Niehues
Hydraulik · Automation

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Truck Hydraulics

Series GPA, GP1, F1, T1, F2, F3, VP1, Fixed and Variable Displacement Pumps, Motors and Accessories

Parker

ENGINEERING YOUR SUCCESS.

Archivierung: 04/2022

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Basic formulas for hydraulic pumps

Flow (q)

$$q = \frac{D \times n \times \eta_v}{1000} \text{ [l/min]}$$

Torque (M)

$$M = \frac{D \times \Delta p}{63 \times \eta_{hm}} \text{ [Nm]}$$

Power (P)

$$P = \frac{q \times \Delta p}{600 \times \eta_t} \text{ [kW]}$$

D – displacement [cm^3/rev]

n – shaft speed [rpm]

η_v – volumetric efficiency

Δp – differential pressure [bar] (between inlet and outlet)

η_{hm} – mechanical efficiency

η_t – overall efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

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^3	0.061 cu in
1 mm	0.039 in
$^9/_5$ °C + 32	1°F
1 kW	1.34 hp

On our website, www. parker.com/pmde, you can find:
2D & 3D drawings,
Installation Manuals,
Service Manuals,
Spare Parts Lists

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

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GPA and GP1 Pumps

Light/medium duty pumps
Parker's truck gear pumps are ideal for operators of light trucks for their hydraulic power needs.

The GPA/GP1 series gear pumps are available to suit most applications. They are light and compact, and can be installed in either rear or or side mount configuration thanks to their unique dual port layout.

The smaller GPA series is built with an extruded aluminum housing for minimum weight.

The larger GP1 pumps are built with compact cast iron housings for strength.

The gear pumps complement our heavy duty piston pumps and vane pumps.

The performance and characteristics are ideal for many light and/or intermittent applications, including the famous Parker reliability, and they are engineered witha long, trouble-free service life.

Series GPA

Series GP1

Features

- Compact and light weight – easy to install even on small vehicles
- Quiet operation – low noise emissions are important in sensitive areas
- Robust and reliable – means a long, trouble-free service life
- Built for high rpm's – less sensitive to over-speeding
- Bi-directional – easy to install
- Side or rear mount – use the ports on the side or at the rear, whichever is most suitable for the application.

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F1 Pump ISO

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

Series F1 is a very efficient and straight forward pump design with unsurpassed reliability.

Its small envelope size gives a simple and inexpensive installation.

Features of the F1 are:

- High selfpriming speeds
- Operating pressures up to 400 bar
- High overall efficiency
- Low noise level
- Small installation dimensions
- Low weight

... thanks to:

- 45° bent-axis angle
- Optimal inlet port geometry in the end cap
- Single housing design
- Spherical pistons – high speeds
- Laminated piston rings – low leakage
- Positive synchronisation 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 for all sizes

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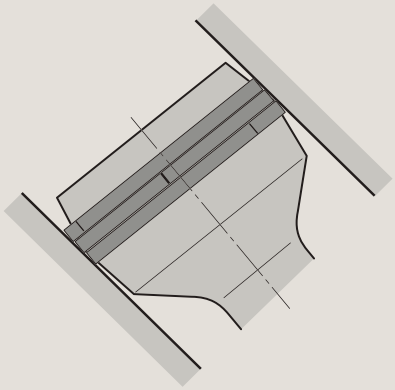
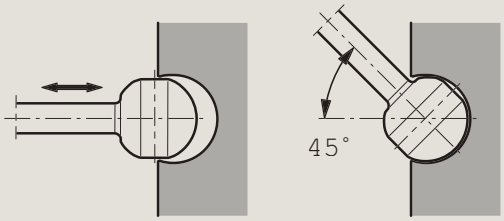


F1 piston with laminated piston ring.



F1 piston-to-shaft locking.

F1 Pump SAE

Features:

- Laminated piston rings – low leakage
- Positive synchronisation with timing gear
- Operating pressure up to 350 bar
- Installation above the reservoir level possible
- Tolerates low temperatures and high temperature shocks
- Shaft end and mounting flange meet the standard SAE-B
- 4 sizes -25 / -41 / -51 / -61 cm^3/rev

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F1 Motor ISO

Features:

- Laminated piston rings – low leakage
- Positive synchronisation with timing gear
- Operating pressure up to 250 bar
- Tolerates low temperatures and high temperature shocks
- Shaft end and mounting flange meet the ISO standard for all sizes
- Tolerates high acceleration

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Pump and Line selection

Installation guide lines for GPA, GP1, F1, T1, F2, F3 and VP1 pumps

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Pump selection

F1, T1 and F3

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

PTO gear ratio	Engine speed [rpm]	Pump flow [l/min]						
		F1-25	F1-41	F1-51	F1-61	F1-81 T1-81 F3-81	F1-101 F3-101	T1 121
1:0.8	800	16	26	33	38	52	66	76
	900	18	29	37	43	59	74	85
	1000	20	33	41	48	65	82	95
	1100	23	36	45	52	72	91	104
	1200	25	39	49	57	78	99	114
1:1.0	800	20	33	41	48	65	82	95
	900	23	37	46	54	73	93	107
	1000	26	41	51	60	82	103	119
	1100	28	45	56	65	90	113	130
	1200	31	49	61	71	98	123	142
1:1.25	800	26	41	51	60	82	103	119
	900	29	46	57	67	92	116	133
	1000	32	51	64	74	102	129	148
	1100	35	56	70	82	111	141	163
	1200	38	61	77	89	122	154	178
1:1.5	800	31	49	61	71	98	123	142
	900	35	55	69	80	110	139	160
	1000	38	61	77	90	122	154	178
	1100	42	67	84	98	135	170	196
	1200	46	74	92	107	147	185	213

NOTE:

- Make sure max torque and bending moment (due to the weight of the pump) of the utilised PTO are not exceeded. (The approx. center of gravity of the various pump sizes are shown in the installation drawings).
- Make sure max allowed output torque from the PTO is not exceeded.
- Contact Parker Hannifin 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.

Flow and torque formulas
no regard to efficiency)

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

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

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

where: D is pump displacement [cm^3/rev]
p is utilised pressure [bar]

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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

As example a PTO with 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).

- F1-61 is a suitable choice

Required input torque

Make sure the PTO and the gear-box tolerates the pump torque. Use diagram 2 to obtain the required pump torque.

Follow a line from 'c' (230 bar) until it crosses the F1-61 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.

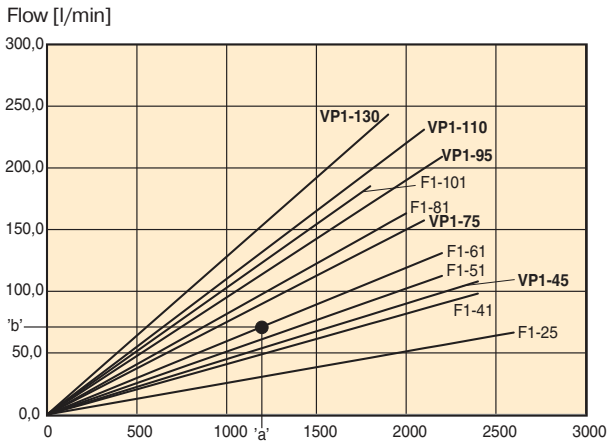

Diagram 1.

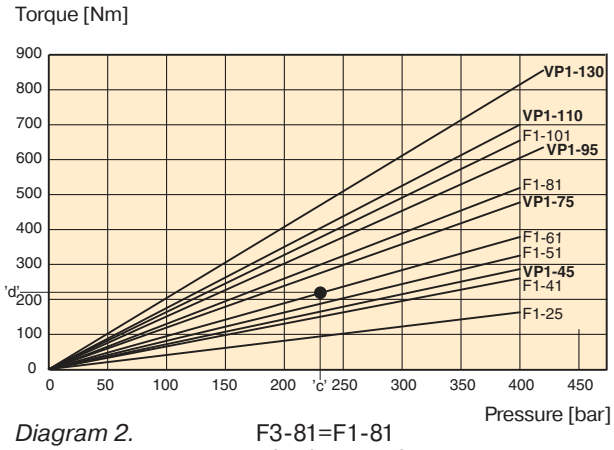

Diagram 2.

F3-81=F1-81
F3-101=F1-101

Line selection

all pumps

Line type	Flow velocity [m/s]
Inlet (suction)	max 1.0
Outlet (pressure)	max 5.0

Flow rate	Flow velocity [m/s] at selected line sizes [mm/inches]						
[l/min]	19 / $^3/_4$"	25 / 1"	32 / 1$^1/_4$"	38 / 1$^1/_2$"	51 / 2"	64 / 2$^1/_2$"	75 / 3"
25	1.5	0.8	0.5	0.4	0.2	0.1	0.1
50	2.9	1.7	1.0	0.7	0.4	0.3	0.2
75	4.4	2.5	1.6	1.1	0.6	0.4	0.3
100	5.9	3.4	2.1	1.5	0.8	0.5	0.4
150	8.8	5.1	3.1	2.2	1.3	0.8	0.5
200	-	-	4.1	2.9	1.6	1.1	0.7
250	-	-	5.3	3.7	2.1	1.3	0.9

Inlet (suction) line

Table 1. Outlet (pressure) line

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Pump & Motor Division Europe
Trollhättan, Sweden

In order to obtain sufficient inlet (suction) pressure to the pump, low noise level and low heat generation, flow speeds shown in table 2, right, should not be exceeded.

From table 1 (page 14), 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 velocity [m/s]
Inlet (suction)	max 1.0
Outlet (pressure)	max 5.0

Table 2.

Nomogram

Flow – Line dimension – Flow velocity

Example 1
Pressure line
Q = 65 l/min
d = 3/4"
v = 3.8 m/s

Example 2
Suction line
Q = 50 l/min
v = 0.8 m/s
d = 1 1/2"

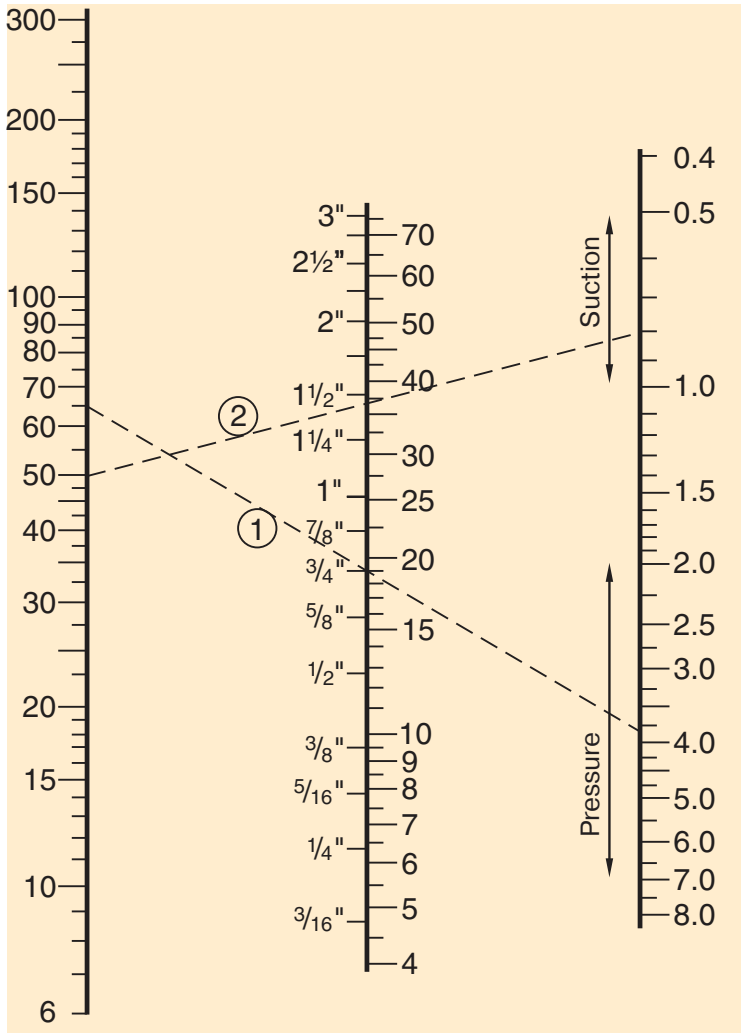

Table 3.

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Pump & Motor Division Europe
Trollhättan, Sweden

F1 Pump

F1-ISO

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F1-25 to -101, ISO

Specifications

Frame size F1-	25	41	51	61	81	101
Displacement [cm^3/rev]	25.6	40.9	51.1	59.5	81.6	102.9
Max flow [1)] [l/min]	78	104	125	143	180	216
Max operating pressure [bar]	400	400	400	400	400	400
Mass moment of inertia J [kgm^2]	0.00274	0.00266	0.00261	0.00257	0.00532	0.00524
Shaft speed [rpm]						
- short circuited pump (low press.)	3100	2700	2700	2700	2300	2300
- max selfpriming speed[2)]	3050	2550	2450	2400	2200	2100
Torque [1)] [Nm]	163	260	324	378	518	653
Max Input power[3)] [kW]	45	61	73	83	105	126
Weight [kg]	8.5	8.5	8.5	8.5	12.5	12.5

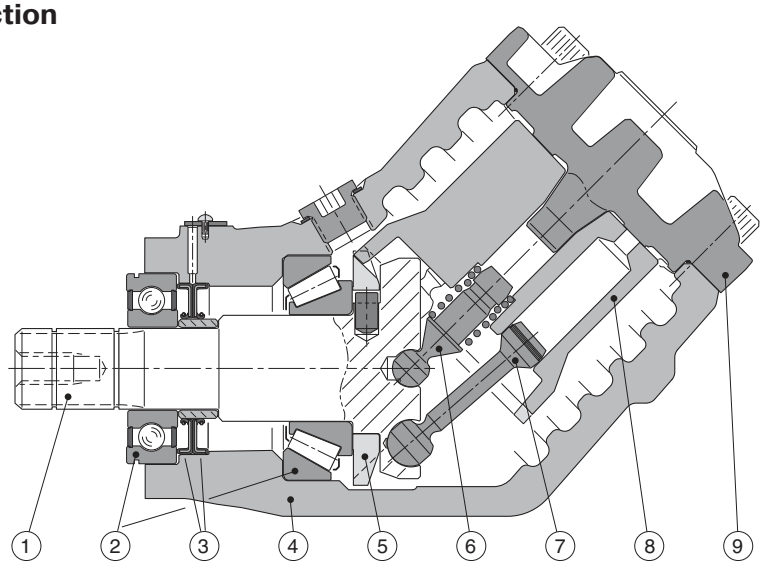
1) Theoretical values

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

3) Max 6 seconds in any one minute.

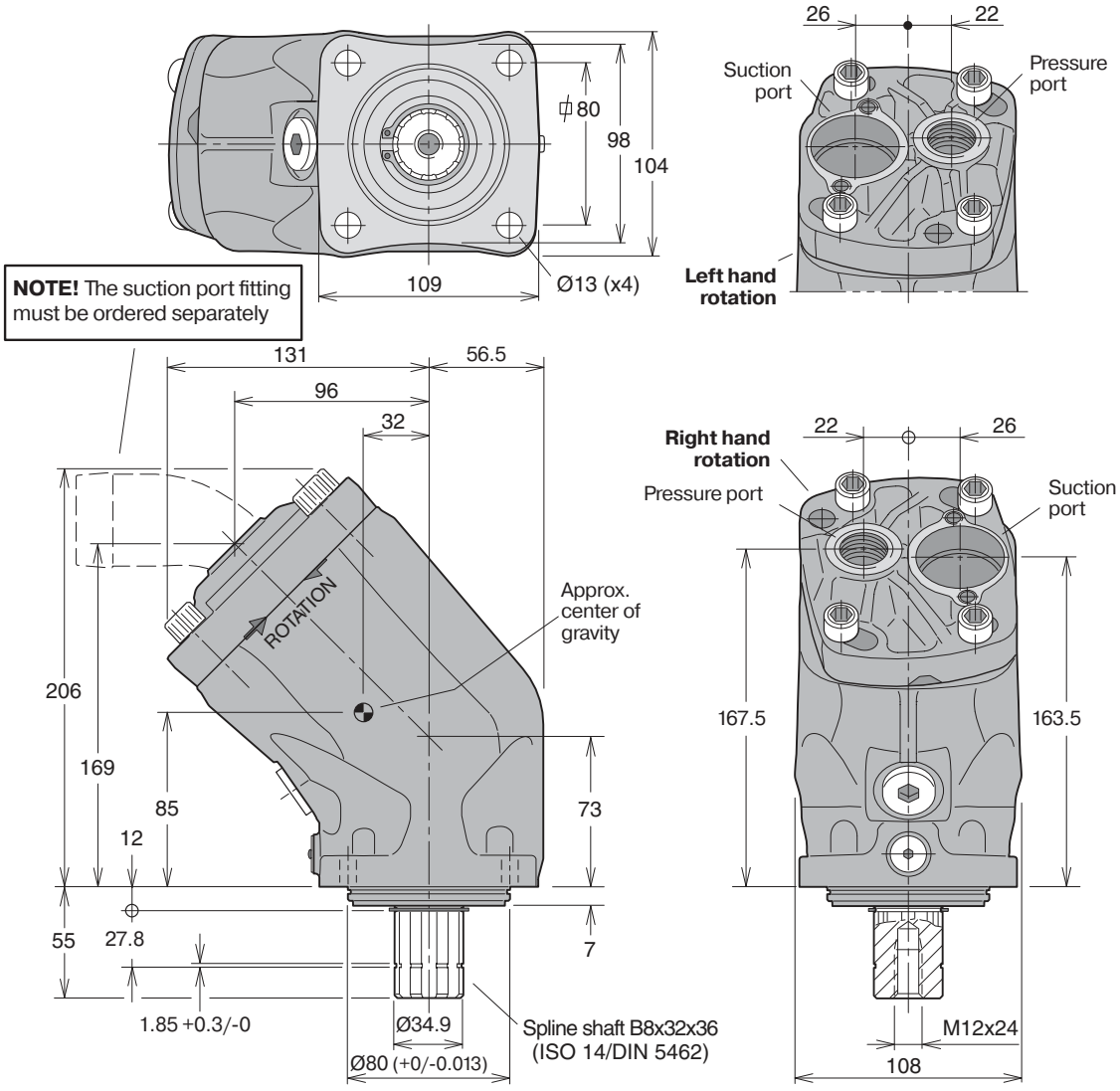
NOTE: For noise level information, contact Parker Hannifin

Pump cross section



1. Input shaft
2. Bearings
3. Shaft seals
4. Housing
5. Timing gear
6. Barrel support
7. Piston with piston ring
8. Cylinder barrel
9. End cap

F1-25, -41, -51 and -61



Ordering code

Example: **F1 - 81 - R**

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

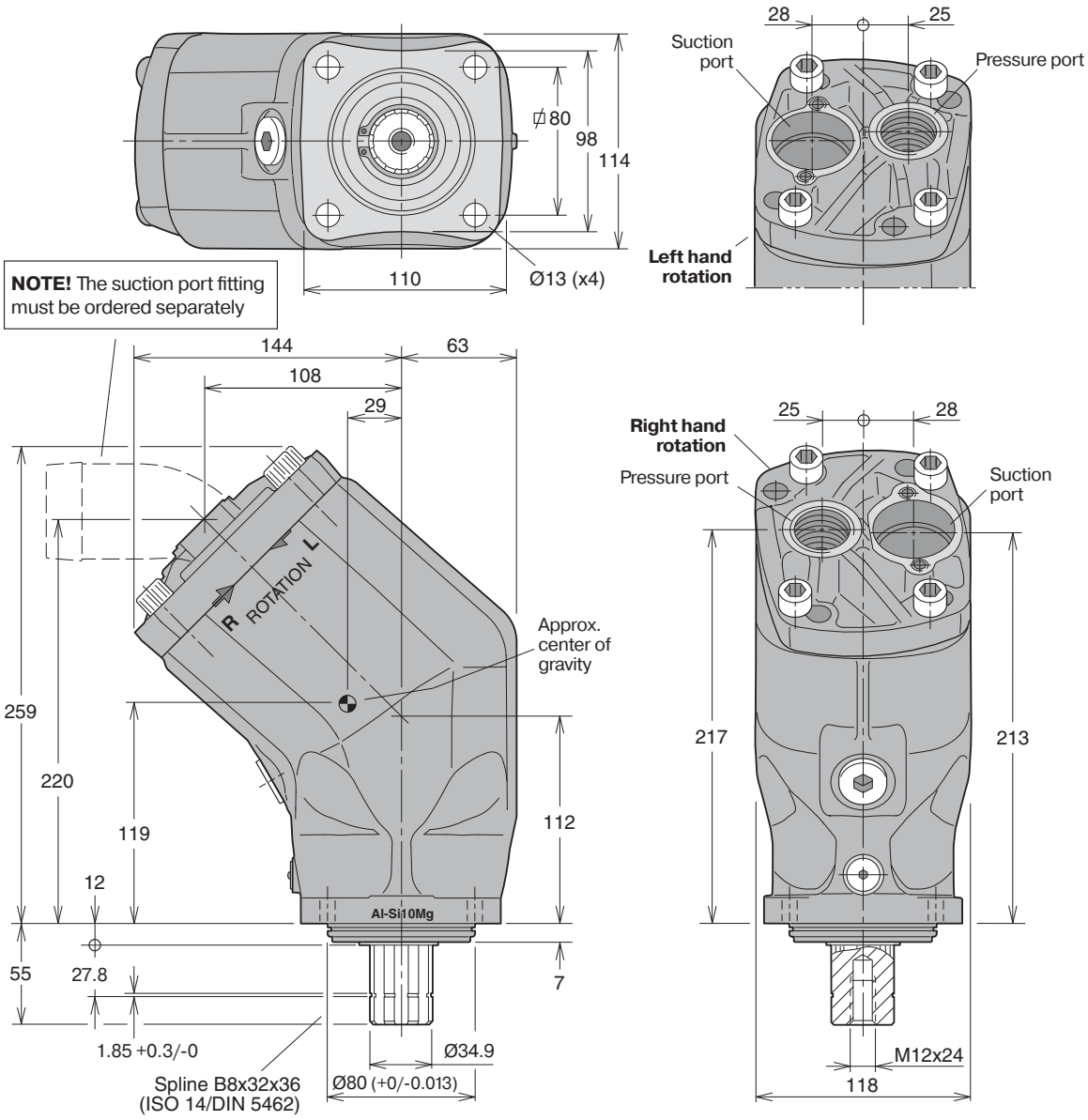
Shaft rotation
R Right hand
L Left hand

NOTE: The pump **does not** include a suction fitting; it must be ordered separately. See page 57ff.

Standard versions

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

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"

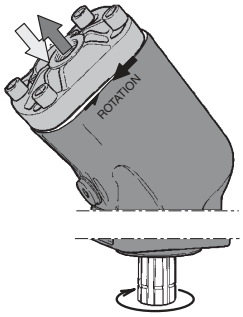
[1] BSP thread (fitting not included)

Standard versions

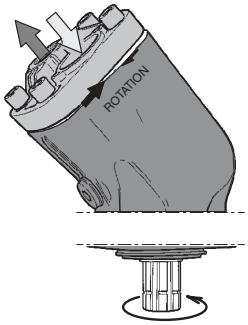
Designation	Ordering no.
F1-81-R	378 1080
F1-81-L	378 1081
F1-101-R	378 1100
F1-101-L	378 1101

NOTE: The pump **does not** include a suction fitting; it must be ordered separately. See page 57ff.

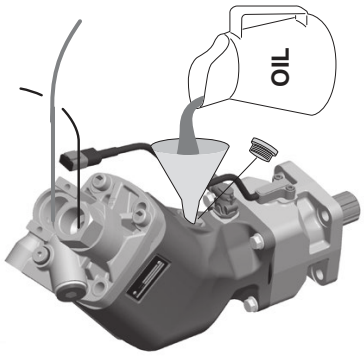
Installation and start-up for F1, T1, F2 and F3



Left hand (L.H.; counter clockwise) rotating pump.



Right hand (R.H.; clockwise) rotating pump.



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
Make sure max torque and bending moment (due to the weight of the pump) of the utilised PTO are not exceeded. (The approx. center of gravity of the various pump sizes are shown in the installation drawings).

The top illustration on page 73 shows two ways of installing a gear on the shaft of fixed displacement pumps. The pump shaft spline end usually fits directly in the PTO internal spline coupling.

NOTE: In order to obtain the longest bearing life, the pump should be installed according to the information shown on page 76"Pump bearing life".

Fluid viscosity
Recommended viscosity:
20 to 30 mm^2/s (cSt).

Operating viscosity limits:
- Min 10 mm^2/s; max 400 mm^2/s.
- At start-up, max 4000 mm^2/s.

Fluids
The fixed displacement pumps data shown in the specifications for each pump 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 degradeable fluids like natural and synthetic esters and polyalfaolefins.

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

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

Contact Parker Hannifin for further information.

NOTE: - ATF (automatic transmission fluid) and API type CD engine oils may also be useable.
- Seals are made of nitrile rubber; make sure the utilised fluid is compatible with this material.

Fluid temperature
Main circuit: Max 75 °C.

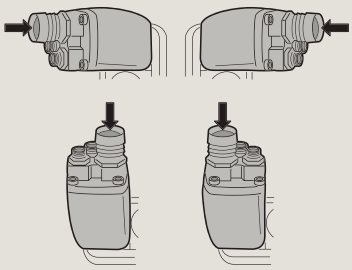
Drain line
Fixed displacement pumps don't need an external drain line as they are internally drained.

When the pump is mounted in a Engine-PTO we recommend a drain line from the bypass valve directly to oil tank.

Filtration
Filtration should follow ISO standard 4406, code 20/18/13.
To obtain the longest life of fixed displacement pumps, 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 illed (to at least 50 %) as the internal leakage does not provide sufficient lubrication at start-up.

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 %.

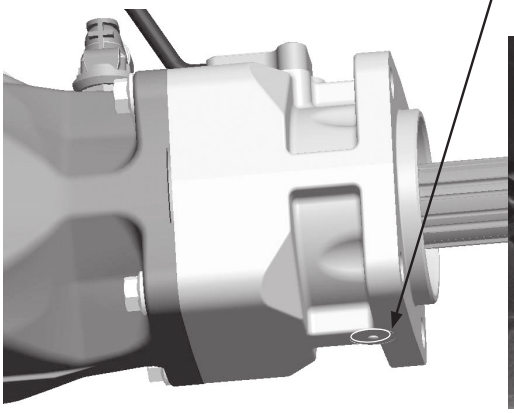


If any oil should drop out of the indication-hole on the pump;

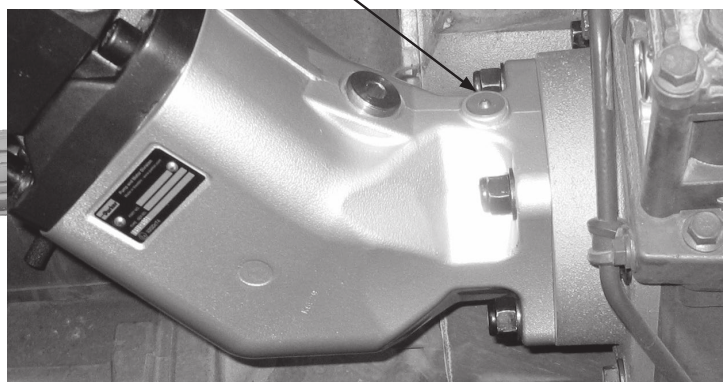
- Stop the system immediately.
- Determine the cause of leakage.
- Replace damaged parts.
- Make sure you have corrected the source of the problem, not only the symptom.

Parker can not be held responsible for damage to PTO, engine and gearbox caused by improper maintenance of the hydraulic system.

F3



F1



Pump bearing life

Bearing life is dependent on how the pump is installed on the PTO as shown in the illustrations below.

A pump mounted according to fig. 1 gives the lowest bearing life; the highest is obtained when installed according to fig. 3.

Parker Hannifin will assist in determining bearing life in a particular application.

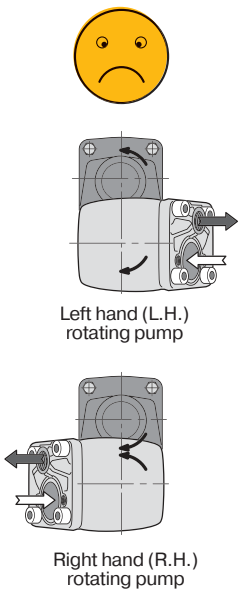


Fig. 1.

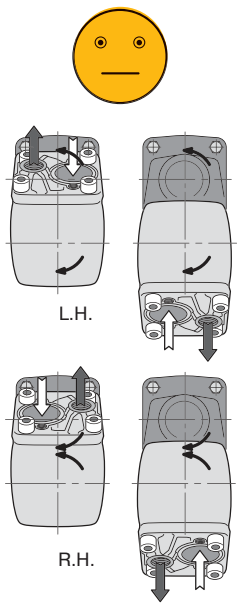


Fig. 2.

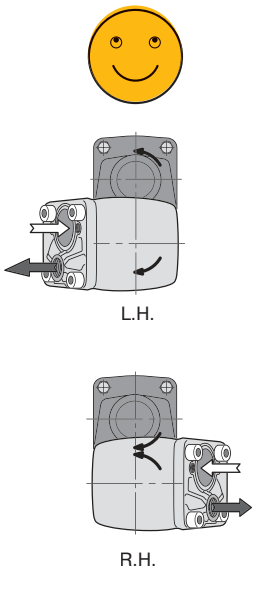


Fig. 3.

Installation and start-up for VP1

Direction of rotation

The basic VP1 pump is uni-directional; there is a left hand and a right hand version (indicated by the arrow on the side of the VP1 pump (fig. 4 and 5).

Consequently, the required direction of rotation must be stated when ordering the pump.

Installation

The VP1 can be installed (close-coupled) directly on a PTO (which meets ISO DIN 5462).

Before start-up, the pump must be filled with hydraulic fluid and purged. Utilise the uppermost purge plug (refer to the installation drawing on pages 49 and 52).

Figure 6 (page 73) shows two ways of installing a gear on the VP1 shaft. On a non-geared or a geared PTO with support bearings, the pump shaft is usually installed directly in the internally splined PTO output shaft.

Make sure max torque and bending moment (due to the weight of the pump) of the utilised PTO are not exceeded. (The approx. center of gravity of the various pump sizes are shown in the installation drawings).

Hydraulic fluids

The VP1 data shown in the specifications on page 48, are valid when operating on a high quality, mineral based fluid.

Hydraulic fluids type HLP (DIN 51524), ATF (automatic transmission fluids), and API type CD engine oils are suitable.

Fluid temperature

Main circuit: Max 75 °C.

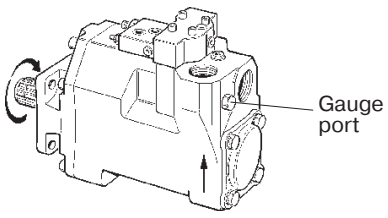


Fig. 4. Left hand rotating pump.

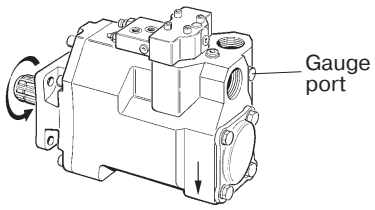


Fig. 5. Right hand rotating pump.

Viscosity

Recommended viscosity: 20 to 30 mm^2/s (cSt).
Operating viscosity limits: 10 to 400 mm^2/s.
At start-up: Max 1000 mm^2/s.

Filtration

To obtain long VP1 life, we recommend a filtration level of:

- 25 µm (absolute) in clean environment or at low pressures.
- 10 µm (absolute) in contaminated environment or at high pressures.

Filtration should meet ISO standard 4406: code 20/18/13.

Drain line

The LS valve requires a separate drain line; it should be routed directly to the reservoir (refer to fig. 8).

Start-up

Make sure the entire hydraulic system is clean before filling it with a recommended fluid.
In addition, the VP1 pump must be purged to remove any entrapped air in the pump housing; utilise the uppermost purge port (fig. 8).

IMPORTANT

As shown in fig. 8, the pump inlet must always be below the lowest reservoir oil level.

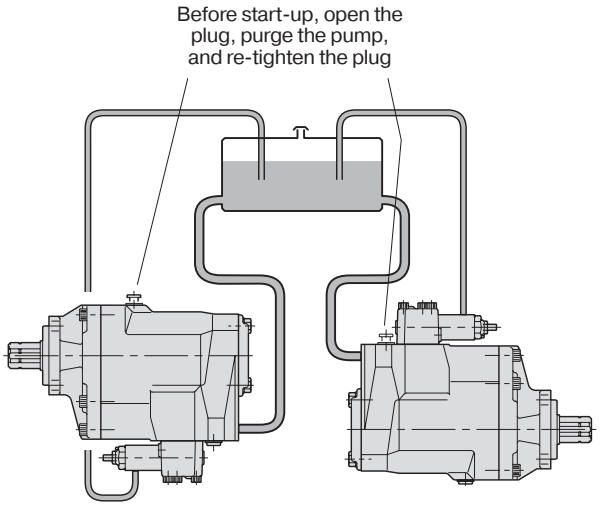


Fig. 8. VP1 should be installed below the reservoir fluid level.

Purging should be performed when the pump is connected to the reservoir and the system is filled with fluid.

Notes

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WARNING – USER RESPONSIBILITY

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