Miller SA Series
Stainless Steel Air Cylinders

Catalog M0914-4
August, 2017

Up to 250 PSI Air Service
Bore Sizes 1-1/8” through 8”
In line with our policy of continuing product improvement, specifications and information contained in this catalog are subject to change.

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</tr>
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Cylinder Features

Series SA

Cylinders for your unique need –

The Miller Fluid Power Series SA stainless steel cylinder combines corrosion resistance with proven reliability. It is specifically designed to meet today’s demand for cylinders in harsh chemical washdown environments.

Series SA premium quality air cylinders have many different options to meet your every need. With eight mounting styles, optional cushions, piston bumper seals, or magnetic piston, you can order exactly what you need. The Series SA cylinder is rated for Non-Lube service to keep the cylinder as low maintenance as possible. It is made completely of 303 and 304 stainless steel material with the exception of the aluminum piston, which resists many corrosive elements. This cylinder is also popular in the food processing industry when cleanliness and a bacteria free environment is of most importance.

Series SA non-lube premium quality air cylinders are available for quick delivery to minimize your downtime. The SA cylinder should be your next choice when specifying stainless steel cylinders.

Parker Cylinder Division and over 130 distributors provide the local personalized service customers demand. The Parker team ensures the right solution and product is in place to meet customer needs.

For further information on our cylinder products and capabilities, contact your local Miller Fluid Power distributor or visit us on the web at www.millerfluidpower.com.
## Cylinder Weights / Technical Data

### Stainless Steel Air Cylinders

#### Series SA

### Cylinder Weights

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<th>Weight (in pounds)</th>
<th>Mounting Code</th>
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<td>3/8&quot;</td>
<td>1.1 (50.26)</td>
<td>J &amp; H</td>
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<tr>
<td></td>
<td>1/2&quot;</td>
<td>1.2 (51.29)</td>
<td></td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>5/8&quot;</td>
<td>3.3 (82.55)</td>
<td>T, F, C, JB, HB, &amp; TE</td>
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<td></td>
<td>1&quot;</td>
<td>4.1 (52.65)</td>
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</tr>
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<td>5/8&quot;</td>
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<td></td>
<td>1&quot;</td>
<td>6.3 (82.55)</td>
<td>'BB &amp; BE</td>
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<td>2 1/2&quot;</td>
<td>5/8&quot;</td>
<td>8.0 (82.55)</td>
<td>D &amp; DB</td>
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<td>1&quot;</td>
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<td>25.40 (203.20)</td>
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*Weight includes pivot pin

### Breakaway Pressure

#### In PSI

- Listed are the average breakaway pressures in PSI for all Series SA cylinder bore sizes.
- Note: Breakaway pressures were established with the cylinders mounted horizontally and no load on the piston rod.

### Cylinder Force and Volume Charts

#### Extended Forces in pounds (newtons)

<table>
<thead>
<tr>
<th>Bore</th>
<th>Rod</th>
<th>Area in² (cm²)</th>
<th>PSI (bar)</th>
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<td>1 1/8&quot;</td>
<td>.99</td>
<td>.94</td>
<td>.99</td>
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<td>1/2&quot;</td>
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<td>1.77</td>
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<tr>
<td></td>
<td>3.14</td>
<td>3.14</td>
<td>3.14</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>4.91</td>
<td>4.91</td>
<td>4.91</td>
</tr>
<tr>
<td></td>
<td>8.30</td>
<td>8.30</td>
<td>8.30</td>
</tr>
<tr>
<td>3 1/4&quot;</td>
<td>12.57</td>
<td>12.57</td>
<td>12.57</td>
</tr>
<tr>
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<td>19.64</td>
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<tr>
<td></td>
<td>78.81</td>
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#### Volumes / Displacement Per Inch

<table>
<thead>
<tr>
<th>Bore</th>
<th>Rod</th>
<th>Area in² (cm²)</th>
<th>PSI (bar)</th>
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</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>.112</td>
<td>.112</td>
<td>.112</td>
</tr>
<tr>
<td>1/2&quot;</td>
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<td>.196</td>
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<td>.307</td>
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<td>1&quot;</td>
<td>.785</td>
<td>.785</td>
<td>.785</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>1.485</td>
<td>1.485</td>
<td>1.485</td>
</tr>
<tr>
<td>1 3/4&quot;</td>
<td>2.404</td>
<td>2.404</td>
<td>2.404</td>
</tr>
</tbody>
</table>

### Deduct these Forces for Retract Strokes in Pounds (newtons)
**Cylinder Features – 1 1/2" to 8" bore**

**Series SA**

---

**Features**

1. **Piston Seals**: Nitrile lipseals are pressure energized and wear compensating. Their excellent lubrication retention characteristics lower seal friction and ensure long life.


3. **Head/Cap**: Precision machined from solid corrosion-resistant 300 series stainless steel bar.

4. **Rod Wiper**: Urethane lipseals aggressively wipe foreign material from piston rod and enhance rod seal life.

5. **Rod Seals**: Rounded urethane lipseals are pressure energized and wear compensating.

6. **Piston Rod**: 303 stainless steel, 40,000 PSI minimum yield, hard chrome plated, ground and polished.

7. **Adjustable Captive Cushion Needle**: Allows for safe and precise adjustment under pressure.

8. **Wear Strip**: PTFE and graphite composition for minimum friction, maximum wear and side load resistance. (Magnetic band under wear strip optional.)

9. **Tube**: Corrosion-resistant 300 series stainless steel.

10. **Tie Rods**: High-strength 303 stainless steel maintains compression on tube end seals.

11. **Retainer**: Stainless steel snap ring securely retains bushing in head.

12. **Rod Bearings**: Machined from 304 stainless steel, with a PTFE composite wear band insert that eliminates metal-to-metal contact.

13. **Acorn Nut**: Tie rod threads are covered by stainless steel acorn nuts which eliminates a bacteria hiding place.
Stainless Steel Air Cylinders
Series SA

Standard Specifications / Mounting Styles

Operating Temperatures:
Standard Seals: -40°F to 200°F
(-40°C to 93°C)
Fluorocarbon Seals: -20°F to 400°F
(-29°C to 204°C)

Operating Pressure:
250 PSIG Air (17.2 Bar)

Supply:
Filtered compressed air to 250 PSI
Petroleum based hydraulic fluid to 400 PSI,
1-1/2"-8" bore only

Lubrication:
None required
Series SA Cylinders are rated for “no lube added” service. All internal components are lubricated at time of assembly with a PTFE based grease.

Materials:
Head and End Caps: 300 series stainless steel
Tube: 300 series stainless steel
Piston Rod: hard chrome plated 303 stainless steel
Piston: 6061 aluminum with PTFE composite wearband
Rod Bearings: 304 stainless steel with PTFE composite wearband
Seals: urethane rod seal and wiper, nitrile piston seals
Tie Rods: 303 stainless steel

Available Mounting Styles 1 1/2" to 8" Bores

<table>
<thead>
<tr>
<th>Style</th>
<th>Mounting Style</th>
<th>Code</th>
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<tr>
<td>Style J</td>
<td>Head Rectangular Flange (1 1/2&quot; to 6&quot; only)</td>
<td>(NFPA MF1)</td>
</tr>
<tr>
<td>Style H</td>
<td>Cap Rectangular Flange (1 1/2&quot; to 6&quot; only)</td>
<td>(NFPA MF2)</td>
</tr>
<tr>
<td>Style T</td>
<td>No Mount (Basic)</td>
<td>(NFPA MX0)</td>
</tr>
<tr>
<td>Style F</td>
<td>Side Tap</td>
<td>(NFPA MS4)</td>
</tr>
<tr>
<td>Style D</td>
<td>Head Trunnion</td>
<td>(NFPA MT1)</td>
</tr>
<tr>
<td>Style DB</td>
<td>Cap Trunnion</td>
<td>(NFPA MT2)</td>
</tr>
<tr>
<td>Style BB</td>
<td>Cap Fixed Clevis</td>
<td>(NFPA MP1)</td>
</tr>
<tr>
<td>Style KT</td>
<td>Double Rod End</td>
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Stainless Steel Air Cylinders
Series SA
Catalog HY08-M0914-4/NA

Dimensions – 1 1/2" to 8" Bore

No Mount Basic (1 1/2" to 8" Bores)
Style T
(NFPA MX0)

Head Rectangular Flange (1 1/2" to 6" Bores)
Style J
(NFPA MF1)

Cap Rectangular Flange (1 1/2" to 6" Bores)
Style H
(NFPA MF2)
Stainless Steel Air Cylinders
Series SA
Catalog HY08-M0914-4/NA

Rod End Dimensions – Basic Cylinder

“Special Thread” Style 3
To order specify “Style 3” and give desired dimensions for CC or KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

Table 1 – Envelope & Mounting Dimensions

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>E</th>
<th>EE</th>
<th>F</th>
<th>FB</th>
<th>G</th>
<th>J</th>
<th>K</th>
<th>R</th>
<th>TF</th>
<th>UF</th>
<th>Add Stroke</th>
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<tbody>
<tr>
<td>1 1/2</td>
<td>2</td>
<td>3/8</td>
<td>3/8</td>
<td>5/16</td>
<td>1 1/2</td>
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<td>1</td>
<td>5/32</td>
<td>1.43</td>
<td>2 3/4</td>
<td>3 3/8</td>
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<tr>
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<td>3</td>
<td>3/8</td>
<td>3/8</td>
<td>3/8</td>
<td>1 1/2</td>
<td>1</td>
<td>17/32</td>
<td>1.84</td>
<td>3 3/8</td>
<td>4 1/8</td>
<td>3 5/8</td>
</tr>
<tr>
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<td>3</td>
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<td>5/8</td>
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<td>3/4</td>
<td>9/16</td>
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<td>8 5/8</td>
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<td>16</td>
<td>8</td>
<td>1/2</td>
<td>3/4</td>
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<td>11/2</td>
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<td>-</td>
<td>6.44</td>
<td>-</td>
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</table>

* On 1 1/2” bore with code 2 rod head end port is 1/4” NPT.

Table 2 – Rod Dimensions

| Bore Size | Rod No. | Dia. | Style 8 | Style 4 | A | B | C | D | LA | LAF | VF | W | WF | Y | Add Stroke |
|-----------|---------|------|---------|---------|---|---|---|---|----|----|----|---|---|---|---|------------|
| 2         | 1       | 7/8-14 | 3/4-16 | 1 1/8 | 1.500 | 1/2 | 13/16 | 2 1/8 | 2 1/2 | 7/8 | 1 | 1 3/8 | 2 3/8 | 5 15/32 | 5 3/8 |
| 3         | 1       | 7/8-14 | 3/4-16 | 1 1/8 | 1.500 | 1/2 | 13/16 | 2 1/8 | 2 1/2 | 7/8 | 1 | 1 3/8 | 2 3/8 | 5 17/32 | 5 3/8 |
| 3         | 1       | 7/8-14 | 3/4-16 | 1 1/8 | 1.500 | 1/2 | 13/16 | 2 1/8 | 2 1/2 | 7/8 | 1 | 1 1/2 | 2 3/8 | 5 21/32 | 5 1/8 |
| 3 1/4     | 1       | 7/8-14 | 3/4-16 | 1 1/8 | 1.500 | 1/2 | 13/16 | 1 7/8 | 2 1/2 | 7/8 | 3 | 1 3/8 | 2 3/8 | 6 1/4 | 6 1/4 |
| 4         | 1       | 7/8-14 | 3/4-16 | 1 1/8 | 1.500 | 1/2 | 13/16 | 1 7/8 | 2 1/2 | 7/8 | 3 | 1 3/8 | 2 3/8 | 6 1/4 | 6 1/4 |
| 5         | 1       | 7/8-14 | 3/4-16 | 1 1/8 | 1.500 | 1/2 | 13/16 | 1 7/8 | 2 1/2 | 7/8 | 3 | 1 3/8 | 2 3/8 | 6 3/8 | 6 1/4 |
| 7         | 1       | 3/4  | 1 1/4-12 | 1 1/4 | 1 1/4 | 2.000 | 5/8 | 1 1/8 | 2 1/2 | 3 1/4 | 1 | 1 5/8 | 2 3/4 | 6 31/32 | 6 3/4 |
| 8         | 1       | 3/4  | 1 1/4-12 | 1 1/4 | 1 1/4 | 2.000 | 5/8 | 1 1/8 | 2 1/2 | 3 1/4 | 1 | 1 5/8 | 2 3/4 | 6 3/8 | 6 1/4 |

Table 3 – Envelope and Mounting Dimensions

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<td>2</td>
</tr>
</tbody>
</table>
Stainless Steel Air Cylinders
Series SA

Dimensions – 1 1/2" to 8" Bore

**Side Tap Mount**

*Style F*  
(NFPA MS4)

**Cap Fixed**

*Clevis Mount*  
*Style BB*  
(NFPA MP1)

**Head Trunnion Mount**

*Style D*  
(NFPA MT1)

**Cap Trunnion Mount**

*Style DB*  
(NFPA MT2)
### Rod End Dimensions – Basic Cylinder

**“Special Thread” Style 3**
To order specify “Style 3” and give desired dimensions for CC or KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

#### Table 1 – Envelope & Mounting Dimensions

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>CB</th>
<th>CD</th>
<th>CW</th>
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<td>3/4</td>
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<td>4 1/2</td>
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1 On 1 1/2" bore with code 2 rod head end port is 1/4" NPT.

#### Table 2 – Rod Dimensions

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>Rod Dia.</th>
<th>Style 8</th>
<th>Style 4, 9</th>
<th>Add Stroke</th>
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<tbody>
<tr>
<td>1 1/2</td>
<td>1 1/4-12</td>
<td>1/8</td>
<td>1 5/8</td>
<td>2 1/2-20</td>
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<tr>
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<td>1 7/8-14</td>
<td>3/4-16</td>
<td>1 1/8</td>
<td>7/16-20</td>
</tr>
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<td>2 1/2</td>
<td>1 7/8-14</td>
<td>3/4-16</td>
<td>1 1/8</td>
<td>7/16-20</td>
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</table>

#### Table 3 – Envelope & Mounting Dimensions

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<th>Style 8</th>
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<td>1 5/8</td>
<td>2 1/2-20</td>
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<td>3/4-16</td>
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<td>7/16-20</td>
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<td>3/4-16</td>
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<td>7/16-20</td>
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<td>1 7/8-14</td>
<td>3/4-16</td>
<td>1 1/8</td>
<td>7/16-20</td>
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<td>7/16-20</td>
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<td>1 7/8-14</td>
<td>3/4-16</td>
<td>1 1/8</td>
<td>7/16-20</td>
</tr>
</tbody>
</table>

---

**Stainless Steel Air Cylinders**

**Dimensions – 1 1/2" to 8" Bore**

**Series SA**

Catalog HY08-M0914-4/NA

- Basic Cylinder

- Rod End Dimensions

- Thread Style 4 (NFPA Style SM) Small Male

- Thread Style 8 (NFPA Style IM) Intermediate Male

- Thread Style 9 (NFPA Style SF) Short Female

Des Plaines, Illinois USA

Miller Fluid Power

www.miller-fluidpower.com
Stainless Steel Air Cylinders
Series SA
Catalog HY08-M0914-4/NA

Dimensions – 8" Bore

Head Square
Style JB
(NFPA ME3)
8" Bore only

Cap Square
Style HB
(NFPA ME4)
8" Bore only

Standard & Optional Rod Ends

Table 1 – Envelope & Mounting Dimensions

<table>
<thead>
<tr>
<th>E</th>
<th>EE</th>
<th>FB</th>
<th>G</th>
<th>J</th>
<th>K</th>
<th>R</th>
<th>Add Stroke</th>
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</thead>
<tbody>
<tr>
<td>JB (ME3)</td>
<td>8 1/2</td>
<td>3/4</td>
<td>11/16</td>
<td>2</td>
<td>1 1/2</td>
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<td>HB (ME4)</td>
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<td>3/4</td>
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<td>1 1/2</td>
<td>1</td>
<td>7.57</td>
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Table 2 – Rod Dimensions

<table>
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<th>Rod Code</th>
<th>Rod Dia.</th>
<th>Style 8 CC</th>
<th>Style 4, 9 KK</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>LAF</th>
<th>VF</th>
<th>WF</th>
<th>Y</th>
<th>Add Stroke</th>
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<tbody>
<tr>
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<td>1-1/4-12</td>
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<td>5/8</td>
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<td>1/8</td>
<td>3 1/4</td>
<td>1</td>
<td>1 5/8</td>
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<tr>
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<td>3 1/4</td>
<td>1-1/2-12</td>
<td>1-1/4-12</td>
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<td>3 7/16</td>
<td>3/4</td>
<td>1/2</td>
<td>3 1/4</td>
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<td>1 5/8</td>
<td>2 7/8</td>
<td>8</td>
</tr>
<tr>
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<td>3 1/4</td>
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<td>1 5/8</td>
<td>2 7/8</td>
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<td>3 1/4</td>
<td>1-1/2-12</td>
<td>1-1/4-12</td>
<td>2</td>
<td>3 7/16</td>
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<td>1 7/8</td>
<td>3 1/8</td>
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Table 3 – Envelope and Mounting Dimensions

www.miller-fluidpower.com

Miller Fluid Power
Des Plaines, Illinois USA
Table 1 – Envelope & Mounting Dimensions

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>E</th>
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<th>G</th>
<th>K</th>
<th>R</th>
<th>Add Stroke</th>
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<td>2</td>
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<td>1 3/4</td>
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<td>1/2</td>
<td>1 3/4</td>
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<td>6.44</td>
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1 On 1 1/2" bore with code 2 rod head end port is 1/4" NPT.

Table 2 – Rod Dimensions

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<th>Rod No.</th>
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<th>Style 9 KK</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>LAF</th>
<th>VF</th>
<th>WF</th>
<th>Add 2x Stroke</th>
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<td>1/2-20</td>
<td>7/16-20</td>
<td>3/4</td>
<td>1.125</td>
<td>3/8</td>
<td>1/2</td>
<td>1 3/4</td>
<td>5/8</td>
<td>1</td>
<td>2</td>
</tr>
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<td>1/2-20</td>
<td>7/16-20</td>
<td>3/4</td>
<td>1.125</td>
<td>3/8</td>
<td>1/2</td>
<td>1 3/4</td>
<td>5/8</td>
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<td>2</td>
</tr>
<tr>
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<td>1/2-20</td>
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<td>1 3/4</td>
<td>5/8</td>
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<td>7/16-20</td>
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<td>1 3/4</td>
<td>5/8</td>
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<td>5/8</td>
<td>1/2-20</td>
<td>7/16-20</td>
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<td>1.125</td>
<td>3/8</td>
<td>1/2</td>
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<td>1</td>
<td>2</td>
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<td>5/8</td>
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<td>7/16-20</td>
<td>3/4</td>
<td>1.125</td>
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<td>1/2</td>
<td>1 3/4</td>
<td>5/8</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>
Rod Clevis
303 Stainless Steel

Eye Bracket
304 Stainless Steel

Pin
303 Stainless Steel

Rod Alignment Coupler

| CB | 3/4 | 1 1/4 | 1 1/2 | 2 |
| CD | 0.500 | 0.750 | 1.000 | 1.375 |
| CE | 1 1/2 | 2 3/8 | 3 1/8 | 4 1/8 |
| CH | 1 | 1 1/4 | 1 1/2 | 2 |
| CW | 1/2 | 5/8 | 3/4 | 1 |
| ER | 1/2 | 3/4 | 1 | 1 3/8 |
| KK | 1/2-20 | 3/4-16 | 1-14 | 1 1/4-12 |
| L | 3/4 | 1 1/4 | 1 1/2 | 2 1/8 |

| BA | 1 5/8 | 2 9/16 | 3 1/4 |
| CB | 3/4 | 1 1/4 | 1 1/2 |
| CD | 0.500 | 0.750 | 1.000 |
| DD | 13/32 | 17/32 | 21/32 |
| E | 2 1/2 | 3 1/2 | 4 1/2 |
| F | 3/8 | 5/8 | 3/4 |
| FL | 1 1/8 | 1 7/8 | 2 1/4 |
| LR | 3/4 | 1 1/4 | 1 1/2 |
| M | 1/2 | 3/4 | 1 |

| CD | 0.500 | 0.750 | 1.000 | 1.375 |
| LH | 2 7/32 | 3 1/8 | 3 3/4 | 5 5/8 |
| LP | 1 7/8 | 2 3/4 | 3 1/4 | 4 1/4 |

| A | 1/2-20 | 3/4-16 | 1-14 |
| B | 1 1/4 | 1 3/4 | 2 1/2 |
| C | 2 | 2 5/16 | 2 15/16 |
| D | 1/2 | 1/2 | 1/2 |
| E | 3/4 | 1 1/8 | 1 5/8 |
| F | 5/8 | 3 1/32 | 1 3/8 |
| G | 1/2 | 13/16 | 1 5/32 |
| H | 1 1/8 | 1 1/2 | 2 1/4 |

Made of 303 Stainless Steel, the Rod Alignment Coupler allows 1/16" of radial float and 2° of spherical movement. This prevents cylinder binding due to misalignment thus extending bearing and seal life, and permits greater tolerance between the center line of the cylinder and mating part for simplified installation.
Excellent operating performance in a 1 1/8" bore size

1 Piston Seals: Nitrile lipseals are pressure energized and wear compensating. Their excellent lubrication retention characteristics lower seal friction and ensure long life.

2 Piston: Solid aluminum alloy, light-weight for low inertia, yet strong.

3 Head/Cap: Precision machined from solid corrosion-resistant 304 stainless steel bar.

4 Piston Rods: 303 stainless steel, 4,000 PSI minimum yield, hard chrome plated, ground and polished.

5 Bearing Seal: PTFE rod wiper provides positive wiping action and low friction. Nitrile lipseals are pressure energized and wear compensating for long life.

6 Wear Strip: PTFE and graphite composition for minimum friction, maximum wear and side load resistance. (Magnetic band under wear strip optional.)

7 Tube: Corrosion-resistant 304 stainless steel.

8 Tie Rods: High-strength 303 stainless steel maintains compression on tube end seals.

9 Rod Bearing: Incorporates a sintered bronze rod bearing which is pressed into the cylinder head.

10 Acorn Nut: Tie rod threads are covered by stainless steel acorn nuts which eliminates a bacteria hiding place.

Optional Features

Cushions and bumpers are features also available on our 1 1/8" bore.

Cushions permit the trapping of cylinder exhaust volume prior to the completion of full rod extension or retraction. This volume is then metered through a finely tapered needle to deliver smooth, adjustable deceleration of the cylinder load.

Note: Cushion block increases stroke related dimensions by .500 per end.

Cushions are not available on 1 1/8" bore with 1/2" diameter rod.
Stainless Steel Air Cylinders

Dimensions – 1 1/8" Bore

Series SA

No Mount Basic
Style T
(NFPA MX0)

Bolt Through Mount
Style C
(NFPA MS8)

Head Rectangular Flange Mount
Style J
(NFPA MF7)

Cap Rectangular Flange Mount
Style H
(NFPA MF2)
Stainless Steel Air Cylinders
Series SA
Catalog HY08-M0914-4/NA

Dimensions – 1 1/8" Bore

Rod End Dimensions

Table 1 – Envelope & Mounting Dimensions

<table>
<thead>
<tr>
<th>Bore</th>
<th>C</th>
<th>DB</th>
<th>DN</th>
<th>E</th>
<th>EE</th>
<th>FB-ed</th>
<th>G</th>
<th>H</th>
<th>J</th>
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</thead>
<tbody>
<tr>
<td>1 1/8</td>
<td>1/4</td>
<td>13/64</td>
<td>1</td>
<td>1 1/2</td>
<td>1/8</td>
<td>7/32</td>
<td>7/8</td>
<td>5/8</td>
<td>5/8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bore</th>
<th>K</th>
<th>R</th>
<th>TB</th>
<th>TF</th>
<th>UF</th>
<th>V</th>
<th>XB</th>
<th>Add Stroke</th>
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<tbody>
<tr>
<td>1 1/8</td>
<td>13/32</td>
<td>1</td>
<td>21/64</td>
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<td>2 1/2</td>
<td>1/8</td>
<td>5/8</td>
<td>1 3/4</td>
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</table>

Table 2 – Rod Dimensions

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>Rod No.</th>
<th>Rod Dia. MM</th>
<th>Thread Style 6 (NFPA Style FM)</th>
<th>Style 8 (NFPA Style IM)</th>
<th>Style 9 (NFPA Style SF)</th>
<th>A</th>
<th>D</th>
<th>LAF</th>
<th>RM</th>
<th>SB</th>
<th>WF</th>
<th>Y</th>
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<tr>
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<td>3/8-24</td>
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<td>7/16</td>
<td>1 1/8</td>
<td>1.000 #10</td>
<td>3/8</td>
<td>15/16</td>
<td>2 1/4</td>
<td>1 3/8</td>
</tr>
</tbody>
</table>

For J (MF7) Mount Only

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>Rod No.</th>
<th>Rod Dia. MM</th>
<th>F</th>
<th>W</th>
<th>LA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/8</td>
<td>1</td>
<td>3/8</td>
<td>1/4</td>
<td>1/8</td>
<td>3/4</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1/2</td>
<td>1/4</td>
<td>1/8</td>
<td>7/8</td>
</tr>
</tbody>
</table>

Thread Style 6
(NFPA Style FM)
Full Male

Thread Style 8
(NFPA Style IM)
Intermediate Male

Thread Style 9
(NFPA Style SF)
Short Female

“Special Thread” Style 3
To order specify “Style 3” and give desired dimensions for CC or KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

Table 3 – Envelope and Mounting Dimensions
Stainless Steel Air Cylinders
Series SA

Dimensions – 1 1/8" Bore

Fixed Eye Mount
Style BE
(NFPA MP3)

Side Tap Mount
Style F
(NFPA MS9)

Head Face Mount
Style TE
(NFPA MR1)

Double Rod End
Style KT
(NFPA MDX0)
Rod End Dimensions

**Thread Style 6**  
(NFPA Style FM)  
Full Male

**Thread Style 8**  
(NFPA Style IM)  
Intermediate Male

**Thread Style 9**  
(NFPA Style SF)  
Short Female

“Special Thread” Style 3  
To order specify “Style 3” and give desired dimensions for CC or KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

Table 1 – Envelope & Mounting Dimensions

<table>
<thead>
<tr>
<th>Bore</th>
<th>BC</th>
<th>C</th>
<th>CB</th>
<th>CD</th>
<th>E</th>
<th>EE</th>
<th>G</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/8</td>
<td>1 19/32</td>
<td>1/4</td>
<td>.375</td>
<td>.375</td>
<td>1 1/2</td>
<td>1/8</td>
<td>7/8</td>
<td>5/8</td>
<td>13/32</td>
<td>7/16</td>
</tr>
</tbody>
</table>

Add Stroke

<table>
<thead>
<tr>
<th>Bore</th>
<th>M</th>
<th>NT</th>
<th>RE</th>
<th>RT</th>
<th>TK</th>
<th>TN</th>
<th>V</th>
<th>XT</th>
<th>Y</th>
<th>SN</th>
<th>XC</th>
<th>ZB*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/8</td>
<td>3/8</td>
<td>10-32</td>
<td>1 1/8</td>
<td>10-32</td>
<td>1/4</td>
<td>1</td>
<td>1/8</td>
<td>5/8</td>
<td>15/16</td>
<td>1 3/4</td>
<td>3 1/16</td>
<td>2 5/8</td>
</tr>
</tbody>
</table>

*ZB dimension for double rod cylinder is 3 1/4 + 2 x stroke

Table 2 – Rod Dimensions

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>Rod. No.</th>
<th>Rod Dia. MM</th>
<th>Style 6 KK</th>
<th>Style 8 CC</th>
<th>Style 9 XX</th>
<th>A</th>
<th>D</th>
<th>LAF</th>
<th>RM</th>
<th>WF</th>
<th>Add Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1/2</td>
<td>1/2-20</td>
<td>7/16-20</td>
<td>3/8-24</td>
<td>3/4</td>
<td>7/16</td>
<td>1 1/8</td>
<td>1.000</td>
<td>3/8</td>
<td>2 1/4</td>
<td>1 3/8</td>
</tr>
</tbody>
</table>
Stainless Steel Air Cylinders
Series SA

Accessories – 1 1/8" Bore

**Rod Eye**
303 Stainless Steel

![Diagram of Rod Eye]

<table>
<thead>
<tr>
<th>Specification</th>
<th>149220037</th>
<th>149220050</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7/16</td>
<td>7/16</td>
</tr>
<tr>
<td>CA</td>
<td>7/8</td>
<td>7/8</td>
</tr>
<tr>
<td>CB</td>
<td>3/8</td>
<td>3/8</td>
</tr>
<tr>
<td>CD</td>
<td>0.375</td>
<td>0.375</td>
</tr>
<tr>
<td>ER</td>
<td>3/8</td>
<td>3/8</td>
</tr>
<tr>
<td>H</td>
<td>3/4</td>
<td>3/4</td>
</tr>
<tr>
<td>KK</td>
<td>3/8-24</td>
<td>1/2-20</td>
</tr>
<tr>
<td>N</td>
<td>7/32</td>
<td>5/16</td>
</tr>
</tbody>
</table>

Includes Jam Nut

**Clevis Bracket**
304 Stainless Steel

![Diagram of Clevis Bracket]

<table>
<thead>
<tr>
<th>Specification</th>
<th>1492230050</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>1 1/8</td>
</tr>
<tr>
<td>CB</td>
<td>3/8</td>
</tr>
<tr>
<td>CD</td>
<td>0.375</td>
</tr>
<tr>
<td>CW</td>
<td>1/4</td>
</tr>
<tr>
<td>DB</td>
<td>21/64</td>
</tr>
<tr>
<td>DD</td>
<td>13/64</td>
</tr>
<tr>
<td>E</td>
<td>1 1/2</td>
</tr>
<tr>
<td>F</td>
<td>1/2</td>
</tr>
<tr>
<td>FL</td>
<td>1 1/8</td>
</tr>
<tr>
<td>LR</td>
<td>5/8</td>
</tr>
<tr>
<td>M</td>
<td>3/8</td>
</tr>
<tr>
<td>TB</td>
<td>1/4</td>
</tr>
</tbody>
</table>

**Pivot Pin**
303 Stainless Steel

![Diagram of Pivot Pin]

<table>
<thead>
<tr>
<th>Specification</th>
<th>0875600050</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>0.375</td>
</tr>
<tr>
<td>LH</td>
<td>1 1/4</td>
</tr>
<tr>
<td>LP</td>
<td>1 1/32</td>
</tr>
</tbody>
</table>

Use with 1449220037, 1449220050, 1492230050

**Rod Alignment Coupler**

![Diagram of Rod Alignment Coupler]

<table>
<thead>
<tr>
<th>Specification</th>
<th>1492240050</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3/8-24</td>
</tr>
<tr>
<td>B</td>
<td>1 1/8</td>
</tr>
<tr>
<td>C</td>
<td>1 3/4</td>
</tr>
<tr>
<td>D</td>
<td>3/8</td>
</tr>
<tr>
<td>E</td>
<td>1/2</td>
</tr>
<tr>
<td>F</td>
<td>1/2</td>
</tr>
<tr>
<td>G</td>
<td>3/8</td>
</tr>
<tr>
<td>H</td>
<td>11/16</td>
</tr>
</tbody>
</table>

Maximum Pull (lbs.) 886

Made of 303 Stainless Steel, the Rod Alignment Coupler allows 1/16" of radial float and 1° of spherical movement. This prevents cylinder binding due to misalignment thus extending bearing and seal life, and permits greater tolerance between the center line of the cylinder and mating part for simplified installation.
How To Use The Chart

The selection of a piston rod for thrust (push) conditions requires the following steps:

1. Determine the type of cylinder mounting style and rod end connection to be used. Then consult the chart below and find the “stroke factor” that corresponds to the conditions used.
2. Using this stroke factor, determine the “basic length” from the equation:
   \[ \text{Basic Length} = \frac{\text{Actual Length} \times \text{Stroke Factor}}{\text{Stroke}} \]
   The graph is prepared for standard rod extensions beyond the face of the gland retainer. For rod extensions greater than standard, add the increase to the stroke in arriving at the “basic length.”
3. Find the load imposed for the thrust application by multiplying the full bore area of the cylinder by the system pressure.
4. Enter the graph along the values of “basic length” and “thrust” as found above and note the point of intersection:
   a) The correct piston rod size is read from the diagonally curved line labeled “Rod Diameter” next above the point of intersection.
   b) The required length of stop tube is read from the right of the graph by following the shaded band in which the point of intersection lies.
   c) If required length of stop tube is in the region labeled “consult factory,” submit the following information for an individual analysis:
      1) Cylinder mounting style.
      2) Rod end connection and method of guiding load.
      3) Bore, required stroke, length of rod extension (Dim. “LA”) if greater than standard, and series of cylinder used.
      4) Mounting position of cylinder. (Note: if at an angle or vertical, specify direction of piston rod.)
      5) Operating pressure of cylinder if limited to less than standard pressure for cylinder selected.

### Recommended Mounting Styles for Maximum Stroke and Thrust Loads

<table>
<thead>
<tr>
<th>Groups 1 or 3</th>
<th>Rod End Connection</th>
<th>Case</th>
<th>Stroke Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long stroke cylinders for thrust loads should be mounted using a heavy-duty mounting style at one end, firmly fixed and aligned to take the principal force. Additional mounting should be specified at the opposite end, which should be used for alignment and support. An intermediate support may also be desirable for long stroke cylinders mounted horizontally.</td>
<td>FIXED AND RIGIDLY GUIDED</td>
<td>I</td>
<td>.50</td>
</tr>
<tr>
<td></td>
<td>PIVOTED AND RIGIDLY GUIDED</td>
<td>II</td>
<td>.70</td>
</tr>
<tr>
<td></td>
<td>SUPPORTED BUT NOT RIGIDLY GUIDED</td>
<td>III</td>
<td>2.00</td>
</tr>
<tr>
<td>Group 2</td>
<td>PIVOTED AND RIGIDLY GUIDED</td>
<td>IV</td>
<td>1.00</td>
</tr>
<tr>
<td>Style D-Trunnion on Head</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Style DB-Trunnion on Cap or Style BB-Clevis on Cap</td>
<td>PIVOTED AND RIGIDLY GUIDED</td>
<td>V</td>
<td>2.00</td>
</tr>
</tbody>
</table>
# Solid State Switches

## Specifications

<table>
<thead>
<tr>
<th>Switch Classification</th>
<th>Standard PNP or NPN</th>
<th>ATEX Certified PNP</th>
<th>High Temperature PNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Electronic</td>
<td>Electronic</td>
<td>Electronic</td>
</tr>
<tr>
<td>Output Function</td>
<td>Normally Open</td>
<td>Normally Open</td>
<td>Normally Open</td>
</tr>
<tr>
<td>Switch Output</td>
<td>PNP/NPN</td>
<td>PNP</td>
<td>PNP</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>10 - 30VDC</td>
<td>18 - 30VDC</td>
<td>10 - 30VDC</td>
</tr>
<tr>
<td>Continuous Current</td>
<td>100 mA max.</td>
<td>70 mA max.</td>
<td>200 mA max.</td>
</tr>
<tr>
<td>Magnetic Field Sensitivity</td>
<td>2.65 - 2.95mT</td>
<td>2.65 - 2.95mT</td>
<td>25 Gauss</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>5 kHz</td>
<td>1 kHz</td>
<td>10 KHz</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>10 mA max.</td>
<td>10 mA max.</td>
<td>15 mA max.</td>
</tr>
<tr>
<td>Voltage Drop</td>
<td>2.2 VDC max.</td>
<td>2.2 VDC max.</td>
<td>3.1 VDC max.</td>
</tr>
<tr>
<td>Ripple</td>
<td>10% of Operating Voltage</td>
<td>10% of Operating Voltage</td>
<td>15% of Operating Voltage</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>1.5 mm max.</td>
<td>1.5 mm max.</td>
<td>1.5 mm max.</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.1 mm max.</td>
<td>0.1 mm max.</td>
<td>0.1 mm max.</td>
</tr>
<tr>
<td>EMC</td>
<td>EN 60 947-5-2</td>
<td>EN 60 947-5-2</td>
<td>EN 60 947-5-2</td>
</tr>
<tr>
<td>Short-circuit Protection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Power-up Pulse Suppression</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Reverse Polarity Protection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Enclosure Rating</td>
<td>IP67</td>
<td>IP68</td>
<td>IP67</td>
</tr>
<tr>
<td>Shock and Vibration Stress</td>
<td>30g, 11 ms,</td>
<td>30g, 11 ms,</td>
<td>30g, 11 ms,</td>
</tr>
<tr>
<td></td>
<td>10 to 55Hz, 1 mm</td>
<td>10 to 55Hz, 1 mm</td>
<td>10 to 55Hz, 1 mm</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-25°C to +75°C,</td>
<td>-20°C to +45°C,</td>
<td>-25°C to +105°C,</td>
</tr>
<tr>
<td></td>
<td>(-13°F to +167°F)</td>
<td>(-4°F to +113°F)</td>
<td>(-13°F to +221°F)</td>
</tr>
<tr>
<td>Housing Material</td>
<td>PA 12 Black</td>
<td>PA 12 Black</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Connector Cable</td>
<td>PUR</td>
<td>PVC</td>
<td>PUR</td>
</tr>
<tr>
<td>Connector</td>
<td>PUR</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Approval for ATEX</td>
<td>–</td>
<td>3D/3G</td>
<td>–</td>
</tr>
</tbody>
</table>

Global solid state switch outputs may be influenced by an external magnetic field. Care must be taken to avoid external magnetic field exposure.

## Solid State Switch – Wiring Connection

**Flying Lead or 8 mm Connector**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Wire</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>Operating Voltage (+VDC)</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>Output signal (N.O.)</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>-VDC</td>
</tr>
</tbody>
</table>

---

*ATEX switch is supplied with 2m Flying Leads.

*High Temperature switch is not UL Listed.*
Global Drop-In Reed Switches

<table>
<thead>
<tr>
<th>Wiring</th>
<th>Reed Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>3m Flying Leads</td>
<td>P8S-GRFAFX</td>
</tr>
<tr>
<td>10m Flying Leads</td>
<td>P8S-GRFDX</td>
</tr>
<tr>
<td>0.3m Lead with 8mm Connector</td>
<td>P8S-GRCHX</td>
</tr>
</tbody>
</table>

Specifications

- Type: 2-Wire Reed
- Output Function: Normally Open
- Operating Voltage: 10 - 30 VDC
- Switching Power: 10 W
- Continuous Current: 100 mA max.
- Response Sensitivity: 2.1 - 3.4 mT
- Switching Frequency: 400 Hz
- Voltage Drop: 2.2 V max.
- Ripple: 10% of Operating Voltage
- Hysteresis: 1.5 mm max.
- Repeatability: 0.2 mm max.
- EMC: EN 60 947-5-2
- Reverse Polarity Protection: Yes
- Enclosure Rating: IP 67
- Shock and Vibration Stress: 30g, 11 ms, 10 to 55 Hz, 1 mm
- Operating Temperature Range: -25°C to +75°C (-13°F to 167°F)
- Housing Material: PA 12 Black
- Connector Cable: PUR
- Connector: PUR

Global Reed Switch output may be influenced by external magnetic fields. Care must be taken to avoid external magnetic field exposure.

Circuit for Switching Contact Protection (Inductive Loads)
(Required for proper operation 24V DC)

Put Diode parallel to loads following polarity as shown below.

D: Diode: select a Diode with the breakdown voltage and current rating according to the load.

Typical Example – 100 Volt, 1 Amp Diode
CR: Relay coil (under 0.5W coil rating)

Caution

- Use an ammeter to test reed switch current. Testing devices such as incandescent light bulbs may subject the reed sensor to high in-rush loads.
- NOTE: When checking an unpowered reed switch for continuity with a digital ohmmeter the resistance reading will change from infinity to a very large resistance (2 M ohm) when the sensor is activated. This is due to the presence of a diode in the reed switch.
- Anti-magnetic shielding is recommended for reed switches exposed to high external RF or magnetic fields.
- The magnetic field strength of the piston magnet is designed to operate with our switches. Other manufacturers' switches may not operate correctly in conjunction with these magnets.
- Use relay coils for reed switch contact protection.
- Switches with long wire leads (greater than 15 feet) can cause capacitance build-up and sticking will result. Attach a resistor in series with the reed switches (the resistor should be installed as close as possible to the switches). The resistor should be selected such that R (ohms) >E/0.3.
- Global reed switch outputs may be influenced by an external magnetic field. Care must be taken to avoid external magnetic field exposure.
# How to Order Series SA Cylinders

Miller Fluid Power Series SA pneumatic cylinders can be specified by model number by using the table below.

## Cylinder Mounting Styles - 1 1/8" Bore

<table>
<thead>
<tr>
<th>Mounting Style Code</th>
<th>N.F.P.A. Style</th>
<th>Mounting Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>MX0</td>
<td>No Mount (Basic)</td>
</tr>
<tr>
<td>C</td>
<td>MS8</td>
<td>Bolt Through</td>
</tr>
<tr>
<td>F</td>
<td>MS9</td>
<td>Side Tapped</td>
</tr>
<tr>
<td>TE</td>
<td>MR1</td>
<td>Head Face</td>
</tr>
<tr>
<td>J</td>
<td>MF7</td>
<td>Head Rectangular Flange</td>
</tr>
<tr>
<td>H</td>
<td>MF2</td>
<td>Cap Rectangular Flange</td>
</tr>
<tr>
<td>BE</td>
<td>MP3</td>
<td>Cap Fixed Eye</td>
</tr>
</tbody>
</table>

## Cylinder Mounting Styles - 1 1/2" - 8" Bores

<table>
<thead>
<tr>
<th>Mounting Style Code</th>
<th>N.F.P.A. Style</th>
<th>Mounting Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>MX0</td>
<td>No Mount (Basic)</td>
</tr>
<tr>
<td>F</td>
<td>MS4</td>
<td>Side Tapped</td>
</tr>
<tr>
<td>J</td>
<td>MF1</td>
<td>Head Rect. Flange (1 1/2&quot;-8&quot;)</td>
</tr>
<tr>
<td>H</td>
<td>MF2</td>
<td>Cap Rect. Flange (1 1/2&quot;-8&quot;)</td>
</tr>
<tr>
<td>D</td>
<td>MT1</td>
<td>Head Trunnion</td>
</tr>
<tr>
<td>DB</td>
<td>MT2</td>
<td>Cap Trunnion</td>
</tr>
<tr>
<td>BB</td>
<td>MP1</td>
<td>Cap Fixed Clevis</td>
</tr>
<tr>
<td>JB</td>
<td>ME3</td>
<td>Head Square (8&quot; only)</td>
</tr>
<tr>
<td>HB</td>
<td>ME4</td>
<td>Cap Square (8&quot; only)</td>
</tr>
</tbody>
</table>

1. See Stroke Loss Chart for Bumper Seals.
2. Reed or solid state switches available with standard seals only.
3. For 1 1/8" Bore Rod thread 4 not available, Rod thread 6 is full male option.
4. In case of stop tube, call out gross stroke length (net stroke + stop tube length).
How to Order Miller Fluid Power Series SA Cylinders with Switches

Switches are not mounted to the cylinder prior to shipment. When ordering a cylinder to accommodate a switch:

1. Derive a proper model number as shown in the table above.
2. Place an "S" in the special modification column of the model number.
3. Underneath the model number specify:
   1) Cylinder prepared for switch.
   2) If switches and switch bracket are required specify the switch part number from the Switch Pages, the required bracket part number P8S-TMA0X and the quantity required for each.

Tie Rod Bracket Assembly Part Number and Dimensions

Global switches and bracket assemblies must be ordered separately.

Cordsets — 8mm Cordset for Global Switches

A female connector is available for all sensors with the male 8mm quick connect option. The male plug will accept a snap-on or threaded connector. Cordset part numbers are listed at right.

<table>
<thead>
<tr>
<th>Cable Length</th>
<th>Threaded Connector</th>
<th>Snap On Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 meters</td>
<td>086620T005</td>
<td>086620S005</td>
</tr>
<tr>
<td>2 meters</td>
<td>086620T002</td>
<td>086620S002</td>
</tr>
</tbody>
</table>

Optional Piston Bumper Seals

Impact dampening Piston Bumper Seals are optional on Series SA cylinders from 1 1/8" through 8" bore. Piston Bumper Seals have a minimum effect on stroke length. The Stroke Loss Chart below gives typical overall stroke loss at various system pressures.

To determine the stroke loss at either end of the cylinder, divide the values by two. Bumper Seals are only available on both sides of the piston.

Stroke Loss Chart

<table>
<thead>
<tr>
<th>Bore</th>
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1 Piston Bumper Seals are not available 1 ½" bore with rod code 2.
**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 Hannifin Corporation (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 the 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 guidelines 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 appropriate 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 1-847-298-2400, or go to 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)” for the publication of 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 should be reviewed with our engineering department.

#### 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.

### 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 position. Improper alignment will result in excessive rod ground 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 rod 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 gland, 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 cylinder when mounting. 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 Accessory 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 preventing 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). 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 any cylinder component (such as bushings) 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.
Offer of Sale

The terms described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors (“Seller”) are hereby offered for sale at prices to be established by Seller. 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 item described in its document, when communicated to Seller, is referred to as a “Product.”

1. Terms and Conditions. Seller’s willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found online at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer’s order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller’s quote or other document offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes that may be charged. Unless otherwise specified by Seller, all references to or uses of F.C.A. Seller’s facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller’s Credit Department. In default thereof, Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any item which Seller shall have retained a security interest in its sole discretion at any time.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of one year from the date of delivery to Buyer. The prices charged for Seller’s products are based upon the exclusions set forth in the following disclaimer: DRAFT OF WARRANTY: THIS WARRANTY COMPRESSES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 30 days after delivery of the Products. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered. Buyer must take action based upon each breach of this agreement or otherwise claim arising out of this sale (other than an action by Seller for an amount due on account) must be commenced within 12 months of the date of the breach without regard to the date on which Buyer first pays interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

6. Limitation of Liability. Upon notification, Seller will, at its option, repair or replace a defective product, or refund the purchase price. NO EXCEPT TO THE EXTENT PERMITTED BY APPLICABLE LAWS, SELLER SHALL NOT BE LIABLE IN ANY MANNER FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PARTS THEREOF, WHETHER ANY CHARGES FOR SUCH SERVICE, REPAIR OR REPLACEMENT OF ANY PRODUCT, OR ANY EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER’S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLECTFUL, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN EVENT SELLER SHALL SELLER’S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all codes, rules, regulations and/or specific customer requirements and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer’s Property. Any designs, tools, patterns, materials, drawings, confidential or other information or equipment furnished by Buyer or any other items which become Seller’s property will be considered obsolete and may be destroyed by Seller after two years. Seller’s willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found online at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer’s order or any other document issued by Buyer.

9. Special Tools. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. 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 Products, even if such apparatus is specially converted or adapted for such manufacture or 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 any manner and at any time.

10. Buyer’s Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in all goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer agrees that the attorney to execute and file on Buyer’s behalf all documents Seller deems necessary to perfect its security interest.

11. Improper Use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer’s employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, on the part of Buyer; (c) Seller’s having sole control over the defense of any allegations or actions including all negotiations to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations or actions and having sole control over the defense of any allegations or actions including all negotiations to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations or actions.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller’s written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Buyer may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk 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, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller’s control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not be deemed to be a waiver of any provision nor will it be deemed to prejudice Seller’s right to enforce that provision in the future. Violation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. 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 as excepted as provided in this Section. Seller will defend and indemnify Buyer, at Seller’s expense, against all actions or suits, including U.S. patents, trademarks, copyrights, trade dress and trade secrets (“Intellectual Property Rights”). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in any such action or suit brought against Buyer based on an allegation that a Product sold pursuant to this Agreement 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 or actions including all negotiations to settle or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole option and expense, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept the return of the Product 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 Products 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 Product sold hereunder. The foregoing provisions of this Section shall constitute Seller’s sole and exclusive liability and Buyer’s sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter hereof are superseded.

20. Compliance with Law. U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or territory in which Seller is located and the Territory in which any Product is to be used or operated. The U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from and against all consequences of any such violations or actions including all negotiations to settle or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller shall, at its sole option and expense, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept the return of the Product 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 Products 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 Product sold hereunder.