



# **Hydraulic Pump Series F1 plus**

**Fixed Displacement**

*Catalog 9129 8218-02  
February 1999, GB*



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## **Conversion factors**

|   |                      |
|---|----------------------|
| 1 kg  | 2.20 lb              |
| 1 N   | 0.225 lbf            |
| 1 Nm  | 0.738 lbf ft         |
| 1 bar                                       | 14.5 psi             |
| 1 l   | 0.264 US gallon      |
| 1 cm <sup>3</sup>                           | 0.061 cu in          |
| 1 mm  | 0.039 in             |
| $\frac{9}{5} \text{ }^{\circ}\text{C} + 32$ | 1 $^{\circ}\text{F}$ |

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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 Parker Hannifin (VOAC Hydraulics Div.).

## F1 *plus*

Series F1 *plus* is a further development of our well known 'truck pump', the F1. The F1 *plus* offers many additional values for operators of cargo cranes, hook loaders, skip loaders, forest cranes, concrete mixers and similar truck applications.

Series F1 *plus* is a very efficient and straight forward pump design with unsurpassed reliability. Its small envelope size makes for a simple and inexpensive installation requiring a minimum of piping.

### New features of the F1 *plus* are:

- Higher selfpriming speeds
- Operating pressures to 400 bar
- New frame sizes to meet market requirements
- Higher overall efficiency
- Increased reliability
- Reduced noise level
- Possible leakage paths reduced
- Easier to change direction of rotation
- Smaller installation dimensions

### ... thanks to:

- 45° bent-axis angle
- 6-piston technology
- Optimal inlet port geometry
- New ball and roller bearings
- Single housing design
- Optimized commutation - low flow pulsations

### All of this in addition to previous F1 features:

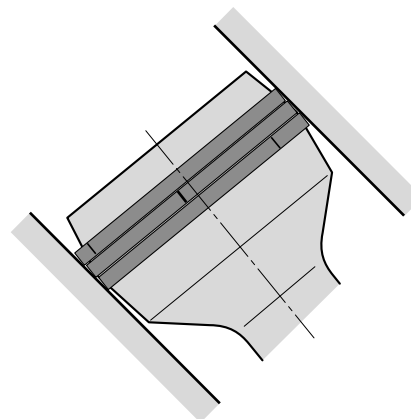
- Spherical pistons - high speeds
- Laminated piston rings - low leakage
- Positive synchronization with timing gear
- Installation above the reservoir level possible
- Tolerates low temperatures and high temperature shocks
- Shaft end and mounting flange meet the ISO standard



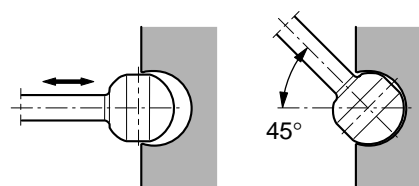
F1-25/-41/-51/-61.



F1-81/-101.



F1 piston with laminated piston ring.



F1 piston-to-shaft locking.

## Specifications

| F1 frame size                              | 25   | 41   | 51   | 61   | 81                 | 101                |
|--|------|------|------|------|--------------------|--------------------|
| <b>Displacement</b> [cm <sup>3</sup> /rev] | 24   | 38   | 49   | 61   | 80                 | 98                 |
| <b>Max flow</b> <sup>1)</sup> [l/min]      |      |      |      |      |                    |                    |
| at 350 bar                                 | 62   | 91   | 108  | 134  | 162 <sup>3)</sup>  | 176 <sup>3)</sup>  |
| at 400 bar                                 | 53   | 80   | 93   | 116  | 142                | 152                |
| <b>Max operating pressure</b> [bar]        |      |      |      |      |                    |                    |
| continuous                                 | 350  |      |      |      |                    | 350                |
| intermittent                               | 400  |      |      |      |                    | 400                |
| <b>Shaft speed</b> [rpm]                   |      |      |      |      |                    |                    |
| - short circuited pump (low press.)        | 2700 | 2700 | 2700 | 2700 | 2300               | 2300               |
| - max speed at 350 bar <sup>2)</sup>       | 2600 | 2400 | 2200 | 2200 | 2000 <sup>3)</sup> | 1800 <sup>3)</sup> |
| at 400 bar <sup>2)</sup>                   | 2200 | 2100 | 1900 | 1900 | 1750               | 1550 <sup>3)</sup> |
| <b>Torque</b> <sup>1)</sup> [Nm]           |      |      |      |      |                    |                    |
| at 350 bar                                 | 133  | 211  | 272  | 338  | 444                | 544                |
| at 400 bar                                 | 152  | 241  | 311  | 387  | 508                | 622                |
| <b>Input power</b> [kW]                    |      |      |      |      |                    |                    |
| - intermittent <sup>4)</sup>               | 36   | 53   | 63   | 78   | 95                 | 103                |
| - continuous                               | 29   | 43   | 50   | 63   | 76                 | 82                 |
| <b>Weight</b> [kg]                         | 8.5  | 8.5  | 8.5  | 8.5  | 12.5               | 12.5               |

1) Theoretical values

2) Valid at an inlet pressure of 1.0 bar (abs.) when operating on mineral oil at a viscosity of 30 mm<sup>2</sup>/s (cSt).

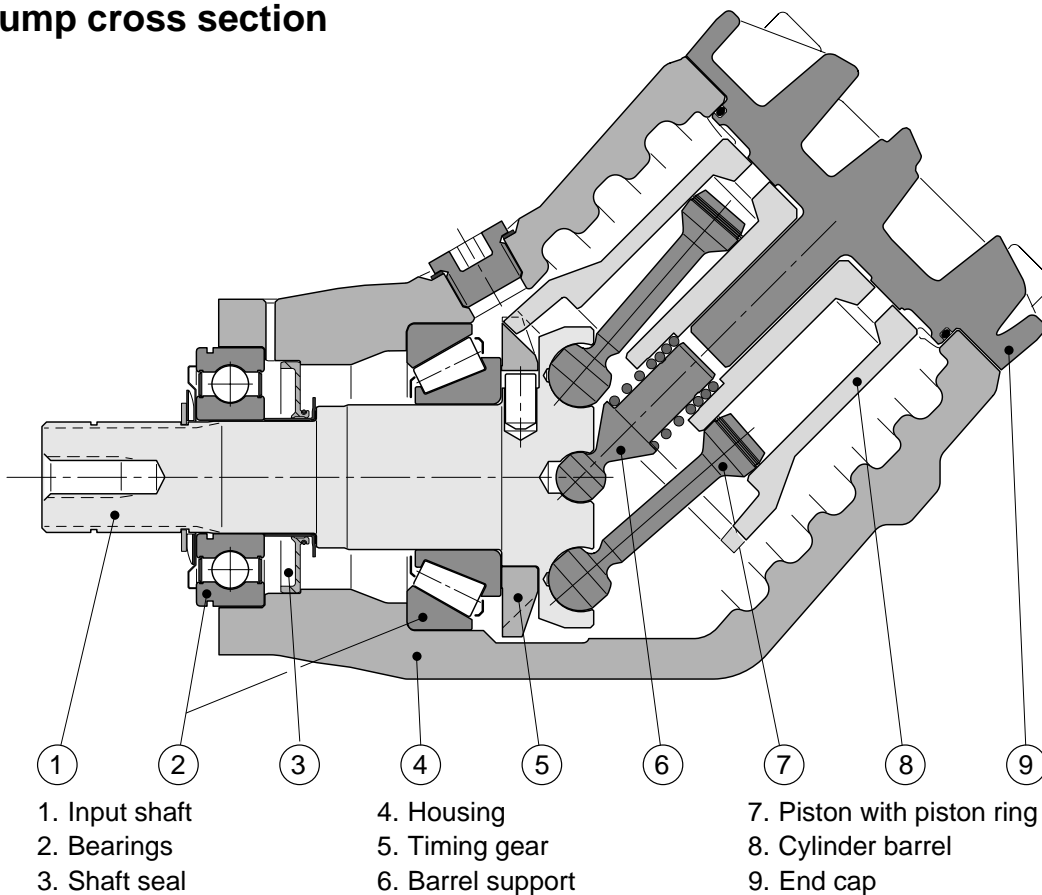
3) Valid with 2 1/2" inlet (suction) line.

With 2" suction line: F1-81 – max 1800 rpm (Q≈140 l/min);  
F1-101 – max 1400 rpm (Q≈140 l/min).

4) Max 6 seconds in any one minute.

**NOTE:** For noise level information, contact Parker Hannifin (VOAC Hydraulics Div.)

## Pump cross section



## Pump and line selection

### Pump selection

The following table shows pump flow at selected PTO gear ratios and engine rpm's.

**NOTE:** - No regard taken to efficiency.  
 - PTO gear ratio 1:0.8 (example):  
 1000 engine rpm - 800 PTO output shaft rpm.

| PTO gear ratio | Engine speed [rpm] | Pump flow [l/min] |       |       |       |       |        |
|----------------|--------------------|-------------------|-------|-------|-------|-------|--------|
|                |                    | F1-25             | F1-41 | F1-51 | F1-61 | F1-81 | F1-101 |
| 1:0.8          | 800                | 15                | 24    | 31    | 39    | 51    | 63     |
|                | 900                | 17                | 27    | 35    | 44    | 58    | 71     |
|                | 1000               | 19                | 30    | 39    | 49    | 64    | 78     |
|                | 1100               | 21                | 33    | 43    | 54    | 70    | 86     |
|                | 1200               | 23                | 36    | 47    | 59    | 77    | 94     |
| 1:1.0          | 800                | 19                | 30    | 39    | 49    | 64    | 78     |
|                | 900                | 22                | 34    | 44    | 55    | 72    | 88     |
|                | 1000               | 24                | 38    | 49    | 61    | 80    | 98     |
|                | 1100               | 26                | 42    | 54    | 67    | 88    | 108    |
|                | 1200               | 29                | 46    | 59    | 73    | 96    | 118    |
| 1.1.25         | 800                | 24                | 38    | 49    | 61    | 80    | 98     |
|                | 900                | 27                | 43    | 55    | 69    | 90    | 110    |
|                | 1000               | 30                | 48    | 61    | 76    | 100   | 123    |
|                | 1100               | 33                | 52    | 67    | 84    | 110   | 135    |
|                | 1200               | 36                | 57    | 74    | 92    | 120   | 147    |
| 1:1.5          | 800                | 29                | 46    | 59    | 73    | 96    | 118    |
|                | 900                | 32                | 51    | 66    | 82    | 108   | 132    |
|                | 1000               | 36                | 57    | 74    | 92    | 120   | 147    |
|                | 1100               | 40                | 63    | 81    | 101   | 132   | 162    |
|                | 1200               | 43                | 68    | 88    | 110   | 144   | 175    |

### Flow and torque formulas (no regard to efficiency)

Flow:  $Q = \frac{D \times n}{1000}$  [l/min]

where: D is pump displacement [cm<sup>3</sup>/rev]  
 n is shaft speed [rpm]

Torque:  $M = \frac{D \times p}{63}$  [Nm]

where: D is pump displacement [cm<sup>3</sup>/rev]  
 p is max utilized pressure [bar]

### NOTE:

- Make sure max torque and bending moment (due to the weight of the pump) of the utilized PTO are not exceeded. (The approx. center of gravity of the various pump sizes are shown in the installation drawings on pages 6 and 7).
- Make sure max allowed output torque from the PTO is not exceeded.
- Contact Parker Hannifin (VOAC Hydraulics Div.) if the inlet (suction) pressure is believed to be less than 1.0 bar (absolute); insufficient inlet pressure can cause noise and pump damage because of cavitation.

### Line selection

In order to obtain sufficient inlet (suction) pressure to the pump, low noise level and low heat generation, flow speeds shown in table 1, right, should not be exceeded.

From table 2, select the smallest line dimension that meets the flow speed recommendation; example:

- At 100 l/min, a 50 mm suction line and a 25 mm pressure line is needed.

**NOTE:** Long inlet (suction) lines, low inlet pressure (caused by e.g. a reservoir positioned below the pump) and/or low temperatures may require larger line dimensions.

Alternatively, the pump speed will have to be lowered to avoid pump cavitation (which may cause noise, deteriorating performance and pump damage).

| Line type     | Flow speed [m/s] |
|---------------|------------------|
| Suction line  | max 1.0          |
| Pressure line | max 5.0          |

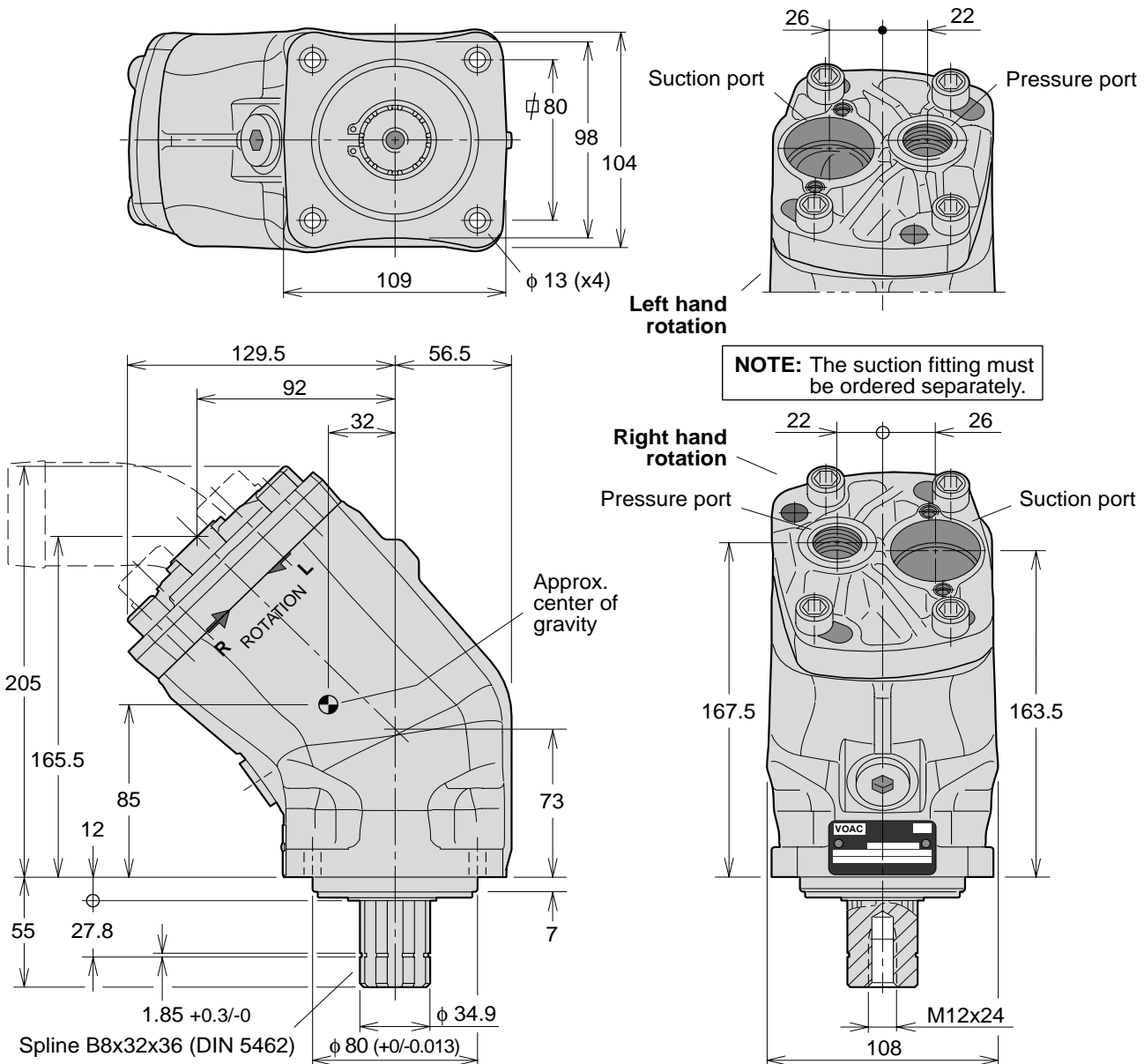
Table 1.

| Fluid flow [l/min] | Flow speed [m/s] at indicated line size [mm] |     |     |     |     |     |
|--------------------|--|-----|-----|-----|-----|-----|
|                    | 19   | 25  | 32  | 38  | 50  | 63  |
| 25                 | 1.5  | 0.8 | 0.5 | 0.4 | 0.2 | 0.1 |
| 50                 | 2.9  | 1.7 | 1.0 | 0.7 | 0.4 | 0.3 |
| 75                 | 4.4  | 2.5 | 1.6 | 1.1 | 0.6 | 0.4 |
| 100                | -  | 3.4 | 2.1 | 1.5 | 0.8 | 0.5 |
| 150                | -  | -   | 3.1 | 2.2 | 1.3 | 0.8 |
| 200                | -  | -   | 4.1 | 2.9 | 1.6 | 1.0 |

Table 2.

Pressure line

## Installations dimensions, F1-25, -41, -51 and -61



### Ordering code

Example: **F1- 81 - R**

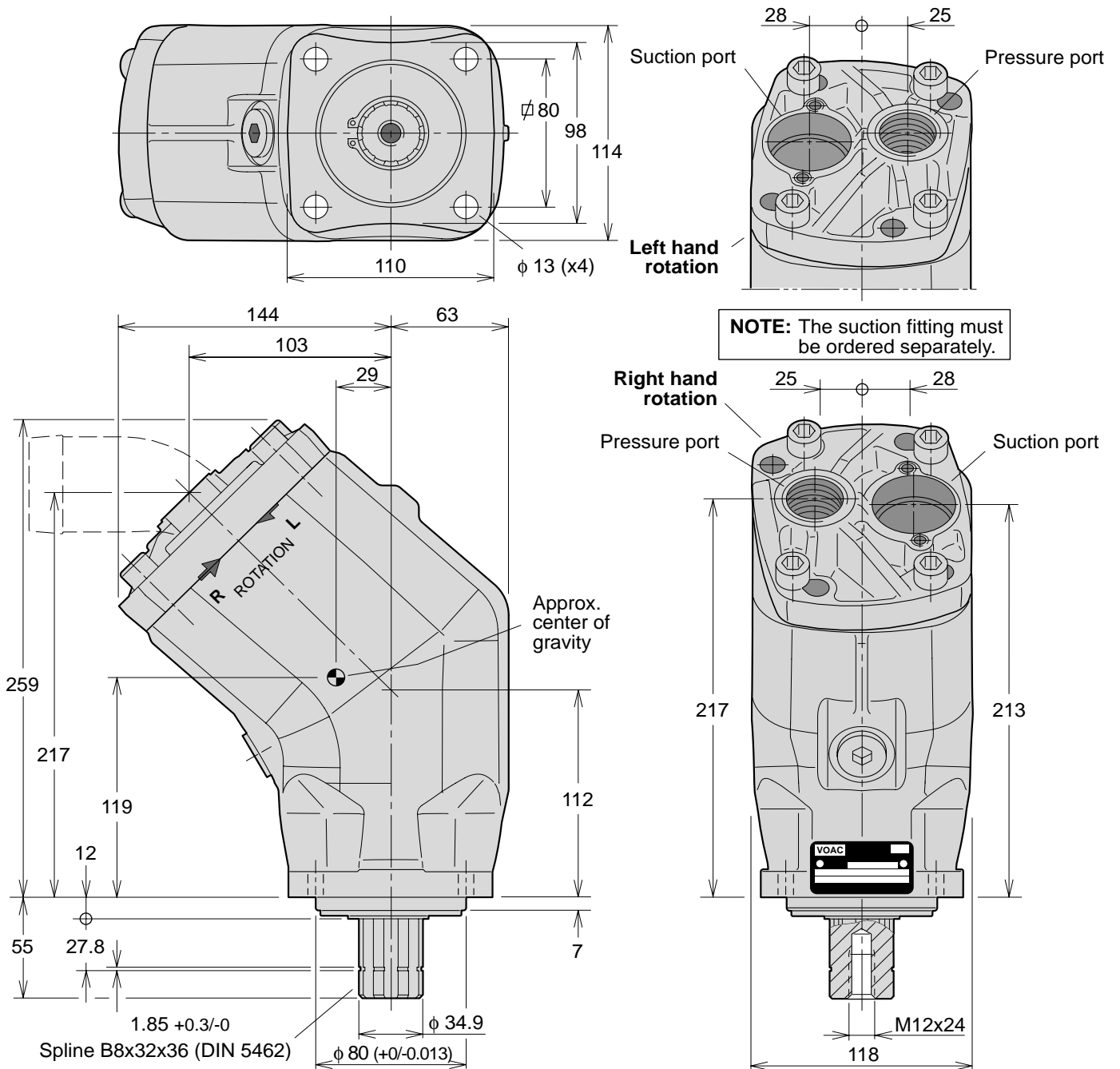
F1 frame size  
**25, 41, 51, 61, 81 or 101**

Shaft rotation  
**R** Right hand  
**L** Left hand

### Standard versions

| Designation | Ordering no. |
|-------------|--------------|
| F1-25-R     | 378 1024     |
| -L          | 378 1025     |
| F1-41-R     | 378 1040     |
| -L          | 378 1041     |
| F1-51-R     | 378 1050     |
| -L          | 378 1051     |
| F1-61-R     | 378 1060     |
| -L          | 379 1061     |

## Installations dimensions, F1-81 and -101



### Port size

| F1 frame size | Pressure port 1) |
|---------------|------------------|
| -25           | 3/4"             |
| -41           | 3/4"             |
| -51           | 3/4"             |
| -61           | 3/4"             |
| -81           | 1"               |
| -101          | 1"               |

1) BSP thread (fitting not included).

**NOTE:** The suction fitting should be ordered separately; refer to page 8.

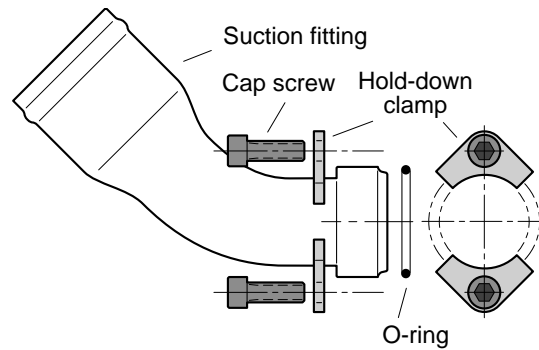
### Standard versions

| Designation | Ordering no. |
|-------------|--------------|
| F1-81-R     | 378 1080     |
| -L          | 378 1081     |
| F1-101-R    | 378 1100     |
| -L          | 378 1101     |

## Suction fittings

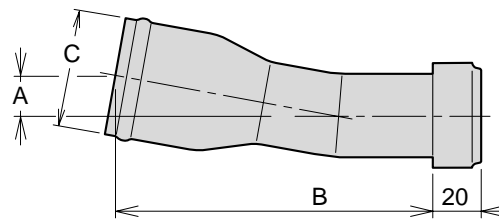
**NOTE:** The F1plus pump **does not** include a suction fitting; it must be ordered separately.

A 'suction fitting' consists of a straight, 45° or 90° suction fitting, 2 clamps, 2 cap screws and an O-ring.



### 'Straight' suction fittings

| Ordering no. | A mm | B mm | C dia. mm (in.) |
|--------------|------|------|-----------------|
| 378 0635     | 0    | 85   | 38 (1½")        |
| 378 0636     | 17   | 136  | 50 (2")         |
| 378 0637     | 25   | 145  | 63 (2½")        |
| 378 0973     | 17   | 136  | 45              |
| 378 0974     | 17   | 136  | 48              |



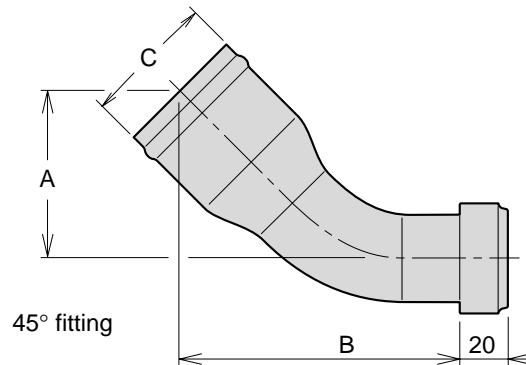
'Straight' fitting

### 45° suction fitting

| Ordering no.           | A mm | B mm | C dia. mm (in.) |
|------------------------|------|------|-----------------|
| 378 0633 <sup>1)</sup> | 60   | 104  | 38 (1½")        |
| 378 0364 <sup>2)</sup> | 67   | 110  | 50 (2")         |
| 378 0634               | 75   | 117  | 63 (2½")        |
| 378 1062               | 67   | 110  | 40              |
| 378 0975               | 67   | 110  | 45              |
| 378 0965               | 67   | 110  | 48              |

1) Suitable for frame size F1-25.

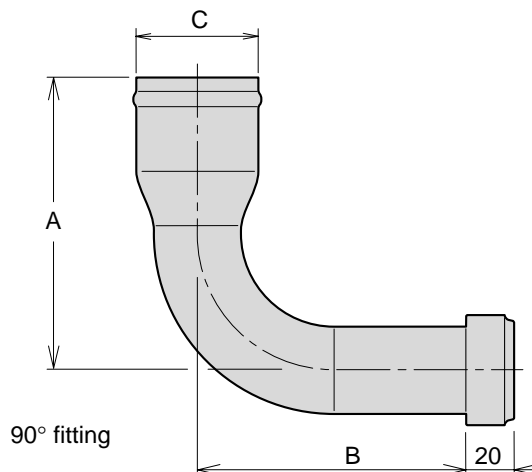
2) Suitable for pump sizes F1-41,-51,-61,-81, -110.



45° fitting

### 90° suction fitting

| Ordering no. | A mm | B mm | C dia. mm (in.) |
|--------------|------|------|-----------------|
| 378 0978     | 126  | 83   | 38 (1½")        |
| 378 0979     | 135  | 83   | 50 (2")         |
| 378 0976     | 135  | 83   | 45              |
| 378 0977     | 135  | 83   | 48              |



90° fitting

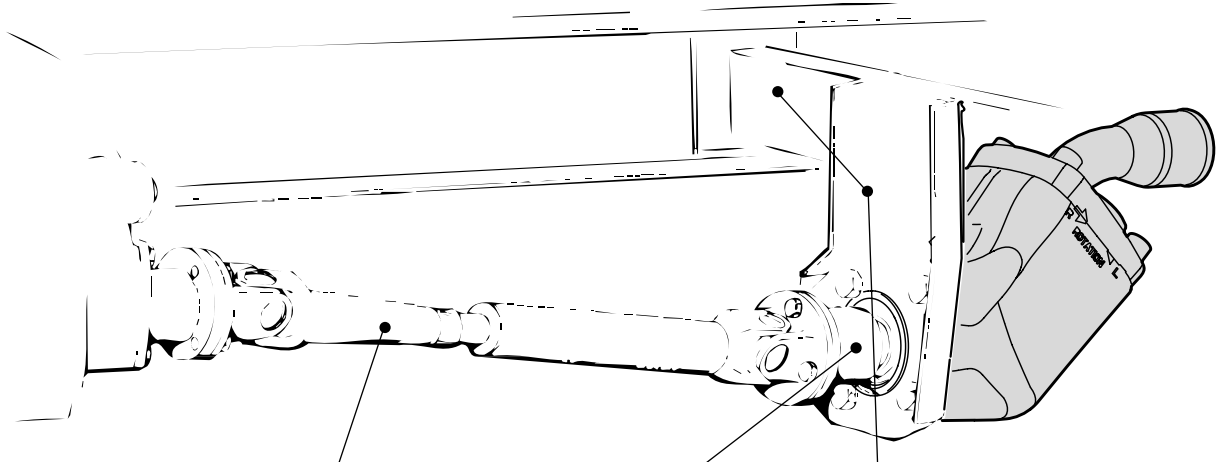
**NOTE:** Suction fittings fit all frame sizes (F1-25, -41, -51, -61, -81 and -101).  
A suction fitting *must be ordered separately* (not included with the pump).



## Cardan shafts, pump couplings and mounting brackets

**NOTE 1:** For additional information, please contact Parker Hannifin (VOAC Hydraulics Div.) or refer to the 'Truck Accessories' catalog (order no. 9129 8242-02).

**NOTE 2:** When considering installing F1 plus pumps on a splitter box, please contact Parker Hannifin (VOAC Hydraulics Div.).



| Pump type | Cardan shaft kit |              | Pump coupling |              | Bracket kit ordering no. |
|-----------|------------------|--------------|---------------|--------------|--------------------------|
|           | Type             | Ordering no. | Type          | Ordering no. |                          |
| F1 plus   | SAE 88           | 073 001      | SAE 88        | 378 0644     | 379 7832                 |
| F1 plus   | SAE 97           | 370 0315     | SAE 97        | 378 0645     | 379 7832                 |

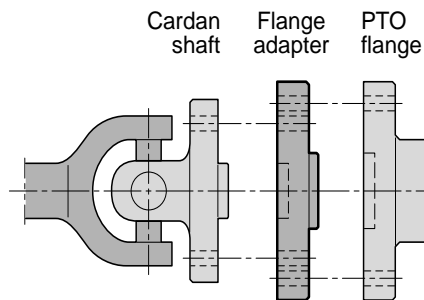
### Cardan shaft specifications

| Cardan shaft type | Spicer designation | Max length [mm]    | Diameter [mm] | Max torque peak/contin. [Nm] | Ordering number |
|-------------------|--------------------|--------------------|---------------|------------------------------|-----------------|
| SAE 88            | K1140              | 1220 <sup>2)</sup> | 45            | 600/300                      | 073 001         |
| SAE 97            | K1310              | 1220 <sup>2)</sup> | 50            | 1000/500                     | 370 0315        |

2) One end not welded

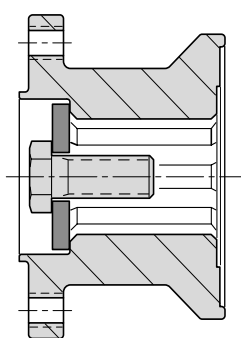
### PTO flange adapters

| Cardan shaft type | PTO flange type | Flange adapter ordering no. |
|-------------------|-----------------|-----------------------------|
| SAE 88            | SAE 116         | 370 5895                    |
| SAE 97            | SAE 116         | 370 5896                    |
| SAE 116           | SAE 97          | 370 5897 <sup>3)</sup>      |
| DIN 90            | DIN 100         | 370 5898                    |
| DIN 100           | DIN 90          | 370 5899 <sup>3)</sup>      |



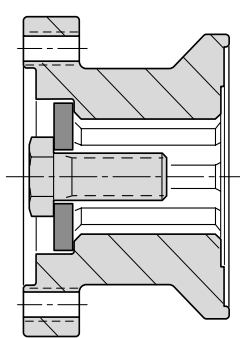
3) Refer to: 'Truck Accessories' (catalog 9129 8242-02)

### F1 plus pump coupling kits



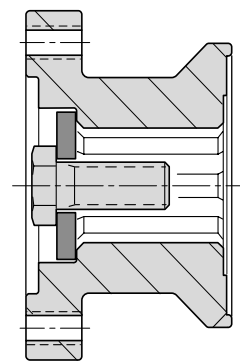
DIN 90<sup>4)</sup>

Order. no. 378 0642



SAE 88<sup>4)</sup>

Order. no. 378 0644



SAE 97<sup>4)</sup>

Order. no. 378 0645

4) Contact Parker Hannifin (VOAC Hydraulics Div.) for installation dimensions.

## Accessories

### BPV-F1-25 and -81 bypass valves

- The bypass valve is mainly utilized in applications where the F1 plus pump is driven from the crankshaft through a cardan shaft or belt, or when it is installed on an engine PTO.
- The BPV bypass valve should be engaged during transportation when the pump is operating constantly and the engine is running at max rpm; the hydraulic system is not sized for the large flow that will otherwise go through the hydraulic system.
- *The hydraulic system must be of the 'open centre' type so that a cooling flow of some 5–10% is circulating through the system; this flow will usually be sufficient to prevent heat build-up during transportation.*
- In addition, the BPV valve substantially reduces the energy loss during transportation.
- The valve installs directly on top of the pump end cap with a pressure port 'banjo' fitting and an inlet port spacer bushing with two cap screws; refer to the illustration to the right.
- As the BPV valve is symmetrical it can be 'turned 180°' to prevent interference with chassis components; it can also be utilized for left or right hand pumps.
- The valve function must only be activated or released (by means of the 24 VDC solenoid) at *no-load system pressure (below 20 bar)*.

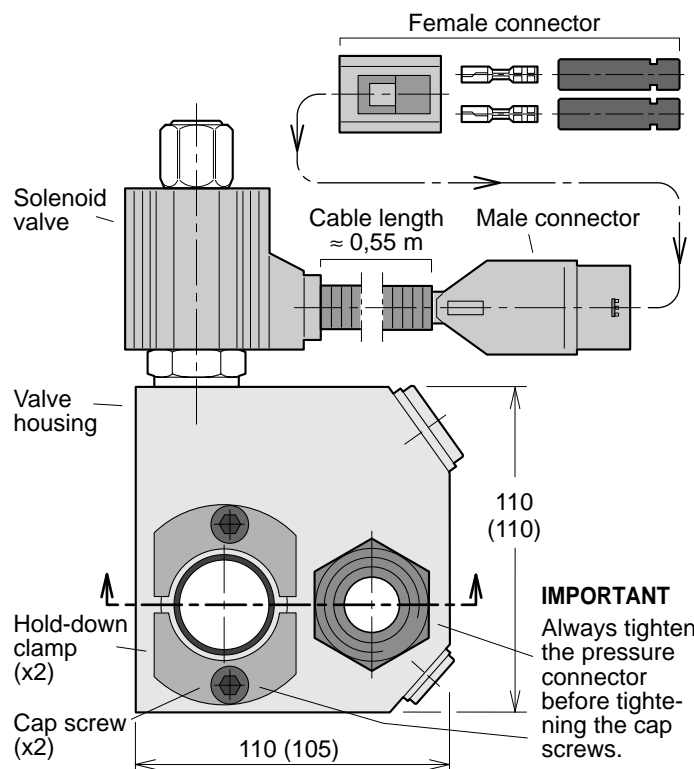
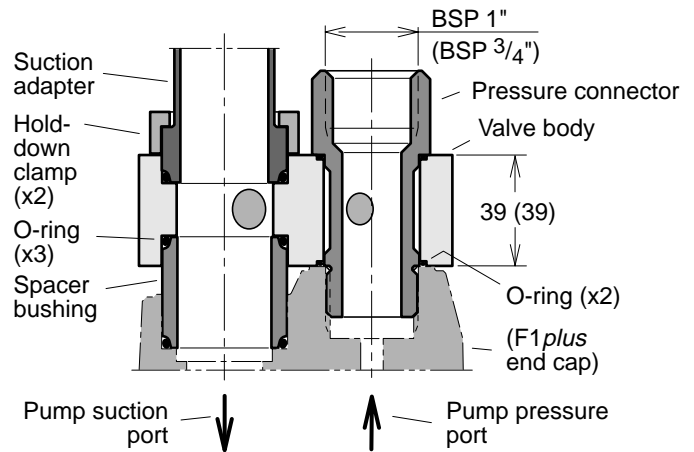
### IMPORTANT

- Make sure a small oil flow (some 5–10% of the pump flow) comes out of the filter (at 'p' in the schematic below right) when the bypass valve solenoid is not activated.

| Bypass valve, type             | BPV-F1-25/-81                             |
|--------------------------------|---|
| Max pressure, continuous [bar] | 350                                       |
| intermittent [bar]             | 400                                       |
| Solenoid voltage [VDC]         | 24  |
| Power requirement [W]          | 10.5                                      |
| Operating mode                 | Activated solenoid:<br>Check valve closed |

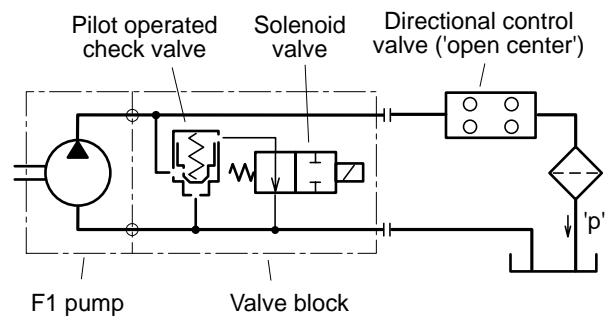
| Bypass valve kit design. | Ordering number | For F1 size  | Torque pressure connector to: |
|--------------------------|-----------------|--|-------------------------------|
| BPV-F1-25                | 378 1064        | -25/-41/<br>-51/-61  | 50 Nm                         |
| BPV-F1-81                | 378 1065        | -81/-101   | 100 Nm                        |
| O-ring kit               | 378 0641        | Contains all five O-rings (as illustrated to the right); included in the valve kits. |                               |

**NOTE:** A 12 VDC solenoid is available as an option.



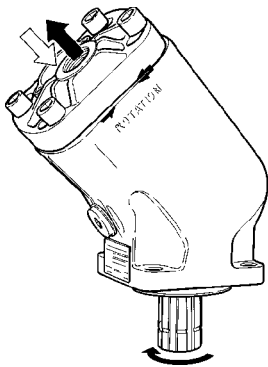
**NOTE:** Dimensions are shown for BPV-F1-81; (those for BPV-F1-25 are in parenthesis).

*Bypass valve installation and cross section.*

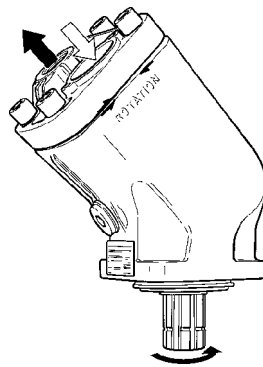


*Bypass valve schematic.*

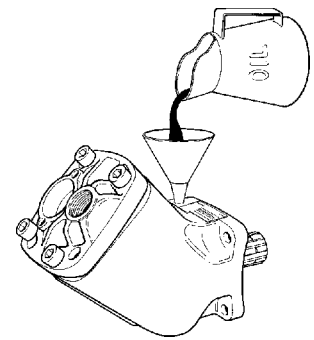
## Installation and start-up



Left hand rotation.



Right hand rotation.



Before start-up, the housing must be filled with hydraulic fluid.

### 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 four cap screws and turn the end cap about half a turn while making sure it stays in contact with the barrel housing.

Re-fit the cap screws and torque to 80-100 Nm.

### Installation

The robust shaft bearings allow the F1 plus to be mounted either on a bracket, driven by a belt or a cardan shaft, or directly on a PTO.

The illustration to the right shows two ways of installing a gear on the F1 plus shaft. The pump shaft spline end usually fits directly in the PTO internal spline coupling.

### Fluid viscosity

Recommended viscosity:  
20 to 30 mm<sup>2</sup>/s (cSt).

Operating viscosity limits:

- Min 10 mm<sup>2</sup>/s; max 400 mm<sup>2</sup>/s.
- At start-up, max 4000 mm<sup>2</sup>/s.

**NOTE:** - The suction port should always be above the pressure port when the pump is installed above the reservoir oil level.  
- During operation, the pump must be filled with oil to at least 50%.

### IMPORTANT

Force must **never** be used when installing a coupling, a sleeve or a gear on the F1 plus pump shaft. The tool shown in the illustration to the right facilitates installation.

### Fluids

The F1 plus data shown in the specifications on page 4 are valid when operating on high quality, mineral based hydraulic oil.

Type HLP (according to DIN 51524) hydraulic oil is suitable as well as biologically degradable fluids like natural and synthetic esters and polyalphaolefins.

The utilized hydraulic fluid shall meet one of the following Swedish standards:

- SS 15 54 34
- SMR Hydraulic Oil Standard 1996-2.

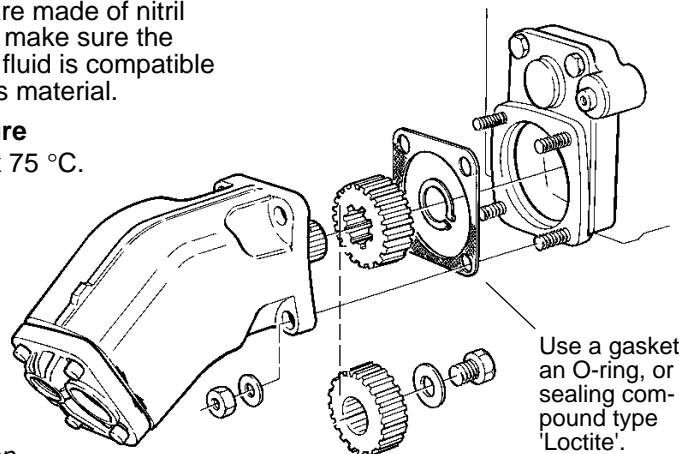
Refer to Parker Hannifin (VOAC Hydr. Div.) for further information.

**NOTE:** - ATF (automatic transmission fluid) and API type CD engine oils may also be useable.

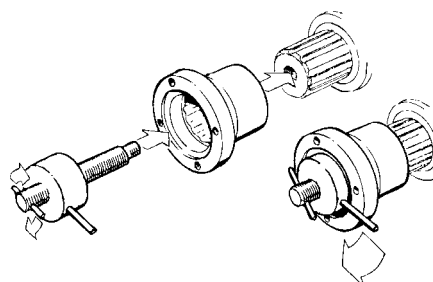
- Seals are made of nitril rubber; make sure the utilized fluid is compatible with this material.

### Fluid temperature

Main circuit: Max 75 °C.



F1 plus installation.



Installation tool (P/N 370 6851).

### Drain line

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

### Filtration

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

To obtain the longest F1 plus life, we recommend an oil cleanliness of 10 µm (absolute).

### Start-up

Make sure the entire hydraulic system is clean before filling it with a recommended hydraulic fluid.

In particular, make sure the pump is filled (to at least 50%) as the internal leakage does not provide sufficient lubrication at start-up.

**NOTE:** When considering installing an F1 plus on a splitter box, please refer to the installation information provided on pages 24 and 25 of the 'Truck Accessories' catalog (order no. 9129 8242-02).



Please contact our sales representative:



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