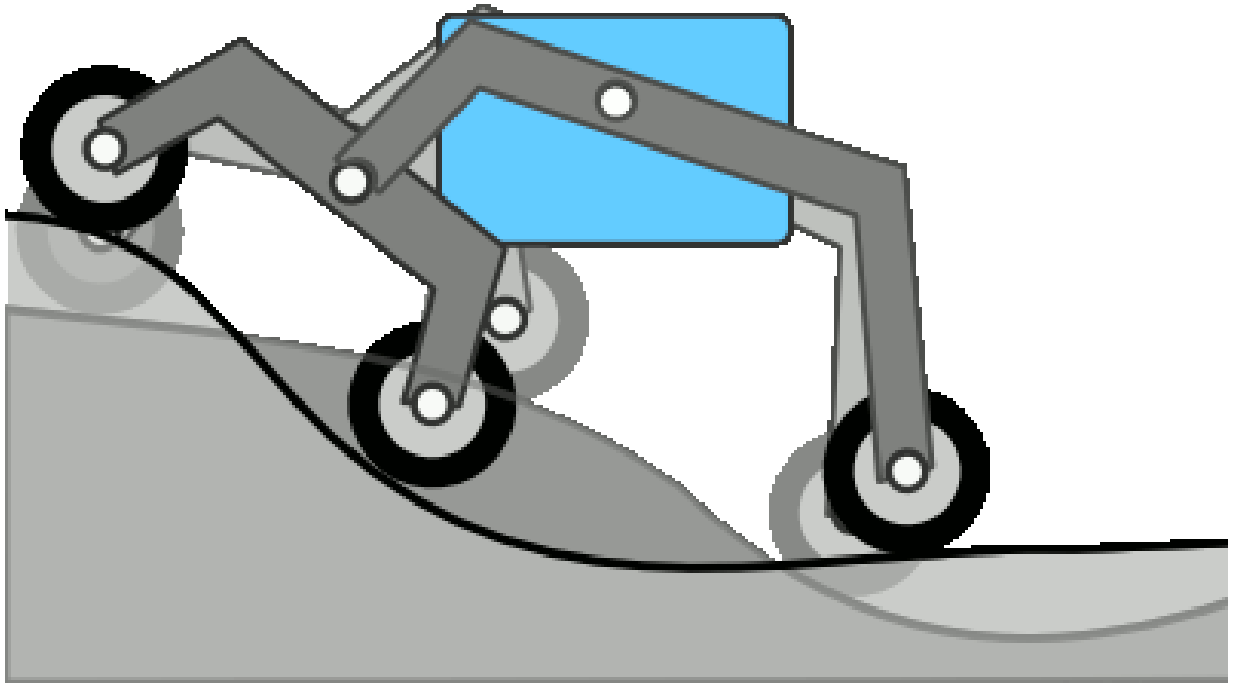
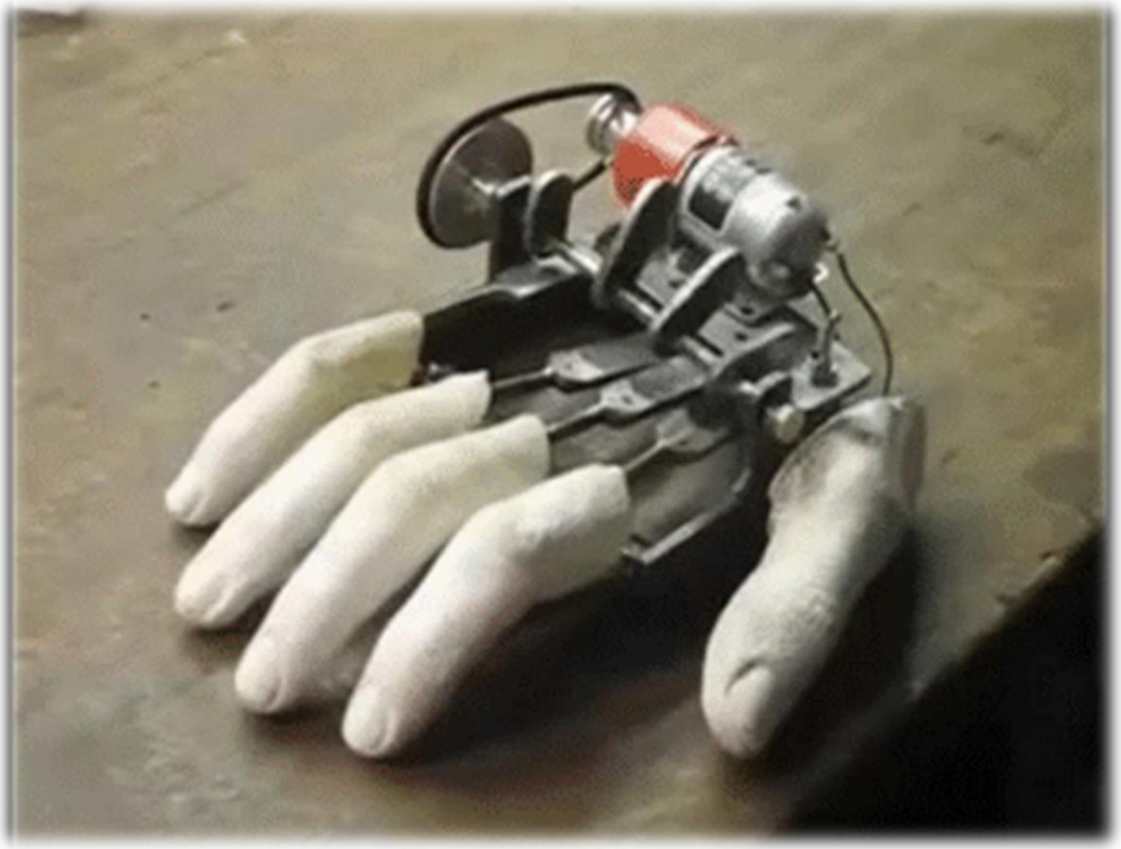
Mechanism

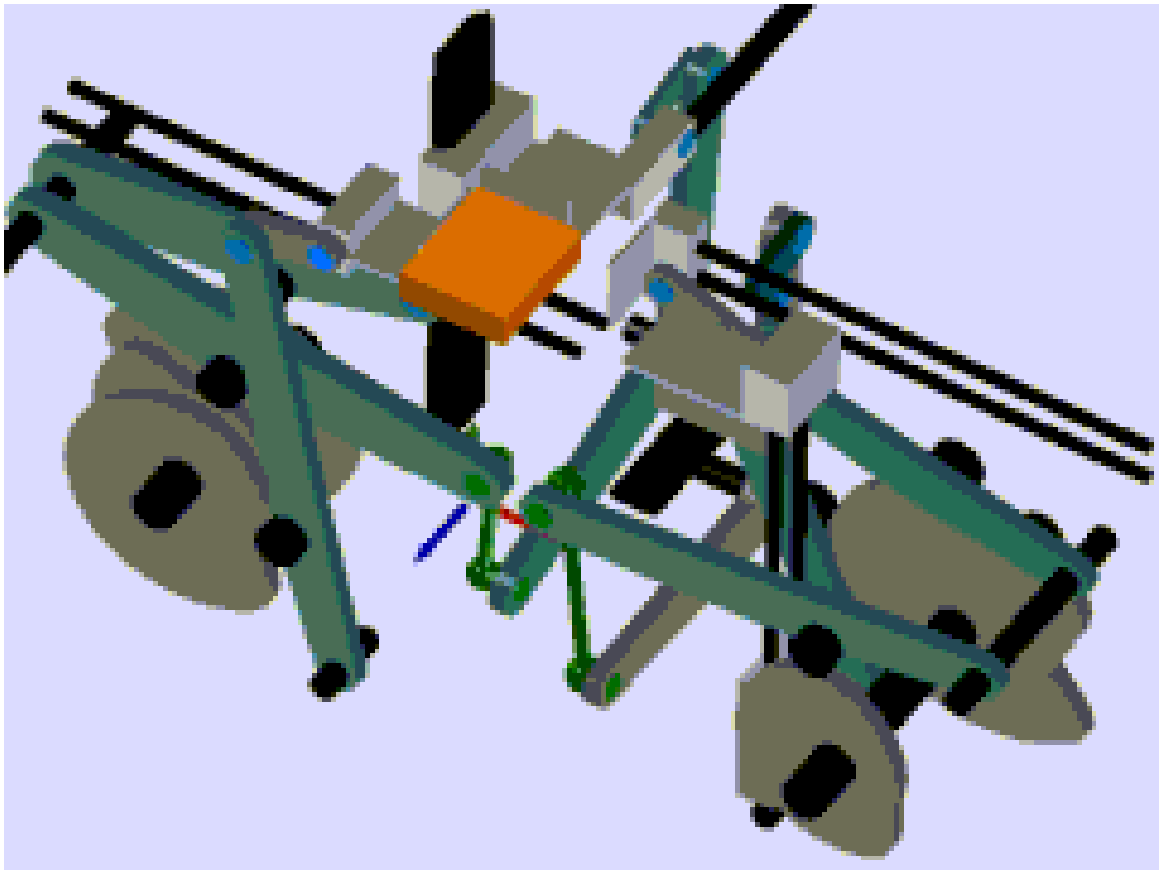


Theory of Machine Working

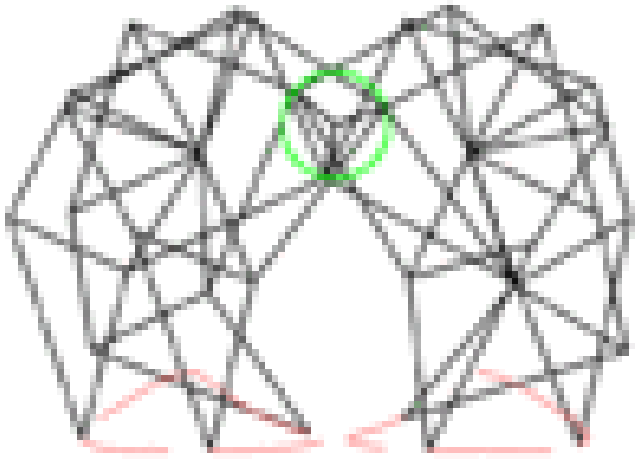
Mechanism



Theory of Machine Working



Mechanism



Theory of Machine Working

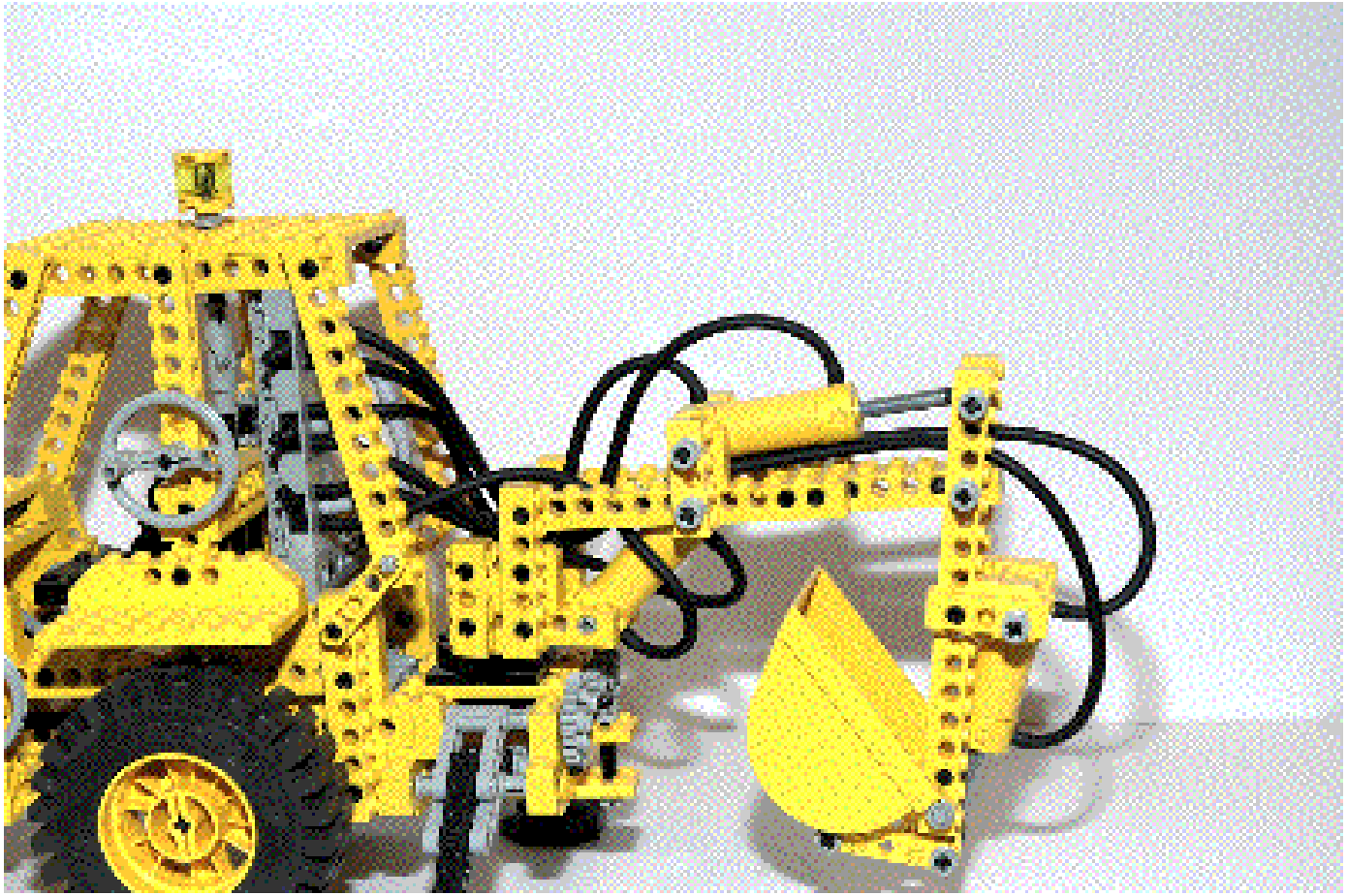
Mechanism

Theory of Machine Working

Mechanism

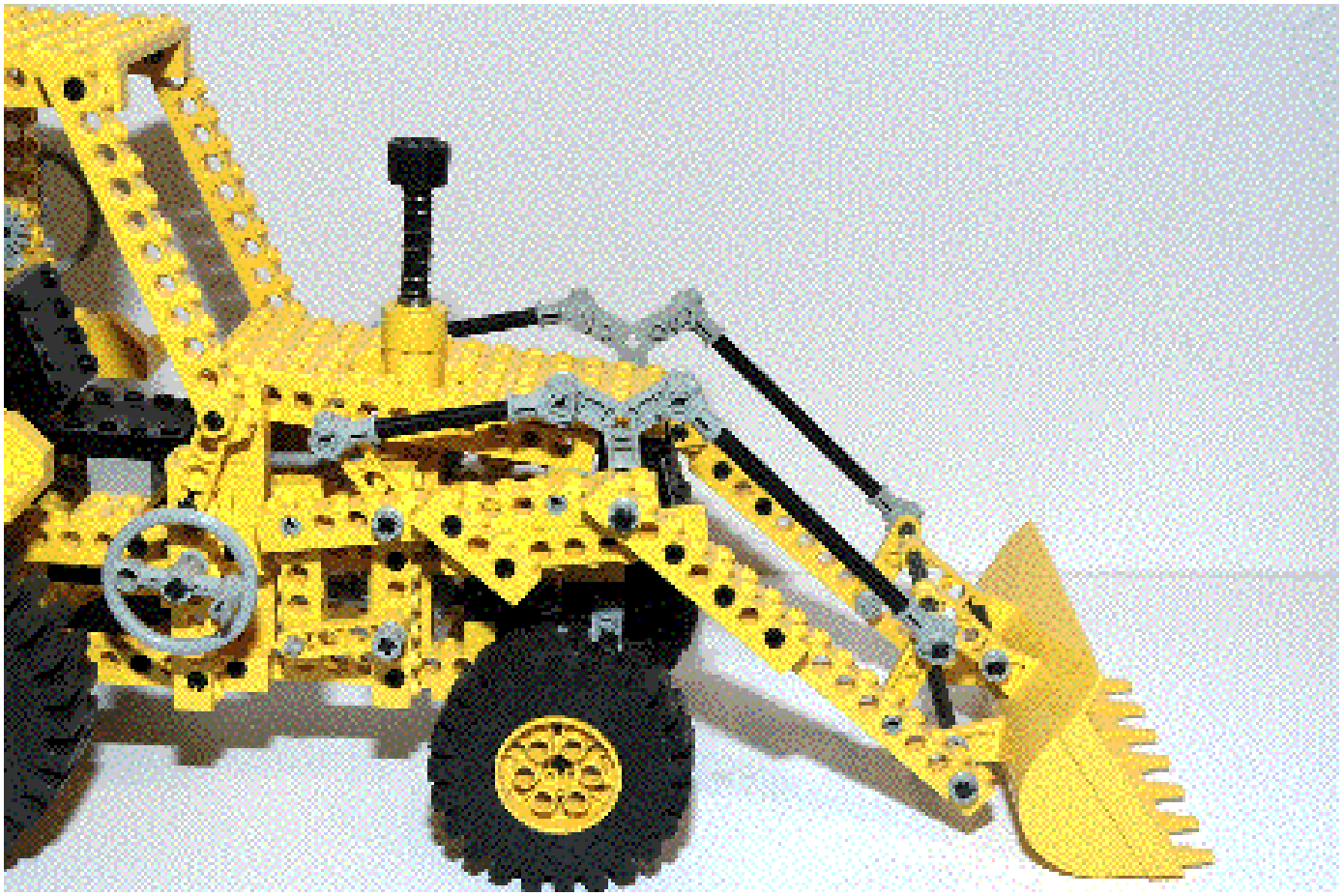
Theory of Machine Working

Mechanism



Theory of Machine Working

Mechanism

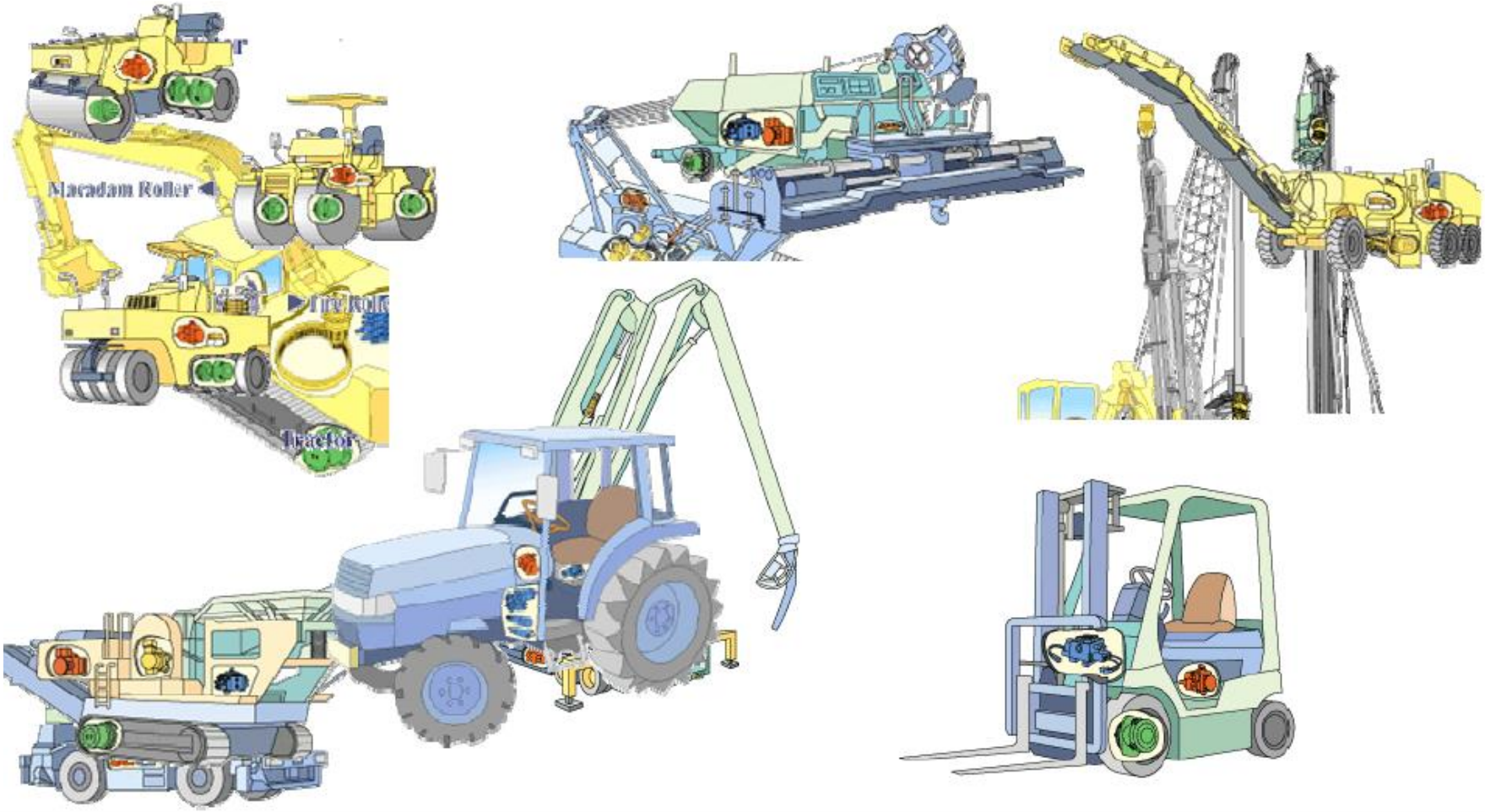


Theory of Machine Working

Controller

Controllers combine sensors, logic, and actuators to maintain the performance of components of a machine. Perhaps the best known is the fly ball governor for a steam engine. Examples of these devices range from a thermostat that as temperature rises opens a valve to cooling water to speed controllers such the cruise control system in an automobile. The programmable logic controller replaced relays and specialized control mechanisms with a programmable computer. Servomotors that accurately position a shaft in response to an electrical command are the actuators that make robotic systems possible.

Applications of Fluid Power: *Mobile Hydraulics*



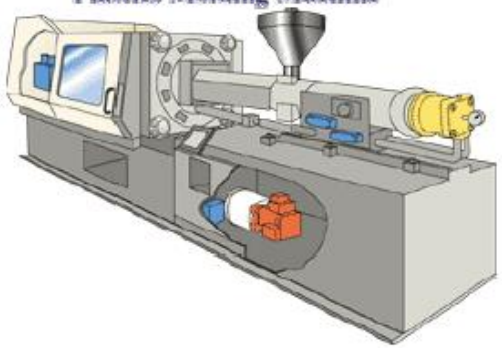
Applications of Fluid Power: *Industrial Hydraulics*

The following application areas are important for stationary hydraulics:

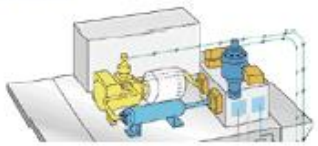
1. Production and assembly machines of all types
2. Transfer lines
3. Lifting and conveying devices
4. Presses
5. Injection molding machines
6. Rolling lines
7. Lifts

Applications of Fluid Power: *Industrial Hydraulics*

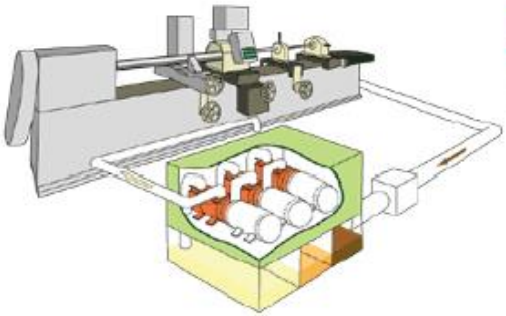
Plastics Molding Machine



Press Machine

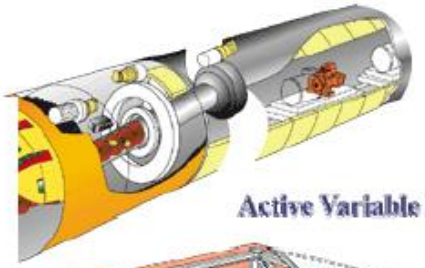


Machine Tool

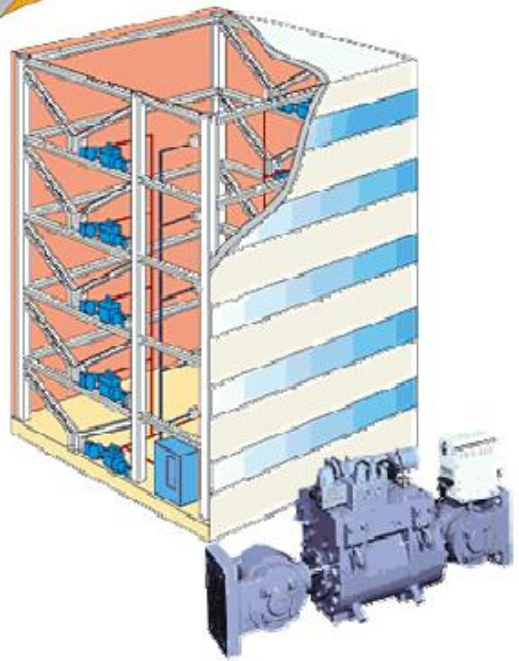


Hydr

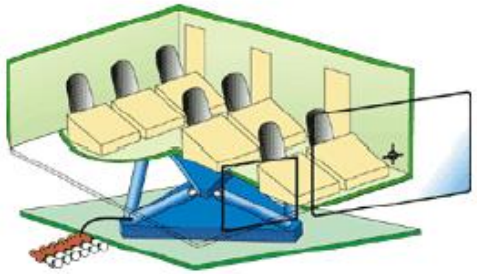
Tunnel Boring Machine

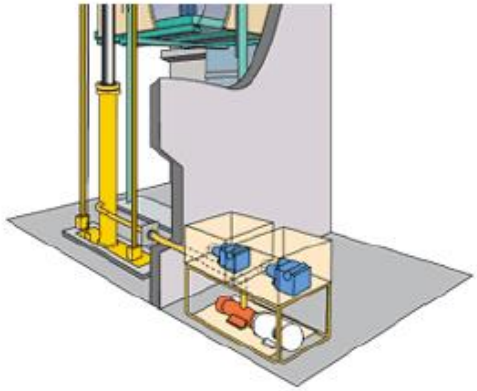


Active Variable Damping System

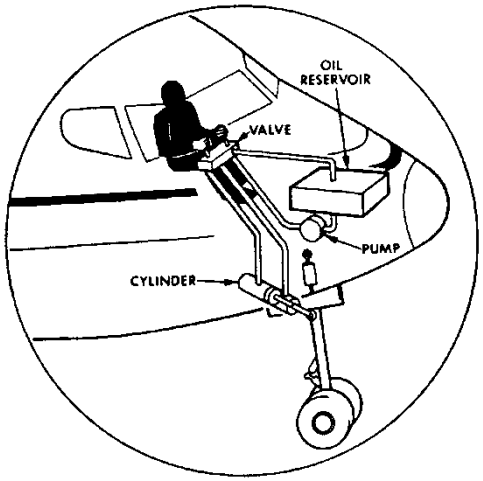


Amusement Machine

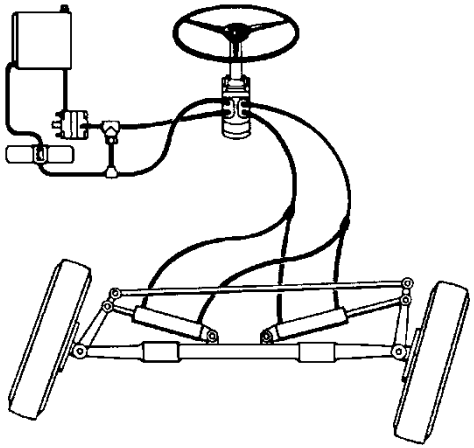




Applications of Fluid Power



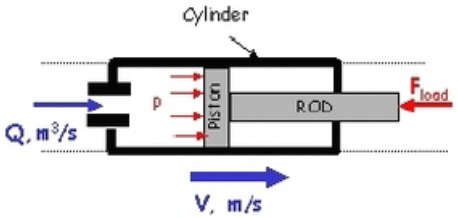
Hydraulic operation of aircraft landing gear

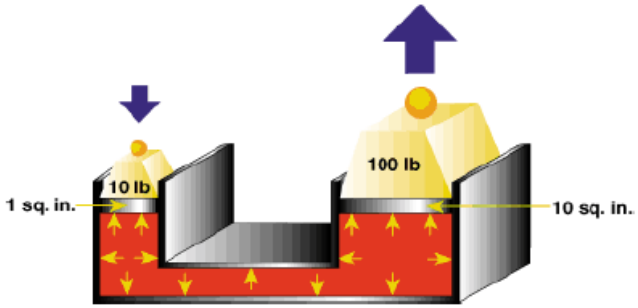


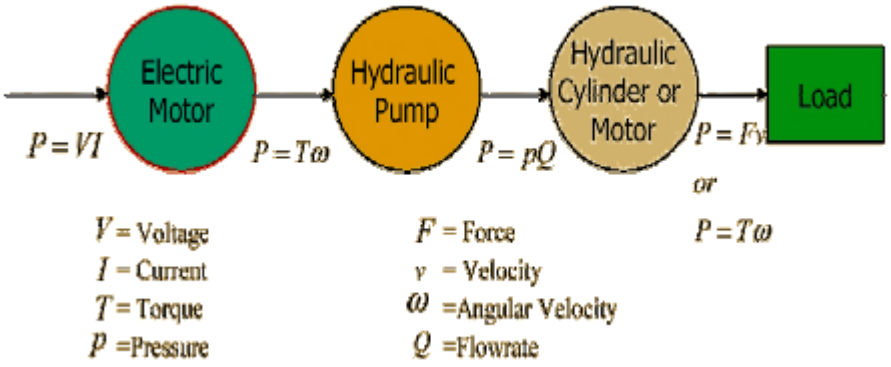
Power steering control system for off-highway vehicles

Fluid Power Theories & Physics

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

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

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

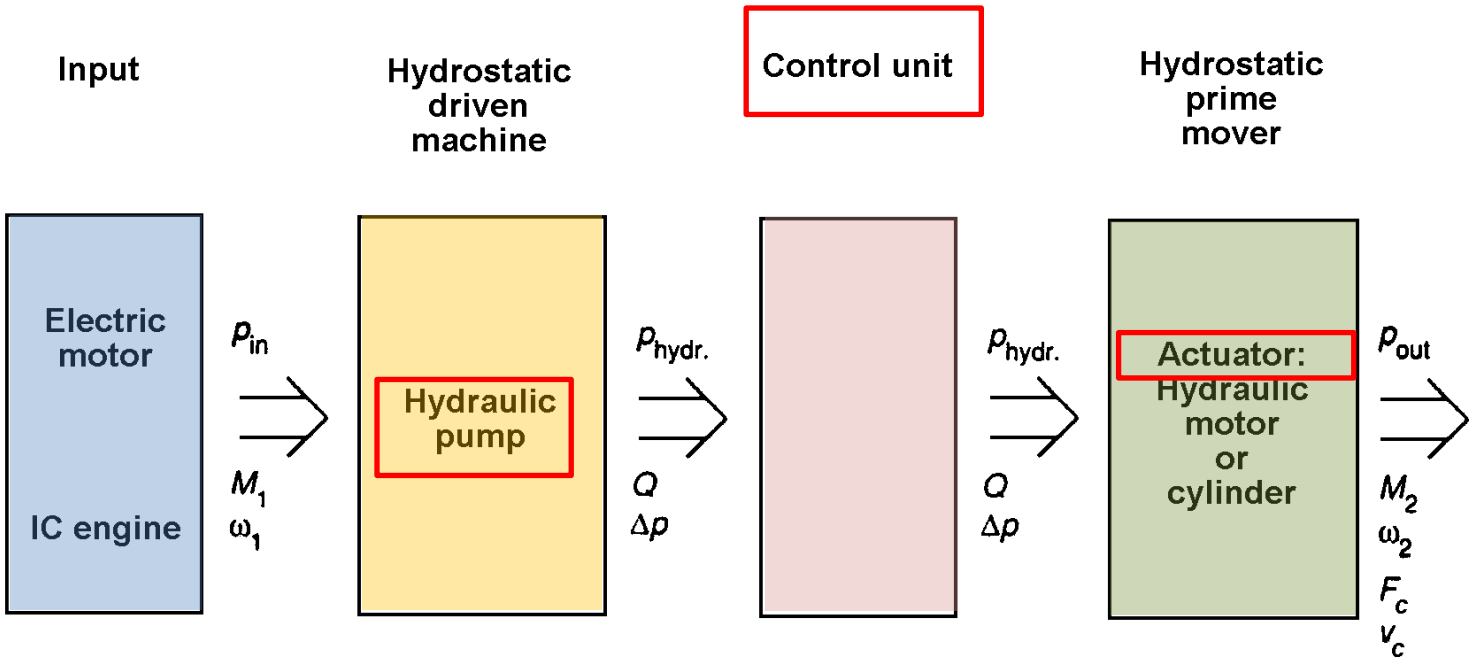
Fluid Power Disadvantages

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

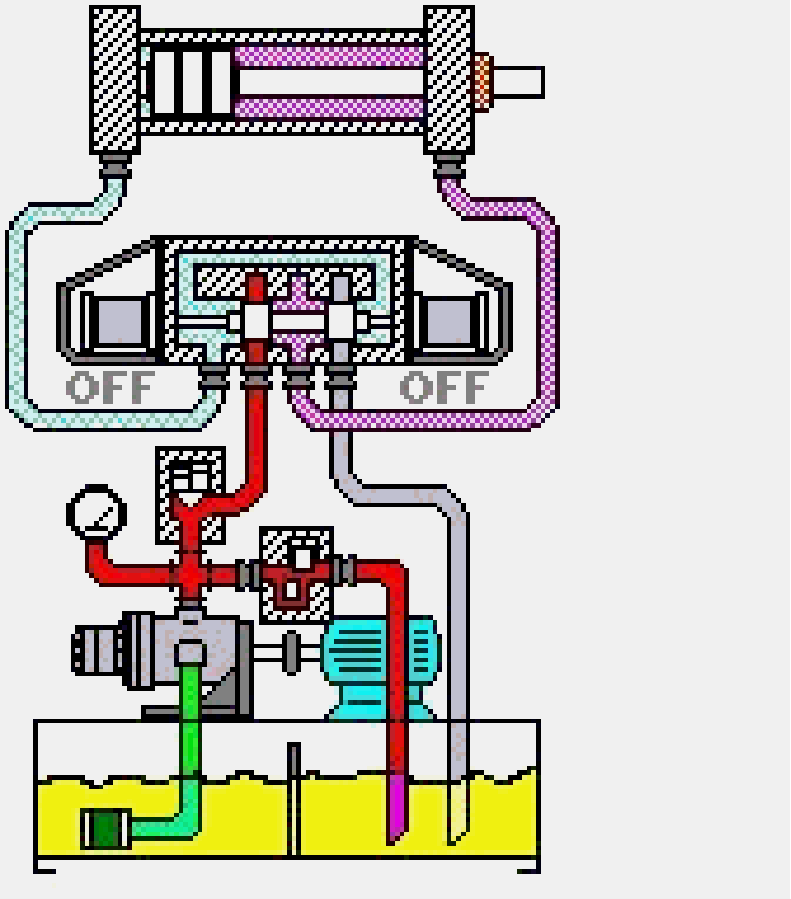
Comparison of Electrical, Hydraulic and Pneumatic Systems

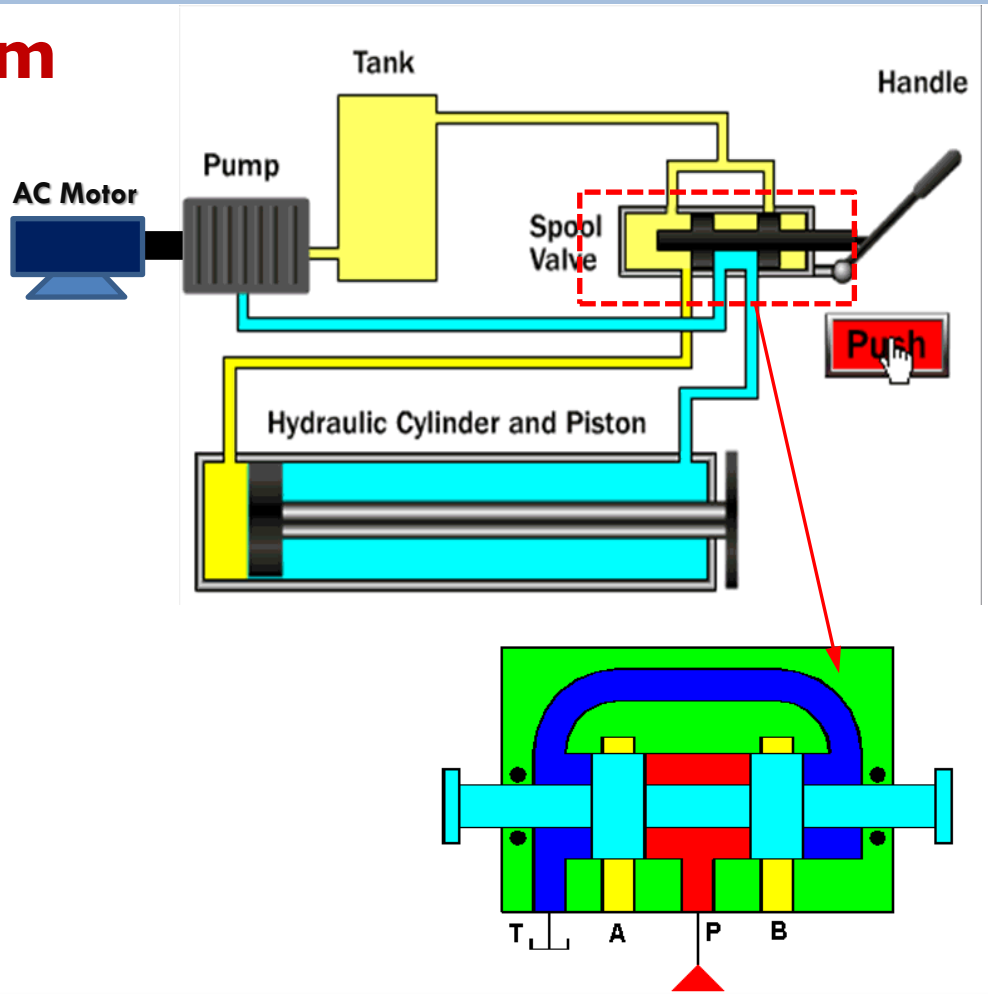
	ELECTRICAL	HYDRAULIC	PNEUMATIC
ENERGY SOURCE	Electrical power station	Electric motor or Diesel engine	
ENERGY STORAGE	Limited (batteries)	Limited (accumulator)	Good (reservoir)
DISTRIBUTION SYSTEM	Excellent with minimum losses	Limited	Good (plant wide)
ENERGY COST	Lowest	Medium	Highest
ACTUATOR	AC motors 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 system



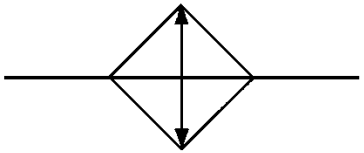
Basic hydraulic system



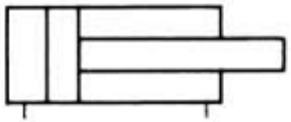


Fluid Power Symbols

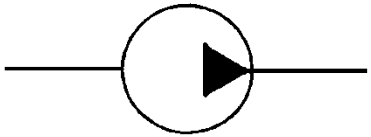
Hydraulic Reservoir Symbol



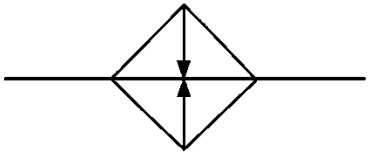
Cooler symbol



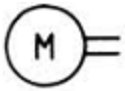
DOUBLE ACTING CYLINDER



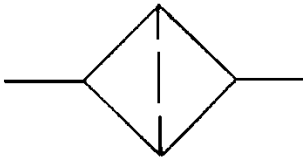
Hydraulic Pump Symbol



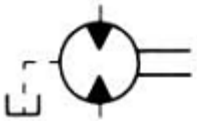
Heater symbol



ELECTRIC MOTOR

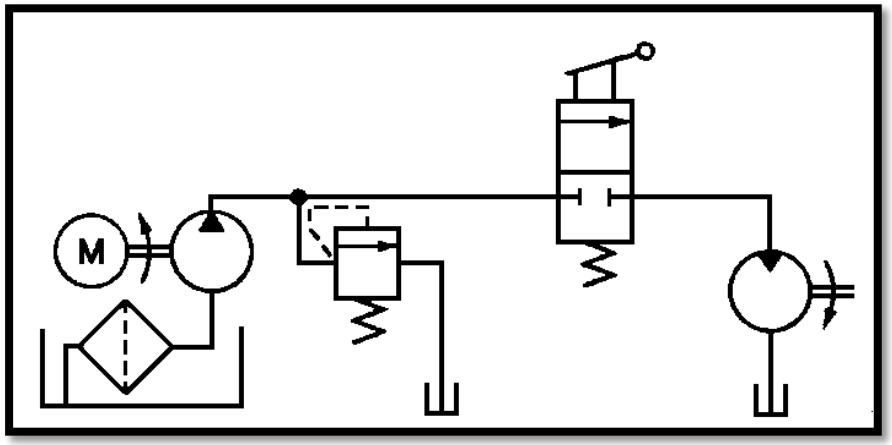


Filter Symbol



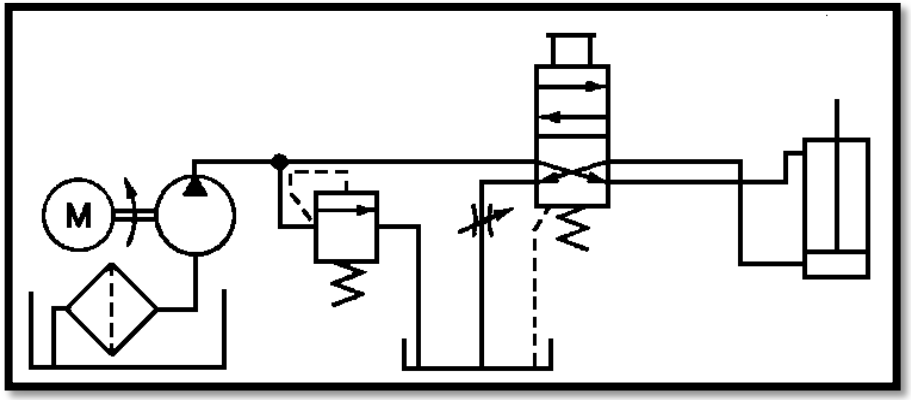
FIXED DISPLACEMENT REVERSIBLE MOTOR WITH DRAIN

Basic hydraulic system

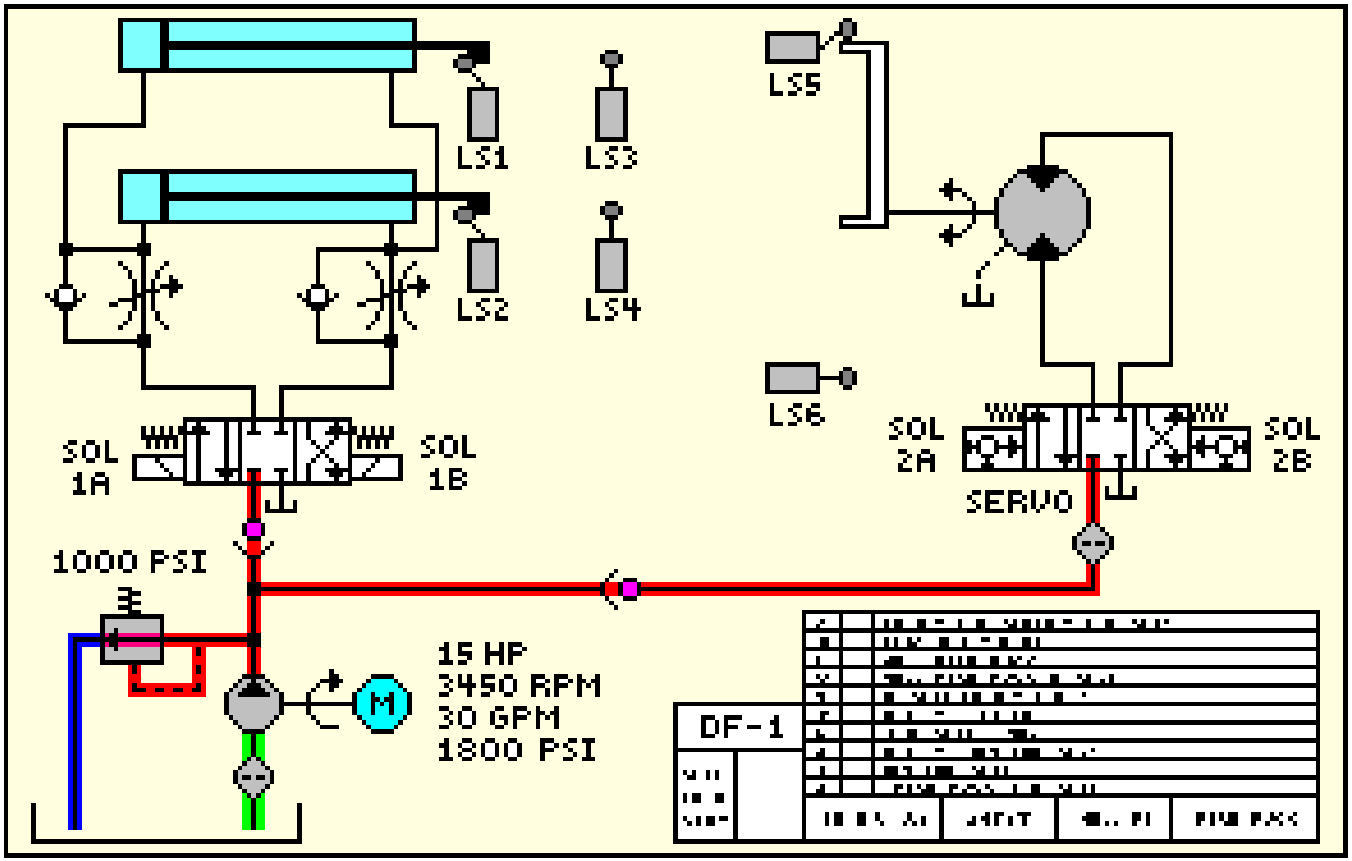


Basic hydraulic system with rotary hydraulic actuator (motor)

Basic hydraulic system with linear hydraulic actuator (cylinder)

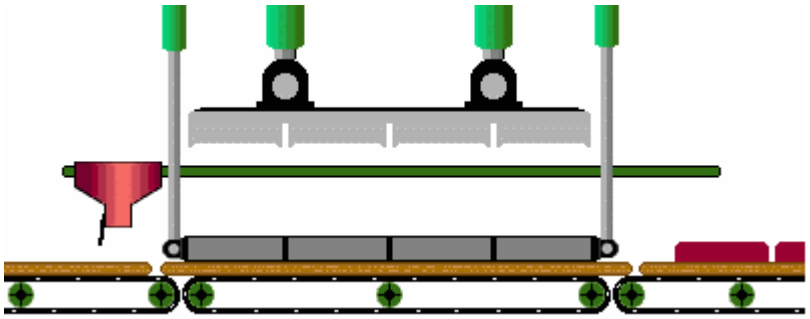


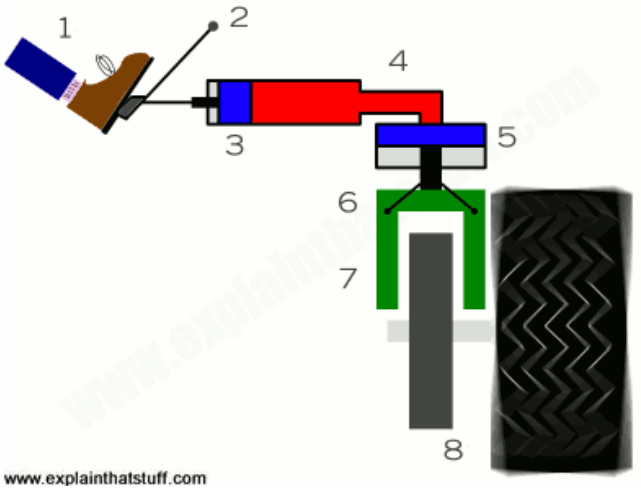
Basic hydraulic system

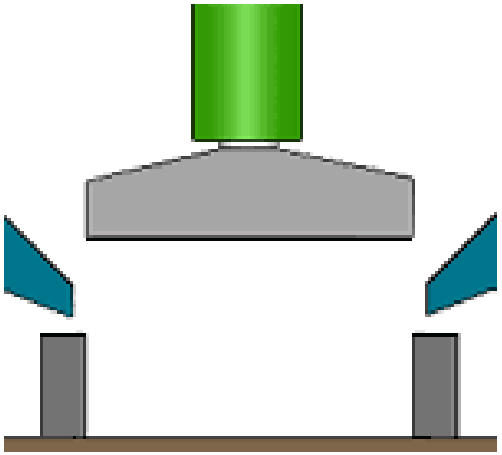


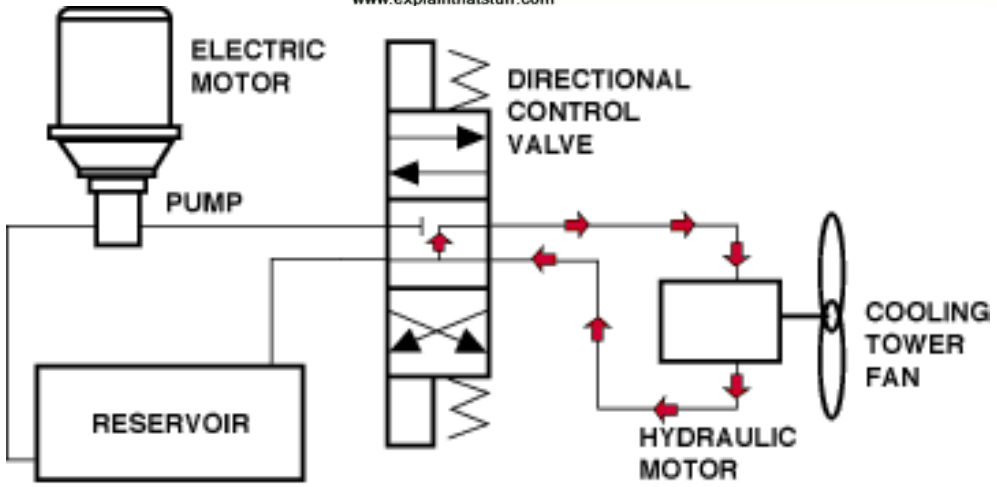
Hydraulic and Pneumatic Control Systems

Basic hydraulic system










Thank You