Hydraulic Pump
Series F1
Fixed Displacement

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Conversion factors

- 1 kg = 2.20 lb
- 1 N = 0.225 lbf
- 1 Nm = 0.738 lbs ft
- 1 bar = 14.5 psi
- 1 l = 0.264 US gallon
- 1 cm³ = 0.061 cu in
- 1 mm = 0.039 in
- 9/5 °C + 32 = 1°F

VOAC Hydraulics reserves the right to modify products without prior notice.
Even though the brochure is revised and updated continuously, there is always a possibility of errors.
For more detailed information about the products, please contact VOAC Hydraulics.
F1, the 'truck pump', has been developed from our well known series F11 hydraulic pumps/motors. It is specifically designed for various truck applications and offers many unbeatable advantages for forest cranes, concrete mixers, container lifts, skip loaders, cargo cranes, and others.

Series F1 is very efficient. Its design is simple with small installation dimensions and few moving parts which contributes to high reliability and an altogether simpler and less expensive installation.

- High output power despite small envelope size
- High overall efficiency
- Operating pressures to 350 bar
- Compact and low weight
- Can be installed above the reservoir oil level
- Tolerates low temperatures
- Easy to service and dependable

All six frame sizes of series F1 have the same shaft end and mounting flange dimensions, and follow the current ISO standard. Consequently, the F1 can easily be installed on most European trucks.

Our product program also contains a series of PTO’s for the F1 pump that fit most truck gearboxes on the market.

### Design

#### Spherical pistons
The lightweight, spherical piston is the key to the so called 40° design, offering many advantages such as:
- Compactness
- Simple construction
- High pressure capability

#### Laminated piston rings
The three part, laminated piston ring offers:
- Low internal leakage
- Non-sensitivity to thermal shocks

#### Dependable piston locking
The specially formed piston ball end is secured in the input shaft socket which means:
- Fewer parts
- Increased dependability
- Simple assembly and disassembly

#### Positive synchronisation
The timing gear between the cylinder barrel and the input shaft contributes to the reliability of the pump.
- Tolerates diesel engine vibrations
- Less piston wear is experienced

#### Stands external shaft loads
The robust roller bearings permit a pulley or a gear to be mounted directly on the pump shaft without the use of additional bearings.

#### Few moving parts
Series F1 has a very simple design with few moving parts:
- Cylinder barrel with hold-down device
- Pistons with piston rings
- Shaft with timing gear and bearings

#### High overall efficiency
The spherical piston with laminated piston ring offers low leakage and has low mechanical losses. It leads to a lower power requirement and higher fuel efficiency.

#### Long life
The piston locking, the timing gear, and the small number of parts contribute to the F1's reputation as a very rugged pump with long life, high reliability, and low service requirement.
## Specifications

<table>
<thead>
<tr>
<th>Frame size</th>
<th>F1-20</th>
<th>F1-30</th>
<th>F1-40</th>
<th>F1-60</th>
<th>F1-80</th>
<th>F1-110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement [cm³/rev]</td>
<td>19.0</td>
<td>28.1</td>
<td>38.7</td>
<td>58.2</td>
<td>78.2</td>
<td>110.1</td>
</tr>
<tr>
<td>Max operating pressure [bar]</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>Shaft speed [rpm]</td>
<td>3000</td>
<td>2700</td>
<td>2400</td>
<td>2200</td>
<td>2000</td>
<td>1800</td>
</tr>
<tr>
<td>Short circuited pump (low press.)</td>
<td>2300</td>
<td>2000</td>
<td>1800</td>
<td>1500</td>
<td>1300</td>
<td>1300</td>
</tr>
<tr>
<td>Max selfpriming speed</td>
<td>3000</td>
<td>2700</td>
<td>2400</td>
<td>2200</td>
<td>2000</td>
<td>1800</td>
</tr>
<tr>
<td>Input power [kW]</td>
<td>28</td>
<td>36</td>
<td>46</td>
<td>56</td>
<td>66</td>
<td>88</td>
</tr>
<tr>
<td>Max intermittent</td>
<td>20</td>
<td>26</td>
<td>33</td>
<td>40</td>
<td>47</td>
<td>66</td>
</tr>
<tr>
<td>Max continuous</td>
<td>6.7</td>
<td>6.9</td>
<td>9.5</td>
<td>10</td>
<td>14</td>
<td>18</td>
</tr>
</tbody>
</table>

### Legend

1. End cap
2. Cylinder barrel
3. Piston with piston ring
4. Barrel housing
5. Timing gear
6. Roller bearings
7. Bearing housing with flange
8. Shaft seals
9. Input shaft
Pump and line selection

Pump selection
A suitable pump size for a truck application can be selected as follows:

Operating conditions
As an example, a cargo crane specifies:
- Flow: 60-80 l/min
- Pressure: 230 bar
- Diesel engine speed = 800 rpm

Determine pump speed
A Volvo type BKUH 1123 PTO on gearbox SR 1700, for example, has a gear ratio of 1:1.54.
The pump speed will be:
- 800 x 1.54 = 1200 rpm

Select a suitable pump size
Use diagram 1 and select a pump that will provide 60 - 80 l/min at 1200 rpm.
Follow line 'a' (1200 rpm) until it crosses line 'b' (70 l/min).
- F1-60 is a suitable choice

Required input torque
Make sure the PTO and the gearbox tolerates the pump torque.
Use diagram 2 and obtain the pump torque required.
Follow a line from 'c' (230 bar) until it crosses the F1-60 line (the selected pump).
- Read 220 Nm (at 'd')

Note: A rule-of-thumb is to select the highest PTO ratio and the smallest pump size that meets the crane specification without exceeding the pump speed, pressure, and power limitations shown in the specifications on page 4.

Pipe/line selection
Flow speeds shown in the table to the right should not be exceeded in order to obtain lowest noise and heat generation.
Select, from the lower table, the smallest line dimension that meets the flow speed recommendations.
- At 70 l/min a 38 mm suction line and a 19 mm pressure line is needed.

Note: Long lines may require larger dimensions.

Ordering code
Example: F1 - 80 - R
F1 frame size
20, 30, 40, 60, 80 or 110
Shaft rotation
R Right hand
L Left hand

Diagram 1

Diagram 2

<table>
<thead>
<tr>
<th>Fluid flow [l/min]</th>
<th>Flow speed [m/s] at indicated line size</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 mm</td>
<td>25</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>32 mm</td>
<td>75</td>
</tr>
<tr>
<td>38 mm</td>
<td>100</td>
</tr>
<tr>
<td>50 mm</td>
<td>150</td>
</tr>
</tbody>
</table>

Suction line
Pressure line

Standard versions
Designation | Ordering no.
F1-20-R      | 370 4520
F1-30-R      | 370 4530
F1-40-R      | 370 3940
F1-60-R      | 370 3960
F1-80-R      | 379 6380
F1-110-R     | 370 9110
Hydraulic Pump

Series F1

Installations dimensions

(Right hand F1-110 shown)

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Designation | F1-20 | F1-30 | F1-40 | F1-60 | F1-80 | F1-110
---|---|---|---|---|---|---
B1 | 98 | 98 | 98 | 98 | 98 | 98
C1 | 104 | 104 | 109 | 109 | 106 | 109
A3 | 144 | 145 | 163 | 167 | 203 | 208
B3 | 73 | 75 | 82 | 86 | 109 | 109
C3 | 53 | 53 | 60 | 60 | 68 | 74
D3 | 206 | 208 | 234 | 238 | 277 | 277
E3 | 191 | 194 | 217 | 221 | 256 | 256
F3 | 114 | 117 | 128 | 134 | 169 | 169
G3 | 104 | 104 | 119 | 119 | 127 | 127
A4 | 48 | 48 | 60 | 60 | 60 | 72
B4 | 106 | 106 | 114 | 114 | 120 | 148
Pressure port | 1/2" | 1/2" | 3/4" | 3/4" | 1" | 1"
Suction port | 3/4" | 3/4" | 1" | 1" | 1 1/4" | 1 1/4"

* Pressure and suction ports are BSP.
Installation and start-up

**Direction of rotation**
The pictures above show direction of flow vs. shaft rotation. The direction of rotation can be changed (i.e., from right hand to left hand) by turning the end cap. Remove the inspection port plug and turn the shaft until the marked teeth of the timing gear and cylinder barrel are visible through the port opening. Remove the four cap screws and turn the end cap 180° while making sure it stays in contact with the barrel housing. Re-fit the cap screws and torque to 50 - 70 Nm on F1-20 to -60. For the F1-80 and F1-110 torque to 80 - 100 Nm.

Check that the marked teeth are still properly engaged. Re-fit the plug (use a new washer) and torque to 70 - 100 Nm.

**Installation**
The robust shaft bearings allow the F1 to be mounted either on a bracket, driven by a belt or a prop-shaft, or directly on a PTO. The illustration to the right shows three ways of installing a gear on the F1 shaft. The pump shaft spline end usually fits directly in the PTO internal spline coupling.

**Filtration**
To obtain the longest F1 life, we recommend:
- 25 µm (absolute) in clean environment or at low pressures
- 10 µm (absolute) in contaminated environment or at high pressures

Filtration should follow ISO standard 4406, code 18/13.

**Start-up**
Make sure the entire hydraulic system is clean before filling it with a recommended hydraulic fluid. The pump must also be filled as internal leakage does not provide sufficient lubrication at start-up.

**F1 pumps don't need an external drain line as they are internally drained.**

**Important**
Our special tool (part no. 370 6851) facilitates installing couplings, sleeves, and gears on the pump shaft. Force must never be used when installing these parts on the F1 shaft.
Please contact our sales representative: