HTR Hydraulic Rotary Actuators
For working pressures up to 210 bar

Catalogue HY07-1220/UK
November 2002
**Introduction**

**HTR Rotary Actuators**

HTR Series heavy duty hydraulic rack and pinion rotary actuators convert fluid power into rotary motion. They are suitable for a wide variety of applications, including material handling and valve actuation, in industries as diverse as machine tools, primary metals, mining and oil field equipment.

HTR Series rotary actuators are designed for slow speed rotation, applying high torque to the movement of large masses. They employ conventional tie rod cylinder construction and are rated for use at working pressures up to 210 bar. The pinion and output shaft are supported in large tapered roller bearings, allowing the unit to support high external and thrust loads. All HTR Series rotary actuators feature a high strength, ductile iron housing, for ease of mounting and good shock resistance.

In addition to the standard HTR Series rotary actuators described in this catalogue, special designs can be produced to suit customer requirements. Our engineers will be pleased to advise on unique designs to meet specific applications.

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**Why use a Rotary Actuator?**

- provides uniform torque in both directions
- simple, compact design
- wide range of sizes
- high torque output from a small envelope
- no external linkage needed for rotary motion
- excellent holding capability
- rotation can be specified to suit application
- will support radial and thrust loads

**Specifications**

- Max. non-shock operating pressure 210 bar
- Design pressure 315 bar
- Rotational range Standard – 90°, 180°, 360°
  Special order – any rotation to a maximum of 1800°
- Rotational tolerance 0°, ±2°
- Output torque at 210 bar 100 – 6800 Nm
- Min. operating pressure 5 bar
- Max. angular backlash
  HTR.9 – HTR10 30 minutes
  HTR15 – HTR150 15 minutes
  HTR300 – HTR600 10 minutes
- Self-energizing, wear-compensating polyurethane piston seals

**About Parker Hannifin**

Parker Hannifin is the global leader in motion and control technologies, partnering with its customers to increase their productivity and profitability. The company employs more than 57,000 people in 43 countries around the world, providing customers with technical excellence and first class customer service.

In addition to the HTR Series of rotary actuators featured in this catalogue, Parker also manufactures a wide range of other hydraulic and electro-hydraulic actuator products. Catalogues describing our standard products are available on request from your nearest Parker sales office – see rear cover for addresses.

Visit us at www.parker.com/eu

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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.

**Offer of Sale**

Please contact your local Parker representative for a detailed offer of sale.
1 Rack and Pinion
Maximum strength and shock resistance result from the use of through-hardened chrome alloy steel for the rack and for the one-piece pinion and output shaft. Gears are packed with molybdenum disulphide grease on assembly, to reduce wear and prolong gear life under conditions of extreme pressure.

2 Bronze Rack Bearings
Generous support for the rack is provided by a bronze rack bearing, reducing wear and extending pinion life. The bronze rack bearing, a standard feature on HTR15 models and above, is available as an option on smaller units.

3 Gear Housing
High strength ductile iron provides resistance to shock loads under the most arduous operating conditions. Four mounting holes in both the front and rear faces permit flexibility in machine design, with base and pilot mounting styles available as options.

4 Tapered Roller Bearings
High capacity tapered roller bearings provide rigid support for the pinion and output shaft. Generous size and capacity allow the bearings to withstand external radial and thrust loads, even under high cycling applications. Correct bearing preload during maintenance is easily achieved by torque adjustment of the threaded retainer ring on the rear face of the rotary actuator, eliminating the inconvenience of shims and reducing the risk of damage to the bearing through incorrect adjustment.

5 Shaft Options
A plain male shaft with two keyways, the most widely used style of shaft, is supplied as standard with all HTR Series rotary actuators. The keyways are set at the 12- and 6-o’clock positions at mid-stroke for ease of positioning and assembly, and are as large as possible to ensure maximum strength. Shaft options include a female shaft with two keyways, and male and female splined types. Both single and double shaft options are available, providing the greatest possible flexibility for the machine designer.

6 Tie Rod Cylinders
Proven tie rod construction, using standard cylinder bore sizes, guarantees reliability and ease of maintenance for the hydraulic cylinders which drive the rack and pinion. Heavy-walled alloy steel tubing is micro-finished for long piston and seal life, while tie rods are drawn from alloy steel, with precision rolled threads for high strength and resistance to fatigue.

7 Pistons and Seals
Rugged one-piece steel pistons (not HTR.9 or HTR1.8) are fitted as standard with polyurethane seals and PTFE wear rings, preventing metal-to-metal contact. The piston seals are self-compensating for long life and reduced maintenance and, subject to access, seals and wear rings can be inspected or replaced without removing the actuator from the machine.

8 Cushioning
Progressive deceleration is available by specifying cushions for either or both directions of rotation. The self-centring cushions are adjustable, permitting exact matching to load and speed conditions, and offer extended machine life with reduced noise and shock.

9 Floating Cushion Bushes
Closer tolerances – and therefore more effective cushioning – are permitted by the use of floating cushion bushes. Lifting of the bronze cushion bush minimises fluid restriction to the start of the return stroke, allowing full pressure to be applied over the whole area of the piston, to provide full power and rapid cycle times.
Advantages of Parker's Rack and Pinion Rotary Actuators

- Cost-effectiveness – especially above 90°, where linear actuators need increasingly intricate linkages to generate rotary motion.
- Simplicity – a rotary actuator with a hollow, or female, shaft can replace support bearings and pillow blocks, due to the high load capacity of the bearings.
- Resistance to hostile environments – no extending/retracting sealing surfaces exposed to abrasive or corrosive substances. Special materials and coatings ensure long life in arduous usage.
- Ease of maintenance – servicing of pistons and seals can be carried out with the actuator in place on the machine, subject to access.
- Leakage resistance – pressurized fluid is remote from the output side of the mechanism; piston seals are the only dynamic seals subject to system pressure.
- Long life – the rack/pinion/bearing assembly is packed with molybdenum grease on assembly and does not come into contact with hydraulic fluid.
- Premium quality – every Parker rotary actuator is proof tested before shipping.

General Specification – Torque Outputs, Pressure Ratings and Weights

<table>
<thead>
<tr>
<th>Model</th>
<th>Continuous Duty 1</th>
<th>Intermittent Duty 2</th>
<th>Static Duty 3</th>
<th>Weights – kg</th>
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<td>Pressure bar</td>
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<td>HTR600</td>
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</table>

1 Continuous duty – >10⁴ cycles  2 Intermittent duty – <10⁴ cycles  3 Static duty – maximum rating (no dynamic loads)
Shaft Options

Keyed and splined shaft designs are available for the HTR Series rotary actuators, in both male and female forms. The standard male, twin key shaft style is illustrated with other major dimensions on pages 6 and 7, while other shaft options are shown below. All the shaft options illustrated are shown in the mid-stroke position. Custom designs, including double-ended shafts, are available to special order – please contact the factory for details.

### Male Splined Shaft

![Diagram of Male Splined Shaft]

### Female Keyed Shaft

![Diagram of Female Keyed Shaft]

### Male Splined Shaft to DIN/ISO 14

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<tr>
<th>Model</th>
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<th>N a11</th>
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<td>HTR300 &amp; 600</td>
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### Female Keyed Shaft to DIN 6885

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<th>E</th>
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### Female Splined Shaft to DIN/ISO 14

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<th>J H7</th>
<th>K</th>
<th>Number of splines</th>
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<td>76</td>
<td>72</td>
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<td>125</td>
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<td>18</td>
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All dimensions are in millimetres unless otherwise stated.
Dimensions – HTR.9 to HTR10

HTR.9 to HTR5
Single Rack Models

HTR1.8 to HTR10
Double Rack Models

Dimensions – with Face Mount and Male Keyed Shaft

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<th>Rotation A max</th>
<th>B</th>
<th>C</th>
<th>Cd</th>
<th>Cs</th>
<th>D</th>
<th>E ±0.13</th>
<th>F ±0.13</th>
<th>Fd ±0.13</th>
<th>Fs ±0.13</th>
<th>G</th>
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<td>–</td>
<td>89</td>
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<td>60</td>
<td>–</td>
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<td>30</td>
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<td>HTR1.8</td>
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<td>257 333 464</td>
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<td>178</td>
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<td>416 553 822</td>
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<td>176</td>
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<td>–</td>
<td>–</td>
<td>254</td>
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<td>387</td>
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<td>–</td>
<td>–</td>
<td>125</td>
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<td>63.5</td>
<td>90° 180° 360°</td>
<td>476.5</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td>101.6</td>
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All dimensions are in millimetres unless otherwise stated.
### Dimensions – HTR15 to HTR600

**Rotary Actuators**  
**HTR Series**

#### Dimensions – with Face Mount and Male Keyed Shaft

<table>
<thead>
<tr>
<th>Model</th>
<th>Bore (mm)</th>
<th>J</th>
<th>K (mm)</th>
<th>L</th>
<th>M (mm)</th>
<th>N</th>
<th>O</th>
<th>P (mm)</th>
<th>R</th>
<th>S</th>
<th>T</th>
<th>U (BSPP)</th>
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<td>191</td>
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* G³⁄₄ when combined with a stroke limiter – see page 11.  
All dimensions are in millimetres unless otherwise stated.
Base and Pilot Mountings
HTR Series rotary actuators are available with the options of face, base or pilot mounting styles, to suit the requirements of different applications. Mounting dimensions for the face mounting styles are shown with other major dimensions on pages 6 and 7. The equivalent dimensions for base and pilot mounting styles are shown in the table.

<table>
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<th>Pilot Mounting</th>
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</tr>
<tr>
<td>HTR3.7 &amp; 7.5</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>HTR5 &amp; 10</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>HTR15 &amp; 30</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>HTR22 &amp; 45</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>HTR75 &amp; 150</td>
<td>145</td>
<td>165</td>
</tr>
<tr>
<td>HTR300 &amp; 600</td>
<td>240</td>
<td>330</td>
</tr>
</tbody>
</table>

Port Sizes and Positions
The standard port style for HTR Series rotary actuators is a BSP (parallel) port, but NPTF, SAE, and metric port styles to DIN 3852/1 and ISO 6149/1 are also available. The relevant sizes of port for each model of rotary actuator are shown in the table.

Ports will be supplied in position 1, as shown in the diagram, unless a different position is specified on the order. Ports are available in positions 2, 3 and 4 at no extra cost; position 5 is available as an extra cost option.

Air Bleeds
These may be fitted in positions unoccupied by ports.
Cushions and Cushion Adjustment Location
Cushioning is recommended as a means of controlling the deceleration of masses. Machine life is extended as a result of the reduced shock, permitting faster cycle times with lower levels of noise. Cushions are recommended for high kinetic energy applications and/or where the full rotation of the actuator is being used. They are available as an option on all HTR Series rotary actuators, for one or both rotations, and do not affect the actuator’s envelope or mounting dimensions. For the HTR Series rotary actuator, the standard angle of cushioning is 20° (0.349 rads).

Each cushion is adjustable individually, allowing cushion performance to be matched to the application. The positions of cushion adjusters, relative to port positions, are shown in the table – numbers relate to the diagram of port positions on page 8.

* Single rack models only

**Note:** Where cushioning is required on double rack units, the High Performance Cushion option described on page 10 should be specified.

<table>
<thead>
<tr>
<th>Port Position</th>
<th>Cushion Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4*</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

Formulae
For a load that moves in the horizontal plane, only the kinetic energy need be considered. If the load is to move vertically, then the potential energy change of the load during cushioning must also be taken into account. Both conditions are described by the following equations. The resulting figure for energy to be absorbed can then be applied to the graph of Cushion Energy Absorption Capacity, to identify a rotary actuator with adequate cushion capacity.

**Note:** the graph of Cushion Energy Absorption Capacity should only be used for initial sizing. For accurate sizing, please contact the factory.

For masses moving horizontally:

\[
E = \frac{1}{2} J_m \omega^2
\]

For masses moving downwards:

\[
E = \frac{1}{2} J_m \omega^2 + mgR\theta
\]

For masses moving upwards:

\[
E = \frac{1}{2} J_m \omega^2 - mgR\theta
\]

Where:
- **E** = energy to be absorbed, Joules
- **J_m** = rotational mass moment of inertia, kgm²
- **\omega** = rotational velocity of load, rads/sec
- **m** = mass of load, kg
- **g** = acceleration due to gravity, 9.81m/s²
- **R** = radius of rotation, m
- **\theta** = angle of cushioning, radians (0.349 rads = 20°)

Example
- **P** = 100 bar
- **m** = 200 kg
- **R** = 0.2 m
- **\omega** = 6 rpm

Standard cushions = 20° = 0.349 rads.

\[
E = \frac{1}{2} J_m \omega^2 + mgR\theta
\]

\[
E = \left(\frac{1}{2} \times 200 \times 0.2^2\right) \times 6 \times \left(\frac{2\pi}{60}\right)
+ (200 \times 9.81 \times 0.2 \times 0.349)
\]

\[E = 1.6 + 136.9\]

\[E = 138.5 \text{ Joules}\]

From the graph of Cushion Energy Absorption Capacity, it can be seen that an HTR7.5 (double rack unit) is capable of absorbing this energy where the High Performance Cushion option is specified. An HTR15 (single rack unit) is also capable of absorbing this energy.
High Performance Cushions
The High Performance cushion option can only be specified on double rack rotary actuators. Double rack rotary actuators can achieve very high torques, to move large masses which need to be decelerated at the end of travel. This cushion energy is absorbed efficiently by the use of High Performance cushions. External piping ensures that during cushioning the maximum deceleration torque is available. External interconnecting pipework for the High Performance cushion is not supplied with the rotary actuator.

Operation
The work ports of a standard directional valve are connected directly to ports C-1 and C-2 of the rotary actuator, as shown. Port A-1 is connected directly to A-2, and B-1 is connected directly to B-2. When pressure is applied directly to port C-1 (clockwise shaft rotation), fluid is also directed through line A to the other rack. Exhaust flow from B-1 and B-2 is directed through the cushion bush and cushion adjustment screw until the cushion spear closes off the main passage. The total flow from both end caps is then directed across one cushion adjustment screw, equalizing back pressure and improving cushion performance. Pressurizing C-2 and exhausting C-1 reverses the operation.

Notes
1. Pipework between A-1 and A-2, and B-1 and B-2 should be kept to a minimum to reduce the inertia of the fluid. Fluid flow should be less than 5m/s.
2. Connection ports will have the same specification as the working ports.

Cushioning

Cushion Energy Absorption Capacity – All Cushion Options

<table>
<thead>
<tr>
<th>Energy Capacity (Joules)</th>
<th>HTR600 High Performance</th>
<th>HTR150 High Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000</td>
<td>HTR150</td>
<td>HTR300</td>
</tr>
<tr>
<td>2000</td>
<td>HTR300</td>
<td>HTR75</td>
</tr>
<tr>
<td>1500</td>
<td>HTR75</td>
<td>HTR15, HTR22</td>
</tr>
<tr>
<td>1000</td>
<td>HTR15, HTR22</td>
<td>HTR3.7, HTR5</td>
</tr>
<tr>
<td>5000</td>
<td>HTR3.7, HTR5</td>
<td>HTR10 High Performance</td>
</tr>
<tr>
<td>4000</td>
<td>HTR10 High Performance</td>
<td>HTR9</td>
</tr>
<tr>
<td>3000</td>
<td>HTR9</td>
<td></td>
</tr>
</tbody>
</table>

Note: Cushion performance may be affected by the addition of a stroke limiter. Please consult the factory in critical applications.

Port Positions
Rotary actuators with High Performance Cushions differ from standard double rack units only in their port positions – all external dimensions of the units remain unaltered.

<table>
<thead>
<tr>
<th>Work Ports C-1 &amp; C-2 Port Position</th>
<th>Cushion Adjuster Position</th>
<th>Connection Ports A-1, A-2, B-1, B-2 Port Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Piston Seals and Seal Kits
The Wear-Pak piston fitted as standard to all HTR Series rotary actuators employs a polyurethane seal to contain hydraulic pressure, and a PTFE wear ring (not for HTR.9 or HTR1.8) to prevent metal-to-metal contact. For higher temperatures or use with synthetic fluids, FPM seals should be specified for the piston; for water glycol or high water content fluids, nitrile seals are available.

Filtration
Effective filtration is vital to the long life and satisfactory performance of a rotary actuator. If the piston seals of a rack and pinion rotary actuator are worn or damaged, fluid which leaks past the piston will enter the gear housing.

In the event of internal leakage into the gear housing, the pressure relief valve will ensure that the housing does not become over-pressurized. Any external leakage from the gear housing, therefore, is indicative of worn or damaged piston seals and these should be examined and, if necessary, replaced, at the earliest opportunity.

Note: it is essential that all hydraulic lines are thoroughly flushed before connection to the rotary actuator.

<table>
<thead>
<tr>
<th>Seal Class</th>
<th>Materials</th>
<th>Fluid Medium</th>
<th>Temperature Range</th>
<th>Seal Kit Code</th>
<th>Filtration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Polyurethane</td>
<td>General purpose, petroleum-based fluids</td>
<td>-30° to +80°</td>
<td>PSKHTR.9</td>
<td>ISO class 17/14 cleanliness level</td>
</tr>
<tr>
<td>V</td>
<td>FPM</td>
<td>High temperature and/or synthetic fluids</td>
<td>-20° to +150°</td>
<td>PSKHTR.9V</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>Carboxilated Nitrile</td>
<td>Water glycol, high water content fluids</td>
<td>0° to +80°</td>
<td>PSKHTR.9W</td>
<td></td>
</tr>
</tbody>
</table>

1 FPM seals also include a back-up washer.
2 The part numbers shown are for HTR.9 models. For other models, replace ‘.9’ with the appropriate size. For example, an FPM seal kit for an HTR15 will be PSKHTR15V.

Stroke Limiters
Fine control of the end of travel points of the rotary actuator can be obtained by specifying stroke limiters. These operate by reducing the maximum rotation of the actuator within preset limits of either 5° or 30° in each direction. Adjustment within this range is infinitely variable and may be carried out by the user. Several types of stroke limiter are available – the design illustrated is suitable for applications requiring infrequent adjustment.

Stroke Limiters and Cushions
5° stroke limiters may be combined with the cushioning devices shown on page 10. 30° stroke limiters cannot be combined with cushions.

The addition of stroke limiters requires an increase in build length. On double rack units with cushions, the cushion is fitted to the upper rack and the stroke limiter to the lower. The increase in build length, for both single and double rack units, is shown as dimension A in the table. Cushion performance may be affected by the addition of a stroke limiter. Please consult the factory in critical applications.

<table>
<thead>
<tr>
<th>Model</th>
<th>Adjustment per Full Turn</th>
<th>A max – Increased Build Length</th>
<th>B Hex Socket Screw in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTR.9 &amp; 1.8</td>
<td>4.0°</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>HTR3.7 &amp; 7.5</td>
<td>3.3°</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>HTRS &amp; 10</td>
<td>2.5°</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>HTR15 &amp; 30</td>
<td>2.0°</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>HTR22 &amp; 45</td>
<td>2.0°</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>HTR75 &amp; 150</td>
<td>2.0°</td>
<td>65</td>
<td>95</td>
</tr>
<tr>
<td>HTR300 &amp; 600</td>
<td>1.2°</td>
<td>90</td>
<td>154</td>
</tr>
</tbody>
</table>

All dimensions are in millimetres unless otherwise stated.
### Bearing Load Capacities

The radial and thrust loads and overhung moments which can be supported by each model of HTR rotary actuator at different operating pressures are shown in the table. These figures should be read in conjunction with the notes below.

#### Notes
1. Static bearing load capacities = dynamic values x 1.5
2. Standard male shafts provide a 4:1 design factor. At the operating conditions marked *, a smaller design factor is achieved and the values listed are ‘bearing’ moment capacities. For higher capacities, larger shaft sizes are available – please consult the factory for details.

#### Dynamic Bearing Load Capacities vs. Operating Pressure

<table>
<thead>
<tr>
<th>Model</th>
<th>Radial Load kN ( R_L ) per Bearing @</th>
<th>Thrust Load kN ( R_T ) @</th>
<th>Overhung Moment kN.m ( R_L \times A ) @</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70 Bar</td>
<td>140 Bar</td>
<td>210 Bar</td>
</tr>
<tr>
<td>HTR.9</td>
<td>16.6</td>
<td>15.2</td>
<td>13.9</td>
</tr>
<tr>
<td>HTR1.8</td>
<td>17.9</td>
<td>17.9</td>
<td>17.9</td>
</tr>
<tr>
<td>HTR3.7</td>
<td>26.3</td>
<td>22.2</td>
<td>18.3</td>
</tr>
<tr>
<td>HTR7.5</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
</tr>
<tr>
<td>HTR5</td>
<td>34.1</td>
<td>30.2</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTR10</td>
<td>38.1</td>
<td>38.1</td>
<td>38.1</td>
</tr>
<tr>
<td>HTR15</td>
<td>61.4</td>
<td>54.4</td>
<td>47.4</td>
</tr>
<tr>
<td>HTR30</td>
<td>68.4</td>
<td>68.4</td>
<td>68.4</td>
</tr>
<tr>
<td>HTR22</td>
<td>57.9</td>
<td>47.4</td>
<td>–</td>
</tr>
<tr>
<td>HTR45</td>
<td>68.4</td>
<td>68.4</td>
<td>–</td>
</tr>
<tr>
<td>HTR75</td>
<td>72.7</td>
<td>44.8</td>
<td>16.8</td>
</tr>
<tr>
<td>HTR150</td>
<td>100.7</td>
<td>100.7</td>
<td>100.7</td>
</tr>
<tr>
<td>HTR300</td>
<td>129.3</td>
<td>66.4</td>
<td>3.4</td>
</tr>
<tr>
<td>HTR600</td>
<td>192.2</td>
<td>192.2</td>
<td>192.2</td>
</tr>
</tbody>
</table>
**Position Switches**

Accurate end of rotation indication can be obtained by specifying position switches. These solid state, inductive-type switches are fitted to the caps of the hydraulic cylinders, where a non-contacting probe senses the presence of a ferrous spear attached to the piston. Position switches are not available on rotary actuators fitted with stroke limiters.

Both flange mounted (EPS-6 and EPS-7) and threaded type (PS201/2/3) position switches are available. Both types of switch can be used to operate relay coils, or as direct input to a PLC. All switches incorporate short-circuit protection. The fault condition must be corrected and the power disconnected in order to reset the switch, preventing automatic restarts.

Two LEDs (in the switch or in the connector) indicate power and switch status.

**CE Marking**

The position switches fitted by Parker are CE marked to certify that they meet the requirements of the EC Directive 89/336/EEC for electromagnetic compatibility.

**DC 3-wire Sensor (PS201, 202 and 203) Wiring Diagram**

```
<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTR.9 &amp; 1.8</td>
<td>A: 63</td>
<td>HTR.9 &amp; 1.8</td>
</tr>
<tr>
<td>HTR3.7 &amp; 7.5</td>
<td>B: 63</td>
<td>HTR3.7 &amp; 7.5</td>
</tr>
<tr>
<td>HTR5 &amp; 10</td>
<td></td>
<td>HTR5 &amp; 10</td>
</tr>
<tr>
<td>HTR15 &amp; 30</td>
<td></td>
<td>HTR15 &amp; 30</td>
</tr>
<tr>
<td>HTR22 &amp; 45</td>
<td>32</td>
<td>HTR22 &amp; 45</td>
</tr>
<tr>
<td>HTR75 &amp; 150</td>
<td></td>
<td>HTR75 &amp; 150</td>
</tr>
<tr>
<td>HTR300 &amp; 600</td>
<td></td>
<td>HTR300 &amp; 600</td>
</tr>
</tbody>
</table>
```

**DC 4-wire Sensor (EPS-6) Wiring Diagram**

**AC/DC 2-wire Sensor (EPS-7) Wiring Diagram**

**Dimensions**

```
<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>EPS-6</th>
<th>PS201, 202 &amp; 203</th>
<th>EPS-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>105000A01F060</td>
<td>PS 011</td>
<td>103000A01F060</td>
</tr>
<tr>
<td>Output Function</td>
<td>PNP/NPN, normally open</td>
<td>PNP, normally open</td>
<td>Normally open</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>10–30V DC</td>
<td>10–30V DC 0–50V AC @ 40–60Hz</td>
<td>0–300V DC</td>
</tr>
<tr>
<td>Operating Current</td>
<td>&lt; 200 mA</td>
<td>200 mA</td>
<td>&lt; 300 mA</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-25°C to +70°C</td>
<td>-25°C to +80°C</td>
<td>-25°C to +70°C</td>
</tr>
<tr>
<td>Protection Class</td>
<td>IP67</td>
<td>IP67 to IEC60529</td>
<td>IP67</td>
</tr>
<tr>
<td>Connector Orientation</td>
<td>direct, switching</td>
<td>dependent on switch adjustment</td>
<td>direct, switching</td>
</tr>
<tr>
<td>Signal</td>
<td>in sensor</td>
<td>in connector</td>
<td>in sensor</td>
</tr>
</tbody>
</table>
```

All dimensions are in millimetres unless otherwise stated.
Feedback Devices
A linear feedback device or a position sensor can be supplied for continual monitoring of the rotational range.

The linear feedback device is built into the cap of the cylinder and registers the position of the rack, and thus indirectly of the pinion. This type of position feedback is offered when the rotational range is greater than 355°.

The position sensor is mounted at the back of the housing and directly registers the position of the pinion.

Linear Feedback Devices
Linear feedback devices are supplied with an optional ultrasonic feedback system. Other types of feedback devices with alternative analogue or digital output signals are available on request. Please consult the factory for further information.

Angular Position Transducer
Angular position transducers are supplied with a rotary potentiometer, which requires user input. Integral signal conditioning is also available as an option.

Technical Data
Potentiometer
Type: single turn precision servo-mount with conductive plastic element
Port: Connector LXES-0033
Effective mechanical angle: 360°
Effective electrical angle: 355° ±2°
Resistance: 5 kΩ
Resistance tolerance: ±20%
Linearity: ±0.075%
Maximum voltage: 42V DC
Maximum current: 10 mA
Recommended operating current: < 1 µA
Temperature rating: -40°C to +100°C
Protection class: IP65

Potentiometer with Integral Signal Conditioning
Type: single turn precision servo-mount with conductive plastic element
Port: Connector LXES-0033
Effective mechanical angle: 360°
Effective electrical angle: 90° or 345°
Output signal: 0–20 or 4–20 mA
Current: 30 mA
Load resistance: 0-500 Ω
Linearity: ±0.1% (345°)
±3% (90°)
Repeatability: 0.007°
Operating voltage: 24V DC
Temperature rating: -25°C to +70°C
Protection class: IP65

1 Available as an accessory – please specify in order

Note
When considering rotary actuator applications using a sensor, it should be borne in mind that rack and pinion actuators have a small amount of backlash. This can be overcome by use of a special hydraulic circuit. Please consult the factory for details.
Ordering and Maintenance Information

HTR Series Rotary Actuators

Product Type
Model Code
Rotation
Cushions
Mounting Style
Shaft Style
Port Type
Port Location
Seals
Design Series
Options

Code Rotation Page
090 90º 2
180 180º 2
360 360º 2
Other – please specify

Code Shaft Style Page
H Male, single ended, double key – standard 6
G Female, double key 9
K Male, double ended, double key 5
L Female spline 5
M Male spline, single ended 5
N Male spline, double ended 5
X Special – add to ‘Options’ 5

Code Stroke Limiter Page
None – standard 11
A 0-5º Clockwise rotation 2 11
B 0-5º Anti-clockwise rotation 3 11
C 0-5º Both rotations 3 11
D 0-30º Clockwise rotation 4 11
E 0-30º Anti-clockwise rotation 3 11
F 0-30º Both rotations 4 11
X Special – add to ‘Options’ 11

Code Bore Page
.9 22.2 mm 6
1.8 22.2 mm 6
3.7 38.1 mm 6
7.5 38.1 mm 6
5 38.1 mm 6
10 38.1 mm 6
15 50.8 mm 6
30 50.8 mm 6
22 63.5 mm 6
45 63.5 mm 6
75 101.6 mm 6
150 101.6 mm 6
300 152.4 mm 6
600 152.4 mm 6

Code Cushioning Page
None – standard 9
1 Clockwise rotation 5 9
2 Anti-clockwise rotation 5 9
3 Both directions 5 9
8 High Performance cushion 2 9
9 Special – add to ‘Options’ 9

Code Seal Page
- Polyurethane – standard 11
V FPM 11
W Carboxilated nitrile 11

Code Port Page
1-4 Side – specify positions 1-4 8
5 End 8
9 Special – add to ‘Options’ 8

Code Location Page
1-4 Side – specify positions 1-4 8
5 End 8
9 Special – add to ‘Options’ 8

Code Type Page
4 BSPP – standard 8
5 Metric – to DIN 3852/1 8
6 Metric – to ISO 6149/1 8
1 SAE straight thread 8
2 NPTF 8
9 Special – add to ‘Options’ 8

Code Style Page
H Male, single ended, double key – standard 6
G Female, double key 9
K Male, double ended, double key 5
L Female spline 5
M Male spline, single ended 5
N Male spline, double ended 5
X Special – add to ‘Options’ 5

Code Option Page
1000 Standard actuator model code
1111 Actuator model code with special options: eg: Air Bleeds – specify positions 1-4 8
Position switches 13
Feedback device 14
Bronze rack bearing (HTR.9-10) 3
Please attach full details of Special Options required

Maintenance and Spare Parts
Full instructions for the maintenance of HTR Series rotary actuators, together with a complete list of the spares available, is contained in the HTR Series Rotary Actuator Maintenance Bulletin. Please ask for bulletin HY07-1220/M.

Notes:
1 Viewed from shaft end
2 Double rack models only
3 Not available with end ports
4 Not available with end ports and cushions
5 Only available on single rack units
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