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# P1D Series

ISO 6431 / ISO 15552 / VDMA 24562  
Pneumatic Cylinders



C

P1D

P1A

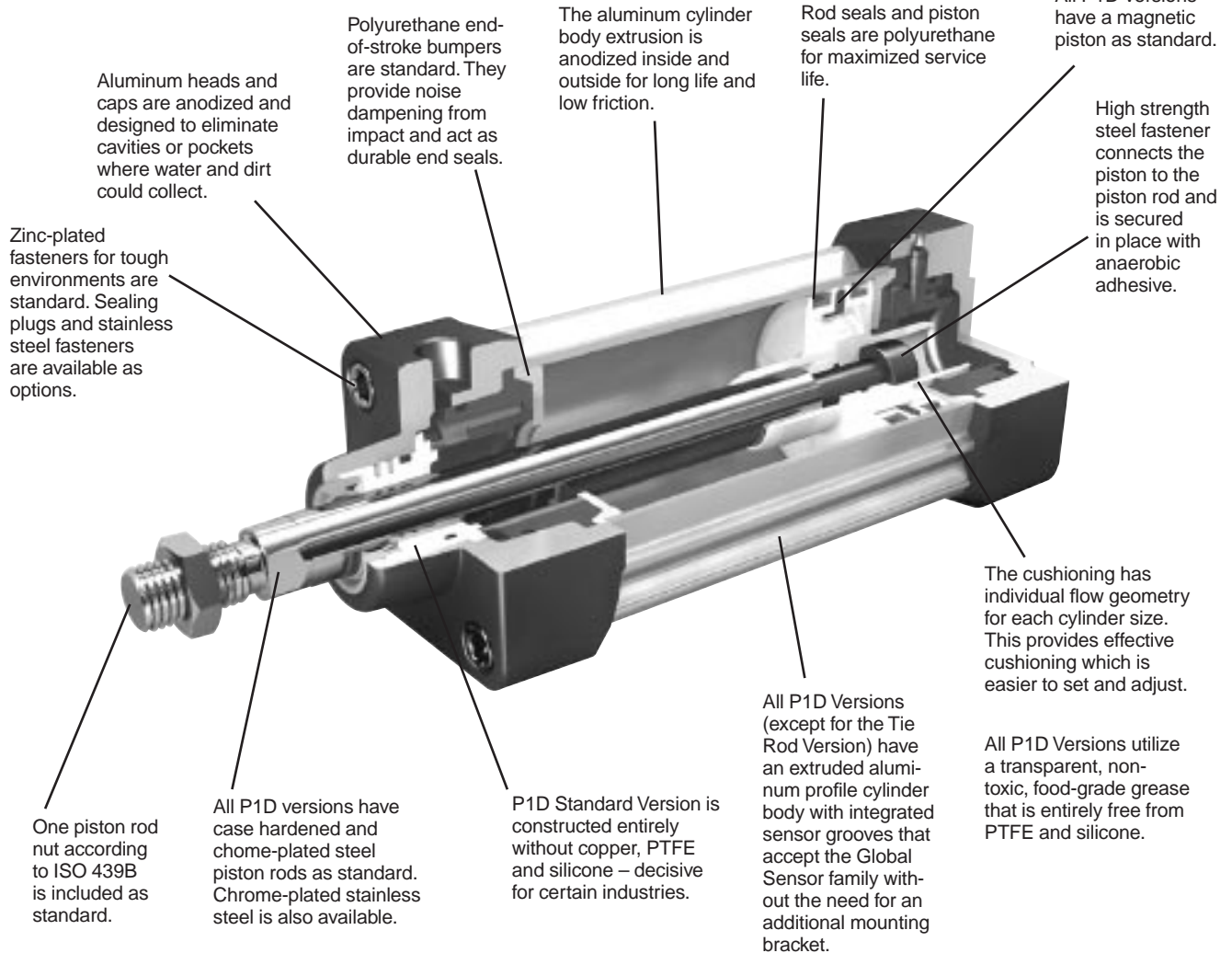
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**P1D Standard Version**

C



Aluminum heads and caps are anodized and designed to eliminate cavities or pockets where water and dirt could collect.

Polyurethane end-of-stroke bumpers are standard. They provide noise dampening from impact and act as durable end seals.

The aluminum cylinder body extrusion is anodized inside and outside for long life and low friction.

Rod seals and piston seals are polyurethane for maximized service life.

All P1D Versions have a magnetic piston as standard.

High strength steel fastener connects the piston to the piston rod and is secured in place with anaerobic adhesive.

Zinc-plated fasteners for tough environments are standard. Sealing plugs and stainless steel fasteners are available as options.

The cushioning has individual flow geometry for each cylinder size. This provides effective cushioning which is easier to set and adjust.

One piston rod nut according to ISO 439B is included as standard.

All P1D versions have case hardened and chrome-plated steel piston rods as standard. Chrome-plated stainless steel is also available.

P1D Standard Version is constructed entirely without copper, PTFE and silicone – decisive for certain industries.

All P1D Versions (except for the Tie Rod Version) have an extruded aluminum profile cylinder body with integrated sensor grooves that accept the Global Sensor family without the need for an additional mounting bracket.

All P1D Versions utilize a transparent, non-toxic, food-grade grease that is entirely free from PTFE and silicone.

**P1D Standard Version**

P1D Standard Version cylinders are available in 32-125mm bores and utilize internal composite technology to save weight, while assuring the high performance and functionality expected of ISO cylinders. Cushions and bumpers at both ends and a magnetic piston are included as standard. The Standard Version serves all markets where performance at an affordable price is desired.

**International standards**

The new P1D Series complies with the current ISO 6431, ISO/DIS 15552, VDMA 24562 and AFNOR installation dimensional standards for customer reassurance world-wide.

**Mechanically protected sensor technology**

The body extrusion has recessed sensor grooves on three sides of the cylinder. The new Global Sensors

drop into the sensor groove quickly and easily. Both the cable and the sensor are protected. Choose a sensor in a variety of cable lengths and with flying leads, 8mm connector or 12mm connector.

**Optimized cushioning**

Thanks to the plastic inserts in the end covers, each cylinder bore has been given individual flow geometry. This provides optimized cushioning, which is quicker and easier to set and adjust.

**Smooth, quiet operation and long service life**

All seals and end-of-stroke bumpers are made from polyurethane (PUR), the bearings and piston are made from proven engineering plastics with excellent bearing properties and all cylinders are greased at the factory with a transparent, food-grade grease. Altogether, this gives the P1D Series very long service life and smooth, quiet operation.



### P1D Removable Gland Version

P1D Removable Gland Version cylinders are available in 32-200mm bores and utilize bar stock endcaps and a removable high-strength bronze bearing for traditional and custom applications. The bronze bearing assembly is externally removable for quick and easy maintenance. No other ISO cylinder manufacturer in the world produces a Removable Gland Version and meets these demands. This version covers all applications which require performance and customization at all bore sizes.

#### Removable Gland

An extra-long inboard bearing surface ensures lubrication from within the cylinder. Outboard of the bearing are two leak-proof seals. The rod wiper seal wipes away any dirt on the rod. This means less wear on bearing surfaces and internal parts. The result is positive, no-leak sealing, regardless of conditions. And with the famous Parker removable style gland, you can replace the rod seals and/or bearings when necessary without disassembling the rest of the cylinder and without the need of any special wrenches.

#### Aluminum Piston Option

For high temperature applications, an aluminum piston is available with fluorocarbon seals. The piston is threaded onto the piston rod and secured in place with anaerobic adhesive which is temperature sensitive. For applications above +121°C (+250°F) specify a pinned piston to rod connection. The polyurethane seals that are standard on the nylon piston are also an available option with the aluminum piston. The magnet that is cleverly hidden underneath the wear-band is also a standard feature on the aluminum piston. The durable wear-band prevents any metal-to-metal contact between the piston and the cylinder body wall increasing the overall life of the cylinder.

#### Machined End Caps with Captive Cushion Screw Adjustment

The end caps are made of precision lightweight aluminum. This allows for maximum flexibility and quick manufacturing for any customization that is required. The end caps also feature a captive cushion needle valve adjustment screw for optimized cushioning that is inherent throughout the P1D family of ISO cylinders.

### P1D Series Rod Lock Cylinder

The P1D Series Rod Lock Cylinder incorporates a powerful piston rod locking device, which clamps the piston rod and locks it in position. The locking device is a spring lock with an air pressure release and is integrated into the front (head) cover of the cylinder.

In the absence of air signal pressure, full holding force is applied to the piston rod. When air is present at 4 Bar (58 psi), the locking device is released.

The P1D Series Rod Lock Cylinder is available for cylinder bores 32-125mm. The design provides several valuable characteristics, such as:

- A holding force corresponding to a pressure of 7 Bar (102 psi)
- A clean design, with the front (head) end cover and locking device built into a common block for compact installation
- Easy to clean, well-sealed construction
- Exhaust air from the locking device can be piped away when there are high demands for a contaminant free environment



### P1D Series Rod Lock Cylinder with Manual Override

The P1D Series Rod Lock Cylinder with Manual Override is available for rod lock release during non-production activities. It incorporates the same features as the standard rod lock cylinder.



**Convex shape for optimum hygiene**

What makes the P1D Clean version unique is its convex body extrusion, which allows the cylinder to be kept clean. Regardless of orientation, fluids will run off the cylinder body surfaces.

**Cushioning screw with positive geometry**

To offer the best hygiene properties, the projecting cushioning screw is sealed against the end cover. This eliminates dirt-collecting cavities and gives the best hygiene, since it is so easy to clean.

**Up to four integral sensors**

Cylinders for two integral sensors have two undivided camshafts along the entire stroke. Free choice of cable exit, front or rear. There is also a version with divided camshafts for up to four sensors, which are installed two from each end cover, with cable exiting both front and rear.

**Sealing plugs**

Plastic sealing plugs are installed in the end cover screws which are not used for the cylinder installation. To ensure the sealing function, the plugs cannot be re-used. When installed in the end cover screws, they are tapped lightly with a hammer for high axial force.

**Patent applied for system of integrated standard sensors**

The Clean Version of the P1D cylinder has a system of sensors, which are fully integrated into the body extrusion to give the cylinders a clean external design. Up to four sensors chosen from the range of P1D standard sensors, can be mounted in two dedicated grooves beneath a transparent, sealed molding. Tightening the stop screw onto the cam shaft will lock each sensor in the desired position. The sensor LEDs are always fully visible, which facilitates initial set-up, adjustment and trouble-shooting. The entire sensor system has a hose-proof design equivalent to IP65.

**P1D Clean Version**

The P1D Clean Version is completely designed for the food industry. The stringent requirements for hygiene regarding choice of material and corrosion resistance have guided the development of this cylinder version. Available with BSPP ports (ISO 1179-1 with ISO 228-1 threads).

All the main dimensions of the P1D Clean comply with ISO 6431, ISO/DIS 1555, VDMA 24562 and AFNOR standards except the somewhat larger footprint of the end covers and envelope of the body extrusion, due to the hygienic, convex, easy-to-clean geometry of the cushioning adjustment screw and the components of the integrated sensor system.

**P1D Tie-Rod Version**

The P1D Tie-Rod Version cylinders are based on the same high level technology as the Standard Version. They accept either Standard Version or Removable Gland Version heads and caps. This cylinder is the perfect choice wherever a true tie-rod cylinder is needed.

**International standards**

The P1D Tie-Rod Version complies with ISO 6431, ISO/DIS 15552, VDMA 24562 and AFNOR installation dimension standards, for customer reassurance world-wide.

**“Drop-in” sensor**

The P1D Tie-Rod Version utilizes the same drop-in Global Sensors as the other versions. An ingenious multi-jointed adapter clamps the sensors to the tie rod in any chosen position along the stroke.

**Large Bore Sizes**

The P1D Tie-Rod Version is now available in 160 and 200mm bore sizes.

32-125mm bores



Using P1D cylinders as a platform, a number of different designs can be produced to suit differing requirements. Please refer to the Ordering Information page for the designation of each variant.

### Alternative piston rod materials

All P1D cylinders in all bores, Ø32-200 mm, can be ordered with the following piston rod materials:

- Steel, hard chrome plated (standard)
- Stainless steel, hard chrome plated
- Acid proof steel

### Double rod cylinders

All bore sizes of all versions are available with a double rod. Cylinders with a double rod can take higher side forces thanks to the double support for the piston rod. In addition, this design makes it easier to install external mechanical position sensors as well as giving equal force and flow on both sides of the piston.

### High ambient temperature

The Removable Gland Version can be supplied in special high ambient temperature version. The cylinders have seal systems, materials and grease for elevated temperature ranges. The high temperature version does not have a magnetic piston (no function at high temperatures). The aluminum piston option is required for service above +80°C (+176°F) and a pinned piston to rod connection is required for service above +121°C (+250°F).

Ambient temperature range:

- 10°C to +121°C, peaks up to +150°C  
(+14°F to +250°F, peaks up to +300°F).

### Low pressure hydraulics

All bore sizes of the Removable Gland Version can be supplied with special seals for operation with low pressure hydraulics up to 10 bar. Temperature range -20 °C to +80 °C (-4°F to +176°F).

### Duplex cylinder – 3 and 4 position cylinders

By installing two cylinders with the same or different stroke, it is possible to build a working unit with three or four positions. This type of unit is available as factory-fitted P1D Tie-Rod Version cylinders in all bore sizes. Other P1D cylinders can be flange mounted back-to-back with a special mounting.

### Tandem cylinder

The P1D Tie-Rod Version is also available as a tandem cylinder, i.e. two cylinders connected in series. This cylinder unit has almost twice the force, which is a great advantage in restricted spaces.

### Guided Cylinders

For guided versions of the P1D, see the P5E Series and HB Series in Section F.



Alternative Piston Rod Materials



Double Rod



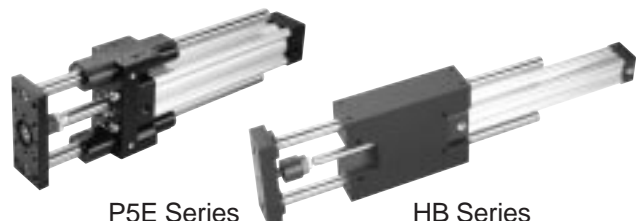
High Ambient Temperature



3 and 4 Position Cylinders



Tandem Cylinders



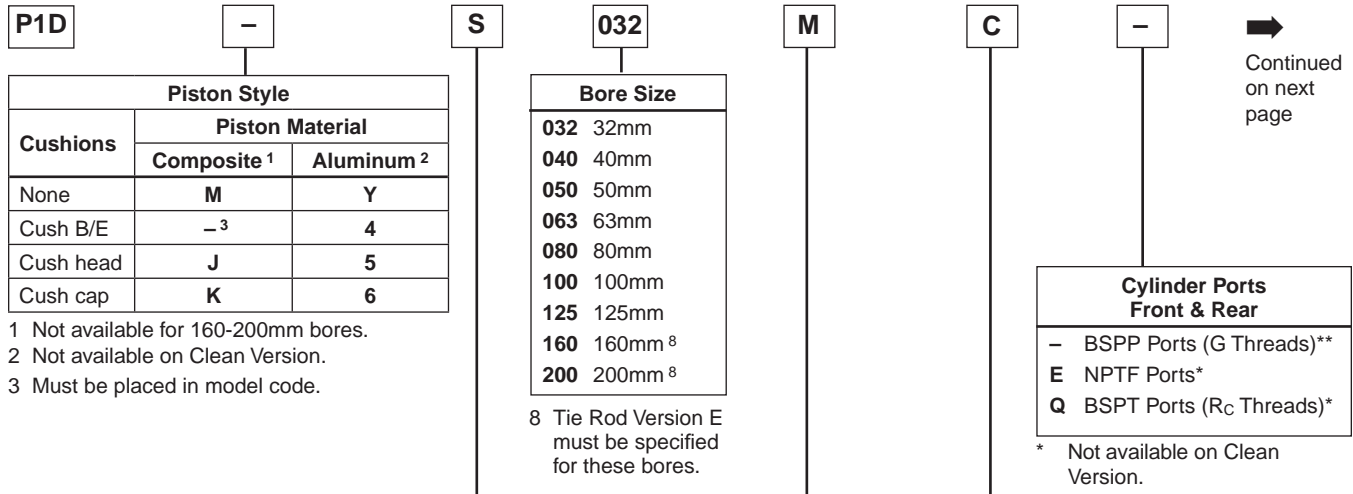
P5E Series

HB Series

C

P1D

P1A



Piston Style		
Cushions	Piston Material	
	Composite <sup>1</sup>	Aluminum <sup>2</sup>
None	<b>M</b>	<b>Y</b>
Cush B/E	— <sup>3</sup>	<b>4</b>
Cush head	<b>J</b>	<b>5</b>
Cush cap	<b>K</b>	<b>6</b>

Bore Size	
<b>032</b>	32mm
<b>040</b>	40mm
<b>050</b>	50mm
<b>063</b>	63mm
<b>080</b>	80mm
<b>100</b>	100mm
<b>125</b>	125mm
<b>160</b>	160mm <sup>8</sup>
<b>200</b>	200mm <sup>8</sup>

<sup>8</sup> Tie Rod Version E must be specified for these bores.

- 1 Not available for 160-200mm bores.
- 2 Not available on Clean Version.
- 3 Must be placed in model code.

Version				
	Cylinder Body Profile	Rod Lock		
		None	Fitted w/Std Rod Lock <sup>7</sup>	Fitted w/Manual Override Rod Lock <sup>7</sup>
Die Cast End Caps <sup>4</sup>	Standard	<b>S</b>	<b>L</b>	N/A
	Tie Rod	<b>T</b>	<b>M</b>	N/A
	Clean	<b>C</b>	<b>D</b>	N/A
Removable Gland <sup>5</sup> (Machined Endcaps)	Standard	<b>G</b>	<b>R</b>	<b>J</b>
	Tie Rod	<b>E</b>	<b>7<sup>4</sup></b>	Consult Factory
Special <sup>6</sup>	Any Special	<b>/</b>		

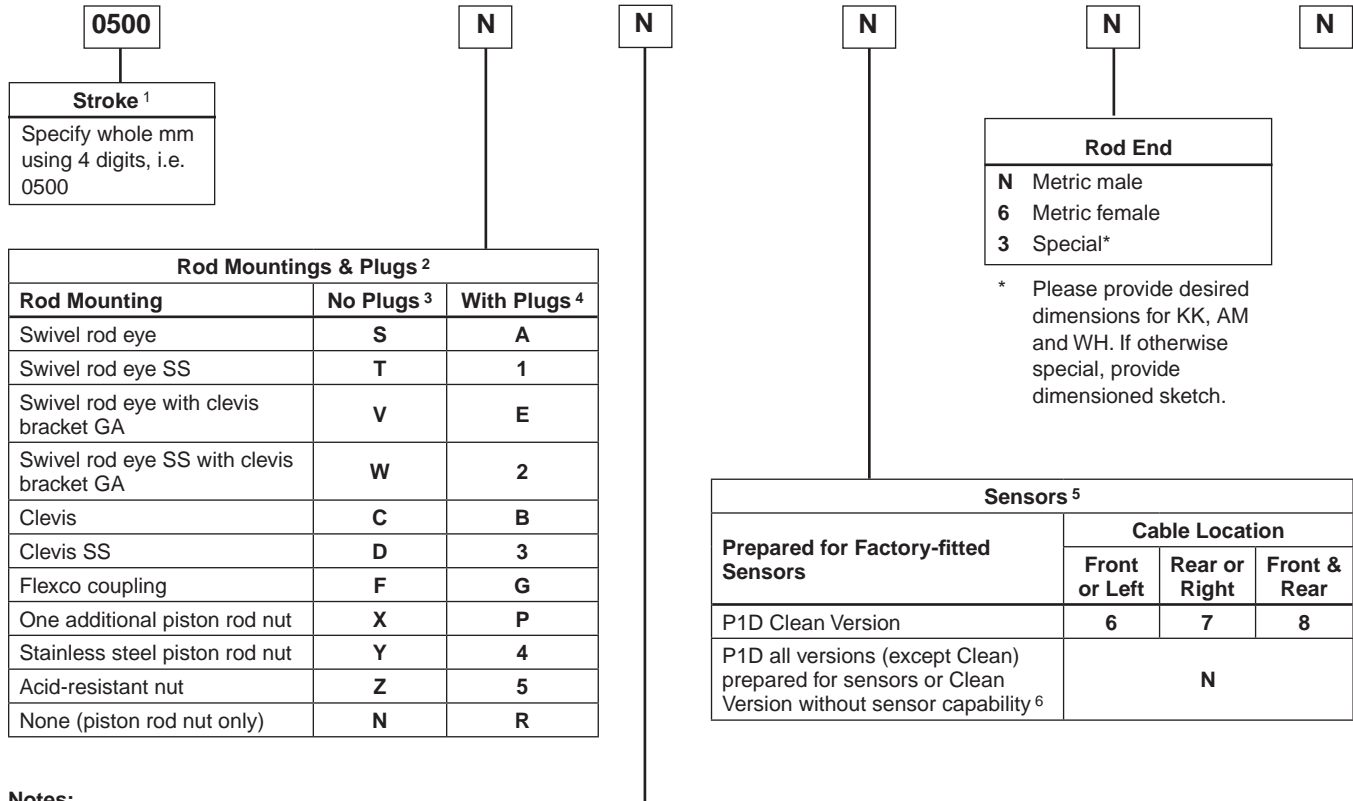
- 4 Not available for 160-200mm bores or with fluorocarbon seals.
- 5 When Removable Gland Version is fitted with rod lock, gland cannot be replaced without disassembling cylinder.
- 6 If special cylinder is ordered (other than rod end), End Cap Style, Cylinder Body Profile and Rod Lock option must be given in addition to the special request.
- 7 Cylinders fitted with rod locks must be cushioned on both ends.

Function				
Fastener Type	Rod Wiper Style	Double Acting	Double Rod	Tandem
Standard end cover screws	Std scraper	<b>M</b>	<b>F</b>	<b>C</b>
	Metal scraper	<b>Q</b>	<b>R</b>	<b>J</b>
Stainless steel end cover screws <sup>9</sup>	Std scraper	<b>A</b>	<b>G</b>	N/A
	Metal scraper	<b>S</b>	<b>T</b>	N/A

- \* Not available on Clean Version.
- \*\* ISO 1179-1 with ISO 228-1 threads.
- 9 Applies only to end cover screws for 32-125mm bores. For stainless steel tie rods and nuts (all bore sizes), change Version to special and request stainless steel tie rods and nuts.
- 10 If used for temperature above +80°C (+176°F), aluminum piston required. Not available with die cast end caps. Fluorocarbon seals for Rod Lock Versions are for chemical compatibility applications only, not for high temperature.
- 11 Hydraulic seal option valid for Removable Gland Version only. Adjustable cushion options and Rod Lock Versions not available.
- 12 Not available on Clean Version.
- 13 Only available on Clean Version.

Piston Rod & Seal Material			
Piston Rod Material	Seal Material		
	Standard	Fluorocarbon <sup>10</sup>	Hydraulic <sup>11</sup>
Chrome plated carbon steel <sup>12</sup>	<b>C</b>	<b>G</b>	<b>J</b>
Chrome plated stainless steel <sup>12</sup>	<b>R</b>	<b>D</b>	<b>Z</b>
Stainless steel <sup>13</sup>	<b>S</b>	N/A	N/A
Acid-resistant stainless steel	<b>M</b>	<b>N<sup>12</sup></b>	N/A

**C**



**0500**

<b>Stroke<sup>1</sup></b>
Specify whole mm using 4 digits, i.e. 0500

Rod Mountings & Plugs <sup>2</sup>		
Rod Mounting	No Plugs <sup>3</sup>	With Plugs <sup>4</sup>
Swivel rod eye	<b>S</b>	<b>A</b>
Swivel rod eye SS	<b>T</b>	<b>1</b>
Swivel rod eye with clevis bracket GA	<b>V</b>	<b>E</b>
Swivel rod eye SS with clevis bracket GA	<b>W</b>	<b>2</b>
Clevis	<b>C</b>	<b>B</b>
Clevis SS	<b>D</b>	<b>3</b>
Flexco coupling	<b>F</b>	<b>G</b>
One additional piston rod nut	<b>X</b>	<b>P</b>
Stainless steel piston rod nut	<b>Y</b>	<b>4</b>
Acid-resistant nut	<b>Z</b>	<b>5</b>
None (piston rod nut only)	<b>N</b>	<b>R</b>

<b>Rod End</b>
<b>N</b> Metric male
<b>6</b> Metric female
<b>3</b> Special*

\* Please provide desired dimensions for KK, AM and WH. If otherwise special, provide dimensioned sketch.

Sensors <sup>5</sup>			
Prepared for Factory-fitted Sensors	Cable Location		
	Front or Left	Rear or Right	Front & Rear
P1D Clean Version	<b>6</b>	<b>7</b>	<b>8</b>
P1D all versions (except Clean) prepared for sensors or Clean Version without sensor capability <sup>6</sup>	<b>N</b>		

**Notes:**

- 1 When specifying a stop tube, place a "/" in the version field. Then specify the version, amount of stop tube and amount of net stroke. The stroke used in the model code should be gross stroke (net stroke plus stop tube).
- 2 Please review Piston Rod Selection Chart in the Engineering Section to check for a rod buckling condition.
- 3 Clean Version comes standard with plugs. Use this column when ordering Clean Version.
- 4 Not available for 160-200mm bores.
- 5 For sensor part numbers and specifications, please refer to Electronic Sensors section.
- 6 P1D Clean Version ordered without sensors **cannot** be retrofitted with sensor capability.

Mounting Style		
	Standard	Rotated 90°
Flange MF1 at head (front) end	<b>1</b>	<b>3</b>
Flange MF2 at cap (rear) end	<b>B</b>	<b>4</b>
Flanges MF1 and MF2 at both ends	<b>2</b>	<b>K</b>
Foot brackets MS1	<b>F</b>	<b>R</b>
Clevis bracket GA aluminum	<b>C</b>	<b>U</b>
Rear eye MP4 aluminum	<b>E</b>	<b>V</b>
Rear swivel eye MP6 aluminum	<b>S</b>	<b>W</b>
Clevis bracket MP2 aluminum	<b>T</b>	<b>Y</b>
Rear eye + clevis (MP4 + MP2) aluminum	<b>L</b>	<b>Z</b>
Clevis bracket MP2 + pivot hinge aluminum	<b>X</b>	<b>5</b>
Clevis bracket GA aluminum + steel swivel hinge	<b>Q</b>	<b>0</b>
Rear swivel eye + clevis bracket GA aluminum	<b>M</b>	<b>A</b>
Intermediate trunnion MT4 (requires XV dimension)	<b>G</b>	<b>7</b>
Trunnion flange at head (front) end <sup>4</sup>	<b>H</b>	<b>P</b>
Trunnion flange at cap (rear) end <sup>4</sup>	<b>J</b>	<b>8</b>
None (MX0)	<b>N</b>	<b>9</b>

**Double Rod Cylinders**

Double rod option is available with Mounting Styles MX0, MS1, MF1, MF2 and MT4.

For double rod cylinders, it is assumed that the rod number and rod end are the same for both piston rods. On a double rod cylinder where the two rod ends are different, use a rod end of '3' and be sure to clearly state which rod end is to be assembled at which end.



**Specifications**

- Bore sizes 32-200mm
- Max stroke 2800mm
- Min stroke 25mm  
(must specify Tie Rod Version for strokes <25mm)
- Rod Ends – 2 standard, specials to order
- Single rod end and double rod end styles
- Working pressure Max 10 Bar (145 PSI)
- Working temperature 

<u>min</u>	<u>max</u>
Standard	-20°C (-4°F)      +80°C (+176°F)
High temp version	-10°C (+14°F)      +121°C (+250°F)
- Aluminum piston is required for service above +80°C (+176°F)
- Greased for life (non-lube), does not normally need additional lubrication. If air line lubrication is initiated, it must always be continued.
- Working medium Dry, filtered compressed air to ISO 8573-1 class 3. 4. 3. or better

**P1D Clean Version**

Min stroke 25mm  
 Protection class Hose-proof in accordance with IP65  
 Chemical resistance Tested for normally used industrial detergents, both acid and alkaline

**P1D Rod Lock Version**

- Fluid Medium: Dry, filtered, compressed air
- Maximum Cylinder Operating Pressure: 10 Bar (145 PSI)
- Required Pressure to Unlock<sup>1</sup>: 4 Bar (58 PSI)
- Minimum Torque Required for Manual Override Version:
  - 32mm Bore = 0.9 N-m / 8 in-lbs
  - 40mm Bore = 0.9 N-m / 8 in-lbs
  - 50mm Bore = 2.7 N-m / 24 in-lbs
  - 63mm Bore = 2.7 N-m / 24 in-lbs
  - 80mm Bore = 27.1 N-m / 240 in-lbs
  - 100mm Bore = 36.6 N-m / 324 in-lbs
  - 125mm Bore = 61.0 N-m / 540 in-lbs
- Maximum Operating Temperature: -10°C to +75°C, +14°F to +167°F
- Maximum Cylinder Operating Speed: 5 feet per second

<sup>1</sup>Signal pressure to port on locking device. Operation at pressures lower than 4 Bar (58 psi) may lead to inadvertent engagement of the rod lock device.

**Quick Reference**

Bore Size	Cylinder Area, cm <sup>2</sup>	Piston Rod			Cushioning Length mm	Air Consumption litre	Connection Thread <sup>4</sup>	Theoretical Cylinder Forces at 6 Bar (N) <sup>2</sup>	
		Dia. mm	Area, cm <sup>2</sup>	Male Thread				Extend Stroke	Retract Stroke
32	8.0	12	1.1	M10x1.25	17	0.105	G1/8	482	414
40	12.6	16	2.0	M12x1.25	19	0.162	G1/4	754	633
50	19.6	20	3.1	M16x1.5	20	0.253	G1/4	1178	989
63	31.2	20	3.1	M16x1.5	23	0.414	G3/8	1870	1681
80	50.3	25	4.9	M20x1.5	23	0.669	G3/8	3016	2721
100	78.5	25	4.9	M20x1.5	27	1.043	G1/2	4712	4417
125	122.7	32	8.0	M27x2	30	1.662	G1/2	7363	6880
160	201.1	40	12.6	M36x2	38	2.724	G3/4	12,064	11,310
200	314.2	40	12.6	M36x2	38	4.256	G3/4	18,850	18,096

Cylinder Bore Size	Total Mass (kg)						Total Mass (kg) Moving Components	
	0mm Stroke <sup>3</sup>			Supplement per 10mm Stroke			at 0mm Stroke	Supplement per 10mm Stroke
	Standard	Tie-Rod	Clean	Standard	Tie-Rod	Clean	All Variants	All Variants
32	0.55	0.54	0.60	0.023	0.022	0.047	0.13	0.009
40	0.80	0.79	0.88	0.033	0.030	0.063	0.24	0.016
50	1.20	1.20	1.32	0.048	0.048	0.094	0.42	0.025
63	1.73	1.73	1.86	0.051	0.051	0.101	0.50	0.025
80	2.45	2.47	2.63	0.075	0.079	0.142	0.90	0.039
100	4.00	4.00	4.22	0.084	0.084	0.168	1.10	0.039
125	6.87	6.73	7.01	0.138	0.129	0.248	2.34	0.063
160	—	16.19	—	—	0.160	—	Consult Factory	Consult Factory
200	—	22.23	—	—	0.185	—	Consult Factory	Consult Factory

<sup>1</sup> Free air consumption per 10 mm stroke for a double stroke at 6 bar

<sup>2</sup> The values for cylinder forces are theoretical and should be reduced to suit working conditions.

<sup>3</sup> Total Mass for composite piston for 32-125mm bores and aluminum piston for 160-200mm bores.

<sup>4</sup> ISO 1179-1 with ISO 228-1 threads



**Standard Version**

Body extrusion	Clear anodized aluminium
End covers	Powder coated or black anodized aluminum
End cover inserts	POM
End cover nuts/screws	Zinc plated steel 8.8
Piston rod nut	Zinc plated steel
Piston rod	Chrome-plated steel (standard)
Rod wiperseal	PUR
Piston rod bearing	POM
Piston	POM
Piston bearing	POM
Magnetic ring	Plastic bound magnetic material
Piston fastener	Zinc plated steel (composite piston)
Piston seal	PUR
O-rings	Nitrile rubber, NBR
End-of-stroke bumpers and end seals	PUR
Cushioning seals	PUR
Cushioning screws	PA

**Piston Rod Material Options (or with equivalent properties):**

Standard	Case-hardened, chrome plated carbon steel
Chrome plated stainless steel	17-4 PH, chrome plated stainless steel
Stainless steel	303 stainless steel
Acid-resistant stainless steel	316 stainless steel



**Additional/Substitute Specifications**

**P1D Clean Version**

Transparent molding	Silicone
Transparent cover	ABS
Screws, sensor system	Stainless steel
Upper seal, cover	EPDM
Lower seal, cover	Rubber
Sealing plugs	PA
Piston rod nut	Stainless steel

**P1D Tie-Rod Version**

Tie-rods	Blackened steel
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**P1D Removable Gland Version**

End covers	Black anodized aluminum
End cover screws	Zinc plated steel 8.8 (32-125mm bores)
Cylinder Body	Clear anodized aluminum
Rod gland	PTFE filled high strength bronze
Rod seal	Buna Nitrile for sealing action
Rod wiper	Buna Nitrile for wiping action
Piston rod	Case hardened chrome-plated steel
Piston rod nut	Zinc plated steel
Piston	POM (standard) Aluminum (optional)
Piston seals	PUR
Piston bearing	POM or Molyguard wear band for aluminum piston
Magnetic ring	Plastic bound magnetic material
Piston fastener	Zinc plated steel (composite piston)
O-rings	Buna Nitrile
Cushioning seals	PUR
Cushioning screws	Stainless steel (brass for 160 and 200mm bores)

**Design Variants for Removable Gland Version**

High temperature option includes:	
All seals	Fluorocarbon
Piston	Aluminum (without magnetic ring)
Low pressure hydraulic option includes:	
Rod seal	Buna Nitrile
Rod wiper	PUR
Piston seals	Buna Nitrile
Piston	Aluminum (non-cushioned)
Metallic Rod Scraper includes:	
Rod wiper	Dual high strength bronze wipers with nitrile or fluorocarbon energizer

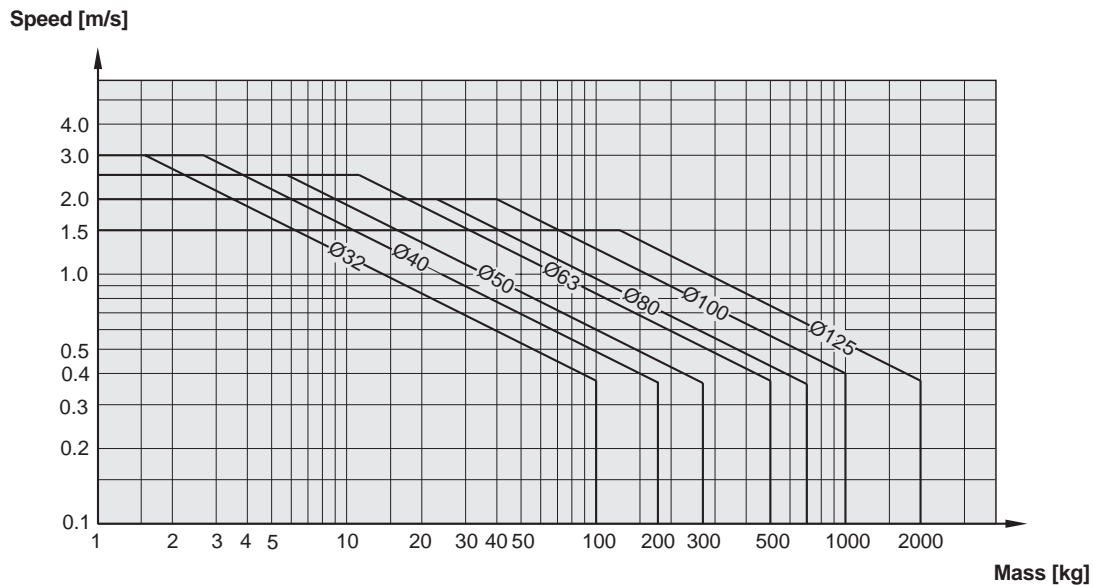


**Cushioning Characteristics**

The diagram below is used for sizing of cylinders related to the cushioning capacity. The maximum cushioning capacity shown in the diagram assumes the following:

- Low load, i.e. low pressure drop across the piston
- Equilibrium speed
- Correctly adjusted cushioning screw
- 6 bar at cylinder port

The load is the sum of internal and external friction, plus any gravitational forces. At high relative load (pressure drop exceeding 1 bar), we recommend that for any given speed, the mass should be reduced by a factor of 2.5, or for a given mass, the speed should be reduced by a factor of 1.5. This is in relation to the maximum performance given in the diagram.



**Recommended Air Quality for Cylinders**

For best possible service life and trouble-free operation, ISO 8573-1 quality class 3.4.3 should be used. This means 5 µm filter (standard filter) dew point +3°C (+37°F) for indoor operation (a lower dew point should be selected for outdoor operation) and oil concentration 1.0 mg oil/m<sup>3</sup>, which is what a standard compressor with a standard filter gives.

**ISO 8573-1 Quality Classes**

Quality Class	Pollution		Water		Oil Max. Concentration (mg/m <sup>3</sup> )
	Particle Size (µm)	Max. Concentration (mg/m <sup>3</sup> )	Max Pressure Dew Point		
			(°C)	(°F)	
1	0.1	0.1	-70	-94	0.01
2	1	1	-40	-40	-0.1
3	5	5	-20	-4	1.0
4	15	8	+3	+37	5.0
5	40	10	+7	+44	25
6	–	–	+10	+50	–

## Guide for Selecting Suitable Tubing

The selection of the correct size of tubing is often based on experience, with no great thought to optimizing energy efficiency and cylinder velocity. This is usually acceptable, but making a rough calculation can result in worthwhile economic gains.

### The following is the basic principle:

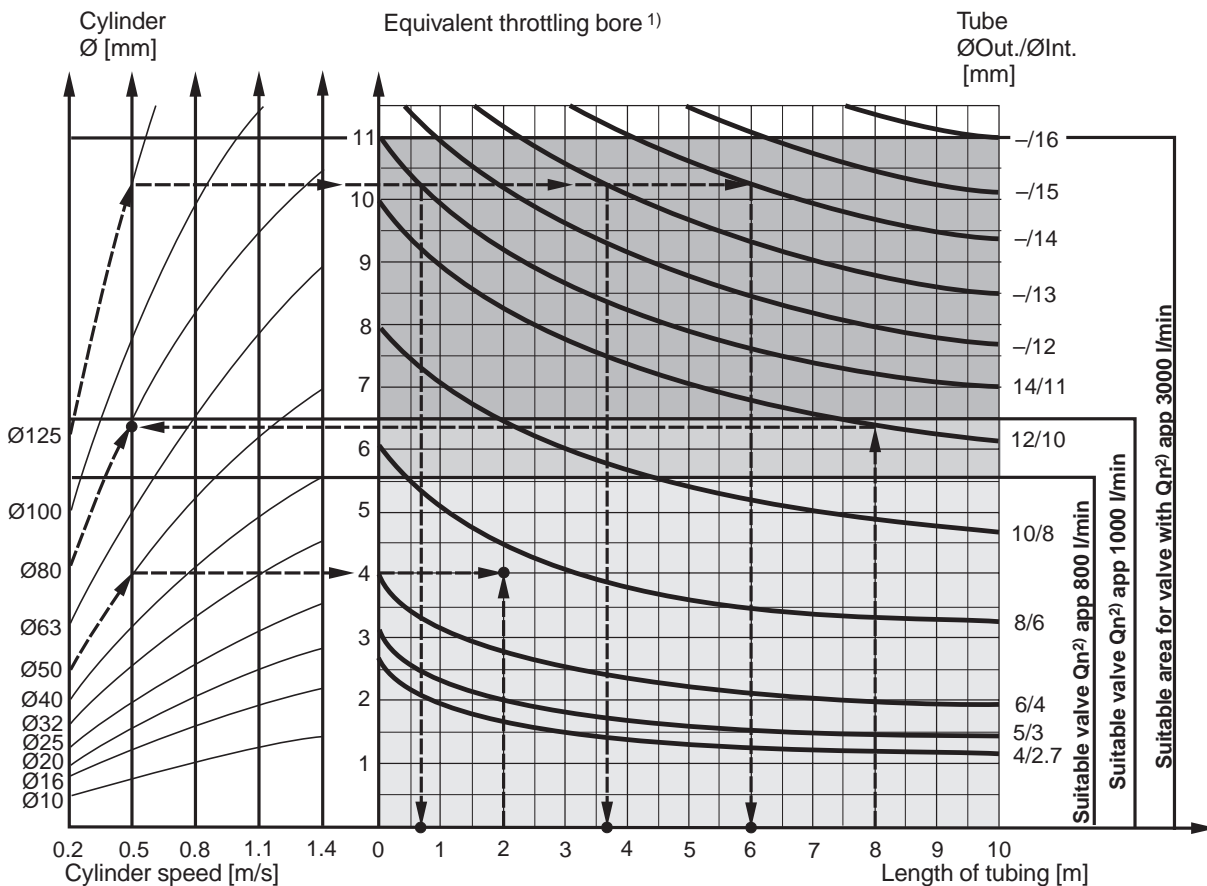
1. The primary line to the working valve could be oversized (this does not cause any extra air consumption and consequently does not create any extra costs in operation).
2. The tubes between the valve and the cylinder should, however, be optimized according to the principle that an insufficient bore throttles the flow and thus limits the cylinder speed, while an oversized pipe creates a dead volume which increases the air consumption and filling time.

The chart below is intended to help when selecting the correct size of tube to use between the valve and the cylinder.

### The following prerequisites apply:

The cylinder load should be about 50% of the theoretical force (= normal load). A lower load gives a higher velocity and vice versa. The tube size is selected as a function of the cylinder bore, the desired cylinder velocity and the tube length between the valve and the cylinder.

If you want to use the capacity of the valve to its maximum, and obtain maximum speed, the tubing should be chosen so that they at least correspond with the equivalent restriction diameter (see description below), so that the tubing does not restrict the total flow. This means that a short tubing must have at least the equivalent restriction diameter. If the tubing is longer, choose it from the table below. Straight fittings should be chosen for highest flow rates. (Elbow and banjo fittings cause restriction.)



- 1) The "equivalent throttling bore" is a long throttle (for example a tube) or a series of throttles (for example, through a valve) converted to a short throttle which gives a corresponding flow rate. This should not be confused with the "orifice" which is sometimes specified for valves. The value for the orifice does not normally take account of the fact that the valve contains a number of throttles.
- 2)  $Q_n$  is a measure of the valve flow capacity, with flow measured in litre per minute (l/min) at 6 bar(e) supply pressure and 1 bar pressure drop across the valve.

**P1D Rod Lock Version – Rod Lock Data**

**Connection**

The signal air for the locking device can be obtained directly from a main air supply, or from the air supply serving the valve that controls the cylinder itself. For controlled ON/OFF operation of the locking device, a separate quick-venting valve is used.

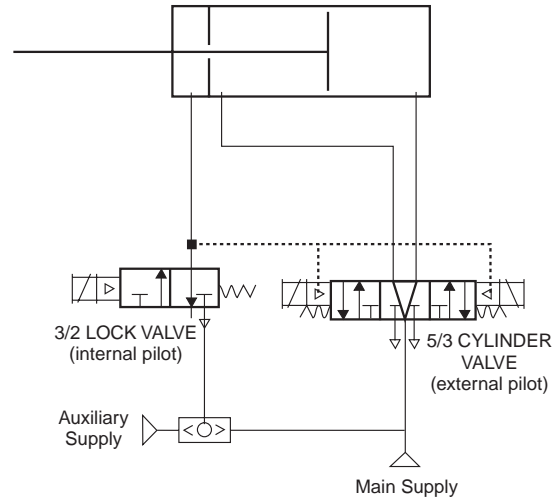
The piston rod should not be moving when the locking device is activated. The locking device is not intended to brake a movement in repeated sequences.

**Holding Forces**

Bore Size	Holding Forces	
	(N)	(lbs)
32mm	550	123
40mm	860	193
50mm	1345	303
63mm	2140	481
80mm	3450	755
100mm	5390	1211
125mm	8425	1894

**NOTE:** All P1D Rod Lock Versions are not intended for use in water service applications, or in environments that have high humidity levels and/or splashing fluids present.

**Sample Pneumatic Circuit**

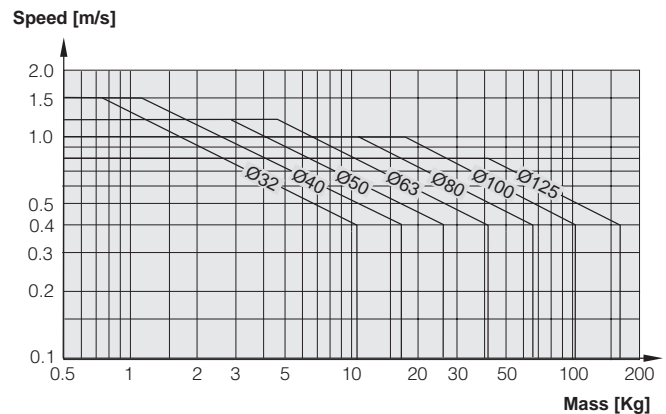


1. Lock valve must be maintained energized during cylinder motion, otherwise rod lock is engaged and cylinder valve shifts to mid position.
2. Cylinder valve must be maintained energized during extend or retract. Also keep energized at end of stroke until change of direction is desired.
3. Mid position of 5/3 Cylinder valve may be pressurized outlets if the combination of pressure load on the cylinder and inertia effects of the attached load do not exceed the holding force rating of the rod lock device, including allowance for wear.
4. Do not use cylinder lines for any logic functions — pressure levels vary too much.

**Use as a Brake**

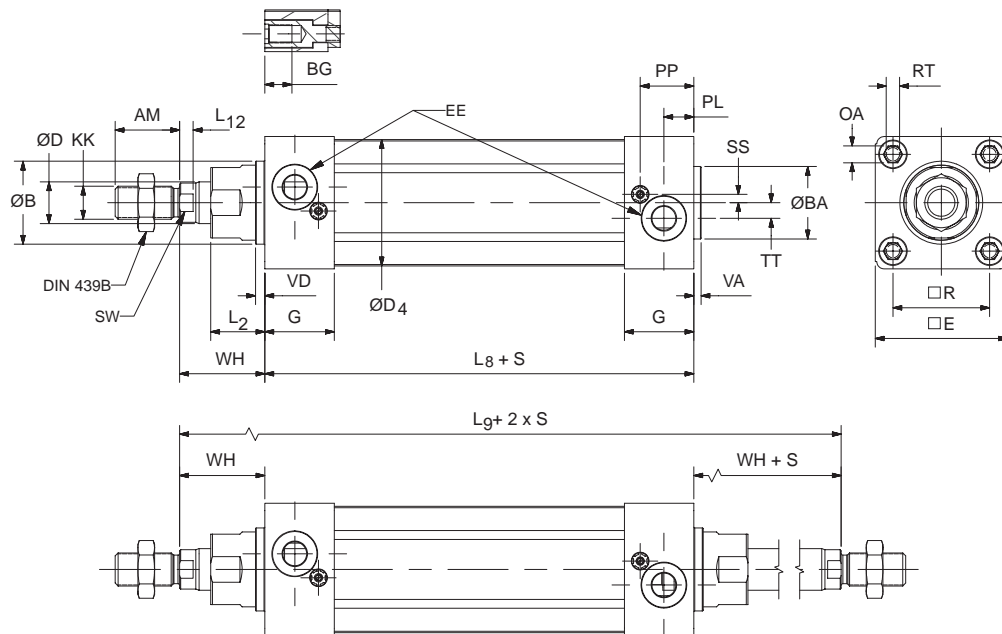
The chart to the right shows the maximum values for speed and braking mass if the cylinder is used as a brake. The cylinder should not be exposed to additional compressive forces as this significantly reduces the external mass that can be braked.

We recommend systems in which the cylinder does not act as a motor during braking. Heat is generated if the brake is used frequently, and this must be taken into account to ensure that the maximum temperature is not exceeded.





**P1D Removable Gland Version**



S=Stroke

**Dimensions**

Cylinder bore	AM mm	B mm	BA mm	BG mm	D mm	D4 mm	E mm	EE		G mm	KK	L2 mm	L8 mm	L9 mm	L12 mm
								BSPP <sup>1</sup>	NPTF/BSPT						
32	22	30	30	16	12	45.0	46.5	G1/8	1/8	28.5	M10x1.25	18	94	146	6.0
40	24	35	35	16	16	52.0	52.0	G1/4	1/4	33.0	M12x1.25	20	105	165	6.5
50	32	40	40	16	20	60.7	63.5	G1/4	1/4	33.5	M16x1.5	26	106	180	6.5
63	32	45	45	16	20	71.5	76.0	G3/8	3/8	39.5	M16x1.5	26	121	195	6.5
80	40	45	45	17	25	86.7	95.5	G3/8	3/8	39.5	M20x1.5	33	128	220	10.0
100	40	55	55	17	25	106.7	114.5	G1/2	1/2	44.5	M20x1.5	33	138	240	10.0
125	54	60	60	20	32	134.0	140.0	G1/2	1/2	51.0	M27x2	41	160	290	13.0

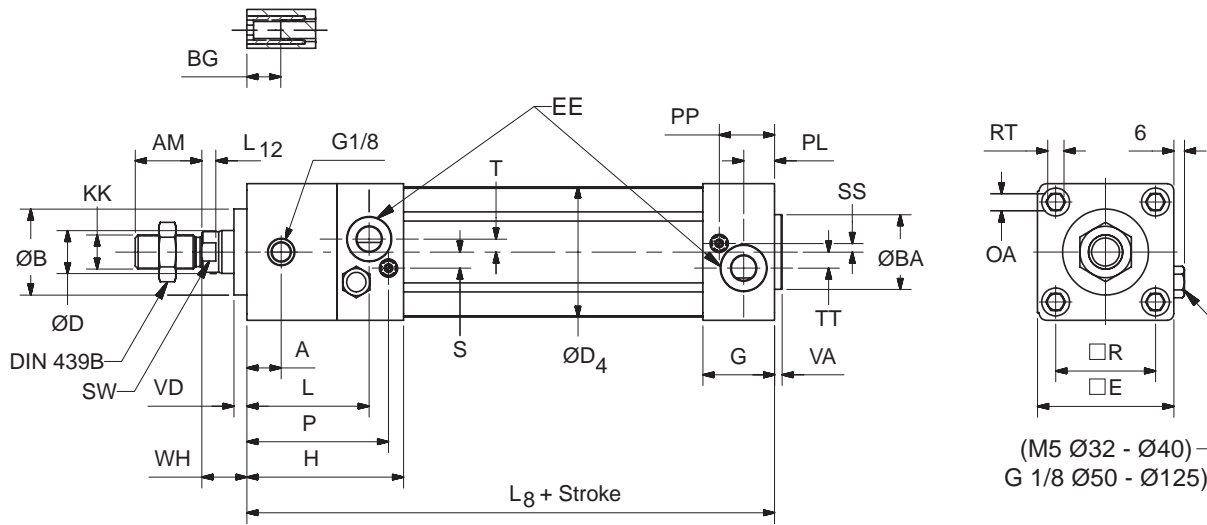
Cylinder bore	OA mm	PL mm	PP mm	R mm	RT	SS mm	SW mm	TT mm	VA mm	VD mm	WH mm
32	6	13	21.8	32.5	M6	6.5	10	4.5	3.5	4.5	26
40	6	14	21.9	38.0	M6	8.0	13	5.5	3.5	4.5	30
50	8	14	25.9	46.5	M8	4.0	17	7.5	3.5	4.5	37
63	8	16	27.4	56.5	M8	6.5	17	11.0	3.5	4.5	37
80	6	16	30.5	72.0	M10	0	22	15.0	3.5	4.5	46
100	6	18	35.8	89.0	M10	0	22	20.0	3.5	4.5	51
125	8	23	40.5	110.0	M12	0	27	17.5	5.5	6.5	65

<sup>1</sup> ISO 1179-1 with ISO 228-1 threads

**Tolerances**

Cylinder Bore	B	BA mm	L8 mm	L9 mm	R mm	Stroke tolerance
32	d11	d11	±0.4	±2	±0.5	+1/-0
40	d11	d11	±0.7	±2	±0.5	+1/-0
50	d11	d11	±0.7	±2	±0.6	+1/-0
63	d11	d11	±0.8	±2	±0.7	+1/-0
80	d11	d11	±0.8	±3	±0.7	+1/-0
100	d11	d11	±1.0	±3	±0.7	+1/-0
125	d11	d11	±1.0	±3	±1.1	+1/-0

**P1D Rod Lock Version**  
 (Version R or L)



**Dimensions**

Cylinder Bore	A mm	AM mm	B mm	BA mm	BG mm	D mm	D4 mm	E mm	EE <sup>1</sup>	G mm	H mm	KK	L mm	L8 mm	L12 mm
32	16	22	30	30	16	12	45.0	46.5	G1/8	28.5	71.5	M10x1.25	56.0	137	6.0
40	16	24	35	35	16	16	52.0	52.0	G1/4	33.0	77.0	M12x1.25	56.0	149	6.5
50	18	32	40	40	16	20	60.7	63.5	G1/4	33.5	80.5	M16x1.5	62.5	153	6.5
63	26	32	45	45	16	20	71.5	76.0	G3/8	39.5	96.5	M16x1.5	74.5	178	6.5
80	35	40	45	45	17	25	86.7	95.5	G3/8	39.5	110.5	M20x1.5	87.0	199	10.0
100	50	40	55	55	17	25	106.7	114.5	G1/2	44.5	132.5	M20x1.5	106.0	226	10.0
125	60	54	60	60	20	32	134.0	140.0	G1/2	51.0	145.0	M27x2	117.0	254	13.0

Cylinder Bore	OA mm	P mm	PL mm	PP mm	R mm	RT mm	S mm	SS mm	SW mm	T mm	TT mm	VA mm	VD mm	WH mm
32	6	64.8	13	21.8	32.5	M6	7	6.5	10	2.5	4.5	3.5	4.5	15
40	6	68.0	14	21.9	38.0	M6	9	8.0	13	2.0	5.5	3.5	4.5	16
50	8	73.5	14	25.9	46.5	M8	8	4.0	17	4.0	7.5	3.5	5.0	17
63	8	89.5	16	27.4	56.5	M8	8	6.5	17	2.0	11.0	3.5	5.0	17
80	—	101.5	16	30.5	72.0	M10	9	0	22	5.0	15.0	3.5	4.0	20
100	—	123.5	18	35.8	89.0	M10	12	0	22	6.0	20.0	3.5	4.0	20
125	—	136.0	23	40.5	110.0	M12	12	0	27	6.0	17.5	5.5	6.0	27

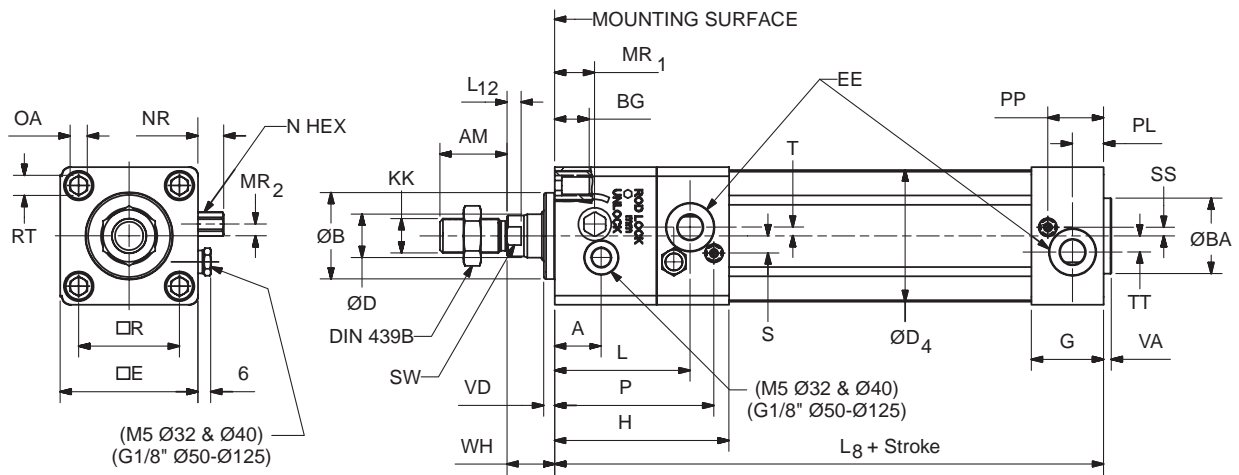
1 ISO 1179-1 with ISO 228-1 threads

**Tolerances**

Cylinder Bore	B mm	R mm	L8 mm	BA mm	Stroke-length Tolerance mm
32	d11	±0.5	±0.4	d11	+1/-0
40	d11	±0.5	±0.7	d11	+1/-0
50	d11	±0.6	±0.7	d11	+1/-0
63	d11	±0.7	±0.8	d11	+1/-0
80	d11	±0.7	±0.8	d11	+1/-0
100	d11	±0.7	±1.0	d11	+1/-0
125	d11	±1.1	±1.0	d11	+1/-0



**P1D Rod Lock Version with Manual Override  
(Version J)**



**Dimensions**

Cylinder Bore	A mm	AM mm	B mm	BA mm	BG mm	D mm	D4 mm	E mm	EE <sup>1</sup>	G mm	H mm	KK	L mm	L8 mm	L12 mm	MR1 mm	MR2 mm
32	27.0	22	30	30	16	12	45.0	46.5	G1/8	28.5	71.5	M10X1.25	56.0	137	6.0	16.0	3.0
40	27.0	24	35	35	16	16	52.0	52.0	G1/4	33.0	77.0	M12X1.25	56.0	149	6.5	16.0	3.0
50	21.5	32	40	40	16	20	60.7	63.5	G1/4	33.5	80.5	M16X1.5	62.5	153	6.5	18.5	5.5
63	39.0	32	45	45	16	20	71.5	76.0	G3/8	39.5	96.5	M16X1.5	74.5	178	6.5	22.0	4.0
80	48.5	40	45	45	17	25	86.7	95.5	G3/8	39.5	110.5	M20X1.5	97.0	—	10.0	15.0	19.8
100	65.0	40	55	55	17	25	106.7	114.5	G1/2	44.5	132.5	M20X1.5	116.0	—	10.0	15.0	20.8
125	71.0	54	60	60	20	32	134.0	140.0	G1/2	51.0	145.0	M27X2	127.0	—	13.0	19.0	23.0

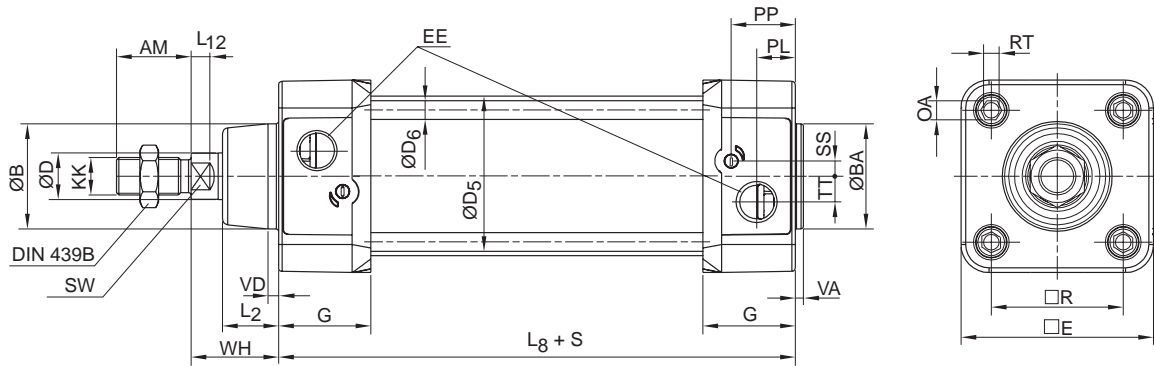
Cylinder Bore	N mm	NR mm	OA mm	P mm	PL mm	PP mm	R mm	RT	S mm	SS mm	SW mm	T mm	TT mm	VA mm	VD mm	WH mm
32	8	10.0	6	64.8	13	21.8	32.5	M6	7	6.5	10	2.5	4.5	3.5	4.5	15
40	8	10.0	6	68.0	14	21.9	38.0	M6	9	8.0	13	2.0	5.5	3.5	4.5	16
50	10	12.0	8	73.5	14	25.9	46.5	M8	8	4.0	17	4.0	7.5	3.5	5.0	17
63	10	12.0	8	89.5	16	27.4	56.5	M8	8	6.5	17	2.0	11.0	3.5	5.0	17
80	11	12.5	—	111.5	16	30.5	72.0	M10	9	0	22	5.0	15.0	3.5	—	30
100	11	12.5	—	133.5	18	35.8	89.0	M10	12	0	22	6.0	20.0	3.5	—	30
125	11	12.5	—	146.0	23	40.5	110.0	M12	12	0	27	6.0	17.5	5.5	—	37

1 ISO 1179-1 with ISO 228-1 threads

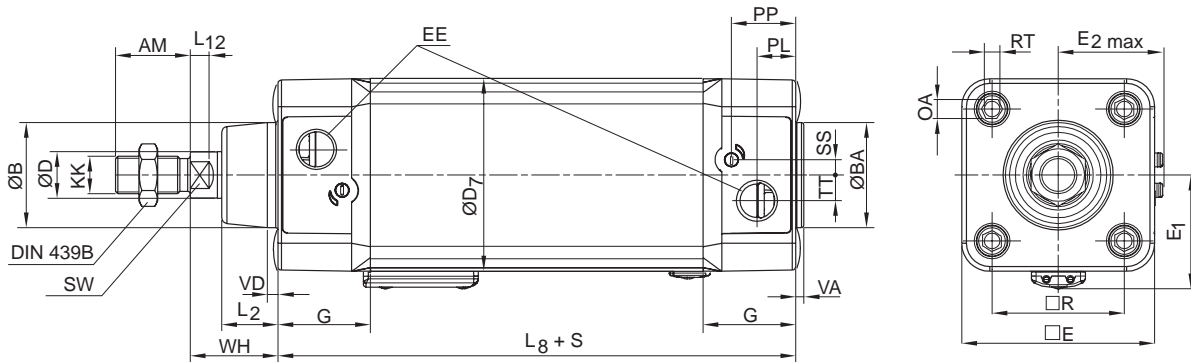
**Tolerances**

Cylinder Bore	B mm	R mm	L8 mm	BA mm	Stroke-length Tolerance mm
32	d11	±0.5	±0.4	d11	+1/-0
40	d11	±0.5	±0.7	d11	+1/-0
50	d11	±0.6	±0.7	d11	+1/-0
63	d11	±0.7	±0.8	d11	+1/-0
80	d11	±0.7	±0.8	d11	+1/-0
100	d11	±0.7	±1.0	d11	+1/-0
125	d11	±1.1	±1.0	d11	+1/-0

**P1D Tie-Rod Version (32-125mm)**



**P1D Clean Version**

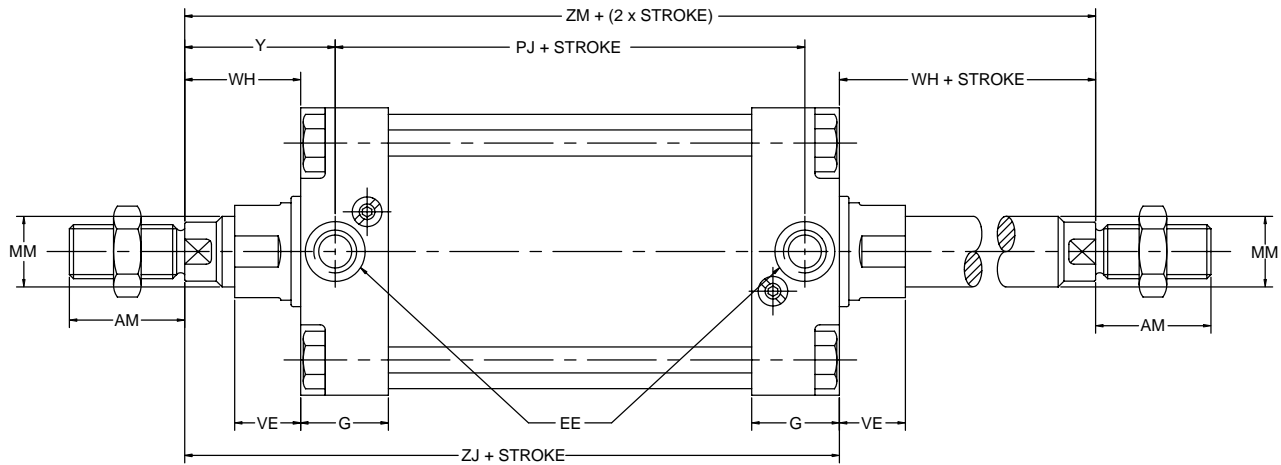
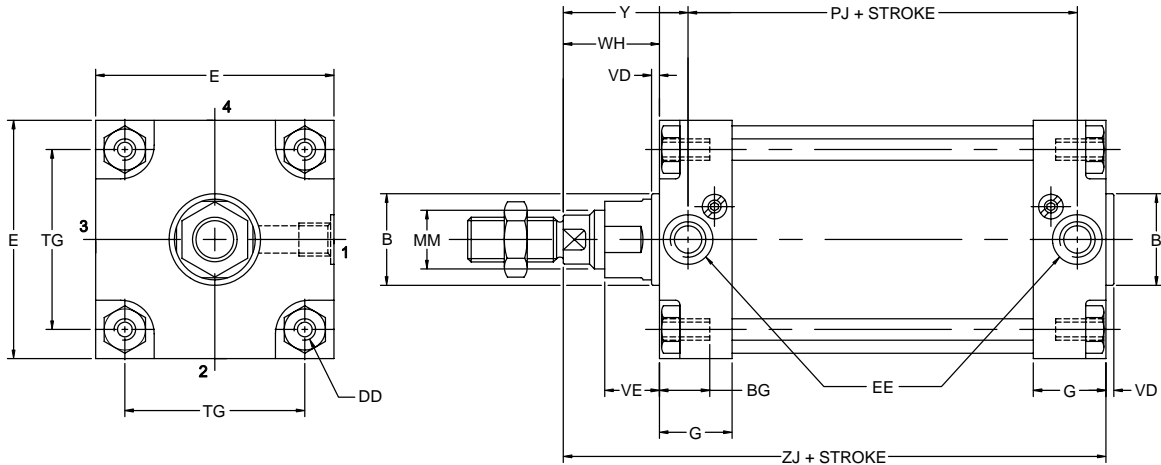


**Dimensions**

Cylinder Bore	D <sub>5</sub> mm	D <sub>6</sub> mm	D <sub>7</sub> mm	E <sub>1</sub> mm	E <sub>2</sub> max mm
32	36	5.3	49.6	32	5
40	45	5.3	57.3	36	6
50	55	7.1	69.3	42	6
63	68	7.1	82.3	49	5
80	85	8.9	99.3	57	5
100	105	8.9	117.6	68	6
125	132	10.7	142.8	81	6

Other dimensions, see page C15.

**P1D Tie-Rod Version (160-200mm)**



Rod End #1

Rod End #2

**Dimensions**

Cylinder Bore	AM mm	B d11 mm	BG mm	DD	E mm	EE		G mm	MM mm	TG mm	VD mm	VE mm	WH mm	Y mm	PJ <sup>1</sup> mm	ZJ <sup>1</sup> mm	ZM <sup>2</sup> mm
						BSPP <sup>3</sup>	NPTF/BSPT										
160	72	65	24	M16	177	G3/4	3/4	54	40	140	6	56	80	105	130	260	340
200	72	75	24	M16	214	G3/4	3/4	54	40	175	6	56	95	120	130	275	370

1 Add stroke

2 Add 2x stroke

3 ISO 1179-1 with ISO 228-1 threads

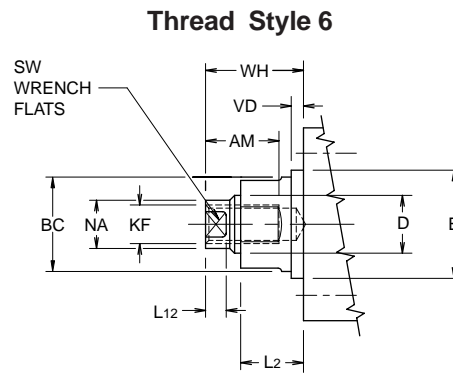
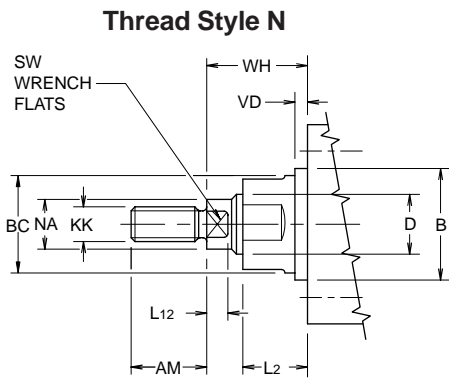
**Double Rod Cylinders**

Double rod option is available on Mounting Styles MX0, MS1, MF1, MF2 and MT4.

For double rod cylinders, it is assumed that the rod number and rod end are the same for both piston rods. On a double rod cylinder where the two rod ends are different, use a rod end of '3' and be sure to clearly state which rod end is to be assembled at which end.

**All Mountings Except MF1**

**NOTE:** Dimensions do not apply to Rod Lock Versions.



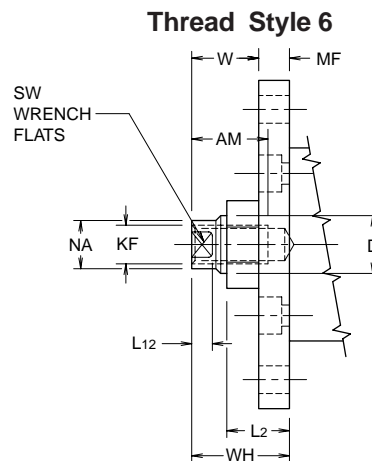
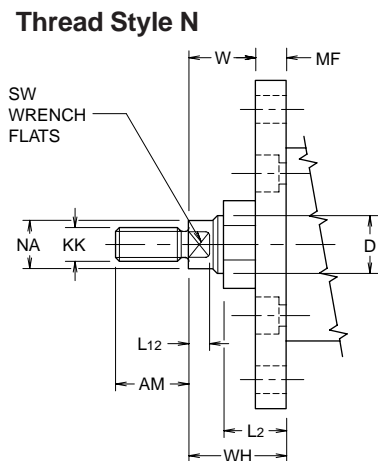
**“Special Thread”  
 Style 3**

Special thread, extension, rod eye, blank, etc are also available. To order, specify “Style 3” and provide desired dimensions for KF or KK, AM and WH. If otherwise special, furnish dimensioned sketch.

Bore	D	KK	KF	AM	B d11	BC	SW across flats	L12	NA	VD	L2	WH
32	12	M10x1.25	M8x1	22	30	27	10	6	11	4.5	18	26
40	16	M12x1.25	M10x1.25	24	35	32	13	6.5	15	4.5	20	30
50	20	M16x1.5	M14x1.5	32	40	36	17	6.5	19	4.5	26	37
63	20	M16x1.5	M14x1.5	32	45	36	17	6.5	19	4.5	26	37
80	25	M20x1.5	M18x1.5	40	45	41	22	10	24	4.5	33	46
100	25	M20x1.5	M18x1.5	40	55	41	22	10	24	4.5	33	51
125	32	M27x2	M24x2	54	60	50	27	13	31	6.5	41	65
160	40	M36x2	M30x2	72	65	60	36	16	39	6	56	80
200	40	M36x2	M30x2	72	75	60	36	16	39	6	56	95

**With MF1 Mounting**

**NOTE:** Dimensions do not apply to Rod Lock Versions.



**“Special Thread”  
 Style 3**

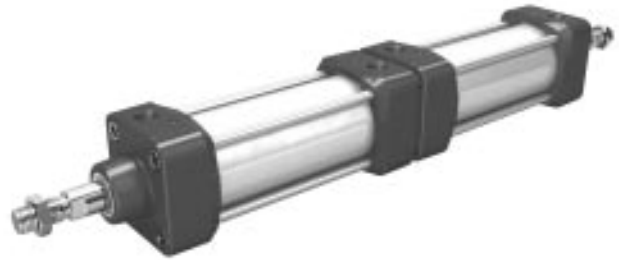
Special thread, extension, rod eye, blank, etc are also available. To order, specify “Style 3” and provide desired dimensions for KF or KK, AM and WH. If otherwise special, furnish dimensioned sketch.

Bore	D	KK	KF	AM	SW across flats	L12	MF	NA	L2	W	WH
32	12	M10x1.25	M8x1	22	10	6	10	11	18	16	26
40	16	M12x1.25	M10x1.25	24	13	6.5	10	15	20	20	30
50	20	M16x1.5	M14x1.5	32	17	6.5	12	19	26	25	37
63	20	M16x1.5	M14x1.5	32	17	6.5	12	19	26	25	37
80	25	M20x1.5	M18x1.5	40	22	10	16	24	33	30	46
100	25	M20x1.5	M18x1.5	40	22	10	16	24	33	35	51
125	32	M27x2	M24x2	54	27	13	20	31	41	45	65
160	40	M36x2	M30x2	72	36	16	20	39	56	60	80
200	40	M36x2	M30x2	72	36	16	25	39	56	70	95

### 3 and 4 Position Cylinders

This type of cylinder function consists of two cylinders installed back to back. Two cylinders with the same stroke give a 3-position cylinder with a symmetrical centre position, whereas different strokes give a 4 position cylinder where the two central positions can be calculated from the different stroke lengths.

3 and 4 position cylinders can be ordered in two ways.



**C**

### Factory-fitted P1D-T

P1D Tie-Rod Version cylinders are completed at the factory and are joined together as one unit by special tie-rods. See function options in model code.

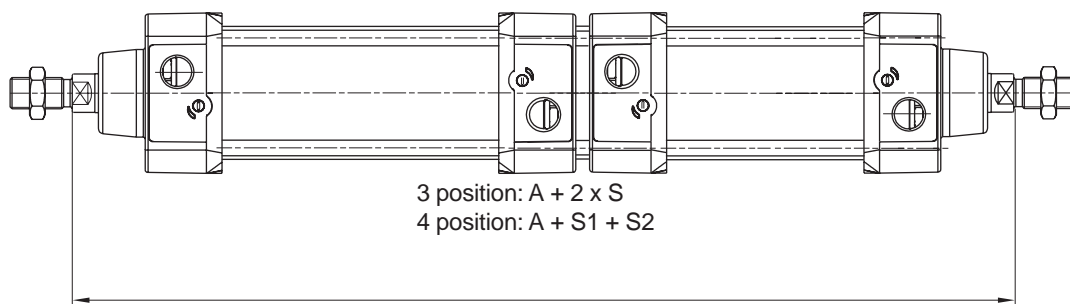
### Installation Kit for all Designs

There is an installation kit for cylinder bores 32 – 100 mm which makes it possible to join any two P1D cylinders together at any time to make a 3 or 4-position cylinder.

Please refer to cylinder mountings, page C28.

Cylinder Bore	A (mm)	
	P1D-T	P1D-S
32	247	256
40	277	286
50	293	306
63	323	336
80	355	373
100	385	403
125	461	–

S=Stroke



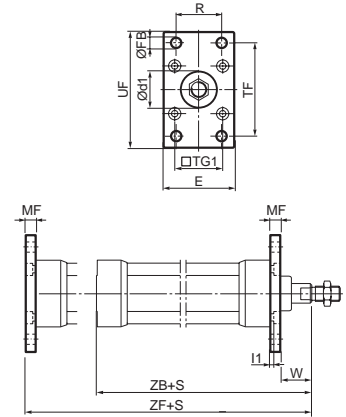
**Flange MF1  
Flange MF2**



Intended for fixed mounting of cylinder. Flange can be fitted to front or rear end cover of cylinder.

**Materials**

32-100mm bore flange: Surface-treated aluminum, black  
125-200mm bore flange: Steel, black  
Mounting screws acc. to DIN 6912: Zinc-plated steel 8.8  
Supplied complete with mounting screws for attachment to cylinder.



According to ISO MF1/MF2, VDMA 24 562, AFNOR

Bore mm	d1 H11 mm	FB H13 mm	TG1 mm	E mm	R JS14 mm	MF JS14 mm	TF JS14 mm	UF	I1 -0.5 mm	W mm	ZF mm	ZB mm	Weight kg	Part Number
32	30	7	32.5	45	32	10	64	80	5.0	16	130	123.5	0.23	<b>P1C-4KMBA</b>
40	35	9	38.0	52	36	10	72	90	5.0	20	145	138.5	0.28	<b>P1C-4LMBA</b>
50	40	9	46.5	65	45	12	90	110	6.5	25	155	146.5	0.53	<b>P1C-4MMBA</b>
63	45	9	56.5	75	50	12	100	120	6.5	25	170	161.5	0.71	<b>P1C-4NMBA</b>
80	45	12	72.0	95	63	16	126	150	8.0	30	190	177.5	1.59	<b>P1C-4PMBA</b>
100	55	14	89.0	115	75	16	150	170	8.0	35	205	192.5	2.19	<b>P1C-4QMBA</b>
125	60	16	110.0	140	90	20	180	205	10.5	45	245	230.5	3.78	<b>P1C-4RMB</b>
160	65	18	140.0	190	115	20	230	279	7.0	60	280	266	C.F.	<b>L075370160</b>
200	75	22	175.0	228	135	25	270	318	13.0	70	300	281	C.F.	<b>L075370200</b>

S = Stroke length

C.F. = Consult Factory

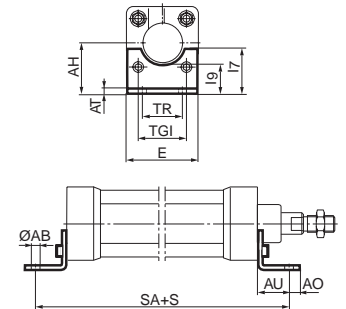
**Foot Bracket MS1**



Intended for fixed mounting of cylinder. Foot bracket can be fitted to front and rear end covers of cylinder.

**Materials**

Foot bracket: Surface-treated steel, black  
Mounting screws acc. to DIN 912: Zinc-plated steel 8.8  
Supplied in pairs with mounting screws for attachment to cylinder.



According to ISO MS1, VDMA 24 562, AFNOR

Bore mm	AB H14 mm	TG1 mm	E mm	TR JS14 mm	AO mm	AU mm	AH JS15 mm	I7 mm	AT mm	I9 JS14 mm	SA mm	Weight* kg	Part Number
32	7	32.5	45	32	10	24	32	30	4.5	17.0	142	0.06	<b>P1C-4KMF</b>
40	9	38.0	52	36	8	28	36	30	4.5	18.5	161	0.08	<b>P1C-4LMF</b>
50	9	46.5	65	45	13	32	45	36	5.5	25.0	170	0.16	<b>P1C-4MMF</b>
63	9	56.5	75	50	13	32	50	35	5.5	27.5	185	0.25	<b>P1C-4NMF</b>
80	12	72.0	95	63	14	41	63	49	6.5	40.5	210	0.50	<b>P1C-4PMF</b>
100	14	89.0	115	75	15	41	71	54	6.5	43.5	220	0.85	<b>P1C-4QMF</b>
125	16	110.0	140	90	22	45	90	71	8.0	60.0	250	1.48	<b>P1C-4RMF</b>
160	18	140.0	177	115	24	60	115	63.5	4.75	63.5	300	C.F.	<b>L075380160</b>
200	22	175.0	214	135	30	70	135	65	8.0	65.0	320	C.F.	<b>L075380200</b>

S = Stroke length

C.F. = Consult Factory

\*Weight per item

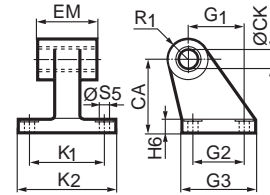
**Pivot Bracket with Rigid Bearing**



Intended for flexible mounting of cylinder. The pivot bracket can be combined with clevis bracket MP2.

**Materials**

Pivot bracket: Surface-treated aluminium, black  
 Bearing: Sintered oil-bronze bushing



According to CETOP RP 107 P, VDMA 24 562, AFNOR

Bore mm	CK H9 mm	S5 H13 mm	K1 JS14 mm	K2	G1 JS14 mm	G2 JS14 mm	EM mm	G3 mm	CA JS15 mm	H6 mm	R1 mm	Weight kg	Part Number
32	10	6.6	38	51	21	18	25.5	31	32	8	10.0	0.06	P1C-4KMD
40	12	6.6	41	54	24	22	27.0	35	36	10	11.0	0.08	P1C-4LMD
50	12	9.0	50	65	33	30	31.0	45	45	12	13.0	0.15	P1C-4MMD
63	16	9.0	52	67	37	35	39.0	50	50	12	15.0	0.20	P1C-4NMD
80	16	11.0	66	86	47	40	49.0	60	63	14	15.0	0.33	P1C-4PMD
100	20	11.0	76	96	55	50	59.0	70	71	15	19.0	0.49	P1C-4QMD
125	25	14.0	94	124	70	60	69.0	90	90	20	22.5	1.02	P1C-4RMD
160	30	14.0	118	156	97	89	88.5	126	115	25	31.0	C.F.	L075480160
200	30	16.0	122	162	105	89	88.5	130	135	30	31.0	C.F.	L075480200

C.F. = Consult Factory

**Swivel Eye Bracket (MP6)**

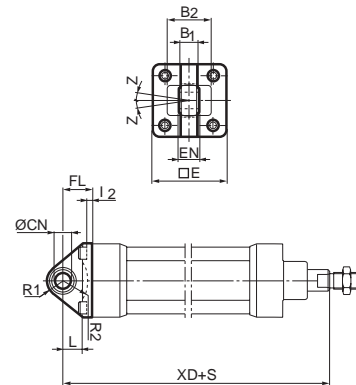


Intended for use together with clevis bracket GA

**Material**

Bracket: Surface-treated aluminium, black  
 (Cast iron for 160-200mm bores)  
 Swivel bearing acc. to DIN 648K: Hardened steel

Supplied complete with mounting screws for attachment to cylinder.



According to VDMA 24 562, AFNOR

Bore mm	E mm	B1 mm	B2 mm	EN mm	R1 mm	R2 mm	FL mm	I2 mm	L mm	CN H7 mm	XD mm	Z	Weight kg	Part Number
32	45	10.5	–	14	16	–	22	5.5	12	10	142	4°	0.08	P1C-4KMSA
40	52	12.0	–	16	18	–	25	5.5	15	12	160	4°	0.11	P1C-4LMSA
50	65	15.0	51	21	21	19	27	6.5	15	16	170	4°	0.20	P1C-4MMSA
63	75	15.0	–	21	23	–	32	6.5	20	16	190	4°	0.27	P1C-4NMSA
80	95	18.0	–	25	29	–	36	10.0	20	20	210	4°	0.52	P1C-4PMSA
100	115	18.0	–	25	31	–	41	10.0	25	20	230	4°	0.72	P1C-4QMSA
125	140	25.0	–	37	40	–	50	10.0	30	30	275	4°	1.53	P1C-4RMSA
160	177	30.0	–	43	44	41	55	4.0	41	35	315	16°	C.F.	L075420160
200	214	30.0	–	43	48	42	60	8.0	42	35	335	16°	C.F.	L075420200

S = Stroke length

C.F. = Consult Factory

**Clevis bracket MP2**



Intended for flexible mounting of cylinder. Clevis bracket MP2 can be combined with clevis bracket MP4.

**Materials**

Clevis bracket: Surface-treated aluminium, black for 32-160mm bores; Cast iron for 200mm bore

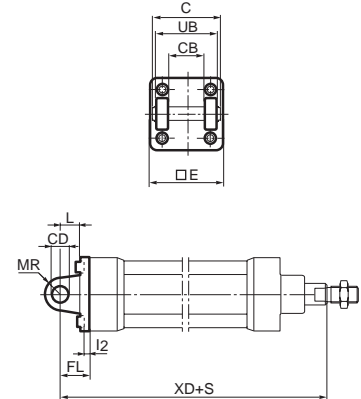
Pin: Surface hardened steel

Circlips according to DIN 471: Spring steel

Mounting screws acc. to DIN 912: Zinc-plated steel 8.8

Now in aluminum!

Supplied complete with mounting screws for attachment to cylinder.



According to ISO MP2, VDMA 24 562, AFNOR

Bore mm	C mm	E mm	UB h14 mm	CB H14 mm	FL ±0.2 mm	L mm	I2 mm	CD H9 mm	MR mm	XD mm	Weight kg	Part Number
32	53	45	45	26	22	13	5.5	10	10	142	0.08	P1C-4KMT
40	60	52	52	28	25	16	5.5	12	12	160	0.11	P1C-4LMT
50	68	65	60	32	27	16	6.5	12	12	170	0.14	P1C-4MMT
63	78	75	70	40	32	21	6.5	16	16	190	0.29	P1C-4NMT
80	98	95	90	50	36	22	10.0	16	16	210	0.36	P1C-4PMT
100	118	115	110	60	41	27	10.0	20	20	230	0.64	P1C-4QMT
125	139	140	130	70	50	30	10.0	25	25	275	1.17	P1C-4RMT
160	178	177	170	90	55	36	10.0	30	30	315	C.F.	L075390160
200	178	214	170	90	60	41	18.0	30	30	335	C.F.	L075390200

S = Stroke length

C.F. = Consult Factory

**Clevis Bracket MP4**



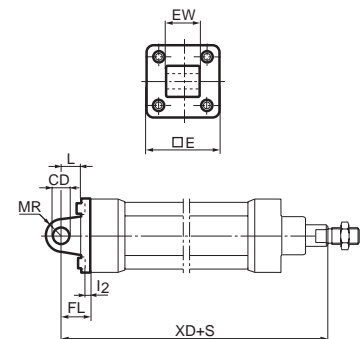
Intended for flexible mounting of cylinder. Clevis bracket MP4 can be combined with clevis bracket MP2.

**Materials**

Clevis bracket: Surface-treated aluminium, black for 32-125mm bores; Cast iron for 160-200mm bores

Mounting screws acc. to DIN 912: Zinc-plated steel 8.8

Supplied complete with mounting screws for attachment to cylinder.



According to ISO MP4, VDMA 24 562, AFNOR

Bore mm	E mm	EW mm	FL mm	L ±0.2 mm	I2 mm	CD mm	MR H9 mm	XD mm	Weight kg	Part Number
32	45	26	22	13	5.5	10	10	142	0.09	P1C-4KME
40	52	28	25	16	5.5	12	12	160	0.13	P1C-4LME
50	65	32	27	16	6.5	12	12	170	0.17	P1C-4MME
63	75	40	32	21	6.5	16	16	190	0.36	P1C-4NME
80	95	50	36	22	10.0	16	16	210	0.46	P1C-4PME
100	115	60	41	27	10.0	20	20	230	0.83	P1C-4QME
125	140	70	50	30	10.0	25	25	275	1.53	P1C-4RME
160	177	90	55	36	13.5	30	30	315	C.F.	L075410160
200	214	90	60	41	18.0	30	30	335	C.F.	L075410200

S = Stroke length

C.F. = Consult Factory

**Clevis Bracket GA**

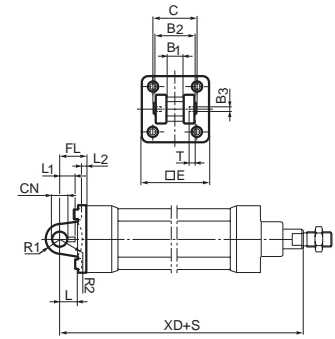


Now in aluminium!

Intended for flexible mounting of cylinder. Clevis bracket GA can be combined with pivot bracket with swivel bearing, swivel eye bracket and swivel rod eye.

**Materials**

- Clevis bracket: Surface-treated aluminium
- Pin: Surface hardened steel
- Locking pin: Spring steel
- Circlips according to DIN 471: Spring steel
- Mounting screws acc. to DIN 912: Zinc-plated steel 8.8
- Supplied complete with mounting screws for attachment to cylinder.



According to VDMA 24 562, AFNOR

Bore mm	C mm	E mm	B2 d12 mm	B1 H14 mm	T mm	B3 mm	R2 mm	L1 mm	FL ±0.2 mm	I2 mm	L mm	CN F7 mm	R1 mm	XD mm	Weight kg	Part Number
32	41	45	34	14	3	3.3	17	11.5	22	5.5	12	10	11	142	0.09	<b>P1C-4KMCA</b>
40	48	52	40	16	4	4.3	20	12.0	25	5.5	15	12	13	160	0.13	<b>P1C-4LMCA</b>
50	54	65	45	21	4	4.3	22	14.0	27	6.5	17	16	18	170	0.17	<b>P1C-4MMCA</b>
63	60	75	51	21	4	4.3	25	14.0	32	6.5	20	16	18	190	0.36	<b>P1C-4NMCA</b>
80	75	95	65	25	4	4.3	30	16.0	36	10.0	20	20	22	210	0.58	<b>P1C-4PMCA</b>
100	85	115	75	25	4	4.3	32	16.0	41	10.0	25	20	22	230	0.89	<b>P1C-4QMCA</b>
125	110	140	97	37	6	6.3	42	24.0	50	10.0	30	30	30	275	1.75	<b>P1C-4RMCA</b>
160	140	178	122	43	6	6.3	46	26.5	55	10.0	37	35 h9	36	C.F.	C.F.	<b>L075510160</b>
200	175	218	122	43	6	6.3	49	26.5	60	11.5	40	35 h9	38	C.F.	C.F.	<b>L075510200</b>

S = Stroke length

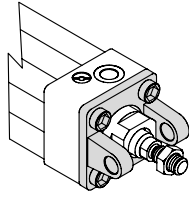
C.F. = Consult Factory

**Stainless Steel Pin Set GA**

- Materials
- Pin: Stainless steel
- Locking pin: Stainless steel
- Circlips according to DIN 471: Stainless steel

Bore mm	Weight kg	Part Number
32	0.05	<b>9301054311</b>
40	0.06	<b>9301054312</b>
50	0.07	<b>9301054313</b>
63	0.07	<b>9301054314</b>
80	0.17	<b>9301054315</b>
100	0.31	<b>9301054316</b>
125	0.54	<b>9301054317</b>

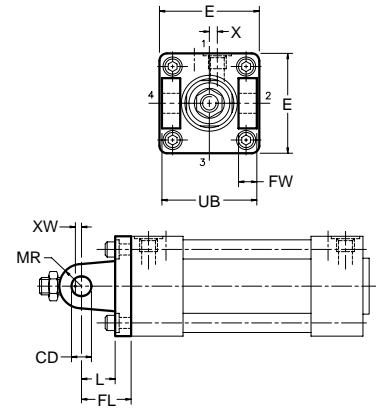
**Head Detachable Clevis MP7**



Intended for flexible mounting of cylinder

**Materials**

Clevis bracket: Cast iron for 32-63mm bores;  
 Surface treated aluminum, black for 80-200mm bores  
 Mounting screws acc. to DIN 912: Zinc-plated steel 8.8  
 Supplied complete with mounting screws for attachment to cylinder.



According to ISO MP7, VDMA 24 562, AFNOR

Bore	CD mm	E mm	FL mm	FW mm	L mm	MR mm	UB mm	XW mm	Part Number
32	10	46.5	22	8	12	10	45	4	L075400032
40	12	52	25	9	15	12	52	5	L075400040
50	12	63.5	27	10	15	13	60	10	L075400050
63	16	76	32	15	20	16	70	5	L075400063
80	16	95.5	36	20	20	17	90	10	L075400080
100	20	114.5	41	25	25	21	110	10	L075400100
125	25	140	50	30	35	25	130	15	L075400125
160	30	177	55	40	36	30	170	25	L075400160
200	30	214	60	40	41	30	170	35	L075400200

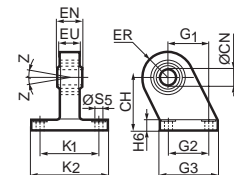
**Pivot Bracket with Swivel Bearing**



Intended for use together with clevis bracket GA.

**Material**

Pivot bracket: Surface-treated steel, black  
 Swivel bearing acc. to DIN 648K: Hardened steel



According to VDMA 24 562, AFNOR

Bore mm	CN H7 mm	S5 H13 mm	K1 JS14 mm	K2 mm	EU mm	G1 JS14 mm	G2 JS14 mm	EN mm	G3 mm	CH JS15 mm	H6 mm	ER mm	Z	Weight kg	Part Number
32	10	6.6	38	51	10.5	21	18	14	31	32	10	16	4°	0.18	P1C-4KMA
40	12	6.6	41	54	12.0	24	22	16	35	36	10	18	4°	0.25	P1C-4LMA
50	16	9.0	50	65	15.0	33	30	21	45	45	12	21	4°	0.47	P1C-4MMA
63	16	9.0	52	67	15.0	37	35	21	50	50	12	23	4°	0.57	P1C-4NMA
80	20	11.0	66	86	18.0	47	40	25	60	63	14	28	4°	1.05	P1C-4PMA
100	20	11.0	76	96	18.0	55	50	25	70	71	15	30	4°	1.42	P1C-4QMA
125	30	14.0	94	124	25.0	70	60	37	90	90	20	40	4°	3.10	P1C-4RMA

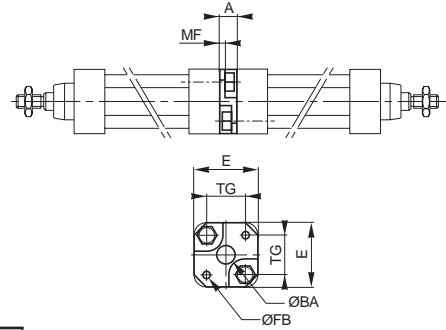
**Mounting Kit**



Mounting kit for back to back mounted cylinders, 3 and 4 position cylinders.

**Material**

Mounting: Aluminium  
 Mounting screws: Zinc-plated steel 8.8



**C**

Bore mm	E mm	TG mm	ØFB mm	MF mm	A mm	ØBA mm	Weight kg	Part Number
32	50	32.5	6.5	5	16	30	0.060	<b>P1E-6KB0</b>
40	60	38.0	6.5	5	16	35	0.078	<b>P1E-6LB0</b>
50	66	46.5	8.5	6	20	40	0.162	<b>P1E-6MB0</b>
63	80	56.5	8.5	6	20	45	0.194	<b>P1E-6NB0</b>
80	100	72.0	10.5	8	25	45	0.450	<b>P1E-6PB0</b>
100	118	89.0	10.5	8	25	55	0.672	<b>P1E-6QB0</b>

**Pivot Bracket for MT4**

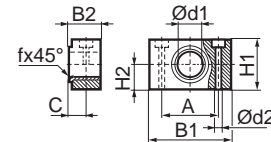


Intended for use together with central trunnion MT4.

**Material**

Pivot bracket: Surface-treated aluminium  
 Bearing acc. to DIN 1850 C: Sintered oil-bronze bushing

Supplied in pairs.



According to ISO, VDMA 24 562, AFNOR

Bore mm	B1 mm	B2 mm	A mm	C mm	d1 mm	d2 H13 mm	H1 mm	H2 mm	fx45° min mm	Weight* kg	Part Number
32	46	18.0	32	10.5	12	6.6	30	15	1.0	0.04	<b>9301054261</b>
40	55	21.0	36	12.0	16	9.0	36	18	1.6	0.07	<b>9301054262</b>
50	55	21.0	36	12.0	16	9.0	36	18	1.6	0.07	
63	65	23.0	42	13.0	20	11.0	40	20	1.6	0.12	<b>9301054264</b>
80	65	23.0	42	13.0	20	11.0	40	20	1.6	0.12	<b>9301054266</b>
100	75	28.5	50	16.0	25	14.0	50	25	2.0	0.21	
125	75	28.5	50	16.0	25	14.0	50	25	2.0	0.21	

\*Weight per item

**Intermediate Trunnion MT4**



Standard\*



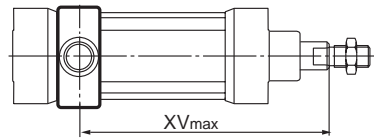
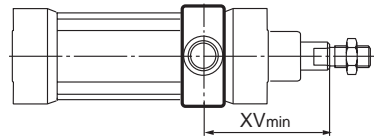
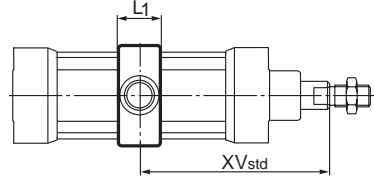
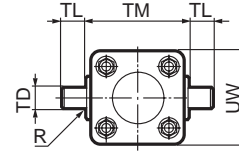
Tie Rod Version

Intended for articulated mounting of cylinder. The trunnion is factory-fitted at an optional location. Order by specifying Mounting Style G or 7 and providing the desired XV dimension (3-digit measure in mm). **See page C9 for Ordering Information.** Combined with pivot bracket for MT4 for 32-125mm bores.

**Material:**

Trunnion: Zinc plated steel (Cast iron for 160-200mm bores)

\*Standard mounting is for the Standard cylinder body and is permanently affixed by the factory.



According to ISO MT4, VDMA 24 562, AFNOR

Bore mm	TM h14 mm	TL h14 mm	TD e9 mm	R mm	UW mm	L1 mm	X1 mm	XV <sub>min</sub> mm	X2 mm	Weight kg
32	50	12	12	1.0	46	15	73.0	62.0	84.0	0.13
40	63	16	16	1.6	59	20	82.5	73.0	92.0	0.31
50	75	16	16	1.6	69	20	90.0	80.5	99.5	0.37
63	90	20	20	1.6	84	25	97.5	89.5	106.0	0.69
80	110	20	20	1.6	102	25	110.0	98.0	122.0	0.89
100	132	25	25	2.0	125	30	120.0	110.5	129.5	1.58
125	160	25	25	2.0	155	32	145.0	132.0	158.0	2.60
160	200	32	32	2.5	190	70	C.F.	169	C.F.	C.F.
200	250	32	32	2.5	242	70	C.F.	184	C.F.	C.F.

$XV_{std} = X1 + \text{Stroke length}/2$

$XV_{max} = X2 + \text{Stroke length}$

C.F. = Consult Factory

**Flange Mounted Trunnion**

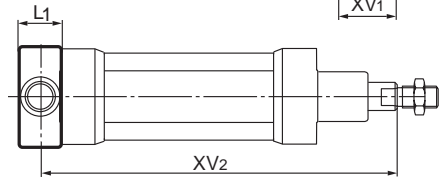
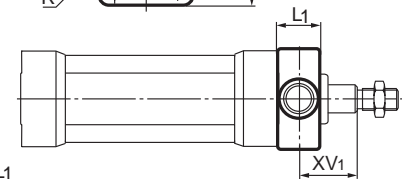
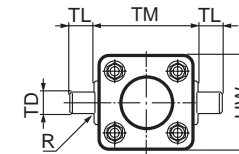


Intended for articulated mounting of cylinder. This trunnion can be flange mounted on the front or rear end cover of all P1D cylinders. If you choose, you can order a complete cylinder with factory-fitted flange mounted trunnion – see the ordering information on pages C4 and C5. Individual trunnions have part numbers as shown below.

**Material**

Trunnion: zinc plated steel  
 Screws: zinc plated steel, 8.8

Delivered complete with mounting screws for attachment to the cylinder



According to ISO MT4, VDMA 24 562, AFNOR

Bore mm	TM h14 mm	TL h14 mm	TD e9 mm	R mm	UW mm	L1 mm	XV <sub>1</sub> mm	X mm	Weight kg	Part Number
32	50	12	12	1.0	46	14	19.0	127.0	0.17	P1D-4KMYF
40	63	16	16	1.6	59	19	20.5	144.5	0.43	P1D-4LMYF
50	75	16	16	1.6	69	19	27.5	152.5	0.55	P1D-4MMYF
63	90	20	20	1.6	84	24	25.0	170.0	1.10	P1D-4NMYF
80	110	20	20	1.6	102	24	34.0	186.0	1.66	P1D-4PMYF
100	132	25	25	2.0	155	29	36.5	203.5	3.00	P1D-4QMYF

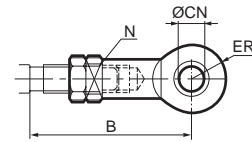
$XV_2 = X + \text{Stroke length}$



**Swivel Rod Eye**

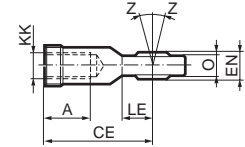


Swivel rod eye for articulated mounting of cylinder.  
Swivel rod eye can be combined with clevis bracket GA.  
Maintenance-free.



**Materials**

Swivel rod eye: Zinc-plated steel  
Swivel bearing according to DIN 648K: Hardened steel



**Stainless Steel  
Swivel Rod Eye**

**Materials**

Swivel rod eye: Stainless steel  
Swivel bearing according to DIN 648K: Stainless steel  
Use stainless steel nut (see page C31) with stainless steel swivel rod eye.

According to ISO 8139

Bore mm	A mm	B min mm	B max mm	CE mm	CN H9 mm	EN h12 mm	ER mm	KK	LE min mm	N mm	O mm	Z	Weight kg	Part Number	Stainless Steel Part Number
32	20	48.0	55	43	10	14	14	M10x1.25	15	17	10.5	12°	0.08	P1C-4KRS	P1S-4JRT
40	22	56.0	62	50	12	16	16	M12x1.25	17	19	12.0	12°	0.12	P1C-4LRS	P1S-4LRT
50	28	72.0	80	64	16	21	21	M16x1.5	22	22	15.0	15°	0.25	P1C-4MRS	P1S-4MRT
63	28	72.0	80	64	16	21	21	M16x1.5	22	22	15.0	15°	0.25		
80	33	87.0	97	77	20	25	25	M20x1.5	26	32	18.0	15°	0.46	P1C-4PRS	P1S-4PRT
100	33	87.0	97	77	20	25	25	M20x1.5	26	32	18.0	15°	0.46		
125	51	123.5	137	110	30	37	35	M27x2	36	41	25.0	15°	1.28	P1C-4RRS	P1S-4RRT
160/200	56	C.F.	C.F.	125	35*	43	40	M36x2	40	50	28.0	15°	C.F.	L075470036	C.F.

\*H7

C.F. = Consult Factory

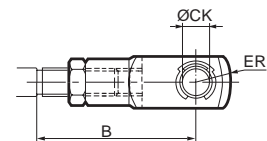
**Clevis**



Clevis for articulated mounting of cylinder.

**Material**

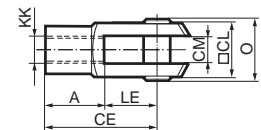
Clevis, clip: Galvanized steel  
Pin: Hardened steel



**Stainless Steel Clevis**

**Material**

Clevis: Stainless steel  
Pin: Stainless steel  
Circlips according to DIN 471: Stainless steel



According to ISO 8140

Bore mm	A mm	B min mm	B max mm	CE mm	CK h11/E9 mm	CL mm	CM mm	ER mm	KK	LE mm	O mm	Weight kg	Part Number	Stainless Steel Part Number
32	20	45.0	52	40	10	20	10	16	M10x1.25	20	28.0	0.09	P1C-4KRC	P1S-4JRD
40	24	54.0	60	48	12	24	12	19	M12x1.25	24	32.0	0.15	P1C-4LRC	P1S-4LRD
50	32	72.0	80	64	16	32	16	25	M16x1.5	32	41.5	0.35	P1C-4MRC	P1S-4MRD
63	32	72.0	80	64	16	32	16	25	M16x1.5	32	41.5	0.35		
80	40	90.0	100	80	20	40	20	32	M20x1.5	40	50.0	0.75	P1C-4PRC	P1S-4PRD
100	40	90.0	100	80	20	40	20	32	M20x1.5	40	50.0	0.75		
125	56	123.5	137	110	30	55	30	45	M27x2	54	72.0	2.10	P1C-4RRC	P1S-4RRD
160/200	71	C.F.	C.F.	144	35	70	35	57	M36x2	72	95	C.F.	L075490036	C.F.

C.F. = Consult Factory

**Flexo Coupling**

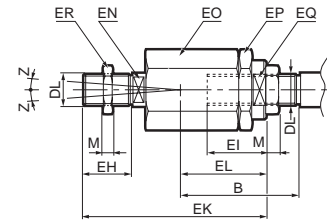


Flexo coupling for articulated mounting of piston rod. Flexo fitting is intended to take up axial angle errors within a range of  $\pm 4^\circ$ .

**Material**

Flexo coupling, nut: Zinc-plated steel  
 Socket: Hardened steel

Supplied complete with galvanized adjustment nut.



Bore mm	B min mm	B max mm	DL	EH mm	EI mm	EK mm	EL mm	EN mm	EO mm	EP mm	EQ mm	ER mm	M mm	Z	Weight kg	Part Number
32	36.0	43	M10x1.25	20	23	70	31	12	30	30	19	30	5.0	4°	0.21	P1C-4KRF
40	37.0	43	M12x1.25	23	23	67	31	12	30	30	19	30	6.0	4°	0.22	P1C-4LRF
50	53.0	61	M16x1.5	40	32	112	45	19	41	41	30	41	8.0	4°	0.67	P1C-4MRF
63	53.0	61	M16x1.5	40	32	112	45	19	41	41	30	41	8.0	4°	0.67	
80	57.0	67	M20x1.5	39	42	122	56	19	41	41	30	41	10.0	4°	0.72	P1C-4PRF
100	57.0	67	M20x1.5	39	42	122	56	19	41	41	30	41	10.0	4°	0.72	
125	75.5	89	M27x2	48	48	145	60	24	55	55	32	55	13.5	4°	1.80	P1C-4RRF
160/200	C.F.	C.F.	M36x2	72	78	251	C.F.	36	75	75	50	55	18.0	4°	C.F.	L075530036

C.F. = Consult Factory

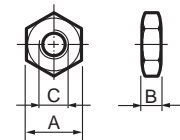
**Nuts**



Intended for fixed mounting of accessories to the piston rod.

Material: Zinc-plated steel

All P1D cylinders are delivered with a zinc-plated steel piston rod nut, except P1D Clean, which is delivered with a stainless steel piston rod nut instead.



**Stainless Steel Nut**

Material: Stainless steel A2

All P1D cylinders are delivered with a zinc-plated steel piston rod nut, except P1D Clean, which is delivered with a stainless steel piston rod nut instead.

**Acid-proof nut**

Material: Acid-proof steel A4

Cylinders with acid-proof piston rod are supplied with nut of acid-proof steel

According to DIN 439 B

Bore mm	A mm	B mm	C	Weight kg	Part Numbers		
					Steel	Stainless Steel	Acid-Proof
32	17	5.0	M10x1.25	0.007	9128985601	9126725404	0261109919
40	19	6.0	M12x1.25	0.010	0261109910	9126725405	0261109920
50	24	8.0	M16x1.5	0.021	9128985603	9126725406	0261109917
63	24	8.0	M16x1.5	0.021			
80	30	10.0	M20x1.5	0.040	0261109911	0261109921	0261109916
100	30	10.0	M20x1.5	0.040			
125	41	13.5	M27x2	0.100	0261109912	0261109922	0261109918
160/200	55	18.0	M36x2	C.F.	L075540036	C.F.	C.F.

C.F. = Consult Factory



**Screw Set for MP2, MP4, MS1 and GA**



Set of stainless steel screws for fitting clevis brackets MP2, MP4 and GA onto the cylinder. The screws have an internal hexagonal head and are used in special environments, e.g. the food industry, or where there are extra demands for protection against corrosion.

Material:  
According to DIN 912, Stainless steel, A2

4 pcs per pack.

Bore mm	Weight kg	Part Number
32	0.02	9301054321
40	0.02	9301054321
50	0.05	9301054322
63	0.05	9301054322
80	0.09	9301054323
100	0.09	9301054323
125	0.15	9301054324

C

**Screw set for MF1/MF2**



Set of stainless steel screws for fitting flanges MF1/MF2 onto the cylinder. The screws have an internal hexagonal head and are used in special environments, e.g. the food industry, or where there are extra demands for protection against corrosion.

Material:  
According to DIN 6912, Stainless steel, A2

4 pcs per pack

Bore mm	Weight kg	Part Number
32	0.02	9301054331
40	0.02	9301054331
50	0.04	9301054332
63	0.04	9301054332
80	0.07	9301054333
100	0.07	9301054333
125	0.12	9301054334

**Sealing plugs**



Set of sealing plugs to be fitted in unused end covers. The plugs can be used for all P1D cylinders to avoid collecting dirt and fluids in the end cover screw recesses.

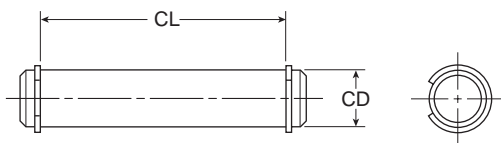
Material:  
Polyamid PA

4 pcs per pack

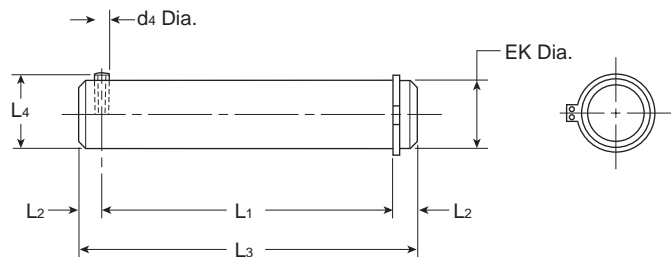
Bore mm	Weight kg	Part Number
32	0.01	9121742201
40	0.01	9121742201
50	0.02	9121742202
63	0.02	9121742202
80	0.02	9121742203
100	0.02	9121742203
125	0.03	9121742204

**Pivot Pin Sets for 160-200mm Bore Cylinder Accessories**

**For Clevis Bracket MP2**



**For Rear Swivel Eye MP6**



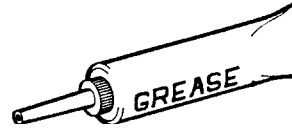
Bore	CD	CL	Part Number
160/200	30	170.50	L075500160

Bore	EK	d4	L1	L2	L3	L4	Part Number
160/200	35	6	119	7	131	41	L075520160

**Seal Kits**

Cyl. Bore	P1D Cylinder Version
mm	<b>Standard</b> P1D-S, P1D-T, P1D-C, P1D-F
32	SK032P1D01
40	SK040P1D01
50	SK050P1D01
63	SK063P1D01
80	SK080P1D01
100	SK100P1D01
125	SK125P1D01

**Grease for P1D**



Standard 30g 9127394541

**Gland Seal Kits**

Bore Size	Rod Dia.	Rod No.	RG-Rod Gland Cartridge Kit		RK-Rod Seal Kit	
			Nitrile Seals	Fluorocarbon Seals	Nitrile Seals	Fluorocarbon Seals
			Consisting of: 1 each items #14, 41, 45 & 104		Consisting of: 1 each items #14, 41, 45 & 104	
mm	mm		Part No.	Part No.	Part No.	Part No.
32	12	1	RG0P1D0121	RG0P1D0125	RK0P1D0121	RK0P1D0125
40	16	1	RG0P1D0161	RG0P1D0165	RK0P1D0161	RK0P1D0165
50 & 63	20	1	RG0P1D0201	RG0P1D0205	RK0P1D0201	RK0P1D0205
80 & 100	25	1	RG0P1D0251	RG0P1D0255	RK0P1D0251	RK0P1D0255
125	32	1	RG0P1D0321	RG0P1D0325	RK0P1D0321	RK0P1D0325

**Piston & End Seal Kits**

Bore Size	PK – Piston Seal Kit		CB – Cylinder Body End Seal Kit	
	Consisting of: 2 each items # 42 & 47 plus 1 each items 121 and #159. NOTE: (Fluorocarbon seals do not include magnetic ring symbol #159.)		Consisting of: 2 each item #47	
	Nitrile Seals	Fluorocarbon Seals	Nitrile Seals	Fluorocarbon Seals
mm	Part No.	Part No.	Part No.	Part No.
32	PK032P1D01	PK032P1D05	CB032P1D01	CB032P1D05
40	PK040P1D01	PK040P1D05	CB040P1D01	CB040P1D05
50	PK050P1D01	PK050P1D05	CB050P1D01	CB050P1D05
63	PK063P1D01	PK063P1D05	CB063P1D01	CB063P1D05
80	PK080P1D01	PK080P1D05	CB080P1D01	CB080P1D05
100	PK100P1D01	PK100P1D05	CB100P1D01	CB100P1D05
125	PK125P1D01	PK125P1D05	CB125P1D01	CB125P1D05

**C**

## Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

**WARNING: ⚠ FAILURE OF THE CYLINDER, ITS PARTS, ITS MOUNTING, ITS CONNECTIONS TO OTHER OBJECTS, OR ITS CONTROLS CAN RESULT IN:**

- Unanticipated or uncontrolled movement of the cylinder or objects connected to it.
- Falling of the cylinder or objects held up by it.
- Fluid escaping from the cylinder, potentially at high velocity.

**THESE EVENTS COULD CAUSE DEATH OR PERSONAL INJURY BY, FOR EXAMPLE, PERSONS FALLING FROM HIGH LOCATIONS, BEING CRUSHED OR STRUCK BY HEAVY OR FAST MOVING OBJECTS, BEING PUSHED INTO DANGEROUS EQUIPMENT OR SITUATIONS, OR SLIPPING ON ESCAPED FLUID.**

Before selecting or using Parker (The Company) cylinders or related accessories, it is important that you read, understand and follow the following safety information. Training is advised before selecting and using The Company's products.

### 1.0 General Instructions

**1.1 Scope** – This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) cylinder products. This safety guide is a supplement to and is to be used with the specific Company publications for the specific cylinder products that are being considered for use.

**1.2 Fail Safe** – Cylinder products can and do fail without warning for many reasons. All systems and equipment should be designed in a fail-safe mode so that if the failure of a cylinder product occurs people and property won't be endangered.

**1.3 Distribution** – Provide a free copy of this safety guide to each person responsible for selecting or using cylinder products. Do not select or use The Company's cylinders without thoroughly reading and understanding this safety guide as well as the specific Company publications for the products considered or selected.

**1.4 User Responsibility** – Due to very wide variety of cylinder applications and cylinder operating conditions, The Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to The Company's design guidelines and do not necessarily meet the design guideline of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

**1.5 Additional Questions** – Call the appropriate Company technical service department if you have any questions or require any additional information. See the Company publication for the product being considered or used, or call 1-800-CPARKER, or go to [www.parker.com](http://www.parker.com), for telephone numbers of the appropriate technical service department.

### 2.0 Cylinder and Accessories Selection

**2.1 Seals** – Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult the "seal information page(s)" of the publication for the series of cylinders of interest.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

**2.2 Piston Rods** – Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.
- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Follow the recommendations of the "Piston Rod Selection Chart and Data" in the publication for the series of cylinders of interest. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod buckling.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston to rod joint.

**2.3 Cushions** – Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be reviewed by our engineering department.

**2.4 Cylinder Mountings** – Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

**2.5 Port Fittings** – Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end. The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure} \times \text{effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

### 3.0 Cylinder and Accessories Installation and Mounting

#### 3.1 Installation

**3.1.1** – Cleanliness is an important consideration, and cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.

**3.1.2** – Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.

**3.1.3** – Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

**3.1.4** – Sometimes it may be necessary to rotate the piston rod in order to thread the piston rod into the machine member. This operation must always be done with zero pressure being applied to either side of the piston. Failure to follow this procedure may result in loosening the piston to rod-threaded connection. In some rare cases the turning of the piston rod may rotate a threaded piston rod gland and loosen it from the cylinder head. Confirm that this condition is not occurring. If it does, re-tighten the piston rod gland firmly against the cylinder head.

For double rod cylinders it is also important that when attaching or detaching the piston rod from the machine member that the torque be applied to the piston rod end of the cylinder that is directly attaching to the machine member with the opposite end unrestrained. If the design of the machine is such that only the rod end of the cylinder opposite to where the rod attaches to the machine member can be rotated, consult the factory for further instructions.

### 3.2 Mounting Recommendations

**3.2.1** – Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

**3.2.2** – Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.

**3.2.3** – Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.

**3.2.4** – Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.

**3.2.5** – Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.

**3.2.6** – Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

### 4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

**4.1 Storage** – At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

**4.1.1** – Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.

**4.1.2** – Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.

**4.1.3** – Port protector plugs should be left in the cylinder until the time of installation.

**4.1.4** – If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

**4.1.5** – When cylinders are mounted on equipment that is stored outside for extended periods, exposed unpainted surfaces, e.g. piston rod, must be coated with a rust-inhibiting compound to prevent corrosion.

### 4.2 Cylinder Trouble Shooting

#### 4.2.1 – External Leakage

**4.2.1.1** – Rod seal leakage can generally be traced to worn or

damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to gland wear. If clearance is excessive, replace rod bushing and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

**4.2.1.2** – Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque tie rods as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorque as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

#### 4.2.2 – Internal Leakage

**4.2.2.1** – Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.

**4.2.2.2** – With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.

**4.2.2.3** – What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

#### 4.2.3 – Cylinder Fails to Move the Load

**4.2.3.1** – Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.

**4.2.3.2** – Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.

**4.2.3.3** – Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.

#### 4.3 Erratic or Chatter Operation

**4.3.1** – Excessive friction at rod gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.

**4.3.2** – Cylinder sized too close to load requirements – Reduce load or install larger cylinder.

**4.3.3** – Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

**4.4 Cylinder Modifications, Repairs, or Failed Component** – Cylinders as shipped from the factory are not to be disassembled and/or modified. If cylinders require modifications, these modifications must be done at company locations or by The Company's certified facilities. The Cylinder Division Engineering Department must be notified in the event of a mechanical fracture or permanent deformation of any cylinder component (excluding seals). This includes a broken piston rod, tie rod, mounting accessory or any other cylinder component. The notification should include all operation and application details. This information will be used to provide an engineered repair that will prevent recurrence of the failure.

It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

## Offer of Sale

The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and Divisions ("Company") and its authorized distributors, are hereby offered for sale at prices to be established by the Company, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such item, when communicated to the Company, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

**1. Terms and Conditions of Sale:** All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

**2. Payment:** Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

**3. Delivery:** Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

**4. Warranty:** Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from the Company. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.**

**NOTWITHSTANDING THE FOREGOING, THERE ARE NOWARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGN OR SPECIFICATIONS.**

**5. Limitation of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.**

**6. Changes, Reschedules and Cancellations:** Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

**7. Special Tooling:** A tooling charge may be imposed for any special tooling, including without limitations, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter,

discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

**8. Buyer's Property:** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer, or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

**9. Taxes:** Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

**10. Indemnity For Infringement of Intellectual Property Rights:** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter "Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

**11. Force Majeure:** Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

**12. Entire Agreement/Governing Law:** The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.