## PILOT'S FLIGHT OPERATING INSTRUCTIONS

P-51-D-5

# MUSTANG IV AIRPLANES

This Technical Order contains specific instructions for pilots and should be available for Transition Flying Training as contemplated in AAF Reg. 50-16.

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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-LIST OF REVISED PAGES ISSUED-

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"Therefore, it is requested that all naval activities check their own local regulations and procedures to make sure that handbooks, service instruc-tions and other restricted technical publications are actually being made available to both civilian and enlisted personnel who have use for them."

### General.

These instructions permit the issue of restricted publications to civilian contract and other accredited schools engaged in training personnel for Government work, to civilian concerns contracting for overhaul and repair of aircraft or aircraft accessories, and to similar commercial organizations.

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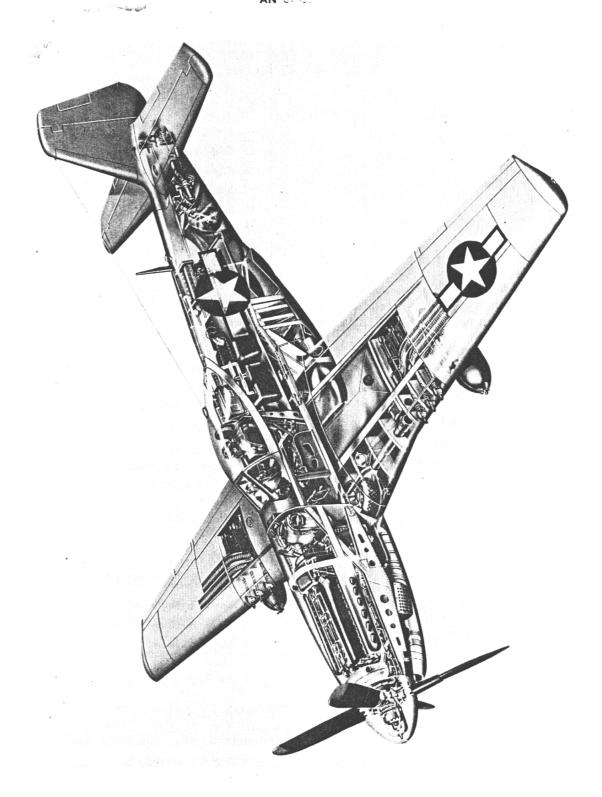
BRITISH ACTIVITIES .- Sul mit requirements on Form 294A, in duplicate, to the Air Publications gate, Yorkshire, England.

### TABLE OF CONTENTS

		PAGE		PAGE
SECTION	Description		21. Diving	. 24
1. G	eneral	1	22. Gliding	. 27
2. Fl	ight Controls	1	23. Night Flying	. 27
3. Lo	anding Gear	1	24. Approach and Landing	. 27
4. B	rakes	1	25. Stopping Engine	
5. H	ydraulic System	5	26. Before Leaving Cockpit	
	ower Plant		27. Tying Down	
	uel System		27. Tyllig 50 William	
	Dil System		SECTION III Flight Operating Data	
	ooling System		Specific Engine Flight Chart	. 29
	lectrical System		2. Airspeed Correction Chart	
	•		SECTION IV Emergency Operating Instructi	ons
SECTION	II Pilot's Operating Instructions		1. General	. 33
1. F	light Restrictions	13	2. Engine Failure During Flight	. 33
2. B	efore Entering Cockpit	13	3. Emergency Exit During Flight	
3. 0	On Entering Cockpit	14	4. Ditching	
4. F	uel System Management	15	5. Landing Gear Emergency Lowering	
5. S	tarting Engine	16	6. Emergency Bomb or Droppable	
	ngine Warm-up		Fuel Tank Release	
	mergency Take-off		7. Emergency Use of Oxygen	35
	ngine and Accessories Ground Test		8. Use of Miscellaneous Emergency	35
	axiing		Equipment	. 00
	Sefore Take-off		SECTION V Operational Equipment	
11. T	ake-off	21	1. Gunnery Equipment	37
	ngine Failure During Take-off		2. Bombing Equipment	
	Climb		3. Communication Equipment	
	During Flight		4. Oxygen System	
	Engine Failure During Flight		5. Heating, Ventilating, and Defrosting	
	lying Characteristics		System	48
	Maneuvers Prohibited		APPENDIX 1 Glossary	49
	Stalls		APPENDIX II Flight Operating Charts	51
	Spins			
20.	Acrobatics	24	1. Flight Planning	31

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### 1. GENERAL.

The North American P-51D Fighter Airplane is a single-place, low-wing monoplane powered by a V-1650-7 liquid-cooled engine. It has a wing span of 37 feet, a length of 32 feet 3 inches, and a height (tail down) of 12 feet, 2 inches. The airplane is armed with six .50-caliber machine guns and may be equipped with wing racks to carry bombs, depth charges, chemical tanks, or fuel tanks. The armor plate protection is shown in figure 8.

### 2. FLIGHT CONTROLS.

The ailerons, elevators, and rudder are conventionally operated by a control stick and rudder pedals. Trim tab controls (a wheel for the elevator tabs and knobs for the rudder and aileron tabs) and the flap control lever are on the control pedestal at the left side of the cockpit. A surface control locking gear is forward of the base of the control stick.

#### 3. LANDING GEAR.

a. GENERAL.—The control lever for the hydraulically operated landing gear is on the left side of the cockpit. When the surface control stick is pulled back, the tail wheel is linked to the rudder cables and is steerable 6 degrees right or left. With the control stick forward, the tail wheel is unlocked and full swiveling.

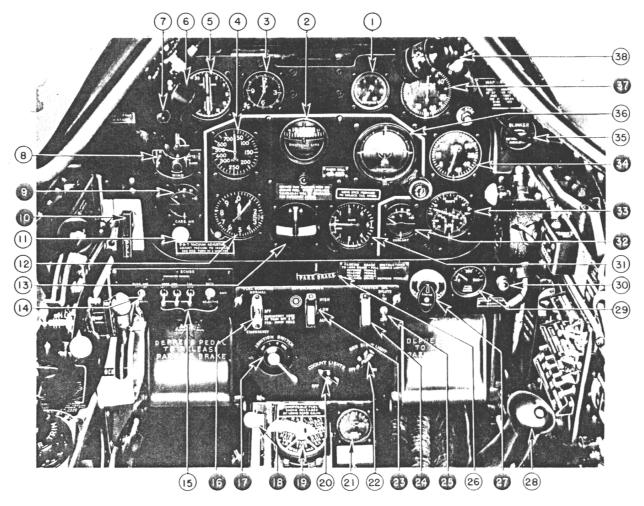
#### WARNING

Do not move the landing gear control when airplane is on the ground, as there is no safety mechanism to prevent the gear from retracting.

b. LANDING GEAR WARNING LIGHT.—A redjeweled light on the left side of the instrument panel will illuminate when the throttle is retarded with the landing gear not locked in the down position. A push-button switch for testing the lamp is adjacent to the warning light.

### 4. BRAKES.

The multiple-disc brakes are hydraulically operated. Fluid for the brake system is obtained from the hydraulic reservoir. A standpipe in the reservoir reserves a supply of fluid for brake operation in case fluid for the hydraulic system is lost. The parking brake control is just below the center of the instrument panel. See figure 5 for brake system diagram.



- 1. Suction Gage
- 2. Directional Gyro
- 3. Clock
- 4. Airspeed Indicator
- 5. Remote Reading Compass Indicator
- 6. Fluorescent Light
- 7. Landing Gear Warning Light
- 8. Remote Contactor
- 9. Carburetor Air

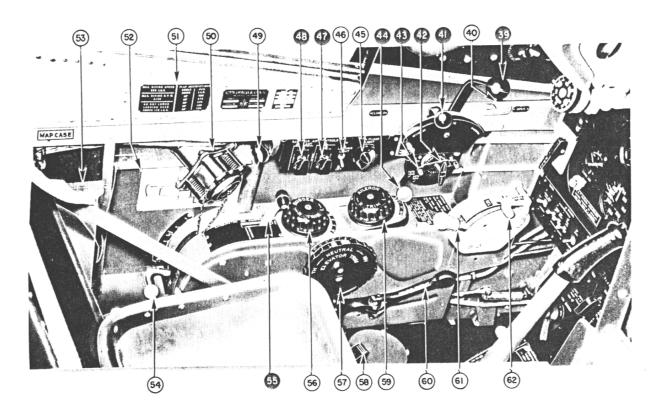
Temperature Indicator

- 10. Boost Control
- Bank-and-Turn Vacuum Adjustment Knob
- 12. Altimeter

- 13. Bank-and-Turn Indicator
- 14. Gun and Camera Safety Switch
- 15. Bomb Control Switches
- 16. Booster Pump Switch
- 17. Ignition Switch
- 18. Fuel Shut-off Control
- 19. Fuel Selector Control
- 20. Cockpit Light Switch
- 21. Hydraulic Pressure Gage
- 22. Gun Sight Rheostat
- 23. Supercharger Control Switch
- 24. Starter Switch
- 25. Oil Dilution Switch

- 26. Parking Brake Handle
- 27. Engine Primer
- 28. Control Stick
- 29. Oxygen Pressure Gage
- 30. Oxygen System Warning Light
- 31. Rate-of-Climb Indicator
- 32. Coolant Temperature Indicator
- Oil Temperature and Fuel and Oil Pressure Gage
- 34. Tachometer
- 35. Oxygen Flow Blinker
- 36. Flight Indicator
- 37. Manifold Pressure Gage
- 38. Fluorescent Light

Figure 2—Cockpit—Forward View



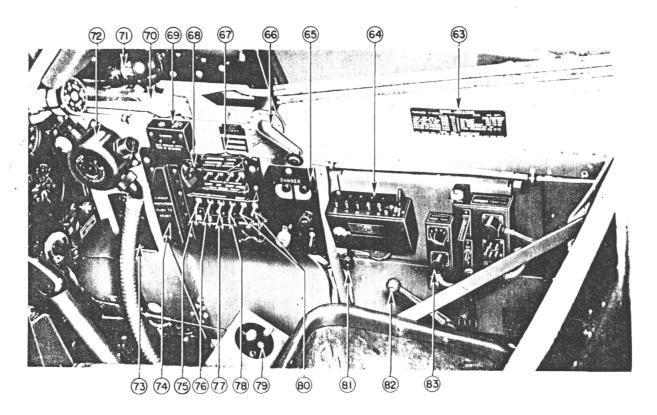
- 39. Throttle
- 40. Throat Microphone Switch
- 41. Propeller Control
- 42. Throttle Friction Lock
- 43. Propeller and Mixture Control Friction Lock
- 44. Mixture Control
- 45. Left-hand Fluorescent Light Switch
- 46. Landing Light Switch
- 47. Oil Cooler Exit Flap Control Switch
- 48. Coolant Radiator Exit Flap Control Switch
- 49. Cockpit Light
- 50. Pyrotechnic Pistol Mount

- 51. Airplane Restriction Plate
- 52. Fuel System Diagram
- 53. Map Case
- 54. Wing Flap Control
- 55. Carburetor Air Control
- 56. Rudder Trim Tab Control
- 57. Elevator Trim Tab Control
- 58. Signal Lamp Stowage Bracket
- 59. Aileron Trim Tab Control
- 60. Landing Gear Control
- 61. Bomb Control Handle
- 62. Bomb Antisalvo Guard

Figure 3-Cockpit-Left Side

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- 63. Engine Limitations Plate
- 64. SCR-522 Radio Control Box
- 65. Detonator Switches
- 66. Canopy Handcrank
- 67. Recognition Light Switches
- 68. Right-hand Fluorescent Light Switch
- 69. Recognition Lights Keying Switch
- 70. Canopy Emergency Release Handle
- 71. Fluorescent Light
- 72. Oxygen Regulator

- 73. Spare Lamp Stowage
- 74. Circuit Breaker Reset Guard
- 75. Generator-disconnect Switch
- 76. Battery-disconnect Switch
- 77. Gun Heater Switch
- 78. Pitot Heater Switch
- 79. Detrola Receiver
- 80. Position Light Switches
- 81. Cockpit Light
- 82. Seat Adjustment Handle
- 83. SCR-695 Radio Control Box

Figure 4-Cockpit-Right Side

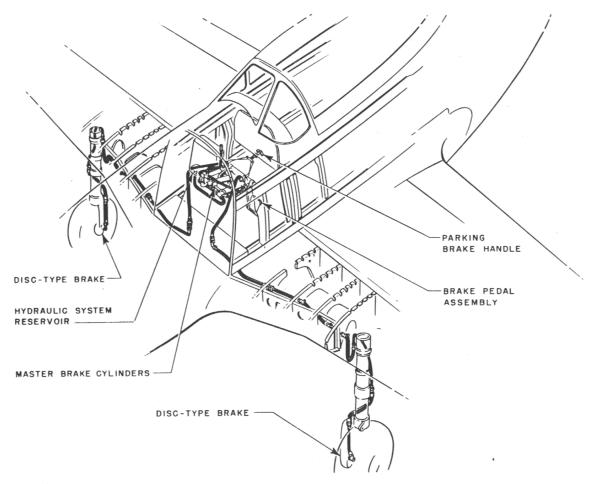


Figure 5-Brake System

### 5. HYDRAULIC SYSTEM.

The hydraulic system (see figures 6 and 7) operates the landing gear and wing flaps. The wing flaps are preselectively set by moving the control lever, on the aft end of the control pedestal, to the desired flap setting. The flaps are automatically held in that position until another flap setting is selected. No emergency hydraulic hand-pump is provided.

### 6. POWER PLANT.

a. ENGINE.—The Packard built Rolls Royce, V-1650-7, twelve-cylinder engine incorporates a two-speed, two-stage supercharger and is equipped with an injection-type carburetor and an automatic manifold pressure regulator. An aneroid switch automatically controls the supercharger shift. Low blower ratio is 5.8:1 and high blower ratio is 7.3 to 1. Field modification kits are available to change supercharger gear ratios, converting V-1650-7 to V-1650-3.

### b. FUEL, OIL, AND COOLANT.

Fuel Spec. AN-F-28, Grade 100/130
Oil Spec. AN-O-5, Grade 1100
Coolant 70% water and 30% ethylene glycol
(Spec. AN-E-2) treated with
NaMBT

- c. ENGINE CONTROLS.—The engine control quadrant has two friction locks, one for the throttle and one for the propeller and mixture controls. The three mixture control positions are: "IDLE CUT OFF," "AUTO LEAN," and "AUTO RICH."
- d. CARBURETOR AIR.—The air induction system supplies either ram air or unrammed, filtered air to the carburetor. The control handle for the system is at the pilot's left. Whenever the air duct becomes obstructed, emergency

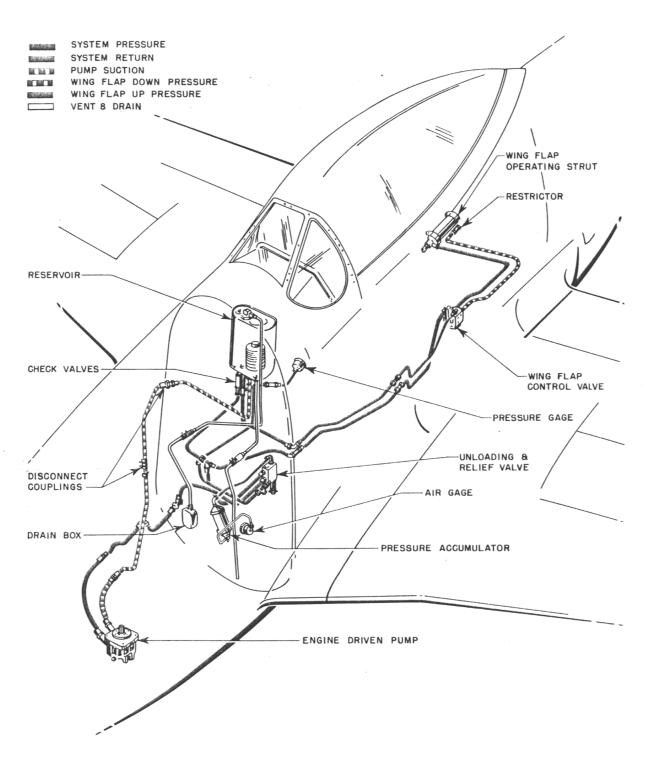


Figure 6-Hydraulic Power and Wing Flap Systems

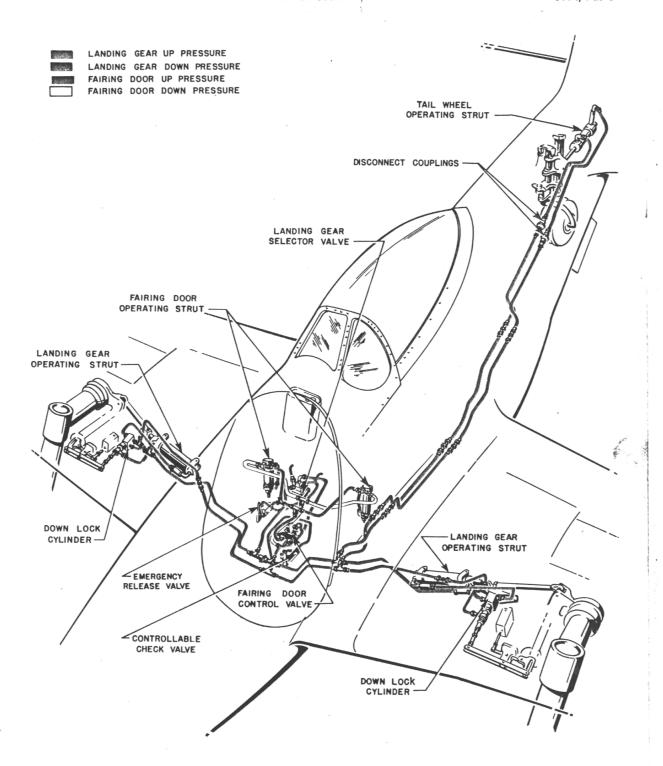


Figure 7—Hydraulic Landing Gear System

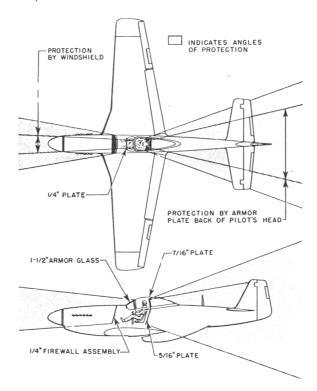


Figure 8-Armor Protection

doors will automatically open to allow engine compartment air to enter the carburetor.

e. PROPELLER.—The airplane is equipped with a Hamilton Standard, four-blade, hydraulically operated constant-speed propeller, 11 feet 2 inches in diameter. The pitch settings are 23° low, 65° high.

### 7. FUEL SYSTEM.

Two self-sealing fuel tanks are carried in the wing, and an auxiliary 85-gallon, self-sealing tank is installed in the fuselage. The fuselage tank is located aft of the cockpit and is equipped with a goose-necked gage visible to the pilot. Two 75-gallon, pressurized combat tanks may be installed on the wing racks. Fuel flows as follows: from either of the wing tanks or the fuselage tank through a booster pump to the fuel selector valve; through the selector valve, shut-off valve, and fuel strainer to the enginedriven fuel pump; then to the carburetor. Fuel from the combat tanks flows through the selector valve into the main fuel line. All main fuel lines are self-sealing. See figure 9 for fuel system diagram.

#### NOTE

All airplanes equipped with 85-gallon fuselage fuel tanks may be identified by a white plus (+) sign printed below the serial number on the left-hand side of the fuselage.

### 8. OIL SYSTEM.

The oil tank is mounted on the forward face of the firewall. Scavenged oil flows from the engine to an oil cooler located in the lower section of the fuselage, beneath the cockpit. A thermostatically controlled air duct exit flap regulates the flow of air through the oil cooler. The oil dilution system is controlled by a switch on the upper right side of the pilot's switch panel. The oil system is shown in figure 10.

#### 9. COOLING SYSTEMS.

The engine incorporates two cooling systems (see figure 11): one cools the engine and the other cools the super-charger fuel-air mixture. Each system has a separate pump, expansion tank, and radiator. The two coolant radiators, constructed as a unit, are located in the air duct above and aft of the oil cooler. An air duct exit flap, thermostatically controlled by the temperature of the main cooling system, regulates the flow of air through the radiators.

### 10. ELECTRICAL SYSTEM.

The electrical system is a 2-1-volt direct-current type, receiving power from a 100-ampere engine-driven generator system supplemented with a 24-volt storage battery which supplies current when the generator system is inoperative. A single-wire direct current distribution system is used, the metallic structure of the airplane serving as a ground. An external power socket is located on the right side of the fuselage just behind the cockpit. External power should be used instead of the airplane battery to start the engine and operate the electrical system while the airplane is on the ground. An adapter for connecting the British type of external power supply is stowed adjacent to the external power socket. All of the electrical circuits are protected by either circuit breakers or circuit-breaker switches located on the right switch panel. See figures 2 and 4 for location of main electrical switches.

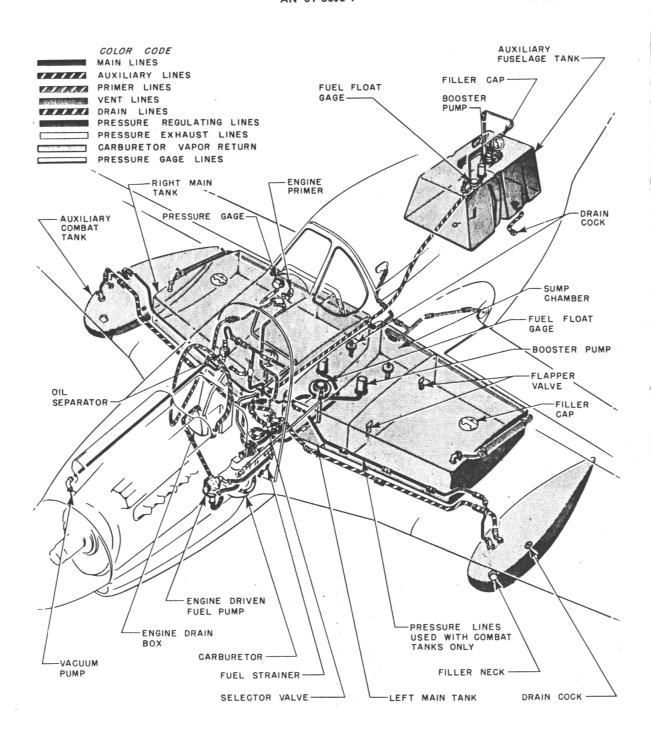


Figure 9-Fuel System

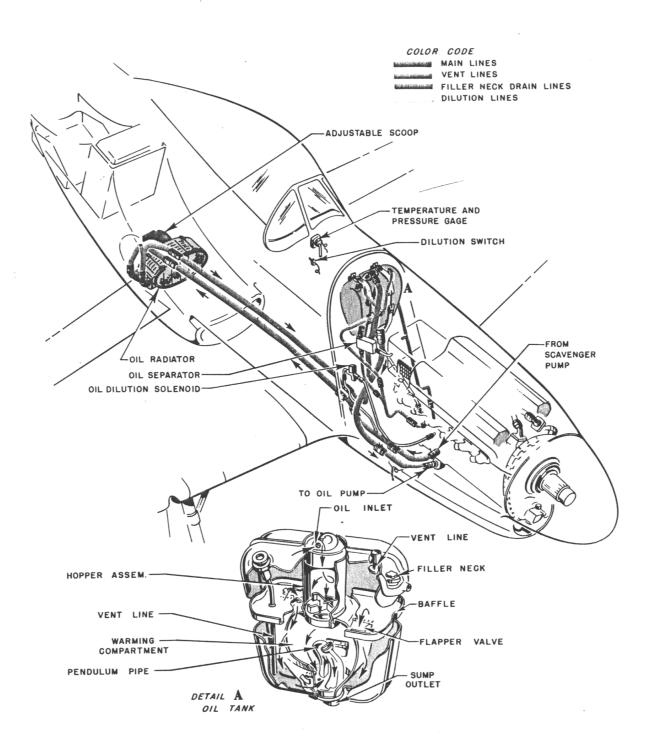


Figure 10-Oil System

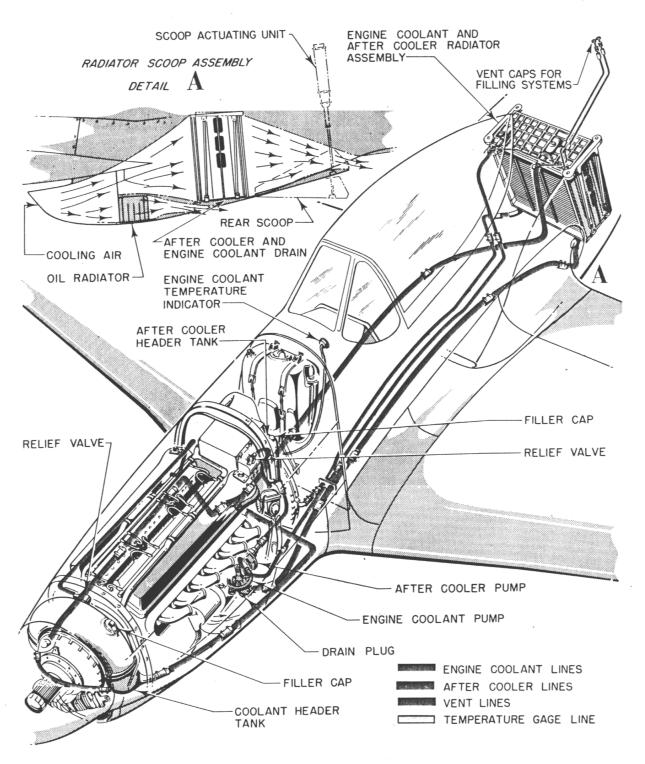
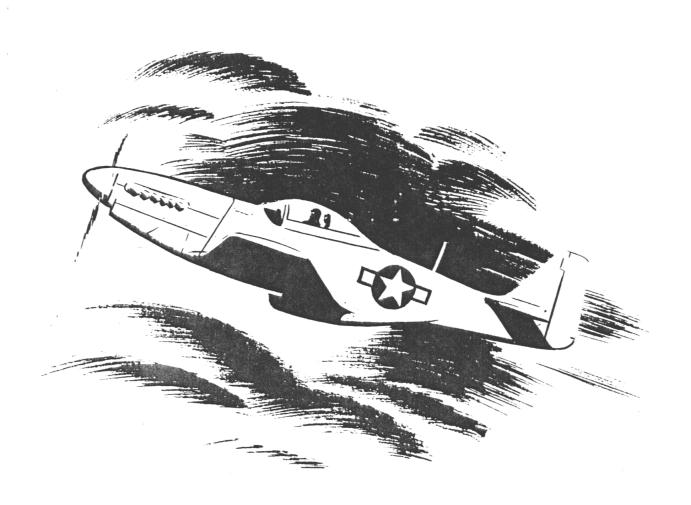
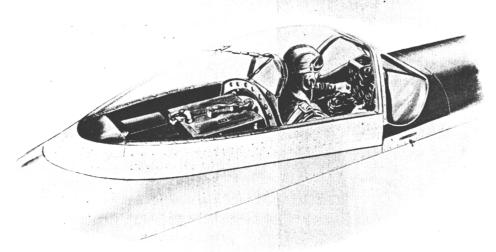


Figure 11—Cooling Systems

### 11. MISCELLANEOUS EQUIPMENT.

- a. MEDICAL FIRST-AID KIT. -- A medical first-aid kit is fastened to a holder on the fuselage at the right of the pilot's seat.
- b. PILOT'S RELIEF TUBE.—The relief tube horn is stowed on a bracket on the floor to the left of the pilot's seat.
- c. DROP MESSAGE BAG.—A drop message bag is contained in a holder on the map case cover.
- d. FLASHLIGHT. —A small flashlight is located on the left underside of the instrument cowl.
- e. ENGINE CRANK.—An engine crank and extension tube are stowed on brackets at the back of the right main landing gear well.





# SECTION II Pilot's Operating Instructions

#### NOTE

A pilot's check list and an engine limitations plate are provided in the cockpit for a quick check of airplane operations.

### 1.. FLIGHT RESTRICTIONS.

### a. MANEUVERS PROHIBITED.

- (1) When external fuel tanks are installed, only normal flying attitudes are permitted.
- (2) Inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenger pumps to operate in an inverted position.
- (3) Intentional "power-off" spins are permitted, provided such spins are started above 12,000 feet.
- (4) Intentional "power-on" spins and snap rolls are prohibited.

### b. AIRSPEED LIMITATIONS.

- (1) The maximum permissible diving speed is 505 IAS.
- (2) Observe the following wing flap setting airspeed restrictions:

- (a) With wing flap setting at 10 degrees, do not exceed 400 IAS.
- (b) With wing flap setting at 20 degrees, do not exceed 275 IAS.
- (c) With wing flap setting at 30 degrees, do not exceed 225 IAS.
- (d) With wing flap setting at 40 degrees, do not exceed 180 IAS.
- (e) With wing flap setting at 50 degrees, do not exceed 165 IAS.
  - (3) In a sideslip, stay above 110 IAS.
  - (4) Do not extend landing gear above 170 IAS.
- (5) With droppable 75-gallon combat fuel tanks installed, speed is limited to about 400 IAS due to incipient buffeting.

### 2. BEFORE ENTERING COCKPIT.

a. Make sure the airplane has been serviced and is ready for flight, particularly in regard to proper quantities of fuel, oil, coolant, hydraulic fluid, and oxygen.

### PILOT'S OPERATING INSTRUCTIONS Sec II, Pars 2-3

### RESTRICTED AN 01-60JE-1



Figure 12-Rudder Pedal Adjustment

- b. Ascertain that the total weight of fuel, oil, ammunition and special equipment carried is suited to the mission to be performed. This is most important in the case of combat missions, as the rate of climb of the airplane may vary as much as 500 feet per minute, depending on the load carried.
- c. Prior to any ground run-up exceeding 40 in. Hg manifold pressure, see that the tail of the airplane is anchored securely to a fixed object. If wheel chocks are available, use them also.
- d. To gain access to cockpit, push in on spring-loaded door on left forward side of sliding canopy, and slide canopy aft.

### 3. ON ENTERING COCKPIT.

- a. The following procedures should be carried out prior to all flights:
- (1) Adjust rudder pedals for proper leg length so as to obtain full brake control while taxiing. Adjustment may be made with the foot by pressing the lever located on the inner side of each rudder pedal.
- (2) Adjust the seat level to obtain full travel of the rudder pedals in the extreme positions. The adjustment lever for raising or lowering the seat is located on the right side of the seat.
  - (3) See that ignition switch is "OFF."

- (4) Set parking brakes by pulling out the handle below the center of the instrument panel, depressing the brake pedals, releasing the pedals, and then releasing the handle.
- (5) On early airplanes only, make sure the bomb release handle is in the "LOCK" position and the antisalvo guard is in place.
- (6) See that the bomb and gun safety switches are "OFF."
- (7) See that landing gear control handle is in the "DOWN" position.
- (8) Unlock surface control lock at the base and just forward of the control stick by pulling the plunger on the left side of the lock. Check the controls for free and proper movement, watching control surfaces for correct response.
  - (9) Set altimeter to correct barometric pressure.
- (10) Test gun sight illumination by operating rheostat control on pilot's switch panel. (Gun safety switch must be moved to "GUNS" or "GUNS AND CAMERA" for test.)
- (11) Check remote reading compass for correct reading.
- (12) Check landing gear warning light on instrument panel by pushing test switch adjacent to light.
  - (13) Close sliding canopy as follows:
- (a) Push in on axle of crank on right side of cockpit to engage clutch.

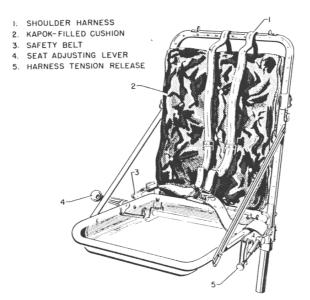


Figure 13—Pilot's Seat

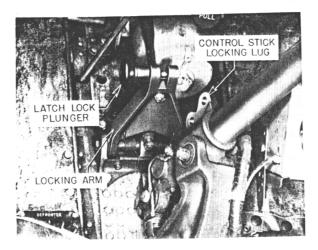


Figure 14—Surface Control Lock

- (b) Disengage pin on crank handle from the holes on the face of the clutch housing by pulling crank knob inboard gently.
- (c) Turn crank counterclockwise, holding knob inboard, to close canopy.

### WARNING

If red indicators show through openings on each side of the forward end of the enclosure, the emergency release is unlocked and unsafe for flight.

- b. When night flying is anticipated, the following additional checks should be made:
- (1) Test fluorescent instrument lights by operating rheostat controls. The control for the left light is on the radiator air control panel; the control for the right light is on the right-hand switch panel.
- (2) Test position lights by moving switches on righthand switch panel to "BRIGHT" and "DIM."
- (3) Test landing light by operating switch on radiator air control panel.
- (4) Test cockpit swivel lights on each side of cockpit by turning on switch located on lamp housing. The cockpit light master switch on the pilot's switch panel must be "ON" before turning on the lights.
- (5) Test operation of recognition lights; the switches are on the right-hand switch panel. The keying switch is on the right longeron.

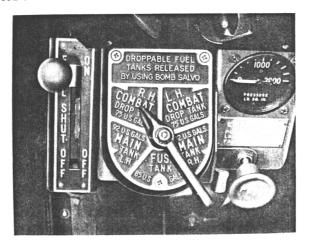


Figure 15-Fuel Selector Control

#### NOTE

Do not operate recognition lights longer than 10 seconds on the ground.

### 4. FUEL SYSTEM MANAGEMENT.

a. Take off and climb to a safe altitude with the fuel selector valve on "FUS. TANK," and the booster pump switch in "EMERGENCY." If fuselage tank is not serviced, take off and climb with fuel selector valve on "MAIN TANK L.H."

### NOTE

The fuselage tank should be used for take-off and climb to a safe altitude as it is the most direct system to the engine and is on a higher plane in relation to the engine. Use of the fuselage tank fuel will also move the C.G. of the airplane forward to a more desirable position for flight.

b. When a safe altitude has been reached, when droppable tanks are installed, switch fuel selector valve to either of the droppable tank positions and use the fuel from them alternately until they are empty; then drop them.

#### NOTE

The combat tanks have no booster pump; a controlled pressure of 5 lbs./sq. in. is maintained within the tanks by pressure obtained from the vacuum pump.

c. Switch selector valve back to "FUS. TANK," with booster pump switch in "NORMAL," and use all but 25 gallons of the fuel to relieve tail heaviness.

### PILOT'S OPERATING INSTRUCTIONS Sec II, Pars 4-5

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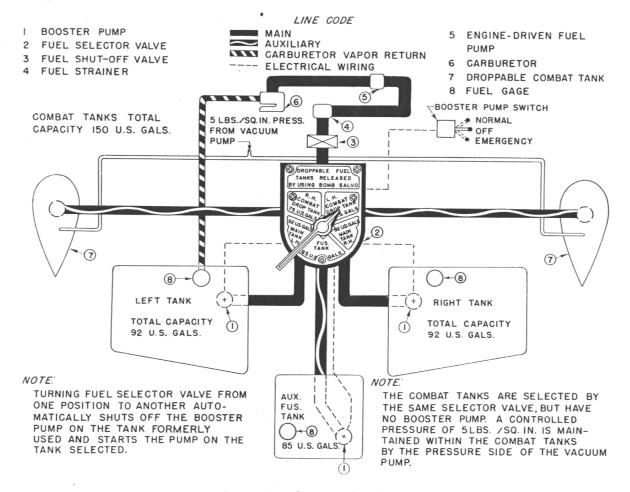


Figure 16-Fuel System Line Diagram

### **IMPORTANT**

It is desirable to retain approximately 25 gallons of fuel in the fuselage tank in order to have the C.G. of the airplane in the optimum position for landing.

d. Switch selector valve to "MAIN TANK L.H."; alternately use fuel from the left and right main tanks to avoid wing heaviness until the wing tanks are empty.

### NOTE

Turning the selector valve from one position to another automatically shuts off the booster pump on the tank formerly used and starts the pump on the tank selected.

e. When wing tanks are empty, switch selector valve back to "FUS. TANK."

### 5. STARTING ENGINE.

- a. The sequence of operations listed below should be followed in starting the engine.
  - (1) See that ignition switch is "OFF."
- (2) Turn generator-disconnect and battery-disconnect switches "ON." These switches are located on the right-hand switch panel.
- (3) Have ground personnel turn the propeller several revolutions by hand.
  - (4) Open throttle one inch.
  - (5) Move mixture control to "IDLE CUT OFF."
  - (6) Move propeller control to full "INCREASE."

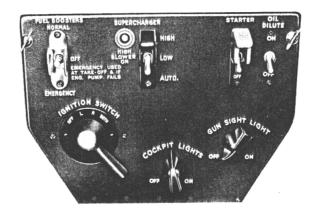


Figure 17—Pilot's Switch Panel

- (7) Make certain boost control on lower left side of instrument panel is in "AUTOMATIC."
- (8) See that supercharger blower switch on pilot's switch panel is in "AUTO."
- (9) Turn oil and coolant radiator air control switches at left side of cockpit to "AUTOMATIC."
- (10) Move carburetor air control at aft end of control pedestal to "RAM AIR" ("UNRAMMED FILTERED AIR," if required).
- (11) Turn ignition switch on pilot's switch panel to "BOTH."
- (12) Turn "ON" fuel shut-off control, which is adjacent to the fuel selector valve at base of pilot's switch panel, place booster pump switch in "NORMAL," and turn fuel



Figure 18—Right-hand Switch Panel

selector valve to "FUS. TANK," or "MAIN TANK L.H." if fuselage tank is not serviced.

- (13) Check fuel pressure gage for 8 to 12 pounds pressure.
- (14) Prime engine 3-4 strokes when cold, one when hot.
  - (15) Check to see that propeller is clear.
- (16) Lift guard on starter switch on pilot's switch panel and press switch to "START."

### NOTE

Whenever possible, an external power supply should be used to start the engine. If external power is not available, use handcrank. Use airplane's battery in an emergency only.

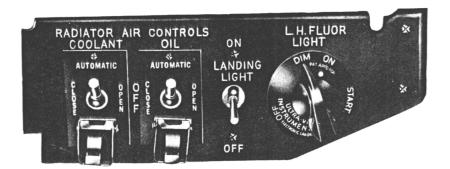


Figure 19-Radiator Air Control Panel

### PILOT'S OPERATING INSTRUCTIONS Sec II, Pars 5-7

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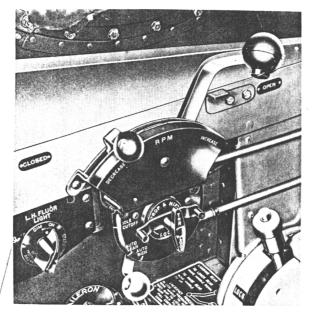


Figure 20-Engine and Propeller Controls

(17) As engine starts, move mixture control to "AUTO RICH." If engine does not start after several turns, continue priming.

### WARNING

When engine is not firing, mixture control should be in "IDLE CUT OFF."

(18) Check oil pressure. If pressure is not up to 50 pounds within 30 seconds, stop engine and investigate.

### 6. ENGINE WARM-UP.

Warm up the engine at 1300 rpm until the oil temperature shows a definite increase and the oil pressure remains steady when the throttle is opened. The desired oil and coolant temperatures will be maintained by having the radiator air controls in "AUTOMATIC."

	DESIRED	MAXIMUM
Oil temp.	70- 80°C (158-176°F)	90°C (194°F)
Coolant temp.	100-110°C (212-230°F)	121°C (250°F)

If coolant and oil temperatures exceed limits with controls in "AUTOMATIC," shut engine off and investigate.

### 7. EMERGENCY TAKE-OFF.

Use oil dilution (2 minutes maximum) to obtain proper oil pressure at moderate power, and as soon as the engine will take the throttle, taxi out, and take off.

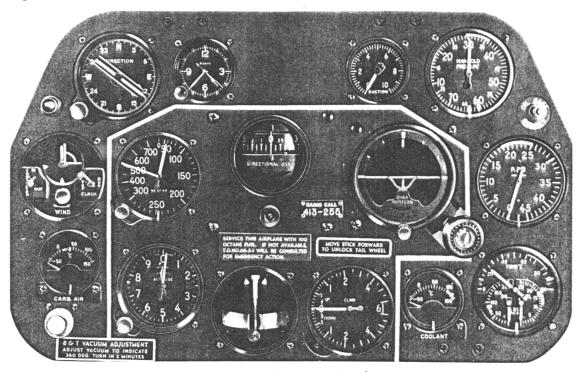


Figure 21—Instrument Panel

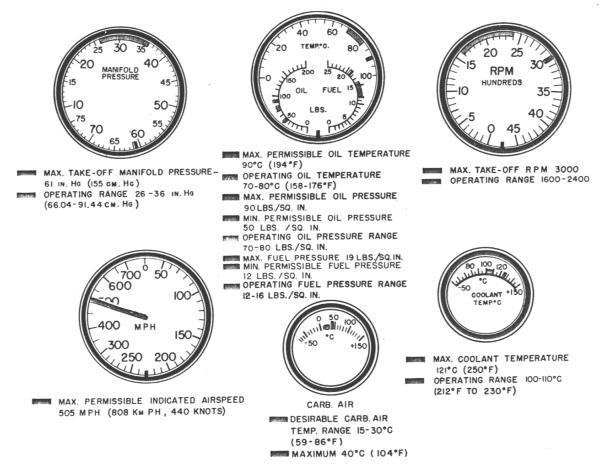


Figure 22—Instrument Limitations

#### NOTE

Overdilution is likely to result under these conditions because of low oil flow and a cold engine which holds back evaporation. If dilution is used, close observation of the oil pressure will be necessary during the time of dilution and take-off to determine whether or not the oil has been overdiluted, resulting in low oil pressure, and loss of oil through the engine breathers.

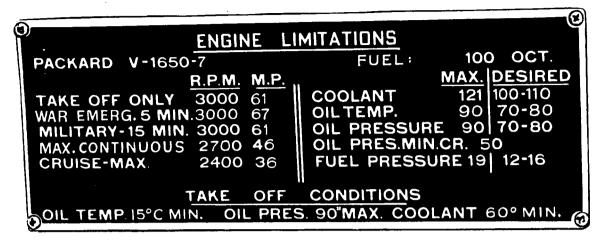
### 8. ENGINE AND ACCESSORIES OPERATION GROUND TEST.

- a. After the engine has been warmed up sufficiently, proceed with these tests:
- (1) Check both left and right main and fuselage fuel systems by rotating fuel selector with booster pump switch

in "EMERGENCY." Check for 14-19 lbs./sq. in. pressure. If droppable tanks are installed, check fuel flow by rotating fuel selector control.

- (2) Check operation of wing flaps.
- (3) Check operation of radiator air exit flaps (with assistance of outside observer) using override positions of radiator air control switches. Return switches to "AUTO-MATIC."
- (4) Check communication equipment for proper operation.
  - (5) At 2000 rpm, check the following: Suction 3.75-4.25 in. Hg

Hydraulic pressure 800-1100 lbs./sq. in.
Ammeter 100 amperes maximum



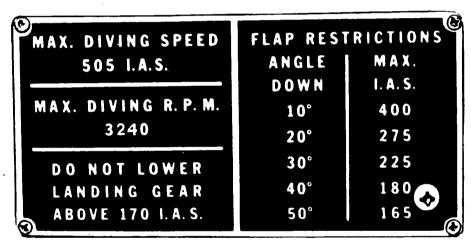


Figure 23—Engine and Airplane Limitations

(6) Check the instruments for the following limitations:

	DESIRED	MAXIMUM
Oil pressure	70-80 lbs./sq. in.	90 lbs./sq. in.
Oil temp.	70-80°C (158-176°F)	90°C (194°F)
Coolant temp.	100-110°C (212-230°F)	121°C (250°F)
Fuel pressure	12-16 lbs./sq. in.	19 lbs./sq. in.

- (7) With propeller control in full "INCREASE," move throttle forward to obtain 2300 rpm. Check each magneto. A maximum loss of 100 rpm is allowable.
- (8) At 2300 rpm, move propeller control back to note maximum drop of 300 rpm. Then move forward to full "INCREASE."
- (9) Check supercharger operation: Set propeller control at full "INCREASE," engine speed 2300 rpm, and hold

supercharger switch in "HIGH." Note rpm drop (at least 50 rpm).

(10) Notify ground personnel to release tail and remove wheel chocks.

### 9. TAXIING.

- a. Observe the following generalities when taxiing:
  - (1) Raise the wing flaps.

#### WARNING

To prevent damage to the wing flaps, they must be up when taxiing. In addition, always taxi cautiously so as to avoid damage from objects which the tires might pick up and throw against the radiator exit flaps.

- (2) Steer a zigzag course to obtain an unobstructed view.
- (3) Taxi with the stick slightly aft of neutral to lock the tail wheel. In the locked position, the tail wheel may be turned 6 degrees to the right or left by the rudder pedals. For sharp turns, push the stick forward of the neutral position to allow the tail wheel full swiveling action.
- (4) Use the brakes as little as possible and always taxi cautiously.
- (5) Upon reaching the take-off position, stop the airplane cross-wind so that approaching airplanes may be plainly seen.

#### 10. BEFORE TAKE-OFF.

- a. Follow this sequence of operations before take-off:
- (1) Set rudder trim 5° to the right, elevator trim 6° back for flaps down take-off; 3° back for flaps up take-off; aileron trim 0 degrees. With full combat and fuselage tanks and a full load of ammunition, set elevator trim ½ degree back for flaps down take-off.
- (2) Check flying controls for free movement (look at control surfaces).
  - (3) Check fuel levels.
- (4) See that fuel selector valve is set on "FUS. TANK" or "MAIN TANK L.H.," if fuselage tank is not serviced, and that booster pump switch is in "EMERGENCY" (pressure 14-19 pounds).
  - (5) Generator-disconnect switch "ON."
  - (6) Mixture control "AUTO RICH."
  - (7) Propeller control full "INCREASE."
  - (8) Supercharger blower switch "AUTO."
- (9) Oil and coolant radiator air controls "AUTO-MATIC."
  - (10) Boost control "AUTOMATIC."
- (11) Carburetor air control "RAM AIR" ("UNRAMMED FILTERED AIR," if required).
- (12) Sliding canopy closed and emergency release handle safetied.

#### 11. TAKE-OFF.

- a. When take-off area is clear, quickly check the following:
  - (1) Wing flaps 20° down ("TAKE-OFF" position).
  - (2) Gyro instruments "UNCAGED."

### NOTE

The gyro instruments should be left "UNCAGED" at all times except during acrobatics.

- (3) Oil pressure 70-90 pounds.
- (4) Oil temperature 15°C (59°F) minimum, 90°C (194°F) maximum.
- (5) Coolant temperature 60°C (140°F) minimum, 121°C (250°F) maximum.
- (6) Open throttle to 61 in. Hg manifold pressure, and take off at 3000 rpm (5 minutes maximum).
- (7) Do not attempt to lift the tail too soon, as this increases the torque action. Pushing the stick forward unlocks the tail wheel, thereby making steering difficult. The best take-off procedure is to hold the tail down until sufficient speed is attained, and then raise the tail slowly.

### 12. ENGINE FAILURE DURING TAKE-OFF.

- a. The chances of the engine failing during take-off can be greatly reduced and prepared for by observing the following practices:
- (1) Run up engine carefully and check thoroughly before take-off.
- (2) Retract the landing gear as soon as the airplane is definitely airborne.
- (3) Raise the flaps as soon as the airplane reaches a safe altitude.
- b. If the engine fails immediately after the take-off, act quickly as follows:
- Depress the nose at once so that the airspeed does not drop below stalling speed.
- (2) If external fuel tanks or bombs are installed, release them immediately.
- (3) Release the sliding canopy by pulling the emergency release handle on top of the longeron just to the right of the instrument panel.

### PILOT'S OPERATING INSTRUCTIONS Sec II. Pars 12-14

### RESTRICTED AN 01-60JE-1

### **IMPORTANT**

When releasing the canopy, bend forward and lower head slightly so as to avoid a head injury from the loose enclosure.

- (4) Make sure landing gear has started to come up. There is no time to take further action, and even if it is only unlocked and on the way up, the gear will collapse on landing. Do not try to lower gear. There is less chance of personal injury if the airplane is landed with the gear up.
  - (5) Lower the flaps fully, if possible.
- (6) Move mixture control to "IDLE CUT OFF" and turn "OFF" ignition switch.
  - (7) Turn fuel shut-off valve "OFF."
  - (8) Turn battery-disconnect switch "OFF."
- (9) Land straight ahead, only changing direction sufficiently to miss obstructions.
- (10) After landing, get out of the airplane as quickly as possible and remain outside.

### 13. CLIMB.

- a. As soon as the airplane is sufficiently clear of the ground, proceed as follows:
- (1) Retract the landing gear by pulling the landing gear control handle inboard and up. The handle is located on the control pedestal to the left and just forward of the seat.
- (2) Raise the flaps by pulling flap control to the full up position when sufficient airspeed is attained and all obstacles are cleared. No sink is noticeable when the flaps are raised.
- (3) Check the coolant and oil temperatures, and the oil pressure.
- (4) As the rate-of-climb can vary widely, depending on weight being carried, external loading, and altitude, refer to Take-off, Climb, and Landing Chart in Appendix II for the rate-of-climb applicable to the particular mission to be conducted.

### 14. DURING FLIGHT.

#### a. GENERAL.

(1) As soon as desired altitude is attained, turn booster pump switch to "NORMAL."

- (2) Set propeller and throttle controls to desired rpm and manifold pressure.
- (3) Periodically check for these desired instrument readings:

Oil pressure 70-80 lbs. (50 lbs. min., 90 lbs. max.)
Oil temp. 70-80°C (158-176°F)
(15°C (59°F) min., 90°C (194°F) max.)
Coolant temp. 100-110°C
(60°C (140°F) min., 121°C (250°F) max.)
Fuel pressure 12-16 lbs.
Suction 3.75-4.25 in. Hg

#### NOTE

With the radiator air controls set in the "AUTO-MATIC" position, the coolant temperatures will be approximately 100-110°C (212-230°F) and the oil temperatures will be approximately 70-80°C (158-176°F). It should be noted that with very high powers on hot days, even though the radiator air controls are in the "AUTOMATIC" position, these temperature limits may be exceeded because the exit flaps are in the full-open position, making it impossible for the automatic control to maintain the above desired temperature limits.

(4) For engine operation, see Specific Engine Flight Chart, Section III, and Flight Operation Instruction Charts, Appendix II.

### b. WAR EMERGENCY RATING.

### (1) GENERAL.

- (a) The basis for establishing the War Emergency Rating, given on the Specific Engine Flight Chart in Section III, is to make available to the pilot in combat the absolute maximum manifold pressure at which the engine may be operated, within reasonable safety limits, for a 5-minute period under emergency conditions.
- (b) The War Emergency Rating is considerably in excess of the ratings given in the engine specification under which the engine was delivered. Use of the War Emergency Rating will decrease the engine's normal service life and time between overhauls, and therefore should be held for use only when emergency conditions exist. The War Emergency Rating is not a guaranteed power rating; it is a maximum manifold pressure rating, available for emergency operation only, as established by the correct setting of the automatic manifold pressure regulator, and the correct setting of the propeller governor to allow the propeller to turn at 3000 rpm.

- (c) The War Emergency Rating is to be used only when each of the following requirements is strictly complied with:
- 1. In combat or precombat areas as designated by the Army Air Forces, and then only when emergency conditions exist.
  - 2. When Spec. No. AN-F-28 fuel is used.
- 3. The mixture control must be set in the "AUTO RICH" position.
- 4. The propeller control must be set in the full "INCREASE RPM" position to maintain 3000 rpm.
- 5. When KLG RC 5/5 or Lodge RS 5/3 spark plugs are installed.
- 6. The break-through seal must be installed on the emergency boost control lever to inform the crew chief that the engine has been operated at War Emergency Ratings, so that he will then make special inspections and checks. Close co-ordination between the pilot, crew chief, and engineering officer will be required to maintain an accurate record of the time the engine has been operated at War Emergency Rating conditions. When five hours of War Emergency time have been accumulated, the engine should be pulled for tear-down inspection and reconditioning.
- 7. During the use of War Emergency Ratings, with Spec. AN-O-5, Grade 1100p lubricating oil in the system, the following oil inlet temperature must not be exceeded: 95°C (203°F) for 5 minutes.

#### CAUTION

It oil dilution has been used, it is desirable that the engine be given 10 to 15 minutes operation at from 80 percent normal to military power prior to the use of War Emergency Ratings.

- 8. During the use of War Emergency Ratings, the cooling system should be filled with 70 percent water and 30 percent ethylene glycol to AN-E-2 specification, and the coolant outlet temperature should not be permitted to exceed 121°C (250°F).
- 9. The airplane must be placarded with a decal stating that War Emergency Ratings are permissible.
- (2) OPERATION.—If the airplane is so placarded and it is deemed necessary to use the War Emergency Rating, proceed as follows:
  - (a) Place mixture control in "AUTO RICH."
  - (b) Move propeller control to full "INCREASE."

- (c) Pull out on boost control lever from "AUTO-MATIC" to "EMERGENCY."
  - (d) Advance throttle to full open position.
- (e) Use War Emergency Rating for 5 minutes maximum.
  - (f) Push boost control lever in.

### 15. ENGINE FAILURE DURING FLIGHT.

Follow instructions in Section IV, paragraph 2.

### 16. FLYING CHARACTERISTICS.

a. GENERAL.—The airplane is stable at all normal loadings, but the directional trim changes at low speeds as speed and horsepower output is varied. The trim tab controls are sensitive and must be used carefully. The effect of flap and landing gear operation on the trim of the airplane in flight is as follows:

Landing gear retracted—airplane becomes tail heavy.

Landing gear extended—airplane becomes nose heavy.

Flaps lowered—airplane becomes nose heavy.

Flaps raised—airplane becomes tail heavy.

A sustained sideslip cannot be performed in this airplane; recovery should be effected above 200 feet.

### b. FLIGHT CHARACTERISTICS FOR AIRPLANES WITH FUSELAGE TANK INSTALLATION.

### **IMPORTANT**

The pilot should become accustomed to the handling qualities of the airplane with full fuselage tanks before engaging in any maneuvers. One or two hours of flying should acquaint the pilot with the airplane characteristics.

- (1) FUSELAGE TANK FULL.—The stability of the airplane improves rapidly as fuel is expended from the fuselage tank. The stick forces will reverse when entering a tight turn or attempting a pull-out with the fuselage tank full. Considerable forward pressure on the stick is necessary to prevent the airplane from tightening up in a turn or pull out to a marked degree. The tendency is more severe in left turns than in turns to the right. In this condition, it is practically impossible to turn the aircraft for hands-off level flight.
- (2) FUSELAGE TANK HALF FULL.—When this condition is reached, the stability is much improved. A slight tendency to tighten up is noticeable in left turns only

### PILOT'S OPERATING INSTRUCTIONS Sec II, Pars 16-21

### RESTRICTED AN 01-60JE-1

and it is impossible to trim for hands-off level flight. The airplane stability improves rapidly and the flying characteristics are normal as more fuel short of the half-full position is used.

### 17. MANEUVERS PROHIBITED.

- a. Only normal flying attitudes are permitted when the airplane is carrying external fuel tanks.
- **b.** The airplane should not be intentionally spun except under the following conditions:
- (1) Intentional "power-off" spins will be permitted, provided such spins are started above 12,000 feet.
- c. Intentional "power-on" spins and snap rolls are prohibited.
- (1) It is impossible to do a good snap roll with the airplane and most attempts usually end up in a power spin.
- (2) In the event a power spin is entered inadvertently, the throttle should be closed immediately and normal recovery methods used. The controls must be held in the recovery position until full recovery is completed. Recovery from a two to five-turn power spin may require up to six turns with a loss in altitude of as much as 9,000 feet.

### 18. STALLS.

The stall in this airplane is comparatively mild in that it does not whip at the stall but rolls rather slowly, and has very little tendency to drop into a spin. If the stick and rudder are released at the stall, the nose drops sharply and the airplane recovers from the stall almost instantly. When the stalling speed is reached, a wing will drop. If the backward movement on the stick continues when the wing drops, the airplane will fall into a steep spiral. In a straight "poweroff" stall, some warning is given about 3 to 4 mph above the stall by slight elevator buffet. A high-speed stall is preceded by sharp buffeting at the elevators and wing root, but recovery is almost immediate when pressure on the stick is released. Recovery from any stall in this airplane is entirely normal, that is, by the release of back pressure on the stick and the application of rudder opposite the dropping wing. As the speed at which a stall occurs can vary widely, depending on the gross weight and external loads of the airplane, the stalling speed charts, figures 24 and 25 should be carefully studied before flight.

### 19. SPINS.

- a. DIFFERENCES.—There are marked differences between a sustained left and right spin in this airplane.
- (1) The left spin oscillates from 80 degrees below the horizon back to the horizon during the first turn, dampens out 50 percent during the second turn, and then becomes stable, smooth, and quiet with the nose approximately 30 to 40 degrees below the horizon.
- (2) The right spin starts exactly the same as the left spin, but the oscillations continue without increasing or decreasing in magnitude.
- b. RECOVERY.—Recovery procedure is the same in both a left and right spin. Upon application of opposite rudder, the nose drops slightly and the spin speeds up rapidly for 1½ turns, after which the spin stops. Rudder force is light at first, becomes very heavy for a period of about one second at the first half turn after starting recovery, then drops to zero as the spin stops. Recovery is effected in the normal manner, that is, by applying full opposite rudder followed by movement of the stick to neutral.

### NOTE

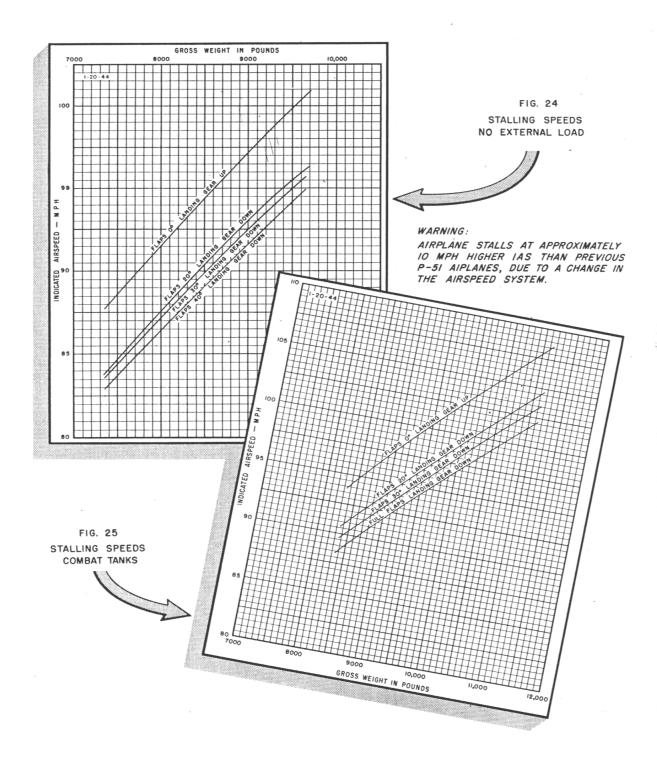
Slight rudder buffet occurs during the spin. If recovery from the dive is attempted too soon after the spin is stopped, a rather heavy elevator and rudder buffet will occur.

### 20. ACROBATICS.

The acrobatic qualities of this airplane are exceptional, and the lateral control is excellent at all speeds. All acrobatics except snap rolls are permitted. However, inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenger pump to operate in inverted position.

### 21. DIVING.

The maximum permissible diving speed is 505 IAS, during which the engine speed must not exceed 3240 rpm. The use of elevator tabs is not required for dive recovery because of the low elevator control forces. As the airplane gains speed very rapidly in a dive, it is of utmost importance to make allowance of ample altitude for a safe recovery before starting the dive. The Estimated Diving Limitations Chart, figure 26, indicates the estimated minimum safe altitudes required for a pull-out from dives of



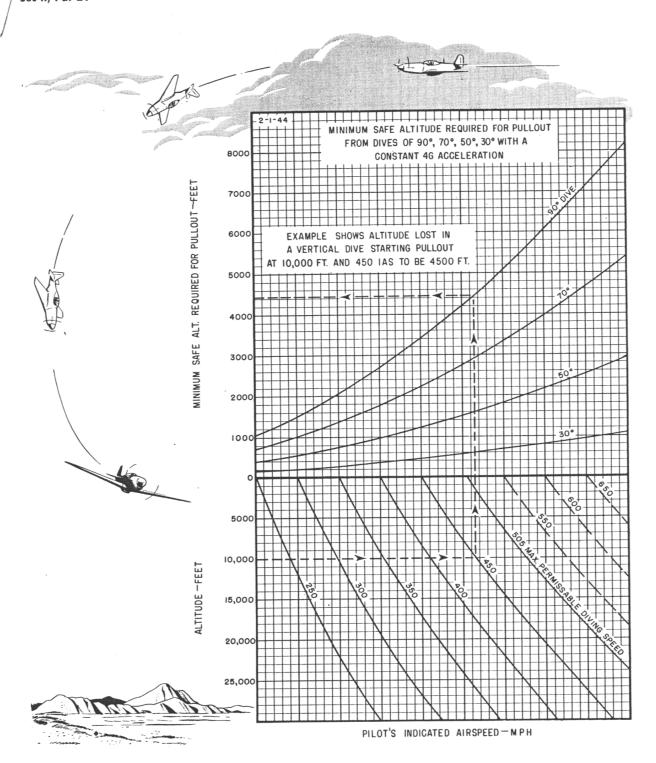


Figure 26—Estimated Diving Limitations

90°, 70°, 50°, and 30°, with a constant 4G acceleration. Pull-outs should not be attempted at greater than 4G's unless the pilot has special equipment to enable him to withstand greater accelerations without blacking out.

### 22. GLIDING.

Gliding may be carried out at any safe speed down to the recommended margin of about 25 percent above stalling speed. With the landing gear and flaps up, the glide is fairly flat with the nose very high. Forward visibility in this condition is poor. Lowering either the flaps or landing gear, or both, greatly steepens the gliding angle, and the rate of descent is greatly increased.

### 23. NIGHT FLYING.

#### IMPORTANT

Become accustomed to the position of the various light switches by feel, especially the switch for the landing light.

### NOTE

Spare bulbs are contained in the small compartment on the right forward side of the cockpit.

- a. In flying this airplane at night, the sequence outlined for daylight operation should be even more strictly observed. In addition, the pilot should familiarize himself with the location of the different lights and their control switches.
- (1) INSTRUMENT LIGHTING.—Turn on the fluorescent lamps by turning the rheostat knobs (on radiator air control panel and right-hand switch panel) to "START" until the lights come on; then switch to either "ON" or "DIM" positions. Rotating the lens housing selects the visible or invisible illumination.
- (2) POSITION LIGHTS.—The position light switches are on the right-hand switch panel. Two intensities of light are available: "BRIGHT" and "DIM."
- (3) LANDING LIGHT.—The switch for the landing light is located on the radiator air control panel.
- (4) COCKPIT LIGHTS.—A cockpit swivel light is on each side of the cockpit. Turn on light by turning switch on lamp housing. The cockpit light switch on the pilot's switch panel must be "ON" before operating the lights.
- (5) RECOGNITION LIGHTS.—Set the switches, located on the right-hand switch panel, for the light or combination of lights desired. Place the switches in "STEADY"

position for continuous operation and in "KEY" position for intermittent operation, by means of the keying switch on the right longeron.

### 24. APPROACH AND LANDING.

- a. APPROACH.—When the airplane approaches the field, this sequence of operations should be followed:
  - (1) Mixture control "AUTO RICH."
- (2) Oil and coolant radiator air controls "AUTO-MATIC."
- (3) Fuel selector valve to either "MAIN L.H.," "MAIN R.H.," or "FUS. TANK." Booster pump switch "NORMAL."
  - (4) Propeller control set for 2700 rpm.
- (5) Lower the landing gear below 170 IAS. Check position of gear by the warning light on the instrument panel.
- (6) If desired, the flaps may be lowered 15 degrees to give a steeper approach angle. When the airplane has been brought into the wind for landing, the flaps should be lowered fully at an altitude of at least 400 feet, provided the indicated airspeed is below 165 IAS and above 100 IAS.

### b. LANDING.

- (1) GENERAL.—Having turned into the field and lowered the flaps, maintain a correct gliding speed. Adjust the elevator trim tab to assist in landing. Having stopped after landing, raise the flaps before taxiing.
- (2) CROSS-WIND LANDING.— As this airplane has a landing gear of wide tread and a locked tail wheel, cross-wind landings may be negotiated safely. Keep one wing down, into the wind, to counteract drift.
- (3) TAKE-OFF IF LANDING IS NOT COM-PLETED.—In the event of an unsuccessful attempt to land, open the throttle and then push the propeller control forward to full "INCREASE." Raise the landing gear immediately; then, when the airspeed has reached 100 IAS, raise the flaps.

### 25. STOPPING ENGINE.

- a. To stop engine, proceed as follows:
  - (1) Turn booster pump switch "OFF."
- (2) If a cold weather start is anticipated, hold oil dilution switch, on pilot's switch panel, "ON" (2 minutes maximum).

### PILOT'S OPERATING INSTRUCTIONS Sec II, Pars 25-27

### RESTRICTED AN 01-60JE-1

- (3) Run engine to 1500 rpm, set mixture control to "IDLE CUT OFF" and move throttle fully open. Leave mixture control in "IDLE CUT OFF" as a precaution against accidental starting.
- (4) Turn ignition switch to "OFF" after the engine ceases firing.
  - (5) Turn "OFF" fuel shut-off valve.

### 26. BEFORE LEAVING COCKPIT.

- a. After engine stops, proceed as follows:
  - (1) Turn "OFF" all switches.
  - (2) Set parking brakes.

#### WARNING

If brakes are hot as a result of frequent applications, wait until they have cooled before applying parking brakes. Otherwise, the brake discs will fuse to each other.

- (3) Lock the control surfaces.
- (4) Place the carburetor air control in "UNRAMMED FILTERED AIR" position.
- (5) Pull out on sliding canopy crank handle, place pin between holes on face of clutch housing, and push on knob of handle. This will disengage crank axle from clutch and allow canopy to be moved manually.
  - (6) Close canopy after leaving cockpit.

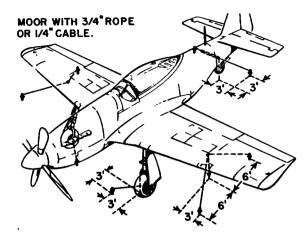


Figure 27—Mooring Airplane

### 27. TYING DOWN.

- a. Head the airplane into the wind.
- b. Set the parking brakes.
- c. Lock the surface control lock, using the lower locking notch on the control stick in order to lock the tail wheel.
- d. Moor the airplane with \(^3\)/4-inch rope or \(^1\)/4-inch cable. Secure the wing with two ropes at each of the mooring rings in the wing, one tied 6 feet forward and 3 feet outboard, and one tied 6 feet aft and 3 feet outboard of each mooring ring. Secure each main landing gear towing lug to the ground with a rope tied 3 feet forward and 3 feet inboard of the respective towing lug. Moor the tail section of the fuselage to the ground with one rope strung through the lift tube and tied on each side of the airplane, 2 feet aft and 3 feet outboard of the lift tube.
  - e. Install engine and cockpit covers.





### 1. SPECIFIC ENGINE FLIGHT CHART.

- a. Operating limitations and characteristics of the V-1650-7 engine are summarized for ready reference on the Specific Engine Flight Chart (figure 28). A similar chart (figure 29), applicable to the V-1650-3 engine, is provided for use on airplanes which have had V-1650-3 engines installed in service. The pilot should be thoroughly familiar with this information.
- b. Engine power ratings shown on the chart are defined as follows:
- TAKE-OFF.—Maximum recommended for takeoff under the specified time limit of five minutes.
- (2) WAR EMERGENCY.—Maximum allowed for emergency operation during combat for a period not exceeding 5 minutes.
- (3) MILITARY.—Maximum recommended for operation for periods not exceeding 15 minutes.
  - (4) MAXIMUM CONTINUOUS.—Maximum rec-

ommended for operation with rich mixture in climb and level flight.

- (5) MAXIMUM CRUISE.—Maximum recommended for operation with lean mixture.
- (6) MINIMUM SPECIFIC CONSUMPTION.—The power at which greatest range can be obtained under average loading conditions.

### 2. AIRSPEED CORRECTION CHART.

INDICATED AIRSPEED-MPH	CALIBRATED INDICATED AIRSPEED-MPH	ALTIMETER ADD TO INSTR S.L.		
180	181.5	20	25	35
210	212	25	35	45
240	242	30	45	60
270	272	35	50	70
300	302	45	60	85
330	332	50	70	100
360	362.5	60	85	115
390	393	70	100	140

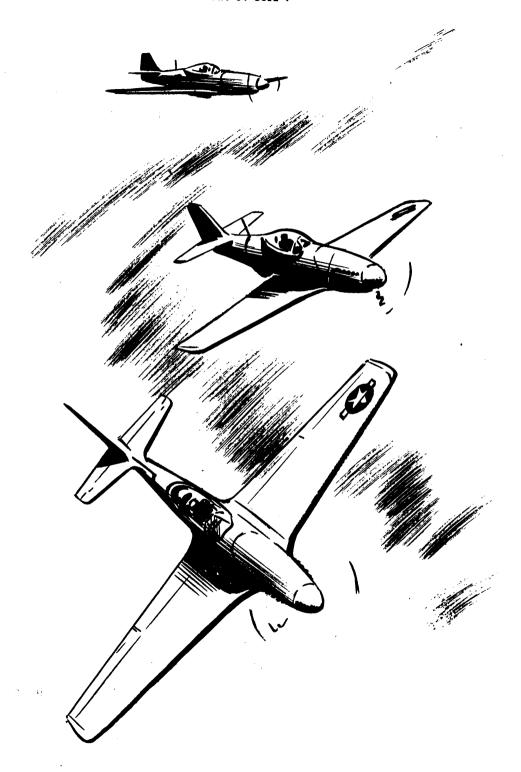


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9   15   16   16   17   16   17   16   17   16   17   17	15	89	9	0+			MIN. SPECIFIC	-	3U.S.QT/HR	S.QT/HR		IMP.PT/HR
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CONTINUOUS	1.80			11,300	# C		A.R.	109				CONT.
MAXIMUM 2400 36	820 760			14,000	H GH		A.L. A.L.	9 z				COMT.
MINIMUM SPECIFIC CONSUMPTION										, <u>.</u>	1.49-1-11	

Figure 28—Specific Engine Flight Chart—V-1650-7

P-51D     P-51D     PACKARD V-1050-3     PACKARD V-1050-3     PACKARD V-1050-3     PACKARD V-1050-3     PACKARD V-1050-3		AIRPLAN	AE MODELS				SPEC	HE	SPECIFIC ENGINE	g		ENG	ENGINE MODELS	ODELS	
FIGH   PRINCE   PRI		á.	-510		:			CHT			:	PACK	ARD V-16	350-3	
12-16   10-16   12-1	4				:										
12-16   70-80   156   110   212   120		FUEL	110	• i	ا ہے	COOL	ANT			MAX. PERMI		DIVING R		3240	
12-16   70-80   156-   100-   212-   100-   212-   100-   212-   100-   212-   100-   212-   100-   212-   100-   212-   100-	CONDITION	PRESSURE		T .		S.			1	CONDITION	_	ALI	OWABLE O	IL CONSU	MPTION
19   90   90   194   121   250   MAX. CRUISE   * U.S.GT/HR	DESIRED	12-16	+-	70-80	158-	+	212-			MAX. CO	F	:	J.S.QT/HR		IMP.PT/HR
15   59   60   140	MAXIMUM	61	06	8	<u>इ</u>	+-	250			MAX. CRU		₹	J.S.QT/HR	:	IMP.PT/HR
Full Grade: 15)   15   15   15   15   15   15   15	MINIMUM	12	20	15	59	8	0+			MIN. SPEC		:	J.S.QT/HR		IMP.PT/HR
Fuel Grade: 39   Fuel Grade: 39   Fuel Grade: 30   Fuel	IDLING	6	15							OIL GRADE: (	S)		<b>3</b>	001	
RPM   PRESSURE   POWER   WITH RAM   NO RAM   20   BLOWE   CONTROL   CT. TEAP.   S.L.   LOW   CONTROL   CGAL/HR/ENG.]   CT. TEAP.   S.L.   LOW   CONTROL   CGAL/HR/ENG.]   CT. TEAP.   CT	SUPERCHAR	GER TYPE:		10 STAGE						FUEL GA	ADE:	SPEC. AN-	.F-28		OCTANE 100
Second   Pressure   Power   With ram   No ram   Second   Below:   Position   U.S.   T.	OPERATING		MANIFOLD	T SACE	Ľ	STICAL ,	ALTITUDE	AEK	USE LOW	MIXTURE	FUEL	FLOW IR/ENG.)	MAXIM CYL. TE	W.	MAXIMUM
3000         61         1400         5.L.         LOW         AR         150           3000         67         1595         17,000         11,700         LOW         AR         166           3000         61         1450         23,200         11,700         LOW         AR         166           2700         61         1450         31,200         25,600         104         AR         119           2700         46         1120         20,500         17,500         LOW         AR         111           2400         36         940         31,400         29,500         104         AR         111           2400         36         700         21,500         18,500         LOW         AL         74           1600         27         370         32,300         30,500         HIGH         AL         70           1600         27         370         30,500         LOW         AL         35           1600         31         480         10,000         LOW         AL         42           1600         51         10,000         LOW         AL         41         45           1600	CONDITION	RPA W	PRESSURE (BOOST)	POWER	H	FAM	NO RAM	1018	BELOW:	POSITION	U.S.		ņ		(MINUTES)
3000         67         1595         17,000         11,700         LOW         AR         166           3000         61         1295         28,800         23,200         HIGH         AR         160           2700         61         1450         31,200         25,600         HIGH         AR         118           2700         46         1120         20,500         17,500         LOW         AR         111           2400         36         800         21,500         18,500         LOW         AR         11           2400         36         800         21,500         18,500         LOW         AL         74           1600         27         370         32,300         30,500         HIGH         AL         70           1600         27         370         5,000         LOW         AL         35           1600         27         440         5,000         LOW         AL         35           1600         71         600         16,000         LOW         AL         35           1600         71         16,000         16,000         10,000         10,000           1600         <	TAKE-OFF	3000	19	001	,	با	S.L.	101		AR	120				ur.
3000         61         1450         1235         28,800         23,200         Hidd         AR         158           2700         46         1130         20,500         17,500         LOM         AR         111           2400         36         940         31,400         29,500         HIGH         AR         111           2400         36         800         21,500         18,500         LOM         AL         74           1600         27         370         32,300         30,500         HIGH         AL         35           1600         27         370         5,000         LOM         AL         35           1600         31         480         16,000         LOM         AL         33           1600         5,000         LOM         AL         35         42           1600         7.7         LOM         AL         42           1600         15,000         LOM         AL         42           1600         16,000         LOM         AL         45           160         16,000         LOM         AL         45           160         16,000         LOM	WAR	3000	29	1595	-1	000	11,700	-		AR	991				w
3000         61         1450         13,000         15,000         15,000         15,000         15,000         15,000         15,000         15,000         16H         AR         111           2700         46         1120         20,500         17,500         LOW         AR         111           2400         36         800         21,500         18,500         LOW         AL         74           2400         36         700         32,300         30,500         LOW         AL         70           1600         37         370         5,000         LOW         AL         35           1600         31         480         16,000         LOW         AL         33           1600         5,000         16,000         LOW         AL         42           1800         F.T.         560         26,000         LOW         AL         45	EMERGENCY			1295	28	980	23,200	+		AK AK	2 2				1
2700         46         1120         20,500         17,500         LOW         AR         111           2400         36         940         31,400         29,500         HIGH         AR         106           2400         36         800         21,500         18,500         LOW         AL         74           1600         27         370         32,300         30,500         HIGH         AL         70           1600         27         370         5,000         LOW         AL         35           1600         31         480         10,000         LOW         AL         42           1600         5,000         15,000         LOW         AL         44         45           2000         5,000         LOW         AL         45         50         44         50	MILITARY	3000	5	06	<u> </u>	8 8	25,600	-		¥ ¥	3				c
2400         36         800         21,500         18,500         LOW         AL         74           2400         36         700         32,300         30,500         HIGH         AL         70           1600         27         370         5.L.         LOW         AL         35           1600         30         440         5,000         LOW         AL         35           1600         31         480         10,000         LOW         AL         445           2000         F.T.         560         20,000         LOW         AL         45	MAXIMUM		911	940	32 20	,500 ,400	17,500			AR AR	= 9				CONT.
1600   27   370   5.1.   LOW   AL   35   1600   31   440   15.000   LOW   AL   45   15.000   LOW   AL   45   15.000   LOW   AL   45   15.000   LOW   AL   50   20.000   L	MAXIMUM	2400	36	800	22	,500	18,500			7 7	₹ 2				CONT.
1600 31 440 10,000 LOW AL 42 1600 15,000 LOW AL 45 50 20,000 LOW AL 50		0091	25	370	8 4			5.6		14 14	35				
	SPECIFIC CONSUMPTIO			2 4 4 2 6 0 2 6 0 2 6 0	258	8888		666		1222	3,3,8				CONT.

Figure 29—Specific Engine Flight Chart—V-1650-3





# 1. GENERAL.

All emergency instructions, except those included in Section II, have been assembled in this Section to facilitate quick reference. The pilot should thoroughly acquaint himself with these instructions before his first flight in this airplane.

# 2. ENGINE FAILURE DURING FLIGHT.

- a. If the engine fails during flight, the airplane may be abandoned, ditched, or brought in for a dead-stick landing, as the case requires. For a landing with the engine dead, follow these instructions:
- Depress the nose at once so that airspeed does not drop below stalling speed.
- (2) If external fuel tanks or bombs are installed, release them immediately (see paragraph 6).
- (3) Release the sliding canopy by pulling emergency release handle on right longeron.

# WARNING

Bend forward and lower head slightly when pulling release handle so as to avoid injury from the lousened canopy. If the canopy does not fly off, move it back with handcrank.

- (4) Do not lower the landing gear. There is less chance of personal injury if the airplane is landed with the gear up.
  - (5) Lower the flaps fully, if possible.
- (6) Move mixture control to "IDLE CUT OFF" and turn ignition switch "OFF."
- (7) Turn "OFF" fuel shut-off valve and battery-disconnect switch.
- (8) Land into the wind, only changing direction sufficiently to miss obstructions.
- (9) After landing, get out of the airplane as quickly as possible and remain outside.

EMERGENCY OPERATING INSTRUCTIONS
Sec IV, Par 2

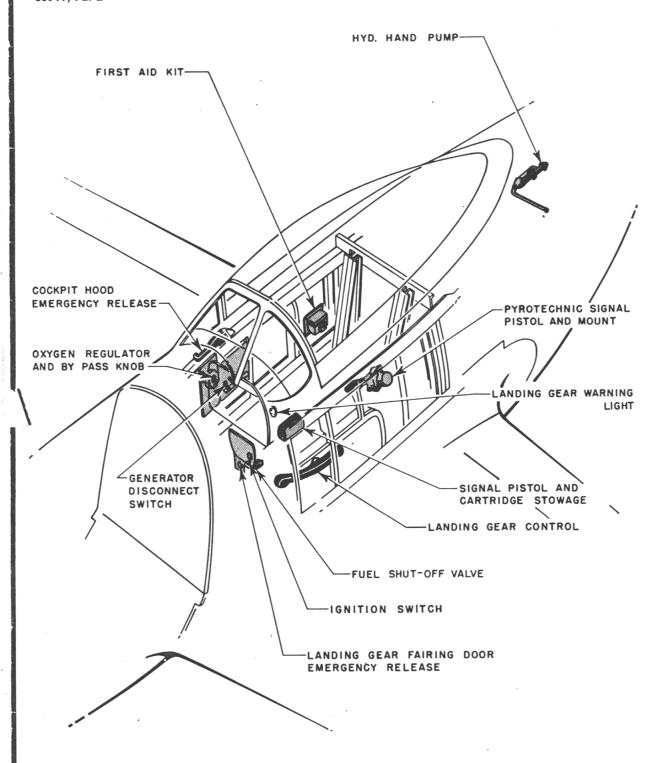


Figure 30-Emergency Equipment

### 3. EMERGENCY EXIT DURING FLIGHT.

- a. In the event that an emergency exit must be made during flight, the following proceduces are recommended:
- (1) Release sliding canopy and unfasten safety belt and shoulder harness. Roll airplane over on its back and drop out.
- (2) Release sliding canopy and unfasten safety belt and shoulder harness. Climb out of cockpit, lower self onto wing, and roll off.

# IMPORTANT

When pulling emergency release handle, bend forward and lower head slightly to avoid head injury when canopy releases.

### 4. DITCHING.

- a. The airplane should be ditched only as a last resort. If, on an overwater flight, trouble arises and the pilot is quite certain that he will not be able to reach land, he should leave the airplane while in flight. However, if it is not possible to maintain sufficient altitude for a successful parachute drop, ditching is the only remaining procedure. The instructions for ditching are as follows:
- (1) If bombs or droppable tanks are installed, release them immediately.
- (2) Release sliding canopy. (See IMPORTANT note in paragraph 3.)
- (3) Be sure the shoulder harness and safety belt are fastened securely, as there is a violent deceleration of the airplane upon final impact.
- (4) Land into the wind with landing gear up. As soon as the airplane comes to rest, get out *immediately*.

### **DANGER**

The pilot must get out quickly upon landing. After the final impact, the airplane will sink very rapidly, only remaining above the surface of the water for a period of  $1\frac{1}{2}$  to 2 seconds.

### 5. LANDING GEAR EMERGENCY LOWERING.

In the event of hydraulic system failure, the landing gear may be lowered by placing the landing gear control handle in the down position and yawing the airplane sideways. If the landing gear warning light does not go out when the throttle is retarded, pull the fairing door emergency knob, located just forward of the control stick, and then yaw the airplane sideways to force the gear into the locked position. If the tail wheel does not lock, increase the airplane's speed to increase the air load on the partially extended wheel, or dive the airplane a short distance and pull out with enough acceleration to down the tail wheel.

# EMERGENCY BOMB OR DROPPABLE FUEL TANK RELEASE.

The bombs or droppable fuel tanks are released as follows:

- a. EARLY AIRPLANES.—Hinge antisalvo guard upward and move bomb release handle to "SALVO."
- b. LATE AIRPLANES.—Pull out on both emergency bomb release handles at left side of instrument panel.

### 7. EMERGENCY USE OF OXYGEN.

If for any reason there is a lack of oxygen or if no oxygen flow is indicated by the flow indicator, immediately turn "ON" the red emergency knob on the regulator.

# 8. USE OF MISCELLANEOUS EMERGENCY EQUIPMENT.

- a. RADIO DEMOLITION SWITCH.—This switch, on the right side of the cockpit, controls a charge for demolishing the identification radio in an emergency. Press both buttons simultaneously to set off the charge.
- **b.** FIRST-AID KIT.—The contents of the first-aid kit are to be used only in an emergency when medical aid is not available. Use contents of kit in accordance with the directions contained therein.
- c. LIFE PRESERVER.—The back cushion on the pilot's seat is filled with kapok and may be used as a life preserver.





### NOTE

The following instructions apply only to operational equipment not used in the actual flying of the airplane. For flight operating instructions, see Section II.

#### 1. GUNNERY EQUIPMENT.

a. DESCRIPTION.—Either of two gun installations may be used: a maximum load of three fixed .50-caliber guns in each wing or an alternate installation of two guns in each wing. The maximum load includes 500 rounds of ammunition for each inboard gun and 270 rounds for each center and outboard gun. When the alternate installation is used, the center guns are removed, and 500 rounds of ammunition are provided for each outboard gun. An optical gun sight and an auxiliary ring sight are mounted on the instrument cowl; a bead sight is forward of the windshield. A Type N-4 gun sight aiming point camera equipped with an overrun control is mounted in the leading edge of the left wing.

#### b. OPERATION.

(1) On missions requiring gun heat, turn "ON" gun heater switch immediately after starting engine. Turn switch "OFF" when firing guns.

- (2) On combat missions, turn gun and camera safety switch to "GUNS AND CAMERA" as soon as the airplane is safely off the ground. Doing this eliminates the possibility of the pilot forgetting to turn the switch on during the excitement of combat.
- (3) To sight guns, turn gun sight rheostat, on right side of pilot's switch panel, toward "ON." Turning the rheostat in a clockwise direction increases the light intensity of the image. The gun sight will not operate until the gun and camera safety switch has been turned on.

#### NOTE

If the optical gun sight fails to function, install the ring sight by slipping the ring sight stem over the stud provided and rotating the ring sight to the left into the stem clip.

(4) Fire guns by squeezing trigger switch on control stick grip. To operate camera only, turn gun safety switch to "CAMERA" and squeeze trigger switch.

### NOTE

When the gun and camera safety switch is on, the heaters in the camera will function automatically at low temperatures. Therefore, make certain the safety switch is "OFF" whenever the guns and camera will not be required.

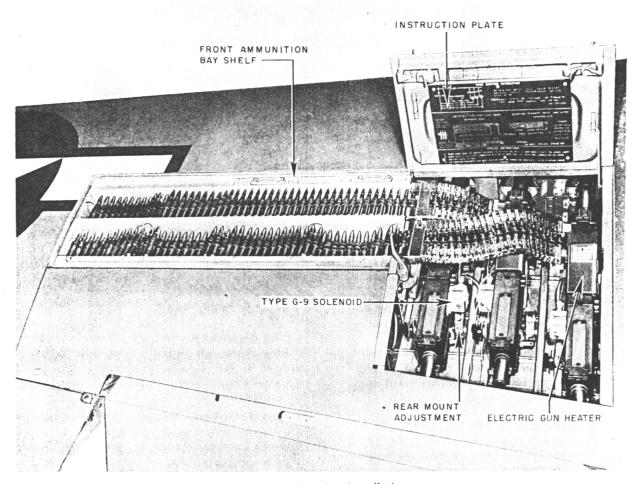


Figure 31—Wing Gun Installation

(5) Before landing, make sure that the gun and camera safety switch and gun heater switch are "OFF."

### 2. BOMBING EQUIPMENT.

a. DESCRIPTION.—An external, removable bomb rack may be installed under each wing. Each rack will hold one 100, 250, or 500-pound bomb. Chemical tanks or combat fuel tanks may be carried on the bomb racks when bombs are not installed. The tanks are released either by normal or salvo operation of the bomb control system. On early airplanes, a bomb salvo handle, on the left side of the cockpit, salvoes the bombs simultaneously. On late airplanes, two bomb salvo handles provide a selective mechanical

release of bombs or fuel tanks. The bomb system electrical controls consist of a bomb release switch on top of the control stick, and three bomb arming switches and a bomb release selector switch on the armament control panel. The gun sight is adjustable for use in low altitude bombing.

## b. OPERATION.

(1) GENERAL.—The electrical release of bombs is the normal release. The "SALVO" release is used only if the electrical release fails. The two "NOSE ARM" switches arm the nose fuse of the bombs on the left and right racks. The "TAIL ARM" switch arms the bomb tail fuse on both racks. The bomb release selector switch has the following positions: "BOTH," "SAFE," and "SELECTIVE." With the

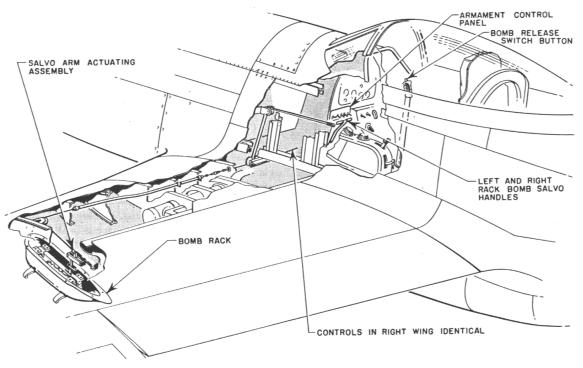


Figure 32-Bomb Rack Control System

selector switch on "BOTH," the bombs will be released simultaneously when the release switch is pressed. When the selector switch is on "SELECTIVE" and the bomb release switch is pressed, the left bomb will be released; when the bomb release switch is pressed again, the right bomb will be released. The bomb release circuit is inoperative when the selector switch is in the "SAFE" position.

#### NOTE

Bombs may be released when the airplane is in any attitude of flight from a 30-degree climb to a vertical dive.

#### CAUTION

To prevent bombs from falling into the propeller, do not release bombs when sideslipping more than 5 degrees in a vertical dive.

- (2) INOPERATIVE POSITION OF CONTROLS.

  —When not in use, the controls shall be positioned as follows:
  - (a) Bomb release selector switch on "SAFE."
  - (b) Nose and tail arming switches "OFF."
- (c) On early airplanes, bomb salvo handle with antisalvo guard down.

- (3) SELECTIVE RELEASE (ELECTRICAL). To release bombs selectively, proceed as follows:
  - (a) Place arming switches in desired position.

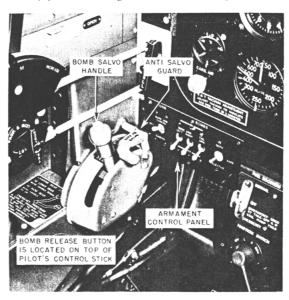


Figure 33-Bomb Controls-Early Airplanes

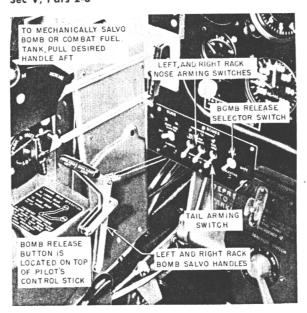


Figure 34-Bomb Controls-Late Airplanes

- (b) Place bomb release selector switch on "SE-LECTIVE."
- (c) Press bomb release switch button momentarily to release bomb on left rack.
- (d) Press bomb release switch button again to release bomb on right bomb rack.
- (e) Bomb arming switches "OFF," bomb release selector switch to "SAFE."
- (4) SALVO RELEASE (ELECTRICAL).—To release both bombs simultaneously, proceed as follows:
  - (a) Place bomb arming switches in desired position.
  - (b) Place bomb release selector switch on "BOTH."
- (c) Press bomb release switch; both bombs will release.
- (d) Bomb arming switches "OFF," bomb release selector switch to "SAFE."

### NOTE

For emergency bomb release instructions, see Section IV, paragraph 6.

# 3. COMMUNICATION EQUIPMENT.

a. GENERAL.—Radio equipment consists of a command set and an identification set. The command radio may be either SCR-522 or SCR-274-N. Identification equip-

ment may be either SCR-695 or SCR-515. Additional communication equipment includes a signal pistol, a signal lamp, and recognition lights.

#### h. COMMAND SET SCR-522.

(1) DESCRIPTION.—This set is a push-button type of transmitter-receiver, operating on the 100 to 156 mc band (see figures 36 and 37). The control box is just aft of the right-hand switch panel in the cockpit. A transmit-receive, remote control button is on the throttle lever. Lamps adjacent to the control buttons indicate which band is being used. A remote contactor, on the left side of the instrument panel, switches the transmitter from any of the four voicemodulated bands to the tone-modulated "D" band for 14 seconds of every minute. The pointer on the face of the contactor indicates when the switch's action will take place. The clock switch on the contactor should never be touched in flight; it is set on the ground by the service crew. A separate receiver, located on the floor at the pilot's right, is installed with this equipment for use in the reception of beacon signals, weather broadcasts, and airport communica-

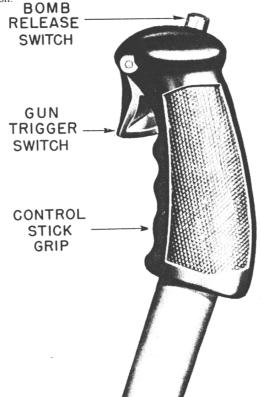
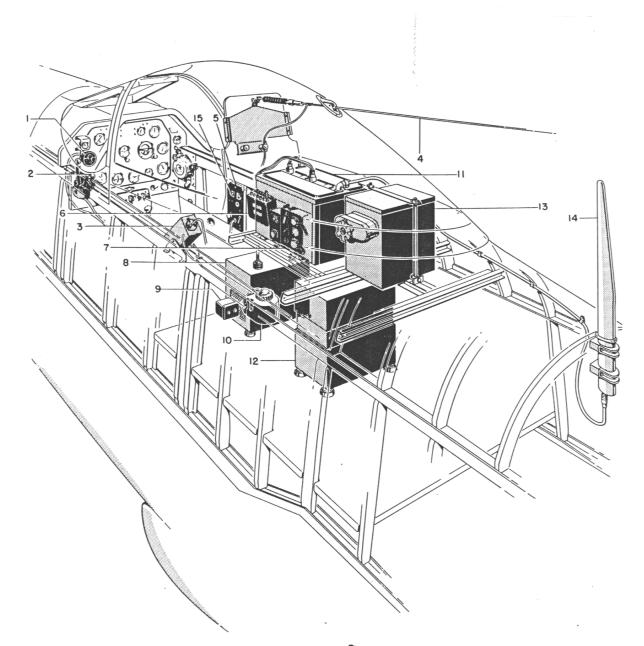


Figure 35—Gun and Bomb Control Switches



I. REMOTE CONTACTOR 2.THROTTLE SWITCH 3. DETROLA RECEIVER SCR-438 4 DETROLA & SCR-274-N ANTENNA 9. INDICATOR LAMPS SCR-695 5.106-71154 PANEL ASSEMBLY

6. CONTROL BOX SCR-522 7. CONTROL BOX SCR-695

8. POWER SUPPLY SCR-522

IO.INERTIA SWITCH SCR-695

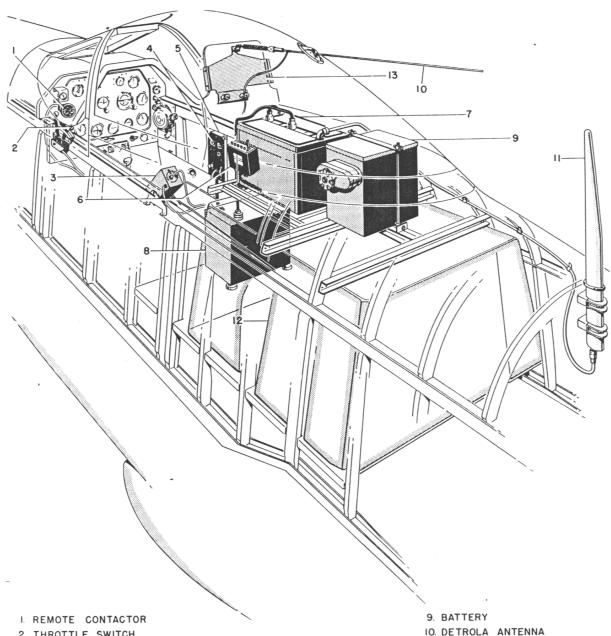
II.TRANSMITTER RECEIVER SCR-522 12. RADIO SCR-695

13. BATTERY

14. ANTENNA SCR-522

15. SCR-695 DETONATOR BUTTONS

Figure 36-SCR-522 and SCR-695 Radio Equipment



- 2. THROTTLE SWITCH
- 3. DETROLA RECEIVER
- 4. SCR-695 DETONATOR BUTTONS
- 5. 106-71154 PANEL ASSEMBLY
- 6. CONTROL BOX SCR-522
- 7. TRANSMITTER RECEIVER SCR-522 12. FUSELAGE FUEL TANK
- 8. POWER SUPPLY SCR-522
- II. ANTENNA SCR-522
- 13. ANTENNA SUPPORT ASSEMBLY

Figure 37—SCR-522 Radio Equipment (On Airplanes With 85 Gallon Fuselage Tank)

# (2) OPERATION.

### (a) TRANSMISSION.

- 1. Push button "A," "B," "C," or "D," depending upon the band to be used.
- 2. Allow set approximately one minute to warm up and, during this time, check contactor operation with switch in "OUT" and "IN" positions.
- 3. Transmit by pushing toggle switch at aft end of control box to "T" (transmit) position. To send an uninterrupted message, place contactor switch in "OUT" position.

### NOTE

The lever just forward of the transmit-receive toggle switch controls the momentary or permanent action of the switch. A similar lever at the forward end of the control box regulates the brightness of the indicator lamps.

- 4. Move transmit-receive toggle switch to "REM" (remote control) if the remote control button on the throttle lever is to be used. Push button to transmit.
  - 5. To turn set off, press button marked "OFF."

# (b) RECEPTION.

- 1. Turn toggle switch at aft end of box to "R" (receive), or to "REM" if remote control is desired.
- 2. Press button "A," "B," "C," or "D," depending on which band is desired. Allow set approximately one minute to warm up. Reception of a signal will indicate whether the receiver is operating properly.
  - 3. To turn set off, press button marked "OFF."

### NOTE

The auxiliary receiver used with this set is turned on and off by the hexagonal control knob. The round knob is the frequency control.

### c. COMMAND SET SCR-274-N.

# (1) DESCRIPTION.

(a) GENERAL.—This set consists of two transmitters and three receivers with independent controls for each group, an antenna switching relay, and the necessary accessory items for interconnection of the units (see figure 38). The control boxes are mounted at the pilot's right. With the fuselage tank installed, one transmitter and two receivers are installed on the upper radio support, providing a transmitting range from 4000 to 5300 kcs and a receiving range from 190 to 550 kcs and 3000 to 6000 kcs. When

the fuselage tank is not installed, an additional transmitter and receiver may be mounted on the fixed radio shelf, extending the transmitting range from 5300 to 7000 kcs and the receiving range from 6000 to 9100 kcs.

- (b) TRANSMITTER.—The transmitter control box contains three switches, marked "TRANS. POWER," "TRANS-MITTER SELECTOR," and "TONE-CW-VOICE." The switch marked "TRANSMITTER SELECTOR" has four divisions, two of which are used. Markings on the "TONE-CW-VOICE" switch indicate the type of signal being transmitted. With the switch turned to the "TONE" position, a signal is transmitted which is practically 100% modulated at 1000 cycles. With the switch turned to the "cw" position, a "continuous wave" or unmodulated signal will be transmitted. With the switch turned to the "VOICE" position, the microphone will be operative and voice will be transmitted when the push-to talk button on the throttle lever is pressed. For long-range communication, "cw" is most effective, "TONE" next, and "VOICE" least effective. The microphone is inoperative on both the "Cw" and "TONE" positions, and code signals may be transmitted by a key on top the transmitter control box. If desired, a separate key may be plugged into the jack marked "KEY."
- (c) RECEIVER.—The receiver control box is divided into three sections. A signal of specific frequency is received by using the section of the receiver control box which controls the particular receiver involved.

### (2) OPERATION.

- (a) TRANSMISSION.—Switch "ON" transmitter power switch, select one of the two transmitters, and turn "TONE-CW-VOICE" switch to the desired position.
- (b) RECEPTION.—Turn on switch in upper righthand corner of the control box section used. This switch, in addition to having an off position, has two selective positions marked "Cw" and "MCw," each of which is an on position and indicates the type of signal to be received. To increase the volume of the signal, turn the knob in the lower left corner of the control section in a clockwise direction.
- d. IDENTIFICATION EQUIPMENT.—The identification equipment is controlled from a box aft of the righthand switch panel. For operating instructions, see the communications officer in charge. Detonator buttons and an inertia crash switch are provided with this equipment.

# WARNING

Insert destructor plug only when the airplane is ready to take off. Remove plug immediately after landing.

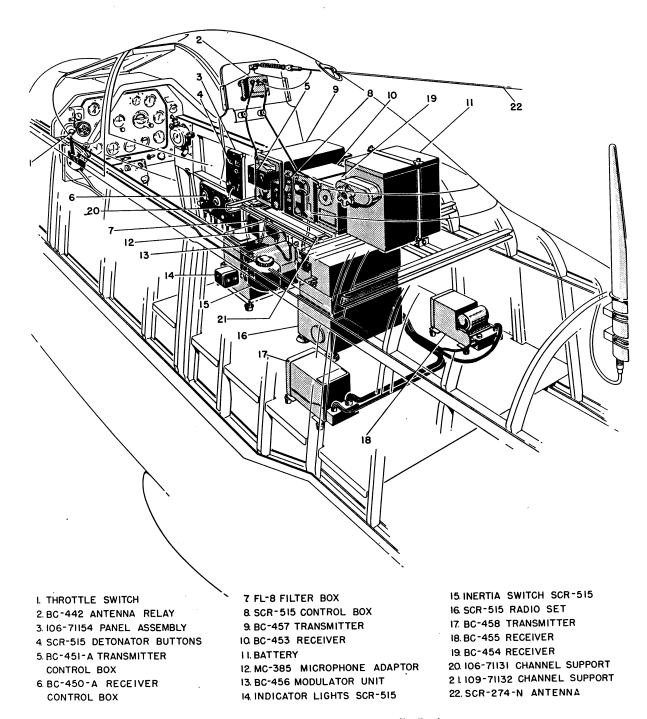


Figure 38—SCR-274-N and SCR-515 Radio Equipment

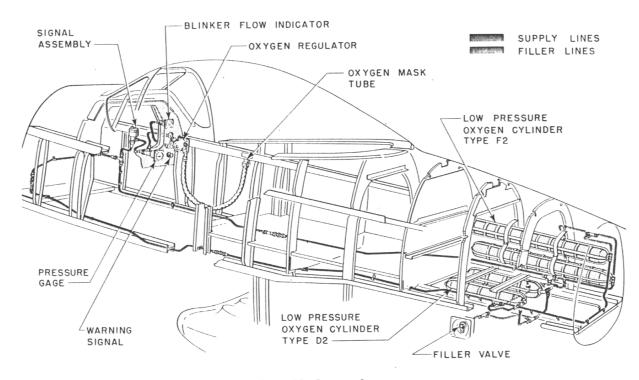


Figure 39-Oxygen System

# e. PYROTECHNIC RECOGNITION SIGNAL PISTOL.

(1) DESCRIPTION.—AN-M-8 pyrotechnic pistol is stowed in a canvas holster strapped to the pistol cartridge stowage bag on the upper left longeron, forward of the pilot's seat. A pistol mount is at the pilot's left. A cap, chained to the mount, covers the port when the pistol is not installed.

### (2) OPERATION.

- (a) Remove cover cap from mount.
- (b) Insert muzzle of pistol in the mount so that the lugs on the pistol barrel slip into the slots; then, while depressing the mount release trigger, turn the pistol to right or left as far as it will go.
- (c) To load pistol, press breech lock lever, behind the mount release trigger, and apply force on the butt until the breech opens. Then insert signal into the chamber and close breech. Pistol is cocked automatically when breech is closed.

### WARNING

Do not load pistol except when it is in the mount, since no safety is provided.

- f. SIGNAL LAMP.—A Type AN-3089 signal lamp may be stowed on a bracket on the left side of the cockpit floor. An electrical receptacle for the lamp is located on the extreme upper right side of the cockpit behind the pilot's seat. Colored filters may be used with the lamp.
- g. RECOGNITION LIGHTS.—For operation of recognition lights, see Section II, paragraph 23, a. (5).

### 4. OXYGEN SYSTEM.

a. DESCRIPTION.—Oxygen is supplied from two Type D-2 and two Type F-2 low pressure oxygen cylinders. A Type A-12 demand regulator, cylinder pressure gage, low-pressure warning signal, and flow indicator are in the cock-pit (see figure 39). A Type A-9, A-9A, A-10, or B-14 mask may be used with this equipment. The blinker flow indicator operates with the breathing of the wearer, indicating proper functioning of the system. When the pressure of the cylinders drops to the danger point (100 lbs./sq. in.), a signal lamp on the instrument panel illuminates. The oxygen cylinders may be refilled without removal from the airplane by means of a filler valve on the left rear side of the fuse-lage. Normal full pressure of the system is 365 lbs./sq. in. See figure 40 for oxygen consumption chart.

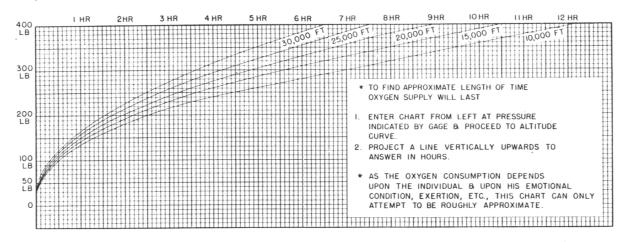


Figure 40—Oxygen Consumption Chart

# b. OPERATION.

# (1) PREFLIGHT CHECK.

- (a) See that mask is properly fitted and check for leakage by holding the thumb over the corrugated hose fitting and inhaling normally. See that mask is clean.
- (b) Check mask fitting to see that gasket is in place; then insert fitting into the end of the tubing from the regulator. Be sure the fit is snug and that a pull of at least 10 pounds is required to separate the two.
- (c) Inspect mask regulator tubing for damage. Make sure all clamps are firmly in place.
- (d) Attach the spring clip on the tubing to the clothing or parachute harness high up on the chest. It may be desirable to sew a tab of fabric or webbing to the cloth-

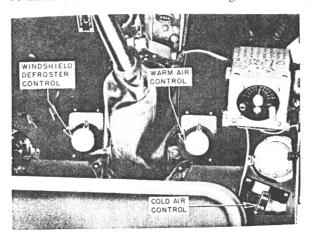


Figure 41—Heating, Ventilating, and Defrosting Controls

ing to accommodate the clip. Be sure that the attachment is high enough to permit free movement of the head without kinking the mask hose.

- (e) Make certain the knurled collar at the outlet end of the regulator is tight. Examine top diaphragm to see that it is not ruptured or distorted.
- (f) Turn emergency knob "ON" to check the flow. Check the pressure gage to see that there is no perceptible pressure drop. Turn emergency knob "OFF" and ascertain that it does not leak. Leave it in this position.
- (g) Turn the auto-mix to "OFF." Note on flow indicator that on inhalation the top diaphragm goes down and that nearly 100 percent oxygen is received. Turn the auto-mix to "ON" and note that there is little or no indication of oxygen flow on the indicator. Leave in this position.
- (b) Check that pressure of the system is not less than 365 lbs./sq. in. Before take-off, make certain that the pressure gage shows sufficient oxygen supply for the mission.

# (2) DURING FLIGHT.

- (a) If ice forms on mask, manipulate the mask at regular intervals to free it from ice.
  - (b) Be sure hose does not become kinked or twisted.
- (c) If a lack of oxygen is experienced, turn "ON" red emergency knob on regulator.
- (d) Check pressure gage and flow indicator frequently.
- (e) In any flight over 30,000 feet, pay particular attention to oxygen equipment. Be sure all units and instruments are functioning perfectly before attempting flight

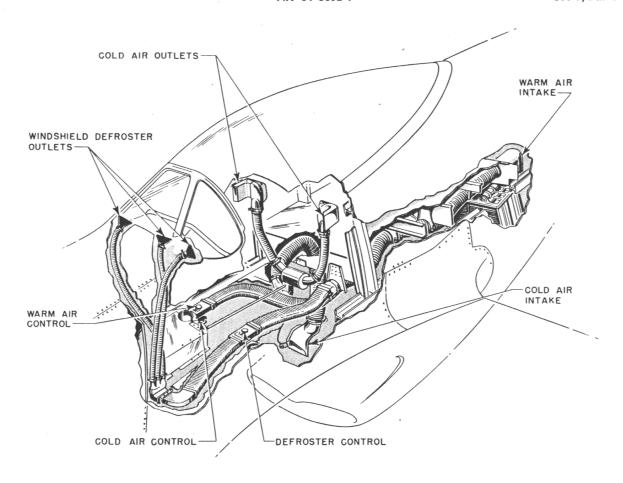


Figure 42—Heating, Ventilating, and Defrosting Systems

to extremely high altitudes. Any failure of the equipment may be fatal.

# (3) AFTER FLIGHT.

- (a) Be sure all oxygen equipment is in proper condition before leaving airplane. If any difficulties have developed during flight, take necessary steps to have them corrected.
- (b) If oxygen pressure is below 100 lbs./sq. in., see that the supply warning light is on. If the pressure is slightly above 100 lbs./sq. in., bleed oxygen out of sys-

tem by turning red emergency knob to "ON" and see that the supply warning light goes on at about 100 lbs./sq. in. Turn emergency knob to "OFF."

(c) Wash mask with mild soap and water, dry thoroughly, and leave in a clean airy place out of the sunlight.

#### NOTE

The oxygen mask will not stand abuse. See that the mask is properly stored or hung up in the airplane when not in use. Exposure of the mask to sunlight causes rapid deterioration.

# OPERATIONAL EQUIPMENT Sec V, Par 5

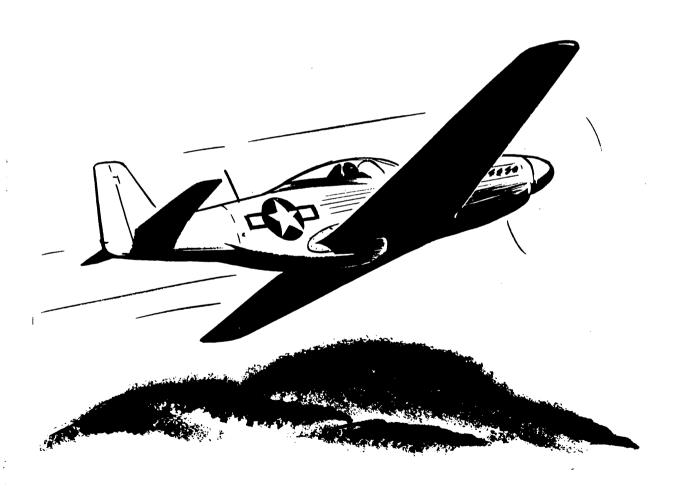
# RESTRICTED AN 01-60JE-1

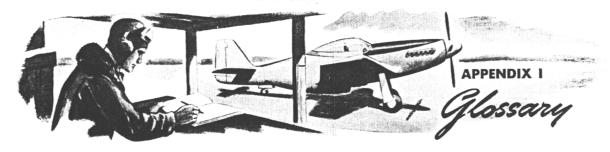
# 5. HEATING, VENTILATING, AND DEFROSTING SYSTEM.

a. COCKPIT HEATING AND DEFROSTING.—Warm air from aft of the coolant radiator is utilized to heat the cockpit and to defrost the windshield and left side window (see figure 42). The cockpit hot air control is on the floor at the right of the control column; the defroster control is on the floor at the left of the control column.

To admit warm air turn desired control to the right, to-ward "ON."

b. COCKPIT VENTILATION.—Air from the forward section of the radiator air scoop is used to cool the cockpit. The cold air control is on the floor at the right side of the pilot's seat. Cold air outlets are located behind the pilot's seat.





AMERICAN TERMINOLOGY	BRITISH TERMINOLOGY
Accumulator	Pressure Reservoir
Battery	Accumulator
Carburetor	Carburettor
Cockpit Enclosure	Cockpit Hood
Control Stick	Control Column
Empennage	Tail Unit
Engine (Power Plant)	Aero-Engine
Firewall	Fireproof Bulkhead
Indicated Airspeed	Air-Speed-Indicator Reading
Land	
Landing Gear	Undercarriage
Left	Port
Lines	Pipes
Manifold Pressure	Boost
Mooring Rings	Picketing Rings
Radio	Wireless
Right	Starboard
Shock Strut	Oleo Leg
Surface Control Lock	Locking Gear
Surface Controls	Flying Controls
Windshield	Windscreen
Wing	Main Plane



RESTRICTED



### 1. FLIGHT PLANNING.

### a. GENERAL.

(1) A series of charts on the following pages is provided to aid in selecting the proper power and altitude to be used for obtaining optimum range of the airplane. Charts are provided for each airplane configuration with the probable ranges of gross weights.

#### NOTE

Two sets of Flight Operation Instruction Charts are provided. The first set of charts (figures 44 through 50) is applicable to airplanes with V-1650-7 engines; the second set (figures 51 through 57) applies to airplanes which have had V-1650-3 engines installed in service.

(2) It the flight plan calls for a continuous flight where the desired cruising power and airspeed are reasonably constant after take-off and climb and the external load items are the same throughout the flight, the fuel required and flight time may be computed as a single section flight. If this is not the case, the flight should be broken up into sections, and each leg of the flight planned separately, since dropping of external bombs or tanks causes considerable changes in range and airspeed for given power. (Within the limits of the airplane, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in an airplane, speed is obtained at a sacrifice of range, and range is obtained at a sacrifice of speed.)

# b. USE OF CHARTS.

- (1) Although instructions for their use are shown on the Flight Operation Instruction Charts, the following expanded information on proper use of the charts may be helpful.
- (2) Select the Flight Operation Instruction Chart for the model airplane, gross weight, and external loading to be used at take-off. The amount of gasoline available for flight planning purposes depends upon the reserve required and the amount required for starting and warm-up. The fuel required for warm-up and initial climb is set forth on

the chart. Reserve should be based on the type of mission, terrain over which the flight is to be made, and weather conditions. The fuel required for climb and time to climb to various altitudes is shown on the Take-off, Climb, and Landing Chart. Fuel remaining after subtracting reserve, warm-up, and climb fuel from total amount available is the amount to be used for flight planning.

- (3) Select a figure in the fuel column in the upper section of the chart equal to, or the next entry less than, the amount of fuel available for flight planning. Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the distance (with no wind) to be flown. Operating values contained in the lower section of the column number in which this figure appears represent the highest cruising speeds possible at the range desired. It will be noted that the ranges listed in column I are correct only at sea level and are conservative for higher altitudes. The ranges shown in column II and other columns to the right of column II can be obtained at any of the altitudes listed in the Altitude column. All of the power settings listed in a column will give approximately the same number of miles per gallon if each is used at the altitude shown on the same horizontal line with it. Note that the time required for the flight may be shortened by selection of the higher altitudes. In long-range cruising it is important that altitude, airspeed, and rpm be held constant. The manifold pressure should be changed as required to hold the above values reasonably constant. The flight duration may be obtained by dividing the true airspeed of the flight altitude into the air miles to be flown.
- (4) The flight plan may be readily changed at any time en route, and the chart will show the balance of range available at various cruising powers by following the Instructions for Using Chart printed on each chart.

### **IMPORTANT**

The above instructions and following charts do not take into account the effect of wind. Adjustments to range values and flight duration to allow for wind may be made by any method familiar to the pilot, such as by the use of a flight calculator or a navigator's triangle of velocities.



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Figure 43—Take-off, Climb, and Landing Chart

MS	-		ed cruising only.	ganons per mour	dicated airspeed			Α	RANGE IN AIR MILES	NAUTICAL	1100	096	830	089	550	420		280	140	MAXIMUM RANGE	MIX. N. P. G. T. TURE In. P. A. R. B.		AR FT 62 360	2 5	70 13	$\overline{}$	42	33 38	AL 31 34 200	F. T.: PUL THEOTILE A.E.: PUL RICH A.E.: AUTO-RICH C. L.: AUTO-RICH C. L.: CRUISING LEAN INARY.
EXTERNAL LOAD ITEMS	BOMB RACKS		Column I is for emergency high speed cruising only.  [, III, IV and V give progressive increase in range at a	ressure (m. r.), I. A. S.) are apj	n cy maintain in	re than 3 in. Hg.			RANGE IN	STATUTE	1270	0111	920	780	Otto	081		320	0 <u>0</u>	MAXIM	R. P. M. L. A. S.		2550 205	3 5	3 6	1800 205	1650	1600	1600 200	LAGEND F.T.: POLITING  I.A.I.: INDICATED ARRESTED  I.A.I.: INT. A.L.: A.T. A.L.  I.A.I.: INT. A.L.: A.L.: A.L.  I.A.I.: A.L.:
EXTE	NING.		for em	niold pi	ficie	ure moi	ľ	FUEL	u.s.	GAL.	269	210	8	22	20	۶	1	8	ဓ		ALT. Feet	40000	85000	20000	25000	20000 15000	10000	2000	S.L.	DICATED ANTOLD A
			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. Manifold pressure (m. r.), gamons per mount (G. P. H.) and true airspeed (T. A. S.) are approximate values	for reference. For efficiency maintain indicated airspeed	(I. A. S.) nourly. Addust RF a sugney in need ceeding manifold pressure more than 3 in. Hg.				NAUTICAL	970	850	730	010	480	360	1	240	120	G DATA	2 4 4 2 4 4			080 67 64	30 /0 30	FT 61 315	36 57 295	36	36 48 250	LABITO
N CHART		5		_				VI	RANGE IN AIR MILES	STATUTE	FLIGHT	980	0118	200	260	150 1150	+	580	0#1	OPERATING DATA	R. P. M. I. A. S. MIG.		į	2#2	2.0	2350 245 AL 2150 250 AL	150 250 AL	2150 250 AL	2150 250 AL	240 GAL OFFUEL CES OF 28 GAL) 20.000 FT.ALT. MPH IND. AIRPEED
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ATION INS	-	rs: 9600	USING CHART: than amount of fu	ft or right and sele	site desired cruisi	. S. and MIXTUR		Ш	RANGE IN AIR MILES		ANCE NOT AV.	830	210	280	η20	350		230	0 =	OPERATING DATA	P. M. I. A. S. MIX.			525	260	0 270 AR	10 270 AR	270	00 270 AR	EXAMPLE 20 CALOFFUEL TOTER DEDUCTIVE TOTAL ALLOWANCES OF 28 CAL) TO FLY 1000 STALARMILES AT 20,000 FT. ALT MAINTAIN 2350 MM AND 245 MFH IND. AIRSPEED WITH HIXTURE SET AUTO LEAN
FLIGHT OPERATION INSTRUCTION CHART		CHART WEIGHT LIMITS:	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to	tically below and opposite desired cruising altitude (ALT.) read	optimum R. P. M., I. A. S. and MIXTURE setting required.			MILES	NAUTICAL	ALLOW 710	620	530	770	350	260	<b>1</b>	170	06	DATA	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	+		2600	2000	FT 97 365 2400	43 88 335 2400	82 310	43 77 290 2400	MARM-UP. Least
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			TIME TOTAL	187	87   78 071	CONT. 109			RANG	STATUTE	05 028 820	720	910	510	017	300	-	-500	00 -	OPE	R.P.M. I. A.S.	-			_	2550 290	2500 285		2550 285	NOTES  TALLOW 2.9 CAL FOR WARRING TAKEOF & INTIAL CLIMB PLUS ALLOWANCE FOR WHICH RESERVE & COMMAN AS REGIO.  2. IF 85 GALLOW FUSELAGE TANK IS INSTALLED AND SERVICES. WARM-I TAKE-OFF. CLIMB. AND CHUSTS OF RESULGET ARK USTILE A TEAST TAKELONS ARE USED BEFORE SWITCHING TO WING TAKES.  HIGH BLOWER ABOVE HEAVY LINE ONLY.
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-	í .		<b>1</b>	3000	3000	2700		F	RANGE IN AIR MILES	_ E	-		-		+		1			O MILMI	L.A.S. MIX.	+		265 AR		290 AR 305 AR	305 AP	305 AR		### ALLOV PLUS. 2. IF 85     TAKE-1     50 GA
		ENGINE(S):	FIXE	WAR	MILITARY	MORMAL			2	STATUTE	980	280	510	750	One	250		170	80	3	R P. K.				-	2700	╀			

Figure 44—Flight Operation Instruction Chart—V-1650-7 Engine (Wing Bomb Racks—9600 to 8000 lbs.)

<u> </u>	OMBS	,	NOTES: Column I is for emergency high speed crushing only. Columns II, III, IV and V give progressive increase in range at a	sacrifice in speed. Manifold pressure (M. P.), gallons per hour	licated airspeed	uary to avoid ex-				AIR, MILES	NAUTICAL		. 1080	086	006	\$10	720	630	MAXIMUM RANGE	MUX. M.P. G. T. TURE No. B. A.		AL FT 53 295	FT 48	AL FT 45 255	FT #2	AL 33 39 225 AL 33 37 210	F. T. PULL THROTTLE F. R. PULL THROTTLE A. R. AUTO-RESI A. L. AUTO-RESI C. L. CRUISING LEAN ICHT CHRAF
EXTERNAL LOAD ITEMS	- 300-LB. WING BOMBS	Witten 0161	Column I is for emergency high speed crusing oury. I, III, IV and V give progressive increase in range at a	seure (M. P.), g	(G. F. E.) and the ampood (1. A. E.) are approximant to the formal for reference. For efficiency maintain indicated airposed	(I. A. S.) hourly. Adjust RPM slightly if necessary to avoid ex-	ceeding manifold pressure more than 3 in. fig.	A		RANGE IN AIR MILES	STATUTE		1240	0111	1030	830	830	730	MAXINU	P. M. L.A.S. M.P.E.		2100 200 /		1800 200	205	1600 205 1	LA & INDICATE ARRESTED F.T. FOLL THE LEGISLATE ARRESTED F.T. CHURCH CONTROL OF THE LEGI
EXTERN	- 300-LB.	5	or energy	Fold big	icies:	st RPM	E Hore			⊐i si	GAL.	569	240	220	200	8	8	0 <del>1</del>		ALT. Feet R.	35000	+	-	15000	10000	S. I.	MITOLE PA MITOLE PA L CAL PER VE AUSFEL A LEVEL
-	64		Olumn I is I	speed. Mani	end true aura ce. For eff	ourly. Adju	nifold pressu	-	1		NAUTICAL		930	850	270	089	620	0	ų.	9 K H		71 350	67 330	FT 63 310	59 290	36 55 270 36 51 250	-
		_	NOTES: (Columns II.	crifice in	r referen	A. S.)	eding m		ż	I AIR MIL			<b>S</b>	•	72	90		240	OPERATING DATA	TURE In. P.		AR 37	AL FT	님	AL 3	AL 3	1
OPERATION INSTRUCTION CHART		5					8	ľ	7	RANGE IN AIR MILES	STATUTE	FLIGHT	020	066	068	800	210	820	OPERA	L.A.S. M.P.R.		235	↓_	245		250	AL. OF TUEL 29 GAL.) FT. ALT. 5. AIRSPEED
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RUCT		٤	slect figur be used f	ANGE	les to be r Utitude (.	optimum R. P. M., I. A. S. and MIXTURE setting required.				E3	NAUTICAL	AVAILABLE	790	730	089	290	530	180		유지배		88	83	78	72	63	AT 9800 LE CROSS WT. WITH 240 C ATTER DEDUCTING TOTAL ALLOWANCES OF TO PEY 1000 STAT. MINHES AT 10.000 MAINTAIN 2200 NAM AND 250 MPH INI WITH MIXTURE SET AUTO LEAR.
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NO		10.000	ING CH/	right and	or nautic desired c	AIM pur			-	RANGE IN AIR MILES	UTB	HON	016	048	780	980	010	530	OPERAT	LA.S.		255	760	260	260	260	AT 9800 LE.GROSS WT. WITH CATTER DEDUCTING TOTAL ALLOW. MAINTAIN 2200 RPM AND 1200 WITH MIXTURE SET AMTO LEAM.
ERAT		IMITS:	INSTRUCTIONS FOR USING CHART column equal to or less than amount of fu	to left or	e statute opposite	I. A. S.				-	STATUTE	GAL. ALLOWANCE NOT	æ	60	-	. eō	•	<b>10</b>		R. P. M.		2450	2550	2400	_	2400	
		CHART WEIGHT LIMITS:	CTIONS qual to or	izontally	r than th clow and	R. P. M.		ľ			CAL	MOTT	0	0	0	0	9	0		0 m H		+	-	96 350	89 325	82 300 75 275	
FLIGHT	į	RT W	TRU Imn e	ve hor	reate V	mum		١		CILES	NAUTICAL	٧ .	680	620	570	510	450	400	ΑŢ	4 d d		T	T	FT	-	£ 5	-1 93
	<b>i</b>	CHA		Mo	F 5	ğ	_		=	RANGE IN AIR MILES	-	GAL 							OPERATING DATA	MIX.				AR	A.R.	* *	1
			TOTAL G. P. H.	<u> </u>	2	2	8			RANGE	STATUTE	<b>83</b> ∴	180	720	650	280	250	094	OPER	I. A. S.			L	280	780	275	HINITIAL CHARACTAS WASTERS WAS
			TIME	9	2	:   }	5				E								L	7. P.			L	2550	2550	2550	AKE-OFF RVE & CO S INSTA IE TANK FAVY
			MIXTURE	AR	1	1	3		FUEL	U.S.	GAL.	508	240	220	500 200	8	8	₹	L	Feet	35000			15000	10000	5 5000 S. L.	NOTES
MODEL(S)	<u> </u>	7-0	# 5	5	3	3					ICAL		0			0	0	0	85	0 4 M		115 395		113 365	108 340	103 315	
MOD	P-510	V-1650-	M.P. BLOW'S	5			<b>3</b>			R MILES	NAUTICAL		560	510	470	420	370	330	TINUO	H - H		9	Ξ	9	9	¥ ¥	ALLOW 29 CAL. FO PLUS ALLOWANCE F IF 85-GALLON FUS CLIMB, AND CRUIS ARE USED BEFORE
			R P. M.	900		1	2708		-	RANGE IN AIR MILES	-				-	•	· U. · 'Ba'.V		MAXIMUM CONTINUOUS	ANY TURE	•	A A	1_		<b>├</b> -		
		ENGINE(S):			4-	4	-			RANG	STATUTE		650	280	Ons	08 <del>1</del>	0E#	380	MAXIM	R.P. M. L.A.S.		0 270	4			290	
		Ĕ	LIMITS	TV.	KILITABY	2	T. T.				25									ا م		2700	2700	2700	270	2700	

Figure 45—Flight Operation Instruction Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—10,000 to 9500 lbs.)

 S		aluo aniisima	se in range at a	roximate values	licated airspeed	ary to avoid ex-			500 1170 617	AIR MILES	NAUTICAL	270	-	630	550	760	370	280	190	100	MAXIMUM RANGE	MIX. M.P. G. T. TURE No. E. A.			AL FT 52 305	6t F1	£	AL FT 42 245	33 40	AL   32   37   210	F. T.: PULL THROTTLE F. R.: PULL RICH A. R.: AUTO-RICH C. L.: AUTO-LEAN C. L.: CRUISHIG I LAN	NART, IGHT CHECK
EXTERNAL LOAD ITEMS	300-LB. WING BOMBS	Vino mising book daid noncember as at 1	NOTES: Column 1 is for emergency high speed clushing only. Columns II, III, and V give progressive increase in range at a	escrince in speed. Manifold pressure (M. F.), ganons per mount (C. P. H.) and true airspeed (T. A. S.) are approximate values	for reference. For efficiency maintain indicated airapeed	(I. A. S.) hourly. Adjust RPM slightly if necessary to avoid ex-	ceeding manifold pressure more than 3 in. Hg.	i i		KANGE IN AIR MILES	STATUTE	Č	0 1	740	0π9	230	0811	320	220	01-	MAXIMU	R. P. M. I. A. S. H.			2100 205 A	205	505	1650 210 A	210	1600 210 A	LASEND  LAS. INDICATED ABSPRED  LAS. INDICATED ABSPRED  C. P. M. J. GAL. PER HOUR  S. L. SEA LEVEL  S. L. SE	RED FIGURES ARE PRELIMINARY. SUBJECT TO REVISION AFTER FLIGHT CHECK
EXTER			V give p	aveed (3	ficier	ust RPM	ure mor		FUEL	zi Si	GAL.	<u>ਰੱ</u>	8	≘	120	8	8	8	Ç	20		ALT. Feet	40000	35000	25000	2000	12000	10000	2000	i i	NDICATED LANIFOLD 1. B. CAL. P. HUE AIRSI	ED FIGU
	6	İ	a de la	d. Mar	For ef	y. Adj	d press	ŀ	Ī	T												pi 4 m			355		3.0	8 290		0 250	LA 8. W	SUBJEC
				in spee	ence.	hour	manifo				NAUTICAL	Θ	0 0	240	160	390	310	230	150	70	Y.T.V	M H H			37 71	1-	FT 62	36 58	36 54	36 50	<b>J</b>	_
		s	Columns 1	L P H	r refer	I. A. S.)	eding 1		2	RANGE IN AIR MILES	<u>z</u>	e		$\dashv$							OPERATING DATA	TURE			A.R	¥	٦ ۲	¥F	¥	¥		
HARI							٦			ANGE	a L	FLIGHT	02./	630	240	150	360	270	081	8	OPERA	I. A. S.			240	240	245	250	250	520	OF FUEL CAL.) FT. ALT	9
OPERATION INSTRUCTION CHART		-	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to	or greater than the statute or nautical air mades to be movil. The fically below and opposite desired cruising altitude (ALT.) read	٠				2	STATUTE	IN FI	, v	ဖိ	ស	ä	ĕ	2	Ξ	_		R P. M.			2400	2#00	2200	2250	2250	2250	CAL. OF FUEL F 24 CAL.) O FT. ALT	MPH IND. AIRSPEED
<u> </u>		800	d for c	value		equired	.	ŀ	<u>-</u>			_		$\dashv$							t	F 4 4			375	1	330	305	280	260	EXAMPLE B GROSS WT. WITH 160 C INC TOTAL ALLOWANCES OF STAT. AIRMLES AT 16.000	E E
202		2	elect fig	ANGE	utitude	tting r				E8	NAUTICAL	AVAILABLE	520	097	390	330	260	190	130	09		0 c z			89	+	79	73	1 67	62	ENAMPLE LB GROSS WT. WITH 160 TING TOTAL ALLOWANCES C STAT. AIRMILES AT 16.00	250 LEAK
STI			7.5 2.5 5.5	elect R	ising (	RE se				IR MÜ	NAT	VAI	·0	7	~	m	2	7	7		IG DAT	# = # # = #	-		AR.	+-	AR 39	AR 38	AR 38	AR 38	ENA GROSS W TOTAL	RPM AN
z		9500	INSTRUCTIONS FOR USING CHART: column equal to or leas than amount of fuel	ht and s	red cru	optimum R. P. M., I. A. S. and MIXTURE setting required.	١		日	RANGE IN AIR MILES		A TON									OPERATING DATA	R. HIX.	H			╂		_			EXAMPLE AT 9300 LB GROSS WT. WITH 160 CAL. OI ANTER DEDUCTIVE TOTAL ALLOWANCES OF 24 TO FLY \$50 STAT AIRMLEY AT 16,000 F	MAINTAIN 2250 RPM AND 250 WITH MIXTURE SET AUTO LEAN
TIO		ä	USING han am	t or rigi	ite des	S. and				KY	STATUTE	Z	800	530	150	380	88	220	52	2	٥	I.A.S.	-		50 255		260	00 260	260	00 200	AT 9300 (AFTER DEDU TO FLY 550	AINTAIN ITH MIX
ER	,	TIME	FOR Fless t	y to lef	ne stat	. I.					ě	ON Y-								<u> </u>	$\downarrow$	R. P. K.			2450		2400	5 2400	2400	0 2400	\$3º	ΣÞ
0		CHART WEIGHT LIMITS:	TIONS ual to o	zontall		R. P. M					7,	ALLOWANCE										9 v H	$\vdash$		╁	╀	100 320	93 325	86 300	80 280		
FLIGHT		RT WE	STRUC Imn eq	ve hori	reater illy bel	imum				TILES.	NAUTICAL	Y.	430	380	330	270	220	160	110	50	ΑŢ	N 4 H	+		$\dagger$	+	<u>-</u>	£3	£,	£		
F		CHA	<b>X</b> 18	Ŋ.	F 5	ğ			=	N AIR	_	GAL.			-		-				OPERATING DATA	# P	1				AR	AR	AR	AR	IMB G.D.	۲۲.
<u> </u>		-	TOTAL G. P. H.	191	28	<b>1</b>	2 2			RANGE IN AIR MILES	Ē	±2.1	_	_		0		0		8	OPERA	LAS					280	280	280	280	HTIAL CL	NE ON
			TIME	<u>_</u>	ي ا	†	COMT.			M	STATUTE	1	200	0111	380	310	250	061	120	60	١	R. P. K.	T		T	1	2550	2550	2550	2550	OFF & IN	=
			MIXTURE T	_	$\perp$	t	-		FUER	C.S.	GAL	2	00	9	82	- 8	8	8	9	20	$\dagger$	ALT. Feet B	0000	82000	2000	20002	15000	10000	8	1 8	YOTES W.RM.LP.TAKE.OFF & INITIAL CLIMB W.IND. RESERVE & COMBAT AS REQ'D.	BOVE HEAVY LINE ONLY.
			N PORT	*	=	H	¥		F	<u> </u>	3	F	_	_	ļ		-		-		+	1144	-	e> 1	305			0	3.5	98 295		ABOVE
MODEL(S)	2	20-1	BLOWE POSITIO	3	3	2	5			n	NAUTHCAL	ļ	370	330	280	230	180	140	08	0.	E	0 a H			1	_	113 365	HE 301		86	CAL. FOR	OWER
10M	Ĺ	V-1650-7	M. P. BLOWER (Dr. MG.) POSITION	2	=		,			E MILL	NAU		m	e.	2	8	7	Ť		·	MINITAL	<u> </u>	1		y S		<b>9</b>	9 2 ~		<del>9</del>	ALLOW 24 GAL. FOR V	HIGH BLOWER
			P. P. K.	3000	1	- 1	2700		-	RANGE IN AIR MILES	-	$\vdash$	-		-		+		-		3	育	$\downarrow$		-	4		¥		¥	T ALLO	<u> </u>
		ENGINE(S):	I-	<u> </u>	1	Ļ				BANG	STATUTE		¥30	380	320	270	2 0	8	0	20	MATERIAL CONTINUING	14.8	1		,			290		290		
		ENG	LIMITS	MAN	MILITARY	NOW E	NORKAL RATED				E											R. P. M.			100	2765 2786	2700	2700	2700	2700	<u> </u>	

Figure 46—Flight Operation Instruction Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—9500 to 8000 lbs.)

	Mo P-:	MODEL(S) P-510			<u> </u>	1	H5	1 0	PERA	FLIGHT OPERATION INSTRUCTION CHART	Ž	T.	UCT	NO.	S	RT	<b> </b>		2 - E	EXTERNAL LOAD ITEMS - 500-LB. WING BOMBS	L LOAI	G BOM	8		
ENGINE(S):	V-1650-7	0-7				CHA	RT W	EIGHT	CHART WEIGHT LIMITS:	3: 10,	10,500		2	TO 10,000	0 POUNDS	ND8									
LIMITS R. P. M.	M. P BLOWES (Df. Mg.) POSITIOS	BLOWER POSITION	POSITION	TIME	TOTAL G. P. H.	Ž 3	STRU( umn eq	CTTON Tual to	S FOR   or less th	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	HART nt of fu	. a	et figu	ire in I	OEL ising.	NOTE Colum	S: II.	II, IV	I is for and V gi	NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a	cy high	ncrease	cruisin in ran	g on	× «
WAR BOO	29	35	W	s	184	9	ve bor	izontal	ly to left	Move horizontally to left or right and select RANGE value equal to	and sel	ct RA	NGE V	alue eq	t t	Sacrif	ce in	peed.	Manifol	sacrifice in speed. Manifold pressure (M. P.), gallons per hour	) (K	P.), gral	d suo	r bo	
MILITARY 2000	=	3	7	•	<b>8</b> 20	F 5	ally be	low an	d opposi	or greater than the statute of natural air muss to be nown, yer- tically below and opposite desired cruising altitude (ALT.) read	d cruis	ng alt	itude (	ALT.)	Lead Tead	9 5	ference	na truk t. For	effic	(G. F. A.) and the arabeed (1. A. S.) are approximate values for reference. For efficiency maintain indicated airapeed	naint	e appro in indic	ated a	irspee	. 7
MORKAL 2700	,	뤃	3	Fi	88	<u></u>	imum	R. P.	f., L. A.	optimum R. P. M., I. A. S. and MIXTURE setting required.	KTUR	E SECT	ng req	uired.		(I. A.	S.) bo	urly. ifold p	Adjust 1	<ol> <li>A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.</li> </ol>	btly if in 8 in.	песеяват Нg.	y to a	oid e	<u>.</u>
																		1					ļ		Π
	1		FUEL			=			_		B			_		À			FUEL			>			Ì
RANGE IN	RANGE IN AIR MILES		i Si		RANGE IN AIR MILES	IN AIR	MILES			RANGE IN AIR MILES	IN AIR	MILES			RANG	RANGE IN AIR MILES	MILE	92	C.S.	Ų	BAN	RANGE IN AIR MILES	R MILI	23	
STATULE	NAUTICAL	TCAL	GAL	ATP.	STATUTE	-	NAUTICAL	CAL	ST.	STATUTE		NAUTICAL	CAL	_	STATUTE	_	NAUTICAL	TCAL	GAL.		STATUTE	-	NAU	NAUTICAL	
630	240	0	200		1 29 7 <b>6</b> 0		A1 860	LLOV	VANC	GAL. ALLOWANCE NOT		AILA 760	AVAILABLE 760		IN FLIGHT	TH	. Q	890	269	-	- 180		1020	20	
											+			_		+			-	_		+			Т
570	200	0	550		200		910			800		630	9		O <del>1</del> 16		810	9			1080		340	0	
520	450	0	8		010		550			730	-	630		_	850		740		88		980		850	9	
0.24	410	0	-80		920		200			650		570	0		770		680		180		880		770	0.	
120	360	0	91		210		440	_		280		500	0		680		590	0	99	_	790		089	0	
370	320	0	2		<b>0ππ</b>		390	_		810		440	0		900		520	0			98		009	9	
MAXIMUM CONTINUOUS	CONTENTO	2		L	OPERA	OPERATING DATA	ATA			OPER	OPERATING DATA	ATA		L	OPR	OPERATING DATA	DATA				¥	MAXIMUM RANGE	ANGE		Γ
R.P.M. LAS.	MISS. M. P. TURE IN.	4 4 4 4 4	ALT.	R. P. M.	T'Y'S'	ADM T	4 4 4	Q V N	R. P. M.	LAB	ADT.	# 4 #	Q U. M.	R. P. M.	E LAS	TORE	N 4 N	9 K M	ALT.	R. P. M.	LLAB	TOTAL T	2. 日期	9 4 2	444
			30000																35000	000					
2700 260	AR 46		25000				+		2500	245	A.	3	91 365	2400	00 235	¥	88	73 31	345 25000	2150	200	=	E	55	295
2700 265 2700 280	AR FT	100 360 113 355	4 20000 5 15000	2550	270	AR	F1 8	95 340	2600 d 2400	255	AR AR	L L	87 350 80 325	50 2450	50 240	A A	FT 36	69 33	325 <b>20000</b>	2100	200	₹ ₹	14 14	- S	275
2700 280	9	108 330	10000	2500	270	84	42 8	89 315	5 2400	255	AR	33	73 300		┺	↓	8		285 10000	╄	-	╀	Ŀ		245
2700 280 2700 280	AR 46	98 285	3 S L	2500	270	AR AR	42 42 43 44 45 45	82 290 76 270	2400	255	* *	88 88	67 275 63 255	275 2350 255 2350	50 245	<b>4</b> 4	38 38	25 26 27 27 28	265 5000 245 S. L.	1600	0 210	4 4	36	3 =	230
O ALI PERIO NATION UNIT	NOTES  **D. ALLOW 29 CAL FOR WARM-UT, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REGO.  2. IF 85-BALLON FUSELAGE THAN IS INSTALLED AND SERVICED MARN-UP. TAKE-OFF. CLIMB, AND CRUISE ON FUSELAGE TAN UNTIL AT LEAST 50 GALLONS ARE USED BEFORE STITCHING TO WING TAKES.  HIGH BLOWER ABOVE HE	LL FOR WASEE FUSELAGE FUSELAGE CE-OFF.	NOTES ARM-UP, TAKE IND, RESERVIE TANK 1S LIMB, AND ALLONS ARE HEGH	NOTES AVABACHE TAKE-OFF & INITIAL CLIMB OFF THE IS INSTALLED AND SERVICED, CIT HR. IS INSTALLED AND SERVICED, CITHB, AND CRUISE ON EUSELGE TAKE VALIDA'S ARE USED BEFORE SHITCHING HIGH BLOWER ABOVE HE	NITIAL CLI BAT AS RE ED AND S ON FUSEL FORE SHI	IMB Q'D. SERVICED AGE TAN TCHING	AVY	LINE	AT (AFT)	EXAMPLE E & COPEA INTITAL CLIMB E & COMBAT AS REGO.  (ATTEN DEDUCTING TOTAL ALLOWANCES OF FOR USE ON FUSEL AGE TANK MAINTAIN 2000 STAT AIRMILES AT 10,000 USED BEFORE SHITCHING WITH MIXTURE SET AIRJOLE SAW HIND BLOWER ABOVE HEAVY LINE ONLY.	EXAMPLE LE GROSS WIT WITH THING TOTAL ALLOWAN STAT. AIRMILES AT 00 RPM AND 245 E SET AUTO LEAN.	EXAMPLE 538 WT. WITH 57AL ALLOW AIRMILES A M AND 245 AUTO LEAN	1 _ 3 ⊢	240 GAL CCES OF 2 10,000 MPH IND.	240 GALOFFUEL CES OF 29 GAL) 10,000 F7.ALT. MPH IND. AIRSPEED	-		43.50	INDECAT MANIPOL U. B. CAN TRUE AL SEA LEV RED FIG	LECEND FOR THE LEGEND FOR THE STREET	LEGEND GRE GRE GRE GRE PREI	LIMINAI R FLIGH	F. T.: PULL THROTTLE F. R. AUTO-RICH A.L.: AUTO-RICH C.L.: CRUIMING LEAN INARY IGHT CHRICK	A DESCRIPTION N	Į ą
								ļ						İ			İ							l	Ì

Figure 47—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,500 to 10,000 lbs.)

<b>S</b>			d cruising only.	allons per hour	licated airspeed	ary to avoid ex-			AIR MILES	NAUTICAL	740	019	520	770	350	270	180	06	M RANGE	ME. M.P. G. T. TURE No. R. R. B.			AL FT   54 300	FT 50	FT #7	¥ -	35 42	AL 34 39 210	F. T. PULL THROTTLE F. R. PULL RICH A. E. AUTO-RICH A. L. AUTO-LEAN C. L. GRUBBNG LEAN IN ARY.
external load items	- 500-LB. WING BOMBS		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. Manifold pressure (M. P.), gallons per hour	(G. F. f.) and the arepect (f. f. S.) are approximate values for reference. For efficiency maintain indicated airspeed	<ol> <li>A. S.) hourly. Adjust RPM slightly if necessary to avoid ex- pending manifold pressure more than 8 in. Hg.</li> </ol>		Λ	RANGE IN AIR MILES	STATUTE	800	200	900	200	001	300	200	00	MAXIMUM RANGE	R.P.M. I.A.S. M			2150 200 /		505	210	210	1600 210	
EXTER	200		for eme V give p	ifold pr	ficien	ure mor		FUEL	u.s.	GAL.	₹8-1	<u></u>	120	8	80	90	01	50	Г	ALT. Foot	40000	30000	25000	20000	15000	10000	2000	3.6	DICATED INITIOLD S. CAL. PI UR AIRST A LEVEL.
	~		3: Column I is as II, III, IV and	e in speed. Mar	for reference. For ef	<ol> <li>A. S.) hourly. Adjust RPM slightly if nece seeding manifold pressure more than 3 in. Hg.</li> </ol>				NAUTICAL	0890		077	370	290	220	140	20	DATA	2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			37 73 345	FT 68 325	902	60 285	26	36 52 245	TAAT YEE THE THE THE TERM THE THE TERM THE THE TERM THE T
N CHART		NO			-			ΝI	RANGE IN AIR MILES	STATUTE	N FLIGHT	00	910	#20	0118	250	170	08	OPERATING DATA	R. P. M. L. A. S. MIG.			2400 235 AR	2400 Z40 AL	240	245	245	2350 245 AL	160 GAL OFFUZL (CES OF 24 GAL.) 10,000 FT.ALT. MPH IND. AIRSPEED
INSTRUCTION			INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to	or greater than the statute or nautical air miles to be hown. Vertically below and opposite desired cruising altitude (ALT.) read	optimum R. P. M., I. A. S. and MIXTURE setting required.		-	IR MILES	NAUTICAL	AVAILABLE IN	440	380	310	250	180	120	09	G DATA	# # # # # # # # # # # # # # # # # # #			41 90 365		38 79 320	73 295	39 68 275	AR 39 63 255	Z .
OPERATION IN		CHART WEIGHT LIMITS: 10,000	INSTRUCTIONS FOR USING CHART: column equal to or less than amount of fuel	to left or right and a	statute or nautical opposite desired cru	I. A. S. and MIXT		Ħ	RANGE IN AIR MILES	STATUTE		310	0811	300	290	210	Oftl	0,	OPERATING DATA	R. P. M. L. A. S. MIX.			2450 245 AR	2550 255 A	255	255	255	2400 255 A	EXAMPLE AT 9800 18. GROSS WT. WITH (AFTER DEDUCTING TOTAL ALLOWA TO FLY 600 STAT. AIRMILES AT MAINTAIN 2300 RPM AND 245 WITH MIXTURE SST AUTO LEAR
FLIGHT OP		HART WEIGHT L	INSTRUCTIONS column equal to or	Move horizontally	or greater than the tically below and	optimum R. P. M.,			IR MILES	NAUTICAL	GAL. ALLOWANCE NOT	380	320	270	210	160	110	50	G DATA	* * * * * * * * * * * * * * * * * * *					FT 97		42 83	43 78 270	
<u>.</u>	-		TOTAL C. P. H.	Z.	178	8 3	8	H	RANGE IN AIR MILES	UTE	₹2			•	٥	0	120		OPERATING DATA	I. A. S. MIX. M.P.H. TURE					265 AR			270 AR	NOTES WARELLY, TAKE-OFF & INITIAL CLIMB I WIND, RESERVE & COMBAT AS REGID. ABOVE HEAVY LINE ONLY.
			TIME	<u>_</u>	2	COM.				STATUTE	95	3	370	310	250	<b>8</b>	2	·		R. P. M.					2500	2500	2500	2550	E-OFF & IN
			MIXTURE	=	44	*	1	FUEL	i.s.	GAL.	₹ 6	9 5	120	8	8	8	O <sub>A</sub>	20	Ī	ALT. Feet	40000	30000	25000	20000	_	_		7 S	NOTES IND. RESERV OVE HEA
MODEL(S) P-510	<u>.</u>	V-1650-7		67 HIGH	107 E	20.00	-			NAUTICAL	360	320	270	230	180	130	96	07	TINUOUS				46 115 385		113 355	108 330	2	46 98 285	NG CAL FOR WARN PLUS ALLOWANCE FOR WING
		ENGINE(S):	P. P. K.	900	9008	2700	-	-	RANGE IN AIR MILES	STATUTE	120	370	310	260	210	150	00 -	20	MAXIMUM CONTINUOUS	R. P. M. L.A.S. MDC.			260 AR	270 AR		280	280	280 AR	TLUS ALLOW PILUS AL
		ENG	ELKT	MAX.	MILITARY	NORMAL				E		.,			Ĺ					2 d			2700	2700	2700	2700	2700	2700	

Figure 48—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,000 to 8500 lbs.)

		MOD	MODEL(S)				ਛ	<u> </u>	F	M	RAT	FLIGHT OPERATION INSTRUCTION CHART	INS	TR	5	NO	E E	7			EXT	EXTERNAL LOAD ITEMS	LOAL	TEME	_		
		_	3																	N	- 75-(	75-GALLON COMBAT TANKS	Š	BAT TA	NKS		
ENGINE(S):		V-1650	50-	7			CH	ART	WEIG	HT L	CHART WEIGHT LIMITS:	10,700	9		TO 92	9600	POU	POUNDS									
LIDETTS R. P. M.	1	M. P. BLOWES (IM. MG.) POSITION	BLOW B	MIXTURE N POSITION	NE TIME	G. P. H.		NSTR olumn	UCTI	ONS 1	FOR US	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column cough to or less than amount of fuel to be used for cruising.	IART: t of fue	Select to be	t figui used t	Select figure in FUEL to be used for cruising.	UEL sing.	Column	S: T	II. IV	is for e nd V griv	NOTES: Column I is for emergency high speed cruising only. Columns II. III. IV and V give progressive increase in range at a	cy high	ncrease	cruisin in ran	ge at	. e
WAR " 3000		67	3=	*	۰	<u>26</u>		fove h	orizon	tally	o left or	Move horizontally to left or right and select RANGE value equal to	nd selection	t RAD	GE VI	due equ	tel to	eacriff (G. D	Ce in s	peed.	Manifold	cacrifice in speed. Manifold pressure (M. P.), gallons per hour	) (K	P.), gra	lons p	er ho	<b>3</b> 8
MILITARY 3000		=	3	*	=	8.8	Γ-	cally	pelow	and o	pposite	or greater than the statute of natureal air mues to be nown. Yer- tically below and opposite desired cruising altitude (ALT.) read	cruisir	ng alti	inde (	ALT.)	- P	9 5	ference	r. For	effici	(G. f. f.,) and the atapead (1. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed	mainte	in indic	a ted	irsper	3 78
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Θ 4	ALLOW PLUS A 1F 85 NARR-I LEAST HIGH	LLOW 29 GAL FOR WILLS ALLOWANCE FOR VILLS ALLOW FUSEL MARH-UP, TAKE-OFF, LEAST 50 GALLOWS A HIGH BLOWER ABO	L. FOR LE FOR LE FUSE!	WARM-UP. WARM-UP. WIND, RES CLINB, CLINB, ARE USED	NOTES  WARN-UP, TAKE-OFF & INITIAL WHO, RESERVE & COMBAT AA CLINB, AND CRUISE ON F IRE USED BEFORE SHITCH IN	MOTES  O ALLOW 28 GAL FOR WARKUT, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REGO. 2. IF 84-BALLOW FUSELAGE THE IS INSTALLED AND SERVICED, WARK-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TAKE UNTIL AT LEAST 50 BALLONS ARE USED SEFORE SHITCHING TO COMBAT TAKES. HIGH BLOMER ABOVE HEAVY LINE ONLY.	LIMB IEQ'D. SERVI IELAGE TO COM	CED, TANK U BAT TA	MES.		AT 10,500 (AFTER DEDUC TO FLY 1500 MAINTAIN 240 WITH MIXTUR	1 - 5 9 w	B. CROSS INC TOTA STAT. A RPM /	EXAMPLE CROSS WT. WITH C TOTAL ALLOWA TAT. AIRMILES AT RPM AND 230 IT AUTO RICH -	30 MT 2 MIG	S OF 25 5,000 14 IND. J	EXAMPLE 300 cal. OF FUEL INCORS WT. WITH 300 cal. OF FUEL STATA ALLOWANCES OF 25 cal.) STATA ARMITES AT 25,000 FT. ALT. RPM AND 230 MPH IND. ARRPEED SET AUTO RICH - HIGH BLOWER.			1.4.2. C.P.N. T.A.S. SUBJE	MANIFOL U. S. GAL TRUE ALI SEA LEVI RED PIG	LASSEND RATE ALBERTED R. P. R. MANTOLD PRESSURE R. P. R. MANTOLD PRESSURE R. P. R. SAL LATTOL T. A. SAL LATTOL T. A. SAL LATTOL T. S. SAL LATTOL T. S. SAL LATTOL T. S. SAL LATTOL T. S. SAL LATTOL T. S. SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL LATTOL T. SAL SAL SAL SAL SAL SAL SAL SAL SAL SAL	LEGEND URE URE URE PRE N AFTEI	ELIMINA RFLIGH	P. T.: PULL THROTTLE A.E.: AUTO-INCH C.L.: AUT	THROTTLE - RICH S- RICH S- RICH SING LEAN	F 3

Figure 49—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—10,700 to 9600 lbs.)

EMS T TANKS		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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airapeed (T. A. S.) are approximate values	for reference. For efficiency maintain indicated airspeed	(I. A. S.) hourly. Adjust KFM signily ii necessary to avoid exceeding manifold pressure more than 8 in. Hg.	Λ	RANGE IN AIR MILES	NAUTICAL	1020	880	770	079	510	380	280	MAXIMUM RANGE	TUNE 15 P. P. P. P. P. P. P. P. P. P. P. P. P.			1	AL FT 49 265	AL FT 46 250	#	AL 34 41 220	2	P.T. FULL TREOTHER P. B. FULL RICH A.E. AUTO-BECH C.L. CRUBNG LEAN C.L. CRUBNG LEAN HINARY
EXTERNAL LOAD ITEMS 75-GALLON COMBAT TANKS		argency high sports	ressure (M. P.), I. A. S.) are ap	n cy maintain i	re than 8 in. Hg.		RANGE	STATUTE	180	1030	880	047	. 089	120	300	MAXIN	R.P. M. L.A.S.			2150 190	2050 195	1850 200		1600 200	207	LACK DATES ARRESTED F. T. FULL TH ALL SEA THE ALBESTED F. T. FULL TH ALL SEA THE ALL SEA T
EXTE 75-6A		for eme V grive j	ifold pa	ficie	ure mo	FUEL	U.S.	GAL.	269	2 0 2	8	02	120	8	88	3	ALT. Feet	40000	35000	25000	20000	15000	10000	2000	4	PECATED ANTIPOLD A CAL. P TO LEVEL TO RE
N		i: Column I is is II, III, IV and	e in speed. Man H.) and true airs	erence. For ef	<ol> <li>A. S.) hourly. Adjust KFM signtly if nece ceeding manifold pressure more than 3 in. Hg.</li> </ol>	4	RANGE IN AIR MILES	NAUTICAL	000 D	780	670	260	450	340.	220	DATA	1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			37 70 335	65 310	FT 62 295	36 57 275	36 53 255		LAS. DE MENTO. C.P.N. U. T.AS. T R.L. SE RIS
E	28	NOTES Column	sacrific (G. P. ]	je .	(I. A. S	ΙΛ	IN AIR	_	는							OPERATING DATA	# P			3 3	=	AL	717	¥ :	4	
HAR	5						RANGE	BTATUTE	FLIGHT	018	780	920	620	390	260	S OF S	_ <del>_</del>			225	225	235	235	235	657	AL. OF FUEL 29 GAL.) O FT. ALT. D. AIRSPEED
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RUC	2	Select 1 to be us	RANG	altitue	etting		SET	NAUTICAL	AVAILABLE 750	650	560	160	370	280	180	3	# d ;	+-		5 8		39 79	38 73		200	EXAMPLE SS WT. WITH TAL ALLOW ARMILES A AND 226 AUTO LEAR
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Z	0096	G CHA	ght and	sired c	I WIXI		RANGE IN AIR MILES	E	1					_		ATAC DATE	LAS R	+-		235	╂-		250		250	M LB
OPERATION INSTRUCTION CHART	MITS	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to	or greater than the statute or naturely are must to be nown. Yestically below and opposite desired cruising altitude (ALT.) read	optimum R. P. M., I. A. S. and MIXTURE setting required.		Z.	STATUTE	ALLOWANCE NOT	750	070	5¥0	730 730	320	210	֓֞֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֓֓֓֓֓֡֓֓֡֓֡	, ki	+		20002	╂┈		-		24.00	EXAMPLE 240 of AFTER DEDOCTIVE OTHER 240 of AFTER DEDOCTIVE OTHER ALLOWANCES OF TO FLY 860 STAT. AIRMILES AT 20.00 MAINTAIN 2350 RPM AND 225 MPH IN WITH MIXTURE SET AUTO LEM.
OPE	CHART WEIGHT LIMITS:	NS Fo	tally to	and op	. M., I	H	┞	_	AW0		-		<del>                                     </del>			$\dagger$	# d	-		1	+	330	305		265	ě
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<u></u>	5	-				F	RANGE IN AIR MILES	-			-		<del>                                     </del>			- Contract of the contract of	A P	-		-	1	¥	⊬		AR	CLIMB ID SERV MK UKT MBAT 1
		TOTAL G. P. H.	25	25	85		BANG	STATUTE	20 20 20 20	920	990	9	370	280	8 8						1	260	↓		265	INITIAL IBAT AS LLED AL LLED AL LLED AL LLED AL LLAGE TV CC G
		TIME	م	<u>.</u>	CONT.			Ę	,	• •		#	, e	N	_		P. P. M.					2550	2550	2550	2550	IL-OF7 & TE & CON A FUSE A STANKE A STA
		MIXTURE	*	=	$\top$	FIRE	0	GAL.	269	2 2	8	20	120	8	88	3	ALT. Feet	40000	32000	20008	20000	15060	10000		8.1.	NOTES  ALLOW 29 CALL FOR WARNIN, TAKEOT & RITTAL CLIMB PLUB ALLOW-WHEE FOR WIND, MESENVE & COMBAT AN RIGOD.  2. IF 85-8ALLON FUSELAGE TAKE IS INSTALLED AND SERVICED, MARN-UP, TAKE-OFF, CLIMB, AND CRIDES ON PUSELAGE TAKE UNTIL AT LEAST OR SALLONS RER USED SEFORE SHITCHING TO COMBAT TAKES. HIGH BI OWER A RROVE HEAVY LIME ONLY.
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<b>A</b> -	>	<u> </u>	8	=	3	_	SATIN ATA WITE	-					<u> </u>			_	LAS ME IL P	-+-		T	× ·		Т		<u>-</u>	LLOW 29 GAL FOR W FLUS ALLOWANCE FOR Y FLYE-OFF, CLIMB, M FAKE-OFF, CLIMB, M SO GALLOMS ARE USE HIGH RI OWFR.
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	ENGINE(S):	E LOCA	MAX.	MILITARY	NORKAL			STATUTE	6	On S	997	380	310	230	52 5	1	R. P. M. L.	+		_	2700 255		+-		2700 27	

Figure 50—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—9600 to 8000 lbs.)

Figures 56-64, pages 61-75, deleted in revision, dated 7 May 1947

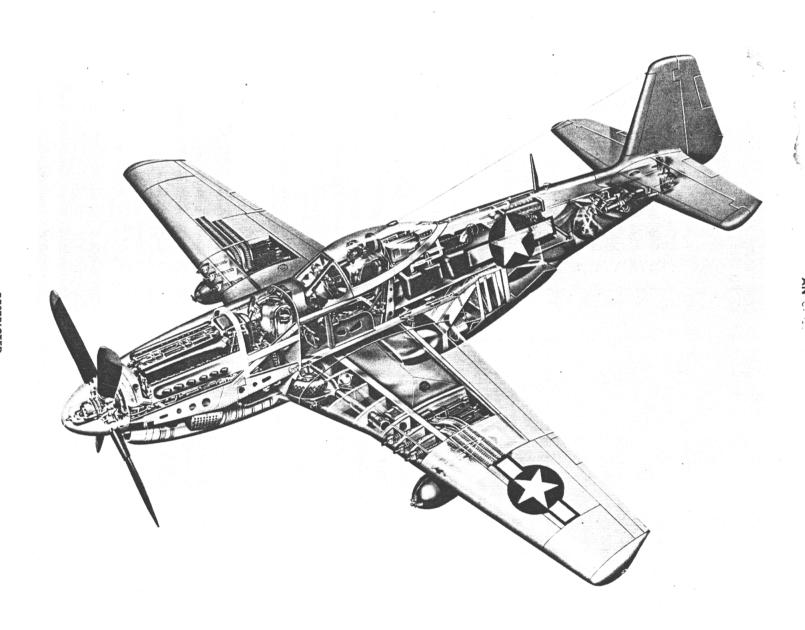
For use with V-1650-3 engine only regardless of airplane model.

-1-49 LHC-253	AIRCRA P-51D	AIRCRAFT MODEL(S)	EL (S)				1 T	TAKE-OFF,		CLIMB	4	LANDING	SNE	CHART					ENG!	ENGINE MODEL(S) V-1650-3	(8)	
								TA	KE-	OFF	DIS	ISTANC	ш	7867								
GROSS	HEAD			HARD	SURFACE	E RUNWAY	ίΑΥ					SOD-TURF	RF RUNWAY	WAY				SOFT	SURFACE	CE RUNWAY	IAY	
WEIGHT	QN I A		- 1		AT 3000 FEET	FEET	AT 6	6000 FEET	$\vdash$	AT SEA	LEYEL	AT 3	AT 3000 FEET	Н	AT 6000 FEET		AT SEA L	LEVEL	AT 300	AT 3000 FEET	AT 60	AT 6000 FEET
18.	M.P. H. KTS.	-			RUN T	TO CLEAR. 50'0BJ.	GROUND		TO CLEAR 6	GROUND RUN	TO CLEAR 50' OBJ.	RUM P	TO CLEAR 50' OLU.		GROUND TO RUN 50	TO CLEAR 50' OBJ.	GROUND	TO CLEAR 50'08J.	GROUND	TO CLEAR 50'OBJ.	UNION D	TO CLEAR
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900	0 0 1850 2700 17 15 1350 2150 34 30 950 1600 51 45 650 1150	1350 1350 950 950 650	276		2000 1500 750	2950 2300 1750 1250	27.7.5.8 8.00.08			83508 8308 8308 8308 8308 8308 8308 8308	225 255 255 255 255 255 255 255 255 255	<b>5888</b>	8 % = = = = = = = = = = = = = = = = = =		2400 1850 1850 1850 1850	2700 2700 2100 1550	1700	3 - 50 2450 1850	2400 1900 1400	3400 2700 2050	2800 2150 1600	3 100 2 200 1 250
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GROSS	BEST 1. A. S.	RATE	BE BE	ST 1. A. S.	RATE	FROM SEA	LEVEL BEST	ST 1. A. S.	RATE	FROM SEA LEVEL		BEST 1. A. S.	RATE	FROM SEA LEVEL	BEST	1. A. S. RJ	RATE FROM S	FROM SEA LEVEL BE	BEST I.A.S.	RATE	FROM SEA LEVE	וביו
WEIGHT LB.	HPH KTS	OF CLIMB F.P.M.		HT ITS	CLIMB F.P. M.	# H	FUEL MPH	H KTS	CLIMB F.P.M.	AIR.	PUEL NE	MPH KTS	OF CLIMB F.P.M.	TIME FI	FUEL MPH USED	E 3 2	OF TIME CLIMB MIN. F. P. M.	FUEL	HPH LT3	OF CLIMB F.P.R	TIME FUEL MIK. USED	
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.e.	N H	H AN	SLM	ROLL	TO CLEAK 50'08J.	ROLL	TO CLEAR 50'08J.		ROLL 5	TO CLEAR 50' 05J.	ROLL	TO CLEAR 50' OBJ.	GROUND	TO CLEAR SO' OBJ.	IR GROUND	D TO CLEAR 50'08J.	ROLL	D TO CLEAR 50' 08J.	ROLL ROLL	TO CLEAR 50'08U.	R GROUNG	TO CLEAR 50'08U.
0008	88	115 130	<u> </u>	200	2300	<u>\$</u> 200 €	2400		1500 2	2600	9 00	2400	0091	2600	1700	2800	3200 2900	908 1	3500	0001	00 ± 00	5000 # 500
REMARKS:		BASED			12313														MALL	DPTIMUM LANDING IS 80% OF CHART LEGEND	LEGEND	T VALUES
NOTE: TO DETER	MINE FUE	L CONSUM	PT 10#				X	MIXTURE:	USE	. NO.	OR A	USE "RUM" OR "AUTO RICH -AUTO LEAM	TUA- HO	IO LEA					Ī	I.A.S. : #	I.A.S. : INDICATED AIRSPEED H.P.H. : MILES PER HOUR	SPEED
MULTIPLY BY 10, THEM DIVIDE BY 12	THEN D	1V 10E BY	12																_	KTS. : KWOTS F.P.M. : FEET	: KNOTS : FEET PER MINUTE	<b>1</b>

For use with V-1650-3 engine only regardless of airplane model.

For use with V-1650-3 engine only regardless of airplane model.

Figure 64—Take-off, Climb and Landing Chart



RESTRICTED

Figure

#### SPEC. AN-H-8 DEC. 18, 1942 **ENGINE MODELS AIRPLANE MODELS** SPECIFIC ENGINE PACKARD V-1650-7 P-51D **FLIGHT CHART** FUEL OIL OIL COOLANT MAX. PERMISSIBLE DIVING RPM:....32\0..... CONDITION **PRESSURE** PRESSURE TEMP. TEMP. ALLOWABLE OIL CONSUMPTION CONDITION (LB/SQ. IN.) (LB/SQ. IN.) °C °F °C °F 100-212-MAX. CONT. DESIRED 12-16 70-80 70-80 110 230 176 ... 4....U.S.QT/HR.....IMP.PT/HR MAX. CRUISE MAXIMUM 19 90 194 121 250 ...3....U.S.QT/HR.....IMP.PT/HR MIN. SPECIFIC MINIMUM 59 60 140 15 12 50 IDLING 9 15 SPEC. AN-F-28 OCTANE 100 TWO SPEED, TWO STAGE **FUEL GRADE:** SUPERCHARGER TYPE: GRADE 130 FUEL FLOW MAXIMUM BLOWER MUMIXAM **CRITICAL ALTITUDE** MIXTURE MANIFOLD **USE LOW OPERATING** HORSE-(GAL/HR/ENG.) CYL. TEMP. **DURATION** CONTROL RPM PRESSURE BLOWER CONDITION **POWER** POSITION (MINUTES) WITH RAM NO RAM (BOOST) BELOW: U.S. .c 5 TAKE-OFF 1490 LOW A.R. 3000 61 S.L. 161 194 1720 6,200 LOW A.R. WAR 5 3000 67 187 1505 19.300 A.R. **EMERGENCY** HIGH 178 8.500 LOW A.R. 1590 MILITARY 15 3000 61 170 1370 21.400 HIGH A.R. 109 MAXIMUM 11.300 A.R. 2700 46 1180 LOW CONT. 106 CONTINUOUS HIGH 1065 23.400 A.R. 66 MAXIMUM 820 14.000 LOW A.L. CONT. 36 2400 64 CRUISE 760 23,700 HIGH A.L. MINIMUM SPECIFIC CONSUMPTION ADDITIONAL INFORMATION WILL BE INCORPORATED IN THIS CHART WHEN AVAILABLE.

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Figure
29-SI
pecific
Engin
. Flight
Chart-V
'-1650-3

RESTRICTED

FC. 18, 1		NE MODELS						ENGINI CHART	E			ARD V-165	<b>DELS</b> 0-3 <sub></sub>
	FUEL PRESSURE	OIL PRESSURE	C	IL		LANT			MAX. PERM	ISSIBLE I	DIVING RI	PM:3	240
CONDITION	(LB/SQ. IN		•c	*F	•c	°F		[[	CONDITIO	ON	ALL.	OWABLE OIL	CONSUMPTION
DESIRED	12-16	70-80	70-80	158- 176	100-	212-			MAX. CO				IMP.PT/HR
MAXIMUM	19	90	90	194	121	250			MAX. CR	UISE .	l	J.S.QT/HR.	IMP.PT/HF
MINIMUM	12	50	15	59	60	140			MIN. SPE				IMP.PT/HF
IDLING	9	15							OIL GRADE:	(S)	166	(W).	
SUPERCHARGI	R TYPE:	TWO SPEED, TV	O STAGE	<b>.</b>		h., ————————————————————————————————————			FUEL G	RADE:	SPEC. AN-		OCTANE 100
OPERATING		MANIFOLD	HORSE-		RITICAL	ALTITUDE	, E	USE LOW	MIXTURE		FLOW IR/ENG.)	MAXIMU/ CYL TEM	
CONDITION	RPM	PRESSURE (BOOST)	POWER	wn	H RAM	NO RA	M M	BLOWER BELOW:	POSITION	U.S.	Ĺ	°c	F (MINUTES)
TAKE-OFF	3000	61	1400	s	3.L.	S.L.	LOW		AR	150			5
WAR EMERGENCY	3000	67	1595 1295		7,000 3,800	11,70	1		AR AR	166 160			5
MILITARY	3000	61	1450	15	9,800 1,200	13,70	O LOW		AR - AR	158 144			15
MAXIMUM CONTINUOUS	2700	46	1120 940	20	),500 1,400	17,50	O LOW		AR AR	111			CONT.
MAXIMUM CRUISE	2400	36 36	800 700	21	,500 2.300	18,50			AL AL	74 70			CONT.
	1600 1600	27 30 31	370 440 480	10	3.L. 5,000 0,000 5.000		LOW LOW LOW		AL AL AL AL	35 39 42 45			CONT.

AN-11-0 10, 1942 A3C-510		AIR		NE M	ODEL	.S 		TAK	E-OFF	, CLI	MB &	LANE	ING	CHAR	T		EN	IGIN	4E V	AODI	ELS	
70 20									TAKE	- 0 F F	DIST	ANC	E (IN	FEET )				V-16	<u> 50</u>	<del>- 7</del>		
GR	oss	HEAD Y	MIND		HAR	SURF	ACE R	U N WAY	,		S (	D-TUR	FRUN	WAY			501	T SU	RFA	CE RU	N WAY	
WEH		<u> </u>			A LEVEL		,000 FT.		6,000 FT.		EA' LEVEL	1	000 FT.		000 FT.	AT SE	A LEVEL	A	\T 3,0	00 FT.	AT 6	,000 FT.
1841		MPH		STAN STAN	TO CLEAR SO' COLL	SUN	TO CLEA				TO CLEAR 50' OBJ.	STON	TO CLEAR SO' OBJ.	BUN	TO CLEAR 50' OBJ.	SUN	TO CLEAR		SHUC HUL	TO CLEAR 50' OOJ.	GROUND	TO CLEAR SO' OBJ.
94	000	0 17 34 51		1400 1000 700 500	2000 1600 1200 800	1500 1200 800 600	1700	130	00 2000 00 1500	1100	1600	1600 1200 900 600	2300 1800 1400 1000	1800 1400 1000 700	2500 2000 1500	1600 ,1200 900 600	2300 1800 1300	13	100	2500 1900 1400	2000 1500 1100	2800 2200 1700
10,0	000	0 17 34 51		1600 1200 900 600	2400 1800 1400 1000	1800 1300 1000 700	2000 1500	150	00 2300 00 1800	1300	1900	1800 1400 1000 700	2600 2100 1600	2100 1600 1200	3000 2400 1800	1900 1400 1000	2700 2100 1600	21 16 12	00	2900 2300 1700	2400 1800 1300	3200 2500 2000
11,0	000	0 17 24 51		1800 1400 1000 700	2700 2100 1600	2000 1500 1100	3000 2300 1800	230 180 130	00 3300 00 2600 00 2100	2000 1500	2800 2200 1700	2100 1600 1200	3100 2400 1900	2400 1900 1400	3400 2700 2100	2300 1700 1200	3200 2500 1900	25 19	000	3400 2700 2100	2800 2200 1600	3900 3100 2400
NOTE	NCRE	استا	ANCE			1						800	1400			1					1200	1700
					· · · · · · · · · · · · · · · · · · ·													3000			- 61	и. но
COMB	AT MISS	SIONS US	27	NA	-			5		CL		ATA		-					<u>'                                    </u>		- 61	
COMB			- 41		NPM &					CL	MB D	ATA	1		FER	RY MISSIO		24	00			IR. NO
COMBA	TYI	PE S.	L 10 5	000 m.	ALT.	IO,	,000 TIM	FT. AI	LT.	15T I.A.S.	I M B D	PT. ALT.		20,	FERI	PY MISSIO FF. ALT. FUEL PROM S	NS USE	24 25	00	TIME FROM	FT. ALT.	IR. HO
	CCTN CCTN	PE S. IF DEST	L TO 5	77/mm	ALT.	10,	7/MM PRO 5.1	PT. AI	LT. SIGN S.L. SI	15T I.A.S.	I M B D 15,000 T/MIN PROM S. L.	PT. ALT.	S.L. SEST I MPH     160   165	20, .A.S. F7/M	FERI	RY MISSIO	NS USE	24 25	.000	TIME PROM	FT. ALT. FUEL FROM S U.S. 51	SLOWER CHAMBS
11,00	TYI O CLM Fun	PE S.  IF MAS MAN  MAT 165  MAT 165	LTO 5	1600 730	ALT. FIME 965 BOM APPL 3.3 165 6.8 165	10, 7 LAS.   p	780 13.	FT. A. B. RUEL FE U. S	AT. SI SI SI SI SI SI SI SI SI SI SI SI SI	5 5 .	15,000 15,000 17/MIN PROM 5.L 1270 9.5 730 20.5 1650 7.8	FT. ALT. FUSI. FROM U. S.	MPH I 60	20, .A.S. 77/M 115 45	FER: 0000 Time PROM S.L. 0 13.5 0 29.0	PT. ALT. PUBL PROM S U.S. 41	NS USE	24 25	00 .000 PT/MIN 950	TIME PROM	FT. ALT. FUEL FROM S U.S.	SLOWER CHANGE AUTO
11,00	TYTO COM	PE S. DEST MAR MART 165 MART 165 MART 165	LTO 5	1600 730 1980 1080	ALT. FIME BOM S. L. MPH 3.3 165 6.8 165 4.8 165 2.1 165 3.0 165	10,	7/MIN TIM PRO S. I. 1630 6. 780 13. 2030 5. 1090 9. 2430 4.	F7. Ad A Mult Pin U. S	16 16 16 16	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	15,000 15,000 T/MIN PROM S.L 1270 9.5 730 20.5 1650 7.8 1050 14.5 2000 6.4	PT. ALT. FURL PROM U. S. 34 37	160 165	20, A.S. 77/M 115 45 156 75	FERI .000 TIME PROM S.L. 0 13.5 0 29.0 0 10.5 0 20.0 0 8.8	PT. ALT. PUBL PROM S U.S. 41 47	NS USE  L BEST  MPH  155 160  155	24 25	00 ,000 PT/MIN 950 200	TIME PROM 5.L. 18.5	FT. ALT. FUEL FROM S U.A. 51 64	AUTO
10,00	TYI OI COM PINE	PE S. PP BEST MAB MPM MAT 165 MAT 165 MAT 165 MAT 165 MAT 165 MAT 165	L 10 5	1600 730 1980 1080 2350 1300	ALT.  FIMAL SESSION  S.L. MPH  3.3 165  8.8 165  2.6 165  4.8 165  2.1 165  3.0 165	10, 7 LAS. P	7/MIN TIM PRO 5.1 1630 6. 780 13. 2030 5. 1090 9.	F7. Al 4 M U. S. 5 28 .5 30 .2 26 .5 26 .2 24 .5 24	15 16 16 16 16 16	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	15,000 15,000 17/MINI PROME NO. 1270 1270 1270 1270 1270 1270 1270 1270	FT. ALT. FURL PROM U. S. 34 37 31 21 28 28	160 165 160 165 160 165	20, A.1. PT/M 115 45 156 75	FERI .000  TIME PROM 5.L.  0 13.5 0 29.0 0 10.5 0 20.0 0 8.8 0 14.0	PY MISSIO FT. ALT. FUEL PROM S U.S. 41 47 36 37 33 33	NS USE  BEST MPN   155   160   155   160   155   160   155   160   1	24 25 1.A.S.	950 200 1360 530	Time Prom S.L. 18.5 43.0 44.0 28.0 11.5 21.0	77. ALT. PUEL PROM S U.4. 51 64 43 46 38 39	AUTO. AUTO. AUTO. AUTO. AUTO. AUTO.
9000   17																						
11,00 10,00 900 NOTE:	TYTO COMMING C	PE S. P. DESTANDA 1 165 MAAT 165 MAY 1	L TO 5	1600 730 1980 1030 2350 1300 MBING 1	ALT. TIMB BESS BOOM 3.3 165 8.8 165 2.6 165 4.8 165 2.1 165 3.0 165 TIME 5	10, 7 LAS. P. 2 2 3 3 5 FOR 2	,000 - TIM PRO   TIM PRO	FT. A. RUEL PM U. S. 5.5 30 2.2 6.5 26 2.2 24 5.5 24 CC ABOVI	15 16 16 16 16 E O'C FREE	ST I.A.S.  N  S  S  S  S  S  S  S  AIR TEMP	15,000 15,000 17/MIN FLOW FLOW FLOW FLOW FLOW FLOW FLOW FLOW	FI. ALT. FUEL PROM U. S. 34 37 31 21 28 28 5 % FG	MPM   160   165   160   165   160   165   DR EACH 2	20, A.S. PT/M 115 45 156 75 195 105	FERI .000  TIME PROM 5.L.  0 13.5 0 29.0 0 10.5 0 20.0 0 8.8 0 14.0	PY MISSIO FT. ALT. FUEL PROM S U.S. 41 47 36 37 33 33	NS USE  L BEST MPM 155 160 155 160 155 160 CCLUDES V	24 25 1.A.S.	950 200 1350 530 1750 850	TIME PROM S.L. 18.5 43.0 14.0 28.0 11.5 21.0 ND TAKE	FT. ALT. FUEL FROM S U.A. 51 64 43 46 38 39	AUTO. AUTO. AUTO. AUTO. AUTO. AUTO.
11,00 10,00 900 NOTE:	TYPE COMPANY C	PE S. DEET I 65 MAY 165 MY 165	L TO 5	1600 730 1980 1030 2350 1300 MBING 1	ALT. TIME SES COM STORY 3.3 165 8.8 165 4.8 165 2.1 165 3.0 165 TIME 5	10,7 LAS. P	,000 - TIME   TI	FT. AI M NUS. THE U.S. 55 30 22 26 .5 26 .5 26 .2 24 .5 24 C ABOVI	15 16 16 16 16 16 16 16 16 16 16 16 16 16	ST I.A.S. PH 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	15,000 15,000 17/MIN PROM 1.01 1270 9.5 730 20.5 1850 7.8 1050 14.5 2000 6.4 1350 11.0 ERATURE (  D 1 S T.	FI. ALT. FUSE PROM U. S. 34 37 31 31 28 28 5 % FC	MPM   160   165   160   165   160   165   165   165   165   165   165   165   167	20, A.1. PT/M 115 45 156 75 195 105 0°F ABOV	FER: .000 FINAL .000 F	PT. ALT. PUR PION S U.S. U.S. U.S. U.S. U.S. U.S. U.S. U.	NS USE  L BEST 155 160 155 160 155 160 CLUDES V	24 25 1.A.S.	950 200 1360 530 1750 850 -UP AI	Time PROM S. L. 18.5 43.0 14.0 28.0 11.5 21.0 ND TAKE	FT. ALT. FUEL FROM S U.S. 51 64 43 46 38 39 I-OFF ALL	AUTO AUTO AUTO OWANCE
11,00 10,00 900 NOTE: GROS WEIGH	TYTO COMPANY OF THE PROPERTY O	PE S. DEET I 65 MAY 165 MY 165	L TO 5	1600 730 1980 1030 2350 1300 MBING 1	ALT.  TIMMS SESSION  3.3 165  8.8 165  2.6 165  4.8 165  2.1 165  3.0 165  TME 5	% FOR 2	,000 - TIM   TIM   PRO   TIM   PRO   TIM   PRO   TIM   PRO   TIM   PRO   TIM	PT. AI AI AI AI AI AI AI AI AI AI AI AI AI	16 16 16 16 16 16 16 16 16 16 16 16 16 1	ST LA.S. PH 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 6 6 6 6	1 M B D 15,000 17/MIN PROM 5.00 1270 9.5 730 20.5 1650 7.8 1050 14.5 2000 6.4 1350 11.0 ERATURE (  D 1 S T	FI. ALT. FUEL PROM U. S. 34 37 31 21 28 28 5 % FC	MPM   160   165   160   165   160   165   160   165   160   165   160   165	20,s. #7/M 115	FER:  .000	FY MISSIO FF. ALT.  FUEL PROM S  U.S.  41  47  36  37  33  FUEL IN	NS USE  L BEST 155 160 155 160 155 160 155 160 WCLUDES V	24 25 1.A.L.	950 950 1360 530 1750 850 -UP AI	TIME PROM 5.1. 18.5 43.0 14.0 28.0 11.5 21.0 ND TAKE	FT. ALT. FUEL FROM S U.S. 51 64 43 46 38 39 I-OFF ALL TO CLEAR	AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. OWANCE
II,00 10,00 900 NOTE: GROS WEIGH IN LBS	TYPE COMPANY C	PE S	L TO 5	1600 730 1980 1030 2350 1300 MBING 1	ALT. TIME BESSON S.L. MIPH S.L MIPH S.L	7 LAS.	,000 - TIMIN POOL 11630 6, 780 13, 2030 5, 1090 9, 2430 4, 1400 7, EACH 10*	FT. AI  A PURE PR  W. S.  5 28  .5 30  .2 26  .5 26  .2 24  .5 24  C ABOVE  AT 4.00  C CLEAR 30° OBJ.  2400	15 16 16 16 16 16 16 16 16 16 16 16 16 16	ST I.A.S.  H  5  5  5  5  AIR TEMP  I N G  AT SEA  TO CLEAR SC ON.  2200	M B D   15,000   15,000   15,000   10	FI. ALT. FUEL PROM U. S. 34 37 31 31 28 5 % FC A. N. C. I FR. M. D. B. A. T. 3,000 0 CLEAR 10' OBJ. 2400	160 165 160 165 160 165 160 165 28 EACH 2	20, A.1. P7/M 115 45 156 75 195 105 105°F ABOVI	FER: .000 TIMAL 0 13.5 0 29.0 0 10.5 0 20.0 0 8.8 0 14.0 E 32*F)  FT.	PT. ALT. PUEL ROOM S U.S. U.S. U.S. U.S. U.S. U.S. U.S. U.	NS USE  L BEST MPM 155 160 155 160 155 160 CLUDES V	24-25-1A.S.   1A.S.   950 200 1360 530 1750 850 -UP AI	TIME PROM 5.L. 18.5 43.0 14.0 28.0 11.5 21.0 ND TAKE	FT. ALT.  FUEL FROM S  U.S.  51  64  43  46  38  39  I-OFF ALL  TO CLEAR  50' ORL.	AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. AUTO. OWANCE	

REMARKS

Figure 43—Take-off, Climb, and Landing Chart

RESTRICTED

9000 POUNDS 13 WITH NO EXTERNAL LOAD 10,000 AND 11,000 POUNDS ARE WITH BOMBS OR EXTERNAL TANKS.

L.A.S.: Indicated Air Speed
RLFM.: Miles Per Heer
S.L.: Soc Lovel
U.S.: U. S. Gallens
RMF: Imperial Gallens
RMF: Imperial Gallens
RMF: RMF: TO SEEN FLIGHT CHECKED
FIGURES MAYE NOT SEEN FLIGHT CHECKED

Figure 44—Flight Operation Instruction Chart—V-1650-7 Engine (Wing Bomb Racks—9600 to 8000 lbs.)

MODEL(S) FLIGHT OPERATION INSTRUCTION CHART P-51D

8000 **POUNDS**  EXTERNAL LOAD ITEMS

WING BOMB RACKS

ENGIN	E(S):	A-10:	00-7				
LIMITS	R. P. M.	M. P. (IN. EG.)	BLOWER	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.	Ī
WAR MAX.	3000	67	LOW	AR	5	194	
MILITARY POWER	3000	61	LOW	AR	15	178	
MORMAL RATED	2700	46	LOW	AR	CONT.	109	١

CHART WEIGHT LIMITS: 9600 INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. 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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

	I RANGE IN AIR MILES						FUEL			II			- 1			Ш			- 1			IV				FUEL						
	RANGE	IN AI	IR M	ILES			U. S.		RANGE	IN AIR	MILE	8			RANGE	IN AIR	MILE	8			RANGE	IN AIR	MILE	8		U. S.		RANGE				
ST/	TUTE	T	N	AUT	ICAL		GAL.	BTA?	TUTE	T :	NAUT	TCAI	<u>.                                    </u>	8TA	TUTE		NAU?	ILOI	,	STA	TUTE		NAU7	IADI	<u>.  </u>	GAL.	STA	TUTE		NAU	TICA	<u>.</u>
6	80			55	0		269 240		29 20	GAI	71		o w	ANCE 9	NOT 50	AV		A B : 20	LE		LIGH 20	T	97	0		269 240		70			00	
51	90			51	0		210	7	20		62	0		8	30	1.	7	20		9	80		85	0	_	210	11	10	1		960	
5	10			44	0		180	6	10		53	0		7	10		. 6	10		8	340		. 73	0		180		50			330	
ų	20			37	0		150	5	10		44	0		5	90		5	10		. 7	700		61	0		150	7	90			590	
3	40	1		28	70		120	¥	10		35	0		ц	70		4	10		5	560		48	0		120	1	40		-	550	
2	50			22	20		90	. 3	00		26	0		3	50	_	_	10		£	120	İ	36	0		00	) i	80		4	<b>4</b> 20	
	70	+		1.	10		60		200	1	17			2	30	1		00		2	280		- 24	0		80	3	20	.	- 4	280	
-	80			_	70		30		00			0		ı	10		1	00		1	140		12	?0		30		60		1	140	
	MAXIMU	M CO	NTI	TUOI	US	-			OPER/	TING E	ATA				OPER.	ATING	DATA				OPER	ATING	DATA					MAXI	MUM R	ANGE	B	
R. P. M	L. A. S. M.P.E.	MIX	2	i. P. In. Mg.	G. P.	Ŧ.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX- TURE	M. P. In. He.	G. P. M.	T.	R. P. M.	I. A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	G. P. H.	T. A. B.	R. P. M.	L. A. S. M.P.R.	MIX- TURE	M. P. In. Mg.	G. P. E.	T. A. B.	ALT. Feet	R. P. M.	L A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	G. P. M.	T. A. B.
2700 2700	230	AR	,	FT	80	1	40000 35000 30000			-				2600	255	AR	FT	90	410	2500	245	AR	FT	75	390	40000 85000 30000	2550 2350	205 205	AR AL	FT	62 58	36 34
2700	1	AR		-		410							<del>  -</del>	2400	260	AR	FT	87	380	2400	245	AL	36	70	360	25000	2100	205	AL	FT	52	30
2700		AR	-			390						_		2600	270	AR	FI	84		2350	245	AL		ı	•	20000		205	AL	FT	48	28 26
2700	305	AR	۱ ا	46	113	385	15000	2550	290	AR	FT	97	365	2400	270	AR	39	78		2150	250	AL		61	1	15000	1800	205	AL	FT		
2700	1	AR			108	355	10000	2500	285	AR	43	ı	335	1	270	AR	38	73	1.	2150	250	AL	36	57 54	295 275	10000	1650	210	AL	FT 33	39	24
2700 2700	1 7	AR		46 46		330	5000 S. L.	2500	285 285	AR	43			2400	270	AR	38	66	1	2150	250	AL	36	į	250	5000 S. L.		200	AL	31	34	20

EXAMPLE AT 9400 1.B. GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT, AIRMILES AT 20,000 FT. ALT. MAINTAIN 2350 RPM AND 245 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND L.A.S.: INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.M.: U.S. GALL PER HOUR T.A.S.: TRUE AIRSPEED S.L.: SEA LEVEL

F.T.: FULL THROTTLE F.R.: FULL RICH A.R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

NOTES T ALLOW 29 GAL, FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

<sup>2.</sup> IF 85 GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP. TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS. HIGH BLOWER ABOVE HEAVY LINE ONLY.

Figure 45-Flight Operation Instruction Chart-V-1650-7, Engine Wing Bombs-10,000 to 9500 lbs.)

RESTRICTED

(Two 300-lb.

#### MODEL(S) P-5ID

CHART WEIGHT LIMITS:

# FLIGHT OPERATION INSTRUCTION CHART

10,000

POUNDS

EXTERNAL LOAD ITEMS

2 - 300-LB. WING BOMBS (OR SMALLER SIZE)

ENGINE(S): V-1650-7 M. P. (DI. HG.) BLOWER MIXTURE TIME LIMIT TOTAL G. P. H. LIMITS R. P. M. POSITION POSITION 194 3000 67 WAR 110 187 LOW H I CH 178 MILITARY 2000 61 AR 15 LOW 109 NORMAL RATED 2700 46 AR CONT.

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. 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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

		1			1	FUEL			П			1			Ш						IA:				FUEL						
	RANGE	IN AIB	MILE	:5	_	U. S.		RANGE	IN AIR	MILE	8			RANGE	IN AIR	MILE	8			RANGE	IN AIR	MILE	8		U.S.		RANGE	IN AIR	,MILI	:8	
STAT	TUTE	$\neg$	NAU	TICAL		GAL.	STA	TUTE	1	NAUT	ICAL	,	STA	TUTE	$\top$	NAU	TCAI	. [	STA	TUTE		TUAN	TCAI	ا د	GAL.	STA	TUTE		NAU	TICA	L
						269		1 29	GA1			ow.	ANCE		AV			LE		LIGH	T	Û			269						
. 6!	50		5	80		240	7	90		6	80		8	10			90		l	070		93	0		240	1	240	Ļ		080	
51	90		51	0		220	7	20		6	20		8	40		7	30			990		85	0		220	1	140		8	90	
5	40		47	70	1 1			350		5	70		7	60		6	60			890		770	)		200	ı	030			00	
Ħ	80		42	20		180		590		5	10		· e	80		5	90			800		690			180		930	_		110	
14	30		3	70		160	,	520		4	50		. 6	110		5	30			710		620	)		160		830		;	20	
3	80		3.	30		140	1	460		4	00			530		4	60			620	ŀ	540			140		730		6	30	
	AXIMU	M CON	TINU	US		<del>                                     </del>	<del></del>	OPERA	TING	ATA				OPER	ATING	DATA				OPER	ATING I	ATA					MAXI	MUM R	ANGE		
R. P. M.	7	MIX- TURE	M. P.	G. P.	T.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	G. P. H.	T. A.	R. P. M.	L. A. S. M.P.M.	MIX- TURE	M. P. In. Hg.	д. г. н.	T. A. E.	R. P. M.	L.A.S. M.P.R.	MEX- TURE	M. P. In. Rg.	G. P. E.	T. A. B.	ALT. Feet	R. P. M.	L A. S. M.P.E.	MIX- TURE	M. P. In. Mg.	G. P. E	T. A.
		•				40000 35000 30000																	·		40000 85000 30000						
2700	270	AR	46	115	395	25000							2450	255	AR	41	86	375	2400	235	AR	37	71	350	25000	2100	200	AL	FT		295
2700	275	AR	FT	100	375	20000							2550	260	AR	FT	83	355	2400	240	AL	FT	67	330	20000	2050	200	AL	FT	48	275
2700	290	AR	46	113	365	15000	2550	280	AR	FT	96	350	2400	260	AR	39	78	330	2200	245	AL	FT	63	310	15000	1800	200	AL	FT	45	255
2700	290	AR	46		340		2550	280	AR	43		325	2400	260	AR	38	72		2200	250	AL	36		290 270	1	1650	205	AL AL	FT 33	42 39	240
2700	290 290	AR	46	1	315		2550 2500	275 275	AR AR	43	l	300 275	2400	260 260	AR AR	38 38	67 63	280 260		250 250	AL	36 36	1	250	1	1	210	AL	33	37	210
<del></del>			_1	Ь.	<del>! ;</del>	NOTES	J	<u> </u>	1		1	<u> </u>			! !	EXAM	PLE	280	<u> </u>	<u> </u>	1				1	L	GEND		9		

D ALLOW 29 CAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT: AS REQ'D.

<sup>2.</sup> IF 85-GALLON FUSELAGE TANK IS INSTALLED, WARM-UP, TAKE-OFF. CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS. HIGH BLOWER ABOVE HEAVY LINE ONLY.

LB. CROSS WT. WITH 240 CAL. OF FUEL AT 9800 (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2200 RPM AND 250 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

L.A.S.: INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.H.: U.S. GAL. PER HOUR T. A. S. TRUE AIRSPEED

F. T.: FULL THROTTLE F. R.: FULL RICH A. R.: AUTO-RICH A. L.: AUTO-LEAN C. L.: CRUISING LEAN

# Figure 46—Flight Operation (Two 300-lb. Wing Bombs-9500 to 8000 lbs.) Instruction Chart—V-1650-7 Engine

RESTRICTED

MODEL(S)	FLICHT	ODEDATION	INSTRUCTION
P-5ID	FLIGHT	UPERATION	INSINOOII

CHART WEIGHT LIMITS:

ION CHART

TO 8000 POUNDS

īV

2 - 300-LB. WING BOMBS (OR SMALLER SIZE)

EXTERNAL LOAD ITEMS

ENGIN	E(S):	V-16	50-7			
LIMITS	R. P. M.	M. P. (Df. HG.)		MIXTURE POSITION	TIME	TOTAL G. P. R.
WAR MAX.	3000	67	LOW	AR	5	194
MILITARY	3000	61	LOW	AR	15	178
NORMAL RATED	2700	46	HIGH	AR	CONT.	109

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

9500

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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

	LANGE	737 4	_																													
STATE	RANGE IN AIR MILES STATUTE NAUTICAL				,	_	U. S.		RANGE I	N AIR	MILE	В		1	RANGE	N AIR	MILE	8		1	RANGE I	N AIR	MILES	3	_	U. S.			IN AIR			
	UTE	Т	N	TUA	TCAL	.	GAL.	STAT	TUTE	1 :	TUAN	ICAL		STA	TUTE		NAUT	ICAL		STA	TUTE	1	TUA	ICAL		GAL.	STAT	TUTE		NAU?	TICAL	
		+					184		1 24	GAI	. А	LL	ow.	ANCE	NOT	AV	AIL	A B	LE.	IN F	LIGH	T,	<b>D</b>		1	184			ì			
43	30	1		37	0	l	160	50	0	1	43	0	- 1	6	00		52	0	- 1	7	20		62	0		160	8	50		74	_	
38	во	1		33	0		140	ĦĦ	0		38	0		5	30		46	0		€	30		54	0	_	140	7	40		65	0	
32	20	$\top$		28	0		120	38	30		33	0		¥	50		39	0		5	340		46	0		120	6	40		55	0	
27	70			23	0		100	31	0		27	0		3	80		33	0		ı	150		3.9	0		100	5	30		46	0	
21	10			18	0		80	25	50 220 90 160			3	100		26	0		3	860		31	0		80	14	30		37	0			
16	60			14	0		60	18	90	160			2	20		18	0		2	270		23	0	_	60	3	20	$\perp$	28	70		
	10			9	0		40	12	20		110			50		13	0			80		15	0		40	2	20		18	0		
	50			4	0		20		30		5	0	1		70		ć	0			90		7	0		20	-	10		10	_	
MA	AXIMUI	M C0	NTL	NUO	US		-		OPERA	TING I	ATA		一		OPER.	TING	DATA				OPER.	ATING I	ATA					MAXI	MUM R	NGE		
	L A.S. M.P.H.	MIX		L. P. In. Mg.	G. P. M.	T.	ALT. Feet	R. P. M.	L A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	G. P. E.	T.	R. P. M.	L. A. S. M.P.E.	MIX- TURE	M. P. In. Hg.	G. г. н.	T. A. B.	R. P. M.	I. A. S. M.P.H.	· MIX- TURE	M. P. In. Hg.	G, P. M.	T. A. S.	ALT. Feet	R. P. M.	L A. S. M.P.H.	MIX- TURE	M. P. In. Mg.	G. P. B.	T. A. B.
1				•			40000 85000 80000																			40000 35000 30000						
2700	270	A	<del>-</del>	46	115	395					-	-	Н	2450	255	AR	41	89	375	2400	240	AR	37	71	355	25000	2100	205	AL	FT	52	305
	275	-	-	FŢ			20000							2550	260	AR	FT	ЯЩ	355	2400	240	AL	FT	66	330	20000	2050	205	AL	FT	49	28
	290	Â	··· I	<b>46</b>		365	1	2550	280	AR	FT	100	350		260	AR	39		330		245	AL	1		310		1800	205	AL	1	45	
2700	290	A	R	46	108	340	10000	2550	280	AR	43	93	325	2400	260	AR	38	73	305	2250	250	AL	36	58	290	10000	1650	210	AL	FT	42	245
	290	A	F	46	103	315	5000	2550	280	AR	43	86	300	2400	260	AR	38	67	280	2250	250	AL	36	54	270	5000	1600	210	AL	33	40	230
2700	290	A	R	46	98	295	8.L	2550	280	AR	43	80	280	2400	260	AR	38	62	260	2250	250	AL	36	50	250	8. L.	1600	210	AL	32	37	210

VOTES T ALLOW 24 GAL. FOR W. RM. UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR W. IND. RESERVE & COMBAT AS REQ'D.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE AT 9300 LB GROSS WT. WITH 160 GAL OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 GAL.) TO FLY 550 STAT, AIRMILES AT 10,000 FT. ALT MAINTAIN 2250 RPM AND 250 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND L.A.S.: INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.M.: U.S. GAL. PER HOUR T.A.S.: TRUE AIRSPEED S.L.: SEA LEVEL

F. T.: FULL THROTTLE F. R.: FULL RICH A. R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

	Figure
(Two 500-lb. Wing E	47-Flight Operation
Wing Bombs-10,500 to 10,000 lbs.)	Instruction Chart—V-1650-7
•	Engine

RESTRICTED

2 - 500-LB. WING BOMBS

ENGINE(S): V-1650-7

CHART WEIGHT LIMITS: 10,500

TO 10.000 POUNDS

20110121	w(D).	V - 10.	,  -			1
LIMITS	R.P.M.	M. P. (Df. EG.)	BLOWER POSITION	MIXTURE POSITION	TIME	TOTAL G. P. H.
WAR	2000	67	LOW	AR	5	194
MILITARY	2000	61	LON	AR	16	178 170
MORMAL RATED	2700	46	HAT	AR	CONT.	188

MODEL(S)

P-51 D

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. 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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

EXTERNAL LOAD ITEMS

		I RANGE IN AIR MILES			FUEL				п						Ш						IV			-	FUEL			٧						
		RANGE	IN A	LIR I	MILE	8		U. S.		RA	NGE I	N AIR	MIL	:8			RANGE	IN ALE	MILI	28			RANGE	IN AIR	MILI	:S		U. S.		RANGE	IN AIR	MILE	ES	
	STA?	TUTE		1	NAU:	MCA	L	GAL	8	TATU	TB.	1	NAU	TICAI	L	ST.	TUTE		NAU	TICA	L	8T.	ATUTE		NAU'	FICA	ւ	GAL.	STA	TUTE		NAU	TICA	L
	(	330			54	0		269 240	1	780		G.A.		ALL 30	οw	ANCE	970	r Av		60	LE		LIGI 1020	IT	D 8	90		269 240	1	180		10	20	
		570			50	0		220		70	0		8.	10	·	1	800		6	90			940		8.	10		220	,	080		94	10	
		520			45			200		640 <i>550</i> 570 <i>500</i>					730		6	30			850		74	0		200		980		85	50			
	1	<b>∔</b> 70			41	0		180		570 500				550		5	70			770		68	0		180		880		77	70	- 1			
		<b>‡2</b> 0			36	-	-	160		51	-			10			580		5	00			680		59	0		160		790		68	ro	
L		370			32	0		140		440	0	1	38	90			510		4	40			600		52	0	- 1	140	l	690		60	10	
	X	AXIMU	M CO	ודאכ	NUO	US				0	PERA'	TING I	ATA				OPER	ATING	DATA				OPER	ATING I	ATA					MAXI	MUM R	ANGE		
R. P	. 14.	L A.S. M.P.E	MIX	<b>L</b> 1	M. P. In. Mg.	G. P. W.	7. A.	ALT. Feet	R. P.		A. S. P.X.	MIX- TURE	M. P. In. Hg.	a. P.	T.	R. P. M.	L A. S. M.P.X.	MIX- TURE	M. P. In. Mg.	G. P. M.	P P H	R. P. M.	L.A.S. M.P.E.	MIX- TURE	M. P. In. Re.	G. P. H.	T. A.	ALT. Feet	R. P. M.	L A. S. M.P.E.	MIX. TURE	M. P. Ia. Hg.	Q 2.	T. A. B.
								40000 85000 80000																				40000 85000 30000						
2	700	260	A	R	46	115	38	25000	$\top$							2500	245	AR	41	91	365	2400	235	AR	38	73	345	25000	2150	200	AL	FT	55	295
1 -	700	265	1	R	- 1		1	20000			T					2600	255	AR	FT	87	350	2450	240	AR	FT	69	325	20000	2100	200	AL	FT		275
2	700	280	_^	R	46	113	35	15000	255	0 2	70	AR	FT	95	340	2400	255	AR	FT	80	325	2250	240	AL	36	65	305	15000	1900	205	AL	FT	48	260
	700	280	Ā	R	46	108	33	1	250	0 2	70	AR	42	89	315	2400	255	AR	39	73	300	2300	245	AL	36	61	285	10000	1650	210	AL	FT	46	245
	700	280		R	46	103	1	1	250	- 1 -	270	AR	42	82	29d	2400	255	AR	38	67	275	2350	245	AL	36	56	265	5000	1600	210	AL	36	43	230
2	700	280	ļ A	R	46	98	28	9 S.L	·   250	0   2	270 l	AR	42	76	270	2400	255	AR	38	63	255	2350	245	AL	36	52	245	S. L.	1600	210	AL	34	41	210

NOTES

# LEGEND

L.A.S.: INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.H.: U.S. GALL PER HOUR T.A.S.: TRUE AIRSPEED S.L.: SEA LEVEL

T ALLOW 29 GAL FOR WARM-UP, TAKE-OFF & INITIAL CLIMB

PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D. 2. IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED. WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

EXAMPLE AT 10, 300 LB. GROSS WT. WITH 240 GAL. OF FUEL

<sup>(</sup>AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 950 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED HIGH BLOWER ABOVE HEAVY LINE ONLY.

F.T.: FULL THROTTLE F.R.: FULL RICH A.R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

R. P. M.

3000

3000

2700

67

61

46

# FLIGHT OPERATION INSTRUCTION CHART

EXTERNAL LOAD ITEMS

2 - 500-LB. WING BOMBS

ENGINE(S):

Figure

48—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs-10,000 to 8500 lbs.)

RESTRICTED

V-1650-7

HIGH

HIGH

LOW

BLOWER MIXTURE

AR

AR

15

CONT.

TOTAL G. P. H.

194

178

170

109

CHART WEIGHT LIMITS: 10,000

TO 8500

POUNDS

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. 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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

	RANGE IN AIR MILES						1		II						ш						IV			- 1	FUEL		_	V			
	RANGE	IN AI	R MIL	ES		U. S.		RANGE	IN AIR	MILI	28			RANGE	IN AII	R MILI	cs			RANGE	IN AIR	MILE	8		U. S.		RANGE	IN AIR	MILE	28	
STAT	TUTE		NA	JTICA	L	GAL.	STA	TUTE	1	NAU	TICA	L	8TA	TUTE	$\neg$	NAU	TICA	L	8T/	TUTE		NAUT	TCAI		GAL.	STA	TUTE		NAU	TICA	L
42	-		_	60		184	5	Ф 24 00	G A	4	30	ow.		580	AV	5	00	LE		880	T	Ф <sub>58</sub>	-	- 1	160	80			74	•	
37	70			20		140	1	40		3	80			510	$\perp$	4.	10			800		52	-		140	70	00 				
3	10			70		120	3	370		3	20		. 1	430		3	80			510		4	40		120	6	00 ,	-	52	20	
20	60		2	30		100	3	310		2	70			360		3	10			420		3	70		100	5	00		4	40	
2	10			80		80	2	250		2	10			290		2	50			340		2	90		80	4	00		3.	50	
- 1	50			30		60	1	80		1	60			210		1	90			250		2.	20		60	3	00		2	70	
1	00			90		40		120		110				140		1	20			170		1	40		40	2	00		1	80	
	50	-		40		20		60			50			70			60			80			70		20	1	00	İ		90	
м	AXIMU	M CO	NTINU	ous			1	OPER.	TING	DATA				OPER	ATING	DATA				OPER	ATING I	DATA					IXAM	MUM R.	ANGE		_
R. P. M.	L A. S. M.P.E.	MIX- TURI		P.	T.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX. TURE	M. P. In. Rg.	G. P. M.	T. A. B.	R. P. M.	L A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	G. P. H.	T. A. B.	R. P. M.	L.A.S. M.P.M.	MIX- TURE	M. P. In. Mg.	G. P. E.	T. A. B.	ALT. Feet	R. P. M.	LAB. M.P.M.	MIX- TURE	M. P. In. Rg.	G. P. ML	T. A. B.
						40000 35000 30000	1																		40000 85000 30000						
2700	260	AP	u.e	111	38	25000	1						2450	245	AR	41	90	365	2400	235	AR	37	73	345	25000	2150	200	AL	FT	54	300
2700	270	AR	FT	_	36	-							2550	255	AR	FT	85	345	2400	240	AL	FT	68	325	20000	2100	205	AL	FT	50	28
2700	280	AR	46	11:	35	15000	2500	265	AR	FT	97	335	2400	255	AR	38	79	320	2250	240	AL	36	64	305	15000	1850	205	AL	FT	47	260
2700	280	AR	46	10	33	10000	2500	265	AR	42	89	310	2400	255	AK	38	73	295	2300	245	AL		1	285		1700		AL		44	
2700	280	AR	46	103	30	1	1-000	270	AR	42	83	290	2400	255	AR	39	68	275	2350	1	AL	1	í	265		1600	1	AL	1	42	1 -
2700	280	AR	46	9	28	5 S.L	2550	2550 270 AR			78	270	2400	255	AR	39	63	255	2350	245	AL	36	52	245	S. L.	1600	210	AL	34	39	210

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE LB. GROSS WT. WITH

160 GAL OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 GAL.) TO FLY 600 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED

WITH MIXTURE SET AUTO LEAR

LEGEND

LA. S.: INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.H.: U.S. GAL. PER HOUR T.A.S.: TRUE AIRSPEED S.L.: SEA LEVEL F. T.: FULL THROTTLE F. R.: FULL RICH A. R.: AUTO-RICH A. L.: AUTO-LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

NOTES T ALLOW 24 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

(Con	Figure 49—Flight C
(Combat Tanks—10,700 to 9600 lbs.)	Operation Instruction
9600 lbs.)	Chart-V-1650-7 E
	Engin

RESTRICTED

MODEL(S) P-5ID									FL	IGI	łT	OP	ERA	rion	INS	STR	U	TI	ON (	CHAR	PT.			2 -		RNAL I			NKS		
ENGI	NE(S):	. v	/ - 16	50-	- 7				CH.	LRT V	WEI	GHT	LIMITS	: 10.	700		то	96	00	POUN	DS			•			VOI.101				
LIMITS	R.P.		M. P.	BLOW		MIXTURE	TIME	TOTAL G. P. H.	IN	STR	UCT	IONS	FOR U	SING C	HART			igure	in FU						s for em						
WAR	* 3000	-	67	10817		AR	5	194					r less the to left o												l V give mifold p						
MAX.			61	LO	W .	AR	15	178	78 or greater than the statute or nautical air miles to be nown. Ver- tically below and opposite desired cruising altitude (ALT.) read for refe																rspeed (						
NORMAL RATED	270	<u> </u>	14	LO		AR	CONT.	170					., I. A. S								(I. A. S	.) ho	urly	Ad	just RP	M slight	ly if ne	cessary			
RATED	1			NI.	-			100													ceeding	man	ifold	pre	sure mo	re than	3 in. H	g.			
				-		FUEL			п						ш			-			IV	-		1	FUEL			v			
RANGE IN AIR MILES U. S. BAI							BANGE		MILE	:3			RANGE		MILE	3			RANGE		MILE	S	-	U.S.		RANGE	IN AU	MILI	25		
				GAL.		TUTE		NAUTICAL				STATUTE			NAUTICAL			ATUTE		NAU			GAL.	STA	TUTE		NAUTICAL				
					,,,,		1 29	GAL. ALLOW				ANCE NOT AVAILABL					LE	IN FLIGHT						419					_		
1000 870					390	12	210		1050			11	110		1230				1610			1400			1		1580				
9	920 800 3		360	11	120		970				310		11.	30		1490			12	90		360	ı	1680			60	50			
	50		73	0		330	<u> </u>	20	890				1.	200		104			1360			11	20		330		540	+	1330		
_				•		1	i ''						1090				-														
	70	4	67	0		300	<u></u>	30		- 8	00		1090			940			1240			1070			300	1		1210			
A	90		60	0		270	,	330		,	20		Ι,	980	- 1	850			۱,		960			270			1090				
-	10		53			240		740	1	-	40			370		7.5	_			990		-	60		240	-	120			70	
	AXIMUI	M COR					<u> </u>	OPER/	TING I	ATA			<u> </u>	OPER	ATING	DATA	_		<del> </del>	OPER	ATING	DATA		_			MAXI	MUM R	ANGE		
R. P. M.	I. A. S. M.P.H.	MIX-		д. Р.	T.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX- TURE	M. P. In. He.	G. P.	T.	R. P. M.	L A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	д. г. н.	T.	R. P. M.	L.A. S. M.P.H.	MIX- TURE	M. P. In. Mg.	a. P.	T.	ALT. Feet	R. P. M.	L. A. S. M.P.X.	MIX- TURE	M. P. In. Hg.	G. P.	T.
			+**	<del>  -</del>	-	40000	_	-			-	È				A8.		-		<del> </del>			-		40000					-	F
			1			35000																			85000						
2700	245	AR	FT	105	390	30000						Ĺ	2600	235	AR	FT		375	2500	225	AR	FT			30000	2400	195	AL	FT	61	_
2700	255	AR	46	115	375	25000							2400	235	AR	FΤ	87	350	2400	230	AR	37		340	20000	2200	200	AL	FT	57	25
2700	260	AR	1	1 1	355								2550	250	AR	FT		340			AL	FT	ŀ	315		2150	200	AL	FT	1	27
2700	275	AR			345		2500	260	AR	FT	96	330		250	AR	39	78	315		ļ	AL	36	_	300		2000	210	AL	FT	52	26
2700	275	AR	46	108	320	10000	2500	260	AR	42	89	305	2400	250	AR	38	72	290	2300	240	AL	36	61	280	10000	1750	210	AL.	FT	48	24

S. L.

275

275

2700

2700

46

46

AR

103 300

98 280

2500 265 AR 42

2550 265 AR

> EXAMPLE
> AT 10,500 LB. GROSS WT. WITH 390 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1500 STAT. AIRMILES AT 25,000 FT. ALT. MAINTAIN 2400 RPM AND 230 MPH IND. AIRSPEED WITH MIXTURE SET AUTO RICH - HIGH BLOWER.

38 67

38 62 250

270 2300 240 AL

> 2300 240 AL 36

83 285 2400

43 75 265 2400

250

250

AR

AR

LEGEND L.A.S.I INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE C.P.M.: U.S. GAL. PER HOUR T.A.S.: TRUE AIRSPEED S. L.: SEA LEVEL

52 240 S. L.

5000

36 57 260

F.T.: FULL THROTTLE F.R.: FULL RICH A.R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

36

34

AL

AL

44 225

39 200

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

1600 205

1600 200

NOTES

O ALLOW 29 GAL. FOR WARMUP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLOW FUSELAGE TANK 15 INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO COMBAT TANKS. HIGH BLOWER ABOVE HEAVY LINE ONLY.

**Figure** 

MODEL(S	3)
P-51D	

# FLIGHT OPERATION INSTRUCTION CHART

8000

**POUNDS** 

EXTERNAL LOAD ITEMS 2 - 75-GALLON COMBAT TANKS

ENGIN	E(S):	V-16	50-7				CHART WEIGHT LIMITS:
LIMITS	R. P. M.	M. P. (IN. MG.)	BLOWER	MIXTURE	TIME LIMIT	TOTAL G. P. H.	INSTRUCTIONS FOR USI column equal to or less than
WAR	3000	67	LOW	AR	6	194	Move horizontally to left or or greater than the statute
MILITARY	2000	61	HIGH	AR	15	178	tically below and opposite
NORMAL BATED	2700	46	LON	AR	CONT.	109	optimum R. P. M., I. A. S. a

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

9600

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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 8 in. Hg.

		ī				1 1	UEL			II						Ш				-		IV			ı	FUEL			V			
2700 245 AF 2700 255 AF 2700 260 AF 2700 275 AF 2700 275 AF	IN AI	R MIL	ES			U. S.		RANGE	N AIR	MILE	8	$\neg$		RANGE	N AIR	MILE	S			RANGE	N AIR	KILE	3		U. S.		RANGE	IN AIR		_		
	T	P AT	JTIC.	AL	٦	GAL.	STAT	UTE		NAUT	TCAL		STA	TUTE		NAU	'ICAI		8TA	TUTE	1 1	TUAN	ICAI		GAL.	8TA	TUTE		NAU	TICA:	Ĺ	
_				530 470		1	269 240 210	⊕ 29 740 650		GAI	640 580			ANCE NOT 860 750			750 650			IN FLIGHT			900 790					80		10 · 8	20	
ų	160			100		T	180	56	30	480				640			560			7		870			180	8	880			70		
3	80			330		ļ	150	0 460			400				540		4	60		•	50		56	0	$\Box$	150	7	40		6	40	_
				120	37	0		320				430			370			520			450					510						
2	30			200		-	90	28	10	-	24	0	ı	8	320	İ	2	80		8	<b>39</b> 0		34	0.	]	90	1	50		3	90	_
				130	-		60 30	16	30		16 8	0		_	210		_	80 90		_	260		22 11	-		<b>60</b> 30	1	300 50		_	80 30	
M	AXIMU	M CO2	NTINU	ous		+			OPERA	TING I	ATA				OPER.	TING	DATA	_			OPER	ATING I	ATA					MAXI	MUM R	ANGE		_
L. P. M.		MIX- TURE		. 2	.   4	T.	ALT. Feet	R. P. M.	I. A. S. H.P.R.	MIX. TURE	M. P. In. He.	G. P.	T.	R. P. M.	L.A.S. M.P.E.	MIX- TURE	M. P. In. Hg.	G. P. H.	7. A. B.	R. P. M.	L A. S. M.P.M.	MIX- TURE	M. P. In. Mg.	G. P. M.	T.	ALT. Feet	R. P. M.	LAS. M.P.E.	MIX. TURE	M. P. In. Eg.	G. P. E.	
						- 1	40000 85000																	·		40000 85000						
2700	245	AR	FT	10	05 3	90	80000							2600	235	AR	FT	_	-	2500	225	AR	_		360		2350	190	AL	FT	57 53	-
2700	255	AR	46	1	15 3	-	25000						1	2450	240	AR	41	89	355	2400	225	AR		_	_	25000	2150			+	-	1
2700	260	AR	FT	- 1 * '	00 3	22	20000							2550	250	AR	FT			2350	225	AL	1		310		2050	195	AL	FT	49	
2700	275	AR	46	-	13 3	73	15000	2550	260	AR	FT			2400	250	AR	39		+	2200	235	AL		_	295	-	1850	200	AL	FT	44	-
		AR	46	1.	08 3		10000	2550	260	AR	43		305		250	AR	38		1 .	2150	235	AL	36	1	275 255	1	1650	200	AL	34	41	
2700	275	AR	46	١.	03 3		5000	2550	265	AR	43		1	2400	250 250	AR	38	63	1	2150	235	AL	36				1600	205	AL	34	38	
2700	275	AR	46	1	98 2	80	8. L.	2550	265	AR	43	77	265	2400	250	AR	38	03	250	2150	235	AL.	1 33	73	205	3.14	1.000	1200	1 ~ 5	1,	1	_

NOTES

ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE 240 GAL OF FUEL LB. GROSS WT. WITH (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.)

TO FLY 950 STAT. AIRMILES AT 20.000 FT. ALT.
MAINTAIN 2350 RPM AND 225
WITH MIXTURE SET AUTO LEAR.

LEGEND

L.A.S.: INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.H.: U.S. GAL. PER HOUR A & TRUE AIRSPEED

F.T.: FULL THROTTLE F.R.: FULL RICH A.R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

<sup>2.</sup> IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, MARN-UP. TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TARK UNTIL AT LEAST SO GALLONS ARE USED BEFORE SMITCHING TO COMBAT TANKS.

#-1-##			FT MO		;)				T	KE	-OF	F, (	CLIMI	B &	L	MD	ING	CH	ART	,			-		_	NG1N V- 16	E MOD 50-3	EL(S)	
											TAP	( E -	OFF	DI	ST	AN	CE	FEET											
GROSS	н	EAD						E RUN								OD-TU											E RUN		
WEIGHT	•	IND		SEA	LEVEL	-	T 3000	FEET O CLEAR	+	T 600	O FEE	-	AT SEA		-	AT 3	000 FE			000 F		-	EA LE			3000			OOO FEET
LB.		ı, KT		UN	50' OB		RUN	50' OBJ.		UNU	50'0		GROUND RUN	TO CL		RUN		CLEAR OBJ.	GROUN RUN		CLEAR OBJ.	GROUN RUN		CLEAR O'OBJ.	GROU!		O CLEAR 50'OBJ.	6ROUN RUN	TO CLEAR 50' 08J
9000	0 17 34 51	15 30 45	10	50 00 50 00	2000 1550 1150 850	11	00 50 00 50	2200 1700 1300 950	13	00 00 50 50	2450 1950 1500 1100		1450 1050 750 500	2 100 1600 1200 850		1600 1200 850 600	22 186 13 106	00 50	1800 1350 1000 700	2	500 000 550 1 <b>50</b>	1600 1200 850 550	17	50 50 800	1750 1350 950 600	3	450 900 400 050	1500 1500 1100 750	1650
11,000	0 17 34 51	15 30 45	13	50 50 50 50	2700 2150 1600 1150	111	00 00 00 50	2950 2300 1750 1250	22 17 13		3300 2650 2050 1500	- 1	1950 1450 1050 700	2800 2200 1650 1200		2 100 1600 1200 800	30: 24: 18:	00 50	2400 1850 1400 950	2 2	100 100 550	2250 1700 1200 800	21	50 50 50 250	2400 1900 1400		1400 1700 1050	2800 2150 1600	2300
13,000	0 17 34 51	15 30 45	12	00 00 50	3600 2800 2050 1550	10	00 00 00	3800 3050 2300 1750	28 22 16 12	00 50 00	4300 3400 2700 2100	;	2450 1850 1350 900	3700 2900 2150 1600	1	26 50 20 50 1500 10 50	39! 320 240 180	00	3000 2350 1750 1300	3	550 600 850 250	2900 2200 1600 1100	3:	100	3200 2400 1800		800 1700 1850 100	3600 2800 2100	5300 4200 3200
IOTE: INCREASE ATA AS OF 5-8		DISTA	BASED		LIGH			5; 125°F	+ 30\$;	150**	1 405	C	LIMI						OPTIMU	M TAKE-	OFF WIT	H 3000	RPM,	6   IN.HG	2	O DEG.	LAP IS	IOS OF CHA	RT VALUES
	Ī	AT S	EA LEVE	<u> </u>	Ť	AT	5000	EET			AT I		FEET				5,000	FEET			NT.	20,000	FEE	т	ΑT	r :	25,000	• FEET	1
GROSS	BEST			BEST	i. A. S.				BEST	I. A. S.	RATE	FROM SE	EA LEVEL BEST		i. A. S.		FROM SE	A LEVEL	BEST	I. A. S.		ROM SE	LEVEL B	EST I.	A. S.	AE -		VEL	
WEIGHT LB.	МРИ	KTS	OF CLIMB F. P. M.	OF FUEL USED		KT3	OF CLIMB F.P.M.	TIME MIM.	FUEL USED	МРИ		OF CLIMB F. P. M.	TIME MIN.	FUEL	MPK	1	OF CLIMB F. P. M.	TIME MIN.	FUEL	<b>IP</b> H		OF CLIMB F. P. M.	TIME MIN.	FUEL N	PH			TIME FU MIN. US	
9000	170	145	2200	15	170	145	2200	2.5	19	170	145	2250	5.0	23	170	145	2250	7.5	27	165	145	1900	10.0	31	160		16 50	13.0	15
11,000	170	145	1500	15	170	145	1500	3.5	20	170	145	1500	7.0	26	170	145	1500	10.5	1	165	145		14.0	39		140		1	17
13,000	175	150	1000	15	175	150	950	5.5	23	175	150	900	11.0	32	175	150	850	17.0	42	170	145	550	23.0	55	165	145	300	37.0	'5
OWER PLANT SETTI		TAILS		SEC	LIGH		STS				L1	-	1			1		l	J		FUEL	. USED	(U.S.	BAL.) I	#C LUDI	ES WAR	H-UP & 1	AKE-OFF	ALLOWANCE
											LAN	101	NG	DIS	T	ANC	Ен	EET											
00000	8	EST	IAS AP	PROACI	1		н	ARD D	RY S	URFA	CE		T				FIRM	DRY	SOD						WET	OR S	SLIPPE	RY	
GROSS WEIGHT	PO	WER	OFF PO	WER O	A T	SEA	LEVEL	AT 3	000	FEET	AT :	5000	FEET	AT S	EA L	EVEL	AT 3	000 F	EET	AT 60	00 FE	ET /	AT SE	LEVEL		T 300	O FEET	AT	SOOO FEET
LB.	*	PH	(TS M	H KT	GRO RO		FO CLEAR 50' OBJ.	GROUN		CLEAR D' OBJ.	GROU		CLEAR 50' OBJ.	GROUN	- 1	CLEAR O' OBJ.	GROUN		LEAR OBJ.	ROUNE	TO C		ROUND	TO CLE/		ROUKD ROLL	TO CLE.		
9000				30 115	1		2300	1400	, ,	2400	1500		2600	1400	- 1	2400 2200	1600	-	00	1700		1 200	200	4300 3800		500	4600	3900	5000
ATA AS OF 5-8				D DN: F				1.200		200	1700		.400	1300		2200	1700	2   23		1500	) 20	- 1			. 1	-	1	F	ART VALUES
REMARKS: NOTE: TO DETE IN BRITISH IN				UMPTIC	<u>!</u> !				н	IXTU	RE:	USE	"RUN"	OR '	"AUT	O R1(	H -A1	UTO L	EAN"							H.	A.S. : I	GEND HOICATED ILES PER	