# Round Head and Square Head Tie Rod Cylinders

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<td>Inside back cover</td>
</tr>
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Available in 2 styles
4 Bore sizes 2" thru 4"
Strokes to 12"

Round Head Style

Square Head Style

- Double acting, single rod
- Duralon® rod bushing
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Ports at position #1

- Media ................................. Air
- Max. operating pressure .............. 250 psi
- Min. operating pressure recommended .... 15 psi
- Ambient & media temperature range ... -25° to +250°F
- Prelubrication ......................... Magnalube® G Grease
- Stroke tolerance ...................... ± 1/64" ± 1/64"
- Optional – Hydraulic ................. 500 psi nonshock

Duralon® Rod Bearings Excel

<table>
<thead>
<tr>
<th>Load Capacity (psi)</th>
<th>Friction Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing Reference Issue</td>
<td>Slipp-</td>
</tr>
<tr>
<td>Hot Bronze ......................... 4,500</td>
<td>Steel-on-steel ........... .50</td>
</tr>
<tr>
<td>Hot Bronze ......................... 4,500</td>
<td>Bronze-on-steel .......... .35</td>
</tr>
<tr>
<td>Phenolic ......................... 6,000</td>
<td>Sintered Bronze-on-steel with mineral oil ... .13</td>
</tr>
<tr>
<td>Nylon* ......................... 1,000</td>
<td>Bronze-on-steel .......... .25</td>
</tr>
<tr>
<td>TFE .................................. 500</td>
<td>with mineral oil .......... .16</td>
</tr>
<tr>
<td>Reinforced Teflon* ............... 2,500</td>
<td>Copper lead alloy-on-steel ... .22</td>
</tr>
<tr>
<td>TFE fabric ......................... 60,000</td>
<td>Acetal-on-steel ............. .20</td>
</tr>
<tr>
<td>Polyimide ......................... 1,000</td>
<td>Nylon-on-steel .............. .32</td>
</tr>
<tr>
<td>Acetal ......................... 1,000</td>
<td>Duralon-on-steel ........... .05 - .16</td>
</tr>
<tr>
<td>Carbongraphite ..................... 600</td>
<td>* Shows Duralon bearing classification. Not to be used for design purposes.</td>
</tr>
</tbody>
</table>

Friction Properties

- Slip Coefficient
- Stick
- Steel-on-steel ..................... .50 Yes
- Bronze-on-steel .................... .35 Yes
- Sintered Bronze-on-steel with mineral oil .......... .13 No
- Bronze-on-steel .................... .25 No
- With mineral oil ................... .16 No
- Copper lead alloy-on-steel .......... .22 Yes
- Acetal-on-steel ..................... .20 No
- Nylon-on-steel ...................... .32 Yes
- Duralon-on-steel ................... .05 - .16 No

Duralon® Rod Bearings Excel

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Piston Seal, internally lubricated O-Ring for long life and improved performance

Groove for magnetic piston position sensing

PTFE Bearing Strip is located away from rod bearing for maximum load support

Specifications subject to change without notice or incurring obligation
**Longstroke™ Cylinders**

### Standard Models

**Standard: Single Rod, Double Acting**

- Rod End Head, aluminum, black anodized
- Cap End Head, aluminum, black anodized
- Recessed faces assure flat mounting
- 1/4 NPT Ports
- Full flow porting for fast response
- Piston Rod Bushing, anodized aluminum housing with Teflon® lined Duralon® insert
- Piston Stop
- Rod Seal, internally lubricated O’Ring for long life
- Piston Rod, stainless steel, centerless ground, polished, and hard chrome plated (68-72Rc)
- Piston, aluminum
- Counter bore locates piston rod to maintain precise concentricity
- Piston Bolt, steel, Loctited® and torqued
- Piston Seal, internally lubricated O’Ring for long life and improved performance
- PTFE Bearing Strip is located away from rod bearing for maximum load support
- Groove for magnet to activate position sensors
- O’Ring bumpers reduce metallic slap of piston on piston stop for quiet operation
- Cylinder Tube, aluminum
- Hard anodized ID (Rc60); Clear anodized OD
- Cylinder Tube end seal
- Stainless steel tie rods
- Stainless steel hex nuts
- Counterbore for nuts assures flat mounting
- Steel double rod stud, Loctited® and torqued
- Guide pin, precision ground tool steel
- Guide pin bushing, SAE 660 bearing bronze
- Guide pin seal, Urethane O’Ring
- Rubber disk prevents guide pin movement

**Option -DR: Double Rod, see page 3.7**

**Option -K: Nonrotating, see page 3.8**

**Cylinder OD** – is clear anodized aluminum for corrosion resistance and an attractive appearance.

**The Bore ID is Hard Anodized** – Hard anodizing is an electrochemical process which provides a very dense surface of aluminum oxide that actually impregnates the base aluminum. It forms an extremely hard (60 Rc) surface with a low coefficient of friction. Hardness, corrosion resistance and wear resistance exceeds that of chrome plated steel.

**An Extra Long Rod Bearing** – provides long and rigid support for the piston rod. The bearing material is Duralon® on all bore sizes. See page 3.2 for a chart comparing the exceptional physical properties of Duralon® to other common, though less durable, bearing materials.

**The Piston Rod** – is Hard Chrome Plated Stainless Steel. The standard rod end is fine female thread tapped and has long wrench flats.

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### Quick Reference to Components

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rod End Head, aluminum, black anodized</td>
</tr>
<tr>
<td>2</td>
<td>Cap End Head, aluminum, black anodized</td>
</tr>
<tr>
<td>3</td>
<td>Recessed faces assure flat mounting</td>
</tr>
<tr>
<td>4</td>
<td>1/4 NPT Ports</td>
</tr>
<tr>
<td>5</td>
<td>Full flow porting for fast response</td>
</tr>
<tr>
<td>6</td>
<td>Piston Rod Bushing, anodized aluminum housing with Teflon® lined Duralon® insert</td>
</tr>
<tr>
<td>7</td>
<td>Piston Stop</td>
</tr>
<tr>
<td>8</td>
<td>Rod Seal, internally lubricated O’Ring for long life</td>
</tr>
<tr>
<td>9</td>
<td>Piston Rod, stainless steel, centerless ground, polished, and hard chrome plated (68-72Rc)</td>
</tr>
<tr>
<td>10</td>
<td>Piston, aluminum</td>
</tr>
<tr>
<td>11</td>
<td>Counter bore locates piston rod to maintain precise concentricity</td>
</tr>
<tr>
<td>12</td>
<td>Piston Bolt, steel, Loctited® and torqued</td>
</tr>
<tr>
<td>13</td>
<td>Piston Seal, internally lubricated O’Ring for long life and improved performance</td>
</tr>
<tr>
<td>14</td>
<td>PTFE Bearing Strip is located away from rod bearing for maximum load support</td>
</tr>
<tr>
<td>15</td>
<td>Groove for magnet to activate position sensors</td>
</tr>
<tr>
<td>16</td>
<td>O’Ring bumpers reduce metallic slap of piston on piston stop for quiet operation</td>
</tr>
<tr>
<td>17</td>
<td>Cylinder Tube, aluminum</td>
</tr>
<tr>
<td>18</td>
<td>Hard anodized ID (Rc60); Clear anodized OD</td>
</tr>
<tr>
<td>19</td>
<td>Cylinder Tube end seal</td>
</tr>
<tr>
<td>20</td>
<td>Stainless steel tie rods</td>
</tr>
<tr>
<td>21</td>
<td>Stainless steel hex nuts</td>
</tr>
<tr>
<td>22</td>
<td>Counterbore for nuts assures flat mounting</td>
</tr>
<tr>
<td>23</td>
<td>Steel double rod stud, Loctited® and torqued</td>
</tr>
<tr>
<td>24</td>
<td>Guide pin, precision ground tool steel</td>
</tr>
<tr>
<td>25</td>
<td>Guide pin bushing, SAE 660 bearing bronze</td>
</tr>
<tr>
<td>26</td>
<td>Guide pin seal, Urethane O’Ring</td>
</tr>
<tr>
<td>27</td>
<td>Rubber disk prevents guide pin movement</td>
</tr>
</tbody>
</table>

Specifications subject to change without notice or incurring obligation
How to Order

1. Specify code for Series and Bore.
2. Specify stroke
   Note standard strokes listed above.
   Any stroke not listed is available, to 12" maximum, at nominal increase in delivery time and cost.
3. Specify mounting if other than standard
4. Specify options

Examples

321 X 8 - MR
Round Head Longstroke, 2" bore, 8" stroke,
Standard Mount – Face Mount on Rod End and Cap End, Male Rod Thread

S721 X 7 - E
Square Head Longstroke, 3" bore, 7" stroke,
Standard Mount – Side Tap Mount, Magnetic Piston
Longstroke™ Cylinders

Round Head, Standard, Face Mount Rod and Cap End

Extended Tie Rod Mount for Round Head Models
Specify mounting option
- Rod End Only: WF
- Cap End Only: WR
- Rod and Cap Ends: WFR

Round Head Clevis Mount Option
Specify mounting option
- Ports in line with slot: PM
- Ports 90° to slot: SM

Dimensions

<table>
<thead>
<tr>
<th>Bore</th>
<th>A</th>
<th>BB</th>
<th>BC</th>
<th>C</th>
<th>E</th>
<th>EE</th>
<th>F Dia.</th>
<th>FF</th>
<th>GG Pin</th>
<th>GG Hole</th>
<th>H</th>
<th>HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>3.25</td>
<td>4.13</td>
<td>2.81</td>
<td>NA</td>
<td>3.00</td>
<td>1.25</td>
<td>.750</td>
<td>.38</td>
<td>3745</td>
<td>.376</td>
<td>63</td>
<td>0.69</td>
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<tr>
<td>2-1/2&quot;</td>
<td>3.75</td>
<td>4.38</td>
<td>3.25</td>
<td>1.75</td>
<td>3.50</td>
<td>1.63</td>
<td>.750</td>
<td>.50</td>
<td>4995</td>
<td>.501</td>
<td>63</td>
<td>0.97</td>
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<tr>
<td>3&quot;</td>
<td>4.25</td>
<td>4.38</td>
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<td>1.75</td>
<td>3.50</td>
<td>1.63</td>
<td>.750</td>
<td>.50</td>
<td>4995</td>
<td>.501</td>
<td>63</td>
<td>0.97</td>
</tr>
<tr>
<td>4&quot;</td>
<td>5.50</td>
<td>4.63</td>
<td>4.63</td>
<td>2.25</td>
<td>4.50</td>
<td>2.00</td>
<td>.875</td>
<td>.63</td>
<td>6245</td>
<td>.626</td>
<td>75</td>
<td>1.22</td>
</tr>
</tbody>
</table>
Square Head, Standard, Side Tap Mount

Note: Ports at Position #3 are not available

Extended Tie Rod Mount for Square Head Models
Specify mounting option
Rod End Only WF
Cap End Only WR
Rod and Cap Ends WFR

2" Bore
3 Tie Rods Equally Spaced
2-1/2", 3", & 4" Bores
4 Tie Rods Equally Spaced

Specifications subject to change without notice or incurring obligation
Longstroke™ Cylinders

Double Rod

Option -DR

A U Cup rod seal is placed inboard in a SAE 660 bronze bushing to eliminate leakage past the rod seal. An additional O’ring is used as an outboard wiper.

Hydraulic

Low Pressure Service to 500 psi non-shock

Option -H

Use with Air-Oil systems and low pressure hydraulic systems when the rigidity and precision smoothness of hydraulics and control is required.

Viton Seals

Option -V

Use for elevated temperatures (−15° to +400°F) or compatibility with exotic media.

Consult engineering for compatibility information.

Male Rod Thread

Single Rod -MR

Double Rod, Rod End Only -MR

Double Rod, Cap End Only -MR1

Double Rod, Rod & Cap Ends -MR2

A high strength stud is threaded into the standard female rod end and retained with Loctite®. This method eliminates the small diameter thread relief area normally required when machining male threads. This provides a much stronger rod end which can be repaired, rather than replacing the complete rod, should the thread be damaged.

BORE THREAD

<table>
<thead>
<tr>
<th>BORE</th>
<th>THREAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1/2–20 x 1.00</td>
</tr>
<tr>
<td>2 1/2</td>
<td>1/2–20 x 1.00</td>
</tr>
<tr>
<td>3</td>
<td>1/2–20 x 1.00</td>
</tr>
<tr>
<td>4</td>
<td>5/8–18 x 1.25</td>
</tr>
</tbody>
</table>

3/8 NPT Ports

Option -P38

Use 3/8 NPT ports for higher flows, air over oil systems, etc.

Rubber Bumpers

Rod End only -BF

Cap End only -BR

Both Rod & Cap Ends -BFR

Option -BFR shown

A rubber doughnut is bonded to the cylinder head to act as the piston stop and absorb the impact of the piston. This reduces noise and absorbs energy, thus reducing destruction of the cylinder and tooling due to pounding. The amount of rubber that extends beyond the normal piston stop is designed to compress and allow full stroke of the cylinder at 60 to 80 psi. If your application uses lower pressure or has high energy, consult engineering with application details so that rubber mass can be adjusted to meet your specific requirements.

Because of the temperature limitations of the adhesives involved (-25° to +220°F) Rubber Bumpers are available in cylinders with standard internally lubricated Buna-N seals only.

Use to reduce noise and absorb impact.

Note! On applications such as punching, shearing, setting blind rivets, etc. where high forces are built up and then released very quickly, the proper method of "CATCHING" this type of load is to adjust the cylinder piston and the tooling so that at the point of breakthrough the piston is very close to the bumper. This reduces the dynamic load that the piston and bumper are required to absorb.
Option Specifications

Adjustable extend stroke  
Option -AS

For strokes through 6°
Full stroke adjustment is standard.

Note!
To maintain operator safety features of this option, it is NOT available with mounting styles: WR and WFR.
Use caution when mounting to avoid creating pinch points.

Nonrotating  
150 psi Max. Operating Pressure

Option -K

Square Head Series only in Single Rod and optional Double Rod (-DR)

Two guide pins incorporated inside the cylinder pass through the piston head. These guide pins prevent rotation of the rod with a tolerance of ±1°. The guide pins, being incorporated inside, are protected from the environment, physical damage, and are lubricated by the system lubrication, and require NO additional space, leaving the rod end area free for attachments and tooling as required by your application.

The guide pins are precision ground tool steel and run in SAE 660 bearing bronze bushings and Polyurethane O’rings. These features provide precision guiding and long, trouble free life. A rubber disk is included at the end of each guide pin to take up end play and firmly seat the pins in the precision guide pin holes.

An information label is applied to each cylinder to warn against damage.

WARNING
THIS CYLINDER HAS A NONROTATING ROD. TO PREVENT INTERNAL DAMAGE HOLD ROD BY WRENCH FLATS WHEN INSTALLING OR REMOVING ATTACHMENTS.

Use when any attachment to the piston rod must not rotate.

Finish  
Plating; Pro-Coat™, Electroless Nickel, Heads & Tube

Option -N

Pro-Coat™, Electroless Nickel Plating is a hard, smooth, corrosion and wear resistant coating. It will often suffice for applications where stainless steel is specified. Its lasting luster provides high eye appeal.

The coating is a high nickel, low phosphorous alloy deposited by chemical reduction without electric current that is “mil-for-mil” more corrosion resistant than electroplated nickel. The surface is virtually pore free. The thickness of the nickel deposit is constant over the entire surface. Blind holes, threads, small diameter holes and internal surfaces all receive the same amount of plating. It has natural lubricity and a high resistance to abrasion. As shipped hardness of the coating is approximately 49 Rockwell C. Heat treating can increase hardness to approximately 60 Rockwell C. For specific applications, consult engineering.

The cylinder heads and tube, inside and outside, are plated. Tie rods and nuts are standard stainless steel. Rod bushing is standard hard anodized aluminum and Duralon®.
**Magnetic Piston**

*Option -E*

(Order Sensors and Sensor Clamps Separately)

- **Option -E** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- **Mounting** – The sensor snaps into a 2-part clamp that attaches rigidly to any of the tie rods and can be positioned anywhere along the length of the cylinder.
- **Reliability** – The annular piston magnet is permanently bonded into a groove in the piston. It is a polarized permanent magnet of rubber bonded barium ferrite that is very stable and is not affected by shock. Under normal usage it will remain magnetized indefinitely.
- **Warning** – External magnetic fields and/or ferrous objects may affect the strength of the piston magnet, therefore affecting sensor actuation and piston position indication. Warning labels (shown left) are affixed to the cylinder.

**Sensor & Clamp Ordering Guide**

<table>
<thead>
<tr>
<th>LED Lighted Magnetic Piston Position Sensors</th>
<th>Temperature Range: –20° to +80°C (–4° to +176°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Type</strong></td>
<td><strong>Prewired 9 ft. Part No.</strong></td>
</tr>
<tr>
<td>Reed Switch</td>
<td>9-2A197-1004</td>
</tr>
<tr>
<td>Electronic</td>
<td>9-2A197-1033</td>
</tr>
<tr>
<td>Electronic</td>
<td>9-2A197-1034</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Female Cordsets for Quick Disconnect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
</tr>
<tr>
<td>1 Meter</td>
</tr>
<tr>
<td>2 Meter</td>
</tr>
<tr>
<td>5 Meter</td>
</tr>
</tbody>
</table>

**Sensor Mounting Clamp - for all Longstroke Models**

For all Longstroke Models Order Part Number 800-200-000
End Lug Mount Kit

Kit includes:
2 brackets and 4 bolts for attaching the brackets to the cylinder heads.

Material:
- Brackets, plated steel
- Screws, Black Oxide Steel

Side Lug Mount Kit

Kit includes:
2 brackets and 4 bolts for attaching the brackets to the cylinder heads.

Material:
- Brackets, plated steel
- Screws, Black Oxide Steel

Rod Clevises

Materials
- Clevis and Stud: Steel, black oxidized
- Pin: 416 Stainless Steel
- Clips: Steel, plated

Eye Bracket Kits mate with Option -PM or -SM and Rod Clevis

Materials
- Bracket: High strength Zinc die casting
- Bushings: Oil filled powdered metal
- Screws: 4, Steel, plated or black oxidized