300	1820	1700	2390
	45	39	560	955	620	1030	730	1190	580	975	680	1090	850	1310	680	1075	870	1255	1110	1570
55,000	0	0	2310	3310	2730	3840	3300	4500	2600	3600	3100	4210	3800	5000	3300	4300	4000	5110	5000	6200
	15	13	1725	2575	2140	3080	2580	3610	2000	2850	2440	3380	3000	4030	2580	3430	3150	4090	4000	5030
	30	26	1230	1950	1530	2325	1890	2750	1430	2150	1770	2565	2200	3060	1890	2610	2360	3150	3020	3880
	45	39	810	1390	1010	1640	1285	1975	960	1540	1170	1800	1525	2215	1285	1865	1620	2250	2120	2810
65,000	0	0	4480	6380	5250	7350	6200	8530	5350	7250	6200	8300	7500	9830	8000	9900	9200	11300		
	15	13	3600	5270	4300	6150	5100	7150	4440	6110	5100	6950	6230	8280	6700	8370	7300	9150		
	30	26	2820	4260	3300	4910	3950	5750	3400	4840	3950	5560	5000	6800	5320	6760	5900	7510		
	45	39	1900	3110	2300	3670	2850	4380	2410	3620	2850	4220	3660	5190	3980	5190	4460	5830		

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%
OPTIMUM TAKE-OFF WITH 2700 RPM, 49 IN.HG. & 20 DEG. FLAP IS 80% OF CHART VALUES
DATA AS OF JAN. 1944 BASED ON: FLIGHT TEST DATA

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET					AT 10,000 FEET					AT 15,000 FEET					AT 20,000 FEET					AT 25,000 FEET				
	BEST I.A.S.		RATE OF CLIMB	GAL. OF FUEL	BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL	
	MPH	KTS	F.P.M.	USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED
45,000	144	125	1380	100	144	125	1335	4.0	140	144	125	1275	7.5	175	144	125	1200	11.5	210	144	125	1085	16.0	255	144	125	920	21.0	305
55,000	154	133	920	100	154	133	890	6.0	160	154	133	845	11.0	205	154	133	780	17.5	270	154	133	680	24.0	335	154	133	530	33.0	420
65,000	162	141	580	100	162	141	555	9.0	185	162	141	515	18.0	275	162	141	460	28.5	375	162	141	365	40.0	490	162	141	240	56.5	650

POWER PLANT SETTINGS: (DETAILS ON FIG. 25/26 SECTION III): 2550 RPM 46 IN. M.P.
DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA
FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
40,000	110	96	110	96	1885	2365	2250	2640	2470	2960	2820	3300	3140	3620	3460	3940						
50,000	110	96	110	96	2410	2940	2610	3140	2850	3380	3490	3920	3700	4240	4040	4560						

DATA AS OF JAN. 1944 BASED ON: CALCULATIONS
OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS: ALL CLIMB DATA ARE QUOTED FOR WIDE BLADE PROPELLERS (NO.6477A-0)

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

LEGEND
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure 89

AAFMC-527
8-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

THREE - ENGINE
TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
R-1830-43 (BENDIX STROMBERG CARB.)
R-1830-65 (CECO CARBURETOR)

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
45,000	0	0	4100	5500	4750	6250	5450	7100	6670	8750	7790	10000	9100	11500						
	15	13	2560	3650	2920	4000	3520	4750	4300	5900	5170	6900	6140	8000						
	30	26	1550	2250	1760	2500	2090	3000	2680	3850	3250	4600	3840	5300						
	45	39	880	1400	1030	1600	1310	2000	1650	2600	2100	3150	2530	3650						
50,000	0	0	5300	7000	6300	8100	7500	9400	8970	11400	10250	12750								
	15	13	3400	4550	4150	5500	5000	6450	5950	7850	7230	9250								
	30	26	2040	2950	2520	3500	3130	4200	3730	5200	4760	6400								
	45	39	1210	1900	1500	2250	1940	2750	2390	3600	3140	4500								
55,000	0	0	7500	8900	9000	10500														
	15	13	5000	6150	6100	7250														
	30	26	3040	4000	3860	4850														
	45	39	1830	2600	2500	3350														

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%
OPTIMUM TAKE-OFF WITH 2700 RPM, 49 IN.HG. & 20 DEG.FLAP IS 80% OF CHART VALUES
DATA AS OF JAN. 1944 BASED ON: ARMY AIR FORCES DATA

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET						AT 10,000 FEET						AT 15,000 FEET						AT 20,000 FEET						AT 25,000 FEET					
	BEST I.A.S.		RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED
45,000	144	125	700	75	144	125	635	7.5	130	144	125	560	16.0	195	144	125	470	25.0	255	144	125	340	38.0	355	144	125	150	58.5	505
50,000	149	129	500	75	149	129	450	10.5	150	149	129	385	22.5	240	149	129	300	36.5	340	149	129	180	57.5	495					
55,000	154	133	340	75	154	133	300	16.0	195	154	133	245	34.0	325	154	133	165	57.0	490	154	133	45	106.0	850					

POWER PLANT SETTINGS: (DETAILS ON FIG. 25/26 SECTION III): 2550 RPM 46 IN. M.P.
DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA
FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
40,000	110	96	110	96	1885	2365	2250	2640	2470	2950	2820	3300	3140	3620	3460	3940						
50,000	110	96	119	96	2410	2940	2610	3140	2850	3380	3490	3920	3700	4240	4040	4560						

DATA AS OF JAN. 1944 BASED ON: CALCULATIONS
OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS: ALL CLIMB DATA ARE QUOTED FOR WIDE BLADE PROPELLERS (NO.6477A-0).
FOR THREE-ENGINE TAKE-OFF PROCEDURE SEE SECTION II, PARAGRAPH 10d.

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

LEGEND
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure 90

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
8-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 65,000 TO 60,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	643

FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3594	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						3594		
1410	1220	3475	1880	1680	2660	2310			3475	3200	2780
1320	1140	3250	1760	1520	2490	2160			3250	2970	2580
1220	1060	3000	1620	1410	2300	2000			3000	2710	2350
1120	970	2750	1490	1290	2110	1830			2750	2460	2140
1020	880	2500	1350	1170	1910	1660			2500	2200	1930
910	790	2250	1220	1060	1720	1500			2250	1960	1700
810	700	2000	1080	940	1530	1330			2000	1720	1490
710	620	1750	950	820	1340	1160			1750	1490	1290
610	530	1500	810	700	1150	1000			1500	1260	1090
510	440	1250	680	590	960	830			1250	1030	900
410	350	1000	540	470	770	670			1000	810	700

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)						(.85 STAT. (.74 NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	46.0	A.R.	588	266	231	25000																			25000						
2550	46.0	A.R.	580	258	224	20000	2350	36.5	A.R.	410	225	195													20000						
2550	46.0	A.R.	578	249	216	15000	2250	35.0	A.R.	354	207	180													15000						
2550	46.0	A.R.	574	239	207	10000	2250	33.5	A.R.	328	197	171													10000						
2550	46.0	A.R.	572	230	200	5000	2200	33.0	A.R.	307	190	165	2100	31.5	A.L.	212	182	158							5000	2050	31.0	A.L.	200	177	154
2550	46.0	A.R.	572	223	193	S.L.	2200	31.0	A.R.	302	181	157	2100	31.0	A.L.	206	176	153							S.L.	1900	31.0	A.L.	176	164	152

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 65,000 LB. GROSS WEIGHT WITH 3494 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 3200 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1900 RPM AND 31 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 91—(Sheet 1 of 5 Sheets)

AAFMC-528
11-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1
ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 60,000 TO 55,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	643	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND) (1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3214	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						3214		
1300	1130	3100	1680	1460	2370	2060	2650	2300	3100	3020	2620
1260	1090	3000	1620	1410	2300	2000	2570	2230	3000	2920	2530
1150	1000	2750	1490	1290	2110	1830	2350	2040	2750	2660	2310
1050	910	2500	1350	1170	1910	1660	2140	1860	2500	2400	2080
940	820	2250	1220	1060	1720	1500	1920	1670	2250	2140	1860
840	730	2000	1080	940	1530	1330	1710	1480	2000	1880	1630
730	640	1750	950	830	1340	1160	1500	1300	1750	1630	1420
630	550	1500	810	700	1150	1000	1280	1110	1500	1380	1200
520	450	1250	680	590	960	830	1070	930	1250	1140	990
420	360	1000	540	470	770	670	860	740	1000	900	780
310	270	750	410	350	570	500	640	560	750	670	580

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)						(.85 STAT. (.74 NAUT.) MI./GAL.)						(.95 STAT. (.83 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	46.0	A.R.	588	274	238	25000																			25000						
2550	46.0	A.R.	580	263	228	20000	2300	35.5	A.R.	373	224	194													20000						
2550	46.0	A.R.	578	252	218	15000	2250	35.0	A.R.	358	215	187	2200	32.0	A.L.	228	202	175							15000						
2550	46.0	A.R.	474	243	211	10000	2250	35.0	A.R.	343	205	178	2150	31.5	A.L.	226	195	169	2050	31.0	A.L.	198	188	163	10000	1950	31.0	A.L.	185	184	160
2550	46.0	A.R.	572	233	202	5000	2250	33.5	A.R.	326	197	171	2150	31.5	A.L.	218	189	164	2000	31.0	A.L.	190	181	157	5000	1800	31.0	A.L.	168	170	148
2550	46.0	A.R.	572	225	195	S.L.	2200	32.0	A.R.	305	187	162	2100	31.5	A.L.	212	182	158	1900	31.0	A.L.	177	170	148	S.L.	1750	31.0	A.L.	156	158	137

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 60,000 LB. GROSS WEIGHT WITH 3114 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 3020 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1750 RPM AND 31 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 91—(Sheet 2 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR)(2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55,000 TO 50,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	643

FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)

COLUMN I Statute	COLUMN I Nautical	FUEL U.S. GAL.	COLUMN II Statute	COLUMN II Nautical	COLUMN III Statute	COLUMN III Nautical	COLUMN IV Statute	COLUMN IV Nautical	FUEL U.S. GAL.	COLUMN V Statute	COLUMN V Nautical
		2364							2364		
960	840	2250	1220	1060	1720	1500	1920	1670	2250	2230	1940
940	820	2200	1190	1030	1680	1460	1880	1630	2200	2180	1890
860	740	2000	1080	940	1530	1330	1710	1480	2000	1970	1710
770	670	1800	970	840	1380	1200	1540	1340	1800	1770	1540
680	590	1600	860	750	1230	1060	1370	1190	1600	1570	1360
600	520	1400	760	660	1070	930	1200	1040	1400	1370	1190
510	450	1200	650	560	920	800	1030	890	1200	1170	1020
430	370	1000	540	470	770	670	860	740	1000	970	840
340	300	800	430	370	610	530	680	590	800	780	680
260	220	600	320	280	460	400	510	440	600	590	510
170	150	400	220	190	310	270	340	300	400	400	350

COLUMN I: NORMAL RATED — COLUMN II: (.6 STAT. (.52 NAUT.) MI./GAL.)

I R.P.M.	I M.P. INCHES	I MIXTURE	I Approx. TOT. G.P.H.	I T.A.S. MPH	I T.A.S. KTS	PRESS ALT. FEET	II R.P.M.	II M.P. INCHES	II MIXTURE	II Approx. TOT. G.P.H.	II T.A.S. MPH	II T.A.S. KTS
						40000						
						35000						
						30000	2400	37.0	AR	433	259	225
2550	46.0	AR	588	280	243	25000	2350	36.5	AR	410	248	215
2550	46.0	AR	580	267	232	20000	2300	35.5	AR	387	234	203
2550	46.0	AR	578	255	221	15000	2300	35.5	AR	370	222	193
2550	46.0	AR	574	246	214	10000	2250	35.0	AR	354	213	185
2550	46.0	AR	572	235	204	5000	2250	35.0	AR	338	203	176
2550	46.0	AR	572	226	196	S.L.	2200	33.5	AR	321	193	168

COLUMN III: (.85 STAT. (.74 NAUT.) MI./GAL.) — COLUMN IV: (.95 STAT. (.83 NAUT.) MI./GAL.)

PRESS ALT. FEET	III R.P.M.	III M.P. INCHES	III MIXTURE	III Approx. TOT. G.P.H.	III T.A.S. MPH	III T.A.S. KTS	IV R.P.M.	IV M.P. INCHES	IV MIXTURE	IV Approx. TOT. G.P.H.	IV T.A.S. MPH	IV T.A.S. KTS
40000												
35000												
30000												
25000												
20000	2200	32.0	AL	242	216	187	2150	31.5	AL	220	213	185
15000	2200	32.0	AL	240	210	182	2100	31.5	AL	214	205	178
10000	2200	32.0	AL	234	201	174	2100	31.5	AL	210	198	172
5000	2200	32.0	AL	226	195	169	2050	31.0	AL	200	189	164
S.L.	2150	31.5	AL	218	187	162	2000	31.0	AL	188	178	154

COLUMN V: MAXIMUM AIR RANGE

PRESS ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	Approx. TOT. G.P.H.	T.A.S. MPH	T.A.S. KTS
40000						
35000						
30000						
25000						
20000						
15000	1850	31.0	AL	178	192	167
10000	1750	31.0	AL	163	177	153
5000	1700	30.5	AL	152	163	141
S.L.	1650	30.0	AL	142	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270° ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 55,000 LB. GROSS WEIGHT WITH 2264 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 2230 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1650 RPM AND 30 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA; SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 91—(Sheet 3 of 5 Sheets)

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1
ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 50,000 TO 45,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	643	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)

COLUMN I Statute	COLUMN I Nautical	FUEL U.S. GAL.	COLUMN II Statute	COLUMN II Nautical	COLUMN III Statute	COLUMN III Nautical	COLUMN IV Statute	COLUMN IV Nautical	FUEL U.S. GAL.	COLUMN V Statute	COLUMN V Nautical
		1600							1600		
660	570	1500	810	700	1150	1000	1280	1110	1500	1540	1340
590	510	1350	730	630	1030	900	1160	1000	1350	1380	1200
520	450	1200	650	560	920	800	1030	890	1200	1220	1060
460	400	1050	570	490	800	700	900	780	1050	1060	920
400	340	900	490	420	690	600	770	670	900	910	790
330	280	750	410	350	570	500	640	560	750	750	650
260	230	600	320	280	460	400	510	450	600	600	520
200	170	450	240	210	340	300	390	330	450	450	390
130	115	300	160	140	230	200	260	220	300	300	260
65	55	150	80	70	115	100	130	110	150	150	130

NORMAL RATED; COLUMN II (.6 STAT. (.52 NAUT.) MI./GAL.)

NR R.P.M.	NR M.P. INCHES	NR MIXTURE	NR TOT. GPH	NR T.A.S. MPH	NR T.A.S. KTS.	PRESS ALT. FEET	II R.P.M.	II M.P. INCHES	II MIXTURE	II TOT. GPH	II T.A.S. MPH	II T.A.S. KTS.
						40000						
						35000						
						30000	2400	38.0	A.R.	454	274	238
2550	46.0	A.R.	588	285	247	25000	2400	37.0	A.R.	428	258	224
2550	46.0	A.R.	580	271	235	20000	2350	36.0	A.R.	400	240	208
2550	46.0	A.R.	578	258	224	15000	2300	35.5	A.R.	382	228	198
2550	46.0	A.R.	574	248	215	10000	2250	35.0	A.R.	362	218	189
2550	46.0	A.R.	572	237	206	5000	2250	35.0	A.R.	346	208	180
2550	46.0	A.R.	572	227	197	S.L.	2250	34.0	A.R.	330	197	171

COLUMN III (.85 STAT. (.74 NAUT.) MI./GAL.); COLUMN IV (.95 STAT. (.83 NAUT.) MI./GAL.); MAXIMUM AIR RANGE

PRESS ALT. FEET	III R.P.M.	III M.P. INCHES	III MIXTURE	III TOT. GPH	III MPH	III KTS.	IV R.P.M.	IV M.P. INCHES	IV MIXTURE	IV TOT. GPH	IV MPH	IV KTS.	MAR R.P.M.	MAR M.P. INCHES	MAR MIXTURE	MAR TOT. GPH	MAR MPH	MAR KTS.
40000																		
35000																		
30000	2200	32.0	A.L.	262	238	206	2200	32.0	A.L.	250	236	205						
25000	2200	32.0	A.L.	257	231	200	2150	31.5	A.L.	238	229	199	1950	31.0	A.L.	192	215	187
20000	2200	32.0	A.L.	254	224	194	2150	31.5	A.L.	224	221	192	1850	30.0	A.L.	170	197	171
15000	2200	32.0	A.L.	250	216	187	2150	31.5	A.L.	218	213	185	1750	29.5	A.L.	156	181	157
10000	2200	32.0	A.L.	242	207	180	2100	31.5	A.L.	213	203	176	1650	30.0	A.L.	148	177	153
5000	2200	32.0	A.L.	230	199	173	2050	31.0	A.L.	204	195	169	1650	29.5	A.L.	143	163	141
S.L.	2200	32.0	A.L.	226	191	166	2050	31.0	A.L.	195	184	160	1600	28.5	A.L.	135	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 50,000 LB. GROSS WEIGHT WITH 1500 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 1540 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1600 RPM AND 28.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 91—(Sheet 4 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-43 (BENDIX STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 45,000 TO 40,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	643	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V NAUTICAL
		1100	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						1100		
440	380	1000	540	470	770	670	860	740	1000	1040	900
400	350	900	490	420	690	600	770	670	900	940	820
350	310	800	430	380	610	530	690	590	800	830	720
310	270	700	380	330	540	470	600	520	700	730	630
270	230	600	320	280	460	400	520	450	600	620	540
220	190	500	270	230	380	330	430	370	500	520	450
175	155	400	220	190	310	270	340	300	400	420	360
135	115	300	160	140	230	200	260	220	300	310	270
90	75	200	110	95	155	135	170	150	200	210	180
45	40	100	55	45	75	65	85	75	100	105	90

PRESS ALT. FEET	NORMAL RATED R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000						
25000	2550	46.0	A.R.	588	289	251
20000	2550	46.0	A.R.	580	274	238
15000	2550	46.0	A.R.	578	260	226
10000	2550	46.0	A.R.	574	250	217
5000	2550	46.0	A.R.	572	238	206
S.L.	2550	46.0	A.R.	572	228	198

PRESS ALT. FEET	(.6 STAT. (.52 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000	2450	38.5	A.R.	469	282	244
25000	2400	37.5	A.R.	440	266	231
20000	2350	36.5	A.R.	410	246	214
15000	2300	36.0	A.R.	390	233	202
10000	2300	35.5	A.R.	369	221	192
5000	2250	35.0	A.R.	354	213	185
S.L.	2250	34.5	A.R.	334	200	174

PRESS ALT. FEET	(.85 STAT. (.74 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000	2200	32.0	A.L.	262	246	214
25000	2200	32.0	A.L.	257	238	206
20000	2200	32.0	A.L.	254	229	199
15000	2200	32.0	A.L.	250	220	191
10000	2200	32.0	A.L.	248	211	183
5000	2200	32.0	A.L.	232	203	176
S.L.	2200	32.0	A.L.	230	194	168

PRESS ALT. FEET	(.95 STAT. (.83 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000	2200	32.0	A.L.	255	245	212
25000	2200	32.0	A.L.	242	236	204
20000	2200	32.0	A.L.	232	227	197
15000	2150	31.5	A.L.	224	218	189
10000	2100	31.5	A.L.	217	208	180
5000	2100	31.5	A.L.	209	199	173
S.L.	2050	31.0	A.L.	198	187	162

PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000	2000	30.0	A.L.	190	222	193
25000	1850	29.5	A.L.	166	203	176
20000	1850	27.5	A.L.	156	192	167
15000	1750	28.0	A.L.	148	181	157
10000	1650	29.0	A.L.	142	177	154
5000	1600	29.0	A.L.	140	163	142
S.L.	1600	28.0	A.L.	132	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 45,000 LB. GROSS WEIGHT WITH 1000 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 1040 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1600 RPM AND 28.0 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 91—(Sheet 5 of 5 Sheets)

AAFMC-528
R-1-RR

AIRCRAFT MODEL(S) B-24 G, H & J NAVY PB4Y-1 ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)	FLIGHT OPERATION INSTRUCTION CHART CHART WEIGHT LIMITS: 65,000 TO 60,000 POUNDS	EXTERNAL LOAD ITEMS NONE NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	670

FOR DETAILS SEE POWER PLANT CHART (FIG. 28 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II STATUTE	COLUMN II NAUTICAL	COLUMN III STATUTE	COLUMN III NAUTICAL	COLUMN IV STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V STATUTE	COLUMN V NAUTICAL
		3594	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						3594		
1370	1190	3475	1880	1630	2340	2030			3475	3090	2680
1290	1120	3250	1760	1520	2200	1900			3250	2850	2470
1190	1030	3000	1620	1410	2030	1760			3000	2600	2260
1090	940	2750	1490	1290	1860	1610			2750	2340	2030
990	860	2500	1350	1170	1690	1470			2500	2100	1820
890	770	2250	1220	1060	1520	1320			2250	1850	1610
790	690	2000	1080	940	1350	1170			2000	1620	1410
690	600	1750	950	820	1180	1020			1750	1380	1200
590	510	1500	810	700	1010	880			1500	1160	1010
490	430	1250	680	590	840	730			1250	940	820
390	340	1000	540	470	680	590			1000	740	640

PRESS ALT. FEET	NORMAL RATED R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	(.6 STAT. (.52 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000												
25000	2550	46.0	A.R.	606	266	231						
20000	2550	46.0	A.R.	594	258	224	2350	36.0	A.R.	387	225	195
15000	2550	46.0	A.R.	590	249	216	2300	35.5	A.R.	354	211	183
10000	2550	46.0	A.R.	580	239	207	2300	35.0	A.R.	338	202	175
5000	2550	46.0	A.R.	584	230	200	2250	34.5	A.R.	323	193	167
S.L.	2550	46.0	A.R.	598	223	3	2200	32.0	A.L.	303	181	157

PRESS ALT. FEET	(.75 STAT. (.65 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000																		
35000																		
30000																		
25000																		
20000																		
15000																		
10000	2200	32.0	A.L.	253	191	166												
5000	2150	31.5	A.L.	244	183	159							2050	31.0	A.L.	219	177	154
S.L.	2050	31.0	A.L.	233	174	151							1900	31.0	A.L.	190	164	142

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 65,000 LB. GROSS WEIGHT WITH 3494 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 3090 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1900 RPM AND 31 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT.	PRESSURE ALTITUDE	F.R.	FULL RICH
M.P.	MANIFOLD PRESSURE	A.R.	AUTO-RICH
GPH	U.S.GAL. PER HOUR	A.L.	AUTO-LEAN
TAS	TRUE AIRSPEED	C.L.	CRUISING LEAN
KTS.	KNOTS	M.L.	MANUAL LEAN
S.L.	SEA LEVEL	F.T.	FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92—(Sheet 1 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 60,000 TO 55,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	670

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3214	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						3214		
1260	1100	3100	1680	1460	2100	1820	2510	2180	3100	2980	2580
1220	1060	3000	1620	1410	2030	1760	2430	2110	3000	2880	2500
1120	970	2750	1490	1290	1860	1610	2230	1940	2750	2610	2260
1020	890	2500	1350	1170	1690	1470	2030	1760	2500	2350	2040
920	800	2250	1220	1060	1520	1320	1820	1580	2250	2080	1800
820	710	2000	1080	940	1350	1170	1620	1410	2000	1820	1580
710	620	1750	950	820	1180	1030	1420	1230	1750	1580	1370
610	530	1500	810	700	1010	880	1220	1060	1500	1330	1150
510	440	1250	680	590	840	730	1010	880	1250	1090	950
410	350	1000	540	470	680	590	810	700	1000	850	740
310	270	750	410	350	510	440	610	530	750	620	540

PRESS ALT. FEET	COLUMN I: NORMAL RATED						COLUMN II: (.6 STAT. (.52 NAUT.) MI./GAL.)					
	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000												
25000	2550	46.0	A.R.	606	274	238	2400	37.0	A.R.	406	244	212
20000	2550	46.0	A.R.	594	263	228	2350	36.0	A.R.	387	232	201
15000	2550	46.0	A.R.	590	252	218	2300	35.5	A.R.	366	219	190
10000	2550	46.0	A.R.	580	243	211	2300	35.5	A.R.	346	210	182
5000	2550	46.0	A.R.	584	233	202	2250	35.0	A.R.	330	199	173
S.L.	2550	46.0	A.R.	598	225	195	2200	32.0	A.L.	303	186	161

PRESS ALT. FEET	COLUMN III: (.75 STAT. (.65 NAUT.) MI./GAL.)						COLUMN IV: (.9 STAT. (.78 NAUT.) MI./GAL.)					
	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000												
25000												
20000												
15000	2200	32.0	A.R.	271	204	177	2100	31.5	A.L.	228	200	174
10000	2200	32.0	A.L.	253	198	172	2000	31.0	A.L.	205	186	161
5000	2150	32.0	A.L.	254	190	165	1950	31.0	A.L.	197	177	153
S.L.	2050	31.0	A.L.	238	179	155	1900	31.0	A.L.	188	169	147

PRESS ALT. FEET	COLUMN V: MAXIMUM AIR RANGE					
	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000						
10000	1950	31.0	A.L.	198	184	160
5000	1800	31.0	A.L.	176	170	148
S.L.	1750	31.0	A.L.	158	158	137

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 60,000 LB. GROSS WEIGHT WITH 3114 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 2980 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1750 RPM AND 31 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92—(Sheet 2 of 5 Sheets)

AAF-MC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55,000 TO 50,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN	260°C*	670

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		2364							2364		
940	810	2250	1220	1060	1520	1320	1820	1580	2250	2270	1970
920	800	2200	1190	1030	1490	1300	1780	1550	2200	2220	1930
830	720	2000	1080	940	1350	1170	1620	1410	2000	2000	1740
750	650	1800	970	840	1215	1060	1460	1270	1800	1790	1550
660	570	1600	860	750	1080	940	1290	1130	1600	1580	1370
580	510	1400	760	660	950	820	1130	990	1400	1370	1190
500	430	1200	650	560	810	700	970	840	1200	1160	1010
420	360	1000	540	470	680	590	810	700	1000	960	830
330	290	800	430	370	540	470	650	560	800	760	660
250	220	600	320	280	410	350	490	420	600	560	490
165	145	400	220	190	270	230	320	280	400	370	320

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000						
						35000						
						30000	2400	38.0	A.R.	443	266	231
2550	46.0	A.R.	606	280	243	25000	2400	38.0	A.R.	424	256	222
2550	46.0	A.R.	594	267	232	20000	2400	37.0	A.R.	400	240	208
2550	46.0	A.R.	590	255	221	15000	2350	36.0	A.R.	379	225	195
2550	46.0	A.R.	580	246	214	10000	2300	35.5	A.R.	358	217	188
2550	46.0	A.R.	584	235	204	5000	2250	35.0	A.R.	340	205	178
2550	46.0	A.R.	598	226	196	S.L.	2200	32.0	A.L.	303	189	164

PRESS	(.75 STAT. (.65 NAUT.) MI./GAL.)						(.9 STAT. (.78 NAUT.) MI./GAL.)						MAXIMUM AIR RANGE					
ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
40000																		
35000																		
30000																		
25000	2250	33.5	A.R.	304	230	200	2200	32.0	A.L.	252	225	195						
20000	2250	33.5	A.R.	298	223	193	2150	32.0	A.L.	240	215	187						
15000	2200	33.0	A.R.	283	212	184	2100	31.5	A.L.	230	207	180	1850	31.0	A.L.	182	192	167
10000	2200	32.0	A.R.	274	203	176	2050	31.0	A.L.	217	196	170	1750	31.0	A.L.	166	177	153
5000	2200	32.0	A.L.	261	196	170	2000	31.0	A.L.	206	186	161	1700	30.5	A.L.	152	163	141
S.L.	2100	31.0	A.L.	246	183	159	1900	31.0	A.L.	194	174	151	1650	30.0	A.L.	140	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 55,000 LB. GROSS WEIGHT WITH 2264 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 2270 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1650 RPM AND 30 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92—(Sheet 3 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PV4Y-1

*ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 50,000 TO 45,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	670

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)

COLUMN I STATUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II STATUTE	COLUMN II NAUTICAL	COLUMN III STATUTE	COLUMN III NAUTICAL	COLUMN IV STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V STATUTE	COLUMN V NAUTICAL
		1600							1600		
640	550	1500	810	700	1010	880	1220	1060	1500	1580	1370
570	500	1350	730	630	910	790	1090	950	1350	1420	1230
510	440	1200	650	560	810	700	970	840	1200	1260	1090
450	390	1050	570	490	710	620	850	740	1050	1100	960
380	330	900	490	420	610	530	730	630	900	940	820
320	280	750	410	350	510	440	610	530	750	780	680
250	220	600	320	280	410	350	490	420	600	620	540
190	165	450	240	210	300	260	360	320	450	470	410
125	110	300	160	140	200	175	240	210	300	310	270
65	55	150	80	70	100	90	120	105	150	160	140

Column I: NORMAL RATED. Column II: (.6 STAT. (.52 NAUT.) MI./GAL.). Column III: (.75 STAT. (.65 NAUT.) MI./GAL.). Column IV: (.9 STAT. (.78 NAUT.) MI./GAL.). Column V: MAXIMUM AIR RANGE.

PRESS ALT. FEET	I R.P.M.	I M.P. INCHES	I MIX-TURE	I TOT. G.P.H.	I T.A.S. MPH.	I T.A.S. KTS.	II R.P.M.	II M.P. INCHES	II MIX-TURE	II TOT. G.P.H.	II T.A.S. MPH.	II T.A.S. KTS.	III R.P.M.	III M.P. INCHES	III MIX-TURE	III TOT. G.P.H.	III T.A.S. MPH.	III T.A.S. KTS.	IV R.P.M.	IV M.P. INCHES	IV MIX-TURE	IV TOT. G.P.H.	IV T.A.S. MPH.	IV T.A.S. KTS.	V R.P.M.	V M.P. INCHES	V MIX-TURE	V TOT. G.P.H.	V T.A.S. MPH.	V T.A.S. KTS.
40000																														
35000																														
30000							2450	39.0	A.R.	462	277	240	2250	35.0	A.R.	330	249	216	2200	32.0	A.L.	258	238	206						
25000	2550	46.0	A.R.	606	285	247	2400	38.5	A.R.	436	262	227	2250	35.0	A.R.	324	240	208	2200	32.0	A.L.	251	231	201						
20000	2550	46.0	A.R.	594	271	235	2400	37.5	A.R.	410	246	214	2250	34.0	A.R.	308	231	200	2200	32.0	A.L.	246	223	194	1850	30.0	A.L.	170	197	171
15000	2550	46.0	A.R.	590	258	224	2350	36.5	A.R.	390	233	202	2250	33.5	A.R.	293	219	190	2150	32.0	A.L.	238	214	186	1750	29.5	A.L.	156	181	157
10000	2550	46.0	A.R.	580	248	215	2300	35.5	A.R.	365	221	192	2200	32.0	A.R.	274	207	180	2100	31.0	A.L.	223	202	175	1650	30.0	A.L.	150	177	153
5000	2550	46.0	A.R.	584	237	206	2300	35.0	A.R.	348	210	182	2200	32.0	A.L.	263	200	174	2000	31.0	A.L.	212	192	167	1650	29.5	A.L.	141	163	141
S.L.	2550	46.0	A.R.	598	227	197	2200	32.0	A.R.	323	193	167	2100	31.0	A.L.	252	187	162	1900	31.0	A.L.	200	179	155	1600	28.5	A.L.	132	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 50,000 LB. GROSS WEIGHT WITH 1500 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 1580 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1600 RPM AND 28.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92—(Sheet 4 of 5 Sheets)

AAFMC-828
8-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 45,000 TO 40,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	670

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		1100	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						1100		
430	370	1000	540	470	680	590	810	700	1000	1060	920
390	330	900	490	420	610	530	730	630	900	960	830
340	300	800	430	370	540	470	650	560	800	850	740
300	260	700	380	330	470	410	570	490	700	740	640
260	220	600	320	280	410	350	490	420	600	640	560
210	185	500	270	230	340	290	410	350	500	530	460
170	150	400	220	190	270	230	320	280	400	430	370
130	115	300	160	140	200	175	240	210	300	320	280
85	75	200	110	95	135	115	160	140	200	210	180
45	35	100	55	50	70	60	80	70	100	105	90

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)						(.75 STAT. (.65 NAUT.) MI./GAL.)						(.9 STAT. (.78 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000	2450	39.5	A.R.	475	284	246	2300	35.0	A.R.	348	261	226	2200	32.0	A.R.	280	246	214	30000	2000	30.0	A.L.	188	222	193
2550	46.0	A.R.	606	289	251	25000	2450	38.5	A.R.	445	268	232	2250	35.0	A.R.	332	248	215	2200	32.0	A.R.	273	238	206	25000	1850	29.5	A.L.	160	203	176
2550	46.0	A.R.	594	274	238	20000	2400	38.0	A.R.	421	252	218	2250	35.0	A.R.	317	237	206	2200	32.0	A.L.	250	229	199	20000	1850	27.5	A.L.	150	192	167
2550	46.0	A.R.	590	260	226	15000	2350	37.0	A.R.	397	238	206	2250	34.0	A.R.	302	225	195	2200	32.0	A.L.	246	220	191	15000	1750	28.0	A.L.	146	181	157
2550	46.0	A.R.	580	250	217	10000	2350	35.5	A.R.	374	225	195	2200	32.0	A.R.	280	211	183	2100	31.5	A.L.	230	206	179	10000	1650	29.0	A.L.	142	177	154
2550	46.0	A.R.	584	238	206	5000	2300	35.0	A.R.	352	213	185	2200	32.0	A.L.	263	203	176	2050	31.0	A.L.	216	196	170	5000	1600	29.0	A.L.	137	163	142
2550	46.0	A.R.	598	228	198	S.L.	2200	32.0	A.R.	325	196	170	2100	31.5	A.L.	260	190	165	1950	31.0	A.L.	208	186	161	S.L.	1600	28.0	A.L.	128	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 45,000 LB. GROSS WEIGHT WITH 1000 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 1060 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1600 RPM AND 28 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92—(Sheet 5 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H, & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR)(2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 45,000 TO 40,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	657

FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		1100	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)						1100		
450	390	1000	540	470	630	550	810	700	1000	1040	900
400	350	900	490	420	570	490	730	630	900	920	800
360	310	800	430	380	500	440	650	560	800	830	720
310	270	700	380	330	440	380	570	490	700	730	630
270	230	600	320	280	380	330	490	420	600	620	540
220	195	500	270	230	320	270	410	350	500	520	450
180	155	400	220	190	250	220	320	280	400	410	360
135	115	300	160	140	190	165	240	210	300	310	270
90	75	200	110	95	125	110	160	140	200	210	180
45	40	100	55	50	65	55	80	70	100	105	90

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)						(.7 STAT. (.61 NAUT.) MI./GAL.)						(.9 STAT. (.78 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000	2450	40.0	A.R.	482	287	249	2350	37.0	A.R.	392	274	238	2200	32.0	A.L.	237	246	213	30000	2000	30.0	A.L.	192	222	193
2550	46.0	A.R.	585	289	251	25000	2450	39.0	A.R.	448	268	232	2350	36.0	A.R.	368	258	224	2200	32.0	A.L.	236	238	206	25000	1850	29.5	A.L.	167	203	176
2550	46.0	A.R.	583	274	238	20000	2400	38.0	A.R.	419	253	220	2300	35.5	A.R.	350	244	212	2200	32.0	A.L.	235	229	199	20000	1850	27.5	A.L.	159	192	167
2550	46.0	A.R.	581	260	226	15000	2400	37.0	A.R.	396	239	207	2300	35.0	A.R.	329	230	199	2200	32.0	A.L.	233	220	191	15000	1750	28.0	A.L.	148	181	157
2550	46.0	A.R.	580	250	217	10000	2350	36.5	A.R.	379	227	197	2250	35.0	A.R.	314	219	190	2200	32.0	A.L.	231	211	183	10000	1650	29.0	A.L.	140	177	154
2550	46.0	A.R.	578	238	206	5000	2350	36.0	A.R.	370	217	188	2250	34.5	A.R.	302	209	181	2150	32.0	A.L.	224	202	175	5000	1600	29.0	A.L.	139	163	142
2550	46.0	A.R.	576	228	198	S.L.	2300	35.5	A.R.	355	207	180	2200	33.0	A.R.	284	198	172	2100	31.5	A.L.	212	191	166	S.L.	1600	28.0	A.L.	132	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-4

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 45,000 LB. GROSS WEIGHT WITH 1000 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 1040 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 1600 RPM AND 28.0 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF NOV. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92A—(Sheet 1 of 5 Sheets)

AAFMC-528
R-1-44

AIRCRAFT MODEL(S)
B-24 G, H, & J
NAVY PB4Y-1
ENGINE(S): R-1830-65 (CECO CARBURETOR)(2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 50,000 TO 45,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	657

FOR DETAILS SEE POWER PLANT CHART (FIG. 26A SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I: RANGE IN AIRMILES, STATUTE	COLUMN I: NAUTICAL	FUEL U.S. GAL.	COLUMN II: STATUTE	COLUMN II: NAUTICAL	COLUMN III: STATUTE	COLUMN III: NAUTICAL	COLUMN IV: STATUTE	COLUMN IV: NAUTICAL	FUEL U.S. GAL.	COLUMN V: STATUTE	COLUMN V: NAUTICAL
		1600	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						1600		
660	570	1500	810	700	950	820	1220	1060	1500	1500	1300
590	510	1350	730	630	850	740	1090	950	1350	1350	1170
530	460	1200	650	560	760	660	970	840	1200	1190	1030
460	400	1050	570	490	660	570	850	740	1050	1030	890
390	340	900	490	420	570	490	730	630	900	880	760
330	290	750	410	350	470	410	610	530	750	740	640
260	230	600	320	280	380	330	490	420	600	590	510
195	170	450	240	210	280	250	360	320	450	440	380
130	115	300	160	140	190	165	240	210	300	300	260
65	55	150	80	70	95	80	120	105	150	150	130

PRESS ALT. FEET	NORMAL RATED: R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	(.6 STAT. (.52 NAUT.) MI./GAL.): R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	(.7 STAT. (.61 NAUT.) MI./GAL.): R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000																		
35000																		
30000							2450	39.5	A.R.	468	280	243	2350	36.5	A.R.	385	266	230
25000	2550	46.0	A.R.	585	285	247	2450	38.5	A.R.	436	263	228	2350	35.5	A.R.	363	250	216
20000	2550	46.0	A.R.	583	271	235	2400	38.0	A.R.	410	248	215	2300	35.5	A.R.	340	236	204
15000	2550	46.0	A.R.	581	258	224	2350	37.0	A.R.	386	233	202	2300	35.0	A.R.	327	225	195
10000	2550	46.0	A.R.	580	248	215	2350	36.5	A.R.	373	224	194	2250	35.0	A.R.	306	215	186
5000	2550	46.0	A.R.	578	237	206	2350	36.0	A.R.	366	214	186	2250	34.0	A.R.	293	205	178
S.L.	2550	46.0	A.R.	576	227	197	2300	35.5	A.R.	350	203	176	2200	32.5	A.R.	277	194	168

PRESS ALT. FEET	(.9 STAT. (.78 NAUT.) MI./GAL.): R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	MAXIMUM AIR RANGE: R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000	2200	32.0	A.L.	237	238	206						
25000	2200	32.0	A.L.	236	231	200	1950	31.0	A.L.	195	215	187
20000	2200	32.0	A.L.	235	224	194	1850	30.0	A.L.	173	197	171
15000	2200	32.0	A.L.	233	216	187	1750	29.5	A.L.	156	181	157
10000	2200	32.0	A.L.	229	207	179	1650	30.0	A.L.	147	171	148
5000	2150	31.5	A.L.	226	198	172	1650	29.5	A.L.	144	163	141
S.L.	2100	31.5	A.L.	209	188	163	1600	28.5	A.L.	140	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTING 700-C-4

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 50,000 LB. GROSS WEIGHT WITH 1500 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 1500 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 1600 RPM AND 28.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF NOV. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92A—(Sheet 2 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H, & J
NAVY PB4Y-1
ENGINE(S): R-1830-65 (CECO CARBURETOR)(2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55,000 TO 50,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	657	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)

COLUMN I Statute	COLUMN I Nautical	FUEL U.S. GAL.	COLUMN II Statute	COLUMN II Nautical	COLUMN III Statute	COLUMN III Nautical	COLUMN IV Statute	COLUMN IV Nautical	FUEL U.S. GAL.	COLUMN V Statute	COLUMN V Nautical
		2364							2364		
970	840	2250	1220	1060	1420	1230	1820	1580	2250	2170	1880
950	820	2200	1190	1030	1390	1210	1780	1550	2200	2120	1840
860	750	2000	1080	940	1260	1100	1620	1410	2000	1900	1650
780	670	1800	970	840	1130	990	1460	1270	1800	1700	1470
690	600	1600	860	750	1010	820	1290	1130	1600	1500	1300
600	520	1400	760	660	880	770	1130	990	1400	1310	1140
520	450	1200	650	560	760	660	970	840	1200	1120	970
430	370	1000	540	470	630	550	810	700	1000	870	750
350	300	800	430	370	500	440	650	560	800	780	680
260	220	600	320	280	380	330	490	420	600	550	480
170	150	400	220	190	250	220	320	280	400	400	350

Column I: NORMAL RATED; Column II: (.6 STAT. (.52 NAUT.) MI./GAL.); Column III: (.7 STAT. (.61 NAUT.) MI./GAL.); Column IV: (.9 STAT. (.78 NAUT.) MI./GAL.); Column V: MAXIMUM AIR RANGE

I R.P.M.	I M.P. INCHES	I MIXTURE	I APPROX. TOT. GPH.	I T.A.S. MPH.	I T.A.S. KTS.	PRESS ALT. FEET	II R.P.M.	II M.P. INCHES	II MIXTURE	II APPROX. TOT. GPH.	II T.A.S. MPH.	II T.A.S. KTS.	III R.P.M.	III M.P. INCHES	III MIXTURE	III APPROX. TOT. GPH.	III T.A.S. MPH.	III T.A.S. KTS.	IV R.P.M.	IV M.P. INCHES	IV MIXTURE	IV APPROX. TOT. GPH.	IV T.A.S. MPH.	IV T.A.S. KTS.	PRESS ALT. FEET	V R.P.M.	V M.P. INCHES	V MIXTURE	V APPROX. TOT. GPH.	V T.A.S. MPH.	V T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000	2450	39.0	A.R.	453	269	233	2350	36.0	A.R.	365	252	218							30000						
2550	46.0	A.R.	585	280	243	25000	2400	38.0	A.R.	424	256	222	2300	35.5	A.R.	347	239	207							25000						
2550	46.0	A.R.	583	267	232	20000	2400	37.5	A.R.	400	241	209	2300	35.5	A.R.	330	230	200	2200	32.0	A.L.	235	217	188	20000	2050	31.0	A.L.	205	208	181
2550	46.0	A.R.	581	255	221	15000	2350	36.5	A.R.	379	228	198	2250	35.0	A.R.	311	219	190	2200	32.0	A.L.	233	211	183	15000	1850	31.0	A.L.	176	192	167
2550	46.0	A.R.	580	246	214	10000	2350	36.0	A.R.	362	219	190	2250	34.5	A.R.	299	209	181	2150	32.0	A.L.	224	202	175	10000	1750	31.0	A.L.	165	177	153
2550	46.0	A.R.	578	235	204	5000	2300	35.5	A.R.	355	209	181	2200	33.0	A.R.	285	199	173	2100	31.5	A.L.	216	193	167	5000	1700	30.5	A.L.	154	163	141
2550	46.0	A.R.	576	226	196	S.L.	2300	35.5	A.R.	346	201	174	2200	32.0	A.R.	271	189	164	2050	31.0	A.L.	202	182	158	S.L.	1650	30.0	A.L.	148	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-4

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 55,000 LB. GROSS WEIGHT WITH 2264 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 2170 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 1650 RPM AND 30.0 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT.	PRESSURE ALTITUDE	F.R.	FULL RICH
M.P.	MANIFOLD PRESSURE	A.R.	AUTO-RICH
GPH	U.S. GAL. PER HOUR	A.L.	AUTO-LEAN
TAS	TRUE AIRSPEED	C.L.	CRUISING LEAN
KTS.	KNOTS	M.L.	MANUAL LEAN
S.L.	SEA LEVEL	F.T.	FULL THROTTLE

DATA AS OF NOV. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92A—(Sheet 3 of 5 Sheets)

AAFMC-528
8-1-44

AIRCRAFT MODEL(S)
B-24 G, H, & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR)(2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 60,000 TO 55,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 26&SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	657	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3214	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						3214		
1310	1130	3100	1680	1460	1950	1700	2510	2180	3100	2880	2500
1270	1100	3000	1620	1410	1890	1650	2430	2110	3000	2780	2410
1160	1010	2750	1490	1290	1730	1510	2230	1940	2750	2520	2180
1060	910	2500	1350	1170	1580	1370	2030	1760	2500	2270	1970
950	830	2250	1220	1060	1420	1230	1820	1580	2250	2020	1750
850	730	2000	1080	940	1260	1100	1620	1410	2000	1780	1540
740	640	1750	950	820	1100	960	1420	1230	1750	1540	1340
640	550	1500	810	700	950	820	1220	1060	1500	1300	1130
530	460	1250	680	590	790	690	1010	880	1250	1070	930
420	370	1000	540	470	630	550	810	700	1000	840	730
320	270	750	410	350	470	410	610	530	750	620	540

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)					
			APPROX.			ALT.				APPROX.		
R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	FEET	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000						
						35000						
						30000	2400	38.0	A.R.	427	256	222
2550	46.0	A.R.	585	274	238	25000	2400	37.5	A.R.	406	245	212
2550	46.0	A.R.	583	263	228	20000	2350	36.5	A.R.	387	233	202
2550	46.0	A.R.	581	252	218	15000	2350	36.0	A.R.	368	222	193
2550	46.0	A.R.	580	243	211	10000	2350	35.5	A.R.	356	215	187
2550	46.0	A.R.	578	233	202	5000	2300	35.5	A.R.	350	205	178
2550	46.0	A.R.	576	225	195	S.L.	2300	35.0	A.R.	340	198	172

PRESS	(.7 STAT. (.61 NAUT.) MI./GAL.)						(.9 STAT. (.78 NAUT.) MI./GAL.)					
ALT.				APPROX.						APPROX.		
FEET	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000												
25000												
20000	2250	35.0	A.R.	312	220	191						
15000	2250	34.5	A.R.	301	211	183	2150	31.5	A.L.	224	202	175
10000	2200	33.5	A.R.	288	201	174	2100	31.5	A.L.	215	193	167
5000	2200	32.0	A.R.	273	192	167	2100	31.5	A.L.	208	187	162
S.L.	2200	32.0	A.R.	271	186	167	2050	31.0	A.L.	200	178	154

PRESS	MAXIMUM AIR RANGE					
ALT.				APPROX.		
FEET	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000	2100	31.5	A.L.	214	199	173
10000	1950	31.0	A.L.	189	184	160
5000	1800	31.0	A.L.	169	170	148
S.L.	1750	31.0	A.L.	160	158	137

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-4

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 60,000 LB. GROSS WEIGHT WITH 3114 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 2880 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 1750 RPM AND 31.0 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF NOV. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92A—(Sheet 4 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H, & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR)(2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 65,000 TO 60,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG.26A SECT.III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	657	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3594	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						3594		
1420	1240	3475	1880	1630	2190	1900			3475	3020	2620
1330	1160	3250	1760	1520	2050	1780			3250	2800	2420
1230	1070	3000	1620	1410	1890	1650			3000	2560	2220
1130	980	2750	1490	1290	1730	1510			2750	2320	2020
1030	890	2500	1350	1170	1580	1370			2500	2080	1800
930	800	2250	1220	1060	1420	1230			2250	1850	1610
820	710	2000	1080	940	1260	1100			2000	1620	1410
720	620	1750	950	820	1100	960			1750	1390	1210
620	530	1500	810	700	950	820			1500	1170	1020
510	450	1250	680	590	790	690			1250	950	820
410	360	1000	540	470	630	550			1000	750	650

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)						(.7 STAT. (.61 NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	46.0	A.R.	585	266	231	25000																			25000						
2550	46.0	A.R.	583	258	224	20000	2350	36.0	A.R.	377	224	194													20000						
2550	46.0	A.R.	581	249	216	15000	2350	36.0	A.R.	356	216	187													15000						
2550	46.0	A.R.	580	239	207	10000	2300	35.5	A.R.	346	208	180	2200	32.0	A.R.	273	191	166							10000	2200	32.0	A.L.	231	191	166
2550	46.0	A.R.	578	230	200	5000	2300	35.0	A.R.	340	200	174	2200	32.0	A.R.	273	187	162							5000	2050	31.0	A.L.	202	177	154
2550	46.0	A.R.	576	223	193	S.L.	2300	35.0	A.R.	334	199	173	2200	32.0	A.R.	271	182	158							S.L.	1900	31.0	A.L.	178	164	142

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 89) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTING 700-C-4

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 65,000 LB. GROSS WEIGHT WITH 3494 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 GAL.) TO FLY 3020 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 1900 RPM AND 31.0 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF NOV. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 92A—(Sheet 5 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1
ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 65,000 TO 60,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED
NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	270	482

FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3594	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING [1]						3594		
1430	1250	3475							3475	1830	1590
1340	1160	3250							3250	1680	1460
1240	1070	3000							3000	1520	1320
1140	980	2750							2750	1370	1190
1030	900	2500							2500	1210	1050
930	810	2250							2250	1070	930
830	720	2000							2000	930	810
720	630	1750							1750	800	690
620	540	1500							1500	670	580
520	450	1250							1250	550	480
410	360	1000							1000	430	370

NORMAL RATED						PRESS	(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
						15000																			15000						
2550	46.0	A.R.	430	198	172	10000																			10000						
2550	46.0	A.R.	429	194	168	5000																			5000	2450	40.0	A.R.	353	177	154
2550	46.0	A.R.	429	189	164	S.L.																			S.L.	2400	37.5	A.R.	316	164	142

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE, AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

EXAMPLE

AT 65,000 LB. GROSS WEIGHT WITH 3519 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.)
TO FLY 1830 STAT. AIRMILES AT S.L. ALTITUDE
MAINTAIN 2400 RPM AND 37.5 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: A.R.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 93—(Sheet 1 of 5 Sheets)

AAFMC-52B
4-1-44

AIRCRAFT MODEL(S) B-24 G, H & J NAVY PB4Y-1 ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)	FLIGHT OPERATION INSTRUCTION CHART CHART WEIGHT LIMITS: 65,000 TO 60,000 POUNDS	EXTERNAL LOAD ITEMS DEAD ENGINE PROPELLER FEATHERED NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	482	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3594	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						3594		
1430	1250	3475							3475	1830	1590
1340	1160	3250							3250	1680	1460
1240	1070	3000							3000	1520	1320
1140	980	2750							2750	1370	1190
1030	900	2500							2500	1210	1050
930	810	2250							2250	1070	930
830	720	2000							2000	930	810
720	630	1750							1750	800	690
620	540	1500							1500	670	580
520	450	1250							1250	550	480
410	360	1000							1000	430	370

NORMAL RATED						PRESS	(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
						15000																			15000						
2550	46.0	A.R.	430	198	172	10000																			10000						
2550	46.0	A.R.	429	194	168	5000																			5000	2450	40.0	A.R.	353	177	154
2550	46.0	A.R.	429	189	164	S.L.																			S.L.	2400	37.5	A.R.	316	164	142

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE, AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 65,000 LB. GROSS WEIGHT WITH 3519 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 1830 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 2400 RPM AND 37.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.R.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 93—(Sheet 1 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1
ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 60,000 TO 55,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED
NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	482	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		3214		SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)					3214		
1410	1220	3100							3100	1770	1540
1370	1190	3000							3000	1700	1480
1220	1090	2750							2750	1530	1330
1140	990	2500							2500	1350	1170
1050	890	2250							2250	1190	1030
910	790	2000							2000	1040	900
800	690	1750							1750	900	780
680	590	1500							1500	760	660
570	490	1250							1250	620	540
460	400	1000							1000	490	430
340	300	750							750	360	310

NORMAL RATED						PRESS	(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2550	46.0	A.R.	435	220	191	20000																			20000						
2550	46.0	A.R.	434	213	185	15000																			15000						
2550	46.0	A.R.	430	205	178	10000																			10000	2400	38.5	A.R.	331	184	160
2550	46.0	A.R.	429	199	173	5000																			5000	2350	36.0	A.R.	292	170	148
2550	46.0	A.R.	429	192	167	S.L.																			S.L.	2250	35.0	A.R.	266	158	137

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 60,000 LB. GROSS WEIGHT WITH 3139 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 1770 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 2250 RPM AND 35 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.R.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 93—(Sheet 2 of 5 Sheets)

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55,000 TO 50,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED

NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	482

FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		2364	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						2364		
1090	950	2250	1220	1060					2250	1360	1180
1070	930	2200	1190	1030					2200	1320	1150
970	840	2000	1080	940					2000	1180	1020
870	760	1800	970	840					1800	1050	910
780	670	1600	860	750					1600	920	800
680	590	1400	760	660					1400	790	690
580	510	1200	650	560					1200	670	580
480	420	1000	540	470					1000	560	490
390	340	800	430	380					800	440	380
290	250	600	320	280					600	320	280
195	170	400	220	190					400	220	190

NORMAL RATED						PRESS	(6 STAT. (.52 NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	46.0	A.R.	441	238	206	25000																			25000						
2550	46.0	A.R.	435	228	198	20000																			20000						
2550	46.0	A.R.	434	220	191	15000	2400	37.5	A.R.	320	193	168													15000	2400	37.0	A.R.	314	191	166
2550	46.0	A.R.	430	210	182	10000	2350	36.5	A.R.	306	185	161													10000	2300	35.5	A.R.	276	176	153
2550	46.0	A.R.	429	203	176	5000	2350	36.0	A.R.	291	177	154													5000	2200	33.5	A.R.	242	163	141
2550	46.0	A.R.	429	195	169	S.L.	2300	35.5	A.R.	281	169	147													S.L.	2150	31.5	A.L.	167	151	131

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 55,000 LB. GROSS WEIGHT WITH 2289 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 1360 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 2150 RPM AND 31.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE	F.R. : FULL RICH
M.P. : MANIFOLD PRESSURE	A.R. : AUTO-RICH
GPH : U.S.GAL.PER HOUR	A.L. : AUTO-LEAN
TAS : TRUE AIRSPEED	C.L. : CRUISING LEAN
KTS. : KNOTS	M.L. : MANUAL LEAN
S.L. : SEA LEVEL	F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 93—(Sheet 3 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528 4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-I

ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 50,000 TO 45,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED

NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	482	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		1600							1600		
750	650	1500	810	700	950	820			1500	960	830
680	590	1300	730	630	850	740			1350	860	750
600	520	1200	650	560	760	660			1200	750	650
530	460	1050	570	490	660	570			1050	650	560
450	390	900	490	420	570	490			900	550	480
380	330	750	410	350	470	410			750	450	390
300	260	600	320	280	380	330			600	360	310
230	195	450	240	210	280	250			450	270	230
150	130	300	160	140	190	165			300	180	155
75	65	150	80	70	95	80			150	90	80

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
						40000						
						35000						
						30000						
2550	46.0	A.R.	441	246	214	25000	2500	41.5	A.R.	386	232	202
2550	46.0	A.R.	435	235	204	20000	2450	40.0	A.R.	358	216	188
2550	46.0	A.R.	434	225	194	15000	2450	38.5	A.R.	338	204	177
2550	46.0	A.R.	430	215	187	10000	2400	38.0	A.R.	323	195	169
2550	46.0	A.R.	429	206	179	5000	2400	37.0	A.R.	308	186	161
2550	46.0	A.R.	429	197	171	S.L.	2350	36.0	A.R.	296	176	153

PRESS	(.7 STAT. (.61 NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						MAXIMUM AIR RANGE					
ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000																		
35000																		
30000																		
25000																		
20000													2350	35.5	A.R.	292	197	171
15000	2250	35.0	A.R.	264	185	161							2250	34.5	A.R.	254	182	158
10000	2250	34.5	A.R.	252	178	154							2150	31.5	A.L.	174	168	146
5000	2250	33.5	A.R.	241	171	148							2000	31.0	A.L.	146	155	134
S.L.	2200	32.5	A.R.	229	163	142							1900	31.0	A.L.	131	144	125

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 50,000 LB. GROSS WEIGHT WITH 1525 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 960 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1900 RPM AND 31 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY. DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 93—(Sheet 4 of 5 Sheets)

AAFMC-52B
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-43 (BENDIX-STROMBERG CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 45,000 TO 40,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED

NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 25 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	482	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		1100	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						1100		
520	450	1000	540	470	630	550			1000	700	610
460	400	900	490	420	570	490			900	630	550
410	360	800	430	380	500	440			800	560	490
360	310	700	380	330	440	380			700	490	430
310	270	600	320	280	380	330			600	420	360
260	220	500	270	230	320	270			500	350	300
205	180	400	220	190	250	220			400	280	240
155	135	300	160	140	190	165			300	210	180
105	90	200	110	95	125	110			200	140	120
50	45	100	55	45	65	55			100	70	60

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)						(.7 STAT. (.61 NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	46.0	A.R.	441	253	220	25000	2500	43.0	A.R.	405	244	212	2350	36.5	A.R.	316	222	193							25000	2250	35.0	A.R.	265	205	178
2550	46.0	A.R.	435	240	208	20000	2500	41.0	A.R.	377	227	197	2350	36.0	A.R.	298	210	182							20000	2200	32.0	A.L.	179	188	163
2550	46.0	A.R.	434	229	199	15000	2450	39.5	A.R.	353	213	185	2300	35.5	A.R.	284	199	173							15000	2050	31.0	A.L.	150	173	150
2550	46.0	A.R.	430	218	189	10000	2450	38.5	A.R.	338	202	175	2300	35.0	A.R.	269	189	164							10000	1900	31.0	A.L.	133	160	139
2550	46.0	A.R.	429	209	181	5000	2400	37.5	A.R.	321	192	167	2250	35.0	A.R.	256	180	156							5000	1750	31.0	A.L.	122	148	129
2550	46.0	A.R.	429	200	174	S.L.	2350	36.5	A.R.	305	182	158	2250	33.5	A.R.	241	169	147							S.L.	1650	30.0	A.L.	110	137	119

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 45,000 LB. GROSS WEIGHT WITH 1025 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 700 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1650 RPM AND 30 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 93—(Sheet 5 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1
ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 65,000 TO 60,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED
NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	503

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II STATUTE	COLUMN II NAUTICAL	COLUMN III STATUTE	COLUMN III NAUTICAL	COLUMN IV STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V STATUTE	COLUMN V NAUTICAL
		3594							3594		
1420	1230	3475							3475	1900	1650
1330	1150	3250							3250	1740	1510
1230	1070	3000							3000	1560	1350
1130	980	2750							2750	1410	1220
1020	890	2500							2500	1250	1090
920	800	2250							2250	1110	970
820	710	2000							2000	960	830
720	620	1750							1750	810	700
610	530	1500							1500	680	590
510	440	1250							1250	550	480
410	360	1000							1000	430	370

COLUMN I: NORMAL RATED; COLUMNS II, III, IV: (STAT. (NAUT.) MI./GAL.); COLUMN V: MAXIMUM AIR RANGE

I R.P.M.	I M.P. INCHES	I MIX-TURE	I APPROX. TOT. GPH.	I T.A.S. MPH.	I T.A.S. KTS.	PRESS ALT. FEET	II R.P.M.	II M.P. INCHES	II MIX-TURE	II TOT. GPH.	II MPH.	II KTS.	III R.P.M.	III M.P. INCHES	III MIX-TURE	III TOT. GPH.	III MPH.	III KTS.	IV R.P.M.	IV M.P. INCHES	IV MIX-TURE	IV TOT. GPH.	IV MPH.	IV KTS.	PRESS ALT. FEET	V R.P.M.	V M.P. INCHES	V MIX-TURE	V TOT. GPH.	V MPH.	V KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
						15000																			15000						
2550	46.0	A.R.	435	198	172	10000																			10000						
2550	46.0	A.R.	437	194	168	5000																			5000	2450	40.0	A.R.	350	177	154
2550	46.0	A.R.	448	189	164	S.L.																			S.L.	2400	37.5	A.R.	331	164	142

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 65,000 LB. GROSS WEIGHT WITH 3519 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 1900 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 2400 RPM AND 37.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.R.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 94—(Sheet 1 of 5 Sheets)

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 60,000 TO 55,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED

NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	503

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]

COLUMN I STATUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II STATUTE	COLUMN II NAUTICAL	COLUMN III STATUTE	COLUMN III NAUTICAL	COLUMN IV STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V STATUTE	COLUMN V NAUTICAL
		3214							3214		
1380	1200	3100							3100	1870	1620
1330	1150	3000							3000	1790	1550
1220	1060	2750							2750	1600	1390
1110	960	2500							2500	1420	1230
1000	870	2250							2250	1240	1080
890	770	2000							2000	1080	940
780	680	1750							1750	930	810
670	580	1500							1500	780	680
560	490	1250							1250	640	560
440	390	1000							1000	500	430
330	290	750							750	360	310

NORMAL RATED			APPROX.			PRESS	(STAT. (NAUT.) MI./GAL.)			APPROX.			(STAT. (NAUT.) MI./GAL.)			APPROX.			(STAT. (NAUT.) MI./GAL.)			APPROX.			PRESS	MAXIMUM AIR RANGE			APPROX.		
R.P.M.	M.P. INCHES	MIX-TURE	TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2550	46.0	A.R.	445	220	191	20000																			20000						
2550	46.0	A.R.	442	213	185	15000																			15000						
2550	46.0	A.R.	435	205	178	10000																			10000	2400	38.5	A.R.	320	184	160
2550	46.0	A.R.	437	199	173	5000																			5000	2350	36.0	A.R.	287	170	148
2550	46.0	A.R.	448	192	167	S.L.																			S.L.	2250	35.0	A.R.	281	158	137

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 60,000 LB. GROSS WEIGHT WITH 3139 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 1870 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 2250 RPM AND 35 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.R.

LEGEND

ALT. :	PRESSURE ALTITUDE	F.R. :	FULL RICH
M.P. :	MANIFOLD PRESSURE	A.R. :	AUTO-RICH
GPH :	U.S.GAL. PER HOUR	A.L. :	AUTO-LEAN
TAS :	TRUE AIRSPEED	C.L. :	CRUISING LEAN
KTS. :	KNOTS	M.L. :	MANUAL LEAN
S.L. :	SEA LEVEL	F.T. :	FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 94—(Sheet 2 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

AAFMC-528
N-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1
ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55,000 TO 50,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED

NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	503

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		2364	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						2364		
1060	920	2250	1220	1060					2250	1460	1270
1040	900	2200	1190	1030					2200	1420	1230
940	820	2000	1080	940					2000	1270	1100
850	740	1800	970	840					1800	1110	970
760	650	1600	860	750					1600	970	840
660	570	1400	760	660					1400	840	730
570	490	1200	650	560					1200	710	620
470	410	1000	540	470					1000	580	500
380	330	800	430	380					800	460	380
280	250	600	320	280					600	320	280
190	165	400	220	190					400	220	190

PRESS ALT. FEET	NORMAL RATED: R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	(.6 STAT. (.52 NAUT.) MI./GAL.): R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000												
25000	2550	46.0	A.R.	455	238	206						
20000	2550	46.0	A.R.	445	228	198	2450	39.5	A.R.	345	207	180
15000	2550	46.0	A.R.	442	220	191	2450	38.5	A.R.	329	198	172
10000	2550	46.0	A.R.	435	210	182	2400	38.0	A.R.	316	190	165
5000	2550	46.0	A.R.	437	203	176	2400	37.0	A.R.	303	180	156
S.L.	2550	46.0	A.R.	448	195	169	2250	35.0	A.R.	272	163	141

PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.): R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.): R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000												
25000												
20000												
15000												
10000												
5000												
S.L.												

PRESS ALT. FEET	MAXIMUM AIR RANGE: R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000	2400	37.0	A.R.	299	191	166
10000	2300	35.5	A.R.	260	176	153
5000	2200	33.5	A.R.	232	163	141
S.L.	2150	31.5	A.L.	204	152	132

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.
(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 55,000 LB. GROSS WEIGHT WITH 2289 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 1460 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 2150 RPM AND 31.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 94—(Sheet 3 of 5 Sheets)

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 50,000 TO 45,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED

NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260°C*	503

FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING(1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		1600							1600		
730	630	1500	810	700	950	820			1500	1050	910
660	570	1350	730	630	850	740			1350	930	810
580	510	1200	650	560	760	660			1200	820	710
510	440	1050	570	490	660	570			1050	700	610
440	380	900	490	420	570	490			900	600	520
360	320	750	410	350	470	410			750	490	430
290	250	600	320	280	380	330			600	390	340
220	190	450	240	210	280	250			450	290	250
145	125	300	160	140	190	165			300	190	165
75	65	150	80	70	95	80			150	100	85

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)						(.7 STAT. (.61 NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
			APPROX.			ALT.				APPROX.						APPROX.						APPROX.			ALT.				APPROX.		
R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	FEET	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	FEET	R.P.M.	M.P. INCHES	MIX-TURE	TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2550	46.0	A.R.	455	246	214	25000	2500	42.0	A.R.	392	235	204	2400	37.0	A.R.	305	215	187							25000						
2550	46.0	A.R.	445	235	204	20000	2500	41.0	A.R.	366	220	191	2350	36.5	A.R.	289	202	175							20000						
2550	46.0	A.R.	442	225	195	15000	2450	40.0	A.R.	347	208	181	2350	36.0	A.R.	277	194	168							15000	2250	34.5	A.R.	229	182	158
2550	46.0	A.R.	435	215	187	10000	2450	39.0	A.R.	330	199	173	2300	35.5	A.R.	264	185	161							10000	2150	32.0	A.L.	186	168	146
2550	46.0	A.R.	437	206	179	5000	2400	37.5	A.R.	314	188	163	2250	35.0	A.R.	252	176	153							5000	2000	31.0	A.L.	161	155	135
2550	46.0	A.R.	448	197	171	S.L.	2300	35.0	A.R.	284	171	148	2200	32.0	A.L.	227	161	140							S.L.	1900	31.0	A.L.	142	144	125

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 50,000 LB. GROSS WEIGHT WITH 1525 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 1050 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1900 RPM AND 31 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE	F.R. : FULL RICH
M.P. : MANIFOLD PRESSURE	A.R. : AUTO-RICH
GPH : U.S.GAL.PER HOUR	A.L. : AUTO-LEAN
TAS : TRUE AIRSPEED	C.L. : CRUISING LEAN
KTS. : KNOTS	M.L. : MANUAL LEAN
S.L. : SEA LEVEL	F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 94—(Sheet 4 of 5 Sheets)

Appendix II of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

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4-1-44

AIRCRAFT MODEL(S)
B-24 G, H & J
NAVY PB4Y-1

ENGINE(S): R-1830-65 (CECO CARBURETOR) (2)

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 45,000 TO 40,000 POUNDS

EXTERNAL LOAD ITEMS
DEAD ENGINE PROPELLER FEATHERED

NUMBER OF ENGINES OPERATING: THREE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 26 SECT. III)
WAR EMERG.								
MILITARY POWER	2700	49.0	-	A.R.	5 MIN.	260° C*	503	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
		1100	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						1100		
500	430	1000	540	470	630	550			1000	770	670
450	390	900	490	420	570	490			900	690	600
400	350	800	430	380	500	440			800	620	540
350	300	700	380	330	440	380			700	540	470
300	260	600	320	280	380	330			600	460	400
250	220	500	270	230	320	270			500	390	340
200	175	400	220	190	250	220			400	310	270
150	130	300	160	140	190	165			300	240	210
100	85	200	110	95	125	110			200	160	140
50	45	100	55	45	65	55			100	80	70

NORMAL RATED						PRESS	(.6 STAT. (.52 NAUT.) MI./GAL.)					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
						40000						
						35000						
						30000						
2550	46.0	A.R.	455	253	220	25000	2500	43.0	A.R.	408	245	213
2550	46.0	A.R.	445	240	208	20000	2500	41.5	A.R.	379	229	199
2550	46.0	A.R.	442	229	199	15000	2450	40.5	A.R.	359	215	187
2550	46.0	A.R.	435	218	189	10000	2450	39.5	A.R.	340	204	177
2550	46.0	A.R.	437	209	181	5000	2400	38.0	A.R.	322	193	168
2550	46.0	A.R.	448	200	174	S.L.	2300	35.0	A.R.	292	176	153

PRESS	(.7 STAT. (.61 NAUT.) MI./GAL.)						(STAT. (NAUT.) MI./GAL.)					
ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000												
35000												
30000												
25000	2400	38.5	A.R.	329	230	200						
20000	2400	37.5	A.R.	307	216	188						
15000	2400	36.5	A.R.	292	203	176						
10000	2350	36.0	A.R.	277	193	168						
5000	2300	35.0	A.R.	262	182	158						
S.L.	2200	32.0	A.R.	242	166	144						

PRESS	MAXIMUM AIR RANGE					
ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. MPH.	T.A.S. KTS.
40000						
35000						
30000						
25000	2250	35.0	A.R.	240	205	178
20000	2200	32.0	A.L.	185	188	163
15000	2050	31.0	A.L.	159	173	150
10000	1900	31.0	A.L.	141	160	139
5000	1750	31.0	A.L.	125	148	129
S.L.	1650	30.0	A.L.	110	137	119

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 90) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) CARBURETOR SETTING 700-C-3.

* UNDER ABNORMAL CONDITIONS, MAXIMUM CYLINDER HEAD TEMPERATURES OF 270°C ARE PERMITTED. (SEE PARAGRAPH 1.g., SECTION III.)

EXAMPLE

AT 45,000 LB. GROSS WEIGHT WITH 1025 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 75 GAL.) TO FLY 770 STAT. AIRMILES AT S.L. ALTITUDE MAINTAIN 1650 RPM AND 30 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL

F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF AUG. 1944 BASED ON: FLIGHT TEST DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 94—(Sheet 5 of 5 Sheets)

APPENDIX II-N
INSTRUCTIONS

The fact that these charts include 65,000 pounds gross weight does not imply that any change has been made in the design or construction of the airplane or in the guaranteed performance. However, conditions may arise wherein it is desired to fly greater loads than the design load (56,000 lb) at reduced load factors. In such cases, take-off with more than 56,000 pounds may be attempted at the discretion of those responsible for the flight operation.

The charts for the CECO Carburetor (1900-CPB-3) are based upon fuel consumption figures for the *700-C-3 setting only.*

1. COMPOSITE LEVEL FLIGHT CRUISING CONTROL CHART.

(See figures 104 and 114.)

The composite cruising control chart is very simple and easy to use if it is properly understood. The chart is divided into four sections, namely, Density Altitude, Air-Speed Conversion, Power Settings, and Weight Correction. An analysis of each section as given below reveals the facts on which the chart is based, and how each contributes to the make-up and use of the complete chart.

a. DENSITY ALTITUDE.—Density altitude describes the mass per unit volume of air at a standard pressure and temperature. Standard air at sea level has been accepted by agreement to have a temperature of 15°C (59°F) at a barometric pressure of 29.92 inches of mercury (in. Hg) or 1013 millibars. Because air is a gas its density varies with pressure and temperature. Since the physical properties of air vary with changes in altitude, standard air must also specify the conditions for each altitude above and below sea level. Thus, it has been assumed that the temperature decreases 1°C for every 504.6 feet increase in altitude above sea level up to a height of 35,332 feet, where the temperature is —55°C (—67°F). Above this altitude the air is assumed to retain a constant temperature of —55°C. Standard air has therefore been defined and the physical relationships may be found in any Standard Atmosphere Table.

Usually, actual air differs from the calculated standard air. In order that the air density may be determined, a comparison must be made with conditions where the air density is already known. This is done by comparing the density of the air through which the flight is being made with the density of the air at a given pressure altitude when the temperature is standard.

The altimeter is set to a barometric pressure of 29.92 inches Hg on the dial of the instrument and the pressure altitude is then read. In this case the pressure altitude reading represents the pressure due to the weight of the air above the altitude through which the flight is being made. Since the pressure altitude has been determined at standard temperature and also due to the fact that the density of the air under these conditions is known, a starting point has been established and the other factor, temperature, which effects density may now be considered.

At standard temperature the pressure altitude and density altitude are the same and the air has a certain known density. When the temperature is higher than standard, the air expands and becomes less dense and thus the density altitude is greater than the pressure altitude. Conversely, when the temperature is lower than standard, the air contracts and becomes more dense and the density altitude is lower than the pressure altitude. Examples from figure 95 may help to clarify the use of the pressure altitude to density altitude conversion chart included

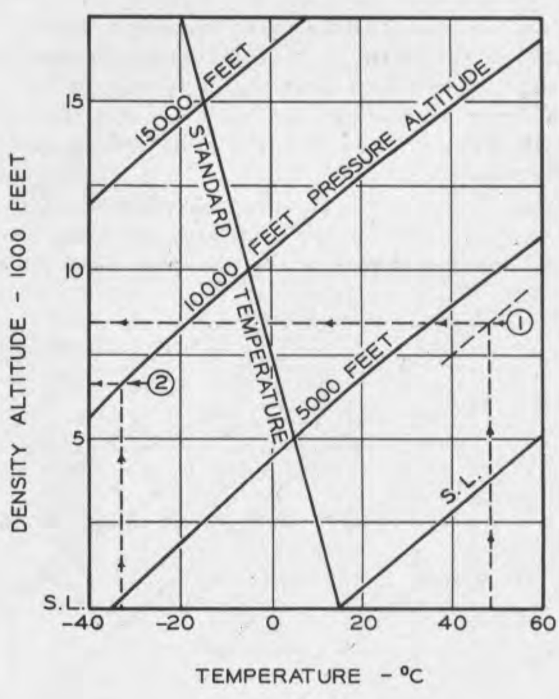

Figure 95

on the left-hand side of the composite cruising control chart.

Example 1:

Pressure altitude = 4000 ft

Air Temperature = 47°C (117°F)

Density altitude = 8500 ft

Example 2:

Pressure altitude = 10,000 ft

Air Temperature = —32°C (—26°F)

Density altitude = 6500 ft

Note: Pressure altitude is the altimeter reading when the barometric scale on the instrument is set to 29.92 inches Hg (1013 millibars).

By correcting the pressure altitude for temperature, the density of the air through which the flight is being made is determined and is expressed in terms of density altitude.

The performance of the airplane (lift, drag, speed, power required and power available) depends upon the density of the air. All aerodynamic calculations and all aerodynamic charts similar to the cruising control charts are usually based upon standard conditions, and therefore, *the pressure altitude must be converted to density altitude for the proper use of the cruising control and other aerodynamic charts.*

b. AIR-SPEED CONVERSION.—The next section of the chart to be considered is that portion dealing with the air-speed conversion. This is the main body of the cruising control chart just to the right of the pressure altitude conversion chart. The vertical lines represent the true indicated (calibrated) air speed with the scale given at the top of the chart. The true air speed is represented by the light diagonally curved lines sloping from the top left-hand part of the chart to the lower right-hand part of the chart. At sea level the true air speed and true indicated air speed are the same.

This portion of the cruising control chart facilitates the conversion of true indicated air speed into true air speed as shown by the examples taken from figure 96.

Example 1:

True indicated air speed = 157 mph

Density altitude = 4000 ft

True air speed = 167 mph

Example 2:

True indicated air speed = 176 mph

Density altitude = 9000 ft

True air speed = 202 mph

The pilot's air-speed indicator reading must be corrected for installation errors to obtain true indicated air speed as given on the cruising control chart. *(See figure 129.)*

c. POWER SETTINGS.—The per cent power lines are the heavy lines sloping toward the left and superimposed on the air-speed conversion chart. These power lines give the power settings (rpm and manifold pressure), the fuel consumption in gallons per hour, and the speed-power relationship for the airplane.

The power settings given are recommended for obtaining the maximum efficiency from the engines with a minimum amount of wear, and the optimum rpm considering propeller efficiency and specific fuel consumption in order that the resulting miles per gallon may be as high as possible. A relatively high rpm and low manifold pressure setting would be easier on the engine; however, the engine would not develop the power of which it is capable and would have an excessive fuel consumption. On the other hand, a relatively low rpm and high manifold pressure setting would build up higher pressures within the cylinders than the engine was designed to withstand and this would result in detonation and possibly blown cylinder heads, etc. It is evident that a compromise must be made between the rpm and manifold pressure settings to obtain the best performance, and the power settings on the cruising control chart were determined for this purpose.

d. WEIGHT CORRECTION.—The fourth and last section composing the cruising control chart includes the weight correction lines underneath the air-speed

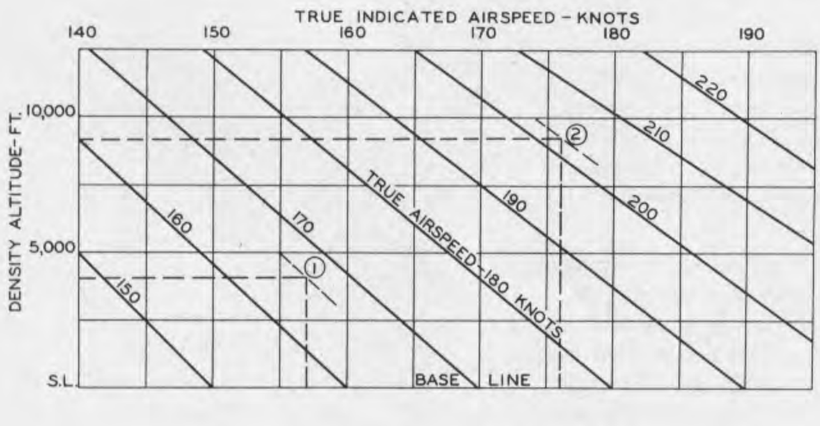

Figure 96

conversion section. The power lines mentioned above give the speed-power relationship only for the gross weight at which the chart is based. Consequently corrections have to be made for variations in gross weight. The chart is based upon a gross weight of 35,000 pounds establishing the base line. The weight correction lines are applicable for any range of gross weights from 35,000 pounds to 65,000 pounds.

The method for using the weight variation lines to correct for gross weight is illustrated in figure 97.

Increasing the weight increases the lift required to maintain the airplane in level flight, which in turn increases the angle of attack and thus increases the drag reducing the speed for the same amount of power or increasing the power required to fly at the same speed. It is necessary, therefore, to adjust for gross weight to obtain the correct air speed or power.

The gross weight of an airplane in flight will decrease as the fuel is burned. This decrease in weight will increase the speed for a given power setting. If a constant air speed is desired, less power is required as the gross weight decreases. For steady cruising it should not be necessary to set power oftener than each hour. Every three hours will probably be satisfactory.

Combining the four sections as shown below, one may see the basis on which the composite cruising control chart is established.

Chart for Density Altitude	Power Required Curves Plotted on Background of Air-Speed Conversion Due to Altitude
	Chart for Wt Correction

e. INSTRUCTIONS FOR USING THE CRUISING CONTROL CHART. — The cruising control chart will give the air speed for a selected per cent of power or the per cent of horsepower required to fly at a desired air speed. Thus two methods may be employed in using the cruising control chart, depending upon which conditions of flight are chosen. Both methods are illustrated in the examples given below and in figure 98.

(1) TO DETERMINE AIR SPEED FOR ANY DESIRED POWER AT ANY GROSS WEIGHT AND ANY ALTITUDE.—Enter chart at outside air temperature (A) and follow arrows to pressure altitude (B) determining density altitude. Follow arrows horizontally across to desired or selected per cent power (C). Project vertically down to gross weight at (D). Follow slope of weight variation lines to base line at (E). Project vertically up to density altitude at (F). True air speed and true indicated air speed are read at (F). Fuel flow, rpm, and manifold pressure are found at (C).

(2) TO DETERMINE POWER REQUIRED FOR ANY DESIRED AIR SPEED AT ANY GROSS WEIGHT AND ANY ALTITUDE.—For this method the procedure is just the reverse of that given in (1), except for steps (A) and (B) which are used for determining the density altitude. In this case the desired air speed is known at (F). Reverse the directions of the arrows projecting vertically down to (E) and follow the slope of the weight variation lines to the gross weight at (D). Project vertically up to the density altitude at (C). The power required (per cent of normal rated power at sea level), fuel flow, rpm, and manifold pressure are found at (C).

(3) EXAMPLES FOR ILLUSTRATING THE USE OF CRUISING CONTROL CHARTS.

(See figures 104 and 114.)

(a) Find the air speed for a power setting of

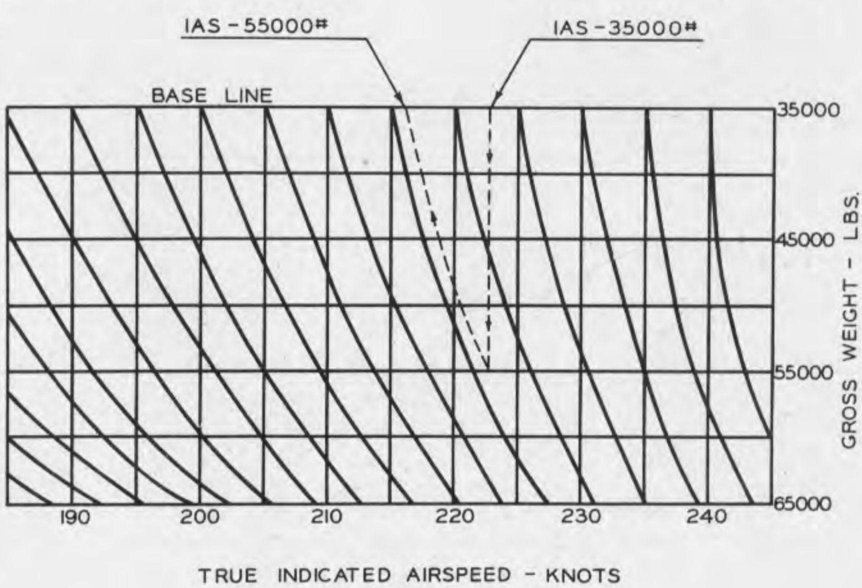

Figure 97

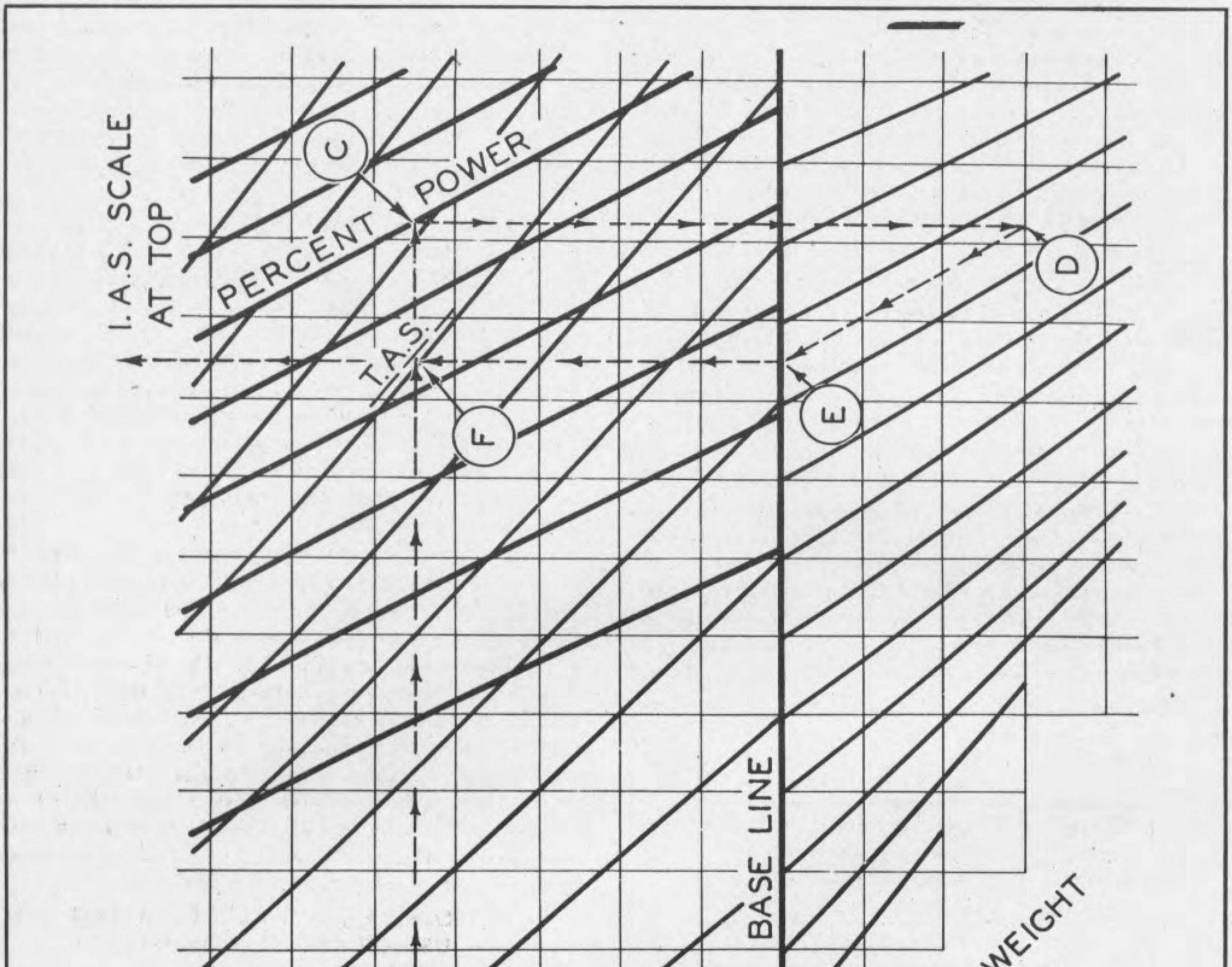
I. A. S. SCALE AT TOP
C
PERCENT POWER
D
T.A.S.
F
E
BASE LINE
GROSS WEIGHT
A
ALTITUDE
B
STANDARD TEMP.
PRESSURE
TEMPERATURE
DENSITY ALTITUDE

Figure 98

2325 rpm and 35.5 inches Hg at a density altitude of 15,000 feet at a gross weight of 50,000 pounds.

By referring to the chart it can be seen that 2325 rpm and 35.5 inches Hg is the power setting for 75 per cent power or 825 bhp per engine. Projecting vertically down to 50,000 pounds gross weight and then parallel to the weight variation lines up to the base line and then vertically up to 15,000 feet density altitude will give a true air speed of 230 mph and a true indicated air speed of 182.5 mph.

(b) Find the power setting to fly maximum range at 7000 feet pressure altitude, outside air temperature 5°C and 61,500 pounds gross weight.

Enter chart at 5°C and project vertically up to the 7000 feet pressure altitude line and read 7500 feet for the density altitude. The recommended speeds for maximum range for various gross weights are given on the left hand portion of the air-speed conversion chart by the vertical dash lines. By interpolating between the speeds for maximum range for 65,000 pounds gross weight and 60,000 pounds gross weight as given on the chart, the indicated air speed is determined to be 160 mph or the true air speed is 180 mph at 7500 feet density altitude. Projecting vertically down to the base line and following the weight variation line to 61,500 pounds and projecting this point vertically up to 7500 feet density altitude gives the required per cent of power to fly maximum range for the conditions given in the above example.

For this example the required per cent of power is between the 55 and 60 per cent power lines on the chart. By interpolation, the power is determined to be 57 per cent. Since 1900 rpm is recommended for 55 per cent power and 2050 rpm for 60 per cent power, 1960 rpm is determined by interpolation to be the required engine speed. In the same manner, manifold pressure is read to be 31 inches Hg. On the cruising control chart for airplanes equipped with the R-1830-43 engines, the fuel flow is interpolated to be 191 gallons per hour. On the cruising control chart for airplanes equipped with the R-1830-65 engines, the fuel flow is interpolated to be 199 gallons per hour. The power setting for any per cent of power may be read directly from the rpm and manifold pressure vs. per cent of power chart. *(See figure 136.)*

(4) A tight exhaust system is necessary for good turbo operation.

(5) When using rated power in level flight on airplanes equipped with the type B-2 turbo superchargers and hydraulic turbo regulators, reduce manifold pressure 1.5 inches Hg per 1000 feet increase in altitude above 27,000 feet. On airplanes equipped with the type B electronic control system, in order to obtain rated power in level flight above 27,000 feet altitude, set the turbo boost until no increase in manifold pressure can be determined and then reduce the resultant manifold pressure two inches.

(6) On airplanes equipped with the type B-22

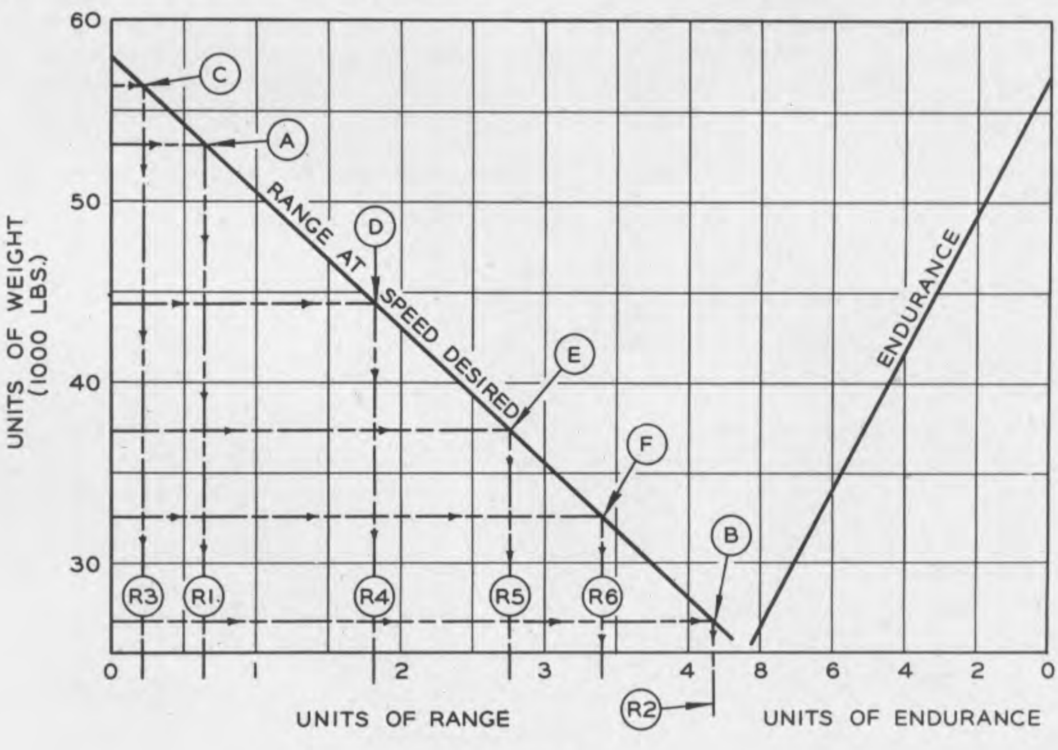

Figure 99

turbo superchargers and type B electronic control system, to obtain rated power in level flight above 31,500 feet altitude, set the turbo boost until no increase in manifold pressure can be determined and then reduce the resultant manifold pressure two inches.

2. RANGE AND ENDURANCE PREDICTION CHARTS.

The purpose of these charts is to show the range attainable at a constant altitude for speeds varying from the speed for maximum range to the speed at rated power.

a. INSTRUCTIONS FOR USING THE RANGE AND ENDURANCE PREDICTION CHARTS.

(See figure 99.)

(1) RANGE: NO BOMBS DROPPED.

Enter chart with initial gross weight at point A and read R_1.

A — B along weight scale = weight of fuel used during the flight.

Enter chart with final gross weight at point B and read R_2.

$R_2 - R_1$ = Range for amount of fuel used.

(2) RANGE: BOMBS DROPPED.

In this case, bombs are dropped at some point during the flight.

C — D along weight scale = weight of fuel used before dropping bombs.

$R_4 - R_3$ = Range before dropping bombs.

D — E along weight scale = weight of bombs dropped.

E — F along weight scale = weight of fuel used after dropping bombs.

$R_6 - R_5$ = Range after dropping bombs.

$(R_4 - R_3) + (R_6 - R_5)$ = Total Range.

(3) ENDURANCE: USE SAME METHOD AS FOR RANGE.

Knowing the altitude of flight, the quantity of gasoline available, and the distance to be covered, the pilot may in most cases have a selection of several speeds. The final selection of speed will be based on the time limitation and on the amount of reserve or conservatism desired. Upon reaching the altitude of flight, power should be set by using the power settings specified on the cruising control chart.

b. GENERAL.

(1) Direct interpolation may be used to estimate the range and endurance for various speeds and altitudes not given on the charts.

(2) The sharp break occurring in several of the range and endurance curves indicates a change from AR to AL mixture setting.

(3) In flight conditions, where the cylinder head temperatures exceed 248°C (478°F), but are under 270°C (518°F) with normal rated power, the maximum allowable use of normal rated power is limited to one hour's duration. If the head temperature does not exceed 248°C, continuous operation at normal rated power is allowable. The curve of range at normal rated power can be used for the purpose of finding the decrease in weight for the time during which normal rated power is used.

(4) All charts must be based on certain established conditions. A separate chart would be required to consider every condition of wind, loading and altitude that might be encountered. Therefore, the charts are based on a no-wind condition, and no allowances for gasoline consumed in warm-up, takeoff and climb to the altitude of flight have been made. If a head wind or a tail wind is anticipated, the gain or loss in true air speed will have to be considered

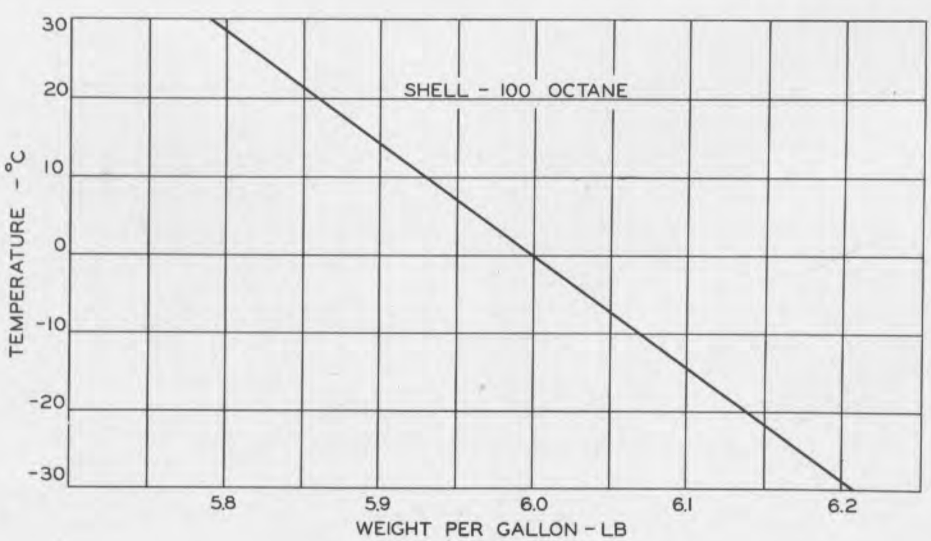

Figure 100

in estimating the range and flying time. When an accurate determination of range is desired the fuel used in warm-up, take-off and climb should be subtracted from the initial amount of fuel on board to obtain the fuel available in flight, and the weight of fuel used should be subtracted from the take-off gross weight to obtain the gross weight at which to enter the chart for finding R_1. Approximately 75 gallons of fuel may be allowed for warm-up and take-off and the fuel used in climb and distance traveled can be estimated from the climb control chart. *(See figure 134.)*

c. EXAMPLES FOR ILLUSTRATING THE USE OF RANGE AND ENDURANCE PREDICTION CHARTS.

Figures 105 to 109 are to be used with engines having Bendix Stromberg carburetors. Figures 115 to 119 are to be used with engines having CECO carburetors.

Note

In order to simplify the examples so as to distinguish the figures given on the charts for the Bendix Stromberg carburetors from those given for the CECO carburetors, the values obtained for the CECO carburetor charts will be enclosed in parentheses ( ).

(1) Gross weight at 1000 feet density altitude is 60,000 pounds with 2000 gallons of fuel available in flight. Find the maximum range attainable with no wind.

Solution: refer to the range and endurance prediction chart for 1000 feet density altitude, figure 105, for airplanes with the Bendix Stromberg carburetors or figure 115 for airplanes with the CECO carburetors. Enter the chart at 60,000 pounds gross weight and read 840 (800) miles for R_1 on the line labaled "Maximum Range." As 2000 gallons of fuel are available for flying, and since the weight of fuel is taken as 5.89 pounds per gallon, the weight of fuel used to consume 2000 gallons would be $5.89 \times 2000 = 11{,}780$ lbs. Then the airplane would weigh 60,000 lbs. — 11,780 lbs. = 48,220 lbs. at the end of the flight. The weight per gallon of gasoline varies with temperature as shown in figure ......, and for an accurate calculation of range the weight of the fuel should be corrected for temperature. However, it is usually safe to assume a weight of 6.0 pounds per gallon for a quick and easy method of calculating the weight of the gasoline.

Enter the chart at 48,220 pounds and read 3000 (2970) miles for R_2 on the line labeled "Maximum Range." The maximum range for the airplane at a gross weight of 60,000 pounds, flying at a density of altitude of 1000 feet with 2000 gallons of fuel available would then be $R_2 - R_1 = 3000 - 840 = 2160$ miles for airplanes with the Bendix Stromberg carburetors, or $2970 - 800 = 2170$ miles for airplanes with the CECO carburetors.

The endurance or length of time for the trip is found in the same manner. Thus at 60,000 pounds E_1 is 5.1 (4.9) hours and at 48,220 pounds E_2 is 19 (18.8) hours. Then $E_2 - E_1 = 19 - 5.1 = 13.9$ hours or 13 hours 54 minutes for airplanes with the Bendix Stromberg carburetors or $18.8 - 4.9 = 13.9$ hours for airplanes with the CECO carburetors.

(2) Gross weight at 25,000 feet density altitude is 62,000 pounds with a 6000 pound bomb load and 2400 gallons of fuel available in flight. It is desired to bomb an objective 690 miles distant and to reach the destination in three hours flying time with no wind. Determine if there is sufficient fuel remaining to make the return trip flying the maximum range line.

Refer to the range and endurance prediction chart for 25,000 feet density altitude, figure 109, for airplanes with the Bendix Stromberg carburetors or figure 119 for airplanes with the CECO carburetors. To fly a distance of 690 miles in three hours would require a speed of $690 \div 3 = 230$ mph. Enter the chart at 62,000 pounds and read R_3 to be 270 (280) miles on the line labeled "Range—True Speed 230 mph." The required distance of flight is 690 miles.

Therefore, $R_3 + 690 = R_4 = 960$ (970) miles on the chart. Project vertically up at 960 (970) miles intersecting the 230 mph range line and read 55,000 (55,600) pounds for the gross weight. In flying the 690 miles the airplane burned $62{,}000 - 55{,}000 = 7000$ lbs of fuel (or $62{,}000 - 55{,}600 = 6400$ lbs) depending upon the carburetor used. Figuring the weight of gasoline at 5.89 pounds per gallon the amount of fuel consumed in traveling the 690 miles is 1190 (1090) gallons. At this point the bombs are dropped and the gross weight now becomes $55{,}000 - 6000 = 49{,}000$ lbs ($55{,}600 - 6000 = 49{,}600$ lbs).

Enter the chart at 49,000 (49,600) and read R_5 on the maximum range line to be 2300 (2200) miles. The return trip is 690 miles, so R_6 is then $R_5 + 690 = 2990$ (2890) miles. Project vertically up at 2990 (2890) intersecting the maximum range line at 45,700 (46,300) pounds gross weight. The amount of fuel burned on the return trip is $49{,}000 - 45{,}700 = 3300$ lbs or 560 gallons for airplanes with the Bendix Stromberg carburetors, and $49{,}600 - 46{,}300 = 3300$ lbs. or 560 gallons for airplanes with the CECO carburetors. Since 1190 (1090) gallons are burned in flying to the objective, 1210 (1310) gallons remain for the return trip. Therefore, $1210 - 560 = 650$, or $1310 - 560 = 750$, gallons of fuel are left over depending upon the carburetor used. The return trip would take approximately 3 hours 39 minutes and consequently the entire flying time would be 6 hours 39 minutes. For this problem it can be seen that the return trip could be made at 230 mph, thus reducing the flying time.

3. EFFECTS OF TEMPERATURE ON FUEL AND RANGE.

Gasoline expands and contracts with temperature changes. Thus one gallon of gasoline would weigh more at a cold temperature and less at a warm temperature. Figure 100 shows the weight per gallon of gasoline at different temperatures and this chart may be used for accurately determining the weight of the fuel by knowing the temperature and number of gallons. It is usually assumed, for convenience in calculating, that gasoline weighs 6.0 pounds per gallon. This assumption may be used for a quick and easy estimate. However, when large quantities of fuel are used it is quite important to calculate the weight correctly as it may sometimes mean a difference of several hundred pounds. For example, 100 octane fuel at —15°C (5°F) would weigh 6.105 pounds per gallon and 2000 gallons would then have a weight of 12,210 pounds as compared to 12,000 pounds calculated on the 6.0 pounds per gallon assumption.

Calculations for charts contained in this handbook are based upon a fuel weight of 5.89 pounds per gallon which is the weight per gallon of gasoline at standard sea level temperature of 15°C (59°F). The range is proportional to the weight of fuel used, and as the fuel weight varies with temperature, the gallons of fuel should be corrected for any changes from the standard basis for an accurate calculation of the range. A quick and easy method for correcting for temperature is given by figure 101.

EXAMPLE:

Fuel temperature = —15°C (5°F)

Fuel in tanks = 2000 gallons

Correction factor = 1.036

Fuel quantity used to calculate range = 2000 × 1.036 = 2062 gallons.

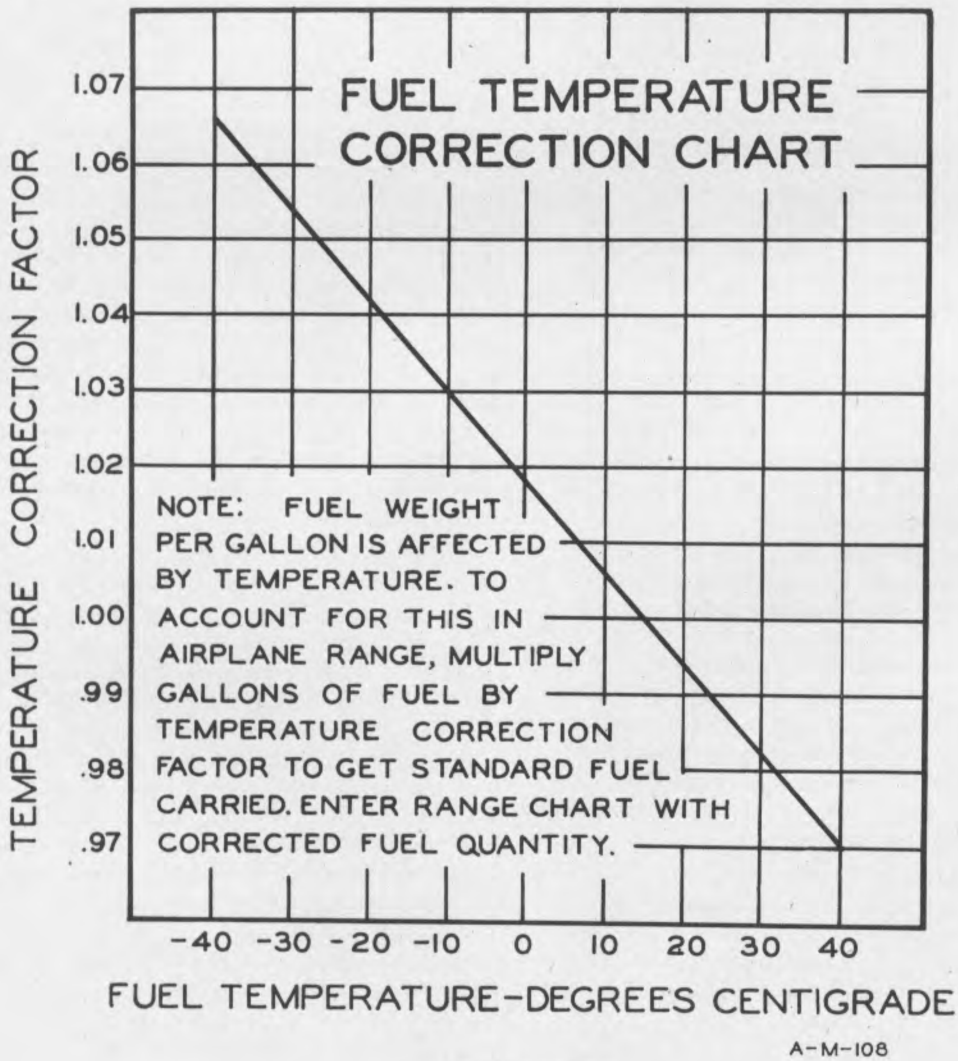

Figure 101

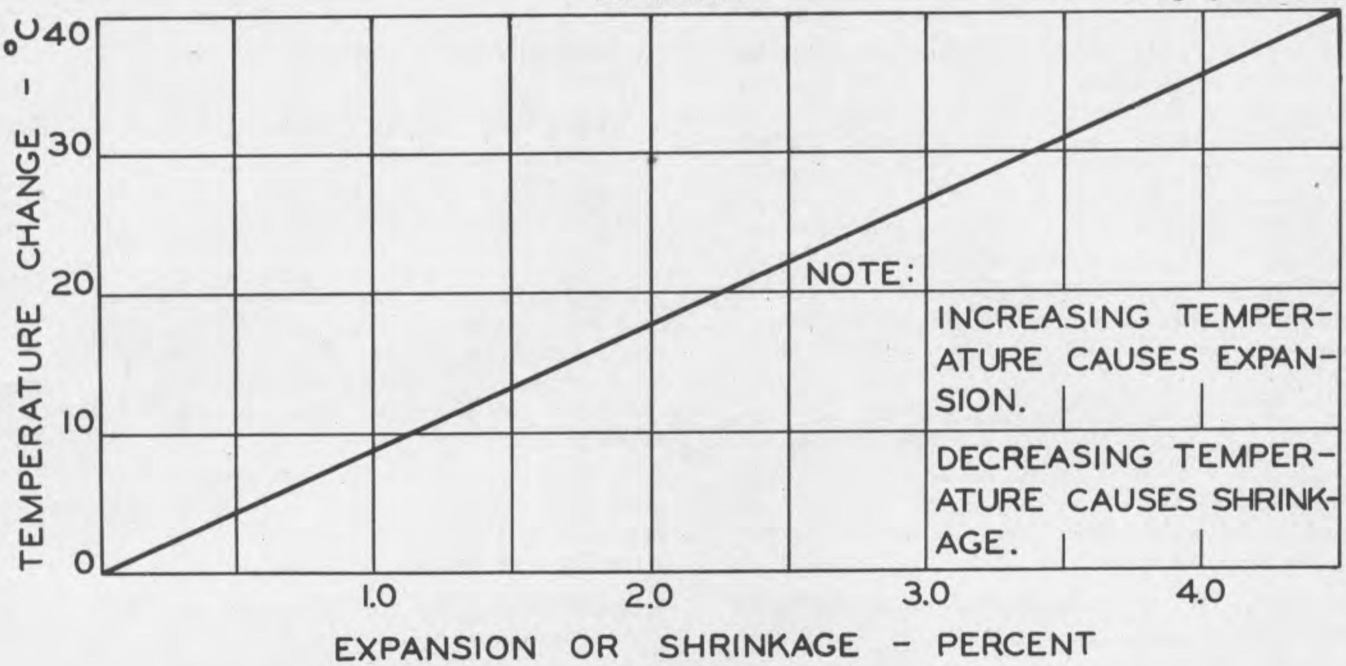

Figure 102

The fuel should be as cold as possible when the tanks are filled but expansion due to heat may cause the tanks to overflow. Figure 102 shows the percentage change in volume of gasoline due to temperature change.

4. MAXIMUM RANGE CONTROL CHART.

(See figures 110 and 121.)

a. By using the maximum range control chart the recommended true indicated air speed and power settings for obtaining maximum range are very easily and quickly read. The speeds and power settings given on this chart are determined from the cruising control chart and thus there is less chance for error as the weight correction has already been made.

b. Enter the chart with the desired gross weight, using the scale at the bottom of the chart. Project vertically, and at the proper altitude for each set of curves, read in turn:

(1) True indicated air speed—To convert to pilot's indicated air speed correct for pitot position error. *(See figure 129.)*

(2) Engine rpm.

(3) Manifold pressure.

(4) Per cent power.

(5) Total fuel consumption (gallons per hour).

(6) Miles per gallon.

c. Having picked off the conditions, the rpm is set first, then manifold pressure is varied to give the desired air speed. At charted speed and rpm, the manifold pressure will be high in hot weather, low in cold weather, when compared to charted values. *Manifold pressure should not be raised more than 2 inches above the charted value without raising rpm.*

d. EXAMPLE: (Taken from Maximum Range Control Chart)

Given:

Gross weight = 55,000 lbs.
Density altitude = 15,000 ft.

Solution:

(1) True indicated air speed = 152 mph. For pilot's indicated air speed, see figure 129. Assume the airplane is equipped with the type D-1 pitot masts. For a true indicated air speed of 152 mph, the pilot's indicator reading is 154 mph.

(2) Engine rpm = 1855.

(3) Manifold pressure = 31 in. Hg. (approximate).

(4) Per cent power = 53.5 (approximate).

For Bendix Stromberg Carburetors

(5_1) Fuel Flow = 176 gallons per hour (approximate).

(6_1) Miles per gallon = 1.09 (approximate).

For CECO Carburetors

(5_2) Fuel Flow = 181 gallons per hour (approximate).

(6_2) Miles per gallon = 1.06 (approximate).

e. GENERAL NOTES:

(1) For steady cruising it should not be necessary to reset power more often than each hour. Every three hours will probably be satisfactory.

(2) At indicated air speeds less than 150 mph when flying on the A.F.C., the pilot should pay close attention to the airplane in order to prevent inadvertent stalling when the airplane flies through sharp updrafts. However, in cases where maximum range and endurance demand low speeds, the airplane may be flown manually, returning to automatic control when the low speeds are no longer required.

(3) At speeds other than those for maximum range or maximum endurance, the cruising control chart is used as a guide to obtain power, rpm and manifold pressure.

(4) The altitude at which the best maximum range conditions can be obtained depends upon the gross weight of the airplane. For high gross weights the maximum range is obtained at the lower altitudes, and as the gross weight decreases, the higher altitudes will give better range.

5. MAXIMUM ENDURANCE CONTROL CHART.

(See figures 111 and 121.)

Maximum endurance means staying in the air the longest possible time; therefore, this chart gives data governing flight at the lowest possible power and fuel consumption. If it is found that the airplane can be flown more slowly with safety, do so by reducing engine power. Go to the lowest safe altitude for maximum endurance.

This chart is used in the same manner as the one for maximum range. A minor change has been made in the form, however, in that the chart gives hours per 100 gallons, instead of gallons per hours. This will give the pilot a quick estimate of the length of time he can stay in the air.

Do not try to decrease fuel consumption by manually leaning the mixture. Set the mixture control to "AUTO-LEAN" when operating at 65 per cent power or below. Leaning the mixture more than this amount would increase cylinder head temperatures with the result that detonation might occur.

Stopping one engine and feathering the propeller in an effort to conserve fuel is a false procedure that should never be followed. A certain amount of power is required to maintain flight, and if one engine is stopped, the drag is increased and more power is required to maintain flight under the same conditions. The power on the other three engines must be increased to compensate for the added drag and loss of power from the fourth engine. This increases the fuel consumption per engine as well as the wear and tear on the engines due to operation at the higher powers. Under the best of conditions the total fuel consumption with three engines operating would at least equal the fuel consumption with four engines, all other factors being equal. Usually the fuel consumption with three engines operating is greater than the fuel consumption with four engines. Also, considering the safety factor, it is much better even for this reason alone, to fly on four engines instead of three.

6. VARIATION OF FUEL CONSUMPTION WITH ALTITUDE.

For Bendix Stromberg Carburetor, see figure 112. For CECO Carburetor, see figure 122.

These charts show the fuel flow in gallons per hour for a given power and altitude. All curves in this handbook for the R-1830-43 engine are based on the fuel flows shown in figure 112. All curves for the R-1830-65 engine are based on the fuel flows shown in figure 122.

The fuel flows on the Bendix Stromberg chart are given for carburetor settings No. PD-12F2-14 and PD-12F5-14. The fuel flows on the CECO chart are given for a carburetor setting No. 700-C-3.

7. ENGINE FLIGHT CALIBRATION CURVES.

(See figures 113 and 123.)

This chart shows the approximate power attainable with any rpm and manifold pressure combination. As the purpose of the turbosupercharger is to maintain sea level density of the air entering the engine, the sea level calibration portion of the chart is good for any altitude up to the critical altitude. The altitude calibration section is based upon the recommended power settings given on the cruising control chart.

The curved lines superimposed on the sea level calibration curves and labeled "S.F.C." show the variation at sea level of specific fuel consumption with power and rpm for auto lean operation.

$$\text{Fuel Consumption (gallons per hour)} = \frac{\text{S.F.C.} \times \text{bhp}}{5.89}$$

Figure 113 gives specific fuel consumption values for the R-1830-43 engine and figure 123 gives values for the R-1830-65 engine.

8. AIR-SPEED CALIBRATION FOR PITOT-STATIC POSITION ERROR.

(See figure 129.)

The conversion of indicated air speeds to calibrated air speeds results in making proper allowances for the effect of the disturbed flow of air around the pitot-static tube, and for the mechanical errors of the pitot-static tube and indicator. If there were no mechanical errors in the pitot-static tube and indicator, and if the pitot-static tube could be projected far enough forward of the airplane to reach a point where it would meet undisturbed air under all flight conditions, the necessity for calibrating air-speed indicator installations would cease to exist. It would then be possible to apply density corrections directly to the indicated air speed as read from the face of the air-speed indicator.

a. DEFINITIONS.

INDICATED AIR SPEED

Indicated air speed is the reading or indication of the air-speed indicator.

CALIBRATED INDICATED AIR SPEED

Calibrated indicated air speed is the indication of the air-speed indicator corrected for instrumental and installation errors.

TRUE AIR SPEED

True air speed is the actual speed of the airplane with respect to the air, or the calibrated indicated air speed corrected for effect of air density and compressibility. True air speed is identical with ground speed under "No Wind" conditions.

GROUND SPEED

Ground speed is the actual speed of the airplane with respect to the ground. This value includes the effect of the wind.

PRESSURE ALTITUDE

Pressure altitude is the calibrated indication of an altimeter with the reference marks set at zero or the reference pressure set at 29.92 inches of mercury.

b. TRUE INDICATED AIR SPEED.

(1) *All charts in this Appendix are presented on the basis of true indicated air speed. True indicated air speed is the same as calibrated indicated air speed as defined above. In other words, true indicated air speed is the pilot's air-speed indicator reading corrected for position and instrument errors from which the air density correction is made to obtain true air speed.*

On these airplanes two different types of pitot-static tube installations have been used, namely the type D-1 (Masts) and the type G-2 (Flush). A short description of each installation is given below.

(a) TYPE D-1 (MASTS).—This installation consists of two pitot masts mounted on each side of the fuselage at a 22° angle with the horizontal, 4 inches aft of station 0.3 and at water line 85.75.

(b) TYPE G-2 (FLUSH).—This installation consists of one pitot tube mounted on the lower left side of the fuselage only, 7.25 inches aft of station 0.3 and at water line 18.65.

(2) A typical calibration of each type installation is shown by figure 129. Care should be exercised to note which type pitot-static tube is installed on the airplane and that the corresponding calibration curve is used.

For example: If it were desired to fly at a true indicated air speed of 180 mph, and if the airplane were equipped with the Type D-1 (Masts) pitot-static tube installation, the pilot's air-speed indicator would read 181 mph for a true indicated air speed of 180 mph. On the other hand, if the airplane were equipped with the Type G-2 (Flush) pitot-static tube installation, the pilot's air-speed indicator reading would be 181.5 mph for a corresponding true indicated air speed of 180 mph.

Note

Figure 129 shows a typical calibration for each type installation and is representative for the B-24 type airplane with a nose turret. For an accurate calibration of the air-speed indicator of each individual airplane, flight tests should be conducted in accordance with Technical Order 05-20-8.

9. RATE-OF-CLIMB AND TIME-TO-CLIMB CHARTS.

Figures 130 and 131 are the "Rate-of-Climb" and "Time-to-Climb" charts to be used for engines having Type B-2 turbosuperchargers installed. Figures 132 and 133 are the "Rate-of-Climb" and "Time-to-Climb" charts to be used for engines having Type B-22 turbosuperchargers installed.

These charts are based on normal rated power climbs with 10 degrees cowl flap opening and 0 degrees wing flaps to give the maximum rate of climb and minimum time to climb from sea level to a given density altitude. The rate of climb decreases with increasing gross weight and consequently the time to climb increases with increasing gross weight. Increasing gross weight has the effect of lowering the service ceiling. The service ceiling is defined as that altitude at which the rate of climb is 100 feet per minute.

The speeds specified for the various gross weights are the ones which will give the best rate of climb. The climbing speed increases with increasing gross weight. Climbing at speeds slower than those recommended may cause excessive engine overheating and climbing at faster than recommended speeds will reduce the rate of climb.

If a lower power than normal rated power is used for climb, the decrease in rate of climb can be approximated by using the following formula.

$$\text{Decrease in rate of climb (ft per min.)} = \frac{(4400 - \text{Total bhp used}) \times 26{,}400}{\text{Initial Gross Weight}}$$

Example:

Find the rate of climb at 5000 feet density altitude for an airplane with an initial gross weight of 55,000 pounds climbing with 2490 rpm and 41.5 inches Hg manifold pressure.

Solution:

By referring to the cruising control chart 2490 rpm and 41.5 inches Hg manifold pressure is the power setting for 90 per cent power or $0.9 \times 4400 = 3960$ bhp.

$$\text{Decrease in rate of climb} = \frac{(4400 - 3960) \times 26{,}400}{55{,}000} = 210 \text{ ft per min.}$$

Rate of climb at normal rated power from rate of climb charts = 890 ft per min.

Rate of climb at 90 per cent power = 890 —210 = 680 ft per min.

10. B-2 AND B-22 TURBOSUPERCHARGERS.

Early model airplanes are equipped with the B-2 type turbosuperchargers and hydraulic turbo regulators, while some airplanes are equipped with the B-2 turbosuperchargers and type B electronic control system. Present model airplanes are equipped with type B-22 turbo, and type B electronic system only. The main difference between the two turbosuperchargers is that the improvements in the B-22 turbo allow higher operating turbine speeds which in turn increase the climb critical altitude, the rate of climb above 25,500 feet (B-2 turbo climb critical altitude) and the service ceiling. The rate of climb and time to climb below 25,500 feet is the same for operation with either turbo. However, it is necessary to use the corresponding chart for the corresponding turbosuperchargers installed on the airplane for determining performance above 25,500 feet.

11. CLIMB CONTROL CHART.

(See figure 134.)

The climb control chart shows the amount of fuel used and the distance traveled (with no wind) while climbing to altitude. The dotted lines on the chart show the performance for airplanes equipped with the type B-2 turbosuperchargers. The values below 25,500 feet density altitude (B-2 turbo climb critical altitude) are identical for airplanes equipped with either type of turbosuperchargers. Care should be exercised to use the proper lines for airplanes equipped with the corresponding turbosuperchargers for operation above 25,500 feet.

The chart is calculated on the basis of rated power climb with 10 degrees cowl flap opening. Since there is only a negligible difference in the average fuel consumption between the R-1830-43 and the R-1830-65 engines at normal rated power, the chart is applicable for airplanes with either type carburetor. A minimum amount of fuel and time is used in attaining a given altitude if normal rated power is used for the climb. Climbing at powers lower than rated power will decrease the rate of climb and increase the total fuel consumed and the distance traveled during climb. Climbing at some speed faster than the values specified on the chart for a given gross weight will have the same effect as decreased power.

Example:

Determine horizontal miles traveled (with no wind) and fuel used to climb from sea level to 15,000 feet density altitude with an initial gross weight of 62,000 pounds.

Solution:

By interpolating between 65,000 pounds and 60,000 pounds initial gross weight, the horizontal miles traveled at 15,000 feet density altitude are approximately 73 miles and the fuel consumed is approximately 235 gallons.

12. FOUR ENGINE TAKE-OFF CHART.

(See figure 135.)

Two types of take-offs are listed below. In order to minimize the strain on the airplane, the Type II take-off is recommended wherever there is sufficient runway. If the runway distance is limited, use the Type I high performance take-off.

Since the take-off distances are most important where the length of runway is limited, the chart is drawn up on the basis of the shortest take-off distance attainable.

Correction to density altitude for this chart is made in the same manner as on the cruising control chart. The main body of this chart gives take-off run for the case of a hard-surfaced runway and no wind.

Note

Take-offs are to be made with 5 degrees cowl flaps and 20 degrees wing flaps.

a. Type I—HIGH PERFORMANCE TAKE-OFF.

The distances shown on the take-off chart are based on the performance values obtained by the Army Air Forces and Consolidated Vultee Aircraft Corporation. To obtain these values, take-off should be made in accordance with the procedure specified on the chart.

Example: (See figure 135.)

Given:

Temperature = 25°C (77°F).
Pressure altitude = 2000 ft.
Gross weight = 56,000 lbs.
Head wind = 10 mph.
Field condition = soft turf.

Solution:

Density Altitude = 3550 ft.

Ground run on concrete runway with no wind = 2980 ft.

Ground run corrected for soft turf condition = 4200 ft.

Ground run corrected for soft turf condition plus 10 mph head wind = 3550 ft.

Distance for transition and climb to fifty feet with no wind = 1180 ft. (same density altitude used as determined from the ground run chart).

Distance for transition and climb to fifty feet corrected from 10 mph head wind = 1050 ft.

Total distance to clear a 50 ft obstacle = 3550 + 1050 = 4600 ft.

b. Type II—AIR-LINE PROCEDURE.

If a high performance take-off is not required, the take-off procedure may be modified as follows:

(1) Referring to item 4 of figure 135, release the brakes at 20 inches Hg manifold pressure instead of 35 inches Hg.

(2) Referring to item 6, take off at the indicated velocities specified on the chart plus 10 mph.

To determine the distance for this type of take-off, add 200 ft to the charted ground run and 600 ft to the total charted distance to clear a 50 ft obstacle.

(3) If for any reason a down wind take-off is contemplated, the approximate distance can be determined by the following method:

(a) GROUND RUN. — Project vertically from the ground condition point to the horizontal line of wind velocity; then follow parallel to the diagonal lines (upward and to the right) to the 0 wind line and project this point to the base scale. *(See figure 103.)*

(b) TRANSITION AND CLIMB TO FIFTY FEET.—Project vertically from the base line (0 wind point) to the horizontal line of wind velocity, then follow parallel to the diagonal lines (upward and to the right) to the 0 wind line and project this point to the base scale. *(See figure 103.)*

13. RPM AND MANIFOLD PRESSURE VS PER CENT OF POWER.

(See figure 136.)

This chart is intended to aid the pilot in determining the power settings for the intermediate per cent powers not appearing on the cruising control chart. The graphs are based on the straight line connection of the values for rpm and manifold pressure for each per cent power given on the cruising control chart.

If the airplane is flown at a per cent power and an altitude which show two different values for rpm and manifold pressure, the lower rpm and the corresponding higher manifold pressure should be used. This corresponds to the jogs in the lower per cent power lines on the cruising control chart which indicate a change in the power settings at the various altitudes.

For Example: At 48 per cent of power and 10,000 feet density altitude the power setting is read from the solid line, and is 1710 rpm and 30.6 inches manifold pressure. However, for the same per cent of power (48%) but 12,000 feet density altitude, the power setting is obtained from the dotted line and is 1750 rpm and 30 inches manifold pressure.

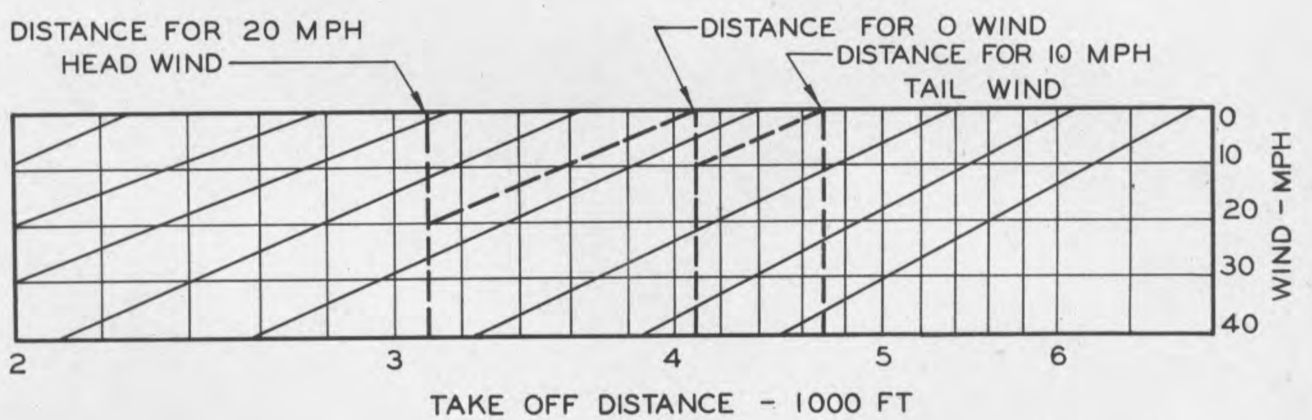

Figure 103

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APPENDIX II-N-1

(For Navy Use Only)

Four-Engine Operation Charts

For Use With

R-1830-43 ENGINES

(Bendix-Stromberg Carburetors)

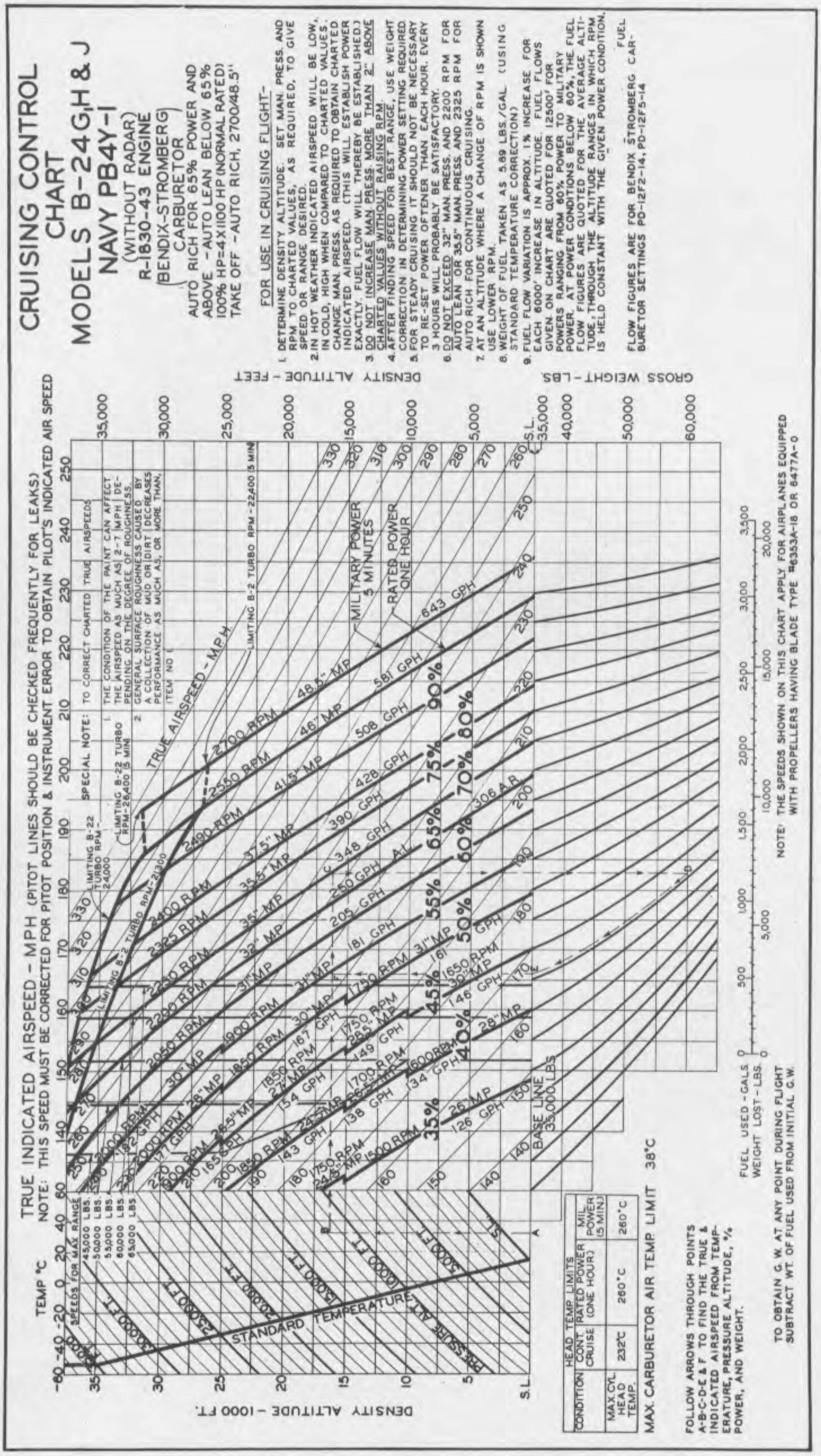

CRUISING CONTROL CHART
MODELS B-24G,H & J
NAVY PB4Y-1
(WITHOUT RADAR)
R-1830-43 ENGINE
(BENDIX-STROMBERG CARBURETOR)
AUTO RICH FOR 65% POWER AND ABOVE - AUTO LEAN BELOW 65%
100% HP=4X1100 HP (NORMAL RATED)
TAKE OFF - AUTO RICH, 2700/48.5"
FOR USE IN CRUISING FLIGHT-
1. DETERMINE DENSITY ALTITUDE. SET MAN. PRESS. AND RPM TO CHARTED VALUES, AS REQUIRED, TO GIVE SPEED OR RANGE DESIRED.
2. IN HOT WEATHER INDICATED AIRSPEED WILL BE LOW, IN COLD, HIGH WHEN COMPARED TO CHARTED VALUES. CHANGE MAN. PRESS. AS REQUIRED TO OBTAIN CHARTED INDICATED AIRSPEED. (THIS WILL ESTABLISH POWER EXACTLY. FUEL FLOW WILL THEREBY BE ESTABLISHED.)
3. DO NOT INCREASE MAN. PRESS. MORE THAN 2" ABOVE CHARTED VALUES WITHOUT RAISING RPM.
4. AFTER FINDING SPEED FOR BEST RANGE, USE WEIGHT CORRECTION IN DETERMINING POWER SETTING REQUIRED.
5. FOR STEADY CRUISING IT SHOULD NOT BE NECESSARY TO RE-SET POWER OFTENER THAN EACH HOUR. EVERY 3 HOURS WILL PROBABLY BE SATISFACTORY.
6. DO NOT EXCEED 32" MAN. PRESS. AND 2200 RPM FOR AUTO LEAN OR 35.5" MAN. PRESS. AND 2325 RPM FOR AUTO RICH FOR CONTINUOUS CRUISING.
7. AT AN ALTITUDE WHERE A CHANGE OF RPM IS SHOWN USE LOWER RPM.
8. WEIGHT OF FUEL TAKEN AS 5.89 LBS./GAL. (USING STANDARD TEMPERATURE CORRECTION)
9. FUEL FLOW VARIATION IS APPROX. 1% INCREASE FOR EACH 6000' INCREASE IN ALTITUDE. FUEL FLOWS GIVEN ON CHART ARE QUOTED FOR 12500' FOR POWERS RANGING FROM 60% POWER TO MILITARY POWER. AT POWER CONDITIONS BELOW 60%, THE FUEL FLOW FIGURES ARE QUOTED FOR THE AVERAGE ALTITUDE, THROUGH THE ALTITUDE RANGES IN WHICH RPM IS HELD CONSTANT WITH THE GIVEN POWER CONDITION.
FUEL FLOW FIGURES ARE FOR BENDIX STROMBERG CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14
TRUE INDICATED AIRSPEED - MPH (PITOT LINES SHOULD BE CHECKED FREQUENTLY FOR LEAKS)
NOTE: THIS SPEED MUST BE CORRECTED FOR PITOT POSITION & INSTRUMENT ERROR TO OBTAIN PILOT'S INDICATED AIR SPEED
TEMP °C
SPEEDS FOR MAX RANGE
SPECIAL NOTE: TO CORRECT CHARTED TRUE AIRSPEEDS
1. THE CONDITION OF THE PAINT CAN AFFECT THE AIRSPEED AS MUCH AS 2-7 MPH DEPENDING ON THE DEGREE OF ROUGHNESS.
2. GENERAL SURFACE ROUGHNESS CAUSED BY A COLLECTION OF MUD OR DIRT DECREASES PERFORMANCE AS MUCH AS, OR MORE THAN, ITEM NO 1
TRUE AIRSPEED - MPH
MILITARY POWER 5 MINUTES
RATED POWER ONE HOUR
STANDARD TEMPERATURE
PRESSURE ALT.
BASE LINE 35,000 LBS
DENSITY ALTITUDE - 1000 FT.
DENSITY ALTITUDE - FEET
GROSS WEIGHT - LBS.
HEAD TEMP LIMITS
CONDITION | CONT. CRUISE | RATED POWER (ONE HOUR) | MIL. POWER (5 MIN.)
MAX. CYL. HEAD TEMP. | 232°C | 260°C | 260°C
MAX. CARBURETOR AIR TEMP. LIMIT 38°C
FOLLOW ARROWS THROUGH POINTS A-B-C-D-E & F TO FIND THE TRUE & INDICATED AIRSPEED FROM TEMPERATURE, PRESSURE ALTITUDE, % POWER, AND WEIGHT.
FUEL USED - GALS.
WEIGHT LOST - LBS.
TO OBTAIN G.W. AT ANY POINT DURING FLIGHT SUBTRACT WT. OF FUEL USED FROM INITIAL G.W.
NOTE: THE SPEEDS SHOWN ON THIS CHART APPLY FOR AIRPLANES EQUIPPED WITH PROPELLERS HAVING BLADE TYPE #6353A-18 OR 6477A-0

Figure 104

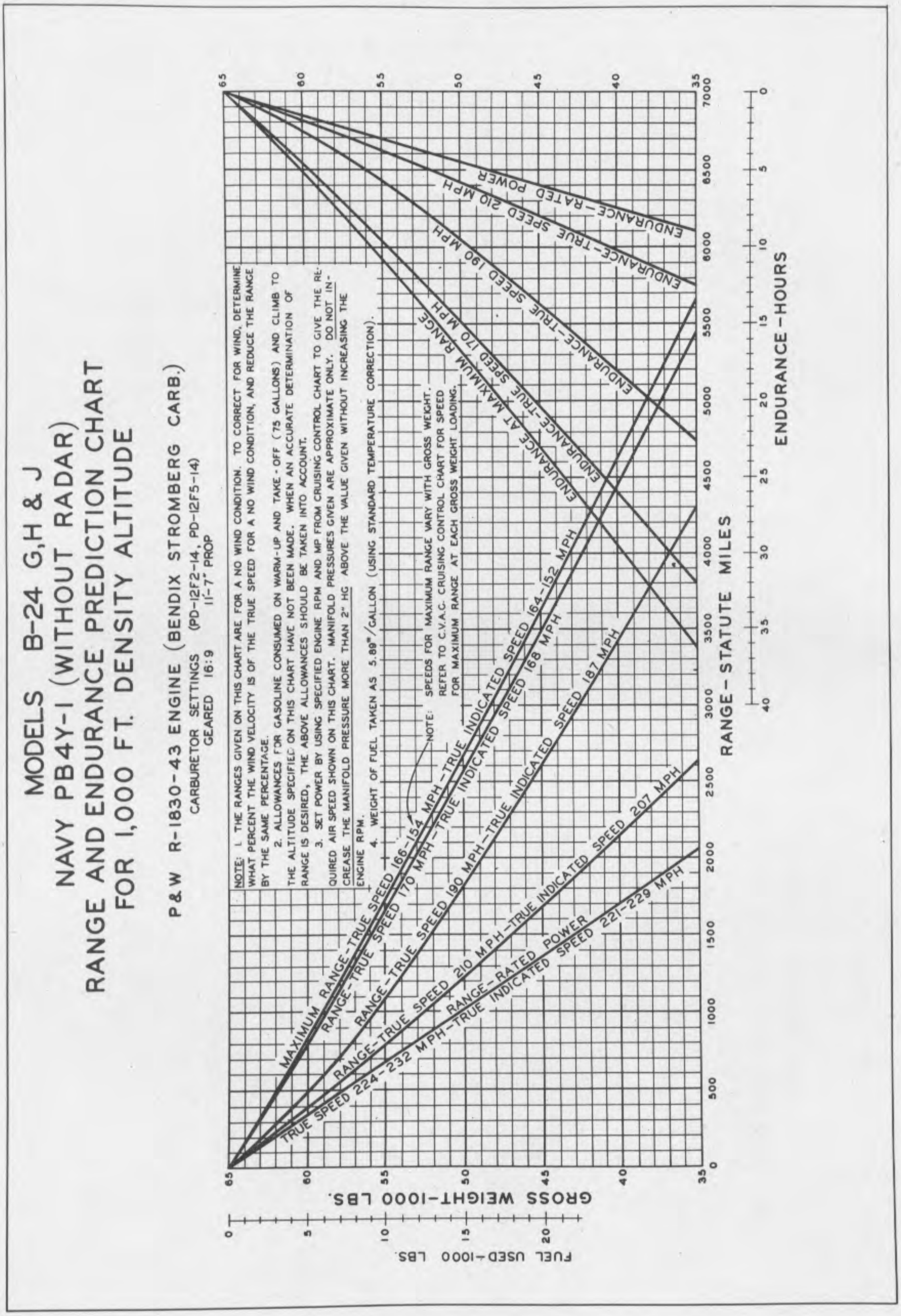

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 1,000 FT. DENSITY ALTITUDE
P&W R-1830-43 ENGINE (BENDIX STROMBERG CARB.)
CARBURETOR SETTINGS (PD-12F2-14, PD-12F5-14)
GEARED 16:9 11'-7" PROP
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
MAXIMUM RANGE-TRUE SPEED 166-154 MPH-TRUE INDICATED SPEED 164-152 MPH
RANGE-TRUE SPEED 170 MPH-TRUE INDICATED SPEED 168 MPH
RANGE-TRUE SPEED 190 MPH-TRUE INDICATED SPEED 187 MPH
RANGE-TRUE SPEED 210 MPH-TRUE INDICATED SPEED 207 MPH
RANGE-RATED POWER
TRUE SPEED 224-232 MPH-TRUE INDICATED SPEED 221-229 MPH
ENDURANCE-RATED POWER
ENDURANCE-TRUE SPEED 210 MPH
ENDURANCE-TRUE SPEED 190 MPH
ENDURANCE-TRUE SPEED 170 MPH
ENDURANCE AT MAXIMUM RANGE
GROSS WEIGHT-1000 LBS.
FUEL USED-1000 LBS.
RANGE-STATUTE MILES
ENDURANCE-HOURS
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000
65 60 55 50 45 40 35
0 5 10 15 20
0 5 10 15 20 25 30 35 40

Figure 105

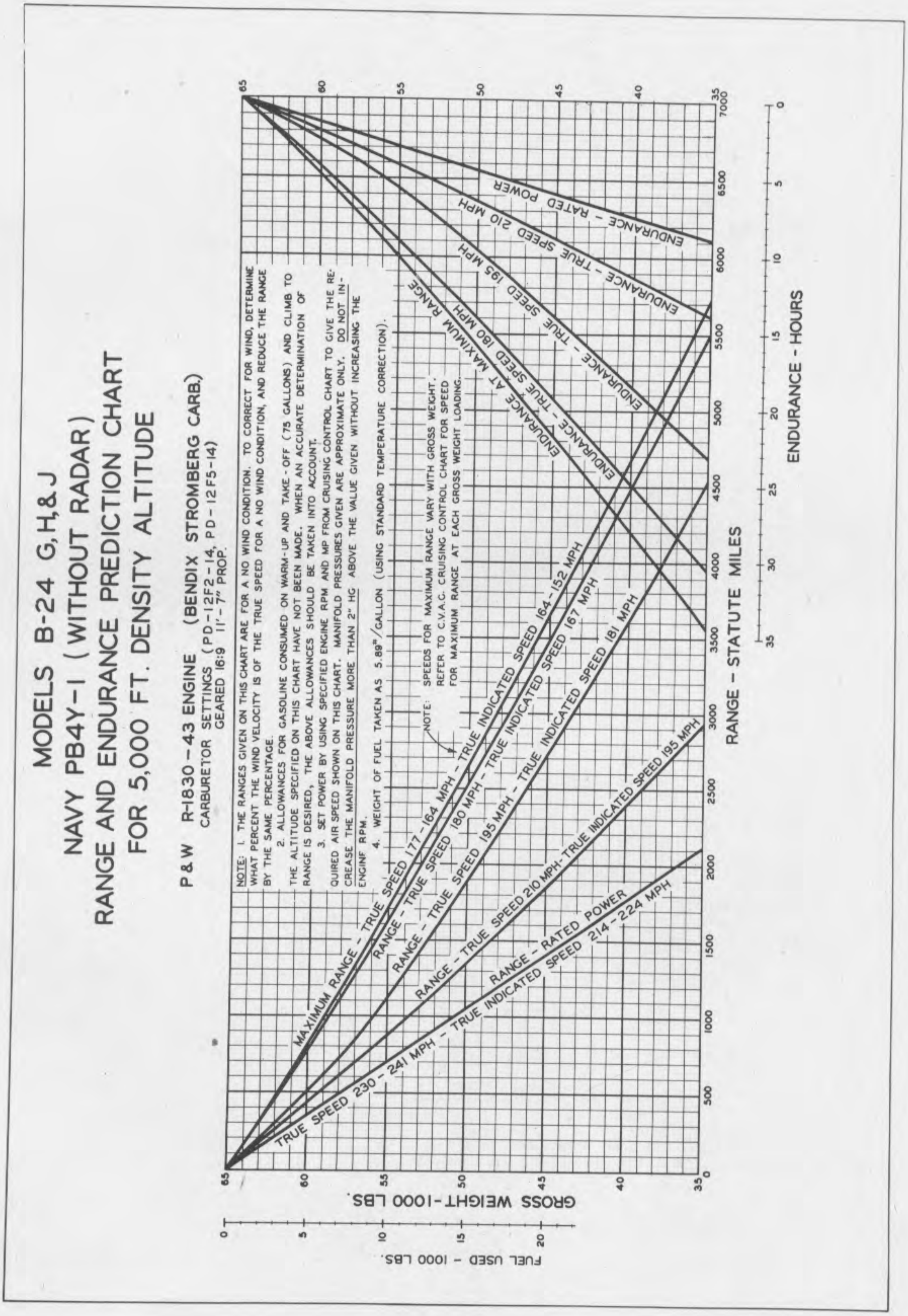

MODELS B-24 G,H,& J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 5,000 FT. DENSITY ALTITUDE
P & W R-1830-43 ENGINE (BENDIX STROMBERG CARB.)
CARBURETOR SETTINGS (PD-12F2-14, PD-12F5-14)
GEARED 16:9 11'-7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.88#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
ENDURANCE - RATED POWER
ENDURANCE - TRUE SPEED 210 MPH
ENDURANCE - TRUE SPEED 195 MPH
ENDURANCE - TRUE SPEED 180 MPH
ENDURANCE AT MAXIMUM RANGE
MAXIMUM RANGE - TRUE SPEED 177-164 MPH - TRUE INDICATED SPEED 164-152 MPH
RANGE - TRUE SPEED 180 MPH - TRUE INDICATED SPEED 167 MPH
RANGE - TRUE SPEED 195 MPH - TRUE INDICATED SPEED 181 MPH
RANGE - TRUE SPEED 210 MPH - TRUE INDICATED SPEED 195 MPH
RANGE - RATED POWER
TRUE SPEED 230-241 MPH - TRUE INDICATED SPEED 214-224 MPH
GROSS WEIGHT - 1000 LBS.
FUEL USED - 1000 LBS.
RANGE - STATUTE MILES
ENDURANCE - HOURS

Figure 106

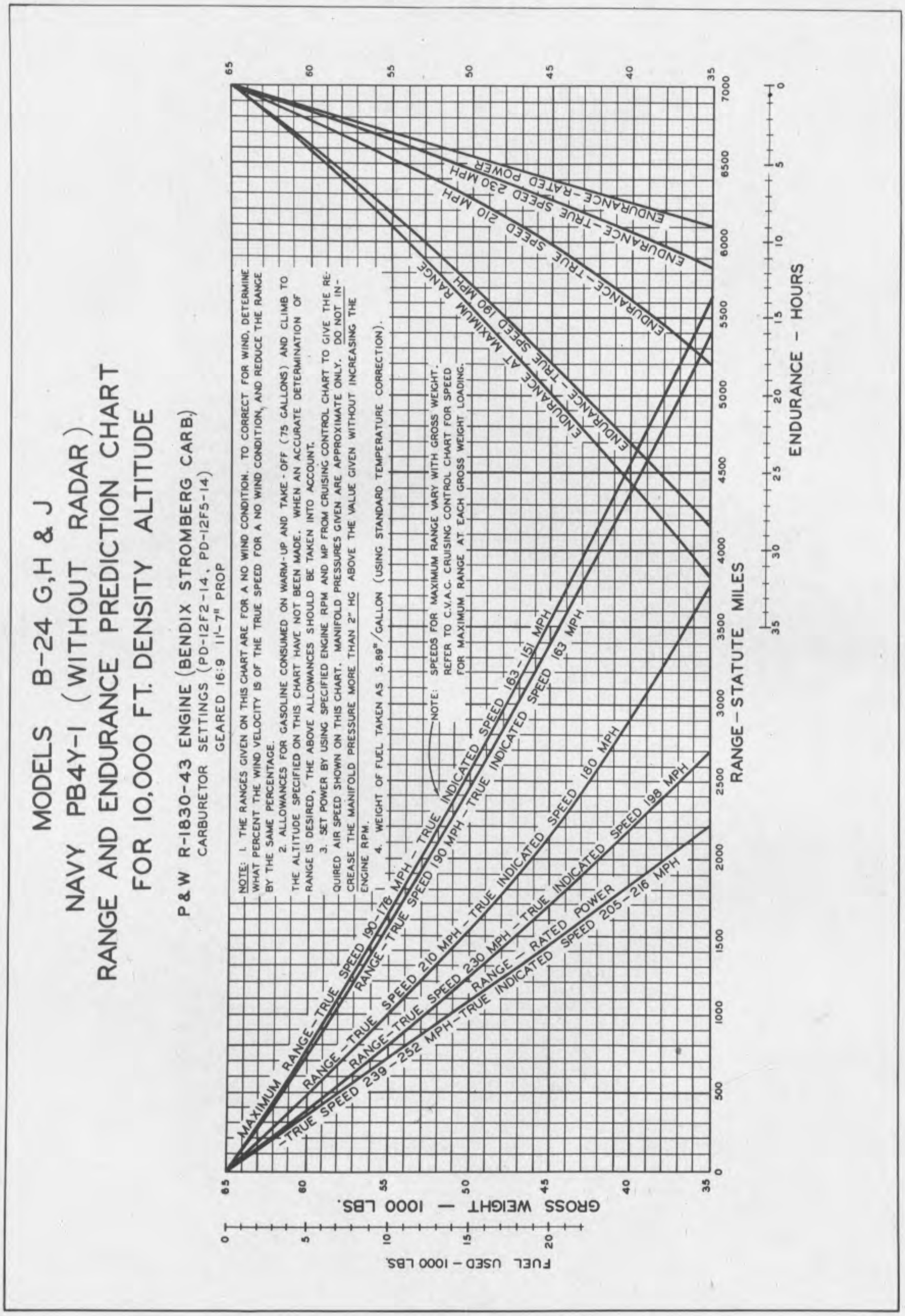

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 10,000 FT. DENSITY ALTITUDE
P & W R-1830-43 ENGINE (BENDIX STROMBERG CARB.)
CARBURETOR SETTINGS (PD-12F2-14, PD-12F5-14)
GEARED 16:9 11'-7" PROP
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
MAXIMUM RANGE-TRUE SPEED 190-178 MPH-TRUE INDICATED SPEED 163-151 MPH
RANGE-TRUE SPEED 190 MPH-TRUE INDICATED SPEED 163 MPH
RANGE-TRUE SPEED 210 MPH-TRUE INDICATED SPEED 180 MPH
RANGE-TRUE SPEED 230 MPH-TRUE INDICATED SPEED 198 MPH
RANGE-RATED POWER-TRUE SPEED 239-252 MPH-TRUE INDICATED SPEED 205-216 MPH
ENDURANCE-RATED POWER
ENDURANCE-TRUE SPEED 230 MPH
ENDURANCE-TRUE SPEED 210 MPH
ENDURANCE-TRUE SPEED 190 MPH
ENDURANCE AT MAXIMUM RANGE
GROSS WEIGHT — 1000 LBS.
65 60 55 50 45 40 35
FUEL USED — 1000 LBS.
0 5 10 15 20
RANGE-STATUTE MILES
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000
ENDURANCE - HOURS
0 5 10 15 20 25 30 35

Figure 107

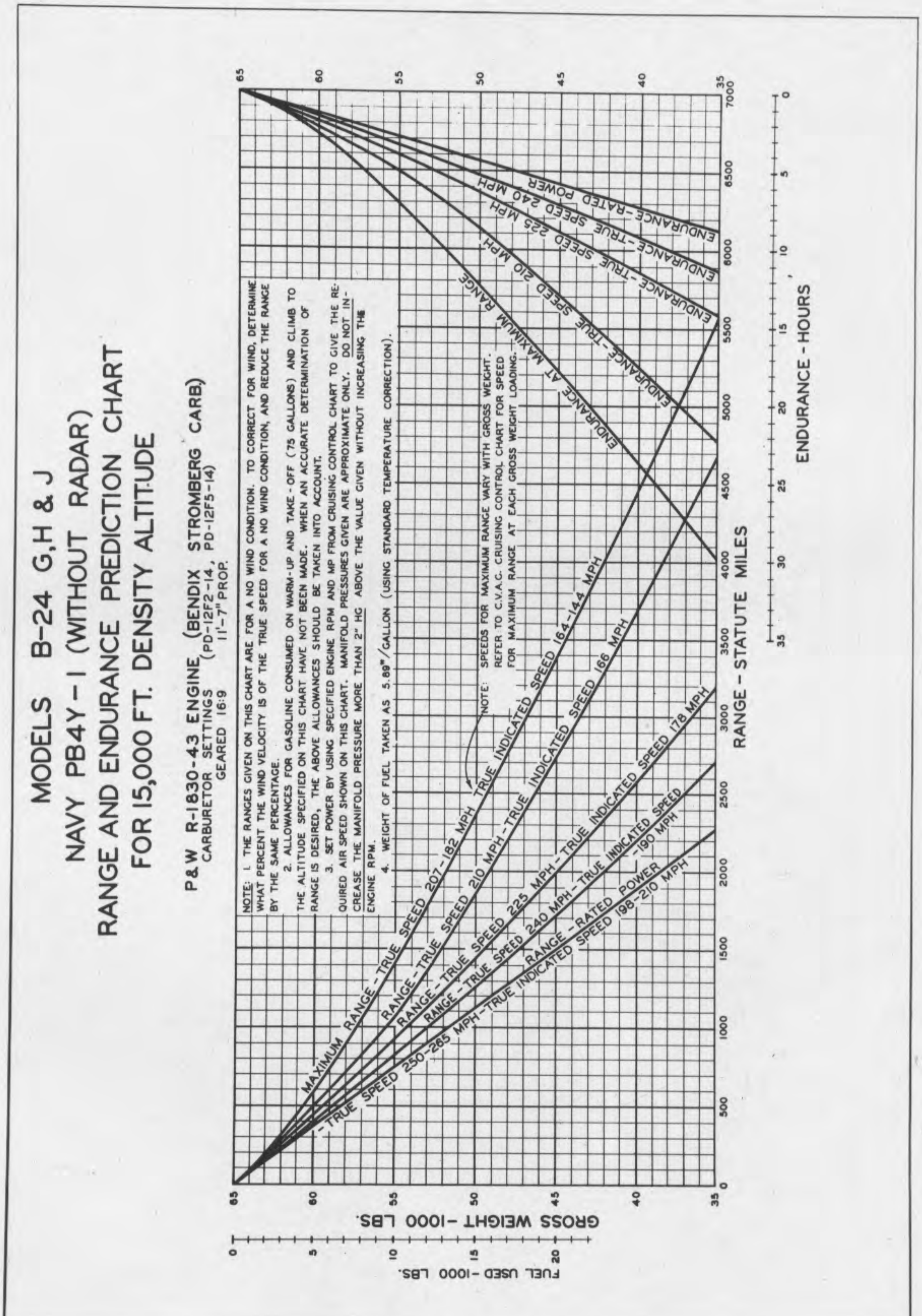

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 15,000 FT. DENSITY ALTITUDE
P&W R-1830-43 ENGINE (BENDIX STROMBERG CARB)
CARBURETOR SETTINGS (PD-12F2-14, PD-12F5-14)
GEARED 16:9 11'-7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89"/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
MAXIMUM RANGE - TRUE SPEED 207-182 MPH TRUE INDICATED SPEED 164-144 MPH
RANGE - TRUE SPEED 210 MPH - TRUE INDICATED SPEED 166 MPH
RANGE - TRUE SPEED 225 MPH - TRUE INDICATED SPEED 178 MPH
RANGE - TRUE SPEED 240 MPH - TRUE INDICATED SPEED -190 MPH
RANGE - RATED POWER - TRUE SPEED 250-265 MPH - TRUE INDICATED SPEED 198-210 MPH
ENDURANCE - RATED POWER
ENDURANCE - TRUE SPEED 240 MPH
ENDURANCE - TRUE SPEED 225 MPH
ENDURANCE - TRUE SPEED 210 MPH
ENDURANCE AT MAXIMUM RANGE
GROSS WEIGHT - 1000 LBS.
65 60 55 50 45 40 35
FUEL USED - 1000 LBS.
0 5 10 15 20
RANGE - STATUTE MILES
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000
ENDURANCE - HOURS
0 5 10 15 20 25 30 35

Figure 108

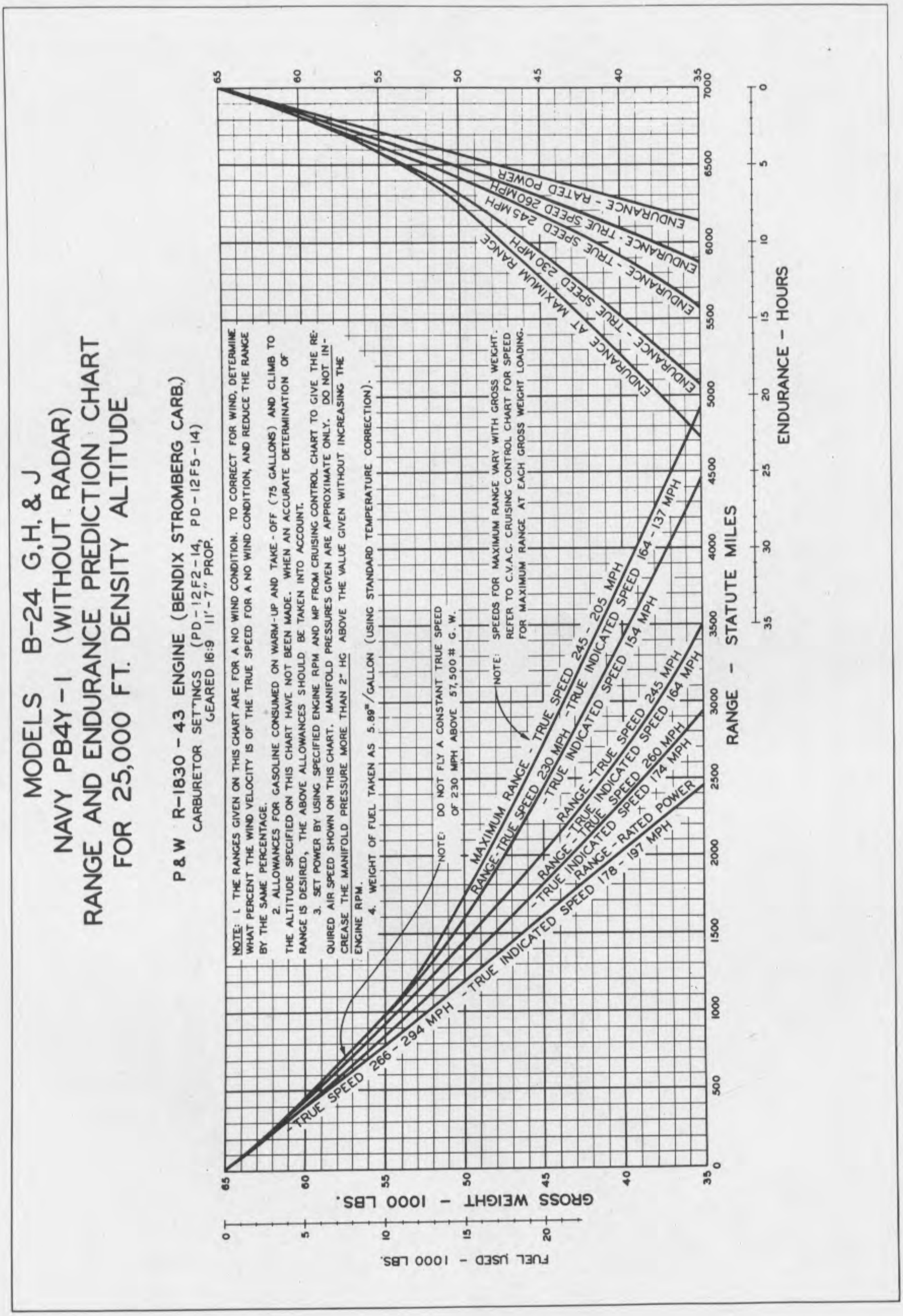

MODELS B-24 G,H, & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 25,000 FT. DENSITY ALTITUDE
P & W R-1830-43 ENGINE (BENDIX STROMBERG CARB.)
CARBURETOR SETTINGS (PD-12F2-14, PD-12F5-14)
GEARED 16:9 11'-7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: DO NOT FLY A CONSTANT TRUE SPEED OF 230 MPH ABOVE 57,500 # G. W.
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
ENDURANCE - RATED POWER
ENDURANCE - TRUE SPEED 260MPH
ENDURANCE - TRUE SPEED 245MPH
ENDURANCE - TRUE SPEED 230MPH
ENDURANCE AT MAXIMUM RANGE
MAXIMUM RANGE - TRUE SPEED 245 - 205 MPH - TRUE INDICATED SPEED 164 - 137 MPH
RANGE-TRUE SPEED 230 MPH - TRUE INDICATED SPEED 154 MPH
RANGE - TRUE SPEED 245 MPH - TRUE INDICATED SPEED 164 MPH
RANGE - TRUE SPEED 260 MPH - TRUE INDICATED SPEED 174 MPH
RANGE - RATED POWER - TRUE SPEED 266 - 294 MPH - TRUE INDICATED SPEED 178 - 197 MPH
GROSS WEIGHT - 1000 LBS.
65
60
55
50
45
40
35
FUEL USED - 1000 LBS.
0
5
10
15
20
RANGE - STATUTE MILES
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
ENDURANCE - HOURS
0
5
10
15
20
25
30
35

Figure 109

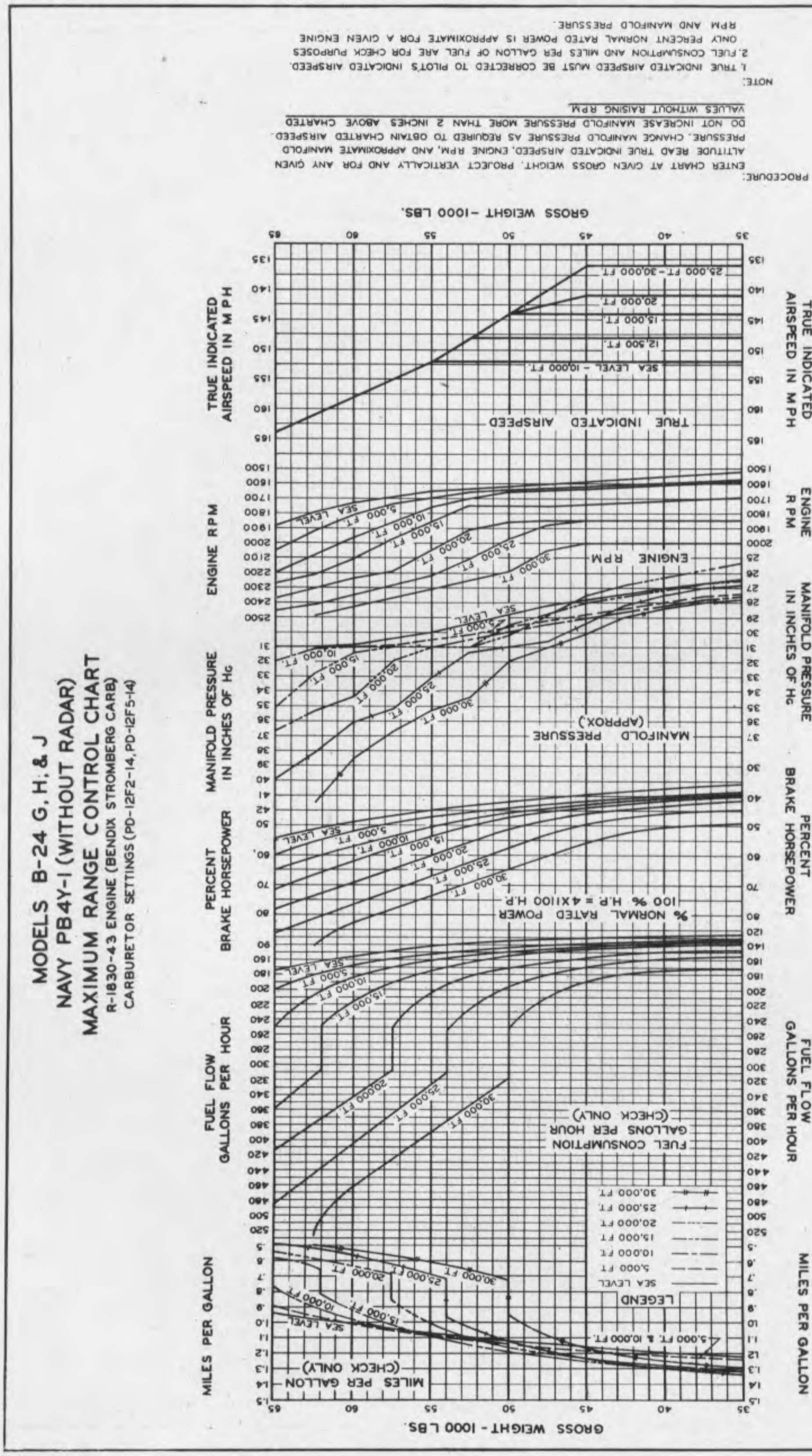

MODELS B-24 G, H, & J
NAVY PB4Y-1 (WITHOUT RADAR)
MAXIMUM RANGE CONTROL CHART
R-1830-43 ENGINE (BENDIX STROMBERG CARB)
CARBURETOR SETTINGS (PD-12F2-14, PD-12F5-14)
PROCEDURE:
ENTER CHART AT GIVEN GROSS WEIGHT, PROJECT VERTICALLY AND FOR ANY GIVEN ALTITUDE READ TRUE INDICATED AIRSPEED, ENGINE RPM, AND APPROXIMATE MANIFOLD PRESSURE. CHANGE MANIFOLD PRESSURE AS REQUIRED TO OBTAIN CHARTED AIRSPEED.
DO NOT INCREASE MANIFOLD PRESSURE MORE THAN 2 INCHES ABOVE CHARTED VALUES WITHOUT RAISING RPM.
NOTE:
1. TRUE INDICATED AIRSPEED MUST BE CORRECTED TO PILOT'S INDICATED AIRSPEED.
2. FUEL CONSUMPTION AND MILES PER GALLON OF FUEL ARE FOR CHECK PURPOSES ONLY. PERCENT NORMAL RATED POWER IS APPROXIMATE FOR A GIVEN ENGINE RPM AND MANIFOLD PRESSURE.
GROSS WEIGHT - 1000 LBS.
TRUE INDICATED AIRSPEED IN MPH
TRUE INDICATED AIRSPEED
ENGINE RPM
MANIFOLD PRESSURE IN INCHES OF Hg
MANIFOLD PRESSURE (APPROX.)
PERCENT BRAKE HORSEPOWER
% NORMAL RATED POWER
100 % H.P. = 4X1100 H.P.
FUEL FLOW GALLONS PER HOUR
FUEL CONSUMPTION GALLONS PER HOUR (CHECK ONLY)
MILES PER GALLON
MILES PER GALLON (CHECK ONLY)
LEGEND
SEA LEVEL
5,000 FT.
10,000 FT.
15,000 FT.
20,000 FT.
25,000 FT.
30,000 FT.

Figure 110

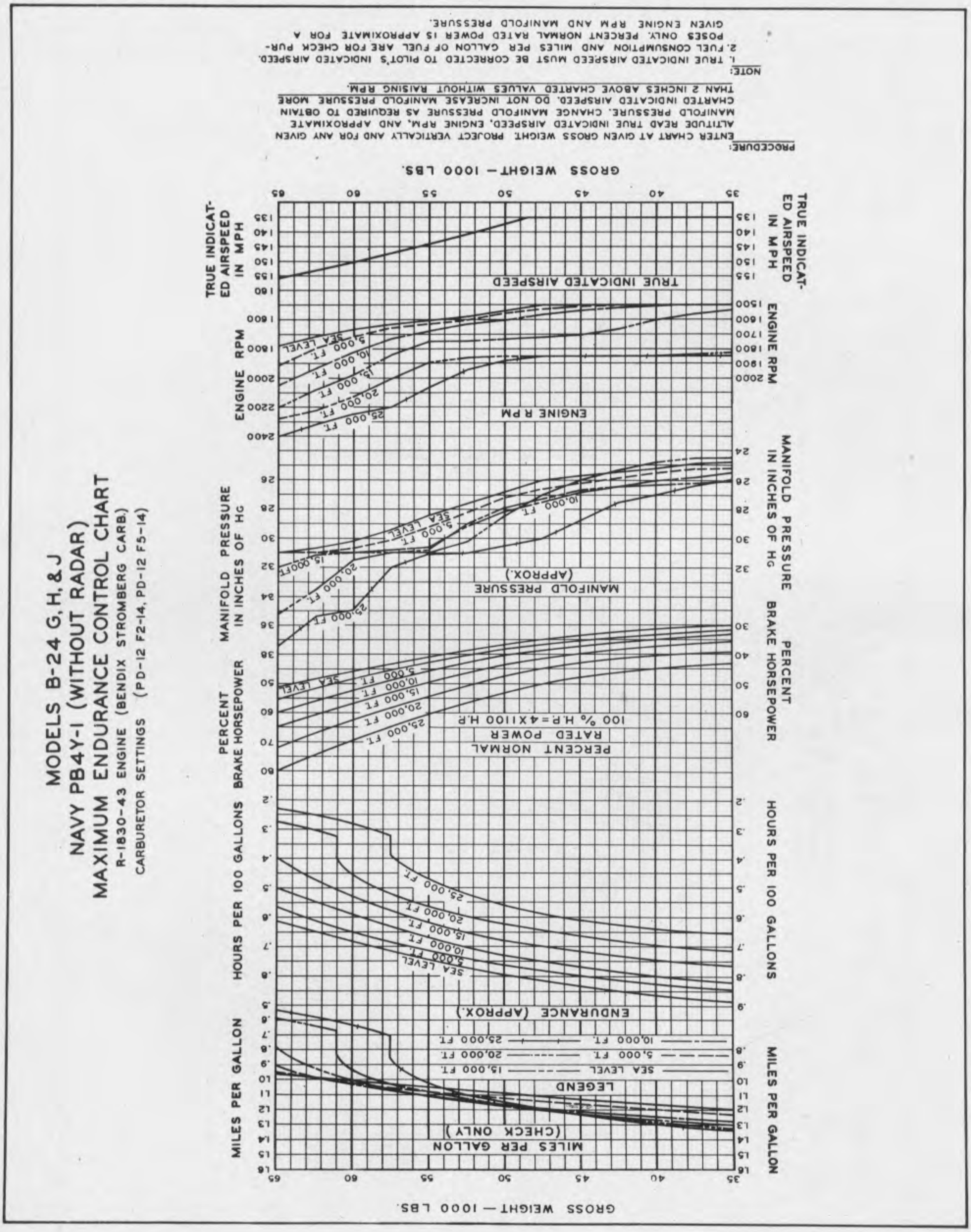

MODELS B-24 G, H, & J
NAVY PB4Y-1 (WITHOUT RADAR)
MAXIMUM ENDURANCE CONTROL CHART
R-1830-43 ENGINE (BENDIX STROMBERG CARB.)
CARBURETOR SETTINGS (PD-12 F2-14, PD-12 F5-14)
PROCEDURE:
ENTER CHART AT GIVEN GROSS WEIGHT. PROJECT VERTICALLY AND FOR ANY GIVEN ALTITUDE READ TRUE INDICATED AIRSPEED, ENGINE RPM, AND APPROXIMATE MANIFOLD PRESSURE. CHANGE MANIFOLD PRESSURE AS REQUIRED TO OBTAIN CHARTED INDICATED AIRSPEED. DO NOT INCREASE MANIFOLD PRESSURE MORE THAN 2 INCHES ABOVE CHARTED VALUES WITHOUT RAISING RPM.
NOTE:
1. TRUE INDICATED AIRSPEED MUST BE CORRECTED TO PILOT'S INDICATED AIRSPEED.
2. FUEL CONSUMPTION AND MILES PER GALLON OF FUEL ARE FOR CHECK PURPOSES ONLY. PERCENT NORMAL RATED POWER IS APPROXIMATE FOR A GIVEN ENGINE RPM AND MANIFOLD PRESSURE.
GROSS WEIGHT — 1000 LBS.
TRUE INDICATED AIRSPEED IN MPH
TRUE INDICATED AIRSPEED
ENGINE RPM
ENGINE R PM
MANIFOLD PRESSURE IN INCHES OF HG
MANIFOLD PRESSURE (APPROX.)
PERCENT BRAKE HORSEPOWER
PERCENT NORMAL RATED POWER
100 % H.P.=4X1100 H.P.
HOURS PER 100 GALLONS
ENDURANCE (APPROX.)
MILES PER GALLON
MILES PER GALLON (CHECK ONLY)
LEGEND
SEA LEVEL
5,000 FT.
10,000 FT.
15,000 FT.
20,000 FT.
25,000 FT.

Figure 111

MODELS B-24 G, H & J
NAVY PB4Y-1

VARIATION OF FUEL CONSUMPTION WITH ALTITUDE

BENDIX STROMBERG CARBURETORS
CARBURETOR SETTINGS-PD-12F2-14, PD-12F5-14
R-1830-43 ENGINE

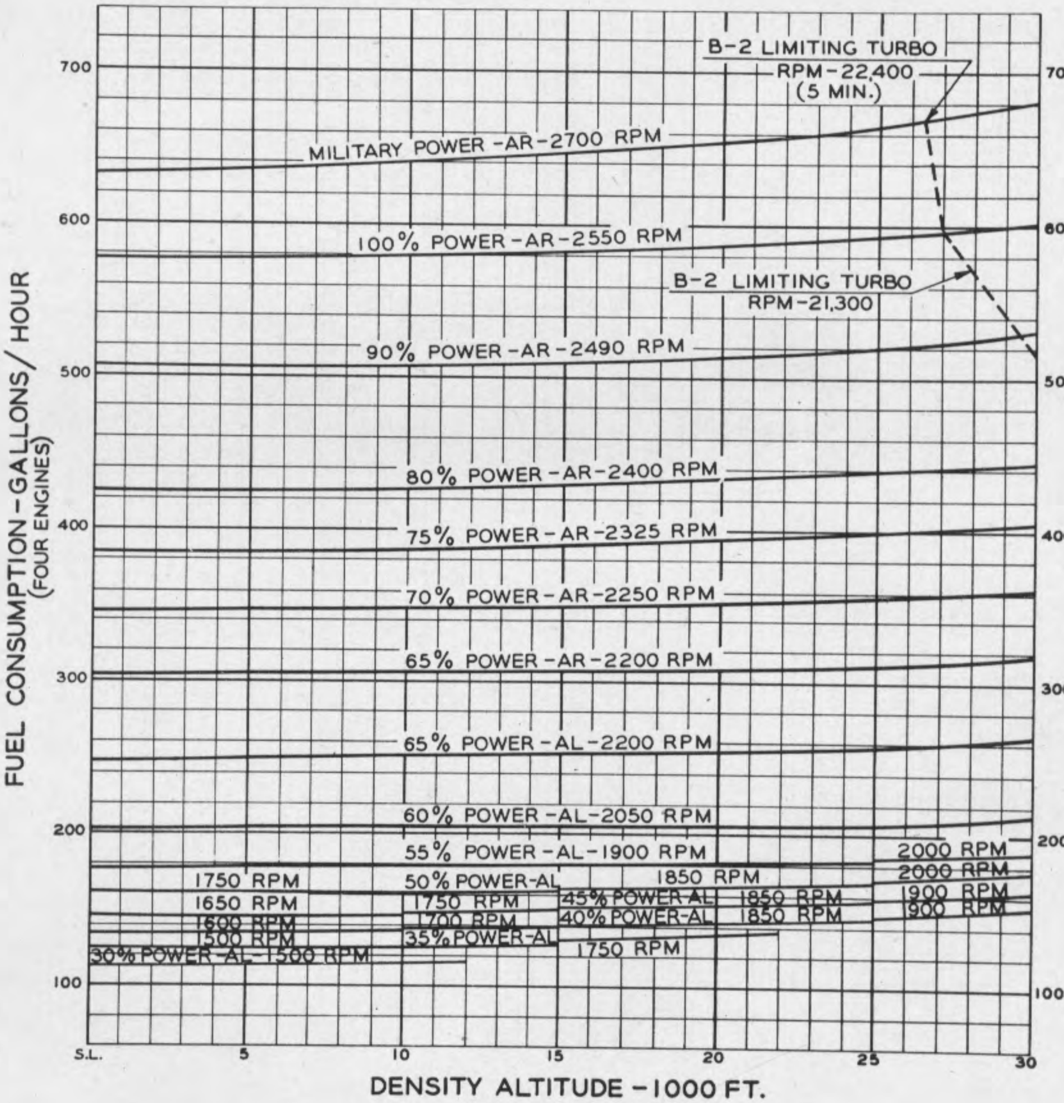


Figure 112

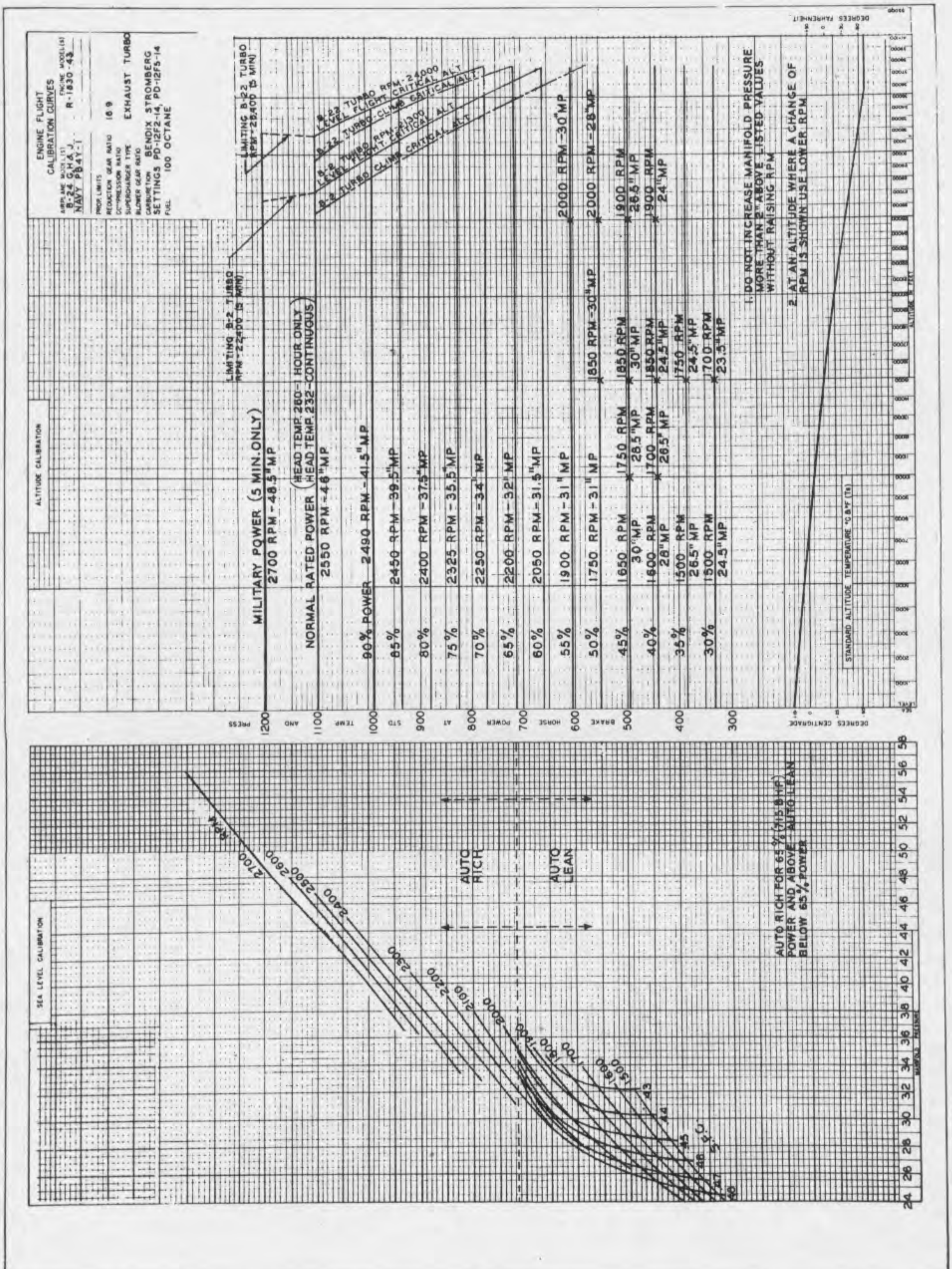

ENGINE FLIGHT CALIBRATION CURVES
AIRPLANE MODEL(S) B-24 G,H,& J, NAVY PB4Y-1
ENGINE MODEL(S) R-1830-43
REDUCTION GEAR RATIO 16:9
SUPERCHARGER TYPE EXHAUST TURBO
CARBURETION BENDIX STROMBERG SETTINGS PD-12F2-14, PD-12F5-14
FUEL 100 OCTANE
ALTITUDE CALIBRATION
SEA LEVEL CALIBRATION
MILITARY POWER (5 MIN. ONLY)
2700 RPM - 48.5"MP
NORMAL RATED POWER (HEAD TEMP. 260-1 HOUR ONLY / HEAD TEMP. 232-CONTINUOUS)
2550 RPM - 46"MP
90% POWER 2490 RPM - 41.5"MP
85% 2450 RPM - 39.5"MP
80% 2400 RPM - 37.5"MP
75% 2325 RPM - 35.5"MP
70% 2250 RPM - 34"MP
65% 2200 RPM - 32"MP
60% 2050 RPM - 31.5"MP
55% 1900 RPM - 31"MP
50% 1750 RPM - 31"MP
45% 1650 RPM 30"MP
40% 1600 RPM 28"MP
35% 1500 RPM 26.5"MP
30% 1500 RPM 24.5"MP
LIMITING B-2 TURBO RPM-22400 (5 MIN)
LIMITING B-22 TURBO RPM-25400 (5 MIN)
B-22 TURBO RPM-24000 LEVEL FLIGHT CRITICAL ALT
B-22 TURBO CLIMB CRITICAL ALT
B-2 TURBO RPM-21300 LEVEL FLIGHT CRITICAL ALT
B-2 TURBO CLIMB CRITICAL ALT
1. DO NOT INCREASE MANIFOLD PRESSURE MORE THAN 2" ABOVE LISTED VALUES WITHOUT RAISING RPM
2. AT AN ALTITUDE WHERE A CHANGE OF RPM IS SHOWN USE LOWER RPM
AUTO RICH
AUTO LEAN
AUTO RICH FOR 65% (715 BHP) POWER AND ABOVE. AUTO LEAN BELOW 65% POWER
BRAKE HORSE POWER AT STD TEMP AND PRESS
STANDARD ALTITUDE TEMPERATURE
DEGREES CENTIGRADE
DEGREES FAHRENHEIT
MANIFOLD PRESSURE

Figure 113

APPENDIX II-N-2

(For Navy Use Only)

Four-Engine Operation Charts

For Use With

R-1830-65 ENGINES

(CECO Carburetors)

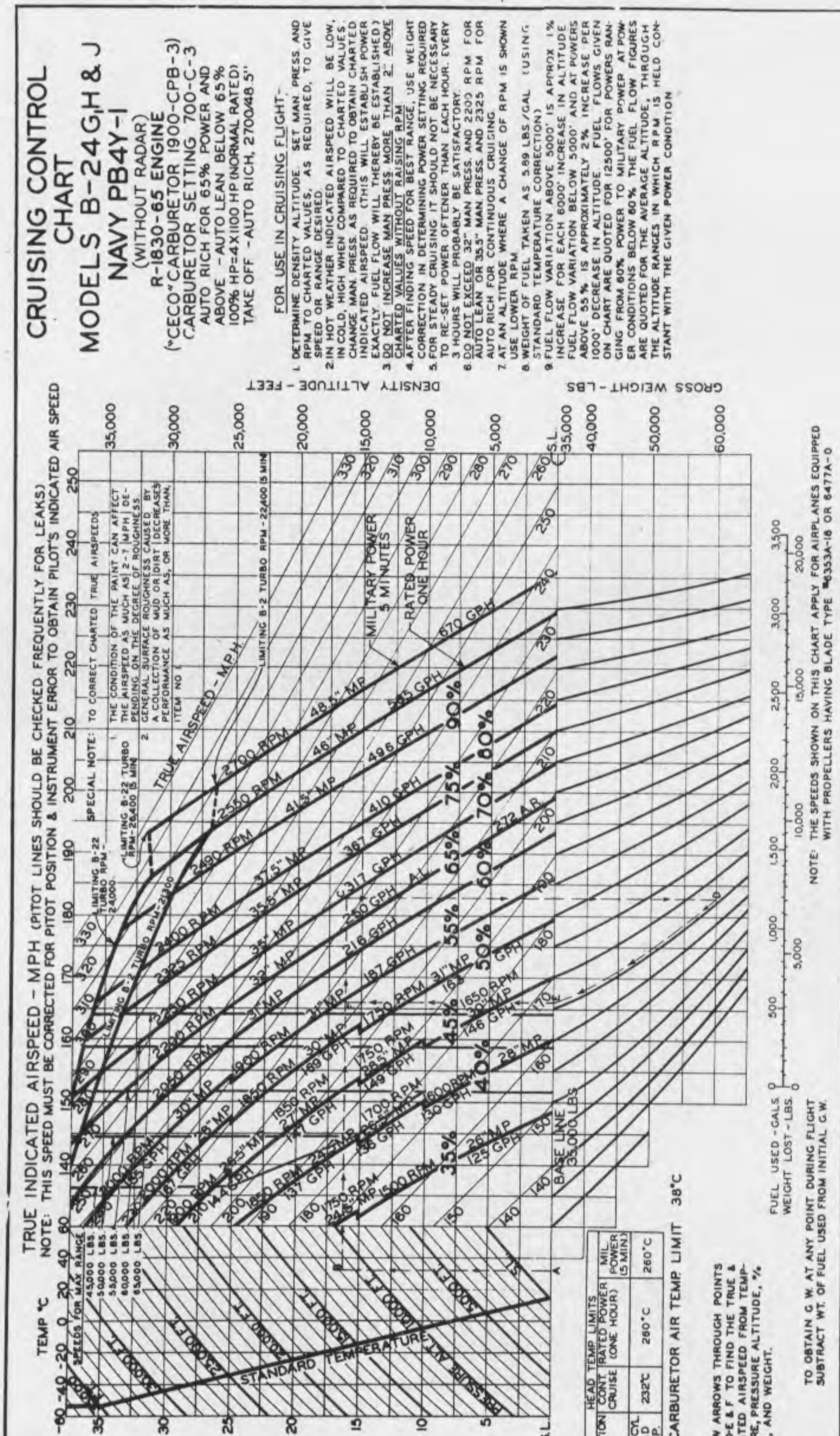

CRUISING CONTROL CHART
MODELS B-24G,H & J
NAVY PB4Y-1
(WITHOUT RADAR)
R-1830-65 ENGINE
("CECO" CARBURETOR 1900-CPB-3)
CARBURETOR SETTING 700-C-3
AUTO RICH FOR 65% POWER AND ABOVE -AUTO LEAN BELOW 65%
100% HP=4X1100 HP (NORMAL RATED)
TAKE OFF -AUTO RICH, 2700/48.5"
FOR USE IN CRUISING FLIGHT-
1. DETERMINE DENSITY ALTITUDE. SET MAN. PRESS. AND RPM TO CHARTED VALUES, AS REQUIRED, TO GIVE SPEED OR RANGE DESIRED.
2. IN HOT WEATHER INDICATED AIRSPEED WILL BE LOW, IN COLD, HIGH WHEN COMPARED TO CHARTED VALUES. CHANGE MAN. PRESS. AS REQUIRED TO OBTAIN CHARTED INDICATED AIRSPEED. (THIS WILL ESTABLISH POWER EXACTLY. FUEL FLOW WILL THEREBY BE ESTABLISHED)
3. DO NOT INCREASE MAN. PRESS. MORE THAN 2" ABOVE CHARTED VALUES WITHOUT RAISING RPM.
4. AFTER FINDING SPEED FOR BEST RANGE, USE WEIGHT CORRECTION IN DETERMINING POWER SETTING REQUIRED
5. FOR STEADY CRUISING IT SHOULD NOT BE NECESSARY TO RE-SET POWER OFTENER THAN EACH HOUR. EVERY 3 HOURS WILL PROBABLY BE SATISFACTORY.
6. DO NOT EXCEED 32" MAN PRESS. AND 2200 RPM FOR AUTO LEAN OR 35.5" MAN. PRESS. AND 2325 RPM FOR AUTO RICH FOR CONTINUOUS CRUISING.
7. AT AN ALTITUDE WHERE A CHANGE OF RPM IS SHOWN USE LOWER RPM.
8. WEIGHT OF FUEL TAKEN AS 5.89 LBS/GAL (USING STANDARD TEMPERATURE CORRECTION)
9. FUEL FLOW VARIATION ABOVE 5000' IS APPROX 1% INCREASE FOR EACH 6000' INCREASE IN ALTITUDE. FUEL FLOW VARIATION BELOW 5000' AND AT POWERS ABOVE 55% IS APPROXIMATELY 2% INCREASE PER 1000' DECREASE IN ALTITUDE. FUEL FLOWS GIVEN ON CHART ARE QUOTED FOR 12500' FOR POWERS RANGING FROM 60% POWER TO MILITARY POWER. AT POWER CONDITIONS BELOW 60% THE FUEL FLOW FIGURES ARE QUOTED FOR THE AVERAGE ALTITUDE, THROUGH THE ALTITUDE RANGES IN WHICH RPM IS HELD CONSTANT WITH THE GIVEN POWER CONDITION
TRUE INDICATED AIRSPEED - MPH (PITOT LINES SHOULD BE CHECKED FREQUENTLY FOR LEAKS)
NOTE: THIS SPEED MUST BE CORRECTED FOR PITOT POSITION & INSTRUMENT ERROR TO OBTAIN PILOT'S INDICATED AIR SPEED
TEMP °C
DENSITY ALTITUDE - 1000 FT.
DENSITY ALTITUDE - FEET
GROSS WEIGHT - LBS
SPEEDS FOR MAX RANGE
SPECIAL NOTE: TO CORRECT CHARTED TRUE AIRSPEEDS
1. THE CONDITION OF THE PAINT CAN AFFECT THE AIRSPEED AS MUCH AS 2-7 MPH DEPENDING ON THE DEGREE OF ROUGHNESS.
2. GENERAL SURFACE ROUGHNESS CAUSED BY A COLLECTION OF MUD OR DIRT DECREASES PERFORMANCE AS MUCH AS, OR MORE THAN, ITEM NO 1
TRUE AIRSPEED - MPH
LIMITING B-2 TURBO RPM - 22,400 (5 MIN)
MILITARY POWER 5 MINUTES
RATED POWER ONE HOUR
STANDARD TEMPERATURE
PRESSURE ALT.
BASE LINE 35,000 LBS
HEAD TEMP LIMITS
CONDITION | CONT. CRUISE | RATED POWER (ONE HOUR) | MIL. POWER (5 MIN)
MAX. CYL. HEAD TEMP. | 232°C | 260°C | 260°C
MAX. CARBURETOR AIR TEMP. LIMIT 38°C
FOLLOW ARROWS THROUGH POINTS A-B-C-D-E & F TO FIND THE TRUE & INDICATED AIRSPEED FROM TEMPERATURE, PRESSURE ALTITUDE, % POWER, AND WEIGHT.
TO OBTAIN G.W. AT ANY POINT DURING FLIGHT SUBTRACT WT. OF FUEL USED FROM INITIAL G.W.
FUEL USED - GALS.
WEIGHT LOST - LBS.
NOTE: THE SPEEDS SHOWN ON THIS CHART APPLY FOR AIRPLANES EQUIPPED WITH PROPELLERS HAVING BLADE TYPE #6353A-18 OR 6477A-0

Figure 114

MODELS B-24 G,H& J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 1,000 FT. DENSITY ALTITUDE

P&W R-1830-65 ENGINE ("CECO" CARBURETOR)
CARBURETOR SETTING (700-C-3)
GEARED 16:9 11'-7" PROP.

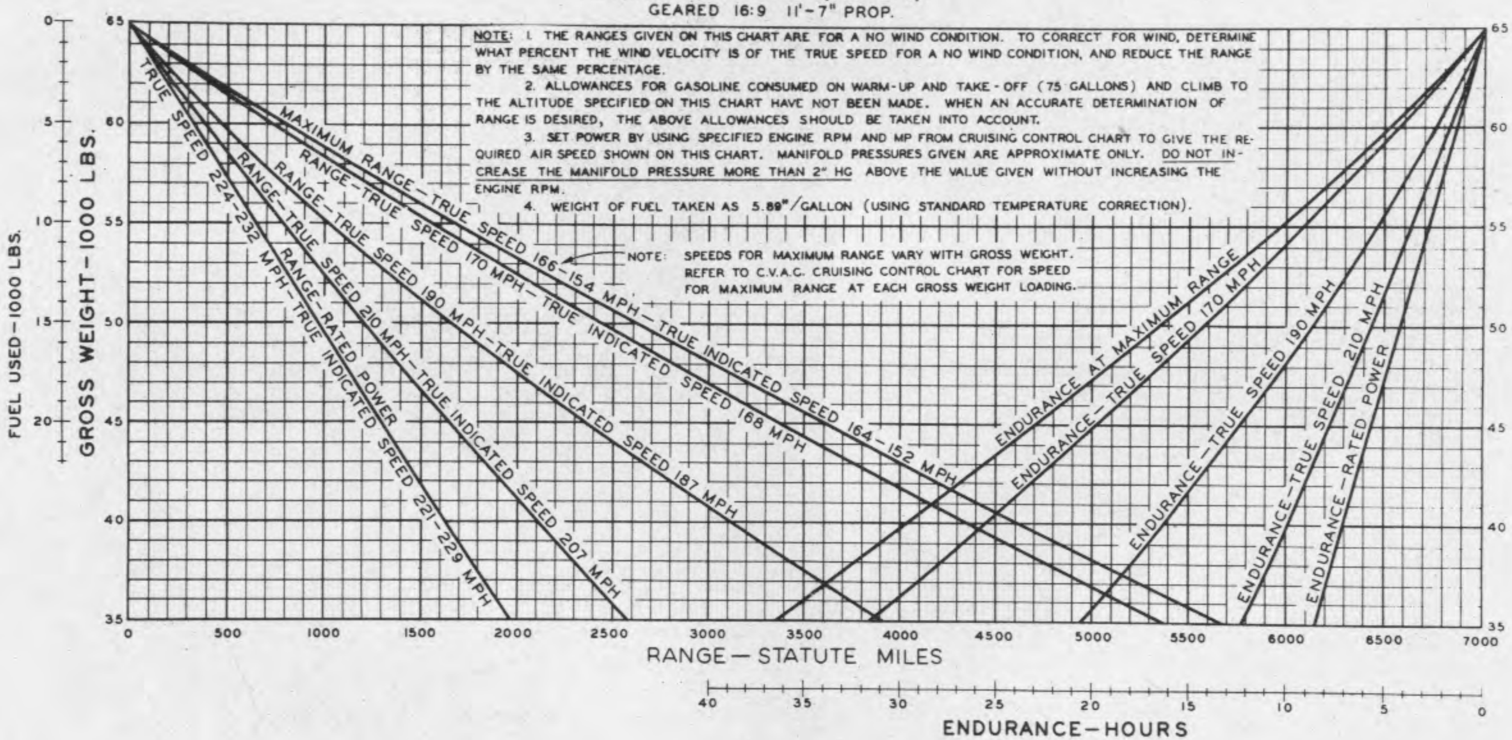


Figure 115

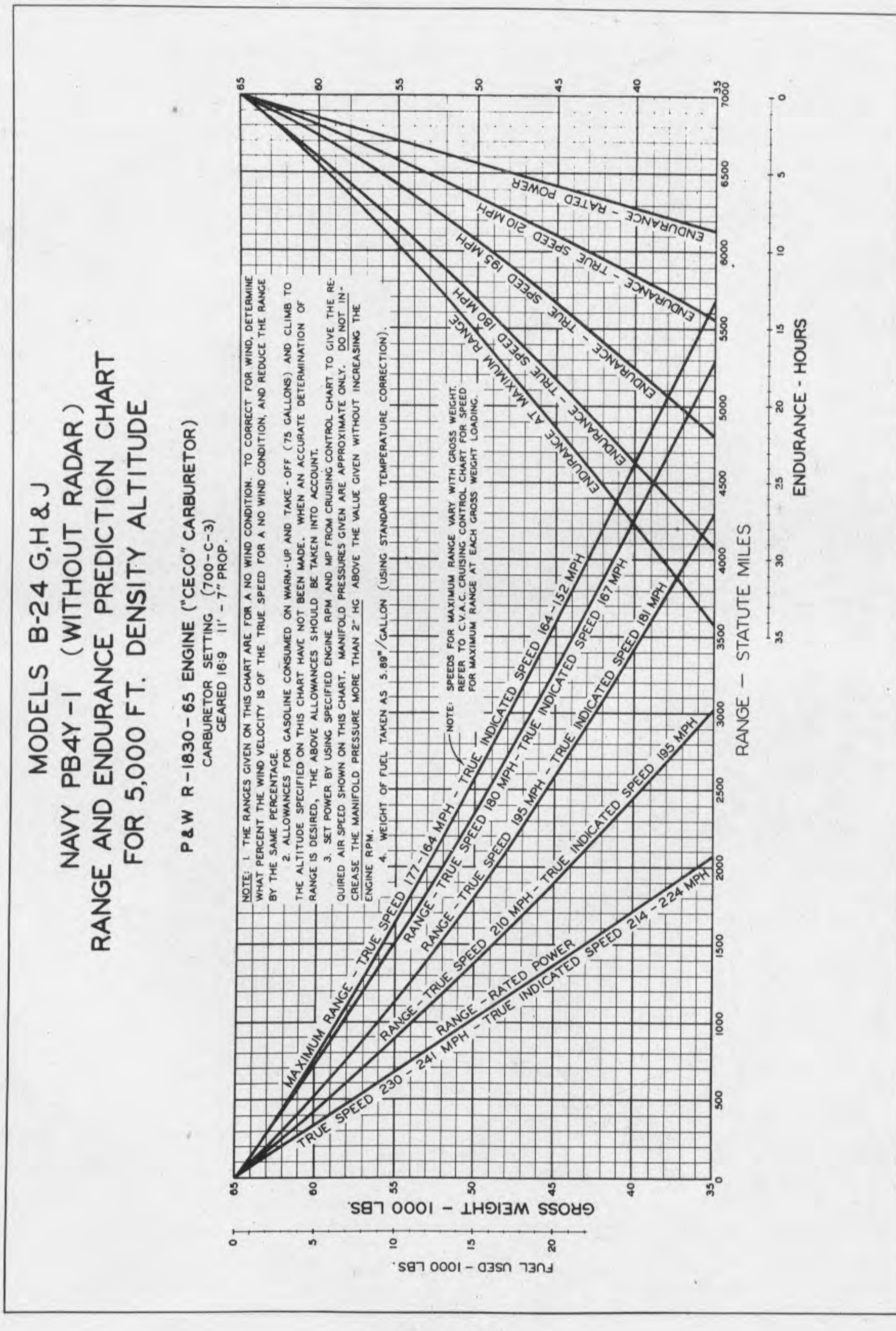

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 5,000 FT. DENSITY ALTITUDE
P & W R-1830-65 ENGINE ("CECO" CARBURETOR)
CARBURETOR SETTING (700-C-3)
GEARED 16:9 11' - 7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
ENDURANCE - RATED POWER
ENDURANCE - TRUE SPEED 210 MPH
ENDURANCE - TRUE SPEED 195 MPH
ENDURANCE - TRUE SPEED 180 MPH
ENDURANCE AT MAXIMUM RANGE
MAXIMUM RANGE - TRUE SPEED 177-164 MPH - TRUE INDICATED SPEED 164-152 MPH
RANGE - TRUE SPEED 180 MPH - TRUE INDICATED SPEED 167 MPH
RANGE - TRUE SPEED 195 MPH - TRUE INDICATED SPEED 181 MPH
RANGE - TRUE SPEED 210 MPH - TRUE INDICATED SPEED 195 MPH
RANGE - RATED POWER
TRUE SPEED 230 - 241 MPH - TRUE INDICATED SPEED 214 - 224 MPH
65
60
55
50
45
40
35
GROSS WEIGHT - 1000 LBS.
0
5
10
15
20
FUEL USED - 1000 LBS.
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
RANGE - STATUTE MILES
0
5
10
15
20
25
30
35
ENDURANCE - HOURS

Figure 116

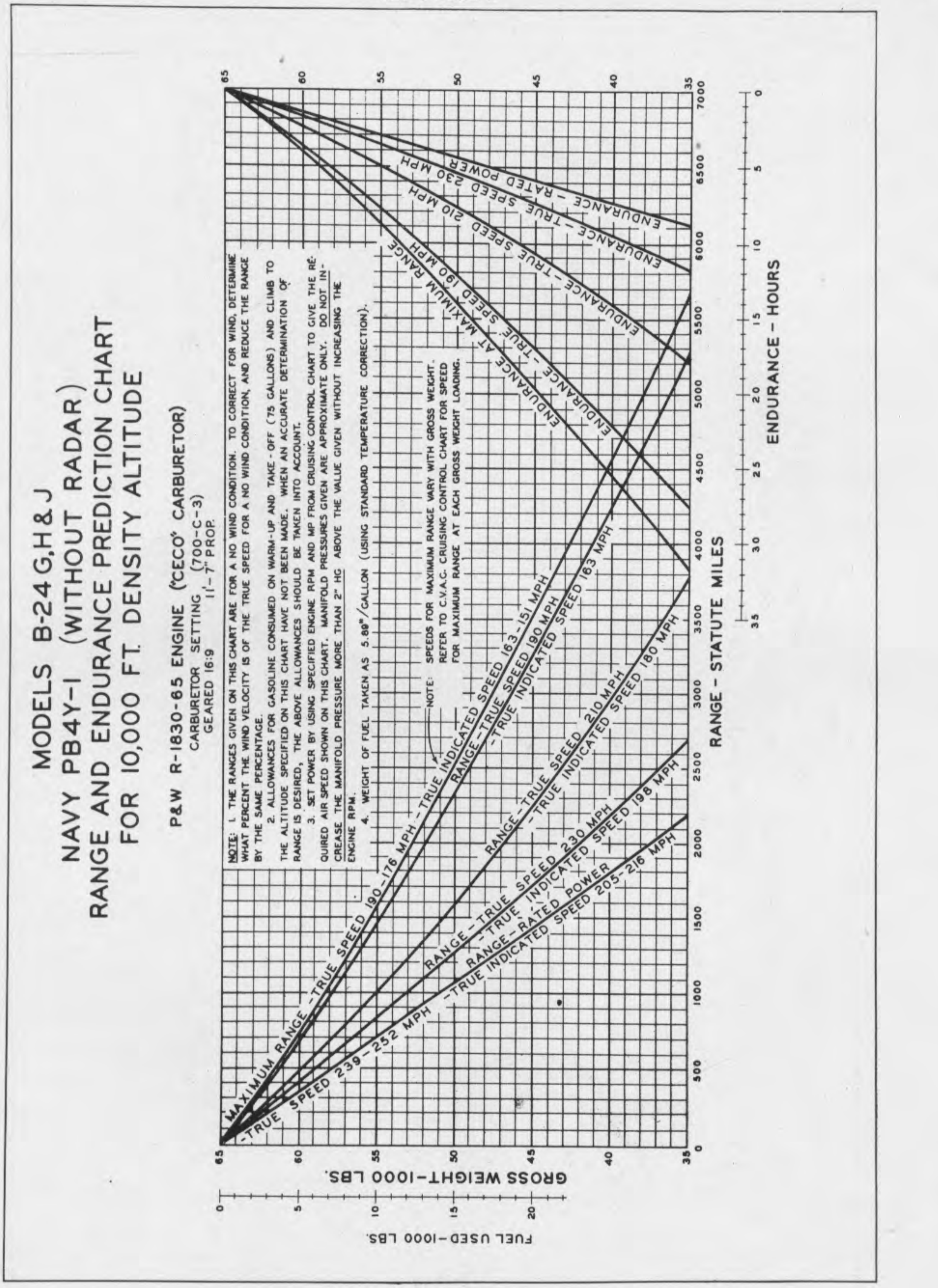

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 10,000 FT. DENSITY ALTITUDE
P&W R-1830-65 ENGINE ("CECO" CARBURETOR)
CARBURETOR SETTING (700-C-3)
GEARED 16:9 11'-7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.86#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
MAXIMUM RANGE - TRUE SPEED 190-176 MPH - TRUE INDICATED SPEED 163-151 MPH
RANGE - TRUE SPEED 190 MPH - TRUE INDICATED SPEED 163 MPH
RANGE - TRUE SPEED 210 MPH - TRUE INDICATED SPEED 180 MPH
RANGE - TRUE SPEED 230 MPH - TRUE INDICATED SPEED 198 MPH
RANGE - RATED POWER - TRUE SPEED 239-252 MPH - TRUE INDICATED SPEED 205-216 MPH
ENDURANCE - RATED POWER
ENDURANCE - TRUE SPEED 230 MPH
ENDURANCE - TRUE SPEED 210 MPH
ENDURANCE - TRUE SPEED 190 MPH
ENDURANCE AT MAXIMUM RANGE
GROSS WEIGHT-1000 LBS.
FUEL USED-1000 LBS.
RANGE - STATUTE MILES
ENDURANCE - HOURS

Figure 117

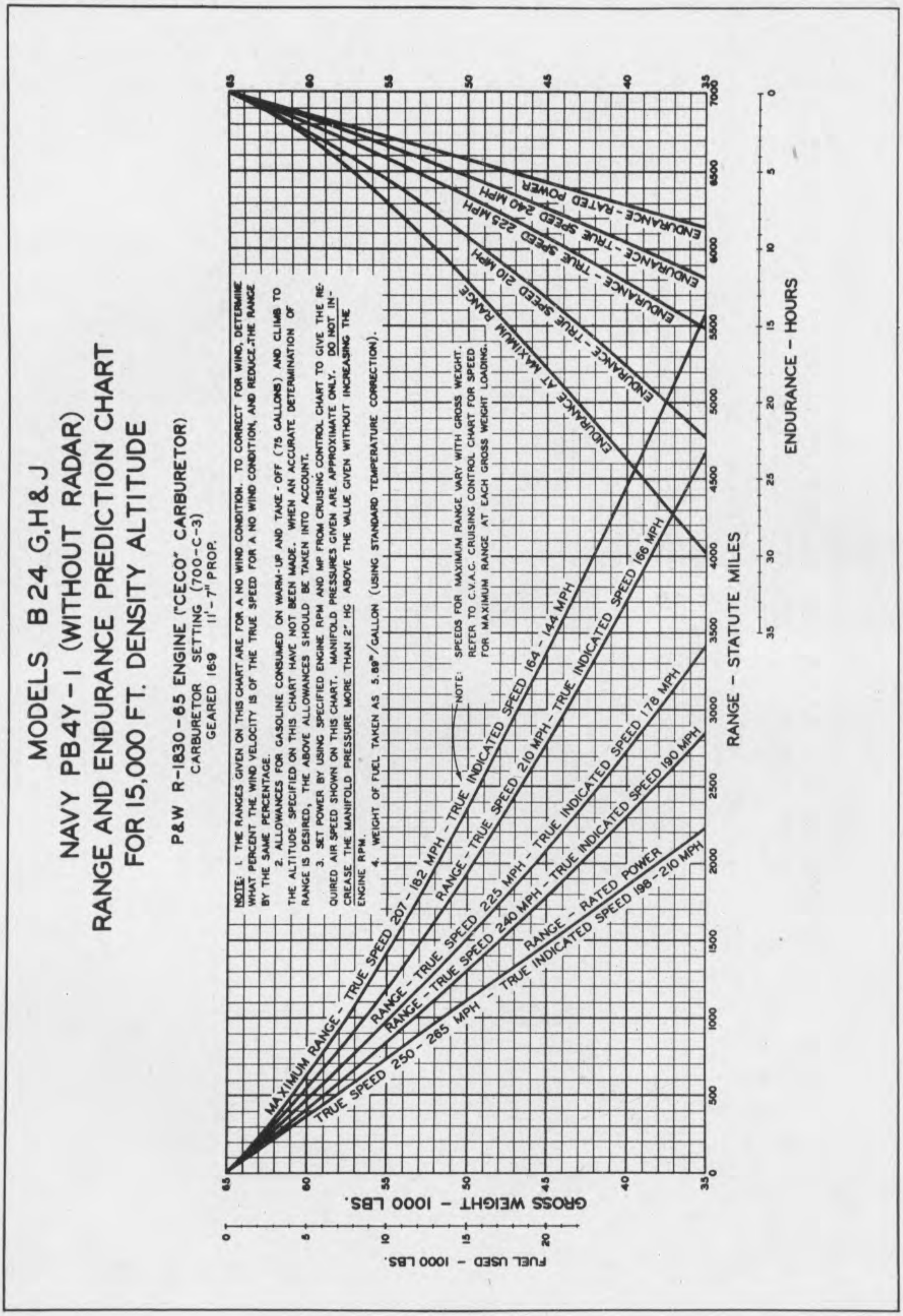

MODELS B 24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 15,000 FT. DENSITY ALTITUDE
P&W R-1830-65 ENGINE ("CECO" CARBURETOR)
CARBURETOR SETTING (700-C-3)
GEARED 16:9 11'-7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
MAXIMUM RANGE - TRUE SPEED 207 - 182 MPH - TRUE INDICATED SPEED 164 - 144 MPH
RANGE - TRUE SPEED 210 MPH - TRUE INDICATED SPEED 166 MPH
RANGE - TRUE SPEED 225 MPH - TRUE INDICATED SPEED 178 MPH
RANGE - TRUE SPEED 240 MPH - TRUE INDICATED SPEED 190 MPH
RANGE - RATED POWER
TRUE SPEED 250 - 265 MPH - TRUE INDICATED SPEED 198 - 210 MPH
ENDURANCE AT MAXIMUM RANGE
ENDURANCE - TRUE SPEED 210 MPH
ENDURANCE - TRUE SPEED 225 MPH
ENDURANCE - TRUE SPEED 240 MPH
ENDURANCE - RATED POWER
FUEL USED - 1000 LBS.
0
5
10
15
20
GROSS WEIGHT - 1000 LBS.
65
60
55
50
45
40
35
RANGE - STATUTE MILES
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
ENDURANCE - HOURS
35
30
25
20
15
10
5
0

Figure 118

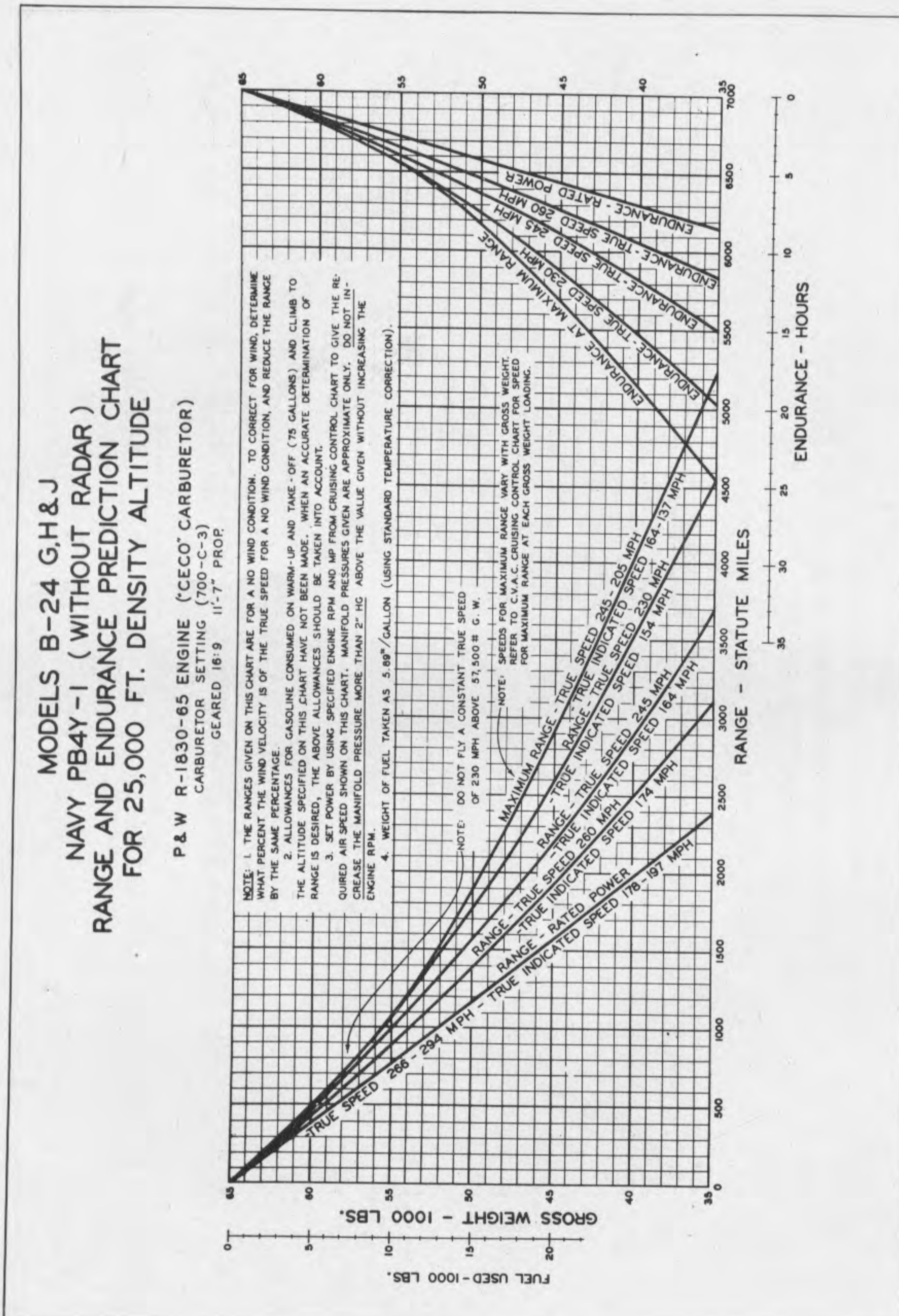

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
RANGE AND ENDURANCE PREDICTION CHART
FOR 25,000 FT. DENSITY ALTITUDE
P & W R-1830-65 ENGINE ("CECO" CARBURETOR)
CARBURETOR SETTING (700-C-3)
GEARED 16:9 11'-7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND, DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: DO NOT FLY A CONSTANT TRUE SPEED OF 230 MPH ABOVE 57,500 # G. W.
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO C.V.A.C. CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
ENDURANCE - RATED POWER
ENDURANCE - TRUE SPEED 260 MPH
ENDURANCE - TRUE SPEED 245 MPH
ENDURANCE - TRUE SPEED 230 MPH
ENDURANCE AT MAXIMUM RANGE
MAXIMUM RANGE - TRUE SPEED 245 - 205 MPH - TRUE INDICATED SPEED 164 - 137 MPH
RANGE - TRUE SPEED 230 MPH - TRUE INDICATED SPEED 154 MPH
RANGE - TRUE SPEED 245 MPH - TRUE INDICATED SPEED 164 MPH
RANGE - TRUE SPEED 260 MPH - TRUE INDICATED SPEED 174 MPH
RANGE - RATED POWER - TRUE SPEED 266 - 294 MPH - TRUE INDICATED SPEED 178 - 197 MPH
GROSS WEIGHT - 1000 LBS.
65
60
55
50
45
40
35
FUEL USED - 1000 LBS.
0
5
10
15
20
RANGE - STATUTE MILES
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
ENDURANCE - HOURS
0
5
10
15
20
25
30
35

Figure 119

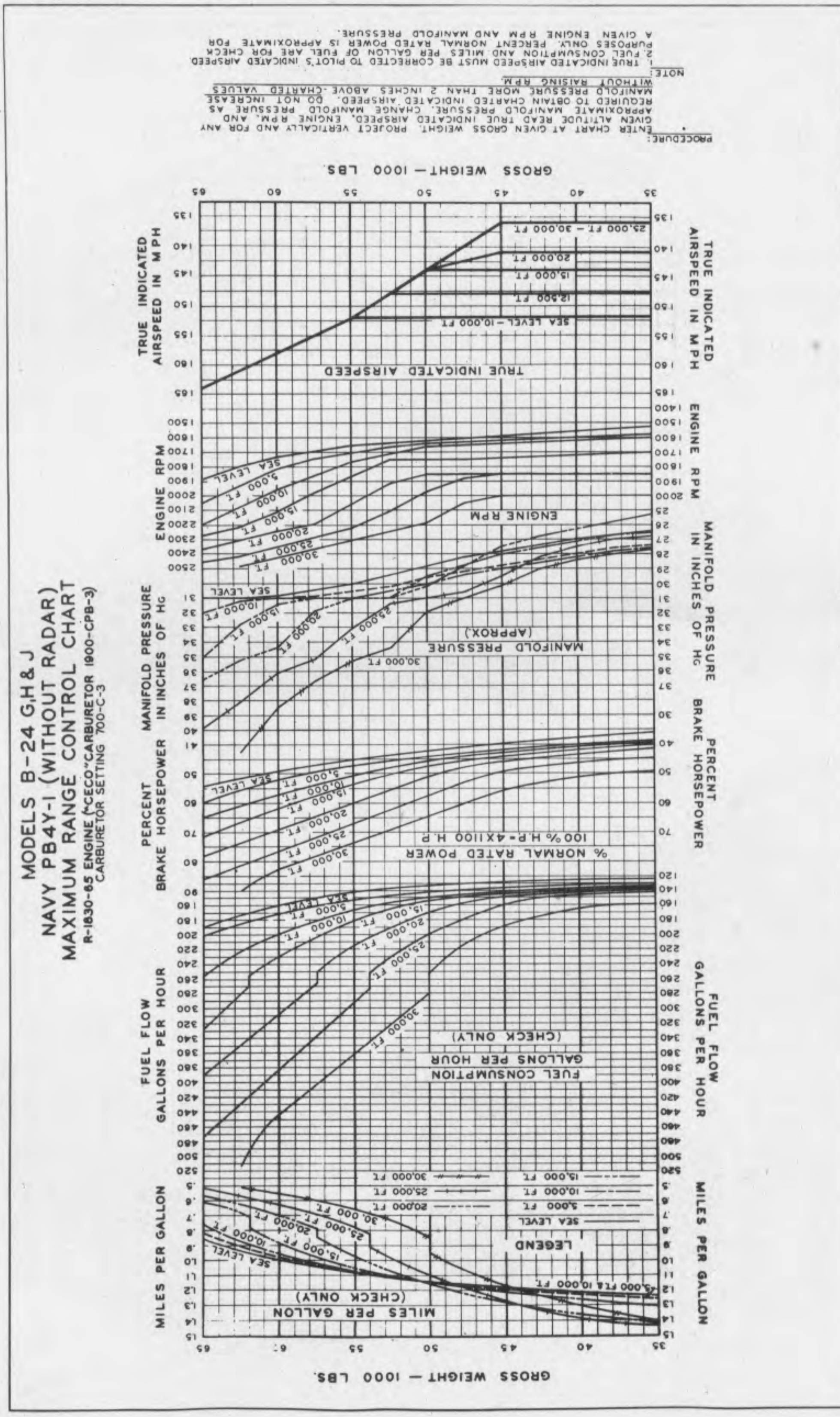

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
MAXIMUM RANGE CONTROL CHART
R-1830-65 ENGINE ("CECO" CARBURETOR 1900-CPB-3)
CARBURETOR SETTING 700-C-3
PROCEDURE:
ENTER CHART AT GIVEN GROSS WEIGHT. PROJECT VERTICALLY AND FOR ANY GIVEN ALTITUDE READ TRUE INDICATED AIRSPEED, ENGINE RPM, AND APPROXIMATE MANIFOLD PRESSURE. CHANGE MANIFOLD PRESSURE AS REQUIRED TO OBTAIN CHARTED INDICATED AIRSPEED. DO NOT INCREASE MANIFOLD PRESSURE MORE THAN 2 INCHES ABOVE CHARTED VALUES WITHOUT RAISING RPM.
NOTE:
1. TRUE INDICATED AIRSPEED MUST BE CORRECTED TO PILOT'S INDICATED AIRSPEED.
2. FUEL CONSUMPTION AND MILES PER GALLON OF FUEL ARE FOR CHECK PURPOSES ONLY. PERCENT NORMAL RATED POWER IS APPROXIMATE FOR A GIVEN ENGINE RPM AND MANIFOLD PRESSURE.
GROSS WEIGHT — 1000 LBS.
TRUE INDICATED AIRSPEED IN MPH
TRUE INDICATED AIRSPEED
ENGINE RPM
MANIFOLD PRESSURE IN INCHES OF HG
MANIFOLD PRESSURE (APPROX.)
PERCENT BRAKE HORSEPOWER
% NORMAL RATED POWER
100% H.P. = 4X1100 H.P.
FUEL FLOW GALLONS PER HOUR
FUEL CONSUMPTION GALLONS PER HOUR (CHECK ONLY)
MILES PER GALLON
MILES PER GALLON (CHECK ONLY)
LEGEND
SEA LEVEL
5,000 FT.
10,000 FT.
15,000 FT.
20,000 FT.
25,000 FT.
30,000 FT.

Figure 120

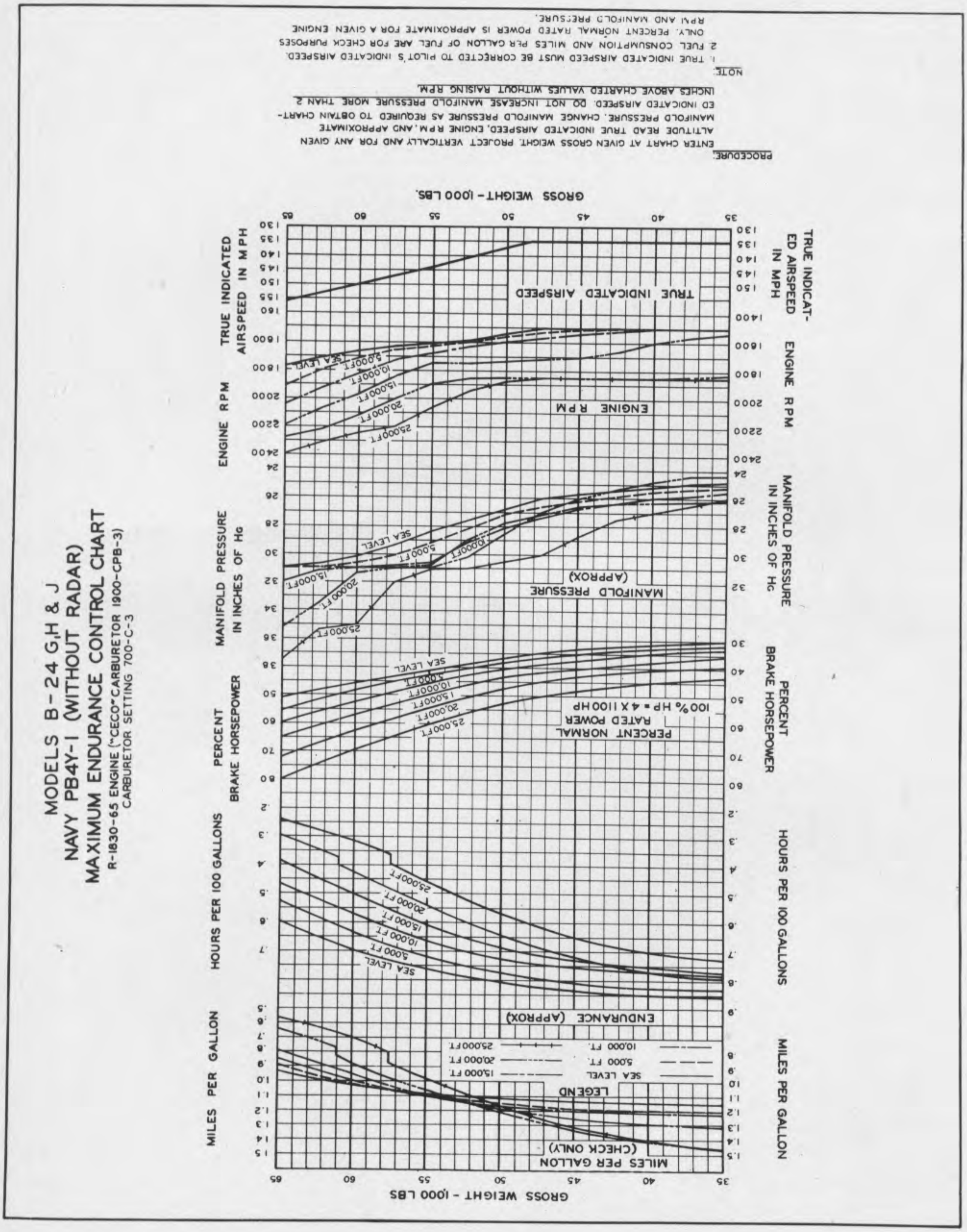

MODELS B-24 G,H & J
NAVY PB4Y-1 (WITHOUT RADAR)
MAXIMUM ENDURANCE CONTROL CHART
R-1830-65 ENGINE ("CECO" CARBURETOR 1900-CPB-3)
CARBURETOR SETTING 700-C-3
PROCEDURE:
ENTER CHART AT GIVEN GROSS WEIGHT. PROJECT VERTICALLY AND FOR ANY GIVEN ALTITUDE READ TRUE INDICATED AIRSPEED, ENGINE R.P.M. AND APPROXIMATE MANIFOLD PRESSURE. CHANGE MANIFOLD PRESSURE AS REQUIRED TO OBTAIN CHARTED INDICATED AIRSPEED. DO NOT INCREASE MANIFOLD PRESSURE MORE THAN 2 INCHES ABOVE CHARTED VALUES WITHOUT RAISING RPM.
NOTE:
1. TRUE INDICATED AIRSPEED MUST BE CORRECTED TO PILOT'S INDICATED AIRSPEED.
2. FUEL CONSUMPTION AND MILES PER GALLON OF FUEL ARE FOR CHECK PURPOSES ONLY. PERCENT NORMAL RATED POWER IS APPROXIMATE FOR A GIVEN ENGINE RPM AND MANIFOLD PRESSURE.
GROSS WEIGHT - 1000 LBS.
TRUE INDICATED AIRSPEED IN MPH
TRUE INDICATED AIRSPEED
ENGINE RPM
MANIFOLD PRESSURE IN INCHES OF Hg
MANIFOLD PRESSURE (APPROX)
PERCENT BRAKE HORSEPOWER
PERCENT NORMAL RATED POWER
100% HP = 4 X 1100 HP
HOURS PER 100 GALLONS
ENDURANCE (APPROX)
MILES PER GALLON
MILES PER GALLON (CHECK ONLY)
LEGEND
SEA LEVEL
5,000 FT.
10,000 FT.
15,000 FT.
20,000 FT.
25,000 FT.

Figure 121

MODELS B-24 G,H & J
NAVY PB4Y-1

VARIATION OF FUEL CONSUMPTION WITH ALTITUDE

("CECO" CARBURETOR 1900-CPB-3)
CARBURETOR SETTING 700-C-3
R-1830-65 ENGINE

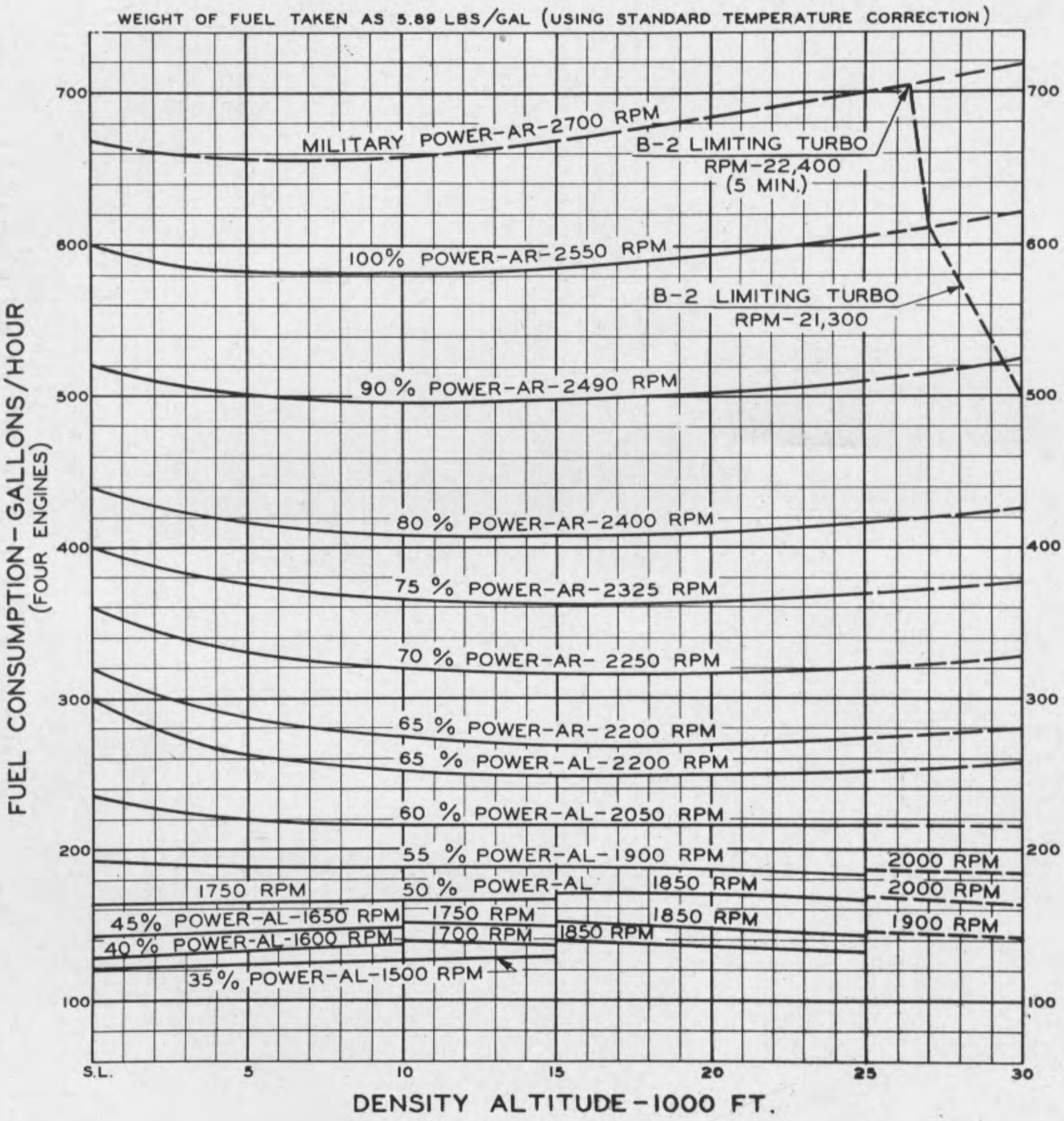


Figure 122

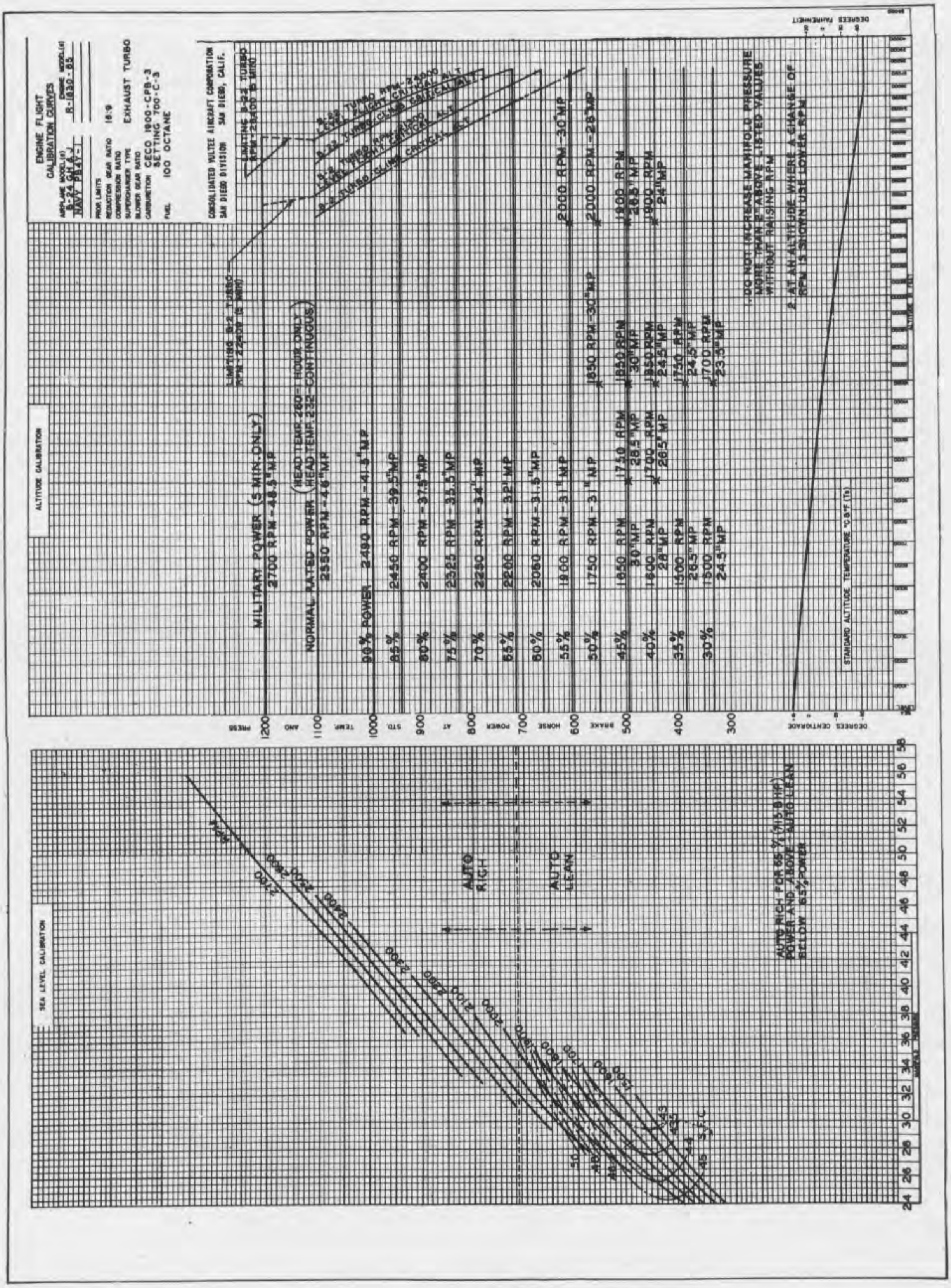


Figure 123

APPENDIX II-N-3

(For Navy Use Only)

Three-Engine Operation Charts

R-1830-43 AND R-1830-65 ENGINES

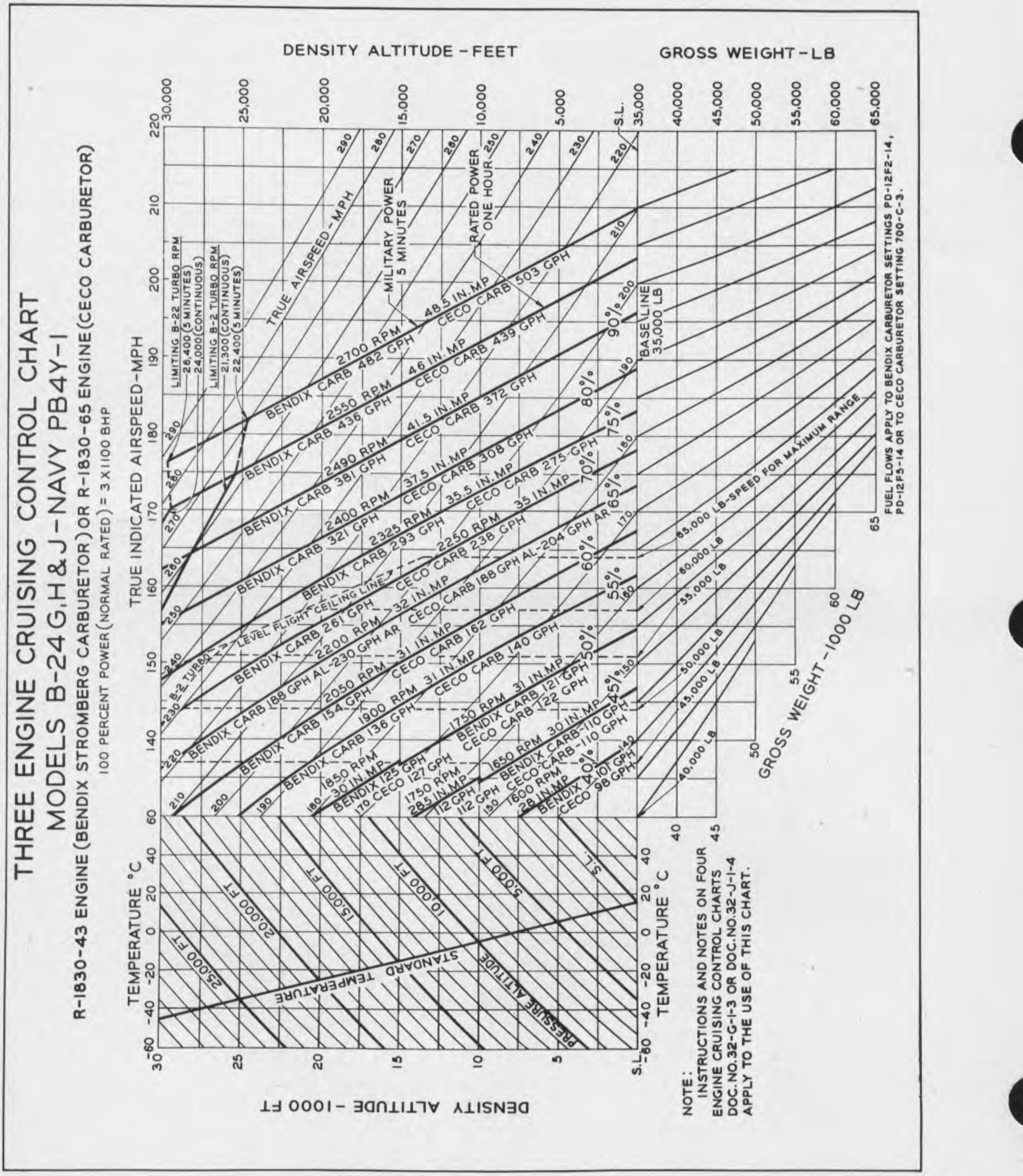

THREE ENGINE CRUISING CONTROL CHART
MODELS B-24 G,H & J - NAVY PB4Y-1
R-1830-43 ENGINE (BENDIX STROMBERG CARBURETOR) OR R-1830-65 ENGINE (CECO CARBURETOR)
100 PERCENT POWER (NORMAL RATED) = 3 X 1100 BHP
DENSITY ALTITUDE - FEET
GROSS WEIGHT - LB
TRUE INDICATED AIRSPEED - MPH
TRUE AIRSPEED - MPH
MILITARY POWER 5 MINUTES
RATED POWER ONE HOUR
LIMITING B-22 TURBO RPM
26,400 (5 MINUTES)
24,000 (CONTINUOUS)
LIMITING B-2 TURBO RPM
21,300 (CONTINUOUS)
22,400 (5 MINUTES)
2700 RPM 48.5 IN. MP
BENDIX CARB 482 GPH CECO CARB 503 GPH
2550 RPM 46 IN. MP
BENDIX CARB 436 GPH CECO CARB 439 GPH
2490 RPM 41.5 IN. MP
BENDIX CARB 381 GPH CECO CARB 372 GPH
2400 RPM 37.5 IN. MP
BENDIX CARB 321 GPH CECO CARB 308 GPH
2325 RPM 35.5 IN. MP
BENDIX CARB 293 GPH CECO CARB 275 GPH
2250 RPM 35 IN. MP
BENDIX CARB 261 GPH CECO CARB 238 GPH
2200 RPM 32 IN. MP
BENDIX CARB 188 GPH AL-230 GPH AR CECO CARB 188 GPH AL-204 GPH AR
2050 RPM 31 IN. MP
BENDIX CARB 154 GPH CECO CARB 162 GPH
1900 RPM 31 IN. MP
BENDIX CARB 136 GPH CECO CARB 140 GPH
1750 RPM 31 IN. MP
BENDIX CARB 121 GPH CECO CARB 122 GPH
1850 RPM 30 IN. MP
BENDIX 125 GPH CECO 127 GPH
1650 RPM 30 IN. MP
BENDIX CARB 110 GPH CECO CARB 110 GPH
1750 RPM 28.5 IN. MP
112 GPH 112 GPH
1600 RPM 28 IN. MP
BENDIX 101 GPH CECO 98 GPH
LEVEL FLIGHT CEILING LINE
B-2 TURBO
90% 80% 75% 70% 65% 60% 55% 50% 45% 40%
BASE LINE 35,000 LB
65,000 LB-SPEED FOR MAXIMUM RANGE
GROSS WEIGHT - 1000 LB
FUEL FLOWS APPLY TO BENDIX CARBURETOR SETTINGS PD-12F2-14, PD-12F5-14 OR TO CECO CARBURETOR SETTING 700-C-3.
TEMPERATURE °C
STANDARD TEMPERATURE
PRESSURE ALTITUDE
DENSITY ALTITUDE - 1000 FT
NOTE:
INSTRUCTIONS AND NOTES ON FOUR ENGINE CRUISING CONTROL CHARTS DOC. NO. 32-G-1-3 OR DOC. NO. 32-J-1-4 APPLY TO THE USE OF THIS CHART.

Figure 124

MODELS B-24 G,H,J
NAVY PB4Y-1 (WITHOUT RADAR)
THREE ENGINE LEVEL FLIGHT CEILING CHART

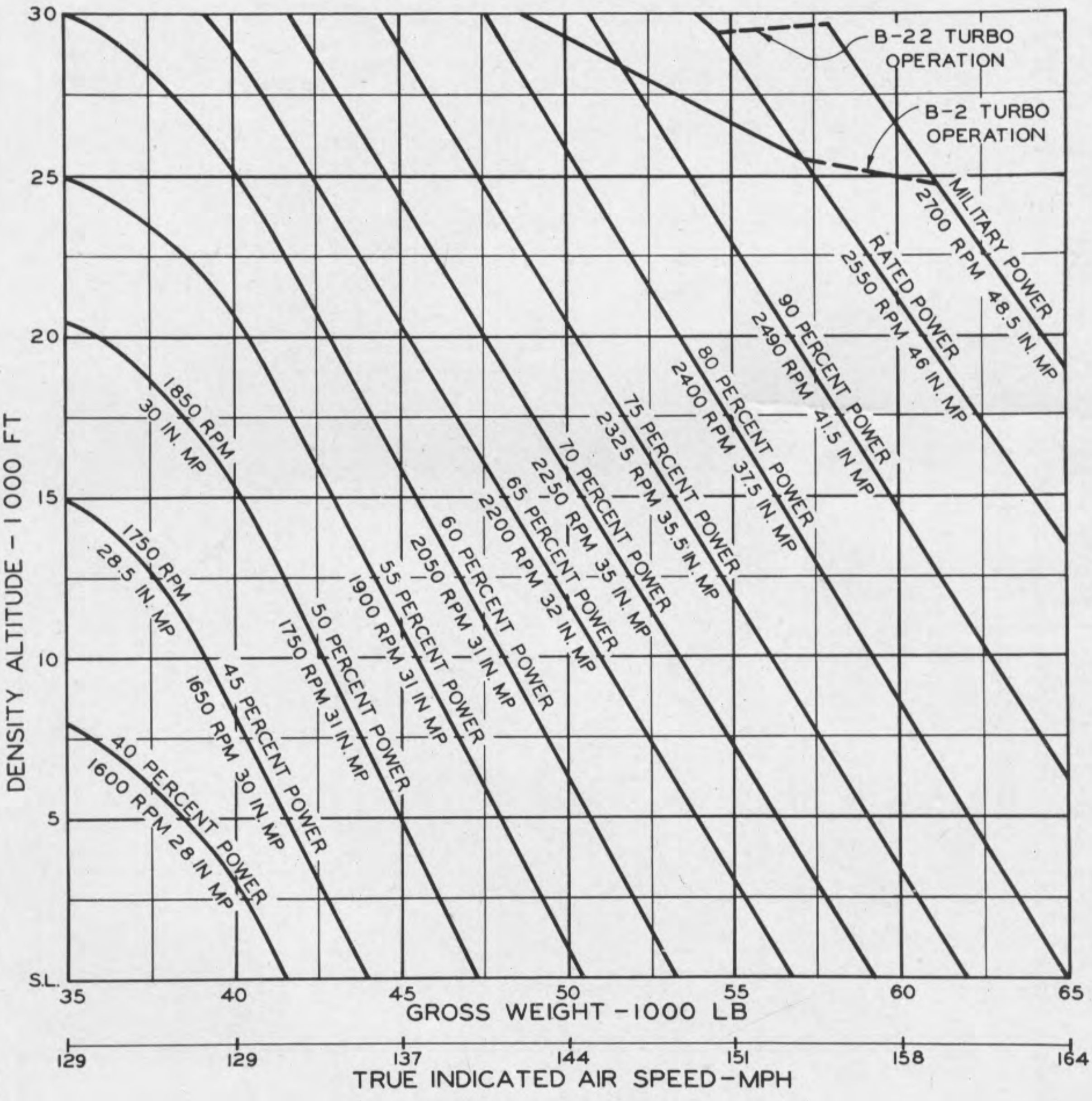


Figure 125

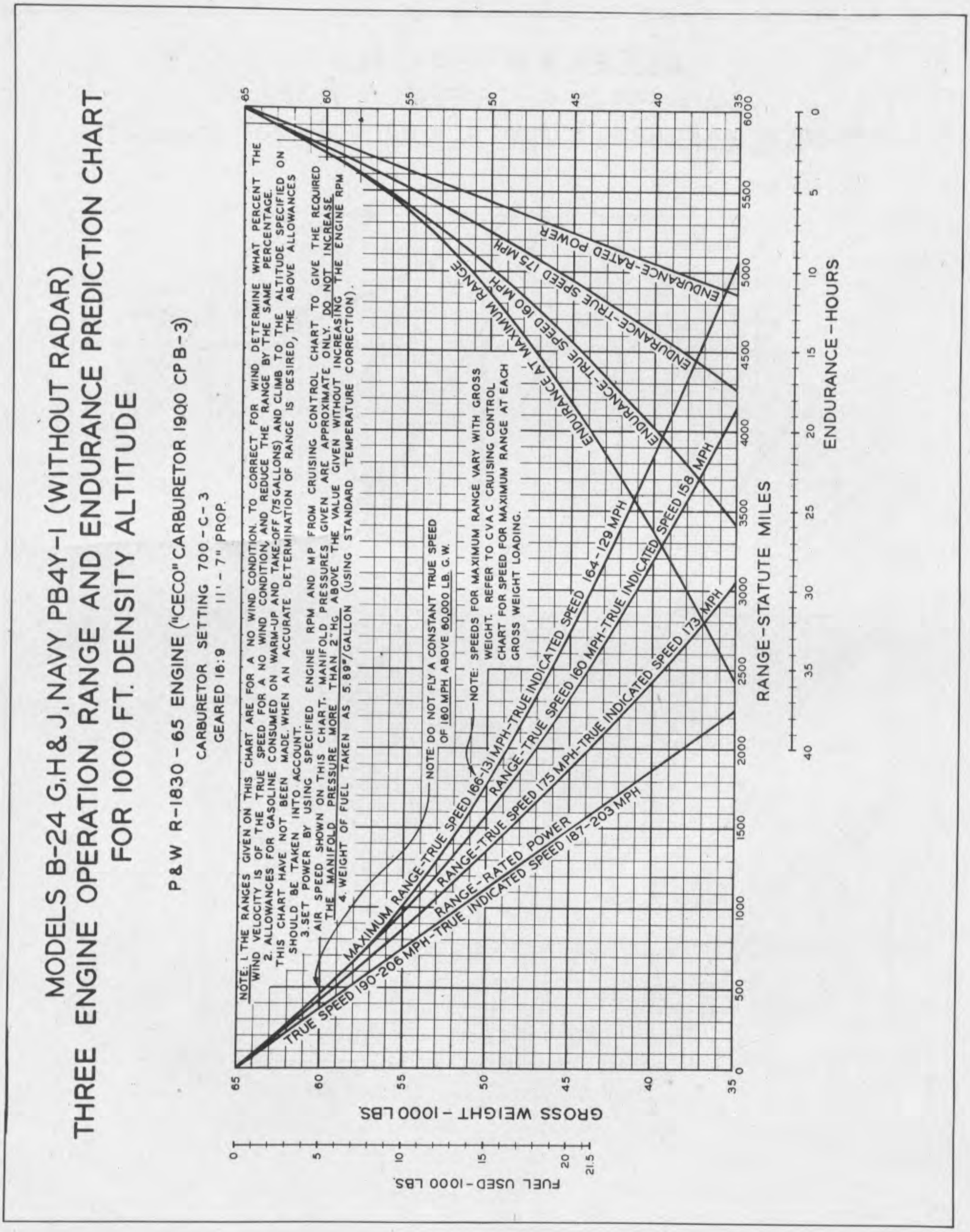

MODELS B-24 G,H & J, NAVY PB4Y-1 (WITHOUT RADAR)
THREE ENGINE OPERATION RANGE AND ENDURANCE PREDICTION CHART
FOR 1000 FT. DENSITY ALTITUDE
P & W R-1830-65 ENGINE ("CECO" CARBURETOR 1900 CPB-3)
CARBURETOR SETTING 700-C-3
GEARED 16:9
11'-7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG. ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: DO NOT FLY A CONSTANT TRUE SPEED OF 160 MPH ABOVE 60,000 LB. G.W.
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO CVAC CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
ENDURANCE-RATED POWER
ENDURANCE-TRUE SPEED 175 MPH
ENDURANCE-TRUE SPEED 160 MPH
ENDURANCE AT MAXIMUM RANGE
MAXIMUM RANGE-TRUE SPEED 166-131 MPH-TRUE INDICATED SPEED 164-129 MPH
RANGE-TRUE SPEED 160 MPH-TRUE INDICATED SPEED 158 MPH
RANGE-TRUE SPEED 175 MPH-TRUE INDICATED SPEED 173 MPH
RANGE-RATED POWER
TRUE SPEED 190-206 MPH-TRUE INDICATED SPEED 187-203 MPH
GROSS WEIGHT - 1000 LBS.
65
60
55
50
45
40
35
FUEL USED - 1000 LBS.
0
5
10
15
20
21.5
RANGE-STATUTE MILES
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
ENDURANCE-HOURS
0
5
10
15
20
25
30
35
40

Figure 126

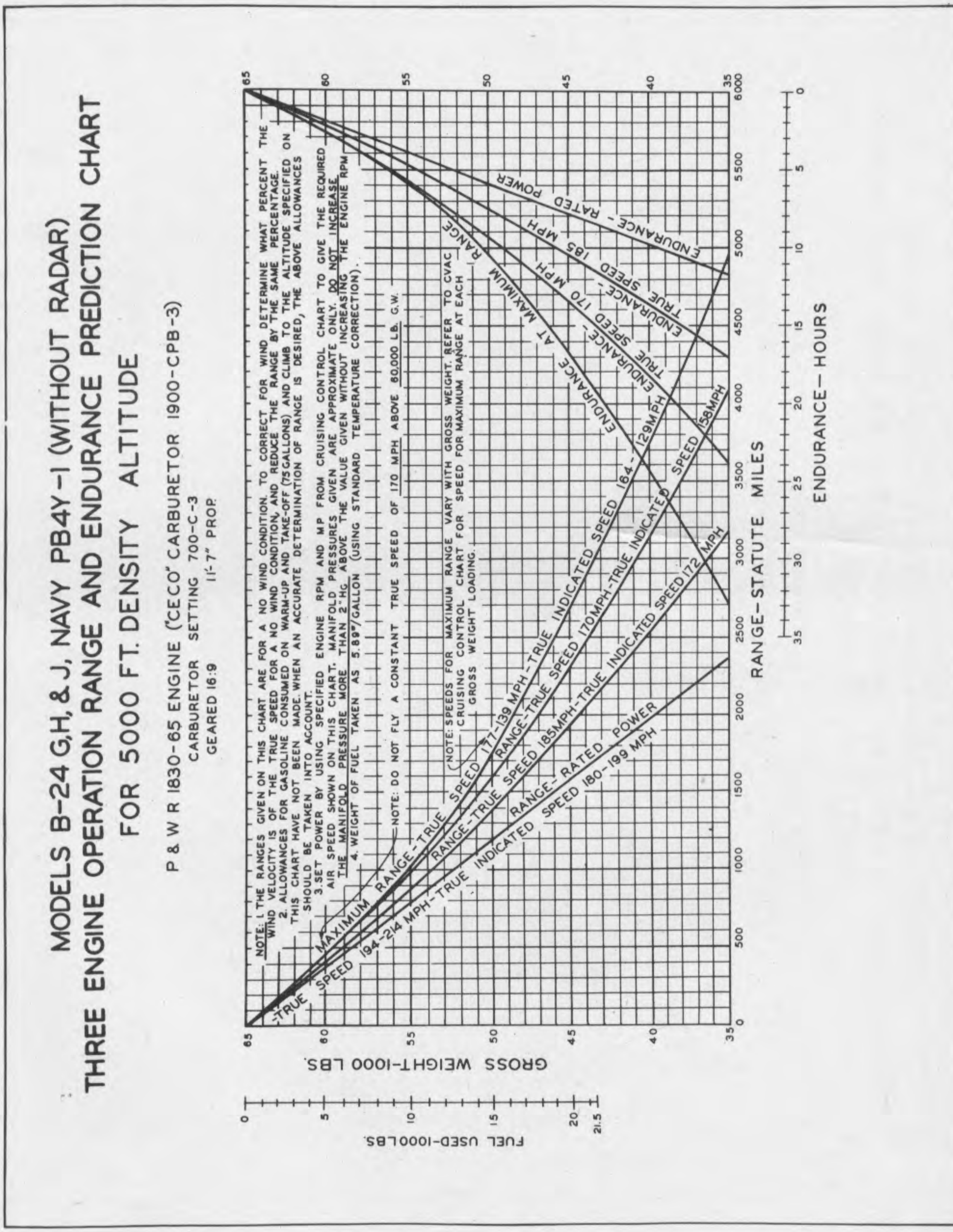

MODELS B-24 G,H, & J, NAVY PB4Y-1 (WITHOUT RADAR)
THREE ENGINE OPERATION RANGE AND ENDURANCE PREDICTION CHART
FOR 5000 FT. DENSITY ALTITUDE
P & W R 1830-65 ENGINE ("CECO" CARBURETOR 1900-CPB-3)
CARBURETOR SETTING 700-C-3
GEARED 16:9
11'-7" PROP
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG. ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM.
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: DO NOT FLY A CONSTANT TRUE SPEED OF 170 MPH ABOVE 60,000 LB. G.W.
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO CVAC CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
ENDURANCE - RATED POWER
ENDURANCE - TRUE SPEED 185 MPH
ENDURANCE - TRUE SPEED 170 MPH
ENDURANCE AT MAXIMUM RANGE
MAXIMUM RANGE-TRUE SPEED 177-139 MPH-TRUE INDICATED SPEED 164-129MPH
RANGE-TRUE SPEED 170MPH-TRUE INDICATED SPEED 158MPH
RANGE-TRUE SPEED 185MPH-TRUE INDICATED SPEED 172 MPH
RANGE-RATED POWER-TRUE SPEED 194-214 MPH-TRUE INDICATED SPEED 180-199 MPH
GROSS WEIGHT-1000 LBS.
FUEL USED-1000 LBS.
RANGE-STATUTE MILES
ENDURANCE-HOURS

Figure 127

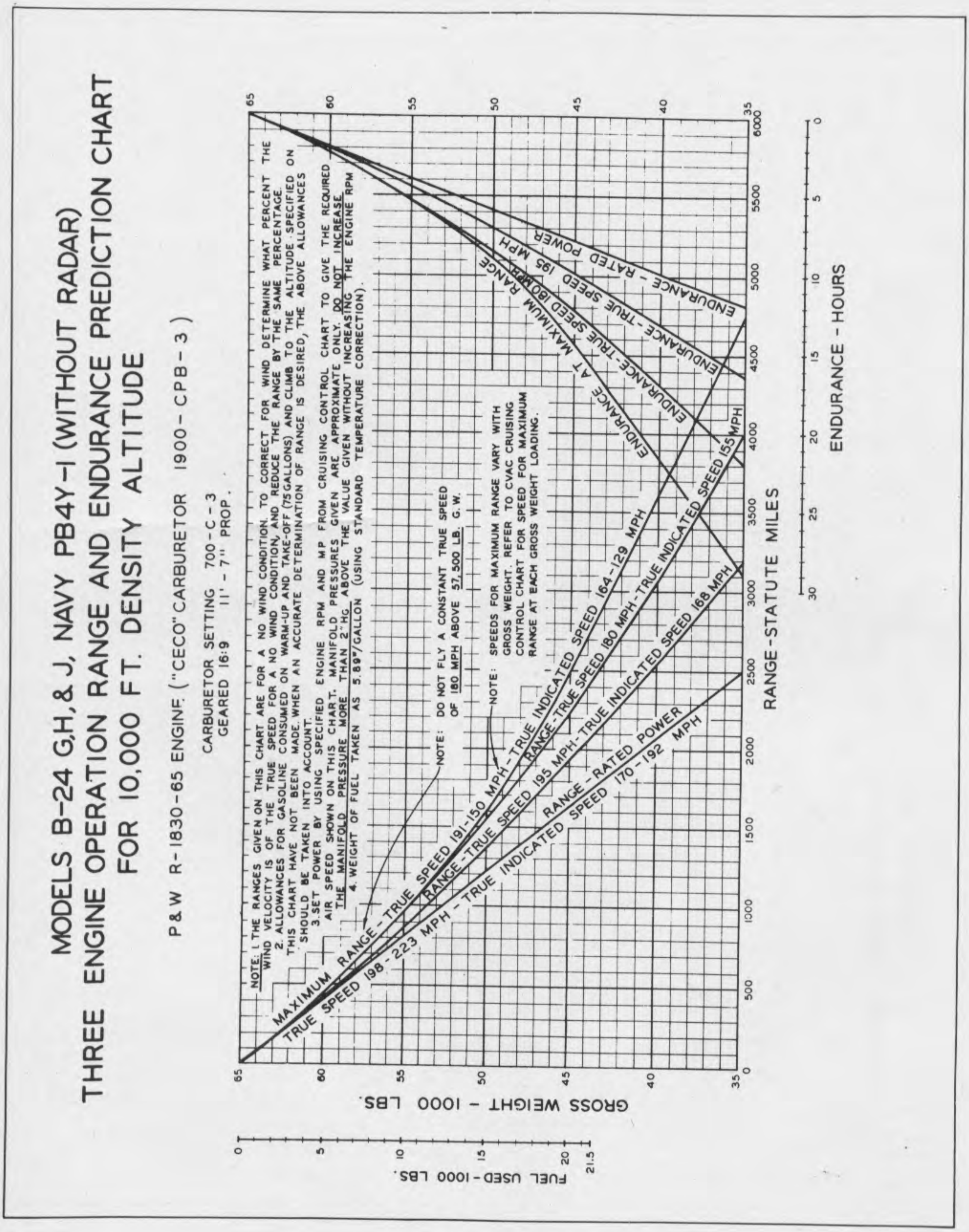

MODELS B-24 G,H, & J, NAVY PB4Y-1 (WITHOUT RADAR)
THREE ENGINE OPERATION RANGE AND ENDURANCE PREDICTION CHART
FOR 10,000 FT. DENSITY ALTITUDE
P & W R-1830-65 ENGINE ("CECO" CARBURETOR 1900-CPB-3)
CARBURETOR SETTING 700-C-3
GEARED 16:9 11' - 7" PROP.
NOTE: 1. THE RANGES GIVEN ON THIS CHART ARE FOR A NO WIND CONDITION. TO CORRECT FOR WIND DETERMINE WHAT PERCENT THE WIND VELOCITY IS OF THE TRUE SPEED FOR A NO WIND CONDITION, AND REDUCE THE RANGE BY THE SAME PERCENTAGE.
2. ALLOWANCES FOR GASOLINE CONSUMED ON WARM-UP AND TAKE-OFF (75 GALLONS) AND CLIMB TO THE ALTITUDE SPECIFIED ON THIS CHART HAVE NOT BEEN MADE. WHEN AN ACCURATE DETERMINATION OF RANGE IS DESIRED, THE ABOVE ALLOWANCES SHOULD BE TAKEN INTO ACCOUNT.
3. SET POWER BY USING SPECIFIED ENGINE RPM AND MP FROM CRUISING CONTROL CHART TO GIVE THE REQUIRED AIR SPEED SHOWN ON THIS CHART. MANIFOLD PRESSURES GIVEN ARE APPROXIMATE ONLY. DO NOT INCREASE THE MANIFOLD PRESSURE MORE THAN 2" HG ABOVE THE VALUE GIVEN WITHOUT INCREASING THE ENGINE RPM
4. WEIGHT OF FUEL TAKEN AS 5.89#/GALLON (USING STANDARD TEMPERATURE CORRECTION).
NOTE: DO NOT FLY A CONSTANT TRUE SPEED OF 180 MPH ABOVE 57,500 LB. G.W.
NOTE: SPEEDS FOR MAXIMUM RANGE VARY WITH GROSS WEIGHT. REFER TO CVAC CRUISING CONTROL CHART FOR SPEED FOR MAXIMUM RANGE AT EACH GROSS WEIGHT LOADING.
MAXIMUM RANGE - TRUE SPEED 191-150 MPH - TRUE INDICATED SPEED 164-129 MPH
RANGE-TRUE SPEED 180 MPH - TRUE INDICATED SPEED 155 MPH
RANGE-TRUE SPEED 195 MPH - TRUE INDICATED SPEED 168 MPH
TRUE SPEED 198-223 MPH - TRUE INDICATED SPEED 170-192 MPH
RANGE - RATED POWER
ENDURANCE AT MAXIMUM RANGE
ENDURANCE - TRUE SPEED 180 MPH
ENDURANCE - TRUE SPEED 195 MPH
ENDURANCE - RATED POWER
GROSS WEIGHT - 1000 LBS.
65
60
55
50
45
40
35
FUEL USED - 1000 LBS.
0
5
10
15
20
21.5
RANGE - STATUTE MILES
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
ENDURANCE - HOURS
30
25
20
15
10
5
0

Figure 128

APPENDIX II-N-4

(For Navy Use Only)

Miscellaneous Charts

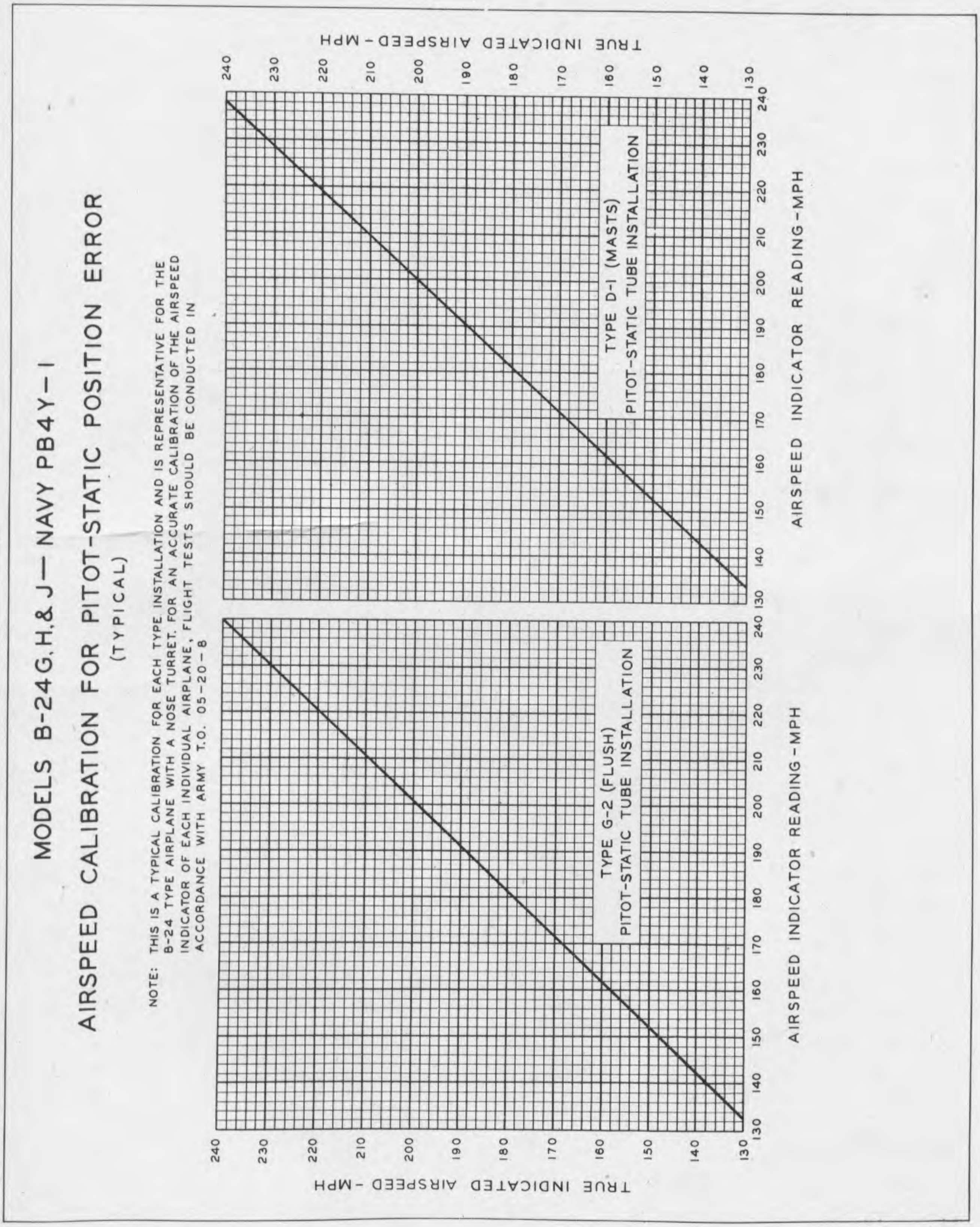

MODELS B-24 G, H, & J— NAVY PB4Y-I
AIRSPEED CALIBRATION FOR PITOT-STATIC POSITION ERROR
(TYPICAL)
NOTE: THIS IS A TYPICAL CALIBRATION FOR EACH TYPE INSTALLATION AND IS REPRESENTATIVE FOR THE B-24 TYPE AIRPLANE WITH A NOSE TURRET. FOR AN ACCURATE CALIBRATION OF THE AIRSPEED INDICATOR OF EACH INDIVIDUAL AIRPLANE, FLIGHT TESTS SHOULD BE CONDUCTED IN ACCORDANCE WITH ARMY T.O. 05-20-8
TYPE G-2 (FLUSH)
PITOT-STATIC TUBE INSTALLATION
TYPE D-1 (MASTS)
PITOT-STATIC TUBE INSTALLATION
TRUE INDICATED AIRSPEED - MPH
AIRSPEED INDICATOR READING-MPH
130 140 150 160 170 180 190 200 210 220 230 240

Figure 129

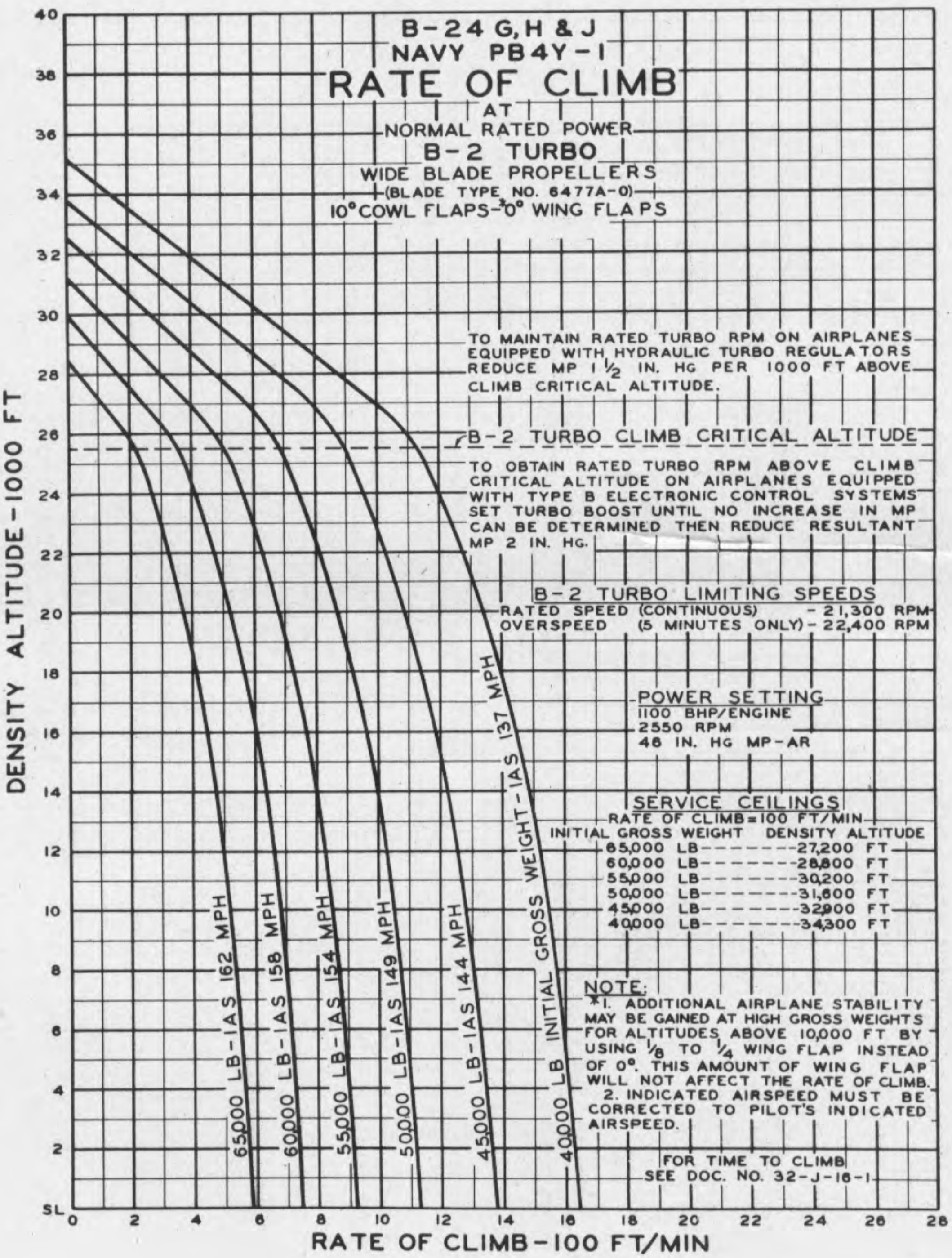

B-24 G, H & J
NAVY PB4Y-1
RATE OF CLIMB
AT
NORMAL RATED POWER
B-2 TURBO
WIDE BLADE PROPELLERS
(BLADE TYPE NO. 6477A-0)
10° COWL FLAPS-*0° WING FLAPS
TO MAINTAIN RATED TURBO RPM ON AIRPLANES EQUIPPED WITH HYDRAULIC TURBO REGULATORS REDUCE MP 1 1/2 IN. HG PER 1000 FT ABOVE CLIMB CRITICAL ALTITUDE.
B-2 TURBO CLIMB CRITICAL ALTITUDE
TO OBTAIN RATED TURBO RPM ABOVE CLIMB CRITICAL ALTITUDE ON AIRPLANES EQUIPPED WITH TYPE B ELECTRONIC CONTROL SYSTEMS SET TURBO BOOST UNTIL NO INCREASE IN MP CAN BE DETERMINED THEN REDUCE RESULTANT MP 2 IN. HG.
B-2 TURBO LIMITING SPEEDS
RATED SPEED (CONTINUOUS) - 21,300 RPM
OVERSPEED (5 MINUTES ONLY) - 22,400 RPM
POWER SETTING
1100 BHP/ENGINE
2550 RPM
46 IN. HG MP-AR
SERVICE CEILINGS
RATE OF CLIMB = 100 FT/MIN
INITIAL GROSS WEIGHT DENSITY ALTITUDE
65,000 LB - 27,200 FT
60,000 LB - 28,800 FT
55,000 LB - 30,200 FT
50,000 LB - 31,600 FT
45,000 LB - 32,900 FT
40,000 LB - 34,300 FT
NOTE:
*1. ADDITIONAL AIRPLANE STABILITY MAY BE GAINED AT HIGH GROSS WEIGHTS FOR ALTITUDES ABOVE 10,000 FT BY USING 1/8 TO 1/4 WING FLAP INSTEAD OF 0°. THIS AMOUNT OF WING FLAP WILL NOT AFFECT THE RATE OF CLIMB.
2. INDICATED AIRSPEED MUST BE CORRECTED TO PILOT'S INDICATED AIRSPEED.
FOR TIME TO CLIMB SEE DOC. NO. 32-J-16-1.
65,000 LB-IAS 162 MPH
60,000 LB-IAS 158 MPH
55,000 LB-IAS 154 MPH
50,000 LB-IAS 149 MPH
45,000 LB-IAS 144 MPH
40,000 LB INITIAL GROSS WEIGHT-IAS 137 MPH
DENSITY ALTITUDE-1000 FT
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
SL
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
RATE OF CLIMB-100 FT/MIN

Figure 130

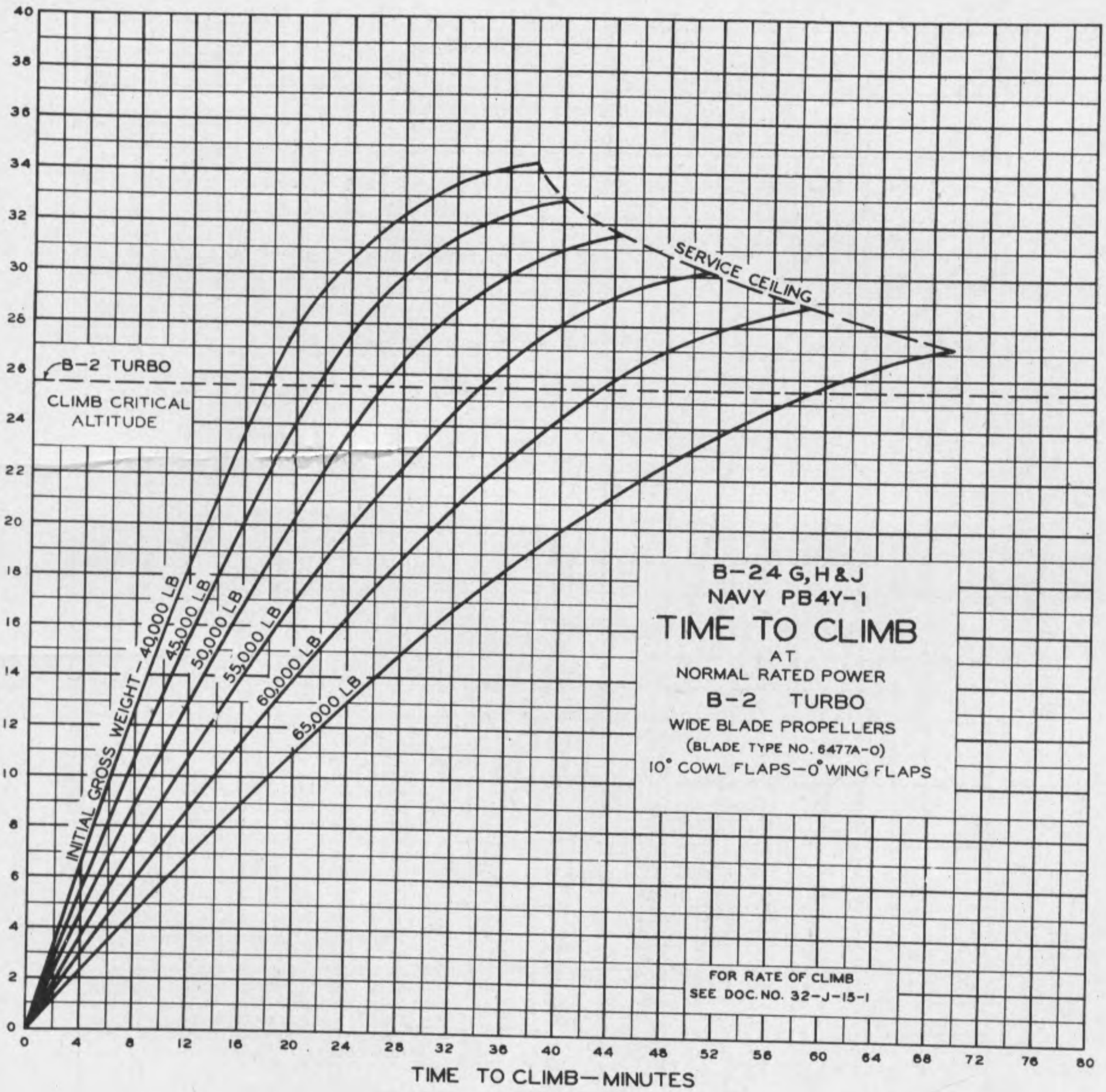

B-24 G, H & J
NAVY PB4Y-1
TIME TO CLIMB
AT
NORMAL RATED POWER
B-2 TURBO
WIDE BLADE PROPELLERS
(BLADE TYPE NO. 6477A-0)
10° COWL FLAPS—0° WING FLAPS
FOR RATE OF CLIMB
SEE DOC. NO. 32-J-15-1
SERVICE CEILING
B-2 TURBO
CLIMB CRITICAL
ALTITUDE
INITIAL GROSS WEIGHT—40,000 LB
45,000 LB
50,000 LB
55,000 LB
60,000 LB
65,000 LB
DENSITY ALTITUDE—1000 FT
TIME TO CLIMB—MINUTES

Figure 131

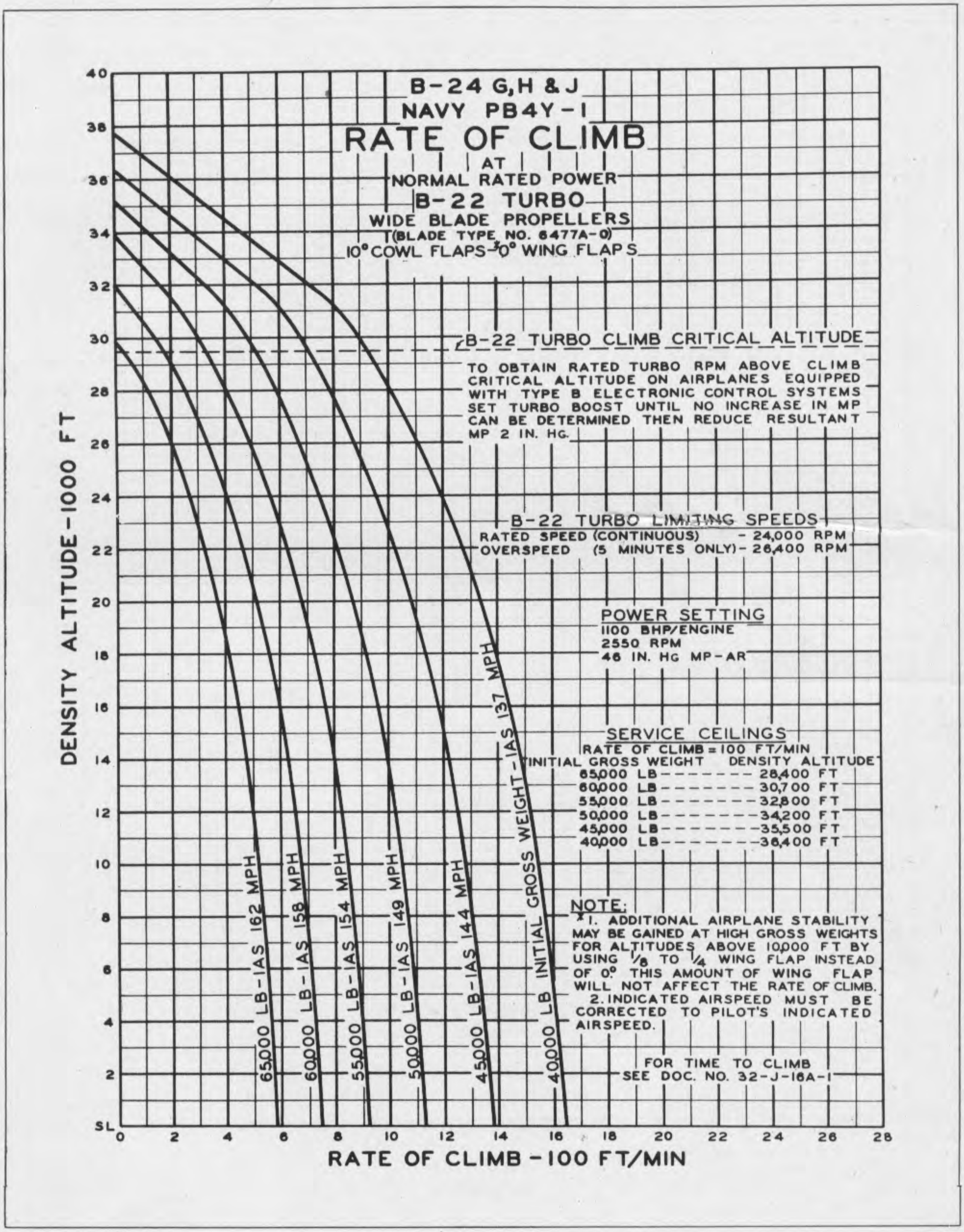

B-24 G,H & J
NAVY PB4Y-1
RATE OF CLIMB
AT
NORMAL RATED POWER
B-22 TURBO
WIDE BLADE PROPELLERS
(BLADE TYPE NO. 6477A-0)
10° COWL FLAPS-*0° WING FLAPS
B-22 TURBO CLIMB CRITICAL ALTITUDE
TO OBTAIN RATED TURBO RPM ABOVE CLIMB CRITICAL ALTITUDE ON AIRPLANES EQUIPPED WITH TYPE B ELECTRONIC CONTROL SYSTEMS SET TURBO BOOST UNTIL NO INCREASE IN MP CAN BE DETERMINED THEN REDUCE RESULTANT MP 2 IN. HG.
B-22 TURBO LIMITING SPEEDS
RATED SPEED (CONTINUOUS) - 24,000 RPM
OVERSPEED (5 MINUTES ONLY) - 26,400 RPM
POWER SETTING
1100 BHP/ENGINE
2550 RPM
46 IN. HG MP-AR
SERVICE CEILINGS
RATE OF CLIMB = 100 FT/MIN
INITIAL GROSS WEIGHT DENSITY ALTITUDE
65,000 LB -------- 28,400 FT
60,000 LB -------- 30,700 FT
55,000 LB -------- 32,800 FT
50,000 LB -------- 34,200 FT
45,000 LB -------- 35,500 FT
40,000 LB -------- 36,400 FT
NOTE:
*1. ADDITIONAL AIRPLANE STABILITY MAY BE GAINED AT HIGH GROSS WEIGHTS FOR ALTITUDES ABOVE 10,000 FT BY USING 1/8 TO 1/4 WING FLAP INSTEAD OF 0°. THIS AMOUNT OF WING FLAP WILL NOT AFFECT THE RATE OF CLIMB.
2. INDICATED AIRSPEED MUST BE CORRECTED TO PILOT'S INDICATED AIRSPEED.
FOR TIME TO CLIMB SEE DOC. NO. 32-J-16A-1
65,000 LB-IAS 162 MPH
60,000 LB-IAS 158 MPH
55,000 LB-IAS 154 MPH
50,000 LB-IAS 149 MPH
45,000 LB-IAS 144 MPH
40,000 LB INITIAL GROSS WEIGHT-IAS 137 MPH
DENSITY ALTITUDE-1000 FT
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
SL
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
RATE OF CLIMB-100 FT/MIN

Figure 132

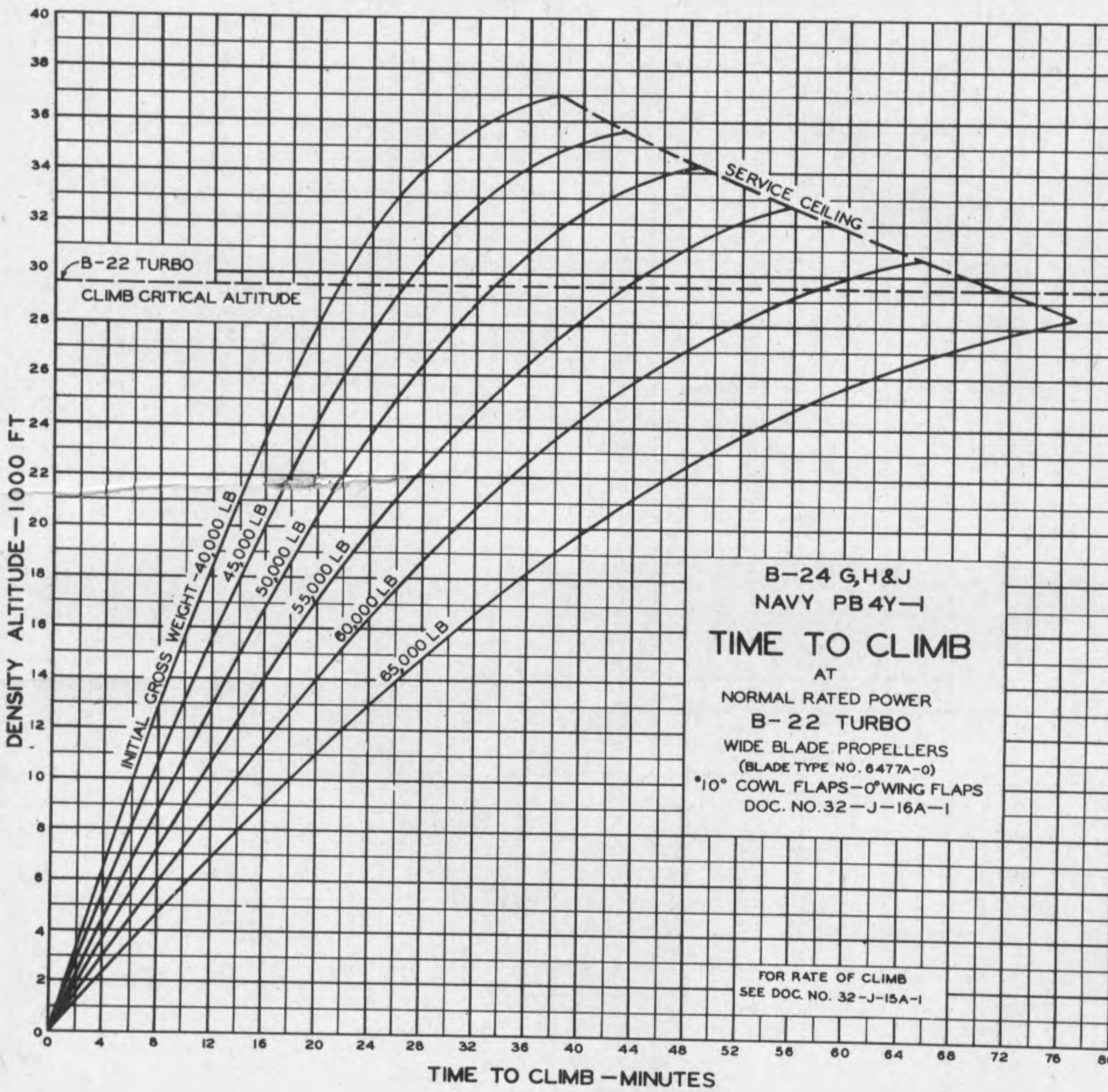

B-24 G,H&J
NAVY PB4Y-1
TIME TO CLIMB
AT
NORMAL RATED POWER
B-22 TURBO
WIDE BLADE PROPELLERS
(BLADE TYPE NO. 6477A-0)
°10° COWL FLAPS-0° WING FLAPS
DOC. NO. 32-J-16A-1
FOR RATE OF CLIMB
SEE DOC. NO. 32-J-15A-1
B-22 TURBO
CLIMB CRITICAL ALTITUDE
SERVICE CEILING
INITIAL GROSS WEIGHT-40,000 LB
45,000 LB
50,000 LB
55,000 LB
60,000 LB
65,000 LB
DENSITY ALTITUDE-1000 FT
TIME TO CLIMB-MINUTES
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
76
80
2
6
10
14
18
22
26
30
34
38

Figure 133

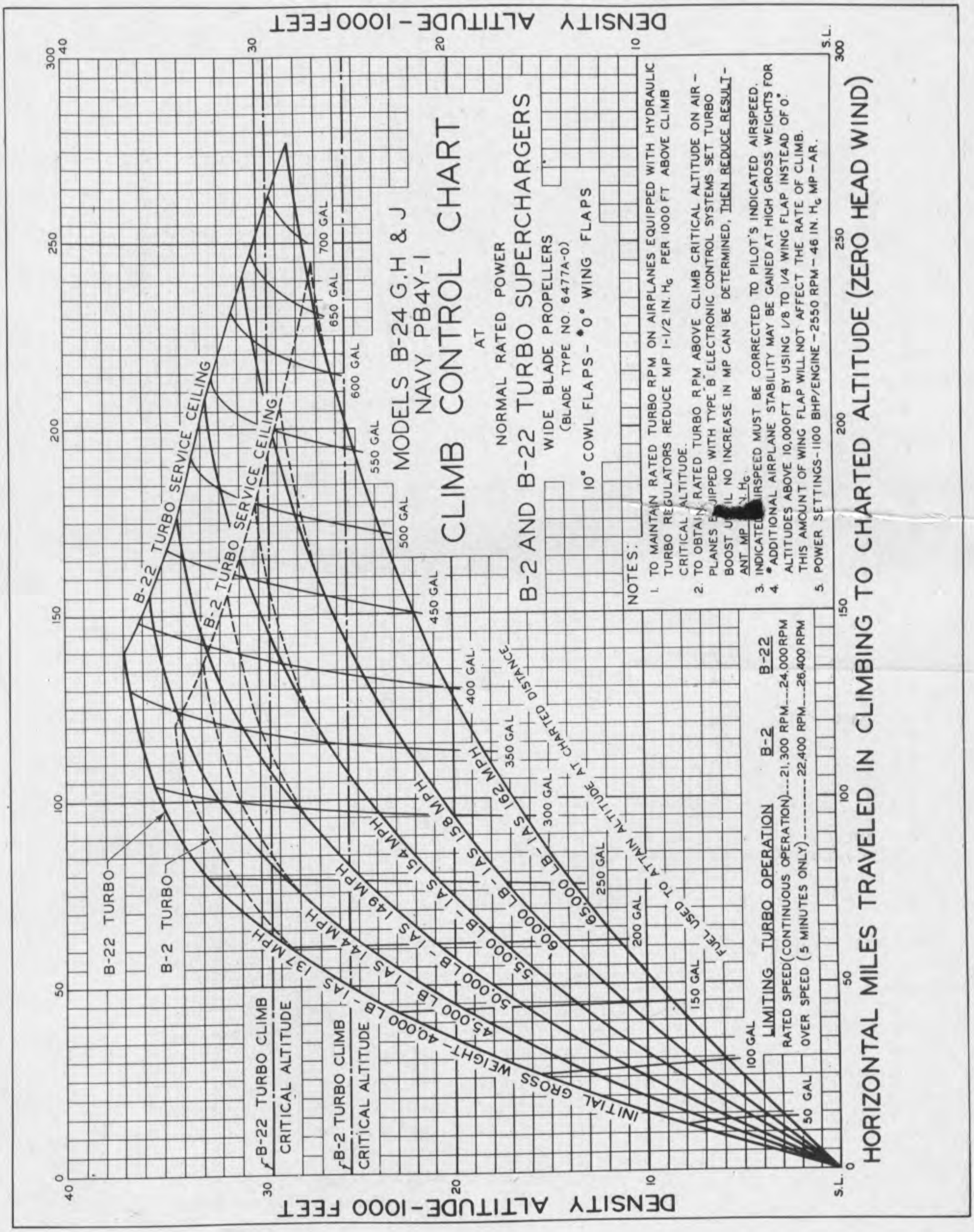

MODELS B-24 G.H & J
NAVY PB4Y-1
CLIMB CONTROL CHART
AT
NORMAL RATED POWER
B-2 AND B-22 TURBO SUPERCHARGERS
WIDE BLADE PROPELLERS
(BLADE TYPE NO. 6477A-0)
10° COWL FLAPS - *0° WING FLAPS
DENSITY ALTITUDE - 1000 FEET
HORIZONTAL MILES TRAVELED IN CLIMBING TO CHARTED ALTITUDE (ZERO HEAD WIND)
B-22 TURBO
B-2 TURBO
B-22 TURBO SERVICE CEILING
B-2 TURBO SERVICE CEILING
B-22 TURBO CLIMB CRITICAL ALTITUDE
B-2 TURBO CLIMB CRITICAL ALTITUDE
INITIAL GROSS WEIGHT - 40,000 LB - IAS 137 MPH
45,000 LB - IAS 144 MPH
50,000 LB - IAS 149 MPH
55,000 LB - IAS 154 MPH
60,000 LB - IAS 158 MPH
65,000 LB - IAS 162 MPH
FUEL USED TO ATTAIN ALTITUDE AT CHARTED DISTANCE
50 GAL
100 GAL
150 GAL
200 GAL
250 GAL
300 GAL
350 GAL
400 GAL
450 GAL
500 GAL
550 GAL
600 GAL
650 GAL
700 GAL
S.L.
0
10
20
30
40
50
100
150
200
250
300
LIMITING TURBO OPERATION B-2 B-22
RATED SPEED (CONTINUOUS OPERATION)...21,300 RPM...24,000 RPM
OVER SPEED (5 MINUTES ONLY)........22,400 RPM...26,400 RPM
NOTES:
1. TO MAINTAIN RATED TURBO RPM ON AIRPLANES EQUIPPED WITH HYDRAULIC TURBO REGULATORS REDUCE MP 1-1/2 IN. HG PER 1000 FT ABOVE CLIMB CRITICAL ALTITUDE.
2. TO OBTAIN RATED TURBO RPM ABOVE CLIMB CRITICAL ALTITUDE ON AIRPLANES E UIPPED WITH TYPE B ELECTRONIC CONTROL SYSTEMS SET TURBO BOOST U IL NO INCREASE IN MP CAN BE DETERMINED, THEN REDUCE RESULTANT MP N. HG.
3. INDICATED IRSPEED MUST BE CORRECTED TO PILOT'S INDICATED AIRSPEED.
4. *ADDITIONAL AIRPLANE STABILITY MAY BE GAINED AT HIGH GROSS WEIGHTS FOR ALTITUDES ABOVE 10,000 FT BY USING 1/8 TO 1/4 WING FLAP INSTEAD OF 0°. THIS AMOUNT OF WING FLAP WILL NOT AFFECT THE RATE OF CLIMB.
5. POWER SETTINGS - 1100 BHP/ENGINE - 2550 RPM - 46 IN. HG MP - AR.

Figure 134

TAKE-OFF CHART

B-24 G.H.& J AIRPLANES
NAVY PB4Y-1

WING FLAPS-20° COWL FLAPS-5°

TAKE OFF POWER-4800 BHP

NOTE: THE TAKE-OFF DISTANCES SHOWN ON THIS CHART ARE HIGH PERFORMANCE AND CAN ONLY BE ATTAINED BY FOLLOWING THE PROCEDURE GIVEN BELOW. FOR NORMAL TAKE-OFF CONDITIONS WHERE HIGH PERFORMANCE IS NOT REQUIRED (AIRLINE PROCEDURE) ADD APPROX. 200 FT. TO THE GROUND RUN AND 600 FT. TO THE TOTAL DISTANCE TO CLEAR A 50 FT. OBSTACLE AND INCREASE THE TAKE-OFF VELOCITIES 10 MPH.

TAKE-OFF PROCEDURE

1. AFTER WARM-UP, RUN UP EACH ENGINE SEPARATELY TO 2700 RPM AND 47" HG MP (THIS SETTING ALLOWS FOR A 1½" HG INCREASE IN MP DUE TO RAM) TO OBTAIN TURBO REGULATOR SETTING.

2. PRIOR TO TAKE-OFF, MAINTAIN TURBO REGULATOR SETTINGS DETERMINED IN ITEM 1 AND REGULATE THE POWER BY MEANS OF THROTTLE ONLY.

3. SET WING FLAPS TO 20° AND COWL FLAPS TO 5°.

4. ON TAKE-OFF DO NOT RELEASE BRAKES UNTIL MP HAS REACHED 35" HG.

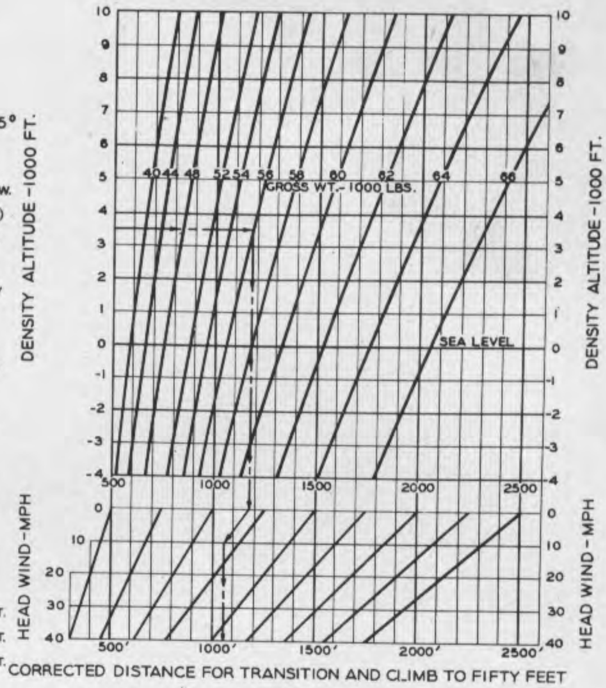
5. UPON RELEASING BRAKES, INCREASE THROTTLE SETTING TO FULL OPEN POSITION AS RAPIDLY AS POSSIBLE.

6. TAKE OFF AT THE INDICATED VELOCITY SPECIFIED ON THE CHART FOR GROUND RUN DISTANCES.

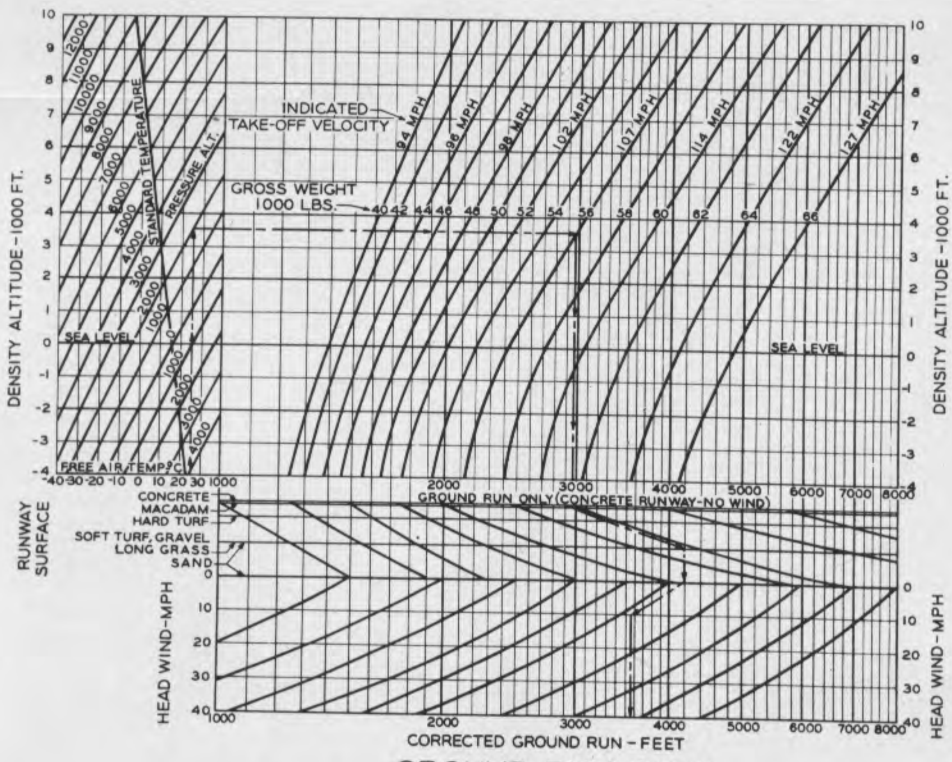
CHART EXAMPLE: G.W.: 56000#; PRESS. ALT.: 2000'; GRD. TEMP.: 25°C (77°F) RUNWAY SURFACE; SOFT TURF; HEAD WIND-10 MPH

FOLLOW ARROWS ON CHARTS OBTAINING:

CORRECTED GROUND RUN ——— 3550 FT.
CORRECTED DISTANCE FOR TRANS. & CLIMB OVER 50 [illegible] ——— 1050 FT.
TOTAL DISTANCE [illegible] 50 FT. OBSTACLE ——— 4600 FT.



HORIZONTAL DISTANCE FOR TRANSITION AND CLIMB TO FIFTY FEET-ONLY



GROUND RUN ONLY

NOTE: ALL TAKE-OFF DISTANCES AT S.L. TO 3000 FT. ON A CONCRETE RUNWAY HAVE BEEN CONFIRMED BY CVAC FLIGHT TESTS

Figure 135