T - 29

STUDY GUIDE

C-131A/T-29 FLIGHT SIMULATOR

375TH AEROMEDICAL WING

SCOTT AIR FORCE BASE, ILL.

TABLE OF CONTENT

T-29 STUDY GUIDE

MAJOR DIFFERENCES

	T-29A	T-29B	T-29C	T-29D
ENGINES	R-2800-97 Maximum wet take-off horsepower - 2400	R-2800-97 Maximum wet take-off horsepower - 2400	R-2800-99W Maximum wet take-off horsepower - 2500	R-2800-99W Maximum wet take-off horsepower - 2500
EXHAUST SYSTEM	Triamese type with 3 cyliners joined into a common outlet	Triamese type with 3 cylinders joined into a common outlet	Siamese type with 2 cylinders joined into a common outlet	Siamese type with 2 cylinders joined into a common outlet
AUGMENTORS	Stovepipe ext.	Stovepipe or "sugar scoop" extensions	"Sugar scoop" extensions	"Sugar scoop" extensions
#2 ENGINE ALTERNATOR & GENERATOR	Engine driven	Hydraulic motor driven	Hydraulic motor driven	Hydraulic motor driven
NACELLE FLAPS	2 on top of cowl panel Open 3 inches at mid-position	2 on top of cowl panel Open 3 inches at mid-position	2 on top cowl panel & 2 on bottom cowl panel Open 2 inches at mid-position	2 on top cowl panel & 2 on bottom cowl panel Open 2 inches at mid-position
FIRE DETECTION & TEST	Push button test switch. Checks all components at one time. (Also on early "B" models)	(Late "B" models) Two circuits, A and B with three position test switch	Two circuits A and B with three position test switch	Two circuits A and B with three position test switch
FIRE EXTINGUISHER SYSTEM	Two-shot Carbon Dioxide (CO_2) 3 main supply cylinders 3 reserve cylinders	One-Shot (DB) Dibromodifloromethane 2 DB containers	One-Shot (DB) Dibromodifloromethane 2 DB containers	One-Shot (DB) Dibromodifloromethane 2 DB containers
LOCATION OF WING FLAP MANUAL OPER ATING HANDLE	Through small door below the floor at student station no. 11 Aft of radar rack	Through small access door in cabin floor left side. in line with trailing edge of wing	Through small access door in cabin floor left side, in line with trailing edge of wing	Through small access door in cabin floor left side, in line with trailing edge of wing

	T-29A	T-29B	T-29C	T-29D
MAIN HYDRAULIC SYSTEM PRESS-URE GAGE	Early models used direct reading	Remote indicating autosyn type	Remote indicating autosyn type	Remote indicating autosyn type
EMERGENCY EXITS	4 on the right and 3 on the left side of the fuselage	4 on the right and 3 on the left side of the fuselage	4 on the right and 3 on the left side of the fuselage	3 on the right and 3 on the left side of the fuselage
CABIN PRESSURIZATION	No	Yes	Yes	Yes
DOOR WARNING LIGHT	Three microswitches on main entrance door only	Switches on main entrance door, rear service door and forward compartment door	Switches on main entrance door, rear service door, forward compartment and bailout door.	Switches on main entrance door, rear service door, forward compartment and bailout door.
REGULATED AC POWER	2 - DC Operated 2.5 KVA Inverters	2 - DC Operated 2.5 KVA Inverters	2 - DC Operated 2.5 KVA Inverters TACAN Inverter	2 - 500 VA Inverters 2 - 750 VA Inverters 2 - 2500 VA Inverters
UNREGULATED AC POWER	2 - 8 KVA engine driven alternators	1 - 8 KVA engine driven alternator and 1 - 8 KVA hydraulically driven alternator	1 - 8 KVA engine driven alternator and 1 - 8. KVA hydraulically driven alternator	1 - 8 KVA engine driven alternator and 1 - 8 KVA hydraulically driven alternator

T-29 GROUND SCHOOL

STUDY GUIDE

I. AIRPLANE GENERAL:

A. The T-29 is a medium range, two engine transport type aircraft. The power plants are two Pratt-Whitney double wasp R-2800 engines. The T-29 (A) and (B) airplanes are equipped with the -97 engines, and (C) and (D) airplanes are equipped with -99W series engines. The engines have integral, two-speed engine blowers and use water injection for maximum power operation. The exhaust system discharges gases into the augmentor tubes which, in turn, route heated air through the wing to the trailing edge and assist in engine cooling by drawing air from the front of the engine through the power plant and into the augmentor tubes. Heat exchangers provide heat for anti-icing and cabin heat. This is accomplished by an integral jacket on the augmentor tubes separated from the gas chamber portion of the tube.

B. Structure of the Aircraft: Wing span is 91' 9". The fuselage consists of three major components: The nose section, the constant or cabin section, and the tail section.

1. Wing Flaps: The wing flaps operate from a torque tube through a worm type reversible gear box. The flaps operate synchronously in alignment and are hydraulically locked in any position through the operating range whenever the control switch is in the NEUTRAL position. The flap selector valve is the control for moving and locking the wing flaps. It is a solenoid operated valve and is provided with a manual override. This valve provides pressure fluid to the hydraulic motor that turns the torque tubes. A guarded flap control switch is located on the aft left hand side of the pilot's pedestal. There are two limit switches that are actuated by the secondary shaft from the gear box which prevent over travel of the wing flaps in either direction when operating electrically. A selector valve override is provided by a handle connected directly to the solenoid operated selector valve. This enables the flaps to be actuated in the event of electrical failure. The manual operation handle is located through a small door below the floor. On the (A), (B), and (C) model, the control is at student position no. 11 aft of the radar equipment rack. On the (D) model the control is under the radar rack on the left side. The flaps operate from 0 to 39 degrees. Limit switches are inoperative when flaps are operated manually, caution must be used to prevent over travel at this time.

2. Ailerons: Ailerons are of all metal construction, operated by a cable arrangement to both control wheels in cockpit. Each aileron is equipped with a servo acting trim tab, controllable from the cockpit. Aileron cables have 2 tension regulators installed to help keep tension constant throughout temp changes. Each aileron has a metal covered trim tab, which thru a bellcrank push rod arrangement gives servo action to aid in moving ailerons.

3. Elevators: Elevators are operated by 4 cables. Each cable is equipped with a tension regulator. Co-pilots control column has 25 lbs lead weight installed below cockpit floor, to aid in maintaining a nose down attitude and to help break aircraft out of stall.

4. Elevator Trim Tab: Mounted on the inboard end of the right elevator Controllable from cockpit and also gives servo action. Tab has 5 degree droop with indicator in cockpit at 0 degrees. Aids in lifting nose off ground on take off roll.

5. Elevator Flight Tab: The elevator flight tab is located on the left elevator. Not controllable from cockpit. Is spring loaded 10½ degrees up from neutral on elevator. Will stream line with elevator at approximately 85 knots. Aids in holding nose of aircraft on ground, till approximate takeoff airspeed is reached. Servo action on elevator in flight.

6. Rudder: A flight tab is attached to the lower trailing edge; a trim tab is installed immediately above the flight tab. A sealed balance curtain is installed between the rudder leading edge and the stabilizer trailing edge. Curtain seals installed between the trailing edge of the vertical and horizontal stabilizer and the leading edge of the rudder and the elevators increase control efficiency by preventing air flow through the slots between the control surfaces and the stabilizers.

7. Rudder Flight Tab: Bottom tab on rudder is adjusted 2½ degrees to left from rudder to overcome engine and propeller torque.

8. Wing Flaps: Hydraulic fluid is taken from the pressure manifold for operating the flaps. Two Fowler type flaps are operated by a hydraulic motor which is coupled to a flap drive gear box mounted on a bracket at the fuselage center line. The hydraulic motor is mounted aft and on the right side of the gear box. The main shaft protrudes outboard at each side of the gear box. The flap selector switch is located on the top left side of the pilot's pedestal. It is a three position switch: UP, OFF, and DOWN. Limit switches on gear box restrict the up and down travel of the flaps.

9. Emergency Air: The aircraft is provided with a small emergency air bottle which will provide pressure for the emergency operation of the landing gear up-latch release and for brakes. This emergency system is used whenever there is a mechanical failure of either the up-latch release or the hydraulic brakes. The air bottle is mounted in the left side of the nose wheel well. Emergency air system has a direct indicater located on the co-pilot's instrument panel. Normal range is 1450 to 2000 psi.

10. Emergency Exits: On the T-29 (A), (B), and (C) aircraft there are seven emergency exits, four on the right side of the fuselage and three on the left. In addition, there are three astrodomes on the top center of the fuselage that may be removed. The T-29 (D) has six emergency exits three on the right side of the fuselage and three on the left.

II. ALTERNATOR-FENERATOR HYDRAULIC SYSTEM T-29 (B), (C), and (D) MODELS.

A. Description: The right generator and No. 2 alternator are driven by a hydraulic motor operated by pressure flow delivered by a pump on the right engine. The alternator-generator hydraulic system is not connected to the airplane's hydraulic power system. It has an accumulator, nitrogen pressure bottle, and accumulator pressure gage on a servicing panel in the trailing edge of the right wing. An electrically operated by pass valve is installed in the pressure line between the pump and the motor. If pressure exceed 3450 psi a valve will operate to route some fluid under pressure to the return manifold. A temperature gage is provided to indicate temperature of hydraulic fluid in the return line to the pump. Excessive temperature indicates a malfunction in the system. Operation of the system must then be discontinued.

1. Engine Gear Box and Pump: The engine driven pump gear box is mounted on the generator pad of the right engine rear accessory case. When the engine is operating at 2000 rpm, the shaft from the engine pad operates at 6066 rpm, and the gear box output pad operates at 3539 rpm. This pump is of positive displacement and at an engine speed of 2000 rpm it will deliver 26.4 gallons per minute at 3000 psi.

2. Alternator-Generator Hydraulic Motor: The pressure line from the pump is connected to a hydraulic motor and also to an electrically operated by-pass valve. The hydraulic motor is a 9-cylinder vickers, which turns at a speed of 3600 rpm under a pressure of 3000 psi. The motor is connected to a gear box which drives the alternator and generator.

3. By-Pass Valve: Pressure from the pump may be routed to by-pass the hydraulic motor whenever the engine is operating and it is not desirable to have the alternator and generator operating; however, the system should not be turned back to the ON position without first stopping the engine. Turning the switch ON with the engine operating imposes a very heavy surge on the gear box. Operating the alternator-generator switch on the co-pilot's console to the OFF position energizes the motor operated by-pass valve and allows pressure fluid to flow to the pump suction line and by-pass the alternator-generator hydraulic motor.

4. Cooler: A cooler is provided in the right wing trailing edge aft of the rear spar, outboard of the nacelle, for cooling the filtered hydraulic oil. This cooler is thermostatically controlled through the valve assembly that permits flow of fluid through the cooler when the oil temperature is above 51.7° C. When the temperature drops below 51.7° the thermostatic shut-off assembly closes the inlet to the cooler and thus by-passes the fluid through the valve assembly into the return line. Air to the cooler is provided by a scoop on the lower surface of the wing trailing edge. The scoop is de-iced by an electrically heated boot controlled through the prop de-ice control breaker switch. Scoop device uses 115V AC from #1 alternator buss.

5. Return Manifold: Fluid flows from the cooler to the return manifold. The return manifold is located on the inboard side of the right wheel well, in the return line between the motor and engine-driven pump. The return manifold distributes fluid to the low pressure warning switch line, the temperature bulb and the pump suction line. The amber low pressure warning indicator light is installed on the co-pilot's console instrument panel skirt. The light will glow when the pressure in the alternator-generator return manifold drops to 69 psi or below. The light will continue to glow until the pressure system returns to 72 psi. The return manifold is also provided with a ground test connection. The system is provided so that under conditions where the pressure in the return manifold exceeds the pressure in the pressure manifold it may be relieved. Relief valve is set at 110 + 3 psi.

6. Hydraulic Firewall Shut-off Valve: A fluid shut-off valve is installed between the return manifold and the engine drive pump aft of the fire wall. It is manually operated by a system of cables and push-pull rods.

7. Accumulator: A piston type accumulator located under the right wing trailing edge keeps the return line pressurized with fluid. The accumulator is charged by a nitrogen bottle located in the cabin under the floor adjacent to the right wing trailing edge. Ground connections and a nitrogen bottle gage are provided in the trailing edge for servicing. The system must be serviced when the alternator and generator accumulator nitrogen pressure gage reads less than placarded, adjacent to the gage.

49

III. ELECTRICAL SYSTEM:

A. General: Direct and alternating current is provided on the T-29 aircraft for the operation of it's electrical equipment. This electrical power is supplied by three basic systems: (1) Direct Current, (2) Regulated Alternating Current, and (3) Unregulated Alternating Current. Direct current (24 to 28 volts) is required to operate lights, motors, actuators, solenoids, propeller governors, fire detection and extinguisher components, and other items of electrical equipment; it is supplied to a main buss and to a non-essential equipment buss by two generators, two batteries, or an external power unit. Regulated (Constant frequency), 115 V alternating current is required to operate the flight instruments, drift meters, autopilot, cabin temperature control, and fuel and oil quantity gages; it is supplied by two DC powered inverters. On (A), (B), and (C) airplanes, only one inverter operates at a time. On (D) model airplanes, both inverters operate simultaneously. Regulated 26 volt alternating current is required to operate pressure gages, torquemeters, and augmentor vane position indicators; it is supplied through a 26 volt AC step down transformer. Unregulated (Variable frequency), 115-volt alternating current is required for reserve oil heat, de-icing equip, and electronic training equipment operation. It is supplied through two buses by an alternator in each nacelle. A receptacle forward of the main entrance door is provided for connecting an external AC power unit.

B. DC POWER SUPPLY SYSTEM: Direct current is supplied by two 30 volt 300 amp generators. One in each nacelle. On (A) model airplanes, both generators are engine-driven. On (B), (C), and (D) airplanes, the left generator is driven by the engine; the right generator is driven by a hydraulic motor. Two 12 volt batteries connected in series provide a 24 volt, 88 ampere hour source of DC power. A receptacle forward of the entrance door is provided for connecting an external DC power supply. External power should be disconnected prior to starting the right engine. When an external DC power source is not available the batteries may be used to start either engine.

CAUTION

When using battery power to check operation of equipment, limit operation to the absolute minimum because of the small capacity of the batteries. NOTE: A load monitoring circuit is provided to disconnect non-essential electrical equipment automatically if either generator fails or is disconnected from the main DC buss.

C. AC Power Supply System:

(1) Regulated AC Power Supply on the T-29 (A), (B), and (C): Two DC operated 2.5 KVA inverters supply single-phase, constant frequency, 115-volt, 400 cycle alternating current to an inverter buss. Only one inverter can be used at a time. Selection can be made between the main and spare inverters; however, the main inverter is normally used and the spare inverter is selected only if the main inverter becomes inoperative. A step-down inverter-powered transformer provides 26 volt, regulated alternating current for operation of some instruments. On (C) models with TACAN installed, a separate inverter is provided to operate this radio set. The TACAN inverter switch and failure warning light are located on the auxiliary circuit breaker panel. The TACAN switch and failure warning light are powered by the 28 volt non-essential buss.

(2) Regulated AC Power Supply on the T-29 (D): Regulated 115 volt constant frequency AC power is supplied by six DC operated inverters: Two 500 VA inverters supplying three-phase and single-phase current (Instrument inverters); two 750 VA inverters supplying three-phase current (Three-phase inverters). The instrument inverters supply current to the flight and engine instruments. The three-phase and single-phase inverters supply current to the electrical training equipment. Each of the groups of inverters consists of a main and spare inverter. Only one of each pair of the training equipment inverters can be used at a time.

(3) Unregulated AC Power Supply System: Two 8-KVA self-exciting alternators supply 115 volt, variable frequency, single-phase alternating current to two busses. One alternator, known as No. 1, is driven by the left engine; the other alternator, known as No. 2, is driven by the right engine on (A) model airplanes and by a hydraulic motor in the right nacelle on (B), (C), and (D) model airplanes. The two unregulated AC busses can be selectively powered by either alternator or by external AC power.

IV. MAIN HYDRAULIC SYSTEM:

A. General: There are three independent hydraulic systems incorported in the T-29 (B), (C), and (D) models: The main hydraulic system, the pressurization hydraulic system, and the alternator-generator hydraulic system; each of these systems are completely independent of each other. The T-29 (A) has no pressurization hydraulic system or alternator-generator hydraulic system. The main hydraulic system operates the same as on the (B), (C), and (D) models. The main hydraulic system operates the following components: Brakes, Landing Gear, Main entrance door and stairway, nose wheel steering, windshield wipers and wing flaps.

B. Power System: (General) Components of the power system are: The fluid reservoir, the engine-driven pumps, the electric-driven pump, the main manifold, the manual by-pass valve, the main and auxiliary relief valves, the accumulator, the pressure transmitter and the ground test connections.

1. Fluid Reservoir: The fluid reservoir is installed in a housing located on the left side of the cabin above the floor level just aft of the radio rack. A sight gage on the reservoir can be read through a window in the aft side of the housing. The reservoir has a usable fluid capacity of 6.2 US gallons, of which 1.3 gallons are reserved for use with the emergency hydraulic pump. The reserve 1.3 gallons provides 1 lowering of wing flaps, 1 charging of

accumulator, 12 to 15 brake applications, the hydraulic reservoir has a foam separator located at the top outboard side, which is attached to the hydraulic reservoir vent line and vented overboard side. The return fluid is routed into the top of the reservoir. A relief valve set at 8 psi is installed in the reservoir filter. Relief valve allows returned fluid to by pass filter it if becomes clogged.

2. Engine-Driven Pumps: One hydraulic pump is located on the upper left side pad of each engine accessory section. The pumps are variable displacement type. Pressure fluid from each engine-driven pump passes through high pressure hose through the firewall, then through ½ inch stainless steel lines through a check valve directly outboard of the fuselage, and into the pressure manifold. Pressure is maintained at 3000 psi by a regulating device in each engine pump. A system relief valve set at 3250 psi returns excess pressure back to reservoir.

3. Electric-Driven Pump: (Emergency Hydraulic Pump) - The electric driven pump provides pressure for auxiliary operation of the hydraulic system on the ground and for emergency operation in flight. The operation unit is a DC motor. The electric pump delivers .95 gallons per minute at 2700 to 2900 psi. CAUTION: The emergency hydraulic pump is limited to five minutes operation with a cooling period of 30 minutes.

4. Hydraulic Pressure Bypass Handle: A hydraulic pressure bypass handle on the aft face of the pilot's pedestal mechanically operates a bypass valve in the pressure supply line of the system. When the by pass handle is is the BYPASS (UP) position the system is depressurized except to the accumulator where pressure is maintained by the pump at approximately 3000 psi to provide adequate reserve pressure for brake operation. When the bypass handle is placed in the PRESS (DOWN) position the output of the variable displacement pumps is directed toward all components of the hydraulic system.

a. When the electric-driven auxiliary pump is being used, the bypass valve should be in the BYPASS position for charging the accumulator and for brake and flap operation.

b. With valve down in PRESSURE position, all units may be used as well as brakes and flaps.

5. Accumulator: The hydraulic accumulator is located on the main hydraulic panel and is accessible through the lower forward compartment door. A synthetic rubber bladder installed in the accumulator divides it into two separate compartments. The lower chamber is charged with air to a maximum of 1000 psi and the upper chamber if filled with hydraulic fluid. With the accumulator charged and the system operating, the pressure indicator and the brake pressure indicator should read 3000 psi. The air valve and air pressure gage for charging the accumulator is located in the nose wheel well. When charging the accumulator care must be taken that the pressure does not exceed 1000 psi as serious injury could result if the accumulator were ruptured.

6. Pressure Transmitter: The main hydraulic system pressure transmitter is autosyn, 26 volt AC. The transmitter's purpose is to transmit main system pressure to an indicator on the co-pilot's instrument panel skirt. There is a snubber valve located in the hydraulic pressure line leading from the pressure transmitter to the pressure indicator. This valve contains a piston within a tubular orifice and aborbs all shocks, surges, and pulsations which would otherwise be transmitted to the indicator. On early T-29 (A) airplanes the gage is direct reading pressure gage. When the pressure bypass handle is in the PRESS (DOWN) position the hydraulic pressure gage indicates the pressure throughout the hydraulic system when the handle is in the BYPASS (UP) position, the pressure gage indicates the pressure of the fluid in the major portion of the system only, this will normally be near zero.

7. Ground Test Connections: This airplane is also designed for operation of the hydraulic system from a ground test unit. The primary purpose of the test hook-up is to actuate any components of the hydraulic system without using either the engine-driven pumps or the emergency hydraulic pump.

8. Main and Auxiliary Relief Valves: The main system relief valve is located on the main hydraulic panel, forward of the accumulator. The valve is set to relieve pressure at 3250 (+50, -0) psi to prevent excessive pressure in the system. An auxiliary relief valve is connected to the pressure lines from the auxiliary pump, and is set to relieve pressure at 2900 (+50, -0) psi.

9. Firewall Shut-off Valve: There are two hydraulic manual shut-off valves in the suction lines located on the aft side of the firewall, one on each engine. They are operated manually from the pilot's compartment and are used in the event of fire in the engine. Other fluid shut-off valves controlled by the same linkage also stop the flow of all other fluids (Except ADI) to the engines. The control handles for operating the firewall shut-off valves are located on the fire control panel forward of the pedestal; the handles are placarded No. 1 and No. 2 "Engine Fluid Off".

C. Components:

1. Brakes: Each wheel on the main landing gear is equipped with a spot-type, single-disc, self-adjusting brake. The brakes are normally operated by hydraulic pressure. An emergency air bottle provides pressure for operation of the brakes when hydraulic pressure is not available. A shuttle lockout and fuse valve is installed in the hydraulic brake system in order to provide emergency air operation of the brakes in case of pressure loss or line breakage. Operation of the valve is automatic. As long as the hydraulic system is in operation, fluid is free to travel through the valve. When emergency air is applied to the valve, the shuttle moves to close off the hydraulic ports allowing air to actuate the brakes. A break in the hydraulic line down stream will cause the fuse to close off the hydraulic line leaking and eliminates further loss of hydraulic fluid. Fuse reaction time is approximately two seconds, which allows 10 to 20 cubic centimeters of hydraulic fluid to escape before the fuse piston locks out. Inspection for wear of the brake linings can be accomplished visually during an exterior inspection by means of the self-adjusting pins.

2. Landing Gear: The gear position selector handle is located on the right side of the pedestal; when the airplane is on the ground, the gear cannot be retracted due to a safety switch located on the LH main landing gear. In flight the safety switch releases a solenoid lock on the gear handle and the gear may then be retracted. There are two ways of extending the landing gear: (a) The first is a normal operation by using hydraulic pressure and cable up-latch release system. (b) In the event of a partial or complete loss of hydraulic pressure or malfunction of system, use following procedure: If gear does not drop out of well when gear selector handle is placed in the down position, move system bypass valve to bypass (up) position. Release uplocks by use of emergency air, gear should now free fail and be forced into lock position by the air stream on landing gear. NOTE: Leave system bypass valve in bypass position until aircraft has come to a complete stop and ground locks have been installed. If original malfunction was caused by inoperative selector valve, gear would be retracted if pressure was applied to the system by placing bypass valve to pressure (down) position. NOTE: Approximately 60 pounds of pull must be exerted on the landing gear lever to release the uplatches if the hydraulic pressure bypass handle is in the bypass (up) position.

3. Entrance Door and Stairway: The main entrance door and stairway on the T-29 is designed for convenience as well as for being a structural part of the airplane. The entrance door and stairway can be actuated either from inside the aircraft or from the outside. For outside operation, first pull the secondary latch handle which is located near the lower aft end of the door. When the secondary latches are released, then actuate both primary release hooks by pulling both handles simultaneously; this will release the door and stairway. The door and stairway can then be manually pulled out and extended for normal operation. When operating the door from the interior of the airplane, the solenoid locks controlled by a toggle switch located on the overhead panel must first be released. These locks are installed to prevent inadvertent opening of the door during flight. Operation of the door is controlled by a selector valve control handle on the forward wall of the entrance area.

4. Nose Wheel Steering: Nose wheel steering is accomplished with hydraulic pressure supplied from the landing gear DOWN line, thus preventing wheels from being turned when the landing gear is retracted. A slide type selector valve is operated by a steering wheel in cockpit and cable follow-up system from the steering actuating cylinder mounted on the nose landing gear. A centering cam on the oleo strut holds the nose wheel in the straight ahead position when the strut is extended; thus, the nose is always in the proper position when landing.

5. Windshield Wipers: The windshield wipers are hydraulic driven. Incoporated in this system is a wiper speed control valve which is operated by a selector located on the pilot's console.

V. CABIN PRESSURIZATION HYDRAULIC SYSTEM T-29 (B), (C), and (D)

A. Hydraulic Drive: Two hydraulic pumps are driven off the accessory case of the right hand engine. Both pumps are positive displacement type. The output from both pumps are combined at the firewall. A hydraulic motor drives the compressor impeller through a gear train. Micronic filters are located in the pump inlet providing 100% filteration of the circulated fluid. A gear pump driven from the compressor gear train and located in compressor sump maintains a positive pressure in the pump return line.

B. Bypass Valve: When the cabin pressurization switch is placed in the ALT AIR FLOW position, the bypass valve in the pressure line opens and allows fluid to circulate freely from the pumps to the return manifold, thus leaving the compressor inoperative. CAUTION: Do not move pressurization switch to AUTO position while the right engine is running. The resulting high pressure surge could damage the system.

C. Fire Wall Shut-off Valve: A shut-off valve is located in the pump inlet line at the engine firewall, and is closed when the fire control handle for the right engine is pulled.

D. Relief Valve: A relief valve is located between the pressure manifold and pump return manifold with a cracking pressure set at 3000 psi to protect the system against excessive pressure surges.

VI. PRESSURIZATION, AIR CONDITIONING, HEATING AND ANTI-ICING SYSTEM

A. T-29 (A): The air conditioning system provides air for heating and ventilating the cabin and the flight compartment when the airplane is in flight. Normally the system is under automatic thermostatic control, but non-automatic electrical controls are also provided. There is no pressurization or refrigeration.

B. T-29 (B), (C), and (D): The air conditioning system provides fuselage ventilation, pressurization, and temperature control automatically during flight. All or part of the system, however, may be operated on a selective non-automatic basis, without pressurization, should such operation be required or preferred. Whenever the right engine is operating at 1400 rpm or more, forced draft ventilation is provided for an air compressor driven by a hydraulic motor. A breakdown of system operation follows:

1. Primary Compressor: The primary compressor is a single stage centrifugal compressor with a radial-vaned impeller, driven by a hydraulic motor, which receives its power from an independent hydraulic system. The compressor supplies 65 lbs of air per minute to the cabin and supplies pressure for maintaining 3.5 differential pressure and also power for driving the refrigeration unit. Air is taken into the compressor through a ram air scoop located on the lower surface of the right wing trailing edge. An alternate air intake is provided between the scoop and the compressor inlet which draws air from a flush opening in the lower trailing edge in the event of obstruction of the ram scoop.

2. Flow Control Valve: The control valve which is mounted on the compressor, regulates the compressor speed indirectly, by controlling the amount of fluid, or pressure in the control line to the throttling valve, hence the air flow. The throttling valve regulates the fluid supply to the hydraulic motor from the engine driven pumps.

3. Differential Switch (Pressure): Is mounted on the compressor gear case. Its function is to open the turbine by-pass valve when the primary compressor impeller wheel speed has been reduced due to reduced engine speed (rpm). Normally, when cooling is required, the temperature control system will signal for closing the refrigeration by-pass valve. If this signal were not blocked by the pressure differential switch (During reduced impeller speed), the ratio of discharge and inlet pressure would be too high in relationship to the impeller speed, causing a surging condition within the compressor.

4. Cabin Ratio Switch: The pressure ratio switch, mounted adjacent to the compressor, limits the ratio of the compressor intake and discharge pressures, when the temperature control system is calling for cooling by opening the refrigeration by-pass valve.

5. Cabin Pressure Relief Valve: The cabin pressure relief valve and dump valve is located in the part of the fuselage under the floor directly across from the auxiliary regulator. Its function is to relieve cabin pressure at 3.75 psi differential in the event of a failure of the cabin pressure regulator. Provisions are made for opening the valve fully, manually or electrically, for depressurizing and alternate air operation. Vacuum relief provisions are incorporated within the valve.

6. Cabin Pressurization Controls: A guarded cabin pressurization switch, located on the co-pilot's console, has AURO and ALT AIR FLOW positions. In AUTO position, the switch closes a DC circuit to the closing side of the bypass valve actuator in the cabin pressure hydraulic system bypass line, thus forcing fluid to flow through the hydraulic motor that operates the air compressor. In ALT AIR FLOW position, the switch closes a DC circuit to the operning side of the bypass valve actuator which lets fluid flow directly from the pressure manifold to the return manifold, thus bypassing the compressor. The manual dump valve also located on the co-pilot's console has NORMAL and DUMP positions. The valve is mechanically linked to the cabin pressure regulator system. In the NORMAL position, the regulator automatically provides pressurization of the fuselage above 8000 feet and a maximum pressure differential of 3.5 psi at 17,700 feet altitude. In the dump position, the valve is opened for emergency relief of cabin pressure in the event pressure is not automatically relieved during descent.

7. Refrigeration Air Conditioning System:

a. All air for heating, cooling and ventilation is normally supplied by the primary compressor or its components, air for ventilating and heating is introduced into the system by means of ram air scoops located in the leading edge of the wing.

b. The system consists primarily of the engine augmentor hear exchangers, primary heat exchanger and intercooler, secondary intercooler, refrigeration unit, associated valves and temperature control.

8. Cooling Cycle: The refrigeration unit consists of a centrifugal type secondary compressor and tangetial flow reaction type expansion turbine mounted on the opposite end of a common shaft. When on a cooling cycle, the cooling air valve at the primary and secondary intercoolers open, permitting cooling air from the ram air scoops to pass across the inter-coolers. The refrigeration bypass valve closes, thus forcing the air from the primary compressor to pass through the secondary compressor, secondary intercooler and expansion turbine. Heat is lost by cooling through the primary intercooler and secondary intercooler, by expansion of air entering the turbine and by mechanical energy to turn the turbine and secondary compressor.

9. Heating Cycle: The sequence of operation consists of gradual opening of the refrigeration by-pass valve, which permits air heated by compression to by-pass the refrigeration unit. When the by-pass valve reaches the full open position, the cooling air valve to the secondary intercooler is automatically shut off. As additional heat is required, the cooling air valve to the primary intercooler is gradually closed. When fully closed, control transfers to the heating air valve. The first movement of the heating air valve opens the two inboard augmentor heat source valves permitting heated air from the augmentor heat exchanger to reach the heating air valve. The valve gradually opens until it reaches its full open position. This point in the sequency of operation represents the maximum heat available. Any intermediate position of the turbine by-pass valve, cooling air valve and heating air valve may be attained, depending on the heat requirements. The positioning of the valves is controlled by the temperature control system.

10. Alternate Air: When using ram air for ventilation in lieu of air from the primary compressor, the refrigeration by-pass valve, cabin pressure regulator and cabin relief and dump valve are in full open position. The primary and secondary intercooler cooling air valves are fully closed. When ventilation only is required, the heating air valve is closed and the alternate air valve is open. Ventilating air from the right hand wing ram air scoop is ducted through the primary heat exhanger. Air from the left hand wing ram air scoop bypasses the primary heat exhanger and mixes with air from the right hand scoop downstream of the primary heat exchanger. When heat is required during alternate air ventilation the heating air valve gradually opens. The first movement of the valve opens the heat source valve at the inboard augmentors, permitting heated air to reach the heating valve. When the heating air valve is full open, control is transferred to the alternate air modulating valve, which gradually closes, shutting off unheated air from the left wing ram air scoop.

C. Anti-Icing and Defrosting: The function of the anti-icing system is to prevent the formation of ice on the leading edges of the wings and vertical and horizontal stabilizers. The purpose of this system is to prevent icing, but, not to remove it; if icing conditions are anticipated, the anti-icing system should be turned on. The heat anti-icing button on the co-pilot's console, controls the operation of the wing and tail anti-icing system. The button is placarded PUSH ON and PULL OFF.

1. Anti-Icing Controls: On T-29 (A) airplanes, the button is in the PULL OFF (Out) position, the outboard heat source valves are closed, the tail anti-icing shut off valve is closed, the inboard heat source valves and the heating air valves are under the control of the cabin temperature control system, and the augmentor vane control circuits are deenergized on (B), (C), and (D) airplanes, when the button is in the PULL OFF (out) position, the outboard heat source valves are closed, the tail anti-icing shut off valve is closed, the inboard heat valves and the heating air valve are under control of the cabin temperature control systems, and the augmentor vane circuits are under control of the augmentor vane switches and the augmentor vane arm switch.

2. Operation: When the heat anti-icing button is pushed in, all four heat source valves and the tail anti-icing shut off valve are opened, and the augmentor vane control circuits are automatically armed. The button is held in the PUSH ON position by a magnetic holding coil. Normally, the button is pulled out manually when anti-icing is no longer required. However, a safety circuit, controlled by thermostatic limit switches in the anti-icing ducts, release the button to PULL OFF position if an anti-icing duct becomes overheated. In that event, the valves and the augmentor vane circuits revert to the closed and deenergized conditions described above.

VII. FIRE DETECTION AND EXTINGUISHING SYSTEM:

A. Fire Detection System: The T-29 is equipped with a rate-of-rise thermocouple type fire detection system. A total of 49 thermocouples are installed in the airplane, segregated as follows:

Circuit A - Left Nacelle, total 10
Circuit B - Left Nacelle, total 12
Circuit A - Right Nacelle, total 10
Circuit B - Right Nacelle, total 12

Reserve oil tank area - under aft cabin flooring, total 5. On some (A) model airplanes, and on early (B) models, one fire detection circuit is provided in each nacelle, and the entire system is tested by depressing a fire detection circuit test button on the fire control panel. Later (B) airplanes, and all (C) and (D) airplanes have two fire detection circuits installed in each nacelle. On these airplanes, the entire fire detection system is tested by alternately placing a fire detection circuit test switch on the fire control panel in the left and right positions. In the presence of fire, any of the thermocouples will generate sufficient current to actuate its detection and warning circuits and cause light on the fire' control panel to illuminate. Operating the test button or switch simulates a fire in the protected areas. NOTE: If the fire warning lights do not illuminate within 15 seconds after actuating the test switch, the fire detection system is defective.

B. Fire Detection Test Switch: On (A) model airplanes, and on early (B) models, a pushbutton switch is provided on the fire control panel to test the operation of all components and circuits of the fire detection system simultaneously. Depressing the button will cause the three warning lights on the fire control panel to illuminate. On the later (B) models and on all (C) and (D) models, a toggle switch is provided to test all components and circuits of the fire detection system. On these airplanes, the switch has three positions: DET "A" L & R, NAC, & FUS OIL (toggle left position). DET, "B" L & R, NAC (toggle right position), corresponding to the two dectector circuits, and an unmarked "OFF" position to which the toggle is spring loaded.

C. Extinguisher System: On (A) model airplanes a two-shot, carbon-dioxide (CO_2), fixed fire extinguisher system is provided to combat fire in the nacelles. CO_2 is stored in three main supply cylinders and three reserve cylinders. The supply to be discharged is determined by use of a selector switch on the fire control panel. The (B),(C), and (D) airplanes use a fixed, one-shot, dibromodifluoromethane (DB) fire extinguisher agent. It is provided for combating one fire in an engine nacelle. Two DB containers, located in the left wing fillet, are connected by tubing to discharge points located in the following areas in each nacelle:

Accessory section, carburetor, alternator and generator, oil cooler, and main landing gear well, and to actuate the piston of the nacelle vent door, The pressure of the DB to the actuating piston releases a spring loaded arm which snaps the vent door closed. WARNING: Care must be used working in or about the vent door, as this door snaps shut with force and hands or fingers could be severly damaged if caught in it.

D. Operation: When a detection light comes on, pull the corresponding fluid shut-off handle and then throw the discharge switch. The discharge switches are located behind the fluid shut-off valve handles in such a manner that it is impossible to operate the switches without first pulling the shut-off handle. If unable to pull handle (Broken or frozen handle) it can be turned 90° to allow discharge switch to be actuated. When the discharge switch is thrown to the ON position, current is sent to the heating element that fires a cartridge in the extinguisher bottle which ruptures a disc and allows the nitrogen pressurized DB liquid to be discharged to the engine nacelle.

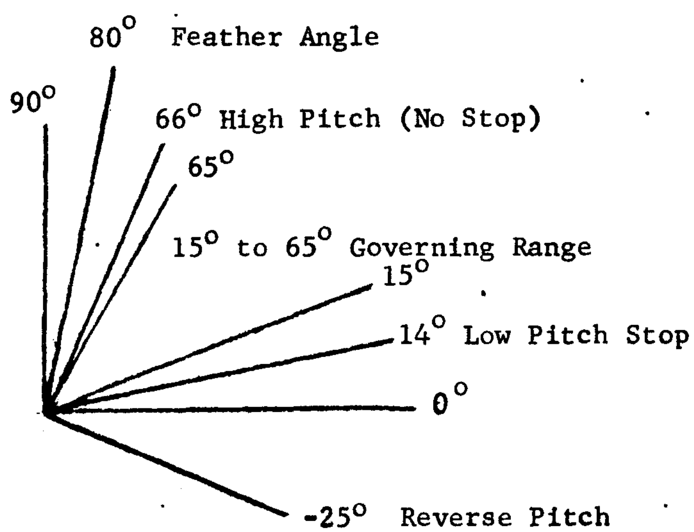
VIII. PROPELLER SYSTEMS:

A. Description: Each engine is equipped with a three-bladed, full feathering, reversible pitch, Hamilton Standard Hydromatic Propeller. A propeller governor on each engine automatically adjusts propeller pitch to maintain constant engine speed under varying flight conditions. Governor settings are electrically controlled from the flight compartment. Automatic and manual feathering controls are provided. Propeller pitch can be reversed after landing to produce aerodynamic braking. Feathering, unfeathering, reversing and unreversing actions of the propeller governor are accelerated by an auxiliary feathering pump which supplies high-pressure oil to the governor, boosting the pitch change rate from approximately 8.75 degrees per second to 14 degrees per second.

B. Autofeather System: The propeller autofeather system automatically feathers the propeller of an engine in the event of engine failure during takeoff. The system is operated automatically causing the appropriate manual feathering button to be magnetically drawn into feathering position if engine torque pressure falls to 40(Plus or minus 5) psi after the throttles have been advanced beyond a position corresponding to approximately 45 in. hg. manifold pressure (Sea level). The system is powered by 28 volts DC thru the autofeather switch, a torque pressure switch at each engine and microswitches in the pedestal quadrant that close as the throttles are advanced. If torque pressure of one of the engines falls due to failure, the torque pressure switch will close and connect DC power to a solenoid and holding coil at the corresponding manual feathering button. The feathering button will be drawn in after a two-to-three second time delay and the propeller will feather. A green indicator light illuminates when the autofeather switch is turned ON and remains on untila propeller has been automatically or manually feathered or the autofeather switch has been turned off. The time delay relay prevents inadvertant auto-feather due to momentary loss of engine power such as a single back fire.

C. Autofeather Test System: The autofeather test switch located on the pilot's pedestal is provided to allow testing of the autofeather system. The switch has LH and RH positions and is spring loaded to an unmarked OFF position. The switch closes a DC circuit that bypasses the corresponding throttle-operated microswitch in the autofeather system. On some (A) and (B) model airplanes (Not modified by TCTO 1T-29-554), the switch is used after the autofeather switch has been turned ON for ground tests and the corresponding throttle has been advanced far enough to obtain 70 psi torque pressure. Placing the autofeather test switch in the LH position will arm the autofeather torque pressure switch at the left engine. Retarding the throttle to a position providing less than 40 psi torque pressure while holding the autofeather test switch to LH position will then cause the autofeather system to draw in the left feathering button to feathered position. The red light in the feather button illuminates and the propeller will begin to feather. On other (A) and (B) airplanes, (modified by TCTO IT-29-554) and all (C) and (D) airplanes, the autofeather system is armed without throttle movement. On these airplanes, when holding the test switch in the LH position will cause the left manual feathering button to be drawn in, and the left propeller will begin to feather. On all airplanes, releasing the autofeathering test switch and pulling the left manual feathering button out to NORMAL position will stop the feathering action and the propeller will return to the rpm setting of the governor. The autofeather switch must then be turned to OFF and back to ON to rearm the autofeathering system for the right engine propeller test. After the second test the autofeather switch must again be moved to OFF and then back to ON to rearm the system prior to takeoff.

Blade pitch settings are as follows:



IX. FUEL, OIL, ADI, AND POWER PLANT SYSTEMS

POWER PLANTS.

A. <u>Type:</u> Pratt and Whitney, R-2800-97 engines are used on the T-29A and (B) models and -99W series on the (C) and (D) airplanes. Both use single stage, two-speed supercharger and water injection system.

B. <u>Piston Displacement and Horsepower</u>: Both engines have a displacement of 2804 cubic inches. The maximum horsepower for a wet take-off iw 2500 on the 99W and 2400 on the -97 series engines.

C. Air Induction: Two routes are provided for admittance of air to the carburetor. A supply of cold ram air is available through an integral air duct in the top cowl panel. This duct has two entry ports which pick up outside air. An alternate air door is located in the main air duct and is manually controlled by a two position lever on the pilot's pedestal. The two positions are marked COLD and HOT. As the control lever is moved towards the hot position heated air taken from the engine section, is directed into carburetor throat through the alternate air door to prevent icing.

D. Exhaust System: There are two augmentor tubes installed in each nacelle. Each augmentor tube receives exhaust gases from nine cylinders. On all T-29 (A) airplanes and most T-29 (B) models the exhaust stacks are of the triamese type with the exhaust from three cylinders joined together into a common outlet. The T-29 (C) and (D) airplanes use the siamese type system with the exhaust from two cylinders joined together into a common outlet. This leaves one cylinder to exhaust through an individual stack. The augmentor vane controls the flow of cooling air and exhaust gas mixture through the augmentor. Normally the vanes are in the trail position and are inoperative unless the heat anti-icing system is being used.

E. Cowling and Cooling: The engine cowling is of the "orange peel" type made up of four major sections, top, bottom and two side panels. The panels are secured together in the closed position by 16 trunnion and handle type latches. Cowl panels incorporate air seals in order to properly control cooling air flow through the power plant area. The top cowl panel includes two nacelle flaps,a carburetor alternate air door, a ventilation door and air duct built integral with the panel. The bottom cowl panel also includes two nacelle flaps on some T-29 (B) and all (C) and (D) airplanes. All T-29 (A) and most (B) airplanes have no nacelle flaps in the lower cowl panel. The nacelle flaps are operated electrically with a single actuator. The carburetor air door is manually operated.

F. Nacelle Flap Control: Two nacelle switches one for each nacelle are available for positioning the nacelle flaps. Each switch has three positions: MID POSITION, OPEN and CLOSED. The switches are spring loaded from open and close position to an unmarked OFF position, while the MID POSITION is a holding position, The switches connect DC power to the closing side of reversible motors at the nacelle flap actuating jacks when held in CLOSE position. When held in OPEN position, power is supplied to the opening side of the motor. When the switches are released to OFF, the nacelle flaps remain in the position they had reached at that time. This allows precision control since it takes 10 seconds to move the nacelle flaps from one extreme position to the other due to reduction gearing between the motors and the appropriate side of the motors and the nacelle flaps open three inches on A and B model airplanes, and two inches on C and D models. Nacelle flaps remain in this position until the switches are again placed in another position.

G. Route of Air For Cooling Engine: The engine cooling system includes provisions for cooling the engine and engine accessories. Cooling air enters the engine section through the opening provided at the nose of the engine cowling, baffles installed on the engine, direct cooling air around the cylinders. Small blast tubes, integral with the baffles, provide ram air for cooling the spark plugs.

H. Accessories: T-29 (A) - (Both Engines) One DC generator, one starter, one main hydraulic system pump, fuel flow transmitter, blower selector valve actuator, water regulator, tach generator, alternator, fuel pump, and water pressure transmitter.

1. T-29 (B), (C), and (D) (Left Engine) DC generator, starter, main hydraulic pump, fuel flos transmitter, blower selector valve actuator, water regulator, tach generator, alternator, fuel pump and water pressure transmitter.

2. T-29 (B), (C) and (D) (Right Engine) Same as the left with the exception of the following: Alternator and generator are located in the right wheel well and are dirven by an engine driven alternator-generator hydraulic pump. The right engine also drives two hydraulic pumps for the cabin pressurization system.

I. Ignition: A low tension ignition system is installed on the engines. In this system the magneto supplies only low voltage current (250 - 350 volts). It remains at low voltage until it is transformed into high voltage current (18000 to 22000) by the ignition transformers. A separate coil is provided for each cylinder. They are the only one carrying a high tension current. This system eliminates the possibility of altitude flashover at the distributor or around the harness because only low voltage current flows in these parts. The magneto has two 4 pole rotating magnets and two pairs of coils.

J. Water Injection: The water injection system includes several items of equipment: A water tank, an electric pump, an oil pressure-operated shut-off valve (Each engine), water "available" indicator lights, water pressure gages, water on each engine and a de-richment valve on each carburetor.

1. Water Tank: The water tank is constructed of synthetic rubber with a capacity of 25 gals and is located in the fuselage at the right wing trailing fairing. An overflow and air vent is installed to relieve pressures within the tank.

2. Water Pump: The water pump is driven by an electric motor and incorporates a slotted liner that precludes the possibility of pumping air. The pump and motor assembly is submerged and mounted on the bottom of the tank.

3. Indicator Lights: Two water lights are mounted on the instrument panel. The lights come on when the ADI switch is turned ON. The lights indicate the water is available under pressure at the regulator.

4. Shut-Off Valve: An oil pressure operated shut-off valve is mounted in the water supply line to each engine. When engine oil pressure has reached a minimum of 30 psi, the valves open to allow water flow to the regulators. Water, after passing through the shut-off valve is routed to the water regulators. On a single engine go-around, since we need oil pressure before water will flow, no water will go to the dead engine.

5. Water Regulator: A variable water-air ratio regulator, the most important unit in the ADI system, meters the water that enters the fuel system in proportion to the air flow. The water pressure (min 18 psi) available at the water regulator closes the derichment valve as soon as the ADI switch is turned on, irrespective of the engine power at the time the switch is actuated. This, however, does not appreciably affect fuel air ratio in the low and medium power range.

6. Water Pressure Operated Vent Valve: The vent valve prevents fuel from backing up into the water tank after the pump is turned off.

7. Water Pump Relief Valve: The pump has a relief valve set at 32 psi. When the pump is operated, and for some reason water is not reaching the engine the relief valve opens and the water is returned to the tank.

8. System Operation: When the ADI switch on the pilot's pedestal is turned on the water pump is operated and water is free to enter the regulator, provided the oil pressure operated valve is open. The oil pressure operated valve blocks the flow of ADI fluid to the regulator until 30 psi of engine oil pressure is available. The water inlet pressure closes the carburetor de-richment valve, but water does not enter the engine until sufficient metering force is developed to permit water pressure to build up and open the water control check valve. As power is gradually increased, the water control check valve gradually opens, causing a relatively large pressure drop in the water passing through it. This pressure drop will be noted on the wated pressure gage. The pressure is at 30 psi when idling; at about 45 in Hg MP the water pressure should drop to 21-23 psi (Same as fuel pressure). Water flow begins early enough to suppress detonation in the power range where fuel flow is reduced, due to the closing of the carburetor de-richment valve.

9. Ground Check of ADI System:

a. Turn ADI switch to ON position. Check for illumination of water pressure lights, a rise in water pressure and a decrease in fuel flow.

b. Advance left throttle (Not to exceed 40 in Hg MP) and note that water pressure decreases, indicating water flow to the engine. Minimum allowable water pressure is 18 psi. Without retarding the throttle turn the water injection switch OFF and check for an increase in fuel flow.

c. Make a similar water check on the right engine.

10. Important Facts About the ADI System:

a. Water used in the ADI System is a mixture of distilled water (40%) and ethyl or methyl alcohol 60% by volume.

b. Consumption of water at take-off is 1.5 gallons per minute per engine.

c. Capacity of tank is 25 gallons, 22 of which are usable.

d. A shut-off switch in the quanity transmitter automatically shuts off water pump when the tank level has reached 3 gallons.

e. If the tank is below 7 gallons, the ADI System will not come on. This is a safety feature that protects the engines. Say, for instance, the tank level was about five gallons, and a "wet" take-off was started. You can see that if full power was left on the engines you would probably run out of water after a short period of time, resulting in detonation, since the "dry" power limitations were exceeded. If, however, water is used with the tank level slightly above seven gallons, the water will stay on during a take-off, even if the tank level goes below seven gallons during and after the take-off. Under these conditions, the system will stay on until a tank level of three gallons is attached, then the ADI system will automatically shut off.

K. Fuel System: The fuel system components in the left nacelle are the same as those in the right nacelle, but they are arranged differently. Fuel enters the area through tank screens and a flex hose manifold system. Flow beyond this point is controlled by a DC operated main fuel valve. This valve is an electrical slide type valve controlled by a switch on the fuel control panel. A valve position light glows if the valve is not in the position selected by the switch. A Koehler type main fuel drain valve for draining the tank is also installed. The fuel flows through the DC electric booster pump. Pump operation may or may not be required; it is used for starting, take-off, initial climb, high altitude operation, cross-feed operation, oil dilution or in case of engine driven pump failure.

1. Operation of Fuel System Cross-Feed: Fuel may be obtained through the crossfeed system instead of from the corresponding main tank. The crossfeed line connects the two main fuel strainers together, left and right side. A two position manually operated slide valve is installed in the line near each strained. Control is by means of a lever on the fuel control panel. Either engine may be supplied by the opposite tank or both engines may be supplied by either tank. NOTE: Since no provisions are made to prevent overfilling, transfer from one tank to the other is not permitted. A drain fitting for the fuel crossfeed line is also located in the right nacelle. A thermo relief valve for the crossfeed line is also located in the right nacelle.

L. Oil System: Each engine has an independent oil system that incorporates an oil tank and an oil cooler in each nacelle. Each tank has a total usable oil capacity of approximately 22 gallons. Only 20 gallons are available for use by the engines. The remaining two gallons are reserved by a short stand-pipe for propeller feathering and reversing. A sealed hopper, installed in each tank provides for quick warmup of the oil when the engines are operating. The hopper is attached to the bottom of the tank to the same housing to which the sump is attached. Two flap valves, installed in the housing control flow of oil between the hopper and the tank.

1. Oil Cooler Operation: Oil cooling air is obtained from a flush scoop at the bottom of the nacelle. The free-flow type oil cooler incorporates a regulating valve assembly which contains a surge protective valve, a thermostatic bypass valve, a core check valve. The surge protection valve permits the flow of oil to bypass the cooler under cold starting conditions when congealed oil would cause high pressure in the cooler. The thermostatic bypass valve bypasses oil around the cooler core when the oil is cold or when there is not enough pressure to open the surge protection valve. The core check valve prevents outlet line oil from returning to the cooler. Under normal conditions, oil flows through the oil cooler core where heat is transferred to the air that flows through the cooler. Flow of air through the cooler is regulated by an automatically operated, full closing, oil cooler door, with selective override electrical control.

M. Reserve Oil System: The reserve oil system consists of a reserve tank, located below the floor on the right side of the fuselage, aft of the rear spar, at sta. 628. Necessary pump, valve and tubing required to transfer oil from the reserve tank to the main oil tanks are also provided. An electric-driven pump transfers oil from the reserve oil tank to the main oil tanks. The reserve oil transfer switch is located on the copilot's console. The switch has LH, OFF, and RH positions, and is spring loaded to OFF. When held in the LH or RH position, the DC operated transfer pump and transfer selector valve are actuated to deliver reserve oil to the selected engine oil tank. The switch is released to the OFF position to stop the transfer process. Over filling of an engine oil tank is prevented by a DC automatic cutoff switch actuated by the oil quantity indicating system, which stops the transfer pump when the main oil quantity gage reaches the full mark. After the reserve oil transfer switch has been released to the OFF position, the transfer pump reserses and rums for approximately two minutes to scarenge oil from the line. As the pump starts the reversing action, an oil transfer fuel valve at the nacelle opens and allows fuel to dilute the oil in the oil transfer line. As oil is scavenged from the line by the pump, fuel fills the line, thus assuring effective oil transfer during winter operation. The oil transfer fuel valve closes at the end of the pump reversing period.