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# Variable Displacement Piston Pumps

## Series PAVC

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</table>
### Variable Displacement Piston Pumps

#### Series PAVC

#### Quick Reference Data Chart

<table>
<thead>
<tr>
<th>Pump Model</th>
<th>Displacement CM³/REV (IN³/REV)</th>
<th>Pump Delivery @ 21 bar (300 PSI) in LPM (GPM)</th>
<th>*Approx. Noise Levels dBA @ Full Flow 1800 RPM (1200 RPM)</th>
<th>Input Power At 1800 RPM, Maximum Displacement &amp; 207 bar (3000 PSI)</th>
<th>Operating Speed RPM (Maximum)</th>
<th>Pressure bar (PSI) Continuous (Maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVC33</td>
<td>33 (2.0)</td>
<td>39.4 (10.4) 59.0 (15.6)</td>
<td>34 bar 69 bar 138 bar 207 bar</td>
<td>21.3 kw (28.5 hp)</td>
<td>3000</td>
<td>207 (3000)</td>
</tr>
<tr>
<td>PAVC38</td>
<td>38 (2.3)</td>
<td>45.0 (11.9) 67.8 (17.9)</td>
<td>34 bar 69 bar 138 bar 207 bar</td>
<td>24.6 kw (33.0 hp)</td>
<td>3000</td>
<td>207 (3000)</td>
</tr>
<tr>
<td>PAVC65</td>
<td>65 (4.0)</td>
<td>78.7 (20.8) 118.1 (31.2)</td>
<td>34 bar 69 bar 138 bar 207 bar</td>
<td>43.1 kw (57.8 hp)</td>
<td>3000</td>
<td>207 (3000)</td>
</tr>
<tr>
<td>PAVC100</td>
<td>100 (6.1)</td>
<td>119.6 (31.6) 179.8 (47.5)</td>
<td>34 bar 69 bar 138 bar 207 bar</td>
<td>71.2 kw (95.5 hp)</td>
<td>2600</td>
<td>207 (3000)</td>
</tr>
</tbody>
</table>

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.
Features

- High Strength Cast-Iron Housing
- Built-In Supercharger Ensures High Speed Capability - 3000 RPM (2600 RPM PAVC100)
- Sealed Shaft Bearing
- Two Piece Design for Ease of Service
- Cartridge Type Controls - Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Thru-Shaft (PAVC100 Only)
- Full Pressure Rating on Most Water Glycol Fluids
- Pump Case and Shaft Seal are Subjected to Inlet Pressure Only
- Filter and/or Cool Drain Line
  7 bar (100 PSI) Maximum

Controls

- Pressure Compensation
- Load Sensing
- Power (Torque) Limiting
- Power and Load Sensing
- Remote Pressure Compensation
- Adjustable Maximum Volume Stop
- Low Pressure Standby
General Description

All control is achieved by the proper positioning of the swash plate. This is achieved by a servo piston acting on one end of the swash plate working against the combined effect of the off-setting forces of the pistons and centering spring on the other end. The control spool acts as a metering valve which varies the pressure behind the servo piston.

As shown in Figure 1, the amount of flow produced by the Parker Piston Pump is dependent upon the length of stroke of the pumping pistons. This length of stroke, in turn, is determined by the position of the swash plate. Maximum flow is achieved at an angle of 17°.

The rotating piston barrel, driven by the prime mover, moves the pistons in a circular path and the piston slippers are supported hydrostatically against the face of the swash plate. When the swash plate is in a vertical position, perpendicular to the centerline of the piston barrel, there is no piston stroke and consequently no fluid displacement. When the swash plate is positioned at an angle, the pistons are forced in and out of the barrel and fluid displacement takes place. The greater the angle of the swash plate, the greater the piston stroke.

The centerline of the pumping piston assembly is offset from the centerline of the swash plate. Therefore, as shown on the accompanying Figure 1A, the pistons’ effective summation force tends to destroke the swash plate to a vertical (neutral) position. This destroking force is balanced as the swash plate is angled by the force of the servo piston.
Variable Displacement Piston Pumps
Series PAVC

**Ordering Information**

<table>
<thead>
<tr>
<th>Code</th>
<th>Multiple Pumps</th>
<th>Omit</th>
<th>Single Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Factory Mounted to Rear of Another Pump</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Displacement in3/rev (cm³/rev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>2.0 (33)</td>
</tr>
<tr>
<td>38</td>
<td>2.3 (38)</td>
</tr>
<tr>
<td>65</td>
<td>4.0 (65)</td>
</tr>
<tr>
<td>100</td>
<td>6.1 (100)</td>
</tr>
</tbody>
</table>

**Ordering Notes**

Unless otherwise specified, pump is shipped at maximum GPM (1800 RPM) and set to 69 bar (1000 PSI) [See † Exceptions]. When factory settings are required, the items shown in Chart #1 must be included with order.

### Chart #1

<table>
<thead>
<tr>
<th>Item</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td>—</td>
</tr>
<tr>
<td>PSI</td>
<td>—</td>
</tr>
<tr>
<td>HP</td>
<td>—</td>
</tr>
<tr>
<td>GPM</td>
<td>—</td>
</tr>
</tbody>
</table>

- **Code**: 33/38 Inlet
- **Outlet Port**: Str. Thd., Rear
- **Rotation**: Right CW
- **Volume Stop Options**: No Volume Stop

Pumps with M, ME, AM, CM or HM controls will be set to compensate at 207 bar (3000 PSI) unless Chart #1 specifies otherwise.
Pressure Compensated Control

Swash plate angle controls the output flow of the pump. Swash plate angle is controlled by the force generated against the swash plate by the pumping pistons and by the force of the servo piston. The force of the servo piston is greater than the force of the pumping pistons when both are at the same pressure.

By means of internal porting, pressure is connected from the output port to the servo piston via orifice (E), and to the control spool via passage (D). Also pressure is applied to the control spool chamber thru orifice (F). As long as the pressures at both ends of the control spool remain equal, the spool will remain offset upward, due to the added force of the spring.

When pressure reaches the setting of the compensator control, the dart leaves its seat causing the pressure in the spool chamber to be reduced. The spool now moves downward causing pressure in the servo piston cavity to vent via port “A”. The reduced pressure at the servo piston allows the servo piston to move to the right. This movement reduces the angle of the swash plate and thereby reduces the pumps output flow.

As pump pressure on the control spool drops below pressure and spring force in the spool chamber, the control spool moves upward to maintain an equilibrium on both sides of the spool. If pump pressure falls below compensator control setting, the control spool moves up, bringing the pump to maximum displacement.

ΔP Adjustment of PAVC Pumps

PROCEDURE:

a. Standard Pressure Compensated Pump

Pumps are shipped from factory with a differential pressure of approximately 150 PSI (10 bar) on PAVC 33/38/65, PAVC 100 is 300 PSI (21 bar) at 50% of maximum swash angle. Differential pressure will not normally change through the life of the pump. If this control has been tampered with, a close approximation of the correct setting can be made as follows:

Dead head the pump (no flow) with a 0-207 bar (0-3000 PSI) gauge in the OUTLET (not the low signal “B” port), back the pressure compensator adjustment out (full counterclockwise).

The gauge should read between 22-26 bar (325-375 PSI) PAVC 33, 38 & 65, 34-40 bar (500-575 PSI) PAVC 100. If the gauge reads different than this, turn the differential adjustment knob (Differential Option 4) or add/remove shims (Omit Option) until correct pressure figure is reached.
Remote Pressure Control

Control Type (M)
Remote control of the PAVC output pressure can be achieved by controlling the pressure in the low signal “B” port when the pump is set up for Control Type (M). A manual, hydraulically piloted, electrical or electro-proportionally controlled pressure control device is installed in the line from the low signal “B” port to tank. The pump will then maintain pressure approximately equal to the pressure in the “B” port plus the pump differential setting.

Low Pressure Standby
This option can be used as an alternative to the load sensing option (A) to achieve low pressure standby. Minimum standby pressure is somewhat higher than that achieved using option (A). In the compensating mode there is approximately 1.1 LPM (.3 GPM) flow from the low signal “B” port in addition to 3.4 LPM (.9 GPM) flow from the control drain port “A”.

Multiple Pressure Standby
If the pressure level in the low signal “B” port is limited by a relief valve, as the desired pump outlet pressure is reached, the relief valve in the “B” port will allow the pump to standby at a preset pressure. Adding to this concept, multiple, remotely piloted relief valves plumbed in parallel in the “B” port line can yield multiple, sequential pressure settings.

CONTROL OPTION - ‘M’
Pressure & Flow Control (Load Sensing)  
Control Type (A)

Flow control is achieved by placing an orifice (fixed or adjustable) in the pump outlet port. The pressure drop ($\Delta P$) across this flow control is the governing signal that controls the pump’s output, as explained below.

Whenever the pressure drop at the flow control increases (indicating an increase in output flow), the pump attempts to compensate by decreasing the output flow. It does this by sensing the lower pressure on the downstream side of the flow control via line (C), which is balanced against the pump pressure via passage (D), on the control spool.

The control spool is forced down against the control spool spring by differential pressure. This vents the servo piston cavity, destroking the pump to a point where the set pressure drop across the orifice is maintained and the flow is obtained.

The converse of this is also true whenever the pressure drop decreases (indicating a decrease in output flow). In this case, the control spool is forced up. This increases pump displacement in an attempt to maintain the predetermined pressure drop or constant flow.

It should be noted that the pump is still pressure compensated and destrokes at the selected pressure setting. The pressure compensator control will override the flow control whenever the pressure compensator control setting is reached.

Low Pressure Standby

This arrangement can also be used to provide low pressure standby by venting the “B” port through a simple on/off valve suitable for flows of 3.8-7.6 LPM (1-2 GPM). When flow or pressure is required, this valve is closed allowing system pressure to build behind the control spool and bringing the pump on-stroke.

Load Sensing

If, instead of measuring the pressure drop across the orifice in the pump outlet port, it is measured downstream of a directional control valve, a constant pressure drop will be maintained across the valve spool. This results in a constant flow for any given opening of the directional control valve regardless of the work load downstream or the operating speed of the pump.

The pump “senses” the amount of pressure necessary to move the load and adjusts output flow to match the valve opening selected and pressure to overcome the load plus the preset $\Delta P$ across the valve spool.

The benefits of this arrangement are that excellent, repeatable flow characteristics are achieved, and considerable energy savings are realized while metering, compared to using a straight pressure compensated system.
Pressure & Power (Torque) Control
Control Type (H)

The power control is sensitive to the position of the servo piston. When the servo piston is to the right, the swash plate causes low flow and the power control piston develops maximum spring pressure on its companion poppet (mechanical feedback). When the servo piston is left and the flow is high, the power control piston reduces spring pressure on the poppet. This allows it to open under less pressure in the control spool chamber, thereby venting some of the pressure in the control spool chamber. As with the operation of the pressure compensator control, this allows the control spool to move downward, venting the servo piston cavity and causing the servo piston to move to the right. This reduces output flow and thereby power.

As indicated in the pictorial drawing, pressure in the control spool chamber is affected by both the pressure compensator control and the power control. The resultant pressure in this chamber is a function of the set points of these two controls. Both set points are adjustable.
Pressure, Power & Flow Control
Control Type (C)

In addition to the three control configurations just discussed, it is possible to combine all three control devices in one pump. In this mode, the position of the control spool is a function of the actions of the pressure compensator adjustment, power adjustment, and flow control.

CONTROL OPTION - ‘C’
How to read input power control curve data.

1. Power “A” curve corresponds to flow “A” curve. This represents a particular setting of the power (torque) control.

2. With this setting the maximum power required will be as shown at the apex (maximum point) of the power curve.

3. The flow at this setting will follow the flow vs. pressure curve shown.

4. Example – 1800 RPM, curve labeled “C”:
   - A. Flow will follow curve “C” and pump will deadhead at 190 bar (2750 PSI).
   - B. Full flow will not be realized above 83 bar (1200 PSI).
   - C. Flow at 103 bar (1500 PSI) will be approximately 48.1 LPM (12.7 GPM).
   - D. Maximum power [11 KW (15 HP)] occurs at approximately 117 bar (1700 PSI).

5. Torque values are shown to correspond to powers at speed shown.
Performance Information
Series PAVC 33/38 Pressure Compensated, Variable Volume, Piston Pumps

Features
• High Strength Cast-Iron Housing
• Built-In Supercharger
• High Speed Capability – 3000 RPM
• Two Piece Design for Ease of Service
• Cartridge Type Controls – Field Changeable
• Replaceable Bronze Clad Port Plate
• Airbleed Standard for Quick Priming
• Hydrodynamic Cylinder Barrel Bearing
• Full Pressure Rating on Water Glycol Fluids
• Filtered and/or Cooled Drain Line Capable
  7 bar (100 PSI) Maximum

Controls
• Pressure Compensation
• Remote Pressure Compensation
• Load Sensing
• Power (Torque) Limiting
• Power Limiting and Load Sensing
• Adjustable Maximum Volume Stop
• Low Pressure Standby

Schematic Symbol
(Basic Pump)

Weight and Package Size

<table>
<thead>
<tr>
<th>Model</th>
<th>Weight Kg (Lb)</th>
<th>Length From Mounting Face in CM (Inches)</th>
<th>Height in CM (Inches)</th>
<th>Height in CM (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVC 33/38</td>
<td>18 (40)</td>
<td>18.41 (7.25)</td>
<td>16.00 (6.30)</td>
<td>16.81 (6.62)</td>
</tr>
</tbody>
</table>

Quick Reference Data Chart

<table>
<thead>
<tr>
<th>Pump Model</th>
<th>Displacement CM/REV (IN/REV)</th>
<th>Pump Delivery @ 21 bar (300 PSI) in LPM (GPM)</th>
<th>Approx. Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)</th>
<th>Input Power At 1800 RPM, Max. Displacement &amp; 207 bar (3000 PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1200 RPM</td>
<td>1800 RPM</td>
<td>34 bar (500 PSI)</td>
</tr>
<tr>
<td>PAVC33</td>
<td>33 (2.0)</td>
<td>39.4 (10.4)</td>
<td>59.0 (15.6)</td>
<td>75 (69)</td>
</tr>
<tr>
<td>PAVC38</td>
<td>38 (2.3)</td>
<td>45.0 (11.9)</td>
<td>67.8 (17.9)</td>
<td>75 (69)</td>
</tr>
</tbody>
</table>

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.
Typical Performance Data - Fluid: Standard Hydraulic Oil 100 SSU @ 49°C (120°F)

PAVC33 @ 1800 RPM

Volumetric Efficiency

Overall Efficiency

Flow

Input Power at Full Flow

Compensated Power

Pressure

Flow

Efficiency - %

Power

Pressure

Flow

Efficiency - %

Power

PAVC38 @ 1800 RPM

Volumetric Efficiency

Overall Efficiency

Flow

Input Power at Full Flow

Compensated Power

Pressure

Flow

Efficiency - %

Power

Pressure

Flow

Efficiency - %

Power

NOTE: The efficiencies and data in the graph are good only for pumps running at 1800 RPM and stroked to maximum. To calculate approximate input power for the other conditions, use the following formula:

\[ HP = Q \times \frac{(PSI)}{1714} + (CHp) \]

WHERE:

\( Q \) = Actual Output Flow in GPM

\( PSI \) = Pressure At Pump Outlet

\( CHp \) = Input Power @ Full Compensation @ 1800 RPM (from graph read at operating pressure)

Actual GPM is directly proportional to drive speed and maximum volume setting. Flow loss, however, is a function of pressure only.

Inlet Characteristics at Full Displacement

(Graph only valid at sea level)

Recommended Operating Condition

DO NOT OPERATE IN THIS REGION

Compensated Control Drain Flow @ 1800 RPM

System Pressure

Drain Flow

Parker Hannifin Corporation
Hydraulic Pump Division
Marysville, Ohio USA
Typical Performance Data -

Minimum Power Settings Attainable With Control Options C, H, CM & HM

NOTE: Minimum attainable HP setting means that input power will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting input power limiter below full flow boundary, full flow may not be obtained at low operating pressure.

Determine maximum input power limitation at desired RPM. All points above desired compensator setting curve can be achieved.

Power (Torque) Limiting Curves

See page 12 for “How to Read Curves” information.
Typical Performance Data - 

Minimum Power Settings Attainable With Control Options C, H, CM & HM

NOTE: Minimum attainable HP setting means that input horsepower will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting input power limiter below full flow boundary, full flow may not be obtained at low operating pressure.

Determine maximum input power limitation at desired RPM. All points above desired compensator setting curve can be achieved.

Power (Torque) Limiting Curves

See page 12 for “How to Read Curves” information.
Rear Ported Pump Dimensions

* Inch equivalents for millimeter dimensions are shown in (**).

NOTE:
1. Pump shown and dimensioned is a clockwise rotation pump. Outlet port, A and B ports, and controls will be on opposite side for a counterclockwise rotation pump.
**Side Ported – Dimensions**

*Inch equivalents for millimeter dimensions are shown in (**).*

**NOTE:**
1. Shown and dimensioned is a clockwise pump. Ports A and B, delivery port and pump controls will be on the opposite side for a counterclockwise pump.

<table>
<thead>
<tr>
<th>Option</th>
<th>Outlet Port</th>
<th>Inlet Port</th>
<th>Control Drain</th>
<th>Signal Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>SAE-12 Straight Thread</td>
<td>1/4 SAE 4-Bolt Flange (1-1/16-12UNC)</td>
<td>SAE-4 Straight Thread</td>
<td>SAE-4 Straight Thread</td>
</tr>
</tbody>
</table>

**Port Location**

**Dimensional Data**

<table>
<thead>
<tr>
<th>Option</th>
<th>Outlet Port</th>
<th>Inlet Port</th>
<th>Control Drain</th>
<th>Signal Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>SAE-12 Straight Thread</td>
<td>1/4 SAE 4-Bolt Flange (1-1/16-12UNC)</td>
<td>SAE-4 Straight Thread</td>
<td>SAE-4 Straight Thread</td>
</tr>
</tbody>
</table>

**Shaft Option “Omit”**

SAE “B” SHAFT 7/8” KEYED MAX. TORQUE = 209 N·m (1,850 IN-LBS)

**Clearance for 500 DIA. MOUNTING BOLTS, SAE “B” 2-BOLT PATTERN**

**Control Drain**

PORT “A” SEE CHART FOR SIZE

**Non-Adjustable Differential Option “Omit”**

**Adjustable Differential Option “4”**

SENSITIVITY: 13.8 BAR (200 PSI) PER TURN

**MAX. VOLUME STOP OPTION “2”**

2.2 CC/REV/TURN (PAVC33) 2.5 CC/REV/TURN (PAVC38)

**MAX. VOLUME STOP OPTION “5”**

2.5 CC/REV/TURN (PAVC33) 2.8 CC/REV/TURN (PAVC38)
Performance Information
Series PAVC65 Pressure Compensated, Variable Volume, Piston Pump

Features
- High Strength Cast-Iron Housing
- Built-In Supercharger
- High Speed Capability - 3000 RPM
- Two Piece Housing for Ease of Service
- Cartridge Type Controls - Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Full Pressure Rating on Water Glycol Fluids
- Filtered and/or Cooled Drain Line Capable - 7 bar (100 PSI) Maximum

Controls
- Pressure Compensation
- Remote Pressure Compensation
- Load Sensing
- Power (Torque) Limiting
- Power Limiting and Load Sensing
- Adjustable Maximum Volume Stop
- Low Pressure Standby

Specifications
Pressure Ratings:
Outlet Port: 207 bar (3000 PSI) Continuous (P1)
248 bar (3600 PSI) Peak (P3)
Inlet Port: 1.7 bar (25 PSI) Maximum
0.17 bar (5 In. Hg.) Minimum
@ 1800 RPM (See Inlet Chart for other speeds)
Control Drain: 7 bar (100 PSI) Maximum
Speed Ratings: 600 to 3000 RPM*
* See Inlet Characteristics Chart on page A155 and consider using Dual Inlet Port configuration on page A178 for applications above 2700 RPM.
Operating Temperature Range: – 40°C to 71°C
(- 40°F to 160°F)
Housing Material: Cast-Iron
Filtration: Maintain SAE Class 4, ISO 16/13, ISO 18/15 Maximum Recommended
Mounting: SAE C 2-Bolt Flange Mount or Diagonally on SAE C 4-Bolt Flange Mount
Installation Data: See page A46 of this catalog for specific recommendations pertaining to system cleanliness, fluids, start-up, inlet conditions, shaft alignment, drain line restrictions and other important factors relative to the proper installation and use of these pumps.

Quick Reference Data Chart

<table>
<thead>
<tr>
<th>Pump Model</th>
<th>Displacement CM³/REV (IN³/REV)</th>
<th>Pump Delivery @ 21 bar (300 PSI) in LPM (GPM)</th>
<th>*Approx. Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)</th>
<th>Input Power At 1800 RPM, Max. Displacement &amp; 207 bar (3000 PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVC65</td>
<td>65 (4.0)</td>
<td>78.7 (20.8)</td>
<td>77 (75) 78 (76) 80 (78) 81 (79)</td>
<td>43.1 kw (57.8 hp)</td>
</tr>
</tbody>
</table>

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.
Typical Performance Data - Fluid: Standard Hydraulic Oil 100 SSU @ 49°C (120°F)

\[ HP = \left( \frac{Q \times (PSI)}{1714} \right) + (CHp) \]

Note: The efficiencies and data in the graph are good only for pumps running at 1800 RPM and stroked to maximum. To calculate approximate input power for the other conditions, use the following formula:

WHERE:
- Q = Actual Output Flow in GPM
- PSI = Pressure At Pump Outlet
- CHp = Input Power @ Full Compensation @ 1800 RPM (from graph read at operating pressure)

Actual GPM is directly proportional to drive speed and maximum volume setting. Flow loss, however, is a function of pressure only.

Inlet Characteristics at Full Displacement

(Graph only valid at sea level)

Compensated Control Drain Flow @ 1800 RPM
Typical Performance Data -

Minimum Power Settings Attainable With Control Options C, H, CM & HM

NOTE: Minimum attainable HP setting means that input power will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting input power limiter below full flow boundary, full flow may not be obtained at low operating pressure.

Determine maximum input power limitation at desired RPM. All points above desired compensator setting curve can be achieved.

See page 12 for “How to Read Curves” information.
### Dimensions – Rear Port

* Inch equivalents for millimeter dimensions are shown in (**).

**NOTES:**

1. Pump shown and dimensioned is a clockwise rotation pump. Outlet port, A and B ports, and controls will be on opposite side for a counterclockwise rotation pump.
2. Pump mounting and shaft comply with SAE "C" dimensions.

![Rear View Diagram]

**Rear View**

**Top View**

**Front View**

**Side View**
Variable Displacement Piston Pumps
Series PAVC 65

Dimensions – Top Port
* Inch equivalents for millimeter dimensions are shown in (**).

NOTES:
1. Pump shown and dimensioned is a clockwise rotation pump. Outlet port, A and B ports, and controls will be on opposite side for a counterclockwise pump.
2. Pump mounting and shaft comply with SAE "C" dimensions.

<table>
<thead>
<tr>
<th>Option</th>
<th>Outlet Port</th>
<th>Inlet Port</th>
<th>Control Drain</th>
<th>Signal Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>SAE-16 Straight Thread (1-5/16-12UNC)</td>
<td>1-1/2 SAE 4-Bolt Flange Standard Pressure Series (Code 61)</td>
<td>SAE-6 Straight Thread (9/16-18UNF)</td>
<td>SAE-4 Straight Thread (7/16-20UNF)</td>
</tr>
</tbody>
</table>
Performance Information
Series PAVC100 Pressure Compensated, Variable Volume, Piston Pump

Features
- High Strength Cast-Iron Housing
- Built-In Supercharger
- High Speed Capability - 2600 RPM
- Cartridge Type Controls - Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Full Pressure Rating on Water Glycol Fluids
- Filtered and/or Cooled Drain Line
  Capable 7 bar (100 PSI) Maximum
- Thru-Shaft Capable

Controls
- Pressure Compensation
- Remote Pressure Compensation
- Load Sensing
- Power (Torque) Limiting
- Power Limiting and Load Sensing
- Adjustable Maximum Volume Stop
- Low Pressure Standby

Specifications
Pressure Ratings:
Outlet Port: 207 bar (3000 PSI) Continuous (P1)
           248 bar (3600 PSI) Peak (P3)
Inlet Port:  1.7 bar (25 PSI) Maximum
            0.17 bar (5 In. Hg.) Minimum
            @ 1800 RPM  (See Inlet Chart for other speeds)
Control Drain: 7 bar (100 PSI) Maximum
Speed Ratings: 600 to 2600 RPM
Operating Temperature Range: –40°C to 71°C
                          (–40°F to 160°F)
Housing Material: Cast-Iron
Filtration: Maintain SAE Class 4, ISO 16/13,
           ISO 18/15 Maximum Recommended
Mounting: SAE C 2-Bolt Flange Mount or Diagonally
          on SAE C 4-Bolt Flange Mount
Installation Data: See page A46 of this catalog
                     for specific recommendations pertaining to system
                     cleanliness, fluids, start-up, inlet conditions, shaft
                     alignment, drain line restrictions and other important
                     factors relative to the proper installation and use
                     of these pumps.

Quick Reference Data Chart

<table>
<thead>
<tr>
<th>Pump Model</th>
<th>Displacement CM/REV (IN3/REV)</th>
<th>Pump Delivery @ 21 bar (300 PSI) in LPM (GPM)</th>
<th>*Approx. Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)</th>
<th>Input Power At 1800 RPM, Max. Displacement &amp; 207 bar (3000 PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVC100</td>
<td>100 (6.1)</td>
<td>119.6 (31.6) 179.8 (47.5)</td>
<td>82 (78) 82 (79) 85 (80)</td>
<td>71.2 kw (95.5 hp)</td>
</tr>
</tbody>
</table>

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.
Typical Performance Data - Fluid: Standard Hydraulic Oil 100 SSU @ 49°C (120°F)

NOTE: The efficiencies and data in the graph are good only for pumps running at 1800 RPM and strocked to maximum. To calculate approximate input power for the other conditions, use the following formula:

\[
HP = \left( \frac{Q \times (PSI)}{1714} \right) + (CHp)
\]

Actual GPM is directly proportional to drive speed and maximum volume setting. Flow loss, however, is a function of pressure only.

WHERE:

- \( Q \) = Actual Output Flow in GPM
- \( PSI \) = Pressure At Pump Outlet
- \( CHp \) = Input Power @ Full Compensation
  @ 1800 RPM (from graph read at operating pressure)

Parker Hannifin Corporation
Hydraulic Pump Division
Marysville, Ohio USA
Typical Performance Data -

Minimum Power Settings Attainable With Control Options C, H, CM & HM

NOTE: Minimum attainable HP setting means that input power will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting input power limiter below full flow boundary, full flow may not be obtained at low operating pressure. Determine maximum input power limitation at desired RPM. All points above desired compensator setting curve can be achieved.

Power (Torque) Limiting Curves

See page 12 for “How to Read Curves” information.
Rear Ported Pump Dimensions

* Inch equivalents for millimeter dimensions are shown in (**).

NOTE:
Pump shown and dimensioned is a clockwise rotation pump. For a counterclockwise rotation pump the outlet port, control drain, signal port and pump controls will be on other side.

<table>
<thead>
<tr>
<th>Port Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outlet Port</strong></td>
</tr>
<tr>
<td>Omit</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

SHAFT OPTION “B”
SAE “C” SPLINE
14 TOOTH 12/24 DP
MAX. TORQUE = 639 N·m (5,680 IN-LBS)

SHAFT OPTION “C”
SAE “C-C” SHAFT
17 TOOTH 12/24 DP
MAX. TORQUE = 1,218 N·m (10,780 IN-LBS)

SHAFT OPTION “D”
SAE “C-C” SPLINE
17 TOOTH 12/24 DP
MAX. TORQUE = 1,218 N·m (10,780 IN-LBS)
Rear Ported Pump Dimensions
* Inch equivalents for millimeter dimensions are shown in (**).

NOTE:
Pump shown and dimensioned is a clockwise rotation pump. For a counterclockwise rotation pump the outlet port, control drain, signal port and pump controls will be on other side.
**Top/Bottom Ported Pump Dimensions**

* Inch equivalents for millimeter dimensions are shown in (**).

**NOTES:**
1. Pump shown and dimensioned is a clockwise rotation top/bottom inlet option pump. For a counterclockwise rotation pump the outlet port, control drain, signal port, and pump controls will be on other side.
2. For other available shafts see page A34.

---

**VARIABLE VOLUME PUMP**

**cc/Rev**  
**PSI max**  
**HP**  
**GPM**  

**@ PSI**  

**Rotation**  

**RPM**  

**INITIAL FACTORY SETTINGS BELOW**

---

**Shaft Option**  

**OMIT**  

**SAE “C” SHAFT MAX. TORQUE = 639 N·m (5,680 IN-LBS)**

**SHAFT OPTION**  

**“OMIT”**  

**SAE “C” SHAFT MAX. TORQUE = 639 N·m (5,680 IN-LBS)**

---

**Control Drain**  

**PORT “A”**  

**SEE CHART A169 FOR PORT SIZE**

---

**Outlet Port**  

**PORT “B”**  

**SEE CHART A169 FOR PORT SIZE**

---

**Airbleed Drain Port**  

**PORT 7/16-20UNF-2B ST. THREAD O-RING SAE-4**

---

**AIRBLEED DRAIN PORT 7/16-20UNF-2B ST. THREAD O-RING SAE-4**

---

**OPTION “8”**  

**ISO 6149-4 ADAPTER FITTING ON OPTION “B”**

---

**OPTION “6”**  

**ISO 6149-4 ADAPTER FITTING ON OPTION “6”**

---

**Option “2”**  

**INLET PORT FLANGE INLET PORT SEE CHART A169 FOR PORT SIZE**

---

**PRESSURE COMPENSATOR ADJUSTMENT SENSITIVITY:**  

**55 BAR (800 PSI) PER REV**

---

**Pressure Compensator Sensitivity:**  

**55 BAR (800 PSI) PER REV**

---

**Torque Control Adjustment**  

**(CONTROL OPTIONS C, H, CM & HM)**  

**SENSITIVITY: 130 N·m (1,150 IN-LB) PER REV.**

---

**Bottom Port**  

**SAME PATTERN ROTATED 90˚**

---

**Bottom Port**  

**OPPOSITE SIDE**

---

**Threaded Outlet Port**  

**OUTLET PORT OPTION “OMIT”**  

**SEE CHART A169 FOR PORT SIZE**

---

**Threaded Outlet Port**  

**OPTION “OMIT”**  

**GREEK LETTERS**

---

**Rear View**  

**Side View**

---

**Front View**  

**Top View**

---

**Dimensional Data**

---

**NOTES:**

1. Pump shown and dimensioned is a clockwise rotation top/bottom inlet option pump. For a counterclockwise rotation pump the outlet port, control drain, signal port, and pump controls will be on other side.
2. For other available shafts see page A34.
Top/Bottom Ported Pump Dimensions

* Inch equivalents for millimeter dimensions are shown in (**).

NOTE:
Pump shown and dimensioned is a clockwise rotation pump. For a counterclockwise rotation pump the outlet port, control drain, signal port and pump controls will be on other side.

### Dimensional Data

<table>
<thead>
<tr>
<th>Variation</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>6A4</td>
<td>—</td>
<td>Ø 82.58/82.60 (3.251/3.252)</td>
<td>106.38 (4.188)</td>
<td>N/A</td>
<td>3/8-16UNC-2B</td>
<td>N/A</td>
<td>9 Tooth 16/32 Pitch</td>
<td>N/A</td>
</tr>
<tr>
<td>6B3</td>
<td>53.98 (2.125)</td>
<td>Ø 101.63/101.65 (4.001/4.002)</td>
<td>146.05 (5.750)</td>
<td>89.81 (3.536)</td>
<td>1/2-13UNC-2B</td>
<td>1/2-13UNC-2B</td>
<td>13 Tooth 16/32 Pitch</td>
<td>N/A</td>
</tr>
<tr>
<td>6B4</td>
<td>53.98 (2.125)</td>
<td>Ø 101.63/101.65 (4.001/4.002)</td>
<td>146.05 (5.750)</td>
<td>89.81 (3.536)</td>
<td>1/2-13UNC-2B</td>
<td>1/2-13UNC-2B</td>
<td>15 Tooth 16/32 Pitch</td>
<td>N/A</td>
</tr>
<tr>
<td>6C3</td>
<td>53.98 (2.125)</td>
<td>Ø 127.03/127.05 (5.001/5.002)</td>
<td>180.98 (7.125)</td>
<td>114.50 (4.508)</td>
<td>5/8-11UNC-2B</td>
<td>1/2-13UNC-2B</td>
<td>14 Tooth 12/24 Pitch</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Thru-Shaft Options – Dimensions

* Inch equivalents for millimeter dimensions are shown in (**).

NOTES:
1. Rear adapters may be rotated 90°.
2. Pump shown is a clockwise rotation pump. For a counterclockwise pump the outlet port, control drain and control adjustments will be on opposite side.
3. Maximum torque transmitting capacity for rear mounting of pumps is 639 Nm (5,680 In. Lbs). Lower allowables may apply based on pump mounted on rear.
Generic Pump Assembly

**Max Vol. Stop Variation - 5**

**Max Vol. Stop Variation - 2**

**23 N·m**

(17 FT·LBS.)

**TORQUE**

**95 N·m**

(70 FT·LBS.)

**TORQUE**

**Installation Information**

**Series PAVC 33/38/65/100**

**TRUNNION CAP ASSEMBLY**

1. Thrust Washer (Not on PAVC100)
2. Snap Ring
3. O-Ring
4. Trunnion Cap
5. Roller Bearing

**SLEEVE ASSEMBLY**

2. Sleeve
3. O-Ring
4. Back-Up Ring

**PLUG ASSEMBLY**

2. Sleeve
3. O-Ring
4. Back-Up Ring

**BEARING SHAFT ASSEMBLY**

5. Bearing Shaft

**PISTON - DIFFERENTIAL CONTROL**

6. Piston Body

**RETAINER DETAIL**

4. Retainer

**AIR BLEED ASSEMBLY**

7. Air Bleed

**ADJUSTING STEM ASSEMBLY**

8. Adjusting Stem

**PORT PLATE**

9. Port Plate

**LEFT HAND (CCW) PORT PLATE SHOWN IN ASSEMBLY (ABOVE). RIGHT HAND (CW) PORT PLATE SHOWN BELOW.**
installation information

13.5 N·m (120 FT. LBS.) TORQUE

108 N·m (80 FT. LBS.) TORQUE

27 N·m (20 FT. LBS.) TORQUE

68 N·m (50 FT. LBS.) TORQUE

non-adjustable differential variation - omit

adjustable differential variation - 4

these items are shown in position for control option "omit". see separate diagram for other control options.

PAVC 33, 38, 65

<table>
<thead>
<tr>
<th>Control Option</th>
<th>Position</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
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<td>Open</td>
<td>800599</td>
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<td>787474*</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>102 x 1</td>
<td>800599</td>
<td>Open</td>
<td>108 x 4</td>
<td>787474*</td>
<td></td>
</tr>
<tr>
<td>H</td>
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<td>800599</td>
<td>108 x 4</td>
<td>108 x 4</td>
<td>Open</td>
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<td>Open</td>
<td>108 x 4</td>
<td>Open</td>
<td></td>
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<tr>
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<td>800599</td>
<td>Open</td>
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<td>787474*</td>
<td></td>
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<td>S</td>
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<td>CM</td>
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<td>Open</td>
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</tr>
</tbody>
</table>

* available only on PAVC65.

PAVC 100

<table>
<thead>
<tr>
<th>Control Option</th>
<th>Position</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>108 x 4</td>
<td>108 x 4</td>
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<td>H</td>
<td>Open</td>
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<td>108 x 4</td>
<td>108 x 4</td>
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</tr>
<tr>
<td>M</td>
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<td>HM</td>
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<td>Open</td>
<td>Open</td>
<td>108 x 4</td>
<td>787474</td>
<td></td>
</tr>
</tbody>
</table>

* 787474 is always included with the PAVC100.

 Toryque (hp) control (see next page)

Part Number Description

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>102 x 1</td>
<td>solid pipe plug (1/16&quot;)</td>
</tr>
<tr>
<td>108 x 4</td>
<td>SAE plug - 4</td>
</tr>
<tr>
<td>690870</td>
<td>.028 orifice plug (1/16&quot;)</td>
</tr>
<tr>
<td>800599</td>
<td>.034 orifice plug (1/16&quot;)</td>
</tr>
<tr>
<td>786635</td>
<td>.034 orifice fitting</td>
</tr>
<tr>
<td>787474</td>
<td>upstroke spring</td>
</tr>
</tbody>
</table>
10. CONTROL OPTION “C” & “H”  PRESSURE, POWER & FLOW

OMIT

ADD

27 N·m (20 FT-LBS.) TORQUE
14 N·m (10 FT-LBS.) TORQUE
SET @ MAX. PRESSURE PER TEST SPEC. THEN INSTALL JAM NUT, LOCKING NUT AND LOCKING TAB.
Use Of A Relief Valve
The use of a relief valve, while not mandatory is recommended in the main circuit to suppress hydraulic shock loads and additional system protection. If a minimum volume stop is used, the use of a relief valve is mandatory.

Fluid Recommendations
Premium quality hydraulic oil with a viscosity range between 150-250 SSU (30-50 cst.) at 38°C (100°F). Normal operating viscosity range between 80-1000 SSU (17-180 cst.). Maximum start-up viscosity is 4000 SSU (1000 cst.).

NOTE: Consult Parker when exceeding 71°C (160°F) operation. Oil should have maximum anti-wear properties, rust and oxidation treatment.

Filtration
For maximum pump and system component life, the system should be protected from contamination at a level not to exceed 125 particles greater than 10 microns per milliliter of fluid. (SAE Class 4/ISO 16/13). Due to the nature of variable displacement pumps, variations in pump inlet conditions, fluid acceleration losses, system aeration, and duty cycle we do not recommend suction line filters. We do recommend the use of a properly sized, in-tank suction strainer. Contact your Parker representative for assistance.

Start-Up
On initial start-up, the case should be filled with oil, pressure should be reduced and the circuit should be open or the air bled from the pump outlet to permit priming. Use of the airbleed is recommended on initial start-up. See Installation and Mounting Section to connect airbleed.

Inlet Conditions
Not to exceed .17 bar (5 In. Hg.). Vacuum at 1800 RPM on petroleum base fluids. See recommended speed spectrum for specific inlet conditions.

Shaft Rotation and Line Up
Pump and motor shaft alignment must be within .010 TIR maximum, using a standard floating coupling. Please follow coupling manufacturer's recommended installation instructions to prevent end thrust on pump shaft. Turn pump to assure freedom of rotation. Pump and motor must be on a rigid base.

The coupling should be sized to absorb the peak horsepower developed.

Installation and Mounting
When a PAVC Series Pump is mounted above the fluid level, the position of the “control drain” is not restricted but the inlet port should not be on the bottom (PAVC100). When a PAVC Series Pump is mounted below the fluid level the position of all ports are not restricted. The “control drain” should be a separate line to the reservoir and extend below the oil level as far from the inlet line as possible. The “control drain” line can be filtered and/or cooled (must not exceed 7 bar (100 PSI) back pressure). Suggested maximum line length is 10 feet.

A built in airbleed is standard on all PAVC 33, 38, 65 and 100 Pumps. To connect, remove airbleed drain plug and connect a line unrestricted to reservoir extending below minimum oil level. Back pressure in this line must not exceed .28 bar (4 PSI).

Special Installations
Consult your Parker representative for any application requiring the following:
Pressure above rated, drive speed above maximum, indirect drive, fluid other than petroleum oil, oil temperature above 71°C (160°F).

Inlet Pressure
Not to exceed 1.72 bar (25 PSI).
1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is expressly conditioned on Buyer's assent to these Terms and Conditions. If any order is placed by Buyer which states terms and conditions found on-line at www.parker.com/sites/en/, Seller objects to any contrary or additional term or condition of Buyer's order or any other document issued by Buyer.

2. Price, Acceptance, Payments. Prices stated on the reverse side or preceding pages of this document are valid for 30 days. After 30 days, Seller may change prices to reflect any increase in its costs resulting from state, federal or local legislation, price increases from its suppliers, and all other increases, including any change, change in classification of warranty. The prices stated on the reverse or preceding pages of this document do not include any sales, use, or other taxes unless so stated specifically. Unless otherwise specified by Seller, all prices are F.O.B. Seller's facility, and payment is due 30 days from the date of invoice. After 30 days, Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to all products and risk of loss or damage shall pass to Buyer upon tender to the carrier at Seller's facility (i.e., when it's on the truck, it's yours). Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No delivery of shipment at Buyers' 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. Buyer shall be responsible for any additional shippingcharges incurred due to Buyer's changes in shipping, product specifications or in accordance with Section 13, herein.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of eighteen months from the date of delivery to Buyer. The prices charged for Seller's products are based upon the existence of limited warranty stated above, and upon the following disclaimer: DISCLAIMER OF WARRANTY: THIS WARRANTY APPLIES TO THE SOLE AND EXCLUSIVE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREBY. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

5. Limitation of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. At or before Seller's receipt of Buyer's written complaint, Seller shall have the right to inspect the alleged shortage. In the event of a confirmed shortage, Buyer shall be responsible for any additional shipping charges incurred due to Buyer's changes in shipping, product specifications or in accordance with Section 13, herein.

6. Limitation of Liability. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE OF THE PRODUCT. NO RESPONSIBILITY SHALL BE IMPLIED FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR AS THE RESULT OF THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF ANY PRODUCTS OR PARTS THEREOF OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY, IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAUSE OF ANY AGREEMENT EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. Contingencies. Seller shall not be liable for any default or delay in performance if caused by circumstances beyond the reasonable control of Seller.

8. 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 industrial standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

9. Special Tooling. Any design, tools, patterns, materials, drawings, confidential information or equipment furnished by Seller or any other items which become Seller's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any lost or damage to such property while it is in Seller's possession or control.

10. 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 or manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

11. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be construed as 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. Seller shall have a security interest in, and lien upon, any property of Buyer in Seller's possession as security for the payment of any amounts owed to Seller by Buyer.

12. Improper Use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damage, loss, suit and expense (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance.

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

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

15. 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 the agreement. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are hereby merged.

16. Waiver and Severability. Failure to enforce any provision of this agreement will not be deemed a waiver or prohibition 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 rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement shall remain in full force and effect.

17. Termination. This agreement may be terminated by Seller for any reason and at any time by giving Buyer thirty (30) days written notice of termination. In addition, Seller may by written notice immediately terminate this agreement for the following: (a) Buyer commits a breach of any provision of this agreement; (b) Seller's use of the Product may cause personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions.

18. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement. Buyer shall be responsible for any and all costs, including reasonable attorney fees, whether incurred by Seller or any third party in connection with any action or proceeding brought either by or on behalf of Seller or any third party.

19. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in 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 will also defend and indemnify Buyer against allegations of infringement, and Seller having 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 may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in any system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

20. Taxes. Unless otherwise indicated, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of Products.

21. Equal Opportunity Clause. For the performance of government contracts and where Seller is a subcontracts manufactured in the United States, Seller shall pay the subcontractor and all suppliers a price for the Products equal to the price paid to the original contractor for the Products equal to the price paid to the original contractor for the Products according to the terms and conditions of the subcontract and original contract, including any applicable taxes.

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, Hydraulics Group, and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods or work described will be referred to as “Products.”
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This literature replaces ALL previous literature
Catalog HY28-2662-CD/US
5/12

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