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- TVWS 250/360/500/750 SP Control ........................................ 42
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- TVWS 250/360/500/750 DP Control ........................................ 46
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Introduction

- Axial piston pumps with swash plate design for reliable operation and long life.
- Rotating and pressure loaded parts are pressure balanced.
- Wide range of available integrated charge and pilot pressure pump combinations for single and combination units.
- Special design for closed loop application.
- Oversize shaft and shaft bearings.
- Standard available transmission circuits with integrated valves and filters to build complete closed loop system. For charge flow and flushing.
- Through drive enable multiple pump installation from a single shaft. Multiple pump combinations are also available.
- Pressure up to 420 bar. Rated speed up to 1800 rpm. Higher speeds possible.
- Large charge flow rates for low system temperature.
- Fast response times.

**Displacement controls:**
- **ES** - Electric motor displacement control
- **HG** - Handwheel displacement control (Special feature)
- **FE** - Screw adjustment control (Special feature)
- **SP, SM** - Displacement proportional to electric signal
- **DP** - Displacement proportional to pressure signal

Extra functions available for SP, SM & DP:
- Pressure Limitation and/or power control overriding function.

**Available Displacement Sizes**

<table>
<thead>
<tr>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>130 ccm</td>
</tr>
<tr>
<td>180 ccm</td>
</tr>
<tr>
<td>250 ccm</td>
</tr>
<tr>
<td>360 ccm</td>
</tr>
<tr>
<td>500 ccm</td>
</tr>
<tr>
<td>750 ccm</td>
</tr>
</tbody>
</table>

Typical Section of Transmission Pump

Dimensional information listed in this catalog is subject to change without notice.
Form Page
The following 55-digit coding system has been developed to identify all of the configuration options for the "W" Series Transmission (Closed Loop) pumps. Use this model code to specify a unit with the desired features. All 55-digits must be present when ordering. You may want to photocopy the matrix below to ensure, that each number is entered in the correct box. If adjustments other than the standard settings (character 47..50) or special features (character 51..53) are needed, please provide the information when ordering. At the end of this section you may need to provide an additional model code if a combination unit is needed. In case of a combination unit, each single pump section must be specified separately using this or other Eaton catalog information.

In the model code string below some characters are already filled out and shown on this and the following pages. For such characters there is no option available.

Explanation for each character can be found as follows:

<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Pump Model Code</td>
<td>1......27 6</td>
</tr>
<tr>
<td>Control Options</td>
<td>28.....46 7 - 10</td>
</tr>
<tr>
<td>Customer Adjustment Specification</td>
<td>47.....50 7 - 10</td>
</tr>
<tr>
<td>Special Features</td>
<td>51.....53 11</td>
</tr>
<tr>
<td>Design Number</td>
<td>54.....55 11</td>
</tr>
<tr>
<td>Combination Model Code</td>
<td>1..... 39 12</td>
</tr>
</tbody>
</table>

In the model code string below some characters are already filled out and shown on this and the following pages. For such characters there is no option available.

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In the model code string below some characters are already filled out and shown on this and the following pages. For such characters there is no option available.

SPECIFY NON STANDARD ADJUSTMENT BELOW

SPECIFY SPECIAL FEATURE BELOW
Model Code
Transmission Pumps
"W" Series - Basic Pump

<table>
<thead>
<tr>
<th>T</th>
<th>V</th>
<th>W</th>
<th>M</th>
<th>I</th>
<th>R</th>
<th>S</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

1. **Pump**
   - T - Transmission Pump

2. **Displacement**
   - V - Variable displacement

3. **Pump Series**
   - W - "W" Series (was 30 design)

4. **Configuration**
   - S - Single Unit
   - F - Front Unit
   - M - Middle Unit
   - R - Rear Unit

5. **Separator**
   - - Separator

6. **Displacement Size**
   - 130 - 130 cm³/r [79 in³/rev]
   - 180 - 180 cm³/r [110 in³/rev]
   - 250 - 250 cm³/r [153 in³/rev]
   - 360 - 360 cm³/r [220 in³/rev]
   - 500 - 500 cm³/r [305 in³/rev]
   - 750 - 750 cm³/r [485 in³/rev]

7. **Basic standard**
   - M - Metric

8. **Mounting flange**
   - 05 - ISO 3019/2 - 160B4HW (130 and 180 cm³/r)
   - 07 - ISO 3019/2 - 200B4HW (250 and 360 cm³/r)
   - 08 - ISO 3019/2 - 250B4HW (500 and 750 cm³/r)

9. **Rotation Direction**
   - R - Right hand [CW]
   - L - Left hand [CCW]

10. **Adjustment stop**
    - 0 - No adjustment stop
    - 4 - Fixed mechanical Adjustment stop side A
    - 5 - Fixed mechanical Adjustment stop side B
    - 6 - Fixed mechanical Adjustment stop side A and B

11. **Thru-Drive Options**
    - 000 - None
    - 00A - SAE A
    - 00B - SAE B
    - 00C - SAE C
    - 00D - ISO 3019/2 - 125A2HW
    - 00E - ISO 3019/2 - 160A2HW
    - 00F - ISO 3019/2 - 125B4HW
    - 00G - ISO 3019/2 - 160B4HW
    - 00H - ISO 3019/2 - 200B4HW
    - 00P - Pilot pump (8 cm³/r)
    - 00T - Charge pump (~25% of unit displacement size)
    - 00TP - Charge pump (~25% of unit displacement size) and Pilot pump (8 cm³/r)
    - 00PP - Double pilot pump (8 cm³/r + 8 cm³/r)

12. **Main Ports**
    - 1 - SAE Port - Metric bolts

13. **Main Port Orientation**
    - R - Radial (side ports)

14. **Main Drive Shaft End**
    - 01 - ISO straight key
    - 02 - ISO spline

15. **Drive Shaft Seal Configuration**
    - S - Single shaft seal

16. **Seal Material**
    - V - Viton®

17. **Housing surface finish**
    - A - Blue painted

18. **Transmission Circuit**
    - 0 - No transmission circuit
    - 1 - Block filter, optical dirt indicator
    - 2 - Block, filter, electrical dirt indicator
    - 3 - Block without filter

19. **Zero Position Valve**
    - 0 - No Zero Position Valve

20. **Add Control Model Code**
    - Code (characters 28...50) on the following pages
Model Code
Transmission Pumps

"W" Series - ES Control

| E | S | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # |

29 Control type
ES – Electric motor - displacement control

29 Displacement Adjustment Options
M – Electric Motor - Fast response
N – Electric Motor - Medium response
P – Electric Motor - Slow response

31 Electronic Controls
00 – Not required

32 Yoke Displacement Zone
A – Single side of center “A”
C – Over center

34 Extra Functions
0 – Not available

Pressure Control Options
0 - Not available

Power Control Options
000000 - Not required

Pilot Oil Filter
0 - Not required

Fail Safe Valve
0 - Not required

Position Monitoring
A – 4 limit switches
B – 8 limit switches
P – 4 limit switches + sensor
T – 8 limit switches + sensor

Electric Motor Type
2 – Motor with brake (IP54)
3 – Motor without brake (Explosion proof)

Control Voltage of Zero Position Valve and Directional Control Valve
0 – Not applicable
B – 110 AC 50 Hz/120 AC 60 Hz
D – 220 AC 50 Hz/240 AC 60 Hz
G – 12 VDC
H – 24 VDC

Customer Adjustment Specification
0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

Special Features - Add special feature description (characters 51...55) on page 11 if required.

Response Time (sec) for Zero to Max. Displacement

<table>
<thead>
<tr>
<th>Size</th>
<th>130</th>
<th>180</th>
<th>250</th>
<th>360</th>
<th>500</th>
<th>750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>50 Hz</td>
<td>60 Hz</td>
<td>50 Hz</td>
<td>60 Hz</td>
<td>50 Hz</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Fast</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Medium</td>
<td>20</td>
<td>17</td>
<td>20</td>
<td>17</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Slow</td>
<td>50</td>
<td>42</td>
<td>50</td>
<td>42</td>
<td>40</td>
<td>33</td>
</tr>
</tbody>
</table>

CUSTOMER ADJUSTMENT SPECIFICATIONS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Standard Setting</th>
<th>Customer Adjustment Option</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Revolution Adjustments below set at ...</td>
<td>rpm</td>
<td>1500</td>
<td>-</td>
</tr>
<tr>
<td>Pressure Relief Valve Side A</td>
<td>bar</td>
<td>350</td>
<td>-</td>
</tr>
<tr>
<td>Pressure Relief Valve Side B</td>
<td>bar</td>
<td>350</td>
<td>-</td>
</tr>
<tr>
<td>Charge Pressure Relief Valve</td>
<td>bar</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Flushing (Low) Pressure Relief Valve</td>
<td>bar</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Mechanical Adjustment Stop Side A</td>
<td>L/min</td>
<td>Q_max</td>
<td>-</td>
</tr>
<tr>
<td>Mechanical Adjustment Stop Side B</td>
<td>L/min</td>
<td>Q_max</td>
<td>-</td>
</tr>
<tr>
<td>Displacement Adjusted to ...</td>
<td>L/min</td>
<td>-50% Q_max</td>
<td>Side A</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>0 from A</td>
<td>-</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>95% Q_max</td>
<td>Side A</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>0 from B</td>
<td>-</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>95% Q_max</td>
<td>Side B</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Position Monitoring Switch</td>
<td>L/min</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
**Model Code**

**Transmission Pumps**

"W" Series - DP Control

---

**Control type**

DP – Pressure signal displacement control

**Displacement Adjustment Options**

G – Mounting interface Cetop 3 only
H – Remote port G 1/4
J – Proportional relief inc. electronics
K – Proportional relief inc. electr. & dir. control

**Electronic Controls**

00 – Not required

**Yoke Displacement Zone**

A – Single side of center “A”
C – Over center

**Extra Functions**

0 – Not required for this control type
1 – Pressure limiter overriding function side A
2 – Pressure limiter overriding function side B
3 – Pressure limiter overriding function side A and B
4 – Pressure limiter and power control overriding function side A
5 – Pressure limiter and power control overriding function side B
6 – Pressure limiter and power control overriding function side A and B
7 – Pressure limiter function side A and B power control function side A
8 – Pressure limiter function side A and B power control function side B

**Pressure Control Options**

0 – Not required for this control type
F – Remote port, only side A
G – Remote port, only side B
H – Remote port, only side A and B
A – Electro Proportional Relief Valve Side A
B – Electro Proportional Relief Valve Side B
K – Electro Proportional Relief Valve Side A and B

**Power Control Options**

000000 – Not required for this control type
???000 – ??? kW at 1500 RPM Side A
000??? – ??? kW at 1500 RPM Side B

**Pilot Oil Filter**

0 – Not applicable
V – Filter with visual indicator
E – Filter with electrical indicator

**Fail Safe Valve**

0 – Not applicable

**Position Monitoring**

0 – No position monitoring

**Electric Motor Type**

0 – No electric motor

**Control Voltage of Zero Position Valve and Directional Control Valve**

0 – Not applicable
B – 110 AC 50 Hz/120 AC 60 Hz
D – 220 AC 50 Hz/240 AC 60 Hz
G – 12 VDC
H – 24 VDC

**Customer Adjustment Specification**

0000 – None

- **Special Features**

Add special feature description (characters 51...55) on page 11 if required

---

<table>
<thead>
<tr>
<th>CUSTOMER ADJUSTMENT SPECIFICATIONS</th>
<th>UNIT</th>
<th>STANDARD SETTING</th>
<th>CUSTOMER ADJUSTMENT OPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Revolution Adjustments below set at ...</td>
<td>rpm</td>
<td>1500</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pressure Relief Valve Side A</td>
<td>bar</td>
<td>350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Relief Valve Side B</td>
<td>bar</td>
<td>350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charge Pressure Relief Valve</td>
<td>bar</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flushing (Low) Pressure Relief Valve</td>
<td>bar</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot Pressure Size 130, 180, 250, 360</td>
<td>bar</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot Pressure Size 500 &amp; 750</td>
<td>bar</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Adjustment Stop Side A</td>
<td>L/min</td>
<td>Q_max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Adjustment Stop Side B</td>
<td>L/min</td>
<td>Q_max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Stop by Control Side A</td>
<td>L/min</td>
<td>95% Q_max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Stop by Control Side B</td>
<td>L/min</td>
<td>95% Q_max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Override Side A</td>
<td>bar</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Override Side B</td>
<td>bar</td>
<td>90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Control type
SP - Proportional valve displacement control

Displacement Adjustment Options
C - With Cetop 3 valve KDG4V S
F - With Cetop 5 Proportional valve

Electronic Controls
03 - ER 9.3 - 10 (Cetop 3)
04 - ER 9.4 - 10 (Cetop 5)

Yoke Displacement Zone
A - Single side of center "A"
C - Over center

Extra Functions
0 - Not required for this control type
1 - Pressure limiter overriding function side A
2 - Pressure limiter overriding function side B
3 - Pressure limiter overriding function side A and B
4 - Pressure limiter and power control overriding function side A

Pressure Control Options
0 - Not required for this control type
F - Remote port, only side A
G - Remote port, only side B
H - Remote port, only side A and B
A - Electro Proportional Relief Valve Side A
B - Electro Proportional Relief Valve Side B
K - Electro Proportional Relief Valve Side A and B

Power Control Options
000000 - Not required for this control type
???000 - ??? kW at 1500 RPM Side A
000??? - ??? kW at 1500 RPM Side B

Pilot Oil Filter
0 - Not applicable
V - Filter with visual indicator
E - Filter with electrical indicator

Fail Safe Valve
0 - Not applicable
1 - With solenoid valve

Position Monitoring
0 - No position monitoring

Electric Motor Type
0 - No electric motor

Customer Adjustment Specification
0000 - None
??? - Yes (final number will be assigned by Eaton. Specify on table below)

Special Features
Add special feature description (characters 51...55) on page 11 if required

### CUSTOMER ADJUSTMENT SPECIFICATIONS

<table>
<thead>
<tr>
<th>Customer Adjustment Specifications</th>
<th>Unit</th>
<th>Standard Setting</th>
<th>Customer Adjustment Option</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Revolution Adjustments below set at ...</td>
<td>rpm</td>
<td>1500</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pressure Relief Valve Side A</td>
<td>bar</td>
<td>350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Relief Valve Side B</td>
<td>bar</td>
<td>350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charge Pressure Relief Valve</td>
<td>bar</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flushing (Low) Pressure Relief Valve</td>
<td>bar</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot Pressure Size 130, 180, 250, 360</td>
<td>bar</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot Pressure Size 500 &amp; 750</td>
<td>bar</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Adjustment Stop Side A</td>
<td>L/min</td>
<td>Q&lt;sub&gt;x&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Adjustment Stop Side B</td>
<td>L/min</td>
<td>Q&lt;sub&gt;x&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Stop by Control Side A</td>
<td>L/min</td>
<td>95% Q&lt;sub&gt;x&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Stop by Control Side B</td>
<td>L/min</td>
<td>95% Q&lt;sub&gt;x&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramp Time _0 _ A</td>
<td>sec</td>
<td>0</td>
<td>El. Card Adjustment Done by Customer</td>
<td>Refer to El. Card manual</td>
</tr>
<tr>
<td>Ramp Time _ A _ 0</td>
<td>sec</td>
<td>0</td>
<td>El. Card Adjustment Done by Customer</td>
<td>Refer to El. Card manual</td>
</tr>
<tr>
<td>Pressure Override Side A</td>
<td>bar</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Override Side B</td>
<td>bar</td>
<td>90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# EATON Vickers Hydrokraft Transmission Piston Pumps

## "W" Series - SM Control

### Model Code

**Transmission Pumps**

### CUSTOMER ADJUSTMENT SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Unit</th>
<th>Standard Setting</th>
<th>Customer Adjustment Option</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Adjustment below set at ...</td>
<td>RPM</td>
<td>1500</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pressure Relief Valve Side A</td>
<td>bar</td>
<td>350</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pressure Relief Valve Side B</td>
<td>bar</td>
<td>350</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Charge Pressure Relief Valve</td>
<td>bar</td>
<td>20</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Flushing (low) Pressure Relief Valve</td>
<td>bar</td>
<td>10</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pilot Pressure Size 130, 180, 250, 360</td>
<td>bar</td>
<td>60</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pilot Pressure Size 500 and 750</td>
<td>bar</td>
<td>80</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Max. Mechanical Stop Side A</td>
<td>l/min</td>
<td>Qmax</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Max. Mechanical Stop Side B</td>
<td>l/min</td>
<td>Qmax</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pressure Override Side A</td>
<td>bar</td>
<td>90</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pressure Override Side B</td>
<td>bar</td>
<td>90</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Model Code
Transmission Pumps

"W" Series -
Special Features

\[
\begin{array}{cccccc}
\ast & \ast & \ast & 1 & 0 \\
51 & 52 & 53 & 54 & 55 \\
\end{array}
\]

** Special Features
000 - None
*** - Defined by Eaton

** Design Number
10 - Design Number
### Combination Units

#### Model Code

**Combination Units**

- **SP** - Proportional Valve
- **DP** - Pressure Signal
- **SM** - Servo Adjustment
- **FE** - Screw Adjustment
- **HG** - Handwheel
- **ES** - Electric Motor Control
- **LR** - Power Control
- **DF** - Pressure Compensator

#### Displacement

- **P** - Pump
- **T** - Transmission Pump
- **M** - Motor

#### Pump Series

- **W** - "W" Series (was 30 design)
- **X** - "X" Series (was 20 design)

#### Separator

- **C**

#### First Control Type

- **00** - No Control (for Fixed Displacement Only)
- **DF** - Pressure Compensator
- **LR** - Power Control
- **ES** - Electric Motor Control
- **HG** - Handwheel
- **FE** - Screw Adjustment
- **SM** - Servo Adjustment
- **SP** - Proportional Valve

#### Second Control Type

- **066** - 66 cm³/r [4.0 in³/rev]
- **090** - 90 cm³/r [5.5 in³/rev]
- **130** - 130 cm³/r [79 in³/rev]
- **180** - 180 cm³/r [110 in³/rev]
- **250** - 250 cm³/r [15.3 in³/rev]
- **360** - 360 cm³/r [22.0 in³/rev]
- **500** - 500 cm³/r [30.5 in³/rev]
- **750** - 750 cm³/r [45.8 in³/rev]

#### Third Control Type

- **00** - No Control (for Fixed Displacement Only)
- **DF** - Pressure Compensator
- **LR** - Power Control
- **ES** - Electric Motor Control
- **HG** - Handwheel
- **FE** - Screw Adjustment
- **SM** - Servo Adjustment
- **SP** - Proportional Valve

#### Fourth Control Type

- **00** - No Control (for Fixed Displacement Only)
- **DF** - Pressure Compensator
- **LR** - Power Control
- **ES** - Electric Motor Control
- **HG** - Handwheel
- **FE** - Screw Adjustment
- **SM** - Servo Adjustment

#### Displacement cm³/r

- **066** - 66 cm³/r [4.0 in³/rev]
- **090** - 90 cm³/r [5.5 in³/rev]
- **130** - 130 cm³/r [79 in³/rev]
- **180** - 180 cm³/r [110 in³/rev]
- **250** - 250 cm³/r [15.3 in³/rev]
- **360** - 360 cm³/r [22.0 in³/rev]
- **500** - 500 cm³/r [30.5 in³/rev]
- **750** - 750 cm³/r [45.8 in³/rev]

#### Assembly Numbers

- **HC81** - Defined By Eaton

### Special Instructions

- Charge and Pilot Pump through drive option must be specified on the rear unit of the combination (as a special feature).
- Front and middle units shall have the through drive option of the following unit in the combination.

For a combination of two or more units fill out this Combination Model Code.

- Start with the biggest size unit for the first displacement.
- For each unit included in this combination, a separate model code must be chosen. Use the form on page 5.
- Character 26 to 39 will be P/N of the combination. This number will be defined by Eaton and provided in the order acknowledgement.
### Example 1: Combination of two closed loop pumps

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Example Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Unit</td>
<td>TVWF-500M08R0000H1R025VMA20SPC03C0000000E100H000000010</td>
</tr>
<tr>
<td>Rear Unit</td>
<td>TVWR-250M07R0000PP1R025VMA20SPC03C0000000E100H000000010</td>
</tr>
<tr>
<td>Combination Unit</td>
<td>TVWC-500SP250SP0000000000HC81**********</td>
</tr>
</tbody>
</table>

### Example 2: Combination of one closed loop - and two open loop pumps

*(For open loop model code refer to the according catalog)*

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Example Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Unit</td>
<td>TVWF-500M08R0000H1R025VMA20SPC03C0000000E100H000000010</td>
</tr>
<tr>
<td>Middle Unit</td>
<td>PVWM-250M07R0000E1R025V0ADF000A0000000000000010</td>
</tr>
<tr>
<td>Rear Unit</td>
<td>PFXT-130M02R0000P1A025V0A00000000000000010</td>
</tr>
<tr>
<td>Combination Unit</td>
<td>TVWC-500SP250DF1300000000HC81**********</td>
</tr>
</tbody>
</table>
### Pump Specifications - US

<table>
<thead>
<tr>
<th>MODEL</th>
<th>TVW 130</th>
<th>TVW 180</th>
<th>TVW 250</th>
<th>TVW 360</th>
<th>TVW 500</th>
<th>TVW 750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Swash plate - Axial piston pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of mounting</td>
<td>Flange or foot-mounted. Combination units foot mounted only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe connection SAE/Flange</td>
<td>B A psi</td>
<td>1-1/4&quot;-6000</td>
<td>1-1/4&quot;-6000</td>
<td>1-1/2&quot;-6000</td>
<td>1-1/2&quot;-6000</td>
<td>2&quot;-6000</td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Clockwise when viewing shaft end of pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed range</td>
<td>n min rpm</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation position</td>
<td>Optional, see mounting information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>min max °F</td>
<td>-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>m lb</td>
<td>353</td>
<td>364</td>
<td>518</td>
<td>529</td>
<td>926</td>
</tr>
<tr>
<td>Mass of inertia</td>
<td>J lb ft²</td>
<td>1.07</td>
<td>1.07</td>
<td>3.46</td>
<td>3.61</td>
<td>11.9</td>
</tr>
</tbody>
</table>

### HYDRAULIC CHARACTERISTICS

<table>
<thead>
<tr>
<th>Nominal pressure (100% duty cycle)</th>
<th>p min psi</th>
<th>5075</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input pressure</td>
<td>p min psi</td>
<td>58 abs</td>
</tr>
<tr>
<td>Max. pressure to DIN 24312</td>
<td>p max psi</td>
<td>6090</td>
</tr>
<tr>
<td>Hydraulic fluid</td>
<td>Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations</td>
<td></td>
</tr>
<tr>
<td>Hydraulic fluid temperature range</td>
<td>min max °F</td>
<td>-13 194</td>
</tr>
<tr>
<td>Viscosity range for continuous operation</td>
<td>min max cSt</td>
<td>10 150</td>
</tr>
<tr>
<td>Max. permissible start viscosity</td>
<td>max cSt</td>
<td>1000²</td>
</tr>
<tr>
<td>Filtering</td>
<td>ISO 4406</td>
<td>18/15/13</td>
</tr>
<tr>
<td>Maximum geometric displacement</td>
<td>V g in³</td>
<td>7.9</td>
</tr>
<tr>
<td>Max. geom. pump flow</td>
<td>n= 1500 rpm</td>
<td>Q g USgpm</td>
</tr>
<tr>
<td>Case pressure</td>
<td>p max psi</td>
<td>7.2 psi over p1. pmax = 58 psi abs.</td>
</tr>
</tbody>
</table>

### HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP

| Displacement charge pump | V g Sp in³ | 2.44 | | | | |
| Charge pressure | p Sp psi | 145/290 |
| Input pressure charge & pilot pump | p min Sp/St psi | 11.6 absolute |
| Displacement pilot pump | V g St in³ | 0.5 |
| Pilot pressure | pSt psi | 870 | 870 | 870 | 870 | 1160 | 1160 |

### DRIVE

| M ax. driving torque - single unit | M 1 Single lb.ft. | 642 | 888 | 1232 | 1774 | 2463 | 3688 |
| M ax. power consumption - single unit | M 1 Single hp | 220 | 304 | 422 | 608 | 845 | 1055¹ |
| M ax. driving torque - comb. unit | M 1 Comb. lb.ft. | 2x642 | 2x888 | 2x1232 | 2x1774 | 3688 | 3688 |

1) TVW - 750 at 1800 rpm reduced to 38.1 in³
2) When pressure below 1450 psi and flow below 25% of max. flow
## Pump Specifications - Metric

<table>
<thead>
<tr>
<th>MODEL</th>
<th>TVW 130</th>
<th>TVW 180</th>
<th>TVW 250</th>
<th>TVW 360</th>
<th>TVW 500</th>
<th>TVW 750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Swash plate - Axial piston pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of mounting</td>
<td>Flange or foot-mounted. Combination units foot mounted only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe connection SAE/Flange</td>
<td>B A psi</td>
<td>1-1/4”-6000</td>
<td>1-1/4”-6000</td>
<td>1-1/2”-6000</td>
<td>1-1/2”-6000</td>
<td>2”-6000</td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Clockwise when viewing shaft end of pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed range</td>
<td>n\text{min}</td>
<td>n\text{max} min^{-1}</td>
<td>150</td>
<td>1800</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td>Installation position</td>
<td>Optional, see mounting information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>\text{min} °C</td>
<td>\text{max} °C</td>
<td>-20</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>m kg</td>
<td>160</td>
<td>165</td>
<td>225</td>
<td>240</td>
<td>420</td>
</tr>
<tr>
<td>Mass of inertia</td>
<td>j kg m²</td>
<td>0,045</td>
<td>0,045</td>
<td>0,146</td>
<td>0,152</td>
<td>0,5</td>
</tr>
</tbody>
</table>

## HYDRAULIC CHARACTERISTICS

<table>
<thead>
<tr>
<th>Nominal pressure (100% duty cycle)</th>
<th>p\text{x} bar</th>
<th>350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input pressure</td>
<td>p\text{min} bar</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>p\text{max} bar</td>
<td></td>
</tr>
<tr>
<td>M\text{ax. pressure to DIN 24312}</td>
<td>p\text{max} psi</td>
<td>420</td>
</tr>
<tr>
<td>Hydraulic fluid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic fluid temperature range</td>
<td>p\text{n Sp} bar</td>
<td>10/20</td>
</tr>
<tr>
<td></td>
<td>p\text{St} bar</td>
<td>60</td>
</tr>
<tr>
<td>Maximum geometric displacement</td>
<td>V\text{g} cm²</td>
<td>130</td>
</tr>
<tr>
<td>M\text{ax. geom. pump flow}</td>
<td>Q\text{g l/min}</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case pressure</td>
<td>p\text{max} bar</td>
<td>max. 0,5 bar over p1, p\text{max} = 4 bar abs.</td>
</tr>
</tbody>
</table>

## HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP

| Displacement charge pump | V\text{g Sp} cm² | 40 |
| Charge pressure | p\text{min Sp} bar | 10/20 |
| | p\text{St} bar | 10/20 |
| Input pressure charge & pilot pump | p\text{min SpSt} bar | 0,8 absolute |
| Displacement pilot pump | V\text{g St} cm² | 8 |
| Pilot pressure | p\text{sc} bar | 60 |

## DRIVE

| M\text{ax. driving torque - single unit} (p2 \text{max., h=100%}) | M\text{1 Single} Nm | 870 |
| M\text{ax. power consumption - single unit} (p2 \text{max., h=100%}; n=1800 min^{-1}) | P\text{1 Single} kW | 164 |
| M\text{ax. driving torque - comb. unit} | M\text{1 Comb. Nm} | 2x870 |

1) TVW - 750 at 1800 min\(^{-1}\) reduced to 625 cm\(^3\)
2) When pressure below 100 bar and flow below 25% of max. flow
Performance
Curves -
130 Series

Combination units
For combination pumps
the characteristic values
are as for the individual
units.

For reduced swash-angle:
\[
L_h = (L \text{ at } V_{\text{max}}) \times \left( \frac{V}{V_{\text{max}}} \right)^{10/3}
\]
**Performance Curves - 180 Series**

---

**Power efficiency performance curve**

- \( \eta_{\text{vol}} \) for 100% \( V_g \)
- \( \eta_{\text{tot}} \) for 100% \( V_g \)
- \( \eta_{\text{tot}} \) for 50% \( V_g \)
- \( \eta_{\text{tot}} \) for 25% \( V_g \)

- \( p_1 \) at \( n=1800 \) rpm
- \( p_1 \) at \( n=1500 \) rpm

---

**Roller bearing life**

- \( L_{10h} \) for \( V=V_{\text{max}} \)

- For \( n=1500 \) rpm
- For \( n=1800 \) rpm

---

**Combination units**

For combination pumps, the characteristic values are as for the individual units.

---

**For reduced swash-angle:**

\[
L_h = (L \text{ at } V_{\text{max}}) \times \frac{1}{\left( \frac{V}{V_{\text{max}}} \right)^{\frac{10}{3}}}
\]
Combination units
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

\[ L_h = (L \text{ at } V_{\text{max}}) \times \left( \frac{V}{V_{\text{max}}} \right)^{\frac{10}{3}} \]
Performance Curves - 360 Series

**Power efficiency performance curve**

- \( \eta_{\text{vol}} (\%) \)
- \( \eta_{\text{tot}} (\%) \)
- \( p_2 \) at \( n=1800 \) rpm
- \( p_1 \) at \( n=1500 \) rpm

**Roller bearing life**

- \( L_{10} (\text{h}) \)
- \( p_2 \) at \( n=1800 \) rpm
- \( n=1500 \) rpm

**Combination units**

For combination pumps, the characteristic values are as for the individual units.

**For reduced swash-angle:**

\[
L_h = (L \text{ at } V_{\text{max}}) \times \left( \frac{V}{V_{\text{max}}} \right)^\frac{10}{3}
\]
Combination units
For combination pumps the characteristic values are as for the individual units. Only the torque $M_1$ is limited to 5000 Nm.

For reduced swash-angle:

$$L_h = (L \text{ at } V_{\text{max}}) \times \frac{1}{\left(\frac{V}{V_{\text{max}}}\right)^{\frac{10}{3}}}$$
Performance Curves - 750 Series

Power efficiency performance curve

- \( \eta \) vol (\%)
- \( \eta \) tot (\%)
- \( \eta \) tot for 100% \( V \)
- \( \eta \) tot for 50% \( V \)
- \( \eta \) tot for 25% \( V \)
- \( p_1 \) at \( n=1800 \) rpm
- \( p_1 \) at \( n=1500 \) rpm

Roller bearing life

- \( L \) 10[h]
- \( V=V_{\text{max}} \)
- \( n=1500 \) rpm
- \( n=1800 \) rpm

For reduced swash-angle:

\[
L_h = (L \text{ at } V_{\text{max}}) \times \left( \frac{V}{V_{\text{max}}} \right)^{10/3}
\]
Hydraulic Transmission Circuit

A, B System port
ASt, BSt Control
L1, L2 Drain port
L3 Ventilation port for vertical mounting
L3.1 Air bleeding port for vertical mounting
L4 Return line charge flow
L5 Oil filling plug
L6 Return line charge flow
MA, MB Gauge port system pressure
Msp, pSp1, pSp2 Port for external charge flow
pSt1 Port for pilot flow
pSt Port for pilot flow to control

Acumulator recommended in case of short pressure build up time

pSp Gauge port charge pressure
pSt Gauge port pilot pressure
pac1 Accumulator port
pac1, pao2 Port for external charge flow
pao2 Port for pilot flow
pac Port for pilot flow to control

S Pilot pump outlet port
T Suction port for charge and pilot pump

Tank port
Hydraulic Transmission Circuit

with Charge Flow Filter

Size 130 .... 500.
(Not available for 750)

A, B System port
Aω, Bω Control
L1, L2 Drain port
L3 Ventilation port for vertical mounting
L3.1 Air bleeding port for vertical mounting
L4 Return line charge flow
L5 Oil filling plug
L6 Return line charge flow

MA, MB Gauge port system pressure
M Sp Gauge port charge pressure
M St Gauge port pilot pressure
p ac1 Accumulator port
p ao1, p ao2 Port for external charge flow
p p1 Port for pilot flow
p p2 Port for pilot flow to control
p p3 Pilot pump outlet port

S Suction port for charge and pilot pump
T Tank port
1 Basic pump
1.1 High pressure relief valve
p St1 Port for pilot flow
p St Port for pilot flow to control
p St2 Pilot pump outlet port

2.4 Clogging indicator for charge flow filter
3 Flushing block
3.1 Low pressure relief valve
3.2 Flushing flow shuttle valve
6 Manifold
6.1 Pilot pressure relief valve
7 Charge/pilot pump
Hydraulic Transmission Circuit
without Charge Flow Filter

Size 130 ..... 750

A, B System port
ASt, BSt Control
L1, L2 Drain port
L3 Ventilation port for vertical mounting
L3.1 Air bleeding port for vertical mounting
L4 Return line charge flow
L5 Oil filling plug
L6 Return line charge flow
MA, MB Gauge port system pressure
MSp Gauge port charge pressure
MSp Gauge port pilot pressure
pac1 Accumulator port
ps1 Port for external charge flow
ps2 Port for pilot flow
ps2 Port for pilot flow
S Suction port for charge and pilot pump
T Tank port
1 High pressure relief valve
1.1 Control Manifold
2 Charge block
2.1 Charge check valve
2.2 Charge pressure relief valve
3 Flushing block
3.1 Low pressure relief valve
3.2 Flushing flow shuttle valve
6 Charge/pilot pump (option)

Items 2.3 & 2.4 provided by customer
Hydraulic Transmission Circuit

Combination of Two Pumps

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>System port</td>
</tr>
<tr>
<td>ASt, BSt</td>
<td>Control</td>
</tr>
<tr>
<td>L1, L2</td>
<td>Drain port</td>
</tr>
<tr>
<td>L3</td>
<td>Ventilation port for vertical mounting</td>
</tr>
<tr>
<td>L3.1</td>
<td>Air bleeding port for vertical mounting</td>
</tr>
<tr>
<td>L4</td>
<td>Return line charge flow</td>
</tr>
<tr>
<td>L5</td>
<td>Oil filling plug</td>
</tr>
<tr>
<td>L6</td>
<td>Return line charge flow</td>
</tr>
<tr>
<td>MA, MB</td>
<td>Gauge port system pressure</td>
</tr>
<tr>
<td>MSP</td>
<td>Gauge port charge pressure</td>
</tr>
<tr>
<td>MSi</td>
<td>Gauge port pilot pressure</td>
</tr>
<tr>
<td>pac1</td>
<td>Accumulator port</td>
</tr>
<tr>
<td>pac2</td>
<td>Port for external charge flow</td>
</tr>
<tr>
<td>pso2</td>
<td>Charge pump outlet pump</td>
</tr>
<tr>
<td>pso1</td>
<td>Port for pilot flow</td>
</tr>
<tr>
<td>pso2</td>
<td>Pilot pump outlet port</td>
</tr>
<tr>
<td>MSP</td>
<td>Suction port for charge and pilot pump</td>
</tr>
<tr>
<td>MSt</td>
<td>Tank port</td>
</tr>
<tr>
<td>pSp1</td>
<td>High pressure relief valve</td>
</tr>
<tr>
<td>pSp2</td>
<td>Charge block</td>
</tr>
<tr>
<td>pSp2</td>
<td>Charge check valve</td>
</tr>
<tr>
<td>pSt1</td>
<td>Pilot pressure relief valve</td>
</tr>
<tr>
<td>pSt2</td>
<td>Flushing block</td>
</tr>
<tr>
<td>L1</td>
<td>Low pressure relief valve</td>
</tr>
<tr>
<td>S</td>
<td>Flushing flow shuttle valve</td>
</tr>
<tr>
<td>T</td>
<td>Control manifold</td>
</tr>
<tr>
<td>1</td>
<td>Pilot pressure relief valve</td>
</tr>
</tbody>
</table>

Diagram showing hydraulic circuit connections.
The unit is used for stepless flow adjustment. It has a three phase electric servo motor, worm gearing and a switch box with 4 and 8 limit switches for 4 or 8 positions. A potentiometer is also available.

The response times from zero to maximum depends on the chosen ratio and the speed of the servo motor (this means that during operation the response times are not variable.)

No pressure/power limiter possible.

Explosion protection version are also available.

### Theoretical Response Time (sec) for Max. Displacement

<table>
<thead>
<tr>
<th>Size</th>
<th>130</th>
<th>180</th>
<th>250</th>
<th>360</th>
<th>500</th>
<th>750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq (Hz)</td>
<td>50</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Fast</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Medium</td>
<td>20</td>
<td>17</td>
<td>20</td>
<td>17</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Slow</td>
<td>50</td>
<td>42</td>
<td>50</td>
<td>42</td>
<td>40</td>
<td>33</td>
</tr>
</tbody>
</table>

Response time from 0 to +Qmax or 0 to -Qmax.
The electro or pressure proportional hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within either electrically or hydraulically adjustable limits. This done by controlling delivery flow respect; ie. swash angle.

The displacement of the axial piston unit is proportional to the swash plate angle and can be adjusted by a spring centered servo piston.

The servo piston is controlled by the required input signal with a mechanical, hydraulic or electrical control device.

Economical and energy saving drives can be produced with the "building block" principle for open loop and closed circuits as well.

Note: setting the pressure compensator or a control or a constant power, lower than the adjusted pilot oil pressure ps min= 60/80 bar (870/1160 psi), is not possible.

**Pressure Limitation:**

Each of the servo controls DP, SM and SP can be combined with a hydraulic mechanical pressure limitation control. This destrokes the swash plate when the system pressure reaches a control setting. The response time for de-stroking the the pump is much faster than that of the servo control alone.

The pressure limitation control can also operate the unit in the motor mode of operation. This means when the hydraulic motor delivers energy to the system e.g. from energy stored in a flywheel, the pump goes over-center thus acting as a motor delivering mechanical energy to the drive, as in a mooring control function.

For each of the system sides, A and B, a separate pressure control is required. This control consist of a main stage valve conducting the system pressure to the pump actuator piston a pressure relief valve where the pressure is set. The minimum setting of this valve cannot be lower than the pilot pressure.

**Power Limitation (Torque Control):**

An additional power limitation valve can be used in conjunction with the pressure limitation control. This senses the position of the pump actuator piston which is proportional to the swash plate angle. In accordance with the swash plate angle the pressure adjustment is set to a determined level to follow a hyperbolic relationship between flow and pressure.

High Flow - Low Pressure
Low Flow - High Pressure

The power level, a function of the product of flow and pressure, is hence adjustable.
The output flow of the pump is proportional to the pilot pressure. Each of the two pilot ports is responsible for an output flow direction.

A separate pilot oil circuit is necessary with $p_{\text{min}} = 60/80$ bar, $Q_{\text{st}} = 12$ l/min (3.17 USgpm). From this the control pressure is reduced to the desired set value by means of a suitable circuit.

For exchange with: Pressure limiting valve (mechanical or proportional) from P to T line and throttle in P line 0.8 Dia. (0.03)

The pressure proportional adjustment can also be supplied with a pressure and/or power limitation.

### Pressure proportional adjustment DP

<table>
<thead>
<tr>
<th>SIZE</th>
<th>RESPONSE TIME (S)</th>
<th>RESPONSE TIME* (S)</th>
<th>PRESSURE CONTROL DESTROKING</th>
<th>PILOT PRESSURE $P_{st}$ BAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>150/180</td>
<td>0.8</td>
<td>0.07</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>250/360</td>
<td>1.0</td>
<td>0.08</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>500/750</td>
<td>2.2</td>
<td>0.110</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

*Measured with a 2m pressure line of diameter 50 mm
Controls –
Example for TVW
- DP Control
with Pressure - & Power
Limiter

A, B System port
ASt, BSt Control
L1, L2 Drain port
L3 Ventilation port for vertical mounting
L3.1 Air bleeding port for vertical mounting
L4 Return line charge flow
L5 Oil filling plug
L6 Return line charge flow
MA, MB Gauge port system pressure
Msp Gauge port charge pressure
Msp Pilot port charge pressure
MSt Gauge port pilot pressure
pac1 Accumulator port
Pst1 Port for external charge flow
pSt1 Port for pilot flow
pSt1.1 Port for pilot flow
pSt2 Pilot pump outlet port
pSp1 Port for external charge flow
pSp2 Port for pilot flow
pSt 1.1 Port for pilot flow
pSp 2 Pilot pump outlet port

2.1 Charge pressure relief valve
2.2 Charge pressure relief valve
2.3 Filter
2.4 Clogging indicator
3 Flushing block
3.1 Low pressure relief valve
3.2 Flushing flow shuttle valve
6 Control manifold
6.1 Pilot pressure relief valve
7 DP-Control
8.1 Pressure limiter 100 to 350 bar

S Suction port for charge and pilot pump
T Tank port
X, XB Pilot port pressure control
Tp Basic pump
Stp High pressure relief valve

Cetop NG6

10 DP - With mounting interface CETOP3
20 DP - With remote port
30 DP - With proportional control

The electro hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within electrically adjustable limits. This is done by controlling delivery flow with swash plate angle feedback. All control valves are recorded as an electrical signal and lead back to the control card. The proportional valve or servo valve and servo piston transform the output signal of the control card to the desired setting. This results in a very precise and dynamic control.

**Electrohydraulic servo adjustment SP**
The electro hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within electrically adjustable limits. This is done by controlling delivery flow swash plate angle feedback.

### PROPORTIONAL VALVE

<table>
<thead>
<tr>
<th>NOMINAL FLOW</th>
<th>CONTROL PRESSURE PST</th>
<th>CONTROL ELECTRONICS</th>
<th>RESPONSE TIME</th>
<th>UNIT SIZE</th>
<th>SERVO PISTON</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMIN (USGPM)</td>
<td>AT ∆P BAR (PSI)</td>
<td>BAR (PSI)</td>
<td>0 &lt; V MAX [MS]</td>
<td>CM³ (IN³)</td>
<td>DIAMETER MM (IN)</td>
<td>STROKE MM (IN)</td>
</tr>
<tr>
<td>Medium response (CETOP 3)</td>
<td>12 (3.17)</td>
<td>10 (150)</td>
<td>60 (870) to 80 (1160)</td>
<td>ER 9.0 - 10</td>
<td>250 to 800</td>
<td>130 (7.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180 (11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>250 (15.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>360 (22)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500 (30.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>750 (45.7)</td>
</tr>
<tr>
<td>High response (CETOP 5)</td>
<td>40 (11) to 80 (21)</td>
<td>70 (1000)</td>
<td>80 (1160) to 100 (1450)</td>
<td>ER 9.4 - 10</td>
<td>40 to 150</td>
<td>130 (7.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180 (11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>250 (15.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>360 (22)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500 (30.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>750 (45.7)</td>
</tr>
</tbody>
</table>
Controls –
Control Cards

SP - Control with Pressure and Power Limitation

Control Cards

The ER 9.3 - 10 and ER 9.4 - 10 Digital control cards are available and optimized for use with the SP - Control. Software is available for parameter setting and storing (Database function).
Contact Eaton to request the free of charge manual- and software CD.

SP - Control with pressure and power limitation

The patented circuit provides extremely short response times for the pressure compensator regardless of the servo control used:
The response time is independent from the particular flow characteristic!

<table>
<thead>
<tr>
<th>FRAME SIZE</th>
<th>RESPONSE TIME WHEN COMPENSATING FROM ( \pm V_{\text{MAX}} ) — 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>130/180</td>
<td>80 ms</td>
</tr>
<tr>
<td>250/360</td>
<td>90 ms</td>
</tr>
<tr>
<td>500/750</td>
<td>110 ... 130 ms</td>
</tr>
</tbody>
</table>
Controls –
SP Control with and without Pressure Limitation
Example for TVWS

A, B System port
ASt, BSt Pilot oil pump side A, B
L1, L2 Drain port
L3 Ventilation port for vertical mounting
L3.1 Air bleeding port
L4 Drain port (charge oil)
L5 Oil filling plug
L6 Drain port (flushing oil)
L7 Port for return line of control circuit
MA, MB Gauge port system pressure
M5p Gauge port charge pressure
MSt Gauge port pilot pressure
pac1 Accumulator port
pSp1 External port charge flow
pSp2 Additional charge pump outlet port
pSt1 Port for pilot pressure
pSt1.1 Port for pilot pressure
pSt2 Piston pump outlet port
S Suction port for charge and pilot pump
T Tank port
XA, XB Pilot port pressure control
1 Basic pump
1.1 High pressure relief valve
2 Charge block
2.1 Charge check valve
2.2 Charge pressure relief valve
3 Flushing block
3.1 Low pressure relief valve
3.2 Flushing flow shuttle valve
4 Charge pump
5 Pilot pump
6 Connection plate for SP-Control
6.1 Pilot pressure relief valve
7 Proportional valve
8 Pressure limiter
8.1 Fail safe valve
9 Intermediate plate
10 Pilot oil filter
Controls –
Servo Adjustment
Displacement
Control with
Mechanical
Feedback SM

- Servo control with integrated mechanical feedback of swash plate position. Mainly used in hazardous environments.
- No electronic control card necessary
- Input signal ± 50 mA (linear coil connection) ; ± 100 mA (parallel coil connection)
- Hysteresis, repeatability: 8% of end value

- Available in explosion proof class Eex i II version for hazardous duty.
- Pressure/power limitation available
Dimensions in mm

**DIRECTION OF ROTATION** | **RANGE OF SWASH ANGLE** | **INPUT** | **OUTPUT**
--- | --- | --- | ---
Right: Hand Rotation | To +V max | B | A
To - V max | A | B

For left hand rotation a special setup of charge and pilot pump is required!

- **A** System pressure port SAE 1 1/4", 6000 psi
- **(L1)** Drain port G 3/4" (charge oil)
- **(L5)** Oil filling plug 1 1/16" - 12 UNF-2B (according to mounting position use upper port)
- **(L6)** Drain port G 3/4" (flushing oil)
- **(L8)** Air bleeding port G 1/4"
- **(L9)** Drain port for low pressure relief valve G 1/4"
- **(L3)** Ventilation port for vertical mounting G 3/8" (shaft upwards)
- **(MA)** Gauge port system pressure G 1/4"
- **(MB)** Gauge port system pressure G 1/4"
- **(M L)** Gauge port of case pressure G 1/4"
- **(M Sp)** Gauge port of charge pressure G 1/4"
- **(M St)** Gauge port of pilot pressure G 1/4"
- **(Sp1)** External port of charge pressure G 3/4"
- **(Sp2)** Additional charge pump outlet port G 3/4" (closed)
- **S** Suction port of charge and pilot pump SAE 1 1/4", 3000 psi (common port)
- **(...)** Normally plugged
Dimensions in mm

<table>
<thead>
<tr>
<th>DIRECTION OF ROTATION</th>
<th>RANGE OF SWASH ANGLE</th>
<th>INPUT</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hand Rotation</td>
<td>To + Vmax</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>To - Vmax</td>
<td>A</td>
<td>B</td>
</tr>
</tbody>
</table>

For left hand rotation a special setup of charge and pilot pump is required!

- **A**
  - System pressure port SAE 1 1/2", 6000 psi
  - Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)
  - Drain port G 1 1/4" (according to mounting position use upper port)

- **B**
  - System pressure port SAE 1 1/2", 6000 psi
  - Drain port G 1/8" (charge oil)
  - Oil filling plug 1 1/16" - 12 UNF-2B

- **L1**
  - Drain port G 1 1/4" (flushing oil)
  - Air bleeding port G 1/4"

- **L2**
  - Ventilation port for vertical mounting G 3/8" (shaft upwards)
  - Port G 1/8"

- **L3**
  - Drain port low pressure relief valve G 1/4"
  - Feedback (potentiometer) with visual indicator

- **L3.1 (L8)**
  - Feedback (potentiometer) with visual indicator

- **L4**
  - Drain port G 1" (charge oil)

- **L5**
  - Oil filling plug 1 1/16" - 12 UNF-2B

- **L6**
  - Drain port G 1" (flushing oil)

- **L8**
  - Air bleeding port G 1/4"

- **L9**
  - External port of charge pressure G 3/4"

- **MA**
  - Gauge port system pressure G 1/4"

- **MB**
  - Gauge port system pressure G 1/4"

- **ML**
  - Gauge port of case pressure G 1/4"

- **MSp**
  - Gauge port of charge pressure G 1/4"

- **pac1**
  - Accumulator port G 1"

- **pSp1**
  - External port of charge pressure G 3/4"

- **pSp2**
  - Additional charge pump outlet port M27x2

- **St2**
  - Pilot pump outlet port G 3/8"

- **Sp2**
  - Suction port of charge and pilot pump SAE 2", 3000 psi (common port)

- **p**
  - Normally plugged

**Dimensions in mm**

**Proportional control valve**

**Fail safe valve intermediate plate**

**Adjustment pilot oil relief valve**

**Feedback (potentiometer) with visual indicator**

**High pressure relief valve (doubleacting) Setting range 100...350 bar**

**Charge pressure relief valve**

**Center bore DM 20 DIN 332**

**Spring centering Stroke limitation 50...100% of Vmax**

**W 62x48x1.25x10a DIN 5480**

**Screw plug M27x2**

**Charge and pilot pump (64/8ccm)**
Dimensions in mm

**DIRECTION OF ROTATION**

<table>
<thead>
<tr>
<th>Right Hand Rotation</th>
<th>To + V(_{\text{max}})</th>
<th>B</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>To - V(_{\text{max}})</td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

For left hand rotation a special setup of charge and pilot pump is required!

- **A**: System pressure port SAE 1 1/2", 6000 psi
- **B**: System pressure port SAE 1 1/2", 6000 psi
  - **L1**: Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)
  - **L2**: Drain port G 1/4" (according to mounting position use upper port)

**Input**

- **(L3)** Ventilation port for vertical mounting G 3/8" (shaft upwards)
- **(L3.1)** Port G 1/8"
- **(L5)** Oil filling plug 1 1/16" - 12 UNF-2B
- **(L6)** Drain port G 1" (flushing oil)
- **(L8)** Air bleeding port G 1/4"
- **(L9)** Drain port for low pressure relief valve G 1/4"

**Output**

- **(MA)** Gauge port system pressure G 1/4"
- **(MB)** Gauge port system pressure G 1/4"
- **(ML)** Gauge port of case pressure G 1/4"
- **(M-SP)** Gauge port of charge pressure G 1/4"
- **(p\(_{\text{sp1}}\)** Accumulator port G 1"
- **(p\(_{\text{sp2}}\)** External port of charge pressure G 3/4"
- **(p\(_{\text{u1}}\)** Additional charge pump outlet port M27x2

- **(p\(_{\text{u2}}\)** Pilot pump outlet port G 3/8"
- **(S)** Suction port of charge and pilot pump SAE 2", 3000 psi (common port)
- **(...)** Normally plugged

**PROPORTIONAL CONTROL VALVE**

- **(MA)** Gauge port system pressure G 1/4"
- **(MB)** Gauge port system pressure G 1/4"
- **(ML)** Gauge port of case pressure G 1/4"
- **(M-SP)** Gauge port of charge pressure G 1/4"
- **(p\(_{\text{sp1}}\)** Accumulator port G 1"
- **(p\(_{\text{sp2}}\)** External port of charge pressure G 3/4"
- **(p\(_{\text{u1}}\)** Additional charge pump outlet port M27x2
Pump Dimensions - TVWS 500

Dimensions in mm

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Drain port 1 5/8” - 12 UNF-2B (according to mounting position use upper port)</td>
</tr>
<tr>
<td>L2</td>
<td>Drain port G 1/2” (according to mounting position use upper port)</td>
</tr>
<tr>
<td>L3</td>
<td>Center bore                    DM 20 DIN 332</td>
</tr>
<tr>
<td>L4</td>
<td>Drain port G 1” (charge oil)</td>
</tr>
<tr>
<td>L5</td>
<td>Oil filling plug 1 1/16” - 12 UNF-2B</td>
</tr>
<tr>
<td>L6</td>
<td>Drain port G 1” (flushing oil)</td>
</tr>
<tr>
<td>L8</td>
<td>Air bleeding port G 1/4”</td>
</tr>
<tr>
<td>L9</td>
<td>Drain port for low pressure relief valve G 1”</td>
</tr>
<tr>
<td>M12</td>
<td>Feedback (potentiometer) with visual indicator</td>
</tr>
<tr>
<td>M5</td>
<td>High pressure relief valve (double acting)</td>
</tr>
<tr>
<td>MA</td>
<td>Spring centering</td>
</tr>
<tr>
<td>MB</td>
<td>Stroke limitation 50…100% of Vmax</td>
</tr>
<tr>
<td>PA</td>
<td>Charge pressure relief valve</td>
</tr>
<tr>
<td>S</td>
<td>Suction port of charge and pilot pump SA 2” 3000 psi</td>
</tr>
<tr>
<td>S2</td>
<td>Pilot pump outlet port G 3/8”</td>
</tr>
<tr>
<td>S2p1</td>
<td>Additional charge pump outlet port M 27 x 2</td>
</tr>
<tr>
<td>S2p2</td>
<td>Port of pilot pressure G 1/2”</td>
</tr>
<tr>
<td>MA</td>
<td>Pilot pump outlet port G 3/8”</td>
</tr>
<tr>
<td>L1</td>
<td>View X - Port L4, M5, P51 only charge block with filter</td>
</tr>
<tr>
<td>L2</td>
<td>View Y - Port L4, M5, P51, P51 only charge block with filter</td>
</tr>
</tbody>
</table>

For left hand rotation a special setup of charge and pilot pump is required!
### Pump Dimensions - TVWS 750

#### Dimensions in mm

**View X**

- **L6**: Drain port G 1 1/4” (flushing oil)
- **L7**: Port G 3/8” for return line of control circuit
- **(L8)**: Air bleeding port G 1/4”
- **(MAB)**: Gauge port system pressure G 1/4”
- **(ML)**: Gauge port of case pressure G 1/4”
- **(MSP)**: Gauge port of charge pressure G 1/4”
- **(MSp)**: Gauge port of pilot pressure G 1/4”
- **Pst1**: Accumulator port G 1 1/4”
- **Pst2**: Accumulator port G 1 1/4” (optional)
- **Psp1**: External port of charge pressure G 1” (Port of charge pressure internal)
- **Psp2**: Additional charge pump outlet port G 1/4”
- **PSt1**: Port of pilot pressure G 1/2”
- **PSt1.1**: Port of pilot pressure G 3/8”
- **PSt2**: Pilot pump outlet port G 3/8”
- **S**: Suction port of charge and pilot pump SAE 3”, 3000 psi (common port)

**Adjustment pilot oil relief valve**

- **(…) normally plugged**
- **(A)**: System pressure port SAE 2”, 6000 psi
- **(B)**: System pressure port SAE 2”, 6000 psi
- **(L1)**: Drain port 1 5/8” - 12 UNF-2B
- **(L2)**: Drain port G 1 1/2”
- **(L3)**: Ventilation port for vertical mounting G 3/8”
- **(L4)**: Drain port G 1 1/4” (charge oil)
- **(L5)**: Oil filling plug 1 1/16” - 12 UNF-2B

**Error Table**

<table>
<thead>
<tr>
<th>DIRECTION OF ROTATION</th>
<th>RANGE OF SWASH ANGLE</th>
<th>INPUT</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hand Rotation</td>
<td>To + Vmax</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>To - Vmax</td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

For left hand rotation a special setup of charge and pilot pump is required!

**Diagram**

- **Feedback (potentiometer) with visual indicator**
- **Spring centering**
- **Stroke limitation**
- **Center bore**
- **DM 24 DIN 332**
- **Adjustment pilot oil relief valve**
- **Proportional control valve**
- **Fail safe valve**
- **Intermediate plate**
- **Controllable check valve**
- **Fail safe check valve**
- **Piping by HYDROKRAFT**
- **(alternatively PSt1 or PSt1.1)**

---

**Table Values**

- **Dimensions in mm**
- **Port SAE 2”, 6000 psi**
- **Port G 3/8”**
- **Port G 1/4”**
- **Port G 1/2”**
- **Port G 3/8”**
- **Port G 1 1/4”**
- **Port G 1 1/2”**
- **Port 0**
- **Port 0**
- **Port 0**
- **Port 0**

---

**Technical Specifications**

- **Fail safe valve with visual indicator**
- **Adjustment pilot oil relief valve**
- **Spring centering**
- **Shaft upwards**
- **Piping by HYDROKRAFT**
- **(alternatively PSt1 or PSt1.1)**

---

**Notes**

- **Normally plugged**
- **According to mounting position use upper port**
- **Shaft upwards**
- **Piping by HYDROKRAFT**
- **(alternatively PSt1 or PSt1.1)**
Dimensions in mm

L1 L2 L3 B1 H1 H2 H3
130° 365 203 216.5 256 192 120 130
180° 365 203 216.5 256 192 120 130
250 410 230 222 271 236 135 160
360 426 230 222 285 236 135 160
500 541.5 300 222 267.5 172 186
750 571 307 222 372 270 172 188.5
* Only alternative location possible.

DISPLACEMENT (CCM)

<table>
<thead>
<tr>
<th>Pump Size</th>
<th>Charge Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>40</td>
</tr>
<tr>
<td>180</td>
<td>40</td>
</tr>
<tr>
<td>250</td>
<td>63</td>
</tr>
<tr>
<td>360</td>
<td>87</td>
</tr>
<tr>
<td>500</td>
<td>125</td>
</tr>
<tr>
<td>750</td>
<td>200</td>
</tr>
</tbody>
</table>

* Only alternative location possible.
Control Dimensions - TVWS 130/180 SP Control

Dimensions in mm

SP - With Prop. Valve CETOP 3

View X

SP - With pressure limiter overriding function

View Y

SP - With pressure limiter and power control overriding function

SP - With Prop. Valve CETOP 3 + Fail safe valve

swash angle indicator

clockwise

SP - With pressure limiter overriding function

SP - With pressure limiter and power control overriding function
Control Dimensions - TVWS 130/180 SP Control

Dimensions in mm

SP - With Prop. Valve CETOP 3 + filter with el. indicator

- Pilot oil filter
- Spacer to be used with filter and pressure control only!

SP - With Prop. Valve CETOP 3 + filter with visual indicator + fail safe valve

- Fail safe valve

View Y

- Charge & pilot pump 40/8ccm
Control Dimensions - TVWS
250/360/500/750
SP Control

Dimensions in mm

SP - With Prop. Valve
CETOP 3

View Z

SP - With pressure limiter
overiding function

SP - With pressure limiter
and power control
overiding function

SP - With pressure limiter
overiding function

SP - With pressure limiter
and power control
overiding function

<table>
<thead>
<tr>
<th></th>
<th>L1</th>
<th>L2</th>
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<td>188.5</td>
</tr>
</tbody>
</table>
Control Dimensions -
TVWS
250/360/500/750
SP Control

Dimensions in mm

SP - With Prop. Valve CETOP
3 + filter with el. indicator

SP - With Prop. Valve CETOP
3 + filter with visual indicator
+ fail safe valve

DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

<table>
<thead>
<tr>
<th>Pump Size</th>
<th>Charge Pump</th>
<th>Pilot Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>64</td>
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</tbody>
</table>
Control
Dimensions -
TVWS 130/180
DP Control

Dimensions in mm

DP - With remote control

DP - With pressure limiter
overriding function

DP - With pressure limiter
and power control overriding
function
Control
Dimensions -
TVWS 130/180
DP Control

Dimensions in mm

DP - With mounting interface
CETOP 3

DP - With prop. relief

Prop. pressure
valve NG6

swash angle indicator

clockwise

charge & pilot pump 40/8ccm

view Y
Control
Dimensions -
TVWS
250/360/500/750
DP Control

Dimensions in mm

DP - With remote port

DP - With pressure limiter overriding function

DP - With pressure limiter and power control overriding function

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</tbody>
</table>
Control Dimensions - TVWS 250/360/500/750 DP Control

Dimensions in mm

DP - With mounting interface CETOP 3

DP - With prop. relief

Prop. pressure valve NG6

View Y

P Sp2

P St2

DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

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</tr>
</tbody>
</table>
Control Dimensions - TVWS 130/180
SM Control

Dimensions in mm

SM - With pressure limiter overriding function

SM - With pressure limiter and power control overriding function

pressure limitation setting

power limitation setting
Control
Dimensions -
TVWS 130/180
SM Control

Dimensions in mm

SM - With pressure limiter
overriding function

SM - With pressure limiter
and power control overriding
function

View X

pilot pressure adjustment

cable connector

View Y

charge & pilo t pump 4 0 /8 ccm
Control Dimensions - TVWS 250/360/500/750 SM Control

Dimensions in mm

<table>
<thead>
<tr>
<th></th>
<th>L1</th>
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</tr>
</tbody>
</table>

SM - With pressure limiter overriding function

SM - With pressure limiter and power control overriding function

View X

View Y

pressure limitation setting
Control Dimensions - TVWS 250/360/500/750 SM Control

Dimensions in mm

| SM - With pressure limiter overriding function | | |
| SM - With pressure limiter and power control overriding function |

DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

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<tr>
<td>750</td>
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<td>8</td>
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</tbody>
</table>
Control Dimensions - TVWS
Position of Center of Gravity
130/180/250/360/500/750
SP - DR

Dimensions in mm

<table>
<thead>
<tr>
<th>TVW SIZE</th>
<th>WEIGHT KG</th>
<th>LS MM</th>
<th>HS MM</th>
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</thead>
<tbody>
<tr>
<td>130</td>
<td>160</td>
<td>205</td>
<td>55</td>
</tr>
<tr>
<td>180</td>
<td>165</td>
<td>205</td>
<td>55</td>
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<td>250</td>
<td>235</td>
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<td>360</td>
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<tr>
<td>500</td>
<td>420</td>
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<td>55</td>
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<tr>
<td>750</td>
<td>460</td>
<td>318</td>
<td>65</td>
</tr>
</tbody>
</table>
TvW - Swash Angle/Flow Direction

Dimensions in mm
### Installation position

Installation position is optional however note bearing lubrication with respect to mounting.

<table>
<thead>
<tr>
<th>INSTALLATION POSITION</th>
<th>DRAIN PIPING</th>
<th>INSTALLATION POSITION</th>
<th>DRAIN PIPING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft horizontal</td>
<td></td>
<td>Shaft pointed downwards</td>
<td>Use ventilation line L4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Prime main case drain connection L2 (L1) with 0.2 bar (2.9 psi)</td>
</tr>
<tr>
<td>Use the highest case drain connection L3</td>
<td></td>
<td>Internal connection to be closed with pin no. HC46082101401</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft pointed upwards</td>
<td>Use ventilation line L4</td>
<td>Internal connection close with plug G 1/8&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre load drain port case drain connection L2 (L1) with 0.2 bar (2.9 psi)</td>
<td>Horizontally mounted</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal connection open L3 plugged</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Shaft horizontal
- Pump can be rotated freely about the lateral axis
- Use the highest case drain connection L3 or L2.
- Shaft pointed downwards
- Use ventilation line L4
- Prime main case drain connection L2 (L1) with 0.2 bar (2.9 psi)
- Vertically mounted
- Internal connection to be closed with pin no. HC46082101401
- Horizontally mounted
- Internal connection open L3 plugged
Case Flushing Requirements
A check valve must not be used in the drain pipe. The drain pipe must terminate below the oil level in the reservoir.
For all other conditions with low pressure (<20 bar (<300 psi) and low flow (<10% of Qmax) case flushing is required.
For operation with special fluids HFB and HFC, case flushing is recommended.

Flushing Flow
Flushing flow via the pump case should be >1% of maximum pump flow. Maximum flushing flow depends on case pressure.

Notes:
• All listed ratings are based on the use of a good quality fluid.
• Alternative fluids have a reduced tolerance for contamination over petroleum base fluids. Good filtration is therefore critical.
• The pumps will provide exceptional life when used with a good quality clean fluid at the pump ratings specified for that fluid.

Fluids
Pumps in the catalogue are primarily designed to operate with conventional petroleum based hydraulic oil. Alternative fluids and restrictions:
• Fluid maintenance is critical to the durability of all hydraulic components, and particularly so with hydraulic pumps. This becomes even more of a factor when alternative fluids are used. All types of alternative fluids require extensive maintenance in order to maintain proper levels of water content, acidity, viscosity and contamination.

Fluid Cleanliness
These pumps are rated for anti-wear petroleum fluids with a contamination level of 18/15/13 per ISO 4406. Operation in fluids with levels more contamination than this is not recommended and may reduce the life of the pump components. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Eaton representative for special duty cycle recommendations.
Eaton pumps, as well as any variable displacement piston pumps, will operate with apparent satisfaction in fluids up to the rating specified here. Experience has shown, however, that pump and hydraulic system life is not optimised with high fluid contamination levels (high ISO cleanliness codes).
Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials, and additives for protection against wear of inclusion of air.
Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561- "Vickers Guide to Systemic Contamination Control"- available from your local Eaton distributor.

In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

Ordering Procedure
When ordering please specify full model designation of items required; see "Model Codes" section of this catalogue.
Note the following:
• Designation of variable displacement pumps must include the supplementary designation of the required control

FLUIDS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>CLASSIFICATION</th>
<th>MAX. PRESSURE BAR</th>
<th>MAX. SPEED RPM</th>
<th>RECOMMENDED SEAL MATERIAL</th>
<th>MAX OPERATING TEMPERATURE °C</th>
<th>BEARING LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil in Water Emulsion</td>
<td>HFAE</td>
<td>Not Rated</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Water in oil Emulsion</td>
<td>HFB</td>
<td>250</td>
<td>1800</td>
<td>Fluorocarbon</td>
<td>49</td>
<td>50%</td>
</tr>
<tr>
<td>Water Glycol</td>
<td>HFC</td>
<td>250</td>
<td>1800</td>
<td>Fluorocarbon</td>
<td>49</td>
<td>25%</td>
</tr>
<tr>
<td>Phosphate Ester</td>
<td>HFDR</td>
<td>350/420</td>
<td>1800</td>
<td>Fluorocarbon</td>
<td>66</td>
<td>100%</td>
</tr>
<tr>
<td>Polyol Ester</td>
<td>HFDU</td>
<td>350/420</td>
<td>1800</td>
<td>Fluorocarbon</td>
<td>66</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Refer to the general specifications for the displacement speed limitation