**WARNING**

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application including consequences of any failure, and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

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The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated on the separate page of this document entitled “Offer of Sale”.

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# Pneumatic Actuator Products
## Product Selection Chart

<table>
<thead>
<tr>
<th>Index</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Application Engineering Data</td>
</tr>
<tr>
<td>B</td>
<td>Tie Rod Cylinders</td>
</tr>
<tr>
<td>C</td>
<td>ISO Cylinders</td>
</tr>
<tr>
<td>D</td>
<td>Round Body Cylinders</td>
</tr>
<tr>
<td>E</td>
<td>Compact Cylinders</td>
</tr>
<tr>
<td>F</td>
<td>Guided Cylinders</td>
</tr>
<tr>
<td>G</td>
<td>Rodless Cylinders</td>
</tr>
<tr>
<td>H</td>
<td>Rotary Actuators</td>
</tr>
<tr>
<td>J</td>
<td>Pneumatic Grippers</td>
</tr>
<tr>
<td>K</td>
<td>Air Motors</td>
</tr>
<tr>
<td>L</td>
<td>Complementary Products</td>
</tr>
<tr>
<td>M</td>
<td>Electronic Sensors</td>
</tr>
<tr>
<td>N</td>
<td>Industrial Shock Absorbers</td>
</tr>
<tr>
<td>P</td>
<td>Fax Forms, Safety Guide, Offer of Sale</td>
</tr>
</tbody>
</table>

### Application Engineering Data

- **Tie Rod Cylinders**: 3MA/4MA Series, 3MAJ/4MAJ Series, 4MNR Series, ACVB Option, LPSO Option, S Series, C Series
- **ISO Cylinders**: P1D Series, P1A Series
- **Round Body Cylinders**: SR Series, SRM Series, SRD/SRDM Series, SRX Series, P1L Series, P Series
- **Compact Cylinders**: P1M Series, P1M Series with Tooling Plate, P1M Series Swing Clamp, LP/LPM Series, C05 Series, P1G Series
- **Guided Cylinders**: P5T Series, P5T2 Series, P5L Series, HB Series, P5E Series
- **Rodless Cylinders**: OSP-P, P1X Series, P1Z Series, RC Series, GDL
- **Rotary Actuators**: PV Series, PRN(A) Series, WR Series, PTR Series, B671/F672 Series, HP Series, P5W Series
- **Pneumatic Grippers**: For Complete Information, Refer to Catalog 1900-2
- **Air Motors**: P1V-S Series For Complete Information, Refer to Catalog PDE2554TCUK-ul
- **Complementary Products**: Linear Alignment Couplers, Flow Controls, 4TK Air Oil Tanks, PRL Series, Transition Kits
- **Electronic Sensors**: Solid State, Reed and Proximity Sensors
- **Industrial Shock Absorbers**: Industrial Shock Absorbers (Linear Decelerators)
- **Fax Forms, Safety Guide, Offer of Sale**: Application FAX Forms
**3MA/4MA NFPA Cylinders**
- Lightweight Aluminum - Durable Construction
- 9 Bore Sizes: 1-1/8” through 8”
- Mounting Styles:
  - 3MA - 18 standard
  - 4MA - 20 standard
- 3MA Series: General Purpose Cylinder.
- 4MA Series: All Purpose Cylinder with Many Options.

**3MAJ / 4MAJ Series**
- Cylinder with Manual Override Rod Lock
- 8 Bore sizes: 1-1/2” through 8”
- Mounting styles: 17 standard
- Bolt-On Modularity

**4MNR Series**
- Multiple Piston Rods, Non-rotating Cylinder
- 6 Bore sizes: 1-1/8” through 4”
- Mounting styles: 14 standard
- Steel Tool Plate Included

**ACVB Option**
- Cylinder with Directional Valve Combination
- 6 Bore Sizes: 1-1/2” through 5”
- Two Different Manifold Sizes & Three Different Valve Sizes
- Utilizes 3MA and 4MA Series Cylinders with B-Series Valves

**LPSO Option**
- Cylinder with Linear Position Sensor Option
- 7 Bore Sizes: 2” through 8”
- Mounting Styles: 16 Standard
- Continuous Analog Position Feedback
ISO and Round Body Cylinders

P1D Series
ISO Pneumatic Cylinders
• 32-125mm bore sizes available
• Four versions
  Standard (die cast end caps, composite piston)
  Removable Gland
  Clean (positive geometry/hygenic design)
  Tie Rod (traditional tube and tie rod)
• Conforms to the ISO6431/VDMA24562 standards
• Rod locking device available

P1A Series
Mini-ISO Cylinders
• 10, 12, 16, 20 and 25mm bore sizes
• Stroke lengths from 20 - 500mm
• Conforms to ISO 6432 dimensional specifications
• Single and double acting versions available

P1L Series
High-Performance
Repairable Cylinders
• 8 Bore sizes: 20mm through 100mm
• Stroke lengths to 1,000mm
• 9 Mounting styles
• Metric, Aluminum, Threaded Body Design

SR/SRM/SRD/SRDM/SRX Series
Non-Repairable Cylinders
• 304 Stainless Steel Body
• 12 Bore Sizes: 5/16” through 3”
• 28 standard mounting styles
• Piston position sensing available
• Delrin® end caps available
• Continuous position feedback capability

Delrin® is a registered trademark of Dupont.
P1M Series  
**Extra Low Profile Cylinders**
- 10 Bore Sizes: 12mm through 100mm
- Three versions
  - Standard Cylinder
  - Tool Plate (12mm through 50mm bores)
  - Swing Clamp (32, 40 and 50mm bores)
- Flexible Porting
- Piston Position Sensing Available

LP/LPM Series
- Non-lube compact air cylinder
- Low profile design
- 8 Bore sizes: 9/16" through 4"
- Stroke lengths from 1/8" to 6"
- Piston Position Sensing Available

C05 Series  
**Short Stroke Cylinders**
- 8, 12, 20, 32, 50 and 63mm bore sizes
- Strokes up to 25 mm
- Single and double acting versions
- Ideal for clamping or locking in confined areas

P1G Series  
**Cartridge Cylinders**
- 6, 10 and 15mm bore sizes
- Stroke lengths up to 15mm
- Nickel plated body and stainless steel piston
- Threaded body provides space savings
P5T Series Thrusters
- Heavy duty short stroke applications
- Compact housing with integral cylinder
- 9 Bore sizes: 16mm through 100mm
- Strokes to 200mm depending on model
- Force output at 75 psi: 23.6 to 913 lb

P5L Series Guided Cylinders
- Thrust, reach and base styles
- 8 Bore Sizes: 20mm through 100mm
- Stroke lengths in excess of 1500 mm
- Shocks, Bumpers, Cushions Available
- Loads in excess of 9000 N (2025 lb)
- Powered by P1L Cylinders

HB Series Guided Cylinders
- Medium duty to extremely heavy duty service
- Compact, Thrust, Reach and Base Versions
- Bore Sizes: 40, 50 and 63mm ISO
  1.5", 2" and 2.5" NFPA
- Force output at 80 psi: 117 to 368 lb
- Powered by 12 standard cylinder types
Parker-Origa System Plus
OSP-P Rodless Cylinders
- Bore Sizes: 10mm through 80mm
- Stroke length up to 6m
- Magnetic piston sensing and transfer porting available
- Various guidance systems available

The Parker-Origa System Plus is a totally modular concept which offers the choice of guidance and control modules to suit the exact needs of individual applications. The actuators at the core of the system all have a common extruded profile, with double dovetail mounting rails on three sides, which are the principle building blocks of the system to which all modular options are directly attached.

P1X Series Rodless Cylinders
- Bore Sizes: 16mm through 63mm
- Stroke length up to 5m
- Magnetic piston sensing and transfer porting standard

The P1X Series Compact Rodless Cylinders feature a high load carrying capability coupled with an oval piston design to provide a band-style rodless cylinder that meets today’s aggressive performance requirements.

In addition to its space saving features, the P1X Series incorporates a variety of options so that it can be applied to the widest variety of applications.

P1Z Series Rodless Cylinders
- 16, 20 and 32mm bore sizes
- Basic and guided versions

The P1Z Series Magnetically Coupled Rodless Cylinders feature a magnetic piston and carriage that allow rodless cylinder design with no external leakage. The P1Z Series cylinders are available in two versions, the basic version in which the load must be externally guided and a guided version that has the guides built in.
PRNA Series
Vane Rotary Actuators

- 5 miniature and 4 standard models
- Rotation angles 90°, 100°, 270° and 280°
- Oscillating reference points of 40°, 45° and 90°
- 1.33 to 2355 lb-in torque at 100 psi

PTR Series
Rack and Pinion Rotary Actuators

- 5 Bore sizes: 1" through 3-1/4"
- 5 Standard rotations
- Single and Double Rack Versions in all bore sizes
- 39 to 2250 lb-in torque at 100 psi
- Air/Oil, 3-Position and Antibacklash units available

PV Series
Vane Rotary Actuators

- 8 model sizes
- Single and Double vanes available
- 2 Standard rotations with stroke adjusters available
- 8 to 1800 lb-in torque at 100 psi
- Low temperature versions available

HP Series
Heavy Duty Rotary Actuators

- 2 Large bore sizes: 6" and 8"
- 3 Standard rotations
- Robust construction
- 4,500 and 10,000 lb-in torque at 100 psi
- End of stroke cushions and stroke adjusters available
**Pneumatic Grippers**

- Parallel, Angular and 3-Jaw models available
- Grip Forces: up to 3000 lbs
- Single acting, double acting, spring assist and spring return

Grippers are available in either true parallel with strokes ranging from 0.12 to 6 inches or angular with 30° or 180° degree gripping configurations in sizes from miniature to heavy duty.

Gripper options include spring assist or spring return grippers which provide a fail-safe mode in the event of a power failure. Reed or Hall Effect switches or proximity sensors are also available with many series.

**Industrial Shock Absorbers**

- Industry interchangeable
- Miniature, small, medium and large bore sizes
- Metric and inch mounting threads available
- Highest effective weight ratings

Parker industrial shock absorbers decrease machine down time, and increase productivity by reducing impact damage.

**P1V-S Series Air Motors**

- Stainless steel external components
- Seven different sizes
- Power range from 20 to 1,200 watts
- Speeds from 5 to 24,000 rpm
- Sealed design for use in food grade applications
The Parker 5-Year Extended Warranty

Parker Hannifin Corporation will extend its warranty on all pneumatic components to sixty (60) months providing they are correctly installed and protected by Parker pneumatic filters which are properly maintained. Components covered by this warranty include all cylinders, valves and pneumatic automation components manufactured by Parker in any of our global facilities. This warranty covers our components anywhere in the world you may ship your equipment.

Parker’s obligation under this warranty is limited to the replacement or repair of any failed components. The buyer understands that the seller will not be liable for any other costs or damages.

The buyers of quality Parker components and filters benefit by having ONE source for all pneumatic needs - Parker.

Roger Sherrard
President
Automation Group
WARNING: \textbf{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.

\textbf{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. 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 manner 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 and OSHA 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-CP ARKER, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2. 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:

- 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. Cushion cylinders 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:

\[ \text{operating pressure} \times \text{effective cap end area} \]

\[ \text{effective rod end piston area} \]

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

3. 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 that 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.

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 seal 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 in 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 re-torque 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 re-torque 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 lip seal 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 lip seal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal seal. 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 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.
**Terms and Conditions**

Seller's willingness to offer Products for sale or accept an order for Products is subject to the terms and conditions contained in this Offer of Sale or any newer version of the same, published by Seller electronically at www.parker.com/salesandterms. All payments, orders, and other communications shall be in writing. No alteration or modification of any terms or conditions of Buyer's order or any other document or other communication issued by Buyer.

**Price; Payment.** Prices stated on Seller’s Quote are valid for thirty (30) days, except as explicitly otherwise stated therein, and do not include any sales, use, or other taxes or duties. Seller reserves the right to modify prices to account for any raw material price fluctuations. Unless otherwise specified by Seller, all prices are F.O.C.A. Seller’s facility (INCOMEWS 2010). Payment is subject to credit approval and payment for all amounts due is required within thirty (30) days from the date of the bill of sale (subject to such terms as specified by Seller’s Credit Department). Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law.

**Shipment; Delivery; Title and Risk of Loss.** All delivery dates are approximate. Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the carrier at Seller’s facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyer’s request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense, which Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer’s acts or omissions.

**Warranty.** Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve (12) months from the date of invoice (or such date as may be specified by Seller). Seller will repair or replace any Product, at Seller’s option, if it is determined by Seller that it is defective in material or workmanship.

**Right to Use Security Interest.** Buyer authorizes Seller as its attorney to execute and file on Buyer’s behalf all documents and other instruments necessary to perfect Seller’s security interest in any Products hereunder. Buyer shall bear all costs and expenses incurred for the filing of such instruments. Buyer shall keep all such instruments and documents in its possession and shall not remove, cancel, release, or otherwise dispose of any such special tooling or other property in its sole discretion at any time.

**Buyer’s Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller retains a security interest in all Products delivered to Buyer and this agreement is in addition to any security interest that may be held by Seller. Buyer shall at all times keep all Products free of any liens, encumbrances, claims, judgments, liens, attachments, or the like and shall forthwith execute and deliver to Seller such security documentation as Buyer may reasonably request. Buyer authorizes Seller as its attorney to execute and file on Buyer’s behalf all documents that Seller deems necessary to perfect its security interest.

**Improper Use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), 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, application, or misuse of Products or Services by Buyer or by any authorized or unauthorized user; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller’s use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Products; or (d) Buyer’s failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

**Cancellation and Changes.** Buyer may not cancel or modify or cancel any order for any reason, except with Seller’s written consent and upon terms that will indemnify, defend and hold Seller harmless against all loss and additional expense, which Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer’s acts or omissions.

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

**Waiver and Severability.** Failure to enforce any provision of this agreement will not invalidate that provision; nor will any such failure prejudice Seller’s right to enforce that provision in the future. Invalidation of any provision of this agreement 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.

**Termination.**Seller may terminate this agreement for any reason at any time prior to delivery of thirty (30) days prior to delivery. Seller may terminate this agreement, in writing, if: (a) Buyer breaches any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer’s property (c) files a petition or relief under bankruptcy on its own behalf or on behalf of another party (d) suspends any assignment for the benefit of creditors; or (e) dissolves its business or liquidates all or a majority of its assets.

**Governing Law.** This agreement and the sale and delivery of all Products are to 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 or relating to this agreement.

**Indemnity for Infringement of Intellectual Property Rights.** Seller is not liable for infringement by any patent, trademark, copyright, trade dress or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (“Intellectual Property Rights”). Seller will defend at its expense and pay the cost of any settlement, or any damages awarded in an action 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 terminates ten (10) days after Buyer notifies Seller of any such infringement. Buyer will provide Seller with immediate notice of any occurrence of such allegations of infringement, and Seller will have sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller will replace the Product, remove or modify the Product so as to make it noninfringing, or offer to accept return of the Product and refund the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller is not liable 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 constitute Seller’s sole and exclusive liability and Buyer’s sole and exclusive remedy for infringement of Intellectual Property Rights.

**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 are herein merged. The terms contained herein may not be modified unless in writing and signed by an authorized representative of Seller.

**Compliance with Laws.** Buyer agrees to comply with all applicable laws, regulations, statutes and orders of any and all governmental authorities, including the Federal, the State of Ohio, the United States of America, and the country or countries in which Buyer may operate, including without limitation the U.S. K. Bitter Act, the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act, the Anti-Drug Abuse and Cosmetic Act ("FDCA")each as currently amended, and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer or its employees or agents. Buyer, by executing this agreement, agrees to the jurisdiction and personal and subject matter jurisdiction of the courts of the U.K. Bitter Act, the FCPA, the FDA, and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any offers or provide anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller.