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Hydraulic Motor/Pump

Series F10/F11/F12
Fixed Displacement

Parker

ENGINEERING YOUR SUCCESS.

Basic formulas for hydraulic motors

Flow (q)

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

Torque (M)

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

Power (P)

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

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 ($\eta_t = \eta_v \times \eta_{hm}$)

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
1°C	$^5/_9$(°F-32)
1 kW	1.34 hp

Conversion factors

1 lb	0.454 kg
1 lbf	4.448 N
1 lbf ft	1.356 Nm
1 psi	0.068948 bar
1 US gallon	3.785 l
1 cu in	16.387 cm^3
1 in	25.4 mm
1°F	$^9/_5$°C + 32
1 hp	0.7457 kW

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

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Valid for sensor 3785190
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Scan for Installation & Startup Manual
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Scan for Manual Speed Sensor
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Scan for Manual Speed Sensor
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Scan for
Noise Installation Guideline

F10

F11

F12

Series F10

F10 is a bent-axis, fixed displacement motor/pump. It can be used in numerous applications in both open and closed loop circuits.

The F10 series is available in sizes 30, 37, 56, 80, 90, 107, and 125 cc

F10 Features

- Max intermittent pressure up to 350 bar and continuous operating pressure up to 300 bar
- The 7 piston design provides high start-up torque and smooth motor operation
- ISO, Cartridge and SAE versions

Series F11

F11 is a bent-axis, fixed displacement motor/pump. It can be used in numerous applications in both open and closed loop circuits.

The F11 series is available in sizes 5, 6, 10, 12, 14 and 19 cc.

F11 Features

- Max intermittent pressure up to 420 bar and continuous operating pressure up to 350 bar
- Thanks to low weight pistons and a compact design of the rotating parts, the F11 tolerates very high speeds, up to 14000 rpm
- CETOP, ISO, SAW and SAE versions

Series F12

F12 is a bent-axis, fixed displacement motor/pump. It can be used in numerous applications in both open and closed loop circuits.

The F12 series is available in sizes 30, 40, 60, 80, 90, 110, 125, 152, 162, 182 and 250 cc.

F12 Features

- Max intermittent pressure up to 500 bar and continuous operating pressure up to 450 bar
- The 7 or 9 piston design provides high start-up torque and smooth motor operation
- ISO, Cartridge, SAW and SAE versions

General Features

- The laminated piston ring offers important advantages such as unbeatable efficiency and thermal shock resistance
- High allowable speeds and operating pressures means high output power
- The unique piston locking, timing gear and bearing set-up as well as the limited number of parts add up to a very robust design with long service life and, above all, proven reliability.
- The 40° angle between shaft and cylinder barrel allows for a very compact, lightweight motor/pump.
- Small envelop size and a high power-to-weight ratio
- The motor version has highly engineered valve plates for high speed and low noise
- The pump version has highly engineered valve plates for increased self priming speed and low noise, available with left and right hand rotation.
- Our unique timing gear design synchronizes shaft and cylinder barrel, making the F10/F11/F12 very tolerant to high 'G' forces and torsional vibrations.
- Heavy duty roller bearings permit substantial external axial and radial shaft loads.

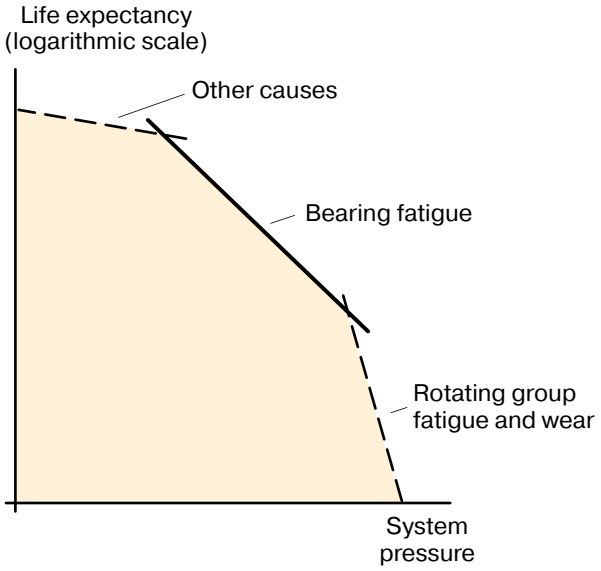
Bearing life

General information

Bearing life can be calculated for that part of the load/life curve (shown below) that is designated 'Bearing fatigue'. 'Rotating group fatigue and wear' and 'Other' caused by material fatigue, fluid contamination, etc. should also be taken into consideration when estimating the service life of a motor/pump in a specific application.

Bearing life calculations are mainly used when comparing different frame sizes. Bearing life, designated B_{10} (or L_{10}), is dependent of system pressure, operating speed, external shaft loads, fluid viscosity in the case, and fluid contamination level.

The B_{10} value means that 90 % of the bearings survive, at a minimum, the number of hours calculated. Statistically, 50 % of the bearings will survive at least five times the B_{10} life.



Hydraulic unit life versus system pressure.

Bearing life calculation

An application is usually governed by a certain duty or work cycle where pressure and speed vary with time during the cycle.

In addition, bearing life depends on external shaft forces, fluid viscosity in the case and fluid contamination.

Parker Hannifin has a computer program for calculating bearing life and will assist in determining F10, F11 or F12 motor/pump life in a specific application.

Required information

When requesting a bearing life calculation from Parker Hannifin, the following information (where applicable) should be provided:

- A short presentation of the application
- F10, F11 or F12 size and version
- Duty cycle (pressure and speed versus time at given displacements)
- Low system pressure
- Case fluid viscosity
- Life probability (B_{10}, B_{20}, etc.)
- Operating mode (pump or motor)
- Direction of rotation (L or R)
- External shaft loads (Forces, Gear, Belt, Cardan or none)

For forces please provide:

- Axial load, Fixed radial load, Bending moment, Rotating radial load and distance flange to radial load.

For Gear please provide:

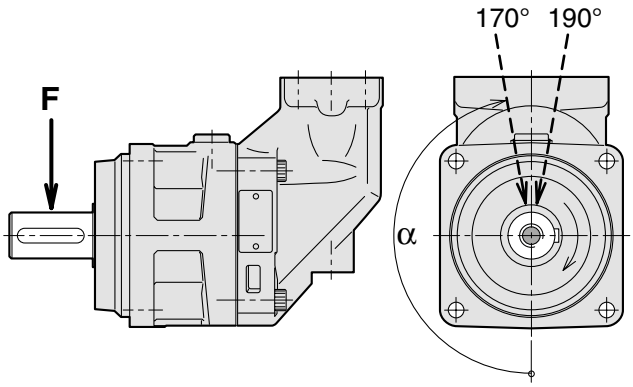
- Pitch diameter, Pressure angle, Spiral angle, Distance flange – gearwheel (mid) and Gearwheel spiral direction (R or L).

For Belt please provide:

- Pretension, Coefficient of friction, Angle of contact, Distance flange – pulley (mid) and Diameter pulley.

For Cardan please provide:

- Shaft angle, Distance flange – first joint and distance between joints
- Angle of attack (α) as defined below



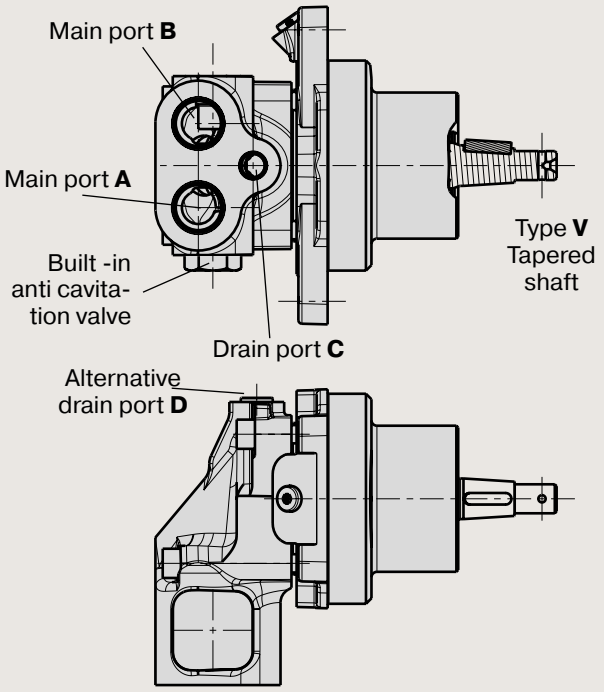
The direction (α) of the radial load is positive in the direction of rotation as shown.

To obtain maximum bearing life, the radial load should, in most cases, be located between 170° and 190°.

F10/F11/F12 Fan motors

F10/F11/F12 motors, in frame sizes -5 to -80 cc, are common in Fan applications. Some typical options are, built in check valve, pressure relief valve, cartridge flange and tapered shaft (refer to the schematic to the right).

The fan motor can be operated at very high speeds without reliability problems. The fan is usually installed directly on the motor shaft without additional bearing support. The F10/F11/F12 has up to 95 % overall efficiency which reduces the diesel consumption and minimizes the cooling demand.



Fan motor (F11-10 left hand rotated shown).

Fan motor circuit

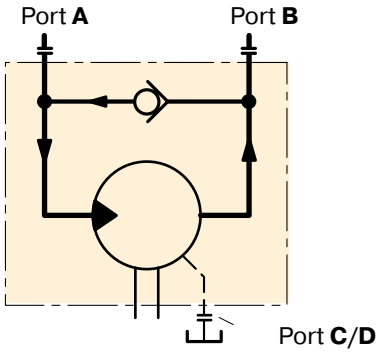
Because of the built-in anti cavitation valve, either left hand (L) or right hand (R) rotation must be specified when ordering the motor.

When the pump flow to the motor is shut off and the motor is operating at very high speeds, it is important that sufficient return port back pressure is available (port B in the schematic to the right).

The anti cavitation valve will then open and direct flow to the motor inlet port. If the inlet pressure is insufficient, motor cavitation will be experienced.

In an open circuit, back pressure can be created by a counter pressure valve installed in the return line; preferably, it should be pilot operated to minimize power losses. A back pressure of about 10 bar is sufficient in most applications.

For more info about integrated pressure relief valves, see page 79.



Schematic Fan motor with anti cavitation valve

Example of ordering code
F11-010-MB-CV-K-000-**MUVL**-P0
MUVL = Make up/anti cavitation valve, counter clockwise rotation
MUVR = Make up/anti cavitation valve, clockwise rotation

F11/F12 in saw motor applications

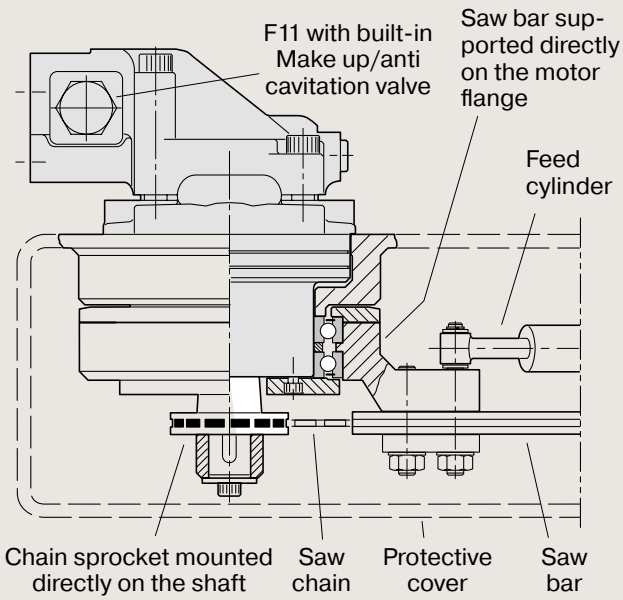
Series F11/F12 motors have proven suitable for demanding applications such as chain saws. Primarily due to the 40° bent-axis design, spherical pistons (with laminated piston rings) and gear synchronization, very high speeds are permissible. Not even low temperatures at start-up affect reliability.

Because of the built-in anti cavitation valve, either left hand (L) or right hand (R) rotation must be specified when ordering the motor.

When the pump flow to the motor is shut off and the motor is operating at very high speeds, it is important that sufficient return port back pressure is available.

The anti cavitation valve will then open and direct flow to the motor inlet port. If the inlet pressure is insufficient, motor cavitation will be experienced.

To further enhance the saw function and, at the same time, reduce weight, cost and installation dimensions, a specific saw motor has been developed (frame sizes F11-6, -10, -12, -14, -19, F12-30 and -40; refer to the illustration to the right) which is specifically dedicated to bar saws. The motor allows the saw bar bearings to be mounted directly on the motor housing, and the sprocket installs on the motor shaft without additional bearings. Catalogue MSG30-8245/UK



Chain saw installation (example; F11-10 shown)

Parker Power Boost

A high speed F11 or F12 motor could be optimized with a Power Boost™, which means less fluid friction and oil compression. This can reduce power losses by up to 5 kW. The improved efficiency generates less heat, reducing the need for cooling and consequently improves fuel consumption.

Parker Power Boost is available for size F11-6, -10, -12, -14, -19 and F12-30.

When to order a motor with Power Boost it is to be specified with a B in last field in model code. Ex below.

F11-019-SB-CS-K-000-MUVL-**B**0

F11

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- F11-006, -010 32
- F11-012 34
- F11-014 36
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Installation dimensions ISO
- F11-006, -010 40
- F11-012 42
- F11-014 44

Installation dimensions SAE
- F11-006, -010 46
- F11-012 48
- F11-014 50
- F11-019 52

Frame size F11	**-005**	**-006**	**-010**	**-012**	**-014**	**-019**
Displacement [cm^3/rev]	4.9	6.0	9.8	12.5	14.3	19.0
Operating pressure						
max intermittent[1)] [bar]	420	420	420	420	420	420
max continuous [bar]	350	350	350	350	350	350
Motor operating speed [rpm]						
max intermittent [1)]	14 000	11 200	11 200	10 300	9 900	8 900
max continuous [3)]	12 800	10 200	10 200	9 400	9 000	8 100
min continuous	50	50	50	50	50	50
Max pump selfpriming speed [2)]						
L or R function; max [rpm]	4 600	–	4 200	3 900	3 900	3 500
Motor input flow						
max intermittent[1)] [l/min]	69	67	110	129	142	169
max continuous [l/min]	63	61	100	118	129	154
Drain temperature[3)], max [°C]	115	115	115	115	115	115
min [°C]	-40	-40	-40	-40	-40	-40
Theoretical torque at 100 bar [Nm]	7.8	9.5	15.6	19.8	22.7	30.2
Mass moment of inertia						
($x10^{-3}$) [kg m^2]	0.16	0.39	0.39	0.40	0.42	1.1
Weight [kg]	4.7	6.5	6.5	7.5	7.5	11

1) Intermittent: max 6 seconds in any one minute.
2) Selfpriming speed valid at sea level. Find more info on page 27
3) See also installation information. Page 85 – 87

Efficiency

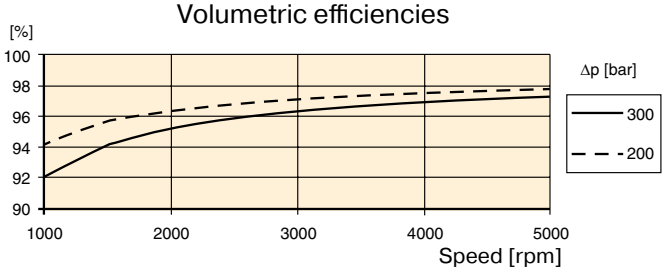
Because of its high overall efficiency, driving a motor/pump from series F11 requires less fuel or electric power. Also, it allows the use of a small reservoir and heat exchanger, which in turn reduce cost, weight, and installation size.

The diagrams to the right show volumetric and mechanical efficiencies of an F11-5 motor.

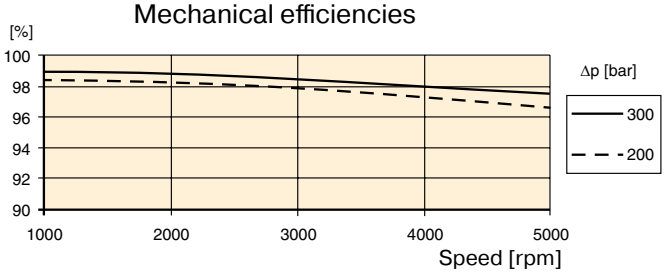
F11-19 motors can be equipped with Power Boost which in high speed applications can decrease the mechanical losses by up to 15 %, see page 7.

Contact Parker Hannifin for efficiency information on a particular F11 frame size that is being considered.

Volumetric efficiencies



Mechanical efficiencies



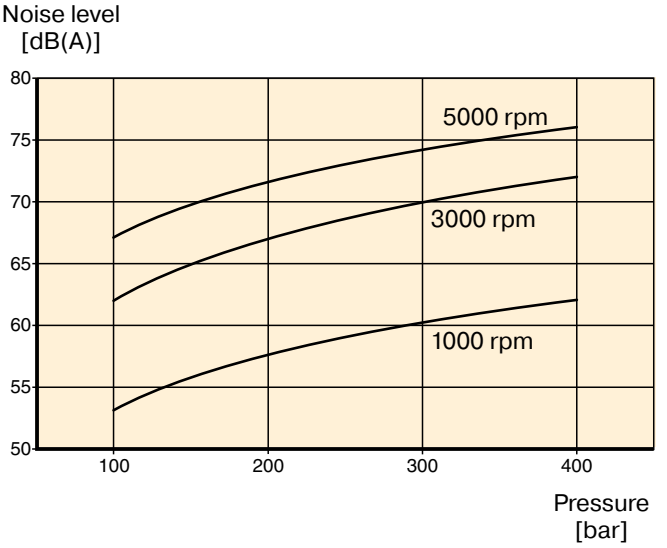
Noise level

Series F11 feature low noise levels from low to high speeds and pressures.

The noise level is measured in a semi-anechoic room, 1 m behind the unit. As an example, the diagram to the right shows the noise level of an F11-005.

The noise level for a particular motor/pump may vary ±2 dB(A) compared to what is shown in the diagram.

NOTE: Noise information for F11/F12 frame sizes are available from Parker Hannifin.



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Pump & Motor Division Europe
Trollhättan, Sweden

Selfpriming speed and required inlet pressure

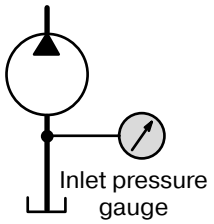
Series F11

In pump applications, the F11 with function **L** (counter clockwise rotation) or **R** (clockwise rotation) is normally used. The L and R (pump) provide the highest self priming speeds (see table) as well as the lowest noise level. The **M** and **H** (motor) function can also be used as a pump, in either direction, but at a lower self priming speed.

Operating above the self priming speed (refer to Diagram 1) requires increased inlet pressure. As an example, at least 1.0 bar is needed when operating the F11-19-M as a pump at 3500 rpm. An F11 used as a motor (e.g. in a hydrostatic transmission), may sometimes operate as a pump at speeds above the selfpriming speed; this requires additional inlet pressure. Insufficient inlet pressure can cause pump cavitation resulting in greatly increased pump noise and deteriorating performance.

Function	**L** or **R**	**M**	**H**
F11-5	4600	3800	3200
F11-6		3100	
F11-10	4200	3100	2700
F11-12	3900	-	3000*
F11-14	3900	-	3000*
F11-19	3500	2400	2100

* Valve plate S



F11 Motor version

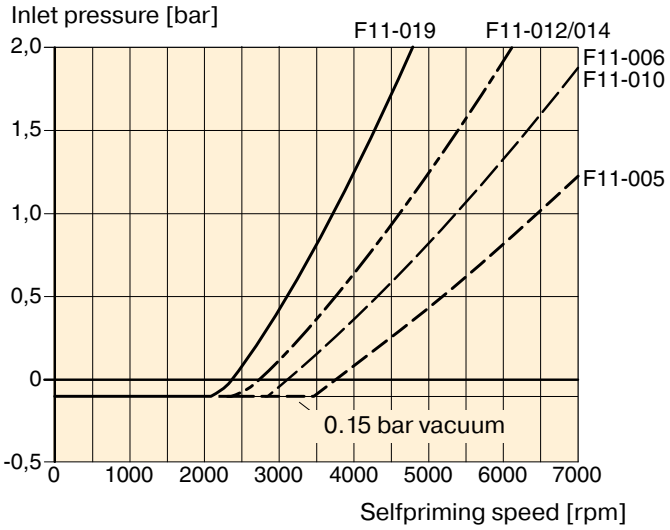


Diagram 1. Min required inlet pressure for Motor.

F11 Pump version

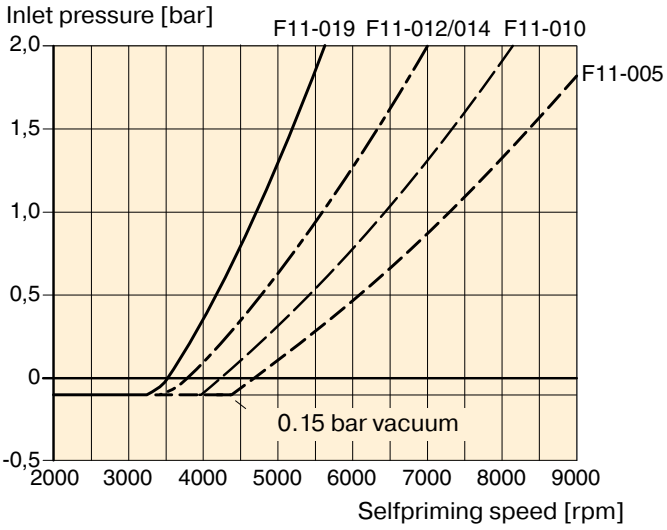


Diagram 2. Min required inlet pressure for Pump.

The inlet pressure can be charged by external pump, pressurized reservoir or using BLA Boost unit

Find more info about the BLA unit at page 84.

F11-CETOP

F11 – [ ] – [ ] [ ] – [ ] [ ] – [ ] – [ ] [ ] – [ ] – [ ] – [ ] – [ ]

Frame size | Function | Main ports | Mounting flange | Shaft seal | Shaft | Version number | Option page 6 | Option page 7

Frame size	
Code	Displacem. (cm^3/rev)
005	4.9
006	6.0
010	9.8
012	12.5
014	14.3
019	19.0

Version number
(assigned for special versions)

Frame size		5	6	10	12	14	19
Code	Function						
M	Motor	x	x	x	-	-	x
Q	Motor, low noise	x	-	x	x	x	x
S	Motor, high speed	-	-	(x)	(x)	(x)	(x)
H	Motor, high pressure	(x)	-	(x)	-	-	(x)
R	Pump, clockwise rot'n	(x)	-	(x)	(x)	(x)	(x)
L	Pump, counter clockw.	(x)	-	(x)	(x)	(x)	(x)

For other versions, contact Parker Hannifin

Frame size		5	6	10	12	14	19
Code	Main ports						
B	BSP threads	x	x	x	x	x	x
U	SAE, UN threads	(x)	(x)	(x)	(x)	(x)	(x)

Frame size		5	6	10	12	14	19
Code	Mounting flange						
C	CETOP flange	x	x	x	x	x	x

Frame size		5	6	10	12	14	19
Code	Shaft seal						
V	FPM, high pressure, high temperature	x	x	x	x	x	x

For other versions, contact Parker Hannifin

Frame size		5	6	10	12	14	19
Code	Option						
0000	Standard	x	x	x	x	x	x
MUVR	Make up/Anti cavitation valve clockwise rotation	-	(x)	(x)	(x)	(x)	(x)
MUVL	Make up/Anti cavitation valve counter clockwise rotation	-	(x)	(x)	(x)	(x)	(x)

Frame size		5	6	10	12	14	19
Code	Shaft*						
K	Metric key	x	x	x	x	x	x
J	Metric key	(x)	(x)	(x)	(x)	-	-
P	Metric key	-	-	-	-	(x)	-
A	Spline, DIN 5480	-	(x)	(x)	(x)	-	-
D	Spline, DIN 5480	x	x	x	x	x	x
S	Spline, SAE	(x)	-	-	-	-	-
V	Tapered shaft	-	(x)	(x)	(x)	(x)	-

*See also dimensional drawings on pages 31 – 39.

Frame size		5	6	10	12	14	19
Code	Option						
00	Standard	x	x	x	x	x	x
P_	Prepared for speed sensor	-	x	x	x	x	x
B_	Power Boost and Prepared for speed sensor	-	(x)	(x)	(x)	(x)	(x)
_T	Painted Black	(x)	(x)	(x)	(x)	(x)	(x)

x: Available (x): Optional – : Not available

NOTE:
All combinations are not valid, please contact Parker Hannifin

F11-ISO

F11 – [ ] – [ ] [ ] – [ ] [ ] – [ ] [ ] – [ ] – [ ] – [ ]

Frame size | Function | Main ports | Mounting flange | Shaft seal | Shaft | Version number | Option page 6 | Option page 7

Frame size	
Code	Displacem. (cm^3/rev)
006	6.0
010	9.8
012	12.5
014	14.3

Version number
(assigned for special versions)

Frame size		6	10	12	14
Code	Option				
0000	Standard	x	x	x	x
MUVR	Make up/Anti cavitation valve clockwise rotation	(x)	(x)	(x)	(x)
MUVL	Make up/Anti cavitation valve counter clockwise rotation	(x)	(x)	(x)	(x)

Frame size		6	10	12	14
Code	Function				
M	Motor	x	x	-	-
Q	Motor, low noise	-	x	x	x
S	Motor, high speed	-	(x)	(x)	(x)
H	Motor, high pressure	-	(x)	-	-
R	Pump, clockwise rot'n	-	(x)	(x)	(x)
L	Pump, counter clockw.	-	(x)	(x)	(x)

For other versions, contact Parker Hannifin

Frame size		6	10	12	14
Code	Shaft*				
K	Metric key	x	x	x	x
J	Metric key	(x)	(x)	(x)	-
P	Metric key	-	-	-	(x)
A	Spline, DIN 5480	(x)	(x)	(x)	-
D	Spline, DIN 5480	x	x	x	x
V	Tapered shaft	(x)	(x)	(x)	(x)

*See also dimensional drawings on pages 41 – 45.

Frame size		6	10	12	14
Code	Main ports				
F	Metric threads	-	x	x	x
B	BSP threads	x	(x)	(x)	(x)
M	Side ports, metric	-	(x)	(x)	(x)

Frame size		6	10	12	14
Code	Mounting flange				
I	ISO flange	x	x	x	x

Frame size		6	10	12	14
Code	Shaft seal				
V	FPM, high pressure, high temperature	x	x	x	x

For other versions, contact Parker Hannifin

x: Available (x): Optional – : Not available

Frame size		6	10	12	14
Code	Option				
00	Standard	x	x	x	x
P_	Prepared for speed sensor	x	x	x	x
B_	Power Boost and Prepared for speed sensor	(x)	(x)	(x)	(x)
_T	Painted Black	(x)	(x)	(x)	(x)

NOTE:
All combinations are not valid, please contact Parker Hannifin

F11-SAE

F11 – [ ] – [ ] [ ] – [ ] [ ] – [ ] [ ] – [ ] – [ ] [ ]

Frame size · Function · Main ports · Mounting flange · Shaft seal · Shaft · Version number · Option page 6 · Option page 7

Frame size	
Code	Displacem. (cm^3/rev)
006	6.0
010	9.8
012	12.5
014	14.3
019	19.0

Version number
(assigned for special versions)

Frame size		6	10	12	14	19
Code	Function					
M	Motor	x	x	-	-	x
Q	Motor, low noise	-	x	x	x	x
S	Motor, high speed	-	(x)	(x)	(x)	(x)
H	Motor, high pressure	-	(x)	-	-	(x)
R	Pump, clockwise rot'n	-	(x)	(x)	(x)	(x)
L	Pump, counter clockw.	-	(x)	(x)	(x)	(x)

For other versions, contact Parker Hannifin

Frame size		6	10	12	14	19
Code	Option					
0000	Standard	x	x	x	x	x
MUVR	Make up/Anti cavitation valve clockwise rotation	(x)	(x)	(x)	(x)	(x)
MUVL	Make up/Anti cavitation valve counter clockwise rotation	(x)	(x)	(x)	(x)	(x)

Frame size		6	10	12	14	19
Code	Shaft*					
T	SAE key	-	-	-	x	x
S	SAE spline	x	x	x	x	x
K	Metric key	x	x	x	-	-
J	Metric key	(x)	(x)	(x)	-	-
V	Tapered shaft	(x)	(x)	(x)	(x)	-

*See also dimensional drawings on pages 46 – 53.

Frame size		6	10	12	14	19
Code	Main ports					
U	SAE, UN threads	x	x	x	x	x
B	BSP threads	(x)	(x)	(x)	(x)	(x)

Frame size		6	10	12	14	19
Code	Mounting flange					
S	SAE flange	x	x	x	x	x

Frame size		6	10	12	14	19
Code	Shaft seal					
V	FPM, high pressure, high temperature	x	x	x	x	x

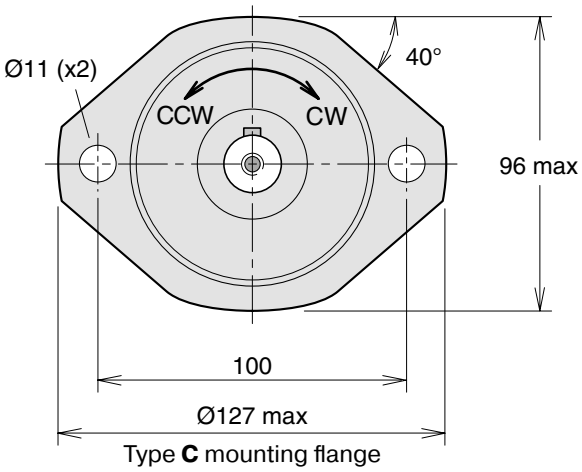
For other versions, contact Parker Hannifin

x: Available (x): Optional – : Not available

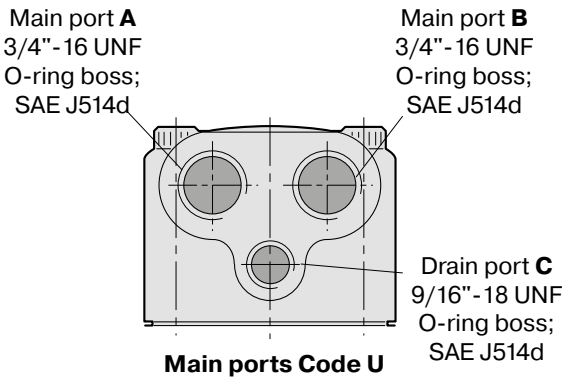
Frame size		6	10	12	14	19
Code	Option					
00	Standard	x	x	x	x	x
P_	Prepared for speed sensor	x	x	x	x	x
B_	Power Boost and Prepared for speed sensor	(x)	(x)	(x)	(x)	(x)
_T	Painted Black	(x)	(x)	(x)	(x)	(x)

NOTE:
All combinations are not valid, please contact Parker Hannifin

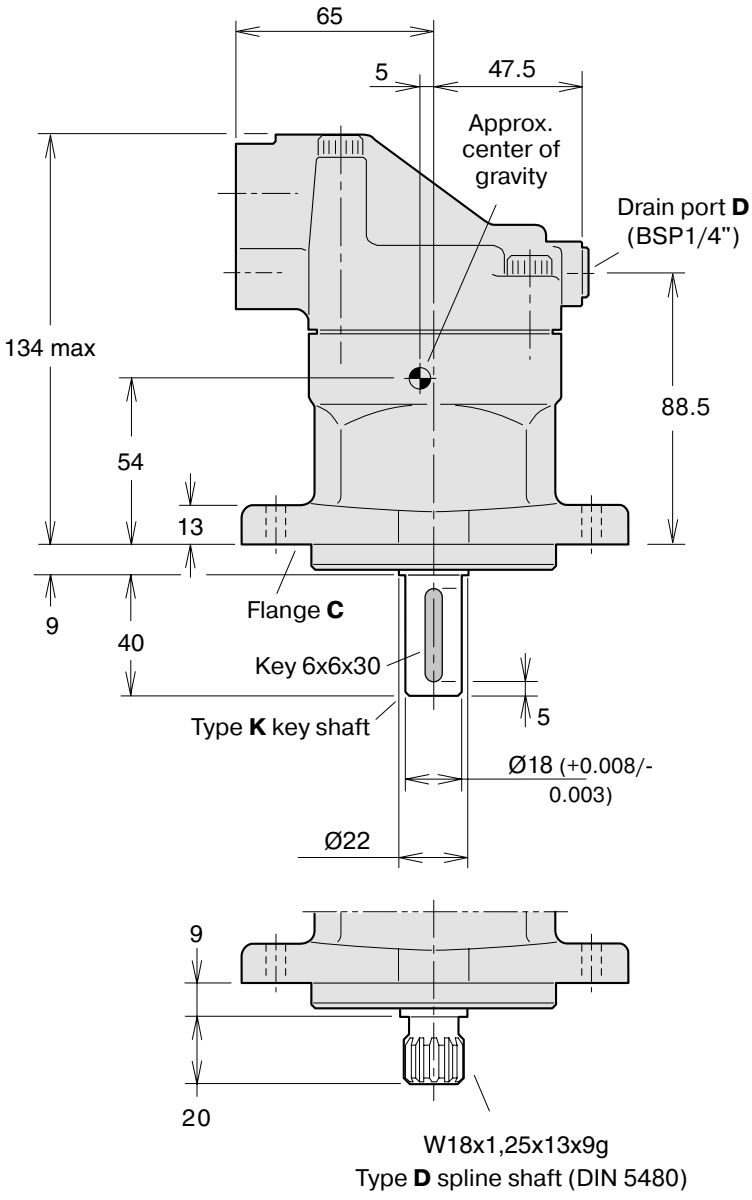
F11-005 (CETOP versions)



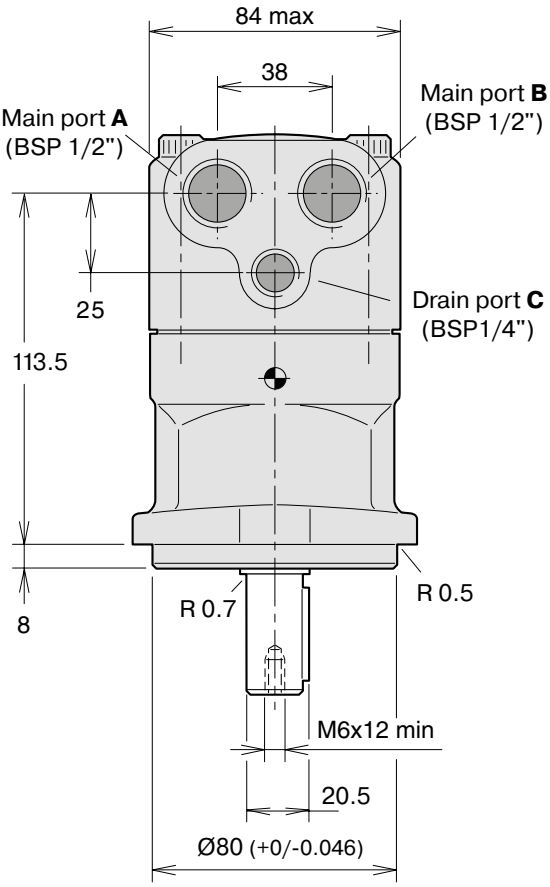
Type **C** mounting flange

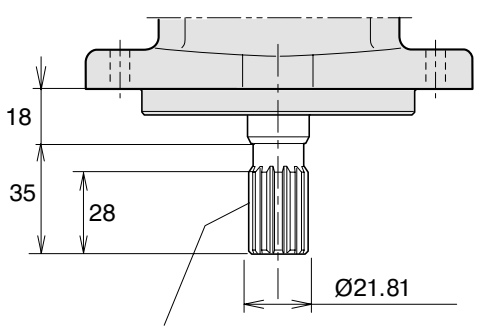


Main ports Code U



W18x1,25x13x9g
Type **D** spline shaft (DIN 5480)





Type **S** spline shaft (13T16/32 DP)

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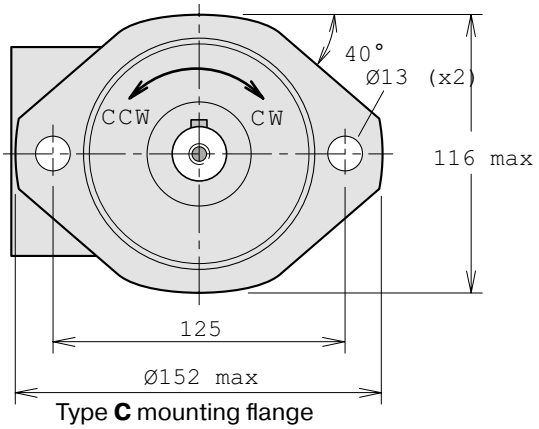
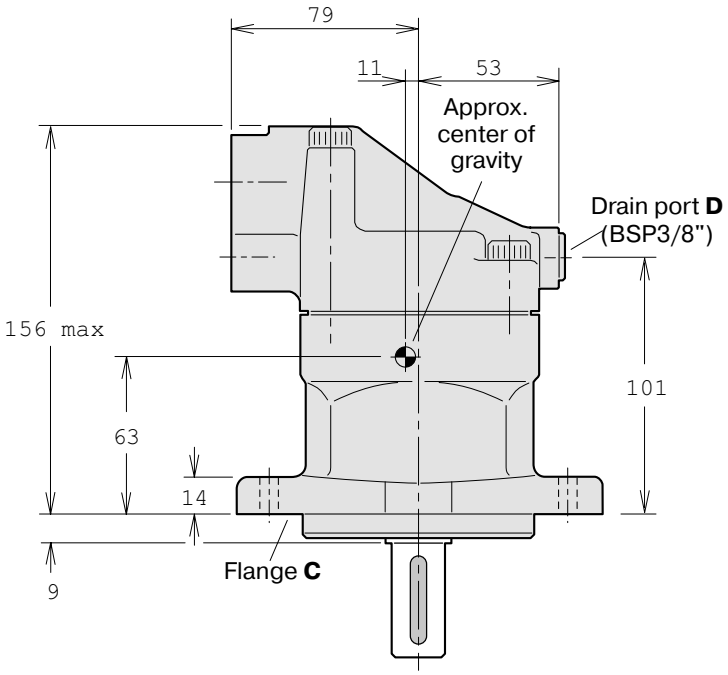
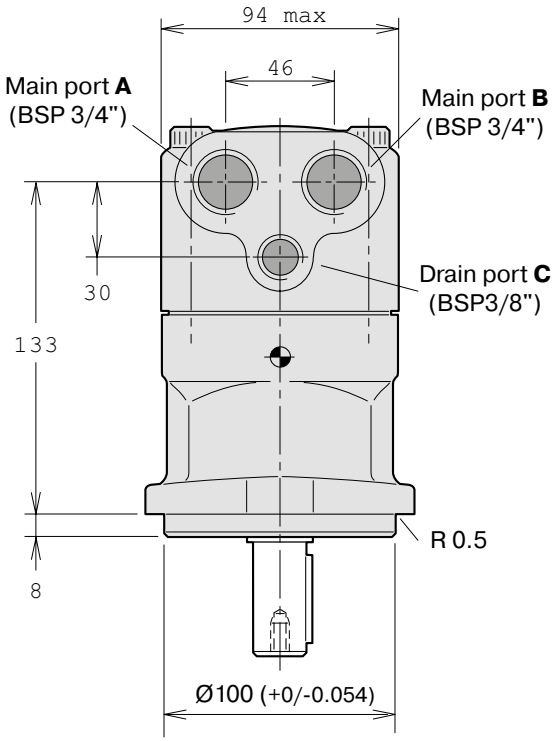
F11-006, -010 (CETOP versions)

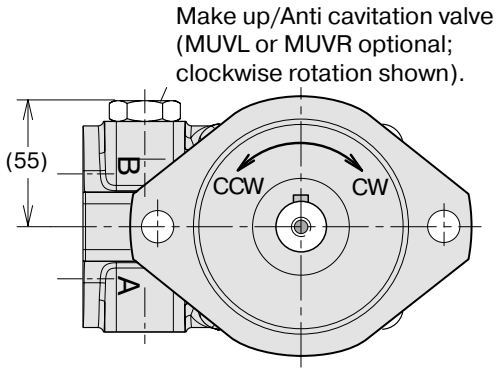


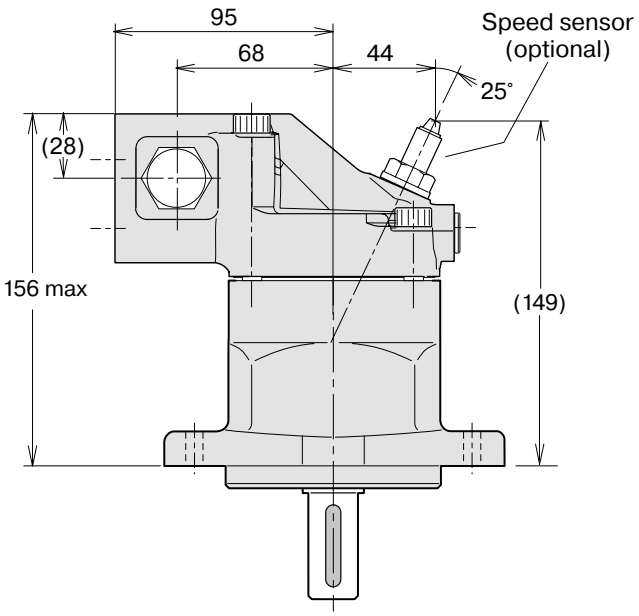
Type **C** mounting flange



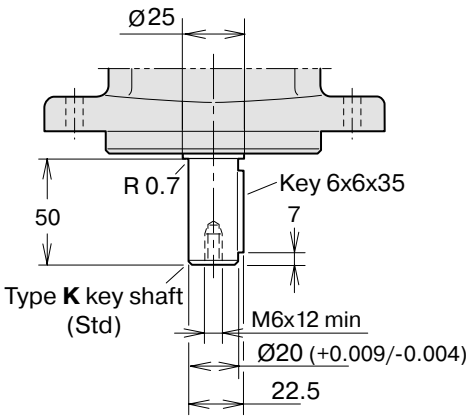


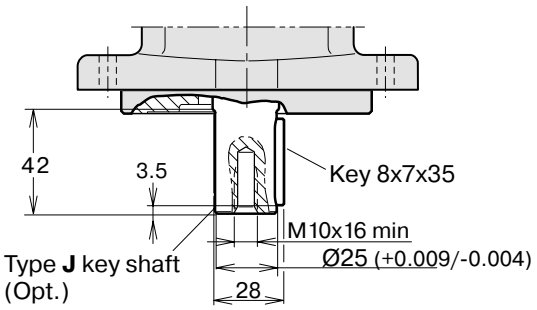
F11-006, -010 (CETOP versions)

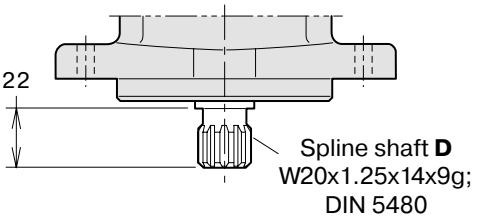


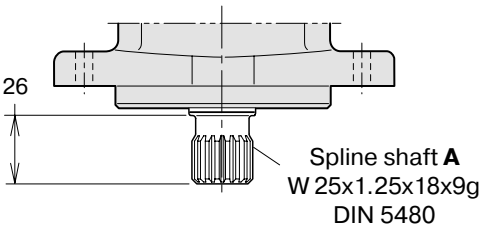


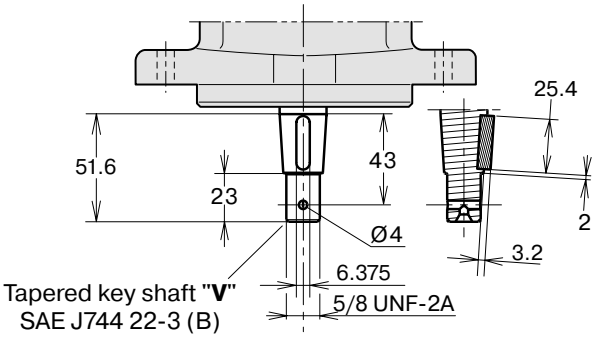
Shaft options



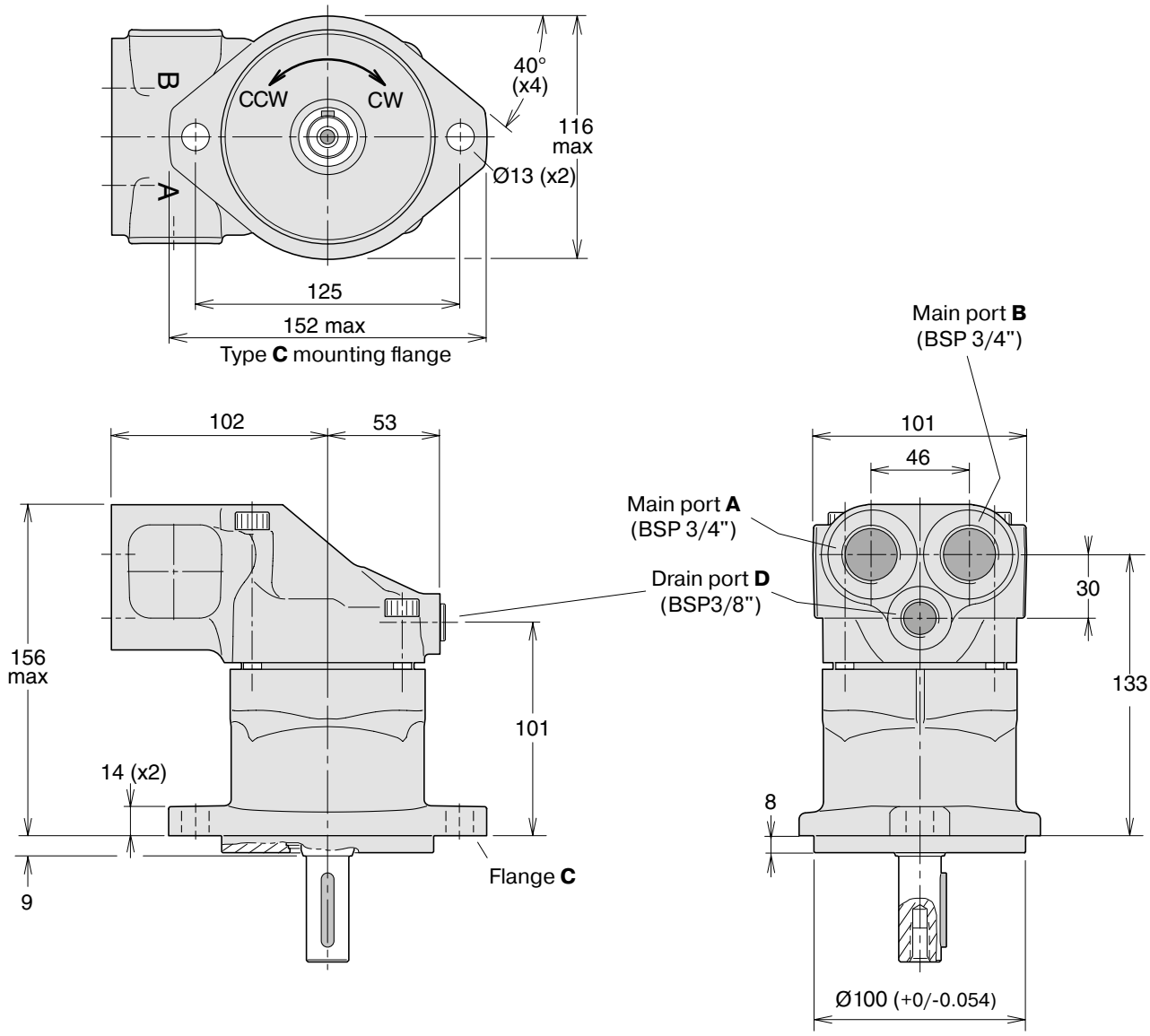




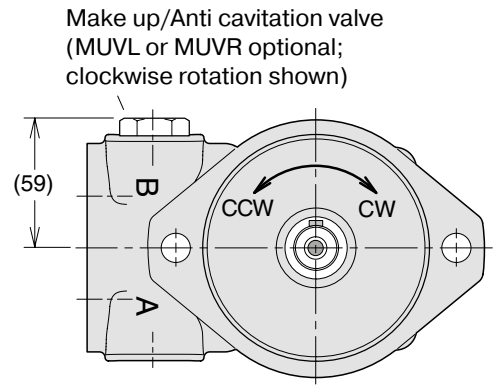


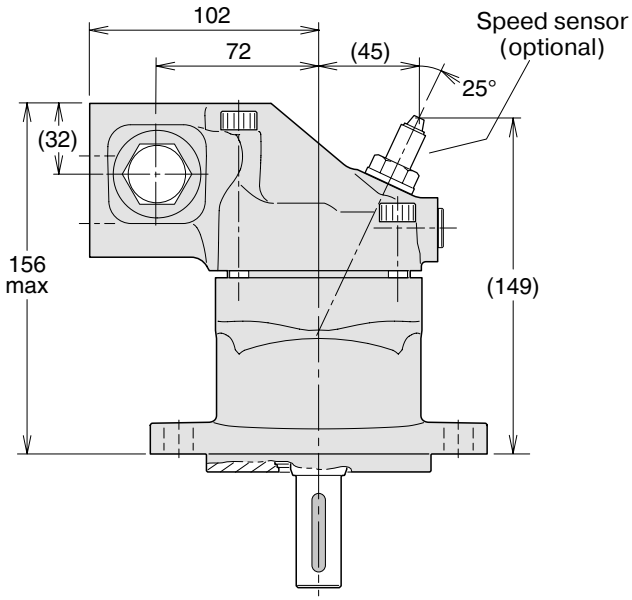


F11-012 (CETOP versions)

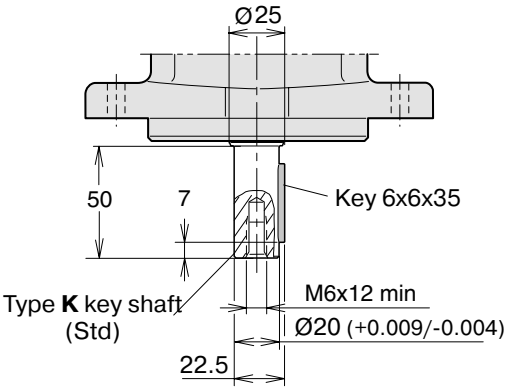


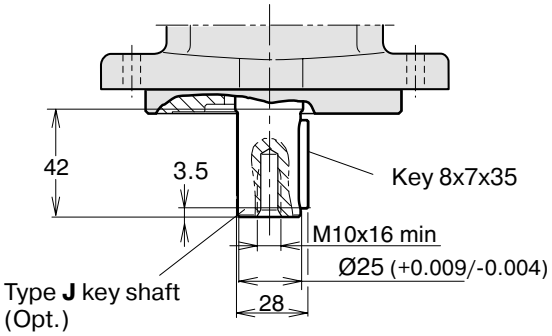
F11-012 (CETOP versions)

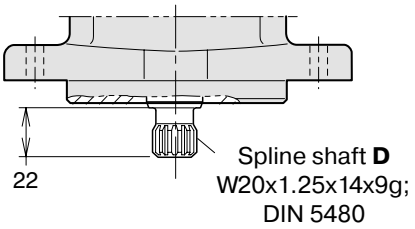


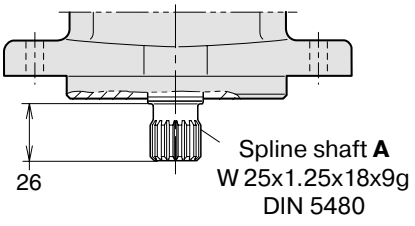


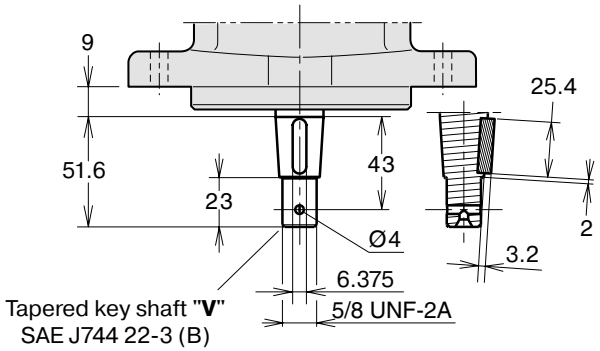
Shaft options



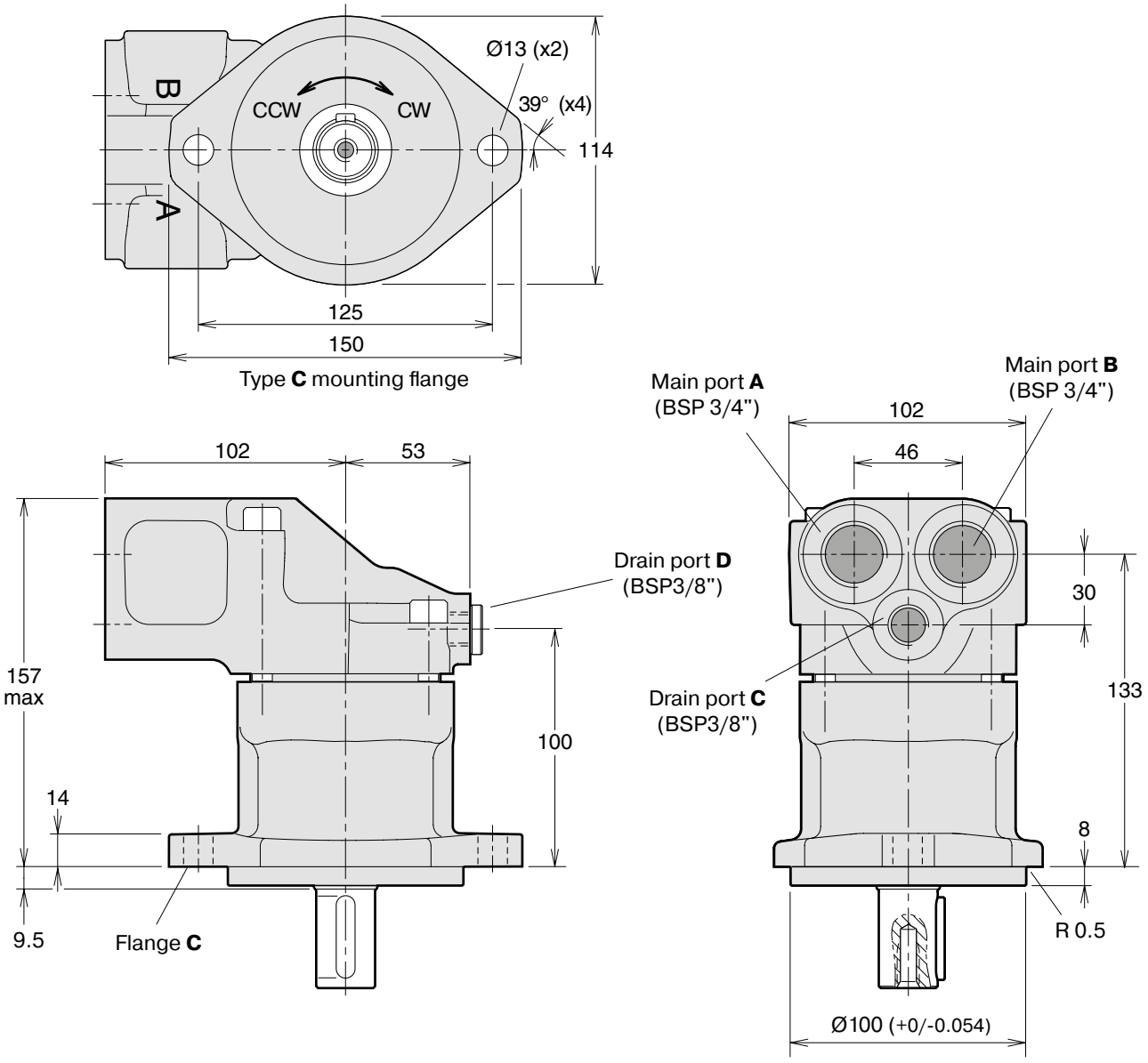




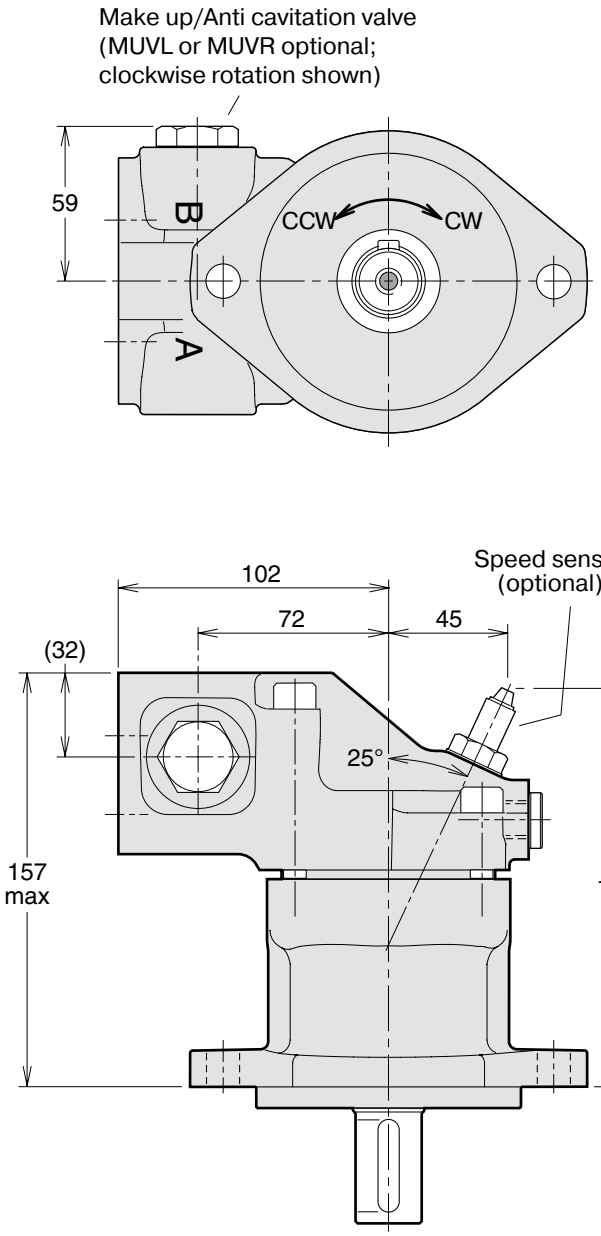




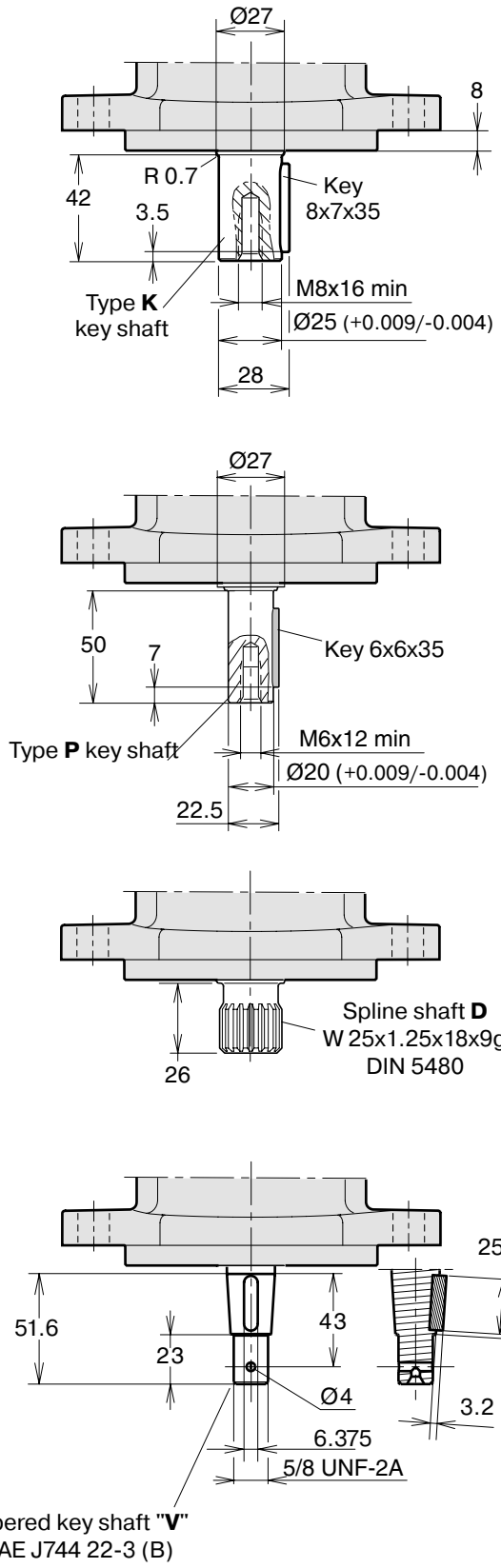
F11-014 (CETOP versions)



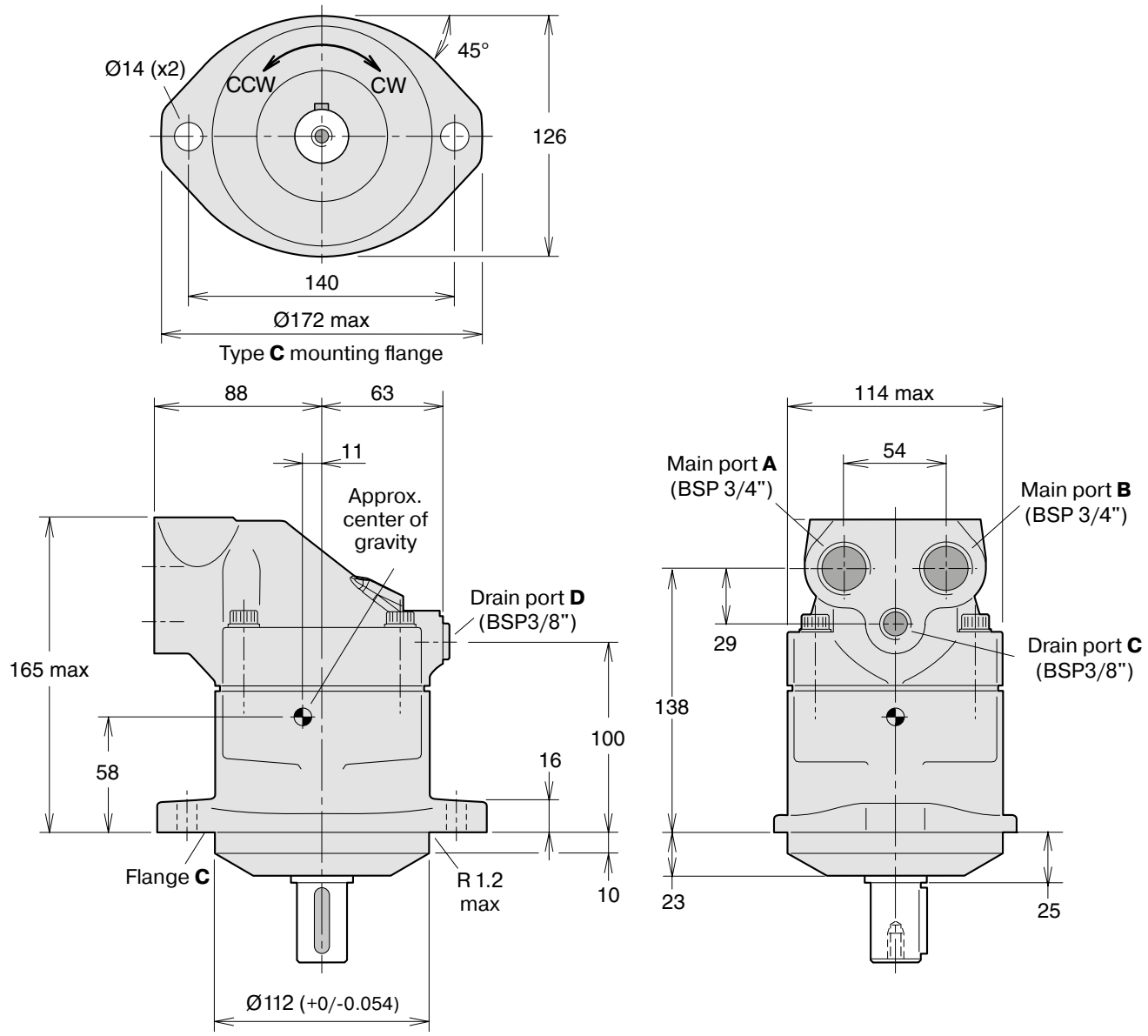
F11-014 (CETOP versions)



Shaft options



F11-019 (CETOP version)



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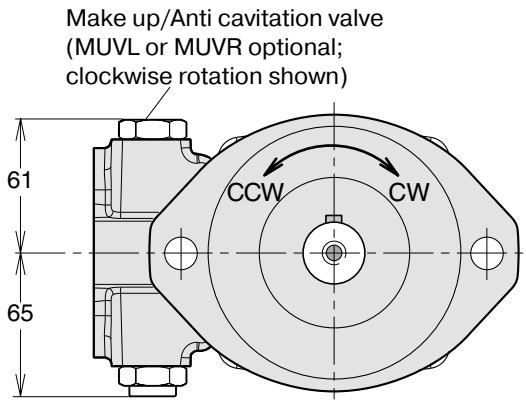
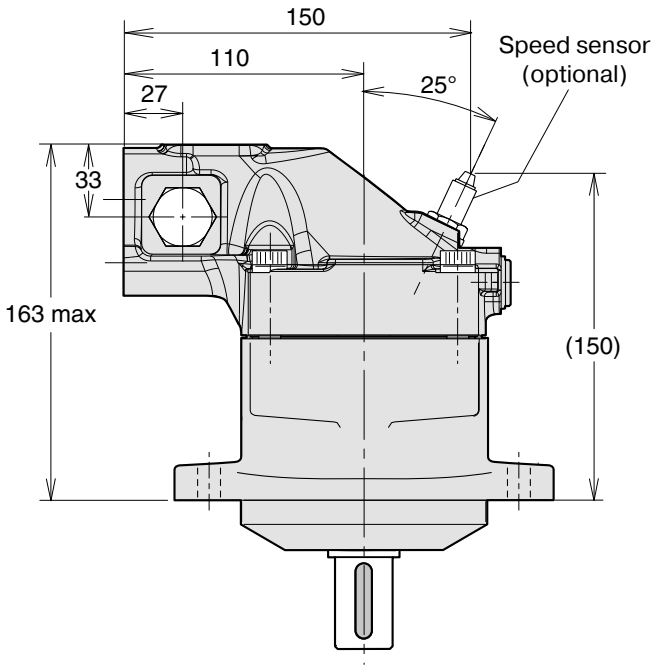
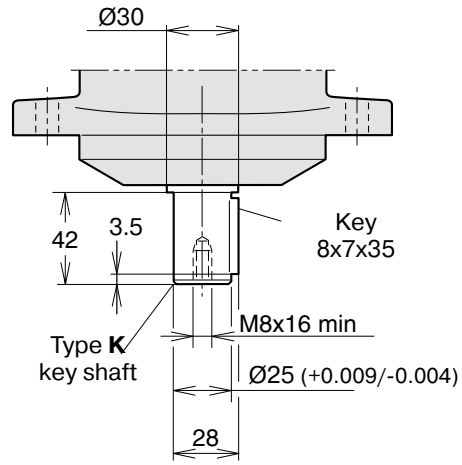
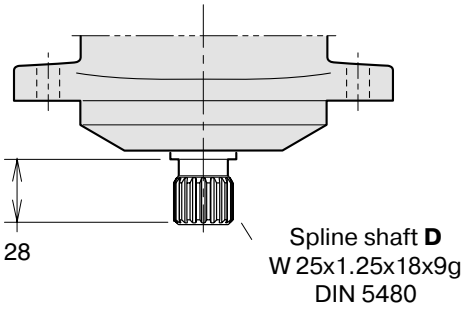
F11-019 (CETOP version)



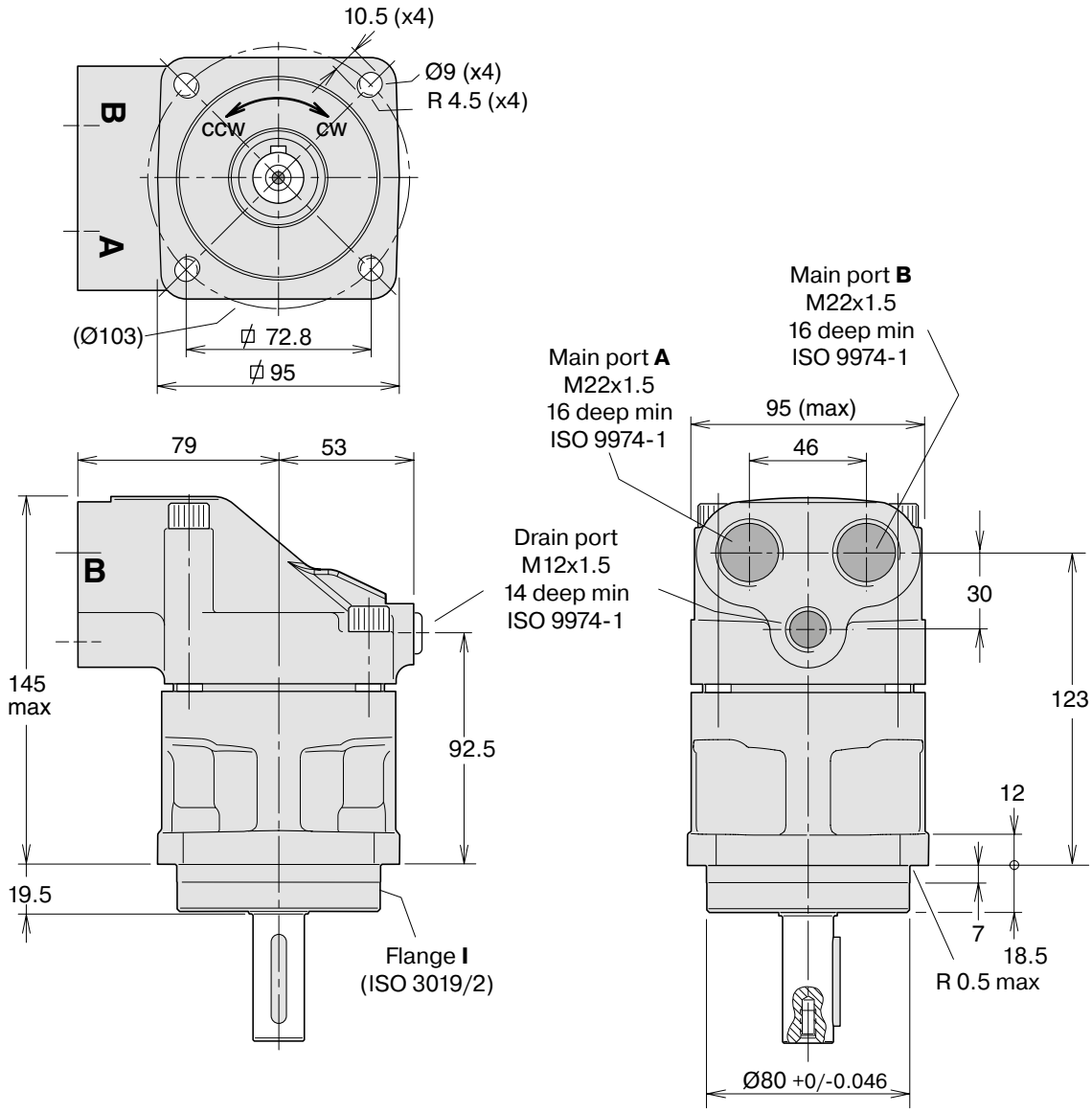


Shaft options

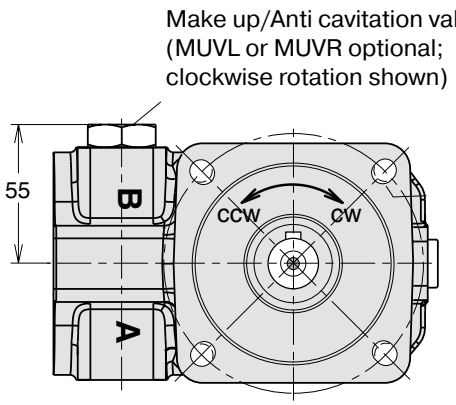


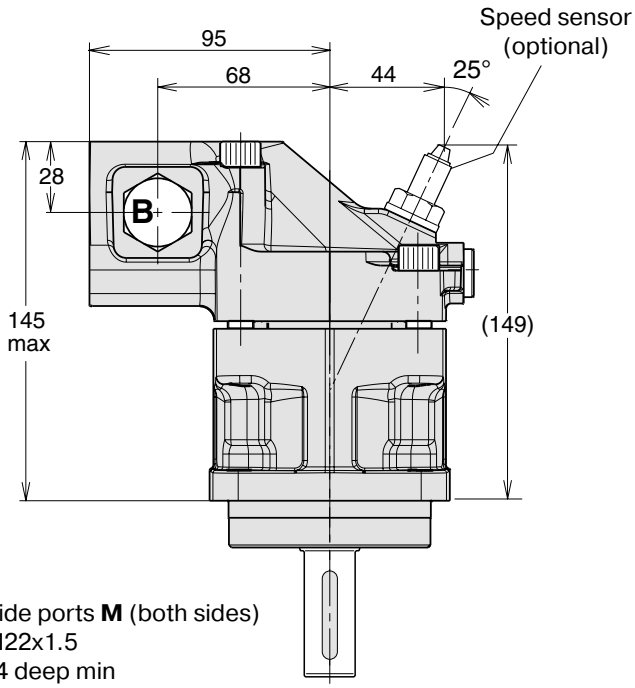


F11-006, -010 (ISO versions)

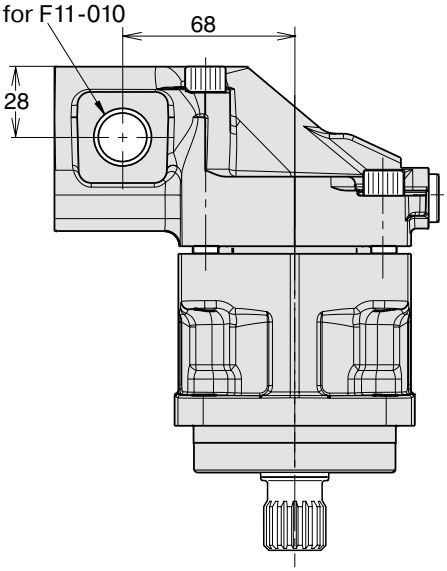


F11-006, -010 (ISO versions)

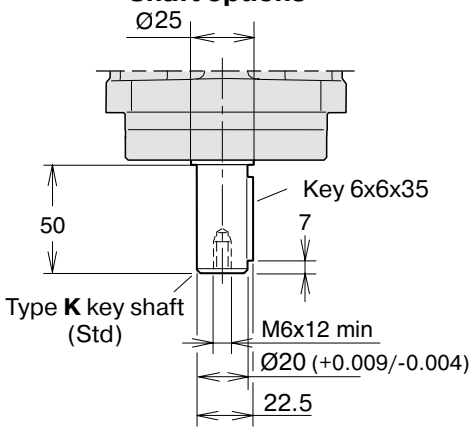


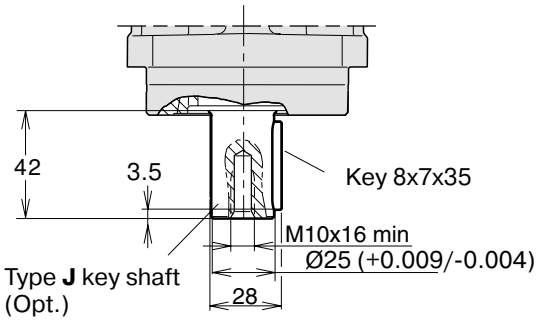


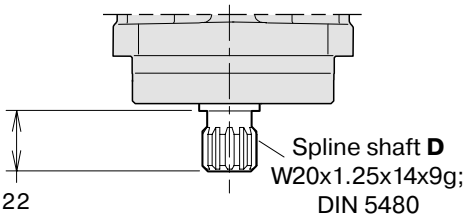
Side ports **M** (both sides)
M22x1.5
14 deep min
ISO 9974-1
Only for F11-010

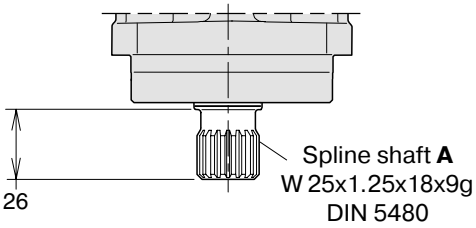


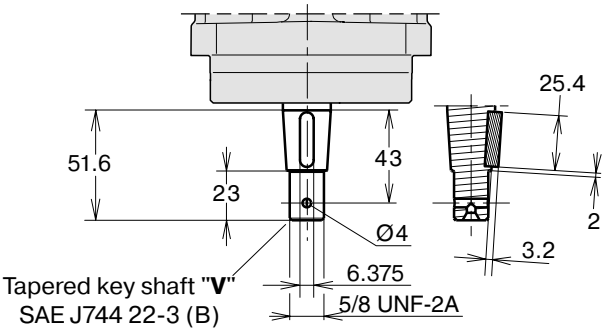
Shaft options











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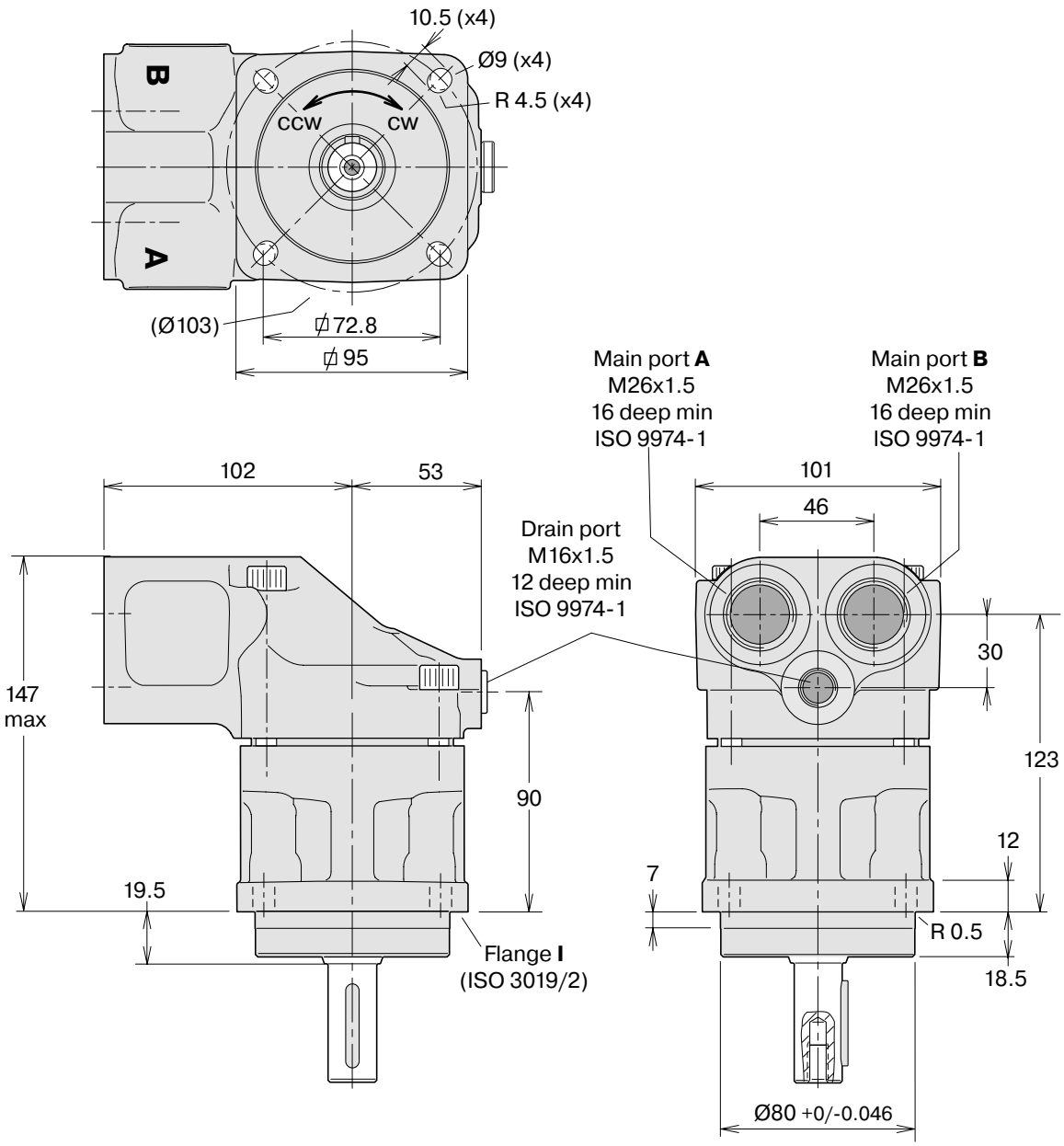
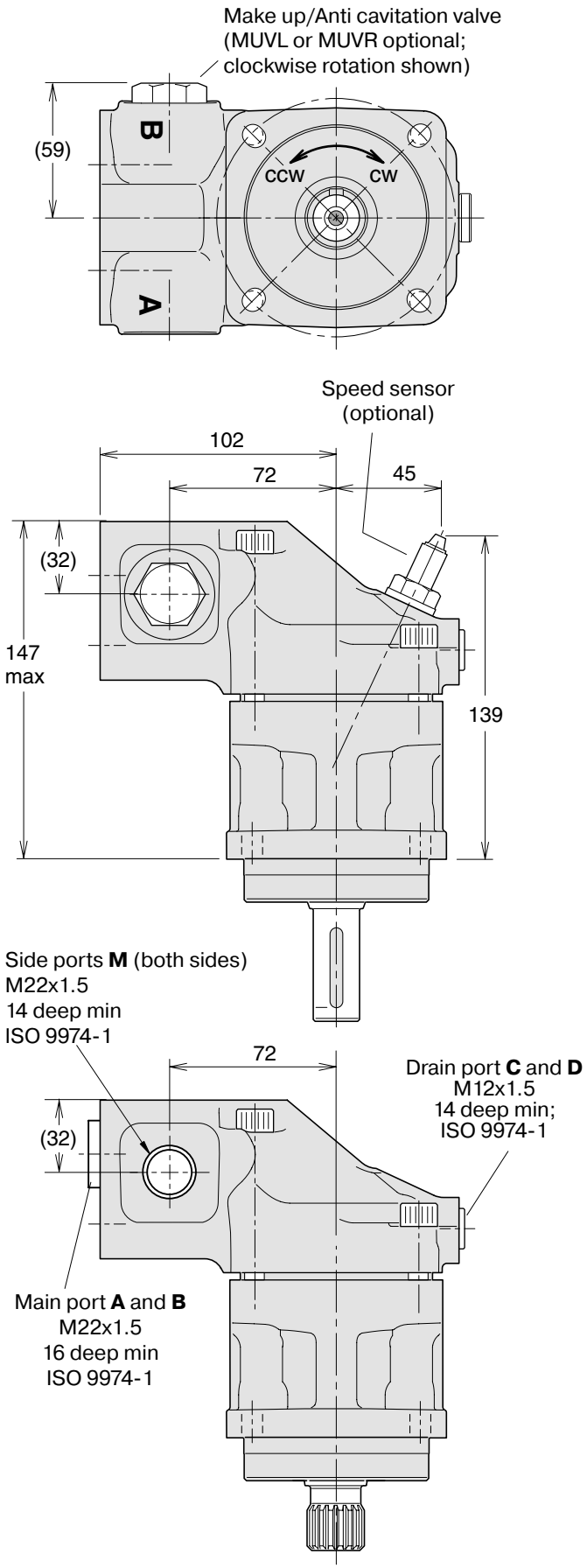
Pump & Motor Division Europe
Trollhättan, Sweden

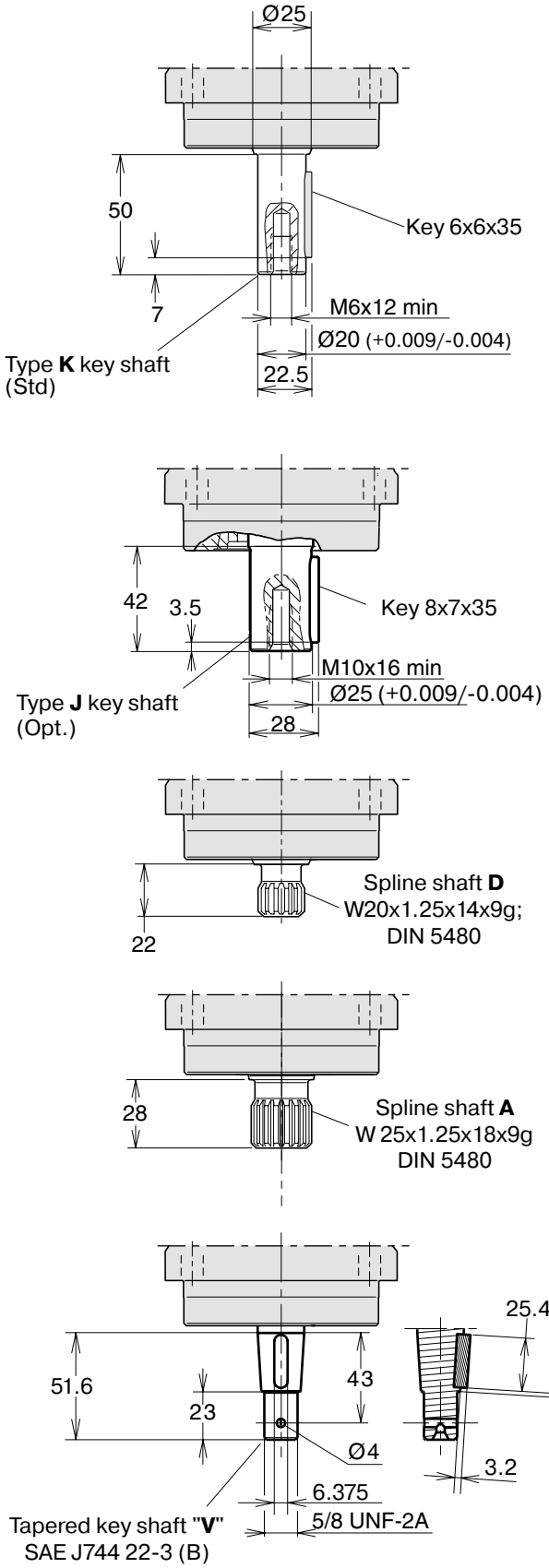
F11-012 (ISO versions)



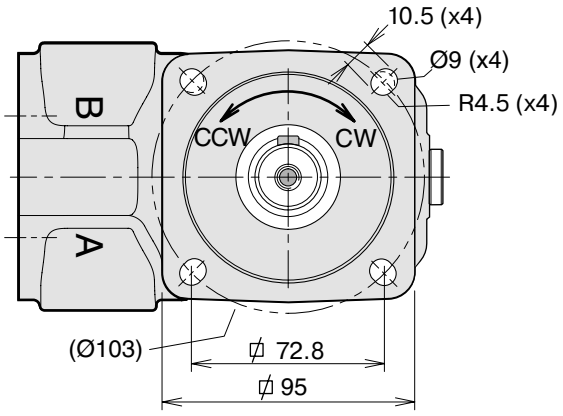
F11-012 (ISO versions)



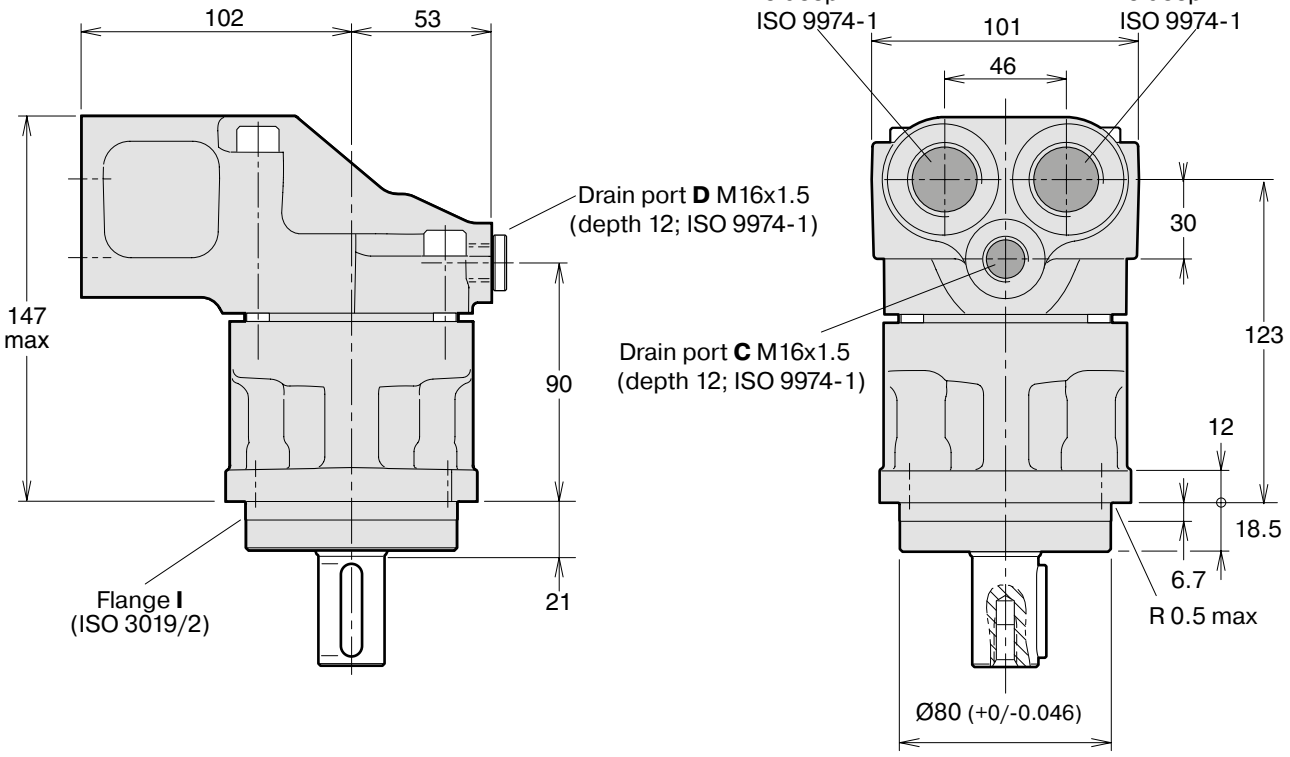
Shaft options



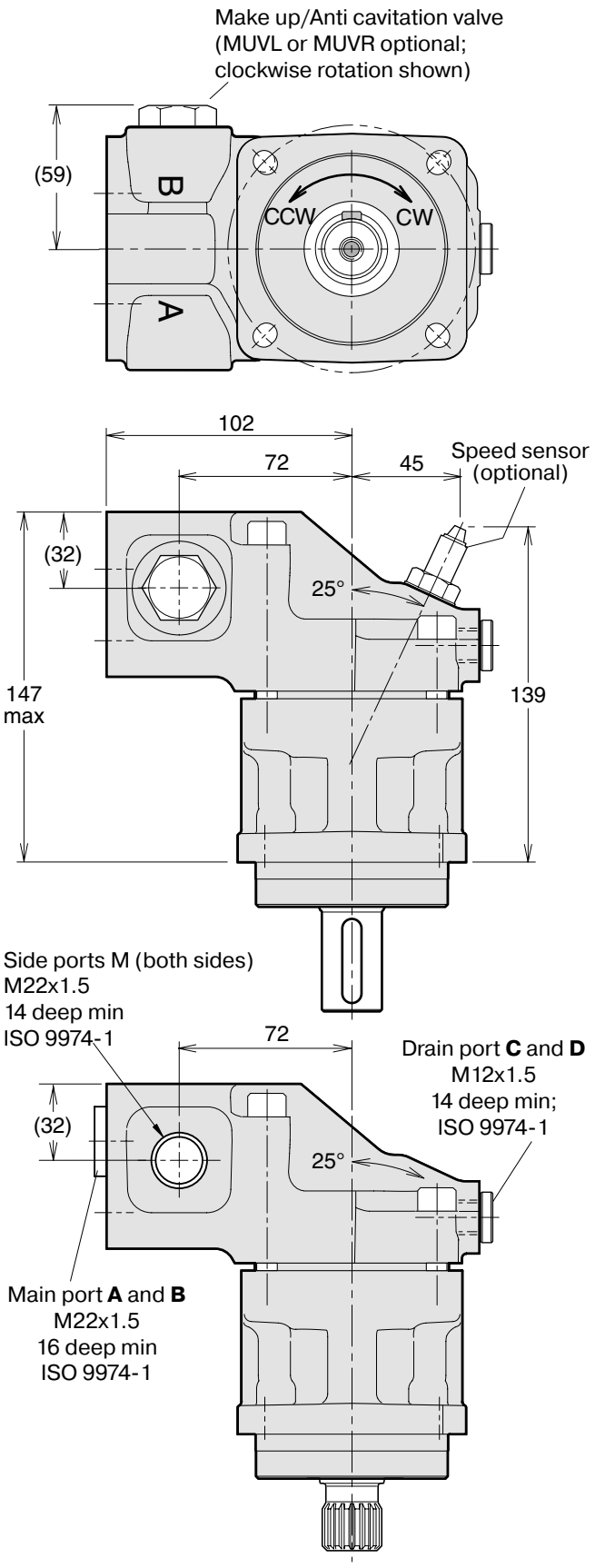
F11-014 (ISO versions)



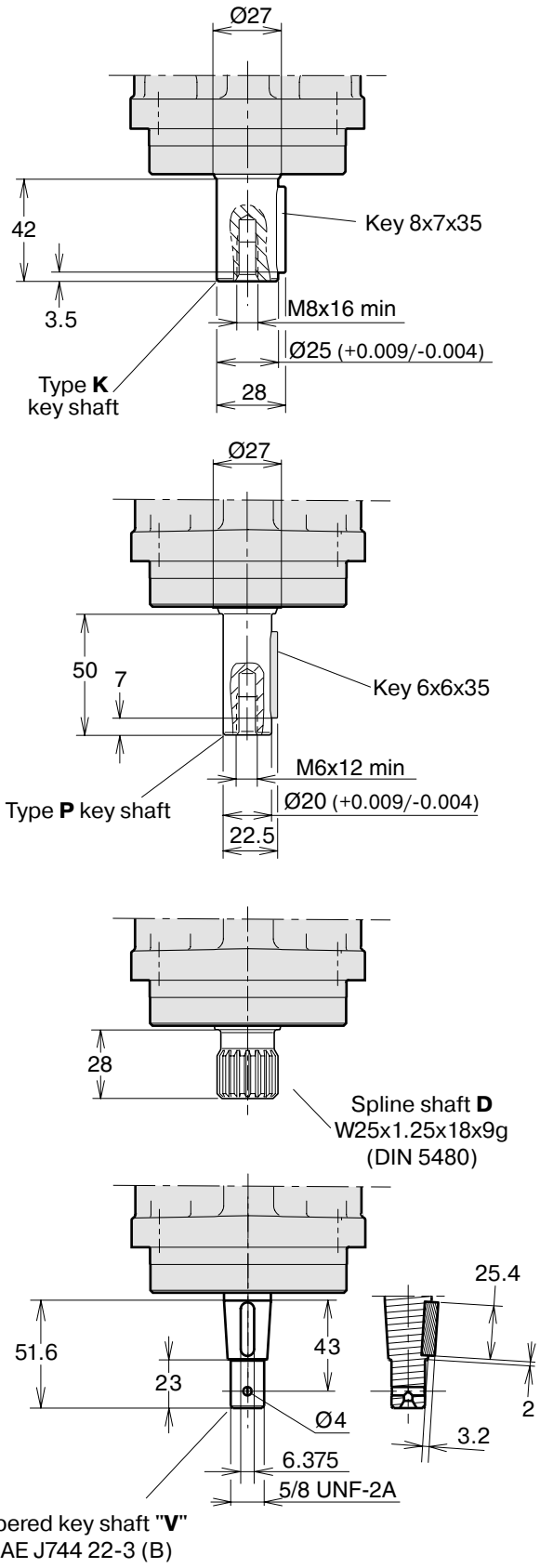
Type **I** mounting flange (ISO 3019/2)



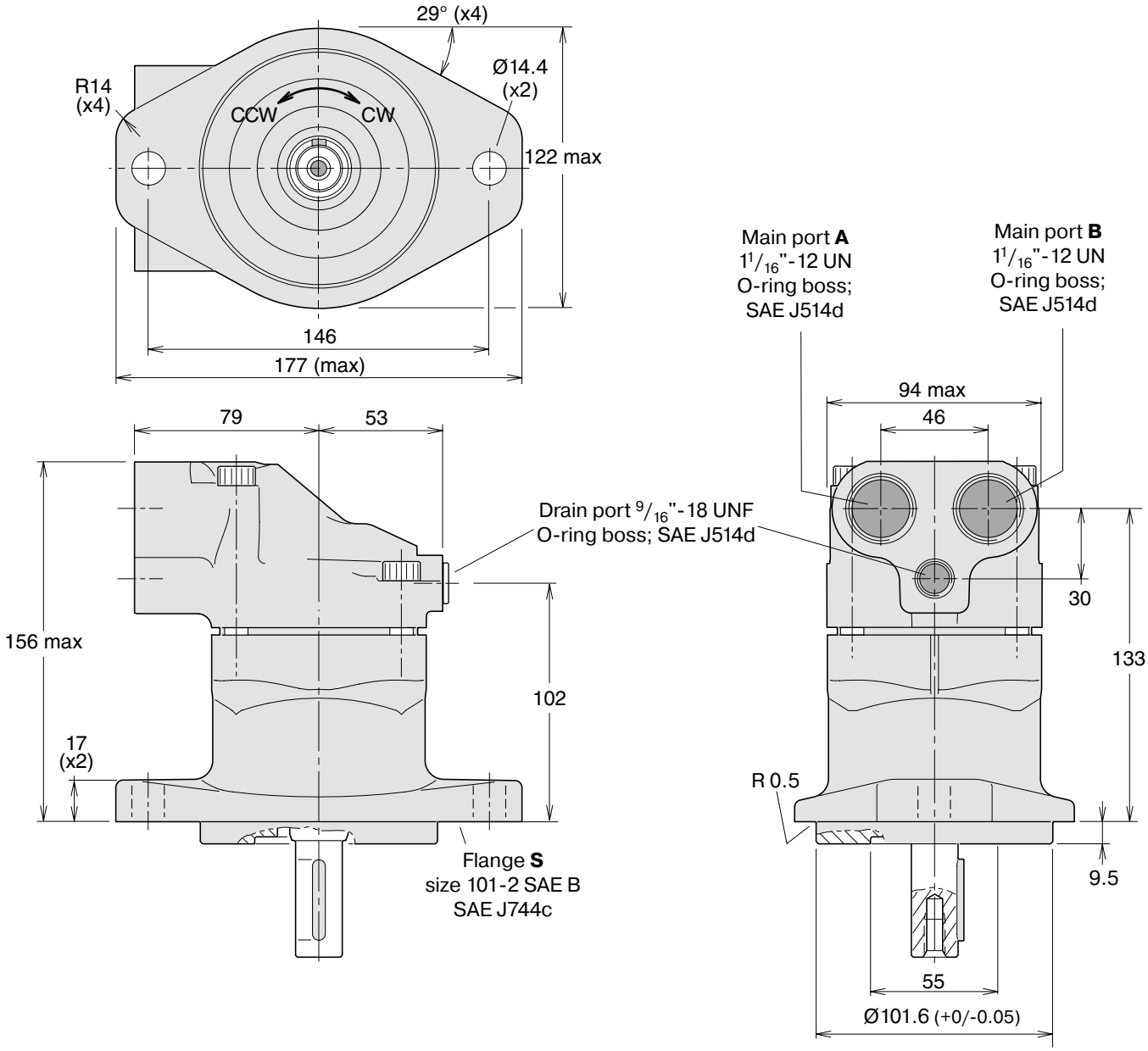
F11-014 (ISO versions)



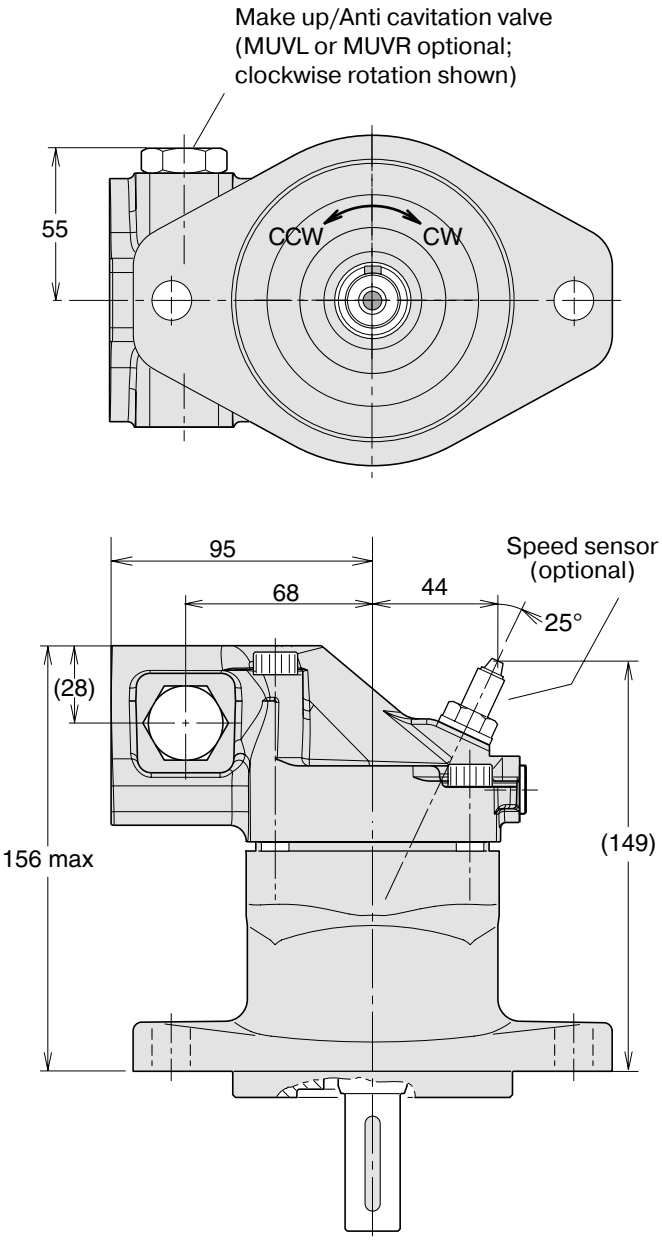
Shaft options



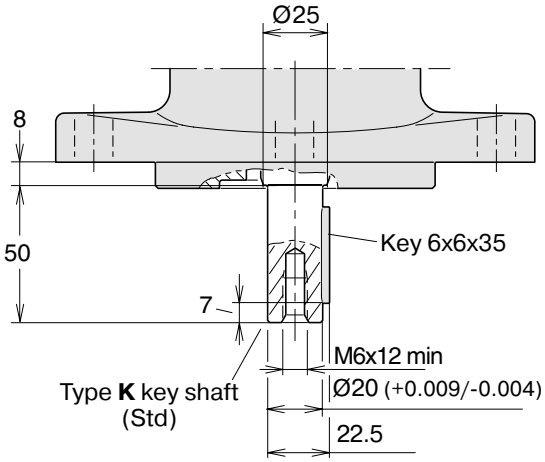
F11-006, -010 (SAE versions)

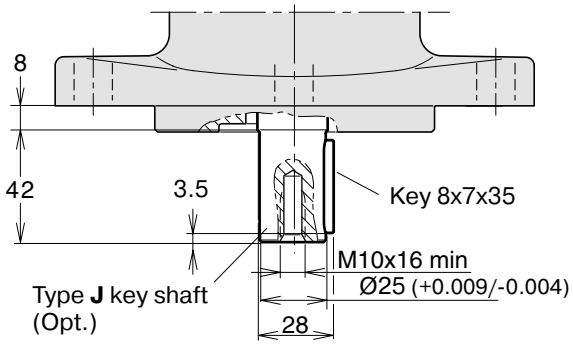


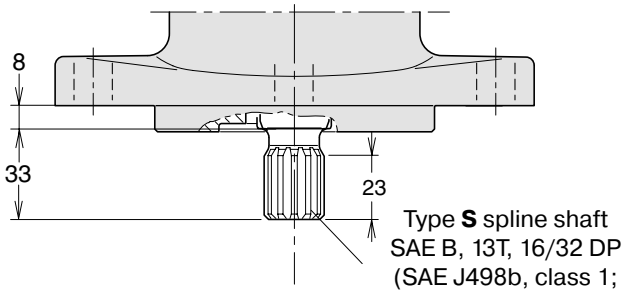
F11-006, -010 (SAE versions)

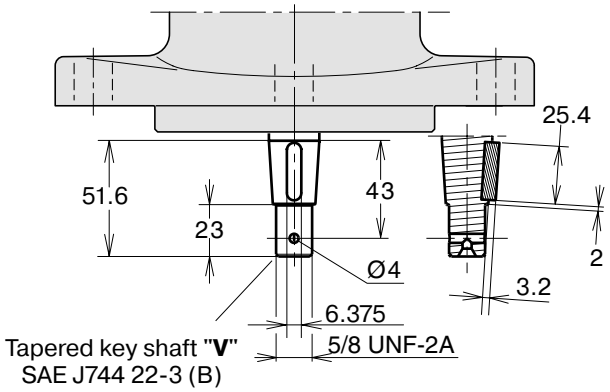


Shaft options

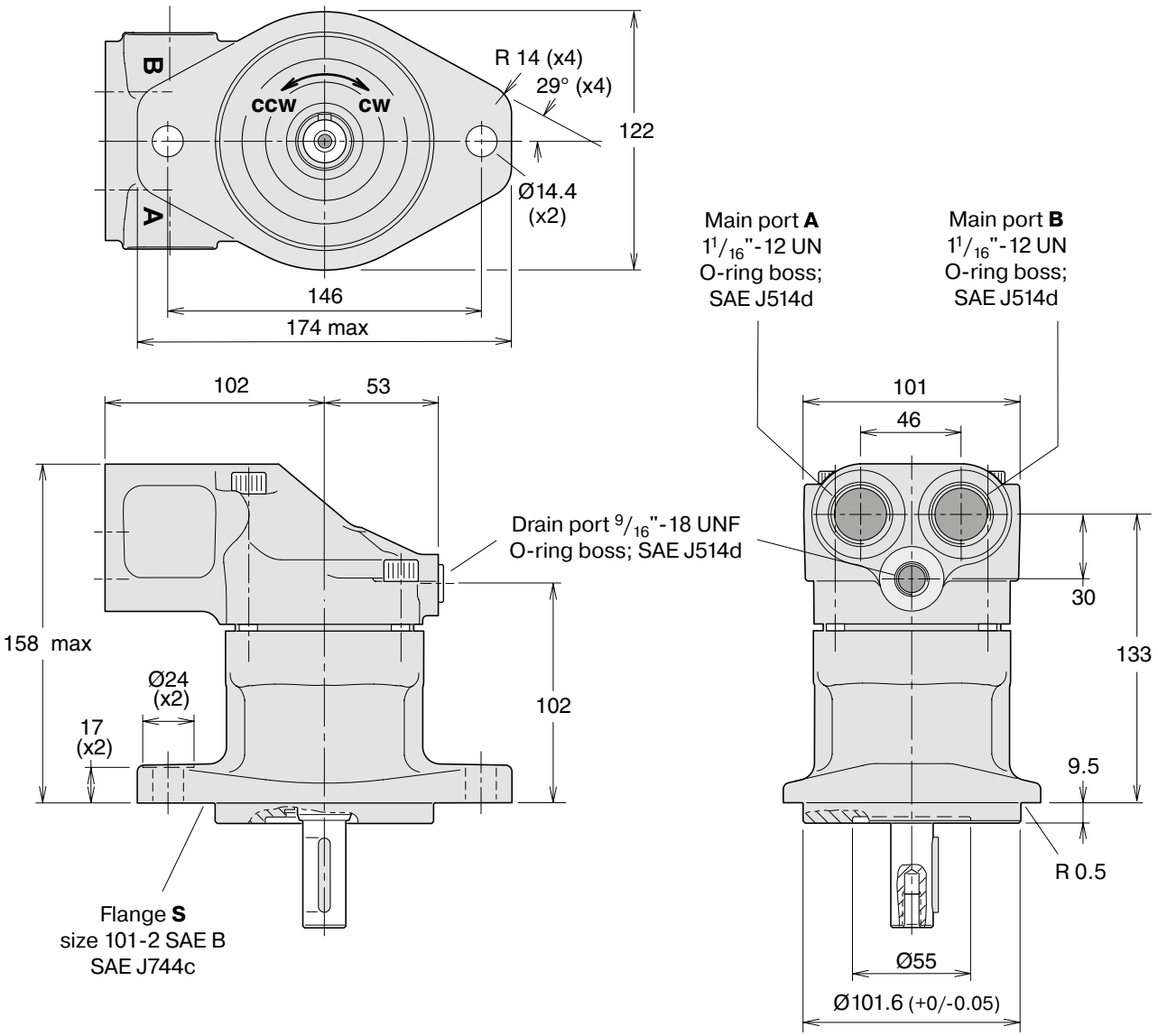




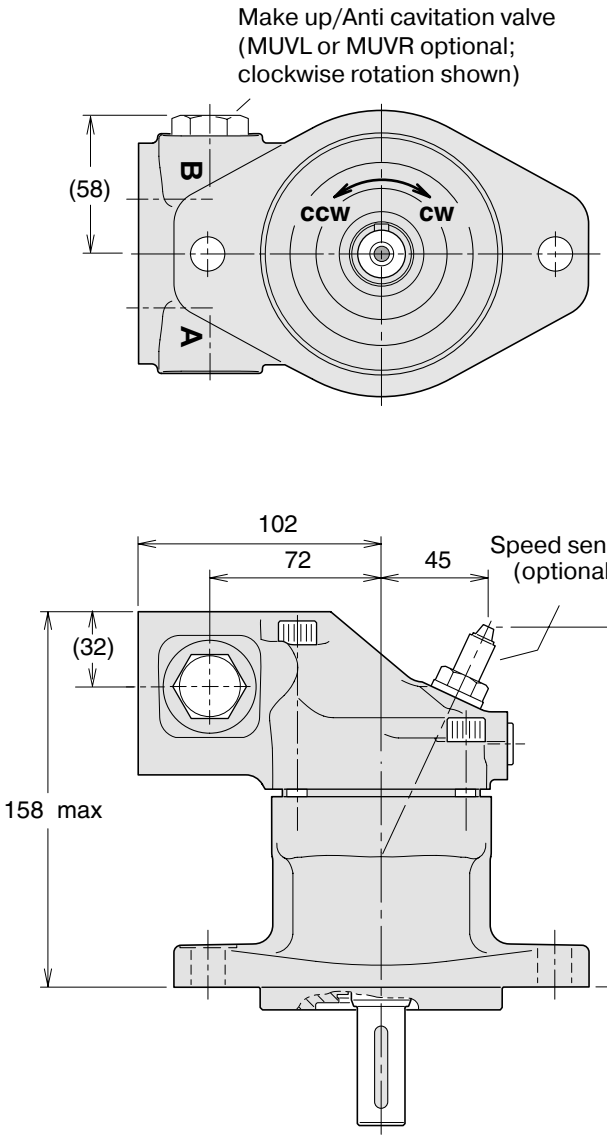




F11-012 (SAE versions)



F11-012 (SAE versions)



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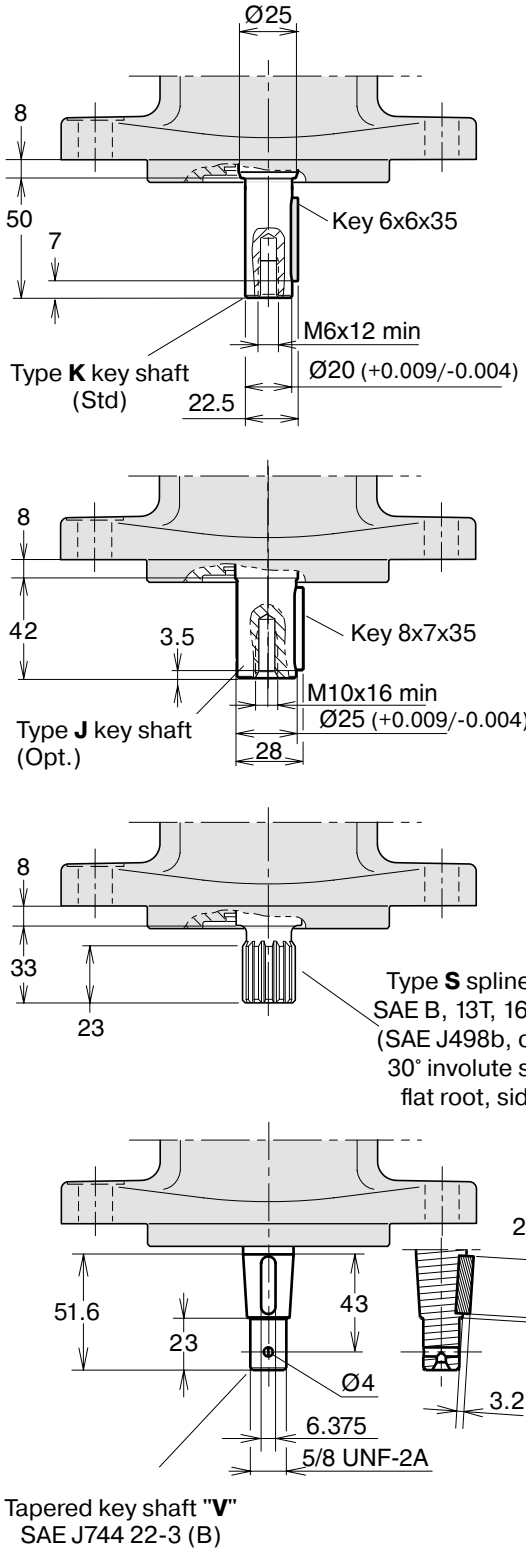
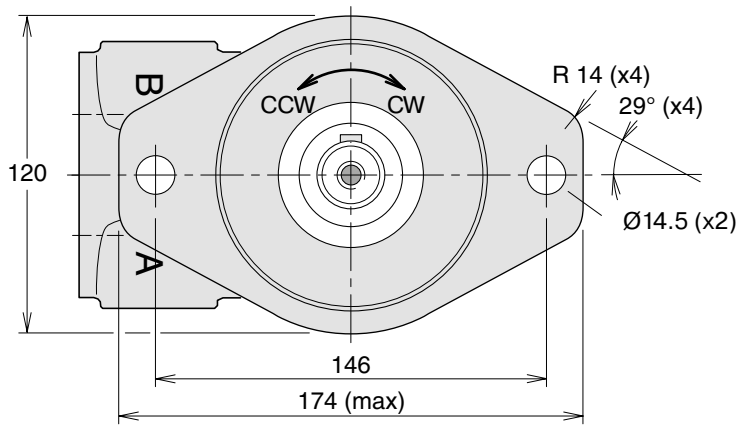
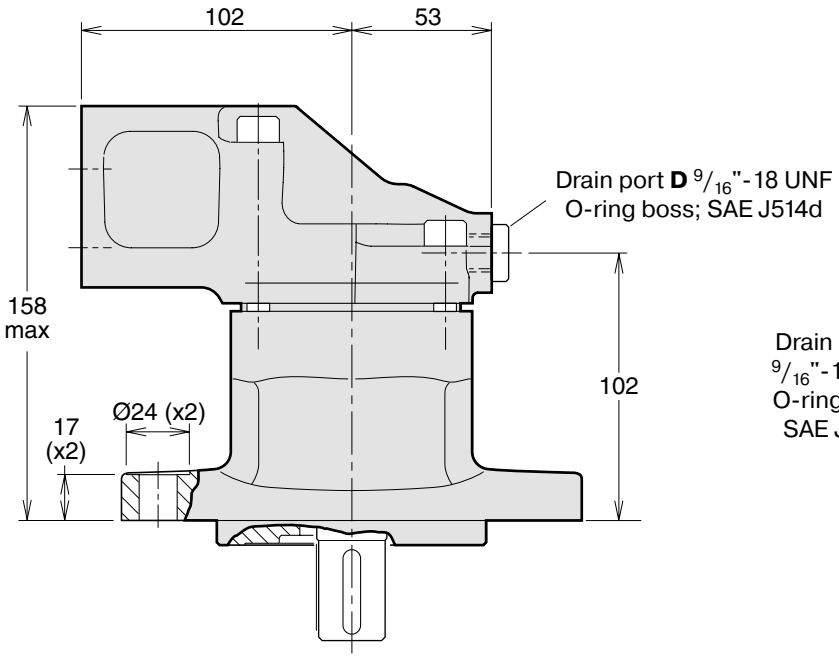
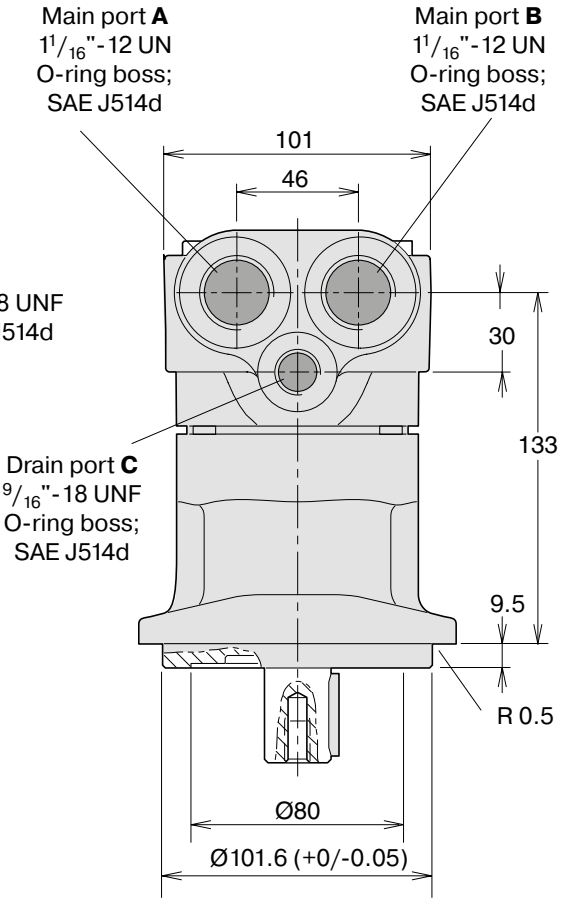


F11-014 (SAE versions)

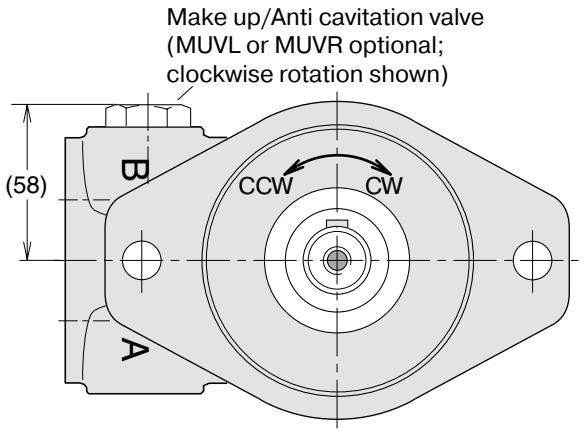


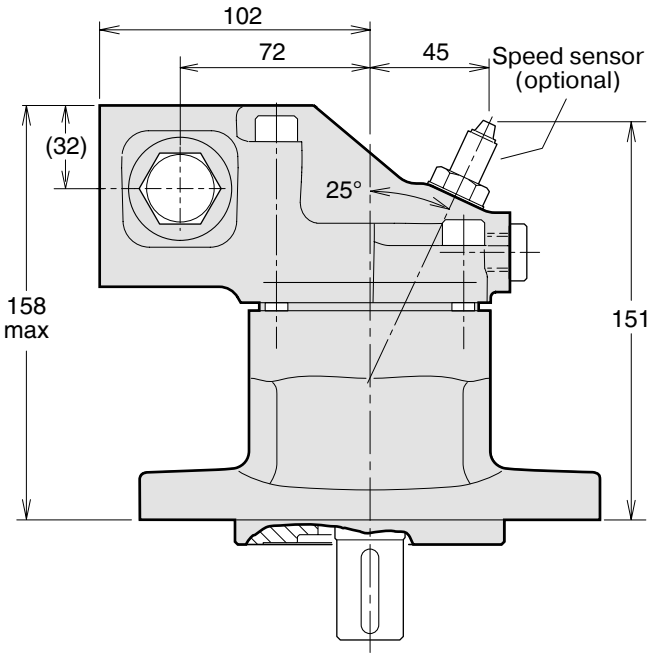
Type **S** mounting flange SAE 'B' (SAE J744c)



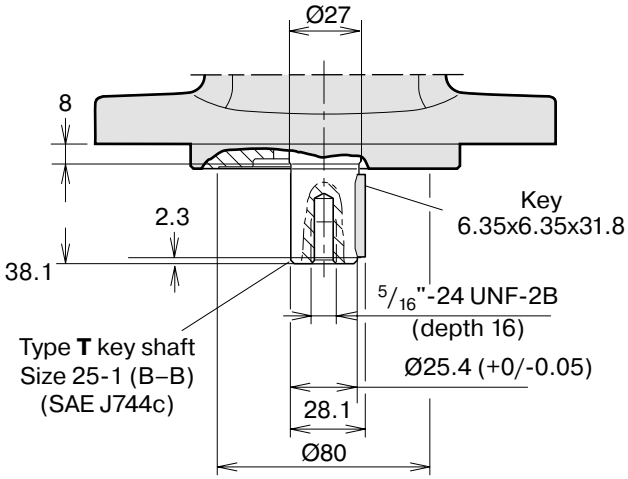


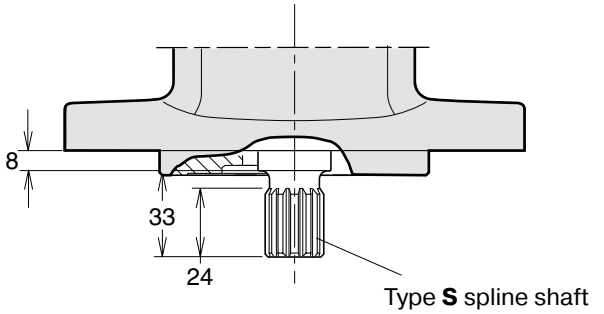
F11-014 (SAE versions)

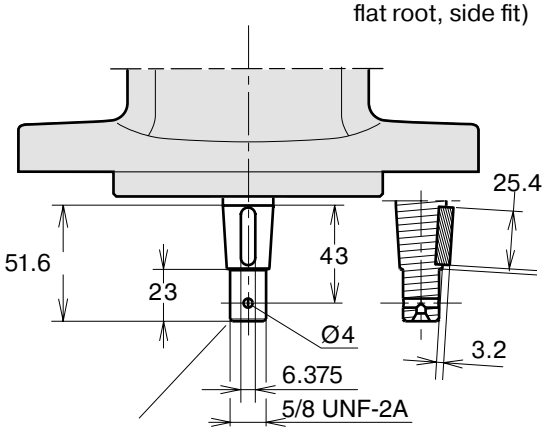




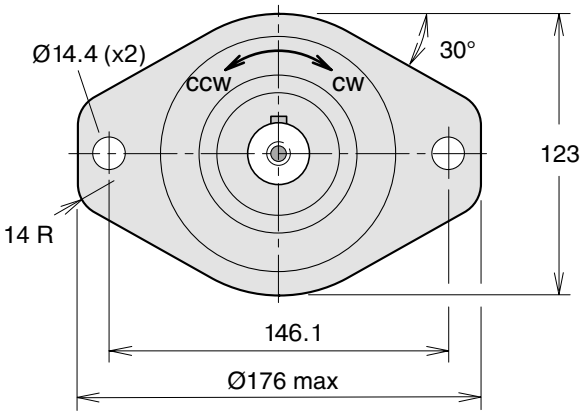
Shaft options



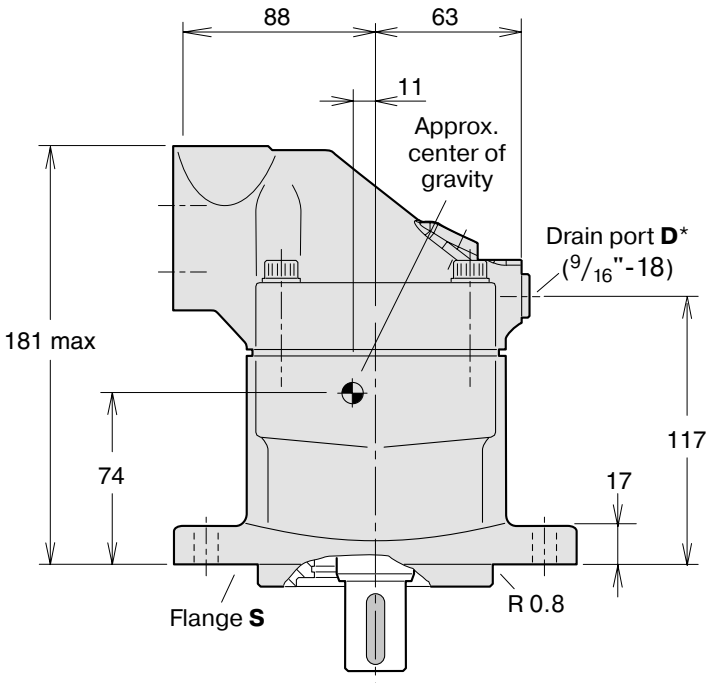


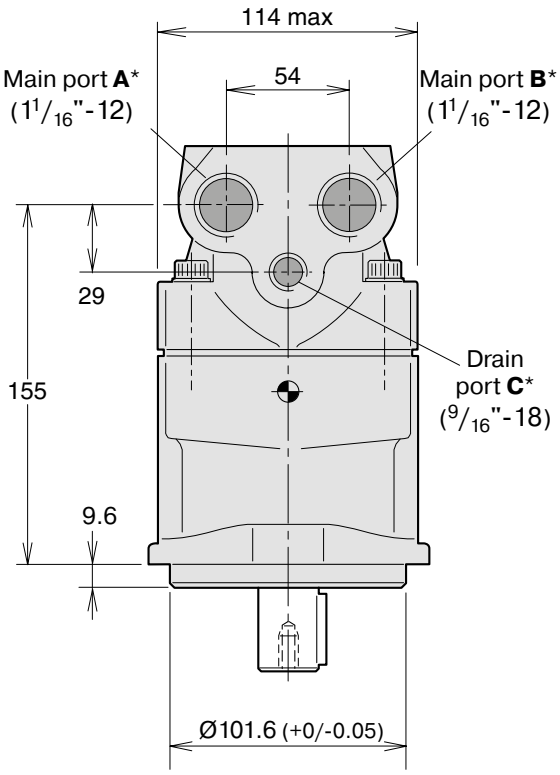


F11-019 (SAE version)



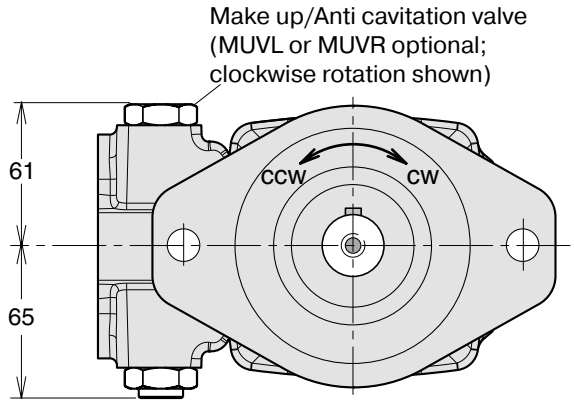
Type **S** mounting flange SAE 'B' (SAE J744c)

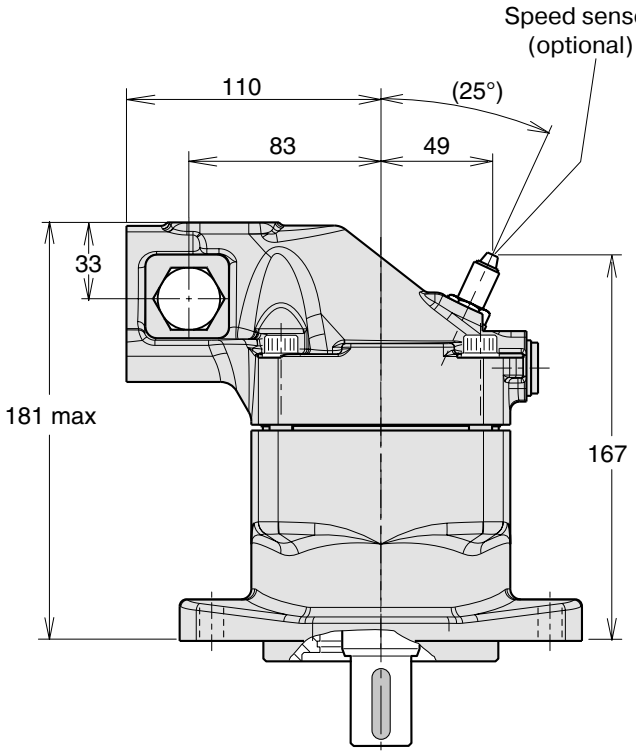




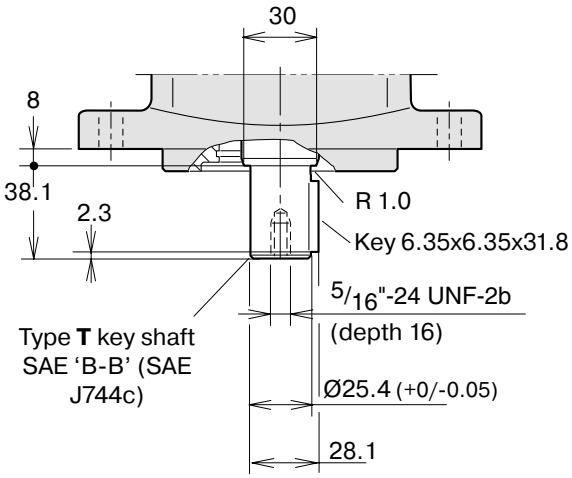
* O-ring ports according to SAE J514d

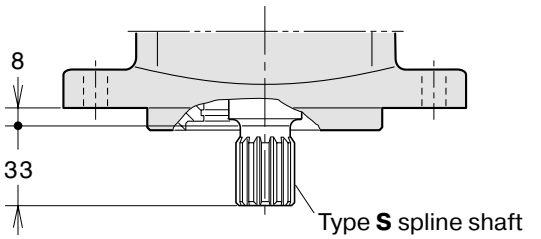
F11-019 (SAE version)





Shaft options





Type **S** spline shaft
SAE B, 13T, 16/32 DP
(SAE J498b, class 1;
30° involute spline;
flat root, side fit)

Accessories

Content ..... Page

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FV13 flushing valve block 78
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Possible pressure settings 79
SR pressure relief anti-cavitation valve 80
SV pressure relief valve 81
SV pressure relief valve, Dimensions 82
MV Anti-cavitation valve / make up valve block 82
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BLA Boost Units 84

Integrated flushing valve (F10-30, -37, -56, -80, -90, -107, F12-30, -40, -60, -80, -90)

General information

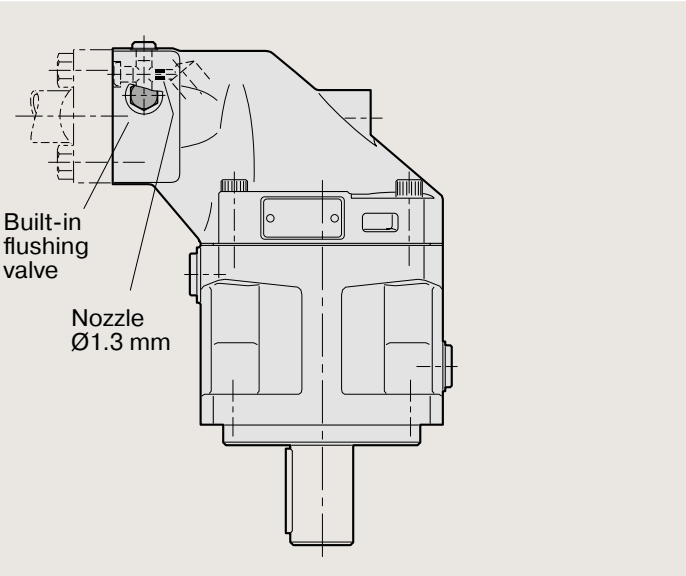
The integrated flushing valve supplies the motor with a cooling flow through the case which may be required when operating at high speeds and power levels.

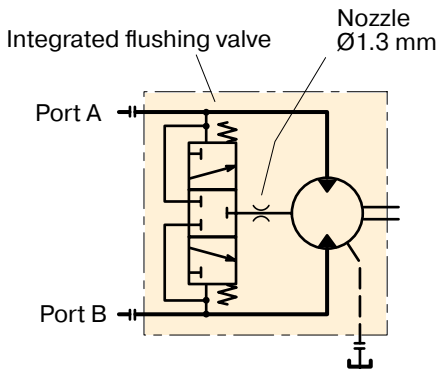
In a closed loop hydrostatic transmission the flushing valve secures that cool fluid from the charge circuit is constantly added to the main circuit.

The flushing valve consists of a 'three-position', three-way spool valve which connects the low pressure side of the main hydraulic circuit with the motor case. The valve opens at a pressure differential between port A and port B of approximately 14 bar.

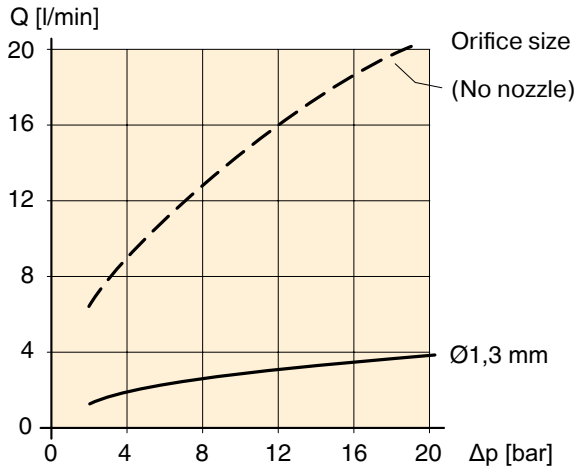
In order to limit the flow, a nozzle with a orifice is available from Parker Hannifin. The diagram to the right shows flow versus differential pressure.

For general advise when flushing might be needed, see page 85.





Hydraulic schematic.



Flow versus pressure differential (port A or B to tank).

Ordering code

F12	–	080	–	MF	–	IV	–	K	–	000	–	L130	–	P0

Standard F12 ordering code

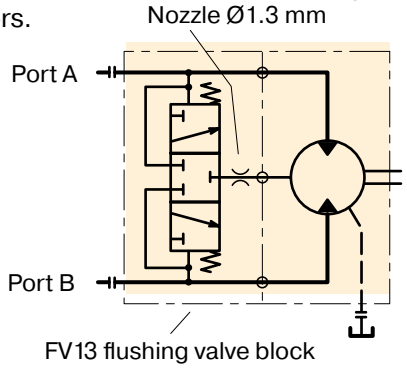
Code	Nozzle designation
L 130	1.3 mm

NOTE: FV13 flushing valve block for F12-110 shown on next page.

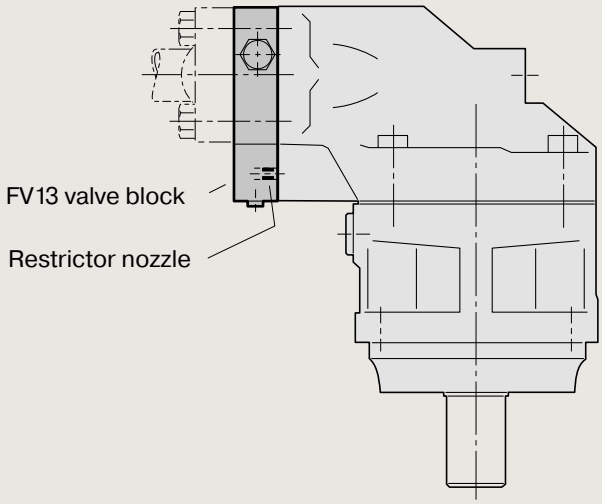
FV13 flushing valve block
(for F10-125, F12-110, -125)

The FV13 for the F10-125/F12-110/-125 motor has the same function as the integrated flushing valve for the other F12 frame sizes. The valve block mounts between the motor port flange and the split-flange tube/hose connectors utilizing 'long' mounting screws (screw size M14x75 or $^1/_2$"-13 UNC based on split-flange height as shown below).

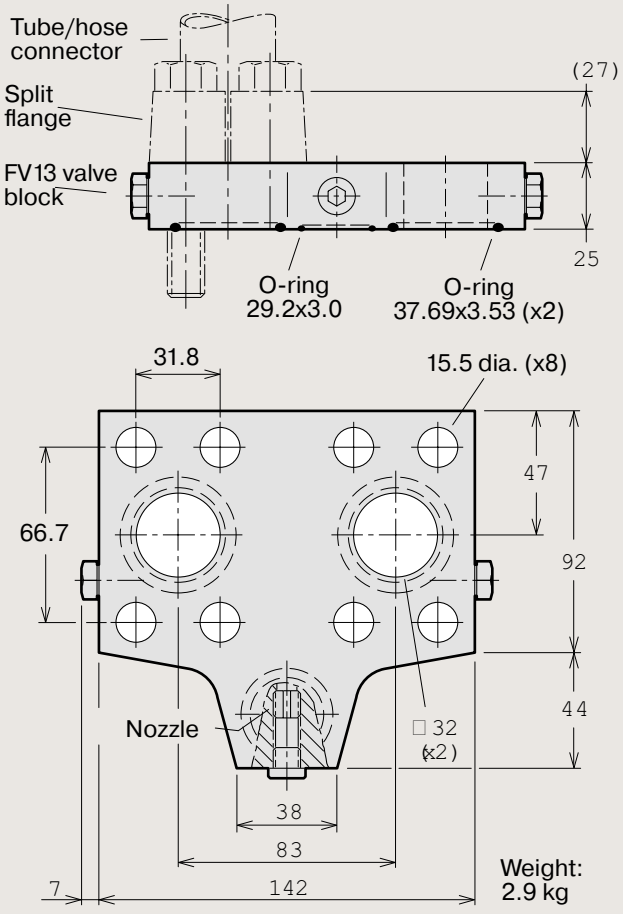
The FV13 flushing valve kit contains the required O-rings (shown below) but no screws, split-flanges or tube/hose connectors.



Hydraulic schematic.



FV13 installation



FV13 Ordering code

FV	1	3	–	H	–	A	–	L130
Valve type	Version	Size		Seals		Techn. status		Nozzel

Flushing valve

Code	Version
1	Factory assigned

Code	Size (SAE 6000 psi)
3	1¼"

Code	Techn. status
A	Factory assigned

Code	Seals
H	Nitrile rubber

Code	Nozzle
L130	Ø1.3 mm

FV13 restrictor nozzles

When required, a nozzle is utilized to restrict the flow through the motor case. The nozzle installs in the drilled and tapped (M10x1.0) drain line located in the valve block as shown to the left. The diagram on page 61 shows flushing flow versus differential pressure for selected orifice sizes.

The following table lists currently available nozzles and the corresponding FV13 ordering code designation.

Designation	Flushing valve Part number	Orifice size [mm]
L000 no nozzle	3780292	
L130 (std.)	3795623	1.3

Integrated pressure relief valve (F10-30, -37, -56, -80, F12-30, -40, -60)

Integrated pressure relief valves are available for F10-30, -37, -56, -80 and F12-30, -40, -60. These are designed to protect the motor from short duration pressure spikes. The motor could be ordered with non-adjustable pressure setting between 210 – 420 bar. The motor has to be ordered as unidirectional, L or R, and this is specified in the ordering code as example below.

F12-030-MS-SV-S-000-**P28L**-P0
P=Pressure relief valve, 28 = 280 bar, L = left

Possible pressure settings

Code	Pressure bar
21	210
23	230
25	250
28	280
30	300
33	330
35	350
38	380
40	400
42	420

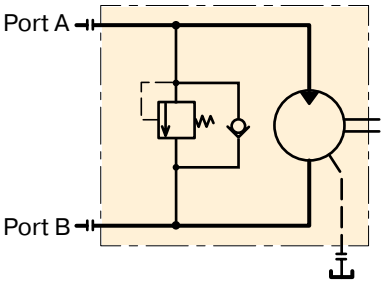


Diagram for PLC082 pressure relief valves integrated in F10-30, -37 and F12-30

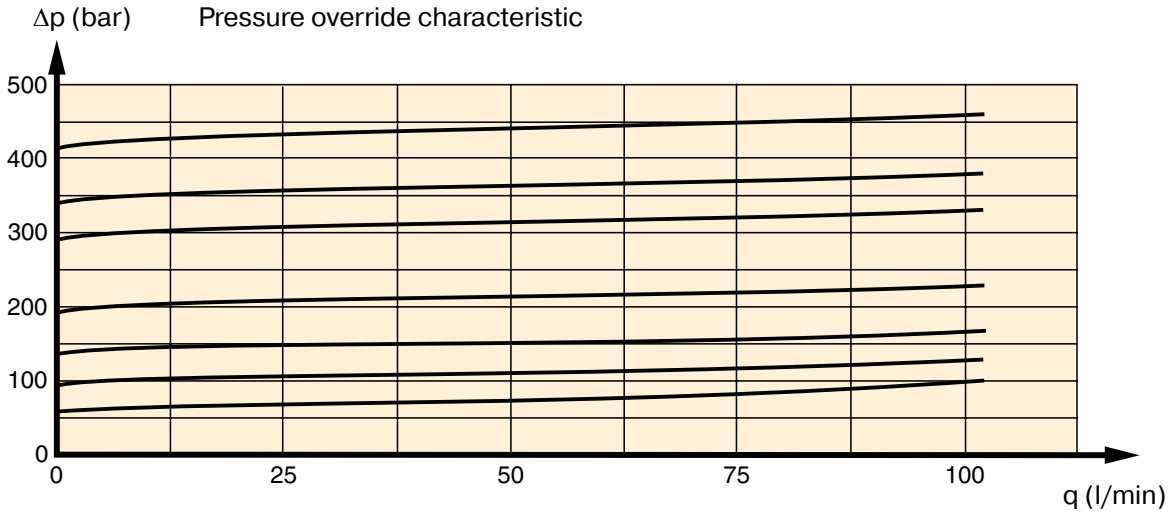
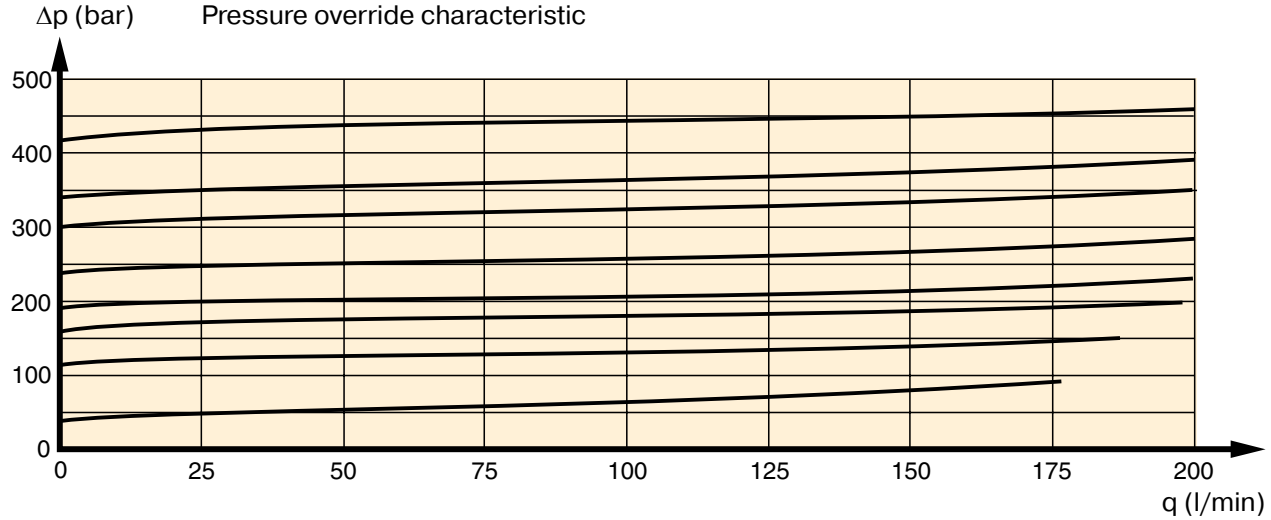


Diagram for PLC182 pressure relief valves integrated in F10-56, -80 and F12-40, -60



SR pressure relief anti-cavitation valve

The SR pressure relief/make-up valve block for series F10/12 motors is designed to protect the motor and the main hydraulic lines from short duration pressure spikes. The valve block also provides an excellent make-up function.

The valve block installs directly on the motor port flange, and is available in 3 sizes:

1 $^3/_4$" for F10-30, -37, -56, -80 and F12-30 -40 -60

2 1" for F10-90, -107 and F12-80, -90

3 1¼" for F10-125 and F12-110, -125

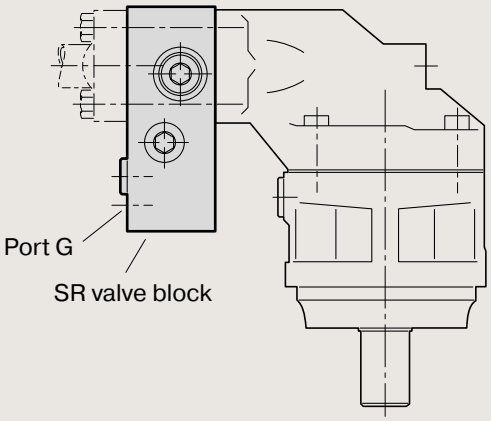
The SR valve block consists of a housing containing two high pressure relief cartridges and two separate check valves for anti-cavitation. Cartridges are available in non-adjustable pressure settings between 280 and 420 bar *(4000 and 6000 psi respectively)*.

A make-up port (G) is also provided. In certain operating conditions, the motor (when operating as a pump) may cavitate because of insufficient inlet pressure.

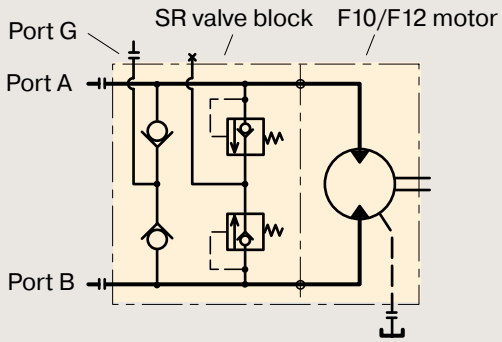
To prevent this, the G port should be pressurized. Contact Parker Hannifin for further information.

The pressure drop through the main ports (A–A' or B–B') is low. As an example, the pressure drop on size 1 ($^3/_4$") is 0.45 bar *(6.5 psi)* at 175 l/min, and on size 2 (1") 0.7 bar *(10 psi)* at 250 l/min.

NOTE: The valve block includes main port O-rings (facing the motor) but no mounting screws.



SR valve block location.



SR valve block schematic.

Ordering code

SR	1		–		/		–	00	–	H	F	–	A
Valve function	Version	Port size		Pressure settings				Serial number		Seals	Threads		Techn. status

Pressure relief/ make-up valve block

Code	Version
1	Factory assigned

Code	Port size (SAE 6000 psi)		
1	$^3/_4$"	for:	F10-30, -37, -56, -80 and F12-30 -40 -60
2	1"	for:	F10-90, -107 and F12-80, -90
3	1¼"	for:	F10-125 and F12-110, -125

Code	Pressure settings (A/B ports) [bar]
280, 300, 330, 350, 380, 400 or 420	

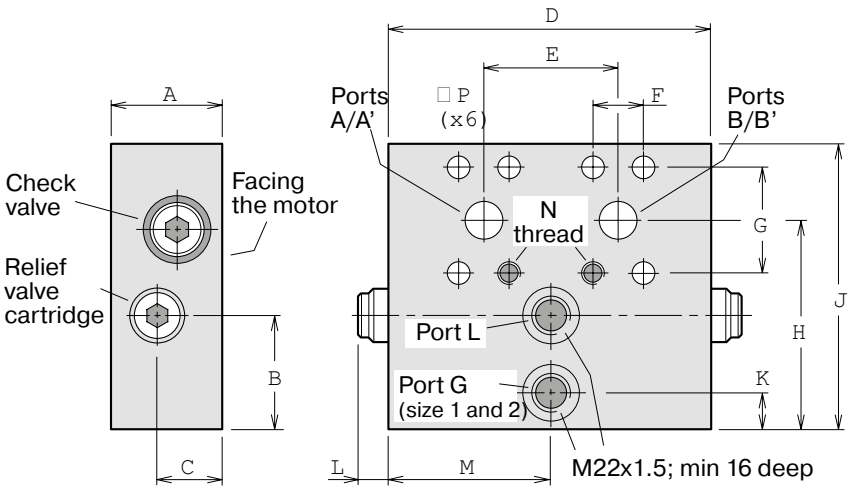
Code	Serial number
00	Factory assigned

Code	Seals
H	Nitrile rubber

Code	Threads (port G)
F	Metric

Code	Techn. status
A	Factory assigned

SR pressure relief anti-cavitation valve, Dimensions



Dim. [mm]	Size 1 (3/4")	Size 2 (1")	Size 3 (1¼")
A	55	57	57
B	55	55	25
C	32	32	26
D	157	160	160
E	66	75	83
F	23.8	27.8	31.8
G	50.8	57.15	66.7
H	103	109	88
J	140	150	135
K	18	18	-
L	18	18	18
M	78.5	80	-
N	M10 x18	M12 x20	M14 x23
P	11	13	15.5

Weight	Size 1 (3/4")	Size 2 (1")	Size 3 (1¼")
[kg]	7.4	9.1	8.5

SV pressure relief valve

General information

The SV pressure relief valve block for series F10/F12 motors is designed to protect the motor and adjacent hydraulic components from short duration pressure peaks.

It installs directly on the motor port flange and is available in two sizes:

'1': 3/4" for F10-30, -37, -56, -80 and F12-30 -40 -60

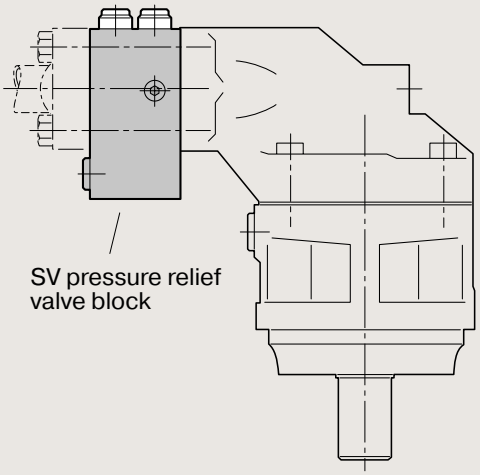
'2': 1" for F10-90, -107 and F12-80, -90

The valve block consists of a housing containing two high pressure relief cartridges with anti-cavitation function. Cartridges are available in non-adjustable pressure settings between 280 and 420 bar.

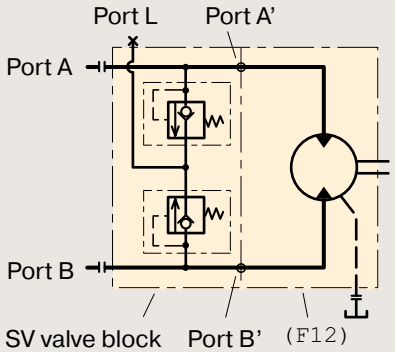
A make-up/drain port, **L**, is also provided. In certain operating conditions the motor may cavitate because of in-sufficient inlet pressure. To prevent this, the L port can be pressurized. When there is a risk of over-heating, the L port can also be utilized to take out part of the flow for cooling. Contact Parker Hannifin for further information.

The pressure drop through the main ports (A–A' or B–B') is low. As an example, the pressure drop on size 1 (3/4") is 0.45 bar *(6,5 psi)* at 175 l/min *(45 gpm)*, and on size 2 (1") 0.7 bar *(10 psi)* at 250 l/min *(65 gpm)*.

NOTE: - The valve block includes main port O-rings (facing the motor) but no mounting screws.



SV valve block installed on an F12 motor.



Hydraulic schematic.

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

Ordering code

SR	1		–		/		–	00	–	H	F	–	A
Valve function	Version	Port size		Pressure settings				Serial number		Seals	Threads		Techn. status

Pressure relief valve

Code	Version
1	Factory assigned

Code	Port size (SAE 6000 psi)		
1	$^3/_4$"	for:	F10-30, -37, -56, -80 and F12-30 -40 -60
2	1"	for:	F10-90, -107 and F12-80, -90

Code	Pressure settings (A/B ports) [bar]
280, 300, 330, 350, 380, 400 or **420**	

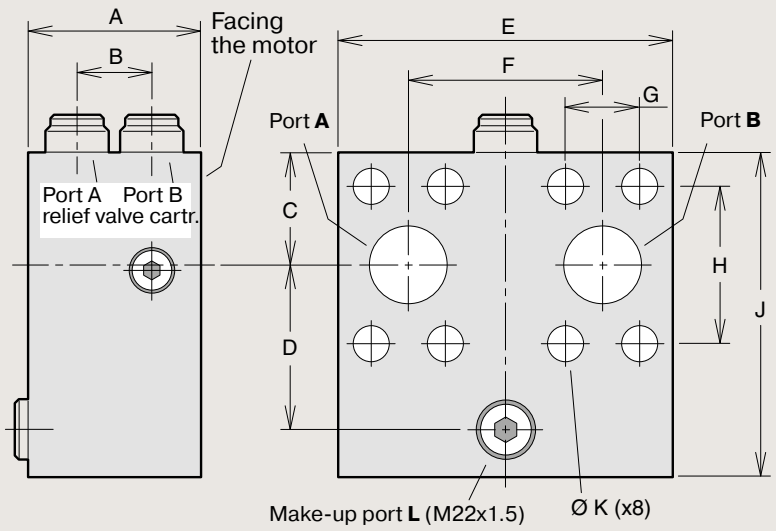
Code	Serial number
00	Factory assigned

Code	Seals
H	Nitrile rubber

Code	Threads (port G)
F	Metric

Code	Techn. status
A	Factory assigned

SV pressure relief valve, Dimensions



Dim. [mm]	SV11	SV12
A	71	73
B	31	31
C	36	41
D	47	51
E	130	127
F	66	75
G	23.8	27.8
H	50.8	57.2
J	99	109
K	11	13
Weight [kg]	4.2	5.0

MV Anti-cavitation valve / make up valve block

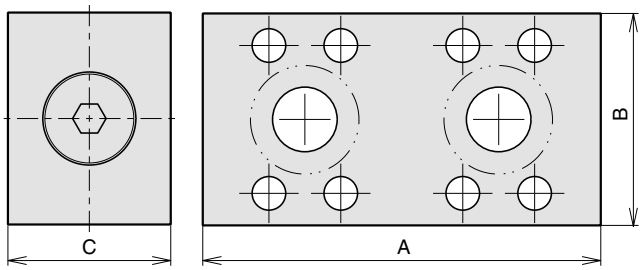
The make-up valve block for series F10/F12 motors is designed to prevent cavitation inside motor by directing flow to inlet port from return side.

The manifold is uni-directional but can be installed in either motor direction

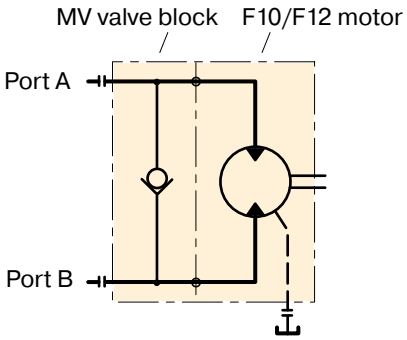
The valve block installs directly on the motor port flange, and is available in 2 sizes.

The valve block consists of one check valve for make-up function.

The make-up valve opens at a pressure of approx. 0,2 bar.



NOTE: The valve block includes main port O-rings (facing the motor) but no mounting screws.



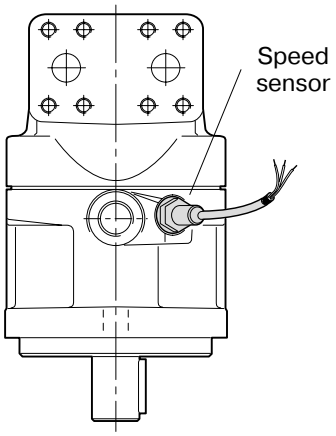
Size	For Motor	A	B	C	Order number
1"	F10-90, 107 and F12-80, -90	154	82	63	3720140
1½"	F12-152, -162, -182, -250	208.5	105	47	3784195

A wide range of speed sensor kits are available for series F10/F11/F12.

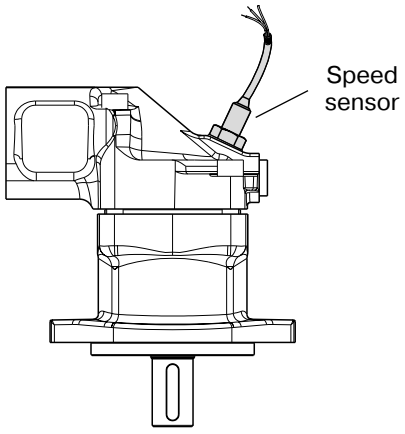
The sensors are ferrostat differential (Hall-effect) On F10/F12 the speed sensor is directed towards the ring gear. On F11 the speed sensor is directed towards the pistons. The sensor output is a square wave signal within a frequency range of 0 Hz to 15 kHz.

NOTE: - All F10/F12 are prepared for speed sensor as standard, but F11 series must be specified in the ordering code refer to pages 35 – 53 (F11)

- **On F11 the pistons position must be known before mounting.**



F10/F12 with speed sensor.



F11-14 with speed sensor.

Order number	Electronic	Signals	Installation	Connector	Cable lenght	Installation instruction
3785190	NPN	2	M12*1 adjustable	Free leads	2500 mm	MSG30-8301-INST
3783883	NPN	2	M12*1 adjustable	Free leads	1000 mm	MSG30-8302-INST
3722481	NPN	2	M12*1 adjustable	M12 4 pin	260 mm	MSG30-8303-INST
3722480	NPN	1	M12*1 adjustable	AMP 3 pin	338 mm	MSG30-8304-INST

BLA

General information

The BLA boost unit simplifies the building of closed or semi-closed hydrostatic transmissions.

Main features are:

- Replaces conventional charge pump and corresponding valves in many applications
- Allows pump speeds above normal selfpriming speed
- Suitable for system flow rates to 400 l/min
- Includes filter
- Simple construction – no moving/wear parts
- Cost-effective installation
- Small tank size
- Helps in building a low-cost hydrostatic transmission.

Description

In a closed circuit hydrostatic transmission, a charge pump is normally included with the main pump, providing make-up fluid which replaces pump and motor volumetric losses. It also maintains sufficient pump inlet pressure to avoid cavitation.

The BLA boost unit replaces the charge pump in many applications, when the following conditions are met:

- The max-to-min pump flow ratio does not exceed 2:1
- System pressure changes gradually without frequent and pronounced pressure peaks
- The line length between pump and boost unit is relatively short.

There are two basic sizes of the BLA boost unit:

- BLA 4 (to 160 l/min pump flow)
- BLA 6 (to 400 l/min pump flow).

The main part of the unit is an aluminium housing with a built-in nozzle and an injector; refer to the cross section to the right.

When fluid flows from the motor outlet port through the unit and to the pump inlet port, the increased fluid velocity between the nozzle and injector creates a low pressure zone causing additional fluid to be drawn from tank into the main circuit.

Also, pressure increases after the injector, allowing the pump to be operated at speeds higher than the self-priming speed. The 'boost pressure' increases with flow.

The housing includes ports that should be connected to the pump and motor drain ports respectively.

An additional bleed-off nozzle diverts approx. 10 % of the main flow through the cartridge filter before being directed to the tank.

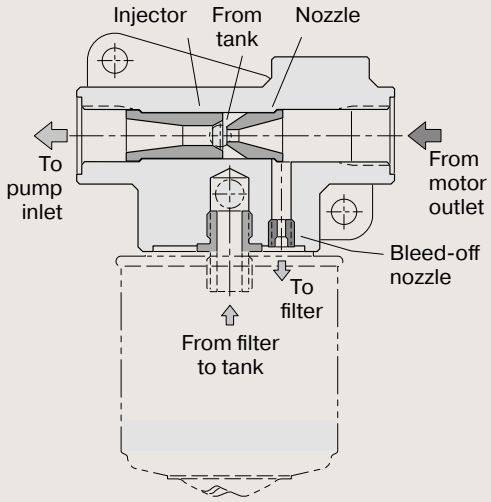
Oil cooling

An oil cooler is usually required in the hydraulic system, in order to remove the heat that is generated in the main circuit. A full-flow oil cooler should be installed in the return line between the motor and the boost unit.

Typical applications:

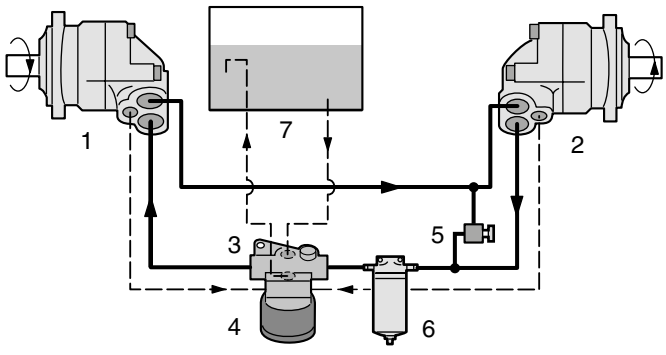
- Fan drives
- Propeller drives
- Generator drives
- Pump drives

For more information please see our technical catalogue BLA boost unit MSG30-8224/UK



BLA boost unit cross section.

Boost unit installation



1. Pump
2. Motor
3. Boost unit (with injector and nozzle
4. Filter cartridge
5. Pressure relief valve
6. Full-flow filter (when required
7. Reservoir

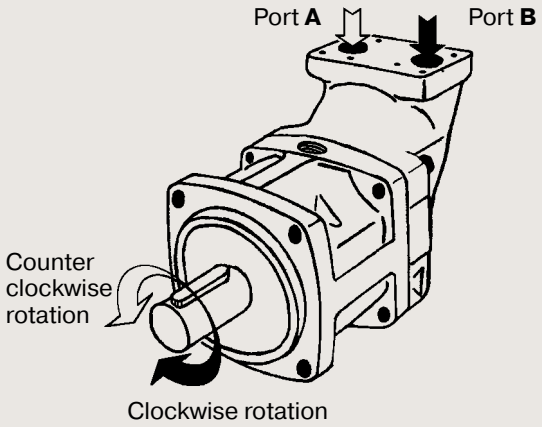
Direction of rotation

The motor versions are bi-directional.

The pump versions are uni-directional, allowing higher selfpriming speeds.

The illustration to the right shows direction of flow versus shaft rotation. In a motor application, the shaft turns clockwise when port **B** (black arrow) is pressurized, and counter clockwise when port **A** (open arrow) is pressurized.

In a pump application where the shaft turns clock-wise, port B is the inlet port and should be connected to tank; when the shaft turns counter clockwise, port A is the inlet port.



Hydraulic fluids

Ratings and performance data for series F10/F11/F12 are based on operating with good quality, contamination-free, petroleum-based fluids.

Hydraulic fluids type HLP (DIN 51524), automatic transmission fluids type A, or API CD engine oils can be used.

Fire resistant fluids (when used under modified operating conditions) and synthetic fluids may also be suitable.

NOTE:
When operating the F10/F11/F12 as a pump above the selfpriming speed (valid for both the pump and motor versions), the inlet must be sufficiently pressurized. Increased noise and deteriorating performance may otherwise be experienced.

For further information refer to 'Selfpriming speed and required inlet pressure' on pages 11, 27 and 58.

Operating temperature

The following temperatures should not be exceeded (type **V** FPM shaft seals):

Main circuit 80 °C

Drain circuit: 115 °C.

NBR shaft seals (type **N)** can be used to 90 °C drain fluid temperature.

NOTE: The temperature should be measured at the utilized drain port.

Continuous operation may require case flushing in order to meet the viscosity and temperature limitations.

The following table shows operating speeds, above which flushing is usually required, as well as suggested flow through the case.

F10/11/F12 in series operation

When running F10/F11/F12 in series at higher pressure levels, Please contact Parker Hannifin for further information.

Series F11

Frame size	Speed [rpm]	Flow [l/min]
F11-5	5500	1 – 2
F11-6	4500	2 – 3
F11-10	4500	2 – 3
F11-12	4500	2 – 3
F11-14	4500	2 – 3
F11-19	4000	2 – 4

Series F10/F12

Frame size	Speed [rpm]	Flow [l/min]
F10-30, -37, F12-30	3500	4 – 8
F10-56, -80, F12-40, -60	3000	5 – 14
F10-90, -107, F12-80, -90	2500	8 – 16
F10-125, F12-110, -125	2300	9 – 18
F12-152, -162, -182	2200	10 – 20
F12-250	1800	12 – 22

Case pressure

The service life of the shaft seal ring is affected by the speed of the motor and the case drain pressure and it can decrease with an increase in the frequency of pressure peaks.
Note, seal life can be shorter at unfavourable operating conditions (high temperature, low oil viscosity, contaminated oil).
The table below shows recommended case pressure as a function of shaft speed.

The case pressure must be equal to or greater than the external pressure on the shaft seal ring.

To secure correct case pressure and lubrication, a spring loaded check valve, 1 – 3 bar, in the drain line (shown on next page) is recommended.

Note: Contact Parker Hannifin for information when operating at high speeds.

Shaft speed	[rpm]	1500	3000	4500	6000	max
F11-5, -6, -10, -12, -14, -19	[bar]	0.5 - 10	0.5 - 7.0	1.0 - 5.0	2.0 - 5.0	3.0 - 5.0
F10-30, -37, -56, -80, -90, -107 F12-30, -40, -60, -80, -90	[bar]	0.5 - 8	0.5 - 6.0	1.0 - 4.5	2.0 - 4.0	-
F10-125, F12-110, -125, -152, -162, -182, -250	[bar]	0.5 - 6	1.0 - 4.0	2.0 - 4.0	-	-

Required inlet pressure

The motor may operate as a pump under certain conditions.

When this occurs, a minimum pressure must be maintained at the inlet port; increased noise and gradually deteriorating performance due to cavitation may otherwise be experienced.

A 15 bar inlet pressure, measured at the motor inlet port, satisfies most operating conditions.

Contact Parker Hannifin for more specific information on inlet pressure requirements.

Viscosity

The ideal operating range is15 to 30 mm^2/s [cSt]. At operating temperature, the viscosity (of the drain fluid) should be kept above 8 mm^2/s [cSt]. At start-up, the viscosity should not exceed 1000 mm^2/s [cSt]

Filtration

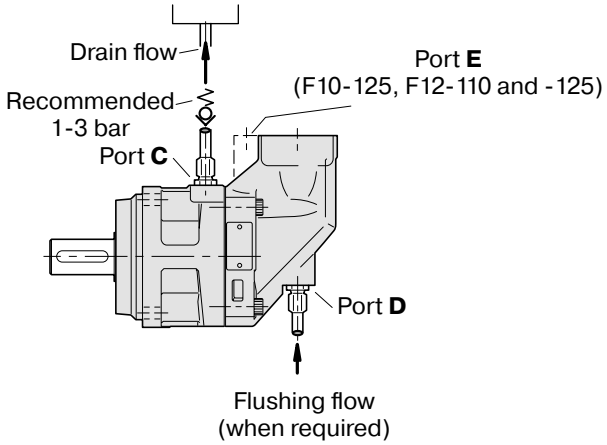
To obtain the highest service life of the F10/F11/F12, the fluid cleanliness should meet or exceed ISO code 20/18/13 (ISO 4406).

During normal operating conditions, a 10 µm (absolute) filter is recommended.

Case drain connections

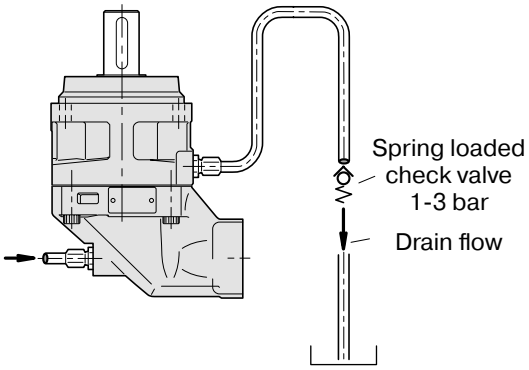
Series F10/F11/F12 have two drain ports, **C** and **D**, while F10-125, F12- 110 and -125 have an additional port, **E**.

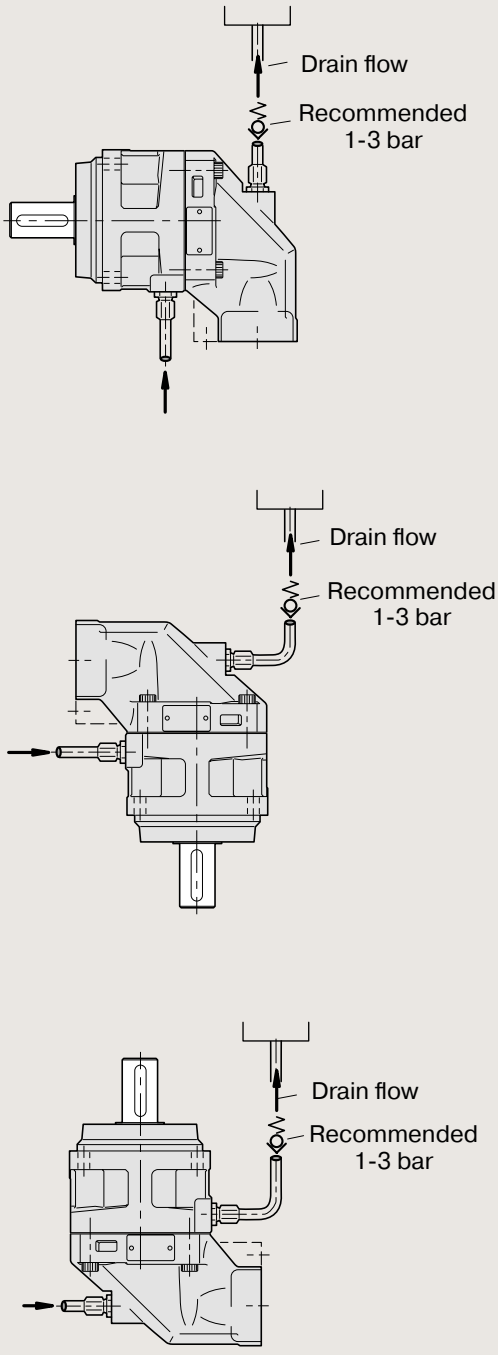
The uppermost drain port (such as port C in the illustration below) should always be utilized.



In mounting positions such as 'shaft up' (below) a spring loaded check valve should be installed in the drain line in order to insure a sufficiently high oil level in the case.

Preferably, the drain line should be connected directly to the reservoir.





Before start-up

Make sure the F10/F11/F12 case as well as the entire hydraulic system is filled with a recommended fluid.

The internal leakage, especially at low operating pressures, is *not* sufficient to provide lubrication at start-up.

NOTE:

- To avoid cavitation and obtain a low noise level as well as reduced heat generation, tubes, hoses and fittings must be adequately dimensioned.
- Preferably, the suction line flow speed should be 0.5 to 1 m/s, and pressure line flow speeds 3 to 5 m/s.

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