Hydraulic Motor/Pump

Series F11/F12
Fixed Displacement

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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

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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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Bent axis piston pump/motor with fixed displacement

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F11, F12

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 480 bar and continuous operating pressure up to 420 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.
- The F11's and F12's have a simple and straight-forward design with very few moving parts, making them very reliable motors/pumps.
- Our unique timing gear design synchronizes shaft and cylinder barrel, making the F11/F12 very tolerant to high 'G' forces and torsional vibrations.
- Heavy duty roller bearings permit substantial external axial and radial shaft loads.

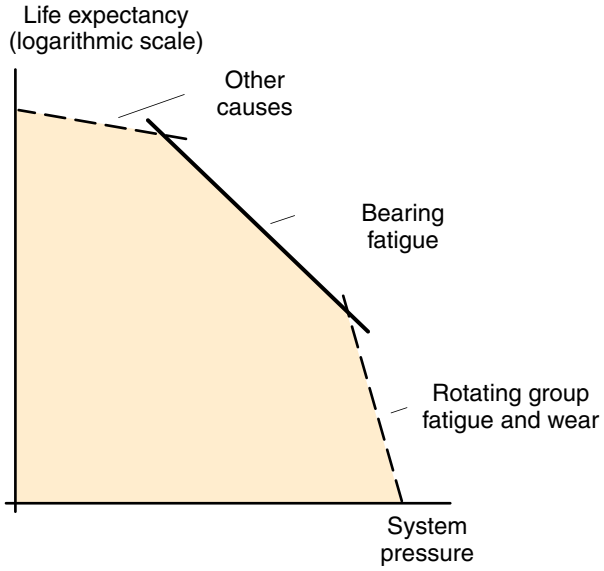
Bearing life

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 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
- 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:

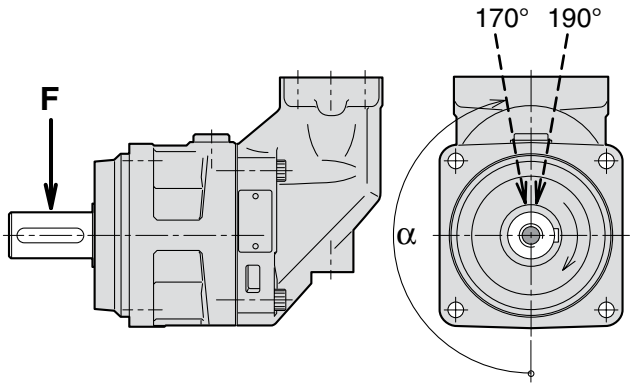
- Pitch diameter, Pressure angle, Spiral angle, Distance flange – gearwheel (mid) and Gearwheel spiral direction (R or L).

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



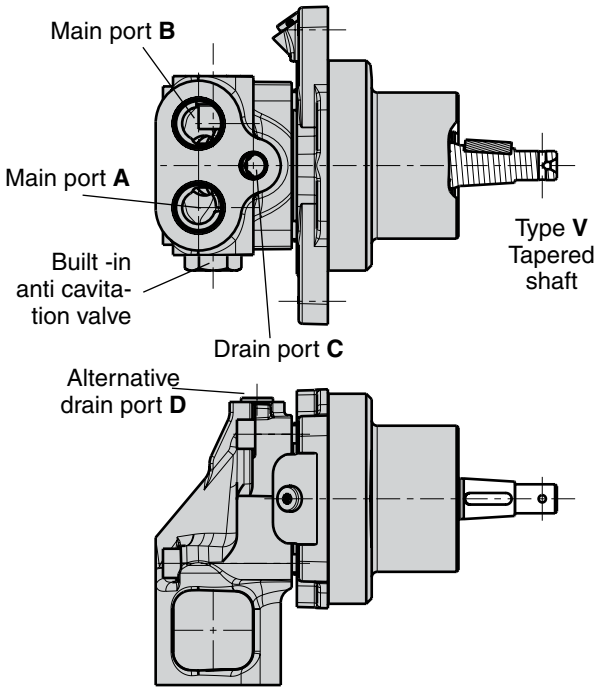
The direction (α) of the radial load is positive in the direction of rotation as shown.

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

F11/F12 Fan motors

F11/F12 motors, in frame sizes -5 to -40 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 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.

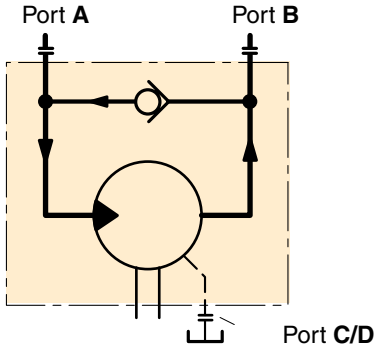
When the pump flow to the motor is shut off and the motor is operating at very high speeds, it is important that sufficient return port back pressure is available (port B in the schematic to the right).

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 drawings illustrating motors with make-up valve, see chapters 2, F11 and 3, F12.

For more info about integrated pressure relief valves, see page 63.



Schematic Fan motor with anti cavitation valve

Example of ordering code
F11-010-MB-CV-K-000-**MUVL**-00
MUVL = Make up/anti cavitation valve, counter clockwise rotation
MUVR = Make up/anti cavitation valve, clockwise rotation

F11/F12 in saw motor applications

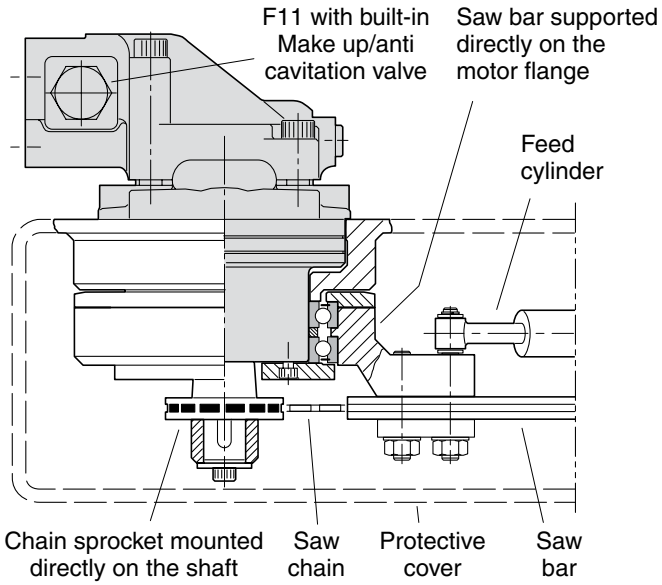
Series F11/F12 motors have proven suitable for demanding applications such as chain saws. Primarily due to the 40° bent-axis design, spherical pistons (with laminated piston rings) and gear synchronization, very high speeds are permissible. Not even low temperatures at start-up affect reliability.

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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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 11
3) See also installation information. Page 69

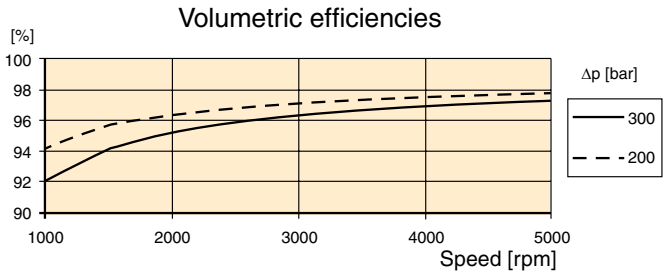
Efficiency

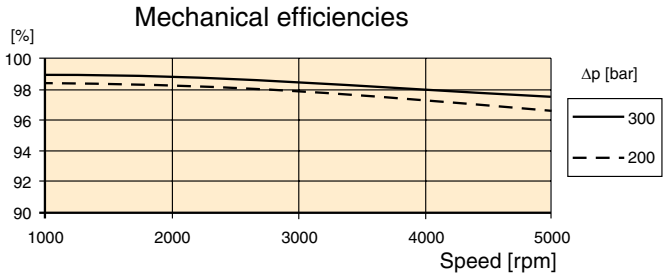
Because of its high overall efficiency, driving a motor/pump from series F11 requires less fuel or electric power. Also, it allows the use of a small reservoir and heat exchanger, which in turn reduce cost, weight, and installation size.

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.





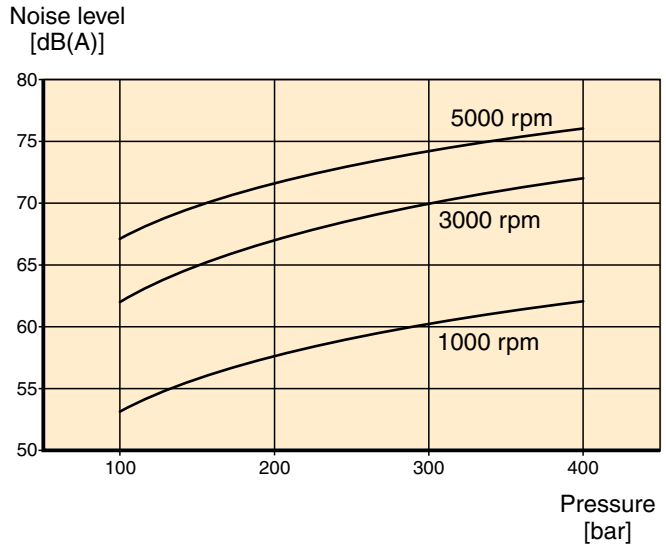
Noise level

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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Selfpriming speed and required inlet pressure

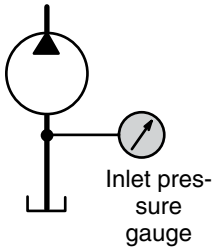
Series F11

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



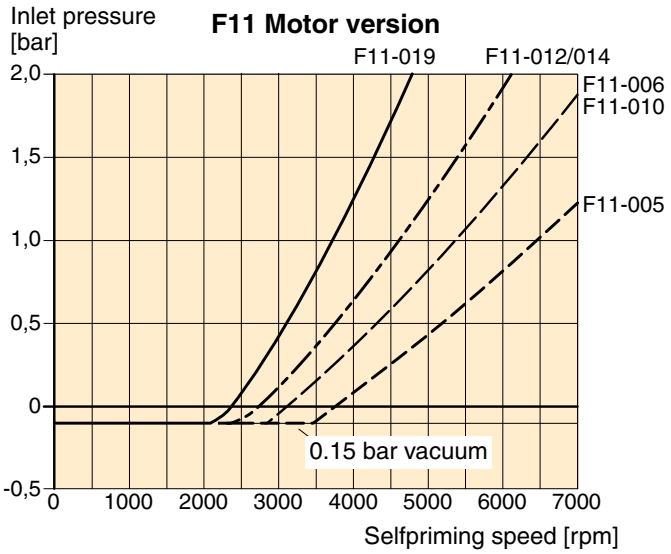


Diagram 1. Min required inlet pressure for Motor.

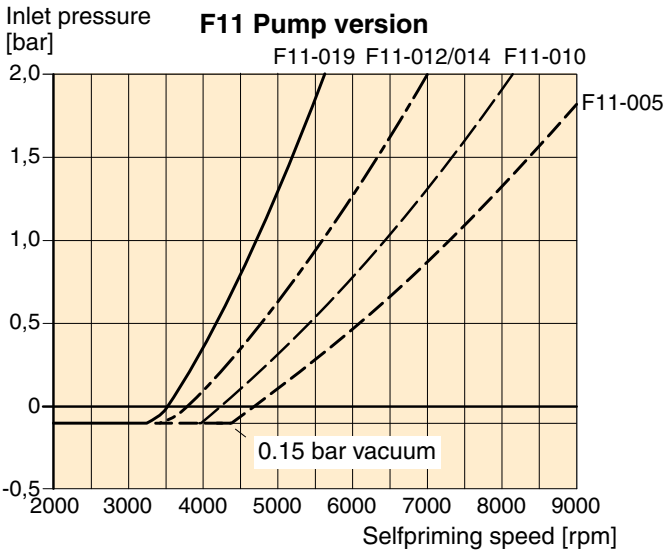
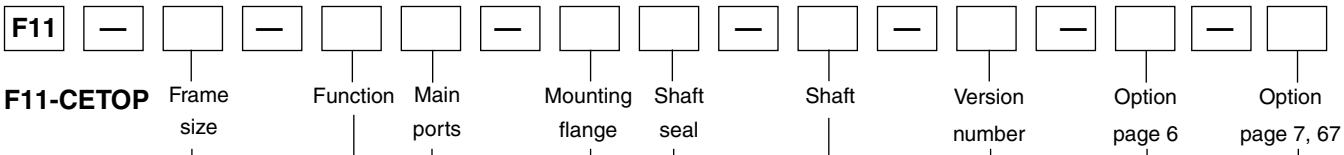


Diagram 2. Min required inlet pressure for Pump.

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 68.



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	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 15-23.

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

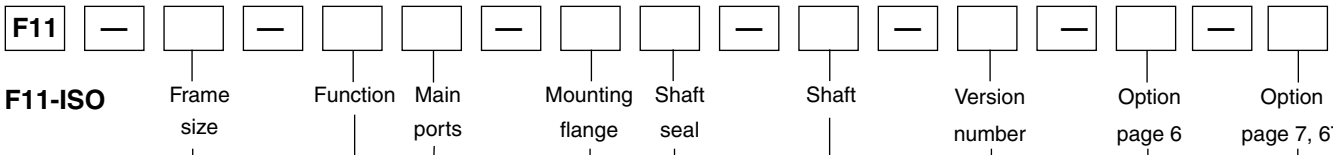
Frame size		5	6	10	12	14	19
Code	Shaft seal						
V	FPM, high pressure, high temperature	x	x	x	x	x	x

For other versions, contact Parker Hannifin

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

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)

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



2

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	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	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	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	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 25-29.

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

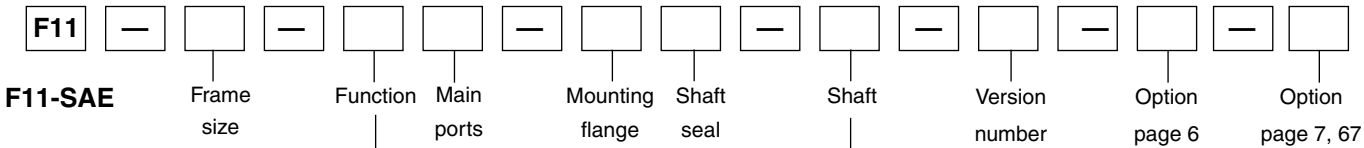
x: Available (x): Optional – : Not available

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

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



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	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	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 31-37.

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

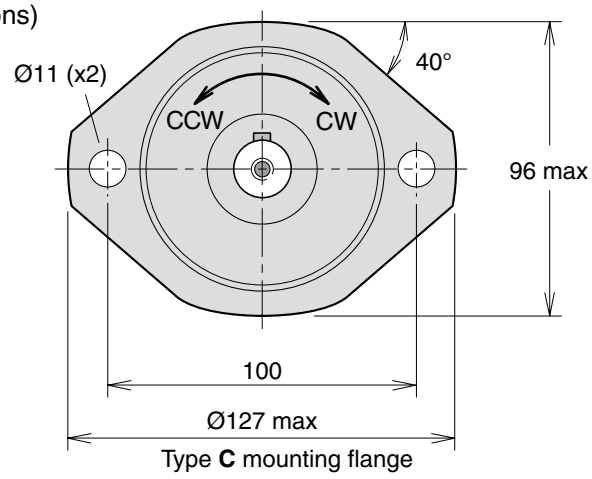
For other versions, contact Parker Hannifin

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

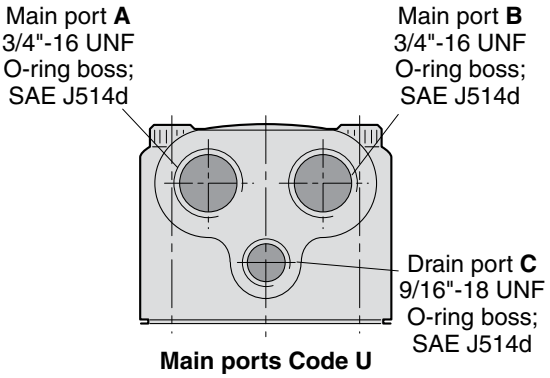
Frame size		6	10	12	14	19
Code	Option					
00	Standard	x	x	x	x	x
P_	Prepared for speed sensor	(x)	(x)	(x)	(x)	(x)
B_	Power Boost and Prepared for speed sensor	(x)	(x)	(x)	(x)	(x)
_T	Painted Black	(x)	(x)	(x)	(x)	(x)

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

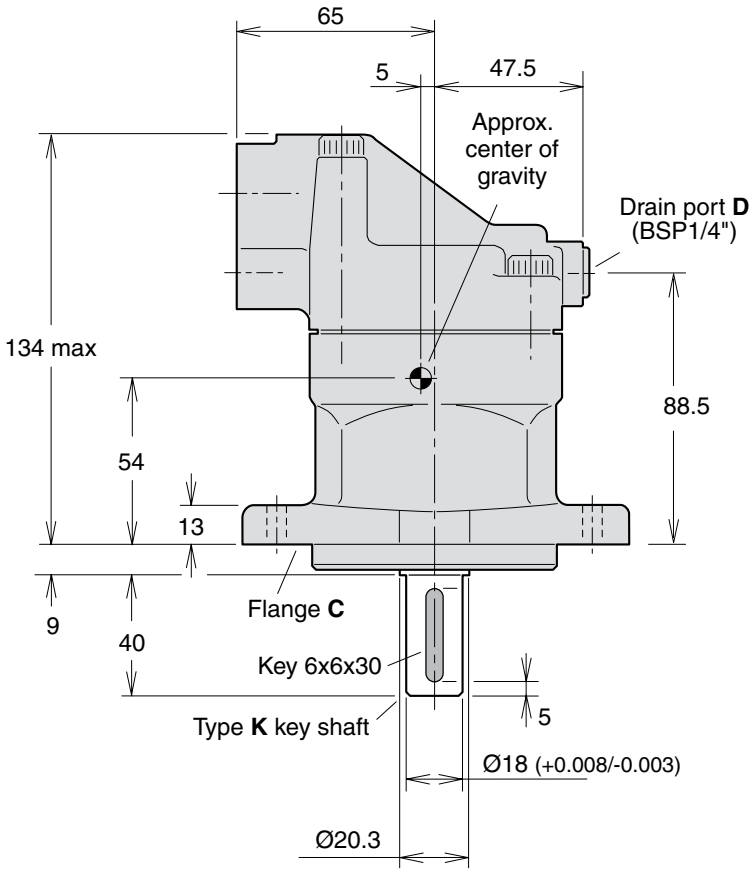
F11-005
(CETOP versions)

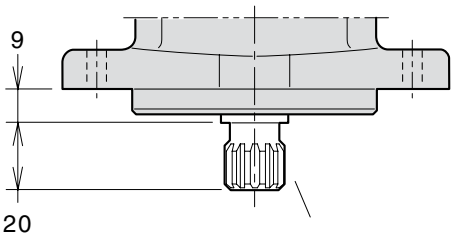


Type **C** mounting flange

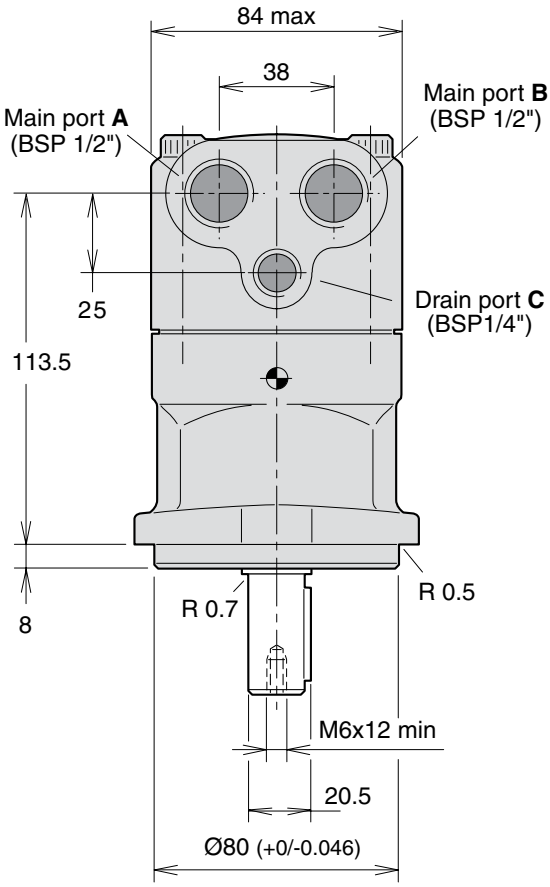


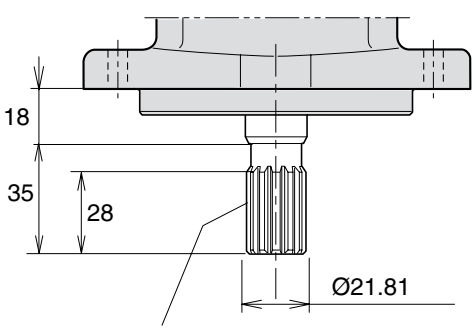
Main ports Code U





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





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

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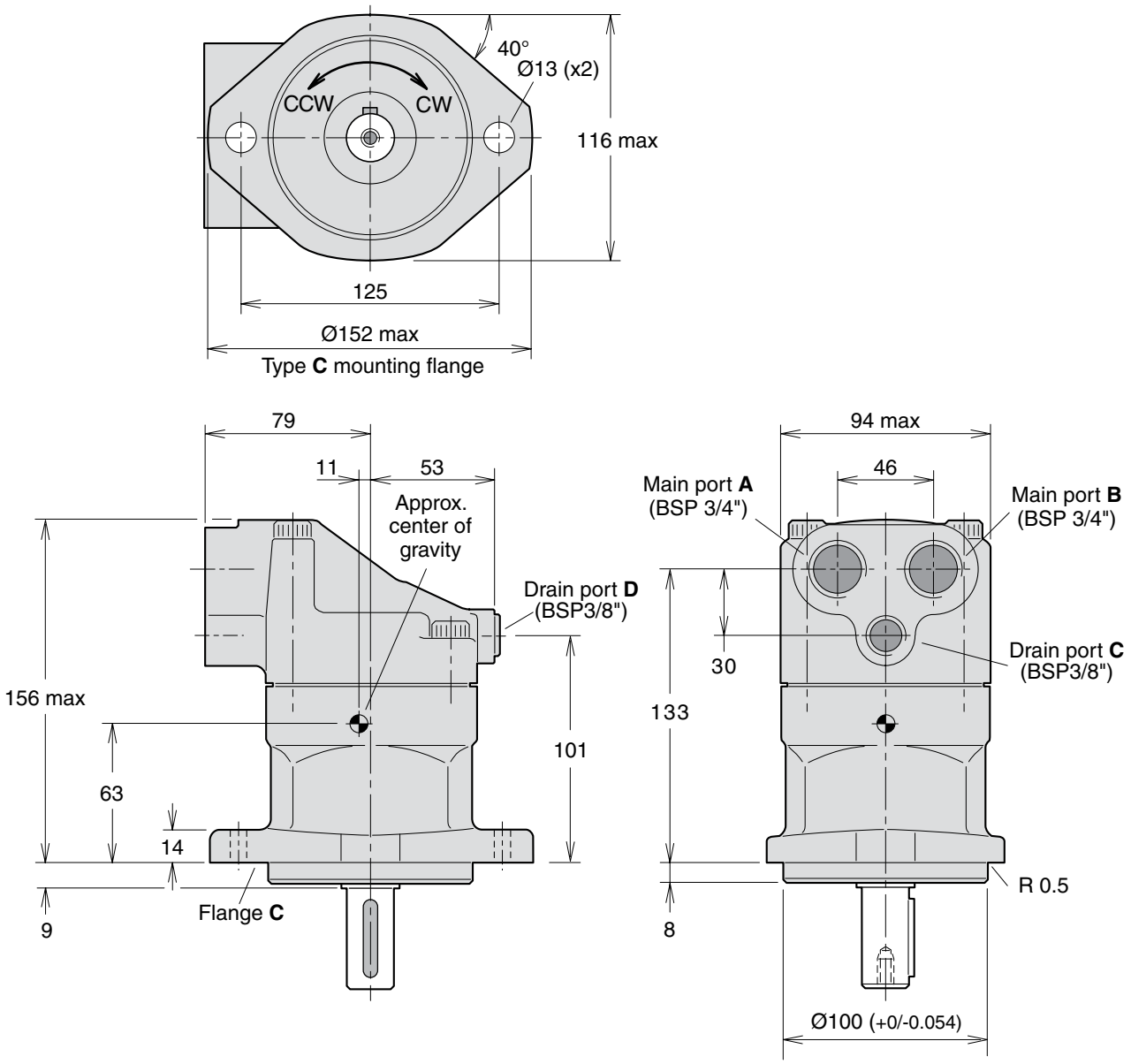
F11-006, -010
(CETOP versions)



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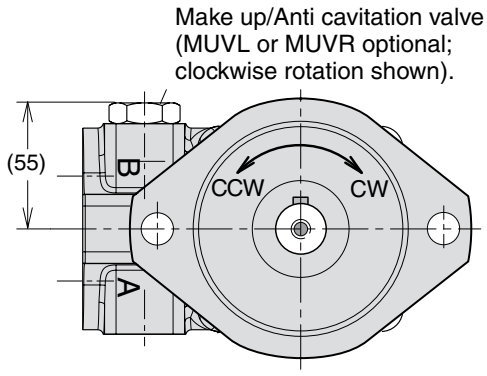
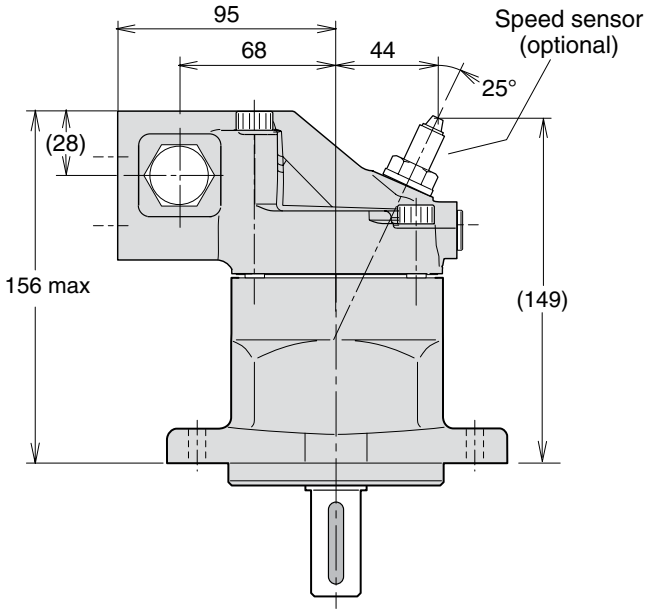
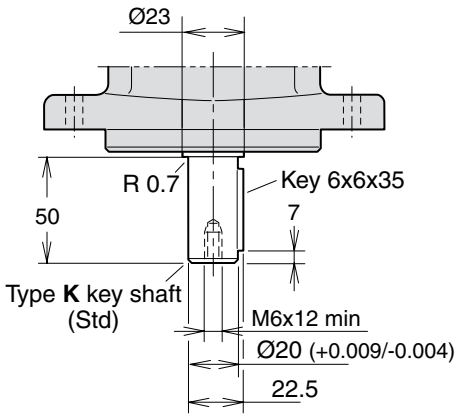
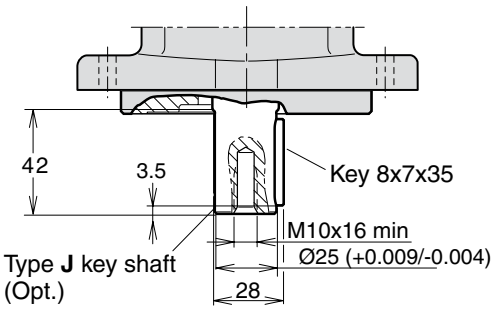
F11-006, -010
(CETOP versions)

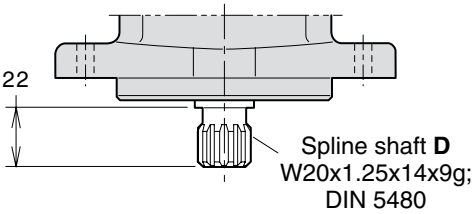


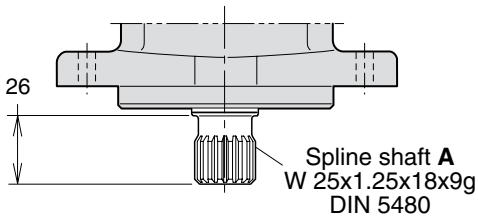


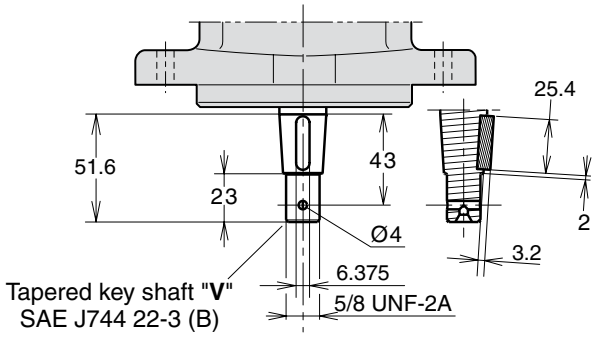
Shaft options











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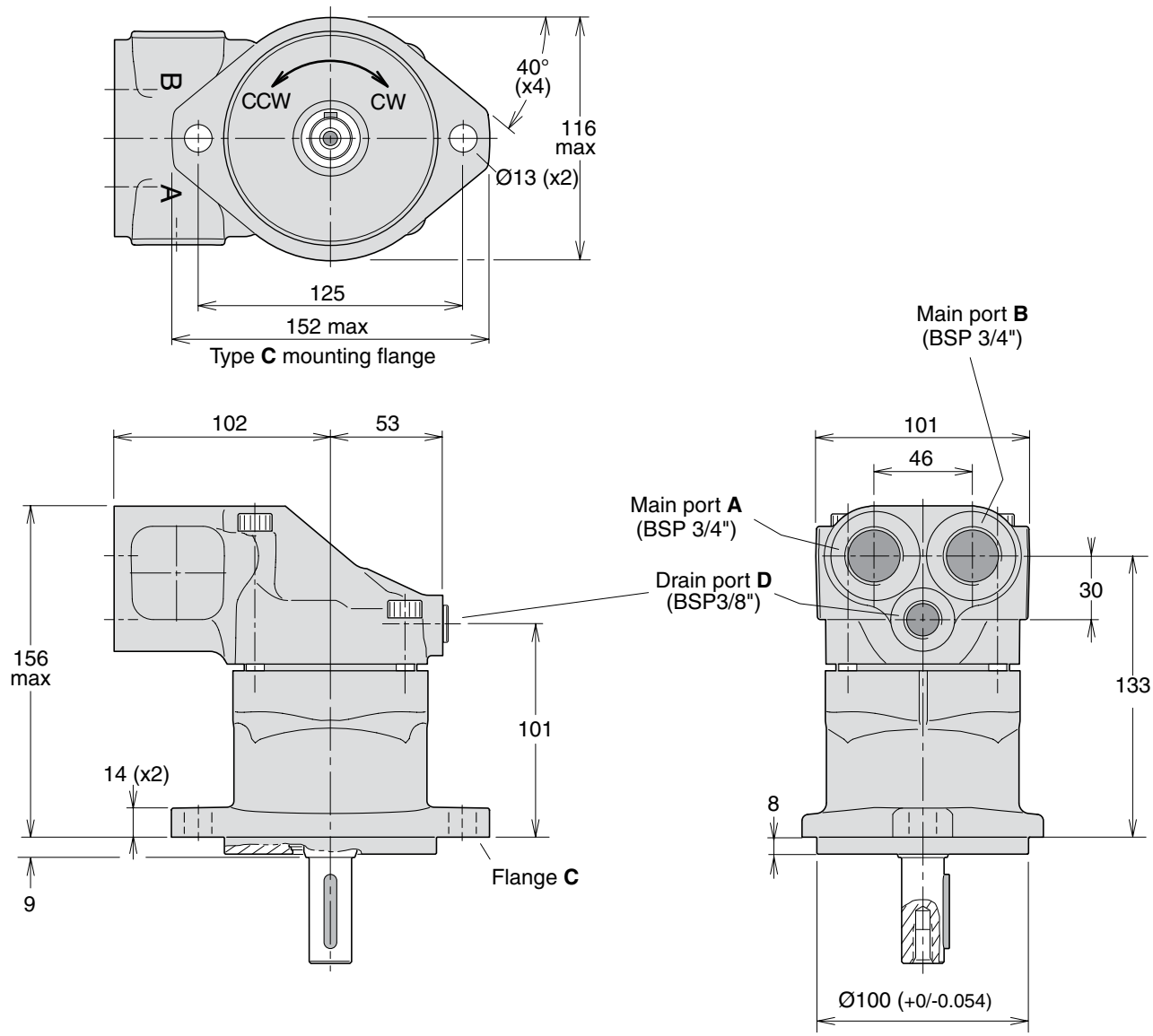
F11-012
(CETOP versions)



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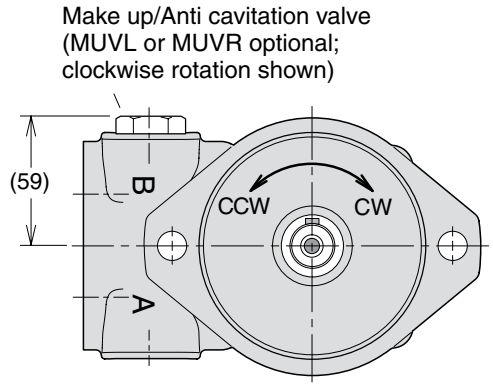
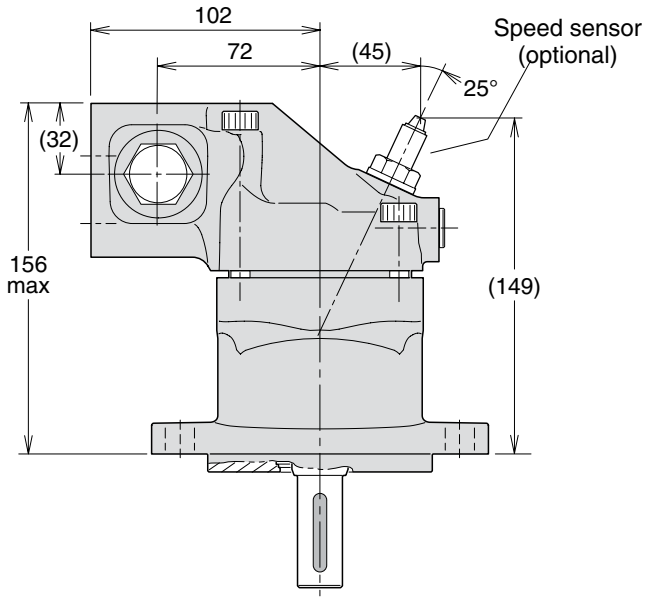
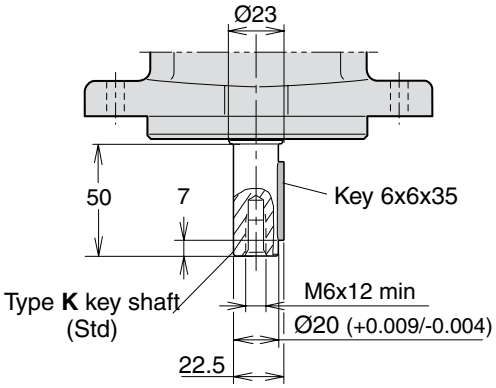
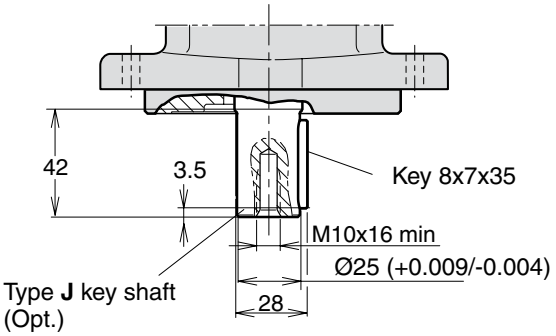
F11-012
(CETOP versions)

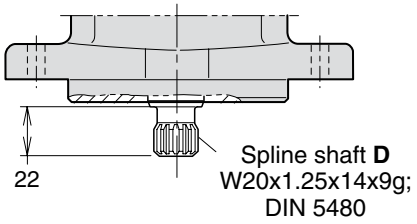


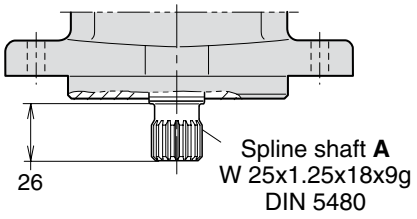


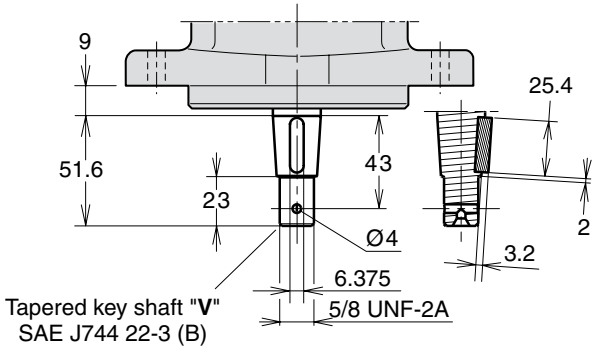
Shaft options











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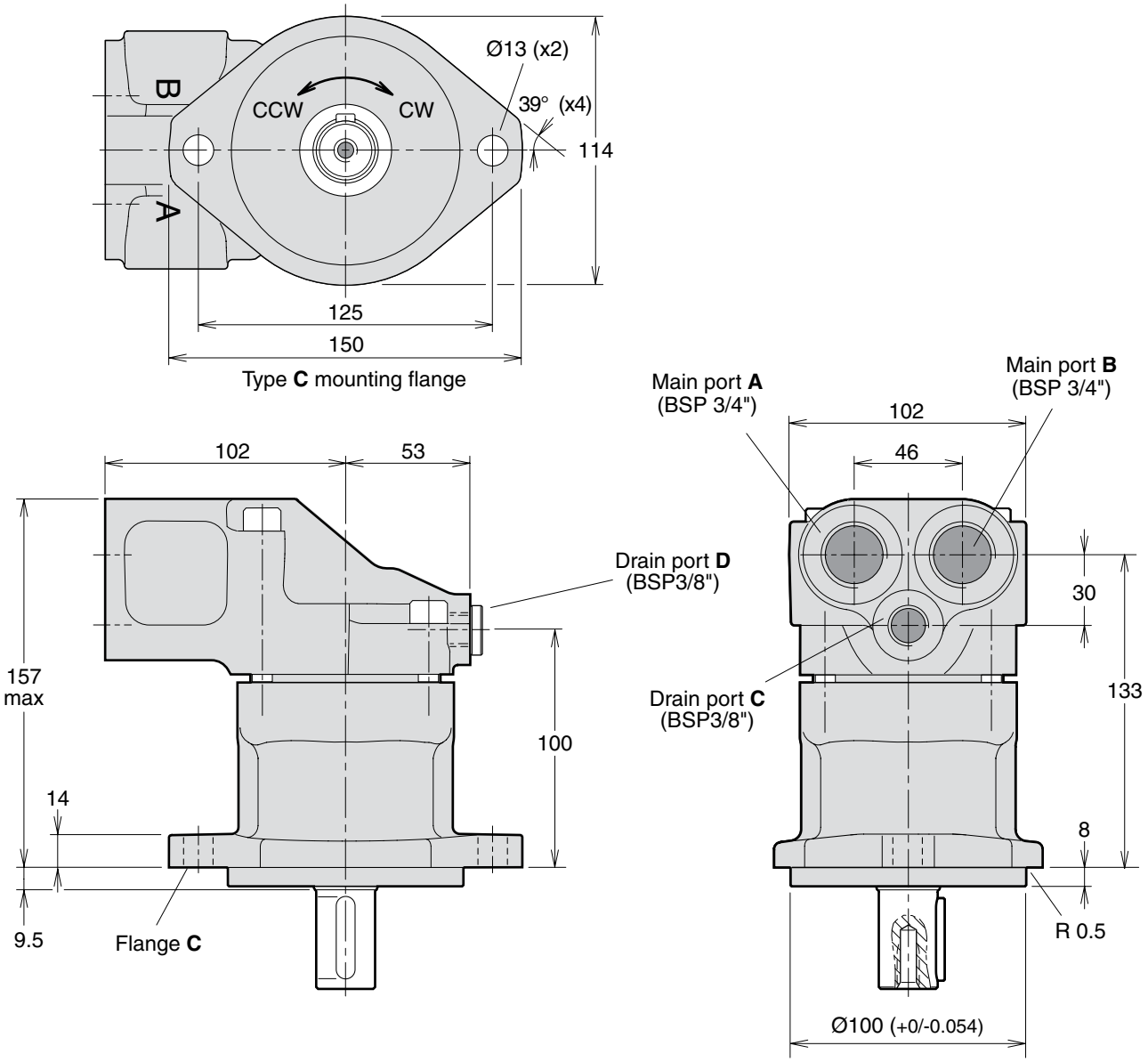
F11-014
(CETOP versions)



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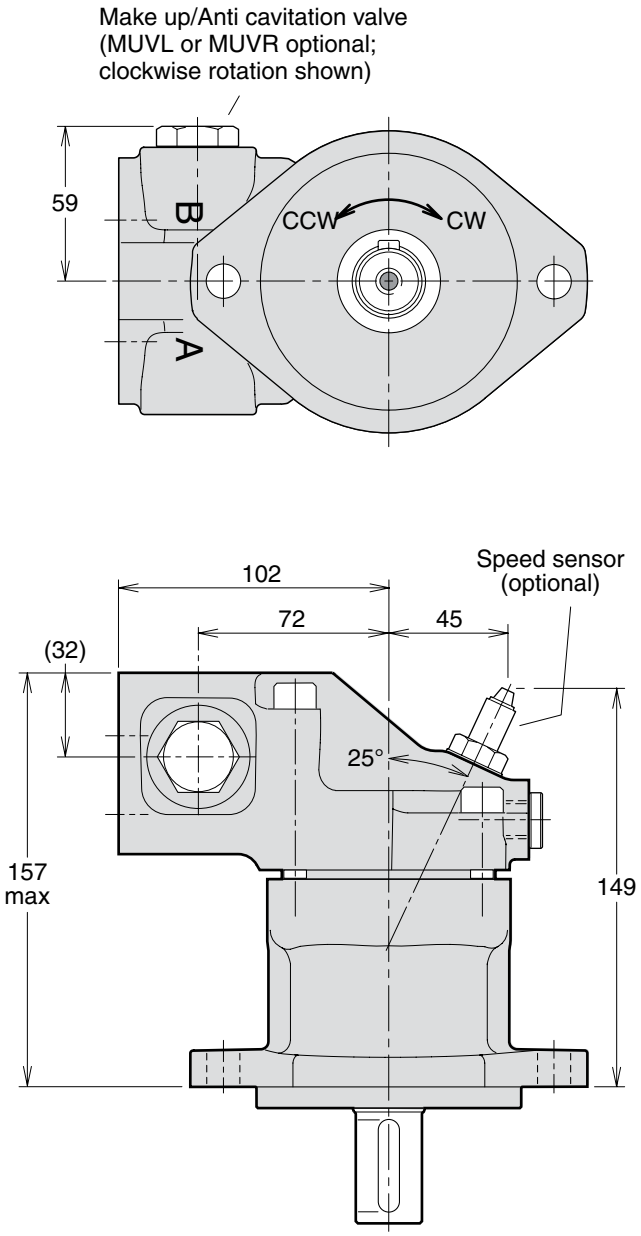
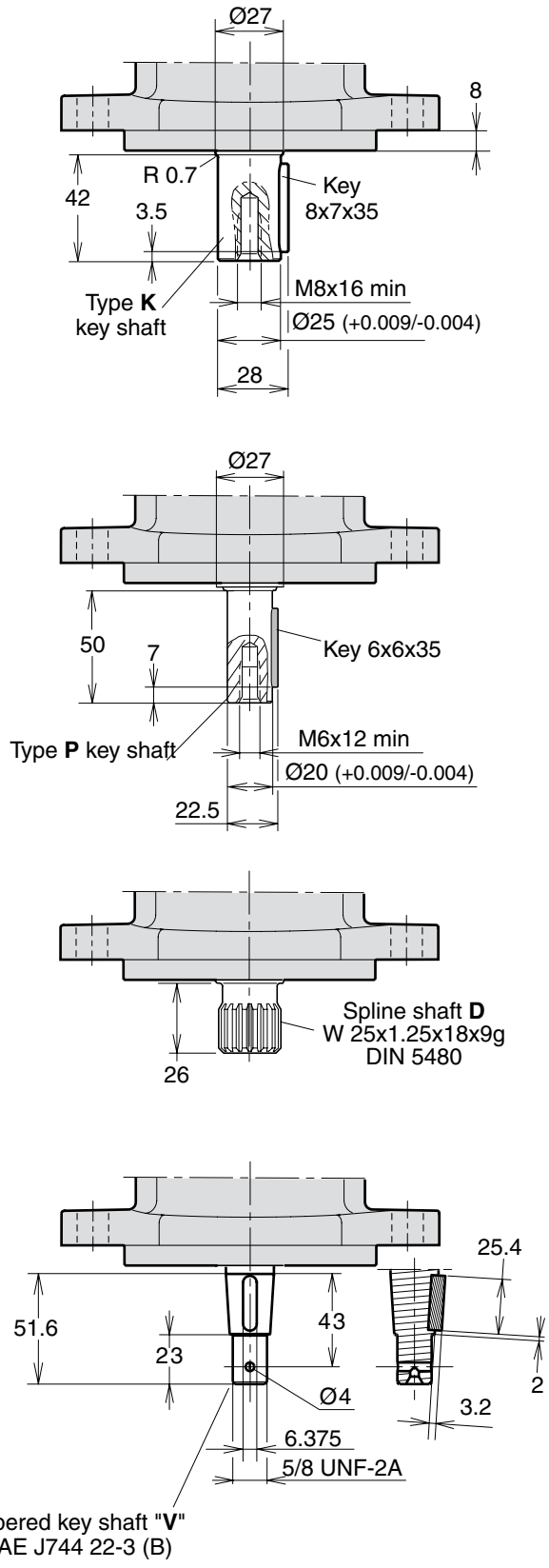
F11-014
(CETOP versions)



Shaft options



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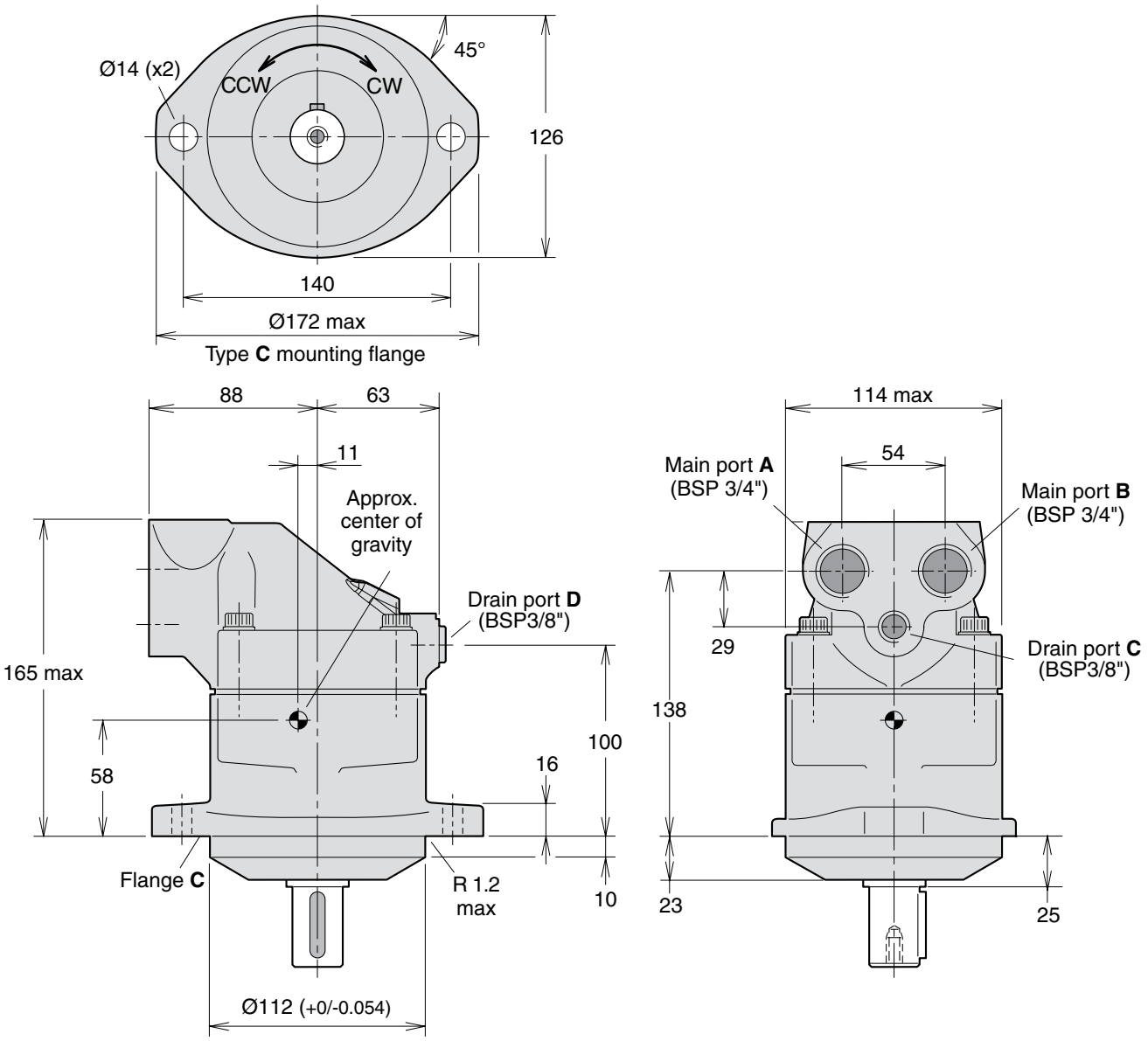
F11-019
(CETOP version)



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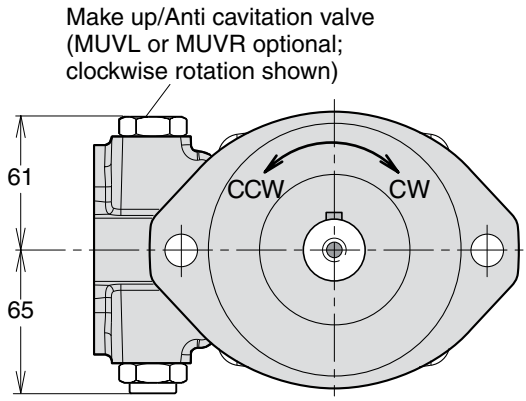
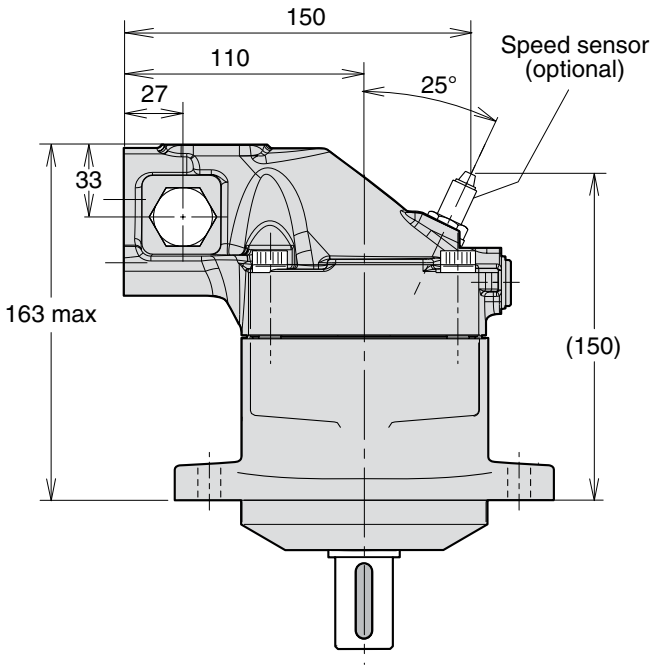
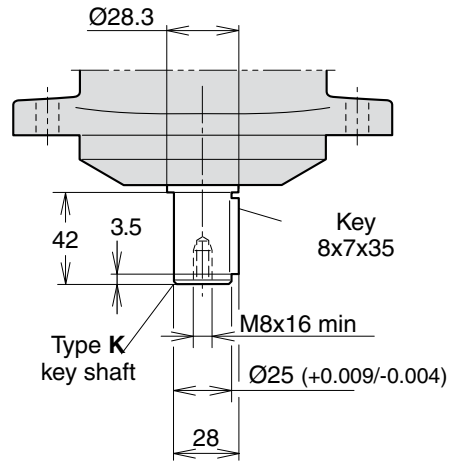
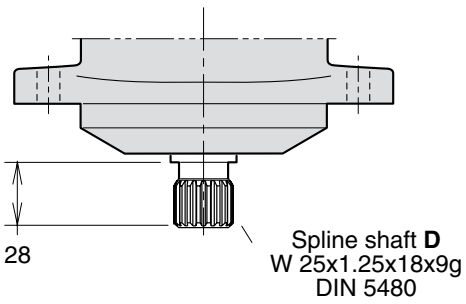
F11-019
(CETOP version)



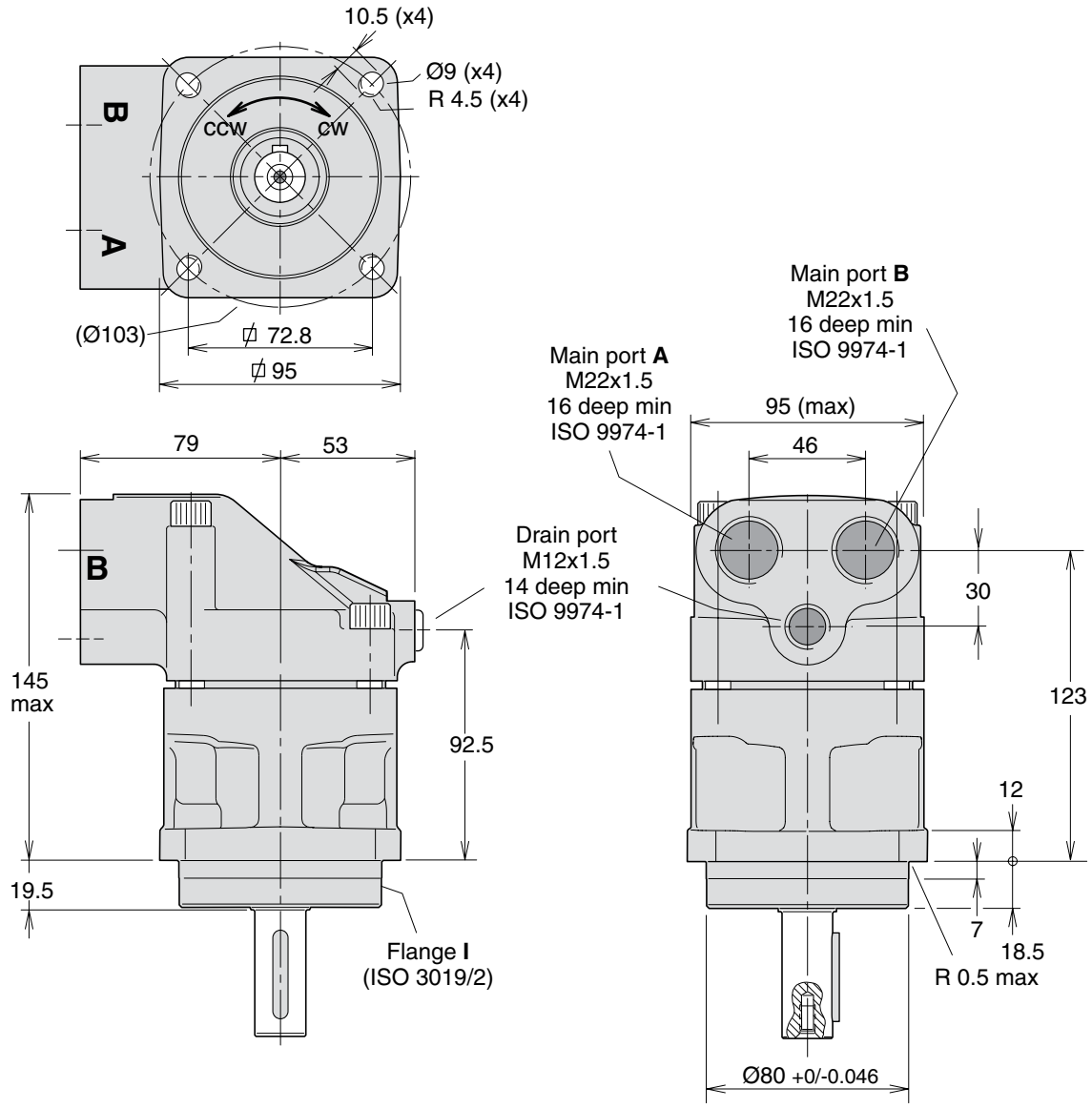


Shaft options

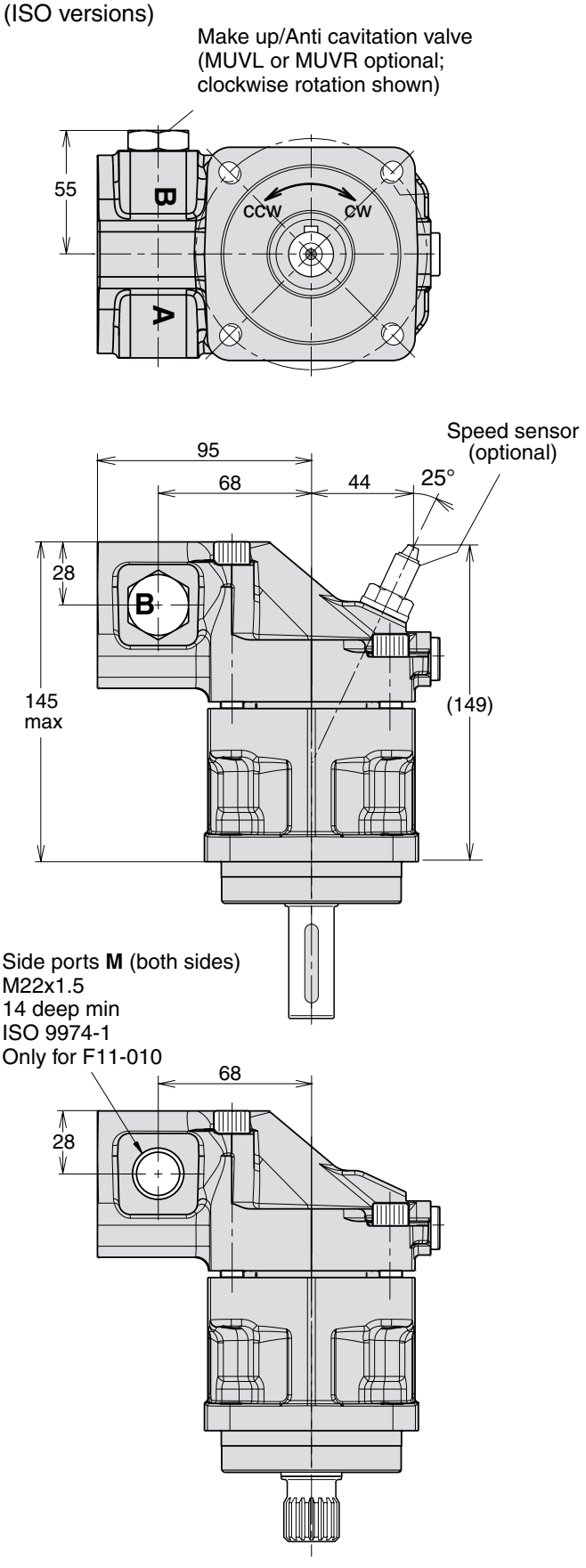




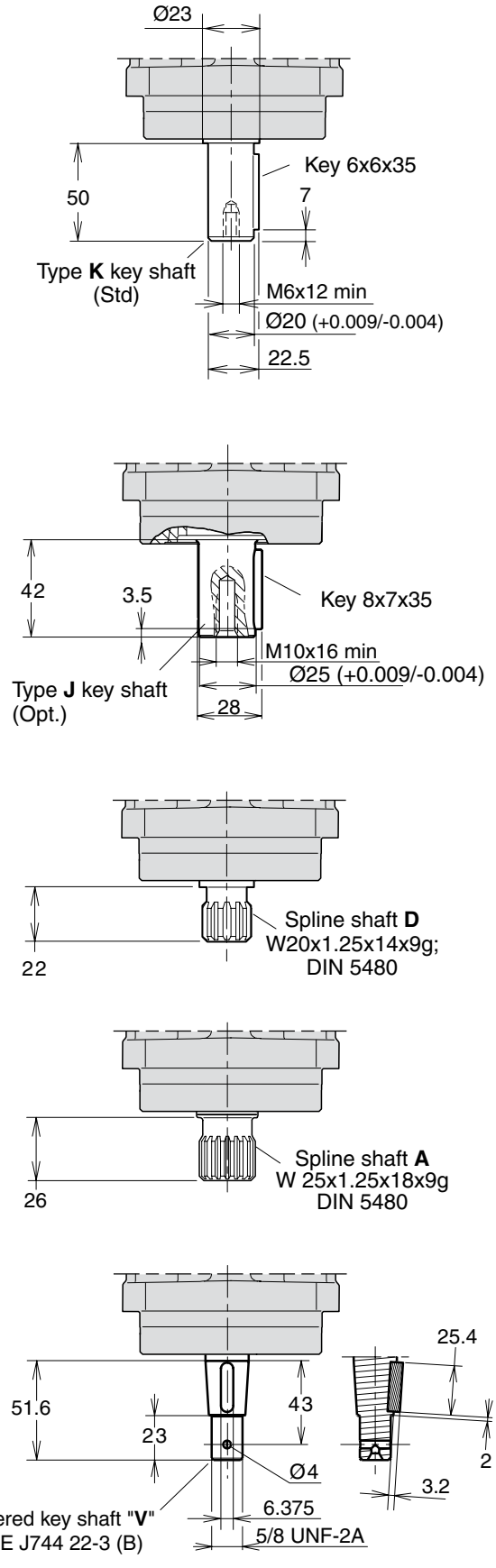
F11-006, -010
(ISO versions)



F11-006, -010
(ISO versions)



Shaft options



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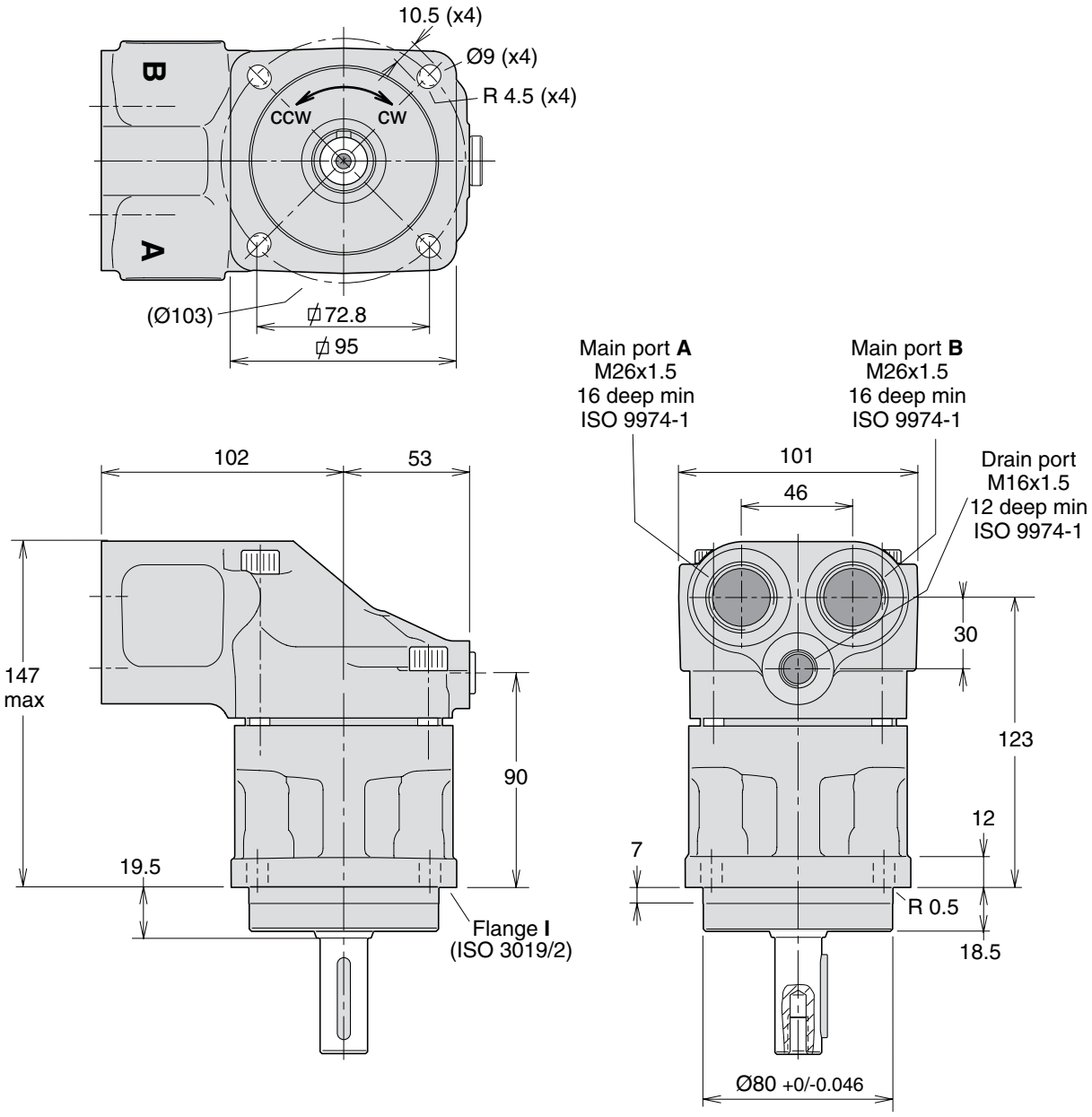
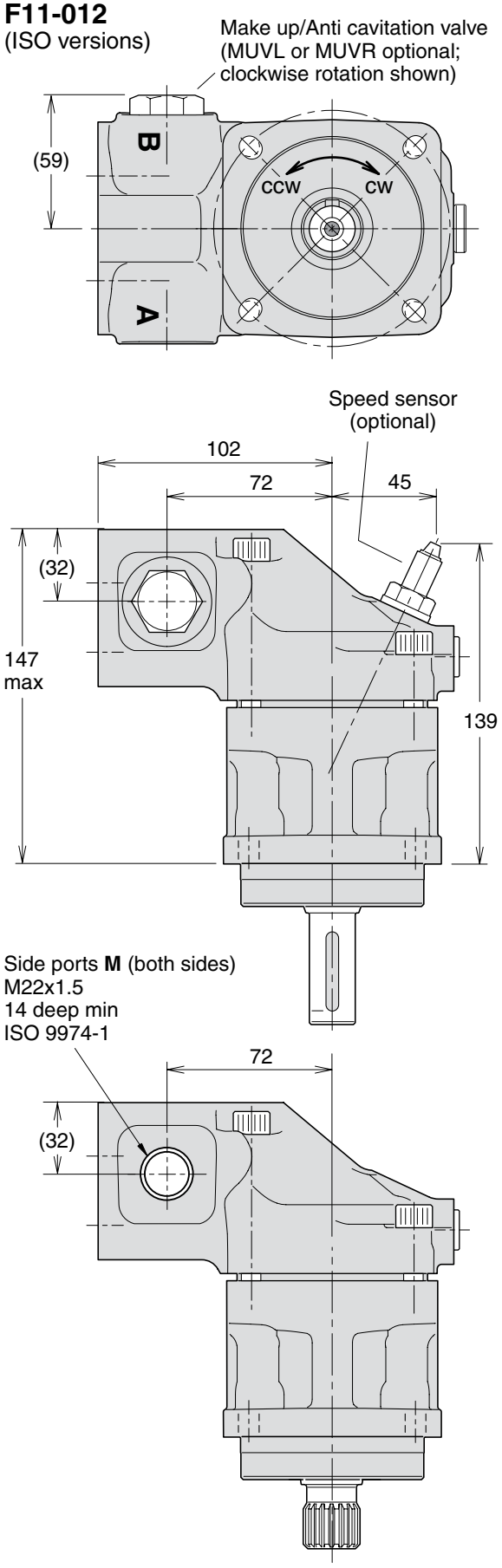
Trollhättan, Sweden

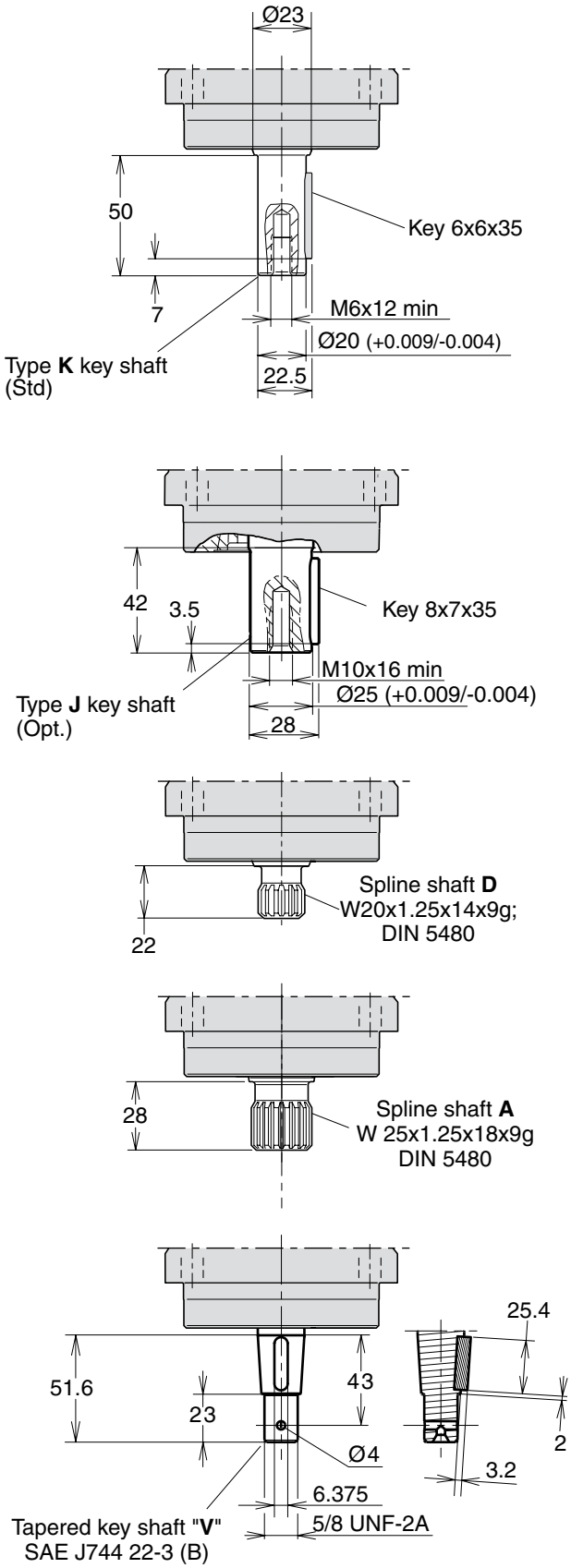
F11-012
(ISO versions)



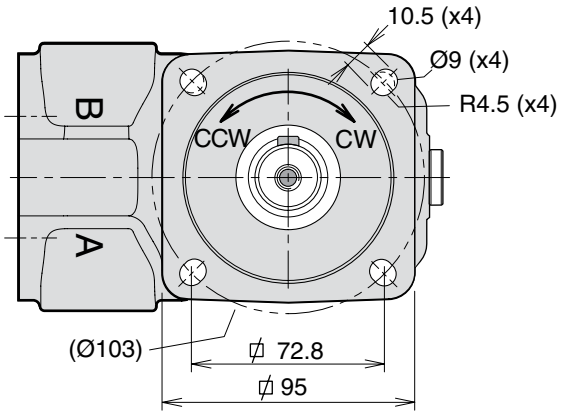
F11-012
(ISO versions)



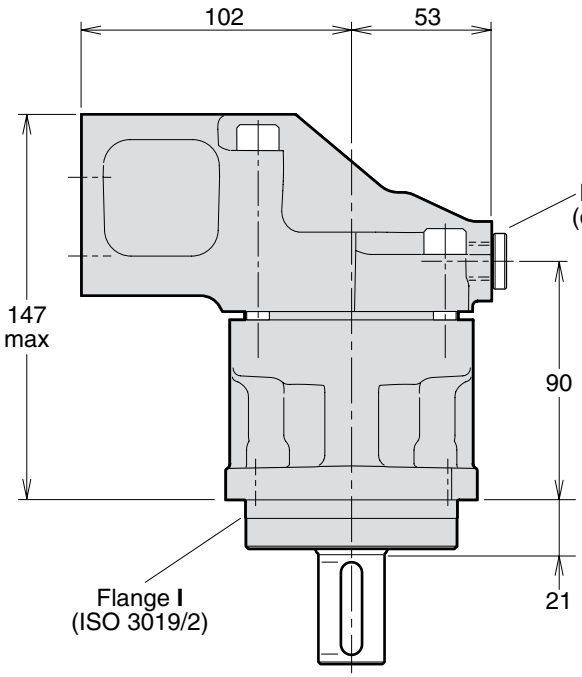
Shaft options

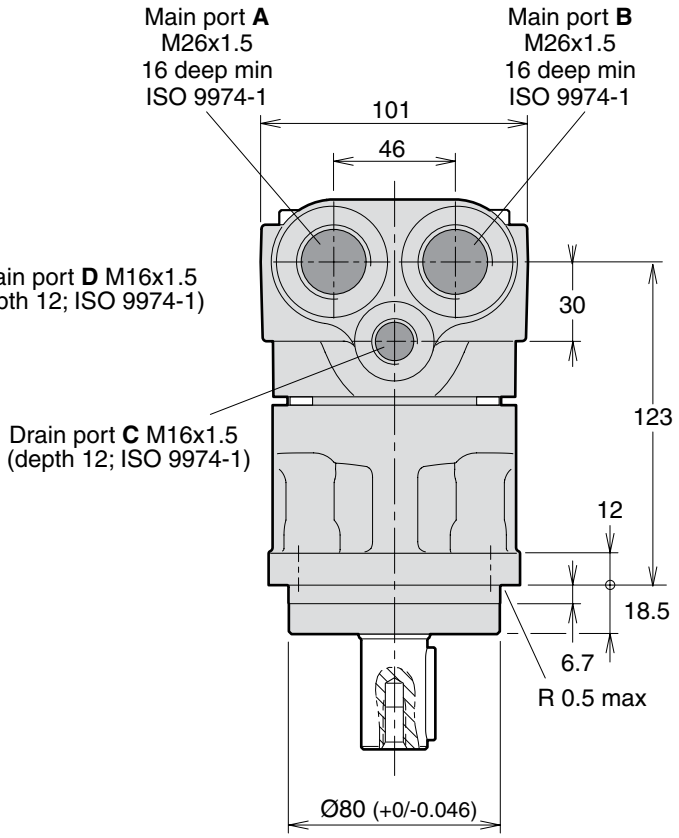


F11-014
(ISO versions)

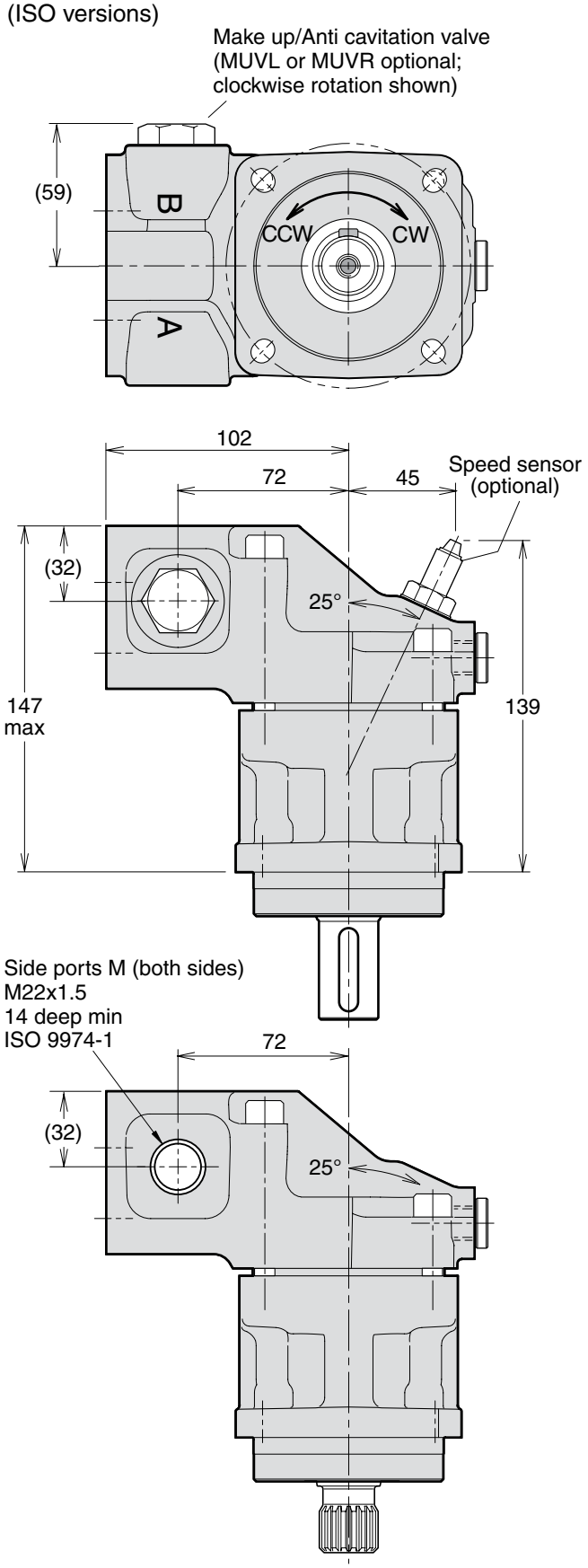


Type **I** mounting flange (ISO 3019/2)

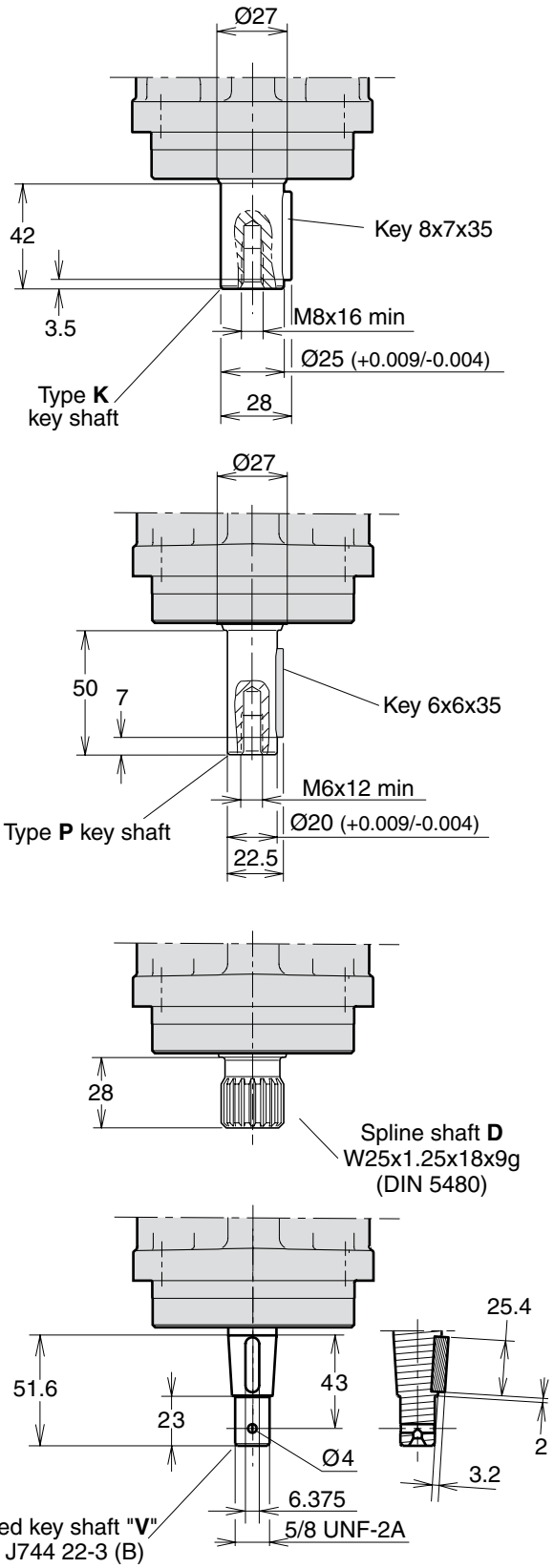




F11-014
(ISO versions)



Shaft options



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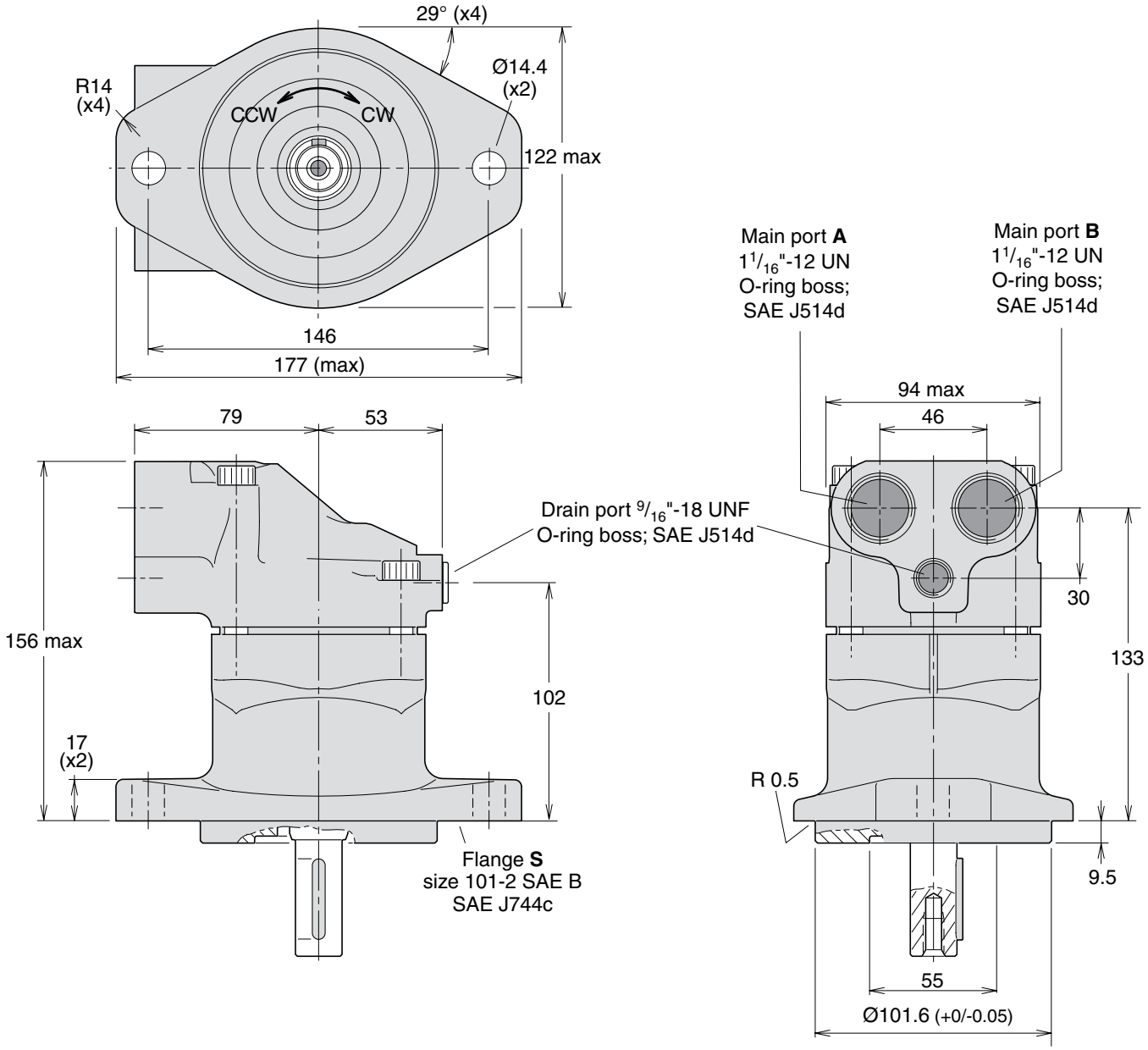
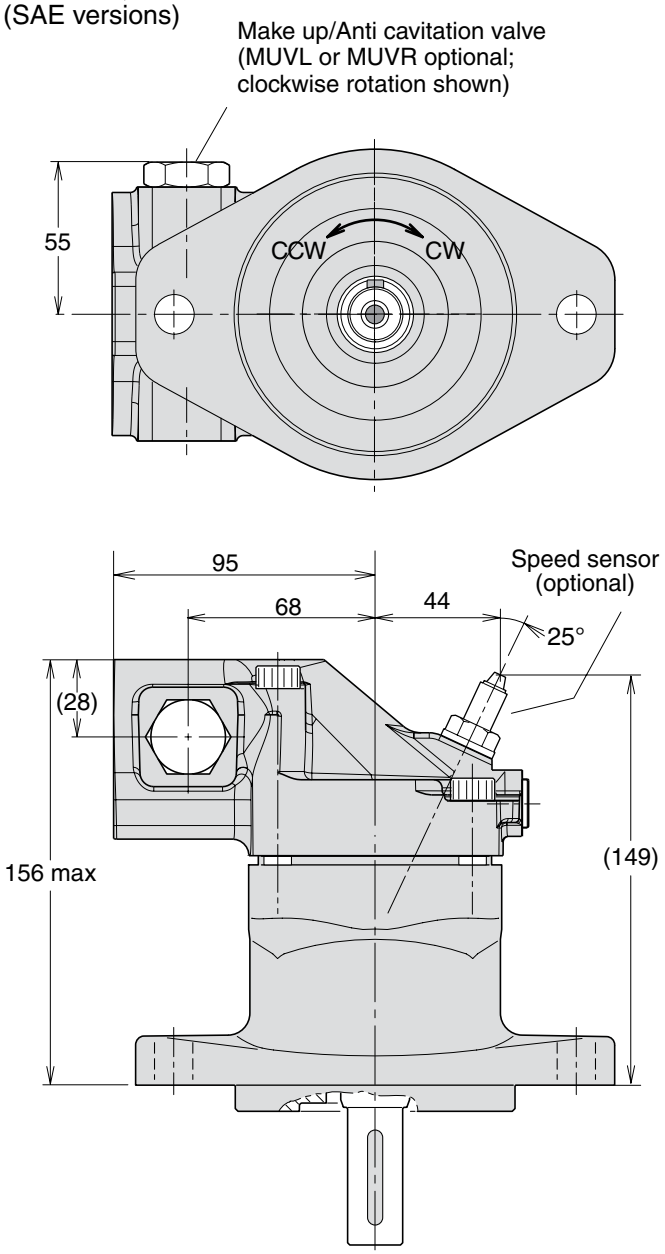
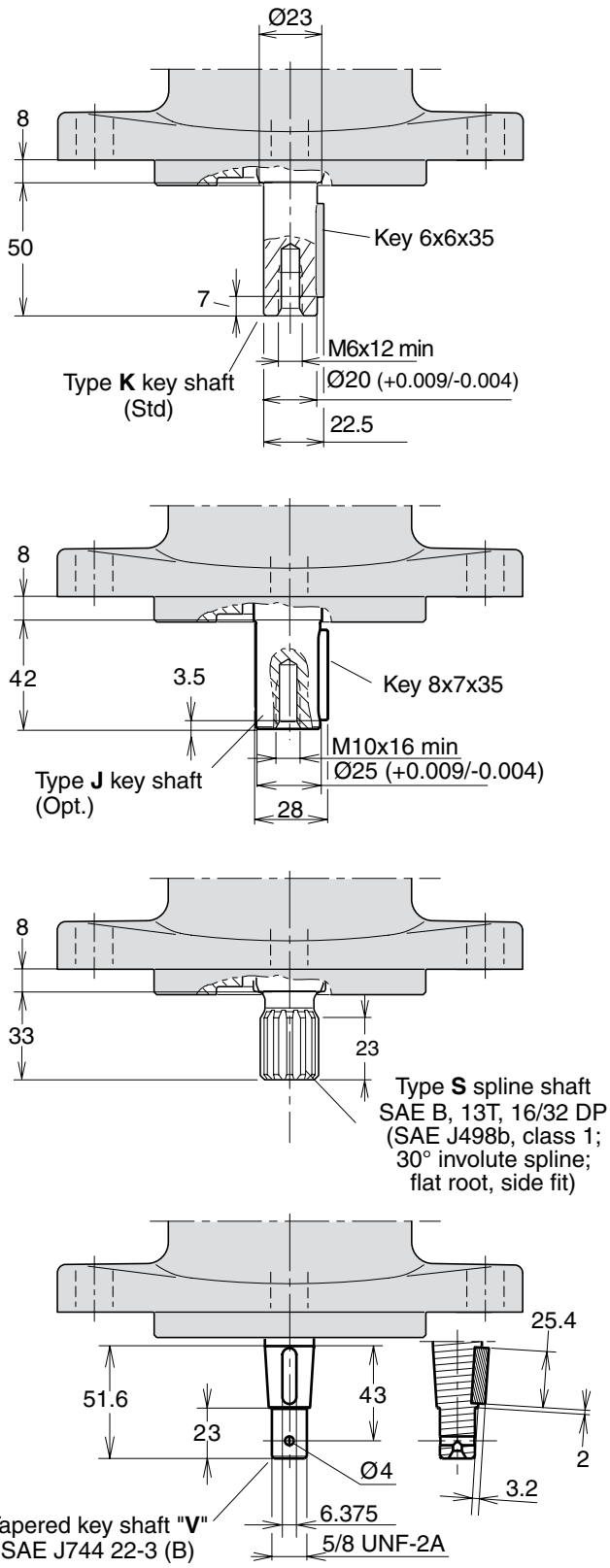
F11-006, -010
(SAE versions)



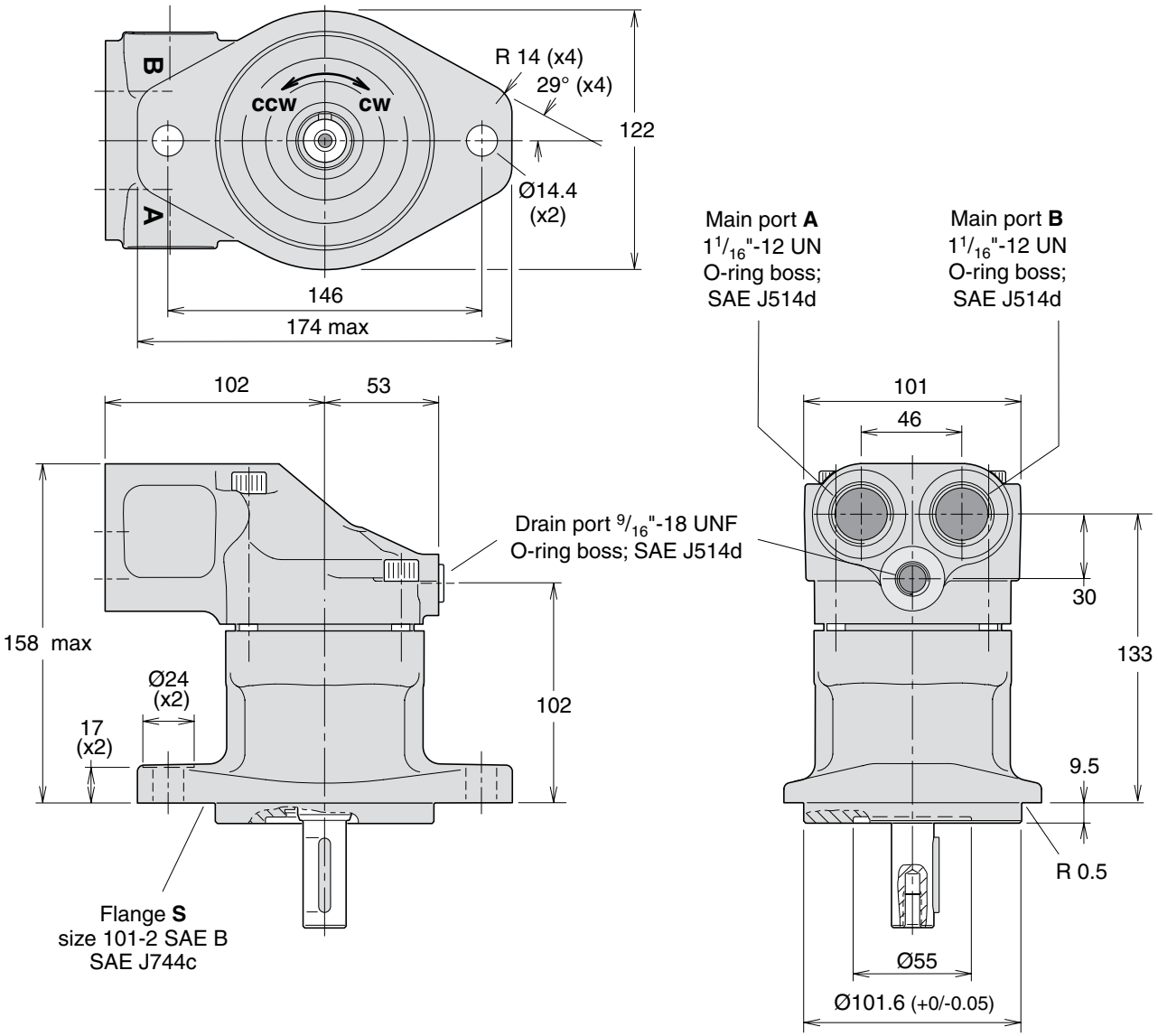
F11-006, -010
(SAE versions)



Shaft options

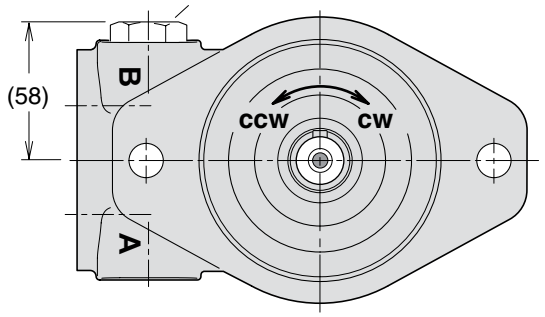


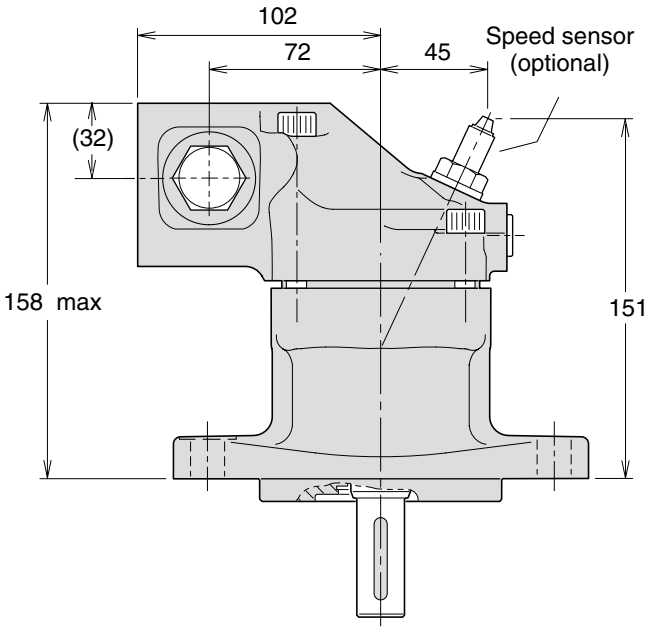
F11-012
(SAE versions)



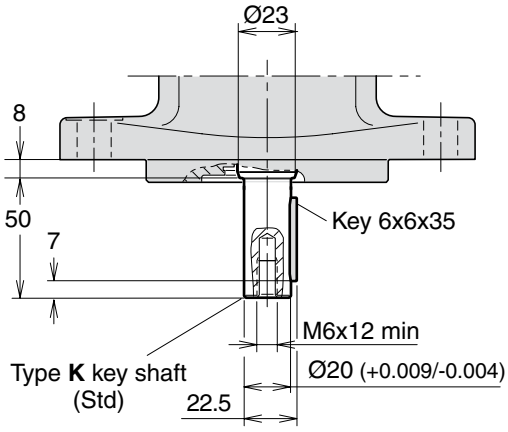
F11-012
(SAE versions)

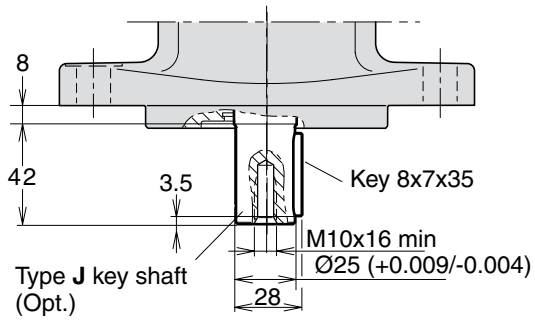
Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown)

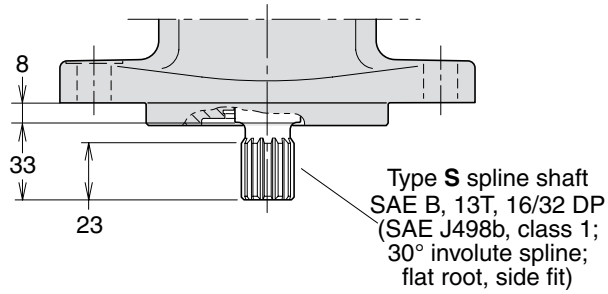


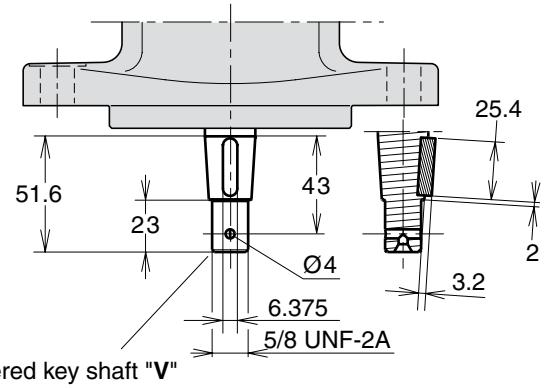


Shaft options

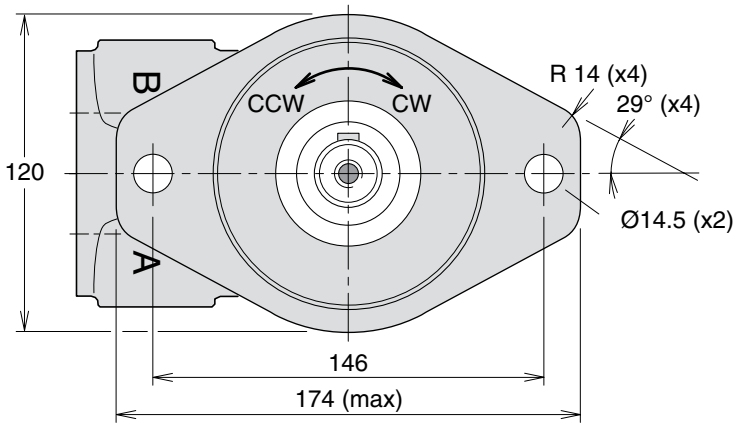




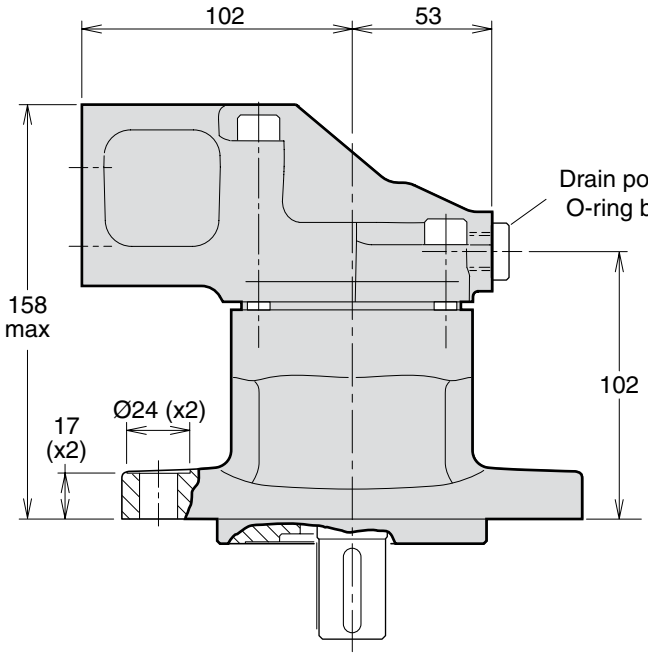


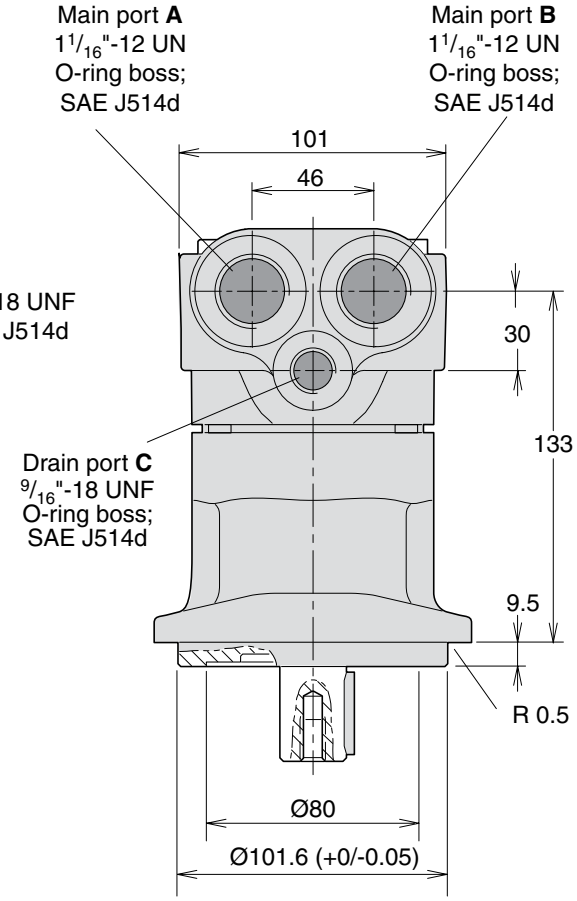


F11-014
(SAE versions)



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





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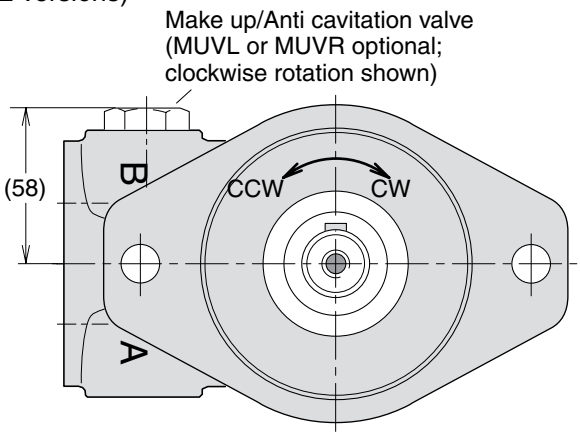
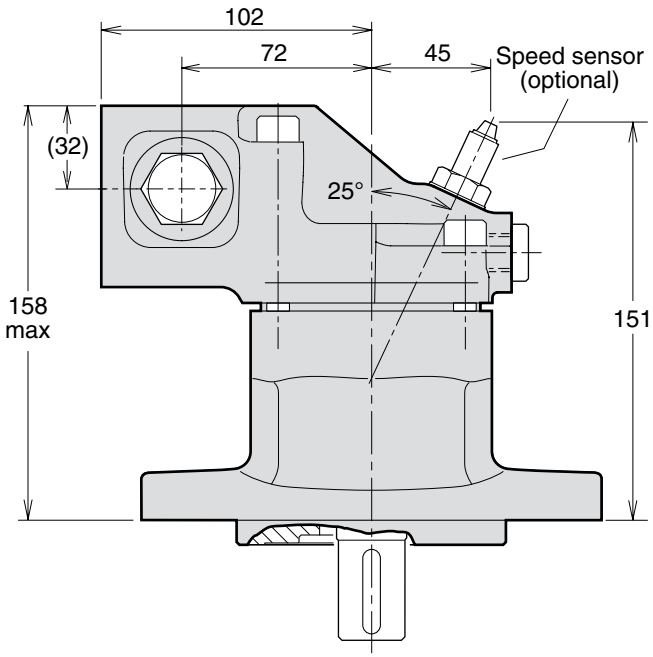
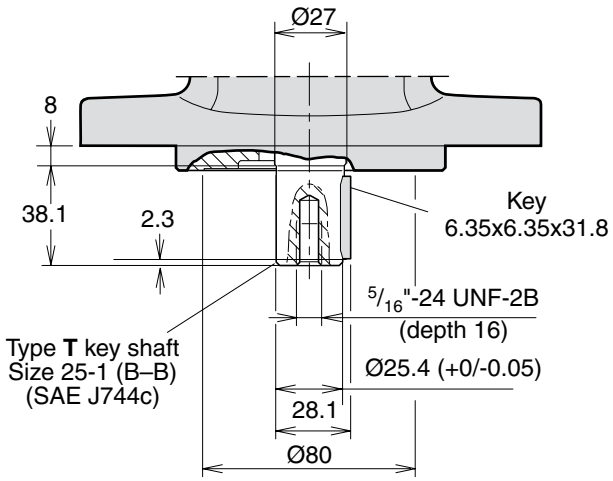
Trollhättan, Sweden

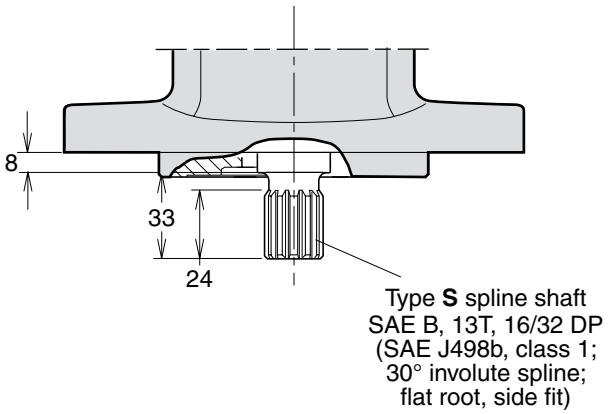
F11-014
(SAE versions)

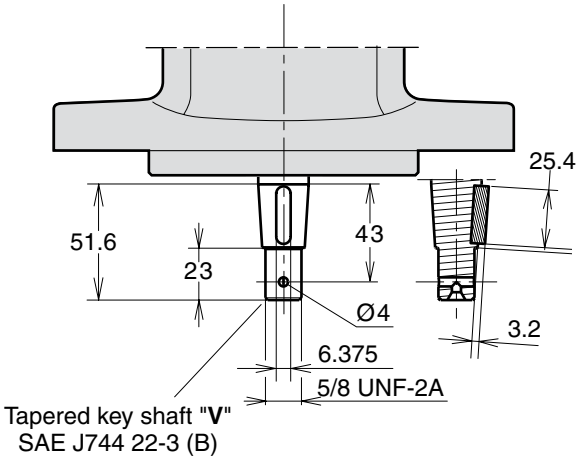




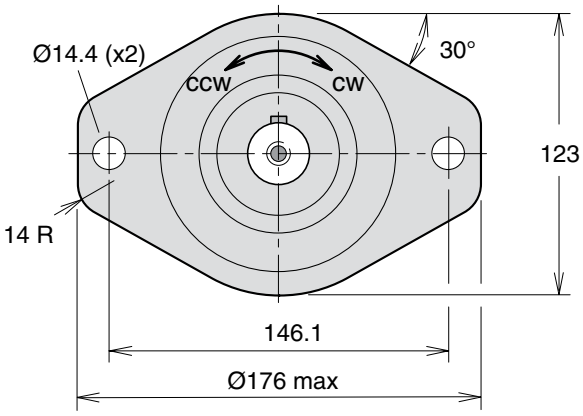
Shaft options



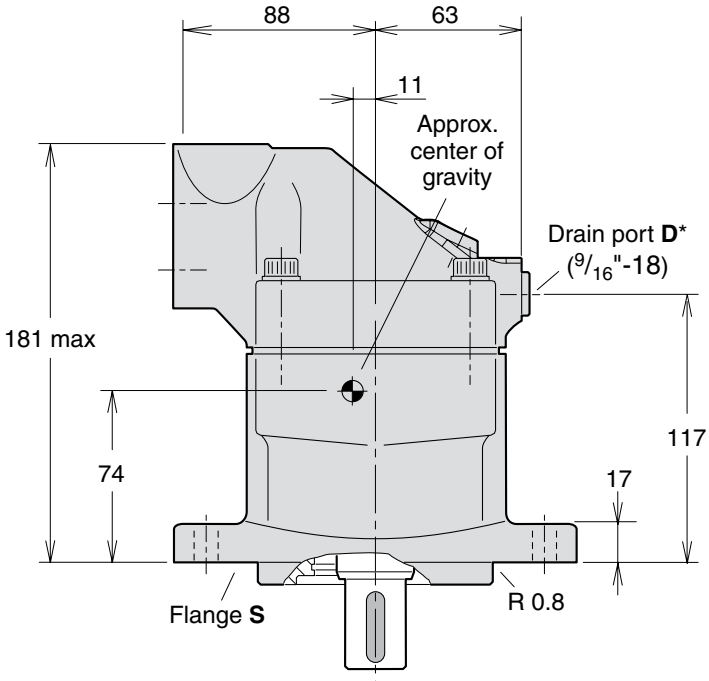


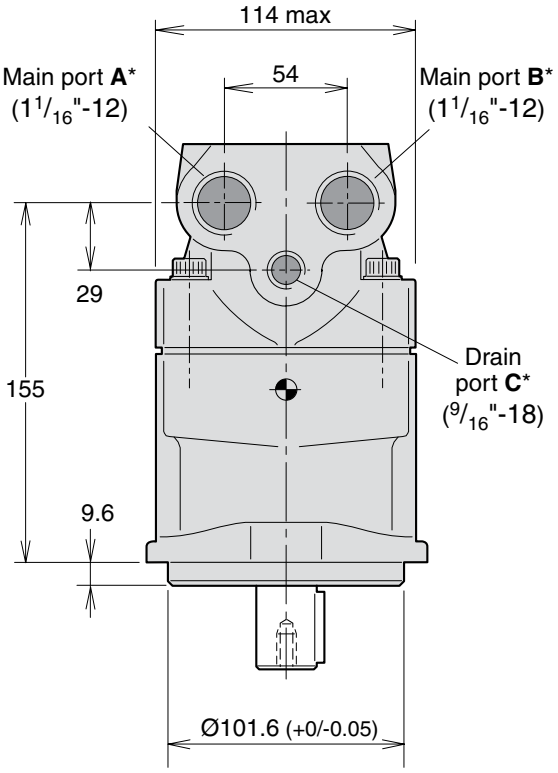


F11-019
(SAE version)



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





* O-ring ports according to SAE J514d

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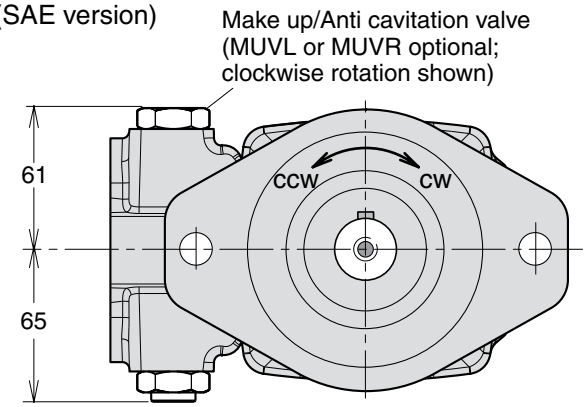
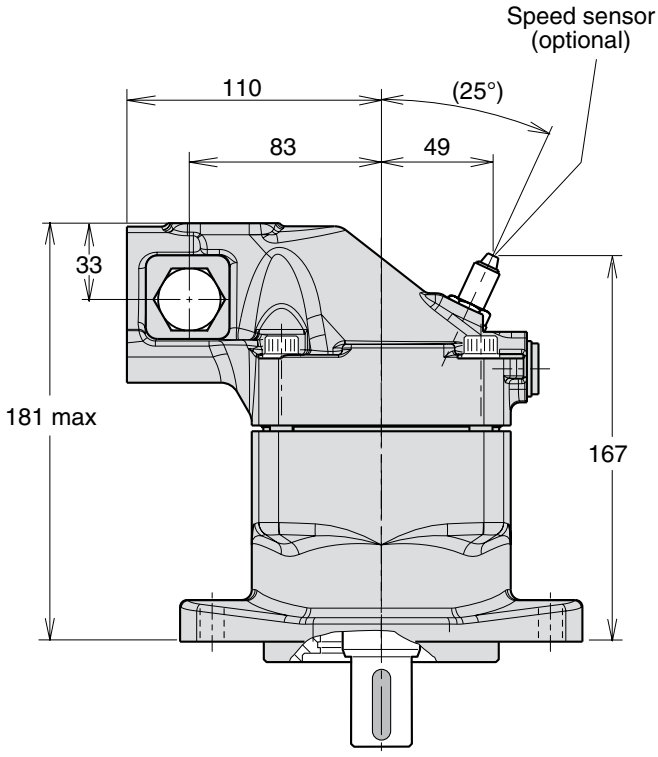
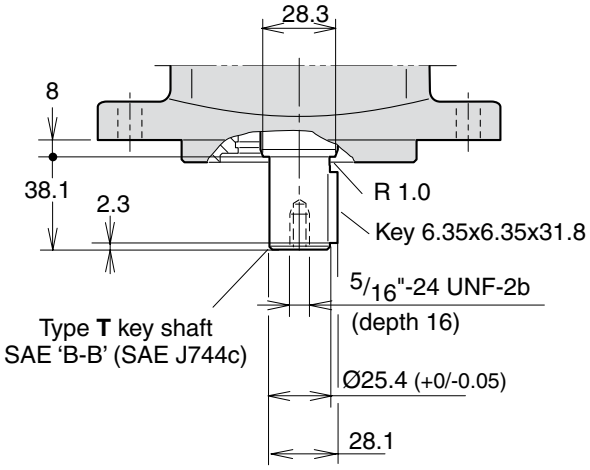
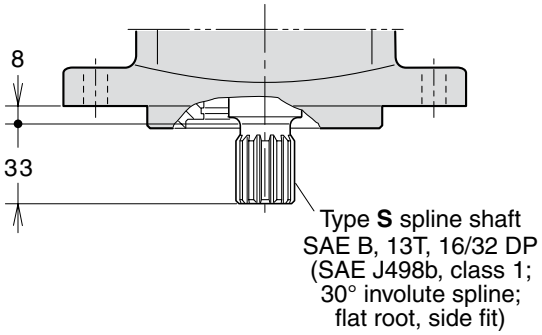
F11-019
(SAE version)





Shaft options





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.

Typical applications:

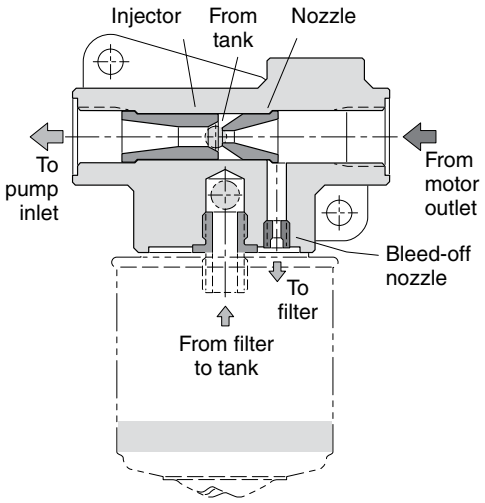
- Fan drives
- Propeller drives
- Generator drives
- Pump drives

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.



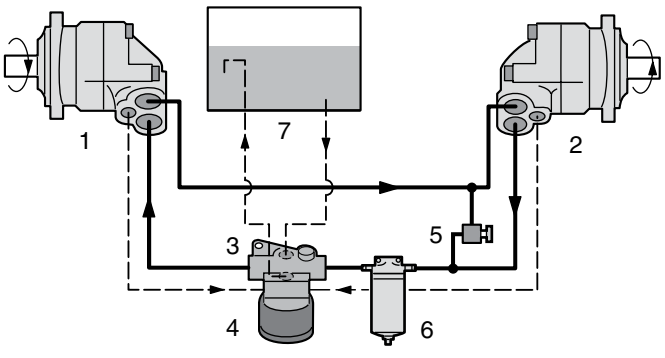
BLA boost unit cross section.

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.

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

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

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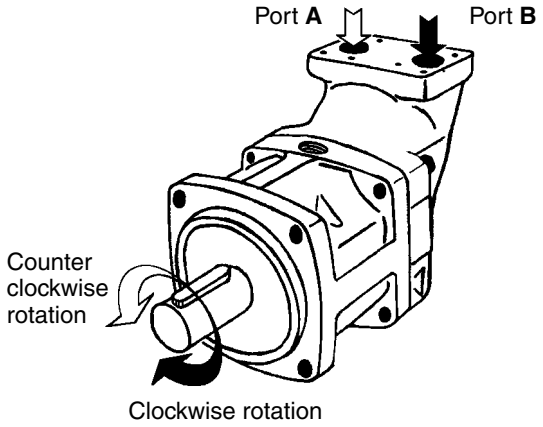
Direction of rotation

The motor versions are bi-directional.

The pump versions are uni-directional, allowing higher selfpriming speeds (refer to pages 9, 11 and 40, 42).

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.



NOTE:
When operating the 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 and 42.

Hydraulic fluids

Ratings and performance data for series 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.

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.

F11/F12 in series operation

When running 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 F12

Frame size	Speed [rpm]	Flow [l/min]
F12-30	3500	4 - 8
F12-40	3000	5 - 10
F12-60	3000	7 - 14
F12-80	2500	8 - 16
F12-90	2500	8 - 16
F12-110	2300	9 - 18
F12-125	2300	9 - 18
F12-152/162/182	2200	10 - 20
F12-250	1800	12 - 22

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 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 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.

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
F12-30, -40, -60, -80, -90	[bar]	0.5 - 8	0.5 - 6.0	1.0 - 4.5	2.0 - 4.0	-
F12-110, -125, -152, -162, -182, -250	[bar]	0.5 - 6	1.0 - 4.0	2.0 - 4.0	-	-

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.

Required inlet pressure

The motor may operate as a pump under certain conditions.

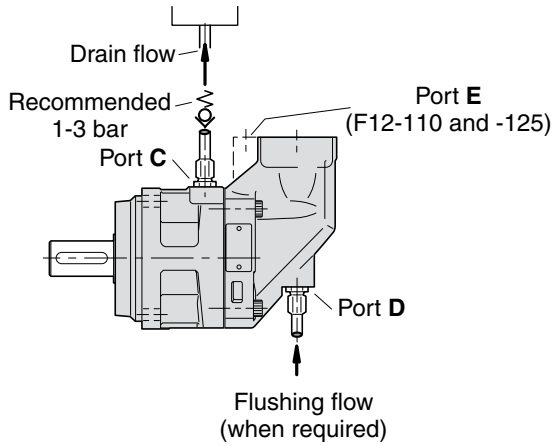
When this occurs, a minimum pressure must be maintained at the inlet port; increased noise and gradually deteriorating performance due to cavitation may otherwise be experienced.

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.

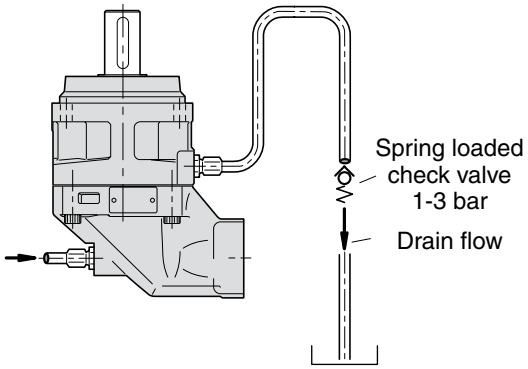
Case drain connections
Series F11/F12 have two drain ports, **C** and **D**, while F12-110 and -125 have an additional port, **E**.

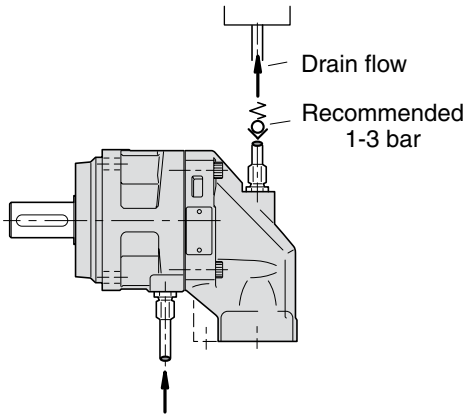
The uppermost drain port (such as port C in the illustration below) should always be utilized.

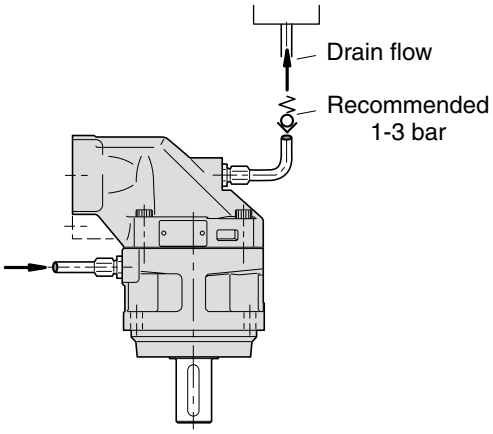


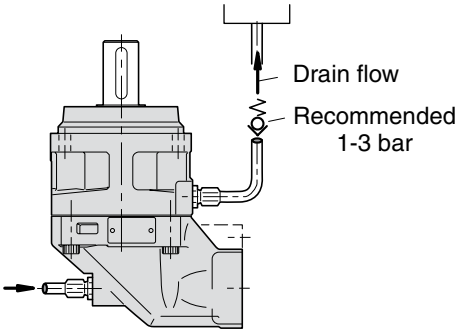
In mounting positions such as 'shaft up' (below) a spring loaded check valve should be installed in the drain line in order to insure a sufficiently high oil level in the case.

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









Before start-up
Make sure the 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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