Compact Fluid Power Systems

Catalog HY22-1131/US
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Compact Fluid Power Systems

Parker Hannifin
HPS Division
New Hope, MN 55428 USA

HPS Division can no longer accept new purchase orders for pressure switches, subplates and related components. Please contact QCC for sales and support of these products.

QCC, LLC
7315 W. Wilson Avenue
Harwood Heights, IL 60706
Contact: Brian Angioletti, Sales Manager
Phone: 708.887.6241
Email: brian@gccorp.com
Oildyne Division

The Oildyne Division of Parker Hannifin Corporation has been manufacturing top quality compact hydraulic products since 1955. Anywhere in the world where there is a need for a compact fluid power system solution requiring flows up to 14.4 liters per minute (3.8 gallons per minute) and pressure to 276 bar (4000 psi), or integrated electro-hydraulic actuators, Parker Oildyne can provide the answer from concept to completion. Parker Oildyne is a company dedicated to providing solutions for today's high pressure, space saving, and power-dense hydraulic installations.

Parker Oildyne’s current state-of-the-art manufacturing facility has been in operation since January 1999. An ISO9001 approach to delivering premium customer service is supported by a dedicated team of design, manufacturing and quality engineers using the latest technologies and equipment. Parker Oildyne pioneered the miniaturization of hydraulic components and offers this expertise to you.

Parker Oildyne products are used in a large range of diverse industries such as marine equipment, recreational vehicles, automotive, medical, material handling, construction equipment, turf care, industrial equipment and many more. Expand your hydraulic usage with compact fluid power systems from Parker Oildyne.

*Note: Oildyne products are designed to industrial standards; they are not to be used in aircraft applications.*
Compact EHA
Electro-Hydraulic Actuators for high power density applications

ENGINEERING YOUR SUCCESS.
Easy to Install and Connect
Compact EHA is designed to make commissioning as simple as possible. The motor is connected to a suitable power supply and switching circuit, and the rod or base end is secured with a pivot pin. The unit is then actuated to align the opposite pivot pin connection, and the pin inserted to secure. And that’s it – your Compact EHA is ready for use.

Specifications

**Actuator**
- Type: hydraulic, double-acting
- Bore sizes: 25.4mm (1.0 in), 31.8mm (1.25 in), 36.5mm (1.44 in)
- Standard stroke lengths: 102mm (4 in), 152mm (6 in), 203mm (8 in)
- Piston rod diameters: 14.2mm (.561 in), 15.9mm (.625 in), 19.1mm (.750 in)
- Standard mounting pin diameters: 6.4mm (.250 in), 9.5mm (.375 in), 12.7mm (.500 in)

**Motor**
- Motor types: 12V DC, 245W (motor A), 12V DC, 560W (motor B), 24V DC, 245W (motor C), 24V DC, 560W (motor D)
- Leads – length: 1.5m (60 in)
- Leads – gauge: 14 gauge (motors A & C), 12 gauge (motors B & D)
- Connector type: ring terminals, 6.6mm (.26 in) I/D

**Pump**
- Pump type: gear, reversible
- Fluid medium: automatic transmission fluid (ATF)

**Circuit**
Sealed hydraulic circuit with integrated pump, motor, actuator and reservoir, relief, thermal, check and back pressure valves.

Certification and Testing
- Vibration: MIL-STD-810F (minimum integrity test)
- Sealing: IP65 and IP67
- Salt spray: 1000 hours per ASTM B117

For other application-specific approvals, please consult factory.

**Performance**
- Maximum force – extend: 21.35kN (4800 lbf)
- Maximum force – retract: 16.00kN (3600 lbf)
- Maximum speed: 84mm/sec (3.3 in/sec)

**General**
- Construction – body: anodized cast aluminium
- one-piece– piston rod: stainless steel
- Orientation: universal
- Manual release option: retained, for emergency use only
- Operating temperature range: -34°C (-30°F) to +65°C (150°F)
- Sound Level: < 70 dBA
- Weight: under 5.5 kg (12 lbs)

Maintenance
Because the Compact EHA is flushed, filled and sealed for life, there is virtually no maintenance required. This, in combination with the anodized housing, stainless steel rod and rugged seals and components, provides a longer service life with reduced warranty costs.

Complete Compact EHA Solutions
In addition to custom actuators, our engineers are experienced in the design of complete actuation systems. Where your requirement includes cable harnesses, switchgear and power supplies, please contact us for further information.

For current Compact EHA literature, please call 1-800-CParker (1-800-272-7537) or e-mail to c-parker@parker.com and ask for Catalog Number HY22-3101.
Oildyne 108/118 and 165/175 Series
Hydraulic Power Units

Pressures to 241 bar (3500 psi)
Flow to 5.3 lpm (1.4 gpm)

Parker
ENGINEERING YOUR SUCCESS.
The Oildyne Division’s compact 108/165 Series power units let you put the power where you need it. They’re completely self-contained with an AC or DC motor, gear pump, reservoir, internal valving, load hold checks and relief valves. The 108/165 Series models are designed for intermittent service and come in six standard pump sizes which produce flows of .16, .31, .41, .52, .82 and 1.06 cc/rev (.0098, .0187, .0246, .0321, .050 and .065 cubic inches/rev). Locking check valves are available in all models. Performance will vary with the type of fluid used. Several hydraulic circuits are available.

108/165 Series units are available with single- or bi-directional rotation. Single direction units are commonly used to charge accumulators, power one-direction hydraulic motors and cylinders, provide pilot flow to servo valves, pressurize lube systems and supply multifunction circuits using external valving.

Bi-directional, reversible units operate double-acting cylinders and two-way motors.

New are the 118 and 175 Series codes. Instead of the standard threaded ports, these new versions provide a four-bolt, flat manifoldable surface to accept the solenoid manifold circuit or your custom manifold.

We’d like to work with you on your hydraulic applications. Our people know small hydraulics. We know how to design them, how to make them and how to apply them. Therefore, we can offer you a practical, economical solution to your fluid power problems.

Oildyne has pioneered top quality, compact hydraulic components since 1955. We can provide standard products or tailor high pressure, space saving solutions to your specific needs.

Note: Parker Oildyne products are not to be applied in aviation applications.
## Standard Product Ordering Code

- **PRODUCT TYPE**
  - 108 108 Power Unit
  - 118 118 Power Unit
  - 165 165 Power Unit
  - 175 175 Power Unit

- **MOTOR CODE – 108/118**
  - AE 12 VDC Perm. Mag.
  - AM 12 VDC Ser. Wnd.
  - BE 24 VDC Perm. Mag.
  - BI 24 VDC Ser. Wnd.
  - HA 115 VAC, 1 phase
  - HD 230 VAC, 1 phase
  - IA
  - IC
  - 36 VDC Perm. Mag.
  - 36 VDC Ser. Wnd.

- **MOTOR CODE – 165/175**
  - AY 12 VDC Perm. Mag. 1 HP
  - BY 12 VDC Perm. Mag. 1 HP

- **PUMP TYPE**
  - S Standard
  - C Cold Temp

- **PUMP SIZE 108/118**
  - 10 .16 cc/rev (.010 in³/rev)
  - 19 .31 cc/rev (.019 in³/rev)
  - 25 .41 cc/rev (.025 in³/rev)
  - 32 .52 cc/rev (.032 in³/rev)

- **PUMP SIZE 165/175**
  - 32 .52 cc/rev (.032 in³/rev)
  - 50 .82 cc/rev (.050 in³/rev)
  - 65 1.06 cc/rev (.065 in³/rev)

- **RESERVOIRS**
  - Vertical Usable
  - CODE
  - Horizontal Usable
  - 340 cc 21 in³ A 410 cc 25 in³
  - 600 cc 37 in³ B 640 cc 37 in³
  - 410 cc 25 in³ C N/A
  - 410 cc 25 in³ D N/A
  - 1500 cc 95 in³ F 1500 cc 92 in³
  - 750 cc 46 in³ G 910 cc 55 in³
  - 1700 cc 104 in³ H 2400 cc 150 in³
  - 3700 cc 226 in³ I 4200 cc 254 in³
  - 5300 cc 323 in³ J 5600 cc 347 in³
  - 950 cc 58 in³ P 940 cc 58 in³
  - 1900 cc 116 in³ Q 1500 cc 95 in³
  - 4500 cc 277 in³ R 3000 cc 185 in³
  - 3200 cc 201 in³ S 2300 cc 141 in³

**NOTES:** C and D reservoirs are Vertical Mount only
A, B and F reservoirs are available only for 108/118 Series
Reservoir A with .32 pump cannot be horizontal mount

### ORDERING CODE INSTRUCTIONS
Select the model code needed based on catalog information. All boxes above must be filled in before Oildyne can process the order. If the power unit is a single direction unit use '00' for the DN (Right Hand) relief valve box. For circuits LL and LB, the two relief valve settings should be within a 5:1 ratio.

### RELIEF VALVE TOLERANCES

<table>
<thead>
<tr>
<th>Pressure Range Bar</th>
<th>14 to 34.4</th>
<th>35 to 68.9</th>
<th>70 to 137.9</th>
<th>138+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Range PSI</td>
<td>200 to 499</td>
<td>500 to 999</td>
<td>1000 to 1999</td>
<td>2000+</td>
</tr>
<tr>
<td>Tolerance +/- (bar/psi)</td>
<td>5.2/75</td>
<td>6.9/100</td>
<td>10.3/150</td>
<td>13.8/200</td>
</tr>
</tbody>
</table>

### Hydraulic Fluid
Acceptable fluids for 108/118/165/175 Series Power Units:
- Standard Automatic Transmission Fluid (ATF)
- Most mineral based hydraulic fluids
Viscosity range: 32-64 cSt (150-300 SSU) at 38°C (100°F).

### Temperature Range
Temperature Ranges for 108/118/165/175 Series:
- Operating: -7 to +60°C (+20 to +140°F)
- Storage: -7 to +60°C (+20 to +140°F)
Please contact Parker Oildyne for usage outside of this range.

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**All Data Subject to Change Without Notice**
For power unit configurations other than those shown please consult Oildyne.

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Parker Hannifin
HPS Division
New Hope, MN 55428 USA
Performance Data

108/118 Series: Permanent Magnet Motors - AE/BE

Note: IA motor (36 VDC) flow will be equivalent to the AE/BE curves: current draw will be about 1/3 of the AE motor values

DC Motor Duty Cycle Characteristics

108/118 Perm. Magnet Motors – AE/BE (for intermittent duty cycles only)

Performance data for reference only. Based on ATF at 21°C (70°F)
Performance Data

108/118 Series: Series Wound Motors - AM/BI

Note: IC motor (36 VDC) flow will be equivalent to the AM/BI curves:
current draw will be about 1/3 of the AM motor values.

108/118 Series SW Motors: AM/BI/IC only (12/24/36 VDC)

1) For Single Direction only, and Reversible with UP port pressure:
   BLUE + VDC 12 (AM); 24 (BI); 36 (IC)
   GREEN unused
   BLACK Ground

2) Reversible with DN port pressure:
   BLUE unused
   GREEN + VDC 12 (AM); 24 (BI); 36 (IC)
   BLACK Ground

For electrical controls suggestions, see page 36

DC Motor Duty Cycle Characteristics

Series Wound Motors - AM/BI

Current Draw vs On Time General Guidelines at room temperature
Current Draw vs On Time General Guidelines at 21°C (70°F)

Performance data for reference only. Based on ATF at 21°C (70°F)
Performance Data

108/118 Series: AC Motors - HA/HD

Performance Data

NOTES:
- S2 = 5  Maximum recommended ON time for the HA/HD motors is 5 minutes, after which the motors must be OFF until cooled to ambient temperature
- 50 Hz performance is about 83% of curves shown

108/118 Series HA Motors (115 VAC)
1) For Single Direction only, and Reversible with UP port pressure:

108/118 Series HD Motors (230 VAC)
1) For Single Direction only, and Reversible with UP port pressure:

For electrical controls suggestions, see page 36.
To reverse rotation, interchange the Black and Red wires.
Performance data for reference only. Based on ATF at 21°C (70°F)
165/175 Series AY Motor
1) For Single Direction only, and Reversible with UP port pressure:
   Terminal 1  Ground
   Terminal 2  +12 VDC
2) Reversible with DN port pressure:
   Terminal 1  +12 VDC
   Terminal 2  Ground

165/175 Series BY Motor
1) For Single Direction only, and Reversible with UP port pressure:
   Terminal 1  Ground
   Terminal 2  +24 VDC
2) Reversible with DN port pressure:
   Terminal 1  +24 VDC
   Terminal 2  Ground

DC Motor Duty Cycle Characteristics
165/175 Series Motors AY/BY (for intermittent duty cycles only)
Current Draw vs On Time General Guidelines at 21°C (70°F)

Performance data for reference only. Based on ATF at 21°C (70°F)

AY and BY motor electrical connections. For electrical controls suggestions, see page 36
Thermal Relief Valves — Why?

The thermal relief valve’s (TRV) purpose is to allow a bleed off of built up pressure due to thermal expansion of the fluid or to act as a (very limited) shock load protection, should a cylinder in the system get bumped.

The thermal relief valve is included in circuits using a pilot operated check valve. The single direction units get one; the reversing units get two. It is located between the check valve and the 108 Series pump outlet port. It is a fixed relief valve with a pressure setting approximately 100-140 bar (1500-2000 psi) above the system relief valve pressure.
Reversible Circuits

Back Pressure Circuits – Why?
The basic reversible circuit is essentially a closed loop. The oil returning from the system is fed back into the pump inlet. When a cylinder is being retracted more oil is being returned to the power unit than is leaving it due to the rod volume. This results in the DN side relief valve cracking open allowing the rod volume of oil to go back to the tank. The larger the rod volume the more open the relief valve will be. In many applications this is not a problem. However, if work is being done on the retract stroke, or if a pressure switch is used to signal the cylinder is fully retracted, the back pressure circuit is required. This circuit allows the rod volume of oil to return to the reservoir through a special shuttle spool, before it reaches the pump. Full relief valve pressure is then available to retract the cylinder, also preventing a pressure switch from tripping before the full retract position is achieved.

Recommended uses:
- In systems where work is being done on the retract stroke
- Where a pressure switch is used to signal the full retract position
- In systems requiring a faster retract than extend speed

Note: Back Pressure circuits (RB and LB) require the UP ports to be connected to the extend ports of cylinders.
Reservoir Dimensions

Note: refer to page 16 for information on the H, I, J, P, Q, R and S reservoirs.

165 Series shown with “G” reservoir

Note: Aside from the electric motors, 108 Series and 165 Series Power Units have the same dimensions.

Note: All dimensions in mm (inches).
108 Series shown with Series Wound motor and “A” reservoir

118/175 Series with solenoid manifold and “D” reservoir (motor shown is 108/118 Series Permanent Magnet)

Please contact Oildyne for detailed 118/175 adapter dimensions.

Note: All dimensions in mm (inches).
165 Series with H, I, and J reservoirs

108 Series with HA/HD Motor and P, Q, R, and S reservoirs

Note: All dimensions in mm (inches).
Oildyne 550 Series
Hydraulic Power Units
Pressures to 207 bar (3000 psi)
Flow to 14.4 lpm (3.8 gpm)
The 550 Series combines the features and benefits our customers and markets have requested in a durable and economical package. The integral motor, pump and reservoir are complemented with a full line of Parker D03/NG6 and cartridge valve options. Add a linear or rotary actuator and you have a complete hydraulic system solution for your application. These high quality power units are ideal for industrial machine tool clamping circuits, dock levelers, food processing, hose crimping, scissor lift, presses, and a myriad of AC applications. Let them go to work for you.

Your local Parker sales representative will be pleased to provide further information.

### Typical Applications

- Machine tool clamping
- Dock levelers
- Man lifts
- Scissors lifts
- Wheelchair lifts
- Trash compactors
- Hose crimpers
- Boat lifts
- Presses
- Commercial ovens

### Features

- Numerous motors from .67 to 4 kW (.5 to 3 HP)
- 7 pump sizes – flows from 1 to 14.4 lpm (.25 to 3.8 gpm)
- Externally adjustable relief valve
- Variety of reservoirs
- 207 bar (3000 psi) capability
- D03/NG6 pad or standard P and T ports
- Vertical and horizontal mounting
Motor Horsepower Recommendations at Flow/Pressure

<table>
<thead>
<tr>
<th>Pump Size</th>
<th>Nominal GPM</th>
<th>@1725</th>
<th>@3450</th>
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<tbody>
<tr>
<td>04</td>
<td>¼</td>
<td>.50 HP</td>
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<td>½</td>
<td>.50 HP</td>
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<td>½</td>
<td>.50 HP</td>
<td>.75 HP</td>
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<td>07</td>
<td>1</td>
<td>.75 HP</td>
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<tr>
<td>10</td>
<td>¾</td>
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<td>.75 HP</td>
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<td>1½</td>
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<td>.75 HP</td>
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<td>14</td>
<td>2</td>
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<tr>
<td>17</td>
<td>1 ¼</td>
<td>.50 HP</td>
<td>1.0 HP</td>
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<tr>
<td>17</td>
<td>2 ½</td>
<td>.50 HP</td>
<td>1.0 HP</td>
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<tr>
<td>20</td>
<td>1 ½</td>
<td>.50 HP</td>
<td>1.0 HP</td>
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<tr>
<td>20</td>
<td>2</td>
<td>.50 HP</td>
<td>1.0 HP</td>
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<tr>
<td>26</td>
<td>1.9</td>
<td>.50 HP</td>
<td>1.5 HP</td>
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<tr>
<td>26</td>
<td>3.8</td>
<td>.75 HP</td>
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<table>
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<tr>
<th>Pressure Bar (PSI)</th>
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<td>.50 HP</td>
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<td>.50 HP</td>
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</tr>
<tr>
<td>.50 HP</td>
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<td>.50 HP</td>
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</tbody>
</table>

Note: Performance data is for reference only.
Hydraulic Power Units

Technical Specifications

Standard Product Ordering Code

550 POWER UNIT
- includes relief valve

MOTOR SELECTION - TEFC
Single Phase = 115/230 VAC, 60 HZ
Three Phase = 230/460 VAC, 60 HZ

<table>
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<tr>
<th>CODE</th>
<th>HP</th>
<th>RPM</th>
<th>PHASE</th>
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<td>.50</td>
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<tr>
<td>TD</td>
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<td>Three</td>
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<tr>
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<tr>
<td>TY</td>
<td>2.0</td>
<td>3450</td>
<td>Three</td>
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<tr>
<td>TH</td>
<td>3.0</td>
<td>3450</td>
<td>Three</td>
</tr>
<tr>
<td>NN</td>
<td>None</td>
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<td>Customer Supplied</td>
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PUMP SIZE

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<tr>
<th>CODE</th>
<th>DISPLACEMENT</th>
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<tbody>
<tr>
<td>04</td>
<td>0.66 cc/rev</td>
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<tr>
<td>07</td>
<td>1.15 cc/rev</td>
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<tr>
<td>10</td>
<td>1.64 cc/rev</td>
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<tr>
<td>14</td>
<td>2.29 cc/rev</td>
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<tr>
<td>17</td>
<td>2.79 cc/rev</td>
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<tr>
<td>20</td>
<td>3.28 cc/rev</td>
</tr>
<tr>
<td>26</td>
<td>4.26 cc/rev</td>
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RESERVOIR VOLUME

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<tr>
<th>CODE</th>
<th>VOLUME</th>
</tr>
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<tbody>
<tr>
<td>05</td>
<td>2 Liter, 0.5 Gallon Steel</td>
</tr>
<tr>
<td>10</td>
<td>4 Liter, 1.0 Gallon Steel</td>
</tr>
<tr>
<td>15</td>
<td>6 Liter, 1.5 Gallon Steel</td>
</tr>
<tr>
<td>50</td>
<td>19 Liter, 5.0 Gallon Steel</td>
</tr>
<tr>
<td>06</td>
<td>2 Liter, 0.5 Gallon Plastic</td>
</tr>
<tr>
<td>11</td>
<td>4 Liter, 1.0 Gallon Plastic</td>
</tr>
<tr>
<td>16</td>
<td>6 Liter, 1.5 Gallon Plastic</td>
</tr>
<tr>
<td>26</td>
<td>10 Liter, 2.5 Gallon Plastic</td>
</tr>
</tbody>
</table>

Note: 19 liter (5 gallon) steel reservoir can be mounted vertically only. All others are vertical and horizontal ready.

FLOW CONTROL

<table>
<thead>
<tr>
<th>CODE</th>
<th>RV SETTING</th>
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<td>29</td>
<td>2900 psi</td>
</tr>
<tr>
<td>12</td>
<td>1200 psi</td>
</tr>
<tr>
<td>04</td>
<td>400 psi</td>
</tr>
</tbody>
</table>

Two Position Two Way Cartridge Valves

Following circuits include outlet port check valve:

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0</td>
<td>D03/NG6 Pad &amp; Extension Fittings</td>
</tr>
<tr>
<td>D1</td>
<td>D03/NG6 Pad with Dual PO Check Manifold (Manapak)</td>
</tr>
<tr>
<td>SA</td>
<td>Standard Pressure &amp; Tank Ports</td>
</tr>
<tr>
<td>SW</td>
<td>Std P &amp; T Ports with Outlet Port Check Valve</td>
</tr>
</tbody>
</table>

In multiples of 100 psi

P8 240 VAC, Normally Open, DIN Connector
P7 120 VAC, Normally Open, DIN Connector
Hydraulic Power Units
550 Series

Hydraulic Fluids:
Standard Automatic Transmission Fluid (ATF)
Most mineral based hydraulic fluids

Viscosity range: 32-64 cSt (150-300 SSU) at 38°C (100°F)
Please contact Parker Oildyne to discuss any alternate fluids.

Temperature Ranges:
Operating: -7 to 60°C (+20 to 140°F)
Storage: -10 to 60°C (+14 to 140°F)

Flow Control
(for use with Cartridge Valves)

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NN</td>
<td>None (use with D0 and D1 circuits)</td>
</tr>
<tr>
<td>HP</td>
<td>None (use with all other circuits)</td>
</tr>
<tr>
<td>F1</td>
<td>Press. Comp., .5 to 1.0 GPM</td>
</tr>
<tr>
<td>F2</td>
<td>Press. Comp., 1.0 to 2.0 GPM</td>
</tr>
</tbody>
</table>

4-WAY VALVE (ALL D03/NG6 SIZE)

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNN</td>
<td>No 4-Way Valve Included</td>
</tr>
<tr>
<td>01Y</td>
<td>Closed Center, 120 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>01T</td>
<td>Closed Center, 240 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>01K</td>
<td>Closed Center, 12 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>01J</td>
<td>Closed Center, 24 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>02Y</td>
<td>Open Center, 120 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>02T</td>
<td>Open Center, 240 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>02K</td>
<td>Open Center, 12 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>02J</td>
<td>Open Center, 24 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>07Y</td>
<td>Float Center, 120 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>07T</td>
<td>Float Center, 240 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>07K</td>
<td>Float Center, 12 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>07J</td>
<td>Float Center, 24 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>08Y</td>
<td>Tandem Center, 120 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>08T</td>
<td>Tandem Center, 240 VAC, Conduit Connectors</td>
</tr>
<tr>
<td>08K</td>
<td>Tandem Center, 12 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>08J</td>
<td>Tandem Center, 24 VDC, Conduit Connectors</td>
</tr>
<tr>
<td>30Y</td>
<td>Single Solenoid, 120 VAC, Conduit Connector</td>
</tr>
<tr>
<td>30T</td>
<td>Single Solenoid, 240 VAC, Conduit Connector</td>
</tr>
<tr>
<td>30K</td>
<td>Single Solenoid, 12 VDC, Conduit Connector</td>
</tr>
<tr>
<td>30J</td>
<td>Single Solenoid, 24 VDC, Conduit Connector</td>
</tr>
<tr>
<td>Y01</td>
<td>Closed Center, 120 VAC, Hirschmann w/out Plugs</td>
</tr>
<tr>
<td>T01</td>
<td>Closed Center, 240 VAC, Hirschmann w/out Plugs</td>
</tr>
<tr>
<td>K01</td>
<td>Closed Center, 12 VDC, Hirschmann w/out Plugs</td>
</tr>
<tr>
<td>J01</td>
<td>Closed Center, 24 VDC, Hirschmann w/out Plugs</td>
</tr>
<tr>
<td>Y02</td>
<td>Open Center, 120 VAC, Hirschmann w/out Plugs</td>
</tr>
<tr>
<td>T02</td>
<td>Open Center, 240 VAC, Hirschmann w/out Plugs</td>
</tr>
<tr>
<td>K02</td>
<td>Open Center, 12 VDC, Hirschmann w/out Plugs</td>
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<tr>
<td>J02</td>
<td>Open Center, 24 VDC, Hirschmann w/out Plugs</td>
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<td>Y07</td>
<td>Float Center, 120 VAC, Hirschmann w/out Plugs</td>
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<td>T07</td>
<td>Float Center, 240 VAC, Hirschmann w/out Plugs</td>
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<tr>
<td>K07</td>
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<tr>
<td>J08</td>
<td>Tandem Center, 24 VDC, Hirschmann w/out Plugs</td>
</tr>
<tr>
<td>Y30</td>
<td>Single Solenoid, 120 VAC, Hirschmann w/out Plug</td>
</tr>
<tr>
<td>T30</td>
<td>Single Solenoid, 240 VAC, Hirschmann w/out Plug</td>
</tr>
<tr>
<td>K30</td>
<td>Single Solenoid, 12 VDC, Hirschmann w/out Plug</td>
</tr>
<tr>
<td>J30</td>
<td>Single Solenoid, 24 VDC, Hirschmann w/out Plug</td>
</tr>
</tbody>
</table>
Circuits

“SA” CIRCUIT

“SW” CIRCUIT

“S1-S4, P1-P4” CIRCUITS

“S5-S8, P5-P8” CIRCUITS
"S1-S4, P1-P4" CIRCUITS WITH PRESSURE COMPENSATED FLOW CONTROL F1 OR F2

"S5-S8, P5-P8" CIRCUITS WITH PRESSURE COMPENSATED FLOW CONTROL F1 OR F2

CLOSED CENTER

OPEN CENTER

FLOAT CENTER

TANDEM CENTER

SINGLE SOLENOID

NOTE: For optimal performance of the D1 circuit, using an Open or Tandem center D03/NG6 valve is recommended.

"D0" CIRCUIT (D03/NG6 VALVE TO BE SELECTED)

"D1" CIRCUIT INCLUDES MANAPAK DUAL PO CHECK VALVE (D03/NG6 VALVE TO BE SELECTED)
Hydraulic Power Units

Dimensions

550 Series shown with P and T ports and plastic reservoir

Note: When mounted in the horizontal configuration the 2½ gallon plastic reservoir must be supported.

Motor foot dimensions are common to all 550 Series electric motors

Note: All dimensions in mm (inches).
550 Series shown with optional solenoid 2-way valve and steel reservoirs

Note: All dimensions in mm (inches).
550 Series shown with 19 liter (5 gallon) steel reservoir and NG6/D03 valves

Note: All dimensions in mm (inches).
Miniature Piston Pumps
5 Piston & Cartridge Design

Pressures to 276 bar (4000 psi)
Displacements from .156 to .865cc/rev (.01 to .05 in³/rev)
Miniature Piston and Cartridge Pumps

Features

Miniature Piston Pumps: Pumping Efficiencies up to 90% Allow Effective Use of .156 to .865 cc/rev Piston Pumps at Pressures to 276 bar (4000 psi)

Breakthrough designs come and go, succeed and fail. The really good designs pass the test of time and continue to succeed. The Oildyne Division mini pump is one of these good designs.

Mini pumps handle hydraulic oil, brake fluid, ultra-low viscosity fluids and many non-water based fluids with equal ease. Need greater versatility? These fixed displacement axial piston pumps are efficient and powerful too. Tests run on 15.1 cSt (78 SSU) fluid at 38°C (100°F) at 207 bar (3000 psi) showed a 90% volumetric efficiency. Capable of 276 bar (4000 psi) operation, mini pumps are available in nine displacements ranging from .156 to .865 cc/rev (.01 to .053 in³/rev).

Compact size, versatility, efficiency, power and speed are combined in a very competitive package in the Oildyne mini pumps. They’re suitable for many applications requiring compact power including automotive, marine, medical and military uses.

Cartridge Piston Pumps: Compact Fluid Power Redefined by the Oildyne Division.

This cartridge piston pump raises the standard for compact fluid power! This three-piston cartridge style pump is an efficient, fixed displacement pump that provided high performance at a very economical price. Pressure ratings up to 276 bar (4000 psi), driven speeds up to 5000 RPM, and the ability to provide a variety of seal types make this the solution to your unique application. This uni-rotational pump is capable of pumping non-water based fluids ranging in viscosity from solvents to thick fluids.

The three-piston cartridge pump maintains the performance and flexibility of the Oildyne five-piston, standalone pump while reducing the overall package dimensions.

This ultra-compact cartridge piston pump, approximately 33 mm (1.3 in) in diameter and 51 mm (2 in) long, is designed to fit into your specially machined manifold allowing for a custom package that fits your space needs.

Three standard displacements are available all within the existing physical size. (The internal cam angle determines the displacement).

Contact Oildyne Division for a drawing showing the cavity details as well as the motor shaft and flange details needed for your motor to drive and mount this pump to your manifold.

Mini Pump Features

• .156 to .865 cc (.01 to .053 in³) displacement per revolution
• Designed for open circuit systems
• Fixed displacement – Output flow is determined by motor drive speed.
• Operating temperature range: -40° to +149°C (-40° to 300°F)
• Inlet port on side or rear
• Will operate efficiently on extremely thin (5 cSt) fluid
• Tandem pumps, special configurations and bi-rotational pumps are available.

Cartridge Pump Features

• .1 to .33 cc (.006 to .020 in³) displacement per revolution
• Designed for manifold mounting
• Fixed displacement – Output flow is determined by motor drive speed.
• Operating temperature range: -40° to +149°C (-40° to 300°F)
• Will operate efficiently on extremely thin (5 cSt) fluid
• Counter clockwise rotation (from pump drive end)

See Page 34 for Cartridge Pump ordering code
## Miniature Piston Pump

### Standard Product Model Code

**COMPONENT**
- H: High Pressure Pump

**SHAFT & MOTOR**
- OO: Std. .81" shaft, no motor
- OR: 12 VDC, 1/3 hp, Perm. Mag., close coupled
- OM: 24 VDC, 1/3 hp, Perm. Mag., close coupled
- AA: 115 VAC, 3450 rpm, 1/3 hp, cap. start
- AD: 230 VAC, 3450 rpm, 1/3 hp, cap. start
- CC: 56C Kit, includes long shaft
- CO: Long shaft, no motor (for use with 56C kit)
- RO: No shaft, replacement pump for use only with close coupled DC motor
- AO: Pump and shaft only for use with standard 115 and 230 VAC motors above

**NOTES:**
1. Tandem pumps must have larger displacement called out first
2. Tandem pumps are not available with the standard AC or DC motors - only standard shaft or 56C kit
3. Drive shaft input torque must be under 3.5 Nm (525 in-oz) (equivalent to HRS865 operating at 207 bar (3000 psi); refer to catalog performance curves for torque data)
4. Bi-rotational pumps require the side port as case drain
5. For configurations not shown above please contact Oildyne

### Technical Specifications

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>High Pressure Pump</td>
</tr>
<tr>
<td>R</td>
<td>CW</td>
</tr>
<tr>
<td>L</td>
<td>CCW</td>
</tr>
<tr>
<td>B</td>
<td>Bi-rotational</td>
</tr>
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### Single or 1st Pump Size

<table>
<thead>
<tr>
<th>Code</th>
<th>DISP.</th>
</tr>
</thead>
<tbody>
<tr>
<td>156</td>
<td>.156 cc/rev</td>
</tr>
<tr>
<td>206</td>
<td>.206 cc/rev</td>
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<tr>
<td>259</td>
<td>.259 cc/rev</td>
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<tr>
<td>311</td>
<td>.311 cc/rev</td>
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<tr>
<td>346</td>
<td>.346 cc/rev</td>
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<td>417</td>
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<td>519</td>
<td>.519 cc/rev</td>
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<tr>
<td>692</td>
<td>.692 cc/rev</td>
</tr>
<tr>
<td>865</td>
<td>.865 cc/rev</td>
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### 2nd Pump Size

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<tr>
<td>156</td>
<td>.156 cc/rev</td>
</tr>
<tr>
<td>206</td>
<td>.206 cc/rev</td>
</tr>
<tr>
<td>259</td>
<td>.259 cc/rev</td>
</tr>
<tr>
<td>311</td>
<td>.311 cc/rev</td>
</tr>
<tr>
<td>346</td>
<td>.346 cc/rev</td>
</tr>
<tr>
<td>417</td>
<td>.417 cc/rev</td>
</tr>
<tr>
<td>519</td>
<td>.519 cc/rev</td>
</tr>
<tr>
<td>692</td>
<td>.692 cc/rev</td>
</tr>
<tr>
<td>865</td>
<td>.865 cc/rev</td>
</tr>
</tbody>
</table>

### Miniature Piston Pump Basic Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>156</th>
<th>206</th>
<th>259</th>
<th>311</th>
<th>346</th>
<th>417</th>
<th>519</th>
<th>692</th>
<th>865</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In&quot; per rev.</td>
<td>.0095</td>
<td>.0126</td>
<td>.0158</td>
<td>.0190</td>
<td>.0211</td>
<td>.0255</td>
<td>.0317</td>
<td>.0422</td>
<td>.0527</td>
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<tr>
<td>cc/rev</td>
<td>.156</td>
<td>.206</td>
<td>.259</td>
<td>.311</td>
<td>.346</td>
<td>.417</td>
<td>.519</td>
<td>.692</td>
<td>.865</td>
</tr>
</tbody>
</table>

| Max RPM @ rated pressure W/O supercharge |
| 4400 | 4200 | 4000 | 3800 | 3800 | 3700 | 3700 | 3600 | 3500 |

| Operating Pressure (psi) |
| Continuous bar (psi) |
| 241 (3500) | 241 (3500) | 241 (3500) | 241 (3500) | 241 (3500) | 241 (3500) | 241 (3500) | 241 (3500) |

| Intermittent bar (psi) |
| 258 (3750) | 258 (3750) | 258 (3750) | 258 (3750) | 258 (3750) | 258 (3750) | 258 (3750) | 258 (3750) | 241 (3500) |

| Maximum bar (psi) |
| 276 (4000) | 276 (4000) | 276 (4000) | 276 (4000) | 276 (4000) | 276 (4000) | 276 (4000) | 258 (3750) | 241 (3500) |
Performance Data

Performance data shown are the average results based upon a series of laboratory tests of production units and are not necessarily representative of any one unit. Tests were run with 15.1 cSt (78 SSU) fluid.

In accordance with our policy of continuing product development, we reserve the right to change specifications shown without notice.

Note: Performance data is for reference only.
Typical Performance Data
at 12 VDC as assembled with a standard DC motor

NOTE: 24 VDC motor current will be approximately 1/2 of the 12 VDC current shown here. Max current for continuous operation is:

12 VDC: 12.6 A
24 VDC: 9.6 A

Average Input Torque
Speed: 3000 RPM

Note: Performance data is for reference only.
Performance Data

DC Motor Duty Cycle Characteristics

Current Draw vs On Time General Guidelines at 21°C (70°F)

NOTES:
The 115 VAC performance shown is at 60 Hz. At 230 VAC the current draw will be approximately ½ of that shown. At 50 Hz, the flow will be about 5/6 of that shown and the current will be about 25% higher than the 60 Hz values. Performance data shown is for reference only.
Dimensions

Miniature Piston Pump

Port Single Direction Rotation (Optional Inlet)
Port Bi-Directional Rotation (Required Case Drain)

All ports are #4 SAE 7/16-20 UNF-2B
Pump shown is Clockwise Rotation
56C Adapter supplied with Coupling and Mounting Screws

Standard 1/3 HP DC Permanent Magnet Motor with Pump

Standard 1/3 HP AC Motor with Pump

Note: All dimensions in mm (inches).
Tandem Miniature Piston Pump

Note: tandem pumps are not completely isolated from each other.

Note: All dimensions in mm (inches)

Cartridge Pump Ordering Code

COMPONENT
C Cartridge Piston Pump

ROTATION
L CCW (from shaft input end)

SEALS
B Buna N
V Fluorocarbon
E EPR

SHAFT/MOTOR
OO No motor or shaft

PUMP SIZE
CODE DISP.
050 .17 cc/rev
075 .25 cc/rev
100 .33 cc/rev
**Specifications**

**Displacements:** .1 cc/rev. (.006 in³/rev.) to .33 cc/rev. (.020 in³/rev.)

**Speeds:** Up to 5000 rpm maximum

**Pressures:** 207 bar (3000 psi) maximum continuous
276 bar (4000 psi) maximum intermittent

**Temperature Ranges:** Up to 120°C (250°F)

**Seals Available:** Variety

**Weight:** .19 kg (.42 lbs)

**Fluids Compatibility:** Variety, not water-based

Specifications subject to change without notice.
Performance data is for reference only.

This cartridge piston pump continues Oildyne’s tradition of producing innovative products which can be customized to specific industries. Please call us to discuss how this cartridge pump can be used in your unique application. **Detailed cavity and motor interface dimensions are available on request. Ask for Oildyne drawing 500059**

---

**Cartridge Pump Dimensions**

*with sample manifold requirements*

*All dimensions in mm (inches)*

---

**Sample Manifold Requirements**
Suggested reversing electrical schematics

Wiring Diagram: AE/BE/IA

- Blue 12 V MOTOR LEAD
- Green 12 V ORANGE 24/36 V MOTOR LEAD
- *DPDT CENTER OFF TOGGLE SWITCH USABLE UP TO 20 AMPS @ 12 VDC

Wiring Diagram: AM/BI/IC

- +12 VDC Supply (AM)
- +24 VDC Supply (BI)
- +36 VDC Supply (IC)

NOTE: If a Double Pole, Double Throw toggle switch with a current rating for your application is not available, refer to the “108/118 AE/BE/IA and 165/175 Motors” below for a possible reversing circuit using control relays.

108/118 Series HA Motors (115 VAC)

- Power to CR-1: L.H. Port Flow
- Power to CR-2: R.H. Port Flow

108/118 Series HD Motors (230 VAC)

- Power to CR-1: L.H. Port Flow
- Power to CR-2: R.H. Port Flow

108/118 AE/BE/IA and 165/175 AY/BY Motors Using Control Relays

NOTE: The UP port corresponds to the Left Hand Port Flow in these schematics. The DN port corresponds to the Right Hand Port Flow. 108/118/165/175 Series power unit castings are marked above the pressure ports UP and DN.
750 Series Hand Pumps

Pressures to 172 bar (2500 psi)
Handle Force at 610 mm (24”): 1kg/6.9 bar (2.2 lbs/100 psi)
Temperature Range: -34 to 100°C (-30 to 212°F)
Hand Pump with 2-Way Valve
750 Series Hand Pumps

Technical Information

Hand Pump Dimensions

![Hand Pump Diagram]

**Model 750-1 Hand Pump**

- 8.2 cc/Stroke (.5 in³/Stroke)
- Suitable for use in Single Acting Cylinder circuits
- Metering release valve for controlled return of fluid
- Weight: .91 kg (2 lbs) pump only

**Note:** Specifications subject to change without notice.
Hand Pump Dimensions

Model 750-2 Hand Pump

- 8.2 cc/Stroke (.5 in³/Stroke)
- Suitable for use in Double Acting Cylinder circuits
- Integral double pilot operated check valves (with soft face seal poppets) hold the load and isolate the hand pump when not in use
- Weight: 1.4 kg (3 lbs) pump only

Note: Specifications subject to change without notice.
Application example for 750-1 Hand Pump

118/175 Series Single Direction with 2-way valve

Application example for 750-2 Hand Pump

750-2 Hand pump used with a reversible locking power unit

......PRODUCTION WILL CONTINUE......
09 Series Hydraulic Gear Motor

Pressures to 276 bar (4000 psi)
Speeds to 20,000 rpm
Torque to 6.1 Nm (54 in-lbs)
Concentric Center Drive

Motor Data
Rotation - Bi Directional
Displacement - 1.48 cc/rev (.09 cipr)
Torque - Approximately 1.47 Nm/70 bar (13 in-lbs/1,000 psi)
Starting Torque - Approximately 1.36 Nm/70 bar (12 in-lbs/1,000 psi)
Static Slip - 541 cc/70 bar (33 CIPM/1,000 psi)

........OBSOLETE PRODUCT........
Performance

09 Series Hydraulic Motor

Dimensions

Standard Product Ordering Code

--- OBSOLETE PRODUCT ---

Note: Specifications subject to change without notice. Performance data is for reference only.

--- OBSOLETE PRODUCT ---

Note: All dimensions in mm (inches).

Catalog HY22-1131/US
Technical Information

09 Series
Hydraulic Gear Motor
Pressure Switches for AC Power
3.4-345 bar (50-5000 psi) Range

........................EFFECTIVE IMMEDIATELY........................

HPS Division can no longer accept new purchase orders for pressure switches, subplates and related components. Please contact QCC for sales and support of these products.

QCC, LLC
7315 W. Wilson Avenue
Harwood Heights, IL 60706
Contact: Brian Angioletti, Sales Manager
Phone: 708.887.6241
Email: brian@gccorp.com
Pressure Switch Features

• **Versatile**
  Our designs allow the switches to be used in any mounting orientation. They can sense hydraulic fluid pressure or air/gas pressure. A simple spring change allows the same basic switch to be used through a wide range of pressure settings.

• **Durable**
  Heavy-duty electrical contacts are rated for 15 amps at 125, 250 or 460 VAC. Normally open and normally closed contacts are provided.

• **Reliable**
  Repeatability is accomplished through a combination of a PTFE seal and a hardened, nickel-plated steel piston. This use of low-friction materials and the design of the unique PTFE seal (or diaphragm*) prevents the piston from sticking. Repeatability, sensitivity and reliability are excellent. Limited piston movement prevents inertial forces from damaging the piston stop.

Typical Applications

Pressure switches sense when a pre-selected fluid pressure is reached or lost and make or break an electrical circuit. Their operation can stop or start a machine’s cycle, actuate indicator lights or sequential operations. Properly installed, their operation is automatic and limited by your imagination and need.

• **Spring Range**
  Duplex models contain two separate switches which can be activated by one or two sensing ports depending on the subplate configuration. See dimensional data for options.

• **Environmentally Resistant**
  Environmentally resistant models are available on special order.

Subplates

Subplates are available for in-line mounting of Oildyne pressure switches. This allows further flexibility in mounting to existing equipment. Ports in 1/8 NPT or 7/16-20 (SAE-4) straight thread are standard. The duplex switch has two types of subplates, one with a port for each side of the switch, the other with one port only, for both sides of the switch.

---

**Effective Immediately**

...HPS Division can no longer accept new purchase orders for pressure switches, subplates and related components. Please contact QCC for sales and support of these products. See page 43 for QCC contact information.
Dimensions

Single Pressure Switch

- Single Pressure Switch dimensions are shown in millimeters (mm) and inches (inches).
- The pressureswitch includes a conduit connection and mounting screws.

Subplates (Single & Duplex)

- Single Subplate dimensions include:
  - Pressure Port 1/8-27 NPSF or 7/16-20 UNF Straight Thread
  - 2 Switch Mounting Holes #10-32 UNF

- Duplex Subplate dimensions include:
  - Pressure Port 1/8-27 NPSF or 7/16-20 UNF Straight Thread
  - 2 Switch Mounting Holes #10-32 UNF

Note: All dimensions in mm (inches).

Weight

- Single: Standard .3 kg (10 oz.)
- Duplex: Standard .4 kg (14 oz.)

Electrical Duty

- Single pole, double throw element, U.L. rated for 15 amps at 125, 250 or 460 VAC. Electrical leads are not furnished with the switch.

Recommended Oil

- Any clean hydraulic fluid. Standard Buna N seals supplied, optional fluorocarbon rubber seals also available.
Technical Information

Pressure Switches

Spring Selection Guide

<table>
<thead>
<tr>
<th>Spring Number</th>
<th>Spring Range</th>
<th>Adjustment Range</th>
<th>Repeatability Plus or Minus</th>
<th>Differential Range</th>
<th>Spring Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50 - 100 psi</td>
<td>50 to 100 psi</td>
<td>2 psi</td>
<td>50 to 90 psi</td>
<td>Green</td>
</tr>
<tr>
<td>2</td>
<td>100 - 300 psi</td>
<td>75 to 300 psi</td>
<td>4 psi</td>
<td>50 to 100 psi</td>
<td>Black</td>
</tr>
<tr>
<td>3</td>
<td>300 - 500 psi</td>
<td>150 to 500 psi</td>
<td>5 psi</td>
<td>50 to 125 psi</td>
<td>Red</td>
</tr>
<tr>
<td>4</td>
<td>500 - 1000 psi</td>
<td>200 to 1000 psi</td>
<td>8 psi</td>
<td>50 to 150 psi</td>
<td>Blue</td>
</tr>
<tr>
<td>5</td>
<td>1000 - 2000 psi</td>
<td>300 to 2000 psi</td>
<td>15 psi</td>
<td>75 to 250 psi</td>
<td>White</td>
</tr>
<tr>
<td>6</td>
<td>2000 - 3000 psi</td>
<td>400 to 3000 psi</td>
<td>20 psi</td>
<td>75 to 250 psi</td>
<td>Yellow</td>
</tr>
<tr>
<td>7</td>
<td>3000 - 4000 psi</td>
<td>500 to 4000 psi</td>
<td>25 psi</td>
<td>125 to 350 psi</td>
<td>Orange</td>
</tr>
<tr>
<td>8</td>
<td>4000 - 5000 psi</td>
<td>500 to 5000 psi</td>
<td>50 psi</td>
<td>150 to 450 psi</td>
<td>Pink</td>
</tr>
</tbody>
</table>

Note: 100 psi = 6.9 bar.

Differential

This is the pressure required to open and close the switch contacts. It is a constant value dependent on the characteristics of the switch. The differential will be in the range as shown on the above table. For minimum differential, select the lightest spring including the maximum setting desired.

Standard Product Ordering Code

<table>
<thead>
<tr>
<th>Seals</th>
<th>Model</th>
<th>Pressure Range of Springs Single Switch or RH Side Duplex</th>
<th>Pressure Range of Springs RH Side Duplex Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>F — Fluorocarbon Rubber</td>
<td>K — Duplex Switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 100 psi = 6.9 bar.

EFFECTIVE IMMEDIATELY

HPS Division can no longer accept new purchase orders for pressure switches, subplates and related components. Please contact QCC for sales and support of these products. See page 43 for QCC contact information.
The goods, services or work (referred to as the “Products”) offered by Parker-Hannifin Corporation, its subsidiaries, groups, divisions, and authorized distributors (“Seller”) are offered for sale at prices indicated in the offer, or as may be established by Seller. The offer to sell the Products and acceptance of Seller’s offer by any customer (“Buyer”) is contingent upon, and will be governed by all the terms, conditions, and permissions of, this Offer of Sale. Buyer’s acceptance of any invoice or quote (“Quote”) attached to the purchase order, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer.

1. **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/saleterms, as well as Buyer’s acceptance of and adherence to any changes or modifications to the terms and conditions of Buyer’s order or any other document or communication issued by Buyer.

2. **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 unless otherwise specified by Seller, and Buyer shall be responsible for all such taxes or duties and shall indemnify Seller from any such liability. Buyer will be responsible for any applicable application, design, specification or other misuse of Products purchased by Buyer from Seller; (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.

3. **Shipping; 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 or risk of loss or damage pass to Buyer upon placement of the Products with the shipment carrier at Seller’s facility. Unless otherwise specified by Buyer, all prices are F.O.B. Seller’s facility, and Buyer will be responsible for all applicable taxes, duties, and other government levies.

4. **Warranty.** Seller warrants that the Products sold hereunder will be free from defects in material or workmanship for a period of twelve (12) months from the date of delivery or 2,000 hours of normal use, whichever occurs first. All prices are based upon the exclusion of warranty charges. Buyer acknowledges and agrees to the following DISCLAIMER OF WARRANTY: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

5. **Claims; Commencement of Actions.** Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to the Seller within ten (10) days of delivery. No other claims against Seller will be allowed unless asserted in writing within thirty (30) days after delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the defect is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

6. **LIMITATION OF LIABILITY.** IN THE EVENT OF BREACH OF WARRANTY, SELLER WILL NOT REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER’S WRITTEN CONSENT, WHETHER IN CONTRACT, TORT OR OTHERWISE ARISING IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT 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 performance, endurance, maintenance, safety 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 based upon data or specifications provided by the user, 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 information or equipment furnished by Buyer or any other items which become Buyer’s property, will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the manufacture using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller’s possession or control.

9. **Special Tooling.** 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 has been specially constructed for Buyer, and Buyer is purchasing or otherwise acquiring such tooling charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. **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 deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its 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 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 or in any way connected with Buyer’s use, operation, application, design, specification or other misuse of Products purchased by Buyer from Seller; (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.

12. **Cancellations and Changes.** Buyer may not cancel or modify or cancel any order for Products after written notice or confirmation of acceptance of the order of Seller. Buyer’s obligations under this agreement are deemed to be a Security Agreement under the Uniform Commercial Code. Buyer may change Product features, specifications, designs and availability.

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 is not liable for delay or failure to perform any of Seller’s obligations by reason of events or circumstances beyond its reasonable control (hereinafter “Events of Force Majeure”). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agencies of nature, delays or failure in delivery from delivery from suppliers or suppliers, shortages of materials, or any other cause beyond Seller’s reasonable control.

15. **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 by legislation or other authority 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 prior written notice. Seller may immediately terminate this agreement by reason of events or circumstances beyond Seller’s reasonable control, such as bankruptcy or insolvency, Buyer’s failure to pay for Products, bankruptcy or insolvency, Buyer’s failure to pay for Products, or any other act or omission of Buyer, or in the event of any failure to perform any of Buyer’s obligations under this agreement.

17. **Governing Law.** This agreement and the sale and delivery of all Products are 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 to all obligations hereunder and to all disputes arising out of or relating to this agreement and its interpretation, and shall be interpreted without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the personal 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 is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of 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 (A) any settlement or any judgment entered against Buyer based upon 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 conditioned on Buyer notifying Seller in writing within (ten) 10) days of delivery. No other claims against Seller will be allowed unless asserted in writing within thirty (30) days after delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the defect is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

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 writings or communications which give rise to or relate to agreements, negotiations, or representations concerning the subject matter are herein merged. The terms contained herein may not be modified unless written in full and signed by an authorized representative of Seller.

20. **Compliance with Laws.** Buyer agrees to comply with all applicable laws, regulations, rules, codes, and permits promulgated by the United States of America, and the country or countries in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act (“FCPA”), the U.S. Anti-Kickback Act (“Anti-Kickback Act”) and the U.S. Food Drug and Cosmetic Act ("FDCA"). Each such law, rule, regulation, or other requirement, is hereby incorporated by reference into this agreement, and Buyer agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that it is familiar with the provisions of the U. K. Bribery 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 will not make any payment or give anything of value, directly or indirectly to any governmental or public official, or any person, for the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller.
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