# F11 Series Axial Piston Fixed Motors Service Manual

Parker

## 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]
$\eta_v$ - volumetric efficiency
$\Delta p$ - differential pressure [bar] (between inlet and outlet)
$\eta_{hm}$ - mechanical efficiency
$\eta_t$ - overall efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

## Basic formulas for hydraulic pumps

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$\eta_v$ - volumetric efficiency
$\Delta p$ - differential pressure [bar] (between inlet and outlet)
$\eta_{hm}$ - mechanical efficiency
$\eta_t$ - 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 |


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Pump & Motor Division Europe
Trollhättan, Sweden

**General product information**
General information and design, Bearing life, F11/F12 Fan motors, F11/F12 in saw motor applications, Parker Power Boost

General product information
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**Series F11**
Bent axis piston pump/motor with fixed displacement

F11
Pages 8 - 38

2



**Parker Hannifin**
Pump & Motor Division Europe
Trollhättan, Sweden

## 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 *(0.3 to 1.16 cu in/rev)*.

**F11 Features**

- Max intermittent pressure up to 420 bar *(6090 psi)* and continuous operating pressure up to 350 bar *(5075 psi)*
- 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 *(1.83 to 14.8 cu in/rev)*.

**F12 Features**

- Max intermittent pressure up to 480 bar *(6960 psi)* and continuous operating pressure up to 420 bar *(6090 psi)*
- The 7 or 9 piston design provides high start-up torque and smooth motor operation
- ISO, CETOP, SAW, Cartridge 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.

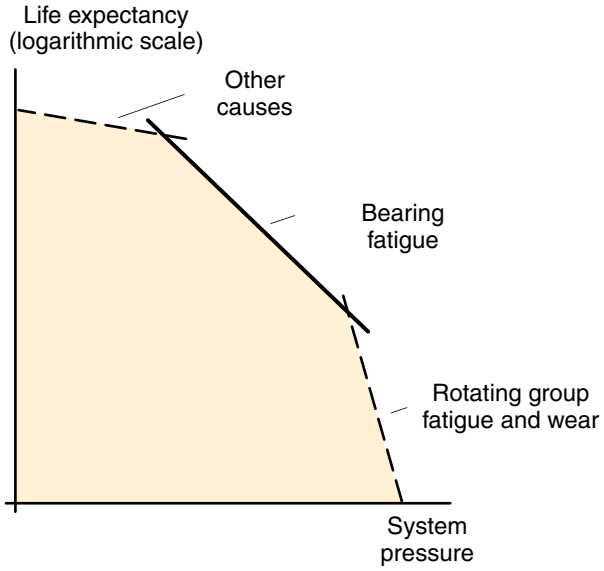
## Bearing life

### 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:

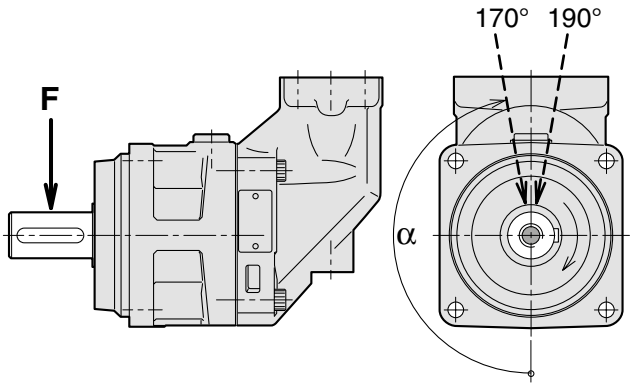
- Pitch diameter, Pressure angle, Spiral angle, Distance flange – gearwheel (mid) and Gearwheel spiral direction (R or L).

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 ($\alpha$) as defined below




The direction ($\alpha$) 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 *(0.3 to 2.44 cu in/rev)*, 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 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.

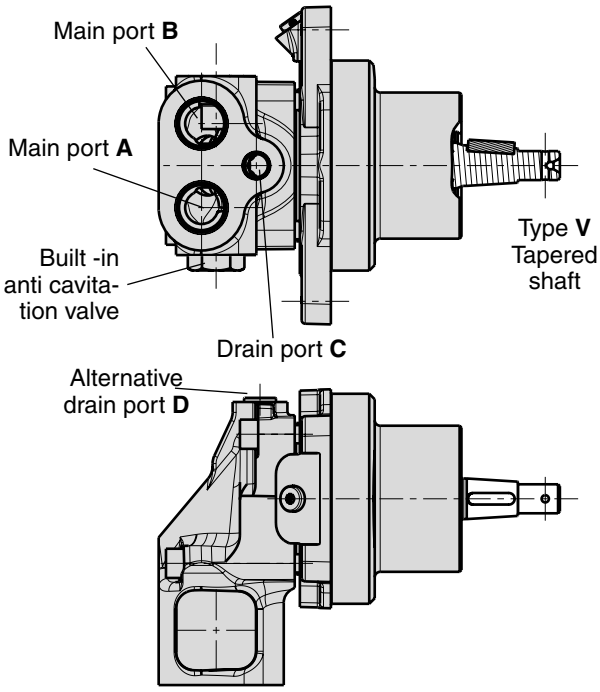
When the pump flow to the motor is shut off and the motor is operating at very high speeds, it is important that sufficient return port back pressure is available (port B in the schematic to the right).

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.

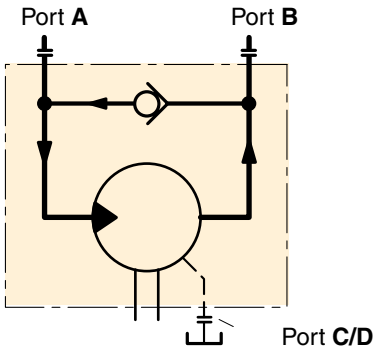
In an open circuit, back pressure can be created by a counter pressure valve installed in the return line; preferably, it should be pilot operated to minimize power losses. A back pressure of about 10 bar is sufficient in most applications.

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.




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




*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

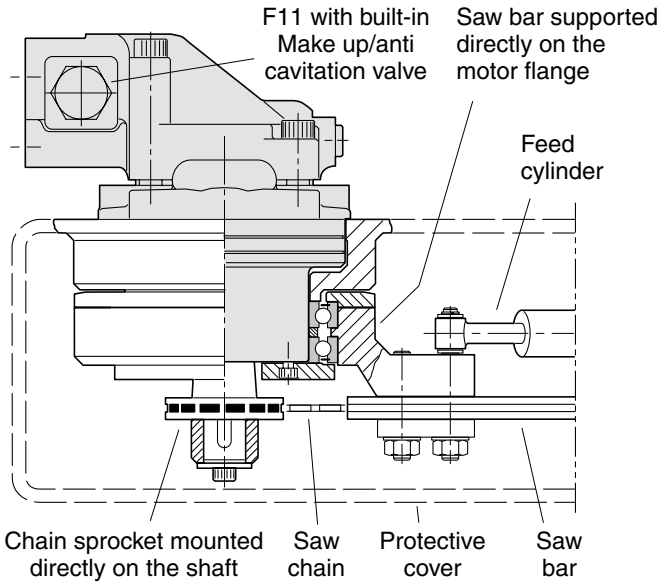
Series F11/F12 motors have proven suitable for demanding applications such as chain saws. Primarily due to the 40° bent-axis design, spherical pistons (with laminated piston rings) and gear synchronization, very high speeds are permissible. Not even low temperatures at start-up affect reliability.

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. Catalog 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 F11-006, -010, -012, -014, -019 and F12-030.

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 |
| *[cu in/rev]* | *0.30* | *0.37* | *0.60* | *0.76* | *0.87* | *1.16* |
| **Operating pressure** 3) | | | | | | |
| max intermittent1) [bar] | 420 | 420 | 420 | 420 | 420 | 420 |
| *[psi]* | *6 000* | *6 000* | *6 000* | *6 000* | *6 000* | *6 000* |
| max continuous [bar] | 350 | 350 | 350 | 350 | 350 | 350 |
| *[psi]* | *5 000* | *5 000* | *5 000* | *5 000* | *5 000* | *5 000* |
| **Motor operating speed** 3) [rpm] | | | | | | |
| max intermittent 1) | 14 000 | 11 200 | 11 200 | 10 300 | 9 900 | 8 900 |
| max continuous | 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] | 5 000 | – | 4 400 | 4 350 | 4 200 | 3 800 |
| **Motor input flow** | | | | | | |
| max intermittent1) [l/min] | 69 | 67 | 110 | 129 | 142 | 169 |
| *[gpm]* | *18.2* | *17.7* | *29.1* | *34.1* | *37.5* | *44.6* |
| max continuous [l/min] | 63 | 61 | 100 | 118 | 129 | 154 |
| *[gpm]* | *16.6* | *16.1* | *26.4* | *31.2* | *34.1* | *40.7* |
| **Drain temperature**3), max [°C] / *[° F]* | 115/*239* | 115/*239* | 115/*239* | 115/*239* | 115/*239* | 115/*239* |
| min [°C] / *[° F]* | -40/*-40* | -40/*-40* | -40/*-40* | -40/*-40* | -40/*-40* | -40/*-40* |
| **Theoretical torque at 100 bar** [Nm] | 7.8 | 9.5 | 15.6 | 19.8 | 22.7 | 30.2 |
| *[lbf ft]* | *5.8* | *7.0* | *11.5* | *14.6* | *16.8* | *22.3* |
| **Mass moment of inertia** | | | | | | |
| ($x10^{-3}$) [kg $m^2$] | 0.16 | 0.39 | 0.39 | 0.40 | 0.42 | 1.1 |
| ($x10^{-2}$) *[lbf$t^2$]* | *0.38* | *0,92* | *0.92* | *0.95* | *1.00* | *2.61* |
| **Weight** [kg] | 4.7 | 6.5 | 6.5 | 7.5 | 7.5 | 11 |
| *[lb]* | *10.4* | *14.3* | *14.3* | *16.5* | *16.5* | *24.3* |

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

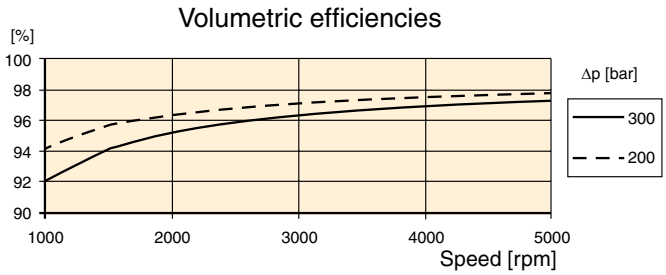
## Efficiency

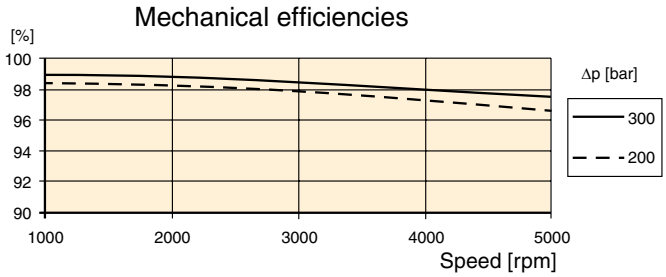
Because of its high overall efficiency, driving a motor/pump from series F11 requires less fuel or electric power. Also, it allows the use of a small reservoir and heat exchanger, which in turn reduce cost, weight, and installation size.

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.



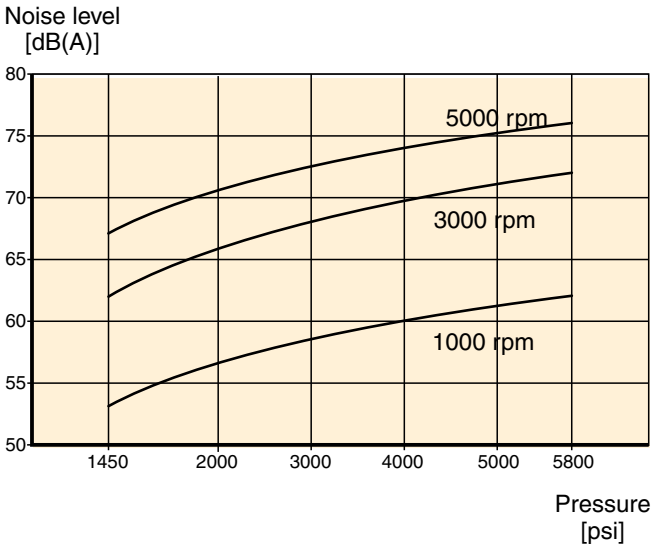

## Noise level

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.



## Selfpriming speed and required inlet pressure

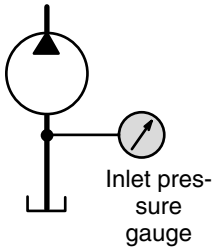
### Series F11

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



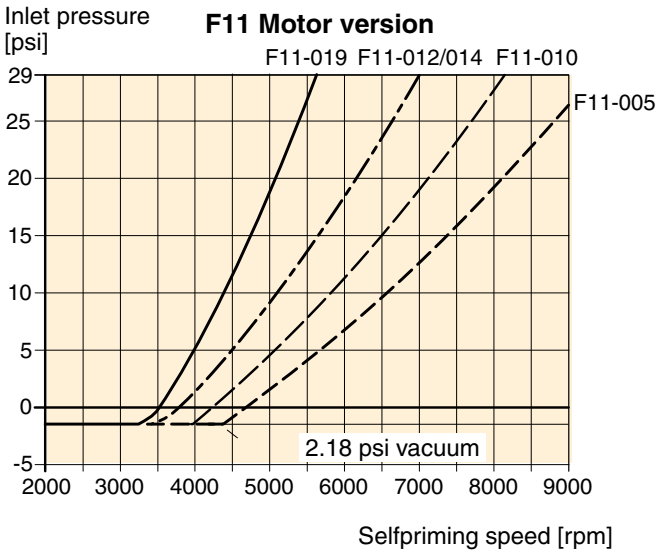




*Diagram 1. Min required inlet pressure for Motor.*

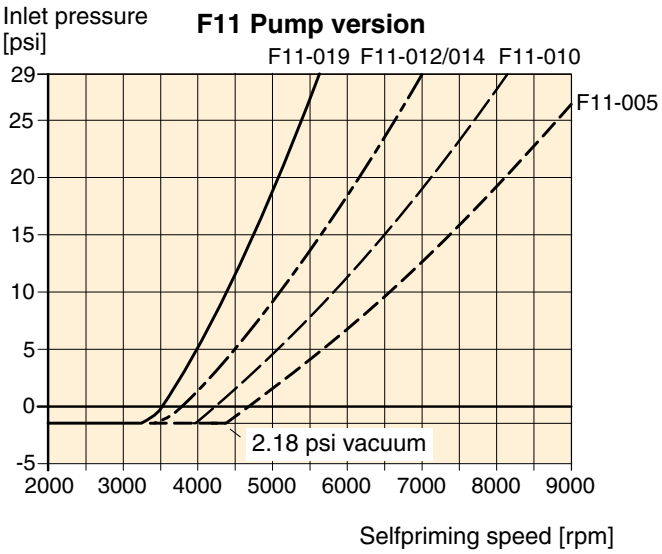



*Diagram 2. Min required inlet pressure for Pump.*

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.



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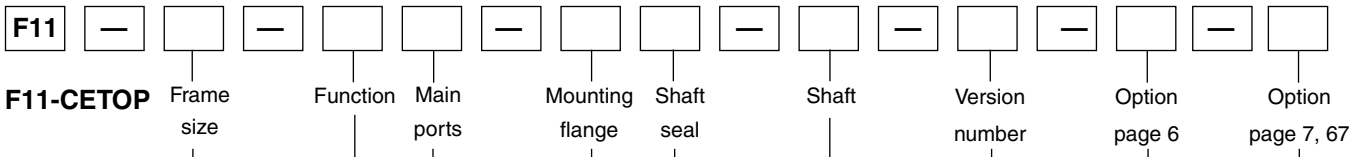



| Frame size | | |
|---|---|---|
| Code | Displacem. ($cm^3$/rev) | Displacem. (cu in/rev) |
| 005 | 4.9 | 0.30 |
| 006 | 6.0 | 0.37 |
| 010 | 9.8 | 0.60 |
| 012 | 12.5 | 0.76 |
| 014 | 14.3 | 0.87 |
| 019 | 19.0 | 1.16 |

| 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 | 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 | 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 | Mounting flange | | | | | | |
| C | CETOP flange | x | x | x | x | x | x |

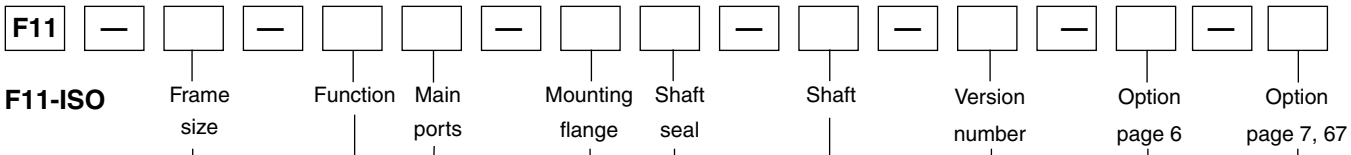
| Frame size | | 5 | 6 | 10 | 12 | 14 | 19 |
|---|---|---|---|---|---|---|---|
| Code | Shaft seal | | | | | | |
| V | FPM, high pressure, high temperature | x | x | x | x | x | x |

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




**F11-ISO**

Frame size | Function | Main ports | Mounting flange | Shaft seal | Shaft | Version number | Option page 6 | Option page 7, 67

| Frame size | | |
|---|---|---|
| Code | Displacem. ($cm^3$/rev) | Displacem. (cu in/rev) |
| 006 | 6.0 | 0.37 |
| 010 | 9.8 | 0.60 |
| 012 | 12.5 | 0.76 |
| 014 | 14.3 | 0.87 |

| 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.

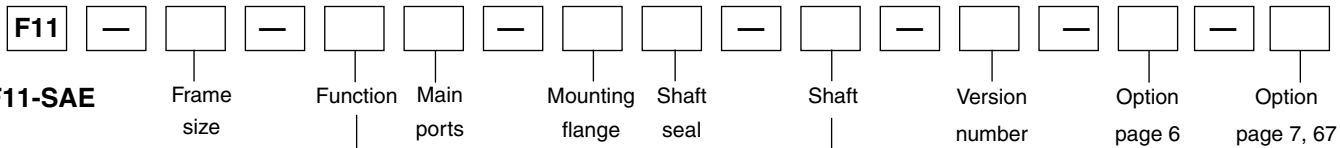
| Frame size | | 6 | 10 | 12 | 14 |
|---|---|---|---|---|---|
| Code | Mounting flange | | | | |
| I | ISO flange | x | x | x | x |

| 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




**F11-SAE**

Frame size | Function | Main ports | Mounting flange | Shaft seal | Shaft | Version number | Option page 6 | Option page 7, 67

| Frame size | | | | | | |
|---|---|---|---|---|---|---|
| Code | Displacem. ($cm^3$/rev) | Displacem. (cu in/rev) | | | | |
| 006 | 6.0 | 0.37 | | | | |
| 010 | 9.8 | 0.60 | | | | |
| 012 | 12.5 | 0.76 | | | | |
| 014 | 14.3 | 0.87 | | | | |
| 019 | 19.0 | 1.16 | | | | |

| 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 31-37.

| 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 seal | | | | | |
| V | FPM, high pressure, high temperature | x | x | x | x | x |

For other versions, contact Parker Hannifin

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

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

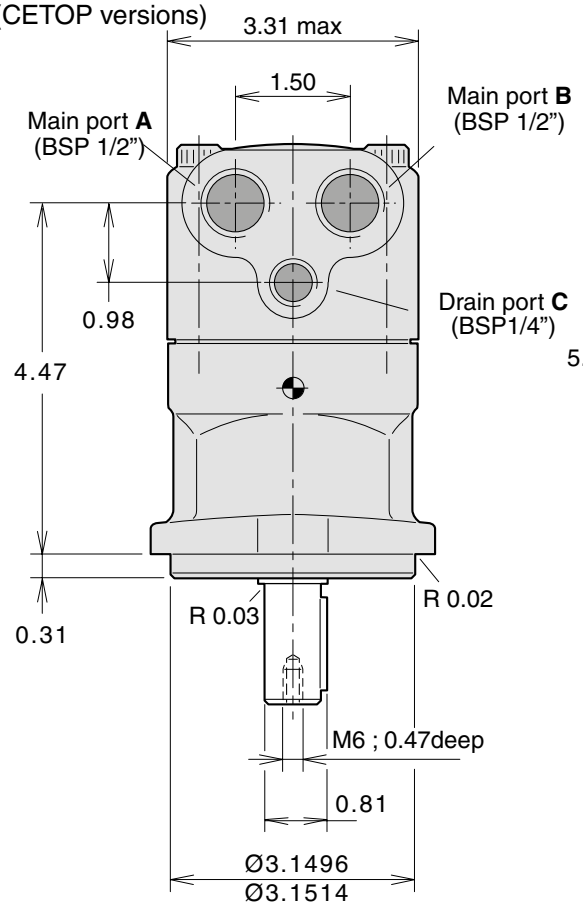
| Frame size | | 6 | 10 | 12 | 14 | 19 |
|---|---|---|---|---|---|---|
| Code | Option | | | | | |
| 00 | Standard | x | x | x | x | x |
| P_ | Prepared for speed sensor | (x) | (x) | (x) | (x) | (x) |
| B_ | Power Boost and Prepared for speed sensor | (x) | (x) | (x) | (x) | (x) |
| _T | Painted Black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

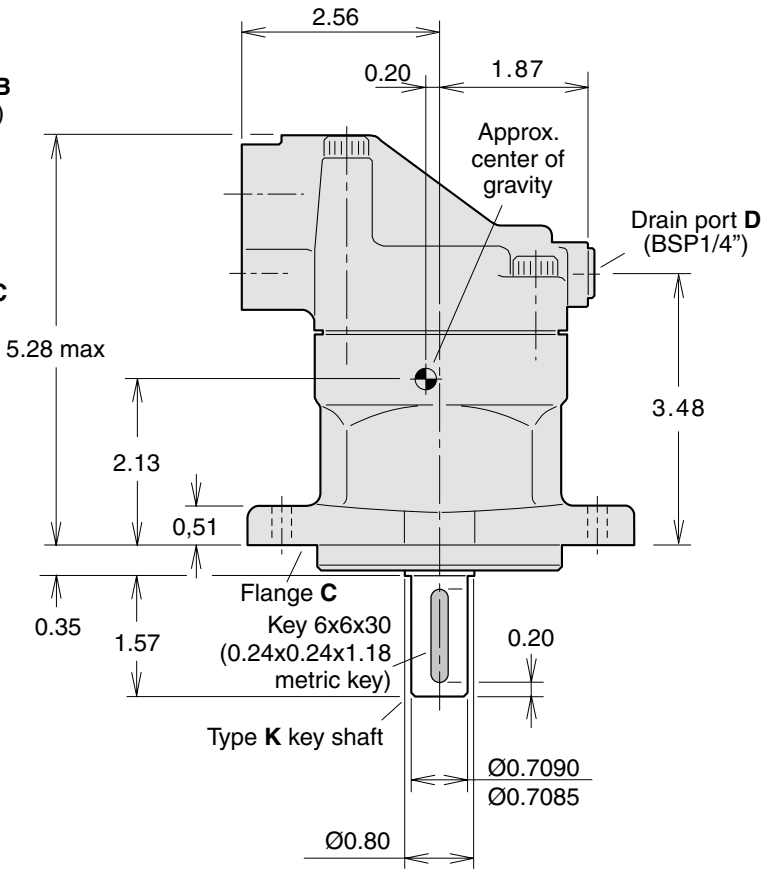
**NOTE**: All combinations are not valid, please contact Parker Hannifin

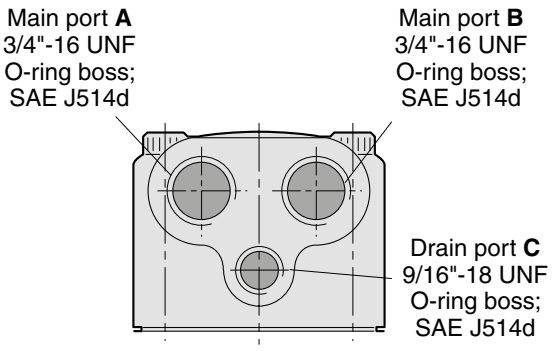


**Parker Hannifin**
Pump & Motor Division Europe
Trollhättan, Sweden

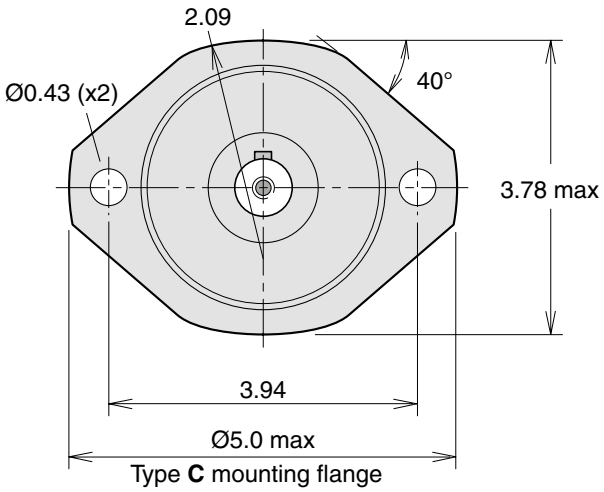
## F11-5
(CETOP versions)



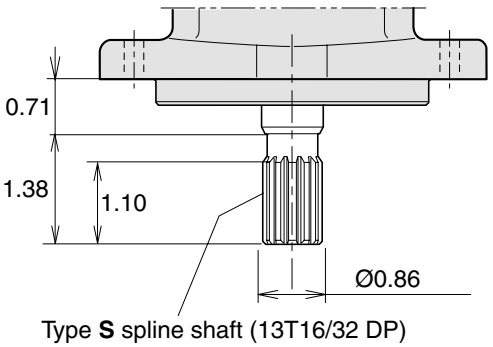



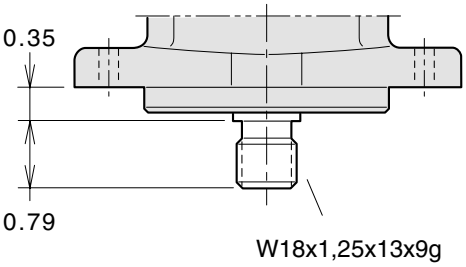

**Main ports Code U**




Type **C** mounting flange



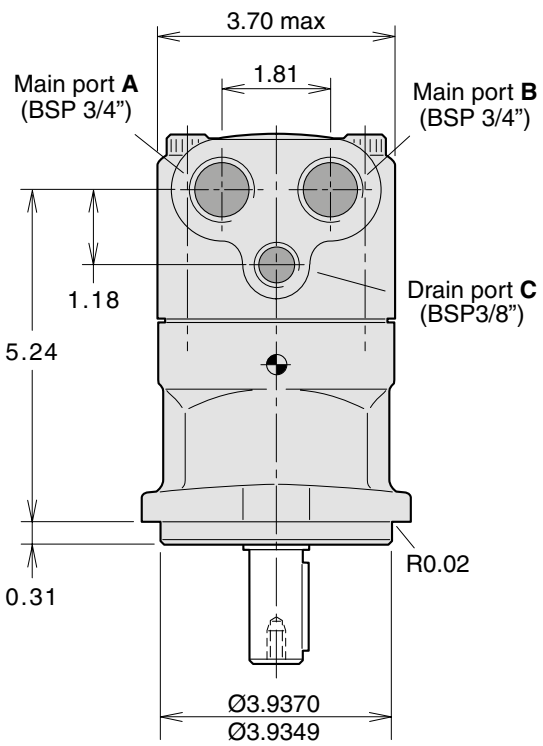

Type **S** spline shaft (13T16/32 DP)

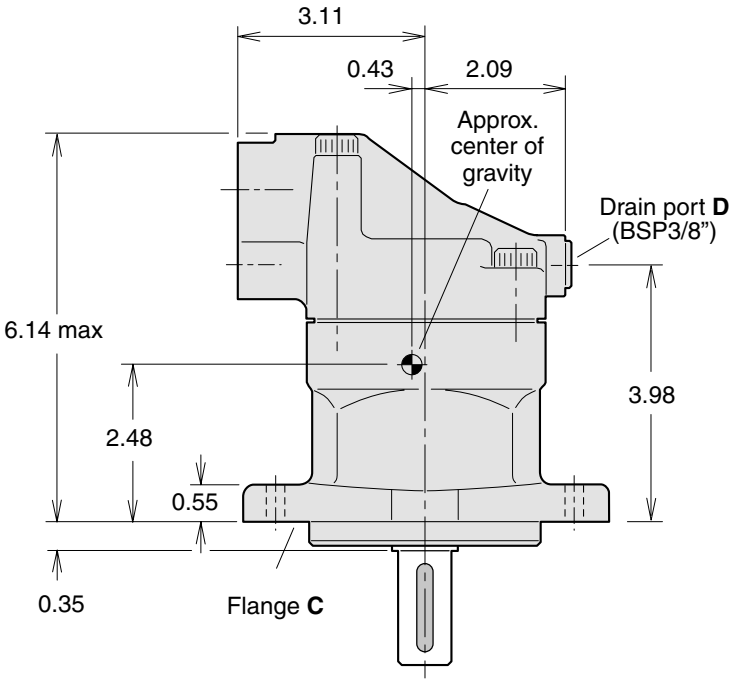


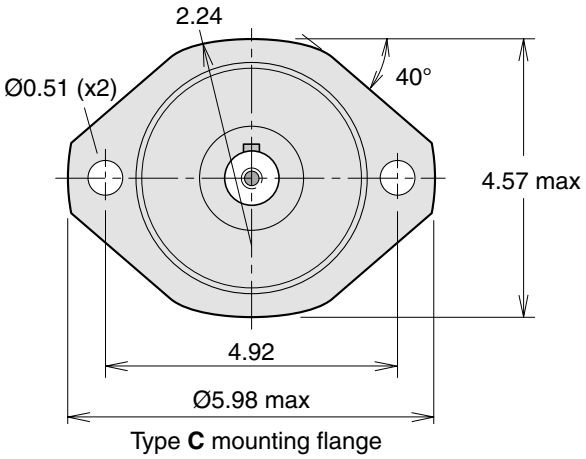

W18x1,25x13x9g

Type **D** spline shaft (DIN 5480)

## F11-006, -010
(CETOP versions)




Type **C** mounting flange



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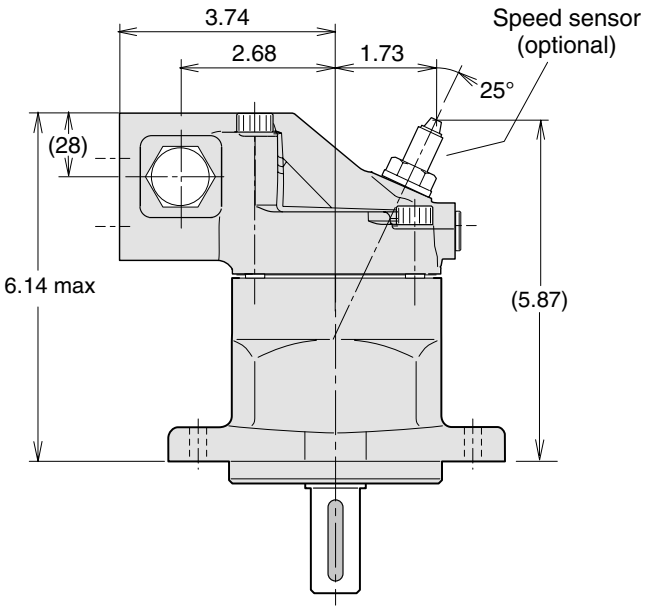
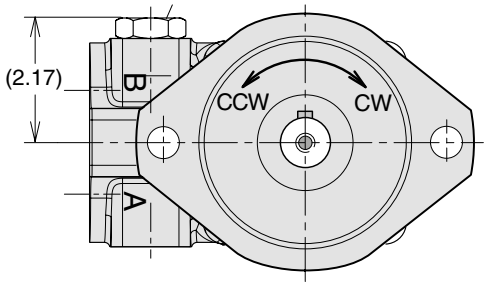
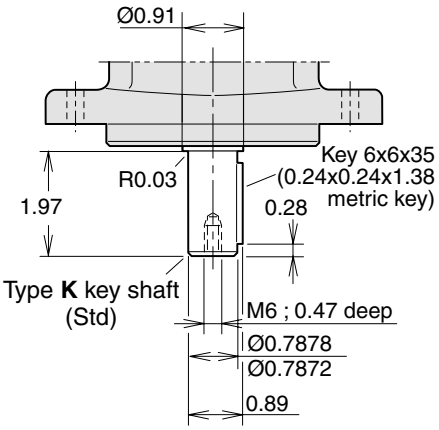
## F11-006, -010
(CETOP versions)

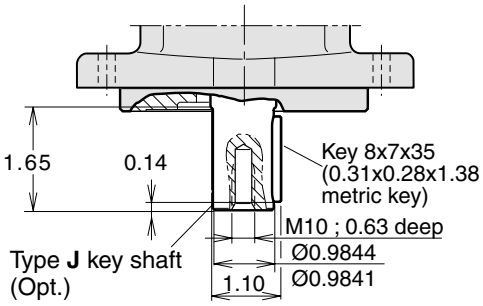


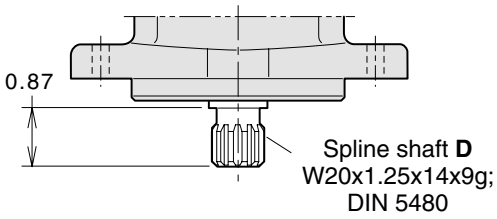

Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown).

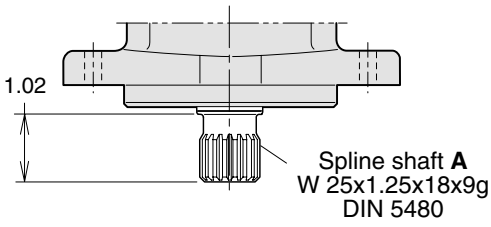


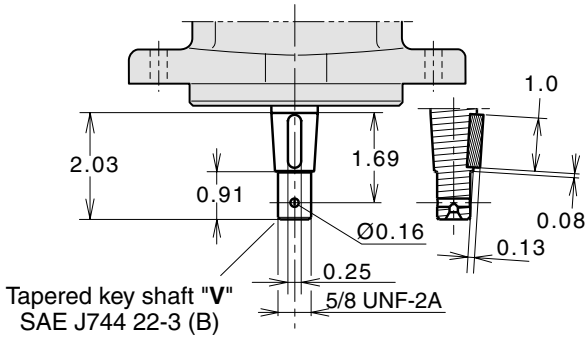

### Shaft options



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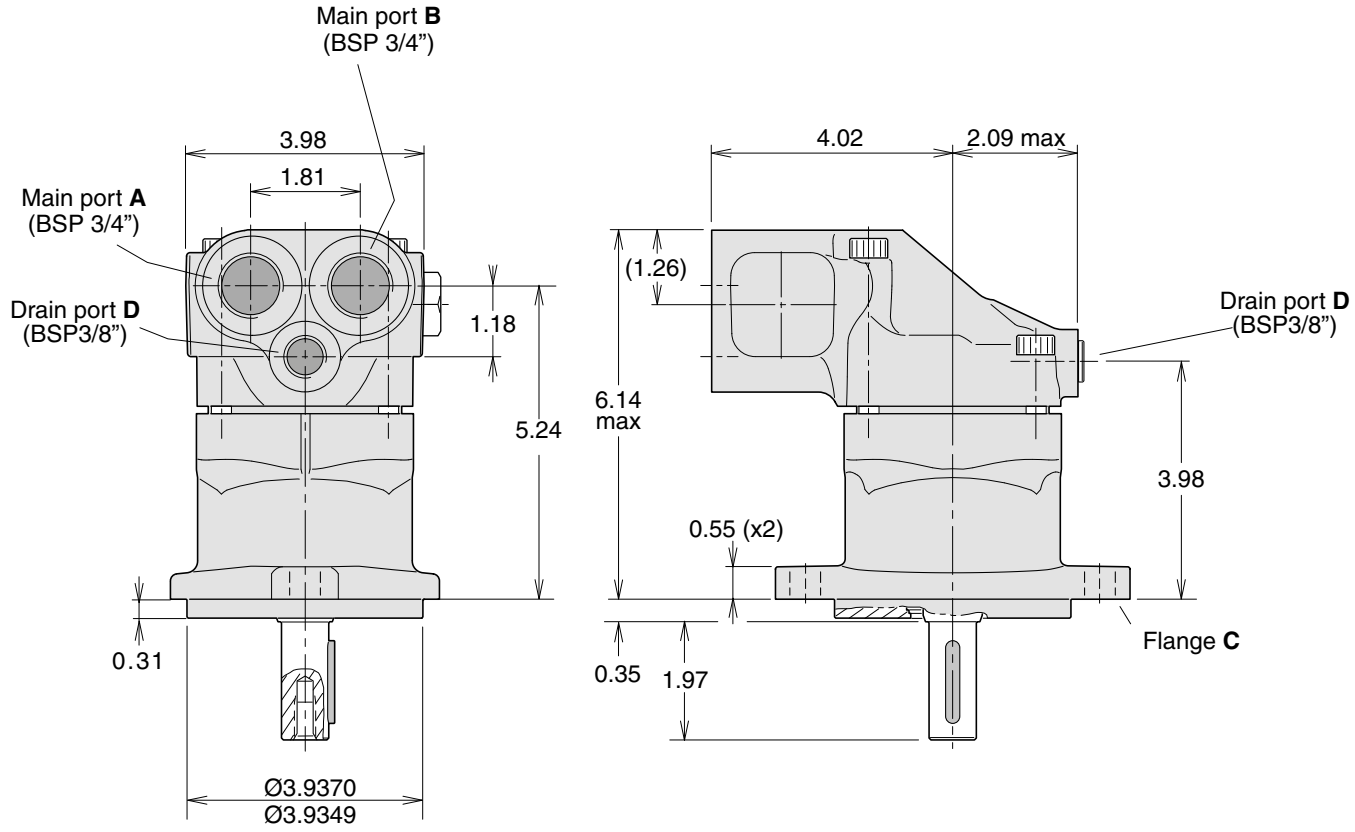
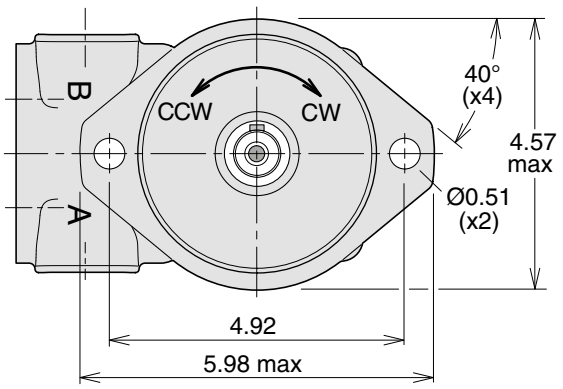
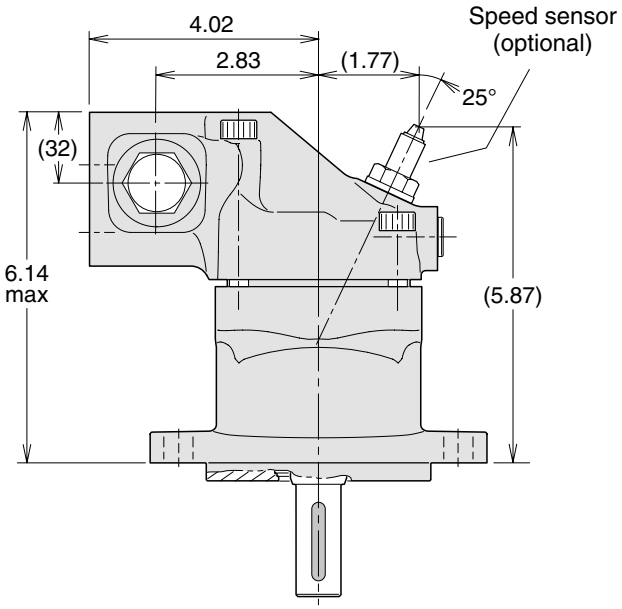
Trollhättan, Sweden

## F11-012
(CETOP versions)

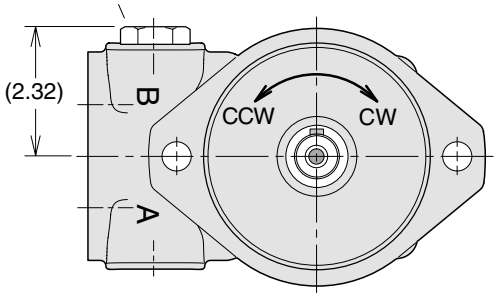


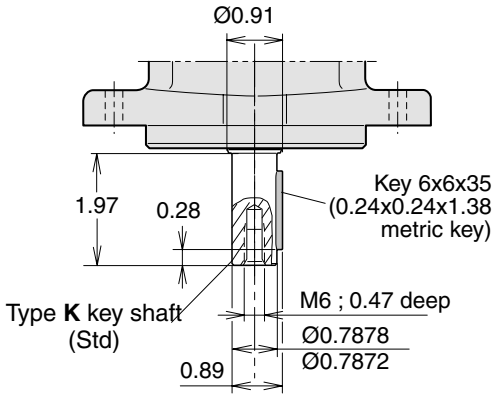
## F11-012
(CETOP versions)

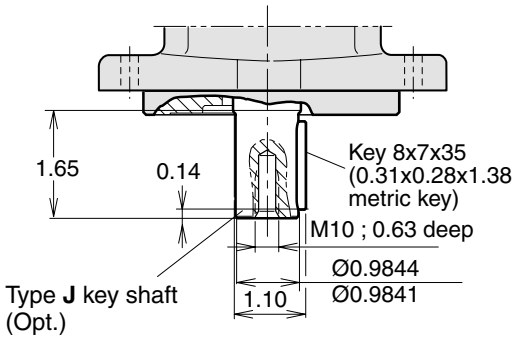


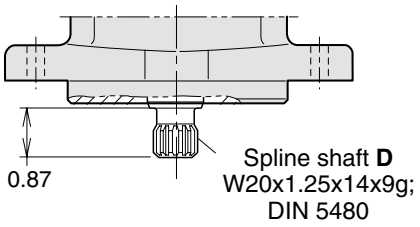

Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown)

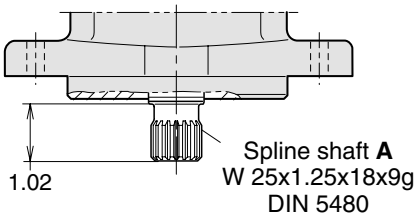


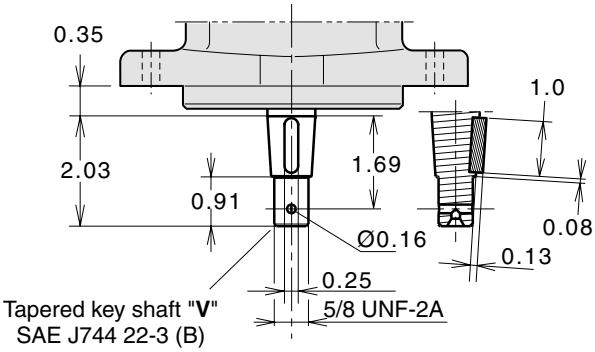

### Shaft options



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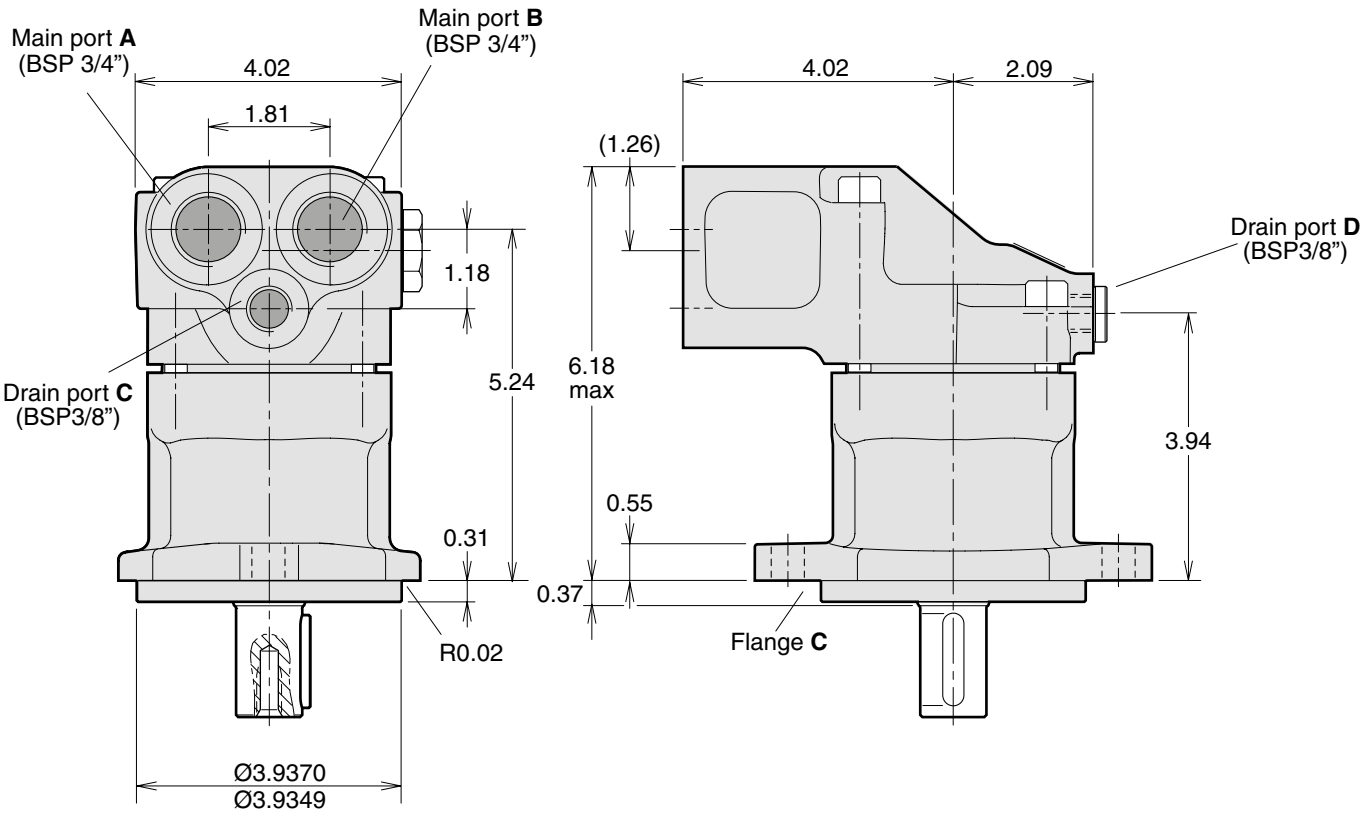
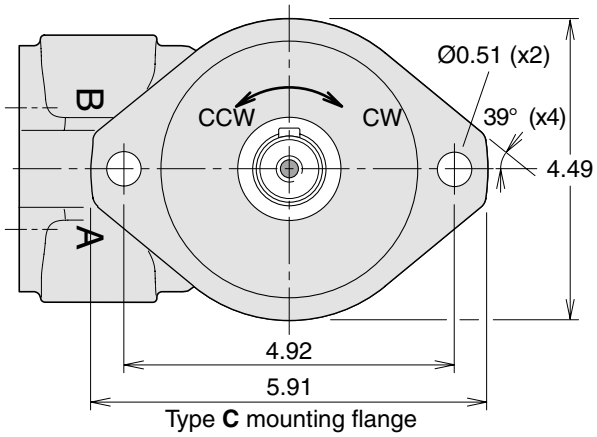
Trollhättan, Sweden

## F11-014
(CETOP versions)



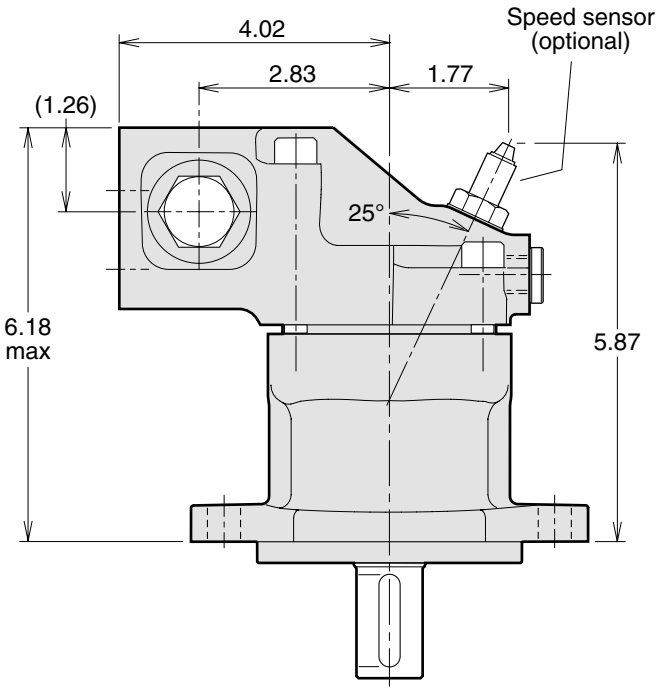



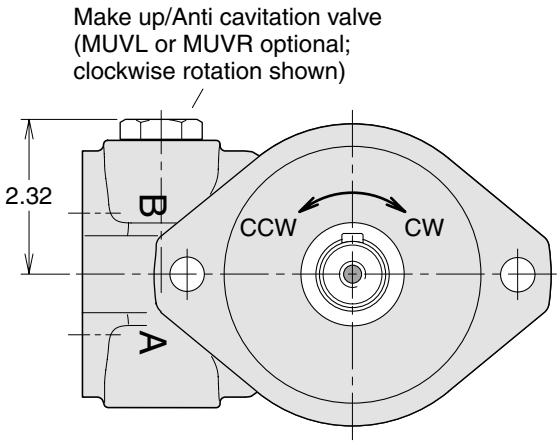

Type **C** mounting flange



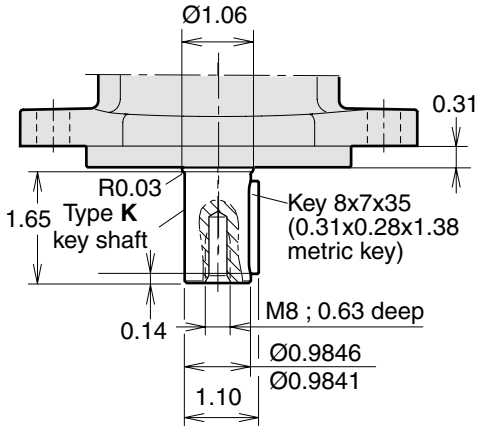
**Parker Hannifin**
Pump & Motor Division Europe
Trollhättan, Sweden

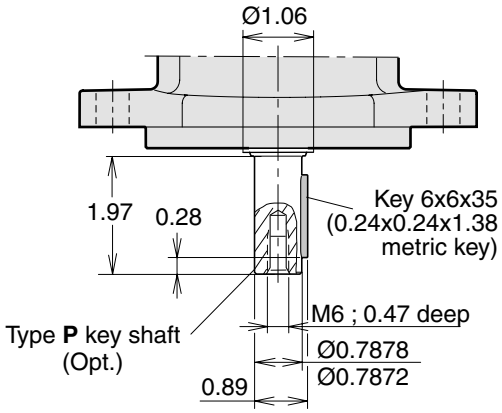
## F11-014
(CETOP versions)

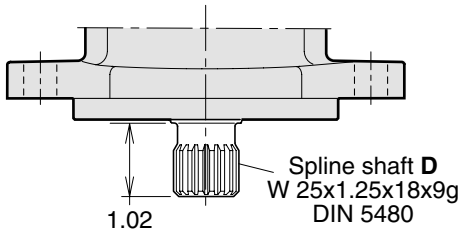


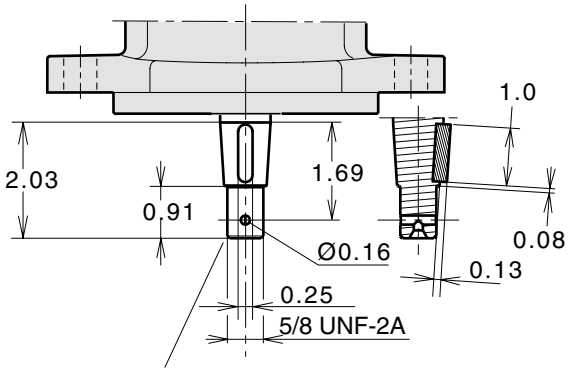




### Shaft options

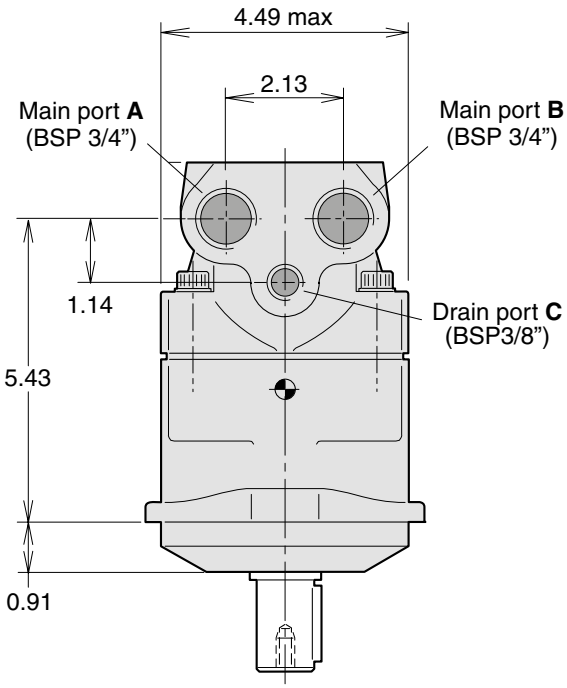


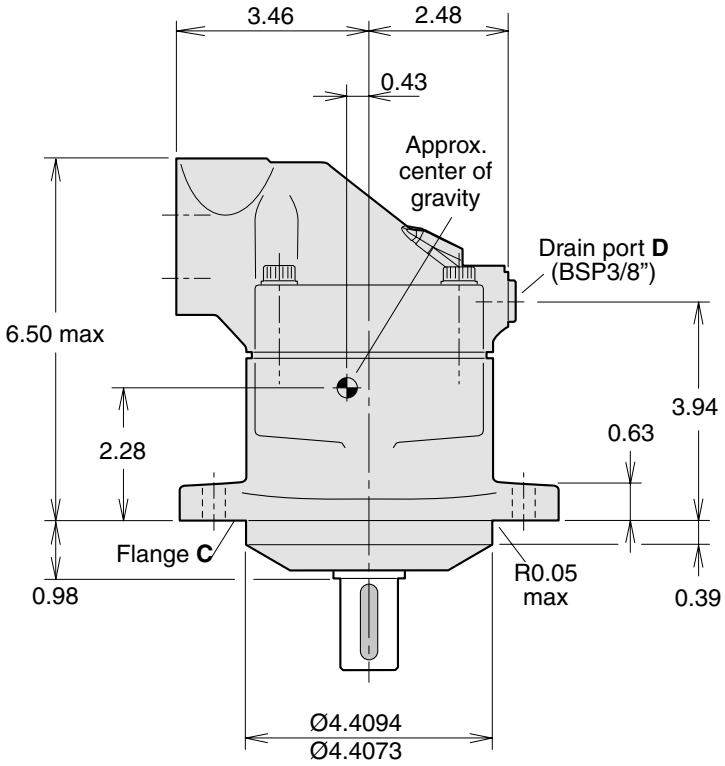



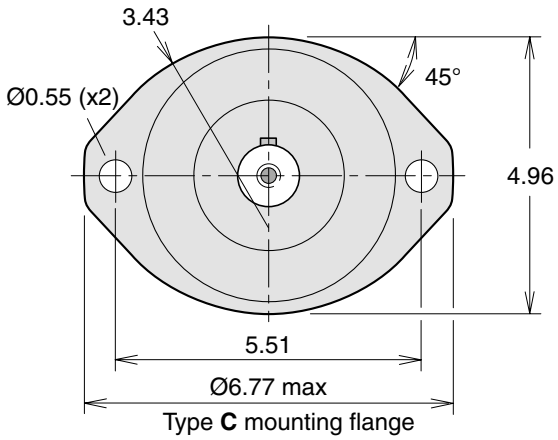



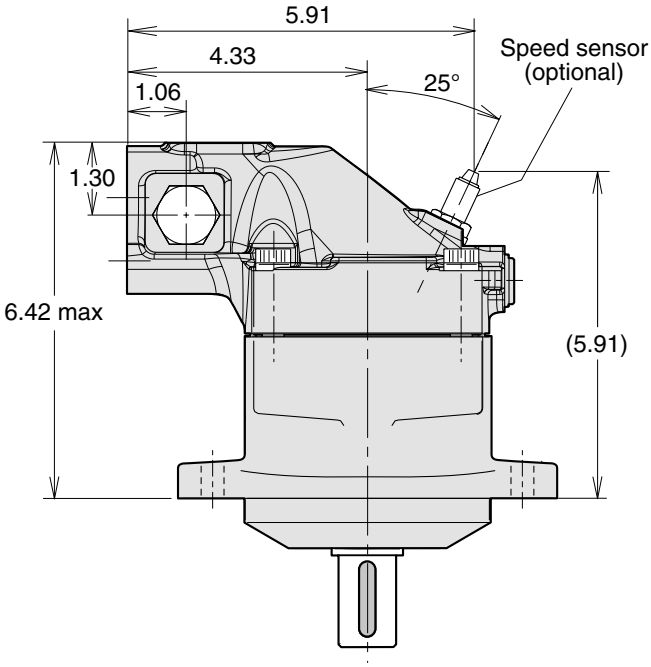
## F11-019
(CETOP version)



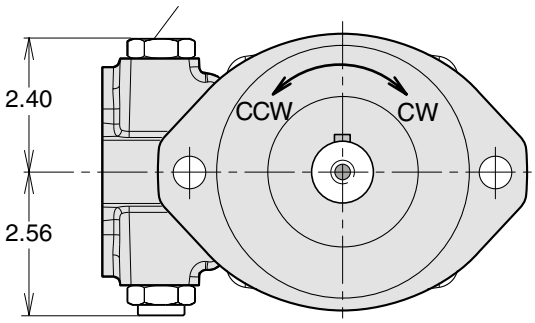



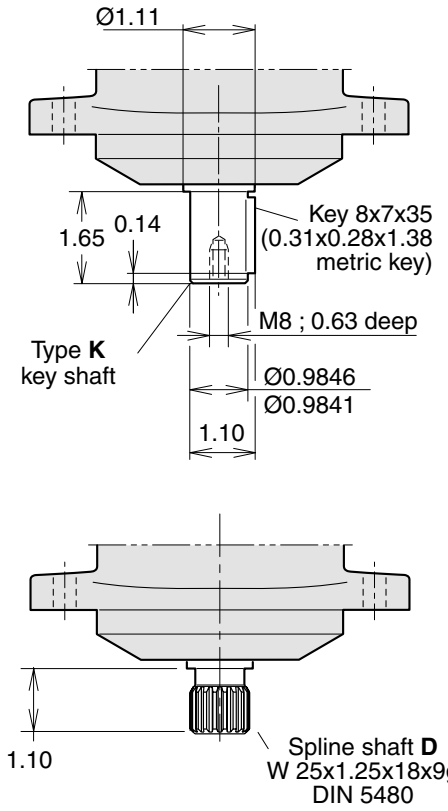
## F11-019
(CETOP version)



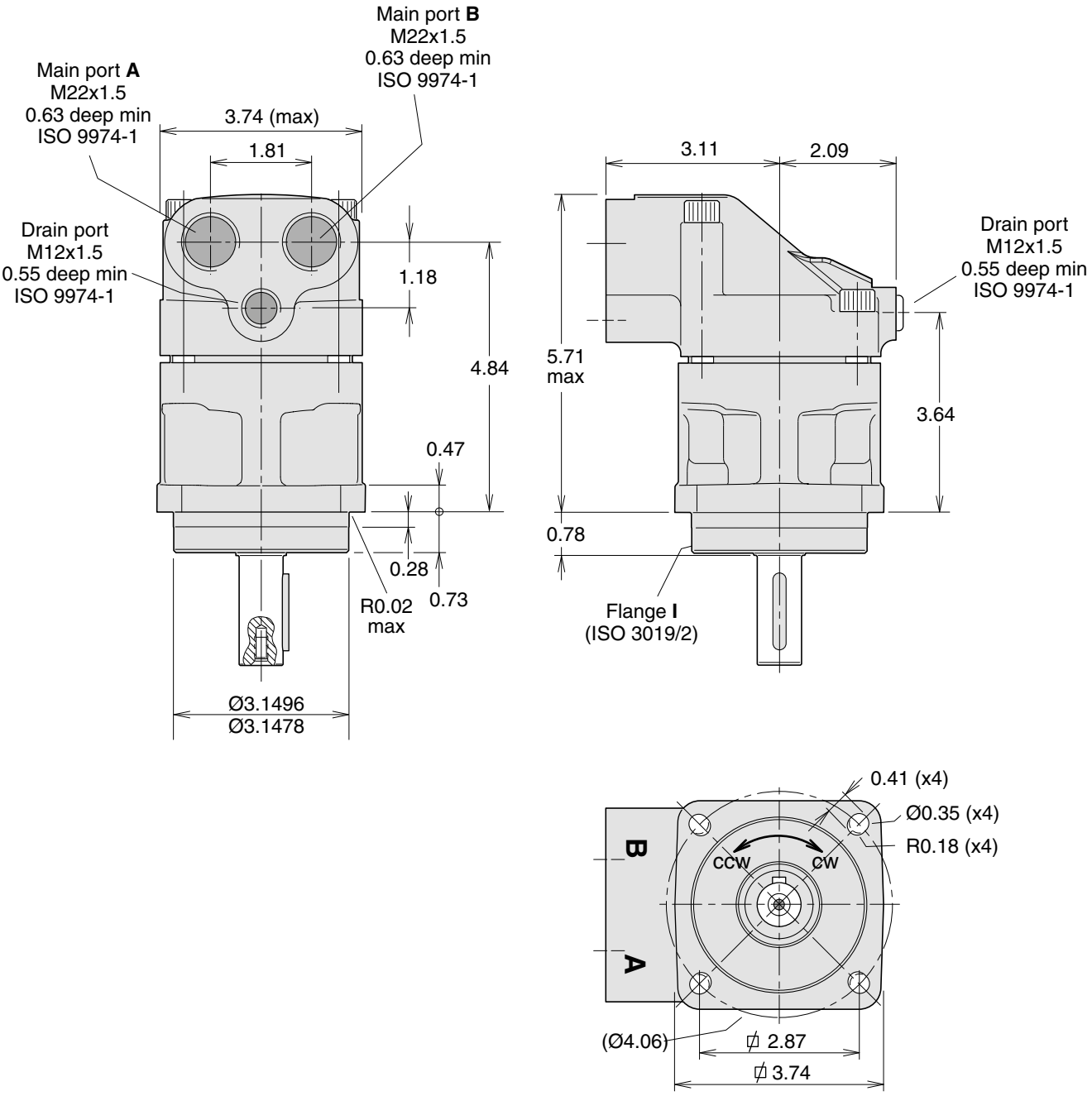

Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown)




**Shaft options**



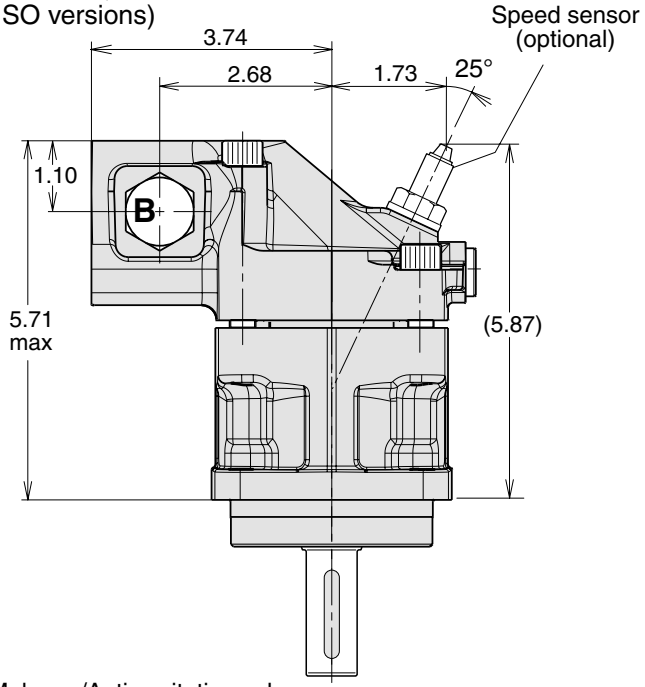
## F11-006, -010
(ISO versions)



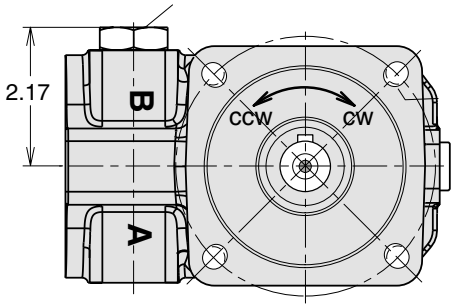



**Parker Hannifin**
Pump & Motor Division Europe
Trollhättan, Sweden

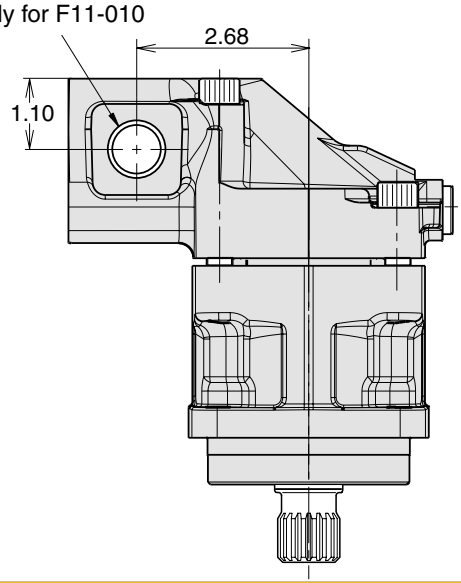
## F11-006, -010
(ISO versions)



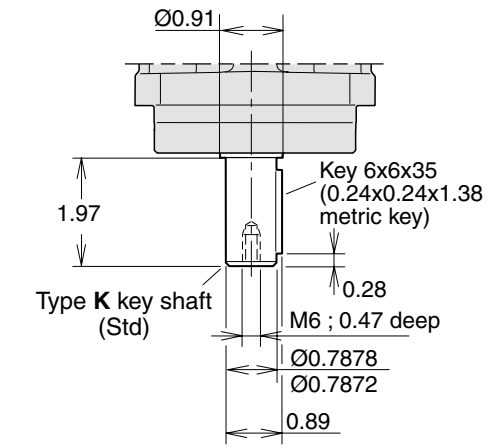

Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown)

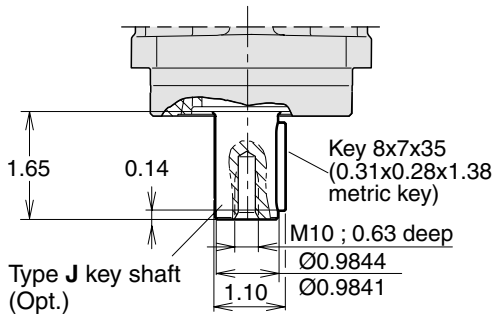


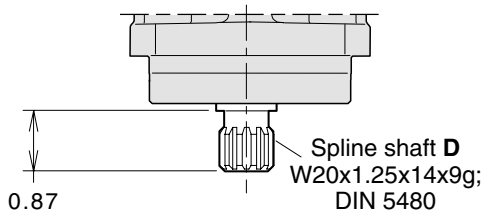

Side ports **M** (both sides)
M22x1.5
14 deep min
ISO 9974-1
Only for F11-010

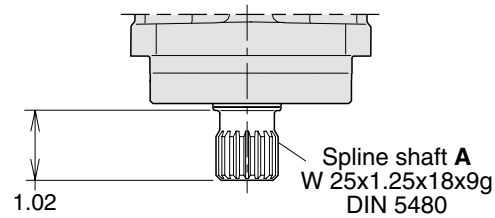


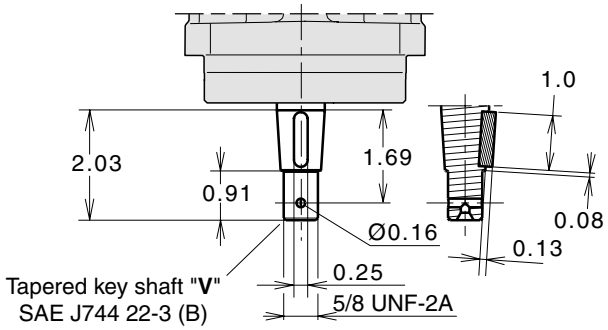

### Shaft options





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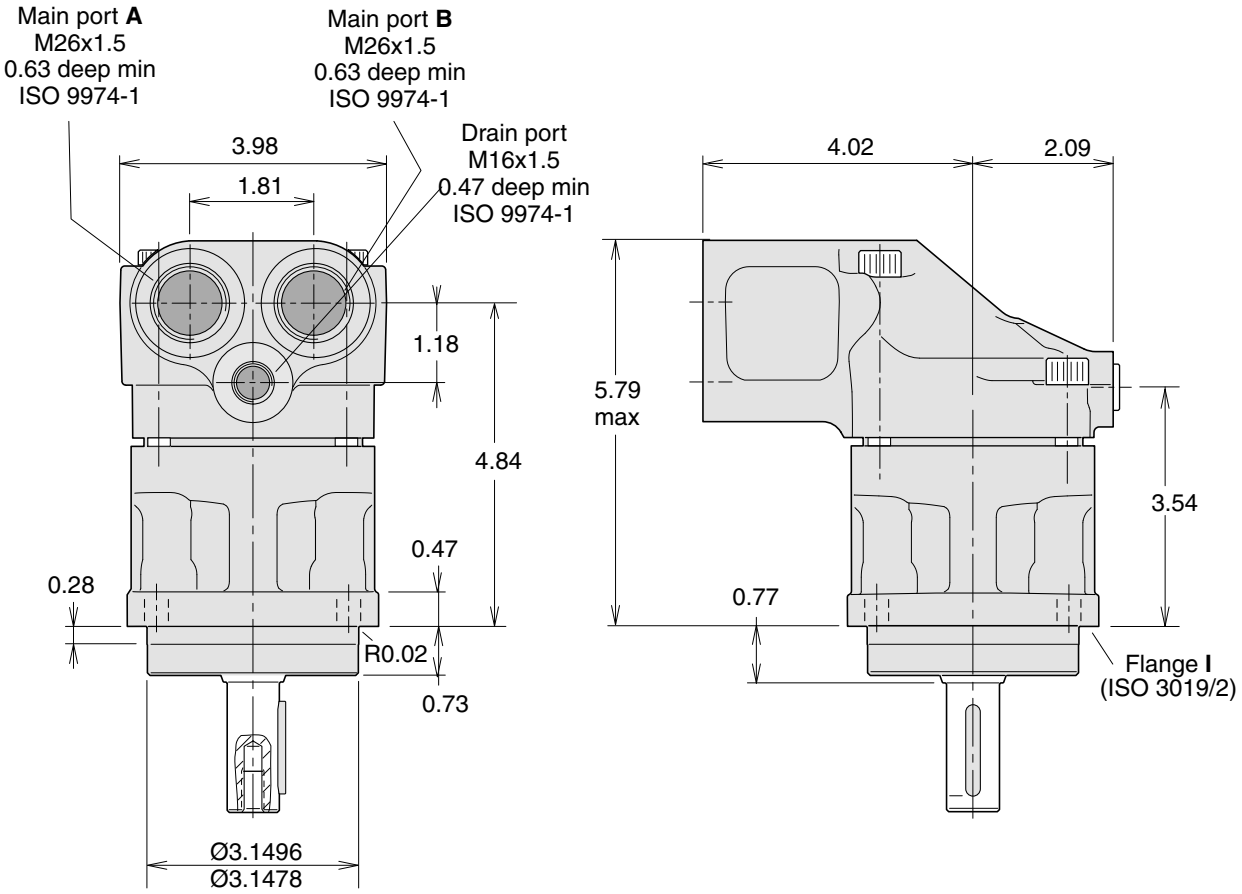
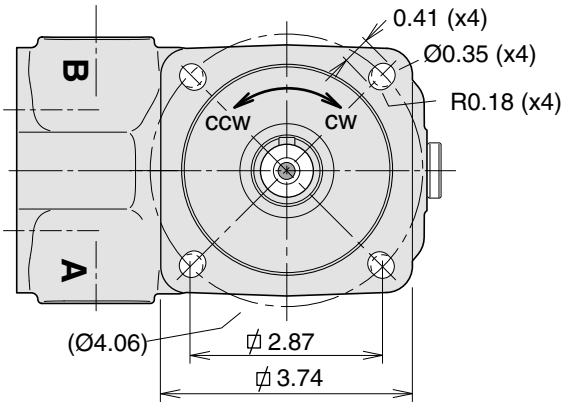
## F11-012
(ISO versions)

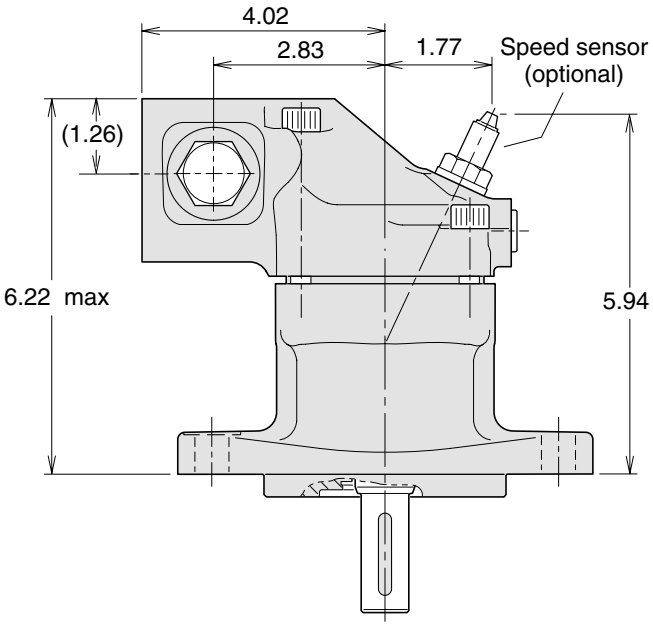


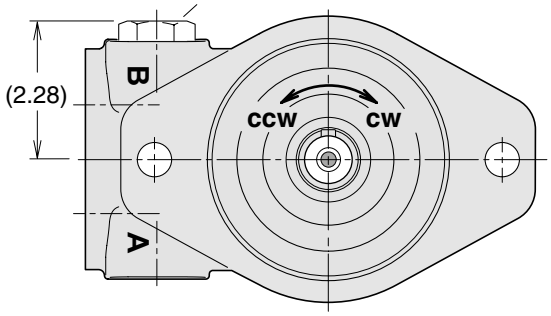



**Parker Hannifin**
Pump & Motor Division Europe
Trollhättan, Sweden

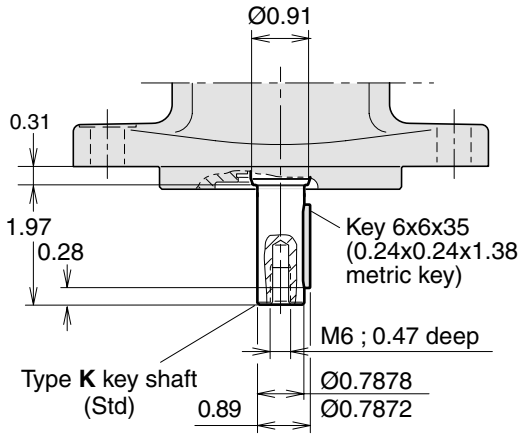
## F11-012
(SAE versions)

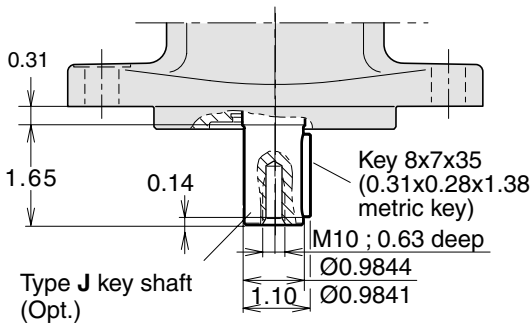


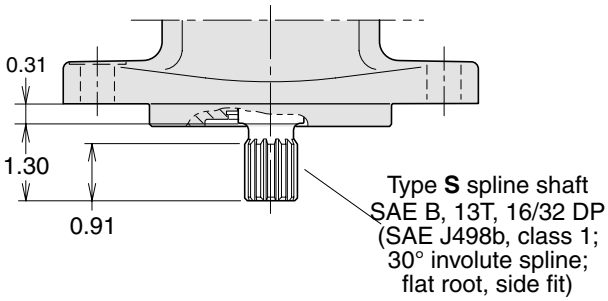

Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown)

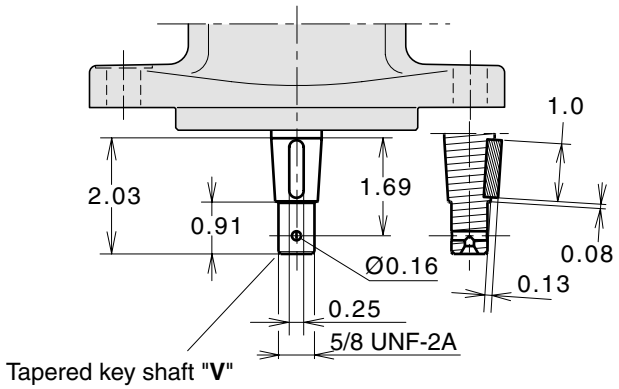



### Shaft options

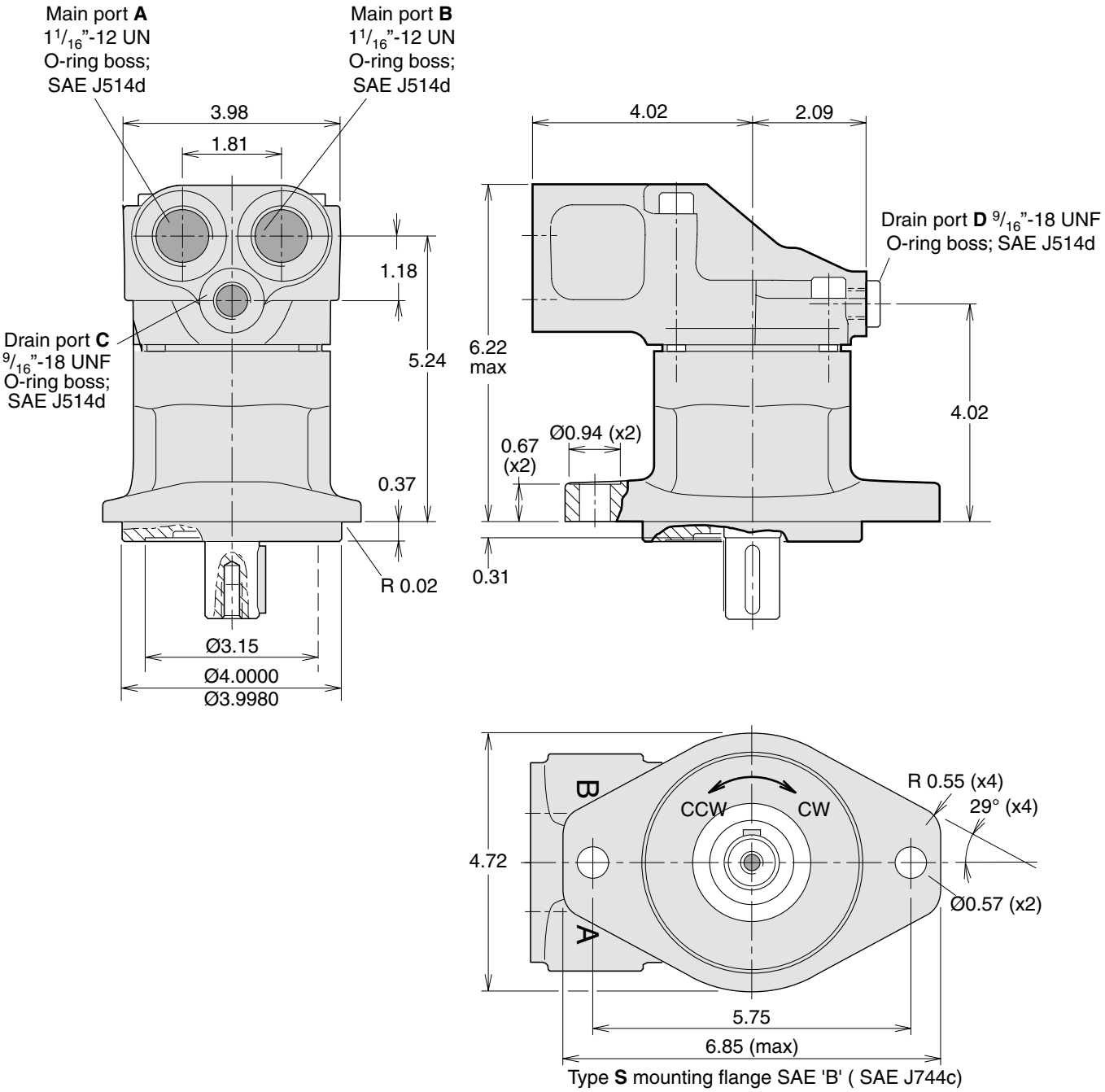


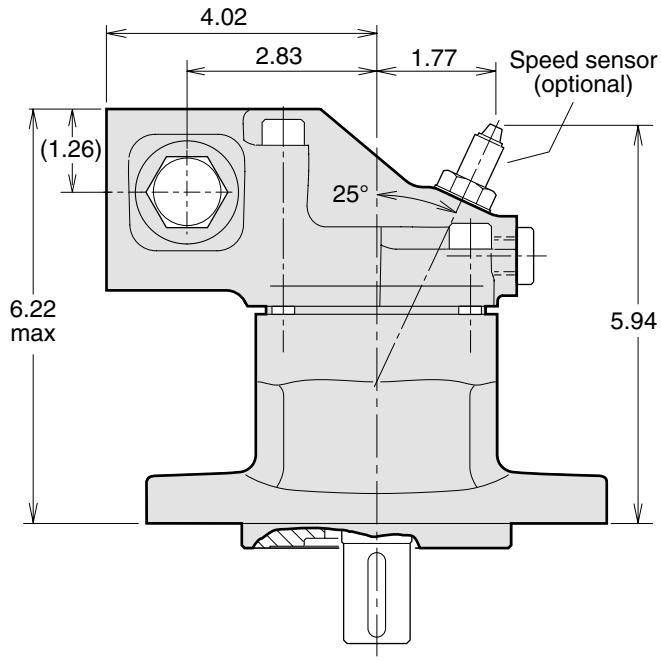



## F11-014
(SAE versions)

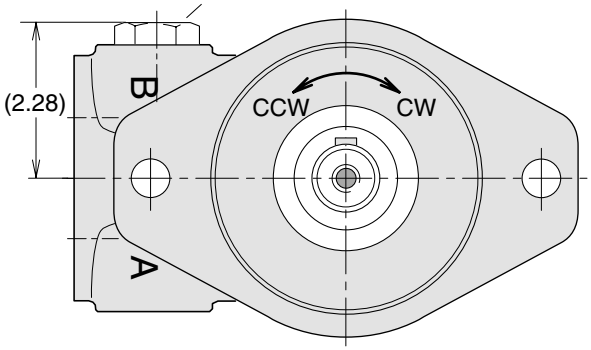



Type **S** mounting flange SAE 'B' ( SAE J744c)

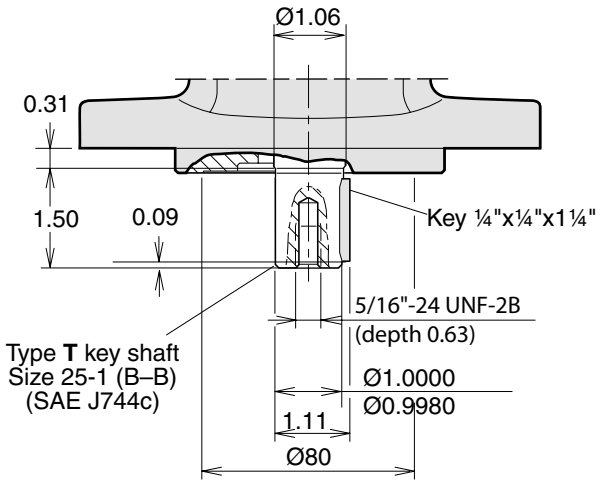
## F11-014
(SAE versions)

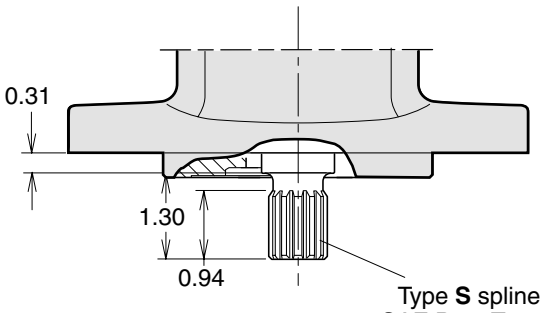



Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown)

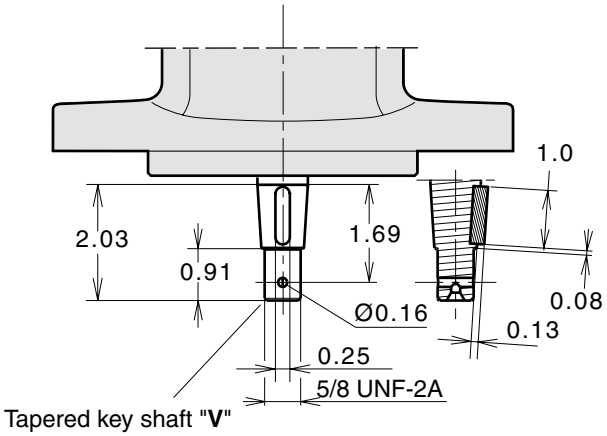



### Shaft options




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




Tapered key shaft "**V**"
SAE J744 22-3 (B)



**Parker Hannifin**
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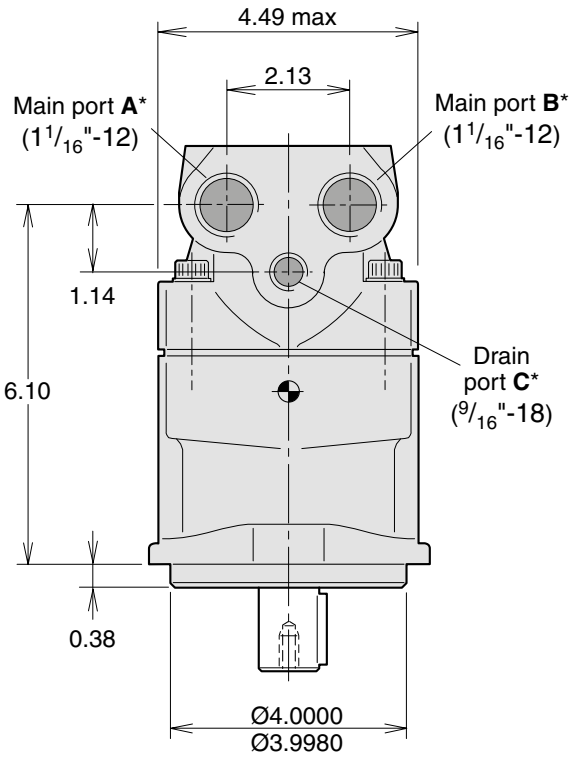
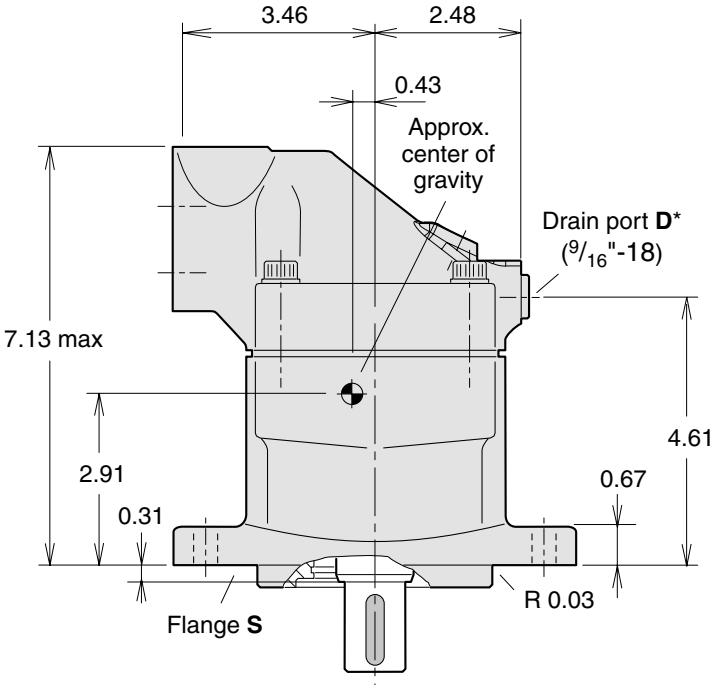
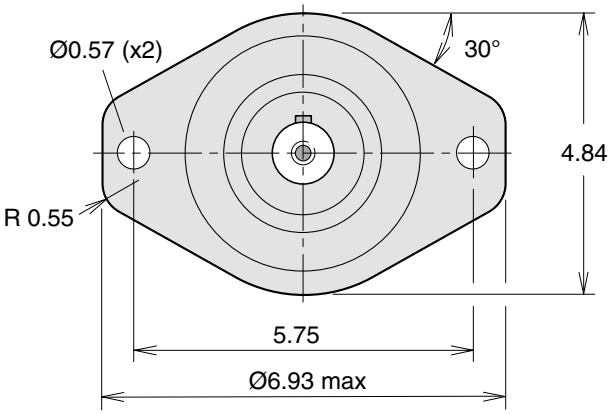
Trollhättan, Sweden

## F11-019
(SAE version)



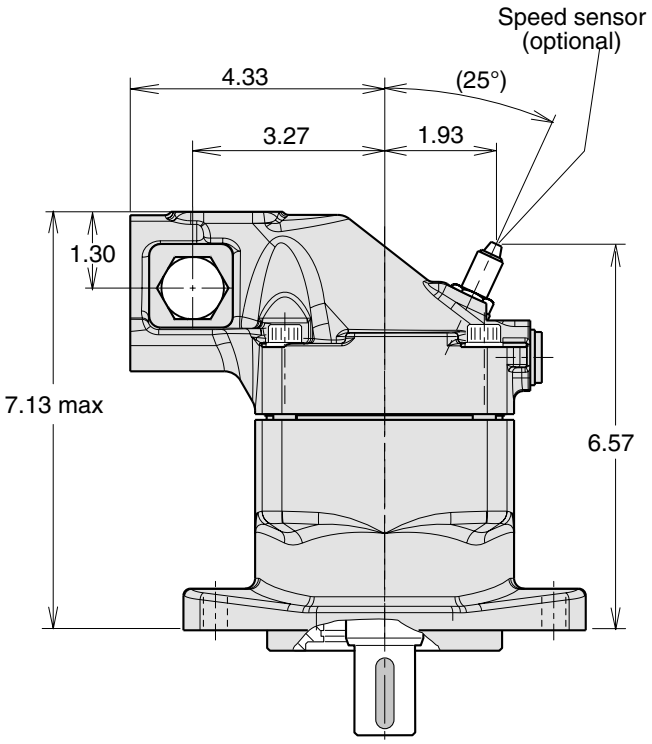



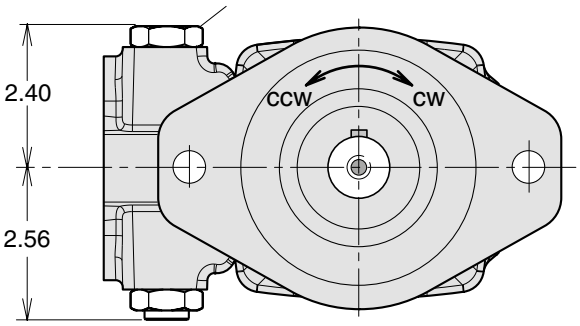

Type **S** mounting flange SAE 'B' (SAE J744c)

* O-ring ports according to SAE J514d

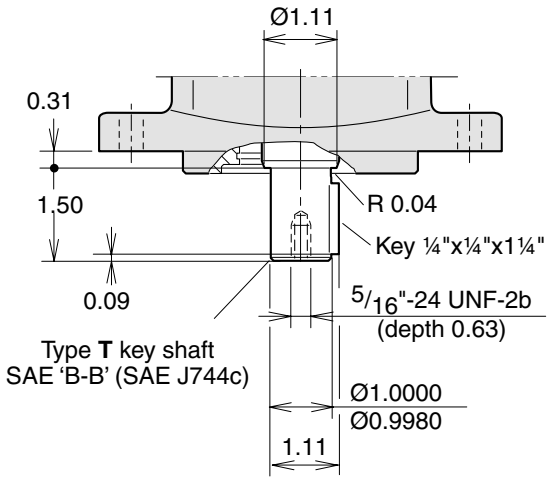
## F11-019
(SAE version)

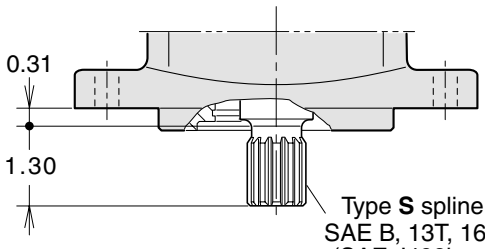



Make up/Anti cavitation valve
(MUVL or MUVR optional;
clockwise rotation shown)




**Shaft options**




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