



# Truck Hydraulics

Serie F3,  
Disengageable Fixed Displacement Pumps



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ENGINEERING YOUR SUCCESS.

# F3 Pump

## F3-ISO

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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 $^{\circ}\text{F}$
1 kW .....	1,34 hp

## F3 Pump ISO

The new, disengageable F3 series is a global innovation in mobile hydraulics. By engaging and disengaging the pump from the diesel engine on the fly, you can save substantial amounts of fuel. But you also reduce wear and tear on the pump and minimize the risk of costly downtime and standstills – while also reducing the noise level. All that is required is to press a button on the dashboard, without turning off the engine!

### Save on fuel!

For the average truck running 100,000 kilometres a year, savings can amount to between 200 and 300 litres (45–65 gallons) less diesel, with a corresponding reduction in emissions of greenhouse gases and particulates, all due to the F3 pump being completely disconnectable when not in use. This is a unique, patented characteristic now being launched by Parker Hannifin.

### Enhanced reliability!

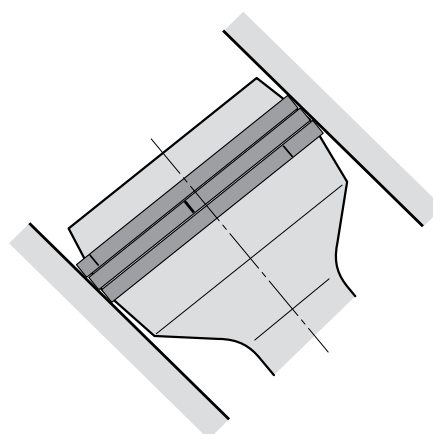
When a pump is fitted to an engine PTO, even small mishaps like a ruptured hose can result in having to be recovered and towed to a workshop, with all its downsides by way of major outlay and high downtime costs. With the new F3, you just disconnect the pump and make your way home under your own steam!

### Reduce noise levels!

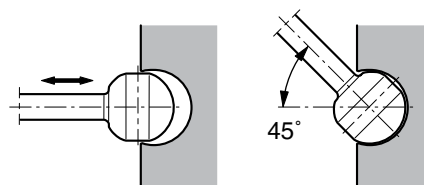
Compared to a conventional hydraulic pump in the unloaded position, the new F3 generates considerably lower noise levels in disconnected mode – this makes matching future noise emissions regulations easier.

### Features of the F3 are:

- Disengageable and engageable
- Air operated
- High selfpriming speeds
- Operating pressures up to 400 bar
- High overall efficiency
- Low noise level
- Small installation dimensions
- Low weight



*F3 piston with laminated piston ring.*



*F3 piston-to-shaft locking.*

### ... thanks to:

- Integrated coupling enables engaging and disengaging the pump
- 45° bent-axis angle
- Optimal inlet port geometry in the end cap
- 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

## F3-81 and -101, ISO Specifications

Frame size F3-	81	101
<b>Displacement</b> [cm <sup>3</sup> /rev]	81.6	102.9
<b>Max flow</b> <sup>1)</sup> [l/min]		
at 350 bar	163 <sup>3)</sup>	185 <sup>3)</sup>
at 400 bar	143	160
<b>Max operating pressure</b> [bar]		
continuous	350	350
intermittent	400	400
<b>Shaft speed</b> [rpm]		
- short circuited pump (low press.)	2300	2300
- max speed at 350 bar <sup>2)</sup>	2000 <sup>3)</sup>	1800 <sup>3)</sup>
at 400 bar <sup>2)</sup>	1750	1550 <sup>3)</sup>
<b>Torque</b> <sup>1)</sup> [Nm]		
at 350 bar	453	572
at 400 bar	518	653
<b>Input power</b> [kW]		
- continuous	76	85
- intermittent <sup>4)</sup>	95	123
<b>Weight</b> [kg]	16.7	16.7

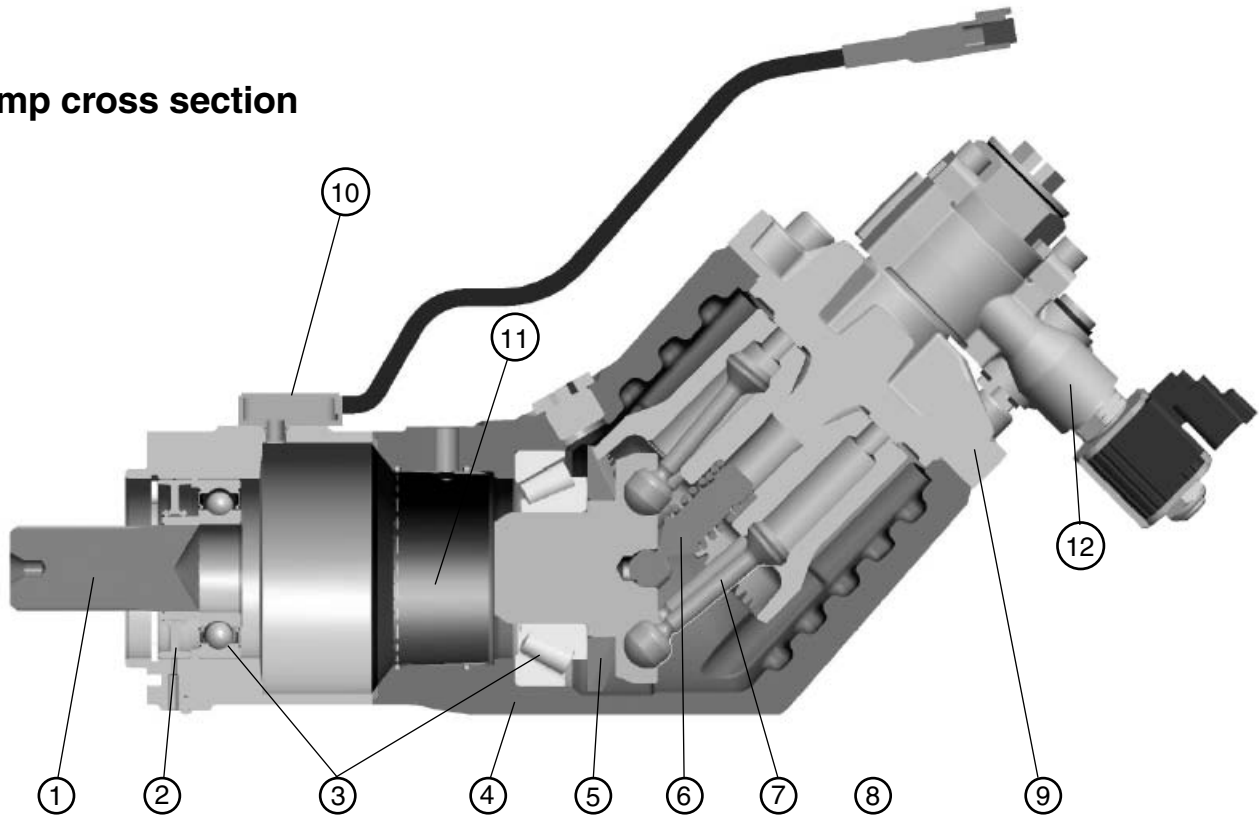
## BPV-F3 Bypass valve Without manual override

Bypass valve, type	BPV-F3
Max pressure, continuous	350 bar
intermittent	400 bar
Solenoid voltage (option)	24 VDC, (12 VDC)
Power requirement	17 W
Operating mode	Activated solenoid: Check valve closed

- 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:  
F3-81 – max 1400 rpm (Q≈120 l/min);  
F3-101 – max 1000 rpm (Q≈120 l/min).
- 4) Max 6 seconds in any one minute.

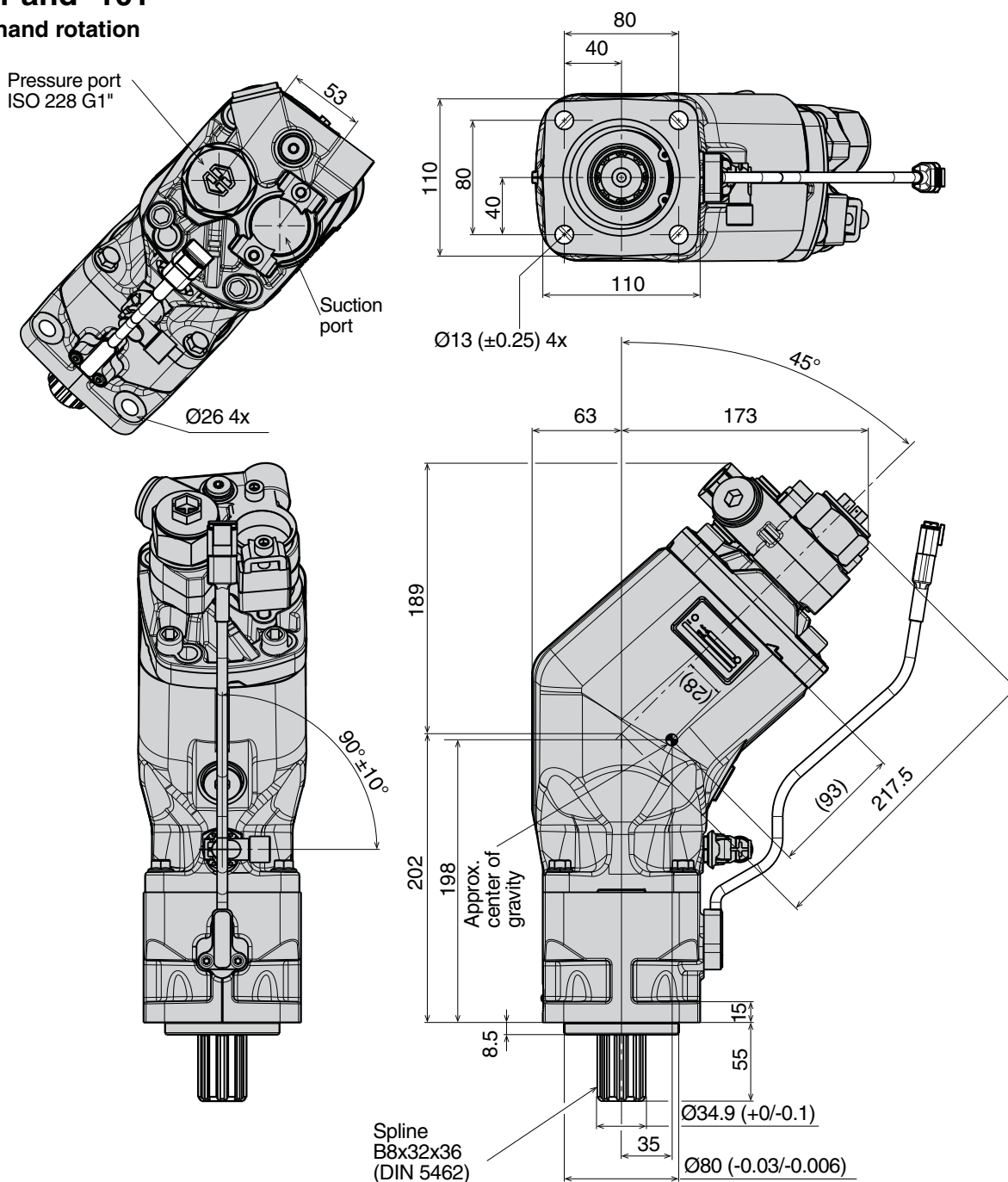
**NOTE:** For noise level information, contact Parker Hannifin

## Pump cross section



- |                |                            |                     |
|----------------|----------------------------|---------------------|
| 1. Input shaft | 5. Timing gear             | 9. End cap          |
| 2. Shaft seals | 6. Barrel support          | 10. Position sensor |
| 3. Bearings    | 7. Piston with piston ring | 11. Air cylinder    |
| 4. Housing     | 8. Cylinder barrel         | 12. Bypass Valve    |

**F3-81 and -101**  
 Right hand rotation



**Port size**

F3 frame size	Pressure port <sup>1)</sup>
-81	1"
-101	1"

1) BSP thread (fitting not included)

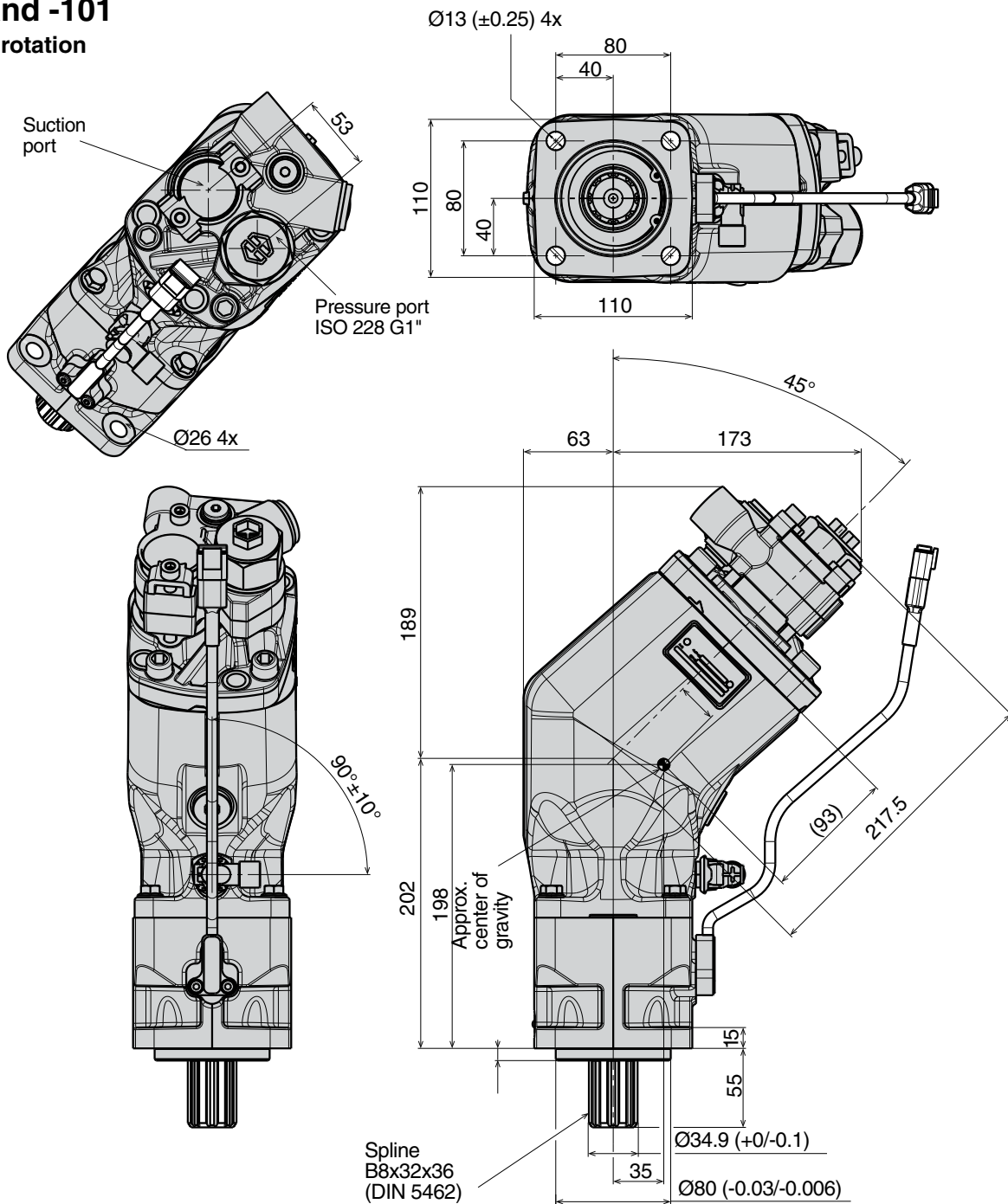
**NOTE:** The pump **does not** include a suction fitting; it must be ordered separately. See page 10.

**Standard versions**

Designation	Ordering no.
F3-081-R	372 0091
F3-081-L	372 0092
F3-101-R	372 0093
F3-101-L	372 0094

**F3-81 and -101**

Left hand rotation



**Port size**

F3 frame size	Pressure port <sup>1)</sup>
-81	1"
-101	1"

1) BSP thread (fitting not included)

**NOTE:** The pump **does not** include a suction fitting; it must be ordered separately. See page 10.

**Standard versions**

Designation	Ordering no.
F3-081-R	372 0091
F3-081-L	372 0092
F3-101-R	372 0093
F3-101-L	372 0094

## Pump selection

### 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]	
		F3-81	F3-101
1:0.8	800	52	66
	900	59	74
	1000	65	82
	1100	72	91
	1200	78	99
1:1.0	800	65	82
	900	73	93
	1000	82	103
	1100	90	113
	1200	98	123
1.1.25	800	82	103
	900	92	116
	1000	102	129
	1100	111	141
	1200	122	154
1:1.5	800	98	123
	900	110	139
	1000	122	154
	1100	135	170
	1200	147	185

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

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

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

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

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

#### 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.



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

**Operating conditions**

As an example, a Hook loader specifies:

- Flow: 70-100 l/min
- Pressure: 350 bar
- Diesel engine speed  $\approx$  800 rpm

**Determine pump speed**

As example a PTO with a Gear Ratio of 1:1.2.

The pump speed will be:

- $800 \times 1.2 \approx 1000$  rpm

**Select a suitable pump size**

Use diagram 1 and select a pump that will provide 70 - 100 l/min at 1000 rpm.

Follow line 'a' (1000 rpm) until it crosses line 'b' (90 l/min).

- F3-101 is a suitable choice

**Required input torque**

Make sure the engine PTO tolerates the pump torque. Use diagram 2 to obtain the required pump torque.

Follow a line from 'c' (350 bar) until it crosses the F3-101 line (the selected pump).

- Read 575 Nm (at 'd')

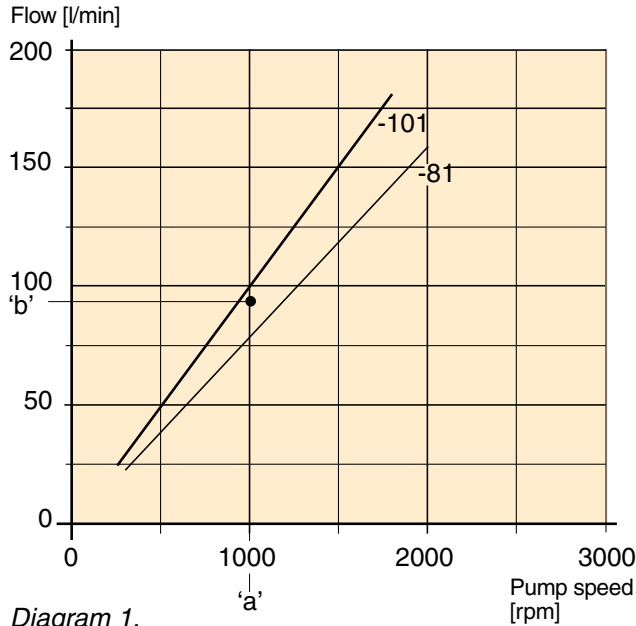


Diagram 1.

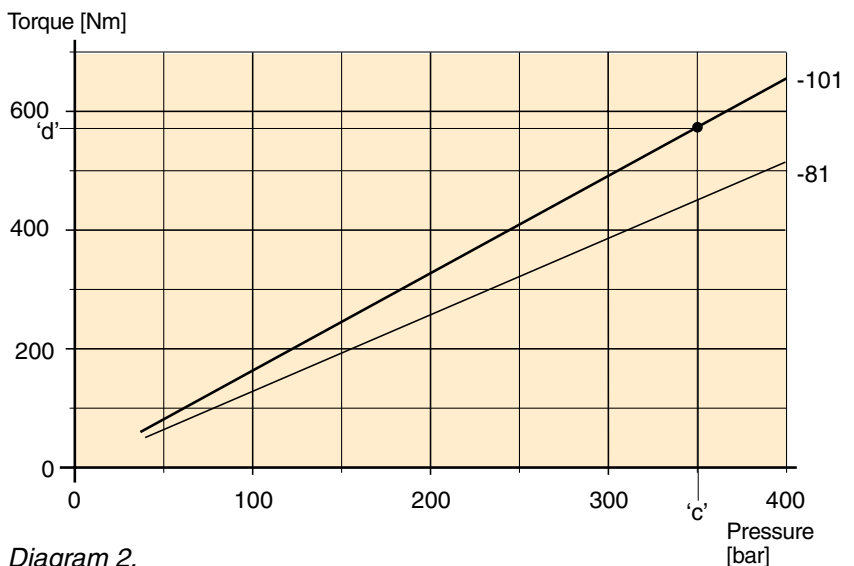


Diagram 2.

**Line selection all pumps**

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

Flow rate [l/min]	Flow velocity [m/s] at selected line sizes [mm/inches]						
	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

Outlet (pressure) line



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 8), 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"

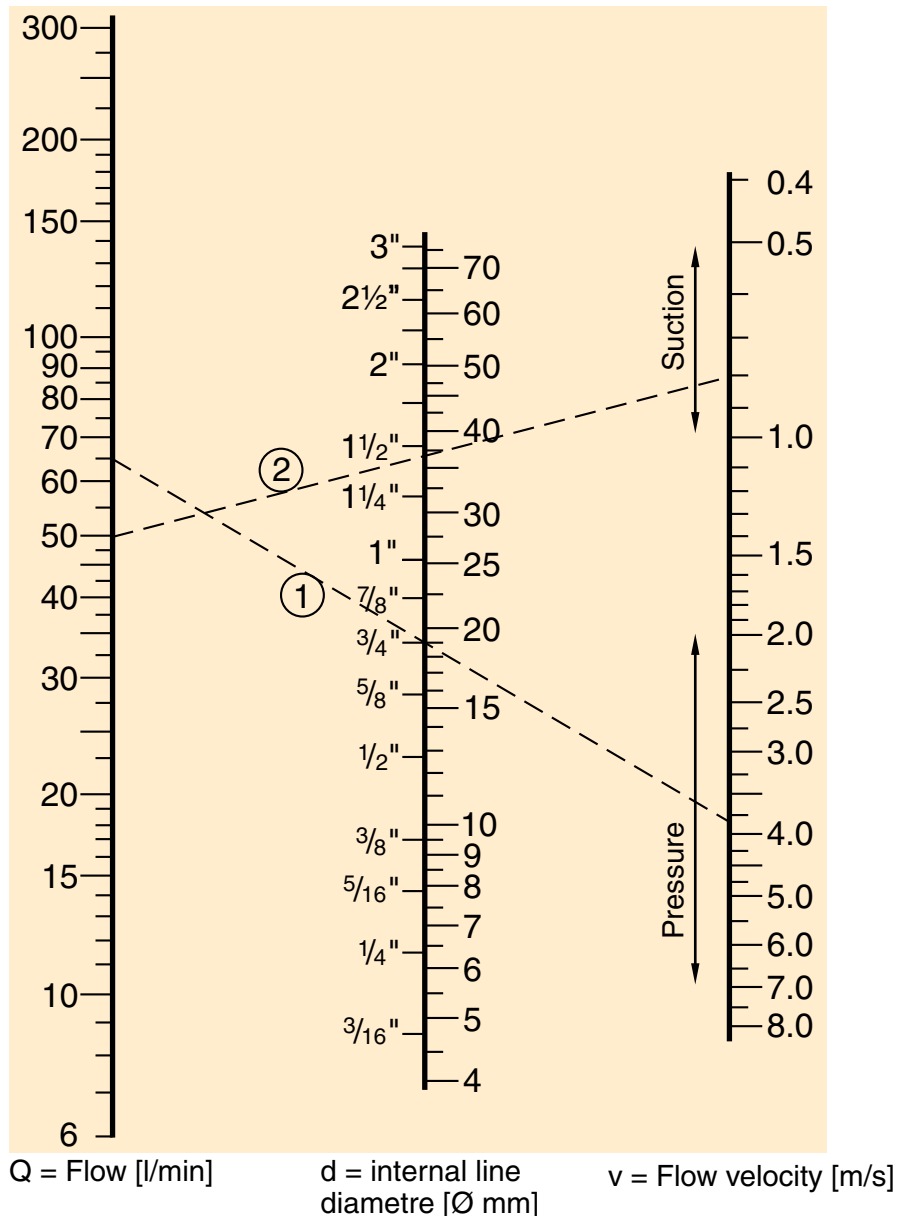


Table 3.

## Suction fittings for series F3

A 'suction fitting' consists of a straight, 45°, 90° or 135° suction fitting, clamps, cap screws and O-ring.

### 'Straight' suction fittings for F3

Ordering no.	A mm	B mm	C dia. mm (in.)
378 0637 <sup>1)</sup>	25	145	63 (2½")
378 3523 <sup>1)</sup>	32	174	75 (3")

### 45° suction fittings for F3

Ordering no.	A mm	B mm	C dia. mm (in.)
378 0634 <sup>1)</sup>	75	117	63 (2½")
378 3367 <sup>1)</sup>	95	138	75 (3")

### 90° suction fittings for F3

Ordering no.	A mm	B mm	C dia. mm (in.)
378 1980 <sup>1)</sup>	147	83	63 (2½")
378 8690 <sup>1)</sup>	185	83	75 (3")

1) (3 clamps and 3 screws)

### Spare parts

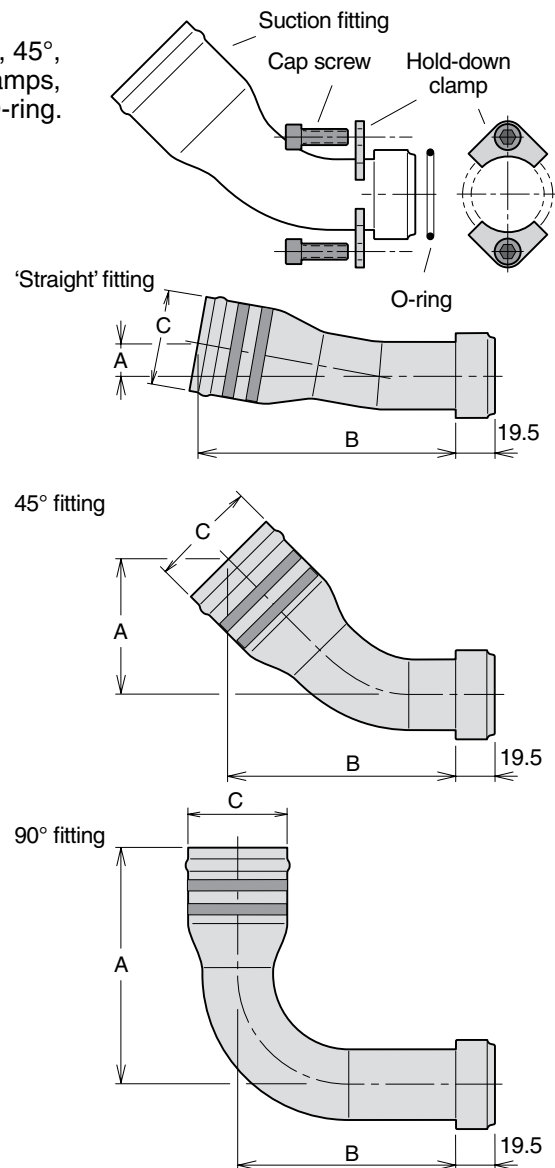
Additional Hold-down-clamp kit consists of:

hold-down-clamp cap screw and O-ring

Ordering no. 378 1321

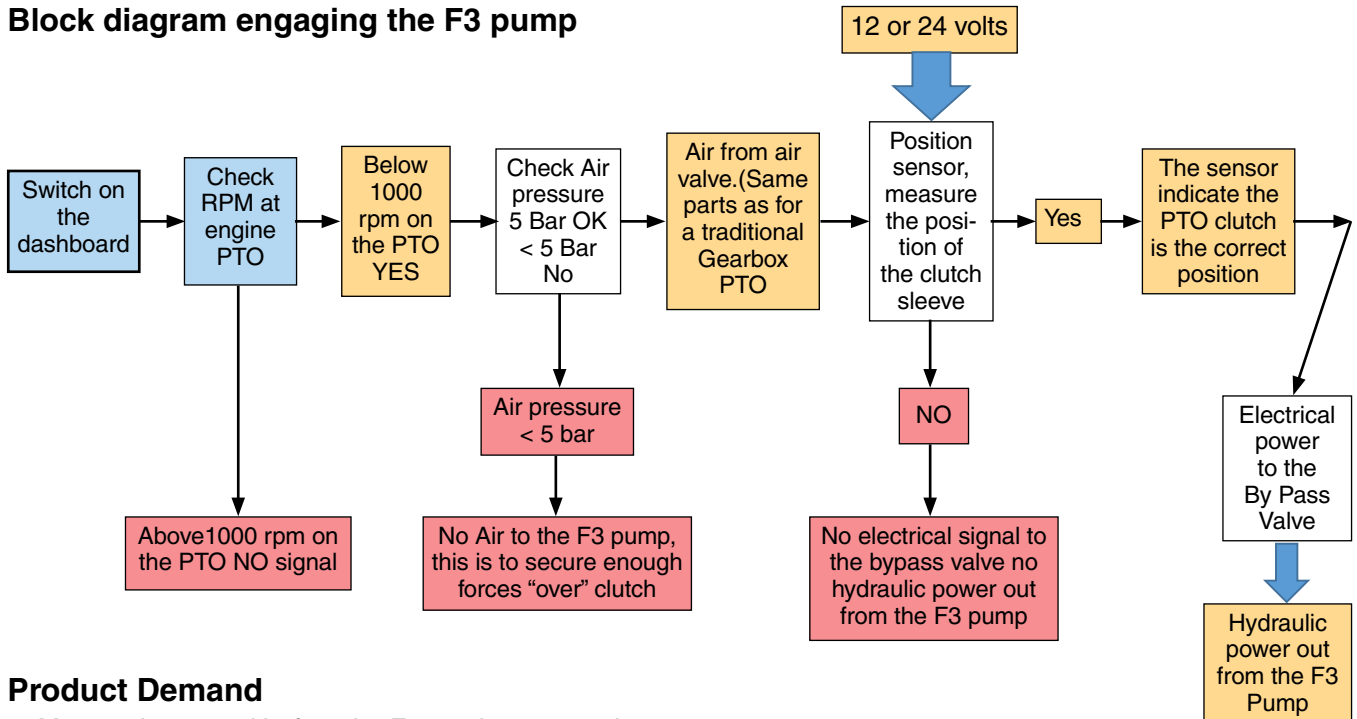
Additional Hold-down-clamp kit for mounting on BPV

Ordering no. 378 2439



**NOTE:** A suction fitting *must be ordered separately* (not included with the pump). To choose the correct dimension of suction connection, see page 9.

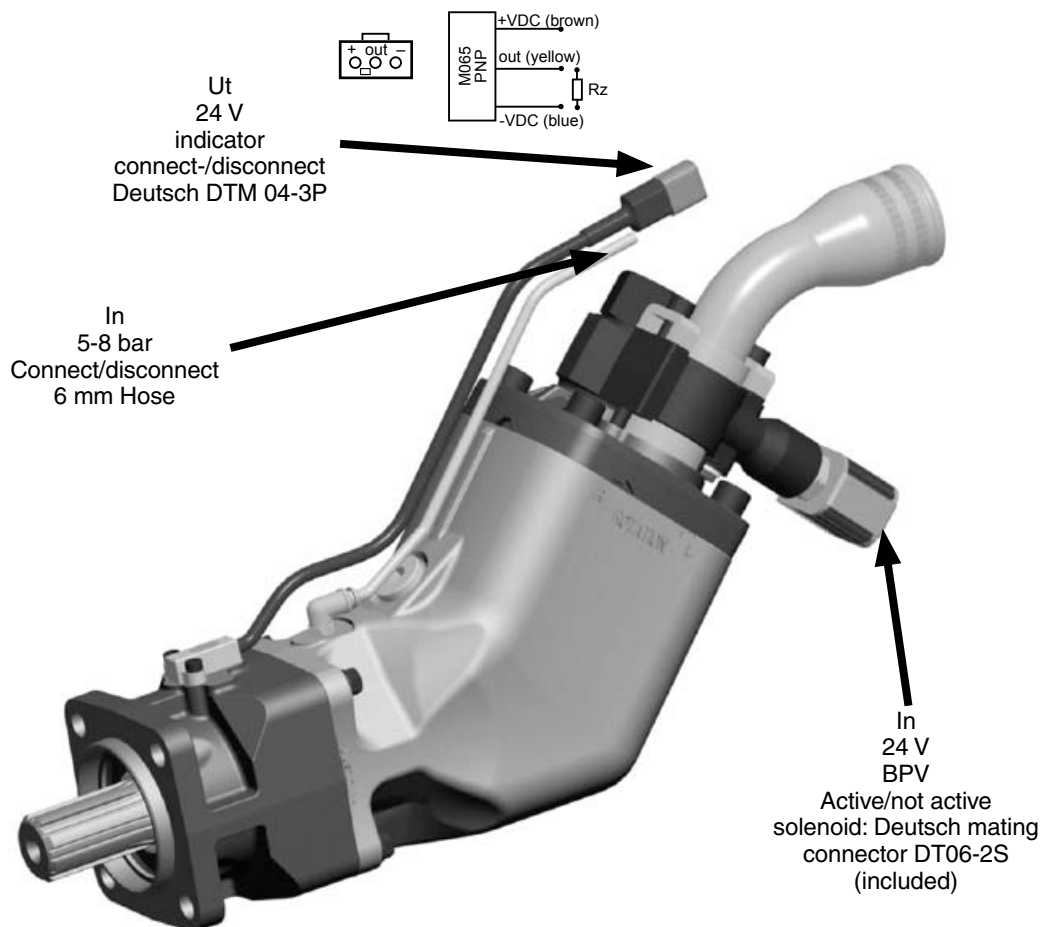
**Block diagram engaging the F3 pump**



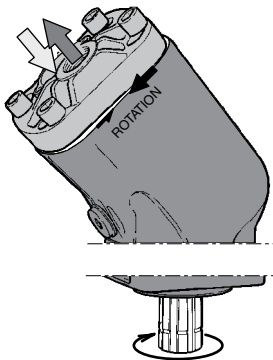
**Product Demand**

- Max engine speed before the F3 can be engaged (max shaft speed during engagement is 1000 rpm)
- Air pressure > 5 bar before the clutch can start to engage the pump

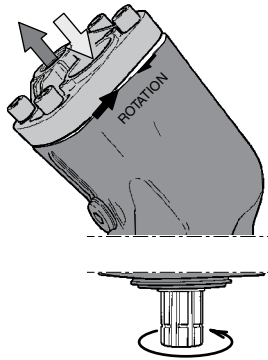
**Interface**



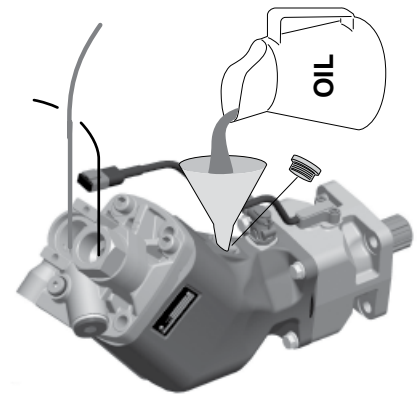
## Installation and start-up for F3



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.

### 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 28 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 30 "Pump bearing life".

### 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.

### 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 degradable fluids like natural and synthetic esters and polyalphaolefins.

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 bypassvalve directly to oiltank.

### Filtration

Filtration should follow ISO standard 4406: 1987, code 18/13.

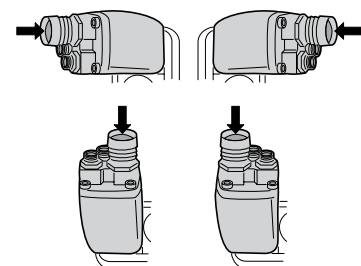
To obtain the longest life of fixed displacement pumps, we recommend an oil cleanliness of 10 µm (absolute).

### Start-up

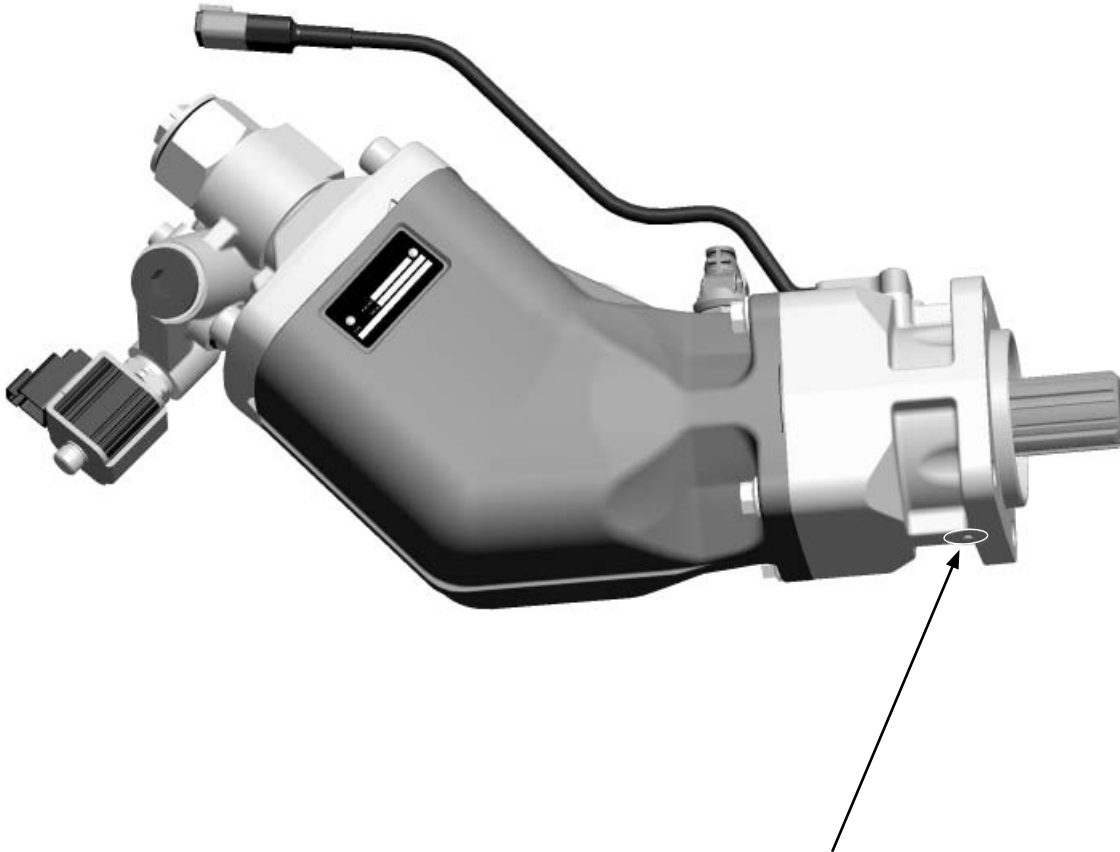
Make sure the entire hydraulic system is clean before filling it with a recommended hydraulic fluid.

In particular, make sure the pump is filled (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%.



### Indication-hole



**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.





## **WARNING – USER RESPONSIBILITY**

**FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.**

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Ed. 2015-04-21

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