

28.1 Principles of Hydraulics

- Hydraulic systems use a confined, incompressible fluid to transmit force and power high-demand systems like landing gear, flight controls, and brakes.
- ☐ Pascal's Law: Pressure applied to a confined fluid is transmitted equally in all directions.
- $(\text{Pressure} = \text{Force} / \text{Area})$.
- ☐ Force Multiplication: By applying a small force to a small piston, a very large force can be generated at a large piston, as the pressure throughout the fluid is the same. However, the small piston must travel a much greater distance.

28.2 Hydraulic Fluid

- Aircraft hydraulic fluids must have specific properties, including being nearly incompressible, having good lubricating qualities, a high flash point, and a wide operating temperature range. The two main types are:
- ☐ Mineral-Based (e.g., DEF STAN 91-48): Red in color. Used with neoprene synthetic rubber seals.
- ☐ Phosphate-Ester Based (e.g., Skydrol): Purple in color. Fire-resistant but is corrosive and harmful to skin. Used with butyl rubber seals. The two types are not interchangeable.

28.3 Hydraulic System Components

- ☐ Reservoir: Stores the system's hydraulic fluid. It is often pressurized with bleed air to provide a positive fluid supply to the pumps and prevent foaming at high altitude.
- ☐ Pumps: Provide the flow of fluid. They can be engine-driven, electric motor-driven, or powered by a Ram Air Turbine (RAT) in an emergency.
- Constant Delivery Pumps: Deliver a fixed volume of fluid per revolution.
- Constant Pressure (Variable Volume) Pumps: The most common type on large aircraft.
- They automatically vary their output volume to maintain a constant system pressure,

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- eliminating the need for an automatic cutout valve.
- ☐ Accumulator: A sphere or cylinder containing a diaphragm or piston, with hydraulic fluid on one side and compressed nitrogen gas on the other. It stores hydraulic fluid under pressure to dampen pressure fluctuations, provide an emergency source of pressure, and handle initial peak demands.
- ☐ Actuators (Jacks): Convert hydraulic pressure into linear mechanical motion to operate components like landing gear.
- ☐ Valves: Control the flow and pressure of the fluid (e.g., Selector Valves, Check Valves, Relief Valves, Sequence Valves, Shuttle Valves).

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