SECTIOII
ENGINE

2-1. ENGINE.

2-2. GENERAL DESCRIPTION. (See figures 2-1 through 2-3.) Airplanes 1 through 4 and 6 through 14 are powered by four Pratt & Whitney T34-P-3A engines, and airplanes 5 and 15 and subsequent are powered by four Pratt & Whitney T34-P-7W engines. The engines are housed in conventional semimonocoque nacelles, and are accessible through quick-opening orangecap-type cowling. Each engine is a multistage, axial-flow, single-compressor gas turbine which produces thrust by driving a propeller at the front and discharging high-velocity gases through a nozzle at the rear. Each engine is capable of developing a static takeoff power of 6000 equivalent shaft horsepower (EHP). A 13-stage, axial-flow compressor produces a maximum compression ratio of approximately 6.7 to 1. To facilitate starting and to prevent compressor stall at low power conditions, overboard air bleeds are provided at the sixth and seventh compression stages. These air bleed ports are automatically actuated and are open for starting and low power ground operation. Additional air bleed ports, located at the compressor discharge, provide high-pressure heated air for wing anti-icing and de-icing, and engine inlet and oil cooler anti-icing. The pressurized air is ducted aft for empennage boot de-icing, and may be used for starting other engines. The high-pressure heated air may also be used for air conditioning and pressurizing the airplane in an emergency (GTU's inoperative). The burner section contains eight combustion cones. Spark igniters are installed in the No. 2 and No. 7 cones for starting purposes. Combustion gases from the burner section enter the turbine section to provide turbine driving energy. The turbine has three expansion stages beyond which the high-velocity gases discharge through the tailpipe. Power from the turbine is transmitted to the compressor and propeller reduction gearing through a single shaft. To prevent an inoperative engine from windmilling either after feathering in flight or while the airplane is parked on the ground, a self-contained engine brake is incorporated on the starter drive shaft. The brake may also be used below 45 percent rpm to reduce the time required to shut down an engine on the ground. The engine incorporates negative torque control (NTC) to reduce asymmetric thrust by automatically suppressing windmilling drag from an inoperative engine before feathering the propeller.

2-3. The principal components of the engine are the nose section, air inlet section, compressor section, accessory section, combustion section, turbine section, and exhaust section. The engine and its accessories, except the oil tank and related components normally installed in the nacelle, make up the demountable power plant (see figure 2-3). The demountable power plant consists of the engine, engine mount, engine accessories, tailpipe extension, and shroud. All T34-P-3A and T34-P-7W demountable power plants, except those which have been specifically adapted for inboard positions by the installation of the alternator, are inter-changeable between nacelle positions.

2-4. ENGINE CONTROLS AND INSTALLATIONS. Engine controls and installations discussed in paragraphs 2-5 through 2-60 include those controls switches, indicators, and installations that relate to the functions of maintenance personnel at the pilots' and systems engineer's stations (see paragraphs 2-61 through 2-85). For additional information on engine controls and indicators, see Sections III through X of this handbook and refer to the volume for Instruments, Handbook Maintenance Instructions.

2-5. ENGINE FUEL CONTROL.

2-6. The engine fuel control system receives fuel under boost pump pressure from the main fuel system through a firewall shutoff valve. The fuel is routed through strainers to the 2-stage engine-driven fuel pump, where its pressure is increased to the required pressure. From the engine-driven pump, fuel is routed to the fuel control unit, which includes a filter. The fuel control unit turns the fuel flow on or off through an integral shutoff valve (by movement of the propeller condition lever), and regulates engine output by controlling fuel flow (by the position of the power lever). The fuel control unit meters fuel to the
1. Propeller Shaft  
2. Reduction Gear  
3. First Stage Axial  
   Flow Compressor  
4. Bleed Air Manifold  
5. Thirteenth Stage Axial  
   Flow Compressor  
6. Engine Vibration Isolator  
   Mounting Pads  
7. Turbine Case  
8. Turbine Exhaust Cone  
9. Turbine Exhaust Extension  
   Outer Duct  
10. Three-Stage Turbine  
   Rotor  
11. Combustion Chamber  
12. Fuel Pressurizing And  
   Dump Valve  
13. Fuel Pump  
14. Fuel Control  
15. Air Inlet Shutter  
16. Annular Air Inlet  
17. Negative Torque Control  
   Switch Actuating Platen  

![Engine Diagram](image)

**Figure 2-1. Engine - Cutaway View - Typical**

- **2-7.** The gear-type fuel pump has two pumping stages. During normal operation, the first stage acts as an engine-driven boost pump which increases fuel pressure to the inlet of the second stage by approximately 25 psi. The second stage increases the pressure to approximately 500 psi. Either stage has adequate capacity to maintain limited power if the other stage fails.

- **2-8.** The amount of fuel metered by the fuel control unit is a function of power lever position, engine speed, compressor inlet temperature, and combustion chamber pressure. Sensing units continuously monitor these operating conditions to regulate fuel flow to the engine.

- **2-9.** The pressurizing and dump valve, located between the fuel control unit and the nozzle manifolds, diverts all fuel through the engine primary fuel manifold at low-pressure flow during engine starting. As the engine starts, the pressurizing valve, through higher pressure flow, opens an additional passage to the engine secondary fuel manifold. At engine shutdown, the loss of pressure allows the dump valve to open, thus draining both engine fuel manifolds overboard.

- **2-10.** POWER LEVERS AND FRICTION LOCK.

- **2-11.** Two banks of four power levers each, located on the control pedestal, are mechanically linked to the engine fuel control units and the propeller circuits to control power output by coordinating fuel flow with propeller rpm. A friction-type power lever lock is actuated by a lever, placarded POWER LOCK, located to the right of the pilot's power levers. The power levers also control propeller reversing. Each power lever actuates a water-alcohol injection switch during advancement to MAX POWER (takeoff) position, and actuates the landing gear warning switch when retarded to the FRGONG horn switch power lever at idle speed.

- **2-12.** GROUND TURBOPOWER LEVERS, installed on the switches provide operation. HI I SWITCH is spring loaded to the respective position; control unit is complete control unit to Clients.

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2-12. GROUND IDLE SPEED SWITCHES. Two ground idle speed switches, one for the No. 1 and No. 4 engines, and one for the No. 2 and No. 3 engines, are installed on the pilots' overhead electrical panel. The switches provide two ranges of idle speed for ground operation, HI IDLE and LOW IDLE. The switches are spring loaded to the HI IDLE position. When a power lever is retarded to the GROUND idle position and the respective ground idle speed switch is momentarily actuated to the LOW IDLE position, a 28-volt d-c circuit is completed to energize a solenoid on the fuel control unit to change the ground idle stop to the low idle position; engine speed then drops to approximately 55.5 percent (6000) rpm. When the power lever is advanced to or above the FLIGHT idle position, or is moved to REVERSE, a cam mechanically actuates a mechanism on the fuel control unit to change the ground idle stop to the righ idle position or 90.9 percent (10,000) rpm. When the power lever is again retarded to the GROUND idle position or taken out of REVERSE, engine speed will be maintained at 90 percent (10,000) rpm until the ground idle speed switch is again actuated to the LOW IDLE position.

2-13. NEGATIVE TORQUE CONTROL.

2-14. A dual negative torque control (NTC) is installed on each engine to automatically provide a decrease pitch (decrease rpm) signal whenever a condition of negative torque (propeller driving the turbine exists. If a condition of negative torque is sensed by the NTC, the propeller pitch circuit is actuated to stall the propeller toward feather position. The propelle will continue toward feather position until a blad angle is reached where negative torque is less than the required to actuate the circuit. The system will no drive the propeller completely to feather. If engine power is restored before feathering, normal propeller operation is automatically restored. The NTC system is automatic during operation in the flight range, syn...
Figure 2-3 (Sheet 1 of 2). Engine—Typical
1. Shroud Cooling Port
2. Oil Supply Hose
3. Starter Supply Pipe
4. Engine Brake Actuator
5. Air Turbine Starter

6. Fire Extinguisher Supply Hose and Spray Ring
7. Engine Control Gear Box
8. Propeller Coordinator
9. Flight Low-Pitch Stop Latch Switch
10. Tachometer Generator

1. Engine and Propeller Control Conduits
2. Oil Return Hose
3. Oil Tank Vent Hose
4. Shroud Cooling Port
5. Alternator Cooling Air Exhaust Port (Covered on Outboard Installations)
6. Ignition Compositor
7. Oil Breather Hose
8. Fuel Supply Hose
9. Cowl Anti-Icing Control Valve
10. Cowl Anti-Icing Supply Hose

Figure 2-3 (Sheet 2 of 2). Engine—Typical
T.O. TC-133A-2-4

Section II

1. Oil Inlet from Tank
2. Engine Brake Actuator
3. Fuel Flow Transmitter
4. Pneumatic Starter
5. Compressor Overboard Air Bleed Control
6. Cowl Nose Ring Support Struts
7. Engine Controls Bracket
8. Engine Inlet Guide Vane Anti-icing Air Tube
9. Propeller Coordinator
10. Propeller Coordinator Seal Drain
11. Propeller Flight Low-Pitch Stop Latch Switch
12. Tachometer Generator

Figure 2-10 (Sheet 1 of 5). Engine Buildup—Right Side

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1. Cowl Nose Ring Strut Support Assembly
2. Oil Tank Vent Hose and Lines
3. Ignition Compositor
4. Oil Return to Tank Hose
5. Fuel in Hose
6. Fuel Pump
7. Engine Cowl Anti-Icing Air Valve
8. Engine Breather Hose

Figure 2-10 (Sheet 2 of 5). Engine Buildup—Left Side