Truck Hydraulics

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

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ENGINEERING YOUR SUCCESS.

Change History for edition 01.2017
Pages 9, 42-46: New F3 pump incorporated.
Page 52: Ordering no. for Black Painted VP1 pumps
Pages 59-64: BPV for F1, T1 and for F2 changed. New design of Manual override.
Pages 49 and 52: Centre of gravity changed, VP1.
Pages 17, 19-21: New GP1-pump. Page 76: New pump pictures for GPA and GP1
Pages 51, 52 and 67: LS-control with alternative drain port T.
Pages 23 and 40: Mass moment of inertia
Pages 59 and 61: BPV-F1 and BPV-F2

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

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

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.

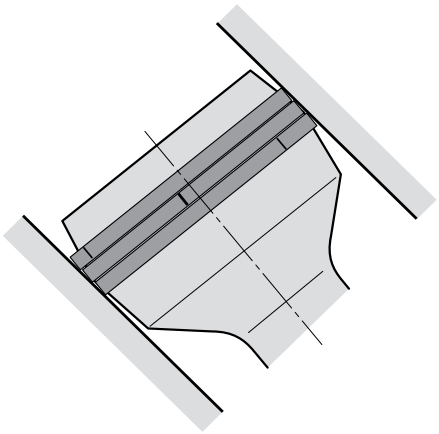
Features of the F1 are:

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

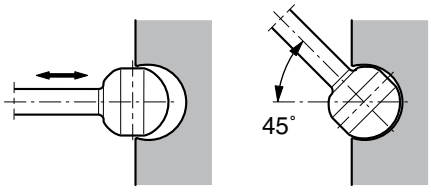
... thanks to:

- 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

See page 22



F1 piston with laminated piston ring.



F1 piston-to-shaft locking.

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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

See page 30

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

See page 37

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]

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

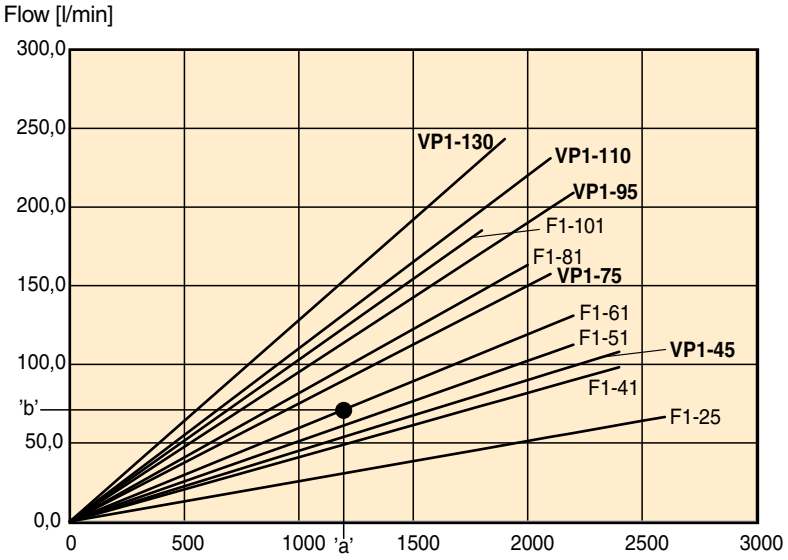

Diagram 1.

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.

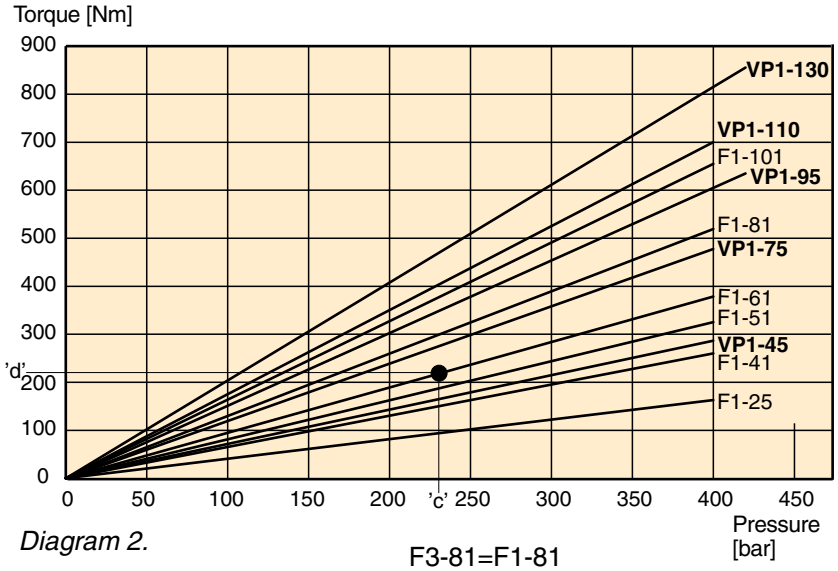

Diagram 2.

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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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 13), 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"

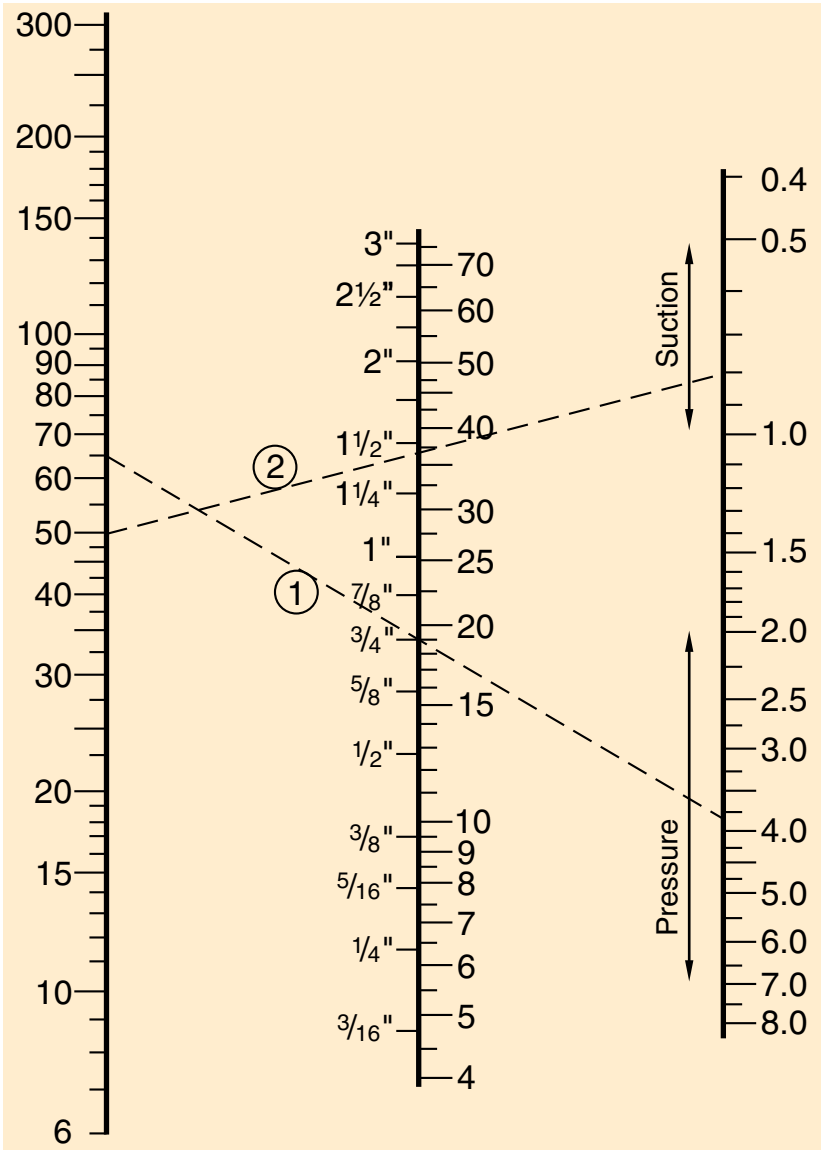

Table 3.

Q = Flow [l/min]

d = internal line diametre [Ø mm]

v = Flow velocity [m/s]

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F1 Pump

F1-ISO

Contents **Page** **Chapter**

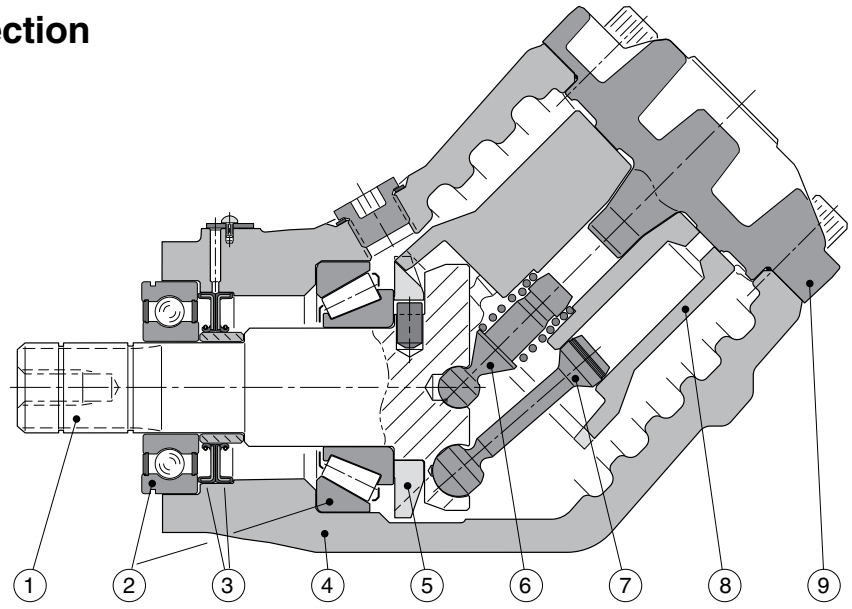
F1-25 to -101, ISO
Specifications

Frame size F1-	25	41	51	61	81	101
Displacement [cm³/rev]	25.6	40.9	51.1	59.5	81.6	102.9
Max flow 1) [l/min]						
at 350 bar	67	98	112	131	163 3)	185 3)
at 400 bar	56	86	97	113	143	160
Max operating pressure [bar]						
continuous	350	350	350	350	350	350
intermittent	400	400	400	400	400	400
Mass moment of inertia J [kgm²]	0,00274	0,00266	0,00261	0,00257	0,00532	0,00524
Shaft speed [rpm]						
- short circuited pump (low press.)	2700	2700	2700	2700	2300	2300
- max speed at 350 bar 2)	2600	2400	2200	2200	2000 3)	1800 3)
at 400 bar 2)	2200	2100	1900	1900	1750	1550 3)
Torque 1) [Nm]						
at 350 bar	142	227	284	331	453	572
at 400 bar	163	260	324	378	518	653
Input power [kW]						
- continuous	31	46	52	61	76	86
- intermittent 4)	39	57	66	76	95	108
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 mm²/s (cSt).
3) Valid with 2 1/2" inlet (suction) line.
With 2" suction line: F1-81 – max 1400 rpm (Q≈120 l/min);
F1-101 – max 1000 rpm (Q≈120 l/min).
4) Max 6 seconds in any one minute.

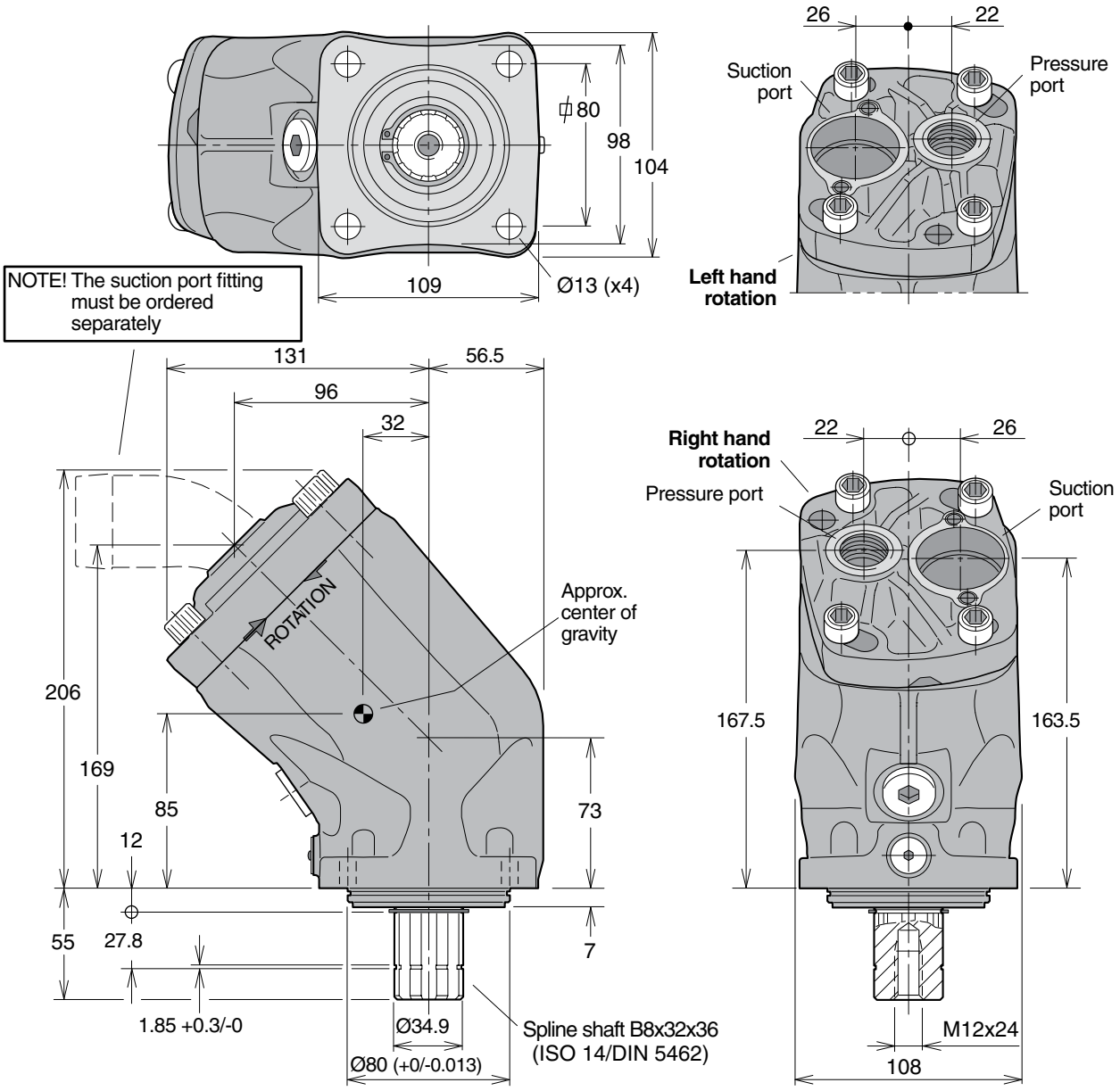
NOTE: For noise level information, contact Parker Hannifin

Pump cross section



1. Input shaft
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

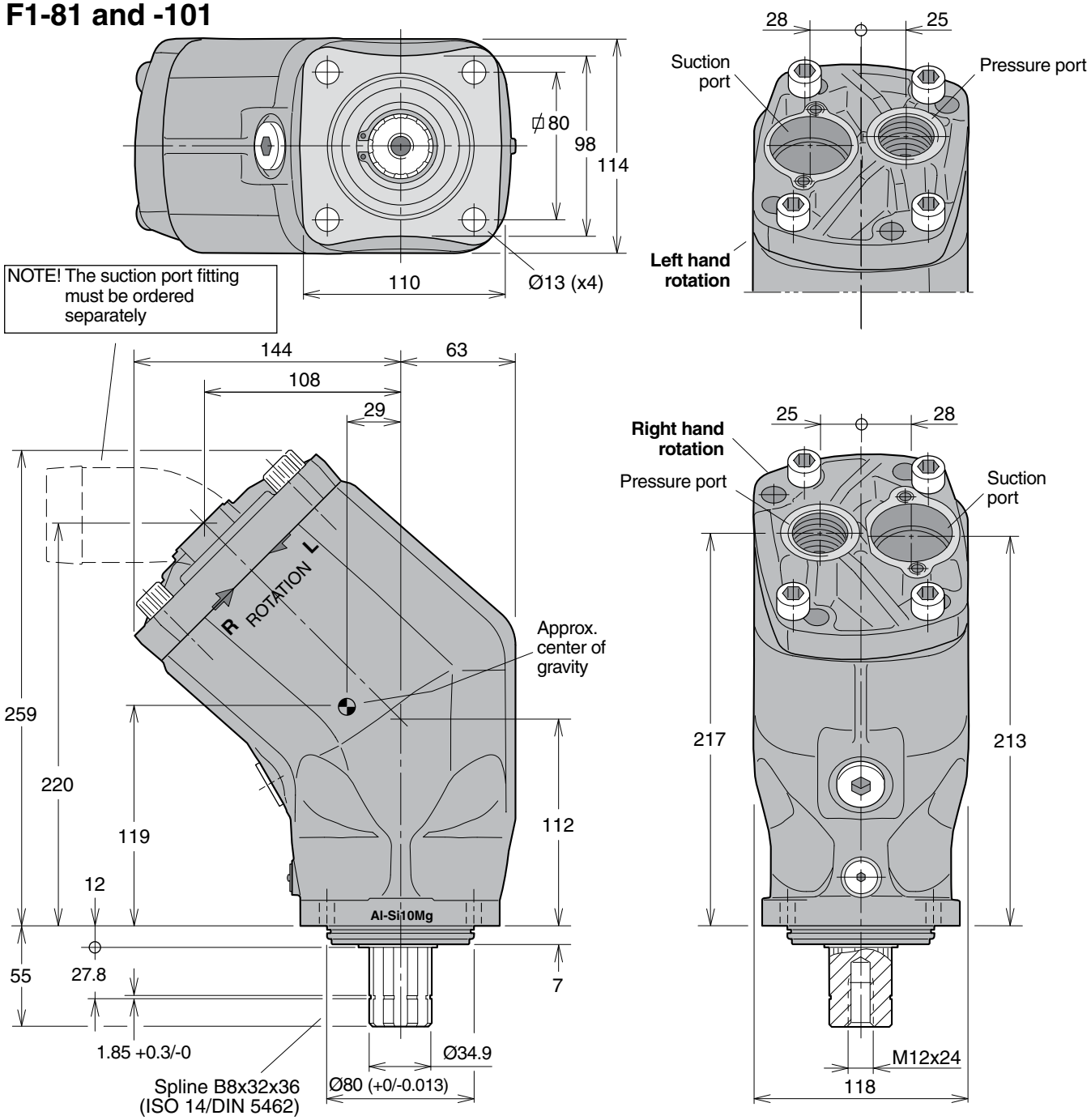
Shaft rotation
R Right hand
L Left hand

NOTE: The pump **does not** include a suction fitting; it must be ordered separately. See chapter 11.

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 chapter 11.

F1-12 ISO with BSP port treads

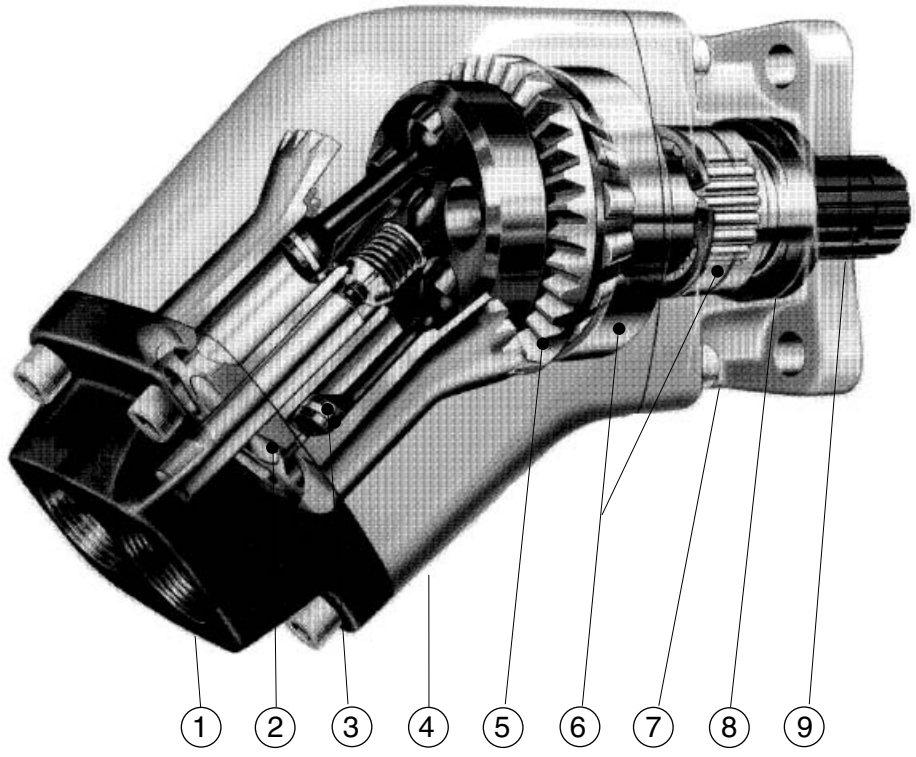
Specifications

Frame size F1-	**12**
Displacement [cm^3/rev]	12
Max flow 1) [l/min]	28
Max operating pressure [bar]	350
Shaft speed [rpm]	
- short circuited pump (low press.)	3100
- max selfpriming speed	2300
Torque 1) [Nm]	67
Input power [kW]	
- continuous	16.1
- intermittent 2)	21.7
Weight [kg]	6.7

1) Theoretical values
2) Max 6 seconds in any one minute.

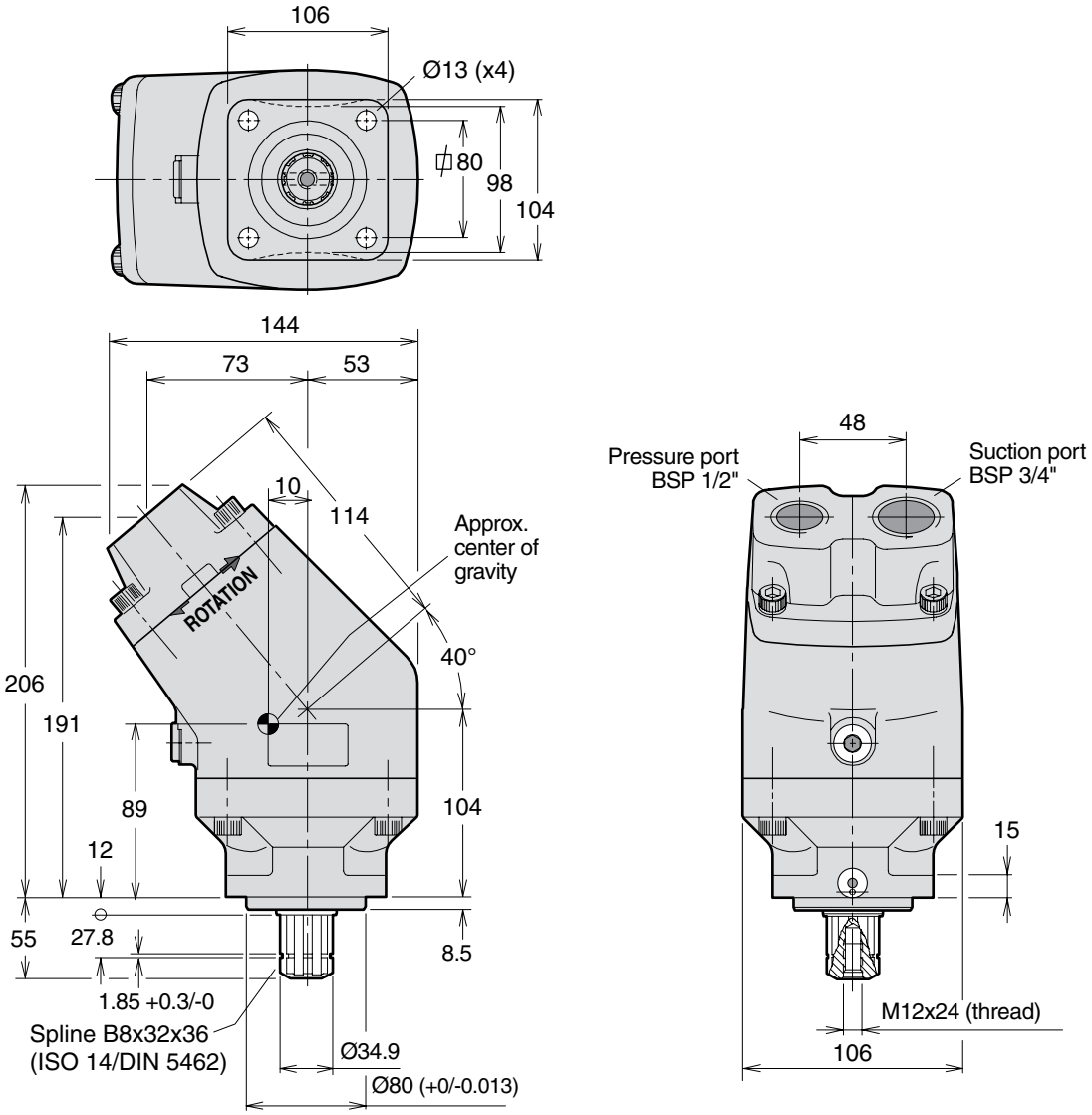
NOTE: For noise level information, contact Parker Hannifin

Pump cross section



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

F1-12 with BSP port treads



Ordering code

Example: **F1- 12 - R**

F1 frame size **12**

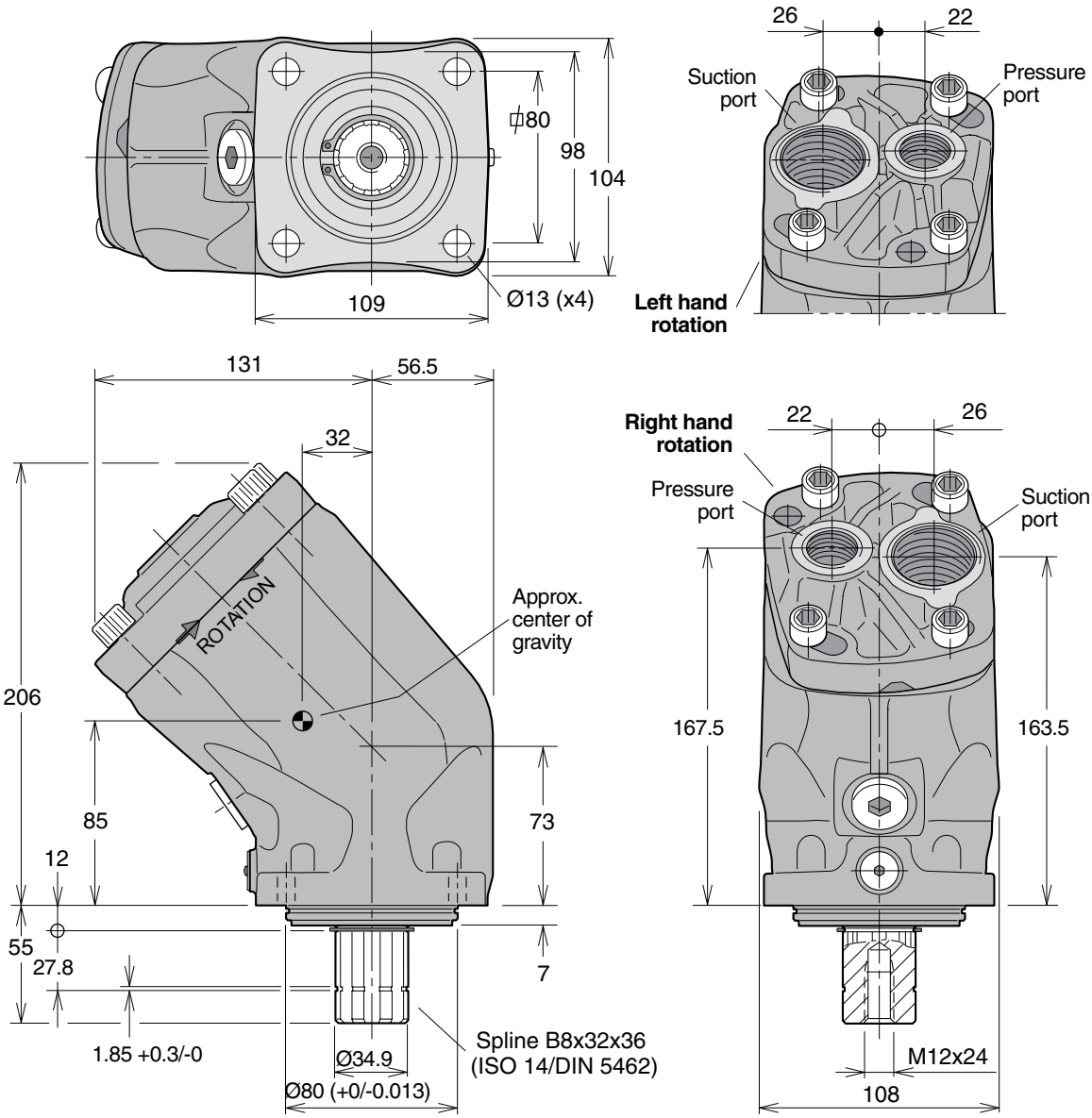
Shaft rotation
R Right hand
L Left hand

NOTE: The pump **does not** include a suction fitting; it must be ordered separately. See chapter 11.

Standard versions

Designation	Ordering no.
F1-12-R	378 2212
F1-12-L	378 2211

F1-25, -41, -51 and -61 with BSP port treads



Port size (all ports are BSP)

F1 frame size	Pressure port [1)]	Suction port
-25	3/4"	1"
-41	3/4"	1"
-51	3/4"	1"
-61	3/4"	1"

Ordering code

Example: **F1- 61 - RB**

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

Shaft rotation/port threads
RB Right hand/BSP
LB Left hand/BSP

Standard versions

Designation	Ordering no.
F1-25-RB	378 4024
F1-25-LB	378 4025
F1-41-RB	378 4040
F1-41-LB	378 4041
F1-51-RB	378 4050
F1-51-LB	378 4051
F1-61-RB	378 4060
F1-61-LB	378 4061

NOTE: The pump **does not** include a suction fitting; it must be ordered separately. See chapter 11.

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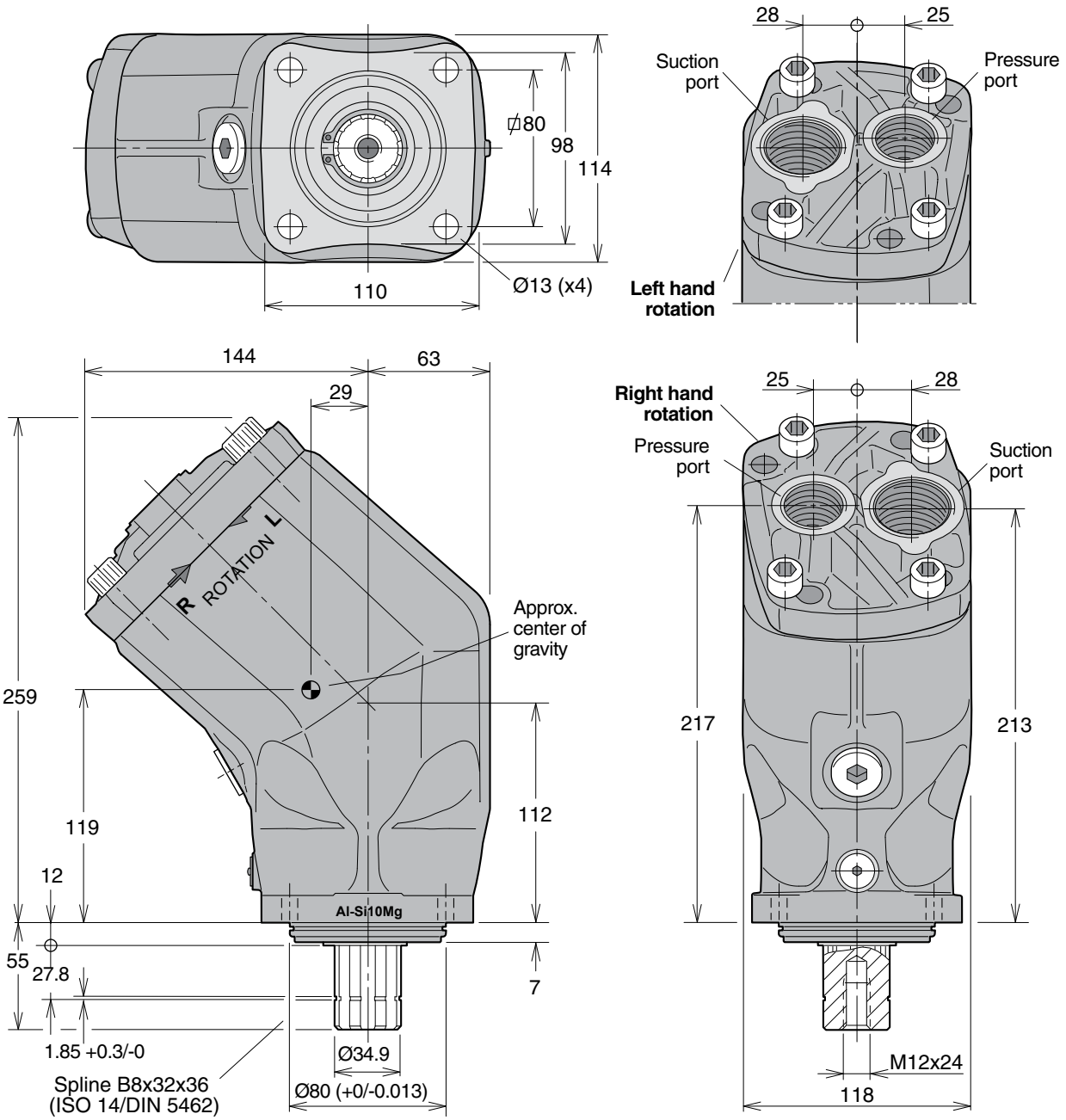
F1-81 and -101 with BSP port treads



Port size (all ports are BSP)

F1 frame size	Pressure port [1)]	Suction port
-81	1"	$1^1/_4$"
-101	1"	$1^1/_4$"

Standard versions

Designation	Ordering no.
F1-81-RB	378 4080
F1-81-LB	378 4081
F1-101-RB	378 4100
F1-101-LB	378 4101

Ordering code

Example: **F1- 81 - RB**

F1 frame size

25, 41, 51, 61, 81 or 101

Shaft rotation/port threads

RB Right hand/BSP

LB Left hand/BSP

NOTE: The pump **does not** include a suction fitting; it must be ordered separately. See chapter 11.

F1 Pump

F1-SAE

Contents **Page** **Chapter**

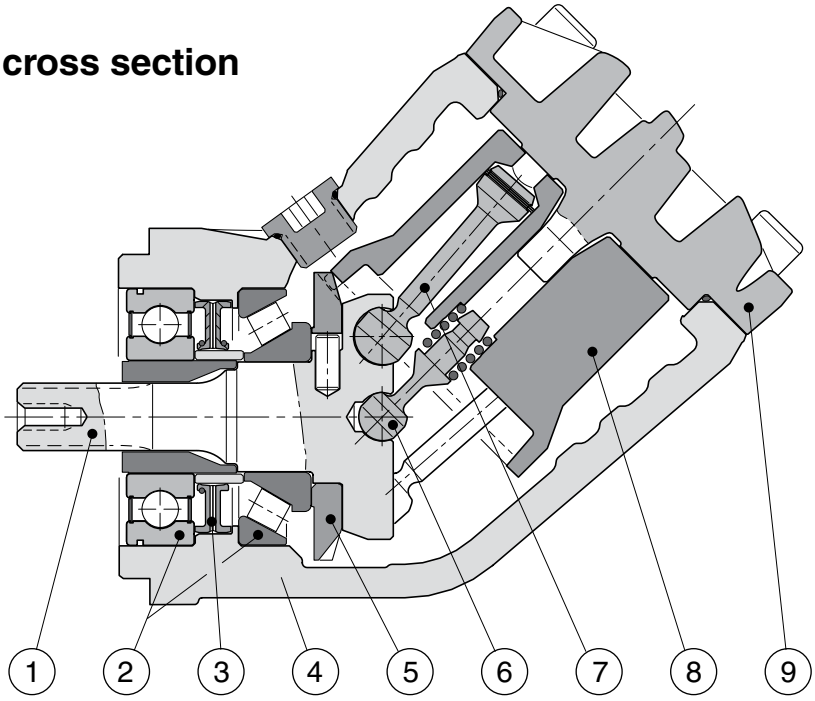
Specifications

Frame size F1-	25	41	51	61
Displacement [cm³/rev]	25.6	40.9	51.1	59.5
[cu in/rev]	*1.56*	*2.50*	*3.12*	*3.63*
Max flow 1)				
at 350 bar [l/min]	67	98	112	131
at 5000 psi *[gpm]*	*17.7*	*25.9*	*29.6*	*34.6*
at 400 bar [l/min]	56	86	97	113
at 5000 psi *[gpm]*	*14.8*	*22.7*	*25.6*	*29.8*
Max operating pressure [bar]				
continuous [bar]/ *[psi]*	350/ *5000*			
intermittent [bar]/ *[psi]*	400/ *5800*			
Shaft speed [rpm]				
- short circuited pump (low press.)	2700	2700	2700	2700
- max speed at 350 bar 2)/ *5000 psi* 2)	2600	2400	2200	2200
at 400 bar 2)/ *5800 psi* 2)	2200	2100	1900	1900
Torque 1)				
at 350 bar [Nm]	142	227	284	331
at 5000 psi *[lbf ft]*	*105*	*168*	*210*	*244*
at 400 bar [Nm]	163	260	324	378
at 5800 psi *[lbf ft]*	*120*	*192*	*239*	*279*
Input power				
- continuous [kW]	31	46	52	61
[hp]	*42*	*62*	*70*	*82*
- intermittent [kW] 3)	39	57	66	76
[hp] 3)	*52*	*76*	*88*	*102*
Weight [kg]	8.5	8.5	8.5	8.5
[lbs]	*18.7*	*18.7*	*18.7*	*18.7*

1) Theoretical values
2) Valid at an inlet pressure of 1.0 bar/*15 psi* (abs.) when operating on mineral oil at a viscosity of 30 mm²/s (cSt)/150 SUS.
3) Max 6 seconds in any one minute.

NOTE: For noise level information, contact Parker Hannifin.

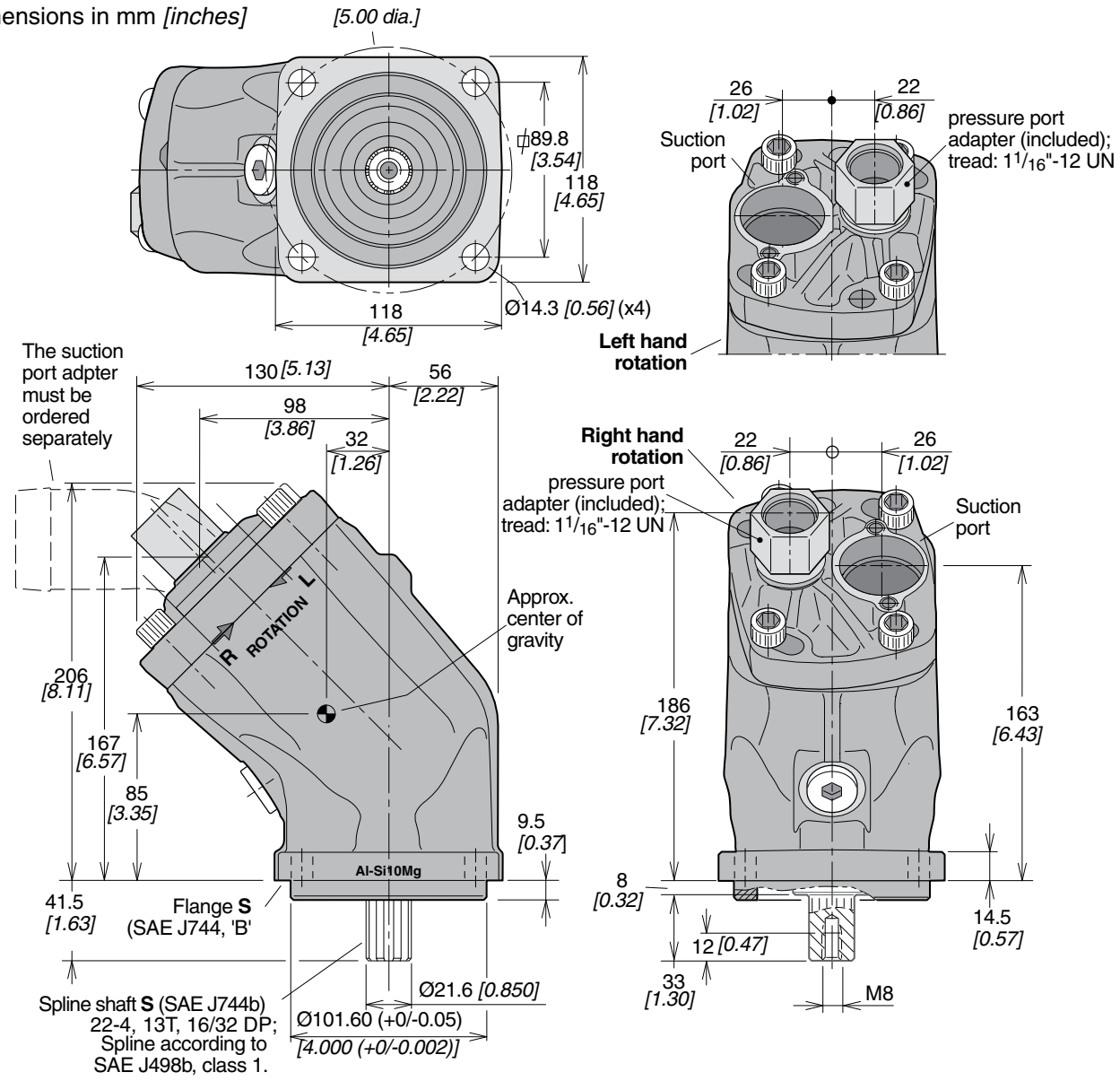
Pump cross section



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

Installation dimensions, F1-25, -41, -51 and -61 (SAE)

Dimensions in mm *[inches]*



Ordering code (SAE)

Example: **F1- 61 - R U - S V - S**

F1 frame size
25, 41, 51 or 61

Shaft rotation
R Right hand
L Left hand

Main port
U SAE O-ring, UN threads

Mounting flange
S SAE "B"

Shaft seal
V FPM

Shaft end
S SAE spline "B" spline

Port size

F1 frame size	Pressure port [1)]
-25	1 1/16"-12 UN
-41	1 1/16"-12 UN
-51	1 1/16"-12 UN
-61	1 1/16"-12 UN

1) BSP-to-SAE adapter (included)

Standard SAE versions

Designation	Ordering no.
F1-25-RU	378 1424
F1-25-LU	378 1425
F1-41-RU	378 1440
F1-41-LU	378 1441
F1-51-RU	378 1450
F1-51-LU	378 1451
F1-61-RU	378 1460
F1-61-LU	378 1461

NOTE: The pump **does not** include a suction fitting; it must be ordered separately. See chapter 11.

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