

Fluid power

* Definition Pg 2

It is the technology that deals with the generation, control and transmission of power using pressurized fluids.

* Advantages Pg 6

- ① Ease and accuracy of Control.
- ② Multiplication of force.
- ③ Constant force or torque.
- ④ simplicity, safety and economy.
- ⑤ protection against overloads.
- ⑥ infinitely variable speed Control.
- ⑦ have the highest horsepower-per-weight ratio of any known power source.

* Drawbacks Pg 11

- ① Hydraulic oils are messy
- ② leakage is impossible to eliminate completely.
- ③ Hydraulic lines can burst (high speed oil + flying pieces of metal).
- ④ loud noise (from pumps ---) (loss of hearing).
- ⑤ Most hydraulic oils can cause fires if an oil leaks in an area of hot equipment.

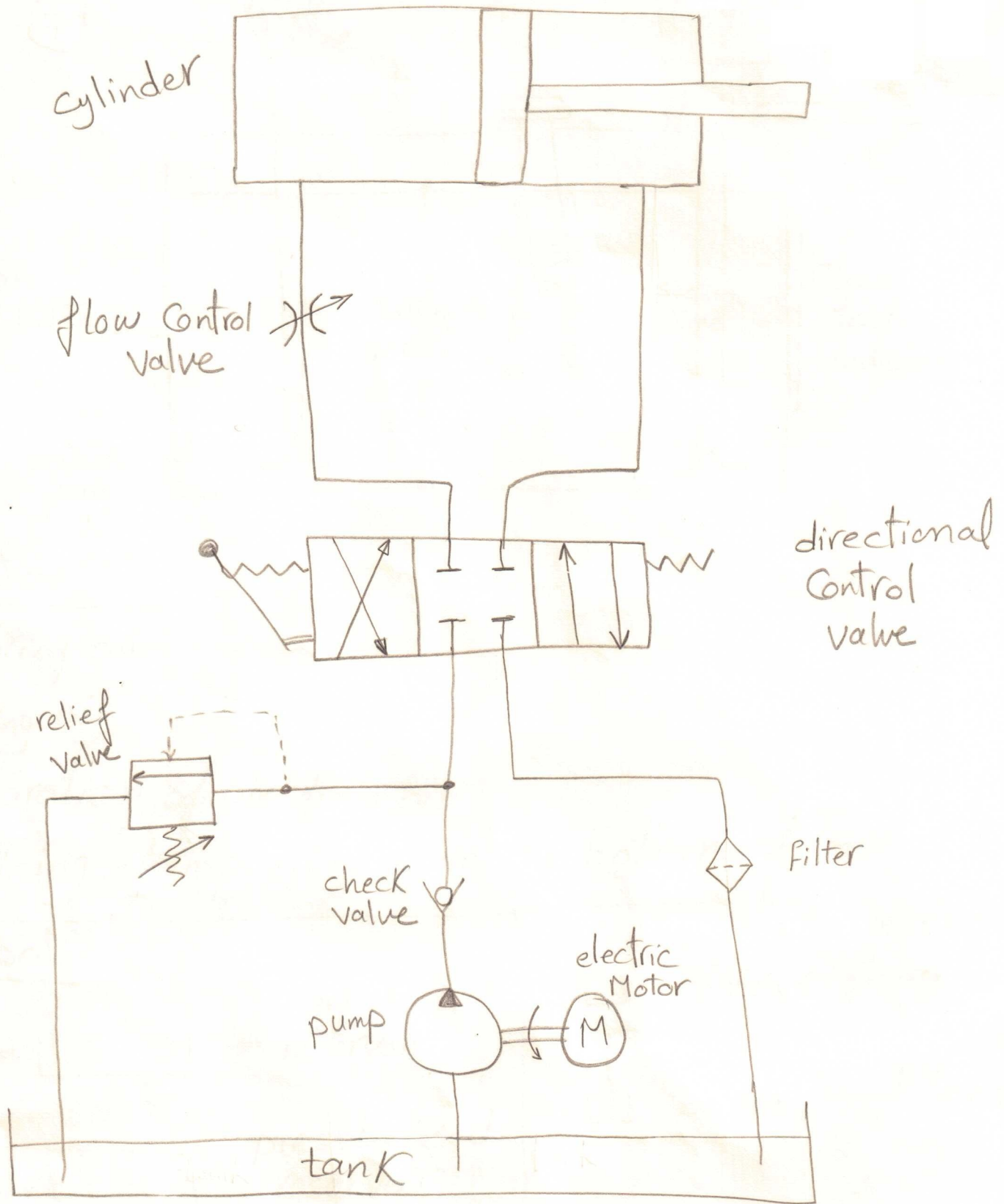
* Applications Pg 11

- ① Fluid power drives high-wire overhead tram
- ② ~ ~ is applied to harvesting Corn.
- ③ Hydraulics power brush drives. ماكينة تنظيف الطرق
- ④ Fluid power positions and holds parts for welding
- ⑤ ~ ~ performs bridge maintenance.
- ⑥ ~ ~ is the muscle in industrial lift trucks.
- ⑦ ~ ~ drives front-end loaders.
- ⑧ Hydraulics power robotic dextrous arm.

* Components of fluid power system

a) Hydraulic system: ~~six~~ basic components. Pg 18

- ① A tank (reservoir) to hold ^②the hydraulic oil.
- ③ A pump to force the liquid through the system.
- ④ An electric motor or other power source to drive the pump.
- ⑤ valves to control liquid direction, pressure, and flow rate.
- ⑥ An actuator to convert the energy of ^{the} liquid into mechanical force or torque to do useful work. (linear - cylinders)
(rotary - hydraulic motors)
- ⑦ piping, which carries the liquid from one location to another.



Hydraulic circuit

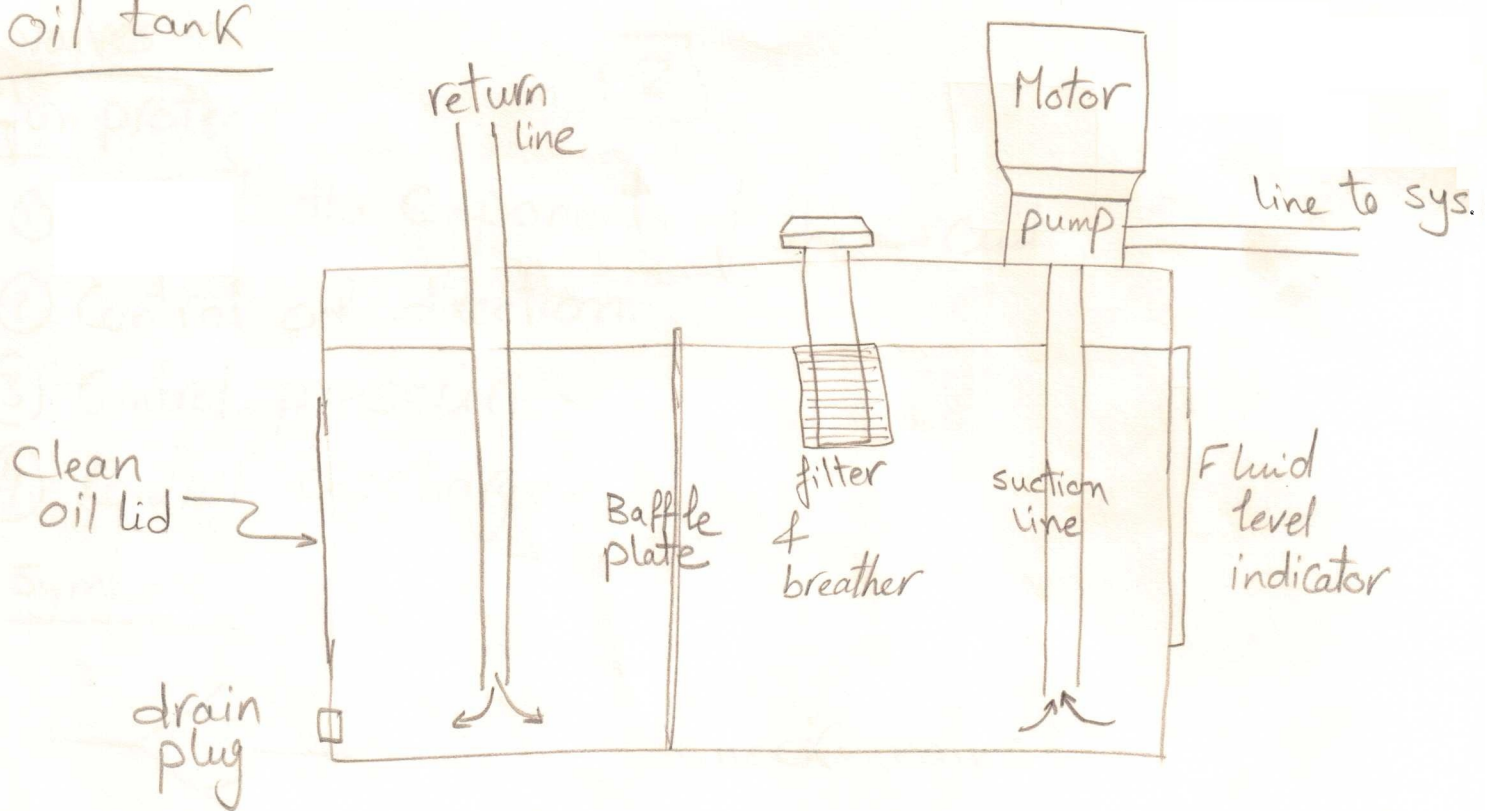
6) Pneumatic system

- ① An air tank to store a given volume of Compress air.
- ② A Compressor to Compress the air that Comes directly from the atmosphere.
- ③ An electric motor or other prime mover to drive the Compressor.
- ④ Valves to Control air direction, pressure and flow rate.
- ⑤ Actuators, which are similar in operation to hydraulic actuators.
- ⑥ piping to Carry the pressurized air from one location to another

A *Hydraulic Fluid functions ^{Pg 34} 2 A *Hydraulic Fluid properties

- | | |
|--|--|
| <ol style="list-style-type: none">① transmit power② lubricate moving parts③ seal clearances between mating parts.④ dissipate heat⑤ prevent Corrosion | <ol style="list-style-type: none">① Good Lubricity② Ideal viscosity③ chemical and environmental stability④ Compatibility with system materials⑤ High degree of incompressibility⑥ Fire resistance⑦ Good heat transfer capability⑧ low density⑨ Foam resistance⑩ Nontoxicity⑪ low volatility⑫ Inexpensive⑬ Ready availability |
|--|--|

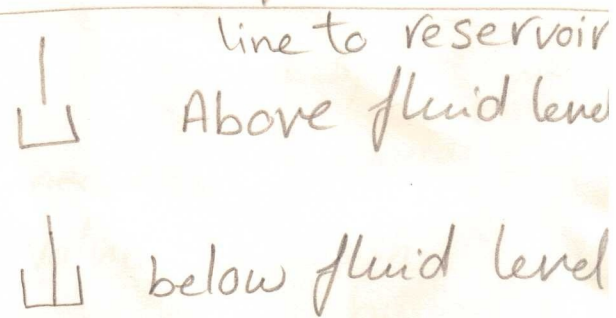
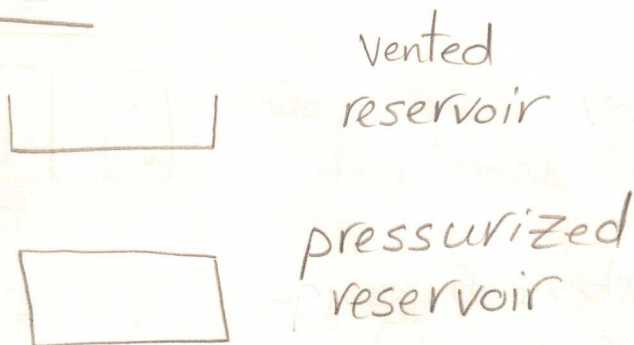
① Oil tank



* function

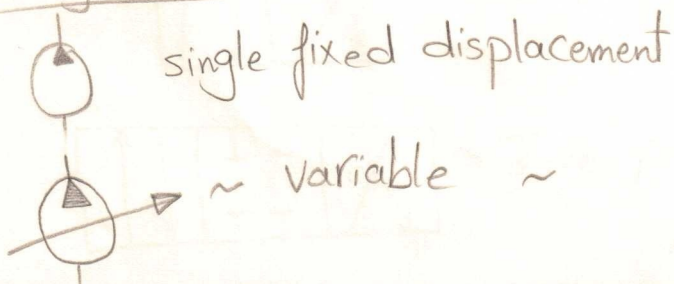
- ① storing oil
- ② Cooling oil
- ③ separation of air from oil
- ④ draining of impurities from the bottom of tank.

* Symbols



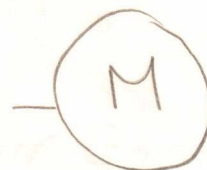
③ pump

* symbols



④ Electric Motor

* symbol



⑤ valves

* function

- ① protect the Components of the circuit.
- ② Control oil direction.
- ③ Control pressure
- ④ Control discharge.

* Symbols

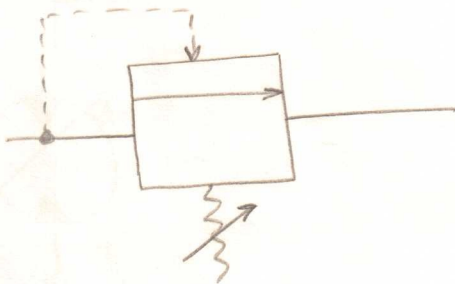


check valve

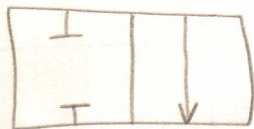


Flow Control valve

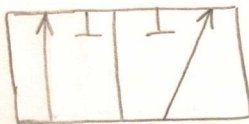
≡ fixed restriction



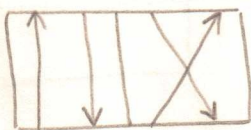
relief valve



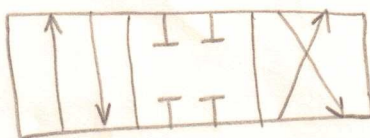
Two position - Two Connections
directional Control Valve



Two position - three Connections
directional Control Valve



Two position - four Connections



Three position - four Connections

spring

manual

push button

push-pull lever

mechanical

solenoid

pilot Control

⑥ Actuators

* function

They transfer Hydraulic energy into mechanical energy
They Contains two types.

① Hydraulic motors

hydraulic energy $\longrightarrow$ rotation motion

② Hydraulic cylinders

Hydraulic energy $\longrightarrow$ translation motion

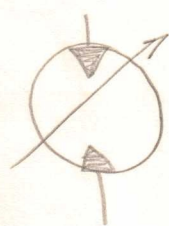
* Symbols



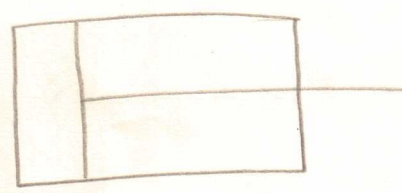
Hyd. Motor - fixed displacement - reversible



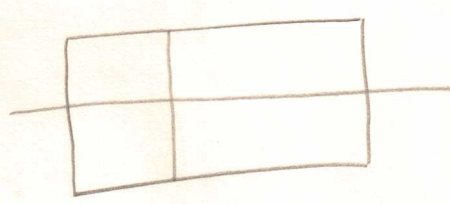
~ ~ ~ ~ ~ Non-reversible



~ ~ variable ~ reversible.



cylinder double acting
Differential



non - differential

⑦ piping

* function

Transmitting oil between the hydraulic circuit components.

* symbols

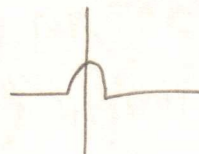
 working line

 pilot line

 connector

 flexible line

 joining line

 passing line