TechTiPS

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Pneumatic How To's

Inside

Why Choose Quick-Connect Fittings?

Courtesy of Clippard

View Clippard Quick-Connect Fittings

Have you ever used a piece of equipment with a Quick-Disconnect fitting? Sometimes they are also called Quick-Disconnect connectors or couplings. If you have used them at some point you know how convenient, effective and noteworthy they are for many applications. If you have never used this piece of equipment, it is definitely worth learning more about them because they are easy to implement and versatile. Most fitting come in three shapes straight, tee or 90° elbow, but they are not limited to these shapes. The purpose of this type of fitting is to be able to disconnect two parts without disrupting the pressure of the contents in the tube or pipe and reconnect them just as easily.

Besides easy on and easy off what makes quick disconnect couplings so beneficial and helpful to so many industries? First of all, safety, no machines are needed to disconnect the tube or hose from the fitting everything can be done and controlled by hand. Having full control over the connecting and disconnecting insures no slip of a button and less man power is needed. Another safety feature is the fitting holds all pressure and does not let gas or liquid escape the hose or tube when it is disconnected. Therefore, when removing no bleeding, purging air or recharging is necessary. The disconnection can be done easily and promptly.

So where can these fittings be found and how much do they cost? The answer for both of these questions varies vastly. To find one of these products you can look near or far, as far as kilometers underwater used in drilling operations or high in orbit around earth, for docking spacecraft. Also, you are able to find them as close as walking into a garage and finding a Quick-Disconnect fittings on the air hose attached to the air compressor. Cost can also vary considerably, all depending on the size, application and material. As you can imagine, underwater drilling will employ a larger fitting than a small air hose used in a mechanics garage. Additionally, materials may change because of corrosive materials present or extreme temperatures.

Quick-Disconnect fittings are used as high as space and as deep down as drilling wells these fittings are used across a plethora of industries. A few of these industries are water transport, chemical industries and pluming in addition to the examples already presented. Limiting the examples to only a few industries does not begin to show the helpfulness and versatility of these components that can make the task at hand so much easier. DW

Fluid Power Safety

Paul Heney, Design World Editorial Director

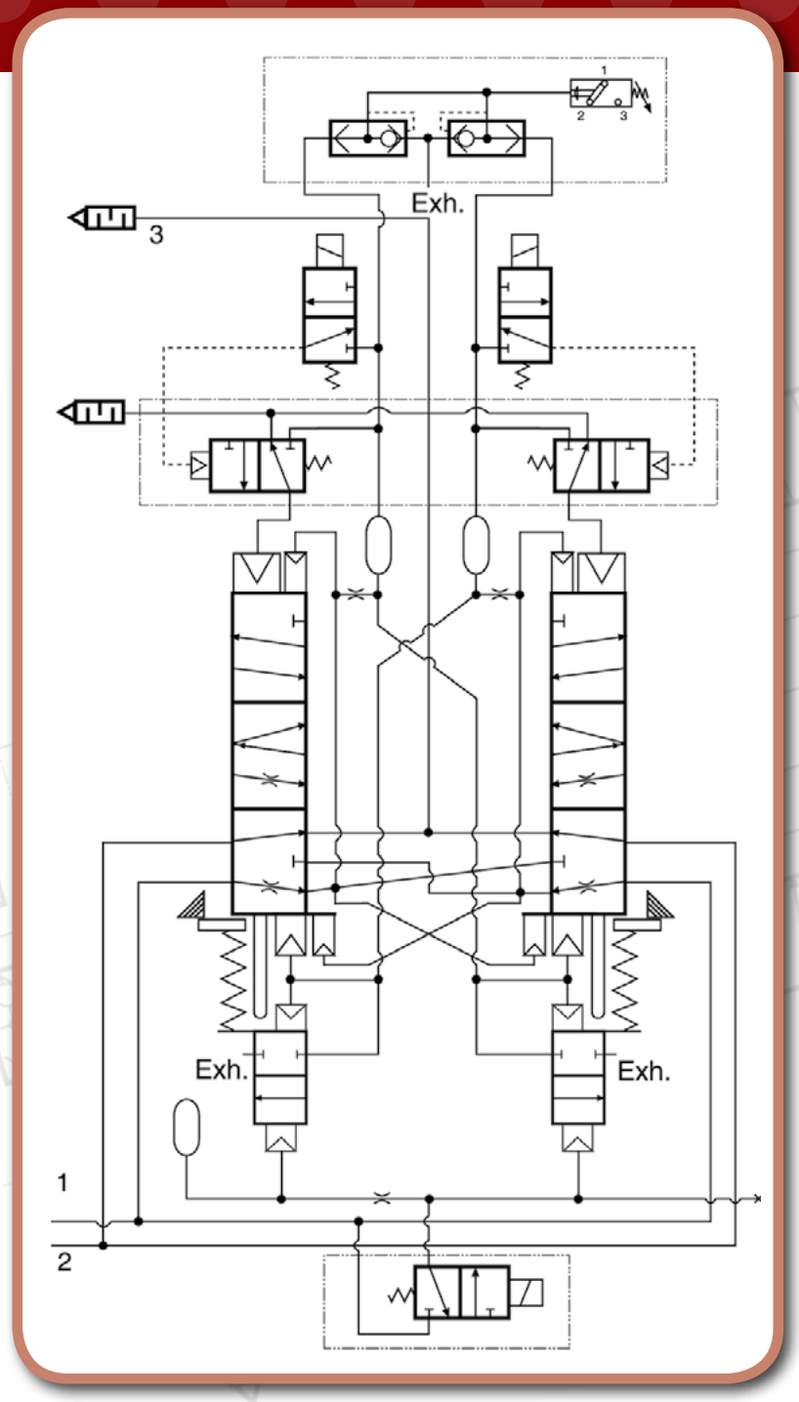
Safety is a critical aspect to any fluid power system, not just from the basic level of keeping components plumbed properly, but also in overall levels of machine safeguarding. It is critical to evaluate the entire system, including the electrical portion, to minimize exposure to unnecessary risk. Systems are rated based on the weakest link in the control chain.

Several standards (including ISO 13849-1:2006, ANSI/ASSE Z244.1-2003 (R2008) and ANSI/PMMI B155.1-2011) define the control system as including not only input, sensing, and interlock devices but also output devices such as pneumatic and hydraulic valves.

The function of a fluid control valve mimics that of an electrical-control relay and, therefore, is subject to the same rules for classifying safety integrity. Thus, properly specified machine safeguarding systems include provisions for pneumatic valves, including:

- Must be functionally redundant
- Must be monitored for faults (including diminished performance faults, which may create the loss of redundancy), without depending on external machine controls or safety circuitry
- Must return to a safe position in the event of a loss of pressure or other such event
- Able to inhibit further operation upon detection of a fault condition until such condition is corrected
- Should have a dedicated, specific function-reset input and should prohibit the ability to perform a reset by simply removing or re-applying pneumatic or hydraulic power, and
- Must not automatically reset.

Providing control reliability with fluid power is not quite the same as with electrical controls, however. For instance, plain redundancy in a safety circuit requires the equivalent function of four valve elements, not just two. Two of the four valve elements handle the inlet function while the other two elements handle the stop function (energy release). Many self-designed systems risk having hidden, potential flaws, which can lead to unsafe conditions because they are unseen, unexpected and, therefore, excluded from design and safety reviews. A good example is the spool cross-over conditions or ghost positions of a valve, which are usually not shown on schematics.



Fluid Power Safety
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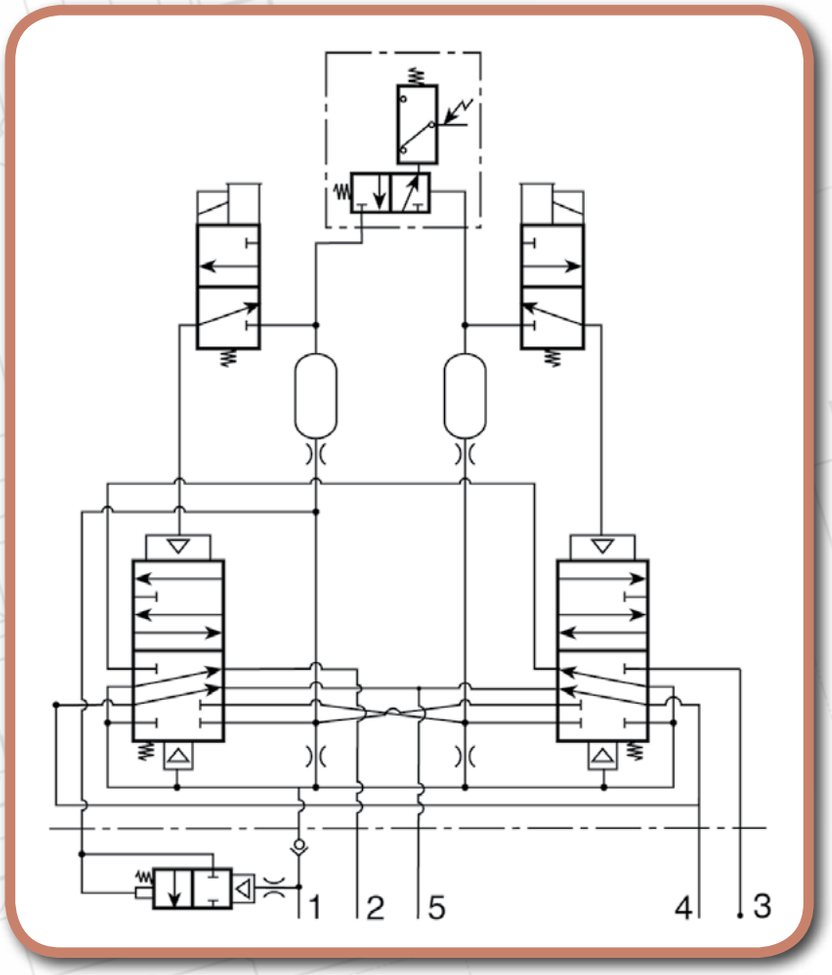
Two general abnormal conditions can affect valve safety. The first is similar to an electrical-control fault, such as when a relay might be stuck in the open or closed position. The second abnormal condition is when a valve develops diminished performance, as when a valve becomes sticky or sluggish. In such cases, the valve reaches the proper position, but slower shifting affects safe stopping distances or precise timing. The ANSI B11.19-2010 Standard mandates a monitoring system that detects these conditions for critical applications and the ANSI/PMMI B155.1-2011 Standard requires diminished performance monitoring if stopping time can be affected. An easy solution is to use a self-monitoring, Category-3 or -4 valve, designed to detect both conditions.



The use of double valves remained relatively unheard of for many years except in a few select industries, such as stamping presses, which first initiated control reliability requirements. Double valves provide dual internal functions (redundancy) so that an abnormal function of one side of the valve does not interfere with the overall normal operation. At the same time, the double valves sense abnormal operation on either side of the valve and then inhibit further operation until the problem has been corrected and the valve deliberately reset. This sensing and inhibiting function is commonly referred to as monitoring.

Two standard air valves, whether in parallel or in series, cannot perform the same safeguarding function as a double valve providing this critical function. By simply incorporating two standard air valves into the circuit, no provision is made to sense the abnormal operation of one side of the valve or, even more preferable, diminished performance such as slow shifting. In addition, there is no provision for inhibiting further operation of the circuit until the valve is repaired. If one valve actuates abnormally, the second one continues to function and redundancy is lost. The circuit doesn't recognize lost redundancy nor would it halt operations as a warning that redundancy has been compromised. Then, if the second valve also actuates abnormally, there is no back up and control integrity no longer exists.

Double valves are appropriate for pneumatic and hydraulic equipment anytime reliability is an issue. Typical applications include E-stop, two-hand-control, light curtains, safety gates, pneumatic locking devices for safety gates, hydraulic brakes, air brakes, amusement rides, hoists, elevators, pinch-point applications, or any other application where control system integrity depends on valve operation.

Non-Contact Gap Sensor

Courtesy of Clippard

Clippard's 1030 Non-Contact Gap Sensor will sense any flat or round object with a 1/32" minimum radius. The sensor produces a positive signal when no object is present, and a negative signal when an object interruts its sensing system.

Medium: Air

Input Pressure: 0.5 to 5 psig

Output:
-3" to 26" H2O at 4 psig

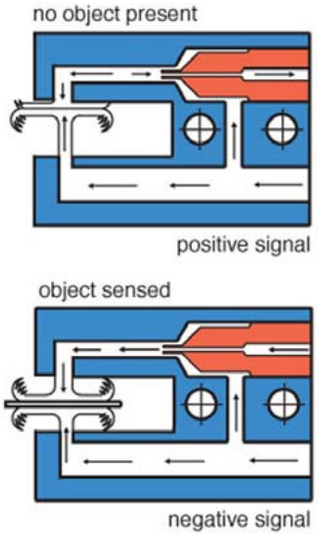
Frequency Response:
1,000 cpm

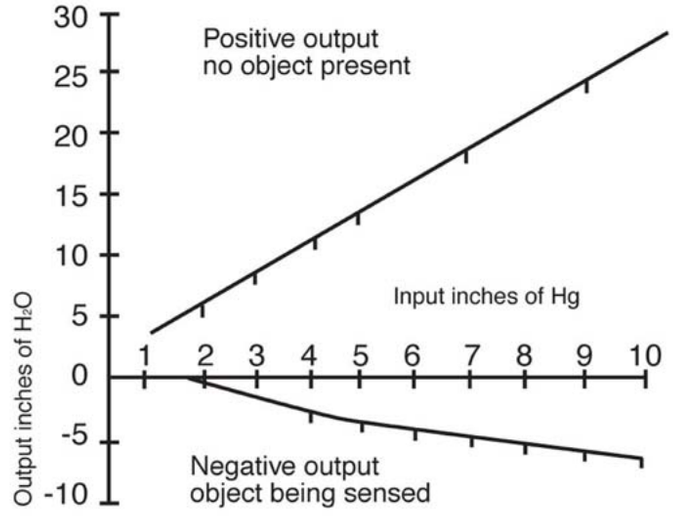
Air Consumption:
1/4 scfm @ 4 psig

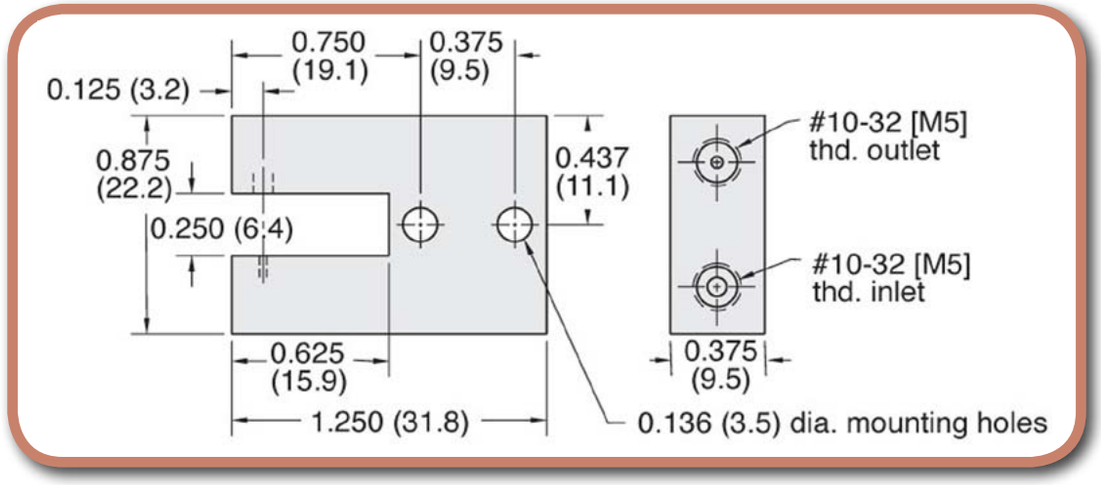
Sensing Capability:
Flat or curved surfaces with 1/32" minimum radius
May be used for up to 4" gap with an additional auxiliary jet

Connections:
#10-32 (M5) female

Construction:
Solid brass bright dipped







Non-Contact Gap Sensor

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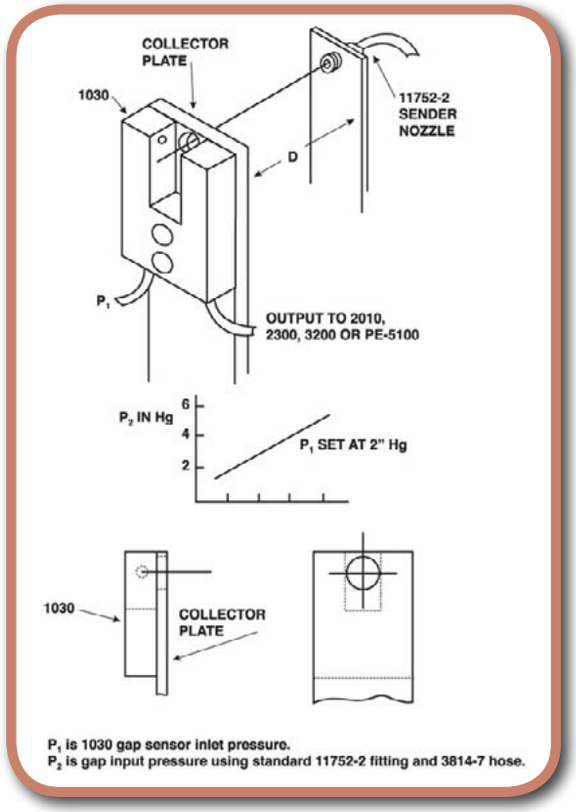
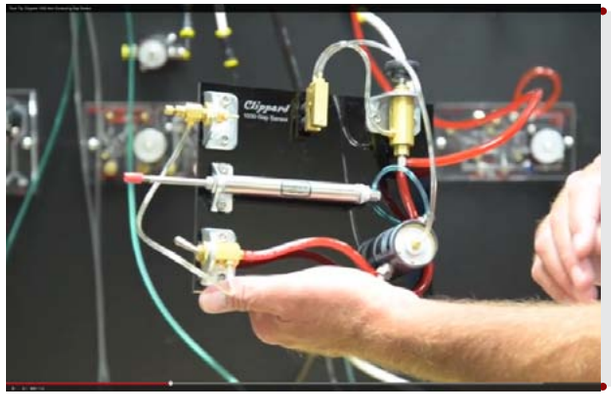
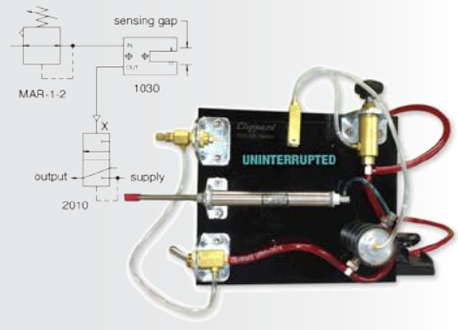
Clippard Tech Tip

In this Tech Tip, Scott Lamb of Clippard Instrument Laboratory explains how Clippard's 1030 Non-Contacting Gap Sensor functions.

(Watch the video)







Non-contact sensing of distances up to 4 inches may be accomplished using a standard 1030 gap sensor and the readily constructed installation shown at left.

Operation of the gap sensor is more consistently stable when the 1030 is mounted on a plate with a 1/4 inch hole to act as a "collector" of the stream of air across the gap from the 11752-2 sender nozzle. This "plate" has been found to minimize interference from ambient air currents and to reduce turbulence of the air stream where it reaches the primary sending gap.

It should be noted that this assembly reverses the sensed output when compared to using the 1030 by itself. The stream of air coming from the sender nozzle causes the 1030 to react as if an object was placed in the sensing gap. An object across the area defined by D eliminates the interference as sensed by the 1030 and the 1030 output becomes a positive pressure.

This design tip is suggested as a possible solution to a sensing/control problem. It has proven to be practical and reliable in laboratory set ups, however, it may not be so in all applications. The user is advised to carefully test this set up under actual working conditions in order to determine its suitability in their specific application. DW

How are Pneumatic Cylinder Slides/ Rodless Cylinders Used?

Paul Heney, Design World Editorial Director

Pneumatic cylinder slides, and rodless cylinders (sometimes referred to as guided cylinders) are designed to provide power and linear motion while supporting a load. Standalone pneumatic cylinders are suitable for providing power and motion, but are not designed to provide support for a side load. Most of these types of cylinders have no way of holding the position of the piston rod, due to the rod's ability to rotate. Pneumatic slides provide the load capability and a stable, non-rotating platform on which to mount tooling or other actuators. This is especially important when a cylinder is moving in a horizontal direction, or where side load is a major issue—common in automation devices used for picking and placing of parts.

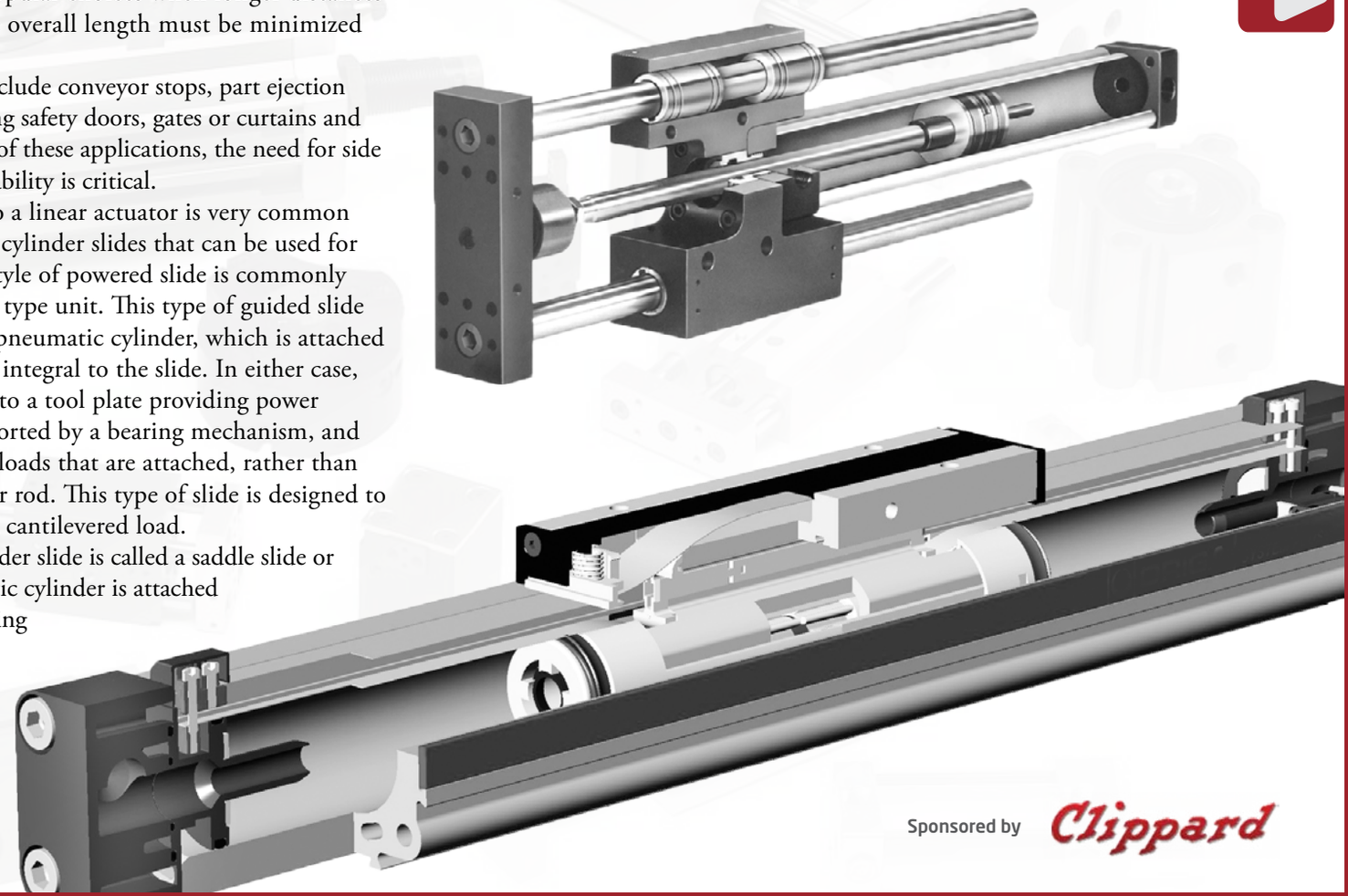
Rodless cylinder slides are popular choices when longer distances of travel are required, or when the overall length must be minimized due to space constraints

Typical uses for these slides include conveyor stops, part ejection and positioning, opening and closing safety doors, gates or curtains and multi-axis configurations. In many of these applications, the need for side load capacity and non-rotating capability is critical.

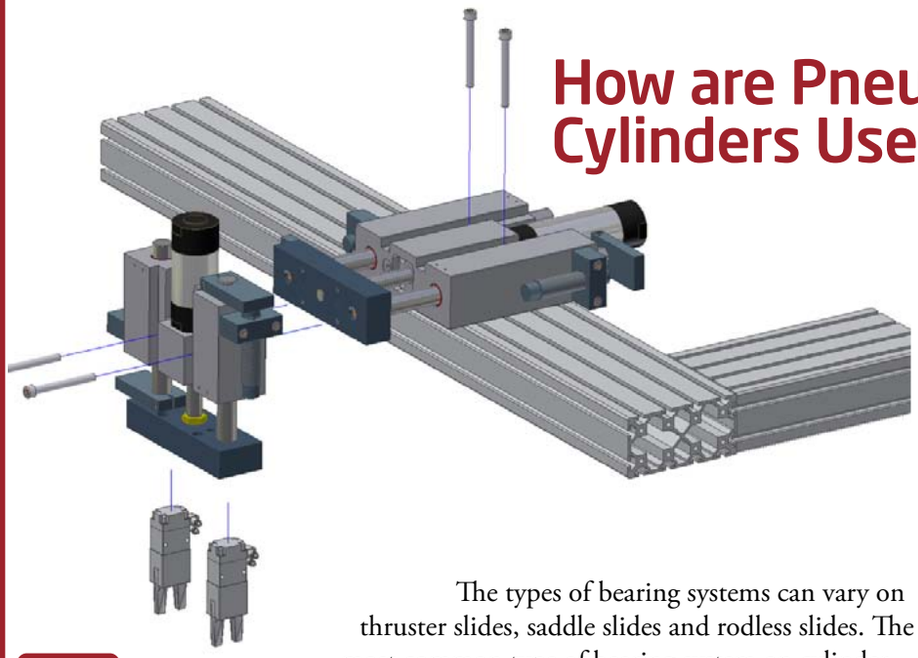
The idea of applying a load to a linear actuator is very common and there are a number of types of cylinder slides that can be used for these applications. The first basic style of powered slide is commonly known as a "thruster" or cantilever type unit. This type of guided slide is typically powered by a rod style pneumatic cylinder, which is attached to the body of the slide, or may be integral to the slide. In either case, the cylinder piston rod is attached to a tool plate providing power and motion. The tool plate is supported by a bearing mechanism, and together they are able to carry any loads that are attached, rather than transferring the load to the cylinder rod. This type of slide is designed to carry an overhung load known as a cantilevered load.

The second basic type of cylinder slide is called a saddle slide or base slide. In this case, the pneumatic cylinder is attached to a saddle which supports the bearing system on each end of the slide's travel. This type of powered slide can be used for longer travels with less deflection based on the bearing system being supported on each end. Like the thruster style slide, the saddle carries the load versus the cylinder's piston rod.

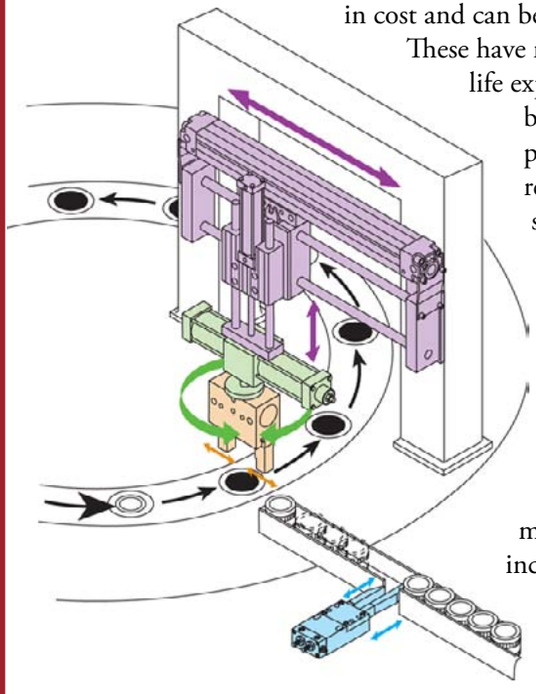
Another type of slide is a rodless slide. In this case, the bearing system is attached to the rodless cylinder directly on one or both sides of the cylinder. The cylinder's piston is linked to a carriage mounted upon the bearing system, offering load carrying capability as well as resistance to side loads. Rodless slides offer the most space savings because the cylinder's travel is contained within its own overall length.



How are Pneumatic Cylinder Slides/ Rodless Cylinders Used? (continued)

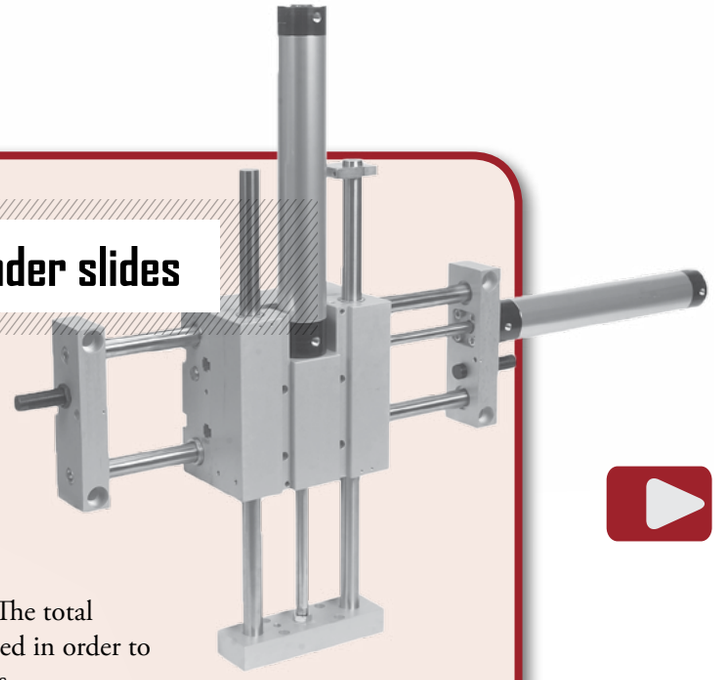


The types of bearing systems can vary on thruster slides, saddle slides and rodless slides. The most common type of bearing system on cylinder slides uses round shafts with linear bearings. The bearings can be precision reciprocating ball bushings or a variety of composite bushings. The precision ball bushings provide low friction and more than 200 million in. of travel life. Composite bushings are typically lower in cost and can be used in harsh environments. These have more friction and do not have the life expectancy of the reciprocating ball bushings. Rodless slides offer either profiled rail bearing systems, or reciprocating ball bearings and in some cases composite bushings. As with thruster or saddle slides, load and life is commensurate with the bearing system.



Other pneumatic cylinder slides use profile rails with reciprocating ball carriage bearings. The profile rail bearing systems provide long life with minimum deflection. These can be incorporated in both thruster and saddle type slides. DW

Specifying cylinder slides



There are several considerations when selecting the best type of pneumatic cylinder slides. These include:

- Load capacity required. The total payload must be calculated in order to start the selection process.
- Life required from the slide. The bearing system selected will have an impact on the expected life of the unit along with the required speed and payload.
- Speed required. The slide speed is a critical component including the ability of the slide to handle the kinetic energy as the load stops at the end of travel. Cylinder shock pads, cylinder cushions or shock absorbers may be required based on the load and speed of the slide.
- Deflection needed. The amount of deflection will vary based on the bearing system and the payload being carried. This deflection will affect the positional accuracy of the slide.

Many manufacturers of pneumatic cylinder slides provide specification and sizing software to allow the proper selection of the slide required for various applications.

How to Select Your EVP Proportional Valve

Selection Tips

Courtesy of Clippard *(Not all configurations are listed online. Please contact Clippard for assistance with product selection.)*

In selecting your EVP Proportional Valve, you have many variables to choose from. Each variable will affect others and this is a simple guide to point you in the right direction. To select the best valve for your application, focus on these three: Control Signal, Valve Orifice and Operating Pressure.

If you can't find the right configuration for you, that doesn't mean we dont have it...
Call Clippard's Tech Team for clarification or help in specifying your valve.

Control Signal:

Everyone understands voltage, however, this valve really cares about current. It works by having a change in current vary the magnetic field, which varies the travel or distance the valve is opening.

Coil Information:			
Voltage Range	Nominal Voltage	Nominal Coil Resistance	Max Current
0-5	5	13.5	.370A
0-10	10	54	.185A
0-20	20	218	.093A

Reminder: *Don't forget... Clippard manufactures these valves and has the capability to customize your valve!*

Important:

IT IS VERY IMPORTANT to specify and use a calibrated valve that matches your application. Be sure to use a valve set to your **operating pressure** to assure you have an all-around good performing valve for your set up.

Otherwise... Your required power for opening the valve will be high, and your resolution to set your flow proportional will be poor.

Valve Orifice:

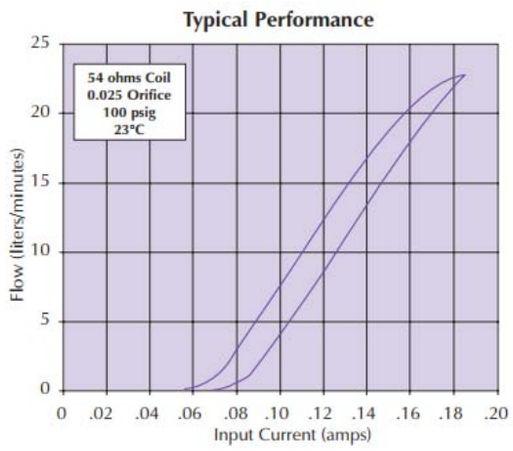
Our Standard Orifice Offering:

Orifice (in)	Max Flow* (lpm)	P/N Code	Max Pressure (psig)
0.009	2.7 +/- 10%	09	Over 100 psig**
0.013	6.7 +/- 10%	13	Over 100 psig**
0.025	22.0 +/- 10%	25	100 psig
0.040	32.0 +/- 10%	40	100 psig**
0.060	23.4 +/- 10%	60	50 psig
0.089**	13.0 +/- 10%	89	15 psig**

Measured at Max Pressure
***Consult Clippard*

Operating Pressure:

The EVP Proportional Valve can be calibrated for pressures less than the maximum pressure shown above. Lower pressures may be substituted in increments of 5 psig, and will be used for calibration. For pressures less than 10 psig, please consult Clippard's Tech Team.

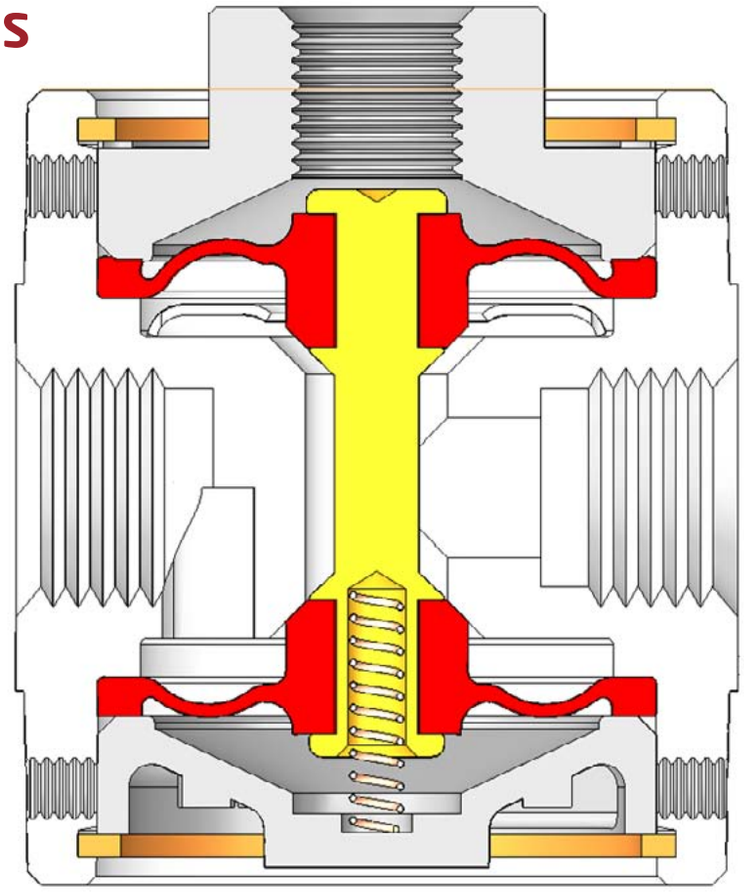


NOTE:
VOLTAGE, ORFICE AND PRESSURE ARE DETERMINED BY PART NUMBER.

FOR EXAMPLE: EV-PM-20-25AO
NOMINAL COIL VOLTAGE
ORFICE DIAMETER
OPERATING PRESSURE

Common uses of pneumatic valves

Paul Heney, Design World Editorial Director



Pneumatic valves include manual valves, mechanical valves, air-piloted, solenoid-piloted and vacuum-piloted. These terms relate to how the valve will be actuated. This is a critical component in understanding how to properly use the valve in an application, but it is essential to understand how a valve is designed. There are four basic valve designs: poppet, diaphragm poppet, spoppet and spool.

Poppet valves use a rubber molded poppet wrapped around the stem and move along the bore of the valve, creating a seal when the poppet is in its seat. One specific advantage to using a valve with this type of internal design is the compatibility with a variety of media other than compressed air. The unique feature that allows this compatibility is less lubrication sensitivity due to few sliding parts or (dynamic seals). Other features within this poppet design include valves that are more tolerant of minor air sediment or debris. They have excellent exhaust capacity and are capable of high flow rates. The poppet design provides a faster response rate due to short stroke and can be mounted in several ways. Poppet valves more readily lend themselves to 2- or 3-way configurations, although 4-way configurations can be achieved by using dual 3-way poppet sets in one valve body. Poppet valves are typically unbalanced designs that use the air pressure as the primary force to return the valve to a given position. This concept ensures that the valve will return to the desired position even if the return spring fails. Balanced poppet valves are used to reduce actuation force and achieve lower current consumption in solenoid valves. Balanced valves typically provide smaller overall physical size and produce greater flow capacity.

Diaphragm-poppet valves expand the poppet valves' design by the use of a diaphragm. Its outer webbing guides the poppet to its seat without using sliding seals. Diaphragm-poppet designs are usually unbalanced, providing the same assurance of return to a given position as the poppet valve. The diaphragm increases durability especially with different or non-lubricated media. The diaphragm also allows for the potential use of liquids through the body of the valve depending on application and rubber compatibility. A variety of durometer and diaphragm compounds make it simple to modify a valve based on the environmental or application requirements for operation. Also,

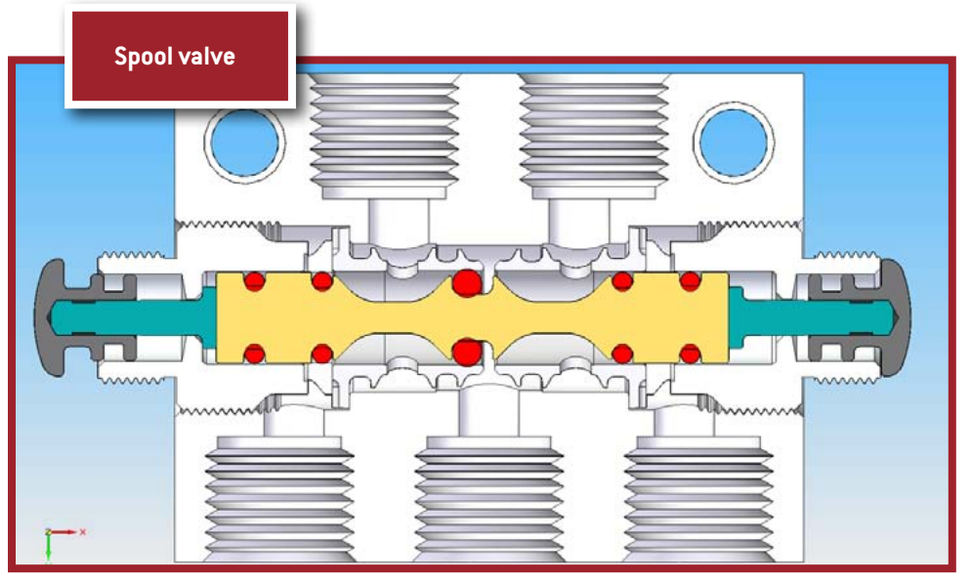
Common uses of pneumatic valves

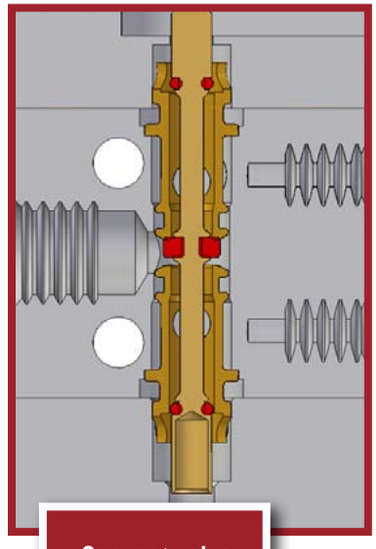
(continued)

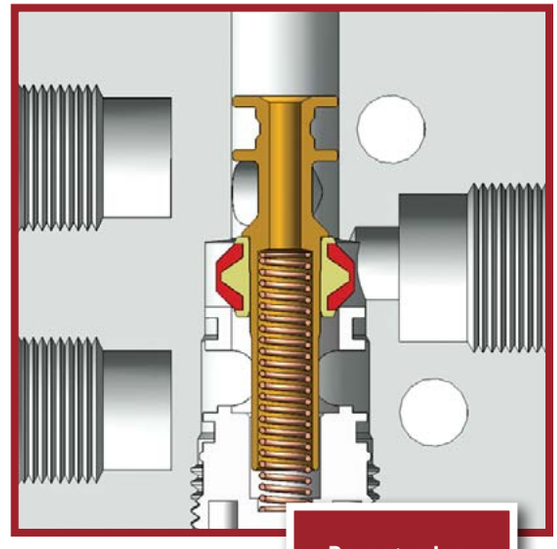
expect extremely low leak rates due to strong sealing control. Diaphragm-poppet valves make 2- or 3-way configurations available, as well as the possibility of 4-way valves, by using dual 3-way diaphragm poppet sets in one valve body.

Spoppet valves combine two designs to provide a blend of primary poppet sealing in conjunction with a minimal number of sliding seals, thus emulating characteristics of a poppet and spool valve design. Spoppet designs retain some unbalance characteristics but with some balance of pressure to reduce actuation forces. This design provides the benefits of the poppet valve with a reduced sensitivity to lubrication. Only one sliding seal engaged at a time reduces the drag within the valve body. These designs can sometimes bridge the gaps or limitations of poppet and spool valves making them more useable in numerous critical applications. By blending the designs, spoppets provide more cost efficient 3- and 4-way valves, and can be used in many different environments and applications.

Spool valves are available in three types: Lapped-/shear-design with no seals, dynamic seals, or 0-ring. Spool valves are designed to be more cost-effective when manufacturing for 4-way valves and are conversely less adaptable for 2- or 3-way configurations. Spool valves can be either balanced or unbalanced, depending on desired position control required. Therefore, understanding this valves' function is critical to the application requirements. Lapped- or shear-design spool valves can operate without lubrication but are less tolerant of variations in lubrication or by-products of compressing the air at the air compressor. Hence, further conditioning of the compressed air is required prior to use. Dynamic seal spool valves generally require lubrication. Lapped spool valves have higher leak rates that may make them unacceptable for control of medias other than air, or limited media sources (air/gas tanks/bottles). DW







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