Pneumatic Valves

For precision and control

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Contents

Click the section to advance directly to it

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Introduction

- The range of pneumatic valves is vast
- To help select a valve they are placed in a variety of categories:
  - style
  - type
  - design principle
  - type of operator
  - function
  - size
  - application
- For all of them, their basic function is to switch air flow
- From the simplest function of switching a single flow path on and off, to the exacting proportional control of pressure and flow

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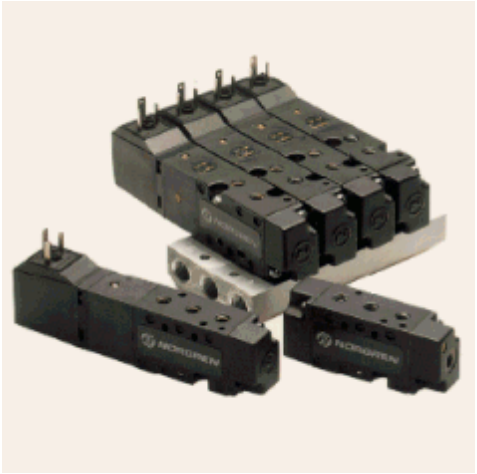
Style

- **Style reflects the look of a valve range as well as the underlying design principle. Examples are Nugget, ISO Star and Super X**



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Type

- **Type refers to the valves installation arrangement for example sub-base, manifold, in line, and valve island**

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Design

- **Design refers to the principle of operation around which the valve has been designed, for example, spool valve, poppet valve and plate valve**

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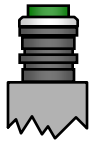
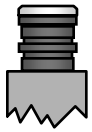
Operators

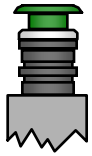
- An operator is the mechanism that causes a valve to change state
- They are classified as manual, mechanical and electrical



Push Button



Shrouded Button



Mushroom Button

Twist

Switch

Emergency Stop

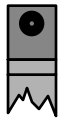
Key Released

Key Operated

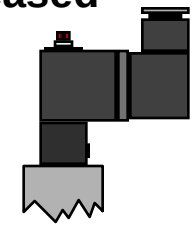
Plunger

Roller

One Way Tip



Air Pilot



Solenoid Pilot

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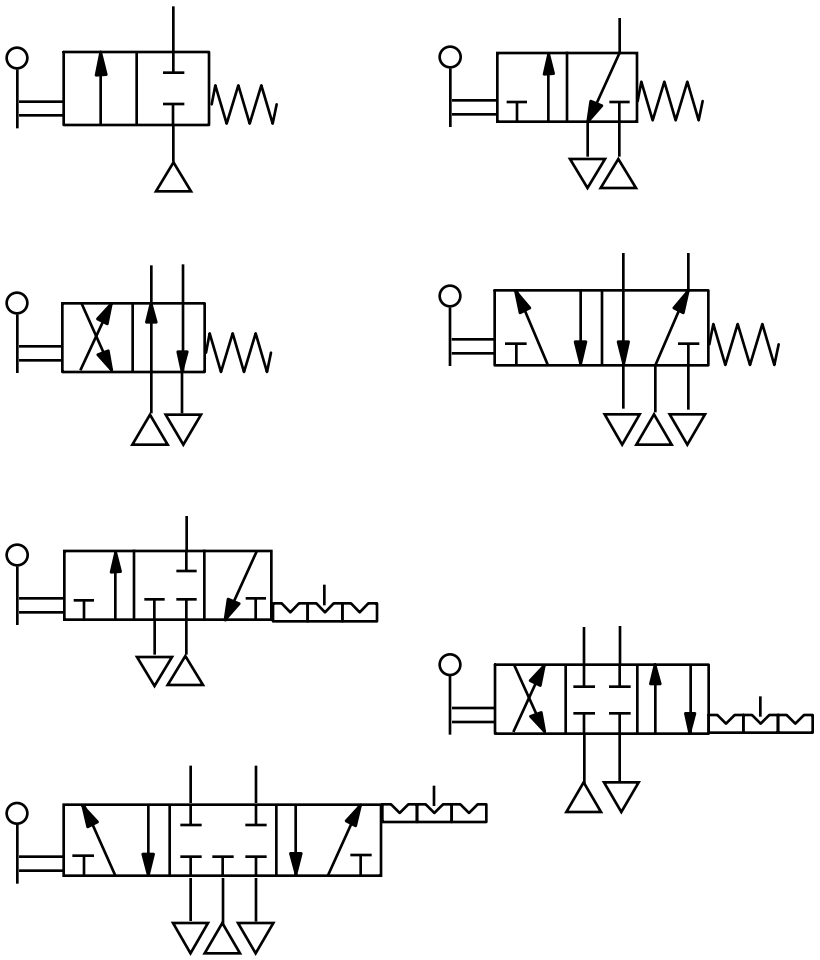
Valve Function

- Function is the switching complexity of a valve
- Shown by two figures 2/2, 3/2, 4/2, 5/2, 3/3, 4/3 & 5/3
- First figure is the number of main ports. Inlets, outlets, and exhausts excluding signal and external pilot supplies
- Second figure is the number of states
- A 3/2 valve has 3 ports, and 2 states, normal and operated.



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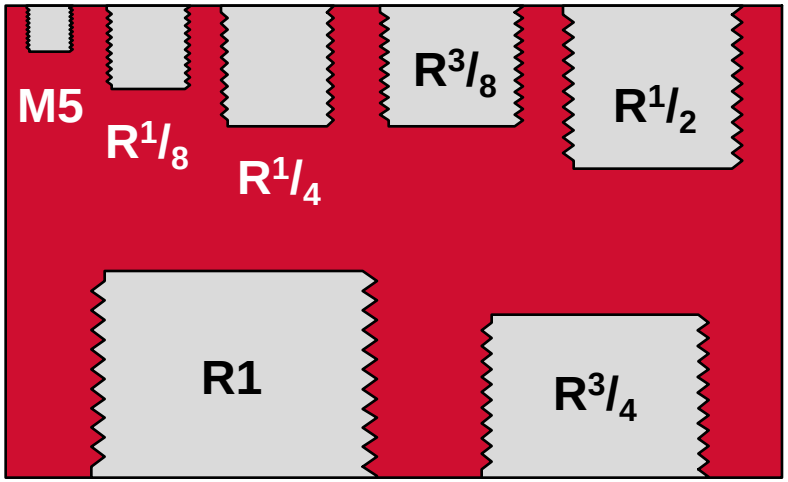
Valve Size

- Size refers to a valve's port thread.
- For similarly designed valves the amount of air flow through the valve usually increases with the port size.
- Port size alone however cannot be relied upon to give a standard value of flow as this is dependent on the design of the valve internals.

- The port size progression M5, $R^1/_8$, $R^1/_4$, $R^3/_8$, $R^1/_2$, $R^3/_4$, R1.



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Application

- Application is a category for valves described by their function or task
- Examples of specialist valves are quick exhaust valve, soft start valve and monitored dump valve
- Examples of standard valves are power valves, logic valves, signal processing valves and fail safe valves
- A standard valve could be in any category depending on the function it has been selected for in a system

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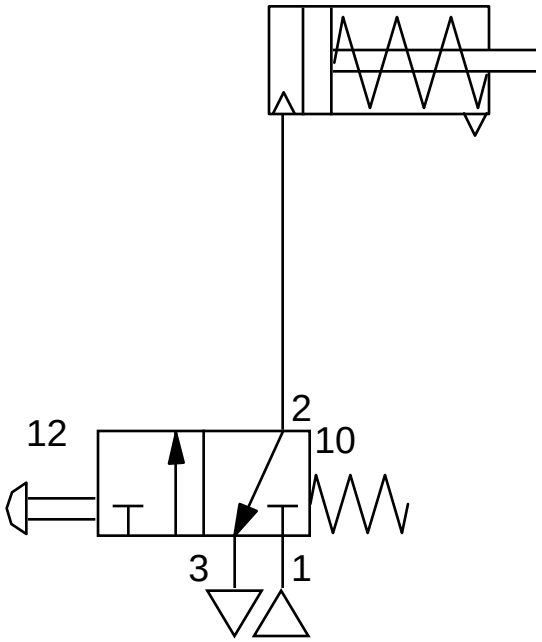
Actuator Control (3/2 valve)

- A 3 port valve provides the inlet, outlet and exhaust path and is the normal choice for control of a single acting cylinder
- In the normal position produced by the spring, the valve is closed
- In the operated position produced by the push button the valve is open
- The push button must be held down for as long as the cylinder is outstroked



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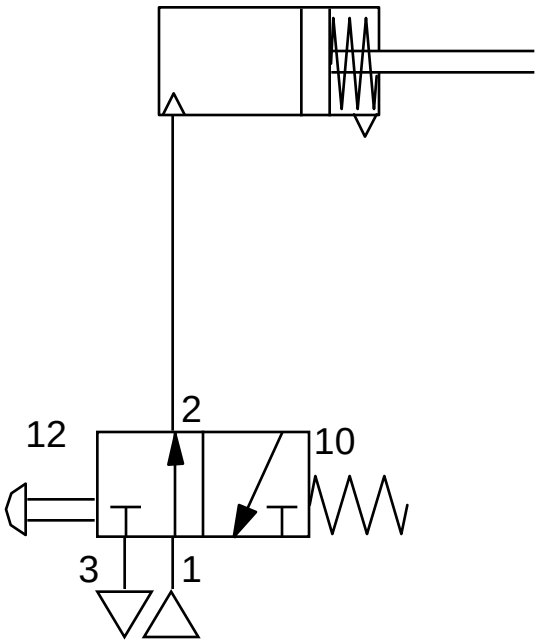

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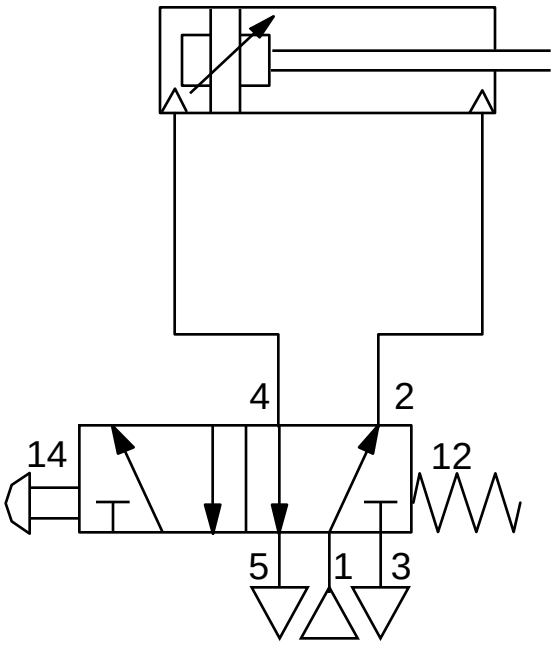
Actuator Control (5/2 valve)

- A five port valve provides an inlet port 1 that is switched between two outlet ports 2 and 4 each with an exhaust port 3 & 5
- In the normal position produced by the spring 1 is connected to 2 with 4 to exhaust 5
- In the operated position produced by pushing the button port 1 is connected to 4 with 2 to exhaust 3



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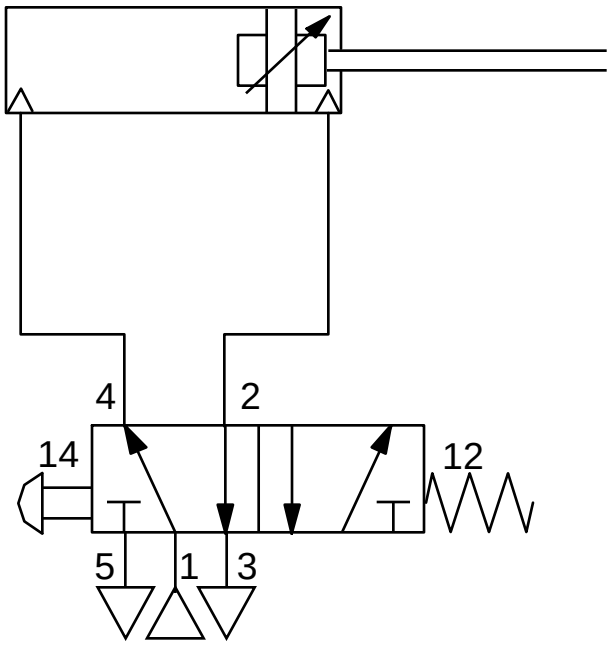

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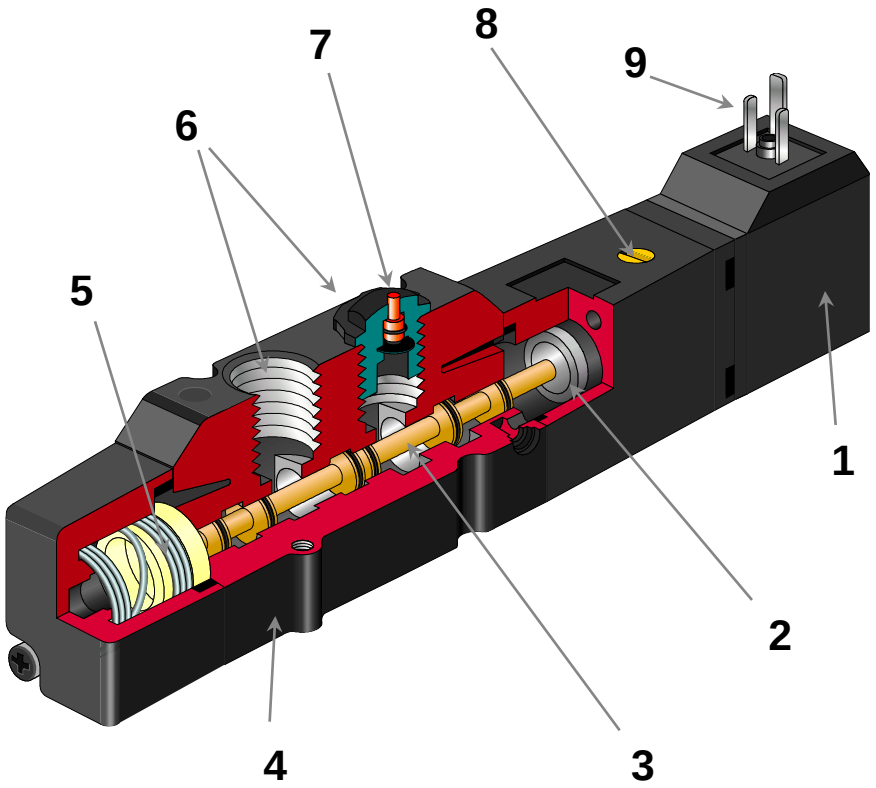
Typical Valve

- **Identification of the component parts of a typical 5/2 solenoid valve with spring return (Sub-base not shown)**
  - **(1) Solenoid (15mm)**
  - **(2) Piston**
  - **(3) Spool with disc seals**
  - **(4) Valve body**
  - **(5) Return spring**
  - **(6) Alternative ports 2, 4**
  - **(7) Pressure indicator**
  - **(8) Manual override**
  - **(9) Electric connectors**



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Poppet Valves

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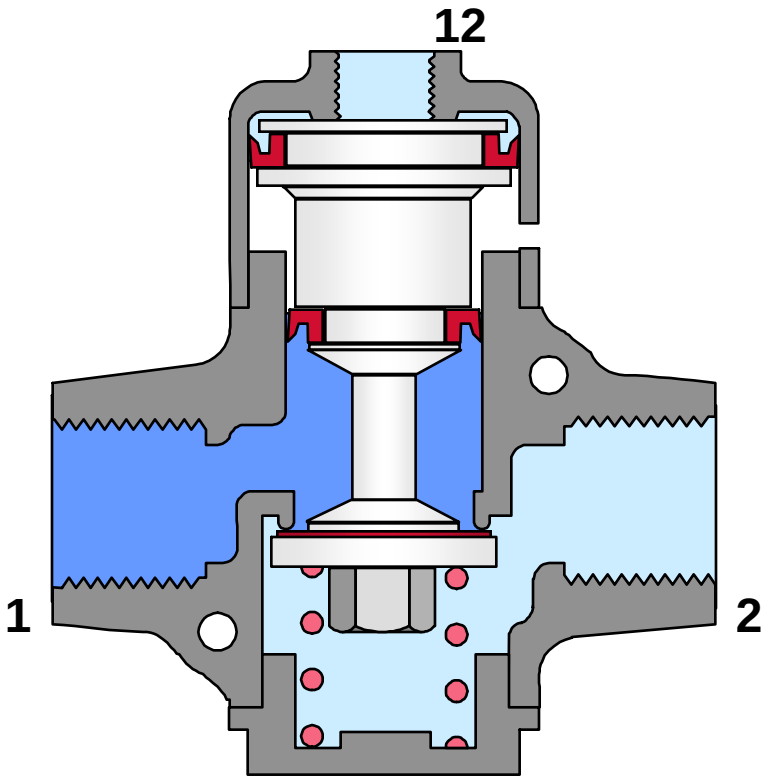
Poppet Valve 2/2

- The Poppet valve is a simple and effective design used mainly in 2/2 and 3/2 functions
- It has good sealing characteristics and can often be the choice for a supply shut off valve
- A poppet seal has a butt action against a raised edged aperture
- Illustrated is a 2/2 air operated poppet valve



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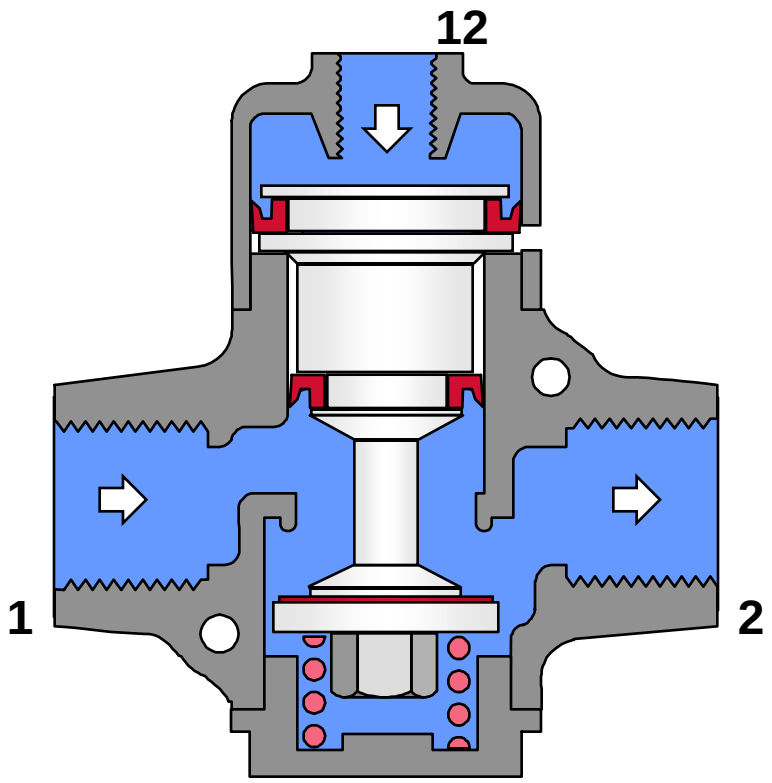

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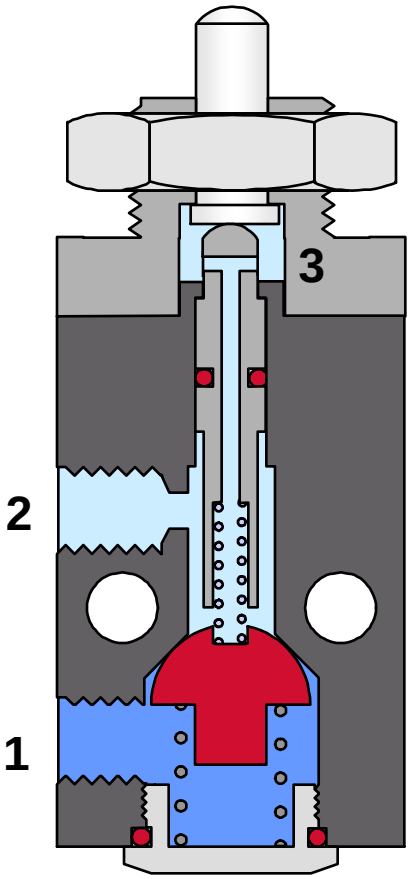
Poppet Valve 3/2

- Miniature 3/2 valve used for generating signals
- The poppet seal will give long life (not subjected to sliding friction)
- Supply to port 1 assists the spring to hold the poppet shut
- Outlet port 2 is connected through the plunger to a plain exhaust port
- When operated exhaust path sealed and poppet opened (flow 1 to 2)



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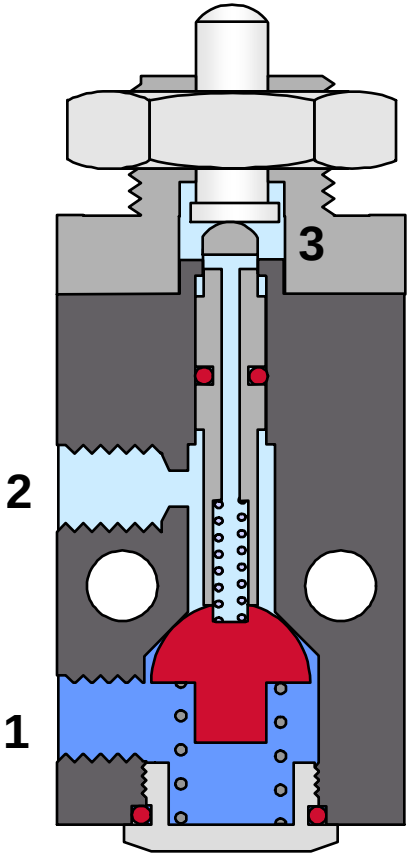

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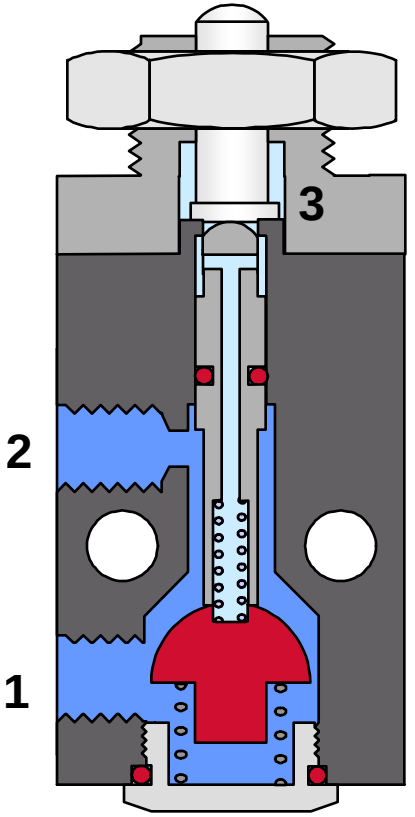

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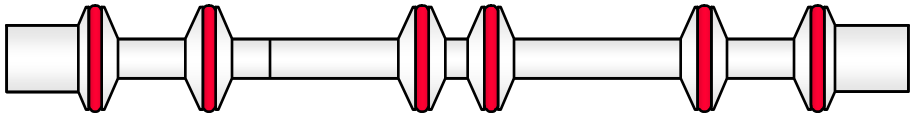
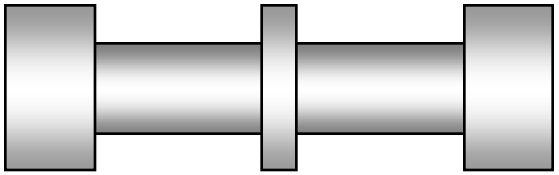
Spool Valves

- A long standing popular versatile design
- Available in most functions 3/2, 3/3, 5/2, 5/3, etc.
- Fully force balanced
- Wide range of styles, sizes, operators and mounting arrangements
- Suit a multiple range of applications

Spool Types

- A spool has a number of major and minor diameters called lands and valleys
- The lands seal with the valve bore and the valleys connect valve ports to control flow direction
- Dynamic seal type has the seals on the spool
- Glandless type have no sliding seals
- Static seal type has the seals fixed in the valve bore





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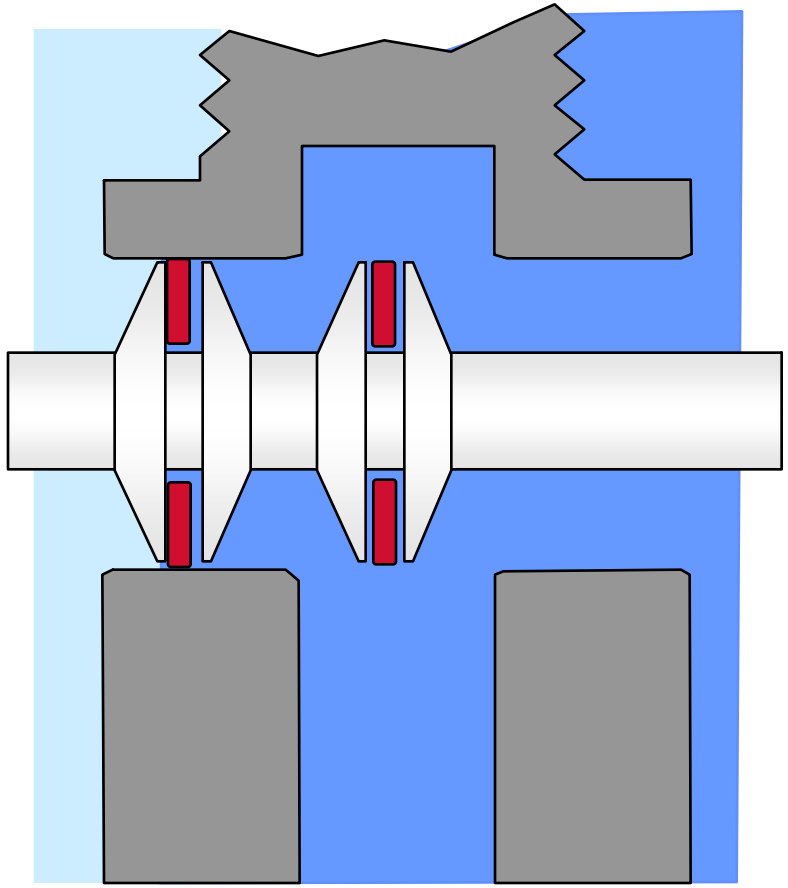
Disc Seals

- A disc seal is a loose fit in the groove, with the outer diameter just in contact with the valve bore.
- Under differential pressure the disc seal is pushed sideways and outwards to seal the clearance between the outer diameter of the piston and the valve bore
- The slim profile gives low radial force therefore reducing friction



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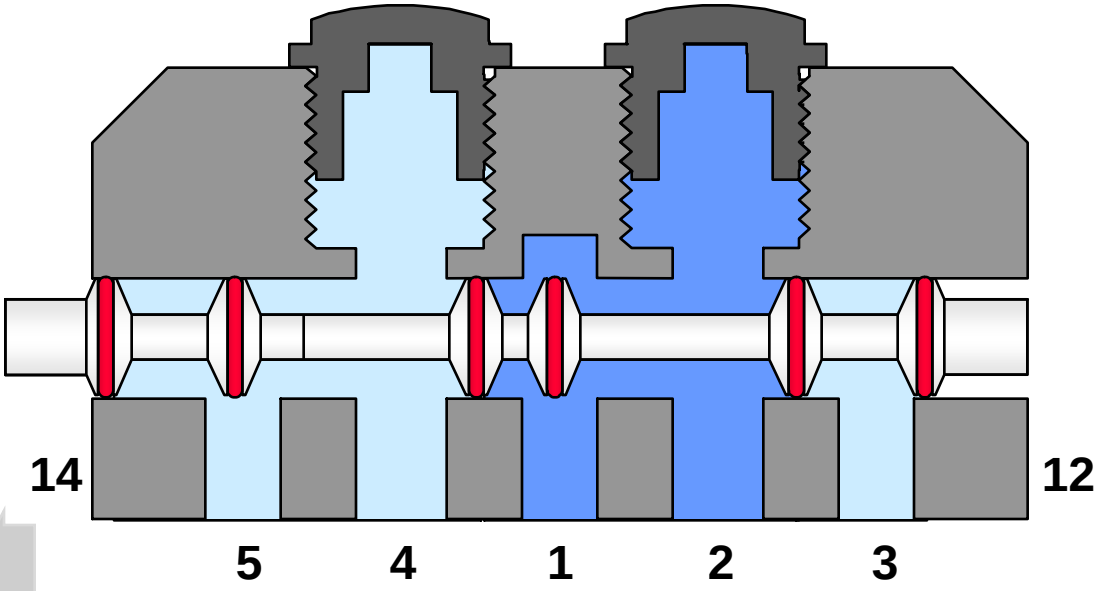
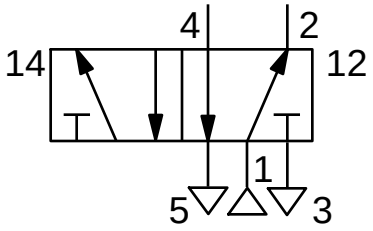
Spool Valve (dynamic seals)

- This 5/2 valve has a spool fitted with disc seals
- The seals move with the spool therefore they are called dynamic
- Normal position: port 1 is joined to 4 and 2 is joined to 3
- Operated position: port 1 is joined to 2 and 4 is joined to 5





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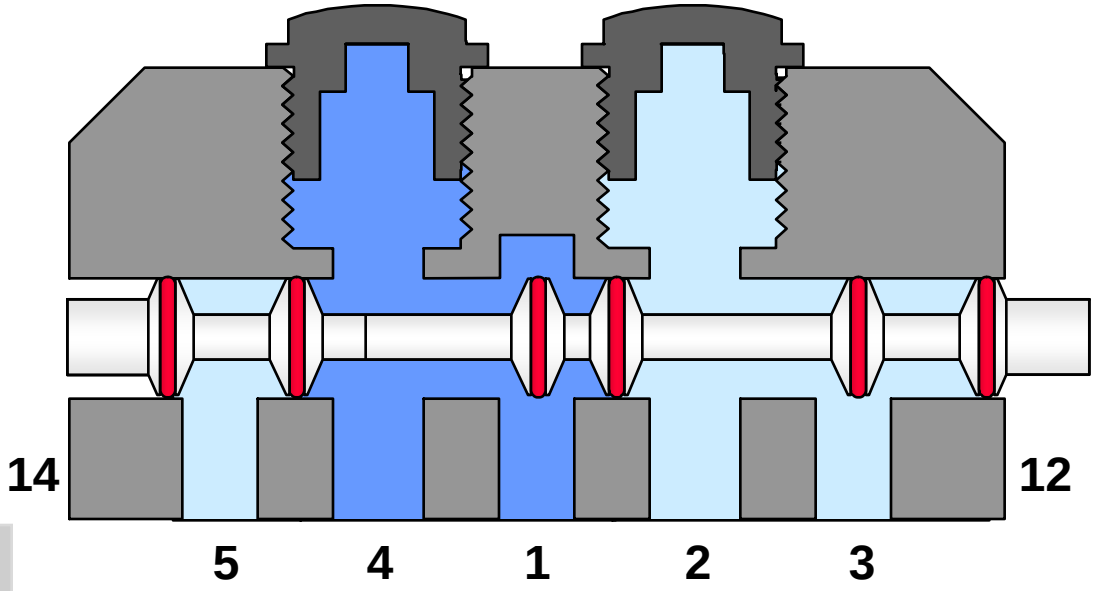

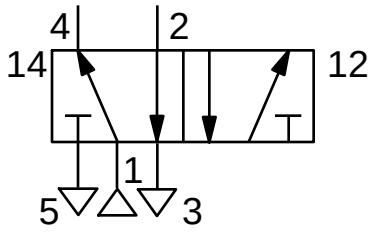

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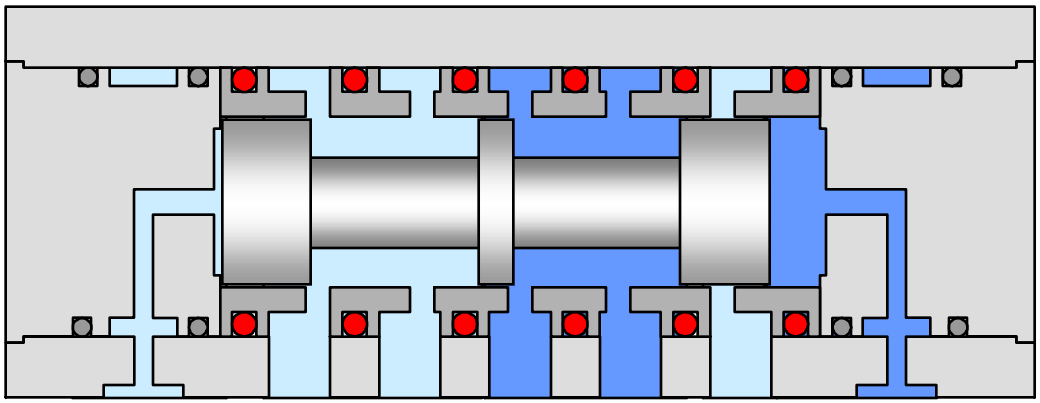
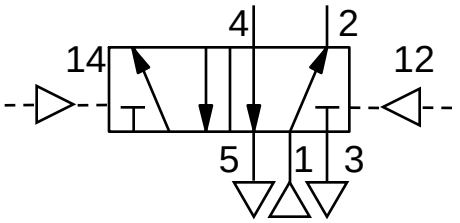
Spool Valve (glandless)

- This 5/2 valve has a matched spool and sleeve. The fit is so precise that seals between them are unnecessary
- The tiny amount of air crossing the spool lands provides an air bearing
- The result is low friction and long life





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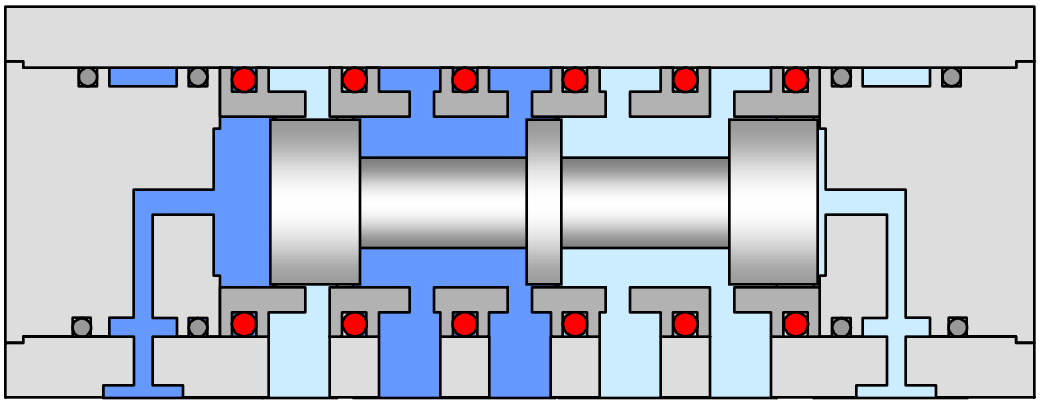

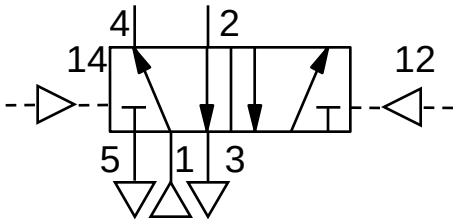

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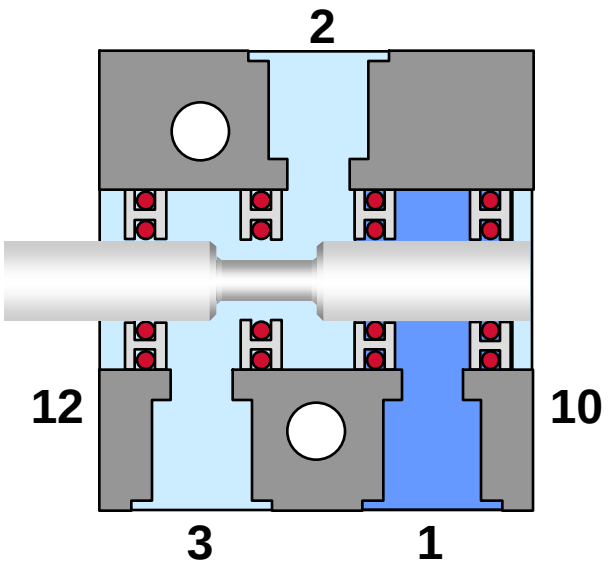
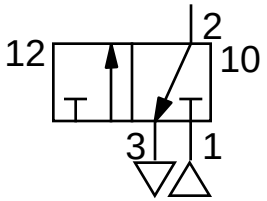
Spool Valve (static seals)

- This 3/2 valve has a plain spool sliding within static seals
- The O Ring seals are held in carriers fixed in the valve bore and positioned by spacers (not shown)
- The larger O Rings seal the valve bore with the carriers
- The smaller O Rings seal the carriers with the spool





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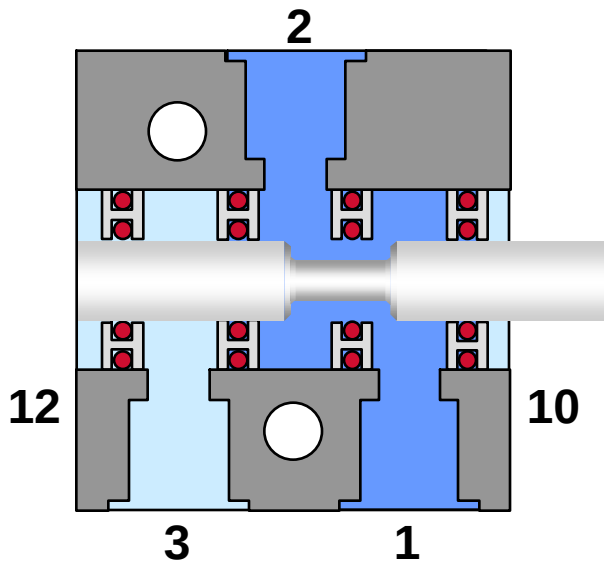

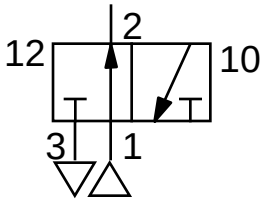

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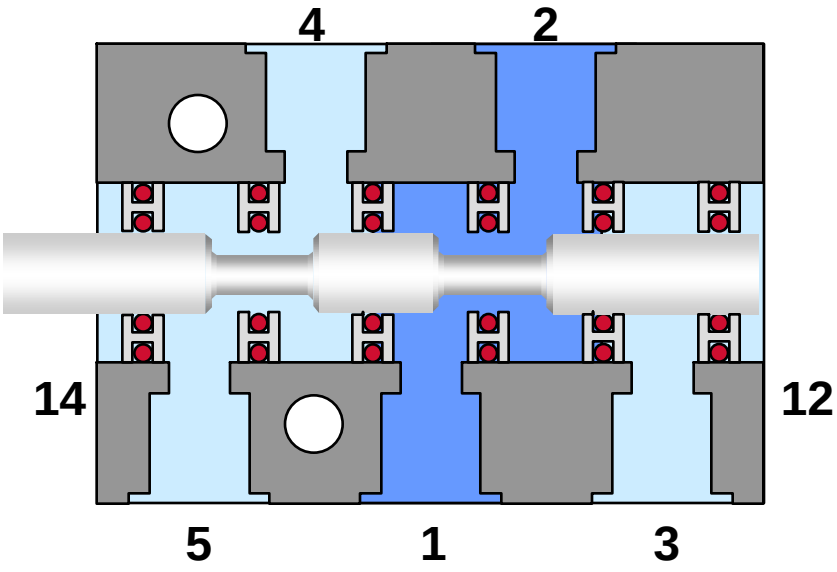

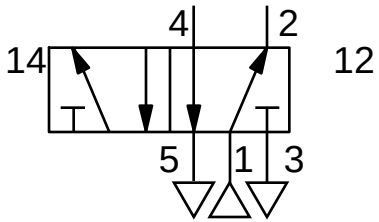

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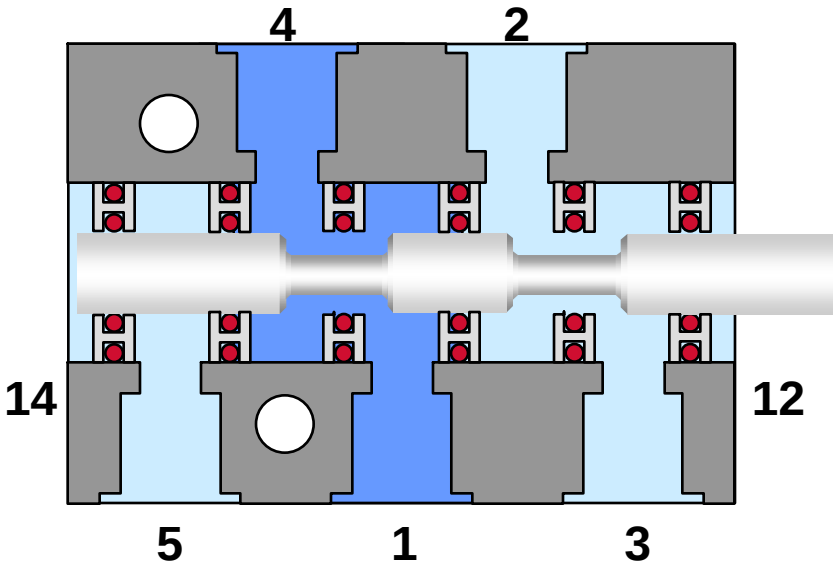

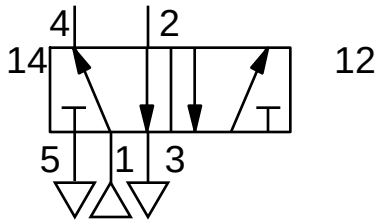

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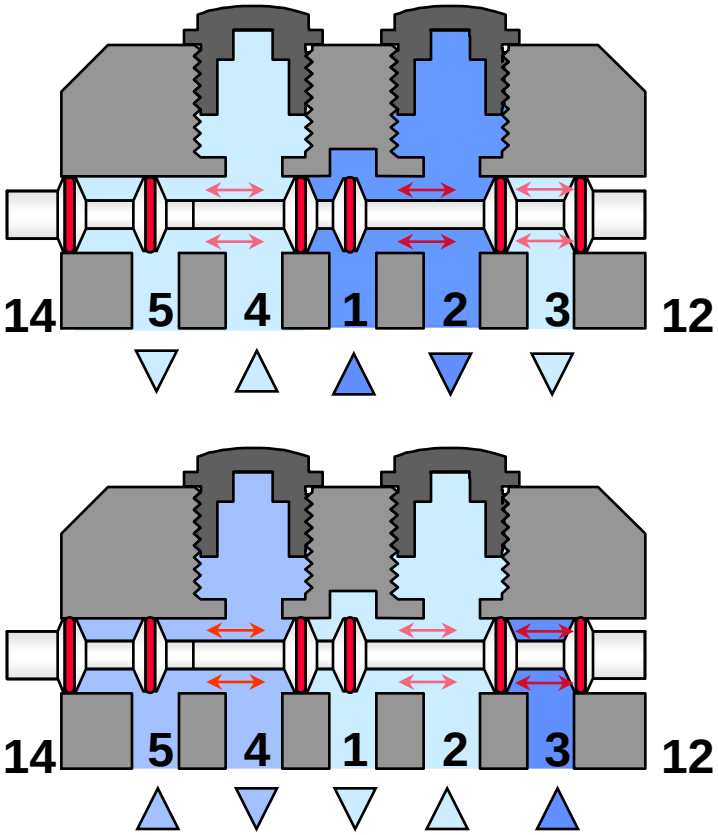
Balanced Spool

- The pressure acting at any port will not cause the spool to move
- The areas to the left and right are equal and will produce equal and opposite forces
- Balanced spool valves have a wide range of application as any selection of pressures can be applied to the 5 ports. Single pressure and twin pressure supply versions shown



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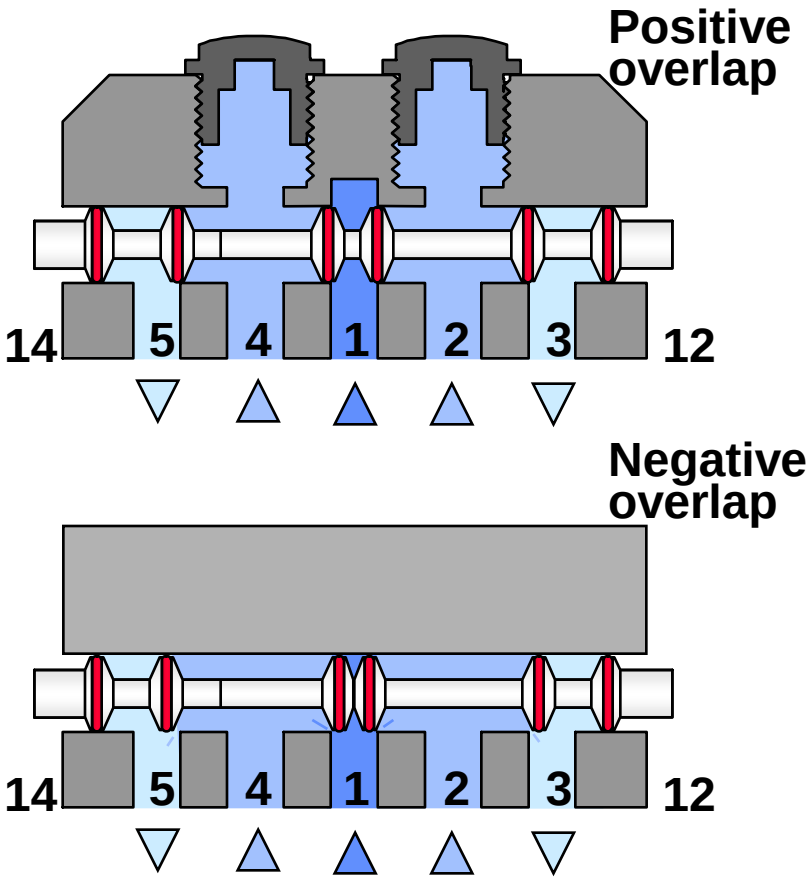
Overlap

- Most spool valves are designed with a positive overlap
- When the spool is in transit from the normal to the operated state port 2 will be closed before port 4 is opened (or 4 before 2)
- If the spool is being moved slowly a negative overlap will cause pressure loss during the spool changeover and may even stall



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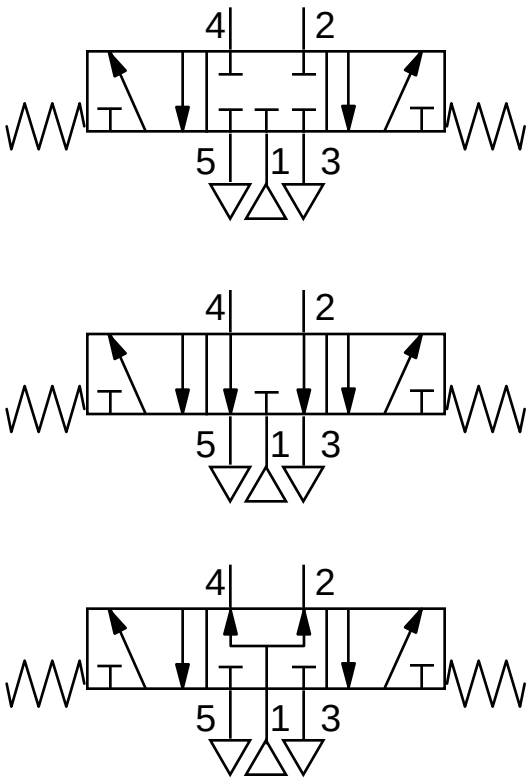
Three Position Spool Valves

- This type of valve has a normal state where the spool is in a mid position
- The characteristic in the centre position is determined by the land spacings on the spool
- The three types are:
  All ports blocked
  Open exhausts
  Open pressure



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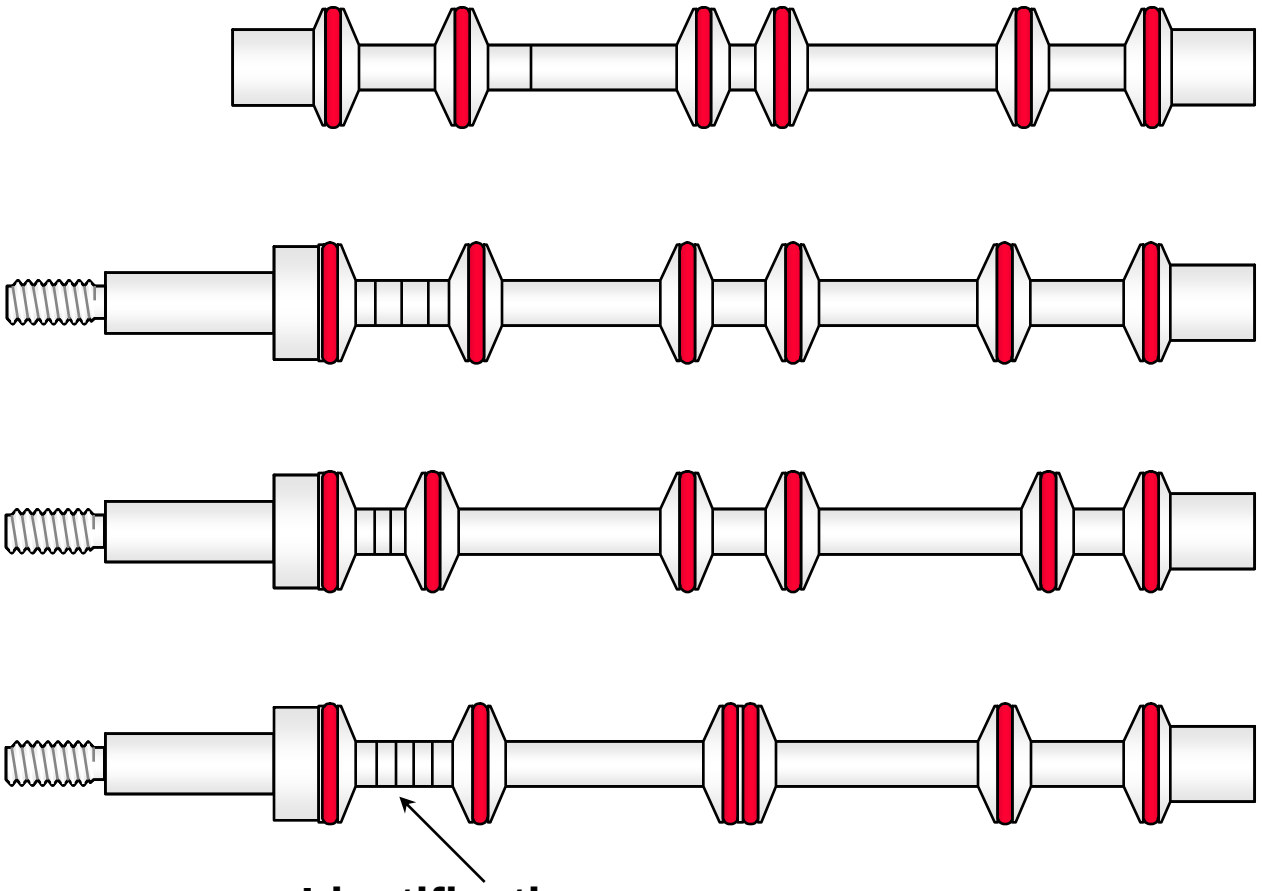
Valve Spools (dynamic seals)



Examples from the Nugget 120 range

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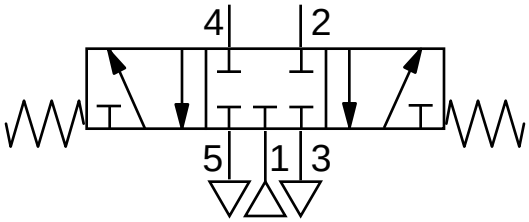
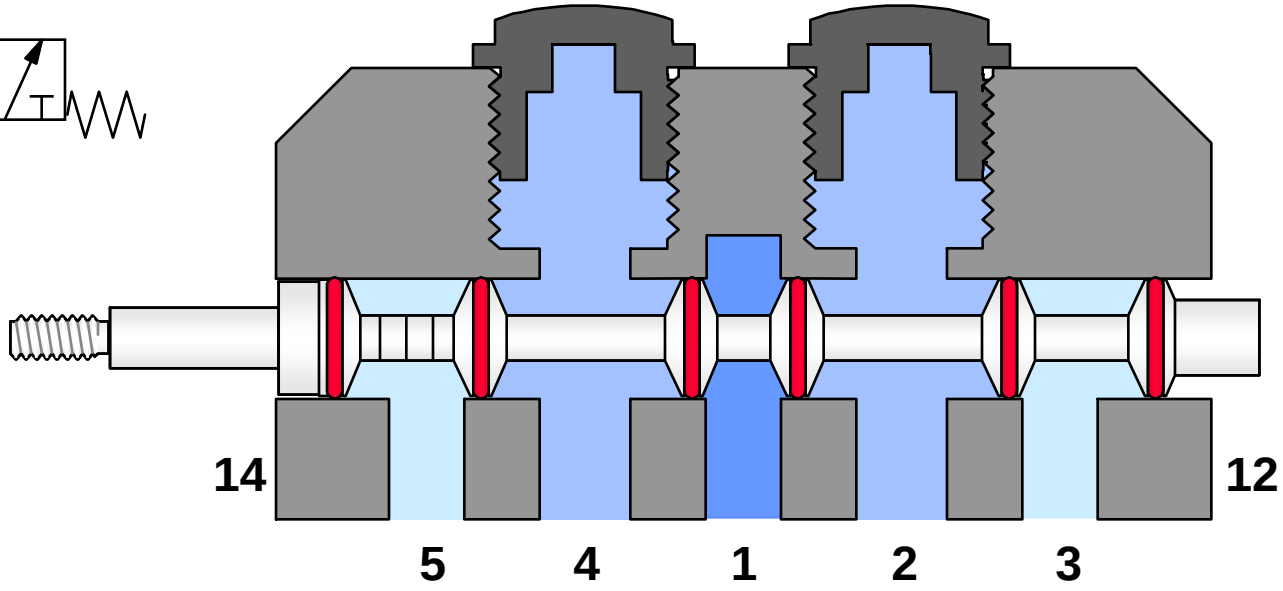
5/3 Valve (all ports sealed)

- **With the spool in the mid (normal) position all ports are sealed**
- **Spool right, port 1 is joined to 4, port 2 is joined to 3**
- **Spool left, port 1 is joined to 2, port 4 is joined to 5**





NORGREN

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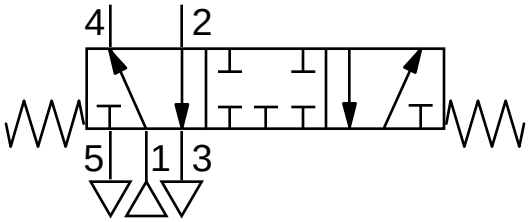

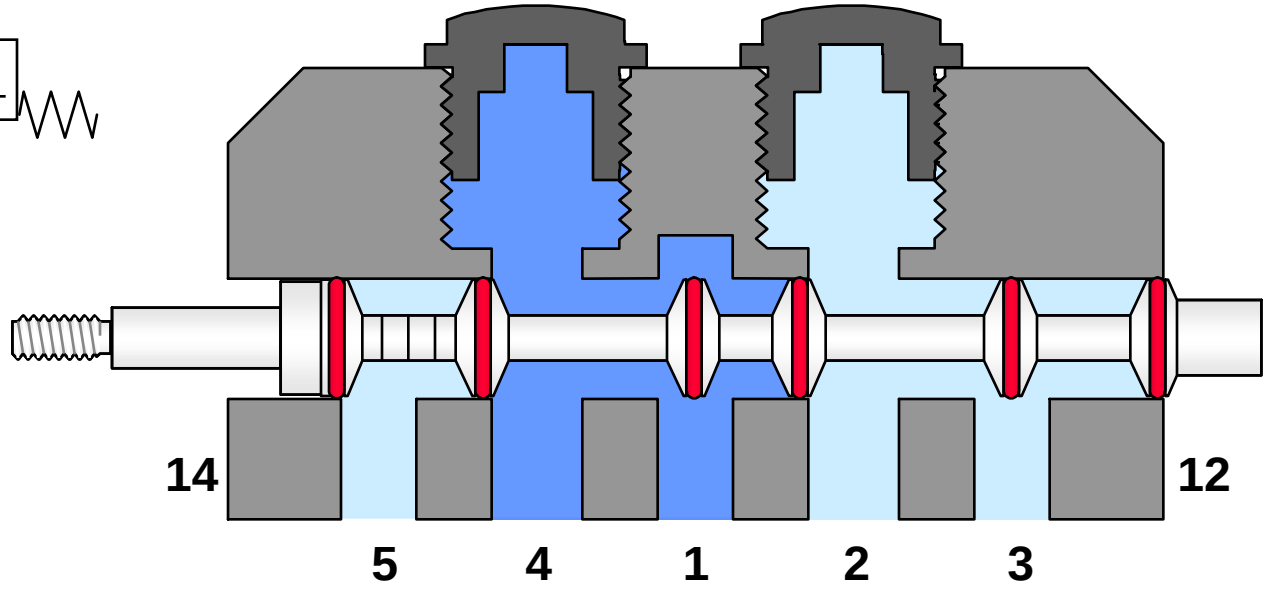

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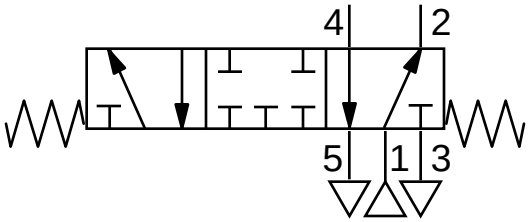

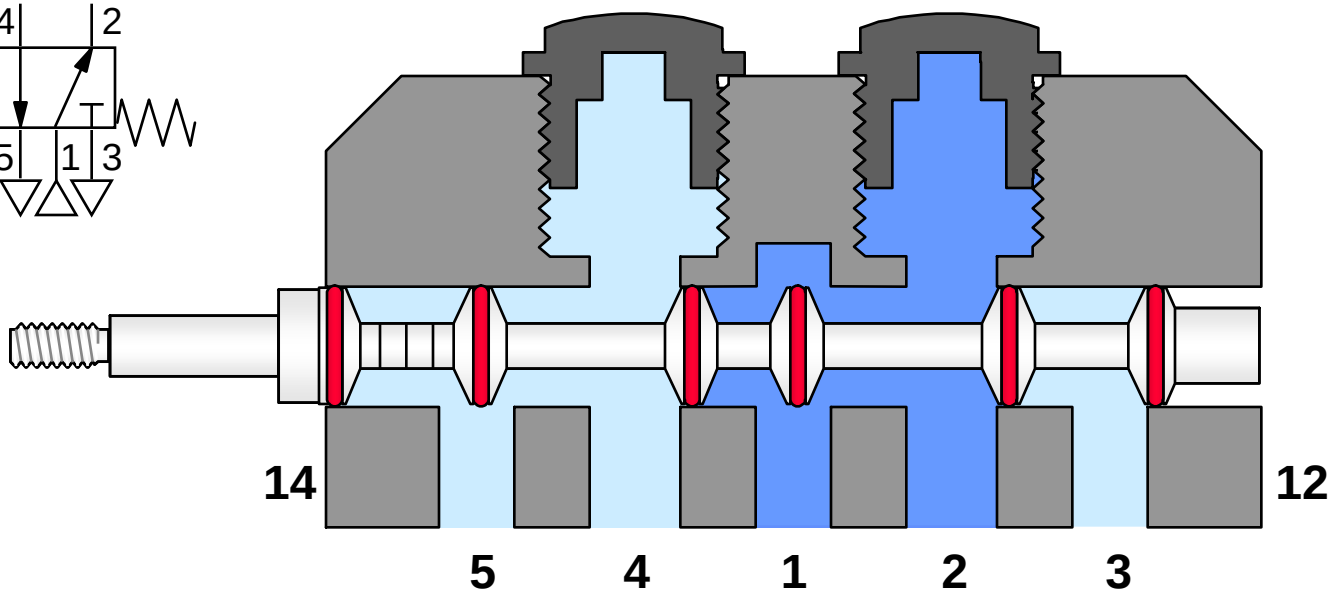

NORGREN

5/3 Valve (open exhausts)

- **With the spool in the mid (normal) position the supply port is sealed and outlet ports are to exhaust**
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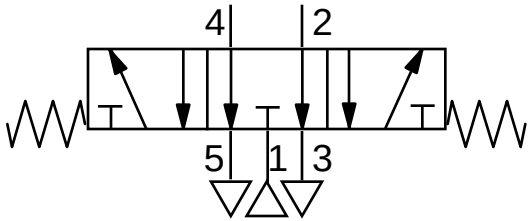

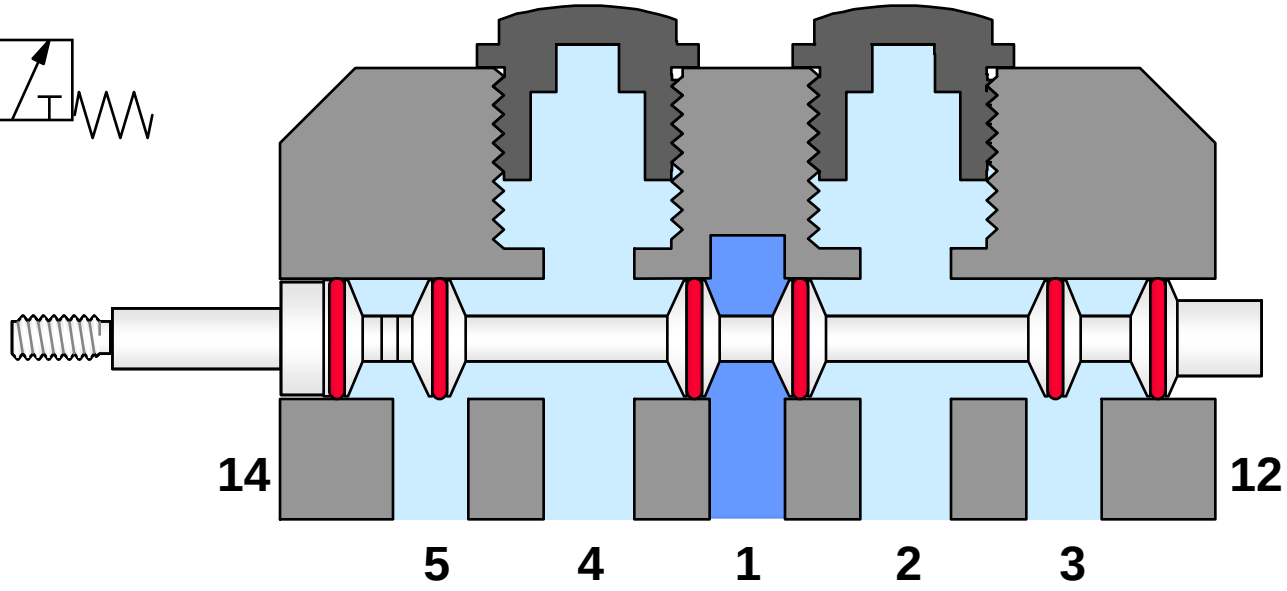

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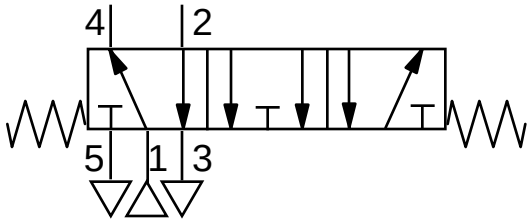

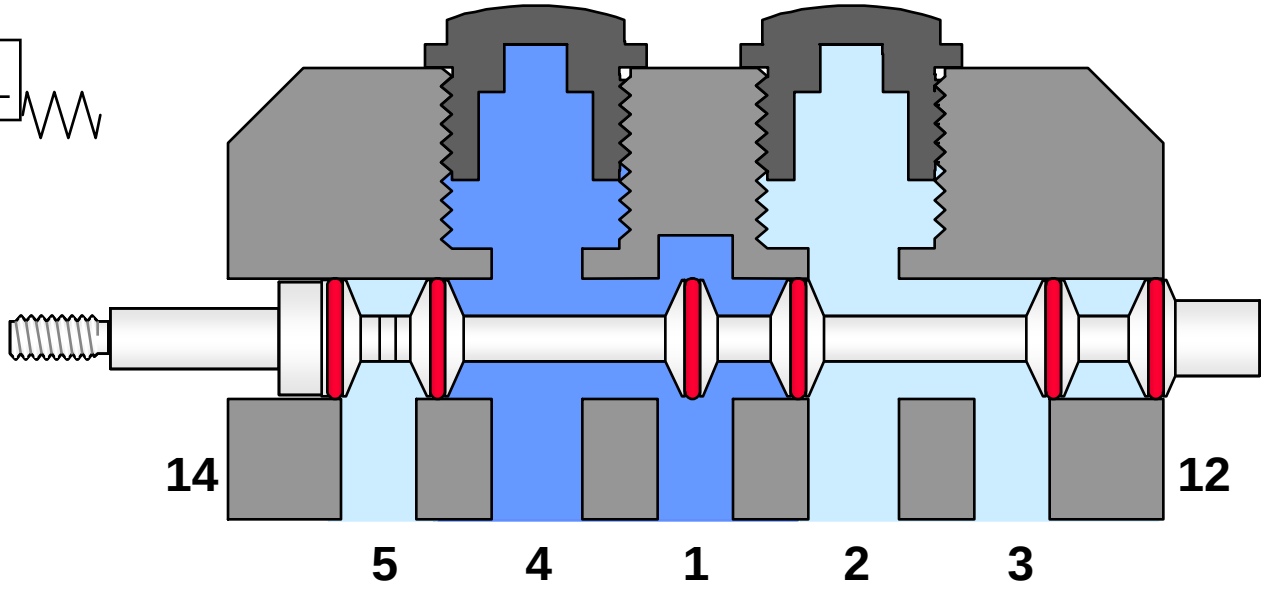

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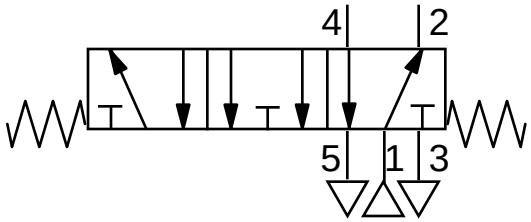

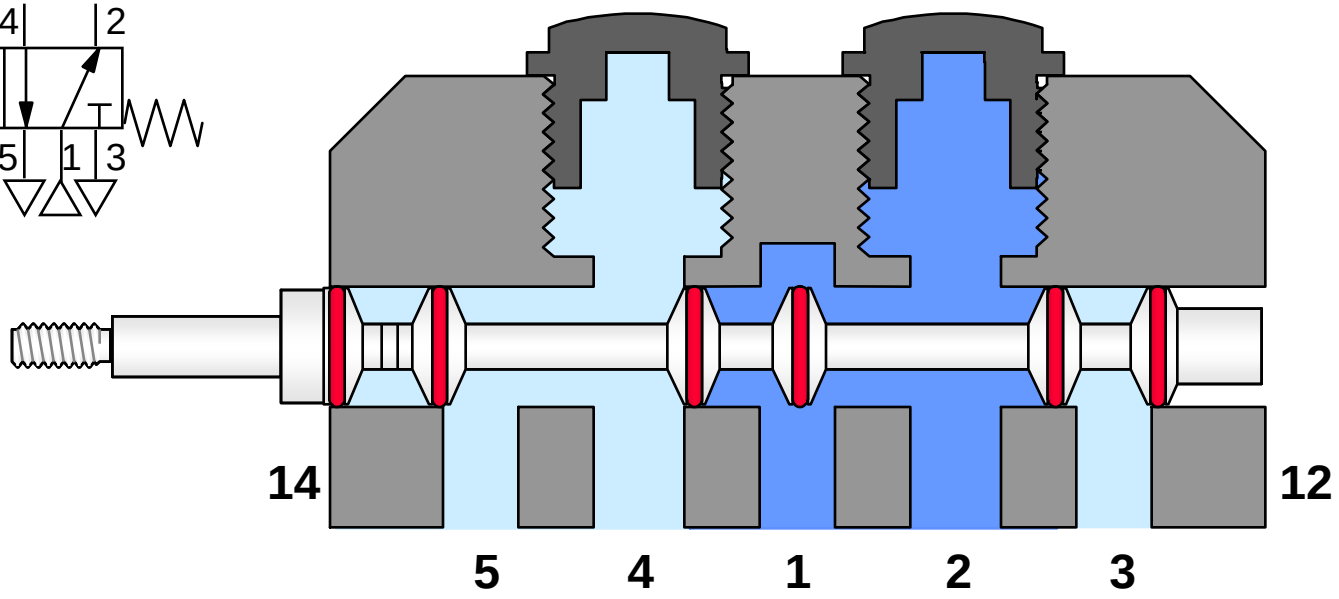

NORGREN

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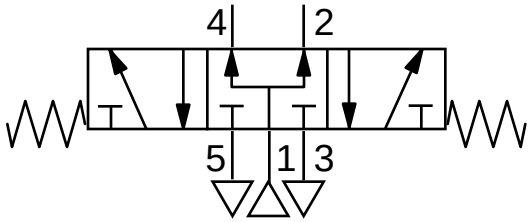

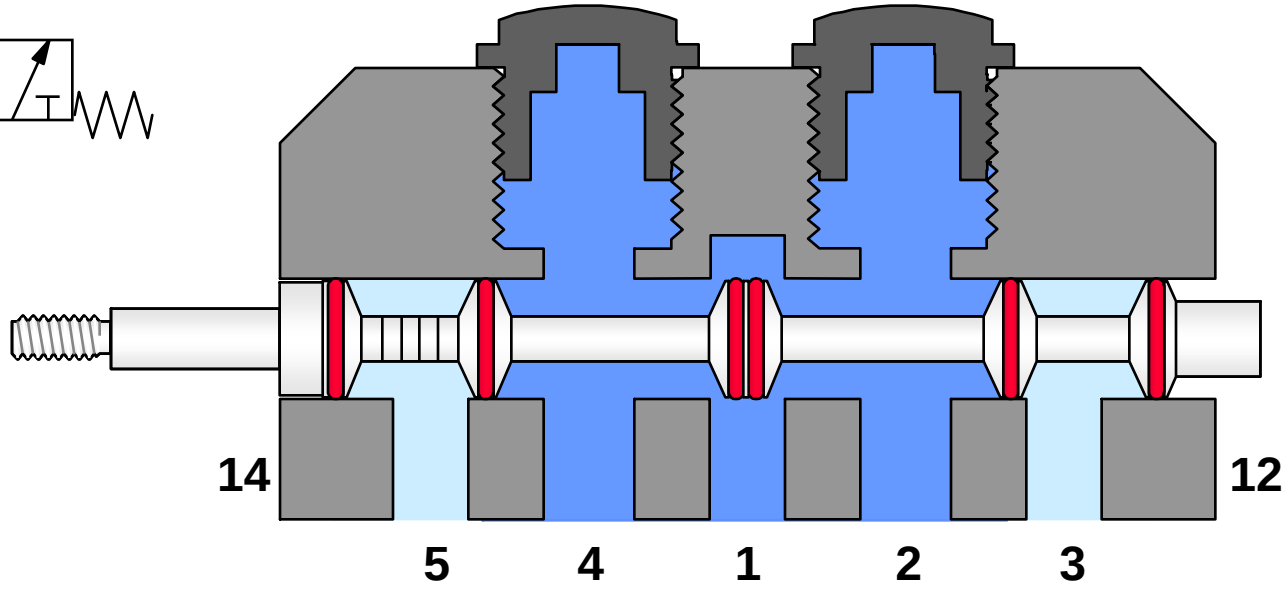

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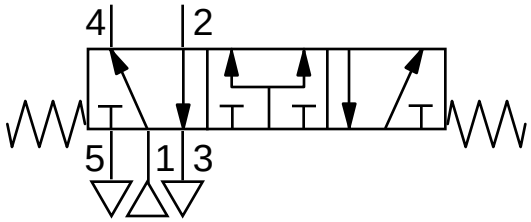

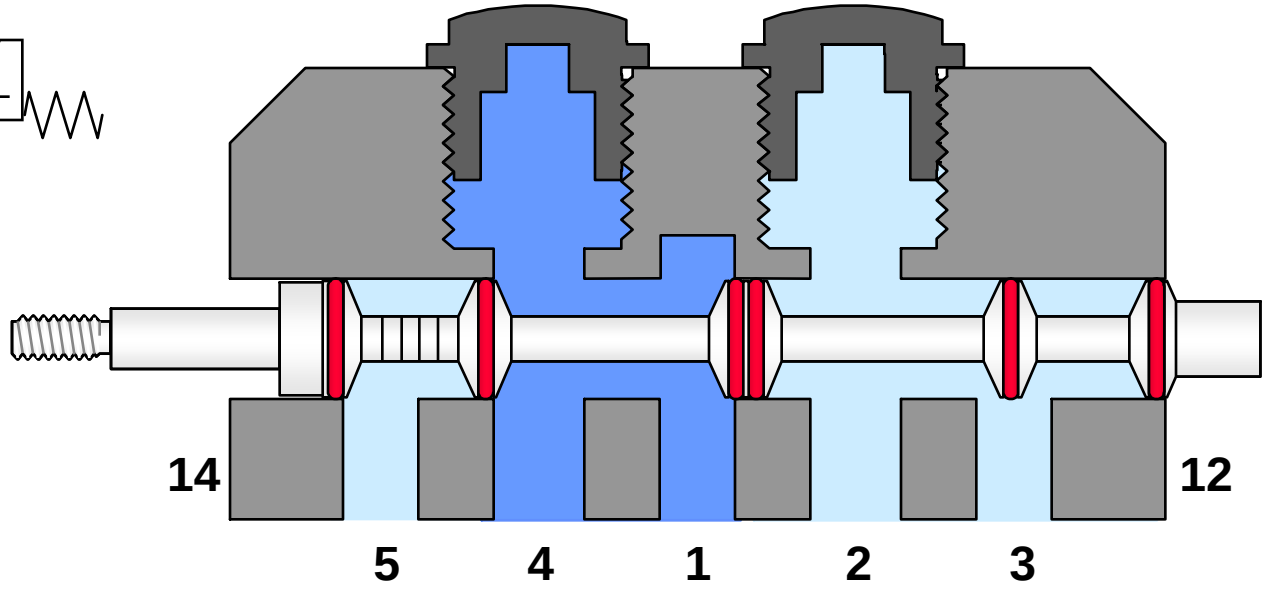

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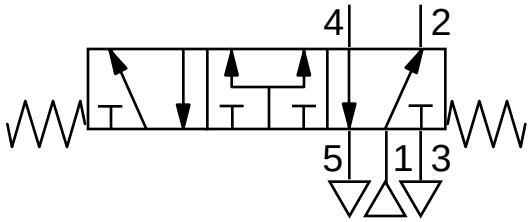
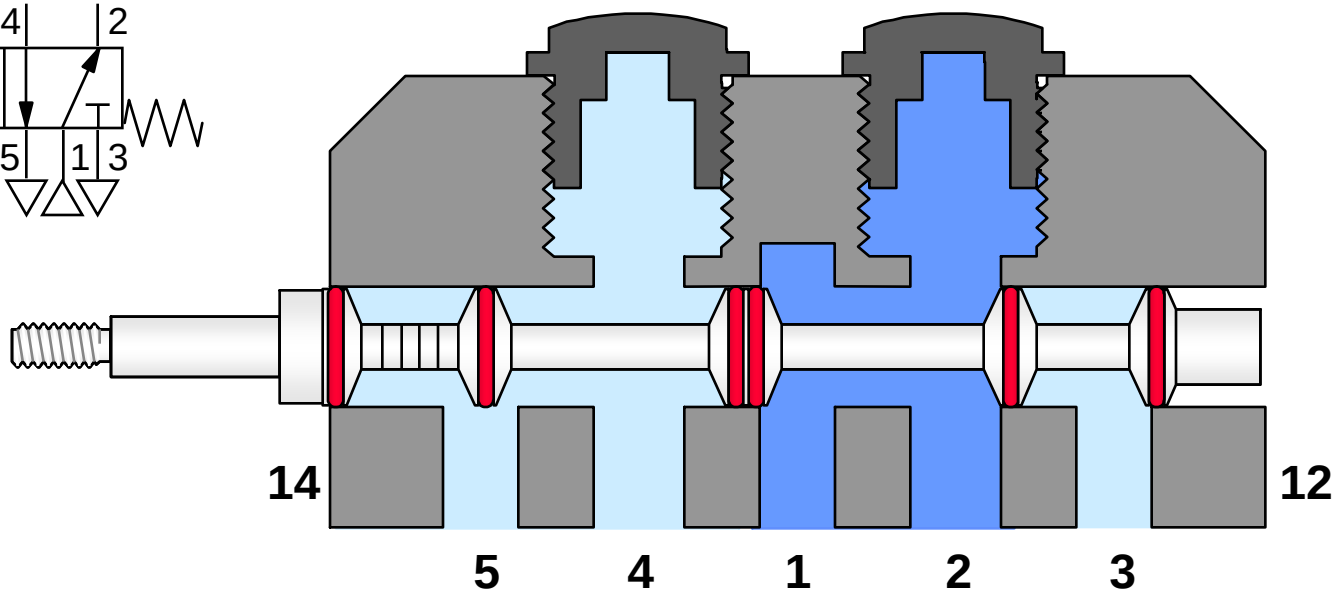


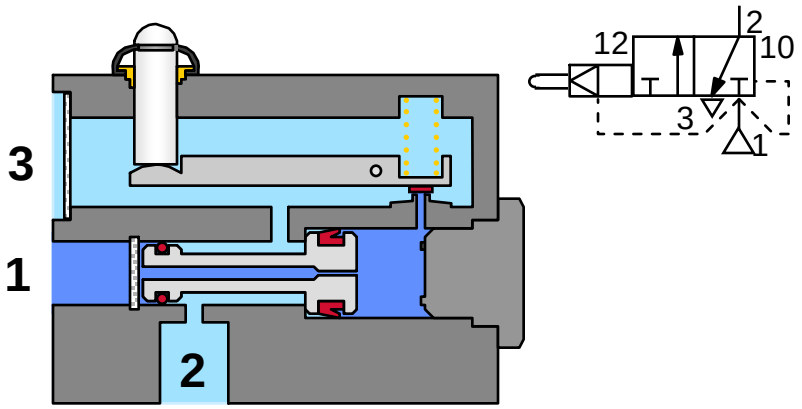


NORGREN

Other Valve Designs

Bleed Valves

- Provide valve operation from a low operating force
- In the normal position the lever arm is holding the bleed orifice closed
- The differential piston has supply pressure acting on the small end, also the large end through a restrictor in the piston
- A light operating force will lift the bleed seal allowing air to escape
- Flow through the piston is slower than the bleed orifice so the pressure is lost and the piston changes state
- Releasing the lever causes the piston to reset



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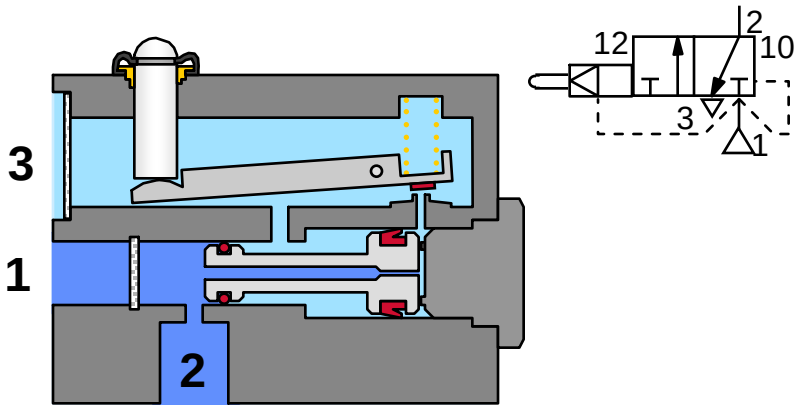
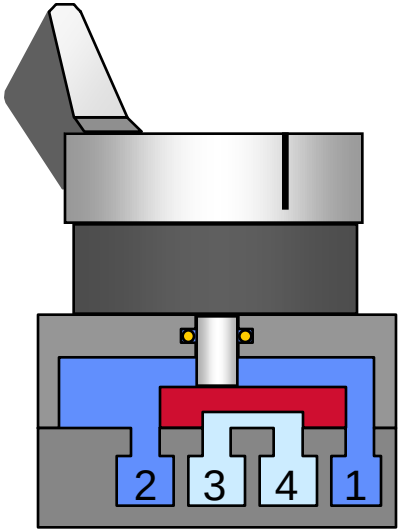
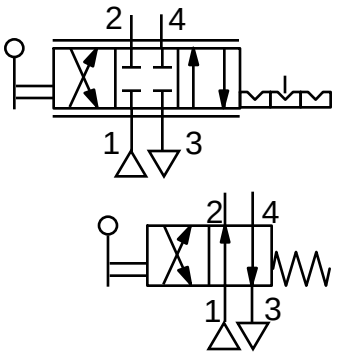


NORGREN

Plate Valves

- Have no sliding synthetic rubber seals
- The rotary slide (red) is ground flat with the base
- Pressure supplied at port 1 pushes the plate down to seal, also supplies outlet port 2
- The cavity in the plate connects outlet port 4 to exhaust port 3
- When operated the plate swings to connect port 2 to exhaust 3 and 1 to 4
- Versions 4/2 and 4/3 with detented centre position
- Part movement of lever will give flow control





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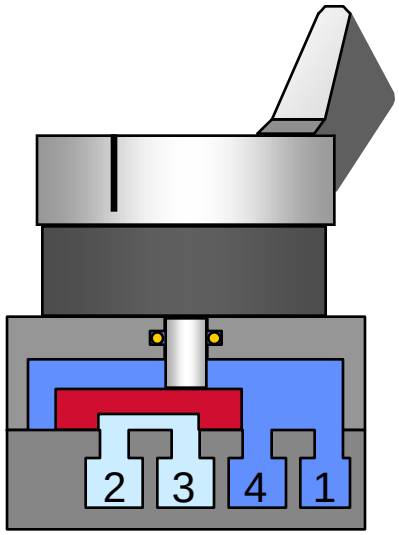
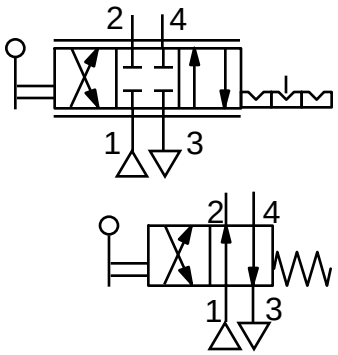
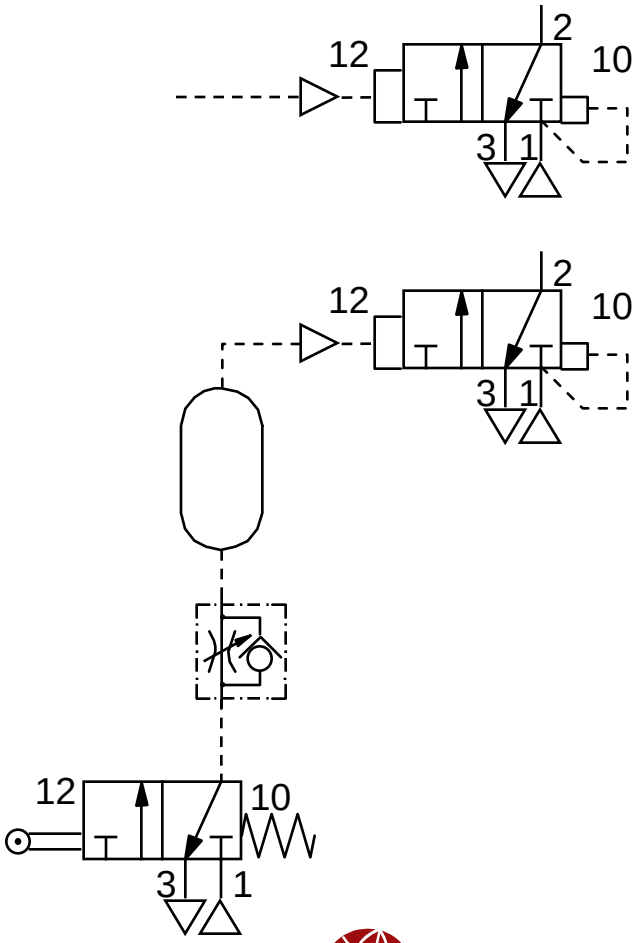




NORGREN

Pressure Switch (pneumatic)

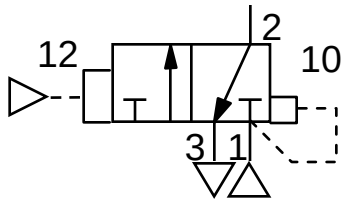
- Relay to boost weak signals
- Relay for a pneumatic time delay
- When the signal at port 12 reaches about 50% of the supply pressure at port 1, the pressure switch operates to give a strong output signal at 2
- For time delays at any pressure only the linear part of the curve will be used giving smooth adjustment

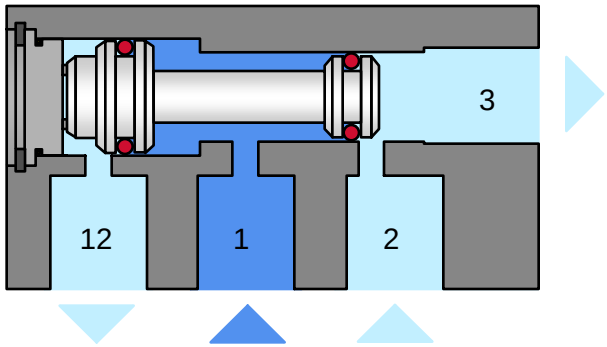


NORGREN

Pressure Switches

- Pressure applied at port 1 acting on the differential annular areas holds the spool to the left
- The weak or slowly rising pressure of a signal applied to port 12 needs only to reach about 50% of he pressure at port 1 to operate the valve
- Port 1 is then connected to port 2
- Removing the signal allows the differential force to reset the valve





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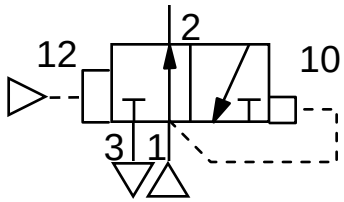
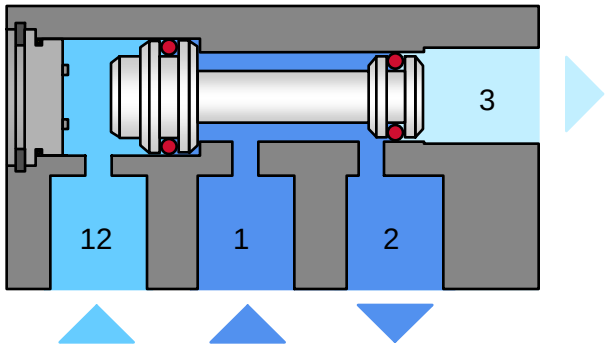
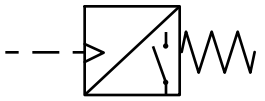




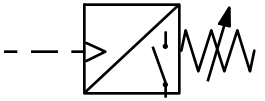
NORGREN

Pressure Switches (electrical)

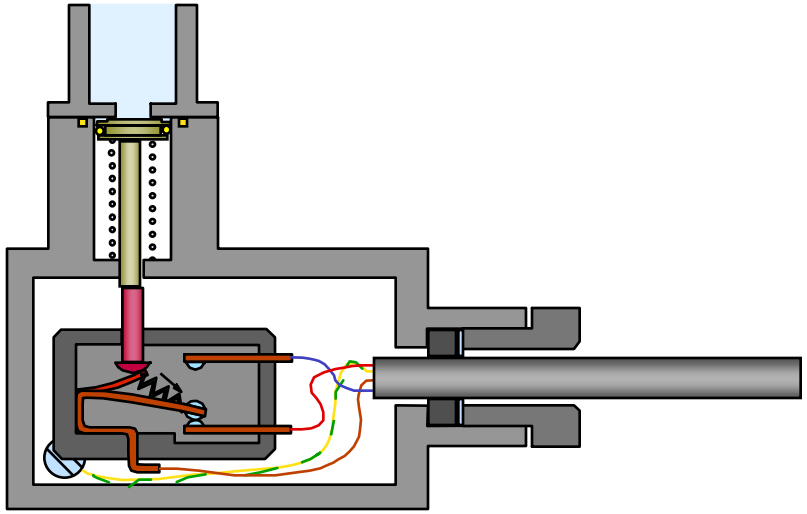
- This fixed value example uses a built in single acting cylinder to operate a standard changeover microswitch
- The operating pressure is about 3 bar this needs to overcome the combined force of the cylinder and microswitch springs
- Adjustable pressure switches are also available



Fixed



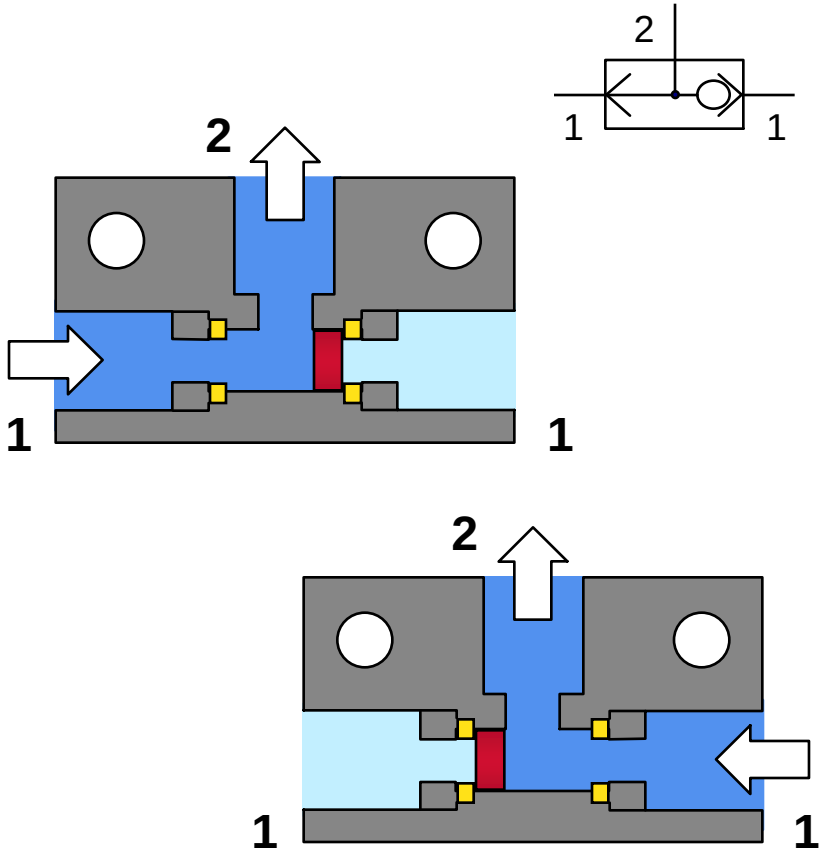
Adjustable



NORGREN

Logic “OR” Shuttle Valve

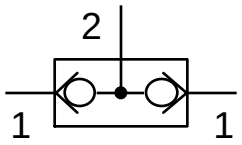
- An air signal given to either the left hand port 1 or the right hand port 1 will result in an output at port 2
- The sealing disc moves across to seal the exhaust signal line to prevent loss of signal pressure



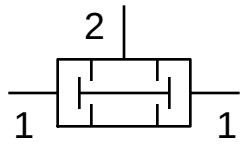
NORGREN

Logic “AND” Shuttle Valve

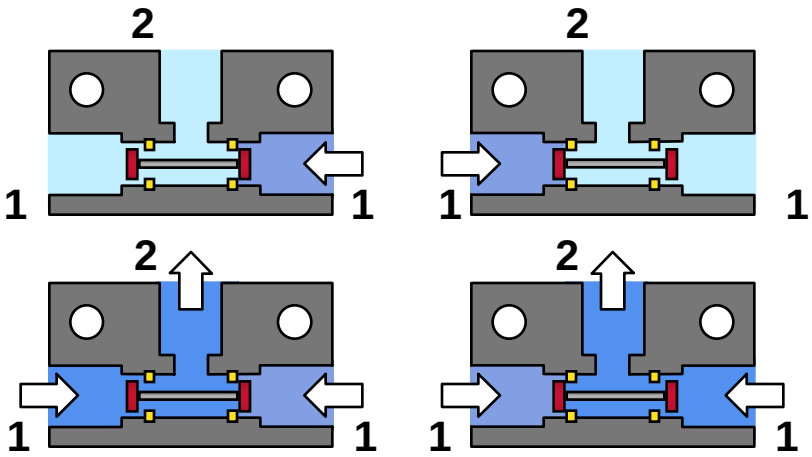
- A single air signal at either of the ports 1 will cause the shuttle to move and block the signal
- If a signals are applied at both the left hand AND right hand ports 1 only one of them will be blocked the other will be given as an output at port 2
- If the pressures are not equal the one with the lowest pressure is switched



ISO 1219-1 symbol



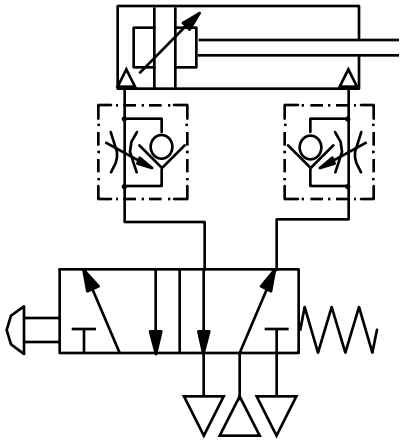
Popular old symbol



NORGREN

Flow Regulation

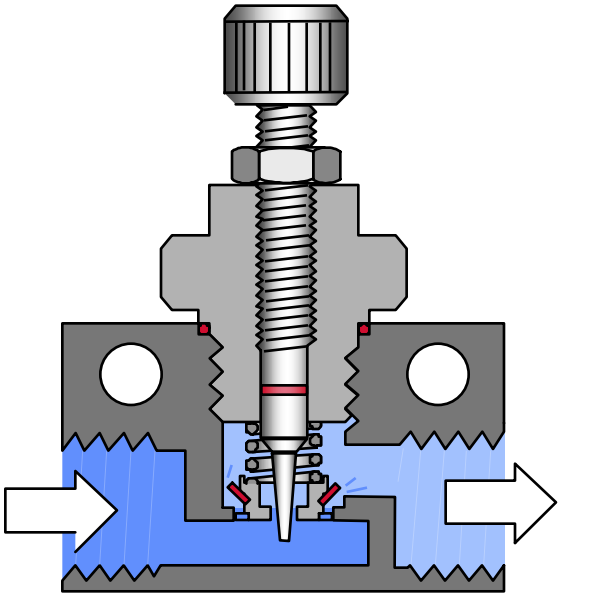
- By the use of flow regulators the outstroke speed and instroke speed of a piston rod can be independently adjusted
- Speed is regulated by controlling the flow of air to exhaust
- The front port regulator controls the outstroke speed and the rear port regulator controls the instroke speed



NORGREN

Flow Regulator

- **Uni-directional, line mounted adjustable flow regulator**
  - **Free flow in one direction**
  - **Adjustable restricted flow in the other direction**



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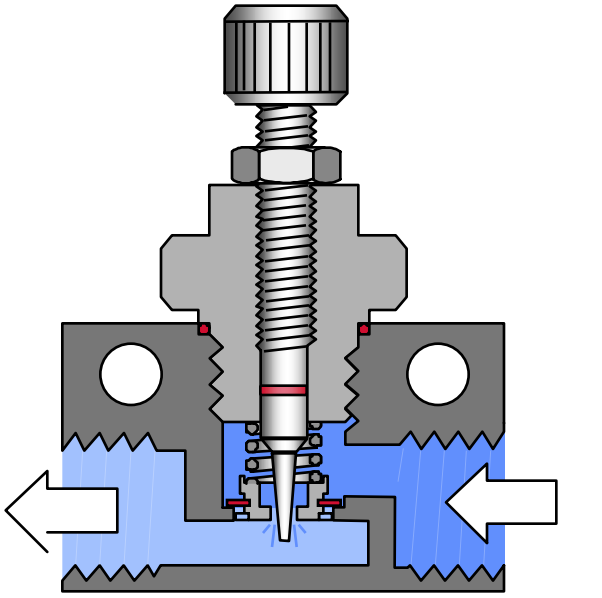
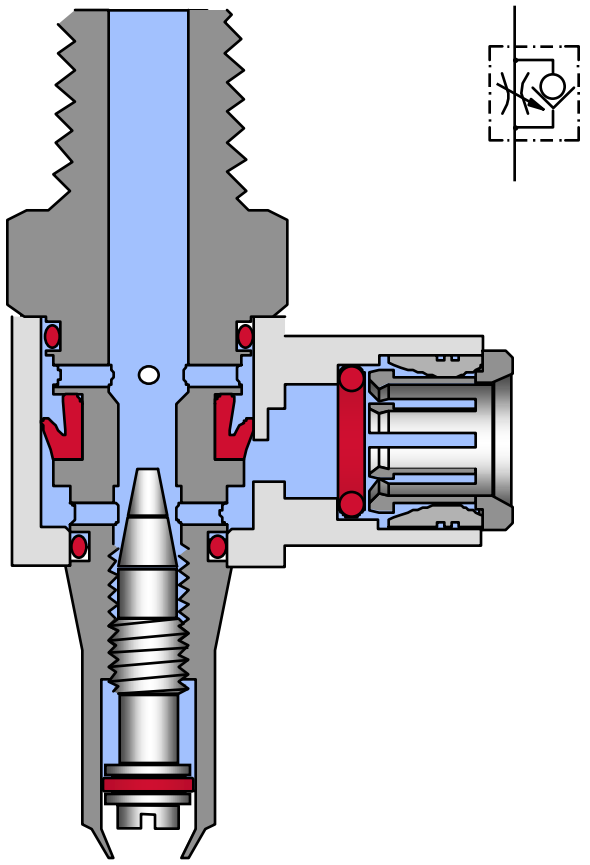


Banjo Flow Regulator

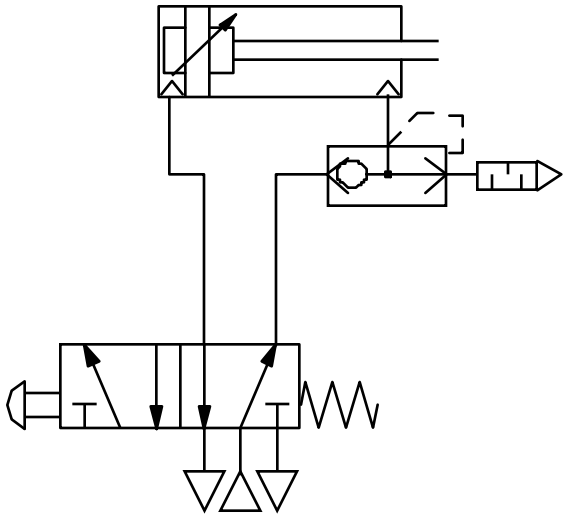
- Designed to fit directly in to cylinder ports, so placing adjustment at the appropriate cylinder end
- Two types:
  - One to give conventional flow restriction out of the cylinder and free flow in (as illustrated)
  - The other type to give restricted flow in to the cylinder and free flow out (not illustrated)



NORGREN

Quick Exhaust Valve

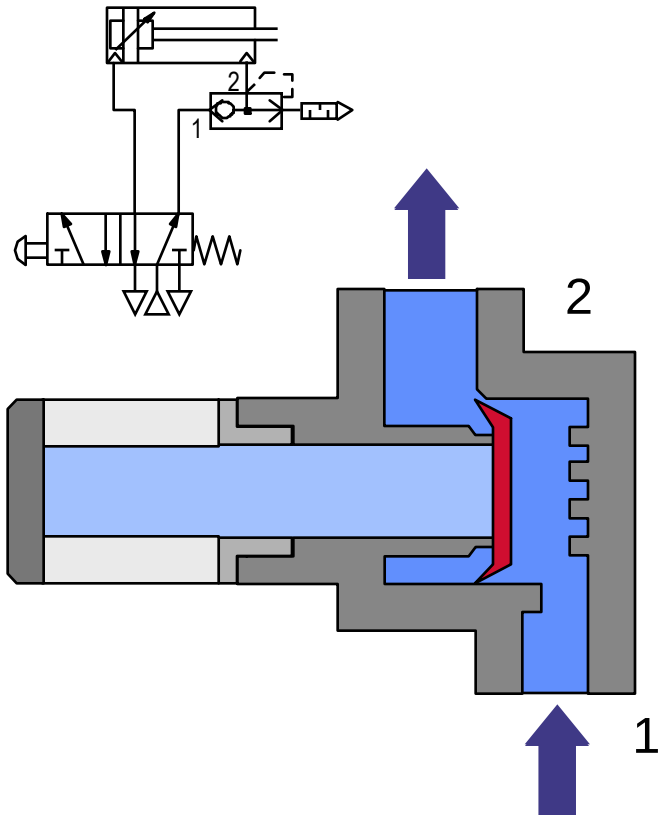
- In some applications cylinder speed can be increased by 50% when using a quick exhaust valve
- When operated, air from the front of the cylinder exhausts directly through the quick exhaust valve
- The faster exhaust gives a lower back pressure in the cylinder therefore a higher pressure differential to drive out the piston rod



NORGREN

Quick Exhaust Valve

- Port 2 is connected directly to the end cover of a cylinder
- Port 1 receives air from the control valve
- Air flows past the lips of the seal to drive the cylinder
- When the control valve is exhausted, the seal flips to the right opening the large direct flow path
- Air is exhausted very rapidly from the cylinder for increased speed



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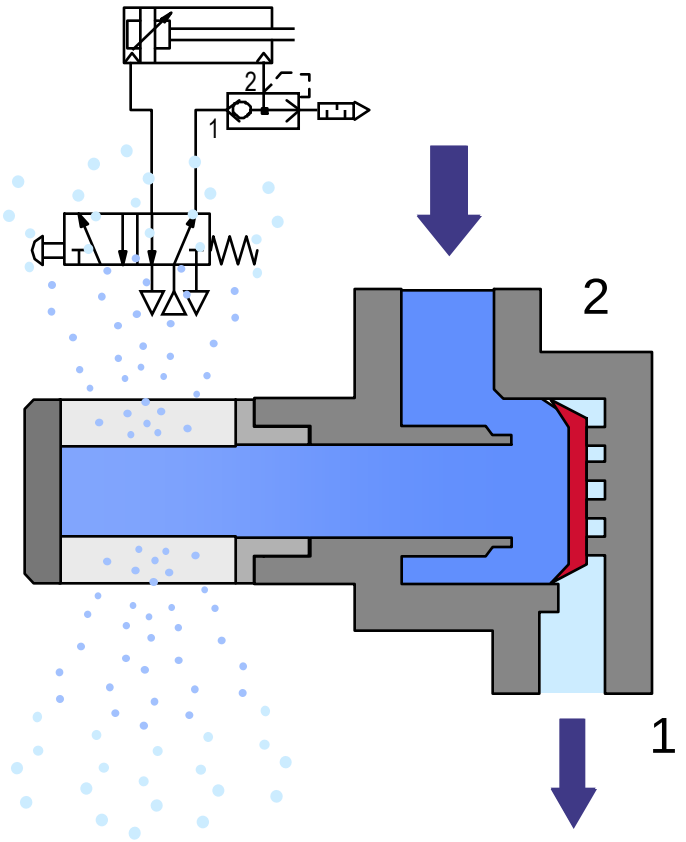
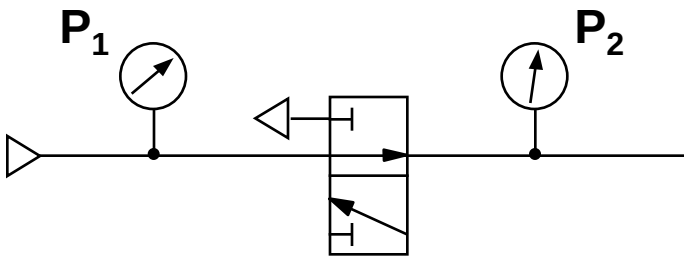


NORGREN

Valve Flow

Flow through valves

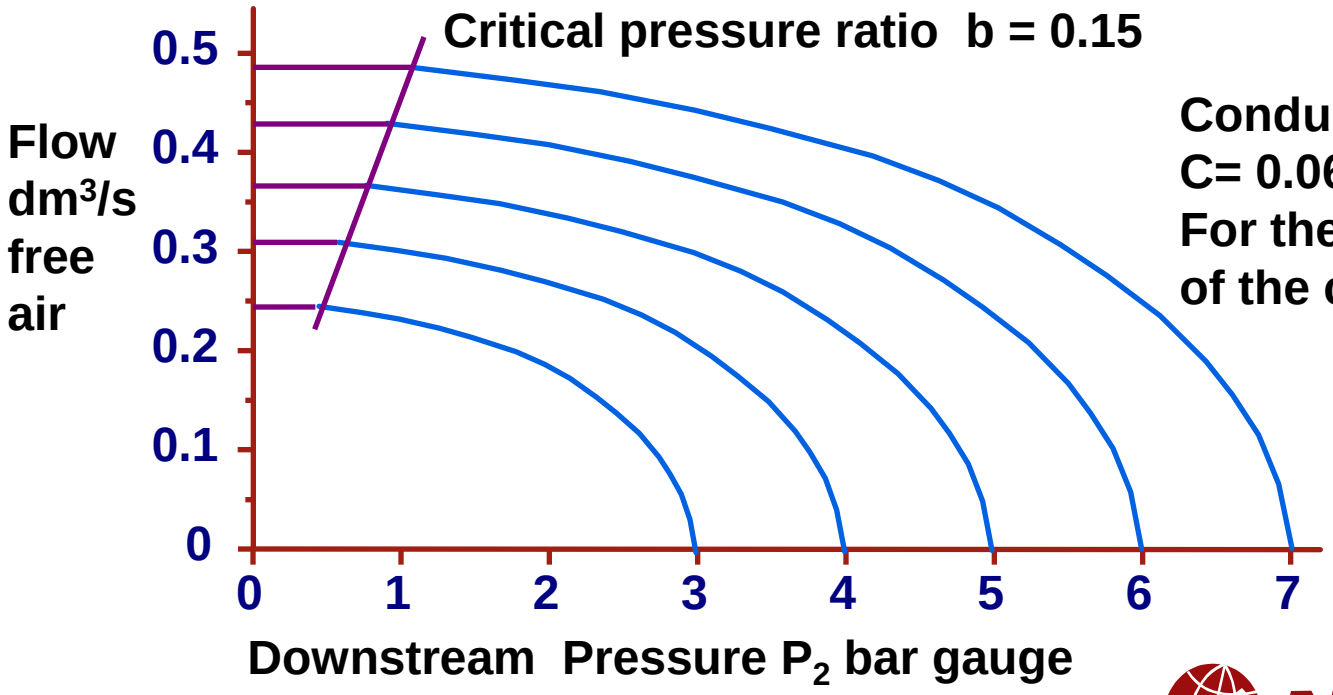
- Valve flow performance is usually indicated by a flow factor of some kind, such as “C”, “b”, “Cv”, “Kv”. Also orifice sizes “A” and “S” or by flow values l/min. and m^3/h.
- Testing a valve to ISO 6358, results in performance values of “C” (conductance) and “b” (critical pressure ratio)
- For a range of steady source pressures P_1 the pressure P_2 is plotted against varying flow through the valve until it reaches a maximum
- The result is a set of curves showing the flow characteristics of the valve



NORGREN

Valve Flow

- From these curves the critical pressure ratio “b” can be found. “b” represents the ratio of P_2 to P_1 at which the flow velocity goes sonic. Also the conductance “C”at this point which represents the flow “dm^3/ second / bar absolute”



Conductance
C= 0.062 dm/s/bar a
For the horizontal part of the curve only

P_1 is the zero flow point for each curve

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Valve Flow

- **If a set of curves are not available but the conductance and critical pressure ratio are known the value of flow for any pressure drop can be calculated using this formulae**

$$Q = C\ P_1 \sqrt{1 - \left[\frac{\frac{P_2}{P_1} - b}{1 - b}\right]^2}$$

Where :

P_1 = upstream pressure bar a

P_2 = downstream pressure bar a

C = conductance $dm^3/s/bar\ a$

b = critical pressure ratio

Q = flow dm^3/s

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Example calculation

- **Calculation of flow through a Nugget 120 valve supplied with 8 bar. A pressure drop of 1.5 bar is acceptable. The conductance and critical pressure ratios for the valve are C = 4.92 and b = 0.23**

$$Q = 4.92 \,.\, (8+1)\sqrt{1 - \left[\frac{\frac{(6.5+1)}{(8+1)} - 0.23}{1 - 0.23}\right]^2}$$

$$Q = 27.45 \text{ l/s} \quad \text{or } 1647 \text{ l/min}$$

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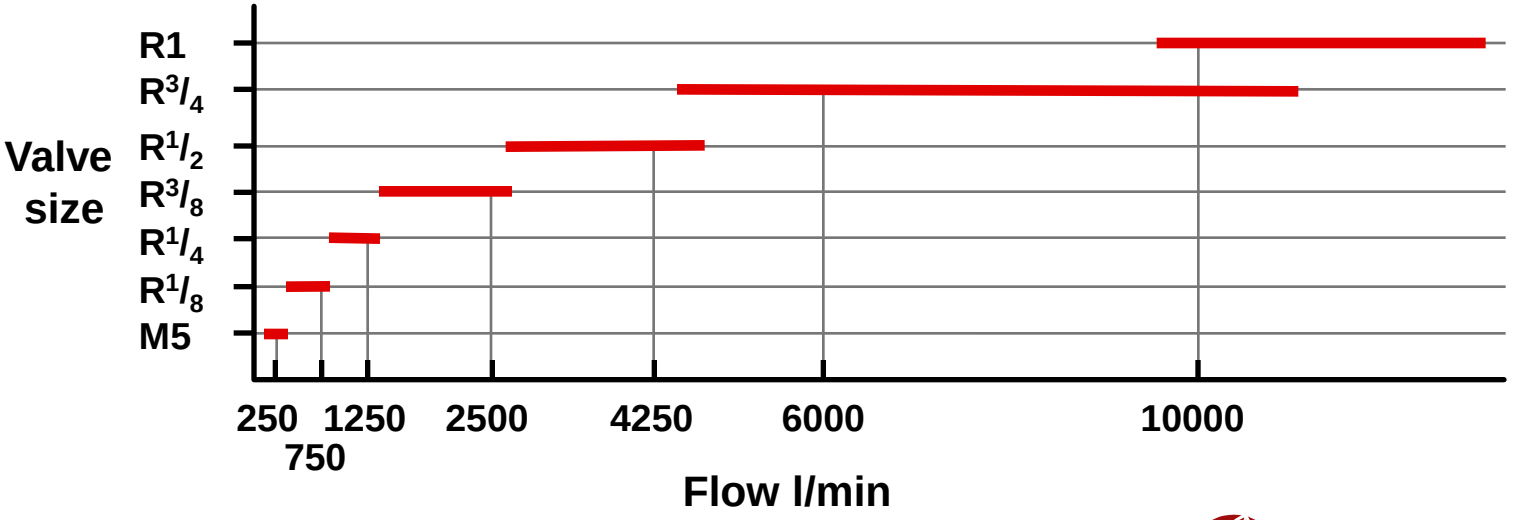
Guide to Valve Size and Flow

- This graph gives a guide to the to flow range appropriate to different valve sizes
- Port size alone can only be a rough guide, individual valve types will vary according to design
- The flow values indicated by the vertical lines are at P_1 = 6 bar, with 1bar pressure drop



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Pressures and Temperatures

- The working pressures for valves generally can range from vacuum to 16 bar
- The majority of applications work at up to 10 bar
- Solenoid pilot operated valves with integral supplies can work down to about 1.5 bar. Below this external pilot supplies are required
- Operating temperature is usually controlled by the limits of the seal material
- The standard range is from 5 to 80^{O}C ambient
- For solenoids due to heat generation 5 to 50^{O}C
- For special low temperature applications down to -20^{O}C but the air must be dried to this dewpoint to prevent ice formation

NORGREN

Filtration and Lubrication

- Valves should be supplied with clean dry air with or without lubrication
- Water droplets and solid particle removal using a standard 40µ filter will normally be sufficient
- Valves are greased when manufactured, this alone will give a long lifetime to the seals and valve bore
- If the air carries additional lubrication from a micro-fog lubricator the normal life of the valve will be extended
- If air is process dried to a very low dewpoint lubrication is necessary
- For extreme high or low operating temperatures lubrication is necessary

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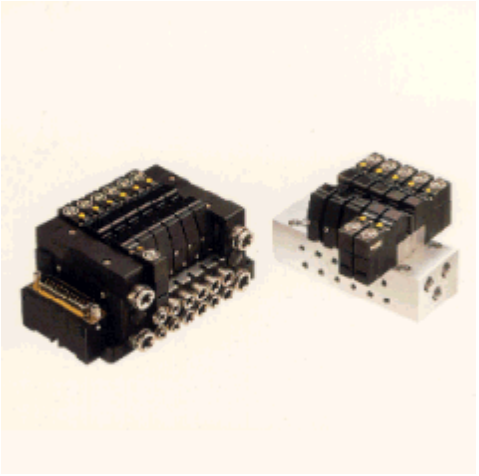
Solenoid Valves

- Solenoid valves are electro-pneumatic relays
- The state of an electrical input controls the state of a pneumatic output
- Solenoid valves are the interface between electronic control systems and pneumatic power
- Types are:
  Direct acting
  Pilot operated
  Proportional



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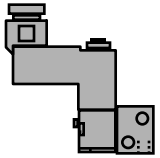
Direct Acting Solenoid Valves

- **Used for:**
  Signal generation and processing
  Control of small bore single acting cylinders
- **Single station sub-base mounted**
- **Multi-station sub-base mounted**
- **Integrated to larger valves to become solenoid pilot operated valves**
- **15, 22, 32 represent the mm width of the valve**

Nugget 30



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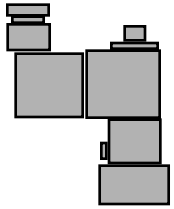

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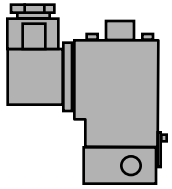
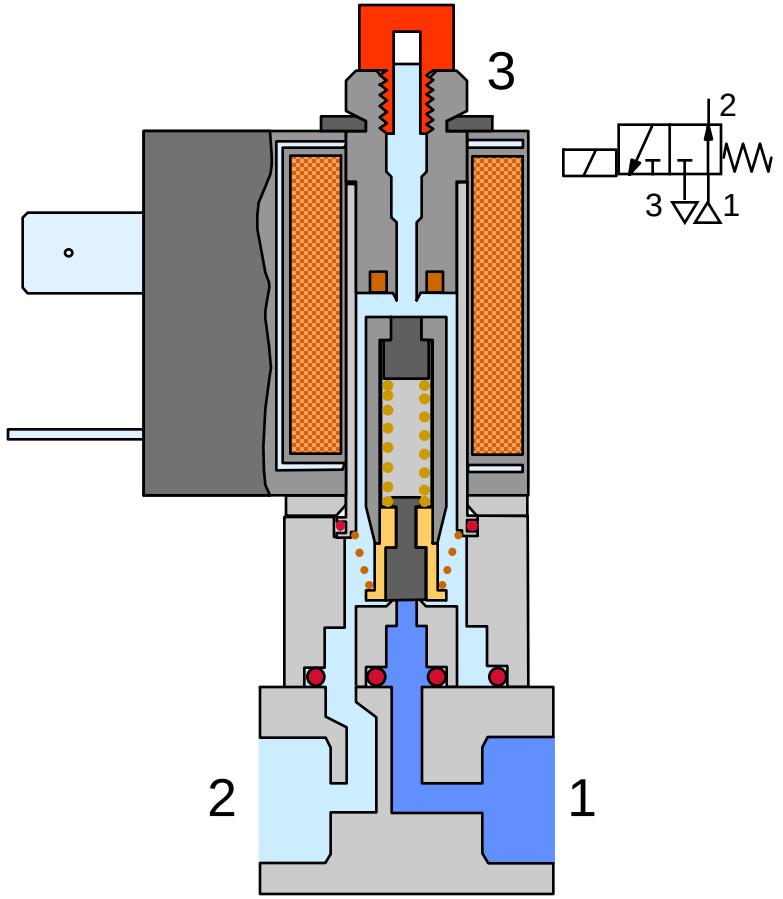


Excel 32

NORGREN

Principle of operation

- The double poppet armature is held by a spring against the inlet orifice sealing the supply at port 1
- Outlet port 2 is connected to exhaust port 3
- When the coil is energised the armature is pulled up closing the exhaust orifice and connecting the supply port 1 to the outlet port 2



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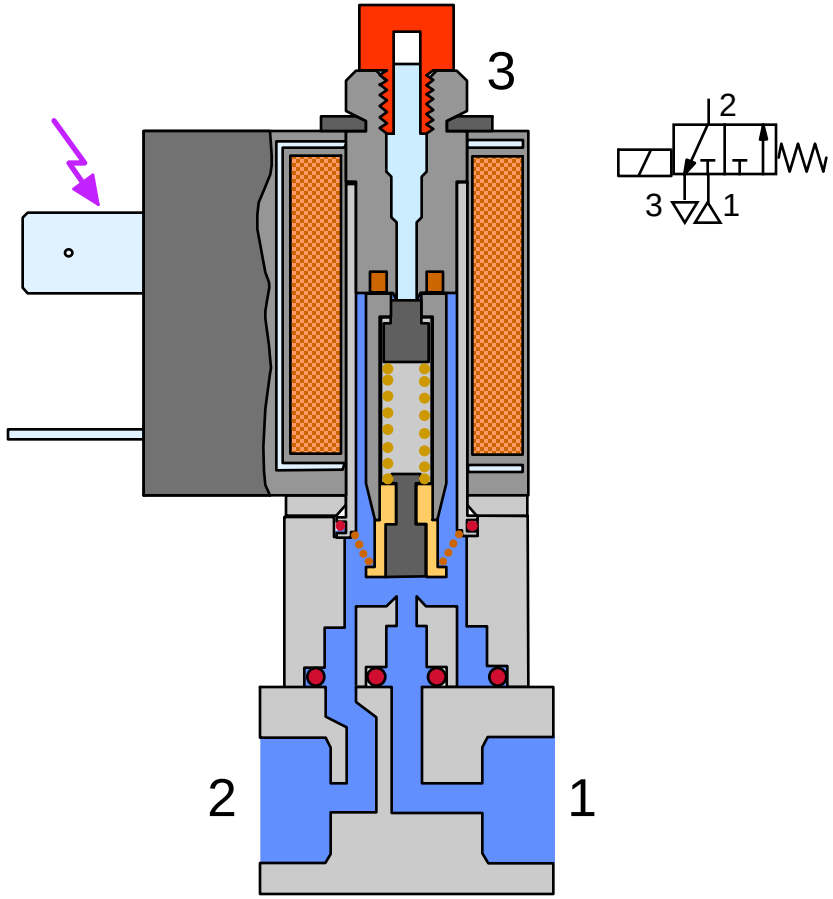

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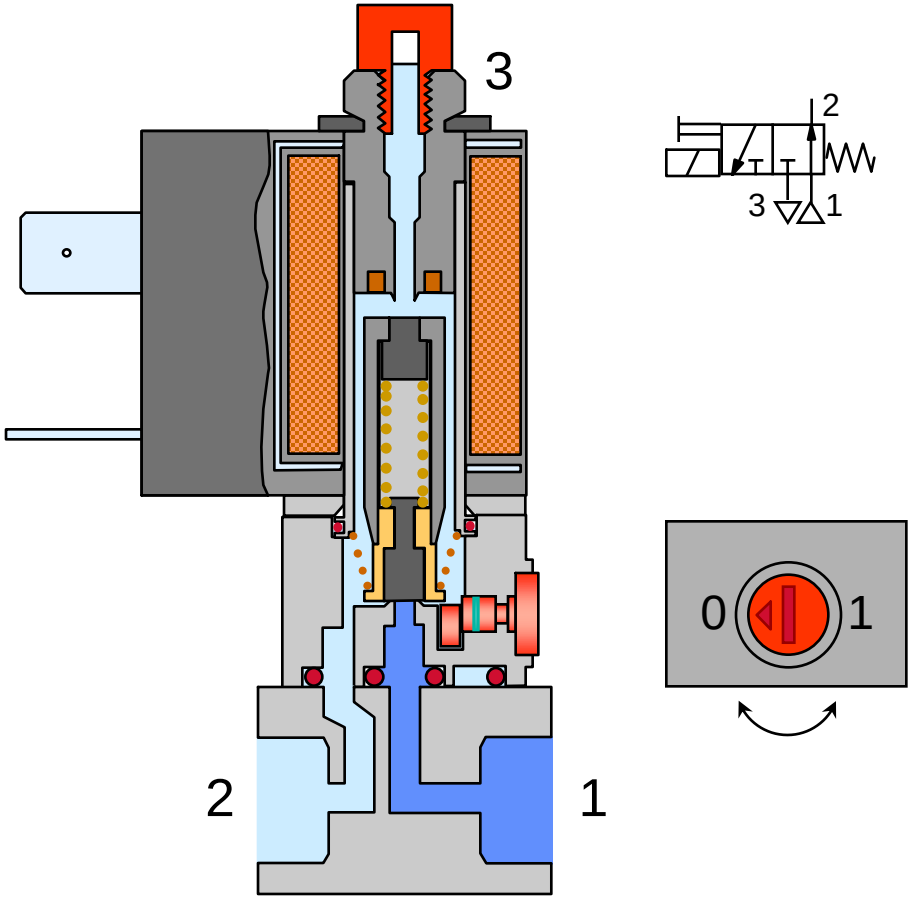
Manual Override

- To test during set up or maintenance without energising the coil
- In position 0 the armature is in the normal closed position
- Turning the cam with a screwdriver to position 1 lifts the armature to operate the valve
- Important to return to position 0 before the machine is restarted



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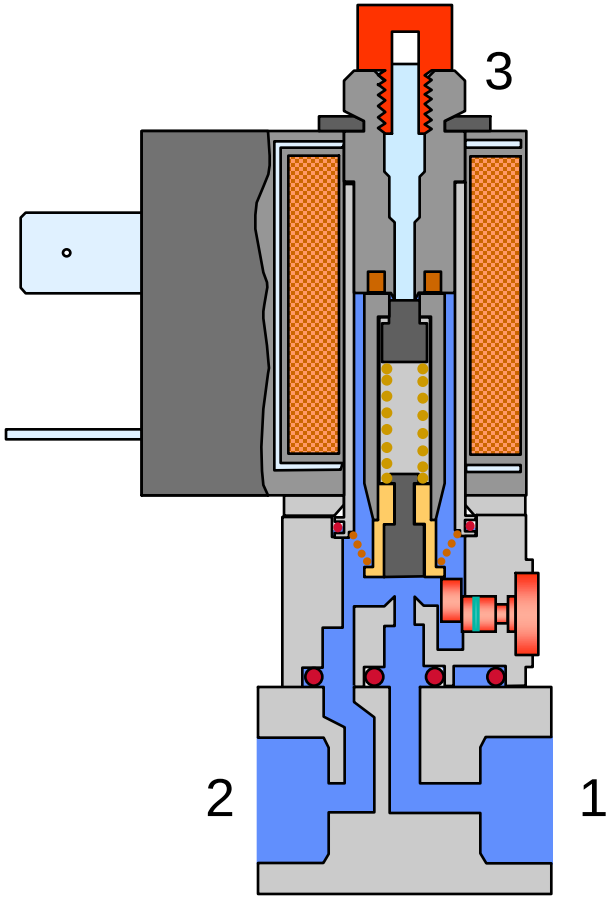

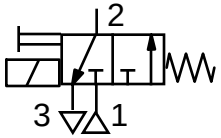

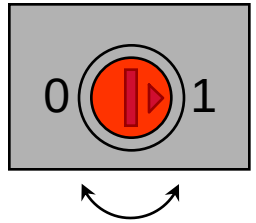

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Direct Acting Solenoid Valves

- The design is a balance between quantity of air flow (orifice diameter) and electrical power consumed
- The higher the air flow, the larger the inlet orifice
- The larger the orifice, the stronger the spring
- The stronger the spring, the greater the power of the magnetic field
- The greater the field, the higher the electrical power consumption
- The desire for low electrical power for direct interface with PLC's and other electronic devices makes this design of valve ideal
- The range offers a variety of orifice sizes and electrical power ratings
- This design is used alone and as an integrated pilot to operate larger valves

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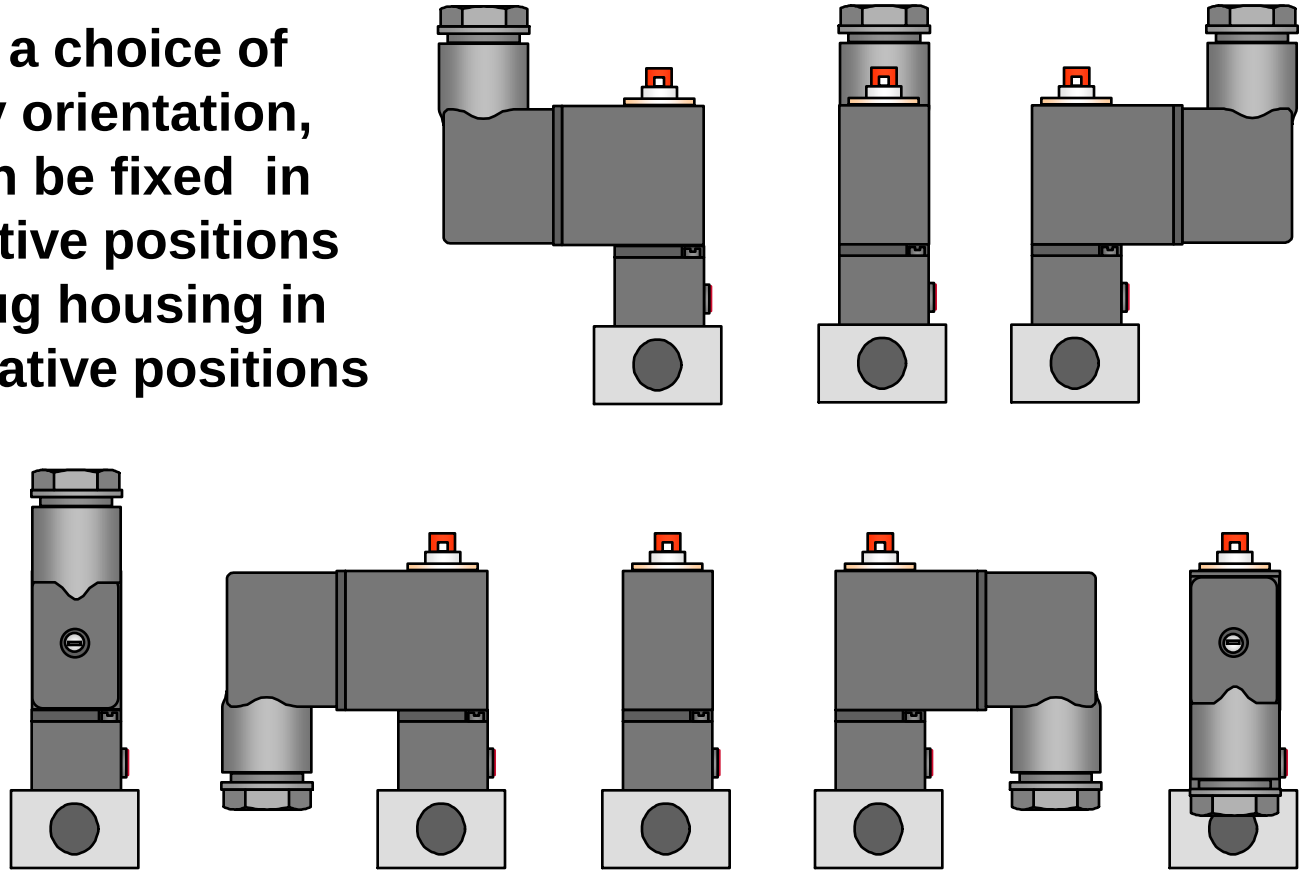
Cable Entry

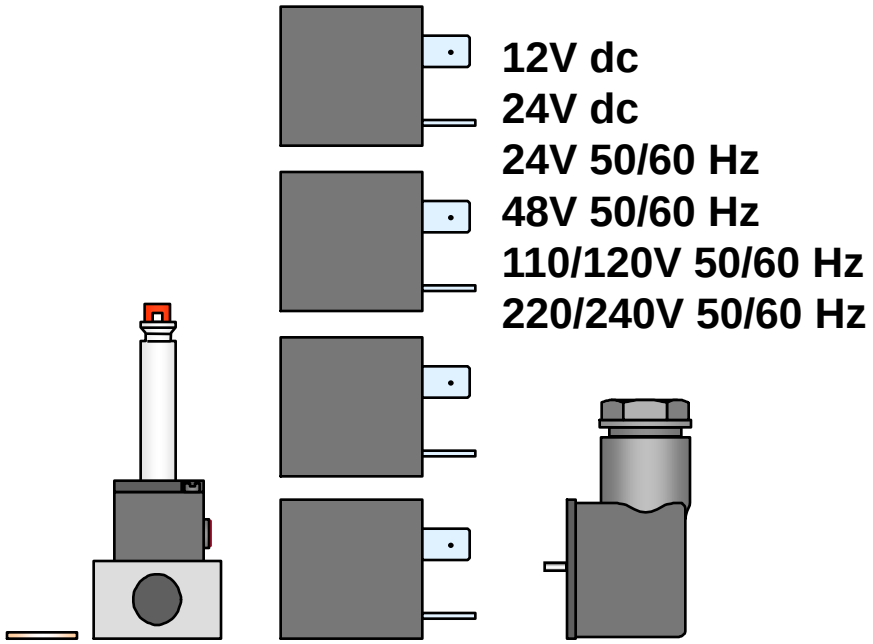
- To provide a choice of cable entry orientation, the coil can be fixed in 90^{O} alternative positions and the plug housing in 180^{O} alternative positions



Interchangeable Coils

- A solenoid valve is designed to work with both AC and DC
- A coil of any voltage AC or DC of the same power can be fitted or exchanged on the same stem
- Important. Low and high power coils cannot be exchanged. The orifice diameter and spring strength must match the coil power

- 100% E.D. The coil can be energised continuously



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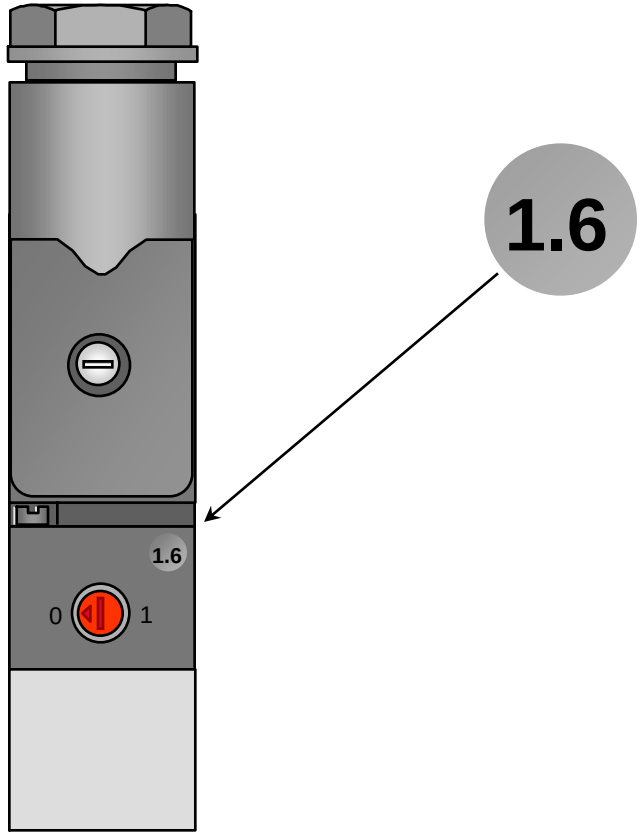
Flow and Power Rating

- **To help identify the solenoid valve body, the orifice diameter is marked in the position shown**
- **12V dc**
  24V dc
  24V 50/60 Hz
  48V 50/60 Hz
  110/120V 50/60 Hz
  220/240V 50/60 Hz
- **2W = 1.0mm orifice diameter**
  6W = 1.6mm orifice diameter
  8VA = 1.6mm orifice diameter



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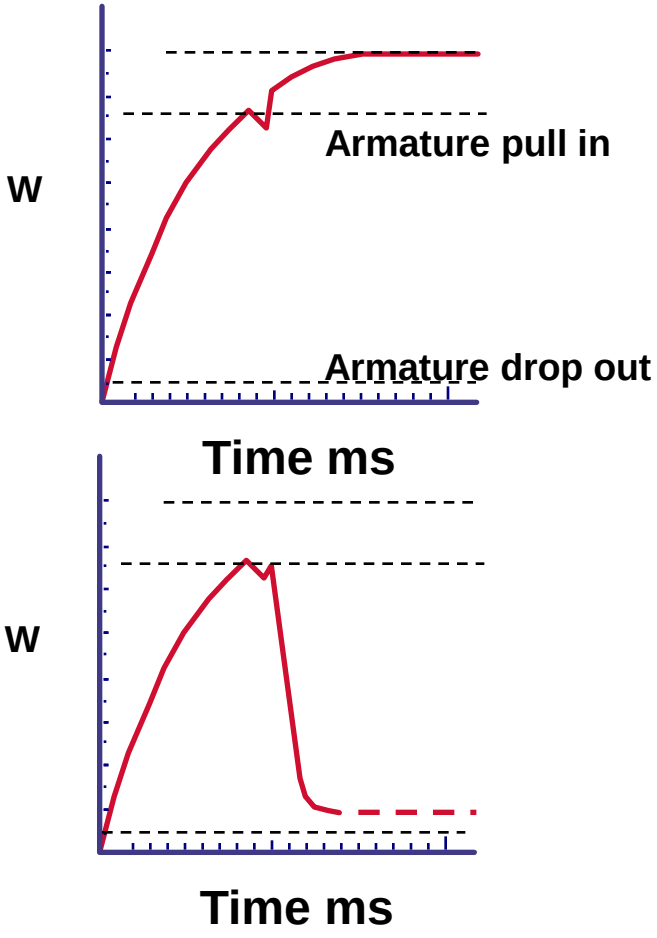
DC Coils

- When a DC coil is switched on, about 85% of the power is developed before the armature can be pulled in
- Little power is needed to hold it in, the rest of the power is given off as heat
- Coils fitted with power saving circuitry detect armature movement and chop the power level
- Power supply units can be smaller and running temperatures lower



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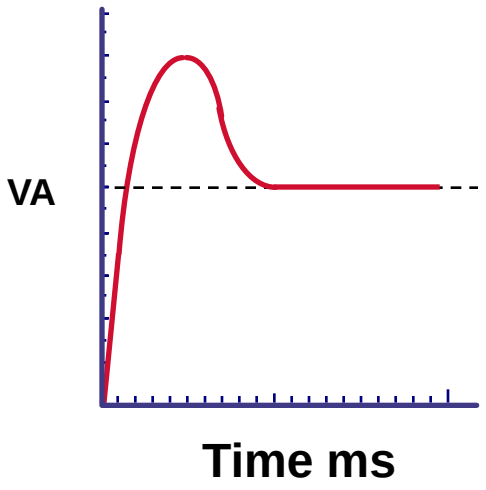
AC Coils (inrush power)

- AC solenoids are given a power rating with two values e.g. 4/2.5 VA
- 4 VA is the inrush power which lasts for a few milliseconds while the armature pulls in
- 2.5 VA is the continuing holding power



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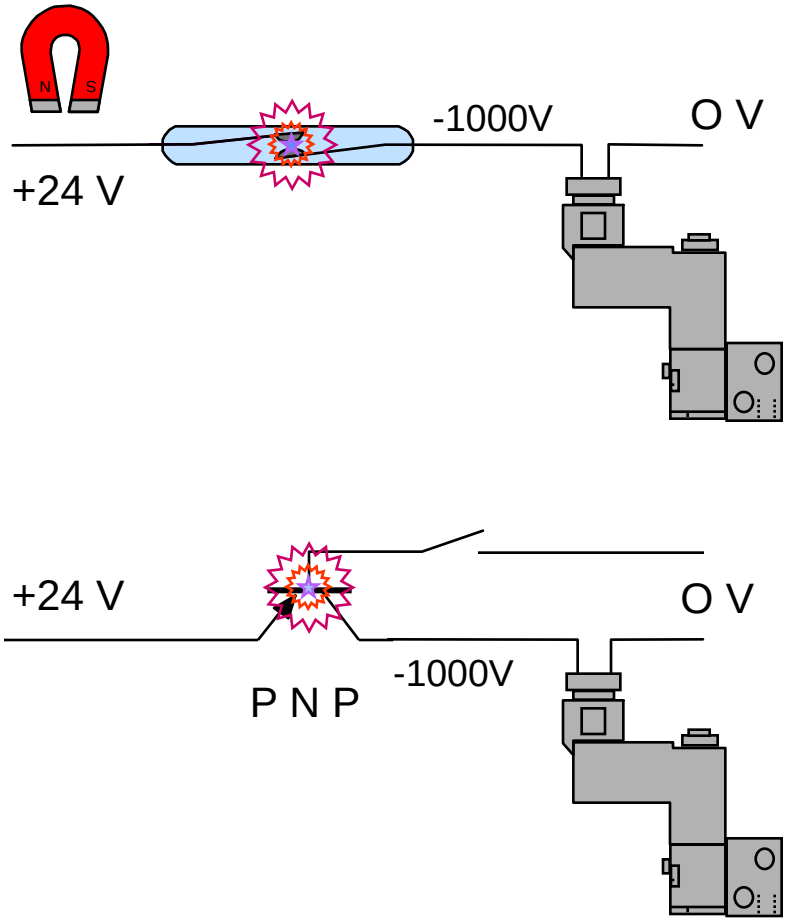
Inrush Power

- An AC coil has impedance which is mainly a combination of resistance and inductive reactance, because of this the pure resistance is lower than a DC coil of equivalent power
- The inductive reactance will be low before the armature is pulled in because the magnetic circuit is incomplete and less efficient
- On initial switch-on a higher current will flow until the armature is pulled in, then the magnetic circuit is fully made and the higher impedance controls the power to the designed level
- If many AC solenoids are switched at the same time ensure the power supply is large enough

Unsuppressed Coils

- At the moment a coil is switched off, the collapsing magnetic field induces current trying to keep it energised. This is seen as high negative voltage at the switch
- If a reed switch is used a series of arcs across the opening contacts will weld them together
- If a solid state switch is used the semiconductor is destroyed



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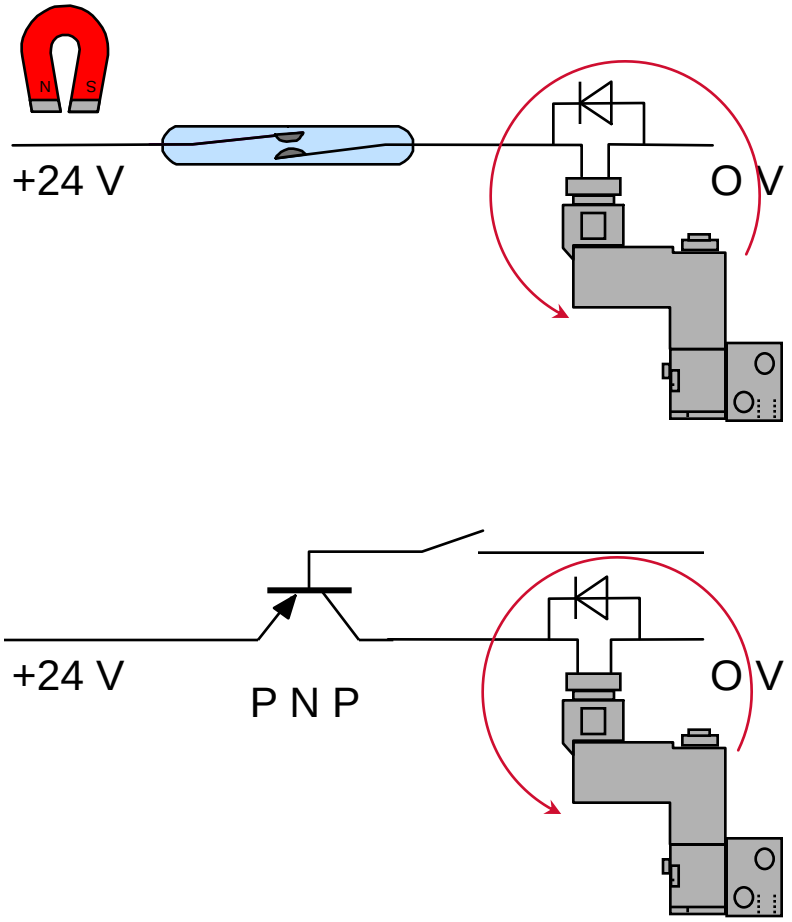
Suppression

- If the ends of the coil were connected at the moment of switch off, the induced current would flow around the coil at low voltage fading to zero in about 200 milliseconds
- For DC this is achieved automatically by fitting a diode across the coil
- A diode allows current to flow in one direction only and needs just 1.5V potential difference



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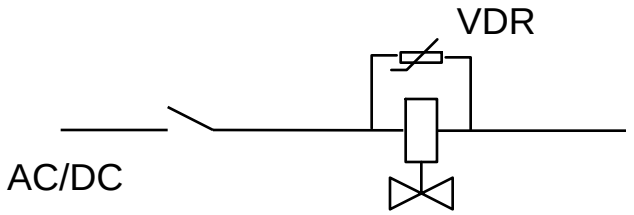
Voltage Dependent Resistor

- For AC coils a diode will short circuit
- A VDR is connected across the coil and works with AC and DC in either direction
- When the voltage across a VDR is below a given threshold there is high resistance preventing current flow.
- For voltage above the threshold the resistance is low allowing current flow
- Current is blocked when the coil is energised as the threshold is above the working voltage
- On switch off, the induced voltage will rise above the threshold and flow around the coil and VDR at that value untill it fades



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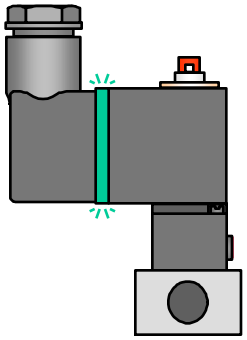
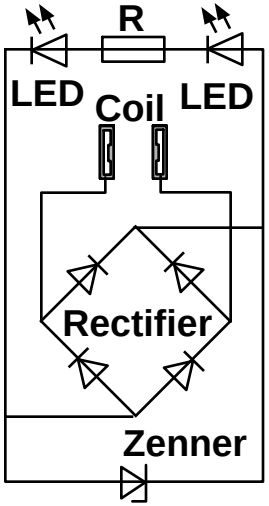
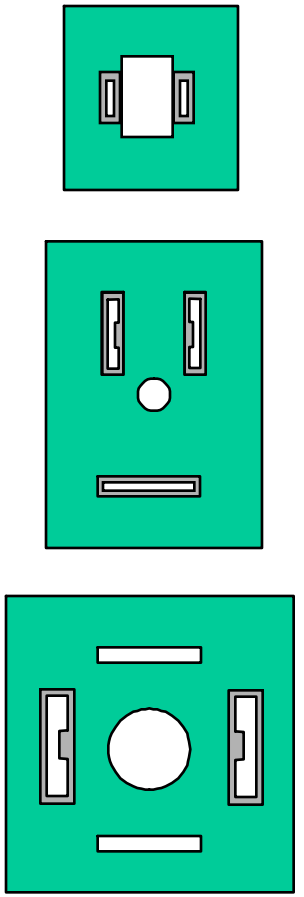
Power On Indication

- Visual indication of the on/off state of a coil is useful for monitoring, and fault finding
- This feature can be included in the plug housing as an LED or a neon lamp
- For retro-fitting, a LEG (light emitting gasket) can replace the normal gasket fitted between the plug and coil
- Zenner suppression







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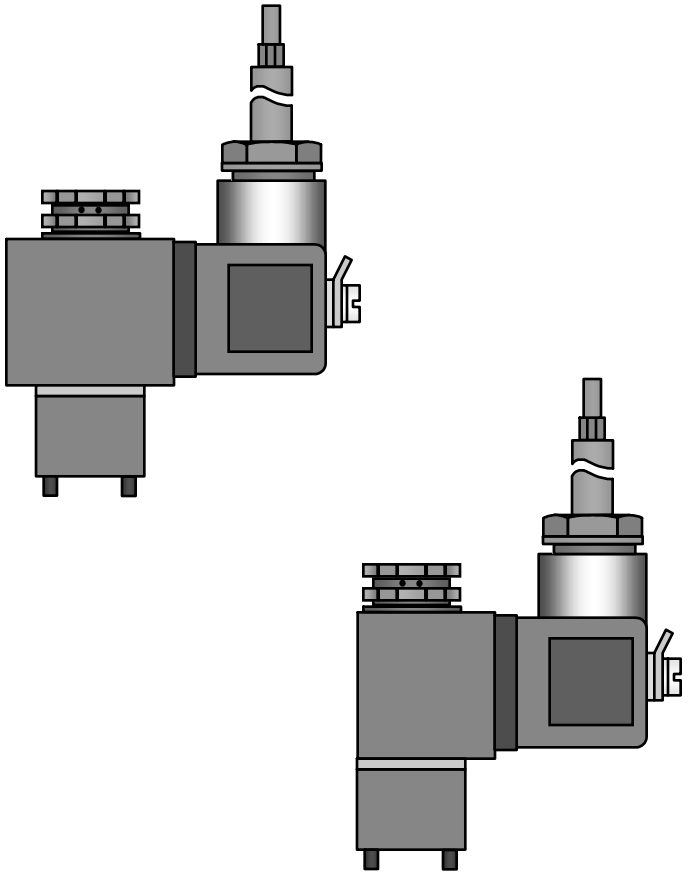
Explosion Proof Solenoids

- For use in hazardous environments e.g. explosive fumes or dust, where sparks could could set of an explosion
- Complies with EN50014 and EN50028
- Classification EEx m ll T6 and EEx m ll T4
- Fits to valves and bases with a standard 22 mm solenoid interface



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Nugget 120 Series

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Nugget 120 series

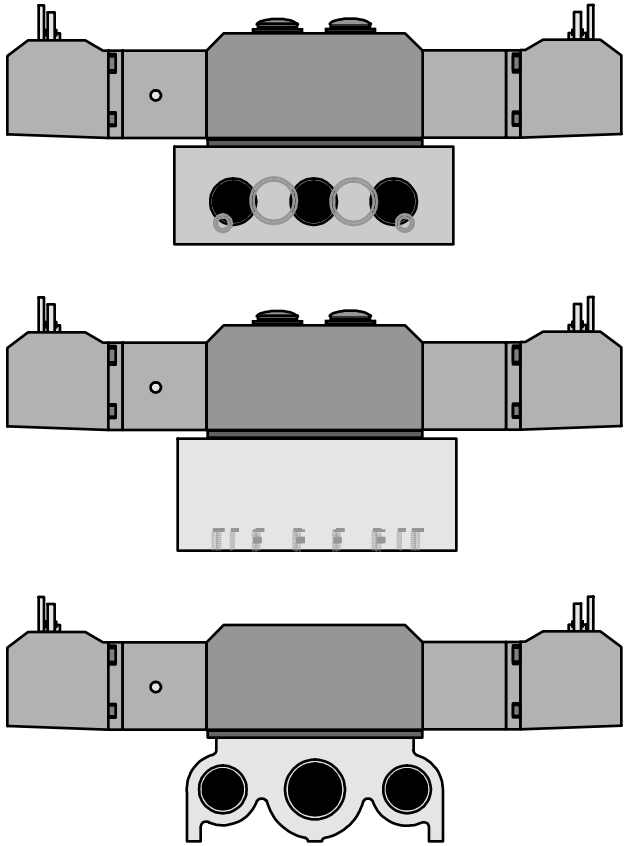
- Slim compact light weight valve for high density installation
- High flow
- Wide range of mounting options
  - Single in line sub-base side or rear entry
  - Fixed length manifolds
  - Modular sub-base single unit expandable
  - Valve Island
  - Fieldbus Valve Islands

Fixed length 6 station manifold with single and double solenoids

NORGREN

Sub-bases

- In line sub-base with side ports, outlets in base or valve body top
- In line sub-base with bottom ports, outlets in base or valve body top
- Fixed length manifold in 1,2,4,6,8,10,&12 station sizes. Outlets in valve body top
- All with choice of gasket for integral solenoid supply from single or twin supply arrangements



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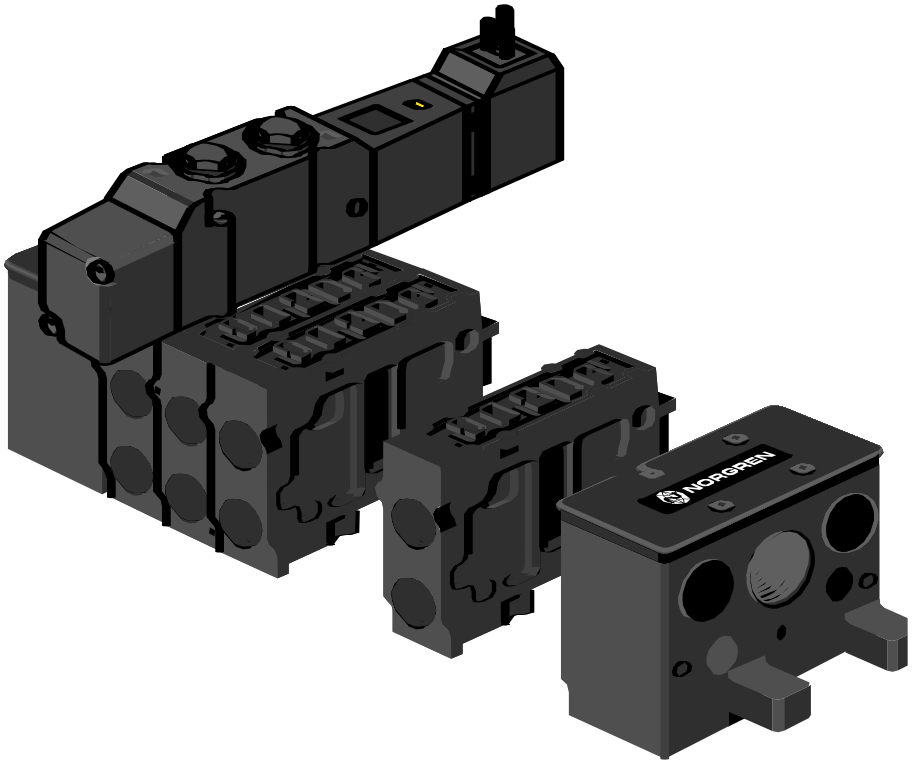
Modular Sub-bases

- Modular sub-base expandable in single units
- Outlets in sub-base side or valve top
- Options for Single, dual, three, four, five and twin pressure supply options
- 5/2 and 5/3 valves
- Integral solenoid supply
- Manifolded external solenoid supply
- Manifolded solenoid exhausts



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Valve Island

- All of the advantages of the modular sub-base system, plus solenoids pre-wired to multipole connector
- Indicator lamps for each solenoid
- Built in suppression
- Diagnostic indication on armature pull-in
- Power saving once the armature has pulled in
- Round IP65, D-sub IP40 or conduit connection

Valve Island showing round multipole connector for solenoids

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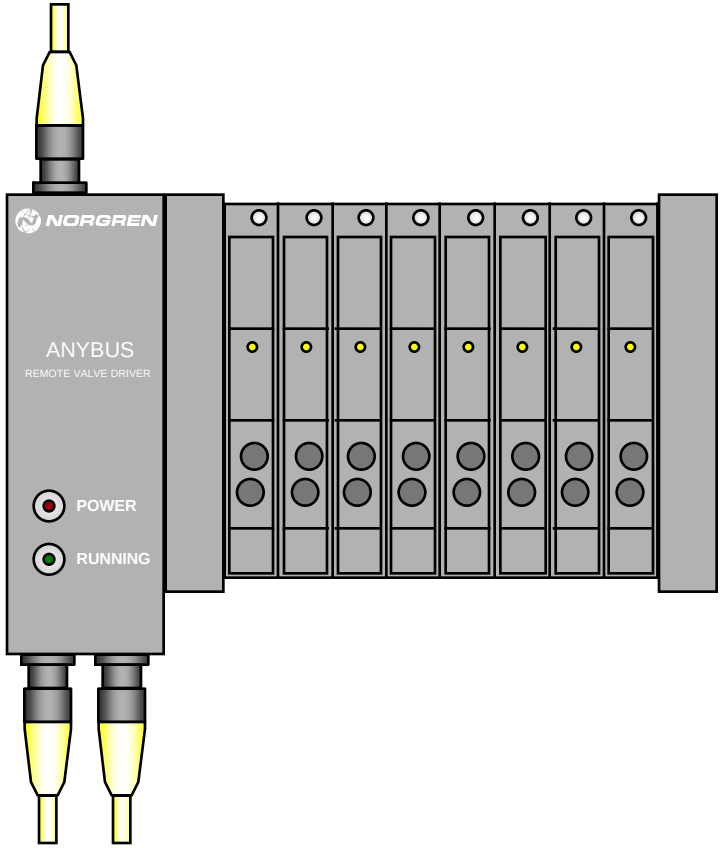
Fieldbus Valve Island

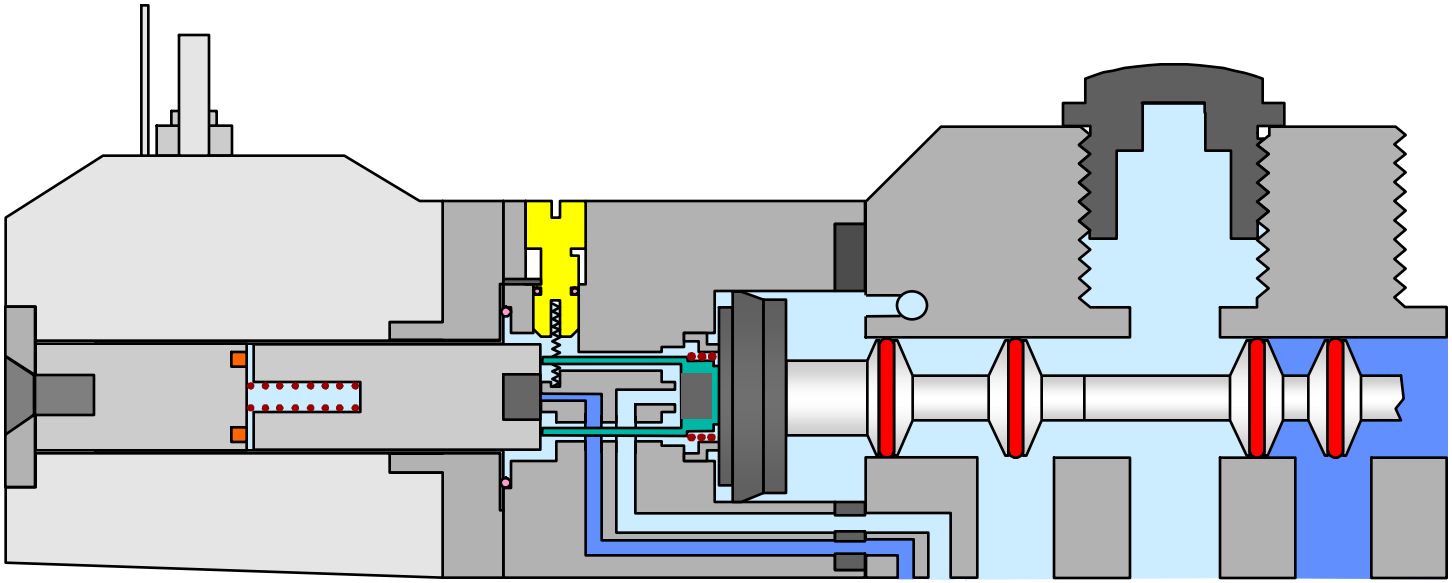
- Valve island with the solenoids pre-wired to a Fieldbus interface module of your choice
- Up to 16 solenoids
- Open systems
  - Device-Net
  - Interbus-S
  - Profibus FMS
  - Profibus DP
  - AS-Interface
- Closed systems
  - Sysmac (Omron)
  - JETWay-R (Jetter)



NORGREN

Nugget 120 Pilot Solenoid

- Internal pilot supply and exhaust ducted to the main valve body for connection to a sub base
- The armature pushes the legs of the poppet to hold the exhaust seat open. It closes when the armature is pulled in



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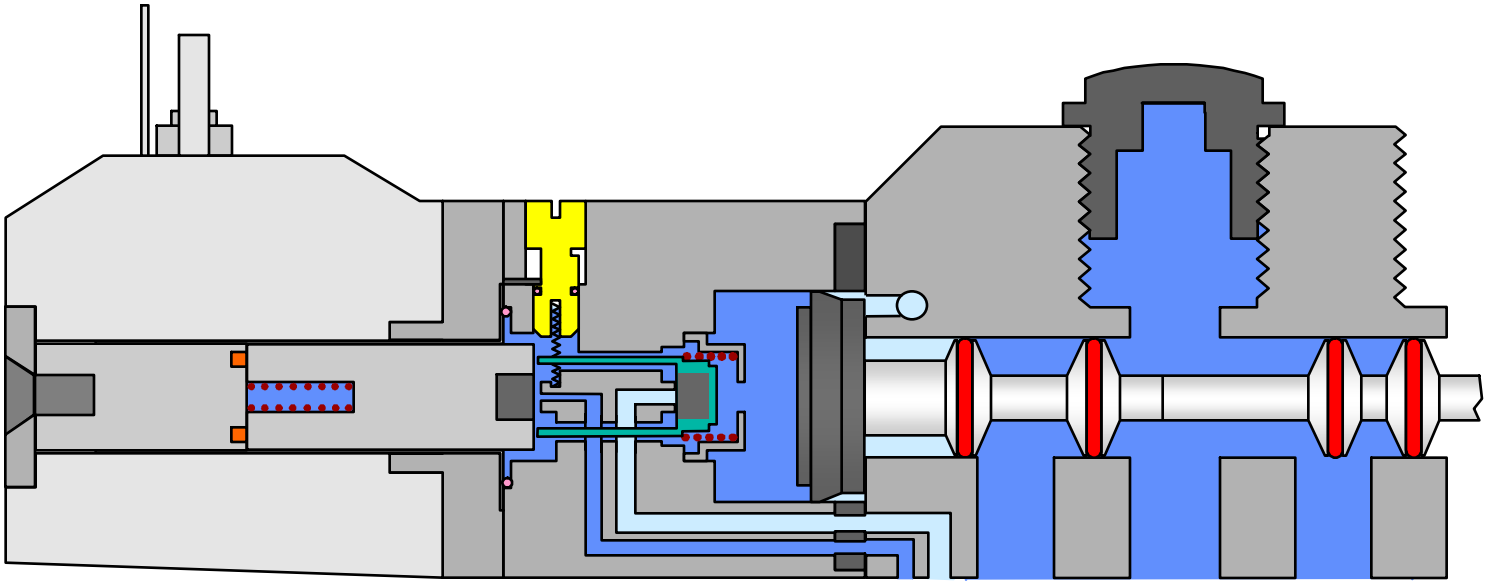

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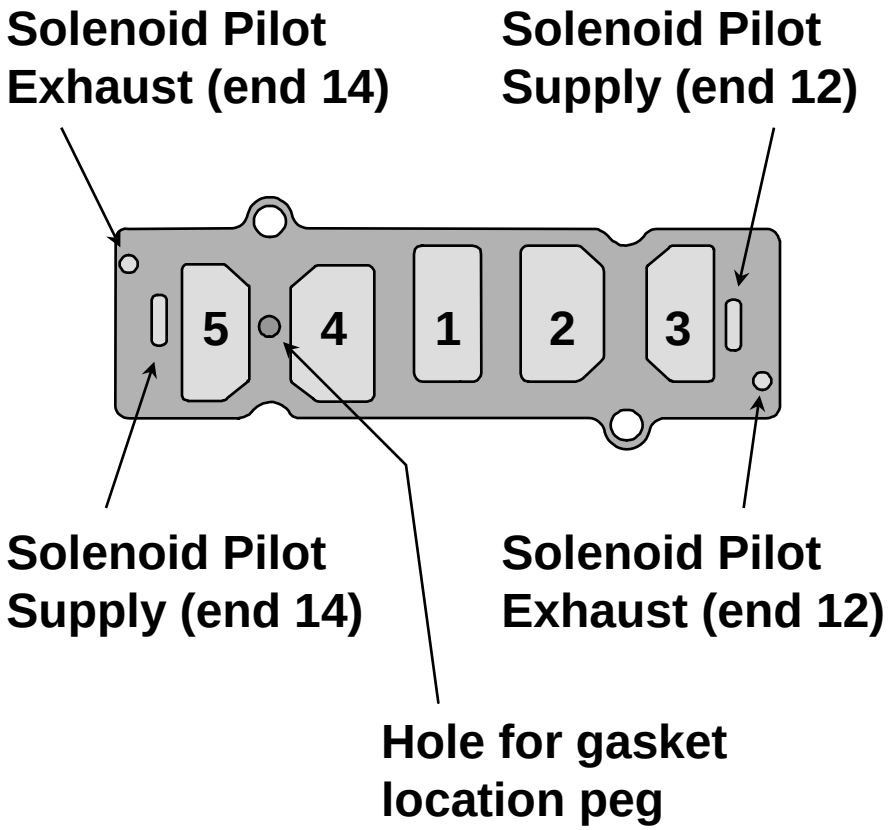
Valve Body Sealing Face

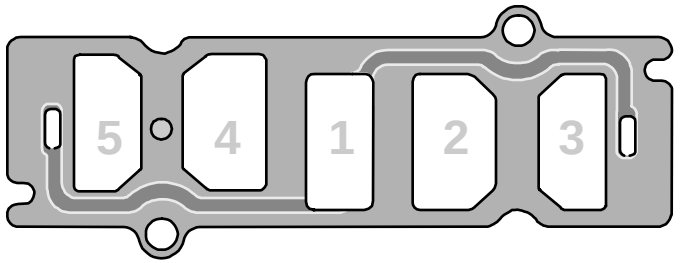
- This view under the valve body shows the ducts for solenoid supply and exhausts
- By selecting the appropriate gasket the solenoids can be integrally supplied for conventional or twin supply arrangements
- Also there are gaskets for external solenoid supply when the pressures to the valves main ports are unsuitable

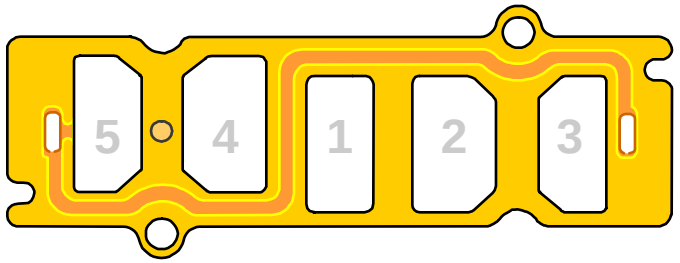


NORGREN

Functional Valve Gaskets

- **For Fixed Length and Single Station Sub-bases**
  - **Internal pilot supply (grey gasket type Y) Air at port 1 channeled to supply both solenoid pilots. Supplied with Fixed Length Manifolds and Single Sub-bases**
  - **Twin supply (yellow gasket type Z) Air at port 5 channeled to supply both solenoid pilots. Supplied with Twin Supply Valves**

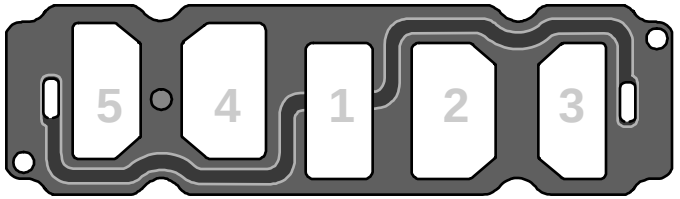


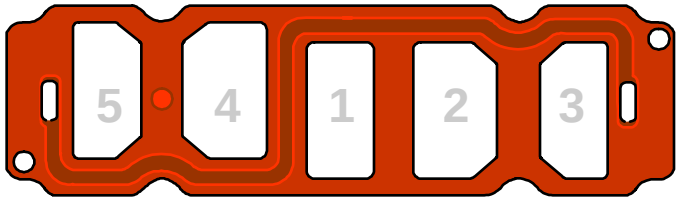


NORGREN

Functional Valve Gaskets

- **For Modular Sub-base**
  - **Internal pilot supply (black gasket type W) Air at port 1 channeled to supply both solenoid pilot valves. Supplied with all internal pilot supply valves**
  - **External pilot supply (red gasket type X) Air supplied to an external pilot port in the sub-base channeled to both solenoid pilot valves. Supplied with all external pilot supply**





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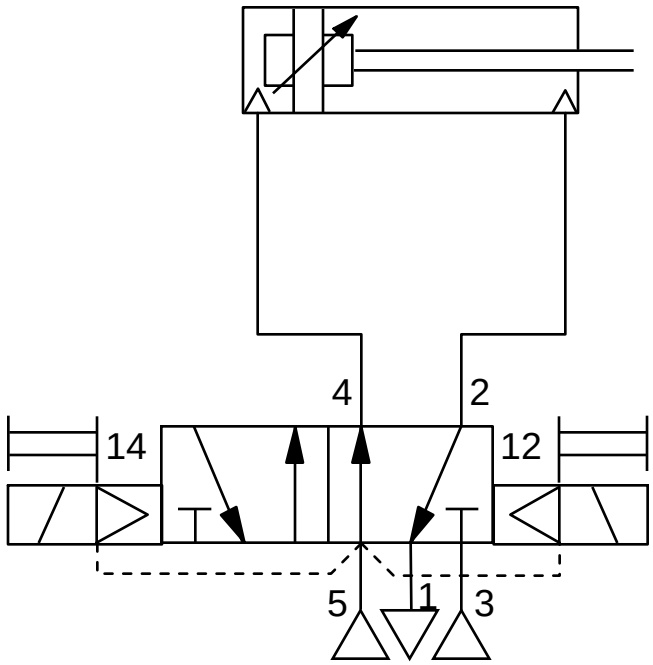
Valve Applications

- Twin supplies to a 5 port valve are connected to ports 3 and 5, these can be used to instroke and outstroke a cylinder at different pressures
- Port 1 is used as a common exhaust
- On fixed length and single station sub-bases the yellow gasket will duct port 5 to the solenoid pilots



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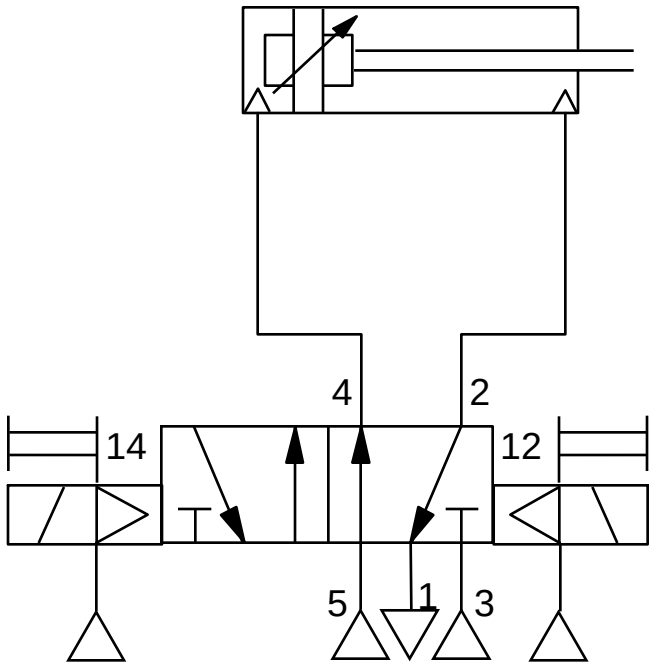
Valve Applications

- For twin supply applications where the source pressures are too low to operate the valve, independent external pilot supplies are required
- For modular sub- base systems and single station sub-bases this is a standard feature
- For fixed length manifolds there are special independent external pilot ported blocks (see next slide)



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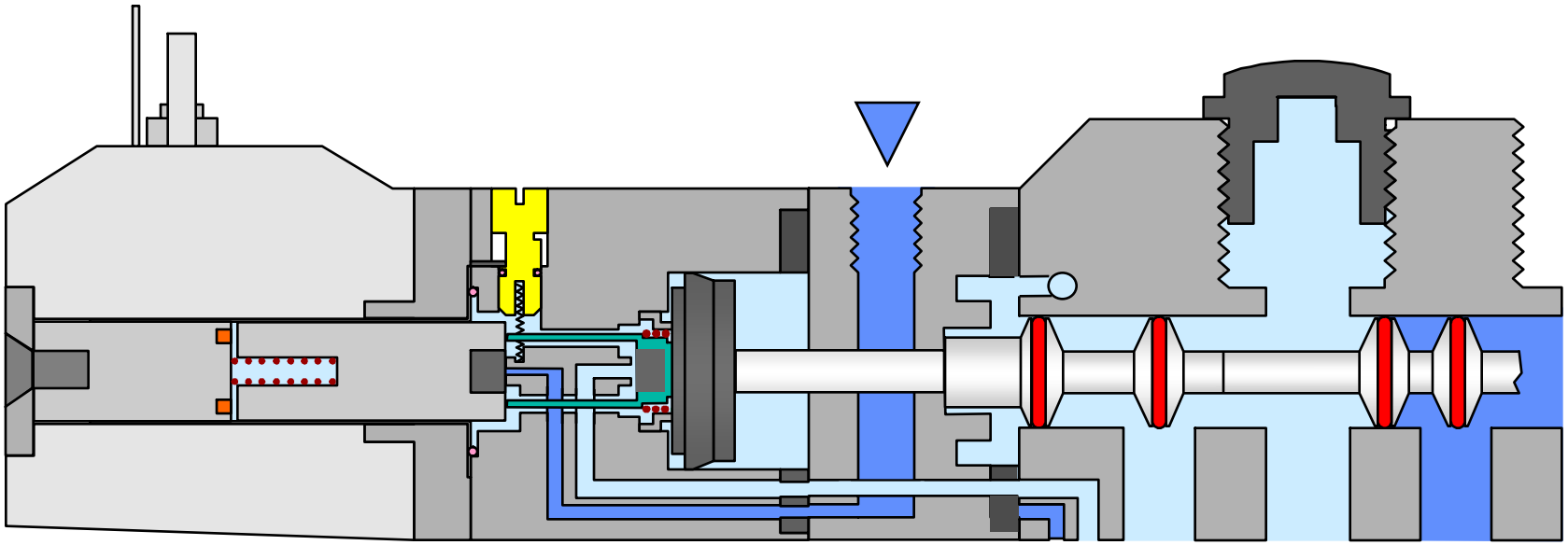
Nugget 120 External Pilot

- Independent external pilot supply for use on fixed length manifolds
- The integral feed from the gasket is blocked



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End

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