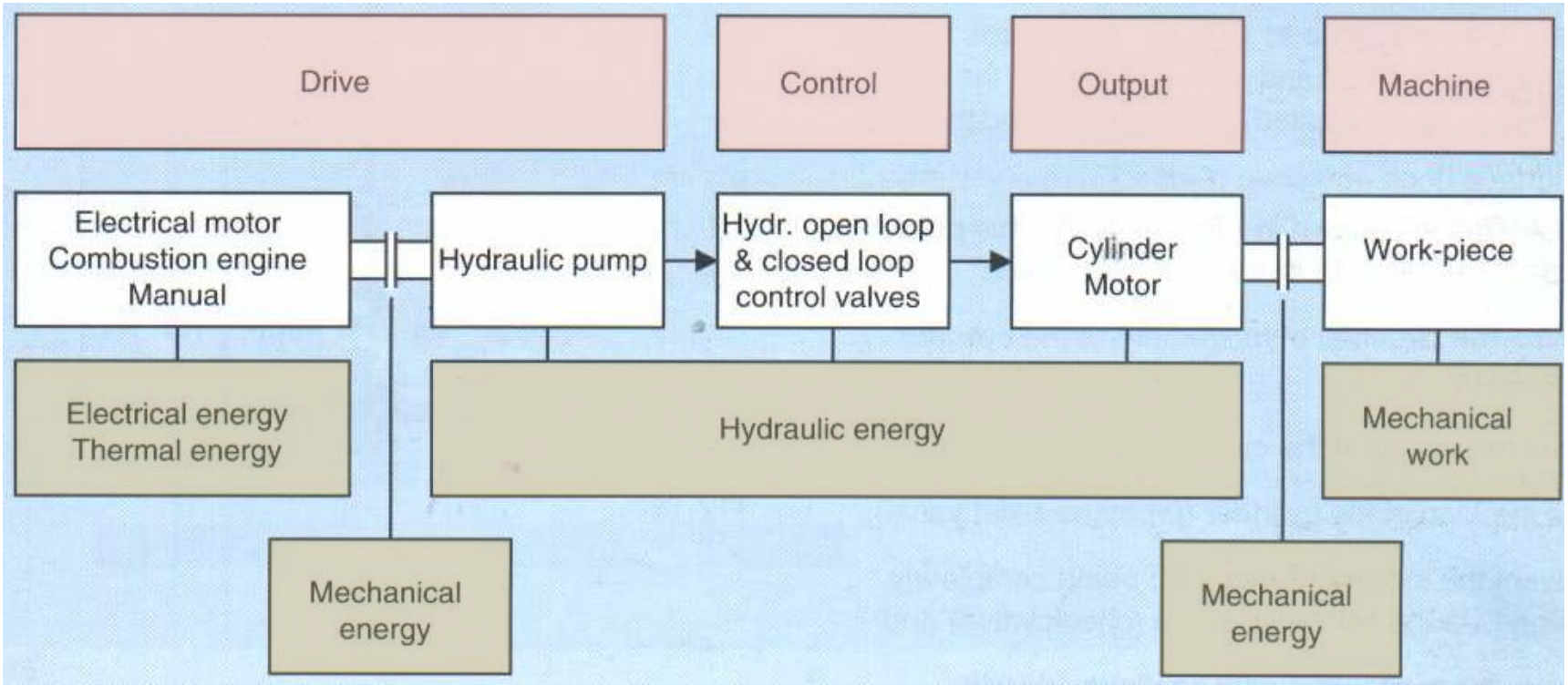
# Energy Transfer in a Hydraulic System



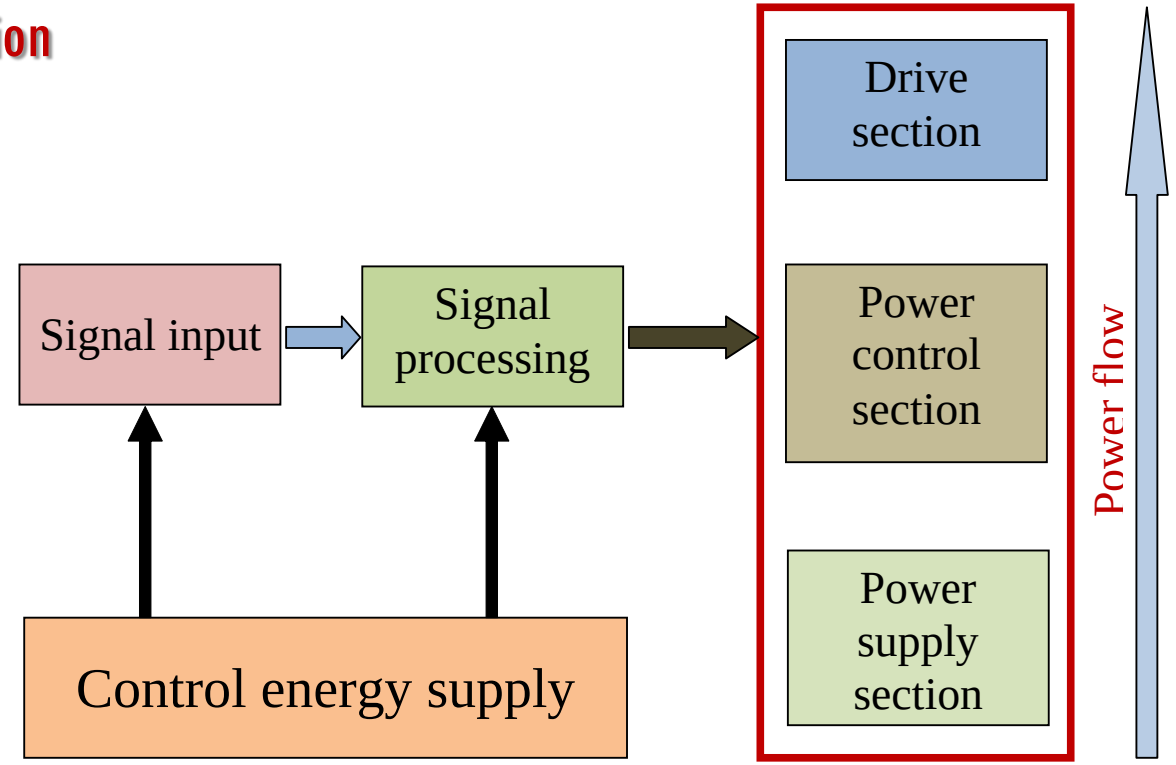


# Control in a Hydraulic System



The signal control section

The power control section



# Control in a Hydraulic System



## The signal control section

The signal control section is divided into signal input (sensing) and signal processing (processing).

Signal input may be carried out:

- Manually
- Mechanically
- Contactless

Signals can be processed by the following means:

- by the operator
- by electronics
- by pneumatics
- by mechanics
- by hydraulics

# Control in a Hydraulic System



## The power control section

The power is supplied to the drive section by the power control

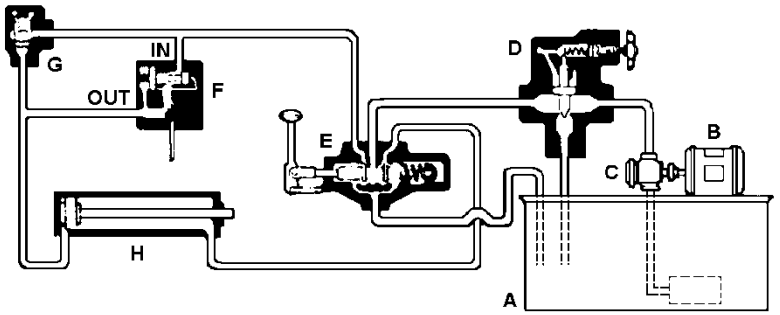
section in accordance with the control problem. The following components perform this task:

- directional control valves
- flow control valves
- pressure valves
- non-return valves.

# Components of a Fluid Power System



1. A tank (reservoir) to hold the liquid, which is usually hydraulic oil.
2. A pump to force the liquid through the system.
3. An electric motor or other power source to drive the pump.
4. Valves to control liquid direction, pressure, and flow rate.
5. An actuator to convert the energy of the liquid into mechanical force or torque to do useful work.
6. Piping, which carries the liquid from one location to another.

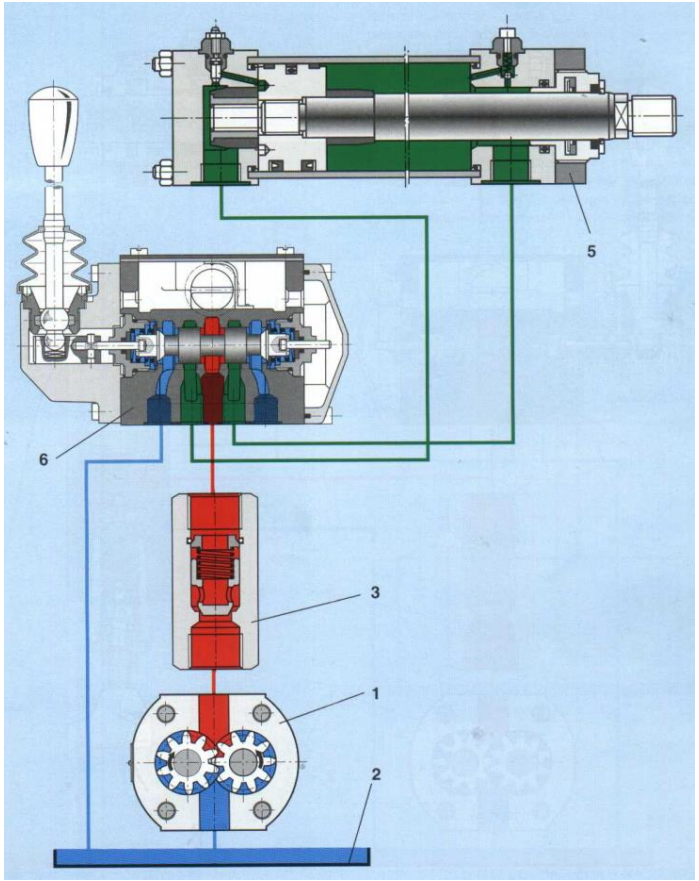


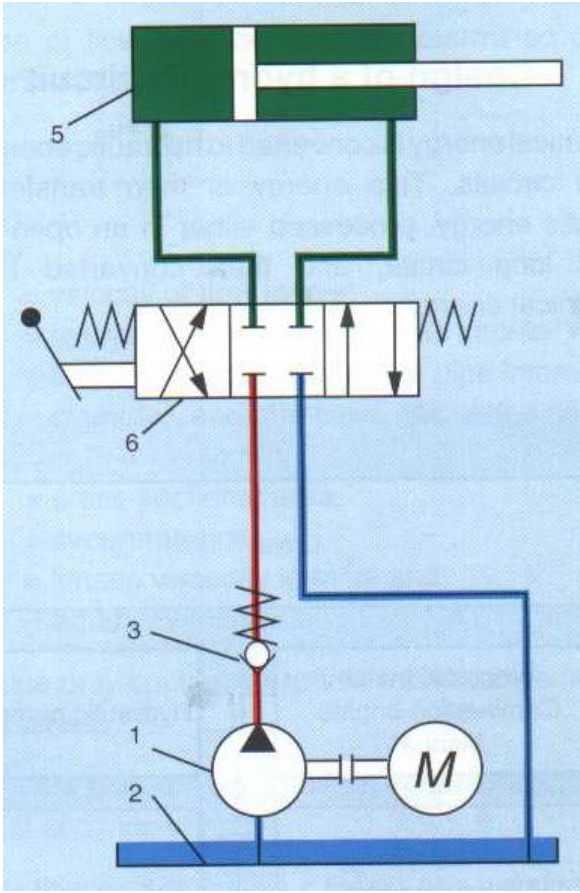

List of Components

A - Reservoir
B - Electric Motor
C - Pump
D - Maximum Pressure (Relief) Valve
E - Directional Valve
F - Flow Control Valve
G - Right Angle Check Valve
H - Cylinder

# Components of a Fluid Power System

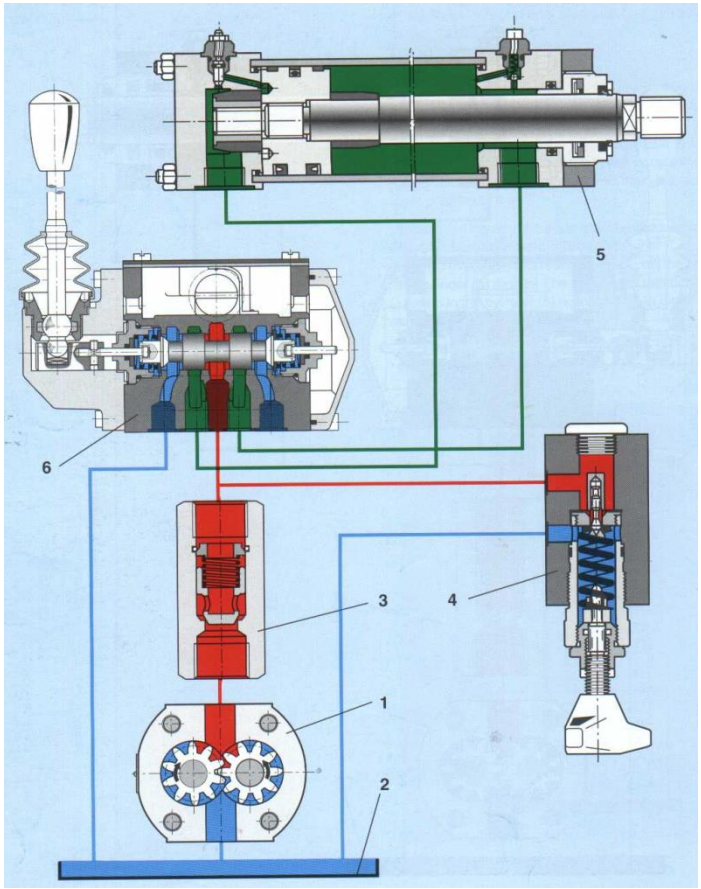


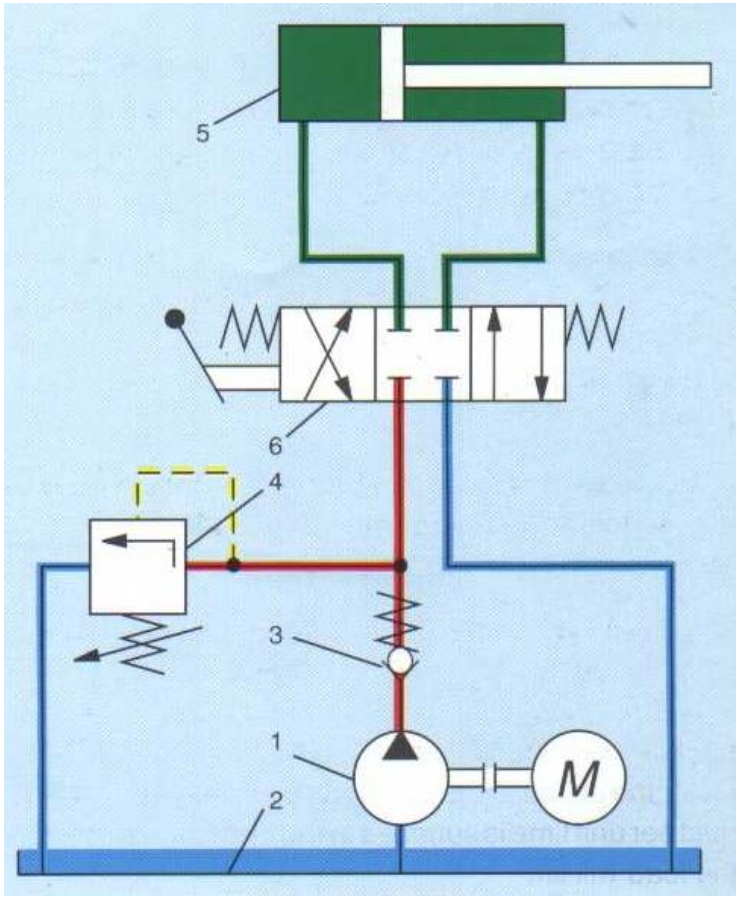


# Components of a Fluid Power System

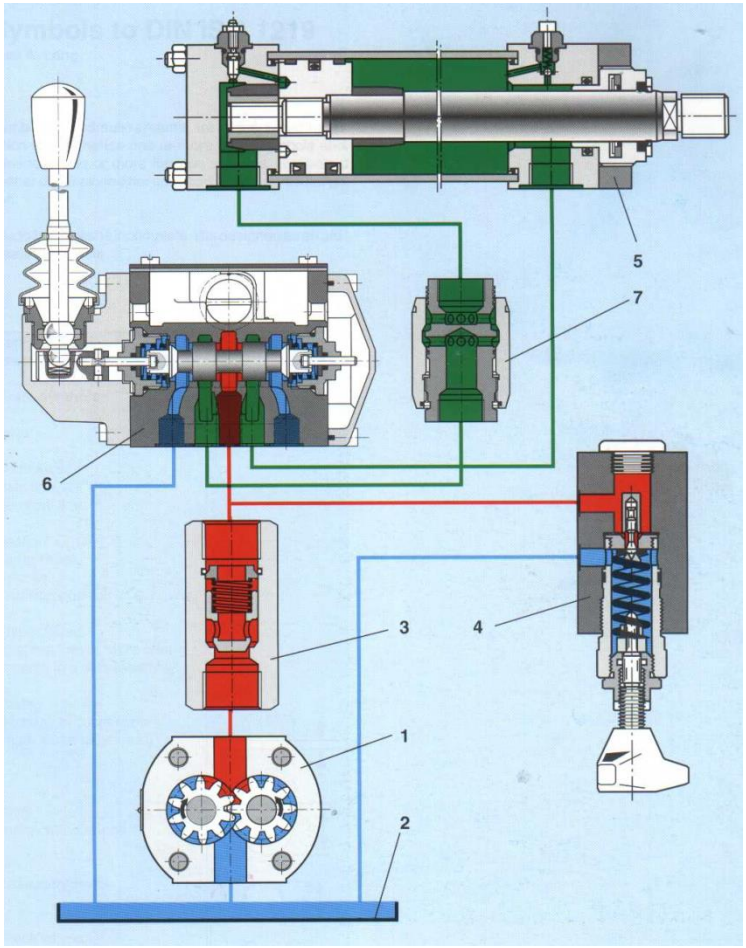


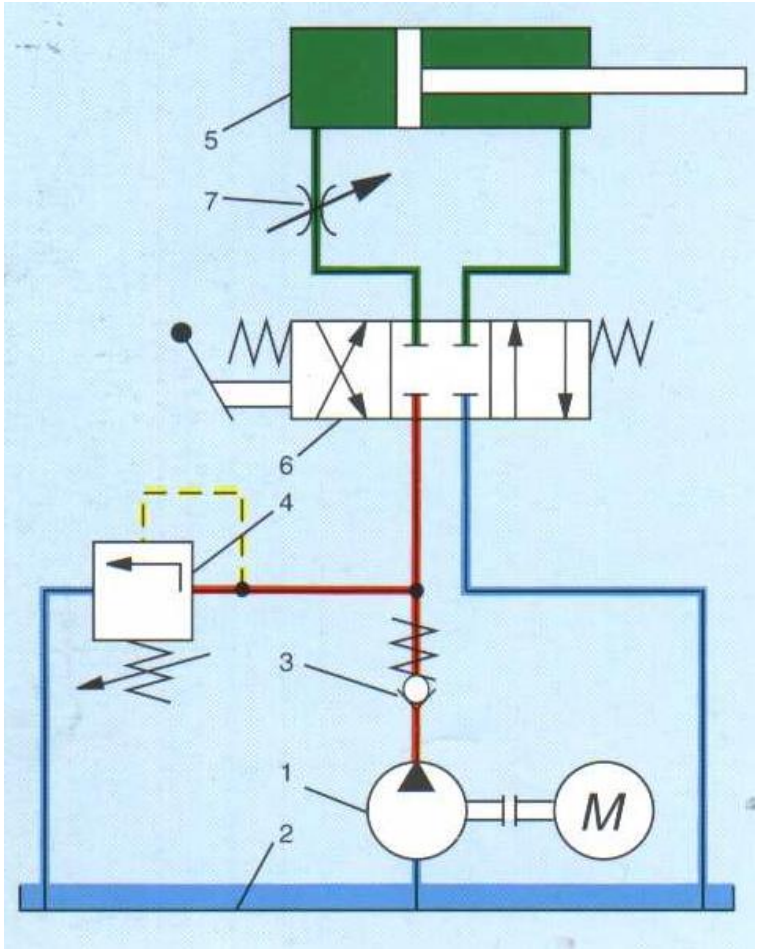


# Components of a Fluid Power System





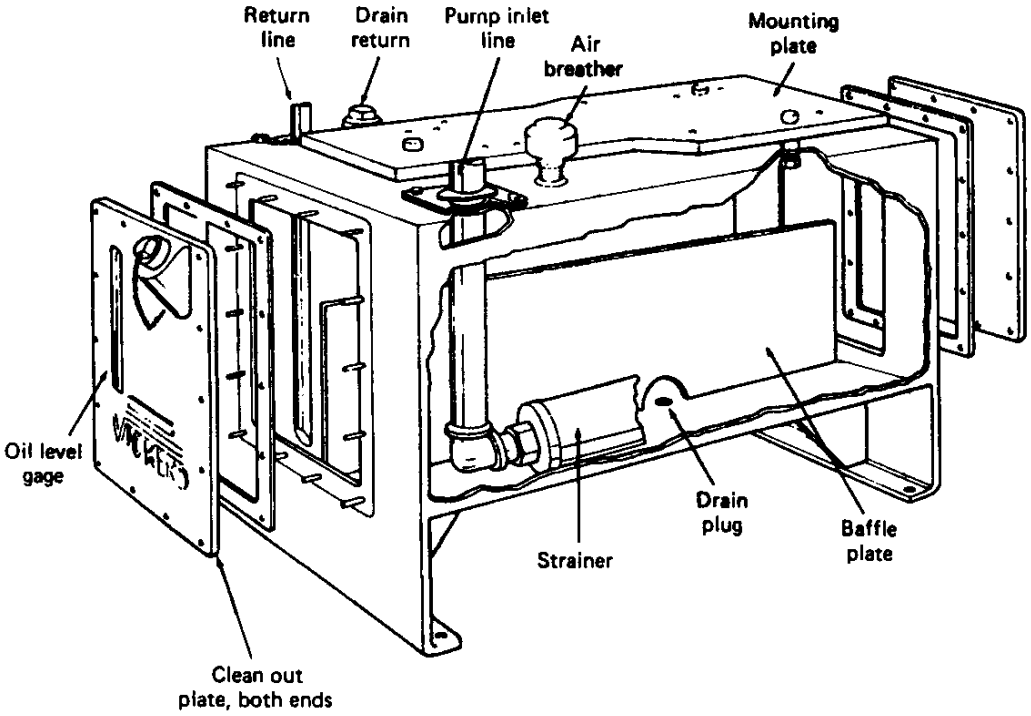



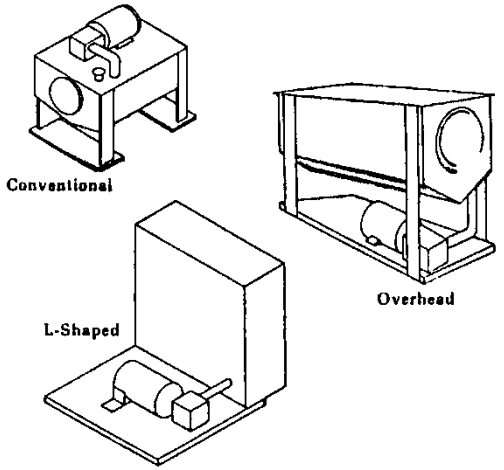
# Components of a Fluid Power System

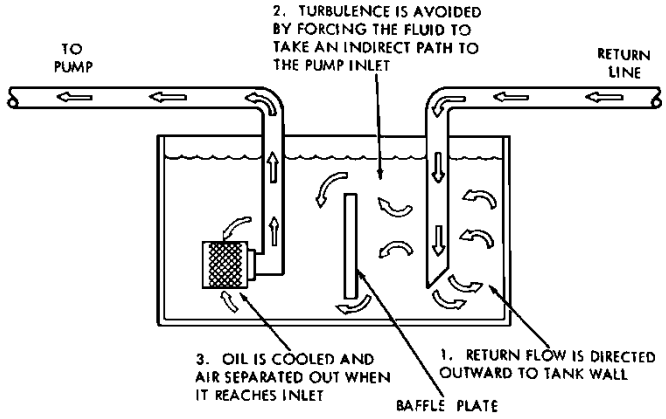


## Reservoir System

Hydraulic Reservoir Symbol



# Components of a Fluid Power System



## Hydraulic Fluids

Theoretically, any fluid can be used as the operating medium in hydraulic systems since they all follow Pascal's Law.

### Requirements of Hydraulic Fluids

1. Good lubricity
2. No corrosion of materials
3. Good viscosity-temperature characteristics
4. Good resistance to oxidation and thermal loading
5. low compressibility
6. Minimum foaming
7. high specific gravity
8. Good thermal conductance
9. Fire resistance for special applications
10. Non-toxic
11. cheap
12. Wide availability
13. Low maintenance cost
14. Easy disposal

# Components of a Fluid Power System



## Hydraulic Fluids - Selection of Hydraulic Fluid

### Viscosity

1. If the viscosity is too high; Cold starting of the hydraulic system will be difficult, control will be sluggish and the air separation capacity will be poor.
2. If the viscosity is too low there will be excessive leakage, more wear and severe overheating of the fluid.
3. The viscosity falls as the temperature rises.
4. The viscosity-pressure behavior of hydraulic fluids is of more importance when operating pressures are higher.

### Pour Point

Pour point is the lowest value of temperature at which the fluid will still flow. In selecting a hydraulic fluid, remember that the minimum permitted temperature in the hydraulic system must be at least 8°C above the pour point.

# Components of a Fluid Power System



## Hydraulic Fluids - Selection of Hydraulic Fluid

### Foaming

Foaming due to the air bubbles that rise to the surface of the fluid must be kept to a minimum through careful design of the tank. Although hydraulic fluids contain anti-foaming additives, impurities such as water, dirt and the products of ageing increase the tendency of the fluid to foam.

### Demulsifying Capacity

The demulsifying capacity of a fluid is the time taken by a mixture of fluid and water to separate into its two components. Any water that penetrates into hydraulic fluid must be removed as quickly as possible because it has an adverse effect on the viscosity and corrosion protection and causes deposits.

# Components of a Fluid Power System



## Hydraulic Fluids - Selection of Hydraulic Fluid

### Resistance to Oxidation

The oxidation stability is the ability of the fluid to resist chemical degradation by reaction with atmospheric oxygen. The degradation of hydraulic fluids by oxidation can result in significant viscosity increases, development of corrosive organic acids, and lacquering of critical surfaces by resinous oxidation products.

### Corrosion Protection

Hydraulic fluid not only has to prevent the rusting of steel components, it also has to be compatible with non-ferrous metals and alloys. Hydraulic fluids, which attack lead or bearing materials containing lead, should not be used

# Components of a Fluid Power System



## Hydraulic Fluids - Types of Hydraulic Fluids

1. Petroleum-base hydraulic oils,
2. Synthetic fluids (Fire-Resistant Fluids),
3. Water glycol fluids (Fire-Resistant Fluids),
4. Oil-in-water and water-in-oil emulsions (Fire-Resistant Fluids),
5. High water content fluids (HWCF) (Fire-Resistant Fluids),
6. Resistance to Oxidation (Fire-Resistant Fluids).