Dual Displacement Radial Piston Staffa Motor
HMC Series
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General Descriptions

The range of dual displacement motors extends from the HMC030 in 492 cc/rev to the HMC325 in 5,326 cc/rev.

There are seven frame sizes as shown in the table below:

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>Max. Torque @275 bar (Nm)</th>
<th>Continuous shaft power (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC030</td>
<td>1,655**</td>
<td>60</td>
</tr>
<tr>
<td>HMC045</td>
<td>2,930</td>
<td>99</td>
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<tr>
<td>HMC080</td>
<td>6,560</td>
<td>138</td>
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<tr>
<td>HMC125</td>
<td>8,220</td>
<td>135</td>
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<tr>
<td>HMC200</td>
<td>12,820</td>
<td>174</td>
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<tr>
<td>HMC270</td>
<td>19,090</td>
<td>189</td>
</tr>
<tr>
<td>HMC325</td>
<td>22,110</td>
<td>189</td>
</tr>
</tbody>
</table>

** Torque calculated at 241 bar

Kawasaki “Staffa” high torque, low speed radial piston motors use hydrostatic balancing techniques to achieve high efficiency, combined with good breakout torque and smooth running capability.

The HMC series dual displacement models have two pre-set displacements which can be chosen from a wide range to suit specific application requirements. The displacements are hydraulically selected by a directional control valve which can be remote mounted or directly on the motor. Motor displacement can be changed with ease when the motor is running.

These motors are also available in a continuously variable version using either hydro-mechanical or electro-hydraulic control methods.

Other mounting options are available on request to match many of the competitor interfaces.

Features

- High torque at low speed
- Smooth running
- Wide range of displacements to suit specific applications
- Displacement changes with ease when the motor is running
- Electro-hydraulic or hydro-mechanical control methods available
- Speed sensing options
1-1 Model Coding

**Fluid Type**
- Blank: Mineral oil
- F3: Phosphate ester (HFD fluid)
- F11: Water based fluids (HFA, HFB & HFC)

**Motor Frame Size**
- 030
- 045
- 080

**Shaft Type**
- See shaft type option list on Page 6

**Shaft Orientation**
- Blank: Standard Orientation
- V: Vertically Up

**Special Features**
- P*****: See options on page 5
- PL***: Non-catalogued features, (****) = number assigned by Kawasaki as required

**Design Series Number**
- Current series for HMC motors

**Tacho Encoder Drive**
- Blank: None
- Tj: Square wave output with directional signal
- Tk: Combines Tj with the T401 instrument to give a 4 to 20 mA output proportional to speed. Directional signal and speed relay output.

**Displacement Control Ports**
- Threaded ports/ bi directional shaft rotation
- X: X and Y ports G¼" (BSPF to ISO 228/1)
- ISO 4401 size 03 mounting face / bi-directional shaft rotation
- C: No shuttle
- CS: With shuttle
- ISO4401 size 03 mount with Additional Regulation
- CP18: Constant Pressure Regulator set to 180 bar
- CHP18: Constant Pressure Regulator set to 180 bar with override valve attached

**Main Port Connections**
- See Port Connection details on page 7

See displacement code details on pages 21 to 28

Please state CP valve setting when placing order and note that maximum setting is 220 bar (ie CP22)
1-1 Model Coding

Special Features Suffix

/ P * * * * *

Shaft Seal Enhancements

A  High pressure shaft seal
B  Improved shaft seal life
C  High pressure shaft seal & improved shaft seal life
D  None

External Protection

A  Anti-pooling bolt heads
B  Marine-specification primer paint
C  Anti-pooling bolt heads & Marine-specification primer paint
D  None

Installation Features

A  Drain port adaptor x 1
B  Drain port adaptor x 2
C  φ21 mm mounting holes
D  φ22 mm mounting holes
E  φ21 mm mounting holes & Drain port adaptor x 1
F  φ21 mm mounting holes & Drain port adaptor x 2
G  φ22 mm mounting holes & Drain port adaptor x 1
H  φ22 mm mounting holes & Drain port adaptor x 2
D  None

Valve Enhancements

A  Improved cavitation resistance
B  Anti-clockwise
C  Thermal shock resistance
D  Improved cavitation resistance & anti-clockwise
E  Improved cavitation resistance & thermal shock resistance
F  Anti-clockwise & thermal shock resistance
G  Improved cavitation resistance & anti-clockwise & thermal shock resistance
D  None

Performance Enhancements

A  Increased starting torque
D  None
# 1-2 Shaft Options

## Product type

<table>
<thead>
<tr>
<th>Product type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HMC030</strong></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Parallel keyed 55mm diameter shaft</td>
</tr>
<tr>
<td>S</td>
<td>Splined shaft 17 teeth BS3550</td>
</tr>
<tr>
<td>Z</td>
<td>Splined shaft DIN5480 (W55x3x17x7h)</td>
</tr>
<tr>
<td>Z2</td>
<td>Splined shaft DIN5480 (W60x3x18x7h)</td>
</tr>
<tr>
<td><strong>HMC045</strong></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Parallel keyed 55mm diameter shaft</td>
</tr>
<tr>
<td>S</td>
<td>Splined shaft 17 teeth BS3550</td>
</tr>
<tr>
<td>Z</td>
<td>Splined shaft DIN5480 (W55x3x17x7h)</td>
</tr>
<tr>
<td>Z2</td>
<td>Splined shaft DIN5480 (W60x3x18x7h)</td>
</tr>
<tr>
<td><strong>HMC080</strong></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Parallel keyed 60mm diameter shaft</td>
</tr>
<tr>
<td>S</td>
<td>Splined shaft 14 teeth BS3550</td>
</tr>
<tr>
<td>Z</td>
<td>Splined shaft DIN5480 (W70x3x22x7h)</td>
</tr>
<tr>
<td>T</td>
<td>Long taper keyed shaft - 95.2 key slot</td>
</tr>
<tr>
<td><strong>HMC125 &amp; HMC200</strong></td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>Parallel keyed 85mm diameter shaft</td>
</tr>
<tr>
<td>S3</td>
<td>Splined shaft 20 teeth BS3550</td>
</tr>
<tr>
<td>S4</td>
<td>Splined shaft 16 teeth BS3550</td>
</tr>
<tr>
<td>Z3</td>
<td>Splined shaft DIN5480 (W85x3x27x7h)</td>
</tr>
<tr>
<td>T</td>
<td>Long taper keyed shaft - 133.4 key slot</td>
</tr>
<tr>
<td><strong>HMC270 &amp; HMC325</strong></td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>Parallel keyed 85mm diameter shaft</td>
</tr>
<tr>
<td>S3</td>
<td>Splined shaft 20 teeth BS3550</td>
</tr>
<tr>
<td>Z</td>
<td>Splined shaft DIN5480 (W90x4x21x7h)</td>
</tr>
<tr>
<td>T</td>
<td>Long taper keyed shaft - 133.4 key slot</td>
</tr>
</tbody>
</table>

**Note:**
For installations where the shaft is vertically upwards specify “V” after the shaft type designator so as to ensure that an additional high level drain port is provided within the front cover of the motor.
1-3 Main Port Connections

Product type

HMC030 = As per HMC045

HMC045
SM3 = 1¼” symmetrical ports with through-holes for manifold connection
F3 = 1¼” SAE 4-bolt flange
FM3 = 1¼” SAE 4-bolt flange

HMC080
SM3 = 1¼” symmetrical ports with through-holes for manifold connection
F3 = 1¼” SAE 4-bolt flange
FM3 = 1¼” SAE 4-bolt flange
F4 = SAE 1½” 4-bolt UNC flanges
FM4 = SAE 4-bolt metric flanges

HMC125
SM3 = 1¼” symmetrical ports with through-holes for manifold connection
F3 = 1¼” SAE 4-bolt flange
FM3 = 1¼” SAE 4-bolt flange
F4 = SAE 1½” 4-bolt UNC flanges
FM4 = SAE 4-bolt metric flanges

HMC200
SM3 = 1¼” symmetrical ports with through-holes for manifold connection
F3 = 1¼” SAE 4-bolt flange
FM3 = 1¼” SAE 4-bolt flange
F4 = SAE 1½” 4-bolt UNC flanges
FM4 = SAE 4-bolt metric flanges

HMC270
F4 = 1½” SAE code 62 4-bolt flange
FM4 = 1½” SAE code 62 4-bolt flange

HMC325
F4 = 1½” SAE code 62 4-bolt flange
FM4 = 1½” SAE code 62 4-bolt flange

See pages 42 to 80 for full dimensionsal details
### 1-4 Special Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Page</th>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
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</thead>
<tbody>
<tr>
<td>High Pressure Shaft Seal</td>
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<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
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<td>⊘</td>
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<td>Improved Shaft Seal Life</td>
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<td>⊘</td>
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<td>⊘</td>
<td>⊘</td>
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<td>⊘</td>
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<tr>
<td>Improved Cavitation Resistance</td>
<td>11</td>
<td>⊘</td>
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<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>Anti-pooling Bolt Heads</td>
<td>12</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>Increased Starting Torque</td>
<td>13</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
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<td>⊘</td>
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<td>Anti-clockwise Rotation</td>
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<td>⊘</td>
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<td>⊘</td>
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<tr>
<td>Thermal Shock Resistance</td>
<td>16</td>
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<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>Drain Port Adaptor - ½&quot; BSPP</td>
<td>18</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>Φ21mm Mounting Holes</td>
<td>19</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
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<tr>
<td>Φ22mm Mounting Holes</td>
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<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>Marine-specification Primer Paint</td>
<td>20</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
</tbody>
</table>

- ⊘ Available
- ○ Not available

If a motor is to be ordered with any special features listed, please contact Kawasaki.
1-4 Special Features

**High Pressure Shaft Seal**

Description:
- > 10 bar rated
- > Recommended for cold climates
- > Rugged steel and PTFE construction

Technical Information

Where crankcase pressure will be higher than 3.5 bar, the high pressure shaft seal should be selected.

<table>
<thead>
<tr>
<th>Case pressure</th>
<th>≤ 10 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-operating temperature limits</td>
<td>Below -30°C and above 120°C</td>
</tr>
<tr>
<td>Minimum operating temperature</td>
<td>-15°C</td>
</tr>
<tr>
<td>Maximum operating temperature</td>
<td>80°C</td>
</tr>
<tr>
<td>Minimum viscosity</td>
<td>2,000 cSt</td>
</tr>
<tr>
<td>Maximum viscosity</td>
<td>150 cSt</td>
</tr>
</tbody>
</table>

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
<tr>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Improved Shaft Seal Life

Description:

- Stainless steel sleeve prevents corrosion
- Improved wear resistance
- Recommended for corrosive environments

Technical Information

A well-established method of increasing rotary seal life in corrosive environments is to fit a thin-walled, stainless steel sleeve to the rotating shaft to provide a corrosion-resistant, wear-resistant counterface surface for the seal to run against. All HMC motors can be fitted with such sleeves upon request.

<table>
<thead>
<tr>
<th>Sleeve material</th>
<th>A304/301 Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleeve surface finish</td>
<td>$R_a 0.25$ to $0.5 \mu m$ (10 to 20 μin)</td>
</tr>
</tbody>
</table>

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

- Improved Cavitation Resistance

**Description:**

- Recommended for overrunning applications
- Protects against seal damage for short periods of operation in vacuum inlet conditions.

Cavitation can occur due to many different factors. Although it is not possible to make the HMC motor resistant to cavitation, certain features can be added to improve the motor’s resistance to short periods of lost port pressure.

In applications where the HMC motor can be driven (like a pump) a risk arises that insufficient fluid will be provided to maintain a positive pressure at both main ports of the motor causing cavitation. The results of extended running at these conditions can be catastrophic to the motor’s function.

The improved cavitation resistance feature should be considered where:

- Overrunning conditions may occur (load driving the motor)
- Loss of main port pressure while motor is rotating

**Applicable to:**

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
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</thead>
<tbody>
<tr>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Anti-pooling Bolt Heads

Description:
- Removes potential for water pooling
- Improved corrosion resistance
- Recommended for marine environments

Technical Information

In many marine applications, water pooling in socket head cap screw heads presents a significant corrosion risk. Corroded cap screws can make service and repair of affected units impossible.

To significantly reduce the risk of water damage through pooling, HMC motors can be supplied with silicone filler in all the bolt heads.

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
<tr>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Increased Starting Torque

Description:

> Optimised for high break-out torque
> Recommended for low speed operation
> Improved service life for low speed applications

Technical Information

If an application demands the drive motor be run at speeds of less than 10 rpm for most of the duty cycle, or involves frequent start/stop or forward/reverse operation, the Staffa HMC motor range has it covered.

By optimising the HMC motor’s design for low speeds, it is possible to increase the break out torque and low speed mechanical efficiency performance.

All figures given in Section 2-1 Performance Data are still valid when selecting this feature.
1-4 Special Features

Increased Starting Torque (cont)

Volumetric Performance

In order to achieve increased torque at low speeds the volumetric characteristics of the motor performance are changed.

When calculating leakage and volumetric efficiency use the constants shown here in place of those given for the standard motor on page 29.

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>Geometric Displacement</th>
<th>Zero Speed Constant</th>
<th>Speed Constant</th>
<th>Creep Speed Constant</th>
<th>Crankcase Leakage Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cc/rev</td>
<td>K1</td>
<td>K2</td>
<td>K3</td>
<td>K4</td>
</tr>
<tr>
<td>HMC030</td>
<td>492</td>
<td>11.66</td>
<td>*</td>
<td>17.42</td>
<td>10.26</td>
</tr>
<tr>
<td>HMC045</td>
<td>737</td>
<td>13.36</td>
<td>47.80</td>
<td>12.26</td>
<td>10.76</td>
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<td>HMC080</td>
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<td>16.26</td>
<td>45.70</td>
<td>9.65</td>
<td>14.66</td>
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<tr>
<td>HMC125</td>
<td>2,048</td>
<td>12.86</td>
<td>38.50</td>
<td>4.55</td>
<td>11.01</td>
</tr>
<tr>
<td>HMC200</td>
<td>3,087</td>
<td>12.86</td>
<td>38.50</td>
<td>3.02</td>
<td>11.01</td>
</tr>
<tr>
<td>HMC270</td>
<td>4,588</td>
<td>13.26</td>
<td>37.30</td>
<td>2.41</td>
<td>12.76</td>
</tr>
<tr>
<td>HMC325</td>
<td>5,326</td>
<td>13.26</td>
<td>40.00</td>
<td>2.08</td>
<td>12.76</td>
</tr>
</tbody>
</table>

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
<tr>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Anti-Clockwise Rotation

Description:

> Reduce installation complexity
> Standardise equipment designs

Technical Information

All HMC motors can be specified with an anti-clockwise rotation valve configuration. All performance and volumetric characteristics remain unchanged.

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
<tr>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Thermal Shock Resistance

Description:
> Recommended for cold climates
> Optimised for start-up in freezing temperatures
> Engineered for total peace of mind

Technical Information
Starting up a cold system with warm hydraulic fluid is a known cause of heavy wear and potential seizure of hydraulic machinery. To minimise this potential risk, the HMC motor can be configured to combat thermal shocks to give complete peace of mind when operating in very cold climates.

Volumetric Performance
In order to provide thermal shock resistance the volumetric characteristics of the motor performance are changed. When calculating leakage and volumetric efficiency use the constants shown on the next page in place of those given for the standard motor on page 29.

All figures given in Section 2-1 Performance Data are still valid when selecting this feature.

Note:
When operating at low temperature, consideration must be given to the guidance notes in Section 2-8 Motor Operation at Low Temperature (see page 37).
1-4 Special Features

Thermal Shock Resistance (cont)

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>Geometric Displacement</th>
<th>Zero Speed Constant</th>
<th>Speed Constant</th>
<th>Creep Speed Constant</th>
<th>Crankcase Leakage Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cc/rev</td>
<td>K1</td>
<td>K2</td>
<td>K3</td>
<td>K4</td>
</tr>
<tr>
<td>HMC080</td>
<td>1,639</td>
<td>11.10</td>
<td>45.70</td>
<td>6.99</td>
<td>7.90</td>
</tr>
<tr>
<td>HMC125</td>
<td>2,048</td>
<td>7.70</td>
<td>38.50</td>
<td>3.78</td>
<td>4.25</td>
</tr>
<tr>
<td>HMC200</td>
<td>3,087</td>
<td>7.98</td>
<td>38.50</td>
<td>2.61</td>
<td>4.25</td>
</tr>
<tr>
<td>HMC270</td>
<td>4,588</td>
<td>8.38</td>
<td>37.30</td>
<td>1.91</td>
<td>6.00</td>
</tr>
<tr>
<td>HMC325</td>
<td>5,326</td>
<td>8.38</td>
<td>40.00</td>
<td>1.65</td>
<td>6.00</td>
</tr>
</tbody>
</table>

Applicable to:

<table>
<thead>
<tr>
<th></th>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Drain Port Adaptors

Description:

> Improves manufacturing logistics

> Motor supplied ready for connection to 1½" BSPP male fitting

Technical Information

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>Adaptor Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC030</td>
<td>¾&quot; UNF 2B to ½&quot; BSPP</td>
</tr>
<tr>
<td>HMC045</td>
<td>¾&quot; UNF 2B to ½&quot; BSPP</td>
</tr>
<tr>
<td>HMC080</td>
<td>¾&quot; UNF 2B to ½&quot; BSPP</td>
</tr>
<tr>
<td>HM(HD)C125</td>
<td>¾&quot; UNF 2B to ½&quot; BSPP</td>
</tr>
<tr>
<td>HM(HD)C200</td>
<td>¾&quot; UNF 2B to ½&quot; BSPP</td>
</tr>
<tr>
<td>HM(HD)C270</td>
<td>¾&quot; UNF 2B to ½&quot; BSPP</td>
</tr>
<tr>
<td>HM(HD)C325</td>
<td>¾&quot; UNF 2B to ½&quot; BSPP</td>
</tr>
</tbody>
</table>

One or two drain adaptors can be supplied.

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
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</thead>
<tbody>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Mounting Hole Diameter

Description:

- Matching mounting holes to bolts
- φ21mm and φ22mm options available

Technical Information

In different markets, different bolt standards are adopted which may not be best suited to the standard φ20 mm mounting hole diameter on the HMC motors. To give a correct fit and optimum installation, φ21 mm or φ22 mm holes can be selected on larger frame sizes.

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
<tr>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
1-4 Special Features

Marine Specification Primer Paint

Description:

- Improves corrosion and water resistance of the finishing system
- Excellent adhesion strength
- Recommended for marine applications

Technical Information

<table>
<thead>
<tr>
<th>Colour</th>
<th>Red oxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Single pack epoxy etching primer</td>
</tr>
<tr>
<td>Standard</td>
<td>BS 3900 part A 8</td>
</tr>
<tr>
<td>Dry film thickness</td>
<td>&gt; 12 μm</td>
</tr>
</tbody>
</table>

Applicable to:

<table>
<thead>
<tr>
<th>HMC030</th>
<th>HMC045</th>
<th>HMC080</th>
<th>HMC125</th>
<th>HMC200</th>
<th>HMC270</th>
<th>HMC325</th>
</tr>
</thead>
<tbody>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Please contact Kawasaki to order this feature.
2-1 Performance Data

Performance data is valid for the range of HMC motors when fully run-in and operating with mineral oil.

The appropriate motor displacements can be selected using performance data shown on pages 22 to 28. Refer to the table on this page for pressures and speed limits when using fire-resistant fluids.

⚠️ Rating definitions

Continuous rating

For continuous duty the motor must be operating within each of the maximum values for speed, pressure and power.

Intermittent rating

Intermittent max pressure: 275 bar.

This pressure is allowable on the following basis:

a) Up to 50 rpm 15% duty for periods up to 5 minutes maximum.
b) Over 50 rpm 2% duty for periods up to 30 seconds maximum.

Static pressure to DNV rules 380 bar.

Intermittent power rating

This is permitted on a 15% duty basis for periods up to 5 minutes maximum.

⚠️ Limits for fire resistant fluids

<table>
<thead>
<tr>
<th>Fluid Type</th>
<th>Continuous Pressure (bar)</th>
<th>Intermittent Pressure (bar)</th>
<th>Max Speed (rpm)</th>
<th>Model Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFA 5/95 oil-in-water emulsion</td>
<td>130</td>
<td>138</td>
<td>50% of limits of mineral oil</td>
<td>All models</td>
</tr>
<tr>
<td>HFB 60/40 water-in-oil emulsion</td>
<td>138</td>
<td>172</td>
<td>As for mineral oil</td>
<td>All models</td>
</tr>
<tr>
<td>HFC water glycol</td>
<td>103</td>
<td>138</td>
<td>50% of limits of mineral oil</td>
<td>All models</td>
</tr>
<tr>
<td>HFD phosphate ester</td>
<td>250</td>
<td>293</td>
<td>As for mineral oil</td>
<td>All models</td>
</tr>
</tbody>
</table>
2-1 Performance Data (cont)

**HMC030 Motor** (see page 30 for power calculation limits)

<table>
<thead>
<tr>
<th>Displacement Code</th>
<th>30</th>
<th>27</th>
<th>24</th>
<th>21</th>
<th>18</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement cc/rev</td>
<td>492</td>
<td>442</td>
<td>393</td>
<td>344</td>
<td>295</td>
<td>246</td>
</tr>
<tr>
<td>Average actual running torque Nm/bar</td>
<td>6.86</td>
<td>6.08</td>
<td>5.3</td>
<td>4.59</td>
<td>3.88</td>
<td>3.2</td>
</tr>
<tr>
<td>Average actual mechanical efficiency %</td>
<td>87.6</td>
<td>86.4</td>
<td>84.7</td>
<td>83.8</td>
<td>82.6</td>
<td>81.7</td>
</tr>
<tr>
<td>Average actual starting efficiency %</td>
<td>82.8</td>
<td>81.4</td>
<td>79.6</td>
<td>77.1</td>
<td>73.9</td>
<td>69.3</td>
</tr>
<tr>
<td>Max continuous speed rpm</td>
<td>450</td>
<td>500</td>
<td>525</td>
<td>550</td>
<td>575</td>
<td>600</td>
</tr>
<tr>
<td>Max continuous power kW</td>
<td>60</td>
<td>60</td>
<td>55</td>
<td>49</td>
<td>42</td>
<td>35</td>
</tr>
<tr>
<td>Max intermittent power kW</td>
<td>66</td>
<td>66</td>
<td>61</td>
<td>55</td>
<td>48</td>
<td>41</td>
</tr>
<tr>
<td>Max continuous pressure bar</td>
<td>207</td>
<td>207</td>
<td>207</td>
<td>207</td>
<td>207</td>
<td>207</td>
</tr>
<tr>
<td>Max intermittent pressure bar</td>
<td>241</td>
<td>241</td>
<td>241</td>
<td>241</td>
<td>241</td>
<td>241</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Displacement Code</th>
<th>12</th>
<th>09</th>
<th>06</th>
<th>03</th>
<th>00</th>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement cc/rev</td>
<td>197</td>
<td>147</td>
<td>98</td>
<td>49</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual running torque Nm/bar</td>
<td>2.51</td>
<td>1.83</td>
<td>1.15</td>
<td>0.44</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual mechanical efficiency %</td>
<td>80.1</td>
<td>78.2</td>
<td>73.7</td>
<td>56.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual starting efficiency %</td>
<td>62.6</td>
<td>51.6</td>
<td>29.1</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Max continuous speed rpm</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>1,000</td>
<td>1,500**</td>
</tr>
<tr>
<td>Max continuous power kW</td>
<td>27</td>
<td>20</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max intermittent power kW</td>
<td>32</td>
<td>24</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max continuous pressure bar</td>
<td>207</td>
<td>207</td>
<td>207</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
</tr>
<tr>
<td>Max intermittent pressure bar</td>
<td>241</td>
<td>241</td>
<td>241</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
</tr>
</tbody>
</table>

Data shown is at 207 bar. Intermediate displacements can be made available to special order.
* See page 34: small displacements.
** A crankcase flushing flow of 15 l/min is required when freewheeling at 1,500 rpm.
## 2-1 Performance Data (cont)

### HMC045 Motor (see page 30 for power calculation limits)

<table>
<thead>
<tr>
<th>Displacement Code</th>
<th>45</th>
<th>40</th>
<th>35</th>
<th>30</th>
<th>25</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>cc/rev</td>
<td>737</td>
<td>655</td>
<td>573</td>
<td>492</td>
<td>410</td>
</tr>
<tr>
<td>Average actual running torque</td>
<td>Nm/bar</td>
<td>10.63</td>
<td>9.4</td>
<td>8.04</td>
<td>6.88</td>
<td>5.68</td>
</tr>
<tr>
<td>Average actual mechanical efficiency</td>
<td>%</td>
<td>90.6</td>
<td>90.2</td>
<td>88.2</td>
<td>87.9</td>
<td>87.0</td>
</tr>
<tr>
<td>Average actual starting efficiency</td>
<td>%</td>
<td>84.5</td>
<td>83.0</td>
<td>81.1</td>
<td>78.4</td>
<td>74.9</td>
</tr>
<tr>
<td>Max continuous speed</td>
<td>rpm</td>
<td>450</td>
<td>550</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Max continuous power</td>
<td>kW</td>
<td>99</td>
<td>89</td>
<td>79</td>
<td>67</td>
<td>54</td>
</tr>
<tr>
<td>Max intermittent power</td>
<td>kW</td>
<td>119</td>
<td>107</td>
<td>95</td>
<td>80</td>
<td>65</td>
</tr>
<tr>
<td>Max continuous pressure</td>
<td>bar</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Max intermittent pressure</td>
<td>bar</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
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<table>
<thead>
<tr>
<th>Displacement Code</th>
<th>15</th>
<th>10</th>
<th>5</th>
<th>00</th>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>cc/rev</td>
<td>246</td>
<td>163</td>
<td>81</td>
<td>0</td>
</tr>
<tr>
<td>Average actual running torque</td>
<td>Nm/bar</td>
<td>3.2</td>
<td>1.55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual mechanical efficiency</td>
<td>%</td>
<td>81.7</td>
<td>59.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual starting efficiency</td>
<td>%</td>
<td>60.6</td>
<td>43.0</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Max continuous speed</td>
<td>rpm</td>
<td>600</td>
<td>600</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Max continuous power</td>
<td>kW</td>
<td>30</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max intermittent power</td>
<td>kW</td>
<td>36</td>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max continuous pressure</td>
<td>bar</td>
<td>250</td>
<td>250</td>
<td>17*</td>
<td>17*</td>
</tr>
<tr>
<td>Max intermittent pressure</td>
<td>bar</td>
<td>275</td>
<td>275</td>
<td>17*</td>
<td>17*</td>
</tr>
</tbody>
</table>

Data shown is at 250 bar. Intermediate displacements can be made available to special order.
* See page 34: small displacements.
** A crankcase flushing flow of 15 l/min is required when freewheeling at 1,500 rpm.
## 2-1 Performance Data (cont)

### HMC080 Motor

(see page 30 for power calculation limits)

<table>
<thead>
<tr>
<th>Displacement Code</th>
<th>97.6</th>
<th>90</th>
<th>85</th>
<th>80</th>
<th>75</th>
<th>70</th>
<th>65</th>
<th>60</th>
<th>55</th>
<th>50</th>
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</thead>
<tbody>
<tr>
<td>Displacement cc/rev</td>
<td>1,600</td>
<td>1,475</td>
<td>1,393</td>
<td>1,311</td>
<td>1,229</td>
<td>1,147</td>
<td>1,065</td>
<td>983</td>
<td>901</td>
<td>819</td>
</tr>
<tr>
<td>Average actual running torque Nm/bar</td>
<td>23.9</td>
<td>22</td>
<td>20.75</td>
<td>19.5</td>
<td>18.25</td>
<td>17.02</td>
<td>15.78</td>
<td>14.55</td>
<td>13.2</td>
<td>12</td>
</tr>
<tr>
<td>Average actual mechanical efficiency %</td>
<td>93.9</td>
<td>93.7</td>
<td>93.6</td>
<td>93.5</td>
<td>93.3</td>
<td>93.2</td>
<td>93.1</td>
<td>93.0</td>
<td>92.1</td>
<td>92.1</td>
</tr>
<tr>
<td>Average actual starting efficiency %</td>
<td>87.1</td>
<td>86.0</td>
<td>85.2</td>
<td>84.3</td>
<td>83.3</td>
<td>80.8</td>
<td>80.8</td>
<td>79.2</td>
<td>77.4</td>
<td>75.1</td>
</tr>
<tr>
<td>Max continuous speed (S03/F3/FM3) rpm</td>
<td>270</td>
<td>300</td>
<td>320</td>
<td>340</td>
<td>365</td>
<td>390</td>
<td>420</td>
<td>450</td>
<td>475</td>
<td>500</td>
</tr>
<tr>
<td>Max continuous speed (S04/F4/FM4) rpm</td>
<td>365</td>
<td>400</td>
<td>415</td>
<td>430</td>
<td>445</td>
<td>460</td>
<td>475</td>
<td>490</td>
<td>500</td>
<td>515</td>
</tr>
<tr>
<td>Max continuous power kW</td>
<td>138</td>
<td>138</td>
<td>134</td>
<td>129</td>
<td>127</td>
<td>123</td>
<td>118</td>
<td>115</td>
<td>110</td>
<td>105</td>
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<tr>
<td>Max intermittent power kW</td>
<td>170</td>
<td>170</td>
<td>165</td>
<td>159</td>
<td>156</td>
<td>151</td>
<td>145</td>
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<tr>
<td>Max intermittent pressure bar</td>
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<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
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</table>

<table>
<thead>
<tr>
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<th>45</th>
<th>40</th>
<th>35</th>
<th>30</th>
<th>25</th>
<th>20</th>
<th>15</th>
<th>10</th>
<th>5</th>
<th>00</th>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement cc/rev</td>
<td>737</td>
<td>655</td>
<td>574</td>
<td>492</td>
<td>410</td>
<td>328</td>
<td>246</td>
<td>164</td>
<td>82</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual running torque Nm/bar</td>
<td>10.6</td>
<td>9.24</td>
<td>7.87</td>
<td>6.48</td>
<td>5.31</td>
<td>3.93</td>
<td>2.56</td>
<td>1.57</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual mechanical efficiency %</td>
<td>90.4</td>
<td>88.6</td>
<td>86.1</td>
<td>82.8</td>
<td>81.4</td>
<td>75.3</td>
<td>65.4</td>
<td>60.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual starting efficiency %</td>
<td>72.4</td>
<td>69.0</td>
<td>64.4</td>
<td>58.6</td>
<td>50.3</td>
<td>38.0</td>
<td>17.5</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Max continuous speed (S03/F3/FM3) rpm</td>
<td>550</td>
<td>600</td>
<td>615</td>
<td>630</td>
<td>630</td>
<td>630</td>
<td>630</td>
<td>630</td>
<td>1,000</td>
<td>1,000</td>
<td>1,500**</td>
</tr>
<tr>
<td>Max continuous speed (S04/F4/FM4) rpm</td>
<td>530</td>
<td>545</td>
<td>560</td>
<td>575</td>
<td>585</td>
<td>600</td>
<td>615</td>
<td>630</td>
<td>1,000</td>
<td>1,000</td>
<td>1,500**</td>
</tr>
<tr>
<td>Max continuous power kW</td>
<td>99</td>
<td>92</td>
<td>79</td>
<td>64</td>
<td>52</td>
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<td>26</td>
<td>12</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>Max intermittent power kW</td>
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<td>113</td>
<td>97</td>
<td>79</td>
<td>64</td>
<td>47</td>
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<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
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<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>17*</td>
<td>17*</td>
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</table>

Data shown is at 250 bar. Intermediate displacements can be made available to special order.
* See page 34: small displacements.
** A crankcase flushing flow of 15 l/min is required when freewheeling at 1,500 rpm.
## 2-1 Performance Data (cont)

**HMC125 Motor** (see page 30 for power calculation limits)

<table>
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<th>Displacement Code</th>
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<th>90</th>
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<th>60</th>
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<td>1,966</td>
<td>1,802</td>
<td>1,639</td>
<td>1,475</td>
<td>1,311</td>
<td>1,147</td>
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<tr>
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<td>Nm/bar</td>
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<td>28.7</td>
<td>26.3</td>
<td>23.6</td>
<td>21</td>
<td>18.3</td>
<td>15.7</td>
</tr>
<tr>
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<td>%</td>
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<td>91.7</td>
<td>90.5</td>
<td>90.5</td>
<td>89.5</td>
<td>87.7</td>
<td>86.0</td>
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<tr>
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<td>%</td>
<td>80.2</td>
<td>79.2</td>
<td>74.3</td>
<td>74.3</td>
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<td>rpm</td>
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<td>225</td>
<td>270</td>
<td>270</td>
<td>300</td>
<td>340</td>
<td>390</td>
</tr>
<tr>
<td>Max continuous speed (S04/F4/FM4)</td>
<td>rpm</td>
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<td>310</td>
<td>340</td>
<td>365</td>
<td>400</td>
<td>430</td>
<td>460</td>
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<td>Max continuous power</td>
<td>kW</td>
<td>135</td>
<td>131</td>
<td>122</td>
<td>114</td>
<td>105</td>
<td>98</td>
<td>88</td>
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<tr>
<td>Max intermittent power</td>
<td>kW</td>
<td>152</td>
<td>147</td>
<td>137</td>
<td>128</td>
<td>118</td>
<td>110</td>
<td>99</td>
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<td>Max continuous pressure</td>
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<td>Displacement</td>
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<td>655</td>
<td>492</td>
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<td>82</td>
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<td>Nm/bar</td>
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<td>8.1</td>
<td>5.9</td>
<td>3.8</td>
<td>0.6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual mechanical efficiency</td>
<td>%</td>
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<td>77.7</td>
<td>75.3</td>
<td>72.8</td>
<td>23.0</td>
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<td>0</td>
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<tr>
<td>Average actual starting efficiency</td>
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<td>30.6</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
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<td>Max continuous speed (S03/F3/FM3)</td>
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<td>630</td>
<td>630</td>
<td>630</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Max continuous speed (S04/F4/FM4)</td>
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<td>545</td>
<td>575</td>
<td>600</td>
<td>630</td>
<td>1,000</td>
<td>1,000</td>
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<tr>
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<td>kW</td>
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<td>62</td>
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<td>24</td>
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<td>kW</td>
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<td>70</td>
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<td>33</td>
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<td>0</td>
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<td>250</td>
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<td>250</td>
<td>17*</td>
<td>17*</td>
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<td>bar</td>
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<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>17*</td>
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</table>

Data shown is at 250 bar. Intermediate displacements can be made available to special order.

* See page 34: small displacements.

** A crankcase flushing flow of 15 l/min is required when freewheeling at 1,500 rpm.
## 2-1 Performance Data (cont)

**HMC200 Motor** (see page 30 for power calculation limits)

<table>
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<th>150</th>
<th>140</th>
<th>130</th>
<th>120</th>
<th>110</th>
<th>100</th>
<th>90</th>
</tr>
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<tbody>
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<td>2.950</td>
<td>2.790</td>
<td>2.620</td>
<td>2.460</td>
<td>2.290</td>
<td>2.130</td>
<td>1.970</td>
<td>1.800</td>
<td>1.639</td>
</tr>
<tr>
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<td>Nm/bar</td>
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<td>44.0</td>
<td>39.1</td>
<td>39.1</td>
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<td>34.3</td>
<td>31.3</td>
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<td>26.3</td>
<td>23.6</td>
</tr>
<tr>
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<td>%</td>
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<td>93.7</td>
<td>93.9</td>
<td>93.8</td>
<td>93.5</td>
<td>93.3</td>
<td>92.3</td>
<td>91.5</td>
<td>91.8</td>
<td>90.5</td>
</tr>
<tr>
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<td>%</td>
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<td>84.9</td>
<td>83.9</td>
<td>83.1</td>
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<td>77.2</td>
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<td>180</td>
<td>190</td>
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<td>205</td>
<td>210</td>
<td>225</td>
<td>240</td>
<td>270</td>
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<td>235</td>
<td>240</td>
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<td>114</td>
</tr>
<tr>
<td>Max intermittent power</td>
<td>kW</td>
<td>195</td>
<td>195</td>
<td>195</td>
<td>185</td>
<td>175</td>
<td>166</td>
<td>156</td>
<td>147</td>
<td>137</td>
<td>128</td>
</tr>
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<td>Max continuous pressure</td>
<td>bar</td>
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<td>250</td>
<td>250</td>
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<td>250</td>
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<td>275</td>
</tr>
<tr>
<td>Max intermittent pressure</td>
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<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
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<th>10</th>
<th>5</th>
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<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>cc/rev</td>
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<td>1.150</td>
<td>093</td>
<td>082</td>
<td>065</td>
<td>049</td>
<td>032</td>
<td>028</td>
<td>016</td>
<td>014</td>
<td>00</td>
</tr>
<tr>
<td>Average actual running torque</td>
<td>Nm/bar</td>
<td>18.3</td>
<td>15.7</td>
<td>12.8</td>
<td>10.6</td>
<td>8.1</td>
<td>5.9</td>
<td>3.8</td>
<td>0.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Average actual mechanical efficiency</td>
<td>%</td>
<td>87.7</td>
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<td>81.8</td>
<td>81.2</td>
<td>77.7</td>
<td>75.3</td>
<td>72.8</td>
<td>72.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
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<td>%</td>
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<td>61.1</td>
<td>54.8</td>
<td>45.7</td>
<td>32.1</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Max continuous speed (S03/F3/FM3) rpm</td>
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<td>500</td>
<td>600</td>
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<td>630</td>
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<td>1.000</td>
<td>1.000</td>
<td>1.500 **</td>
</tr>
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<td>485</td>
<td>515</td>
<td>545</td>
<td>575</td>
<td>600</td>
<td>630</td>
<td>1.000</td>
<td>1.000</td>
<td>1.500 **</td>
</tr>
<tr>
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<td>88</td>
<td>81</td>
<td>72</td>
<td>62</td>
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<td>25</td>
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<td>Max intermittent power</td>
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<td>91</td>
<td>81</td>
<td>70</td>
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<td>33</td>
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</table>

Data shown is at 250 bar. Intermediate displacements can be made available to special order.

* See page 34: small displacements.

** A crankcase flushing flow of 15 l/min is required when freewheeling at 1,500 rpm.
# HMC270 Motor (see page 30 for power calculation limits)

## 2-1 Performance Data (cont)

<table>
<thead>
<tr>
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<td>4,097</td>
<td>3,605</td>
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<th>30</th>
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<td>Displacement</td>
<td>cc/rev</td>
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<td>655</td>
<td>492</td>
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<td>164</td>
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<td>/</td>
<td>/</td>
<td>/</td>
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<td>490</td>
<td>515</td>
<td>545</td>
<td>1,000</td>
<td>1,000</td>
<td>1,500**</td>
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</tr>
<tr>
<td>Max continuous pressure bar</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
</tr>
<tr>
<td>Max intermittent pressure bar</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
</tr>
</tbody>
</table>

* Data shown is at 250 bar. Intermediate displacements can be made available to special order.
  * See page 34: small displacements.
  ** A crankcase flushing flow of 15 l/min is required when freewheeling at 1,500 rpm.
### HMC325 Motor

(see page 30 for power calculation limits)

<table>
<thead>
<tr>
<th>Displacement Code</th>
<th>325</th>
<th>310</th>
<th>300</th>
<th>280</th>
<th>250</th>
<th>220</th>
<th>200</th>
<th>180</th>
<th>160</th>
<th>140</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>5,326</td>
<td>5,080</td>
<td>4,916</td>
<td>4,588</td>
<td>4,097</td>
<td>3,605</td>
<td>3,277</td>
<td>2,950</td>
<td>2,622</td>
<td>2,294</td>
<td>1,966</td>
</tr>
<tr>
<td>Average actual running torque</td>
<td>80.4</td>
<td>76.6</td>
<td>74.1</td>
<td>69.1</td>
<td>61.6</td>
<td>53.9</td>
<td>49</td>
<td>43.6</td>
<td>38.3</td>
<td>33.2</td>
<td>27.9</td>
</tr>
<tr>
<td>Average actual mechanical efficiency</td>
<td>94.8</td>
<td>94.7</td>
<td>94.7</td>
<td>94.6</td>
<td>94.5</td>
<td>93.9</td>
<td>94</td>
<td>92.9</td>
<td>91.8</td>
<td>90.9</td>
<td>89.2</td>
</tr>
<tr>
<td>Average actual starting efficiency</td>
<td>85.7</td>
<td>85.4</td>
<td>85.2</td>
<td>84.7</td>
<td>83.8</td>
<td>82.7</td>
<td>81.8</td>
<td>80.6</td>
<td>79.2</td>
<td>77.3</td>
<td>74.9</td>
</tr>
<tr>
<td>Max continuous speed</td>
<td>130</td>
<td>135</td>
<td>140</td>
<td>150</td>
<td>160</td>
<td>170</td>
<td>190</td>
<td>215</td>
<td>230</td>
<td>275</td>
<td>330</td>
</tr>
<tr>
<td>Max continuous power</td>
<td>189</td>
<td>189</td>
<td>189</td>
<td>189</td>
<td>176</td>
<td>161</td>
<td>150</td>
<td>139</td>
<td>128</td>
<td>116</td>
<td>104</td>
</tr>
<tr>
<td>Max intermittent power</td>
<td>213</td>
<td>213</td>
<td>213</td>
<td>213</td>
<td>198</td>
<td>181</td>
<td>169</td>
<td>156</td>
<td>144</td>
<td>132</td>
<td>120</td>
</tr>
<tr>
<td>Max continuous pressure</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Max intermittent pressure</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Displacement Code</th>
<th>100</th>
<th>95</th>
<th>80</th>
<th>60</th>
<th>40</th>
<th>30</th>
<th>20</th>
<th>10</th>
<th>00</th>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>1,639</td>
<td>1,557</td>
<td>1,311</td>
<td>983</td>
<td>655</td>
<td>492</td>
<td>328</td>
<td>164</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual running torque</td>
<td>22.4</td>
<td>20.9</td>
<td>17.1</td>
<td>12.2</td>
<td>7.9</td>
<td>5.15</td>
<td>2.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual mechanical efficiency</td>
<td>85.9</td>
<td>84.3</td>
<td>82.0</td>
<td>78.0</td>
<td>75.8</td>
<td>65.8</td>
<td>46.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average actual starting efficiency</td>
<td>71.5</td>
<td>70.4</td>
<td>66.3</td>
<td>57.8</td>
<td>40.7</td>
<td>23.5</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Max continuous speed</td>
<td>370</td>
<td>405</td>
<td>440</td>
<td>460</td>
<td>495</td>
<td>515</td>
<td>545</td>
<td>1,000</td>
<td>1,000</td>
<td>1,500**</td>
</tr>
<tr>
<td>Max continuous power</td>
<td>89</td>
<td>85</td>
<td>73</td>
<td>57</td>
<td>38</td>
<td>26</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max intermittent power</td>
<td>107</td>
<td>101</td>
<td>95</td>
<td>80</td>
<td>55</td>
<td>38</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max continuous pressure</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
</tr>
<tr>
<td>Max intermittent pressure</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
<td>17*</td>
</tr>
</tbody>
</table>

Data shown is at 250 bar. Intermediate displacements can be made available to special order.

* See page 34: small displacements.

** A crankcase flushing flow of 15 l/min is required when freewheeling at 1,500 rpm.
### 2-2 Volumetric Efficiency Data

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>Geometric Displacement (cc/rev)</th>
<th>Zero Speed Constant ($K_1$)</th>
<th>Speed Constant ($K_2$)</th>
<th>Creep Speed Constant ($K_3$)</th>
<th>Crankcase Leakage Constant ($K_4$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC030</td>
<td>492</td>
<td>4.90</td>
<td>*</td>
<td>10.00</td>
<td>3.50</td>
</tr>
<tr>
<td>HMC045</td>
<td>737</td>
<td>6.60</td>
<td>47.80</td>
<td>8.50</td>
<td>4.00</td>
</tr>
<tr>
<td>HMC080</td>
<td>1,639</td>
<td>9.50</td>
<td>45.70</td>
<td>5.80</td>
<td>7.90</td>
</tr>
<tr>
<td>HMC125</td>
<td>2,048</td>
<td>6.10</td>
<td>38.50</td>
<td>3.00</td>
<td>4.25</td>
</tr>
<tr>
<td>HMC200</td>
<td>3,087</td>
<td>6.10</td>
<td>38.50</td>
<td>2.00</td>
<td>4.20</td>
</tr>
<tr>
<td>HMC270</td>
<td>4,588</td>
<td>6.50</td>
<td>37.30</td>
<td>1.50</td>
<td>6.00</td>
</tr>
<tr>
<td>HMC325</td>
<td>5,326</td>
<td>6.50</td>
<td>40.00</td>
<td>1.30</td>
<td>6.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluid Viscosity (cSt)</th>
<th>Viscosity Factor ($K_v$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1.58</td>
</tr>
<tr>
<td>25</td>
<td>1.44</td>
</tr>
<tr>
<td>30</td>
<td>1.30</td>
</tr>
<tr>
<td>40</td>
<td>1.10</td>
</tr>
<tr>
<td>50</td>
<td>1.00</td>
</tr>
<tr>
<td>60</td>
<td>0.88</td>
</tr>
</tbody>
</table>

The motor volumetric efficiency can be calculated as follows:

\[
\text{Volumetric efficiency (\%)} = \frac{\text{(speed x disp.)}}{\text{(speed x disp.) + Qt}} \times 100
\]

**Example:**

HMC200 motor with displacement of 3.087 l/rev.
- Speed: 60 rpm
- Differential pressure: 200 bar
- Fluid viscosity: 50 cSt

Total leakage:
\[
\text{Total leakage} = (K_1 + n/K_2) \times \Delta P \times K_v \times 0.005 \text{ l/min}
\]
\[
= (6.1 + 60/38.5) \times 200 \times 1 \times 0.005
\]
\[
= 7.7 \text{ l/min}
\]

Volumetric efficiency:
\[
\text{Volumetric efficiency} = \frac{(60 \times 3.087)}{(60 \times 3.087) + 7.7} \times 100
\]
\[
= 96\%
\]
2-3 Shaft Power Calculation

Example

HMC270 motor with a displacement code of 280:

Firstly, to find the maximum differential pressure $\Delta P$ at rated speed:

Rated shaft power (W): 189,000
Average actual running torque (Nm/bar): 69.4
Rated shaft speed (rpm): 150

$$189,000 = 69.4 \times \Delta P \times 150 \times 2 \times \frac{p}{60}$$

$\Delta P = 174 \text{ bar (max.)}$

Secondly, to find the maximum speed at rated pressure:

Rated shaft power (W): 189,000
Average actual running torque (Nm/bar): 69.4
Rated pressure (bar): 250

$$189,000 = 69.4 \times 250 \times n \times 2 \times \frac{p}{60}$$

$n = 104 \text{ rpm (max.)}$

In summary, operating the motor within its shaft power limit, at rated speed, would give a maximum pressure of 174 bar, and operating the motor at rated pressure, would give a maximum speed of 104 rpm.

Notes

1) The maximum calculated speed is based on a rated inlet pressure of 250 bar.

2) The maximum shaft power is only allowable if the motor drain temperature remains below 80°C.

3) The maximum calculated differential pressure assumes that the low pressure motor port is less than 30 bar.
2-4 Functional Symbols

Example model code:

HMC***/P/***/*/*FM3/X/...

X - external pilot supply to 'X' and 'Y' ports

HMC***/P/***/*/*FM3/C/...

C - single external supply to PC port

HMC***/P/***/*/*FM3/CS/...

CS - internally shuttled pilot supply

There is a single port (PC) in the 'C' spacer.

Pressure ports in FM3 & FM4 valve housings can be called up as special features when required.
2-5 Stress Limits

When applying large external radial loads, consideration should also be given to motor bearing lives (see page 33).

<table>
<thead>
<tr>
<th>Motor Frame Size</th>
<th>Maximum External Radial Bending Moment [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC030</td>
<td>2,600</td>
</tr>
<tr>
<td>HMC045</td>
<td>3,300</td>
</tr>
<tr>
<td>HMC080</td>
<td>4,500</td>
</tr>
<tr>
<td>HMC125</td>
<td>6,500</td>
</tr>
<tr>
<td>HMC200</td>
<td>6,750</td>
</tr>
<tr>
<td>HMC270</td>
<td>8,250</td>
</tr>
<tr>
<td>HMC325</td>
<td>8,250</td>
</tr>
</tbody>
</table>

**Example:**

Determine the maximum radial shaft load of a HMC080 motor:

Radial load offset, A = 100 mm
Maximum radial load, W = 4,500 (see table)/100
W = 45kN (4,587 kg)

A = Distance from mounting face to load centre (mm)
W = Side load (N)

**[Note]**
The offset distance A is assumed to be greater than 50 mm. Contact KPM UK if this is not the case.
Consideration should be given to the required motor bearing life in terms of baring service life. The factors that will determine bearing life include:

1) Duty cycle - time spent on and off load
2) Speed
3) Differential pressure
4) Fluid viscosity
5) External radial shaft load
6) External axial shaft load
2-7 Circuit and Application Notes

⚠️ Limits for fire resistant fluids
To select either displacement, a pressure at least equal to 67% of the motor inlet/outlet pressure (whichever is higher) is required. In most applications the motor inlet pressure will be used. If the inlet/outlet pressure is below 3.5 bar, a minimum control pressure of 3.5 bar is required. In the event of loss of control pressure the motor will shift to its highest displacement.

⚠️ Starting torque
Refer to performance data, (see pages 7 to 13).

⚠️ Low speed operation
The minimum operating speed is determined by load inertia, drive elasticity, motor displacement and system internal leakage. If the application speed is below 3 rpm, then consult KPM UK.

If possible, always start the motor in high displacement.

⚠️ High back pressure
When both inlet and outlet ports are pressurised continuously, the lower pressure port must not exceed 70 bar at any time. Note that high back pressure reduces the effective torque output of the motor.

⚠️ Boost pressure
When operating as a motor the outlet pressure should equal or exceed the crankcase pressure. If pumping occurs (i.e. overrunning loads) then a positive pressure, "P", is required at the motor ports. Calculate "P" (bar) from the operating formula Boost Formula

\[ P = 1 + \frac{N^2 \times V^2 + C}{K} \]

Where P is in bar, N = motor speed (rpm), V = motor displacement (cc/rev), C = Crankcase pressure (bar) and K = a constant from the table below:

<table>
<thead>
<tr>
<th>Motor</th>
<th>Porting</th>
<th>Constant (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC030</td>
<td>F(M)3 &amp; SM3</td>
<td>7.5 \times 10^9</td>
</tr>
<tr>
<td>HMC045</td>
<td>F(M)3 &amp; SM3</td>
<td>1.6 \times 10^9</td>
</tr>
<tr>
<td>HMC080</td>
<td>F(M)3 &amp; SM3</td>
<td>3.3 \times 10^9</td>
</tr>
<tr>
<td>HMC125 &amp; HMC200</td>
<td>F(M)3 &amp; SM3</td>
<td>1.6 \times 10^9</td>
</tr>
<tr>
<td>HMC270 &amp; HMC325</td>
<td>F(M)4</td>
<td>3.3 \times 10^9</td>
</tr>
<tr>
<td></td>
<td>F(M)4</td>
<td>4.0 \times 10^9</td>
</tr>
</tbody>
</table>
The flow rate of oil for the make-up system can be estimated from the crankcase leakage data (see page 29) plus an allowance for changing displacement:

<table>
<thead>
<tr>
<th>E.g.</th>
<th>To change high to low in 0.2 sec requires 11 l/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC030</td>
<td></td>
</tr>
<tr>
<td>HMC045</td>
<td>To change high to low in 0.25 sec requires 15 l/min</td>
</tr>
<tr>
<td>HMC080</td>
<td>To change high to low in 0.25 sec requires 32 l/min</td>
</tr>
<tr>
<td>HMC125</td>
<td>To change high to low in 0.5 sec requires 15 l/min</td>
</tr>
<tr>
<td>HMC200</td>
<td>To change high to low in 0.5 sec requires 15 l/min</td>
</tr>
<tr>
<td>HMC270</td>
<td>To change high to low in 1 sec requires 24 l/min</td>
</tr>
<tr>
<td>HMC325</td>
<td>To change high to low in 1 sec requires 20 l/min</td>
</tr>
</tbody>
</table>

Allowances should be made for other systems losses and also for “fair wear and tear” during the life of the motor, pump and system components.

Motorcase pressure

The motorcase pressure should not continuously exceed 3.5 bar with a standard shaft seal fitted. On installations with long drain lines a relief valve is recommended to prevent over-pressurising the seal.

Notes

1) The motorcase pressure at all times must not exceed either the motor inlet or outlet pressure.

2) High pressure shaft seals are available to special order for casing pressures of: 10 bar continuous and 15 bar intermittent.

3) Check installation dimensions (pages 27 to 67) for maximum crankcase drain fitting depth.

Hydraulic Fluids

Dependent on motor (see model code fluid type - page 3) suitable fluids include:

- Antiwear hydraulic oils
- Phosphate ester (HFD fluids)
- Water glycols (HFC fluids)
- 60/40% water-in-oil emulsions (HFB fluids)
- 5/95% oil-in-water emulsions (HFA fluids)

Reduce pressure and speed limits, as per table on page 21.

Viscosity limits when using any fluid except oil-in-water (5/95) emulsions are:

- Max. off load: 2,000 cSt (9270 SUS)
- Max. on load: 150 cSt (695 SUS)
- Optimum: 50 cSt (232 SUS)
- Minimum: 25 cSt (119 SUS)

Mineral oil recommendations

The fluid should be a good hydraulic grade, non-detergent Mineral Oil. It should contain anti-oxidant, antifoam and demulsifying additives. It must contain antiwear or EP additives. Automatic transmission fluids and motor oils are not recommended.
2-7 Circuit and Application Notes (cont)

Temperature limits

Ambient min. -30°C (-22°F)
Ambient max. +70°C (158°F)

Max. operating temperature range.

Mineral oil Water containing
Min. -20°C (-4°F) +10°C (50°F)
Max. +80°C (175°F) +54°C (130°F)

Note: To obtain optimum services life from both fluid and hydraulic systems components, a fluid operating temperature of 40°C is recommended.

Filtration

Full flow filtration (open circuit), or full boost flow filtration (close circuit) to ensure system cleanliness to ISO4406/1986 code 18/14 or cleaner.

Noise levels

The airborne noise level is less than 66.7 dB(A) DIN & dB(A) NFPA through the “continuous” operating envelope. Where noise is a critical factor, installation resonances can be reduced by isolating the motor by elastomeric means from the structure and the return line installation. Potential return line resonances originating from liquid borne noise can be further attenuated by providing a return line back pressure of 2 to 5 bar.

Polar moment of intertia and mass table

<table>
<thead>
<tr>
<th>Motor Frame Size</th>
<th>Displacement code</th>
<th>Polar Moment of Intertia (kg.m²) (Typical data)</th>
<th>Mass (kg) (Approx. all models)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC030</td>
<td>30</td>
<td>0.0120</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>0.0094</td>
<td></td>
</tr>
<tr>
<td>HMC045</td>
<td>45</td>
<td>0.0440</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>0.0410</td>
<td></td>
</tr>
<tr>
<td>HMC080</td>
<td>90</td>
<td>0.0520</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>0.0440</td>
<td></td>
</tr>
<tr>
<td>HMC125</td>
<td>125</td>
<td>0.2000</td>
<td>235</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.1400</td>
<td></td>
</tr>
<tr>
<td>HMC200</td>
<td>188</td>
<td>0.2300</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>0.1800</td>
<td></td>
</tr>
<tr>
<td>HMC270</td>
<td>280</td>
<td>0.4900</td>
<td>450</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>0.4700</td>
<td></td>
</tr>
<tr>
<td>HMC325</td>
<td>325</td>
<td>0.5000</td>
<td>460</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>0.4700</td>
<td></td>
</tr>
</tbody>
</table>
2-8 Motor Operation at Low Temperature

When operating the motor at low temperature consideration should be given to the fluid viscosity. The maximum fluid viscosity before the shaft should be turned is 2,000 cSt. The maximum fluid viscosity before load is applied to the motor shaft is 150 cSt.

If low ambient temperature conditions exist, then a crankcase flushing flow of at least 5 l/min should be applied to the motor during periods when the motor is not in use.

The shaft seal temperature limits for both medium and high pressure applications are shown in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Non-operating temperature limits</th>
<th>Minimum operating temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard pressure shaft seal</td>
<td>below minus 40°C and above 100°C</td>
<td>minus 30°C</td>
</tr>
<tr>
<td>High pressure shaft seal</td>
<td>below minus 30°C and above 120°C</td>
<td>minus 15°C</td>
</tr>
</tbody>
</table>

All seals are very brittle below minus 40°C and are likely to break very easily and due to their sluggish response may not provide a 100% leak free condition.

It should be noted that the maximum continuous operating temperature within the motor crankcase is plus 80°C.
2-9 Crankcase Drain Connections

**Motor axis - horizontal**

The recommended minimum pipe size for drain line lengths up to approx. 5m is 12.0 mm (½") bore. Longer drain lines should have their bore size increased to keep the crankcase pressure within limits.

**Motor axis - vertical shaft up**

Specify “V” within the model code for extra drain port, G¼” (BSPF). Connect this port into the main drain line downstream of a 0.35 bar check valve to ensure good bearing lubrication. The piping arrangement must not allow syphoning from the motorcase. (refer to installation drawing for details).

**Motor axis - vertical shaft down**

The piping, from any drain port, must be taken above the level of the motorcase to ensure good bearing lubrication. The arrangement must not allow syphoning from the motorcase.
2-10 Freewheeling Notes

All Staffa motors can be used in freewheeling applications. In all circumstances it is essential that the motor is unloaded (“A” and “B” ports connected together) and that the circuit is boosted. The required boost pressure is dependent on both the speed and displacement conditions of the motor determined by the maximum overrunning load condition (see boost pressure calculation method on page 19).

It should be noted that for “B” motors large flows will re-circulate around the motor. This will require a large recirculating valve and consideration of circuit cooling as the motor will be generating a braking torque. It is for these reasons that “C” series motors are the preferred option for freewheeling applications. It is normal to select displacement codes 00, 05 or 10.

Selecting the lowest zero displacement option (00) will allow the motor shaft to be rotated at high speed without pumping fluid and with a minimum boost and drive torque requirement. Consideration must also be given when freewheeling that the load does not drive the motor above its rated freewheeling speed condition. (see pages 22 to 28).

Displacement selection

Under all operating conditions the control pressure port should be at least 67% of the motor inlet/outlet pressure whichever is the higher.

A minimum control pressure at the low displacement selection port of 3.5 bar is necessary to ensure that the motor remains in its minimum displacement condition. A separate pressure supply may be necessary to ensure this condition is always maintained. It should be noted that with the loss of control pressure, the motor will shift to its high displacement condition, which could result in damage to the motor.

Boost requirement

The minimum required boost pressure as noted above can be ascertained utilising the calculation method shown on page 19. The maximum motor and control pressure at 100 rpm is 17 bar and must not be exceeded since higher pressures will increase motor losses at the conrod slipper interface and valve assembly and thereby will significantly increase the motor operating temperature.

The boost flow required should be sufficient to make-up circuit leakage loss and provide cooling for recirculating flow pressure drop.

Crankcase cooling

A crankcase flushing flow of up to 15 l/min can be used to control and reduce the temperature rise of the motor during the freewheel operation.

This should not be necessary for speeds below 1,000 rpm.

For speeds above this up to 1,500 rpm then crankcase flushing flow must be used.
2-11 Constant Pressure Regulator (CP)

Introduction

The constant pressure regulator control has been developed for the HMC dual displacement motor series. Whereas the standard dual displacement motor operates only at either maximum or minimum displacement, the constant pressure regulator continually adjusts the motor displacement within the selected displacement range so as to keep the hydraulic inlet pressure constant. In order to provide an infinite smooth and controllable displacement change an enhanced low friction crankshaft assembly with anti-scuffing features is utilised.

Description

A constant pressure regulated motor incorporates a pressure sensing control (CP in model code) which senses and responds to variations in motor inlet pressure. Changes in inlet pressure from a chosen, preset value cause the control to direct oil to the relevant displacement piston chamber within the crankshaft, thereby altering displacement so as to maintain the inlet motor pressure constant.

The factory preset pressure of this valve is matched to the specific power requirements of the application.

An optional ISO4401, size 3 override valve (CHP in the model code) can be incorporated which enables high and low displacements to be selected individually.

It should be noted that for inlet pressures below 7 bar, independent of the preset pressure setting, the motor will stay in its fail safe high displacement condition. An increasing pressure thereafter will instantaneously force the motor to its low displacement condition after which the constant pressure regulation will commence.

Consult KPM UK for further details.
2-12 Installation Data

General

Spigot
The motor should be located by the mounting spigot on a flat, robust surface using correctly sized bolts. The diametrical clearance between the motor spigot and the mounting must not exceed 0.15 mm. If the application incurs shock loading, frequent reversing or high speed running, then high tensile bolts should be used, including one fitted bolt.

Bolt Torque
The recommended torque wrench setting for bolts is as follows:

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Torque (N.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M18</td>
<td>312 +/- 7</td>
</tr>
<tr>
<td>½” UNF</td>
<td>265 +/- 14</td>
</tr>
<tr>
<td>M20</td>
<td>407 +/- 14</td>
</tr>
<tr>
<td>¾” UNF</td>
<td>393 +/- 14</td>
</tr>
</tbody>
</table>

Shaft coupling:
Where the motor is solidly coupled to a shaft having independent bearings the shaft must be aligned to within 0.13 mm TIR.

Motor axis - horizontal
The crankcase drain must be taken from a position above the horizontal centre line of the motor, (refer to installation drawing for details).

Motor axis - vertical shaft up
The recommended minimum pipe size for drain line lengths up to approx. 5 m is 12.0 mm as an internal diameter. If using longer drain lines, then increase the pipe internal bore diameter to keep the motorcase pressure within specified limits.

Specify “V” in the model code for extra drain port, G¼” (BSPF). Connect this port into main drain line downstream of a 0.35 bar check valve.

Motor axis - vertical shaft down
Piping (from any drain port) must be taken above level of motorcase.

Bearing lubrication - piping
The installation arrangement must not allow syphoning from the motorcase. Where this arrangement is not practical, please consult KPM UK.

Any of the drain port positions can be used, but the drain line should be run above the level of the uppermost bearing and if there is risk of syphoning then a syphon breaker should be fitted.

Start - up
Fill the crankcase with system fluid. Where practical, a short period (30 minutes) of “running in” should be carried out with the motor unloaded and set to its high displacement.
Conversion Table

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Torque</th>
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<tr>
<td>bar</td>
<td>Nm</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>PSI</td>
<td>lbf ft</td>
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<tr>
<td>14.5</td>
<td>1.737</td>
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</table>

<table>
<thead>
<tr>
<th>Flow</th>
<th>Power</th>
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<td>l/min</td>
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<td>0.264 US</td>
<td>1.341</td>
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<tr>
<td>0.219 UK</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mass</th>
<th>Length</th>
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<td>inch</td>
</tr>
<tr>
<td>1</td>
<td>25.4</td>
</tr>
<tr>
<td>2.2</td>
<td>1</td>
</tr>
</tbody>
</table>

3-1 HMC030

◆ 'P', 'S', 'Z' & 'Z2' Shafts

**SPLINE DATA**

'S'
TO BS 3550 (ANSI B92.1 CLASS 5)
FLAT ROOT SIDE FIT, CLASS 1
PRESSURE ANGLE 30°
NUMBER OF TEETH 17
PITCH 8/16
MAJOR DIAMETER 56.41/56.29
FORM DIAMETER 50.70
MINOR DIAMETER 50.06/49.60
PIN DIAMETER 6.096
DIAMETER OVER PINS 62.984/62.931

'Z'
DIN 5480 W55 x 3 x 17 x 7h

'Z2'
DIN 5480 W60 x 3 x 18 x 7h

KEY SUPPLIED—
14.046/14.028 WIDE
9.04/8.96 THICK

1/2"-20 UNF-2B X 32
FULL THREAD DEPTH

100
130.6
128.8

88.1
5

71 STRAIGHT

1/2"-20 UNF-2B X 32
FULL THREAD DEPTH

130.6
128.8
3-1 HMC030 (cont)

\* 'F3' & 'FM3' Valve Housings

**F3/FM3**

- 3” VALVE HOUSING WITH
- 1 1/4” SAE 4-BOLT FLANGES

**PORT FLANGE BOLT TAPPING SIZE**

- **F3**: 7/16”-14 UNC-2B X 27 FULL THREAD DEPTH
- **FM3**: M12 X P1.75 X 27 FULL THREAD DEPTH

**8 HOLES, SEE TABLE FOR THREAD SIZES**

**PORT 1**

- 30.2

**PORT 2**

- 30.2

**PORT FLANGE**

- 58.7

**SAE PORTS (3000 SERIES)**

- 1 1/4” CODE 61
3-1 HMC030 (cont)

'C', 'CS' & 'X' C Spacers

Mounting Interface for Directional Control

Valve* to: ISO 4401 Size 03/ANSI B93.7m Size D03
*Displacement Selector Valve is Not Supplied
With Motor; Specify & Order Separately

Displacement Selection:
High Displacement: P to B; A to T
Low Displacement: P to A; B to T

Connection to P Port
1/4" (BSPP) x 15
Full Thread Depth, Supplied Plugged

Displacement Selection (Via Remotely Located Valve*)
High Displacement: P to Y; X to T
Low Displacement: P to X; Y to T
*Displacement Selector Valve is Not Supplied with Motor; Specify & Order Separately

Types C & CS
Displacement Control

Type X
Displacement Control

CS Type Shuttle on F3 & FM3 Assemblies Only
3-1 HMC030 (cont)

Installation

3/8" BSP x 17 FULL THREAD (CHOICE OF 3 POSITIONS)
(2 NORMALLY PLUGGED)

NOTE: ENSURE ON INSTALLATION THAT DRAIN IS
TAKEN FROM ABOVE MOTOR CENTRELINE.
DO NOT EXCEED 12 DEPTH OF COUPLING
IN TO DRAIN PORT

FLOW DIRECTION FOR
ALL VLV HSG VARIANTS
EXCEPT F2/FM2/SM3

REVERSE PORT CONNECTIONS
FOR OPPOSITE DIRECTION OF
SHAFT ROTATION

SEE C–SPACERS

5 HOLES #18 EQU-SPACED AS
SHOWN ON A 260.1 P.C.D. SPOTFACED
TO GIVE AN EFFECTIVE #35.

+0.15
3-2 HMC045

- 'P', 'S', 'Z' & 'Z2' Shafts

**SPLINE DATA**

'S''
- TO BS 3550 (ANSI B92.1 CLASS 5)
- FLAT ROOT SIDE FIT, CLASS 1
- PRESSURE ANGLE: 30°
- NUMBER OF TEETH: 17
- PITCH: 8/16
- MAJOR DIAMETER: 56.41/56.29
- FORM DIAMETER: 50.70
- MINOR DIAMETER: 50.06/49.60
- PIN DIAMETER: 6.096
- DIAMETER OVER PINS: 62.984/62.931

'Z''
- DIN 5480 W55 x 3 x 17 x 7h

'Z2''
- DIN 5480 W60 x 3 x 18 x 7h
3-2 HMC045 (cont)

◆ 'F3' & 'FM3' Valve Housings

**F3/FM3**

3” VALVE HOUSING WITH
1 1/4” SAE 4-BOLT FLANGES

PORT FLANGE BOLT TAPPING SIZE –

F3: 7/16”–14 UNC–2B X 27 FULL THREAD DEPTH
FM3: M12 X P1.75 X 27 FULL THREAD DEPTH

1 1/4” CODE 61
S.A.E. PORTS
(3000 SERIES)

8 Holes, see table
for thread sizes

PORT 1

PORT 2

PORT 3

PORT 4

PORT 5

PORT 6

PORT 7

PORT 8

87

319

411

30.2

46.5

58.7

60.7

58.7

30.2

PORT 1

PORT 2

PORT 3

PORT 4

PORT 5

PORT 6

PORT 7

PORT 8

87

319

411

30.2

46.5

58.7

60.7

58.7

30.2
3-2 HMC045 (cont)

'C', 'CS' & 'X' C Spacers

Mounting Interface for Directional Control
Valve* to: ISO 4401 Size 03/ANSI B93.7M Size DD3
*Displacement Selector Valve is Not Supplied
With Motor: Specify & Order Separately

Connection to P Port
G1/4" (BSPP) X 15
Full Thread Depth, Supplied Plugged.

Displacement Selection:
High: Displacement: P to B; A to T
Low: Displacement: P to A; B to T

Displacement Selection (Via Remotely Located Valve*)
High: Displacement: P to Y; X to T
Low: Displacement: P to X; Y to T
*Displacement Selector Valve is Not Supplied with Motor; Specify & Order Separately

Types C & CS
Displacement Control

Type X
Displacement Control

CS Type Shuttle on F3 & FM3 Assemblies Only
3-2 HMC045 (cont)

Installation

3/4”-UNF-2B DRAIN (CHOICE OF 3 POSITIONS)
(2 NORMALLY PLUGGED)

NOTE:— ENSURE ON INSTALLATION THAT DRAIN IS TAKEN FROM ABOVE MOTOR CENTRELINE.
DO NOT EXCEED 12 DEPTH OF COUPLING IN TO DRAIN PORT

FLOW DIRECTION FOR ALL VLV HSG VARIANTS EXCEPT F2/FM2/SM3

REVERSE PORT CONNECTIONS FOR OPPOSITE DIRECTION OF SHAFT ROTATION

SEE C-SPACERS
3-3 HMC080

'S', 'S' & 'Z' Shafts

**SPLINE DATA**

'S'
- TO BS 3550 (ANSI B92.1 CLASS 5)
- FLAT ROOT SIDE FIT, CLASS 1
- PRESSURE ANGLE: 30°
- NUMBER OF TEETH: 14
- PITCH: 6/12
- MAJOR DIAMETER: 62.553/62.425
- FORM DIAMETER: 55.052
- MINOR DIAMETER: 54.084/53.525
- PIN DIAMETER: 8.128
- DIAMETER OVER PINS: 71.593/71.544

'Z'
- DIN 5480 W70 x 3 x 30 x 22 x 7h

KEY SUPPLIED:
- 18.037/18.019 WIDE
- 11.99/11.94 THICK

1/2"-20 UNF-2B X 32 FULL THREAD DEPTH
3-3 HMC080 (cont)

'T' Shaft

- KEY SUPPLIED—19.10/19.05 SQ.
- M20 x 2.5P x 50 LONG
- BASIC TAPER, ON DIA 0.1001/0.0999 : 1
- 45 MIN.

Dimensions:
- MOUNTING FACE: 95.2
- 6.4
- 10.92
- 10.77
- 83.5
- 81.9
- 165
3-3 HMC080 (cont)

'SM3' Valve Housing

SM3 - 3" VALVE HOUSING FOR BOLT ON MANIFOLD.

REVERSE PORT CONNECTIONS FOR OPPOSITE DIRECTION OF SHAFT ROTATION

HOLE DETAIL TYP. 4 POS'N

FLOW DIRECTION

VIEWS ON ARROW 'A'

MOUNTING FACE
3-3 HMC080 (cont)

'F3' & 'FM3' Valve Housings

F3/FM3 —
3” VALVE HOUSING WITH
1 1/4” SAE 4-BOLT FLANGES

PORT FLANGE BOLT TAPPING SIZE —
F3: 7/16”-14 UNC–2B X 27 FULL THREAD DEPTH
FM3: M12 X P1.75 X 27 FULL THREAD DEPTH

PORT 1

PORT 2

8 HOLES, SEE TABLE FOR THREAD SIZES
3-3 HMC080 (cont)

'F4' & 'FM4' Valve Housings

F4/PM4 — 4" VALVE HOUSING WITH 1 1/2" SAE 4-BOLT FLANGES

PORT FLANGE BOLT TAPPING SIZE —
F4: 5/8"-11 UNC-2B X 35 FULL THREAD DEPTH
FM4: M16 X P2 X 35 FULL THREAD DEPTH

Ø1 1/2" SAE (CODE 62) PORTS (6000 SERIES)

8 HOLES, SEE TABLE FOR THREADED SIZES

36.5 PORT 2

450 PORT 1

371 79.4

36.5

70.0

78.0

130
3-3 HMC080 (cont)

- 'C', 'CS' & 'X' C Spacers

**DISPLACEMENT SELECTION (via remotely located valve)**
- HIGH DISPLACEMENT: P to X, Y to T
- LOW DISPLACEMENT: P to X, Y to T
- *Displacement selector valve is not supplied with motor; specify & order separately*

**MOUNTING INTERFACE FOR DIRECTIONAL CONTROL VALVES TO ISO 4401 SIZE 03/ANSI 3003.7 SIZE 003**
- Connection to P port: G1/4" (BSPP) x 15 full thread depth, supplied plugged
- 4 holes M5 x 12 deep
- Orientation pin:

**CS TYPE SHUTTLE END CAP ON F4 & FM4 ASSEMBLIES ONLY**

**CS TYPE SHUTTLE ON F3 & FM3 ASSEMBLIES ONLY**
Installation

3/4"-16UNF-2B DRAIN (CHOICE OF 3 POSITIONS) (2 NORMALLY PLUGGED)

NOTE:— ENSURE ON INSTALLATION THAT DRAIN IS TAKEN FROM ABOVE MOTOR CENTRELINE.
DO NOT EXCEED 12 DEPTH OF COUPLING IN TO DRAIN PORT.

5 HOLES #20 EQUIL-SPACED AS SHOWN ON A [27.03] P.C.D. SPOTFACED TO GIVE AN EFFECTIVE #40.

SEE C-SPACERS
3-4 HMC125

'S1', 'S3' & 'Z3' Shafts

SPLINE DATA

'S'
TO BS 3550 (ANSI B92.1, CLASS 5)
FLAT ROOT SIDE FIT, CLASS 1
PRESSURE ANGLE 30'
NUMBER OF TEETH 20
PITCH 6/12
MAJOR DIAMETER 87.953/87.825
FORM DIAMETER 80.264
MINOR DIAMETER 79.485/78.925
PIN DIAMETER 8.128
DIAMETER OVER PINS 97.084/97.030

'S3' & 'Z3'
DIN 5480 W85 x 3 x 27 x 7h
3-4 HMC125 (cont)

'T' Shaft

MOUNTING FACE

KEY SUPPLIED -
22.27/22.22 WIDE
15.92/15.87 THICK

M30 x 60 LG
HEX HEAD SCREW

BASIC TAPER, ON DIAMETER
0.1001/0.0999 PER mm
3-4 HMC125 (cont)

'SM3' Valve Housing

- Flow Direction
- Hole Detail
- Mounting Face
- Reverse Port Connections for opposite direction of shaft rotation

SM3 = 3" Valve Housing for bolt on manifold.

Views on arrow 'A'
3-4 HMC125 (cont)

- 'F3' & 'FM3' Valve Housings

<table>
<thead>
<tr>
<th>F3/FM3</th>
<th>3&quot; VALVE HOUSING WITH 1 1/4&quot; SAE 4-BOLT FLANGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORT FLANGE BOLT TAPPING SIZE</td>
<td>-</td>
</tr>
<tr>
<td>F3: 7/16&quot;-14 UNC-2B X 27 FULL THREAD DEPTH</td>
<td></td>
</tr>
<tr>
<td>FM3: M12 X P1.75 X 27 FULL THREAD DEPTH</td>
<td></td>
</tr>
</tbody>
</table>

1 1/4" CODE 61 S.A.E. PORTS (3000 SERIES)

PORT 1

8 HOLES, SEE TABLE FOR THREAD SIZES

PORT 2

46.5

334

426
3-4 HMC125 (cont)

‘F4’ & ‘FM4’ Valve Housings

VIEWS ON ARROW ‘A’

F4/FM4 —
4” VALVE HOUSING WITH
1 1/2” SAE 4—BOLT FLANGES

PORT FLANGE BOLT TAPPING SIZE —
F4: 5/8”-11 UNC—2B X 35 FULL THREAD DEPTH
FM4: M16 X P2 X 35 FULL THREAD DEPTH

Φ1 1/2” SAE (CODE 62)
PORTS (6000 SERIES)

8 HOLES, SEE TABLE
FOR THREAD SIZES

PORT 1

PORT 2

347

402

36.5

79.4

480
3-4 HMC125 (cont)

'C', 'CS' & 'X' C Spacers

**HMC MOTORS**

**DISPLACEMENT SELECTION (Via Remotely Located Valve)**

High Displacement: P to Y; X to T

Low Displacement: P to X; Y to T

*Displacement Selector Valve Is Not Supplied With Motor; Specify & Order Separately*

**Mounting Interface For Directional Control**

Valve* to ISO 4405 Size 03, YAMS 883.19 Size 003

*Displacement Selector Valve Is Not Supplied With Motor; Specify & Order Separately*

**Connection To P Port**

1/4" (BSPP) x 1/2 Full Thread Depth, Supplied Plugged.

**Detail Scale 2:1**

4 Holes M5 x 12 Deep

FOR ORIENTATION MARK

---

**Types C & CS Displacement Control**

**CS Type Shuttle Endcap on F4 & FM4 Assemblies Only**

**CS Type Shuttle on F3 & FM3 Assemblies Only**
Installation

\( \frac{3}{8} \text{-} 16 \text{UNF} \text{-} 2B \text{ DRAIN (CHOICE OF 3 POSITIONS)} \)  
(2 NORMALLY PLUGGED)

**NOTE** — ENSURE ON INSTALLATION THAT DRAIN IS TAKEN FROM ABOVE MOTOR CENTRELINE. DO NOT EXCEED 12 DEPTH OF COUPLING IN TO DRAIN PORT.

SEE C-SPACERS

FLOW DIRECTION FOR ALL YLV HSG VARIANTS EXCEPT F2/FM2/SM3

REVERSE PORT CONNECTIONS FOR OPPOSITE DIRECTION OF SHAFT ROTATION

CLOCKWISE DIRECTION OF ROTATION

MOUNTING FACE

CENTRELINE OF DRAINS 203.8

44.4 MAX

5 HOLES #21 EQU-SPACED AS SHOWN ON A (191) PCD. SPOTFACED TO GIVE AN EFFECTIVE #40  
\( \phi \approx 0.15 \)
3-5 HMC200

**'P1', 'S3' & 'Z3' Shafts**

**SPLINE DATA**

**'S'**
- TO BS 3550 (ANSI B92.1, CLASS 5)
- FLAT ROOT SIDE FIT, CLASS 1
- PRESSURE ANGLE: 30°
- NUMBER OF TEETH: 20
- PITCH: 6/12
- MAJOR DIAMETER: 87.953/87.825
- FORM DIAMETER: 80.264
- MINOR DIAMETER: 79.485/78.925
- PIN DIAMETER: 8.128
- DIAMETER OVER PINS: 97.084/97.030

**'Z'**
- DIN 5480 WB5 x 3 x 27 x 7h

**'S3' & 'Z3'**
- 3/4"-16 UNF-2B X 32 FULL THREAD DEPTH
- 76 MIN STRAIGHT

**'P1'**
- KEY SUPPLIED:
  - 24.066/24.000 WIDE
  - 16.05/16.00 THICK
- 3/4"-16 UNF-2B X 32 FULL THREAD DEPTH
3-5 HMC200 (cont)

'T' Shaft

- Key supplied:
  - 22.27/22.22 wide
  - 15.92/15.87 thick

- Basic taper, on diameter:
  - 0.1001/0.0999 per mm

- M30 x 60 LG Hex Head Screw

Dimensions:
- Mounting Face: 133.4 mm
- Shaft Diameter: 9.575 mm
- 9.525 mm
- 85.344 (Datum)
- 61.8 mm
- 60.6 mm
- 172 mm
- 6.4 mm

- Shaft Length: 12 mm
3-5 HMC200 (cont)

'SM3' Valve Housing

- Flow direction
- Hole detail, typical 4 positions
- Mounting face
- Views on arrow 'A'
- SM3 - 3" valve housing for bolt on manifold.
- Reverse port connections for opposite direction of shaft rotation

Dimensions:
- Hole detail: A21, A14, 30
- Flow direction: 87
- Mounting face dimensions: 180, 31.8, 88, 379
3-5 HMC200 (cont)

- 'F3' & 'FM3' Valve Housings

F3/FM3 –
3” VALVE HOUSING WITH
1 1/4” SAE 4-BOLT FLANGES

PORT FLANGE BOLT TAPPING SIZE –
F3: 7/16”-14 UNC-2B X 27 FULL THREAD DEPTH
FM3: M12 X P1.75 X 27 FULL THREAD DEPTH

1 1/4” CODE 61 S.A.E. PORTS (3000 SERIES)

PORT 1

PORT 2

8 HOLES, SEE TABLE FOR THREAD SIZES

PORT 1

PORT 2

87

30.2

30.2

46.5

346

438
3-5 HMC200 (cont)

◆ 'F4' & 'FM4' Valve Housings

**F4/FM4**

- **4” Valve Housing with 1 1/2” SAE 4-Bolt Flanges**

**Port Flange Bolt Tapping Size**

- **F4:** 5/8”-11 UNC-2B X 35 Full Thread Depth
- **FM4:** M16 X P2 X 35 Full Thread Depth

**VIEW ON ARROW ‘A’**

- \( \Phi 1/2” \) SAE (Code 62) Ports (6000 Series)

- 8 Holes, See Table for Thread Sizes
3-5 HMC200 (cont)

'C', 'CS' & 'X' C Spacers

**HMC MOTORS**

'C', 'CS' & 'X' C Spacers

- **TYPE X**
  - DISPLACEMENT CONTROL

- **TYPES C & CS**
  - DISPLACEMENT CONTROL

- **CS TYPE SHUTTLE END CAP ON F4 & FM4 ASSEMBLIES ONLY**

- **CS TYPE SHUTTLE ON F3 & FM3 ASSEMBLIES ONLY**
3-5 HMC200 (cont)

Installation

3/4"-15SUNF-2B DRAIN (CHOICE OF 3 POSITIONS)
(2 NORMALLY PLUGGED)

NOTE: - ENSURE ON INSTALLATION THAT DRAIN IS
TAKEN FROM ABOVE MOTOR CENTRELINE.
DO NOT EXCEED 1/2 DEPTH OF COUPLING
IN TO DRAIN PORT.

5 HOLES #20 EQUALLY SPACED AS
SHOWN ON A (120) PCD SPOTFACED
TO GIVE AN EFFECTIVE #40

FLOW DIRECTION FOR
ALL VLV HSG VARIANTS
EXCEPT F2/FM2/SM3

REVERSE PORT CONNECTIONS
FOR OPPOSITE DIRECTION OF
SHAFT ROTATION

CLOCKWISE DIRECTION
OF ROTATION

SEE C-SPACERS
3-6 HMC270

• 'P1', 'S3' & 'Z4' Shafts

SPLINE DATA

'S'
TO BS 3550 (ANSI B92.1, CLASS 5)
FLAT ROOT SIDE FIT, CLASS 1
PRESSURE ANGLE 30°
NUMBER OF TEETH 20
PITCH 6/12
MAJOR DIAMETER 87.953/87.825
FORM DIAMETER 80.264
MINOR DIAMETER 79.485/78.925
PIN DIAMETER 8.128
DIAMETER OVER PINS 97.084/97.030

'Z'
DIN 5480 W90 x 4 x 21 x 7h
3-6 HMC270 (cont)

'T' Shaft

Key supplied:
- 25.45/25.40 Wide
- 17.539/17.483 Thick

Basic taper, on diameter:
- 0.1001/0.0999 per mm
3-6 HMC270 (cont)

'F4' & 'FM4' Valve Housings

F4/FM4 —
4" VALVE HOUSING WITH
1 1/2" SAE 4-BOLT FLANGES

PORT FLANGE BOLT TAPPING SIZE —
F4: 5/8"-11 UNC-2B X 35 FULL THREAD DEPTH
FM4: M16 X P2 X 35 FULL THREAD DEPTH

® 1/2" SAE (CODE 62)
PORTS (6000 SERIES)

8 HOLES; SEE TABLE FOR THREAD SIZES

PORT 1
70.0
36.5
79.4
375

PORT 2
79.4

430
511
3-6 HMC270 (cont)

'C', 'CS' & 'X' C Spacers

**DISPLACEMENT SELECTION (VIA REMOTELY LOCATED VALVE)***
HIGH DISPLACEMENT: P TO Y; X TO T
LOW DISPLACEMENT: P TO X; Y TO T
*DISPLACEMENT SELECTOR VALVE IS NOT SUPPLIED WITH MOTOR; SPECIFY & ORDER SEPARATELY

2 PORTS G1/4" (BSPP) X 10 FULL THREAD DEPTH

**MOUNTING INTERFACE FOR DIRECTIONAL CONTROL VALVE TO ISO 4401 SIZE 03/ANSI B105.7M SIZE 003**
*DISPLACEMENT SELECTOR VALVE IS NOT SUPPLIED WITH MOTOR; SPECIFY & ORDER SEPARATELY

**CONNECTION TO P PORT G1/4" (BSPP) X 15 FULL THREAD DEPTH SUPPLIED PLUGGED**

**DETAIL SCALE 2:1**

**#4.0 X 6 DEEP HOLE FOR ORIENTATION PIN**

**538.0**

**CS TYPE SHUTTLE ENDCAP ON F4 & FM4 ASSEMBLIES ONLY**
3-6 HMC270 (cont)

Installation

3/4"-16UNF-2B DRAIN (CHOICE OF 3 POSITIONS) (2 NORMALLY PLUGGED)
NOTE: ENSURE ON INSTALLATION THAT DRAIN IS TAKEN FROM ABOVE MOTOR CENTRELINE.
DO NOT EXCEED 12 DEPTH OF COUPLING IN TO DRAIN PORT

7 HOLES #30, EQUALLY SPACED AS SHOWN ON A 1/2" RC2 SPOTFACE TO GIVE EFFECTIVE #40

SEE C-SPACERS
3-7 HMC325

‘P1’, ‘S3’ & ‘Z4’ Shafts

**SPLINE DATA**

‘S’
- TO BS 3550 (ANSI B92.1, CLASS 5)
- FLAT ROOT SIDE FIT, CLASS 1
- PRESSURE ANGLE: 30°
- NUMBER OF TEETH: 20
- PITCH: 6/12
- MAJOR DIAMETER: 87.953/87.825
- FORM DIAMETER: 80.264
- MINOR DIAMETER: 79.485/78.925
- PIN DIAMETER: 8.128
- DIAMETER OVER PINS: 97.084/97.030

‘Z’
- DIN 5480 W90 x 4 x 21 x 7h

**KEY SUPPLIED –**
- 24.066/24.000 WIDE
- 16.05/16.00 THICK

3/4”-16 UNF-2B X 32
FULL THREAD DEPTH

---

‘P1’

140.2 3

187.7 189.4

‘S3’ & ‘Z4’

76 MIN STRAIGHT

138.2 139.9

3/4”-16 UNF-2B X 32
FULL THREAD DEPTH
3-7 HMC325 (cont)

' T ' Shaft

MOUNTING FACE

6.3
133.4

10.54
10.49

58.6
57.0

183

KEY SUPPLIED –
25.45/25.40 WIDE
17.539/17.463 THICK

M30 x 60 LG HEX HEAD SCREW

BASIC TAPER, ON DIAMETER
0.1001/0.0999 PER mm
3-7 HMC325 (cont)

'F4' & 'FM4' Valve Housings

F4/FM4 -
4" VALVE HOUSING WITH
1 1/2" SAE 4-BOLT FLANGES

PORT FLANGE BOLT TAPPING SIZE -
F4: 5/8"-11 UNC-2B X 35 FULL THREAD DEPTH
FM4: M16 X P2 X 35 FULL THREAD DEPTH

Ø1 1/2" SAE (CODE 62) PORTS (6000 SERIES)

8 HOLES, SEE TABLE FOR THREAD SIZES

PORT 1

PORT 2

DIMENSIONS:
79.4
79.4
78.0
70.0
36.5
36.5
430
511
375
3-7 HMC325 (cont)

'C', 'CS' & 'X' C Spacers

**DISPLACEMENT SELECTION (VIA REMOTELY LOCATED VALVE)
HIGH DISPLACEMENT: P TO Y, X TO T
LOW DISPLACEMENT: P TO X, Y TO T
*DISPLACEMENT SELECTOR VALVE IS NOT SUPPLIED WITH MOTOR; SPECIFY & ORDER SEPARATELY**

**MOUNTING INTERFACE FOR DIRECTIONAL CONTROL VALVE TO: ISO 4401 SIZE G3/ANSI B103.7M SIZE D03
*DISPLACEMENT SELECTOR VALVE IS NOT SUPPLIED WITH MOTOR; SPECIFY & ORDER SEPARATELY**

**DETAIL SCALE 2:1
#4.0 X 8 DEEP HOLE FOR ORIENTATION PIN**

**TYPE X DISPLACEMENT CONTROL**

**TYPES C & CS DISPLACEMENT CONTROL**

**CS TYPE SHUTTLE ENDCAP ON F4 & FM4 ASSEMBLIES ONLY**
3-7 HMC325 (cont)

Installation

3/4"-18UNF-2B DRAIN (CHOICE OF 3 POSITIONS)
(2 NORMALLY PLUGGED)

NOTE: ENSURE ON INSTALLATION THAT DRAIN IS TAKEN FROM ABOVE MOTOR CENTRELINE.
DO NOT EXCEED 12 DEPTH OF COUPLING IN TO DRAIN PORT

FLOW DIRECTION FOR ALL VLV HSG VARIANTS

REVERSE PORT CONNECTIONS FOR OPPOSITE DIRECTION OF SHAFT ROTATION

SEE C-SPACERS
3-12 Speed Sensing Options

Tj speed sensor with Tk readout option

Tj Speed Sensor Technical Specification

The Tj speed sensor is a hall effect dual channel speed probe that can provide feedback of both speed and direction.

- Signal Outputs: Square wave plus directional signal
- Power Supply: 8 to 32 V @ 40 mA
- Protection class: IP68
- Output frequency: 16 pulses/revolution

Installation Details

Tk Output Module

The Tk option consists of the Tj speed sensor together with the optional T401 output module.

The addition of the T401 module provides a software configured single channel tachometer and relay with a 0/4-20 mA analogue current output.

The software and calibration cable is also provided.
KA

AWASAKI PRECISION
MACHINERY (UK) LTD
Ernesettle, Plymouth
Devon, PL5 2SA, England

Tel: +44 1752 364394
Fax: +44 1752 364816
Mail: info@kpm-uk.co.uk
Website: www.kpm-eu.com

OTHER GLOBAL SALES OFFICES

JAPAN
Kawasaki Heavy Industry Ltd, Precision Machinery Ltd. Tokyo Office World
Trade Center Bldg.
4-1 Hamamatsu-cho
2-chome, Minato-ku
Tokyo 105-6116
Japan
Tel: +81-3-3435-6862
Website: www.khi.co.jp/kpm

U.S.A
Kawasaki Precision Machinery (U.S.A.), Inc.
3838 Broadmoor Avenue S.E.
Grand Rapids
Michigan 49512
U.S.A.
Tel: +1-616-975-3101
Website: www.kpm-usa.com

CHINA
Kawasaki Precision Machinery Trading (Shanghai) Co., Ltd. 17th Floor (Room
1701), The Headquarters Building No168 XiZang Road (M)
Huangpu District
Shanghai 200001
China
Tel: +86-021-3366-3800

KOREA
Flutek, Ltd
192-11, Shinchon-dong
Changwon
Kyungnam 641-370
Korea
Tel: +82-55-286-5551
Website: www.flutek.co.kr

The specified data is for product description purposes only
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confirmed in the contract.

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