TEMCO MODEL 33

Pilot

MILITARY TRAINER

FLIGHT HANDBOOK

TEMCO AIRCRAFT CORPORATION
P. O. BOX 6191 — DALLAS, TEXAS, U. S. A.

FLIGHT HANDBOOK

PRELIMINARY

MODEL 33 AIRCRAFT

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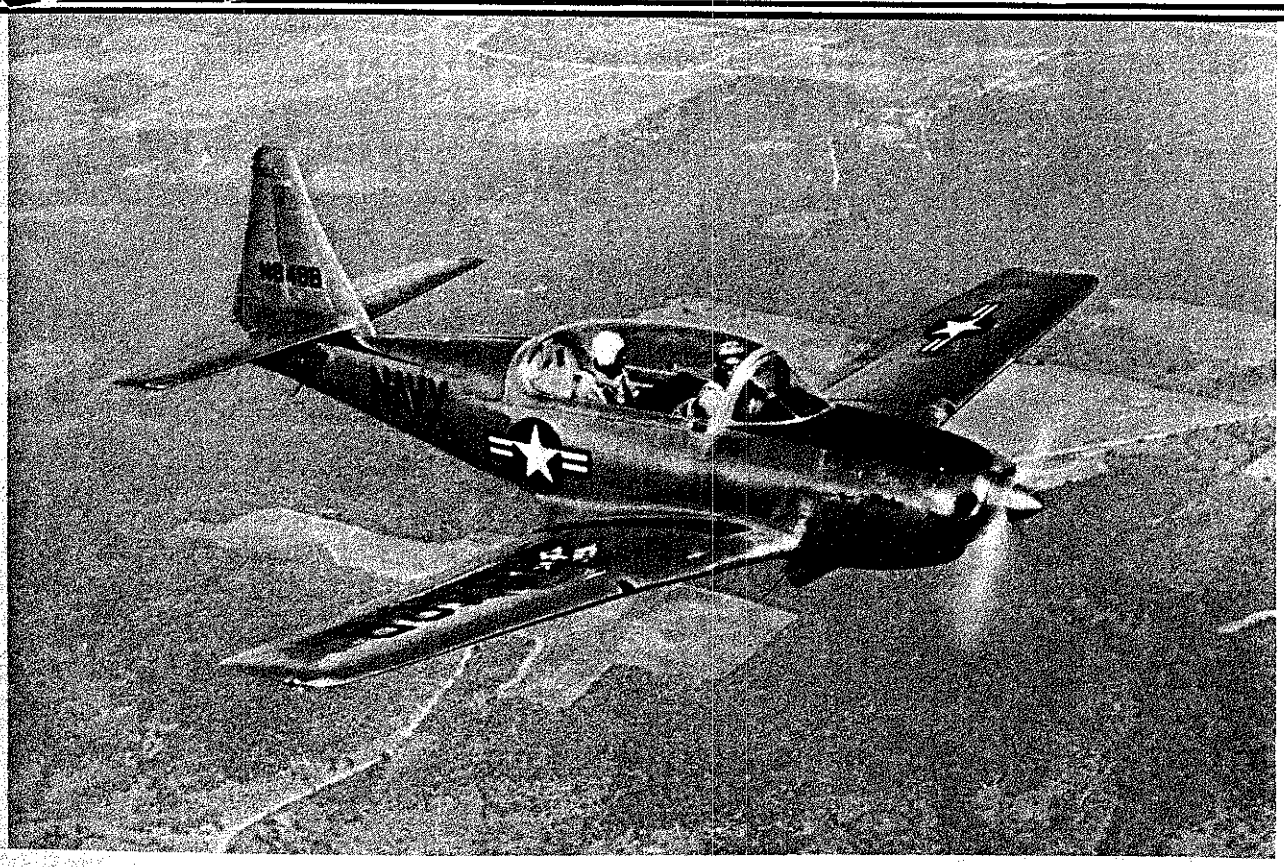

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Introduction

IMPORTANT

In order to gain maximum benefit from this handbook please read the introduction carefully.

The primary function of this handbook is to describe the Model 33 Airplane, its operation, its equipment and its characteristics in enough detail so that the pilot will have sufficient information to intelligently, efficiently and safely accomplish a complete flight.

This handbook is divided into 6 Sections and an appendix as follows:

Section I, DESCRIPTION—A detailed picture of the complete airplane (except operational equipment) telling what is in the airplane, where it is located, and how it is operated. This section does not contain any operating instructions.

Section II, NORMAL OPERATION—An amplified check list covering normal operation of the aircraft in flight and a discussion of the airplane characteristics during flight.

Section III, EMERGENCY OPERATION—Specific instructions to be followed under all emergency conditions, and a discussion of airplane flight characteristics in an emergency.

Section IV, OPERATIONAL EQUIPMENT—Description of and operation instructions for all equipment, not essential to the airplanes flight, such as communication equipment.

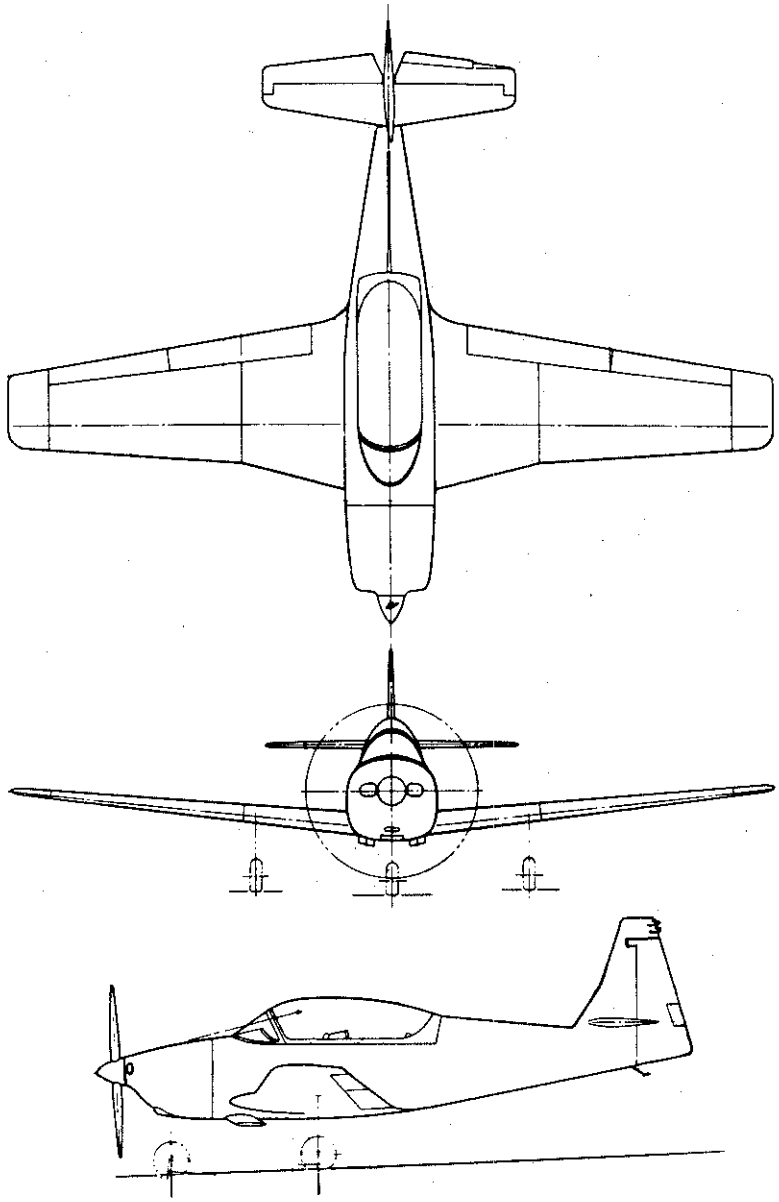
Section V, OPERATION RESTRICTIONS—Detailed data as to the limitations of the aircraft and its component parts during operation.

Section VI, FLIGHT CHARACTERISTICS—A word description of the flying characteristics of the airplane including stalls, dives, spins, and other maneuvers.

Appendix I, OPERATING CHARTS—Operating data essential to flight planning, such as take-off charts, climb data and maximum range charts.

NOTE

This handbook is kept current by frequent revisions. However, because of the time required for incorporation of these revisions, it is imperative that flying personnel be aware of the latest information which may not as yet be included in the handbook. Such information can be obtained from pertinent technical directives, which frequently cover critical flight restrictions and new techniques.



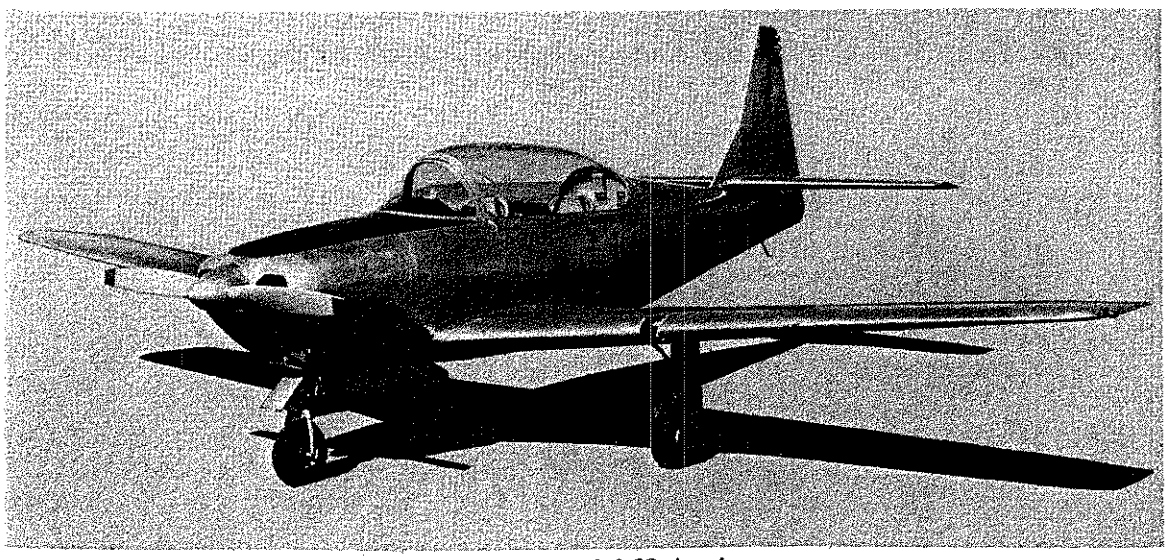
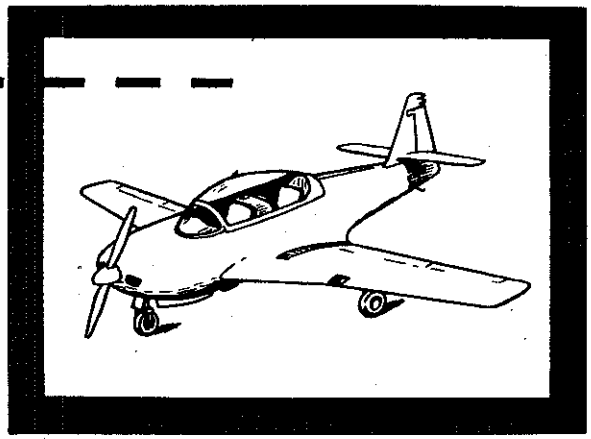


Figure 1-1. Model 33 Airplane

section I

description



1-1. THE AIRPLANE.

1-2. GENERAL

1-3. The Model 33 airplane, manufactured by Temco Aircraft Corporation, is a two-place, tandem seating, training, low wing land monoplane of all metal semi-monoque construction. It is powered by a six cylinder, air-cooled engine driving a two bladed constant speed type propeller of all metal construction. The landing gear is of conventional tricycle design with fully retractable nose and main gears. The main landing gear wheels are equipped with disc type brakes. The student sits in the front cockpit, the instructor in the rear cockpit, but solo flight is permissible only from the front cockpit. Both cockpits are provided with conventional controls and instruments. The cockpit area is enclosed by a one piece bubble type canopy operated electrically or manually from the interior or exterior of the airplane. Structurally, the airplane is designed to withstand all aerobatics encountered in student training. Aerodynamically, the aircraft has no undesirable handling characteristics.

1-4. AIRPLANE DIMENSIONS.

1-5. The overall dimensions are:

Length . . . . . 24 ft. 3 in.

Wing Span . . . . . 31 ft. 2½ in.

Height (to top of fin) . . . . . 10 ft.

Tread . . . . . 11 ft. 1½ in.

1-6. AIRPLANE GROSS WEIGHT.

1-7. The maximum weight of the airplane is 2500 pounds.

1-8. ENGINE.

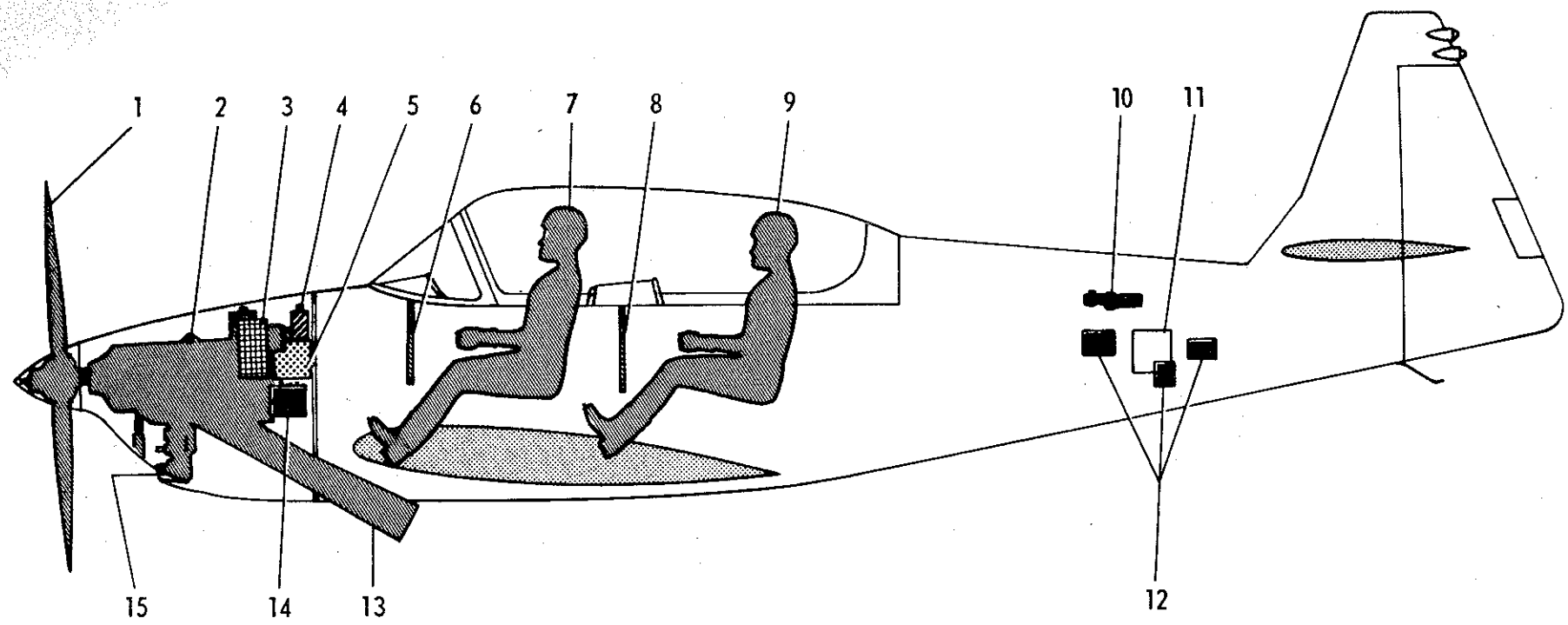
1-9. The airplane is powered by a six cylinder opposed, air cooled, naturally aspirated, direct drive, dry sump engine, with a power rating of 225 BHP at 2600 RPM at sea level, designated Model 0-470-13 by the manufacturer, Continental Motors Corporation. Air intakes for cooling and the carburetor are provided in the engine cowling. Exhaust gases are ejected through two exhaust manifolds and augmentors extending through the bottom of the fuselage.

1-10. ENGINE CONTROLS.

1-11. Throttle and mixture controls (grouped with propeller control lever) located on the left side of each cockpit are interconnected between cockpits to move simultaneously. Each type control handle is shaped differently to facilitate identification by the pilot. The front cockpit (solo position) quadrant is provided with a friction lock knob on the inboard face; rotation of the knob clockwise increases friction of the throttle lever only.

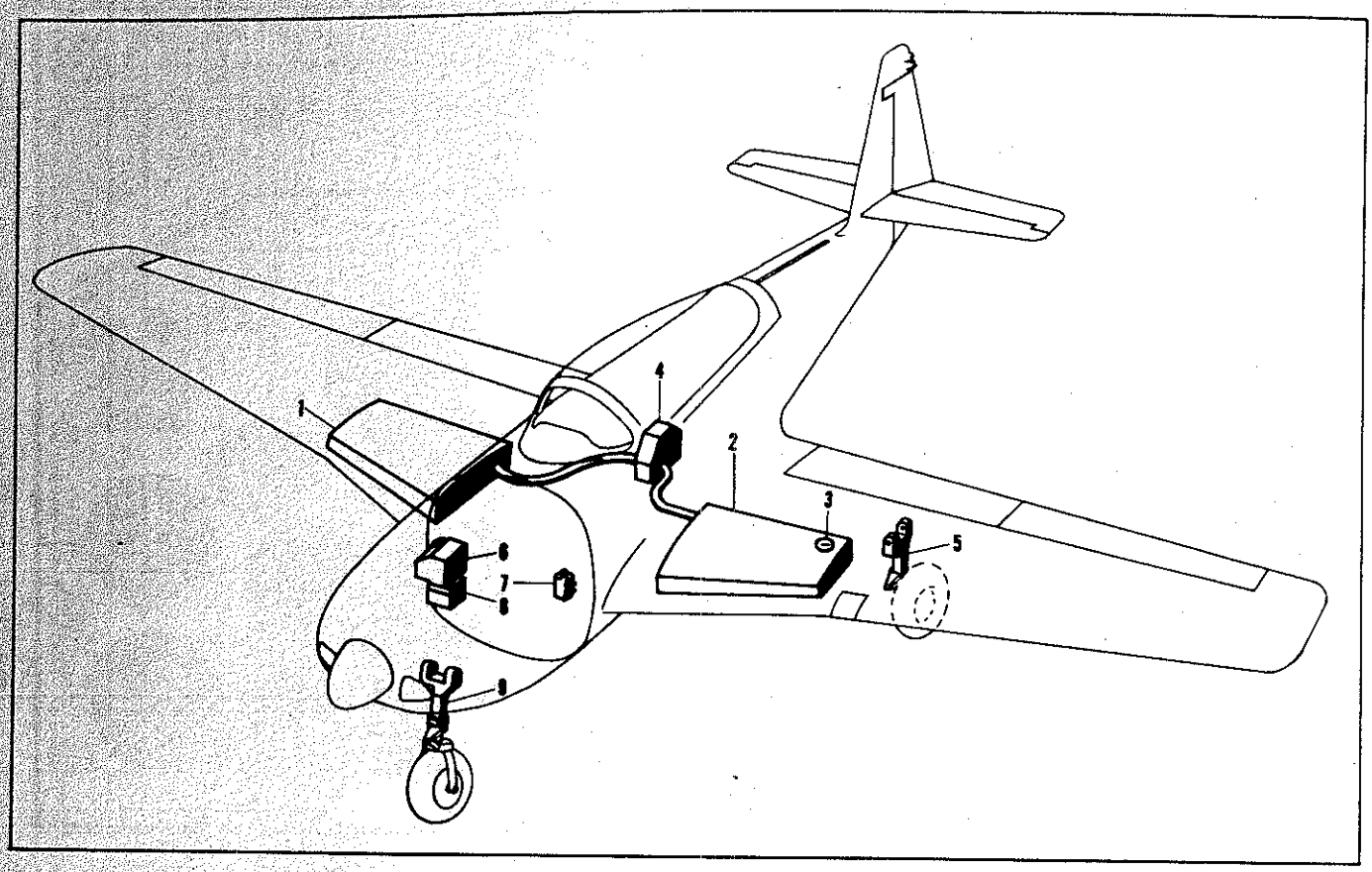
1-12. THROTTLE. The throttle levers, mounted on quadrants at the left side of each cockpit, (See figure 1-6 and figure 1-8), when in the extreme aft position are "CLOSED", and in the extreme forward position are "OPEN". The levers may be positioned between the "OPEN" and "CLOSED" positions for intermediate power settings.

1-13. MIXTURE CONTROL. The mixture control levers, mounted on quadrants at the left side of each cockpit, (See Figure 1-6 and Figure 1-8) enable the pilot to control the fuel-air mixture to the engine. Positions identified as "RICH", "MAN. LEAN", and "IDLE CUT OFF" are marked on the quadrants. The levers when in the full forward position are "RICH", in the middle position are "MAN. LEAN". Intermediate positions



1. Propeller
2. Engine
3. Oil Cooler
4. Hydraulic Reservoir
5. Oil Tank
6. Front Instrument Panel
7. Student Pilot
8. Rear Instrument Panel
9. Instructor Pilot
10. Canopy Actuation Motor
11. Communication Equipment Access Door
12. Communication Equipment
13. Augmentor Tube
14. Battery
15. Carburetor Air Screen

Figure 1-2. General Arrangement



1. Right Main Fuel Tank
2. Left Main Fuel Tank
3. Fuel Filler Cap.
4. Fuel Sump Tank
5. Main Gear Hydraulic Shock Strut
6. Engine Oil Reservoir
7. Hydraulic System Reservoir
8. Battery
9. Nose Gear Hydraulic Shock Strut

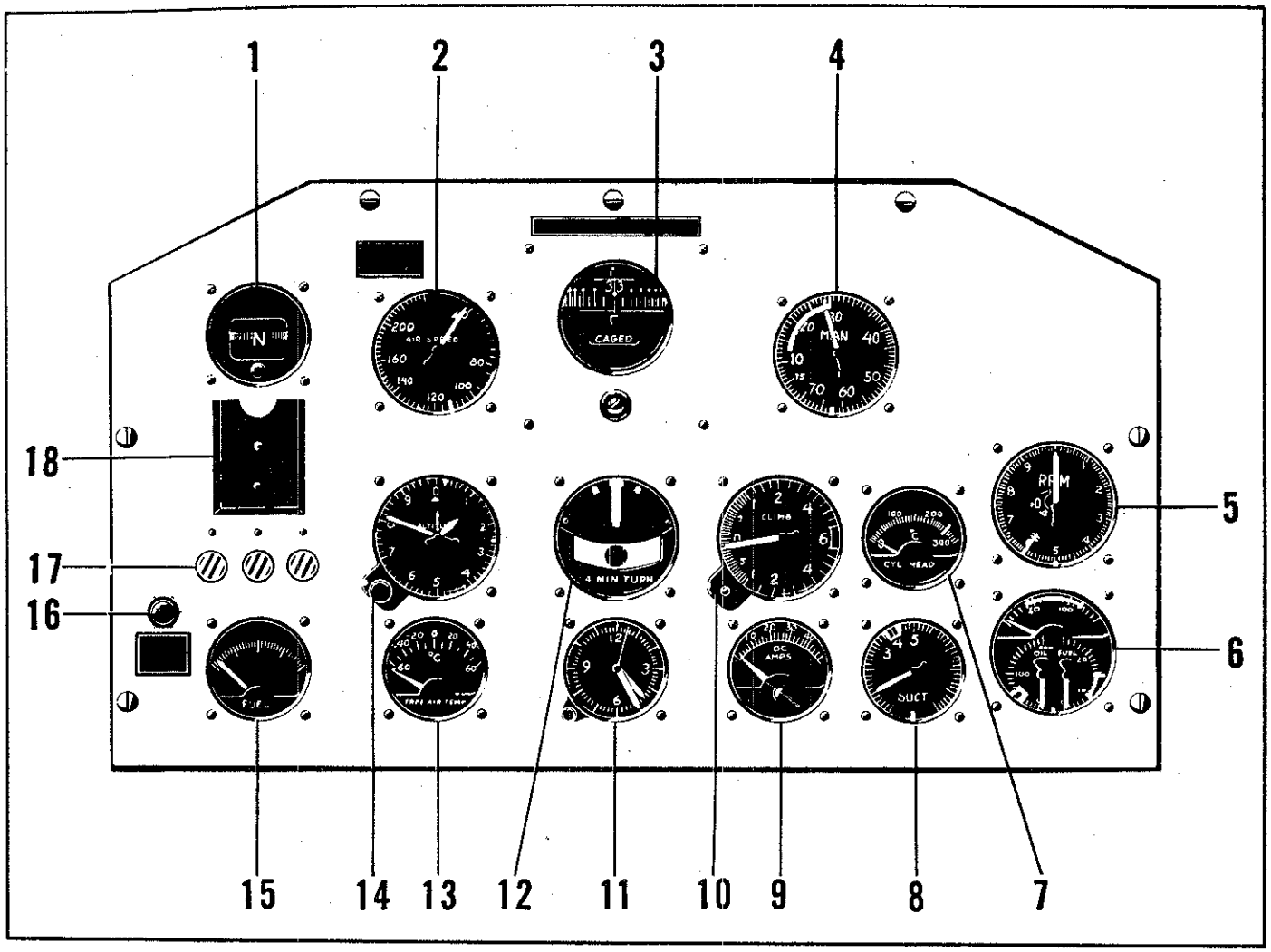
Figure 1-3. Servicing

are used to provide proper fuel-air mixture as required at different power settings. When the lever is placed in the full aft position, "IDLE CUT OFF", fuel flow to the carburetor is cut off, stopping the engine. The front cockpit mixture control lever is equipped with a spring loaded lock and ratchet, which prevents the lever from inadvertently being moved to a too-lean mixture setting. Moving the mixture controls forward releases the lock automatically: however, before the mixture control can be moved back to the "LEAN" or "IDLE CUT-OFF" position, it is necessary to press forward on the lock lever on the front mixture control.

1-14. CARBURETOR AIR. No cockpit control of carburetor air temperature is required. A ram air opening located on the lower forward portion of the engine cowling directs entering air through an air filter. In the event of filter clogging or icing, a spring loaded door in the carburetor air duct will automatically be opened by pressure differential allowing the carburetor to receive warm sheltered air from inside the engine compartment.

1-15. IGNITION SWITCH. A standard ignition switch is installed on a panel to the right side of each instrument panel (See Figure 1-7 and Figure 1-9. The two switches are mechanically interconnected and the positions are: "OFF," "L," "R," and "BOTH."

1-16. STARTER SWITCH. The starter switch, located on the right console of the front cockpit, is a two position switch spring loaded to the "OFF" position (See Figure 1-7). This switch, when held in the "ON" position, energizes the starter. The switch is protected by a red plastic safety guard.



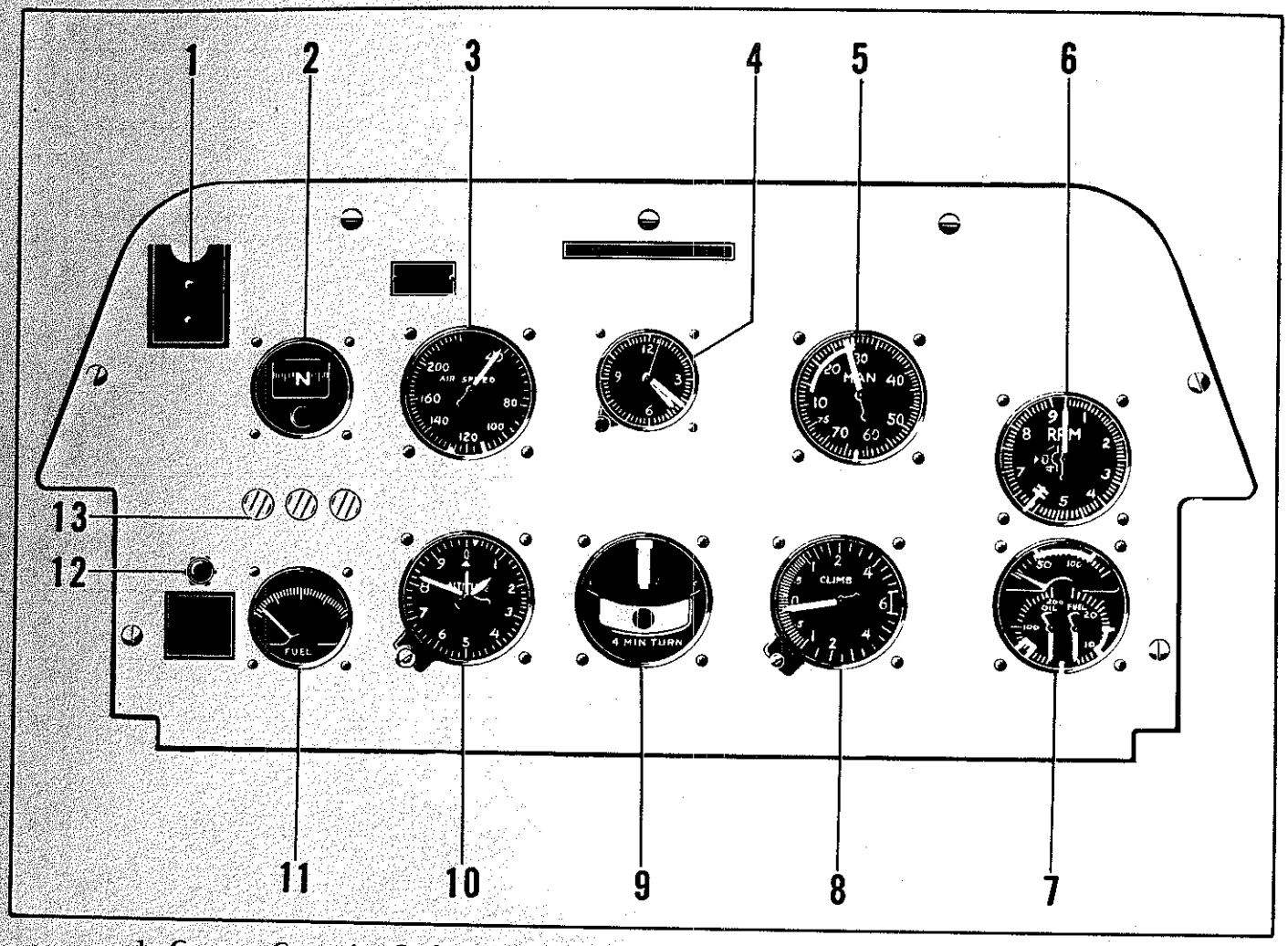
1. Magnetic Compass
2. Air Speed Indicator
3. Directional Gyro
4. Manifold Pressure Indicator
5. Tachometer
6. Engine Gage Unit
7. Cylinder Head Temperature Indicator
8. Vacuum Gage
9. Ammeter
10. Rate-of-Climb Indicator
11. Clock
12. Turn-and-Bank Indicator
13. Free Air Temperature Indicator
14. Altimeter
15. Fuel Quanity Gage
16. Fuel Low-Level Indicator Light
17. Landing Gear Position Indicators
18. Compass Correction Card Holder

Figure 1-4. Instrument Panel, Front Cockpit

1-17. PRIMER SWITCH. The primer switch, located on the right console of the front cockpit, is a two position switch spring loaded to the "OFF" position (See Figure 1-7). This switch when held in the "ON" position energizes a priming solenoid. When this solenoid is energized, fuel is injected, through a priming manifold, directly into each cylinder.

1-18. ENGINE INSTRUMENTS.

1-19. The engine instruments, consisting of a tachometer, manifold pressure indicator, engine gage unit (fuel pressure, oil pressure, and oil temperature indicators) are duplicated in each cockpit (See Figure 1-4 and Figure 1-5). A cylinder head temperature indicator and a vacuum gage are



1. Compass Correction Card Holder
2. Magnetic Compass
3. Airspeed Indicator
4. Clock
5. Manifold Pressure Indicator
6. Tachometer
7. Engine Gage Unit
8. Rate-of-Climb Indicator
9. Turn and Bank Indicator
10. Altimeter
11. Fuel Quanity Gage
12. Fuel Low-Level Indicator Light
13. Landing Gear Position Indicators

Figure 1-5. Instrument Panel, Rear Cockpit

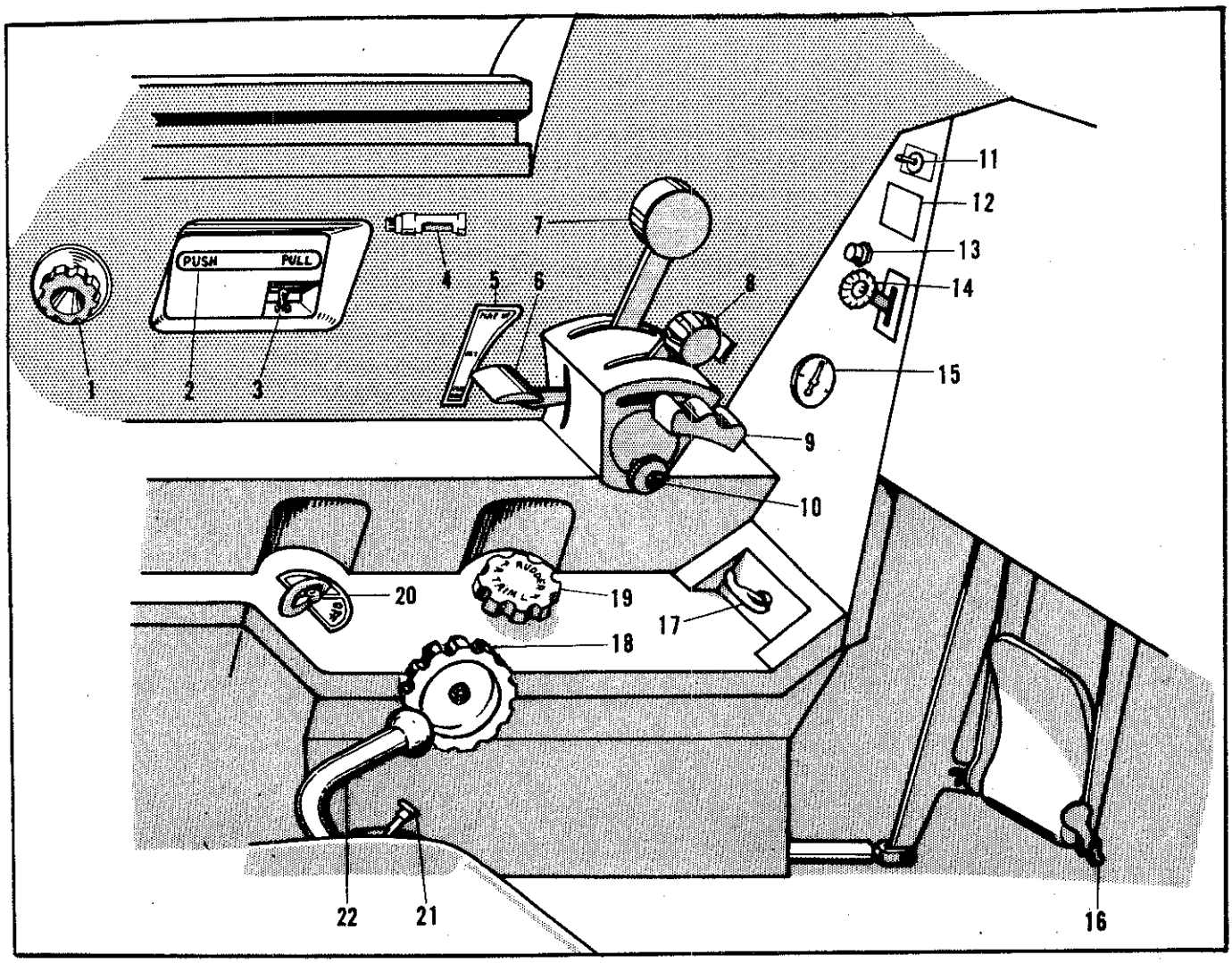
provided in the front cockpit only (See Figure 1-4). The remote indicating tachometer derives its power from a tachometer generator mounted on the engine accessory section. The fuel and oil pressure gages are direct reading instruments. The oil and cylinder head temperature indicators are resistance type instruments operating from the 28 volt D.C. supply system. When the engine is inoperative, the manifold pressure indicator reading should correspond to the barometric pressure.

1-20. PROPELLER.

1-21. The propeller, manufactured by McCauley Industrial Corporation, is two bladed, of all metal construction, using a controllable-pitch mechanism. Pitch control is supplied hydraulically, utilizing the engine oil system.

1-22. PROPELLER CONTROL.

1-23. The propeller pitch change mechanism is controlled by a lever on the engine control quadrant (grouped with throttle and mixture control levers) located in each cockpit (See Figure 1-6 and Figure 1-8). The controls are interconnected between cockpits to move simultaneously. The quadrant is marked "INCREASE" at the forward position and "DECREASE" in the aft position. Moving the lever forward increases rpm and conversely moving the lever aft decreases rpm. The lever may be positioned between "INCREASE" and "DECREASE" rpm for intermediate settings.



1. Heat and Ventilating Outlet
2. Canopy Manual Control Handle
3. Canopy Electrical Control Switch
4. Console Light
5. Flap Direction-of-Travel Indicator
6. Flap Control Handle
7. Throttle Lever
8. Mixture Control Lever
9. Propeller Control Lever
10. Throttle Friction Lock
11. Landing and Taxi Light Switch
12. Landing Check List Decal
13. Push-to-Silence Switch-L.G. Horn
14. Landing Gear Control Handle
15. Hydraulic Pressure Gage
16. Rudder Pedal Adjustment Lever
17. Parking Brake Handle
18. Elevator Trim Tab Control
19. Rudder Trim Tab Control
20. Fuel Selector Vave Handle
21. Shoulder Harness Lock
22. Hydraulic Hand Pump Handle

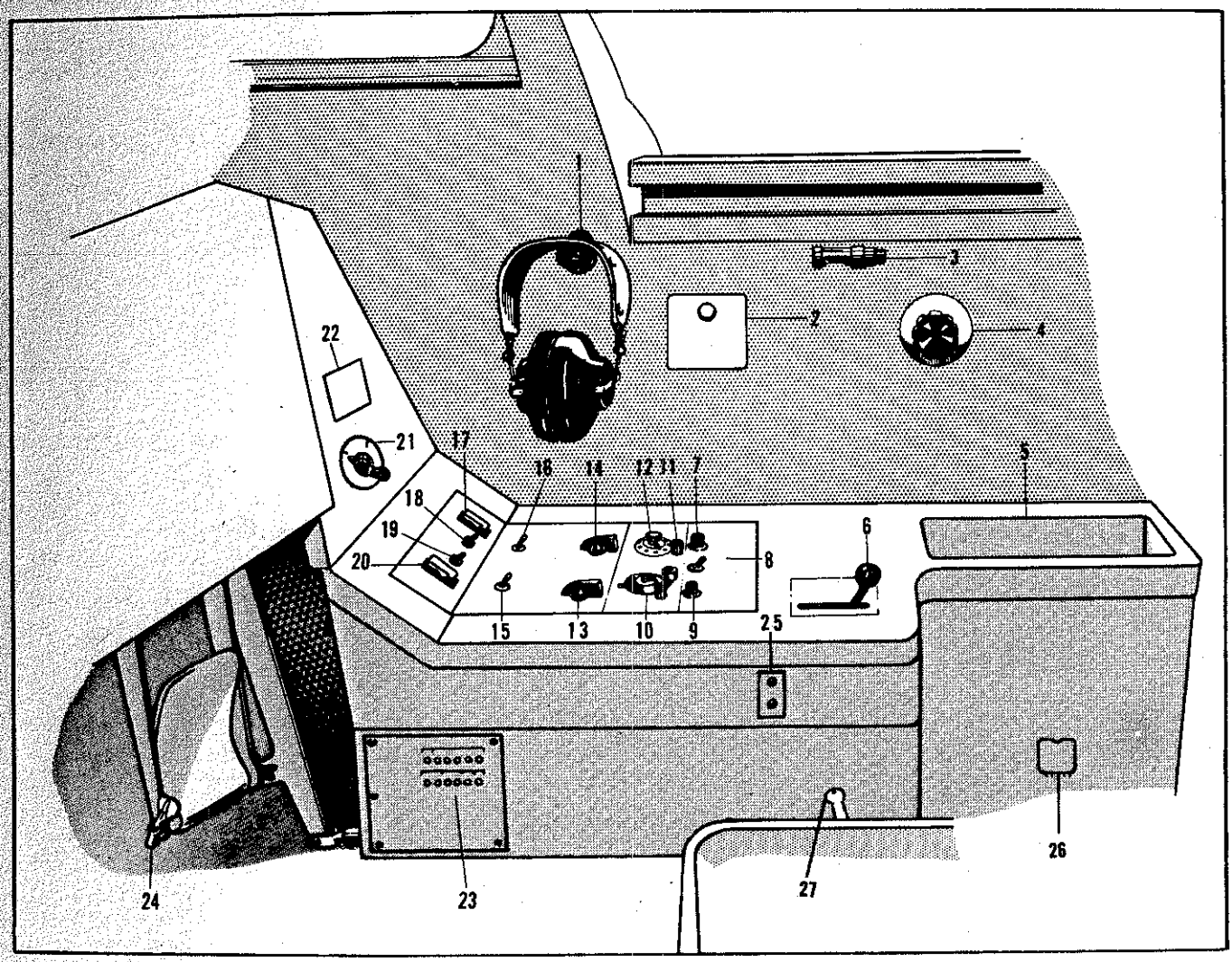
Figure 1-6. Front Cockpit, Left Side

1-24. OIL SYSTEM.

1-25. Oil for engine lubrication and propeller pitch change mechanism is supplied from a 3 (U.S.) gallon capacity oil tank (See Figure 1-3). Circulation of oil is accomplished by an engine driven dual pressure and scavenger oil pump. After passing through the engine, the oil is returned to the reservoir through an oil cooler. A thermostatic valve is provided to allow oil to by-pass the cooler when the oil temperature is less than 85°F (29.4°C). No pilot operated controls are required. Oil temperature and oil pressure gages are provided on both the front and rear cockpit instrument panels. (See Figure 1-4 and Figure 1-5).

1-26. The following engine lubricating oil shall be used:

SAE 50, MIL-0-6082,
Grade 1100

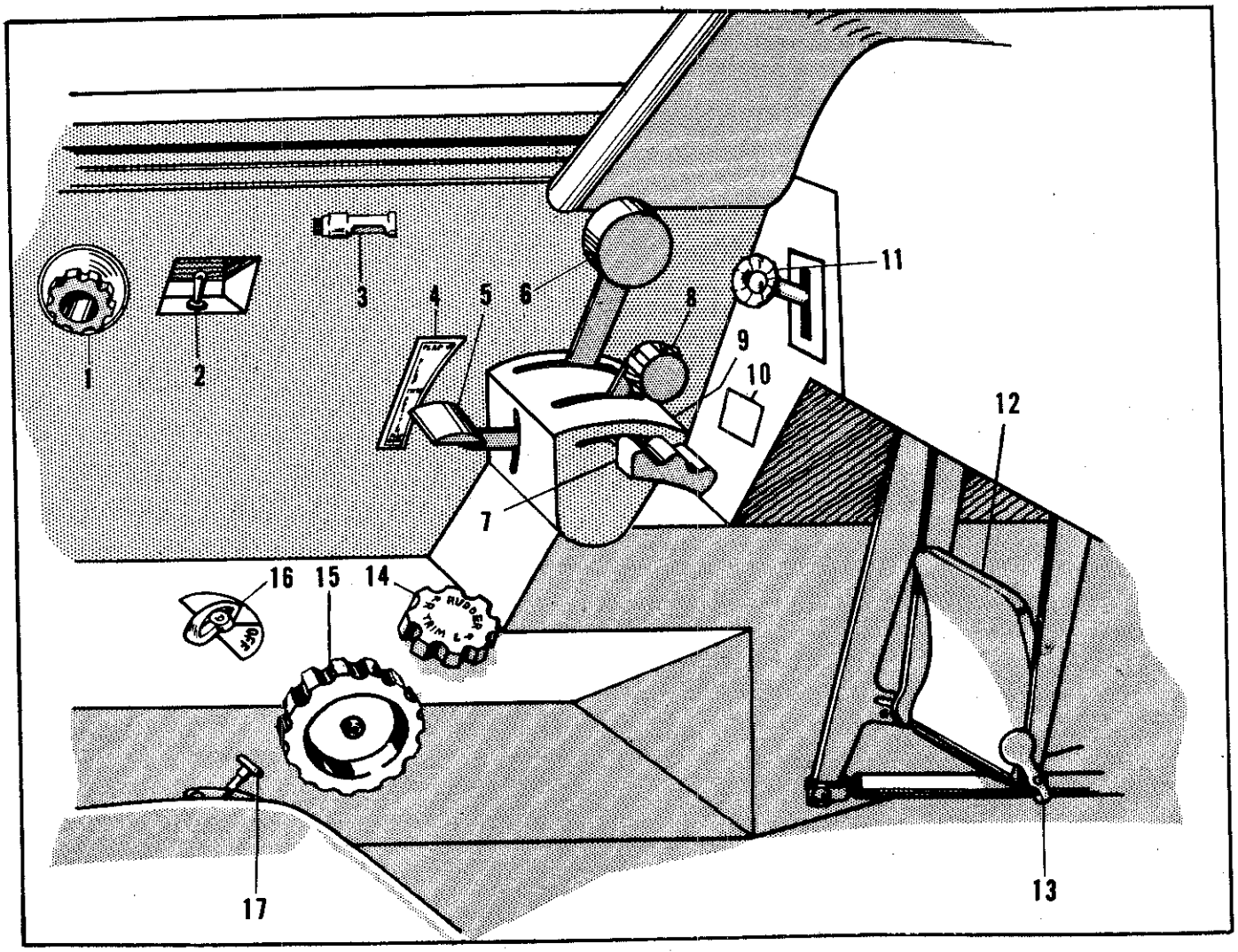


1. Headset and Microphone Stowage Hook
2. Ash Tray
3. Console Light
4. Heating and Ventilating Outlet
5. Flight Log and Map Case
6. Heating and Ventilating Control Handle
7. Radio Control Indicator Light
8. Radio Control Transfer Switch
9. Radio Call Switch
10. Radio Receiver Selector
11. Radio Sensitivity Control
12. Radio Transmitter Selector
13. Console Light Rheostat
14. Instrument Lights Rheostat
15. Position Light Switch
16. Fuselage Light Switch
17. Starter Switch
18. Primer Switch
19. Battery Switch
20. Generator Switch
21. Ignition Switch
22. Take Off Check List Decal
23. Circuit Breaker Panel
24. Rudder Pedal Adjustment Lever
25. Communication Jacks
26. Spare Lamp Receptacle
27. Seat Adjustment

Figure 1-7. Front Cockpit, Right Side

1-27. FUEL SYSTEM.

1-28. A 24 (U.S.) gallon capacity bladder type fuel tank is installed in the leading edge of each wing center section. These two tanks are interconnected for gravity feed to a 3 (U.S.) gallon capacity metal sump tank located in the fuselage. Servicing of fuel tanks is made through a single fuel filler located in the left wing center section (See Figure 1-3 and Figure 1-10). Fuel is supplied to the engine by a continuous duty electrically operated booster pump, located in the sump tank, and an engine driven fuel pump located in the engine accessory section. The fuel tanks are vented by a single vent system. A vapor return line is incorporated in the fuel system for returning excess fuel and vapors from the carburetor to the sump tank.



1. Heat and Ventilating Outlet
2. Canopy Control Switch
3. Console Light
4. Flap Direction-of-Travel Indicator
5. Flap Control Handle
6. Throttle Lever
7. Propeller Control Lever
8. Mixture Control Lever
9. Engine Control Quadrant
10. Landing Check List Decal
11. Landing Gear Control Handle
12. Rudder Pedal
13. Rudder Pedal Adjustment Lever
14. Rudder Trim Tab Control
15. Elevator Trim Tab Control
16. Fuel Selector Handle
17. Shoulder Harness Lock

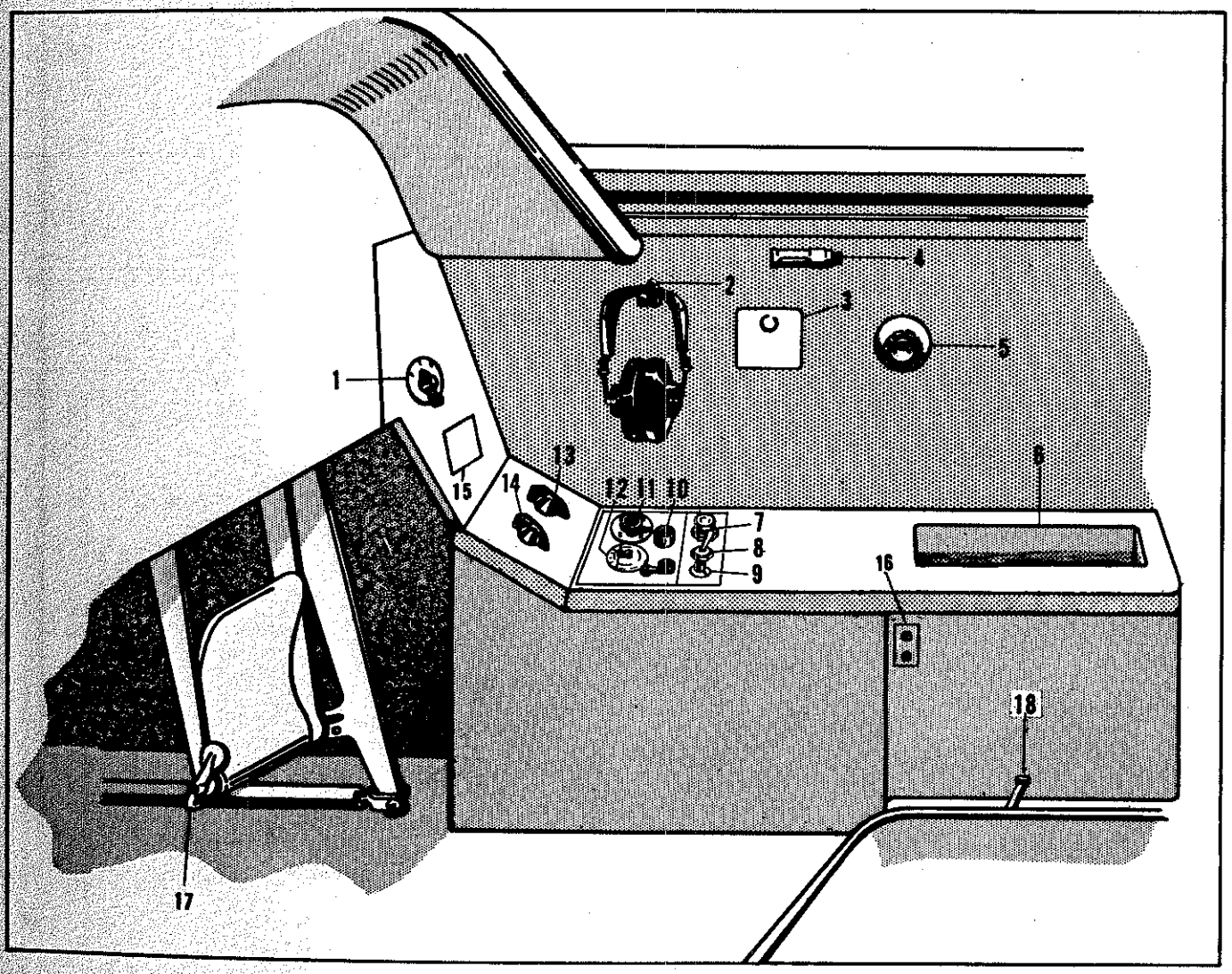
Figure 1-8. Rear Cockpit, Left Side

1-29. FUEL SYSTEM CONTROL.

1-30. The only control for the fuel system is provided by a fuel selector, located on the left console, aft of the engine control quadrant in each cockpit (See Figure 1-6 and Figure 1-8). Both cockpit fuel selectors are mechanically interconnected and operate the fuel shut-off valve and the fuel booster pump. Fuel selector positions are "OFF" and "ON". When the fuel selector is placed in the "ON" position, a micro switch on the selector control is actuated, energizing the fuel booster pump. Moving the lever to the "OFF" position stops the fuel flow and actuates the micro switch de-energizing the fuel booster pump.

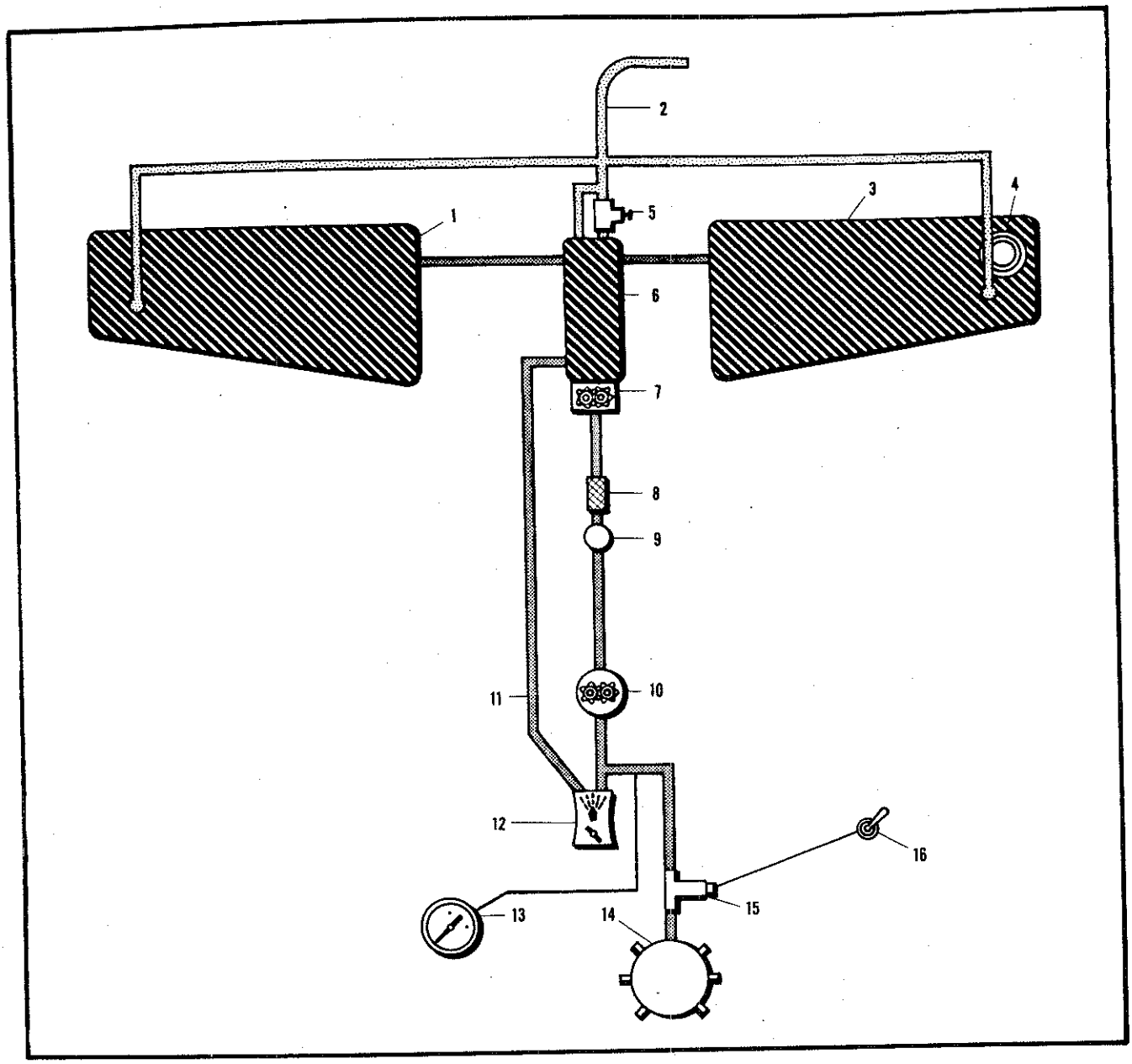
1-31. FUEL SYSTEM INDICATORS.

1-32. The fuel system is provided with a fuel quantity gage, a fuel pressure indicator, and a fuel low level warning light ("PUSH-TO-TEST" type), all mounted on the instrument panel of each cockpit (See Figure 1-4 and Figure 1-5). The fuel quantity gage indicates total fuel quantity, the fuel pressure gage indicates pressure at the carburetor, and the fuel warning light illuminates when 20 minutes fuel supply, at normal rated cruising power, remains in the tanks.



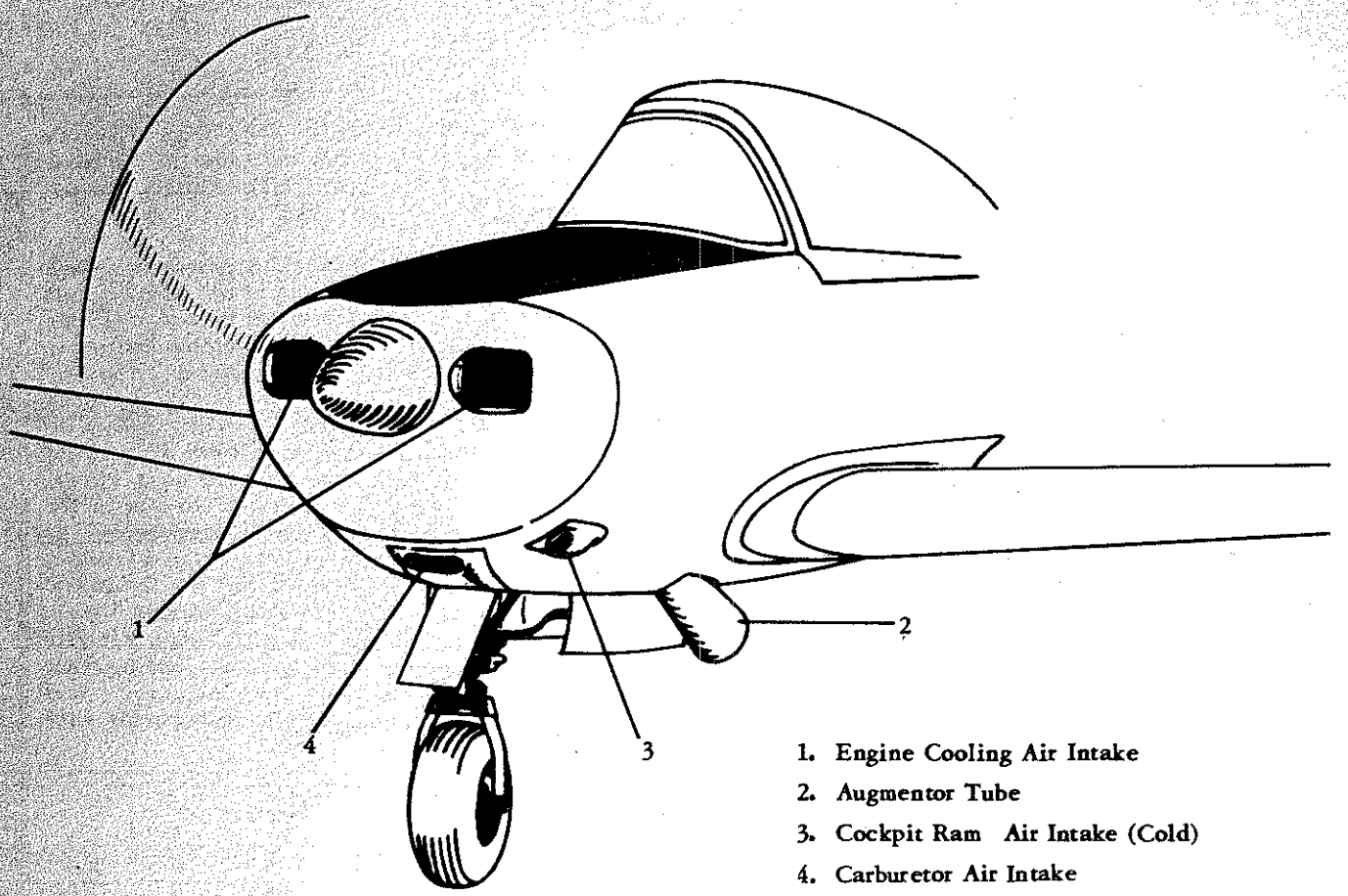
1. Ignition Switch
2. Headset and Microphone Stowage Hook
3. Ash Tray
4. Console Light
5. Heat and Ventilation Outlet
6. Map Case
7. Radio Control Indicator Light
8. Radio Control Transfer Switch
9. Radio Call Switch
10. Radio Sensitivity Control
11. Radio Transmitter Selector
12. Radio Receiver Selector
13. Instrument Lights Rheostat
14. Console Lights Rheostat
15. Take Off Check List Decal
16. Communication Jack
17. Rudder Pedal Adjustment Lever
18. Seat Adjustment

Figure 1-9. Rear Cockpit, Right Side



1. Right Main Fuel Tank
2. Fuel Vent Line
3. Left Main Fuel Tank
4. Fuel System Filler Cap
5. Drain Valve
6. Fuel Sump Tank
7. Boost Pump
8. Fuel Filter
9. Fuel Shut-Off Valve
10. Engine-Driven Fuel Pump
11. Vapor Return Line
12. Carburetor
13. Fuel Pressure Gage
14. Priming Manifold
15. Priming Solenoid
16. Primer Switch

Figure 1-10. Fuel System



1. Engine Cooling Air Intake
2. Augmentor Tube
3. Cockpit Ram Air Intake (Cold)
4. Carburetor Air Intake
5. Oil Cooler

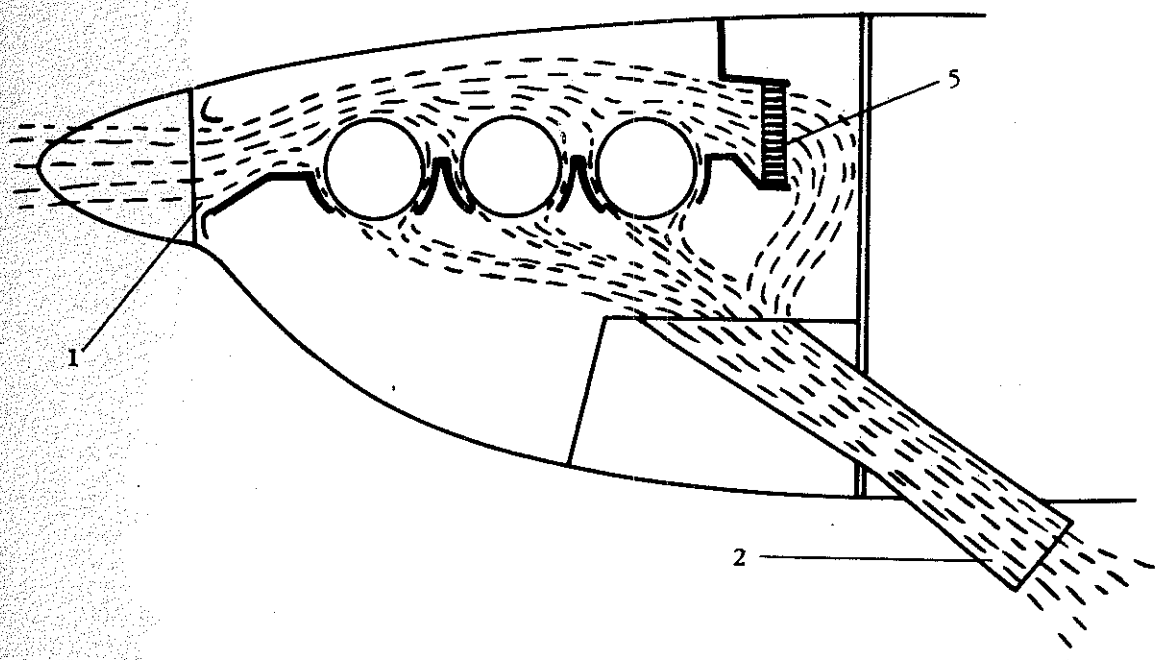


Figure 1-11. Engine Cooling Air

1-33. ELECTRIC POWER SUPPLY SYSTEM.

1-34. Electric power is supplied by a 28 volt direct current, single wire, negative ground return system powered by an engine driven 50 amp generator and controlled by a voltage regulator and a reverse current relay. A 24 volt alkaline, silver-zinc, 20 ampere-hour capacity, battery serves as a stand-by source supplying current to the system when the generator output is insufficient (below 26.5 volts) to close the reverse current relay. The reverse current relay closes when engine rpm is increased above 1200 to 1400 rpm.

1-35. EXTERNAL POWER RECEPTACLE. For starting the engine and for electrical ground checks, an external power source may be connected to the external power receptacle located inside an access door on the right side of the fuselage immediately aft of the firewall. (See para. 1-40).

1-36. ELECTRICAL SYSTEM CONTROLS.

1-37. BATTERY SWITCH. The battery switch is located on the right console panel in the front cockpit only (See Figure 1-7). Battery switch positions are "ON" and "OFF".

1-38. GENERATOR SWITCH. A generator switch is located on the right console in the front cockpit only (See Figure 1-7). Generator switch positions are "ON" and "OFF". The generator switch is protected by a red plastic safety guard.

1-39. CIRCUIT BREAKER PANEL. All dc circuits are protected from over loads by push-to-reset type circuit breakers mounted on a circuit breaker panel located on the right console in the front cockpit (See Figure 1-7). Circuits may be opened manually by pulling the associated breaker. Circuit breakers are provided for the following: instrument lights, interior lights, warning lights, position lights, landing and taxi lights, electric instruments, landing gear warning, landing gear system, radio-normal, radio-emergency, fuel boost pump and engine primer, and canopy (See Figure 1-12).

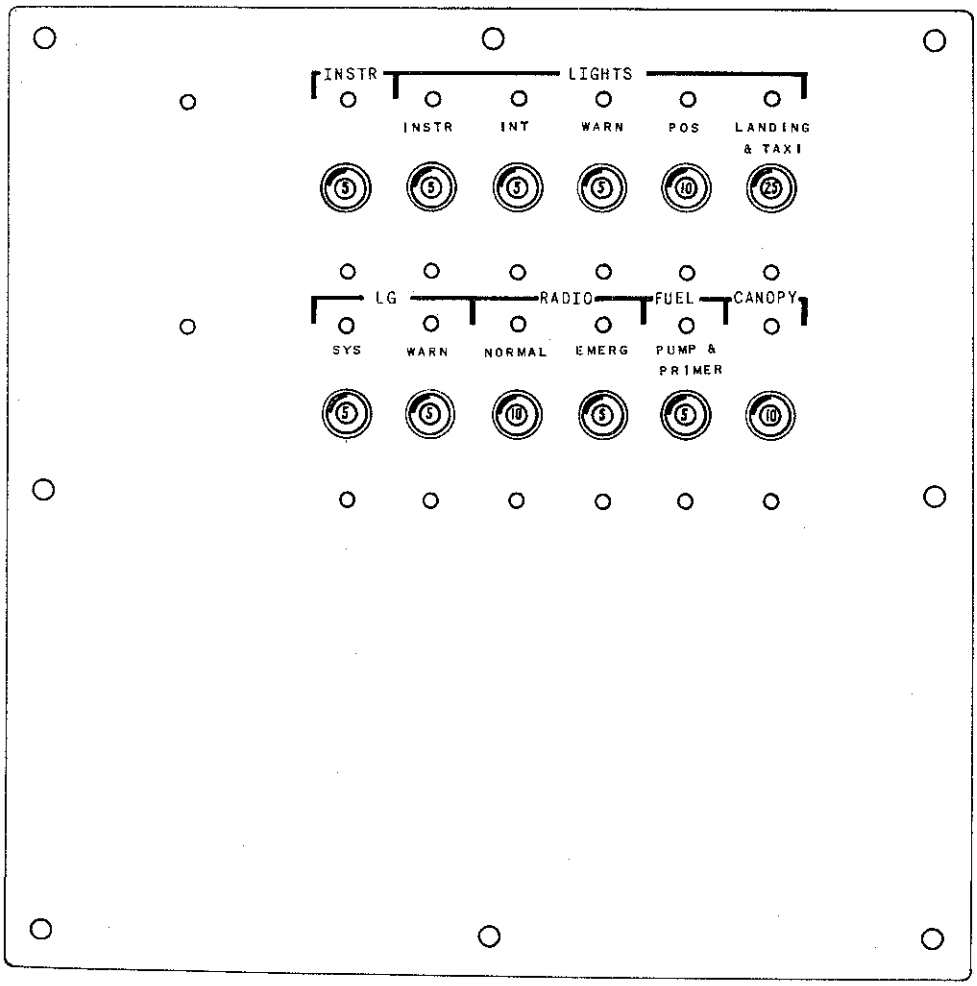
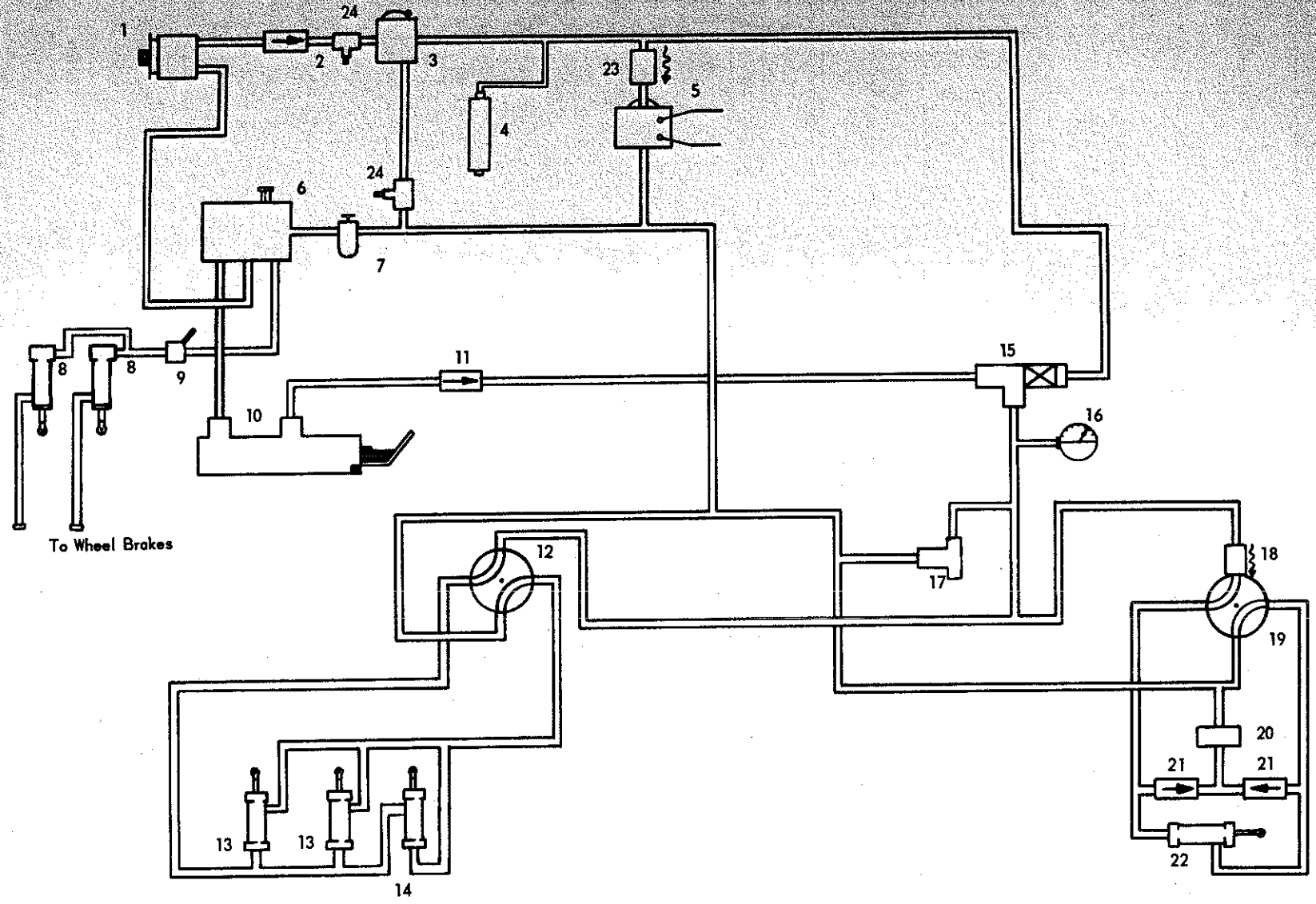


Figure 1-12. Circuit Breaker Panel



1. Engine Driven Pump
2. Check Valve
3. Unloading Valve
4. Accumulator
5. Depressurization Valve
6. Reservoir
7. Filter
8. Brake Master Cylinder
9. Parking Brake Valve
10. Hand Pump
11. Check Valve
12. Landing Gear Selector
13. Main Landing Gear Actuator
14. Nose Gear Actuator
15. Shuttle Valve
16. Pressure Gage
17. Thermal Relief Valve
18. Restrictor Valve
19. Flap Selector
20. Thermal Relief and Blow-Up Valve
21. Check Valve
22. Flap Actuator
23. Restrictor Valve
24. External Power Connection

Figure 1-13. Hydraulic System Schematic Diagram

1-40. MASTER BATTERY SWITCH. An emergency master battery disconnect switch is housed in the external power receptacle recess (See Paragraph 1-35) located inside an access door on the right side of the fuselage immediately aft of the firewall. This switch is normally "ON" but in an emergency when placed in the "OFF" position, the entire electrical system is de-energized.

1-41. ELECTRIC SYSTEM INDICATOR. An ammeter is located on the right side of the front instrument panel (See Figure 1-4). The ammeter indicates generator output.

1-42. HYDRAULIC SYSTEM.

1-43. Hydraulic power is used to operate the landing gear and wing flaps. An engine driven, constant displacement type pump supplies hydraulic pressure (1500 psi) for operation of the units. However, when the landing gear is full up or down and locked, and the flap control handle is in the neutral position, the hydraulic system is depressurized by means of an electrically actuated by-pass valve. When any hydraulic selector control handle is operated, the by-pass valve closes and pressurizes the system for operation of the selected unit. In the event of an electrical failure, the by-pass valve will automatically close and pressurize the system. A reservoir, mounted on the forward face of the firewall, is utilized to supply hydraulic fluid. In the event of loss of fluid below the level of the highest, or normal system, standpipe in the reservoir, the emergency system will still be supplied with sufficient fluid to allow operation of the flaps and landing gear from an outlet in the bottom of the reservoir. Master cylinders for the brakes on the main wheels also receive fluid from a second lower standpipe in the hydraulic system reservoir. A hydraulic pressure gage is provided on the panel to the left of the instrument panel in the front cockpit only.

1-44. Hydraulic system fluid conforming to Specification MIL-0-5606 is required (See Figure 1-3).

1-45. HYDRAULIC HAND PUMP. In the event of normal hydraulic system failure, emergency operation of the landing gear and wing flaps is provided by a hand pump located on the left side of the front cockpit (See Figure 1-6). To operate either the landing gear or flaps manually, the appropriate selector handle is placed in the desired position and the pump handle actuated until the desired position of flaps or landing gear is achieved. A maximum pressure of 2050 psi can be obtained by the use of the emergency system hand pump before the main system thermal relief valve is actuated.

1-46. FLIGHT CONTROL SYSTEM.

1-47. The primary flight control surfaces (ailerons, rudder, and elevator) are operative from either cockpit by conventional stick and rudder pedal controls. Trim tabs on the aileron, rudder, and elevator are provided. Wing flaps are provided for use at airspeeds below the gear-and flap-down limit airspeed. Rudder pedals are adjustable fore and aft. When parked, the elevator & aileron controls can be locked in the neutral position by a mechanical control lock in the front cockpit.

1-48. CONTROL LOCK. A control is installed in the front cockpit for locking the aileron and elevator controls. To lock controls, raise the lock, slide the guard, and insert lock pin in the control eye (See Figure 1-14).

1-49. RUDDER PEDAL ADJUSTMENTS. The rudder pedals in both the front and rear cockpits are independently adjustable fore and aft. The rudder pedals may be moved to a new position by using the side of the foot on the outboard side of the pedal releasing a catch and moving pedals to the desired position.

1-50. TRIM TABS.

1-51. AILERON TRIM TAB. An aileron trim tab is provided on the left wing aileron. This tab is ground adjustable only.

1-52. ELEVATOR TRIM TAB. An elevator trim tab is located on the left elevator and is manually adjustable by a control wheel located on the left console of each cockpit (See Figure 1-6 and Figure 1-8).

1-53. RUDDER TRIM TAB. The rudder trim tab is manually adjustable by a control wheel located on the left console of each cockpit (See Figure 1-6 and Figure 1-8).

1-54. WING FLAPS.

1-55. Interconnected all metal, hydraulically operated wing flaps are located one on each wing and are actuated by a single hydraulic actuating cylinder. The flaps have a maximum travel of 30°. A combination thermal relief and blow-up valve is incorporated in the flap hydraulic system (See Figure 1-13).

1-56. WING FLAP CONTROL.

1-57. A wing flap control handle is located on the outboard aft side of the engine control quadrant in each cockpit (See Figure 1-6 and 1-8). The handle is in the shape of an airfoil to facilitate recognition by feel and preclude the necessity of looking for the control. The handle has three direction markings, "UP", "DOWN", and "INTER.". Normally the handle is left in the "INTER." position so that the hydraulic system will be depressurized provided the landing gear is not being actuated. To raise or lower the flaps, place the flap handle in the "UP" or "DOWN" position as required to achieve the desired change. When the desired position is achieved, return the flap handle to the "INTER." position. If the handle is not returned to "INTER.", the flaps

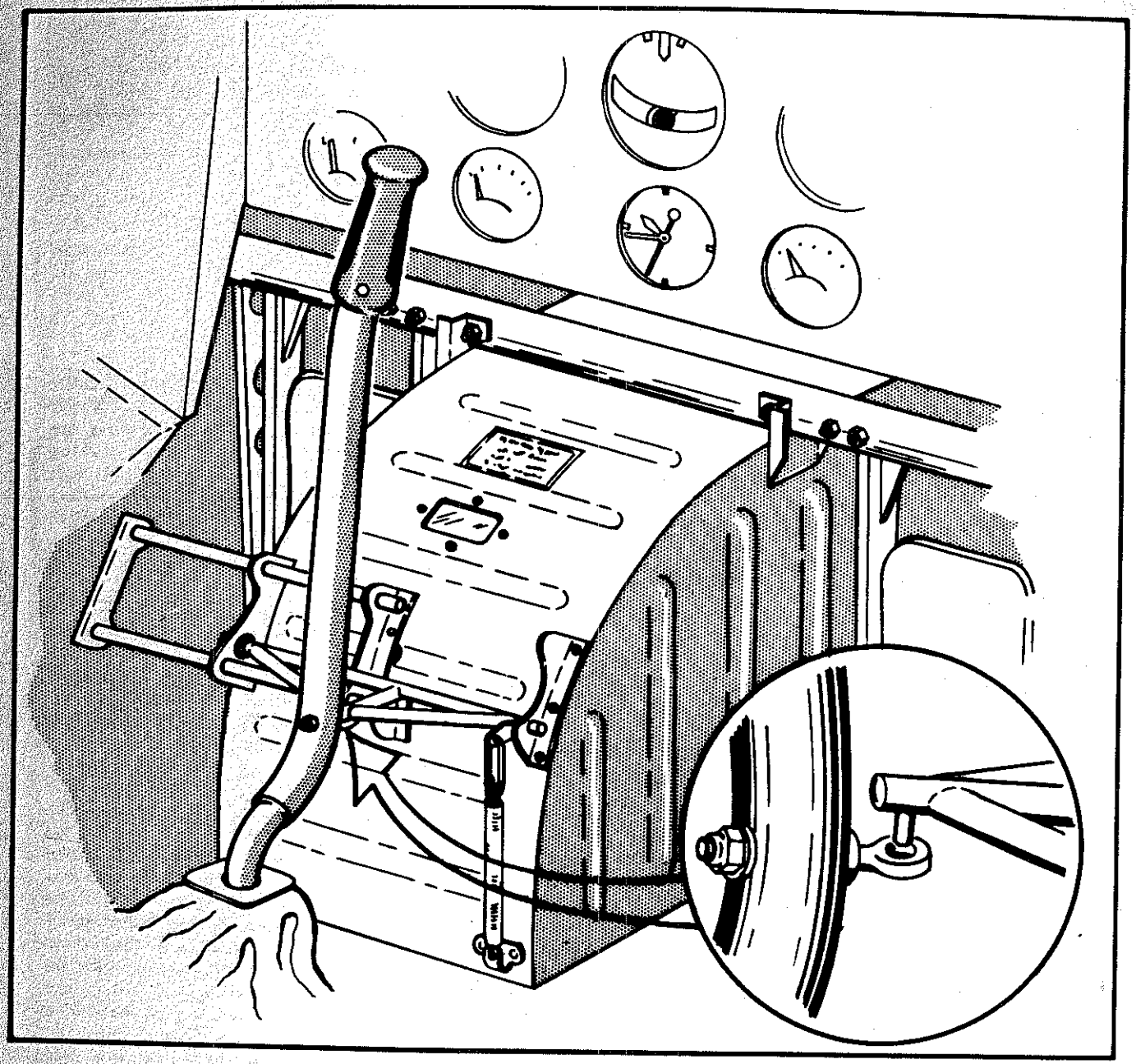


Figure 1-14. Surface Control Lock

will be automatically stopped at the full throw of the selected position; i.e., full "UP" or full "DOWN."

1-58. EMERGENCY FLAP OPERATION. If the normal hydraulic system fails, the flaps may be lowered by placing the flap control handle in the desired position and operating the emergency hydraulic hand pump (See Figure 1-6).

1-59. WING FLAP POSITION INDICATORS

1-60. Flap position markings are located on the inboard end of each flap. These markings are visible from either cockpit.

1-61. LANDING GEAR.

1-62. The tricycle landing gear is fully retractable and is hydraulically actuated. All gears are provided with air and oil shock struts. The main gear retracts inboard into the wing center section; the nose gear retracts aft into the fuselage. Wheel well doors and fairings are mechanically operated by the retraction or extension of the gears. All fairing and doors remain open when the gears are down. Mechanical locks hold the gear in either the up or down position. The nose wheel is free swiveling and the main wheels are equipped with brakes. A tail skid is provided to protect the aft fuselage in the event of a nose-high take-off or landing.

1-63. LANDING GEAR CONTROL

1-64. LANDING GEAR HANDLE. A two position transparent control handle in the form of a wheel is located on the left side of the instrument panel in each cockpit (See Figure 1-6 and Figure 1-8). Control positions are "UP" and "DOWN". The control is left in the desired position as no neutral position is provided. To prevent the gear from being inadvertently retracted on the ground, a solenoid stop is mounted on the control linkage. The solenoid is energized by a switch located on the right main gear which is actuated when the strut is fully extended as on take-off when the airplane becomes airborne. A safety pin on the control linkage may be sheared off by application of considerable "UP" force for emergency gear retraction when gear is still in contact with the ground and strut is not fully extended or in case of complete electrical system failure.

1-65. SHIMMY DAMPENER. The nose wheel incorporates a shimmy dampener to reduce shock transmission when taxiing the airplane.

1-66. LANDING GEAR INDICATORS.

1-67. POSITION INDICATORS. Position of the landing gear is shown by three individual indicators, one for each gear, located on the instrument panel in both cockpits (Figure 1-4 and Figure 1-5). Each indicator shows crosshatching if the related gear is in any unlocked condition; the word "UP" appears if the gear is up and locked, or a wheel shows if the gear is down and locked. Crosshatching will also show on the indicators whenever the electrical system is not energized. The transparent control handle contains a red light which illuminates when the gears are not fully up and locked or fully down and locked or anytime the throttle is retarded below normal cruising power and the gear is not down and locked.

1-68. WARNING HORN. A cockpit warning horn is provided which blows at any time throttle is retarded below normal cruising power and the gear is not down and locked. A push-to-silence switch is located to the left side of the front instrument panel (See Figure 1-6). Repositioning of the throttle will also automatically reclose the signal circuit silencing the horn.

1-69. EXTERIOR GEAR POSITION LIGHTS. To aid in determining gear position from the ground at night, a white light is installed near each landing gear. The main landing gear position lights are mounted on the forward side of the wing wheel wells. The nose gear position light is mounted near the bottom edge of the nose wheel strut fairing. The lights are illuminated when the gear is fully down and locked and the position lights are on.

1-70. BRAKE SYSTEM.

1-71. Disc type brakes are installed on each main landing gear wheel. The brakes are actuated by two independent master brake cylinders by applying pressure on the top portion of each rudder pedal. The brake system receives its fluid from the main hydraulic reservoir.

1-72. PARKING BRAKE. A parking brake handle is provided on the left console in the front cockpit only. The parking brakes are set by applying toe pressure to the rudder pedals, pulling the parking brake handle out and releasing the pedals first (See Figure 1-6). To release the parking brakes apply toe pressure to the rudder pedals and push parking brake handle in.

1-73. INSTRUMENTS

1-74. All instruments are duplicated in both cockpits, with the exception of a directional gyro, vacuum gage, ammeter, free air temperature indicator, and cylinder head temperature indicator, which are installed only in the front cockpit. The electrically operated instruments are: ammeter, cylinder head temperature, fuel gage, free air temperature indicator, tachometer, and turn and bank indicator. The vacuum instruments include: directional gyro, vacuum gage, and provisions for other vacuum type instruments. The air speed indicator is operated by the pitot static system. This system measures the difference between ram air pressure entering the pitot tube, mounted on the leading edge of the left wing, and the static air pressure which is obtained at a static port on the left side of the fuselage above and aft of the wing. At all times when the aircraft is parked on the ground, a cover should be placed over the pitot head to protect the opening from dust and water. The altimeter and rate-of-climb indicators are vented to the static system to preclude the possibility of difference in cockpit air pressure and static air pressure causing an erroneous reading.

1-75. CANOPY.

1-76. A single piece, full vision, bubble type plastic canopy encloses both cockpits. The canopy can be operated either manually or electrically from either the inside or outside of the airplane. The canopy is fully jettisonable in case of emergency (See Figure 1-16 and Section III).

1-77. CANOPY OPERATION CONTROLS-EXTERIOR. For access to the cockpit, two separate external canopy controls are provided on

the left exterior side of the cockpit. Opposite the forward seat position, a manual pull handle is provided. This spring loaded to close handle when pulled and held open declutches the canopy actuator, permitting the canopy to be easily pushed along the canopy tracks to any desired position. A second external electrical switch is provided inside a receptacle, covered by a spring loaded door, located at a position opposite the rear seat. The switch has three positions, "OPEN," "OFF," and "CLOSE." The switch is a normal return to "OFF," and to operate the canopy, it must be held in position to secure the desired operation. Pushing the canopy switch to "OPEN" or "CLOSED" energizes a circuit operating directly from the battery. By holding the switch, the canopy will continue to travel to the full "OPEN" or full "CLOSED" position as selected. Releasing the switch at any time during the cycle will stop the canopy at that intermediate position. The canopy electrical circuit is designed to operate directly from the battery, if the electrical system is off inside the airplane. The only switch that de-energizes the canopy electrical operation circuit is the Master Battery Switch (See para. 1-40).

CAUTION

As the canopy external operating switch's power supply is a battery, continual electrical operation of the canopy with the engine not operating will discharge the battery.

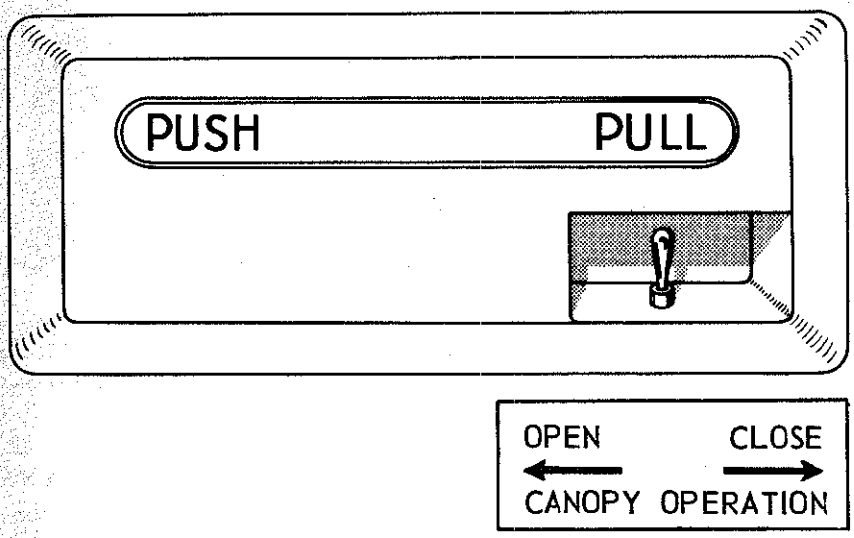


Figure 1-15. Normal Canopy Controls

1-78. CANOPY OPERATION CONTROLS-INTERIOR. Electrical operating switches are provided at both the forward and aft cockpit positions. These switches, located on the left side of each cockpit opposite the pilot seats, have three positions; "OPEN," "OFF," and "CLOSED." By holding the switch in the position describing the desired canopy action, the canopy will travel to the full "OPEN" or full "CLOSED" position as selected. Releasing the switch at any time during the cycle will stop the canopy at that intermediate position. An additional manual pull handle is provided in the front cockpit on the left side. This spring loaded to close handle, when pulled and held open, declutches the canopy actuator permitting the canopy to be easily pushed along the canopy tracks to any desired position. (See Figure 1-15).

CAUTION

Do not use manual pull handle in flight, as air pressure will force canopy to aft position and may damage canopy and track mechanism.

1-79. CANOPY OPERATION CONTROLS-EMERGENCY. The canopy is fully removable, in an emergency, from the interior or the exterior of the airplane. A canopy emergency release handle, is provided in both the forward and aft cockpits, located on the right hand side of the canopy skirt. Operation, by a push-pull handle releases the canopy forward hold down mechanism (See Figure 1-16). An additional exterior canopy emergency release handle is provided on the outer right side of the canopy skirt opposite the front cockpit.

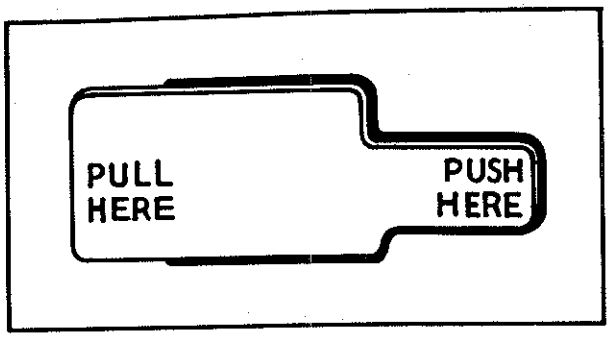


Figure 1-16. Canopy Jettison Control

1-80. SEATS.

1-81. Two vertically adjustable 20 "G" attachment seats are provided. The seats are equipped with safety belt and shoulder harness.

1-82. SEAT ADJUSTMENT CONTROL. The seats are adjusted by means of a lever at the right side of each seat. Pulling the lever back allows the seat to be raised or lowered approximately three and one-half inches in ½ inch increments. When the lever is pulled back, the pilot is assisted in raising the seat by spring action which tends to force the seat up. Seat pack or back pack type parachutes may be worn.

1-83. SHOULDER HARNESS LOCK CONTROL. A two-position (locked and unlocked) shoulder harness inertia reel lock control is located on the left side of each seat. A latch is provided for positively retaining the control at either position. By pressing down on the top of the control, the latch is released and the control may be moved from one position to the other. It is necessary to manually lock the harness during maneuvers and flight in rough air, or as an added safety precaution in event of a forced landing.

CAUTION

Before a forced landing, all switches not readily accessible with the harness locked, should be turned off before moving harness lock control to the locked position.

If the harness is locked while the pilot is leaning forward, the harness will retract with him as he straightens up until the pilot is against the seat back. To unlock the harness, the pilot must be able to lean back enough to relieve the tension on the lock. If the pilot is not able to lean back further, it is necessary to release the harness momentarily at the safety belt or release the harness buckles. After automatic locking of the harness, it will remain locked until the lock control is moved to the locked position and then back to unlocked.

1-84. MISCELLANEOUS EQUIPMENT.

1-85. FLIGHT REPORT HOLDER AND MAP CASE. A flight report holder and map case is located in the front and rear cockpit on the rear section of the right console (See Figure 1-7 and Figure 1-9).

1-86. CHECK LIST. A take off check list decal is mounted above the right console in either cockpit. A landing check list decal is mounted above the left console in each cockpit (See Figure 1-6 and Figure 1-7).

1-87. ASH TRAYS. An ash tray is installed directly above the right console in each cockpit (See Figure 1-7 and Figure 1-9).

1-88. OPERATION EQUIPMENT.

1-89. The operational equipment is covered in Section IV and consists of communications, heat and ventilation, and lighting.

1-88. SPARE BULB STOWAGE. Four spare replacement light bulbs are carried in a stowage compartment located in the front cockpit right hand console (See Figure 1-7). One each of the following is carried.

a. Large clear bulb (identified on bulb as 301). Used for instrument flood lighting.

b. Small clear bulb (identified on bulb as 313). Used for fuel level warning, consoles and instrument panel (one position) lighting.

c. Small clear bulb (identified on bulb as 1819). Used for communication control indicator light on the "Radio Control" panel.

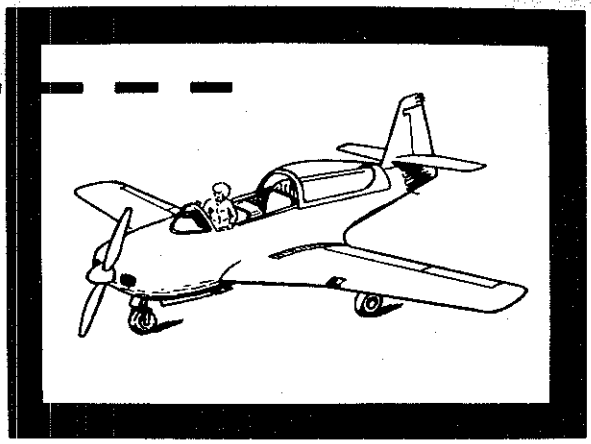
d. Miniature red bulb. Used for landing gear position handle lighting.

1-89. OPERATION EQUIPMENT.

1-90. The operational equipment is covered in Section IV and consists of communications, heat and ventilation, and lighting.

section II

normal operation



Section II - NORMAL OPERATING INSTRUCTIONS

CAUTION

Refer to Section V for flight limitations and restrictions.

2-1. BEFORE ENTERING AIRPLANE

2-2. a. Obtain takeoff and anticipated landing gross weights to complete the proposed mission. Using this information refer to Appendix for operating data. Note that the gross weight of the airplane allows a useful load consisting of two pilots, full fuel tanks, and full oil-tank.

b. Check for aircraft engineering and airworthiness status.

c. Make sure airplane has been serviced with required quantities of fuel, oil, and hydraulic fluid.

2-3. PRE-INSPECTION CHECK

2-4. a. External battery switch to "ON" position.

b. Open canopy either manually or electrically when the engine is not operating.

CAUTION

Excessive operation of the electrical canopy controls when the engine is not operating, will discharge the battery.

2-5. PRE-FLIGHT INSPECTION

2-6. EXTERIOR INSPECTION

2-7. After completing pre-inspection check, make an exterior inspection starting at the front cockpit and working clockwise around the airplane as follows:

A. COCKPIT

a. Ignition switch "OFF."

b. Trim tab controls neutral.

c. Surface control lock disconnected and stowed.

d. If flying solo, secure rear seat safety belt, shoulder harness, etc.

e. Check that no loose equipment is in either cockpit that could possibly jam controls or operating mechanism of airplane.

f. Check canopy and windshields for cleanliness.

B. LEFT WING

a. Ground adjusted aileron trim tab for damage.

b. Position light for condition.

c. Fuel tank for proper servicing and filler cap secured.

d. Landing light cover and light for condition.

e. Pitot tube cover removed and pressure opening in pitot tube clear.

C. LEFT LANDING GEAR

a. Main wheels chocked.

b. Gear strut extended approximately one and one-quarter inches.

c. Tire for proper inflation, cuts, blister, and slippage.

d. Check for hydraulic leaks.

D. POWER PLANT SECTION

a. Engine oil tank and hydraulic fluid caps secured.

b. Cowling latches secured.

c. Carburetor and air scoops free of obstructions.

d. Propeller for nicks and hydraulic leaks.

E. NOSE GEAR

a. Nose gear wheel strut extended approximately one and one-quarter inches.

b. Tire for proper inflation, cuts, blisters, and slippage.

c. Check for hydraulic leaks.

F. RIGHT LANDING GEAR

a. Gear strut extended approximately one and one-quarter inches.

b. Tire for proper inflation, cuts, blisters, and slippage.

c. Check for hydraulic leaks.

G. RIGHT WING

a. Position light for condition.

b. Landing light cover and light for condition.

H. FUSELAGE RIGHT SIDE

a. Fuselage lights for condition.
b. Radio door secured.
c. Sump drains for closed position.
d. Sump tank door secured.
e. Check canopy release safetied.

I. EMPENNAGE

a. Elevator and rudder trim tabs neutral.

b. Fuel vent line on side of stabilizer free of obstructions.

c. Position lights for condition.

d. Tail skid for security.

J. FUSELAGE LEFT SIDE

a. Static port free of obstructions.

b. Canopy center track for evidence of binding.

NOTE

During this pre-flight check, inspect all skins for wrinkles, dents, and loose rivets.

2-8. ON ENTERING COCKPIT

2-9. Make the following checks before starting engine.

a. Make sure all switches are "OFF."

b. Circuit breakers "IN."

c. Adjust seat and rudder pedals.

d. Check flight controls for free and proper movement.

e. Fasten safety belt and shoulder harness. Check operation of shoulder harness lock.

f. Set parking brakes.

g. External power connected (if not available, battery switch "ON").

h. Fuel selector handle "OFF."

i. Check fuel quantity.

j. Wing flaps up, control handle "INTER." Landing gear handle "DOWN." Check gear position indicators.

k. Mixture control "IDLE CUT-OFF."

l. Propeller control full "INCREASE."

m. Throttle open approximately one inch.

n. Generator switch "ON."

o. Cockpit heater control "OFF."

p. Altimeter and clock set.

q. Note manifold pressure reading (field barometric pressure), for subsequent use during engine power check.

r. Test operation of communications equipment, if external power is being used; if external power is not used, make this check after engine is running. (See Section IV.

s. Push to test and adjust intensity of all indicator and warning lights.

t. Be sure you have a flash light.

u. Check instrument glass for cleanliness and slippage.

v. Have ground crew turn propeller through (minimum of four blades).

w. Check L.H. canopy release pin for proper engagement.

2-10. If night flying is anticipated, the following additional checks should be made:

a. With aid of outside observer, test operation of position, fuselage, landing, taxiing, and exterior gear down lights.

b. Check operation of instrument panel lights, console lights, etc.

2-11. STARTING ENGINE

2-12. Start the engine as follows:

a. Fire guard posted.

b. Recheck position of throttle (open approximately one inch) and propeller (full "INCREASE") and mixture ("IDLE CUT-OFF") controls.

c. Turn fuel selector to "ON."

d. Check fuel pressure, should read 8-15 PSI.

e. Check propeller clear.

f. Turn ignition switch to "BOTH." Use primer to give two five second injections of fuel (there should be a perceptable drop shown on the fuel pressure gage) and hold starter switch to "ON."

g. Continue holding starter switch "ON." Use primer as needed but only while engine is turning.

h. When engine catches, release starter switch and immediately advance mixture control to "RICH."

i. Move throttle to obtain 700 RPM as soon as possible.

j. Check oil pressure. If pressure does not reach 10 PSI within thirty seconds, stop engine and investigate.

k. Check hydraulic system pressure by moving flap handle to "UP" position and observe pressure gage reading between 1450 and 1550 psi.

l. Adjust throttle to smoothest speed between 1400 and 1600 RPM as soon as oil pressure permits.

m. Have external power disconnected and turn battery switch to "ON" position.

NOTE

Refer to Section III for instructions in case of fire during starting.

2-13. WARM-UP

2-14. Before making any engine performance checks or before taxiing, warm-up engine at 1400-1600 RPM until oil temperature reaches 24°C (77.2°F).

CAUTION

Avoid prolonged engine operation at idling speed as spark plugs will foul.

2-15. GROUND TESTS

2-16. While engine is warming up, make the following tests:

a. Hydraulic system – check by operating wing flaps.

b. Instruments – check for readings in desired ranges.

c. Electrical system – check ammeter to make sure that the generator cuts in for charging between 1000-1200 RPM.

d. Communications Equipment – check for proper operation, if not previously accomplished.

e. Ignition switch check–at 700 RPM, turn ignition switch "OFF" momentarily and note that engine stops firing completely. If engine does not cease firing completely, it indicates the magnetos are not grounded. Shut down the engine and warn personnel to keep clear of the propeller until the difficulty has been remedied.

CAUTION

Perform this check as rapidly as possible to prevent severe backfire when ignition switch is turned on again.

f. Check engine fuel pump by pulling booster pump circuit breaker and observing fuel pressure–it will drop 1-2 psi and hold steady.

2-17. If performing a night flying mission, the following additional checks should be made:

a. Console and instrument lights, "ON," adjust intensity.

b. Adjust intensity of "PUSH TO TEST" lights.

c. Position (navigation) lights "STEADY."

d. Fuselage lights "BRIGHT."

e. Check taxi and landing lights.

2-18. TAXIING INSTRUCTIONS. Observe following instructions and precautions for taxiing:

a. Chocks removed.

b. Wing flaps up.

c. Release parking brakes, and allow airplane to roll straight ahead.

d. As soon as airplane is moving straight, apply brakes evenly and firmly to check for adequate braking action. Never allow speed to build up without checking brakes.

e. Taxi airplane using normal rudder and slight pressure of brakes. Nose wheel is free to swivel 30° left or right.

f. Taxi slowly, do not use brakes excessively as heat may deteriorate brake expander tubes.

g. Whenever you stop the airplane, idle at 1400 RPM. This will prevent plug fouling and create enough propeller blast to help cool the engine.

h. Park a safe distance off end of runway you are using for take-off, and turn into the wind to provide maximum cooling for engine warm-up.

2-19. If taxiing is being performed at night, the following additional instructions should be followed:

a. Taxi light "ON."

2-20. BEFORE TAKE-OFF

2-21. PRE-FLIGHT ENGINE CHECK

CAUTION

When running engine up, be careful to have feet on brakes.

Before each flight, make following checks:

NOTE

All checks except the propeller check should be accomplished with the propeller control in full "INCREASE."

a. Cruising Fuel Air Mixture Check – Set throttle at 2300 RPM and mixture control "RICH." After engine speed and instruments have stabilized, pull mixture control back slowly toward "LEAN." An increase of over 1000 RPM indicates an excessively rich mixture.

b. Propeller Check – At 2300 RPM, pull propeller control from full "INCREASE" RPM position to full "DECREASE" RPM position and note RPM drop. RPM reading will drop 1600 – 1800 RPM. Return control to full "INCREASE" position.

c. Power Check – Open throttle until manifold pressure is equal to field barometric pressure. The RPM should be approximately 2600.

d. Cylinder Head Temperature – Observe cylinder head temperature, "Within Limits."

e. Ignition Check – At 2000 RPM, check "L" and "R" ignition system for maximum drop of 100 RPM. Return ignition switch to "BOTH" between checks to allow speed to stabilize.

f. Idle Mixture and Speed Check – Close throttle. With throttle against idle stop, the engine should idle at 700 RPM. When engine speed is stabilized, pull the mixture control back slowly toward "MAN LEAN" and carefully observe the tachometer and manifold pressure during this leaning procedure. When the engine speed has dropped to 300 RPM during the leaning procedure, return the mixture control to the "RICH" position. While leaning out the mixture, an increase of more than 10 RPM and a decrease of more than ¼ inch manifold pressure indicates an excessively rich idle mixture. An immediate increase in manifold pressure not preceded by a momentary decrease in manifold pressure indicates the idle mixture is too lean.

NOTE

This check should be made in relatively still air with cylinder head temperature at stabilized idling temperature. A strong wind affects the propeller loading and the RPM change may be different from that noted.

g. Acceleration Test – With mixture control "RICH," advance throttle firmly and smoothly from idle to 2600 RPM. Engine should accelerate rapidly and smoothly without faltering or backfiring.

CAUTION

Do not run up engine over loose sand or gravel as propeller blade damage may result. Make certain the area to the rear of the airplane is clear of other airplanes or objects which could be damaged by the propeller blast.

2-22. PRE-FLIGHT AIRPLANE CHECK

a. Surface controls rechecked for free and proper movement.

b. Canopy closed.

c. Fuel Selector "ON."

d. Trim tab set for take-off, i.e., rudder-zero degrees, elevator-zero degrees.

e. Flaps down at 30°.

f. Propeller control full "INCREASE."

g. Mixture control "RICH."

h. Check all instruments for desired normal operating range.

2-23. If take-off is to be made at night: Landing lights "ON."

2-24. TAKE-OFF. Plan take-off according to the following variables affecting take-off technique: gross weight, wind, outside air temperature, type of runway, and height and distance of nearest obstacles. (See Appendix for required take-off distances.)

2-25. NORMAL TAKE-OFF

a. Visually check final approach for other aircraft and control tower for customary signals.

b. Roll into take-off position and align nose wheel with runway.

c. Advance throttle smoothly to take-off power.

NOTE

The rudder is effective for directional control above approximately 30 knots IAS.

d. As speed increases and elevator control becomes effective, lift nose wheel slightly: Then, as speed builds up, increase slight back pressure and allow airplane to fly itself off.

e. Normal take-off speed is approximately 57 knots IAS, with full flaps and a gross weight of 2500 pounds.

NOTE

For procedure to follow if engine fails during take-off, refer to Section III.

2-26. MINIMUM RUN TAKE-OFF. A minimum run take-off is a maximum performance maneuver, requiring excellent feel of the airplane near stalling speeds.

The pilot should be familiar with the slow flying and flaps-down stalling characteristics of the airplane before attempting this maneuver. When it is necessary to make a shortfield take-off use the following procedure:

a. Complete normal pre-take-off checks.

b. Trim tabs set.

c. Flaps down at 30°.

d. Line up airplane on runway, hold brakes and advance throttle to take-off power.

e. Release brakes.

f. Raise nose as soon as sufficient speed is gained. At approximately 54 to 57 knots IAS, increase back pressure on stick to lift airplane off and hold 61 knots IAS in initial climb.

g. Immediately move landing gear handle to "UP." After obstacles are cleared and approximately 75 knots IAS is attained, lower nose and raise wing flaps to full "UP."

2-27. AFTER TAKE-OFF

a. When airplane is definitely airborne, apply brakes to stop wheels and move landing gear handle to "UP." (Gear retraction occurs in approximately 8 seconds).

b. Retract flaps (Return flap handle to "INTER" position).

c. Continue climb at full throttle but do not exceed 2600 RPM.

d. Hold minimum angle of climb until airspeed builds up to normal climb speed of 86 knots IAS.

e. Check that cylinder head, and oil temperatures are within limits.

2-28. If flying at night:

a. Turn landing lights "OFF."

b. After leaving traffic pattern, turn position lights to "FLASH" and fuselage lights to "DIM."

2-29. CLIMB. Initial climb will be made at 86 knots with zero flaps and a gross weight of 2500 pounds. For further information on climb data, refer to Appendix.

2-30. ENGINE OPERATION IN FLIGHT. Make the following engine checks during flight:

a. Set throttle and propeller controls for desired power settings at 5000 ft. Normal cruise setting is 2400 RPM, 24" Hg manifold pressure and 140 knots IAS. For further data on cruise refer to Appendix.

NOTE

The basic sequence to remember in engine operation is: When increasing power, first enrich mixture, then advance propeller control, then throttle, When decreasing power, first retard throttle, then propeller control. This procedure helps prevent detonation from high manifold pressure and low RPM.

b. Set mixture control as needed for smooth operation to best power as follows:

(1) Gently pull mixture control back until the engine definitely falters.

(2) Immediately push the mixture control slightly forward until the engine is again running smoothly.

(3) Slowly push the mixture control forward of last position approximately 1/16 inch on the quadrant.

(4) When engine and propeller controls are adjusted, the quadrant throttle friction lock may be applied. This is located on the front quadrant only.

CAUTION

Do not exceed the maximum allowable cylinder head temperature when leaning out mixture.

c. Check periodically for desired instrument readings (See Figure 5-2).

2-31. DESCENT. Before starting any descent, always place mixture control in "RICH." Engine cut-out may occur at retarded throttle settings, such as are used during glides and landing

approaches, if mixture control is not in "RICH" position.

2-32. PRE-TRAFFIC PATTERN CHECK

a. Contact control tower for landing instructions.

b. If rear seat is occupied, notify occupant to prepare for landing.

c. Check safety belts.

2-33. TRAFFIC PATTERN CHECK. For normal landing, (See Figure 2-1). Check the following:

a. Mixture control "RICH."

b. Throttle at 2300 RPM. Propeller to full "INCREASE."

c. Check landing gear warning horn by retarding throttle momentarily and noting that horn blows.

d. Lower landing gear below 100 knots IAS. Check gear position indicators. Retard throttle momentarily to make sure that warning horn does not blow.

e. Instruments in desired range.

f. Maintain 86 knots IAS in the pattern (gear down).

2-34. LANDING

2-35. NORMAL LANDING

a. After turning on base leg, reduce airspeed to 80 knots IAS and recheck gear down and lock. Lower wing flaps 15° and cut throttle. (See Figure 2-1).

b. After roll out on final, lower wing flaps as required.

c. Maintain a final approach speed of approximately 70 knots IAS. Establish a constant glide and hold it.

d. Adjust trim.

e. Keep airspeed constantly down to point of flare-out. If you find you are undershooting, maintain same airspeed, but add power to decrease rate of descent. Set up glide again when field can be made power-off. Normal landing speed is 63 knots IAS with 30° flaps.

f. Just before reaching runway, start flare. Use smooth continuous back pressure on stick to obtain a slight nose high attitude.

g. Touch ground on main landing gear only and as soon as ground run is established lower nose wheel lightly to the runway.

h. Use rudder to retain directional control until speed diminishes.

i. When possible, take advantage of runway length to save brakes. Test brakes gently.

2-36. If landing at night perform the following: Turn landing lights "ON" during final approach.

2-37. CROSS WIND LANDING

2-38. The exceptionally wide-tread landing gear minimizes difficulties associated with cross-wind landings. On approach, use normal procedure required to maintain a straight flight path and to touch down with minimum drift. Land faster and lower nose wheel to ground to obtain use of nose wheel as soon as possible after touch down for directional control.

2-39. MINIMUM RUN LANDING

2-40. When brakes are used to stop airplane following a full-flap, power-off approach, a very short landing roll is possible. An alternate technique for minimum run landing over an obstacle is to use a full-flap, partial power approach. Use enough power to keep airplane at a gliding speed slightly below normal, and as soon as obstacle is cleared, close throttle and start flare as for normal landing.

2-41. GO AROUND. Decide early in the approach whether it is necessary to go around, and start before you reach too low an airspeed and altitude.

a. Advance throttle to full "OPEN."

b. Keep nose down to attain safe flying speed.

c. Retrim.

d. Landing gear handle "UP."

e. Turn slightly to clear runway for other traffic and start a normal climb.

f. Raise wing flaps gradually.

2-42. If flying at night perform the following: Turn landing lights "OFF."

2-43. EMERGENCY LANDING

See Section III

2-44. AFTER LANDING

2-45. AFTER TURNING OFF RUNWAY: Wing flaps "UP."

2-46. If flying at night perform the following:

a. Turn landing lights "OFF."

b. Turn Taxi light "ON."

2-47. POST FLIGHT ENGINE CHECK

(LAST FLIGHT OF DAY ONLY)

2-48. After the last flight of the day, make the following engine checks:

a. Ignition Switch Test – At 700 RPM, turn ignition switch "OFF" momentarily and note that engine stops firing completely. If engine does not cease firing completely, it indicates that magnetos are not grounded, and personnel should be cautioned to keep clear of propeller until corrective action is taken.

CAUTION

Perform the check as rapidly as possible to prevent severe backfire when ignition switch is turned on again.

b. Cruising Fuel-Air Mixture Check – Set throttle at 2300 RPM and mixture control "RICH." After engine speed and instruments have stabilized, pull mixture control back slowly toward "LEAN." An increase of over 100 RPM indicates an excessively rich mixture.

c. Propeller Check – At 2300 RPM, pull propeller control from full "INCREASE" RPM position to full "DECREASE" RPM position and note RPM drop. RPM reading will drop to 1600 – 1800 RPM. Return control to full "INCREASE" position.

d. Power Check – Open throttle until manifold pressure is equal to field barometric pressure. The RPM should be approximately 2600.

e. Cylinder Head Temperature. – Observe cylinder head temperature, "within limits."

f. Ignition Test – At 2000 RPM check "L" and "R" ignition system for maximum drop of 100 RPM. Return ignition switch to "BOTH" between checks to allow speed to stabilize. Normal difference between "L" and "R" is 50 RPM or less.

g. Idle Mixture and Speed Check – Close throttle. With throttle against idle stop, the engine should idle at 700 RPM. When engine speed is stabilized, pull the mixture control back slowly toward "MAN. LEAN" and carefully observe the tachometer and manifold pressure during this leaning procedure. When the engine speed has dropped to 300 RPM during the leaning procedure, return the mixture control to the "RICH" position. While leaning out the mixture, an increase of more than 10 RPM and a decrease of more than ¼ inch manifold pressure indicates an excessively rich idle mixture. An immediate increase in manifold pressure not preceded by a momentary decrease in manifold pressure indicates the idle mixture is too lean.

NOTE

This check should be made in relatively still air with cylinder head temperature at stabilized idling temperature. A strong wind affects the propeller loading and the RPM change may be different from that noted.

h. Acceleration Test – With mixture control "RICH," advance throttle firmly and smoothly from idle to 2600 RPM. Engine should accelerate rapidly and smoothly without faltering or backfiring.

2-49. STOPPING ENGINE

2-50. a. Parking brake set.

b. Open throttle to approximately 1400 RPM, place propeller control in full "DECREASE" and allow engine to run for approximately one minute. Return propeller control to full "INCREASE" RPM and allow to stabilize.

c. Stop engine by pulling mixture control to full "IDLE CUT OFF."

d. When engine stops firing and the propeller stops turning, close throttle completely.

e. Place fuel handle in "OFF" position.

f. Turn off ignition and all electrical switches.

2-51. BEFORE LEAVING AIRCRAFT. Make the following checks before you leave the airplane:

a. Have the wheels chocked, then release brakes.

b. Complete Flight Log and applicable aircraft forms.

c. Surface controls locked.

d. Close canopy.

e. Install pitot cover.

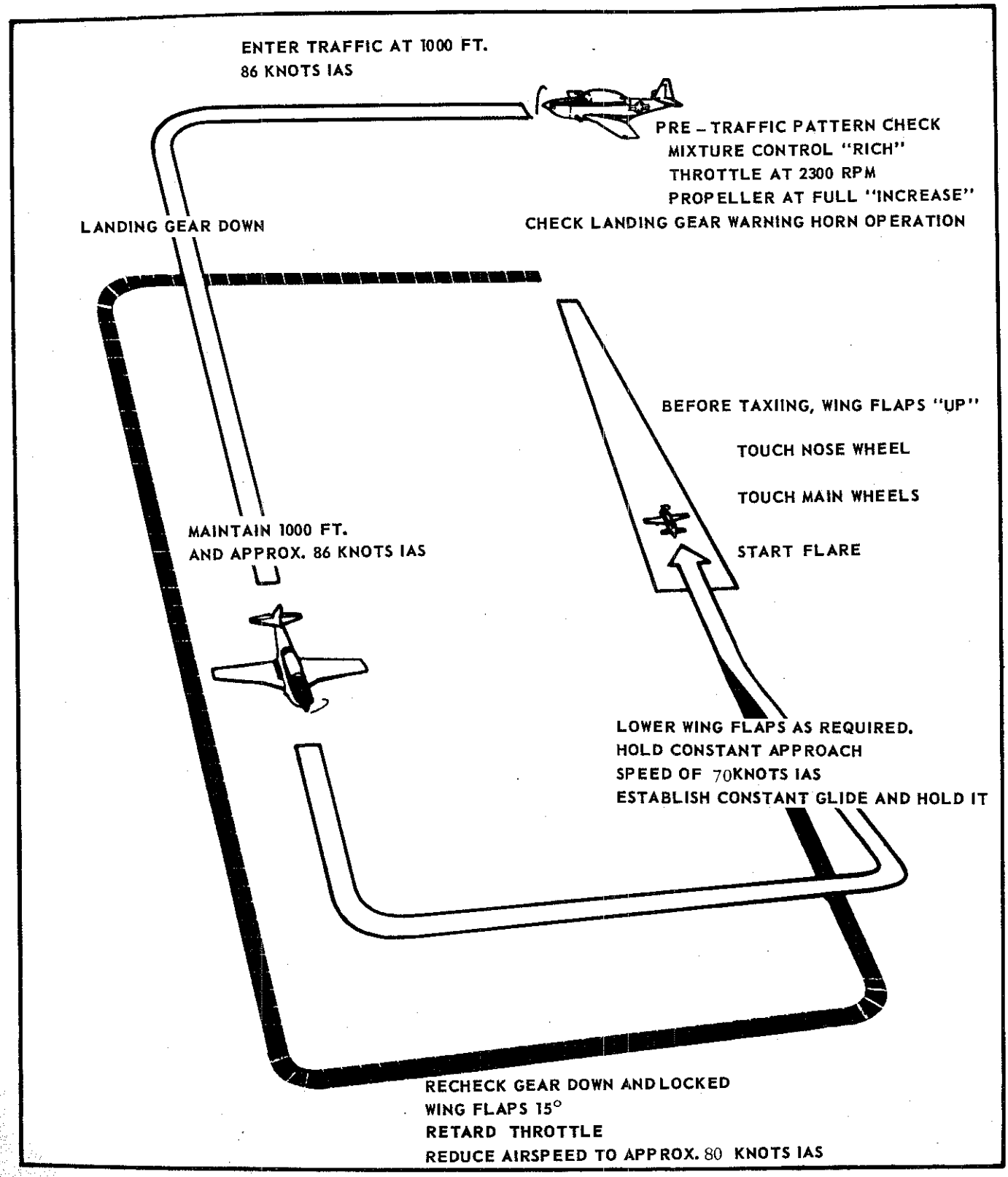
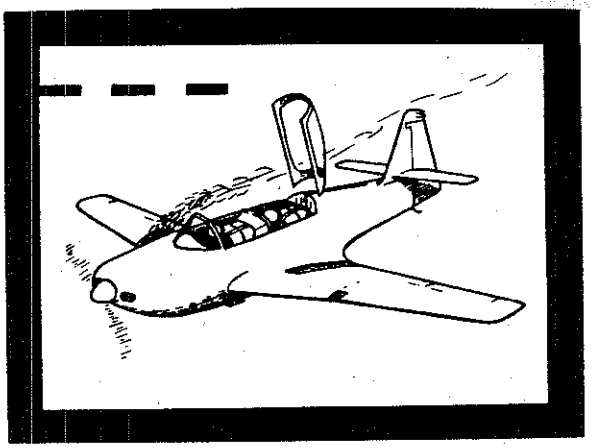


Figure 2-1. Traffic Pattern

section III
emergency procedures



SECTION III – EMERGENCY PROCEDURES

3-1. ENGINE FAILURE. Engine failure during take-off, in flight, or in landing, does not necessarily mean a crash if the pilot will familiarize himself with correct procedures to be taken. The following paragraphs outline the procedures to be taken in these emergencies.

3-2. ENGINE FAILURE ON TAKE-OFF. Should the engine fail during the take-off run, immediately close throttle and apply brakes. If remaining runway is insufficient for stopping and it becomes necessary to collapse the gear, proceed as follows:

a. Turn fuel selector handle to "OFF."

b. Turn ignition, battery and generator switches to "OFF."

c. Open canopy.

d. Unbuckle parachute.

e. Move landing gear handle to "UP." (Considerable pressure will be necessary, if gear is still on the ground, to shear safety pin on control linkage).

3-3. ENGINE FAILURE AFTER TAKE-OFF. If engine fails after take-off, proceed as follows:

a. Immediately lower nose to maintain airspeed above stall.

b. Landing gear handle "UP." (Even if there is not sufficient time to completely raise gear, it is better to have it unlocked so it will collapse on landing. Judgement should be used on long runways where a gear-down landing could be accomplished.)

c. Turn fuel selector handle to "OFF."

d. Turn ignition, battery and generator switches to "OFF."

e. Open canopy.

f. Unbuckle parachute.

g. Land straight ahead, changing direction only enough to miss obstacles. Do not try to turn back to the field—making a crash landing straight ahead with airplane under control is much better than turning back and taking the chance of an uncontrolled roll into the ground.

3-4. ENGINE FAILURE IN FLIGHT. If the engine fails in flight and sufficient altitude is available, attempt to restart as follows:

a. Lower nose immediately to maintain airspeed well above stall.

b. Be sure fuel selector handle is "ON."

c. Check ignition and battery switches to "BOTH" and "ON."

d. Move mixture control to "RICH," propeller control to full "INCREASE."

e. Hold starter switch "ON."

f. If it is impossible to restart the engine, decide whether you can make a dead-engine landing or if it is necessary to abandon the airplane.

3-5. ENGINE FAILURE ON LANDING. If it is necessary to make a forced landing:

a. Lower nose of airplane to maintain flying speed.

b. Turn fuel selector handle to "OFF."

c. Turn ignition, battery and generator switches to "OFF."

d. Unbuckle parachute, tighten and lock safety belt and shoulder harness.

CAUTION

Before locking shoulder harness, turn off all switches not accessible with harness locked.

e. Leave landing gear handle "UP" (unless absolutely certain that intended landing area is suitable for a gear-down landing).

f. Remember – if the gear is up, the airplane will glide farther.

g. Open canopy.

h. Lower flaps as required.

i. Maintain normal landing attitude before ground contact, even with gear up.

j. Land as nearly up-wind as possible.

k. After landing, leave airplane immediately.

3-6. MAXIMUM GLIDE. On failure of engine in flight, strive for maximum glide to enable a longer search for a smooth landing area. Airplane will glide farther with gear and flaps fully retracted.

3-7. PROPELLER FAILURE. In the event of propeller control failure, the propeller will go to low pitch, high engine rpm automatically and will remain in that position. At first evidence of propeller failure:

a. Retard throttle.

b. Manipulate propeller control in an attempt to bring propeller within limits. If impossible to control propeller, adjust throttle so that maximum engine rpm of 2600 is not exceeded. The airplane can be safely flown with propeller at low pitch.

3-8. FIRE.

3-9. ENGINE FIRE. There are no integral provisions for combating engine fires.

3-10. ENGINE FIRE DURING STARTING. If an engine fire occurs during starting:

a. Leave mixture control in "IDLE CUTOFF" position. Do not prime engine.

b. Continue cranking in an attempt to start engine, as fire may be drawn through engine or blown out the exhaust stacks and extinguished.

c. If engine does not start, continue cranking, turn off ignition and generator switches and fuel selector. Advance throttle to full "OPEN."

d. If fire continues to burn, stop cranking and turn battery switch "OFF." Signal ground crew to use portable fire extenquishing equipment.

e. Get out of airplane.

3-11. ENGINE FIRE AFTER STARTING. If an engine fire occurs after the engine has started;

a. Mixture control "IDLE SHUTOFF" and throttle full "OPEN." Ignition, battery and generator switches, and fuel selector "OFF."

b. If fire continues to burn, signal ground crew to use portable extinguishing equipment. Access to the engine compartment is through two quick release latched hinged doors aft of the air inlet nose cowling section.

c. Get out of airplane.

3-12. ENGINE FIRE DURING FLIGHT. Depending upon seriousness of fire, either bail out immediately or attempt to extinguish fire as follows:

a. Mixture control "IDLE CUTOFF."

b. Throttle closed.

c. Fuel selector "OFF."

d. Ignition switch "OFF."

e. Battery and generator switches "OFF."

f. Do not attempt to restart engine after fire is out unless cause of fire is determined and can be isolated.

g. If fire is extinguished and a forced landing is possible, leave wheels up unless absolutely sure landing field is suitable for a wheels down landing.

3-13. FUSELAGE FIRE (DURING FLIGHT). If a fuselage fire occurs during flight, proceed as follows:

a. Reduce speed immediately.

b. Attempt to determine cause of fire by shutting off (one at a time), the generator switch and battery switch.

c. If fire persists, shut down engine.

d. If fire is not extinguished immediately, bail out.

3-14. WING FIRES. If a fire breaks out in the wing:

a. Turn off all wing light switches (position and landing).

b. Attempt to extinguish fire by sideslipping airplane away from fire.

c. If fire continues, bail out.

3-15. ELECTRICAL FIRE. Circuit breakers protect most electrical circuits and tend to isolate an electrical fire. In case of an electrical fire, determine system causing fire and isolate, if possible. If necessary, however, turn generator and battery switches "OFF." All electrical equipment is inoperative when the battery and generator switches are "OFF." If system can be isolated,

place generator and battery back on line. If the system on fire cannot be isolated, the switches should be left "OFF" and an emergency landing made as soon as possible.

3-16. DITCHING.

3-17. The airplane should be ditched only as a last resort. Since all emergency equipment is carried by the pilot, there is no advantage in riding the airplane down. However, if altitude is insufficient for bail-out and ditching is unavoidable, proceed as follows:

a. Follow radio distress procedure.

b. See that no personal equipment will foul you when you leave the airplane. Disconnect radio equipment.

c. Turn battery switch "OFF."

d. Unbuckle parachute; tighten and lock safety belt and shoulder harness.

CAUTION

Before locking shoulder harness, turn off all switches not readily accessible with harness locked.

e. Landing gear handle "UP."

f. Open canopy.

g. Lower wing flaps.

h. Make normal approach with power, if possible, and flare out to normal landing attitude. Land fully stalled, tail low. Unless wind is high or sea is rough, plan approach heading parallel to any uniform swell pattern and try to touch down along wave crest or just after crest passes. If wind is as high as 25 knots or surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of a wave.

i. Just before impact, turn ignition switch "OFF."

3-18. AIR CRAFT SYSTEMS IN EMERGENCY.

3-19. FUEL SYSTEM. If engine fuel pump is inoperative, fuel boost pump will furnish adequate fuel pressure to continue flight.

3-20. ELECTRICAL SYSTEM.

a. In case of odor in cockpit of burning insulation, immediately turn off battery and generator switches until trouble can be located.

b. Generator trouble. If ammeter shows zero current during flight, it may indicate failure of the generator system. In such case, the battery will supply the electrical load for a short time only. Turn generator switch "OFF," and conserve the battery by using electrical equipment sparingly.

3-21. FLIGHT CONTROL SYSTEM. Control of flight surfaces are duplicated in each cockpit. In the event of failure of one control, other control can be used. There are provisions for emergency wing flap control if hydraulic system is inoperative. Set flap selector handle to desired position and operate hand pump, return flap selector handle to neutral position after desired flap position has been reached.

3-22. LANDING GEAR SYSTEM. The landing gear can be lowered manually by the emergency hydraulic hand pump (See Figure 1-6) in event of engine driven hydraulic pump failure. Place landing gear control handle in desired position and operate hand pump.

3-23. EMERGENCY HYDRAULIC SYSTEM. Two standpipes located in the hydraulic system reservoir govern the flow of the hydraulic fluid. The normal system operation can use only the fluid above and within the highest standpipe. The lower standpipe acts as a separate reservoir for the emergency system.

3-24. BAIL OUT. When decision is made to abandon the airplane in flight:

a. Slow airplane down as much as possible, trim it slightly nosedown, and head toward an uninhabitated area.

b. Open canopy.

c. Warn other pilot to bail out and receive acknowledgement.

d. Raise seat to top position.

e. Unfasten safety belt and shoulder harness.

f. Remove head set and throat mike (if used). Stow in a position that will not allow them to become entangled and hamper exit.

g. From rear cockpit, rise to a crouched position in seat and dive toward wing tip. From the front cockpit, go out flat onto the wing and slide headfirst off the trailing edge.

CAUTION

If airplane is in a spin, both pilots should bail out to the inside of the spin to clear the tail surfaces.

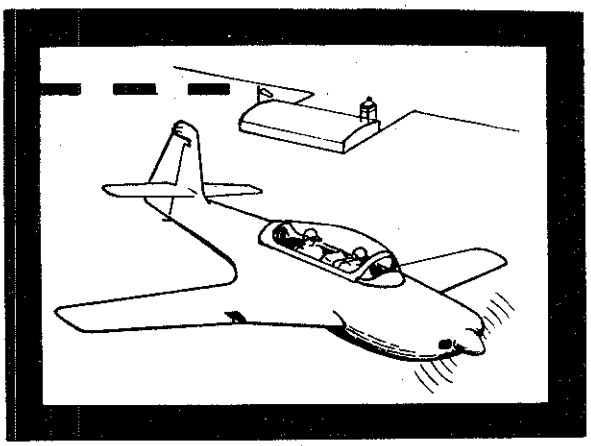
3-25. EMERGENCY OPERATION OF CANOPY-INTERIOR. To jettison canopy, operate handle

marked "Pull–"Canopy Emergency Jettison"–"Push Here." (See Figure 1-16). This handle is on the right side of the front and rear cockpits. In flight when the emergency handle is operated the forward canopy-rail attachment releases and permits the canopy to raise, due to air pressure action, thus permitting the aft canopy attachment to disengage. The canopy will make a 60° vertical arc and tumble free of the airplane. On the ground, when the canopy emergency release handle is operated, the canopy may be quickly removed by raising the front end and tumbling the canopy from the airplane.

3-26. EMERGENCY OPERATION OF CANOPY-EXTERIOR. To release and remove canopy in an emergency, from outside the airplane, operate handle located on right side of canopy skirt opposite the forward seat, marked "Canopy Emergency Release" "Turn." Canopy will be released from tracks and can be disengaged and pulled free.

section IV

operational equipment



4-1. COCKPIT HEATING AND VENTILATING.

4-2. A ducted fully controllable heating and ventilating system is installed to provide a comfortable temperature in each cockpit. The heating system receives ram air from the engine cooling baffle area. The air is directed through a simple heat exchanger installed on the three left exhaust stacks, and thence into a mixer control valve located on the left forward side of the firewall. When hot air is not utilized in the cockpit, the mixer control valve diverts the hot air overboard through the left augmentor tube. An additional intake duct is installed on the left lower side of the engine cowling, which directs fresh ram air into the mixer control valve.

4-3. COCKPIT AIR CONTROL.

4-4. TEMPERATURE SELECTOR. A temperature control handle is located on the right hand console panel in the front cockpit only. Positions are marked "Hot Air" and "Fresh Air." Placing the control handle in the "Hot Air" position insures a full flow of hot air from the mixer control valve. Placing the control in the "Fresh Air" position insures a full flow of fresh air from the mixer control valve. Intermediate positions permit mixture of hot and fresh air to be directed from the mixture control valve into the cockpit, as desired.

4-5. COCKPIT AIR DISTRIBUTION OUTLETS. Ducts are installed to distribute air from the mixer control valve to six cockpit outlets. Four of the outlets are located one on each side of each cockpit (See Figure 4-1). Positions on these outlets are marked "ON" and "OFF" with intermediate positions available between. The outlets may also be adjusted to direct the hot air fore and aft (See Figure 4-2). The remaining two outlets are positioned to direct air to the feet of each occupant. No pilot adjustments can be made on the foot outlets.

CAUTION

The temperature selector is to be positioned to "Fresh Air" at all times except during flight conditions when heated air is required. This prevents inadvertent high temperature air from entering any cockpit outlets due to low airflow under non-flight conditions.

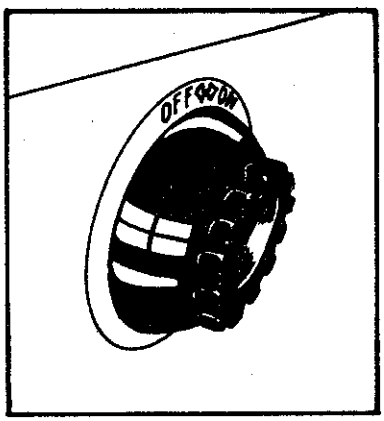


Figure 4-1. Heating and Ventilation Outlet

4-6. LIGHTING EQUIPMENT.

4-7. EXTERIOR LIGHTS.

4-8. All exterior lights (landing, taxi, position, and fuselage) are operated from the 28 volt dc system and controlled from the front cockpit only.

4-9. EXTERIOR LIGHT CONTROLS.

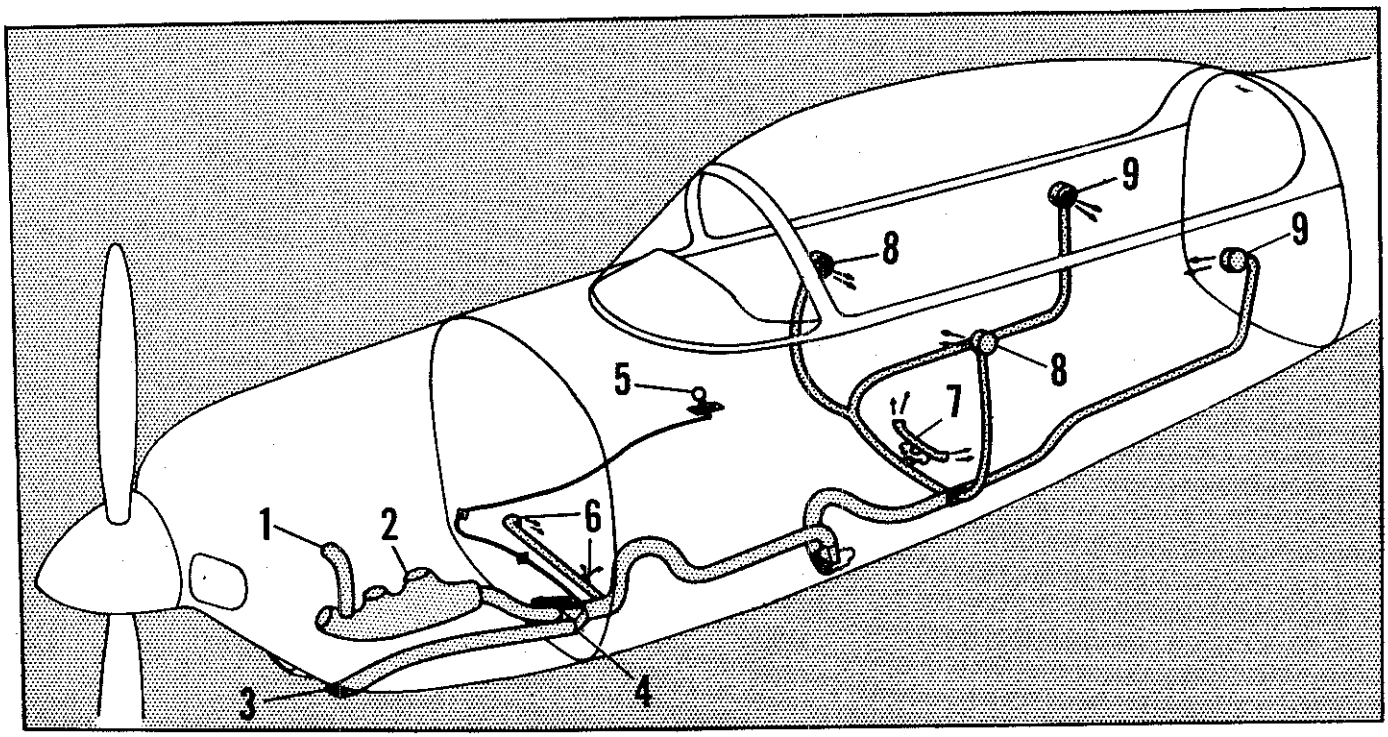
4-10. LANDING AND TAXI LIGHTS SWITCH. A three position toggle switch, located on the upper

portion of a panel to the left of the forward main instrument panel, is provided for the operation of the landing and taxi lights. The switch positions are marked "LAND," "OFF," and "TAXI." Placing the switch in the "LAND" position causes the landing lights, one mounted in each outer wing leading edge, to illuminate. Placing the switch in the "TAXI" position causes only the right landing light to burn. This light is used for taxiing purposes.

4-11. POSITION LIGHT SWITCH. The position lights consist of a red light on the portwing tip, a green light on the starboard wing tip, and a clear and yellow light in the trailing edge of the rudder. A three position toggle switch, located on the right console of the forward cockpit, is provided for the operation of the position lights. The switch positions are marked "STEADY," "OFF," and "FLASH." Placing the switch in the "STEADY" position turns the lights on. Placing the switch in the "FLASH" position causes all position lights to flash at a 40 cycle per minute rate.

4-12. FUSELAGE LIGHT SWITCH. Two white lights are installed on the fuselage aft of the rear cockpit. One light is on top of the fuselage and the other is on the bottom. These lights are controlled by a three position toggle switch, located on the right console in the front cockpit. The switch has three positions, "BRIGHT," "OFF," and "DIM."

4-13. EXTERIOR GEAR DOWN LIGHTS. To aid ground observers at night, three small white lights are placed near each landing gear position. The lights are located: one on the bottom edge of the nose gear door, and the other two are just forward of each main gear wheel well on the wing center section. Each light illuminates automatically when the gear is down and locked and the position light switch is on either "STEADY" or "FLASH."



1. Ram Intake, Heated Air
2. Heater Muff
3. Ram Intake, Cooling Air
4. Mixer Valve
5. Heat and Ventilation Control
6. Heat and Ventilation Floor Outlet, Front Cockpit
7. Heat and Ventilation Floor Outlet, Rear Cockpit
8. Heat and Ventilation Adjustable Outlet, Front Cockpit
9. Heat and Ventilation Adjustable Outlet, Rear Cockpit

Figure 4-2. Heating and Ventilation System

4-14. INTERIOR LIGHTS.

4-15. INTERIOR LIGHT CONTROLS.

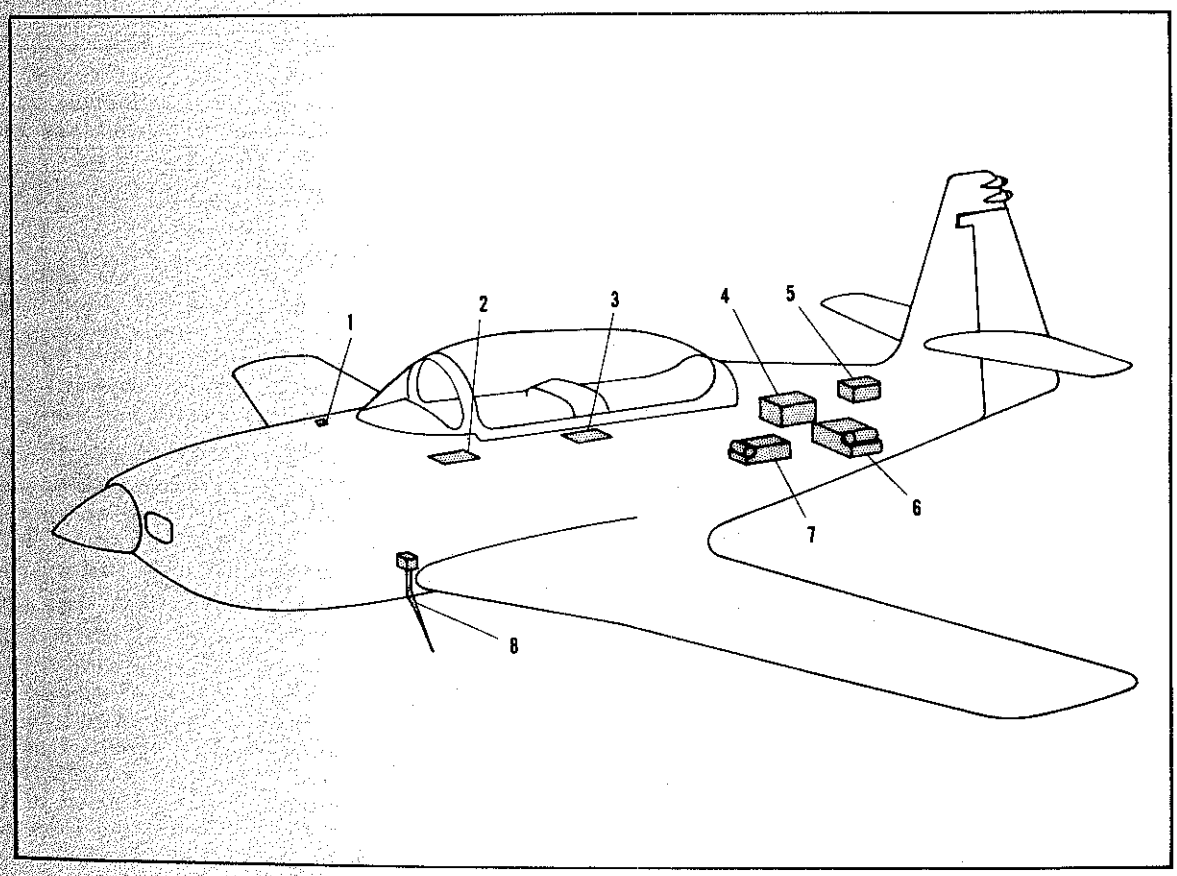
4-16. INSTRUMENT LIGHT SWITCH-RHEOSTAT. Three red flood lights are provided on the top of each main instrument panel for instrument illumination. The instrument lights are controlled by a rheostat located on the right console of each cockpit. Control markings are "DIM-OFF" and "BRIGHT," with direction arrows to indicate movement of the knob. To turn the instrument lights on, rotate the control knob clockwise from the "DIM-OFF" position until the desired intensity of lighting is achieved.

4-17. CONSOLE LIGHT SWITCH-RHEOSTAT. Two red flood lights, one on right hand and other on left hand side of each cockpit, are used to illuminate the cockpit consoles. The console lights are controlled by a rheostat located on the right console of each cockpit. Control markings are "DIM-OFF" and "BRIGHT," with direction arrows to indicate movement of the knob. To turn the console lights on, rotate the control knob clockwise from the "DIM-OFF" position until the desired intensity of lighting is achieved.

4-18. COMMUNICATION EQUIPMENT.

4-19. Communication equipment is furnished to permit VHF transmission and reception (including the 121.5 m.c. guard channel) and intercommunication between cockpits. Provisions are made to permit the installation of a portable radio range receiver, if desired. The basic communication equipment consists of: (See Figure 4-3).

a. Two VHF transmitters (ARC T13A and ARC T11B) located in the radio compartment of the aft fuselage.



1. Whip Antenna Mount Plate
2. Radio Control Panel, Front Cockpit
3. Radio Control Panel, Rear Cockpit
4. ARC T13A Transmitter
5. ARC T11B Transmitter
6. ARC R19 Receiver
7. ARC R19 Receiver (modified)
8. VHF Type A12 Antenna

Figure 4-3. Communication System

b. Two VHF receivers (ARC R19 and a modified ARC R19, crystal tuned for operation on the 121.5 m.c. guard channel only), located in the radio compartment of the aft fuselage.

c. Two control panels; "VHF COMM" and "RADIO CONTROL," located on the right consoles in each cockpit (See Figure 1-7 and Figure 1-9).

d. A VHF Type A12 antenna located on the bottom fuselage center line between the main wheel wells.

e. Headset and microphone jacks are provided on the right console in each cockpit. Two types of lead in ends are provided:

1. A headset extension cord for use when the pilot operates a hand microphone.

2. A duplex cord for use with a headset and lip microphone containing an integral microphone switch.

f. A wired terminal strip for quick electrical hook-up to accommodate a portable Radio Range Receiver is provided in the front cockpit, located aft and above the left console.

g. A quickly removable whip type antenna for the portable Radio Range Receiver is provided as fly-a-way equipment but is not installed. Plug-in provisions for installation, including all structural and operational hook-ups for quick installation of the antenna are an integral part of the airplane. The whip antenna, when used, is positioned on the exterior starboard side of the airplane immediately aft of the firewall.

4-20. COMMUNICATION EQUIPMENT CONTROLS.

4-21. "RADIO CONTROL" PANEL. A "Radio Control" panel is located on the right console in each cockpit. Each "Radio Control" panel is equipped with an indicator light and two controls:

a. COMMUNICATION CONTROL INDICATOR LIGHT. A push to test type indicator light labeled "IND" is provided on the "Radio Control" panel. The indicator light will illuminate only in the cockpit which has control of the communication equipment. To adjust the intensity of the Communication Control Indicator Light, turn the light housing clockwise to increase intensity and counterclockwise to decrease the intensity.

b. TRANSFER SWITCH. Each cockpit "Radio Control" panel is equipped with a two position toggle switch labeled "TRANSFER." When this switch is moved to the opposite position, communication control is transferred from one cockpit panel to the other. If communication control is taken by the switch operator, the Communication Control Indicator Light will illuminate on his panel. If communication control is given by the switch operator to the other cockpit, the Communication Control Indicator Light in the switch operator's cockpit will go out and the other cockpit's Communication Control Indicator Light will illuminate.

NOTE

When control is transferred by operating the transfer switch in one cockpit, the switch in the other cockpit does not operate – therefore, the position of the transfer switch is no indication as to which "Radio Control" panel has control.

c. INTERCOMMUNICATION CALL BUTTON. A push to operate type button labeled "CALL" can be utilized by either pilot to over-ride all communication equipment and places the operator of the call button on intercommunication transmission only. Operation of the button is effective only as long as it is held depressed.

4-22. VHF COMMAND PANEL. A "VHF COMM" panel is located adjacent to the "Radio Control" panel on the right console in each cockpit. Each "VHF COMM" panel is equipped with four controls and two indicator dials:

a. SENSITIVITY KNOB: The sensitivity knob is used to turn the communication equipment on and to control the volume of VHF normal reception (Except the fixed volume 121.5 m.c. guard channel). The sensitivity knob is marked "SENS" and "OFF." The full counterclockwise position of the knob is "OFF." Turning the knob clockwise from the "OFF" position turns the communications equipment on and increases the reception volume.

b. RECEIVER TUNING CRANK AND DIAL. A tuning dial and control crank, all marked "REC," provides a means for selecting the desired VHF frequency

to be received. Turning the control crank in either direction rotates the dial face and locates the desired frequency. Readings on the dial are in megacycles.

c. MIXER CONTROL. Mounted on top of the receiver tuning dial cover is a three position mixer switch with markings reading from left to right; "T/R," "BOTH," and "GUARD." When the mixer control is in the "T/R" position, reception will be obtained on the VHF station tuned on the receiver tuning dial only. When the mixer control is moved to the "BOTH" position, reception will be obtained from the station tuned on the receiver tuning dial and the 121.5 m.c. guard channel. Changing the mixer control to the "Guard" position provides reception on the 121.5 guard channel only.

d. TRANSMITTER CHANNEL SELECTOR KNOB AND DIAL. A channel selector dial and control knob, all marked "TRANS," provides a means for selecting the desired VHF transmitting channel. A separate position for the 121.5 m.c. guard channel is provided. An additional position is provided, marked I-C, to turn on the interphone.

4-23. COMMUNICATION EQUIPMENT OPERATION

4-24. GENERAL:

a. Connect auxiliary power to aircraft or use battery power.

b. Push "Radio-Normal" and "Radio-Emergency" circuit breakers in, on breaker panel (See Figure 1-12).

NOTE

When the above has been performed, the communication control indicator light will illuminate in one cockpit, indicating the cockpit having communication control. To transfer control the transfer switch in either cockpit may be actuated.

c. Plug earphones and microphone into receptacle provided in each cockpit.

d. Turn sensitivity knob clockwise from "OFF" position.

4-25. VHF RECEPTION

a. Turn mixer control located on "VHF COMM" panel to "T/R" position if reception on any normal VHF frequency is desired. If reception on any normal VHF frequency is desired as well as reception on the 121.5 mc guard channel place mixer control on the "BOTH" position. If reception on the 121.5 guard channel only is desired, place mixer control on the "Guard" position.

b. If "T/R" or "Both" mixer position is selected, rotate the receiver tuning crank until the desired VHF frequency is achieved. The receiving tuning dial can be used to help locate specific frequencies.

c. Adjust sensitivity knob for desired volume.

NOTE

If the mixer control is in the "BOTH" position the sensitivity knob will adjust the volume of the normal VHF frequency. The 121.5 mc guard channel has a preset volume which cannot be adjusted in flight.

4-26. VHF TRANSMISSION

a. Adjust transmitter channel selector knob to desired channel:

NOTE

If transmission on the 121.5 guard channel is desired, turn selector knob to the extreme clockwise position marked "Guard."

b. If a hand held microphone is connected, transmission may be made by use of the push-to-talk button on the microphone. If a throat microphone is used, a separate cord with microphone push-to-talk button must be used to connect the microphone to the transmission jack.

4-27. INTER-COMMUNICATION

a. Turn transmitter channel selector knob to the extreme counterclockwise position marked "I-C."

NOTE

When the transmission channel selector is in the I-C position some VHF reception will always be heard depending upon the position of the VHF mixer switch. If operating on interphone and the VHF reception is annoying, the volume of this signal may be removed by rotating the sensitivity control in the counterclockwise direction.

b. If a hand held microphone is connected,

transmission may be made by use of the push-to-talk button on the microphone. If a throat microphone is used, a separate cord with microphone push-to-talk button must be used to connect the microphone to the transmission jack.

NOTE

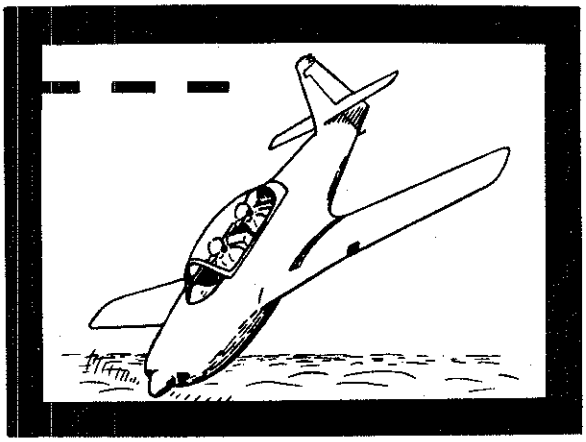
The volume of the interphones are preset and cannot be changed in the air.

4-28. INTERCOMMUNICATION CALL BUTTON. If the channel selector is tuned to a frequency and the pilots wish to converse over the interphone without changing the transmitter selector to the I-C position, the call button may be used. When the call button is depressed, all VHF transmission and reception ceases, and a pure interphone condition exists.

4-29. RADIO RANGE RECEIVER. All controls for the portable radio range receiver are a part of the unit. Consult individual radio range receiver manual for operation instructions.

section V

operating limitations



5-1. FLIGHT RESTRICTIONS

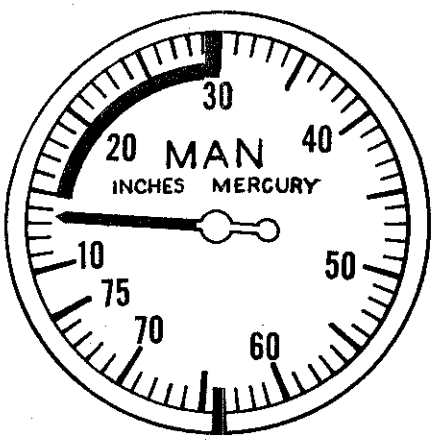
5-2. Observe the following limitations and restrictions.

NOTE

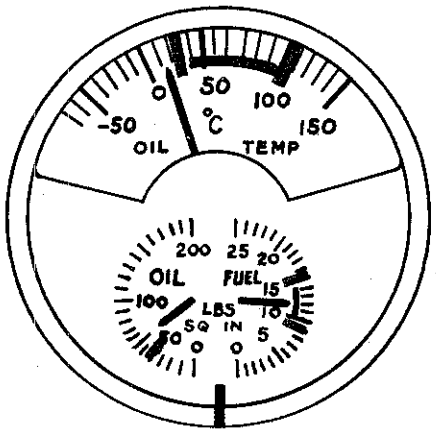
These limitations and restrictions are subject to change. Consult latest Service Directives and Orders.

1. SOLO FLIGHT FROM REAR COCKPIT IS PROHIBITED.
2. MAXIMUM ALLOWABLE ENGINE SPEED 2600 RPM.
3. MAXIMUM GROSS WEIGHT 2500 POUNDS.
4. MAXIMUM ALLOWABLE DIVING SPEED 230 KNOTS IAS.
5. DO NOT LOWER WING FLAPS OR LANDING GEAR IN EXCESS OF 100 KNOTS IAS.
6. CANOPY SHOULD BE CLOSED AT ALL TIMES DURING ACROBATIC OR HIGH SPEED MANEUVERS.
7. INVERTED FLIGHT MUST BE LIMITED TO *10* SECONDS SINCE NO PROVISIONS ARE MADE TO INSURE CONTINUOUS FLOW OF FUEL AND OIL IN THIS ATTITUDE.
8. ALL ACROBATIC MANEUVERS ARE PERMITTED EXCEPT OUTSIDE LOOPS.
9. PERFORM NO VIOLENT ACROBATIC MANEUVERS WITH GEAR AND/OR FLAPS DOWN.

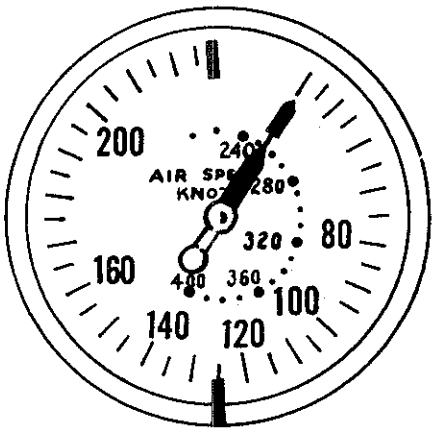
Figure 5-1. Restriction Chart



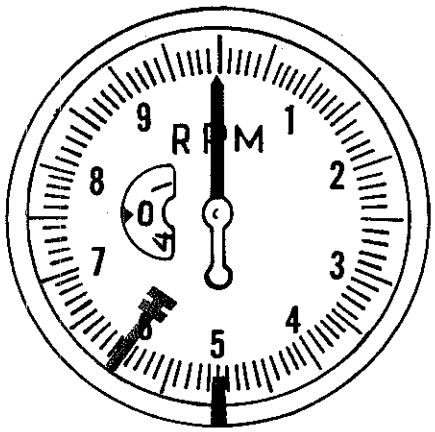
MANIFOLD PRESSURE
- Normal
- 29.5 IN HG (Max.)



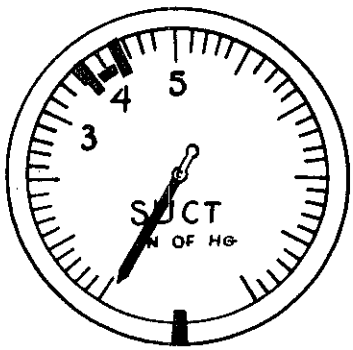
ENGINE GAGE UNIT
- 107.2°C (Max.), 23.9°C (Min.)
- 30 PSI (Min.), 62 PSI (Max.) (Oil Press)
- 9.0 PSI (Min.), 15.0 PSI (Max.) (Fuel Press)



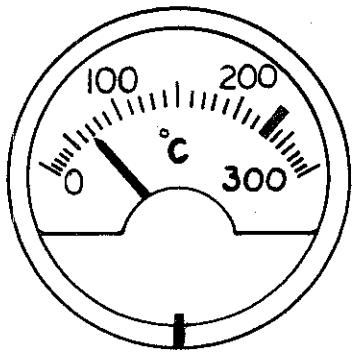
AIRSPEED INDICATOR
- 230 Kts (Max.)
- 100 Kts (Max.)



TACHOMETER
- 2600 RPM (Max.)



VACUUM GAGE
- 3.75 IN HG (Min.), 4.25 IN HG (Max.)

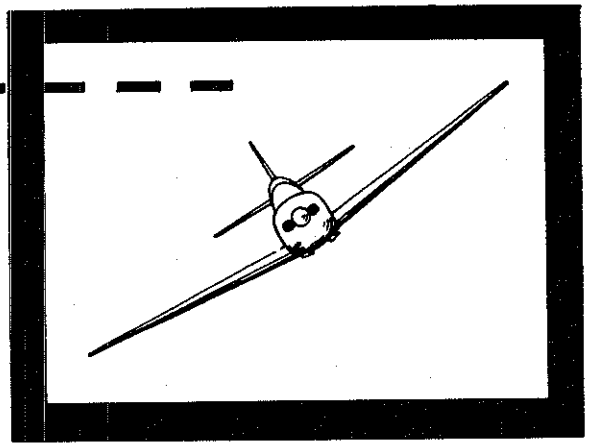


CYLINDER HEAD TEMPERATURE
- 232°C (Max.)

Figure 5-2. Instrument Limits

section VI

flight characteristics



6-1. GENERAL.

6-2. Under normal flight conditions and when properly trimmed, the airplane is completely stable and will maintain level flight "Hands Off" in smooth air.

6-3. PROPELLER TORQUE. Propeller torque has a slight tendency to pull the nose of the airplane to the left during take-offs when take-off power is used and when the airplane is in advance power maneuvers, however, if desired a small amount of rudder trim will counteract this pull.

6-4. GLIDING. With landing gear and flaps up, the glide is very flat and long distances can be covered for a small loss of altitude. Lowering flaps and/or landing gear greatly steepens the gliding angle and increases the rate of descent.

CAUTION

Because the engine cools rapidly during a glide with the throttle retarded, clear the engine every few minutes by advancing the throttle slowly and smoothly to prevent fouled plugs.

6-5. STALLS.

6-6. Learn how and when the airplane stalls—gear and flaps up or down, level flight or banked, power on or off—each condition will have an effect that you should know in order to fly the airplane safely and confidently. For each type of stall, learn the following key points:

a. Airplane attitude relative to horizon at point of stall.

b. Indicated airspeed at which stall occurs (See Appendix

c. Characteristics of the stall.

d. Proper stall recovery.

6-7. STALLS CHARACTERISTICS. Stalls in this airplane are mild. Normally you can feel a stall approaching. The airplane buffets at the beginning of a stall. As the airplane stalls, the nose drops slightly. Then is the time for recovery.

6-8. STALL RECOVERIES. The importance of proper recovery technique cannot be over-emphasized. During stall recovery you must avoid the danger of a secondary stall, which may result from attempting to return to level flight before airspeed is sufficient, or from handling the controls roughly. You can recover from partial stalls by reducing back pressure on stick or by adding sufficient power to obtain control without undue loss of altitude.

NOTE

Should stall warning occur during normal flight, act immediately to avoid completely stalling airplane. If in level flight, increase airspeed; if in a turn, decrease angle of bank.

6-9. STANDARD STALL RECOVERY. The standard procedure for recovering from a stall is as follows:

a. Move stick forward quickly but smoothly.

b. At the same time, advance throttle in a smooth movement, move mixture control to "RICH" and make sure propeller control setting is at least 2000 RPM.

NOTE

Be sure to move the stick and throttle together smoothly. Do not drop the nose too far below the horizon.

c. If a wing drops, apply opposite rudder at first indication. The ailerons generally are effective through the stall and can be used to reduce slipping and skidding. Ailerons should be used cautiously,

since large aileron deflections may tend to make the stall condition on the down wing worse.

d. After the nose has been lowered, speed will increase quickly. When you attain safe flying speed, raise the nose to level flight with steady back pressure on the stick. Avoid abrupt changes of attitude.

e. Retard throttle to cruising power after leveling off.

6-10. PRACTICE STALLS. To familiarize yourself with the stall characteristics and speed of the airplane under various flight conditions, practice the series of stalls outlined in subsequent paragraphs. For both power-on and power-off stalls, set propeller control at 2000 RPM. Retard throttle smoothly for power-off stalls; set at 15-in. Hg for power-on stalls. (See Appendix.)

CAUTION

Enter all stalls at a safe altitude above the ground. Recoveries should be completed at 5000 feet above the terrain, or higher. Remember that considerable altitude can be lost in a stall maneuver.

6-11. PRACTICE STALL–GEAR DOWN, FLAPS FULL DOWN, POWER OFF, STRAIGHT AHEAD. This stall is, in effect a power-off landing. Simulate a traffic pattern and make standard landing checks. Turn on final approach, make final check, and set up approach speed of approximately 69 knots IAS with normal rate of descent. Flare at simulated runway altitude, pull nose up to landing attitude and hold until stall occurs. At this point observe the characteristics of the airplane in the stall. Note the feel. Execute a standard stall recovery as the nose passes through the horizon. Raise landing gear and bring the flaps up by increments as soon as possible. Retard throttle to 15-in Hg.

6-12. PRACTICE STALL–GEAR UP, FLAPS UP, POWER ON, STRAIGHT AHEAD. Raise nose to a position approximately 35 degrees above the horizon. Hold that attitude with wings level and nose steady. As the stall approaches, observe the laxity of the controls, attitude of the airplane and the sound of the engine. Notice how the airplane shudders when the stall occurs. Notice also how effective the rudder is through the stall. As the stall occurs, apply brisk forward pressure to the stick at the same time, advance throttle smoothly to stop. First, use rudder to pick up the low wing; then use aileron as airspeed increases. When flying speed is attained, ease airplane out of dive and back to cruising altitude and retard throttle to 15-in. Hg.

6-13. PRACTICE STALL–GEAR UP, FLAPS UP, POWER ON, 20-DEGREE BANK. Establish a coordinated climbing turn with a bank of approximately 20 degrees. Raise the nose well above the horizon and keep the nose turning at a steady rate until the stall occurs. As soon as the stall occurs, apply brisk forward pressure on stick and advance throttle to stop. Make a coordinated roll out of the turn and dive. Return to level attitude as in straight ahead stalls.

6-14. PRACTICE STALL–GEAR DOWN, FLAPS UP, POWER OFF, 40-DEGREE BANK. This stall will enable you to recognize the stalls that sometimes occur in making power-off turns in traffic or landings. Assume a normal glide; then roll into a medium gliding turn with about 40 degrees of bank. Maintain a steady turn and at the same time raise the nose slowly until it is slightly above the horizon. It is necessary to increase back pressure on the stick to hold this altitude until the stall occurs. Make standard recovery. Raise gear immediately after applying power and after recovering speed, use coordinated controls to level the airplane.

6-15. PRACTICE STALL–GEAR DOWN, FLAPS UP, POWER OFF, STRAIGHT AHEAD. Close throttle completely, dissipate airspeed to approximately 69 knots IAS, and establish a normal glide. Retrim the airplane. Raise the nose of the airplane into a landing attitude and hold it on a point straight ahead until the stall occurs. As you approach the stall, observe the feel of the controls, the mushy feeling of the airplane, and the fast-dropping airspeed. Note the altitude lost during this maneuver. Use standard recovery procedure. Apply definite forward pressure on the stick to prevent entry into a secondary power-on stall. Raise gear immediately after applying power.

6-16. PRACTICE STALL–GEAR DOWN, FLAPS DOWN, POWER ON, STRAIGHT AHEAD. Set throttle to 15-in Hg. Trim for straight and level flight. Raise the nose of the airplane. As you approach the stall, observe the feel of the controls, the mushy feeling of the airplane, and the lowering airspeed. Use standard recovery procedure. Apply full power to effect a more rapid recovery before the nose has fallen completely through. Raise flaps and gear immediately after applying power.

6-17. SPINS

6-18. Spins are not difficult to enter or recover from, if the instructions presented are followed.

Intentional spins should not be made with the gear and/or flaps down. Before attempting to spin, make sure the area around and under you is clear. See that enclosure is locked closed. Make certain you enter the spin at a safe altitude above the ground—7000 feet or higher.

6-19. ENTERING SPIN. When you are ready to enter the spin, proceed as follows:

a. Mixture control "RICH."

b. Propeller at 2000 RPM.

c. Throttle closed.

d. Add back pressure to stick until nose is approximately 35 degrees above the horizon with wings level.

e. When airplane approaches stall, lead with the rudder in direction of desired spin.

f. As the stall occurs, use full rudder in the direction of the spin, and bring the stick all the way back and hold it there. You are then in a spin.

g. Hold the controls full with the spin before attempting recovery; then proceed with spin recovery.

6-20. SPIN RECOVERY. To recover from a spin, proceed as follows:

a. Apply full opposite rudder briskly.

b. After airplane has made about a half turn, move the stick forward briskly to its full forward position.

c. Hold controls in these positions against the spin until rotation stops. Then neutralize the rudder and elevator, recover from the dive, and assume level flight.

d. Increase throttle setting to 15-in Hg.

6-21. PERMISSIBLE ACROBATICS. The acrobatic qualities of this airplane are exceptional and control is excellent at all speeds. All normal acrobatics except those prohibited in Paragraph 5-2 are permitted. Keep enclosure closed during all maneuvers.

WARNING

All acrobatic maneuvers should be completed at an altitude of 5000 feet above the ground or higher.

6-22. DIVING.

6-23. In dives to limit airspeed, the handling characteristics of the airplane are good. All control movements are effective, and the airplane responds rapidly. The amount of forward stick pressure required to hold the airplane in a dive is relatively small, as is the amount of aileron pressure needed to keep the wings level. If the airplane is trimmed for level flight at maximum continuous power, the tab settings should be satisfactory for diving. Use the following procedure in a dive:

a. Do not exceed maximum permissible indicated airspeed during dive (230 knots).

b. Mixture "RICH."

c. Decrease RPM as necessary.

d. Do not exceed maximum permissible engine RPM during dive (2600 RPM).

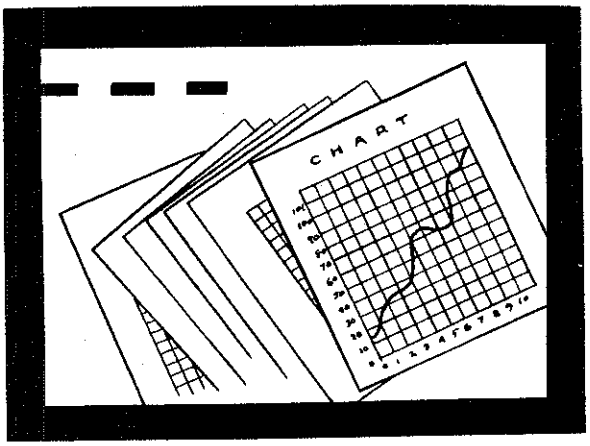
e. At completion of dive, open throttle slowly to prevent cooled engine from cutting out.

WARNING

Consult aircraft restriction (Paragraph 5-2).

appendix A

operating charts



A-1. OPERATION DATA.

A-2. To promote efficient operation of the airplane and facilitate flight planning, the group of charts on the following pages presents performance data. All charts are based on operation in NACA standard atmosphere.

A-3. TAKE OFF, CLIMB AND LANDING CHART.

A-4. Take-off and landing ground run distances and total distances to clear a 50-foot obstacle are tabulated for a dry hard-surface runway at several altitudes. (See Figure A-1). The landing chart also includes recommended final approach speed.

A-5. Best climb speed, fuel consumption, time of climb and rate of climb can be determined from the climb data. A fuel allowance for warm-up, taxi and take-off is listed in the column labeled "AT SEA LEVEL." Fuel requirements listed at other altitudes include this allowance plus the fuel required from sea level. Fuel required for an in-flight climb from one altitude to another is the difference between the tabulated fuel required to climb to each altitude from sea level.

A-6. FLIGHT OPERATION INSTRUCTION CHARTS.

A-7. To assist in selecting the engine operating conditions required for obtaining various ranges, a Flight Operation Instruction Chart (Figure A-2) is provided. The chart is divided into four main columns. Data listed under Column I is for emergency high-speed cruising at maximum continuous power. Operation conditions in Columns III, IV and V give progressively greater ranges at lower cruising speeds. Ranges shown in any column for a given fuel quantity can be obtained at various altitudes by using power settings listed in the lower half of the charts in the same column. No allowances are made for wind, navigational error, simulated combat, formation flights, etc., and such allowances must be made as required.

A-8. USE OF CHART.

A-9. Enter the chart at a fuel quantity equal to or less than the total amount in the airplane minus all allowances. (Ranges listed for each fuel quantity are based on using the entire quantity in level flight at the recommended operating conditions.) Fuel allowance for warm-up, taxi, take-off and climb is obtained from the Take-Off, Climb and Landing Chart. Other allowances based on the type of mission, terrain over which the flight is to be made, and the weather conditions are dictated by local policy. If your flight plan calls for a continuous flight at reasonably constant cruising power, compute the fuel required and flight time as a single-section flight. Otherwise, the flight must be broken up into sections and each leg of the flight planned separately. The flight plan may be changed at any time enroute and the charts will show the balance of range available at various cruising powers and altitudes if the instructions printed at the top of each chart are followed.

A-10. SAMPLE PROBLEM. The following sample problem employing actual chart values demonstrates how the charts should be used:

PROBLEM I. It is required that the airplane be flown to a base located 350 nautical miles from the airfield. The first 150 nautical miles of the flight will be at 5,000 feet. At this point, a climb will be made to 8,000 feet to avoid mountainous terrain, and the flight will be completed at this altitude.

Conditions of problem:

Required range	350 nautical miles
Weather	CAVU
Winds (home field)	10 knot headwind at 5,000 ft.
(150 miles out)	15 knot tailwind at 8,000 ft.
Aircraft basic weight	1,820 lbs.
Crew weight	380 lbs.
Maximum fuel (50 gals.)	300 lbs.
Total gross weight	2500 lbs.

With the conditions of the flight determined, establish a flight plan. Determine the fuel available for flight planning by deducting the necessary fuel allowances and reserves from the actual fuel aboard as follows:

General reserve	5 gallons

From Column V, the fuel required to fly 20 min. at sea level is equal to ⅓ × 7.6 = 2.5 gals. 5% of the initial fuel is equal to .05 × 50 = 2.5 gals. Then the general reserve is equal to 2.5 + 2.5 = 5 gals.

Warm-up, take-off and climb to 5,000 feet —3.2 gallons. The Climb Data Chart shows that 3.2 gallons is required for warm-up, take-off and climb to 5,000 feet.

Climb from 5,000 to 8,000 feet — .96 gallon.

After the airplane has flown 150 nautical miles, a climb is made to 8,000 feet where the flight is completed. The Climb Data Chart shows that 4.8 gallons is required to climb to 10,000 feet, and 3.2 gallons is required to climb to 5,000 feet. The difference between the two quantities is 1.6 gallons then ⅗ × 1.6 = .96 gal, the amount of fuel used to climb from 5,000 to 8,000 feet.

Wind reserve (first section) — 1.12 gallons.

This figure is arrived at as follows: The first section of the trip is 150 miles, and assuming it will be flown according to instructions in Column III, the true airspeed will be 151 knots (find airspeed opposite the 5,000-foot entry in Column III). Therefore, the no-wind time of the first section would be: 150/151 = .993 hours. The actual time, allowing for a 10 knot headwind, is 150 ÷ (151 - 10) = 1.063 hours. The fuel required because of the headwind at 15.3 gph (from Column III of the chart) is (1.063 - .993 × 15.3 = 1.07 gallons.

Wind reserve (second section) — 0 gallons.

Normally, tailwinds are treated as a no-wind condition. Collecting all the required fuel allowances:

General reserve	5	gallons
Warm-up, Take-off and Climb to 5,000 feet	3.2	gallons
Climb from 5,000 to 8,000 feet	.96	gallon
Wind reserve (first Sec)	1.07	gallons
Wind reserve (Second Sec)	0	gallons
Total Fuel Allowance	10.23	gallons

Therefore, the actual fuel available for cruising is 50-10.23 = 39.77 gallons. Reference to the Flight Operation Instruction Chart shows that the required flight of 350 nautical miles with 39.77 gallons of fuel can be flown under Column III. Should an emergency arise during flight, the remainder of the flight would have to be planned in the air.

AIRCRAFT MODEL(S): 33

ENGINE MODEL(S): O-470-13

TAKE-OFF, CLIMB & LANDING CHART

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3000 FEET GROUND RUN	SOD-TURF RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6000 FEET GROUND RUN	SOD-TURF RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 3000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
2500 ZERO FLAP	0	0	910	1360	1235	1840	1645	2465													
	20	17	505	840	705	1160	970	1555													
	40	35	205	410	305	605	450	870													
2500 30° FLAP	0	0	730	1200	1000	1680	1365	2370													
	20	17	365	700	520	1010	745	1475													
	40	35	120	300	185	470	290	735													

DATA AS OF 9-1-53 BASED ON: AERODYNAMIC CALCULATIONS

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL BEST C.A.S. MPH	AT SEA LEVEL BEST C.A.S. KTS	AT SEA LEVEL RATE OF CLIMB F.P.M.	AT SEA LEVEL GAL. OF FUEL USED	AT 5000 FEET BEST C.A.S. MPH	AT 5000 FEET BEST C.A.S. KTS	AT 5000 FEET RATE OF CLIMB F.P.M.	AT 5000 FEET FROM SEA LEVEL TIME MIN.	AT 5000 FEET FROM SEA LEVEL FUEL USED	AT 10,000 FEET BEST C.A.S. MPH	AT 10,000 FEET BEST C.A.S. KTS	AT 10,000 FEET RATE OF CLIMB F.P.M.	AT 10,000 FEET FROM SEA LEVEL TIME MIN.	AT 10,000 FEET FROM SEA LEVEL FUEL USED	AT 15,000 FEET BEST C.A.S. MPH	AT 15,000 FEET BEST C.A.S. KTS	AT 15,000 FEET RATE OF CLIMB F.P.M.	AT 15,000 FEET FROM SEA LEVEL TIME MIN.	AT 15,000 FEET FROM SEA LEVEL FUEL USED	AT FEET BEST C.A.S. MPH	AT FEET BEST C.A.S. KTS	AT FEET RATE OF CLIMB F.P.M.	AT FEET FROM SEA LEVEL TIME MIN.	AT FEET FROM SEA LEVEL FUEL USED	AT FEET BEST C.A.S. MPH	AT FEET BEST C.A.S. KTS	AT FEET RATE OF CLIMB F.P.M.	AT FEET FROM SEA LEVEL TIME MIN.	AT FEET FROM SEA LEVEL FUEL USED
2500	99	86	1320	1.8	95	83	1000	4.3	3.2	92	80	690	10.3	4.8	91	79	405	19.6	6.9											

POWER PLANT SETTINGS: 2600 RPM & F.T. RICH MIXTURE

DATA AS OF 9-1-53 BASED ON: AERODYNAMIC CALCULATIONS

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST CAS APPROACH POWER OFF MPH	BEST CAS APPROACH POWER OFF KTS	BEST CAS APPROACH POWER ON MPH	BEST CAS APPROACH POWER ON KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3000 FEET GROUND ROLL	HARD DRY SURFACE AT 3000 FEET TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6000 FEET GROUND ROLL	HARD DRY SURFACE AT 6000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3000 FEET GROUND ROLL	FIRM DRY SOD AT 3000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6000 FEET GROUND ROLL	FIRM DRY SOD AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3000 FEET GROUND ROLL	WET OR SLIPPERY AT 3000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6000 FEET GROUND ROLL	WET OR SLIPPERY AT 6000 FEET TO CLEAR 50' OBJ.
2500 (0° FLAP)	87	76	79	69	510	1620	555	1775	610	1930												
(30° FLAP)	77	67	69	61	420	1170	460	1275	500	1390												

DATA AS OF 9-1-53 BASED ON: AERODYNAMIC CALCULATIONS

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

BASED ON FUEL GRADE 80

LEGEND

C.A.S. : CALIBRATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

FIGURE A-1. TAKE-OFF, CLIMB AND LANDING CHART

AAFMC-526 8-1-48

AIRCRAFT MODEL(S): 33

ENGINE(S): 0-470-13

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 2500 OR LESS POUNDS

EXTERNAL LOAD ITEMS: NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2600	F.T.		RICH	None	232	21.7

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN (1) EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING. MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE AND CRUISING ALTITUDE VALUE EQUAL TO OR GREATER THAN THE NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST SELECTED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN NAUTICAL AIRMILES				FUEL U.S. GAL.	COLUMN II RANGE IN NAUTICAL AIRMILES				COLUMN III RANGE IN NAUTICAL AIRMILES				COLUMN IV RANGE IN NAUTICAL AIRMILES				FUEL U.S. GAL.	COLUMN V RANGE IN NAUTICAL AIRMILES			
ALT. SL	ALT. 5000	ALT. 10000	ALT. 15000						ALT. SL	ALT. 5000	ALT. 10000	ALT. 15000	ALT. SL	ALT. 5000 (1)	ALT. 10000	ALT. 15000		ALT. SL	ALT. 5000	ALT. 10000	ALT. 15000
SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING																					
371	459	520	585	50					470	493	552	611	540	565	586	628	50	631	643	665	654
334	413	468	527	45					423	444	497	550	487	509	527	565	45	568	579	598	589
297	367	417	467	40					376	395	442	488	433	452	469	503	40	505	515	532	523
222	276	312	351	30					282	296	331	366	324	339	351	377	30	379	386	399	392
148	184	208	234	20					188	197	221	244	216	226	234	251	20	252	258	266	262
74	92	104	117	10					94	99	110	122	108	113	117	125	10	126	129	133	131
37	46	52	58	5					47	49	55	61	54	56	58	62	5	63	64	66	65

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	PRESS ALT. FEET	COLUMN II R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	COLUMN III R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	COLUMN IV R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2600	F.T.	RICH	12.4		145	25000 20000 15000							2450	16.0	LEAN	11.3		138	2300	16.0	LEAN	10.5		132	25000 20000 15000	2100	16	LEAN	9.4		123
2600	F.T.	RICH	14.6		152	10000							2450	20.0	LEAN	13.4		148	2300	20.2	LEAN	12.2		143	10000	1800	18	LEAN	8.5		113
2600	F.T.	RICH	17.1		157	5000							2400	23.8	LEAN	15.3		151	2000	24.0	LEAN	12.2		138	5000	1800	18	LEAN	8.0		103
2600	F.T.	RICH	21.7		161	S.L.							2400	24.8	LEAN	15.3		144	2000	25.2	LEAN	12.2		132	S.L.	1800	19.5	LEAN	7.6		96

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-1) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) TO LEAN FOR BEST MIXTURE. MOVE CONTROL TO ELIMINATE ENGINE ROUGHNESS.

EXAMPLE

AT 2500 LB. GROSS WEIGHT WITH 30 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 8.2 GAL.) TO FLY 350 NAUT. AIRMILES AT 5000 FT. ALTITUDE MAINTAIN 1800 RPM AND 18 IN. MANIFOLD PRESSURE WITH MIXTURE SET: LEAN

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 9-1-53 BASED ON: AERODYNAMIC CALCULATIONS

FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

FIGURE A-2. FLIGHT OPERATION INSTRUCTION CHART

ESTIMATED STALLING SPEEDS KNOTS									
GROSS WEIGHT	GEAR AND FLAPS UP			GEAR UP AND FULL FLAPS DOWN			GEAR AND FLAPS DOWN		
	LEVEL	30° BANK	60° BANK	LEVEL	30° BANK	60° BANK	LEVEL	30° BANK	60° BANK
2300	60	65	86	54	58	77	53	57	75
2500	63	68	89	57	61	80	55	59	78

Figure A-3. Stalling Speeds Chart