



The Productivity Devices Company

PROFESSIONAL GRADE

PNEUMATIC CLAMPING

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www.vektek.com



VEKTEK, INC.

Why use VektorAir™?

Since the 1980's, Vektek has researched, designed, manufactured, direct-sold and serviced the VektorFlo® line of hydraulic clamping devices. During this time, we have often had requests for pneumatic products. While we have successfully converted many of our hydraulic clamps for air use, we wanted to offer a complete line of pneumatic products, specifically designed to meet the requests we were hearing about.

We are now proud to offer you the VektorAir™ line of pneumatic swing clamps, toggles, intensifier, valves, hardware and plumbing accessories, designed specifically for clamping. We think you will find many uses for these. Durable enough for use in machining and welding operations, they are also a good fit for woodworking, assembly and automation. We've created our pneumatic line with the same careful detail to quality that we give our hydraulic clamps. Moreover, we back them with applications staff, our VektorAir™ warranty and our signature service before and after the sale.

Perhaps the most exciting product in our line is our air-to-air intensifier. If your shop is like most, your standard air runs about 80 psig. This intensifier easily boosts 80 psig to 250 psig. With our intensifier you are capable of getting much greater clamping forces from your clamps. For example, our swing clamp P1-5240-00 has a clamping force of 300 pounds at 80 psig, but has a clamping force of 900 pounds at the top rated 250 psig. Unless specified, all of our pneumatic products are rated for a minimum operating pressure of 30 psig to a maximum operating pressure of 250 psig. Operating temperature limits for VektorAir™ devices are 32-150° F unless otherwise noted. Minimum filtration is 40 microns. Minimum required airflow is listed with dimensional information for each device as needed.

Quality Product

Quality has always been important to Vektek. This product line is no exception. Some quality features include:

- PHC™ (Pneumatic Hardcoat), for wrought aluminum surfaces, extends the life of many of our devices. This is a hard anodizing procedure. Internal surfaces are also hard coated and rods are chrome plated for corrosion and maximum abrasion resistance.
- Magnetic position sensors are available for most cylinders. The channel for the sensor is built into each cylinder already, and all the pistons are magnetized. Simply order the sensor if you want it! It doesn't add to the envelope of the cylinder since the switch mounts below the clamp surface. LED indicator switches help reduce set-up time.
- Make connections easily with Vektek's push-to-connect tubing. It functions with Nylon 11 for inch sizes or Nylon 12 for metric sizes. Fittings are shipped with non-PTFE based thread sealant applied. Standard NPT ports are used.
- All dynamic seals are made of internally lubricated specially compounded elastomer to promote smooth break away and low operational drag.



WARRANTY

Vektek, Inc. warrants each VektorAir™ product to the original purchaser unless end user assignment is made at the time of purchase. Each device is warranted against defects in workmanship and materials for a period of six months from the date of delivery.

This warranty is limited to the repair or replacement of any part or parts which are found by Vektek to be defective and does not cover ordinary wear and tear, abuse, misapplication, overloading, excessive flow rates, or altered products.

This warranty is the only warranty covering VektorAir™ products. There are no other warranties covering VektorAir™ products, either expressed or implied.

When question of warranty arises, the user may contact the factory for authorization to return the merchandise. All returned merchandise must be addressed to a Return Authorization number and shipped to the address indicated on the RA.



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SAFETY

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SAFETY

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Planning/Concepts

Planning Steps 1-10

A-1

Step 1:

First, determine the nature of the operation to be performed, the number of parts to be processed per cycle, and whether operations will be performed on more than one surface of each part. Also, determine the time that should be allowed for part loading, unloading, and clamping.

In the initial phases of system planning, include adequate measures and devices to ensure the safety of workers and equipment. For more information, see the safety section on the back inside cover.

Step 2:

Prepare an outline of the sequence of events that will take place during the manufacturing cycle. This will assist you in determining the types of circuits that you might need, as well as any external control (such as a tie-in with machine controls) that your application may require.

Step 3:

If you are fixturing for a machine operation, calculate the cutting forces generated in the machining process and note the direction that these forces tend to act on the workpiece. If you are planning a retrofit of a manual clamping system, you may use the torques presently being used. However, it is recommended that cutter forces be calculated as a precaution in such a case to ensure that clamping devices are sized to provide an adequate margin of safety. The operation manuals of many machine tools contain tables that list machining forces or simple formulas for calculating these forces. However, if you can't find the information, give us a call. We'll be glad to get you started.

Step 4:

When planning for a machine operation fixture(s), plan with positive fixed stops to resist the majority of the cutting forces and to ensure correct location of the workpiece, using the primary part locating features.

Step 5:

After you have determined the machine cutting forces, it's easy to calculate the clamping forces required to hold the workpiece on the fixture or machine table. Again, a simple formula is all you need to arrive at an answer for the materials you'll be using. Give us a call if you need help.

Step 6:

Determine where clamps should contact the part to hold or support it securely and to avoid interference with operations. If clamps cannot be located so as to avoid interference with manufacturing operations, it will be necessary to use an external control device to move the clamps out of the way as the need arises during the manufacturing sequence. This will require that electrically actuated valving be used to control the offending devices separately.

Step 7:

Determine the type and number of clamping devices you need based on the total clamping force required and clamping positions you've selected; on the size, strength and shape of the part; and on the operation.

Step 8:

Select valves and other control components to accomplish the sequence of operations you outlined in Step 2. See the valve section of this catalog for guidance.

Step 9:

Finally, select the plumbing components required to connect the air supply to the valves and devices. Simply review your system specifications and layout to determine what you need in terms of ratings, sizes, and lengths.

Step 10:

Call us for help. Our application engineers do not design fixtures. Their job is to help you use pneumatic clamps successfully, whether you are retrofitting existing fixtures, need an idea (concept) for clamping a new part or want a quick review of your design, we stand ready to help you.

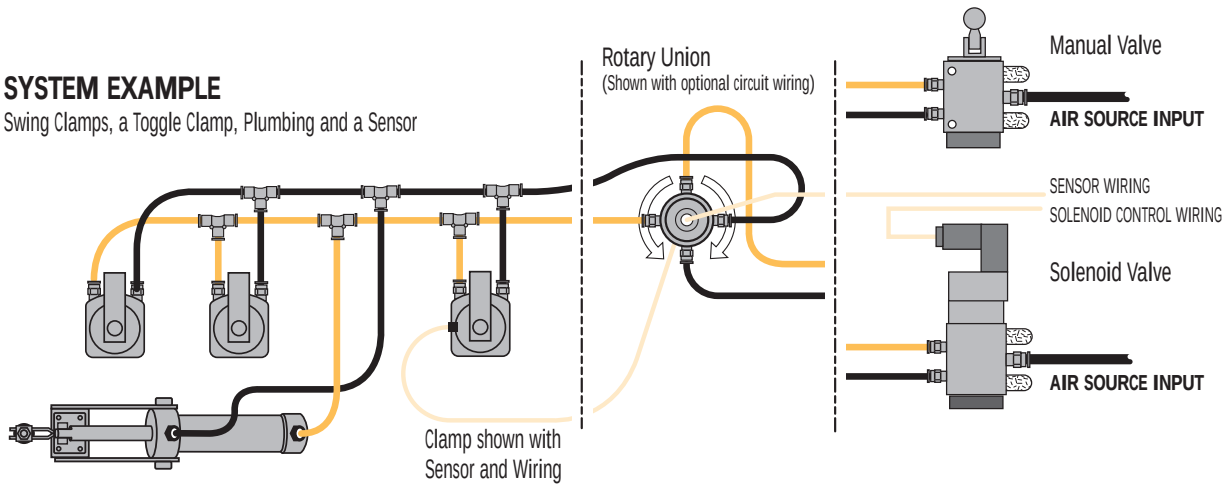
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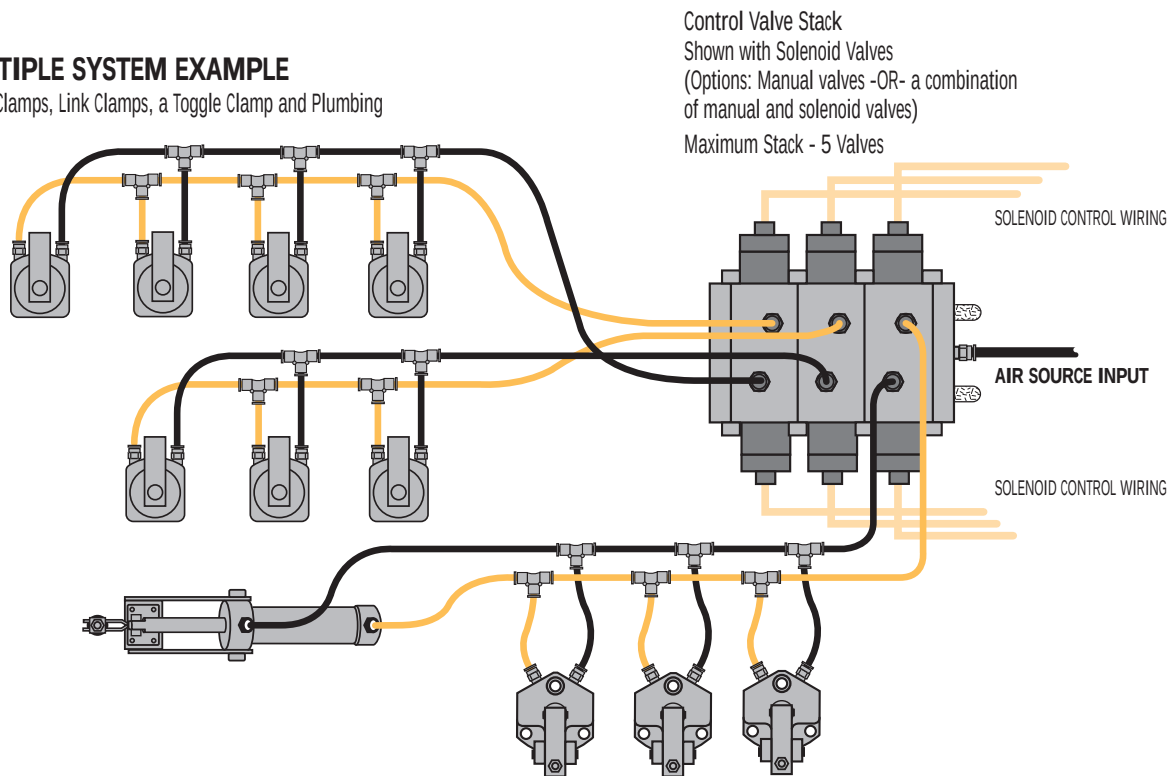
SYSTEM EXAMPLE

Swing Clamps, a Toggle Clamp, Plumbing and a Sensor



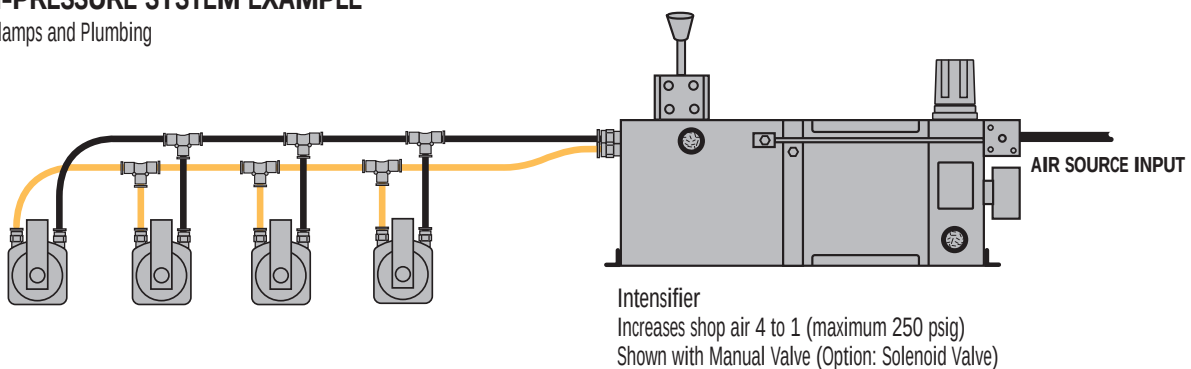
MULTIPLE SYSTEM EXAMPLE

Swing Clamps, Link Clamps, a Toggle Clamp and Plumbing



HIGH-PRESSURE SYSTEM EXAMPLE

Swing Clamps and Plumbing



Swing Clamp Frequently Asked Questions

B-1

Following are some of the questions we have been asked while developing the VektorAir™ line. Please read them carefully before planning your system. Many common problems can be identified and corrected before you even order a part!

Why do I need to know my shop air pressure when planning my system?

Your shop air pressure (in psig, pounds per square inch gauge) will help you determine the size clamp necessary to perform the work that you want to accomplish. The pressure should be measured with an accurate gauge at the point nearest the work area and with normal demand on your system. Pressure measured at the compressor is not valid because continuously pressurized gauges are notoriously inaccurate and there is measurable pressure drop over any extended length of pipe, hose or tubing. Demand on your system will result in fluctuations between just a few percent and as much as 50% for an undersized compressor. You will need to know the minimum air pressure supplied continuously to avoid having parts come unclamped or clamps not operating properly.

Is it necessary to check our clamping system for air leaks?

Yes. Since air used in a pneumatic system is a compressible medium, leakage will dramatically affect clamping loads. Therefore, circuits should be checked with a suitable leak detection solution such as SNOOP® or equivalent.*

* SNOOP® is a registered trademark of Swagelok®

We shut the air supply down to our clamps once they are in position. Sometimes we notice that they are sticking. Could this be the cause?

Yes, you should avoid deadheading clamp circuits. Keep the valve engaged and air flow to the clamps during the entire clamping cycle.

After clamping, my swing clamps are moving. I cannot detect a leak. Why do I have this movement?

Where have you set your minimum operating pressure? When establishing operating pressure for the system, remember that 30 psig is the minimum and must be maintained during cycling. If you set your regulator to 30 psig and then open the valve and the pressure drops to 20 psig during clamping, you need to increase pressure until 30 psig is maintained during the entire clamping cycle. This will prevent cycle problems like the one you describe.

We need to regulate the speed of the clamping. How is this best done?

If component speed is an issue, always regulate the speed from the opposite side of the piston where the pressure is being applied. In other words, if the return stroke is to be controlled, use the exhaust flow from the extend stroke to regulate the speed. This will give superior control and avoid problems with devices sticking.

Is it necessary to use an intensifier?

No. You do not need an air intensifier to make your clamps work. Air intensifiers will allow smaller physical size clamps to do more work. For example, referring to the charts on the next page, clamp P1-5110-00 will generate 165 lbs. clamp force at 250 psig, P1-5240-00 will generate 165 lbs. at 60 psig, but is over twice the bore diameter, jumps from 1 7/8" to 3 1/4" in body thread and from about 5 1/2" to over 8" in height. If smaller is better, higher-pressure makes swing clamps smaller.

How do we determine what valve to use with our intensifier?

Please see the Valve section of this catalog. The ISO 1, 5 port valves are properly sized for direct pump mounting. Other valves from alternate suppliers may work, but why take the chance? It should be noted that intensifiers are not intended to have multiple sub-bases installed to control multiple circuits, no direct feed crossover plate is available to deliver uncontrolled high air pressure.

Can we restrict our swing clamps to rotate less than 90 degrees, or make them rotate further than 90 degrees?

Restricting the swing to less than 90 degrees is reasonably simple. We can provide 45 degrees and 60 degrees for a small up-charge. Precise swing angles and those greater than 90 degrees are possible as specials and will be costly. Contact your Vektex representative to discuss special swing clamp needs.

Can we modify the standard arm that is included with the swing clamp?

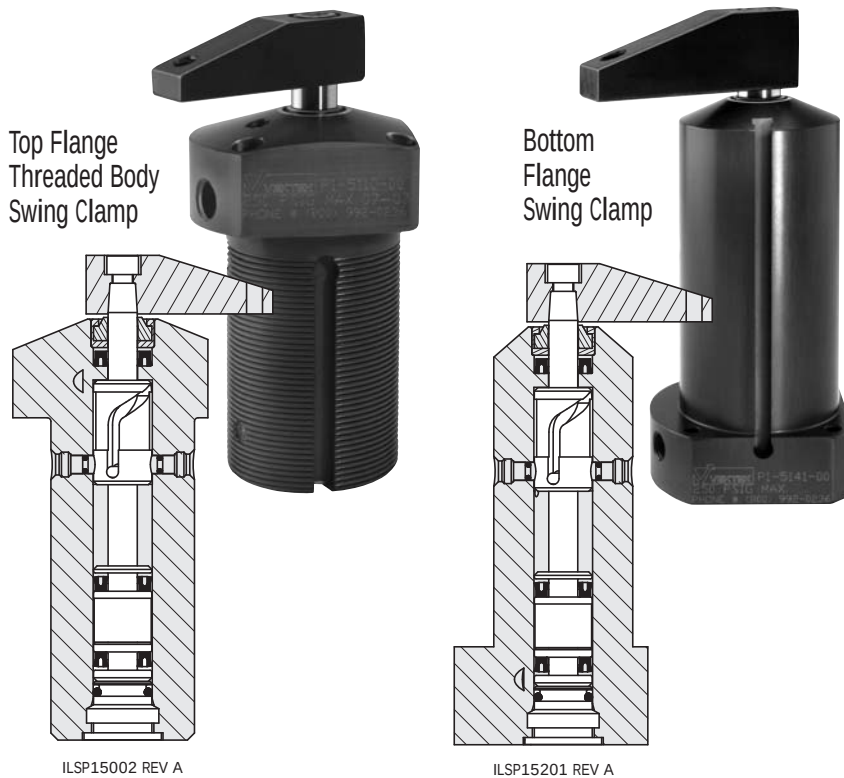
Yes, you may modify the standard arm; it is machinable and weldable steel. In order to remove it, please be sure to follow arm removal and re-installation instructions. Remember that larger arms are larger mass and reduced rotational speed is recommended to avoid damage to the rotational cam track.

Why would we use a sensor switch with our swing clamps?

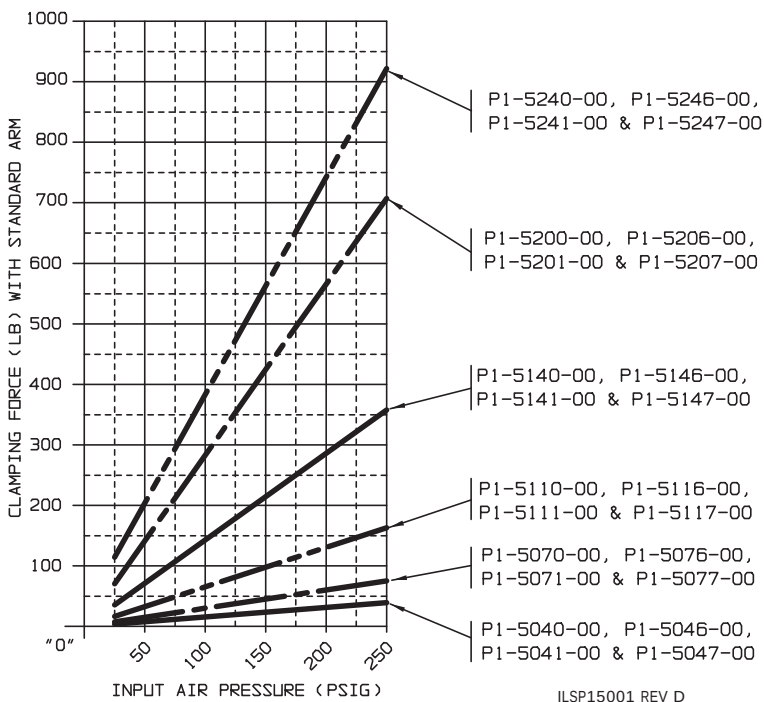
You may choose to use a position sensor to detect the location of the swing clamp plunger. The sensors can confirm clamp in position, clamp in unclamp position or clamp in neither clamp or unclamp position.

Swing Clamps

Standard Features



Product Clamping Forces



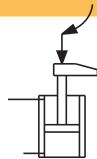
- Arms swing 90°.
- Our capscrew arm design is available. You may modify our arm, or we have provided you with dimensions to make your own.
- Special wipers and swept-line cylinder tops help keep chips from packing and coolant contaminants from entering the swing clamp.
- Swing clamp bodies are wrought aluminum alloy with PHC™ (Pneumatic Hardcoat) coating on all external and internal surfaces. This gives the clamps extended life.
- Plungers are carbon steel with hard chrome plating. The guide bushings are hardened alloy steel.
- All dynamic seals are internally lubricated and made from a specially compounded elastomer to promote smooth break away and low operational drag.
- Six bore sizes are available in two mounting styles to best adapt to your application.
- All models are available in straight pull and left or right swings.
- Magnetic pistons are standard on all models, allowing you to use position-indicating sensors.
- Position sensors mount within the clamp's space envelope so sensor usage doesn't encroach on the clamp's mounting envelope.
- Position sensors have an LED indicator to reduce setup time.
- All swing clamps have internal orifices to prevent cam damage caused from over accelerating the clamp.
- VektorAir™ clamps are double acting to reduce mounting envelope and prevent non-return and slow return problems inherent with single acting clamps.
- To determine whether a straight pull, left or right swing should be specified, imagine viewing the arm from above during the clamping stroke. Arms moving clockwise are right hand swings, counter-clockwise are left hand swings.

B-2

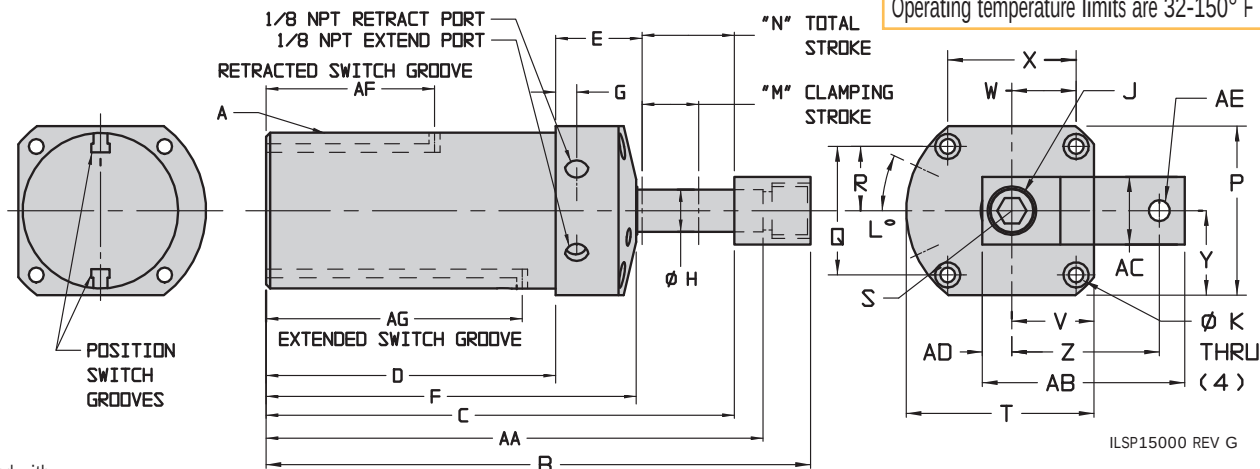
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Swing Clamps



Double Acting Top Flange Threaded Body Specifications



Operating temperature limits are 32-150° F

B-3

Clamp supplied with a standard arm.



Double Acting (D/A) Cylinders, actuated pneumatically both directions.

* See graphs, on B-7 for clamp curves and extended arm performance force. It is recommended that the clamp position be set at about 50% of the clamp stroke. These devices should be positioned in no less than 1/2 second.

These recommendations apply when using the standard arm. When using the extended or large custom arms, allow 1 second for positioning.

* Per complete cycle

Swing Direction Double Acting Top Flange Swing Clamp Model Numbers*

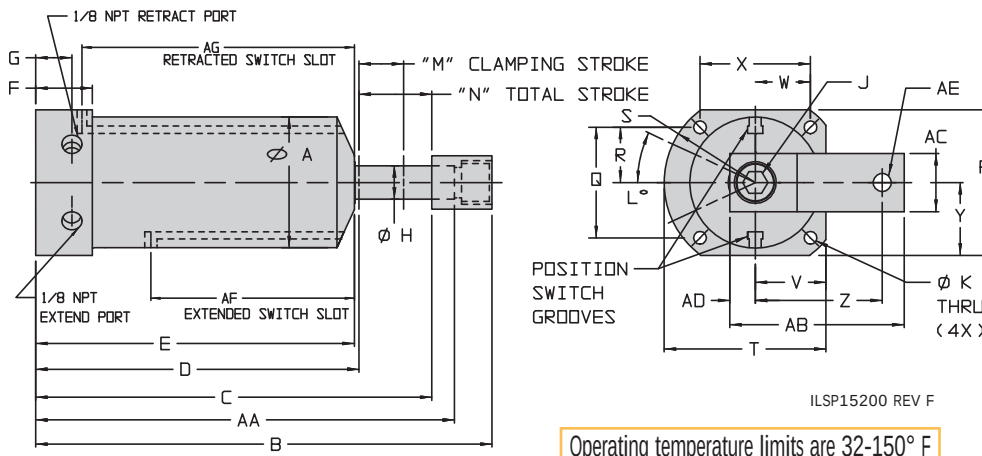
Swing Direction	P1-5040-00	P1-5070-00	P1-5110-00	P1-5140-00	P1-5200-00	P1-5240-00
RIGHT HAND	P1-5046-00	P1-5076-00	P1-5116-00	P1-5146-00	P1-5206-00	P1-5246-00
LEFT HAND	P1-5048-00	P1-5078-00	P1-5118-00	P1-5148-00	P1-5208-00	P1-5248-00
STRAIGHT						
Bore	0.500	0.875	1.125	1.500	2.000	2.500
A	1 1/4 - 16	1 5/8 - 16	1 7/8 - 16	2 5/16 - 16	2 3/4 - 16	3 1/4 - 16
B	4.87	5.48	5.48	8.24	8.24	8.20
C	4.37	4.79	4.79	7.11	7.11	7.07
D	2.75	2.80	2.80	4.28	4.28	4.28
E	0.93	1.17	1.17	1.33	1.33	1.29
F	3.59	3.91	3.91	5.47	5.47	5.47
G	0.31	0.31	0.31	0.31	0.31	0.31
Ø H	0.25	0.50	0.50	0.63	0.63	0.75
J	8-32 x .5	5/16-18 x .5	5/16-18 x .5	3/8-24 x .75	3/8-24 x .75	3/8-24 x .75
Ø K	0.17	0.19	0.19	0.22	0.22	0.28
L°	23	25	25	25	25	25
M RIGHT HAND**	0.40	0.47	0.47	0.75	0.75	0.75
LEFT HAND**	0.40	0.47	0.47	0.75	0.75	0.75
STRAIGHT**	0.69	0.82	0.82	1.50	1.50	1.50
N	0.69	0.82	0.82	1.50	1.50	1.50
P	1.44	1.75	2.00	2.50	2.87	3.40
Q	1.10	1.37	1.55	1.90	2.21	2.61
R	0.55	0.69	0.78	0.95	1.10	1.30
S	0.94	1.19	1.31	1.56	1.81	2.13
T	1.67	2.06	2.28	2.78	3.24	3.81
V	0.73	0.87	0.97	1.22	1.43	1.68
W	0.55	0.69	0.78	0.95	1.10	1.30
X	1.10	1.37	1.55	1.90	2.21	2.61
Y	0.72	0.88	1.00	1.25	1.44	1.70
Z	1.13	1.50	1.50	2.18	2.18	2.43
AA	4.59	5.02	5.02	7.56	7.56	7.56
AB	1.59	2.19	2.19	2.99	2.99	3.31
AC	0.38	0.63	0.63	0.75	0.75	0.87
AD	0.31	0.44	0.44	0.50	0.50	0.50
AE	8-32	1/4 - 20	1/4 - 20	3/8 - 16	3/8 - 16	3/8 - 16
AF	1.56	1.76	1.76	2.88	2.88	2.88
AG	2.18	2.38	2.38	3.50	3.50	3.50
Effective Piston Area (sq. in.)*						
Extend	0.20	0.60	1.00	1.77	3.14	4.91
Retract	0.15	0.40	0.80	1.46	2.83	4.47
Air Usage (cu. in.)**	0.25	0.80	1.50	5.00	9.00	14.00

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Swing Clamps

Bottom Flange Specifications



Clamp supplied with a standard arm.

B-4



Double Acting (D/A) Cylinders, actuated pneumatically both directions.

* See graphs, on B-7 for clamp curves and extended arm performance force. It is recommended that the clamp position be set at about 50% of the clamp stroke. These devices should be positioned in no less than 1/2 second.

These recommendations apply when using the standard arm. When using the extended or large custom arms, allow 1 second for positioning.

* Per complete cycle

Rotation		Model Number					
RIGHT HAND		P1-5041-00	P1-5071-00	P1-5111-00	P1-5141-00	P1-5201-00	P1-5241-00
LEFT HAND		P1-5047-00	P1-5077-00	P1-5117-00	P1-5147-00	P1-5207-00	P1-5247-00
STRAIGHT		P1-5049-00	P1-5079-00	P1-5119-00	P1-5149-00	P1-5209-00	P1-5249-00
Bore		0.50	0.875	1.125	1.50	2.00	2.50
A		1.19	1.56	1.81	2.25	2.69	3.19
B		4.86	5.48	5.48	8.24	8.24	8.20
C		4.36	4.79	4.79	7.11	7.11	7.07
D		3.67	3.97	3.97	5.61	5.61	5.57
E		3.59	3.91	3.91	5.47	5.47	5.47
F		0.84	0.91	0.91	0.97	0.97	0.97
G		0.56	0.56	0.56	0.62	0.62	0.62
H		0.25	0.50	0.50	0.63	0.63	0.75
J		8-32 x .5	5/16 - 18 x .5	5/16 - 18 x .5	3/8 - 24 x .75	3/8 - 24 x .75	3/8 - 24 x .75
K		0.17	0.19	0.19	0.22	0.22	0.28
L		23	25	25	25	25	25
M RIGHT HAND		0.40	0.47	0.47	0.75	0.75	0.75
LEFT HAND		0.40	0.47	0.47	0.75	0.75	0.75
STRAIGHT		0.69	0.82	0.82	1.50	1.50	1.50
N		0.69	0.82	0.82	1.50	1.50	1.50
P		1.44	1.75	2.00	2.50	2.87	3.40
Q		1.10	1.37	1.55	1.90	2.21	2.61
R		0.55	0.69	0.78	0.95	1.10	1.30
S		0.94	1.19	1.31	1.56	1.81	2.13
T		1.67	2.06	2.28	2.78	3.24	3.81
V		0.73	0.87	0.97	1.22	1.43	1.68
W		0.55	0.69	0.78	0.95	1.10	1.30
X		1.10	1.37	1.55	1.90	2.21	2.61
Y		0.72	0.88	1.00	1.25	1.44	1.70
Z		1.13	1.50	1.50	2.18	2.18	2.43
AA		4.59	5.02	5.02	7.56	7.56	7.56
AB		1.59	2.19	2.19	2.99	2.99	3.31
AC		0.38	0.63	0.63	0.75	0.75	0.87
AD		0.31	0.44	0.44	0.44	0.44	0.50
AE		8-32	1/4 - 20	1/4 - 20	3/8 - 16	3/8 - 16	3/8 - 16
AF		2.12	2.37	2.37	3.87	3.87	3.87
AG		2.91	3.16	3.16	4.66	4.66	4.66
Effective Piston Area (sq. in.)*							
Extend		.20	.60	1.00	1.77	3.14	4.91
Retract		.15	.40	.80	1.46	2.83	4.47
Air Usage (cu. in.)**							
		.25	.8	1.5	5	9	14

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Swing Clamp Sensors

Position Sensor

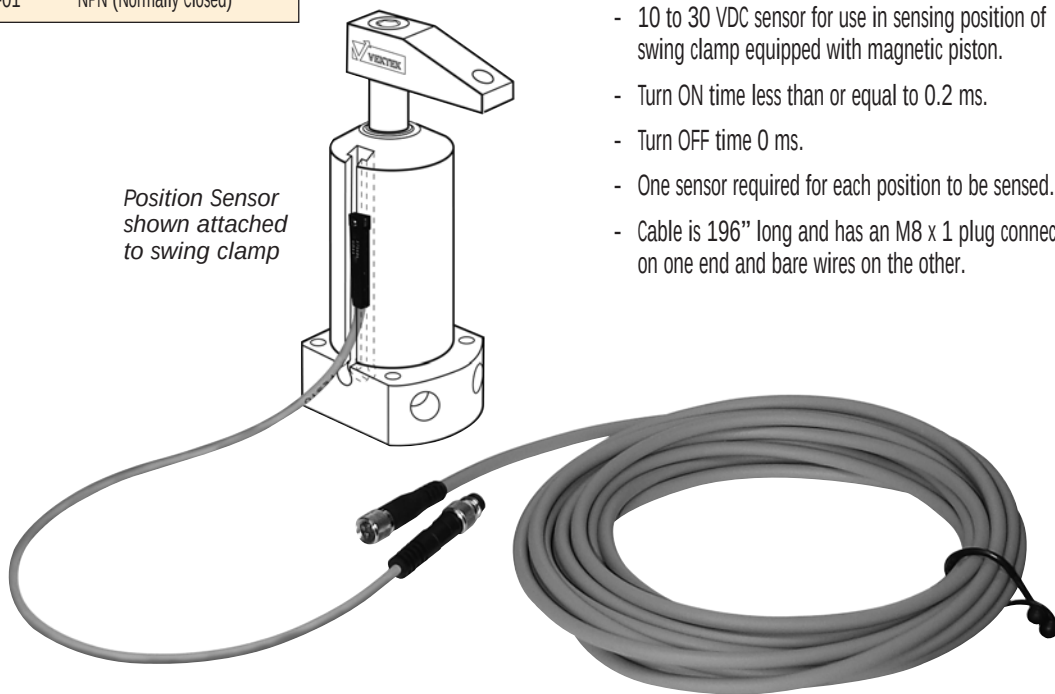
B-5

Position Sensing Kit

Model Number and Description

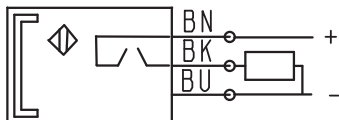
P6-2297-00	PNP (Normally Open)
P6-2297-01	NPN (Normally Closed)

Position Sensor
shown attached
to swing clamp

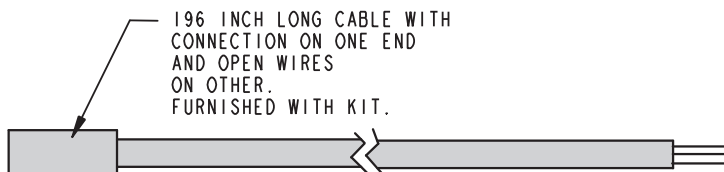
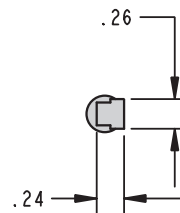
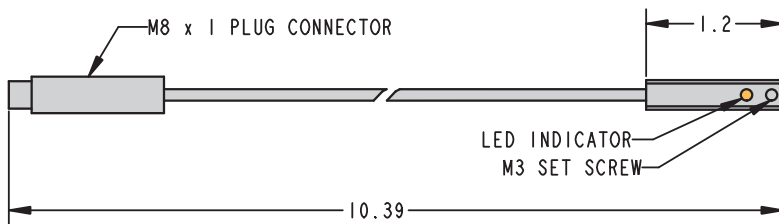
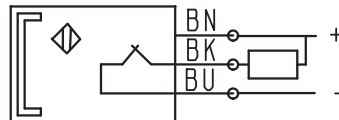


- The use of NPN or PNP is determined by the customer for the device to be connected to the sensor.
- 0.188" Sensing Range
- Kit Consists of Sensor and Cable:
 - 10 to 30 VDC sensor for use in sensing position of swing clamp equipped with magnetic piston.
 - Turn ON time less than or equal to 0.2 ms.
 - Turn OFF time 0 ms.
 - One sensor required for each position to be sensed.
 - Cable is 196" long and has an M8 x 1 plug connector on one end and bare wires on the other.

PNP WIRING CONNECTION, NORMALLY OPEN



NPN WIRING CONNECTION, NORMALLY CLOSED



ILSP29700 REV B

Threaded Body Swing Clamp Hardware

Mounting



Mounting Bracket



Mounting Flange

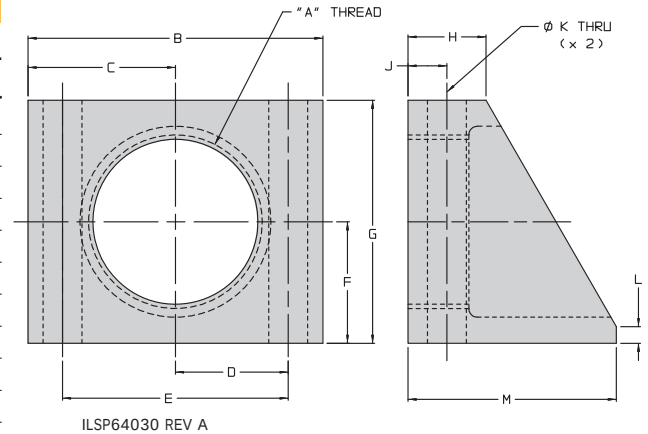


Retaining Ring

B-6

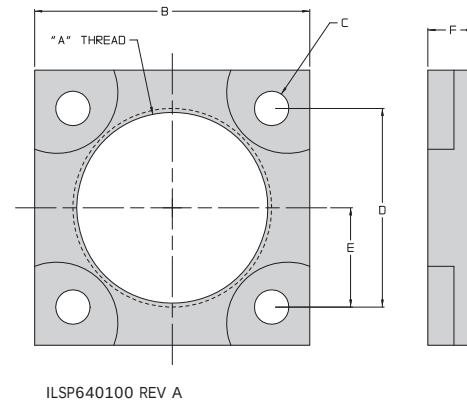
Mounting Bracket

	Model Number					
	P6-4031-20	P6-4031-60	P6-4031-80	P6-4032-30	P6-4032-70	P6-4033-20
A	1 1/4 - 16	1 5/8 - 16	1 7/8 - 16	2 5/16 - 16	2 3/4 - 16	3 1/4 - 16
B	2.13	2.50	3.38	3.25	3.75	4.25
C	1.06	1.25	1.69	1.63	1.88	2.13
D	.81	1.00	1.28	1.38	1.63	1.81
E	1.63	2.00	2.56	2.75	3.25	3.63
F	.88	1.13	1.25	1.50	1.75	2.00
G	1.75	2.25	2.50	3.00	3.44	4.00
H	.56	.50	1.00	.63	.75	.75
J	.28	.25	.62	.31	.31	.31
K	.28	.28	.53	.28	.28	.28
L	.12	.09	.25	.62	.84	1.40
M	1.50	1.75	2.50	2.00	2.25	2.25



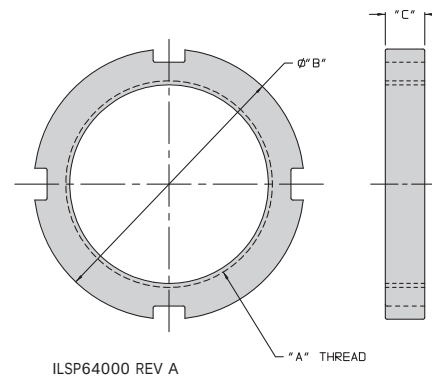
Mounting Flange

	Model Number					
	P6-4011-20	P6-4011-60	P6-4011-80	P6-4012-30	P6-4012-70	P6-4013-20
A	1 1/4 - 16	1 5/8 - 16	1 7/8 - 16	2 5/16 - 16	2 3/4 - 16	3 1/4 - 16
B	2.25	2.25	2.50	2.75	3.25	3.63
C	.34	.28	.41	.28	.34	.34
D	1.56	1.63	1.88	2.13	2.50	2.88
E	.78	.81	.94	1.06	1.25	1.44
F	.75	.63	1.00	.63	.63	.63



Retaining Ring

	Model Number					
	P6-4001-20	P6-4001-60	P6-4001-80	P6-4002-30	P6-4002-70	P6-4003-20
A	1-1/4 - 16	1-5/8 - 16	1-7/8 - 16	2-5/16 - 16	2-3/4 - 16	3-1/4 - 16
B	1.63	2.13	2.44	2.88	3.25	3.75
C	.31	.31	.31	.31	.31	.31



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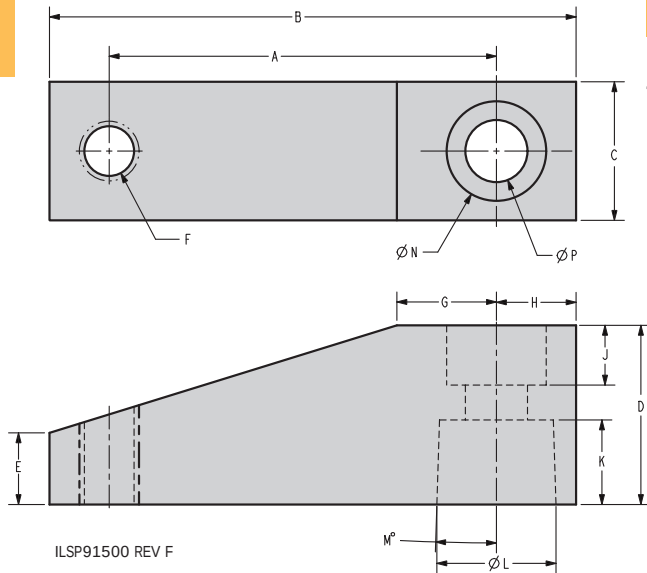
Swing Clamp Arm

Arm Specifications

If custom building arms with longer than standard "A" dimension, use the clamp arm performance graphs below to determine the maximum operating pressure of the clamp and available clamp force.



B-7

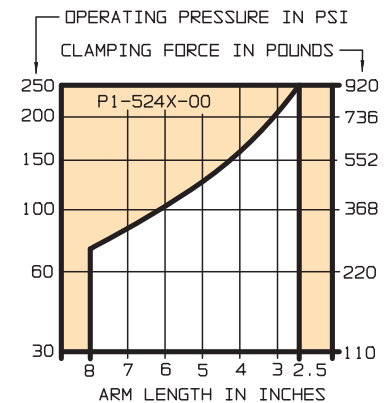
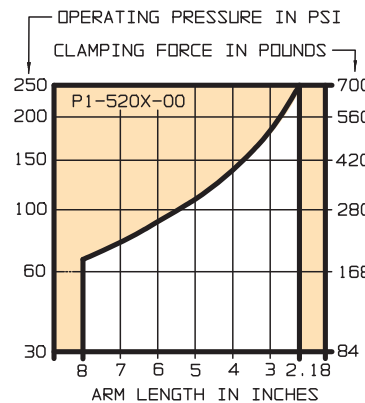
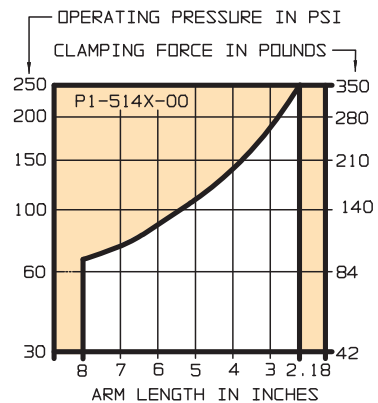
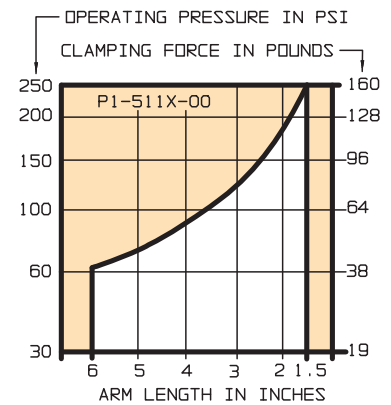
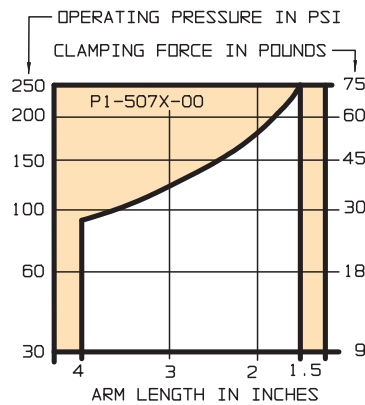
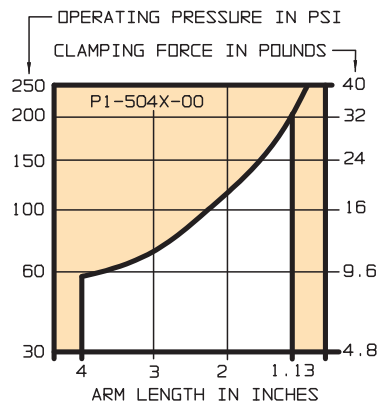


Dimensions

Model Number	91-5005-03	91-5009-03	91-5015-03	91-5025-03
Model Bore Ø	.50	.875 & 1.125	1.5 & 2.0	2.50
A	1.13	1.50	2.18	2.43
B	1.59	2.19	2.99	3.31
C	.38	.63	.75	.87
D	.50	.69	1.13	1.13
E	.20	.27	.45	.45
F	8 - 32	1/4 - 20	3/8 - 16	3/8 - 16
G	.31	.53	.63	.63
H	.31	.44	.44	.50
J	.16	.31	.38	.38
K	.262	.262	.516	.531
L	Ø .245 ± .002	Ø .492 ± .002	Ø .623 ± .002	Ø .748 ± .002
M	3.5 ± .25	3.5 ± .50	1.8 ± .25	1.8 ± .25
N	.31	.53	.63	.63
P	.180	.344	.390	.390

CLAMP ARM PERFORMANCE

Arm lengths and pressures operating at or below the curves shown are in the safe operating zones for their corresponding model number. When using extended or large custom arms allow one second minimum for positioning.



ILSP91501 REV A

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Link Clamp Frequently Asked Questions

The link clamp lever arcs up and out of the way to accommodate hard-to-reach or hard-to-hit clamping points. Link clamps contain the beam mechanism often preferred by fixture builders. This self-contained beam eliminates the need to build or design a clamp mechanism as part of the fixture. Vektek's unique single piece body and pivot design provides the least side-to-side axial deflection and the most rigid product on the market today.

Do I have to use the adapters included on the pneumatic link clamp?

The included adapters are required to change the device port to NPT from SAE. It is possible to make a transition to either compression tube fittings or to flared tube and hose fittings in one connector. You should call Vektek, Inc. or visit our website at www.vektek.com. If you are using soft tubing you will need to provide your own ferrule for compression fittings as Vektek does not stock low pressure nylon, brass or bronze ferrules.

When should I use a link clamp?

A link clamp is often preferred when you must reach over, not swing over or around a height obstacle. Reaching down into a die casting, between two mounting lugs, or a direct overhead vertical load are good examples where these devices are required. Keep in mind that the vertical clearance must be greater when you are bringing a part into position, but direct drop in loading is easily accomplished by an operator or robot in either swing clamp or link clamp fixtures.

What is the vertical stroke of a link clamp?

It is the portion of the clamping stroke that must be used when contacting the part. The maximum part variation is included in the vertical stroke, when outside the specifications, the force generated by the clamp will be reduced and may result in reduced clamp life.

How do I control the speed of a swing clamp or a link clamp?

Avoid high flow rates. The link clamp positions with less mechanical resistance, but mass, acceleration, and sudden stops affect all clamps adversely. Make your decision based on your acceptance of the shortened life cycle. Pneumatic flows are normally restricted on the "out-flow" rather than the current inlet port. In some cases, both inlet and outlet may require restrictions to achieve desired speed results.

Is the link clamp more accurate than swing clamps?

In some cases it may be preferred, its link mechanism still has a limited amount of play and may not be as precise as you desire. This type of decision is application dependent and generally decided by loading direction, part clamping target, and clearance limitations.

The part thickness varies on my application. Which component will work best for my situation, the swing clamp or the link clamp?

Swing clamps have more part variation tolerance, with nominal installation height being at 1/2 of straight stroke, it can tolerate $\pm 1/2$ stroke variations. The limit on link clamps is $\pm 3^\circ$ which is more limited.

When should a link clamp not be used?

If you are clamping on a draft angle, the angle will exert undue stresses on the linkage mechanism. Please avoid stressing guidance mechanisms of either swing clamps or link clamps as these stresses will cause premature failure not covered by warranty due to mis-application.



LINK CLAMPS SHOWN WITH
STANDARD LENGTH LEVERS

Levers sold separately • page C-4

C-1

Link Clamps

Pneumatic Link Clamp Specifications

Double Acting

- Excellent alternative to swing clamps when swing space is limited.
- Available in three sizes: 1, 1-1/2, and 2-1/8 inch bore.
- Top Flange body mount.
- Left, forward, or right lever position from the same body.
- Link clamps clear large obstructions better than other types of clamps.
- Manifold mounted or standard plumbed using standard NPT fittings.
- Levers sold separately (see page C-4).

C-2

Specifications

Lever Position		Model No.		
		P1-6621-10	P1-6621-50	P1-6622-10
FORWARD		P1-6621-10	P1-6621-50	P1-6622-10
RIGHT		P1-6621-11	P1-6621-51	P1-6622-11
LEFT		P1-6621-12	P1-6621-52	P1-6622-12
Bore Diameter (in.)		1.00	1.50	2.125
Vertical Clamping Stroke *		.09	.125	.125
Standard Lever Length **		1.875	2.625	3.094
Effective Piston Area (sq. in.)				
Extend		.785	1.767	3.546
Retract		.479	1.325	2.761
Air Consumption (cu. in.) ***		1.15	3.48	8.63

Operating Pressure Range: 30-250 psi

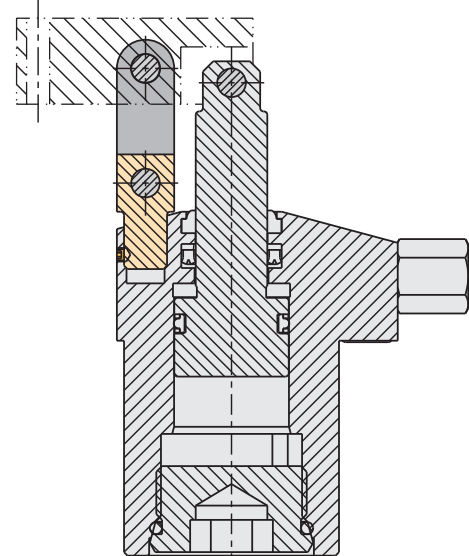
Fluid: Clean Dry Air

Lubrication: Not Required

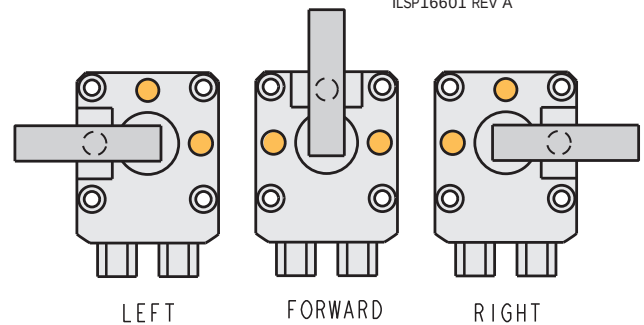
* Equal to $\pm 3^\circ$ with standard lever.

** Use of extended length arms will result in a reduction of clamp capacity. See graphs of lever output curves for clamping force of various arm lengths. The clamping force is adjustable by varying the pneumatic system pressure. To insure maximum service life and trouble-free operation, these devices should be positioned in no less than 1/2 second. These recommendations apply when using the standard arm. When using the optional long arm or your custom arm, please restrict the flow rates to position the arm in no less than 1 second.

*** Per complete cycle.



ILSP16601 REV A



Lever can be easily positioned in any one of the three directions in relation to the ports.

LINK CLAMPS SHOWN WITH EXTENDED LENGTH LEVERS

Levers sold separately (page C-4)

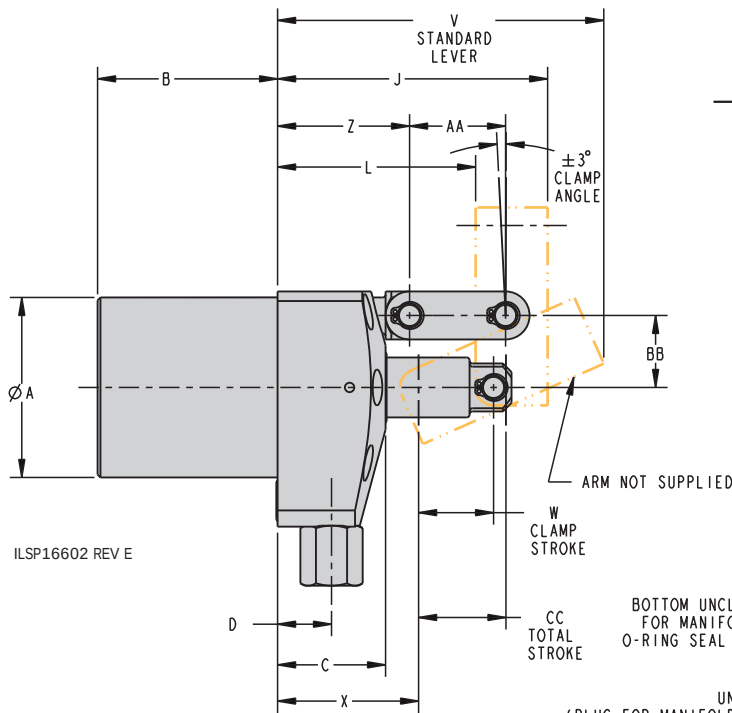


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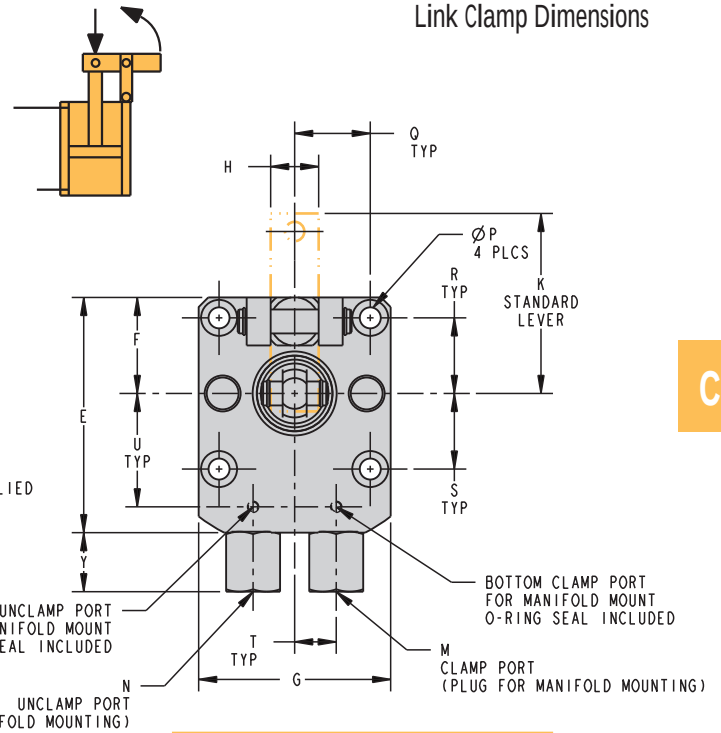
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Link Clamps

Link Clamp Dimensions



ILSP16602 REV E

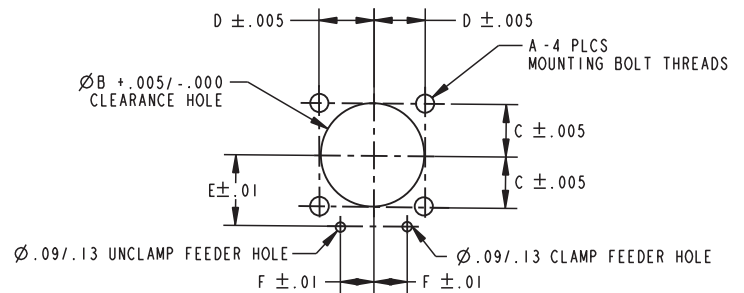


Operating temperature limits are 32-150° F

Dimensions

Model Number	P1-6621-1X	P1-6621-5X	P1-6622-1X
A	1.88	2.53	2.94
B	1.88	2.50	2.75
C	1.13	1.19	1.44
D	.56	.59	.63
E	2.45	3.19	3.72
F	1.00	1.38	1.67
G	2.00	2.75	3.34
H	.50	.75	.88
J	2.81	3.44	4.13
K	1.88	2.63	3.09
L	2.06	2.44	2.88
M	1/8 NPT	1/8 NPT	1/8 NPT
N	1/8 NPT	1/8 NPT	1/8 NPT
P	.219	.281	.344
Q	.788	1.083	1.240
R	.788	1.083	1.240
S	.788	1.083	1.240
T	.433	.591	.630
U	1.181	1.555	1.772
V	3.36	4.42	5.23
W	.781	1.000	1.188
X	1.47	1.75	2.06
Y	.625	.625	.625
Z	1.38	1.56	1.88
AA	1.00	1.50	1.75
BB	.75	1.00	1.19
CC	.91	1.13	1.32

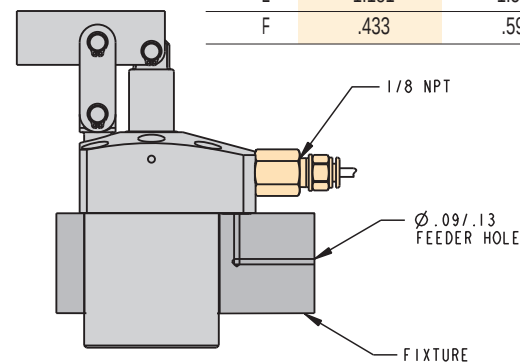
Levers are to be adjusted to within $\pm 3^\circ$ of nominal clamp angle to prevent premature failure.



FOR MANIFOLD MOUNTING, MATING SURFACE SHOULD BE FLAT WITHIN .003 WITH A MAXIMUM SURFACE ROUGHNESS OF RA 63

Manifold Port/Mounting Dimensions

Model Number	P1-6621-1X	P1-6621-5X	P1-6622-1X
A	10-32 UNF	1/4-20 UNC	5/16-18 UNC
B	1.890	2.560	2.950
C	.788	1.083	1.240
D	.788	1.083	1.240
E	1.181	1.555	1.772
F	.433	.591	.630



ILSP16603 REV B

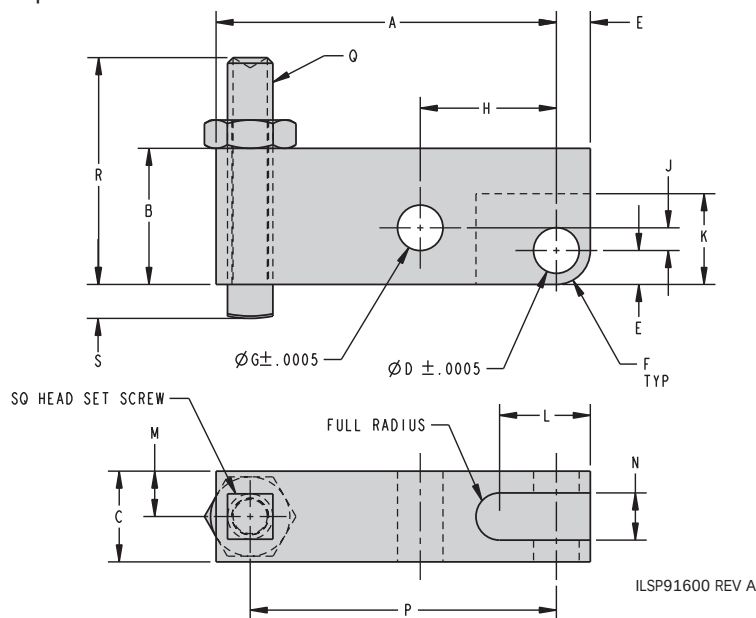
C-3

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Link Clamp Levers

Link Clamp Lever Dimensions



Standard Length Lever

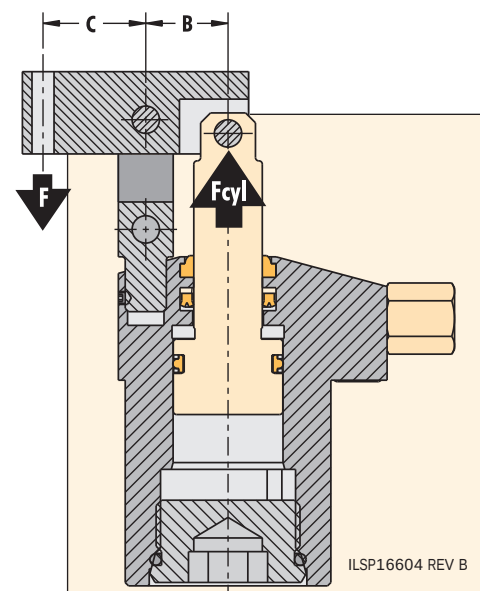
Dimensions

Model Number	91-6011-03	91-6015-03	91-6021-03
Cyl Bore Dia.	1.00	1.50	2.125
A	1.88	2.63	3.09
B	.75	1.00	1.25
C	.50	.75	.88
D	.2515	.3765	.5015
E	.19	.31	.38
F	.19	.31	.38
G	.2505	.3755	.5005
H	.75	1.00	1.19
J	.13	.31	.38
K	.50	.75	.94
L	.50	.69	.88
M	.25	.38	.44
N	.26	.39	.45
P	1.69	2.25	2.69
Q	1/4-20 UNC	3/8-16 UNC	1/2-13 UNC
R	1.25	2.25	3.00
S	.19	.28	.38

Extended Length Lever WITHOUT Tapped Hole

Dimensions

Model Number	91-6011-02	91-6015-02	91-6021-02
Cyl Bore Dia.	1.00	1.50	2.125
A	3.00	3.50	4.00
B	.75	1.00	1.25
C	.50	.75	.88
D	.2515	.3765	.5015
E	.19	.31	.38
F	.19	.31	.38
G	.2505	.3755	.5005
H	.75	1.00	1.19
J	.13	.31	.38
K	.50	.75	.94
L	.50	.69	.88
N	.26	.39	.45



The clamping force varies according to the clamp arm length. The clamping force F can be calculated using the following formula.

Clamping force calculation formula:

$$F = F_{cyl} \times (B \div C) \times E$$

F = Clamping force (lb)

F_{cyl} = Cylinder force (lb)

F_{cyl} = P x A

P = Operating Pressure (psi)

A = Cylinder Area (sq in) (See table below)

B, C = Clamp Lever Length (in) (See Table below)

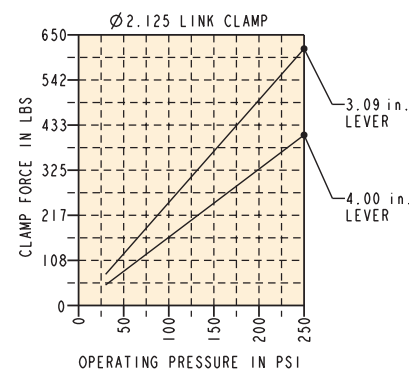
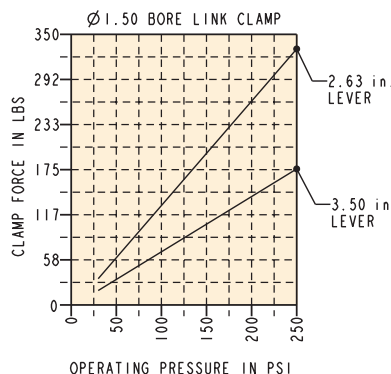
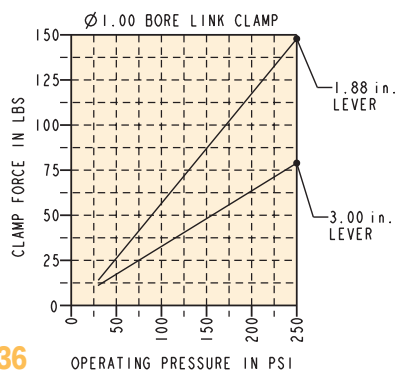
E = Output Efficiency (Approx. 0.9 for standard length and 1.5 for extended length lever)

Dimensions

Model Number	P1-6621-1X	P1-6621-5X	P1-6622-XX
Bore Dia. (in.)	1.000	1.500	2.125
A - Area (sq. in.)	0.785	1.767	3.547
B (in.)	0.750	1.000	1.187
Standard Length Lever -			
C (in.)	0.937	1.250	1.500
Extended Length Lever (Maximum)			
C (in.)	3.000	3.500	4.000

Double Acting Pneumatic Link Clamp Lever Output Curves

Modifications to levers that result in clamp ratios below that of the standard lever are not in the safe operating zone for the corresponding link clamp and could result in premature failure.



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Special Use Clamps

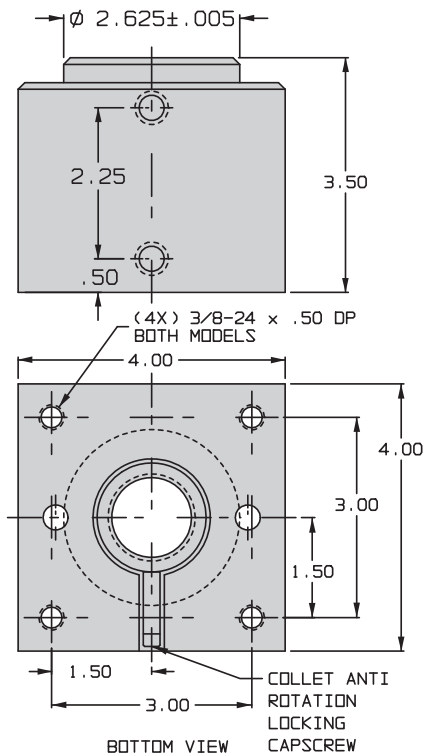
Air Powered Collet Vise Specifications

Double Acting

- Single collet styles only.
- Compact design yields (downward) 750 lb. collet closing force generated at 100 psig air pressure.
- Concentric piston pulls the standard 5-C collet on center line.
- Available with or without mounting flange for easy fastening from either top or bottom.
- Through-hole design allows you to feed bar stock (1.062" maximum diameter) from the bottom of the collet for high production applications.
- Lightweight, only 5 lbs.

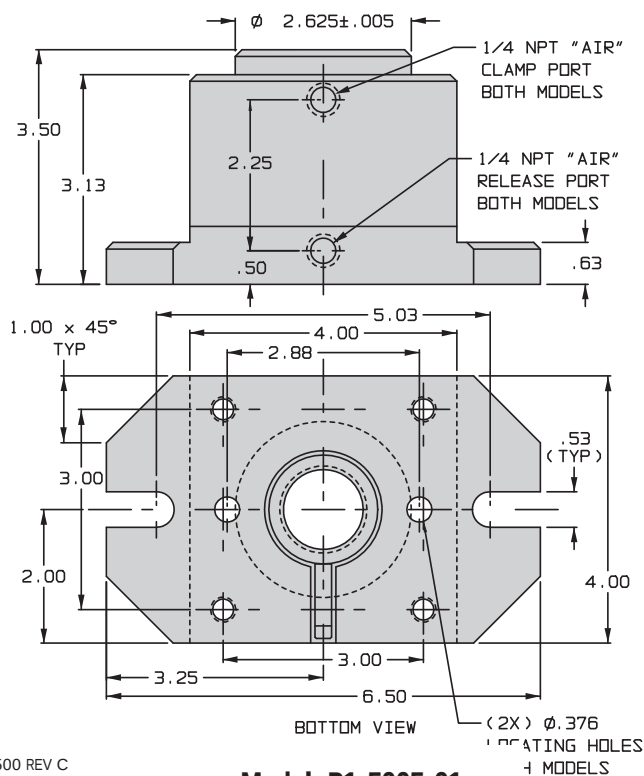


D-1



Model: P1-5005-00

ILSP15500 REV C



Model: P1-5005-01

Specifications

Model No.	P1-5005-00	P1-5005-01
Base Style	Square	Flange Mount
Approximate Radial Clamp Force Per Station (lb)*	115 lbs	
Approximate Downward Clamp Force Per Station (lb)**	750 lbs	
Weight	5 lbs	

* Radial clamp force with 100 psi air pressure using 1/2" collet

** Capacities are given at 100 psi air pressure, 150 psi maximum

Operating temperature limits are 32-150° F

800-992-0236

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Intensifier and Accessories

Dimensions/Specifications

Pneumatic Intensifier Features

- Increases clamping forces by increasing shop air. This eliminates the need for high pressure compressors or the need to utilize hydraulic systems for low to medium clamp forces.
- The VektorAir™ intensifier has a built in adjustable regulator to easily allow for precise adjustment of clamp force.
- Designed specifically for clamping applications, our intensifier has an exclusive feature that uses standard shop air to advance the clamps. Then, the intensifier engages, building pressure to the predetermined setting. This decreases cycle time to clamp and lengthens the life of the intensifier.
- Valve mounting is simplified with the inclusion of an ISO 1 mounting pad.
- The intensifier will automatically start cycling if there is a loss of pressure during the clamp cycle. Cycling will continue until the pressure loss is eliminated.

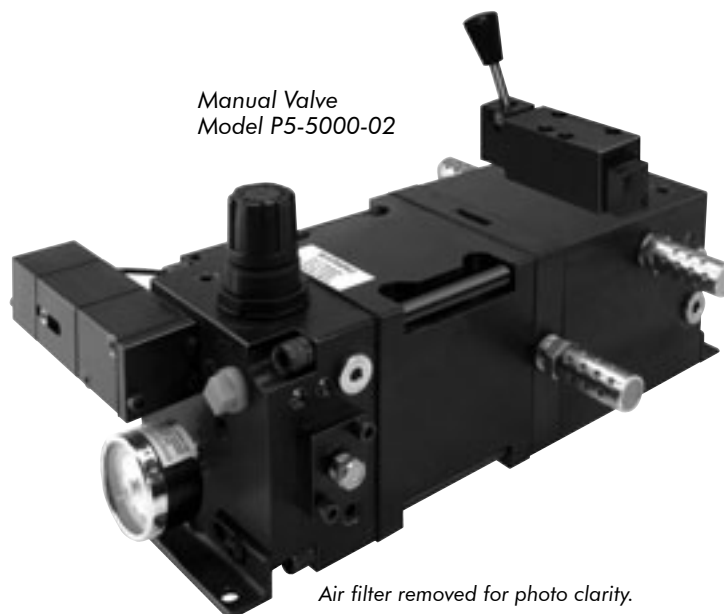
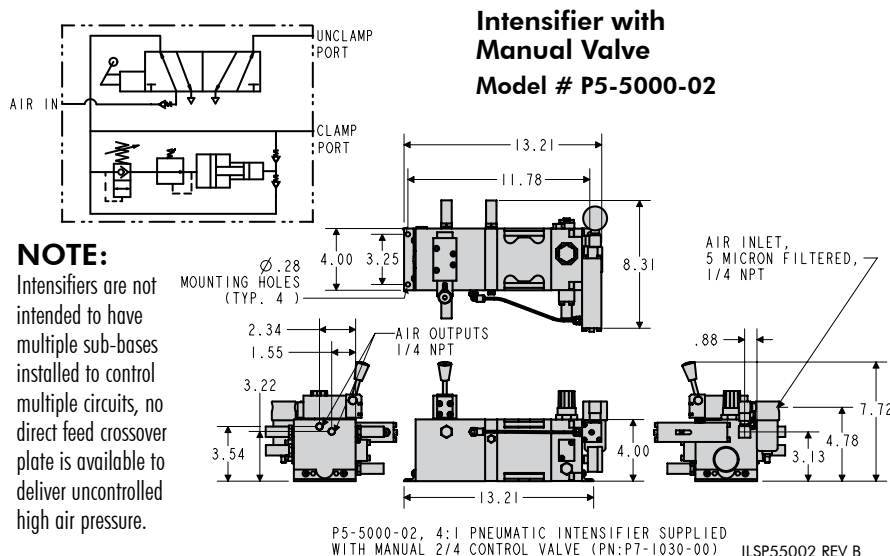
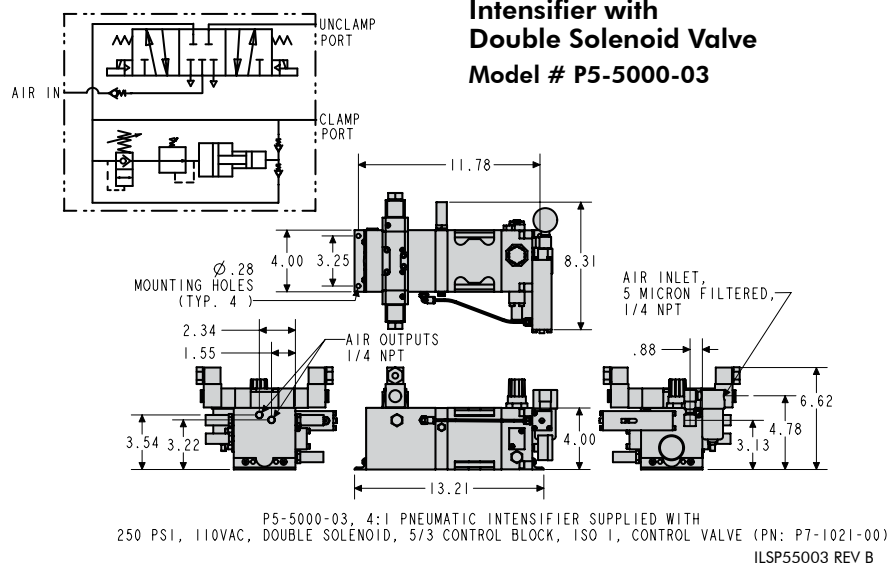
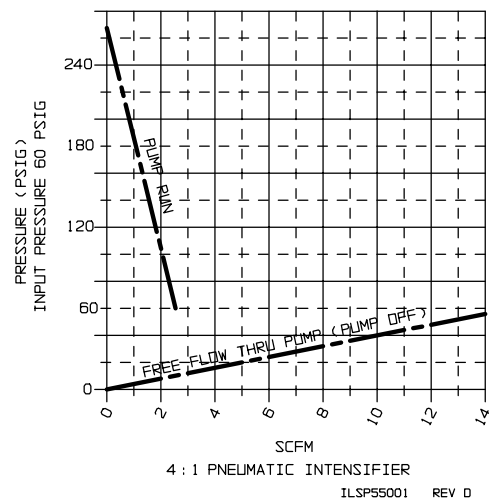
E-1

4:1 Pneumatic Intensifier

Model Number and Description

- | |
|--|
| P5-5000-03 with Double Solenoid, 5/3 Control Valve |
| P5-5000-02 with Manual, 2/4 Control Valve |

NOTE: 60/65 psig MAX. Input
Vekttek pneumatic devices are rated at 250 psig or less. This intensifier will produce pressure greater than 250 psig. CAUTION should be used to prevent damage to devices.



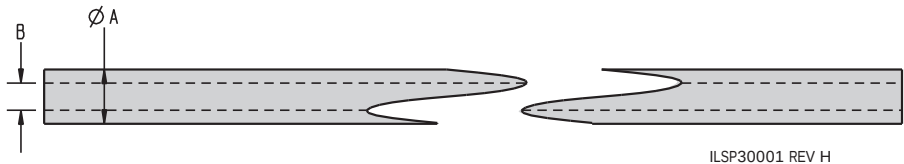
Miscellaneous Plumbing

Tubing & Air Filter Regulator

Pneumatic Tubing

ORDER IN ONE FOOT INCREMENTS

FOR SYSTEM PRESSURES OVER THE MAXIMUM WORKING PRESSURE OF NYLON TUBING, TO A MAXIMUM PRESSURE OF 250 PSI, STEEL OR COPPER TUBING MUST BE USED ALONG WITH APPROPRIATELY RATED FITTINGS.



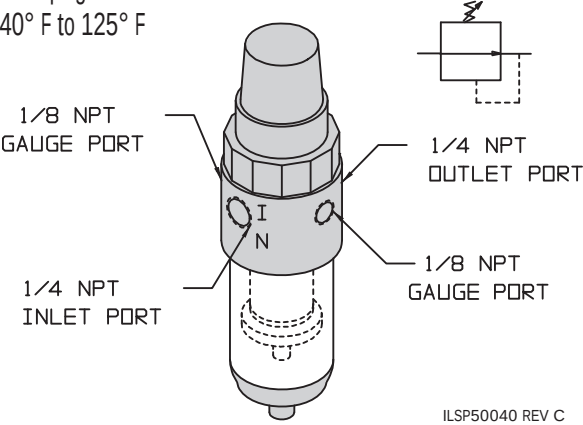
ILSP30001 REV H

F-1

Pneumatic Tubing								
Model Number	Ø A	Ø B	Material Grade	Maximum working pressure reduction due to increase in tubing temperature.				Minimum Bend Radius
				75 °F	100 °	F125 °	F150 °F Max.	
P3-0015-00	1/8	.093	Nylon 11	225	168	146	124	.38
P3-0015-01	1/4	.180	Nylon 11	250	188	162	137	.88
P3-0015-02	3/8	.275	Nylon 11	220	165	143	121	1.50
P3-0015-03	5/32 (4mm)	.106	Nylon 11	250	188	162	137	.50
P3-0015-04	5mm	3mm	Nylon 12	250	188	162	137	25mm
P3-0015-05	6mm	4mm	Nylon 12	250	188	162	137	30mm

Air Filter Regulator

Regulated Pressure Range: 0 to 125 psig
Temperature Operating Range: 40° F to 125° F

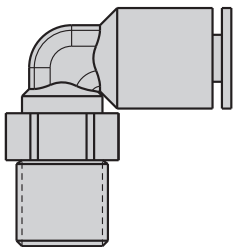


ILSP50040 REV C

Air Filter Regulator
Model Number
P5-0044-00

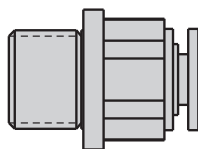
Miscellaneous Plumbing

Fittings



Swivel Elbow Connector

P3-0141-00	ISO G1/8 to 4 METRIC TUBE
P3-0241-00	ISO G1/4 to 4 METRIC TUBE



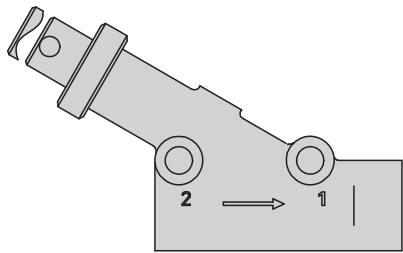
Straight Connector

P3-0148-00	ISO G1/8 to 4 METRIC TUBE
P3-0248-00	ISO G1/4 to 4 METRIC TUBE

Metric Adapters
Used with toggles.
See section: "H"
Reference callouts: "PORT"

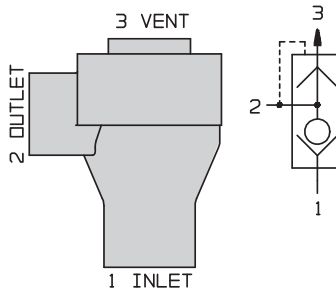


ILSP30100 REV A



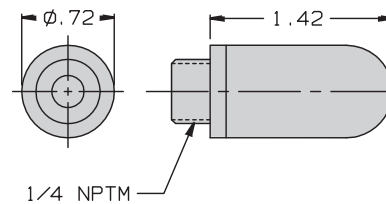
In-Line Flow Control

P7-0020-00	1/8 NPT
P7-0020-01	1/4 NPT



Quick Exhaust Valve

P7-0010-01	1/4 NPT
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Pneumatic Muffler

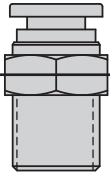
P5-0303-00

ILSP50000 REV B

F-2

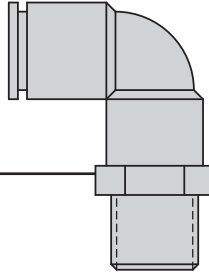
Miscellaneous Plumbing

Fittings



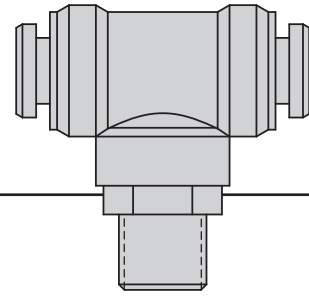
Male Connector • Straight

P3-0218-00	1/8 TUBE	x	1/4 NPTF
P3-0128-00	1/4 TUBE	x	1/8 NPTF
P3-0228-00	1/4 TUBE	x	1/4 NPTF
P3-0328-00	1/4 TUBE	x	3/8 NPTF
P3-0238-00	3/8 TUBE	x	1/4 NPTF



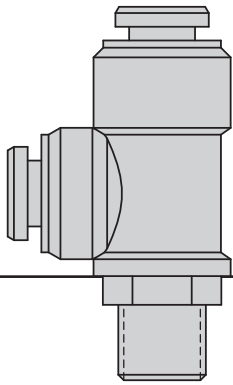
Male Elbow, 90° Swivel

P3-0121-00	1/4 TUBE	x	1/8 NPTF
P3-0221-00	1/4 TUBE	x	1/4 NPTF
P3-0321-00	1/4 TUBE	x	3/8 NPTF
P3-0131-00	3/8 TUBE	x	1/8 NPTF
P3-0231-00	3/8 TUBE	x	1/4 NPTF



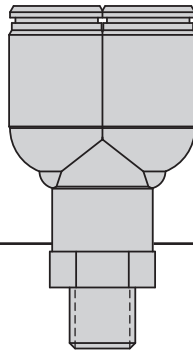
Swivel Male Branch Tee

P3-0122-00	1/4 TUBE	x	1/8 NPTF
P3-0222-00	1/4 TUBE	x	1/4 NPTF
P3-0132-00	3/8 TUBE	x	1/8 NPTF
P3-0232-00	3/8 TUBE	x	1/4 NPTF
P3-0332-00	3/8 TUBE	x	3/8 NPTF



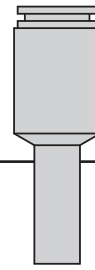
Swivel Male Run Tee

P3-0112-01	1/8 TUBE	x	1/8 NPTF
P3-0122-01	1/4 TUBE	x	1/8 NPTF
P3-0232-01	3/8 TUBE	x	1/4 NPTF
P3-0332-01	3/8 TUBE	x	3/8 NPTF



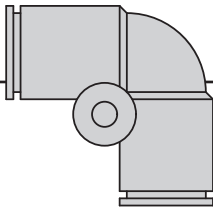
Parallel Male Y Swivel

P3-0120-00	1/4 TUBE	x	1/8 NPTF
P3-0230-00	3/8 TUBE	x	1/4 NPTF



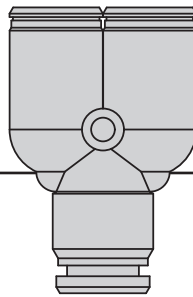
Expander / Reducer

P3-0128-01	1/8 TUBE	x	1/4 TUBE
P3-0238-01	1/4 TUBE	x	3/8 TUBE
P3-0218-01	1/4 TUBE	x	1/8 TUBE
P3-0128-02	5/32 TUBE	x	1/4 TUBE
P3-0138-01	5/32 TUBE	x	3/8 TUBE



Union Elbow

P3-0021-01	1/4 TUBE
P3-0031-01	3/8 TUBE



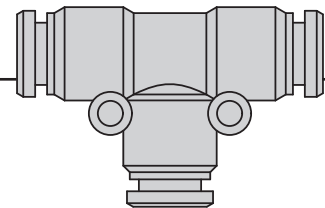
Parallel Union Y Connector

P3-0220-01	1/4 TUBE
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Plug

P3-0016-00	1/8 TUBE
P3-0026-00	1/4 TUBE
P3-0036-00	3/8 TUBE



Union Tee

P3-0012-00	1/8 TUBE
P3-0022-00	1/4 TUBE
P3-0032-00	3/8 TUBE

ILSP30000 REV F

F-3

800-992-0236

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Miscellaneous Plumbing

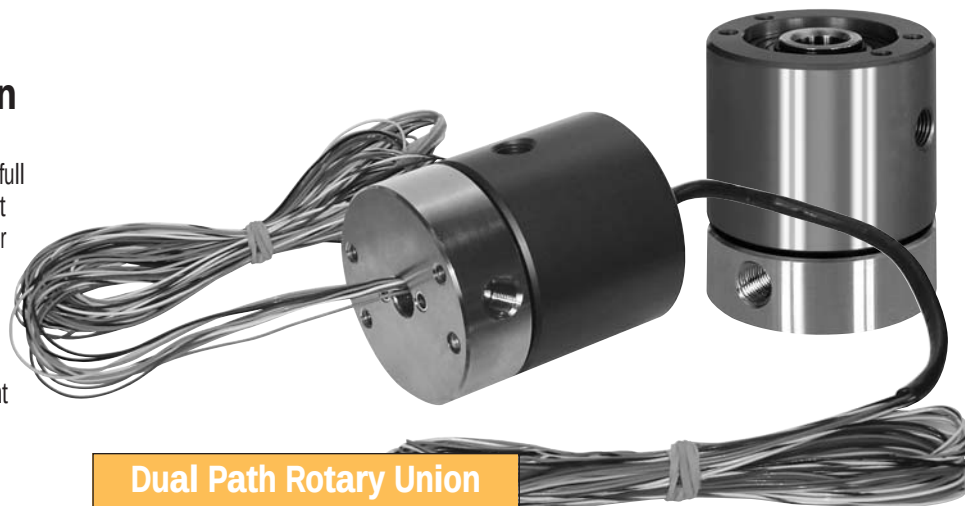
Rotary Union

Dual Path Rotary Union

- Rotating unions are a rotary connection, feeding pressure to fixtures while allowing full 360° rotation of the fixture with or without pressure. A machine or independent indexer may do this indexing.
- Feature aluminum construction for low weight and excellent durability.
- Dual precision sealed bearings for consistent performance and long seal life.
- Larger units are available upon request.

Operating Parameters

- Max Pressure: 200 psig
- Max. Rotational Speed: up to 100 RPM



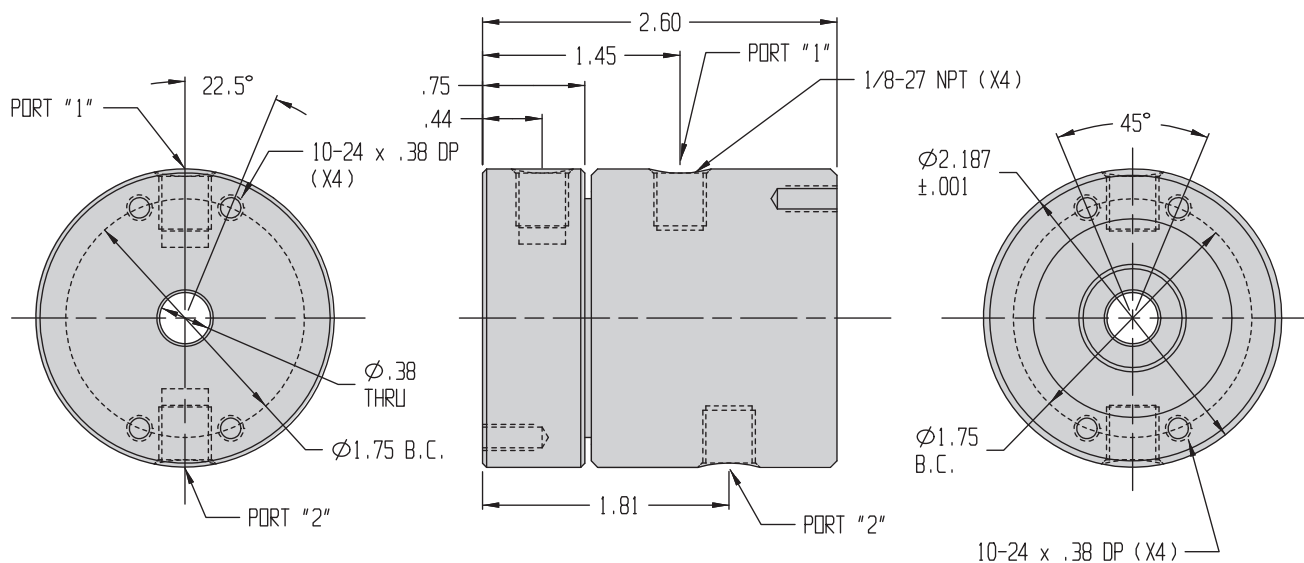
Dual Path Rotary Union

Model Number

P3-2242-01

P3-2242-01-ES6A
WITH OPTIONAL 6 CIRCUIT SLIP RING

P3-2242-01-ES12A
WITH OPTIONAL 12 CIRCUIT SLIP RING

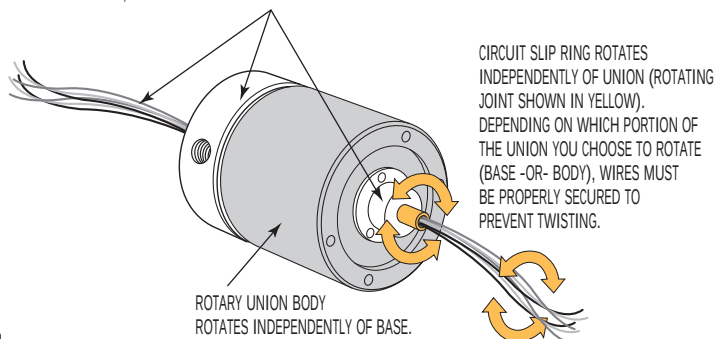


ILSP32201 REV A

OPTIONAL 6 OR 12
CIRCUIT SLIP RING

MAX. AMPS PER CIRCUIT: 2
MAX. VOLTS PER CIRCUIT: 120
LEAD WIRE LENGTH FROM SLIP RING: 24"

ROTARY UNION BASE, WIRES FROM BASE AND CENTER CORE MAINTAIN THE SAME POSITION



800-992-0236

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Quad Path Rotary Union

- Rotating unions are a rotary connection, feeding pressure to fixtures while allowing full 360° rotation of the fixture with or without pressure. A machine or independent indexer may do this indexing.
- Feature aluminum construction for low weight and excellent durability.
- Dual precision sealed bearings for consistent performance and long seal life.
- Larger units are available upon request.

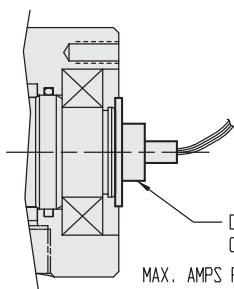
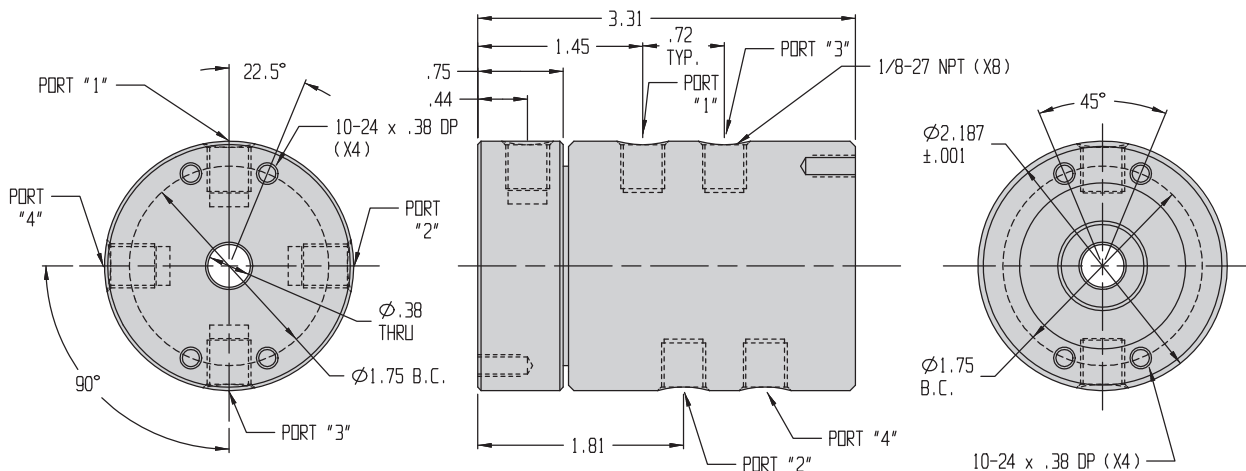


Operating Parameters

- Max Pressure: 200 psig
- Max. Rotational Speed: up to 100 RPM

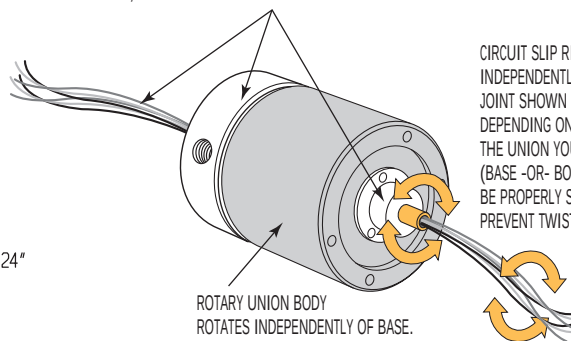
Quad Path Rotary Union	
Model Number	
P3-2442-01	
P3-2442-01-ES6A	WITH OPTIONAL 6 CIRCUIT SLIP RING
P3-2442-01-ES12A	WITH OPTIONAL 12 CIRCUIT SLIP RING

F-5



OPTIONAL 6 OR 12 CIRCUIT SLIP RING
 MAX. AMPS PER CIRCUIT: 2
 MAX. VOLTS PER CIRCUIT: 120
 LEAD WIRE LENGTH FROM SLIP RING: 24"

ROTARY UNION BASE, WIRES FROM BASE AND CENTER CORE MAINTAIN THE SAME POSITION



CIRCUIT SLIP RING ROTATES INDEPENDENTLY OF UNION (ROTATING JOINT SHOWN IN YELLOW). DEPENDING ON WHICH PORTION OF THE UNION YOU CHOOSE TO ROTATE (BASE-OR- BODY), WIRES MUST BE PROPERLY SECURED TO PREVENT TWISTING.

ROTARY UNION BODY ROTATES INDEPENDENTLY OF BASE.

ILSP32202 REV A

800-992-0236

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Valves

Manual Valve, Check Valve



5/2 ISO 1, Manual Valve

Model Number and Specifications

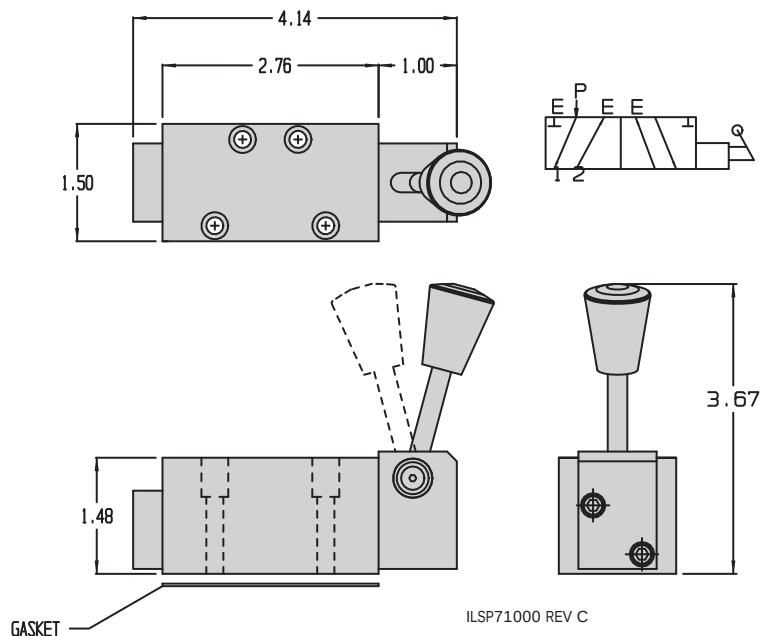
P7-1030-00

OPERATING PRESSURE RANGE: 0 - 250 PSIG

CV = .50

SEAL MATERIAL: POLYURETHANE

ISO 1 MOUNTING • 2 POSITION



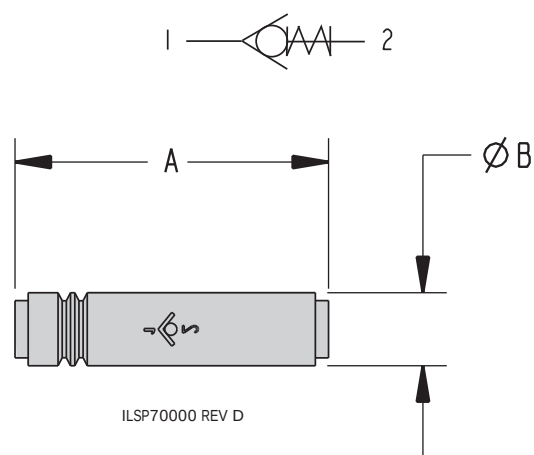
G-1



Push to Connect Check Valve

Model Number	P7-0030-00	P7-0030-01
Tubing	1/4	3/8
A	2.19	3.05
B	.51	.79

Maximum working pressure 145 psig.
For nylon tubing only.



800-992-0236

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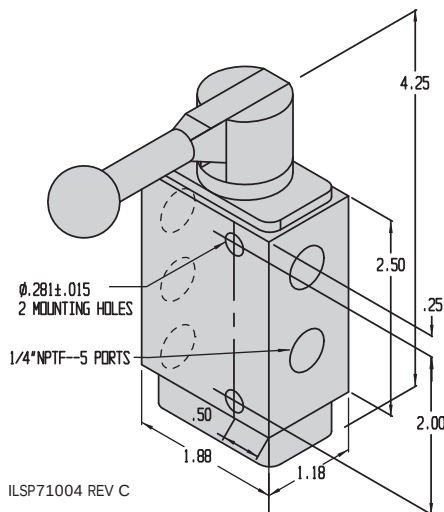
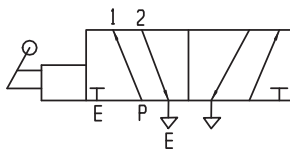


5/2 Manual Valve

Model Number and Specifications

P7-1030-01

OPERATING PRESSURE RANGE: 0 - 150 PSIG
AMBIENT TEMPERATURE RANGE: 0° - 120° F



ILSP71004 REV C

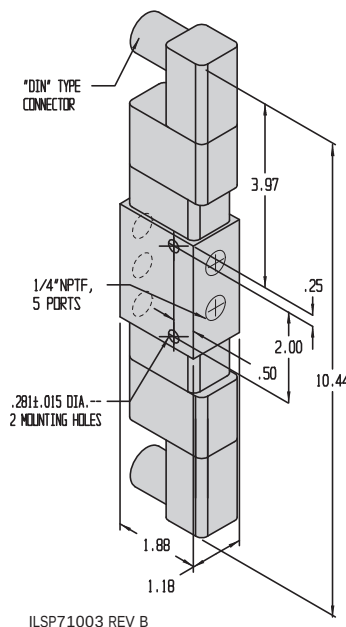
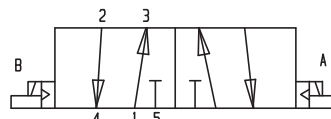


5/2 Double Solenoid Valve

Model Number and Specifications

P7-1021-02 • 120 VAC Double Solenoid Operated

OPERATING PRESSURE RANGE: 25 - 150 PSIG
AMBIENT TEMPERATURE RANGE: 0° - 120° F



ILSP71003 REV B



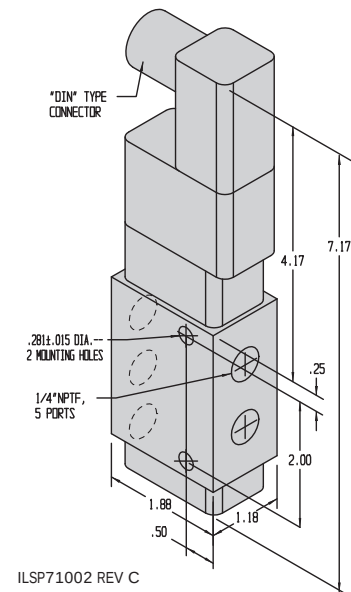
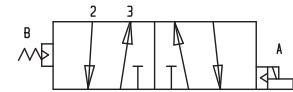
5/2 Single Solenoid Valve

Model Number and Specifications

P7-1011-00 • 120 VAC Solenoid Operated

P7-1012-00 • 24 VDC Solenoid Operated

OPERATING PRESSURE RANGE: 25 - 150 PSIG
AMBIENT TEMPERATURE RANGE: 0° - 120° F



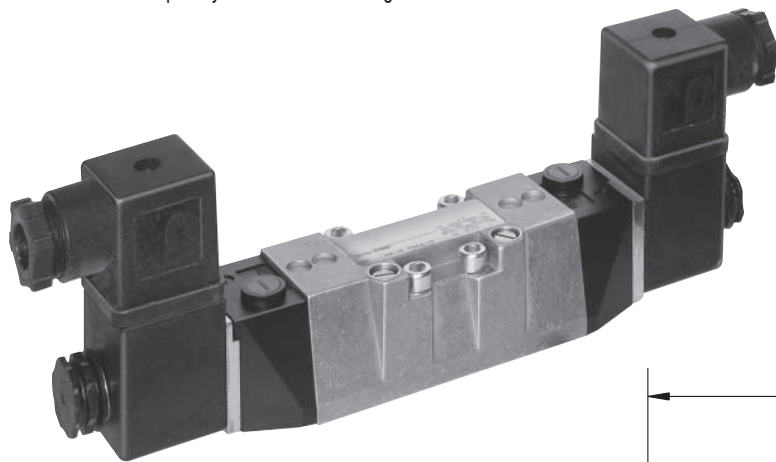
ILSP71002 REV C

Valves

Valve, 5 Port, 3 Position

Control valves: 5 port, 3 position ISO 1

- These valves are designed to control double acting pneumatic clamping systems.
- Valves can run on lubricated or unlubricated air. Cylinder exhaust is controlled by internal flow controls, allowing individual exhausts to be controlled with only one common exhaust in the end plate.
- If electrical power is lost, manual overrides allow the valves to be shifted. Overrides can also be used to help in system troubleshooting.
- Rapid return is achieved when the valve is deactuated, since the exhaust orifice is oversized.
- Installing the valves is aided by captive mounting parts, eliminating lost screws and seals during assembly/disassembly.
- Installation is made easier since the coil can be rotated in 90° increments and the grip connector moves 180°.
- Connections are made easily with our push-to-connect tubing. It functions with Nylon 11 tubing for inch sizes and Nylon 12 tubing for metric sizes. Standard NPT ports are used in the manifolds.
- Valve bodies are made of die-cast aluminum.



Control Valve

Model Number and Description

P7-1021-00

ISO 1 - 5/3 CENTER BLOCKED

115V AC • 250 PSIG

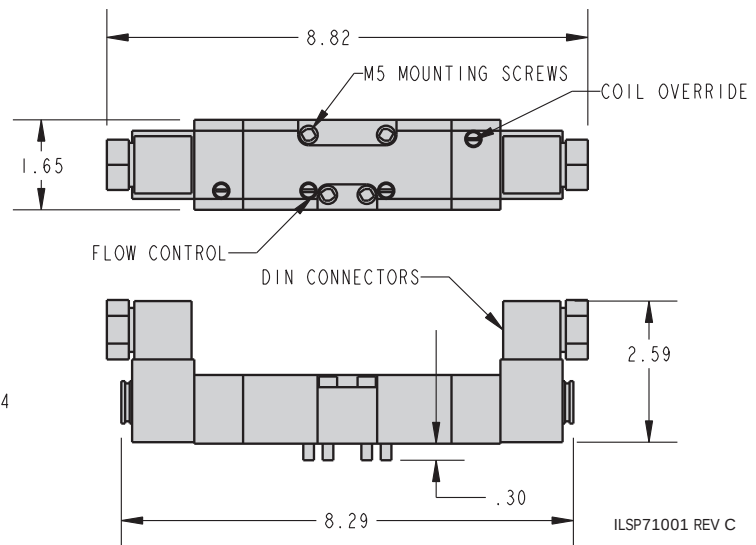
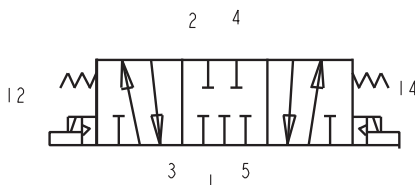
Must use external pilot pressure - not to exceed 150 PSIG

P7-1021-01

ISO 1 - 5/3 CENTER BLOCKED

115V AC • 150 PSIG

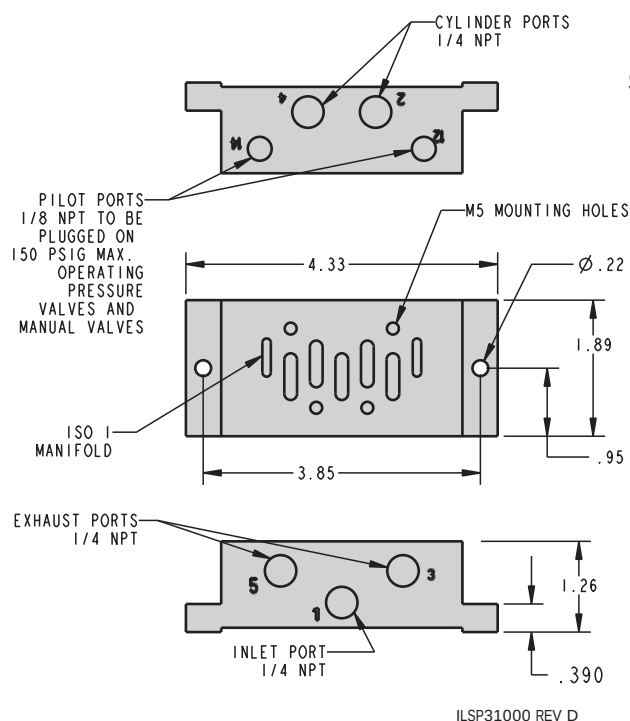
External pilot NOT required



Specification

Standard Power Requirements	Seals	Ambient Temperature Range	Inlet Temperature	Response Time On/Off	Duty Rating	Override	Electrical Interface
120V/60Hz	Nitrile Viton®	5° to 120° F	23° to 175° F	20/34 msec ± 20%	Continuous at 90% to 105% of rated voltage	Manual, Locking/Non-locking	3 pin Plug In Din Connect

Use with Manual
-OR-
Solenoid Control Valves



Single Valve Sub-base Mounting Plate

Model Number and Specifications

P3-1002-00

USED FOR SINGLE VALVE
ISO 1 MOUNTING

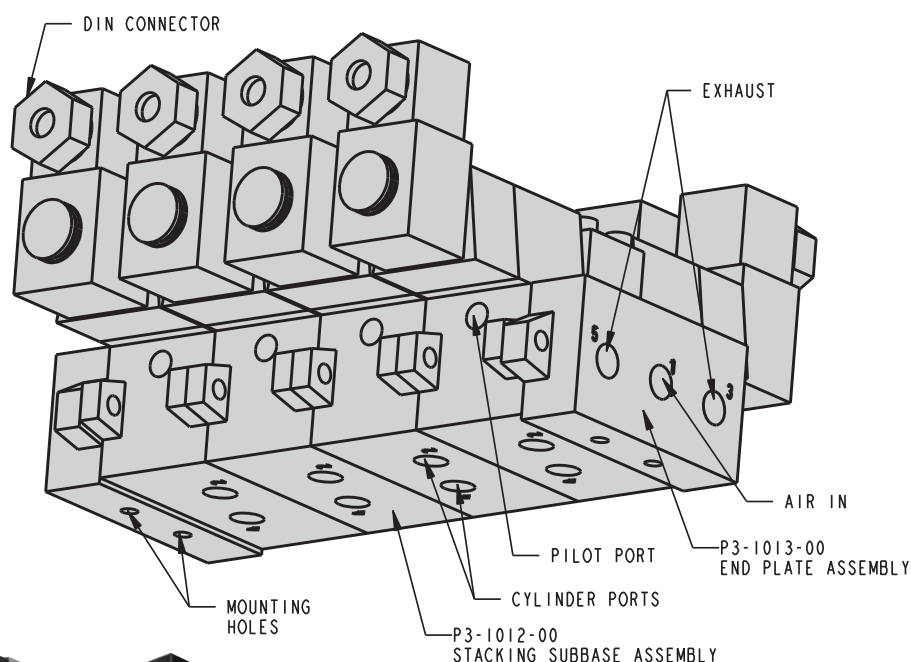
This photo and illustration shows a
**MULTIPLE VALVE
ISO 1 SYSTEM
WITH SOLENOID VALVES**

Assembly Includes:

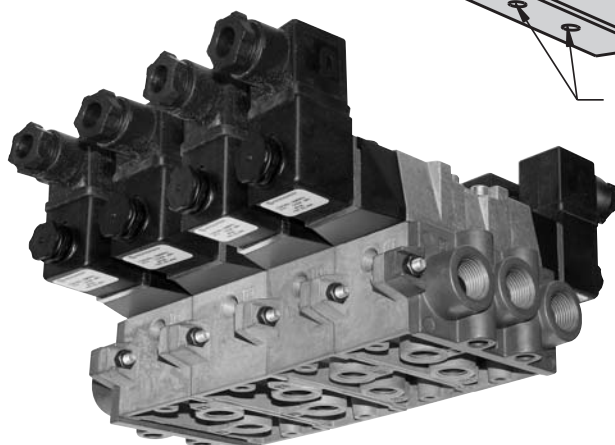
- Control Valve (page G-3)
- Stacking Sub-base (page G-5)
- Stacking End Plates (page G-5)

Configuration Options:

Use Manual Valves -OR- a combination of Manual and Solenoid Valves.



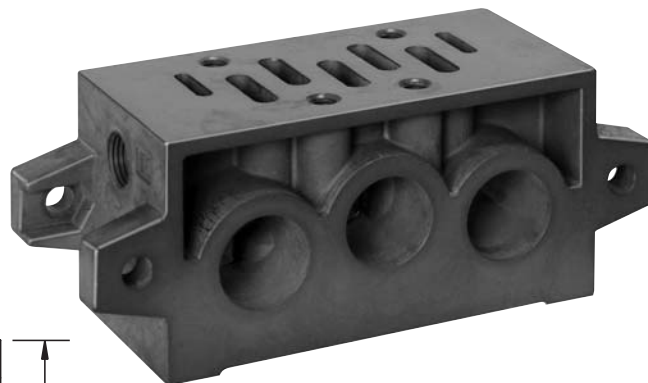
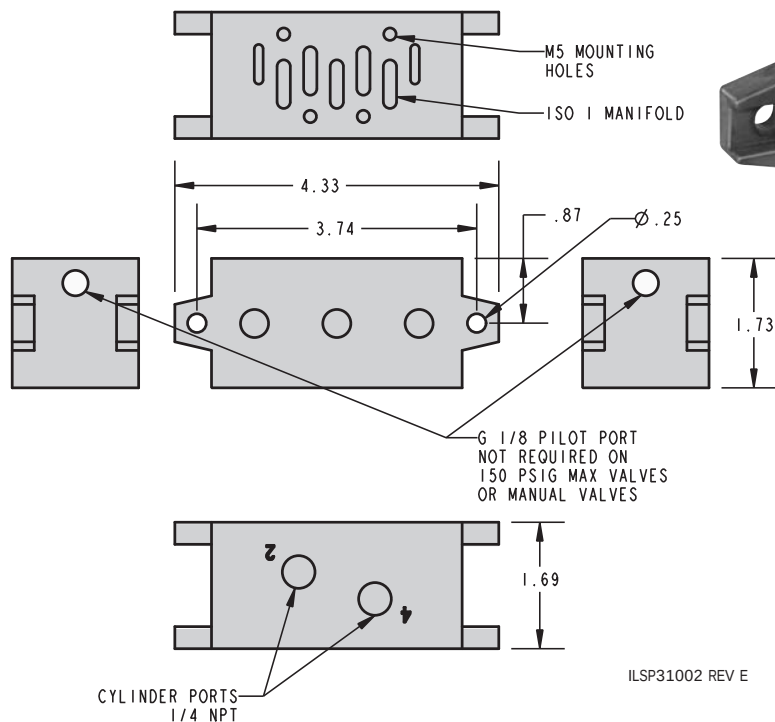
MAXIMUM 5 VALVES PER STACK



Valves

Sub-bases

Multiple Valve System Components



Stacking Sub-base ISO 1

Model Number and Specifications

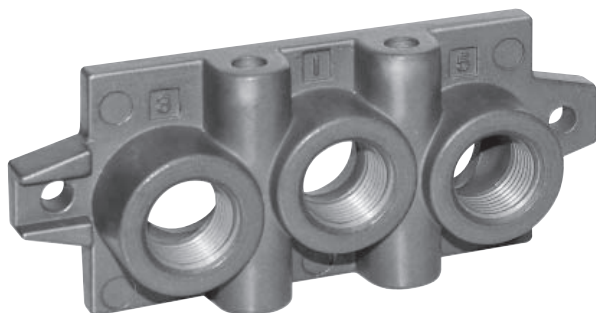
P3-1012-00

MAXIMUM NUMBER PER STACK IS 5

TWO P3-1013-00 END PLATES REQUIRED PER STACK
(SEE BELOW)

G-5

See composite drawing and photo on page G-4



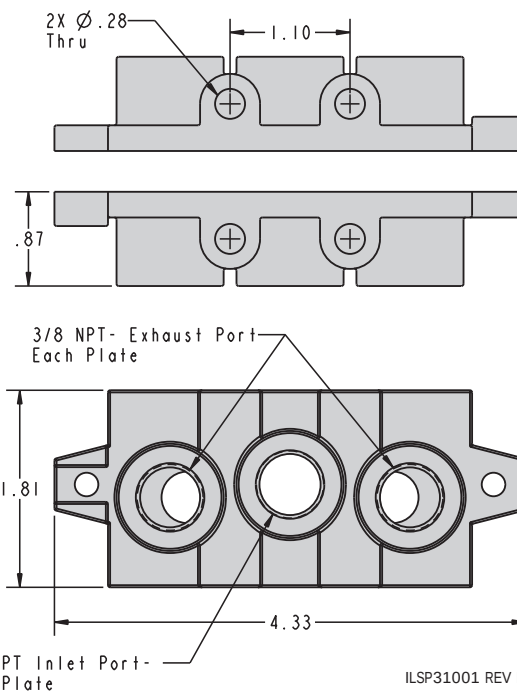
Stacking End Plate ISO 1

Model Number and Specifications

P3-1013-00

2 REQUIRED PER STACK

STACKING PLATE USED WITH P3-1012-00 STACKING SUB-BASE
(SHOWN ABOVE)



Kit No. P3-1013-00
Valve Subbase End Plate Kit
Includes: Plain plate & O-ring plate
with fasteners and o-rings

Toggle Features

- Quick opening, workpieces are cleared completely, allowing operators easy access to the workpiece.
- Clamps remain locked, resisting forces produced when workpieces are machined or welded.
- Used in many applications in metalworking, woodworking and the plastics industry including welding, machining, grinding, testing, cutting, drilling, bending and fitting.
- Zinc plated parts.
- Pivot pins in sizes 2 and larger are in case-hardened bushings.
- Heat treated and zinc plated clamping screws, fitted with a removable oil-resistant rubber cap, are adjustable by the T-slot nut.

Frequently Asked Questions

In your parts catalog on some of the toggles, it lists Festo® part numbers. Why?

Several of the toggles are driven by Festo® cylinders. The air cylinders use different proximity sensors and mounting kits. Please order them from the manufacturer. In the interest of making service parts available and economical, please feel free to order cylinders or sensors from them directly. These cylinders are of the best possible commercial grade and are suitable for toggle activation.

Do I have to have pressure going to my toggle the entire time it is clamped so it will remain clamped?

We would recommend that you leave air pressure on the toggle to prevent vibration from releasing the clamp. While most toggles are “over center” devices, vibrations, impacts and shifting parts can cause them to release. Leaving air on them reduces the chance that a clamp will come loose and release unexpectedly.

Can I get more force out of my toggle by using an intensifier?

Yes, forces F3, F4 and F5 up to the 116 or 145 psig pressure limit depending on the model in question. Please be sure that you do not exceed the inlet air pressure for these devices. They are not rated for 250 psig air pressure like our swing clamps.

Do all of your toggles have a place to attach a proximity switch?

No, Festo® part numbers and mounting kits are listed for the items where they are applicable. Since different cylinders require different switches, the details of the switch and mount are available from Festo®. Swing clamps have built in mounts and use the position-sensing switch on page B-5.

What is the F1, F2, F3, F4, and F5 force listed in the catalog?

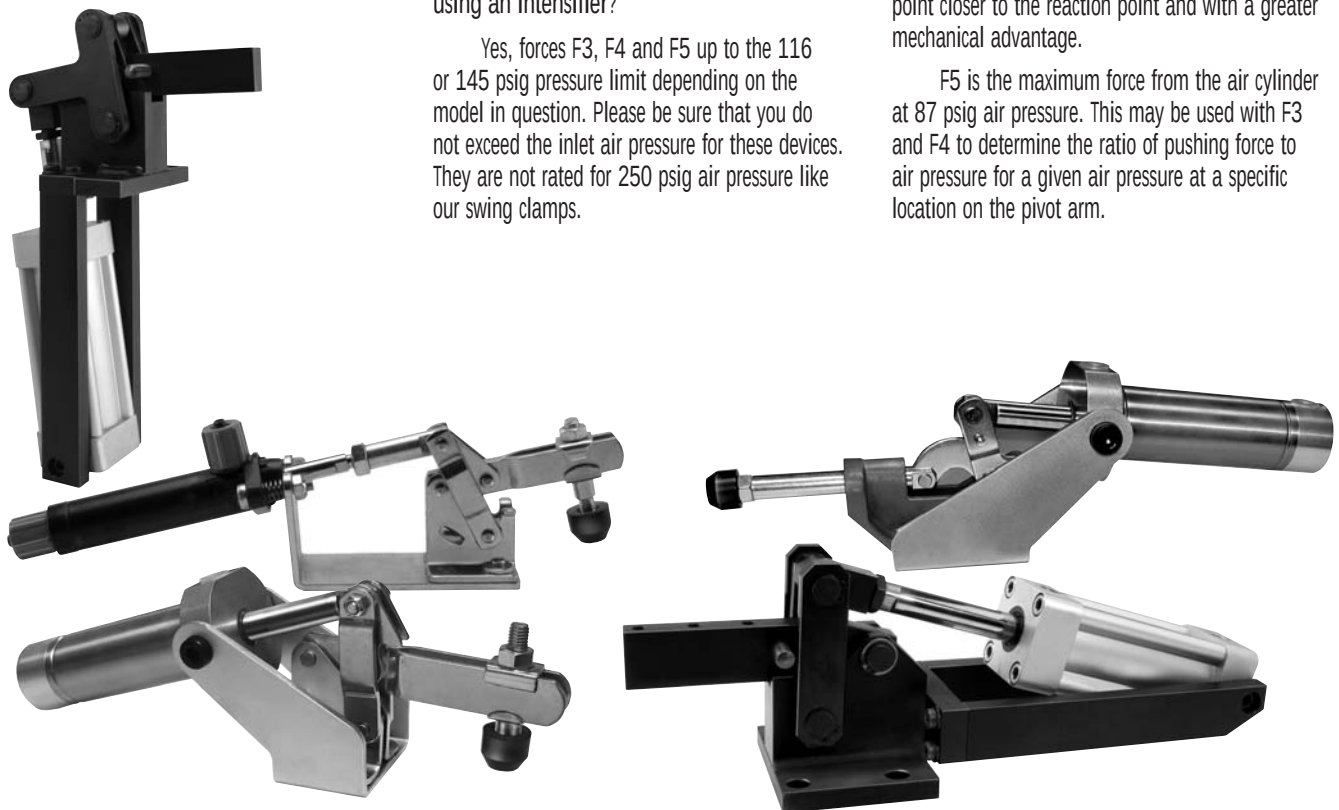
F1 is the holding capacity of the materials and clamp when locked in the over center position at that point on the arm.

F2 is the same specification closer to the clamp and the reaction point; hence, it is a larger capacity.

F3 is the maximum force to push something into place by the cylinder and arm while the arm is in motion and not yet locked over center. This can be used to position heavy parts or straighten out a bend or bow in a part and is dependent on air cylinder pressure.

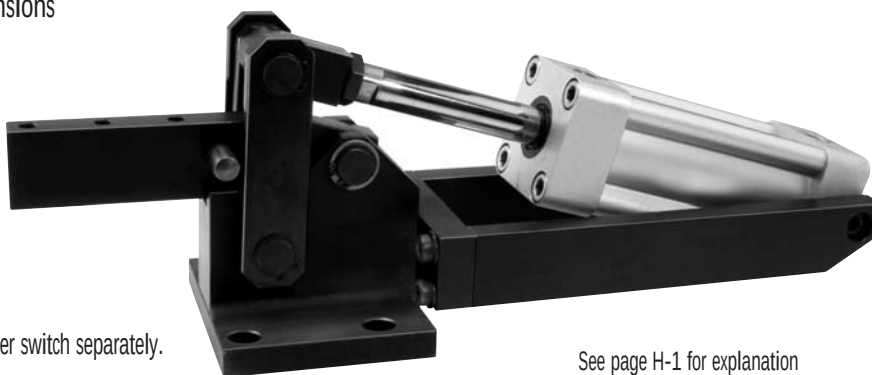
F4 is the same push force capability at a point closer to the reaction point and with a greater mechanical advantage.

F5 is the maximum force from the air cylinder at 87 psig air pressure. This may be used with F3 and F4 to determine the ratio of pushing force to air pressure for a given air pressure at a specific location on the pivot arm.



Toggles

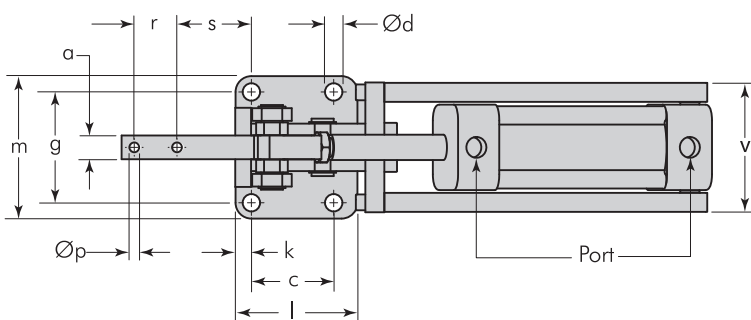
Vertical, Heavy Duty Dimensions



■ Proximity switch capable, order switch separately.

Operating temperature limits are -14 to 140° F

See page H-1 for explanation of F1, F2, F3, F4 and F5

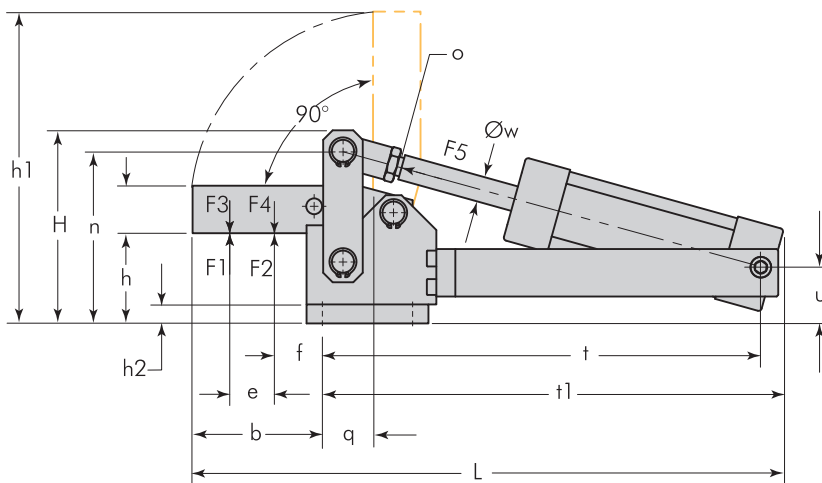


ILSP92201 REV B

Dimensions

Model Number	P9-2205	P9-2213	P9-2221
F1 lbs.	1349	2698	4496
F2 lbs.	2023	4047	6744
F3 lbs.	337	562	899
F4 lbs.	495	787	1349
F5 lbs.	169	225	405
Vn*	1.0	1.8	4.3
H	4.80	5.79	7.72
L	14.96	17.13	21.26
Weight lbs.	9.8	16.5	37.8
a	0.59	0.79	1.18
b	3.23	3.54	5.02
c	2.05	2.17	3.15
Ød	0.43	0.43	0.51
e	2.13	2.36	3.74
f	0.79	0.83	0.87
g	2.76	3.27	4.37
h	2.24	2.40	3.39
h1	7.68	8.66	12.20
h2	0.47	0.47	0.47
i	1.18	1.57	2.36
k	0.39	0.43	0.49
l	3.23	3.54	4.72
m	3.54	4.13	5.31
n	4.29	5.08	6.93
o	M12 x 1.25mm	M16 x 1.5mm	M16 x 1.5mm
Øp	0.24	0.32	0.52
q	1.26	1.18	1.65
r	1.06	1.02	1.57
s	1.85	2.07	2.74
t	10.91	12.40	15.08
t1	11.73	13.58	16.24
u	1.40	1.57	2.13
v	3.23	3.98	4.84
Øw	0.63	0.63	0.79
Cylinder			
Stroke	3.15	3.94	4.72
Piston Dia.	1.57	1.97	2.48
Port	G1/4	G1/4	G1/4

H-2



FESTO Proximity Switch
Model Number: SMEO-1-S-LED-24-B for
P9-2205, P9-2213 or P9-2221

FESTO Mounting Kit
Model Number: SMBU-1-B for P9-2205 & P9-2213
Model Number: SMBU-2-B for P9-2221

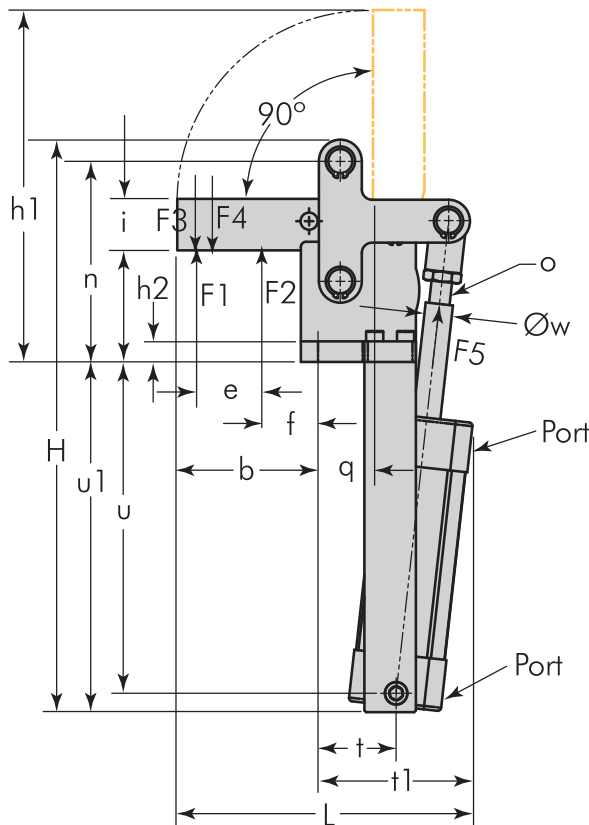
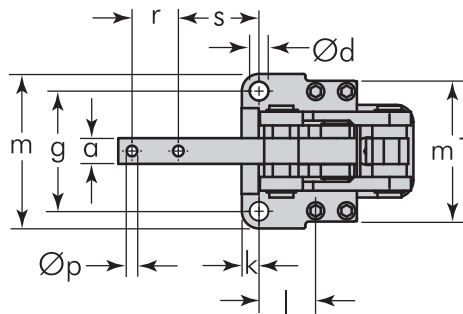
* Vn = Air consumption in cu. in. per double stroke at 85 psig.
Maximum Operating Pressure 145 psig.

ILSP92200 REV D

800-992-0236

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■ Proximity switch capable, order switch separately.



ILSP92203 REV B

FESTO Proximity Switch
Model Number: SMEO-1-S-LED-24-B for
P9-2262, P9-2270 or P9-2288

FESTO Mounting Kit
Model Number: SMBU-1-B for P9-2262 & P9-2270
Model Number: SMBU-2-B for P9-2288

* Vn = Air consumption per double stroke in cu. in. at 85 psig.
Maximum Operating Pressure 145 psig.

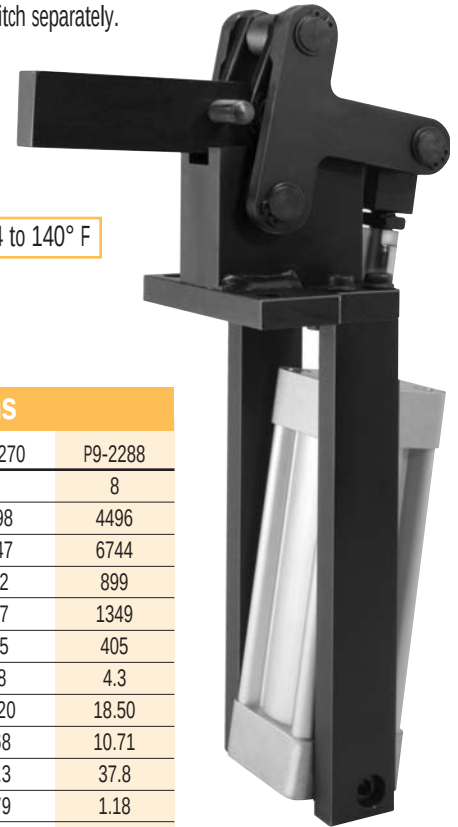
Operating temperature limits are -14 to 140° F

See page H-1 for explanation
of F1, F2, F3, F4 and F5

Dimensions

Model Number	P9-2262	P9-2270	P9-2288
Size	4	6	8
F1 lbs.	1349	2698	4496
F2 lbs.	2023	4047	6744
F3 lbs.	337	562	899
F4 lbs.	495	787	1349
F5 lbs.	169	225	405
Vn*	1.0	1.8	4.3
H	13.39	15.20	18.50
L	6.77	7.68	10.71
Weight lbs.	9.5	16.3	37.8
a	0.59	0.79	1.18
b	3.23	3.54	4.92
Ød	0.43	0.51	0.67
e	2.13	2.36	3.74
f	0.79	0.87	0.96
g	2.76	3.27	4.53
h	2.56	2.72	3.70
h1	8.11	8.90	12.68
h2	0.47	0.59	0.79
i	1.18	1.57	2.36
k	0.39	0.47	0.59
l	1.38	1.26	1.93
m	3.54	4.13	5.71
m1	3.54	3.94	4.84
n	4.61	5.39	7.24
o	M12 x 1.25mm	M16 x 1.5mm	M16 x 1.5mm
Øp	0.24	0.32	0.52
q	1.26	1.14	1.77
r	1.06	1.02	1.57
s	1.85	2.13	2.64
t	1.81	1.89	3.03
t1	2.99	3.46	4.72
u	7.60	8.70	10.04
u1	8.03	9.21	10.71
Øw	0.63	0.63	0.63
Cylinder			
Stroke	2.91	3.43	4.72
Piston Dia.	1.57	1.97	2.48
Port	G1/4	G1/4	G1/4

ILSP92202 REV C



H-3

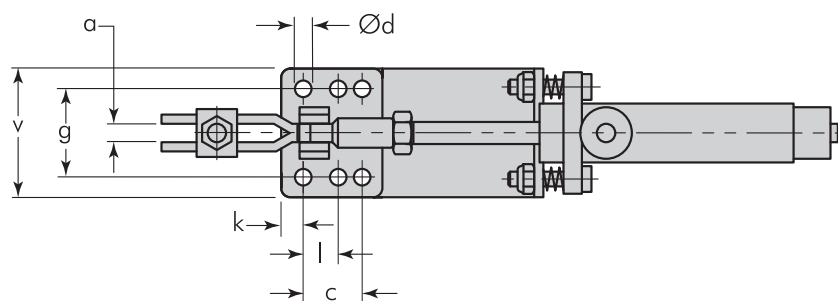
Toggles

Vertical Dimensions



- Includes heat treated, zinc plated clamping screw.

Operating temperature limits are -14 to 140° F



Dimensions

Model Number	P9-1710	P9-1728	P9-1736
Size	0	1	2
F1 lbs.	112	180	225
F2 lbs.	157	247	270
F3 lbs.	16	29	79
F4 lbs.	20	40	112
F5 lbs.	8.5	13.5	38
Vn*	0.03	0.06	0.17
H	1.77	1.97	2.52
L	6.50	7.32	8.66
Clamping Screw	M4 x 25mm	M5 x 30mm	M6 x 35mm
Weight lbs.	0.3	0.9	1.3
a	0.16	0.20	0.24
b	1.22	1.50	2.01
c	0.53	0.63	0.79
Ød	0.18	0.18	0.21
e	0.63	0.75	1.06
f	0.39	0.55	0.79
g	0.91	0.94	1.06
h	0.79	0.91	1.06
h1	2.76	3.35	4.13
hw	-0.04 to 0.24	-0.08 to 0.20	-0.04 to 0.31
i	0.31	0.39	0.47
k	0.20	0.24	0.24
l	-	-	0.49
n	1.57	1.77	2.20
o	M4	M6	M8
q	.39	.47	.51
v	1.30	1.34	1.73
Øw	0.16	0.24	0.31
Cylinder			
Stroke	1.57	1.57	1.57
Piston Dia.	0.39	0.47	0.79
Port	M6 x 0.75mm	M10 x 1mm	M10 x 1mm

ILSP91700 REV E

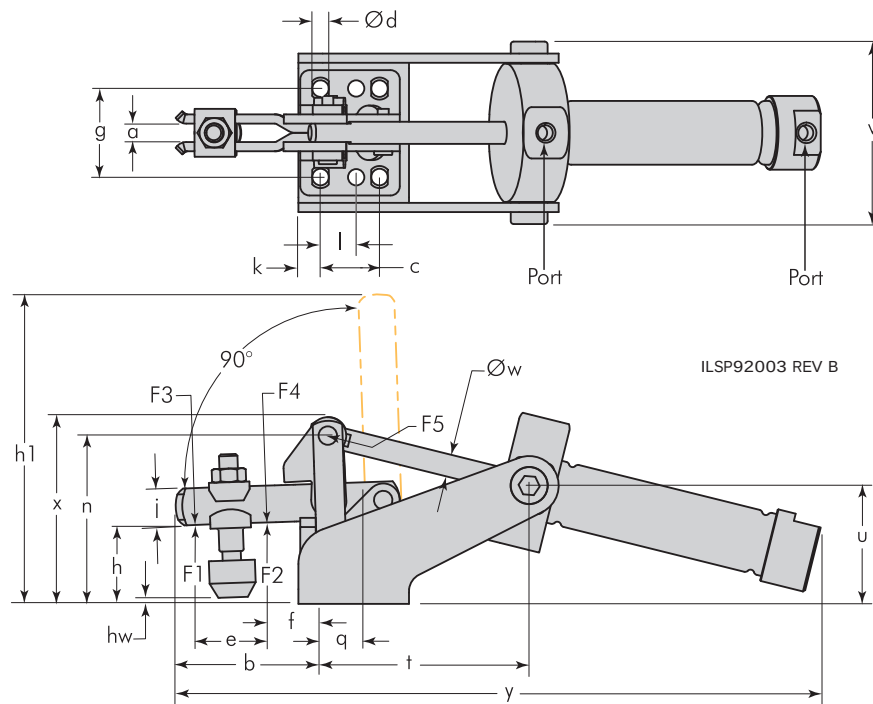
Use plastic tubing P3-0015-04 for model number P9-1710
Use plastic tubing P3-0015-05 for model P9-1728 & P9-1736

* Vn = Air consumption in cu. in. per double stroke at 85 psig.
Maximum Operating Pressure 116 psig.

See page H-1 for explanation of F1, F2, F3, F4 and F5

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Dimensions

Model Number	P9-2015	P9-2023	P9-2031	P9-2049
F1 lbs.	180	225	315	450
F2 lbs.	247	270	562	674
F3 lbs.	45	157	146	337
F4 lbs.	67	225	247	495
F5 lbs.	22	67	112	169
Vn*	0.77	2.15	4.76	8.69
Clamping Screw	M5 x 30mm	M6 x 35mm	M8 x 45mm	M8 x 65mm
a	0.20	0.24	0.31	0.39
b	1.50	2.01	3.15	3.94
c	0.63	0.79	0.79	1.26
Ød	0.18	0.22	0.28	0.33
e	0.75	1.06	1.69	2.05
f	0.55	0.71	1.06	1.38
g	0.94	1.06	1.26	1.77
h	0.87	1.06	1.42	1.77
h1	3.78	4.17	6.18	7.64
hw	-0.08 to 0.20	-0.04 to 0.31	-0.08 to 0.55	-0.20 to 0.94
j	0.39	0.47	0.71	0.79
k	0.24	0.22	0.30	0.31
l	-	0.49	-	-
n	1.85	2.20	2.91	3.43
q	0.47	0.51	0.63	0.87
t	2.28	2.09	2.48	3.39
u	1.26	1.61	2.20	2.52
v	1.97	2.44	2.76	3.31
Øw	0.24	0.39	0.47	0.63
x	2.05	2.60	3.35	3.94
y	6.89	7.87	10.24	12.40
Cylinder				
Stroke	1.34	1.61	2.05	2.44
Piston Dia.	0.63	0.98	1.26	1.57
Port	M5	M5	G1/8	G1/8



H-5

- Includes heat treated, zinc plated clamping screw.
- Proximity switch capable, order switch separately.

Operating temperature limits are -14 to 140° F

FESTO Proximity Switch

Model Number: SME-8-S-LED-24 for
P9-2015, P9-2023, P9-2031, or P9-2049

FESTO Mounting Kit

Model Number: SMBR-8-16 for P9-2015
Model Number: SMBR-8-25 for P9-2023
Model Number: SMBR-8-32 for P9-2031
Model Number: SMBR-8-40 for P9-2049

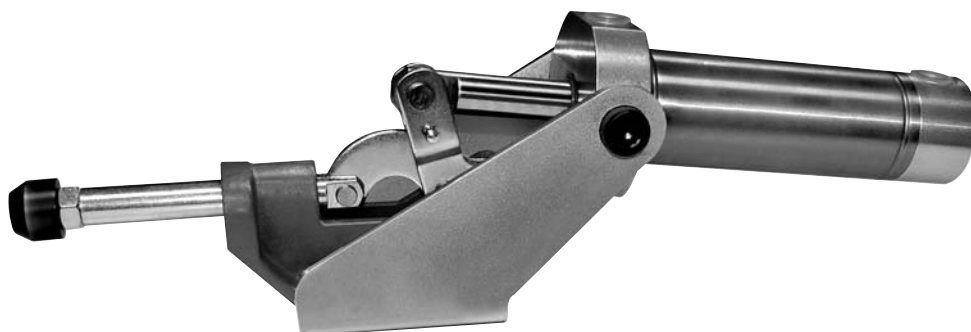
* Vn = Air consumption in cu. in. per double stroke at 85 psig.
Maximum Operating Pressure 145 psig

See page H-1 for explanation of F1, F2, F3, F4 and F5

Toggles

Push Type Dimensions

See page H-1 for explanation of F1, F3 and F5



■ Includes heat treated, zinc plated clamping screw.

Operating temperature limits are -14 to 140° F

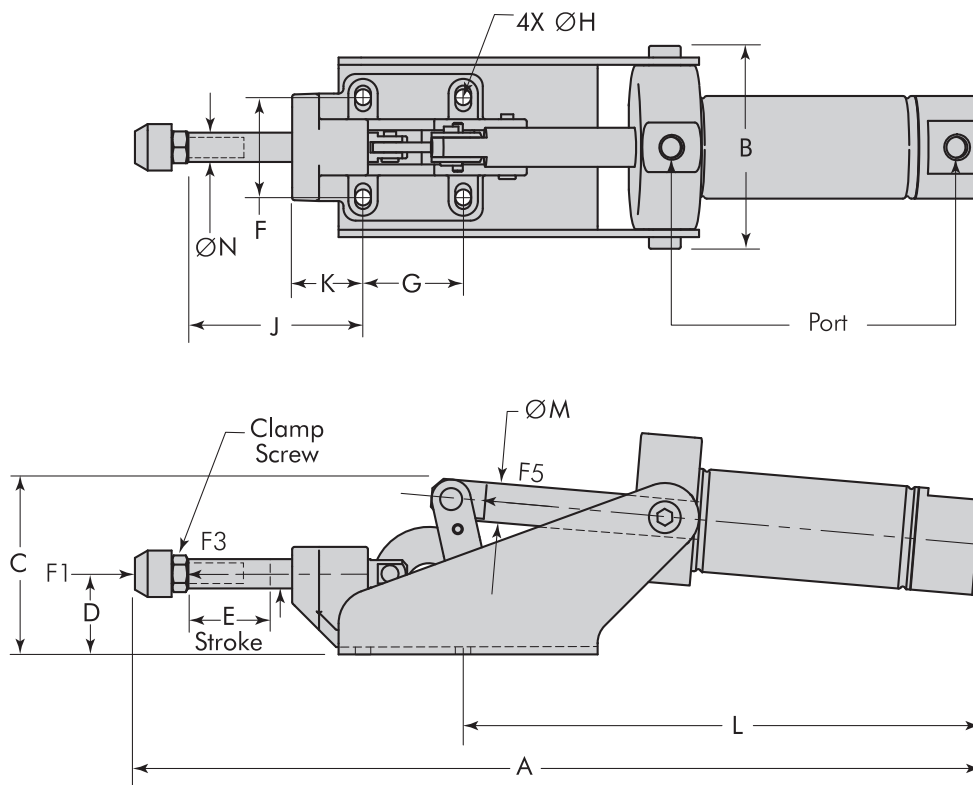
Dimensions

Model Number	P9-5034	P9-5059
F1 lbs.	900	2248
F3 lbs.	674	1124
F5 lbs.	169	225
Vn*	0.80	2.20
A	12.91	17.20
B	3.31	3.31
C	3.58	4.33
D	1.28	1.61
E	0.79	1.26
F	1.61	1.61
G	1.61	1.61
Ø H	0.26	0.33
J	2.83	3.82
K	1.10	1.77
L	10.24	13.00
Ø M	0.63	0.63
Ø N	0.47	0.63
Weight lbs.	4.00	7.50
Clamping Screw	M8 x 35mm	M12 x 50mm
Cylinder		
Stroke	2.28	3.54
Piston Dia.	1.57	1.97
Port	G1/8	G1/8

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* Vn = Air consumption in cu. in. per double stroke at 85 psig.
Maximum operating pressure 145 psig.

H-6



ILSP95001 REV D

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Just as we have addressed safety in our VektorFlo® catalog, we will address that issue here. Safety starts in the planning stages, and should remain a focus during daily use. Thinking and working safely will allow you to benefit from using pneumatic clamping in many applications. If safety is forgotten, workers can be injured and expensive equipment damaged.

Like other mechanical devices, the use of pneumatic clamping is subject to certain hazards that cannot be precluded by mechanical means, but only by the exercise of intelligence, care and common sense. It is essential that personnel working with this equipment be careful, competent, trained and qualified in the safe operation of the pneumatic clamping. Some examples of hazards include, but are not limited to: inadequate clamping capacity; unprotected pinch points; hoses, tubing and fittings not rated for system working pressures; improper installation and maintenance; and inadequate system monitoring.

These clamps, like any other clamp, have pinch points. Secondary pinch points also exist in some devices, such as swing clamps, because of their rotation. If any of these conditions exist, personal injury may result from crushing action, flying projectiles and burst plumbing. These same actions may also result in destruction of property.

Plan with safety in mind

No matter what your application, start by providing good lighting, ample workspace and easy access for inspection and maintenance of your clamping equipment. When planning the position of valves, safety guards and controls, keep the operator's safety in mind. Make sure that all components being used are rated for the highest working pressures the system will encounter. Check compatibility of all components and their ability to perform their functions.

Assemble and install equipment with care

Always use caution where high-pressure air leaks could happen, as high-pressure air can cut. Improperly secured components can become projectiles and careless installation of your pneumatic system can create built-in hazards.

Route tubing where it won't be exposed to damage. Make sure connections are properly made and tight, with threads fully engaged on mountings. Be sure your stops are able to withstand the clamping forces that may develop. Test the system before production starts.

Keep your operators thinking

With your system on line and in production, set-up and enforce work rules that help avoid human injury and damage to equipment. Be sure every operator knows his equipment and develops good work habits. An operator should always make sure valves are in the correct position before starting the system. Keep hands clear during operations. Use judgment when positioning the workpiece; make sure it is properly positioned when clamping forces are applied. Watch for kinks in tubing. Make sure system pressures remain within your boundaries. Swing clamps must be able to rotate freely through 90 degrees into position before force is applied.

Caution: Keep clear of swing clamp pinch points. All setups should be carefully planned and checked.

Follow good maintenance practices.

A clean and well cared for workplace is a safer workplace; inspect daily for damaged tubing, fittings and leaks. Repair or replace components that show signs of wear or damage. Minor problems become major when they are not addressed.

Designed and built for durability, performance and safety, your VektorAir™ components last long when properly selected, installed and maintained.

As an integral part of system design, care must be taken to select the proper devices and accessories to work well with your operations and personnel. Sufficient safety measures must be taken to avoid the risk of personal injury and property damage from your application or system. Vektek, Inc. can not be responsible for injury or damage caused by unsafe use, maintenance or application of its products.

Please write the Vektek office including specifics for guidance when you are in doubt as to proper safety precautions regarding design, installation or operation in your particular application.



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800-992-0236

Fax: 816-364-0471
sales@vektek.com

www.vektek.com

In order to support our process of ongoing product improvements, specifications are subject to change without notice. Due to these improvements, products may not be exactly as illustrated.

November 2012

Contoured nest fixture shown with 2.5" bore pneumatic swing clamps.

