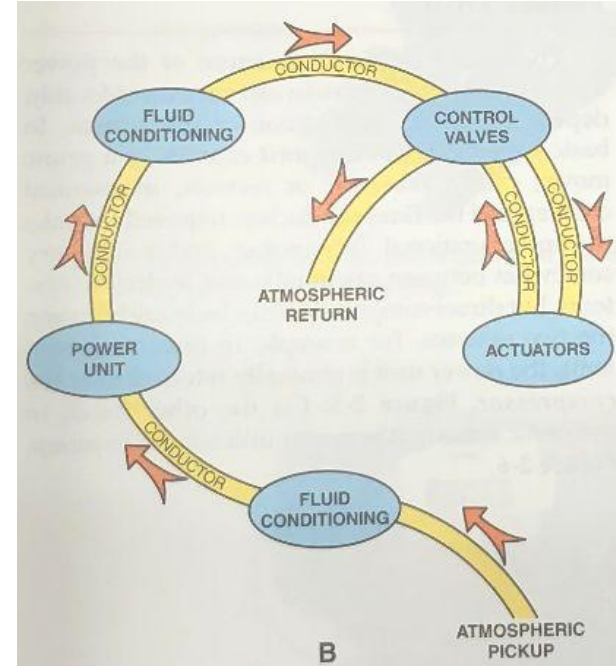
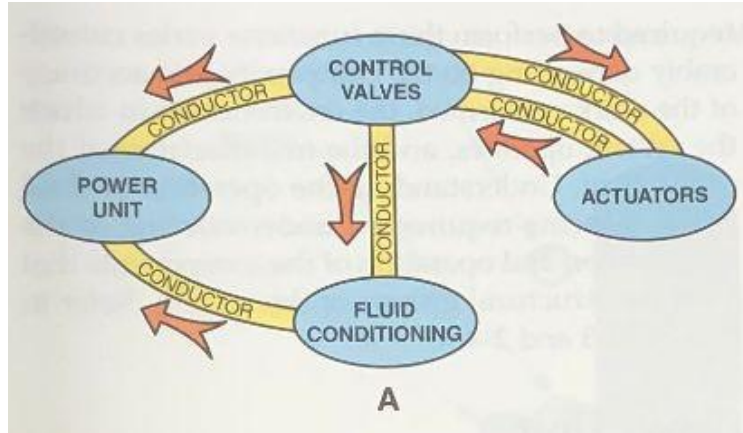


Fluid Power

John R. Leeman
GEARS 2023

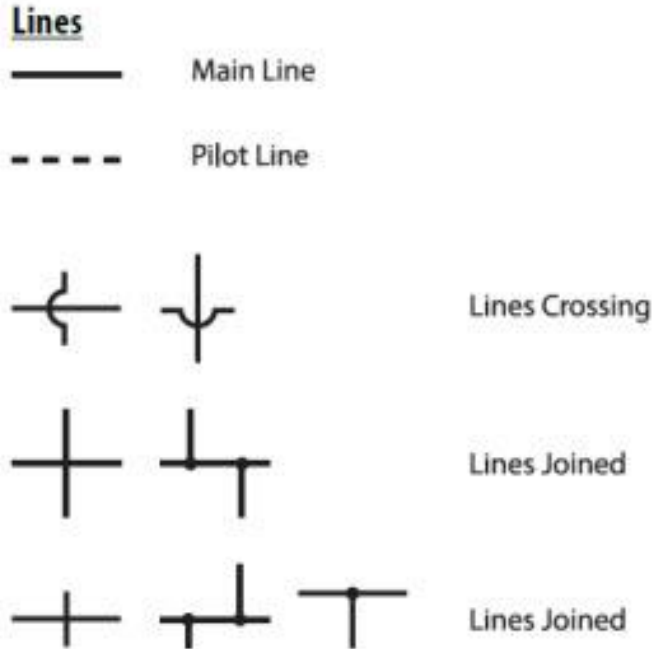
Fluid power systems consist of components to condition, power, conduct, control, and utilize fluids for force amplification



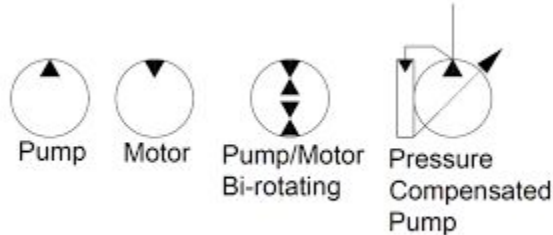
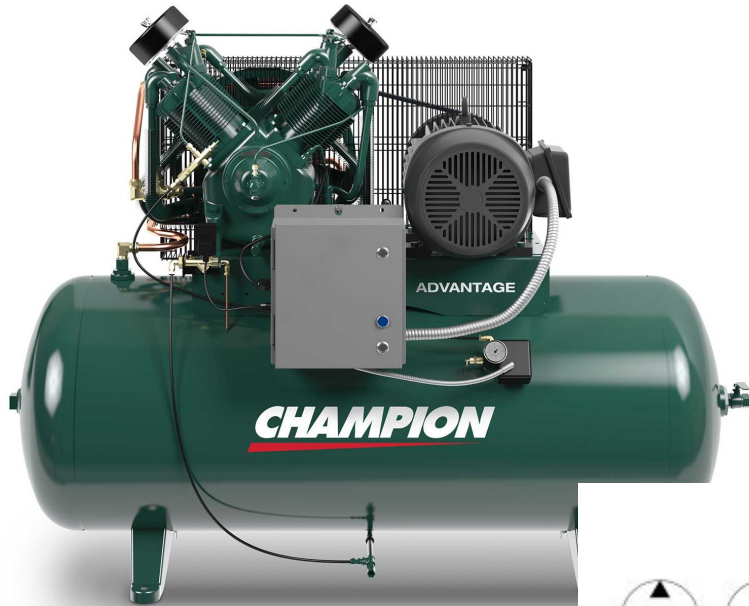
Hydraulic and air hoses, fittings, etc come in MANY varieties



Fluid conductors are drawn like electrical conductors

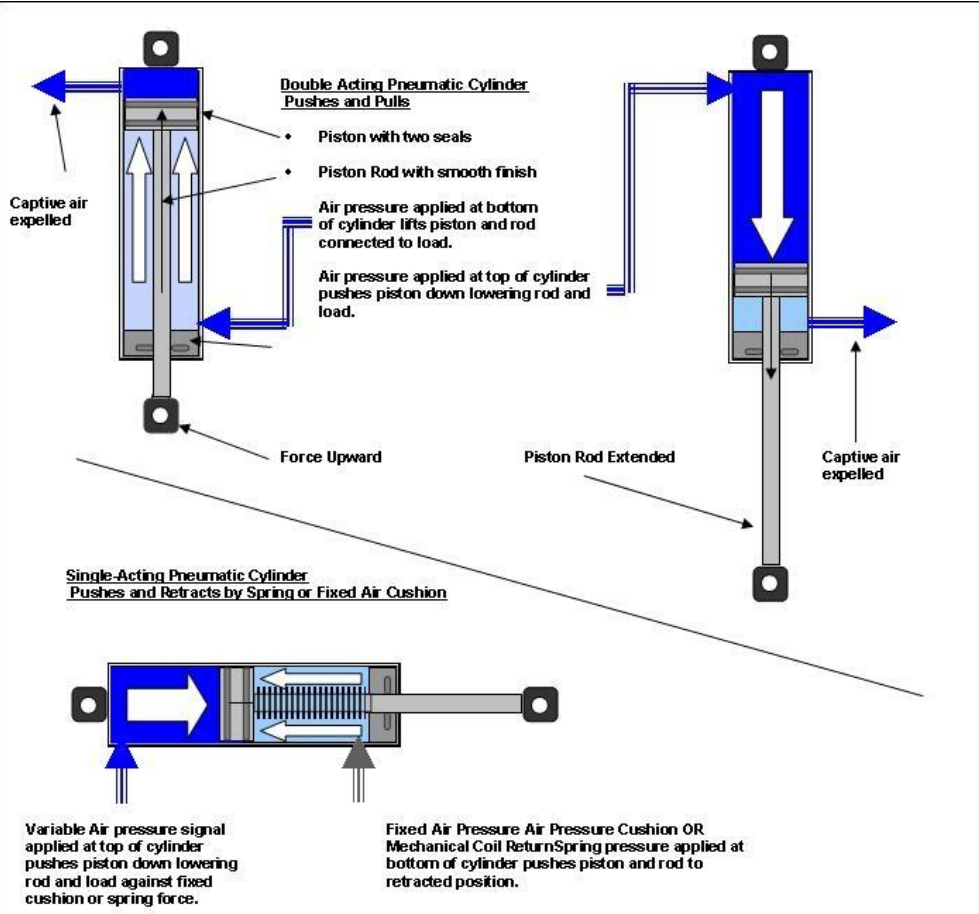


Power units provide the energy the system needs to move fluids

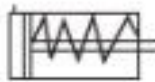


Images: Champion, Grainger, sealingandcontaminationtips.com

Cylinders are one of the most common actuators and come in several varieties



Cylinders are one of the most common actuators and come in several varieties



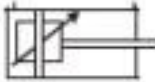
Cylinder (Spring Return)



Cylinder Double Acting (Double Rod)



Cylinder Double Acting (Single fixed cushion)

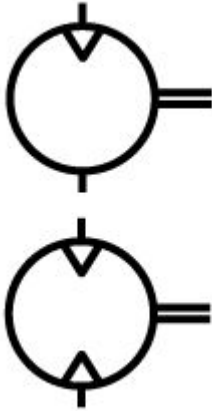


Cylinder Double Acting (Two adjustable cushions)



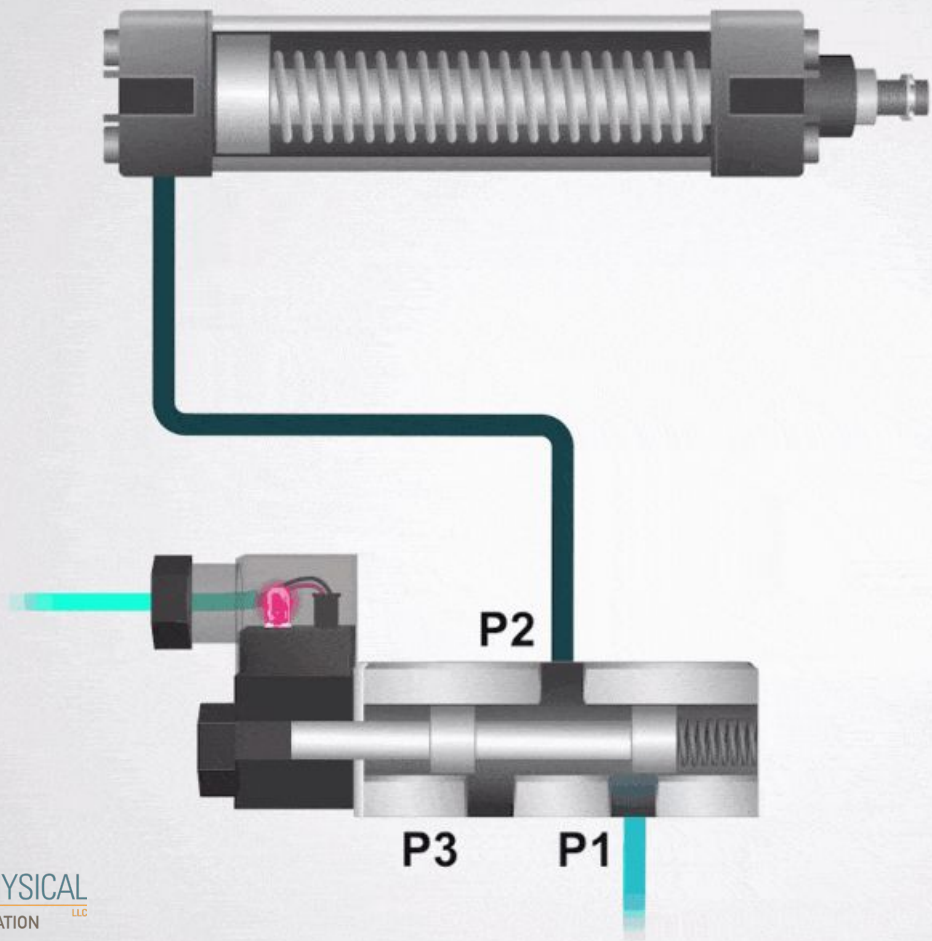
Differential Pressure

Motors are another convenient tool

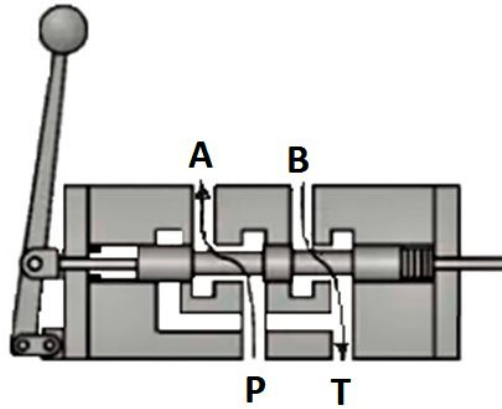
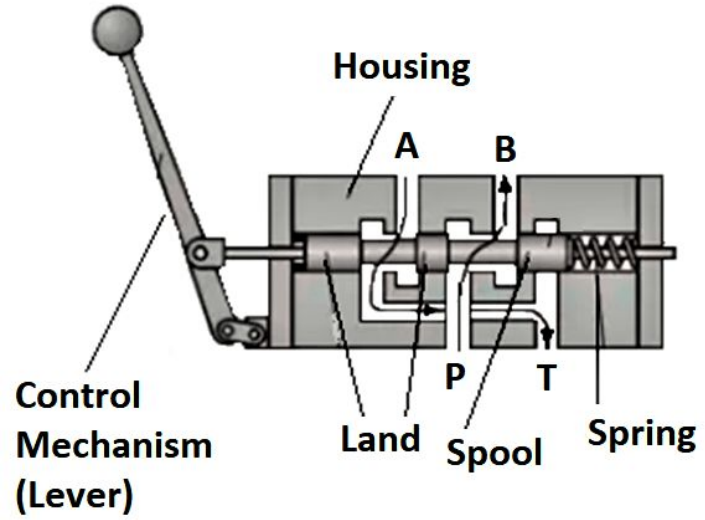


Control valves direct our fluid with manual, fluid, or electrical inputs

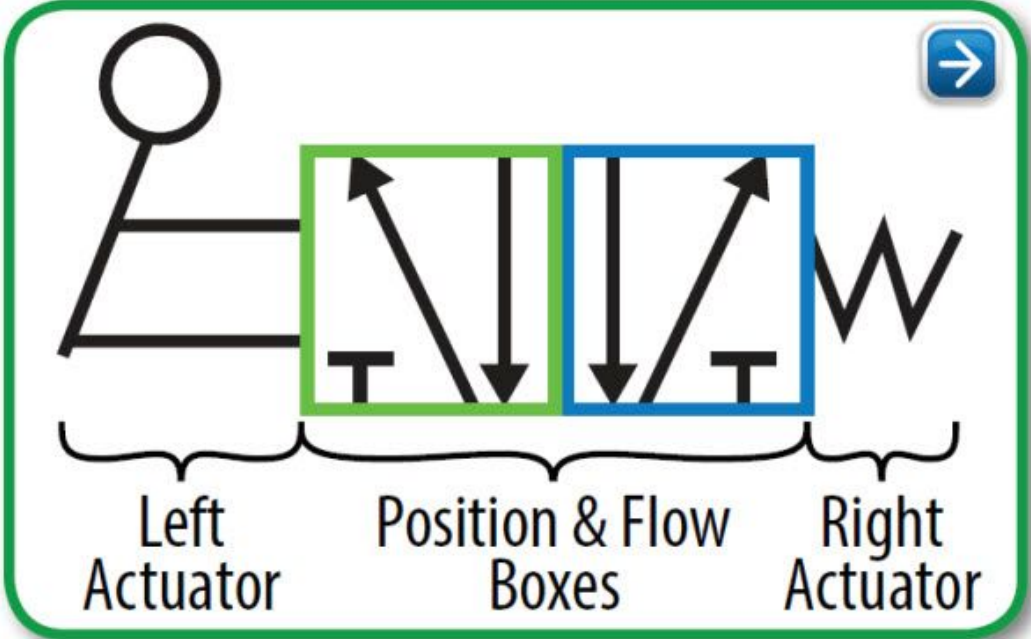




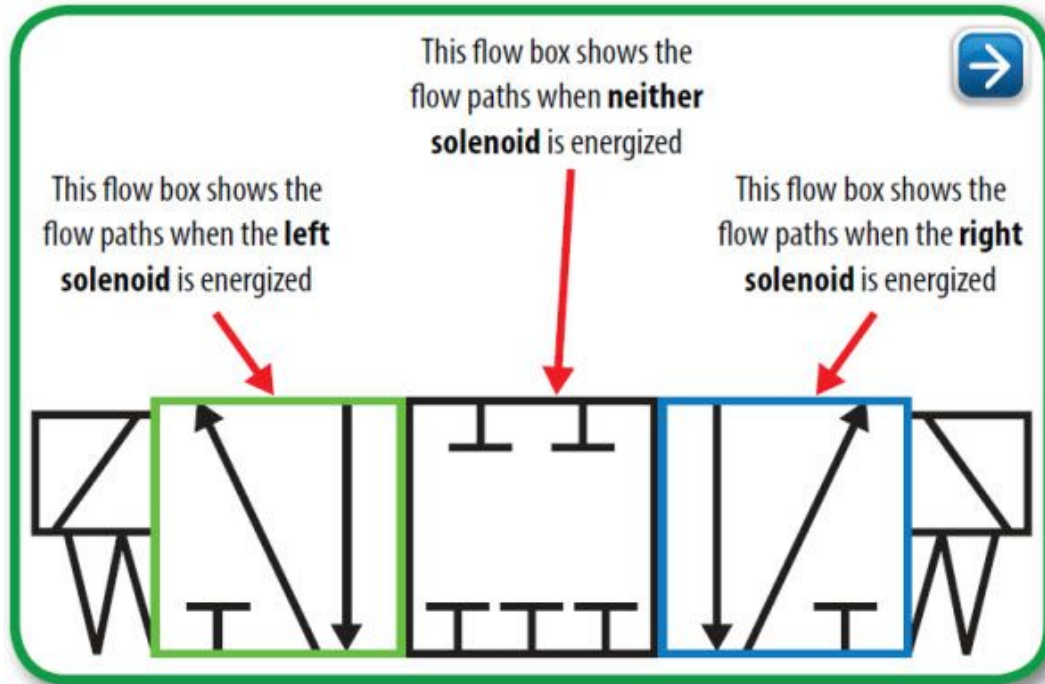
REALPARS



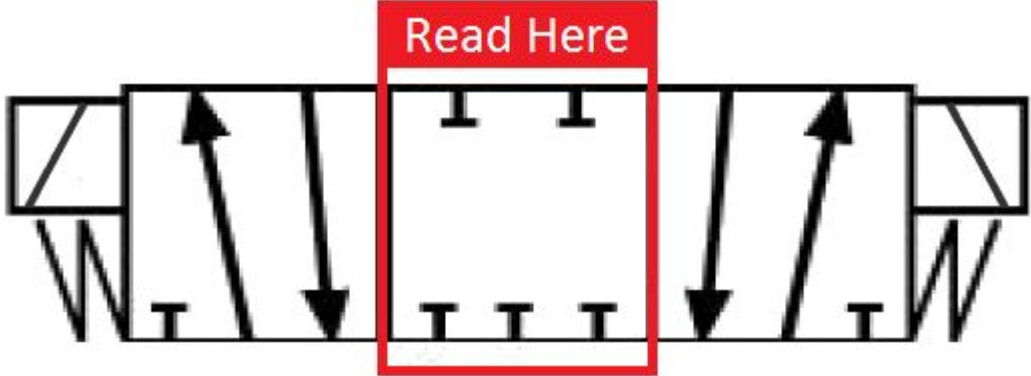
Reading the valve nomenclature can be confusing at best



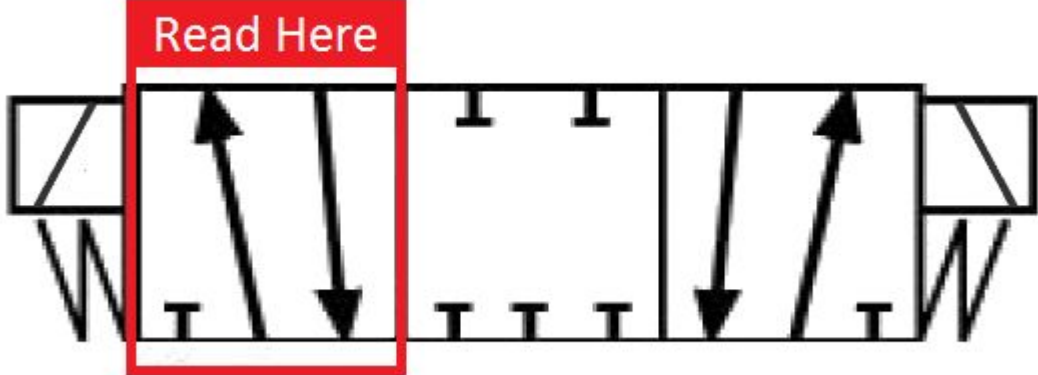
Reading the valve nomenclature can be confusing at best



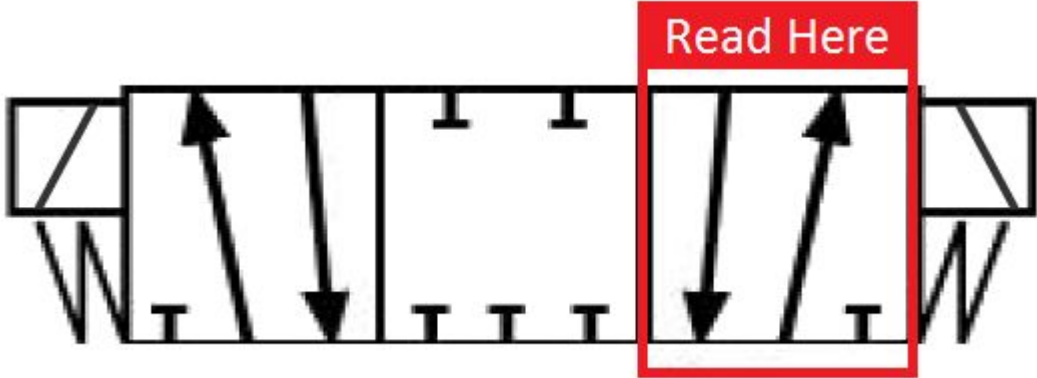
Reading the valve nomenclature can be confusing at best



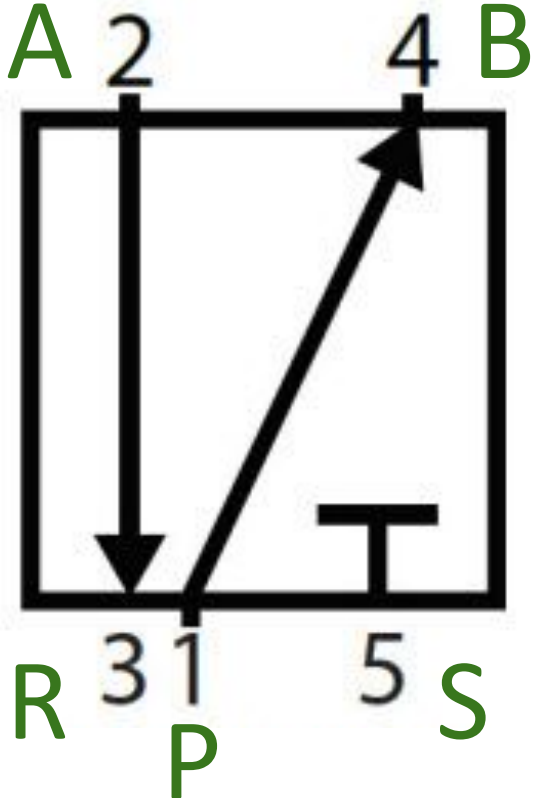
Reading the valve nomenclature can be confusing at best



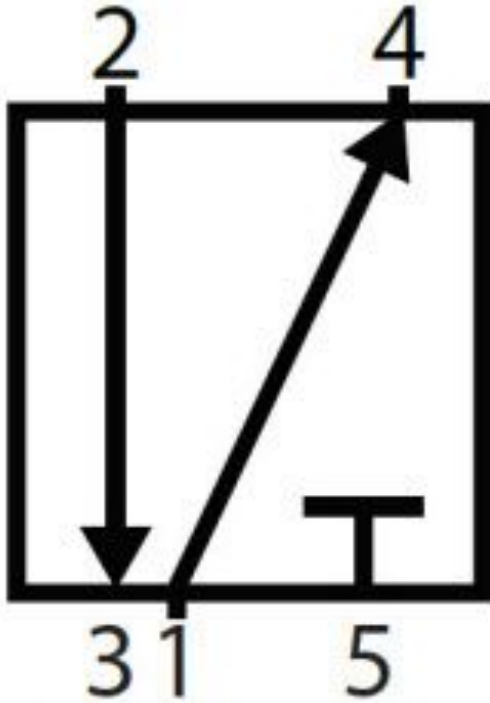
Reading the valve nomenclature can be confusing at best



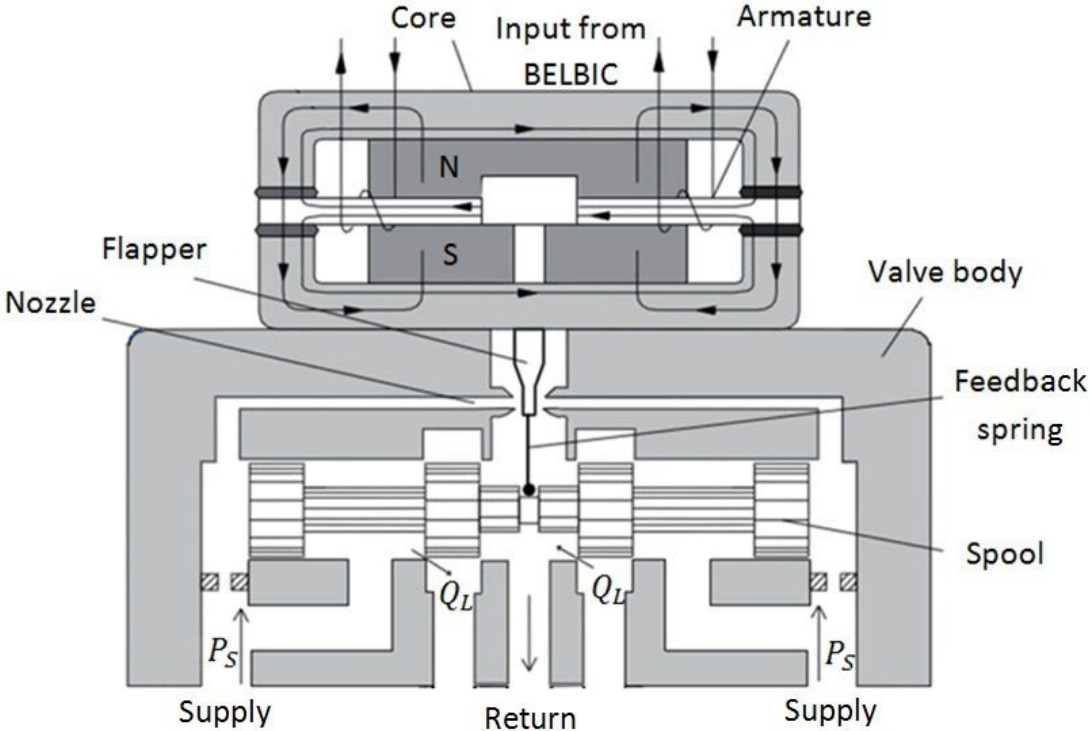
Ports are the number of endpoints shown in a single box



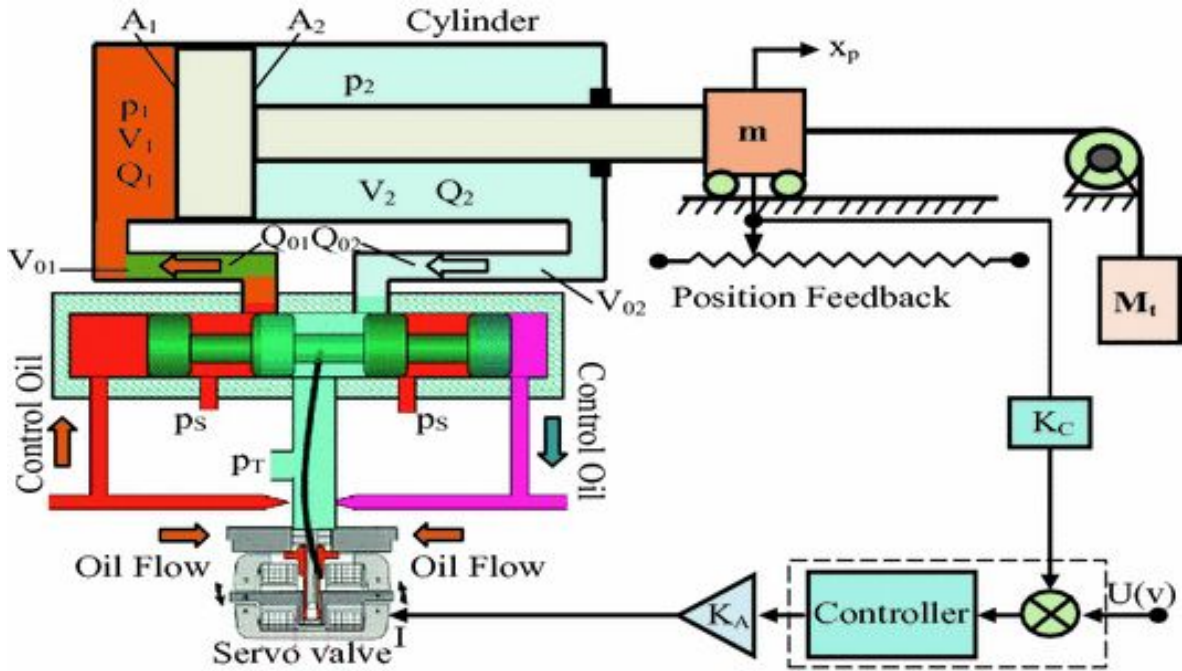
Ports vs. Ways can get confusing when buying a valve



Servo valves are commonly used for precision control of hydraulic systems

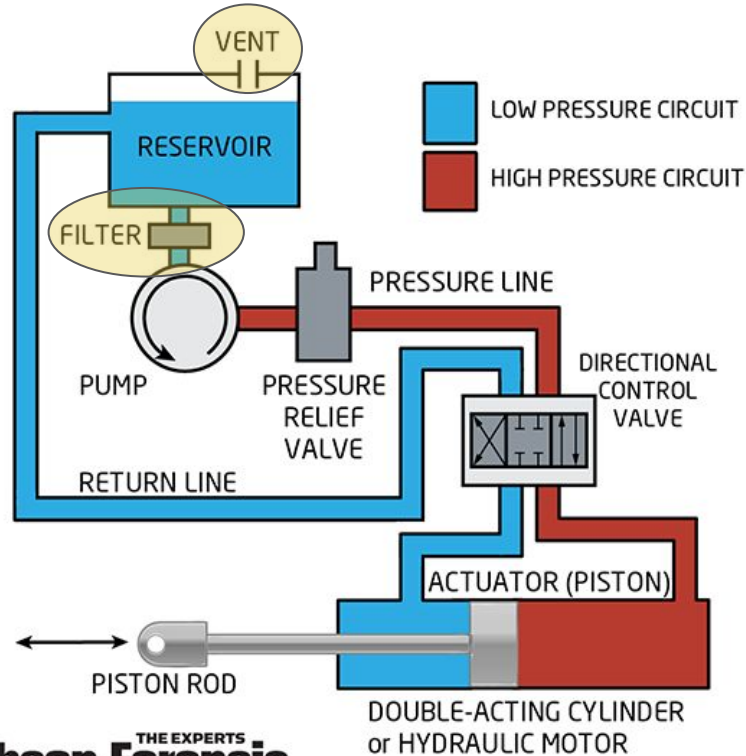


Servo valves are commonly used for precision control of hydraulic systems

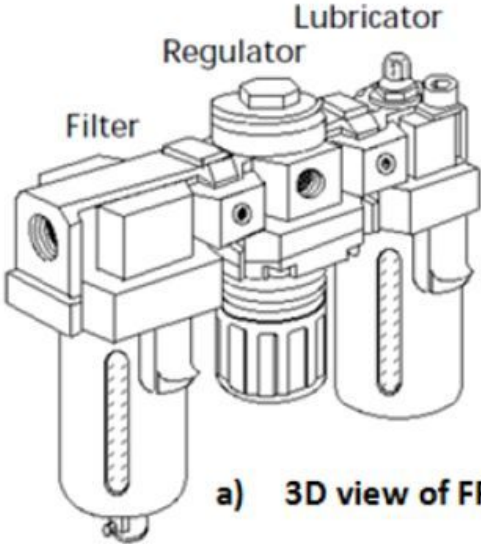


Fluid conditioning for hydraulics is relatively straightforward

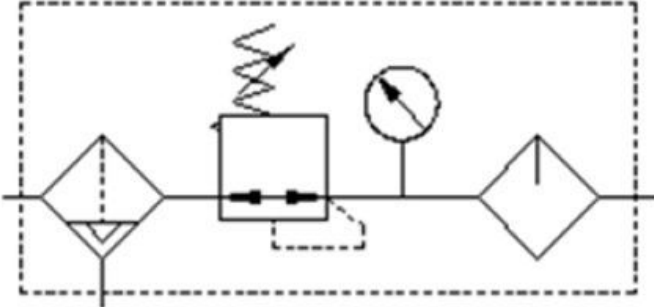
Basic Hydraulic System



Pneumatics has a few more steps















a) 3D view of FRL unit








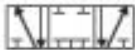


b) Symbol for FRL unit

Keeping a table of symbols is handy since we don't do this full time

Actuator Symbols

| | | | |
|---|----------------|---|-------------------------------------|
|  | Manual |  | External Pilot |
|  | Push Button |  | Pilot Solenoid with Manual Override |
|  | Lever |  | Lever Operated, Spring Return |
|  | Foot Operated | | |
|  | Mechanical | | |
|  | Spring | | |
|  | Detent | | |
|  | Solenoid | | |
|  | Internal Pilot | | |

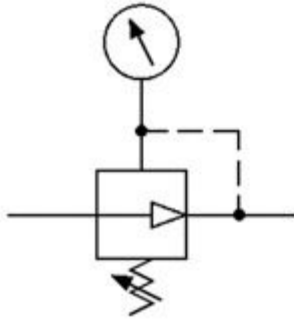
Directional Control Valve Symbols

| | |
|---|---|
|  | 2-position, 2-way, 2 ported |
|  | 2-position, 3-way, 3 ported |
|  | 2-position, 4-way, 4 ported |
|  | 2-position, 4-way, 5 ported |
|  | 3-position, 4-way, 4 ported Closed Center |
|  | 3-position, 4-way, 5 ported Closed Center |
|  | 3-position, 4-way, 5 ported Pressure Center |
|  | 3-position, 4-way, 5 ported Open Center |

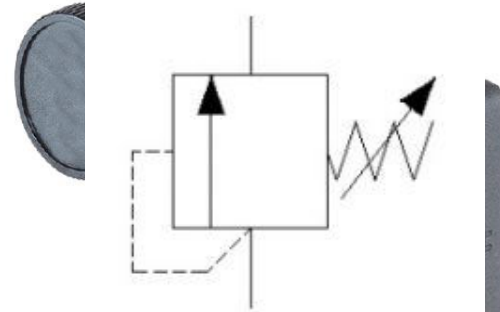
Regulation of system pressure is also important, but very similar



OMAX[®]

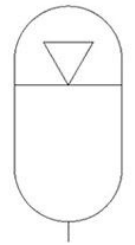


AIR REGULATOR

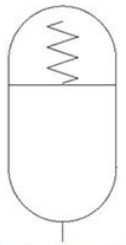


Relief Valve

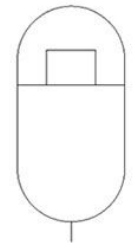
Accumulators are like fluid power capacitors



Accumulator



Spring Loaded Accumulator

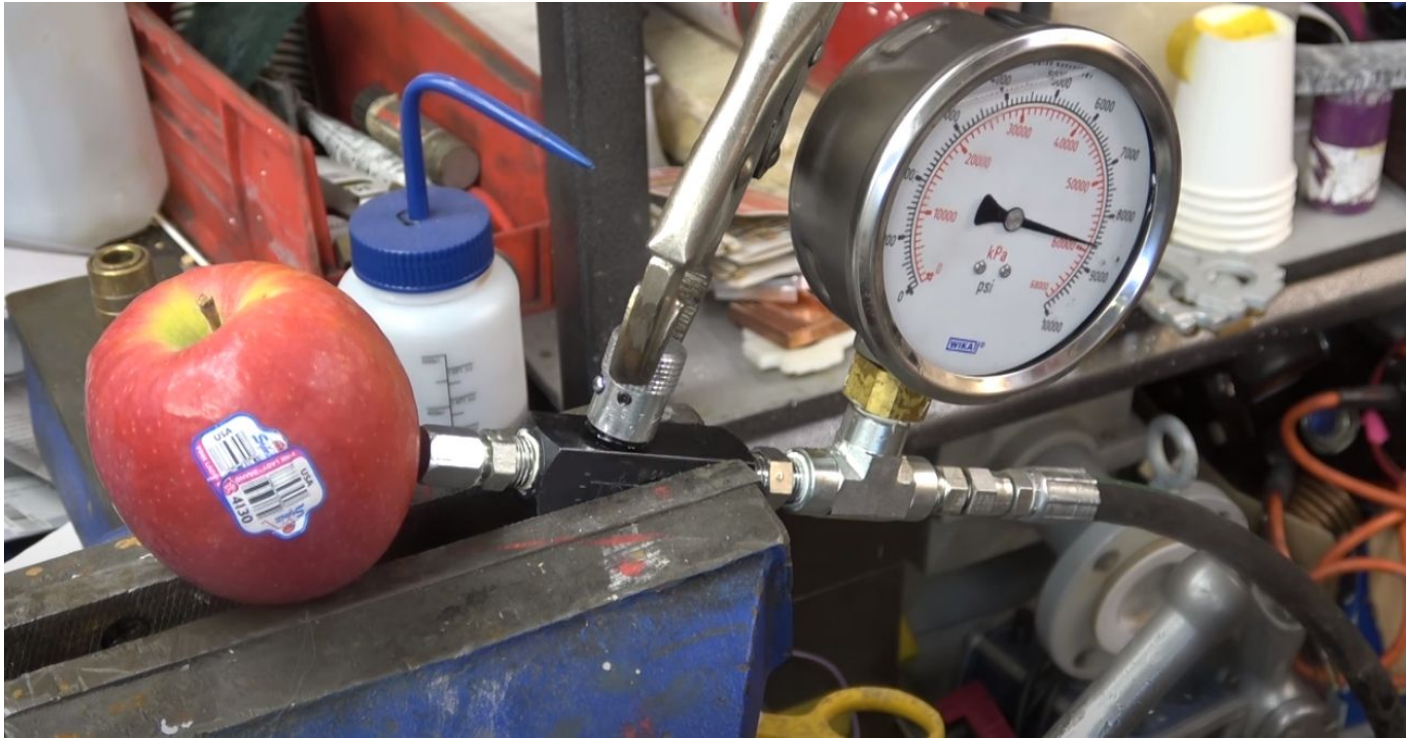


Weighted Accumulator

Pneumatics store a dangerous amount of energy!



Hydraulics can cause injection injury and severe burns



Common things to look for

- Blocked lines
- Bad filters
- Worn seals
- Moisture in the system
- Stuck valves
- Leaking conduits
- Bad pressure reliefs

