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## Basic Schematic Symbols Chart (Hydraulic and Pneumatic circuit design)

### Other fluid power informational links:

- [Download Autocad symbols from the Autodesk website](#)
- [Fluid Power Information Center](#)  
(Educational Resource for Hydraulics,Pneumatics,and Automation)
- [Electronic Circuit Schematic Symbols :](#)

### Lines

*Connecting Pressure Lines (usually representing plastic tubing for pneumatic [air] lines with low pressures, metal piping for hydraulic [fluid] lines with high pressure)*



-continuous line (for) flow line



-dashed line (for) pilot, drain



-envelope (for) long and short dashes around two or more component symbols.

### Circular



-large circle - pump, motor



-small circle - Measuring devices



-semi-circle - rotary actuator

### Square



-one square - pressure control function  
-two or three adjacent squares - directional control

### Diamond



-diamond - Fluid conditioner (filter, separator, lubricator, heat exchanger)

### Miscellaneous Symbols



-Spring



-Flow Restriction

### Triangle



-solid - Direction of Hydraulic Fluid Flow



-open - Direction of Pneumatic flow

## Pumps and Compressors

*(turn rotary torque from an AC or DC electric motor into pressure in a hydraulic or pneumatic system)*

### Fixed Displacement hydraulic pump



-unidirectional



-bidirectional

### Variable displacement hydraulic pump



-unidirectional



-bidirectional

### Compressor



## Motors

### Fixed displacement hydraulic motor



-unidirectional



-bidirectional

### Variable displacement hydraulic motor



-unidirectional



-bidirectional

### Pneumatic motor



-unidirectional



-bidirectional

### Rotary Actuator



- hydraulic



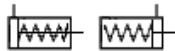
- pneumatic

## Cylinders

### Single acting cylinder



-returned by external force

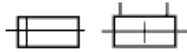


-returned by spring or extended by spring force

### Double acting cylinders



-single piston rod (fluid required to extend and retract)



-double ended piston rod

### Cylinders with cushions



- single fixed cushion



- double fixed cushion



- single adjustable cushion



- double adjustable cushion

## Directional Control Valves

### Directional control valve (2 ports / 2 positions)



-Normally closed directional control valve with 2 ports and 2 finite positions.



-Normally open directional control valve with 2 ports and 2 finite positions.

### Directional control valve (3 ports / 2 positions)



-Normally closed directional control valve with 3 ports and 2 finite positions.



-Normally open directional control valve with 3 ports and 2 finite positions.

### Directional control valve (4 ports / 2 positions)



-directional control valve with 4 ports and 2 finite positions

### Directional control valve (4 ports / 3 positions)



-directional control valve with 4 ports and 3 finite positions  
\*-(center position can have various flow paths)

### Directional control valve (5 ports / 2 positions) Normally a pneumatic valve



-directional control valve with 5 ports and 2 finite positions

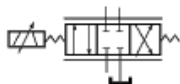
### Directional control valve (5 ports / 3 positions) Normally a pneumatic valve



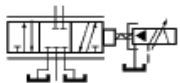
-directional control valve with 5 ports and 3 finite positions

### Proportional directional control valve Electro-hydraulic servo valve

-The spool positions on these valves is variable allowing for variable flow conditions.



-single-stage **direct operation** unit which accepts an analog signal and provides a similar analog fluid power output



-two-stage with mechanical feedback **indirect pilot operation** unit which accepts an analog signal and provides a similar analog fluid power output

## Control Methods

### Manual Control



-general symbol (without showing the control type)



-pushbutton



-lever



-foot pedal

### Mechanical Control



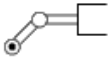
-plunger or tracer



-spring



-roller



-roller(one direction only)

### Electrical Control



-Solenoid (the one winding)

### Pilot Operation



-pneumatic



-hydraulic

### Pilot operated two-stage valve



-Pneumatic: Sol first stage



-Pneumatic: Air pilot second stage



-Hydraulic: Sol first stage



-Hydraulic: Hyd pilot second stage

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## Check valves, Shuttle valves, Rapid Exhaust valves

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-check valve -free flow one direction, blocked flow in other direction



-pilot operated check valve, pilot to close



-pilot operated check valve, pilot to open

### Shuttle valve



-to isolate one part of a system from an alternate part of circuit.

### Rapid exhaust valve/Pneumatic



-installed close to an actuator for rapid movement of the actuator.

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## Pressure Control Valves

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### Pressure Relief Valve(safety valve) normally closed



- line pressure is limited to the setting of the valve, secondary part is directed to tank.

### Proportional Pressure Relief



- line pressure is limited to and proportional to an electronic signal

### Sequence Valve



- when the line pressure reaches the setting of the valve, valve opens permitting flow to the secondary port. The pilot must be externally drained to tank.

### Pressure Reducing valve

- pressure downstream of valve is limited to the setting of the valve



## Flow Control Valves

### Throttle valve



-adjustable output flow

### Flow Control valve



-with fixed output (variations in inlet pressure do not affect rate of flow)



-with fixed output and relief port to reservoir with relief for excess flow (variations in inlet pressure do not affect rate of flow)



-with variable output



-fixed orifice



-metered flow toward right free flow to left



-pressure compensated flow control fixed output flow regardless of load



-pressure and temperature compensated



-with variable output and relief port to reservoir

### Flow dividing valve



-flow is divided equally to two outputs.

## Shut-Off Valve



-Simplified symbol

## Accumulators



## Reservoir (Tank)



## Filters, Water Traps, Lubricators and Miscellaneous Apparatus

### Filter or Strainer



### Water Trap



-with manual drain



-with automatic drained

### Filter with water trap



-with manual drain



-automatic drain

### Air Dryer



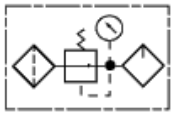
refrigerant, or chemical removal of water from compressed air line

### Lubricator

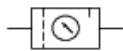


-oil vapor is injected into air line

### Conditioning unit



-compound symbol of filter, regulator, lubricator unit



-Simplified Symbol

## Heat Exchangers



-air or water cooled unit designed to remove heat from oil returning to reservoir



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