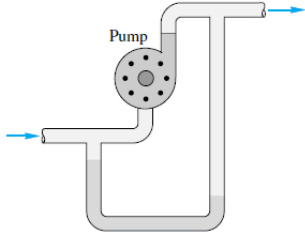
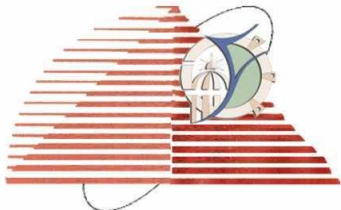


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

***Mechanical
Engineering
(2)***



Fayoum University



**Faculty of Engineering
Mechanical Engineering Dept.**

***Lecture (7)
on***

***Application of Fluid
Mechanics***
(Hydraulic and Pneumatic Control Systems)

By

Dr. Emad M. Saad

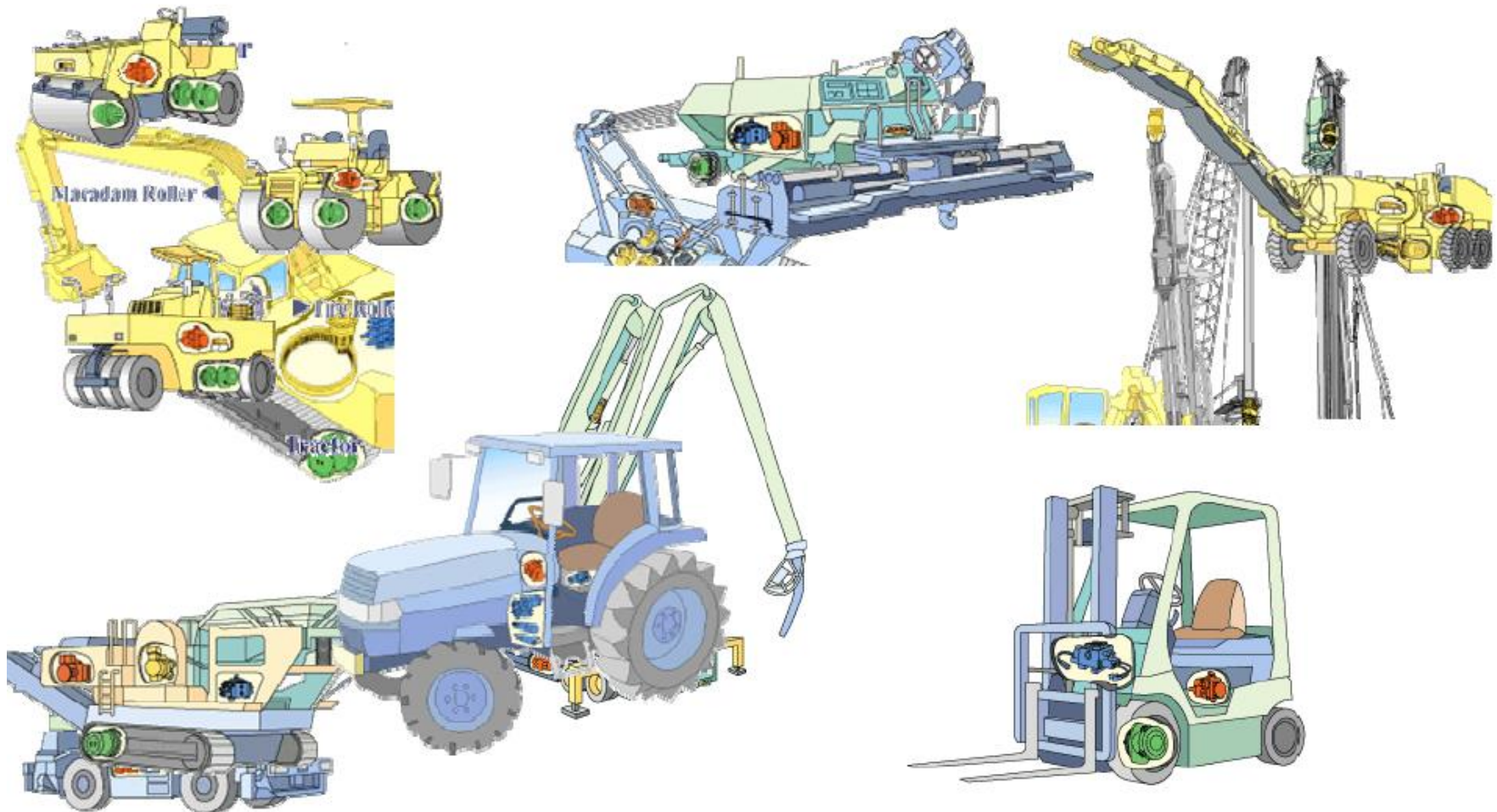
*Mechanical Engineering Dept.
Faculty of Engineering
Fayoum University*

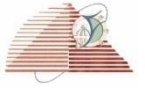
2015 - 2016



Applications of Fluid Power: *Mobile Hydraulics*

3





Applications of Fluid Power: *Industrial Hydraulics*

4

The following application areas are important for stationary hydraulics:

- 1. Production and assembly machines of all types**
- 2. Transfer lines**
- 3. Lifting and conveying devices**
- 4. Presses**
- 5. Injection molding machines**
- 6. Rolling lines**
- 7. Lifts**

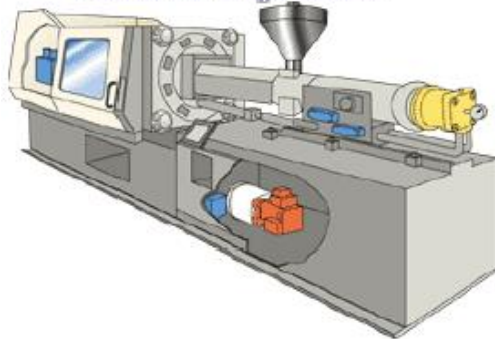




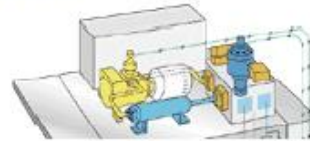
Applications of Fluid Power: *Industrial Hydraulics*

5

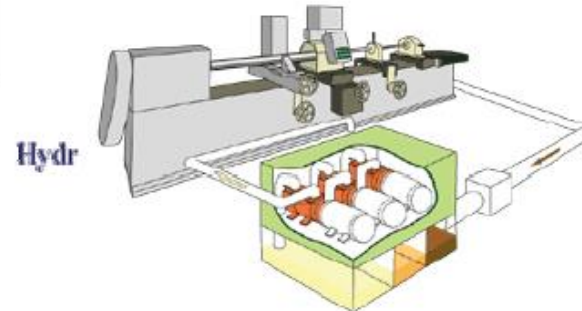
Plastics Molding Machine



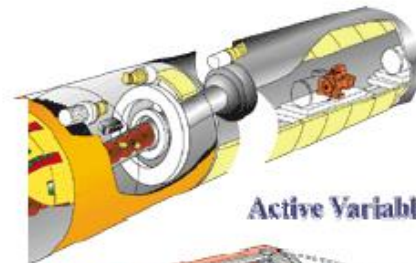
Press Machine



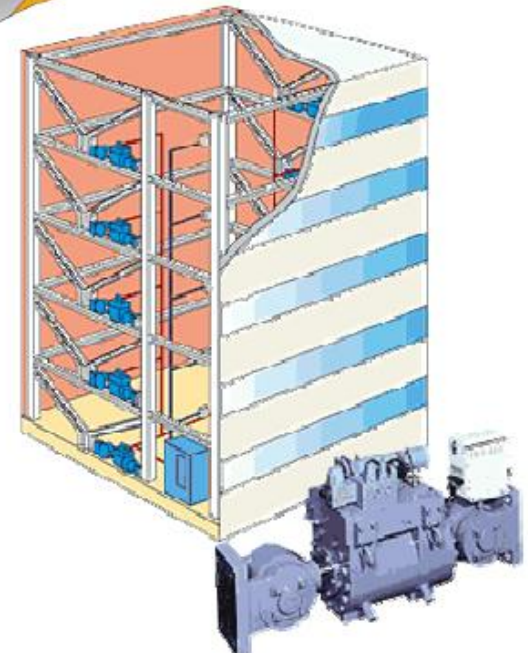
Machine Tool



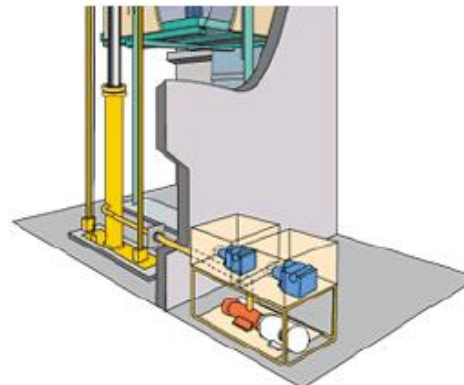
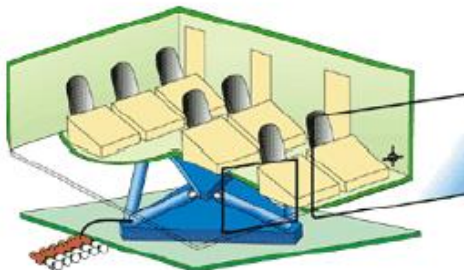
Tunnel Boring Machine



Active Variable Damping System



Amusement Machine

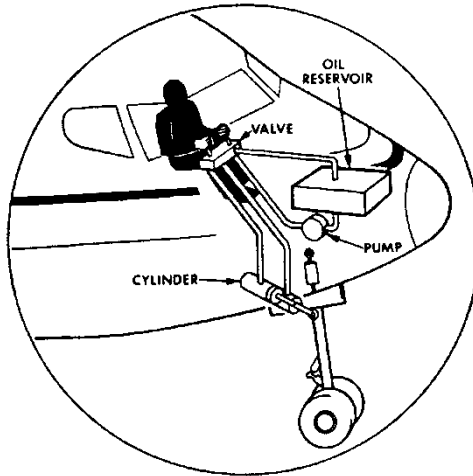




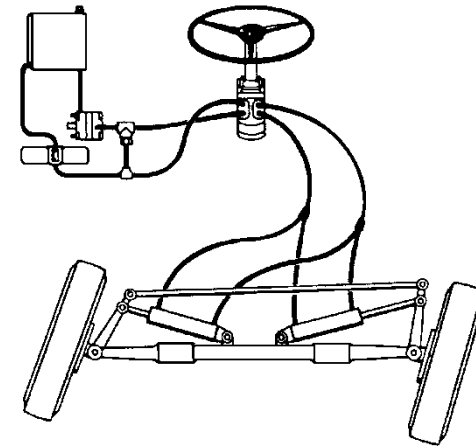
Hydraulic and Pneumatic Control Systems

6

Applications of Fluid Power



Hydraulic operation of aircraft landing gear



Power steering control system for off-highway vehicles

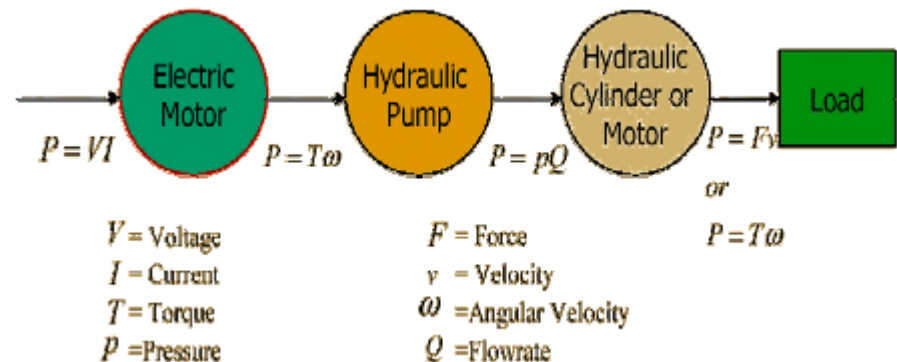
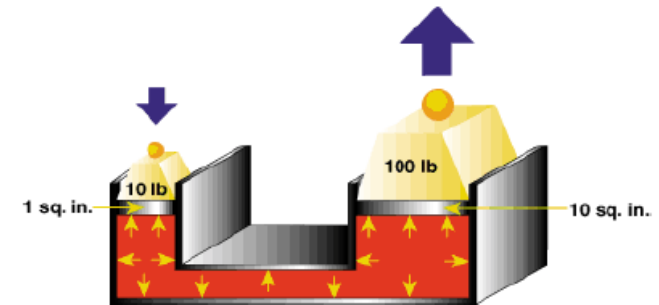
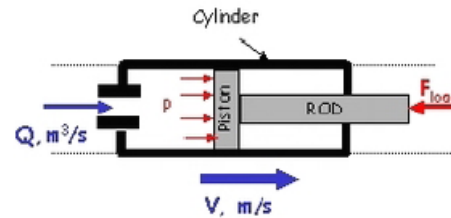


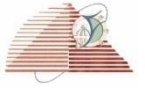


Fluid Power Theories & Physics

7

1. Continuity Equation
2. Power Analogy
3. Bernoulli's Equation
4. Viscosity
5. Atmospheric and Gage Pressures
6. Conversion of fluid pressure . . .
7. Pascal's Law
8. Typical hydraulic system





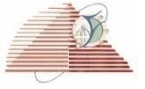
Fluid Power Advantages

8

hydraulics is concerned with the transmission of force and power by means of the static pressure of a fluid. The tasks are performed by hydraulic systems which, in the market place, are in competition with mechanical, electrical and pneumatic systems.

1. Transmission of high forces within a small space
2. Energy storage capability
3. Stepless variation in motive quantities, such as speeds, forces and torques
4. Easy monitoring of forces
5. Rapid reversal due to low component masses (low inertia)
6. Fast operating response
7. Uniform motion (free from shock and chatter)
8. Wide transmission ratio



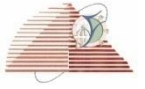


Fluid Power Advantages

9

8. Simple conversion from rotary to linear motion or vice versa
9. Design freedom in the arrangement of components
10. Physical separation of drive input and output by pipes or hoses
11. Automatic control of all types of motion by pilot valves and electric signals
12. Easy usage of standard components and sub-assemblies
13. Overload protection
14. Minimum wear rates because hydraulic components are lubricated by the operating medium
15. Long service life
16. Energy recovery capability





Fluid Power Disadvantages

10

1. Pressure and flow losses in pipes and control devices (fluid friction)
2. Fluid viscosity sensitive to temperature and pressure
3. Leakage problems (external and internal)
4. Compressibility of the hydraulic fluid





Comparison of Electrical, Hydraulic and Pneumatic Systems

11

	ELECTRICAL	HYDRAULIC	PNEUMATIC
ENERGY SOURCE	Electrical power station	Electric motor or Diesel engine	
ENERGY STORAGE	Limited (batteries)	Limited (accumulator)	Good (reservoir)
DISTRIBUTION SYSTEM	Excellent with minimum losses	Limited	Good (plant wide)
ENERGY COST	Lowest	Medium	Highest
ACTUATOR	AC motors cheap, Good speed control in DC motors, Short linear motion with solenoids	Low speed with good control	Wide speed range, speed control difficult
FORCE AVAILABLE	Low	High	Medium
HAZARDS	Electric shock	Oil leakage dangerous and unsightly	Noise

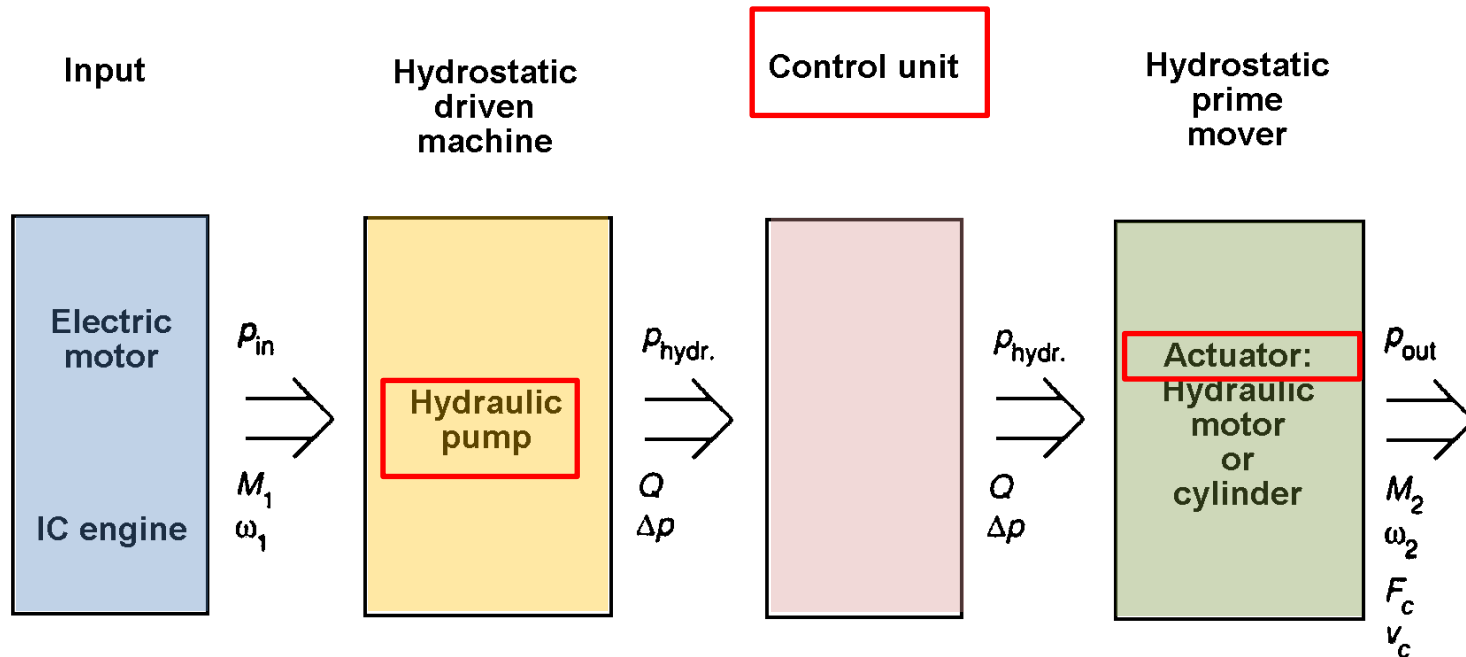




Hydraulic and Pneumatic Control Systems

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Hydraulic system

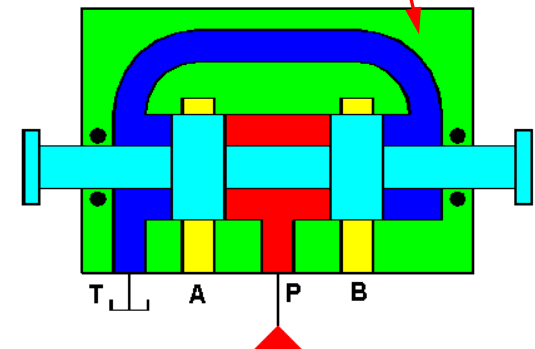
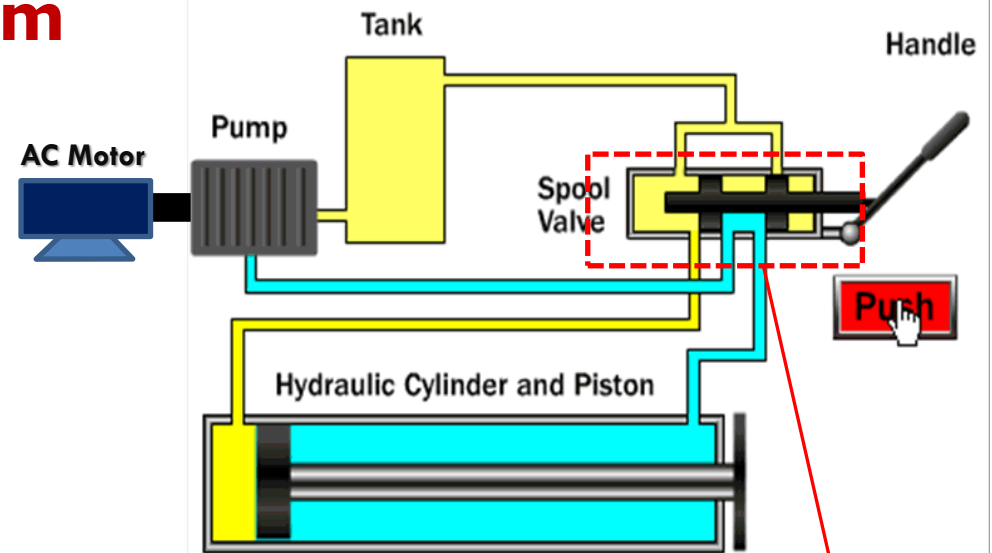
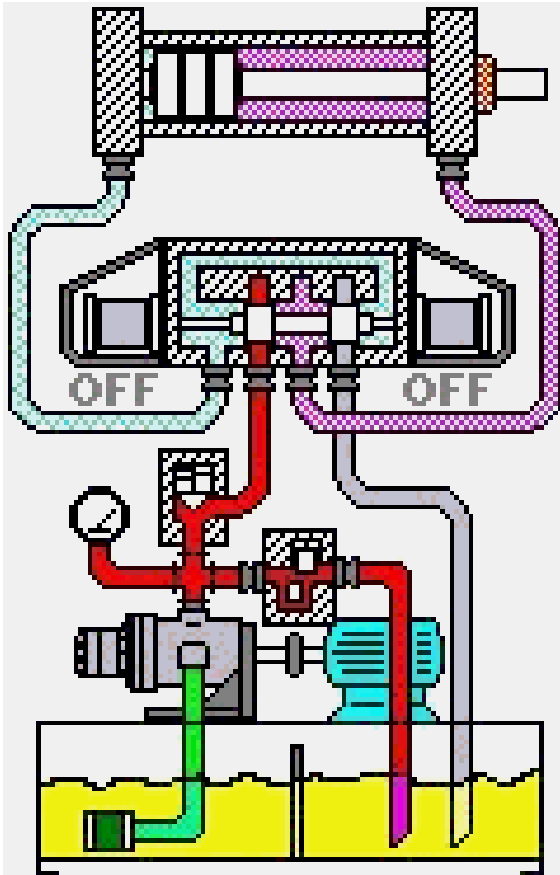




Hydraulic and Pneumatic Control Systems

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Basic hydraulic system





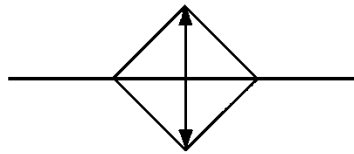
Hydraulic and Pneumatic Control Systems

14

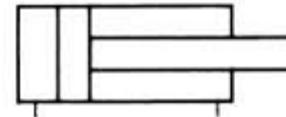
Fluid Power Symbols



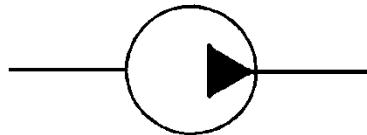
Hydraulic Reservoir Symbol



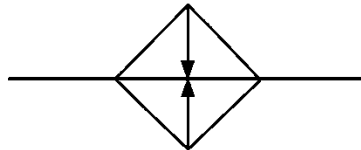
Cooler symbol



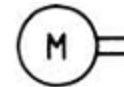
DOUBLE ACTING CYLINDER



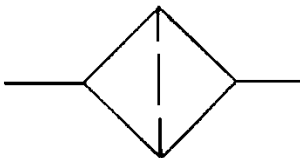
Hydraulic Pump Symbol



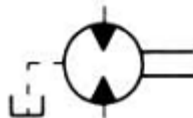
Heater symbol



ELECTRIC MOTOR



Filter Symbol



FIXED DISPLACEMENT REVERSIBLE
MOTOR WITH DRAIN

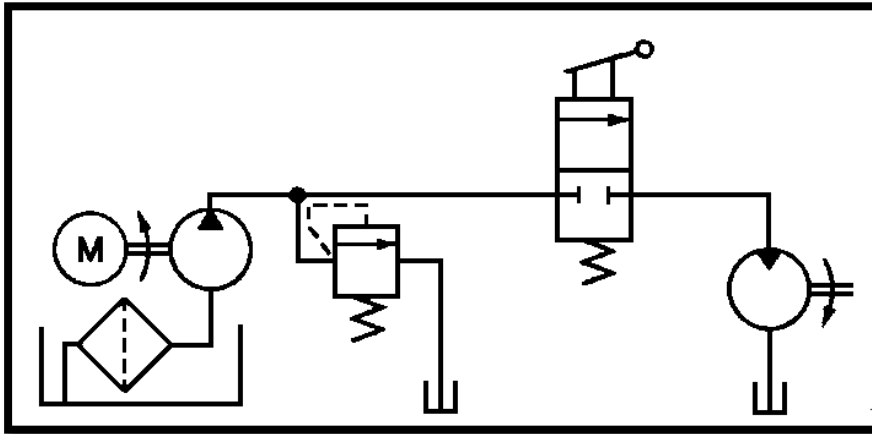




Hydraulic and Pneumatic Control Systems

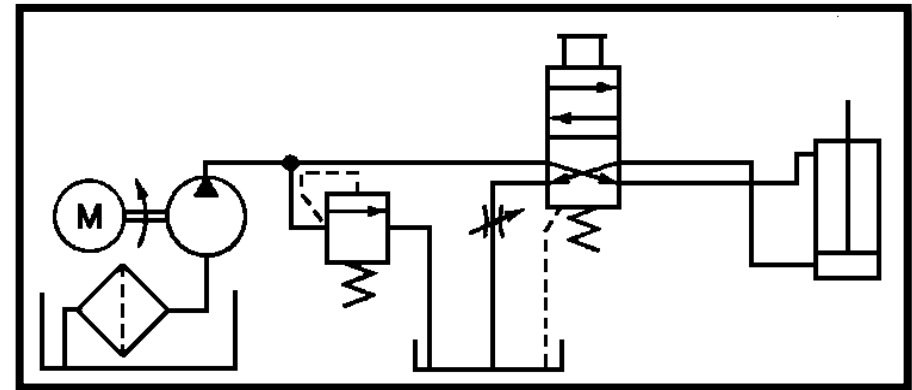
15

Basic hydraulic system



Basic hydraulic system with rotary hydraulic actuator (motor)

Basic hydraulic system with linear hydraulic actuator (cylinder)

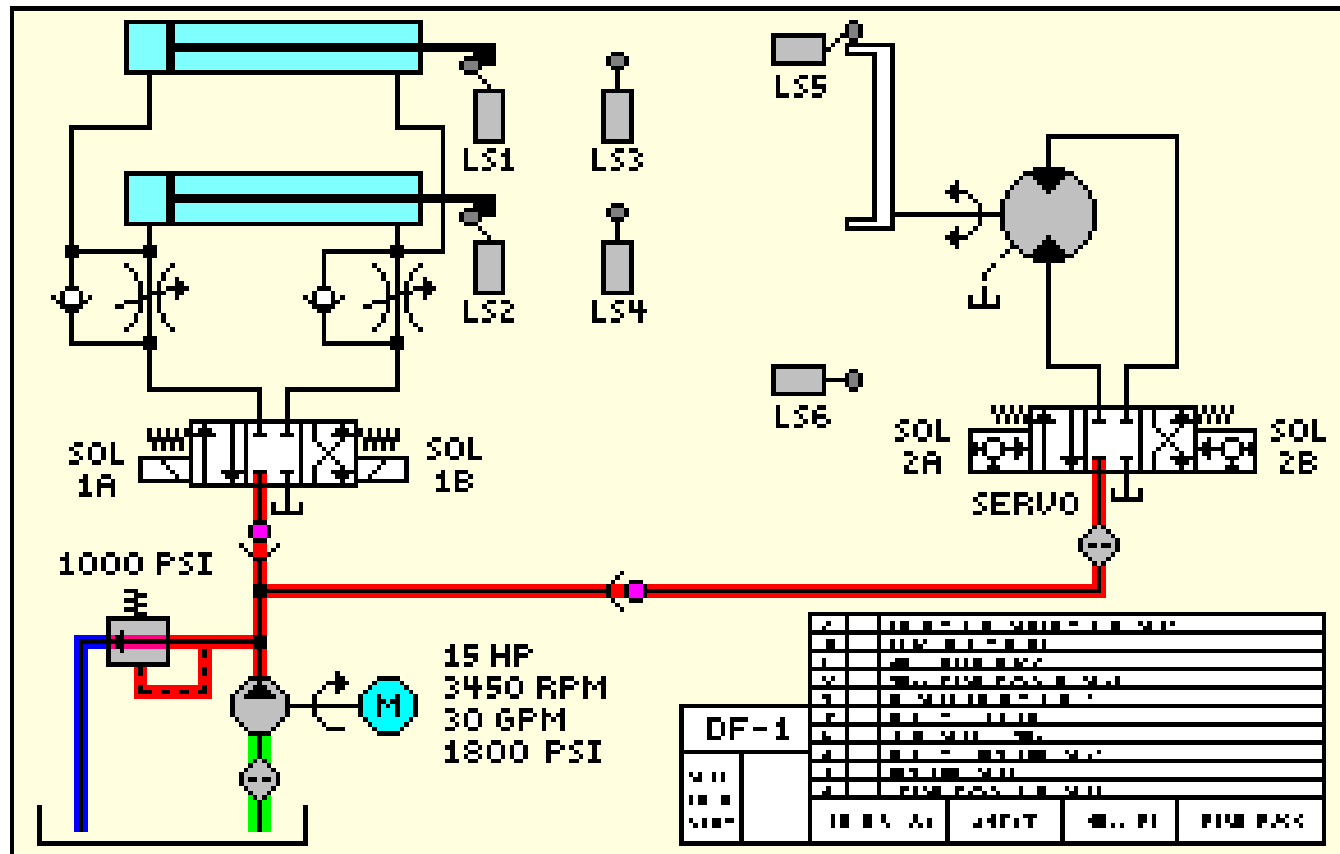




Hydraulic and Pneumatic Control Systems

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Basic hydraulic system

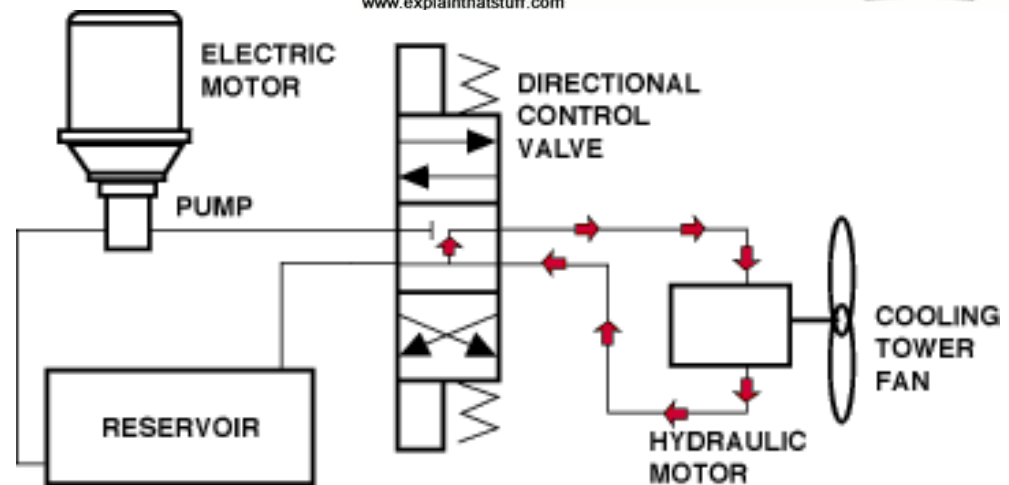
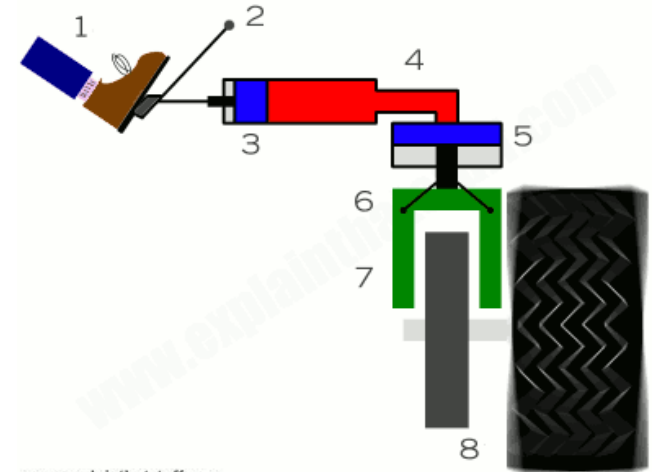
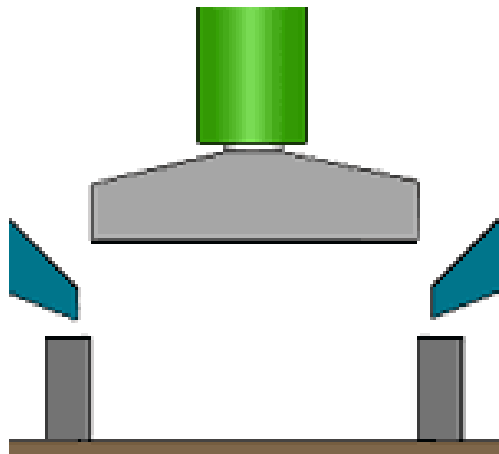
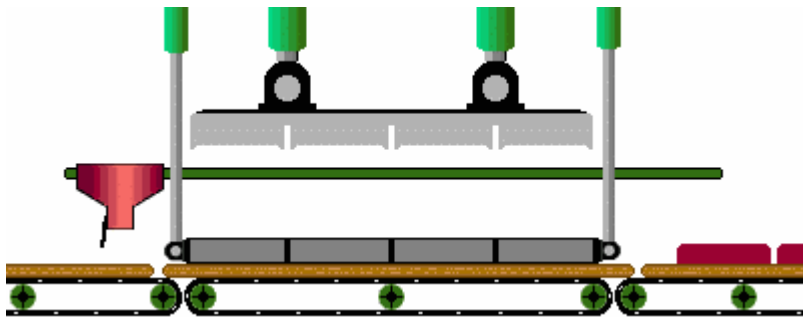




Hydraulic and Pneumatic Control Systems

17

Basic hydraulic system



Thank
You