Hydraulic Motor

Series F10
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 ($\eta_t = \eta_v \times \eta_{hm}$)

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

Content Page

Series F10

F10 is a bent-axis, fixed displacement motor. It can be used in numerous applications in both open and closed loop circuits.
The F10 series is available in sizes 5, 6, 10, 12, 14, 19, 30, 40, 60, 80, 90, 110 and 125 cc.

F10 Features

- Max intermittent pressure up to 300 bar and continuous operating pressure up to 280 bar
- Thanks to low weight pistons and a compact design of the rotating parts, the F10 tolerates high speeds, up to 7500 rpm
- ISO, SAE, and CETOP/Cartridge versions

General Features

- The laminated piston ring offers important advantages such as unbeatable efficiency and thermal shock resistance
- 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.
- Small envelop size
- The F10's have a simple and straight-forward design with very few moving parts, making them very reliable motors.
- Our unique timing gear design synchronizes shaft and cylinder barrel, making the F10 very tolerant to high 'G' forces and torsional vibrations.
- Heavy duty roller bearings permit substantial external axial and radial shaft loads.

Specifications

Frame Size	Displacement cc/rev	Max speed	Pressure		Weight
			Continuously	Intermittent [1]	kg
F10-5	4,9	7500	280	300	4,7
F10-6	6,0	7200	280	300	7,5
F10-10	9,8	7200	280	300	7,5
F10-12	12,5	7000	280	300	8,3
F10-14	14,3	7000	280	300	8,3
F10-19	19,0	6800	280	300	11
F10-30	30,0	4700	280	300	12
F10-40	40,0	4300	280	300	16,5
F10-60	59,8	3700	280	300	21
F10-80	80,4	3400	280	300	26
F10-90	93,0	3400	280	300	26
F10-110	110,1	3100	280	300	36
F10-125	125,0	3000	280	300	36

1) Intermittent: max 6 seconds in any one minute

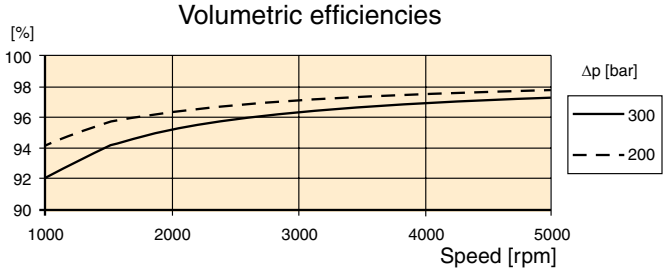
Efficiency

Because of its high overall efficiency, driving a motor from series F10 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.

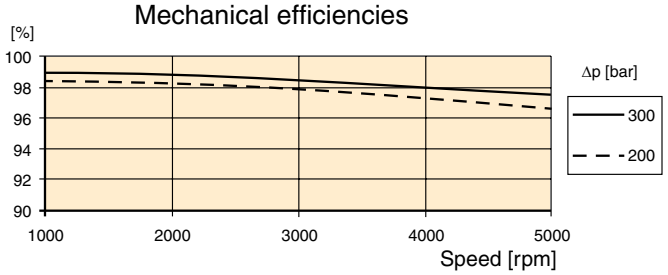
The diagrams to the right show volumetric and mechanical efficiencies of an F10-5 motor.

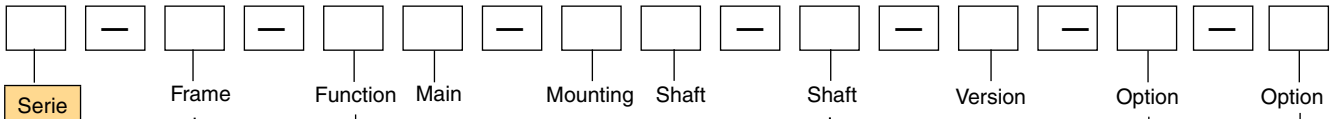
Contact Parker Hannifin for efficiency information on a particular F10 frame size that is being considered.

Volumetric efficiencies



Mechanical efficiencies





Frame size	
Code	Displacem. (cm^3/rev)
006	6.0
010	9.8
012	12.5
014	14.3
030	30.0
040	40.0
060	59.8
080	80.4
090	93.0
110	110,1
125	125,0

Version number
(assigned for special versions)

Frame size		6	10	12	14	30	40	60	80	90	110	125
Code	Option											
0000	Standard	x	x	x	x	x	x	x	x	x	x	x
MUVR	Option	x	x	x	x	x	-	-	-	-	-	-
MUVL	Option	x	x	x	x	x	-	-	-	-	-	-

Frame size		6	10	12	14	30	40	60	80	90	110	125
Code	Shaft											
K	Metric key	x	x	x	x	x	x	x	x	x	x	x
J	Metric key	x	x	x	-	-	x	-	-	-	-	-
P	Metric key	-	-	-	x	x	-	-	-	-	-	-
A	Metric Spline	x	x	x	-	-	-	-	-	-	-	-
D	Metric Spline	x	x	x	x	x	x	x	x	x	x	x
Z	Metric Spline	-	-	-	-	x	x	x	x	x	x	x
V	Tapered key	x	x	x	x	x	x	x	-	-	x	x

Frame size		6	10	12	14	30	40	60	80	90	110	125
Code	Function											
A	Motor	x	x	x	x	x	x	x	x	x	x	x
R	Pump cw	-	x	x	x	x	x	x	x	x	x	x
L	Pump ccw	-	x	x	x	x	x	x	x	x	x	x

Frame size		6	10	12	14	30	40	60	80	90	110	125
Code	Main ports											
F	Metric threads	x	x	x	x	-	-	-	-	-	-	-
	SAE flange 6000 psi	-	-	-	-	x	x	x	x	x	x	x

Frame size		6	10	12	14	30	40	60	80	90	110	125
Code	Shaft seal											
V	FPM, high pressure, high temperature	x	x	x	x	x	x	x	x	x	x	x

Frame size		6	10	12	14	30	40	60	80	90	110	125
Code	Flange											
I	ISO	x	x	x	x	x	x	x	x	x	x	x

Frame size		6	10	12	14	30	40	60	80	90	110	125
Code	Option											
P0	Standard	x	x	x	x	x	x	x	x	x	x	x

x: Available – : Not available

For other versions, contact Parker Hannifin

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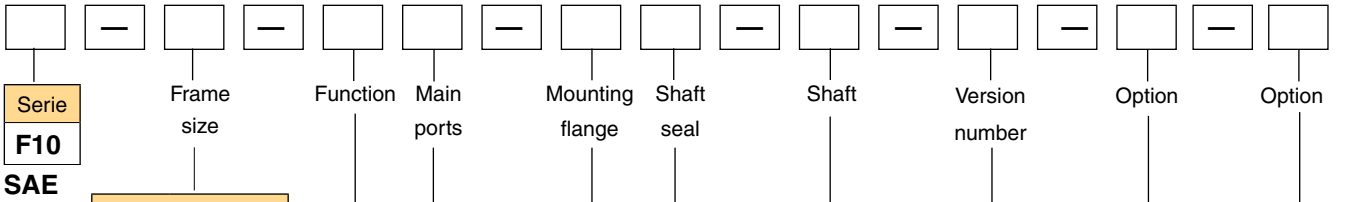
Trollhättan, Sweden



Frame size	Displacem. (cm^3/rev)
006	6.0
010	9.8
012	12.5
014	14.3
019	19.0
030	30.0
040	40.0
060	59.8
080	80.4
090	93.0
110	110,1
125	125,0

Version number
(assigned for special versions)

Frame size		6	10	12	14	19	30	40	60	80	90	110	125
Code	Option												
0000	Standard	x	x	x	x	x	x	x	x	x	x	x	x
MUVR	Option	x	x	x	x	x	x	-	-	-	-	-	-
MUVL	Option	x	x	x	x	x	x	-	-	-	-	-	-

Frame size		6	10	12	14	19	30	40	60	80	90	110	125
Code	Function												
A	Motor	x	x	x	x	x	x	x	x	x	x	x	x
R	Pump cw	-	x	x	x	x	x	x	x	x	x	x	x
L	Pump ccw	-	x	x	x	x	x	x	x	x	x	x	x

Frame size		6	10	12	14	19	30	40	60	80	90	110	125
Code	Shaft												
K	Metric key	x	x	x	x	x	x	x	x	x	x	x	x
T	SAE key	x	x	x	x	x	x	x	x	x	x	x	x
R	SAE key	-	-	-	-	-	-	-	-	x	x	-	-
S	SAE Spline	x	x	x	x	x	x	x	x	x	x	x	x
U	SAE Spline	-	-	-	-	-	-	-	-	x	x	-	-
V	Tapered Shaft	x	x	x	x	-	x	x	x	-	-	x	x

Frame size		6	10	12	14	19	30	40	60	80	90	110	125
Code	Main ports												
U	UN threads	x	x	x	x	x	-	-	-	-	-	-	-
S	SAE flange 6000 psi	-	-	-	-	-	x	x	x	x	x	x	x

Frame size		6	10	12	14	19	30	40	60	80	90	110	125
Code	Shaft seal												
V	FPM, high pressure, high temperature	x	x	x	x	x	x	x	x	x	x	x	x

Frame size		6	10	12	14	19	30	40	60	80	90	110	125
Code	Mounting flange												
S	SAE flange 2 bolt	x	x	x	x	x	x	x	x	-	-	-	-
	SAE flange 4 bolt	-	-	-	-	-	x	x	x	x	x	x	x

Frame size		6	10	12	14	19	30	40	60	80	90	110	125
Code	Option												
P0	Standard	x	x	x	x	x	x	x	x	x	x	x	x

x: Available – : Not available

For other versions, contact Parker Hannifin

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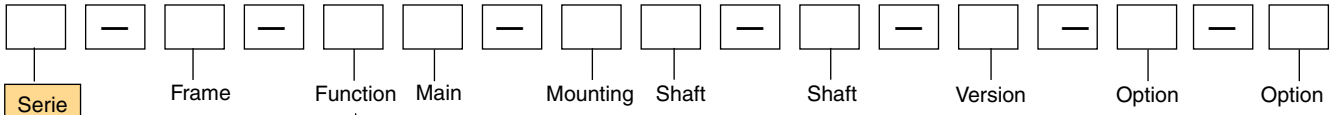
Trollhättan, Sweden



CETOP/ Cartridge

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
030	30.0
040	40.0
060	59.8
080	80.4
090	93.0
110	110,1
125	125,0

Version number
(assigned for special versions)

Frame size		5	6	10	12	14	19	30	40	60	80	90	110	125
Code	Option													
0000	Standard	x	x	x	x	x	x	x	x	x	x	x	x	x
MUVR	Option	-	x	x	x	x	x	x	-	-	-	-	-	-
MUVL	Option	-	x	x	x	x	x	x	-	-	-	-	-	-

Frame size		5	6	10	12	14	19	30	40	60	80	90	110	125
Code	Function													
A	Motor	x	x	x	x	x	x	x	x	x	x	x	x	x
R	Pump cw	x	-	x	x	x	x	x	x	x	x	x	x	x
L	Pump ccw	x	-	x	x	x	x	x	x	x	x	x	x	x

Frame size		5	6	10	12	14	19	30	40	60	80	90	110	125
Code	Shaft													
K	Metric key	x	x	x	x	x	x	-	-	-	-	-	x	x
C	DIN spline	-	-	-	-	-	-	x	x	x	x	x	x	x
V	Tapered	-	x	x	x	x	-	x	x	x	-	-	x	x

Frame size		5	6	10	12	14	19	30	40	60	80	90	110	125
Code	Main ports													
B	BSP threads	x	x	x	x	x	x	-	-	-	-	-	-	-
F	SAE flange 6000 psi	-	-	-	-	-	-	x	x	x	x	x	x	x

Frame size		5	6	10	12	14	19	30	40	60	80	90	110	125
Code	Shaft seal													
V	FPM, high pressure, high temperature	x	x	x	x	x	x	x	x	x	x	x	x	x

Frame size		5	6	10	12	14	19	30	40	60	80	90	110	125
Code	Mounting flange													
C	CETOP	x	x	x	x	x	x	-	-	-	-	-	-	-
	Cartridge	-	-	-	-	-	-	x	x	x	x	x	x	x

Frame size		5	6	10	12	14	19	30	40	60	80	90	110	125
Code	Option													
P0	Standard	-	x	x	x	x	x	x	x	x	x	x	x	x

x: Available – : Not available

For other versions, contact Parker Hannifin

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

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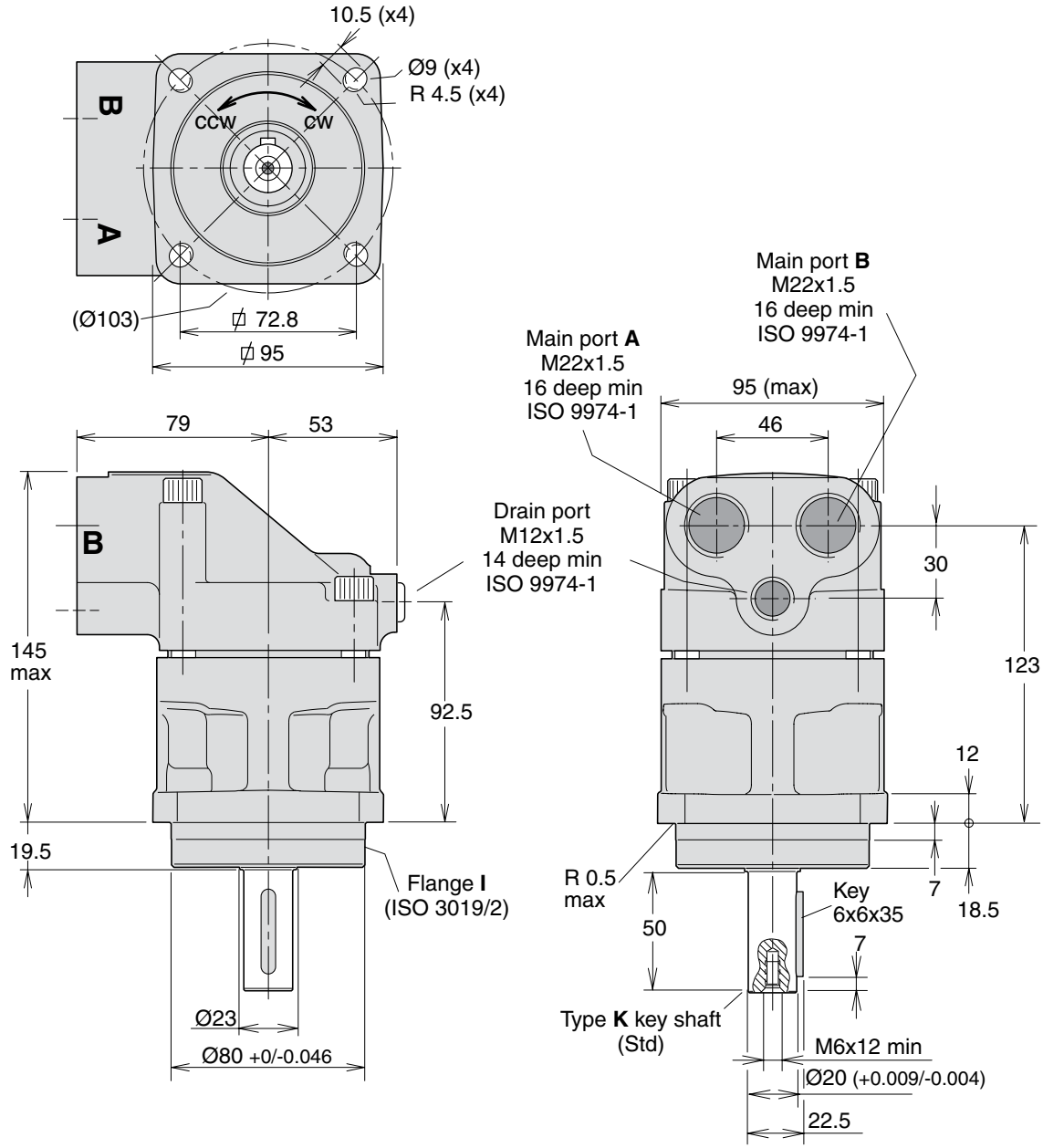
Pump & Motor Division Europe
Trollhättan, Sweden

F10-006, -010
(ISO versions)



Other drawings on request

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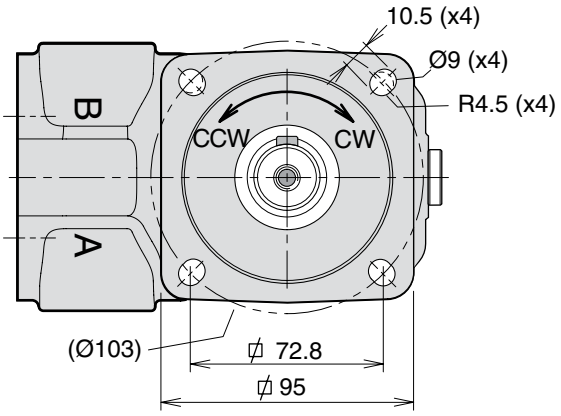
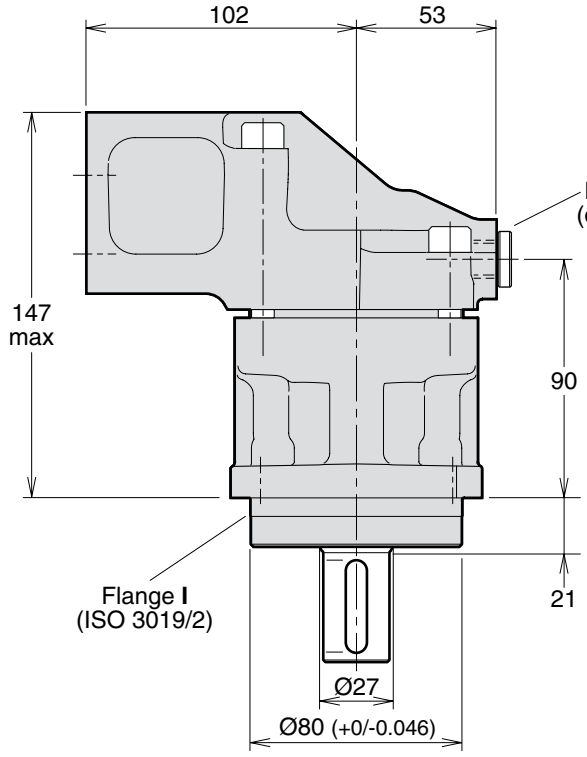
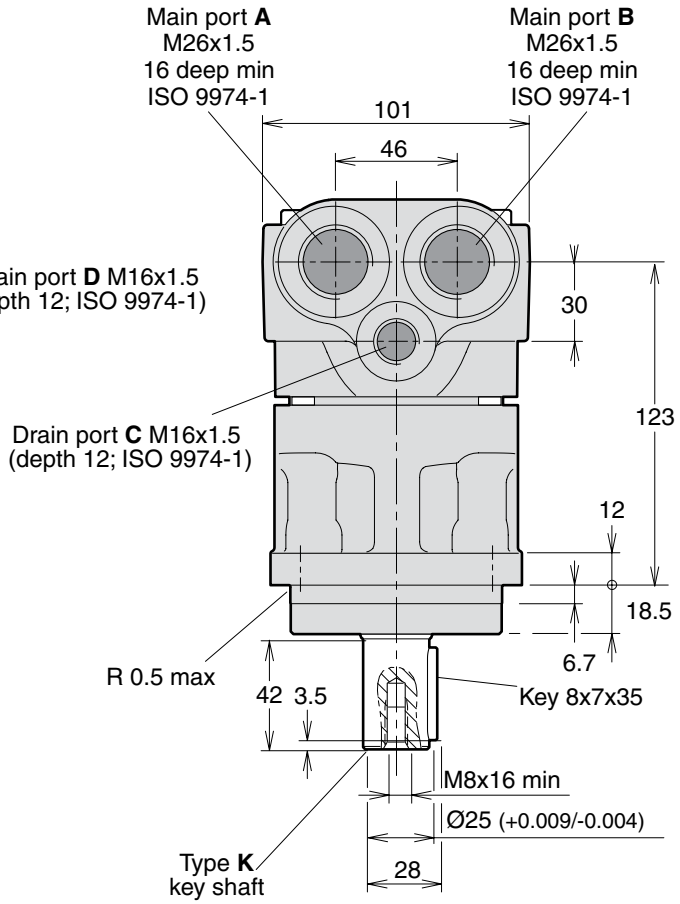
F10-012, -014
(ISO versions)



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





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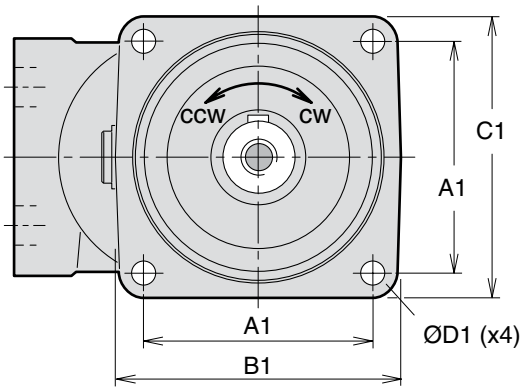
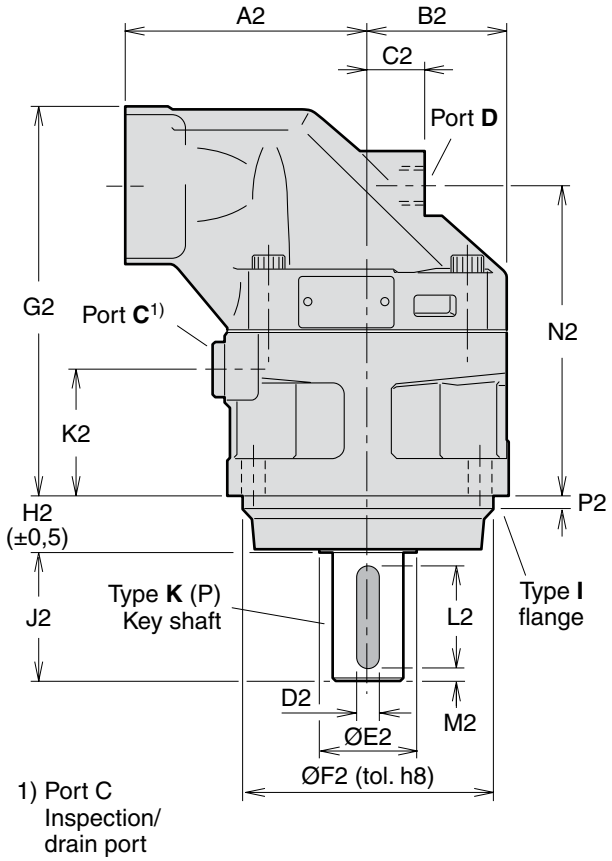
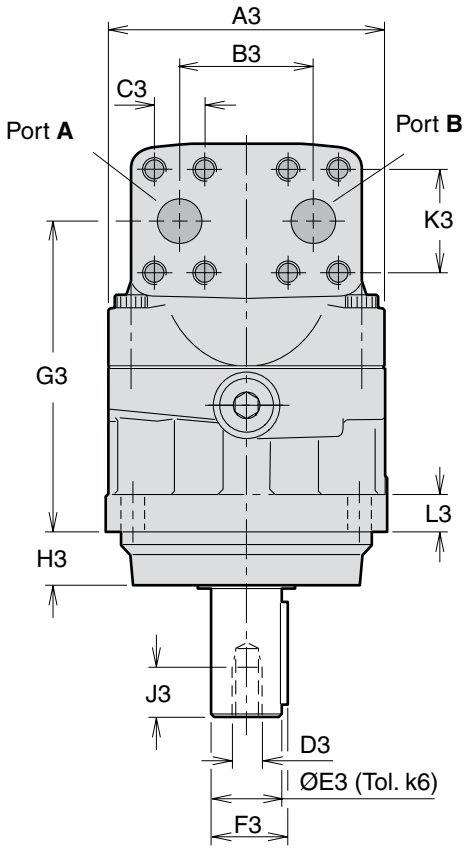
F10-30, -40, -60, -80, -90, -110 and -125
(ISO versions)



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



1) Port C
Inspection/
drain port



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Trollhättan, Sweden

Dim.	F10-30	F10-40	F10-60	F10-80 F10-90	F10-110 F10-125
A1	88.4	113.2	113.2	127.2	141.4
B1	118	146	146	158	180
C1	118	142	144	155	180
D1	11	13.5	13.5	13.5	18
A2	100	110	125	135	145
B2	59	65	70	78	85
C2	25	26	22	32	38
D2	8	8	10	12	14
E2	33	42	42	52	58
F2	100	125	125	140	160
G2	172	173	190	216	231
H2	25.5	32.5	32.5	32.5	40.5
J2	50	60	60	70	82
K2	55	52	54	70.5	66.5
L2	40	50	50	56	70
M2	5	5	5	7	6
N2	136.5	137	154	172.5	179
P2	8	8	8	8	8
A3	122	134	144	155	170
B3	66	66	66	75	83
C3	23.8	23.8	23.8	27.8	31.8
D3	M12	M12	M12	M16	M16
E3	30	30	35	40	45
F3	33	33	38	43	49
G3	136.5	137	154	172.5	179
H3	23.5	30.5	30.5	30.5	38.5
J3	24	24	28	36	36
K3	50.8	50.8	50.8	57.2	66.7
L3	18	20	20	20	22
T3	-	-	-	-	68

Ports	F10-30	F10-40	F10-60	F10-80 F10-90	F10-110 F10-125
A, B size	$^3/_4$"	$^3/_4$"	$^3/_4$"	1"	$1^1/_4$"
Screw thread*)	M10 x20	M10 x20	M10 x20	M12 x20	M14 x26
C thread**)	M22 x1.5	M22 x1.5	M22 x1.5	M22 x1.5	M22 x1.5
D thread**)	M18 x1.5	M18 x1.5	M22 x1.5	M22 x1.5	M22 x1.5
E thread	-	-	-	-	M22 x1.5

A, B: ISO 6162

*) Metric thread x depth in mm
**) Metric thread x pitch in mm.

Key shaft

	Type **K** (std)
F10-30	Ø30
-40	Ø30
-60	Ø35
-80	Ø40
-90	Ø40
-110	Ø45
-125	Ø45

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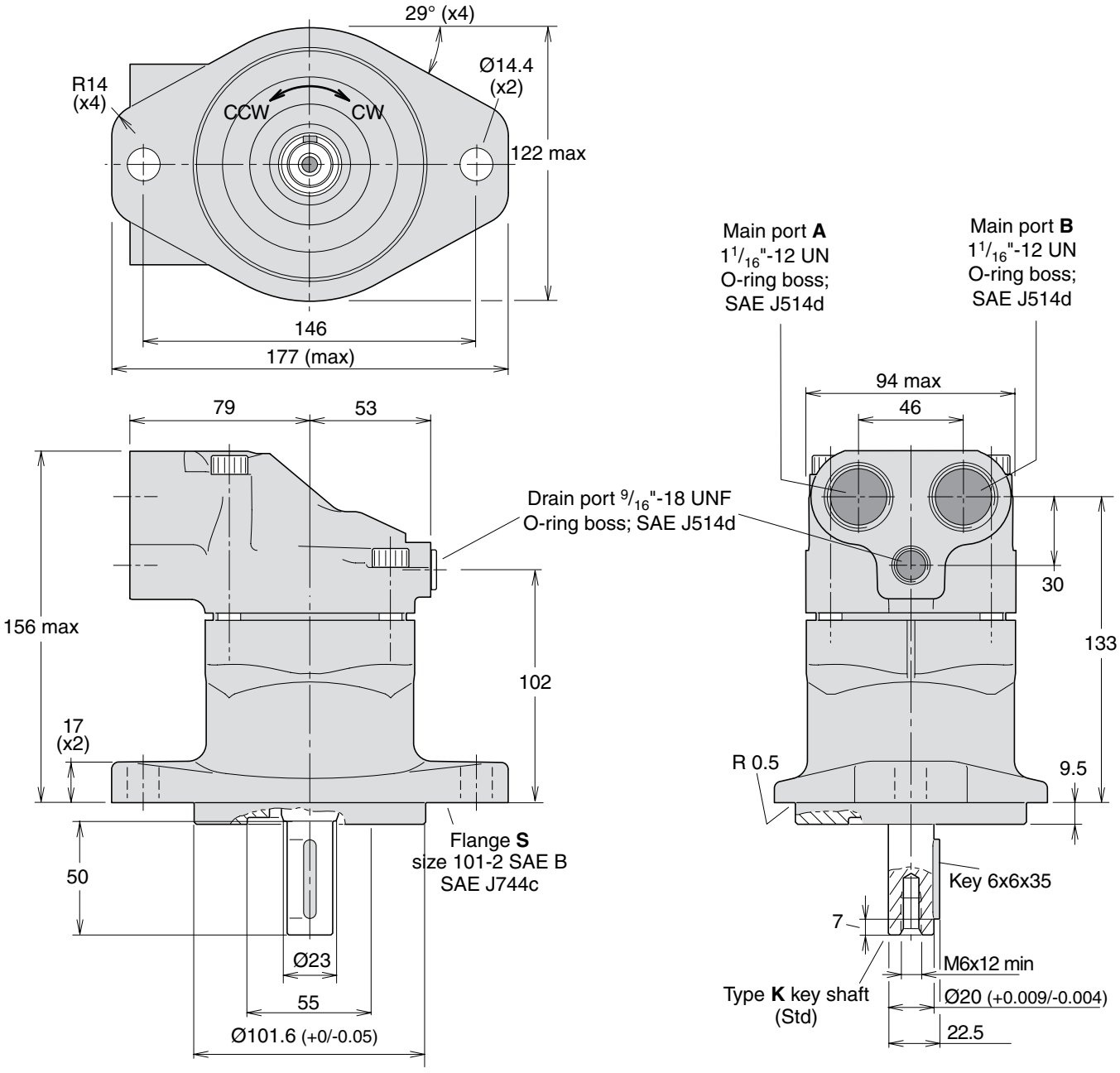
F10-006, -010
(SAE versions)



Other drawings on request

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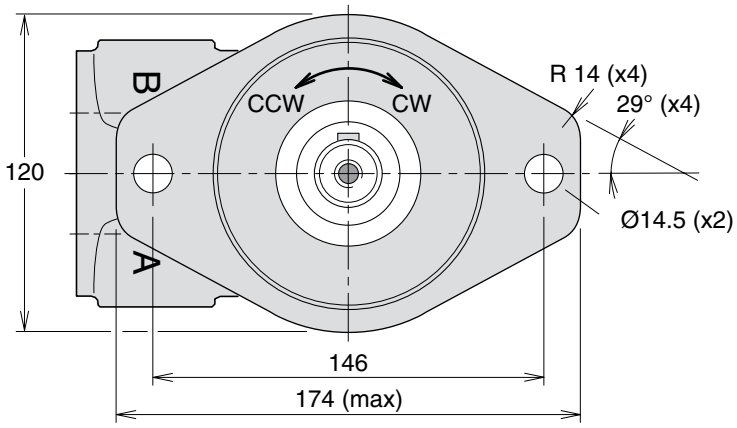
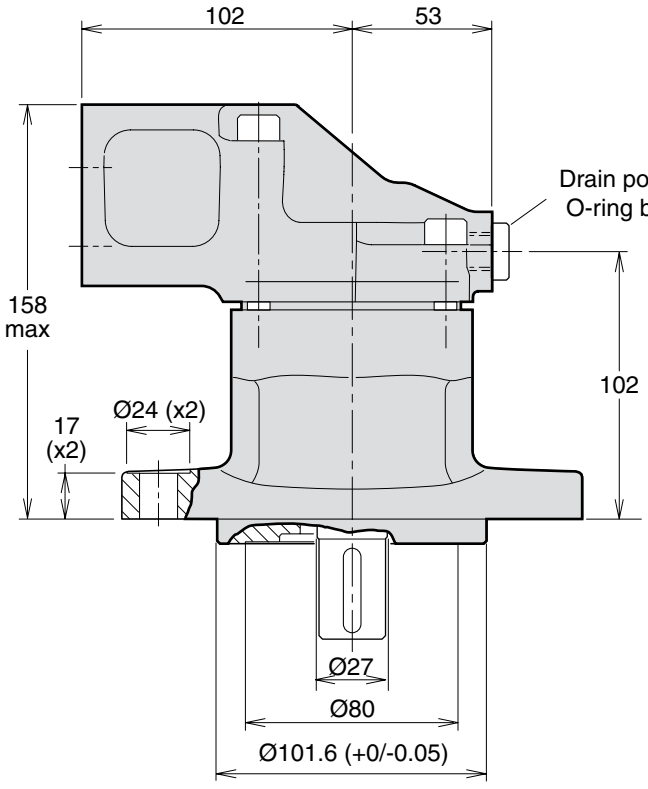
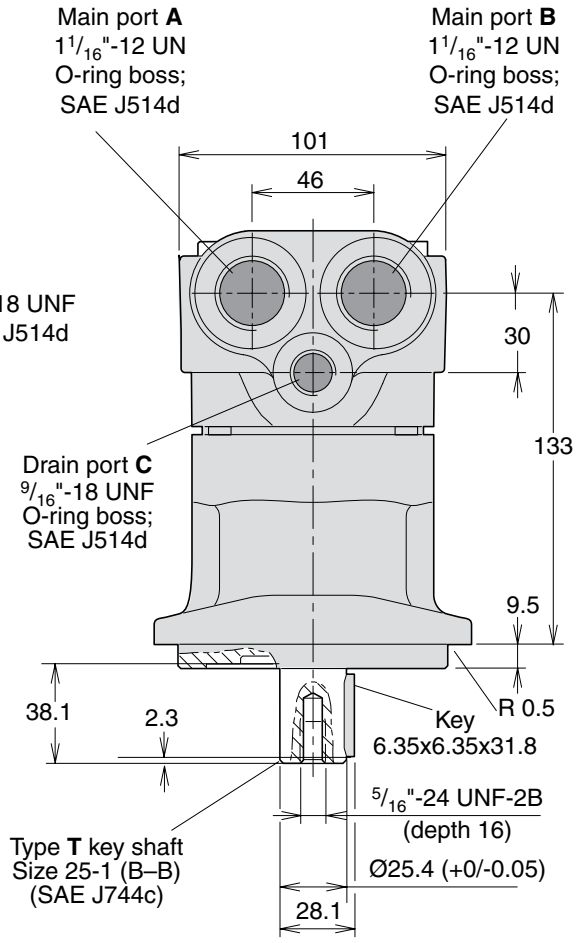
Trollhättan, Sweden

F10-012, -014
(SAE versions)



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





Other drawings on request

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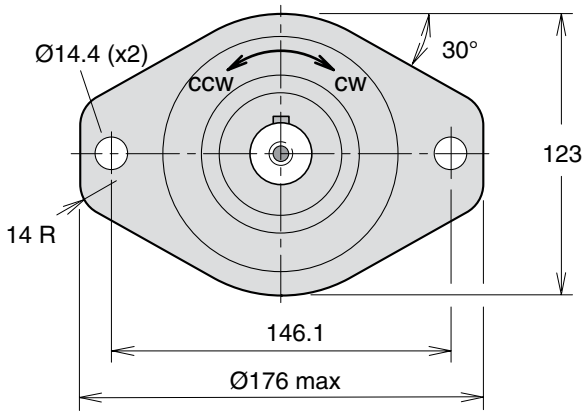
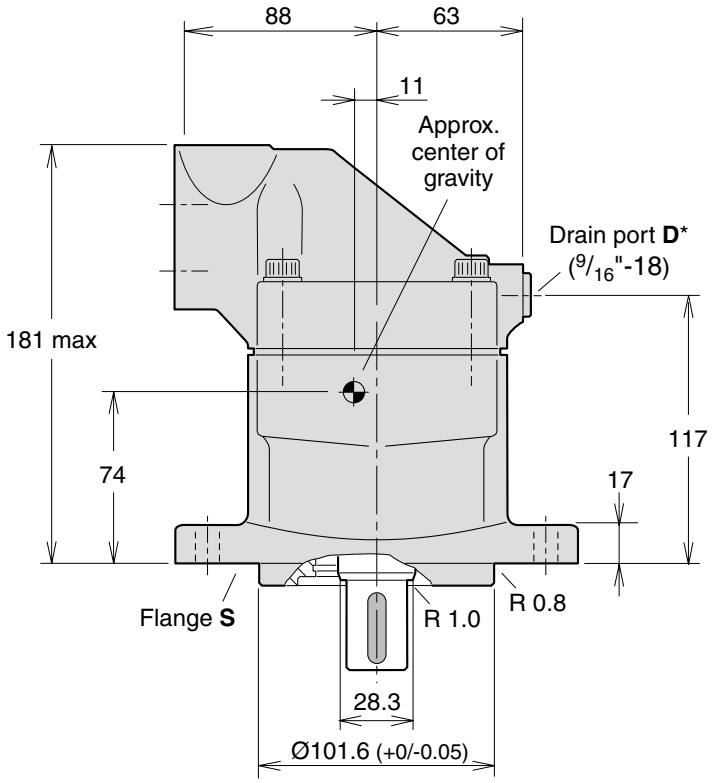
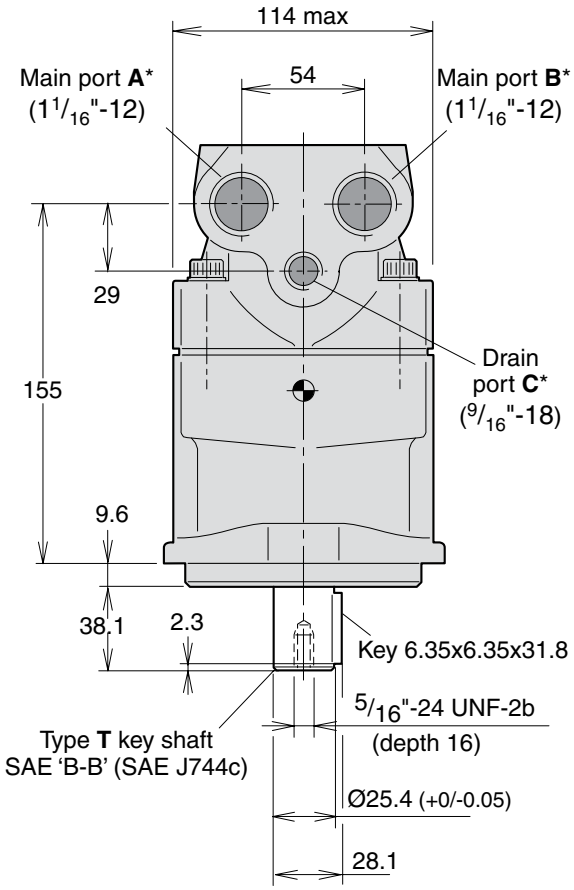
F10-019
(SAE version)



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





Other drawings on request

* O-ring ports according to SAE J514d

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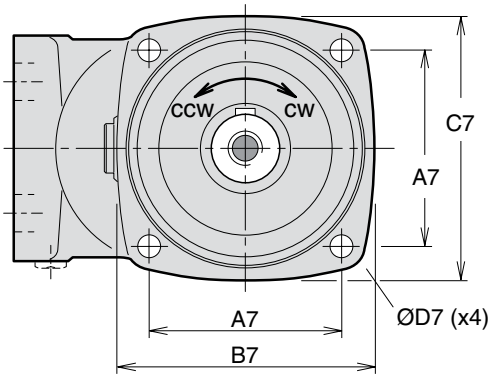
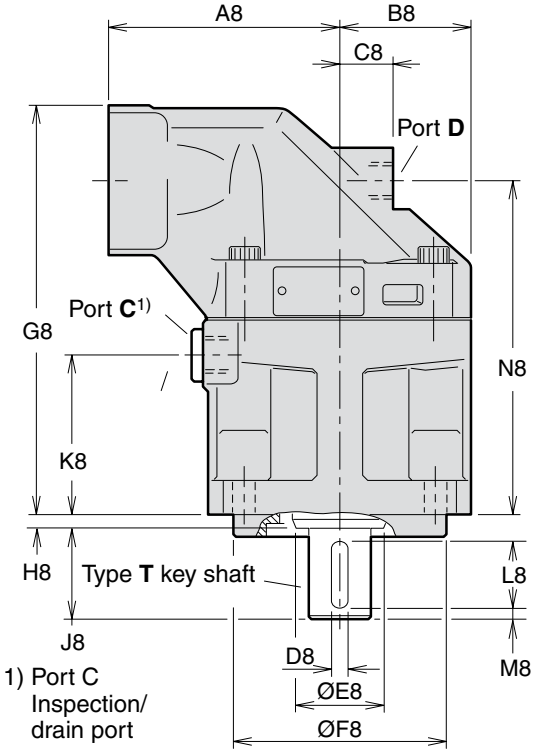
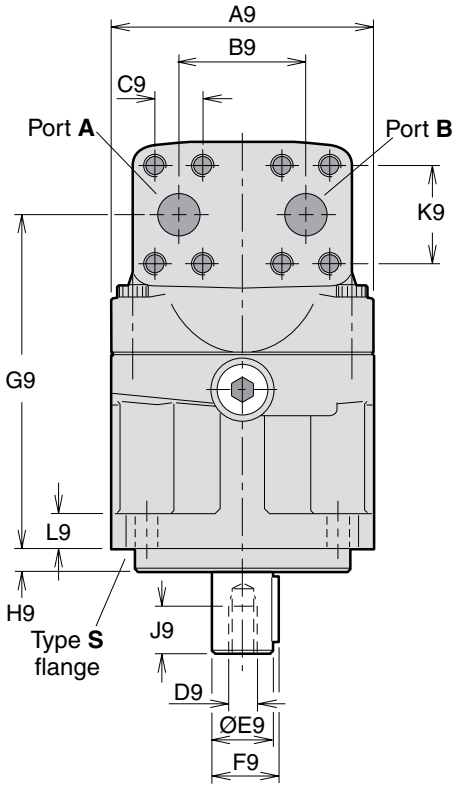
Pump & Motor Division Europe
Trollhättan, Sweden

F10-30, -40, -60, -80, -90, -110 and -125
(SAE versions with 4 bolt flange)



Type **S** (SAE 4 bolt) mounting flange





Other drawings on request

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Dim.	F10-30	F10-40	F10-60	F10-80 F10-90	F10-110 F10-125
A7	89.8	114.5	114.5	114.5	161.6
B7	118	148	148	155	204
C7	118	144	144	155	200
D7	14	14	14	14	21
A8	100	110	125	135	145
B8	59	65	70	77.5	85
C8	25	26	22	32	38
D8	6.35	7.94	7.94	9.53	11.1
E8	33	42	42	52	57.5
F8	101.60/ 101.55	127.00/ 126.94	127.00/ 126.94	127.00/ 126.94	152.40/ 152.34
G8	189.5	197	214	240	264
H8	8	8	8	8	8
J8	38	48	48	54	67
K8	72	76	79	95	99
L8	31.8	38.1	38.1	44.5	54.1
M8	2.5	4	4	4	7.5
N8	153.5	161	178.3	197.1	212
A9	122	134	144	155	170
B9	66	66	66	75	83
C9	23.8	23.8	23.8	27.8	31.8
D9*	5/16"-24	3/8"-24	3/8"-24	1/2"-20	5/8"-18
E9	25.40/ 25.35	31.75/ 31.70	31.75/ 31.70	38.10/ 42.3	44.45/ 44.40
F9	28.2	35.3	35.3	42.3	49.4
G9	153.8	161	178.3	197.1	212
H9	9.7	12.7	12.7	12.7	12.7
J9	16	19	19	26	32
K9	50.8	50.8	50.8	57.2	66.7
L9	18	20	20	20	22
T9	-	-	-	-	68

* UNF-2B thread

Ports	F10-30	F10-40	F10-60	F10-80 F10-90	F10-110 F10-125
A, B size	3/4"	3/4"	3/4"	1"	1 1/4"
Screw thread**)	3/8"-16 x22	3/8"-16 x20	3/8"-16 x22	7/16"-14 x27	1/2"-13 x25
C thread	7/8"-14	7/8"-14	7/8"-14	7/8"-14	1 1/16"-12
D thread	3/4"-16	3/4"-16	7/8"-14	7/8"-14	1 1/16"-12
E thread	-	-	-	-	1 1/16"-12

A, B: ISO 6162 C, D, E: O-ring boss (SAE J514)
**) UN thread x depth in mm.

Mounting flange (SAE J744)

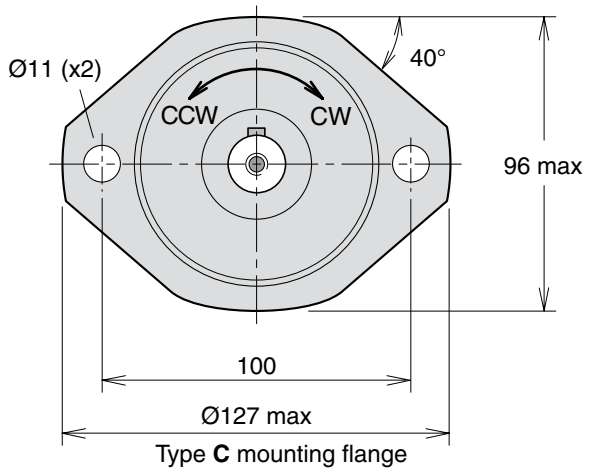
	S (standard)
F10-30	SAE 'B', 4 bolt
-40	SAE 'C', 4 bolt
-60	SAE 'C', 4 bolt
-80	SAE 'C', 4 bolt
-90	SAE 'C', 4 bolt
-110	SAE 'D', 4 bolt
-125	SAE 'D', 4 bolt

Key shaft (SAE J744)

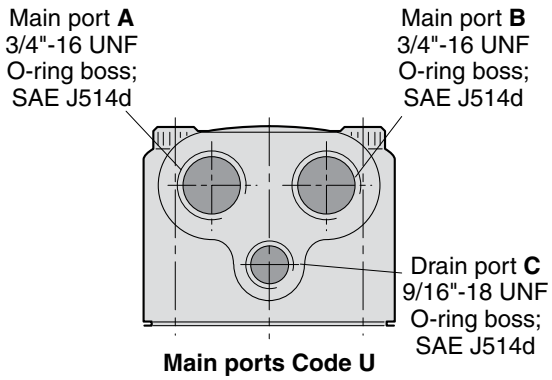
F10	**T** (standard)
-30	SAE 'B-B' (Ø25.4 mm/1")
-40	SAE 'C' (Ø31.75 mm/1 1/4")
-60	SAE 'C' (Ø31.75 mm/1 1/4")
-80	SAE 'C-C' (Ø38.1 mm/1 1/2")
-90	SAE 'C-C' (Ø38.1 mm/1 1/2")
-110	SAE 'D' (Ø44.45 mm/1 3/4")
-125	SAE 'D' (Ø44.45 mm/1 3/4")

F10-5

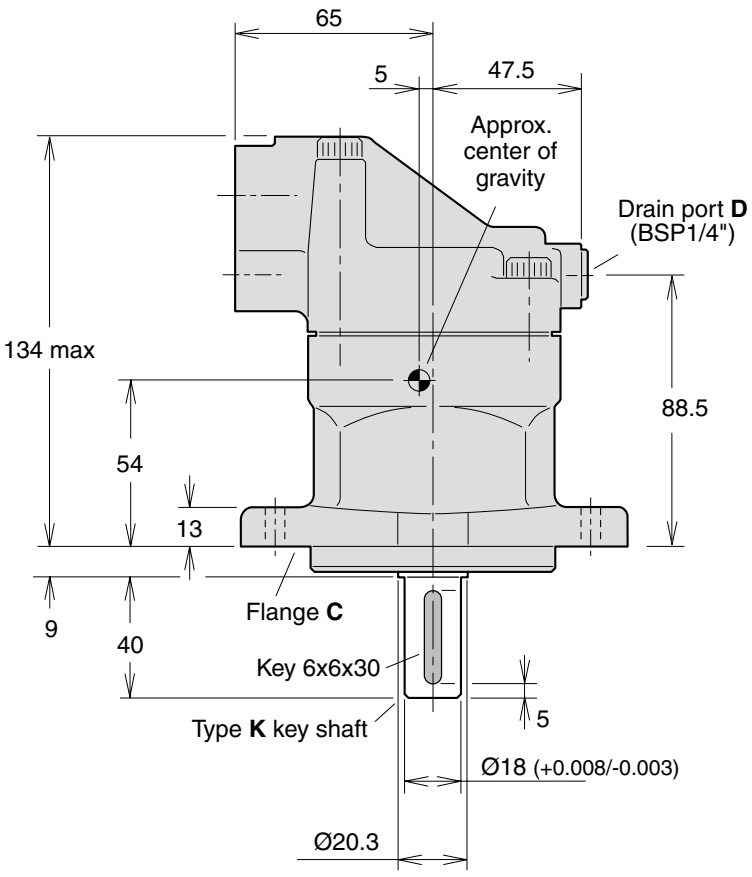
(CETOP versions)

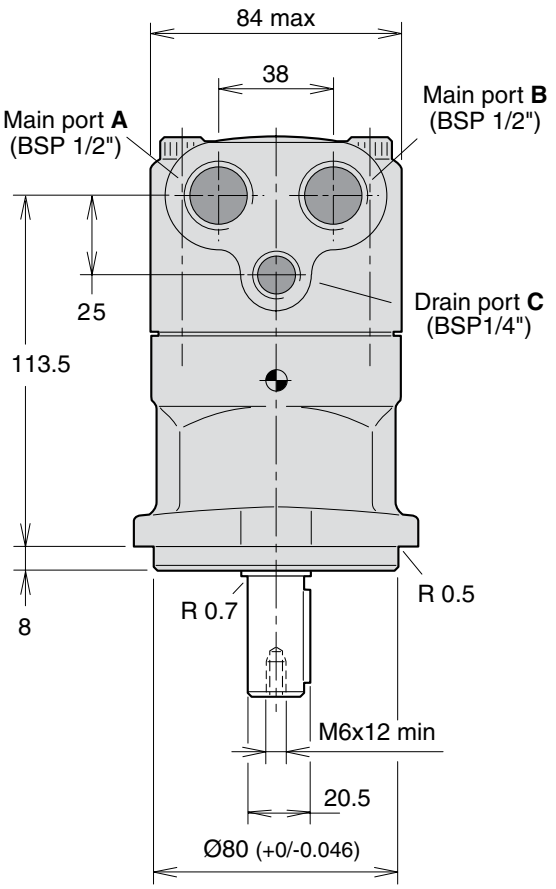


Type **C** mounting flange



Main ports Code U





Other drawings on request

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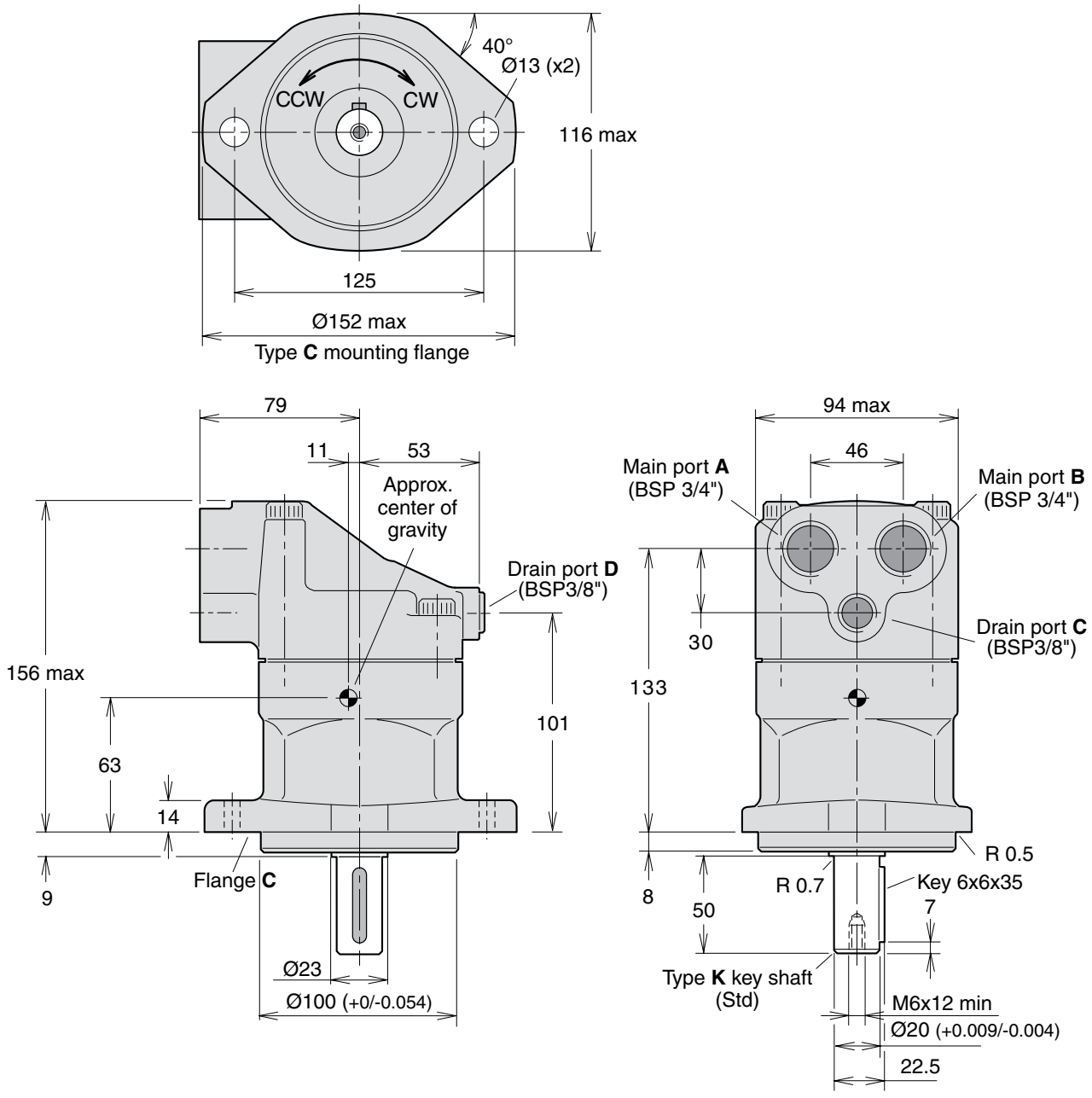
F10-006, -010
(CETOP versions)



Other drawings on request

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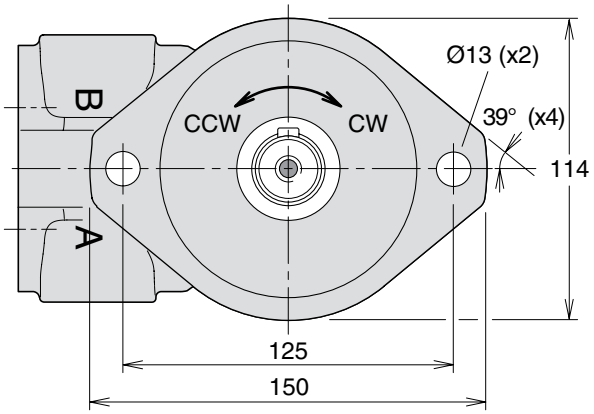
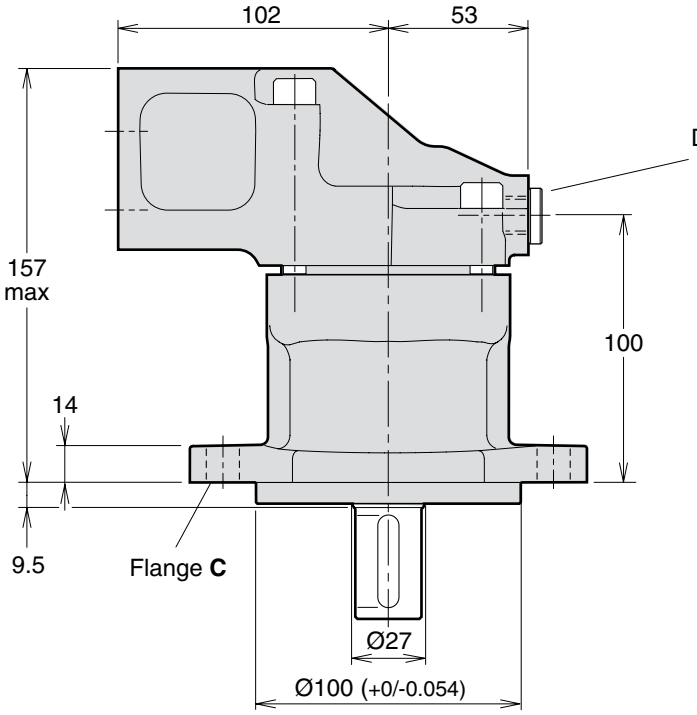
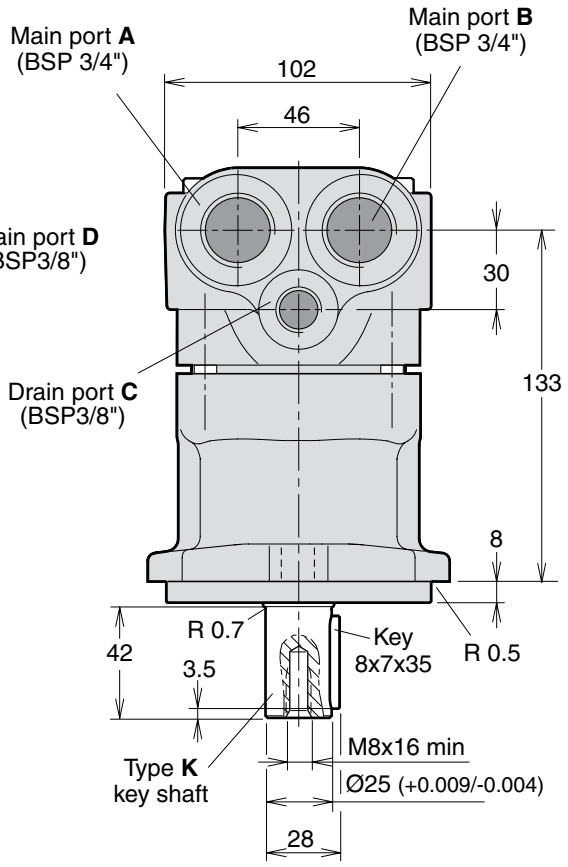
F10-012, -014
(CETOP versions)



Type **C** mounting flange





Other drawings on request

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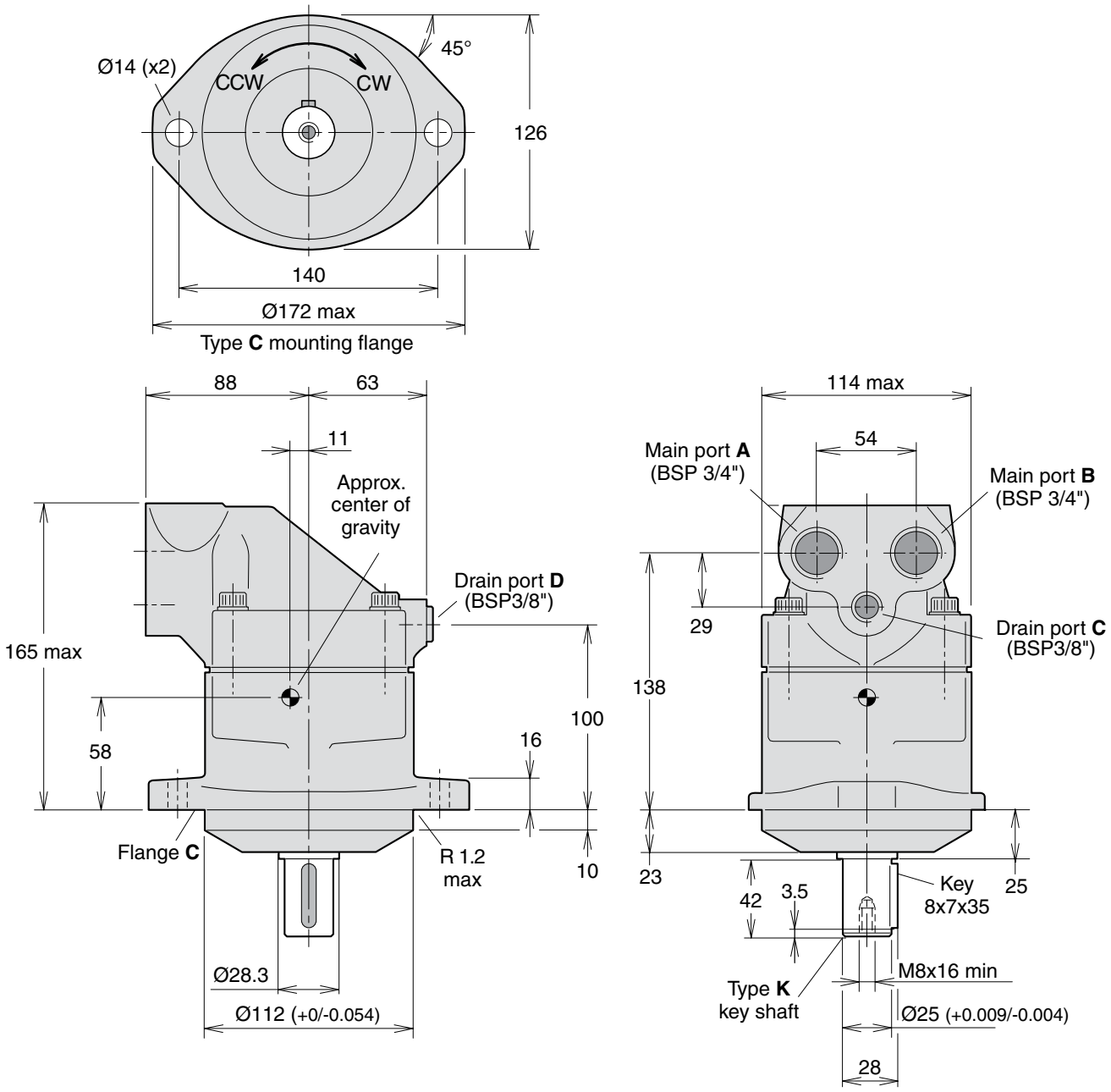
F10-019
(CETOP version)



Other drawings on request

Parker Hannifin
Pump & Motor Division Europe
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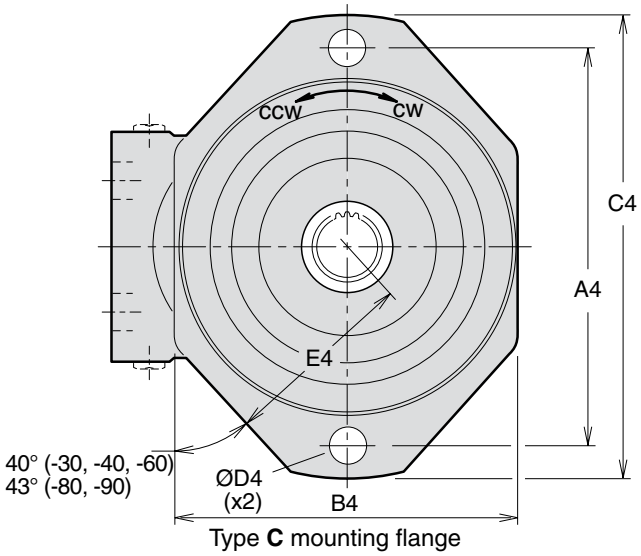
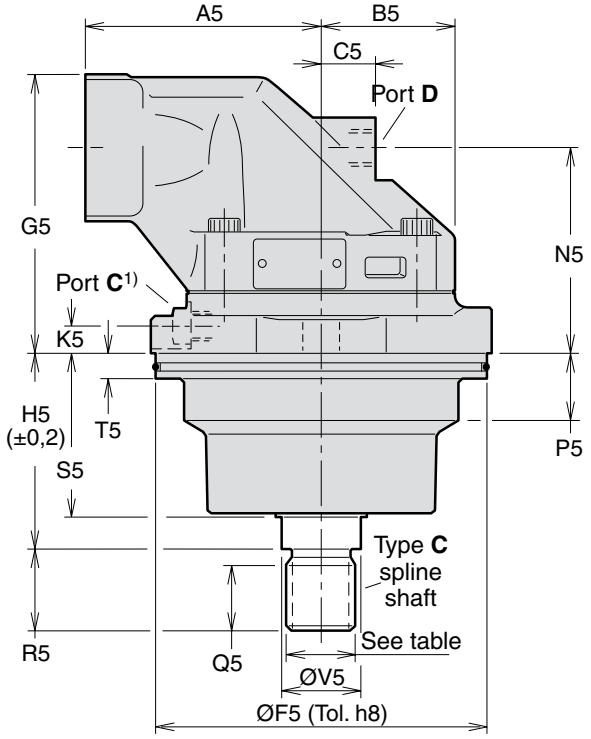
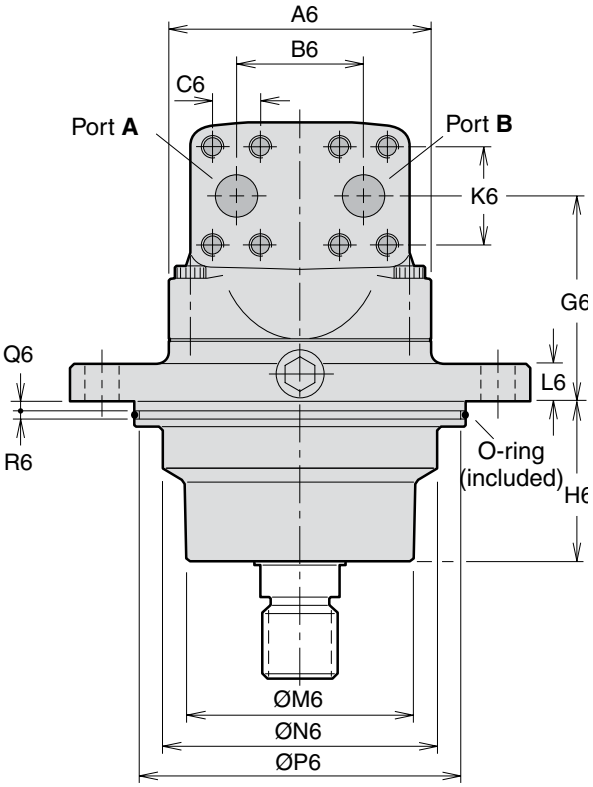
F10-30, -40, -60, -80, -90, -110 and -125
(Cartridge versions)



Type **C** mounting flange





1) Port C
Inspection/
drain port

Other drawings on request

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

Dim.	F10-30	F10-40	F10-60	F10-80 F10-90	F10-110 F10-125
A4	160	200	200	224	250
B4	140	164	164	196	206
C4	188	235	235	260	286
D4	14	18	18	22	22
E4	77	95	95	110	116
A5	100	110	125	135	145
B5	59	65	70	77.5	85
C5	25	26	22	32	38
F5	135	160	160	190	200
G5	127	133	146	157	175
H5	89	92.3	92.3	110.5	122.8
K5	14	16	15	15	15
N5	91	97	110	114	123
P5	22	30	31	40	40
Q5	28	28	28	37	37
R5	35	35	35	45	45
S5	70.5	72	76	91	95.7
T5	15	15	15	15	15
V5	32	35	35	45	45
A6	122	134	144	155	170
B6	66	66	66	75	83
C6	23.8	23.8	23.8	27.8	31.8
G6	91.5	97	110	114	123
H6	69.5	71	74	89.5	93.7
K6	50.8	50.8	50.8	57.2	66.7
L6	16	18	18	20	20
M6	92	115	115	130	140
N6	110	127	135	154	160
P6	128.2	153.2	153.2	183.2	193.2
Q6	5	5	5	5	5
R6	5	5	5	5	5
T6	-	-	-	-	68

Ports	F10-30	F10-40	F10-60	F10-80 F10-90	F10-110 F10-125
A, B size	$^3/_4$"	$^3/_4$"	$^3/_4$"	1"	$1^1/_4$"
Screw thread	M10 x20	M10 x20	M10 x20	M12 x22	M14 x26
C thread	M14 x1.5	M14 x1.5	M14 x1.5	M14 x1.5	M14 x1.5
D, E thread	M18 x1.5	M18 x1.5	M22 x1.5	M22 x1.5	M22 x1.5

A, B: ISO 6162

Spline shaft (DIN 5480)

	Type **C** (standard)
F10-30	W30x2x14x9g
-40	W30x2x14x9g
-60	W30x2x14x9g
-80	W40x2x18x9g
-90	W40x2x18x9g
-110	W40x2x18x9g
-125	W40x2x18x9g

O-ring dimensions	
F10-30	127x4
-40	150x4
-60	150x4
-80	180x4
-90	180x4
-110	190x4
-125	190x4

Hydraulic fluids

The motor data shown in the specification are valid when operating on a high quality, mineral based fluid with a minimum of contamination.

Hydraulic fluids type HLP (DIN 51524), ATF (automatic transmission fluid), and API type CD engine oils are suitable.

Operating temperature

The fluid temperature in the main hydraulic system must not exceed 70 °C; the drain fluid must not exceed 115 °C. **NOTE:** Fluid temperature should be measured at the utilized motor drain port.

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
F10-5, -6, -10, -12, -14, -19	[bar]	0.5 - 10	0.5 - 7.0	1.0 - 5.0	2.0 - 5.0	3.0 - 5.0
F10-30, -40, -60, -80, -90	[bar]	0.5 - 8	0.5 - 6.0	1.0 - 4.5	2.0 - 4.0	-
F10-110, -125	[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.

Viscosity

The ideal viscosity for the motor is 15–30 mm^2/s (cSt). When the hydraulic system has reached full operating temperature, the drain fluid viscosity must not be lower than 8 mm^2/s.

(measured at the utilized motor drain port).

Max start-up viscosity: 1 000 mm^2/s..

Filtration

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

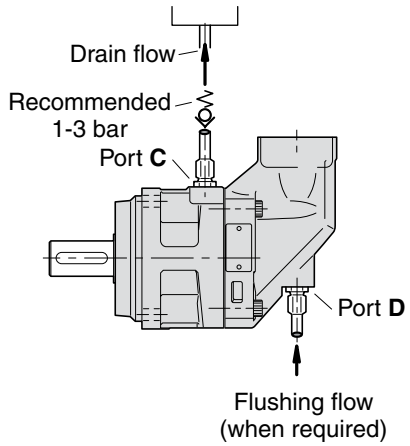
During normal operating conditions, a 10 µm (absolute) filter is recommended.

Case drain connections

Series F10 have two drain ports, **C** and **D**.

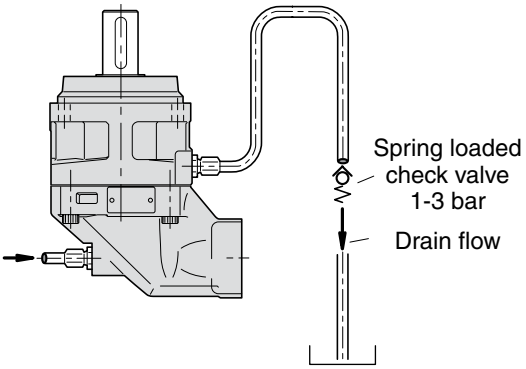
The uppermost drain port (such as port C in the illustration below) should always be utilized.

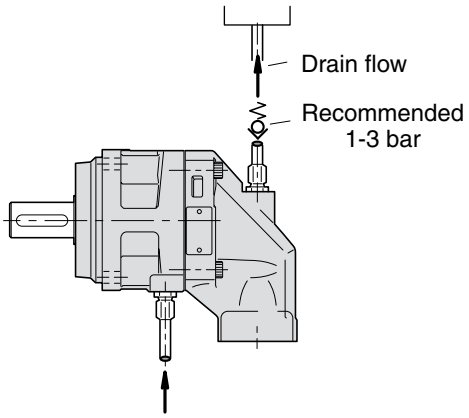
In mounting positions such as 'shaft up' (below)

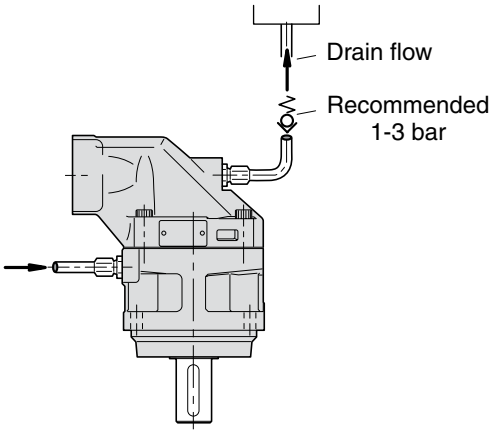


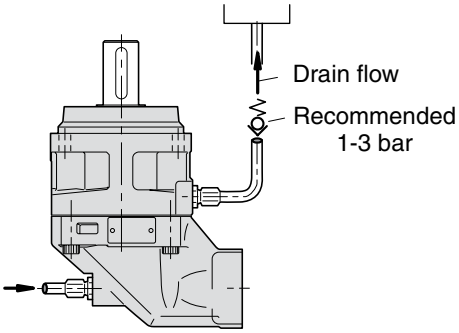
a spring loaded check valve should be installed in the drain line in order to insure a sufficiently high oil level in the case.

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









Before start-up

Make sure the F10 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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