

Basic Hydraulic Symbols

Lines



-continuous line - flow line



-dashed line - pilot, drain



-envelope - 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

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



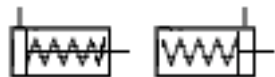
- pneumatic

Cylinders

Single acting cylinder



-returned by external force

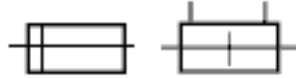


-returned by spring or extended by spring force

Double acting cylinders

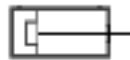


-single piston rod (fluid required to extend and retract)

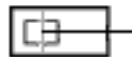


-double ended piston rod

Cylinders with cushions



- single fixed cushion



- double fixed cushion



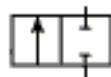
- single adjustable cushion



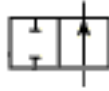
- double adjustable cushion

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.



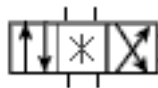
-Normally open directional control valve with 3 ports and 2 finite positions.

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

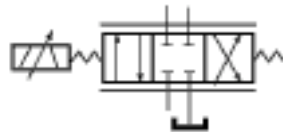


-directional control valve with 5 ports and 3 finite positions

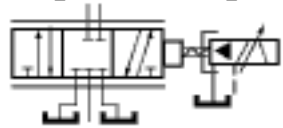
Proportional directional control valve

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

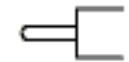


-lever



-foot pedal

Mechanical Control



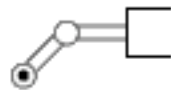
-plunger or tracer



-spring



-roller



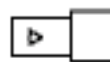
-roller(one direction only)

Electrical Control



-Solenoid (the one winding)

Pilot Operation



-pneumatic

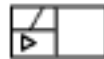


-hydraulic

Pilot operated two-stage valve



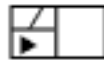
-Pneumatic: Sol first stage



-Pneumatic: Air pilot second stage



-Hydraulic: Sol first stage



-Hydraulic: Hyd pilot second stage

Check valves, Shuttle valves, Rapid Exhaust valves



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



-pilot operated check valve, pilot to close



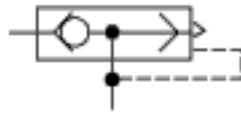
-pilot operated check valve, pilot to open

Shuttle valve



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

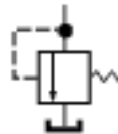
Rapid exhaust valve/Pneumatic



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

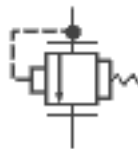
Pressure Control Valves

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

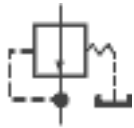
Sequence Valve



- 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



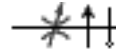
-fixed orifice



-metered flow toward right free flow to left



-pressure compensated flow control fixed output flow regardless of load

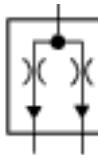


-pressure and temperature compensated



-with variable output and relief port to reservoir

Flow dividing valve



-flow is divided equally to two outputs.

Shut-Off Valve



-Simplified symbol

Accumulators

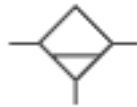


Filters, Water Traps, Lubricators and Miscellaneous Apparatus

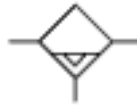
Filter or Strainer



Water Trap



-with manual drain



-with automatic drained

Filter with water trap



-with manual drain



-automatic drain

Air Dryer



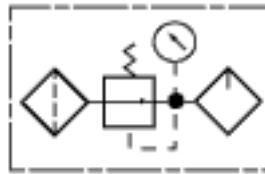
refrigerant, or chemical removal of water from compressed air line

Lubricator

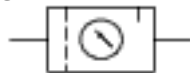


-oil vapor is inducted into air line

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