

Basic Components of a Hydraulic System

Scope of presentation

Basic Components of a Hydraulic System

Cylinder movement

four main divisions in an electrical system

Basic Components of a Pneumatic System

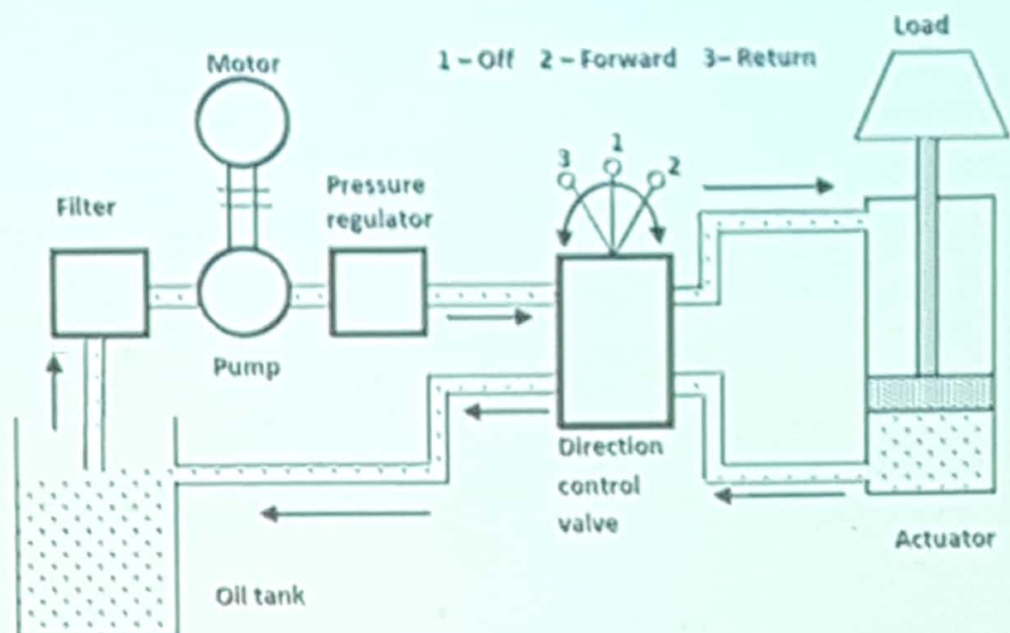
Basic Components of a Hydraulic System

Comparison between Hydraulic and Pneumatic Systems

Comparison of Different Power Systems

Experiment – 1

Thanks & Questions



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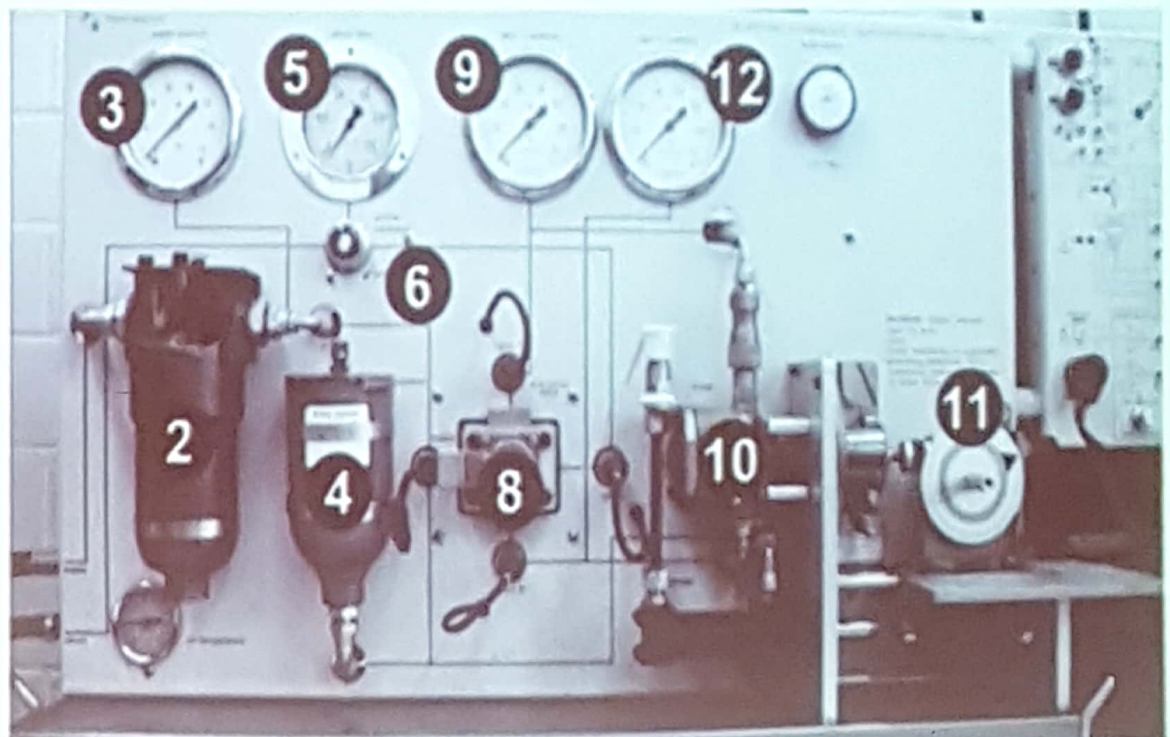
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➤ Motor and Reservoir

- ✓ External power supply (motor) is required to drive the pump.
- ✓ Reservoir is used to hold the hydraulic liquid, usually hydraulic oil.

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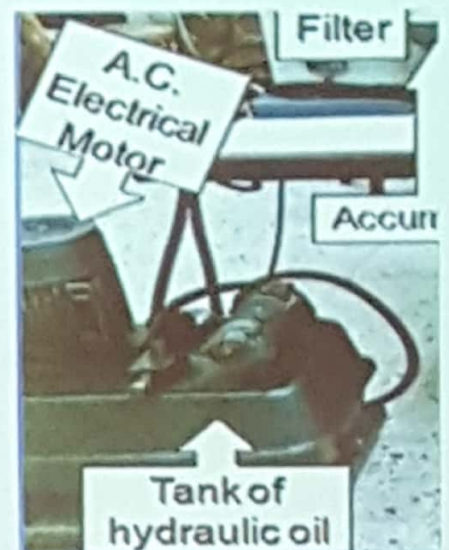
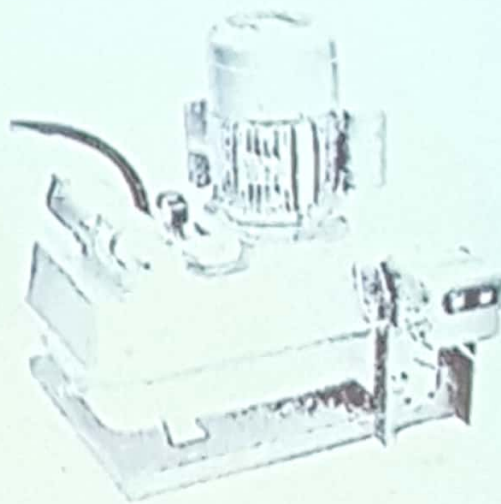
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➤ Motor and Reservoir (EHS160)

➤ The hydraulic power supply



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➤ Filters

- ✓ Filters are used to remove any foreign particles so as keep the fluid system clean and efficient, as well as avoid damage to the actuator and valves.

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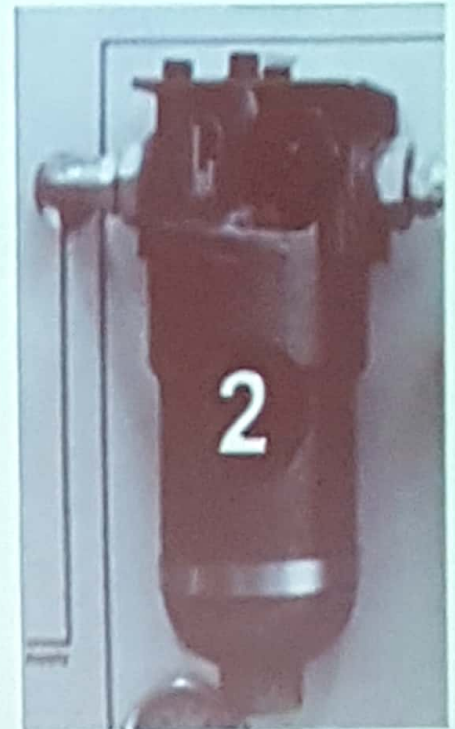
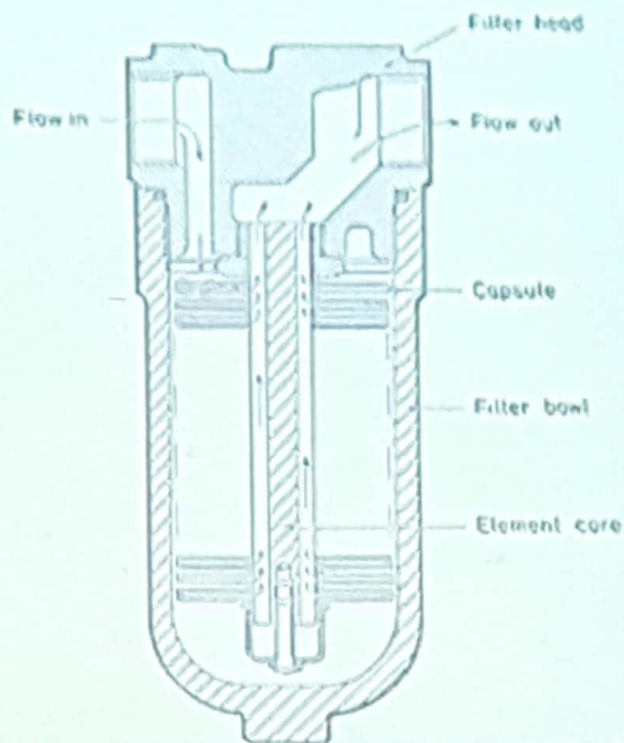
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➤ Filters (Servo Unit) (EHS160)



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➤ Pressure regulator

- ✓ Regulates (i.e., maintains) the required level of pressure in the hydraulic fluid.

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➤ Hydraulic accumulator (Servo Unit) (EHS160)

- ✓ The accumulator tries to hold up the pressure by supplying oil to the system to replace that lost.
- ✓ The oil in it is pressurized by a bag of nitrogen gas
- ✓ The bag has been precharged with gas to a pressure of 3 .5MPa (500psi) in the absence of oil.

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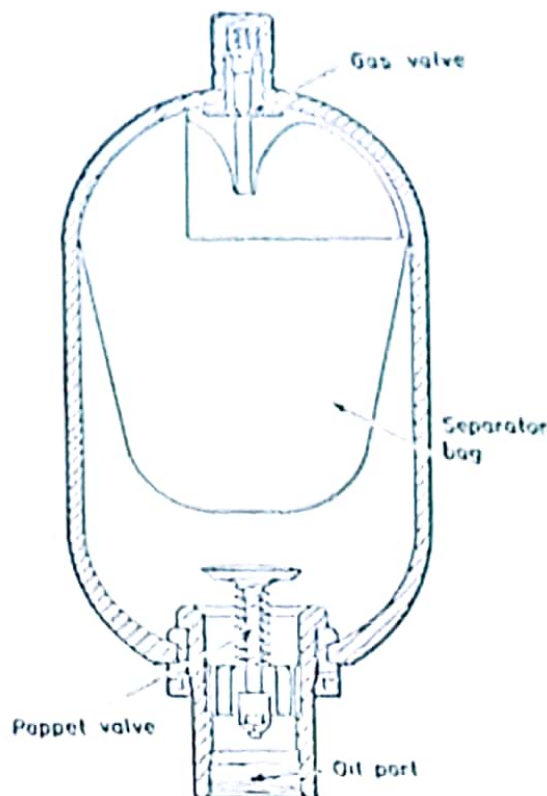
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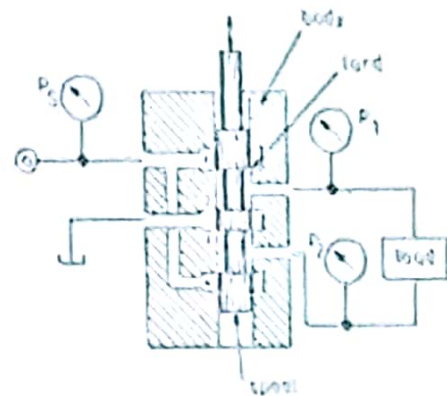
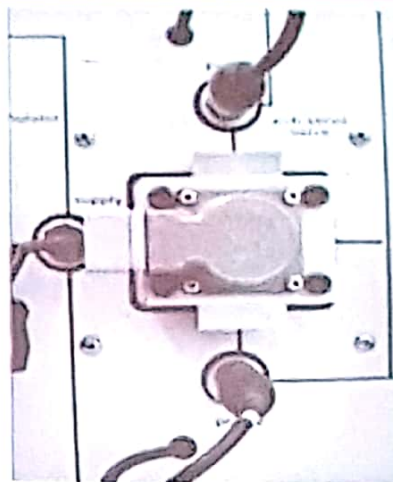
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➤ Valves

✓ Valves are used to control the direction, pressure and flow rate of a fluid flowing through the circuit.



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➤ The hydraulic actuator

- ✓ The hydraulic actuator is a device used to convert the fluid power into mechanical power to do useful work.
- ✓ The actuator may be of the linear type (e.g., hydraulic cylinder) or rotary type (e.g., hydraulic motor) to provide linear or rotary motion, respectively.

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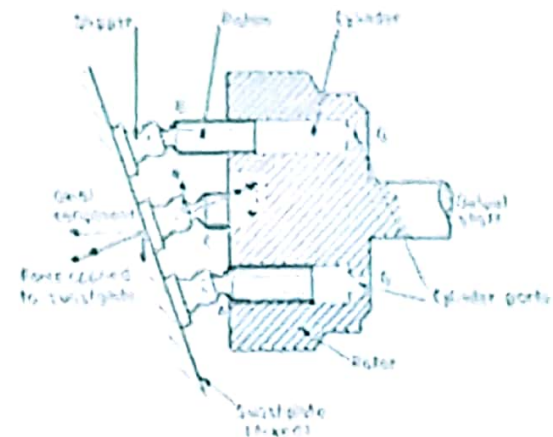
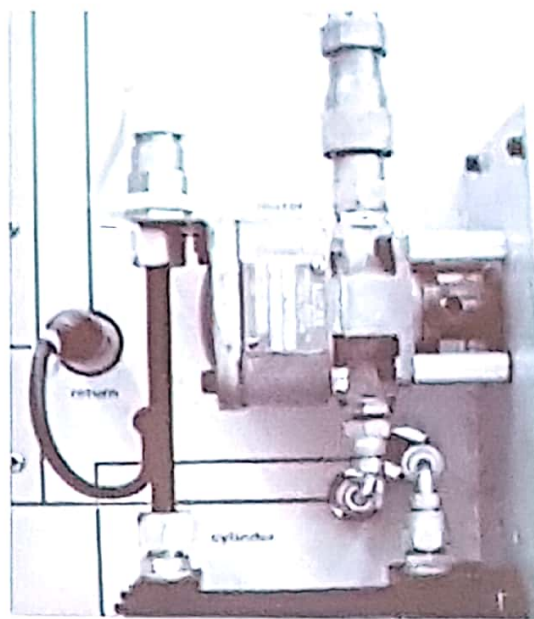
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➤ A rotary hydraulic motor (Servo) (EHS160)



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➤ A cylinder (or linear hydraulic motor) (Servo Unit) (EHS160)

✓ Cylinder movement is controlled by a three-position change over a control valve.

- When the piston of the valve is changed to upper position, the pipe pressure line is connected to port A and thus the load is raised.
- When the position of the valve is changed to lower position, the pipe pressure line is connected to port B and thus the load is lowered.
- When the valve is at center position, it locks the fluid into the cylinder (thereby holding it in position) and dead-ends the fluid line (causing all the pump output fluid to return to tank via the pressure relief).

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➤ The Servo Unit (EHS160)

✓ Oil temperature

- ✓ The oil temperature should not be allowed to exceed an indicated 40°C . Above this the oil may become an inadequate lubricant. That damage the system or not provide the desired pressure. Keeping the temperature of the system under 30°C is very important for safety reasons.

✓ Rotary transducer

There are two Rotary transducer, one is the DC tachogenerator and the other is synchro transformer.

✓ Pressure and flow transducers

- ✓ The pressure and flow transducers are all of strain gauge bridge type.

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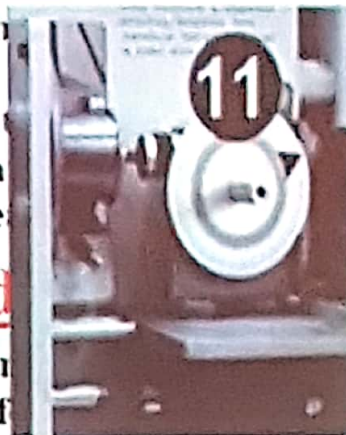
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➤ The Servo Unit (EHS160)

✓ Oil temperature

- ✓ The oil temperature should be kept below 40°C. Above this the oil will oxidize. That damage the system. Keeping the temperature low is very important for safety reasons.



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✓ Rotary transducer

There are two Rotary transducers, one is C tacho-generator and the other is synchro transducer.

C tacho-generator and

✓ Pressure transducer

- ✓ The pressure transducer is used to measure the pressure in the hydraulic system.



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➤ The Servo Unit (EHS160)

✓ Transport lag

- ✓ This is a lag which introduces a constant time delay but does not affect the gain.



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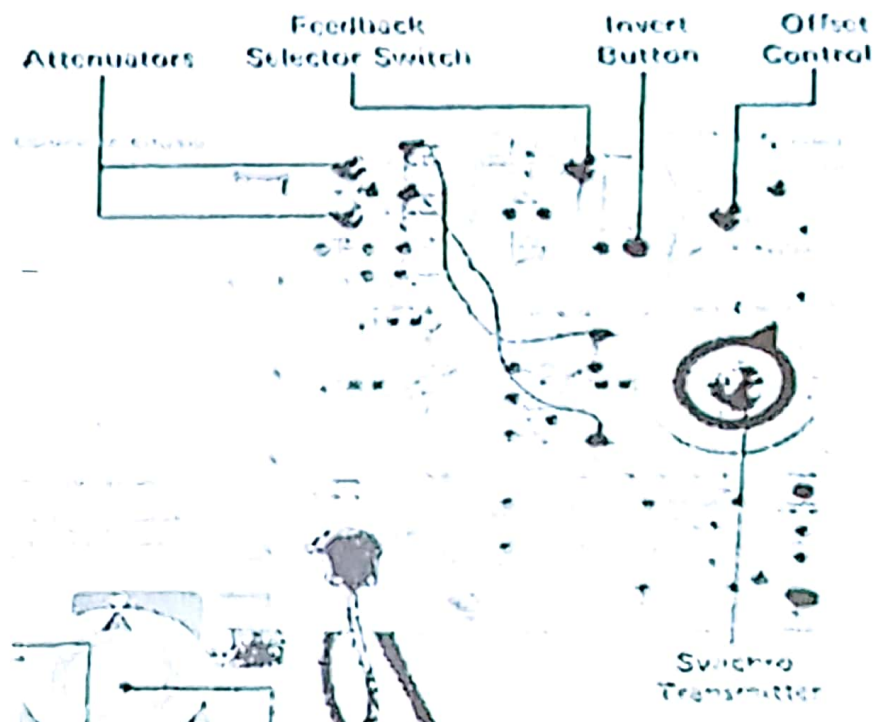
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➤ The Control Unit (EHS160)



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➤ Calibration of flow gauge

- ✓ In this experiment you identified many of the components of the EHS 160 system, and learnt that:
- ✓ Cleanliness is essential in any hydraulic system.
- ✓ A servo valve provides progressive and reversible control of the flow in a hydraulic load, which in an electro-hydraulic servo is responsive to an electrical input signal.
- ✓ The hydraulic motor passes a fixed amount of fluid (oil) for every revolution, so that its speed is proportional to oil flow (ignoring leakages).
- ✓ The tachogenerator provides an electrical signal proportional to speed.
- ✓ An orifice produces a pressure drop related to flow by a parabolic curve.

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- ✓ The hydraulic system discussed above can be broken down into four main divisions that are analogous to the four main divisions in an electrical system.
1. The power device parallels the electrical generating station.
 2. The control valves parallel the switches, resistors, timers, pressure switches, relays, etc.
 3. The lines in which the fluid power flows parallel the electrical lines.
 4. The fluid power motor (whether it is a rotating or a non rotating cylinder or a fluid power motor) parallels the solenoids and electrical motors.

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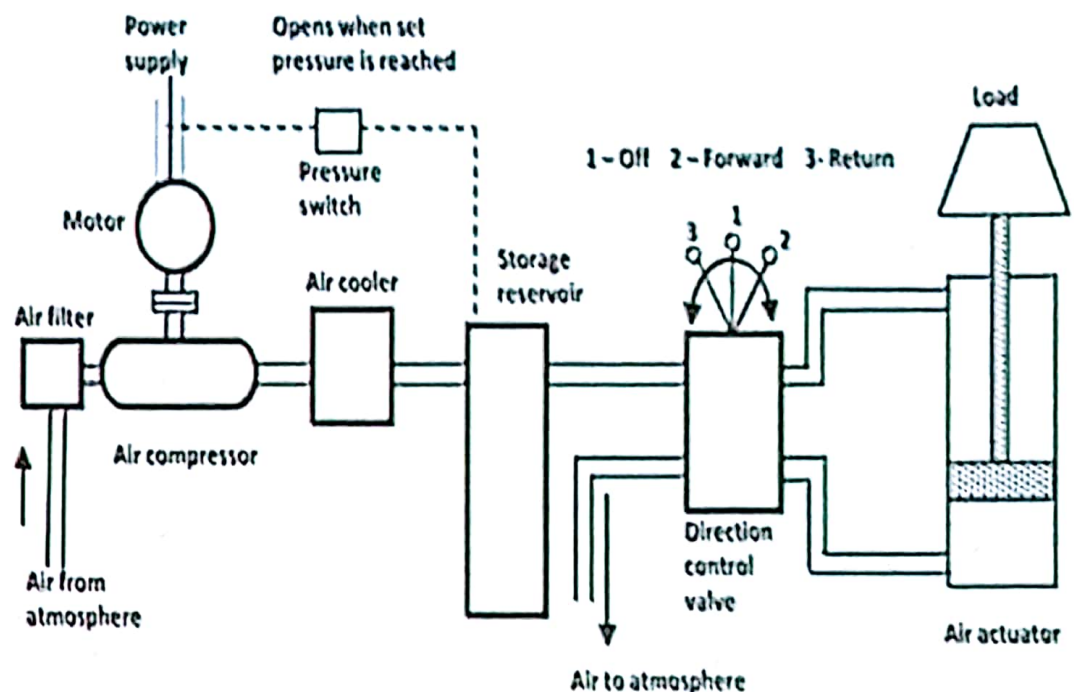
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Basic Components of a Pneumatic System

Scope of presentation	✓ <u>The functions of various components shown in Figure</u>
Basic Components of a Hydraulic System	1. The pneumatic actuator converts the fluid power into mechanical power to perform useful work.
Cylinder movement	2. The compressor is used to compress the fresh air drawn from the atmosphere.
four main divisions in an electrical system	3. The storage reservoir is used to store a given volume of compressed air.
Basic Components of a Pneumatic System	4. The valves are used to control the direction, flow rate and pressure of compressed air.
Basic Components of a Hydraulic System	5. External power supply (motor) is used to drive the compressor.
Comparison between Hydraulic and Pneumatic Systems	6. The piping system carries the pressurized air from one location to another.
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Comparison between Hydraulic and Pneumatic Systems

S. No.	Hydraulic System	Pneumatic System
1.	It employs a pressurized liquid as a fluid	It employs a compressed gas, usually air, as a fluid
2.	An oil hydraulic system operates at pressures up to 700 bar	A pneumatic system usually operates at 5–10 bar
3.	Generally designed as closed system	Usually designed as open system
4.	The system slows down when leakage occurs	Leakage does not affect the system much
5.	Valve operations are difficult	Valve operations are easy
6.	Heavier in weight	Lighter in weight
7.	Pumps are used to provide pressurized liquids	Compressors are used to provide compressed gases
8.	The system is unsafe to fire hazards	The system is free from fire hazards
9.	Automatic lubrication is provided	Special arrangements for lubrication are needed

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Property	Mechanical	Electrical	Pneumatic	Hydraulic
Input energy source	IC engines Electric motor	IC engines Water/gas turbines	IC engines Pressure tank	IC engines Electric motor Air turbine
Energy transfer element	Levers, gears, shafts	Electrical cables and magnetic field	Pipes and hoses	Pipes and hoses
Energy carrier	Rigid and elastic objects	Flow of electrons	Air	Hydraulic liquids
Power-to-weight ratio	Poor	Fair	Best	Best
Torque/inertia	Poor	Fair	Good	Best
Stiffness	Good	Poor	Fair	Best
Response speed	Fair	Best	Fair	Good
Dat sensitivity	Best	Best	Fair	Fair
Relative cost	Best	Best	Good	Fair
Control	Fair	Best	Good	Good
Motion type	Mainly rotary	Mainly rotary	Linear or rotary	Linear or rotary

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Dirt sensitivity	Best	Best	Fair	Fair
Relative cost	Best	Best	Good	Fair
Control	Fair	Best	Good	Good
Motion type	Mainly rotary	Mainly rotary	Linear or rotary	Linear or rotary