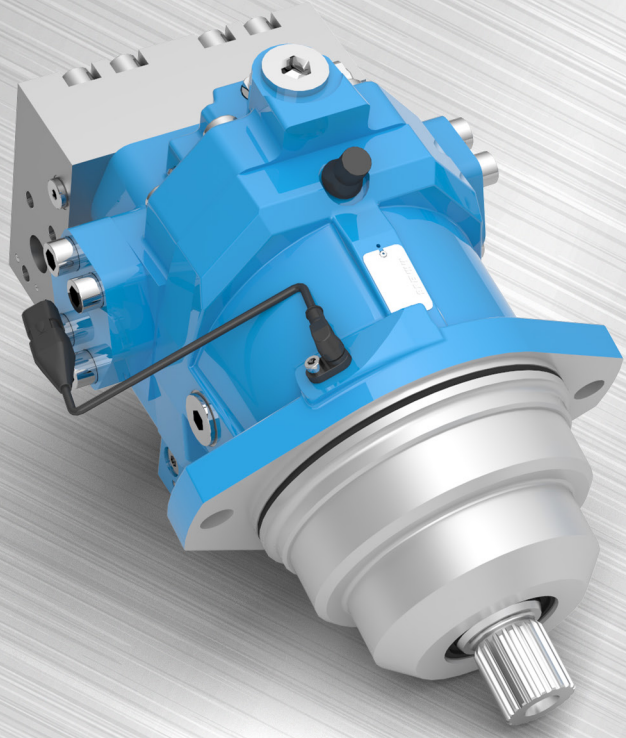
DANA BREVINI® Motion Systems

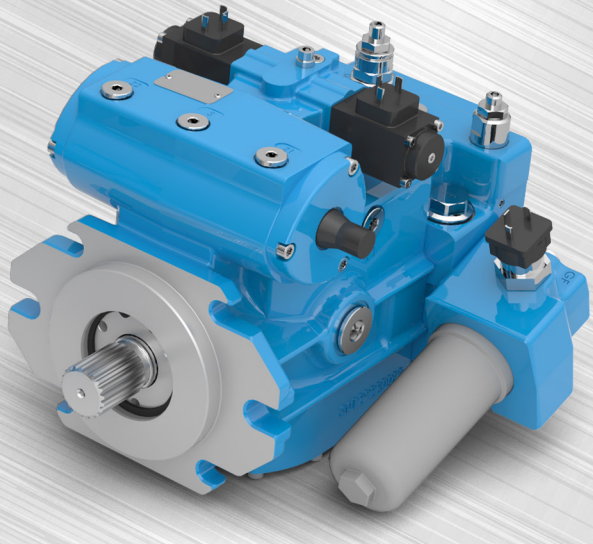
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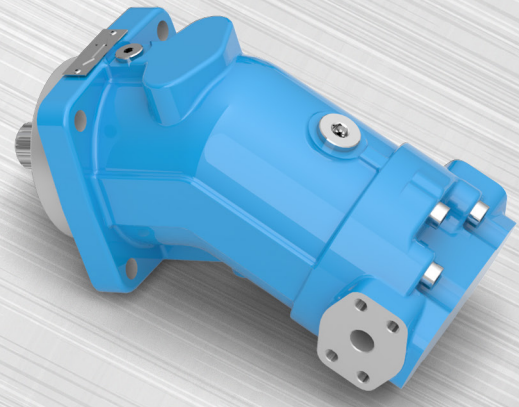
Product Catalog

Brevini Hydraulic Products
Axial Piston Motors and Pumps

Swashplate and bent axis design, variable and fixed displacement,
for open and closed loop applications







Axial piston motors and pumps

Extensive range for high performance circuits, open and closed loop, ISO and SAE versions available
Displacement from 10 to 226 cc/rev, pressure up to 480 bar
Wide range of on-board valves and controls

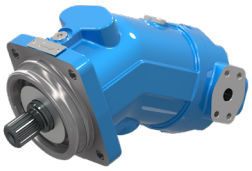
Index

	General Information - Features	A2
	Fluids and filtering	A6
	Service life of bearings for axial piston units	A11
	General installation guidelines	A16
	Nominal values calculation	A23
	Conversion Factor	A24
	Product Identification	A25
SH11C	Fixed displacement motors	**B1**
SH11CR	Fixed displacement motors for gearbox, plug in version	**C1**
SH11C	Fixed displacement pumps	**D1**
H1C	Fixed displacement motors	**E1**
H1CR	Fixed displacement motors for gearbox, plug in version	**F1**
H1C	Fixed displacement pumps	**G1**
H1V	Variable displacement axial piston pumps for open circuit	**H1**
S5AV	Variable displacement axial piston pumps for open circuit	**I1**
HD1	Variable displacement axial piston pumps for closed circuit	**L1**
S6CV	Variable displacement axial piston pumps for closed circuit	**M1**
SH7V	Variable displacement axial piston motor for open and closed circuit	**N1**
SH7VR	Variable displacement motor for gearbox, plug in version	**O1**
SH9V	Variable displacement axial piston motor for open and closed circuit	**P1**
MAV4211SH	Electronic control card	**Q1**
VALVES	Valves	**R1**

PUMPS - AXIAL PISTON UNITS, BENT AXIS DESIGN

SH11C Sez. D

- Fixed displacement
- For open circuit
- ISO and SAE version
- Sizes: 10-16-20-30-45-55-63-75-90-108-125-160-180
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



H1C Sez. G

- Fixed displacement
- For open and closed circuit
- Sizes 06-12-20-30-45-55-75-90-108-160-226
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



H1V Sez. H

- Variable displacement
- For open circuit
- ISO and SAE version
- Sizes 55-75-108-160-226
- Nominal pressure 350 bar [5080 psi]
- Peak pressure 450 bar [6530 psi]



PUMPS - AXIAL PISTON UNITS, SWASH PLATE DESIGN

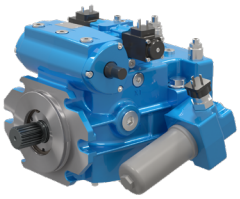
S5AV Sez. I

- Variable displacement
- For open circuit
- Sizes 32-45-50-63-75-93
- Nominal pressure 280÷350 bar [4060÷5080 psi]
- Peak pressure 350÷420 bar [5080÷6090 psi]



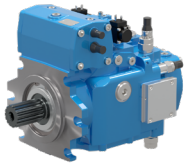
HD1 Sez. L

- Variable displacement
- For closed circuit
- ISO and SAE version
- Size 55
- Nominal pressure 420 bar [6090 psi]
- Peak pressure 450 bar [6530 psi]



S6CV Sez. M

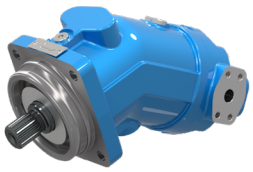
- Variable displacement
- For closed circuit
- ISO and SAE version
- Sizes 75-128
- Nominal pressure 400 bar [5800 psi]
- Peak pressure 450 bar [6530 psi]



MOTORS - AXIAL PISTON UNITS, BENT AXIS DESIGN

SH11C Sez. B

- Fixed displacement
- For open circuit
- ISO and SAE version
- Sizes 10-16-20-30-45-55-63- 75-90-108-125 160-180
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



SH11CR Sez. C

- Fixed displacement
- For open and closed circuit
- Sizes 20-30-45-55-63-75-90- 108-125-160-180
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



H1C Sez. E

- Fixed displacement
- For open and closed circuit
- Sizes 6-40-226
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



H1CR Sez. F

- Fixed displacement
- For open and closed circuit
- Displacements 45 cm^3/rev
- Nominal pressure 350 bar [5080 psi]
- Peak pressure 450 bar [6530 psi]



MOTORS - AXIAL PISTON UNITS, BENT AXIS DESIGN

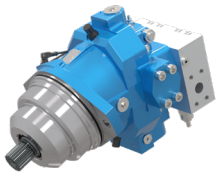
SH7V Sez. N

- Variable displacement
- For open and closed circuit
- ISO and SAE version
- Sizes 55-75-108-160-200
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



SH7VR Sez. O

- Variable displacement
- For open and closed circuit
- ISO and SAE version
- Sizes 55-75-108-160
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



SH9V Sez. P

- Variable displacement
- For open and closed circuit
- ISO and SAE version
- Execution with 9 pistons for greater torque and smoothness rotation
- Sizes 85-115-215
- Nominal pressure 430 bar [6240 psi]
- Peak pressure 480 bar [6960 psi]



1. Case drain pressure:
The table below shows the main types of hydraulic fluid as set out in ISO 6743-4 standard. In normal operating conditions, Dana recommends mineral oil-based fluids with anticorrosive and anti-wear additives (HL or HM grade) for its axial piston units. Flame-resistant fluids (HF grade) and organic fluids (HE grade) may not be fully compatible with materials and may therefore reduce the maximum pressure and speed specification of axial piston units. Customers are advised to contact Dana before using flame-resistant or organic fluids.

Mineral oil-based fluids	
HH	Additive-free
HL	Anticorrosive, antioxidant
HM	HL and anti-wear additives
HV	HM additives and viscosity controls
Flame-resitant fluids	
HFA	Oil-based emulsion in water (water > 90%)
HFB	Water-based emulsion in oil (water > 40%)
HFC	Water in glycol solution (polyhydrate alcohols)
HFD	Water-free synthetic fluids (phosphoric esters)
Organic fluids	
HETG	Vegetable-based fluids
HEPG	Synthetic polyglycol-based fluids
HEE	Synthetic ester-based fluids

2. Viscosity index
The optimum viscosity of the fluid ν_{opt} at the operating temperature (temperature of the tank for open circuits or temperature of the circuit for closed circuits) must fall between the minimum and maximum values shown in the table below. The minimum viscosity ν_{min} shown in the table is permitted in extreme conditions and for short periods. This value refers to a maximum fluid temperature of 90°C (temperature of drainage fluid). The maximum viscosity ν_{max} for short intervals and during cold starts is shown in the table below. The temperature of the fluid must never exceed a maximum of +90°C and a minimum of -25°C.

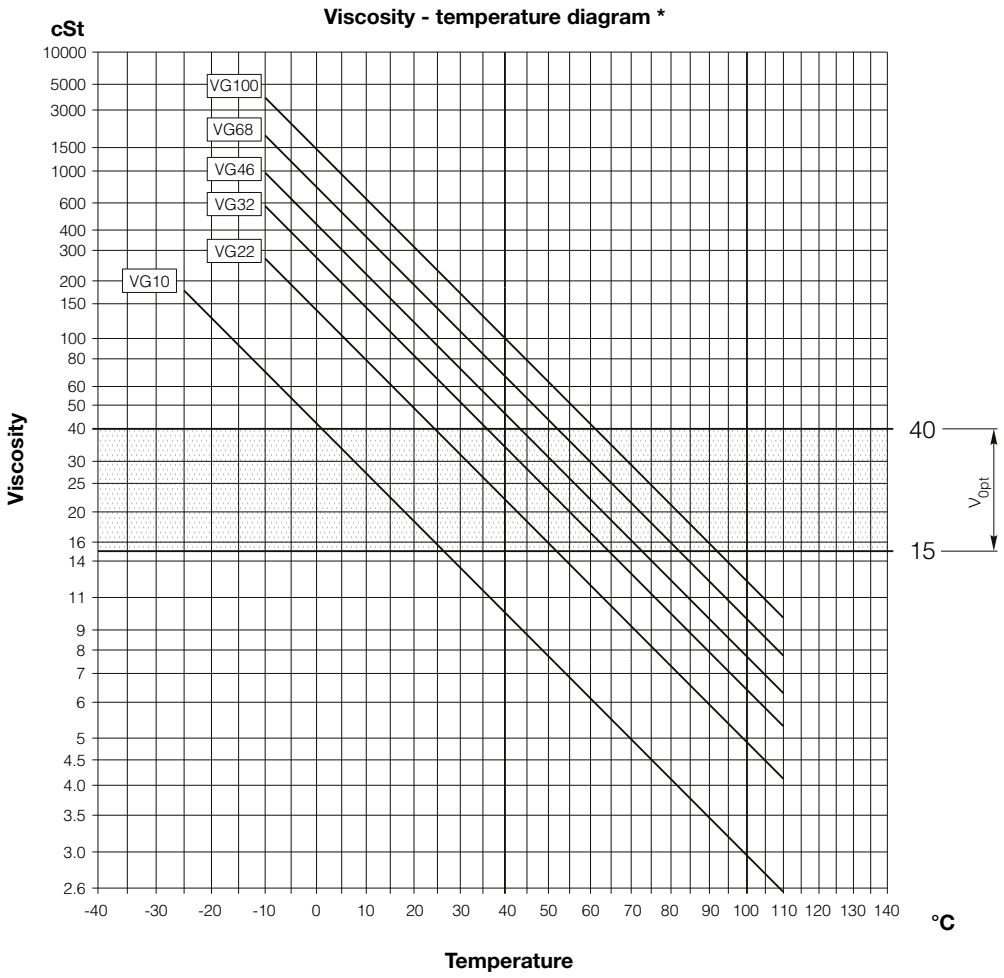
	ν_{opt} (cSt)	ν_{min} (cSt)	ν_{max} (cSt)
H1C - SH11C	15 ÷ 40	10	800
H1CR - SH11CR	15 ÷ 40	10	800
H1V - HD1	15 ÷ 40	10	800
S5AV	15 ÷ 40	10	800
S6CV	15 ÷ 40	10	800
SH7V - SH7VR	15 ÷ 40	10	800

3. Viscosity grades

Under the ISO standard, hydraulic fluids are divided into 6 grades of viscosity (see table below). Viscosity grades are shown by the letters VG followed by the viscosity of the fluid in cSt at a temperature of 40 °C.

ISO viscosity grades	$\nu_{40°}$ (cSt)
VG 10	9 ÷ 11
VG 22	19.8 ÷ 24.2
VG 32	28.8 ÷ 35.2
VG 46	41.4 ÷ 50.6
VG 68	61.2 ÷ 71.5
VG 188	90 ÷ 110

In order to choose the correct type of fluid, it is essential to know the operating temperature of the fluid (temperature of the tank for open circuits or temperature of the circuit for closed circuits) and its viscosity index. At the operating temperature, the viscosity of the fluid must fall within the optimum viscosity values (ν_{opt}). The diagram below shows the variations of viscosity at various temperatures of a class of fluids sharing the same viscosity index.



* The diagram is only an example. It shows the viscosity–temperature characteristics of typical fluids with different viscosities but sharing the same viscosity index. Ask to your hydraulic fluid supplier for the real viscosity-temperature diagram of the fluid used in your system.

Example: in a fully operational system, the operating temperature of the fluid is 50°. Suitable fluids for this type of system are those with viscosity which falls within the range ν_{opt} at a temperature of 50° (VG32 and VG46 in this case). The operating temperature of a fluid in a system depends on a large number of factors. The temperature stabilises when the heat produced by the system (due to mechanical friction and rolling of the fluid) is equal to the heat released outside (heat exchangers and tank). Since the heat produced increases at the same rate as the difference between the ambient temperature and that of the system, the system has a specific thermal equilibrium temperature for every ambient temperature. As a result, the working environment must be taken into consideration when choosing a fluid. A machine located in North Africa, for example, should be operated with a different type of fluid to a machine in northern Europe.

4. Contamination levels

Efficient filtering is essential if an hydraulic system is to work correctly. A good quality fluid extends the working life of hydraulic parts and makes the system more reliable. Bent axis units usually have a higher tolerance of pollutants than swash plate ones. Dana allows the following maximum permissible contamination grades for its axial piston units:

Maximum permissibile contamination grades	
Standard	ISO 4406 : 1999
H1C - H1CR - SH11C - SH11CR	21/19/16
H1V - HD1	21/19/16
SH7V - SH7VR	21/19/16
S6CV	20/18/15
S5AV	20/18/15

Axial piston pumps usually work satisfactorily even if the fluid does not meet the maximum contamination standard mentioned above. However, experience has shown that keeping the contamination grade below certain limits and a good quality of the hydraulic fluid (antifoaming capacity, anti-wear additives, etc.) is essential for the durability and efficient operation of hydraulic systems.

5. Filtering grade

ISO 16889 standard states that the filtering grade $\beta_{x(c)}$ is the ratio between the number of particles of pollutant (per unit of volume) of a size greater than or equal to “x”µm(c) entering the filter and the number of particles of the same size leaving the filter. The grade $\beta_{x(c)}$ therefore gives an indication of the efficiency of the filter.

Ratio $\beta_{x(c)}$	**Filtering capacity**	**Notes**
≥ 2	50%	Average size of filter pores equal to smallest particles retained
≥ 20	95%	Normal retention
≥ 100	99%	Absolute retention

Example: A filter with a filtering ratio of $\beta_{10(c)} \geq 100$ is able to capture almost all particles greater than or equal to 10 µm(c). To achieve the correct contamination level, Dana recommends filters with the following $\beta_{x(c)}$ ratios for its axial pis-ton pumps):

Contamination Grades required from ISO 4406:1999	**Ratio** $\beta_{x(c)}$
18/16/13	$\beta_{4(c)} \geq 100$
20/18/15	$\beta_{10(c)} \geq 100$

6. ISO 4406:1999 table

The ISO 4406:1999 standard defines a contamination level code which is in direct relation with the number of particles of average dimension ≥ 4 µm(c), .≥ 6 µm(c), ≥ 14 µm(c) in a unit of volume of fluid. The code number values and their corresponding concentration are shown below.

ISO 4406:1999 CONTAMINATION CODES		
Number of particles for 100 ml of fluid		Code Number
Bigger of	Until	
130.000.000	250.000.000	28
64.000.000	130.000.000	27
32.000.000	64.000.000	26
16.000.000	32.000.000	25
8.000.000	16.000.000	24
4.000.000	8.000.000	23
2.000.000	4.000.000	22
1.000.000	2.000.000	21
500.000	1.000.000	20
250.000	500.000	19
130.000	250.000	18
64.000	130.000	17
32.000	64.000	16
16.000	32.000	15
8.000	16.000	14
4.000	8.000	13
2.000	4.000	12
1.000	2.000	11
500	1.000	10
250	500	9
130	250	8
64	130	7
32	64	6
16	32	5
8	16	4
4	8	3
2	4	2
1	2	1
0	0	0

To better understand, an example of ISO contamination code is discussed below.

ISO 4406 : 1999
Contamination code = 21/ 15 / 11

Code Number of particles which dimension is ≥ 4 µm(c)

Code Number of particles which dimension is ≥ 6 µm(c)

Code Number of particles which dimension is ≥ 14 µm(c)

Looking at the table in page 8, the code 21/15/11 of ISO 4406:1999 standard states that in a volume unit of 1 ml are present:
Between 10000 and 20000 particles of dimension ≥ 4 µm (c);
Between 160 and 320 particles of dimension ≥ 6 µm (c);
Between 10 and 20 particles of dimension ≥ 14 µm (c).

7. Recommended contamination levels
The table below is shows the recommended contamination levels of different type of duty cycles using ISO 4406:1999 and NAS 1638 standards.

Recommended contamination levels				
Components	**Use**	**Pressure level bar [psi]**	**Contamination ISO 4406:1999**	**Contamination NAS 1638**
Axial piston Pumps - Motors Fixed - Variable displacement	Occasional	X<140 [2030]	20/18/15	9
		140 [2030]<X<210 [3045]	20/18/15	9
		X>210 [3045]	19/17/14	8
	Continuous	X<140 [2030]	19/17/14	8
		140 [2030]<X<210 [3045]	19/17/14	8
		X>210 [3045]	18/16/13	7

The recommended levels above are referred to normal operating conditions and a normal environment. Should the unit be used with particular kind of fluids or in corrosive environments please contact us.

1. Introduction

The sliding surfaces of the moving parts in the pumps/motors are protected by a film of oil which provides lubrication and hydrostatic balancing and the related wear is negligible when optimum filtration and recommended operating conditions are achieved. Therefore the operating life of the pumps/motors can be defined by bearing life. L10h factor of bearing life means that 90% of the bearings will last longer than the number of hours calculated. In practice 50% of the bearings will last more than five times the L10h life. L_{10h} bearing life is dependent on operating pressure and speed and also on external shaft loads and fluid viscosity. L_{10h} bearing life at given pressure and speed can be estimated by the formula:

$$L_1 = L_0 \times \left(\frac{n_0}{n_1}\right) \times \left(\frac{p_0}{p_1}\right)^{\frac{10}{3}}$$

Where L_0 is the L_{10h} life (in hours) of the bearings at n_0 rpm and p_0 bar (the operating pressure is the sum of pressures on the motor inlet and outlet ports or pump delivery and suction ports), n_1 is the speed of the shaft in rpm, p_1 is the operating pressure in bar and L_1 is the estimated service life (in hours) at a pressure of p_1 and a speed of n_1.

Note: Dana has a computer program for determining the estimated operating bearing life. It is our commitment to help and assist you in determining life at specific operating conditions and cycle. Please contact us should you require it.

2. Operating cycle

When the operating cycle of the pumps/motors shows time variant (alone or in combinations) of speed and pressure, the bearing life formula comes to:

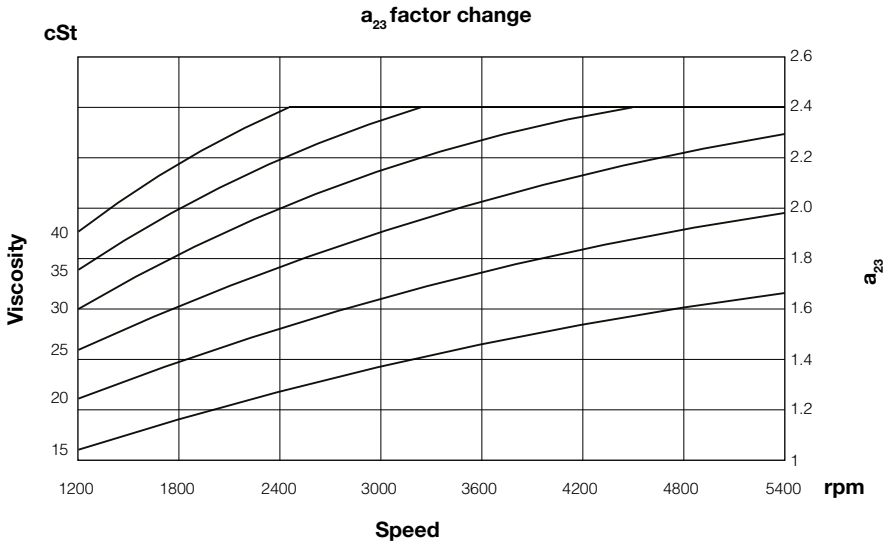
$$\frac{1}{L_t} = \sum_i \left(\frac{1}{L_i} \times \frac{T_i}{T_t}\right)$$

service life of the bearings at a pressure of p_i and a speed of n_i, T_i is the length of the cycle during which the unit operates at a speed of n_i and a pressure of p_i and T_t is the total length of the cycle.

3. Influence of viscosity and speed

The bearing operating life is significantly influenced by the shaft speed and fluid viscosity. Increasing speed and viscosity result usually in an extended bearing operating life. To determine the corresponding bearing life multiply the operating life L_{10h} by the correction factor a_{23}. This gives the rectified life L_{10ha} ($L_{10ha} = a_{23} \times L_{10h}$). The diagram below show factor a_{23} at various speeds
and with various degrees of viscosity.

Service life of bearings for axial piston units

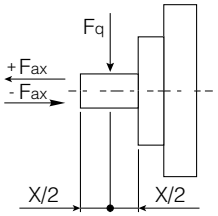


4. Permissible external loads

It is generally allowable to apply external radial and axial load on the drive shaft of axial piston pumps and motors. The permissible value of external loads depends on the pump/motor design (swash plate or bent axis) and on the pump/motor size. The following paragraphs are a guideline to the external loads for different size and design pumps and motors.

5. S6CV pump

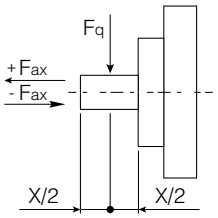
The drive shaft can stand both radial and axial loads. The maximum permissible loads in the following table are calculated in such a way as to guarantee a service life of at least 80% of the service life of bearings to which no load is applied.



			Displacement	
			75	128
Radial load	$F_{q\ max}$	N [lbf]	2400 [540]	4600 [1035]
Axial load	$F_{ax\ max}$	N [lbf]	1900 [428]	4300 [967]

6. S5AV pump

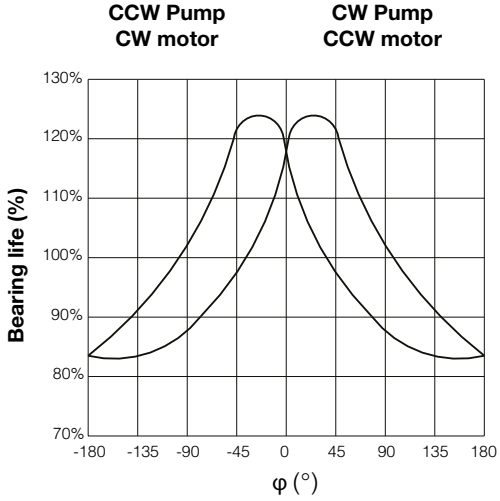
The drive shaft can stand both radial and axial loads. The maximum permissible loads in the following table are calculated in such a way as to guarantee a service life of at least 80% of the service life of bearings to which no load is applied.

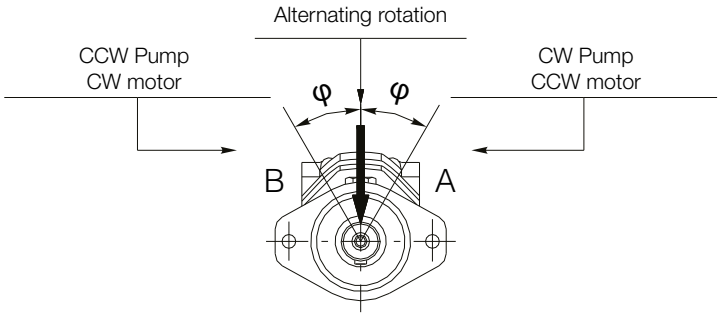


			Displacement		
			32/45	50/63	75/90
Radial load	$F_{q\ max}$	N [lbf]	1000 [225]	1500 [338]	2400 [540]
Axial load	$F_{ax\ max}$	N [lbf]	1200 [270]	1500 [338]	1900 [428]

1. Bent axis design pumps and motors: Radial loads

When an external side (radial) load is applied to the drive shaft, the bearing life will vary accordingly to the magnitude, location and direction of the load. Following diagram shows how the bearing operating life varies versus the direction of the load. In the diagram 100% represents the bearing operating life where no external side load is applied to the drive shaft. The optimum direction is dependent on which port is pressurised.





The bearing operating life increases up to 30% when the load is applied with some peculiar directions and the maximum increase is dependent on the operating pressure and the nominal size of the unit. The following table is a guide to determine max. permissible radial loads. Values are calculated in such a way to assure at least 80% of the bearing operating life where no radial load is applied. The published values are related to loads applied midshaft and in the least favourable direction. The max permissible load is dependent on the operating pressure and the values are in N/bar.

Acceptable radial loads		
H1C Size	**Load** N/bar [lbf/psi]	**Load at 350 bar [5075 psi]** N [lbf]
6	5 [0.075]	1.750 [393.7]
12	5 [0.075]	1.750 [393.7]
20	5 [0.075]	1.750 [393.7]
30	5 [0.075]	1.750 [393.7]
40	10 [0.15]	3.500 [787.5]
55	10 [0.15]	3.500 [787.5]
75	13 [0.195]	4.550 [1023.7]
90	13 [0.195]	4.550 [1023.7]
108	16 [0.24]	5.600 [1260]
160	14 [0.21]	4.900 [1102.5]
226	13 [0.195]	4.550 [1023.7]

Acceptable radial loads		
SH7V Size	**Load** N/bar [lbf/psi]	**Load at 350 bar [5075 psi]** N [lbf]
055	25 [0.375]	10500 [2362.5]
075	38 [0.57]	13300 [2992.5]
108	44 [0.66]	15400 [3465]
160	60 [0.9]	21000 [4725]
200	70 [1.05]	23000 [5175]

Acceptable radial loads		
H1V Size	**Load** N/bar [lbf/psi]	**Load at 350 bar [5075 psi]** N [lbf]
55	10 [0.15]	3.500 [787.5]
75	13 [0.195]	4.550 [1023.7]
108	16 [0.24]	5.600 [1260]
160	14 [0.21]	4.900 [1102.5]
226	13 [0.195]	4.550 [1023.7]

Acceptable radial loads		
SH11C Size	**Load** N/bar [lbf/psi]	**Load at 350 bar [5075 psi]** N [lbf]
010	8.5 [0.128]	2000 [450]
016	9 [0.135]	3200 [720]
020	12 [0.18]	4200 [945]
030	19 [0.285]	6650 [1496.25]
045	20 [0.3]	7200 [1620]
055	25 [0.375]	8750 [1968.75]
063	30 [0.45]	10500 [2362.5]
075	25.7 [0.386]	8995 [2023.87]
090	28.5 [0.428]	9975 [2244.37]
108	35 [0.525]	12250 [2756.25]
125	37 [0.555]	12950 [2913.75]
160	41 [0.615]	14350 [3228.75]
180	45 [0.675]	15750 [3543.75]

Service life of bearings for axial piston units

8. Bent axis design pumps and motors: Axial loads

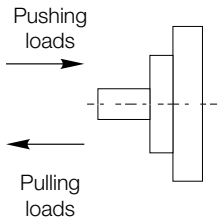
Axial loads can be either pulling or pushing. Acceptable axial loads and the resulting bearing operating life considerably differ under the two above conditions.

Pushing loads

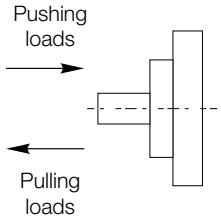
Within certain limits and at low operating pressure, pushing loads do not affect the bearing operating life. The following table shows maximum pushing axial loads at pressures less than 100 bar [1450 psi]. At pressures above 100 bar [1450 psi], higher pushing loads may be applied in proportion to the pressure increase. Pushing loads tend to extend the bearing operating life.

Pulling loads

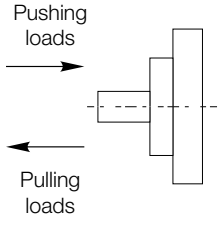
Pulling loads always reduce the bearing operating life. The following table shows maximum pulling axial loads which, at pressures of 250 bar [3625 psi] and 350 bar [5075 psi], assure an operating life more than 80% of the service life under no axial loads. **Where possible pulling loads should be avoided.**



Size		Pushing loads		Admissible pulling loads	
H1C	H1V	< 100 bar [<1450 psi] N [lbf]	> 100 bar [>1450 psi] N/bar [lbf/psi]	250 bar [3625 psi] N [lbf]	350 bar [5075 psi] N [lbf]
6	–	250 [56.2]	10 [0.15]	500 [112.5]	250 [56.2]
12	–	250 [56.2]	10 [0.15]	500 [112.5]	250 [56.2]
20	–	300 [67.5]	15 [0.225]	1600 [360]	800 [180]
30	–	300 [67.5]	15 [0.225]	1600 [360]	800 [270]
40	–	500 [112.5]	25 [0.375]	2500 [562.5]	1200 [180]
–	55	500 [112.5]	25 [0.375]	2500 [562.5]	1200 [180]
–	75	600 [135]	30 [0.45]	3000 [675]	1500 [337.5]
90	-	700 [157.5]	30 [0.45]	3500 [787.5]	1700 [382.5]
–	108	800 [180]	40 [0.6]	4000 [900]	2000 [450]
–	160	1200 [270]	60 [0.9]	6500 [1462.5]	3000 [675]
226	226	1200 [270]	60 [0.9]	6500 [1462.5]	3000 [675]



Size	Pushing loads		Admissible pulling loads	
SH11C	< 100 bar [<1450 psi] N [lbf]	> 100 bar [>1450 psi] N/bar [lbf/psi]	250 bar [3625 psi] N [lbf]	350 bar [5075 psi] N [lbf]
010	320 [72]	3 [0.045]	300 [67.5]	700 [157.5]
016	320 [72]	3 [0.045]	500 [112.5]	900 [202.5]
020	500 [112.5]	5 [0.075]	1000 [225]	1300 [292.5]
030	500 [112.5]	5 [0.075]	1300 [292.5]	1800 [405]
045	800 [180]	9 [0.135]	1800 [405]	2350 [528.75]
055	800 [180]	9 [0.135]	1920 [432]	2650 [596]
063	800 [180]	9 [0.135]	2150 [484]	2990 [673]
075	1000 [225]	12 [0.18]	2300 [517.5]	3550 [798.75]
090	1000 [225]	12 [0.18]	2800 [630]	3800 [855]
108	1250 [281.25]	13 [0.195]	2900 [652.5]	4050 [911.25]
125	1250 [281.25]	13 [0.195]	3300 [742.5]	4550 [1023.75]
160	1600 [360]	17 [0.255]	3800 [855]	5300 [1192.5]
180	1600 [360]	17 [0.255]	4050 [911.2]	5800 [1305]



Size	Pushing loads		Admissible pulling loads	
SH7V	< 100 bar [<1450 psi] N [lbf]	> 100 bar [>1450 psi] N/bar [lbf/psi]	250 bar [3625 psi] N [lbf]	350 bar [5075 psi] N [lbf]
055	500 [112.5]	50 [0.75]	2800 [630]	3800 [855]
075	710 [159.75]	62 [0.93]	3300 [742.5]	4550 [1023.75]
108	900 [202.5]	74 [1.11]	4100 [922.5]	5650 [1271.25]
160	1200 [270]	60 [0.9]	5000 [1125]	7000 [1575]
200	1300 [292.5]	63 [0.95]	5700 [1282.5]	7600 [1710]

9. Bent axis design motors and pumps: Flushing the bearings

The operating temperature influences the operating life of the bearings to a significant degree. As a result it is essential to prevent the temperature of the oil in the proximity of the bearings from exceeding acceptable levels. H1C, SH11C, H1V, H2V and SH7V series can be provided with bearing flushing with cooled oil. Flushing is recommended where pumps/motors are installed vertically and if operating cycles have long periods at high differential pressure DP (> 250 bar [> 3625 psi]) or when motors are operated in series (i.e. with pressure on both ports - please contact us for further information about series applications with H1C / SH11C / H2V / SH7V motors). The following table shows the recommended flushing flow rates for each nominal size. For motors in closed loop applications we always recommend to provide a flushing valve. Flushing valve's output flow should be selected according to the each circuit requirements. It is important that the flushing valve flow rate doesn't exceed 80% of the minimum boost pump flow rate (i.e.: the boost pump flow rate with the prime mover at the idling speed). If in doubt, please contact us for further details.

H1C Size	Flushing flow rates l/min [U.S. gpm]
6	6 [1.585]
12	6 [1.585]
40	10 [2.642]
55	3.5 [0.92]
75	5 [1.32]
90	5 [1.32]
108	10 [2.642]
160	15 [3.96]
226	20 [5.283]

H1V Size	Flushing flow rates l/min [U.S. gpm]
55	10 [2.642]
75	10 [2.642]
108	10 [2.642]
160	10 [2.642]
226	20 [5.283]

SH7V Size	Flushing flow rates l/min [U.S. gpm]
055	5 [1.32]
075	5 [1.32]
108	10 [2.642]
160	15 [3.963]
200	15 [3.963]

SH11C Size	Flushing flow rates l/min [U.S. gpm]
010	1.5 [0.396]
016	1.5 [0.396]
020	3 [0.792]
030	3 [0.792]
045	3.5 [0.924]
055	3.5 [0.924]
063	3.5 [0.924]
075	5 [1.32]
090	5 [1.32]
108	10 [2.642]
125	10 [2.642]
160	15 [3.963]
180	15 [3.963]

General installation guidelines

These general installation and commissioning specifications are intended for Dana axial piston units. Adherence to these recommendations has a decisive effect on the service life of the units. The following specifications refer to standard units with standard internal elements, used with common hydraulic fluids. Carefully read these notes before installing and commissioning the application. For every unit type, a specific installation and commissioning manual is available: please ask for a copy. In case of doubt, please contact us.

1. Filling the casing

The casing of axial piston pumps and motors must be pre filled with hydraulic oil before the system is started for the first time. Oil is maintained in the units by fitting a drain line to the upper case connection, (see figure 2). All unit types H1C, SH11C, SH7V, SH9V, S5AV, HD1, S6CV must be pre filled with oil and have drain lines fitted. Only unit type H1V have their cases connected to the suction port and therefore do not necessarily need external drain lines fitting. These units are filled at the same time as the system tank is filled (special care should be used when installing H1V above the tank to avoid emptying the casing when the pump is stopped - see H1V installation manual). In this case remove the top drain plug when filling in order to bleed air from the casing. In pumps for closed circuit (S6CV) the casing is filled by charge pump during operation but the casing and the suction line must be filled before starting. The pump must not work unless it has been filled completely.

Caution:

starting any axial piston pump or motor with little or no oil in the casing causes immediate damage of the piston unit.

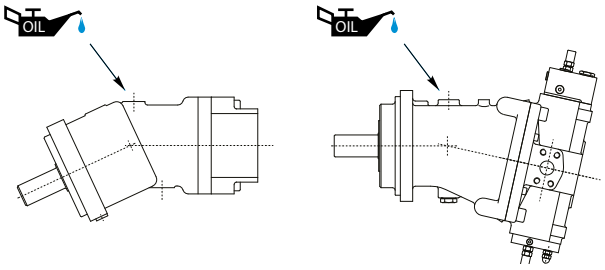


Fig. 1 - Example of filling the casing

2. Connections

To reduce noise levels, rigid pipes with short flexible hoses sections are recommended (suction and return hoses, delivery and drain hoses respectively for pumps and motors plus a bleed hose). Suction and drainage hoses should be as short and straight as possible. Ensure that pressure drops in lines are not caused by couplings, elbows and differences in diameter, particularly in suction hoses.

Where rigid pipes are used, ensure that the pipes do not put stresses on the piston unit ports. All lines connected to the tank (suction, return and drainage lines) should be immersed at least 200 mm [7.80 in] below the minimum oil level and at least 150 mm [5.85] in from the bottom of the tank.

3. Minimum suction pressure
Whatever the position and angle of installation, ensure that the pressure at the pump suction intake is never less than 0.8 bar [11.6 psi] (absolute value) regardless if the circuit is open or closed. Lower pressures lead to cavitation and cause damage to the pump. See installation manuals for further guidelines.

4. Dimensioning lines (guidelines)
As stated previously, the minimum absolute pressure in suction line should never be below 0.8 bar (abs). To achieve this, the fluid velocity in the suction line must be kept as low as possible. Moreover, the pressure and drain lines should also be dimensioned in such a way to keep the pressure drop across them limited.
Recommended ranges for the fluid velocity in relation to the service are shown in the table below.

Service	**Fluid velocity** m/s
Suction / intake	0.6 ÷ 1.2
Drain line	1.5 ÷ 4
Pressure lines	2 ÷ 5.5

The lower the fluid velocity is kept, the more efficient and safe the operation of the pump will be. Practical and cost limitations will tell how far to go in this direction. To Calculate fluid velocity (see also Flow - Velocity Nomogram in the following page):

$v = Q \times 21.22 / D^2$

Where:
v = velocity in metres per second (m/sec)
Q = flow rate in litres per minute (l/min)
D = inside diameter of pipe or hose in millimetres (mm)

Example:
if boost pump of an S6CV 75 is (18 cm3/giro [1.09 in3/rev]) and maximum engine speed is 2200 rpm the boost pump output flow will be about 40 l/min [10.56 U.S. gpm].
To avoid cavitation conditions or not fall below 0.8 bar [11.6 psi] absolute pressure in the suction line a 1 m/s fluid velocity is to be considered as acceptable. At 40 l/min [10.56 U.S. gpm] this require a line of 29 mm [1.13 in] minimum inside diameter (1 1/4 G BSPP). An effective solution is to use both FA1 and FA2 ports connected to the selected 1 1/4 G (BSPP) suction line via a T fitting, splitting the line in two (as short as possible) 1 G (BSPP) sections. Always avoid elbows and sharp bends.

When the pump is in neutral the flow above is the amount of flow that will pass through the case drain ports and drain lines. If the pump is working under load the case drain flow can be increased due to external leakage flow peaks. Considering a 8% reduction of pump efficiency under peak loading conditions, the case drain lines can be dimensioned for

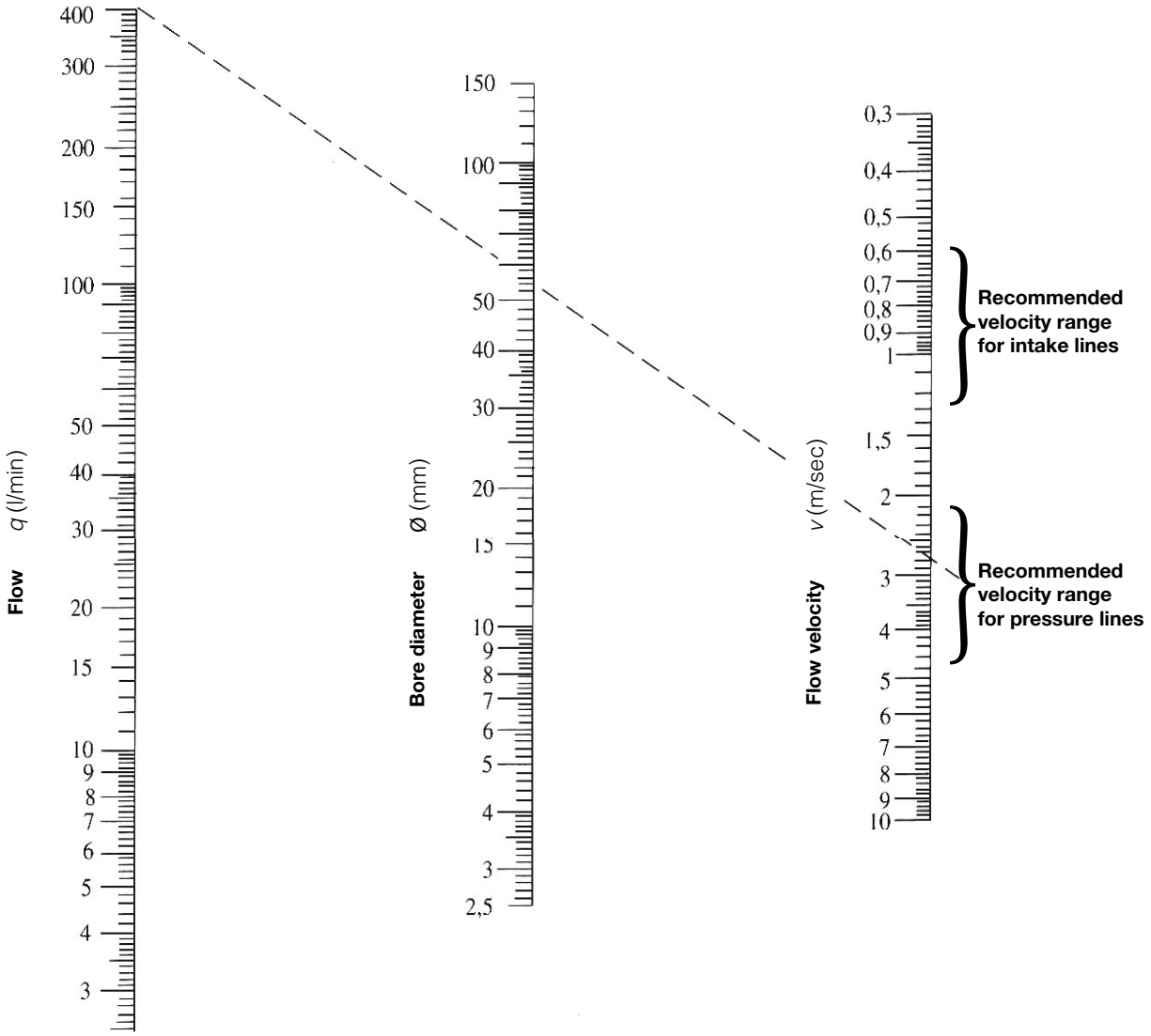
40 + (75 x 2.2 x 0.08) = 53.2 l/min.

This, considering a flow velocity of 3.0 m/s requires a 3/4 G (BSPP) drain line.

As for the pressure lines, the maximum output flow of the S6CV 75 @ 2200 rpm is 165 l/min [43.56 U.S. gpm]. Using an optimum 3.5 m/sec flow velocity the required line diameter should be 30 mm [1.17 in], close to a 1 1/4 G (BSPP) line.

WARNING:
whatever is the theoretical calculation, NEVER use fittings or line diameters lower than the port dimension on the pump. Larger lines are viceversa welcome.

FLOW - VELOCITY NOMOGRAM



5. Drive shaft

Take special care to ensure that the units are correctly flanged and coupled. Ensure that the shaft and flange are lined up ac-curately to prevent additional loads on the shaft bearings. Flexi-ble couplings should be used for pumps. Caution: incorrectly aligned parts significantly reduce the service life of the bear-ings.

6. Installation position

Pumps and motors may be installed both above and below the level of the fluid in the tank, that is, the lowest level of the oil when the system is in use (see note 6 and 7). When the circuits are open, the oil level is influenced by the number and size of any hydraulic cylinders used on the system. In case of mobile installations it is important to take into account the slope of the ground and the effect of centrifugal forces on the oil level.

7. Installation below the tank

Installation below the minimum level of the fluid (or immersed in fluid) does not create particular problems. Where pumps are immersed in the fluid, ensure that the suction intake is at least 200 mm [7.80 in] below the minimum oil level. If the pump is installed vertically with the shaft turned upwards, remove the bearing drain plug to bleed air and also insert a hose which takes the fluid to at least 200 mm [7.80 in] below the minimum oil level.

8. Installation above the tank

Particular care should be taken when installing the units above the tank. Special hoses layout and/or check valves must always be used to prevent the casing from emptying out. Always use the highest drainage outlet and ensure that the hose is shaped so that the casing is constantly filled (to avoid siphon effect). It is advisable to position a pre-loaded check valve in the drain hose (maximum pressure when open: 0.5 bar [7.25 psi]) to pre-vent oil from draining from the casing when the system is not in use (Figure 2). The oil level of the units should be checked at regular intervals. It is essential to check the level if the system is out of service for extended periods of time, since the force of gravity causes oil to drain from the casing. Installing bent axis pumps vertically with the shaft turned up-wards can cause air to build up, preventing the bearings from being lubricated correctly. Where the system is operated continuously at high pressures, it inadvisable to install a special flow circuit for the bearings.

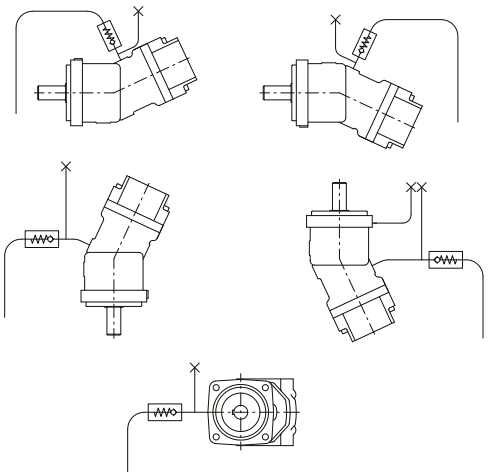


Fig. 2 - Installation above the tank

Special requirement for H1V units when mounted above the tank:

H1V series variable piston pumps must always be installed horizontally with the intake turned upwards. The suc-tion hose should be curved upwards and positioned higher than the pump to prevent fluid from draining from the casing when the machine is out of service (Figure 3) and should have a check valve. Observe the maximum levels shown in Figure 3. Caution: above the reservoir the pump must never be operated with zero displacement; a minimum displacement of 5% of the maximum value is essential.

Warning:

it is a general recommendation to mount all pumps below the tank where possible.

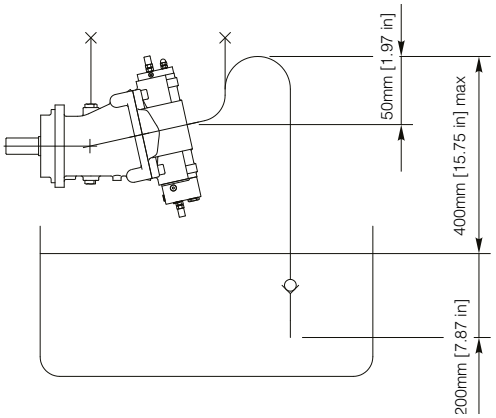


Fig. 3 - H1V installation

9. First starting
Before starting fill the system components with new and filtered oil. In addition fill the pre-cleaned reservoir with the same type of oil. We recommend to flush the circuit. Verify that charge pressure is correct (closed circuits). Restore oil level inside reservoir.

10. Flushing
In case bent axis design axial piston motors and bent axis design axial piston pumps for open circuit are installed with shaft turned upwards, and/or in case of high oil temperature inside the tank (>50°), and/or in case units are used for a long operation time at high pressures (>250 bar [>3625 psi]), it is recommended to flush motor/pump bearings, by using oil at equal or lower temperature than the tank one. Flush the bearing through the port R (Figure 4).

Warning:
H1V pumps with constant pressure control (PC, CR, PI+PC etc.) must be always flushed in case of zero stroke operation for more than 5 min. and a working pressure higher than 250 bar [3626 psi]. In this case it is recommended the use of both the R and S1 or S2 ports (Figure 4).

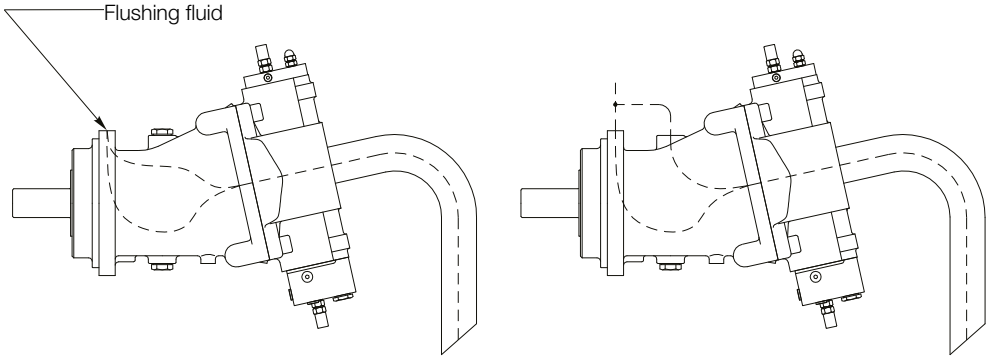


Fig. 4 - Bearing flushing

11. Closed loop flushing procedure
After the first starting is completed, the flushing must be done. This procedure applies to brand new machines, after a major maintenance work or when the pressure lines between pump and motor have been changed or disconnected. This procedure is mandatory to remove any presence of contaminant in hoses, pipes and fittings. Both pump and motor will function even if the flushing procedure is not performed, but the service life of both could be seriously reduced. To flush the closed loop it must be used an in line filter with suitable pressure and flow rate rating. The filter element must be preferably 4μm absolute - 10μm absolute can be used as an alternative. Since the filter has only one possible flow direction, the pump control must be operated to achieve the correct flow direction (if one it's not sure of it, check the highest pressure side between A or B: this will be the output flow side!). The in line filter can be mounted in two different position on option (see figure 5):

A Connecting the pressure lines of the motor to the filter.
B Connecting the filter on the return line before the oil goes back to the pump and by passing the motor by the means of an additional hose (preferable solution).

The flushing can be stopped as the oil contamination level in the closed loop according to ISO 4406:1999 is at least conformal to the values shown in "Recommended contamination levels" of page A/9 or lower. The same maximum acceptable oil contamination level applies to the whole circuit. When the flushing is completed, the in line filter and the eventual auxiliary hoses must be removed to configure the circuit to the design layout. After the circuit has been restored to the design layout, the machine can be tested under load, and the eventual pressure adjustments and final tests can be done.

Circuit example

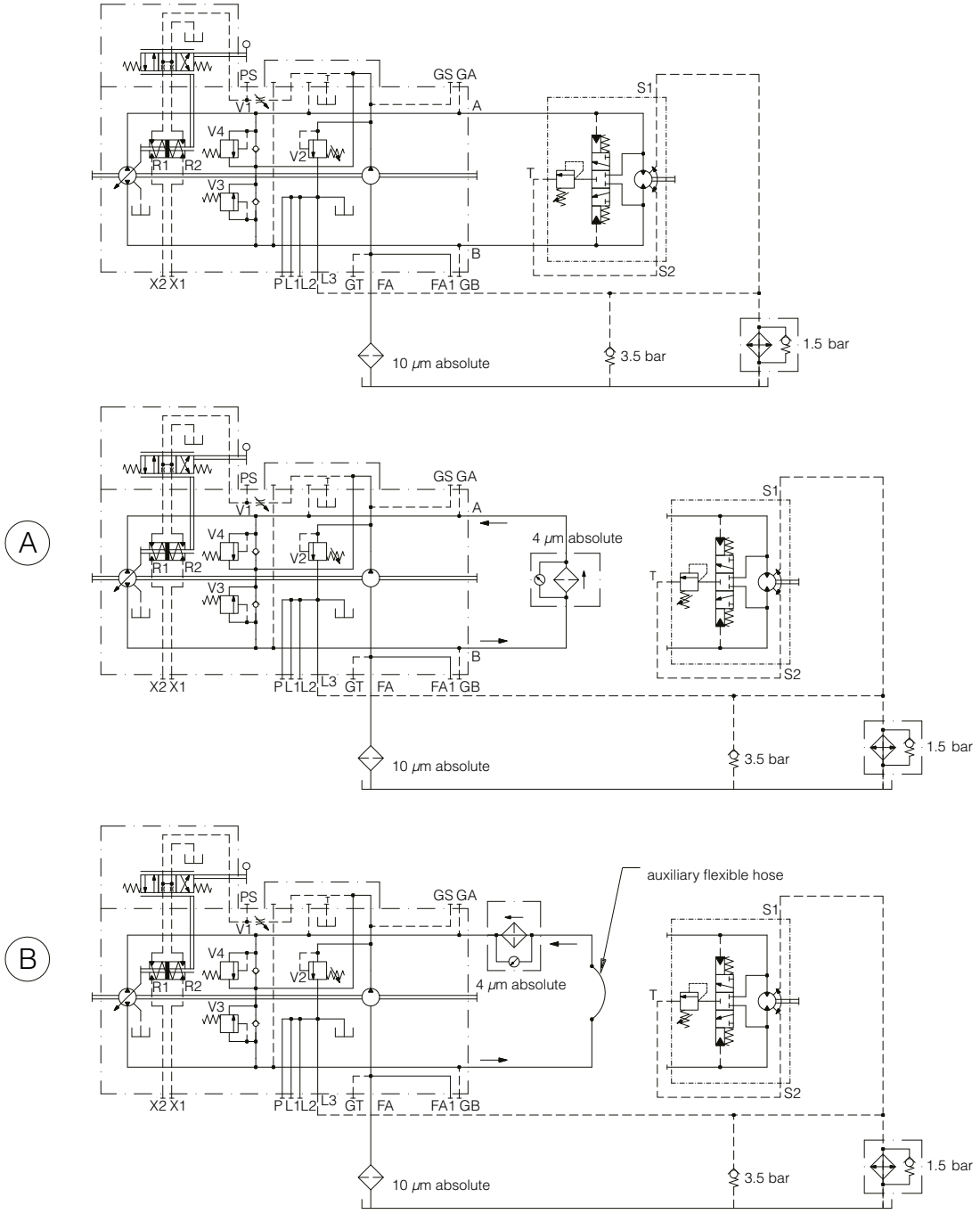


Fig. 5 - Closed circuit cleaning

12. Maintenance

First oil change to be made after approximately 500 hours of operation. Filter cartridge must be replaced first time after 50 hours for preliminary circuit cleaning and then every 500 hours. Subsequent oil change every 2000 hours.
Such intervals should be reduced when the filter clogging indicator shows that the cartridge is clogged or when the system works in a heavily polluted environment and/or at high temperatures and/or high pressure.

Pump: Nominal values calculation

Output flow

$$Q = \frac{V_g \times n \times \eta_v}{1000}$$

Drive torque

$$M = \frac{\Delta p \times V_g}{62.8} \times \frac{1}{\eta_{hm}}$$

Driver power

$$W = \frac{M \times n}{9550} = \frac{Q \times \Delta p}{600} \times \frac{1}{\eta_t}$$

Motors: Nominal values calculation

Input flow

$$Q = \frac{V_g \times n}{1000} \times \frac{1}{\eta_v}$$

Output torque

$$M = \frac{\Delta p \times V_g \times \eta_{hm}}{62.8}$$

Output power

$$W = \frac{M \times n}{9550} = \frac{Q \times \Delta p \times \eta_t}{600}$$

Output speed

$$n = \frac{Q \times 1000 \times \eta_v}{V_g}$$

V_g = geometrical displacement (cm^3/rev)
Δp = drop of pressure (bar)
n = speed (rpm)
Q = flow (l/min)
M = torque (Nm)
W = power (kW)
η_v = volumetric efficiency
η_{hm} = mech-hyd. efficiency
η_t = overall efficiency ($\eta_t = \eta_v \cdot \eta_{hm}$)

Conversion factors

The following table shows the conversion factor from the Metric system to English (or American) system for the main units used in hydraulics.

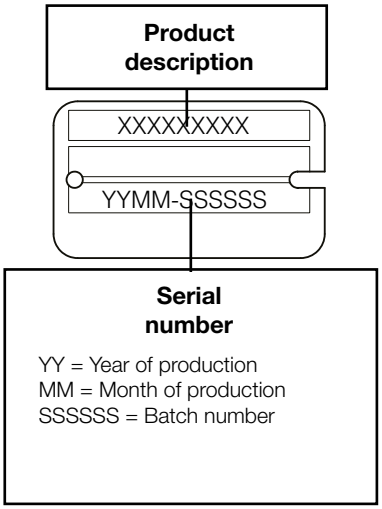
	to convert		multiply by	to convert		multiply by
	from	**to**		**from**	**to**	
length	mm	in	0.039	in	mm	25.4
capacity	l	gal	0.219	gal	l	4.546
mass	kg	lb	2.204	lb	kg	0.4536
force	N	lbf	0.225	lbf	N	4.45
torque	N·m	lbf·ft	0.737	lbf·ft	N·m	1.357
pressure	bar	psi	14.5	psi	bar	0.06895
flow	l/min	U.S. gpm	0.264	U.S. gpm	l/min	3.79
power	kW	hp	1.34	hp	kW	0.746
rotation speed	giri/min	r.p.m.	1	r.p.m.	giri/min	1
displacement	cm^3/giro	in^3/rev	0.061	in^3/rev	cm^3/giro	16.387
temperature	°C	°F	1.8x°C+32	°F	°C	(°F-32)/1.8

Data plate

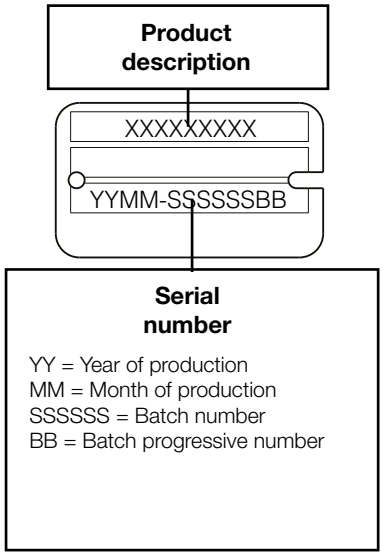
Each Dana AXIAL products are supplied with an identification data plate. The full identification of the product is made only through the serial number. Every request of information must quote this number.

OLD SOLUTION

FIXED DISPLACEMENT UNITS

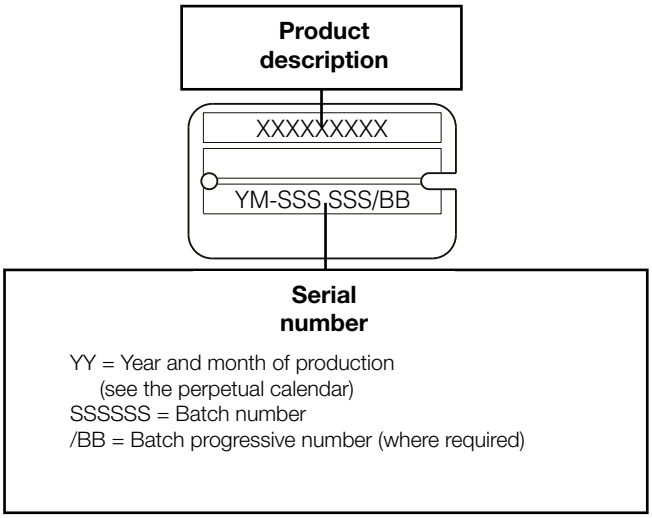


VARIABLE DISPLACEMENT UNITS

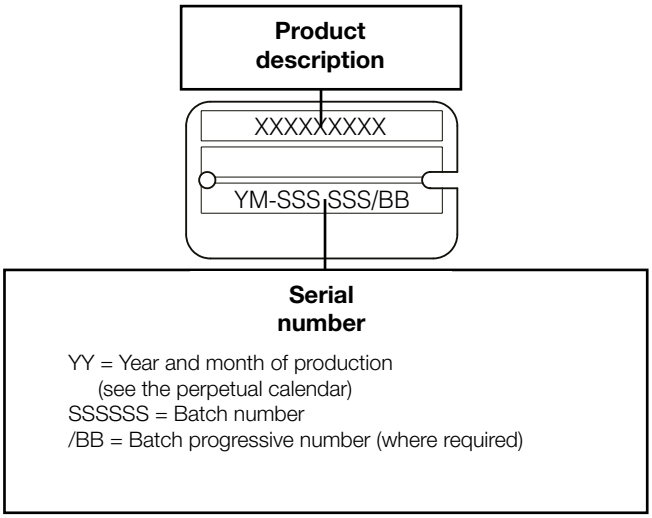


OLD SOLUTION

FIXED DISPLACEMENT UNITS

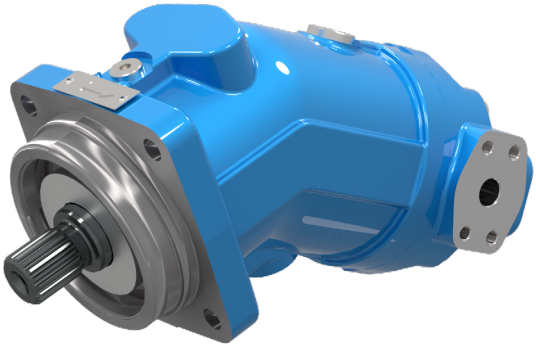


VARIABLE DISPLACEMENT UNITS



DANA BREVINI® Motion Systems





Index

General information - Features B2
Technical data B5
SH11C 010-016 Fan motors B6
Ordering code B7
Dimensions ISO 4 Bolts flange B13
Dimensions SAE B 2 Bolts flange B19
Other caratteristics B25

Type	Displacement cm³/rev [in³/rev]	Max. flow l/min [U.S. gpm]	Max pressure bar [psi]	Max peak pressure bar [psi]
SH11C 010	10.3 [0.626]	82 [21.66]	430 [6235]	480 [6960]
SH11C 016	16 [0.976]	128 [33.81]	430 [6235]	480 [6960]
SH11C 020	19.9 [1.213]	125 [33.00]	430 [6235]	480 [6960]
SH11C 030	31.9 [1.945]	201 [53.06]	430 [6235]	480 [6960]
SH11C 045*	46 [2.807]	257 [67.89]	430 [6235]	480 [6960]
SH11C 055	56.35 [3.437]	282 [74.45]	430 [6235]	480 [6960]
SH11C 063	63.26 [3.859]	316 [83.42]	430 [6235]	480 [6960]
SH11C 075	77.82 [4.747]	350 [92.4]	430 [6235]	480 [6960]
SH11C 090	86.23 [5.26]	388 [102.5]	430 [6235]	480 [6960]
SH11C 108	108.4 [6.612]	433 [114.31]	430 [6235]	480 [6960]
SH11C 125	124.8 [7.613]	500 [132.00]	430 [6235]	480 [6960]
SH11C 160	163.9 [9.998]	590 [155.76]	430 [6235]	480 [6960]
SH11C 180	178.1 [10.864]	641 [169.22]	430 [6235]	480 [6960]

*: Under development

SH11C motors are a family of fixed displacement, bent axis piston motors for operation in both open and closed circuit.
The proven design incorporating the lens shape valve plate, the high quality components and manufacturing techniques make the SH11C motors to able provide up to 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak performance.
Fully laboratory tested and field proven, these units provide maximum efficiency and longlife. Heavy duty bearings permit high radial and axial loads.
Versatile design includes a variety of port plates, shaft ends and valves packages that will fit the SH11C motors to any application both industrial and mobile. SH11C motors are available in both ISO and SAE version.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m² [lbf·ft²]	Moment of inertia
m	kg [lbs]	Weight
n_{max}	rpm	Maximum speed
p_{max}	bar [psi]	Maximum continuous pressure
p_{peak}	bar [psi]	Maximum pressure peak

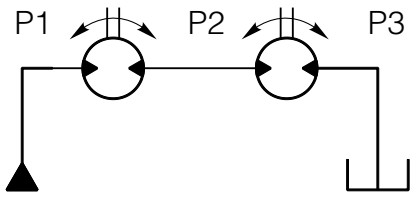
Q_{max}	l/min [U.S. gpm]	Maximum flow
Q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{max}	Nm [lbf.ft]	Maximum torque at pressure continuous
T_{peak}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm³/rev [in³/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed, for different types of viscosity please contact Dana. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷ 15 cSt is allowed for extreme operating conditions and for short periods only.

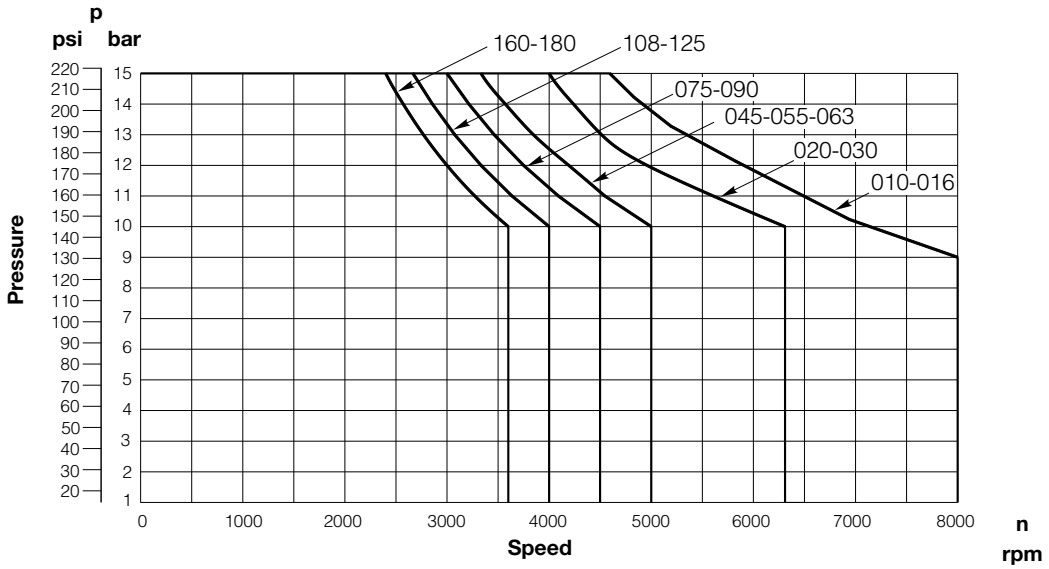
Temperature ranges:
The operating temperature of the oil must be within -25ºC÷ 115ºC [-13ºF ÷ 239ºF]. For applications with lower temperatures please contact Dana.

Filtering:
A correct filtering is essential for long and satisfactory life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999.

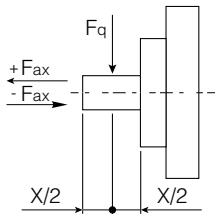
Operating pressure:
The maximum permissible pressure on pressure ports is 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak. If two motors are connected in series, total working pressure P1+P2 has to be limited 700 bar max. [10150 psi].



Case drain pressure:
Maximum permissible case drain pressure is 10 bar [145 psi]. A higher pressure can damage the main shaft seal or reduce its life.



Output shaft:
Table is a guide to determine max. permissible loads. Values are calculated in such a way to assure at least 80% of the bearing operating life where no external load is applied. The published values are related to loads applied in the middle of shaft and in the least favourable direction.

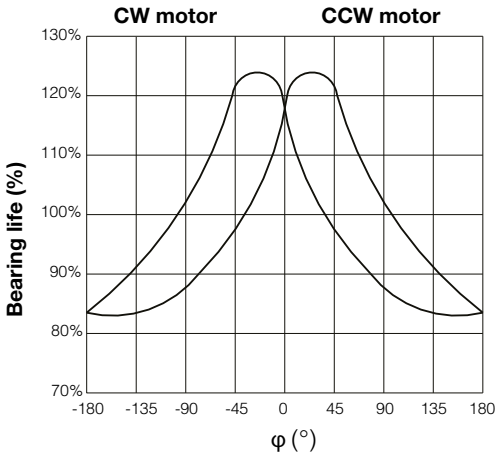


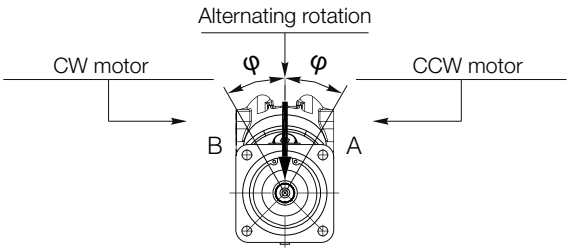
				Size												
				010	016	20	30	045*	55	63	75	90	108	125	160	180
Radial load	$F_{q\ max}$	N [lbf]		3000 [674.4]	3200 [719.4]	4300 [967.5]	6100 [1372.5]	8350 [1877.2]	9200[1] [2068]	10300[1] [2317.5]	11500[1] [2587.5]	12900[1] [2902.5]	13600[1] [3060]	15900[1] [3577.5]	18400[1] [4140]	20600[1] [4635]
Load		N/bar [lbf/psi]		8.5 [0,128]	9 [0,135]	12 [0.18]	19 [0.285]	23.8 [0,357]	25 [0.375]	30 [0.45]	25.7 [0.386]	28.5 [0.428]	35 [0.525]	37 [0.555]	41 [0.615]	45 [0.675]
Axial pulling load	$F_{ax\ max}$	N [lbf]	250 bar [3625 psi]	550 [123.6]	850 [191.1]	1000 [225]	1300 [292.5]	1740 [391.2]	1920 [432]	2150 [484]	2300 [517.5]	2800 [630]	2900 [652.5]	3300 [742.5]	3800 [855]	4050 [911.2]
			350 bar [5075 psi]	800 [179.8]	1050 [236.0]	1300 [292.5]	1800 [405]	2400 [539.5]	2650 [596]	2990 [673]	3550 [798.75]	3800 [855]	4050 [911.25]	4550 [1023.7]	5300 [1192.5]	5800 [1305]
Axial pushing load	$F_{ax\ max}$	N [lbf]	< 100 bar [< 1450 psi]	320 [71.9]	320 [71.9]	500 [112.5]	500 [112.5]	800 [179.8]	800 [180]	800 [180]	1000 [225]	1000 [225]	1250 [281.25]	1250 [281.25]	1600 [360]	1600 [360]
			> 100 bar [> 1450 psi]	3 [0,045]	3 [0,045]	5 [0.075]	5 [0.075]	8.7 [0,131]	9 [0.135]	9 [0.135]	12 [0.18]	12 [0.18]	13 [0.195]	13 [0.195]	17 [0.255]	17 [0.255]

* : under development
1) : in the following table, values of Fq_{max} for the output shafts

			Max permissible radial force on the shaft:			
			SAI (SH11C 055-063)	**SAM (SH11C 075-090)**	**SAO (SH11C 108-125)**	**SAP (SH11C 160-180)**
Radial load	$F_{q\ max}$	N [lbf]	6500 [1462.5]	6500 [1462.5]	6500 [1462.5]	6500 [1462.5]

When an external side (radial) load is applied to the drive shaft, the bearing life will vary accordingly to the magnitude, location and direction of the load. The diagram shows how the bearing operating life varies versus the direction of the load. In the diagram 100% represents the bearing operating life where no external side load is applied to the drive shaft.





The bearing operating life increases up to 30% when the load is applied with some peculiar directions and the maximum increase is dependent on the operating pressure and the nominal size of the unit.
When considering the permissible axial force, the force - transfer direction must be taken in account:

- Pushing axial loads increase the bearing life.
- Pulling axial loads reduce the bearing life (if possible pulling axial loads should be avoided).

Seals:
Seals used on SH11C series are of FKM (Fluoroelastomer). In case of use of special fluids, contact Dana.

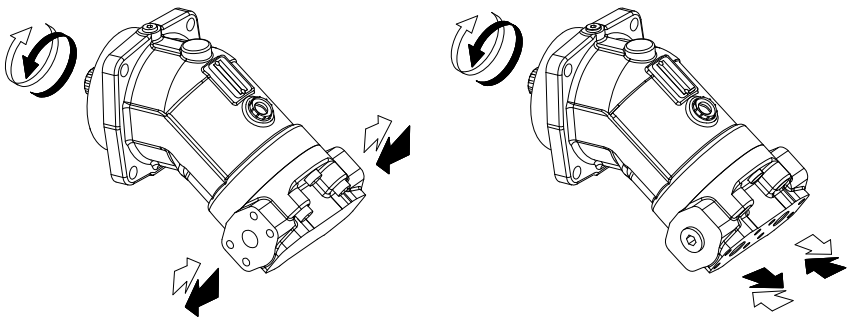
Minimum rotating speed:
No limit to Minimum speed; if uniformity of rotation is required, speed must not be less than 50 rpm. In case of use of special applications, contact Dana.

Installation:
SH11C series motors can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. For further details see on the General Information Catalogue, the section “General installation guidelines”.

Flangeable valves:
Flangeable valves are available for motors both in open and closed loop. For more information see the catalogue Axial Valves.

Flushing valves:
The motors can be equipped with flushing valves.
The mount the flushing valve on motors, it is necessary to use a special port cover. For more information see the catalogue Axial Valves.

Relation between direction of rotation and direction of flow:
The relation between direction of rotation of shaft and direction of flow in SH11C piston units is shown in the picture below.



Reversible motor

			Size												
			010	016	20	30	045*	55	63	75	90	108	125	160	180
Displacement	V_g	cm^3/rev [in^3/rev]	10.3 [0.626]	16 [0.976]	19.9 [1.213]	31.9 [1.945]	46 [2.807]	56.35 [3.437]	63.26 [3.859]	77.82 [4.747]	86.23 [5.26]	108.4 [6.612]	124.8 [7.613]	163.9 [9.998]	178.1 [10.864]
Max. pressure	p_{max}	bar [psi]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]
Max. peak pressure	p_{peak}	bar [psi]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]
Max. speed	n_{max}	rpm	8000	8000	6300	6300	5600	5000	5000	4500	4500	4000	4000	3600	3600
Max. flow	Q_{max}	l/min [US gpm]	82 [21.66]	128 [33.81]	125 [33]	201 [53.06]	257 [67.89]	282 [74.45]	316 [83.42]	350 [92.4]	388 [102.5]	433 [114.31]	500 [132]	590 [155.76]	641 [169.22]
Max. power at p_{max}	P_{max}	kW [hp]	59 [79.1]	92 [123.4]	90 [120.6]	144 [192.96]	184 [246.7]	202 [270.68]	226 [302.84]	251 [336.34]	278 [372]	310 [415.4]	358 [479.72]	423 [566.82]	459 [615.06]
Torque costant	T_k	Nm/bar [lbf.ft/psi]	0.16 [0.008]	0.25 [0.013]	0.3 [0.015]	0.5 [0.025]	0.73 [0.037]	0.9 [0.045]	1 [0.05]	1.2 [0.06]	1.4 [0.07]	1.7 [0.085]	2 [0.1]	2.6 [0.13]	2.8 [0.14]
Max. torque at p_{max}	T_{max}	Nm [lbf.ft]	71 [52.36]	110 [81.13]	136 [100.23]	218 [160.66]	315 [232.33]	386 [284.48]	433 [319.12]	533 [392.82]	590 [435.13]	742 [546.85]	855 [630.13]	1122 [826.91]	1219 [898.40]
Max peak torque at p_{peak}	T_{peak}	Nm [lbf.ft]	79 [58.27]	122 [89.98]	152 [112.02]	244 [179.82]	352 [260.36]	431 [317.65]	484 [356.71]	595 [438.51]	659 [486.05]	829 [610.97]	954 [703.10]	1253 [923.46]	1361 [1003.06]
Moment of inertia (1)	J	$kg \cdot m^2$ [$lbf.ft^2$]	0.0005 [0,0118]	0.0005 [0,0118]	0.001 [0.0235]	0.001 [0.0235]	0.004 [0.094]	0.004 [0.094]	0.004 [0.094]	0.007 [0.1645]	0.007 [0.1645]	0.012 [0.2820]	0.012 [0.2820]	0.022 [0.5170]	0.022 [0.5170]
Weight (1)	m	kg [lbs]	6 [13.22]	6 [13.22]	10 [22.04]	10 [22.04]	18 [39.68]	19 [41.876]	19 [41.876]	23.7 [52.23]	23.7 [52.23]	35 [77.14]	35 [77.14]	48 [105.79]	48 [105.79]
External drain flow (2)	Q_d	l/min [US gpm]	0.8 [0.2113]	0.8 [0.2113]	1 [0.264]	1 [0.264]	1.2 [0.317]	1.2 [0.317]	1.2 [0.317]	2.5 [0.66]	2.5 [0.66]	3 [0.79]	3 [0.79]	3 [0.79]	3 [0.79]

*: Under development
1) Approximate values.
2) Average values at 250 bar [3625 psi] with mineral oil at 45°C [113°F] and 35 cSt of viscosity.

Theorical values, without considering η_{hm} and η_v approximate values. Peak operations must not exceed 1% of every minute.
A simultaneous maximum pressure and maximum speed not recommended.

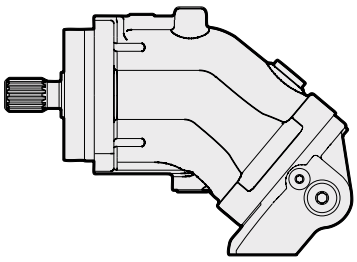
SH11C 010-016 Fan motors

SH11C 10-16 cc motors are common in fan application. Typical need of this application are built-in check valve in anti-cavitation function.

The fan motor can work safely at very high speed without reliability problems thanks to anti-cavitation valve. When the flow to the motor is shut off and the motor is rotating at high speed, the anti-cavitation valve will open and direct flow to the motor inlet port. To execute this function, it is necessary that sufficient return port back pressure is available. If the inlet pressure is insufficient, motor cavitation will be experienced.

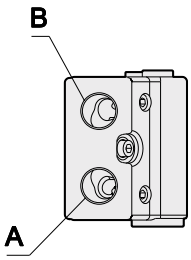
A back pressure, in an open circuit, can be created by a counter pressure valve through the line to the tank; if possible, it should be pilot operated to minimize power losses. A back pressure of about 8÷10 bar is sufficient in most applications.
Ordering code due to the built-in anti-cavitation valve, the direction of rotation of the motor must be specified when ordering the motor.

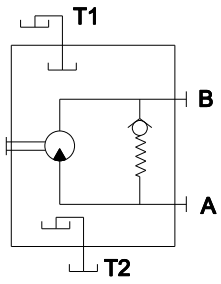
Typical applications
- Head exchangers
- Air seeders
- Blowers



Clockwise

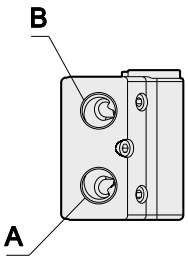
Rear cover VMD

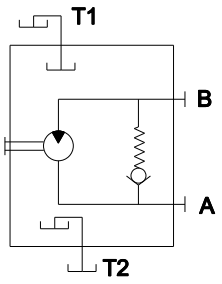




Counter Clockwise

Rear cover VMS





A - B Service ports

T1 - T2 Drain ports

The following alphanumeric codes system has been developed to identify all of the configuration options for the SH11C motors. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Series	Motor	Size	Version	Mount flange	Shaft end	Port cover	Direction of rotation	Seal	Valve	Valve feature	Flushing valve	Special feature	Painting
SH11C	M	030	ME	OC	CMB	LM1	RV	V	VCDM	000	06	03	01

1

Series	
SH11C	Fixed displacement, bent axis, axial piston unit

2

Motor	
M	Motor

3

Size		
010	10.3 cm^3/rev	[0.626 in^3/rev]
016	16 cm^3/rev	[0.976 in^3/rev]
020	19.9 cm^3/rev	[1.213 in^3/rev]
030	31.9 cm^3/rev	[1.945 in^3/rev]
045*	46 cm^3/rev	[2.807in^3/rev]
055	56.35 cm^3/rev	[3.437 in^3/rev]
063	63.26 cm^3/rev	[3.859 in^3/rev]
075	77.82 cm^3/rev	[4.747 in^3/rev]
090	86.23 cm^3/rev	[5.260 in^3/rev]
108	108.4 cm^3/rev	[6.612 in^3/rev]
125	124.8 cm^3/rev	[7.613 in^3/rev]
160	163.9 cm^3/rev	[9.998 in^3/rev]
180	178.1 cm^3/rev	[10.984 in^3/rev]

*** :** under development

4

Version	
ME	ISO
SE	SAE

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	M	030	ME	OC	CMB	LM1	RV	V	VCDM	000	06	03	01

5

Mount flange		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
OA	ISO 4 holes Ø 80 mm [Ø3.15 in]	ME	–	–	–	–	–
OB	ISO 4 holes Ø 100 mm [Ø3.937 in]	–	ME	–	–	–	–
OC	ISO 4 holes Ø 125 mm [Ø4.921 in]	–	–	ME	–	–	–
OD	ISO 4 holes Ø 140 mm [Ø5.511 in]	–	–	–	ME	–	–
OE	ISO 4 holes Ø 160 mm [Ø6.299 in]	–	–	–	–	ME	–
OF	ISO 4 holes Ø 180 mm [Ø7.086 in]	–	–	–	–	–	ME
02	SAE-B 2 holes	SE	–	–	–	–	–
05	SAE-C 4 holes	–	SE	SE	SE	–	–
08	SAE-D 4 holes	–	–	–	–	SE	SE

* : under development

1) The ME digit means that the flange in only available for the ISO version.
2) The SE digit means that the flange in only available for the SAE version.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	M	030	ME	OC	CMB	LM1	RV	V	VCDM	000	06	03	01

6

Shaft end		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
CAV	Parallel keyed Ø20 mm k6 [0.787 in k6] Key 6x6x30 [0.23x0.23x1.18]	ME	–	–	–	–	–
CMB	Parallel keyed Ø25 mm k6 [0.984 in k6] Key 8x7x32 [0.31x0.27x1.25]	ME	–	–	–	–	–
CBM	Parallel keyed Ø25 mm k6 [0.984 in k6] Key 8x7x40 [0.31x0.27x1.57]	–	ME	–	–	–	–
CBN	Parallel keyed Ø 30 mm k6 [1.181 in k6] Key 8x7x40 [0.31x0.27x1.57]	–	ME	–	–	–	–
CAW	Parallel keyed Ø 30 mm k6 [1.181 in k6] Key 8x7x50 [0.31x0.27x1.97]	–	–	ME	–	–	–
CBP	Parallel keyed Ø 40 mm k6 [1.574 in k6] Key 12x8x56 [0.47x0.31x2.204]	–	–	–	ME	–	–
CAK	Parallel keyed Ø 40 mm k6 [1.574 in k6] Key 12x8x63 [0.47x0.31x2.48]	–	–	–	–	ME	–
CAJ	Parallel keyed Ø 45 mm k6 [1.772 in k6] Key 14x9x63 [0.55x0.35x2.48]	–	–	–	–	ME–SE	–
CBQ	Parallel keyed Ø 45 mm k6 [1.772 in k6] Key 14x9x70 [0.55x0.35x2.75]	–	–	–	–	–	ME
CAX	Parallel keyed Ø 50 mm k6 [1.968 in k6] Key 14x9x70 [0.55x0.35x2.75]	–	–	–	–	–	ME–SE
CAY	Parallel keyed Ø 35 mm k6 [1.377 in k6] Key 10x8x56 [0.39x0.31x2.204]	–	–	–	ME	–	–
SAF	Splined W20x1.25x30x14x9g DIN 5480	ME	–	–	–	–	–
SAG	Splined W25x1.25x18x9g DIN 5480	ME	ME	–	–	–	–
SAI	Splined W30x2x14x9g DIN 5480	–	ME	ME	–	–	–
SAM	Splined W35x2x16x9g DIN 5480	–	–	ME	ME	–	–
SAO	Splined W40x2x18x9g DIN 5480	–	–	–	ME	ME	–
SAP	Splined W45x2x21x9g DIN 5480	–	–	–	–	ME	ME
SAR	Splined W50x2x24x9g DIN 5480	–	–	–	–	–	ME
C16	Parallel keyed Ø 22.22 mm [0.874 in] Key 6.35x6.25x25.4 [0.25x0.246x1]	–	SE	–	–	–	–
C17	Parallel keyed Ø 31.75 mm [1.25 in] Key 7.93x7.3x40 [0.31x0.287x1.57]	–	–	SE	–	–	–
C18	Parallel keyed Ø 44.45 mm [1.75 in] Key 11.11x9.2x60 [0.43x0.36x2.36]	–	–	–	–	SE	SE
S05	Splined 13T 16/32 DP	SE	SE	–	–	–	–
S12	Splined 14T 12/24 DP	–	SE	SE	SE	–	–
S15	Splined 13T 8/16 DP	–	–	–	–	SE	SE
S16	Splined 23T 16/32 DP	–	–	–	–	SE	–

* : under development

1) The ME digit means that the flange in only available for the ISO version.
2) The SE digit means that the flange in only available for the SAE version.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	M	030	ME	OC	CMB	LM1	RV	V	VCDM	000	06	03	01

7

Port cover		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
LM1	Lateral ports	SE	–	–	–	–	–
LM2	Lateral ports	–	ME–SE	ME–SE	ME–SE	ME–SE	ME–SE
LM3	Lateral ports	ME	ME	ME	–	–	–
FM2	Frontal ports	–	ME–SE	ME–SE	ME–SE	ME–SE	ME–SE
FM3	Frontal ports	ME	ME	ME	–	–	–
VM2	Lateral ports same side	–	ME–SE	ME–SE	ME–SE	ME–SE	ME–SE
VMD	Lateral ports same side with valve CW	ME	–	–	–	–	–
VMS	Lateral ports same side with valve CCW	ME	–	–	–	–	–
VSD	Lateral ports same side with valve CW	SE	–	–	–	–	–
VSS	Lateral ports same side with valve CCW	SE	–	–	–	–	–

* : under development
1) The ME digit means that the flange in only available for the ISO version.
2) The SE digit means that the flange in only available for the SAE version.

8

Direction of rotation (viewed from shaft side)	
RV	Reversible

9

Seal	
V	FKM

10

Valve		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
XXXX	None	•	•	•	•	•	•
VCDM	VCD/M Pilot assisted overcentre valve	–	VM2–FM2	VM2–FM2	VM2–FM2	VM2–FM2	VM2–FM2
VCD1	VCD/1 Pilot assisted overcentre valve	–	–	LM2	LM2	LM2	LM2
VCD2	VCD/2 Pilot assisted overcentre valve	–	–	–	LM2	LM2	LM2
VCR1	VCR1 D/AF Double acting overcentre valve	–	VM2–FM2	–	–	–	–
VCR3	VCR3 Double acting overcentre valve	–	–	VM2–FM2	VM2–FM2	VM2–FM2	VM2–FM2
VU16	VU165 Check valve	–	LM2	–	LM2	–	–
VSD1	SD 120 anti-shock valve	–	–	–	–	–	LM2

*** :** under development
• : Available
The valves are available with ISO port cover only, please contact Technical department for SAE version.
The VM2-FM2-LM2 digits means that the valves are only available with VM2-FM2-LM2 port covers.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	M	030	ME	OC	CMB	LM1	RV	V	VCDM	000	06	03	01

11

Valve feature		Valve							
		XXXX	VCDM	VCD1	VCD2	VCR1	VCR3	VU16	VSD1
000	Feature not necessary	●	–	–	–	–	●	–	–
001	Not Set 30÷350 bar [435 to 5075 psi] (Piloting ratio 6.2:1)	–	–	–	–	●	–	–	–
002	Not Set 0÷350 bar [0 to 5075 psi] (Piloting ratio 2.9:1) - Control of rotation CW	–	–	●	–	–	–	–	–
006	Not Set 0÷350 bar [0 to 5075 psi] (Piloting ratio 2.9:1) - Control of rotation CCW	–	–	●	–	–	–	–	–
004	Not Set 30÷350 bar [435 to 5075 psi] (Piloting ratio 6.2:1) - Control of rotation CW	–	●	–	–	–	–	–	–
005	Not Set 30÷350 bar [435 to 5075 psi] (Piloting ratio 6.2:1) - Control of rotation CCW	–	●(1)	–	–	–	–	–	–
003	Not Set 250÷500 bar [3625 to 7250 psi] (Piloting ratio 13:1) - Control of rotation CW	–	–	–	●	–	–	–	–
007	Not Set 250÷500 bar [3625 to 7250 psi] (Piloting ratio 13:1) - Control of rotation CCW	–	–	–	●	–	–	–	–
008	Not Set (Max setting 350 bar [5075 psi]) Max Flow 65 l/min [17.2 U.S. gpm] Control of rotation CW	–	–	–	–	–	–	●	–
009	Not Set (Max setting 350 bar [5075 psi]) Max Flow 65 l/min [17.2 U.S. gpm] Control of rotation CCW	–	–	–	–	–	–	●	–
014	Not Set (Max setting 350 bar [5075 psi]) Control of rotation CW	–	–	–	–	–	–	–	●
015	Not Set (Max setting 350 bar [5075 psi]) Control of rotation CCW	–	–	–	–	–	–	–	●

• : Available
1) : Not available with VM2 port cover.

Please contact Technical department for valve which requie specific setting.
For the technical specifications see catalogue valves.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	M	030	ME	OC	CMB	LM1	RV	V	VCDM	000	06	03	01

12

Flushing valve		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
XX	None	•	•	•	•	•	•
PR	Arranged for Flushing Valve	–	LM2	LM2	LM2	LM2	LM2
06	VSC/F Flushing valve - 6 l/min [1.58 U.S. gpm]	–	LM2-VM2	LM2-VM2	LM2-VM2	LM2-VM2	LM2-VM2
09	VSC/F Flushing valve - 10.5 l/min [2.77 U.S. gpm]	–	LM2-VM2	LM2-VM2	LM2-VM2	LM2-VM2	LM2-VM2
15	VSC/F Flushing valve - 15 l/min [3.96 U.S. gpm]	–	LM2-VM2	LM2-VM2	LM2-VM2	LM2-VM2	LM2-VM2

*** :** under development
• : Available
It is not possible to combine the flushing valves with valve on table 10. For the technical specifications see catalogue valves.
1) The ME digit means that the flange in only available for the ISO version.
2) The SE digit means that the flange in only available for the SAE version.

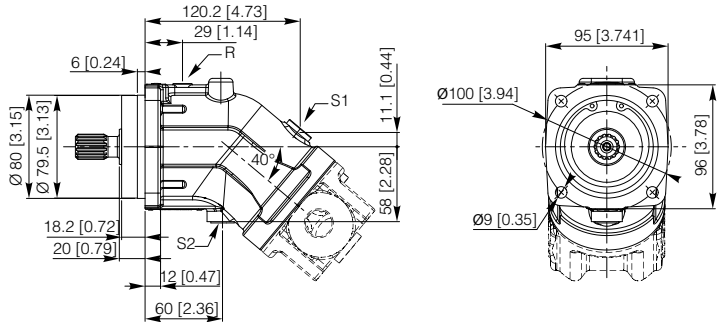
13

Special feature		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
XX	None	•	•	•	•	•	•
03	SAE version with ISO port cover	•	–	• (1)	• (2)	–	• (2)
RD	Drain plugs reversed	–	•	•	•	•	•
TS	Prepared for tachometer sensor	–	•	•	•	•	•
TZ	Tachometer + sensor 2-channel-Hall effect	–	•	•	•	•	•

* : under development
• : Available
1) Available with VM2 port cover
2) Available with FM2 port cover
3) Available only in ME (ISO) version and LM2 port Cover

14

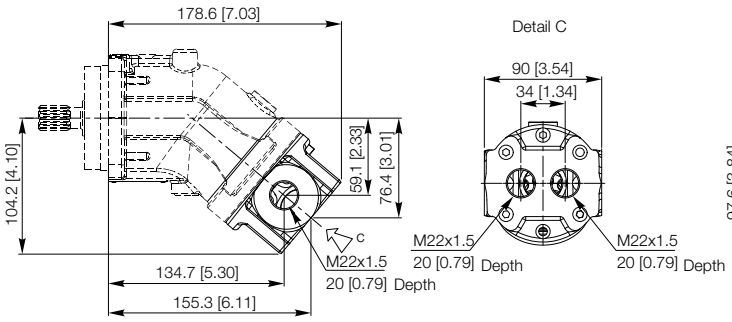
Painting	
XX	None
01	Painted RAL 9005
02	Painted RAL 5015



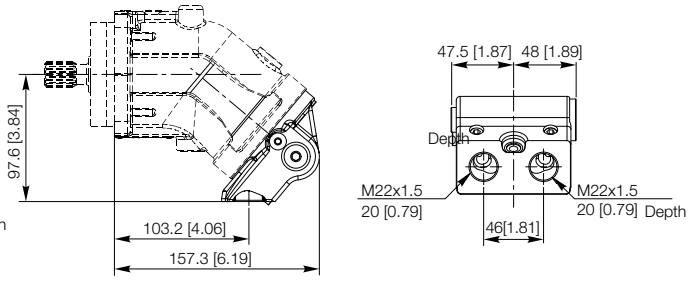
S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

FM3 - LM3

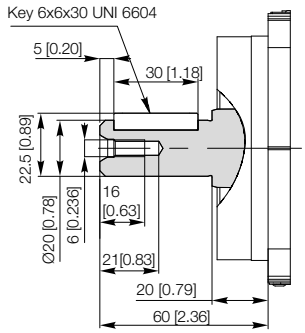


VMD - VMS

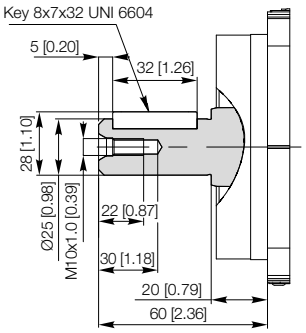


6 Shaft end

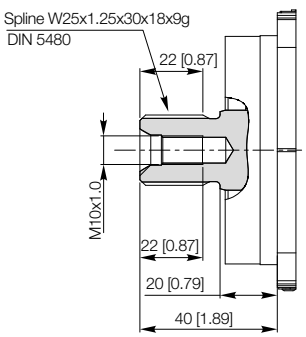
CAV Parallel keyed shaft



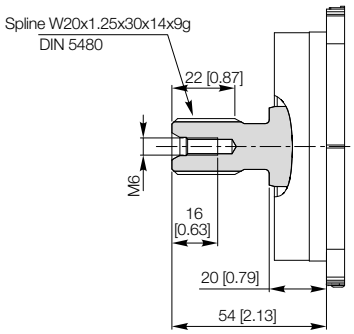
CMB Parallel keyed shaft



SAG Splined shaft

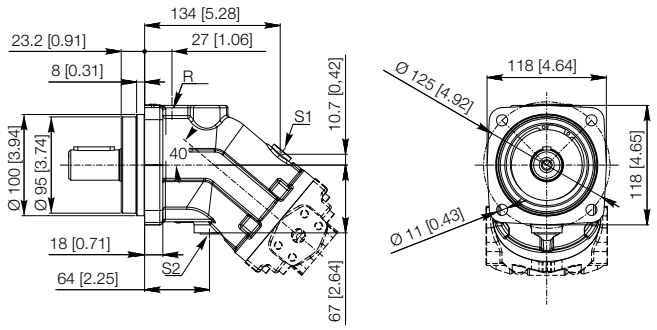


SAF Splined shaft



Dimensions ISO 4 Bolts flange (OA)

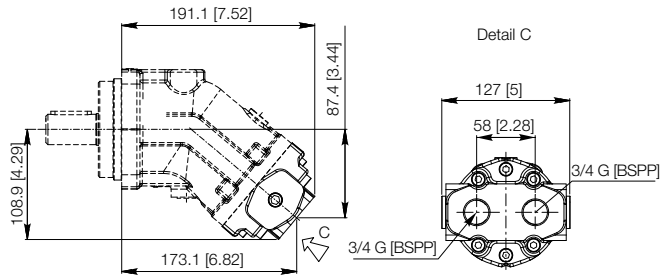
SH11C 020-030 ME



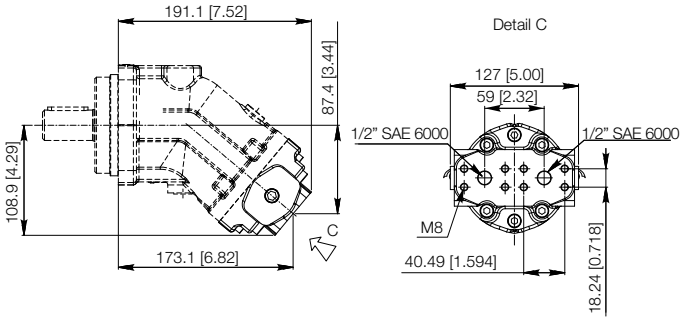
S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

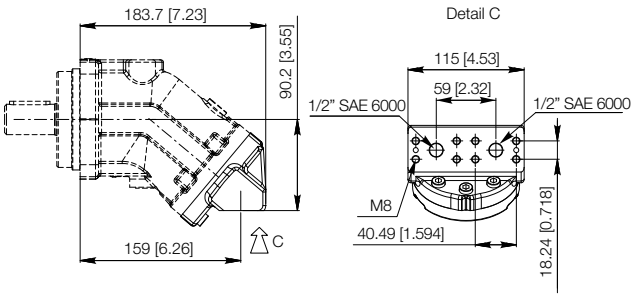
FM3 - LM3



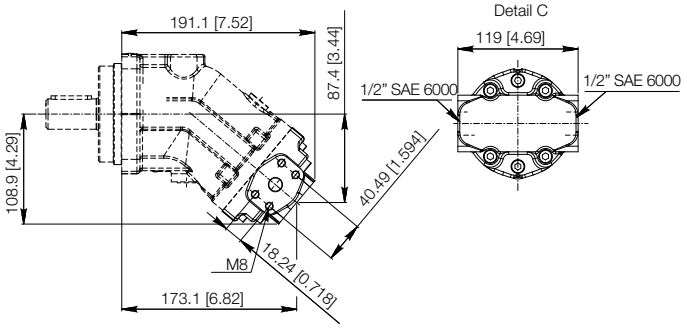
FM2



VM2

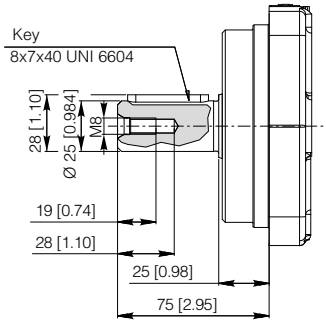


LM2

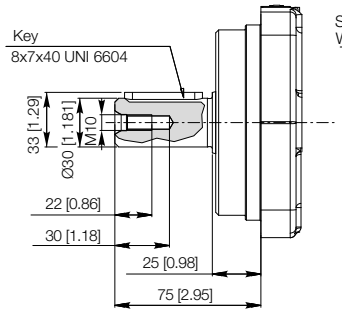


6 Shaft end

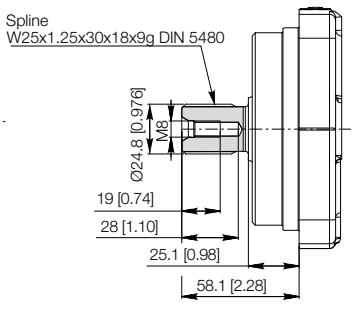
CBM Parallel keyed shaft



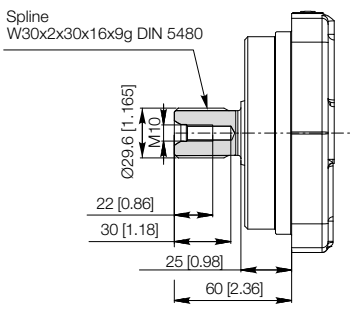
CMN Parallel keyed shaft

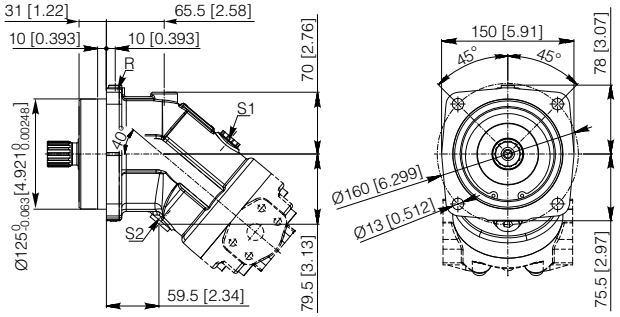


SAG Splined shaft



SAI Splined shaft

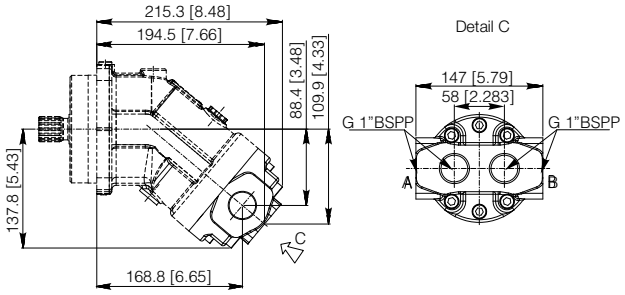




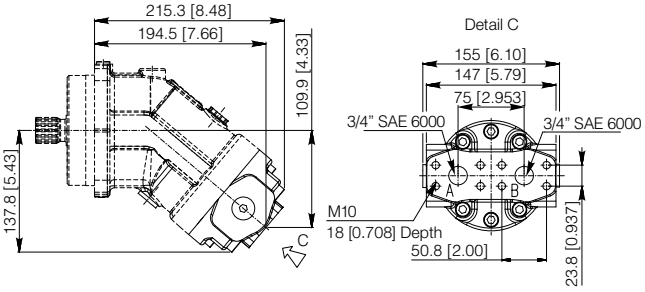
S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

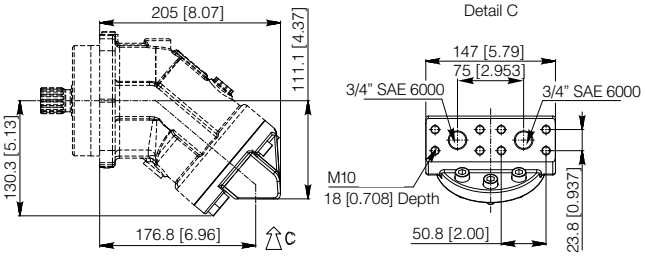
FM3 - LM3



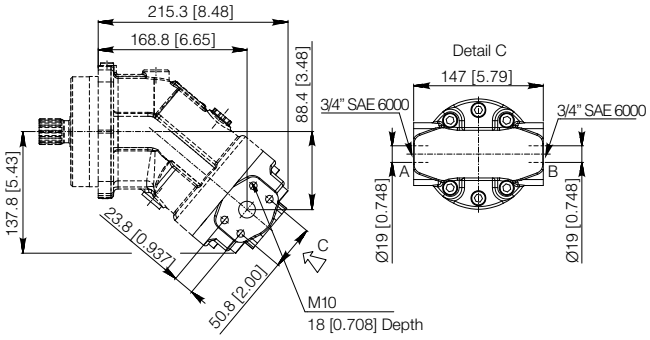
FM2



VM2

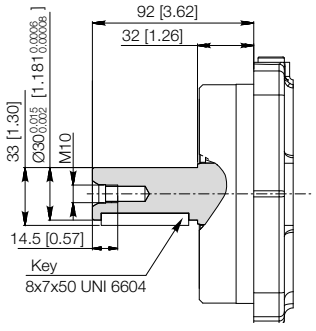


LM2

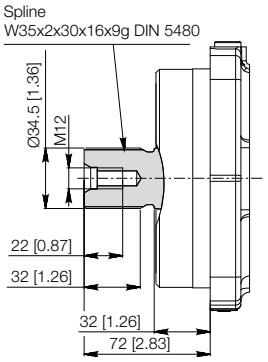


6 Shaft end

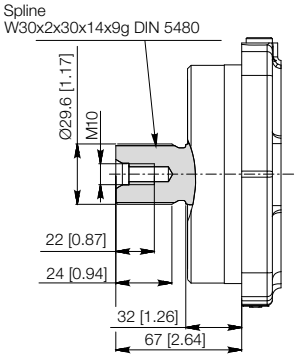
CAW Parallel keyed shaft



SAM Splined shaft

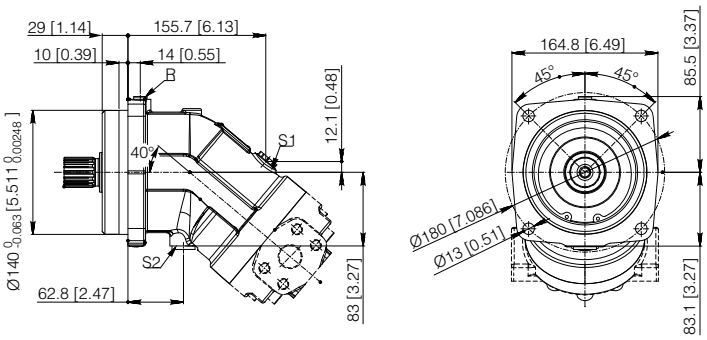


SAI Splined shaft



Dimensions ISO 4 Bolts flange (OD)

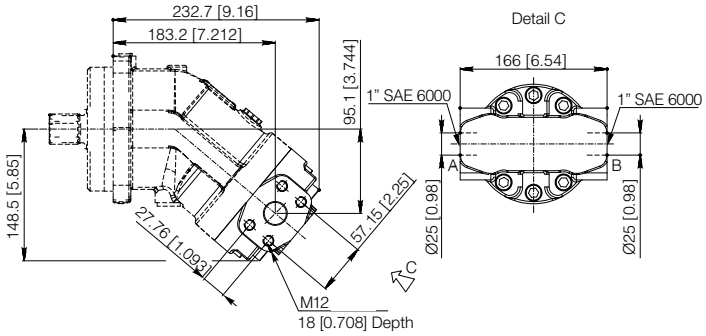
SH11C 075-090 ME



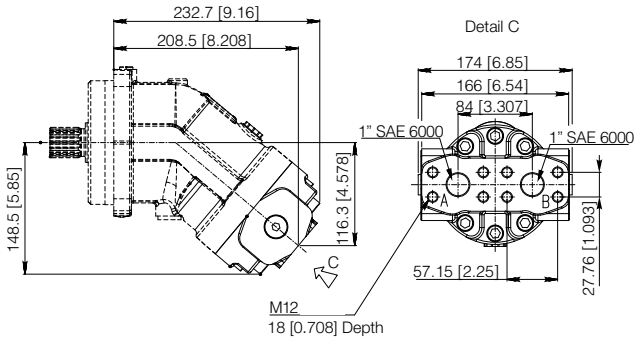
S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

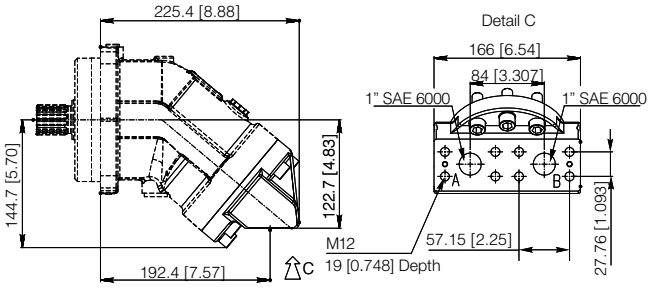
LM2



FM2

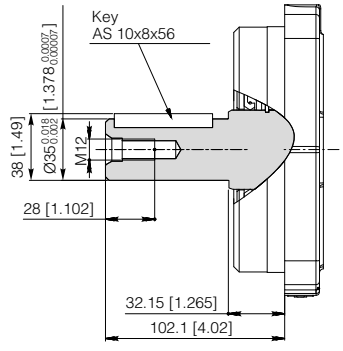


VM2

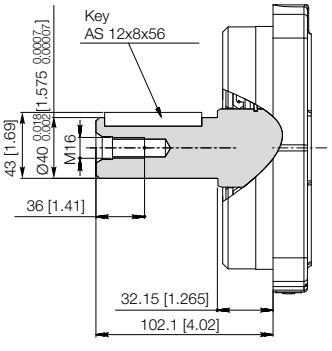


6 Shaft end

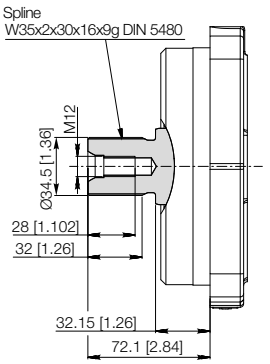
CAY Parallel keyed shaft



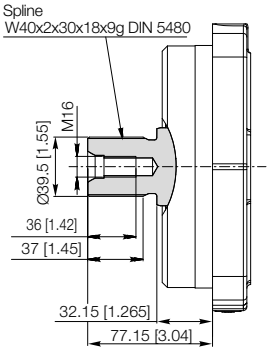
CBP Parallel keyed shaft



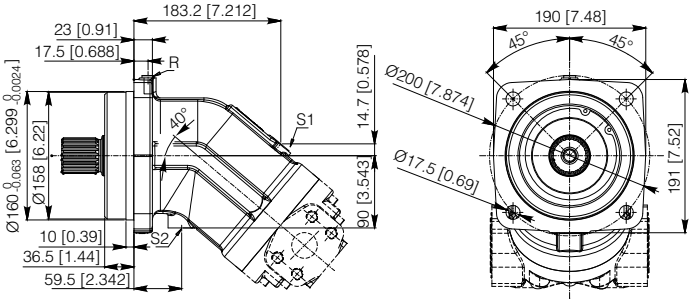
SAM Splined shaft



SAO Splined shaft



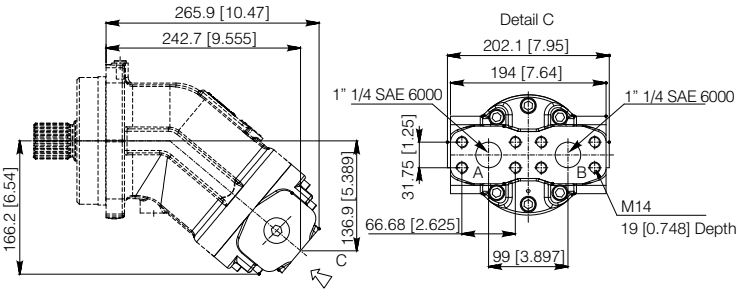
Click DANA button to return to Section Index
Click i button to return to main index



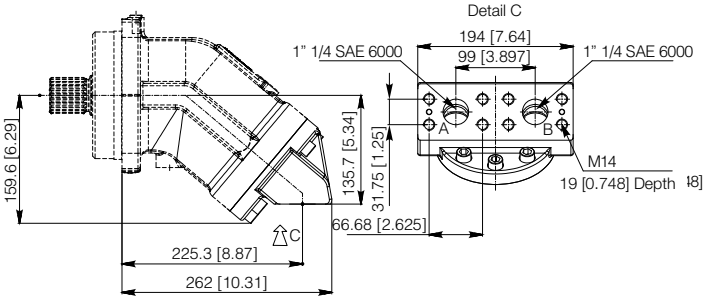
S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

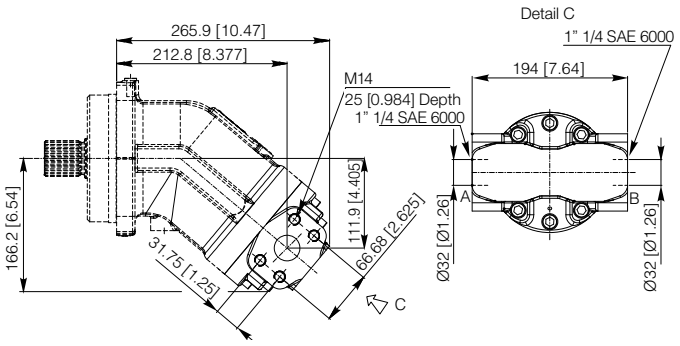
FM2



VM2

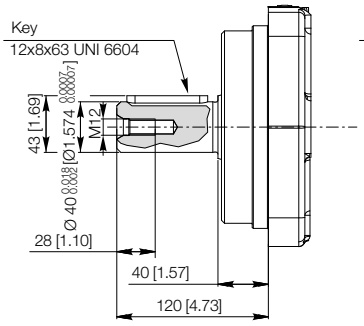


LM2

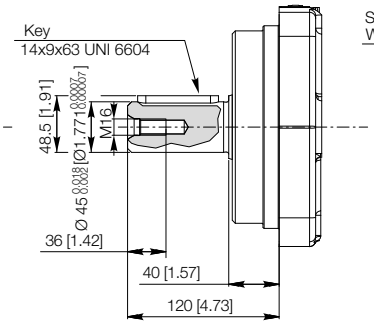


6 Shaft end

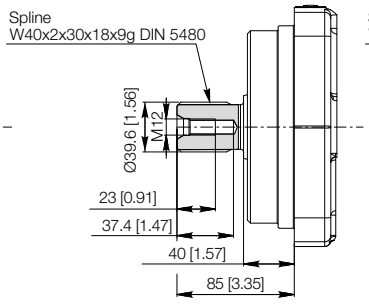
CAK Parallel keyed shaft



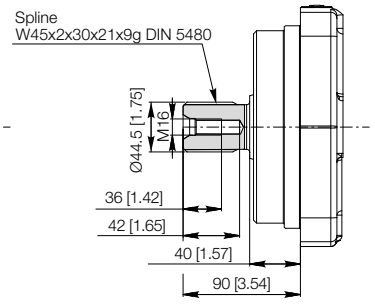
CAJ Parallel keyed shaft



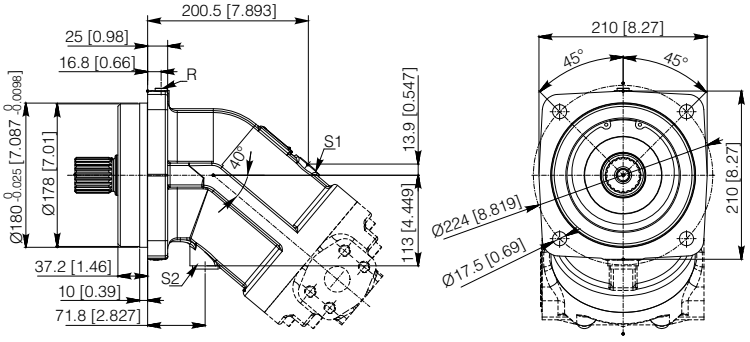
SAO Splined shaft



SAP Splined shaft



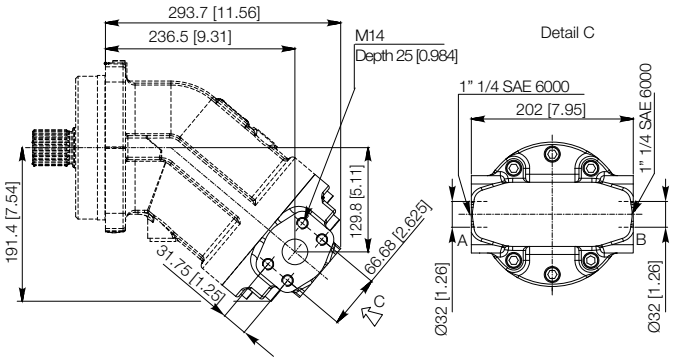
Dimensions ISO 4 Bolts flange (OF) — SH11C 160-180 ME



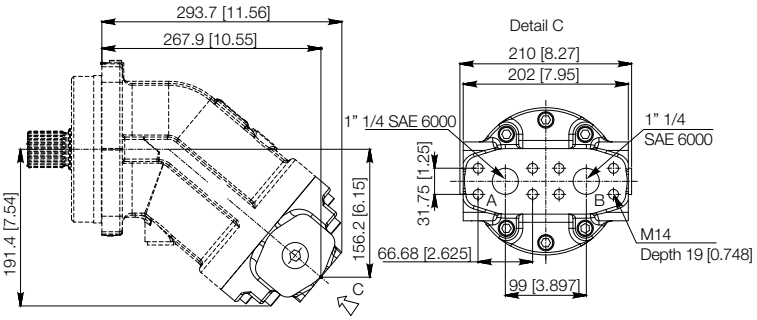
S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

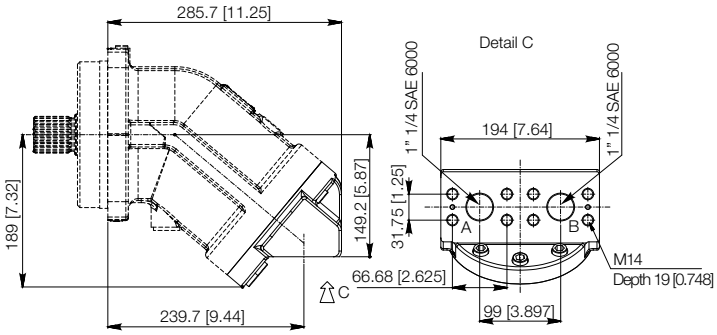
LM2



FM2

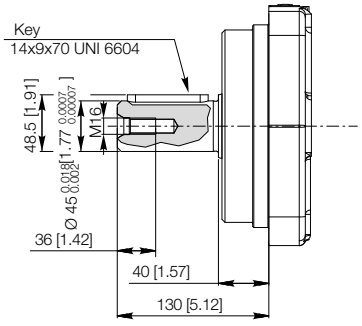


VM2

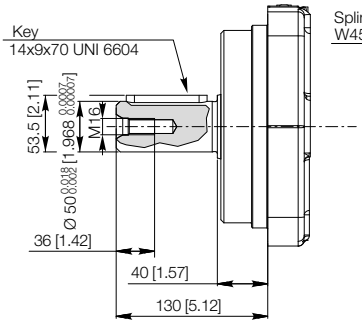


6 Shaft end

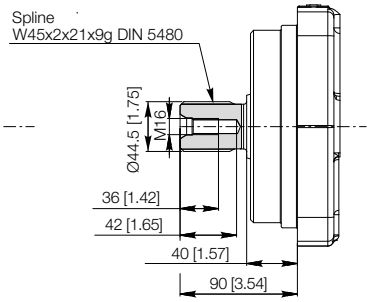
CBQ Parallel keyed shaft



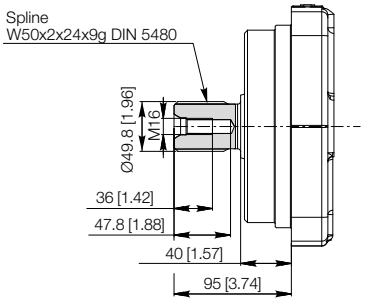
CAX Parallel keyed shaft



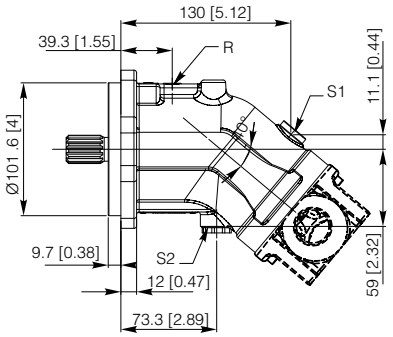
SAP Splined shaft

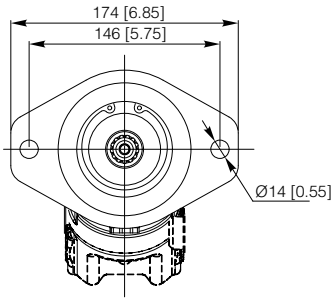


SAR Splined shaft



Click DANA button to return to Section Index
Click i button to return to main index

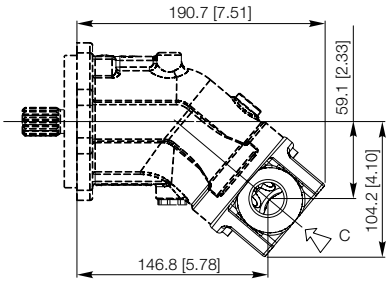


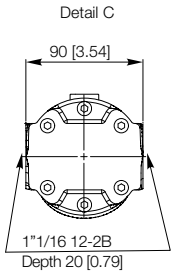


S1, S2: Drain ports (1 plugged) - 3/4”-16 UNF 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF 2B

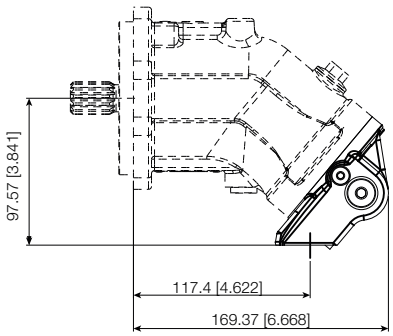
7 Port cover

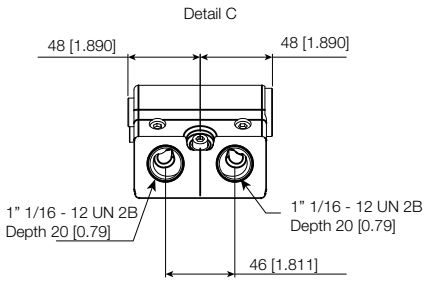
LM1





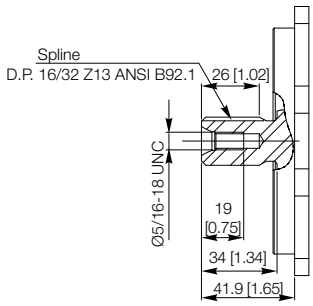
VSD - VSS





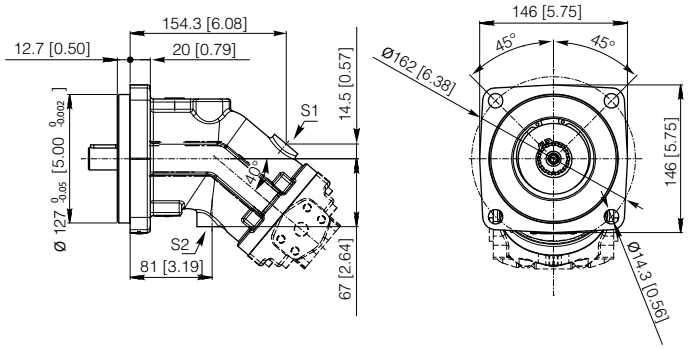
6 Shaft end

S05 Splined shaft



Dimensions SAE C 4 Bolts flange (O5)

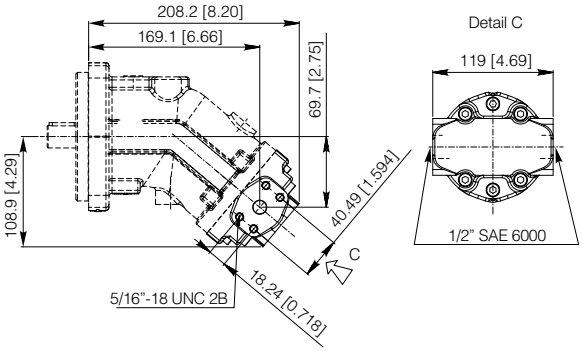
SH11C 020-030 SE



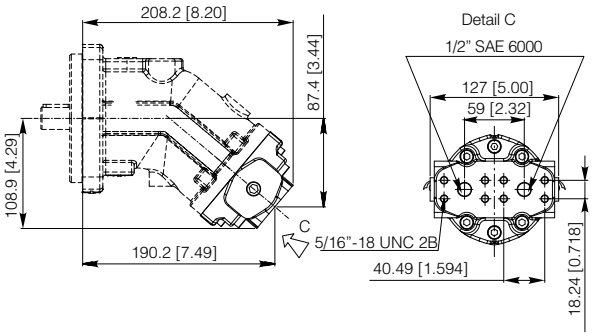
S1, S2: Drain ports (1 plugged) - 3/4"-16 UNF 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16"-20 UNF 2B

7 Port cover

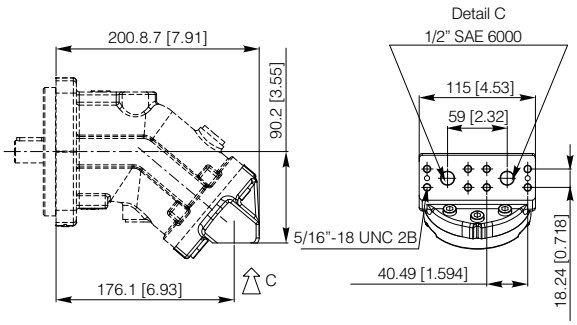
LM2



FM2

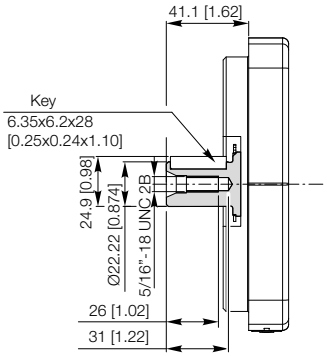


VM2

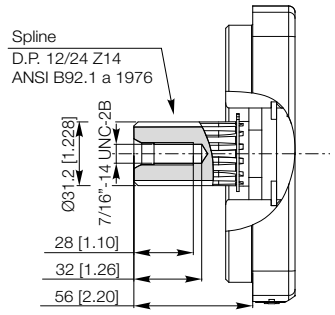


6 Shaft end

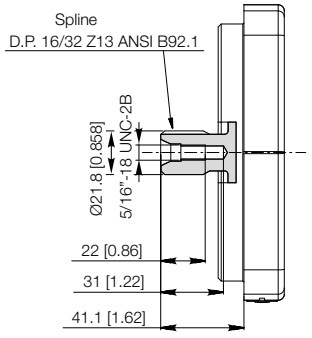
C16 Parallel keyed shaft

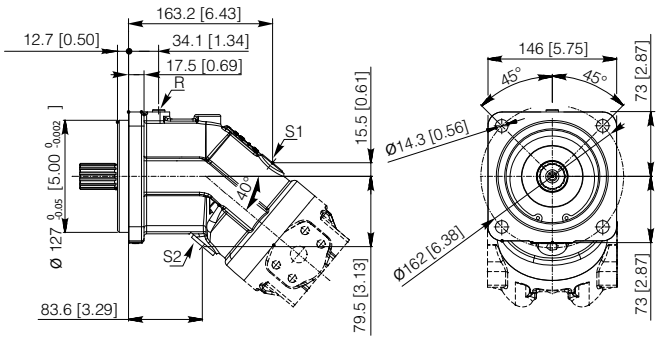


S12 Splined shaft



S05 Splined shaft

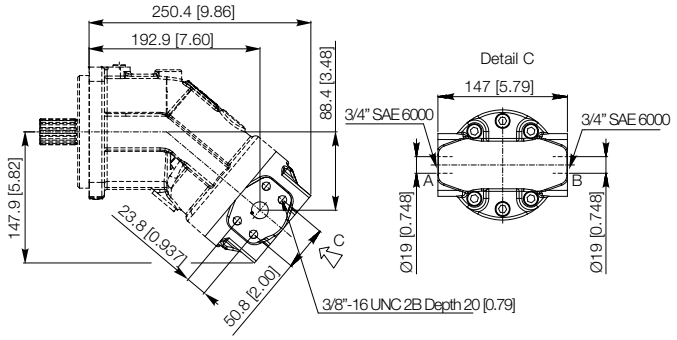




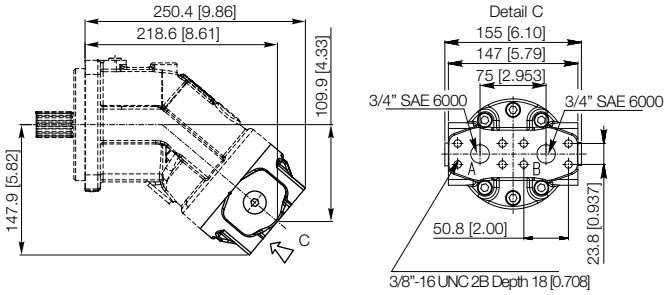
S1, S2: Drain ports (1 plugged) - 1” 1/16 - 12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF

7 Port cover

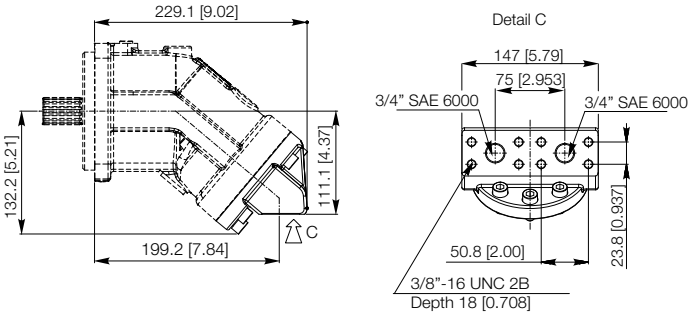
LM2



FM2

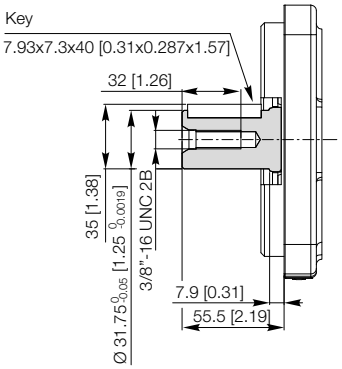


VM2

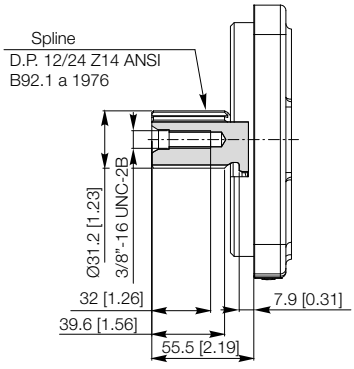


6 Shaft end

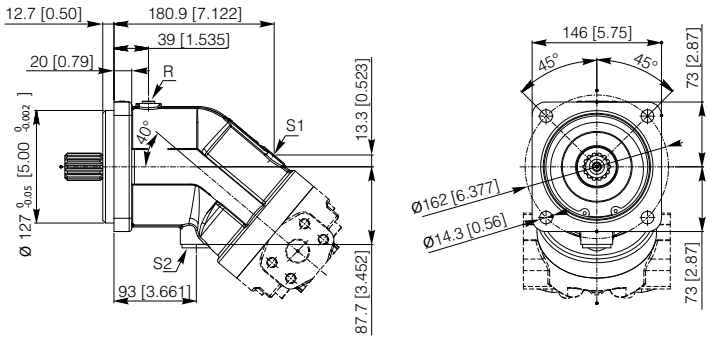
C17 Parallel keyed shaft



S12 Splined shaft



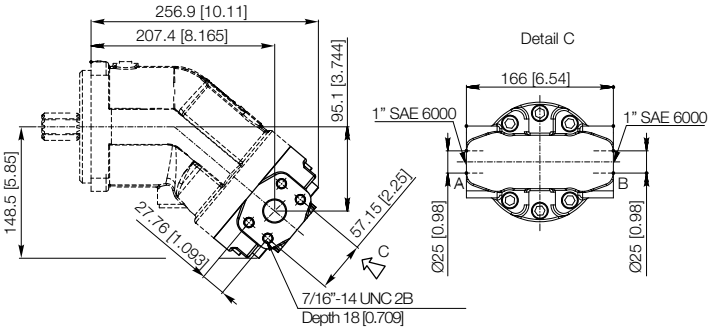
Dimensions SAE C 4 Bolts flange (O5) — SH11C 075-090 SE



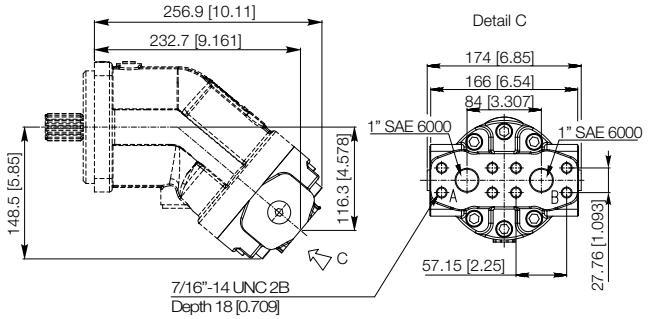
S1, S2: Drain ports (1 plugged) - 1” 1/16-12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF 2B

7 Port cover

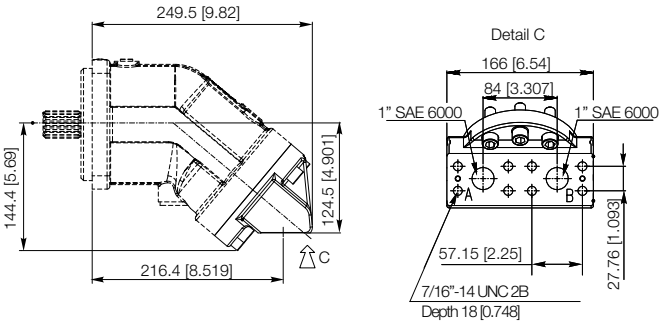
LM2



FM2

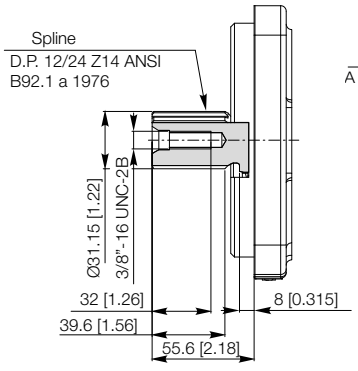


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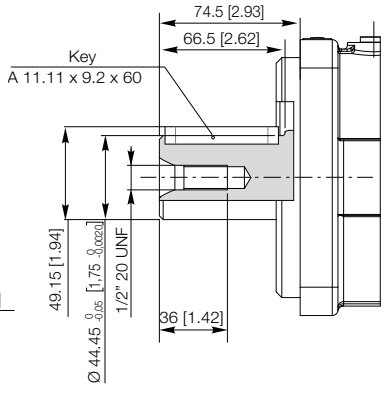


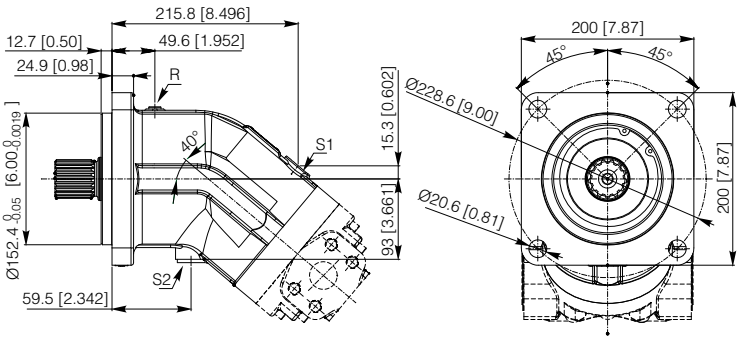
6 Shaft end

S12 Splined shaft



C18 Parallel shaft

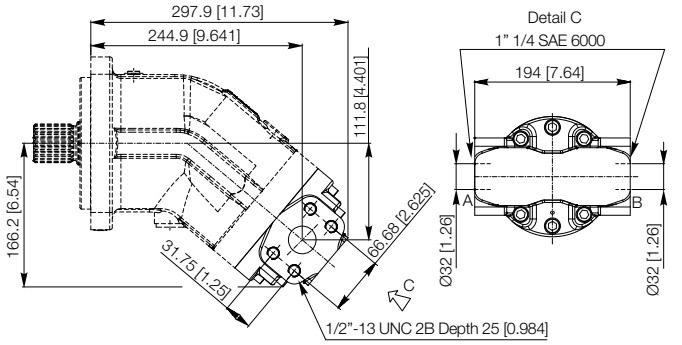




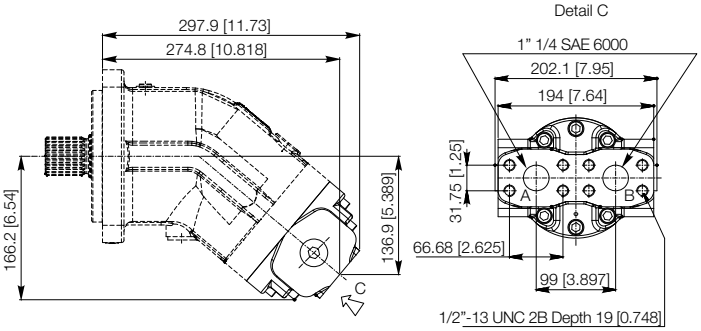
S1, S2: Drain ports (1 plugged) - 1” 1/16-12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF

7 Port cover

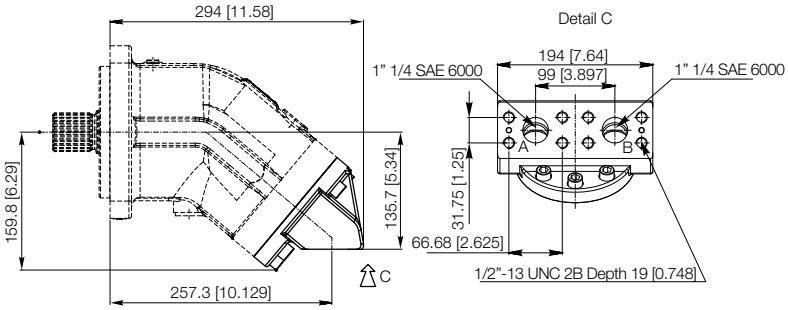
LM2



FM2

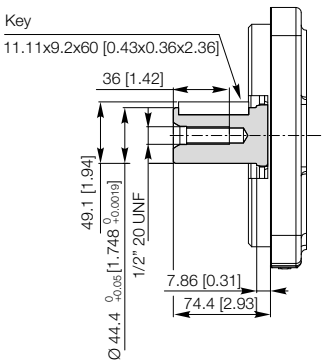


VM2

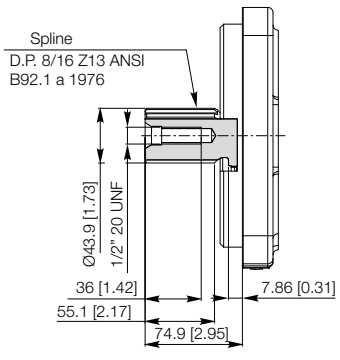


6 Shaft end

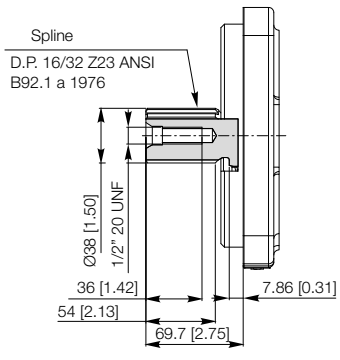
C18 Parallel keyed shaft



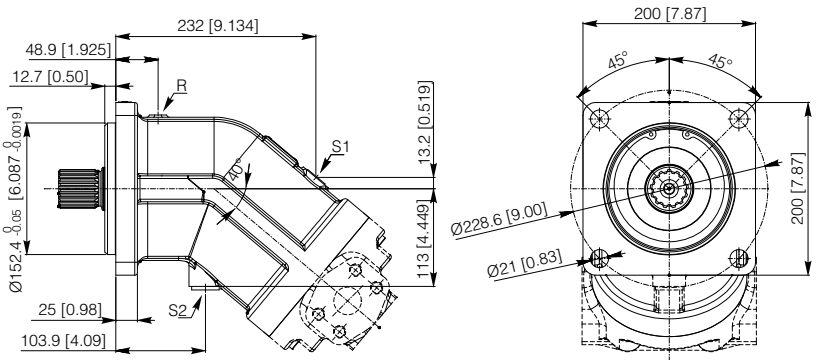
S15 Splined shaft



S16 Splined shaft



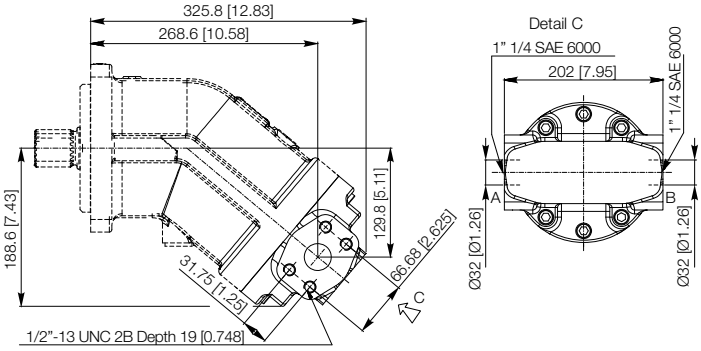
Dimensions SAE D 4 Bolts flange (O8) SH11C 160-180 SE



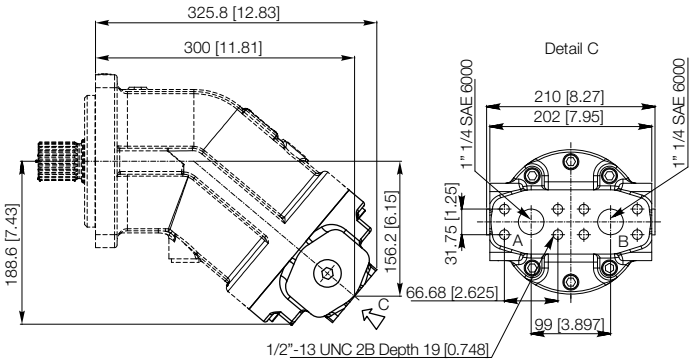
S1, S2: Drain ports (1 plugged) - 1” 1/16-12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF

7 Port cover

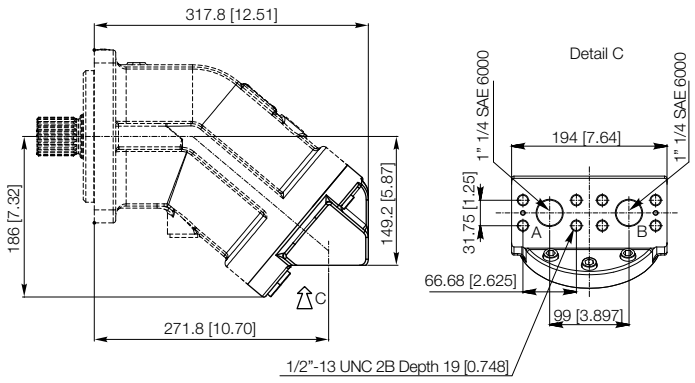
LM2



FM2

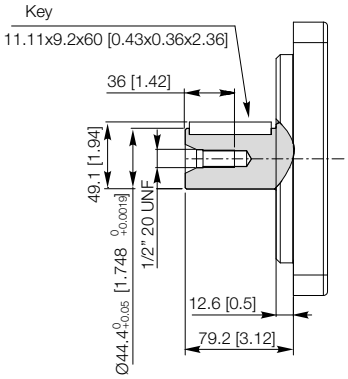


VM2

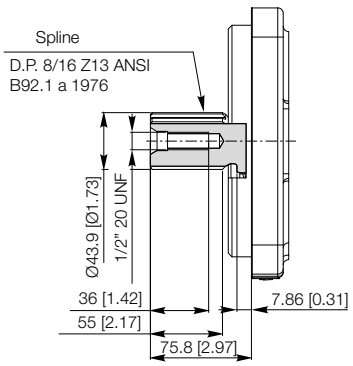


6 Shaft end

C18 Parallel keyed shaft

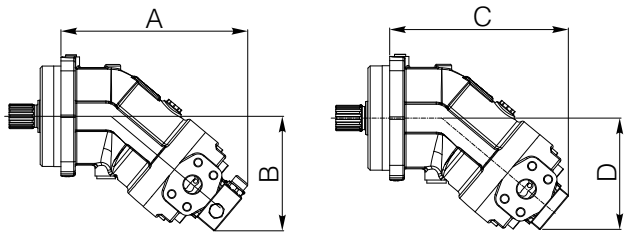


S15 Splined shaft



Click DANA button to return to Section Index
Click i button to return to main index

7 + 12 Version with flushing valve version and port cover “LM2”

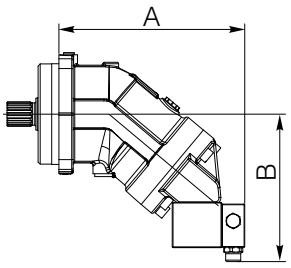


Flushing valve (06-09-15)

Arranged for flushing valve (PR)

		ME						SE					
		010 016	020 030	045-055 063	075 090	108 125	160 180	010 016	020 030	055 063	075 090	108 125	160 180
A	mm [in]	–	225 [8.85]	245.7 [9.67]	259.4 [10.21]	294.3 [11.58]	319.6 [12.58]	–	242 [9.52]	269.8 [10.62]	283.5 [11.16]	326.4 [12.85]	351.7 [13.85]
B	mm [in]	–	130 [5.11]	152.8 [6.01]	159.1 [6.26]	179.9 [7.08]	199.1 [7.84]	–	130 [5.11]	152.8 [6.01]	159.1 [6.26]	179.8 [7.08]	199.1 [7.84]
C	mm [in]	–	204 [8.03]	225.7 [8.88]	239.4 [9.42]	274.3 [10.79]	299.6 [11.79]	–	221 [8.70]	204 [9.83]	263.5 [10.37]	306.4 [12.06]	331.7 [13.05]
D	mm [in]	–	120 [4.72]	142.8 [5.62]	149.1 [5.87]	169.9 [6.68]	189.1 [7.44]	–	120 [4.72]	142.8 [5.62]	149.1 [5.87]	169.8 [6.68]	189.1 [7.44]

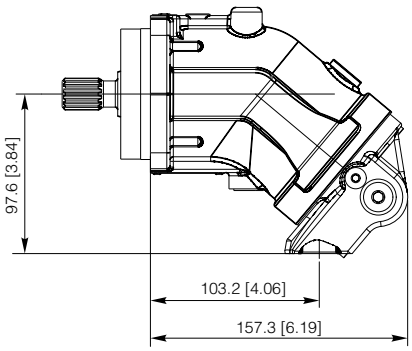
7 + 12 Version with flushing valve version and port cover “VM2”



Flushing valve (06-09-15)

		ME						SE					
		010 016	020 030	045-055 063	075 090	108 125	160 180	010 016	020 030	055 063	075 090	108 125	160 180
A	mm [in]	–	211 [8.31]	239.2 [9.41]	258.8 [10.18]	298.8 [1.76]	313.2 [12.33]	–	229 [9.01]	263.3 [10.36]	282.9 [11.13]	330.8 [13.02]	345.3 [13.59]
B	mm [in]	–	173 [6.81]	193.6 [7.62]	205.2 [8.08]	218.2 [8.59]	231.7 [9.12]	–	173 [6.81]	193.6 [7.62]	205.2 [8.08]	218.2 [8.59]	231.7 [9.12]

7 Lateral ports same side and unidirectional valve “VMD-VMS”

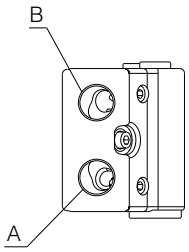


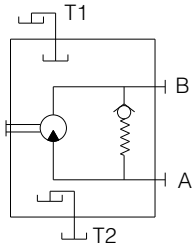
A - B Service ports M22x1.5

T1- T2 Drain ports 3/8 G (BSPP)

Rear cover VMD

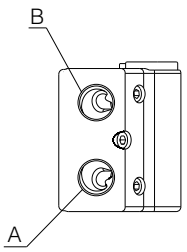
Clockwise

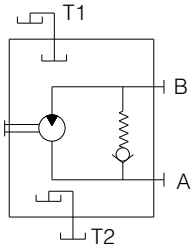




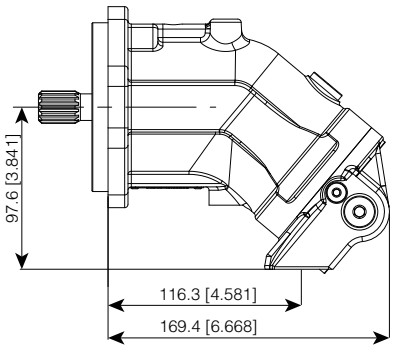
Rear cover VMS

Counterclockwise





7 Lateral ports same side and unidirectional valve “VSD-VSS”

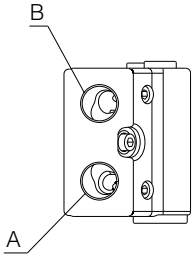


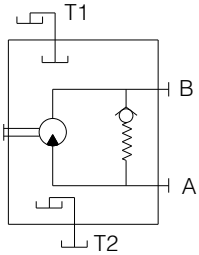
A - B service ports SAE 10 - 7/8 14 UNF 2B

T1- T2 Drain ports SAE 6 - 9/16 18 UNF 2B

Rear cover VSD

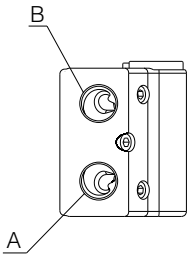
Clockwise

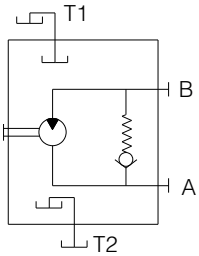




Rear cover VSS

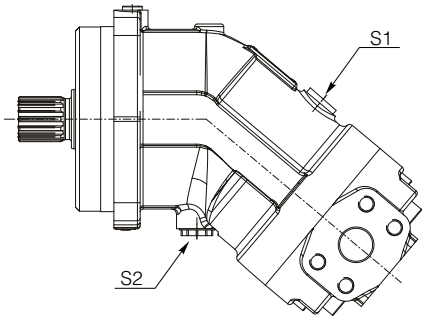
Counterclockwise





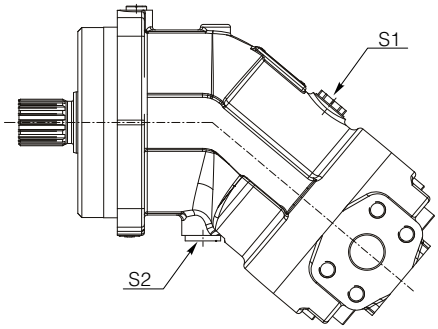
13 Drain plug reversed “RD”

STANDARD VERSION



S1 - Metallic plug.
S2 - Plastic plug.

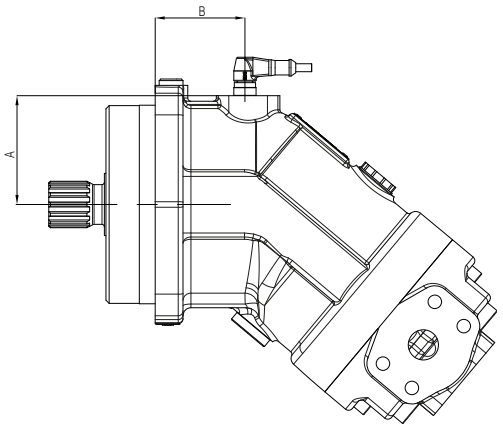
“RD” VERSION



S1 - Plastic plug.
S2 - Metallic plug.

For the SH11C is possible to request the drain plug reversed compared to standard.
If it is necessary in this configuration, to specify in the purchase order the value “RD” (see position 13 of ordering code).

13 Version with tachometer and sensor “TZ”



	ME					SE				
	020	045-055	075	108	160	020	045-055	075	108	160
	030	063	090	125	180	030	063	090	125	180
A mm [inch]	61.5 [2.42]	56.5 [2.22]	63 [2.48]	74 [2.91]	74.5 [2.93]	78.5 [3.09]	81 [3.18]	88 [3.46]	106 [4.17]	107.5 [4.23]
B mm [inch]	57 [2.24]	68.5 [2.69]	71.7 [2.82]	77.4 [3.04]	85 [3.34]	57 [2.24]	68.5 [2.69]	71.7 [2.82]	77.4 [3.04]	85 [3.34]

2-Channel differential-hall effect operating principle Sensor with dual-channel output (90°)
Power supply 8-32 VDC
Frequency 0-20.000 Hz
Operating temperature -40°C +125°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

	Size				
	020	045-055	075	108	160
	030	063	090	125	180
Number of pulses per revolution	38	47	53	59	67

SH11CR - Fixed displacement motors for gearbox, plug in version





Index

General information - Features C2
Technical data C5
Ordering code C6
Dimensions 2 Bolts flange C10
Other caratteristics C15

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max pressure** bar [psi]	**Max peak pressure** bar [psi]
SH11CR 020	19.9 [1.213]	125 [33]	430 [6235]	480 [6960]
SH11CR 030	31.9 [1.945]	201 [53.06]	430 [6235]	480 [6960]
SH11CR 045*	46 [2.807]	257 [67.89]	430 [6235]	480 [6960]
SH11CR 055	56.35 [3.437]	282 [74.45]	430 [6235]	480 [6960]
SH11CR 063	63.26 [3.859]	316 [83.42]	430 [6235]	480 [6960]
SH11CR 075	77.82 [4.747]	350 [92.4]	430 [6235]	480 [6960]
SH11CR 090	86.23 [5.26]	388 [102.5]	430 [6235]	480 [6960]
SH11CR 108	108.4 [6.612]	433 [114.31]	430 [6235]	480 [6960]
SH11CR 125	124.8 [7.613]	500 [132]	430 [6235]	480 [6960]
SH11CR 160	163.9 [9.998]	590 [155.76]	430 [6235]	480 [6960]
SH11CR 180	178.1 [10.864]	641 [169.22]	430 [6235]	480 [6960]

*: Under development

SH11CR series are a family of fixed displacement motors, bent axis piston design for operation in both open and closed circuit. SH11CR series motors are mainly intended for installation in mechanical gearboxes such as track drive and winches gear boxes.
The proven design incorporating the lens shape valve plate, the high quality components and manufacturing tecniques make the SH11CR series motors able to provide up to 430 bar [6235 psi] continuos and 480 bar [6960 psi] peak performance.
Fully laboratory tested and field proven, these motors provide maximum efficiency and long life. Heavy duty bearings permit high radial and axial loads.
Flangeable valves, both for open and closed circuit, enable SH11CR series motors to meet the requirements of the most different types of applications.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
n_{max}	rpm	Maximum speed
p_{max}	bar [psi]	Maximum continuous pressure
p_{peak}	bar [psi]	Maximum pressure peak

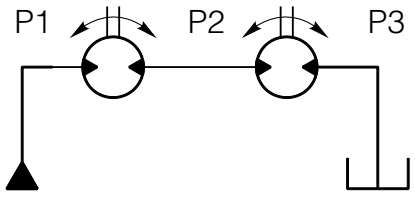
Q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{max}	Nm [lbf.ft]	Maximum torque at pressure continuous
T_{peak}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed, for different types of viscosity please contact Dana. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷ 15 cSt is allowed for extreme operating conditions and for short periods only.

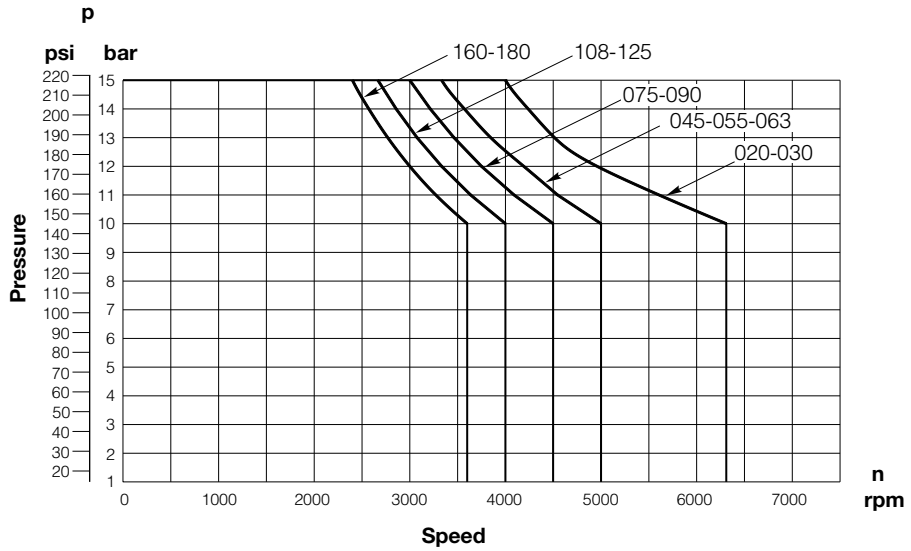
Temperature ranges:
The operating temperature of the oil must be within -25ºC÷ 115ºC [-13ºF ÷ 239ºF]. For applications with lower temperatures please contact Dana.

Filtering:
A correct filtering is essential for long and satisfactory life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999.

Operating pressure:
The maximum permissible pressure on pressure ports is 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak. If two motors are connected in series, total working pressure P1+P2 has to be limited 700 bar max. [10150 psi].



Case drain pressure:
The service life of the shaft seal is influenced by the speed of rotation of the motor and by case pressure. It's recommended not to exceed the value of 10 bar [145 psi], at reduced speed please see the diagram. Instantaneous pressure spikes (t<0.1 sec) up to 15 bar [217.5 psi] are permitted.



Output shaft:
The service life of the shaft seal is influenced by the speed of rotation of the motor and by case pressure. It's recommended not to exceed the value of 10 bar [145 psi], at reduced speed please see the diagram. Instantaneous pressure spikes (t<0.1 sec) up to 15 bar [217.5 psi] are permitted.

Seals:
Seals used on standard SH11CR series axial piston motors are made by FKM seals (Fluoroelastomer). In case of use of special fluids, contact Dana.

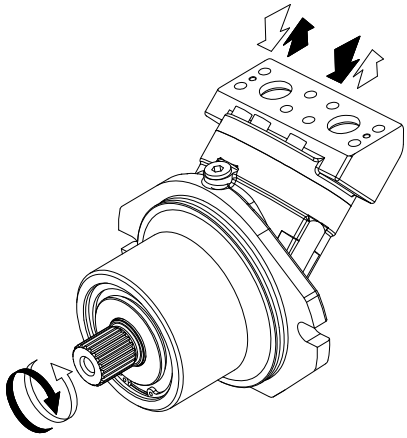
Minimum rotating speed:
No limit to Minimum speed; if uniformity of rotation is required, speed must not be less than 50 rpm. In case of use of special applications, contact Dana.

Installation:
SH11CR motors can be installed in various position and directions; however, installation in vertical position with shaft towards upper is not allowed. These axial piston units have separated ports and drain chambers and so must be always drained. For further detail see at General installation guidelines.

General information - Features

Flangeable valves:
Flangeable valves are available for motors both in open and closed loop. For more information see the catalogue Axial Valves.

Flushing valves:
The motors can be equipped with flushing valves.
The mount the flushing valve on motors, it is necessary to use a special port cover. For more information see the catalogue Axial Valves.
Relation between direction of rotation and direction of flow:
The relation between direction of rotation of shaft and direction of flow in SH11CR piston units is shown in the picture below.



			Size										
			020	030	045*	055	063	075	090	108	125	160	180
Displacement	V_g	cm^3/rev [in^3/rev]	19.9 [1.213]	31.9 [1.945]	46 [2.807]	56.35 [3.437]	63.26 [3.859]	77.82 [4.747]	86.23 [5.26]	108.4 [6.612]	124.8 [7.613]	163.9 [9.998]	178.1 [10.864]
Max. pressure	p_{max}	bar [psi]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]
Max. peak pressure	p_{peak}	bar [psi]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]
Max. speed	n_{max}	rpm	6300	6300	5600	5000	5000	4500	4500	4000	4000	3600	3600
Max. flow	Q_{max}	l/min [US gpm]	125 [33]	201 [53.06]	257 [67.89]	282 [74.45]	316 [83.42]	350 [92.4]	388 [102.5]	433 [114.31]	500 [132]	590 [155.76]	641 [169.22]
Max. power at p_{max}	P_{max}	kW [hp]	90 [120.6]	144 [192.96]	184 [246.7]	202 [270.68]	226 [302.84]	251 [336.34]	278 [372]	310 [415.4]	358 [479.72]	423 [566.82]	459 [615.06]
Torque costant	T_k	Nm/bar [lbf.ft/psi]	0.3 [0.015]	0.5 [0.025]	0.73 [0.037]	0.9 [0.045]	1 [0.05]	1.2 [0.06]	1.4 [0.07]	1.7 [0.085]	2 [0.1]	2.6 [0.13]	2.8 [0.14]
Max. cont. torque at p_{max}	T_{max}	Nm [lbf.ft]	136 [100.23]	218 [160.66]	315 [232.33]	386 [284.48]	433 [319.12]	533 [392.82]	590 [435.13]	742 [546.85]	855 [630.13]	1122 [826.91]	1219 [898.40]
Max peak torque at p_{peak}	T_{peak}	Nm [lbf.ft]	152 [112.02]	244 [179.82]	352 [260.36]	431 [317.65]	484 [356.71]	595 [438.51]	659 [486.05]	829 [610.97]	954 [703.10]	1253 [923.46]	1361 [1003.06]
Moment of inertia (2)	J	$kg \cdot m^2$ [$lbf.ft^2$]	0.001 [0.0235]	0.001 [0.0235]	0.004 [0.094]	0.004 [0.094]	0.004 [0.094]	0.007 [0.1645]	0.007 [0.1645]	0.012 [0.2820]	0.012 [0.2820]	0.022 [0.5170]	0.022 [0.5170]
Weight (2)	m	kg [lbs]	10 [22.04]	10 [22.04]	18 [39.68]	19 [41.876]	19 [41.876]	23.7 [52.23]	23.7 [52.23]	35 [77.14]	35 [77.14]	48 [105.79]	48 [105.79]
External drain flow (2)	Q_d	l/min [US gpm]	1 [0.264]	1 [0.264]	1.2 [0.317]	1.2 [0.317]	1.2 [0.317]	2.5 [0.66]	2.5 [0.66]	3 [0.79]	3 [0.79]	3 [0.79]	3 [0.79]

* : under development

Theorical values, without considering η_{hm} and η_v approximate values. Peak operations must not exceed 1% of every minute. A simultaneous maximum pressure and maximum speed not recommended.

Notes:

1) Approximate values.
2) Average values at 250 bar [3625 psi] with mineral oil at 45°C [113°F] and 35 cSt of viscosity.

Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the SH11CR series. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Series	Motor	Size	Version	Mount flange	Shaft end	Port cover	Direction of rotation	Seal	Valve	Valve feature	Flushing valve	Special feature	Painting
SH11CR	M	030	GE	OH	SAG	VM2	RV	V	VCDM	000	06	RD	01

1

Series	
SH11CR	Fixed displacement, bent axis, axial piston unit

2

Motor	
M	Motor

3

Size		
020	20 cm^3/rev	[1.22 in^3/rev]
030	30 cm^3/rev	[1.83 in^3/rev]
045*	46 cm^3/rev	[2.807in^3/rev]
055	55 cm^3/rev	[3.355 in^3/rev]
063	63 cm^3/rev	[3.843 in^3/rev]
075	75 cm^3/rev	[4.575 in^3/rev]
090	90 cm^3/rev	[5.49 in^3/rev]
108	108 cm^3/rev	[6.588 in^3/rev]
125	125 cm^3/rev	[7.625 in^3/rev]
160	160 cm^3/rev	[9.76 in^3/rev]
180	180 cm^3/rev	[10.98 in^3/rev]

* : under development

4

Version	
GE	ISO 3019-2 metric

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11CR	M	030	GE	OH	SAG	VM2	RV	V	VCDM	000	06	RD	01

5

Mount Flange		Size				
		020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
OH	2 holes Ø 135 mm [Ø 5.315 in]	●	–	–	–	–
OL	2 holes Ø 160 mm [Ø 6.299 in]	–	●	–	–	–
OM	2 holes Ø 190 mm [Ø 7.480 in]	–	–	●	–	–
ON	2 holes Ø 200 mm [Ø 7.874 in]	–	–	–	●	●

● : Available
* : under development

6

Shaft end		Size				
		020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
SAG	Splined W25x1.25x18x9g DIN 5480	●	–	–	–	–
SAI	Splined W30x2x14x9g DIN 5480	●	●	–	–	–
SAM	Splined W35x2x16x9g DIN 5480	–	●	●	–	–
SAO	Splined W40x2x18x9g DIN 5480	–	–	●	●	–
SAP	Splined W45x2x21x9g DIN 5480	–	–	–	●	●
SAR	Splined W50x2x24x9g DIN 5480	–	–	–	–	●

● : Available
* : under development

7

Port cover		Size				
		020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
VM2	Lateral ports same side	●	●	●	●	●
LM2	Lateral ports same side	●	●	●	●	●
FM2	Frontal ports (only 055-063 displacements)	–	●	–	–	–

8

Direction of rotation (viewed from shaft side)	
RV	Reversible

9

Seal	
V	FKM

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11CR	M	030	GE	OH	SAG	VM2	RV	V	VCDM	000	06	RD	01

10

Valve		Size				
		020 - 030	045 - 055* - 063	075 - 090	108 - 125	160 - 180
XXXX	None	●	●	●	●	●
VCDM	VCD/M Pilot assisted overcentre valve	VM2	VM2–FM2	VM2	VM2	VM2
VCD1	VCD/1 Pilot assisted overcentre valve	–	LM2	LM2	LM2	LM2
VCD2	VCD/2 Pilot assisted overcentre valve	–	–	LM2	LM2	LM2
VCR1	VCR1 D/AF Double acting overcentre valve	VM2	–	–	–	–
VCR3	VCR3 Double acting overcentre valve	–	VM2	VM2	VM2	VM2

• : Available
* : under development

1) The VM2 digit means that the valve is only available with VM2 port cover.
2) The LM2 digit means that the valve is only available with LM2 port cover.

11

Valve feature		Valve					
		XXXX	VCDM	VCD1	VCD2	VCR1	VCR3
000	Feature not necessary	●	–	–	–	–	●
001	Not Set 30÷350 bar [435 to 5075 psi] (Piloting ratio 6.2:1)	–	–	–	–	●	–
002	Not Set 0÷350 bar [0 to 5075 psi] (Piloting ratio 2.9:1) Control of rotation CW	–	–	●	–	–	–
006	Not Set 0÷350 bar [0 to 5075 psi] (Piloting ratio 2.9:1) Control of rotation CCW	–	–	●	–	–	–
004	Not Set 30÷350 bar [435 to 5075 psi] (Piloting ratio 6.2:1) Control of rotation CW	–	●	–	–	–	–
005	Not Set 30÷350 bar [435 to 5075 psi] (Piloting ratio 6.2:1) Control of rotation CCW	–	●(1)	–	–	–	–
003	Not Set 250÷500 bar [3625 to 7250 psi] (Piloting ratio 13:1) Control of rotation CW	–	–	–	●	–	–
007	Not Set 250÷500 bar [3625 to 7250 psi] (Piloting ratio 13:1) Control of rotation CCW	–	–	–	●	–	–

• : Available
1) : Available with FM2 port cover

Please contact Technical department for valve which requie specific setting.
For the technical specifications see catalogue valves.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11CR	M	030	GE	OH	SAG	VM2	RV	V	VCDM	000	06	RD	01

12

Flushing valve		
XX	None	•
PR	Arranged for Flushing Valve	LM2
06	VSC/F Flushing valve - 6 l/min [1.58 U.S. gpm]	LM2-VM2
09	VSC/F Flushing valve - 10.5 l/min [2.77 U.S. gpm]	LM2-VM2
15	VSC/F Flushing valve - 15 l/min [3.96 U.S. gpm]	LM2-VM2

• : Available

It is not possible to combine the flushing valves with valve on table 10.
For the technical specifications see catalogue valves.

1) The LM2-VM2 digit means that the valve is only available with LM2 and VM2 port cover.

13

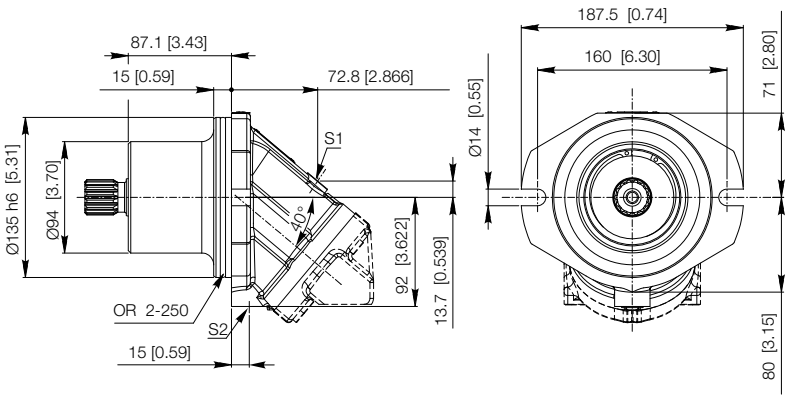
Special feature	
XX	None
RD	Drain plugs reversed
TS	Prepared for tachometer sensor
TZ	Tachometer + sensor 2-channel-Hall effect

14

Painting	
XX	None
01	Painted RAL 9005
02	Painted RAL 5015

Dimensions 2 Bolts flange (OH)

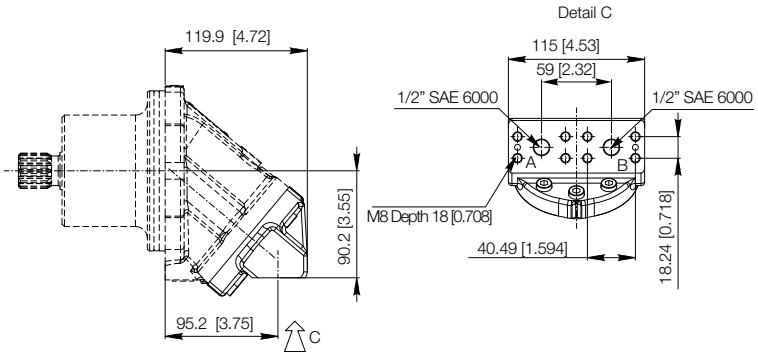
SH11CR 020-030



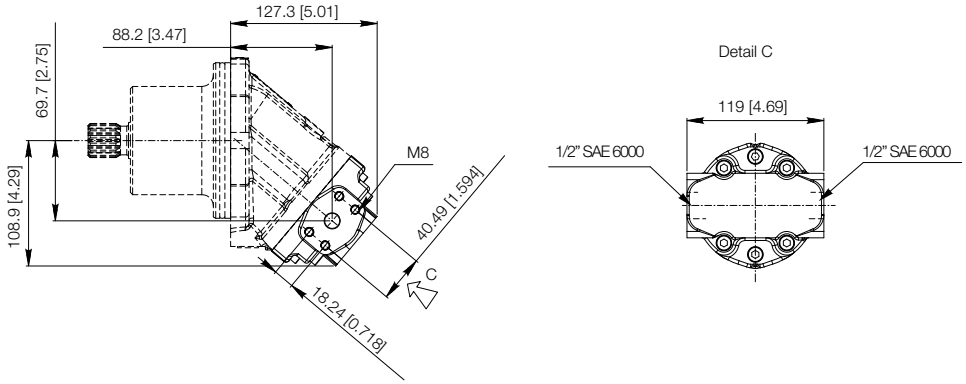
S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports

7 Port cover

VM2



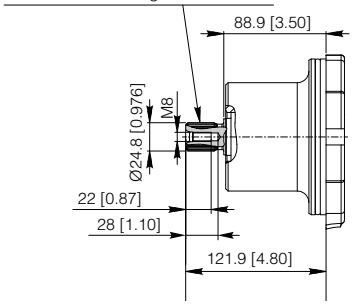
LM2



6 Shaft end

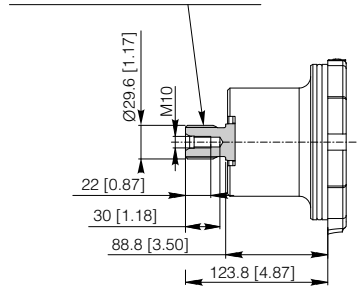
SAG Splined shaft

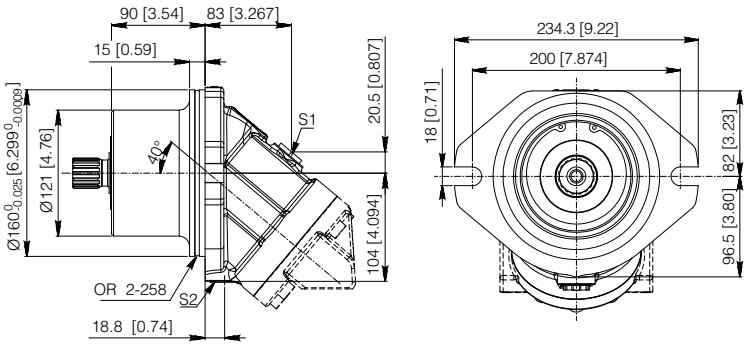
Spline
W25x1.25x30x18x9g DIN 5480



SAI Splined shaft

Spline
W30x2x30x14x9g DIN 5480

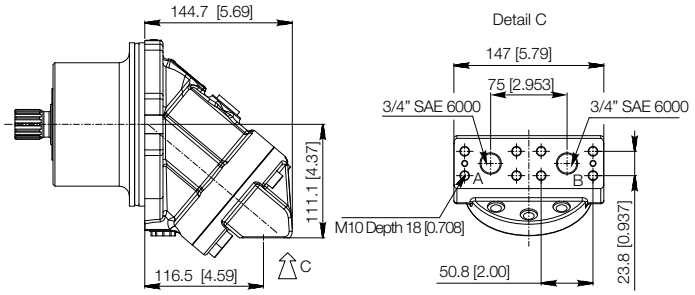




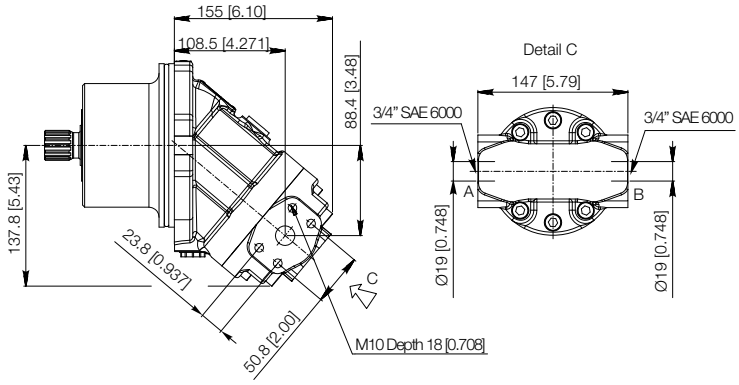
S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

7 Port cover

VM2

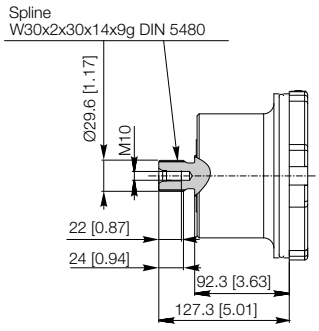


LM2

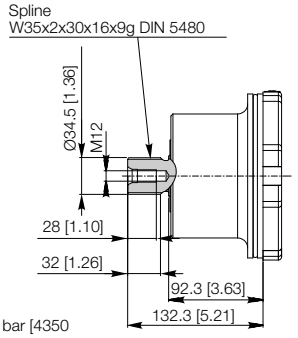


6 Shaft end

SAI Splined shaft

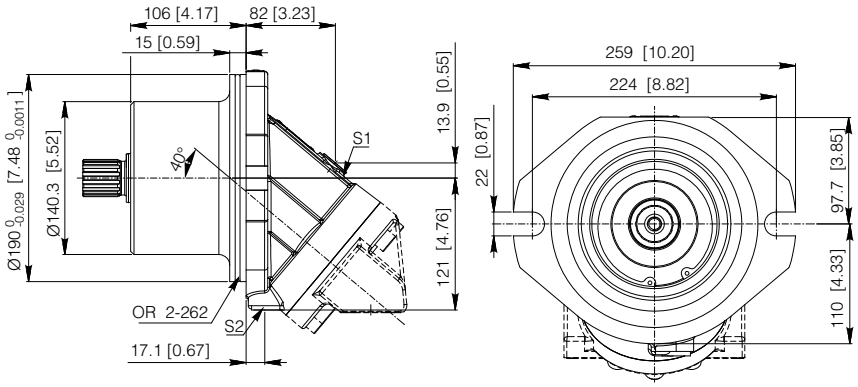


SAM Splined shaft



Maximum working pressure for 063 displacement: 300 bar [4350 psi]

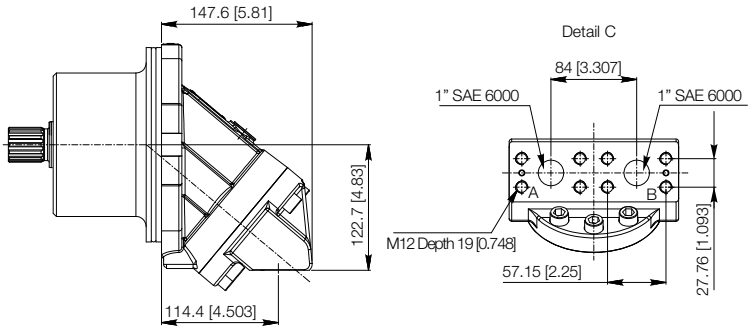
Click i button to return to main index
Click Dana button to return to Section index



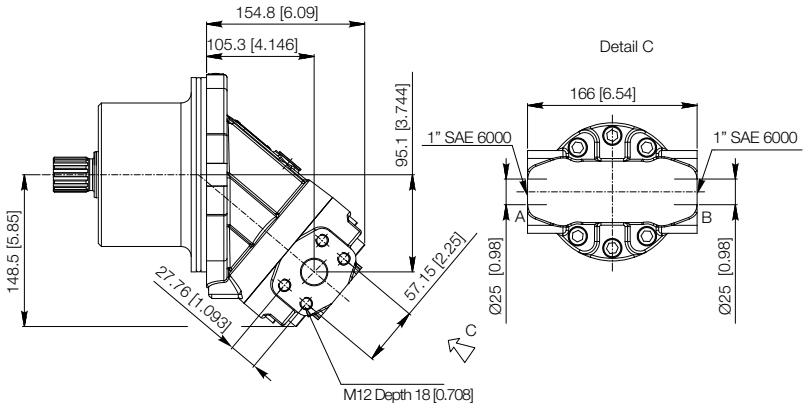
S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

7 Port cover

VM2

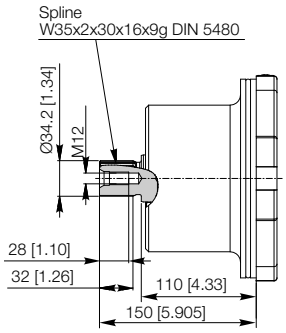


LM2

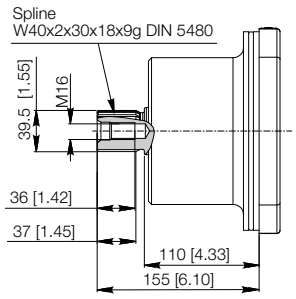


6 Shaft end

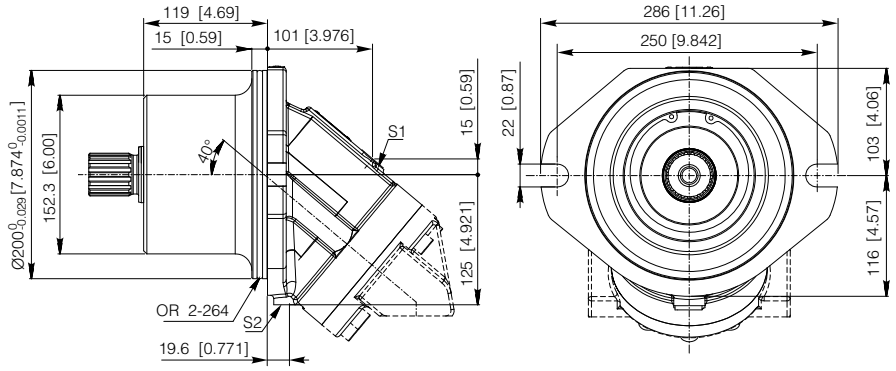
SAM Splined shaft



SAO Splined shaft



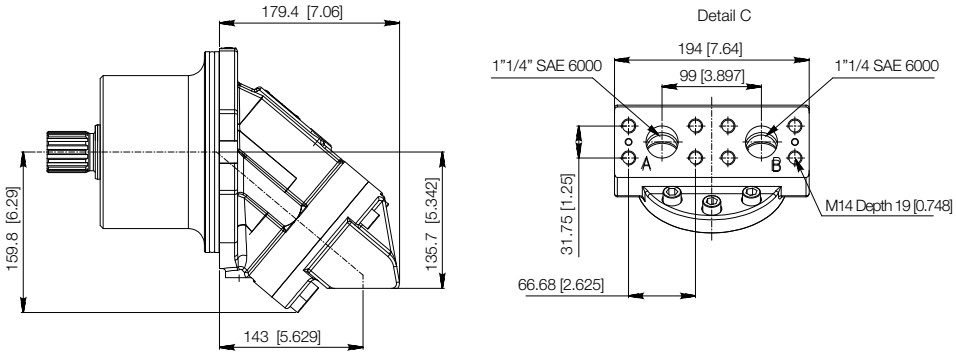
Maximum working pressure for 090displacement: 300 bar [4350 psi]



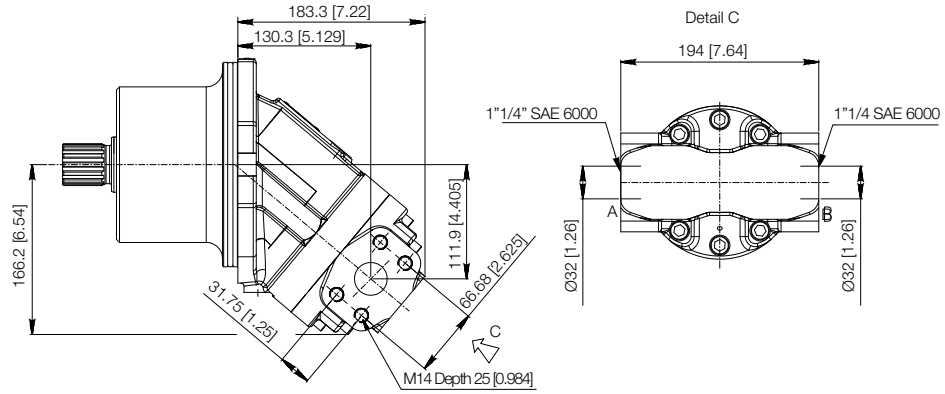
S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

VM2

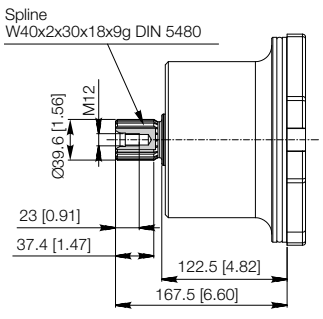


LM2

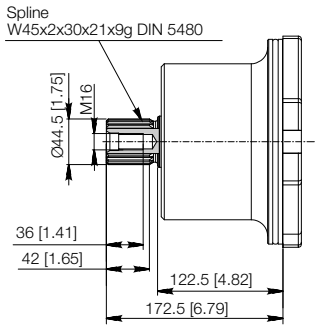


6 Shaft end

SAO Splined shaft



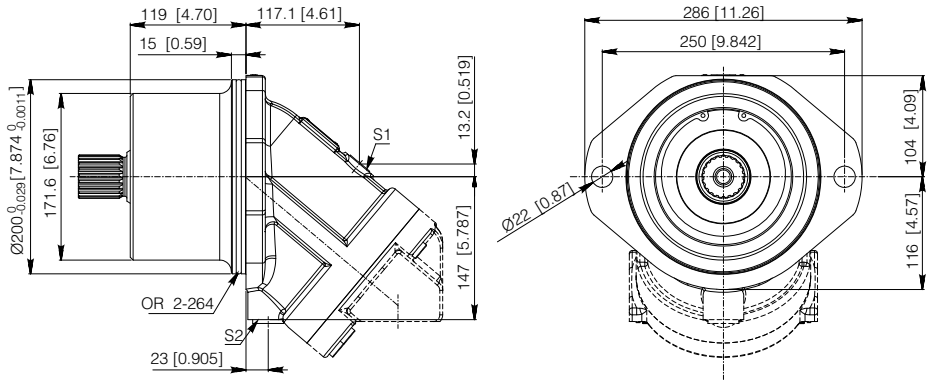
SAP Splined shaft



Maximum working pressure for 125 displacement: 300 bar [4350 psi]

Dimensions 2 Bolts flange (ON)

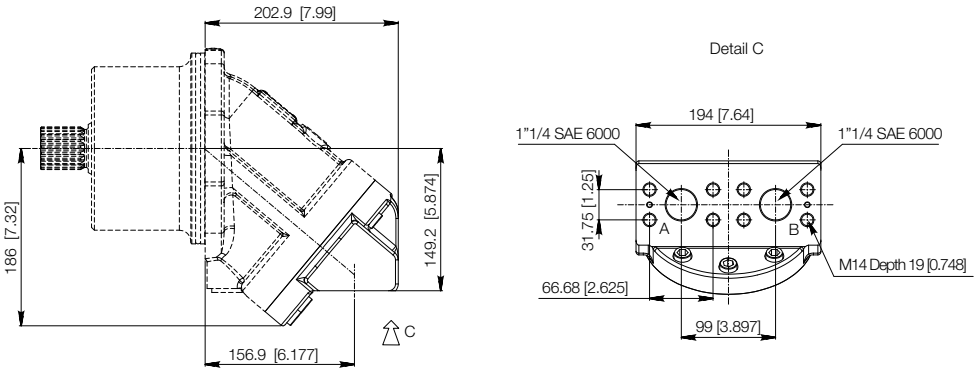
SH11CR 160-180



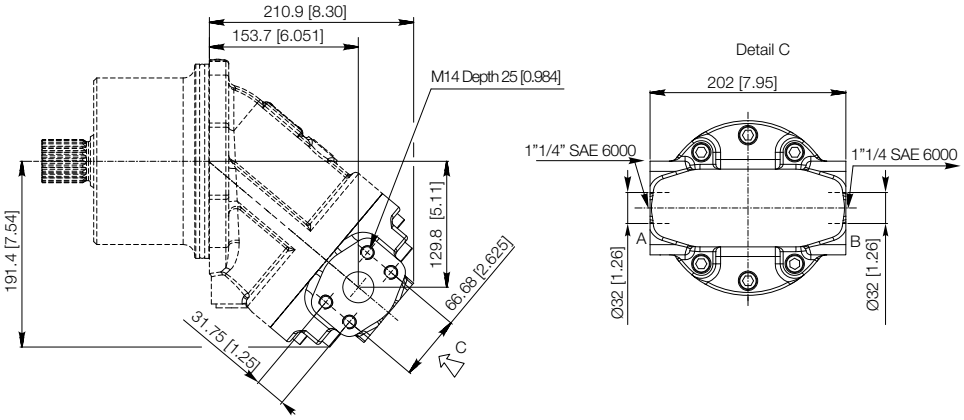
S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

VM2



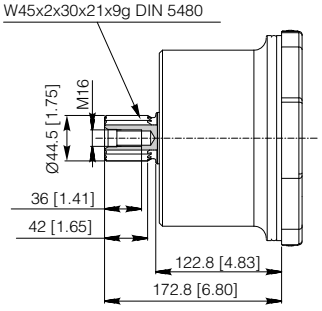
LM2



6 Shaft end

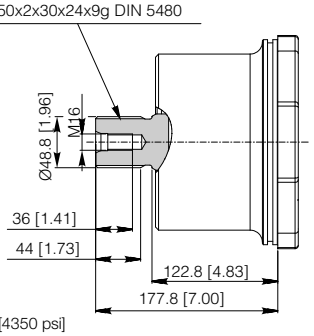
SAP Splined shaft

Spline
W45x2x30x21x9g DIN 5480



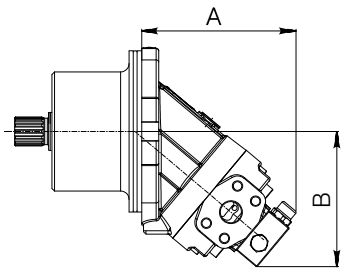
SAR Splined shaft

Spline
W50x2x30x24x9g DIN 5480

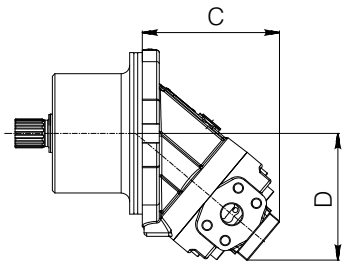


Maximum working pressure for 180 displacement: 300 bar [4350 psi]

7 + 12 Flushing valve version and port cover “LM2”



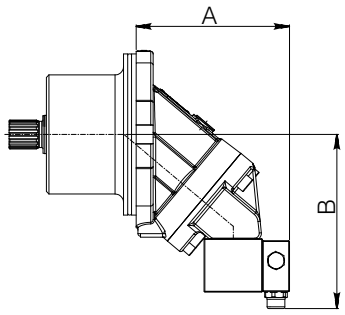
Flushing valve



Arranged for flushing valve

			020	045-055	075	108	160
			030	063	090	125	180
A	mm [in]	**LM2**	161 [6.33]	245.7 [9.67]	259.4 [10.21]	294.3 [11.58]	319.6 [12.58]
B	mm [in]	**LM2**	130 [5.12]	152.8 [6.01]	159.1 [6.26]	179.9 [7.08]	199.1 [7.84]
C	mm [in]	**LM2**	140 [5.51]	225.7 [8.88]	239.4 [9.42]	274.3 [10.79]	299.6 [11.79]
D	mm [in]	**LM2**	120 [4.72]	142.8 [5.62]	149.1 [5.87]	169.9 [6.68]	189.1 [7.44]

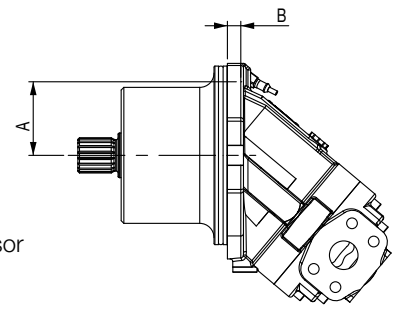
7 + 12 Flushing valve version and port cover “VM2”

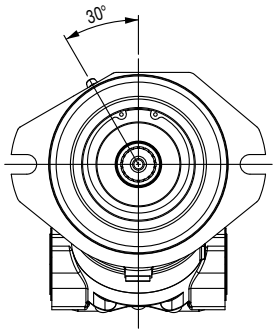


			020	045-055	075	108	160
			030	063	090	125	180
A	mm [in]	VM2	148 [5.82]	178 [7.01]	181 [7.12]	216.5 [8.52]	223.4 [8.79]
B	mm [in]	VM2	173 [6.81]	194 [7.64]	205 [8.07]	218 [8.58]	231.7 [9.12]

13 Version with tachometer and “TZ” sensor

TZ: With tachometer. Supplied with phonic wheel and sensor.





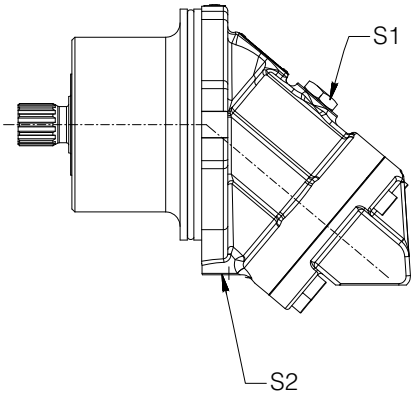
2-Channel differential-hall effect operating principle Sensor with dual-channel output (90°)
Power supply 8-32 VDC
Frequency 0-20.000 Hz
Operating temperature -40°C +125°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

		020 030	045-055 063	075 090	108 125	160 180
A	mm [in]	58 [2.28]	77 [3.03]	76 [2.99]	86 [3.39]	93.5 [36.81]
B	mm [in]	15 [0.59]	32 [1.26]	11 [0.43]	25 [0.98]	26.5 [1.04]

	Size				
	020 **030**	**045-055** **063**	**075** **090**	**108** **125**	**160** **180**
Number of pulses per revolution	38	47	53	59	67

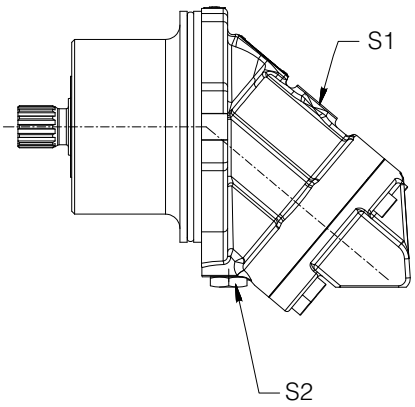
13 Drain plug reversed “RD”

STANDARD VERSION



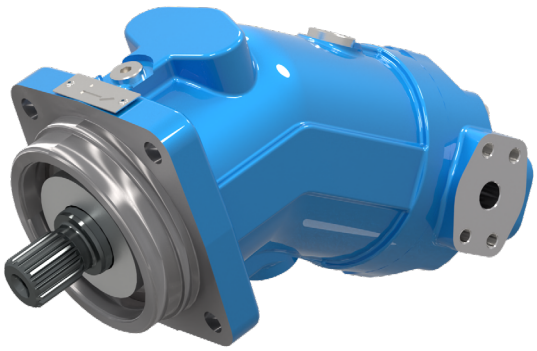
S1 - Metallic plug.
S2 - Plastic plug.

“RD” VERSION



S1 - Plastic plug.
S2 - Metallic plug.

For the SH11CR motors it is possible to request the drain plug reversed compared to standard.
If it is necessary the motor with this configuration, to specify in the purchase order the value “RD” (See position 13 of ordering code).





Index

General information - Features D2
Technical data D5
Ordering code D6
Dimensions ISO 4 Bolts flange D11
Dimensions SAE B 2 Bolts flange D17
Dimensions SAE D 4 Bolts flange D21
Other caratteristics D23

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max pressure** bar [psi]	**Max peak pressure** bar [psi]
SH11C 010	10.3 [0.626]	32 [8.5]	430 [6235]	480 [6960]
SH11C 016	16 [0.976]	50 [13.2]	430 [6235]	480 [6960]
SH11C 020	19.9 [1.213]	50 [13.2]	430 [6235]	480 [6960]
SH11C 030	31.9 [1.945]	80 [21.1]	430 [6235]	480 [6960]
SH11C 045*	46 [2.807]	103 [27.2]	430 [6235]	480 [6960]
SH11C 055	56.35 [3.437]	282 [74.45]	430 [6235]	480 [6960]
SH11C 063	63.26 [3.859]	112 [29.5]	430 [6235]	480 [6960]
SH11C 075	77.82 [4.747]	127 [33.5]	430 [6235]	480 [6960]
SH11C 090	86.23 [5.26]	388 [102.5]	430 [6235]	480 [6960]
SH11C 108	108.4 [6.612]	140 [36.96]	430 [6235]	480 [6960]
SH11C 125	124.8 [7.613]	155 [40.92]	430 [6235]	480 [6960]
SH11C 160	163.9 [9.998]	173 [45.67]	430 [6235]	480 [6960]
SH11C 180	178.1 [10.864]	193 [50.95]	430 [6235]	480 [6960]

*: Under development

SH11C pumps are a family of fixed displacement, bent axis piston pumps for operation in open circuit. The proven design incorporating the lens shape valve plate, the high quality components and manufacturing techniques make the SH11C pumps to able provide up to 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak performance. Fully laboratory tested and field proven, these pumps provide maximum efficiency and longlife. Heavy duty bearings permit high radial and axial loads.
Versatile design will be fit the SH11C pumps to any application both industrial and mobile. SH11C pumps are available in both ISO and SAE version.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m² [lbf·ft²]	Moment of inertia
m	kg [lbs]	Weight
n_{max}	rpm	Maximum speed
p_{max}	bar [psi]	Maximum continuous pressure
p_{peak}	bar [psi]	Maximum pressure peak

Q_{max}	l/min [U.S. gpm]	Maximum flow
Q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{max}	Nm [lbf.ft]	Maximum torque at pressure continuous
T_{peak}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm³/rev [in³/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

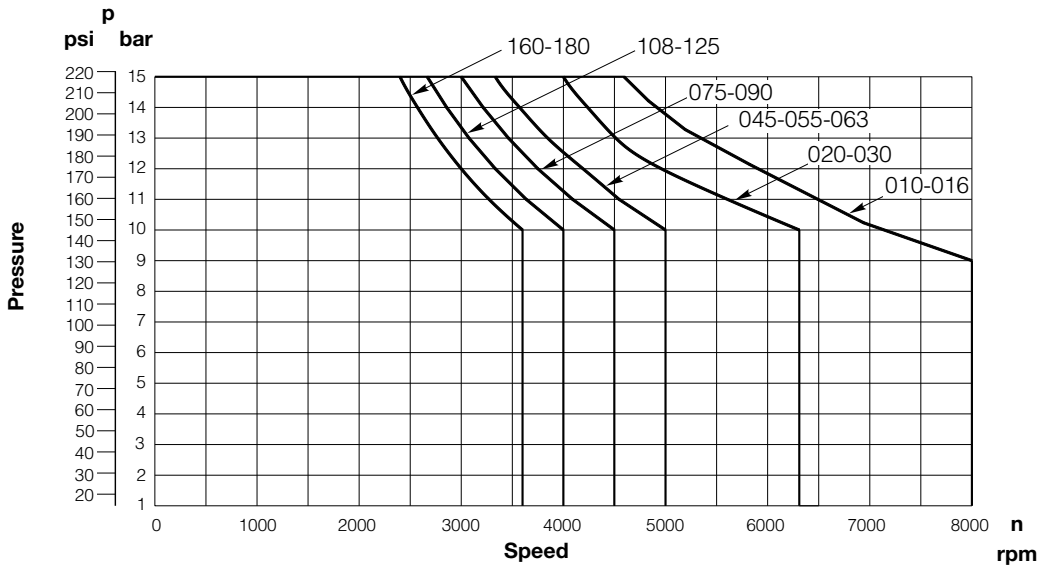
Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed, for different types of viscosity please contact Dana. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷ 15 cSt is allowed for extreme operating conditions and for short periods only.

Temperature ranges:
The operating temperature of the oil must be within -25ºC÷ 115ºC [-13ºF ÷ 239ºF]. For applications with lower temperatures please contact Dana.

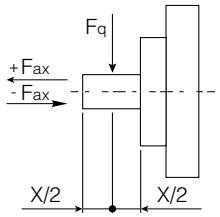
Filtering:
A correct filtering is essential for long and satisfactory life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999.

Operating pressure:
Maximum permissible case drain pressure is 10 bar [145 psi].
A higher pressure can damage the main shaft seal or reduce its life.

Case drain pressure:
Maximum permissible case drain pressure is 10 bar [145 psi]. A higher pressure can damage the main shaft seal or reduce its life.



Output shaft:
Table is a guide to determine max. permissible loads. Values are calculated in such a way to assure at least 80% of the bearing operating life where no external load is applied. The published values are related to loads applied in the middle of shaft and in the least favourable direction.



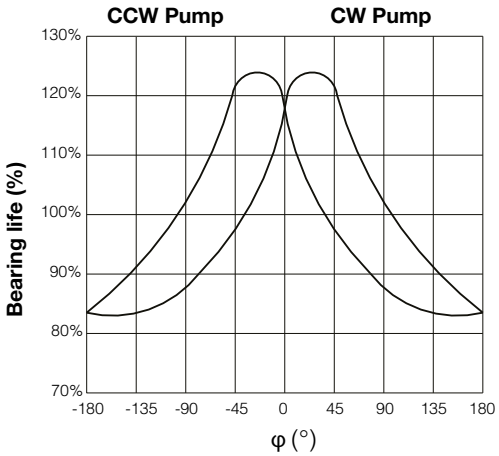
				Size												
				010	016	020	030	045*	055	063	075	090	108	125	160	180
Radial load	$F_{q\ max}$	N [lbf]		3000 [674.4]	3200 [719.4]	4300 [967.5]	6100 [1372.5]	8350 [1877.2]	9200[1] [2068]	10300[1] [2317.5]	11500[1] [2587.5]	12900[1] [2902.5]	13600[1] [3060]	15900[1] [3577.5]	18400[1] [4140]	20600[1] [4635]
Load		N/bar [lbf/psi]		8.5 [0.128]	9 [0.135]	12 [0.18]	19 [0.285]	23.8 [0,357]	25 [0.375]	30 [0.45]	25.7 [0.386]	28.5 [0.428]	35 [0.525]	37 [0.555]	41 [0.615]	45 [0.675]
Axial pulling load	$F_{ax\ max}$	N [lbf]	250 bar [3625 psi]	550 [123.6]	850 [191.1]	1000 [225]	1300 [292.5]	1740 [391.2]	1920 [432]	2150 [484]	2300 [517.5]	2800 [630]	2900 [652.5]	3300 [742.5]	3800 [855]	4050 [911.2]
			350 bar [5075 psi]	800 [179.8]	1050 [236.0]	1300 [292.5]	1800 [405]	2400 [539.5]	2650 [596]	2990 [673]	3550 [798.75]	3800 [855]	4050 [911.25]	4550 [1023.7]	5300 [1192.5]	5800 [1305]
Axial pushing load	$F_{ax\ max}$	N [lbf]	< 100 bar [< 1450 psi]	320 [71.9]	320 [71.9]	500 [112.5]	500 [112.5]	800 [179.8]	800 [180]	800 [180]	1000 [225]	1000 [225]	1250 [281.25]	1250 [281.25]	1600 [360]	1600 [360]
			> 100 bar [> 1450 psi]	3 [0.045]	3 [0.045]	5 [0.075]	5 [0.075]	8.7 [0.131]	9 [0.135]	9 [0.135]	12 [0.18]	12 [0.18]	13 [0.195]	13 [0.195]	17 [0.255]	17 [0.255]

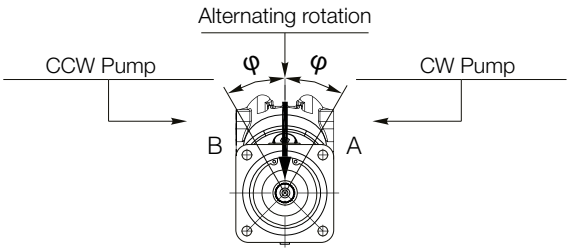
* : under development
1) : in the following table, values of Fq_{max} for the output shafts

			Max permissible radial force on the shaft:			
			SAI (SH11C 055-063)	SAM (SH11C 075-090)	SAO (SH11C 108-125)	SAP (SH11C 160-180)
Radial load	$F_{q\ max}$	N [lbf]	6500 [1462.5]	6500 [1462.5]	6500 [1462.5]	6500 [1462.5]

When an external side (radial) load is applied to the drive shaft, the bearing life will vary accordingly to the magnitude, location and direction of the load. The diagram shows how the bearing operating life varies versus the direction of the load. In the diagram 100% represents the bearing operating life where no external side load is applied to the drive shaft.

General information - Features





The bearing operating life increases up to 30% when the load is applied with some peculiar directions and the maximum increase is dependent on the operating pressure and the nominal size of the unit.
When considering the permissible axial force, the force - transfer direction must be taken in account:

- Pushing axial loads increase the bearing life.
- Pulling axial loads reduce the bearing life (if possible pulling axial loads should be avoided).

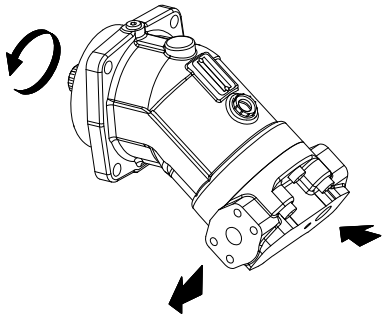
Seals:
Seals used on SH11C series are of FKM (Fluoroelastomer). In case of use of special fluids, contact Dana.

Minimum rotating speed:
If uniformity of constant flow is required, speed must not be less than 500 rpm. In case of use of special applications, contact Dana.

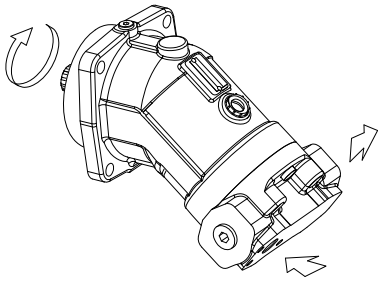
Installation:
SH11C series motors can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. For further details see on the General Information Catalogue, the section “General installation guidelines”.

Flangeable valves:
Flangeable valves are available for motors both in open and closed loop. For more information see the catalogue Axial Valves.

Relation between direction of rotation and direction of flow:
The relation between direction of rotation of shaft and direction of flow is shown in the picture below.



CW rotating pump



CCW rotating pump

			Size												
			010	016	020	030	045*	055	063	075	090	108	125	160	180
Displacement	V_g	cm^3/rev [in^3/rev]	10.3 [0.626]	16 [0.976]	19.9 [1.213]	31.9 [1.945]	46 [2.807]	56.35 [3.437]	63.26 [3.859]	77.82 [4.747]	86.23 [5.26]	108.4 [6.612]	124.8 [7.613]	163.9 [9.998]	178.1 [10.864]
Max. pressure	p_{max}	bar [psi]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]
Max. peak pressure	p_{peak}	bar [psi]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]
Max. continuous speed	n_{max}	rpm	3150	3150	2500	2500	2245	2000	2000	1800	1800	1600	1550	1450	1450
Max. intermittent speed(1)	n_{max}	rpm	6000	6000	4750	4750	4250	3750	3750	3350	3350	3000	3000	2650	2650
Max. flow	Q_{max}	l/min [US gpm]	32 [8.5]	50 [13.2]	50 [13.2]	80 [21.1]	103 [27.2]	282 [74.45]	112 [29.5]	127 [33.5]	388 [102.5]	140 [36.96]	155 [40.92]	173 [45.67]	193 [50.95]
Max. power at p_{max} (2)	P_{max}	kW [hp]	23 [30.8]	35.8 [48]	35.8 [48]	57 [76.4]	74 [99.2]	80.3 [107.6]	91 [24.0]	100 [134]	111 [148.7]	124 [166.2]	138 [184.9]	170 [227.8]	185 [48.9]
Max. cont. torque at p_{max}	T_{max}	Nm [lbf.ft]	71 [52.36]	110 [81.13]	136 [100.23]	218 [160.66]	315 [232.33]	386 [284.48]	433 [319.12]	533 [392.82]	590 [435.13]	742 [546.85]	855 [630.13]	1122 [826.91]	1219 [898.40]
Max peak torque at p_{peak}	T_{peak}	Nm [lbf.ft]	79 [58.27]	122 [89.98]	152 [112.02]	244 [179.82]	352 [260.36]	431 [317.65]	484 [356.71]	595 [438.51]	659 [486.05]	829 [610.97]	954 [703.10]	1253 [923.46]	1361 [1003.06]
Moment of inertia (3)	J	$kg{\cdot}m^2$ [$lbf.ft^2$]	0.0005 [0.0118]	0.0005 [0.0118]	0.001 [0.0235]	0.001 [0.0235]	0.004 [0.094]	0.004 [0.094]	0.004 [0.094]	0.007 [0.1645]	0.007 [0.1645]	0.012 [0.2820]	0.012 [0.2820]	0.022 [0.5170]	0.022 [0.5170]
Weight (3)	m	kg [lbs]	6 [13.22]	6 [13.22]	10 [22.04]	10 [22.04]	18 [39.68]	19 [41.876]	19 [41.876]	23.7 [52.23]	23.7 [52.23]	35 [77.14]	35 [77.14]	48 [105.79]	48 [105.79]
External drain flow (4)	Q_d	l/min [US gpm]	0.8 [0.2113]	0.8 [0.2113]	1 [0.264]	1 [0.264]	1.2 [0.317]	1.2 [0.317]	1.2 [0.317]	2.5 [0.66]	2.5 [0.66]	3 [0.79]	3 [0.79]	3 [0.79]	3 [0.79]

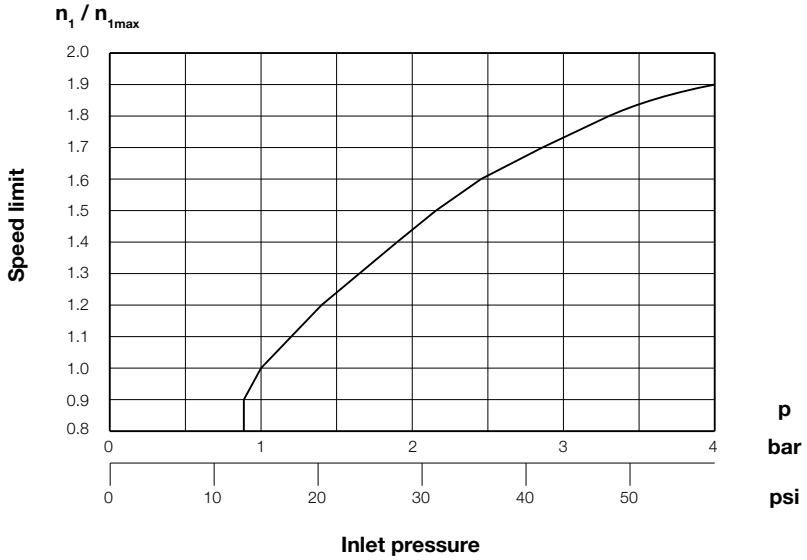
* : under development

Theorical values, without considering η_{hm} and η_v approximate values. Peak operations must not exceed 1% of every minute. Simultaneous maximum pressure and maximum speed are not recommended.

Notes: Calculation of permissible speed

1) The pump rotation speed my be increased by increasing the suction pressure. To calculate the max. permissible speed related to the pump suction pressure see the diagram below.
2) The values are valid for a rotating speed of n1 max cont.
3) Approximate values.
4) Average values at 250 bar [3625 psi] with mineral oil at 45°C [113°F] and 35 cSt of viscosity.

Speed limits calculation:



Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the SH11C motors. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Series	Pump	Size	Version	Mount flange	Shaft end	Port cover	Direction of rotation	Seal	Valve	Valve feature	Flushing valve	Special feature	Painting
SH11C	P	030	ME	OC	CMB	FP2	DX	V	XXXX	000	XX	RD	01

1

Series	
SH11C	Fixed displacement, bent axis, axial piston unit

2

Pump	
P	Pump

3

Size		
010	10.3 cm^3/rev	[0.626 in^3/rev]
016	16 cm^3/rev	[0.976 in^3/rev]
020	19.9 cm^3/rev	[1.213 in^3/rev]
030	31.9 cm^3/rev	[1.945 in^3/rev]
045*	46 cm^3/rev	[2.807in^3/rev]
055	56.35 cm^3/rev	[3.437 in^3/rev]
063	63.26 cm^3/rev	[3.859 in^3/rev]
075	77.82 cm^3/rev	[4.747 in^3/rev]
090	86.23 cm^3/rev	[5.260 in^3/rev]
108	108.4 cm^3/rev	[6.612 in^3/rev]
125	124.8 cm^3/rev	[7.613 in^3/rev]
160	163.9 cm^3/rev	[9.998 in^3/rev]
180	178.1 cm^3/rev	[10.984 in^3/rev]

*** :** under development

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	P	030	ME	OC	CMB	FP2	DX	V	XXXX	000	XX	RD	01

4

Version	
ME	ISO
SE	SAE

5

Mount flange		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
OA	ISO 4 holes Ø 80 mm [Ø3.15 in]	ME	–	–	–	–	–
OB	ISO 4 holes Ø 100 mm [Ø3.937 in]	–	ME	–	–	–	–
OC	ISO 4 holes Ø 125 mm [Ø4.921 in]	–	–	ME	–	–	–
OD	ISO 4 holes Ø 140 mm [Ø5.511 in]	–	–	–	ME	–	–
OE	ISO 4 holes Ø 160 mm [Ø6.299 in]	–	–	–	–	ME	–
OF	ISO 4 holes Ø 180 mm [Ø7.086 in]	–	–	–	–	–	ME
02	SAE-B 2 holes	SE	–	–	–	–	–
05	SAE-C 4 holes	–	SE	SE	SE	–	–
08	SAE-D 4 holes	–	–	–	–	SE	SE

* : under development

1) The ME digit means that the flange in only available for the ISO version.

2) The SE digit means that the flange in only available for the SAE version.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	P	030	ME	OC	CMB	FP2	DX	V	XXXX	000	XX	RD	01

6

Shaft end		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
CAV	Parallel keyed Ø20 mm k6 [0.787 in k6] Key 6x6x30 [0.23x0.23x1.18]	ME	–	–	–	–	–
CMB	Parallel keyed Ø25 mm k6 [0.984 in k6] Key 8x7x32 [0.31x0.27x1.25]	ME-SE	–	–	–	–	–
CBM	Parallel keyed Ø25 mm k6 [0.984 in k6] Key 8x7x40 [0.31x0.27x1.57]	–	ME	–	–	–	–
CBN	Parallel keyed Ø 30 mm k6 [1.181 in k6] Key 8x7x40 [0.31x0.27x1.57]	–	ME	–	–	–	–
CAW	Parallel keyed Ø 30 mm k6 [1.181 in k6] Key 8x7x50 [0.31x0.27x1.97]	–	–	ME	–	–	–
CBP	Parallel keyed Ø 40 mm k6 [1.574 in k6] Key 12x8x56 [0.47x0.31x2.204]	–	–	–	ME	–	–
CAK	Parallel keyed Ø 40 mm k6 [1.574 in k6] Key 12x8x63 [0.47x0.31x2.48]	–	–	–	–	ME	–
CAJ	Parallel keyed Ø 45 mm k6 [1.772 in k6] Key 14x9x63 [0.55x0.35x2.48]	–	–	–	–	ME–SE	–
CBQ	Parallel keyed Ø 45 mm k6 [1.772 in k6] Key 14x9x70 [0.55x0.35x2.75]	–	–	–	–	–	ME
CAX	Parallel keyed Ø 50 mm k6 [1.968 in k6] Key 14x9x70 [0.55x0.35x2.75]	–	–	–	–	–	ME–SE
CAY	Parallel keyed Ø 35 mm k6 [1.377 in k6] Key 10x8x56 [0.39x0.31x2.204]	–	–	–	ME	–	–
SAF	Splined W20x1.25x30x14x9g DIN 5480	ME	–	–	–	–	–
SAG	Splined W25x1.25x18x9g DIN 5480	ME	ME	–	–	–	–
SAI	Splined W30x2x14x9g DIN 5480	–	ME	ME	–	–	–
SAM	Splined W35x2x16x9g DIN 5480	–	–	ME	ME	–	–
SAO	Splined W40x2x18x9g DIN 5480	–	–	–	ME	ME	–
SAP	Splined W45x2x21x9g DIN 5480	–	–	–	–	ME	ME
SAR	Splined W50x2x24x9g DIN 5480	–	–	–	–	–	ME
C16	Parallel keyed Ø 22.22 mm [0.874 in] Key 6.35x6.25x25.4 [0.25x0.246x1]	–	SE	–	–	–	–
C17	Parallel keyed Ø 31.75 mm [1.25 in] Key 7.93x7.3x40 [0.31x0.287x1.57]	–	–	SE	–	–	–
C18	Parallel keyed Ø 44.45 mm [1.75 in] Key 11.11x9.2x60 [0.43x0.36x2.36]	–	–	–	SE	SE	SE
S05	Splined 13T 16/32 DP	SE	SE	–	–	–	–
S12	Splined 14T 12/24 DP	–	SE	SE	SE	–	–
S15	Splined 13T 8/16 DP	–	–	–	–	SE	SE
S16	Splined 23T 16/32 DP	–	–	–	–	SE	–

* : under development
1) The ME digit means that the flange in only available for the ISO version.
2) The SE digit means that the flange in only available for the SAE version.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	P	030	ME	OC	CMB	FP2	DX	V	XXXX	000	XX	RD	01

7

Port cover		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
FP2	Frontal ports	ME–SE	ME–SE	ME–SE	ME–SE	ME–SE	ME–SE

* : under development

1) The ME digit means that the flange in only available for the ISO version.
2) The SE digit means that the flange in only available for the SAE version.

8

Direction of rotation (viewed from shaft side)	
DX	CW
SX	CCW

9

Seal	
V	FKM

10

Valve	
XXXX	None

11

Valve feature	
000	None

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SH11C	P	030	ME	OC	CMB	FP2	DX	V	XXXX	000	XX	RD	01

12

Flushing valve	
XX	None

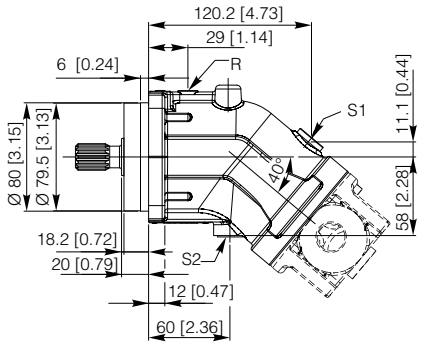
13

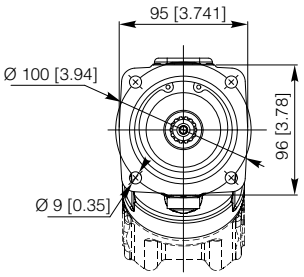
Special feature		Size					
		010 - 016	020 - 030	045* - 055 - 063	075 - 090	108 - 125	160 - 180
XX	None	●	●	●	●	●	●
RD	Drain plugs reversed	–	●	●	●	●	●
TZ	Tachometer + sensor 2-channel-Hall effect	–	●	●	●	●	●
03	SAE Version with ISO port Cover	●	–	–	–	–	–

* : under development
● : Available

14

Painting	
XX	None
01	Painted RAL 9005
02	Painted RAL 5015

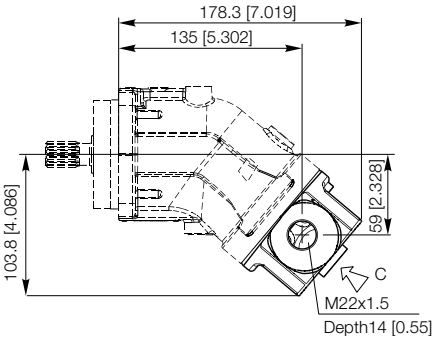


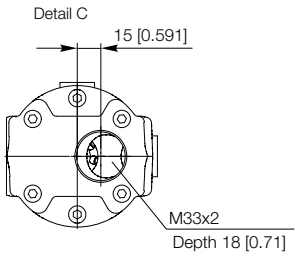


S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

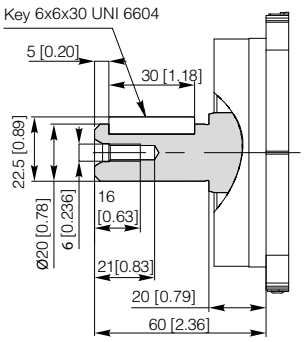
FP2



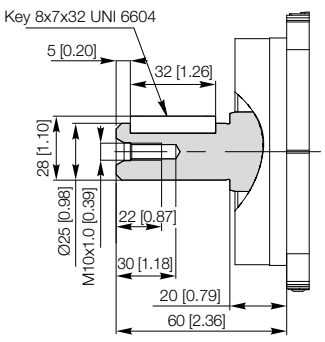


6 Shaft end

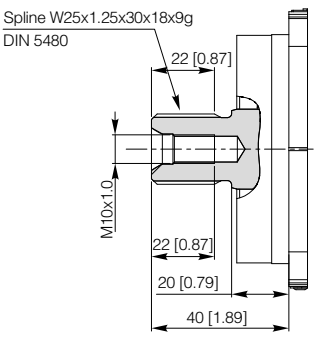
CAV Parallel keyed shaft



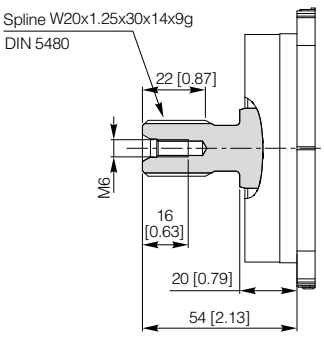
CMB Parallel keyed shaft



SAG Splined shaft

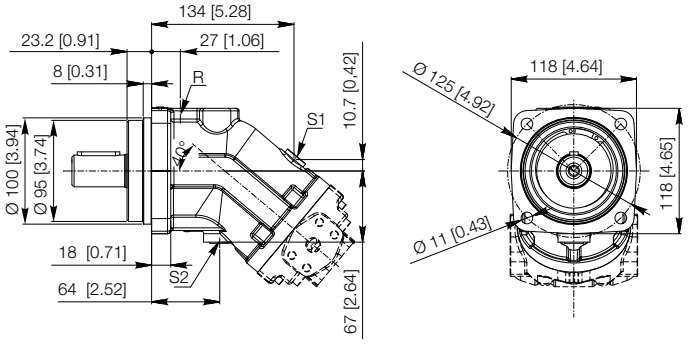


SAF Splined shaft



Dimensions ISO 4 Bolts flange (OB)

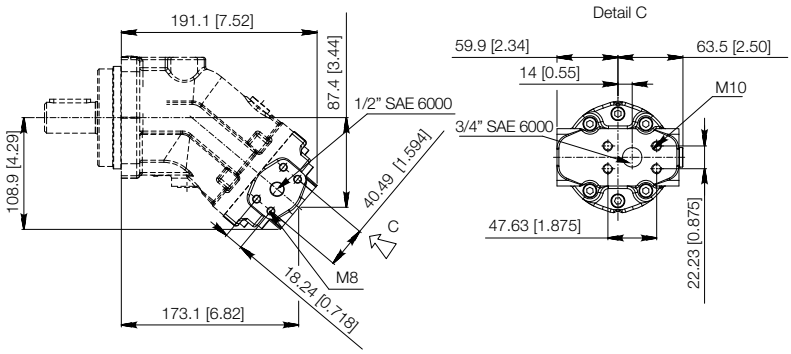
SH11C 020-030 ME



S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

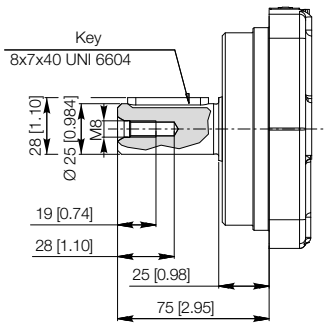
7 Port cover

FP2

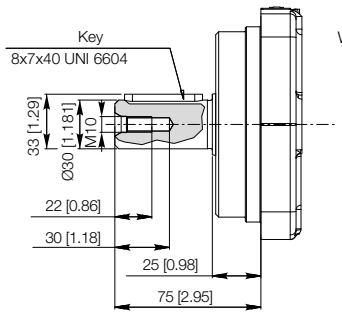


6 Shaft end

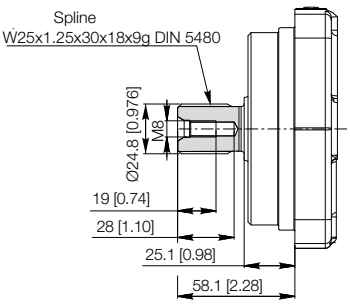
CBM Parallel keyed shaft



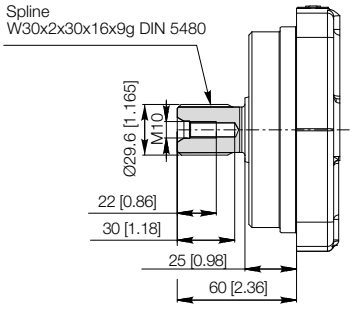
CBN Parallel keyed shaft

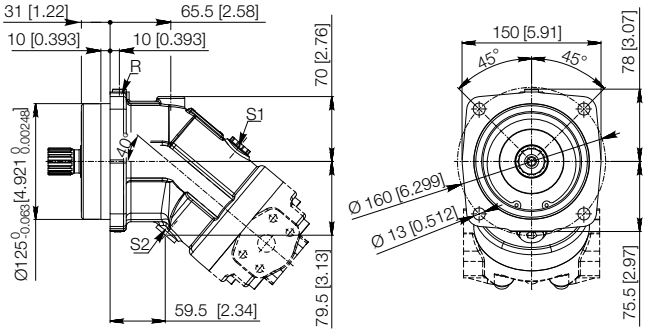


SAG Splined shaft



SAI Splined shaft

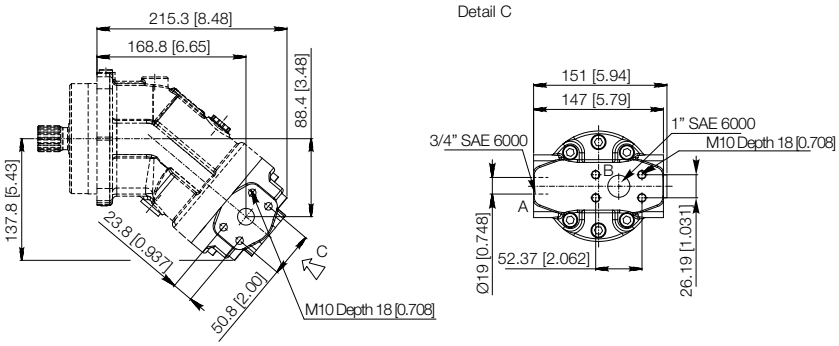




S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

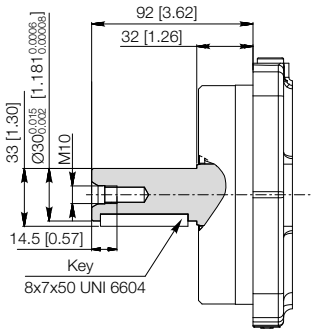
7 Port cover

FP2

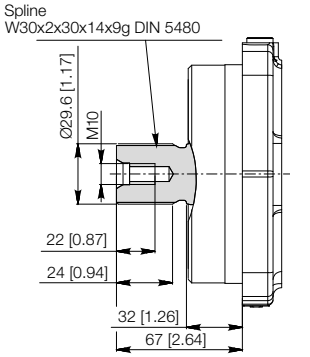


6 Shaft end

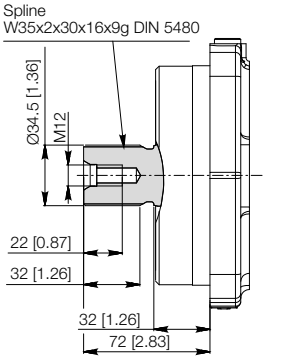
CAW Parallel keyed shaft



SAI Splined shaft

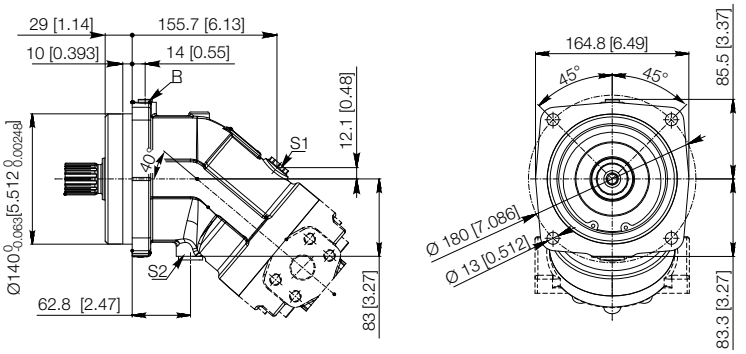


SAM Splined shaft



Dimensions ISO 4 Bolts flange (OD)

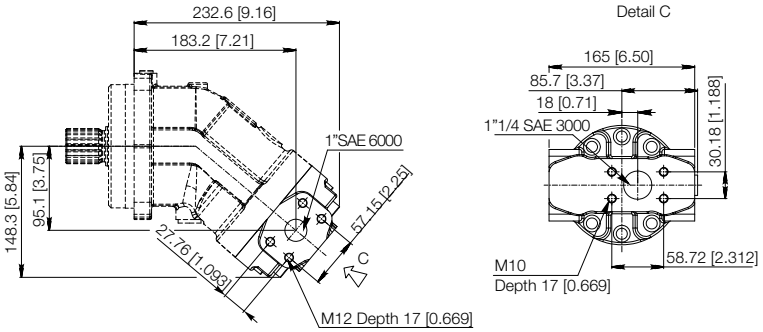
SH11C 075-090 ME



S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

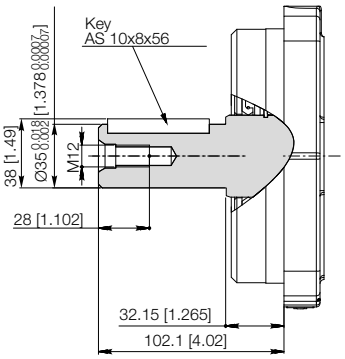
7 Port cover

FP2

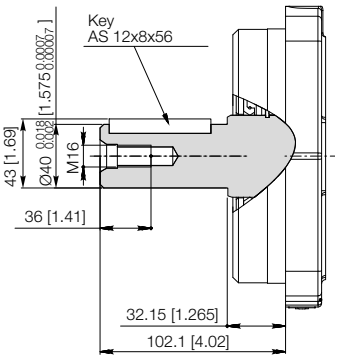


6 Shaft end

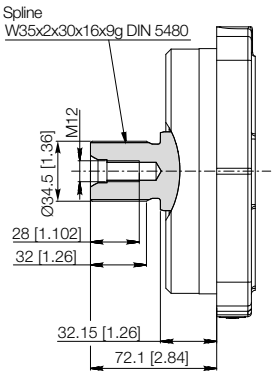
CAY Parallel keyed shaft



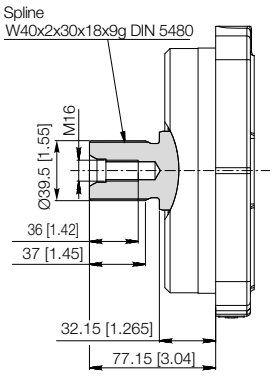
CBP Parallel keyed shaft

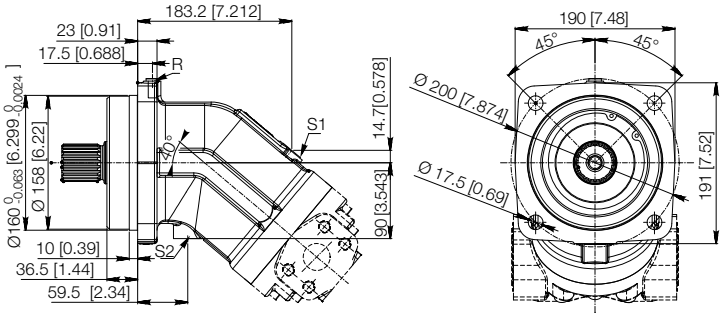


SAM Splined shaft



SAO Splined shaft

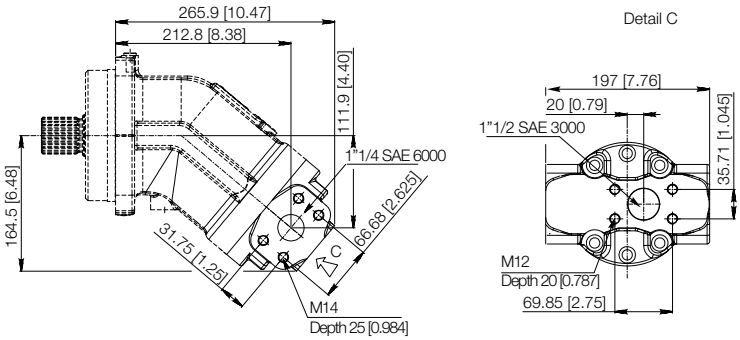




S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

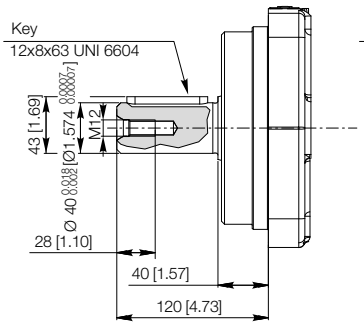
7 Port cover

FP2

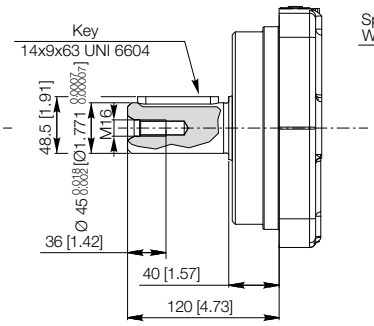


6 Shaft end

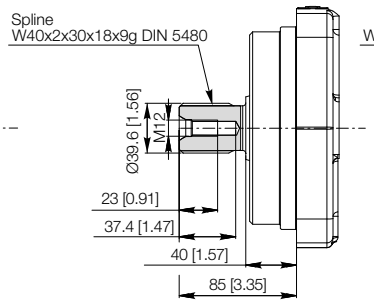
CAK Parallel keyed shaft



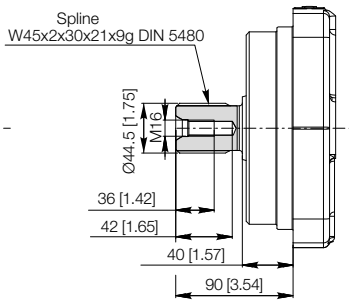
CAJ Parallel keyed shaft



SAO Splined shaft

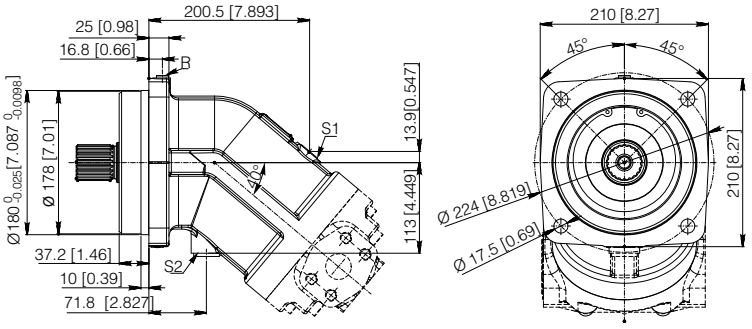


SAP Splined shaft



Dimensions ISO 4 Bolts flange (OF)

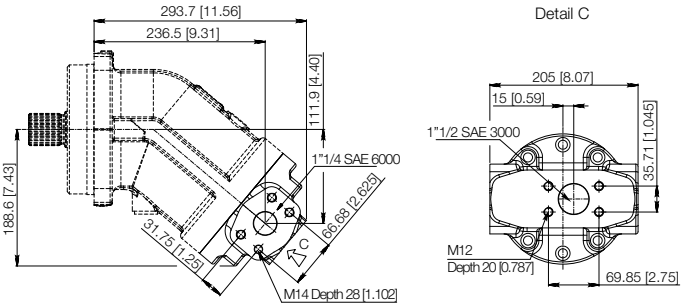
SH11C 160-180 ME



S1, S2: Drain ports (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
R: Air bleed (plugged) - 1/8 G (BSPP)

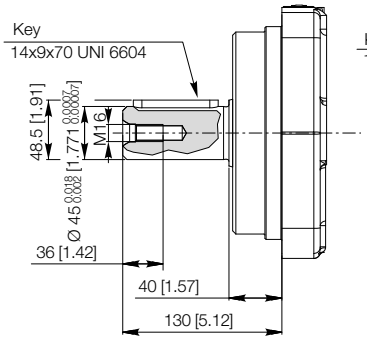
7 Port cover

FP2

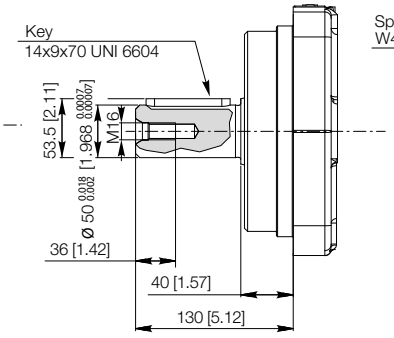


6 Shaft end

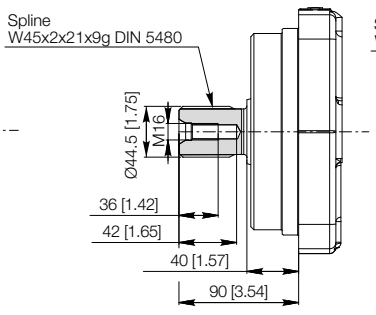
CBQ Parallel keyed shaft



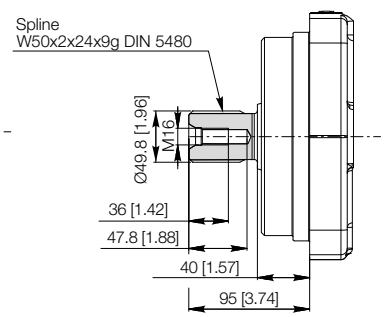
CAX Parallel keyed shaft

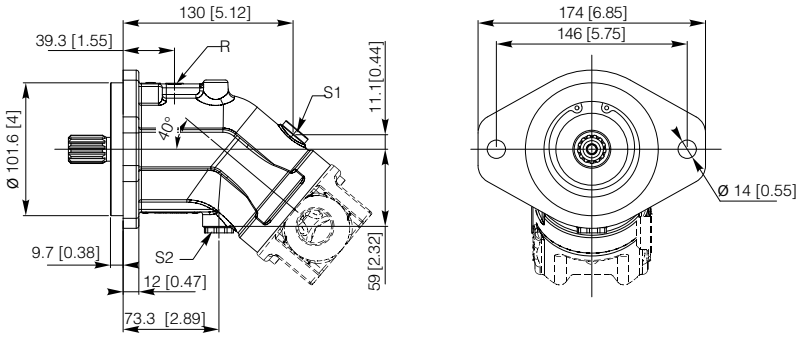


SAP Splined shaft



SAR Splined shaft

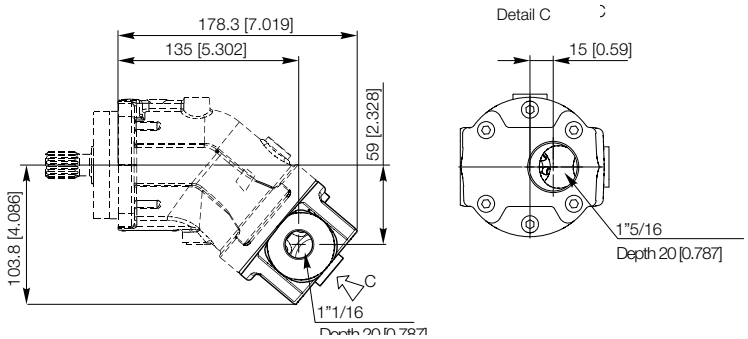




S1, S2: Drain ports (1 plugged) - 3/4”-16 UNF 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF 2B

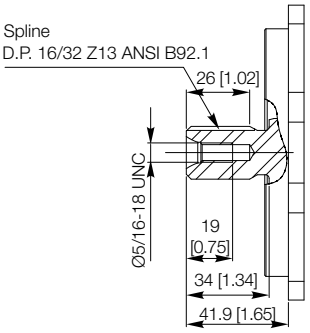
7 Port cover

FP2

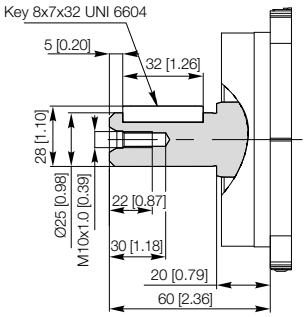


6 Shaft end

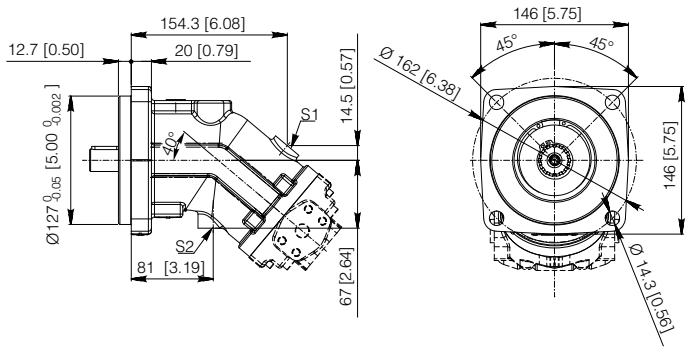
S05 Splined shaft



CMB Parallel keyed shaft



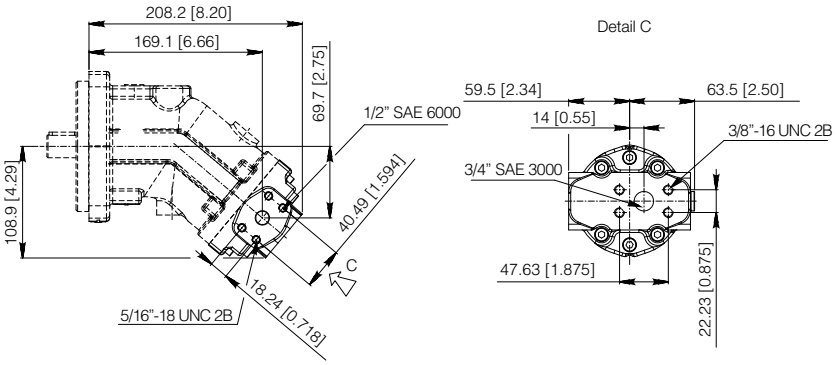
Dimensions SAE C 4 Bolts flange (O5) SH11C 020-030 SE



S1, S2: Drain ports (1 plugged) - 3/4”-16 UNF 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF 2B

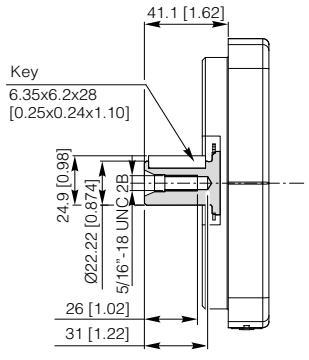
7 Port cover

FP2

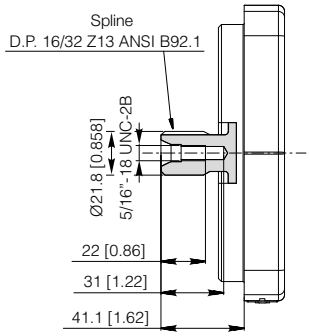


6 Shaft end

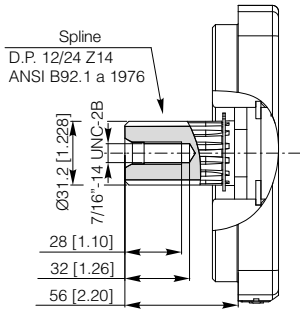
C16 Parallel keyed shaft

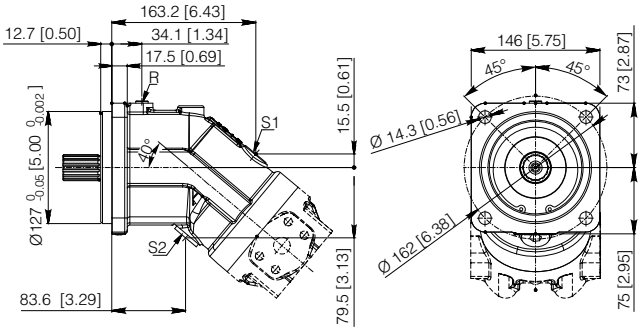


S05 Splined shaft



S12 Splined shaft

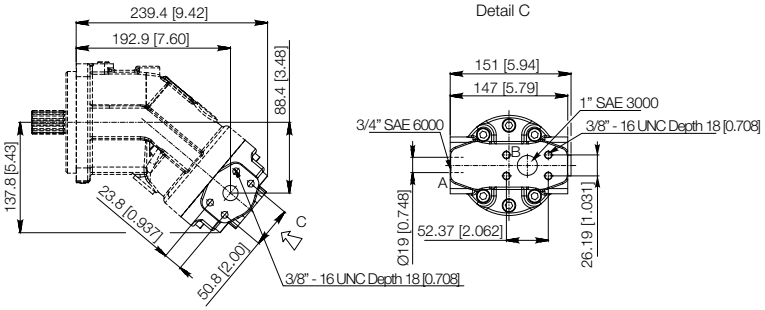




S1, S2: Drain ports (1 plugged) - 1” 1/16 - 12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF

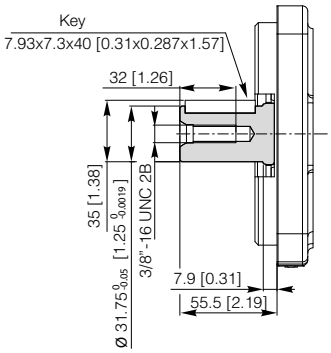
7 Port cover

FP2

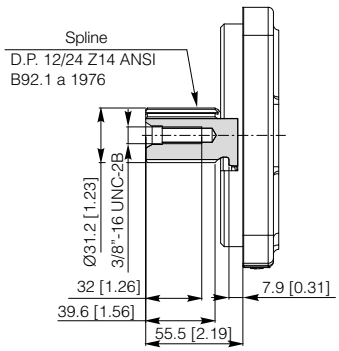


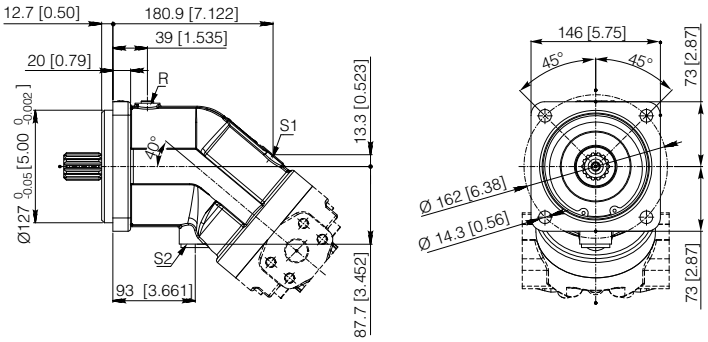
6 Shaft end

C17 Parallel keyed shaft



S12 Splined shaft

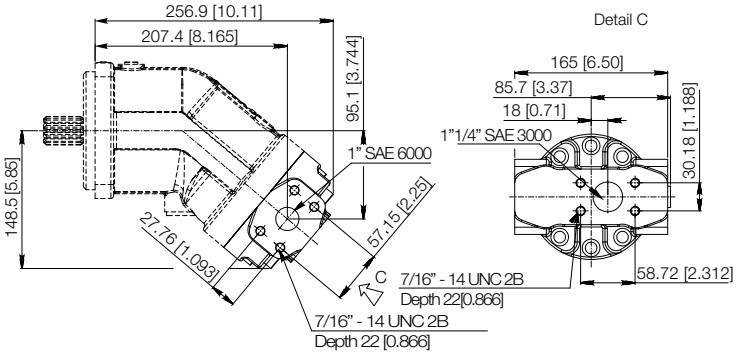




S1, S2: Drain ports (1 plugged) - 1” 1/16-12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF 2B

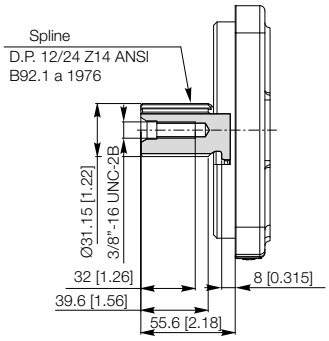
7 Port cover

FP2

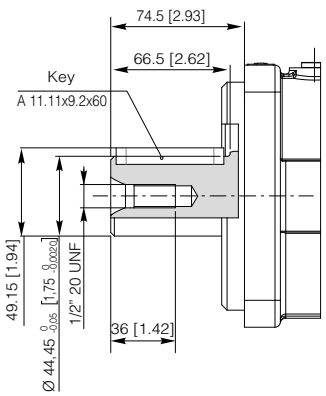


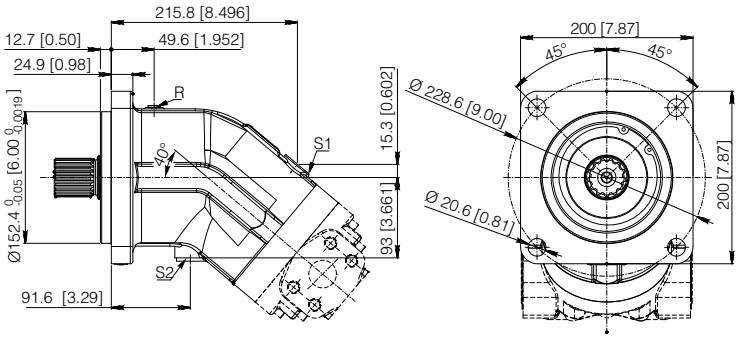
6 Shaft end

S12 Splined shaft



C18 Parallel shaft

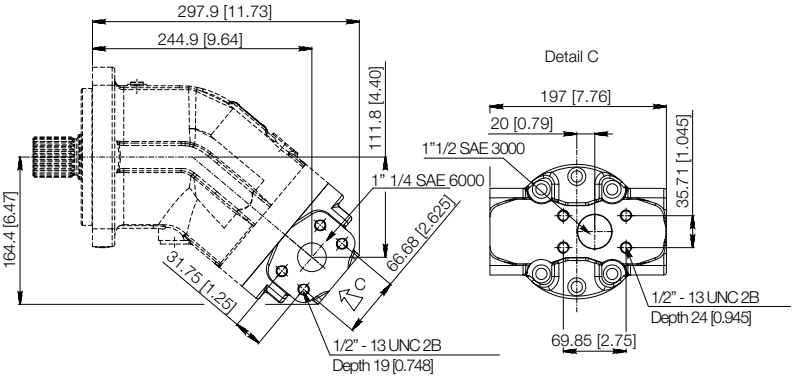




S1, S2: Drain ports (1 plugged) - 1” 1/16-12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF

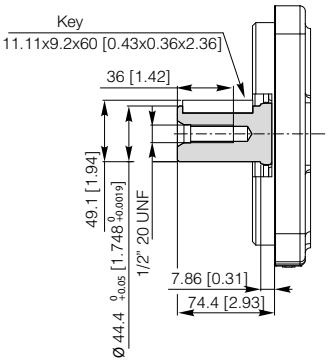
7 Port cover

FP2

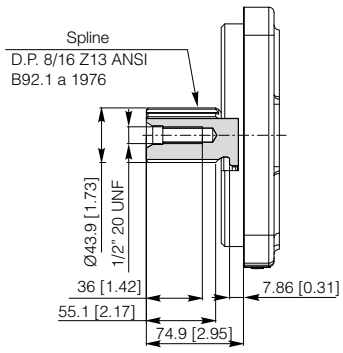


6 Shaft end

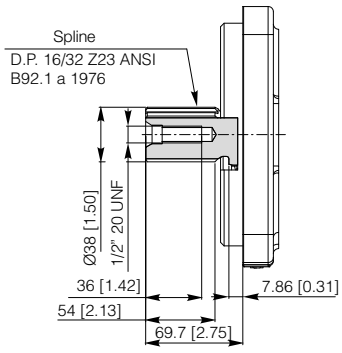
C18 Parallel keyed shaft



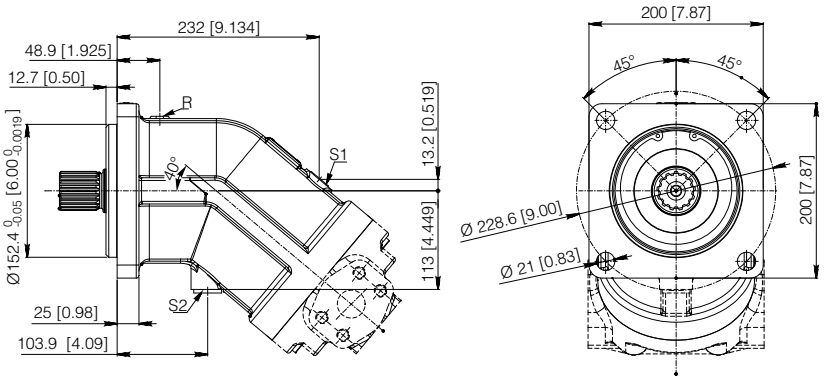
S15 Splined shaft



S16 Splined shaft



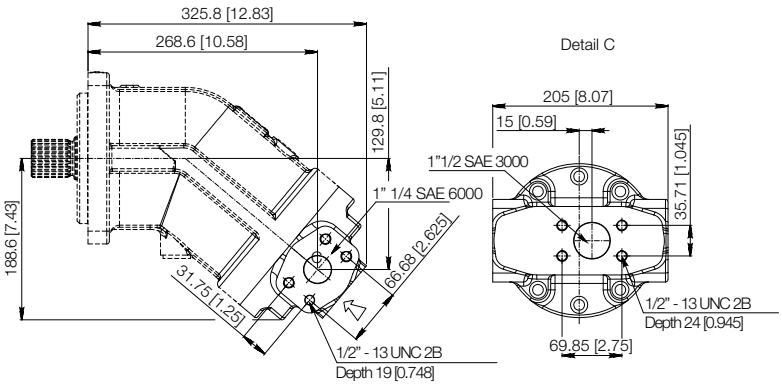
Dimensions SAE D 4 Bolts flange (O8) SH11C 160-180 SE



S1, S2: Drain ports (1 plugged) - 1” 1/16-12 UN 2B
A, B: Service line ports
R: Air bleed (plugged) - 7/16”-20 UNF

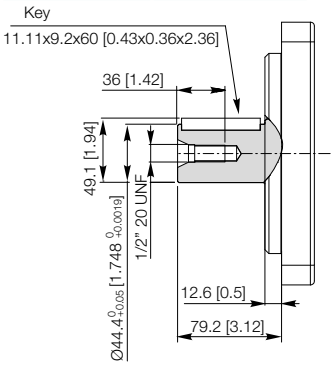
7 Port cover

FP2

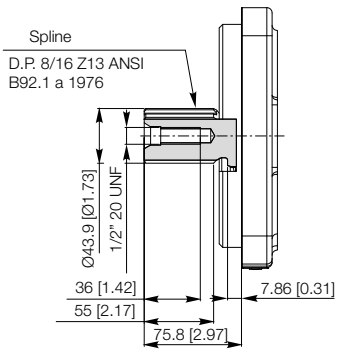


6 Shaft end

C18 Parallel keyed shaft

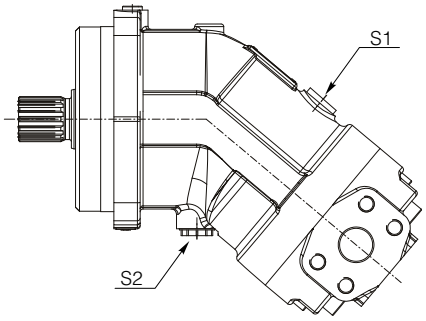


S15 Splined shaft



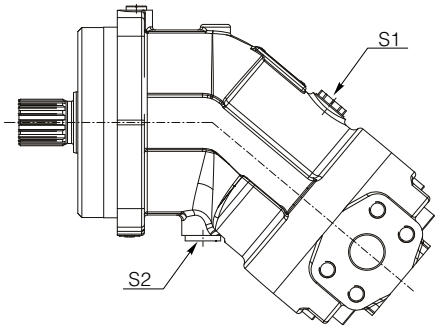
13 Drain plug reversed “RD”

STANDARD VERSION



S1 - Metallic plug.
S2 - Plastic plug.

“RD” VERSION

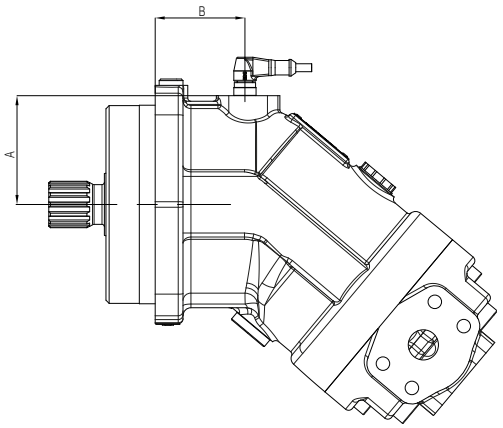


S1 - Plastic plug.
S2 - Metallic plug.

For the SH11C is possible to request the drain plug reversed compared to standard.
If it is necessary in this configuration, to specify in the purchase order the value “RD” (see position 13 of ordering code).

Other caratteristics

13 Version with tachometer and sensor “TZ”

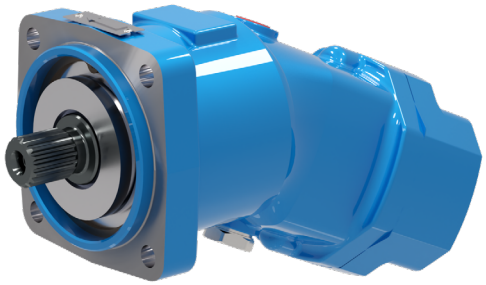


	ME					SE				
	020 030	**045-055 063**	**075 090**	**108 125**	**160 180**	**020 030**	**045-055 063**	**075 090**	**108 125**	**160 180**
A mm [inch]	61.5 [2.42]	56.5 [2.22]	63 [2.48]	74 [2.91]	74.5 [2.93]	78.5 [3.09]	81 [3.18]	88 [3.46]	106 [4.17]	107.5 [4.23]
B mm [inch]	57 [2.24]	68.5 [2.69]	71.7 [2.82]	77.4 [3.04]	85 [3.34]	57 [2.24]	68.5 [2.69]	71.7 [2.82]	77.4 [3.04]	85 [3.34]

2-Channel differential-hall effect operating principle Sensor with dual-channel output (90°)
Power supply 8-32 VDC
Frequency 0-20.000 Hz
Operating temperature -40°C +125°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

	Size				
	020 030	**045-055 063**	**075 090**	**108 125**	**160 180**
Number of pulses per revolution	38	47	53	59	67

H1C - Fixed displacement motors





Index

General information - Features..... E2
Technical Data..... E4
Ordering code..... E5
Dimensions ISO 4 Bolts flange..... E9
Dimensions SAE C 4 Bolts flange..... E12
Dimensions SAE E 4 Bolts flange..... E13

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow motor** l/min [U.S. gpm]	**Max. flow pump** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]
H1C 006	6.067 [0.37]	36.4 [9.61]	30.3 [7.99]	350 [5100]
H1C 040	40.1 [2.45]	175 [46.1]	132 [34.8]	350 [5100]
H1C 226	225.1 [13.73]	540 [142.5]	360 [95]	350 [5100]

H1C series units are a family of fixed displacement pumps and motors, bent axis piston design for operation in both open and closed circuit. The proven design incorporating the lens shape valve plate, the high quality components and manufacturing techniques make the H1C series units to able provide up to 350 bar [5100 psi] continuous and 450 bar [6500 psi] peak performance. Fully laboratory tested and field proven, these units provide maximum efficiency and longlife. Heavy duty bearings permit high radial and axial loads. Versatile design includes a variety of port plate, shaft end and valves package that will adapt the H1C series units to any application both industrial and mobile. H1C series units are available in both ISO and SAE version.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m² [lbf·ft²]	Moment of inertia
m	kg [lbs]	Weight
n_{max}	rpm	Maximum speed
p_{max}	bar [psi]	Maximum continuous pressure
p_{peak}	bar [psi]	Maximum pressure peak

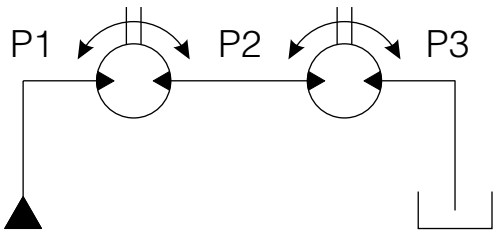
Q_{max}	l/min [U.S. gpm]	Maximum flow
Q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{max}	Nm [lbf.ft]	Maximum torque at pressure continuous
T_{peak}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm³/rev [in³/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷ 15 cSt is allowed for extreme operating conditions and for short periods only. For further information see on the General Information Catalogue, the section “Fluids and filtering”.

Temperature ranges:
The operating temperature of the oil must be within -25ºC÷ 90ºC [-13ºF ÷ 194ºF]. The running of the axial piston unit with oil temperature higher than 90ºC [194°F] or lower than -25ºC [-13°F] is not allowed. For further information see at Fluids and filtering section.

Filtering:
A correct filtering is essential for long and satisfactory life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999. For further details see on the General Information Catalogue, the section “Fluids and filtering”.

Inlet pressure:
(Pumps in open circuit) Minimum absolute pressure at suction port is 0.8 bar [11.6 psi]. In no circumstances can inlet pressure be lower.



Operating pressure:
The maximum permissible pressure on pressure ports is 350 bar [5100 psi] continuous and 450 bar [6500 psi] peak. If two motors are connected in series, working pressure has to be limited to following values: P1 400 bar max. [5800 psi] and P2 200 bar max. [2900 psi].

Case drain pressure:
Maximum permissible case drain pressure is 1.5 bar [22 psi]. A higher pressure can affect the main shaft seal or reduce its life.

Seals:
Seals used on standard H1C series axial piston pumps/motors are of NBR (Acrylonitrile-Butadiene Elastomer). For special uses (high temperatures or corrosive fluids) it is possible to order the unit with FKM seals (Fluoroelastomer). In case of use of special fluids, contact Dana.

Output shaft:
Main shaft has bearings that can bear both radial and axial loads. As for loads permissible values, see on the General Information Catalogue, the section “Service life of bearings for axial piston units”.

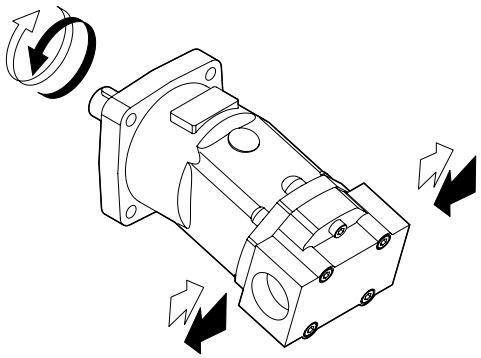
Minimum rotating speed:
Minimum rotating speed is the minimum speed ensuring a smooth running of the piston unit. Operation smooth at low speeds depends on many factors, as type of load and operating pressure. At a speed higher than 150 rpm, a smooth running is ensured almost in every case. Lower speeds are, usually, possible. Please contact Dana.

Installation:
H1C series pumps and motors can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. As for pumps, installation of the unit with shaft in vertical position and above the tank involves some limitations. For further details see on the General Information Catalogue, the section “General installation guidelines”.

Flangeable valves:
Flangeable valves are available for motors both in open and closed loop. For further details see at Valves Catalogue.

Relation between direction of rotation and direction of flow:
The relation between direction of rotation of shaft and direction of flow in H1C piston units is shown in the picture below.

Note: for pump operation, the direction of rotation is determined by the port plate mounting position. Usually, in order to change direction of rotation of a pump, port plate has to be removed, turned of 180° and reassembled.



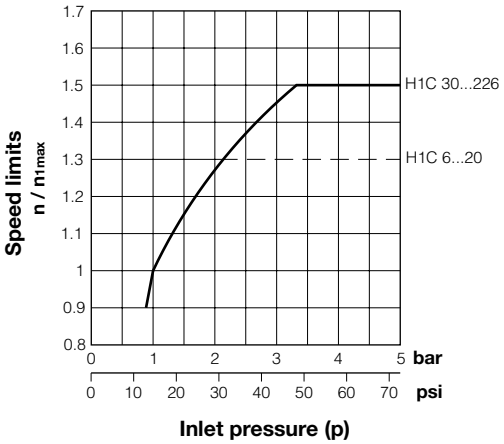
Reversible motor

			Size		
			006	040	226
Displacement	V_g	cm^3/rev [in^3/rev]	6.067 [0.37]	40.1 [2.45]	225.1 [13.73]
Max. pressure	p_{max}	bar [psi]	350 [5100]	350 [5100]	350 [5100]
Max. peak pressure	p_{peak}	bar [psi]	450 [6500]	450 [6500]	450 [6500]
Max. speed motor	n_{max}	rpm	6500	4350	2400
Max. flow motor	Q_{max}	l/min [U.S.gpm]	36.4 [9.61]	175 [46.1]	540 [142.5]
Max. power at p_{max} motor	P_{max}	kW [hp]	21.2 [28.4]	102 [136.8]	315 [422]
Torque costant	T_k	Nm/bar [lbf.ft/psi]	0.097 [0.005]	0.64 [0.032]	3.58 [0.182]
Max. torque at p_{max}	T_{max}	Nm [lbf.ft]	33.8 [24.9]	223 [164]	1254 [925]
Max. torque at p_{peak}	T_{peak}	Nm [lbf.ft]	43.5 [32.1]	288 [212]	1613 [1189]
Moment of inertia (3)	J	$kg \cdot m^2$ [$lbf.ft^2$]	0.0007 [0.016]	0.004 [0.094]	0.040 [0.949]
Weight (3)	m	kg [lbs]	5.5 [12.1]	22 [48.5]	86 [189.5]
External drain flow (4)	Q_d	l/min [U.S.gpm]	0.4 [0.10]	0.7 [0.18]	2.5 [0.66]

(Theorical values, without considering η_{hm} e η_v approximate values). Peak operations must not excede 1% of every minute. A simultaneus maximum pressure and maximum speed not recomended.

Notes: Calculation of permissible speed
(1) The pump rotation speed my be increased by increasing the
suction pressure. The max. pump speed must be always less then value n0 max shown in table. To calculate the max. permissible speed related to the pump suction pressure see the diagram at side. (2) The values are valid for a rotating speed of n1 max. (3) Approximate values. (4) Average values at 250 bar [3600 psi] with mineral oil at 45°C [113°F] and 35 cSt of viscosity.

Speed limits calculation



Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the H1C series. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Series	Motor/pump	Size	Version	Mount flange	Shaft end	Port cover	Direction of rotation	Seal	Valve	Valves feature	Flushing valve	Special feature	Painting
H1C	M	006	ME/SE	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XX	XX

1

Series	
H1C	Fixed displacement, bent axis, axial piston unit

2

Motor / Pump	
M	Motor

3

Size	
006	6.067 cm^3/giro [0.37 in^3/rev]
040	40.1 cm^3/giro [2.45 in^3/rev]
226	225.1 cm^3/giro [13.73 in^3/rev]

4

Version		Size		
		006	**040**	**226**
ME	ISO	●	●	●
SE	SAE	–	●	●

5

Mount flange		Size		
		006	**040**	**226**
OA	ISO 4 Bolts Ø 80 mm [Ø 3.12 in]	ME(1)	–	–
OC	ISO 4 Bolts Ø 125 mm [Ø 4.92 in]	–	ME(1)	–
05	SAE-C 4 Bolts	–	SE(2)	–
OG	ISO 4 Bolts Ø 200 mm [Ø 7.88 in]	–	–	ME(1)
10	SAE-E 4 Bolts	–	–	SE(2)

–: Not Available
1) The ME digit means that the flange is only available for the ISO version
2) The SE digit means that the flange is only available for the SAE version

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
H1C	M	006	ME/SE	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XX	XX

6

Shaft end		Size		
		006	040	226
CAV	Parallel keyed Ø 20 mm k6 [0.79 in k6]	ME	–	–
SAF	Splined W20x1.25x14x9g DIN 5480	ME	–	–
CAW	Parallel keyed Ø 30 mm k6 [1.18 in k6]	–	ME(1)	–
SAI	Splined W30x2x14x9g DIN 5480	–	ME(1)	–
C17	Parallel keyed Ø 31.75 mm [1.25 in]	–	SE(2)	–
S12	Splined 14T 12/24 DP	–	SE(2)	–
C18	Parallel keyed Ø 44.45 mm [1.75 in]	–	–	SE(2)
S15	Splined 13T 8/16 DP	–	–	SE(2)
CAX	Parallel keyed Ø 50 mm k6 [1.97 in k6]	–	–	ME(1)
SAR	Splined W50x2x24x9g DIN 5480	–	–	ME(1)

- : Not available
1) The ME digit means that the shaft is only available for the ISO version
2) The SE digit means that the shaft is only available for the SAE version

7

Port Cover		Size		
		006	040	226
FM1	Frontal ports	–	ME(1)	–
LM1	Lateral ports	ME(1)	–	–
LM2	Lateral ports	–	ME-SE(2)	ME-SE(2)
VM2(*)	Lateral ports same side	–	ME-SE(1-2)	–

- : Not Available

(*) The port cover threads are ISO also in SAE option.
1) The ME digit means that the port cover is only available for the ISO version.
2)The ME-SE digit means that the port cover is available for the ISO and SAE version.

8

Direction of rotation (viewed from shaft side)	
RV	Reversible

1	2	3	4	5	6	7	8	9	10	11	12	13	14
H1C	M	006	ME/SE	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XX	XX

9

Seal	
N	NBR
V	FKM

10

Valve		Size		
		006	040	226
XXXX	None	●	●	●
VCDM	VCD/M Pilot assisted overcentre valve	–	VM2	–
VCD1	VCD/1 Pilot assisted overcentre valve	–	LM2	LM2
VCD2	VCD/2 Pilot assisted overcentre valve	–	–	LM2
VCR3	VCR3 Double acting overcentre valve	–	VM2	–
VSD1	VSD 120 anti-shock valve	–	–	LM2

●: Available
–: Not Available

The valves are available with ISO port cover only, please contact Technical department for SAE version The VSD1 is not available with flushing valve.
1) The VM2 digit means that the valve is only available with VM2 port cover.
2) The LM2 digit means that the valve is only available with LM2 port cover.

11

Valves feature		Valves					
		XXXX	VCDM	VCD1	VCD2	VCR3	VSD1
000	Feature not necessary	●	–	–	–	–	–
004	Not Set 30÷350 bar [435 to 5075 psi] [Piloting ratio 6.2:1] Control of rotation CW	–	●	–	–	–	–
005	Not Set 30÷350 bar [435 to 5075 psi] [Piloting ratio 6.2:1] Control of rotation CCW	–	●	–	–	–	–
002	Not Set 0÷350 bar [0 to 5075 psi] [Piloting ratio 2.9:1] Control of rotation CW	–	–	●	–	–	–
006	Not Set 0÷350 bar [0 to 5075 psi] [Piloting ratio 2.9:1] Control of rotation CCW	–	–	●	–	–	–
003	Not Set 250÷500 bar [3625 to 7250 psi] [Piloting ratio 13:1] Control of rotation CW	–	–	–	●	–	–
007	Not Set 250÷500 bar [3625 to 7250 psi] [Piloting ratio 13:1] Control of rotation CCW	–	–	–	●	–	–
014	Not Set (Max setting 350 bar [5075 psi]) Control of rotation CW	–	–	–	–	–	●
015	Not Set (Max setting 350 bar [5075 psi]) Control of rotation CCW	–	–	–	–	–	●
012	Not Set [Piloting ratio 8:1]	–	–	–	_	●	–

●: Available
–: Not Available
Please contact Technical department for valve which requie specific setting.
For the feature see catalogue valves.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
H1C	M	006	ME/SE	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XX	XX

12

Flushing valve		Size		
		006	040	226
XX	Not Required	●	●	●
06	Flushing Valve VSC/F - 6 l/min	–	LM2-VM2	LM2
09	Flushing Valve VSC/F - 10.5 l/min	–	LM2-VM2	LM2
15	Flushing Valve VSC/F - 15 l/min	–	LM2-VM2	LM2

● : Available
– : Not Available
It is not possible to combine the flushing valves with valve in pos.10
For the feature see catalogue valves.

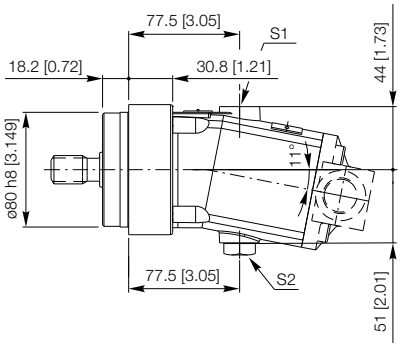
13

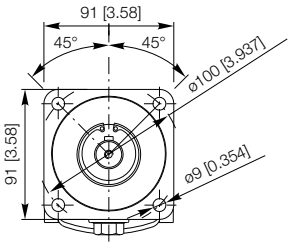
Special feature		Size		
		006	040	226
XX	None	●	●(1)	●
01	Special shaft seal 5 bar [72.5 psi]	–	●(2)	●
03	SAE Version with ISO port cover	–	●(3)	●(4)

● : Available
– : Not Available
1) Not available with SAE version and VM2 port cover.
2) Only with NBR seals.
3) Available with FM1 - VM2 - LP2 port cover.
4) Available with LM2 port cover.

14

Painting	
XX	None
01	Black Painted RAL 9005
02	Blue Painted RAL 5015

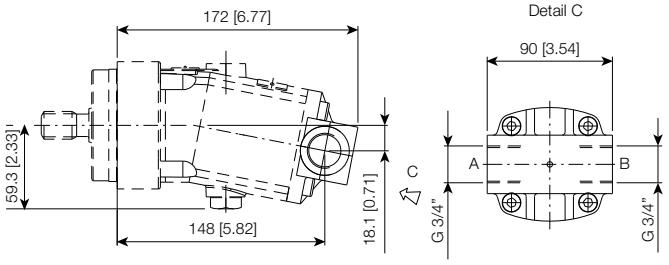




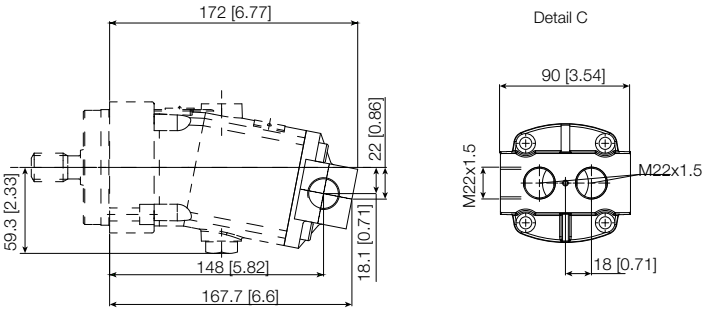
S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports
S: Suction port

7 Port cover

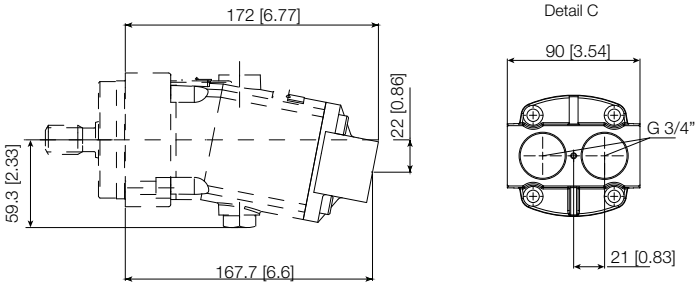
LM1



FLM

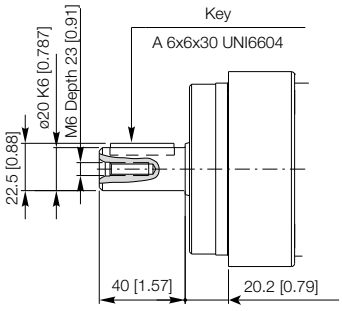


FM1

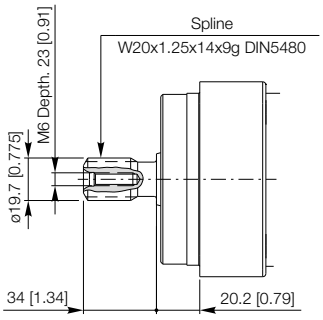


6 Shaft end

CAV Splined shaft

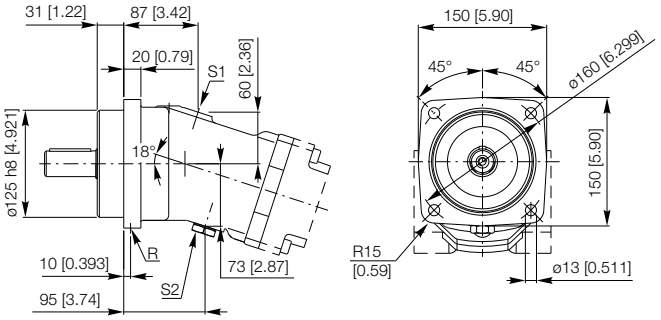


SAF Splined shaft



Dimensions ISO 4 Bolts flange (OC)

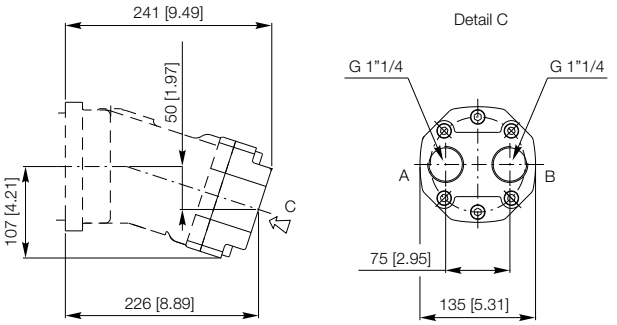
H1C 040 ME



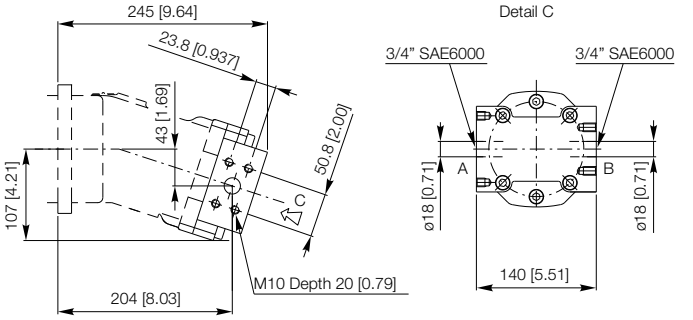
S1, S2: Drain ports - (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
S: Suction port
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

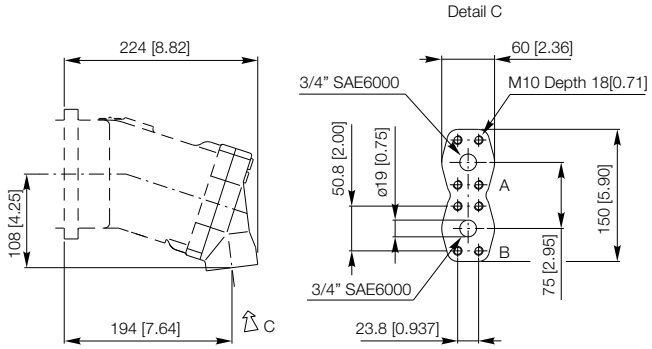
FM1



LM2

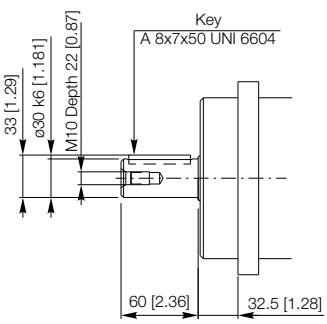


VM2

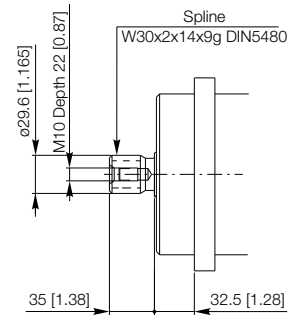


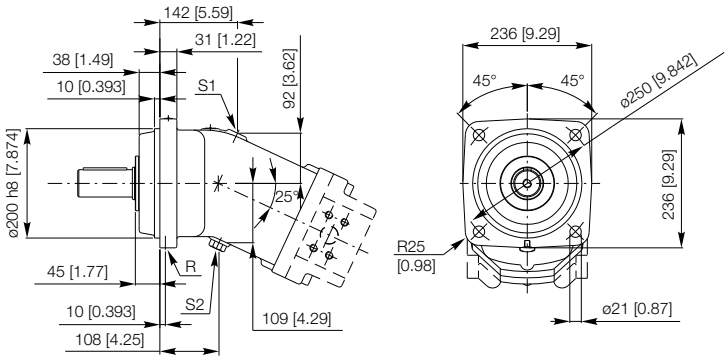
6 Shaft end

CAW Parallel keyed shaft



SAI Splined shaft

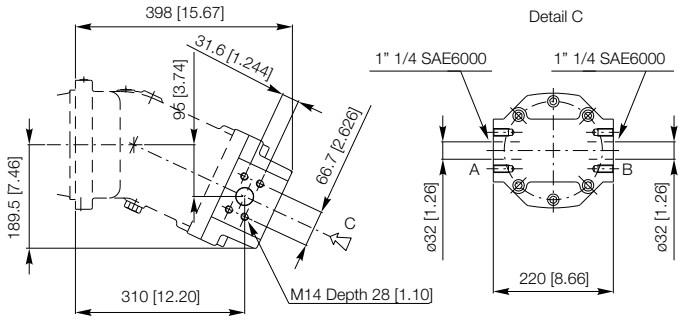




S1, S2: Drain ports (1 plugged) - 3/4 G (BSPP)
A, B: Service line ports
S: Suction port
R: Air bleed (plugged) - 1/8 G (BSPP)

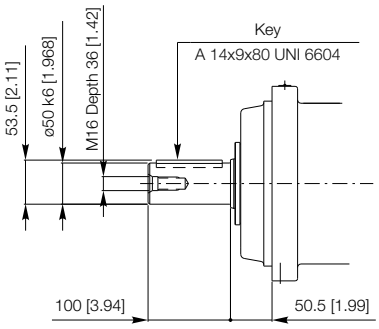
7 Port cover

LM2

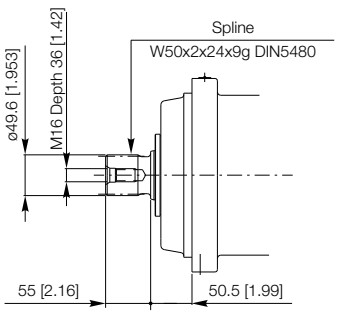


6 Shaft end

CAX Parallel keyed shaft

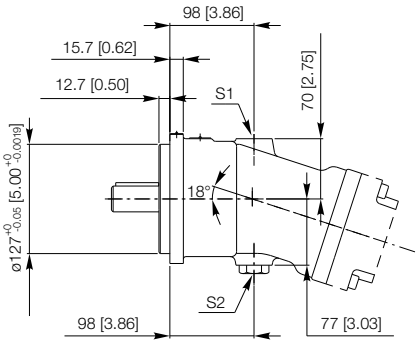


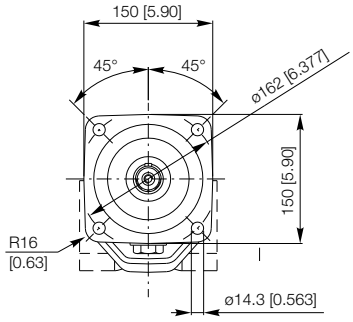
SAR Splined shaft



Dimensions SAE C 4 Bolts flange (05)

H1C 040 SE

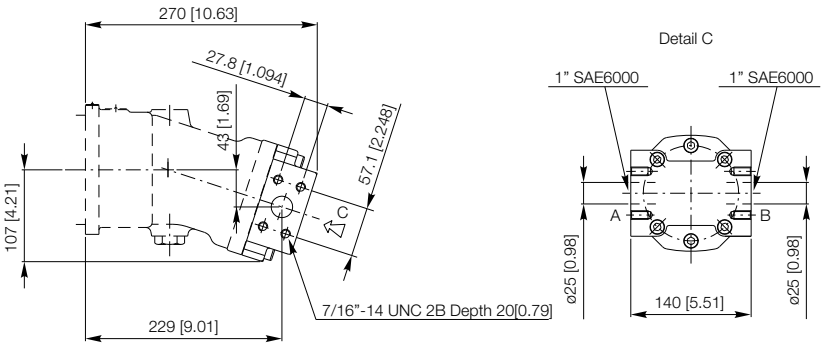




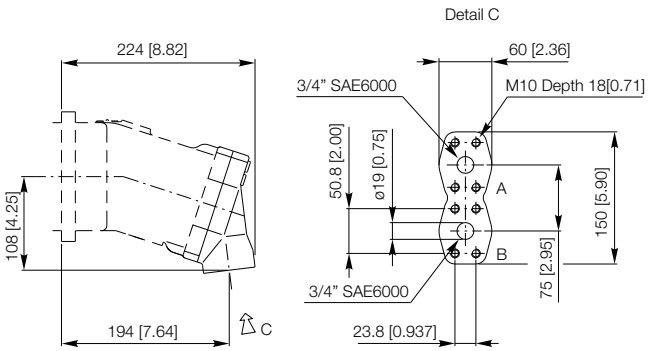
S1, S2: Drain ports (1 plugged) - 1” 1/16-12 UN 2BA, A,
B: Service line ports
S: Suction port

7 Port cover

LM2

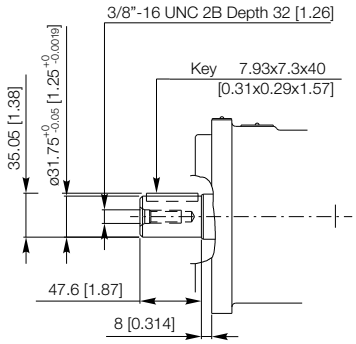


VM2

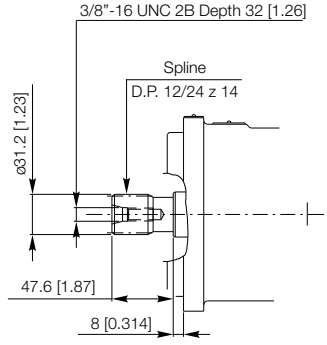


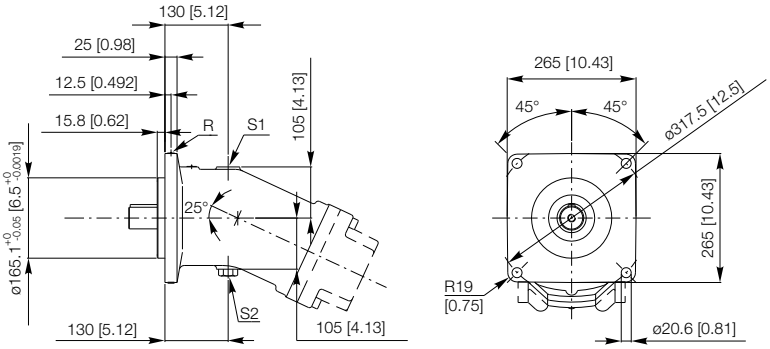
6 Shaft end

C17 Splined shaft



S12 Splined shaft

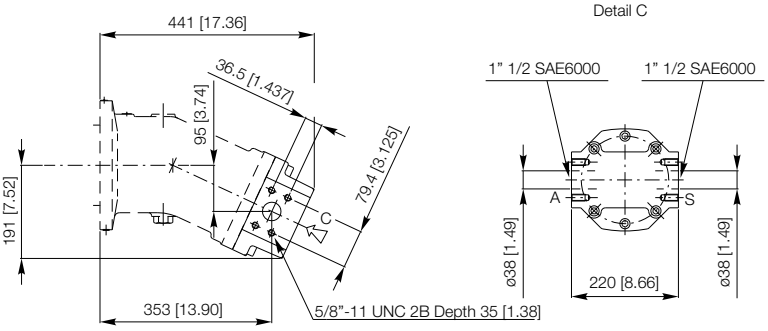




S1, S2: Drain ports (1 plugged) - 1" 3/16-12 UN 2B
A, B: Service line ports
S: Suction port
R: Air bleed (plugged) - 7/16"-20 UNF

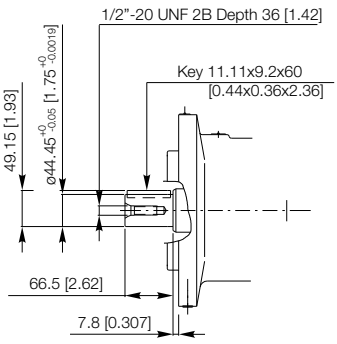
7 Port cover

LM2

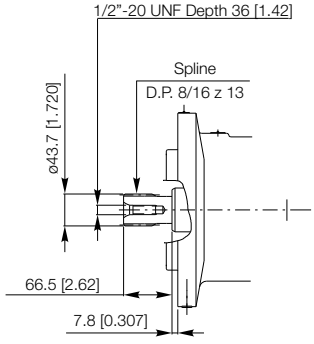


6 Shaft end

C18 Parallel keyed shaft



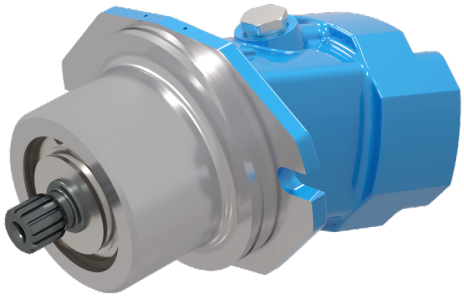
S15 Splined shaft



DANA BREVINI® Motion Systems

H1CR - Fixed displacement motors for gearbox, plug in version





Index

General information - Features.....F2
Technical data F4
Ordering code F5
Dimensions 2 Bolts flange (OL) F8
Special version F9

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]
H1CR 045	44.3 [2.67]	186 [49]	350 [5100]

H1CR series are a family of fixed displacement motors, bent axis piston design for operation in both open and closed circuit. H1CR series motors are mainly intended for installation in mechanical gearboxes such as track drive and winches gear boxes.
The proven design incorporating the lens shape valve plate, the high quality components and manufacturing tecniques make the H1CR series motors able to provide up to 350 bar [5100 psi] continuos and 450 bar [6500 psi] peak performance.
Fully laboratory tested and field proven, these motors provide maximum efficiency and long life. Heavy duty bearings permit high radial and axial loads.
Flangeable valves, both for open and closed circuit, enable H1CR series motors to meet the requirements of the most different types of applications.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m² [lbf·ft²]	Moment of inertia
m	kg [lbs]	Weight
$n_{0\ max}$	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure
p_{max}	bar [psi]	Maximum pressure peak

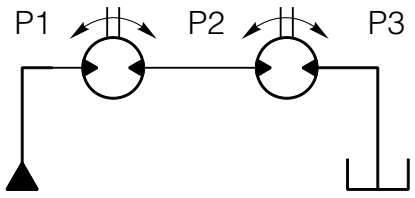
q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm³/rev [in³/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10÷15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and filtering section.

Temperature ranges:
The operating temperature of the oil must be within -25ºC÷90ºC [-13ºF÷194ºF]. The running of the axial piston unit with oil temperature higher than 90ºC [194°F] or lower than -25ºC [-13°F] is not allowed. For further information see at Fluids and filtering section.

Filtering:
A correct filtration helps to extend the service life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999. For further details see at Fluids and filtering section.

Operating pressure:
The maximum permissible pressure on pressure ports is 350 bar [5100 psi] continuos and 450 bar [6500 psi] peak. It two motors are connected in series, working pressure has to be limited to following values: P1 400 bar max. [5800 psi] and P2 200 bar max. [2900 psi].



Case drain pressure:
Maximum permissible case drain pressure is 1.5 bar [22 psi]. A higher pressure can damage the main shaft seal or reduce its life.

Seals:
Seals used on standard H1CR series axial piston motors are of NBR (Acrylonitrile-Butadiene Elastomer). For special uses (high temperatures or corrosive fluids) it is possible to order the unit with FKM seals (Fluoroelastomer). In case of use of use special fluids, contact Dana.

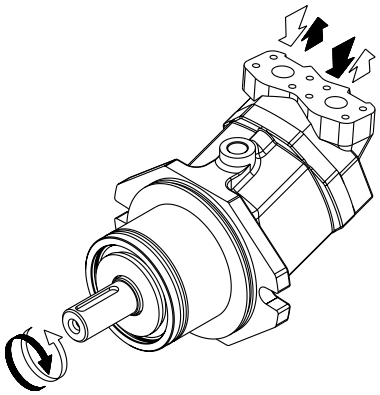
Loads on output shaft:
Main shaft has bearings that can bear both radial and axial loads. As for loads permissible values, see relevant section at Bearing life on axial piston unit Service life of bearings for axial piston units.

Minimum rotation speed:
Under “minimum rotating speed” we mean the minimum speed ensuring a smooth running of the piston motor. Operation smoothness at low speeds depends on many factors, as type of load and operating pressure. At a speed higher than 150 rpm, a smooth running is ensured almost in every case. Lower speeds are, usually, possible. For special applications please contact Dana.

Installation:
H1CR motors can be installed in various position and directions; however, installation in vertical position with shaft towards upper is not allowed. These axial piston units have separated ports and drain chambers and so must be always drained. For further detail see at General installation guidelines.

Flangeable valves:
Flangeable valves are available for motors both in open and closed loop. VSC06F, VSC09F, VSC15F AND VSC21F flushing valves are for closed loop, VCD/M overcentre valve is for open loop. For further details see at Valves section.

Relation between direction of rotation and direction of flow:
The relation between direction of rotation of shaft and direction of flow in H1CR piston motors is shown in the picture below**.**



Technical data

Displacement	V_g	cm^3/rev [in^3/rev]	44.3 [2.67]
Max. Press. cont.	p_{nom}	bar [psi]	350 [5100]
Max. Press. peak	p_{max}	bar [psi]	450 [6500]
Max. speed	$n_{0\ max}$	rpm	4200
Max. flow	q_{max}	l/min [U.S.gpm]	186 [49]
Max. power at p_{nom}	P_{max}	kW [hp]	108 [145]
Torque costant	T_k	Nm/bar [lbf.ft/psi]	0.70 [0.036]
Max. torque cont. at p_{nom}	T_{nom}	Nm [lbf.ft]	247 [182]
Max torque peak at p_{max}	T_{max}	Nm [lbf.ft]	317 [233.6]
Moment of inertia (1)	**J**	$kg{\cdot}m^2$ [$lbf.ft^2$]	0.004 [0.094]
Weight (1)	**m**	kg [lbs]	20 [44.1]
External drain flow (2)	q_d	l/min [U.S.gpm]	0.7 [0.18]

Theorical values, without considering η_{hm} and η_v; approximate values. Peak operations must not excede 1% of every minute.
A simultaneus maximum pressure and maximum speed not recomended.
Pump values refer to open circuit operation.

Notes:
(1)Approximate values.
(2)Average values at 250 bar [3600 psi] with mineral oil at 45°C [113°F] and 35 cSt.

Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the H1CR series. Use the model code below to specify the desired features. All alphanumeric digits system of the code must be present when ordering. We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Series	Motor	Size	Version	Mount flange	Shaft end	Port cover	Direction of rotation	Seal	Valve	Valves feature	Flushing valve	Special feature	Painting
H1CR	M	045	GE	OL	SAI	LM2	RV	V	VCDM	000	06	RD	01

1

Series	
H1CR	Plug-in fixed displacement motors for gearbox

2

Motor	
M	Motor

3

Size	
045	44.3 cm^3/rev [2.67 in^3/rev]

4

Version	
GE	ISO 3019-2 metric.

5

Flange	
OL	2 bolts Ø 160 mm h6 [Ø 6.3 in]

6

Shaft end	
SAI	Splined W30x2x14x9g DIN 5480

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
H1CR	M	045	G	OL	SAI	LM2	RV	V	VCDM	000	06	RD	01

7

Port cover	
FM1	Frontal ports
LM2	Lateral ports
VM2	Lateral ports same side

8

Direction of rotation (viewed from shaft side)	
RV	Reversible

9

Seal	
N	NBR
V	FKM

10

Valve		Port cover		
		FM1	**LM2**	**VM2**
XXXX	None	●	●	●
VCDM	VCD/M Pilot assisted overcentre valve	–	–	●
VCR3	VCR3 Control Rotation Valve	–	–	●

11

Valvel feature		Valve		
		XXXX	**VCDM**	**VCR3**
000	None	●	–	–
004	Not Set 30÷350 bar [435 to 5075 psi] Piloting ratio 6.2:1 Control of rotation CW	–	●	–
005	Not Set 30÷350 bar [435 to 5075 psi] Piloting ratio 6.2:1 Control of rotation CCW	–	●	–
012	Not Set (Piloting ratio 8:1)	–	–	●

– : Not available
• : Available

Please contact Technical department for valve which require specific setting. For the technical specifications see catalogue valves.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
H1CR	M	045	G	OL	SAI	LM2	RV	V	VCDM	000	06	RD	01

12

Flushing valve		Port cover		
		FM1	LM2	VM2
XX	None	●	●	●
06	VSC/F Flushing valve - 6 l/min [1.58 U.S. gpm]	–	●	●
09	VSC/F Flushing valve - 10.5 l/min [2.77 U.S. gpm]	–	●	●
15	VSC/F Flushing valve - 15 l/min [3.96 U.S. gpm]	–	●	●
21	VSC/F Flushing valve - 20 l/min [5.28 U.S. gpm]	–	●	●

– : Not available
● : Available

It is not possible to combine the flushing valves with valve in pos.10. For the technical specifications see catalogue valves.

13

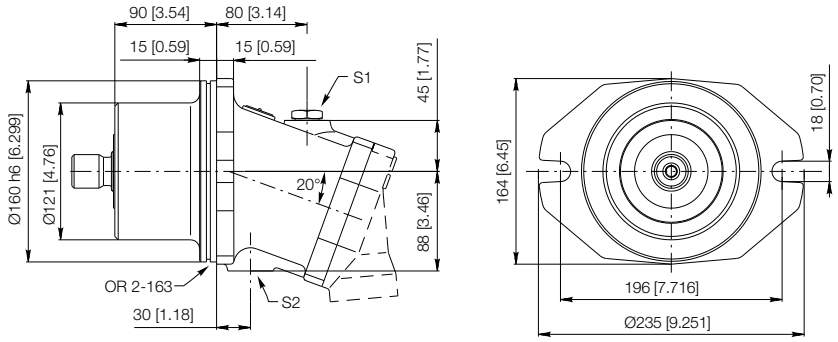
Special feature	
XX	None
RD	Drain plugs reversed

14

Painting	
XX	None
01	Black Painted RAL 9005
02	Blue Painted RAL 5015

Dimensions 2 Bolts flange (OL)

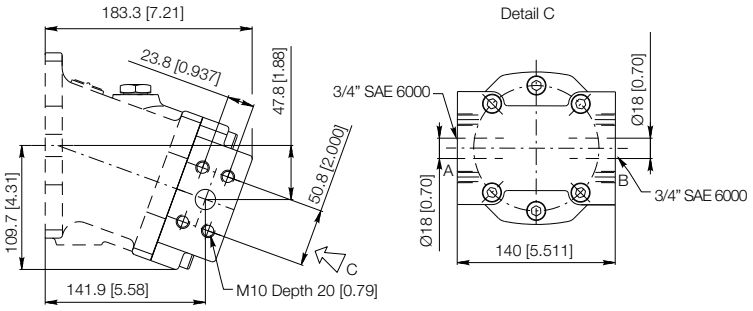
H1CR 045



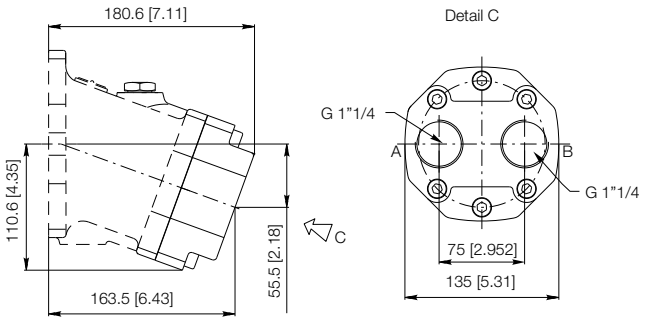
S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

7 Port cover

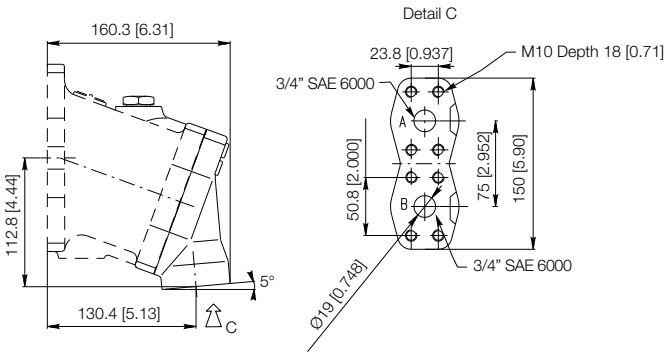
LM2



FM1

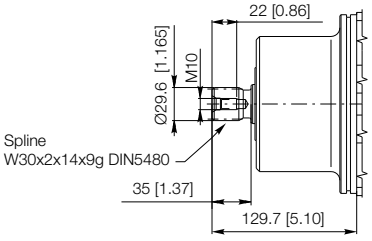


VM2



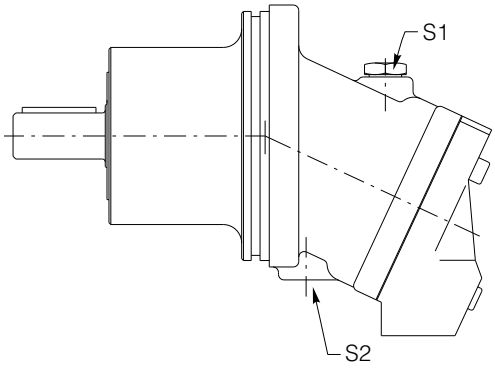
6 Shaft end

SAI Splined shaft



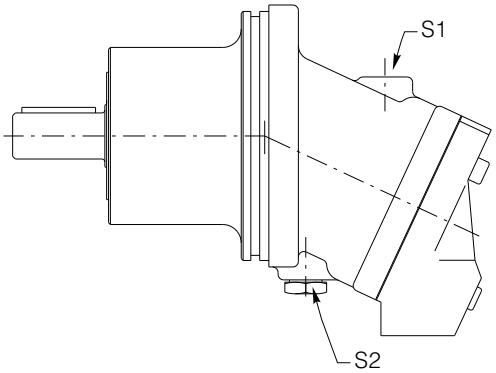
13 Drain plugs reversed

STANDARD VERSION



S1 - Metallic plug.
S2 - Plastic plug.

"RD" VERSION

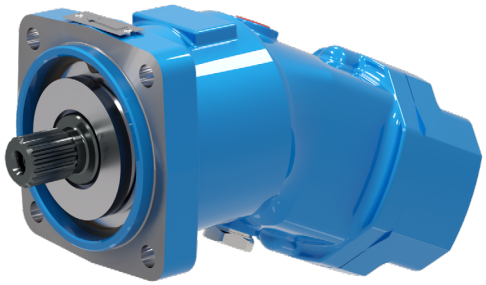


S1 - Plastic plug.
S2 - Metallic plug.

For the H1CR motors it is possible to request the drain plug reversed compared to standard.
If it is necessary the motor with this configuration, to specify in the purchase order the value "RD" (See position 13 of ordering code).

DANA BREVINI® Motion Systems

H1C - Fixed displacement pump





Index

General information - Features..... G2
Technical Data..... G4
Ordering code..... G5
Dimensions ISO 4 Bolts flange..... G9

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]
H1C 006	6.067 [0.37]	30.3 [7.99]	350 [5100]
H1C 012	10.9 [0.66]	47 [12.4]	350 [5100]
H1C 020	19.6 [1.20]	84 [22.2]	350 [5100]
H1C 030	30.0 [1.83]	90 [23.7]	350 [5100]
H1C 040	40.1 [2.45]	132 [34.8]	350 [5100]
H1C 055	54.8 [3.34]	143 [37.7]	350 [5100]
H1C 075	75.3 [4.60]	173 [45.6]	350 [5100]
H1C 090	87.0 [5.30]	217 [57.3]	350 [5100]
H1C 108	107.5 [6.56]	215 [56.7]	350 [5100]
H1C 160	160.8 [9.81]	289 [76.3]	350 [5100]
H1C 226	225.1 [13.73]	360 [95]	350 [5100]

H1C series units are a family of fixed displacement pumps, bent axis piston design for operation in both open and closed circuit. The proven design incorporating the lens shape valve plate, the high quality components and manufacturing techniques make the H1C series units to able provide up to 350 bar [5100 psi] continuous and 450 bar [6500 psi] peak performance. Fully laboratory tested and field proven, these units provide maximum efficiency and longlife. Heavy duty bearings permit high radial and axial loads. Versatile design includes a variety of port plate, shaft end and valves package that will adapt the H1C series units to any application both industrial and mobile. H1C series units are available in both ISO and SAE version.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m² [lbf·ft²]	Moment of inertia
m	kg [lbs]	Weight
n_{max}	rpm	Maximum speed
p_{max}	bar [psi]	Maximum continuous pressure
p_{peak}	bar [psi]	Maximum pressure peak

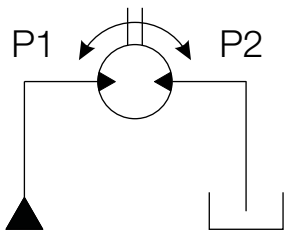
Q_{max}	l/min [U.S. gpm]	Maximum flow
Q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{max}	Nm [lbf.ft]	Maximum torque at pressure continuous
T_{peak}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm³/rev [in³/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷ 15 cSt is allowed for extreme operating conditions and for short periods only. For further information see on the General Information Catalogue, the section “Fluids and filtering”.

Temperature ranges:
The operating temperature of the oil must be within -25ºC÷ 90ºC [-13ºF ÷ 194ºF]. The running of the axial piston unit with oil temperature higher than 90ºC [194°F] or lower than -25ºC [-13°F] is not allowed. For further information see at Fluids and filtering section.

Filtering:
A correct filtering is essential for long and satisfactory life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999. For further details see on the General Information Catalogue, the section “Fluids and filtering”.

Inlet pressure:
(Pumps in open circuit) Minimum absolute pressure at suction port is 0.8 bar [11.6 psi]. In no circumstances can inlet pressure be lower.



Operating pressure:
The maximum permissible pressure on pressure ports is 350 bar [5100 psi] continuous and 450 bar [6500 psi] peak. If two motors are connected in series, working pressure has to be limited to following values: P1 400 bar max. [5800 psi] and P2 200 bar max. [2900 psi].

Case drain pressure:
Maximum permissible case drain pressure is 1.5 bar [22 psi]. A higher pressure can affect the main shaft seal or reduce its life.

Seals:
Seals used on standard H1C series axial piston pumps are of NBR (Acrylonitrile-Butadiene Elastomer). For special uses (high temperatures or corrosive fluids) it is possible to order the unit with FKM seals (Fluoroelastomer). In case of use of special fluids, contact Dana.

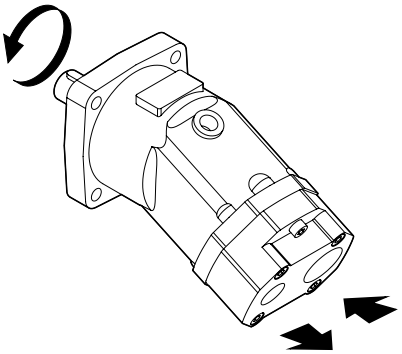
Output shaft:
Main shaft has bearings that can bear both radial and axial loads. As for loads permissible values, see on the General Information Catalogue, the section “Service life of bearings for axial piston units”.

Minimum rotating speed::
Minimum rotating speed is the minimum speed ensuring a smooth running of the piston unit. Operation smooth at low speeds depends on many factors, as type of load and operating pressure. At a speed higher than 150 rpm, a smooth running is ensured almost in every case. Lower speeds are, usually, possible. Please contact Dana.

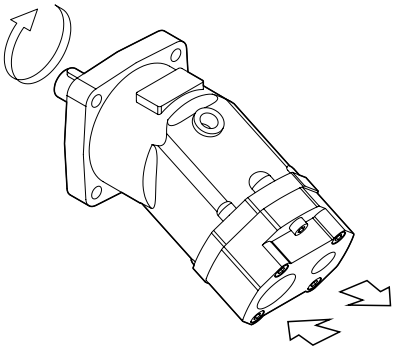
Installation:
H1C series pumps can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. As for pumps, installation of the unit with shaft in vertical position and above the tank involves some limitations. For further details see on the General Information Catalogue, the section “General installation guidelines”.

Relation between direction of rotation and direction of flow:
The relation between direction of rotation of shaft and direction of flow in H1C piston units is shown in the picture below.

Note: for pump operation, the direction of rotation is determined by the port plate mounting position. Usually, in order to change direction of rotation of a pump, port plate has to be removed, turned of 180° and reassembled.



CW rotating pump



CCW rotating pump

			Size										
			006	012	020	030	040	055	075	090	108	160	226
Displacement	V_g	cm^3/rev [in^3/rev]	6.067 [0.37]	10.9 [0.66]	19.6 [1.20]	30.0 [1.83]	40.1 [2.45]	54.8 [3.34]	75.3 [4.60]	87.0 [5.30]	107.5 [6.56]	160.8 [9.81]	225.1 [13.73]
Max. pressure	p_{max}	bar [psi]	350 [5100]	350 [5100]	350 [5100]	350 [5100]	350 [5100]	350 [5100]	350 [5100]	350 [5100]	350 [5100]	350 [5100]	350 [5100]
Max. peak pressure	p_{peak}	bar [psi]	450 [6500]	450 [6500]	450 [6500]	450 [6500]	450 [6500]	450 [6500]	450 [6500]	450 [6500]	450 [6500]	450 [6500]	450 [6500]
*** Max. speed pump (1)**	n_{max}	rpm	5000	4300	4300	3000	3300	2600	2300	2500	2000	1800	1600
Max. flow pump (2)	$Q_{1\ max}$	l/min [U.S.gpm]	30.3 [7.99]	47 [12.4]	84 [22.2]	90 [23.7]	132 [34.8]	143 [37.7]	173 [45.6]	217 [57.3]	215 [56.7]	289 [76.3]	360 [95]
Max. power at p_{max} pump	P_{max}	kW [hp]	17.7 [23.7]	27 [36]	49 [65]	53 [71]	77 [103]	83 [111]	101 [135]	127 [170]	125 [167]	169 [226]	210 [281]
Torque costant	T_k	Nm/bar [lbf.ft/psi]	0.097 [0.005]	0.17 [0.0087]	0.31 [0.016]	0.48 [0.024]	0.64 [0.032]	0.87 [0.044]	1.20 [0.0061]	1.38 [0.070]	1.71 [0.087]	2.56 [0.130]	3.58 [0.182]
Max. torque at p_{max}	T_{max}	Nm [lbf.ft]	33.8 [24.9]	60.5 [44.5]	109 [80]	167 [123]	223 [164]	306 [225]	420 [310]	485 [357]	599 [442]	896 [661]	1254 [925]
Max. torque at p_{peak}	T_{peak}	Nm [lbf.ft]	43.5 [32.1]	76 [56]	139 [102]	216 [159]	288 [212]	391 [288]	540 [398]	623 [460]	770 [568]	1152 [849]	1613 [1189]
Moment of inertia (3)	J	$kg{\cdot}m^2$ [$lbf.ft^2$]	0.0007 [0.016]	0.0007 [0.016]	0.002 [0.047]	0.002 [0.047	0.004 [0.094]	0.004 [0.094]	0.008 [0.190]	0.013 [0.308]	0.13 [0.308]	0.025 [0.593]	0.040 [0.949]
Weight (3)	m	kg [lbs]	5.5 [12.1]	5.5 [12.1]	13 [28.7]	13 [28.7]	22 [48.5]	22 [48.5]	30 [66.1]	45 [99.2]	45 [99.2]	61 [134.5]	86 [189.6]
External drain flow (4)	Q_d	l/min [U.S.gpm]	0.4 [0.10]	0.4 [0.10]	0.4 [0.10]	0.6 [0.16]	0.7 [0.18]	0.8 [0.21]	0.9 [0.23]	1.0 [0.26]	1.2 [0.31]	1.8 [0.47]	2.5 [0.66]

Theorical values, without considering η_{hm} e η_v approximate values. Peak operations must not excede 1% of every minute. Simultaneous maximum pressure and maximum speed are not recommended.

Notes:

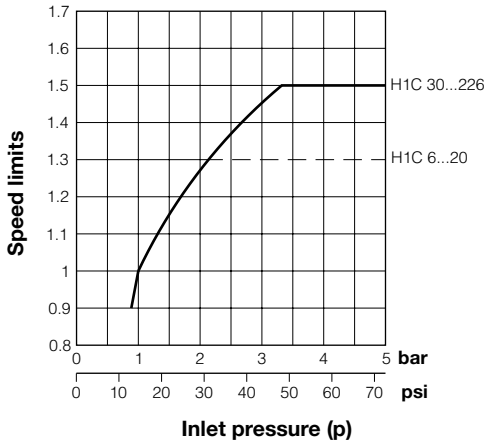
(1) Calculation of permissible speed: the pump rotation speed may be increased by increasing the suction pressure. The max pump speed must be always less then value n_{max} shown in table. To calculate the max permissible speed related to the pump suction pressure see the diagram below.

(2) The values are valid for a rotating speed of n_{max}.

(3) Approximate values.

(4) Average values at 250 bar [3600 psi] with mineral oil at 45°C [113°F] and 35 cSt of viscosity.

Speed limits calculation



Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the H1C series. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10 (*)	11(*)	12(*)	13	14
Series	Motor/pump	Size	Version	Mount flange	Shaft end	Port cover	Direction of rotation	Seal	Valve	Valves feature	Flushing valve	Special feature	Painting
H1C	P	006	ME/SE	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XX	XX

1

Series	
H1C	Fixed displacement, bent axis, axial piston unit

2

Pump	
P	Pump

3

Size	
006	6.067 cm³/giro [0.37 in³/rev]
012	10.9 cm³/giro [0.66 in³/rev]
020	19.6 cm³/giro [1.20 in³/rev]
030	30.0 cm³/giro [1.83 in³/rev]
040	40.1 cm³/giro [2.45 in³/rev]
055	54.8 cm³/giro [3.34 in³/rev]
075	75.3 cm³/giro [4.60 in³/rev]
090	87.0 cm³/giro [5.30 in³/rev]
108	107.5 cm³/giro [6.56 in³/rev]
160	160.8 cm³/giro [9.81 in³/rev]
226	225.1 cm³/giro [13.73 in³/rev]

4

Version	
ME	ISO

(*) Fields 10, 11 and 12 reserved for H1C motors

Ordering code

1	2	3	4	5	6	7	8	9	10(*)	11(*)	12(*)	13	14
H1C	P	006	ME	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XX	XX

5

Mount Flange		Size										
		006	012	020	030	040	055	075	090	108	160	226
OA	ISO 4 Bolts Ø 80 mm [Ø 3.149 in]	●	●	-	-	-	-	-	-	-	-	-
OB	ISO 4 Bolts Ø 100 mm [Ø 3.937 in]	-	-	●	●	-	-	-	-	-	-	-
OC	ISO 4 Bolts Ø 125 mm [Ø 4.921 in]	-	-	-	-	●	●	-	-	-	-	-
OD	ISO 4 Bolts Ø 140 mm [Ø 5.511 in]	-	-	-	-	-	-	●	-	-	-	-
OE	ISO 4 Bolts Ø 160 mm [Ø 6.299 in]	-	-	-	-	-	-	-	●	●	-	-
OF	ISO 4 Bolts Ø 180 mm [Ø 7.086 in]	-	-	-	-	-	-	-	-	-	●	-
OG	ISO 4 Bolts Ø 200 mm [Ø 7.874 in]	-	-	-	-	-	-	-	-	-	-	●

●: Available
–: Not Available

6

Shaft end		Size										
		006	012	020	030	040	055	075	090	108	160	226
CAV	Parallel keyed Ø 20 mm k6 [0.787 in k6]	●	●	-	-	-	-	-	-	-	-	-
SAF	Splined W20x1.25x14x9g DIN 5480	●	●	-	-	-	-	-	-	-	-	-
CBM	Parallel keyed Ø 25 mm k6 [0.984 in k6]	-	●	●	●	-	-	-	-	-	-	-
SAG	Splined W25x1.25x18x9g DIN 5480	-	-	●	●	-	-	-	-	-	-	-
CAW	Parallel keyed Ø 30 mm k6 [1.181 in k6]	-	-	-	-	●	●	-	-	-	-	-
SAI	Splined W30x2x14x9g DIN 5480	-	-	-	-	●	●	-	-	-	-	-
CAY	Parallel keyed Ø 35 mm k6 [1.377 in k6]	-	-	-	-	-	-	●	-	-	-	-
SAM	Splined W35x2x16x9g DIN 5480	-	-	-	-	-	-	●	-	-	-	-
SAO	Splined W40x2x18x9g DIN 5480	-	-	-	-	-	-	-	●	●	-	-
CAK	Parallel keyed Ø 40 mm k6 [1.574 in k6]	-	-	-	-	-	-	-	●	●	-	-
CAJ	Parallel keyed Ø 45 mm k6 [1.771 in k6]	-	-	-	-	-	-	-	-	-	●	-
SAP	Splined W45x2x21x9g DIN 5480	-	-	-	-	-	-	-	-	-	●	-
CAX	Parallel keyed Ø 50 mm k6 [1.968 in k6]	-	-	-	-	-	-	-	-	-	-	●
SAR	Splined W50x2x24x9g DIN 5480	-	-	-	-	-	-	-	-	-	-	●

●: Available
–: Not Available

(*) Fields 10, 11 and 12 reserved for H1C motors

Ordering code

1	2	3	4	5	6	7	8	9	10(*)	11(*)	12(*)	13	14
H1C	P	006	ME	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XX	XX

7

Port Cover		Size										
		006	012	020	030	040	055	075	090	108	160	226
FP1	Frontal ports	●	●	●	●	●	-	●	●	●	-	-
LP2	Lateral ports	-	-	-	-	●	●	●	●	●	-	-
FP2	Frontal ports	-	-	-	-	-	-	-	-	-	●	●
FPM	Special FP2+LM2	-	-	-	-	-	-	-	-	-	-	●

●: Available
–: Not Available

8

Direction of rotation (viewed from shaft side)	
DX	CW - Clockwise
SX	CCW - Counter Clockwise

9

Seal	
N	NBR
V	FKM

(*) Fields 10, 11 and 12 reserved for H1C motors

Ordering code

1	2	3	4	5	6	7	8	9	10(*)	11(*)	12(*)	13	14
H1C	P	006	ME	OA	CAV	LM1	RV	N/V	XXXX	000	XX	XXX	XXX

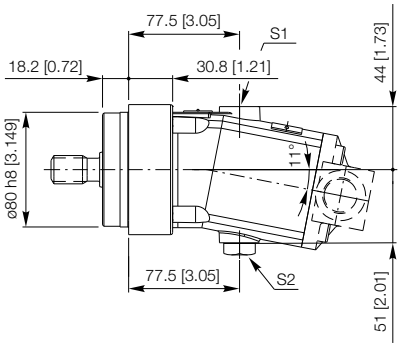
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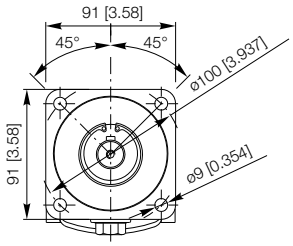
Special feature	
XXX	None

14

Painting	
XXX	None
01	Black Painted RAL 9005
02	Blue Painted RAL 5015

(*) Fields 10, 11 and 12 reserved for H1C motors

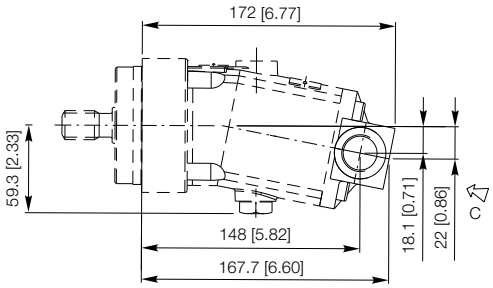


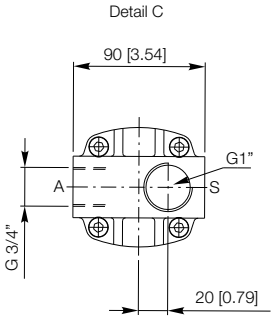


S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports
S: Suction port

7 Port cover

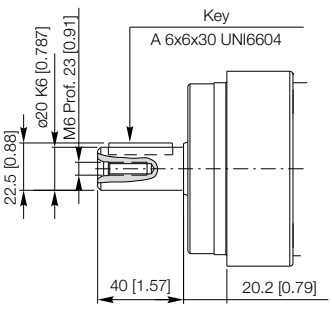
FP1



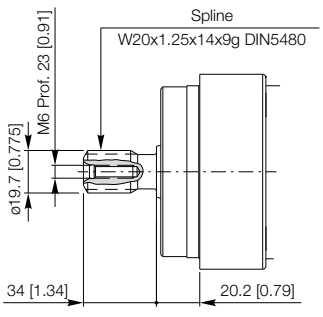


6 Shaft end

CAV Splined shaft

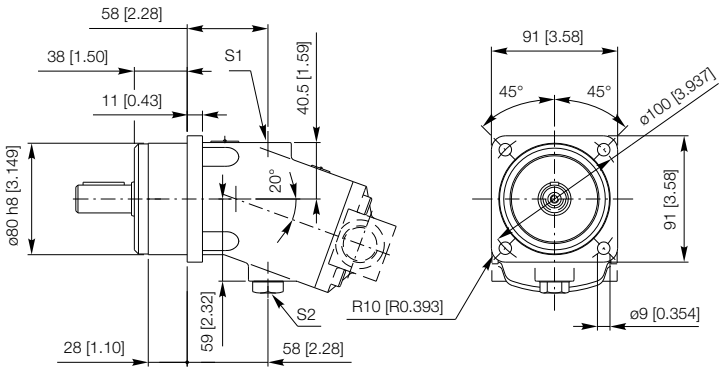


SAF Splined shaft



Dimensions ISO 4 Bolts flange (OA)

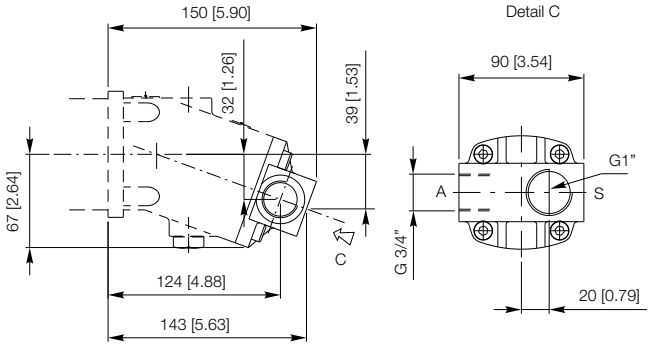
H1C 012 ME



S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

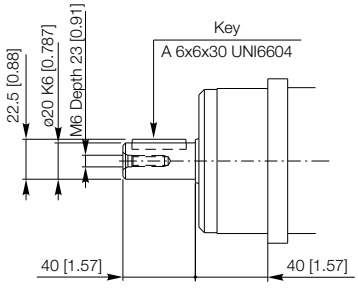
7 Port cover

FP1

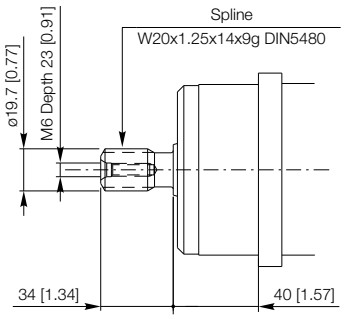


6 Shaft end

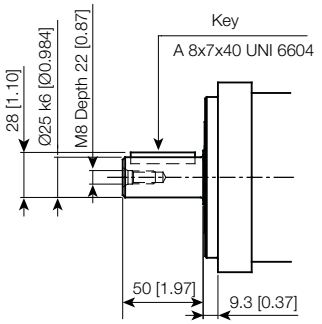
CAV Splined shaft

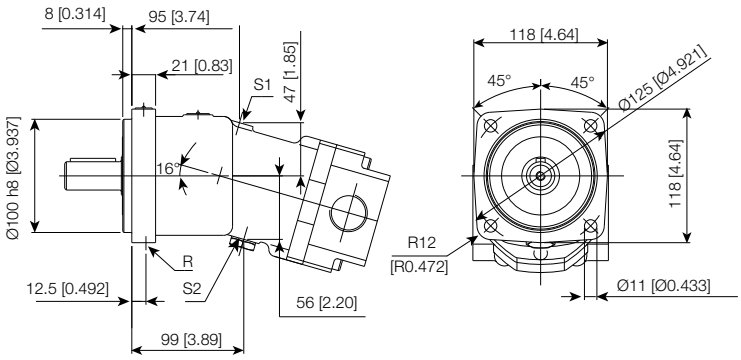


SAF Splined shaft



CBM Parallel keyed Shaft

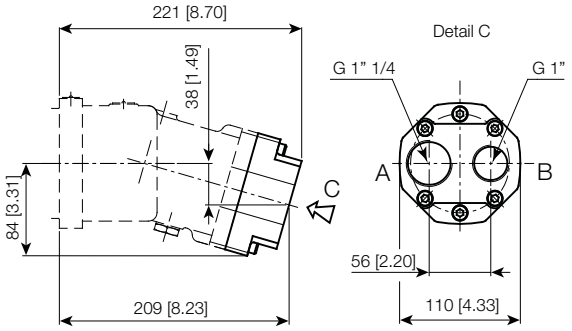




S1, S2: Drain ports (1 plugged) - 3/8 G (BSPP)
A, B: Service line ports
S: Suction port

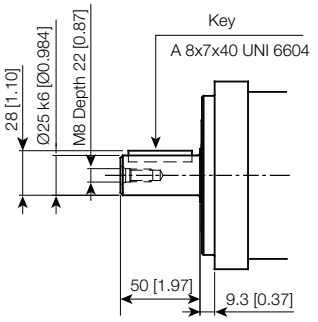
7 Port cover

FP1

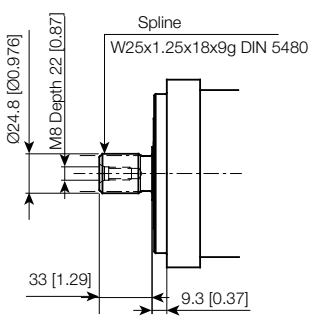


6 Shaft end

CBM Parallel keyed Shaft

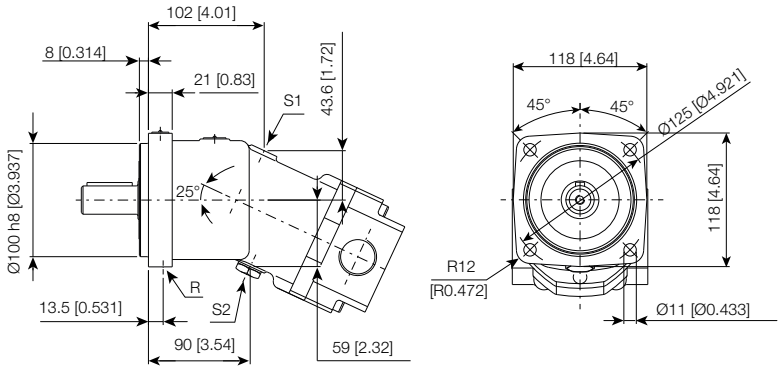


SAG Splined shaft



Dimensions ISO 4 Bolts flange (OA)

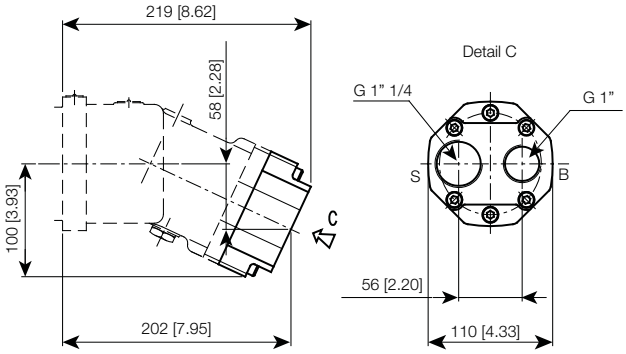
H1C 030 ME



S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

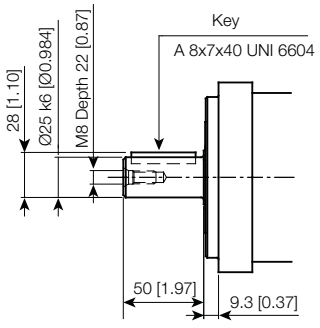
7 Port cover

FP1

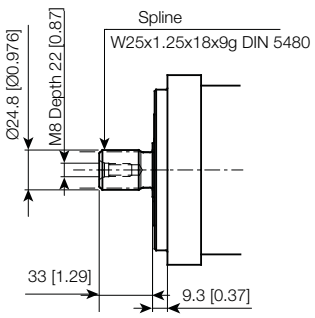


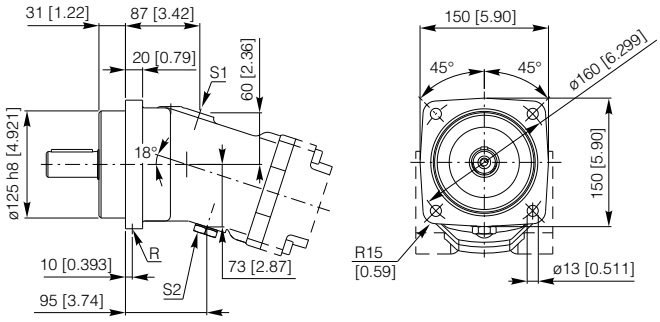
6 Shaft end

CBM Parallel Splined shaft



SAG Splined shaft

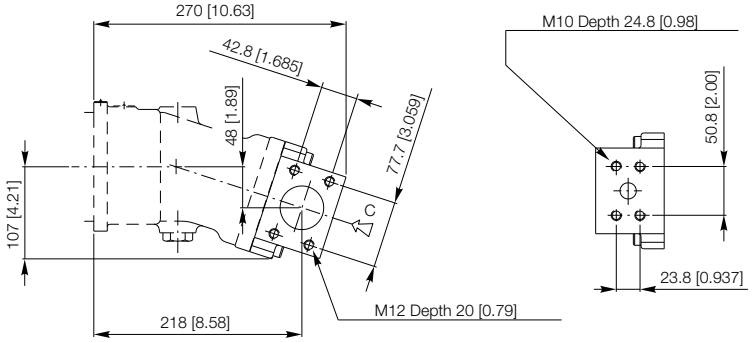


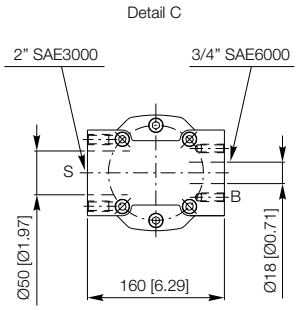


S1, S2: Drain ports - (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
S: Suction port
R: Air bleed (plugged) - 1/8 G (BSPP)

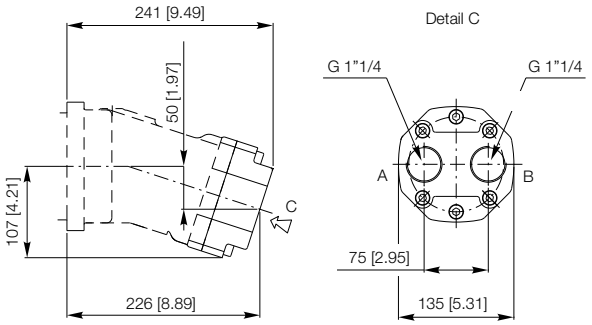
7 Port cover

LP2



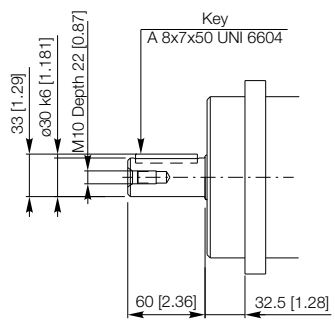


FP1

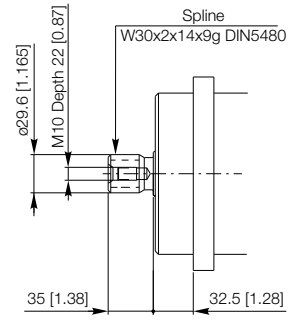


6 Shaft end

CAW Parallel keyed shaft

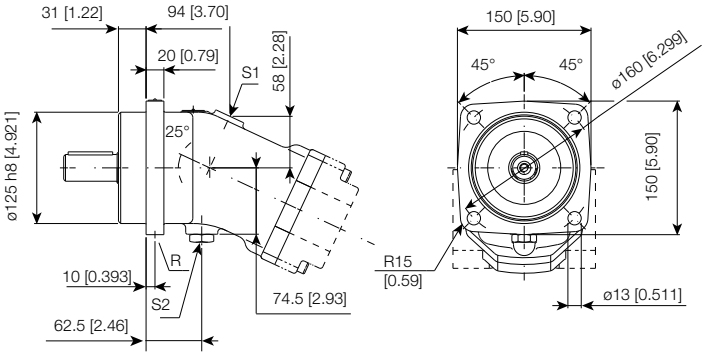


SAI Splined shaft



Dimensions ISO 4 Bolts flange (OA)

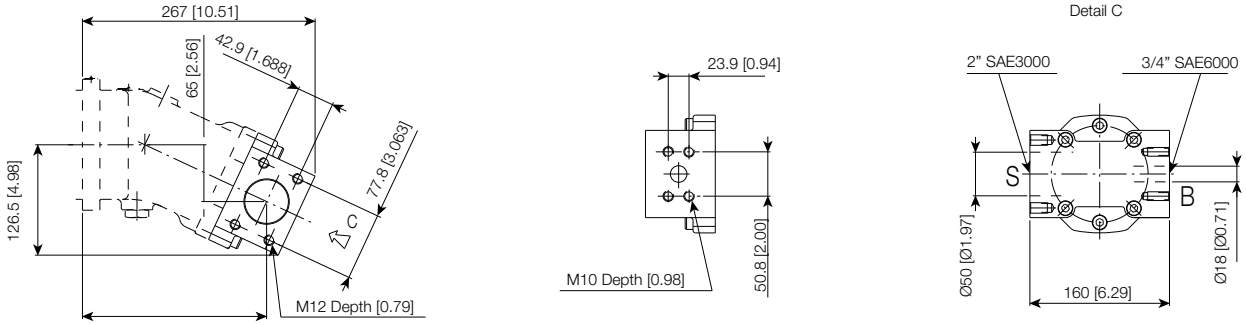
H1C 055 ME



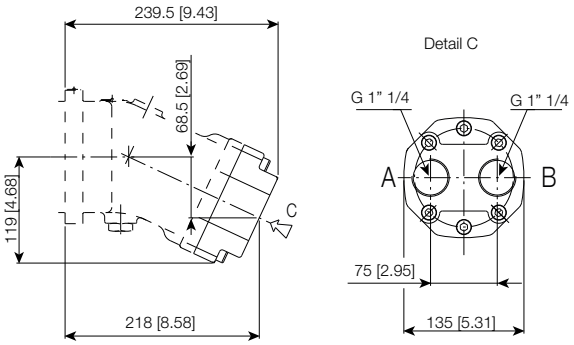
S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

7 Port cover

LP2

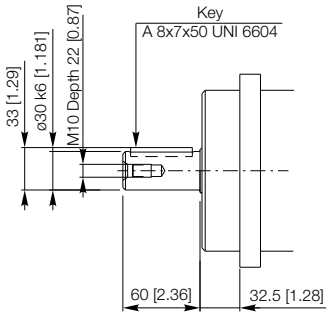


FP1

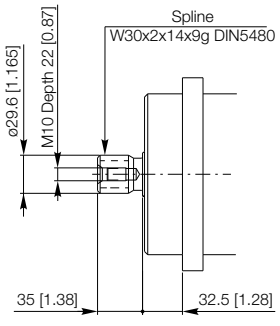


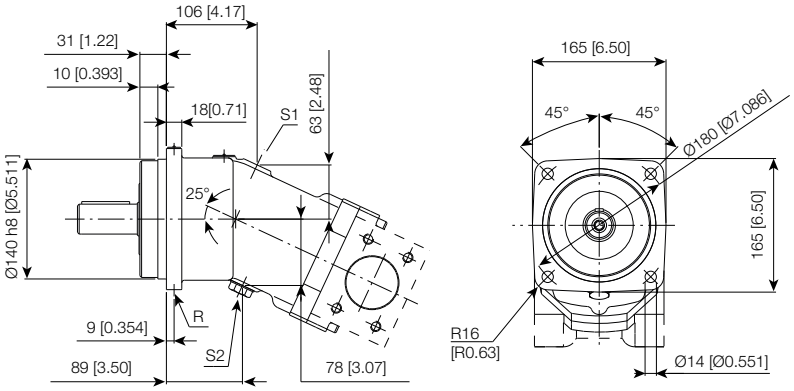
6 Shaft end

CAW Parallel keyed shaft



SAI Splined shaft

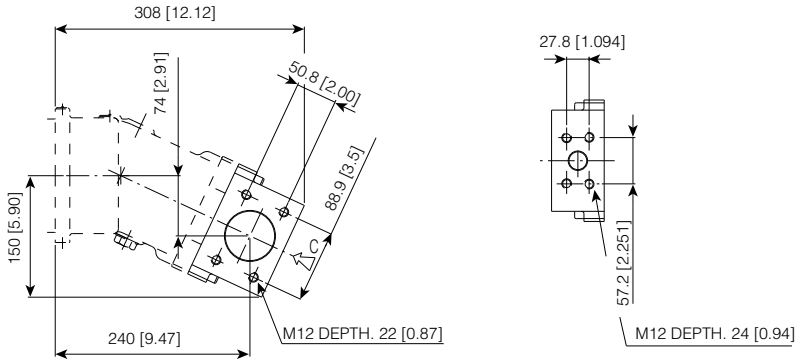




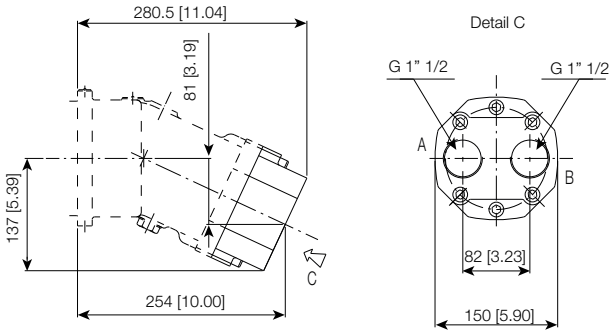
S1, S2: Drain ports - (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
S: Suction port
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

LP2

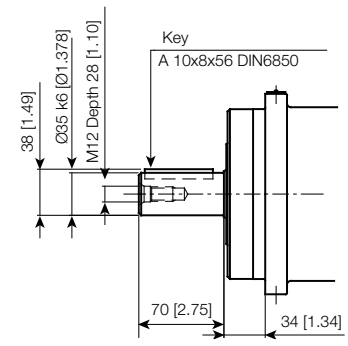


FP1

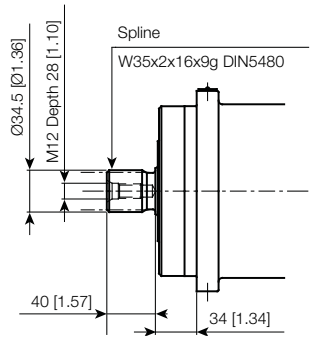


6 Shaft end

CAY Parallel keyed shaft

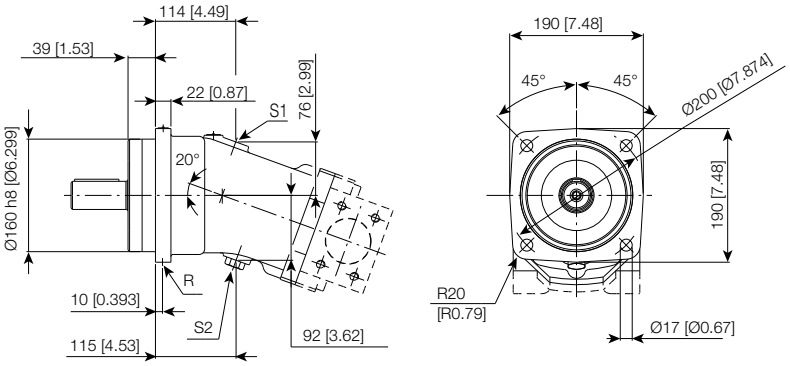


SAM Splined shaft



Dimensions ISO 4 Bolts flange (OA)

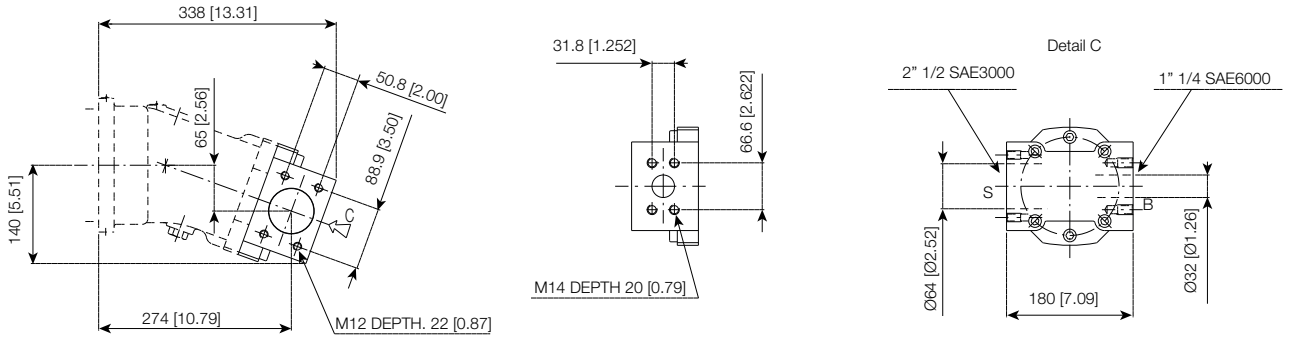
H1C 090 ME



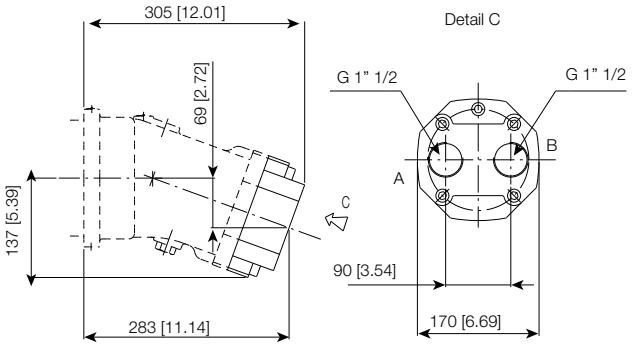
S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

7 Port cover

LP2

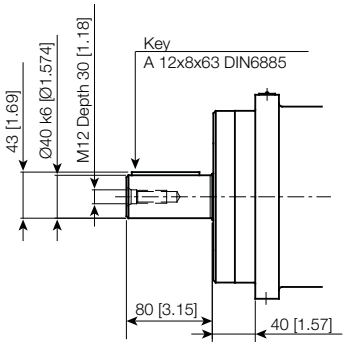


FP1

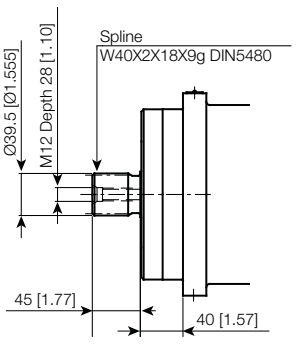


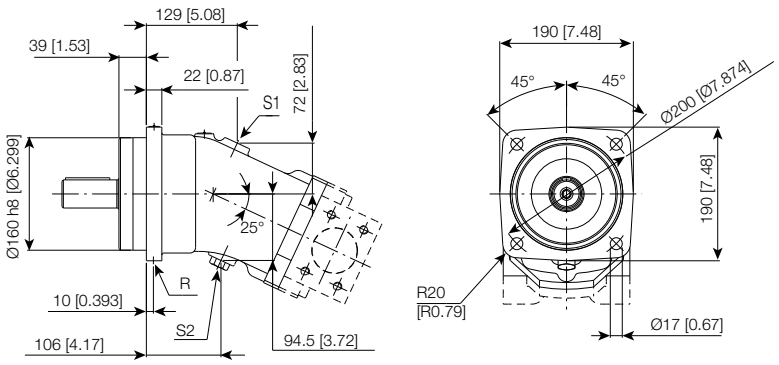
6 Shaft end

CAK Parallel keyed shaft



SAO Splined shaft

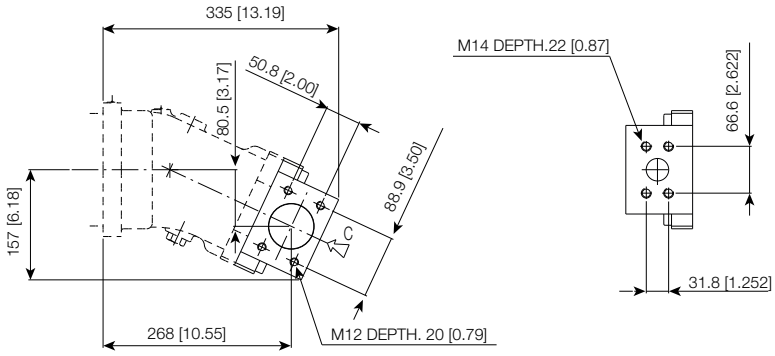


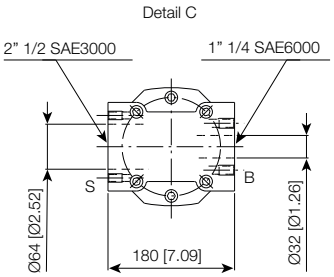


S1, S2: Drain ports - (1 plugged) - 1/2 G (BSPP)
A, B: Service line ports
S: Suction port
R: Air bleed (plugged) - 1/8 G (BSPP)

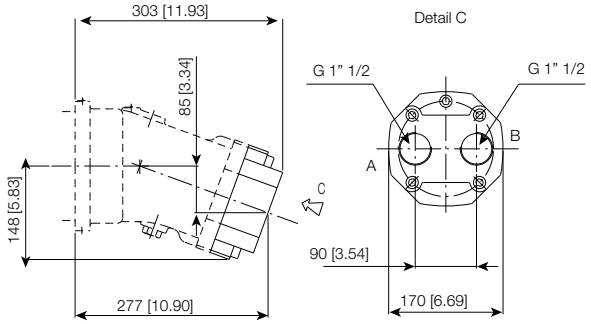
7 Port cover

LP2



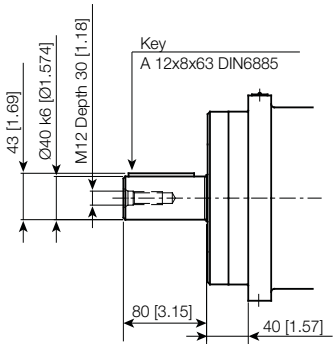


FP1

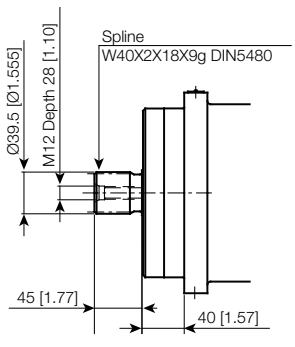


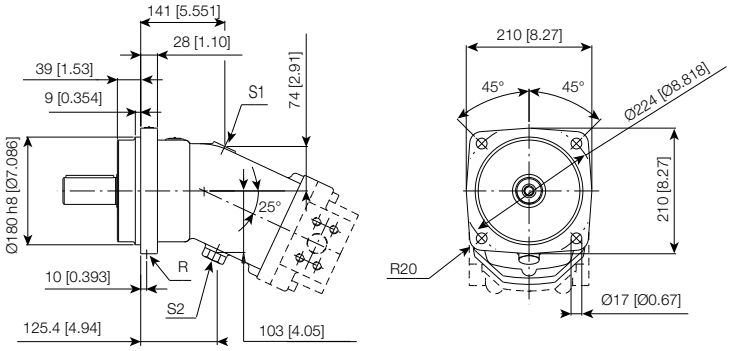
6 Shaft end

CAK Parallel keyed shaft



SAO Splined shaft

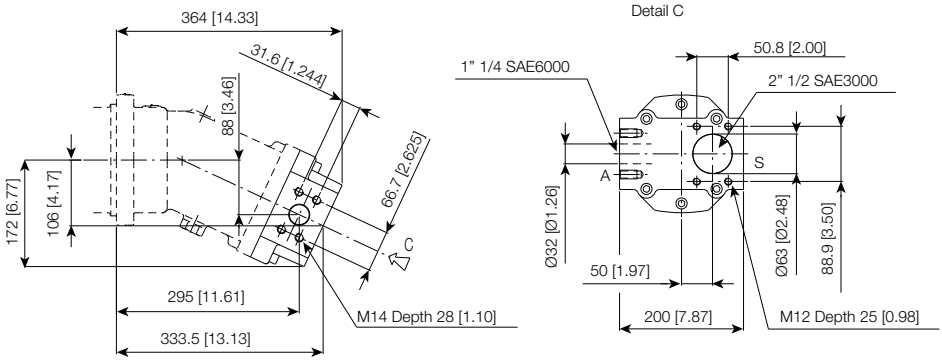




S1, S2: Drain ports - 1/2 G (BSPP)
A, B: Service line ports

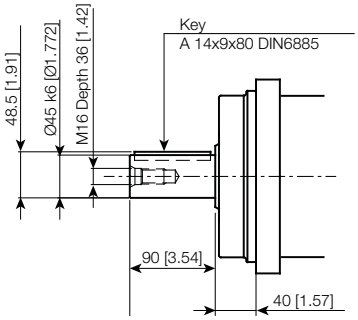
7 Port cover

FP2

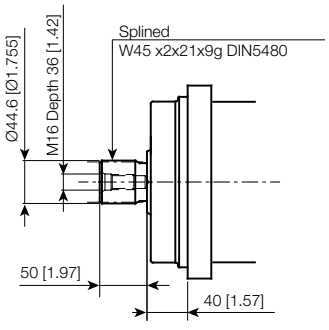


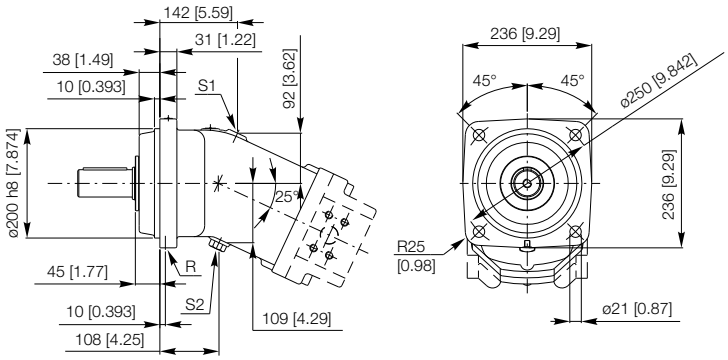
6 Shaft end

CAJ Parallel key shaft



SAP Splined shaft

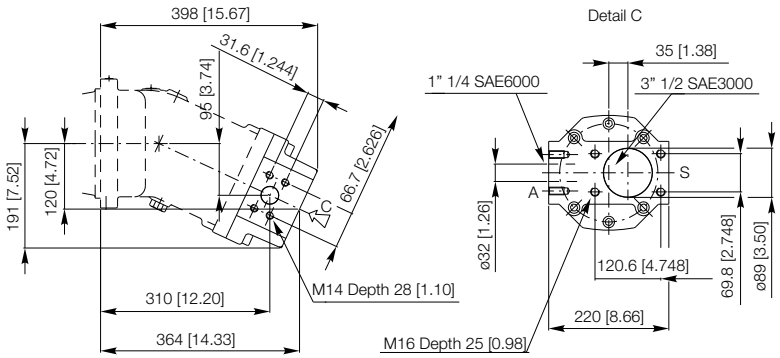




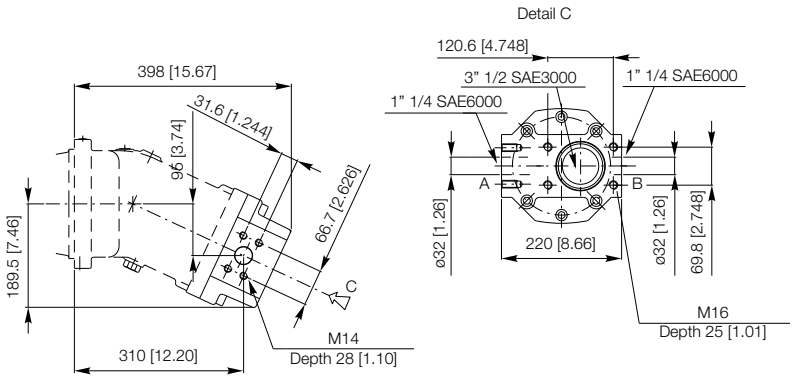
S1, S2: Drain ports (1 plugged) - 3/4 G (BSPP)
A, B: Service line ports
S: Suction port
R: Air bleed (plugged) - 1/8 G (BSPP)

7 Port cover

FP2

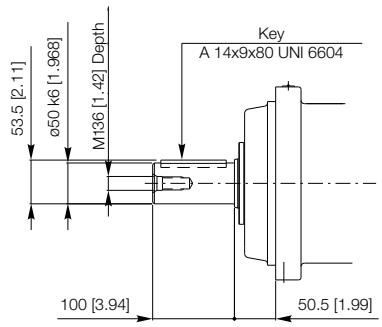


FPM

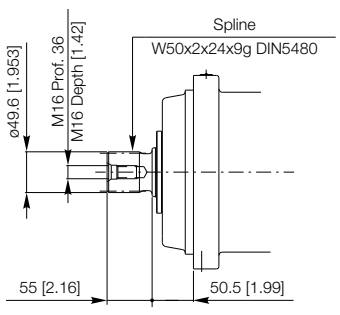


6 Shaft end

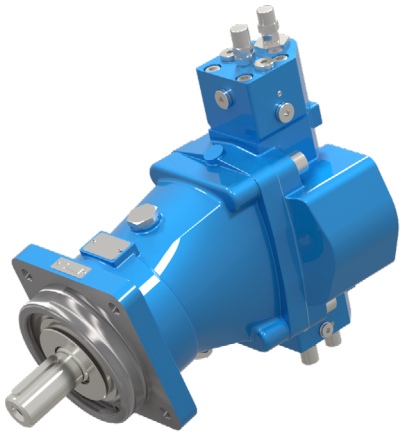
CAX Parallel keyed shaft



SAR Splined shaft



H1V - Variable displacement axial piston pumps for open circuit





Index

General information - Features..... H2
Technical data H4
Ordering code H6
Control H9
Dimensions ISO 4 Bolts flange..... H19
Dimensions SAE C 4 Bolts flange H24
Dimensions SAE D 4 Bolts flange H25
Dimensions SAE E 4 Bolts flange..... H28
Control dimensions..... H29

Type	**Displacement** cm^3/rev [in^3/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]
H1V 055	54.8 [3.34]	143 [37.8]	350 [5100]
H1V 075	75.3 [4.60]	173 [45.6]	350 [5100]
H1V 108	107.5 [6.56]	215 [56.7]	350 [5100]
H1V 160	160.8 [9.81]	289 [76.2]	350 [5100]
H1V 226	225.1 [13.73]	338 [89.1]	350 [5100]

H1V series are a family of variable displacement pumps, bent axis piston design for operation in open circuit. The proven design incorporating the lens shape valve plate, the high quality components and manufacturing tecniques make able the H1V series pumps to provide up to 350 bar [5100 psi] continuous and 450 bar [6500 psi] peak performance. Fully laboratory tested and field proven, these pumps assure maximum efficiency and long life, even at very bad filtering conditions. Heavy duty bearings permit high radial and axial loads.
Versatile design includes a variety of control and shaft ends that will adapt the H1V series pumps to any application both industrial and mobile. H1V series pumps are available in both ISO and SAE version.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
$n_{0\ max}$	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure

p_{max}	bar [psi]	Maximum pressure peak
q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10¸15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and filtering section.

Temperature ranges:
The operating temperature of the oil must be within -25ºC÷90ºC [-13ºF÷194ºF]. The running of the axial piston unit with oil temperature higher than 90ºC [194°F] or lower than -25ºC [-13°F] is not allowed. For further information see at Fluids and filtering section.

Filtering:
A correct filtering is essential for long and satisfactory life of axial piston units. In order to ensure a correct functioning of the unit, the maximum permissible contamination class is 21/19/16 according to ISO 4406:1999. For further details see at Fluids and filtering section.

Inlet pressure:
(Pumps in open loop) Minimum absolute pressure at suction port is 0.8 bar [11.6 psi]. Case inlet pressure can never be lower.

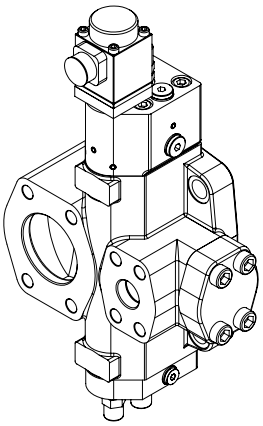
Operating pressure:
The maximum permissible continuous pressure on pressure ports is 350 bar [5100 psi]. The peak pressure is 450 bar [6500 psi].

Case drain pressure:
Maximum permissible case drain pressure is 1.5 bar [22 psi]. A higher pressure can affect the shaft seal or reduce its life.

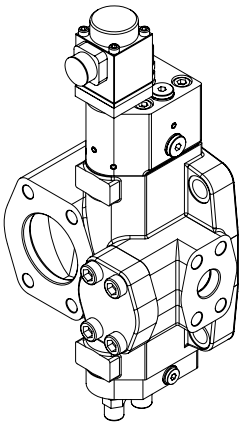
Seals:
Seals used on standard H1V series axial piston pumps are of NBR (Acrylonitrile-Butadiene Elastomer). For special uses (high temperatures or special fluids) it is possible to order the unit with FKM seals (Viton®). In case of use of special fluids, contact Dana.

Output shaft:
Shaft has bearings that can bear both radial and axial loads. As for loads permissible values, see relevant section at Service life of bearings for axial piston units.

Port plates:
The H1V pump port plate has outlet ports, both lateral (L2 cover) and frontal (F2 cover). Unused port is plugged with a blind flange. The kind of port to be used must be specified when ordering. The suction port is always frontal.



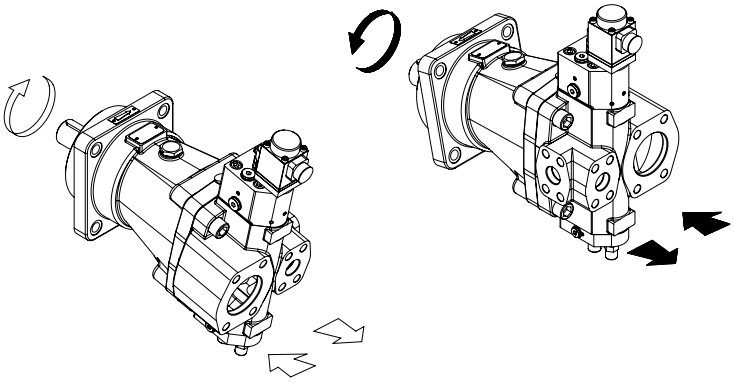
F2 Port plate



L2 Port plate

Installation:
H1V series pumps can be installed in every position or direction. These axial piston units do not have have separate inlet and drain chambers and so must be never drained. Installation of the unit with shaft in vertical position and above the tank involves some limitations. For further details see at General installation guidelines.

Relation between direction of rotation and director of flow:
The relation between direction of rotation of shaft and direction of flow in H1V piston pumps is shown in the picture below.
In order to change direction of rotation, port plate and control have to be removed, and after the valve plate has been replaced, they must be reassembled with the port plate turned of 180°.



Technical data

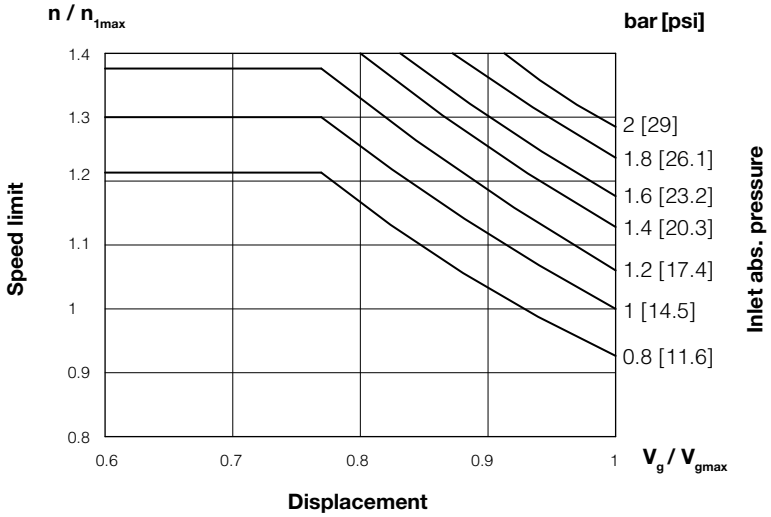
			Size				
			55	75	108	160	226
Max. displacement	V_{gmax}	cm^3/rev [in^3/rev]	54.8 [3.34]	75.3 [4.60]	107.5 [6.56]	160.8 [9.81]	225.1 [13.73]
Min. displacement	V_{gmin}	cm^3/rev [in^3/rev]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Max. Press. cont.	p_{nom}	bar [psi]	350 [5100]				
Max. Press. peak	p_{max}	bar [psi]	450 [6500]				
Max. speed at V_{gmax}	n_{max1} (2)	rpm	2600	2300	2000	1800	1500
Max. speed at $V_g < V_{gmax}$	n_{max2} (2)		3300	2900	2600	2300	1900
Speed limit	n_{lim} (3)	rpm	3700	3200	2800	2500	2100
Max. flow at n_{max1} e V_{gmax}	q_{max}	l/min [U.S.gpm]	143 [37.8]	173 [45.6]	215 [56.7]	289 [76.2]	338 [89.1]
Max. power at n_{max1} e p_{nom}	P_{max}	kW [hp]	83 [111]	101 [135]	125 [168]	168.5 [226]	197 [264]
Torque costant at V_{gmax}	T_k	Nm/bar [lbf.ft/psi]	0.87 [0.044]	1.20 [0.061]	1.71 [0.087]	2.56 [0.13]	3.58 [0.18]
Permissible max. torque at V_{gmax} e p_{nom}	T_{nom}	Nm [lbf.ft]	306 [225]	420 [310]	559 [442]	896 [661]	1254 [925]
Permissible max. torque at V_{gmax} e p_{max}	T_{max}	Nm [lbf.ft]	393 [290]	540 [398]	770 [568]	1152 [849]	1613 [1189]
Moment of inertia	J	$kg \cdot m^2$ [$lbf.ft^2$]	0.0004 [0.095]	0.0008 [0.189]	0.0013 [0.308]	0.025 [0.593]	0.040 [0.948]
Weight	m (4)	kg [lbs]	30 [66]	42 [92]	55 [121]	77 [170]	107 [236]

(Theorical values, without considering η_{hm} e η_v; approximate values). Peak operations must not excede 1% of every minute.
A simultaneus maximum pressure and maximum speed not recomended.

Notes:

1. The minimum and maximum displacements are infinitely adjustable. In the order code please indicate the needed Vg_{max} and V_{gmin}.
2. The values shown are valid for an absolute pressure of 1 bar [14.5 psi] at the suction inlet port an when operated on mineral oil. By decreasing the the displacement the speed may be increased to the max permissible speed, see diagram.
3. By increasing the inlet pressure (pabs > 1 bar [14.5 psi]) the speed my be increased to the max. permissible speed (nlim), see diagram.
4. Approximate values.

Calculation of permissible speed:
The pump rotation speed my be increased by decreasing the displacement or by increasing the suction pressure. The maximum suction pressure must be less then 2.5 bar [36.2 psi] absolute. The max. pump speed must be always less then value shown table (nlim). To calculate the max. permissible speed related to the pump displacement and the suction pressure see the diagram below.



Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the H1V pumps.
Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	6A	6B	6C	6D	7	8	9
Series	Size	Shaft end	Port plate	Direct. of rotat.	Control	Displac. setting	Power at 1500 rpm	Pressure	Solenoid voltage	Displacement min / max	Version	Seals
H1V	075	S	L2	D	NC	1	030	50	03	17/160	ME	NBR

1

Series	
H1V	Variable displacement axial piston pumps for open circuit

2

Size	
055	54.8 cm^3/rev [3.34 in^3/rev]
075	75.3 cm^3/rev [4.60 in^3/rev]
108	107.5 cm^3/rev [6.56 in^3/rev]
160	160.8 cm^3/rev [9.81 in^3/rev]
226	225.1 cm^3/rev [13.73 in^3/rev]

3

Shaft end	
C	Cylindrical keyed
S	Splined

4

Port plate	
L2	At side
F2	At rear

5

Direction of rotation (viewed from shaft side)	
D	CW
S	CCW

1	2	3	4	5	6	6A	6B	6C	6D	7	8	9
H1V	075	S	L2	D	NC	1	030	50	03	17/160	ME	NBR

6

Controls	
NC	Power controls - Constant power control
NC+PC (1)	Constant power control with pressure compensator
NC+PI	Constant power control with hydraulic limiting device
PC	Constant pressure control
CR	Remote constant pressure control
PI	Hydraulic proportional control
EM	Electric proportional control
CLS+TP with drain	Load sensing control with pressure cut-off (with drain)
CLS+TP without drain	Load sensing control with pressure cut-off (without drain)
LC	Manual control

1) The NC+PC control is not available with displacement 55 cm^3/rev [3.34 in^3/rev].

6A

Displacement Setting		Controls								
		NC	**NC+PC**	**NC+PI**	**PC**	**CR**	**PI**	**EM**	**CLS+TP**	**LC**
1	(V_{gmax} - V_{gmin})	●	●	●	●	●	●	●	●	●
2	(V_{gmin} - V_{gmax})	–	–	–	–	–	●	●	–	●

● : Available
- : Not Available

6B

Power at 1500 rpm (1)		Size				
		55	**75**	**108**	**160**	**226**
	kW [hp]	5 ÷ 30 [6.7 ÷ 40.2]	11 ÷ 45 [14.7 ÷ 60.3]	13 ÷ 70 [17.4 ÷ 93.8]	22 ÷ 98 [29.4 ÷ 131.2]	27 ÷ 130 [36.1 ÷ 174.2]

1) Field to be filled only with NC / NC+PC / NC+PI Controls by setting specific value in kW

6C

Pressure (1)	Controls								
	NC	**NC+PC**	**NC+PI**	**PC**	**CR**	**PI**	**EM**	**CLS+TP**	**LC**
50 ÷ 350 bar [725 ÷ 5075 psi]	–	●	–	●	●	–	–	–	–
18 ÷ 35 bar (CLS) / 50 ÷ 350 bar (TP) [261 ÷ 507.5 psi] (CLS) / [725 ÷ 5075 psi] (TP)	–	–	–	–	–	–	–	●	–

1) Field to be filled only with NC+PC / PC / CR / CLS+TP Controls by setting specific value in bar

● : Available
- : Not Available

Ordering code

1	2	3	4	5	6	6A	6B	6C	6D	7	8	9
H1V	075	S	L2	D	NC	1	030	50	03	17/160	ME	NBR

6D

Solenoid voltage (1)	Controls								
	NC	NC+PC	NC+PI	PC	CR	PI	EM	CLS+TP	LC
12 Vdc	–	–	–	–	–	–	●	–	–
24 Vdc	–	–	–	–	–	–	●	–	–

1) Field to be filled only with EM Controls
● : Available
- : Not Available

7

V_{gmin} / V_{gmax}	Size				
	55	75	108	160	226
Control NC	6 / 55 cm³/rev [0.37 / 3.36 in³/rev]	10 / 75 cm³/rev [0.61 / 4.58 in³/rev]	13 / 107 cm³/rev [0.79 / 6.54 in³/rev]	17 / 160 cm³/rev [1.04 / 9.77 in³/rev]	20 / 225 cm³/rev [1.22 / 13.74 in³/rev]
Other control	0 / 55 cm³/rev [0 / 3.36 in³/rev]	0 / 75 cm³/rev [0 / 4.58 in³/rev]	0 / 107 cm³/rev [0 / 6.54 in³/rev]	0 / 160 cm³/rev [0 / 9.77 in³/rev]	0 / 225 cm³/rev [0 / 13.74 in³/rev]

8

Version	
ME	ISO
SE	SAE

9

Seals	
NBR	Nitrile STD
FKM	Viton ®

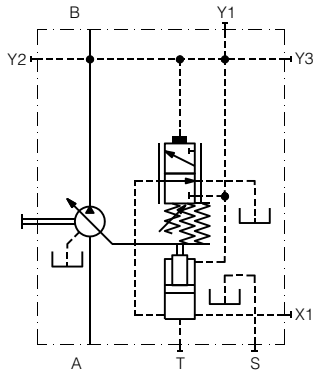
The constant power control makes it possible to control the output flow of the pump in relation to the operating pressure so to keep the pre-set drive power constant at a constant speed:

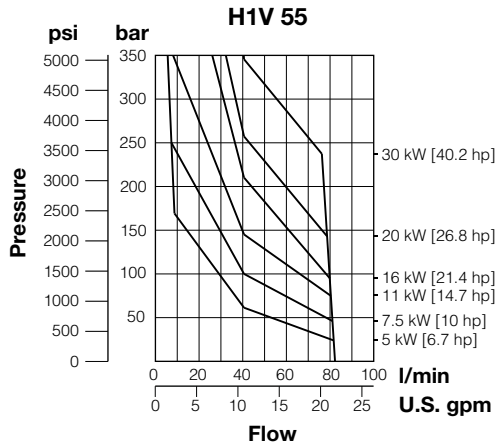
$$N = \frac{p \cdot Q}{600} = cost$$

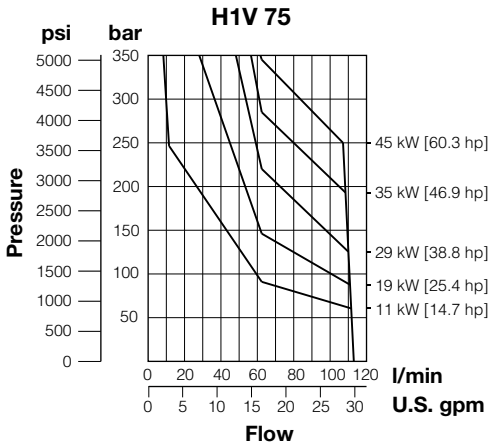
N = Power (kW)
p = pressure (bar)
Q = flow (l/min)

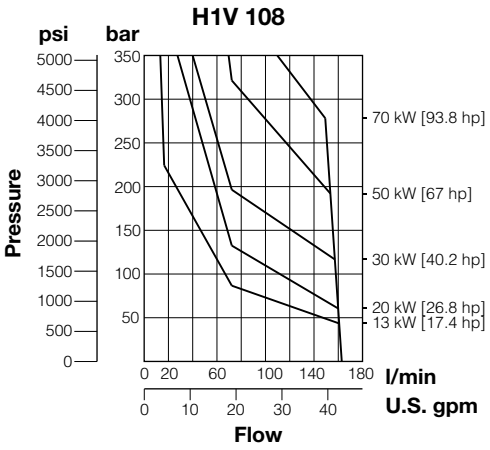
The operating pressure applies a force on the pilot which is matched by an adjustable spring so that the pump keeps Vg max until the operating pressure overtakes the pre-set spring force. When the operating pressure rises beyond the pre-set spring force, the spool valve opens and the positioning piston moves allowing the pump to swivel toward Vg min until a force balance on the control rod is restored by feed back springs so that the output flow reduces in the same ratio by which the operating pressure has risen. Therefore at constant drive speed the drive power keeps constant. The displacement setting is (1) (MAX-MIN) with two feed back springs. Calibration starts from 50 bar [725 psi].

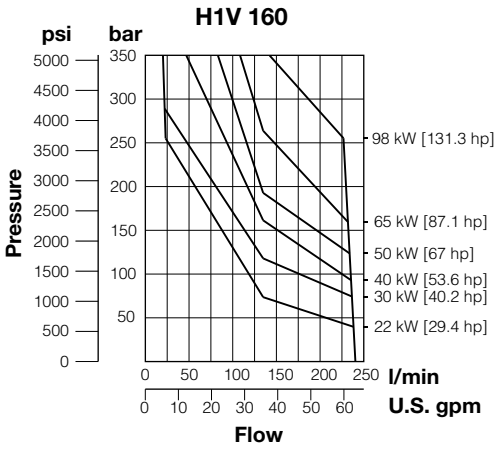
When ordering, please clearly state:
- Input power (kW) at 1500 rpm.

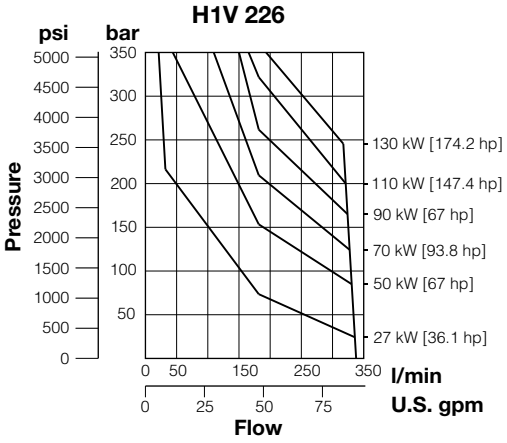






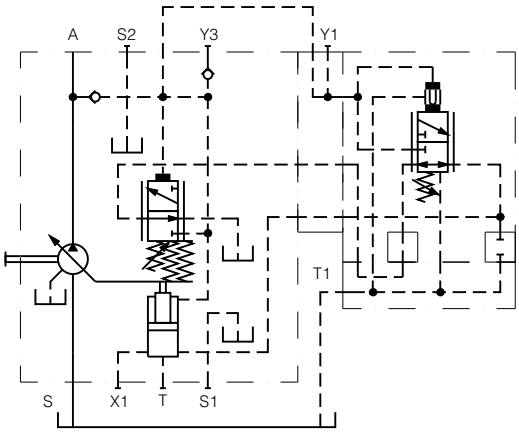

H1V 108
psi
bar
Pressure
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
350
300
250
200
150
100
50
70 kW [93.8 hp]
50 kW [67 hp]
30 kW [40.2 hp]
20 kW [26.8 hp]
13 kW [17.4 hp]
0 20 60 100 140 180 l/min
0 10 20 30 40 U.S. gpm
Flow

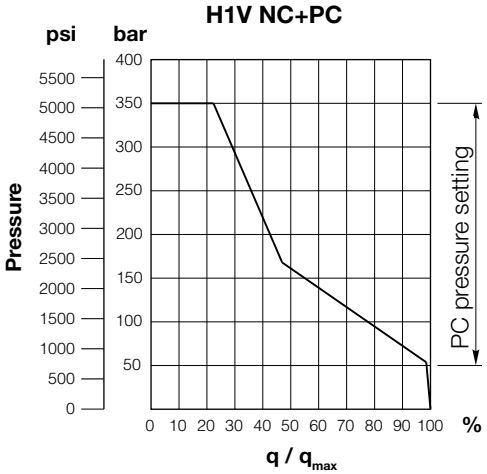

H1V 160
psi
bar
Pressure
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
350
300
250
200
150
100
50
98 kW [131.3 hp]
65 kW [87.1 hp]
50 kW [67 hp]
40 kW [53.6 hp]
30 kW [40.2 hp]
22 kW [29.4 hp]
0 50 100 150 200 250 l/min
0 10 20 30 40 50 60 U.S. gpm
Flow


H1V 226
psi
bar
Pressure
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
350
300
250
200
150
100
50
130 kW [174.2 hp]
110 kW [147.4 hp]
90 kW [67 hp]
70 kW [93.8 hp]
50 kW [67 hp]
27 kW [36.1 hp]
0 50 150 250 350 l/min
0 25 50 75 U.S. gpm
Flow

The NC+PC control operates as the NC constant power control with the addition of a max pressure cut-off so that, if the operating pressure exceeds the setting value, the pump automatically detrokes to Vg_{min} maintaning the pressure.
The pressure limiting device is made by the adjustable sequence valve mounted on the pump. The valve is adjustable up to 350 bar [5000 psi]. The pressure limiting device overrides the constant power control, i.e. below the pre-set operating pressure the displacement is adjusted according to the pre-set drive power curve and if the operating pressure rises such as to exceed the pre-set operating pressure, the pressure limiting device overrides the constant power control. It should be required for the pump to operate long term at zero stroke, more then 200 bar [2900 psi] for more than 5 min., pump flushing is necessary through the S port and flushing flow must be 7-10% approx. of the nominal pump flow. The VSI T1 port must be connected to the tank directly. Any relief included in the circuit must be set at least at 30 bar [435 psi] above the pressure limiting device setting. Displacement setting is (1) (MAX-MIN).

When order, please clearly state:
- Input power (kW) at 1500 rpm
- Pressure limiting device setting.

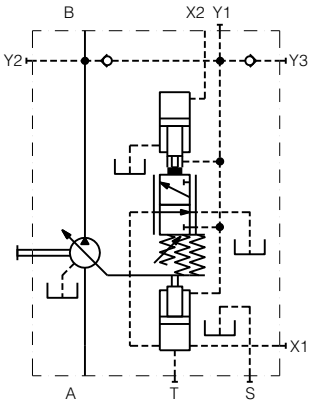


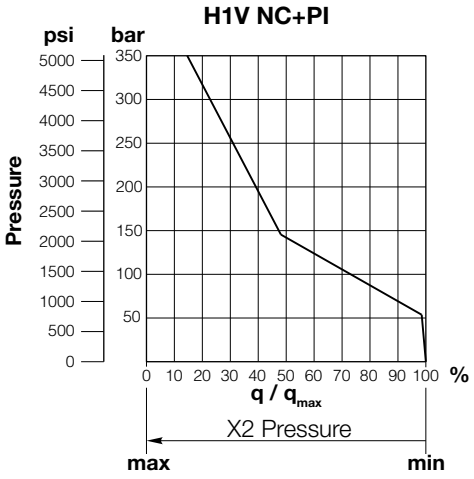


Constant power control with hydraulic limiting device NC+PI

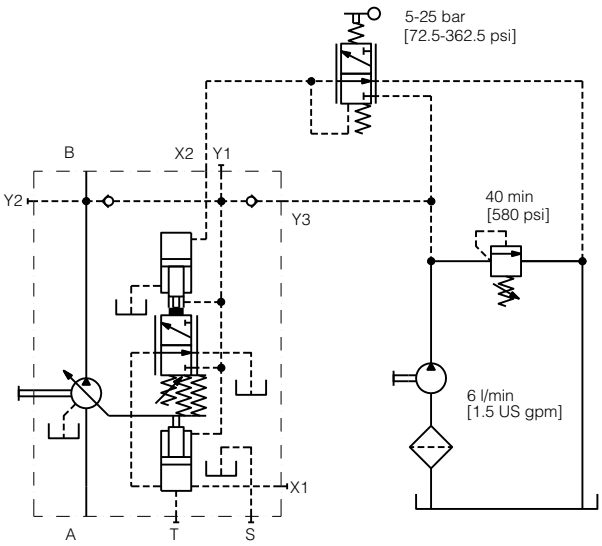
The NC+PI control operates as the NC constant power control, with the additional option of being able to limit the flow in proportion of the pilot pressure applied on port X2. The hydraulic limiting device is overridden by the constant power control, i.e. below the pre-set drive power curve the displacement is adjusted in relation to the pilot pressure and if operating pressure rises such as to exceed the power curve, the constant power control overrides the hydraulic limiting device and reduces the displacement according to the power curve. To zero the displacement a piloting pressure of about 10% of working pressure (10 to 35 bar depending on spool diameter) [145-508 psi] is required at port X2; maximum pressure on X2 port 250 bar [3625 psi].
Displacement setting is (1) (MAX to MIN).

When ordering, please clearly state:
- Input power (kW) at 1500 (rpm).





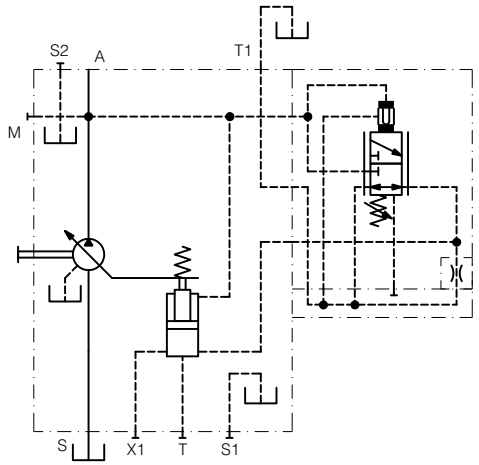
Control boosting:
When it is necessary to change the displacement of the pump with a working pressure lower than 40 bar [580 psi], the control must be boosted by means of an auxiliary circuit connected at Y3 port.

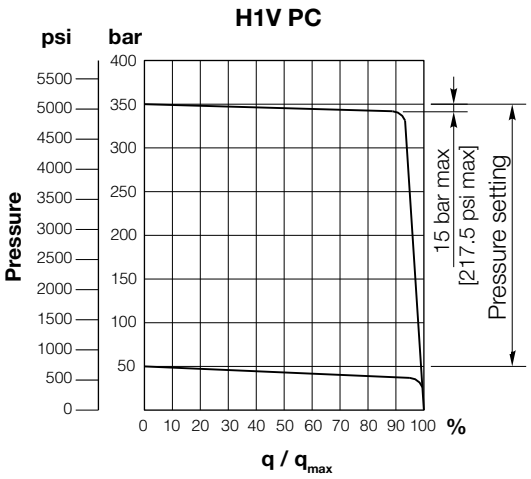


Note:
The above illustrated circuit has the only aim to show the connection required to construct a boosting circuit.

The constant pressure control controls the pump displacement in relation to flow requirements in such a way to maintain the pressure in the hydraulic circuit constant.
The operating pressure applies a force on the pilot which is matched by an adjustable spring. There is no feed back. Should the flow requirements reduce, the operative pressure rises and exceed the pre-set pressure, consequently the spool opens and the pump swivels back until the pre-set pressure is restored. The swivel back time to zero stroke is about 0.2 sec. while the time to restore the output flow is about 0.8 sec. The setting range of the control is 50 bar [725 psi] to 350 bar [5000 psi]. Should it be requested the pump to operate for long time, i.e. more then 200 bar [2900 psi] for more than 5 min, at zero stroke, pump flushing is necessary through the port S and flushing must be 7% approx. of the nominal pump flow. The relief valve included in the circuit should be set at least at 30 bar [435 psi] above the constant pressure control setting and the T1 port of the control must be connected directly to the tank. Displacement settng is (1) (MAX- MIN).

When order, please clearly state:
- Valve calibration pressure.



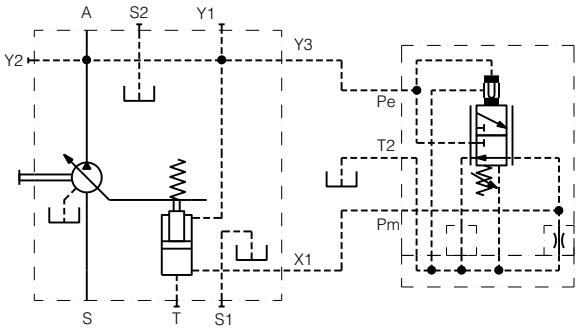


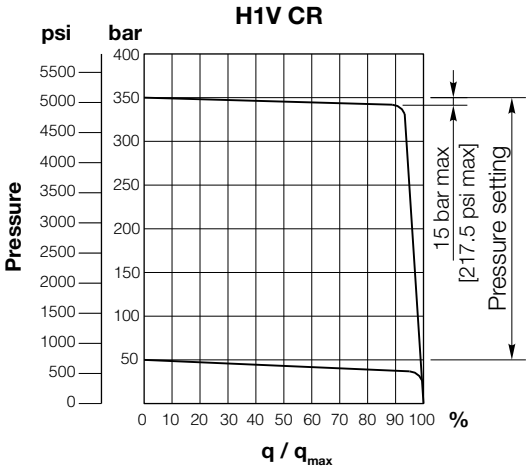
Remote constant pressure control CR

The constant pressure control of the pump can be remotely piloted by means of the internal piloting sequence valve VSI (see valves and accessories section). VSI valve is directly assembled on pump, but it also can be ordered separately. Setting adjustment is 50 bar [725 psi] to 350 bar [5075 psi]; the piping length should not exceed 5 mt [16ft]. Port T2 (fixed restrictor) must be directly connected to the tank and circuit relief valve must be 30 bar [435 psi] higher than the PCR control.
Other features of PCR controls are similar to PC ones.
Displacement setting is 1 (MAX to MIN).

Note:
Please contact our technical department when 2 or more pressure settings are required.

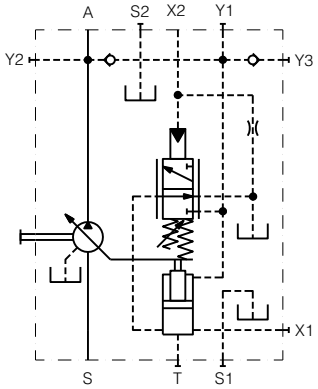
When ordering, please clearly state:
- Control pressure setting.

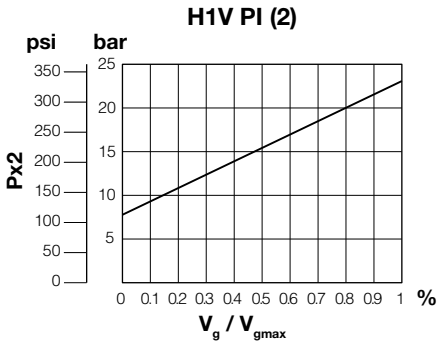


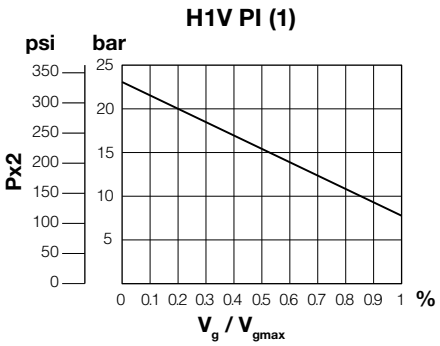


The hydraulic proportional control allows a stepless adjustment of the pump displacement proportionally to the pilot pressure applied to port X2. The pilot pressure applies a force on the spool and the pump swivels until a force balance on the arm is restored by feed back spring. Therefore the pump displacement is adjusted in direct proportion with the pilot pressure. Standard displacement setting is 2 (Min → Max), however displacement setting 1 (Min → Max) is also available. The required flow can be obtained by setting the pressure relief valve at X2 port: 8 - 23 bar [115 - 335 psi]. Maximum permissible pilot pressure at port X2 is 50 bar [725 psi] A min. 40 bar [580 psi] approx. operating pressure is required to operate the control. In case of operating pressure lower than 40 bar [580 psi], a boost pressure must be applied at port Y3 to control the pump.

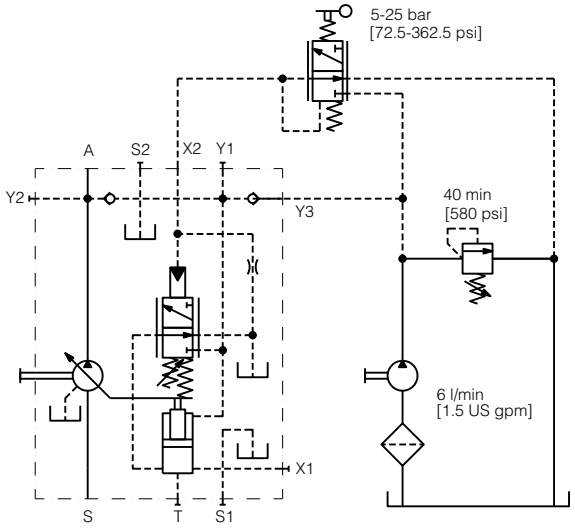
When ordering please state clearly:
- Displacement setting.







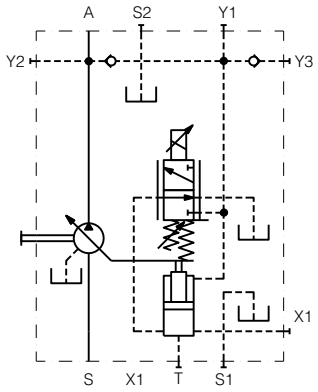
Control boosting:
When it is required to change the displacmeent of the pump with working pressure lower than 40 bar [580 psi], the control must be boosted by means of an auxiliary circuit connected at port Y3.

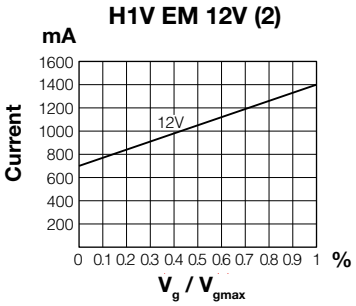


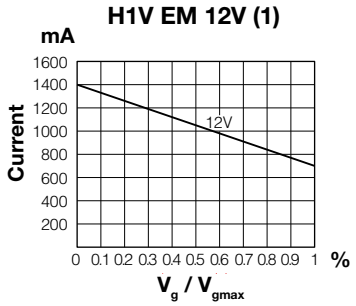
Note:
The above illustrated circuit has the only aim to show the connection required to construct a boosting circuit.

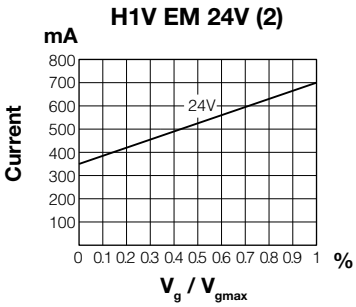
The electrical proportional control allows stepless and programmable adjustment of the pump displacement proportionally to the current strength supplied to a proportional solenoid valve, available in 12V DC and 24V DC versions. The proportional solenoid valve applies a force on the spool proportional to the current strength and the pump swivels until a force balance is restored by a feed-back spring. To control the proportional solenoid valve a 24V DC (12V DC) supply is required. Current range between 350 (700) and 700 (1400) mA approx. (with standard setting of Max and Min displacement). Max permissible current = 800 (1600) mA. Usually the swivel range is from Vgmin to Vgmax (displacement setting 2) so that increasing the current strength the pump swivels towards Vgmax, however displacement setting 1 (swivels range from Vgmax to Vgmin) is also available. A min. 40 bar [580 psi] approx. operating pressure is required to operate the control. Two electronic devices are available to control the solenoid (they must be ordered separately): VPD/AD (two channel) - VPC/AP (one channel).

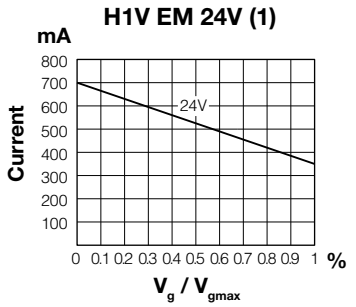
When ordering please state clearly:
- Displacement setting
- Solenoid voltage.



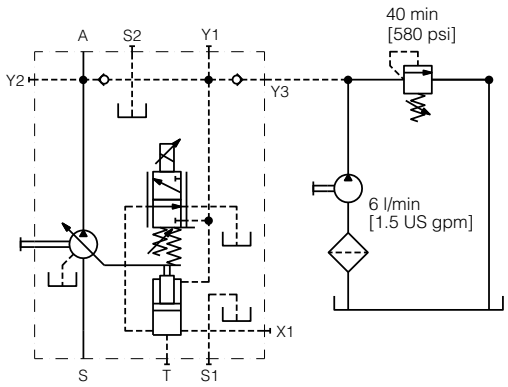








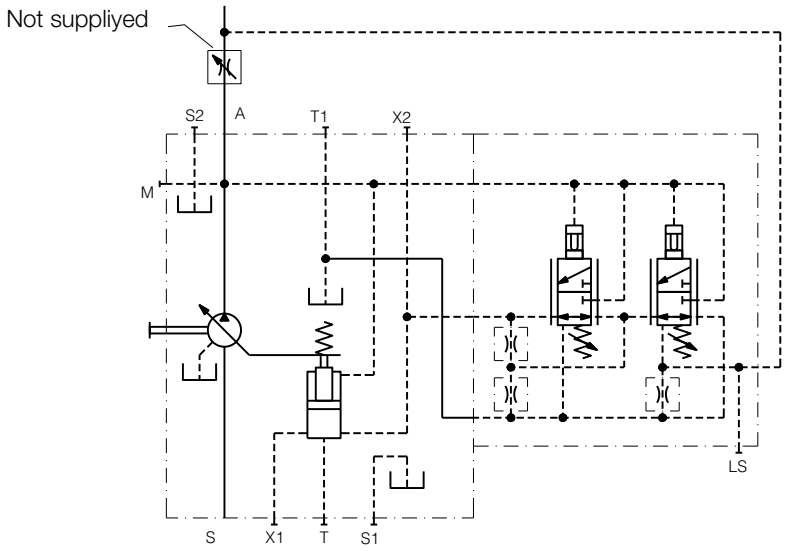
Control boosting:
When it is required to change the displacement of the pump with working pressure lower than 40 bar [580 psi], the control must be boosted by means of an auxiliary circuit connected at port Y3.

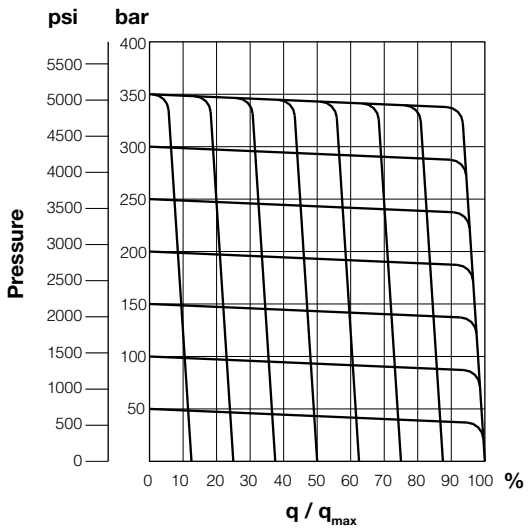


Note:
The above illustrated circuit has the only aim to show the connection required to construct a boosting circuit.

The Load Sensing control device is a regulating valve that controls the pump displacement in function of the working pressure so as to satisfy the demands for the various users. The pump flow is influenced from an external restrictor (the variable restrictor or proportional compensated flow control valve) placed between the user and the pump.
The Load Sensing control compares the pressure before and after the restrictor and varies the pump displacement so as to maintain a constant the pressure drop through the restrictor (Δp). In this way, the flow of the pump depends exclusively on the section of passage of the variable restrictor. The field of calibration of the Δp is contained between 18 bars [261 psi] end 35 bars [507 psi]. The standard calibration is 20 bars [290 psi]. The variable restrictor not supplied with the pump.
The control has a pressure cut-off built-in valve (with drain) with setting from 50 to 350 bar [725 ÷ 5075 psi].
The pressure of calibration of the control however, can not exceed the value of nominal pressure (pnom) of the pump. The pressure relief valve in the circuit has to be set at a pressure level of at least 20 bar [290 psi] higher than the setting pressure of the TP control.

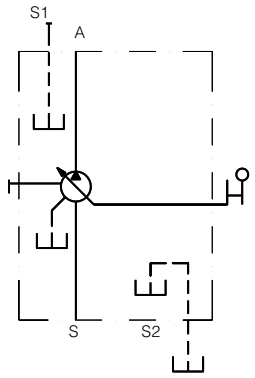
When ordering. Please state clearly:
- CLS Δp pressure setting
- TP pressure setting [psi]





The pump displacement is adjusted by manually operating the handwheel. The standard swivel range is from Vg_{max} to Vg_{min} (displacement setting 1 as per our ordering code), however displacement setting 2 (swivel range from Vg_{min} to Vg_{max}) can be supplied.

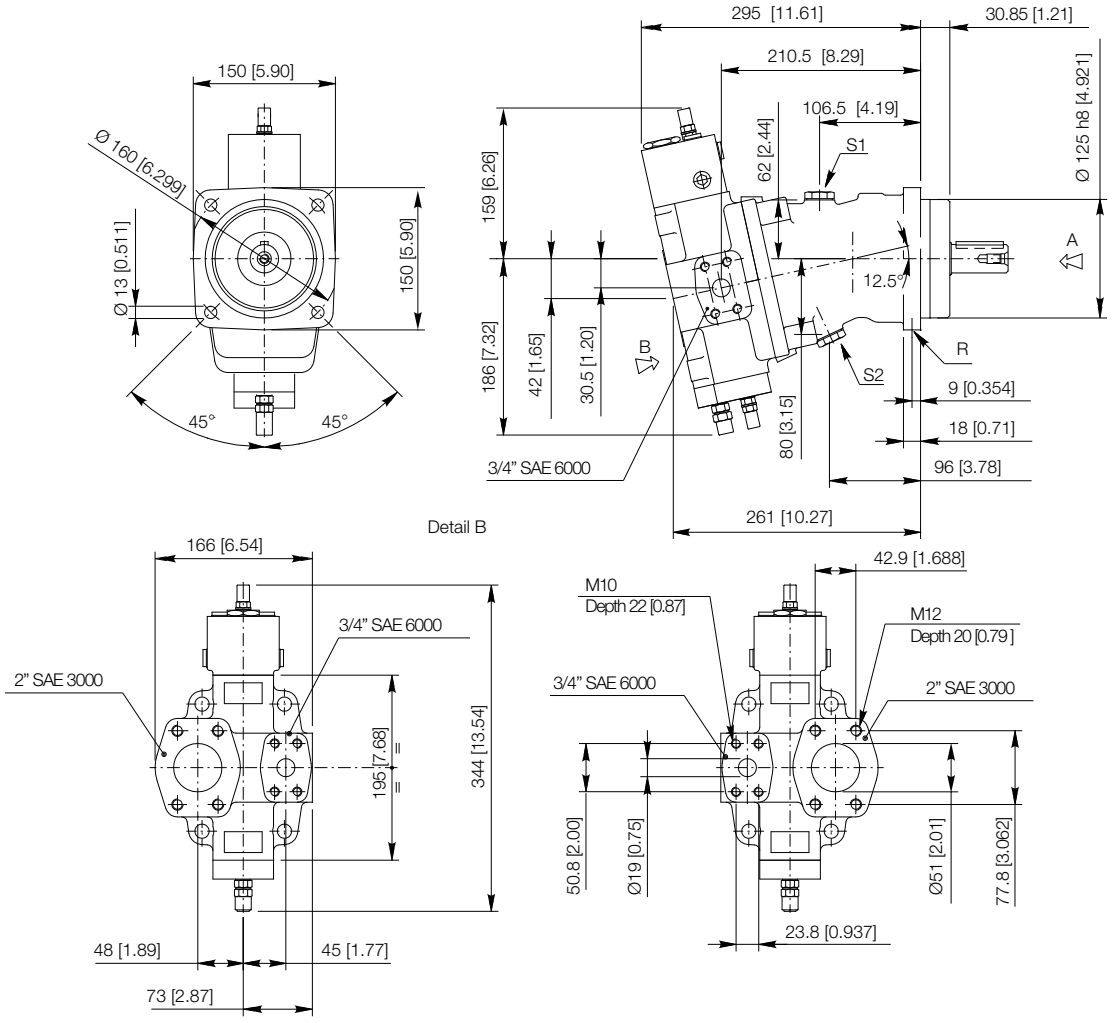
When ordering please state clearly:
- Displacent setting



The table shows number of handwheel turns required to swivel the pump from zero displacement to maximum displacement or vice versa.

	Size				
	55	**75**	**108**	**160**	**226**
Handwhell rounds	28	29	24	36	40

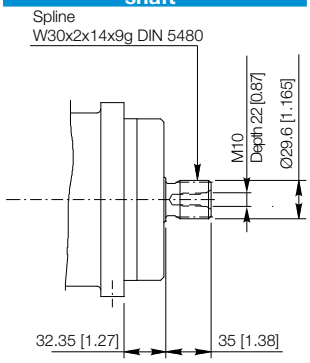
S1, S2: Flushing ports (plugged) - 1/8" G (BSPP)
R: Air bleed (plugged) - 1/8" G (BSPP)



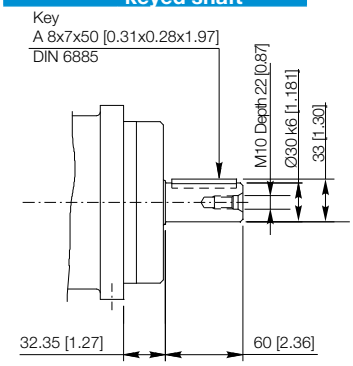
Anti-clockwise rotation **Clockwise rotation**

3 Shaft end

S Splined shaft



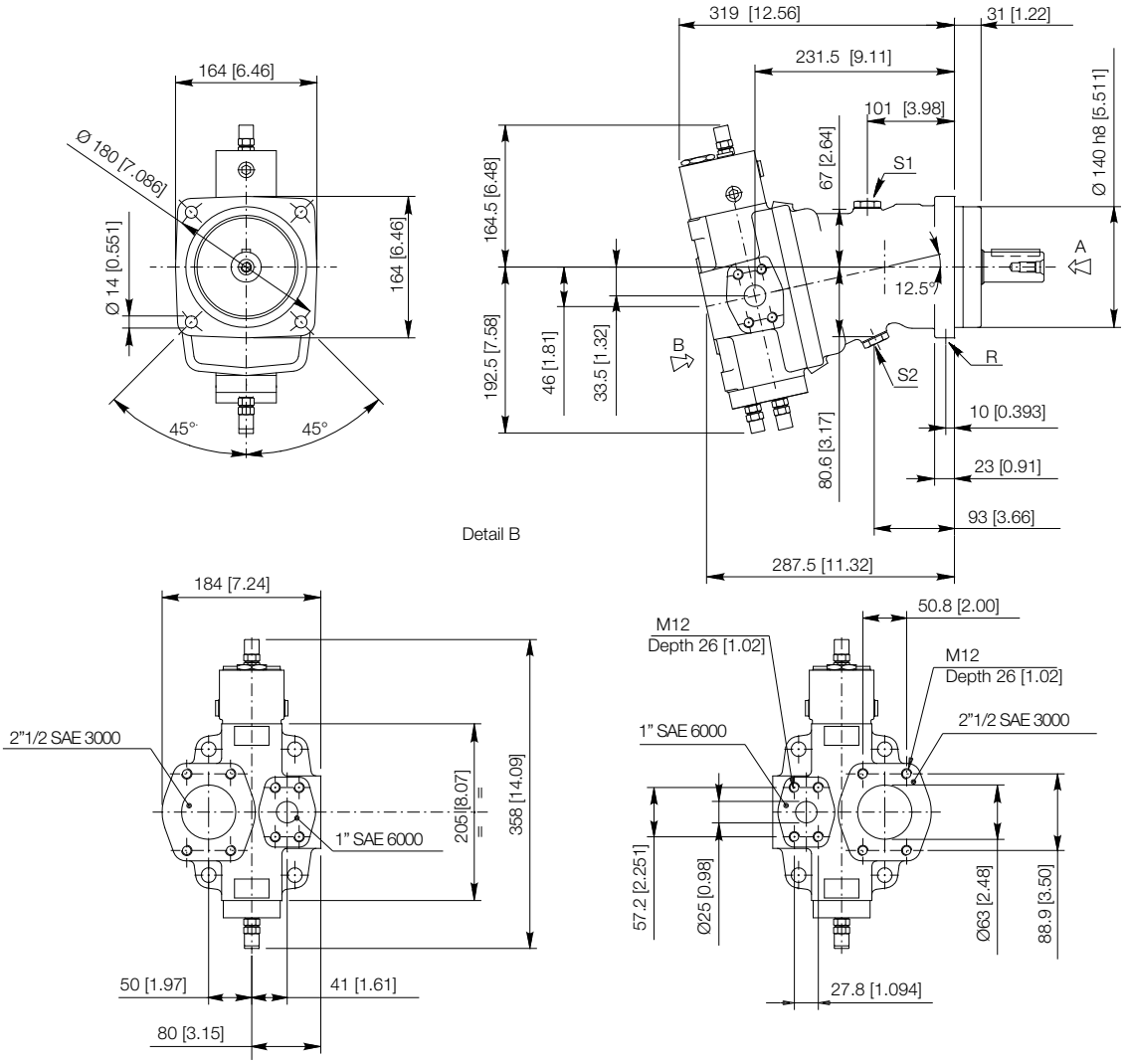
C Parallel keyed shaft



Dimensions ISO 4 Bolts flange

H1V 75 M

S1, S2: Flushing ports (plugged) - 1/2" G (BSPP)
R: Air bleed (plugged) - 1/8" G (BSPP)

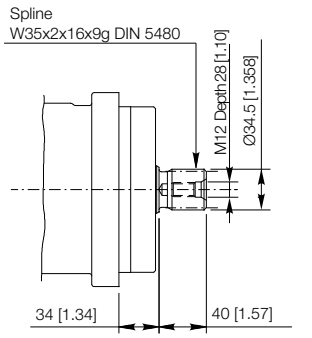


Anti-clockwise rotation

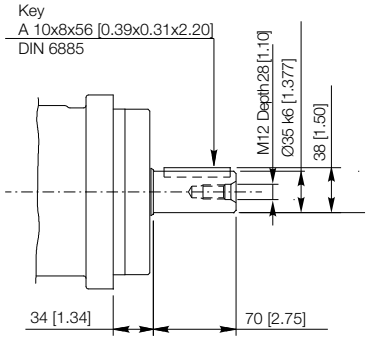
Clockwise rotation

3 Shaft end

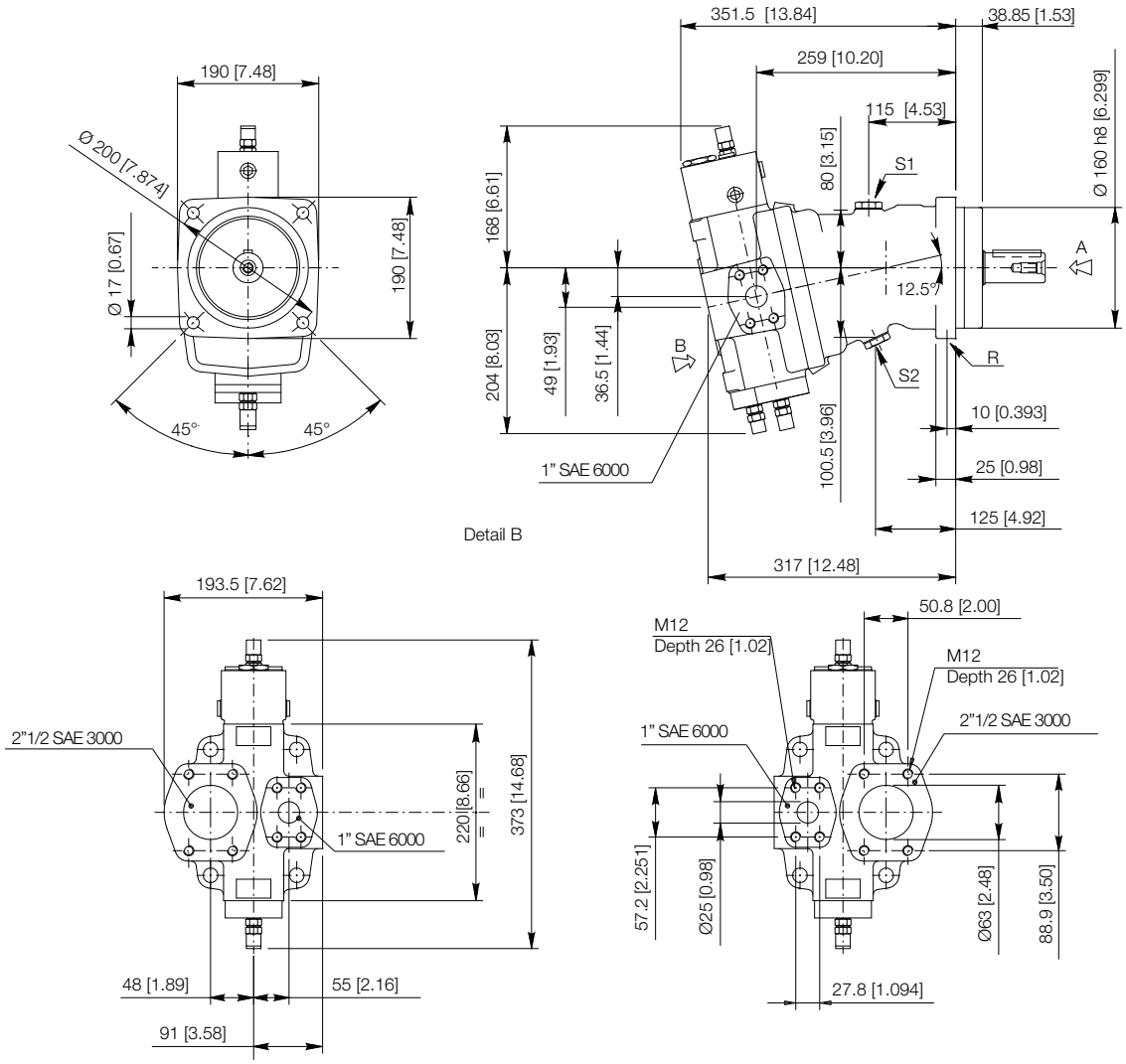
S Splined shaft



C Parallel keyed shaft



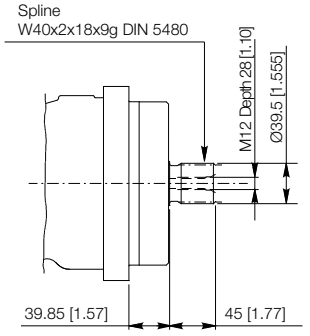
S1, S2: Flushing ports (plugged) - 1/2" G (BSPP)
R: Air bleed (plugged) - 1/8" G (BSPP)



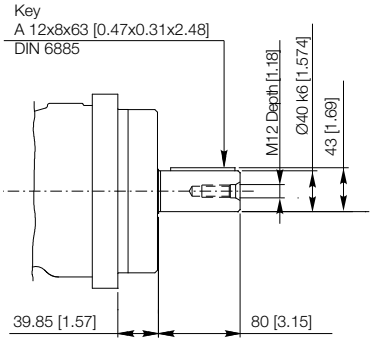
Anti-clockwise rotation **Clockwise rotation**

3 Shaft end

S Splined shaft



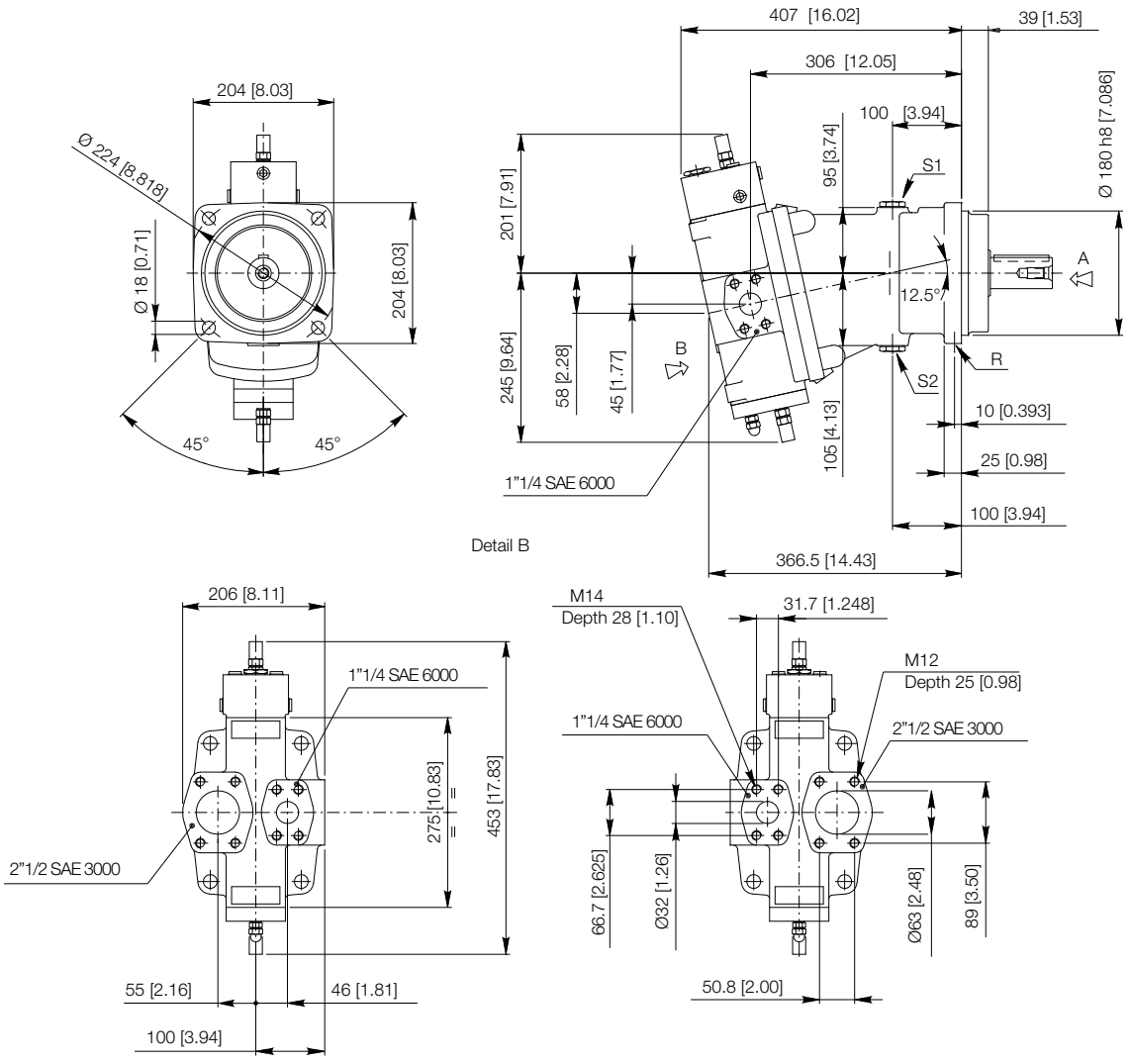
C Parallel keyed shaft



Dimensions ISO 4 Bolts flange

H1V 160 M

S1, S2: Flushing ports (plugged) - 3/4" G (BSPP)
R: Air bleed (plugged) - 1/8" G (BSPP)



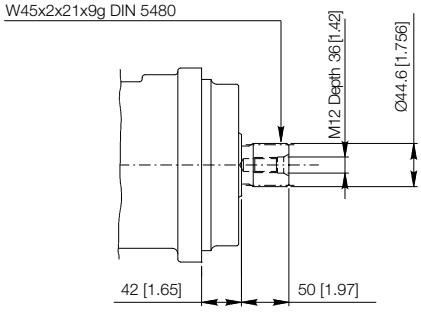
Anti-clockwise rotation

Clockwise rotation

3 Shaft end

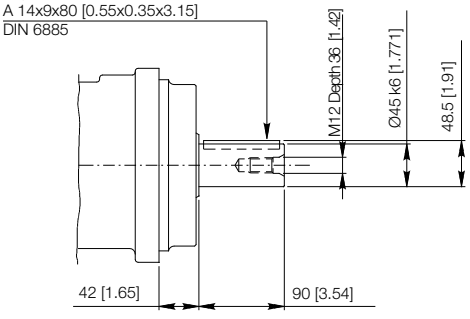
S Splined shaft

Spline
W45x2x21x9g DIN 5480

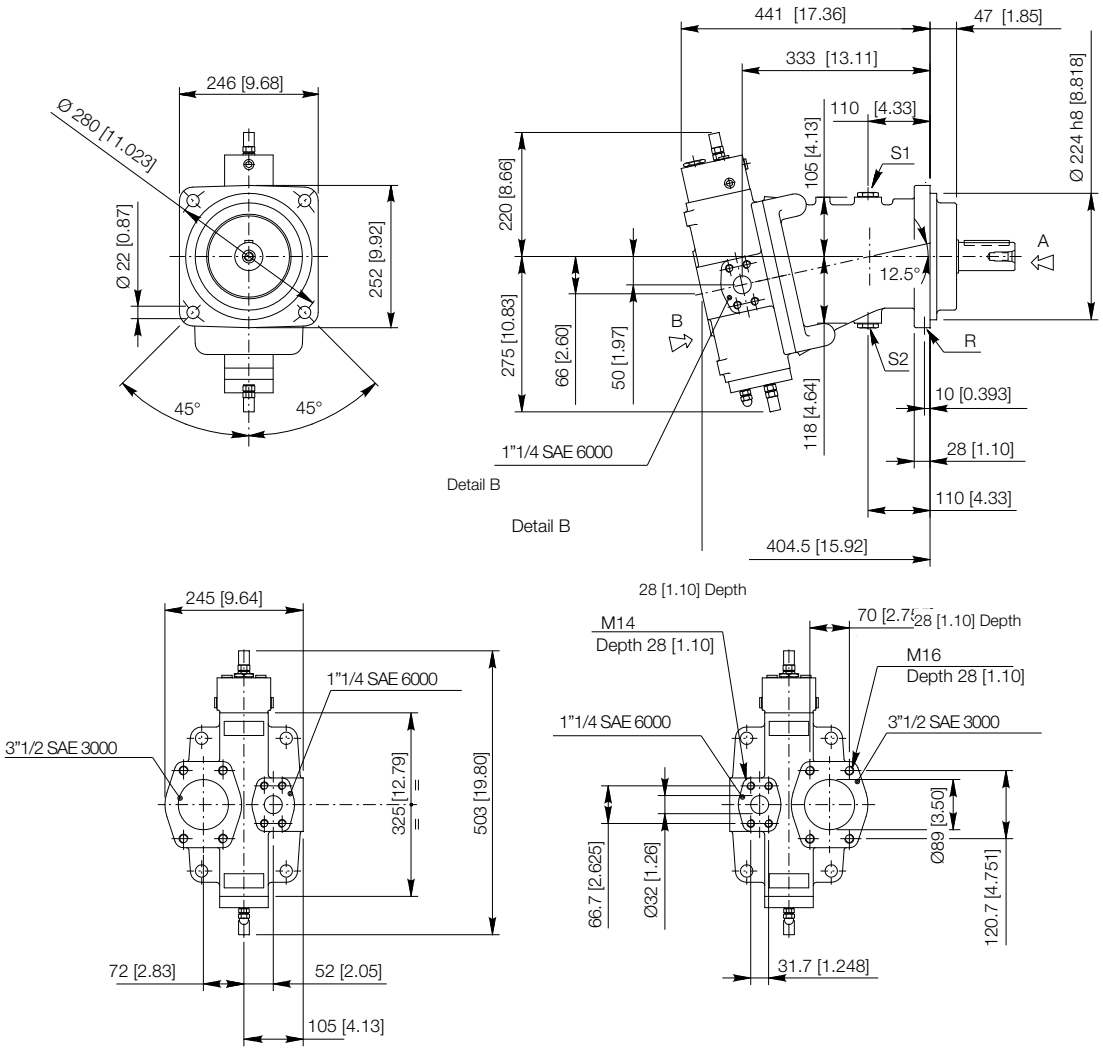


C Parallel keyed shaft

Key
A 14x9x80 [0.55x0.35x3.15]
DIN 6885



S1, S2: Flushing ports (plugged) - 3/4" G (BSPP)
R: Air bleed (plugged) - 1/8" G (BSPP)

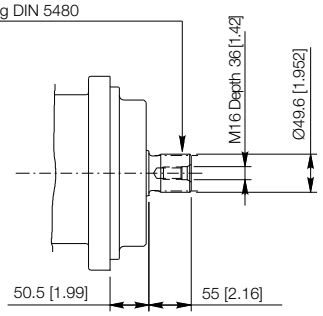


Anti-clockwise rotation **Clockwise rotation**

3 Shaft end

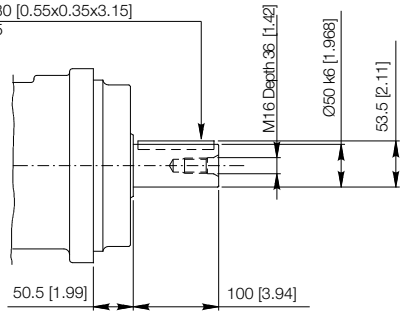
S Splined shaft

Spline
W50x2x24x9g DIN 5480



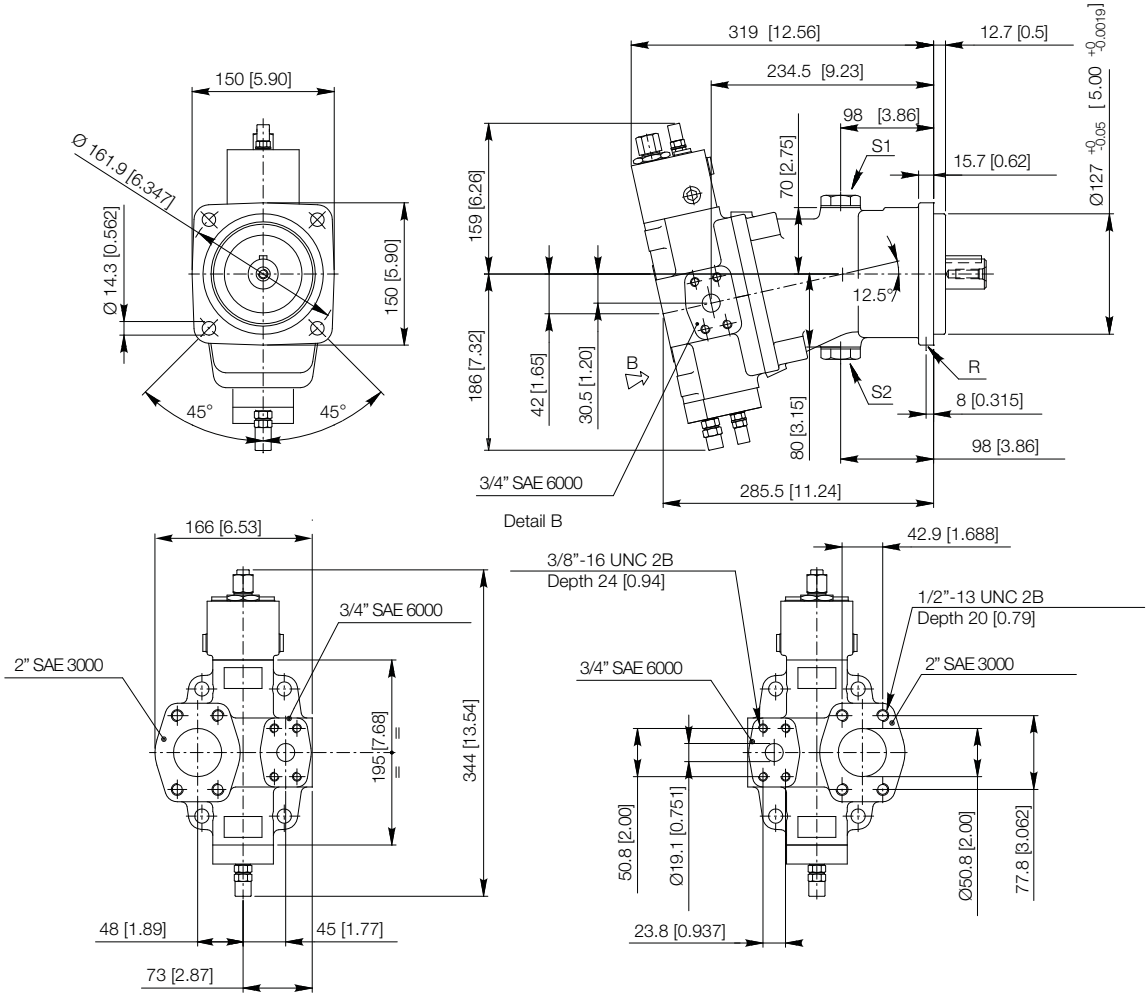
C Parallel keyed shaft

Key
A 14x9x80 [0.55x0.35x3.15]
DIN 6885



Dimensions SAE C 4 Bolts flange

S1, S2: Flushing ports (plugged) - 1” 1/16-12 UN 2B
R: Air bleed (plugged) - 7/16” -20 UNF

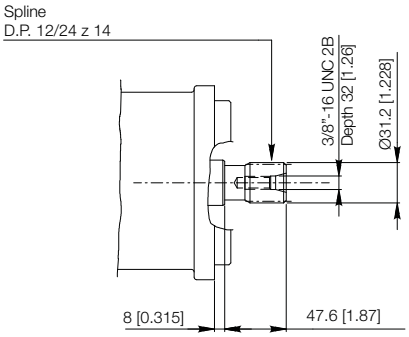


Anti-clockwise rotation

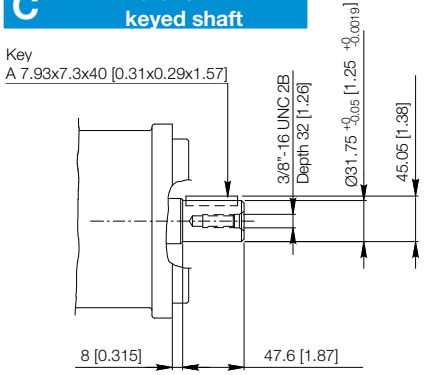
Clockwise rotation

3 Shaft end

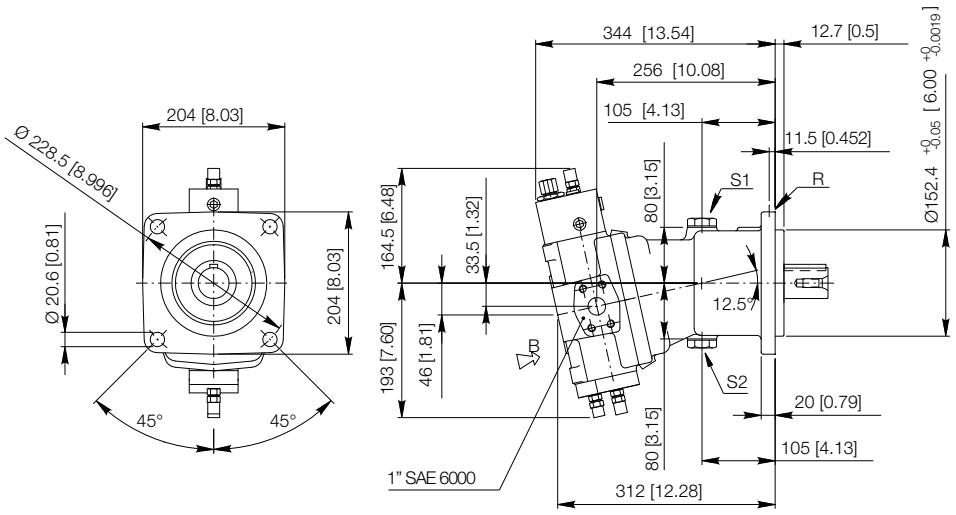
S Splined shaft



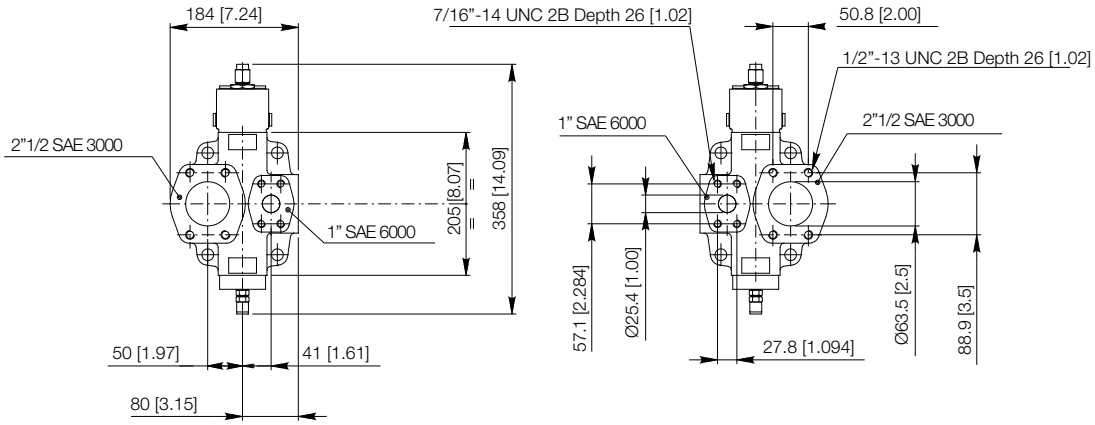
C Parallel keyed shaft



S1, S2: Flushing ports (plugged) - 1” 1/16-12 UN 2B
R: Air bleed (plugged) - 7/16”-20 UNF



Detail B

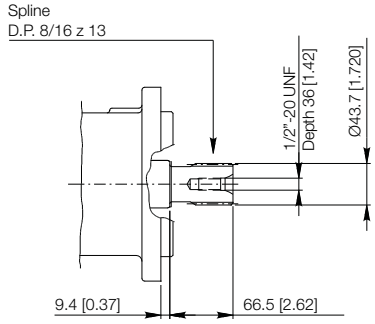


Anti-clockwise rotation

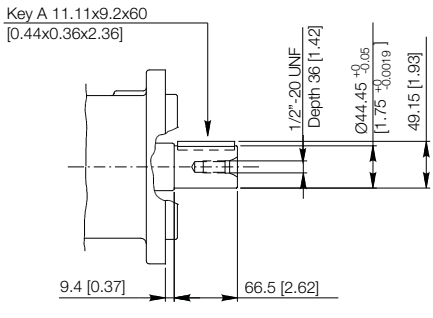
Clockwise rotation

3 Shaft end

S Splined shaft

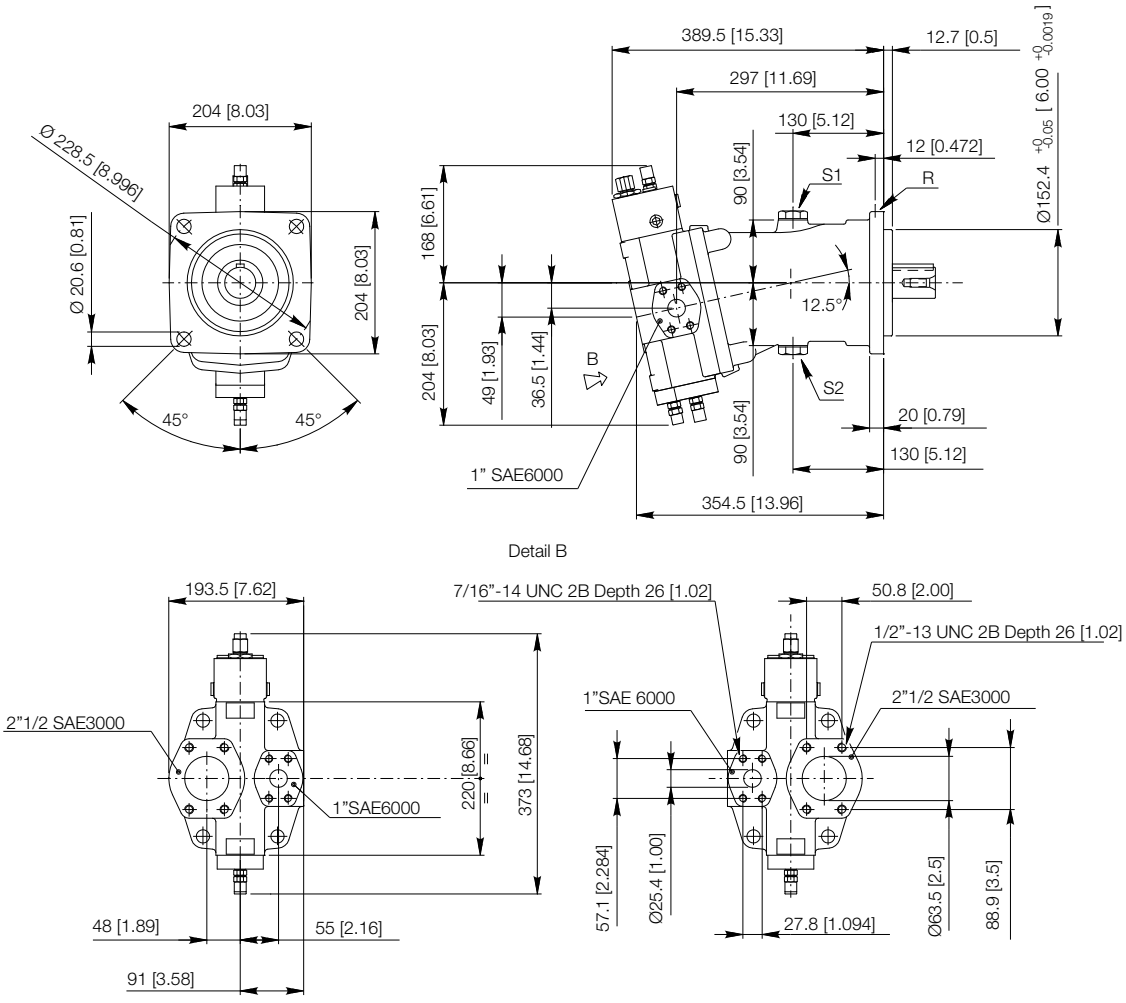


C Parallel keyed shaft



Dimensions SAE D 4 Bolts flange

S1, S2: Flushing ports (plugged) - 1” 1/16-12 UN 2B
R: Air bleed (plugged) - 7/16”-20 UNF

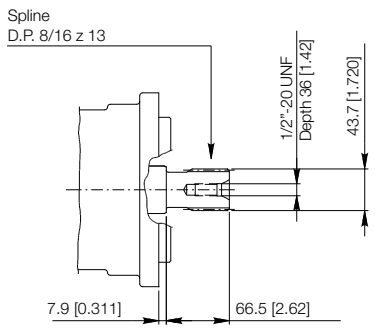


Anti-clockwise rotation

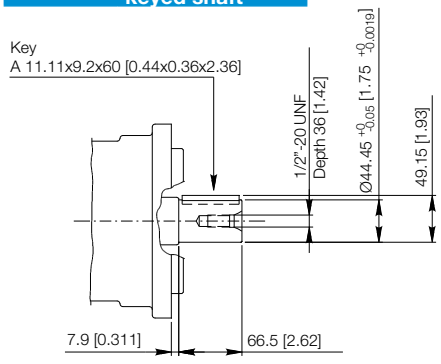
Clockwise rotation

3 Shaft end

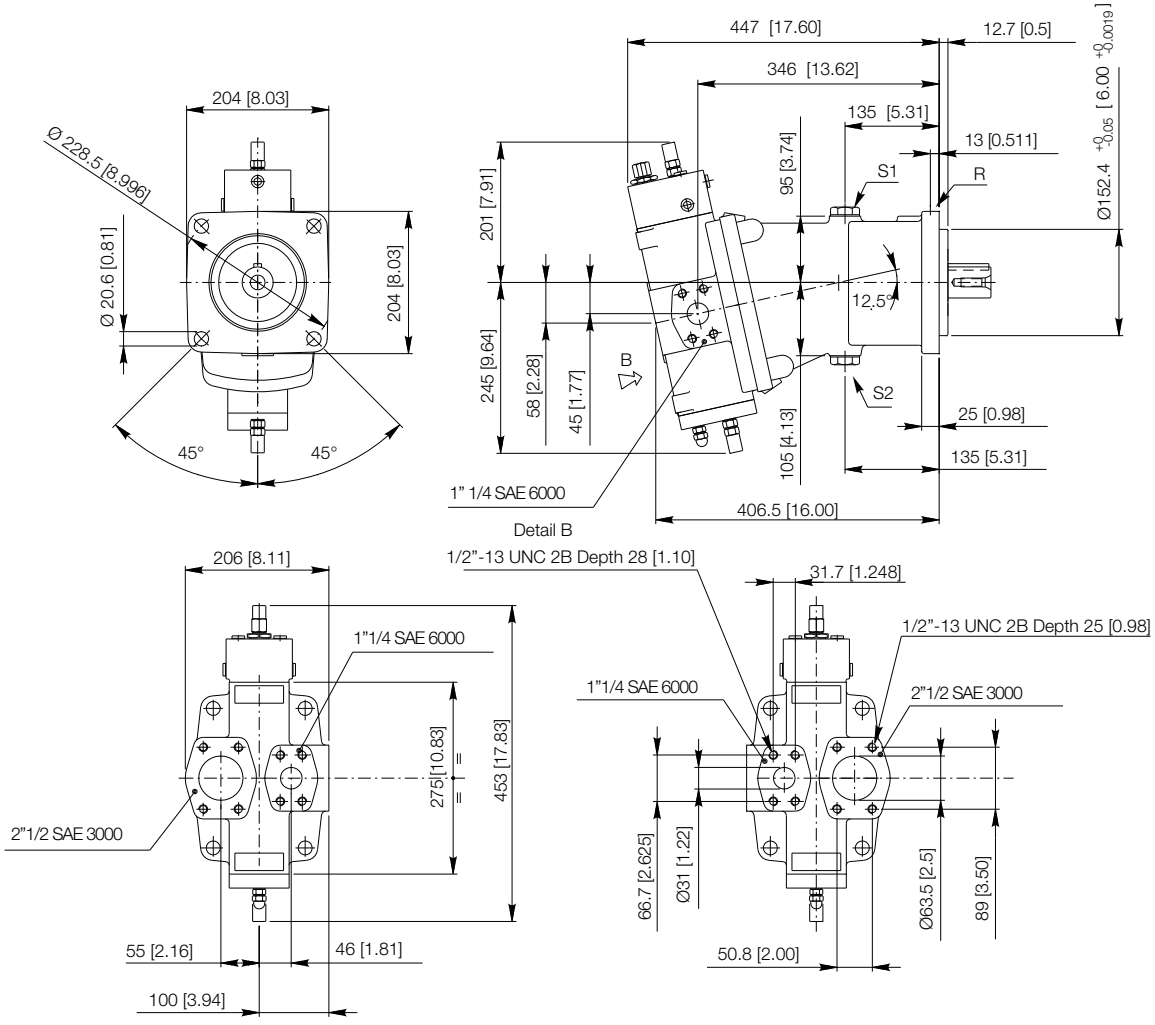
S Splined shaft



C Parallel keyed shaft



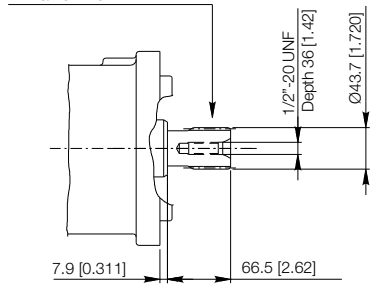
S1, S2: Flushing ports (plugged) - 1” 1/16-12 UN 2B
R: Air bleed (plugged) - 7/16”-20 UNF



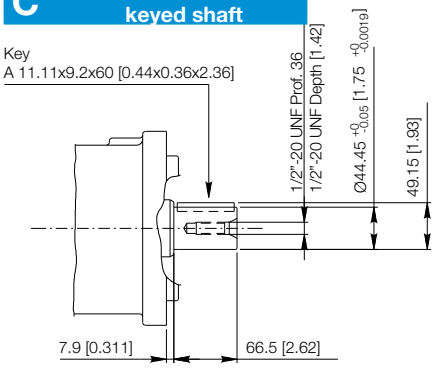
Anti-clockwise rotation **Clockwise rotation**

3 Shaft end

S Splined shaft



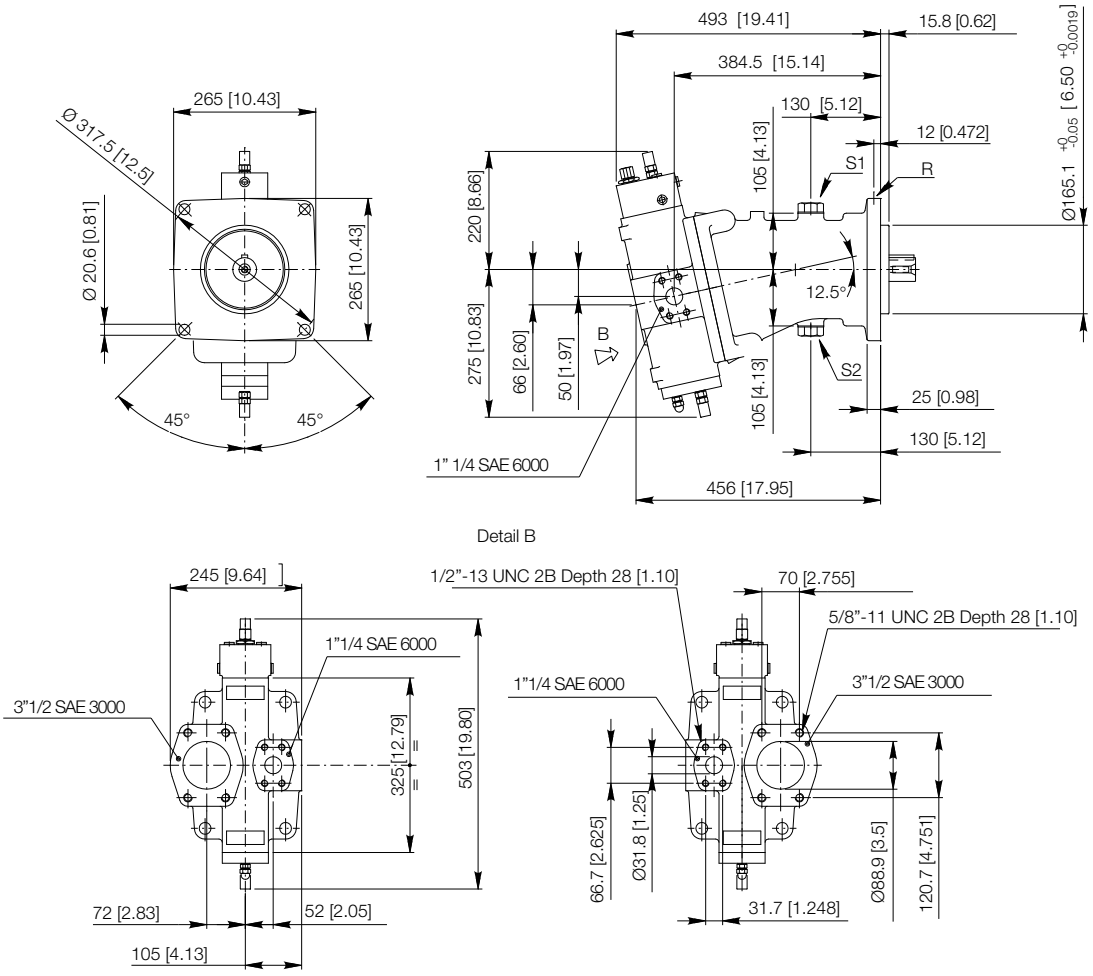
C Parallel keyed shaft



Dimensions SAE E 4 Bolts flange

H1V 226 SAE

S1, S2: Flushing ports (plugged) - 1” 3/16-12 UN 2B
R: Air bleed (plugged) - 7/16”-20 UNF

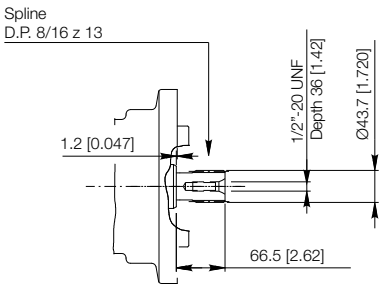


Anti-clockwise rotation

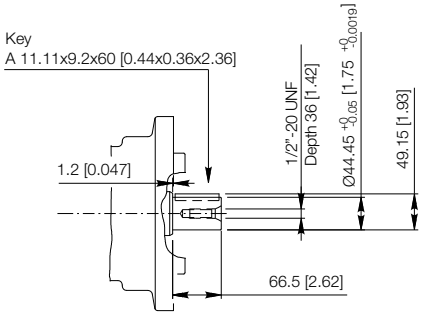
Clockwise rotation

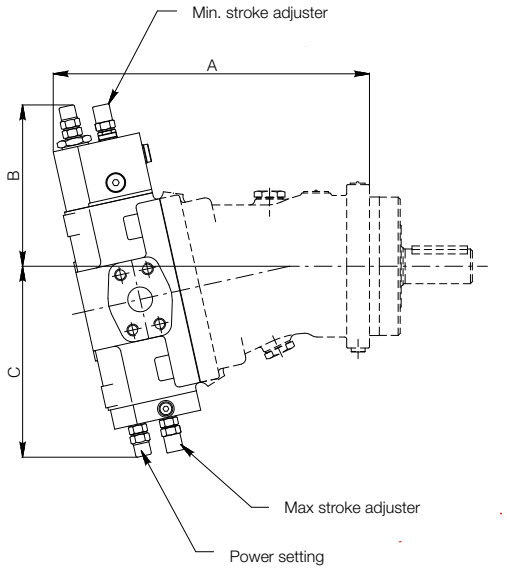
3 Shaft end

S Splined shaft

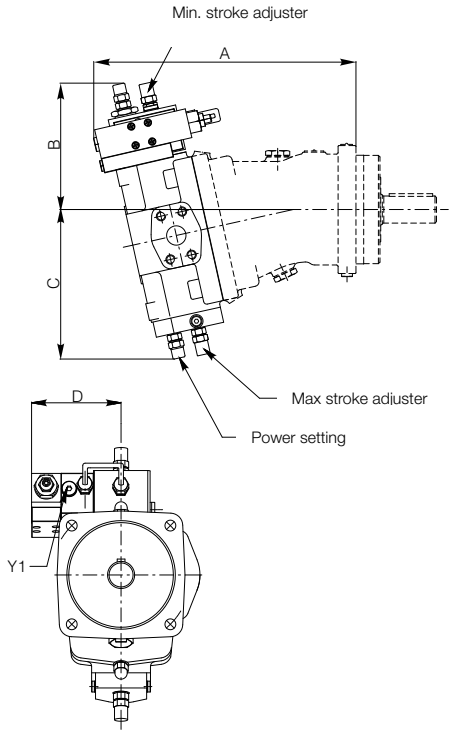


C Parallel keyed shaft

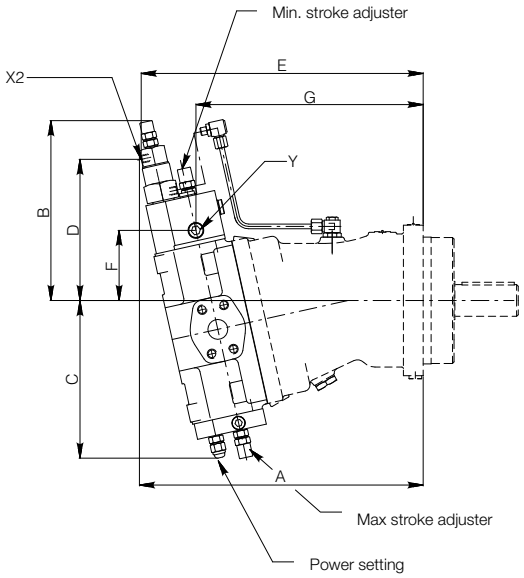




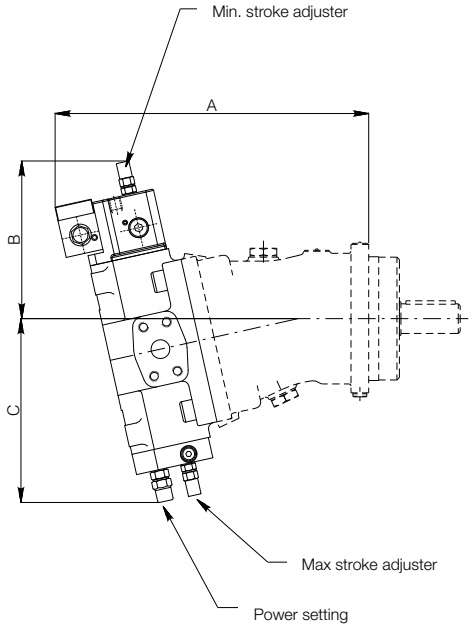
Size	Version	A mm [in]	B mm [in]	C mm [in]
55	M	295 [11.61]	161 [6.33]	186 [7.32]
	SAE	319 [12.55]	161 [6.33]	186 [7.32]
75	M	320 [12.59]	164 [6.45]	193 [7.59]
	SAE	344 [13.54]	164 [6.45]	193 [7.59]
108	M	350 [13.77]	169 [6.65]	203 [7.99]
	SAE	388 [15.27]	169 [6.65]	203 [7.99]
160	M	408 [16.06]	199 [7.83]	247 [9.72]
	SAE	447 [17.59]	199 [7.83]	247 [9.72]
226	M	441 [17.36]	218 [8.58]	276 [10.86]
	SAE	492 [19.37]	218 [8.58]	276 [10.86]



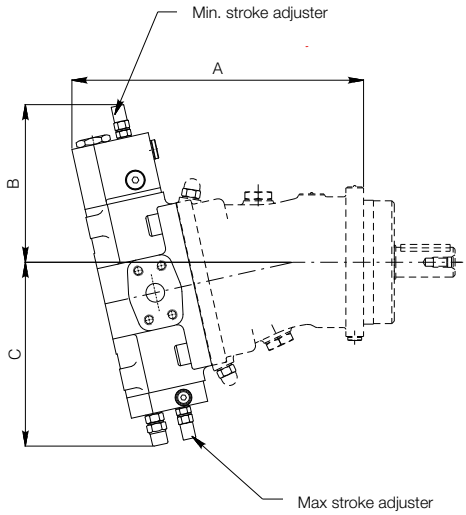
Size	Version	A mm [in]	B mm [in]	C mm [in]	D mm [in]	Y1
75	M	339 [13.34]	164 [6.45]	193 [7.59]	115.5 [4.54]	1/4 G (BSPP)
	SAE	364 [14.33]	164 [6.45]	193 [7.59]	115.5 [4.54]	7/16” - 20 UNF
108	M	369.5 [14.54]	117.5 [4.62]	203 [7.99]	115.5 [4.54]	1/4 G (BSPP)
	SAE	407.5 [16.04]	117.5 [4.62]	203 [7.99]	115.5 [4.54]	7/16” - 20 UNF
160	M	420 [16.53]	199 [7.83]	247 [9.72]	126.5 [4.98]	1/4 G (BSPP)
	SAE	460 [18.11]	199 [7.83]	247 [9.72]	126.5 [4.98]	7/16” - 20 UNF
226	M	452 [17.79]	218 [8.58]	276 [10.86]	126.5 [4.98]	1/4 G (BSPP)
	SAE	504 [19.84]	218 [8.58]	276 [10.86]	126.5 [4.98]	7/16” - 20 UNF



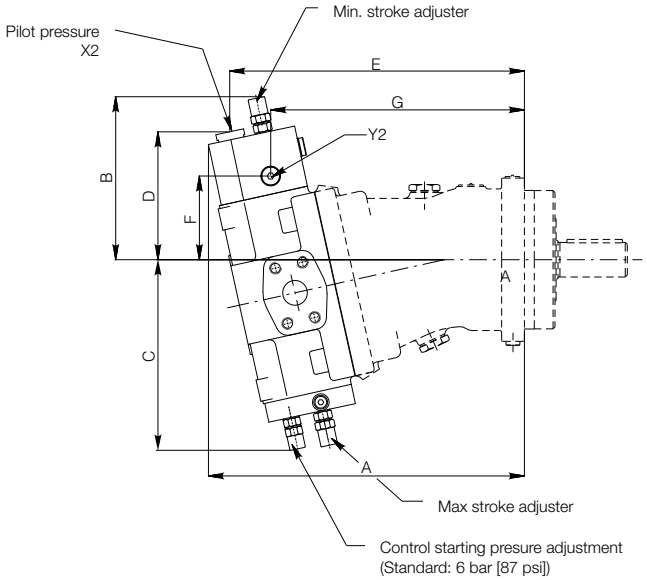
Size	Version	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	F mm [in]	G mm [in]	Y	X2
55	M	303 [11.92]	222 [8.74]	186 [7.32]	172.5 [6.79]	301 [11.85]	83 [3.26]	231 [9.09]	1/4 G (BSPP)	1/8 G (BSPP)
	SAE	349 [13.74]	222 [8.74]	186 [7.32]	167.5 [6.59]	346 [13.62]	83 [3.26]	255 [10.03]	7/16” - 20 UNF	7/16” - 20 UNF
75	M	328 [12.91]	223 [8.77]	193 [7.59]	174 [6.85]	325.5 [12.81]	84.5 [3.32]	256.5 [10.09]	1/4 G (BSPP)	1/8 G (BSPP)
	SAE	374 [14.72]	223 [8.77]	193 [7.59]	169.5 [6.67]	371 [14.60]	84.5 [3.32]	280.5 [11.04]	7/16” - 20 UNF	7/16” - 20 UNF
108	M	359 [14.13]	227 [8.93]	204 [8.03]	178 [7.01]	356 [14.01]	88.5 [3.48]	287 [11.29]	1/4 G (BSPP)	1/8 G (BSPP)
	SAE	417.5 [16.43]	227 [8.93]	204 [8.03]	173.5 [6.83]	415 [16.33]	88.5 [3.48]	324.5 [12.77]	7/16” - 20 UNF	7/16” - 20 UNF
160	M	415 [16.33]	245 [9.64]	246 [9.68]	196 [7.71]	413 [16.25]	111 [4.37]	323.5 [12.73]	1/4 G (BSPP)	1/8 G (BSPP)
	SAE	476 [18.74]	245 [9.64]	246 [9.68]	191.5 [7.53]	473.5 [18.64]	111 [4.37]	362.5 [14.27]	7/16” - 20 UNF	7/16” - 20 UNF
226	M	448 [17.63]	264 [10.39]	275 [10.82]	215 [8.46]	445.5 [17.53]	129.5 [5.09]	356 [14.01]	1/4 G (BSPP)	1/8 G (BSPP)
	SAE	520 [20.47]	264 [10.39]	275 [10.82]	210 [8.26]	518 [20.39]	129.5 [5.09]	407 [16.02]	7/16” - 20 UNF	7/16” - 20 UNF



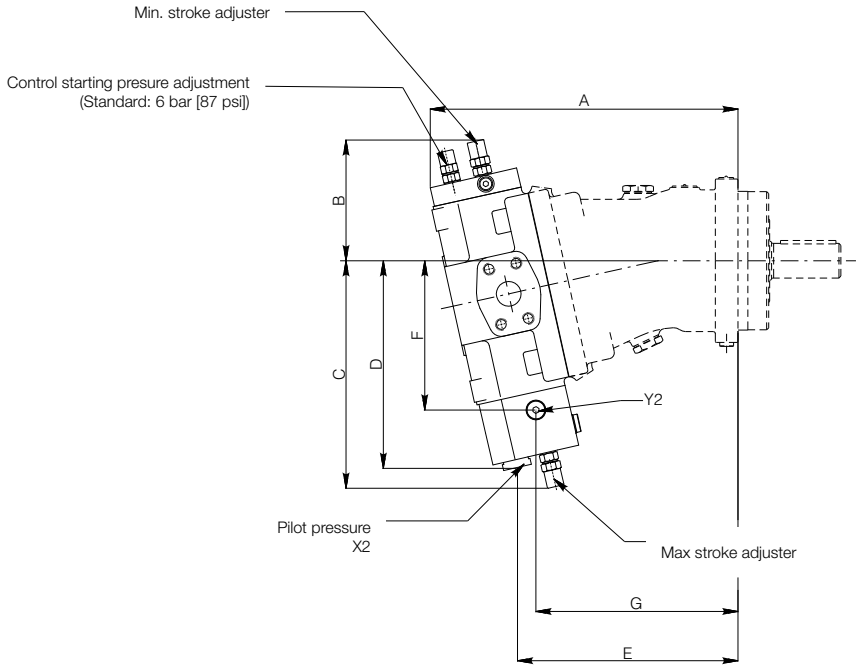
Size	Version	A mm [in]	B mm [in]	C mm [in]
55	M	317 [12.48]	159.5 [6.27]	186 [7.32]
	SAE	341 [13.42]	159.5 [6.27]	186 [7.32]
75	M	342.5 [13.48]	164 [6.45]	193 [7.59]
	SAE	367.5 [14.46]	164 [6.45]	193 [7.59]
108	M	373 [14.68]	168.5 [6.63]	203 [7.99]
	SAE	411 [16.18]	168.5 [6.63]	203 [7.99]
160	M	425.5 [16.75]	201 [7.91]	247 [9.72]
	SAE	465.5 [18.32]	201 [7.91]	247 [9.72]
226	M	457.5 [18.01]	220 [8.66]	276 [10.86]
	SAE	509.5 [20.05]	220 [8.66]	276 [10.86]



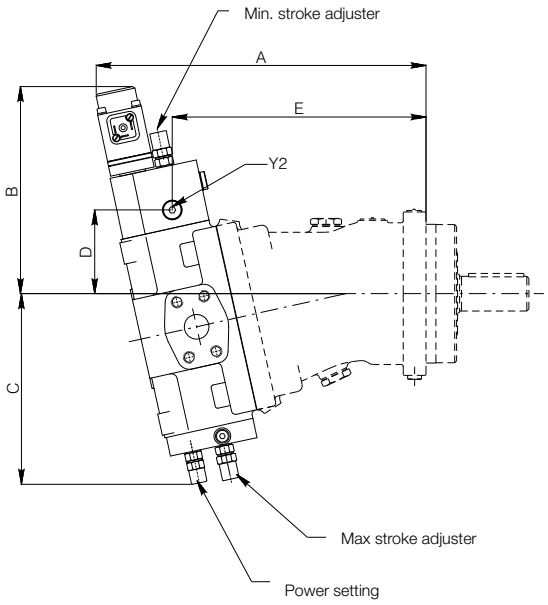
Size	Version	A mm [in]	B mm [in]	C mm [in]
55	M	295 [11.61]	161 [6.33]	189 [7.44]
	SAE	319 [12.55]	161 [6.33]	189 [7.44]
75	M	320 [12.59]	164 [6.45]	193 [7.59]
	SAE	344 [13.54]	164 [6.45]	193 [7.59]
108	M	350 [13.77]	169 [6.65]	203 [7.99]
	SAE	388 [15.27]	169 [6.65]	203 [7.99]
160	M	408 [16.06]	199 [7.83]	247 [9.72]
	SAE	447 [17.59]	199 [7.83]	247 [9.72]
226	M	441 [17.36]	218 [8.58]	276 [10.86]
	SAE	492 [19.37]	218 [8.58]	276 [10.86]



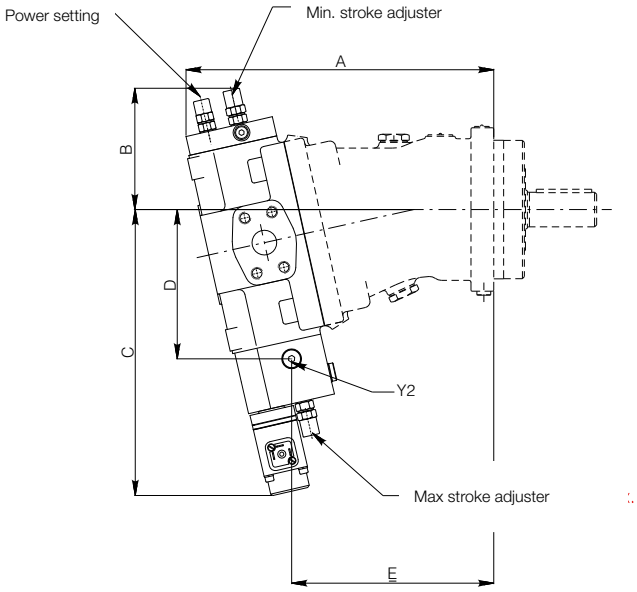
Size	Version	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	F mm [in]	G mm [in]	X2	Y2
55	M	295 [11.61]	159 [6.25]	186 [7.32]	126.5 [4.98]	274 [10.78]	83 [3.26]	231 [9.09]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	319 [12.55]	159 [6.25]	186 [7.32]	147 [5.78]	302.5 [11.90]	83 [3.26]	255 [10.04]	7/16” - 20 UNF	7/16” - 20 UNF
75	M	320 [12.59]	165 [6.49]	193 [7.59]	128.5 [5.06]	299 [11.77]	84.5 [3.32]	256.5 [10.09]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	344 [13.54]	165 [6.49]	193 [7.59]	149 [5.86]	327.5 [12.89]	84.5 [3.32]	280.5 [11.04]	7/16” - 20 UNF	7/16” - 20 UNF
108	M	351 [13.81]	168 [6.61]	204 [8.03]	132.5 [5.21]	329.5 [12.97]	88.5 [3.48]	287 [11.29]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	388 [15.27]	168 [6.61]	204 [8.03]	153 [6.02]	371.5 [14.62]	88.5 [3.48]	324.5 [12.77]	7/16” - 20 UNF	7/16” - 20 UNF
160	M	408 [16.06]	201 [7.91]	246 [9.68]	150 [5.90]	386.5 [15.21]	111 [4.37]	323.5 [12.73]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	447 [17.59]	201 [7.91]	246 [9.68]	170.5 [6.71]	430 [16.92]	111 [4.37]	362.5 [14.27]	7/16” - 20 UNF	7/16” - 20 UNF
226	M	441 [17.36]	220 [8.66]	275 [10.82]	169 [6.65]	419 [16.49]	129.5 [5.09]	356 [14.01]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	492 [19.37]	220 [8.66]	275 [10.82]	189.5 [7.46]	474.5 [18.68]	129.5 [5.09]	407 [16.02]	7/16” - 20 UNF	7/16” - 20 UNF



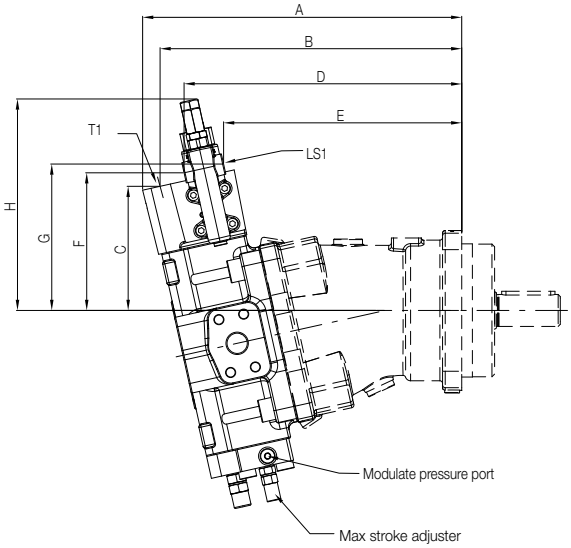
Size	Version	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	F mm [in]	G mm [in]	X2	Y2
55	M	286 [11.25]	119 [4.68]	220 [8.66]	200.5 [7.89]	201.5 [7.93]	142.5 [5.61]	180.5 [7.10]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	310 [12.20]	119 [4.68]	223 [8.77]	221 [8.70]	221 [8.70]	142.5 [5.61]	204.5 [8.05]	7/16” - 20 UNF	7/16” - 20 UNF
75	M	311 [12.24]	123 [4.84]	230 [9.05]	208.5 [8.20]	244 [9.60]	151 [5.94]	204.5 [8.05]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	335 [13.18]	123 [4.84]	231 [9.09]	229 [9.01]	219.5 [8.64]	151 [5.94]	227 [8.93]	7/16” - 20 UNF	7/16” - 20 UNF
108	M	342 [13.46]	127 [5.00]	241 [9.48]	219 [8.62]	252 [9.92]	161.5 [6.35]	232 [9.13]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	380 [14.96]	127 [5.00]	242 [9.52]	239.5 [9.42]	284.5 [11.20]	161.5 [6.35]	269.5 [10.61]	7/16” - 20 UNF	7/16” - 20 UNF
160	M	399 [15.70]	160 [6.29]	287 [11.29]	255.5 [10.05]	296.5 [11.67]	193 [7.59]	256 [10.07]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	438 [17.24]	160 [6.29]	287 [11.29]	276 [10.86]	331 [13.03]	193 [7.59]	295 [11.61]	7/16” - 20 UNF	7/16” - 20 UNF
226	M	433 [17.04]	178 [7.01]	316 [12.44]	285 [11.22]	318.5 [12.53]	223 [8.77]	278 [10.94]	1/4 G (BSPP)	1/4 G (BSPP)
	SAE	484 [19.05]	178 [7.01]	316 [12.44]	305.5 [12.02]	365 [14.37]	223 [8.77]	329 [12.95]	7/16” - 20 UNF	7/16” - 20 UNF

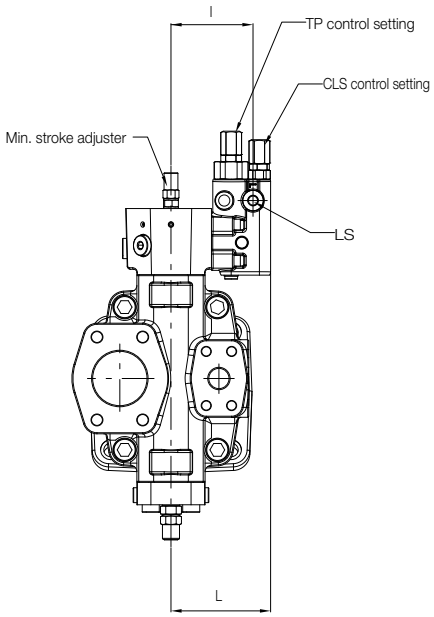


Size	Version	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	Y2
55	M	310 [12.20]	207 [8.14]	186 [7.32]	83 [3.26]	231 [9.09]	1/4 G (BSPP)
	SAE	334 [13.14]	207 [8.14]	186 [7.32]	83 [3.26]	255 [10.4]	7/16” - 20 UNF
75	M	335 [13.18]	209 [8.22]	193 [7.59]	84.5 [3.32]	256.5 [10.09]	1/4 G (BSPP)
	SAE	359 [14.13]	209 [8.22]	193 [7.59]	84.5 [3.32]	280.5 [11.04]	7/16” - 20 UNF
108	M	366 [14.40]	213 [8.38]	204 [8.03]	88.5 [3.48]	287 [11.29]	1/4 G (BSPP)
	SAE	404 [15.90]	213 [8.38]	204 [8.03]	88.5 [3.48]	324.5 [12.75]	7/16” - 20 UNF
160	M	423 [16.65]	230 [9.05]	246 [9.68]	111 [4.37]	323.5 [12.73]	1/4 G (BSPP)
	SAE	462 [18.18]	230 [9.05]	246 [9.68]	111 [4.37]	362.5 [14.27]	7/16” - 20 UNF
226	M	455 [17.91]	249 [9.80]	275 [10.82]	129.5 [5.09]	356 [14.01]	1/4 G (BSPP)
	SAE	506 [19.92]	249 [9.80]	275 [10.82]	129.5 [5.09]	407 [16.02]	7/16” - 20 UNF

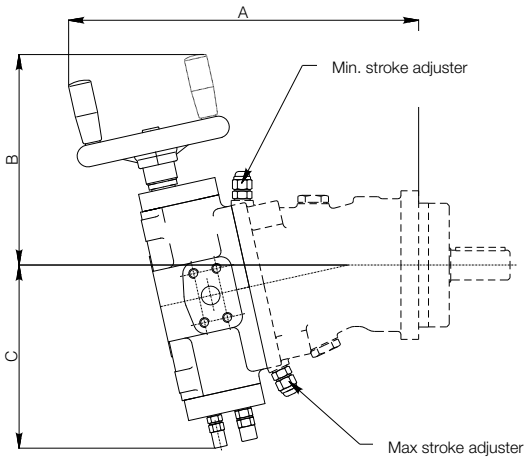


Size	Version	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	Y2
55	M	286 [11.25]	119 [4.68]	281 [11.06]	142.5 [5.61]	180.5 [7.10]	1/4 G (BSPP)
	SAE	310 [12.20]	119 [4.68]	281 [11.06]	142.5 [5.61]	204.5 [8.05]	7/16” - 20 UNF
75	M	311 [12.24]	123 [4.84]	289 [11.37]	151 [5.94]	204.5 [8.05]	1/4 G (BSPP)
	SAE	335 [13.18]	123 [4.84]	289 [11.37]	151 [5.94]	227 [8.93]	7/16” - 20 UNF
108	M	342 [13.46]	127 [5.00]	299 [11.77]	161.5 [6.35]	232 [9.13]	1/4 G (BSPP)
	SAE	380 [14.96]	127 [5.00]	299 [11.77]	161.5 [6.35]	269.5 [10.61]	7/16” - 20 UNF
160	M	399 [15.70]	160 [6.29]	336 [13.22]	193 [7.59]	256 [10.07]	1/4 G (BSPP)
	SAE	438 [17.24]	160 [6.29]	336 [13.22]	193 [7.59]	295 [11.61]	7/16” - 20 UNF
226	M	433 [17.04]	178 [7.01]	365 [14.37]	223 [8.77]	278 [10.94]	1/4 G (BSPP)
	SAE	484 [19.05]	178 [7.01]	365 [14.37]	223 [8.77]	329 [12.95]	7/16” - 20 UNF

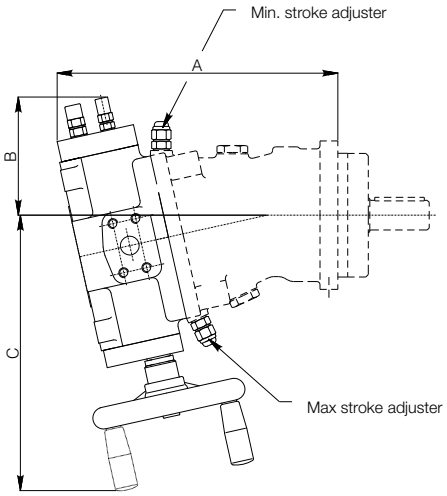




Size	Version	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	F mm [in]	G mm [in]	H mm [in]	I mm [in]	L mm [in]	LS / LS1	T1
55	M	299.5 [11.79]	282.6 [11.12]	116.6 [4.59]	260.6 [10.26]	223.5 [8.79]	129.2 [5.08]	137.4 [5.41]	198.5 [7.81]	77 [3.03]	93.5 [3.68]	1/8 G (BSPP)	1/4 G (BSPP)
75	M	329.7 [12.98]	313.1 [12.33]	117.5 [4.62]	291.7 [11.48]	254.6 [10.02]	130.4 [5.13]	138.7 [5.46]	199.7 [7.86]	76.5 [3.01]	93 [3.66]	1/8 G (BSPP)	1/4 G (BSPP)
108	M	356.6 [14.04]	340 [13.38]	121.9 [4.79]	318.6 [12.54]	281.5 [11.08]	134.5 [5.29]	142.1 [5.59]	204.1 [8.03]	76.5 [3.01]	93 [3.66]	1/8 G (BSPP)	1/4 G (BSPP)
160	M	411.8 [16.21]	395.9 [15.58]	139.6 [5.49]	360.6 [14.19]	323.5 [12.73]	155.1 [6.10]	163.3 [6.43]	224.4 [8.83]	87 [3.42]	103.5 [4.07]	1/8 G (BSPP)	1/4 G (BSPP)
226	M	445.1 [17.52]	429.3 [16.90]	158.5 [6.24]	394 [15.51]	356.9 [14.05]	174 [6.85]	182.2 [7.17]	243.3 [9.57]	87 [3.42]	103.5 [4.07]	1/8 G (BSPP)	1/4 G (BSPP)



Size	Version	A mm [in]	B mm [in]	C mm [in]
55	M	354 [13.93]	213 [8.38]	185 [7.28]
	SAE	378 [14.88]	213 [8.38]	185 [7.28]
75	M	354 [13.93]	225 [8.85]	193 [7.59]
	SAE	378 [14.88]	225 [8.85]	193 [7.59]
108	M	386 [15.19]	229 [9.01]	204 [8.03]
	SAE	423 [16.65]	229 [9.01]	204 [8.03]
160	M	428 [16.85]	250 [9.84]	246 [9.68]
	SAE	467 [18.38]	250 [9.84]	246 [9.68]
226	M	461 [18.14]	269 [10.59]	275 [10.82]
	SAE	512 [20.15]	269 [10.59]	275 [10.82]

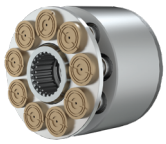


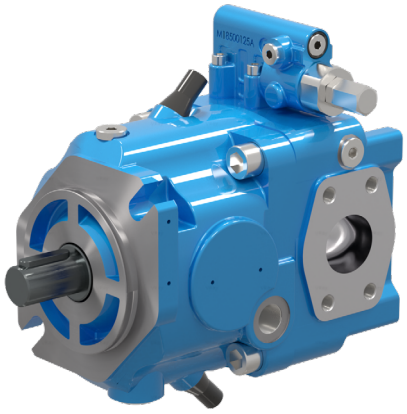
Size	Version	A mm [in]	B mm [in]	C mm [in]
55	M	284 [11.18]	119.5 [4.70]	278.5 [10.96]
	SAE	308 [12.12]	119.5 [4.70]	278.5 [10.96]
75	M	311 [12.24]	123 [4.84]	291 [11.45]
	SAE	335 [13.18]	123 [4.84]	29 [11.45]
108	M	342 [13.46]	127 [5.00]	302 [11.88]
	SAE	380 [14.96]	127 [5.00]	302 [11.88]
160	M	399 [15.70]	160 [6.29]	336 [13.22]
	SAE	438 [17.24]	160 [6.29]	336 [13.22]
226	M	433 [17.04]	178 [7.01]	365 [14.37]
	SAE	484 [19.05]	178 [7.01]	365 [14.37]

DANA BREVINI® Motion Systems

DANA BREVINI® Motion Systems

S5AV - Variable displacement axial piston pumps for open circuit





Index

General information - Features.....I2
Technical data I4
Ordering code I5
Operating curves I11
Control I13
Pump and controls dimensions.....I17
Through drive I25
Through drives dimensions I26
Tandem combination dimensions.....I28

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]
S5AV 032	32.00 [1.95]	100 [26.4]	280 [4000]
S5AV 045	43.3 [2.64]	117 [30.88]	300 [4350]
S5AV 050	49.65 [3.05]	149 [39.3]	320 [4600]
S5AV 063	63.98 [3.90]	160 [42.24]	320 [4600]
S5AV 075	75.00 [4.57]	169 [44.62]	350 [5000]
S5AV 093	93.76 [5.72]	197 [52]	320 [4600]

S5AV is a family of pumps for open circuit, axial piston design for mobile and industrial applications. A strong proven rotating roup allows the pumps to handle high continuous and peak pressure. The pump features patented swash plate assembly resulting in minimal leaks and high volumetric efficiency. An adjustable maximum/minimum volume stops provides a means of tuning flow to your system.
Controls options are designed lo provide high accuracy and repeatability of operation.
Versatile design includes 100% through-drive capability for multiple pump options.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
$n_{0\ max}$	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure

p_{max}	bar [psi]	Maximum pressure peak
q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficwiency
η_v	%	Volumetric efficiency

Features and benefits
- Compact size
- Quiet pump operation
- High efficiency
- Accurate control function
- Reduced maintenance
- Long pump life
- Flexibility in machine design

Typical applications
- Industrial equipments
- Earth moving machines and construction machinery
- Agricultural and forestry machines
- Marine and Off-Shore equipments

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and filtration section.

Temperature ranges:
The operating temperature of the oil must be within -25 ºC ÷ 90 ºC (-13 ºF ÷ 194 ºF). The running of the axial piston unit with oil temperature higher than 90 ºC (194 °F) for lower than -25 ºC (-13 °F) is not allowed. For further information see at Fluids and filtration section.

Filtration:
A correct filtration is essential for long and satisfactory life of axial piston units. In order to ensure a correct functioning of the unit, the maximum permissible contamination class is 20/18/15 according to ISO 4406:1999. For further details see at Fluids and filtration section.

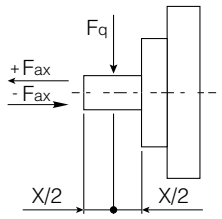
Inlet pressure:
Minimum absolute pressure at suction port 0.8 bar [11.6 psi]. In no case inlet pressure can be lower.

Case drain pressure:
Maximum permissible case drain pressure 1.5 bar [22 psi]. A higher pressure can affect the shaft seal or reduce its life.

Seals:
Seals used on standard S5AV series axial piston pumps are of NBR (Acrylonitrile-Butadiene Elastomer). For special uses (high temperatures or special fluids) it is possible to order the unit with FKM seals (Viton®).

Warning:
In the unit with FKM (Viton®) version, the seals on the controls are in NBR version.
In case of use of special fluids, contact Dana.

Drive shaft Radial and Axial forces:
The drive shaft can support both radial and axial forces. The maximum permissible loads in the following table are calculated in such a way as to guarantee a service life of at least 80% of the service life of bearings to which no load is applied.



			Size					
			032	045	050	063	075	093
Radial load	$F_{q\ max}$	lbf	225	225	338	338	540	540
Axial load	$F_{ax\ max}$	lbf	270	270	338	338	428	428

Installation:
S5AV series pumps can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. Installation of the unit with shaft in vertical position and above the tank involves some limitations. For further details see at General installation guide lines.

Noise level:
Researches carried out by a university institute supplied us with some data concerning noise level and its correlation with structural vibrations. These data allow us to state as partial result a max. noise level value of 70 dB, at 1 m distance from the pump, under following working conditions: max. displacement, rotating speed 1500 rpm, pressure 200 bar [2900 psi] and mineral oil at 45 °C with viscosity 35 cSt.

			Size					
			032	045	050	063	075	093
Displacement (1)	$V_{g\ max}$	cm^3/rev [in^3/rev]	32.00 [1.95]	43.3 [2.64]	49.65 [3.05]	63.98 [3.90]	75.00 [4.57]	93.76 [5.72]
Displacement (1)	$V_{g\ min}$	cm^3/rev [in^3/rev]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Press. max. cont.	p_{nom}	bar [psi]	280 [4000]	300 [4350]	320 [4600]	320 [4600]	350 [5000]	320 [4600]
Press. max. peak	p_{max}	bar [psi]	350 [5000]	350 [5000]	380 [5500]	380 [5500]	420 [6000]	380 [5500]
Max speed at $V_{g\ max}$ (1)	$n_{max\ nom}$	rpm	3150	2700	3000	2500	2250	2100
Minimum Recommended Speed	n_{min}	rpm	500	500	500	500	500	500
Max flow at $n_{max\ nom}$ e $V_{g\ max}$	$q_{max\ nom}$	l/min [U.S.gpm]	100 [26.4]	117 [30.88]	149 [39.3]	160 [42.24]	169 [44.62]	197 [52]
Max power at $q_{max\ nom}$ e p_{nom}	$P_{max\ nom}$	kW [hp]	46 [62]	57 [76]	79 [105]	85 [114]	113 [151]	121 [162]
Torque constant	T_k	Nm/bar [lbf.ft/psi]	0.51 [0.026]	0.69 [0.035]	0.79 [0.040]	1.01 [0.052]	1.20 [0.061]	1.49 [0.076]
Max torque cont. at p_{nom}	T_{nom}	Nm [lbf.ft]	142 [105]	207 [152.5]	253 [186]	326 [240]	418 [308]	477 [351]
Max torque peak at p_{max}	T_{max}	Nm [lbf.ft]	177 [130]	241 [177]	300 [221]	387 [285]	500 [368]	567 [418]
Moment of inertia (2)	J	$kg{\cdot}m^2$ [$lbf.ft^2$]	0.0034 [0.081]	0.0034 [0.081]	0.0065 [0.154]	0.0065 [0.154]	0.0098 [0.232]	0.0098 [0.232]
Weight (2)	m	kg [lbs]	19 [42]	20 [44]	30 [66]	31 [68]	42 [92]	44 [96]

(Theoretical values, without considering h_{hm} and h_v;approximate values). Peak operations must not excide 1% of every minute. A simultaneous maximum pressure and maximum speed are not recommended.
If speed and oil viscosity are different from standard, please contact us.

Notes:
(1)The values shown are valid for an absolute pressure (pass) of 1 bar [14.5 psi] at the suction inlet port an when operated on mineral oil in conditions of optimum viscosity.
(2)Approximate values.

Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the S5AV pumps. Use the model code below to specify the desired features. **All alphanumeric digits system of the code must be present when ordering.** We recommend to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Series	Pump	Size	Maximum displacement limitation	Minimum displacement limitation	Version	Mount flange	Shaft end	Direction of rotation	Seal	Control	Control feature	Through drive	Serie feature	Painting
S5AV	P	032	0÷32	0÷32	ME	02	S10	DX	N	PCXXX	000	XX	XX	XX

1

Series	
S5AV	Variable displacement axial piston pump

2

Pump	
P	Pump

3

Size	
032	32 cm³/rev [1.95 in³/rev]
045	43.2 cm³/rev [2.64 in³/rev]
050	49.65 cm³/rev [3.05 in³/rev]
063	63.98 cm³/rev [3.9 in³/rev]
075	75 cm³/rev [4.57 in³/rev]
093	93.76 cm³/rev [5.673 in³/rev]

4

Maximum displacement limitation		Size					
		032	045	050	063	075	093
32÷0	From 32 cm³/rev [1.95 in³/rev] to 0 cm³/rev [0 in³/rev]	●	–	–	–	–	–
45÷0	From 43.2 cm³/rev [2.64 in³/rev] to 0 cm³/rev [0 in³/rev]	–	●	–	–	–	–
50÷0	From 49.65 cm³/rev [3.05 in³/rev] to 0 cm³/rev [0 in³/rev]	–	–	●	–	–	–
63÷0	From 63.98 cm³/rev [3.9 in³/rev] to 0 cm³/rev [0 in³/rev]	–	–	–	●	–	–
75÷0	From 75 cm³/rev [4.57 in³/rev] to 0 cm³/rev [0 in³/rev]	–	–	–	–	●	–
93÷0	From 93.76 cm³/rev [5.673 in³/rev] to 0 cm³/rev [0 in³/rev]	–	–	–	–	–	●

● Available
– Not available

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S5AV	P	032	0÷32	0÷32	ME	02	S10	DX	N	PCXXX	000	XX	XX	XX

5

Minimum displacement limitation		Size					
		032	045	050	063	075	093
0÷32	From 0 cm³/rev (0 in³/rev) to 32 cm³/rev (1.95 in³/rev)	●	–	–	–	–	–
0÷45	From 0 cm³/rev (0 in³/rev) to 45 cm³/rev (2.745 in³/rev)	–	●	–	–	–	–
0÷50	From 0 cm³/rev (0 in³/rev) to 50 cm³/rev (3.05 in³/rev)	–	–	●	–	–	–
0÷63	From 0 cm³/rev (0 in³/rev) to 63 cm³/rev (3.843 in³/rev)	–	–	–	●	–	–
0÷75	From 0 cm³/rev (0 in³/rev) to 75 cm³/rev (4.575 in³/rev)	–	–	–	–	●	–
0÷93	From 0 cm³/rev (0 in³/rev) to 93 cm³/rev (5.673 in³/rev)	–	–	–	–	–	●

● Available
– Not available

6

Version	
ME	ISO

7

Mount flange		Size					
		032	045	050	063	075	093
02	2 Bolts SAE-B	●	●	●	●	–	–
04	2 Bolts SAE-C	–	–	–	–	●	●
08(*)	4 Bolts SAE-D	–	–	–	–	●	●

* : Not available for second pump Tandem 075 / 093 + 075 / 093.
● Available
– Not available

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S5AV	P	032	0÷32	0÷32	ME	02	S10	DX	N	PCXXX	000	XX	XX	XX

8

Shaft end		Size					
		032	045	050	063	075	093
S10	Splined 15T - 16/32 DP	●	●	–	–	–	–
SAX	Splined 13T - 16/32 DP	●	●	–	–	–	–
CBB	Cylindrical Ø25 mm [Ø0.984 in]	●	●	–	–	–	–
S11	Splined 15T - 16/32 DP	–	–	●	●	–	–
SAH	Splined DIN 5480 W35x2x30x16x9g	–	–	●	●	–	–
CBC	Cylindrical Ø32 mm [Ø1.260 in]	–	–	●	●	–	–
S13	Splined 14T - 12/24 DP	–	–	–	–	●	●
SAC	Splined 21T - 16/32 DP	–	–	–	–	●	●
SAL	Splined DIN 5480 W40x2x30x18x9g	–	–	–	–	●	●
CBD	Cylindrical Ø40 mm [Ø1.575 in]	–	–	–	–	●	●

For Tandem assembly check chapter “TANDEM COMBINATION DIMENSIONS”

● Available
– Not available

9

Direction of rotation (viewed from shaft side)	
DX	CW
SX	CCW

10

Seal	
N	NBR
V(*)	FKM

* : The seals on the Controls are in NBR version.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S5AV	P	032	0÷32	0÷32	ME	02	S10	DX	N	PCXXX	000	XX	XX	XX

11

Control		Size					
		032	045	050	063	075	093
PCXXX	Constant Pressure - CTP	●	●	●	●	●	●
LSPCX	Load Sensing + Pressure Cut-Off with drain - CLS+TP	●	●	●	●	●	●
LSPCY	Load Sensing + Pressure Cut-Off without drain - CLS+TP	●	●	●	●	●	●
NCPCX	Constant Power + Constant Pressure - NC+PC	–	–	●	●	●	●
NLP0X	Constant Power + Load Sensing + pressure Cut-Off without drain - NC+LS+TP3	–	–	●	●	●	●
NLP1X	Constant Power + Load Sensing + pressure Cut-Off with drain - NC+LS+TP3C	–	–	●	●	●	●

● Available
– Not available

12

Control feature			Control					
			PCXXX	LSPCX	LSPCY	NCPCX	NLP0X	NLP1X
000	None		–	–	–	–	–	–
6.5÷35	Power at 1500 rpm [kW]	S5AV 50	–	–	–	●	●	●
8÷45		S5AV 63	–	–	–	●	●	●
9.5÷60		S5AV 75	–	–	–	●	●	●
12÷60		S5AV 93	–	–	–	●	●	●
18÷35	Load Sensing (bar)	Standard 20 bar	–	●	●	–	●	●
50÷350	Pressure Setting (bar)	Standard 305 bar	●	●	●	●	●	●

● Available
– Not available

Please verify the possibility of the values showed with the control diagrams present on the catalogue.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S5AV	P	032	0÷32	0÷32	ME	02	S10	DX	N	PCXXX	000	XX	XX	XX

13

Through drive		Size					
		032	045	050	063	075	093
Through drive for 2nd Pump assembled by the customer							
XX	Without through drive	●	●	●	●	●	●
SA	SAE A = Z9 - 16/32 DP	●	●	●	●	●	●
SB	SAE B = Z13 - 16/32 DP	●	●	●	●	●	●
BB	SAE B-B = Z15 - 16/32 DP	●	●	●	●	●	●
SC	SAE C = Z14 - 12/24 DP	–	–	●	●	●	●
CC	SAE C-C = Z17 - 12/24 DP	–	–	●	●	●	●
G2	GR2 L=4	●	●	●	●	●	●
2G	GR2 L=3.2	●	●	●	●	●	●
G3	GR3	●	●	●	●	●	●
Through drive for 2nd Pump assembled by Dana							
TA	Pump combination c/w through drive SAE A = 9T - 16/32 DP	●	●	●	●	●	●
TB	Pump combination c/w through drive SAE B = 13T - 16/32 DP	●	●	●	●	●	●
BT	Pump combination c/w through drive SAE B-B = 15T - 16/32 DP	●	●	●	●	●	●
TC	Pump combination c/w through drive SAE C = 14T - 12/24 DP	–	–	●	●	●	●
T0	Pump Combination only with S5AV 32/45 shaft S10	●	●	●	●	●	●
T1	Pump Combination only with S5AV 50/63 shaft S11	–	–	●	●	●	●
T2	Pump Combination only with S5AV 50/63 shaft SAH	–	–	●	●	●	●
T4	Pump Combination only with S5AV 75/93 shaft SAC	–	–	–	–	●	●

● Available
– Not available

In tandem combinations where 2nd pump is S5AV, use only T0-T1-T2-T4 through drive.

Ordering code

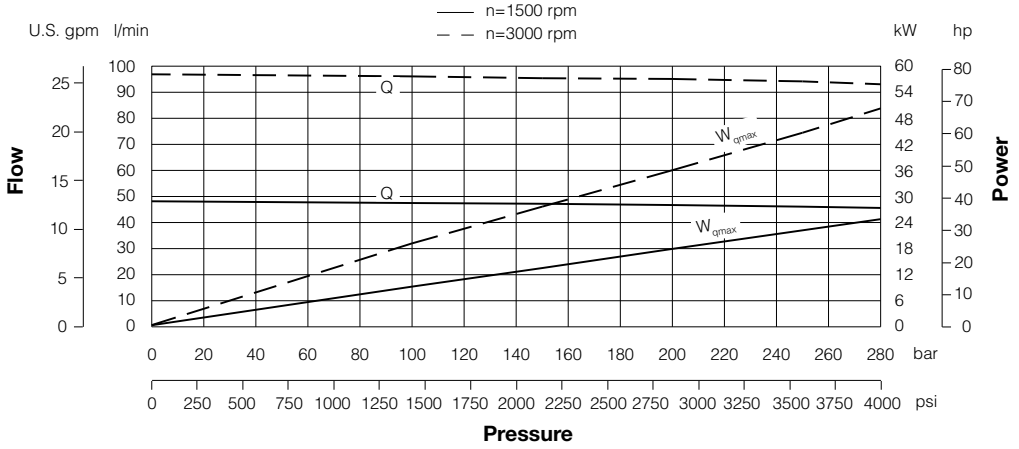
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S5AV	P	032	0÷32	0÷32	ME	02	S10	DX	N	PCXXX	000	XX	XX	XX

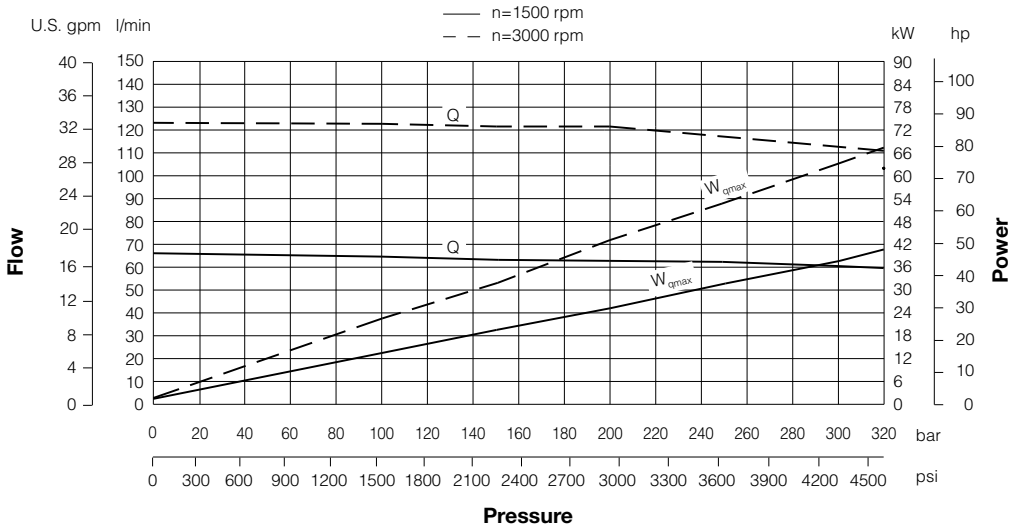
14

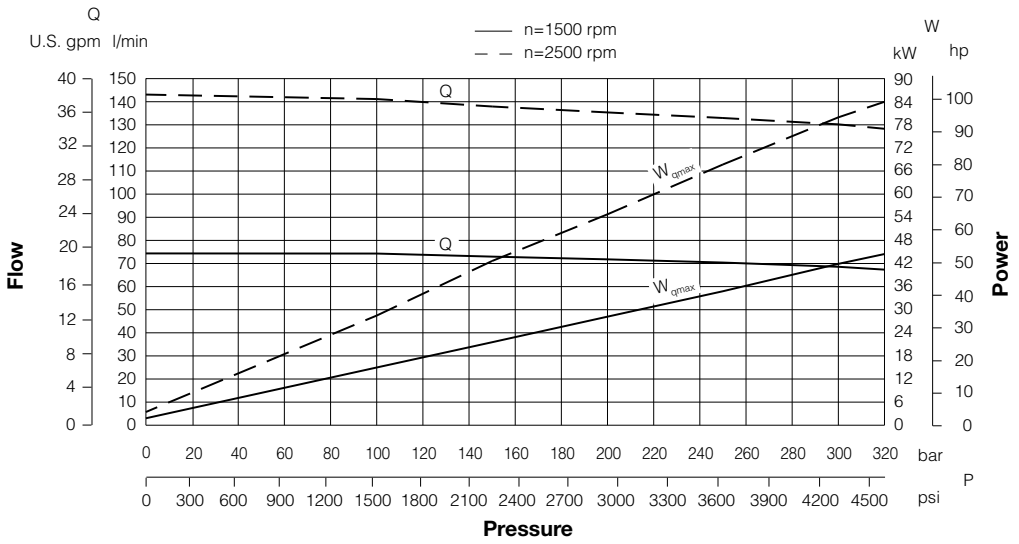
Serie feature	
XX	None

15

Painting	
XX	None
01	Black Paint ed RAL 9005

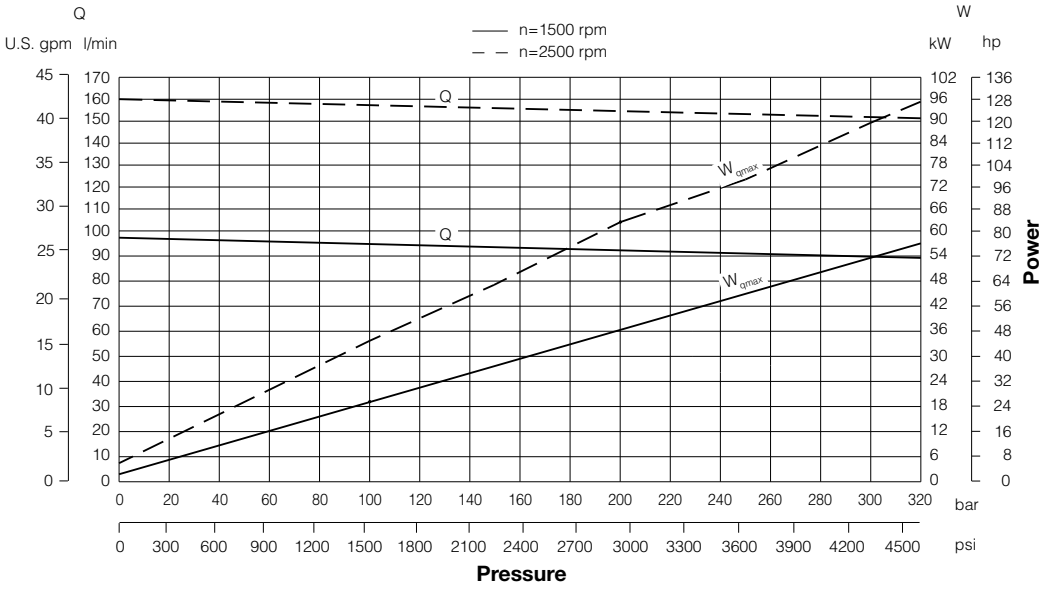


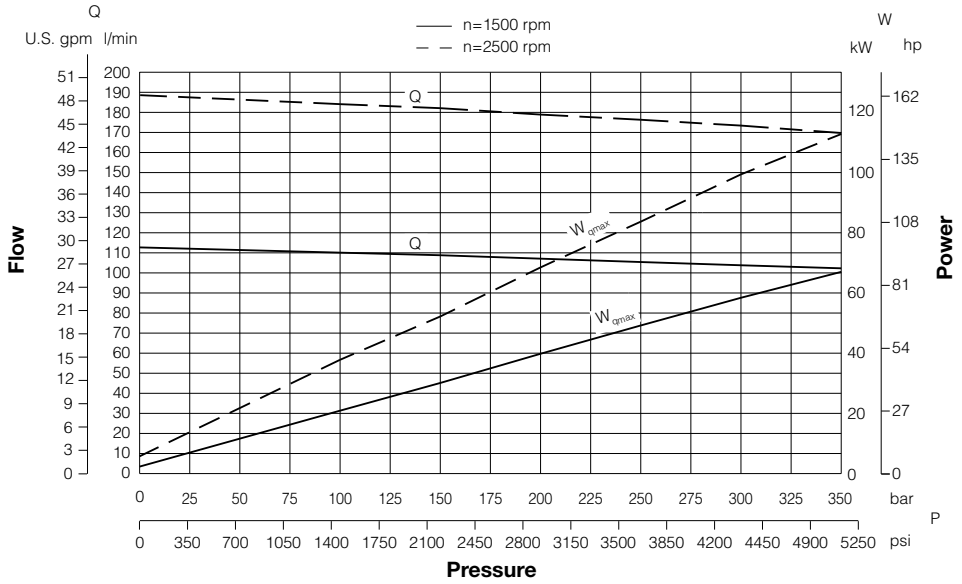


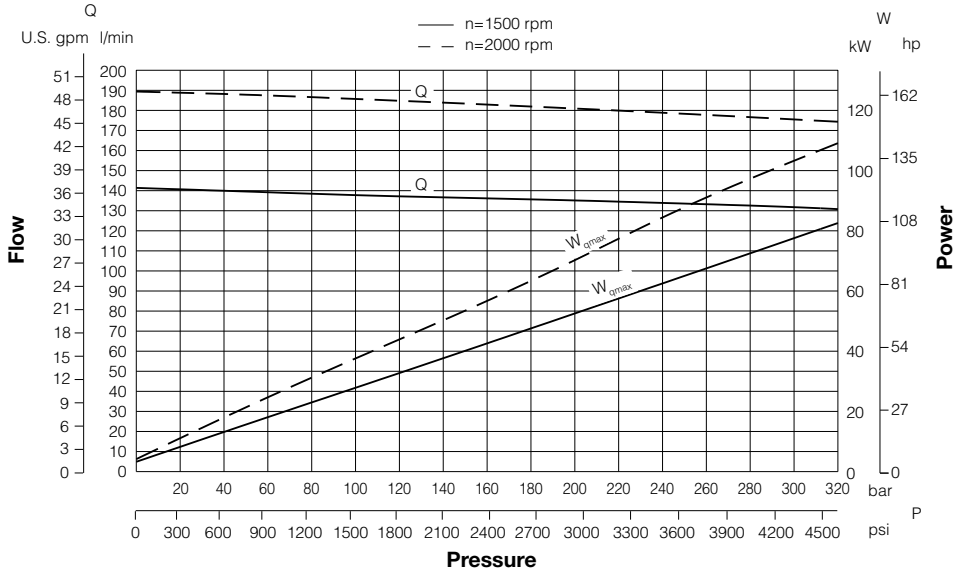


The curves are representative of the standard Dana production. Tests made with mineral oil ISO VG 46 at 50°C

Operating curves



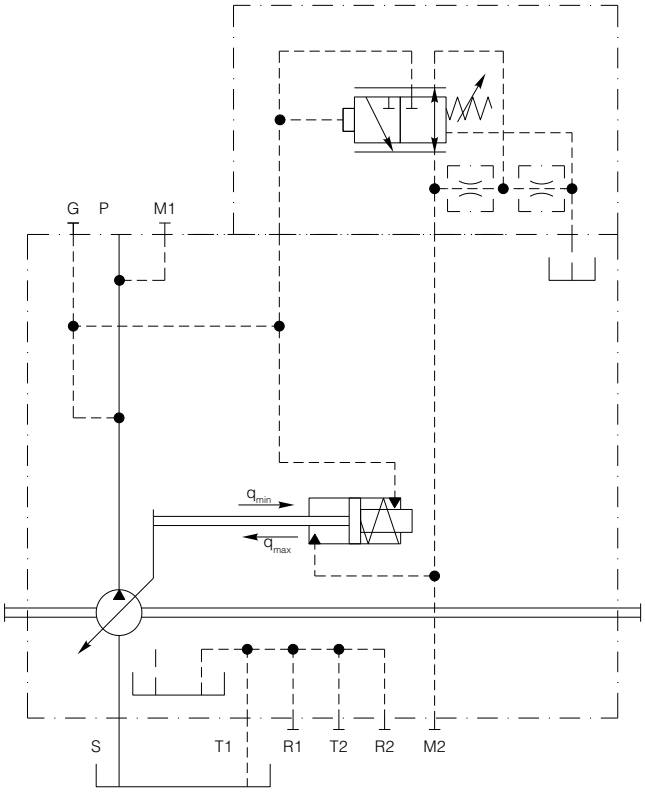


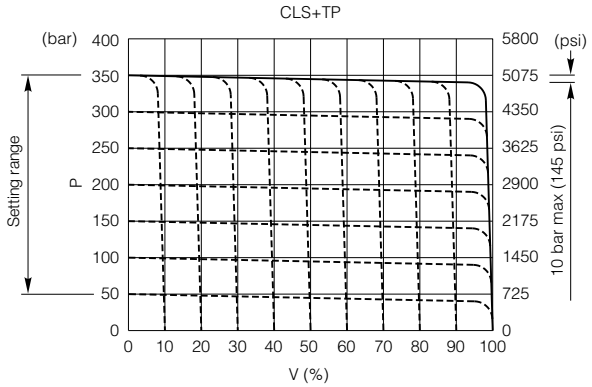


The curves are representative of the standard Dana production. Tests made with mineral oil ISO VG 46 at 50°C

The constant pressure control device allows to maintain a constant pressure in the hydraulic circuit, within the field of regulation of the pump, by changing the flow to adapt it to the demands of the system.
In absence of pressure, the pump will swivel to the maximum displacement.
The range of calibration of the pressure control device is comprised between 50 [730 psi] and 350 bar [5000 psi]. However, the setting pressure of the control does not have to exceed the value of the nominal pressure (pnom) of the pump. The pressure relief valve inserted in the circuit must be set at a pressure of at least 20 bar [290 psi] higher than the setting pressure of the CTP control device.

When ordering. Please state clearly:
- Control pressure setting [psi]





The control has a internal drain line to cool the pump during the stand-by operations. The drain flow value depends on pressure setting. The average oil flow at different working pressures can be found in the following table.

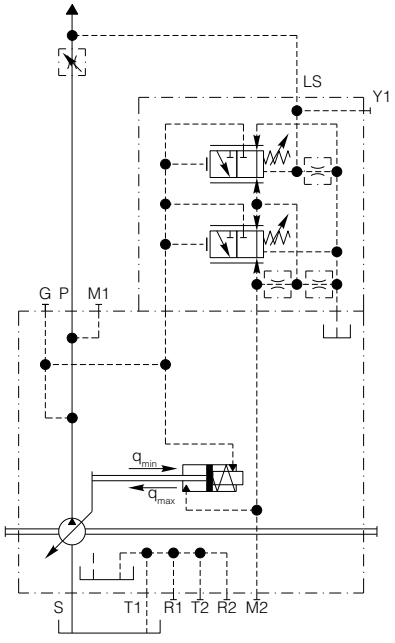
Pressure	psi	725	1450	2175	2900	3625	4350	4640
Oil flow	U.S. gpm	0.66	0.92	1.19	1.45	1.58	1.72	1.85

Load sensing control with pressure cut-off (CLS+TP)

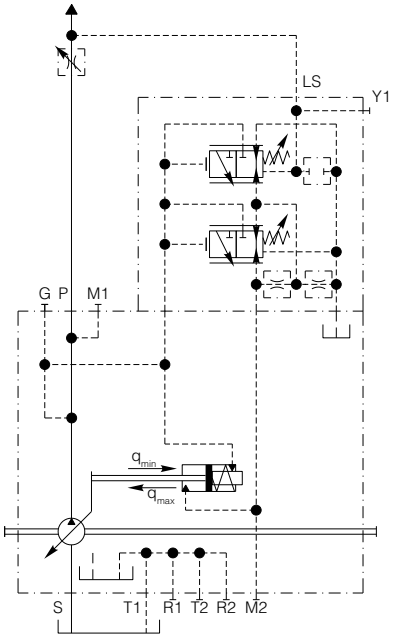
The Load Sensing control device is a regulating valve that controls the pump displacement in function of the working pressure so as to satisfy the demands for the various users. The pump flow is influenced from an external restrictor (the variable restrictor or proportional compensated flow control valve) placed between the user and the pump. The Load Sensing control compares the pressure before and after the restrictor and varies the pump displacement so as to maintain a constant the pressure drop through the restrictor (Δp). In this way, the flow of the pump depends exclusively on the section of passage of the variable restrictor. The range of calibration of the Δp is contained between 18 bars [261 psi] end 35 bars [507 psi]. The standard calibration is 20 bars [290 psi]. The variable restrictor not supplied with the pump.
The control has a pressure cut-off built-in valve. Two are the valves available whit one field of calibration: LSPCX from 50 to 350 bar [730 ÷ 5000 psi] with drain and LSPCY from 50 to 350 bar [730 ÷ 5000 psi] without drain.
The pressure of calibration of the control however, can not exceed the value of nominal pressure (pnom) of the pump. The pressure relief valve in the circuit has to be set at a pressure level of at least 20 bar [290 psi] higher than the setting pressure of the TP control.

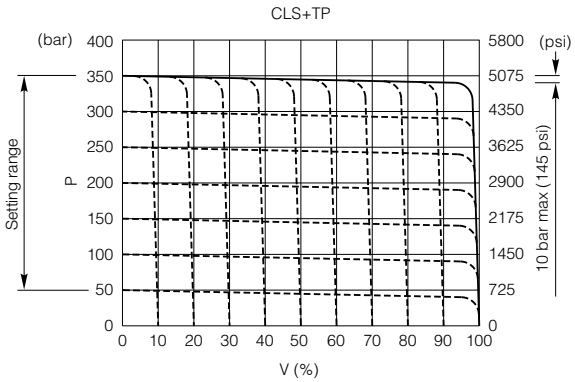
When ordering. Please state clearly:
- CLS Δp pressure setting
- TP pressure setting [psi]

WITH DRAIN



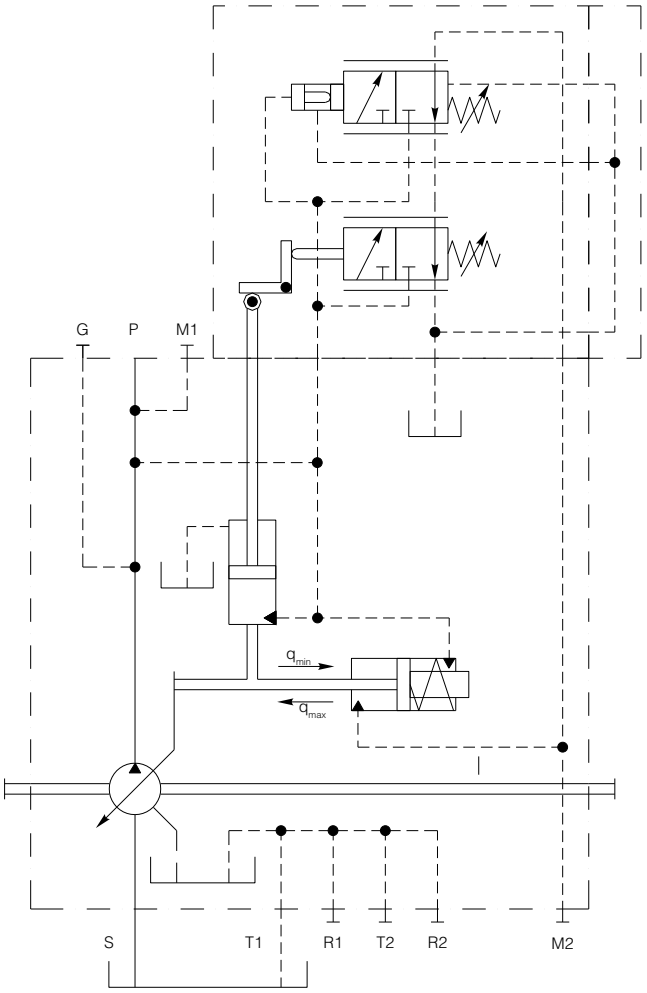
WITHOUT DRAIN

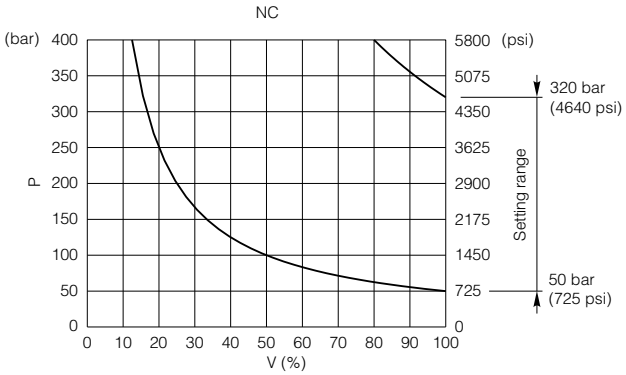


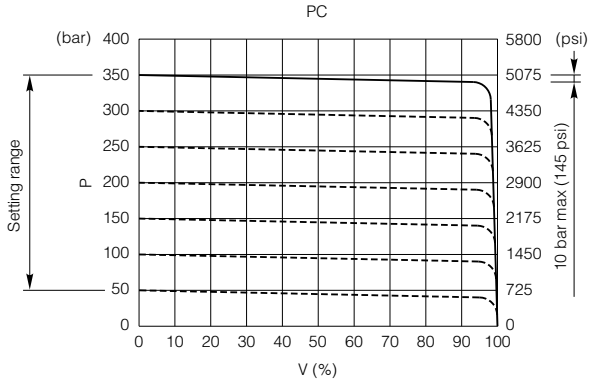


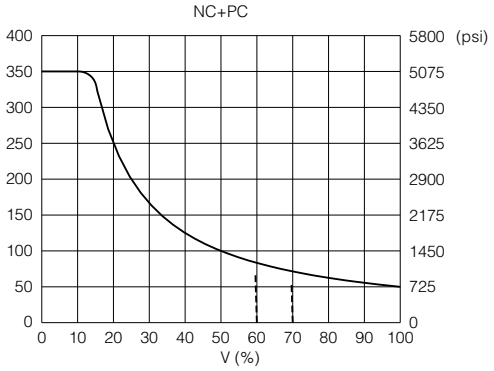
The constant power control regulates the pump displacement depending on the working pressure to avoid that the power absorbed by the pump can never exceed the power supplied by the engine.
The NC+PC includes also the Constant Pressure features that overrides the constant power control.
The minimum pressure of the setting operation of the NC control is between 50 bar [725 psi] and 320 bar [4.640 psi]. The range of calibration of the pressure control device is comprised between 50 [730 psi] and 350 bar [5000 psi]. The setting pressure of the control, however can not exceed the nominal pressure (pnom) of the pump.
The pressure relief valve in the circuit has to be set at a pressure level of at least 20 bar [290 psi] higher than the setting pressure of the TP control.

When ordering. Please state clearly:
- Input power [hp] at 1500 rpm
- TP pressure setting [psi]



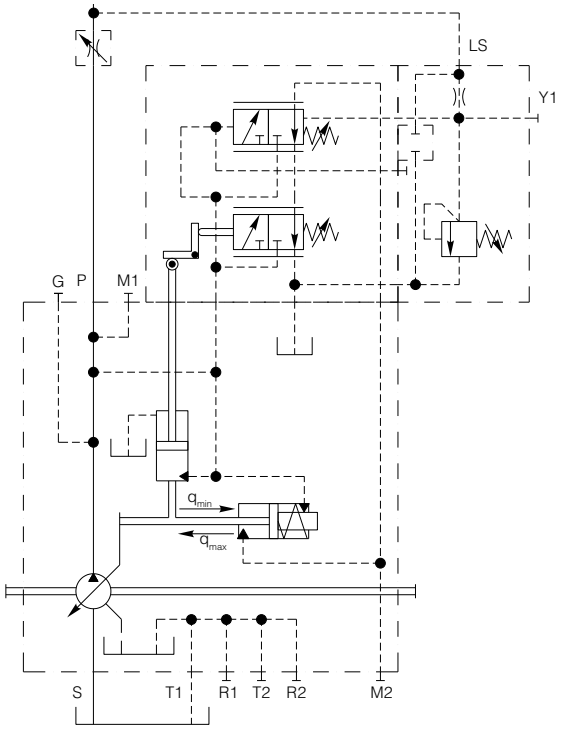




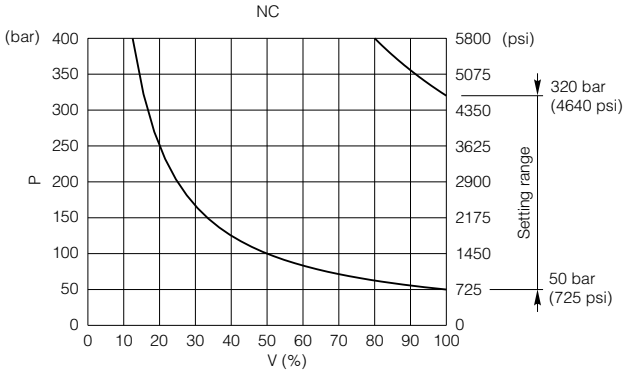


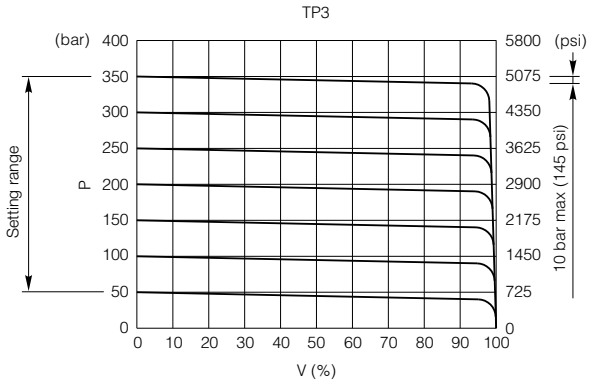
The constant power control regulates the pump displacement depending on the working pressure to avoid that the power absorbed by the pump can never exceed the power supplied by the engine.
The NC+LS+TP3 includes also the Load Sensing and Pressure Cut-Off features.
The minimum pressure of the setting operation of the NC control is between 50 bar [725 psi] and 320 bar [4.640 psi]. The pressure setting range of the Δp is between 18 bar [261 psi] and 35 bar (507 psi). The standard setting is 20 bar [290 psi].
Inside the control there is a pressure cut-off built-in valve (TP3).
Two are the TP valves available with one field of calibration:
TP3C from 50 to 350 bar [730 ÷ 5000 psi] with drain and TP3 from 50 to 350 bar [730 ÷ 5000 psi] without drain.
The pressure relief valve in the circuit has to be set at a pressure level of at least 20 bar [290 psi] higher than the setting pressure of the TP3 control.

When ordering. Please state clearly:
- Input power [hp] at 1500 rpm
- LS Δp pressure setting
- TP3(TP3C) pressure setting [psi]

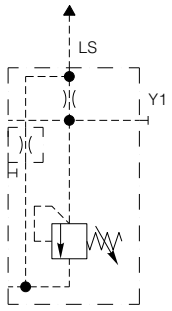


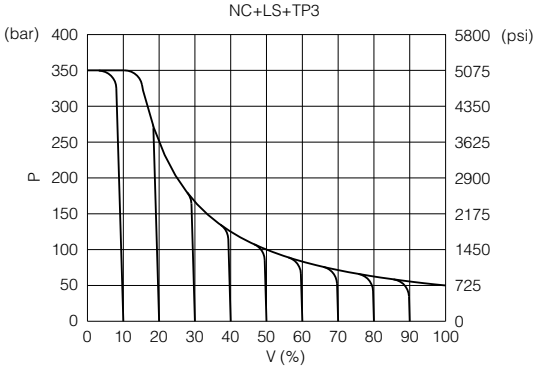
NC+LS+TP3 (Without drain)



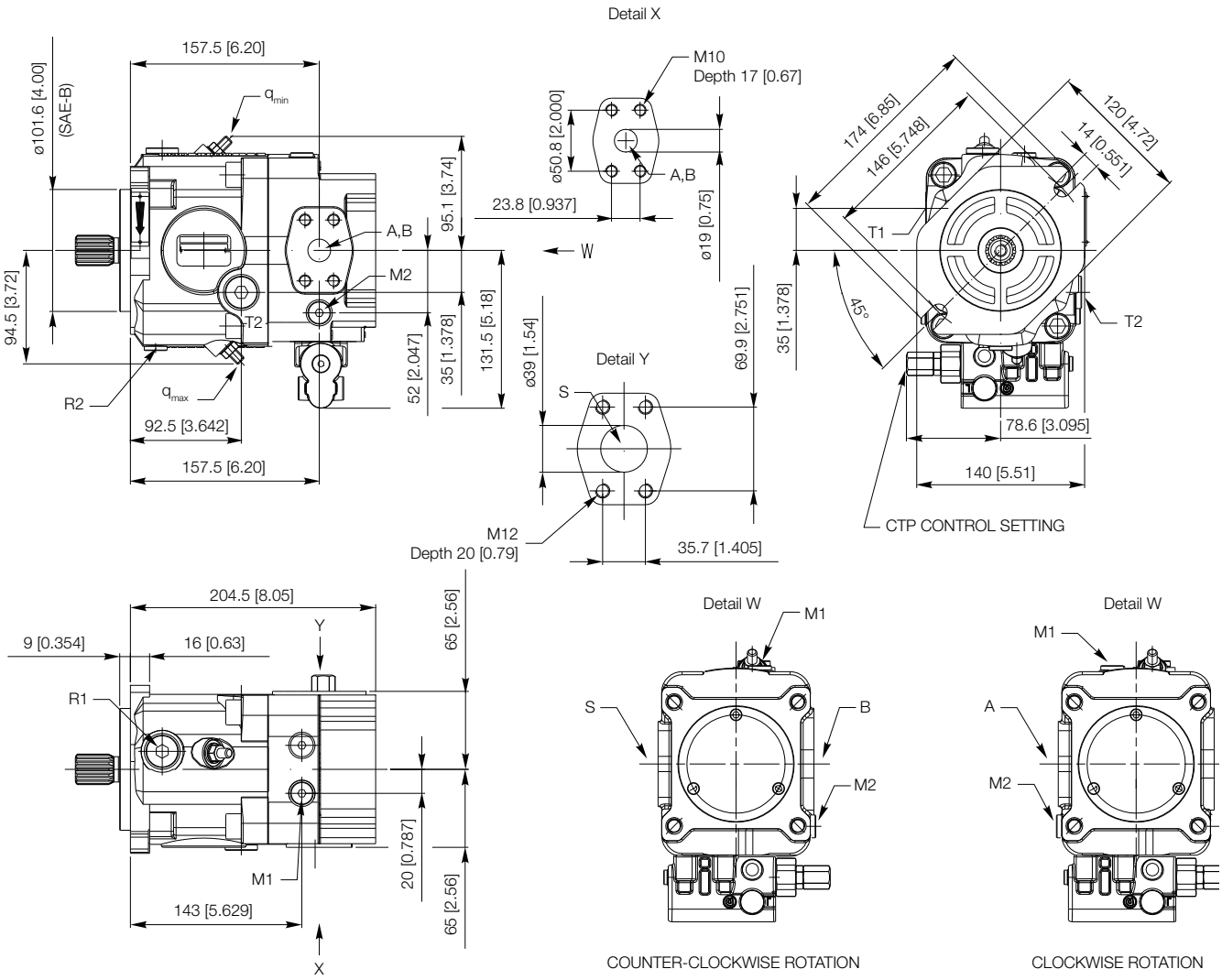


NC+LS+TP3C (With drain)



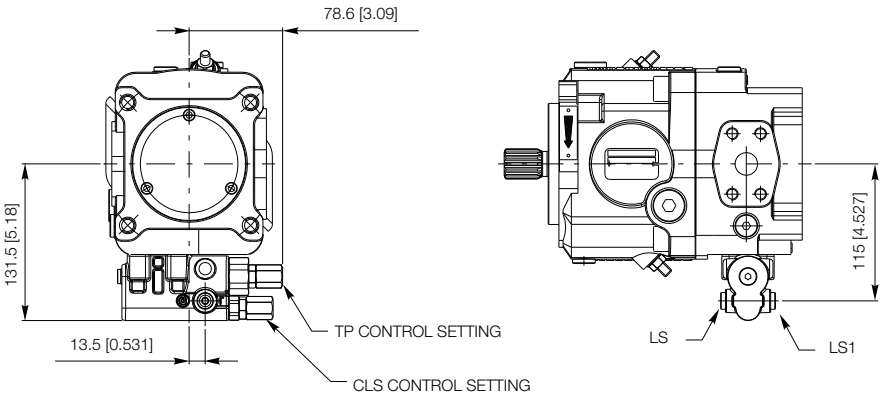


Mounting flange SAE B 2 Bolts - CTP (PCXXX) Control



A-B: Pressure port - 3/4” SAE 6000
S: Suction port - 1” 1/2 SAE 3000
T1, T2: Case drain port (1 plugged) - 1/2 G (BSPP) deep 20 [0.78]
M1: Gauge port - working pressure - 1/4 G (BSPP) deep 13 [0.511]
M2: Gauge port - stroking chamber - 1/4 G (BSPP) deep 13 [0.511]
R1: Case vent port - 1/2 G (BSPP) deep 20 [0.78]
R2: Bearing flushing port - 1/4 G (BSPP) deep 13 [0.511]

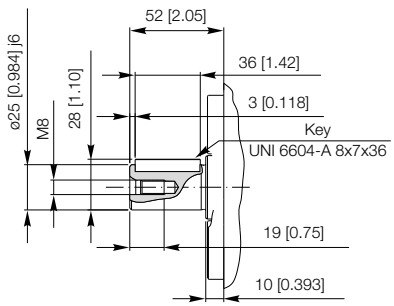
Mounting flange SAE B 2 Bolts - CLS+TP (LSPCX - LSPCY) Control



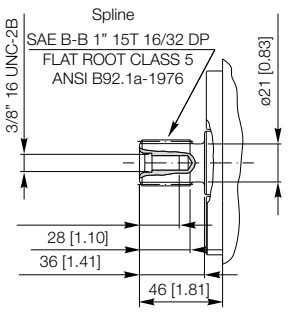
LS/LS1: Load Sensing Pressure port - 1/8 G (BSPP) Deep 10 [0.393]

8 Shaft options

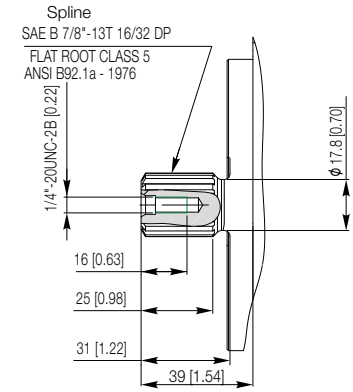
CBB Parallel keyed shaft



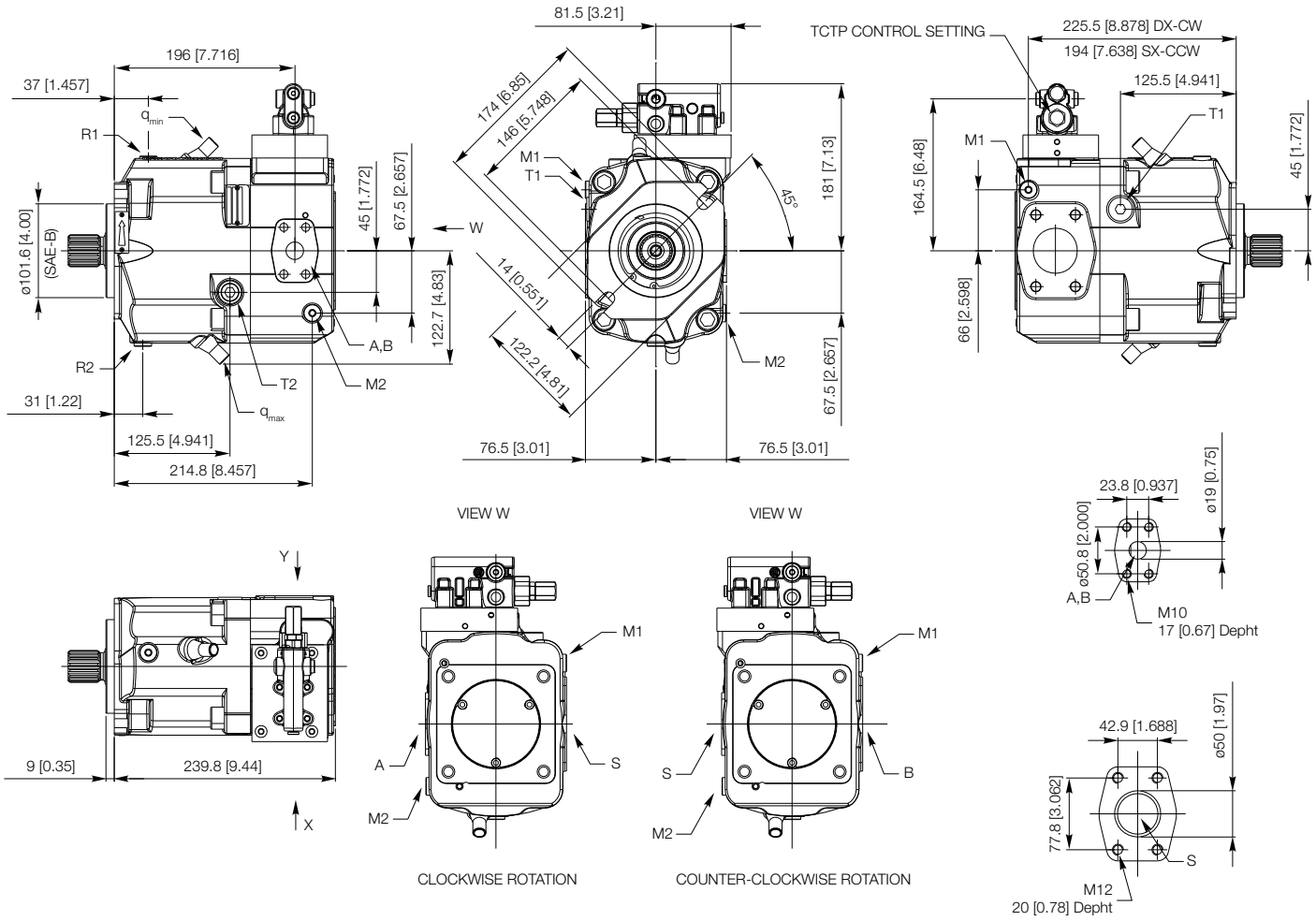
S10 Splined shaft



SAX Splined shaft

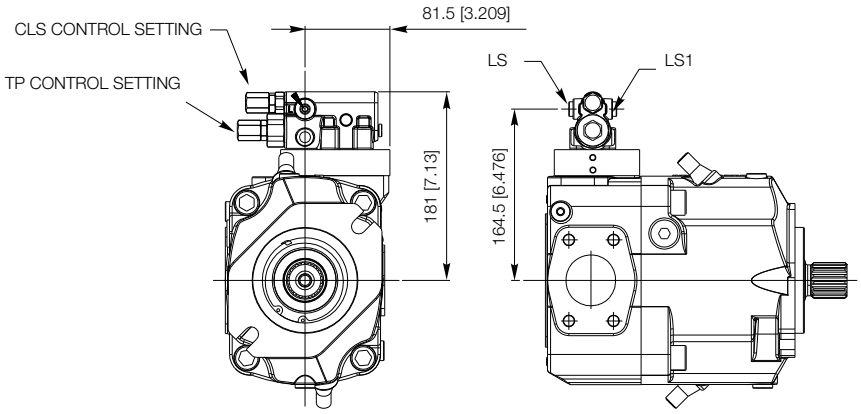


Mounting flange SAE B 2 Bolts - CTP (PCXXX) Control



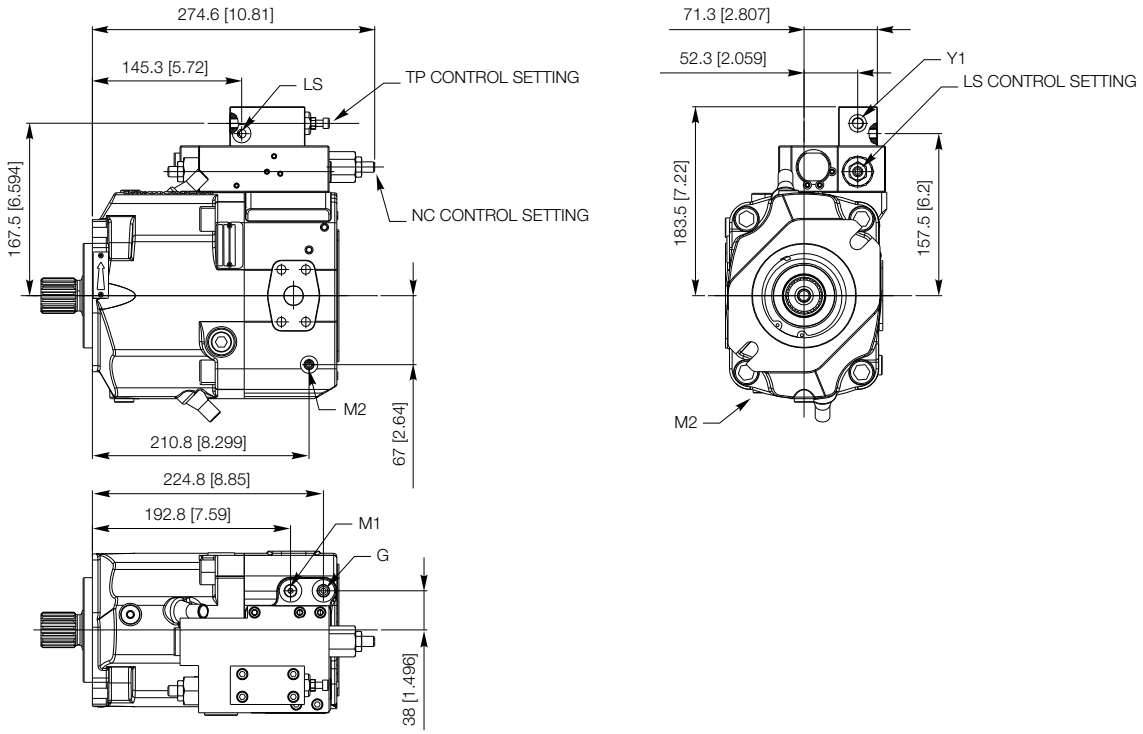
A-B: Pressure port - 3/4” SAE 6000
S: Suction port - 2” SAE 3000
T1, T2: Case drain port (1 plugged) - 1/2 G (BSPP) deep 20 [0.78]
M1: Gauge port - working pressure - 1/4 G (BSPP) deep 13 [0.511]
M2: Gauge port - stroking chamber - 1/4 G (BSPP) deep 13 [0.511]
R1: Case vent port - 1/2 G (BSPP) deep 20 [0.78]
R2: Bearing flushing port - 1/4 G (BSPP) deep 13 [0.511]
G: Control boost port (PI control only) - 1/4 G (BSPP) deep 13 [0.511]

Mounting flange SAE B 2 Bolts - CLS+TP (LSPCX - LSPCY) Control

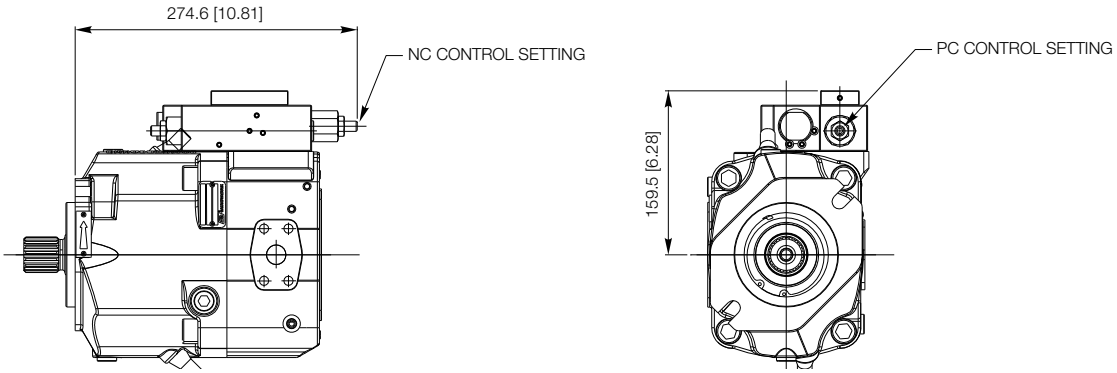


LS/LS1: Load Sensing Pressure port - 1/8 G (BSPP) Deep 10 [0.393]
For the ports not showed please to make reference to PCXXX Control

Mounting flange SAE B 2 Bolts - NC+LS+TP3 (NLP0X-NLP1X) Control



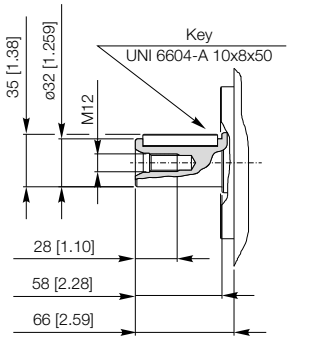
LS: Load Sensing Pressure port - 1/8 G (BSPP) Deep 10 [0.393]
Y1: Remote port - 1/8 G (BSPP) Deep 10 [0.393]
M1: Gauge port - working pressure - 1/4 G (BSPP) Deep 13 [0.511]
M2: Gauge port - stroking chamber - 1/4 G (BSPP) Deep 13 [0.511]
G: Control boost port (PI control only) - 1/4 G (BSPP) Deep 13 [0.511]



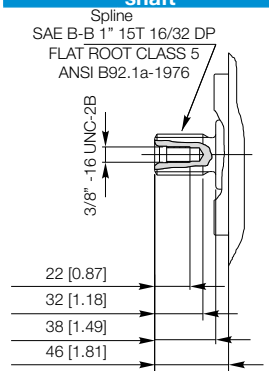
For the ports not showed please to make reference to NLP0X-NLP1X Control

8 Shaft options

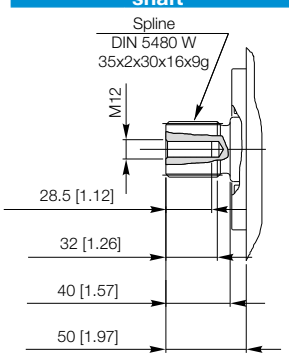
CBC Parallel keyed shaft



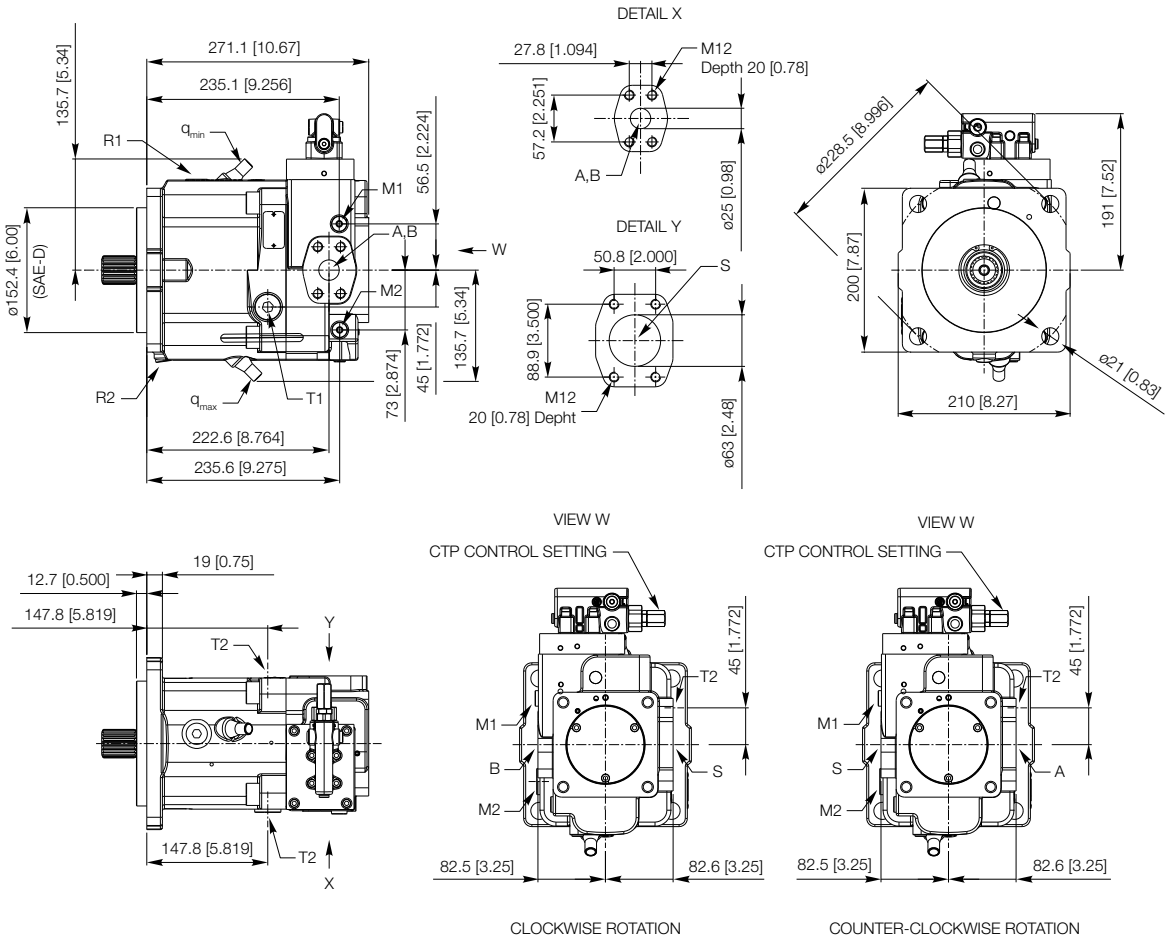
S11 Splined shaft



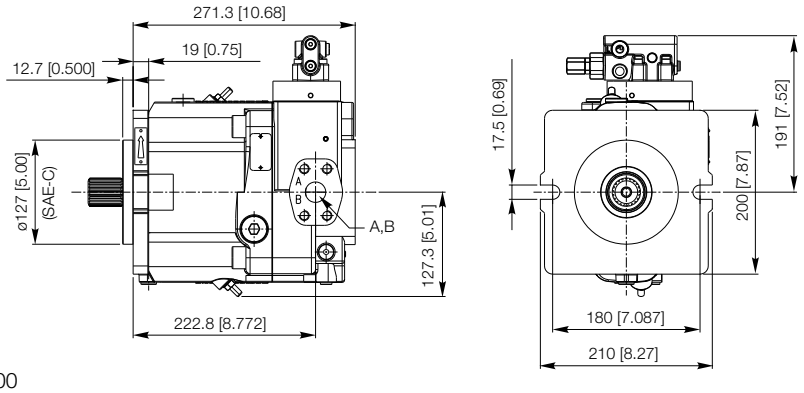
SAH Splined shaft



Mounting flange SAE D 4 Bolts - PCXXX (CTP) Control

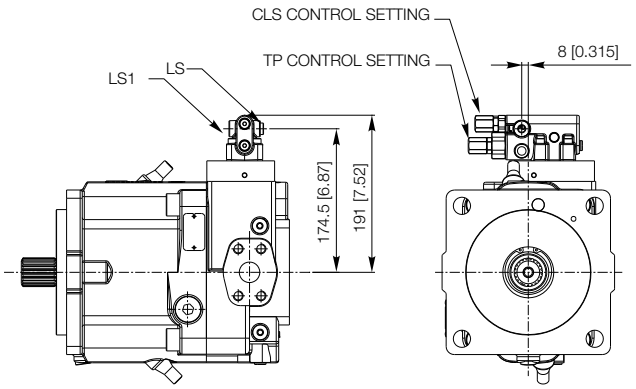


S5AV 075/093 Pump - Mounting flange SAE C 2 Bolts - PCXXX (CTP) Control



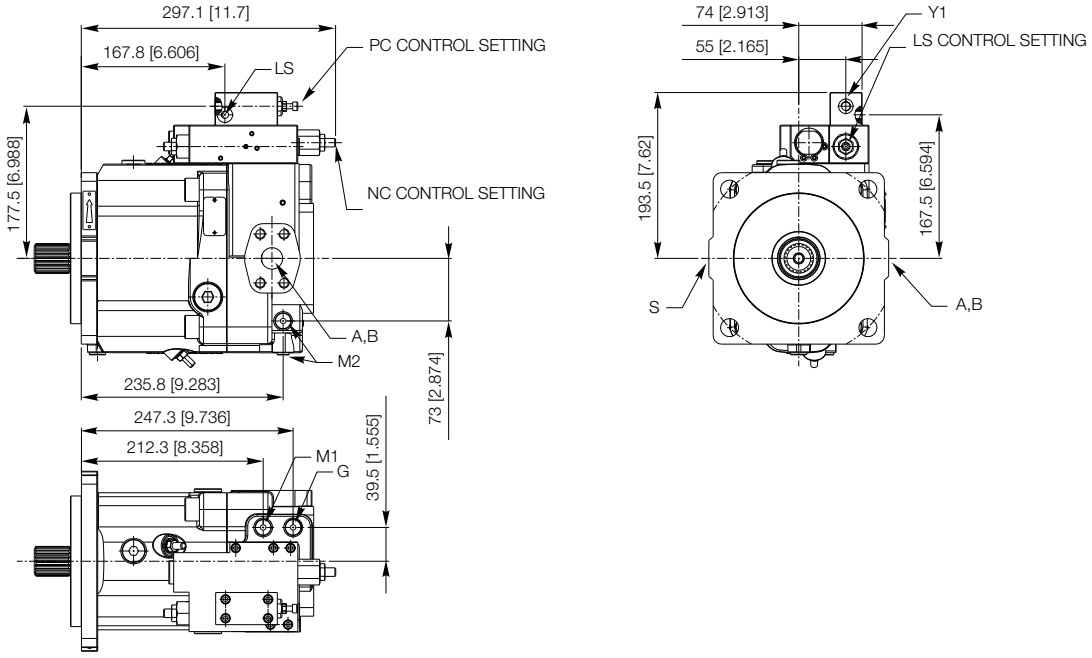
A-B: Pressure port - 1" SAE 6000
S: Suction port - 2" 1/2 SAE 3000
T1, T2: Case drain port (1 plugged) - 3/4 G (BSPP) deep 20 [0.78]
M1: Gauge port - working pressure - 1/4 G (BSPP) deep 13 [0.511]
M2: Gauge port - stroking chamber - 1/4 G (BSPP) deep 13 [0.511]
R1: Case vent port - 1/2 G (BSPP) deep 20 [0.78]
R2: Bearing flushing port - 1/4 G (BSPP) deep 13 [0.511]
G: Control boost port (PI control only) - 1/4 G (BSPP) deep 13 [0.511]

Mounting flange SAE D 4 Bolts - LSPCX - LSPCY (CLS+TP) Control



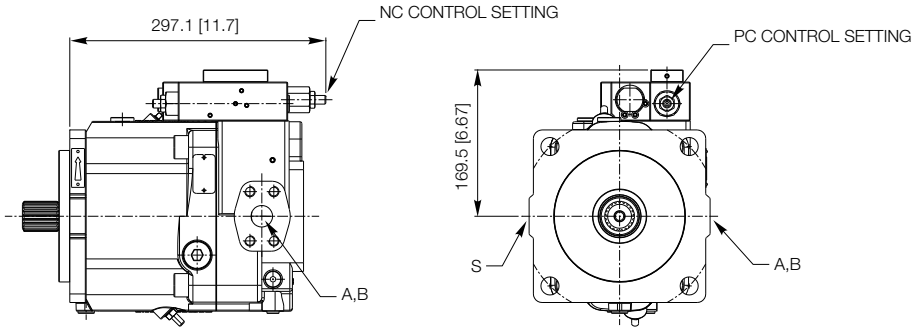
LS/LS1: Load Sensing Pressure port - 1/8 G (BSPP) Deep 10 [0.393]
For the ports not showed please to make reference to PCXXX Control

Mounting flange SAE D 4 Bolts - NLP0X-NLP1X (NC+LS+TP3) Control



LS: Load Sensing Pressure port - 1/8 G (BSPP) Deep 10 [0.393]
Y1: Remote port - 1/8 G (BSPP) Deep 10 [0.393]
G: Control boost port (PI control only) - 1/4 G (BSPP) deep 13 [0.511]
M1: Gauge port - working pressure - 1/4 G (BSPP) deep 13 [0.511]

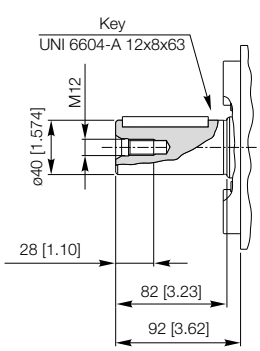
Mounting flange SAE D 4 Bolts - NCPCX (NC+PC) Control



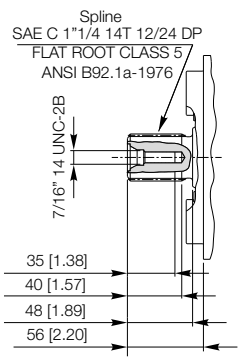
For the ports not showed please to make reference to NLP0X-NLP1X Control

8 Shaft options

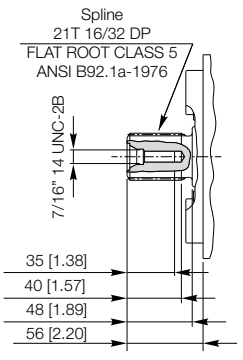
CBD Parallel keyed shaft



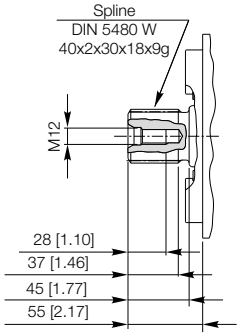
S13 Splined shaft



SAC Splined shaft



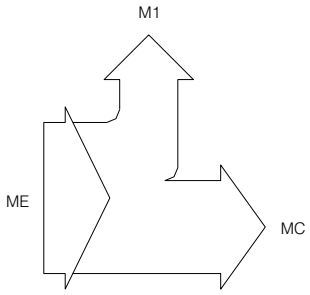
SAL Splined shaft



S5AV pump can be supplied with through drive. It is possible use the through drive with a second pump (another S5AV or a pump of other kind). Available flanges are:
- Standard G2 and G3 gear pump flange
- SAE A, SAE B, SAE B-B, SAE C and SAE C-C flange
- TANDEM flange

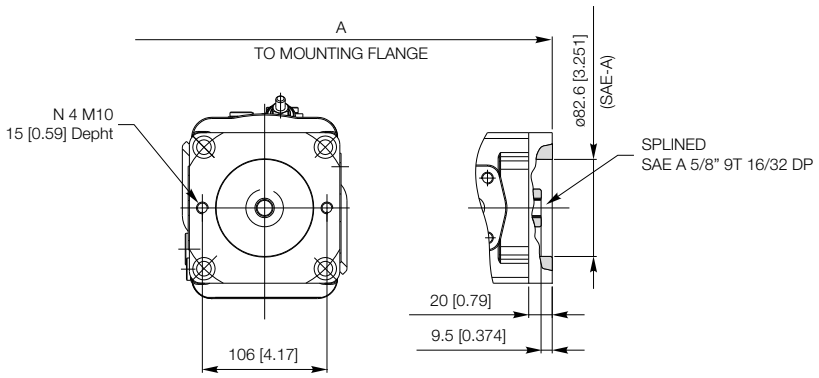
The maximum permissible torques on drive shaft of the first pump and the maximum through drive torques are listed in the btables below.

WARNING: The effective torque value on the shaft of first
pump is given by the sum of the torques required from each pump making the system.



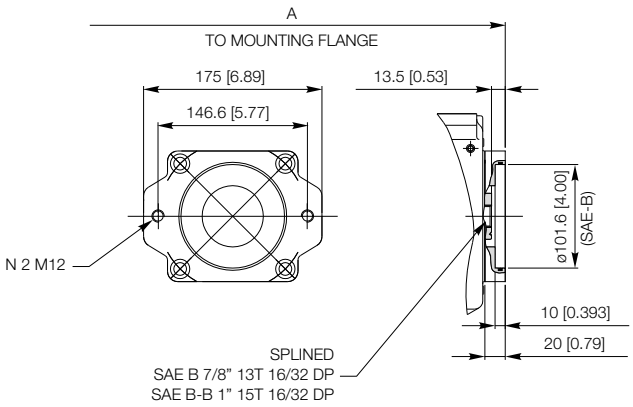
Size	Drive Shaft	Drive Shaft max torque ME Nm [lbf•ft]	Through drive max torque MC Nm [lbf•ft]
032/045	**CBB** (Ø 25)	170 [125]	170 [125]
	S10 (15T 16/32 DP)	300 [221]	250 [184]
	SAX (13T 16/32 DP)	210 [169]	210 [169]
050/063	**CBC** (Ø 32)	450 [330]	350 [260]
	SAH (W 35x2x30x16x9g)	800 [590]	350 [260]
	S11 (15T 16/32 DP)	300 [220]	300 [220]
075/093	**CBD** (Ø 40)	700 [516]	610 [450]
	SAL (W 40x2x30x18x9g)	11850 [364]	610 [450]
	SAC (21T 16/32 DP)	950 [700]	610 [450]
	S13 (14T 12/24 DP)	620 [457]	610 [450]

SAE A (SA) Flange



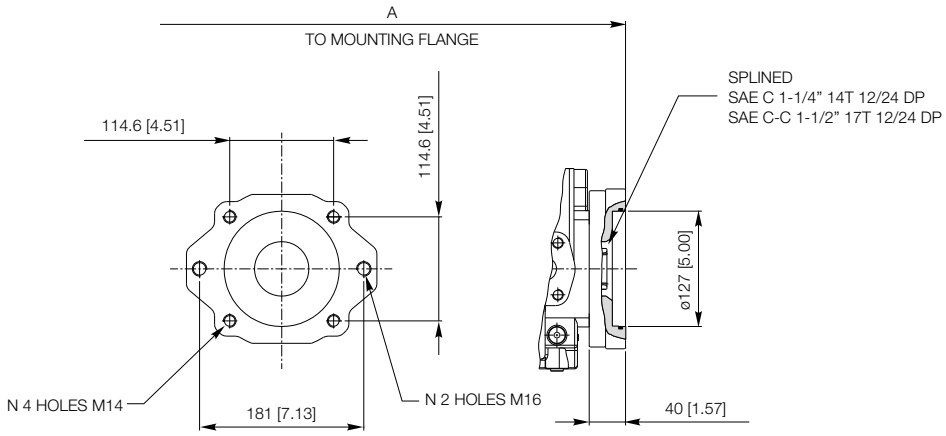
	Size		
	032/045	050/063	075/093
A mm [in]	224.5 [8.83]	260 [10.23]	291.3 [11.46]

SAE B (SB) - SAE B-B (BB) Flange



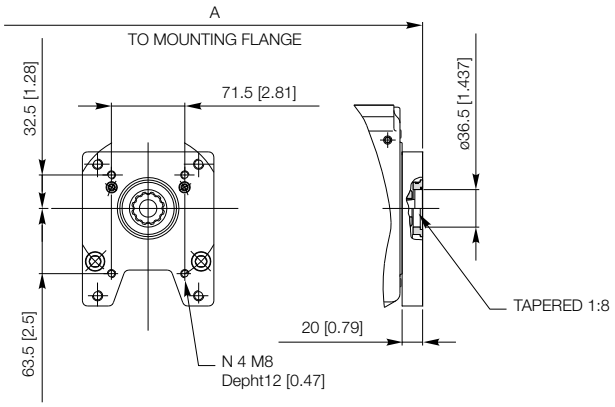
	Size		
	032/045	050/063	075/093
A mm [in]	224.5 [8.83]	2260 [10.23]	291.3 [11.46]

SAE C (SC) - SAE C-C (CC) Flange



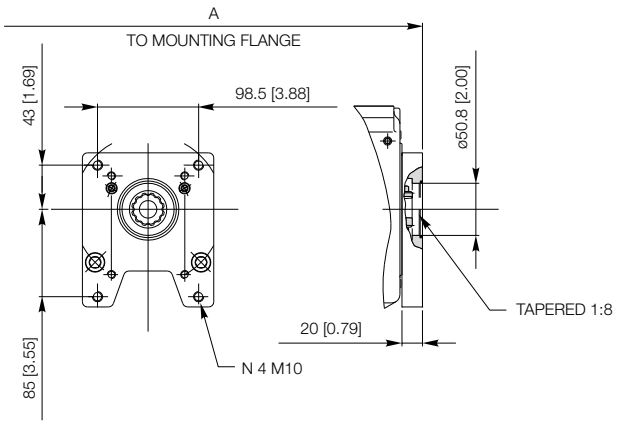
	Size	
	050/063	075/093
A mm [in]	280 [11.02]	311.3 [12.25]

G2 Flange



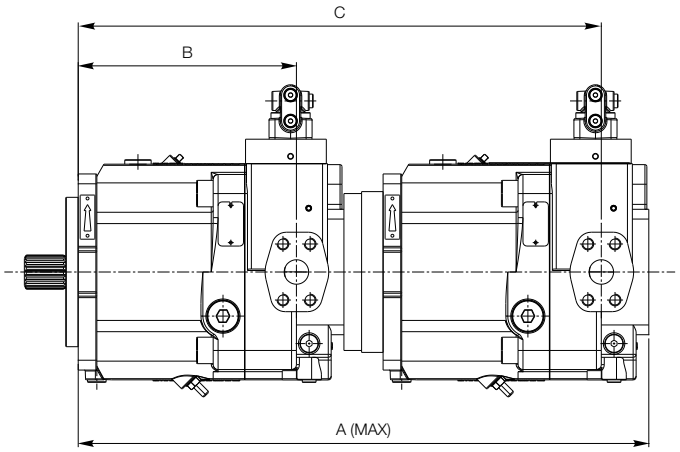
	Size		
	032/045	**050/063**	**075/093**
A mm [in]	224 [8.83]	260 [10.23]	291.3 [11.46]

G3 Flange



	Size		
	032/045	**050/063**	**075/093**
A mm [in]	224.5 [8.83]	260 [10.23]	291.3 [11.46]

Tandem combination dimensions



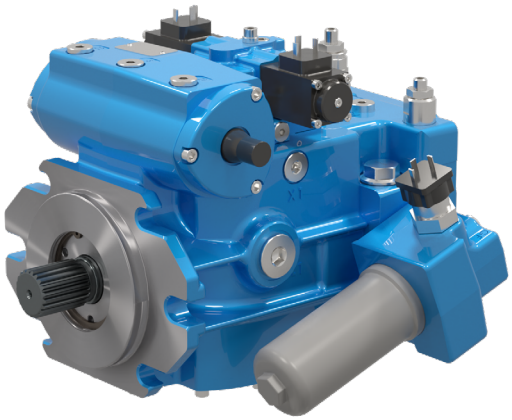
Size	A (Max) mm [in]	B mm [in]	C mm [in]
032 T0 / 045 T0 + 032	431 [16.97]	157.5 [6.20]	384 [15.12]
045 T0 + 032 / 045	431 [16.97]	157.5 [6.20]	384 [15.12]
050 T0 / 063 T0 + 032 / 045	466.5 [18.36]	196 [7.71]	419.5 [16.51]
050 T1-T2 / 063 T1-T2 + 050	502 [19.76]	196 [7.71]	458 [18.03]
063 T1-T2 + 050 / 063	502 [19.76]	196 [7.71]	458 [18.03]
075 T0 / 093 T0 + 032 / 045	498 [19.61]	223 [8.78]	451 [17.75]
075 T1-T2 / 093 T1-T2 + 050 / 063	533 [20.98]	223 [8.78]	489 [19.25]
075 T4-TC / 093 T4-TC + 075	583 [22.95]	223 [8.78]	534 [21.02]
093 T4-TC + 075 / 093	583 [22.95]	223 [8.78]	534 [21.02]

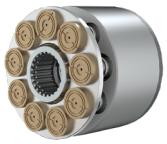
WARNING: In combination pump the rear pump can be equipped only with one of the shaft listed in the following table.
For an S5AV 075 / 093 used as 2nd pump is available only the option for SAE-C 2 holes flange.

Combination pump / Rear pump shaft

+		2nd Pump		
		S5AV 032 / 045 Shaft	**S5AV 050 / 063 Shaft**	**S5AV 075 / 093 Shaft**
1st Pump	**S5AV 032 / 045**	(S10)		
	S5AV 050 / 063	(S10)	(SAH)	
			(S11)	
	S5AV 075 / 093	(S10)	(SAH)	(S13)
			(S11)	(SAC)

HD1 - Variable displacement axial piston pumps for closed circuit





Index

General information - Features.....L2
Ordering code L5
Controls.....L11
Automotive.....L19
Pressure compensator valves.....L20
Pressure filter.....L22
By-pass valve.....L24
Shafts dimensions L25
Pump and controls dimensions.....L26
Pump and accessories dimensions.....L32
Through drives.....L36
Tandem combination dimensions.....L37
Through drives dimensions L38

	Displacement cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]
HD1	55 [3.35]	209 [55.2]	450 [6525]

The HD1 series variable piston pumps for closed loop circuits are axial pistons pumps with swash plate design and through drive shaft on option. These pumps have been specifically designed for use in closed circuit hydrostatic transmissions. The delivery is proportional to the rotation speed and the swash plate angle. The delivery increases when swash plate's angle of inclination increases from 0 to maximum position. Inverting the swash plate's angle, the flow direction is inverted. The technical choices allow the new unit to operate at pressures up to of 450 bar [6525 psi].

General information - Features

The series offers the following range of controls :

- HLR Manual lever with feed-back.
- HIR Hydraulic proportional with feed-back.
- HIN Hydraulic proportional without feed-back.
- HER Electric proportional with feed-back.
- HEN Electric proportional without feed-back.
- HFD Electric fun drive control.
- HE2 Electric on-off.
- HEH Electric proportional with hydraulic emergency override.
- Automotive

The pump has two built-in pressure relief valves to protect the circuit from pressure overloads. The charge pump circuit features a gerotor pump with different displacement on option.

The pump design allows the installation of many accessories, such as:
- Hydraulic pressure compensator standard.
- Electric cut-off valve.
- Combined electric cut-off – hydraulic pressure compensator.
- A wide range of through drive options.
- Charge pump delivery pressure filter.
- Electric or optical clogging sensor on the filter.

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
n_{max}	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure
p_{max}	bar [psi]	Maximum pressure peak

q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
Vg	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency
I	A	Current

Fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷ 40 cSt. For short periods and upon cold start, a max.viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and Filtration section.

Operating temperature:
The operating temperature of the oil must be within -25 °C ÷ 90 °C (-13 °F ÷ 194 °F). The running of the axial piston unit with oil temperature higher than 90 °C (194 °F) or lower than -25 °C (-13 °F) is not recommended. For further information see at Fluids and filtration section.

Filtration:
In the HD1 pump it is possible to provide a filter in the suction line but we recommend to use the optional pressure filter on the out-let line of the charge pump. The filter on the charge pump out-let line is supplied by Dana while if the filter assembled in the suction line is used the following recommendation applies:
Install the filter on the suction line of the auxiliary pump. We recommend to use filters with clogging indicator, no by-pass or with by-pass plugged and filter elementrating of 10 µm absolute. The maximum pressure drop on the filtration element must not exceed 0.2 bar [3 psi]. A correct filtration helps to extend the service life of axial piston units.In order to ensure a correct functioning of the unit, the max permissible contamination class is 20/18/15 according to ISO 4406:1999.

Suction pressure:
The minimum absolute pressure on the auxiliary pump suction must be of 0.8 bar [11.6 absolute psi]. On cold starting and for short-periods an absolute pressure of 0.5 bar [7.25 psi] is allowed. In no case inlet pressure can be lower.

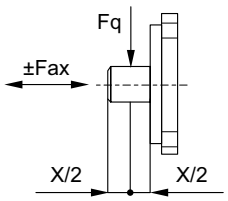
Operating pressure:
Main pump: The maximum permissible continuous pressure on pressure ports is 450 bar [6525 psi]. Peak pressure is 480 bar [6960 psi]. Charge pump: The nominal pressure is 22 bar [319 psi]. Maximum admissible pressure is 30 bar [435 psi].

Case drain pressure:
Maximum case drain pressure is 4 bar [58 psi]. On cold starting and for short-term a pressure of 6 bar [86 psi] is allowed. A higher pressure can damage the input shaft seal or reduce its life.

Seals:
Standard seals used on HD1 pumps are of FKM (Fluoroelastomer). In case of use special fluids, contact Dana.

Displacement limiting:
The pump is equiped with the externally adjustable mechanical displacement limiting device. Displacement limitation is obtained by means of two setting screws which limit the control piston stroke.

Input shaft Radial and Axial loads:
The input shaft can stand both radial and axial loads. The maximum permissible loads are in the following table.



Radial load	$F_{q\ max}$	N [lbf]	1900 [428]
Axial load	$F_{ax\ max}$	N [lbf]	1500 [337]

Installation:
HD1 series pumps can be installed in every position or direction. For further details contact Dana.

Displacement	**Vg_{max}**	cm^3/rev [in^3/rev]	55 [3.35]
Displacement	**Vg_{min}**	cm^3/rev [in^3/rev]	0 [0]
Pressure cont.	**p_{nom}**	bar [psi]	450 [6525]
Pressure peak	**p_{max}**	bar [psi]	480 [6960]
Max speed cont.	**$n_{0\ max}$**	rpm	3800
Max speed int.	**$n_{0\ max}$**	rpm	4000
Min speed	**n_{min}**	rpm	500
Max flow at n_{max}	**q_{max}**	l/min [U.S.gpm]	209 [55.2]
Maximum power cont.	**P_{max}**	kW [hp]	157 [210]
Maximum power int.	**P_{max}**	kW [hp]	167 [224]
Max torque cont. (p_{nom}) at Vg_{max}	**T_{nom}**	Nm [lbf.ft]	394 [291]
Max torque peak (p_{max}) at Vg_{max}	**T_{max}**	Nm [lbf.ft]	420 [310]
Moment of inertia(1)	**J**	$kg{\cdot}m^2$ [$lbf.ft^2$]	0.0064 [0.156]
Weight(1)	**m**	kg [lbs]	46 [101.4]

Charge pump technical data				
Displacement charge pump	cm^3/rev [in^3/rev]	11 [0.67]	14 [0.85]	18 [1.1]
Charge pump setting pressure	bar [psi]	22 [319]		
Charge pump maximum pressure	bar [psi]	40 [580]		
Maximum Pressure in the housing cont.	bar [psi]	4 [58]		
Maximum Pressure in the housing int	bar [psi]	6 [87]		

Theorical values, without considering the efficency; approximate values. Peak operations must not excide 1% of every minute. Avoid continuously working at simultaneusly maximum pressure and maximum speed.

Notes:
(1) Approximate values.

The following alphanumeric codes system has been developed to identify all of the configuration options for the HD1 pumps.
Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering (as in the example below).
We recommend to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Series	Pump	Size	Displacement limitation side A	Displacement limitation side B	Version	Mounting flange	Shaft end	Direction of rotation	Control	Control feature	Charge pump	Pressure relief valve side A	Pressure relief valve side B	Charge pressure relief valve	Pressure compensator valves	Pressure compensator feature	Filter	Through drive	Flushing valve	Pump feature	Painting
HD1	P	055	A55	B55	ME	06	13	DX	HIR	IH	00	25	25	AE	PC	000	XX	XX	XX	XXX	XX

1

Series	
HD1	Variable displacement axial piston pump for closed circuit

2

Pump	
P	Pump

3

Size	
055	55 cm³/rev [3.35 in³/rev]

4

Displacement limitation side A	
A0 ÷ A55	Stroke Limiter (From 0 cm³/rev to 55 cm³/rev [3.35 in³/rev])

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
HD1	P	055	A55	B55	ME	06	13	DX	HIR	IH	00	25	25	AE	PC	000	XX	XX	XX	XXX	XX

5

Displacement limitation side B	
B0 ÷ B55	Stroke Limiter (From 0 cm^3/rev to 55 cm^3/rev [3.35 in^3/rev])

6

Version	
ME	ISO
SE	SAE

7

Mouting flange	
06	SAE-C 2/4 Bolts

8

Shaft end	
13	Splined 14T - 12/24 DP
AC	Splined 21T - 16/32 DP

Note:
For Tandem assembly check chapter “TANDEM COMBINATION DIMENSIONS”

9

Direction of rotation (viewed from shaft side)	
DX	CW
SX	CCW

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
HD1	P	055	A55	B55	ME	06	13	DX	HIR	IH	00	25	25	AE	PC	000	XX	XX	XX	XXX	XX

10

Control	
HLR	Manual lever with feed-back
HIR	Hydraulic proportional with feed-back
HIN	Hydraulic proportional without feed-back
HER	Electric proportional with feed-back
HEN	Electric proportional without feed-back
HE2	Electric on-off
HEH	Electric proportional with emergency hydraulic override
HFD	Electric fun drive control (minimum boost pressure 25 bar 363 PSI - Mandatory for feature 15 - AG)
HME (*)	Electric Automotive
HMI (*)	Hydraulic Automotive

(*) Available for quantity.

11

Control feature				Control									
				HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
IH	Inching		Hydraulic inching	–	–	–	–	–	–	–	–	•	•
IM			Mechanical inching	–	–	–	–	–	–	–	–	–	–
00			Without inching	–	–	–	–	–	–	–	–	•	•
12	Voltage	(V)	12 connector DIN 43650	–	–	–	•	–	•	•	–	•	–
24		(V)	24 connector DIN43650	–	–	–	•	–	•	•	–	•	–
D2		(V)	12 - Deutsch DT04	–	–	–	•	–	•	•	–	•	–
D4		(V)	24 - Deutsch DT04	–	–	–	•	–	•	•	–	•	–
N2		(V)	12 AMP JUNIOR	–	–	–	–	•	–	–	•	–	–
N4		(V)	24 AMP JUNIOR	–	–	–	–	•	–	–	•	–	–
00	Control orifices diameter (1)	mm [in]	Without control orifices	S	•	–	•	•	–	–	•	–	–
05		mm [in]	Ø 0.5 [Ø 0.019]	–	–	•	–	–	–	–	–	–	–
06		mm [in]	Ø 0.6 [Ø 0.024]	–	•	–	•	–	–	–	–	–	–
07		mm [in]	Ø 0.7 [Ø 0.027]	–	•	•	•	–	–	–	–	–	–
08		mm [in]	Ø 0.8 [Ø 0.031]	–	S	S	S	–	–	S	–	–	–
09		mm [in]	Ø 0.9 [Ø 0.035]	–	•	•	–	–	–	–	–	–	–
12		mm [in]	Ø 1.2 [Ø 0.047]	–	•	–	–	–	S	–	–	S	S
15		mm [in]	Ø 1.5 [Ø 0.059]	–	–	–	–	–	–	–	–	•	•
(*)	Starting speed	(rpm)		–	–	–	–	–	–	–	–	•	•
(*)	Maximum torque speed	(rpm)		–	–	–	–	–	–	–	–	•	•
(*)	Maximum torque value	(Nm)		–	–	–	–	–	–	–	–	•	•

(*) Supply the setting value.
• : Available
– : Not available
S: standard

(1) in case of the different response times, please you contact sales office

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
HD1	P	055	A55	B55	ME	06	13	DX	HIR	IH	00	25	25	AE	PC	000	XX	XX	XX	XXX	XX

12

Charge pump		
00	Without charge pump	Not Available with Filter and Automotive control
18	Displacement 18 cm^3/rev [1.098 in^3/rev]	Standard

13

Pressure relief valve side A		
25	250 bar [3625 psi]	
30	300 bar [4350 psi]	
35	350 bar [5075 psi]	
42	420 bar [6090 psi]	Standard
45	450 bar [6527 psi]	

14

Pressure relief valve side B		
25	250 bar [3625 psi]	
30	300 bar [4350 psi]	
35	350 bar [5075 psi]	
42	420 bar [6090 psi]	Standard
45	450 bar [6527 psi]	

15

Charge pressure relief valve			Control									
			HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
AE	20 bar a 1000 rpm [290 psi at 1000 rpm]		•	•	•	•	•	•	•	–	•	•
AF	22 bar a 1000 rpm [319 psi at 1000 rpm]	Standard	•	•	•	•	•	•	•	–	•	•
AG	25 bar a 1000 rpm [363 psi at 1000 rpm]		•	•	•	•	•	•	•	•	•	•

• : Available
– : Not available

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
HD1	P	055	A55	B55	ME	06	13	DX	HIR	IH	00	25	25	AE	PC	000	XX	XX	XX	XXX	XX

16

	Pressure compensator valves	Control									
		HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
XX	Without Pressure Compensator	–	–	–	–	•	–	–	•	•	•
PC	Pressure compensator	•	•	•	•	–	•	•	–	–	–
EP	Electric Cut-Off + Pressure Compensator	•	•	•	•	–	•	•	–	–	–

• : Available
– : Not available

17

Pressure compensator feature			Compensator		
			XX	PC	EP
000	Feature not necessary		•	–	–
000	Pressure Setting (bar)	Locked	–	•	•
100 ÷ 430	Pressure Setting (bar)	100÷430 bar [1450÷6237 psi]	–	•	•
12	Voltage	12 V - Connector DIN 43650	–	–	–
24	Voltage	24 V - Connector DIN 43650	–	–	–
D2	Voltage	12 V - Deutsch DT04	–	–	–
D4	Voltage	24 V - Deutsch DT04	–	–	•

• : Available
– : Not available

18

• : Available – : Not available	Filter		Control HLR - HIR - HIN - HER HEN- HE2 - HEH - HFD	Control HME - HMI
XX	Without Filter	Standard	•	•
M8	Optical clogging sensor (8 bar) [116 psi]		•	–
E9	Electric clogging sensor (8 bar) [116 psi]		•	–
E3	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector		•	–
E2	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector with LED 24V		•	–
E1	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector with LED 12V		•	–
FR	Through drive remote filter		•	–
FP	Arranged for filter		•	–

Note:
E9 feature as “Standard production” for electric clogging sensor

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
HD1	P	055	A55	B55	ME	06	13	DX	HIR	IH	00	25	25	AE	PC	000	XX	XX	XX	XXX	XX

19

Through drive		
Through drive for 2nd pump assembled by the customer		
XX	Through drive for 2nd pump assembled by the customer	Standard
SA	SAE A = Z9 - 16/32 DP	
AA	SAE A = Z11 - 16/32 DP	
SB	SAE B = Z13 - 16/32 DP	
BB	SAE B-B = Z15 - 16/32 DP	
SC	SAE C = Z14 - 12/24 DP	
Through drive for 2nd pump assembled by Dana		
TA	Tandem through drive with flange SAE A = 9T - 16/32 DP	
TB	Tandem through drive with flange SAE B = 13T - 16/32 DP	
BT	Tandem through drive with flange SAE B-B = 15T - 16/32 DP	
TC	Tandem through drive with flange SAE C = 14T - 12/24 DP	

20

Additional feature	
XX	Not Required

21

Pump feature	
XXX	Not Required
BPV	By Pass valve
ASI (*)	Angle swivel indicator
ASB (*)	Angle swivel indicator + by-pass valve

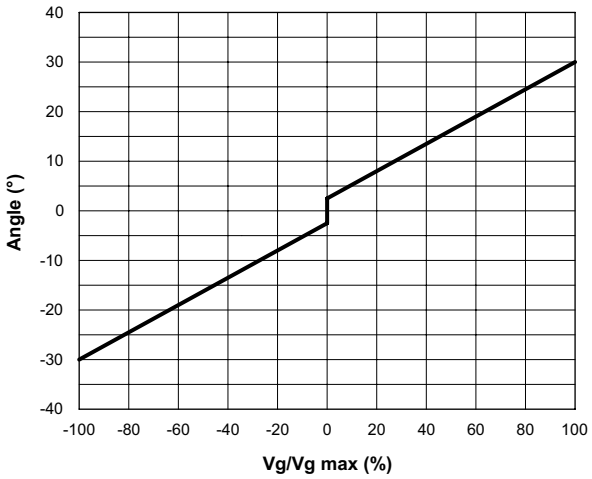
(*) Available for quantity.

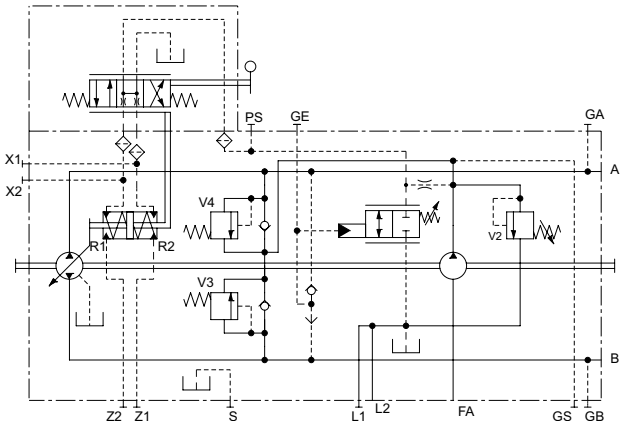
22

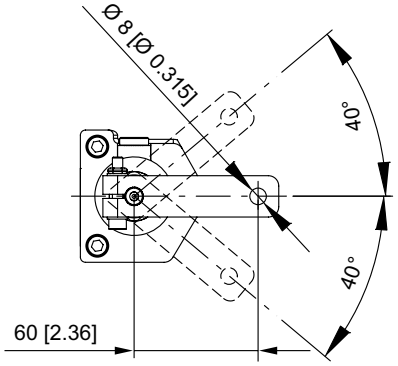
Painting	
XX	Not Required
01	Black Painted RAL 9005

10 Control

The displacement of the pump is directly proportional to the angle of rotation of the lever. The feedback system feels the position of the swashplate and works automatically to compensate a positioning error. The diagram below shows the relationship between angle and displacement.





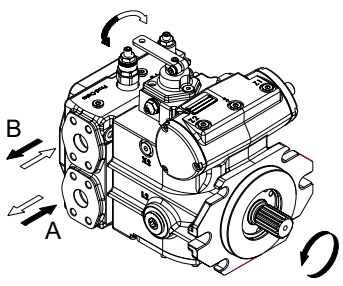


The torque necessary at the control lever is between 1 and 2.45 Nm [0.737 and 1.80 lbf·ft].

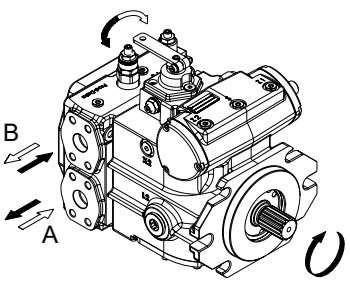
Note:
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HLR (CCW)

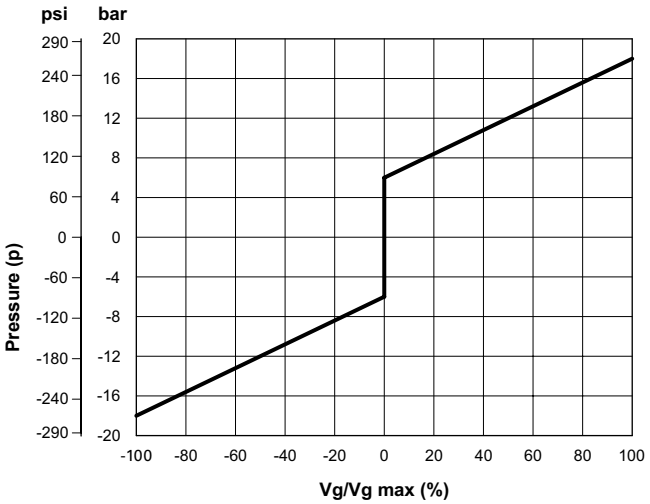


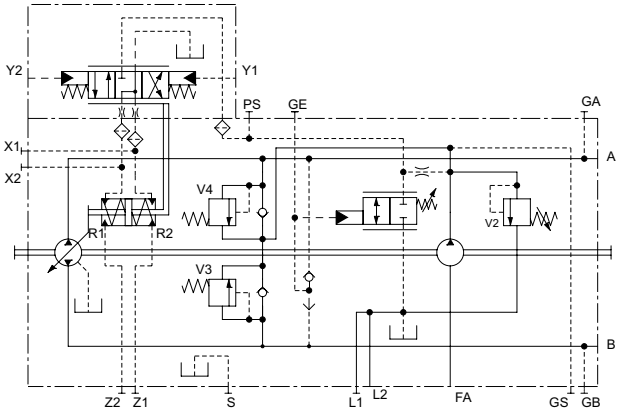
HLR (CW)



10 Control

The pump displacement is proportional to the pilot pressure on Y1 or Y2 ports, which also affect flow direction. The feedback system feels the position of the swashplate and works automatically to compensate a positioning error. Piloting can be provided by boost pressure from GS port. The piloting pressure will have to be controlled then by a joystick or by a pressure reducing valve (not supplied).





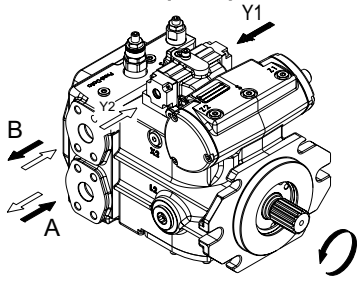
Start of control = 6 bar [87 psi]
End of control = 18 bar [261 psi] (Max displacement)

Note:
The tolerance on piloting pressure is ± 10% of maximum value.

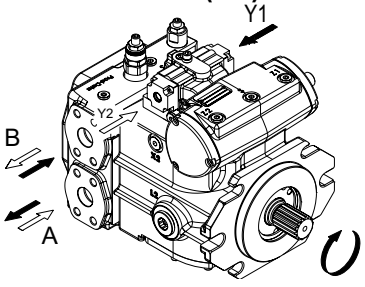
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HIR (CCW)



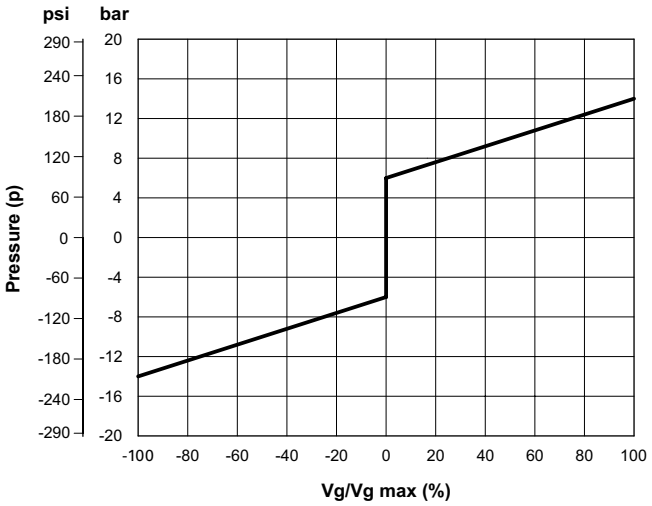
HIR (CW)

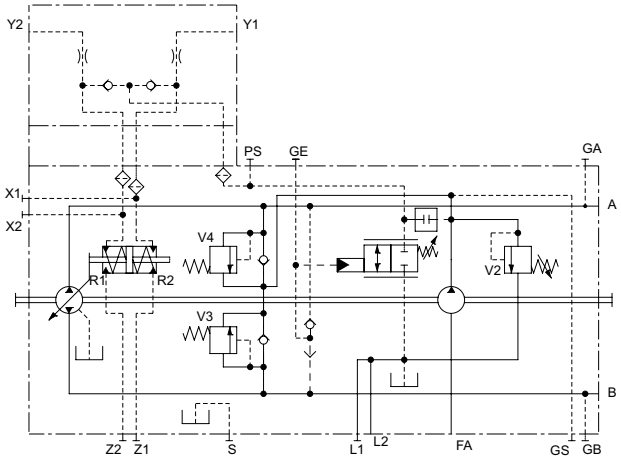


10 Control

The pump displacement is proportional to the pilot pressure on Y1 or Y2 piloting ports, which also affect flow direction. The flow is also influenced by the working pressure and by the rotation speed of the pump. With a given input signal (piloting pressure) the pump can vary the displacement and the flow when working pressure or rotating speed change. Feeding pressure to the control joystick can be provided by charge pressure from GS port. The piloting pressure must then be controlled by said joystick or by a pressure reducing valve (not supplied). The orifice dimensions must be choosed in function of the response time required, see the table below.

Warning:
HIN control could require working parameters review. Please contact Dana technical service



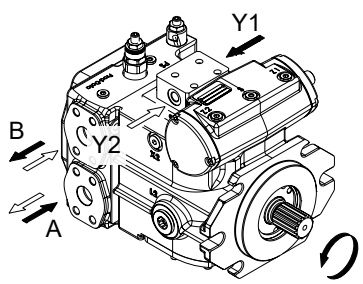


Maximum Pilot pressure = 30 bar [435 psi]
Start of control = 6 bar [87 psi]
End of control = 14 bar [203 psi](Max displacement)

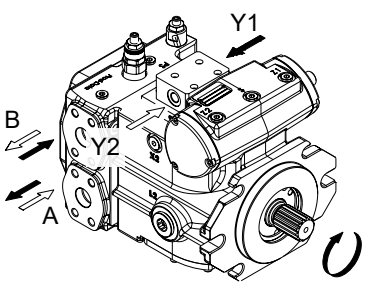
Note:
The tolerance on piloting pressure is ± 10% of maximum value.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HIN (CCW)

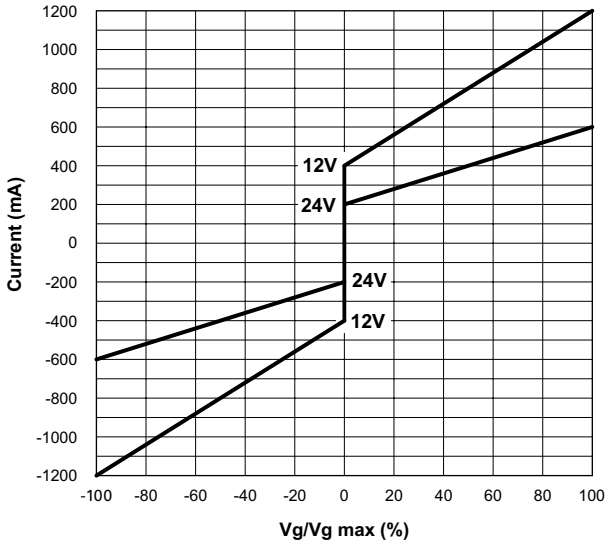


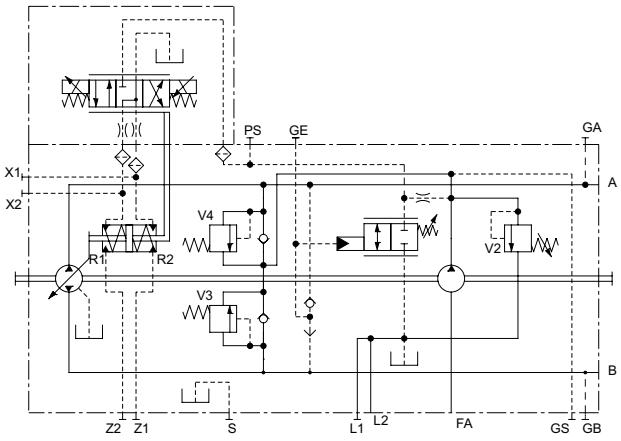
HEN (CW)



10 Control

The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids. The feedback system feels the position of the swashplate and works automatically to compensate a positioning error. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for HD1. Flow direction depends on which solenoid is energized. Standard solenoids are proportional at 24V d.c. max. current 1A. (Optional solenoids 12V d.c. max. current 2A). For emergency operation only it is however possible to control solenoids directly with 24V d.c.voltage (or 12V d.c.), by-passing the amplifier.





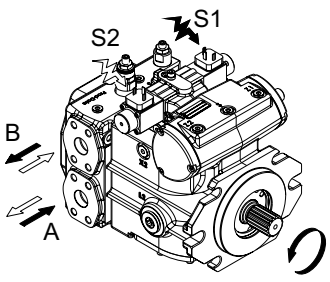
Solenoid 24V:
Current min. 200 mA max 600 mA
Solenoid 12V:
Current min. 400 mA max 1200 mA

Note:
The tolerance on piloting current is ± 10% of maximum value.

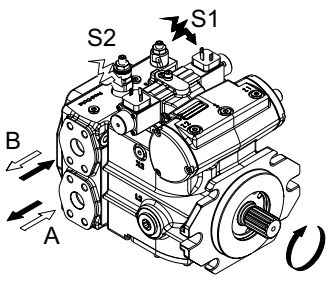
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HER (CCW)



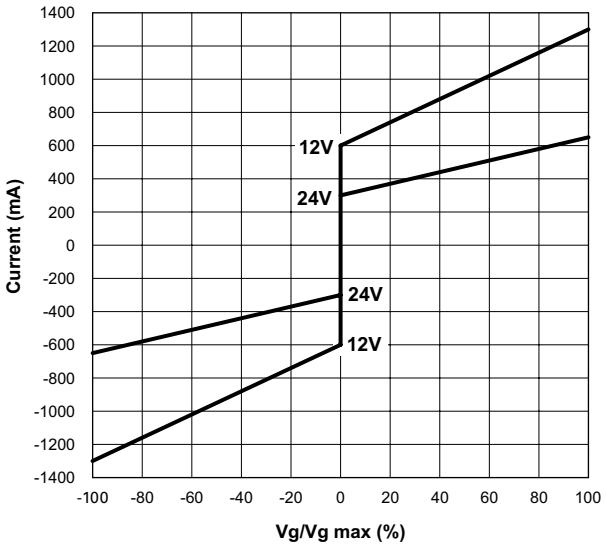
HER (CW)

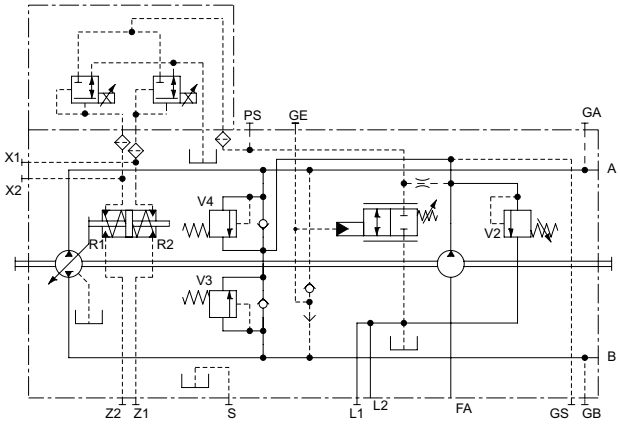


10 Control

The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids. The flow is also influenced by the working pressure and by the rotation speed of the pump. With a given input signal (piloting current) the pump can vary the displacement and the flow when working pressure or rotating speed change. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for HD1. Flow direction depends on which solenoid is energized. Standard solenoids are proportional 24V d.c. max. current 1A. (Optional solenoids 12V d.c. max. current 2A). For emergency operation only it is however possible to control solenoids directly with 24V d.c.voltage (or 12V d.c.), by-passing the amplifier.

Warning:
HIN use could require working parameters review. Please contact Dana technical service



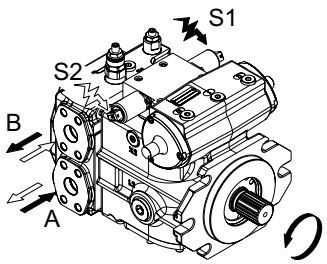


Solenoid 24V:
Current min. 300 mA max 650 mA
Solenoid 12V:
Current min. 600 mA max 1300 mA

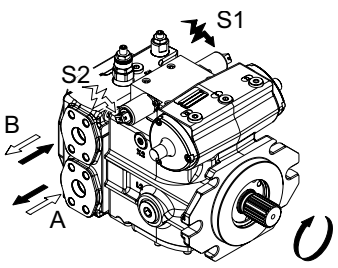
Note:
The tolerance on piloting current is ± 10% of maximum value.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HEN (CCW)

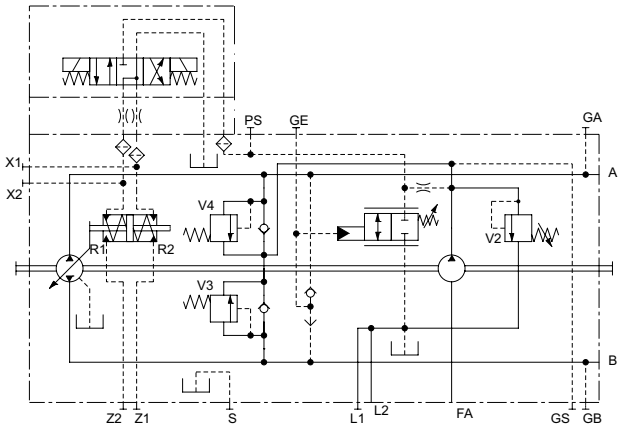


HEN (CW)



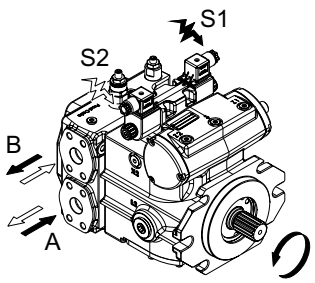
10 Control

Switching one of the solenoids the pump swivels to maximum displacement in the corresponding output flow direction. Switching off the stated solenoid will result in swivelling back the pump to zero displacement position.

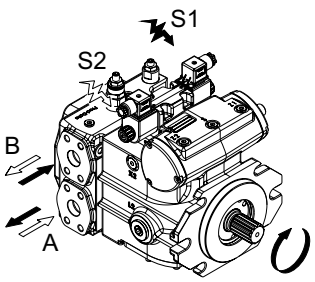


Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HE2 (CCW)

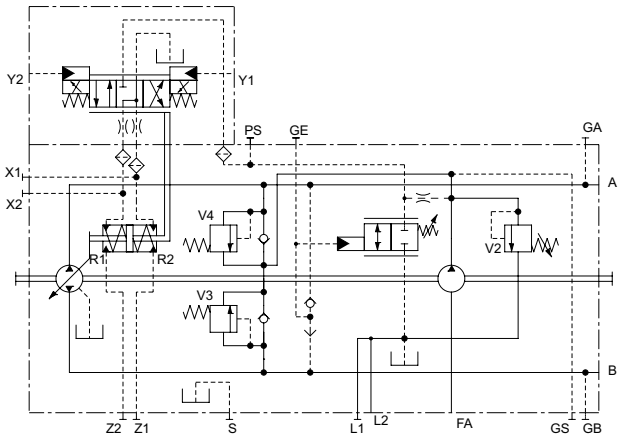


HE2 (CW)



10 Control

This control has the same electric proportional features of HER control, but it also has an emergency hydraulic proportional control capability when a pilot pressure on Y1 and Y2 ports. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for HD1. Hydraulic operation of HEH control is meant to be an emergency device to control displacement of the pump in case of a breakdown of the electric circuit. A pilot pressure of 22 bar [319 psi] is required to swivel the pump to max displacement in emergency operation.

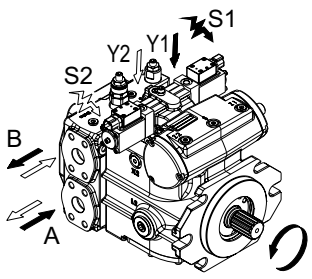


Warning:
Y1 and Y2 ports must not have any back pressure during normal electric control operation (vented to tank).

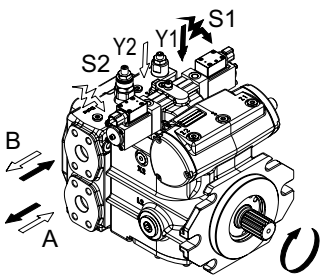
Note:
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HEH (CCW)



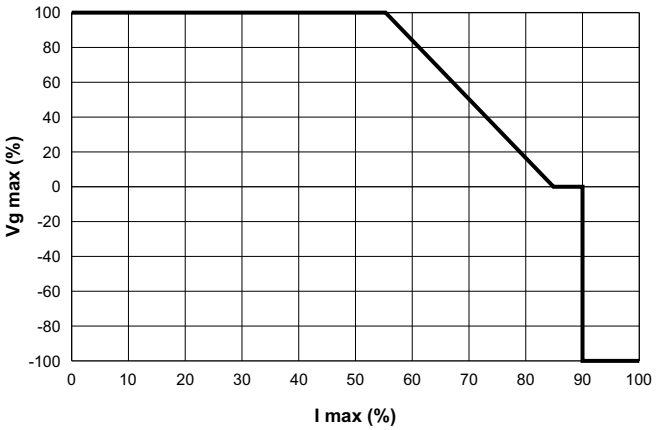
HEH (CW)

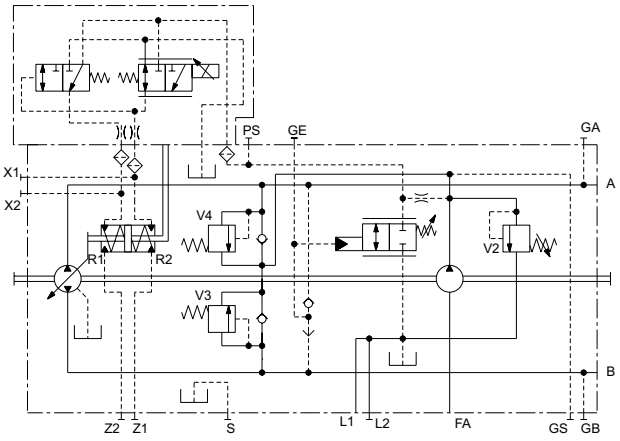


10 Control

Fan drive control (HFD) is a non-feedback control electrically operated.
Pump displacement is proportional to the input current on the solenoid. Flow is also influenced by working pressure and rotation speed, with a given input signal pump can vary displacement and flow due to working pressure and speed rotation variation.
Input current must be control by an external amplifier.
Flow direction depends on pump direction of rotation and on input current (see below diagram).

Pump displacement





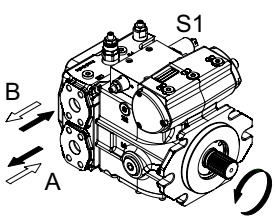
Voltage	I max	Protection	Resistance	Connector
12 VDC	1.5 A	DIN VDE 0470 / EN 60 529 -IP65	3.85 Ohm	AMP Junior Timer
24 VDC	0.75 A		15.15 Ohm	

Minimum boost pressure 25 bar - 363 PSI.

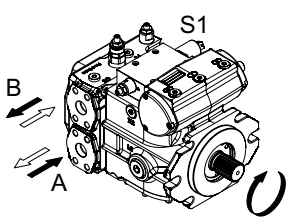
Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.
Flow direction depending to the I max current value.

Flow direction	
	S1 < 85% I max
	S1 > 90% I max

HFD (CCW)



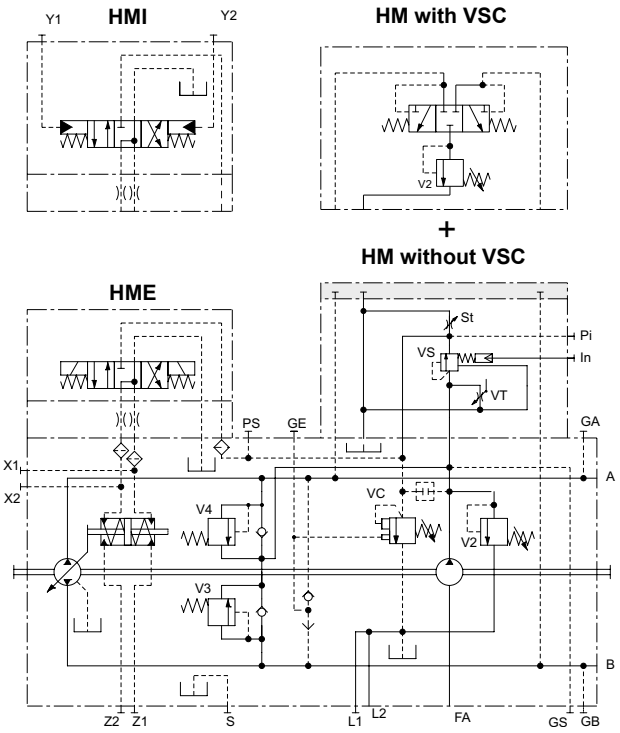
HFD (CW)



10 Control

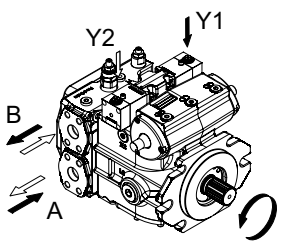
The “AUTOMOTIVE” (speed related) control, is used in hydrostatic transmissions with closed loop variable displacement pumps. This kind of controls allows to:

- Control of the vehicle translation speed;
- Limit the amount of Torque required from the Engine;
- Inching of the vehicle speed. The control of the Inching valve can be done with an hydraulic signal (Minimum 12 bar [174 psi] is required to swivel the pump to null displacement) or with a lever.
- Possibility to control the direction of flow electrically (HME) and hydraulically (HMI).

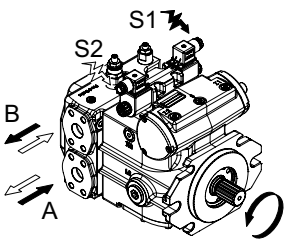


Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

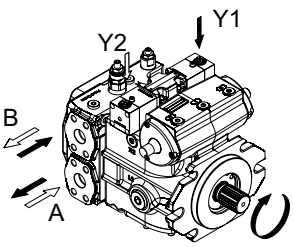
HMI (CCW)



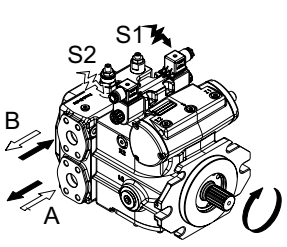
HME (CCW)



HMI (CW)



HME (CW)

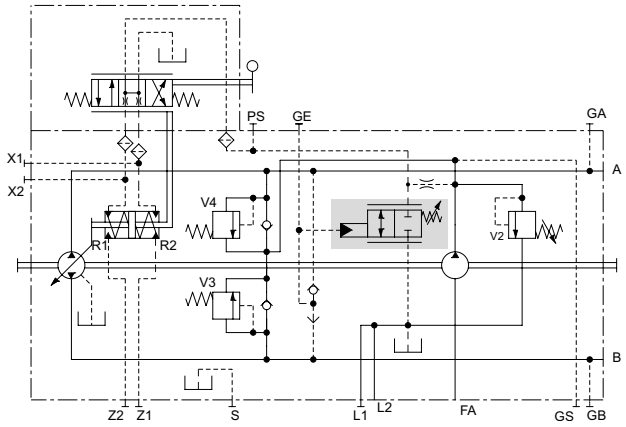


16 Pressure compensator valves

PC Pressure compensator

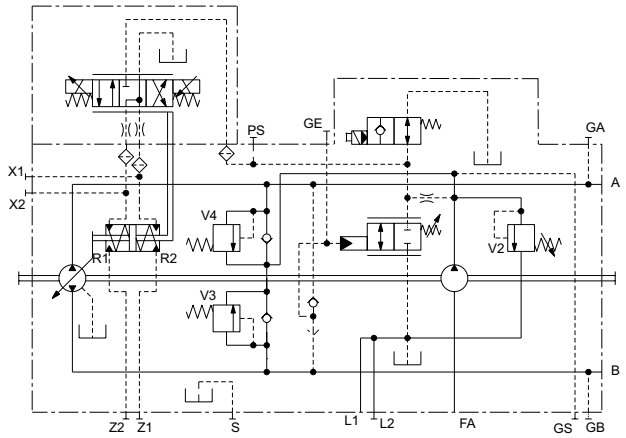
The pressure compensator valve is meant to avoid opening of the relief valves: whenever working pressure reaches the PC valve setting, the swashplate is swivelled back reducing flow. The valve allows to maintain a costant pressure in the circuit at the setting value. It is advisable to fit the cut-off valve to all system where pressure peaks close to the relief valves setting value occur or in hydraulic systems engineered to the maximum pump pressure. It is recommended to set the pressure cut-off valve at 30 bar [435 psi] lower than the high pressure relief valve setting. Setting range:100÷430 bar [1450÷6237 psi].

Note:
The pressure compensator valve is standard on HD1 pump and it can be combined with TE (EP) valve.



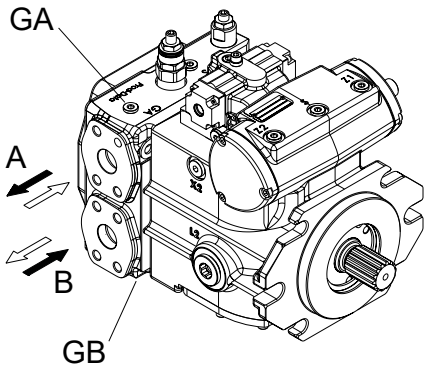
EP Electric cut off valve

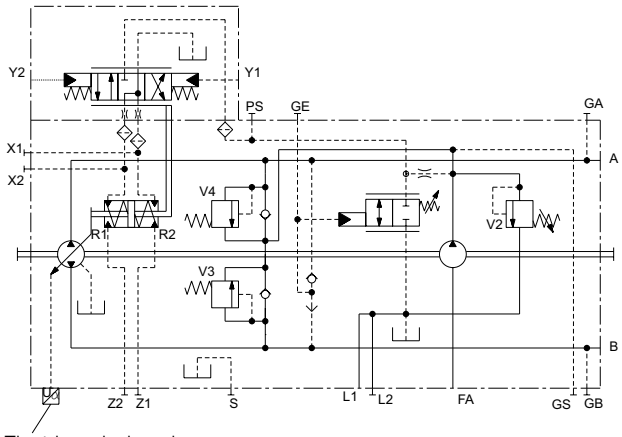
The electric cut-off valve swivels back to zero the pump flow when power supply to the ON/OFF solenoid is cut-off. This valve has been designed for applications subject to safety rules, which required stopping of the machine in case of no electric signal. Feed voltage is 24V d.c.



21 Pump feature

Pump swivel angle is measured by an electric swivel angle sensor.
As an output parameter, the hall effect swivel angle sensor delivers a voltage proportional to the swivel angle (see table of output voltage).



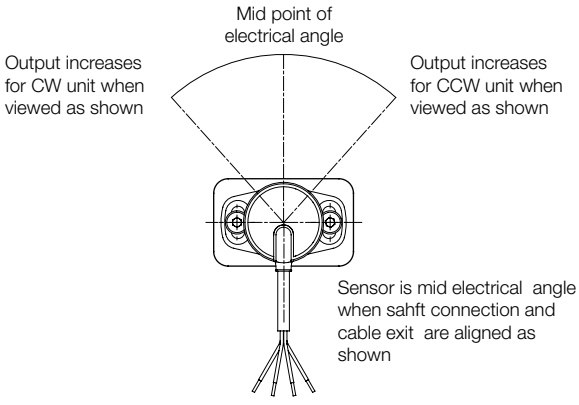


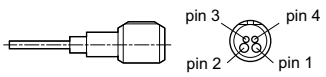
Electric swivel angle sensor

Output Voltage

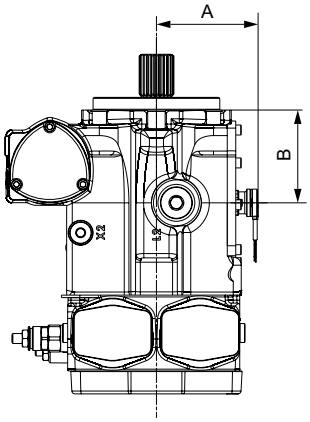
		Flow direction	Operating Pressure	Output Voltage
Shaft direction of Rotation	CW	B to A	Gb	> 2.5
		A to B	Ga	< 2.5
	CCW	A to B	Ga	> 2.5
		B to A	Gb	< 2.5

Features	Range		
Supply Voltage Ub	9 to 30 V DC		
Output Voltage Ua	0.5 V (Vg max)	2.5 V (Vg 0)	4.5 V (-Vg max)
Reverse voltage protection	Short circuit-resistance		
Operating temperature range	-40 °C to +140 °C		
Vibration resistance Sinusoidal vibration EN 60068-2-6	BS EN 60068-2-64:1995 Sec 8.4(31.4gn rms) 20 to 2000Hz random		
Shock resistance Continuous shock IEC 68-2-29	3m drop onto concrete And 2500g		
Type of protection DIN/EN 60529	IP68 (to 2m depth for 1 hour) and IP69K		





pin	Description	Color
1	+V Supply	Red
2	0V Supply GND	Black
3	CH1 Output	Yellow
4	CH2 Output	White



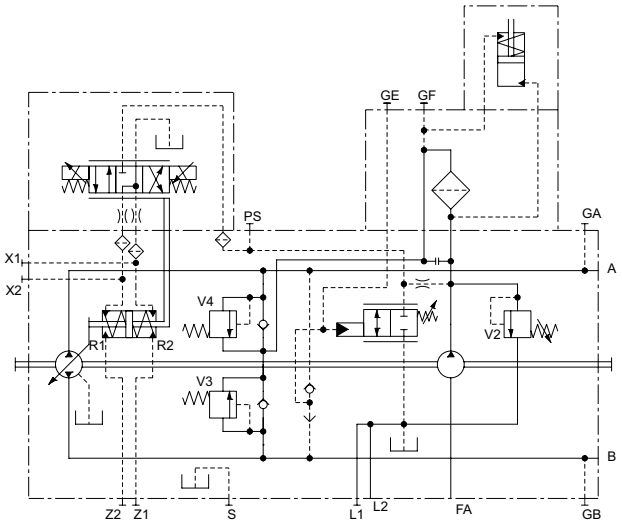
	mm [inch]
A	101.9 [4.01]
B	93 [3.66]

18 Filter

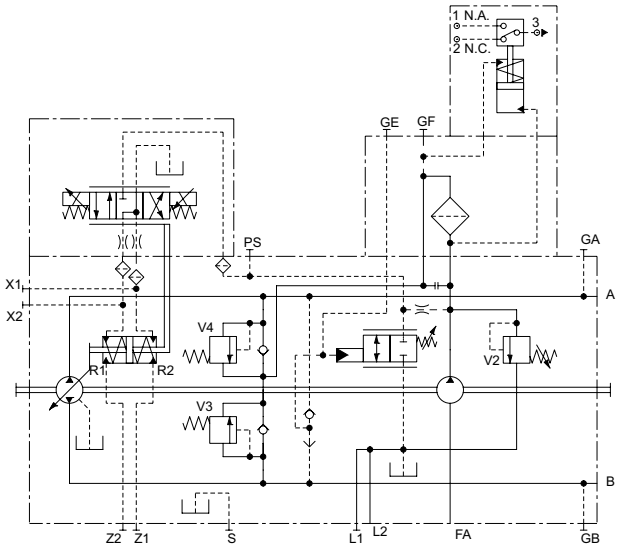
In order to guarantee an optimum fluid contamination level in the closed loop the HD1 can be equipped with a filter positioned on the delivery outlet of the charge pump. Only the flow necessary to reintegrate the lost oil due to leakage will pass through the filter, all the excess flow is not filtered and discharged through the pump drain line. In this way a longer life of the filter is achieved. The filter contains a composite fibre filtering element, with capacity of 12 micron absolute. The system uses sensors of clogging differential pressure of 8 bar [116 psi]) in optical and electrical (Connector DIN43650/ISO4400) version.
It is available a conversion cable from DIN43650/ISO4400 to Deutsch DT04 connector code M54050011. The filter is without by-pass.
It is available a version for filtering in filter pressure not mounted on the pump. It's available also version:

- FP arranged for filter
- FR with openings for external filter under pressure

M8 With optical sensor

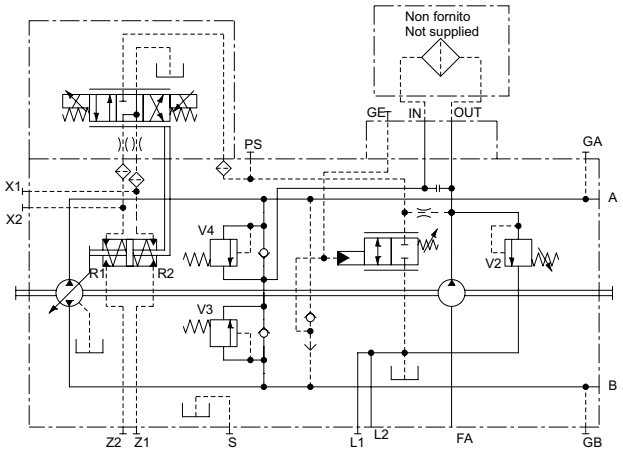


E1 - E2 - E3 - E9 With electric sensor

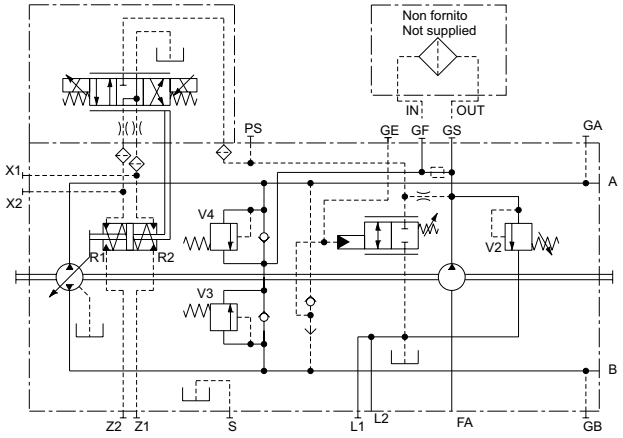


SPDT	Max resistive load	Max inductive load
258. C.A.\ A.C. 125-250 V	1 A	1 A
C.C.\ D.C. 30 V	2 A	2 A
C.C.\ D.C. 50 V	0.5 A	0.5 A
C.C.\ D.C. 75 V	0.25 A	0.25 A
C.C.\ D.C. 125 V	0.2 A	0.03 A

FR Remote filter



FP Arranged for filter



By-pass valve

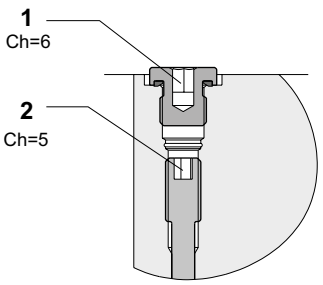
21 Pump feature

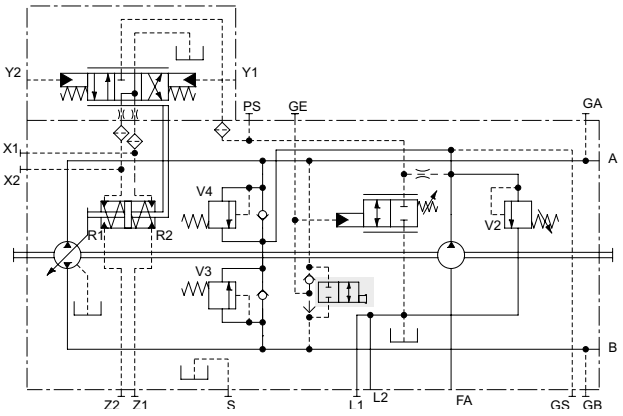
BPV By-pass valve

The By-pass valve allows, if necessary, to connect the pressure port line A and B.

By-pass function:
- Take out the cap **1**;
- Unscrew the valve **2** max 5 turns.

By-pass valve position and dimensions see page l35.

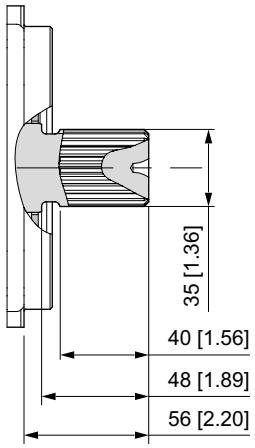




8 Shaft end

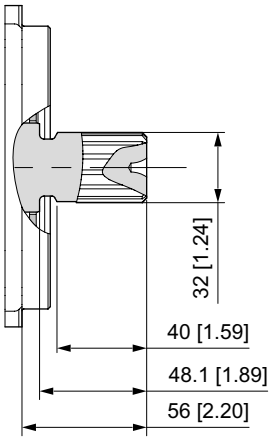
AC Splined

SAE 1-1/4” 21T 16/32 - FLAT ROOT CLASS 5 ANSI B92.1a - 1976

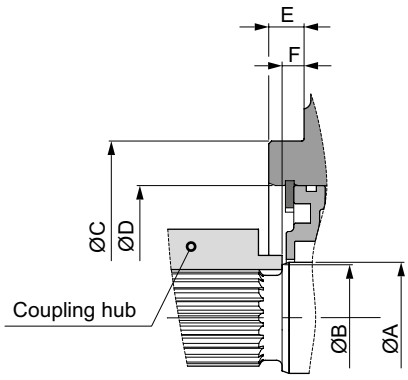


13 Splined

14T 12/24 DP - FLAT ROOT CLASS 5 ANSI B92.1a - 1976



Measures for installing the coupling hub



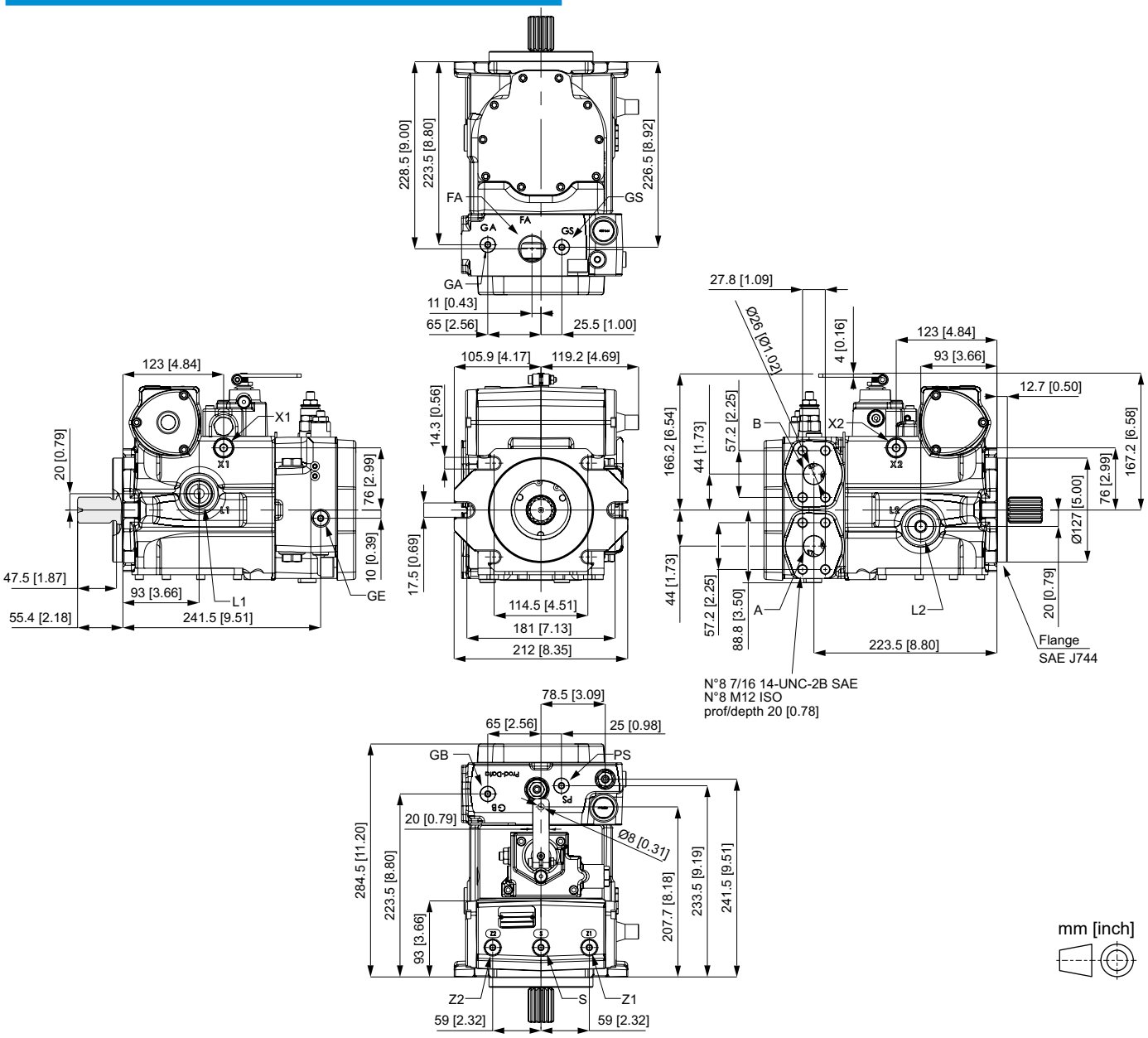
Type		mm [inch] ØA	ØB	ØC	ØD	E	F
AC	21T 16/32” DP	35 [1.38]	34 [1.34]	127 [5.08]	72 [2.83]	12.7 [0.50]	7.9 [0.31]
13	14T 12/24” DP		32.9 [1.30]				

To avoid dangerous contacts, the external diameter of the hub must be less than the diameter dimension “ØD” while the internal diameter must be less than the diameter “ØB”.

Pump and controls dimensions

10 Control

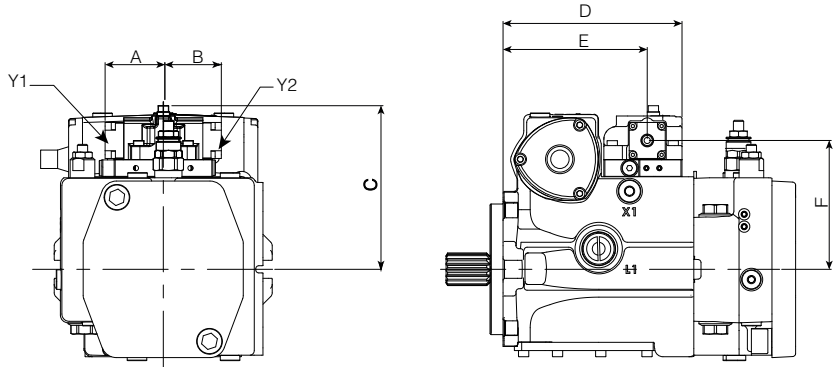
HLR



	Connections	ISO		SAE	
A-B	Pressure ports	1” ISO 6162 - 6000 psi		1” SAE J 518 - 6000 psi	
L1-L2	Case drain	3/4 G (BSPP) Depth 20 [0.59]	UNI/ISO 228/1	1-1/16”-12UN-2B Depth 20 [0.59]	ISO 11926
FA	Suction	1 G (BSPP) Depth 19 [0.75]		1-5/16”-12UN-2B Depth 19 [0.75]	
GA-GB	Gauge pressure A-B	1/4 G (BSPP) Depth 12 [0.47]		7/16”-20UNF-2B Depth 12 [0.47]	
GS	Boost pressure	1/4 G (BSPP) Depth 12 [0.47]		7/16”-20UNF-2B Depth 12 [0.47]	
GE	Working pressure	1/4 G (BSPP) Depth 12 [0.47]		7/16”-20UNF-2B Depth 12 [0.47]	
PS	Control pressure	1/4 G (BSPP) Depth 12 [0.47]		7/16”-20UNF-2B Depth 12 [0.47]	
X1-X2	Pressure stroking chamber	3/8 G (BSPP) Depth 13 [0.51]		9/16”-18UNF-2B Depth 13 [0.51]	
Z1-Z2	Pressure stroking chamber	1/8 G (BSPP) Depth 12 [0.47]		7/16”-20UNF-2B Depth 12 [0.47]	
S	Bleed	1/4 G (BSPP) Depth 12 [0.47]		7/16”-20UNF-2B Depth 12 [0.47]	

10 Control

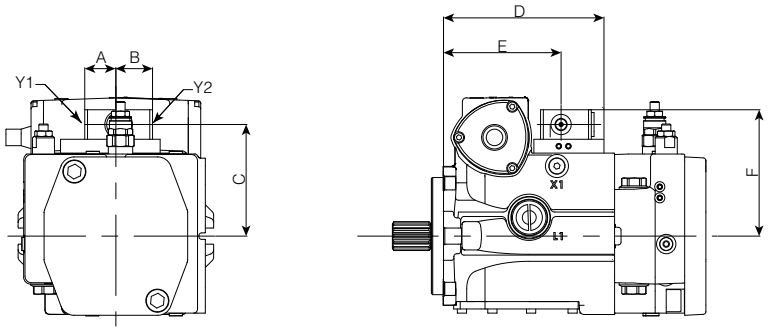
HIR



	mm [inch]
A	56.5 [2.22]
B	56.5 [2.22]
C	159.1 [6.26]
D	174 [6.85]
E	140.2 [5.52]
F	123.3 [4.93]

Y1, Y2: control piloting pressure ports -1/4 G (BSPP) (ISO) - 7/16” - 20 UNF 2B (SAE)

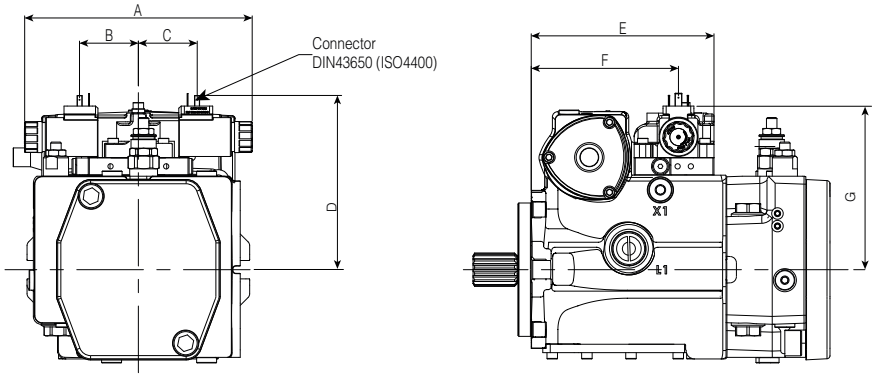
HIN



	mm [inch]
A	33.8 [1.33]
B	39.7 [1.56]
C	137 [5.39]
D	174 [6.35]
E	127.5 [5.02]
F	121 [4.76]

Y1, Y2: control piloting pressure ports -1/4 G (BSPP) (ISO) - 7/16” - 20 UNF 2B (SAE)

HER - DIN 43650 (ISO 4400)

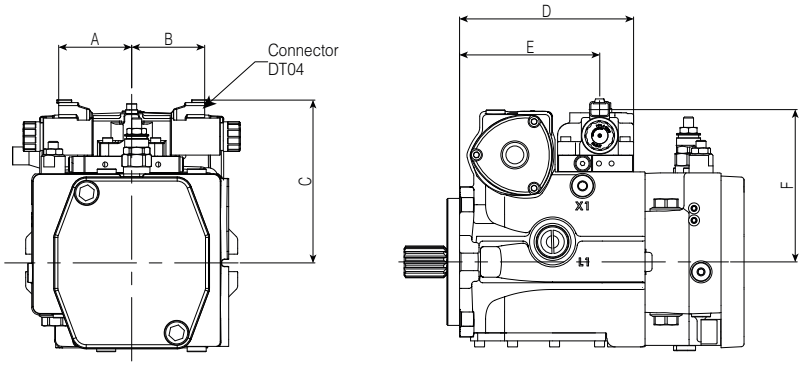


	mm [inch]
A	195 [7.63]
B	67.4 [2.65]
C	67.4 [2.65]
D	159.1 [6.26]
E	174 [6.85]
F	140.2 [5.52]
G	153.3 [6.04]

pump shape for reference only

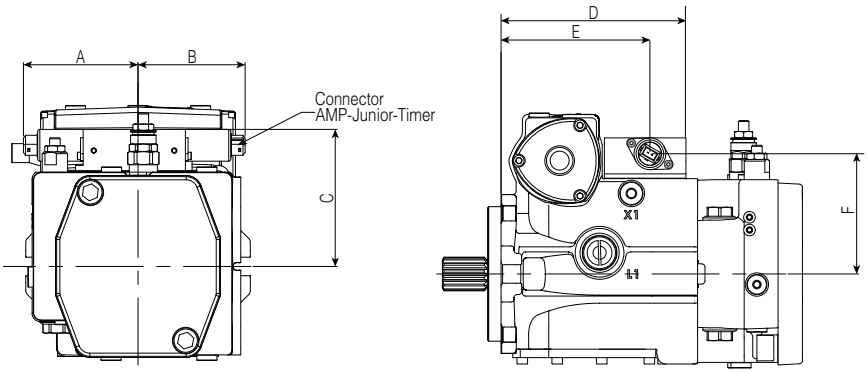
10 Control

HER - DT04



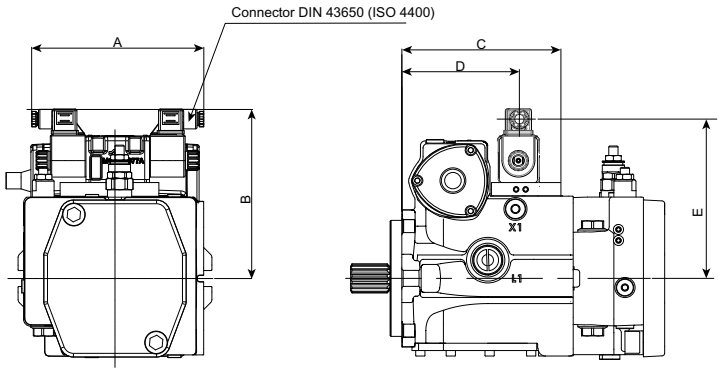
	mm [inch]
A	85.5 [3.37]
B	85.5 [3.37]
C	162.4 [6.33]
D	174 [6.85]
E	140.2 [5.52]
F	151.2 [3.95]

HEN



	mm [inch]
A	108.2 [4.26]
B	101.1 [3.98]
C	129.4 [5.09]
D	175 [6.89]
E	141 [5.55]
F	114.4 [4.50]

HE2

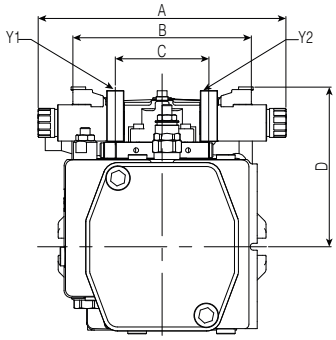


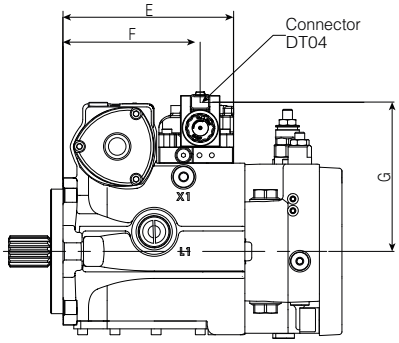
	mm [inch]
A	188.3 [7.41]
B	185.5 [7.30]
C	174 [6.85]
D	128.5 [5.06]
E	174.4 [6.87]

pump shape for reference only

10 Control

HEH - DT04

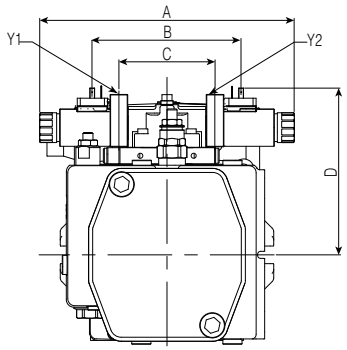


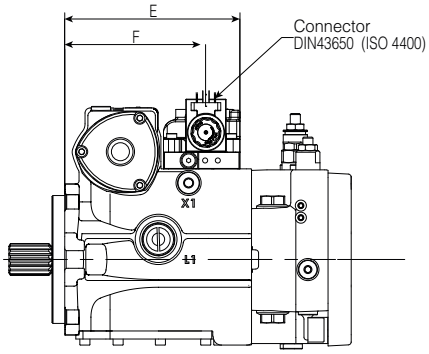


	mm [inch]
A	241.8 [9.52]
B	207 [8.15]
C	95 [3.74]
D	162.6 [6.40]
E	174 [6.85]
F	140.2 [5.52]
G	151.2 [5.99]

Y1, Y2: control piloting pressure ports -1/8" G (BSPP) (ISO) - 5/16" - 24 UNF (SAE)

HEH - DIN 43650 (ISO 4400)

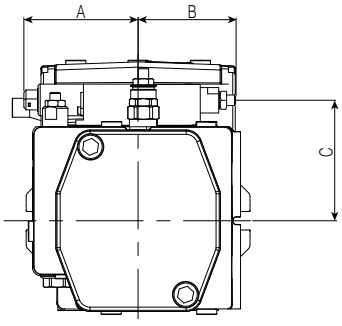


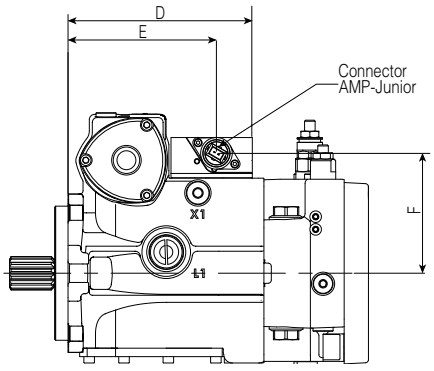


	mm [inch]
A	239.8 [9.44]
B	171.7 [6.76]
C	95 [3.74]
D	152.9 [6.02]
E	174 [6.85]
F	140.2 [5.52]

Y1, Y2: control piloting pressure ports -1/8" G (BSPP) (ISO) - 5/16" - 24 UNF (SAE)

HFD



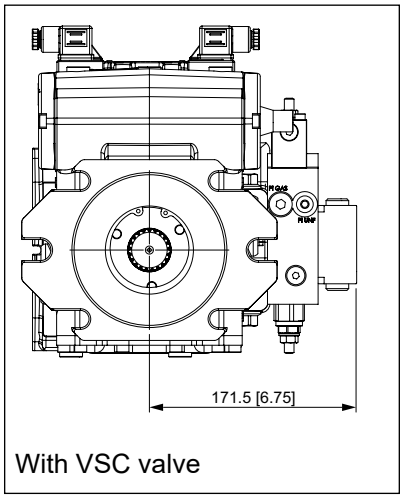


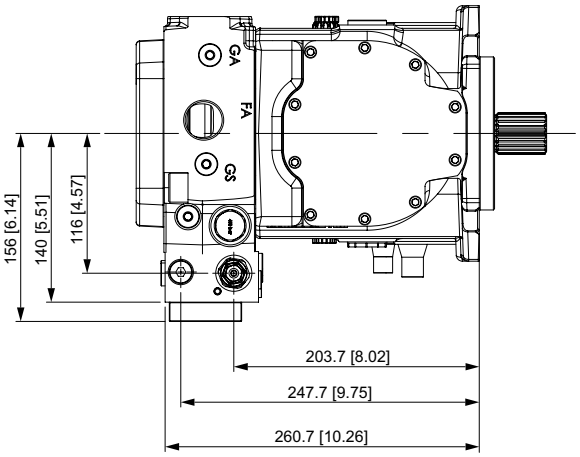
	mm [inch]
A	108.2 [4.26]
B	93.2 [3.67]
C	114.4 [4.50]
D	175 [6.83]
E	141 [5.55]
F	129.4 [5.09]

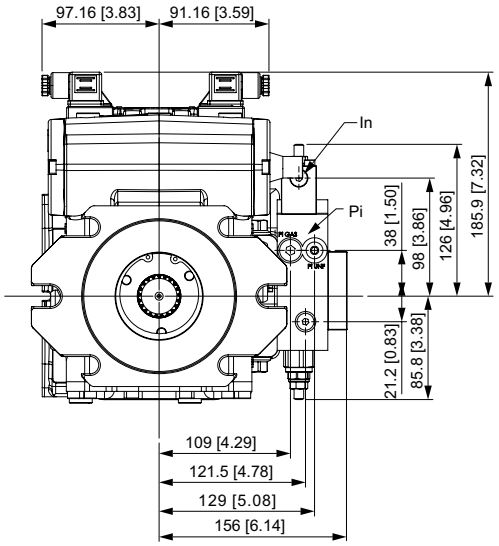
pump shape for reference only

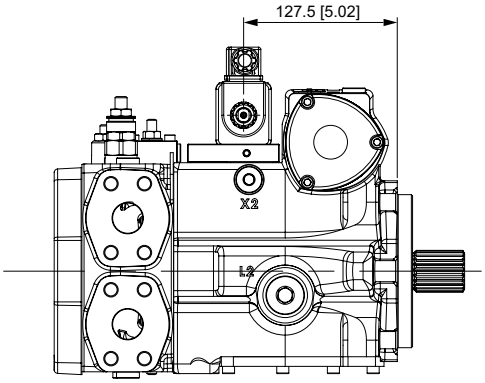
10 Control

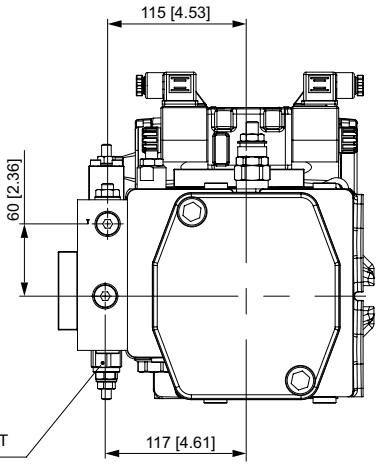
HME Automotive

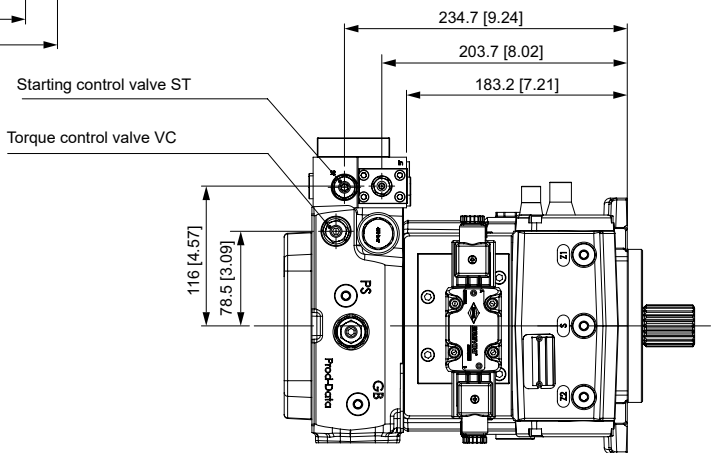










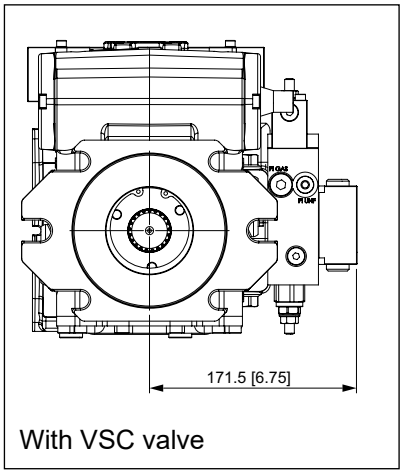


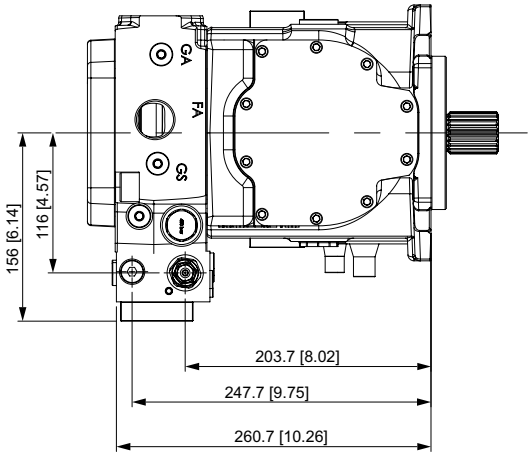
mm [inch]

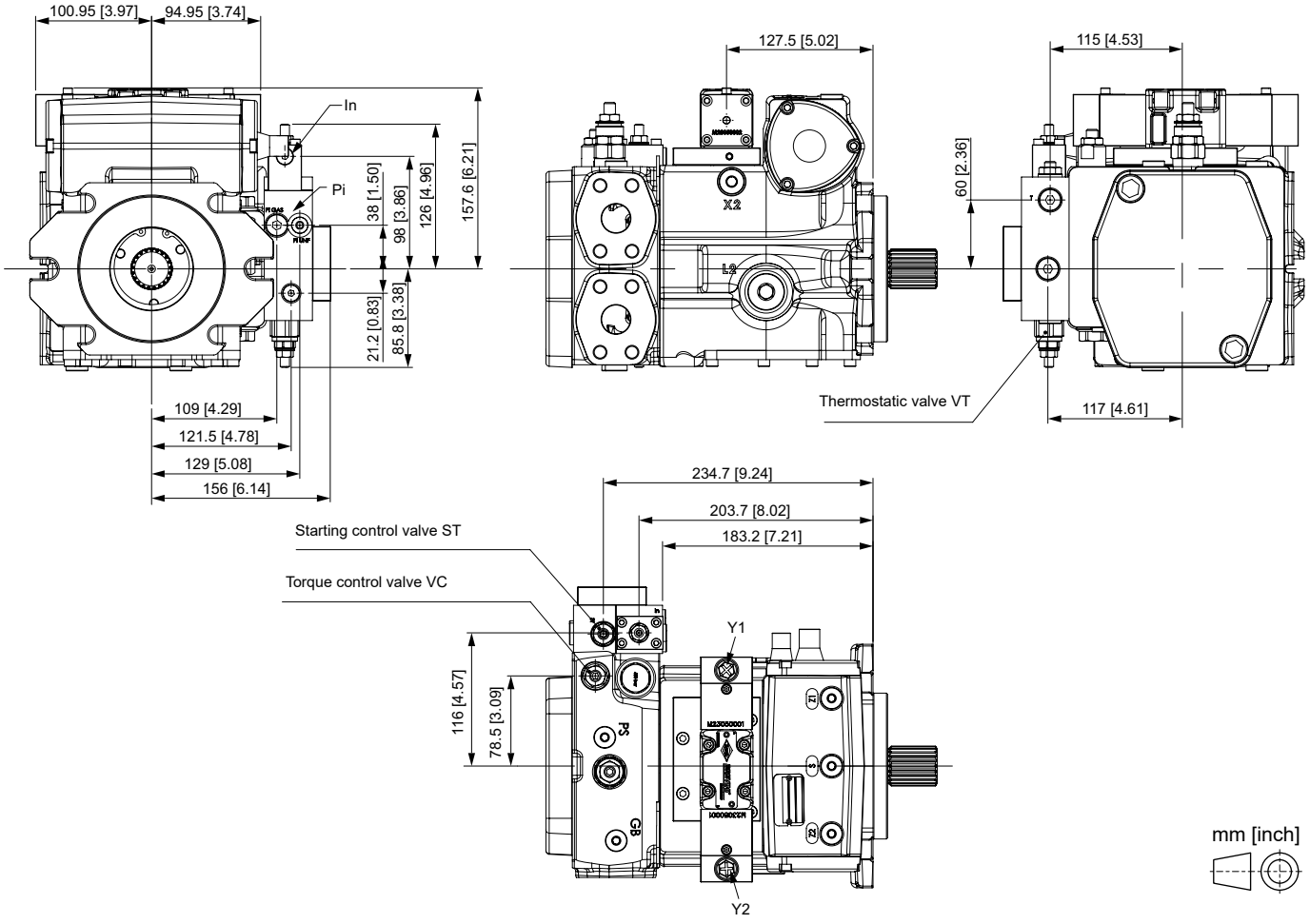
Pi Gas: Piloting pressure gauge port - 1/4 G (BSPP) (ISO)
Pi UNF: Piloting pressure gauge port - 7/16" - 20 UNF (SAE)
In: Piloting pressure Inching port - 1/8 G (BSPP) (ISO)

10 Control

HME Automotive





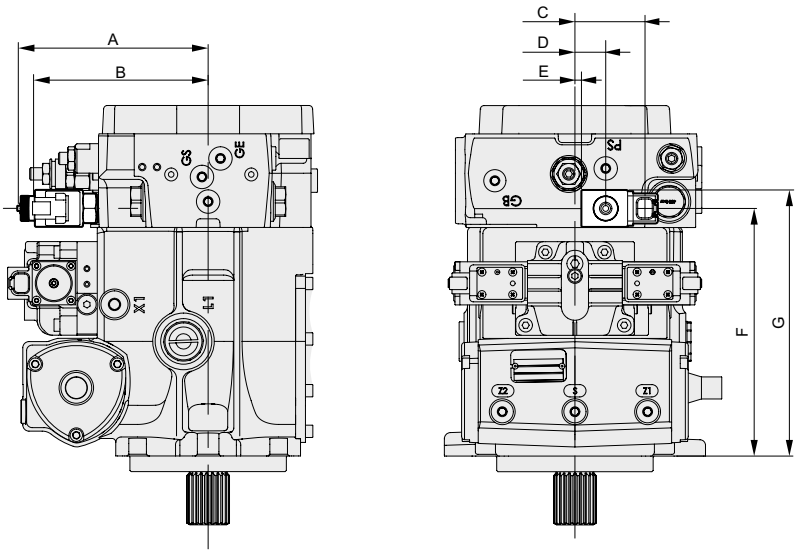


Pi Gas: Piloting pressure gauge port - 1/4 G (BSPP) (ISO)
Pi UNF: Piloting pressure gauge port - 7/16” - 20 UNF (SAE)
In: Piloting pressure Inching port - 1/8 G (BSPP) (ISO)
Y1, Y2: Control piloting pressure ports - 1/4 G (BSPP) (ISO) - 7/16” - 20 UNF with Nipple SAE

Pump and accessories dimensions

16 Pressure compensator valve

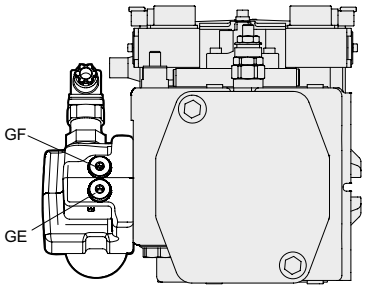
EP Electric Cut-Off + Pressure Compensator valve



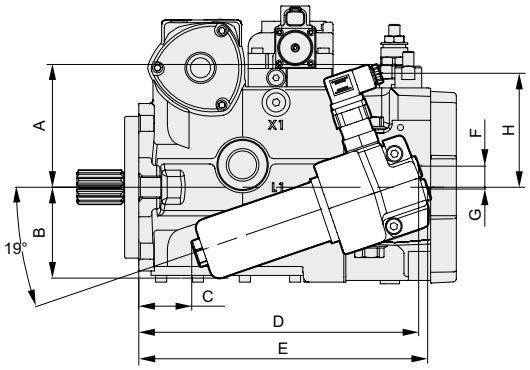
	mm [inch]
A	154.1 [6.07]
B	141.7 [5.58]
C	56.9 [2.24]
D	25 [0.98]
E	5.3 [0.21]
F	201 [7.91]
G	216 [8.50]

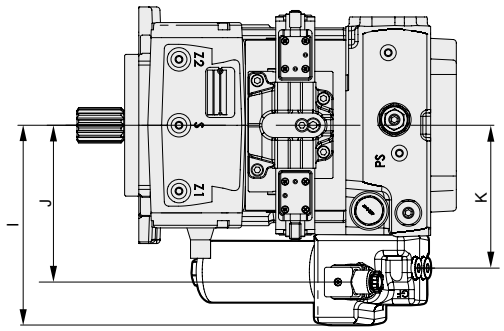
18 Filter

E1/E2/E3/E9 Filter with electric clogging sensor



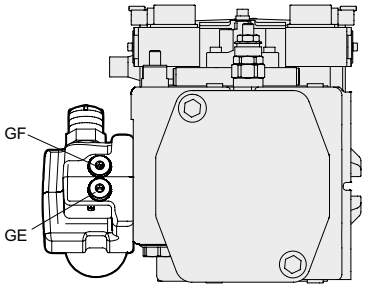
GF: Boost pressure
GE: Working pressure



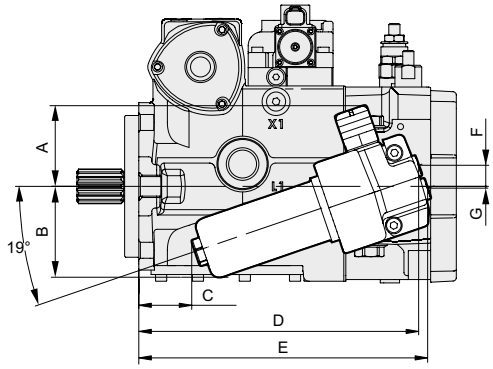


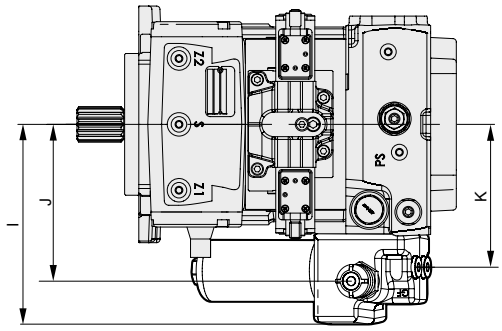
	mm [inch]
GF GE ISO	1/4" G (BSPP) UNI/ISO 228/1 Depth 12 [0.47]
GF GE SAE	7/16"-20 UNF-2B ISO 11926 Depth 12 [0.47]
A	110 [4.33]
B	81.4 [3.21]
C	47.4 [1.87]
D	250.8 [9.87]
E	258.8 [10.19]
F	18.9 [0.74]
G	1.6 [0.06]
H	102.1 [4.02]
I	179 [7.05]
J	140.5 [5.53]
K	128 [5.04]

M8 Filter with optical clogging sensor



GF: Boost pressure
GE: Working pressure





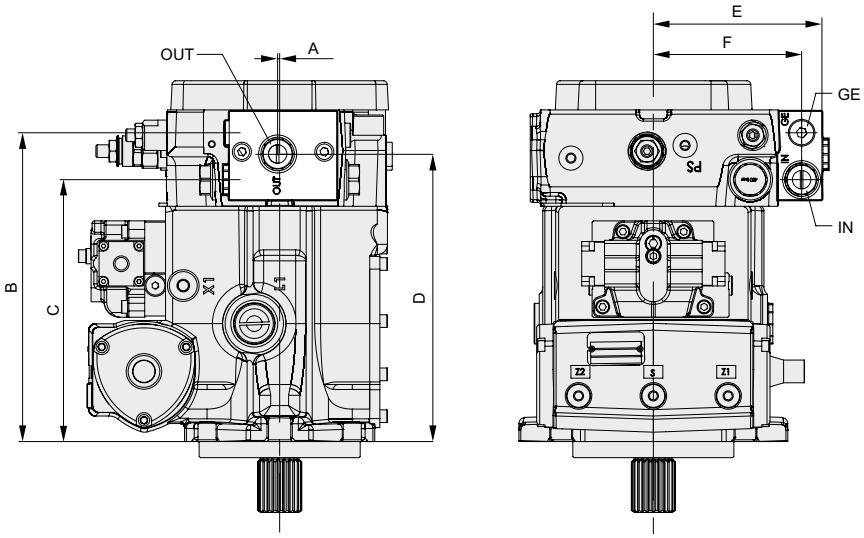
	mm [inch]
GF GE ISO	1/4" G (BSPP) UNI/ISO 228/1 Depth 12 [0.47]
GF GE SAE	7/16"-20 UNF-2B ISO 11926 Depth 12 [0.47]
A	72 [2.83]
B	81.4 [3.21]
C	47.4 [1.87]
D	250.8 [9.87]
E	258.8 [10.19]
F	18.9 [0.74]
G	1.6 [0.06]
I	179 [7.05]
J	140.5 [5.53]
K	128 [5.04]

pump shape for reference only

Pump and accessories dimensions

18 Filter

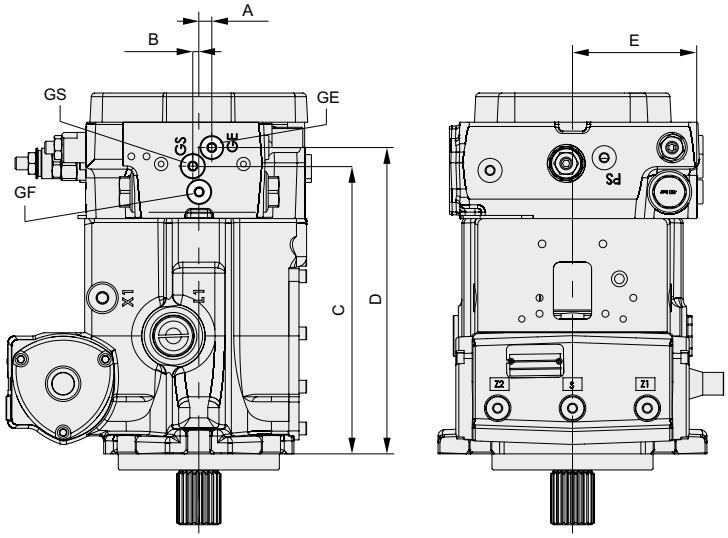
FR Remote filter option



IN: Return from the filter
OUT: Flow to the filter
GE: Working pressure

	mm [inch]
IN OUT ISO	1/2" G (BSPP) UNI/ISO 228/1 Depth 18 [0.71]
IN OUT SAE	3/4" - 16 UNF-2B ISO R725 Depth 15 [0.59]
GE ISO	1/4" G (BSPP) UNI/ISO 228/1 Depth 12 [0.47]
GE SAE	7/16"-20 UNF-2B ISO 11926 Depth 12 [0.47]
A	-0.2 [-0.01]
B	243.5 [9.59]
C	206.5 [8.13]
D	226.5 [8.92]
E	132.9 [5.23]
F	116.9 [4.60]

FP Arranged for filter

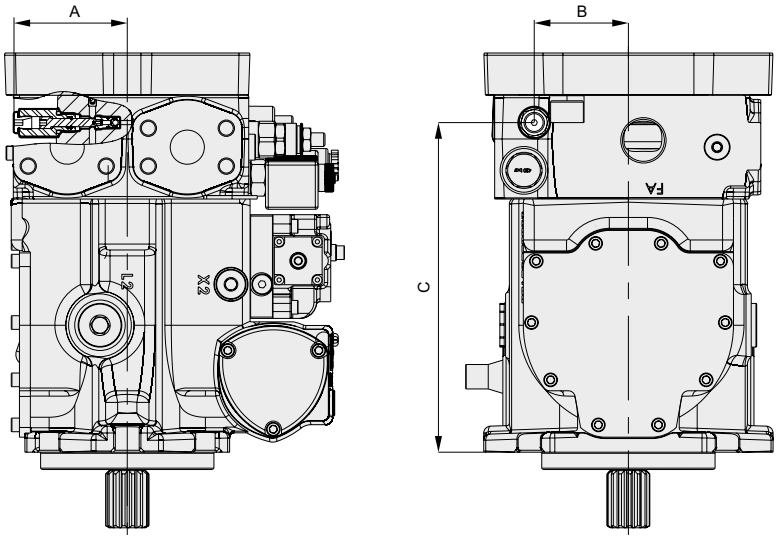


GF/GS: Boost pressure
GE: Working pressure

	mm [inch]
GS GE GF ISO	1/4" G (BSPP) UNI/ISO 228/1 Depth 12 [0.47]
GS GE GF SAE	7/16"-20 UNF-2B ISO 11926 Depth 12 [0.47]
A	10 [0.39]
B	5 [0.20]
C	226.8 [8.93]
D	241.5 [9.51]
E	98 [3.86]

21 Pump feature

BPV By-pass valve



	mm [inch]
A	83 [3.27]
B	69 [2.72]
C	241.5 [9.51]

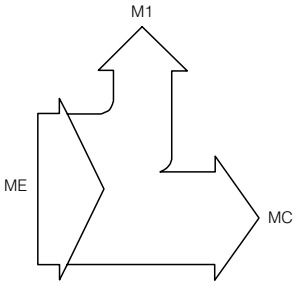
19 Through drives

HD1 pump can be supplied with through drive. The through drive can driving with a second HD1 or a pump of other kind.
Available flanges are:

- SAE A, SAE B, SAE C, SAE B-B and SAE C-C flange
- TANDEM flange

The maximum permissible torques on drive shaft of the first pump and the maximum through drive torques are listed in the table below.

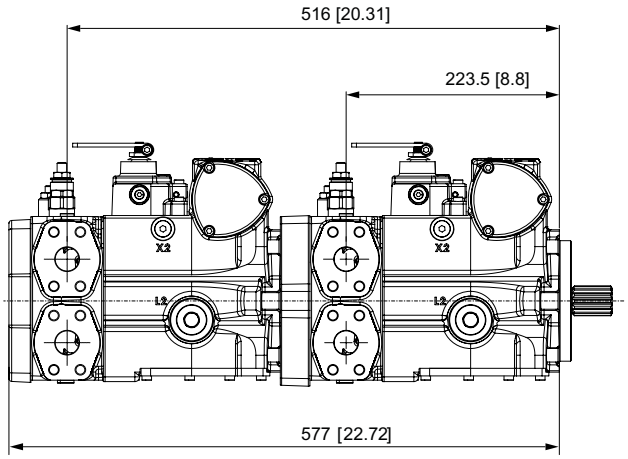
Warning:
The effective torque value on the shaft of first pump is given by the sum of the torques required from each pump making the system.



			Drive shaft	
			AC (Z21 16/32 DP)	**13** (Z14 12/24 DP)
Drive shaft max torque	**ME**	Nm [lbf·ft]	950 [700]	620 [457]
Through drive max torque	**MC**	Nm [lbf·ft]	522 [385]	522 [385]

19 Through drives

TC - TX Tandem through drive



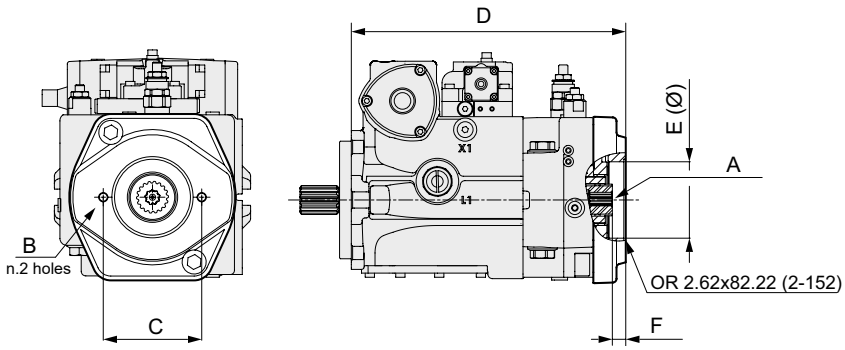
	Shafts for combination pumps	
	Front Pump	**Rear Pump**
Shafts	AC	13
	13	13

Warning: the TC-TX through drives must be used in the configuration of the first pump in the following cases:
1. Tandem pump combination.
2. Dana second pump

Example:
• If it is needed to purchase a single pump for Tandem pump combination, the pump will must have the TC through drive.

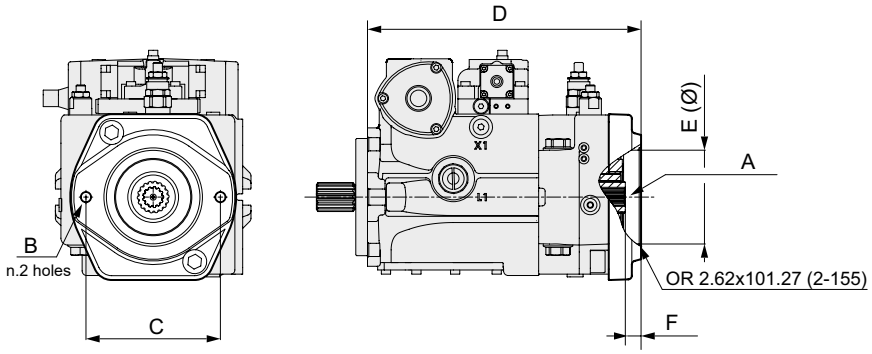
19 Through drives

SA-AA SAE A / SAE A-A - Flange



	Type	mm [inch]
A	SA	SAE A - 5/8"- 9T 16/32 DP
	AA	SAE AA - 3/4" - 11T 16/32 DP
B	ISO	M10 Dept 16 [0.63]
	SAE	3/8" 16 UNC-2B Dept 16 [0.63]
C		106.4 [4.19]
D		296.5 [11.67]
E		82.55 [3.25]
F	SA	14.5 [0.57]
	AA	14.5 [0.57]

SB/BB SAE B / SAE B-B Flange

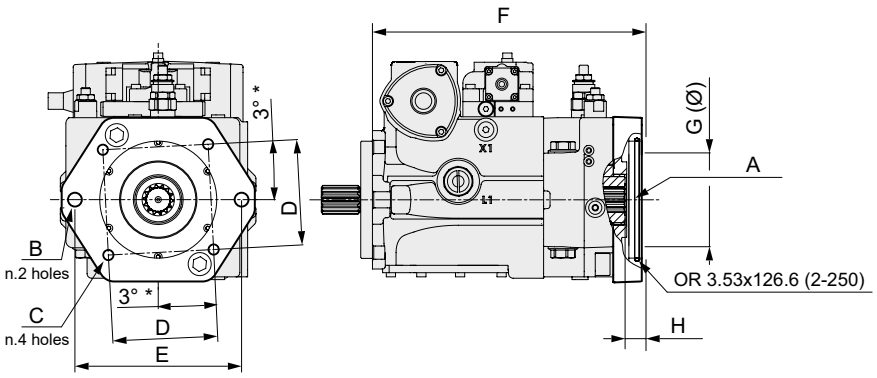


	Type	mm [inch]
A	SB	SAE B - 7/8" -13T 16/32 DP
	BB	SAE BB - 1" - 15T 16/32 DP
B	ISO	M12 Dept 19 [0.75]
	SAE	1/2" 13 UNC-2B Dept 19 [0.75]
C		146 [5.75]
D		296.5 [11.67]
E		101.6 [4.00]
F	SB	17.1 [0.67]
	BB	15.1 [0.59]

pump shape for reference only

19 Through drives

SC SAE C Flange

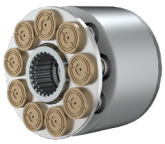


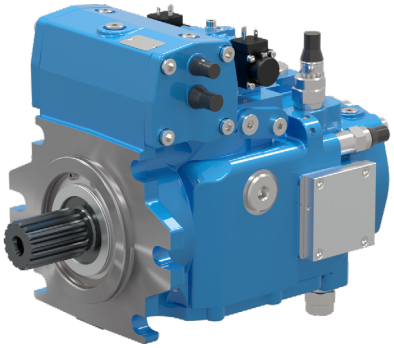
	Type	mm [inch]
A		SAE - C 1 1/4" - 14T 12/24 DP
B	ISO	M16 Dept 30 [1.18]
	SAE	5/8" 11 UNC-2B Dept 30 [1.18]
C	ISO	M12 Dept 21 [0.83]
	SAE	1/2" 13 UNC-2B Dept 21 [0.83]
D		114.5 [4.51]
E		181 [7.13]
F		292.5 [11.52]
G		127 [5.00]
H		18.1 [0.71]

pump shape for reference only

DANA BREVINI® Motion Systems

S6CV - Variable displacement axial piston pumps for closed circuit





Index

General information - Features M2
S6CV 075 - Ordering code M5
S6CV 075 - Control M11
S6CV 075 - Automotive M19
S6CV 075 - Pressure compensator valve and electric Cut-off valve ... M20
S6CV 075 - Pressure filter M21
S6CV 075 - By-Pass valve M22
S6CV 075 - Pump and controls dimensions M23
S6CV 075 - Shafts dimensions M29
S6CV 075 - Pump and accessories dimensions M30
S6CV 075 - Throught drives M34
S6CV 075 - Tandem combination dimensions M35
S6CV 075 - Throught drives dimensions M36
S6CV 128 - Ordering code M38
S6CV 128 - Control M43
S6CV 128 - Automotive M52
S6CV 128 - Pressure compensator valve and electric Cut-off valve ... M53
S6CV 128 - Pressure filter M54
S6CV 128 - Pump and controls dimensions M55
S6CV 128 - Shafts dimensions M61
S6CV 128 - Pump and accessories dimensions M62
S6CV 128 - Throught drives M64
S6CV 128 - Tandem combination dimensions M65
S6CV 128 - Throught drives dimensions M66

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]
S6CV 075	75 [4.57]	255 [67.32]	400 [5800]
S6CV 128	128 [7.8]	365 [96.3]	400 [5800]

The S6CV series variable piston pumps for closed loop circuits are axial pistons pumps with swash plate design and through drive shaft on option. These pumps have been specifically designed for use in closed circuit hydrostatic transmissions. The delivery is proportional to the rotation speed and the swash plate angle. The delivery increases when swash plate's angle of inclination increases from 0 to maximum position. Inverting the swash plate's angle, the flow direction is inverted. The technical choices allow the new unit to operate at pressures up to of 400 bar [5800 psi].

General information - Features

The series offers the following range of controls :
- HLR Manual lever with feed-back.
- HIR Hydraulic proportional with feed-back.
- HIN Hydraulic proportional without feed-back.
- HER Electric proportional with feed-back.
- HEN Electric proportional without feed-back.
- HE2 Electric on-off.
- HEH Electric proportional with hydraulic emergency override.
- Automotive

The pump has two built-in pressure relief valves to protect the circuit from pressure overloads. The charge pump circuit features a gerotor pump with different displacement on option.
The pump design allows the installation of many accessories, such as:
- Hydraulic pressure compensator.
- Electric cut-off valve.
- Combined electric cut-off – hydraulic pressure compensator.
- A wide range of through drive options.
- Charge pump delivery pressure filter.
- Electric or optical clogging sensor on the filter.

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
$n_{0\ max}$	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure
p_{max}	bar [psi]	Maximum pressure peak

q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15 ÷ 40 cSt. For short periods and upon cold start, a max.viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10 ÷15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and Filtration section.

Operating temperature:
The operating temperature of the oil must be within -25 °C ÷ 90 °C (-13 °F ÷ 194 °F). The running of the axial piston unit with oil temperature higher than 90 °C (194 °F) or lower than -25 °C (-13 °F) is not recommended. For further information see at Fluids and filtration section.

Filtration:
In the S6CV pump it is possible to provide a filter in the suction line but we recommend to use the optional pressure filter on the out-let line of the charge pump. The filter on the charge pump out-let line is supplied by Dana while if the filter assembled in the suction line is used the following recommendation applies:
Install the filter on the suction line of the auxiliary pump. We recommend to use filters with clogging indicator, no by-pass or with by-pass plugged and filter elementrating of 10 µm absolute. The maximum pressure drop on the filtration element must not exceed 0.2 bar [3 psi]. A correct filtration helps to extend the service life of axial piston units.In order to ensure a correct functioning of the unit, the max. permissible contamination class is 20/18/15 according to ISO 4406:1999.

Suction pressure:
The minimum absolute pressure on the auxiliary pump suction must be of 0.8 bar [11.6 absolute psi]. On cold starting and for short-periods an absolute pressure of 0.5 bar [7.25 psi] is allowed. In no case inlet pressure can be lower.

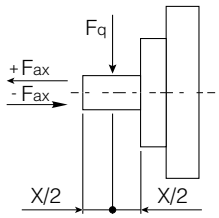
Operating pressure:
Main pump: The maximum permissible continuous pressure on pressure ports is over 400 bar [5800 psi]. Peak pressure is 450 bar [6525 psi]. Charge pump: The nominal pressure is 22 bar [319 psi]. Maximum admissible pressure is 40 bar [580 psi].

Case drain pressure:
Maximum case drain pressure is 4 bar [58 psi]. On cold starting and for short-term a pressure of 6 bar [86 psi] is allowed. A higher pressure can damage the input shaft seal or reduce its life.

Seals:
Standard seals used on S6CV pumps are of FKM (Viton ®). In case of use special fluids, contact Dana.

Displacement limiting:
The pump is equiped with the externally adjustable mechanical displacement limiting device. Displacement limitation is obtained by means of two setting screws which limit the control piston stroke.

Input shaft Radial and Axial loads:
The input shaft can stand both radial and axial loads. The maximum permissible loads are in the following table.



			Size	
			075	128
Radial load	$F_{q\ max}$	N [lbf]	2400 [540]	4600 [1035]
Axial load	$F_{ax\ max}$	N [lbf]	1900 [428]	4300 [967]

Installation:
S6CV series pumps can be installed in every position or direction. For further details contact Dana.

General information - Features

			Size	
			075	128
Displacement	$V_{g\ max}$	cm^3/rev [in^3/rev]	75[1] [4.57] [1]	128 [1] [7.8] [1]
Displacement	$V_{g\ min}$	cm^3/rev [in^3/rev]	0 [0]	0 [0]
Pressure cont.	p_{nom}	bar [psi]	400 [5800]	400 [5800]
Pressure peak	p_{max}	bar [psi]	450 [6525]	450 [6525]
Max speed cont.	$n_{0\ max}$	rpm	3400	2850
Max speed int.	$n_{0\ max}$	rpm	3600	3250
Min speed	n_{min}	rpm	500	500
Max flow at n_{max}	q_{max}	l/min [U.S.gpm]	255 [67.32]	365 [96.3]
Maximum power cont.	P_{max}	kW [hp]	170 [227.8]	259 [347]
Maximum power int.	P_{max}	kW [hp]	202.5 [271.3]	343 [459]
Max torque cont.(p_{nom}) at Vg_{max}	T_{nom}	Nm [lbf.ft]	478 [352]	858 [632]
Max torque peak (p_{max}) at Vg_{max}	T_{max}	Nm [lbf.ft]	537 [396]	980 [722]
Moment of inertia[2]	J	$kg \cdot m^2$ [$lbf.ft^2$]	0.014 [0.34]	0.040 [0.96]
Weight[2]	m	kg [lbs]	51 [112.5]	86 [189.5]

		Charge pump technical data		
Displacement charge pump	cm^3/rev [in^3/rev]	18 [1.1]	23 [1.4]	27 [1.6]
Charge pump setting pressure	bar [psi]	22 [319]		
Charge pump maximum pressure	bar [psi]	40 [580]		
Charge pump power cont. at 3400 rpm	kW [hp]	2.2 [2.95]	2.8 [3.75]	3.3 [4.4]
Maximum Pressure in the housing cont.	bar [psi]	4 [58]		
Maximum Pressure in the housing int	bar [psi]	6 [87]		

Theorical values, without considering the efficency; approximate values. Peak operations must not excide 1% of every minute. Avoid continuously working at simultaneusly maximum pressure and maximum speed.

Notes:

(1) For 075 displacement it is possible to achieve the displacement 81 cm^3/rev [4.941 in^3/rev]. For 128 displacement it is possible to achieve the displacement 136 cm^3/rev [8.296 in^3/rev]. Please contact our technical service for the technical specifications.

(2) Approximate values.

S6CV 075 - Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the S6CV 75 pumps.
Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering. We recommend to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Series	Pump	Size	Displacement limitation side A	Displacement limitation side B	Version	Flange	Shaft end	Direction of rotation	Control	Control feature	Charge pump	Pressure relief valve side A	Pressure relief valve side B	Charge pressure relief valve	Pressure compensator and cut-off valves	Cut-off valves feature	Filter	Through drive	Flushing valve	Pump feature	Painting
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

1

Series	
S6CV	Variable displacement axial piston pump for closed circuit

2

Pump	
P	Pump

3

Size	
075	75 cm^3/rev [4.575 in^3/rev]

4

Displacement limitation side A	
0+81	From 0 cm^3/rev to 81 cm^3/rev [4.940 in^3/rev]

5

Displacement limitation side B	
0+81	From 0 cm^3/rev to 81 cm^3/rev [4.940 in^3/rev]

S6CV 075 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

6

Version	
ME	ISO
SE	SAE

7

Mouting flange	
06	SAE-C 2/4 Bolts

Note:
For Tandem assembly check chapter “TANDEM COMBINATION DIMENSIONS”

8

Shaft end	
13	Splined 14T - 12/24 DP
AC	Splined 21T - 16/32 DP

9

Direction of rotation (viewed from shaft side)	
DX	CW
SX	CCW

10

Control	
HLR	Manual lever with feed-back
HIR	Hydraulic proportional with feed-back
HIN	Hydraulic proportional without feed-back
HER	Electric proportional with feed-back
HEN	Electric proportional without feed-back
HE2	Electric on-off
HEH	Electric proportional with emergency hydraulic override
HFD	Electric fan drive control
HME	Electric Automotive
HMI	Hydraulic Automotive

S6CV 075 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

11

Control features				Control									
				HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
IH	Inching		Hydraulic inching	–	–	–	–	–	–	–	_	●	●
IM			Mechanical inching	–	–	–	–	–	–	–	–	–	–
00			Without inching	–	–	–	–	–	–	–	–	●	●
12	Voltage	(V)	12 connector DIN 43650	–	–	–	●	–	●	●	–	●	–
24		(V)	24 connector DIN43650	–	–	–	●	–	●	●	–	●	–
D2		(V)	12 - Deutsch DT04	–	–	–	●	–	●	●	–	●	–
D4		(V)	24 - Deutsch DT04	–	–	–	●	–	●	●	–	●	–
N2		(V)	12 AMP JUNIOR	–	–	–	–	●	–	–	●	–	–
N4		(V)	24 AMP JUNIOR	–	–	–	–	●	–	–	●	–	–
00	Control orifices diameter [(1)]	mm [in]	Without control orifices	S	●	–	●	●	–	–	●	–	–
05		mm [in]	Ø 0.5 [Ø 0.019]	–	–	●	–	–	–	–	–	–	–
06		mm [in]	Ø 0.6 [Ø 0.024]	–	●	–	●	–	–	–	–	–	_
07		mm [in]	Ø 0.7 [Ø 0.027]	–	●	●	●	–	–	–	–	–	–
08		mm [in]	Ø 0.8 [Ø 0.031]	–	S	S	S	–	–	S	–	–	–
H8		mm [in]	Ø 0.8 [Ø 0.031]	–	●	–	–	–	–	–	–	–	–
09		mm [in]	Ø 0.9 [Ø 0.035]	–	●	●	–	–	–	–	–	–	–
10		mm [in]	Ø 1.0 [Ø 0.039]	–	●	–	–	–	–	–	–	–	–
12		mm [in]	Ø 1.2 [Ø 0.047]	–	●	–	–	–	S	–	–	S	S
15		mm [in]	Ø 1.5 [Ø 0.059]	–	–	–	–	–	–	–	–	●	●
20		mm [in]	Ø 2.0 [Ø 0.0787]	–	–	–	●	–	–	–	–	–	–
(*)	Starting speed	(rpm)		–	–	–	–	–	–	–	–	●	●
(*)	Maximum torque speed	(rpm)		–	–	–	–	–	–	–	–	●	●
(*)	Maximum torque value	(Nm)		–	–	–	–	–	–	–	–	●	●

(*) Supply the setting value.
• : Required
– : Not required
S: standard
[(1)] in case of the different response times, please you contact sales office

12

Charge pump		
00	Without charge pump	
18	Displacement 18 cm^3/rev [1.098 in^3/rev]	Standard
23	Displacement 23.1 cm^3/rev [1.41 in^3/rev]	
27	Displacement 27.3 cm^3/rev [1.647 in^3/rev]	

S6CV 075 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

13

Pressure relief valve side A		
25	250 bar [3625 psi]	
30	300 bar [4350 psi]	
35	350 bar [5075 psi]	
42	420 bar [6090 psi]	Standard

14

Pressure relief valve side B		
25	250 bar [3625 psi]	
30	300 bar [4350 psi]	
35	350 bar [5075 psi]	
42	420 bar [6090 psi]	Standard

15

Charge pressure relief valve			Control									
			HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
AE	20 bar a 1000 rpm [290 psi at 1000 rpm]		●	●	●	●	●	●	●	–	●	●
AF	22 bar a 1000 rpm [319 psi at 1000 rpm]	Standard	●	●	●	●	●	●	●	–	●	●
AG	25 bar a 1000 rpm [319 psi at 1000 rpm]		●	●	●	●	●	●	●	●	●	●

16

Pressure compensator and Cut-Off valves			Control									
			HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
XX	Without pressure compensator	Standard	–	–	–	–	●	–	–	●	●	●
PC	Pressure compensator		●	●	●	●	–	●	●	●	–	–
TE	Electric Cut-Off		●	●	●	●	–	●	●	–	–	–
EP	Electric Cut-Off + Pressure Compensator		●	●	●	●	–	●	●	–	–	–

17

Cut-Off valves feature			Cut-Off valves			
			XX	PC	TE	EP
000	Feature not necessary		●	–	–	–
000	Pressure setting (bar)	Locked	–	●	–	●
100÷400	Pressure setting (bar)	100÷400 bar (*)	–	●	–	●
12	Voltage	12 V	–	–	●	●
24	Voltage	24 V	–	–	●	●

• : Required
– : Not required
(*) Supply the setting value

S6CV 075 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

18

Filter			Control									
			HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
XX	Without Filter	Standard	•	•	•	•	•	•	•	•	•	•
M8	Optical clogging sensor (8 bar) [116 psi]		•	•	•	•	•	•	•	•	–	–
E9	Electric clogging sensor (8 bar) [116 psi]		•	•	•	•	•	•	•	•	–	–
E3	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector		•	•	•	•	•	•	•	•	–	–
E2	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector with LED 24V		•	•	•	•	•	•	•	•	–	–
E1	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector with LED 12V		•	•	•	•	•	•	•	•	–	–
FR	Through drive remote filter		•	•	•	•	•	•	•	•	=	=

• : Available
– : Not available
= : Not available for HME/HMI + Cut-Off valve TE/TP

Note:
E9 feature as “Standard production” for electric clogging sensor

19

Through drive		
Through drive for 2ndPump assembled by the customer		
XX	Without through drive	Standard
SA	SAE A = Z9 - 16/32 DP	
SB	SAE B = Z13 - 16/32 DP	
BB	SAE B-B = Z15 - 16/32 DP	
SC	SAE C = Z14 - 12/24 DP	
CC	SAE C-C = Z17 - 12/24 DP	
G2	GR2 L = 4	
G3	GR3	
Through drive for 2nd pump assembled by Dana		
TA	Tandem through drive with flange SAE A = 9T - 16/32 DP	
TB	Tandem through drive with flange SAE B = 13T - 16/32 DP	
TZ (1)	Tandem through drive with flange SAE B-B = 15T - 16/32 DP (Special for S5AV 032/045/050/063 pumps)	
TY (2)	Tandem through drive with flange SAE B - DIN 5480 W35x2x30x16x9g (Special for S5AV 050/063 pumps)	
BT	Tandem through drive with flange SAE B-B = 15T - 16/32 DP	
TC	Tandem through drive with flange SAE C = 14T - 12/24 DP	
TX	Tandem through drive with flange SAE C = 21T - 16/32 DP	

(1) Tandem S6CV 75 + S5AV 032/045/050/063 with shaft Z15 16/32 DP
(2) Tandem S6CV 75 + S5AV 050/063 with shaft DIN 5480 W35x2x30x16x9g

S6CV 075 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

20

Flushing valve		Controls									
		HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
XX	Not request	●	●	●	●	●	●	●	●	●	●
PR	Arranged for Flushing Valve	–	–	–	–	–	–	–	–	●	●
06	6 l/min [1.58 U.S. gpm] Orifice Diameter Ø 1.5 [0.005]	–	–	–	–	–	–	–	–	●	●
09	10.5 l/min [2.77 U.S. gpm] Orifice Diameter Ø 2.0 [0.07]	–	–	–	–	–	–	–	–	●	●
15	15 l/min [3.96 U.S. gpm] Orifice Diameter Ø 2.5 [0.09]	–	–	–	–	–	–	–	–	●	●

• : Available
– : Not available

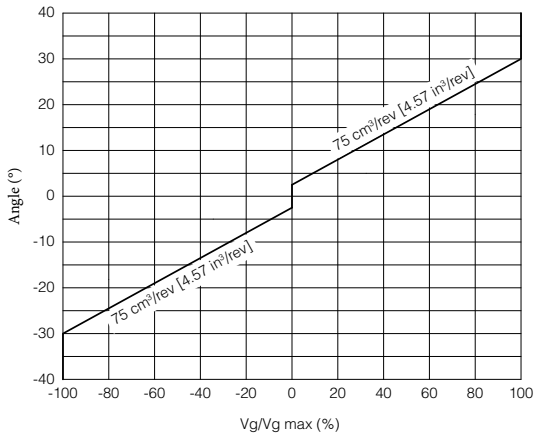
21

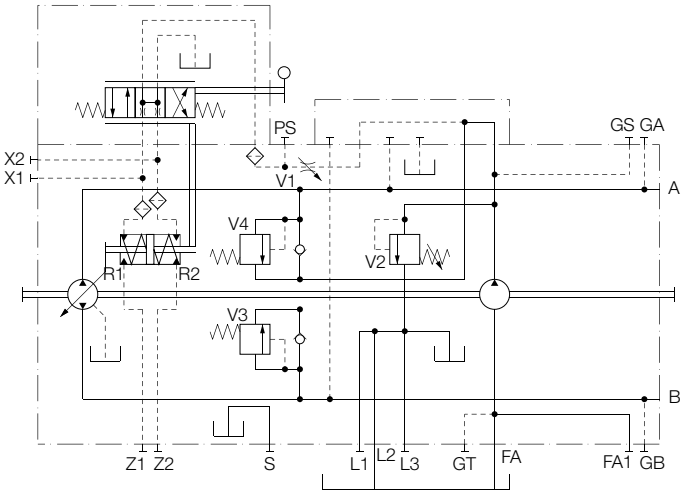
Pump Feature	
XXX	Not request
BPV	By Pass valve
DT4	Conversion cable from DIN43650/ISO4400 to Deutsch DT04 connector

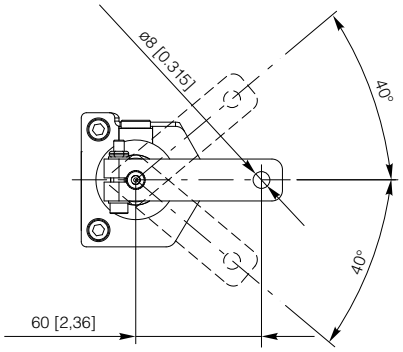
22

Painting	
XX	Not request
01	Black Painted RAL 9005

The displacement of the pump is directly proportional to the angle of rotation of the lever. The feedback system feels the position of the swashplate and works automatically to compensate for a positioning error. The diagram below shows the ralationship between angle and displacement.





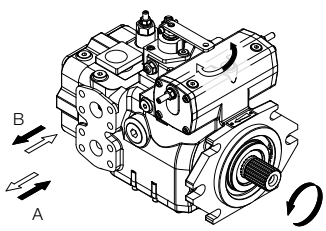


The torque necessary at the control lever is between 1 and 2.45 Nm [0.737 and 1.80 lbf·ft].

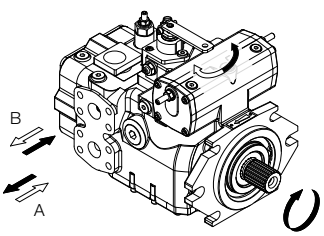
Note:
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

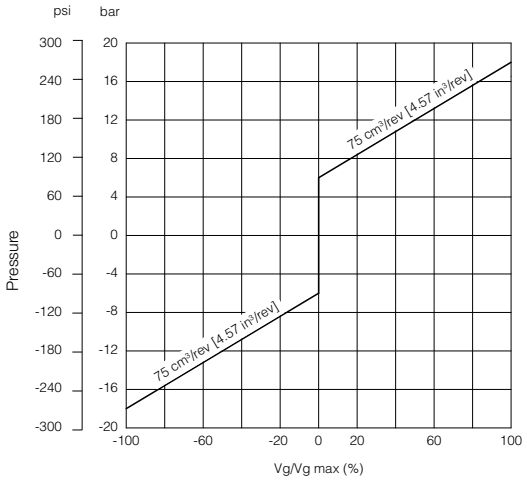
HLR (CCW)

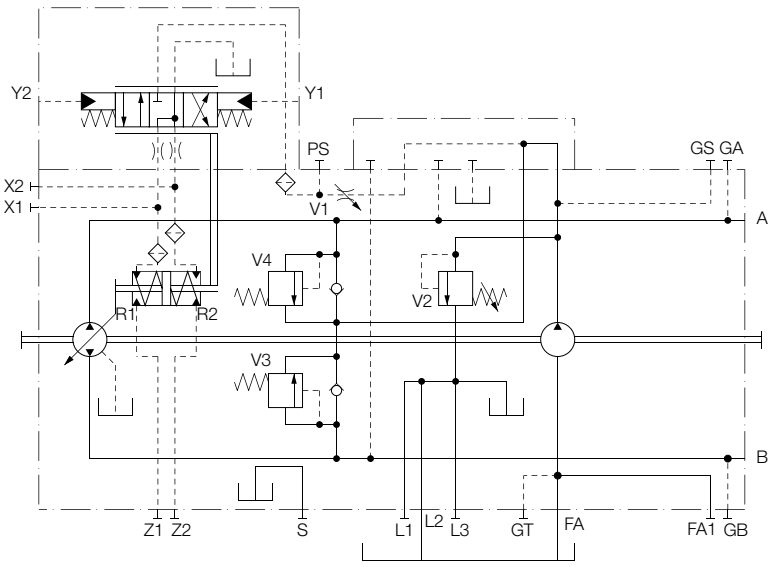


HLR (CW)



The pump displacement is proportional to the pilot pressure on Y1 or Y2 ports, which also affect flow direction. The feedback system feels the position of the swashplate and works automatically to compensate for a positioning error. Piloting can be provided by boost pressure from GS port. The piloting pressure will then have to be controlled by a joystick or by a pressure reducing valve (not supplied).





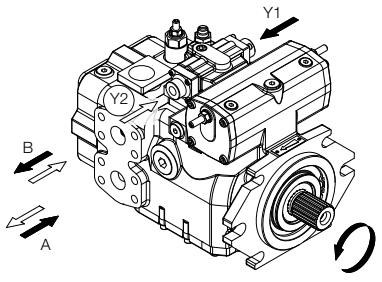
Pilot pressure = 6÷18 bar [87÷261 psi] (at ports Y1, Y2)
Start of control = 6 bar [87 psi]
End of control = 18 bar [261 psi] (Max displacement)

Note:
The tolerance on piloting pressure is ± 10% of maximum value.

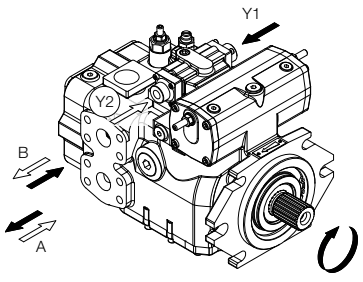
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HIR (CCW)



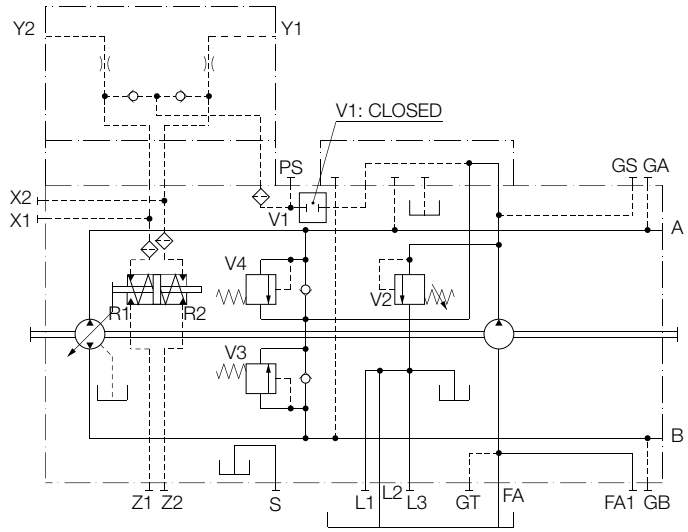
HIR (CW)



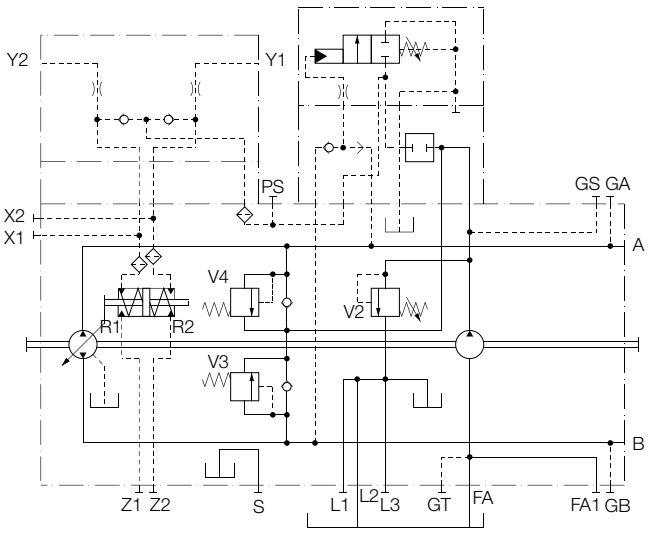
The pump displacement is proportional to the pilot pressure on Y1 or Y2 piloting ports, which also affect flow direction. The flow is also influenced by the working pressure and by the rotation speed of the pump. With a given input signal (piloting pressure) the pump can vary the displacement and the flow when working pressure or rotating speed change. Feeding pressure to the control joystick can be provided by charge pressure from GS port. The piloting pressure must then be controlled by said joystick or by a pressure reducing valve (not supplied). The orifice dimensions must be choosed in function of the response time required, see the table below.

Warning:
HIN control could require working parameters review. Please contact Dana technical service

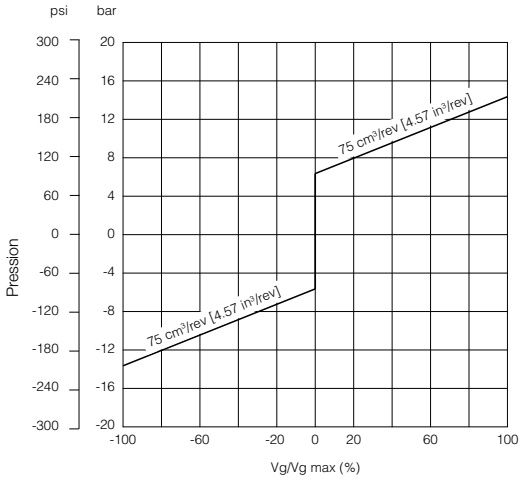
HIN



HIN with cut-off valves



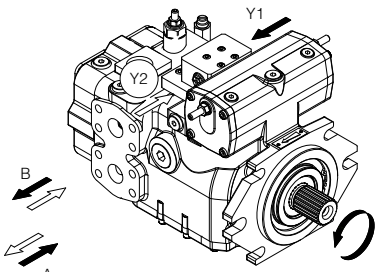
Pilot pressure = 6÷14 bar [87÷ 203 psi] (at ports Y1, Y2)
Maximum Pilot pressure = 30 bar [435 psi]
Start of control = 6 bar [87 psi]
End of control = 14 bar [203 psi](Max displacement)



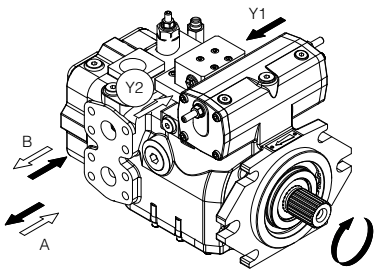
Note:
The tolerance on piloting pressure is ± 10% of maximum value.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HIN (CCW)

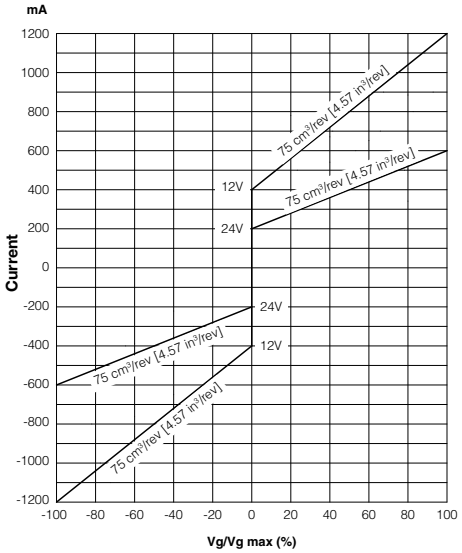


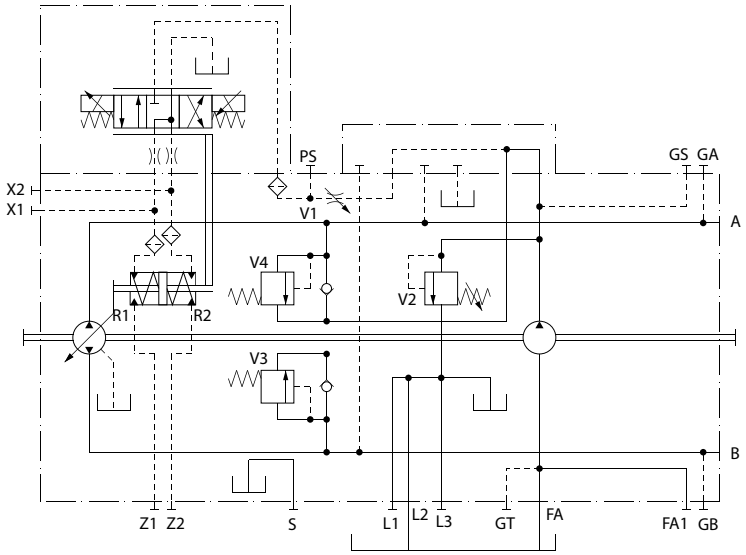
HIN (CW)



S6CV 075 - Electric proportional control with feed-back

The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids. The feedback system feels the position of the swashplate and works automatically to compensate for a positioning error. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for S6CV. Flow direction depends on which solenoid is energized. Standard solenoids are proportional at 24V d.c. max. current 1A. (Optional solenoids 12V d.c. max. current 2A).
For emergency operation only it is however possible to control solenoids directly with 24V d.c.voltage (or 12V d.c.), by-passing the amplifier.





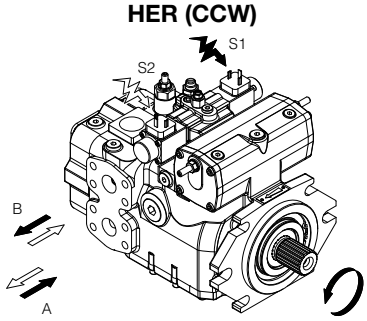
Solenoid 24V:
Current min. 200 mA max 600 mA
Solenoid 12V:
Current min. 400 mA max 1200 mA

Note:
The tolerance on piloting current is ± 10% of maximum value.

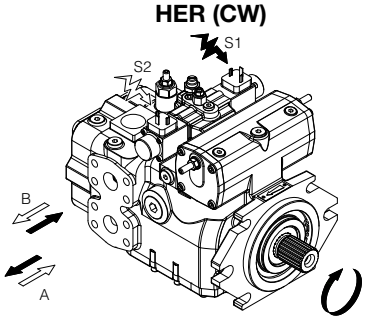
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HER (CCW)

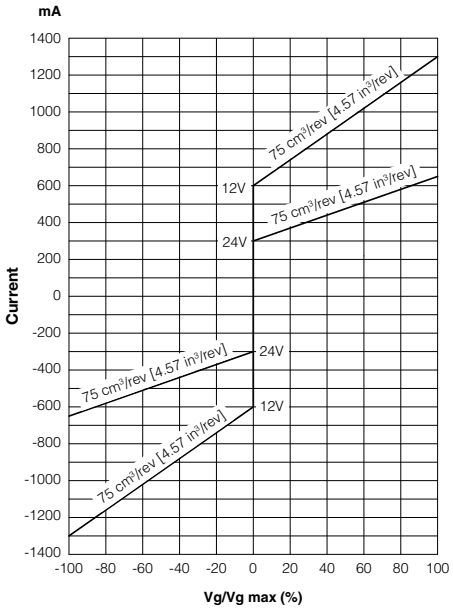


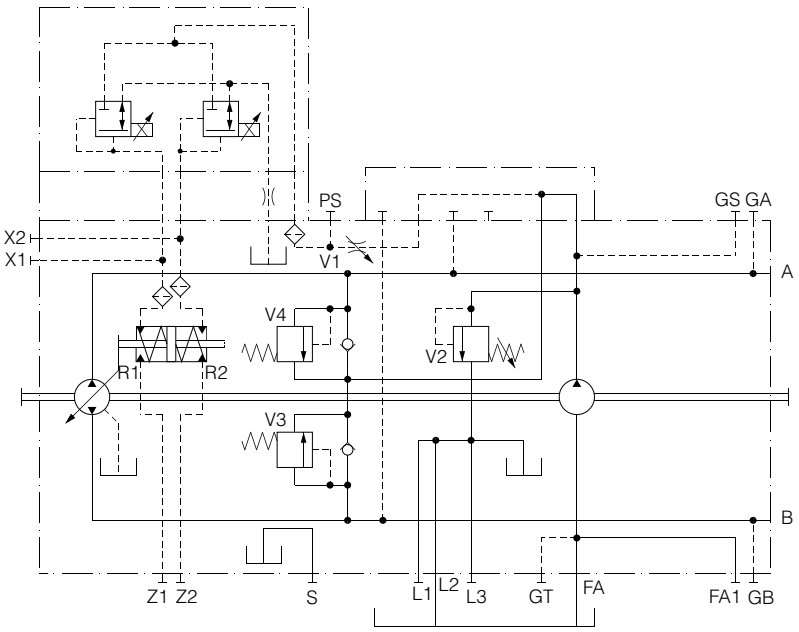
HER (CW)



The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids. The flow is also influenced by the working pressure and by the rotation speed of the pump. With a given input signal (piloting current) the pump can vary the displacement and the flow when working pressure or rotating speed change. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for S6CV. Flow direction depends on which solenoid is energized. Standard solenoids are proportional 24V d.c. max. current 1A. (Optional solenoids 12V d.c. max. current 2A). For emergency operation only it is however possible to control solenoids directly with 24V d.c.voltage (or 12V d.c.), by-passing the amplifier.

Warning:
HEN control could require working parameters review. Please contact Dana technical service



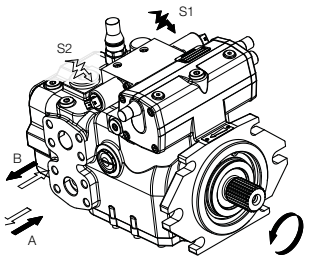


Solenoid 24V:
Current min. 300 mA max 650 mA
Solenoid 12V:
Current min. 600 mA max 1300 mA

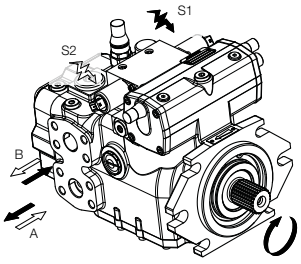
Note:
The tolerance on piloting current is ± 10% of maximum value.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

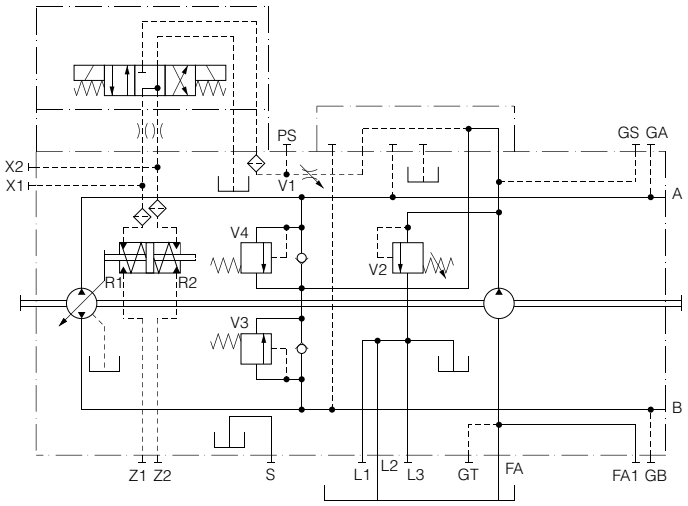
HEN (CCW)



HEN (CW)

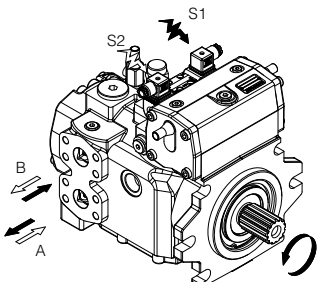


By switching on one of the solenoids the pump swivels to maximum displacement in the corresponding output flow direction.
Switching off the stated solenoid will result in swivelling back the pump to zero displacement position.

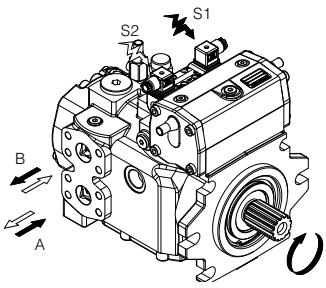


Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

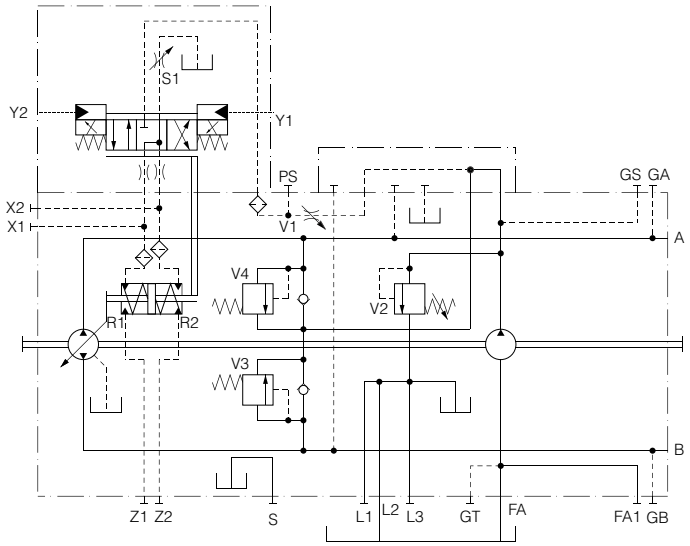
HE2 (CCW)



HE2 (CW)



This control has the same electric proportional features of HER control, but it also has an emergency hydraulic proportional control capability when a pilot pressure on Y1 and Y2 ports. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for S6CV. Hydraulic operation of HEH control is meant to be an emergency device to control displacement of the pump in case of a breakdown of the electric circuit. A pilot pressure of 22 bar [319 psi] is required to swivel the pump to max displacement in emergency operation.

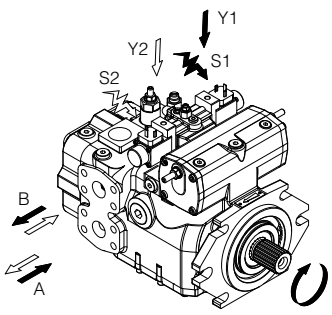


Warning:
Y1 and Y2 ports must not have any back pressure durino normal electric control operation (vented to tank).

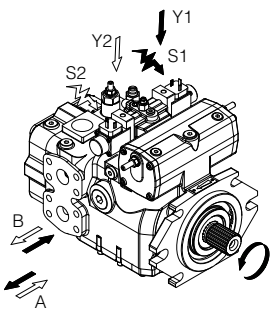
Note:
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HEH (CCW)

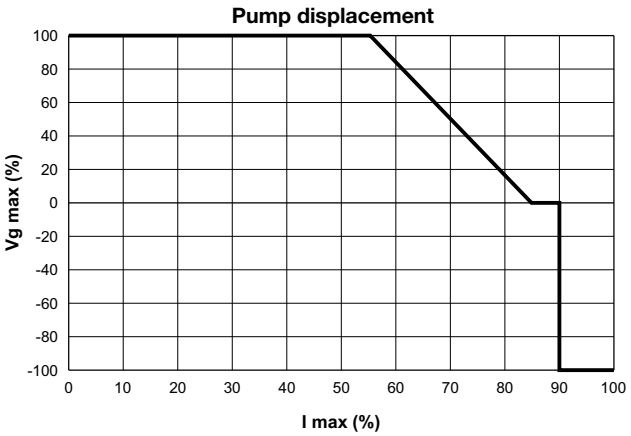


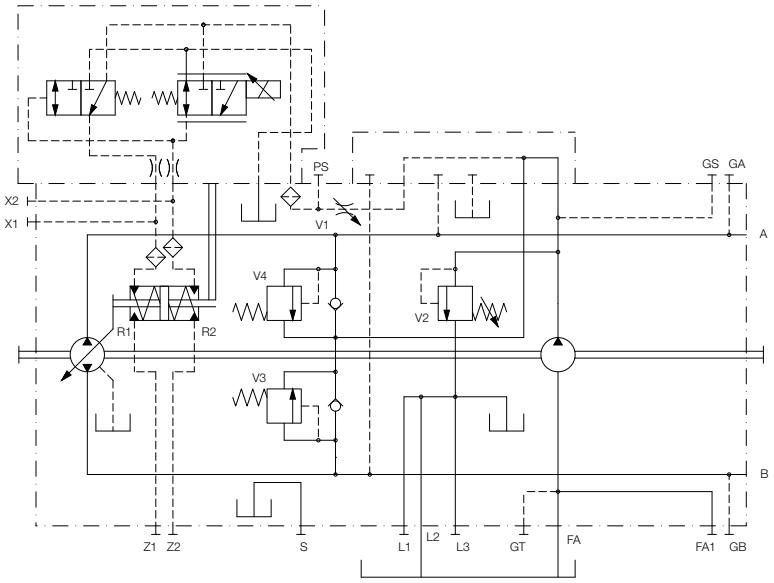
HEH (CW)



S6CV 075 - Electric fan drive control HFD

Fan drive control (HFD) is a non-feedback control electrically operated.
Pump displacement is directly proportional to the input current on the proportional solenoid. Flow is also influenced by working pressure and rotation speed, with a given input signal pump can vary displacement and flow due to working pressure and speed rotation variation.
Input current must be control by an external amplifier.
Flow direction depends on pump direction of rotation and on input current (see below diagram).



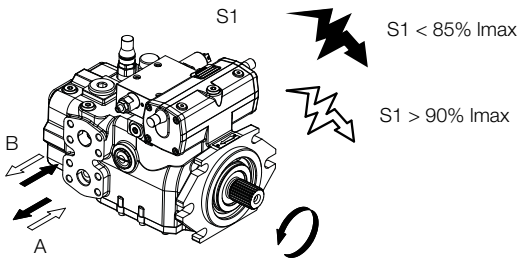


Voltage	I max	Protection	Resistance	Connector
12 VDC	1.5 A	DIN VDE 0470 / EN 60 529 -IP65	3.85 Ohm	AMP Junior Timer
24 VDC	0.75 A		15.15 Ohm	

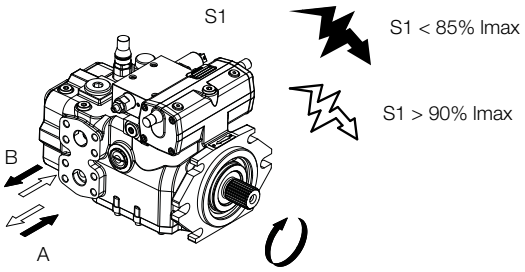
Minimum boost pressure 25 bar - 363 PSI.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.
Flow direction depending to the I max current value.

HFD (CCW)



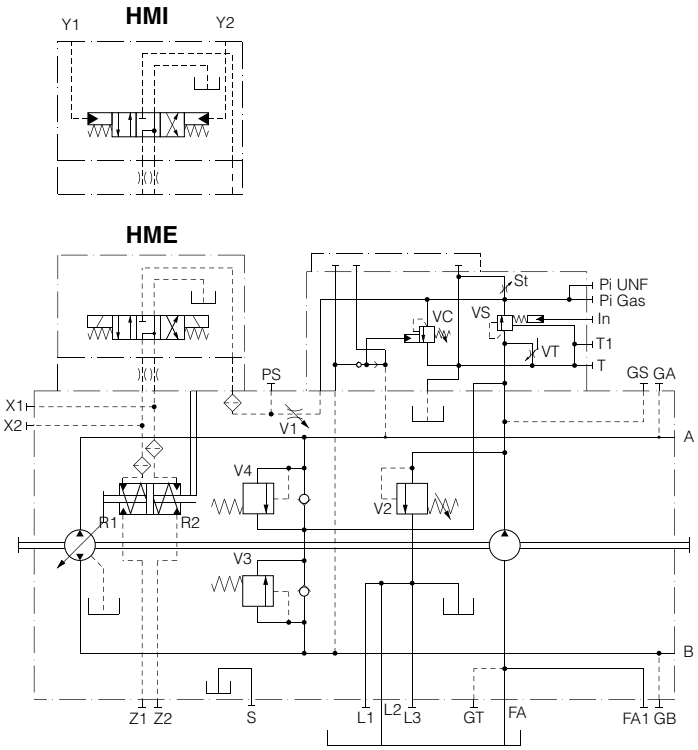
HFD (CW)



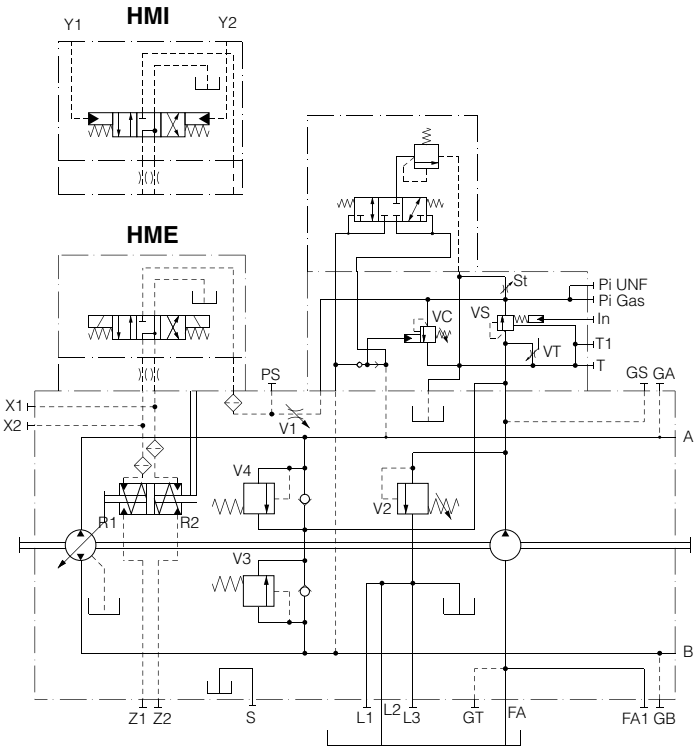
The “AUTOMOTIVE” (speed related) control, is used in hydrostatic transmissions with closed loop variable displacement pumps. This kind of controls allows to:
- Control of the vehicle translation speed;
- Limit the amount of Torque required from the Engine;
- Inching of the vehicle speed. The control of the Inching valve can be done with an hydraulic signal (Minimum 12 bar [174 psi] is required to swivel the pump to null displacement) or with a lever.
- Possibility to control the direction of flow electrically (HME) and hydraulically (HMI).

To allows an oil cooling action, when operating at high speed and power, it is possible to mount a flushing valve.

Electric (HME) / hydraulic (HMI) automotive with hydraulic Inching (IH)

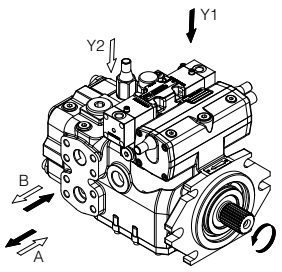


Electric (HME) / hydraulic (HMI) automotive with hydraulic Inching (IH) + Flushing valve

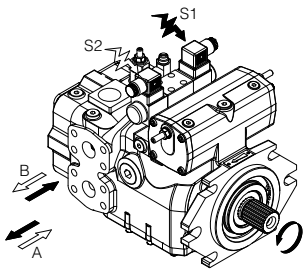


Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

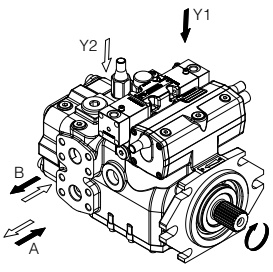
HMI (CCW)



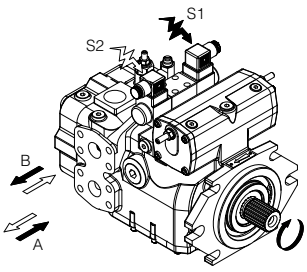
HME (CCW)



HMI (CW)



HME (CW)

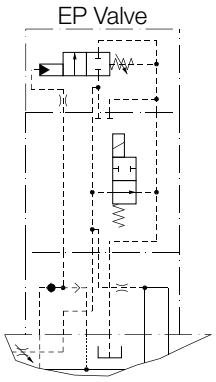


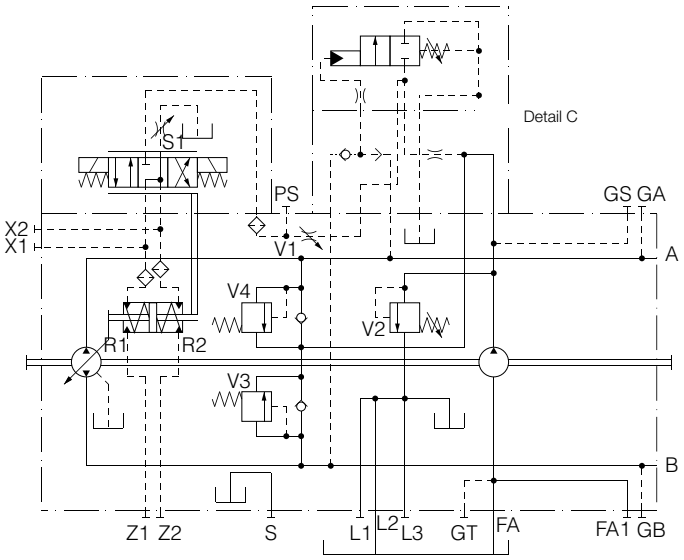
16 Pressure compensator and Cut-Off valve

PC Pressure compensator valve

The pressure compensator valve is meant to avoid opening of the relief valves: whenever working pressure reaches the PC valve setting, the swashplate is swivelled back reducing flow. The valve allows to maintain a costant pressure in the circuit at the setting value. It is advisable to fit the cut-off valve to all system where pressure peaks close to the relief valves setting value occur or in hydraulic systems engineered to the maximum pump pressure. It is recommended to set the pressure cut-off valve at 30 bar [435 psi] lower than the high pressure relief valve setting. Setting range:100÷400 bar [1450÷5800 psi].

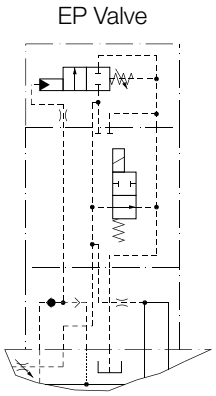
Note:
The pressure compensator valve is standard on HD1 pump and it can be combined with TE (EP) valve.

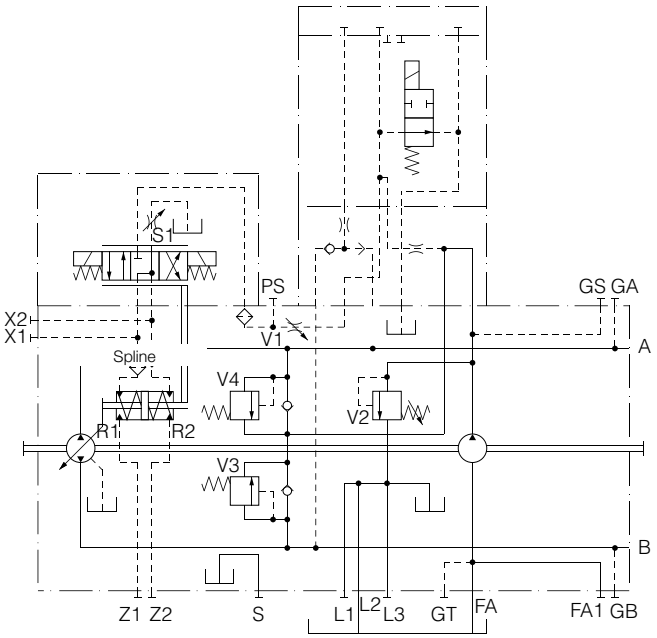




TE Electric Cut-Off valve

The electric cut-off valve, directly flangeable on S6CV pump housing, swivels back to zero the pump flow when power supply to the ON/OFF solenoid is cut-off. This valve has been designed for applications subject to safety rules, which required stopping of the machine in case of no electric signal. Feed voltage is 24V d.c. (optional 12V d.c.).

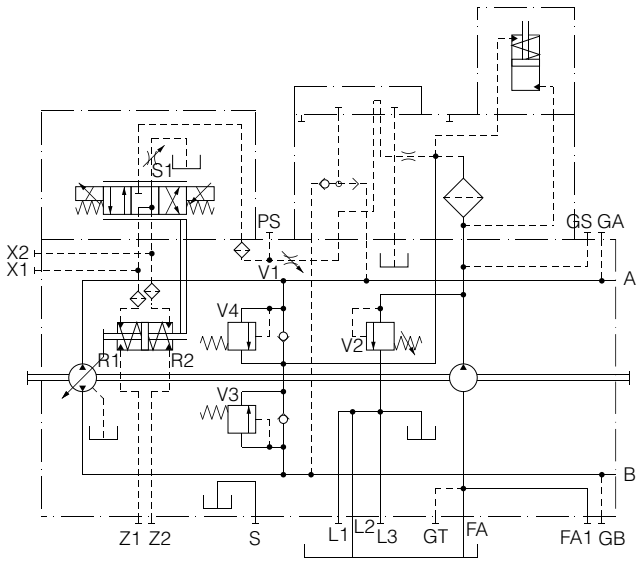




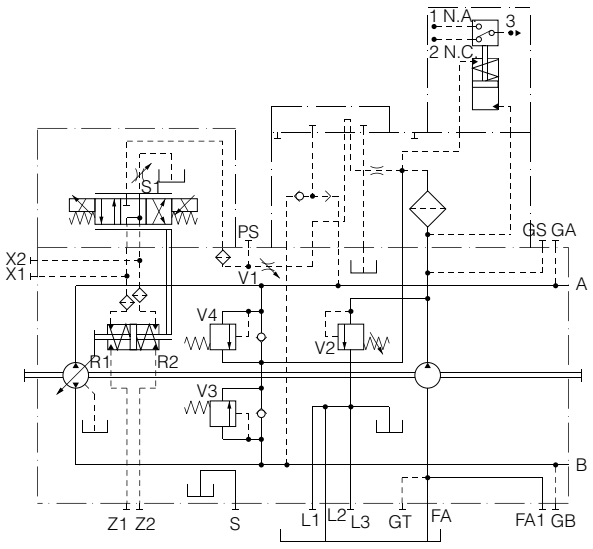
18 Filter

In order to guarantee an optimum fluid contamination level in the closed loop the S6CV can be equipped with a filter positioned on the delivery outlet of the charge pump. Only the flow necessary to reintegrate the lost oil due to leakage will pass through the filter, all the excess flow is not filtered and discharged through the pump drain line. In this way a longer life of the filter is achieved. The filter contains a composite fibre filtering element, with capacity of 12 micron absolute. The system uses sensors of clogging differential pressure of 8 bar [116 psi]) in optical and electrical (Connector DIN43650/ISO4400) version.
It is available a conversion cable from DIN43650/ISO4400 to Deutsch DT04 connector. The filter is without by-pass.
It is available a Remote Filter version for filtering in filter pressure not mounted on the pump.
It's possible to combine the filter with both cut-off valves.

M8 Optical sensor

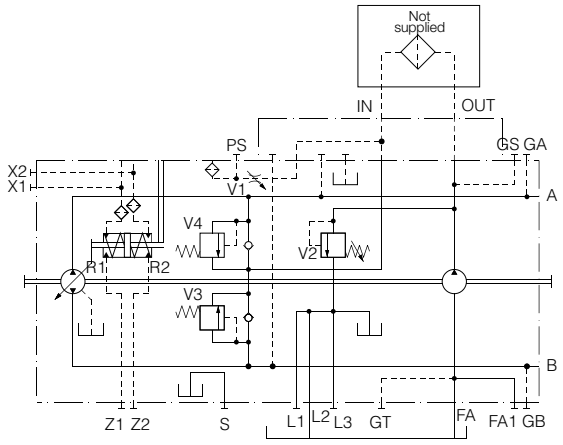


E1 - E2 - E3 - E9 Electrical sensor

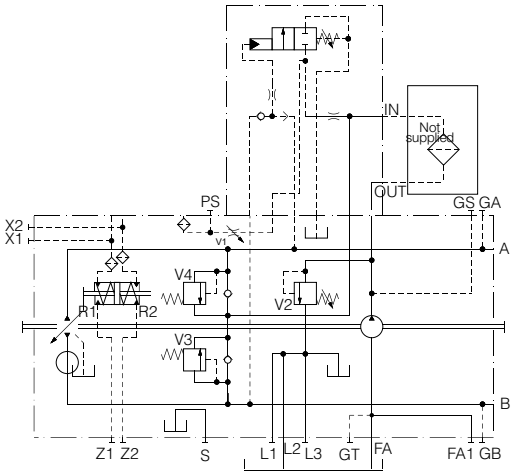


Share contact SPDT	Max. resistive load	Max. inductive load
C.A./A.C. 125-250 V	1 A	1 A
C.C./D.C. 30V	2 A	2 A
C.C./D.C. 50V	0.5 A	0.5 A
C.C./D.C. 75V	0.25 A	0.25 A
C.C./D.C. 125V	0.20 A	0.03 A

FR Remote filter



FP Remote filter + Cut-Off valve (FR+PC = FP)

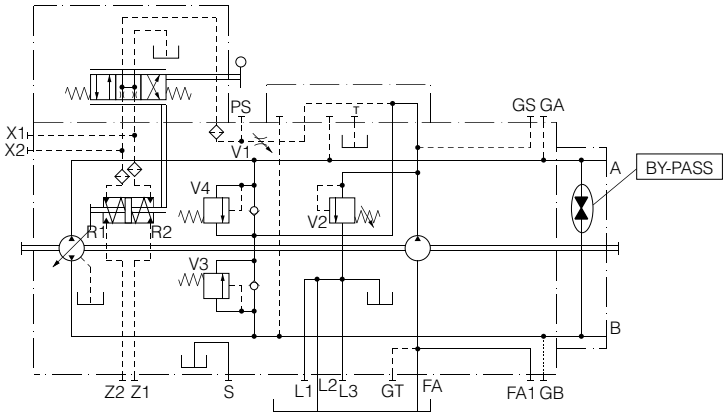


S6CV 075 - By-Pass valve

21 Pump feature

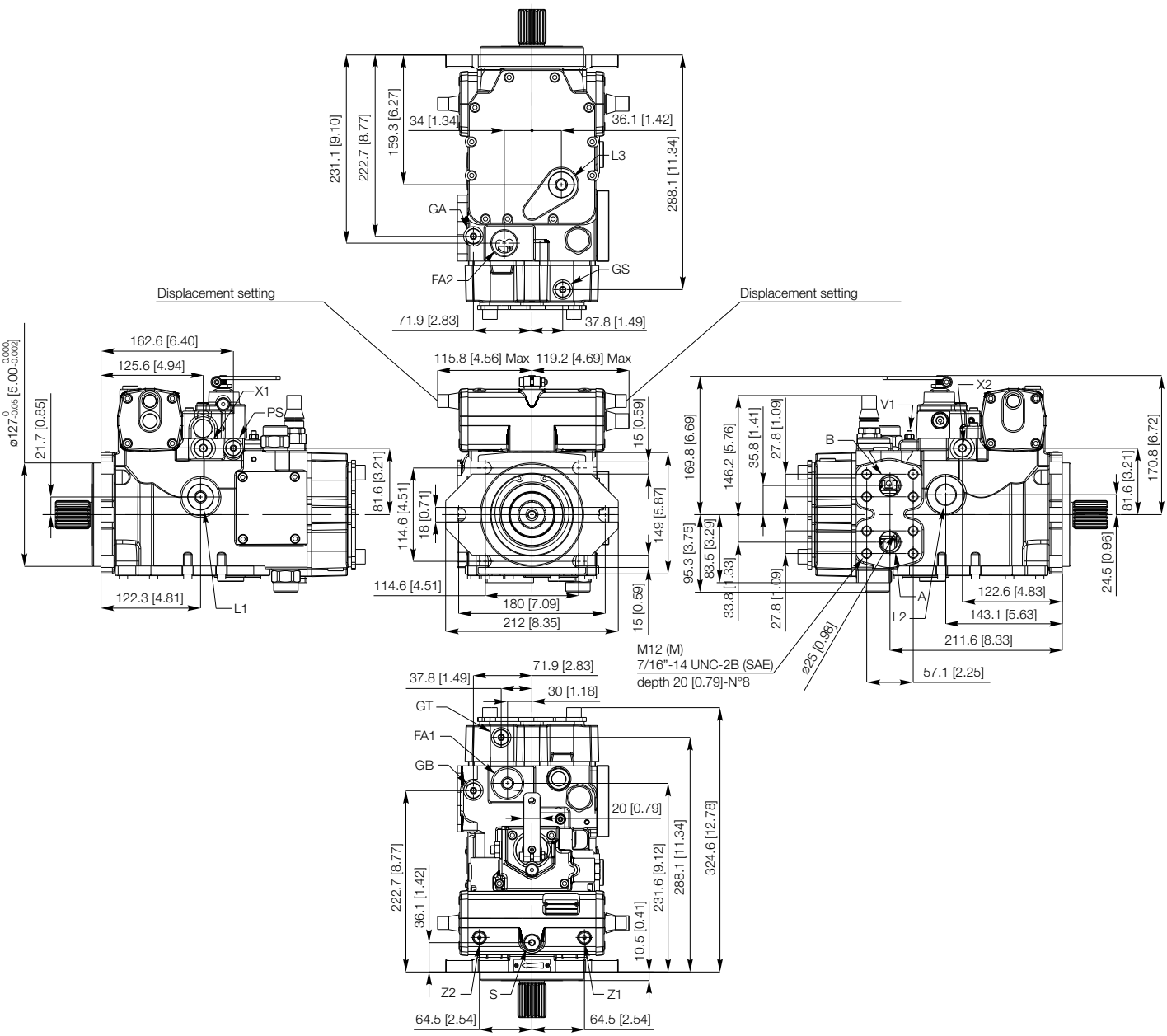
BPV By-Pass valve

The By-pass valve allows, if necessary, to connect the pressure port line A and B.
To open the valve unlock the locking nut and turn the screw 6 turns counter-clockwise



10 Control

HLR

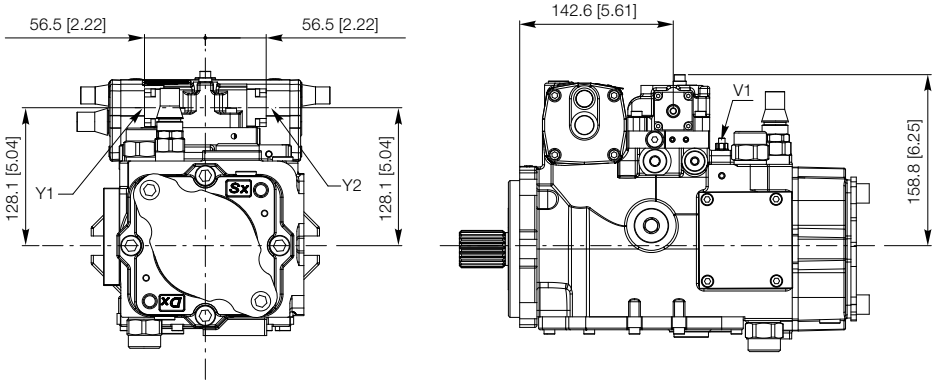


	Ports	ISO	SAE
A-B	Pressure ports	1" SAE 6000 psi	
L1-L2-L3	Case drain ports	3/4" G (BSPP) Depth 15	1-1/16"-12UN-2B Depth 15
FA1-FA2	Boost pump suction port	1" G (BSPP) Depth 21	1-5/16"-12UN-2B Depth 24
GA-GB	Pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
GS	Boost pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
PS	Control pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
X1-X2	Gauge port stroking chamber	3/8" G (BSPP) Depth 13	
S	Bleed port	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
Z1-Z2	Control pressure gauge	1/8" G (BSPP) Depth 10	7/16"-20UNF-2B Depth 16
GT	Boost inlet pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Prof.16
V1	Adjustable throttle valve		

S6CV 075 - Pump and controls dimensions

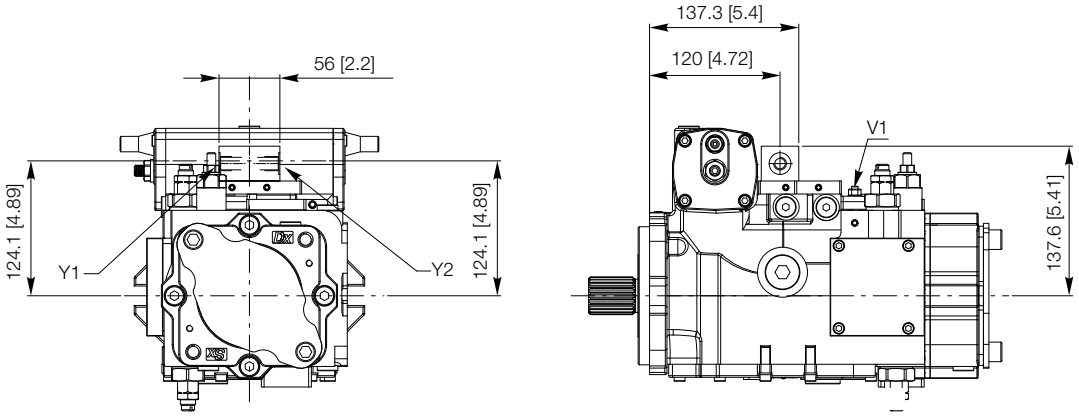
10 Control

HIR



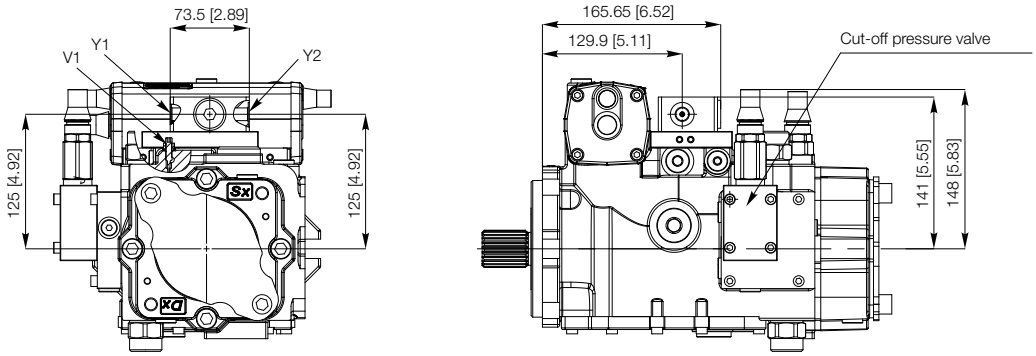
Y1, Y2: Control piloting pressure ports -1/4” G (BSPP) (ISO) - 7/16” - 20 UNF 2B (SAE)
V1: Adjustable throttle valve

HIN



Y1, Y2: Control piloting pressure ports -1/4” G (BSPP) (ISO) - 7/16” - 20 UNF 2B (SAE)
V1: Adjustable throttle valve

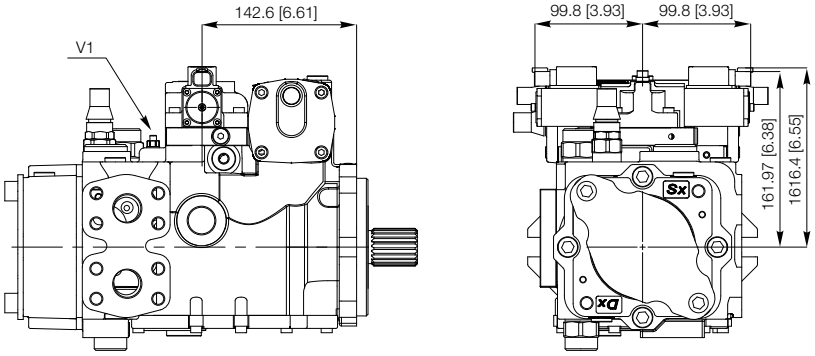
HIN with Cut-Off valve



Y1, Y2: Control piloting pressure ports -1/4” G (BSPP) (ISO) - 7/16” - 20 UNF 2B (SAE)
V1: Adjustable throttle valve

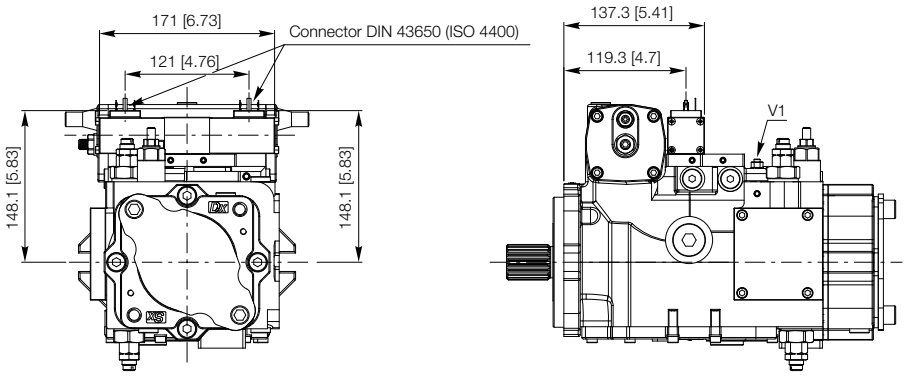
10 Control

HER



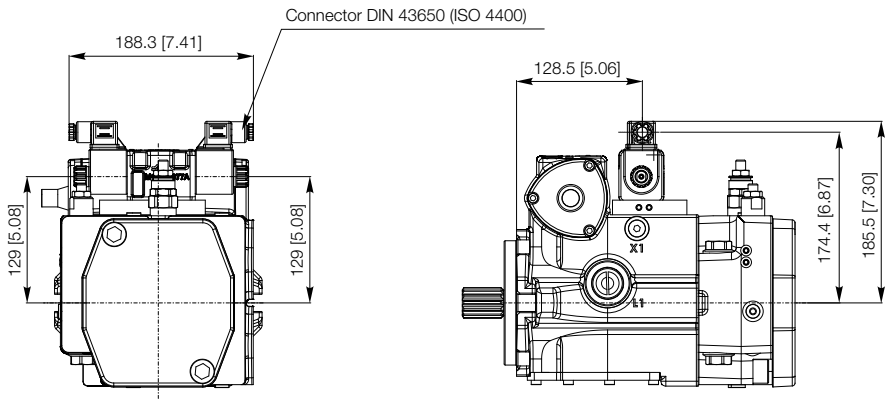
V1: Adjustable throttle valve

HEN



V1: Adjustable throttle valve

HE2

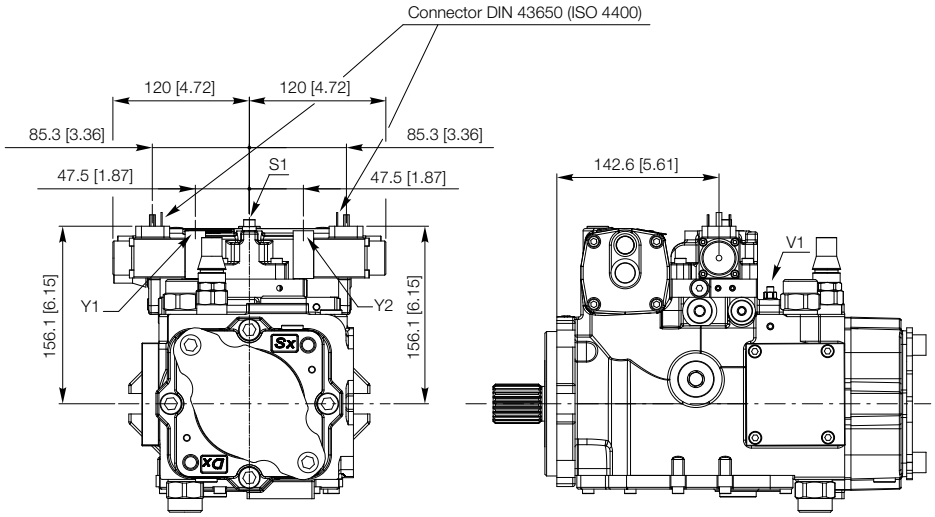


V1: Adjustable throttle valve

S6CV 075 - Pump and controls dimensions

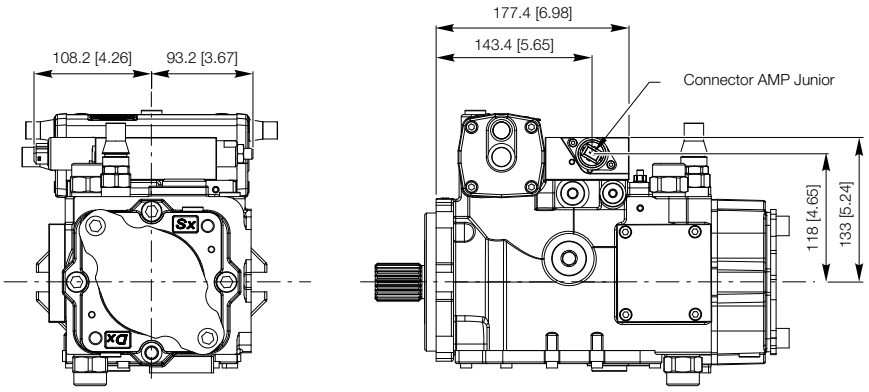
10 Control

HEH



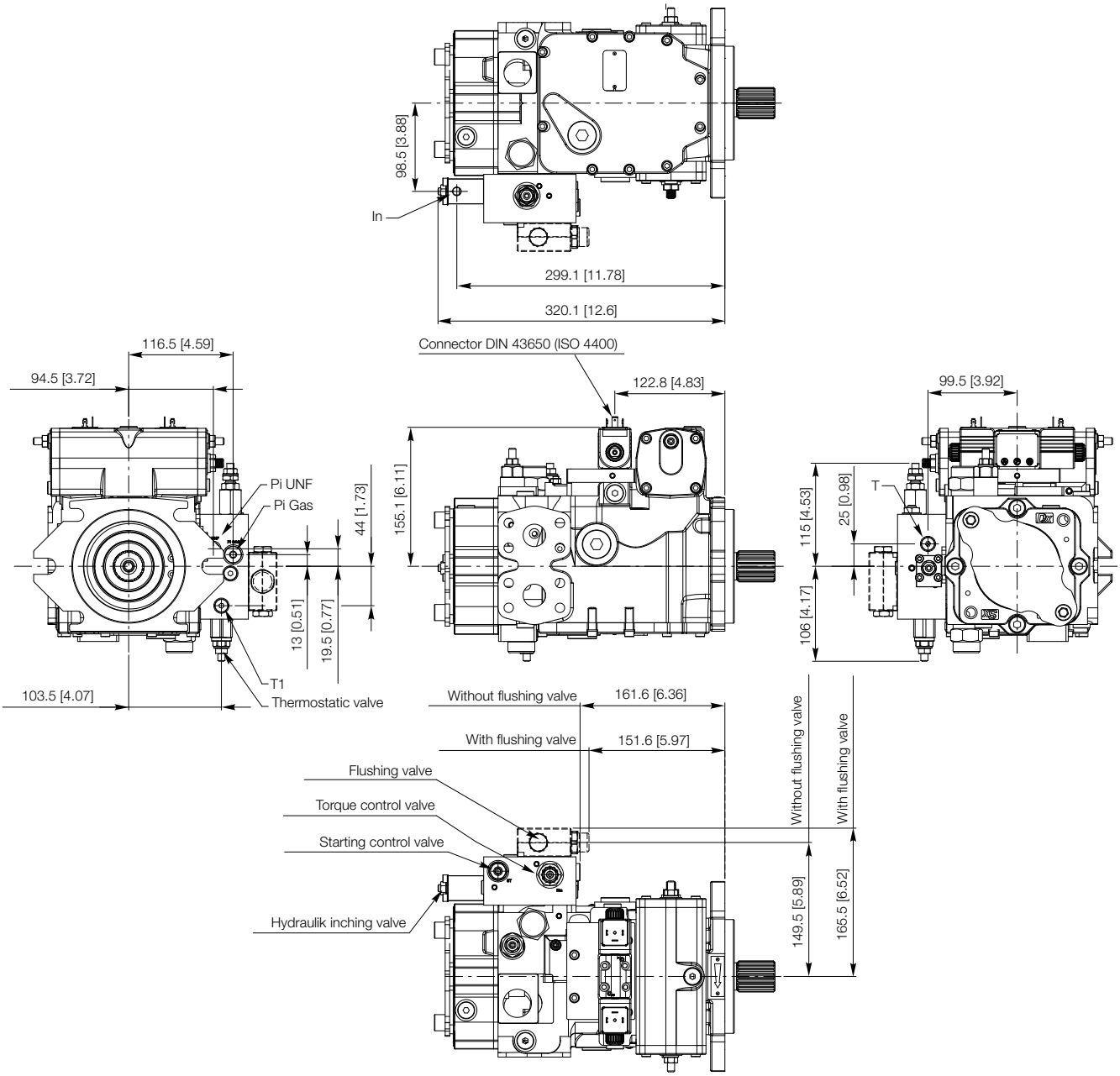
Y1, Y2: Control piloting pressure ports -1/8” G (BSPP) (ISO) - 5/16” - 24 UNF (SAE)
V1: Adjustable throttle valve

HFD



10 Control

Automotive HME with hydraulic Inching (IH)

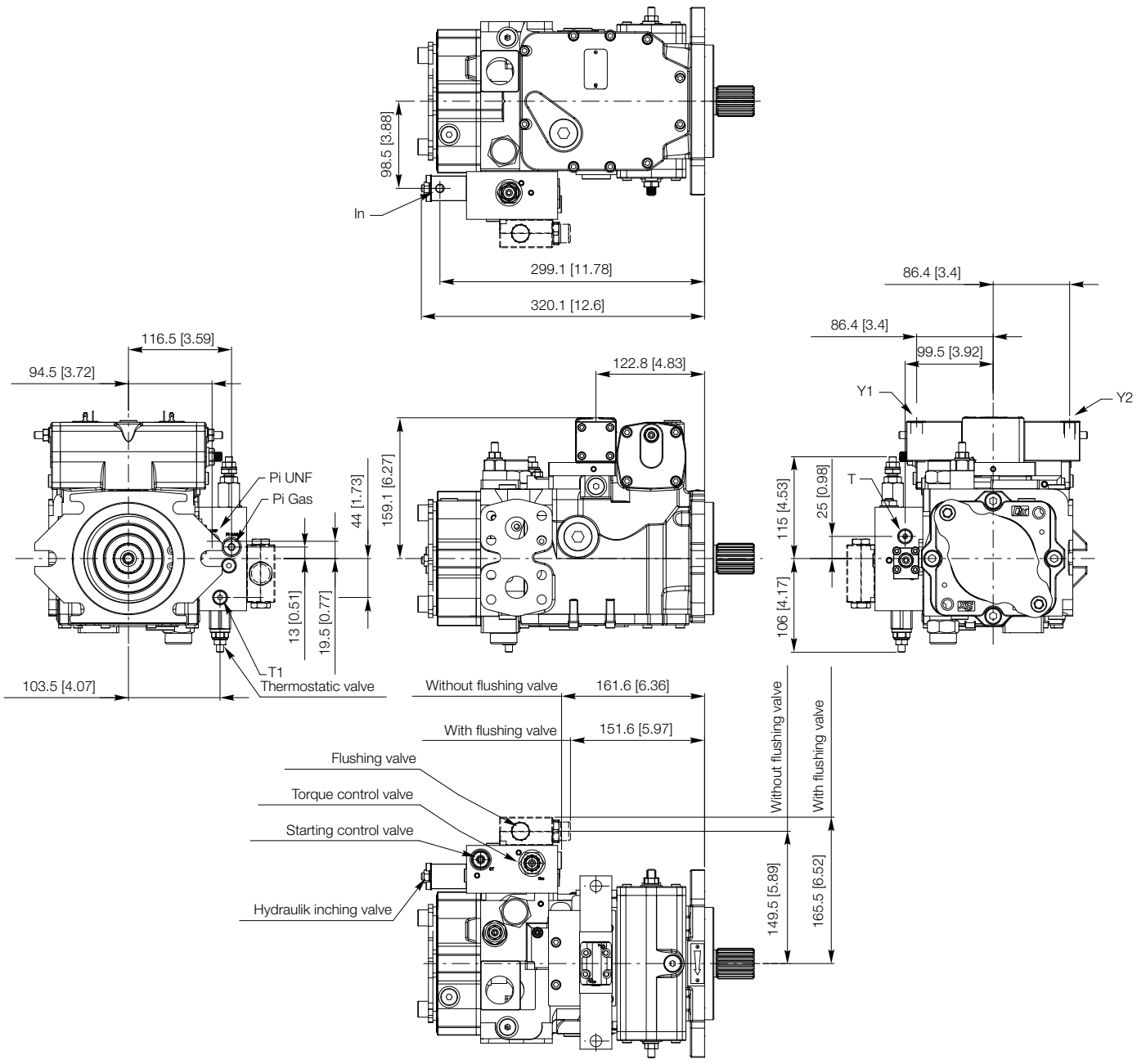


Pi Gas: Piloting pressure gauge port - 1/4 G (BSPP) (ISO)
Pi UNF: Piloting pressure gauge port - 7/16" - 20 UNF (SAE)
In: Piloting pressure Inching port - 1/8 G (BSPP) (ISO) - 7/16" - 20 UNF with Nipple (SAE)
T1: Drainage pressure gauge port - 1/8 G (BSPP)
T: Drainage pressure gauge port - 1/4 G (BSPP)

S6CV 075 - Pump and controls dimensions

10 Control

Automotive HMI with hydraulic Inching (IH)



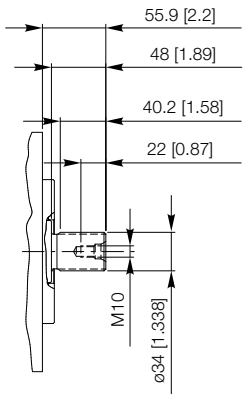
Y1-Y2: Control piloting pressure ports - 1/4” G (BSPP) (ISO) - 7/16” - 20 UNF with Nipple (SAE

Pi Gas: Piloting pressure gauge port - 1/4” G (BSPP) (ISO)
Pi UNF: Piloting pressure gauge port - 7/16” - 20 UNF (SAE)
In: Piloting pressure Inching port - 1/8” G (BSPP) (ISO) - 7/16” - 20 UNF with Nipple (SAE)
T1: Drainage pressure gauge port - 1/8” G (BSPP)
T: Drainage pressure gauge port - 1/4” G (BSPP)

10 Shaft end

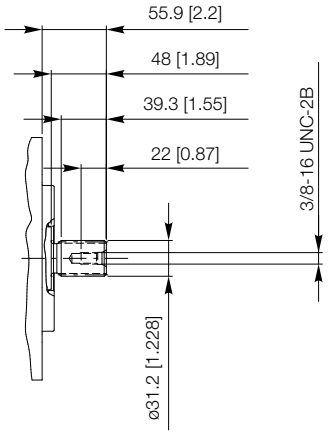
AC Splined shaft

SAE 1-3/8” 21T 16/32 - FLAT ROOT CLASS 5
ANSI B92.1a - 1976



13 Splined shaft

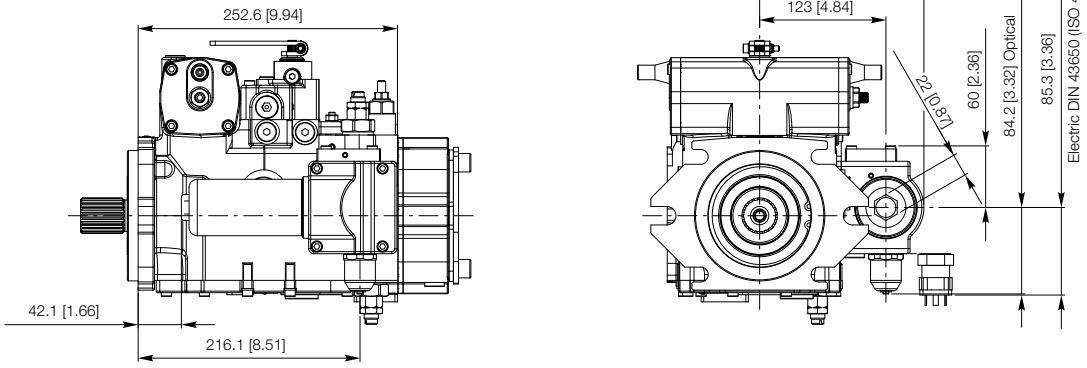
SAE 1-1/4” 14T 12/24 DP - FLAT ROOT CLASS 5
ANSI B92.1a - 1976



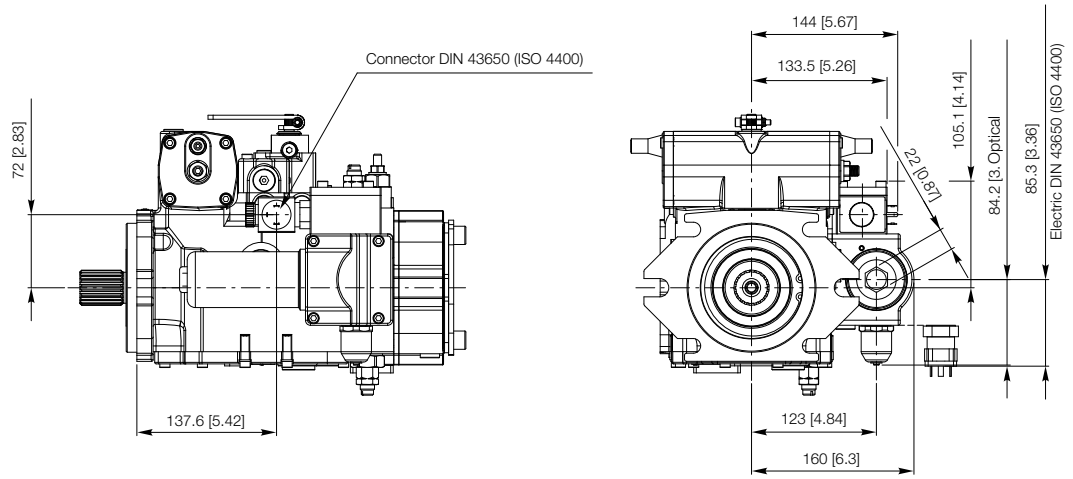
S6CV 075 - Pump and accessories dimensions

16 + 18 Pressure compensator and Cut-Off + Filter

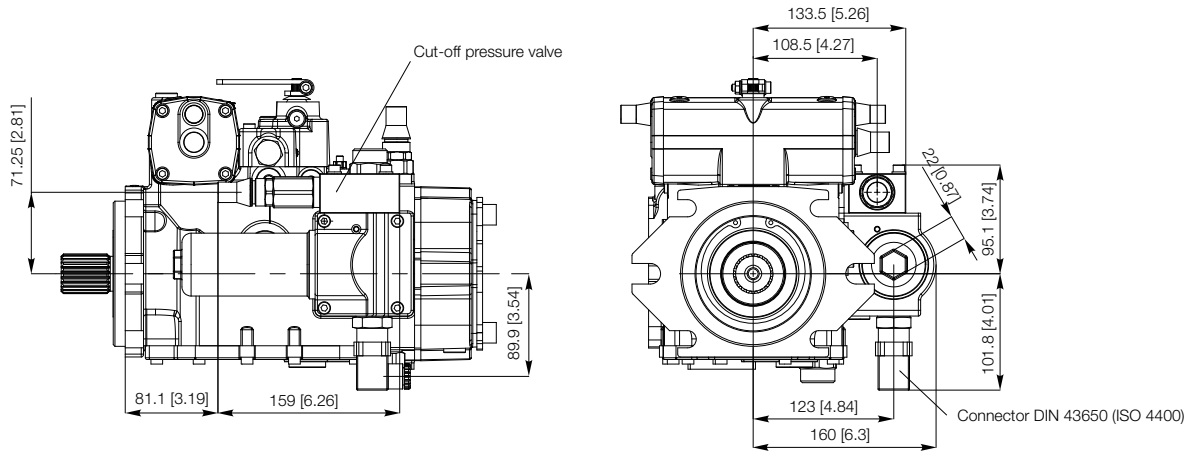
Filter



TE Filter + Electric Cut-Off valve

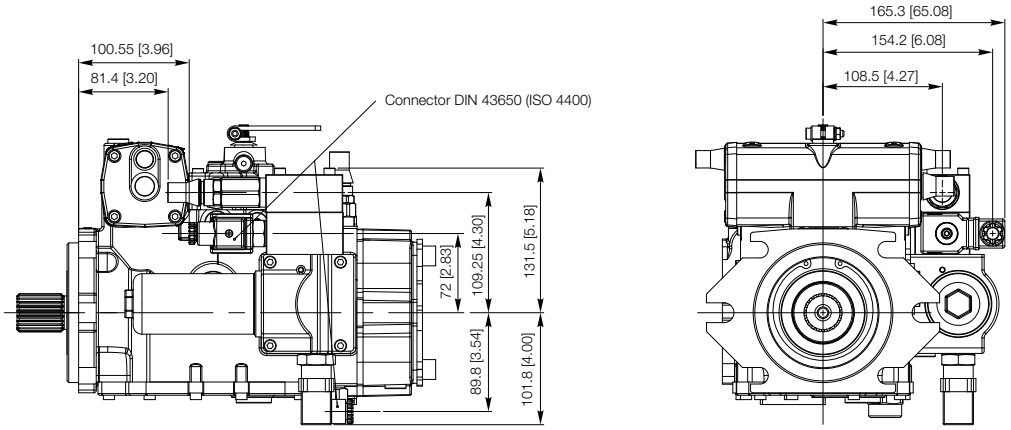


PC Filter + Pressure compensator

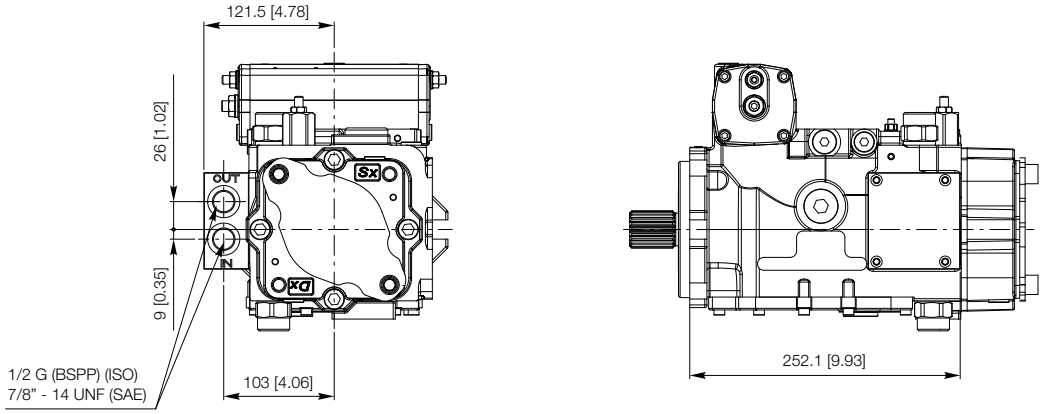


16 + 18 Pressure compensator and Cut-Off + Filter

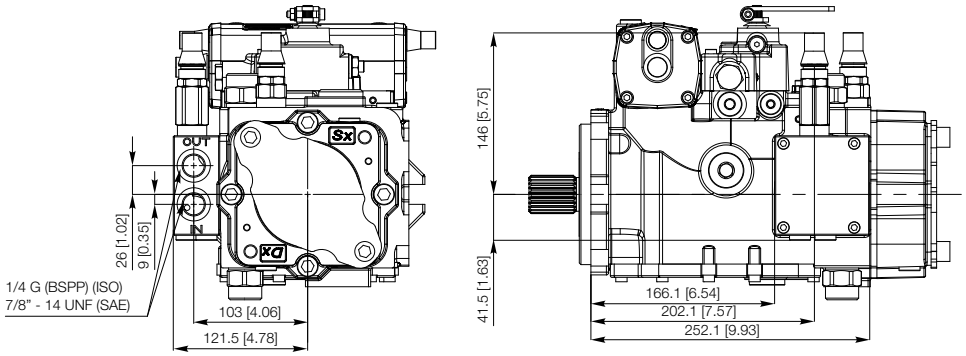
EP Filter + Electric Cut-Off valve + Pressure compensator



Remote filter



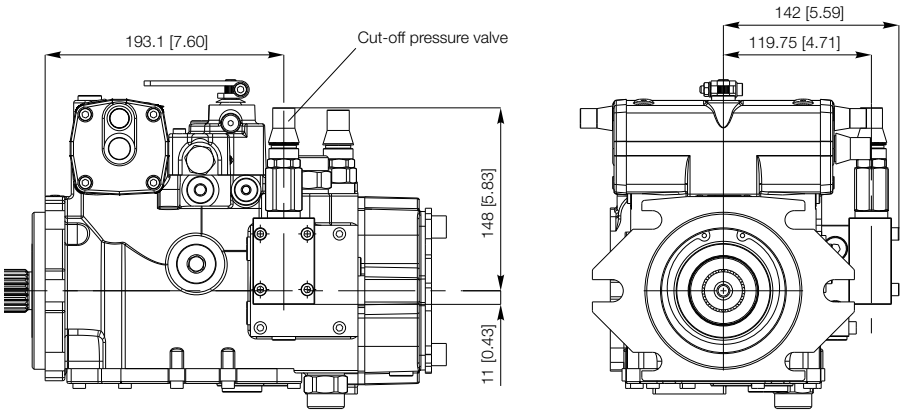
PC Remote filter + Pressure compensator



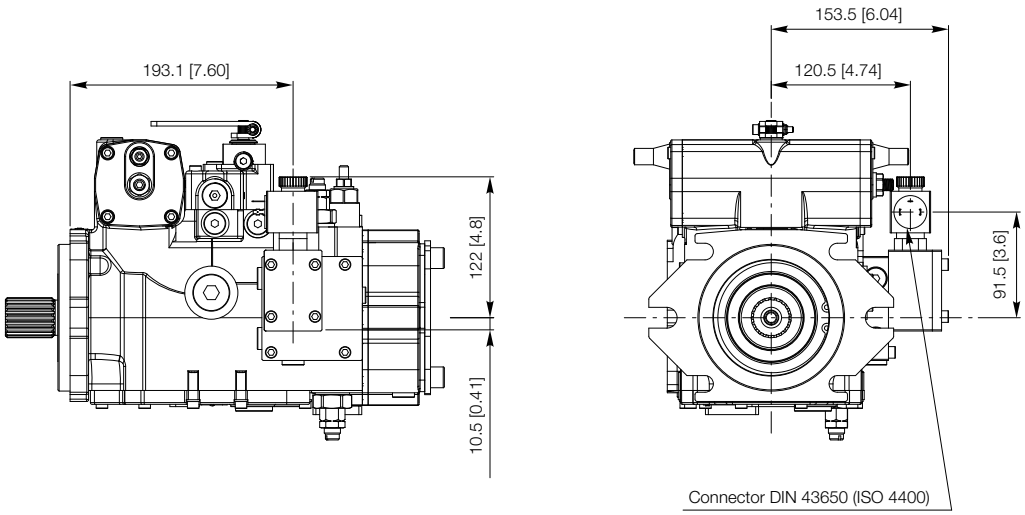
S6CV 075 - Pump and accessories dimensions

16 Pressure compensator and Cut-Off

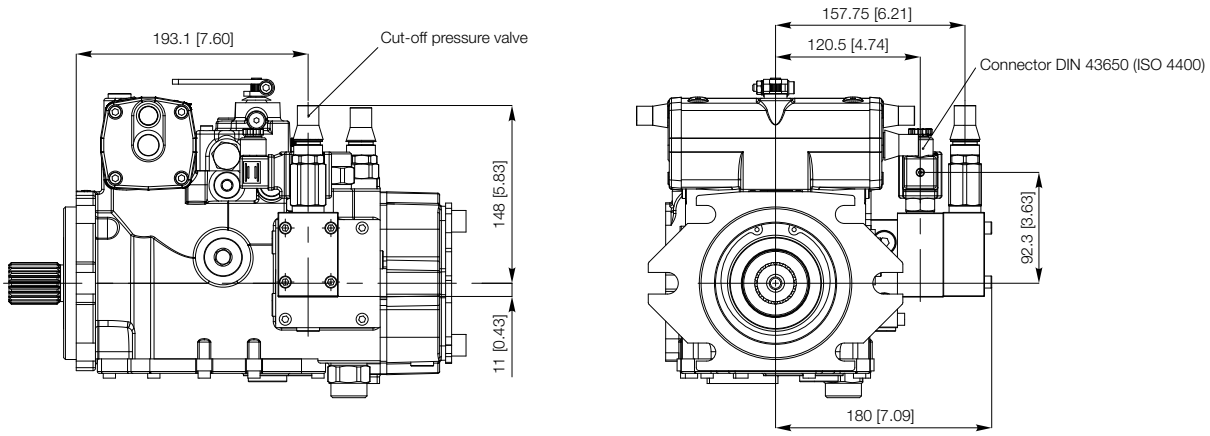
PC Pressure compensator



TE Electric Cut-Off valve

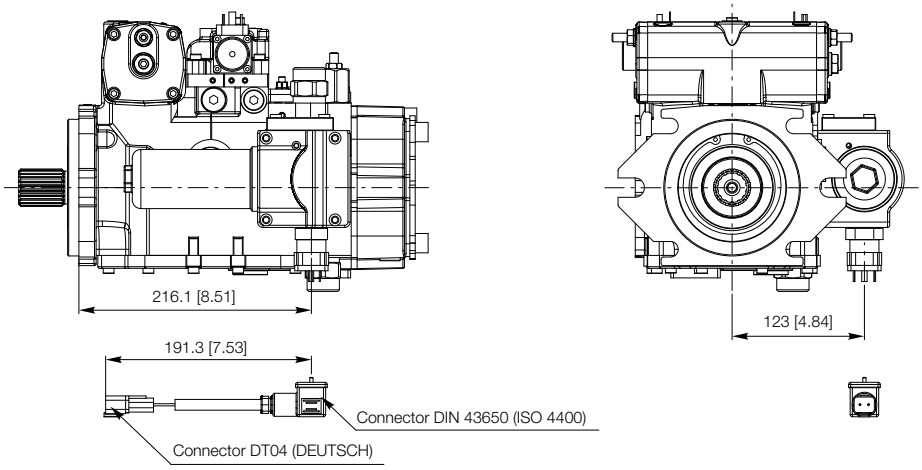


EP Electric Cut-Off + Pressure compensator

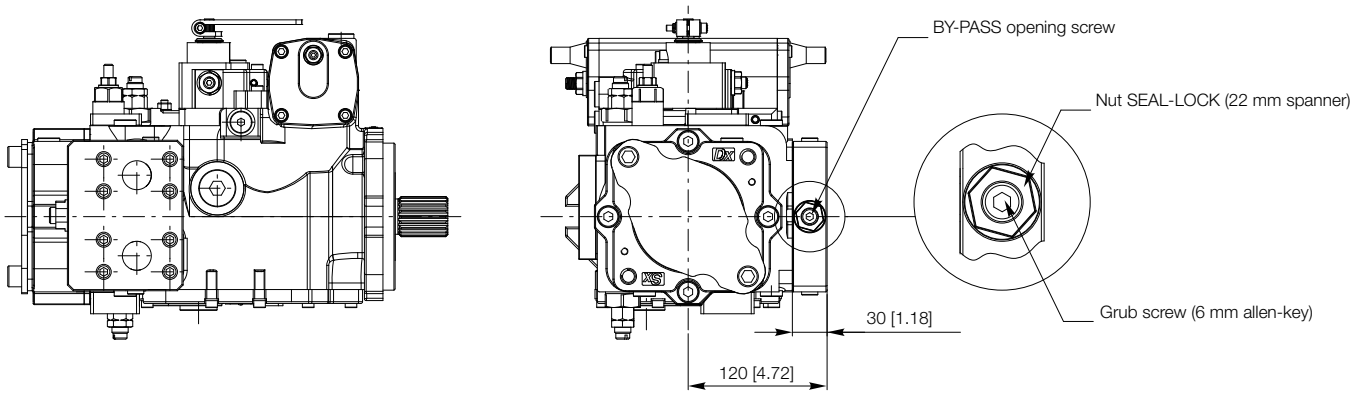


21 Pump feature

DT4 Conversion cable from DIN 43650/ISO 4400 to Deutsch DT04 connector (DET4)



BPV By - pass



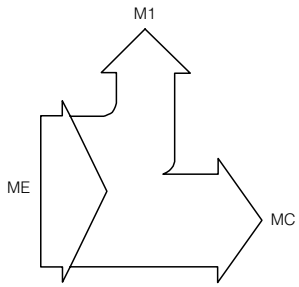
S6CV 075 - Throught drives

S6CV 75 pump can be supplied with through drive. The through drive can driving with a second S6CV 75 or a pump of other kind.

Available flanges are:
Standard G2 and G3 gear pump flange
SAE A, SAE B, SAE C, SAE B-B and SAE C-C flange
TANDEM flange

The maximum permissible torques on drive shaft of the first pump and the maximum through drive torques are listed in the table below.

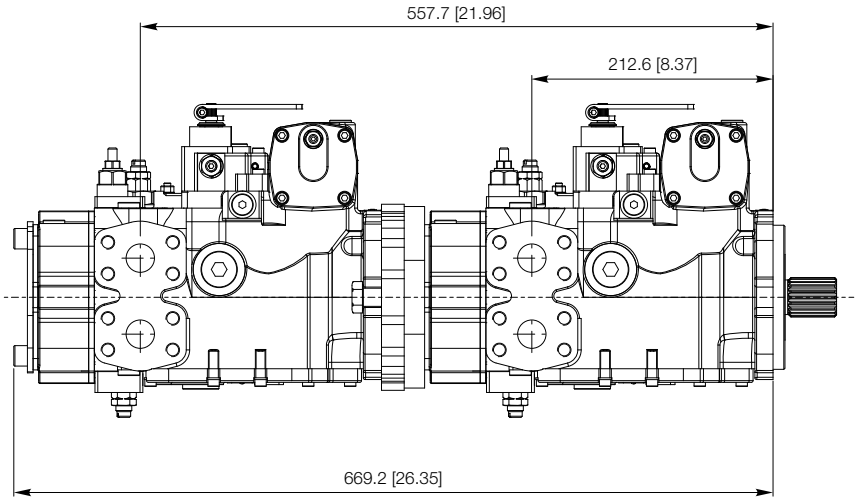
WARNING:
The effective torque value on the shaft of first pump is given by the sum of the torques required from each pump making the system.



Drive shaft			AC (Z21 16/32 DP)	13 (Z14 12/24 DP)
Drive shaft max torque	ME	Nm [lbf·ft]	950 [700]	620 [457]
Through drive max torque	MC	Nm [lbf·ft]	665 [490]	620 [457]

19 Throught drive

S6CV 075 + S6CV 075 Tandem



Shafts for combination pumps

	Configuration 075/075	
Pump	1st.	2nd.
Shafts	AC	AC
Shafts	AC	13
Shafts	13	13

Warning:
The TA-TB-BT-TC-TX-TZ-TY through drives must be used in the configuration of the first pump in the following cases:

1. Tandem pump combination.
2. Single pump for possible Tandem pump combination with Dana second pump.

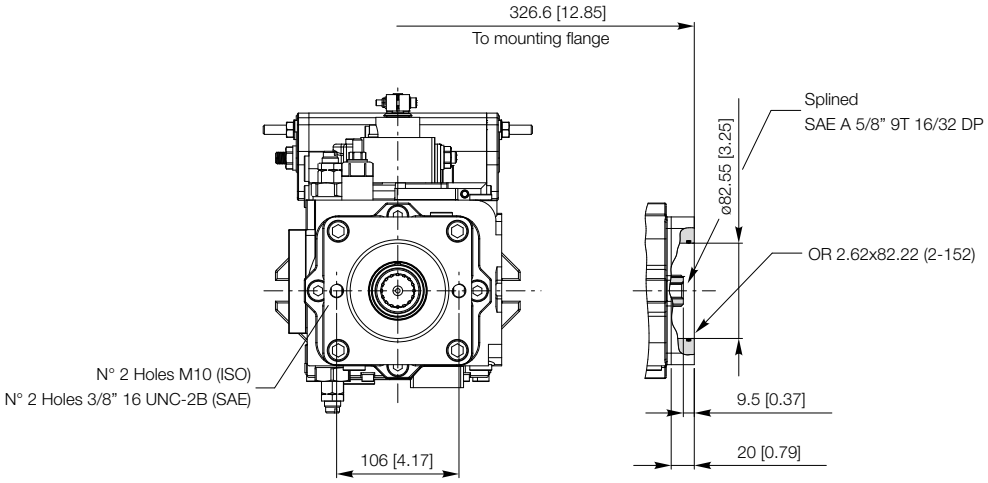
Example:

- If it is needed to purchase a Tandem pump combination with two S6CV 75 pumps and the second pump has the AC (21T - 16/32 DP) shaft, the first pump will must have the TX through drive.
- If it is needed to purchase a single S6CV 75 pump for Tandem pump combination with a S6CV 75 second pump with 13 (14T - 12/24 DP shaft, the pump will must have the TC through drive.

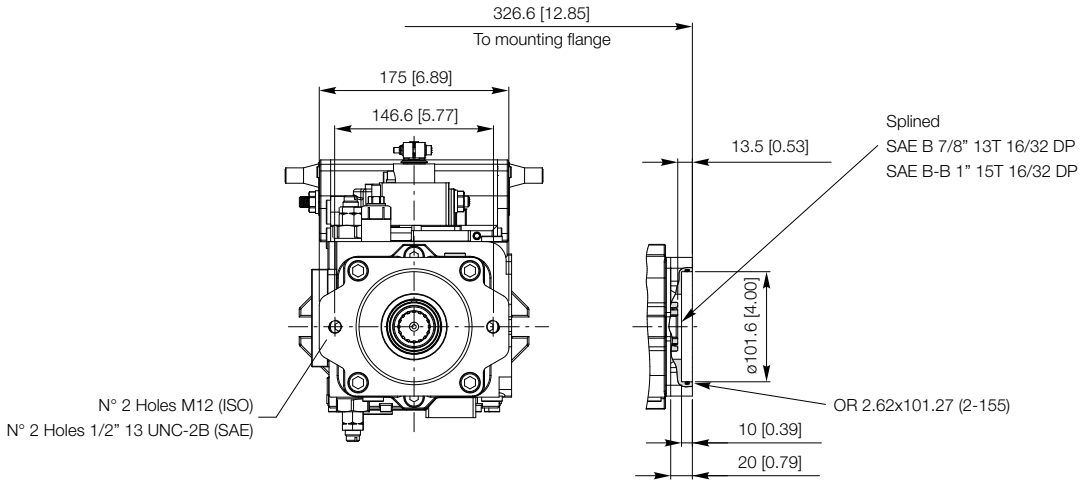
S6CV 075 - Throught drives dimensions

19 Throught drive

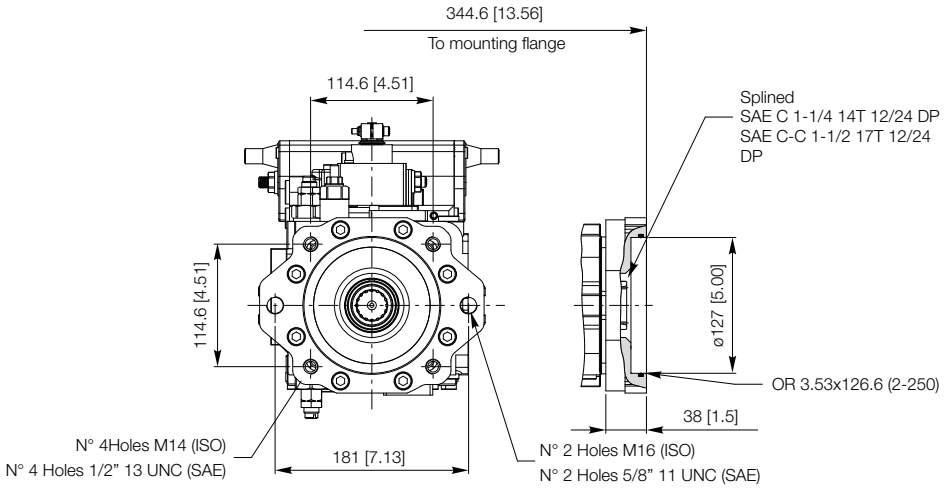
SA SAE A flange



SB/BB SAE B / SAE B-B flange

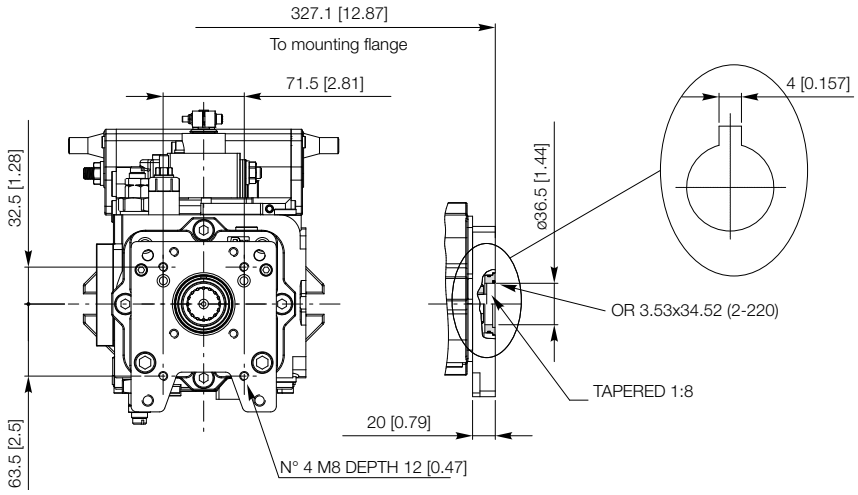


SC/CC SAE C / SAE C-C flange

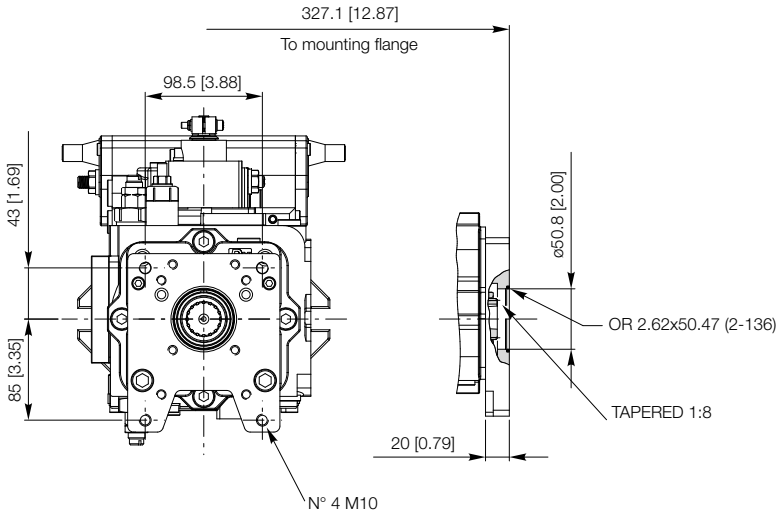


19 Throught drive

G2 G2 flange



G3 G3 flange



S6CV 128 - Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the S6CV 128 pumps. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering. We recommend to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Series	Pump	Size	Displacement limitation side A	Displacement limitation side B	Version	Flange	Shaft end	Direction of rotation	Control	Control feature	Charge pump	Pressure relief valve side A	Pressure relief valve side B	Charge pressure relief valve	Pressure compensator and cut-off valves	Cut-off valves feature	Filter	Through drive	Flushing valve	Pump feature	Painting
S6CV	P	128	60	60	ME	11	BE	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

1

Series	
S6CV	Variable displacement axial piston pump for closed circuit

2

Pump	
P	Pump

3

Size	
128	128 cm³/rev [7.808 in³/rev]

4

Displacement limitation side A	
0+136	From 0 cm³/rev to 136 cm³/rev [8.296 in³/rev]

5

Displacement limitation side B	
0+136	From 0 cm³/rev to 136 cm³/rev [8.296 in³/rev]

S6CV 128 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

6

Version	
ME	ISO
SE	SAE

7

Mouting flange	
11	SAE-D 2/4 Bolts

8

Shaft end	
BF	Splined Z23 - 16/32" DP
BE	Splined Z27 - 16/32" DP
BG	Splined Z15 - 8/16" DP
BH	Splined Z13 - 8/16" DP
BI	Splined W45x2x30x21
BL	Splined W40x2x30x18

Note:
For Tandem assembly check chapter "TANDEM COMBINATION DIMENSIONS"

9

Direction of rotation (viewed from shaft side)	
DX	CW
SX	CCW

10

Control	
HLR	Manual lever with feed-back
HIR	Hydraulic proportional with feed-back
HIN	Hydraulic proportional without feed-back
HER	Electric proportional with feed-back
HEN	Electric proportional without feed-back
HE2	Electric on-off
HEH	Electric proportional with emergency hydraulic override
HFD	Electric fan drive control
HME	Electric Automotive
HMI	Hydraulic Automotive

S6CV 128 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

11

Control features				Control									
				HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
IH	Inching		Hydraulic inching	–	–	–	–	–	–	–	_	●	●
IM			Mechanical inching	–	–	–	–	–	–	–	–	–	–
00			Without inching	–	–	–	–	–	–	–	–	●	●
12	Voltage	(V)	12 connector DIN 43650	–	–	–	●	–	●	●	–	●	–
24		(V)	24 connector DIN43650	–	–	–	●	–	●	●	–	●	–
D2		(V)	12 - Deutsch DT04	–	–	–	●	–	●	●	–	●	–
D4		(V)	24 - Deutsch DT04	–	–	–	●	–	●	●	–	●	–
N2		(V)	12 AMP JUNIOR	–	–	–	–	●	–	–	●	–	–
N4		(V)	24 AMP JUNIOR	–	–	–	–	●	–	–	●	–	–
00	Control orifices diameter (1)	mm [in]	Without control orifices	S	●	–	●	●	–	–	●	–	–
05		mm [in]	Ø 0.5 [Ø 0.019]	–	–	●	–	–	–	–	–	–	–
06		mm [in]	Ø 0.6 [Ø 0.024]	–	●	–	●	–	–	–	–	–	_
07		mm [in]	Ø 0.7 [Ø 0.027]	–	●	●	●	–	–	–	–	–	–
08		mm [in]	Ø 0.8 [Ø 0.031]	–	S	S	S	–	–	S	–	–	–
09		mm [in]	Ø 0.9 [Ø 0.035]	–	●	●	–	–	–	–	–	–	–
10		mm [in]	Ø 1.0 [Ø 0.039]	–	●	–	–	–	–	–	–	–	–
12		mm [in]	Ø 1.2 [Ø 0.047]	–	●	–	–	–	S	–	–	S	S
15		mm [in]	Ø 1.5 [Ø 0.059]	–	–	–	–	–	–	–	–	●	●
20		mm [in]	Ø 2.0 [Ø 0.0787]	–	–	–	●	–	–	–	–	–	–
(*)	Starting speed	(rpm)		–	–	–	–	–	–	–	–	●	●
(*)	Maximum torque speed	(rpm)		–	–	–	–	–	–	–	–	●	●
(*)	Maximum torque value	(Nm)		–	–	–	–	–	–	–	–	●	●

(*) Supply the setting value.
• : Required
– : Not required
S: standard
(1) in case of the different response times, please you contact sales office

12

Charge pump		
00	Without charge pump	
23	Displacement 23.1 cm3/rev [1.41 in3/rev]	
27	Displacement 27.3 cm3/rev [1.647 in3/rev]	Standard

13

Pressure relief valve side A		
25	250 bar [3625 psi]	
35	350 bar [5075 psi]	
42	420 bar [6090 psi]	Standard

S6CV 128 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

14

Pressure relief valve side B		
25	250 bar [3625 psi]	
35	350 bar [5075 psi]	
42	420 bar [6090 psi]	Standard

15

Charge pressure relief valve			Control									
			HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
AF	22 bar a 1000 rpm [319 psi at 1000 rpm]	Standard	●	●	●	●	●	●	●	–	●	●
AG	25 bar a 1000 rpm [319 psi at 1000 rpm]		●	●	●	●	●	●	●	●	●	●

16

Pressure compensator and Cut-Off valves			Control									
			HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
XX	Without pressure compensator	Standard	●	●	●	●	●	●	●	●	●	●
PC	Pressure compensator		●	●	●	●	●	●	●	●	–	–
TE	Electric Cut-Off		●	●	●	●	●	●	●	●	–	–
EP	Electric Cut-Off + Pressure Compensator		●	●	●	●	●	●	●	●	–	–

17

Cut-Off valves feature			Cut-Off valves			
			XX	PC	TE	EP
000	Feature not necessary		●	–	–	–
000	Pressure Setting (bar)	Locked	–	●	–	●
100÷400	Pressure Setting (bar)	100÷400 bar (*)	–	●	–	●
12	Voltage	12 V	–	–	●	●
24	Voltage	24 V	–	–	●	●

• : Required
– : Not required
(*) Supply the setting value

S6CV 128 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

18

Filter			Control									
			HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
XX	Without Filter	Standard	●	●	●	●	●	●	●	●	●	●
M8	Optical clogging sensor (8 bar) [116 psi]		●	●	●	●	●	●	●	●	–	–
E9	Electric clogging sensor (8 bar) [116 psi]		●	●	●	●	●	●	●	●	–	–
E3	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector		●	●	●	●	●	●	●	●	–	–
E2	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector with LED 24V		●	●	●	●	●	●	●	●	–	–
E1	Electric clogging sensor (8 bar) [116 psi] + DIN 43650 connector with LED 12V		●	●	●	●	●	●	●	●	–	–
FR	Through drive remote filter		●	●	●	●	●	●	●	●	=	=

● : Available
– : Not available
= : Not available for HME/HMI + Cut-Off valve TE/TP

Note:
E9 feature as “Standard production” for electric clogging sensor

19

Through drive		
Through drive for 2ndPump assembled by the customer		
XX	Without through drive	Standard
SA	SAE A = Z9 - 16/32 DP	
SB	SAE B = Z13 - 16/32 DP	
BB	SAE B-B = Z15 - 16/32 DP	
SC	SAE C = Z14 - 12/24 DP	
S5	SAE C = Z21 - 16/32 DP	
CC	SAE C-C = Z17 - 12/24 DP	
SD	SAE D = Z13 - 12/24 DP	
G2	GR2 L = 4	
G3	GR3	
Through drive for 2nd pump assembled by Dana		
TA	Tandem through drive with flange SAE A = 9T - 16/32 DP	
TB	Tandem through drive with flange SAE B = 13T - 16/32 DP	
TZ (1)	Tandem through drive with flange SAE B-B = 15T - 16/32 DP (Special for S5AV 032/045/050/063 pumps)	
TY (2)	Tandem through drive with flange SAE B - DIN 5480 W35x2x30x16x9g (Special for S5AV 050/063 pumps)	
BT	Tandem through drive with flange SAE B-B = 15T - 16/32 DP	
TC	Tandem through drive with flange SAE C = 14T - 12/24 DP	
T5	Tandem through drive with flange SAE C = 21T - 16/32 DP	
CT	Tandem through drive with flange SAE C = 21T - 16/32 DP	
TD	Tandem through drive with flange SAE D = 13T - 8/16 DP	
TJ	Tandem through drive with flange SAE D = 23T - 16/32 DP	

(1) Tandem S6CV 75 + S5AV 032/045/050/063 with shaft Z15 16/32 DP
(2) Tandem S6CV 75 + S5AV 050/063 with shaft DIN 5480 W35x2x30x16x9g

S6CV 128 - Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S6CV	P	075	60	60	ME	06	AC	DX	HME	24	00	25	25	AF	PC	000	XX	XX	XX	XXX	01

20

Flushing valve		Controls									
		HLR	HIR	HIN	HER	HEN	HE2	HEH	HFD	HME	HMI
XX	Not request	●	●	●	●	●	●	●	●	●	●
PR	Arranged for Flushing Valve	–	–	–	–	–	–	–	–	●	●
06	6 l/min [1.58 U.S. gpm] Orifice Diameter Ø 1.5 [0.005]	–	–	–	–	–	–	–	–	●	●
09	10.5 l/min [2.77 U.S. gpm] Orifice Diameter Ø 2.0 [0.07]	–	–	–	–	–	–	–	–	●	●
15	15 l/min [3.96 U.S. gpm] Orifice Diameter Ø 2.5 [0.09]	–	–	–	–	–	–	–	–	●	●

● : Available
– : Not available

21

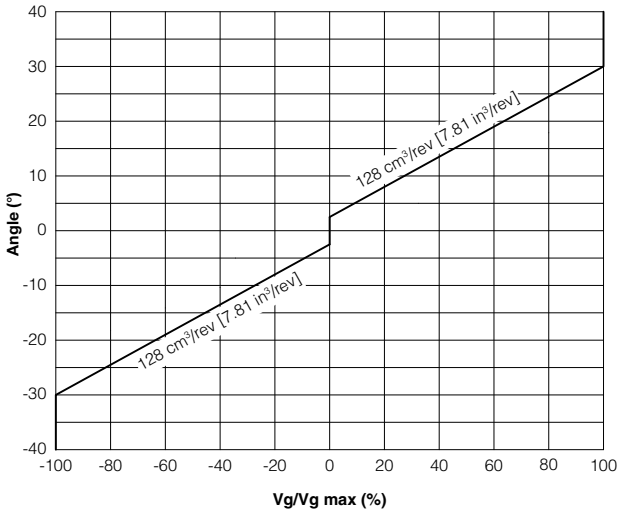
Pump feature	
XXX	Not request
DT4	Conversion cable from DIN43650/ISO4400 to Deutsch DT04 connector
001	ISO Version with SAE Through drive

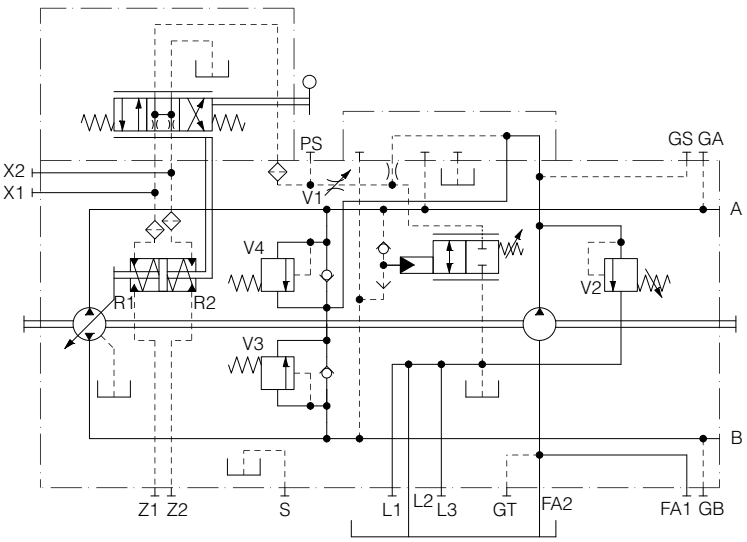
22

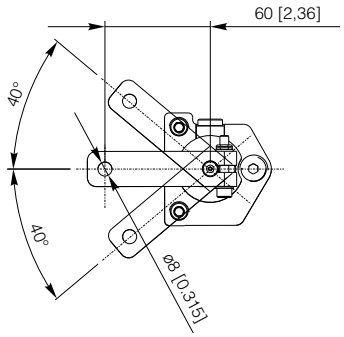
Painting	
XX	Not request
01	Black Painted RAL 9005

10 Control

The displacement of the pump is directly proportional to the angle of rotation of the lever. The feedback system feels the position of the swashplate and works automatically to compensate for a positioning error. The diagram below shows the ralationship between angle and displacement.





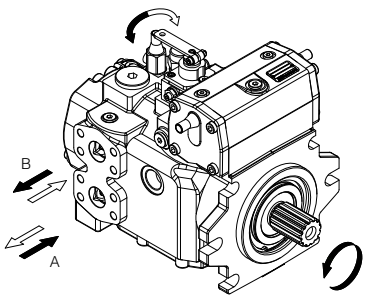


The torque necessary at the control lever is between 1 and 2.45 Nm [0.737 and 1.80 lbf·ft].

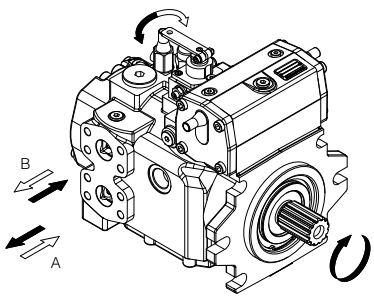
Note:
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

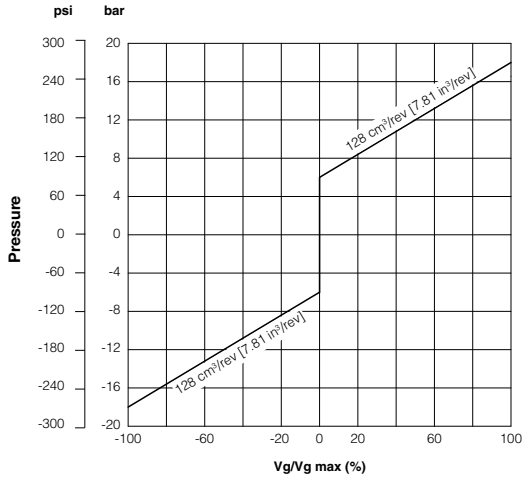
HLR (CCW)

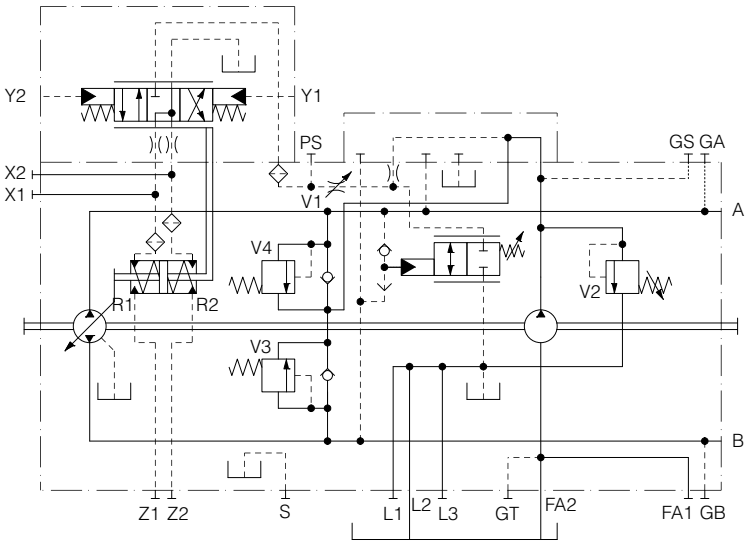


HLR (CW)



The pump displacement is proportional to the pilot pressure on Y1 or Y2 ports, which also affect flow direction. The feedback system feels the position of the swashplate and works automatically to compensate for a positioning error. Piloting can be provided by boost pressure from GS port. The piloting pressure will then have to be controlled by a joystick or by a pressure reducing valve (not supplied).





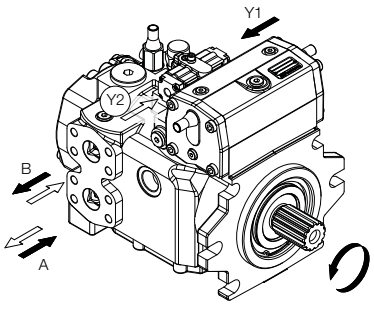
Pilot pressure = 6÷18 bar [87÷261 psi] (at ports Y1, Y2)
Start of control = 6 bar [87 psi]
End of control = 18 bar [261 psi] (Max displacement)

Note:
The tolerance on piloting pressure is ± 10% of maximum value.

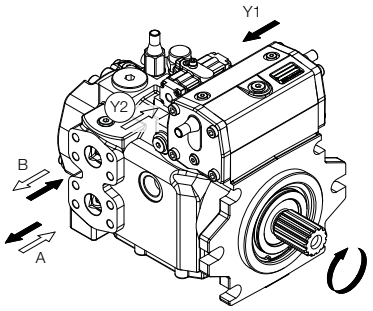
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HIR (CCW)



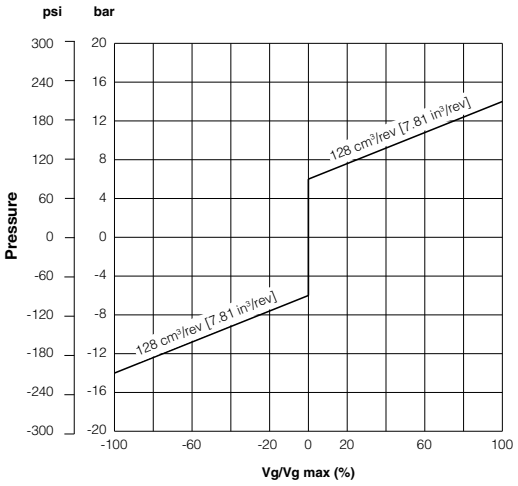
HIR (CW)

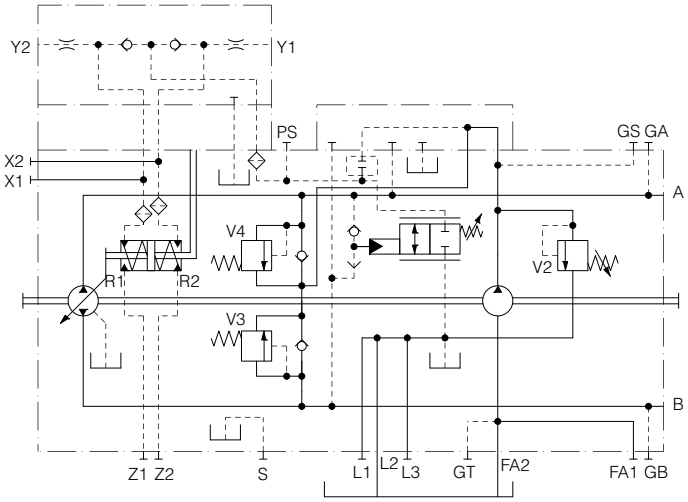


S6CV 128 - Hydraulic proportional control without feed-back HIN

The pump displacement is proportional to the pilot pressure on Y1 or Y2 piloting ports, which also affect flow direction. The flow is also influenced by the working pressure and by the rotation speed of the pump. With a given input signal (piloting pressure) the pump can vary the displacement and the flow when working pressure or rotating speed change. Feeding pressure to the control joystick can be provided by charge pressure from GS port. The piloting pressure must then be controlled by said joystick or by a pressure reducing valve (not supplied). The orifice dimensions must be choosed in function of the response time required, see the table below.

Warning:
HIN control could require working parameters review. Please contact Dana technical service



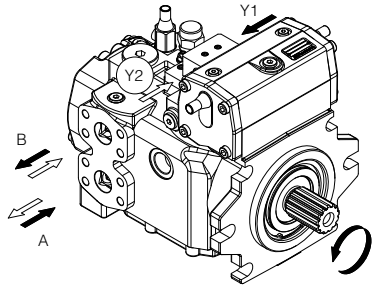


Pilot pressure = 6÷14 bar [87÷ 203 psi] (at ports Y1, Y2)
Maximum Pilot pressure = 30 bar [435 psi]
Start of control = 6 bar [87 psi]
End of control = 14 bar [203 psi](Max displacement)

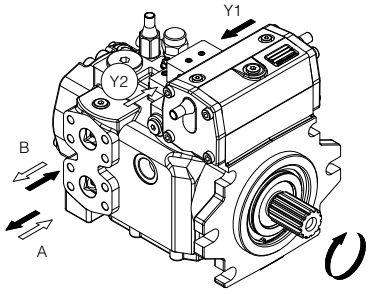
Note:
The tolerance on piloting pressure is ± 10% of maximum value.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

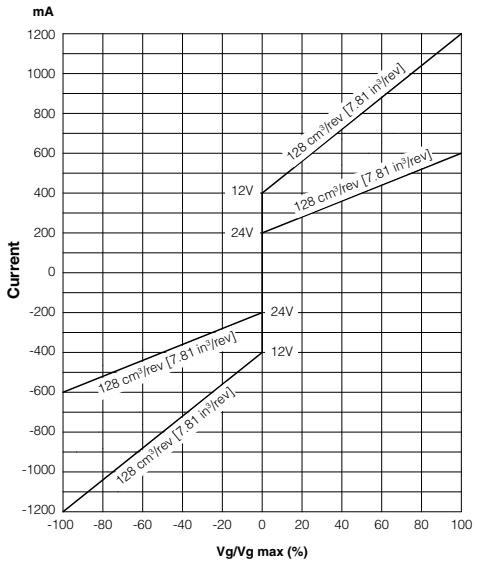
HIN (CCW)

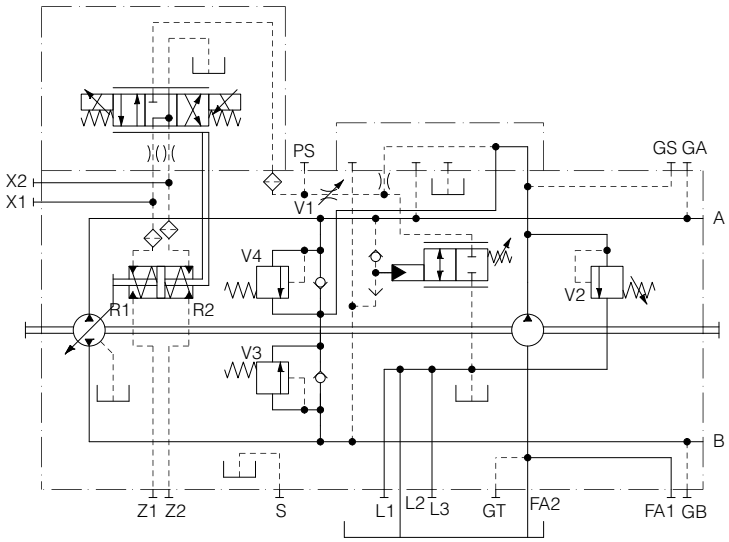


HIN (CW)



The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids. The feedback system feels the position of the swashplate and works automatically to compensate for a positioning error. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for S6CV. Flow direction depends on which solenoid is energized. Standard solenoids are proportional at 24V d.c. max. current 1A. (Optional solenoids 12V d.c. max. current 2A).
For emergency operation only it is however possible to control solenoids directly with 24V d.c.voltage (or 12V d.c.), by-passing the amplifier.





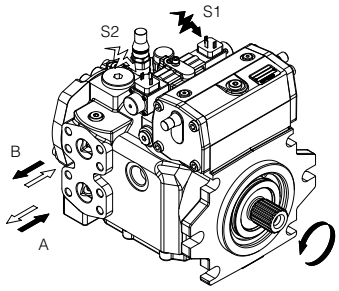
Solenoid 24V:
Current min. 200 mA max 600 mA
Solenoid 12V:
Current min. 400 mA max 1200 mA

Note:
The tolerance on piloting current is ± 10% of maximum value.

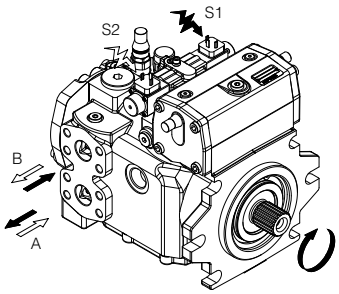
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HER (CCW)

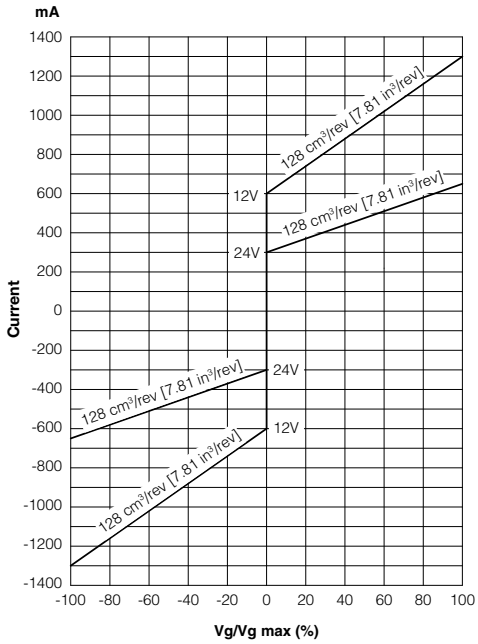


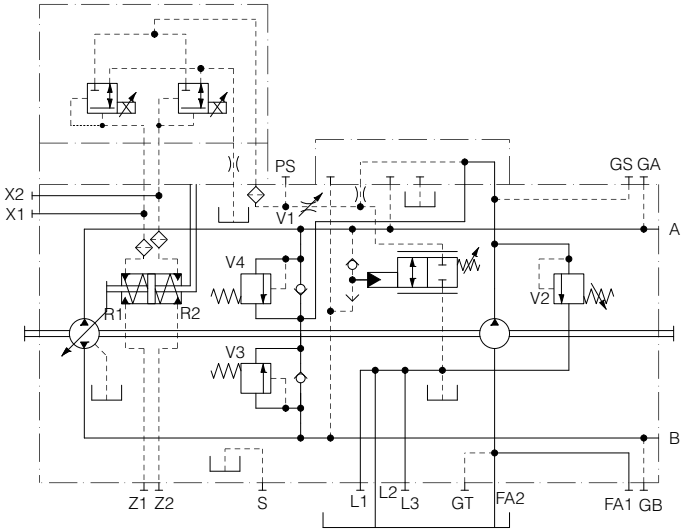
HER (CW)



The displacement of the pump is directly proportional to the input current of one of the two proportional solenoids. The flow is also influenced by the working pressure and by the rotation speed of the pump. With a given input signal (piloting current) the pump can vary the displacement and the flow when working pressure or rotating speed change. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for S6CV. Flow direction depends on which solenoid is energized. Standard solenoids are proportional 24V d.c. max. current 1A. (Optional solenoids 12V d.c. max. current 2A). For emergency operation only it is however possible to control solenoids directly with 24V d.c.voltage (or 12V d.c.), by-passing the amplifier.

Warning:
HEN control could require working parameters review. Please contact Dana technical service



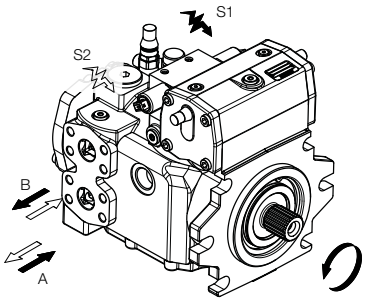


Solenoid 24V:
Current min. 300 mA max 650 mA
Solenoid 12V:
Current min. 600 mA max 1300 mA

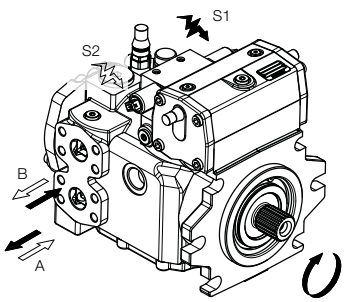
Note:
The tolerance on piloting current is ± 10% of maximum value.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

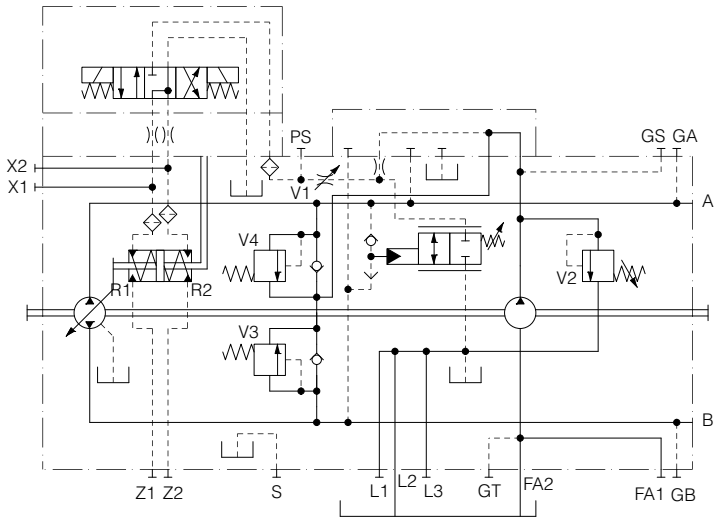
HEN (CCW)



HEN (CW)

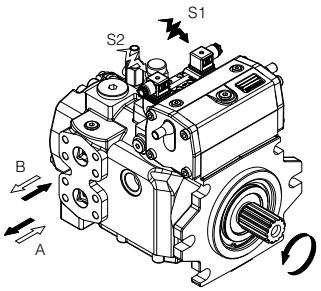


By switching on one of the solenoids the pump swivels to maximum displacement in the corresponding output flow direction.
Switching off the stated solenoid will result in swivelling back the pump to zero displacement position.

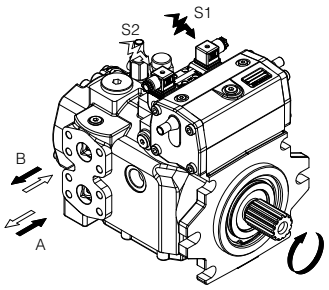


Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

HE2 (CCW)

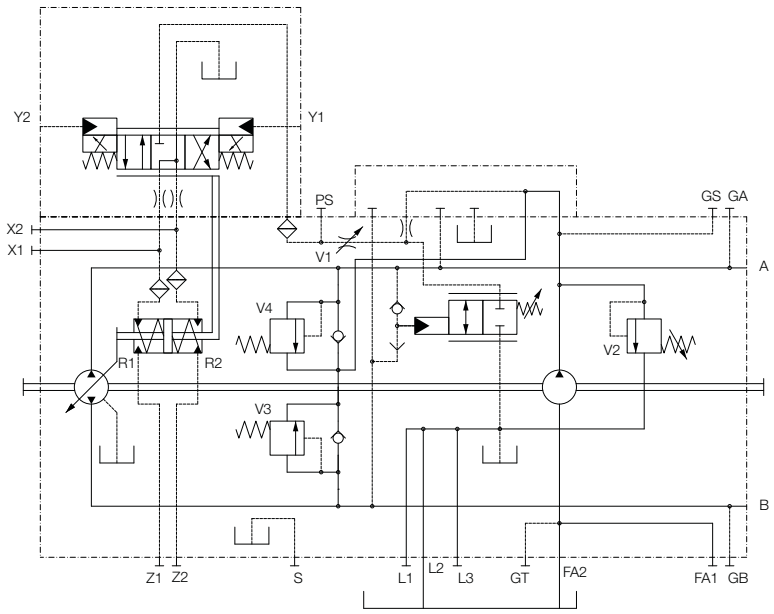


HE2 (CW)



S6CV 128 - Electric proportional control with hydraulic emergency override HEH

This control has the same electric proportional features of HER control, but it also has an emergency hydraulic proportional control capability when a pilot pressure on Y1 and Y2 ports. The input current of the two proportional solenoids must be controlled by an external amplifier card and it is recommended to use our amplifier specific for S6CV. Hydraulic operation of HEH control is meant to be an emergency device to control displacement of the pump in case of a breakdown of the electric circuit. A pilot pressure of 22 bar [319 psi] is required to swivel the pump to max displacement in emergency operation.

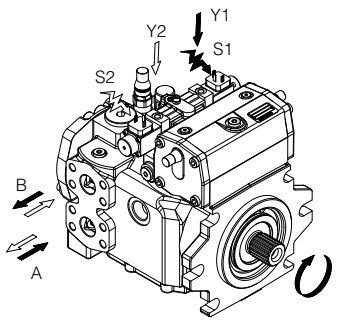


Warning:
Y1 and Y2 ports must not have any back pressure normal electric control operation (vented to tank).

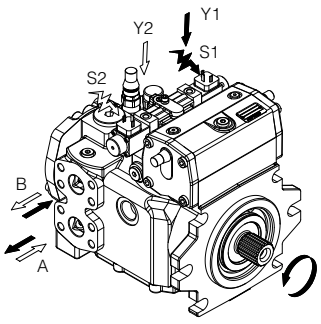
Note:
The spring return feature in the control units is not a safety device.
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator. Check whether your application requires that remedial measures be taken on your machine in order to bring the driver consumer into a safe position (e.g. immediate stop).

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

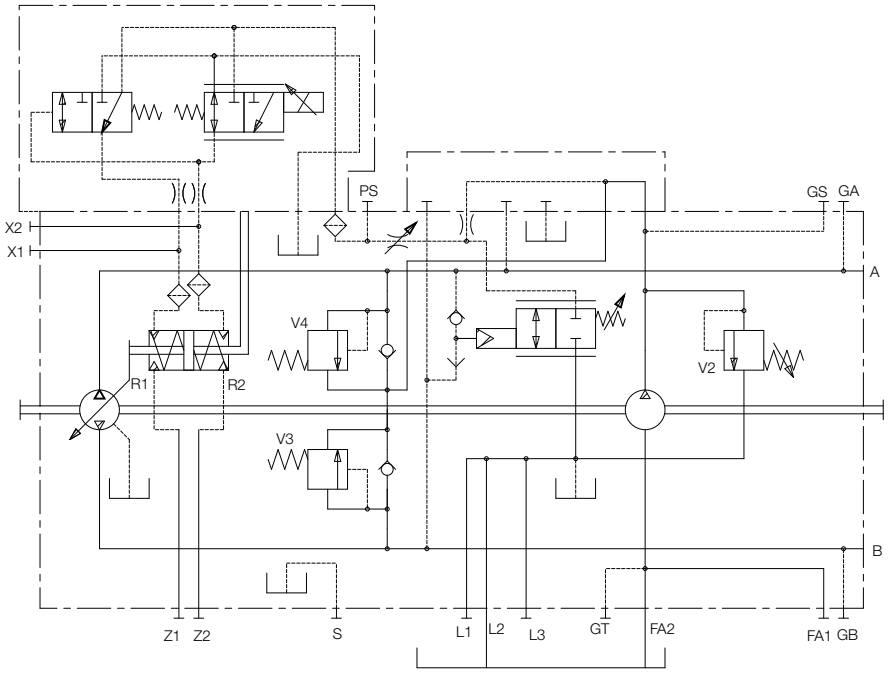
HEH (CCW)



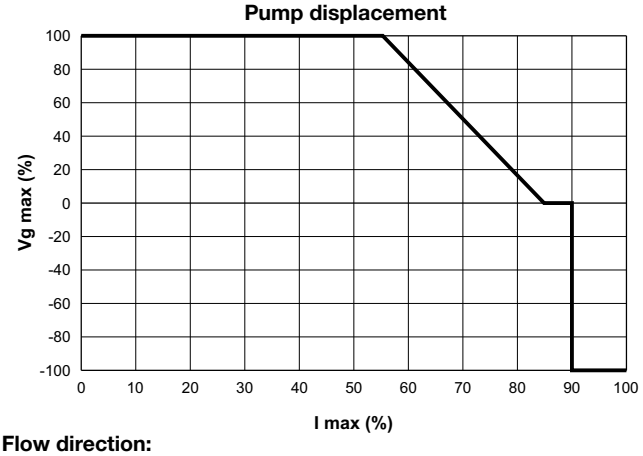
HEH (CW)



Fan drive control (HFD) is a non-feedback control electrically operated.
Pump displacement is directly proportional to the input current on the proportional solenoid. Flow is also influenced by working pressure and rotation speed, with a given input signal pump can vary displacement and flow due to working pressure and speed rotation variation.
Input current must be control by an external amplifier.
Flow direction depends on pump direction of rotation and on input current (see below diagram).



Pump displacement

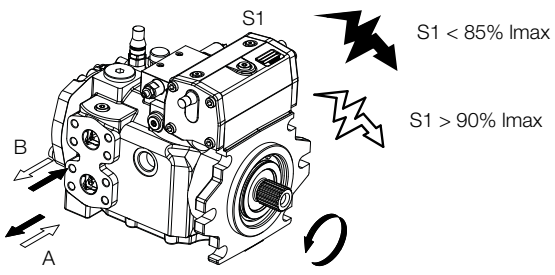


Voltage	I max	Protection	Resistance	Connector
12 VDC	1.5 A	DIN VDE 0470 / EN 60 529 -IP65	3.85 Ohm	AMP Junior Timer
24 VDC	0.75 A		15.15 Ohm	

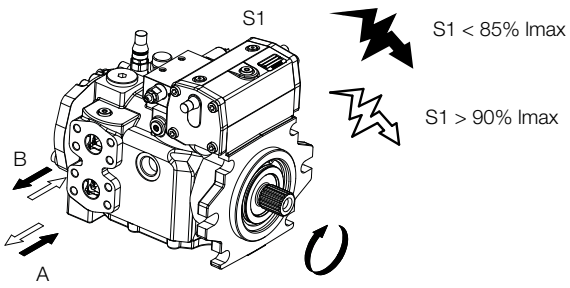
Minimum boost pressure 25 bar - 363 PSI.

Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.
Flow direction depending to the I max current value.

HFD (CCW)



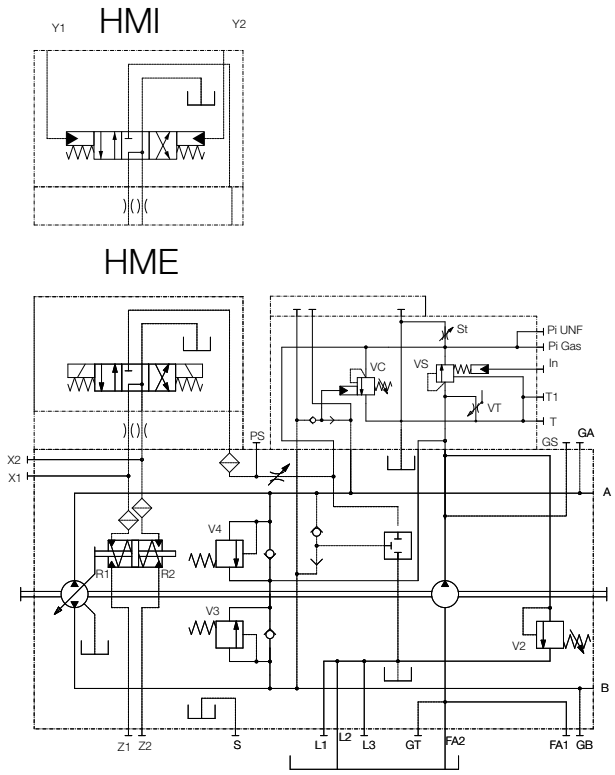
HFD (CW)



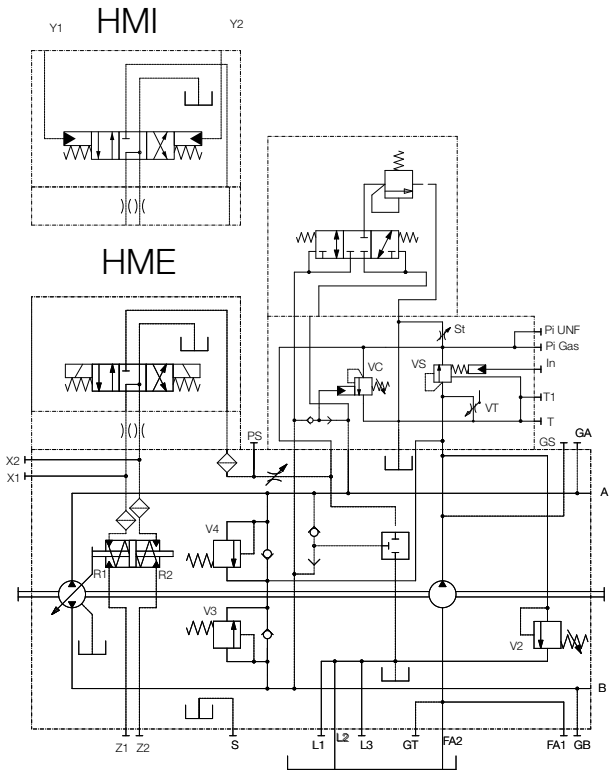
The “AUTOMOTIVE” (speed related) control, is used in hydrostatic transmissions with closed loop variable displacement pumps. This kind of controls allows to:
- Control of the vehicle translation speed;
- Limit the amount of Torque required from the Engine;
- Inching of the vehicle speed. The control of the Inching valve can be done with an hydraulic signal (Minimum 12 bar [174 psi] is required to swivel the pump to null displacement) or with a lever.
- Possibility to control the direction of flow electrically (HME) and hydraulically (HMI).

To allows an oil cooling action, when operating at high speed and power, it is possible to mount a flushing valve.

Electric (HME) / hydraulic (HMI) automotive with hydraulic Inching (IH)

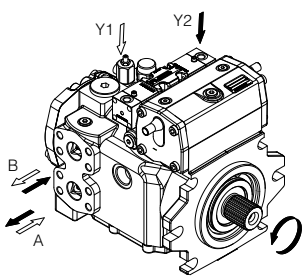


Electric (HME) / hydraulic (HMI) automotive with hydraulic Inching (IH) + Flushing valve

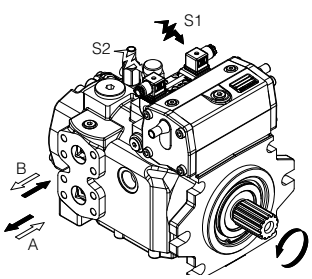


Flow direction:
Correlation between direction of rotation (shaft view) control and direction of flow.

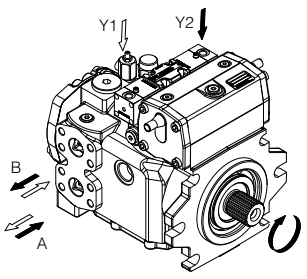
HMI (CCW)



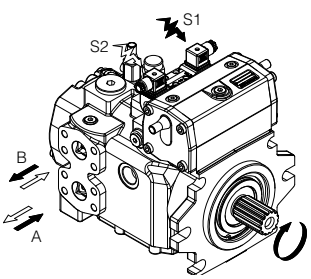
HME (CCW)



HMI (CW)



HME (CW)



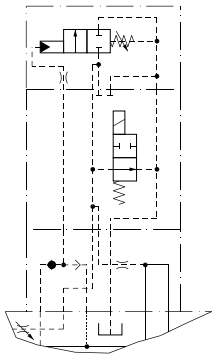
16 Pressure compensator and Cut-Off valve

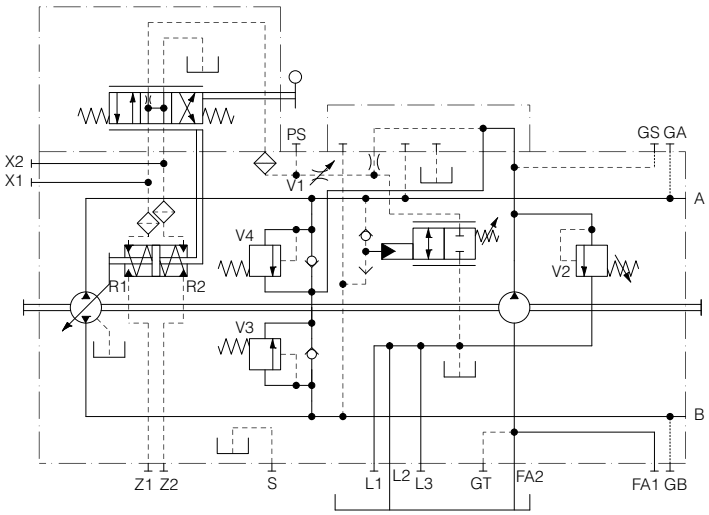
PC Pressure compensator valve

The pressure compensator valve is meant to avoid opening of the relief valves: whenever working pressure reaches the PC valve setting, the swashplate is swivelled back reducing flow. The valve allows to maintain a costant pressure in the circuit at the setting value. It is advisable to fit the cut-off valve to all system where pressure peaks close to the relief valves setting value occur or in hydraulic systems engineered to the maximum pump pressure. It is recommended to set the pressure cut-off valve at 30 bar [435 psi] lower than the high pressure relief valve setting. Setting range:100÷400 bar [1450÷5800 psi].

Note:
The pressure compensator valve is standard on HD1 pump and it can be combined with TE (EP) valve.

EP valve



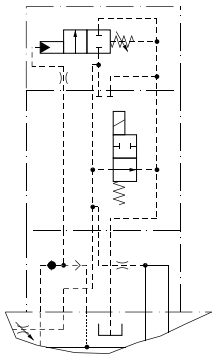


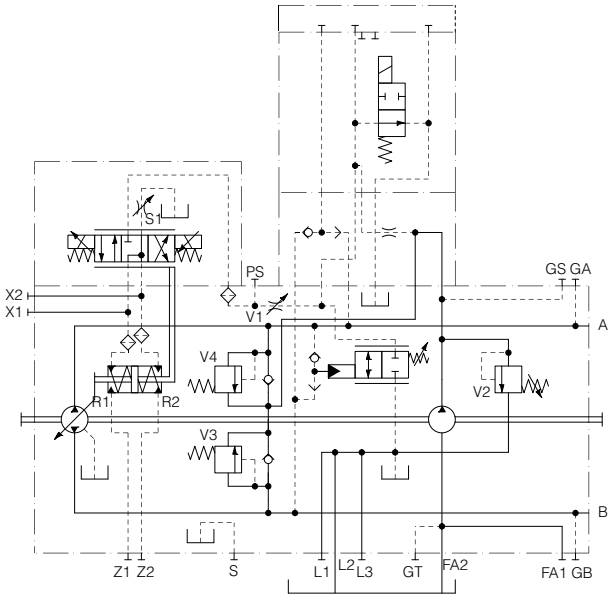
TE Electric Cut-Off valve

The electric cut-off valve, directly flangeable on S6CV pump housing, swivels back to zero the pump flow when power supply to the ON/OFF solenoid is cut-off. This valve has been designed for applications subject to safety rules, which required stopping of the machine in case of no electric signal. Feed voltage is 24V d.c. (optional 12V d.c.).

Note :
The electric Cut-Off valve can be assembled on standard S6CV pump and it can be combined with PC (EP) valve.

EP valve



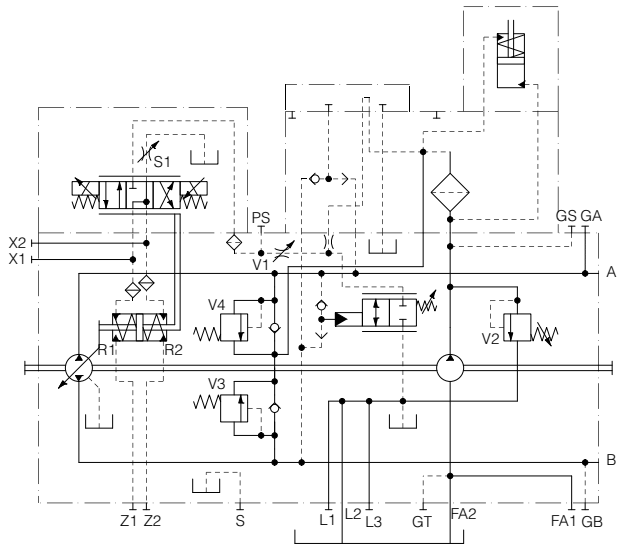


S6CV 128 - Pressure filter

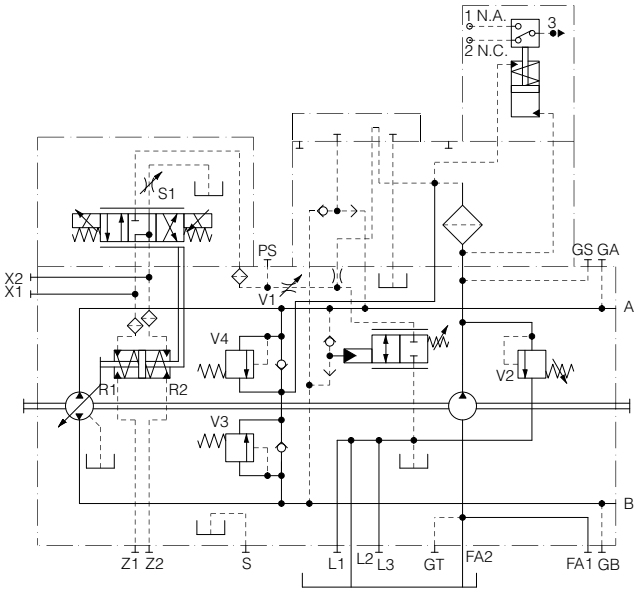
18 Filter

In order to guarantee an optimum fluid contamination level in the closed loop the S6CV can be equipped with a filter positioned on the delivery outlet of the charge pump. Only the flow necessary to reintegrate the lost oil due to leakage will pass through the filter, all the excess flow is not filtered and discharged through the pump drain line. In this way a longer life of the filter is achieved. The filter contains a composite fibre filtering element, with capacity of 12 micron absolute. The system uses sensors of clogging differential pressure of 8 bar [116 psi]) in optical and electrical (Connector DIN43650/ISO4400) version.
It is available a conversion cable from DIN43650/ISO4400 to Deutsch DT04 connector. The filter is without by-pass.
It is available a Remote Filter version for filtering in filter pressure not mounted on the pump.
It's possible to combine the filter with both cut-off valves.

M8 Optical sensor

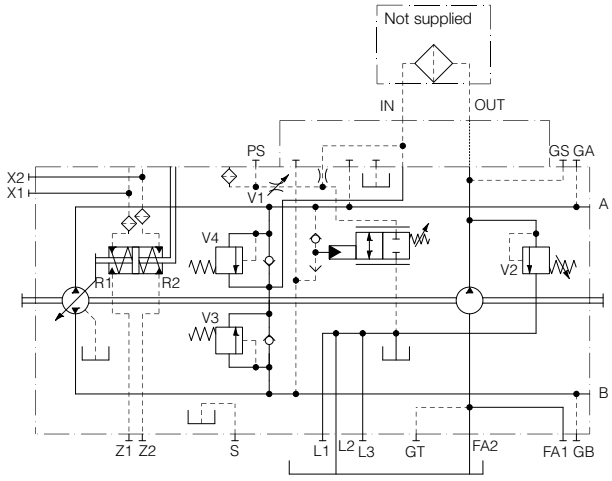


E1 - E2 - E3 - E9 Electrical sensor



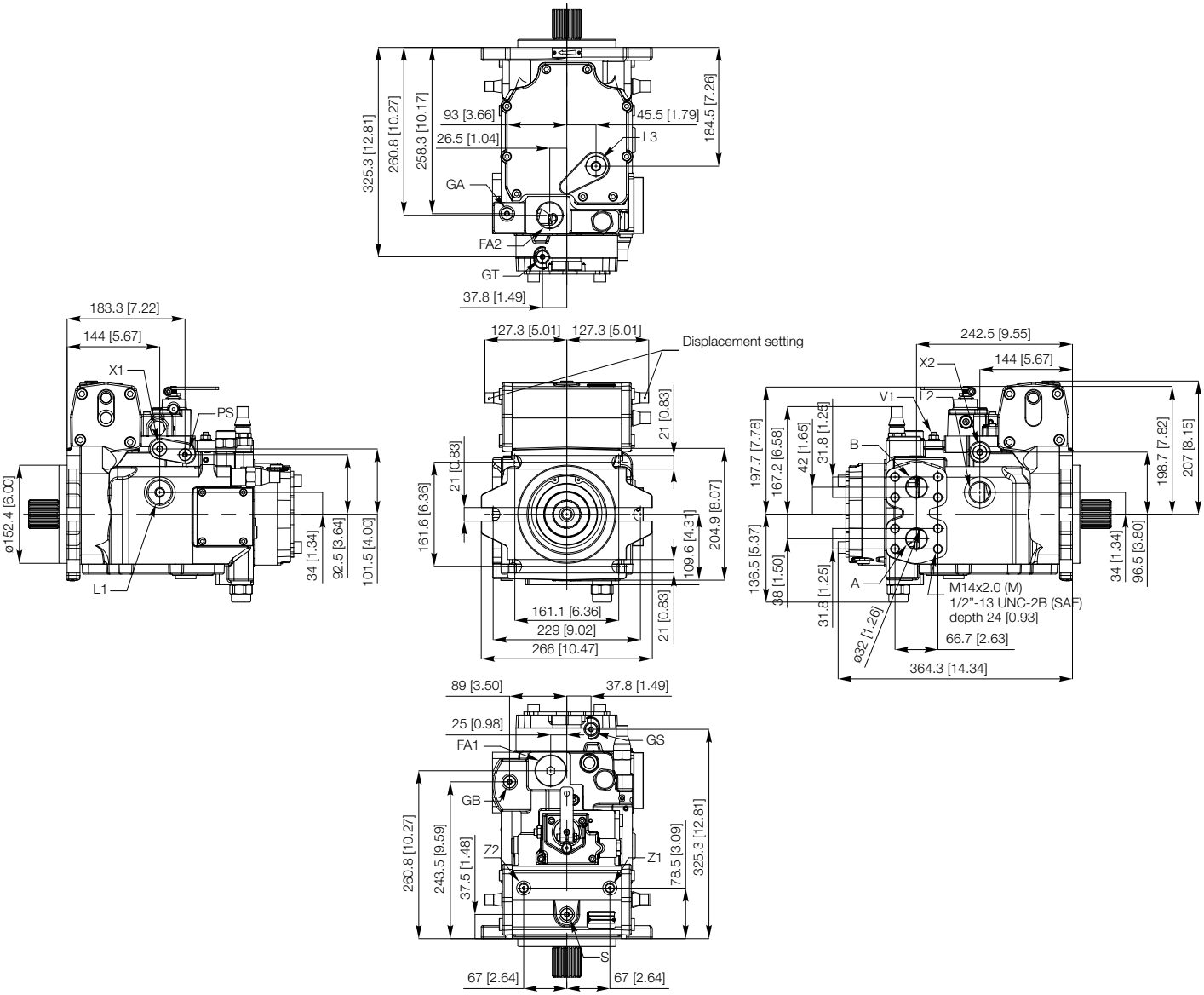
Share contact SPDT	Max. resistive load	Max. inductive load
C.A./A.C. 125-250 V	1 A	1 A
C.C./D.C. 30V	2 A	2 A
C.C./D.C. 50V	0.5 A	0.5 A
C.C./D.C. 75V	0.25 A	0.25 A
C.C./D.C. 125V	0.20 A	0.03 A

FR Remote filter



10 Control

HLR

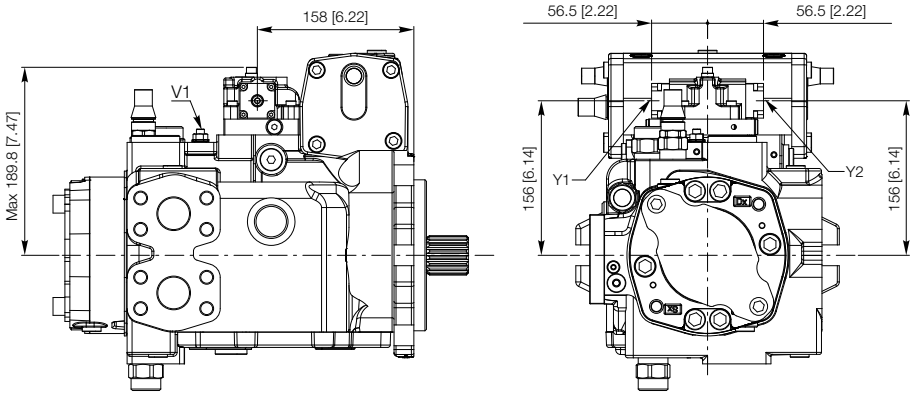


	Ports	ISO	SAE
A-B	Pressure ports	1" ¼ SAE 6000 psi	
L1-L2	Case drain ports	1" G (BSPP) Depth 18	1-5/16"-12UN-2B Depth 24
L3	Case drain ports	3/4" G (BSPP) Depth 15	1-1/16"-12UN-2B Depth 19
FA1-FA2	Boost pump suction port	1-1/4"G (BSPP) Depth 21	1-5/8"-12UN-2B Depth 24
GA-GB	Pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
GS	Boost pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
PS	Control pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
X1-X2	Gauge port stroking chamber	3/8" G (BSPP) Depth 13	
S	Bleed port	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
Z1-Z2	Control pressure gauge	1/8" G (BSPP) Depth 10	7/16"-20UNF-2B Depth 16
GT	Boost inlet pressure gauge	1/4" G (BSPP) Depth 13	7/16"-20UNF-2B Depth 16
V1	Adjustable throttle valve		

S6CV 128 - Pump and controls dimensions

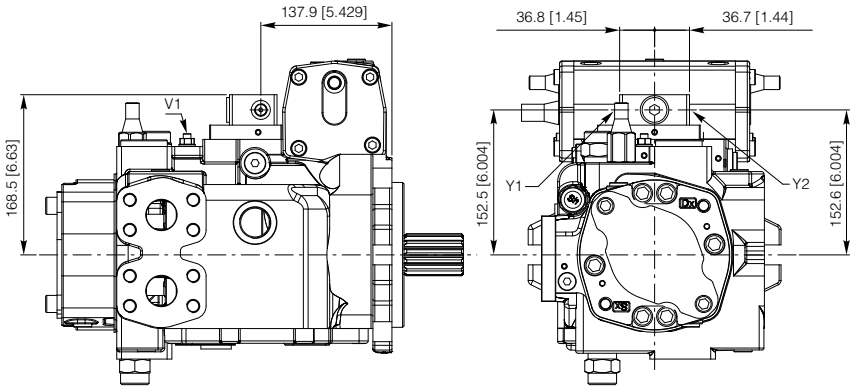
10 Control

HIR



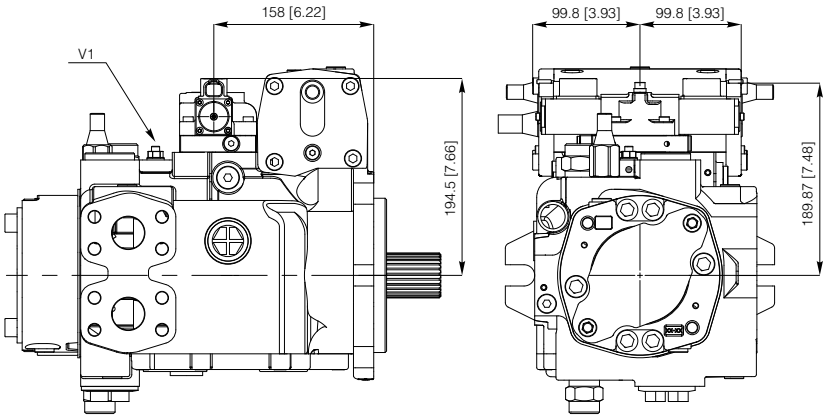
Y1, Y2: Control piloting pressure ports -1/4” G (BSPP) (ISO) - 7/16” - 20 UNF 2B (SAE)
V1: Adjustable throttle valve

HIN



Y1, Y2: Control piloting pressure ports -1/4” G (BSPP) (ISO) - 7/16” - 20 UNF 2B (SAE)
V1: Adjustable throttle valve

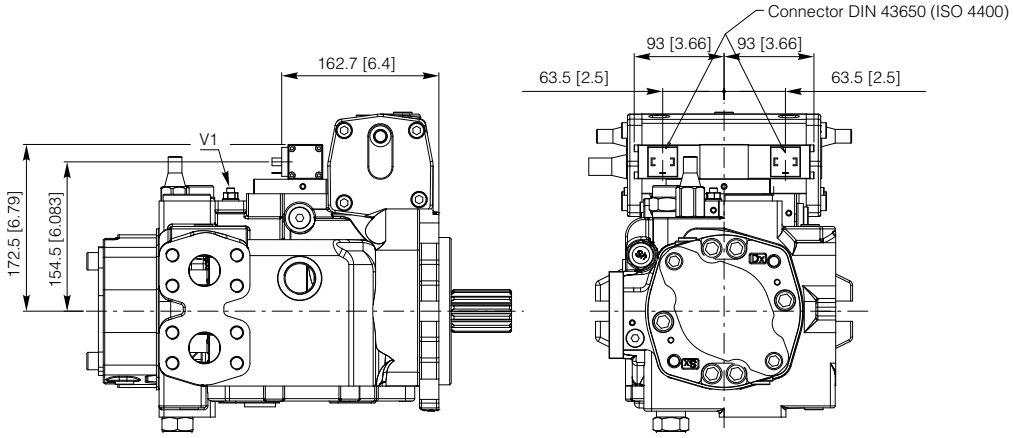
HER



V1: Adjustable throttle valve

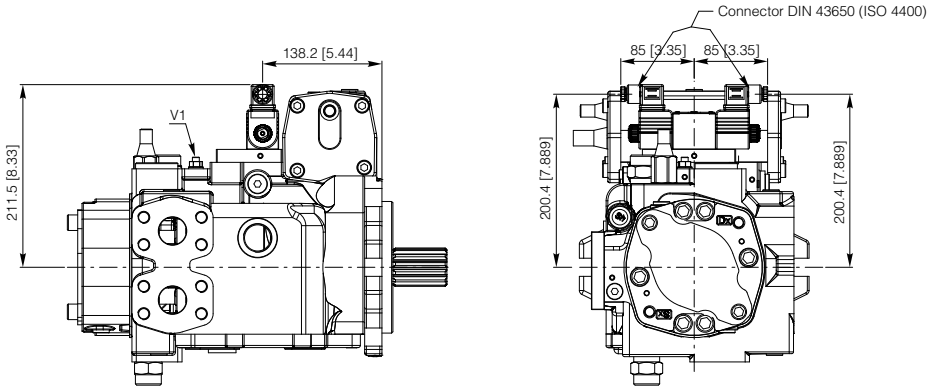
10 Control

HEN



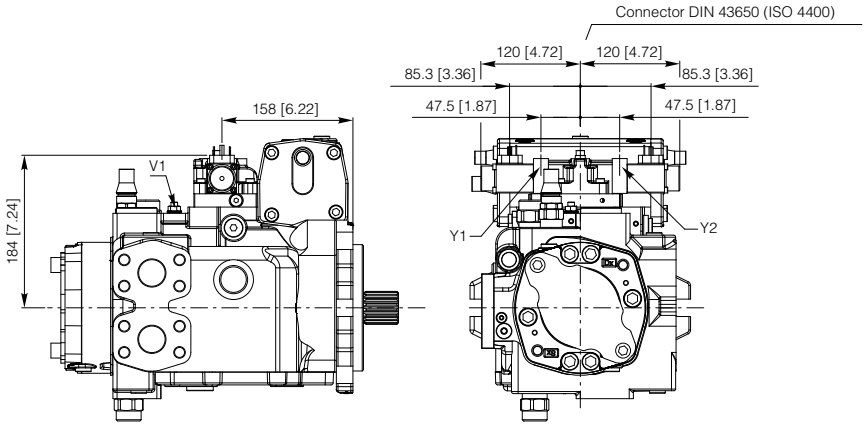
V1: Adjustable throttle valve

HE2



V1: Adjustable throttle valve

HEH

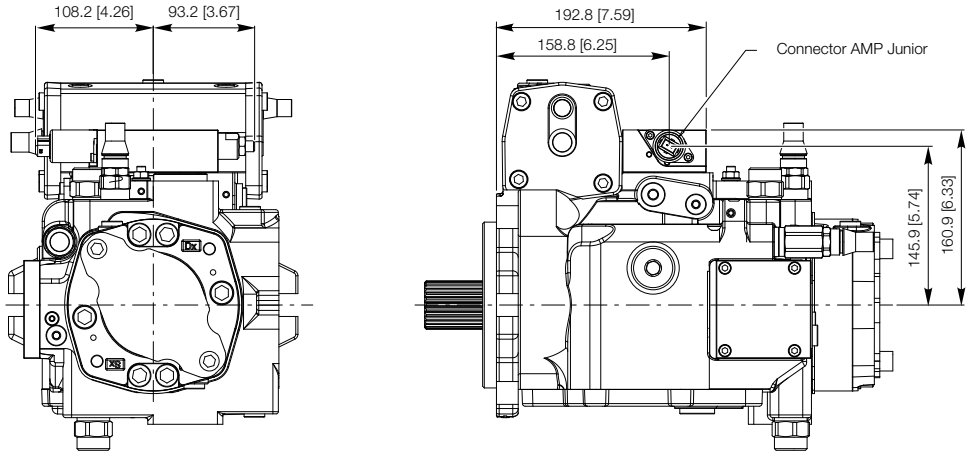


Y1, Y2: Control piloting pressure ports -1/8" G (BSPP) (ISO) - 5/16" - 24 UNF (SAE)
V1: Adjustable throttle valve

S6CV 128 - Pump and controls dimensions

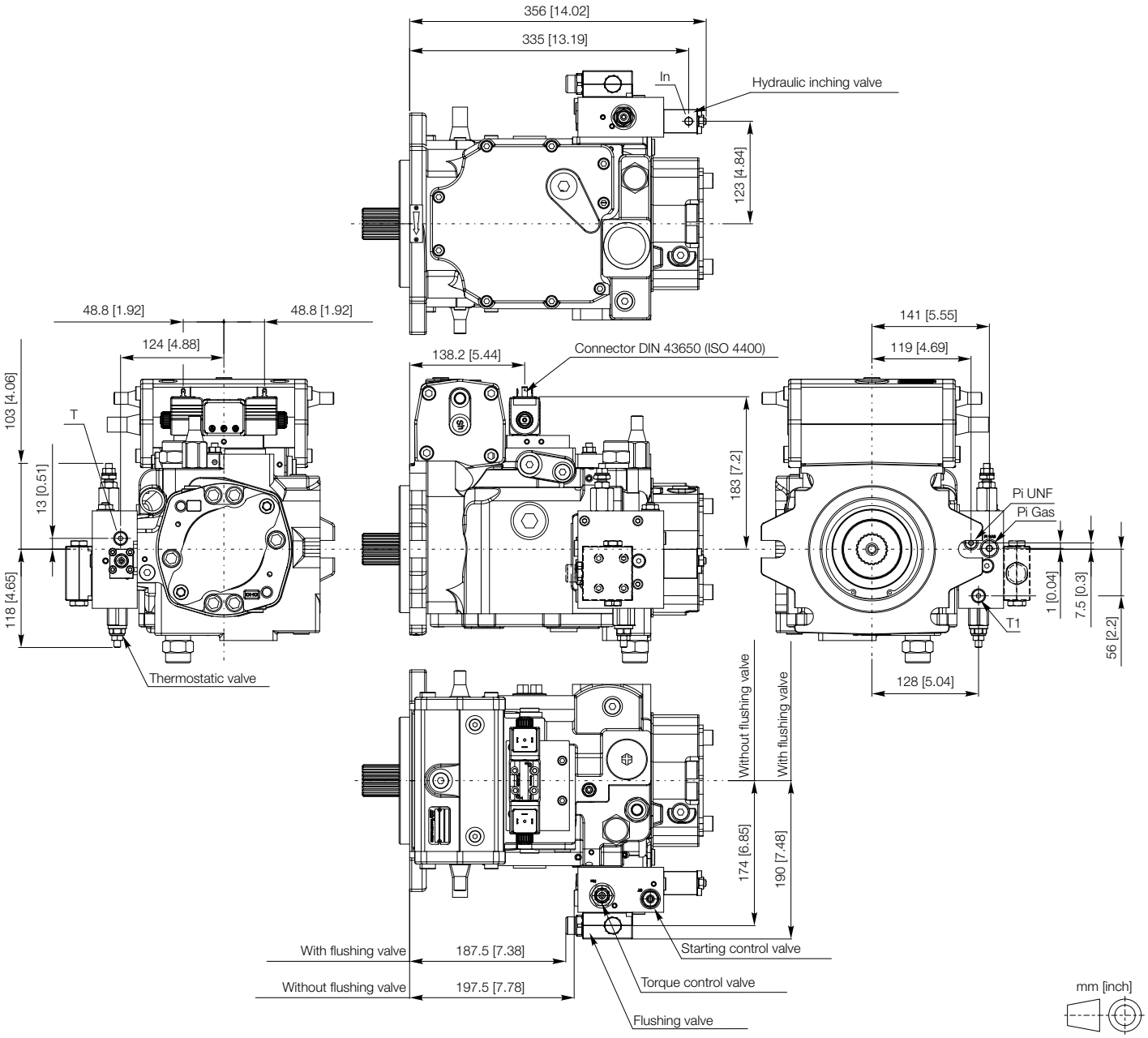
10 Control

HFD



10 Control

Automotive HME with hydraulic Inching (IH)

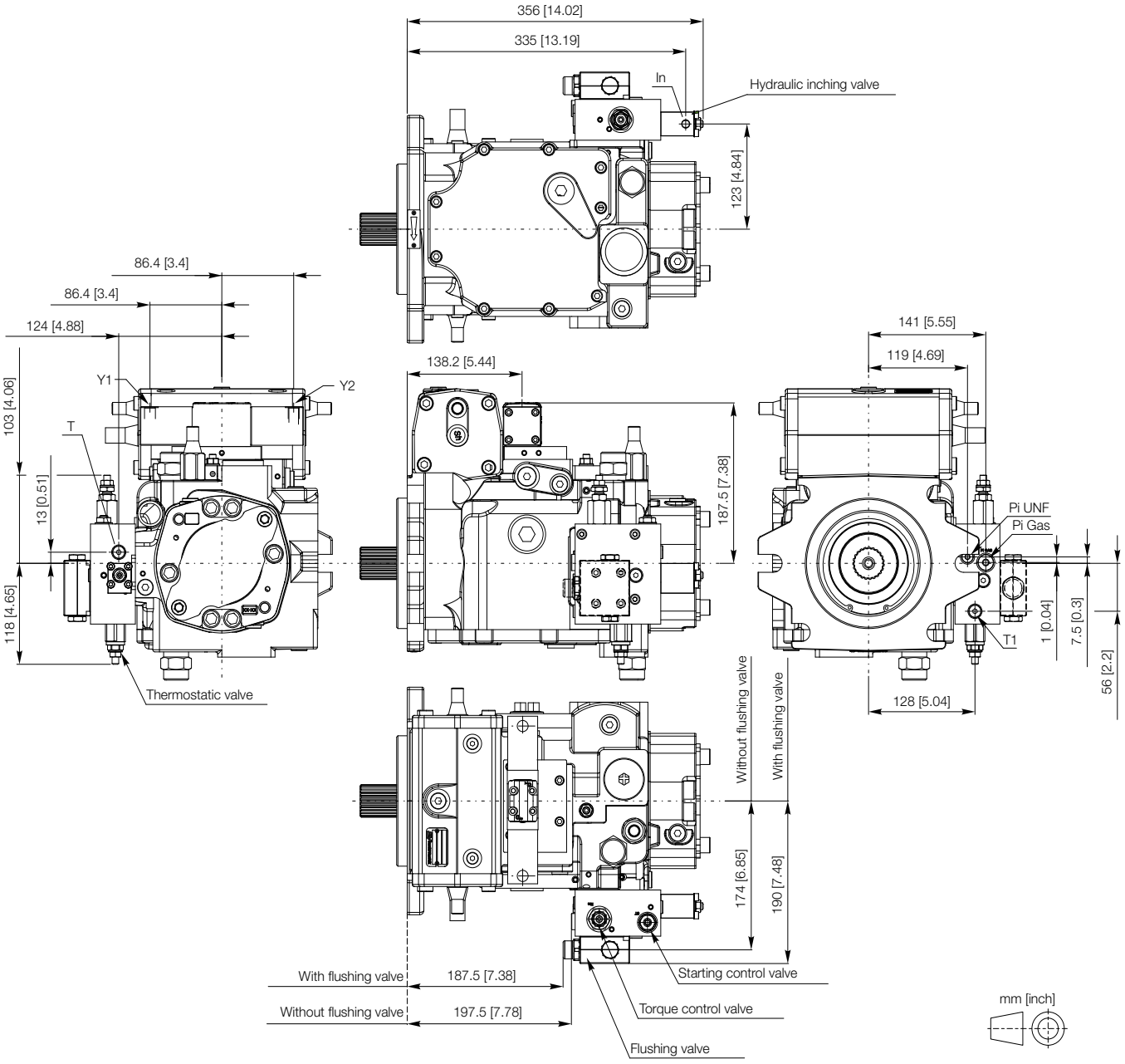


Pi Gas: Piloting pressure gauge port - 1/4" G (BSPP) (ISO)
Pi UNF: Piloting pressure gauge port - 7/16" - 20 UNF (SAE)
In: Piloting pressure Inching port - 1/8" G (BSPP) (ISO) - 7/16" - 20 UNF with Nipple (SAE)
T1: Drainage pressure gauge port - 1/8" G (BSPP)
T: Drainage pressure gauge port - 1/4" G (BSPP)

S6CV 128 - Pump and controls dimensions

10 Control

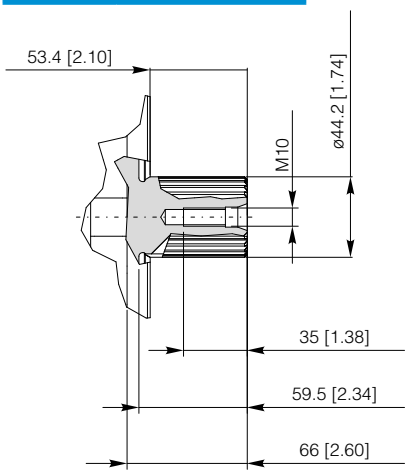
Automotive HMI with hydraulic Inching (IH)



Y1-Y2: Control piloting pressure ports - 1/4" G (BSPP) (ISO) - 7/16" - 20 UNF with Nipple (SAE)
Pi Gas: Piloting pressure gauge port - 1/4" G (BSPP) (ISO)
Pi UNF: Piloting pressure gauge port - 7/16" - 20 UNF (SAE)
In: Piloting pressure Inching port - 1/8" G (BSPP) (ISO) - 7/16" - 20 UNF with Nipple (SAE)
T1: Drainage pressure gauge port - 1/8" G (BSPP)
T: Drainage pressure gauge port - 1/4" G (BSPP)

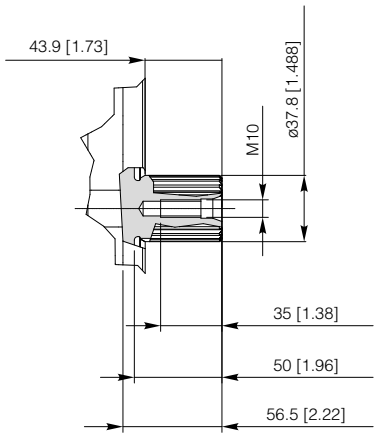
8 Shaft end

BE Splined



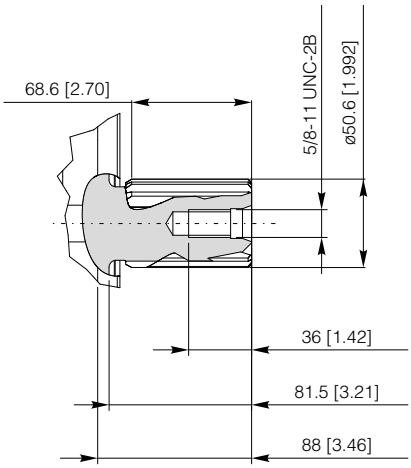
27T 16/32" DP - ANSI B92.1a - 1976 FLAT ROOT

BF Splined



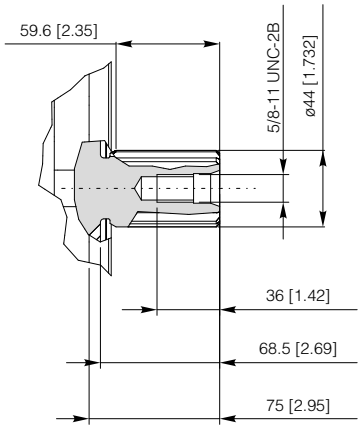
23T 16/32" DP - ANSI B92.1a - 1976 FLAT ROOT

BG Splined



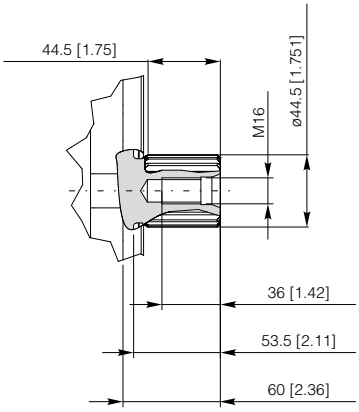
15T 8/16" DP - ANSI B92.1a - 1976 FLAT ROOT

BH Splined



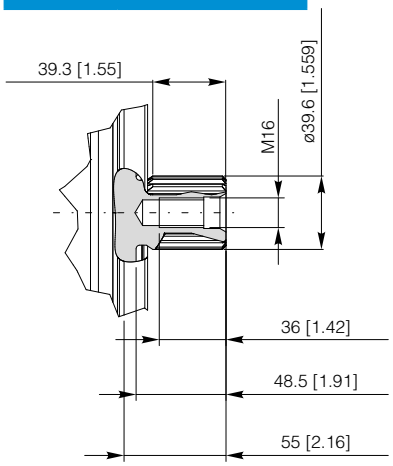
13T 8/16" DP - ANSI B92.1a - 1976 FLAT ROOT

BI Splined



W45x2x30x21 DIN 5480

BL Splined

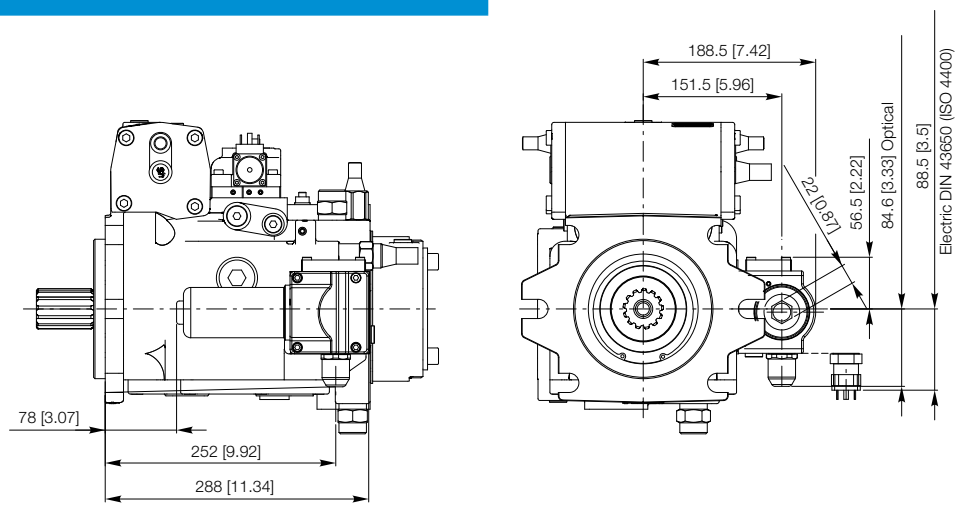


W40x2x30x18 DIN 5480

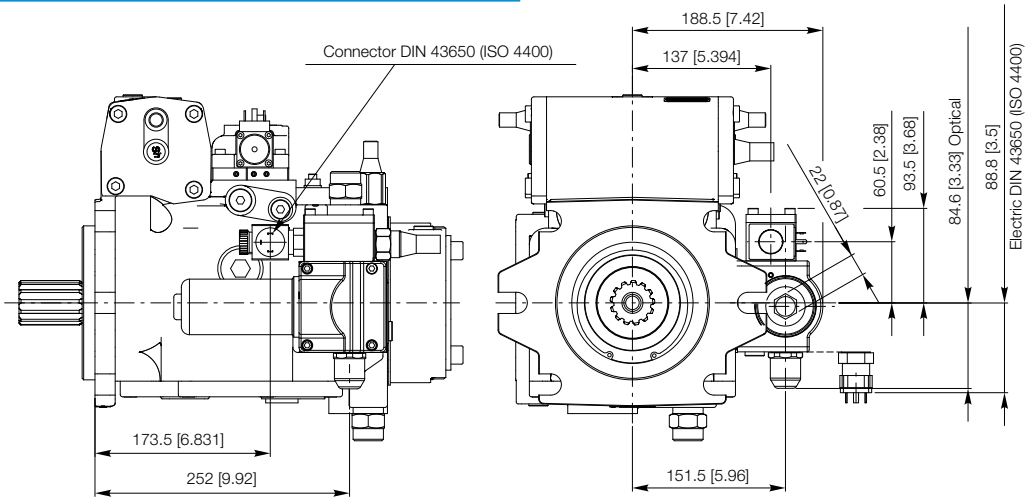
S6CV 128 - Pump and accessories dimensions

16 + 18 Pressure compensator and Cut-Off + Filter

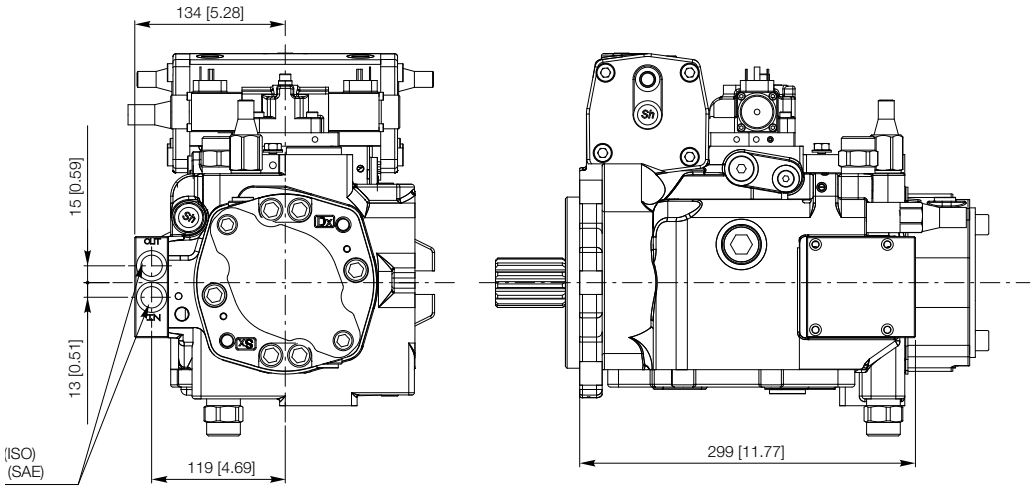
Filter



TE-EP Filter + Electric Cut-Off valve

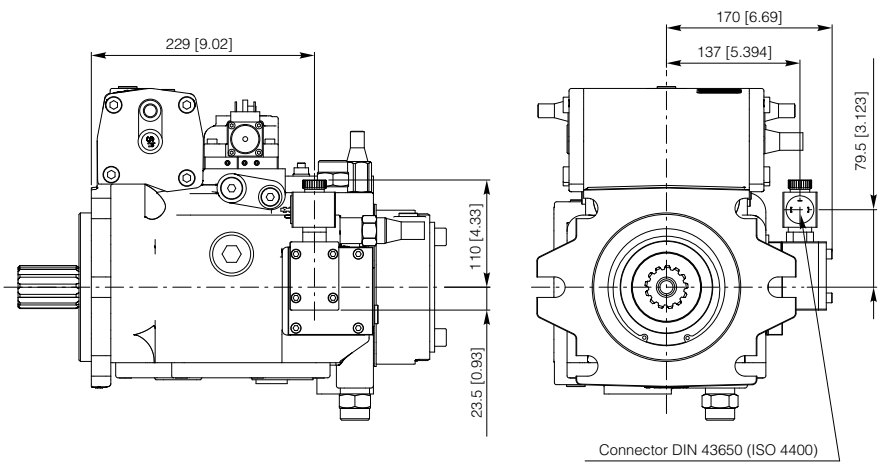


FR Remote filter



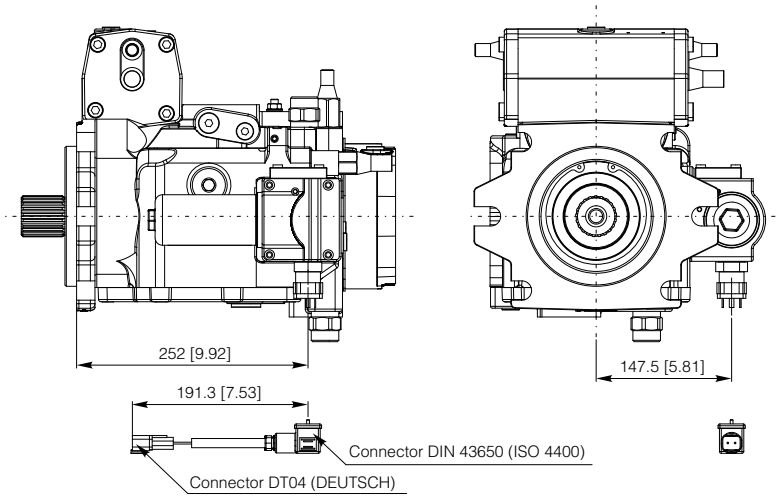
16 Pressure compensator and Cut-Off

TE Electric Cut-Off



21 Pump feature

DT4 Conversion cable from DIN43650 / ISO4400 to Deutsch DT04 connector (DT4)



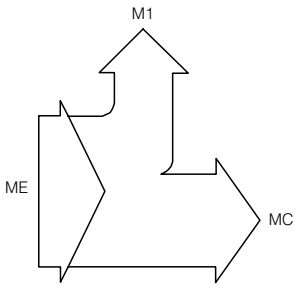
S6CV 128 - Throught drives

S6CV 128 pump can be supplied with through drive. The through drive can driving with a second S6CV or a pump of other kind.

Available flanges are:
Standard G2 and G3 gear pump flange
SAE A, SAE B, SAE C, SAE B-B and SAE C-C and SAE-D flange
TANDEM flange

The maximum permissible torques on drive shaft of the first pump and the maximum through drive torques are listed in the table below.

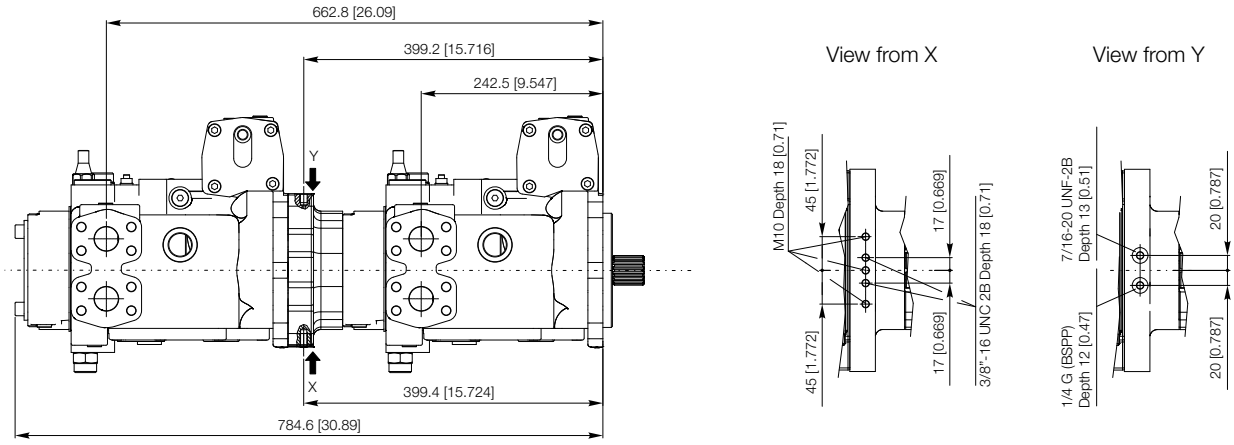
WARNING:
The effective torque value on the shaft of first pump is given by the sum of the torques required from each pump making the system.



Drive shaft			**BE** (Z27 16/32 DP)	**BF** (Z23 16/32 DP)	**BG** (Z15 8/16 DP)	**BH** (Z13 8/16 DP)	**BI** (W45x2x30x21)	**BL** (W40x2x30x18)
Drive shaft max torque	ME	Nm [lbf·ft]	1900 [1400]	1250 [921]	2670 [1967]	1640 [1208]	2190 [1614]	1460 [1076]
Through drive max torque	MC	Nm [lbf·ft]	1000 [737]	1000 [737]	1000 [737]	1000 [737]	1000 [737]	1000 [737]

19 Throught drive

S6CV 128 + S6CV 128 Tandem



Shafts for combination pumps

	Configuration 128/128	
Pump	1st.	2nd.
Shaft	**BF**	**BF-BH**
Shaft	**BE**	**BF-BH**
Shaft	**BG**	**BF-BH**
Shaft	**BH**	**BF-BH**
Shaft	**BI**	**BF-BH**
Shaft	**BL**	**BF-BH**

Warning:
The TA-TB-TZ-TY-BT-TC-CT-TD-TJ through drives must be used in the configuration of the first pump in the following cases:

1. Tandem pump combination.
2. Single pump for possible Tandem pump combination with Dana second pump.

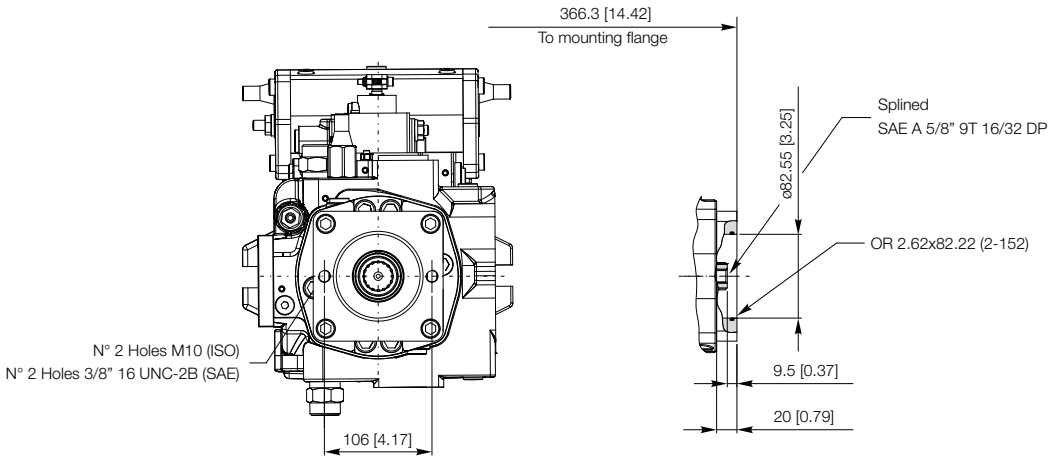
Example:

- If it is needed to purchase a Tandem pump combination with two S6CV 128 pumps and the second pump has the BF (23T - 16/32 DP) shaft, the first pump will must have the TJ through drive.
- If it is needed to purchase a single S6CV 128 pump for Tandem pump combination with a second pump has the BH (13T - 8/16 DP) shaft, the pump will must have the TD through drive.

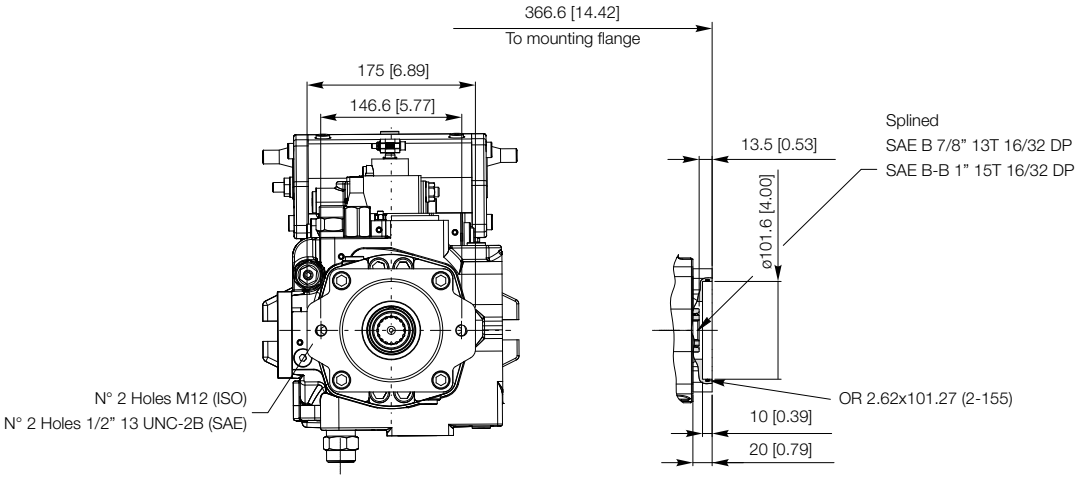
S6CV 128 - Throught drives dimensions

19 Throught drive

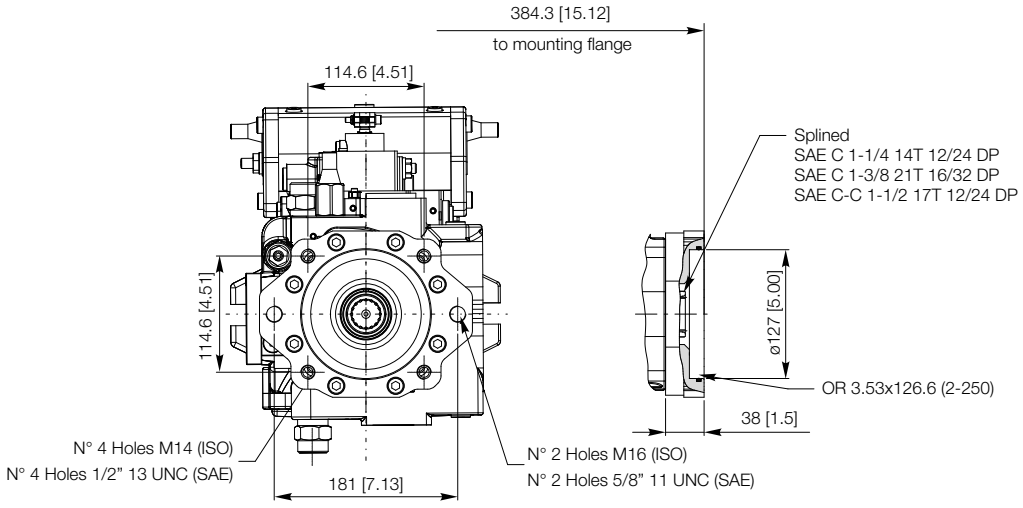
SA SAE A flange



SB/BB SAE B / SAE B-B flange

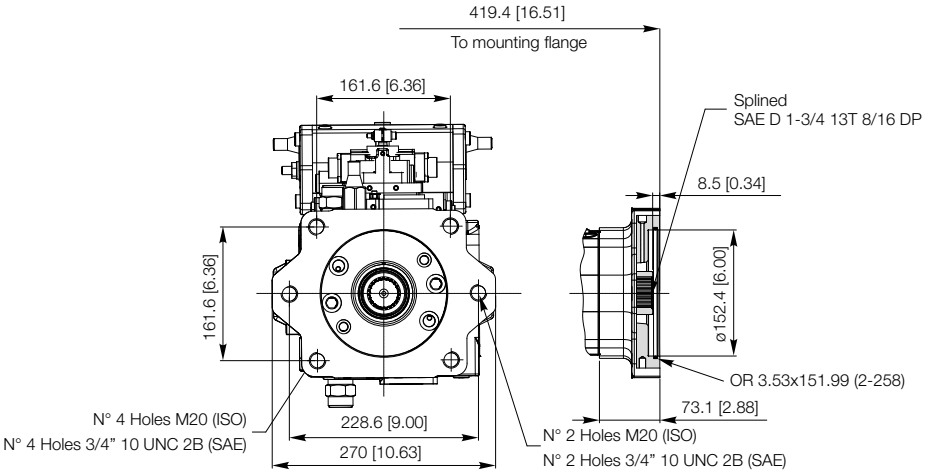


SC-S5/CC SAE C / SAE C-C flange

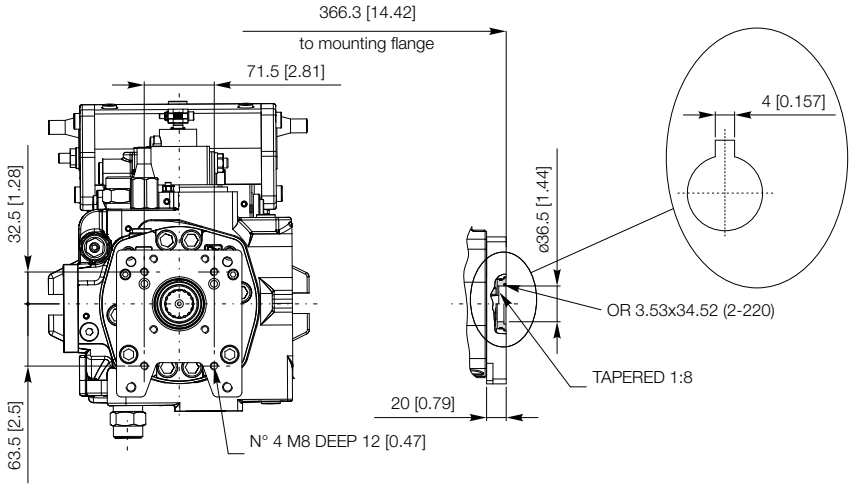


19 Throught drive

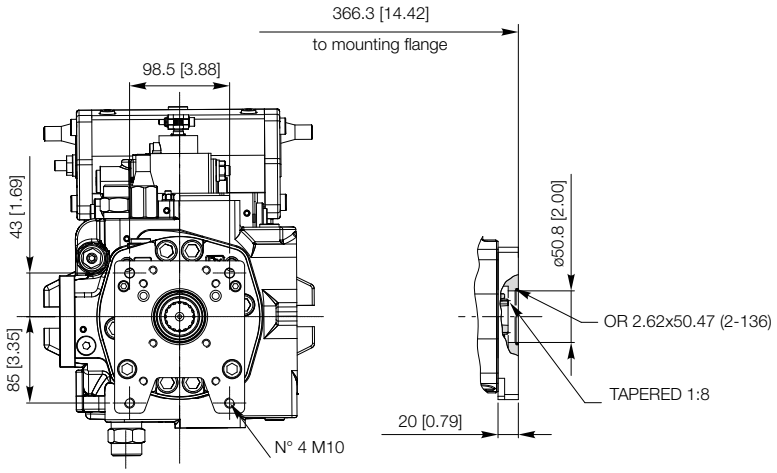
SD SAE D flange



G2 G2 flange



G3 G3 flange



DANA BREVINI® Motion Systems

SH7V - Variable displacement axial piston motors for open and closed circuit





Index

General information - Features N2
Technical data N4
Ordering code N5
Control N12
SH7V 055 ..... N28
SH7V 075 ..... N39
SH7V 108 ..... N50
SH7V 160 ..... N61
SH7V 200 ..... N72
Flushing valve N82
Tachometer N85

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]	**Max. peak pressure** bar [psi]
SH7V 055	61 [3.72]	271 [71.5]	430 [6235]	480 [6960]
SH7V 075	80.58 [4.91]	322 [85]	430 [6235]	480 [6960]
SH7V 108	112.5 [6.86]	400 [105.6]	430 [6235]	480 [6960]
SH7V 160	160.8 [9.81]	500 [132]	430 [6235]	480 [6960]
SH7V 200	216 [13.176]	626 [165.37]	430 [6235]	480 [6960]

SH7V series are a family of variable displacement motors, bent axis piston design for operation in both open and closed circuit. The proven design incorporating the lens shape valve plate, the high quality components and manufacturing techniques make able the SH7V series motors to provide up to 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak performance. Fully laboratory tested and field proven, these motors provide maximum efficiency and long life even at very bad filtering conditions. Heavy duty bearings permit high radial and axial loads. Versatile design includes a variety of control and shaft ends that will adapt the SH7V series motors to any application both industrial and mobile.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
$n_{0\ max}$	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure
p_{max}	bar [psi]	Maximum pressure peak

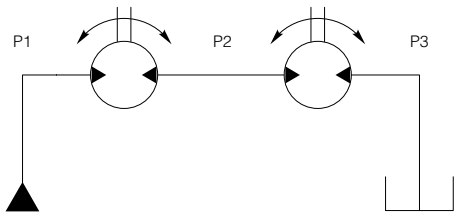
q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10÷15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and filtering section.

Temperature ranges:
The operating temperature of the oil must be within -25ºC ÷ 115ºC [-13ºF ÷ 239ºF]. The running of the unit with oil temperature higher than 115ºC [239°F] or lower than -25ºC [-13°F] is not allowed. For further information see at Fluids and filtering section.

Filtering:
A correct filtering helps to extend the service life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999. For further details see at Fluids and filtration section.

Operating pressure:
The maximum permissible pressure on pressure ports is 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak. It two motors are connected in series, total pressure has to be limited to following values: P1+P2 700 bar max. [10150 psi max].

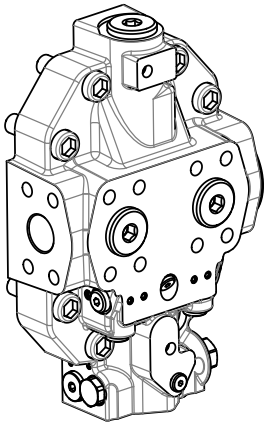


Case drain pressure:
Maximum permissible case drain pressure is 10 bar [145 psi]. A higher pressure can damage the main shaft seal or reduce its life.

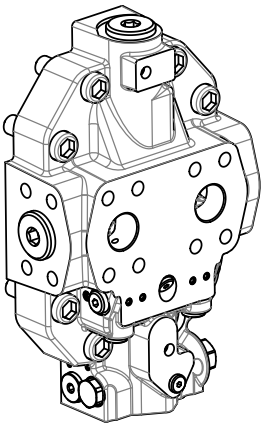
Seals:
Seals used on standard SH7V series axial piston motors are of FKM seals (Fluoroelastomer - Viton®). In case of use of use special fluids, contact Dana.

Minimum rotating speed:
Under “minimum rotating speed” we mean the minimum speed ensuring a smooth running of the piston unit. Operation smoothness at low speeds depends on many factors, as type of load and operating pressure. At a speed higher than 150 rpm, a smooth running is ensured almost in every case. Lower speeds are, usually, possible. For special applications please contact Dana.

Port plates:
The SH7V motor port plate has inlet and outlet ports, both lateral (LM-LS cover) and frontal (FM-FS cover). Unused ports are plugged with blind flanges. The kind of ports to be used must be specified when ordering.



LM-LS Port plate



FM-FS Port plate

Flushing valve:
The motors can be equipped with built in flushing valve for closed circuit operation. The use of the flushing valve in open loop circuits should be avoided, please contact Dana for further information

Installation:
SH7V series motors can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. Installation of the unit with shaft in vertical position and above the tank involves some limitations. For further details see at General installation guidelines.

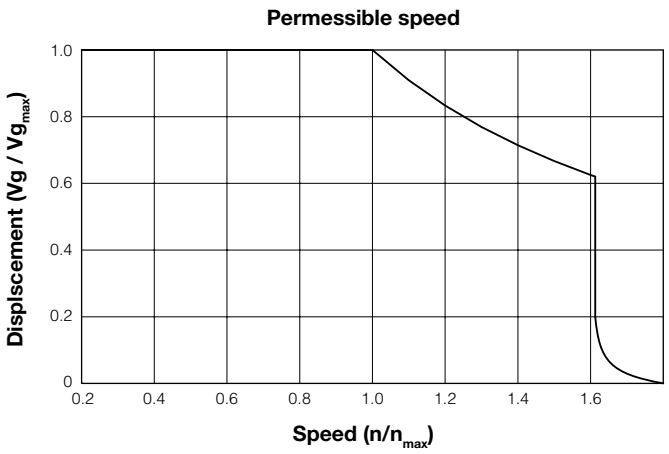
Technical data

			Size				
			55	75	108	160	200
Max. Displacement	**Vg**	cm^3/rev [in^3/rev]	61 [3.72]	80.58 [4.91]	112.5 [6.86]	160.8 [9.81]	216 [13.176]
Min. Displacement	**Vg_{min}**	cm^3/rev [in^3/rev]	30 [1.83]	40 [2.44]	56 [3.416]	80 [4.88]	108 [6.59]
Displacement minimum possible	**Vg_{min}**	cm^3/rev [in^3/rev]	12.2 [0.74]	16 [0.97]	22 [1.34]	32.2 1.96]	43 [2.62]
Displacement Optional	**Vg_{o}**	cm^3/rev [in^3/rev]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Max. Press. cont.	**p_{nom}**	bar [psi]	430 [6235]	430 [6235]	430 [6235]	430 [6235]	430 [6235]
Max. Press. peak	**p_{max}**	bar [psi]	480 [6960]	480 [6960]	480 [6960]	480 [6960]	480 [6960]
Max. flow	**q_{max}**	l/min [U.S.gpm]	271 [71.5]	322 [85]	400 [105.6]	500 [132]	626 [165.37]
Max. speed at Vg_{max} and q_{max}	**$n_{0\ max}$**	rpm	4450	4000	3550	3100	2900
Max. speed at $Vg<Vg_{max}$ (2)	**$n_{0\ max\ lim}$**	rpm	7000	6150	5600	5000	4600
Max. speed at Vg_0	**$n_{0\ max\ lim}$**	rpm	8350	7350	6300	5500	5100
Torque constant Vg_{max}	**T_k**	Nm/bar [lbf.ft/psi]	0.97 [0.04]	1.28 [0.06]	1.79 [0.09]	2.56 [0.13]	3.44 [0.17]
Max power at q_{max} and p_{nom}	**P_{max}**	kW [hp]	194 [259.9]	231 [309.5]	273 [365.8]	330 [442.2]	449 [602.1]
Max. torque cont. at p_{nom}	**T_{nom}**	Nm [lbf.ft]	418 [308]	552 [406.8]	770 [567.5]	1101 [811.4]	1479 [1090]
Max torque peak at p_{max}	**T_{max}**	Nm [lbf.ft]	466 [343.4]	616 [453.9]	859 [633]	1230 [906.5]	1651 [1216]
Moment of inertia	**J**	$kg{\cdot}m^2$ [$lbf.ft^2$]	0.005 [0.12]	0.009 [0.22]	0.0124 [0.31]	0.026 [0.616]	0.035 [0.829]
Weight (3)	**m**	kg [lbs]	28 [61.7]	36 [79.3]	47 [103.6]	63 [138.4]	82 [180.7]
Drain flow (4)	**q_d**	l/min [U.S.gpm]	3 [0.79]	4 [1.05]	5 [1.32]	5 [1.32]	5 [1.32]

(Theorical values, without considering η_{hm} and η_v approximate values). Peak operations must not exceed 1% of every minute. A simultaneous maximum pressure and maximum speed not recommended.

Notes:

(1) Maximum and minimum displacement can be changed with continuity. When ordering state Vg_{max} and Vg_{min} required.
(2) Determination of admissible speed n_{max} value can be increased by reducing motor maximum displacement. To determine the relationship beetwen Vg_{max} and nmax use the right side chart. Motor maximum admissible speed is $n_{max\ lim}$.
(3) Approximate values.
(4) Maximum value at 250 bar [3625 psi] with mineral oil at 45ºC [113°F] and 35 cSt of viscosity.



Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the SH11C motors. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Series	Motor	Size	Maximum displacement limitation	Minimum displacement limitation	Mount flange	Shaft end	Port cover	Seal	Control	Control specification	Valve	Flanged valves features	Flushing valve	Series feature	Painting
SH7V	M	055	61	30	OC	S20	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

1

Series	
SH7V	Variable displacement axial piston motor for open and closed circuit

2

Motor	
M	Motor

3

Size	
055	61 cm³/rev [3.72 in³/rev]
075	80.58 cm³/rev [4.91 in³/rev]
108	112.5 cm³/rev [6.86 in³/rev]
160	160.8 cm³/rev [9.81 in³/rev]
200	216 cm³/rev [13.176 in³/rev]

4

Maximum displacement limitation			Size				
			055	075	108	160	200
61÷30	From 61 cm³/rev [3.721 in³/rev] to 30 cm³/rev [1.830 in³/rev]	Standard 61 cm³/rev [3.721 in³/rev]	●	–	–	–	–
80÷64	From 80 cm³/rev [4.880 in³/rev] to 64 cm³/rev [3.904 in³/rev]	Standard 80 cm³/rev [4.880 in³/rev]	–	●	–	–	–
112÷91	From 112 cm³/rev [6.832 in³/rev] to 91 cm³/rev [5.551 in³/rev]	Standard 112 cm³/rev [6.832 in³/rev]	–	–	●	–	–
160÷130	From 160 cm³/rev [9.760 in³/rev] to 130 cm³/rev [7.930 in³/rev]	Standard 160 cm³/rev [9.760 in³/rev]	–	–	–	●	–
216÷172	From 216 cm³/rev [13.176 in³/rev] to 172 cm³/rev [10.492 in³/rev]	Standard 216 cm³/rev [13.176 in³/rev]	–	–	–	–	●

● Available
– Not available

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7V	M	055	61	30	OC	S20	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

5

Minimum displacement limitation			Size				
			055	075	108	160	200
0	0 cm³/rev		●	●	●	●	●
12÷42	From 12 cm³/rev [0.732 in³/rev] to 42 cm³/rev [2.562 in³/rev]	Standard 30 cm³/rev [1.830 in³/rev]	●	–	–	–	–
16÷56	From 16 cm³/rev [0.976 in³/rev] to 56 cm³/rev [3.416 in³/rev]	Standard 40 cm³/rev [2.440 in³/rev]	–	●	–	–	–
22÷80	From 22 cm³/rev [1.342 in³/rev] to 80 cm³/rev [4.880 in³/rev]	Standard 56 cm³/rev [3.416 in³/rev]	–	–	●	–	–
32÷112	From 32 cm³/rev [1.952 in³/rev] to 112 cm³/rev [6.832 in³/rev]	Standard 80 cm³/rev [4.880 in³/rev]	–	–	–	●	–
43÷108	From 43 cm³/rev [2.623 in³/rev] to 108 cm³/rev [6.588 in³/rev]	Standard 108 cm³/rev [6.588 in³/rev]	–	–	–	–	●

● Available
– Not available

6

Mount flange		Size				
		055	075	108	160	200
OC	ISO 4 Bolts Ø 125 mm [Ø 4.921 in]	●	–	–	–	–
OD	ISO 4 Bolts Ø 140 mm [Ø 5.511 in]	–	●	–	–	–
OE	ISO 4 Bolts Ø 160 mm [Ø 6.299 in]	–	–	●	–	–
OF	ISO 4 Bolts Ø 180 mm [Ø 7.086 in]	–	–	–	●	–
OG	ISO 4 Bolts Ø 200 mm [Ø 7.87 in]	–	–	–	–	●
05	SAE-C 4 Bolts	●	●	–	–	–
08	SAE-D 4 Bolts	–	–	●	●	–
10	SAE-E 4 Bolts	–	–	–	–	●

● Available
– Not available

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7V	M	055	61	30	OC	S20	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

7

Shaft end		Size				
		055	075	108	160	200
S20	Splined 27T - 16/32 DP	–	–	●	●	–
S19	Splined 15T - 8/16 DP	–	–	–	●	●
S15	Splined 13T - 8/16 DP	–	–	●	●	●
S12	Splined 14T - 12/24 DP	●	●	–	–	–
SAR	Splined W50x2x30x24 - DIN 5480	–	–	–	●	●
SAP	Splined W45x2x30x21 - DIN 5480	–	–	●	●	–
SAO	Splined W40x2x30x18 - DIN 5480	–	●	●	–	–
SAM	Splined W35x2x30x16 - DIN 5480	●	●	–	–	–
SAI	Splined W30x2x30x14 - DIN 5480	●	–	–	–	–
C18	Ø44.45 mm [1.75 in] Parallel keyed	–	–	●	–	–
C17	Ø31.75 mm [1.25 in] Parallel keyed	●	–	–	–	–
CAJ	Ø45 mm [1.772 in] Parallel keyed	–	–	–	●	–
CAK	Ø40 mm [1.574 in] Parallel keyed	–	–	●	–	–
CAY	Ø35 mm - 10x8x56 [1.378 in - 0.39x0.31x2.2] Parallel keyed	–	●	–	–	–
CAW	Ø30 mm [1.181 in] Parallel keyed	●	–	–	–	–

● Available
– Not available

8

Port cover		Size									
		055		075		108		160		200	
		Mount flange									
		OC	05	OD	05	OE	08	OF	08	OG	10
FM	Metric End Main ports	●	●	●	●	●	●	●	●	●	●
FS	SAE End Main ports	●	●	●	●	●	●	●	●	●	●
LM	Metric Main Ports positioned 180° apart	●	●	●	●	●	●	●	●	●	●
LS	SAE Main Ports positioned 180° apart	●	●	●	●	●	●	●	●	●	●
L3	Metric Main Ports positioned 180° apart (no VSC)	●	-	●	-	●	-	●	-	-	-

● Available
– Not available

Warning
Referred ports are the ones on the portplate and on the controls

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7V	M	055	61	30	OC	S20	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

9

Seal	
V	FKM

10

Control		Port Cover				
		FM	FS	LM	LS	L3
2EE	Electric two positions control with pressure override	●	●	●	●	–
2EN	Electric two positions control	●	●	●	●	–
2IE	Hydraulic two positions control with pressure override	●	●	●	●	–
2IN	Hydraulic two positions control	●	●	●	●	–
REE	Electric proportional control with pressure override	●	●	●	●	●
RED	Electric proportional control with double step pressure override	●	●	●	●	●
REN	Electric proportional control	●	●	●	●	●
RIE	Hydraulic proportional control with pressure override	●	●	●	●	●
RID	Hydraulic proportional control with double step pressure override	●	●	●	●	●
RIN	Hydraulic proportional control	●	●	●	●	●
RPE	Working pressure control	●	●	●	●	–
RPI	Working pressure control with hidraulic override	●	●	●	●	●
RPS	Working pressure control with electric override	●	●	●	●	●
ROE	Working pressure control Δp 100 bar	●	●	●	●	●
ROI	Working pressure control Δp 100 bar with hidraulic override	●	●	●	●	●
ROS	Working pressure control Δp 100 bar with electric override	●	●	●	●	●

● Available
– Not available

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7V	M	055	61	30	OC	S20	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

11

Control specification			Control (Chosen)														
			RPE	ROE	2EE	2EN	2IE	2IN	REE	RED [1]	REN	RID [1]	RIE	RIN	RPI	ROI	ROS	RPS
Displacemet setting	1	From Max. Displac. to Min. Displac. ($Vg_{max} \rightarrow Vg_{min}$)	–	–	●	●	●	●	●	●	●	●	●	●	–	–	–	–
	2	From Min. Displac. to Max. Displac. ($Vg_{min} \rightarrow Vg_{max}$)	●	●	–	●	–	●	–	–	●	–	–	●	●	●	●	●
None	00		–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–
Pressure Setting (*)	(*)	100÷400 bar [1430÷5802 psi]	●	–	●	–	●	–	●	●	–	●	●	–	●	–	–	–
		100÷350 bar [1430÷5076 psi]	–	●	–	–	–	–	–	–	–	–	–	–	–	●	●	●
Start of control, Setting range (*)	(*)	5-10-15-20 bar [72-145-218-290 psi]	–	–	–	–	–	–	–	–	–	●	●	●	–	–	–	–
Δp Displacement change	25	25 bar [363 psi]	–	–	–	–	–	–	–	–	–	●	●	●	–	–	–	–
Voltage	12	12 - Connector DIN43650	–	–	●	●	–	–	●	●	●	–	–	–	–	–	●	●
	24	24 - Connector DIN43650	–	–	●	●	–	–	●	●	●	–	–	–	–	–	●	●
	D2	12 - Deutsch DT04	–	–	●	●	–	–	●	–	●	–	–	–	–	–	●	●
	D4	24 - Deutsch DT04	–	–	●	●	–	–	●	–	●	–	–	–	–	–	●	●
	A2	12 V - ATEX T6 (Solo 55 2EN)	–	–	–	●	–	–	–	–	●	–	–	–	–	–	–	–
	A4	24 V - ATEX T6 (Solo 55 2EN)	–	–	–	●	–	–	–	–	●	–	–	–	–	–	–	–
Control orifice (**)	04	With Ø 0.4 mm [Ø 0.015 in] Control Orifice	●	–	●	●	●	●	–	–	–	–	–	–	–	–	–	–
	05	With Ø 0.5 mm [Ø 0.0196 in] Control Orifice	–	●	–	–	–	–	●	●	●	●	●	●	●	●	●	●
	07	With Ø 0.7 mm [Ø 0.027 in] Control Orifice	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Specify for each control, all the required values for the chosen control.

● Available
– Not available

[1] Specify Pressure Setting values for Step 1 and Step 2 (Step1<Step2)
(*) Supply the setting value
(**) 0.4 mm [Ø 0.015 in] (standard) nozzle, provides a smooth control response (max-to-min and min-to-max), while Ø 0.5-0.7 mm [Ø 0.0196-0.027 in] (optional) nozzle, provides a faster reaction.

Warning:
The values showed are only valid in maximum and minimum displacement conditions of the respective displacement.
For different values, verify the possibility with the control diagrams present on the catalogue.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7V	M	055	61	30	OC	S20	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

12

Valve		Size				
		055	075	108	160	200
XXXX	None	●	●	●	●	●
VCD1	VCD/1 Pilot assisted overcentre valve	LM	LM	LM	LM	LM
VCD2	VCD/2 Pilot assisted overcentre valve	–	LM	LM	LM	LM
VCR2	VCR2 D/AF Double acting overcentre valve	FM	–	–	–	–
VCR4	VCR4 double acting overcentre valve	–	FM	FM	FM	–

● Available
– Not available

The valves are available with ISO port cover only, please contact Technical department for SAE version
The LM - FM digit means that the valve is only available with LM - FM port cover.

13

Flanged valves features		Valve				
		XXXX	VCD1	VCD2	VCR2	VCR4
000	Feature not necessary	●	–	–	–	–
002	Not Set 0÷350 bar [0 to 5075 psi] [Piloting ratio 2.9:1] - Control of rotation CW	–	●	–	–	–
006	Not Set 0÷350 bar [0 to 5075 psi] [Piloting ratio 2.9:1] - Control of rotation CCW	–	●	–	–	–
003	Not Set 250÷500 bar [3625 to 7250 psi] [Piloting ratio 13:1] - Control of rotation CW	–	–	●	–	–
007	Not Set 250÷500 bar [3625 to 7250 psi] [Piloting ratio 13:1] - Control of rotation CCW	–	–	●	–	–
010	Not Set - Aluminum 60÷350 bar [870 to 5075 psi] [Piloting ratio 6.2:1]	–	–	–	●	–
013	Not Set 140÷350 bar [2030 to 5075 psi] [Piloting ratio 4.5:1]	–	–	–	–	●

● Available
– Not available

Please contact Technical department for valve which require specific setting.
For the feature see catalogue valves.

14

Flushing valve		Port Cover				
		FM	FS	LM	LS	L3
XX	No Flushing Valve	-	-	-	-	●
PR	Arranged for Flushing Valve	●	●	●	●	-
06	VSC/F Flushing valve - 6 l/min [1.58 U.S. gpm]	●	●	●	●	-
09	VSC/F Flushing valve - 10.5 l/min [2.77 U.S. gpm]	●	●	●	●	-
15	VSC/F Flushing valve - 15 l/min [3.96 U.S. gpm]	●	●	●	●	-

● Available
– Not available

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7V	M	055	61	30	OC	S20	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

15

Series feature	
XX	None
TS	Prepared for tachometer sensor
TW	Tachometer + sensor 2-channel-Hall effect PNP - 5V
TZ	Tachometer + sensor 2-channel-Hall effect

● Available
– Not available

16

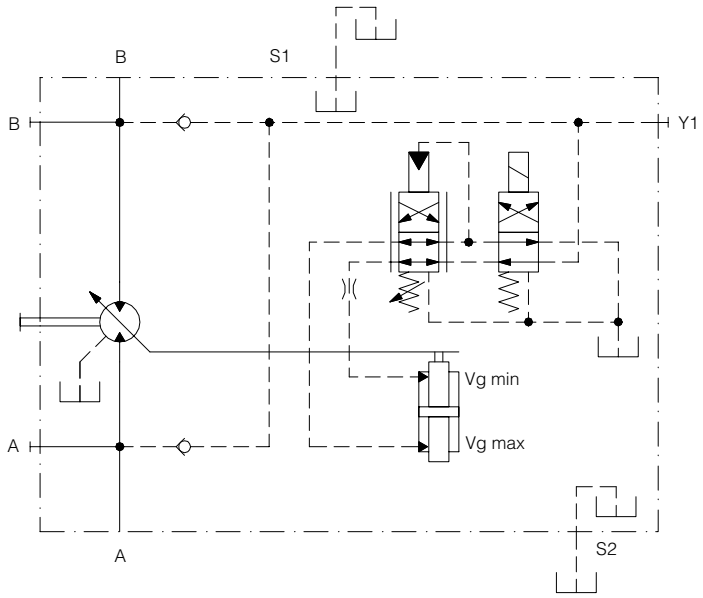
Painting	
XX	Not Required
01	Black Painted RAL 9005
02	Blue Painted RAL 5015

Hydraulic two positions control with pressure override 2EE

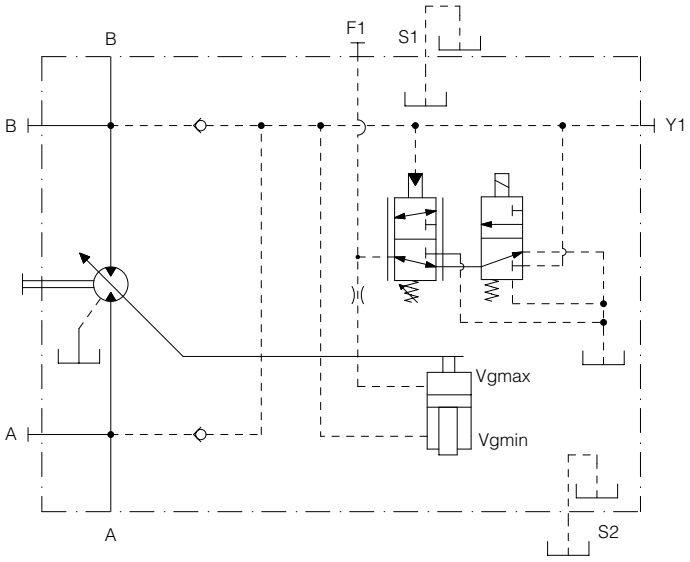
The 2EE control version with the pressure override allows the motor to swivel to Vg_{max} when the pressure setting is reached. Same as '2EN' control, when solenoid valve is switched off the motor is at Vg_{max}. The motor displacement is adjusted to Vgmin when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to Vg_{max}. Swivel range is from Vg_{max} to Vg_{min} (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

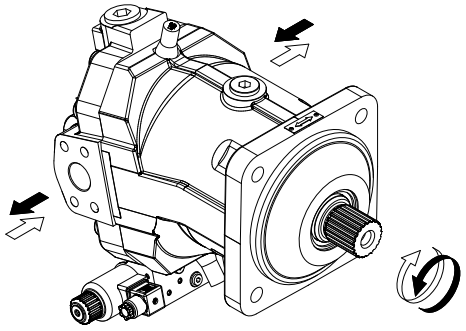
Size:
055-075-108-160



Size:
200



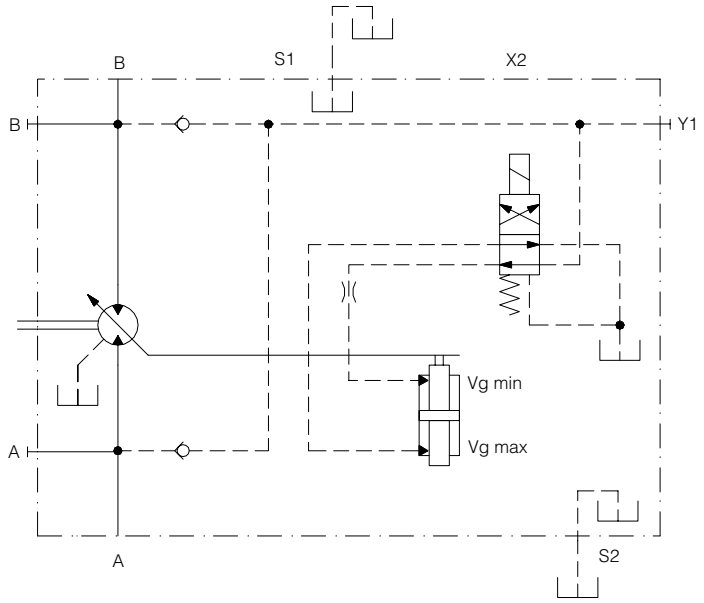
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



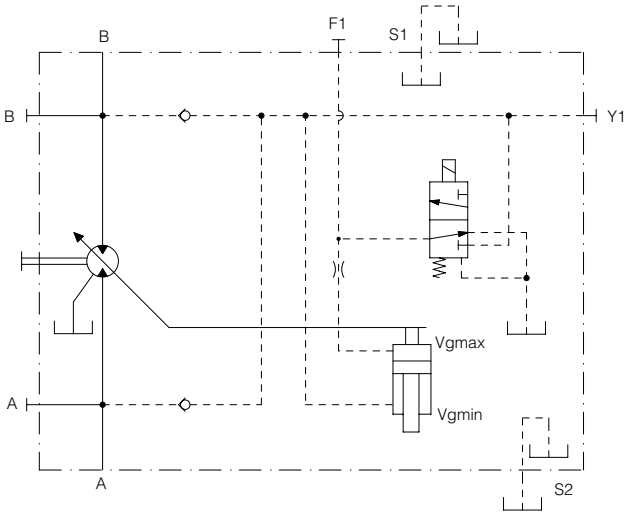
The electric two positions control allows the displacement of the motor to be set to Vg_{max} or Vg_{min} by switching an ON/OFF solenoid valve. The feed back spring is missing so Vgmax or Vgmin only can be set. 12V DC and 24V DC ON/OFF solenoid are available. The swivel range is 1 (from Vg_{max} to Vg_{min}) or 2 (swivel range from Vg_{min} to Vg_{max}).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

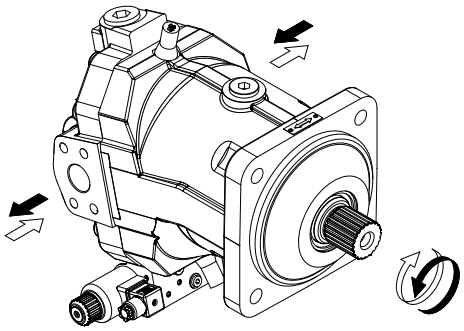
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The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.

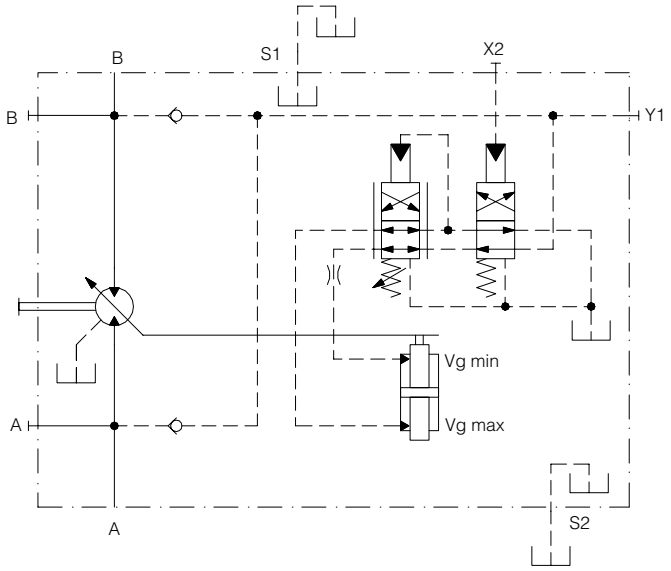


Hydraulic two positions control with pressure override 2IE

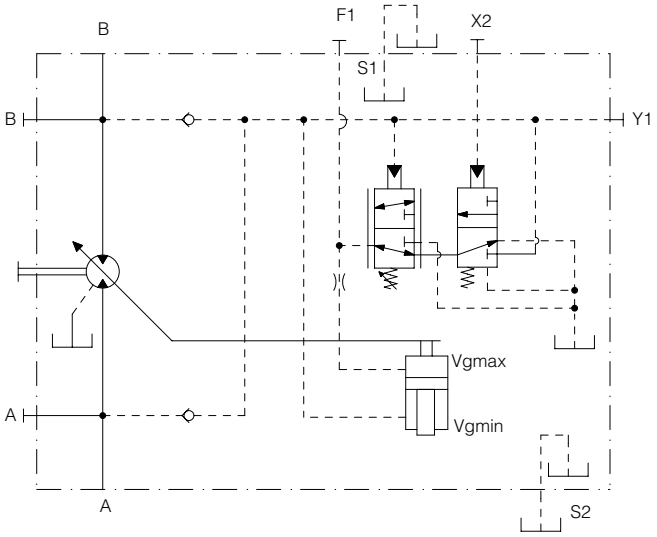
The 2IE control version with the pressure override allows the motor to swivel to Vg_{max} when the pressure setting is reached. Same as 2IN control, the motor displacement is adjusted to Vgmin when the pilot pressure applied at port X2. Minimum required pilot pressure = 10 bar [145 psi] and maximum permissible pressure at port X2=100 bar [1450 psi]. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to Vg_{max}. Swivel range is from Vg_{max} to Vg_{min} (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

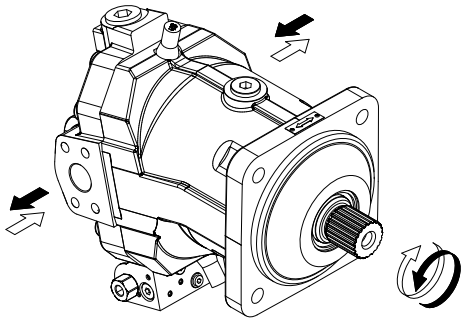
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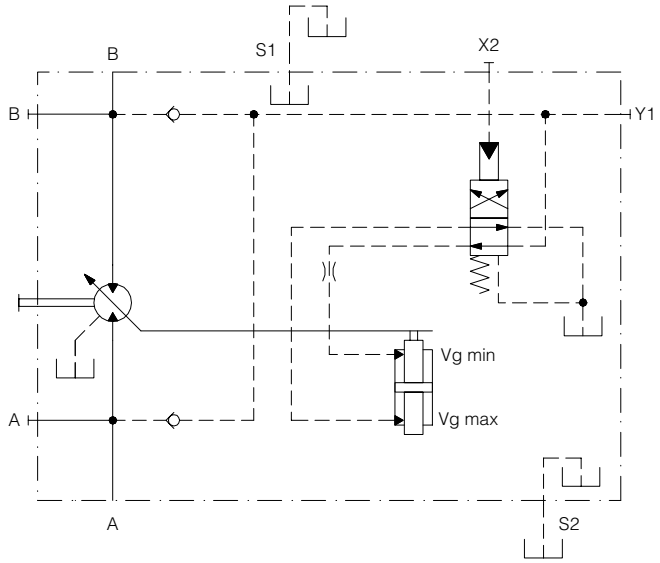
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



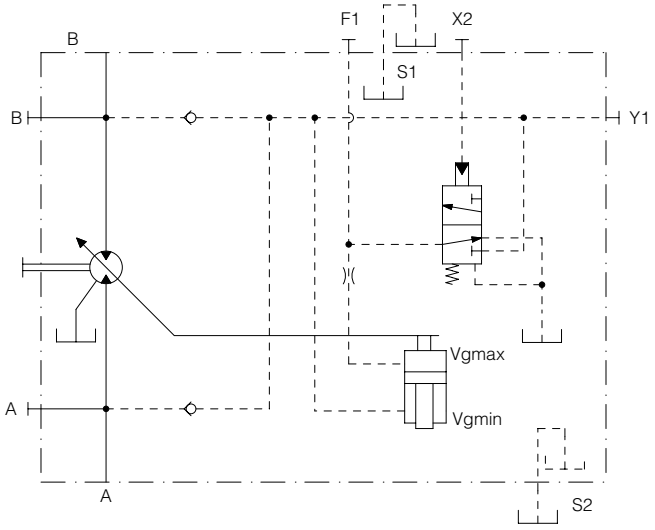
The hydraulic two positions control allows the displacement of the motor to be set to Vg_{max} or Vg_{min} by applying or not a pilot pressure at port X2. The feed back spring is missing so Vg_{max} or Vg_{min} only can be set. Minimum required pilot pressure = 10 bar [145 psi] and maximum permissible pressure at port X2=100 bar [1450 psi]. The swivel range is 1 (from Vg_{max} to Vg_{min}) or 2 (swivel range from Vg_{min} to Vg_{max}).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

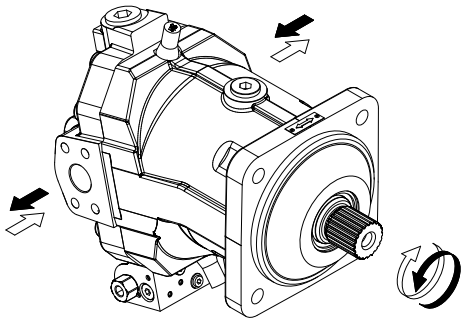
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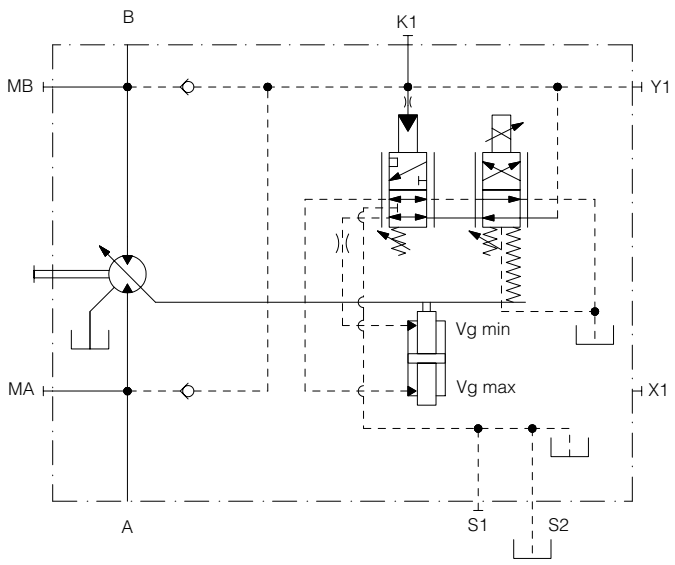
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



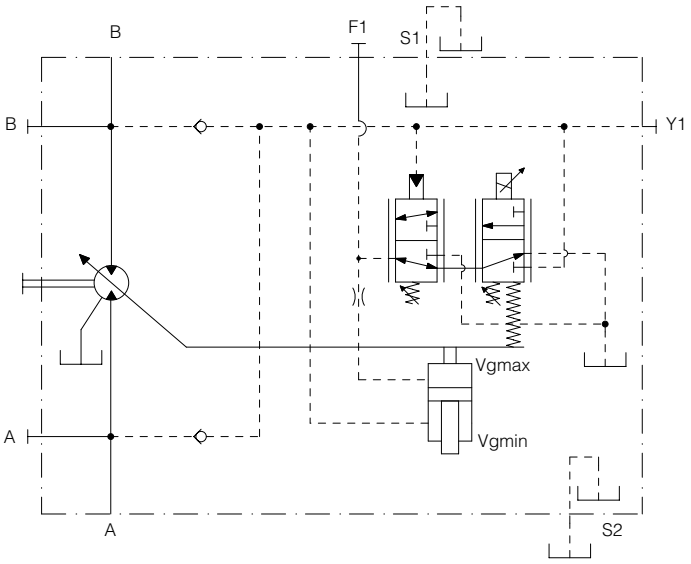
The REE control version with the pressure override allows the motor to swivel to Vg_{max} when the pressure setting is reached. Same as REN control, when solenoid valve is switched off the motor is at Vgmax. The proportional solenoid valve is available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The motor displacement is adjusted to Vg_{min} when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to Vg_{max}. Swivel range is from Vgmax to Vg_{min} (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

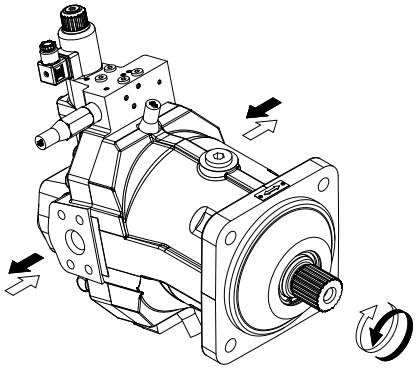
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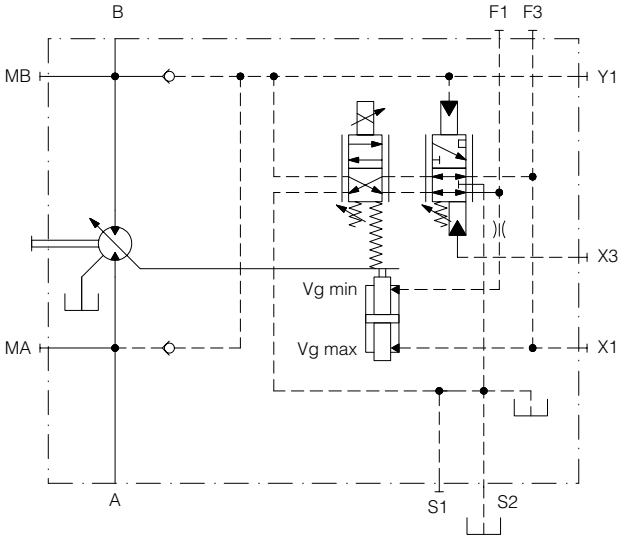
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



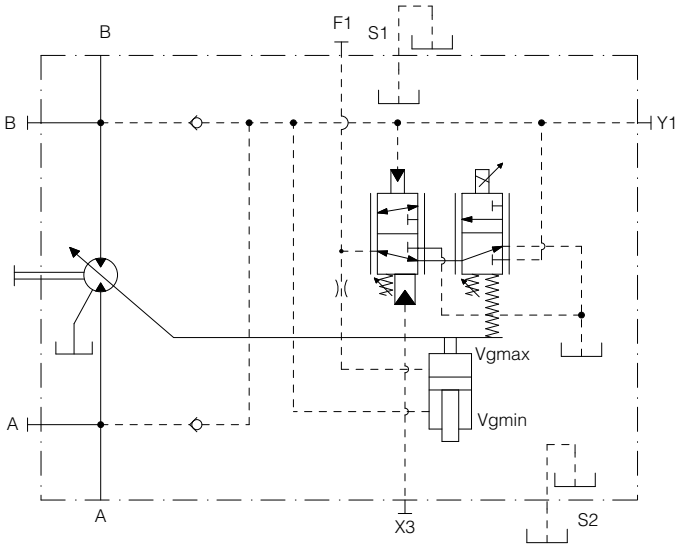
The RED control version with the pressure override allows the motor to swivel to Vg_{max} when the pressure setting is reached. Same as REN control, when solenoid valve is switched off the motor is at Vg_{max}. The proportional solenoid valve is available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The motor displacement is adjusted to Vg_{min} when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to Vg_{max}. Swivel range is from Vg_{max} to Vg_{min} (displacement setting 1 per our ordering code). Applying a pressure to port X3, the setting of PE control can be overridden by a different value of pressure. Setting range from 16 bar [232 psi] to 64 bar [928 psi] around.

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

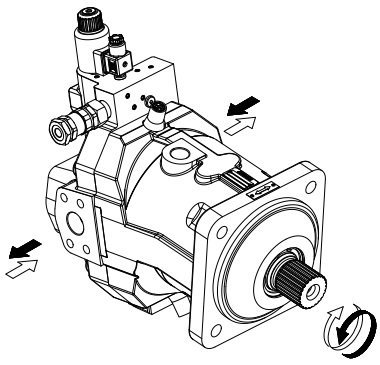
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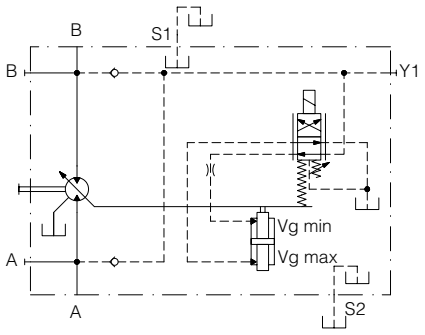
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.

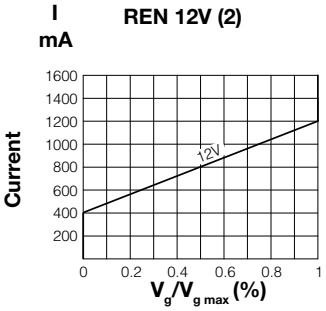


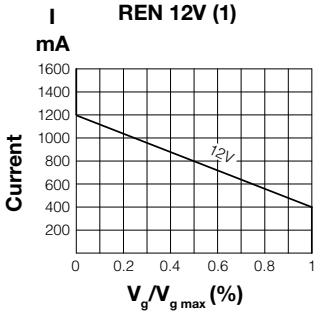
The electrical proportional control allows stepless and programmable adjustment of the motor displacement proportionally to the current strength supplied to a proportional solenoid valve available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The proportional solenoid valve applies a force on the spool proportional to the current strength and the motor swivels until a force balance is restored by a feed-back spring. To control the proportional solenoid valve a 24V DC (12V DC) supply is required. Current range between 200 (400) and 600 (1200) mA approx. (with standard setting of Max and Min displacement). Max permissible current = 800 (1600) mA. Usually the swivel range is from Vg_{max} to Vg_{min} (displacement setting type 1 as per our ordering code) so that increasing the current strength the motor swivels towards Vg_{min}, however displacement setting type 2 (swivels range from Vg_{min} to Vg_{max}) is also available. The electronic devices are available to control the solenoid (they must be ordered separately).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

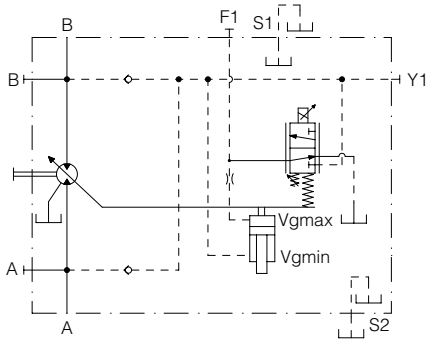
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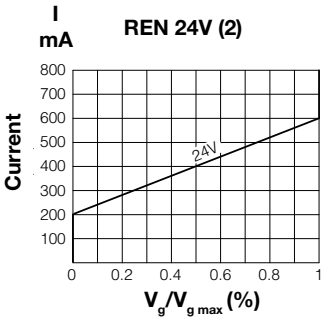


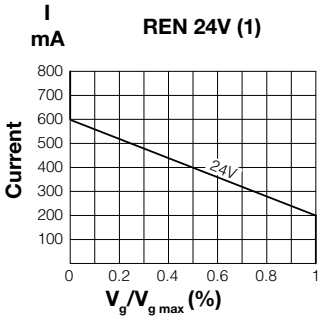




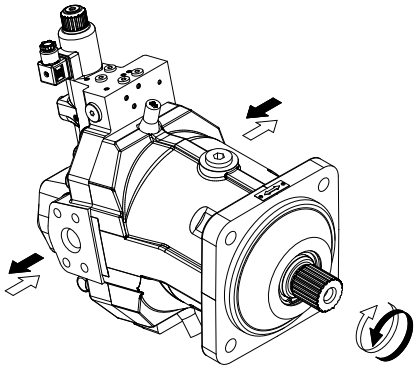
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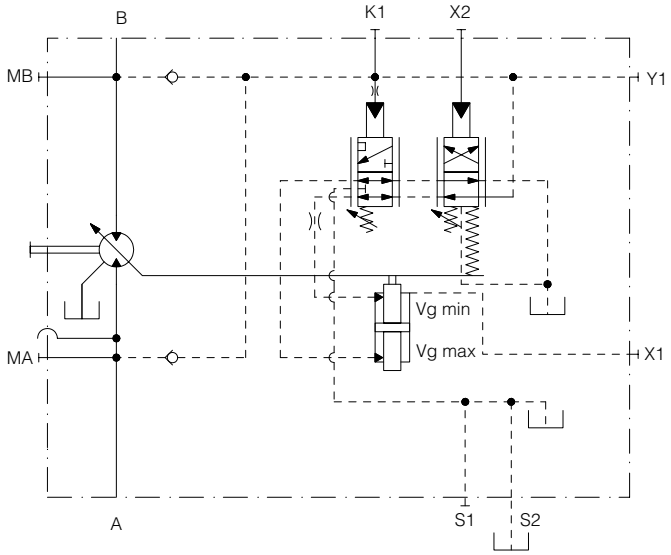
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



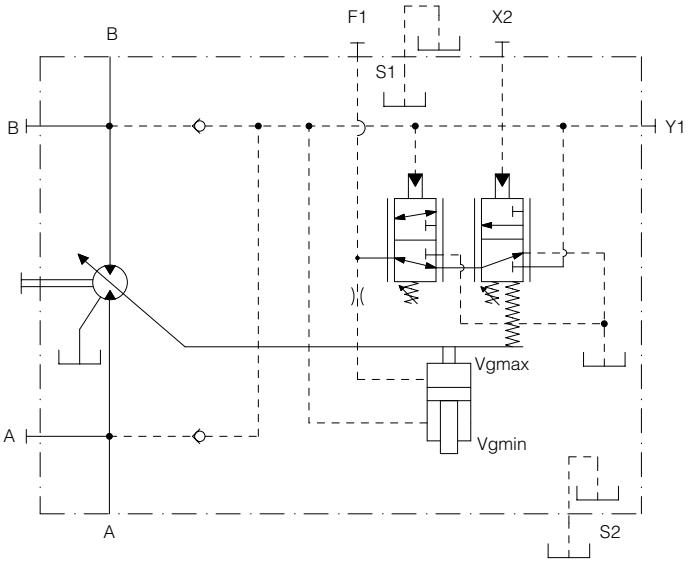
The RIE control version with the pressure override allows the motor to swivel to Vg_{max} when the pressure setting is reached. Same as RIN control, the motor displacement is adjusted to Vg_{min} when the pilot pressure applied at port X2. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to Vg_{max}. Swivel range is from Vg_{max} to Vg_{min} (displacement setting 1 per our ordering code). Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

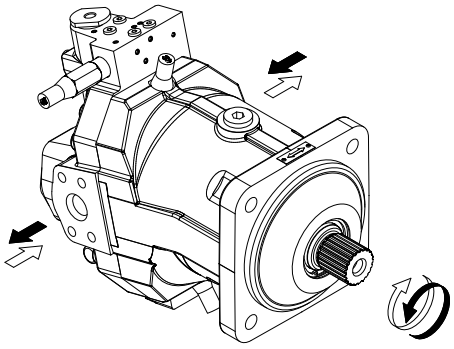
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The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.

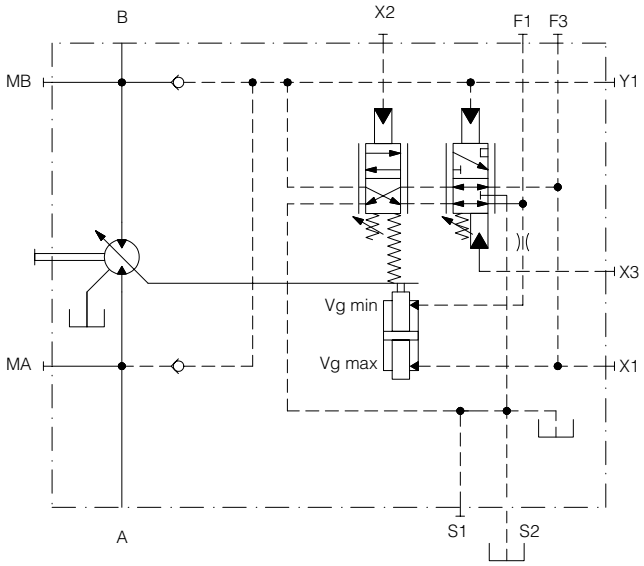


Hydraulic proportional control with double step pressure override RID

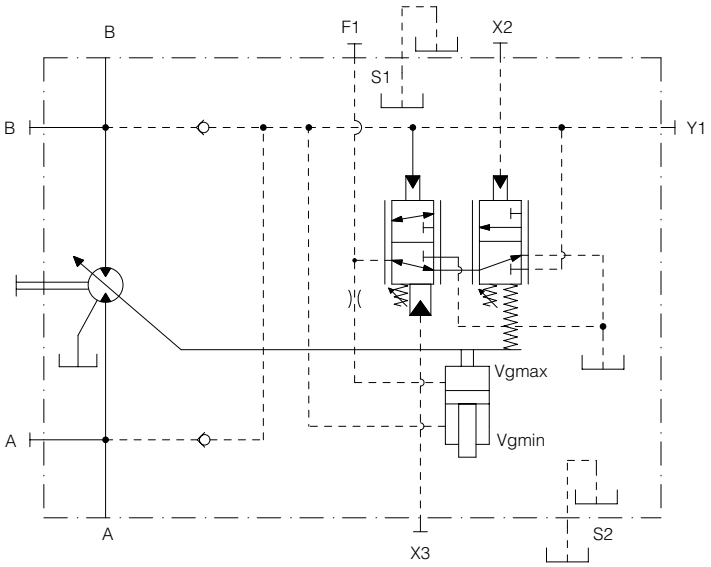
The RID control version with the pressure override allows the motor to swivel to Vg_{max} when the pressure setting is reached. Same as RIN control, the motor displacement is adjusted to Vgmin when the pilot pressure applied at port X2. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to Vg_{max}. Swivel range is from Vg_{max} to Vg_{min} (displacement setting 1 per our ordering code). Applying a pressure to port X3, the setting of PE control can be overridden by a different value of pressure. Setting range from 16 bar [232 psi] to 64 bar [928 psi] around. Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

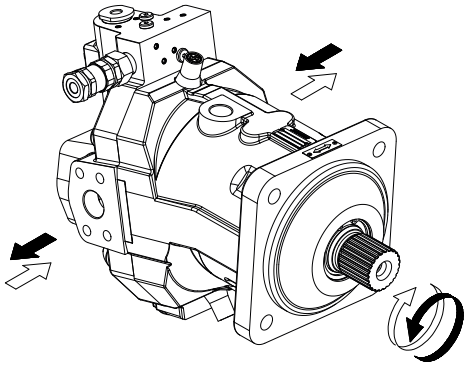
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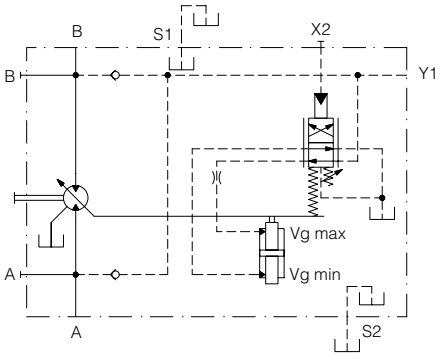
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.

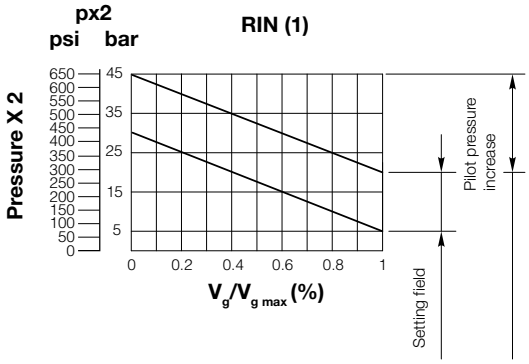


The hydraulic proportional control allows a stepless adjustment of the motor displacement proportionally to the pilot pressure applied at port X2. The pilot pressure applies a force on the spool and the motor swivels until a force balance on the arm is stored by feed back spring. Therefore the motor displacement is adjusted in direct proportion with the pilot pressure. Usually the swivel range is from Vgmax to Vg_{min} (displacement setting type 1 as per our ordering code) so that increasing the pilot pressure the motor swivels towards Vg_{min}, however, displacement setting type 2 (swivel range from Vg_{min} to Vg_{max}) is also available. Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

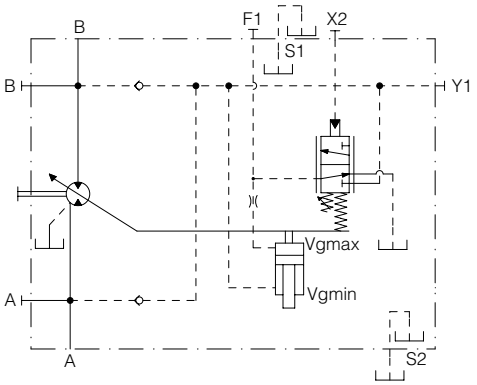
Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

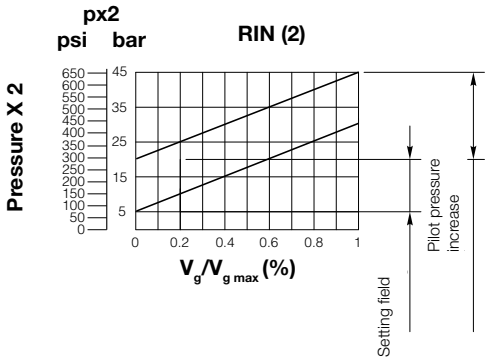
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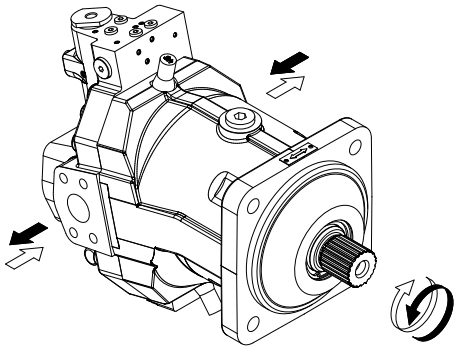


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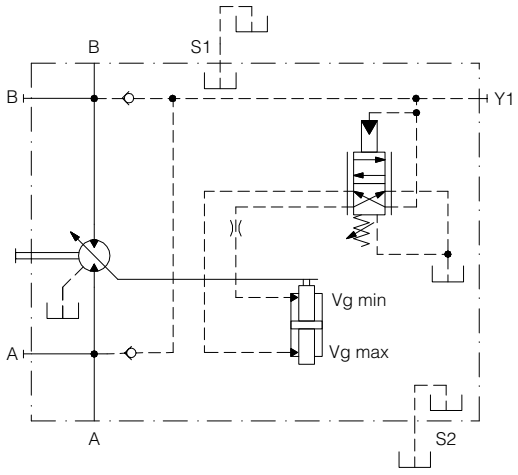
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.

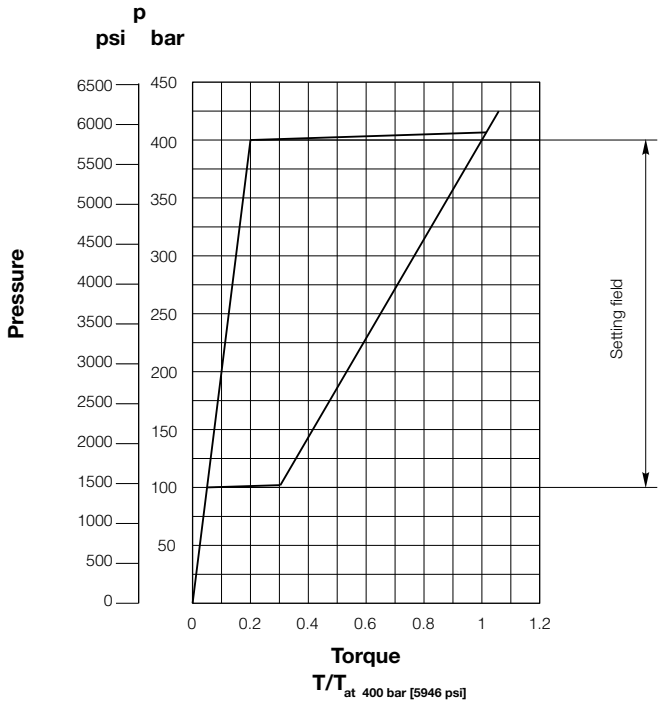


The working pressure control allows to swivel the motor displacement from $V_{g\,min}$ to $V_{g\,max}$ when the operating pressure rises beyond the preset operating pressure, so that the motor is at $V_{g\,min}$ when min torque and max speed are required and at $V_{g\,max}$ when max torque and min speed are required. The operating pressure applies a force on the spool which is matched by an adjustable spring. The motor keeps the Vgmin until the operating pressure reaches the setting value (pressure setting). Once the preset pressure rises beyond, the motor swivels from $V_{g\,min}$ to $V_{g\,max}$. The swivel range is from $V_{g\,min}$ to $V_{g\,max}$ (displacement setting type 2 as per our ordering code). Start of control adjustable between 100 and 400 bar [1450 and 5800 psi].

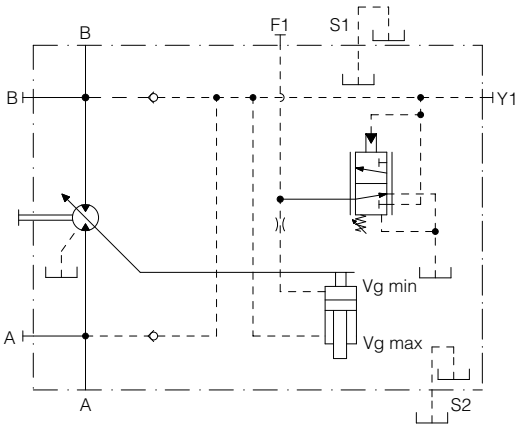
When ordering please clearly state:
Control pressure setting.

Size:
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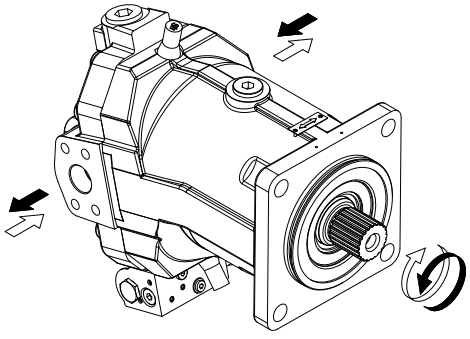




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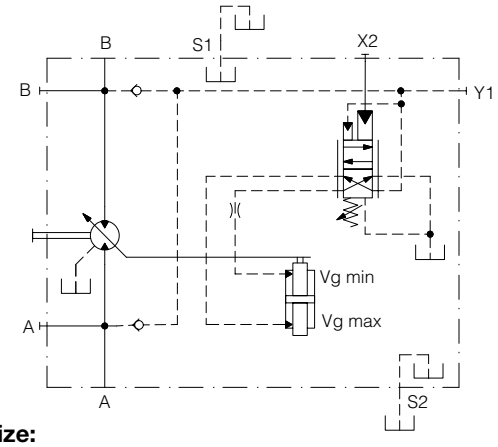
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



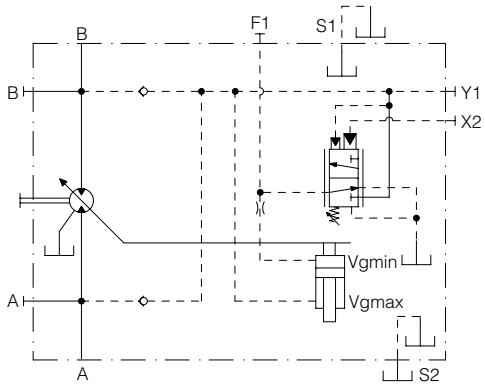
The hydraulic limiting device makes possible to reduce the pressure setting of RPE control by means of an external pilot pressure applied at port X2. The RPE control pressure setting is reduced proportionally to the pilot pressure in the ratio of 1/17 (for each pilot pressure bar, the preset operating pressure is reduced of 17 bar) [170 psi each 10 psi of pilot pressure]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi]. Example: preset operating pressure of RPE control = 300 bar [4350 psi]. By applying at port X2 a pilot pressure of 10 bar [145 psi] , the pressure setting comes to 130 bar [1885 psi] (300-(10x17)=130) (4350- (145X17)=1885). Should it be required to swivel the motor to Vgmax independently from the operating pressure, a pilot pressure of 20 bar [290 psi] should be applied at port X2. Swivel range from Vg_{min} to Vg_{max} (assembly type 2 as per our ordering code). Start of control adjustable between 100 and 400 bar [1450 and 5800 psi].

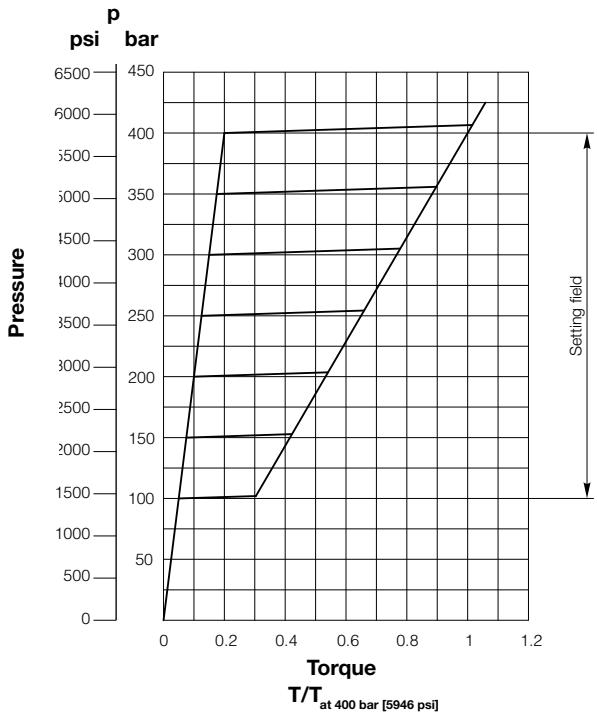
When ordering please clearly state:
Control pressure setting.

Size:
055-075-108-160

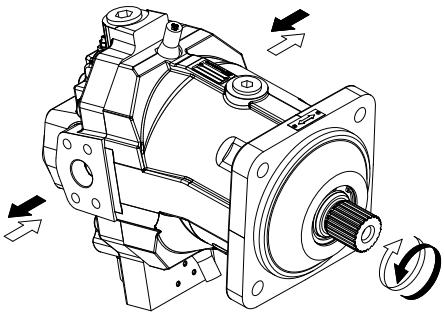


Size:
200





The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



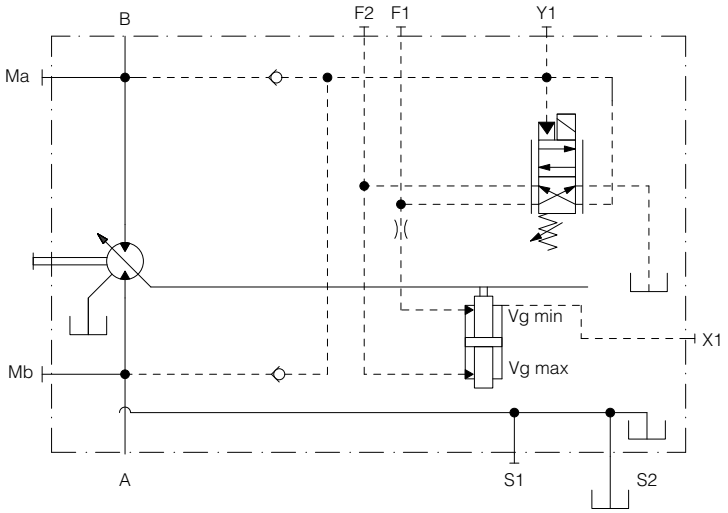
Working pressure control with electrical override

RPS

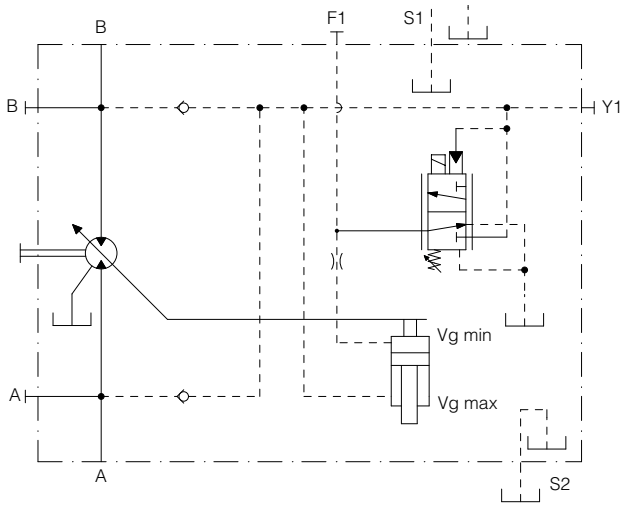
RPS control is a pressure related control which permits the changing of displacement $V_{g\,min}$ to $V_{g\,max}$ when working pressure exceeds setting threshold, so that the motor works at $V_{g\,min}$ when low torque and high speed are required and at $V_{g\,max}$ when high torque and low speed are required. The motor stands at $V_{g\,min}$ till working pressure reaches setting threshold.
Δp of working pressure that allows the changing of diaplacement from minimum to maximum is around 10 bar (such as RPE control).
This pressure related control can be overridden by an electrical signal; when solenoid is energized , the motor reaches maximum displacement without stopping in an intermediate position. Swivel range from $V_{g\,min}$ to $V_{g\,max}$ (assembly type 2 as per our ordering code).
Setting pressure range is 100-300 bar.

When ordering please clearly state:
Control pressure setting.

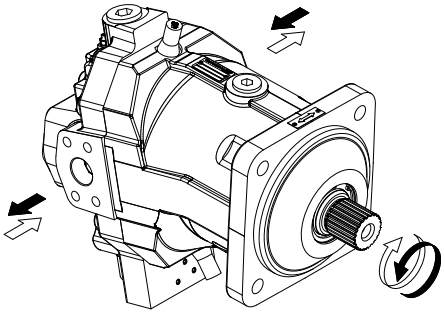
Size:
055 - 075 - 108 - 160



Size:
200



The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.

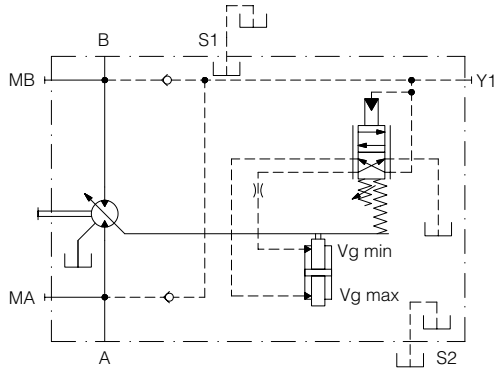


The “ROE” control allows a larger pressure range for displacement variation in comparison to “RPE” control. The increase of pressure range for variation from Vg_{min} to Vg_{max} allows a smoother working of the motor during displacement variation. The “ROE” allows the displacement variation with the pressure range show in the table.

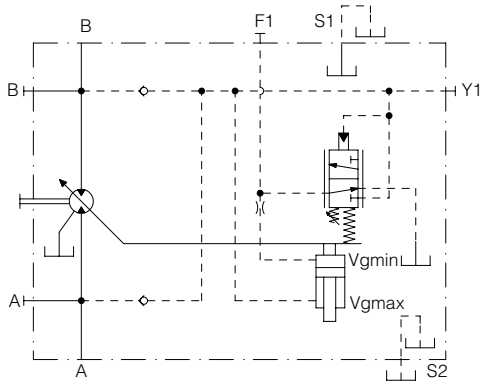
Δp bar [psi]	**P_{min}** bar [psi]	**P_{max}** bar [psi]
100 [1450]	100 [1450]	350 [5075]

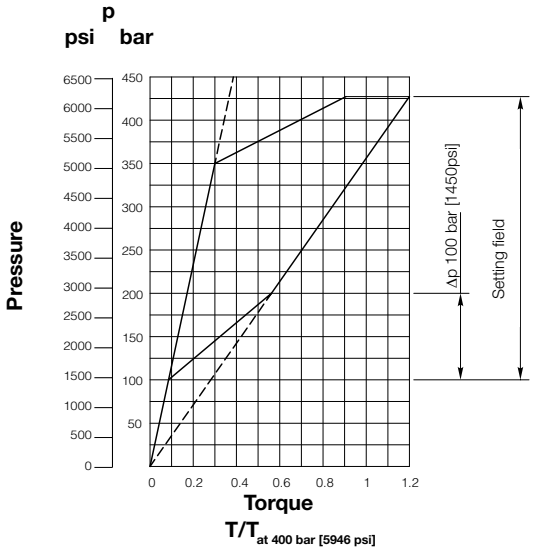
Where:
- Δp is the working pressure range that allows the displacement variation.
- P_{min} is the minimum pressure at which displacement variation starting can be set.
- P_{max} is the maximum pressure at which displacement variation starting can be set.

Size:
055-075-108-160



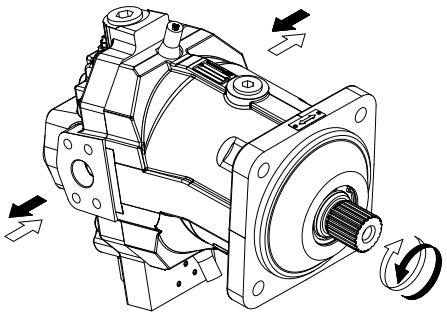
Size:
200





Warning:
in case of displacement limitation, the control shall vary of a reduced Δp with respect to its standard one.
Please contact Dana for more info.

The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.

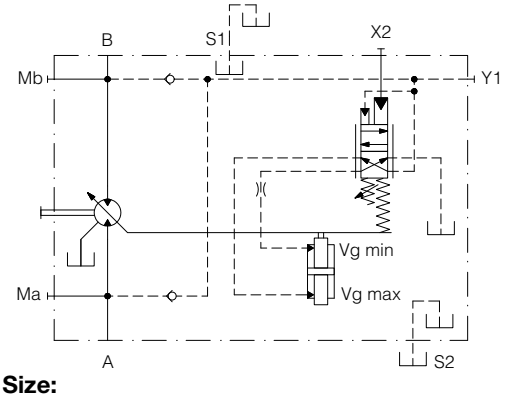


Working pressure control Δp 100 bar with hydraulic override

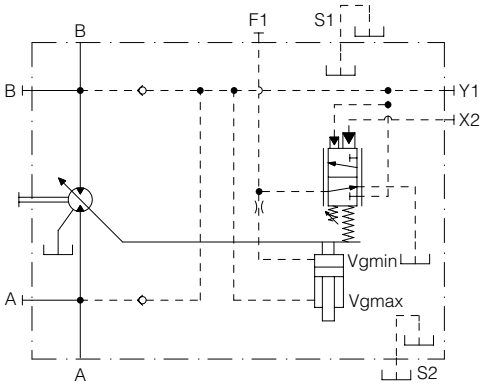
The hydraulic limiting device makes possible to reduce the pressure setting of ROE control by means of an external pilot pressure applied at port X2. The ROE control pressure setting is reduced proportionally to the pilot pressure in the ratio of 1/17 (for each pilot pressure bar, the preset operating pressure is reduced of 17 bar) [170 psi each 10 psi of pilot pressure]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].
Example: preset operating pressure of ROE control = 300 bar [4350 psi]. By applying at port X2 a pilot pressure of 10 bar [145 psi] , the pressure setting comes to 130 bar [1885 psi] (300-(10x17)=130) (4350 - (145X17)=1885). Should it be required to swivel the motor to $V_{g\,max}$ independently from the operating pressure, a pilot pressure of 20 bar [290 psi] should be applied at port X2.
Swivel range from $V_{g\,min}$ to $V_{g\,max}$ (assembly type 2 as per our ordering code). Start of control adjustable between 100 and 350 bar [1450 and 5000 psi].

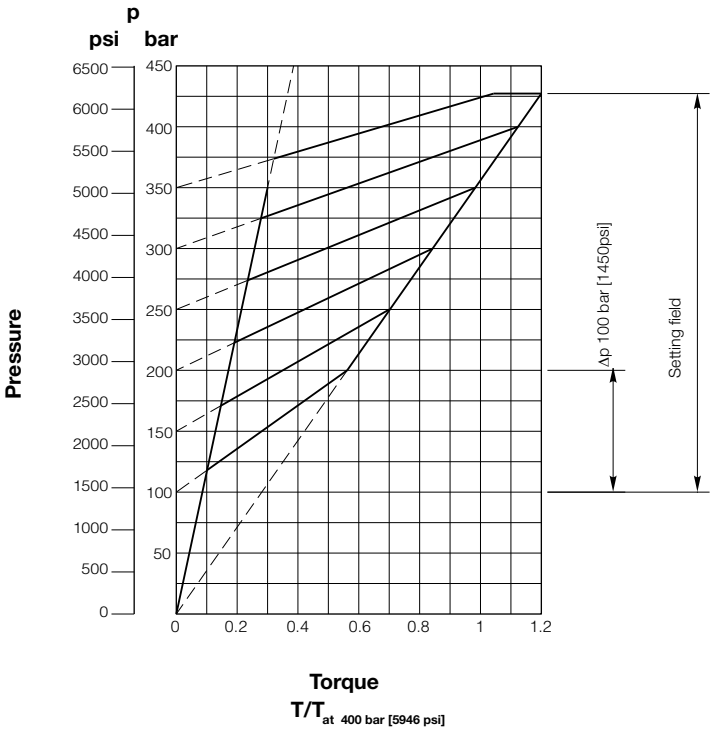
When ordering please clearly state:
Control pressure setting.

Size:
055 - 075 - 108 - 160

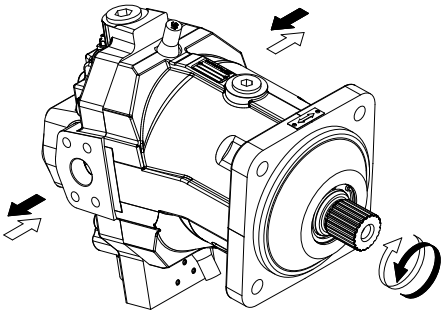


Size:
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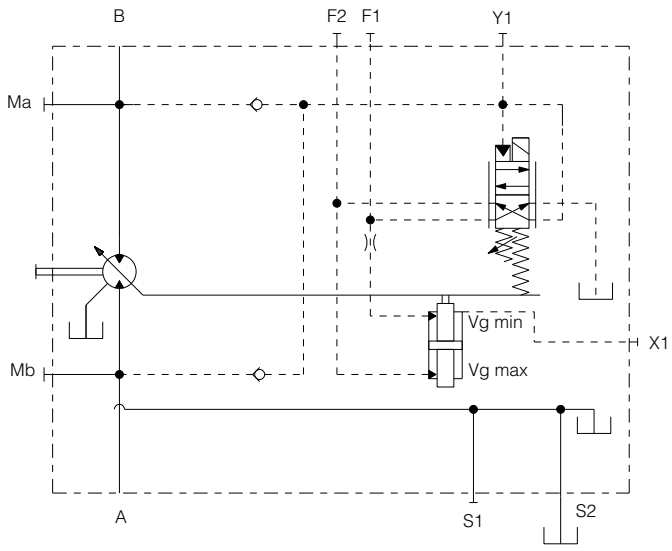
The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



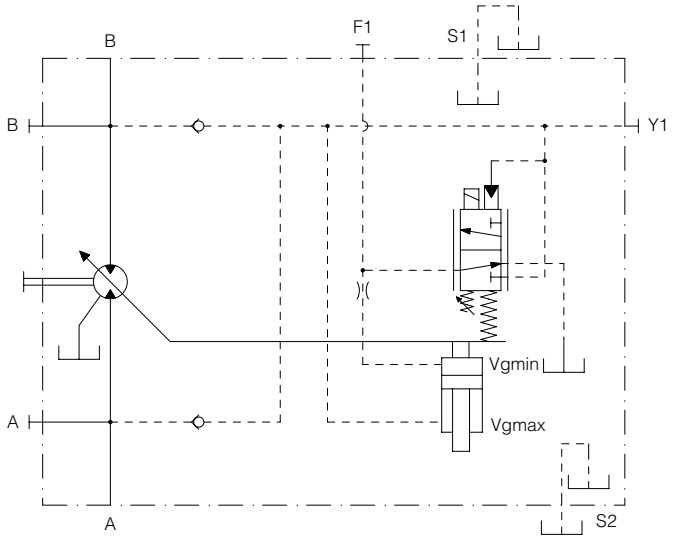
ROS control is a pressure related control which permits the changing of displacement $V_{g\,min}$ to $V_{g\,max}$ when working pressure exceeds setting threshold, so that the motor works at $V_{g\,min}$ when low torque and high speed are required and at $V_{g\,max}$ when high torque and low speed are required. The motor stands at $V_{g\,min}$ till working pressure reaches setting threshold. Δp of working pressure that allows the changing of diaplacement from minimum to maximum is 100 bar (such as ROE control).
This pressure related control can be overridden by an electrical signal; when solenoid is energized , the motor reaches maximum displacement without stopping in an intermediate position. Swivel range from $V_{g\,min}$ to $V_{g\,max}$ (assembly type 2 as per our ordering code).
Setting pressure range is 100-300 bar.

When ordering please clearly state:
Control pressure setting.

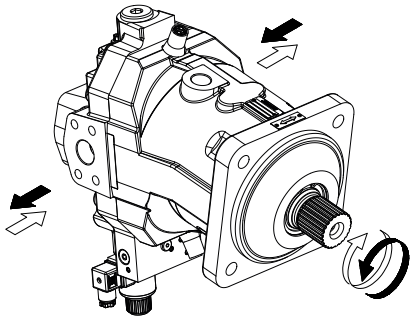
Size:
055 - 075 - 108 - 160



Size:
200

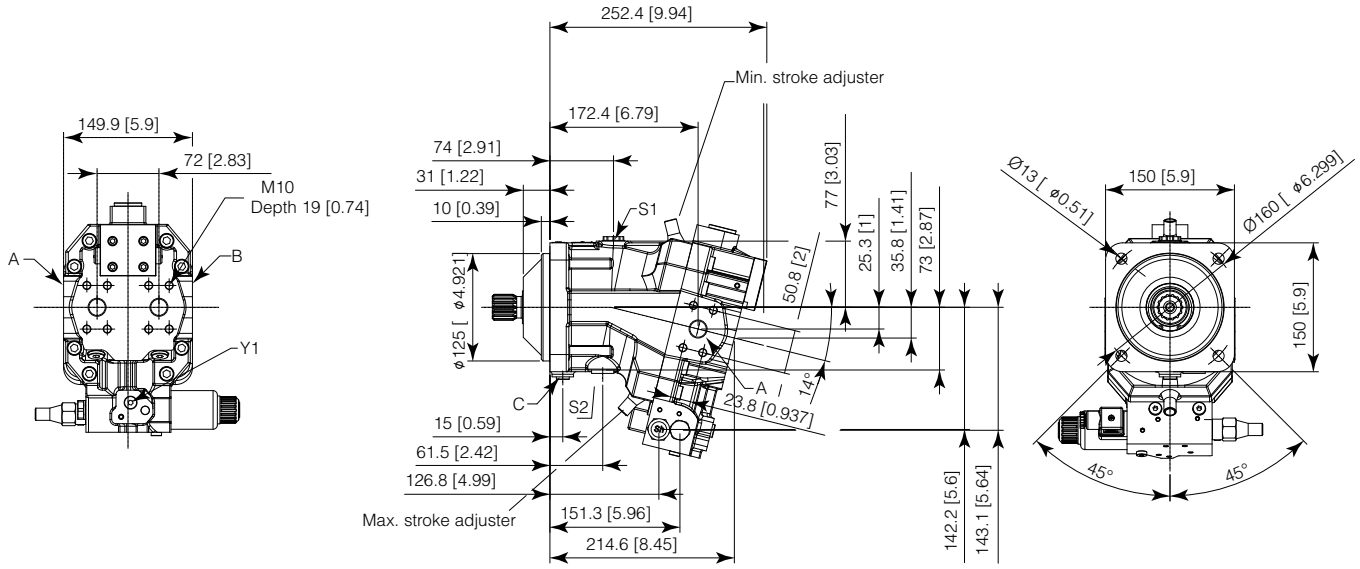


The relation between direction of rotation of shaft and direction of flow in SH7V motor is shown in the picture below.



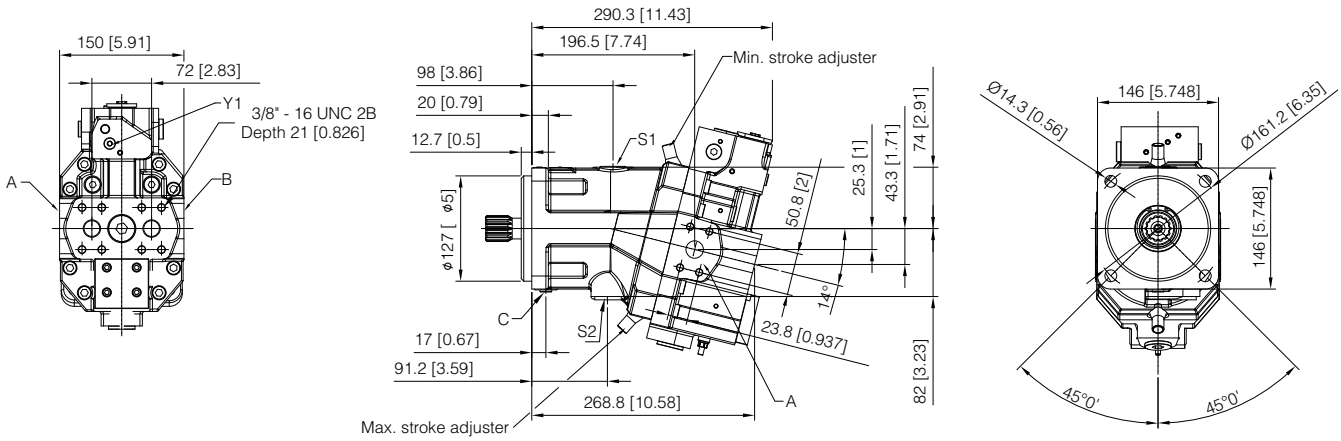
SH7V 055 - Motor dimensions

SH7V 055 Motor - Mounting flange ISO 4 Bolts (OC)



A-B: Service line ports - 3/4” SAE 6000
C: Air bleed bearings flushing port - 1/8 G (BSPP)
S1-S2: Case drain port - 1/2 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

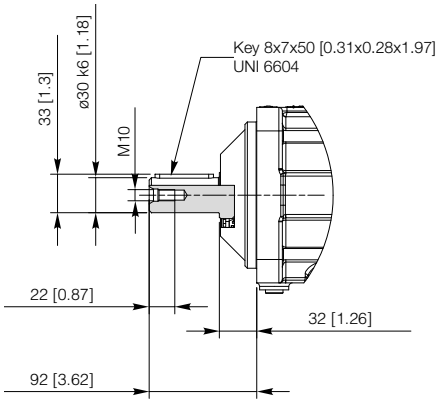
SH7V 055 Motor - Mounting flange SAE-C 4 Bolts (O5)



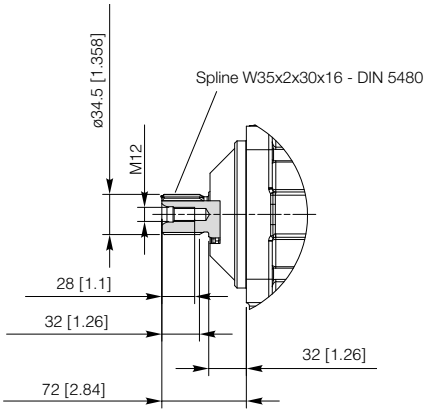
A-B: Service line ports - 3/4” SAE 6000
C: Air bleed bearings flushing port - 7/16”-20 UNF
S1-S2: Case drain port - 1” 1/16 - 12 UN 2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

7 Shaft end

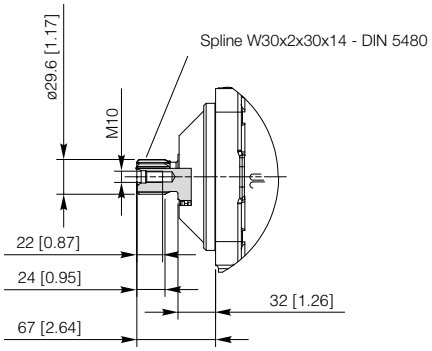
CAW Parallel keyed shaft



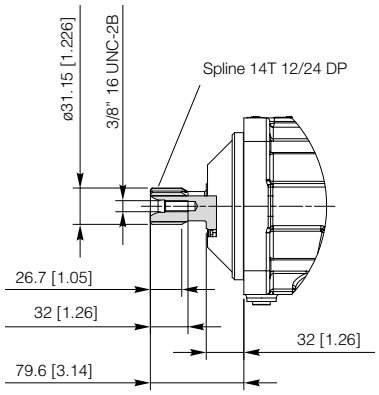
SAM Splined shaft



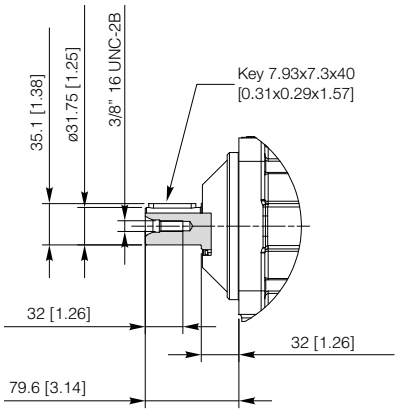
SAI Splined shaft



S12 Splined shaft



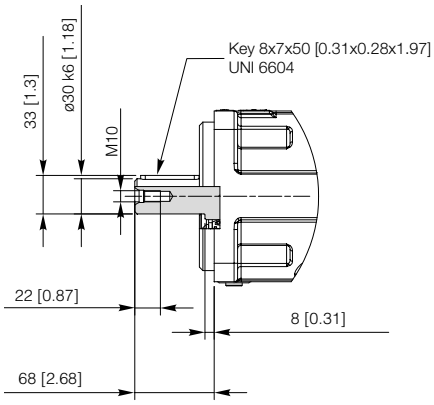
C17 Parallel keyed shaft



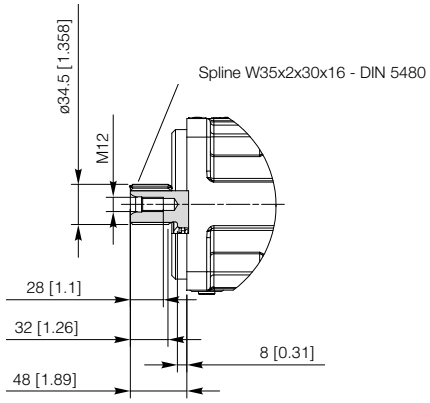
SH7V 055 - Shafts dimensions for mounting flange SAE-C 4 bolts (O5)

7 Shaft end

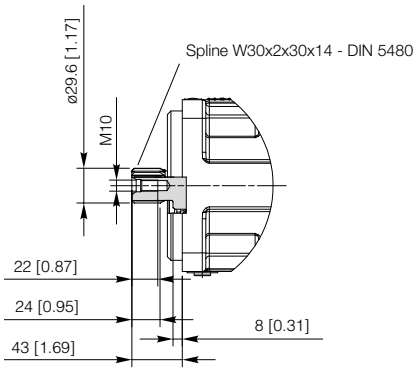
CAW Parallel keyed shaft



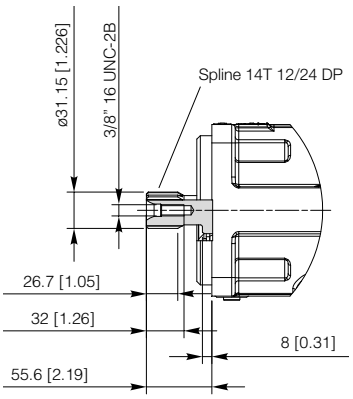
SAM Splined shaft



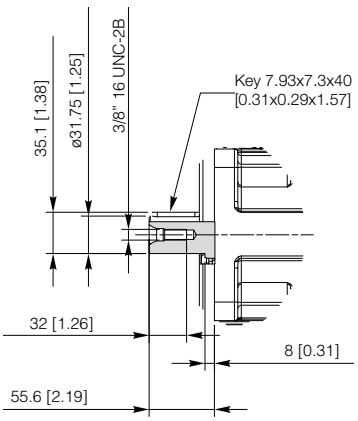
SAI Splined shaft



S12 Splined shaft

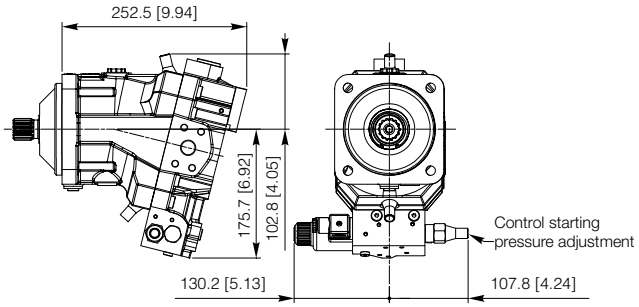


C17 Parallel keyed shaft

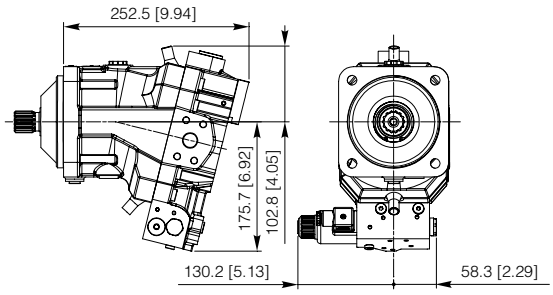


10 Control

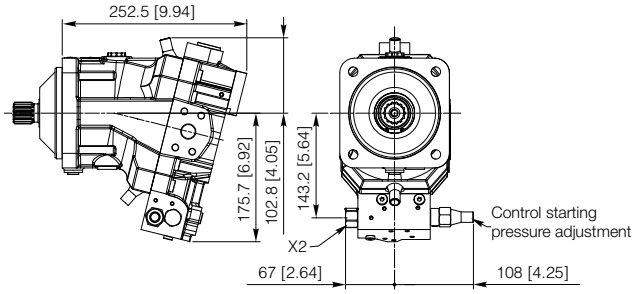
2EE Control



2EN Control

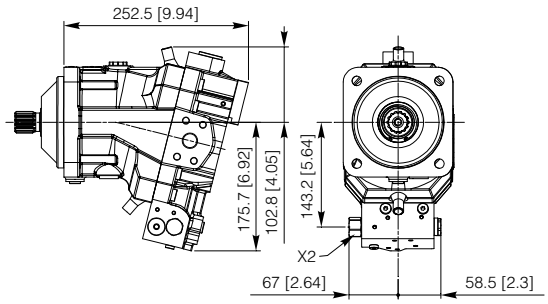


2IE Control



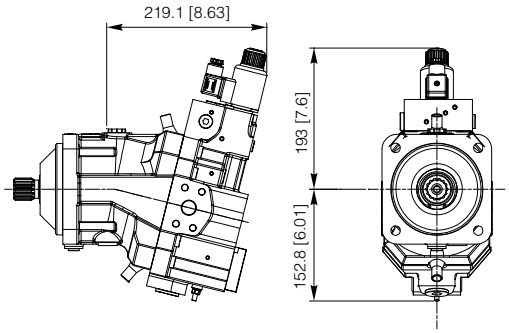
X2: Piloting port - 1/4 G (BSPP)

2IN Control

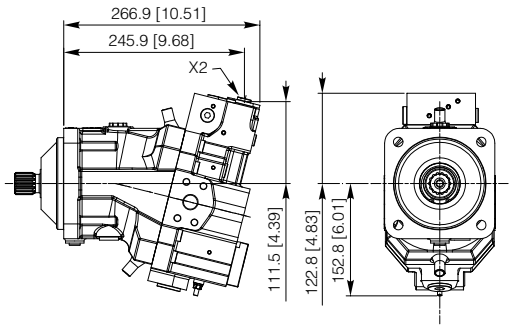


X2: Piloting port - 1/4 G (BSPP)

REN Control



RIN Control

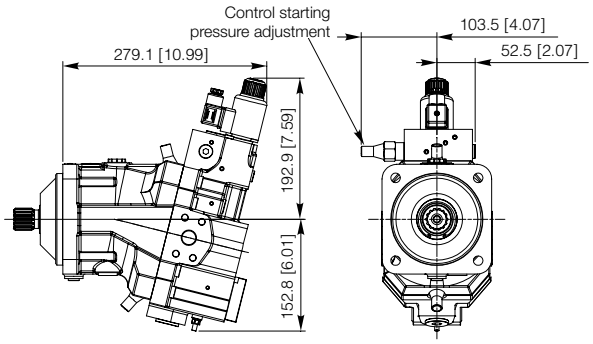


X2: Piloting port - 1/4 G (BSPP)

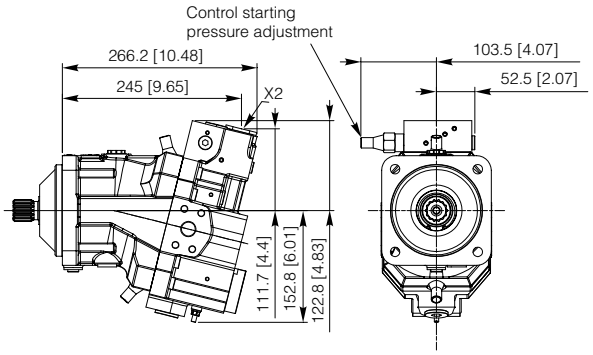
SH7V 055 - Control dimensions for mounting flange ISO 4 bolts (OC) (Displ. setting 1)

10 Control

REE Control

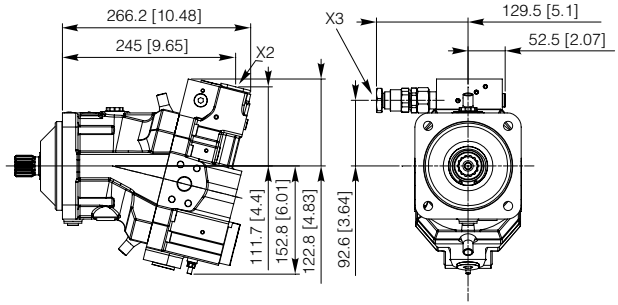


RIE Control



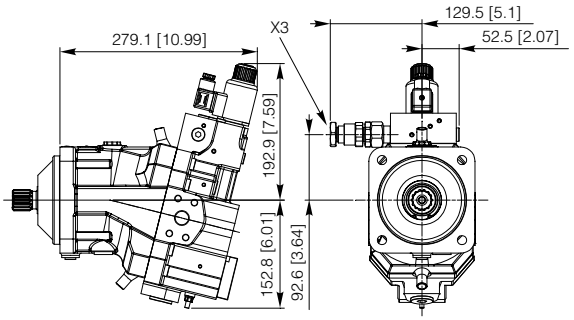
X2: Piloting port - 1/4 G (BSPP)

RID Control



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

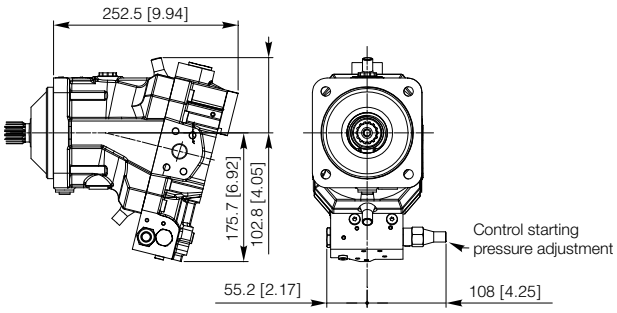
RED Control



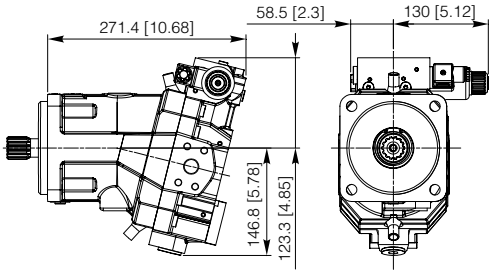
X3: Double step piloting port - 1/4 G (BSPP)

10 Control

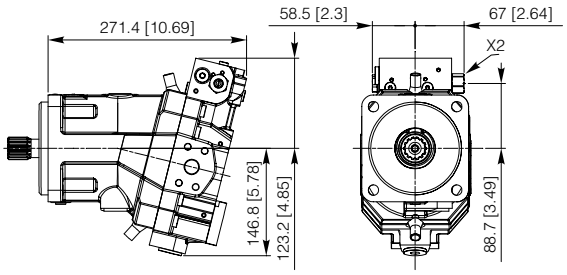
RPE Control



2EN Control

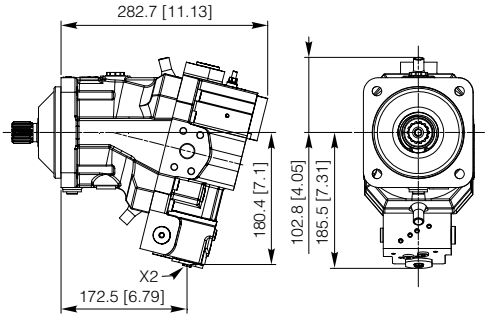


2IN Control



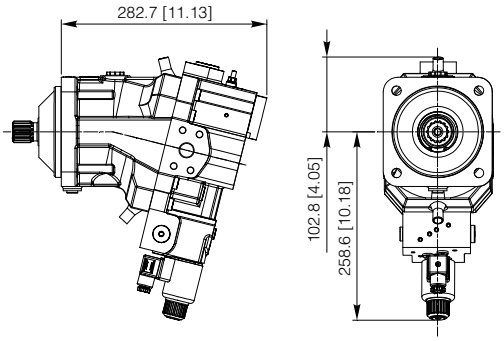
X2: Piloting port - 1/4 G (BSPP)

RIN Control

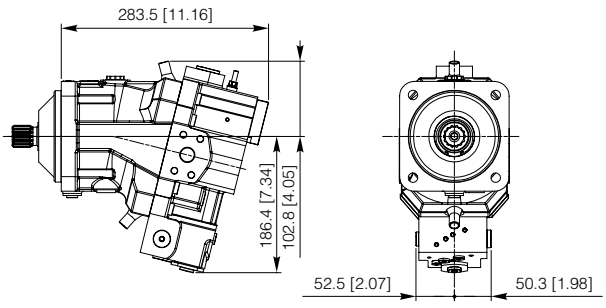


X2: Piloting port - 1/4 G (BSPP)

REN Control



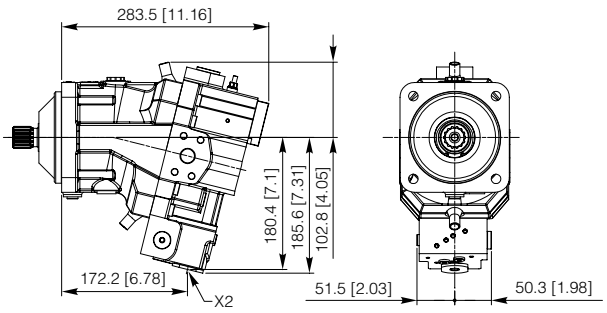
ROE Control



SH7V 055 - Control dimensions for mounting flange ISO 4 bolts (OC) (Displ. setting 2)

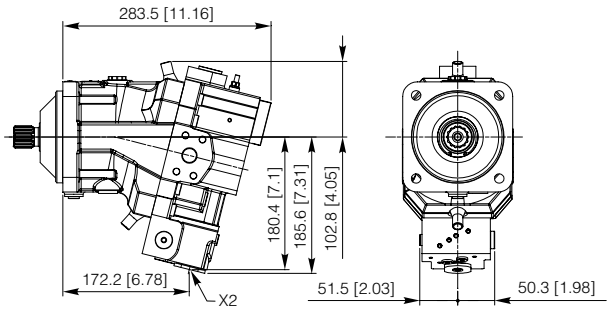
10 Control

ROI Control



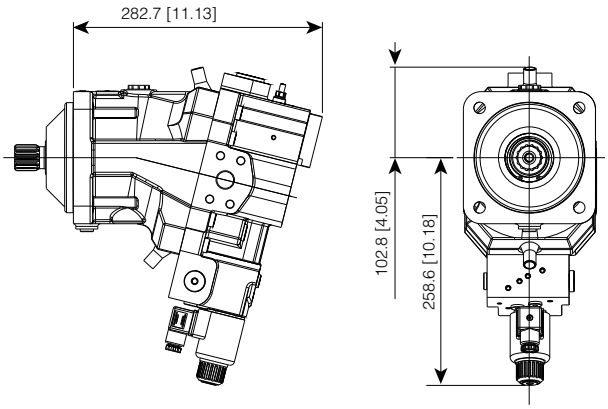
X2: Piloting port - 1/4 G (BSPP)

RPI Control

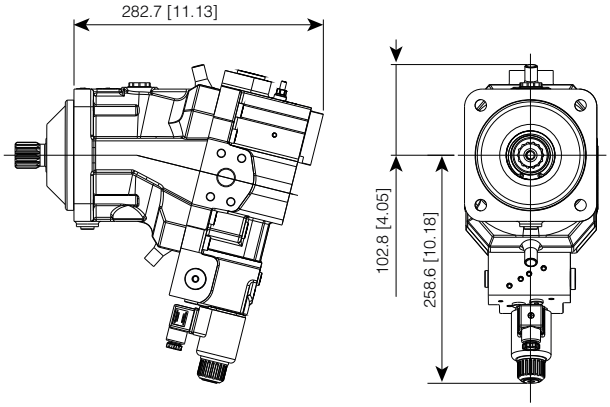


X2: Piloting port - 1/4 G (BSPP)

ROS Control

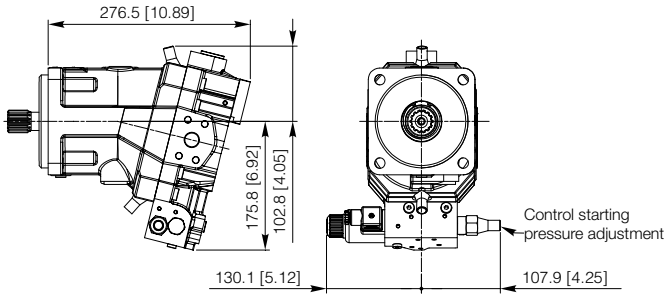


RPS Control

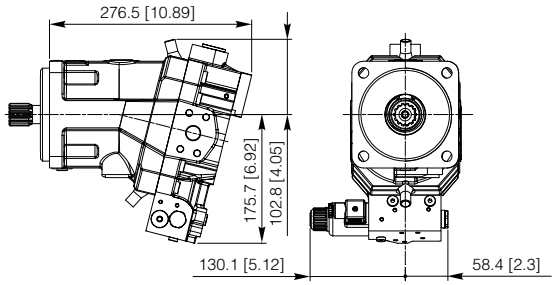


10 Control

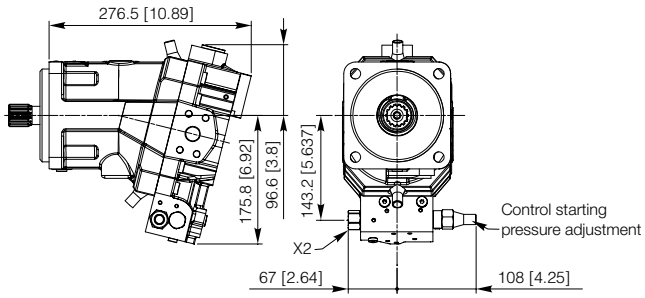
2EE Control



2EN Control

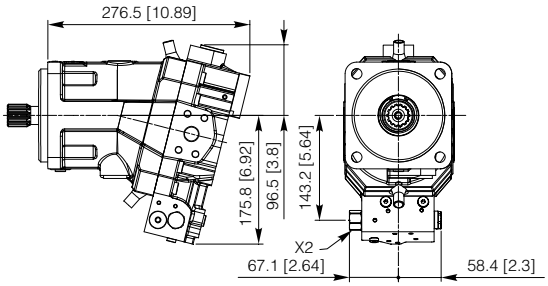


2IE Control



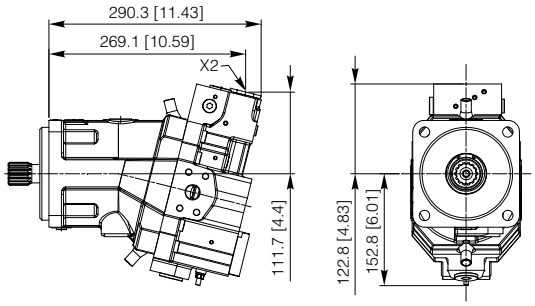
X2: Piloting port - 7/16” - 20 UNF

2IN Control



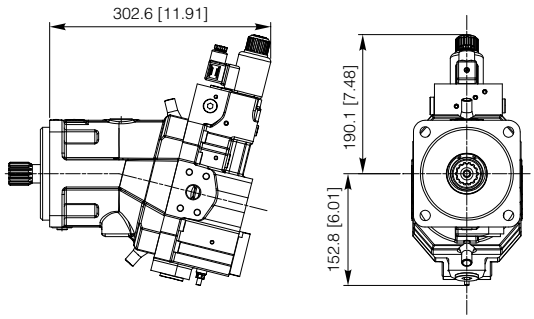
X2: Piloting port - 7/16” - 20 UNF

RIN Control



X2: Piloting port - 7/16” - 20 UNF

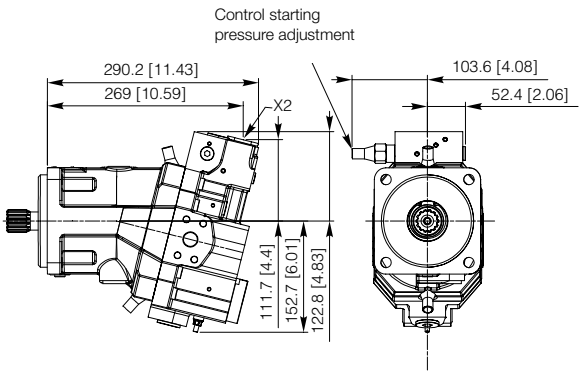
REN Control



SH7V 055 - Control dimensions for mounting flange SAE-C 4 bolts (O5) (Displ. setting 1)

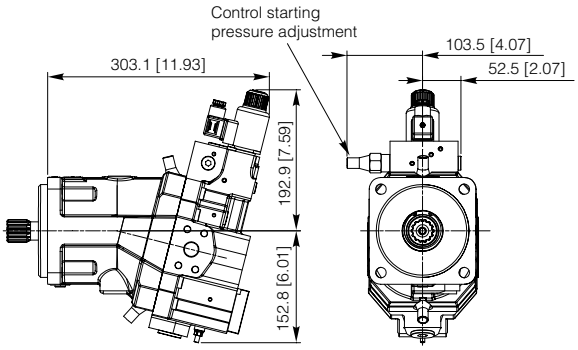
10 Control

RIE Control

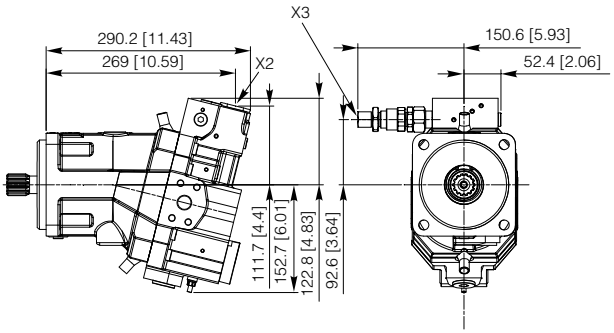


X2: Piloting port - 7/16” - 20 UNF

REE Control

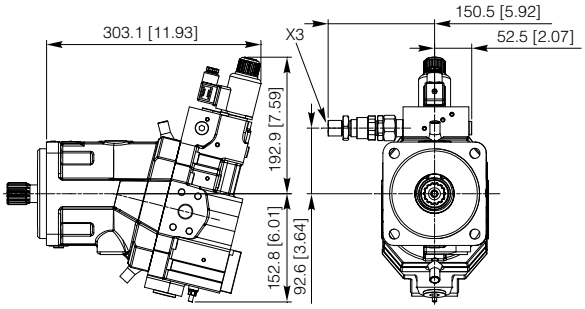


RID Control



X2: Piloting port - 7/16” - 20 UNF
X3: Double step piloting port - 7/16” - 20 UNF

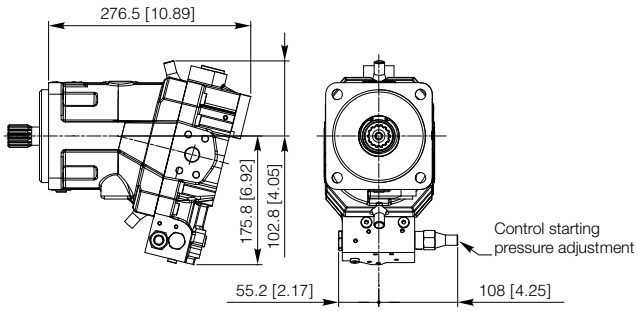
RED Control



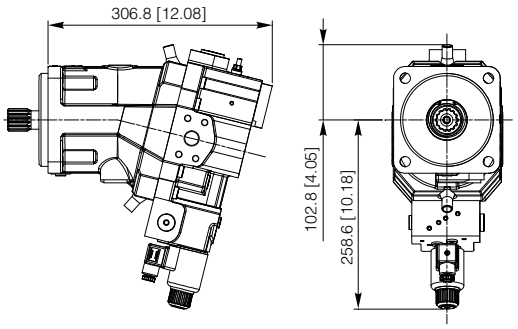
X3: Double step piloting port - 7/16” - 20 UNF

10 Control

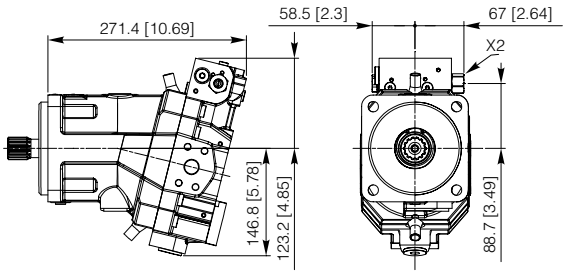
RPE Control



2EN Control

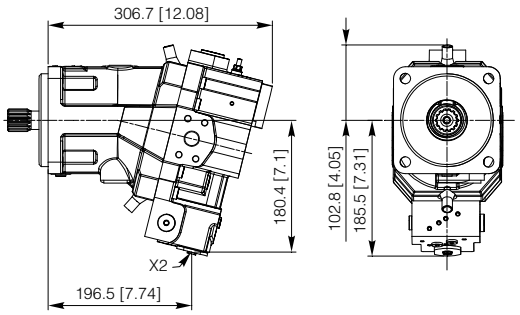


2IN Control



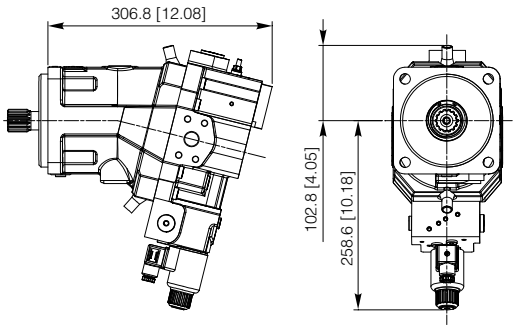
X2: Piloting port - 7/16" - 20 UNF

RIN Control

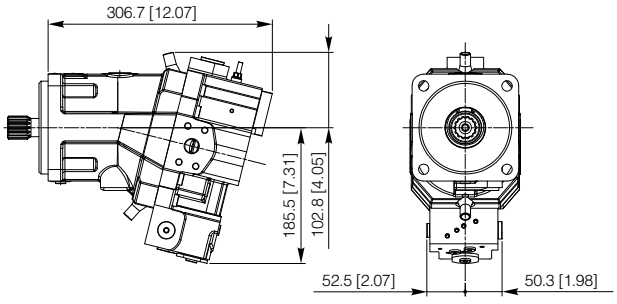


X2: Piloting port - 7/16" - 20 UNF

REN Control



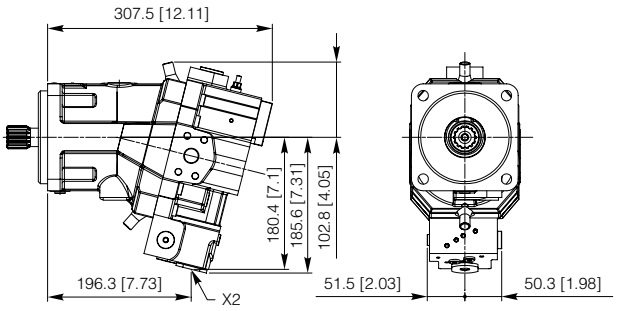
ROE Control



SH7V 055 - Control dimensions for mounting flange SAE-C 4 bolts (O5) (Displ. setting 2)

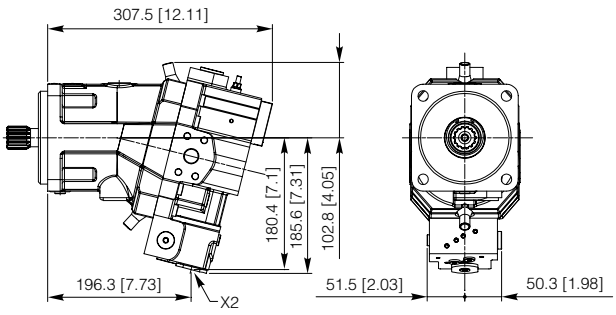
10 Control

ROI Control



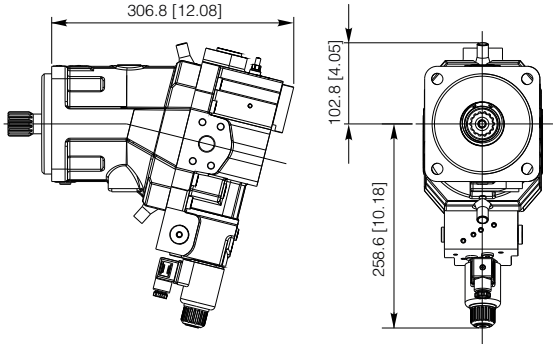
X2: Piloting port - 7/16” - 20 UNF

RPI Control

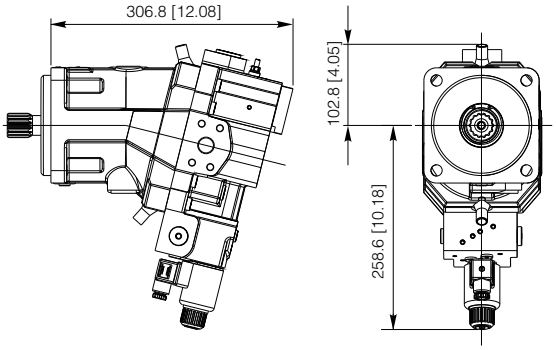


X2: Piloting port - 7/16” - 20 UNF

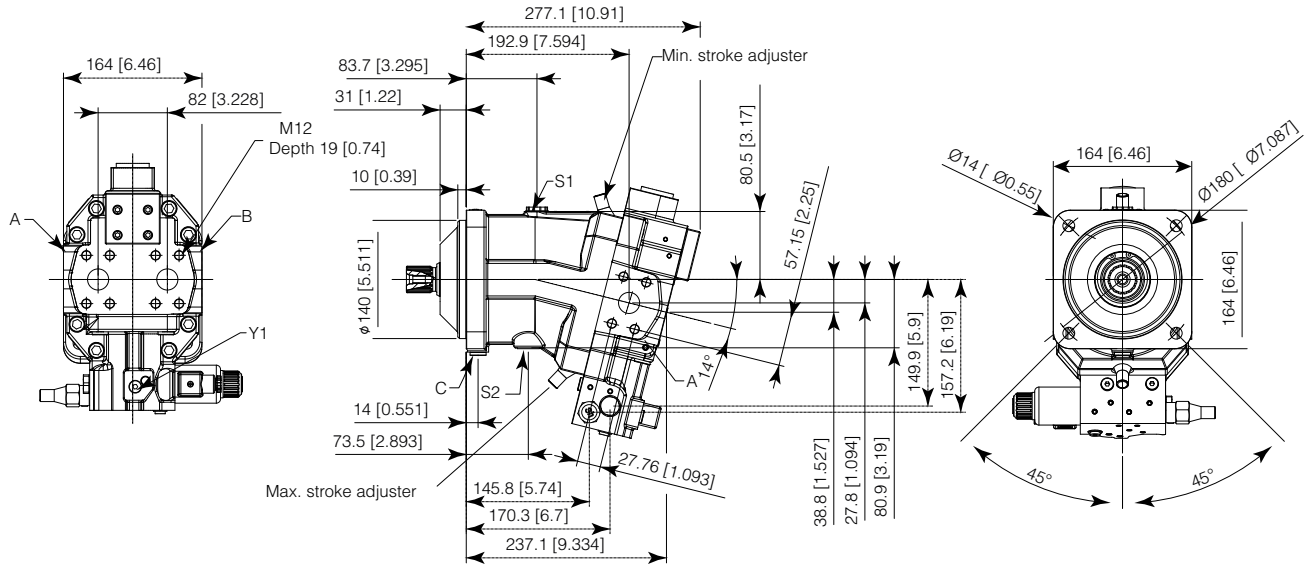
ROS Control



RPS Control

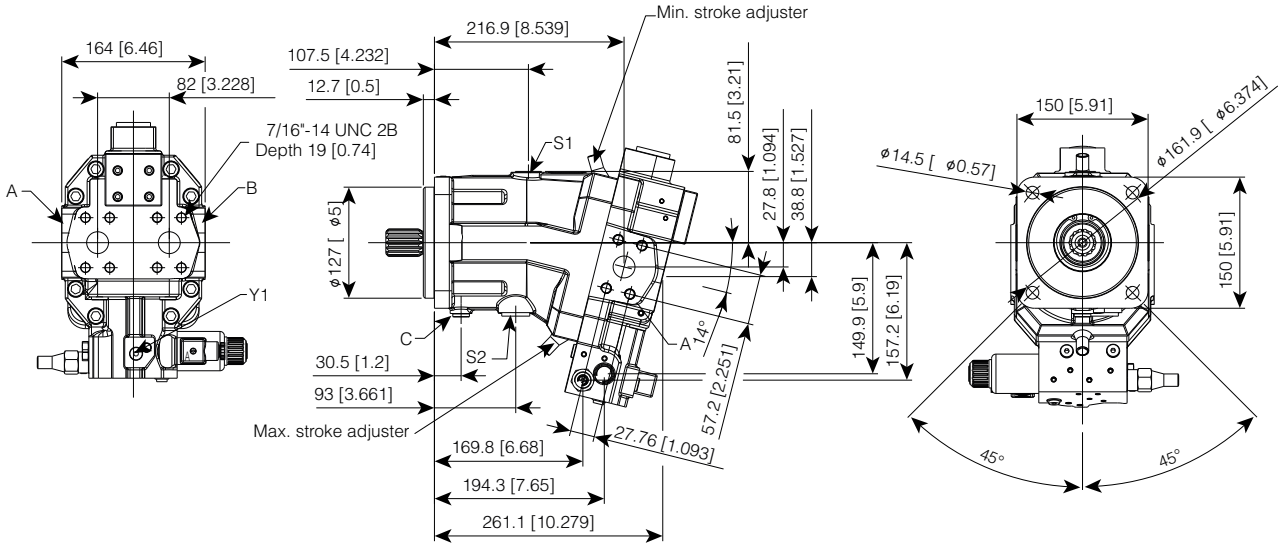


SH7V 075 Motor - Mounting flange ISO 4 Bolts (OD)



A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 1/4 G (BSPP)
S1-S2: Case drain port - 1/2 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

SH7V 075 Motor - Mounting flange SAE-C 4 Bolts (O5)

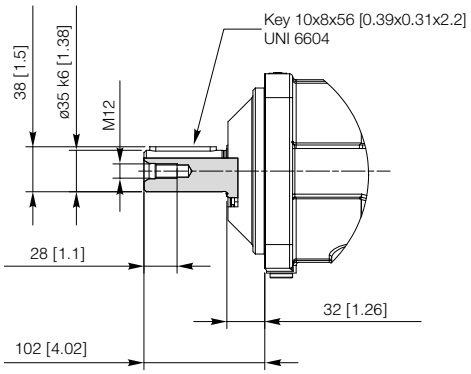


A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 7/16”-20 UNF
S1-S2: Case drain port - 1” 1/16 - 12 UN 2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

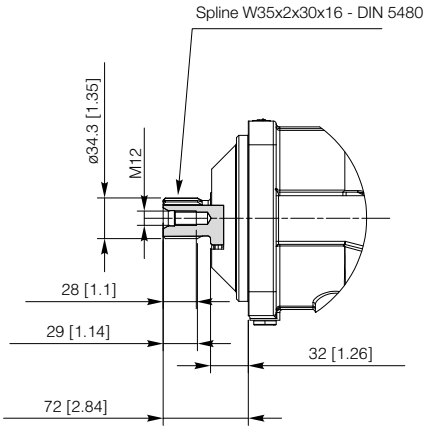
SH7V 075 - Shafts dimensions for mounting flange ISO 4 bolts (OD)

7 Shaft end

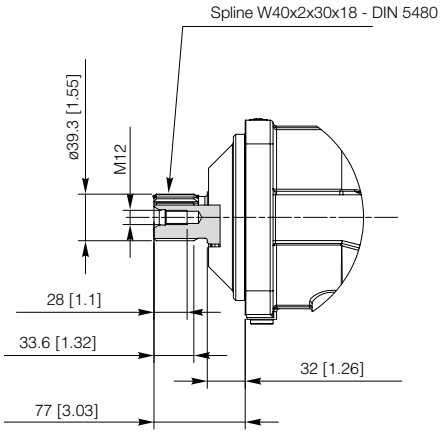
CAY Parallel keyed shaft



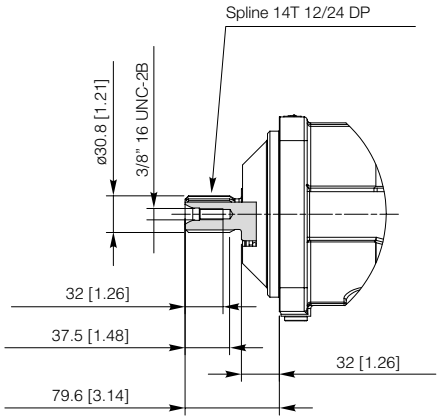
SAM Splined shaft



SAO Splined shaft

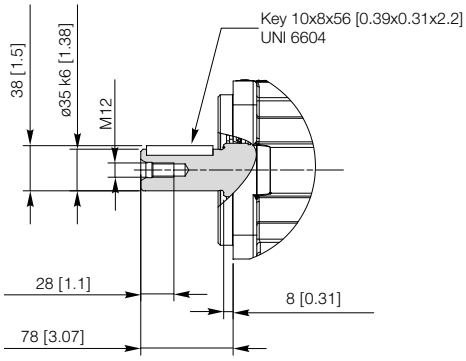


S12 Splined shaft

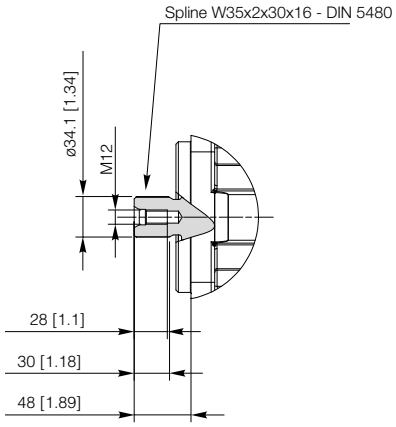


7 Shaft end

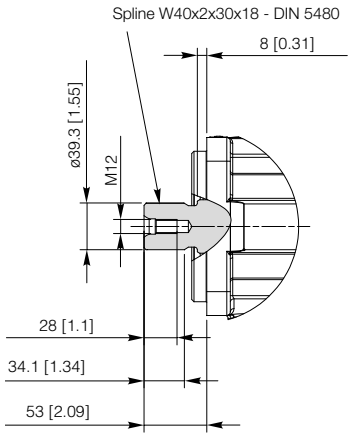
CAY Parallel keyed shaft



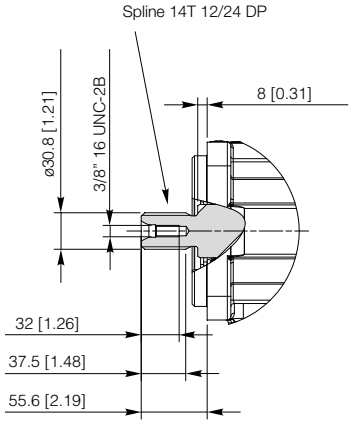
SAM Splined shaft



SAO Splined shaft



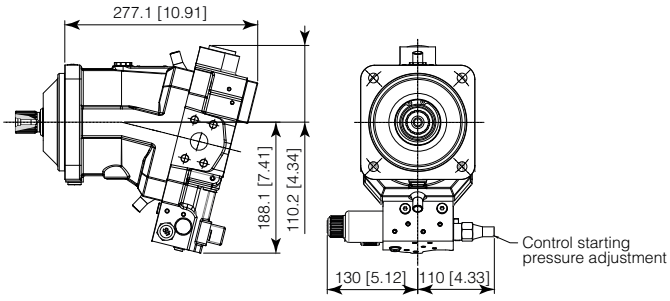
S12 Splined shaft



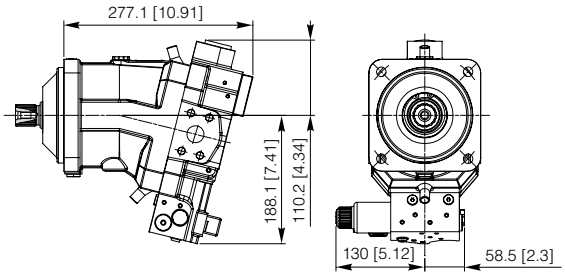
SH7V 075 - Control dimensions for mounting flange ISO 4 bolts (OD) (Displ. setting 1)

10 Control

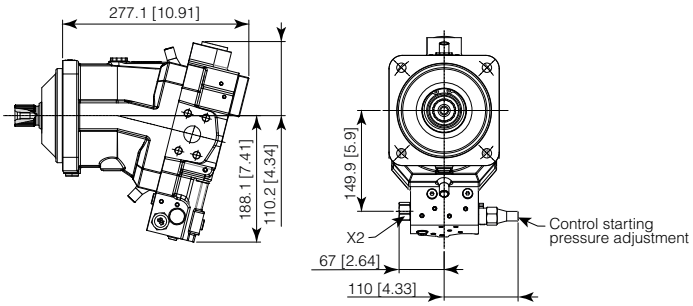
2EE Control



2EN Control

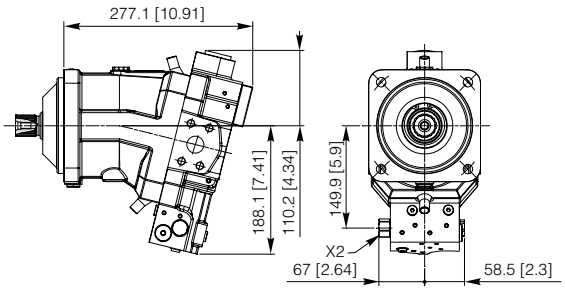


2IE Control



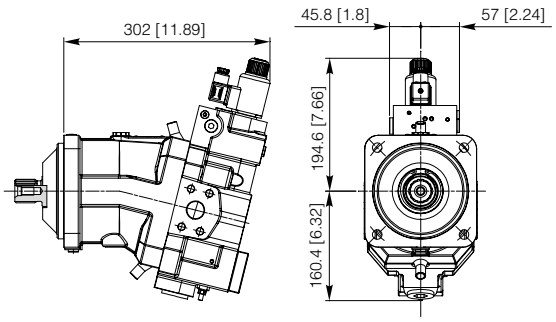
X2: Piloting port - 1/4 G (BSPP)

2IN Control

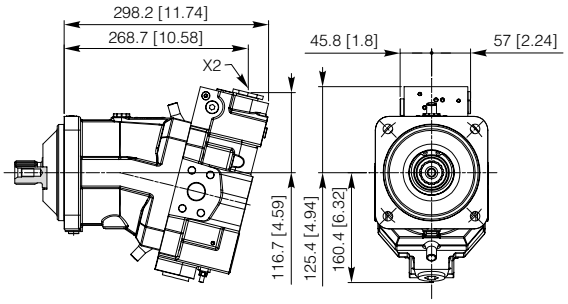


X2: Piloting port - 1/4 G (BSPP)

REN Control



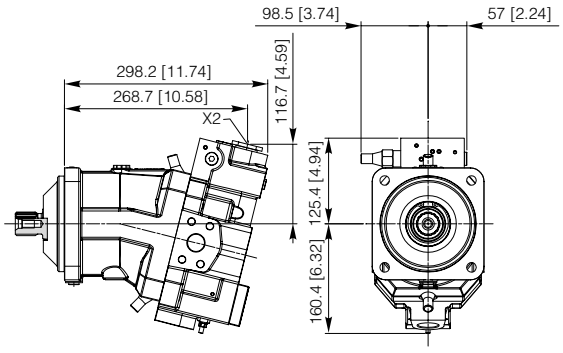
RIN Control



X2: Piloting port - 1/4 G (BSPP)

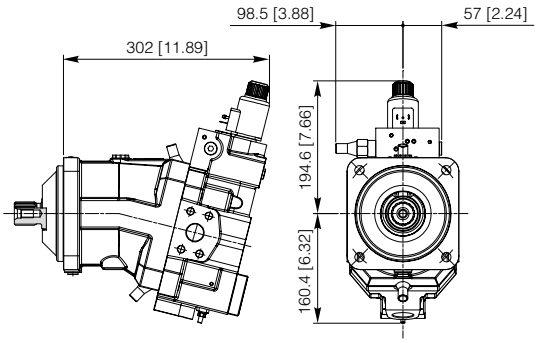
10 Control

RIE Control

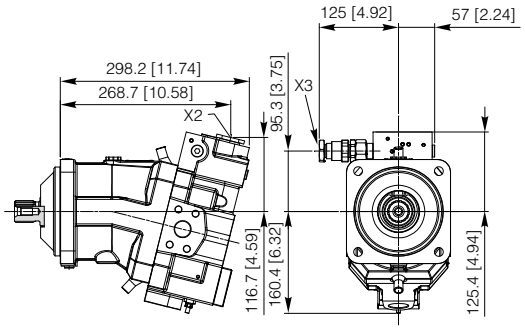


X2: Piloting port - 1/4 G (BSPP)

REE Control

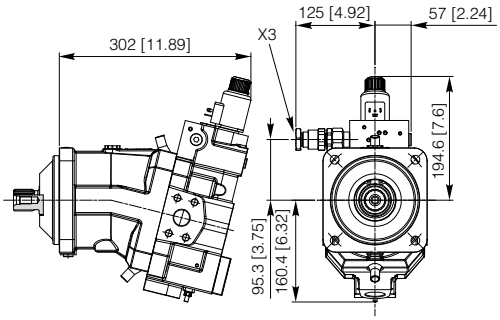


RID Control



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

RED Control

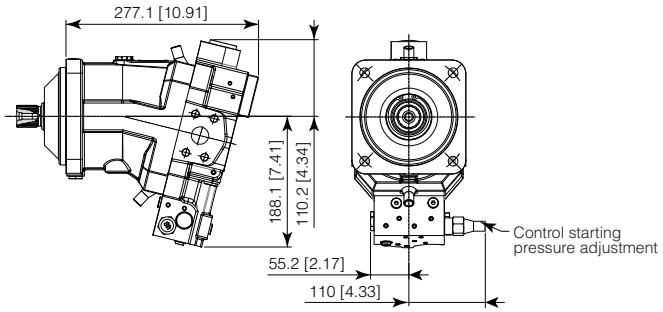


X3: Double step piloting port - 1/4 G (BSPP)

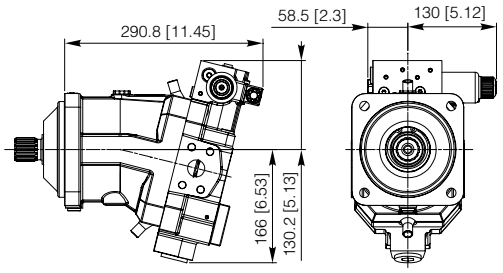
SH7V 075 - Control dimensions for mounting flange ISO 4 bolts (OD) (Displ. setting 2)

10 Control

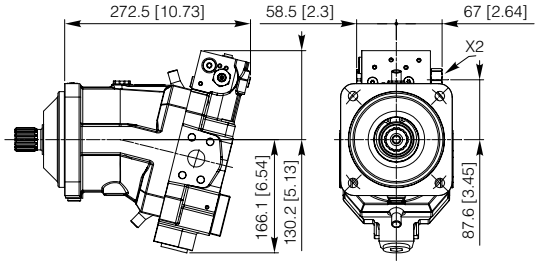
RPE Control



2EN Control

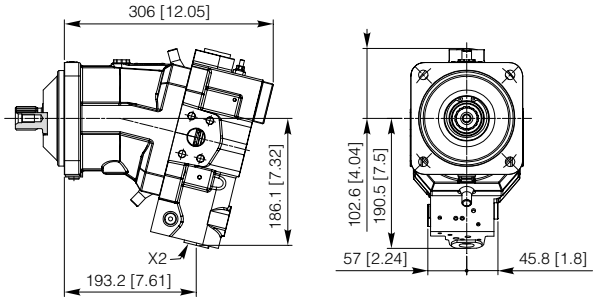


2IN Control



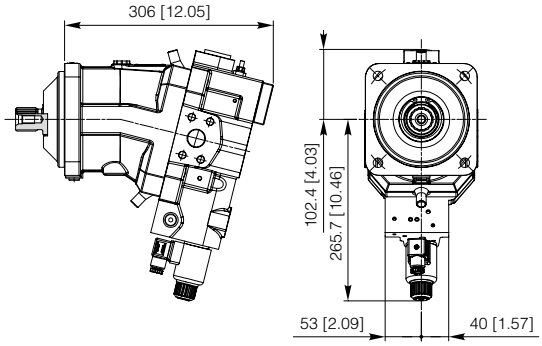
X2: Piloting port - 1/4 G (BSPP)

RIN Control

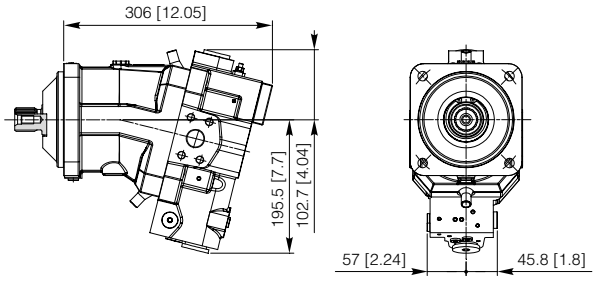


X2: Piloting port - 1/4 G (BSPP)

REN Control

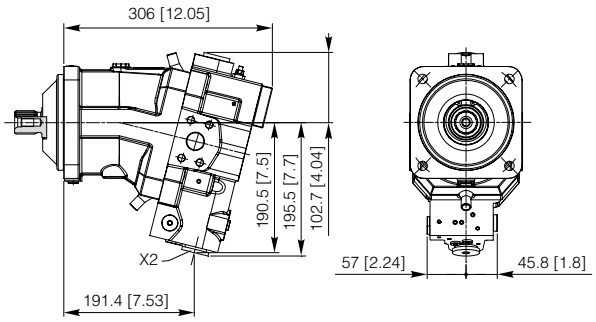


ROE Control



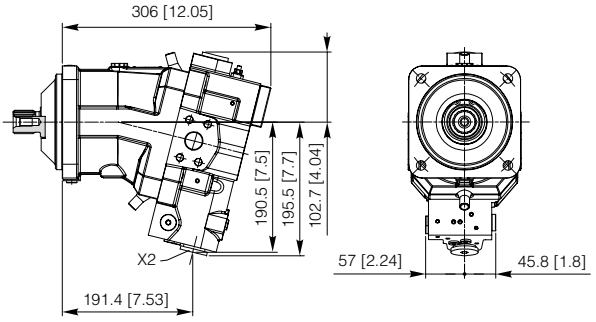
10 Control

ROI Control



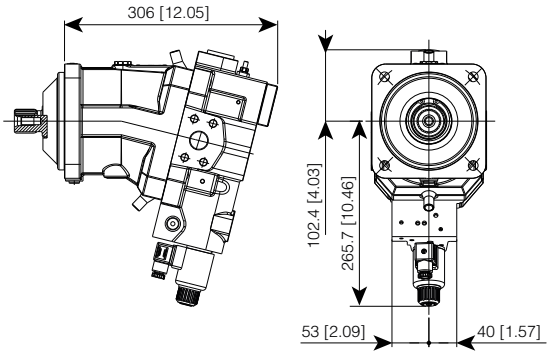
X2: Piloting port - 1/4 G (BSPP)

RPI Control

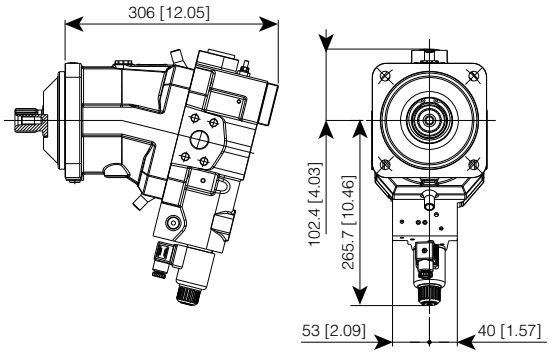


X2: Piloting port - 1/4 G (BSPP)

ROS Control



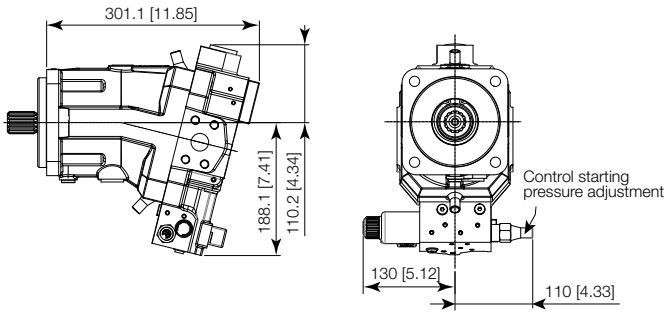
RPS Control



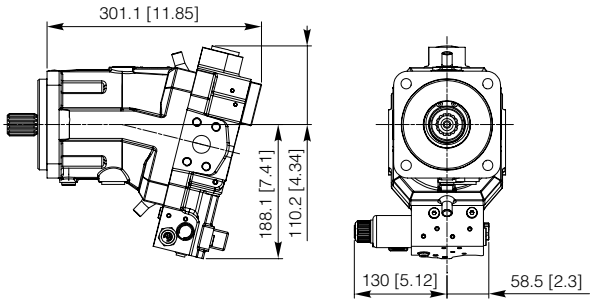
SH7V 075 - Control dimensions for mounting flange SAE-C 4 bolts (05) (Displ. setting 1)

10 Control

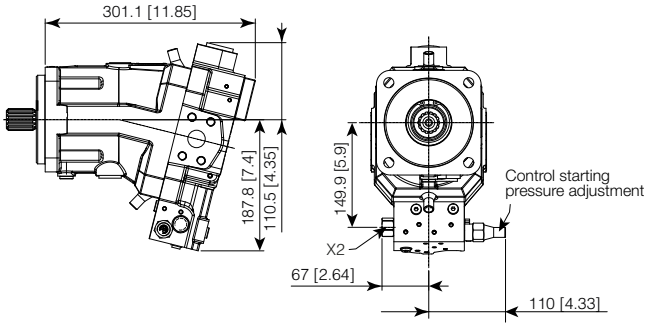
2EE Control



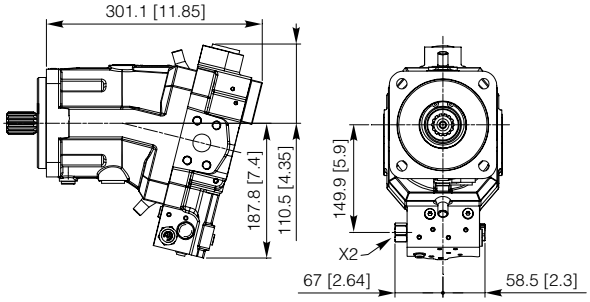
2EN Control



2IE Control

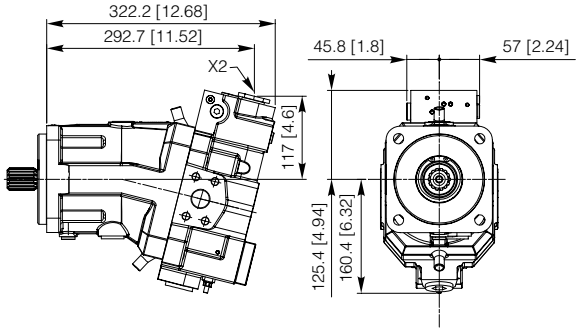


2IN Control

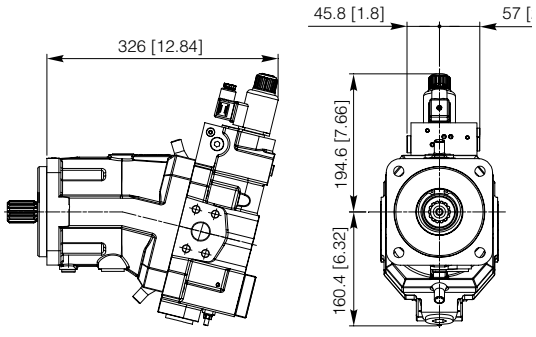


X2: Piloting port - 7/16”-20 UNF

RIN Control



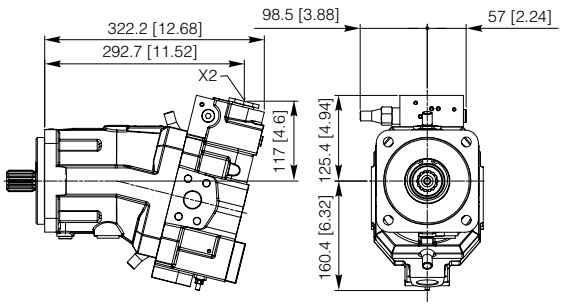
REN Control



X2: Piloting port - 7/16”-20 UNF

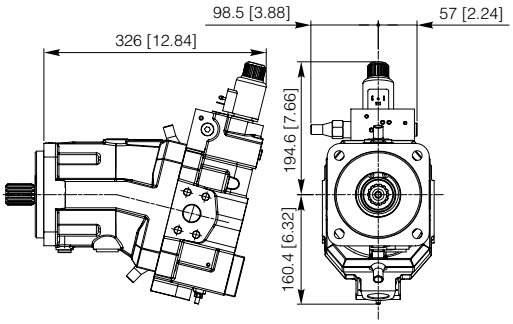
10 Control

RIE Control

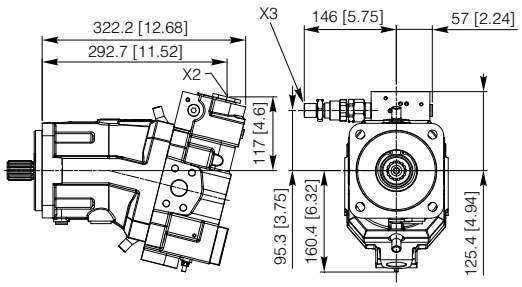


X2: Piloting port - 7/16”-20 UNF

REE Control

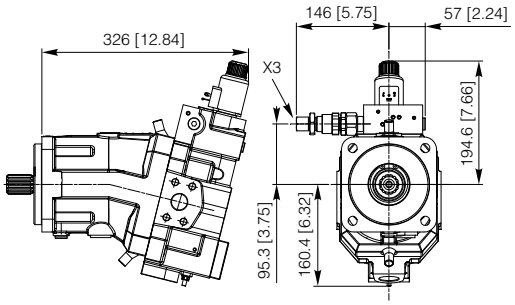


RID Control



X2: Piloting port - 7/16”-20 UNF
X3: Double step piloting port - 7/16”-20 UNF

RED Control

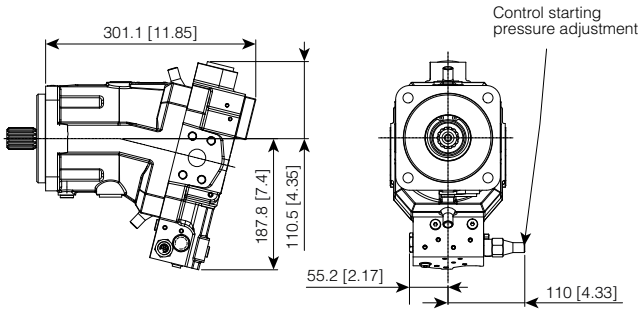


X3: Double step piloting port - 7/16”-20 UNF

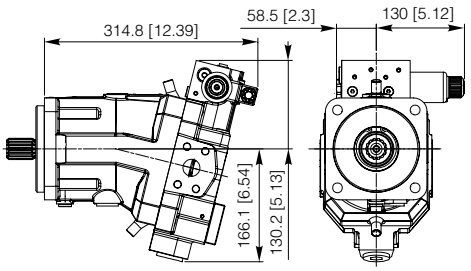
SH7V 075 - Control dimensions for mounting flange SAE-C 4 bolts (05) (Displ. setting 2)

10 Control

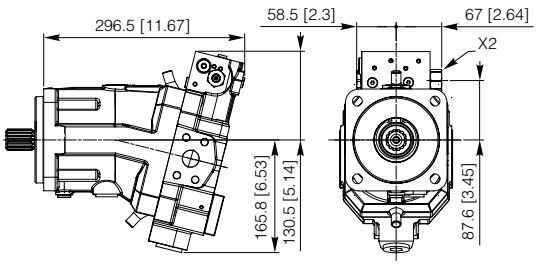
RPE Control



2EN Control

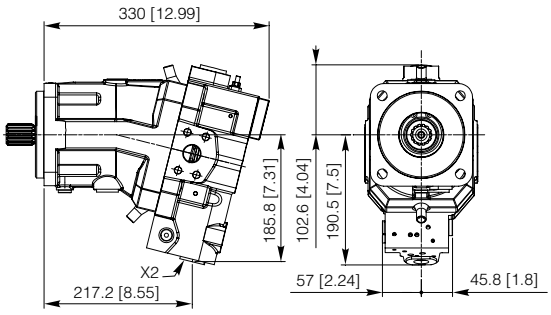


2IN Control



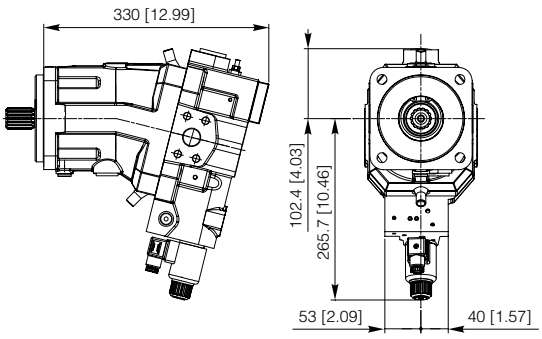
X2: Piloting port - 7/16”-20 UNF

RIN Control

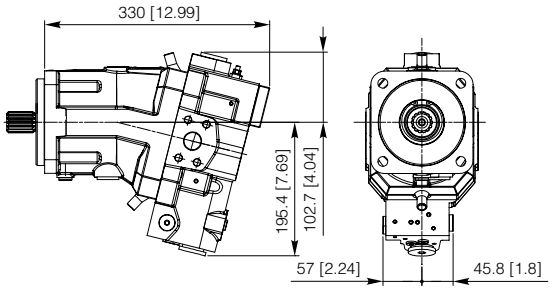


X2: Piloting port - 7/16”-20 UNF

REN Control

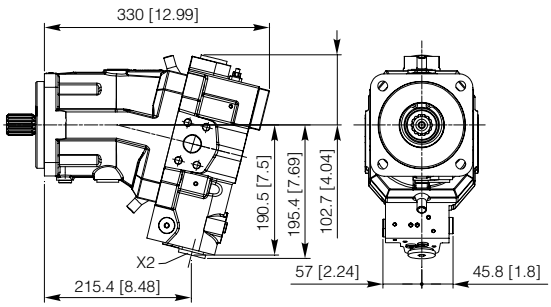


ROE Control



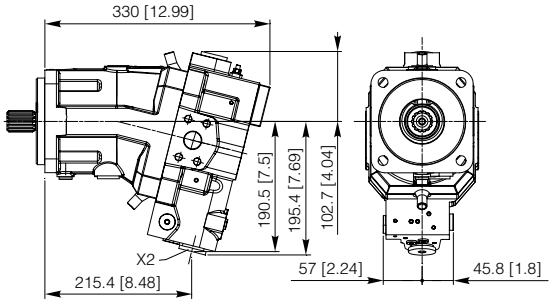
10 Control

ROI Control



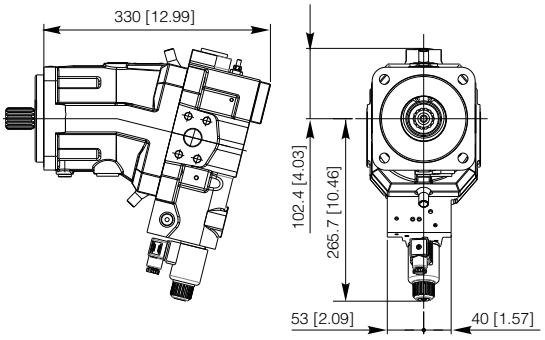
X2: Piloting port - 7/16”-20 UNF

RPI Control

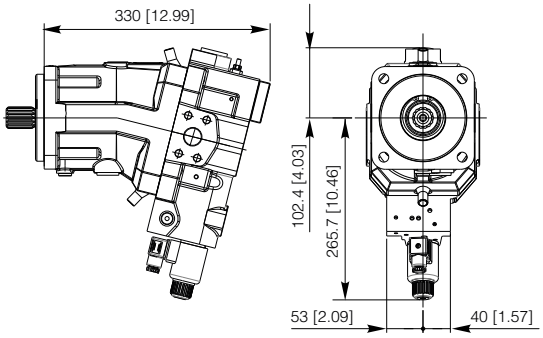


X2: Piloting port - 7/16”-20 UNF

ROS Control

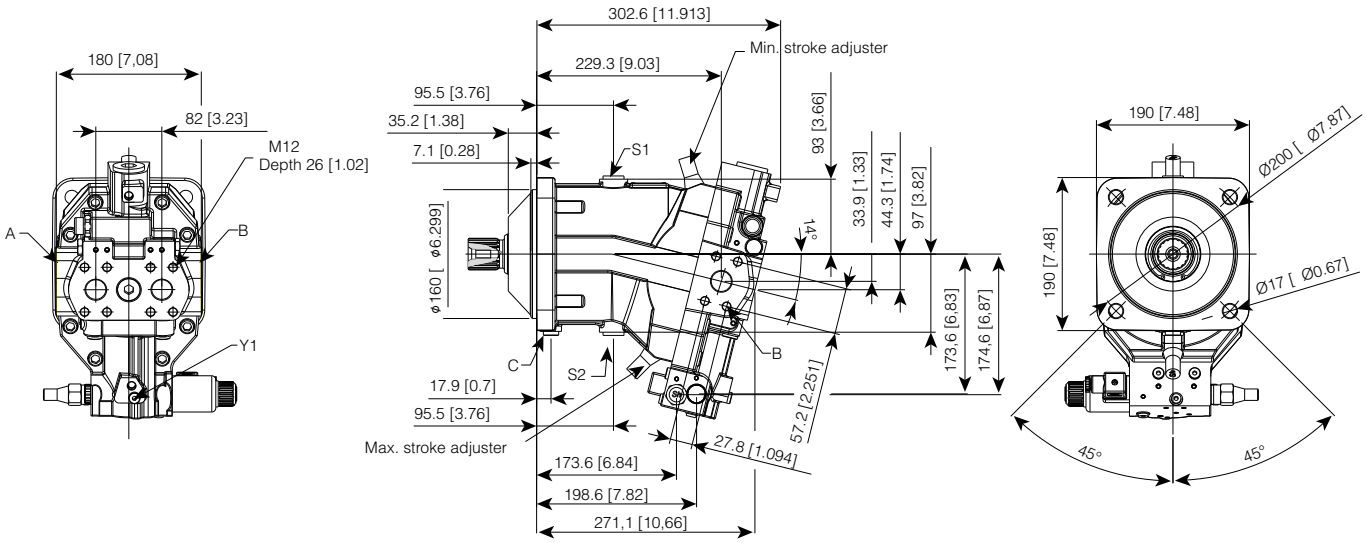


RPS Control



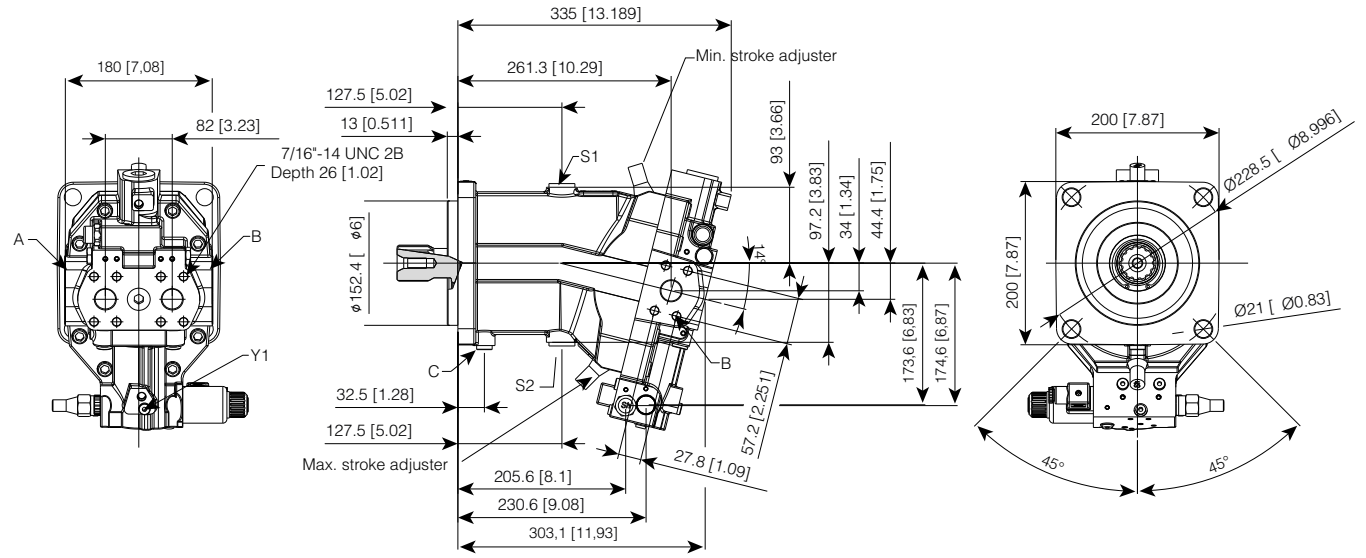
SH7V 108 - Motor dimensions

SH7V 108 Motor - Mounting flange ISO 4 Bolts (OE)



A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 1/4 G (BSPP)
S1-S2: Case drain port - 1/2 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

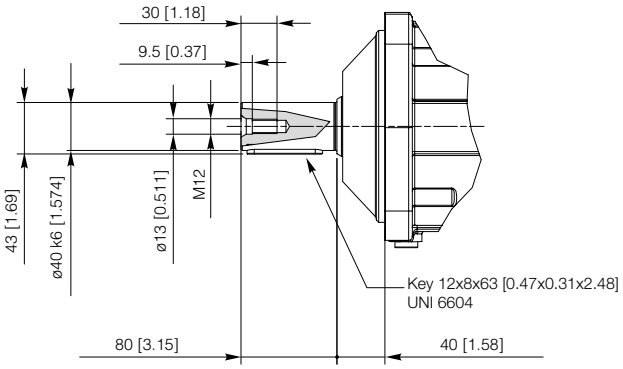
SH7V 108 Motor - Mounting flange SAE-C 4 Bolts (08)



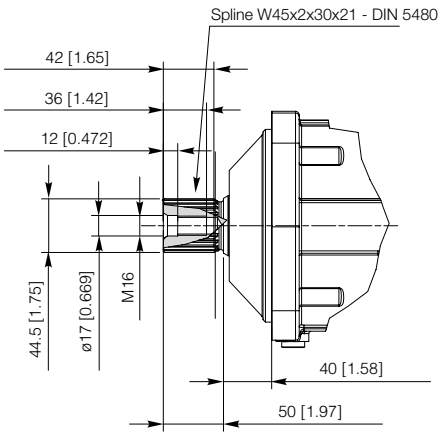
A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 7/16”-20 UNF
S1-S2: Case drain port - 1” 1/16 - 12 UN 2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

7 Shaft end

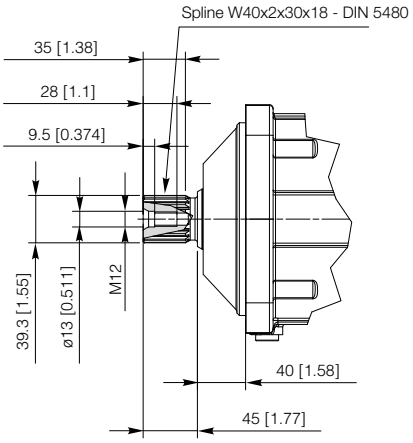
CAK Parallel keyed shaft



SAP Splined shaft



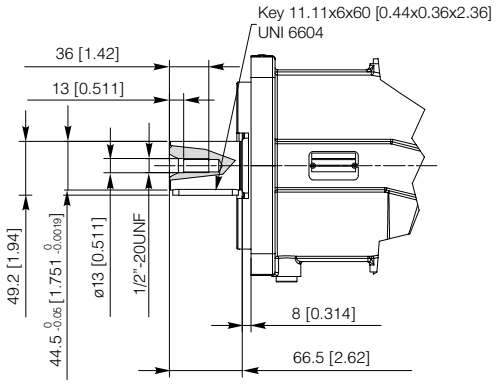
SA0 Splined shaft



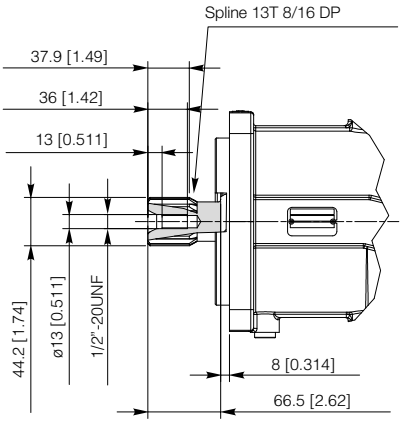
SH7V 108 - Shafts dimensions for mounting flange SAE-C 4 bolts (08)

7 Shaft end

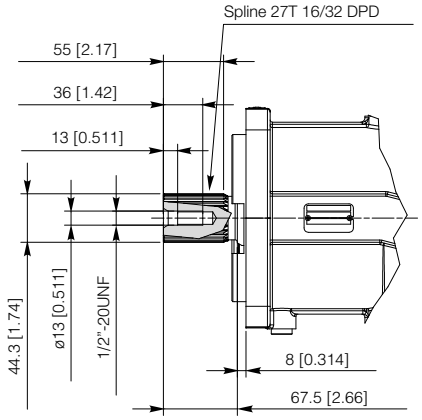
C18 Parallel keyed shaft



S15 Splined shaft

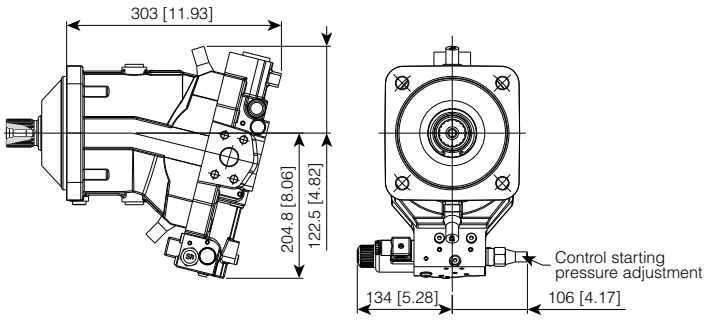


S20 Splined shaft

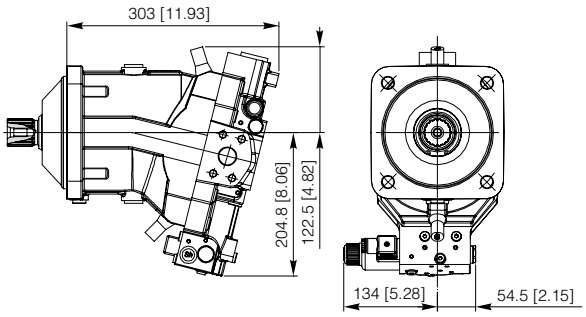


10 Control

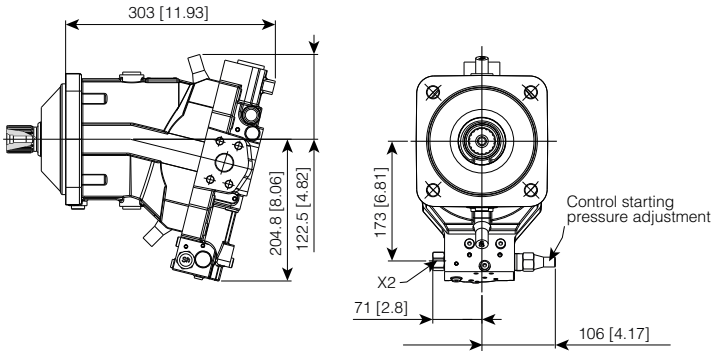
2EE Control



2EN Control

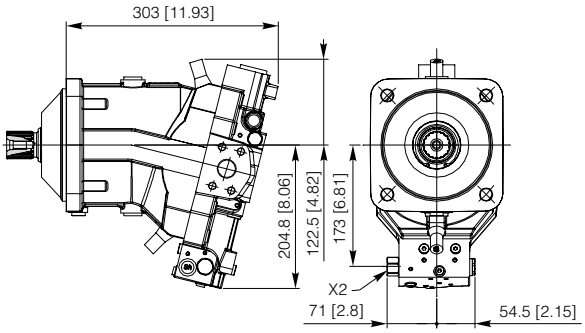


2IE Control



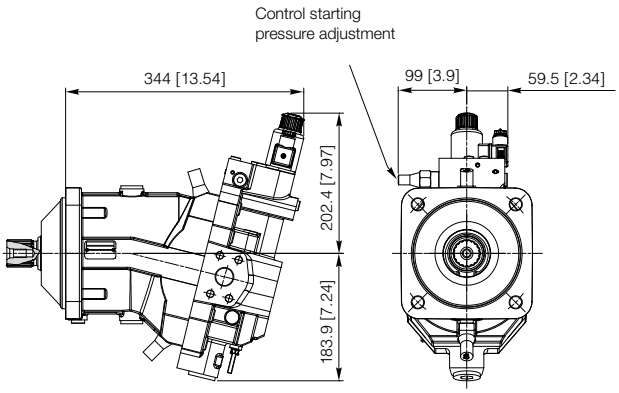
X2: Piloting port - 1/4 G (BSPP)

2IN Control

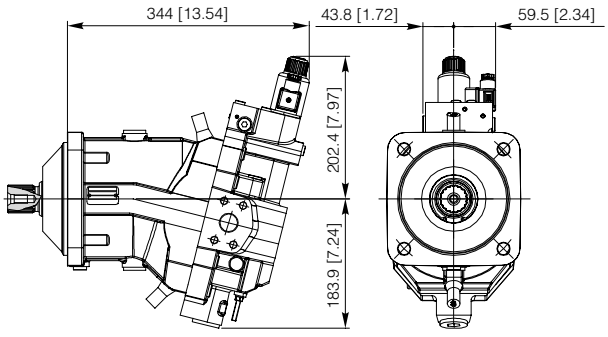


X2: Piloting port - 1/4 G (BSPP)

REE Control



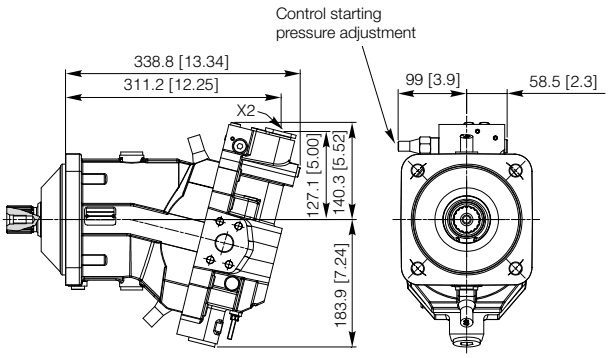
REN Control



SH7V 108 - Control dimensions for mounting flange ISO 4 bolts (OE) (Displ. setting 1)

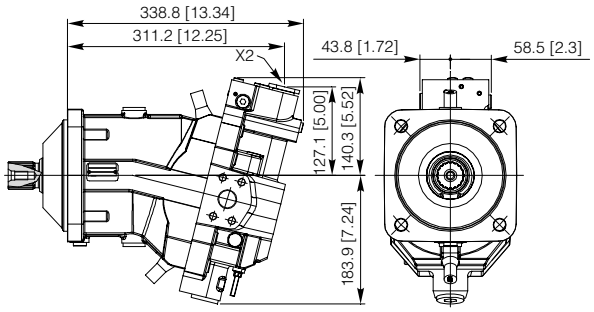
10 Control

RIE Control



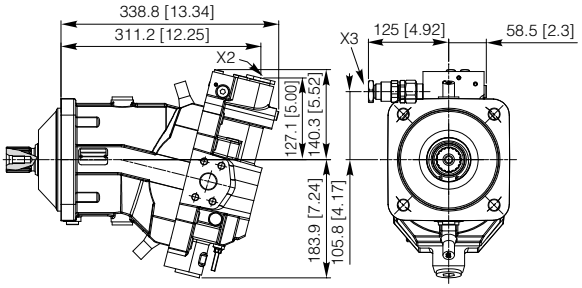
X2: Piloting port - 1/4 G (BSPP)

RIN Control



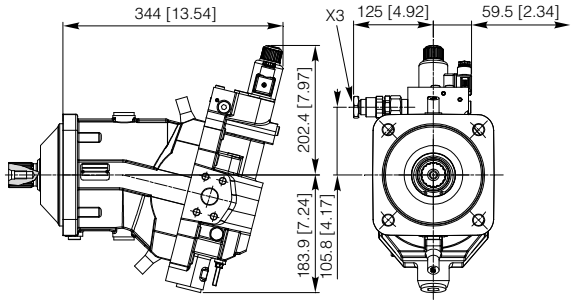
X2: Piloting port - 1/4 G (BSPP)

RID Control



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

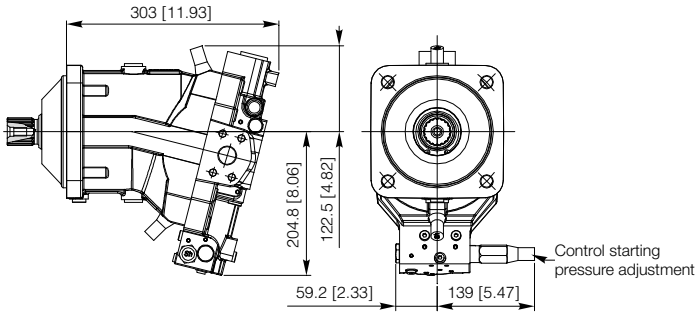
RED Control



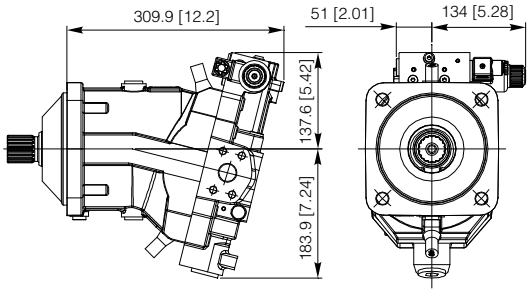
X3: Double step piloting port - 1/4 G (BSPP)

10 Control

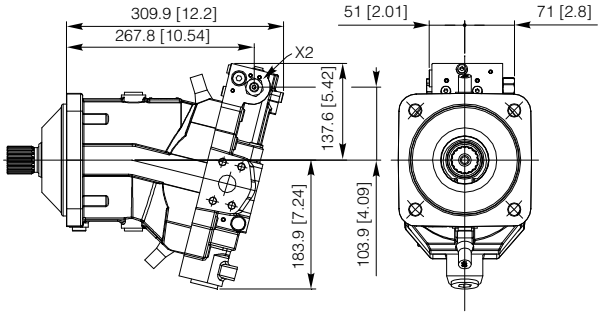
RPE Control



2EN Control

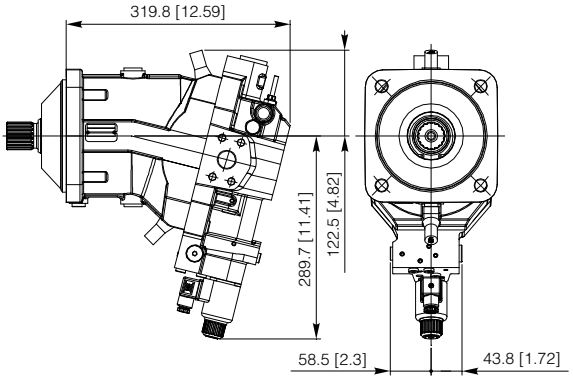


2IN Control

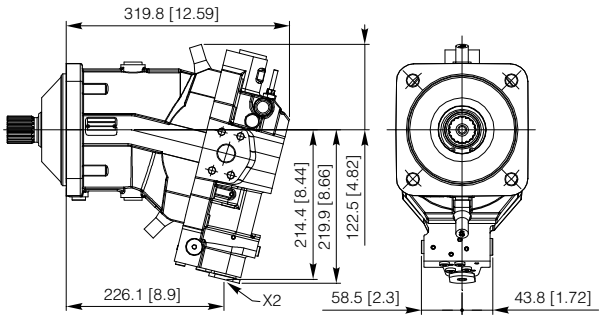


X2: Piloting port - 1/4 G (BSPP)

REN Control

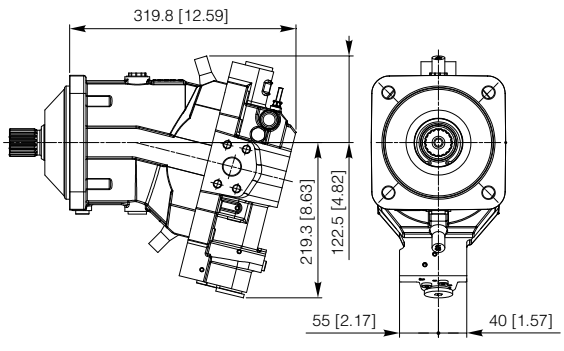


RIN Control



X2: Piloting port - 1/4 G (BSPP)

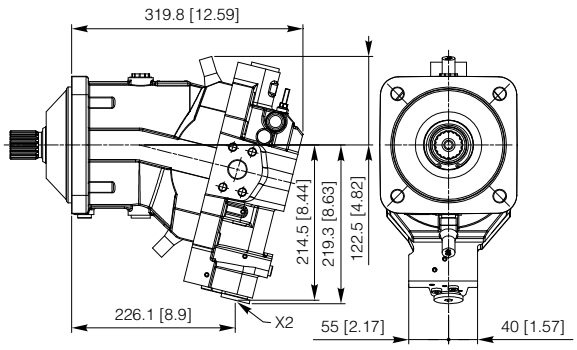
ROE Control



SH7V 108 - Control dimensions for mounting flange ISO 4 bolts (OE) (Displ. setting 2)

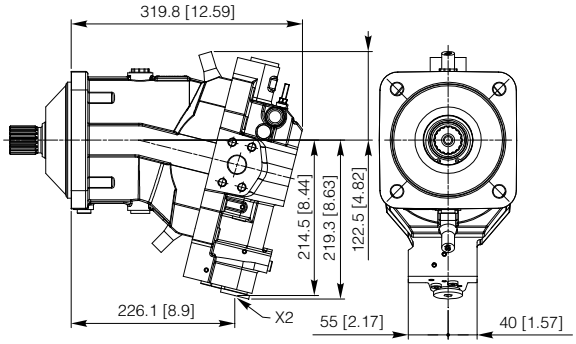
10 Control

ROI Control



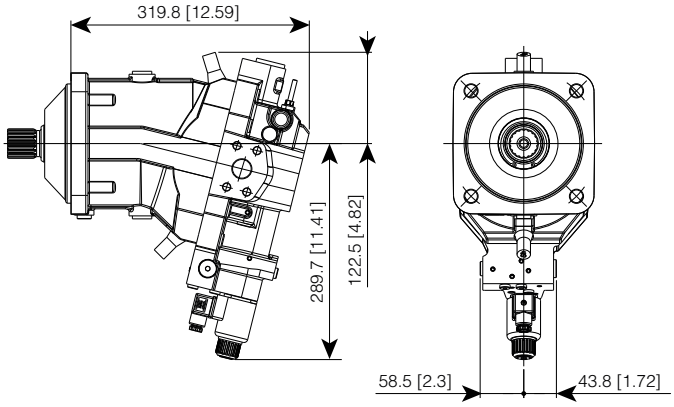
X2: Piloting port - 1/4 G (BSPP)

RPI Control

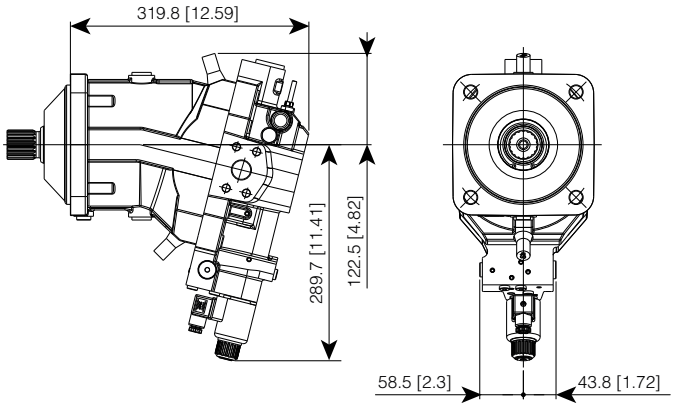


X2: Piloting port - 1/4 G (BSPP)

ROS Control

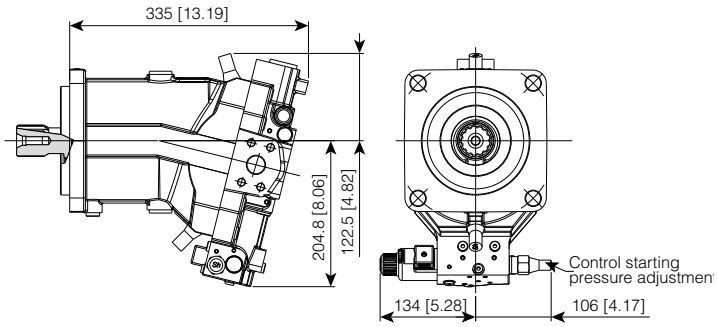


RPS Control

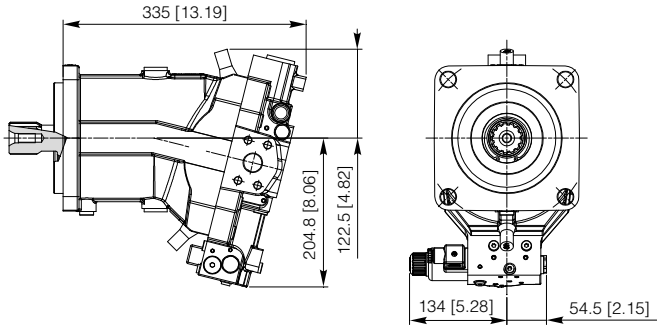


10 Control

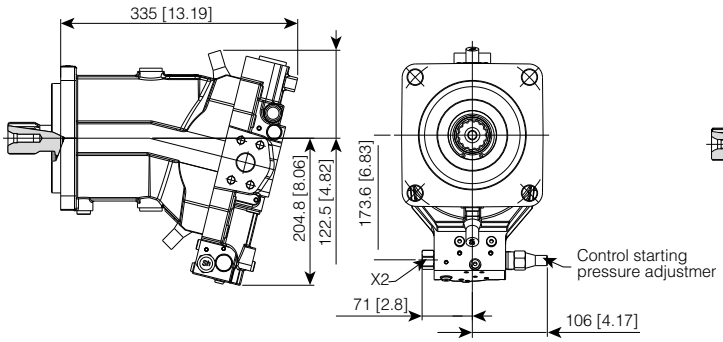
2EE Control



2EN Control

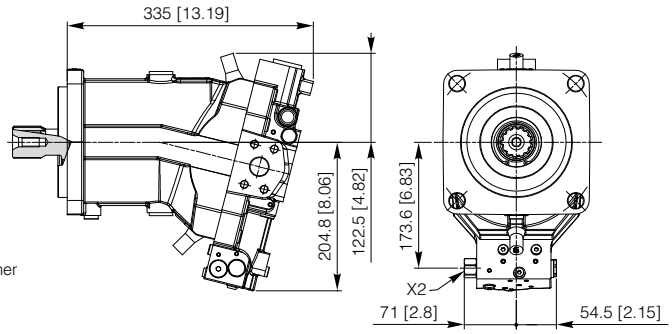


2IE Control



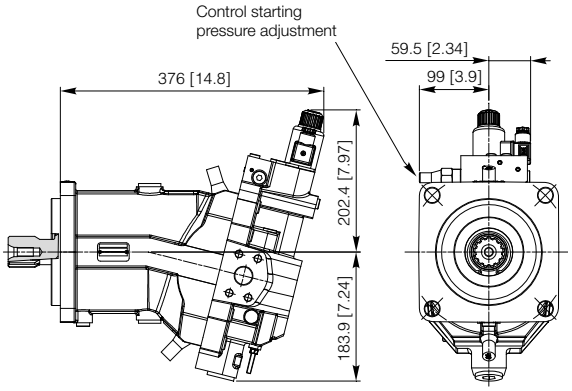
X2: Piloting port - 7/16”-20 UNF

2IN Control

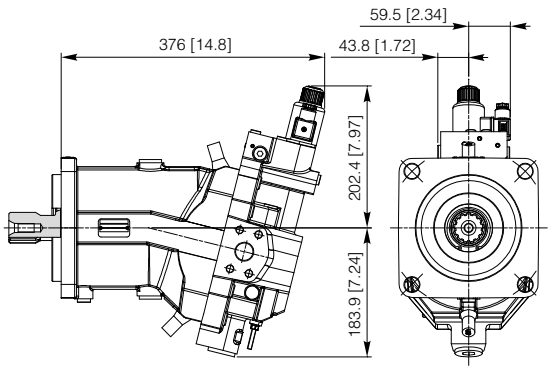


X2: Piloting port - 7/16”-20 UNF

REE Control



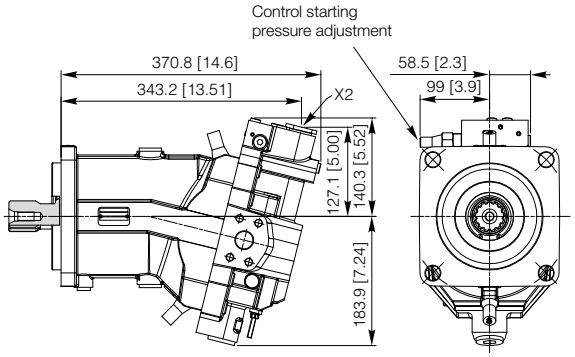
REN Control



SH7V 108 - Control dimensions for mounting flange SAE-C 4 bolts (08) (Displ. setting 1)

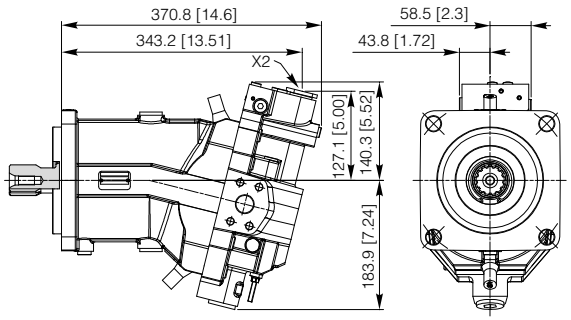
10 Control

RIE Control



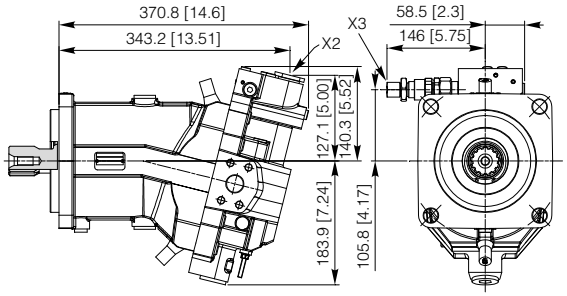
X2: Piloting port - 7/16”-20 UNF

RIN Control



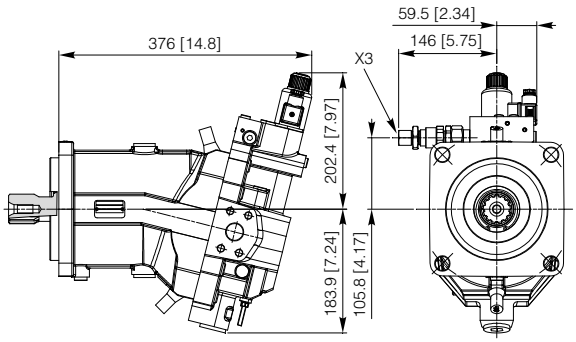
X2: Piloting port - 7/16”-20 UNF

RID Control



X2: Piloting port - 7/16”-20 UNF
X3: Double step piloting port - 7/16”-20 UNF

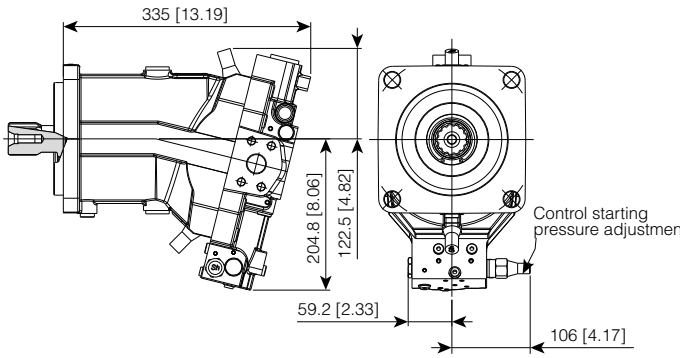
RED Control



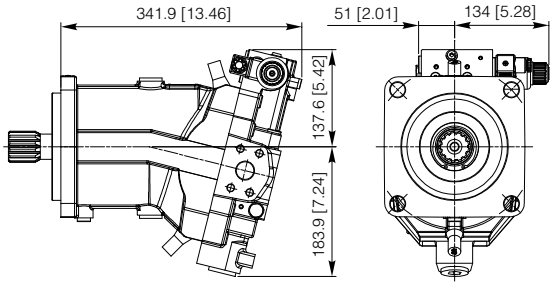
X3: Double step piloting port - 7/16”-20 UNF

10 Control

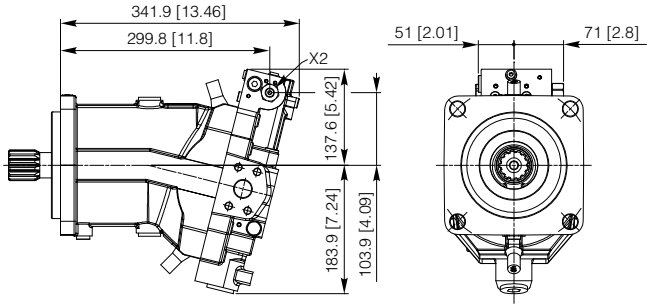
RPE Control



2EN Control

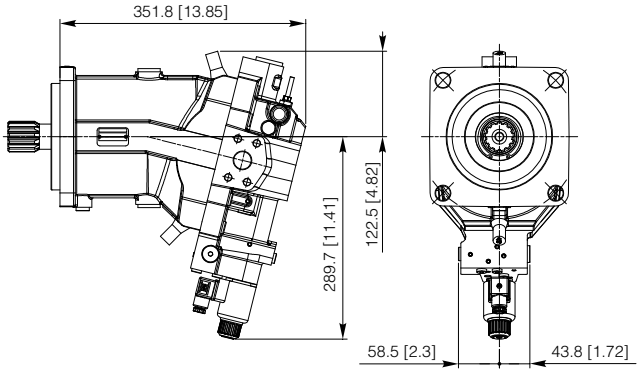


2IN Control

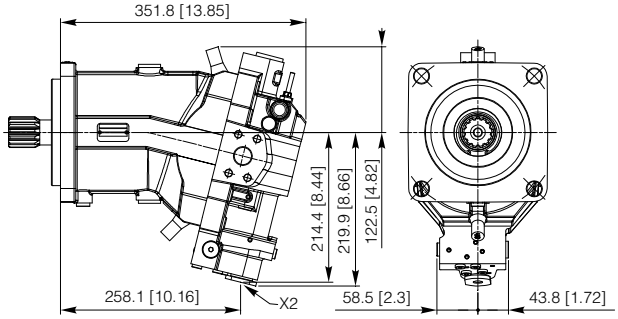


X2: Piloting port - 7/16”-20 UNF

REN Control

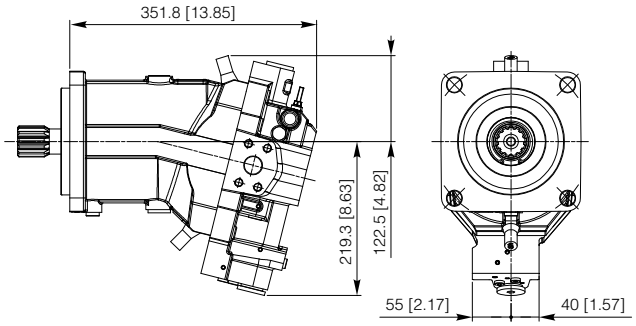


RIN Control



X2: Piloting port - 7/16”-20 UNF

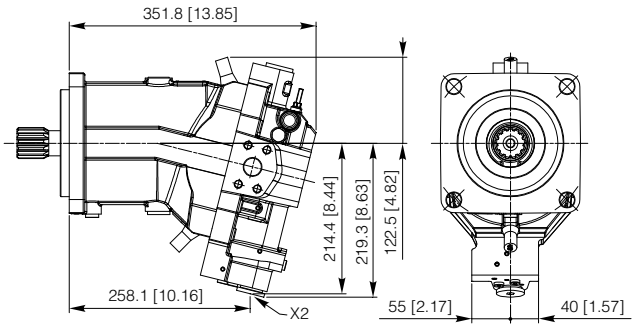
ROE Control



SH7V 108 - Control dimensions for mounting flange SAE-C 4 bolts (08) (Displ. setting 2)

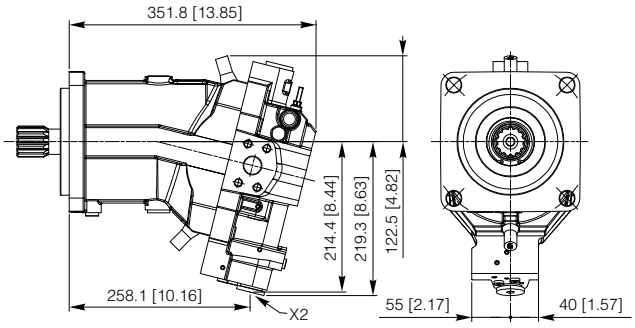
10 Control

ROI Control



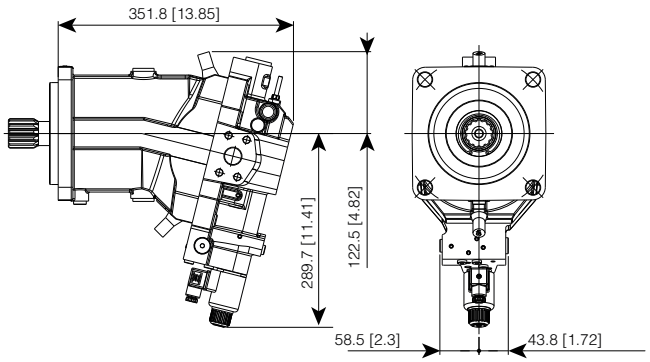
X2: Piloting port - 7/16”-20 UNF

RPI Control

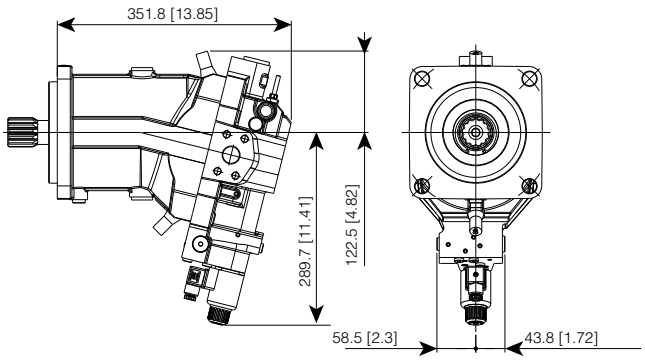


X2: Piloting port - 7/16”-20 UNF

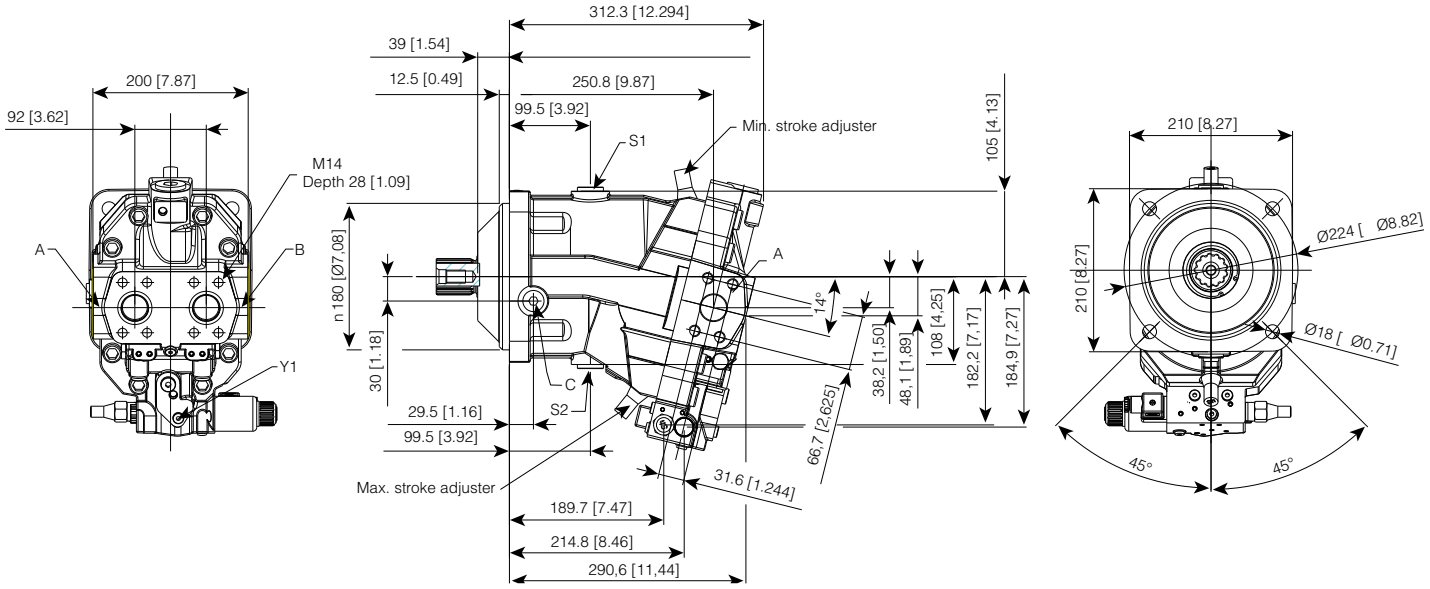
ROS Control



RPS Control

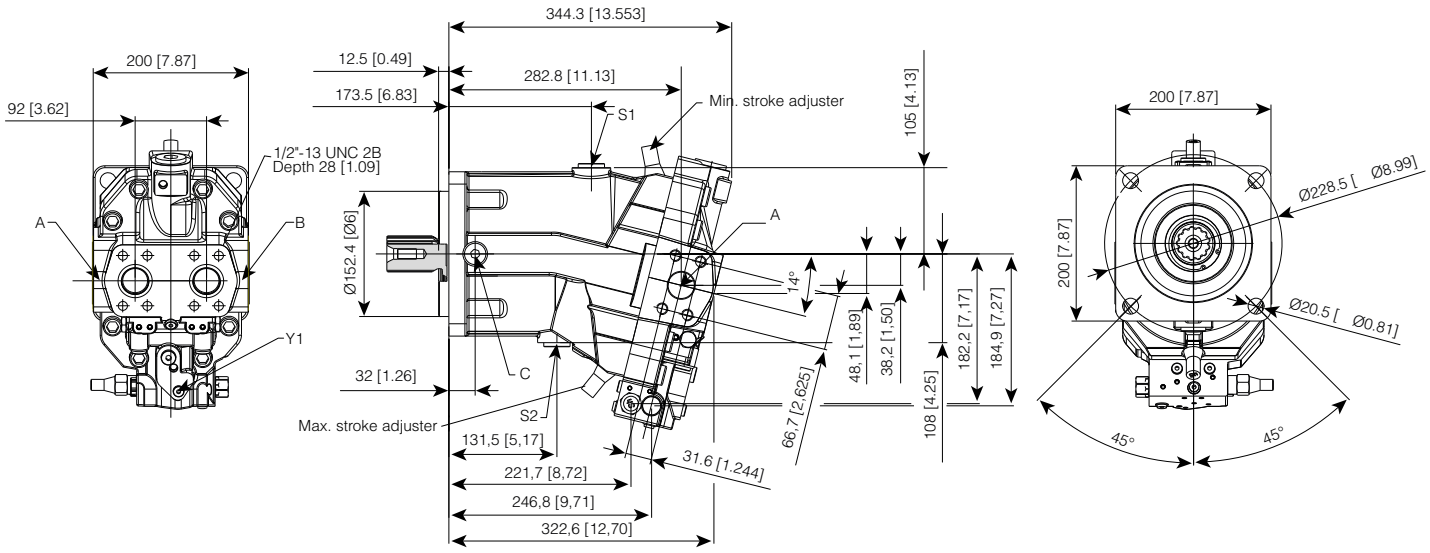


SH7V 160 Motor - Mounting flange ISO 4 Bolts (OF)



A-B: Service line ports - 1”1/4 SAE 6000
C: Air bleed bearings flushing port - 1/2 G (BSPP)
S1-S2: Case drain port - 3/4 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

SH7V 160 Motor - Mounting flange SAE-D 4 Bolts (08)

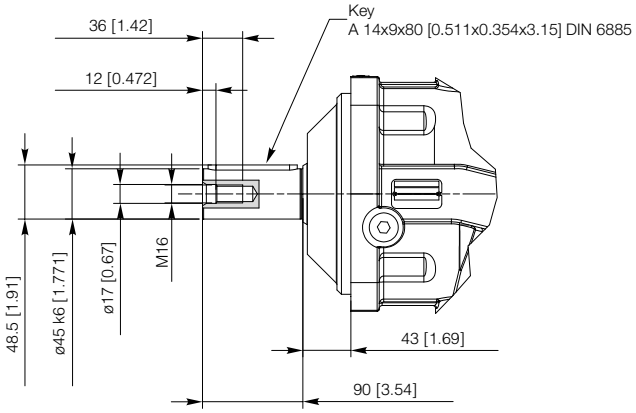


A-B: Service line ports - 1”1/4 SAE 6000
C: Air bleed bearings flushing port - 3/4”-16 UNF-2B
S1-S2: Case drain port - 1” 1/16 - 12 UN-2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

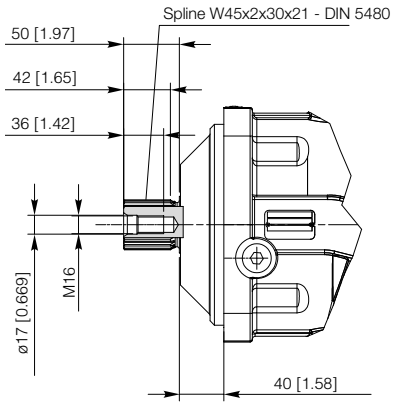
SH7V 160 - Shafts dimensions for mounting flange ISO 4 bolts (OF)

7 Shaft end

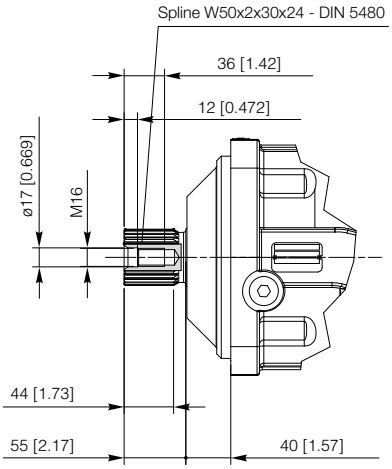
CAJ Parallel keyed shaft



SAP Splined shaft

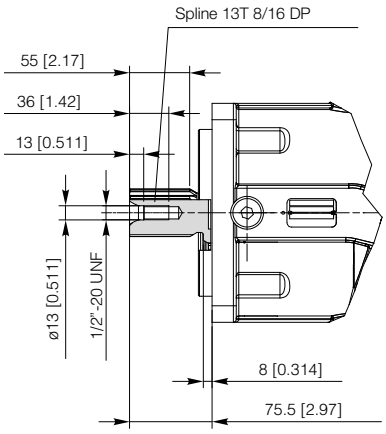


SAR Splined shaft

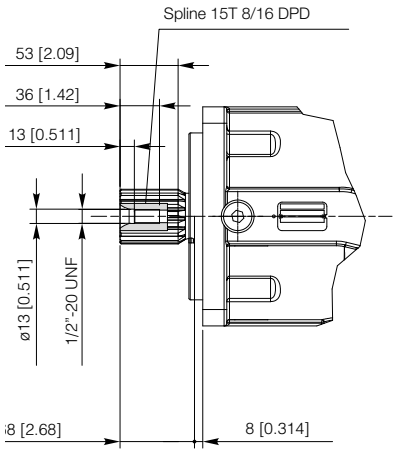


7 Shaft end

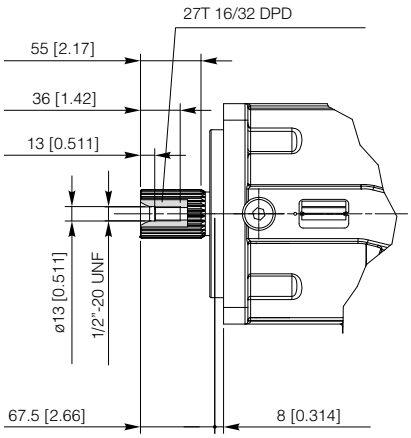
S15 Splined shaft



S19 Splined shaft



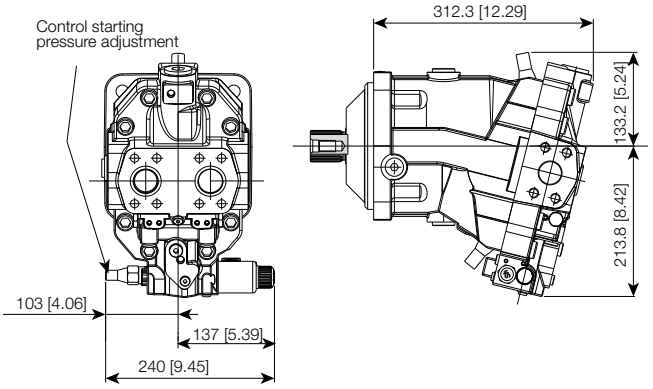
S20 Splined shaft



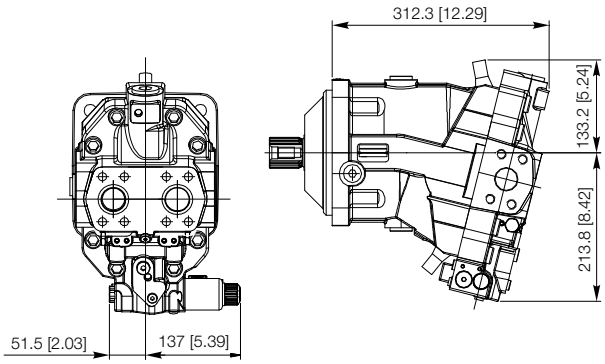
SH7V 160 - Control dimensions for mounting flange ISO 4 bolts (OF) (Displ. setting 1)

10 Control

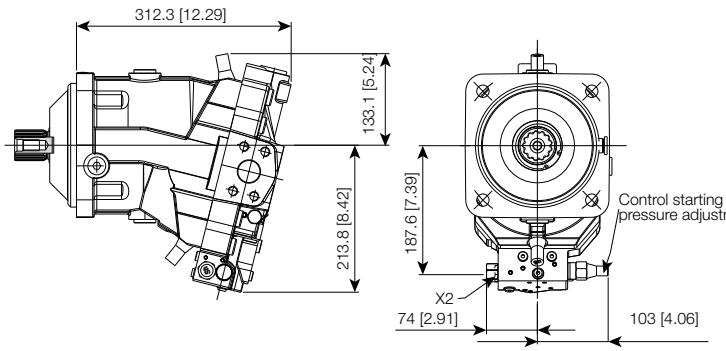
2EE Control



2EN Control

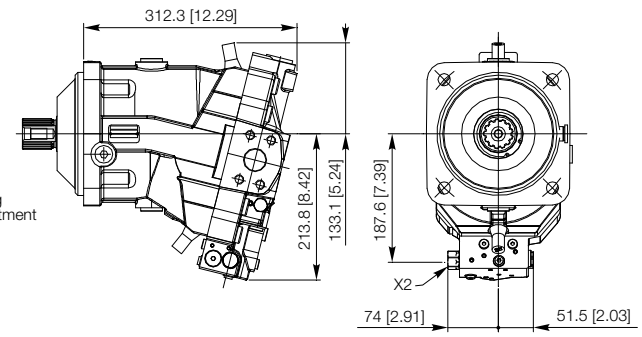


2IE Control



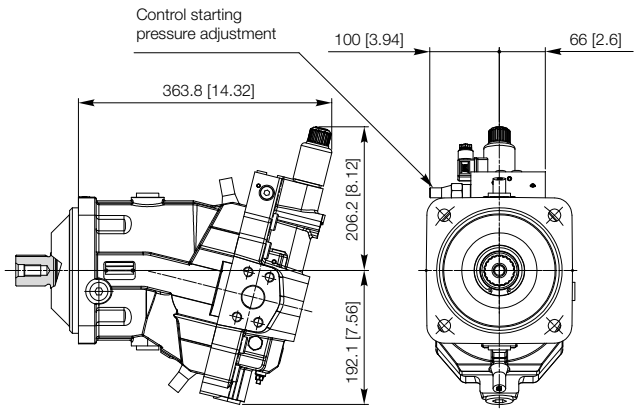
X2: Piloting port - 1/4 G (BSPP)

2IN Control

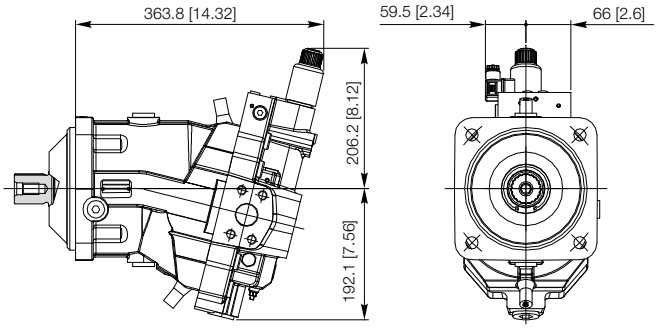


X2: Piloting port - 1/4 G (BSPP)

REE Control

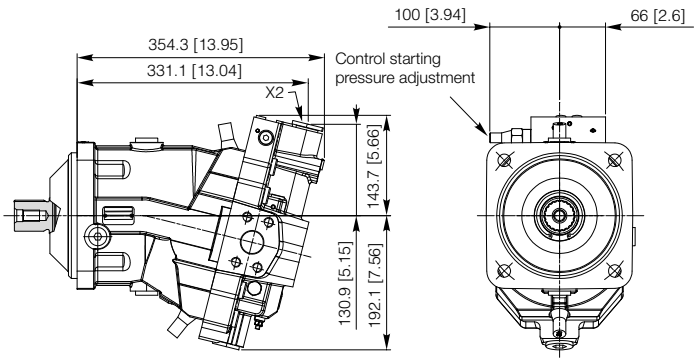


REN Control



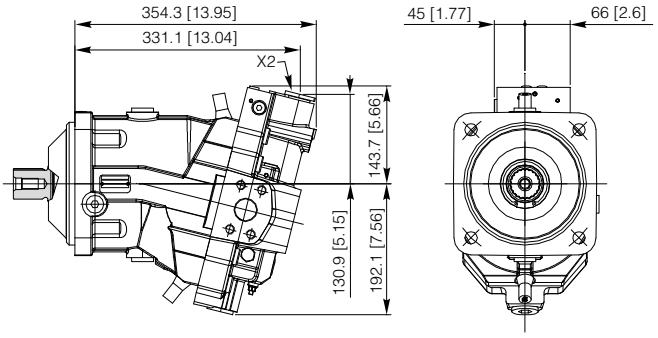
10 Control

RIE Control



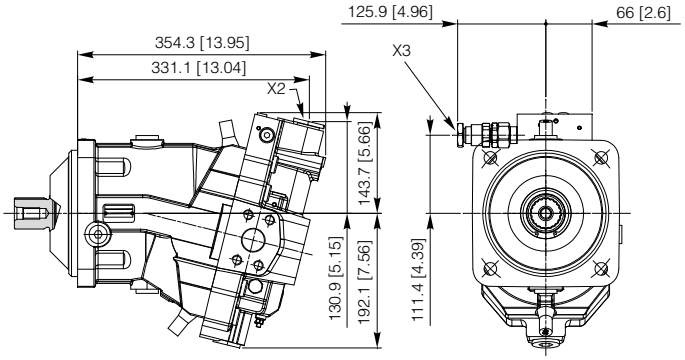
X2: Piloting port - 1/4 G (BSPP)

RIN Control



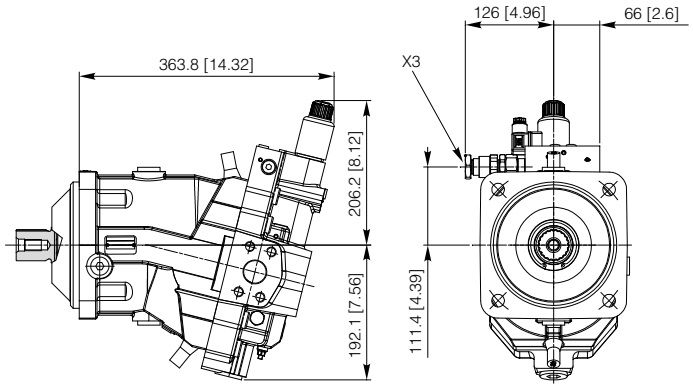
X2: Piloting port - 1/4 G (BSPP)

RID Control



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

RED Control

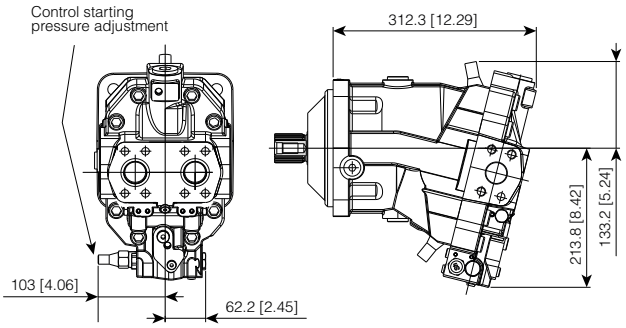


X3: Double step piloting port - 1/4 G (BSPP)

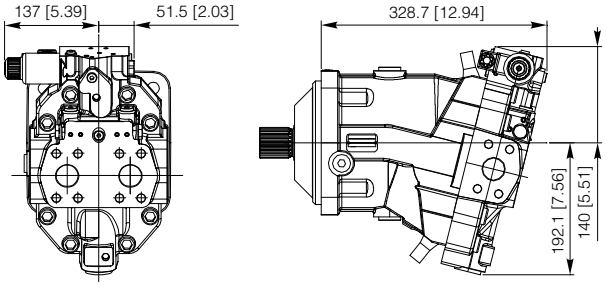
SH7V 160 - Control dimensions for mounting flange ISO 4 bolts (OF) (Displ. setting 2)

10 Control

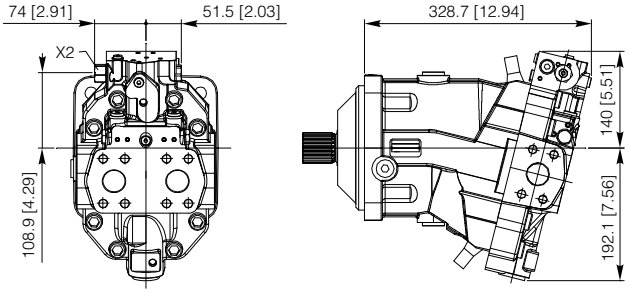
RPE Control



2EN Control

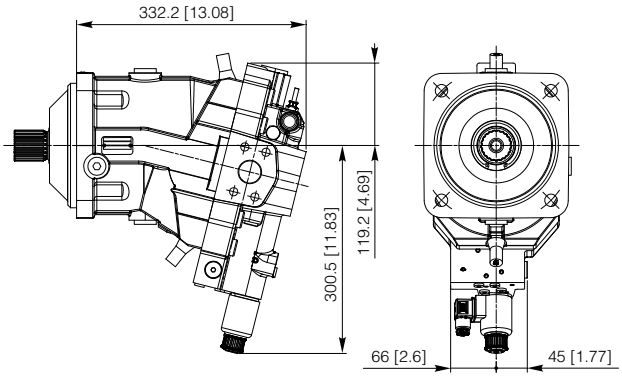


2IN Control

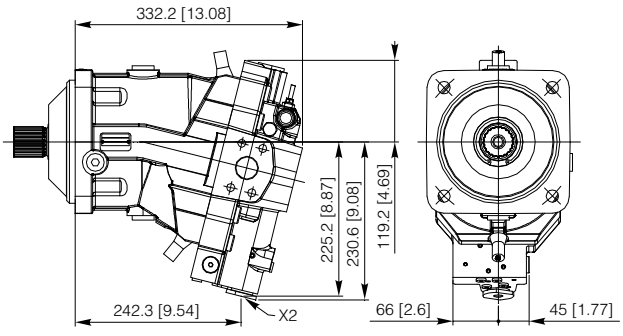


X2: Piloting port - 1/4 G (BSPP)

REN Control

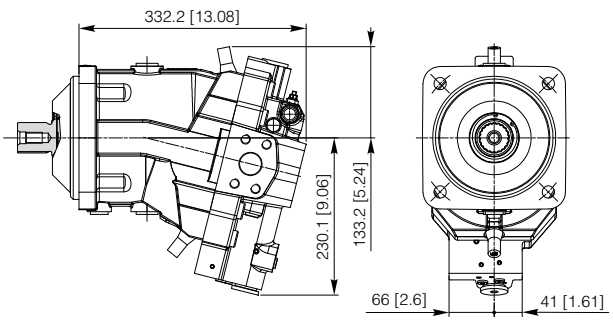


RIN Control



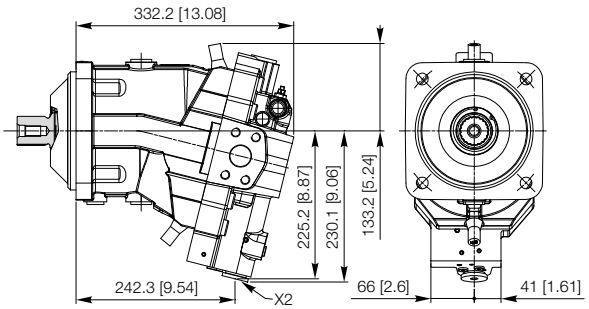
X2: Piloting port - 1/4 G (BSPP)

ROE Control



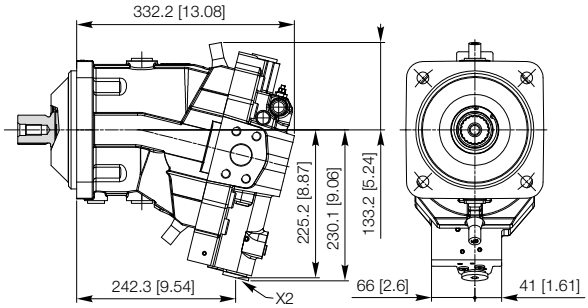
10 Control

ROI Control



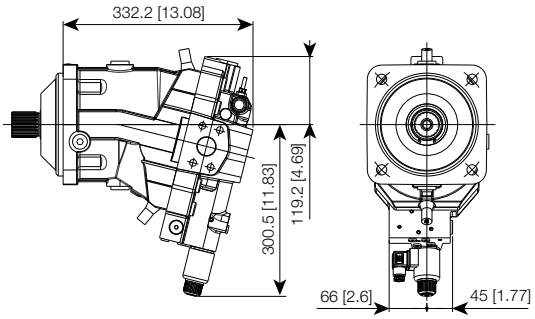
X2: Piloting port - 1/4 G (BSPP)

RPI Control

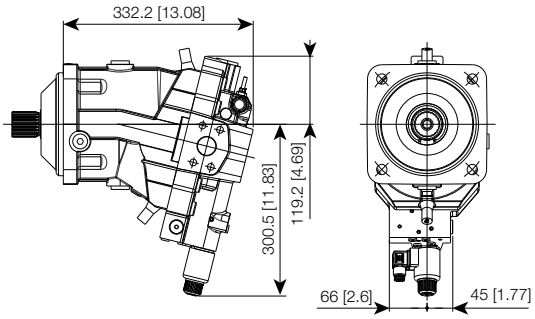


X2: Piloting port - 1/4 G (BSPP)

ROS Control



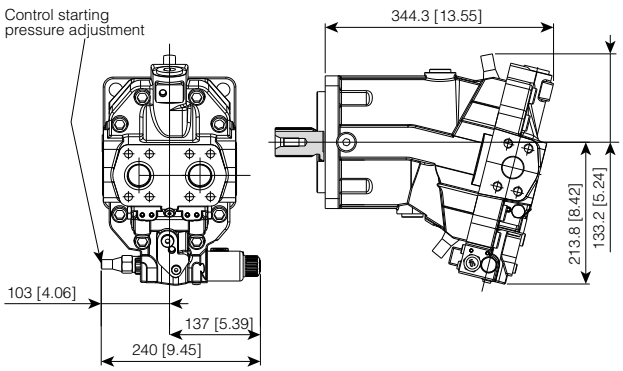
RPS Control



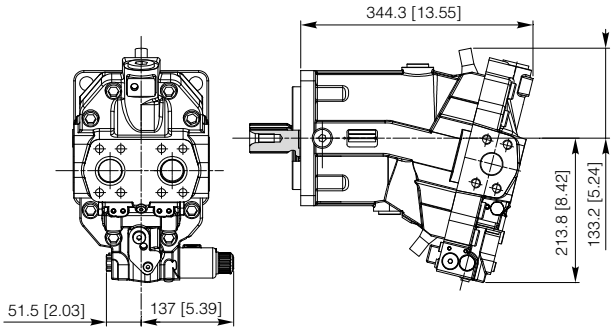
SH7V 160 - Control dimensions for mounting flange SAE-D 4 bolts (08) (Displ. setting 1)

10 Control

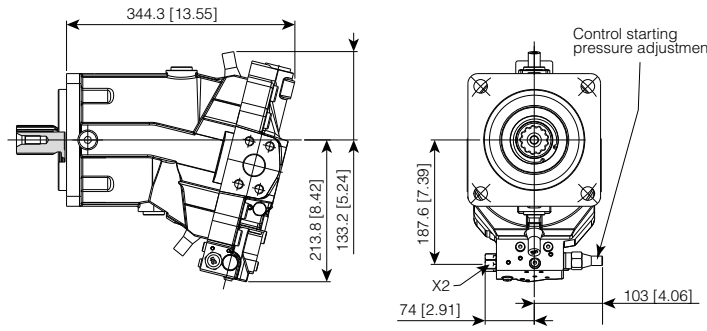
2EE Control



2EN Control

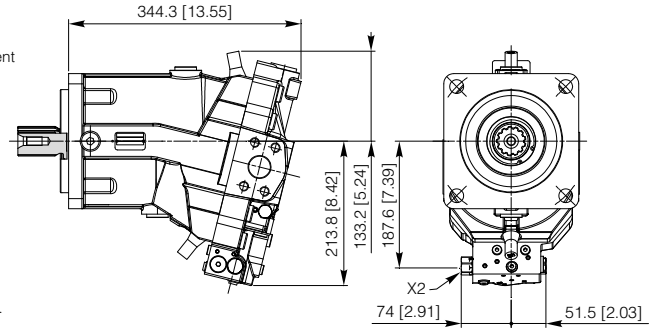


2IE



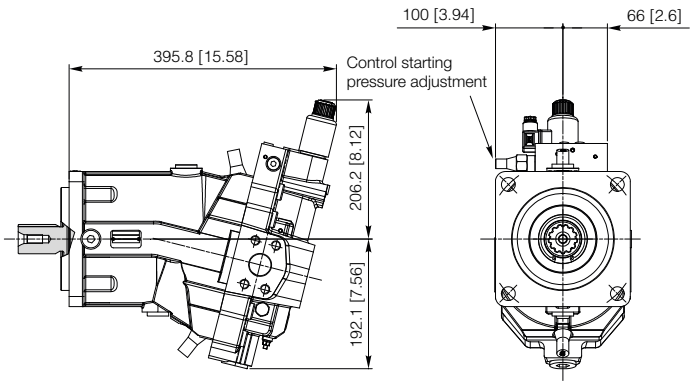
X2: Piloting port - 7/16”-20 UNF-2B

2IN Control

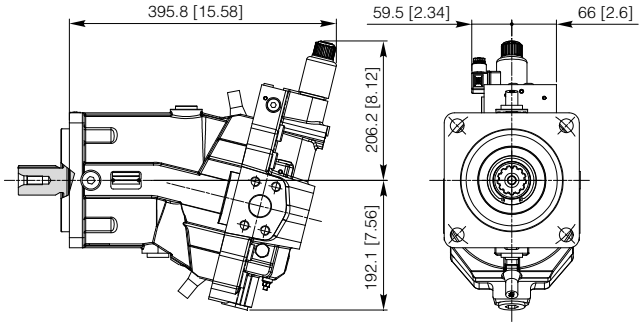


X2: Piloting port - 7/16”-20 UNF-2B

REE Control

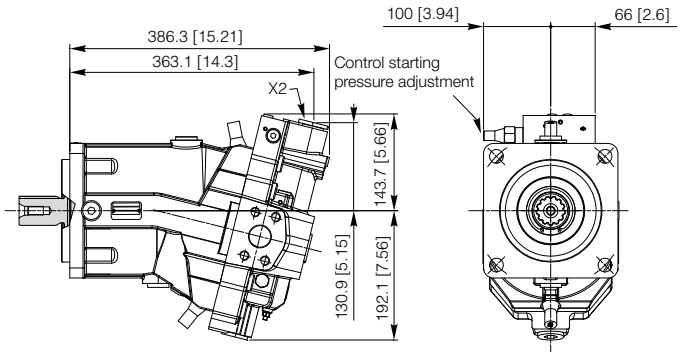


REN Control



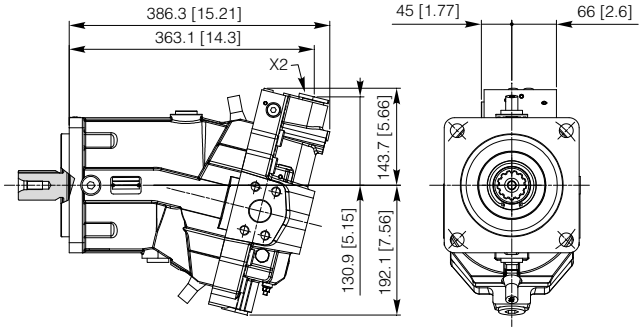
10 Control

RIE Control



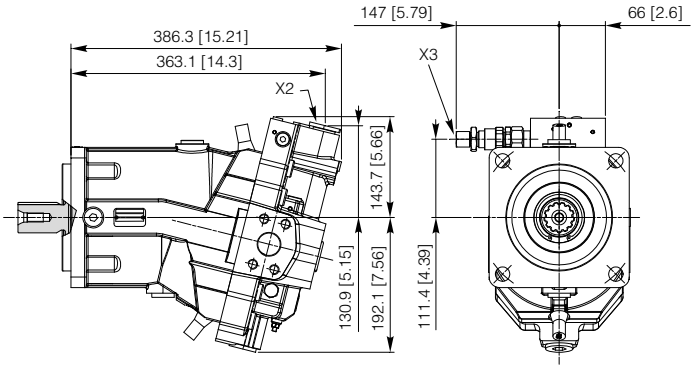
X2: Piloting port - 7/16”-20 UNF-2B

RIN Control



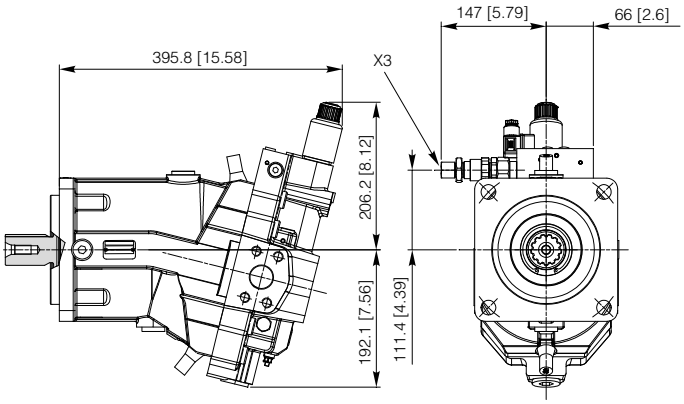
X2: Piloting port - 7/16”-20 UNF-2B

RID Control



X2: Piloting port - 7/16”-20 UNF
X3: Double step piloting port - 7/16”-20 UNF

RED Control

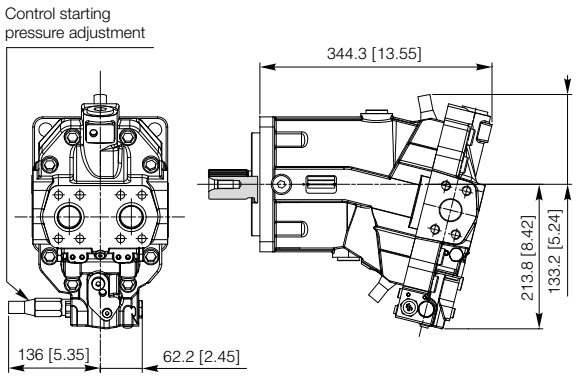


X3: Double step piloting port - 7/16”-20 UNF

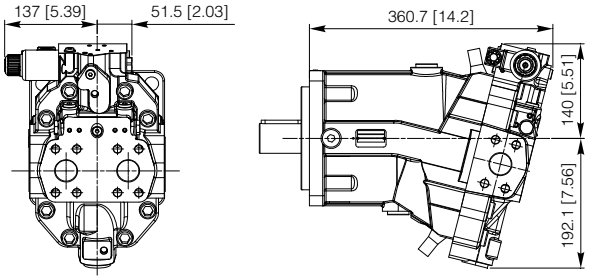
SH7V 160 - Control dimensions for mounting flange SAE-D 4 bolts (08) (Displ. setting 2)

10 Control

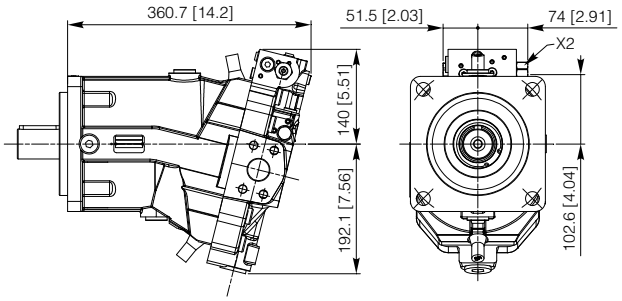
RPE Control



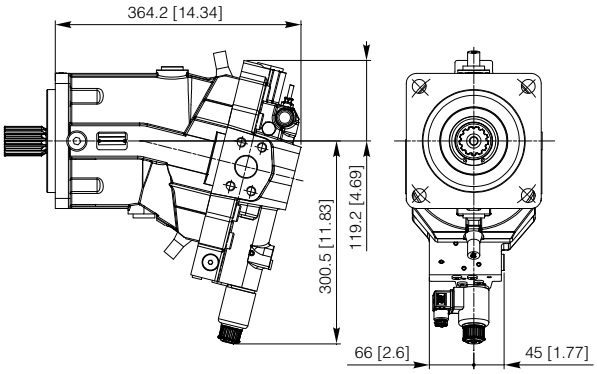
2EN Control



2IN Control

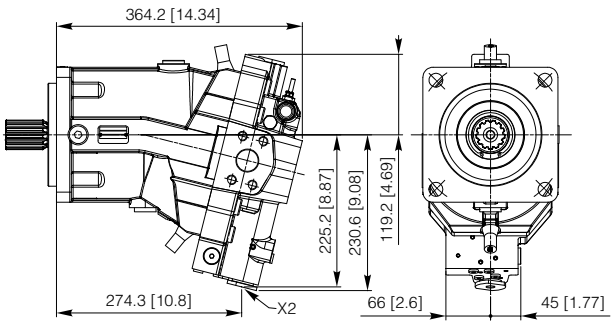


REN Control

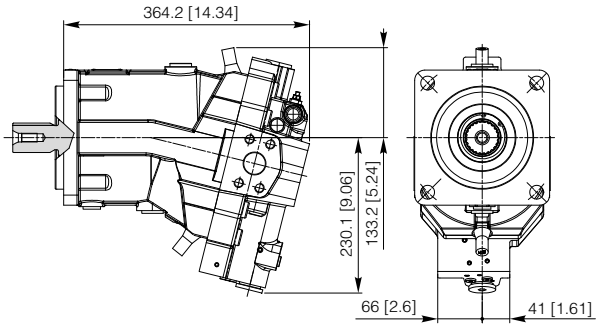


X2: Piloting port - 7/16”-20 UNF-2B

RIN Control



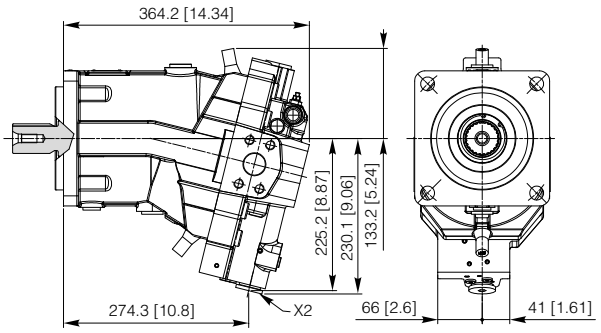
ROE Control



X2: Piloting port - 7/16”-20 UNF-2B

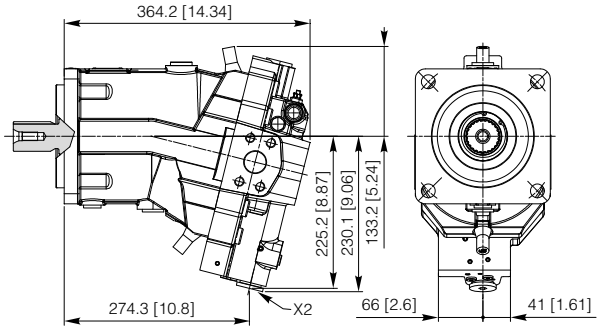
10 Control

ROI Control



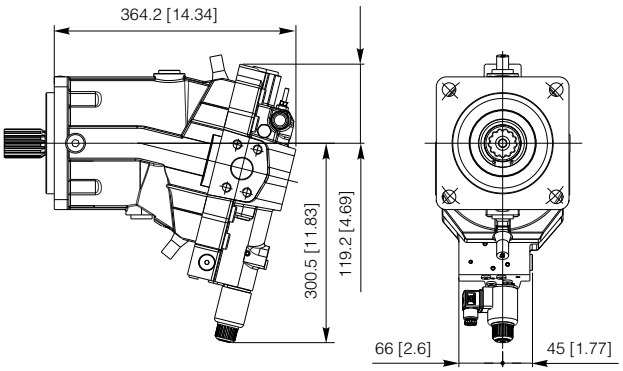
X2: Piloting port - 7/16”-20 UNF-2B

RPI Control

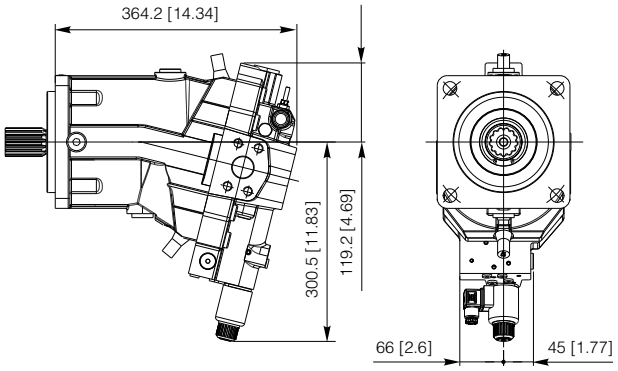


X2: Piloting port - 7/16”-20 UNF-2B

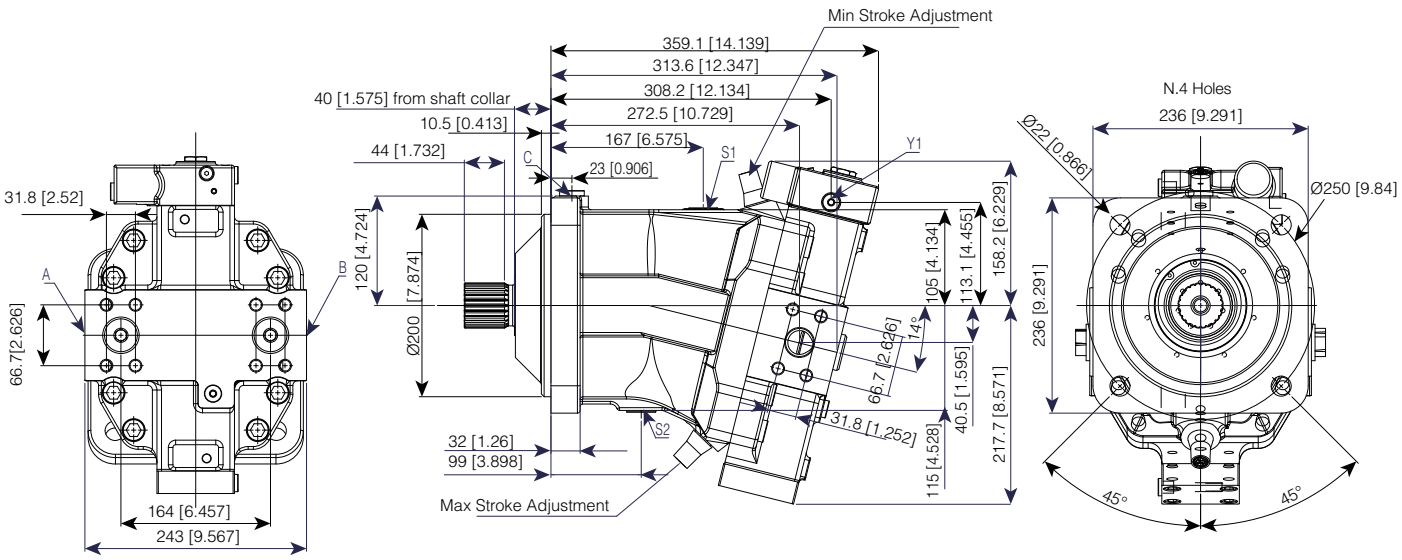
ROS Control



RPS Control

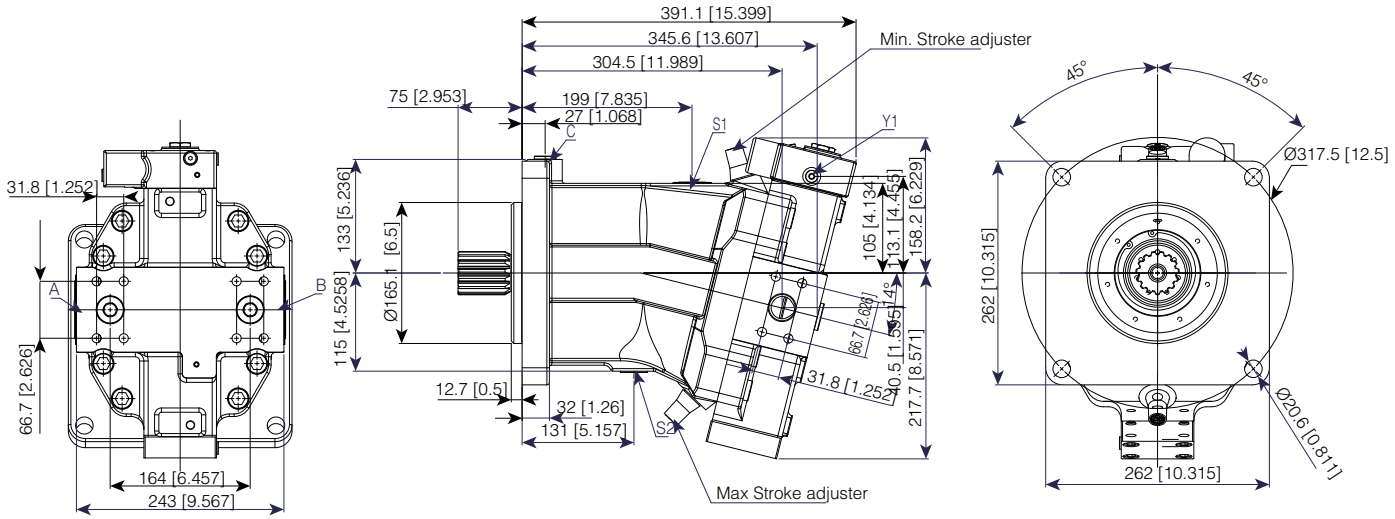


SH7V 200 Motor - Mounting flange ISO 4 Bolts (OG)



A-B: Service line ports - 1”1/4 SAE 6000
C: Air bleed bearings flushing port - 1/2 G (BSPP)
S1-S2: Case drain port - 3/4 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

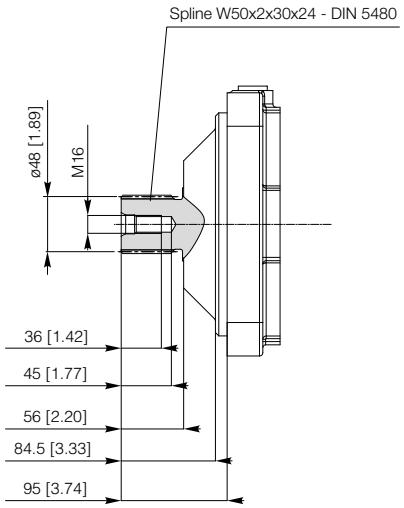
SH7V 200 Motor - Mounting flange SAE-E 4 Bolts (10)



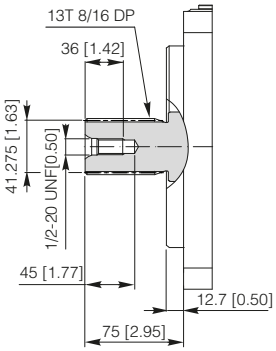
A-B: Service line ports - 1”1/4 SAE 6000
C: Air bleed bearings flushing port - 3/4”-16 UNF-2B
S1-S2: Case drain port - 1” 1/16 - 12 UN-2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

7 Shaft end - for mounting flange SAE

SAR Splined shaft

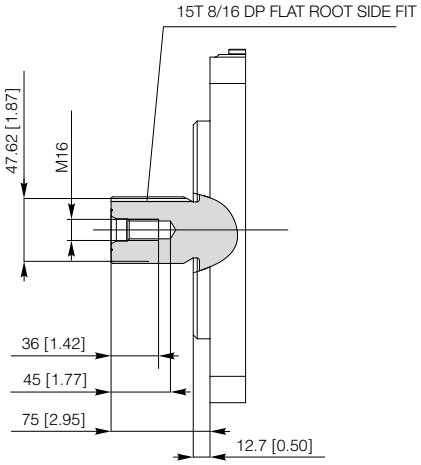


S15 Splined shaft



7 Shaft end - for mounting flange ISO

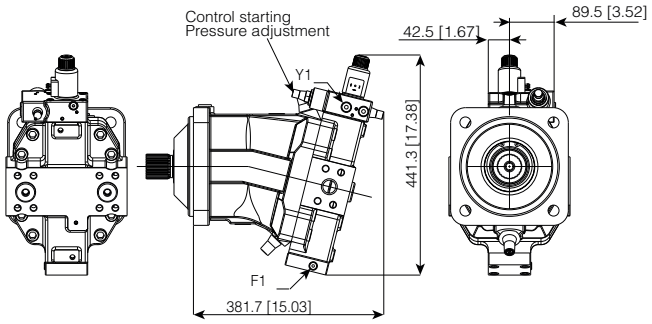
S19 Splined shaft



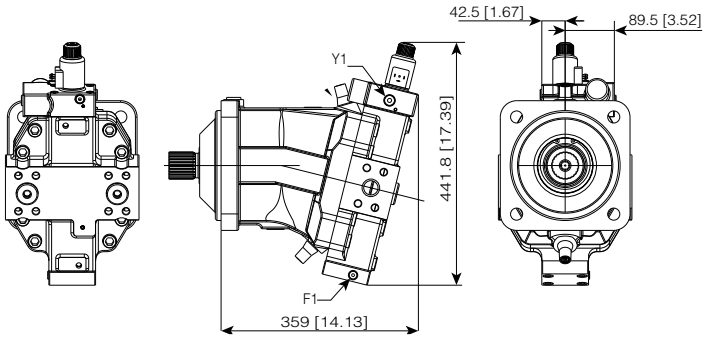
SH7V 200 - Control dimensions for mounting flange ISO 4 bolts (OG) (Displ. setting 1)

10 Control

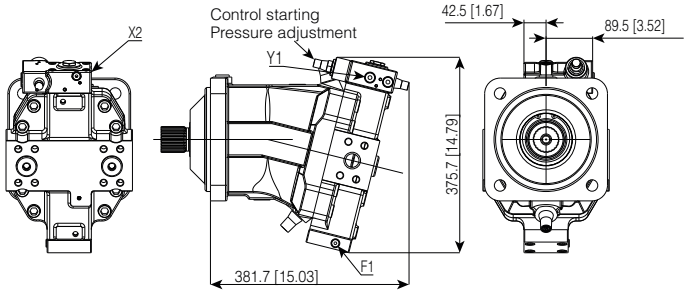
2EE Control



2EN Control

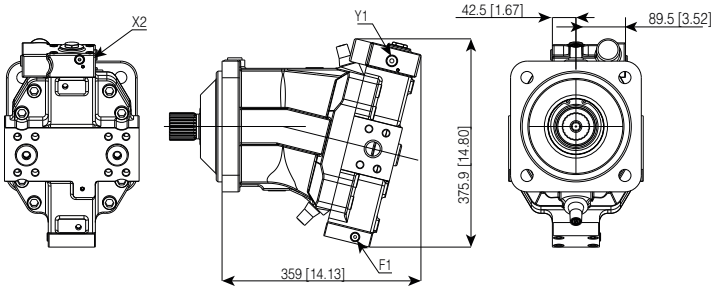


2IE Control



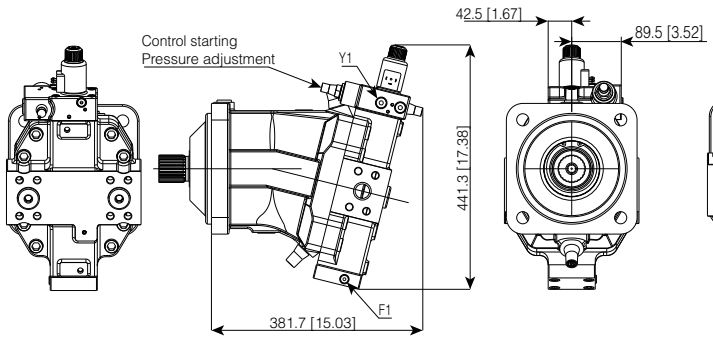
X2: Piloting port - 7/16”-20 UNF

2IN Control

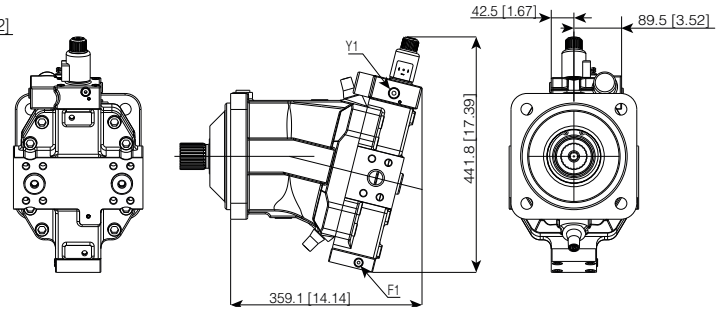


X2: Piloting port - 7/16”-20 UNF

REE Control

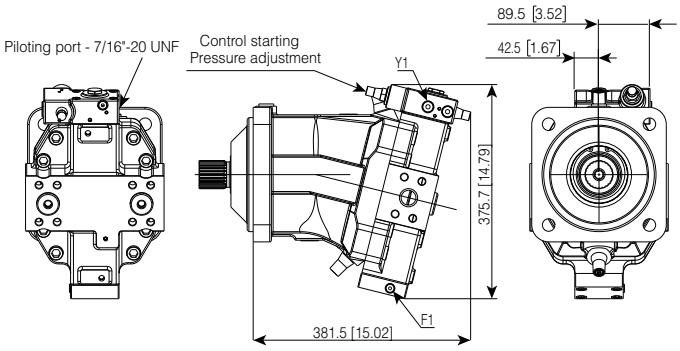


REN Control

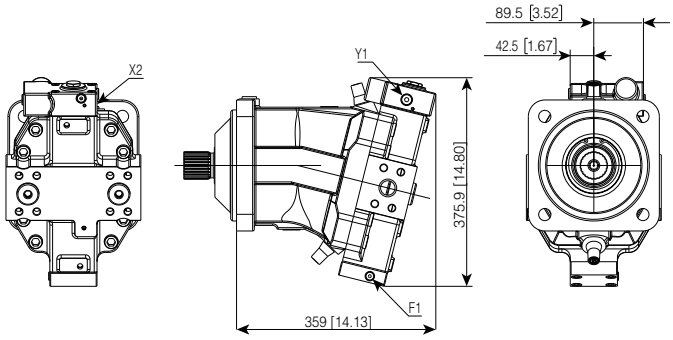


10 Control

RIE Control

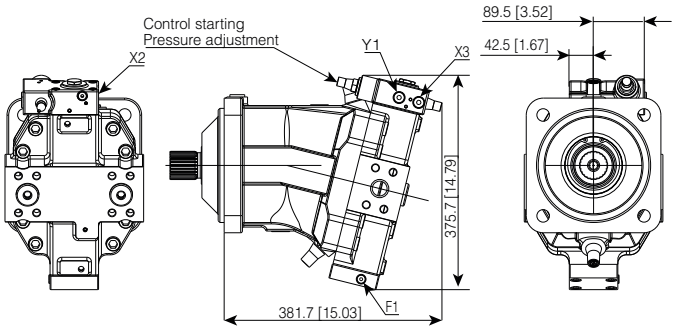


RIN Control



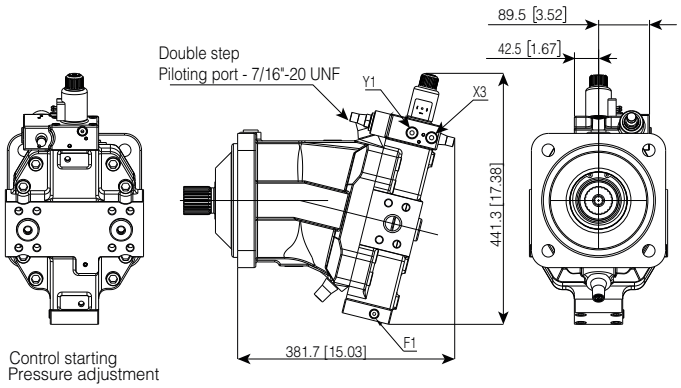
X2: Piloting port - 7/16”-20 UNF

RID Control



X2: Piloting port - 7/16"-20 UNF
X3: Double step Piloting port - 7/16"-20 UNF

RED Control

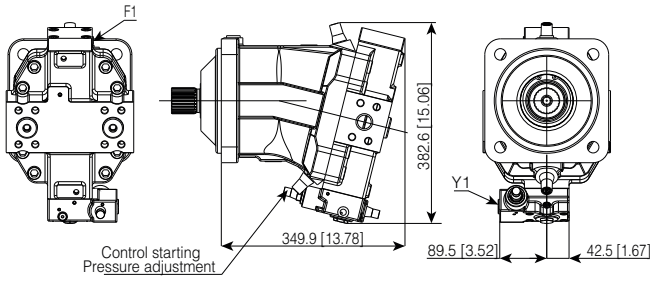


X3: Double step piloting port - 1/4 G (BSPP)

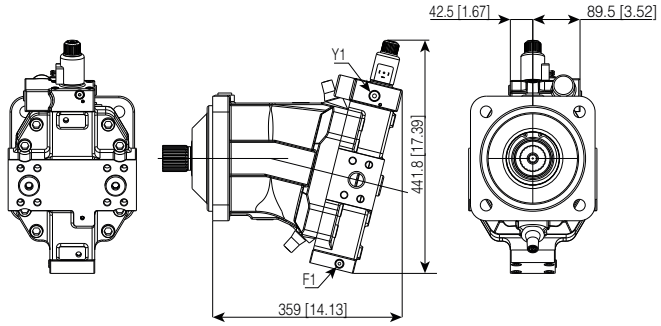
SH7V 200 - Control dimensions for mounting flange ISO 4 bolts (OG) (Displ. setting 2)

10 Control

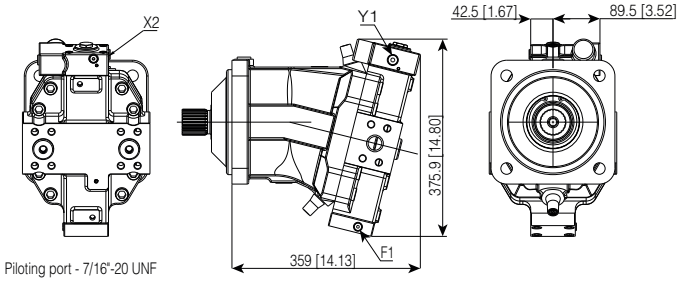
RPE Control



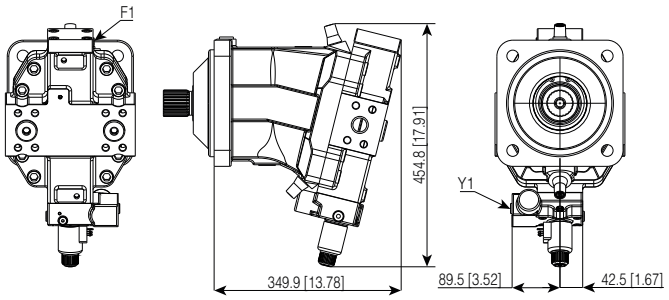
2EN Control



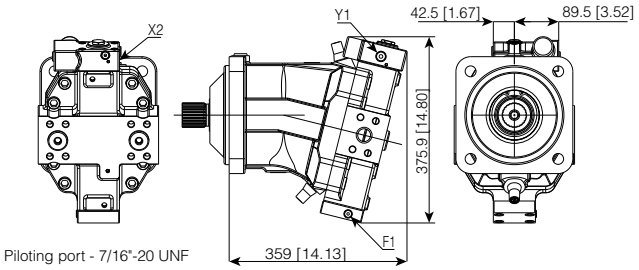
2IN Control



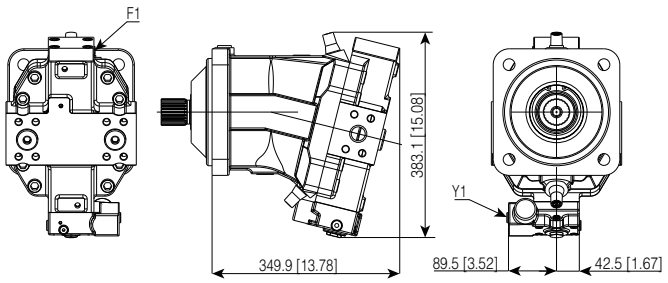
REN Control



RIN Control

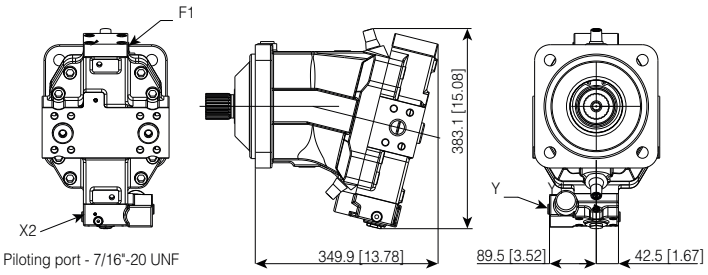


ROE Control

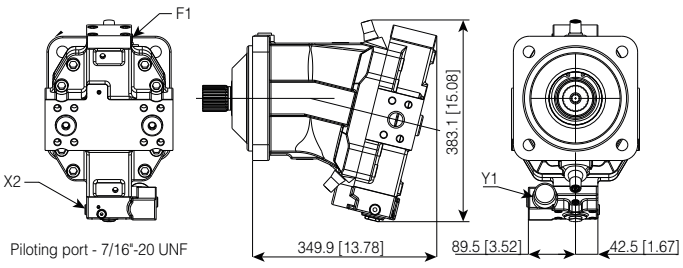


10 Control

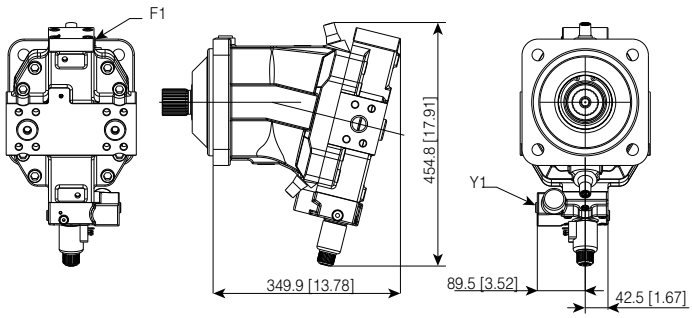
ROI Control



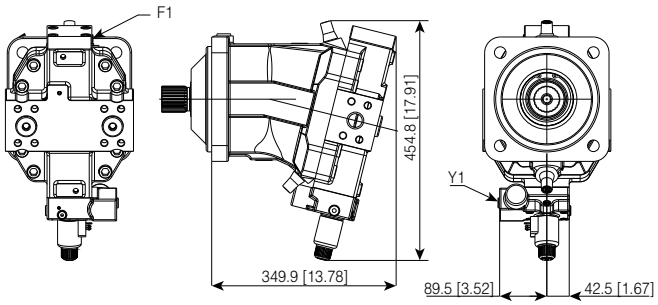
RPI Control



ROS Control



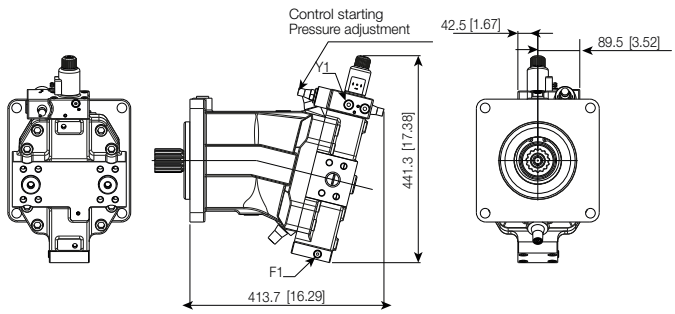
RPS Control



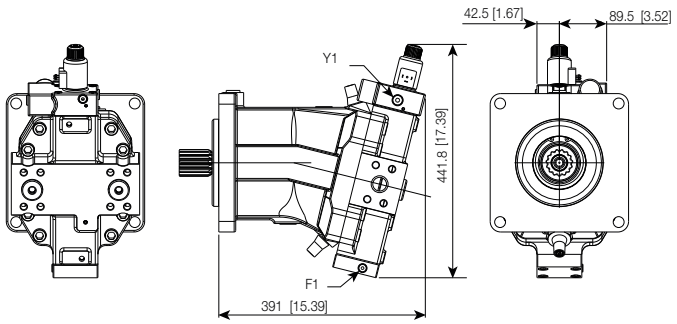
SH7V 200 - Control dimensions for mounting flange SAE-D 4 bolts (10) (Displ. setting 1)

10 Control

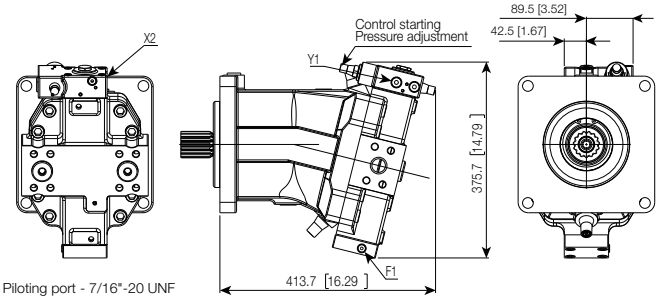
2EE Control



2EN Control

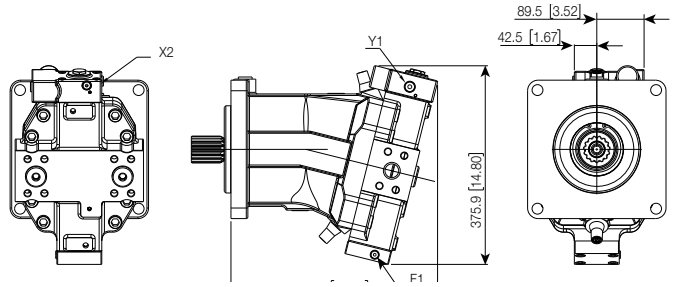


2IE Control

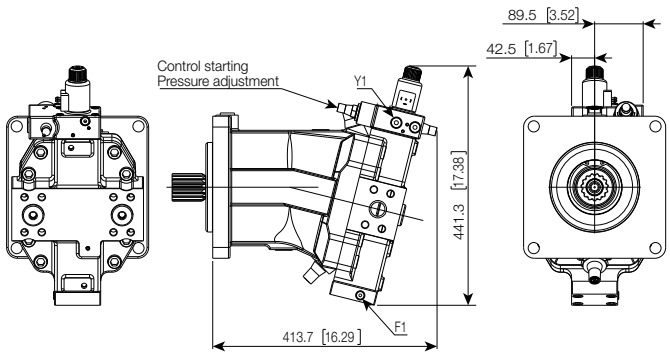


Piloting port - 7/16"-20 UNF

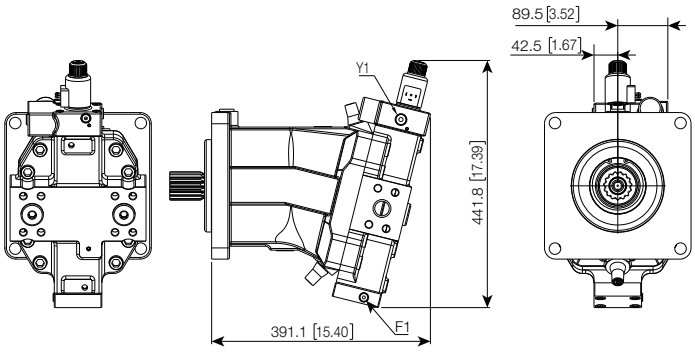
2IN Control



REE Control

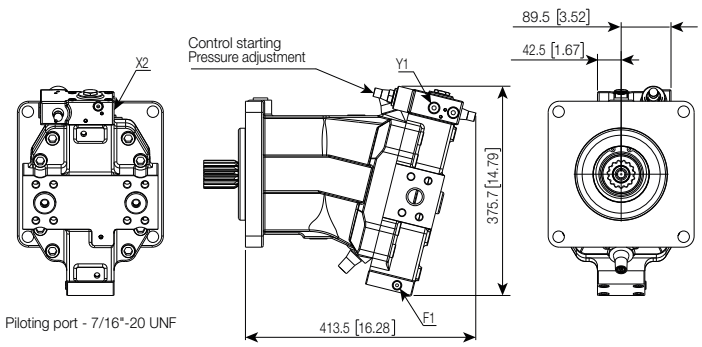


REN Control

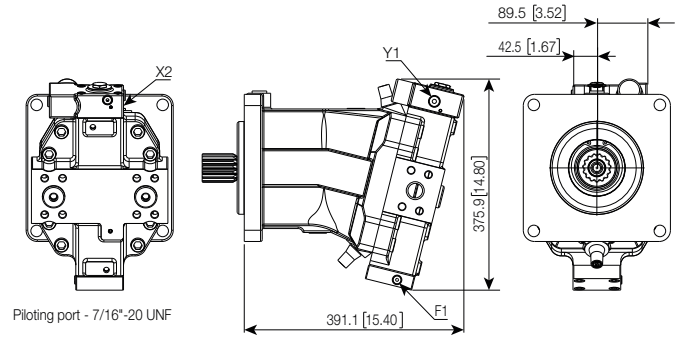


10 Control

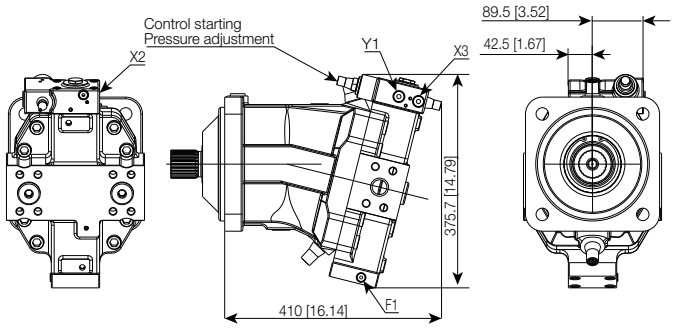
RIE Control



RIN Control

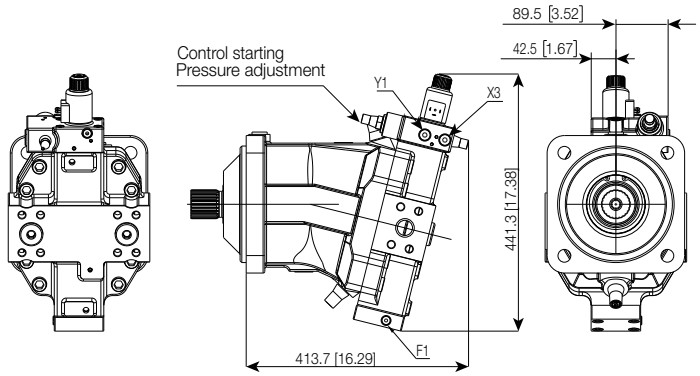


RID Control



X2: Piloting port - 7/16"-20 UNF
X3: Double step piloting port - 7/16"-20 UNF

RED Control

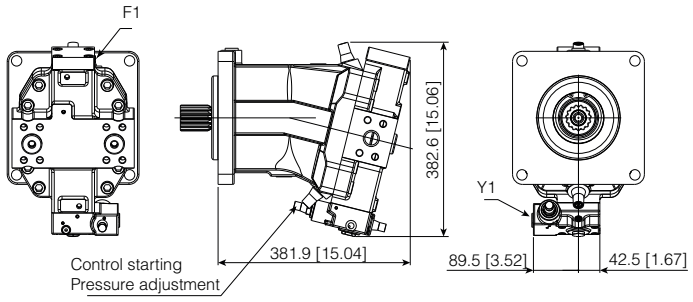


X3: Double step piloting port - 7/16"-20 UNF

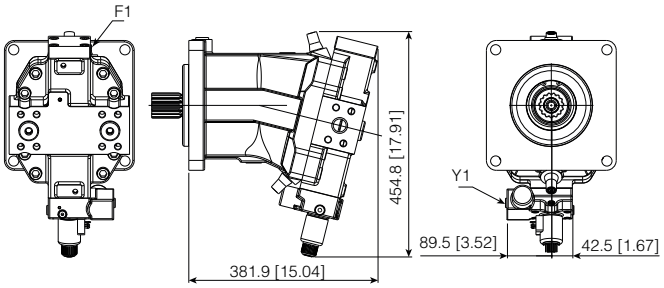
SH7V 200 - Control dimensions for mounting flange SAE-D 4 bolts (10) (Displ. setting 2)

10 Control

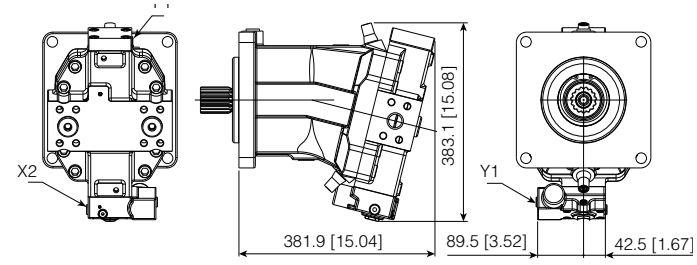
RPE Control



2EN Control

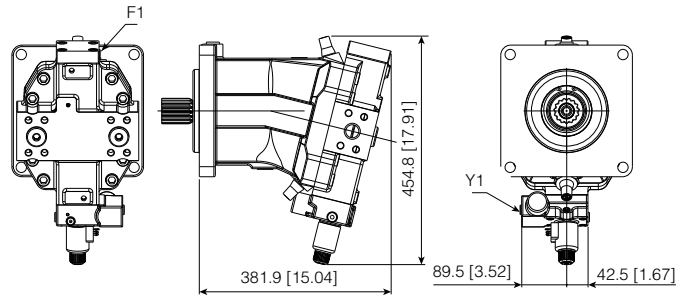


2IN Control

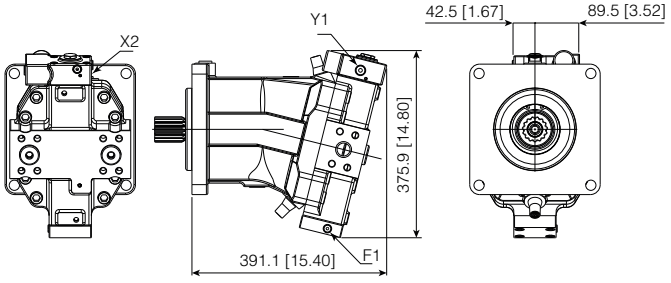


Piloting port - 7/16" - 20 UNF

REN Control

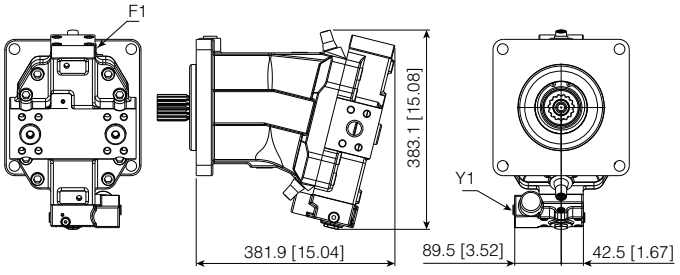


RIN Control



Piloting port - 7/16"-20 UNF

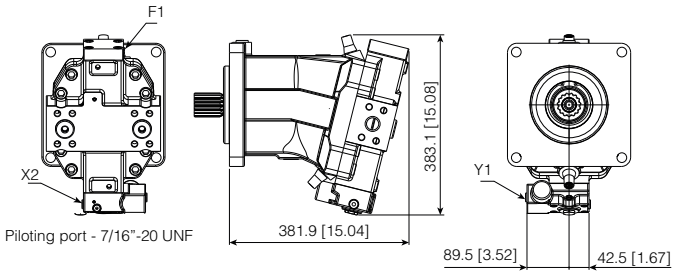
ROE Control



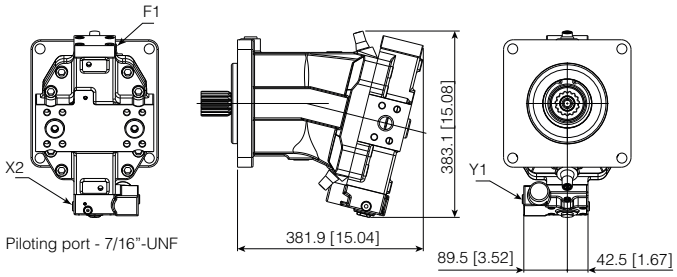
X2: Piloting port - 7/16"-20 UNF-2B

10 Control

ROI Control

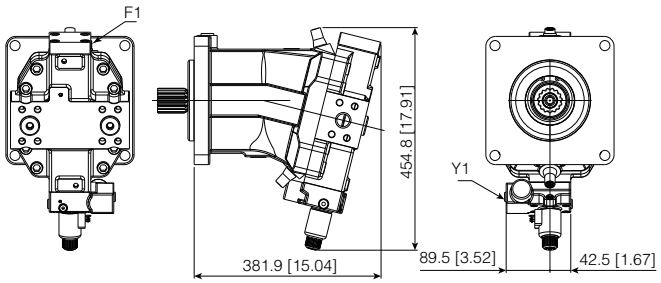


RPI Control

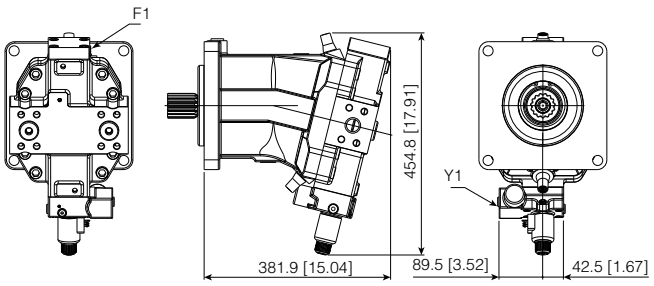


X2: Piloting port - 7/16"-20 UNF-2B

ROS Control



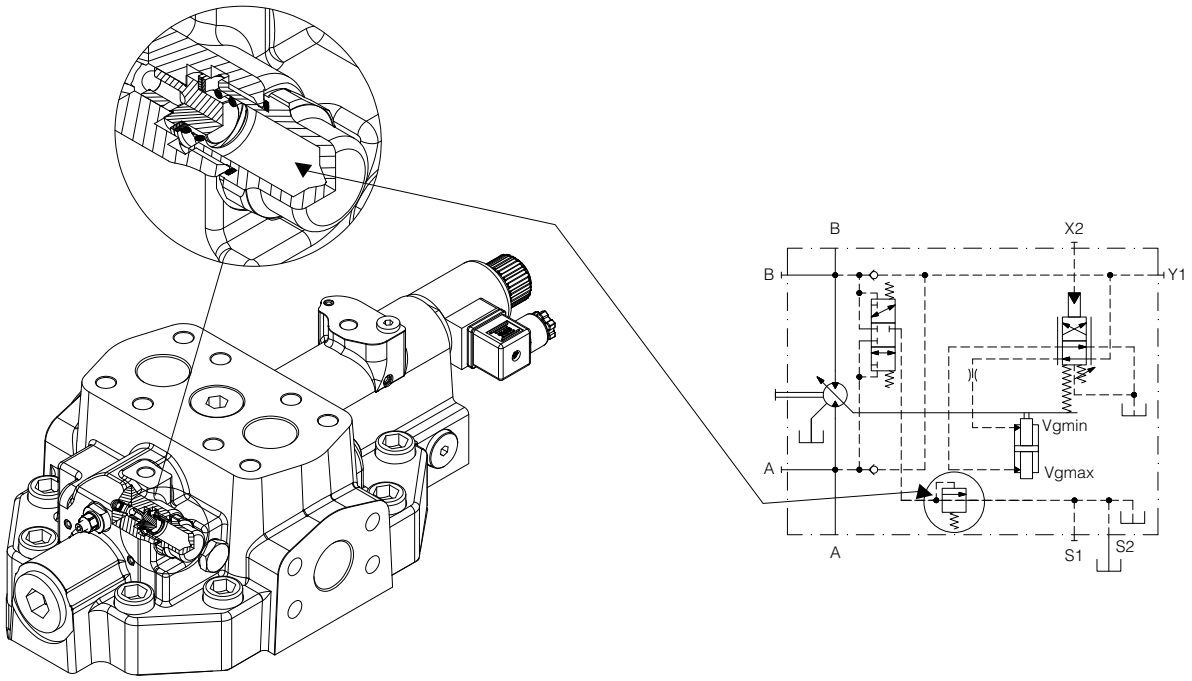
RPS Control



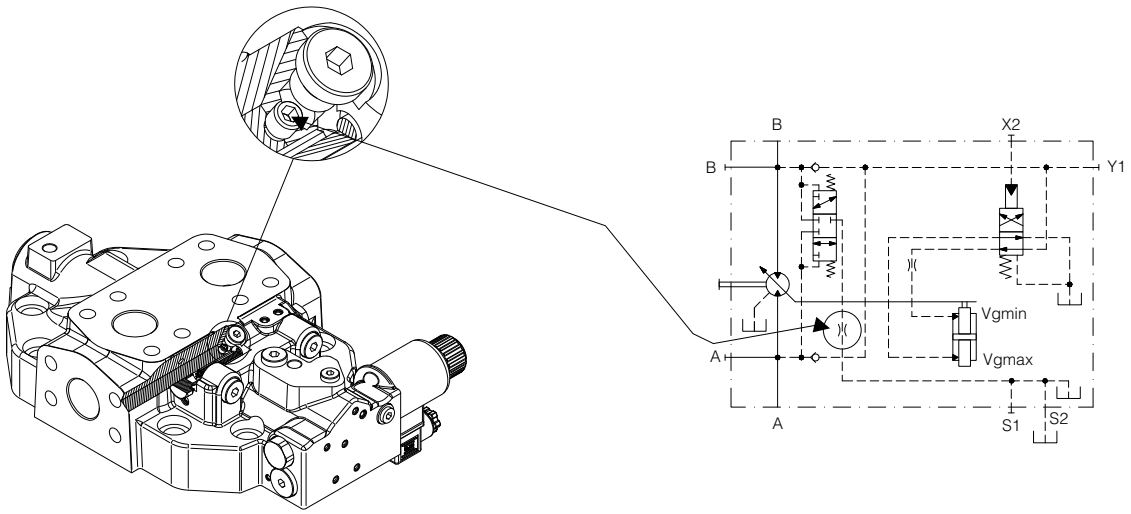
Flushing valve

For closed circuit operation, the motors can be equipped with built in flushing valve.

Only for SH7V 108 - 160

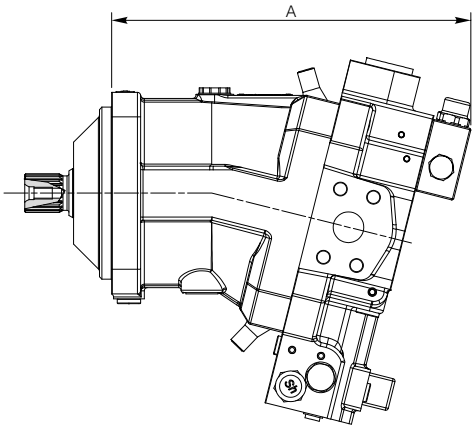


Only for SH7V 160 with two positions controls



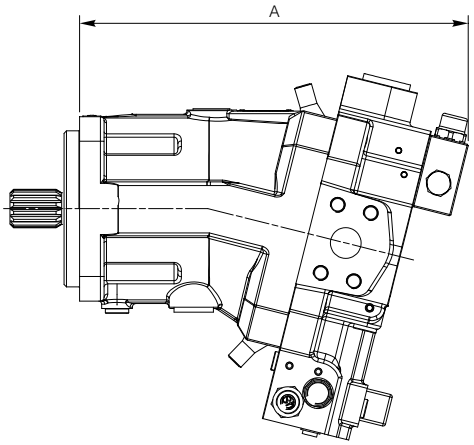
SH7V 055-075 Motor - Mounting flange ISO

Only for SH7V 055 - 075



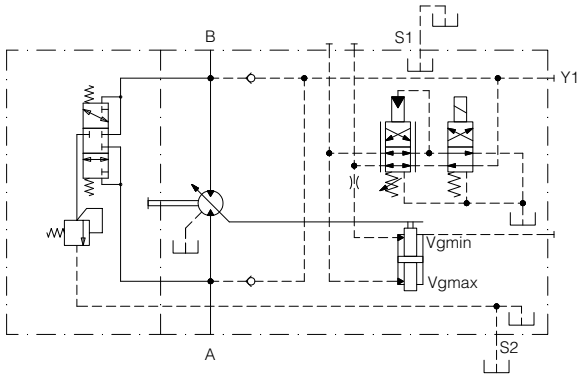
SH7V 055 - 075 Motor - Mounting flange SAE

Only for SH7V 055 - 075

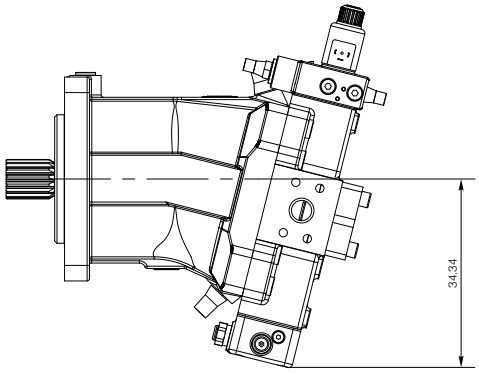


Flushing valve

	Size			
	SH7V 055 ISO	**SH7V 075 ISO**	**SH7V 055 SAE**	**SH7V 075 SAE**
A mm [in]	268.3 [10.56]	292.6 [11.51]	323 [12.72]	316.6 [12.46]



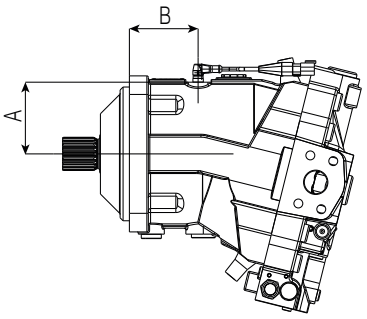
Only for SH7V 200

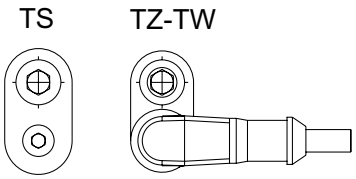


TS - TW - TZ

TS: Tachometer predisposition. Supplied with phonic wheel assembled on rotating group **without sensor**.

TW-TZ: With tachometer. Supplied with phonic wheel and sensor.





	Size									
	SH7V055 ME	**SH7V075 ME**	**SH7V108 ME**	**SH7V160 ME**	**SH7V200 ME**	**SH7V55 SE**	**SH7V075 SE**	**SH7V108 SE**	**SH7V160 SE**	**SH7V200 SE**
A mm [inch]	64 [2.52]	79.9 [3.14]	88.9 [3.49]	96.9 [3.81]	101.9 [4.01]	88 [3.46]	79.9 [3.14]	88.9 [3.49]	96.9 [3.81]	101.9 [4.01]
B mm [inch]	75.5 [2.97]	76.5 [3.01]	86.5 [3.40]	92.5 [3.64]	105 [4.13]	75.5 [2.97]	100.5 [3.95]	120.5 [4.74]	124.5 [4.90]	105 [4.13]

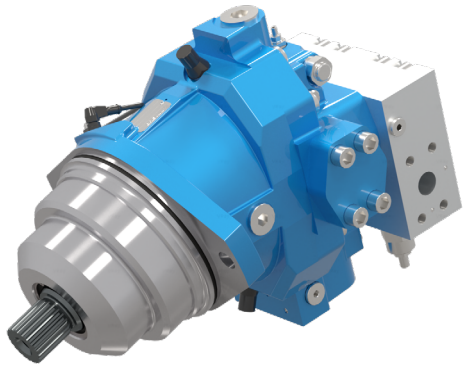
TW
2-Channel differential-hall effect operating principle (1 square wave -1 digital for direction of rotation) Output signal PNP
Power supply 4.5-16 VDC
Frequency 0 - 20.000 Hz
Operating temperature -40°C - +110°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

TZ
2-Channel differential-hall effect operating principle Sensor with dual-channel output (90°)
Power supply 8-32 VDC
Frequency 0-20.000 Hz
Operating temperature -40°C +125°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

	Size				
	SH7V 055	**SH7V 075**	**SH7V 108**	**SH7V 160**	**SH7V 200**
Number of pulses per revolution	54	58	67	75	80

SH7VR -Variable displacement motor for gearbox, plug in version





Index

General information - Features O2
Technical data O4
Ordering code O5
Control O11
SH7VR 055 ..... O27
SH7VR 075 ..... O32
SH7VR 108 ..... O37
SH7VR 160 ..... O42
Other caratteristics O47
Tachometer O49

Type	**Displacement** cm³/rev [in³/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]	**Max peak Pressure** bar [psi]
SH7VR 055	61 [3.72]	271 [71.5]	430 [6235]	480 [6960]
SH7VR 075	80.58 [4.91]	322 [85]	430 [6235]	480 [6960]
SH7VR 108	112.5 [6.86]	400 [105.6]	430 [6235]	480 [6960]
SH7VR 160	160.8 [9.81]	500 [132]	430 [6235]	480 [6960]

SH7VR series are a family of variable displacement motors, bent axis piston design for operation in both open and closed circuit. SH7VR series motors are mainly intended for installation in mechanical gearboxes such as track drive and winches gear boxes.
The proven design incorporating the lens shape valve plate, the high quality components and manifacturing tecniques make able the SH7VR series motors to provide up to 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak performance.
Fully laboratory tested and field proven, these motors assume maximum efficiency and long life even at very bad filtering conditions. Heavy duty bearings permit high radial and axial loads.
Versatile design includes a variety of control and shaft ends that will adapt the SH7VR series motors to any application both industrial and mobile.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
$n_{0\ max}$	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure
p_{max}	bar [psi]	Maximum pressure peak

q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency
I	A	Current

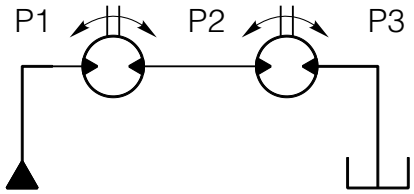
Fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10÷15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and filtering section.

Operating temperature:
The operating temperature of the oil must be within -25ºC ÷ 115ºC [-13ºF ÷ 239ºF]. The running of the unit with oil temperature higher than 115ºC [239°F] or lower than -25ºC [-13°F] is not allowed. For further information see at Fluids and filtering section

Filtration:
A correct filtering helps to extend the service life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999. For further details see at Fluids and filtration section.

Operating pressure:
The maximum permissible pressure on pressure ports is 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak. It two motors are connected in series, total pressure has to be limited to following values: P1+P2 700 bar max. [10150 psi max].

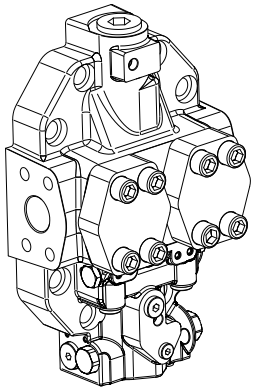
Case drain pressure:
Maximum permissible case drain pressure is 10 bar [145 psi]. A higher pressure can damage the main shaft seal or reduce its life.



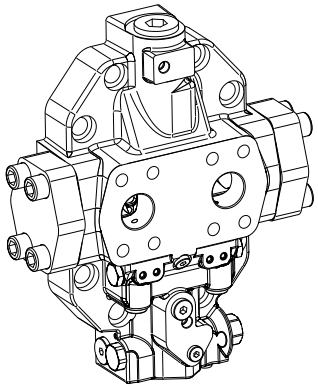
Seals:
Seals used on standard SH7VR series axial piston motors are of FKM seals (Fluoroelastomer - Viton®). In case of use of use special fluids, contact Dana.

Minimnum rotating speed:
Under “minimum rotating speed” we mean the minimum speed ensuring a smooth running of the piston unit. Operation smoothness at low speeds depends on many factors, as type of load and operating pressure. At a speed higher than 150 rpm, a smooth running is ensured almost in every case. Lower speeds are, usually, possible. For special applications please contact Dana.

Port plates:
The SH7VR motor port plate has inlet and outlet ports, both lateral (LM cover) and frontal (FM cover). Unused ports are plugged with blind flanges. The kind of ports to be used must be specified when ordering.



LM port plate



FM port plate

Flushing valve:
The motors can be equipped with built in flushing valve for closed circuit operation.

Installation:
SH7VR series motors can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. Installation of the unit with shaft in vertical position and above the tank involves some limitations. For further details see at General installation guidelines.

			Size			
			055	075	108	160
Displacement	$V_{g\ max}$	cm^3/rev [in^3/rev]	61 [3.72]	80.58 [4.91]	112.5 [6.86]	160.8 [9.81]
Displacement standard	$V_{g\ min}$	cm^3/rev [in^3/rev]	30 [1.83]	40 [2.44]	56 [3.416]	80 [4.88]
Displacement min. possible	$V_{g\ min}$	cm^3/rev [in^3/rev]	12.2 [0.74]	16 [0.97]	22 [1.34]	32.2 [1.96]
Displacement optional	V_{g0}	cm^3/rev [in^3/rev]	0 [0]	0 [0]	0 [0]	0 [0]
Max. pressure cont.	p_{nom}	bar [psi]	430 [6235]	430 [6235]	430 [6235]	430 [6235]
Max. pressure peak	p_{max}	bar [psi]	480 [6960]	480 [6960]	480 [6960]	480 [6960]
Max flow	q_{max}	l/min [U.S. gpm]	271 [71.5]	322 [85]	400 [105.6]	500 [132]
Max speed at $V_{g\ max}$ e q_{max}	n_{max}	rpm	4450	4000	3550	3100
Max speed at $V_g < V_{g\ max}$ (2)	$n_{max\ lim}$	rpm	7000	6150	5600	5000
Max speed at $V_{g\ 0}$	$n_{max\ 0\ lim}$	rpm	8350	7350	6300	5500
Torque costant Vg_{max}	T_k	Nm [lbf·ft/psi]	0.97 [0.04]	1.28 [0.06]	1.79 [0.09]	2.56 [0.13]
Max power at q_{max} e p_{nom}	P_{max}	kW [hp]	194 [259.9]	231 [309.5]	273 [365.8]	330 [442.2]
Max torque at $V_{g\ max}$ cont. (p_{nom})	T_{nom}	Nm [lbf.ft]	418 [308]	552 [406.8]	770 [567.5]	1101 [811.4]
Max torque at $V_{g\ max}$ peak (p_{max})	T_{max}	Nm [lbf ·ft]	466 [343.4]	616 [453.9]	859 [633]	1230 [906.5]
Moment of inertia	J	$kg·m^2$ [$lbf·ft^2$]	0.005 [0.12]	0.009 [0.22]	0.0124 [0.31]	0.026 [0.616]
Weight (3)	m	kg [lbs]	28 [61.7]	36 [79.3]	47 [103.6]	63 [138.8]
Drainage flow (4)	q_d	l/min [U.S. gpm]	3 [0.79]	4 [1.05]	5 [1.32]	5 [1.32]

(Theorical values, without considering η_{hm} e η_v; approximate values). Peak operations must not excede 1% of every minute. A simultaneous maximum pressure and maximum speed not recommended.

Notes:

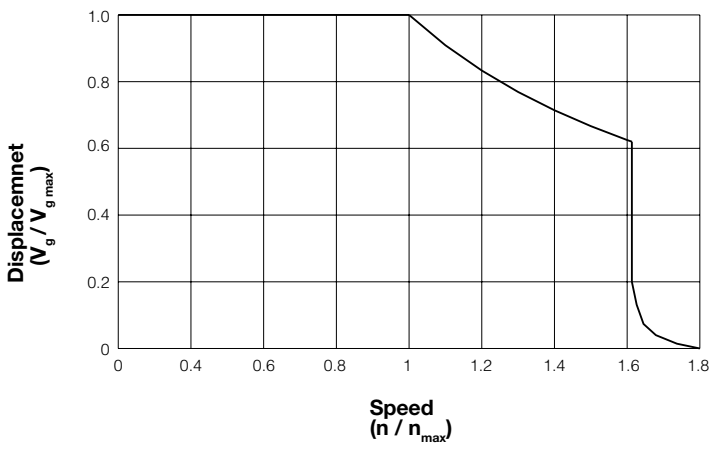
(1) Maximum and minimum displacement can be changed with continuity. When ordering state $V_{g\ max}$ and $V_{g\ min}$ required.

(2) Determination of admissible speed n_{max} value can be increased by reducing motor maximum displacement. To determine the relationship beetwen $V_{g\ max}$ and n_{max} use the right side chart. Motor maximum admissible speed is $n_{max\ lim}$.

(3) Approximate values.

(4) Maximum value at 250 bar [3625 psi] with mineral oil at 45ºC [113°F] and 35 cSt of viscosity.

Permissible speed



Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the SH7VR motors. Use the model code below to specify the desired features. **All alphanumeric digits system of the code must be present when ordering**. We recommend to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Series	Motor	Size	Maximum displacement limitation	Minimum displacement limitation	Mount flange	Shaft end	Port cover	Seal	Control	Control specification	Valves	Valves feature	Flushing valve	Serie feature	Painting
SH7VR	M	055	61	30	OL	SAI	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

1

Series	
SH7VR	Plug-in variable displacement motor for gearbox

2

Motor	
M	Motor

3

Size	
055	61 cm³/rev [3.72 in³/rev]
075	80.58 cm³/rev [4.91 in³/rev]
108	112.5 cm³/rev [6.86 in³/rev]
160	160.8 cm³/rev [9.81 in³/rev]

4

Maximum displacement limitation			Displacement			
			055	075	108	160
61÷49	From 61 cm³/rev [3.721 in³/rev] to 49 cm³/rev [2.989 in³/rev]	Standard 61 cm³/rev [3.721 in³/rev]	●	–	–	–
80÷64	From 80 cm³/rev [4.880 in³/rev] to 64 cm³/rev [3.904 in³/rev]	Standard 80 cm³/rev [4.880 in³/rev]	–	●	–	–
112÷91	From 112 cm³/rev [6.832 in³/rev] to 91 cm³/rev [5.551 in³/rev]	Standard 112 cm³/rev [6.832 in³/rev]	–	–	●	–
160÷130	From 160 cm³/rev [9.760 in³/rev] to 130 cm³/rev [7.930 in³/rev]	Standard 160 cm³/rev [9.760 in³/rev]	–	–	–	●

● : Required
– : Not required

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7VR	M	055	61	30	OL	SAI	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

5

Minimum displacement limitation			Size			
			055	075	108	160
12÷42	From 12 cm³/rev [0.732 in³/rev] to 42 cm³/rev [2.562 in³/rev]	Standard 30 cm³/rev [1.830 in³/rev]	●	–	–	–
16÷56	From 16 cm³/rev [0.976 in³/rev] to 56 cm³/rev [3.416 in³/rev]	Standard 40 cm³/rev [2.440 in³/rev]	–	●	–	–
22÷80	From 22 cm³/rev [1.342 in³/rev] to 80 cm³/rev [4.880 in³/rev]	Standard 56 cm³/rev [3.416 in³/rev]	–	–	●	–
32÷112	From 32 cm³/rev [1.952 in³/rev] to 112 cm³/rev [6.832 in³/rev]	Standard 80 cm³/rev [4.880 in³/rev]	–	–	–	●
0	0 cm³/rev		●	●	●	●

● : Required
– : Not required

6

Mount Flange		Size			
		055	075	108	160
OL	2 Bolts Ø 160 mm [Ø 6.299 in]	●	–	–	–
OM	2 Bolts Ø 190 mm [Ø 7.48 in]	–	●	–	–
ON	2 Bolts Ø 200 mm [Ø 7.874 in]	–	–	●	●

● : Available
– : Not Available

7

Shaft end		Size			
		055	075	108	160
SAI	Splined W30x2x30x14 - DIN 5480	●	–	–	–
SAM	Splined W35x2x30x16 - DIN 5480	●	–	–	–
SAO	Splined W40x2x30x18 - DIN 5480	–	●	●	
SAR	Splined W50x2x30x24 - DIN 5480	–	–	–	●

● : Available
– : Not Available

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7VR	M	055	61	30	OL	SAI	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

8

Port cover	
FM	Metric End Main ports
LM	Metric Main Ports positioned 180° apart
L3	Metric Main Ports positioned 180° apart (no VSC)

9

Seal	
V	FKM

10

Control		Port cover		
		FM	**LM**	**L3**
RPE	Working pressure control	•	•	–
ROE	Working pressure control Δp 100	•	•	•
2EE	Electric two positions control with pressure override	•	•	–
2EN	Electric two positions control	•	•	–
2IE	Hydraulic two positions control with pressure override	•	•	–
2IN	Hydraulic two positions control	•	•	–
REE	Electric proportional control with pressure override	•	•	•
RED	Electric proportional control with double step pressure override	•	•	•
REN	Electric proportional control	•	•	•
RIE	Hydraulic proportional control with pressure override	•	•	•
RID	Hydraulic proportional control with double step pressure override	•	•	•
RIN	Hydraulic proportional control	•	•	•
RPI	Working pressure control with hidraulic override.	•	•	•
ROI	Working pressure control Δp 100 with hidraulic override.	•	•	•
ROS	Working pressure control Δp 100 with electric override.	•	•	•
RPS	Working pressure control with electric override.	•	•	•

• : Available
– : Not Available

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7VR	M	055	61	30	OL	SAI	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

11

Control specification			(Chosen) Control															
			RPE	ROE	2EE	2EN	2IE	2IN	REE	RED [1]	REN	RID [1]	RIE	RIN	RPI	ROI	ROS	RPS
Displacement setting	1	From max displacement to min displacement ($V_{g\,max} \rightarrow V_{g\,min}$)	–	–	●	●	●	●	●	●	●	●	●	●	–	–	–	–
	2	From min displacement to max displacement ($V_{g\,min} \rightarrow V_{g\,max}$)	●	●	–	●	–	●	–	–	●	–	–	●	●	●	●	●
None	00		–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–
Pressure Setting (*)	XXX	100÷400 bar [1430÷5802 psi]	●	–	●	–	●		●	●	–	●	●	–	●	–	–	–
	XXX	100÷350 bar [1430÷5076 psi]	–	●	–	–	–	–	–	–	–	–	–	–	–	●	●	●
Start of control, Setting range (*)	XX	5-10-15-20 bar [72-145-218-290 psi]	–	–	–	–	–	–	–	–	–	●	●	●	–	–	–	–
Δp Displacement change	25	25 bar [363 psi]	–	–	–	–	–	–	–	–	–	●	●	●	–	–	–	–
Voltage	12	12 - Connector DIN43650	–	–	●	●	–	–	●	●	●	–	–	–	–	–	●	●
	24	24 - Connector DIN43650	–	–	●	●	–	–	●	●	●	–	–	–	–	–	●	●
	D2	12 - Deutsch DT04	–	–	●	●	–	–	●	–	●	–	●	–	–	–	●	●
	D4	24 - Deutsch DT04	–	–	●	●	–	–	●	–	●	–	●	–	–	–	●	●
Control orifice (**)	04	With Ø0.4 mm [Ø 0.015 in] Control Orifice	●	–	●	●	●	●	–	–	–	–	–	–	–	–	–	–
	05	With Ø0.5 [Ø 0.0196 in] Control Orifice	–	●	–	–	–	–	●	●	●	●	●	●	●	●	●	●
	07	With Ø0.7 [Ø 0.027 in] Control Orifice	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Specify for each control, all the required values for the chosen control.

● Available
– Not available

[1] Specify Pressure Setting values for Step 1 and Step 2 (Step1<Step2)
(*) Supply the setting value
(**) 0.4 mm [Ø 0.015 in] (standard) nozzle, provides a smooth control response (max-to-min and min-to-max), while Ø 0.5-0.7 mm [Ø 0.0196-0.027 in] (optional) nozzle, provides a faster reaction.

Warning:
The values showed are only valid in maximum and minimum displacement conditions of the respective displacement.
For different values, verify the possibility with the control diagrams present on the catalogue.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7VR	M	055	61	30	OL	SAI	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

12

Valves		Size			
		055	075	108	160
XXXX	NONE	●	●	●	●
VCD1	VCD/1 Pilot assisted overcentre valve	LM	LM	LM	LM
VCD2	VCD/2 Pilot assisted overcentre valve	–	LM	LM	LM
VCR2	VCR2 D/AF Double acting ove centre valve	FM	–	–	–
VCR4	VCR4 double acting overcentre valve	–	FM	FM	FM

● : Available
– : Not Available

The valves are available with ISO port cover only, please contact Technical department for SAE version.

(1) The LM - FM digit means that the valve is only available with LM - FM port cover.

13

Valves feature		Valve				
		XXXX	VCD1	VCD2	VCR2	VCR4
000	Feature not necessary	●	–	–	–	–
002	Not Set 0÷350 bar [0 to 5075 psi] [Piloting ratio 2.9:1] Control of rotation CW	–	●	–	–	–
006	Not Set 0÷350 bar [0 to 5075 psi] [Piloting ratio 2.9:1] Control of rotation CCW	–	●	–	–	–
003	Not Set 250÷500 bar [3625 to 7250 psi] [Piloting ratio 13:1] Control of rotation CW	–	–	●	–	–
007	Not Set 250÷500 bar [3625 to 7250 psi] [Piloting ratio 13:1] Control of rotation CCW	–	–	●	–	–
010	Not Set - Aluminum [60÷350 bar [870 to 5075 psi] [Piloting ratio 6.2:1]	–	–	–	●	–
013	Not Set 140÷350 bar [2030 to 5075 psi] [Piloting ratio 4.5:1]	–	–	–	–	●

● : Available
– : Not Available

Note:
Please contact Technical department for valve which requie specific setting.
For the feature see catalogue valves.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH7VR	M	055	61	30	OL	SAI	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

14

Flushing valve		Port Cover		
		FM	LM	L3
XX	No Flushing Valve	–	–	●
PR	Arranged for Flushing Valve	●	●	●
06	VSC/F Flushing valve - 6 l/min [1.58 U.S. gpm]	●	●	●
09	VSC/F Flushing valve - 10.5 l/min [2.77 U.S. gpm]	●	●	●
15	VSC/F Flushing valve - 15 l/min [3.96 U.S. gpm]	●	●	●
21(*)	VSC/F Flushing valve - 20 l/min [5.28 U.S. gpm]	●	●	–

● : Available
– : Not Available
(*) : Not available with 055-075 displacements

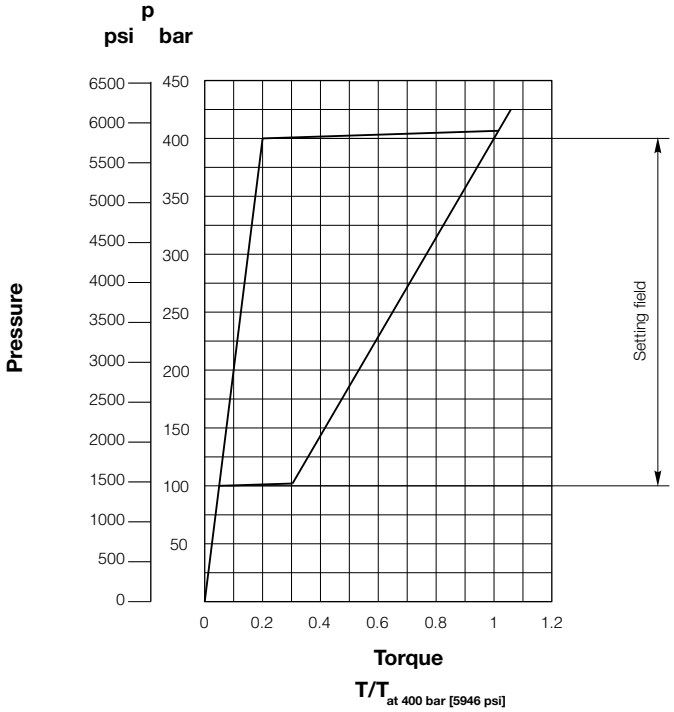
15

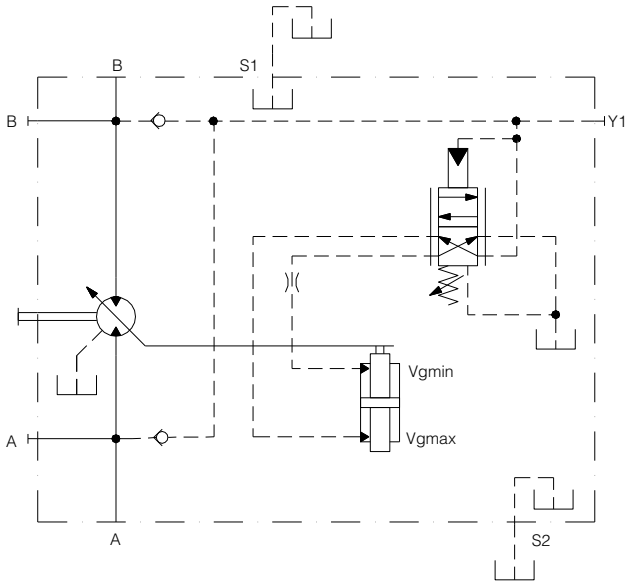
Serie feature	
XX	None
TS	Prepared for tachometer sensor
TW	Tachometer + sensor 2-channel-Hall effect PNP - 5V
TZ	Tachometer + sensor 2-channel-Hall effect

16

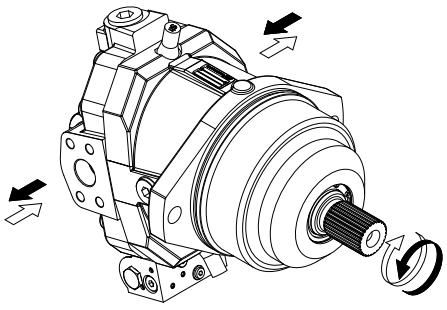
Painting	
XX	Not Required
01	Painted RAL 9005
02	Painted RAL 5015

The working pressure control allows to swivel the motor displacement from $V_{g\,min}$ to $V_{g\,max}$ when the operating pressure rises beyond the preset operating pressure, so that the motor is at $V_{g\,min}$ when min torque and max speed are required and at $V_{g\,max}$ when max torque and min speed are required. The operating pressure applies a force on the spool which is matched by an adjustable spring. The motor keeps the $V_{g\,min}$ until the operating pressure reaches the setting value (pressure setting). Once the preset pressure rises beyond, the motor swivels from $V_{g\,min}$ to $V_{g\,max}$. The swivel range is from $V_{g\,min}$ to $V_{g\,max}$ (displacement setting type 2 as per our ordering code). Start of control adjustable between 100 and 400 bar [1450 and 5800 psi].





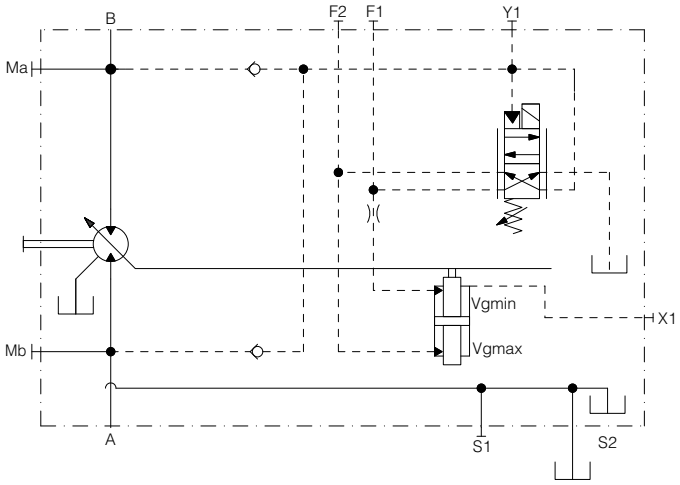
The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.



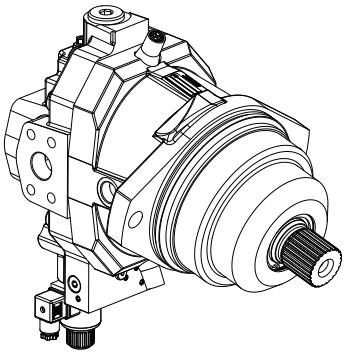
Working pressure control with electrical override

RPS

RPS control is a pressure related control which permits the changing of displacement $V_{g\ min}$ to $V_{g\ max}$ when working pressure exceeds setting threshold, so that the motor works at $V_{g\ min}$ when low torque and high speed are required and at V_{gmax} when high torque and low speed are required. The motor stands at $V_{g\ min}$ till working pressure reaches setting threshold. Δp of working pressure that allows the changing of diaplacement from minimum to maximum is around 10 bar (such as RPE control).
This pressure related control can be overridden by an electrical signal; when solenoid is energized, the motor reaches maximum displacement without stopping in an intermediate position.
Swivel range from $V_{g\ min}$ to $V_{g\ max}$ (assembly type 2 as per our ordering code).
Setting pressure range is 100-300 bar.

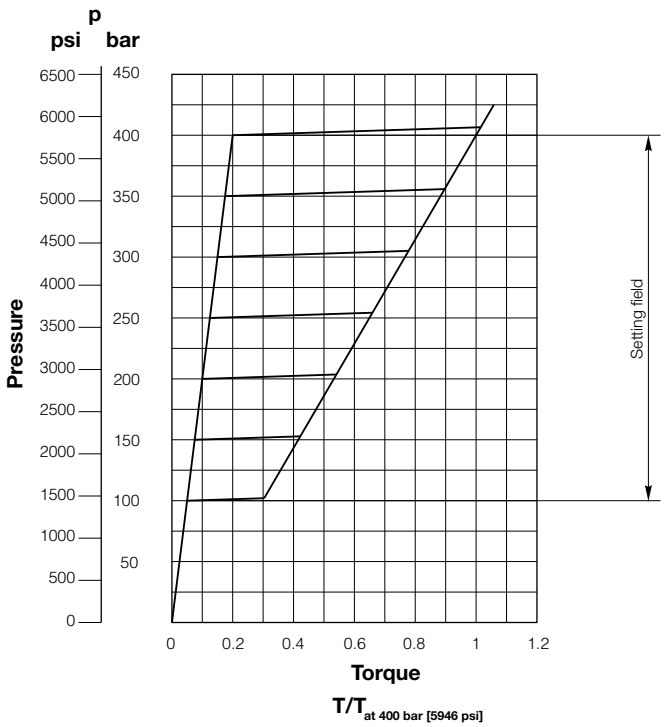


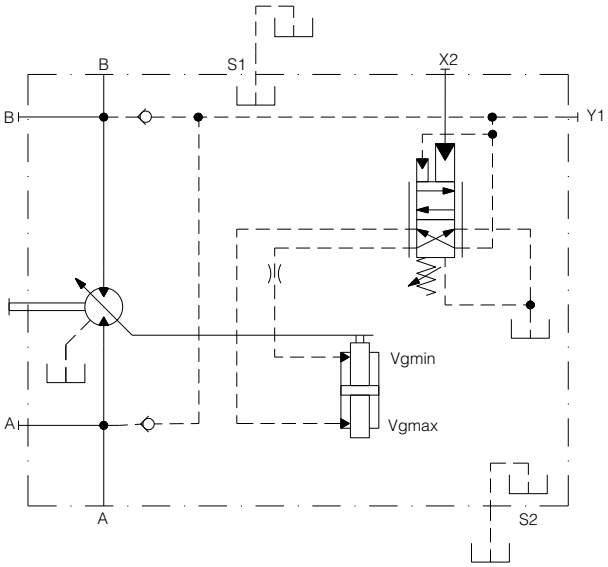
The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.



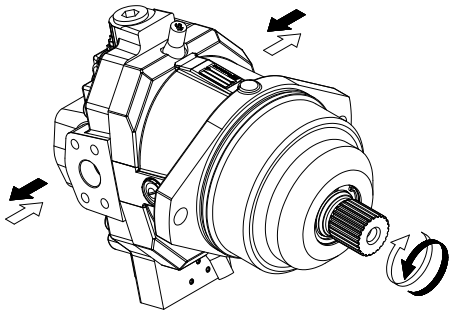
The hydraulic limiting device makes possible to reduce the pressure setting of RPE control by means of an external pilot pressure applied at port X2. The RPE control pressure setting is reduced proportionally to the pilot pressure in the ratio of 1/17 (for each pilot pressure bar, the preset operating pressure is reduced of 17 bar) [170 psi each 10 psi of pilot pressure]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi]. Example: preset operating pressure of RPE control = 300 bar [4350 psi]. By applying at port X2 a pilot pressure of 10 bar [145 psi] , the pressure setting comes to 130 bar [1885 psi] (300-(10x17)=130) (4350- (145X17)=1885). Should it be required to swivel the motor to $V_{g\,max}$ independently from the operating pressure, a pilot pressure of 20 bar [290 psi] should be applied at port X2.
Swivel range from $V_{g\,min}$ to $V_{g\,max}$ (assembly type 2 as per our ordering code). Start of control adjustable between 100 and 400 bar [1450 and 5800 psi].

When ordering please clearly state:
Control pressure setting.





The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

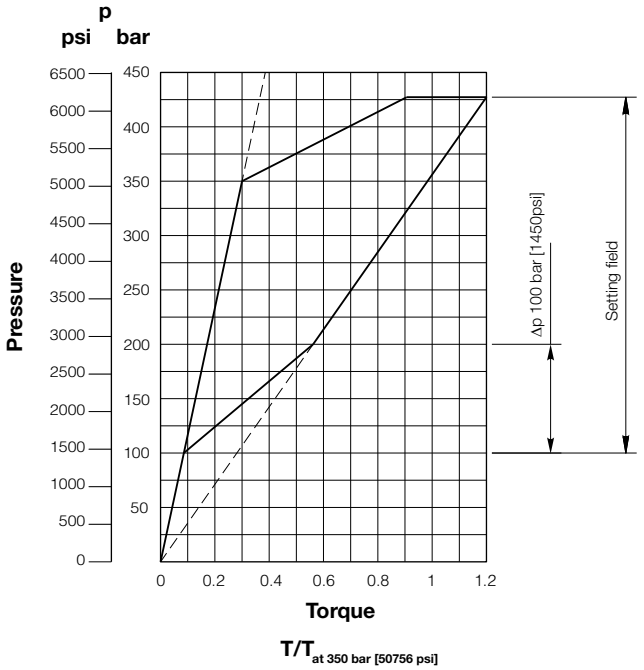


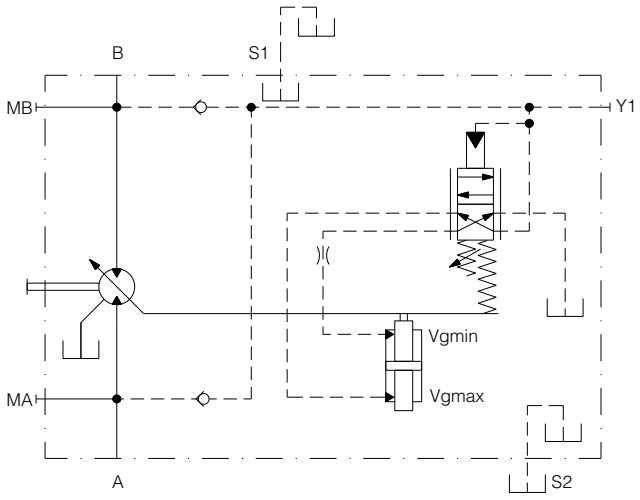
The “ROE” control allows a larger pressure range for displacement variation in comparison to “RPE” control. The increase of pressure range for variation from $V_{g\,min}$ to $V_{g\,max}$ allows a smoother working of the motor during displacement variation. The “ROE” allows the displacement variation with the pressure range show in the table.

Where:

- Δp is the working pressure range that allows the displacement variation.
- Pmin is the minimum pressure at which displacement variation starting can be set.
- Pmax is the maximum pressure at which displacement variation starting can be set.

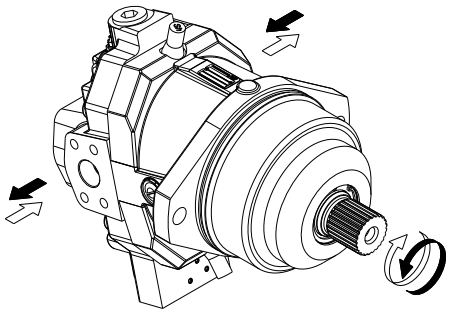
Δp bar [psi]	P_{min} bar [psi]	P_{max} bar [psi]
100 [1450]	100 [1450]	350 [5075]





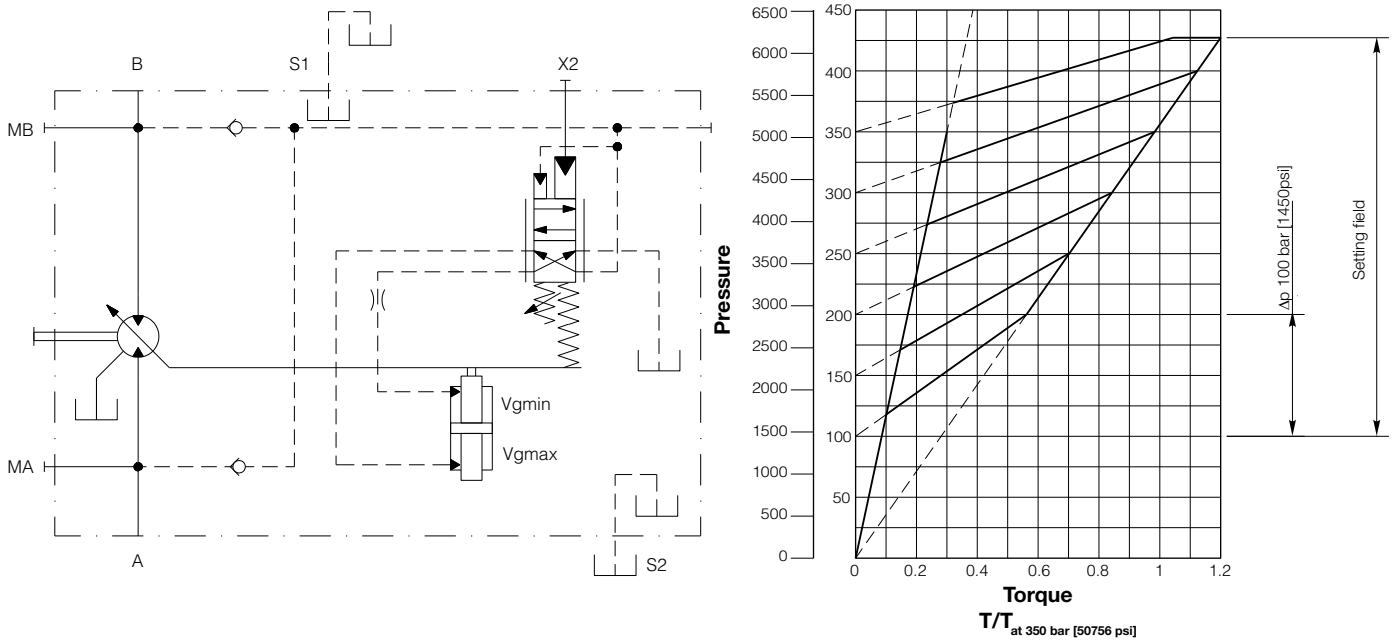
Warning: in case of displacement limitation, the control shall vary of a reduced Δp with respect to its standard one. Please contact Dana for more info.

The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

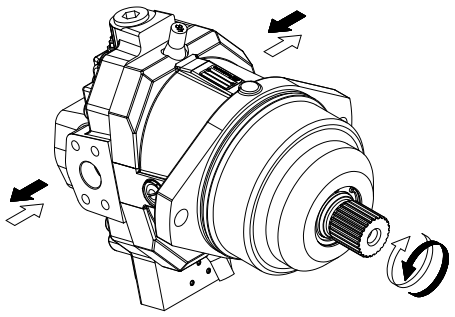


The hydraulic limiting device makes possible to reduce the pressure setting of ROE control by means of an external pilot pressure applied at port X2. The ROE control pressure setting is reduced proportionally to the pilot pressure in the ratio of 1/17 (for each pilot pressure bar, the preset operating pressure is reduced of 17 bar) [170 psi each 10 psi of pilot pressure]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi]. Example: preset operating pressure of ROE control = 300 bar [4350 psi]. By applying at port X2 a pilot pressure of 10 bar [145 psi] , the pressure setting comes to 130 bar [1885 psi] (300-(10x17)=130) (4350- (145X17)=1885). Should it be required to swivel the motor to $V_{g\,max}$ independently from the operating pressure, a pilot pressure of 20 bar [290 psi] should be applied at port X2. Swivel range from $V_{g\,min}$ to $V_{g\,max}$ (assembly type 2 as per our ordering code). Start of control adjustable between 100 and 350 bar [1450 and 5000 psi].

When ordering please clearly state:
Control pressure setting.



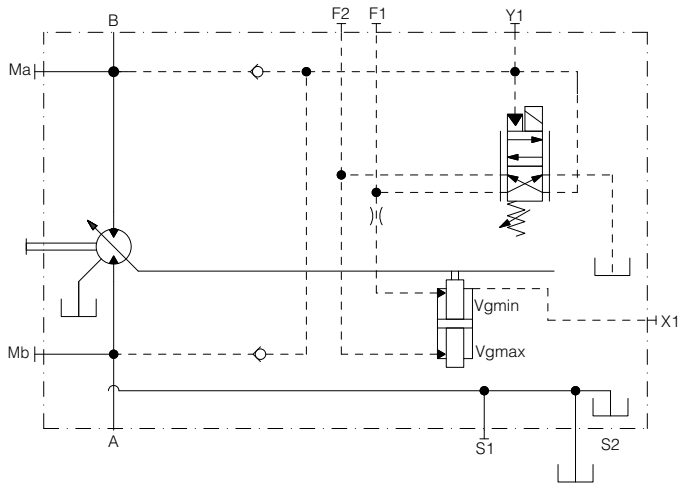
The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.



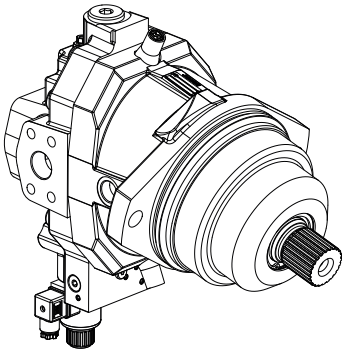
Working pressure control Δp 100 bar with electrical override

ROS

ROS control is a pressure related control which permits the changing of displacement $V_{g\ min}$ to $V_{g\ max}$ when working pressure exceeds setting threshold, so that the motor works at $V_{g\ min}$ when low torque and high speed are required and at $V_{g\ max}$ when high torque and low speed are required. The motor stands at $V_{g\ min}$ till working pressure reaches setting threshold. Δp of working pressure that allows the changing of diaplacement from minimum to maximum is 100 bar (such as ROE control).
This pressure related control can be overridden by an electrical signal; when solenoid is energized , the motor reaches maximum displacement without stopping in an intermediate position.
Swivel range from $V_{g\ min}$ to $V_{g\ max}$ (assembly type 2 as per our ordering code).
Setting pressure range is 100-300 bar.

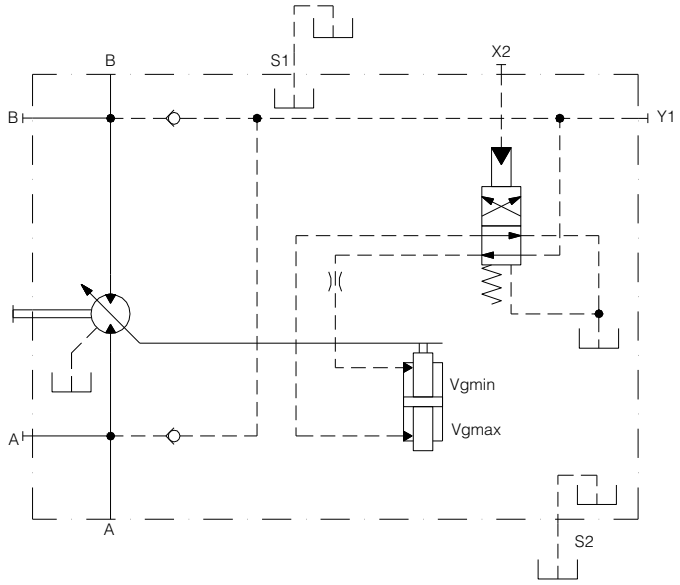


The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

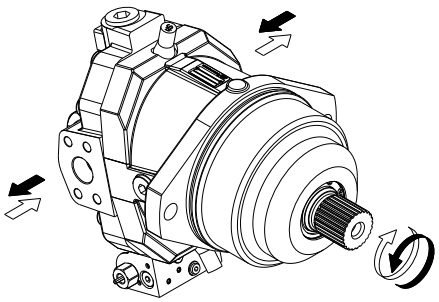


The hydraulic two positions control allows the displacement of the motor to be set to $V_{g\,max}$ or $V_{g\,min}$ by applying or not a pilot pressure at port X2. The feed back spring is missing so $V_{g\,max}$ or $V_{g\,min}$ only can be set. Minimum required pilot pressure = 10 bar [145 psi] and maximum permissible pressure at port X2=100 bar [1450 psi]. The swivel range is 1 (from $V_{g\,max}$ to $V_{g\,min}$) or 2 (swivel range from $V_{g\,min}$ to $V_{g\,max}$).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.



The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

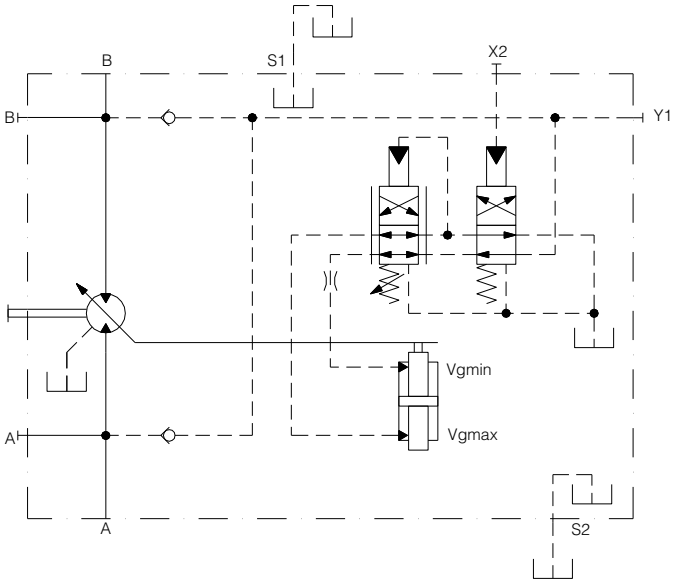


Hydraulic two positions control with pressure override

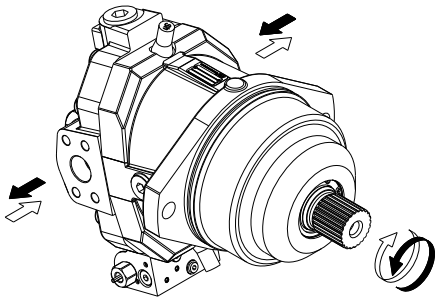
2IE

The 2IE control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as 2IN control, the motor displacement is adjusted to $V_{g\ min}$ when the pilot pressure applied at port X2. Minimum required pilot pressure = 10 bar [145 psi] and maximum permissible pressure at port X2=100 bar [1450 psi]. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

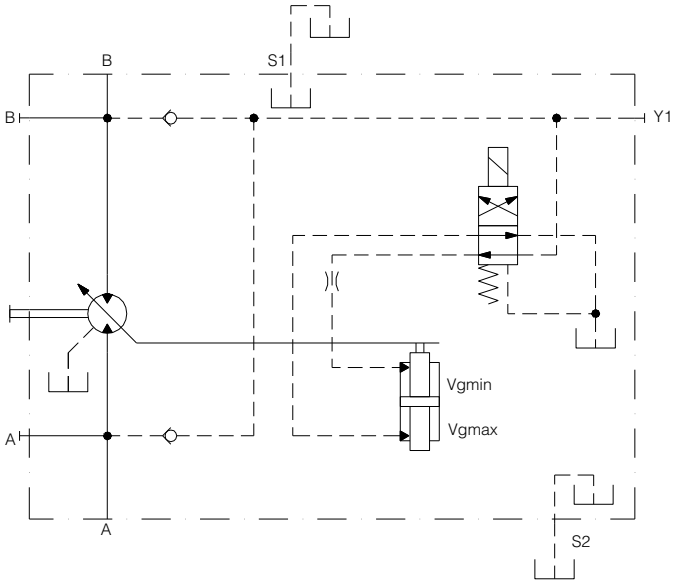


The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

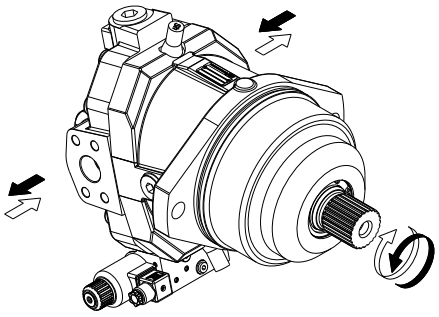


The electric two positions control allows the displacement of the motor to be set to $V_{g\,max}$ or $V_{g\,min}$ by switching an ON/OFF solenoid valve. The feed back spring is missing so $V_{g\,max}$ or $V_{g\,min}$ only can be set. 12V DC and 24V DC ON/OFF solenoid are available. The swivel range is 1 (from $V_{g\,max}$ to $V_{g\,min}$) or 2 (swivel range from $V_{g\,min}$ to $V_{g\,max}$).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.



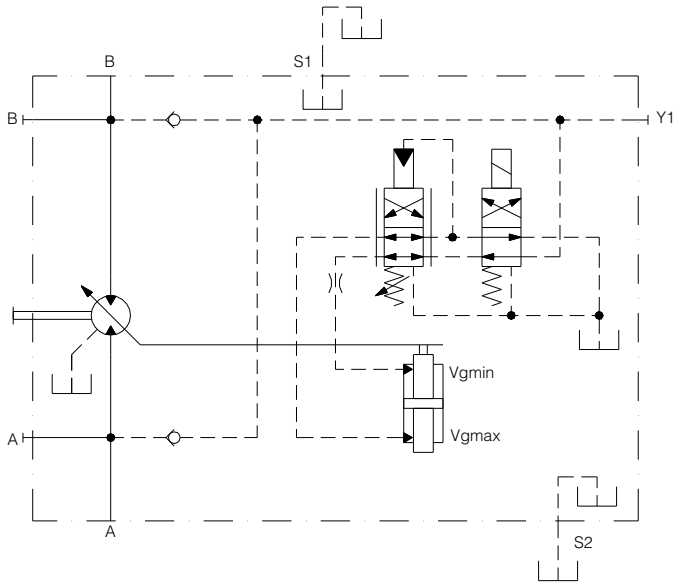
The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.



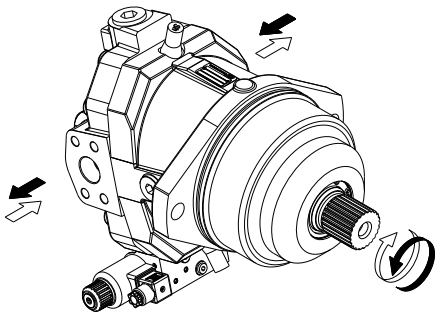
Hydraulic two positions control with pressure override 2EE

The 2EE control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as '2EN' control, when solenoid valve is switched off the motor is at $V_{g\ max}$. The motor displacement is adjusted to $V_{g\ min}$ when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

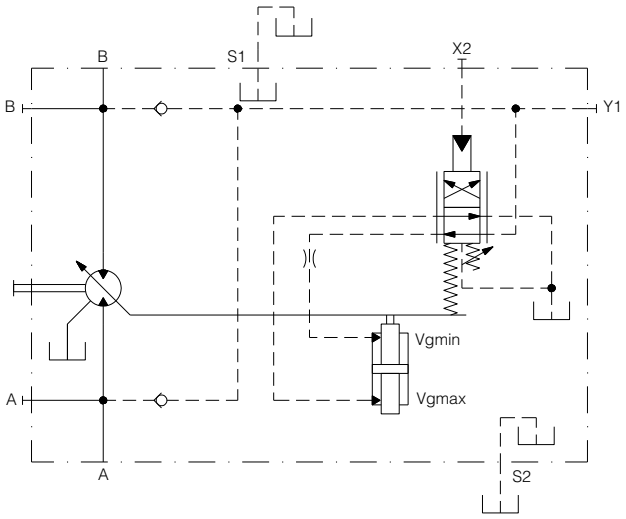


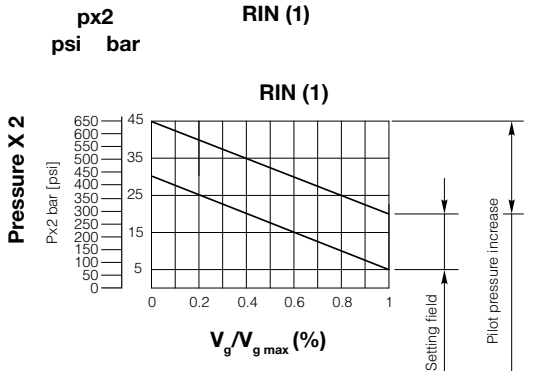
The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

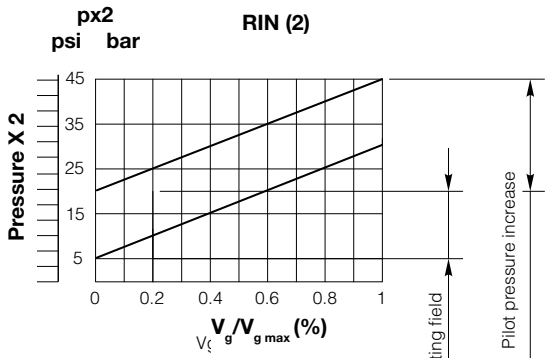


The hydraulic proportional control allows a stepless adjustment of the motor displacement proportionally to the pilot pressure applied at port X2. The pilot pressure applies a force on the spool and the motor swivels until a force balance on the arm is stored by feed back spring. Therefore the motor displacement is adjusted in direct proportion with the pilot pressure. Usually the swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting type 1 as per our ordering code) so that increasing the pilot pressure the motor swivels towards $V_{g\,min}$, however, displacement setting type 2 (swivel range from $V_{g\,min}$ to $V_{g\,max}$) is also available. Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

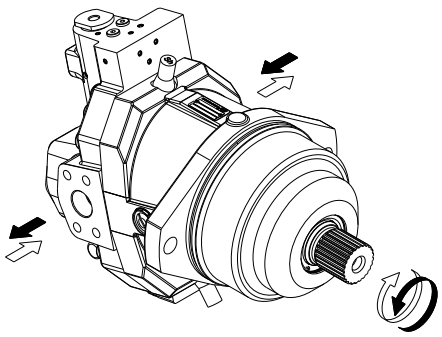
Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.







The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

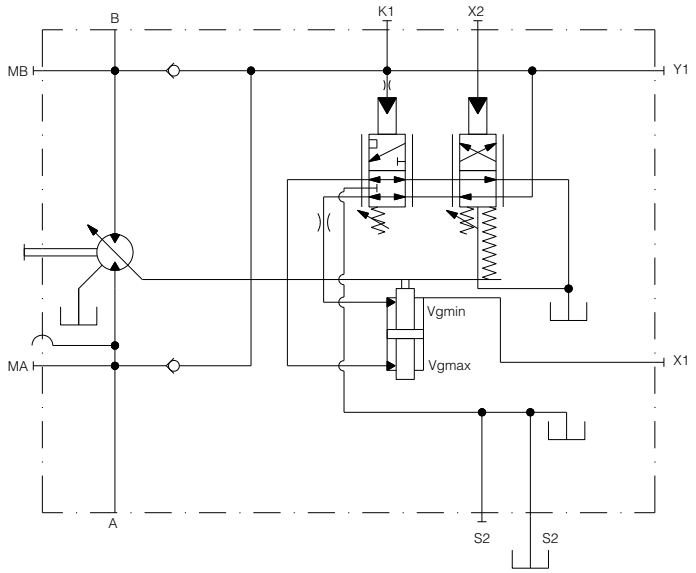


Hydraulic proportional control with pressure override

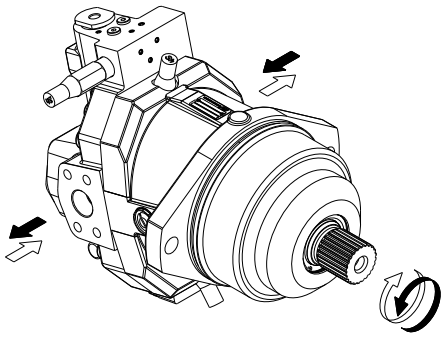
RIE

The RIE control version with the pressure override allows the motor to swivel to $V_{g\,max}$ when the pressure setting is reached. Same as RIN control, the motor displacement is adjusted to $V_{g\,min}$ when the pilot pressure applied at port X2. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to $V_{g\,max}$. Swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting 1 per our ordering code).
Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

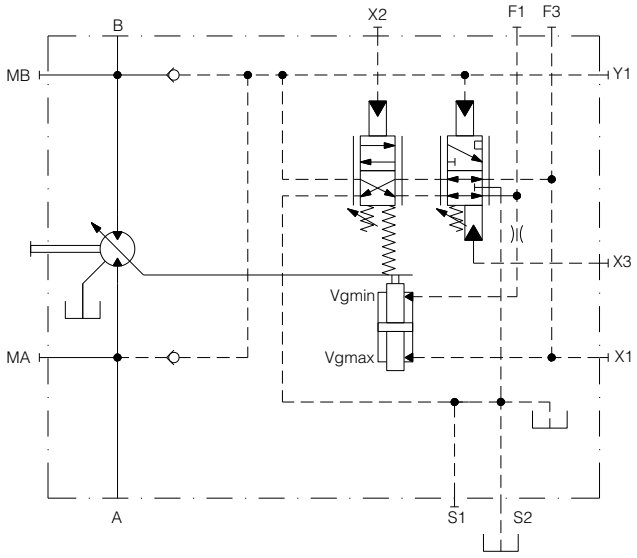


The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

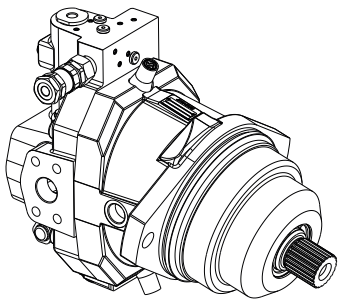


The RID control version with the pressure override allows the motor to swivel to $V_{g\,max}$ when the pressure setting is reached. Same as RIN control, the motor displacement is adjusted to $V_{g\,min}$ when the pilot pressure applied at port X2. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to $V_{g\,max}$. Swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting 1 per our ordering code).
Applying a pressure to port X3, the setting of PE control can be overridden by a different value of pressure.
Setting range from 16 bar [232 psi] to 64 bar [928 psi] around. Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

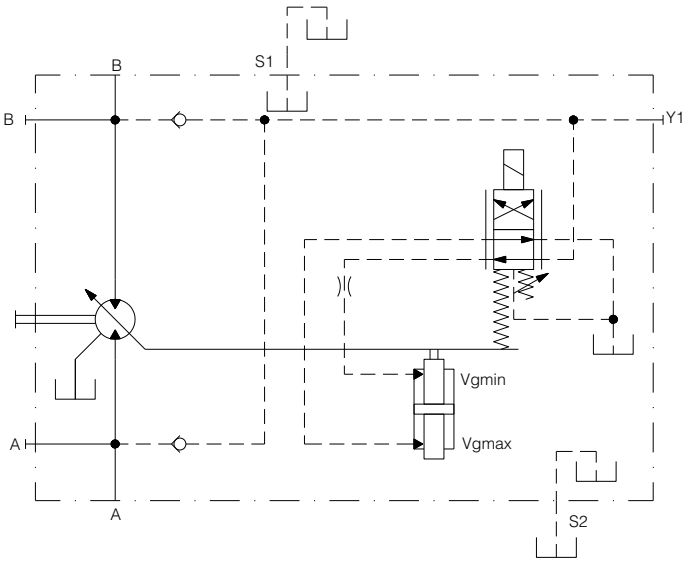


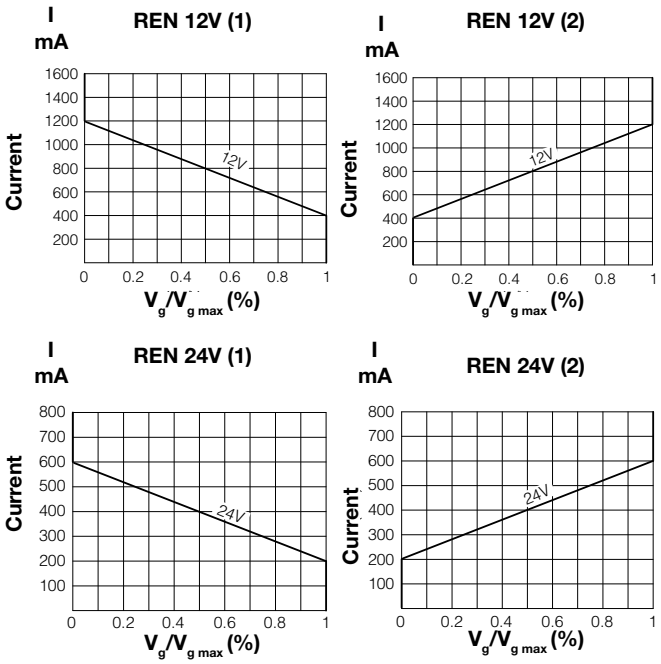
The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.



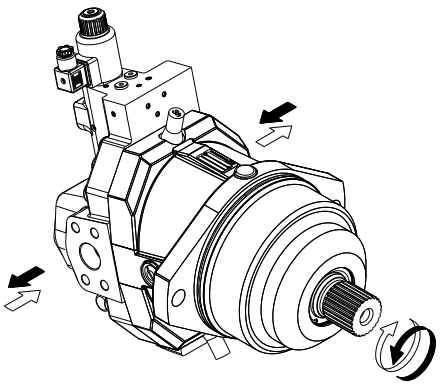
The electrical proportional control allows stepless and programmable adjustment of the motor displacement proportionally to the current strength supplied to a proportional solenoid valve available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The proportional solenoid valve applies a force on the spool proportional to the current strength and the motor swivels until a force balance is restored by a feed-back spring. To control the proportional solenoid valve a 24V DC (12V DC) supply is required. Current range between 200 (400) and 600 (1200) mA approx. (with standard setting of Max and Min displacement). Max permissible current = 800 (1600) mA. Usually the swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting type 1 as per our ordering code) so that increasing the current strength the motor swivels towards $V_{g\,min}$, however displacement setting type 2 (swivels range from $V_{g\,min}$ to $V_{g\,max}$) is also available. The electronic devices are available to control the solenoid (they must be ordered separately).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.



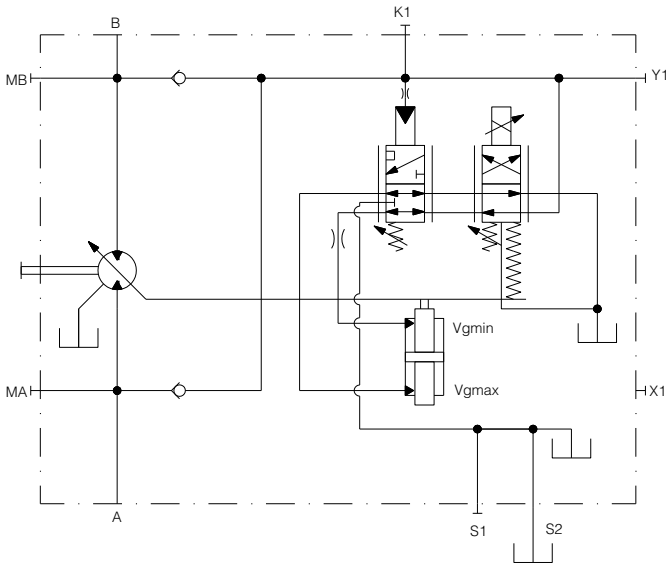


The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.

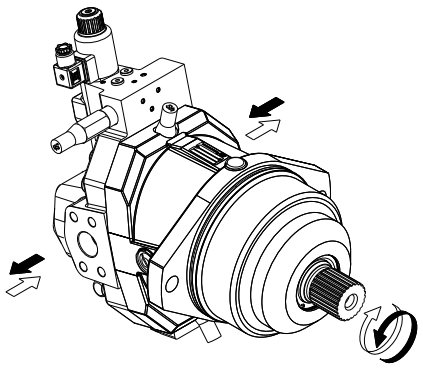


The REE control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as REN control, when solenoid valve is switched off the motor is at $V_{g\ max}$. The proportional solenoid valve is available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The motor displacement is adjusted to $V_{g\ min}$ when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.



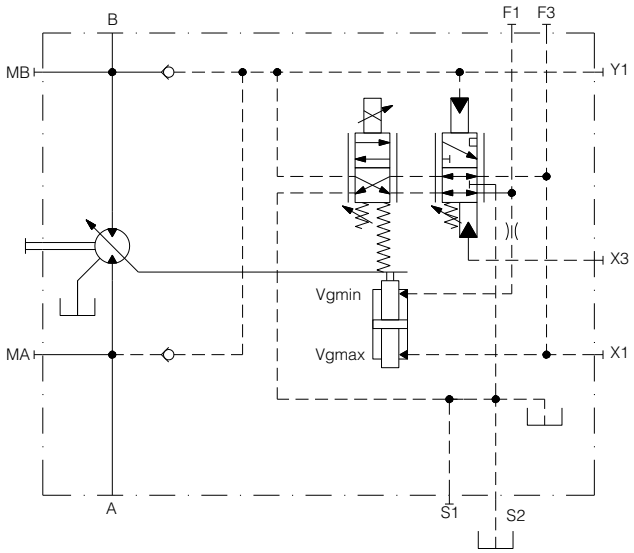
The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.



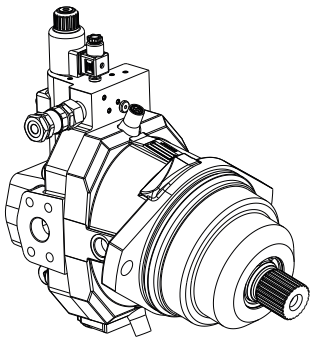
Electric proportional control with double step pressure override RED

The RED control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as REN control, when solenoid valve is switched off the motor is at $V_{g\ max}$. The proportional solenoid valve is available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The motor displacement is adjusted to $V_{g\ min}$ when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code). Applying a pressure to port X3, the setting of PE control can be overridden by a different value of pressure.
Setting range from 16 bar [232 psi] to 64 bar [928 psi] around.

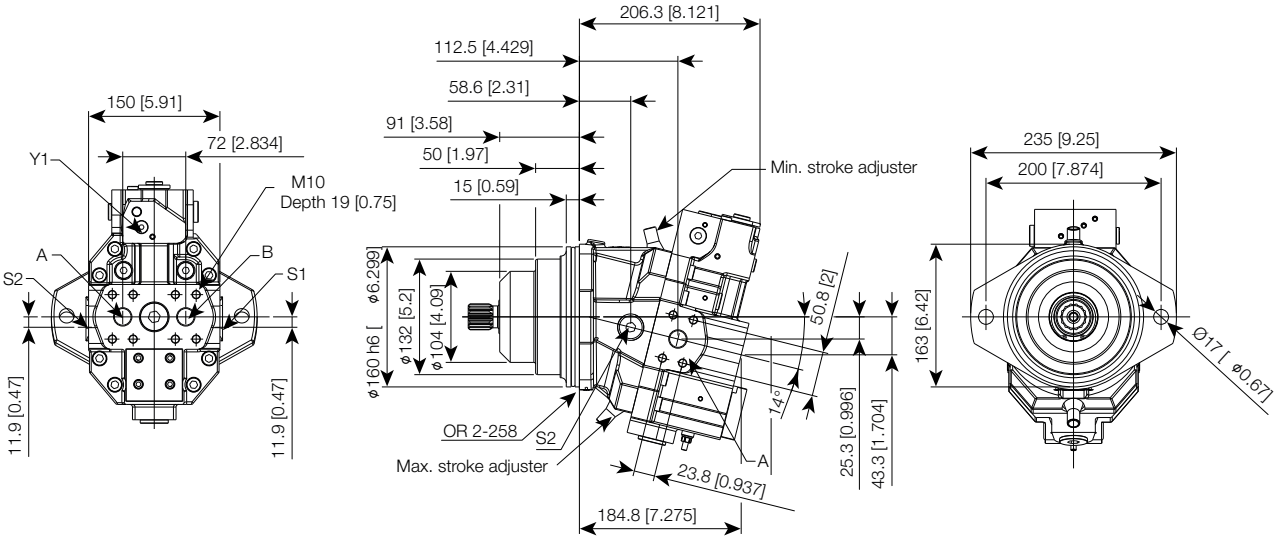
Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.



The relation between direction of rotation of shaft and direction of flow in SH7VR motor is shown in the picture below.



SH7VR 055 Motor - Mounting flange 2 Bolts (OL)

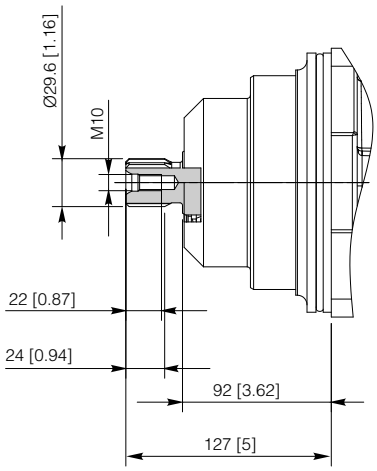


S1, S2: Case drain port - 1/2 G (BSPP)
A, B: Service line ports - 3/4 SAE 6000
Y1: Working pressure piloting port - 1/8 G (BSPP)
F1-F2: Pressure port - 1/8 G (BSPP)

8 Shaft end

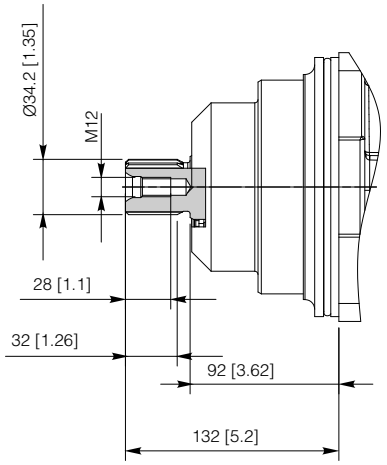
SAI Splined shaft

W30x2x30x14 - DIN 5480



SAM Splined shaft

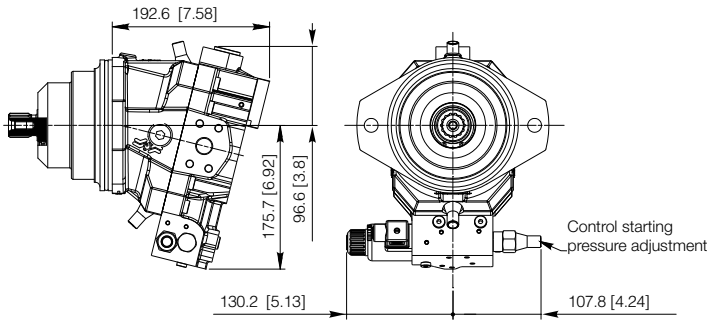
W35x2x30x16 - DIN 5480



SH7VR 055 - Control dimensions (displacement setting 1)

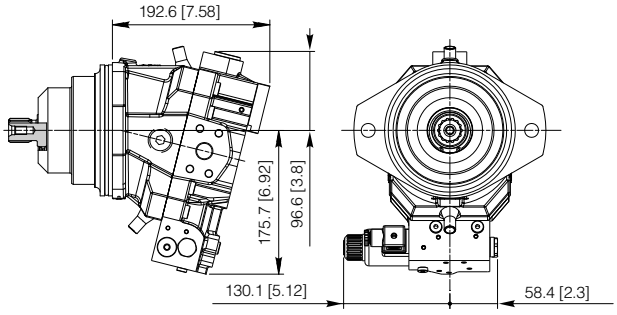
10 Control

2EE



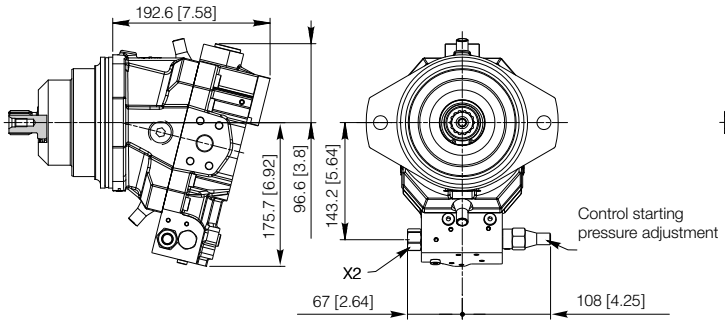
X2: Piloting port - 1/4 G (BSPP)

2EN



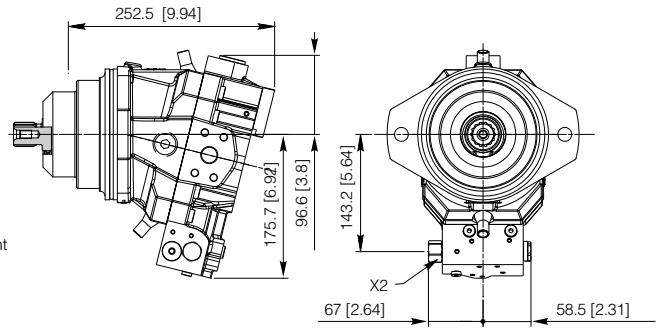
X2: Piloting port - 1/4 G (BSPP)

2IE



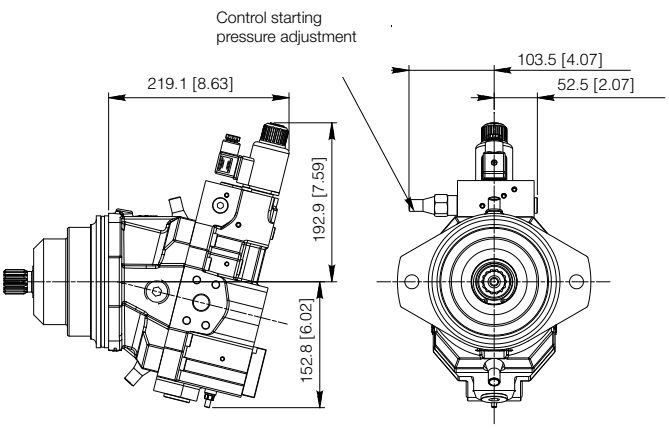
X2: Piloting port - 1/4 G (BSPP)

2IN

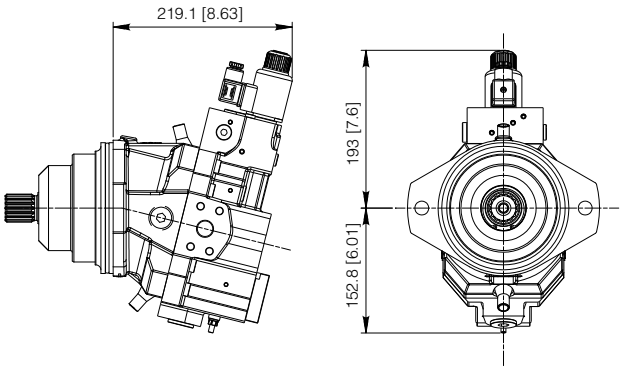


X2: Piloting port - 1/4 G (BSPP)

REE

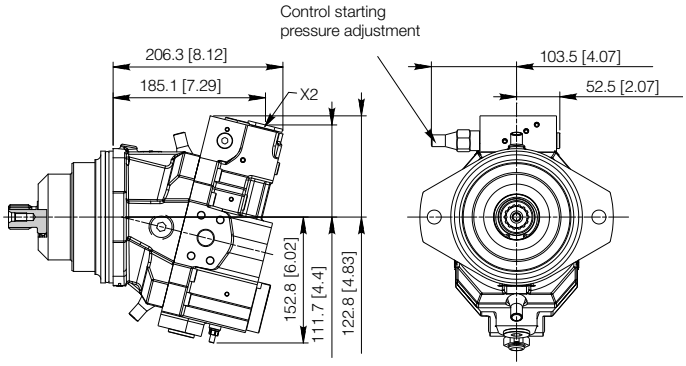


REN



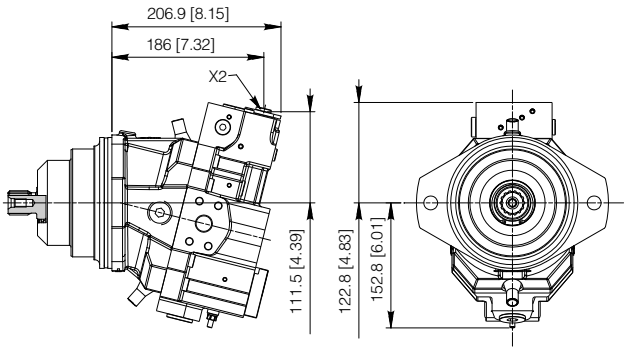
10 Control

RIE



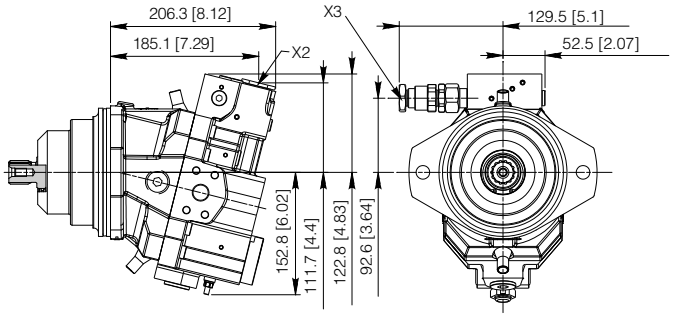
X2: Piloting port - 1/4 G (BSPP)

RIN



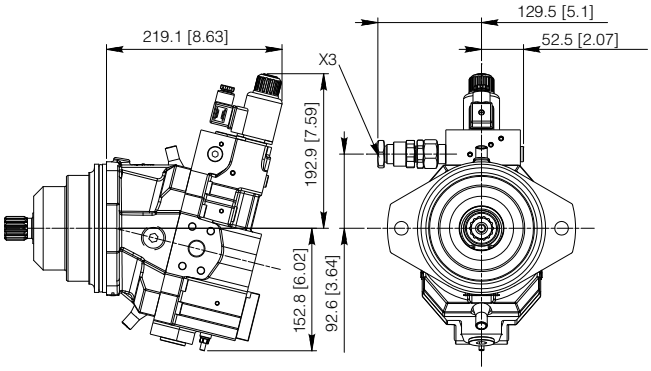
X2: Piloting port - 1/4 G (BSPP)

RID



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

RED

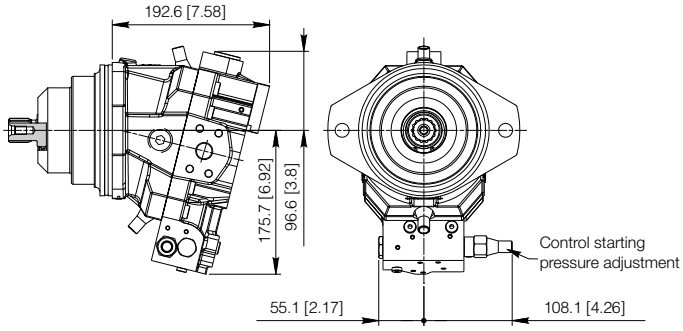


X3: Double step piloting port - 1/4 G (BSPP)

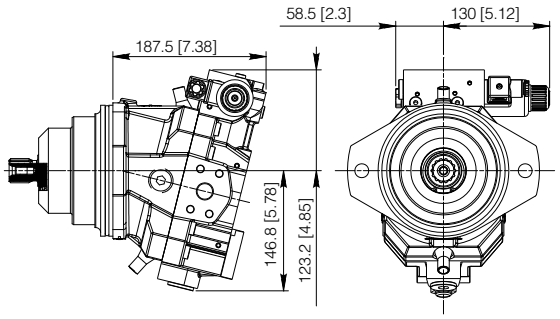
SH7VR 055 - Control dimensions (displacement setting 2)

10 Control

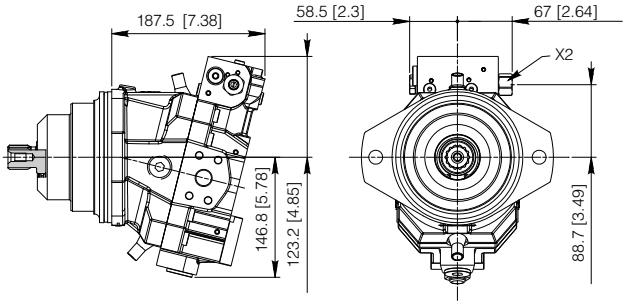
RPE



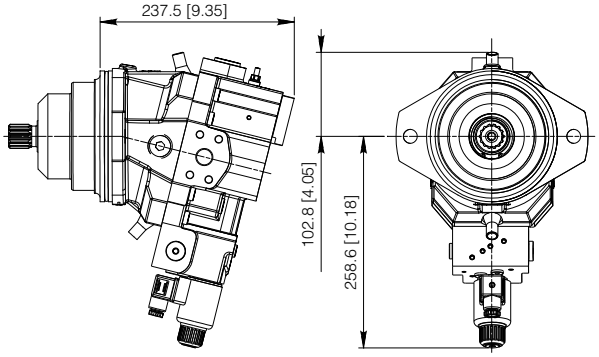
2EN



2IN

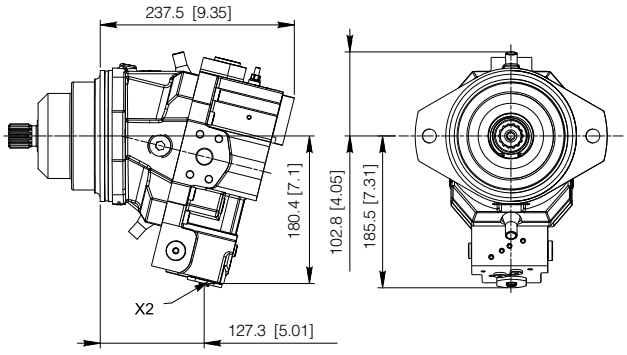


REN

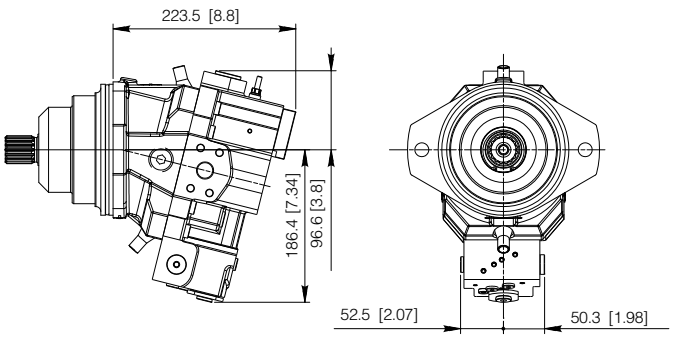


X2: Piloting port - 1/4 G (BSPP)

RIN



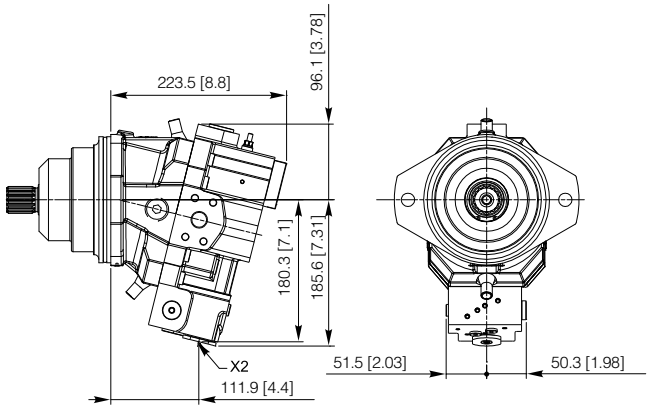
ROE



X2: Piloting port - 1/4 G (BSPP)

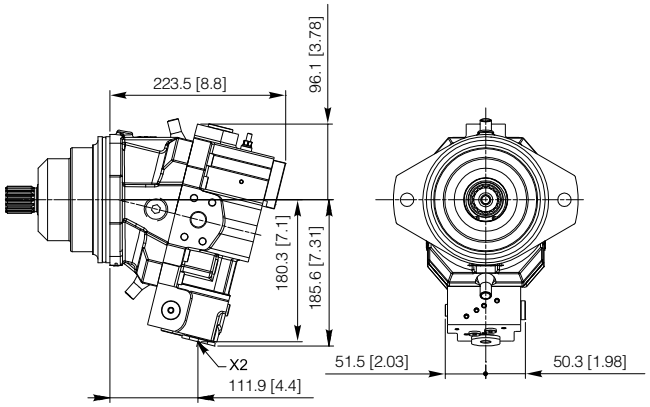
10 Control

RPI



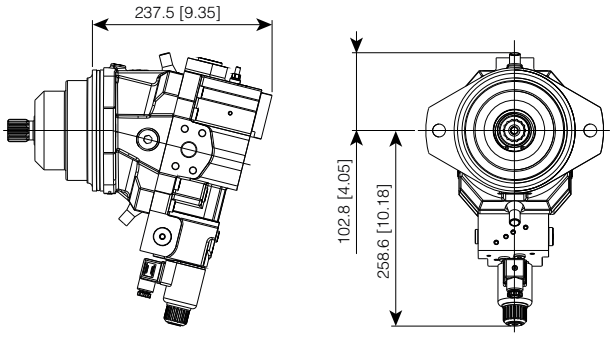
X2: Piloting port - 1/4 G (BSPP)

ROI

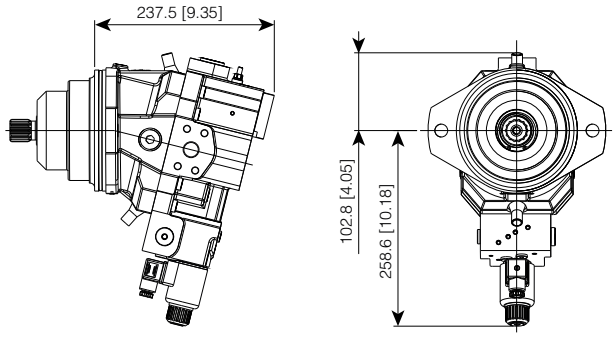


X2: Piloting port - 1/4 G (BSPP)

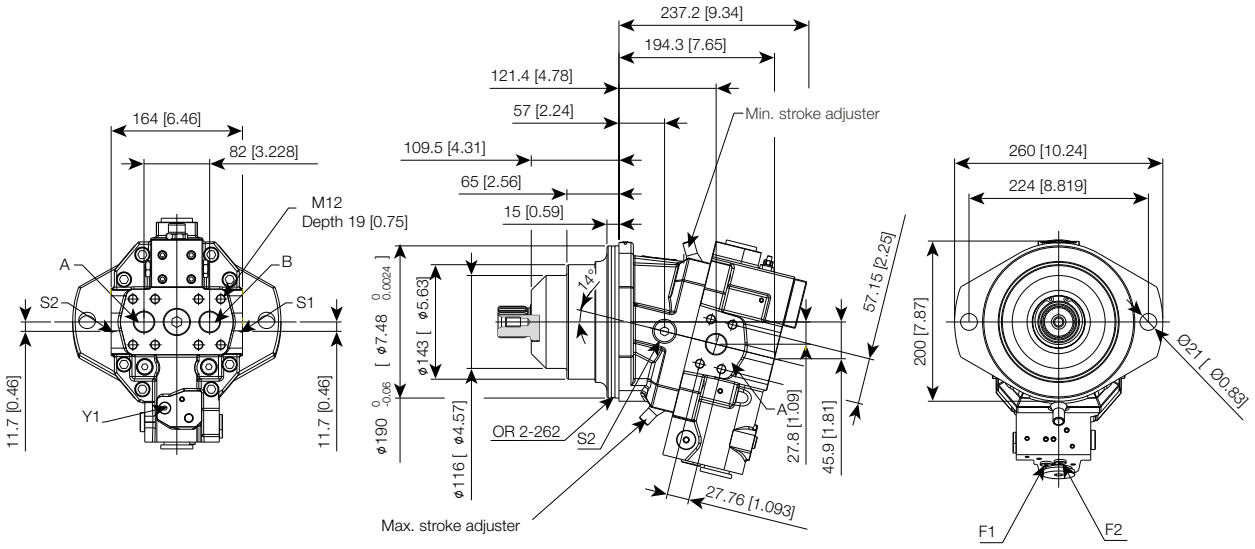
ROS



RPS



SH7VR 075 Motor - Mounting flange 2 Bolts (OM)

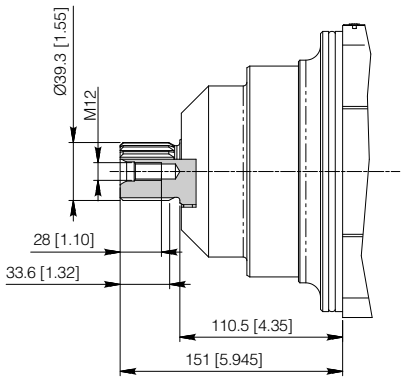


S1, S2: Case drain port - 1/2 G (BSPP)
A, B: Service line ports - 1" SAE 6000
Y1: Working pressure piloting port - 1/8 G (BSPP)
F1-F2: Pressure port - 1/8 G (BSPP)

8 Shaft end

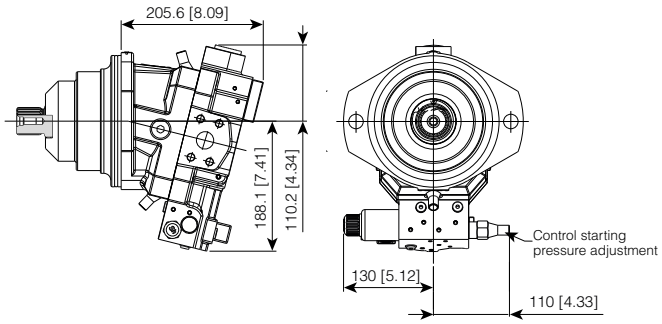
SAO Splined shaft

W40x2x30x18 - DIN 5480

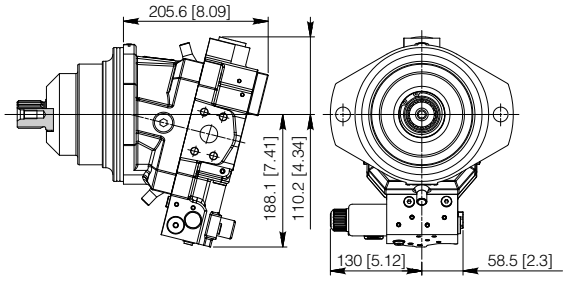


10 Control

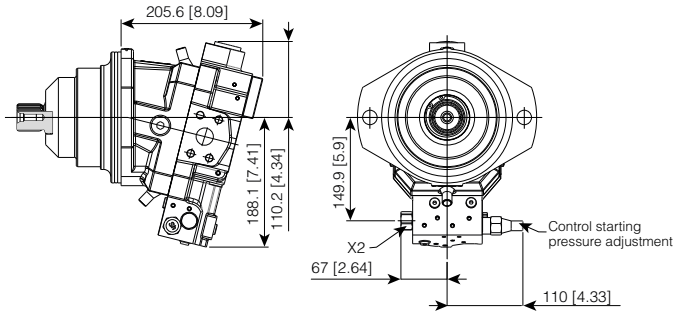
2EE



2EN

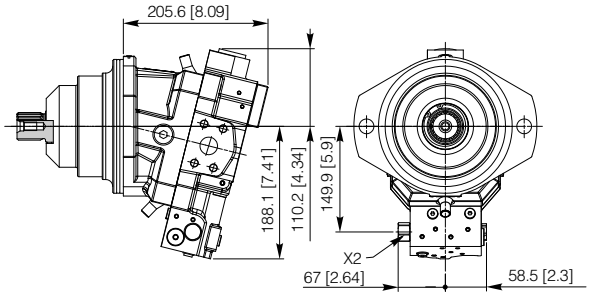


2IE



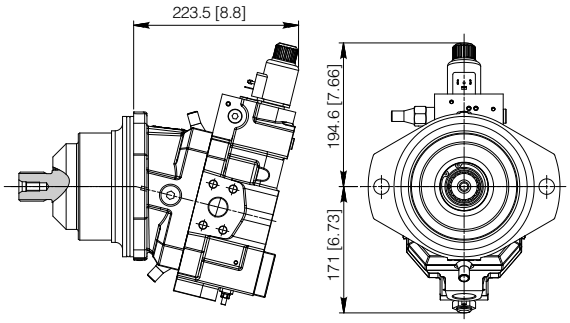
X2: Piloting port - 1/4 G (BSPP)

2IN

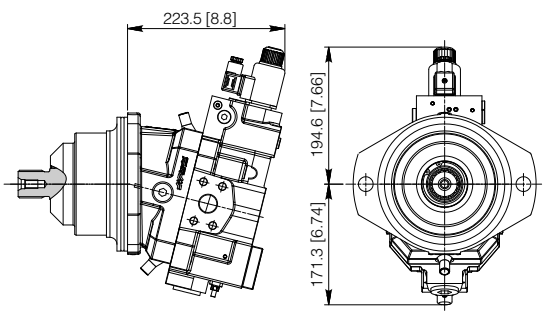


X2: Piloting port - 1/4 G (BSPP)

REE



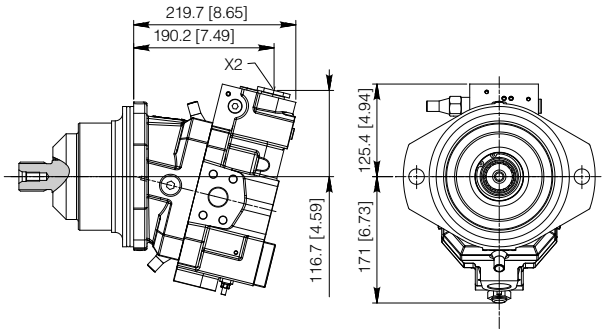
REN



SH7VR 075 - Control dimensions (displacement setting 1)

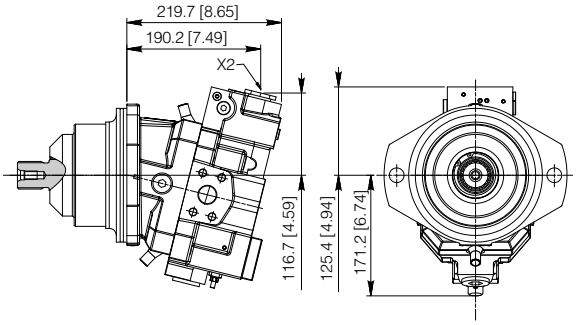
10 Control

RIE



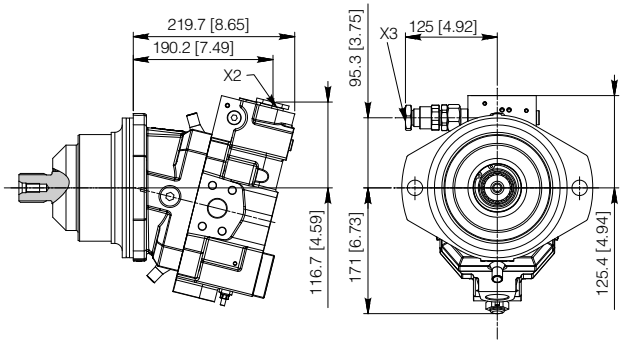
X2: Piloting port - 1/4 G (BSPP)

RIN



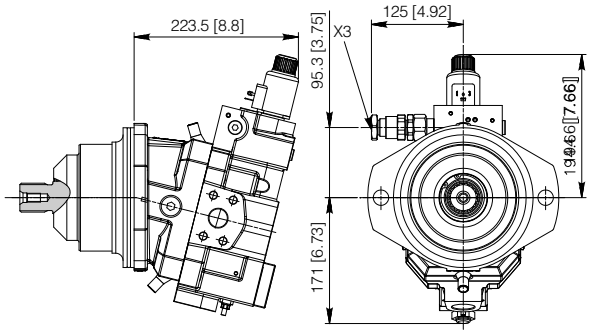
X2: Piloting port - 1/4 G (BSPP)

RID



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

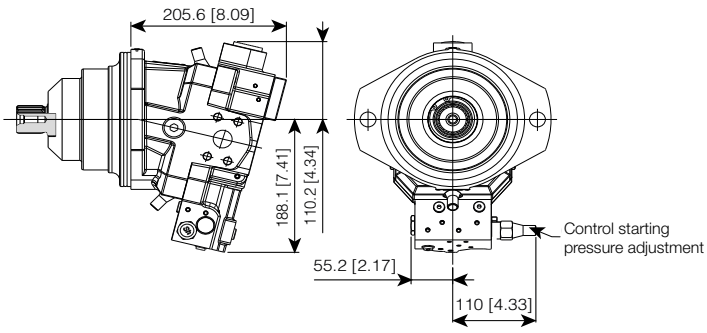
RED



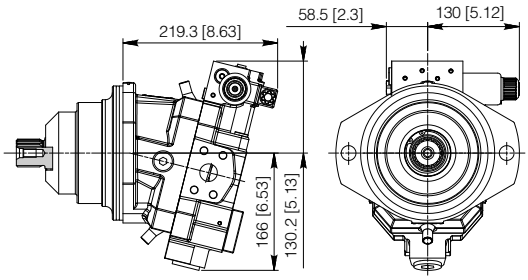
X3: Double step piloting port - 1/4 G (BSPP)

10 Control

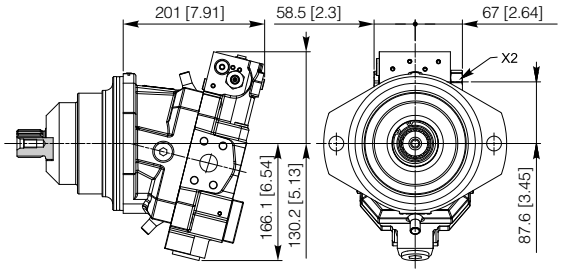
RPE



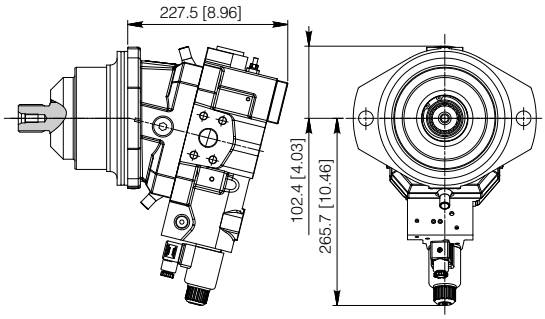
2EN



2IN

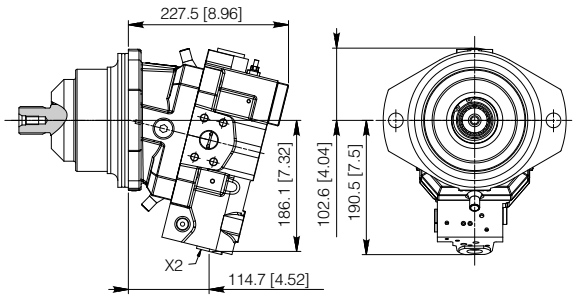


REN

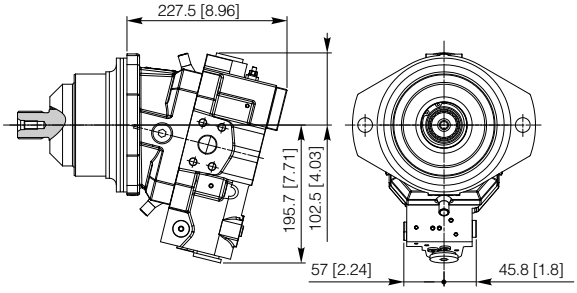


X2: Piloting port - 1/4 G (BSPP)

RIN



ROE

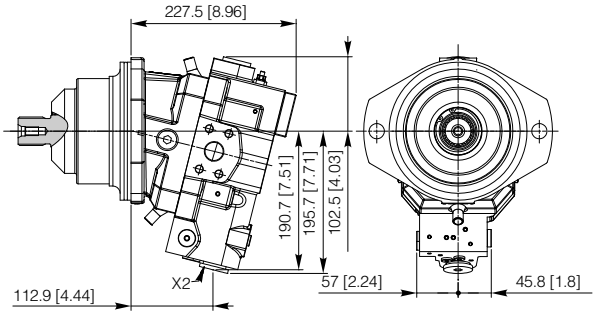


X2: Piloting port - 1/4 G (BSPP)

SH7VR 075 - Control dimensions (displacement setting 2)

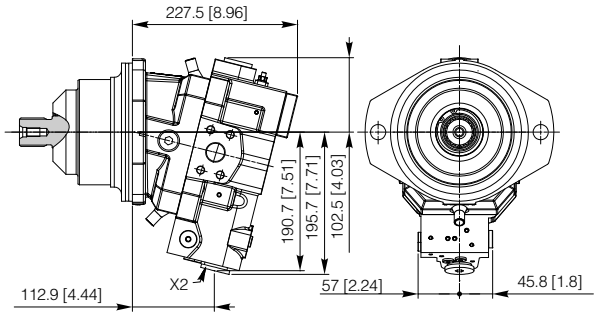
10 Control

RPI



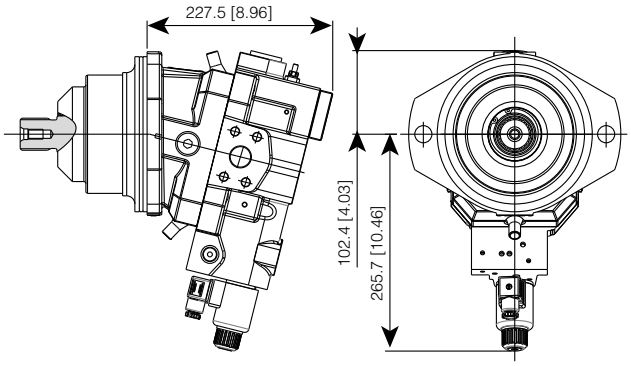
X2: Piloting port - 1/4 G (BSPP)

ROI

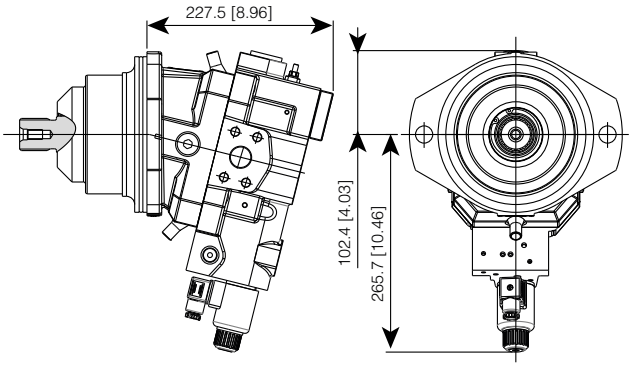


X2: Piloting port - 1/4 G (BSPP)

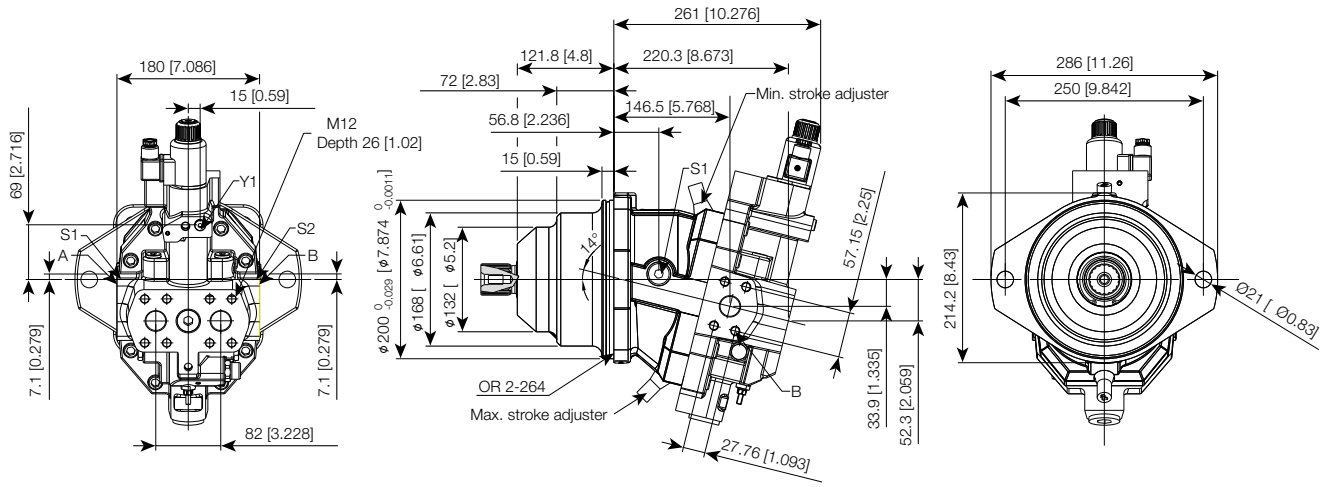
ROS



RPS



SH7VR 108 Motor - Mounting flange 2 Bolts (ON)

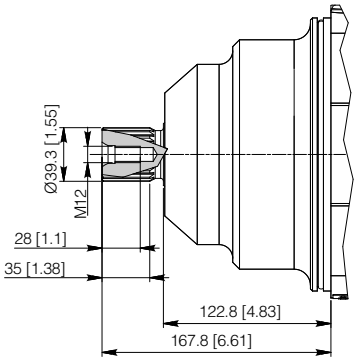


S1, S2: Case drain port - 1/2 G (BSPP)
A, B: Service line ports - 1” SAE 6000
Y1: Working pressure piloting port - 1/8 G (BSPP)

8 Shaft end

SAO Splined shaft

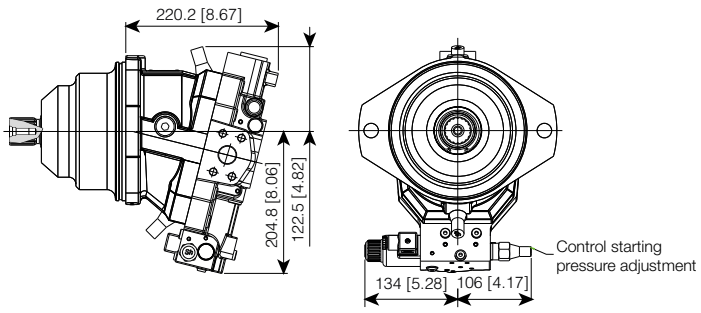
W40x2x30x18 - DIN 5480



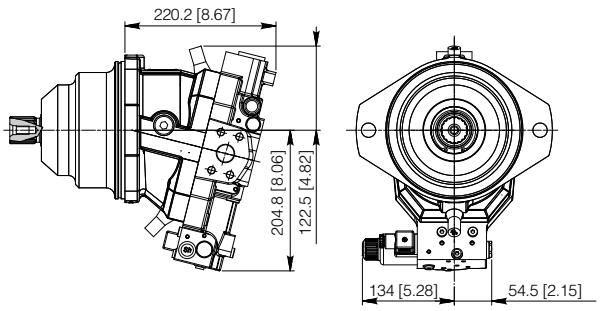
SH7VR 108 - Control dimensions (displacement setting 1)

10 Control

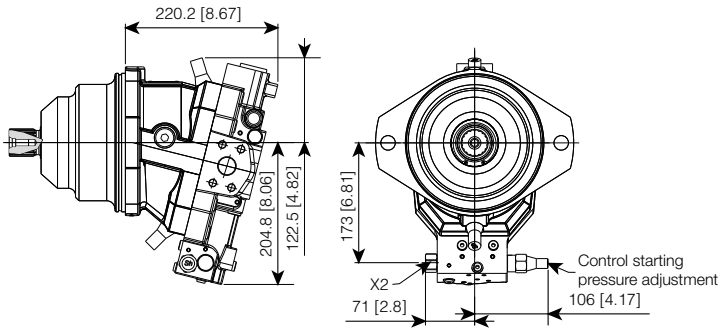
2EE



2EN

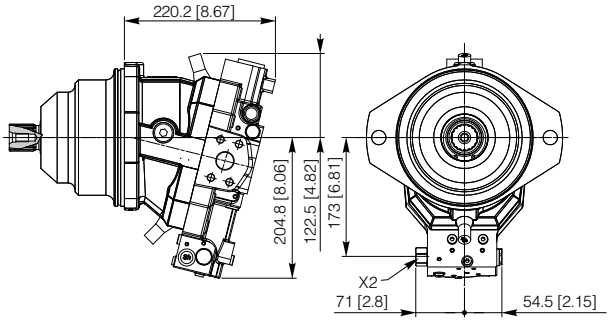


2IE



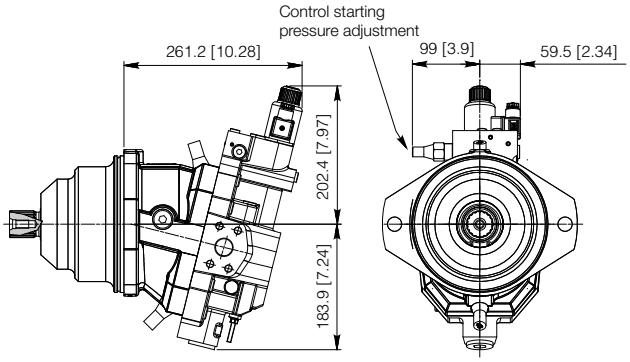
X2: Piloting port - 1/4 G (BSPP)

2IN

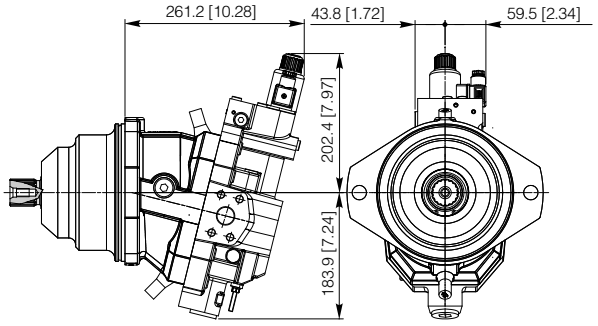


X2: Piloting port - 1/4 G (BSPP)

REE

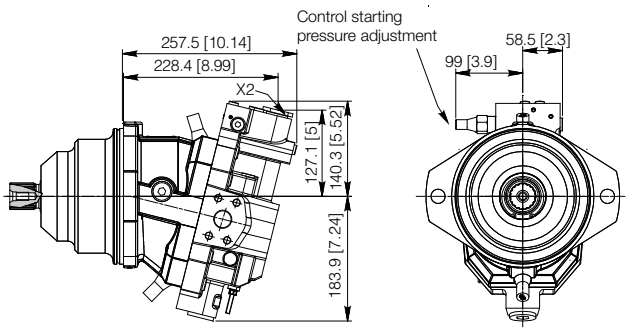


REN



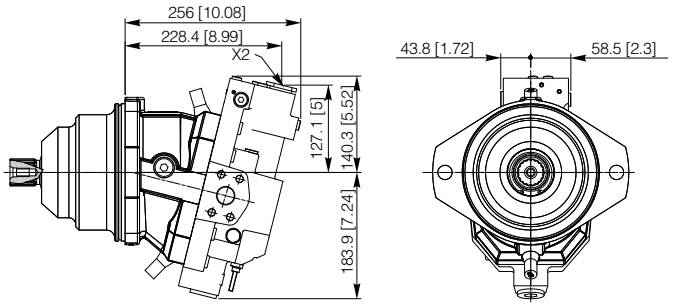
10 Control

RIE



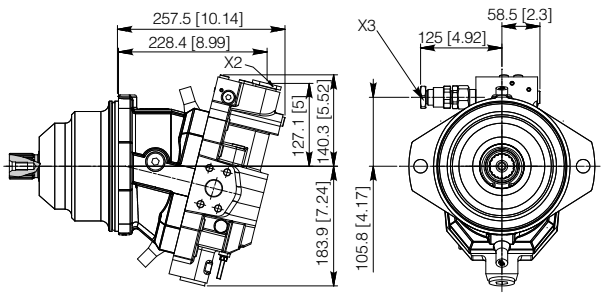
X2: Piloting port - 1/4 G (BSPP)

RIN



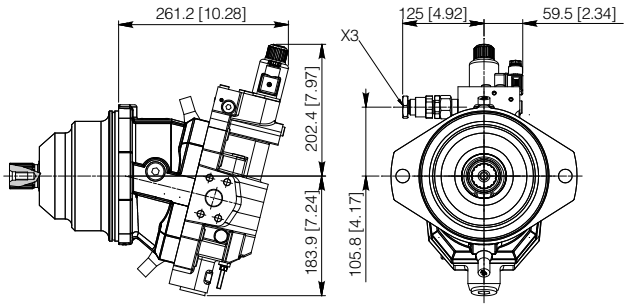
X2: Piloting port - 1/4 G (BSPP)

RID



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

RED

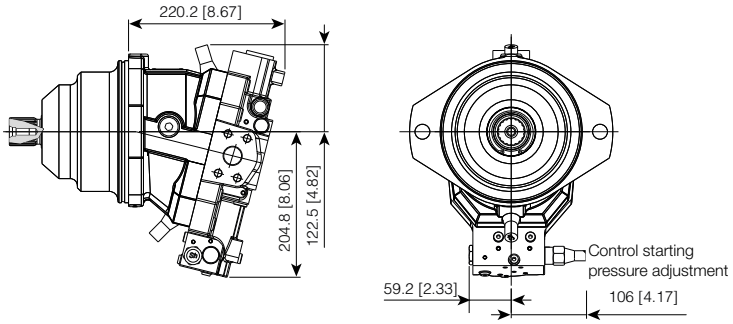


X3: Double step piloting port - 1/4 G (BSPP)

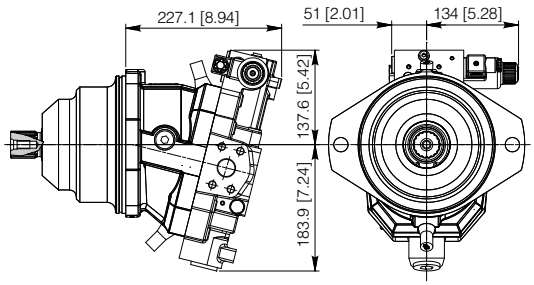
SH7VR 108 - Control dimensions (displacement setting 2)

10 Control

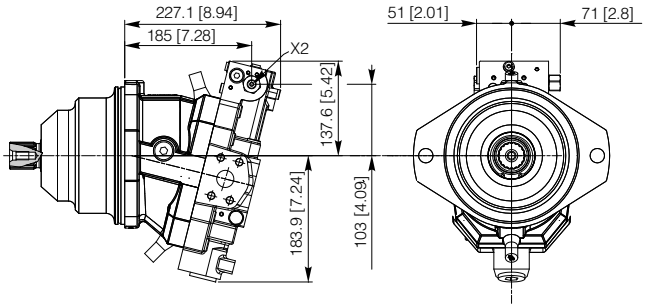
RPE



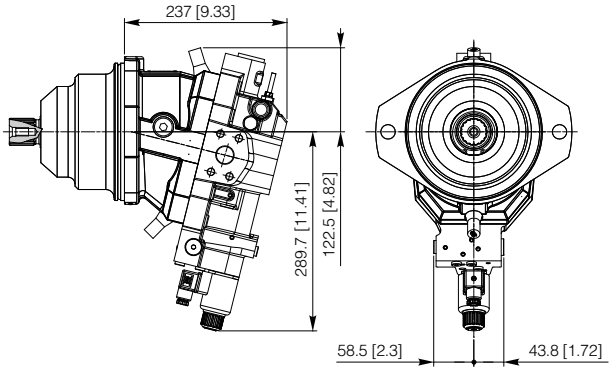
2EN



2IN

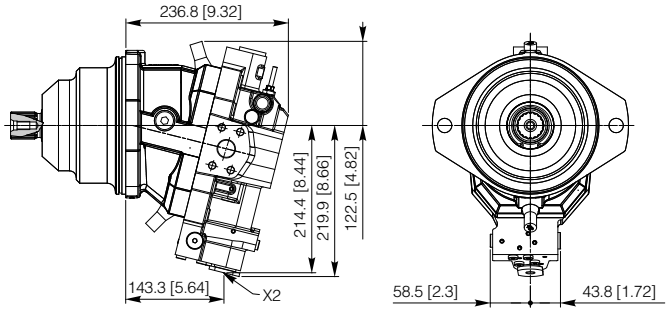


REN

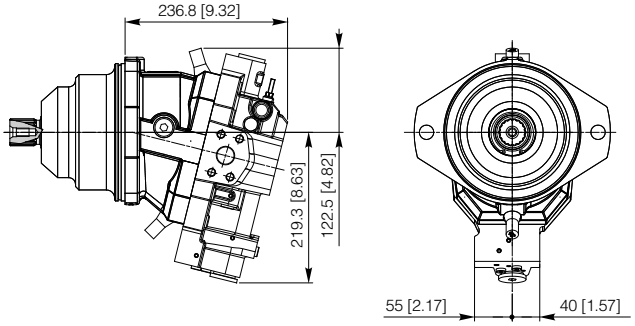


X2: Piloting port - 1/4 G (BSPP)

RIN



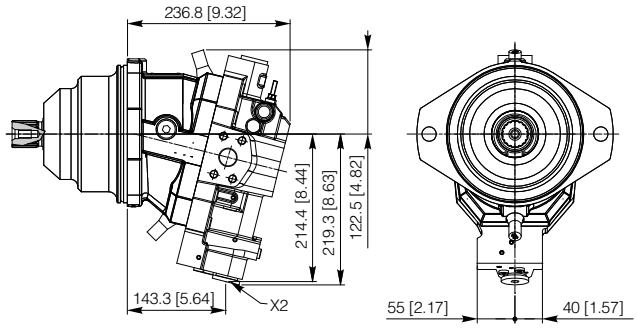
ROE



X2: Piloting port - 1/4 G (BSPP)

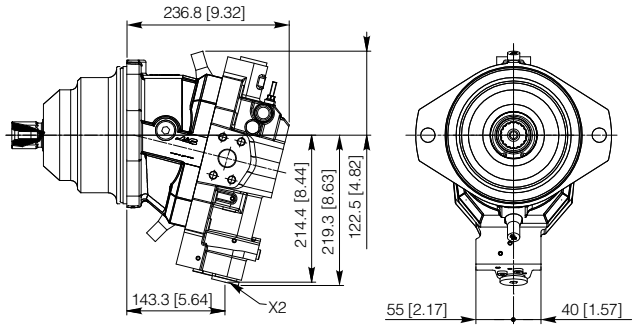
10 Control

RPI



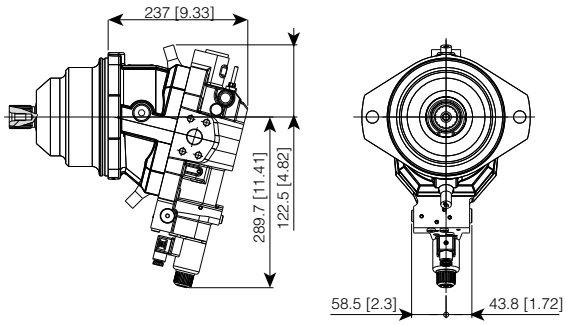
X2: Piloting port - 1/4 G (BSPP)

ROI

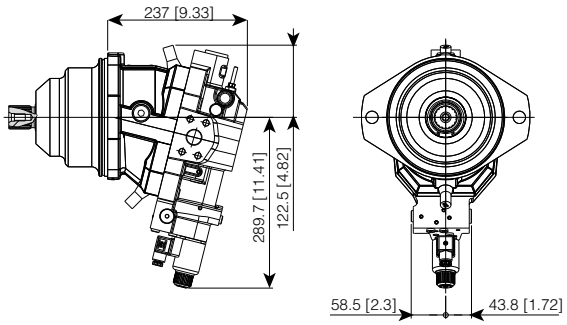


X2: Piloting port - 1/4 G (BSPP)

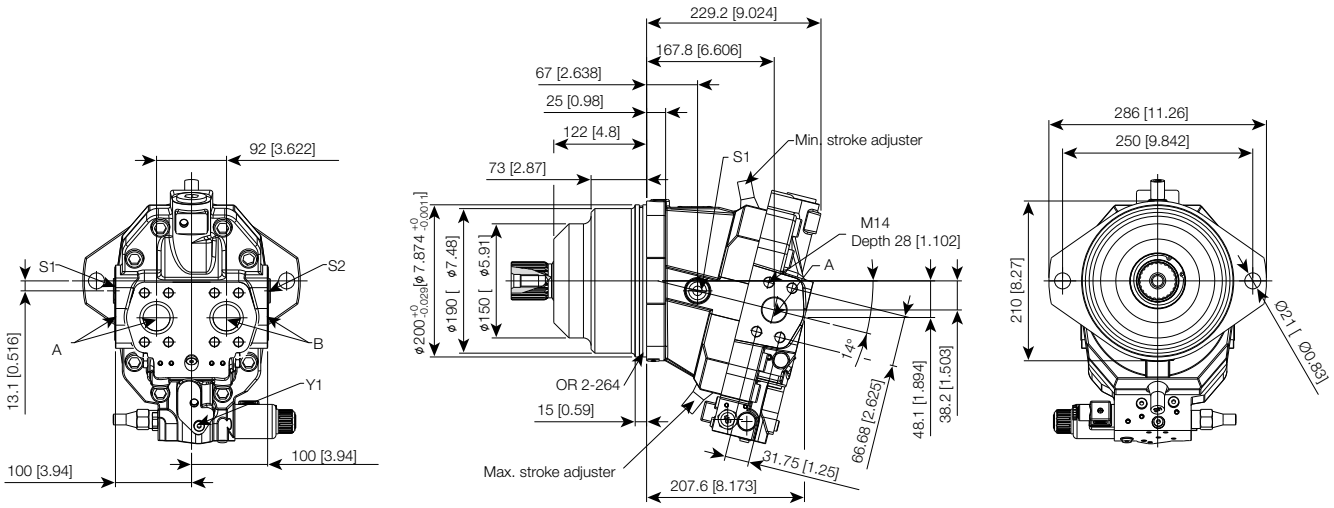
ROS



RPS



SH7VR 160 Motor - Mounting flange 2 bolts (ON)

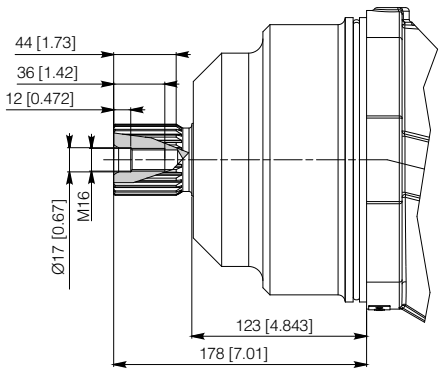


S1, S2: Case drain port - 3/4 G (BSPP)
A, B: Service line ports - 1” 1/4 SAE 6000
Y1: Working pressure piloting port - 1/8 G (BSPP)

8 Shaft end

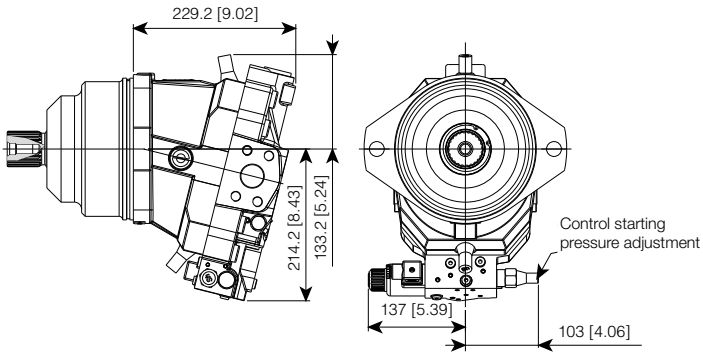
SAR Splined shaft

W50x2x30x24 - DIN 5480

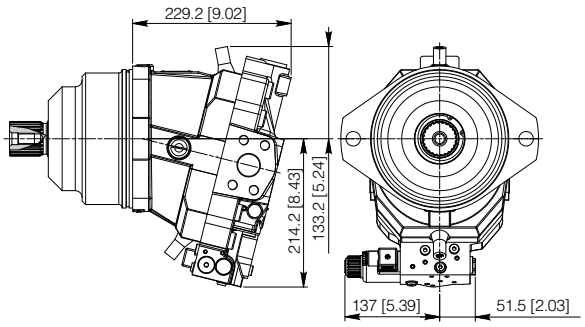


10 Control

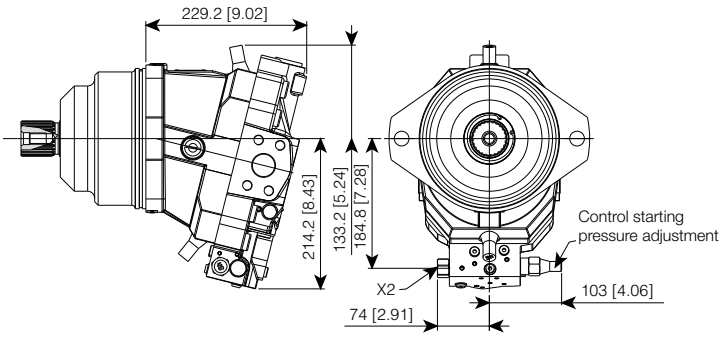
2EE



2EN

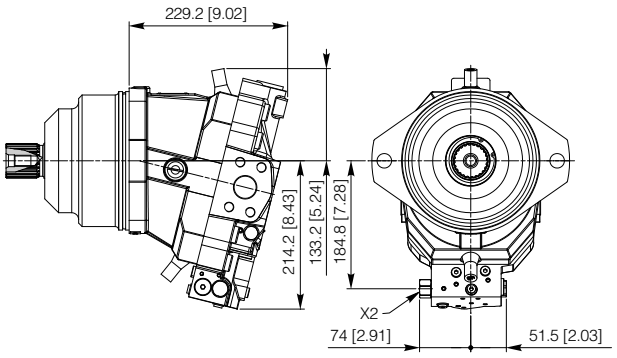


2IE



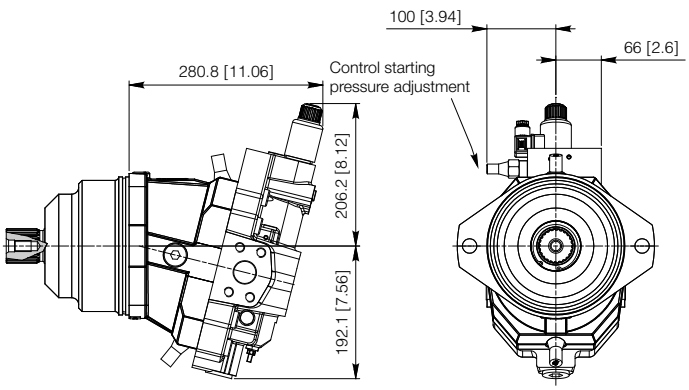
X2: Piloting port - 1/4 G (BSPP)

2IN

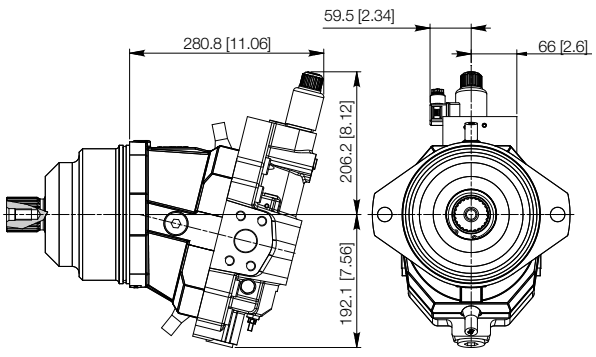


X2: Piloting port - 1/4 G (BSPP)

REE



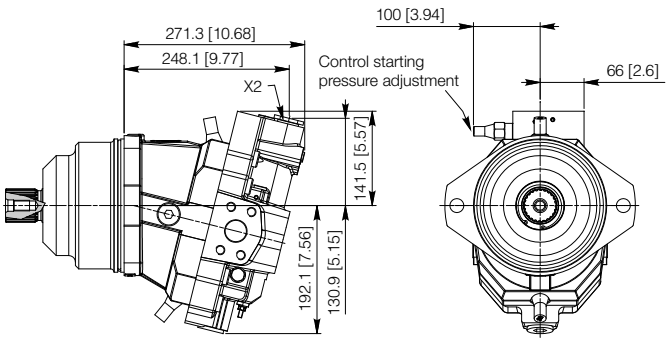
REN



SH7VR 160 - Control dimensions (displacement setting 1)

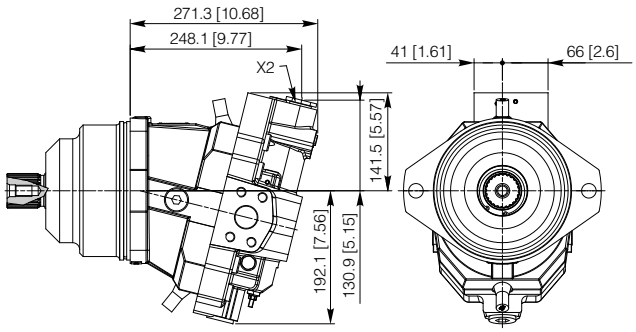
10 Control

RIE



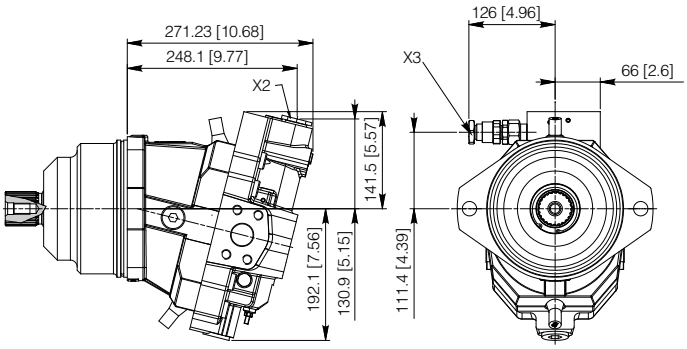
X2: Piloting port - 1/4 G (BSPP)

RIN



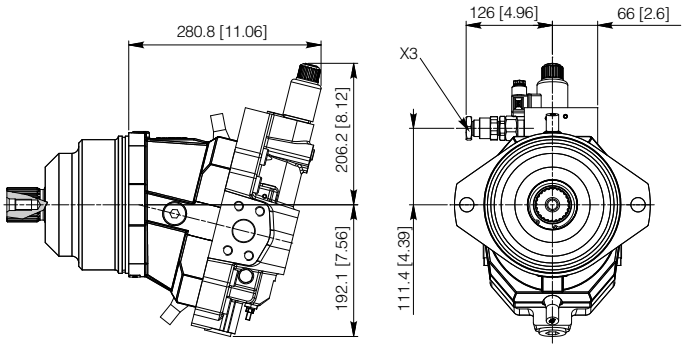
X2: Piloting port - 1/4 G (BSPP)

RID



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

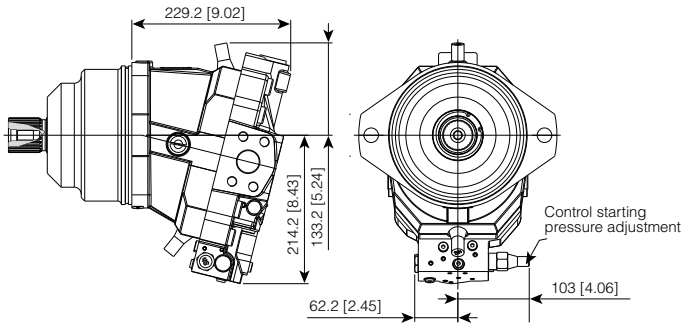
RED



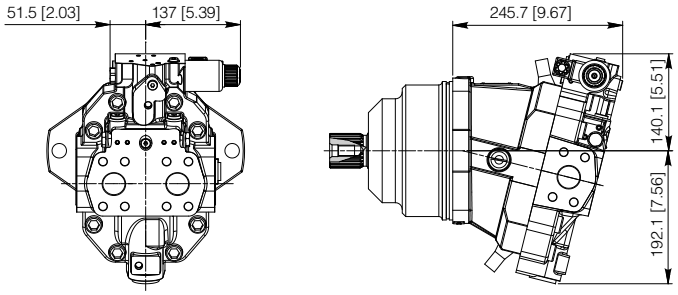
X3: Double step piloting port - 1/4 G (BSPP)

10 Control

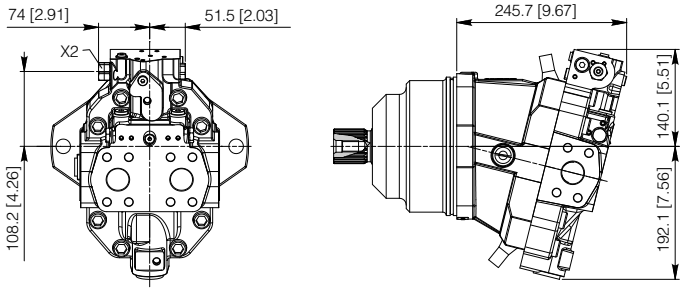
RPE



2EN

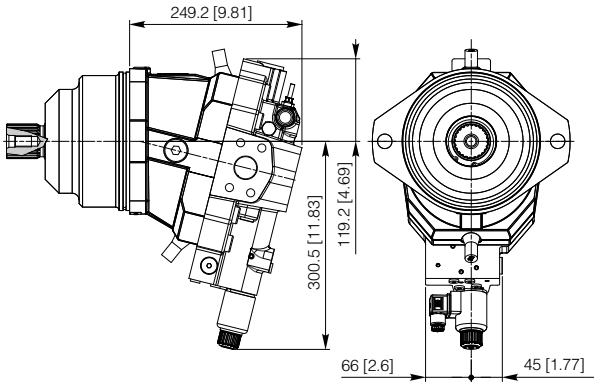


2IN

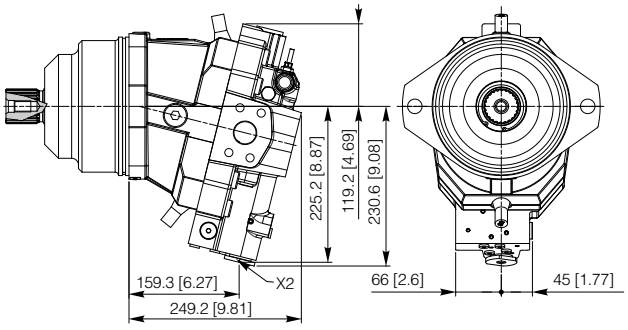


X2: Piloting port - 1/4 G (BSPP)

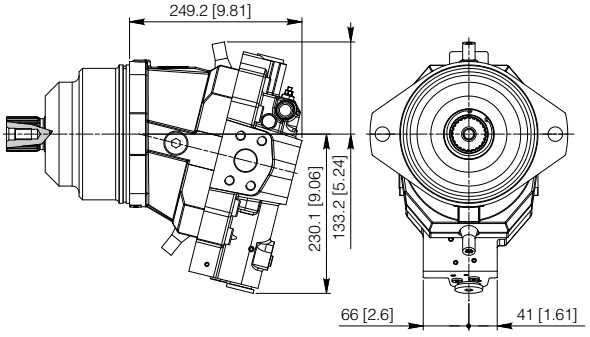
REN



RIN



ROE

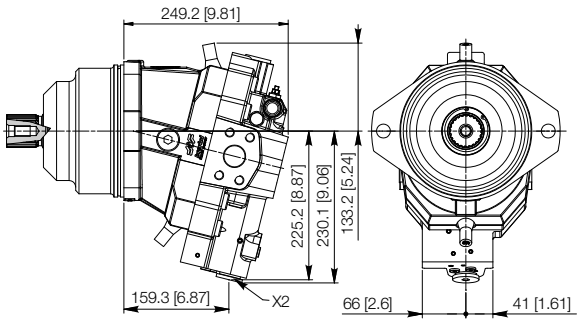


X2: Piloting port - 1/4 G (BSPP)

SH7VR 160 - Control dimensions (displacement setting 2)

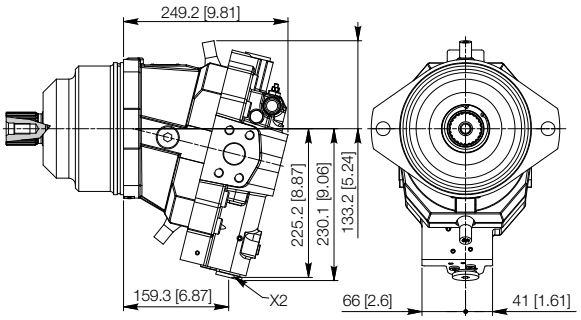
10 Control

RPI



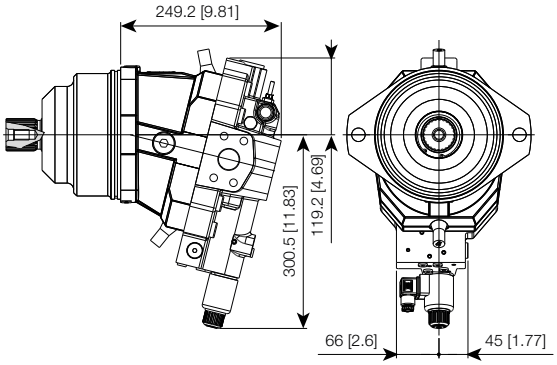
X2: Piloting port - 1/4 G (BSPP)

ROI

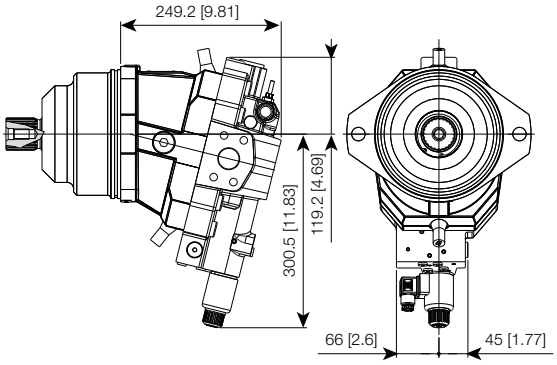


X2: Piloting port - 1/4 G (BSPP)

ROS



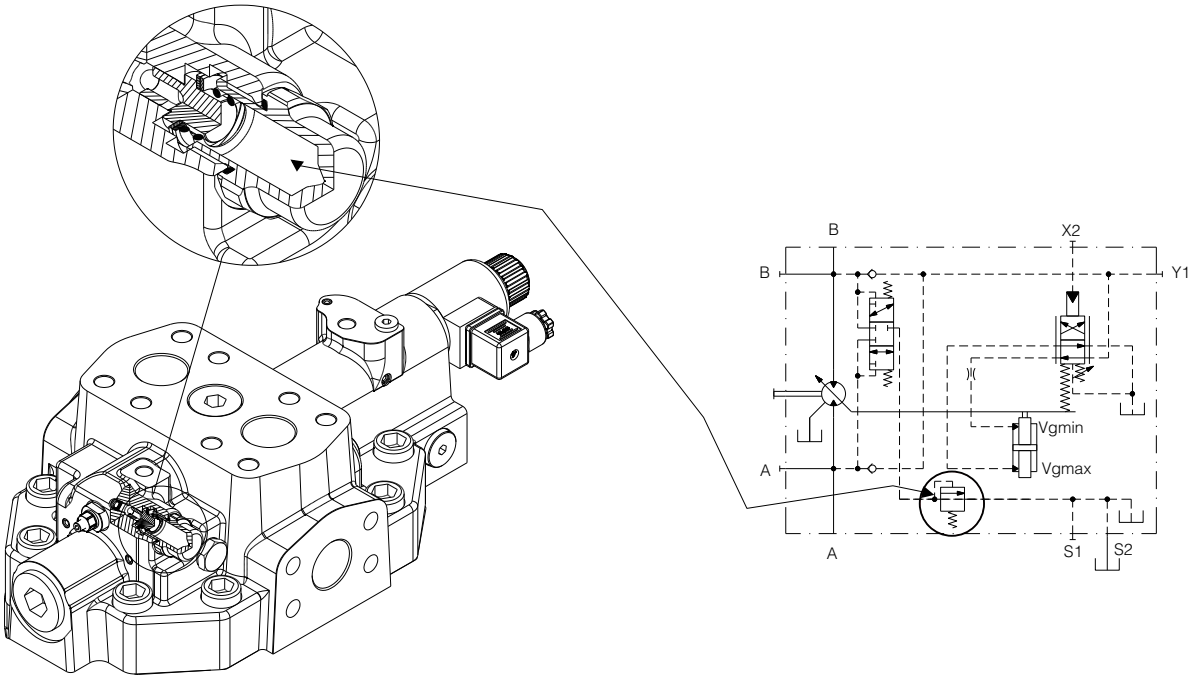
RPS



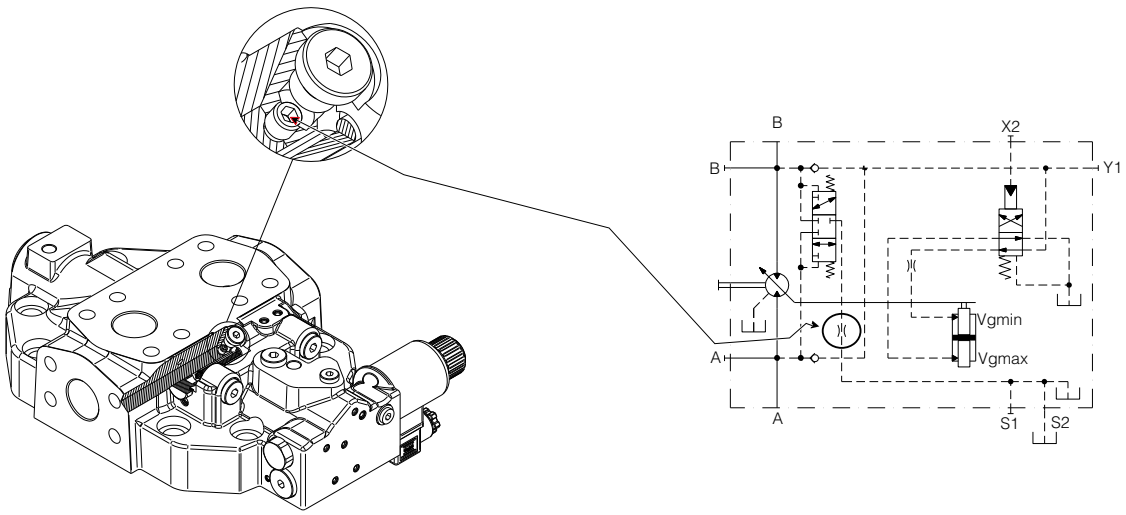
14 Flushing valve

For closed circuit operation, the motors can be equipped with built in flushing valve.

Only for SH7VR 108-160

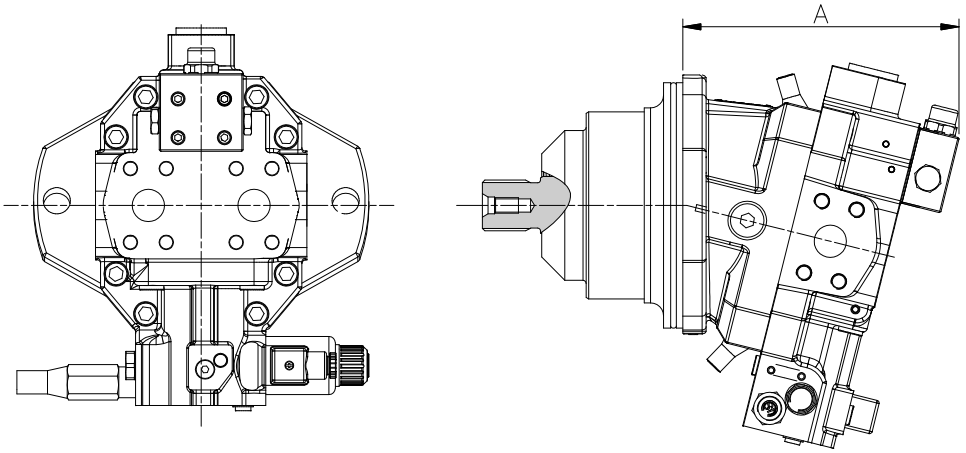


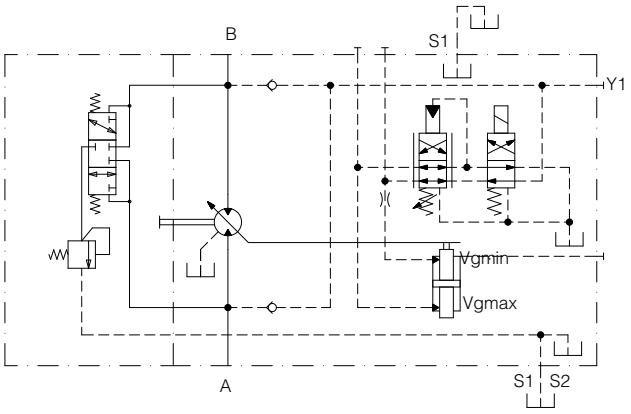
Only for SH7VR 160 with two positions controls



14 Flushing valve

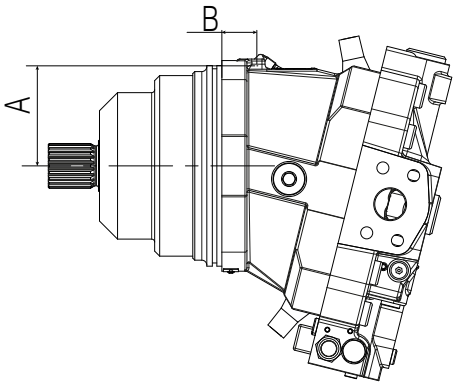
Only for SH7VR 055-075





		SH7VR 055	SH7VR 075
A	mm [in]	214 [8.42]	250 [9.84]

TS - TW - TZ



		Size			
		SH7VR 055	**SH7VR 075**	**SH7VR 108**	**SH7VR 160**
A	mm [inch]	84.2 [3.3]	88 [3.46]	96.2 [3.787]	103.8 [4.086]
B	mm [inch]	23.5 [0.925]	23 [0.906]	25 [0.984]	29.4 [1.157]

TW
2-Channel differential-hall effect operating principle (1 square wave -1 digital for direction of rotation) Output signal PNP
Power supply 4.5-16 VDC
Frequency 0 - 20.000 Hz
Operating temperature -40°C - +110°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

TZ
2-Channel differential-hall effect operating principle Sensor with dual-channel output (90°)
Power supply 8-32 VDC
Frequency 0-20.000 Hz
Operating temperature -40°C +125°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

	Size			
	SH7VR 055	**SH7VR 075**	**SH7VR 108**	**SH7VR 160**
Number of pulses per revolution	54	58	67	80

SH9V - Variable displacement axial piston motors for open and closed circuit





Index

General information - Features P2
Technical data P4
Ordering code P5
Control P12
SH9V 061 ..... P28
SH9V 085 ..... P28
SH9V 115 ..... P39
SSH9V 215 ..... P50
Flushing valve P61
Tachometer P63

Type	**Displacement** cm^3/rev [in^3/rev]	**Max. flow** l/min [U.S. gpm]	**Max. pressure cont.** bar [psi]	**Max Peak Pressure** bar [psi]
SH9V 085	85.3 [5.203]	341 [90.02]	430 [6235]	480 [6960]
SH9V 115	115.7 [7.05]	411 [108.5]	430 [6235]	480 [6960]
SH9V 215	216 [13.176]	627 [165.63]	430 [6235]	480 [6960]

H9V series are a family of variable displacement motors, bent axis piston design for operation in both open and closed circuit. The proven design incorporating the lens shape valve plate, the high quality components and manufacturing techniques make able the SH9V series motors to provide up to 430 bar [6235 psi] ontinuous and 480 bar [6960 psi] peak performance.
Fully laboratory tested and field proven, these motors provide maximum efficiency and long life even at very bad filtering conditions. Heavy duty bearings permit high radial and axial loads. Versatile design includes a variety of control and shaft ends that will adapt the SH9V series motors to any application both industrial and mobile.

General information - Features

Simbology:

C	N/bar [lbf/psi]	Load
$F_{ax\ max}$	N [lbf]	Axial pushing load
$F_{ax\ max}$	N [lbf]	Axial pulling load
F_q	N [lbf]	Radial load
$F_{q\ max}$	N [lbf]	Maximum permissible radial load
J	kg·m^2 [lbf·ft^2]	Moment of inertia
m	kg [lbs]	Weight
$n_{0\ max}$	rpm	Maximum speed
p_{nom}	bar [psi]	Maximum cont. pressure
p_{max}	bar [psi]	Maximum pressure peak

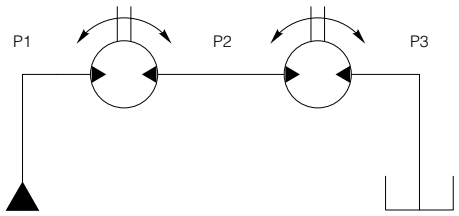
q_{max}	l/min [U.S. gpm]	Maximum flow
q_d	l/min [U.S. gpm]	External drain flow
T_k	Nm/bar [lbf.ft/psi]	Torque costant
T_{nom}	Nm [lbf.ft]	Maximum torque at pressure cont.
T_{max}	Nm [lbf.ft]	Maximum torque at pressure peak
V_g	cm^3/rev [in^3/rev]	Displacement
P_{max}	kW [hp]	Maximum power at p_{nom}
η_{hm}	%	Mech-hyd. efficiency
η_v	%	Volumetric efficiency

Hydraulic fluids:
Use fluids with mineral oil basis and anticorrosive, antioxidant and wear preventing addition agents (HL or HM). Viscosity range at operating temperature must be of 15÷40 cSt. For short periods and upon cold start, a max. viscosity of 800 cSt is allowed. Viscosities less then 10 cSt are not allowed. A viscosity range of 10÷15 cSt is allowed for extreme operating conditions and for short periods only. For further information see at Fluids and filtering section.

Temperature ranges:
The operating temperature of the oil must be within -25ºC ÷ 115ºC [-13ºF ÷ 239ºF]. The running of the unit with oil temperature higher than 115ºC [239°F] or lower than -25ºC [-13°F] is not allowed. For further information see at Fluids and filtering section

Filtering:
A correct filtering helps to extend the service life of axial piston units. In order to ensure a correct functioning of the unit, the max. permissible contamination class is 21/19/16 according to ISO 4406:1999. For further details see at Fluids and filtration section.

Operating pressure:
The maximum permissible pressure on pressure ports is 430 bar [6235 psi] continuous and 480 bar [6960 psi] peak. It two motors are connected in series, total pressure has to be limited to following values: P1+P2 700 bar max. [10150 psi max].

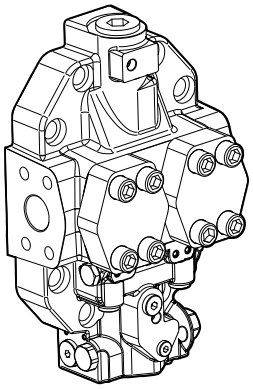


Case drain pressure:
Maximum permissible case drain pressure is 10 bar [145 psi]. A higher pressure can damage the main shaft seal or reduce its life.

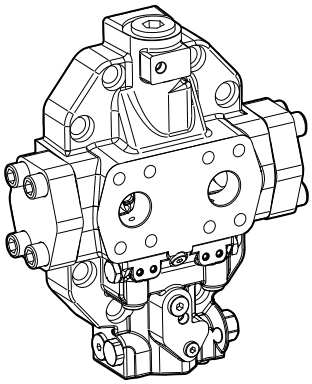
Seals:
Seals used on standard SH9V series axial piston motors are of FKM seals (Fluoroelastomer - Viton®). In case of use of use special fluids, contact Dana.

Minimum rotating speed:
Under “minimum rotating speed” we mean the minimum speed ensuring a smooth running of the piston unit. Operation smoothness at low speeds depends on many factors, as type of load and operating pressure. This unit offers consistent advantages at very low speeds. For special applications please contact Dana.

Port plates:
The SH9V motor port plate has inlet and outlet ports, both lateral (LM-LS cover) and frontal (FM-FS cover). Unused ports are plugged with blind flanges. The kind of ports to be used must be specified when ordering.

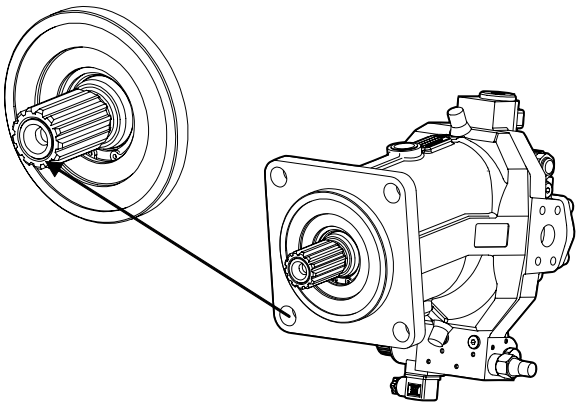


LM-LS Port plate



FM-FS Port plate

Unit identification:
The SH9V motors compared to SH7V motors can be regognized by an identification mark on the topo of the shaft.



Flushing valve:
The motors can be equipped with built in flushing valve for closed circuit operation.

Installation:
The motors can be installed in every position or direction. These axial piston units have separate ports and drain chambers and so must be always drained. Installation of the unit with shaft in vertical position and above the tank involves some limitations. For further details see at General installation guidelines

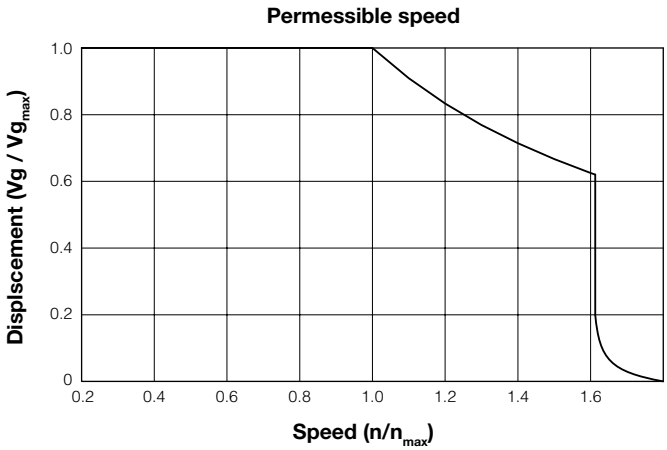
Technical data

			Size		
			085	115	215
Max. Displacement	**Vg**	cm^3/rev [in^3/rev]	85.3 [5.203]	115.7 [7.05]	216 [13.176]
Min. Displacement	**Vg_{min}**	cm^3/rev [in^3/rev]	40 [2.44]	56 [3.416]	108 [6.59]
Displacement minimum possible	**Vg_{min}**	cm^3/rev [in^3/rev]	17 [1.03]	23 [1.403]	43 [2.62]
Displacement Optional	**Vg_{o}**	cm^3/rev [in^3/rev]	0 [0]	0 [0]	0 [0]
Max. Press. cont.	**p_{nom}**	bar [psi]	430 [6235]	430 [6235]	430 [6235]
Max. Press. peak	**p_{max}**	bar [psi]	480 [6960]	480 [6960]	480 [6960]
Max. flow	**q_{max}**	l/min [U.S.gpm]	341 [90.02]	411 [108.5]	627 [165.63]
Max. speed at Vg_{max} and q_{max}	**$n_{0\ max}$**	rpm	4000	3550	2900
Max. speed at $Vg<Vg_{max}$ (2)	**$n_{0\ max\ lim}$**	rpm	6150	5600	4600
Max. speed at Vg_0	**$n_{0\ max\ lim}$**	rpm	7350	6300	5100
Torque constant Vg_{max}	**T_k**	Nm/bar [lbf.ft/psi]	1.36 [0.05]	1.84 [0.07]	3.44 [0.17]
Max power at q_{max} and p_{nom}	**P_{max}**	kW [hp]	244 [326.9]	295 [395.3]	449 [602.1]
Max. torque cont. at p_{nom}	**T_{nom}**	Nm [lbf.ft]	584 [430.4]	792 [583.7]	1480 [1091.6]
Max torque peak at p_{max}	**T_{max}**	Nm [lbf.ft]	652 [480.5]	884 [651.5]	1652 [1218.4]
Moment of inertia	**J**	$kg·m^2$ [$lbf.ft^2$]	0.009 [0.22]	0.0124 [0.31]	0.035 [0.829]
Weight (3)	**m**	kg [lbs]	36 [79.3]	47 [103.6]	82 [180.7]
Drain flow (4)	**q_d**	l/min [U.S.gpm]	4 [1.05]	5 [1.32]	5 [1.32]

(Theorical values, without considering η_{hm} and η_v; approximate values). Peak operations must not excide 1% of every minute. Avoid continuously working at simultaneusly maximum pressure and maximum speed.

Notes:

(1) Maximum and minimum displacement can be changed with continuity. When ordering state Vg_{max} and Vg_{min} required.
(2) Determination of admissible speed n_{max} value can be increased by reducing motor maximum displacement. To determine the relationship beetwen Vg_{max} and nmax use the right side chart. Motor maximum admissible speed is $n_{max\ lim}$.
(3) Approximate values.
(4) Maximum value at 250 bar [3625 psi] with mineral oil at 45ºC [113°F] and 35 cSt of viscosity.



Ordering code

The following alphanumeric codes system has been developed to identify all of the configuration options for the SH11C motors. Use the model code below to specify the desired features.
All alphanumeric digits system of the code must be present when ordering.
We advise to carefully read the catalogue before filling the ordering code.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Series	Motor	Size	Maximum displacement limitation	Minimum displacement limitation	Mount flange	Shaft end	Port cover	Seal	Control	Control specification	Valve	Flanged valves features	Flushing valve	Serie feature	Painting
SH9V	M	085	85	17	OD	S19	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

1

Series	
SH9V	Variable displacement axial piston motor for open and closed circuit

2

Motor	
M	Motor

3

Size	
085	85.3 cm³/rev [5.203 in³/rev]
115	115.7 cm³/rev [7.05 in³/rev]
215	216 cm³/rev [13.176 in³/rev]

4

Maximum displacement limitation			Size		
			085	115	215
85÷68	From 85 cm³/rev [5.185 in³/rev] to 68 cm³/rev [4.148 in³/rev]	Standard 85 cm³/rev [5.185 in³/rev]	●	–	–
115÷091	From 115 cm³/rev [7.015 in³/rev] to 91 cm³/rev [5.551 in³/rev]	Standard 115 cm³/rev [7.015 in³/rev]	–	●	–
216÷172	From 216 cm³/rev [13.176 in³/rev] to 172 cm³/rev [10.492 in³/rev]	Standard 216 cm³/rev [13.176 in³/rev]	–	–	●

● Required
– Not required

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH9V	M	085	85	17	OD	S19	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

5

Minimum displacement limitation			Size 085	115	215
0	0 cm³/rev		●	●	●
17÷56	From 17 cm³/rev [1.037 in³/rev] to 56 cm³/rev [3.416 in³/rev]	Standard 40 cm³/rev [2.440 in³/rev]	●	–	–
23÷80	From 23 cm³/rev [1.403 in³/rev] to 80 cm³/rev [4.880 in³/rev]	Standard 56 cm³/rev [3.416 in³/rev]	–	●	–
43÷108	From 43 cm³/rev [2.623 in³/rev] to 108 cm³/rev [6.588 in³/rev]	Standard 108 cm³/rev [6.588 in³/rev]	–	–	●

● Required
– Not required

6

Mount flange		Size 085	115	215
OD	ISO 4 Bolts Ø 140 mm [Ø 5.511 in]	●	–	–
OE	ISO 4 Bolts Ø 160 mm [Ø 6.299 in]	–	●	–
OG	ISO 4 Bolts Ø 200 mm [Ø 7.874 in]	–	–	●
05	SAE-C 4 Bolts	●	–	–
08	SAE-D 4 Bolts	–	●	–
10	SAE-E 4 Bolts	–	–	●

● Available
– Not available

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH9V	M	085	85	17	OD	S19	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

7

Shaft end		Size 085	115	215
S19	Splined 15T - 8/16 DP	–	–	●
S15	Splined 13T - 8/16 DP	–	●	–
S12	Splined 14T - 12/24 DP	●	–	–
SAR	Splined W50x2x30x24 - DIN 5480	–	–	●
SAP	Splined W45x2x30x21 - DIN 5480	–	●	–
SAO	Splined W40x2x30x18 - DIN 5480	●	●	–
SAM	Splined W35x2x30x16 - DIN 5480	●	–	–
C18	Parallel keyed Ø 44.45 mm [1.75 in]	–	–	●
CAX	Parallel keyed Ø 50 mm k6 [1.97 in k6]	–	–	●

● Available
– Not available

8

Port cover		Size 085	115	215
FM	Metric End Main ports	●	●	●
FS	SAE End Main ports	●	●	●
LM	Metric Main Ports positioned 180° apart	●	●	●
LS	SAE Main Ports positioned 180° apart	●	●	●

● Available
– Not available

Warning
Metric Ports (FM-LM) means both main ports and control ports
SAE Ports (FS-LS) means both main ports and control ports

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH9V	M	085	85	17	OD	S19	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

9

Seal	
V	FKM

10

Control	
2EE	Electric two positions control with pressure override
2EN	Electric two positions control
2IE	Hydraulic two positions control with pressure override
2IN	Hydraulic two positions control
REE	Electric proportional control with pressure override
RED	Electric proportional control with double step pressure override
REN	Electric proportional control
RIE	Hydraulic proportional control with pressure override
RID	Hydraulic proportional control with double step pressure override
RIN	Hydraulic proportional control
RPE	Working pressure control
RPI	Working pressure control with hidraulic override
RPS	Working perssure control with electric override
ROE	Working pressure control Δp 100 bar
ROI	Working pressure control Δp 100 bar with hidraulic override
ROS	Working pressure control Δp 100 bar with electric override

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH9V	M	085	85	17	OD	S19	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

11

Control specification			Control (Chosen)														
			RPE	ROE	2EE	2EN	2IE	2IN	REE	RED (1)	REN	RID (1)	RIE	RIN	RPI	ROI	ROS	RPS
Displacemet setting	1	From Max. Displac. to Min. Displac. ($Vg_{max} \rightarrow Vg_{min}$)	–	–	●	●	●	●	●	●	●	●	●	●	–	–	–	–
	2	From Min. Displac. to Max. Displac. ($Vg_{min} \rightarrow Vg_{max}$)	●	●	–	●	–	●	–	–	●	–	–	●	●	●	●	●
None	00		–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–
Pressure Setting (*)	(*)	100÷400 bar [1430÷5802 psi]	●	–	●	–	●	–	●	●	–	●	●	–	●	–	–	–
		100÷350 bar [1430÷5076 psi]	–	●	–	–	–	–	–	–	–	–	–	–	–	●	●	●
Start of control, Setting range (*)	(*)	5-10-15-20 bar [72-145-218-290 psi]	–	–	–	–	–	–	–	–	–	●	●	●	–	–	–	–
Δp Displacement change	(*)	25 bar [363 psi]	–	–	–	–	–	–	–	–	–	●	●	●	–	–	–	–
Voltage	12	12 - Connector DIN43650	–	–	●	●	–	–	●	●	●	–	–	–	–	–	●	●
	24	24 - Connector DIN43650	–	–	●	●	–	–	●	●	●	–	–	–	–	–	●	●
	D2	12 - Deutsch DT04	–	–	●	●	–	–	●	–	●	–	–	–	–	–	●	●
	D4	24 - Deutsch DT04	–	–	●	●	–	–	●	–	●	–	–	–	–	–	●	●
	A2	12 V - ATEX T6 (Solo 55 2EN)	–	–	–	●	–	–	–	–	●	–	–	–	–	–	–	–
	A4	24 V - ATEX T6 (Solo 55 2EN)	–	–	–	●	–	–	–	–	●	–	–	–	–	–	–	–
Control orifice (**)	04	With Ø 0.4 mm [Ø 0.015 in] Control Orifice	●	–	●	●	●	●	–	–	–	–	–	–	–	–	–	–
	05	With Ø 0.5 mm [Ø 0.0196 in] Control Orifice	–	●	–	–	–	–	●	●	●	●	●	●	●	●	●	●
	07	With Ø 0.7 mm [Ø 0.027 in] Control Orifice	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Specify for each control, all the required values for the chosen control.

● Available
– Not available

(1) Specify Pressure Setting values for Step 1 and Step 2 (Step1<Step2)
(*) Supply the setting value
(**) 0.4 mm [Ø 0.015 in] (standard) nozzle, provides a smooth control response (max-to-min and min-to-max), while Ø 0.5-0.7 mm [Ø 0.0196-0.027 in] (optional) nozzle, provides a faster reaction.

Warning:
The values showed are only valid in maximum and minimum displacement conditions of the respective displacement.
For different values, verify the possibility with the control diagrams present on the catalogue.

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH9V	M	085	85	17	OD	S19	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

12

Valve		Size 085	115	215
XXXX	None	●	●	●
VCD1	VCD/1 Pilot assisted overcentre valve	LM	LM	LM
VCD2	VCD/2 Pilot assisted overcentre valve	LM	LM	LM
VCR4	VCR4 double acting overcentre valve	FM	FM	–

● Available
– Not available

The valves are available with ISO port cover only, please contact Technical department for SAE version
The LM - FM digit means that the valve is only available with LM - FM port cover.

13

Flanged valves features		Valve XXXX	VCD1	VCD2	VCR2	VCR4
000	Feature not necessary	●	–	–	–	–
002	Not Set 0÷350 bar [0 to 5075 psi][Piloting ratio 2.9:1] - Control of rotation CW	–	●	–	–	–
006	Not Set 0÷350 bar [0 to 5075 psi][Piloting ratio 2.9:1] - Control of rotation CCW	–	●	–	–	–
003	Not Set 250÷500 bar [3625 to 7250 psi][Piloting ratio 13:1] - Control of rotation CW	–	–	●	–	–
007	Not Set 250÷500 bar [3625 to 7250 psi] [Piloting ratio 13:1] - Control of rotation CCW	–	–	●	–	–
010	Not Set - Aluminum 60÷350 bar [870 to 5075 psi] [Piloting ratio 6.2:1]	–	–	–	●	–
013	Not Set 140÷350 bar [2030 to 5075 psi] [Piloting ratio 4.5:1]	–	–	–	–	●

● Available
– Not available

Please contact Technical department for valve which requie specific setting.
For the feature see catalogue valves.

14

Flushing valve		Size 085	115	215
PR	Arranged for Flushing Valve	●	●	●
06	VSC/F Flushing valve - 6 l/min [1.58 U.S. gpm]	●	●	●
09	VSC/F Flushing valve - 10.5 l/min [2.77 U.S. gpm]	●	●	●
15	VSC/F Flushing valve - 15 l/min [3.96 U.S. gpm]	●	●	●
21	VSC/F Flushing valve - 20 l/min [5.28 U.S. gpm]	–	●	●

Ordering code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SH9V	M	085	85	17	OD	S19	FM	V	RPE	2 100 04	XXXX	000	PR	XX	XX

15

Serie feature		Size 085	115	215
XX	None	●	●	●
TW	Tachometer + sensor 2-Channel Differential Hall effect PNP - 5V	●	●	●
TZ	Tachometer + sensor 2-Channel Differential-Hall effect	●	●	●

● Available
– Not available

16

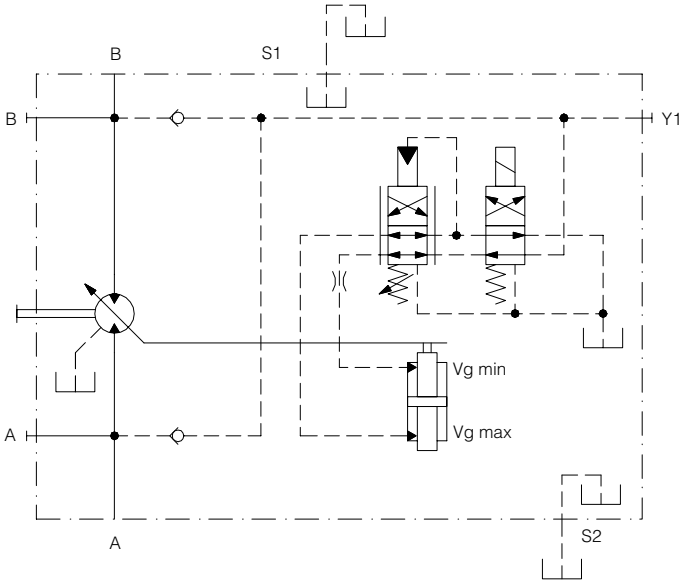
Painting	
XX	Not Required
01	Black Painted RAL 9005
02	Blue Painted RAL 5015

Electric two positions control with pressure override 2EE

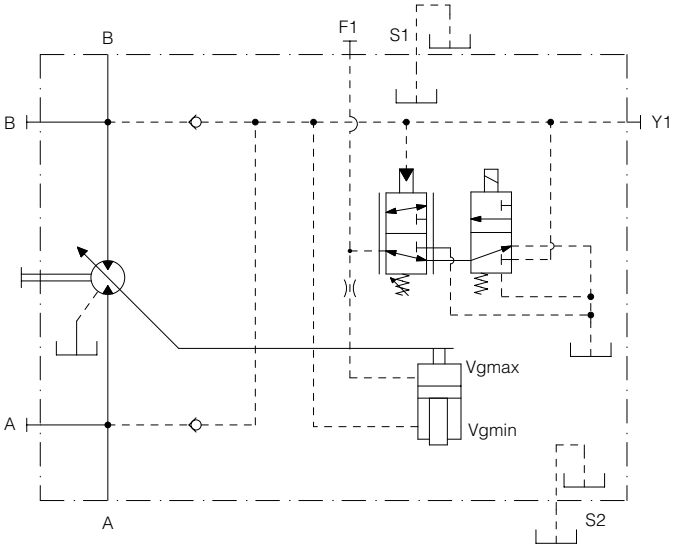
The 2EE control version with the pressure override allows the motor to swivel to $V_{g\,max}$ when the pressure setting is reached. Same as '2EN' control, when solenoid valve is switched off the motor is at $V_{g\,max}$. The motor displacement is adjusted to $V_{g\,min}$ when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to $V_{g\,max}$. Swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

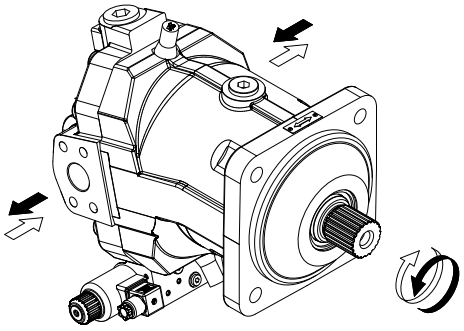
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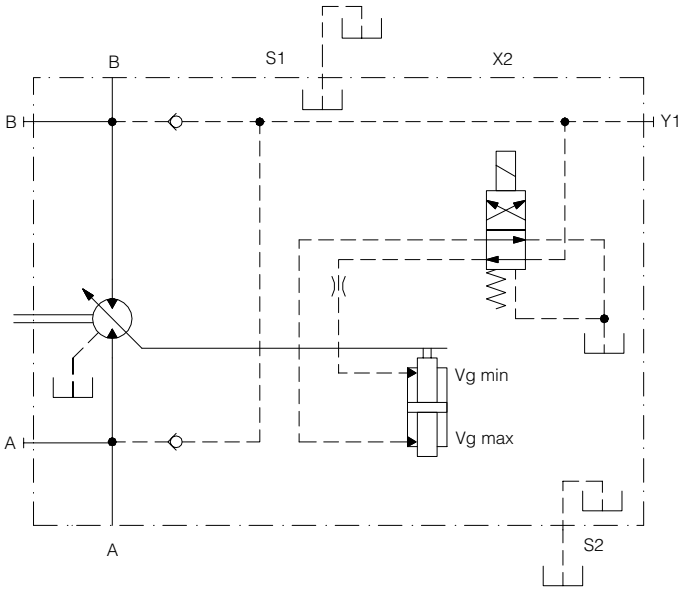
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



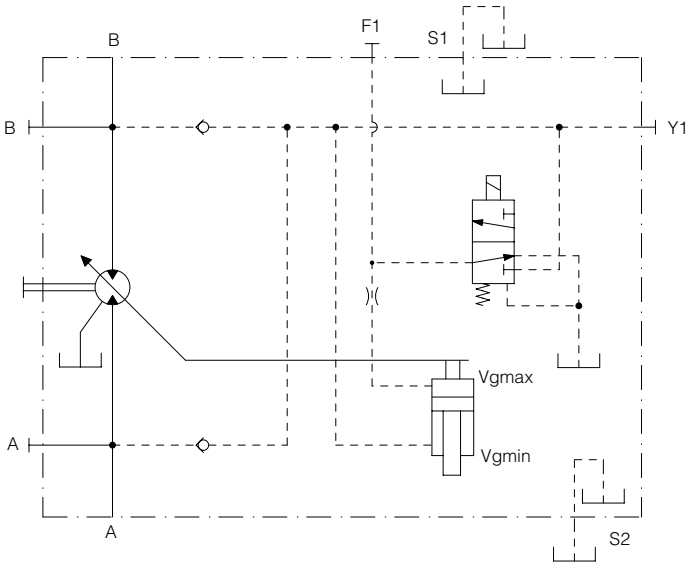
The electric two positions control allows the displacement of the motor to be set to $V_{g\,max}$ or $V_{g\,min}$ by switching an ON/OFF solenoid valve. The feed back spring is missing so $V_{g\,max}$ or $V_{g\,min}$ only can be set. 12V DC and 24V DC ON/OFF solenoid are available. The swivel range is 1 (from $V_{g\,max}$ to $V_{g\,min}$) or 2 (swivel range from $V_{g\,min}$ to $V_{g\,max}$).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

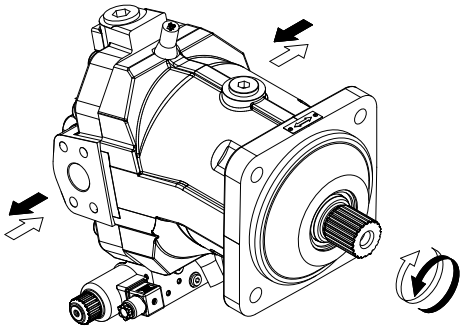
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215



The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

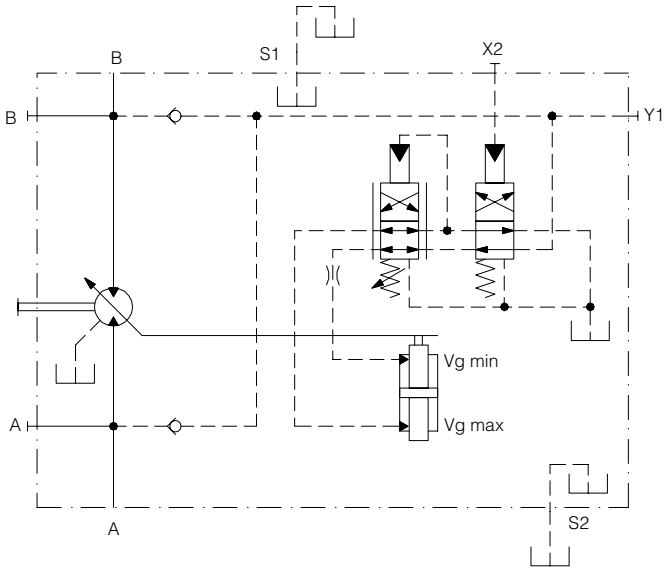


Hydraulic two positions control with pressure override 2IE

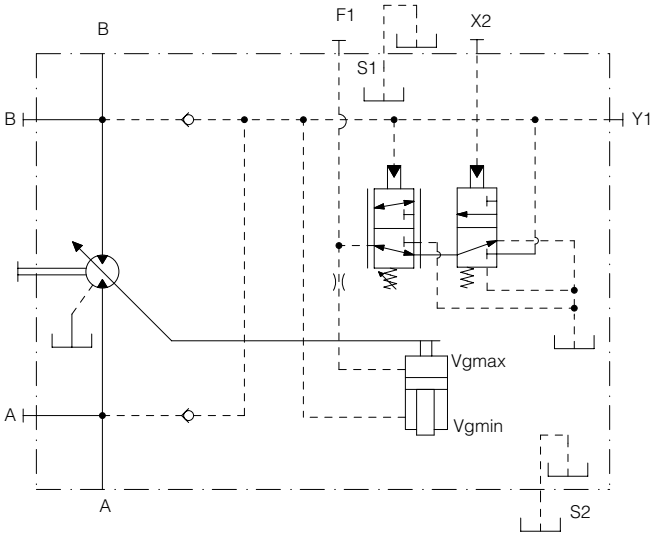
The 2IE control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as 2IN control, the motor displacement is adjusted to $V_{g\ min}$ when the pilot pressure applied at port X2. Minimum required pilot pressure = 10 bar [145 psi] and maximum permissible pressure at port X2=100 bar [1450 psi]. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

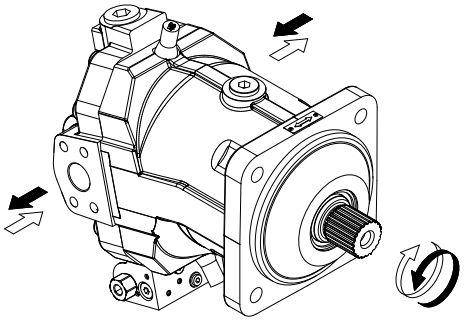
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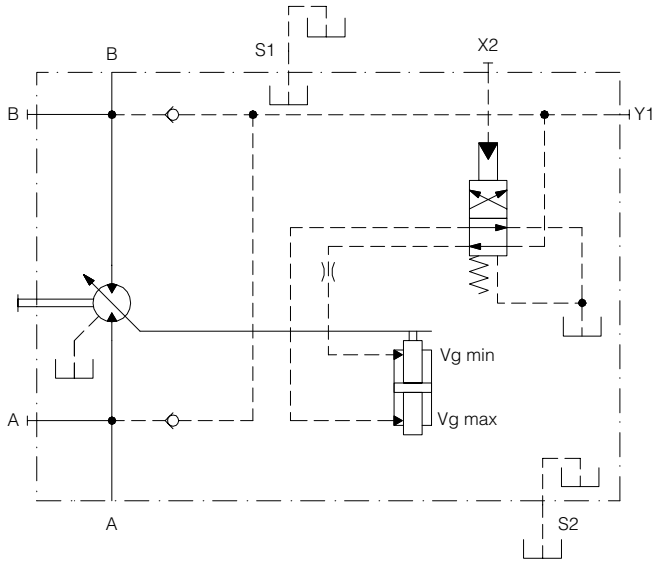
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



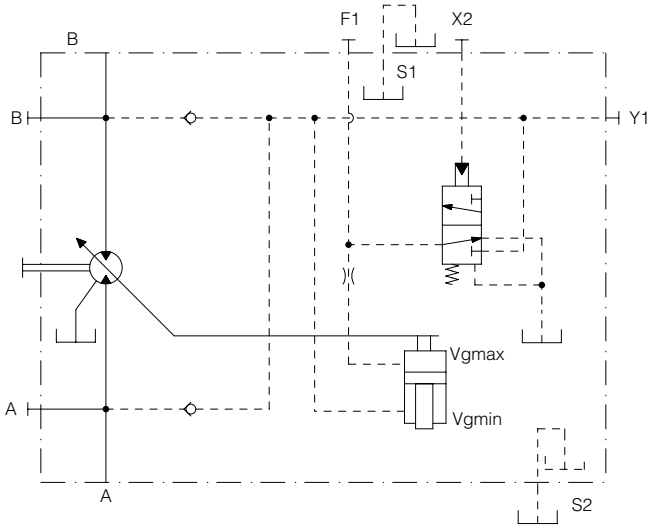
The hydraulic two positions control allows the displacement of the motor to be set to Vgmax or Vgmin by applying or not a pilot pressure at port X2. The feed back spring is missing so Vgmax or Vgmin only can be set. Minimum required pilot pressure = 10 bar [145 psi] and maximum permissible pressure at port X2=100 bar [1450 psi]. The swivel range is 1 (from Vgmax to Vgmin) or 2 (swivel range from Vgmin to Vgmax).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

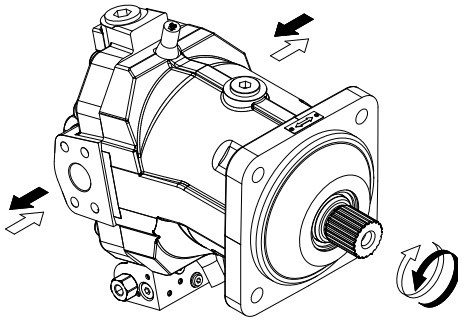
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The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



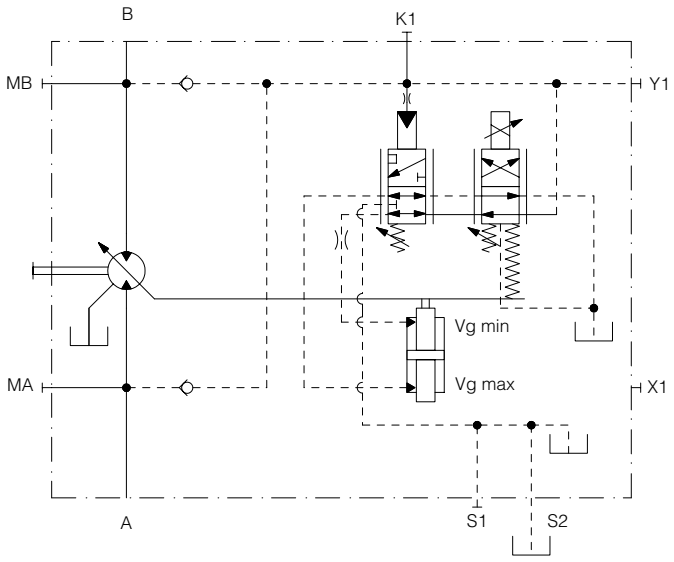
Electric proportional control with pressure override

REE

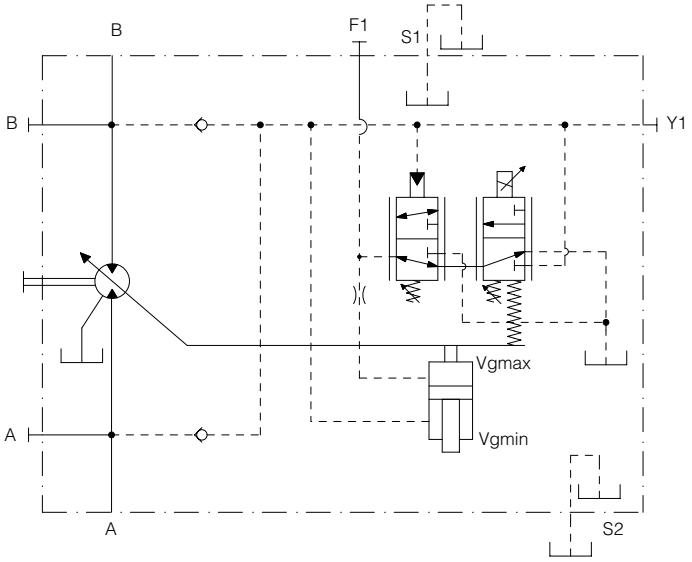
The REE control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as REN control, when solenoid valve is switched off the motor is at $V_{g\ max}$. The proportional solenoid valve is available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The motor displacement is adjusted to $V_{g\ min}$ when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

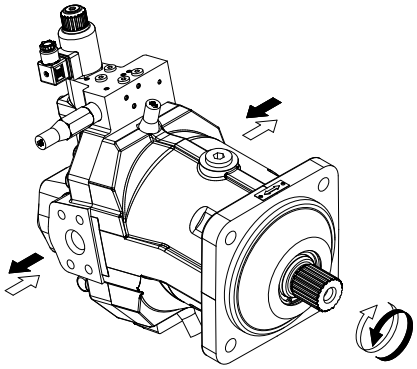
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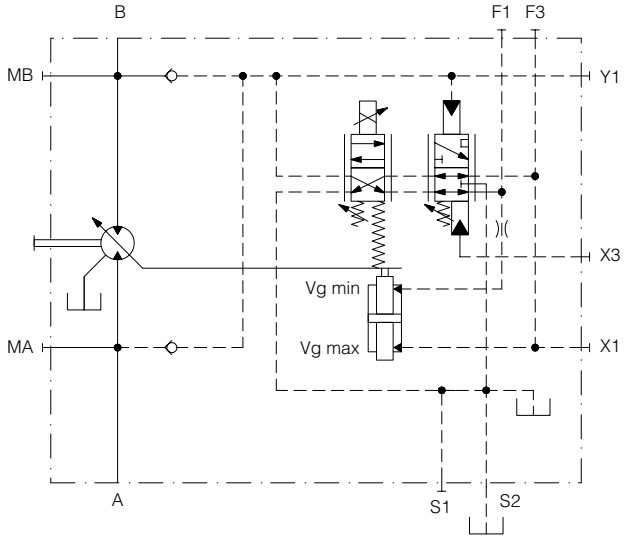
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



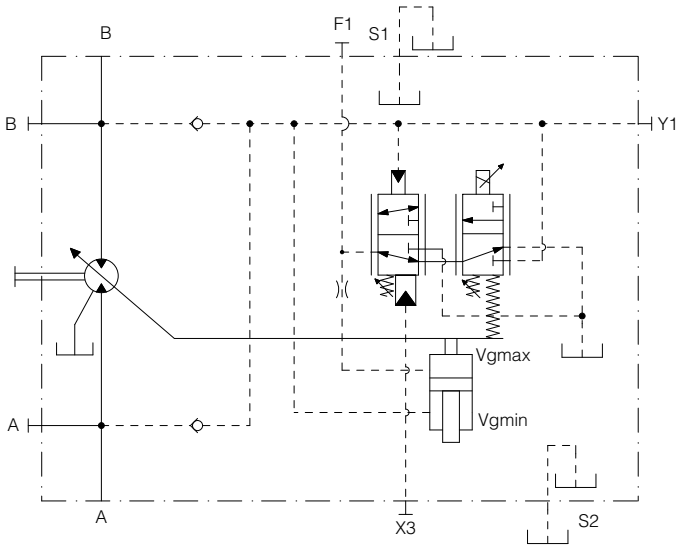
The RED control version with the pressure override allows the motor to swivel to Vgmax when the pressure setting is reached. Same as REN control, when solenoid valve is switched off the motor is at $V_{g\,max}$. The proportional solenoid valve is available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The motor displacement is adjusted to $V_{g\,min}$ when the solenoid valve is switched on and if the operating pressure rises beyond the pressure setting, the pressure limiting device overrides the electric two positions control and the motor swivels out to $V_{g\,max}$. Swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting 1 per our ordering code). Applying a pressure to port X3, the setting of PE control can be overridden by a different value of pressure.
Setting range from 16 bar [232 psi] to 64 bar [928 psi] around.

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

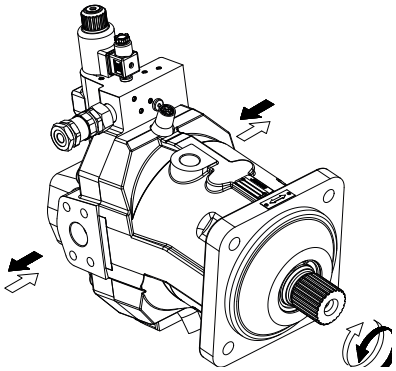
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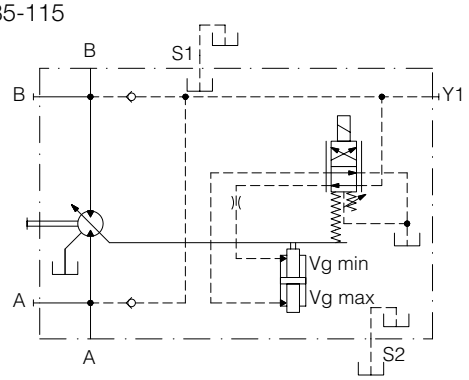
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

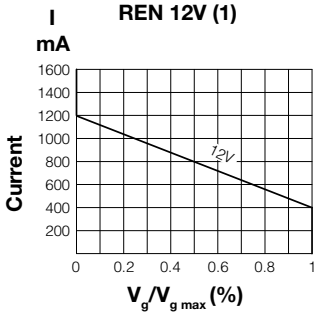


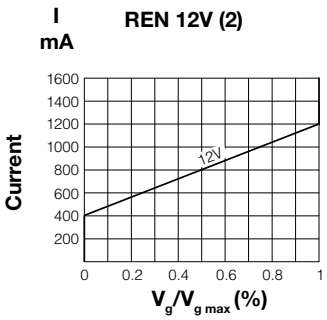
The electrical proportional control allows stepless and programmable adjustment of the motor displacement proportionally to the current strength supplied to a proportional solenoid valve available in 12V DC and 24V DC version and with connector DIN 43650 o DEUTSCH. The proportional solenoid valve applies a force on the spool proportional to the current strength and the motor swivels until a force balance is restored by a feed-back spring. To control the proportional solenoid valve a 24V DC (12V DC) supply is required. Current range between 200 (400) and 600 (1200) mA approx. (with standard setting of Max and Min displacement). Max permissible current = 800 (1600) mA. Usually the swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting type 1 as per our ordering code) so that increasing the current strength the motor swivels towards $V_{g\,min}$, however displacement setting type 2 (swivels range from $V_{g\,min}$ to $V_{g\,max}$) is also available. The electronic devices are available to control the solenoid (they must be ordered separately).

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

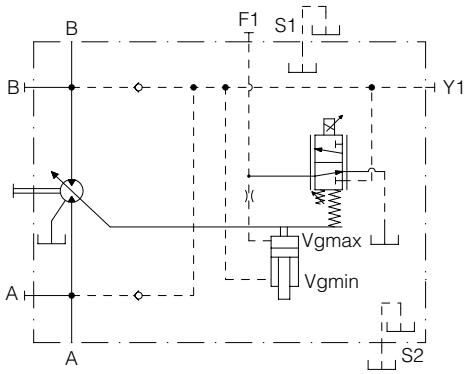
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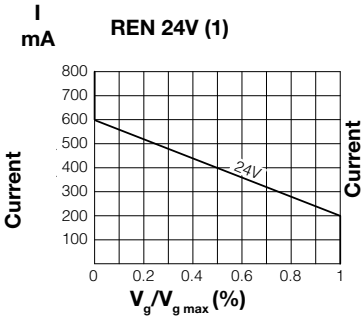


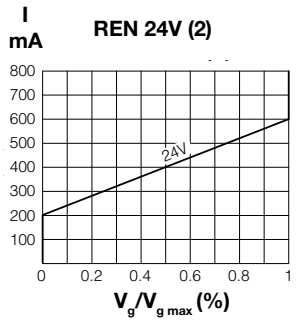




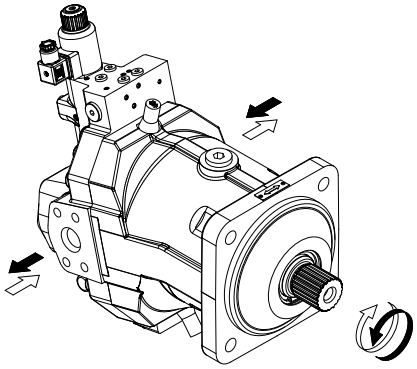
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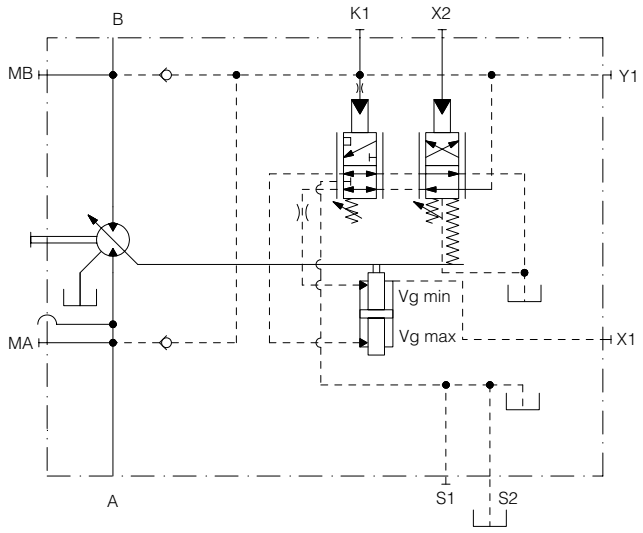
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



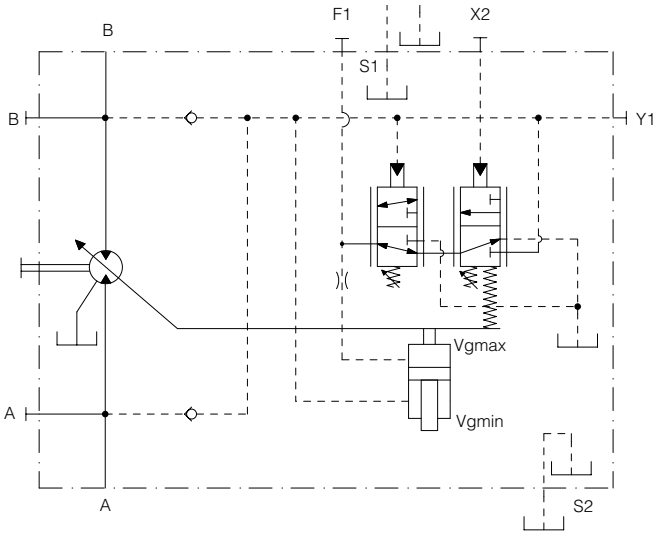
The RIE control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as RIN control, the motor displacement is adjusted to $V_{g\ min}$ when the pilot pressure applied at port X2. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code).
Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

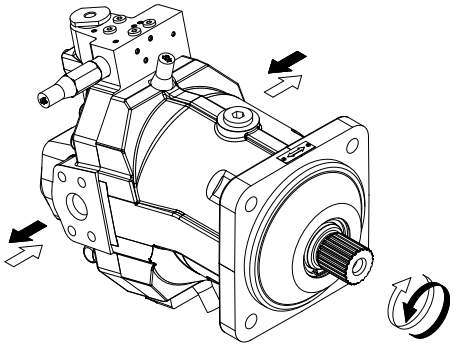
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The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

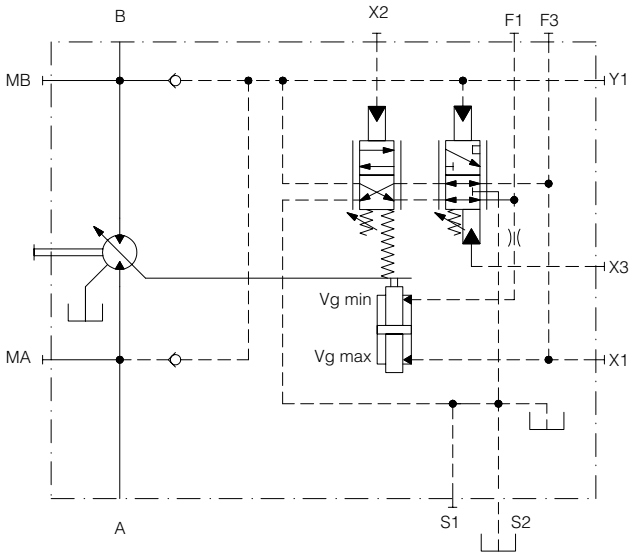


Hydraulic proportional control with double step pressure override RID

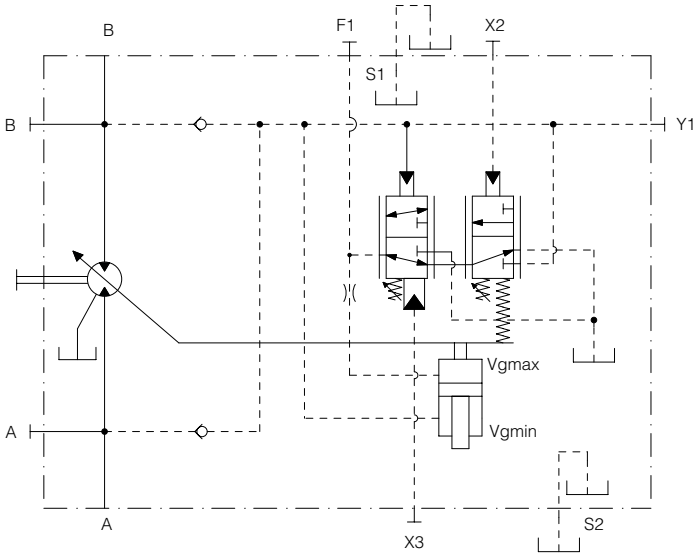
The RID control version with the pressure override allows the motor to swivel to $V_{g\ max}$ when the pressure setting is reached. Same as RIN control, the motor displacement is adjusted to $V_{g\ min}$ when the pilot pressure applied at port X2. If the operating pressure rises beyond the pressure setting, the pressure limiting device the motor swivels out to $V_{g\ max}$. Swivel range is from $V_{g\ max}$ to $V_{g\ min}$ (displacement setting 1 per our ordering code).
Applying a pressure to port X3, the setting of PE control can be overridden by a different value of pressure.
Setting range from 16 bar [232 psi] to 64 bar [928 psi] around. Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

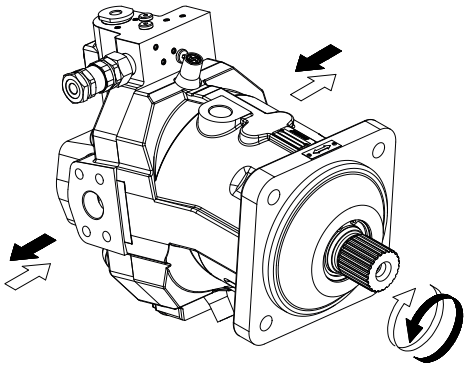
Size:
085-115



Size:
215



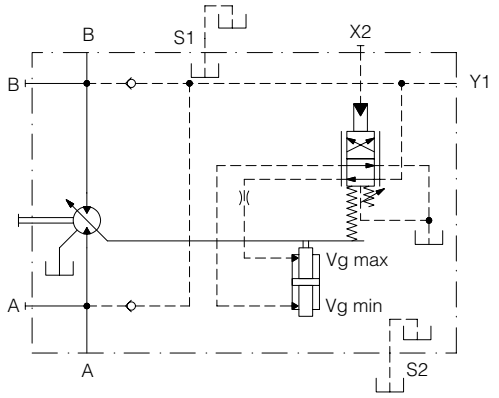
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

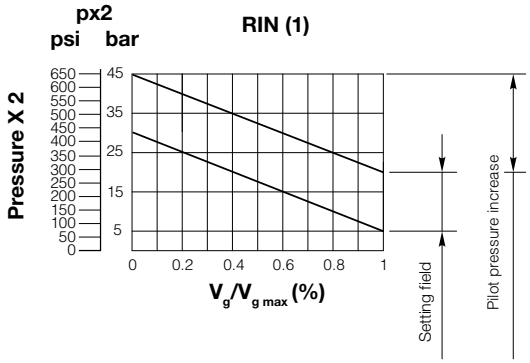


The hydraulic proportional control allows a stepless adjustment of the motor displacement proportionally to the pilot pressure applied at port X2. The pilot pressure applies a force on the spool and the motor swivels until a force balance on the arm is stored by feed back spring. Therefore the motor displacement is adjusted in direct proportion with the pilot pressure. Usually the swivel range is from $V_{g\,max}$ to $V_{g\,min}$ (displacement setting type 1 as per our ordering code) so that increasing the pilot pressure the motor swivels towards $V_{g\,min}$, however, displacement setting type 2 (swivel range from $V_{g\,min}$ to $V_{g\,max}$) is also available. Start of control, Setting range from 5 bar [72.5 psi] to 20 bar [290 psi] around. Pilot pressure range 25 bar [362.5 psi]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].

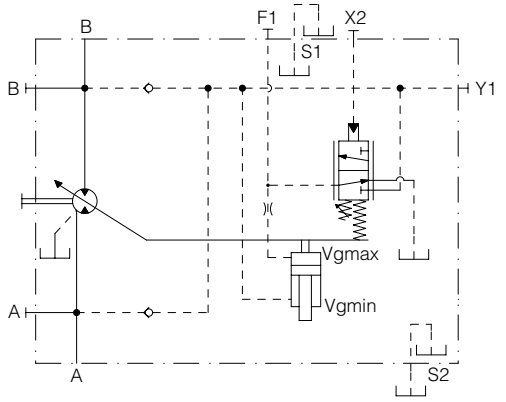
Note:
For reliable control, an operating pressure of at least 20 bar [290 psi], is necessary at port A (B). If in the application this pressure is not guaranteed, an auxiliary pressure of 20 bar [290 psi] is to be applied at port Y1.

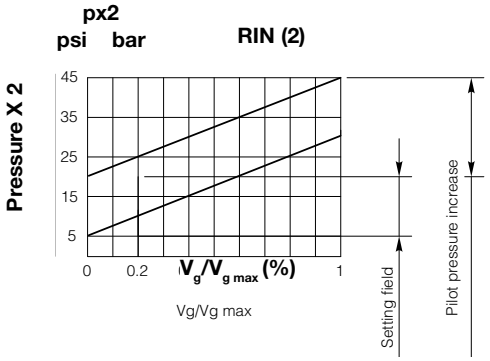
Size:
085-115



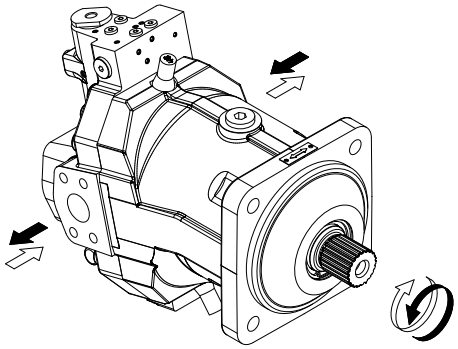


Size:
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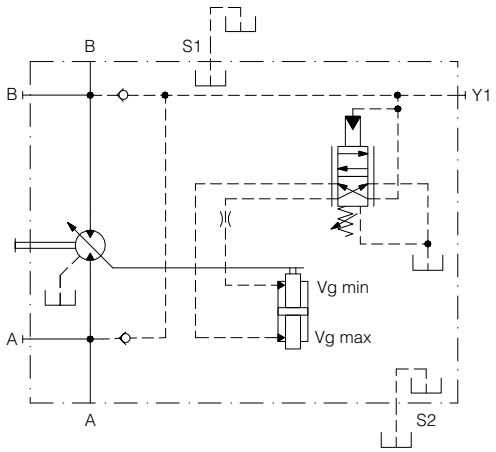
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

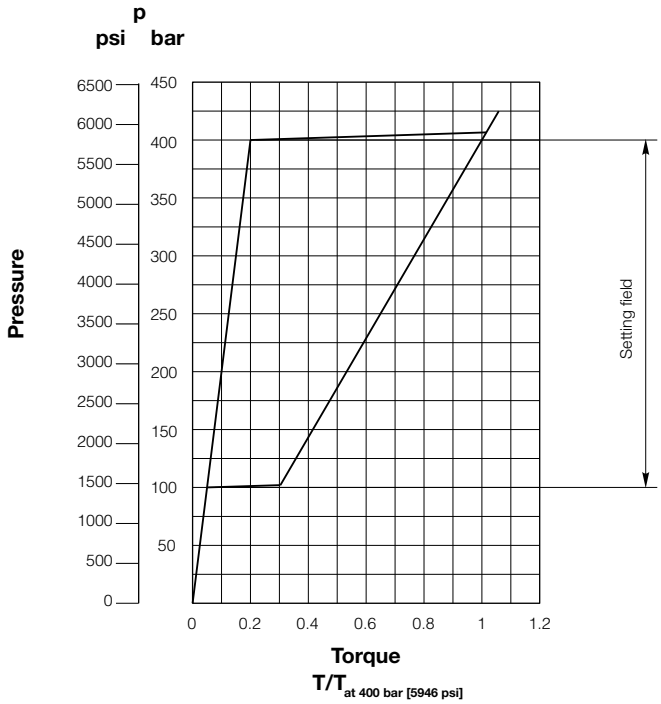


The working pressure control allows to swivel the motor displacement from $V_{g\,min}$ to $V_{g\,max}$ when the operating pressure rises beyond the preset operating pressure, so that the motor is at $V_{g\,min}$ when min torque and max speed are required and at $V_{g\,max}$ when max torque and min speed are required. The operating pressure applies a force on the spool which is matched by an adjustable spring. The motor keeps the Vgmin until the operating pressure reaches the setting value (pressure setting). Once the preset pressure rises beyond, the motor swivels from $V_{g\,min}$ to $V_{g\,max}$. The swivel range is from $V_{g\,min}$ to $V_{g\,max}$ (displacement setting type 2 as per our ordering code). Start of control adjustable between 100 and 400 bar [1450 and 5800 psi].

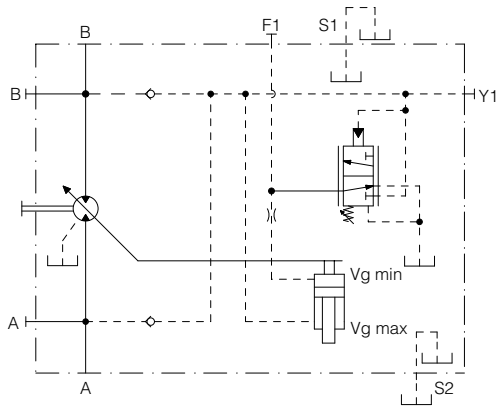
When ordering please clearly state:
Control pressure setting.

Size:
085 - 115

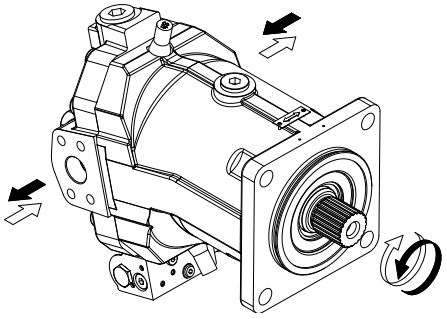




Size:
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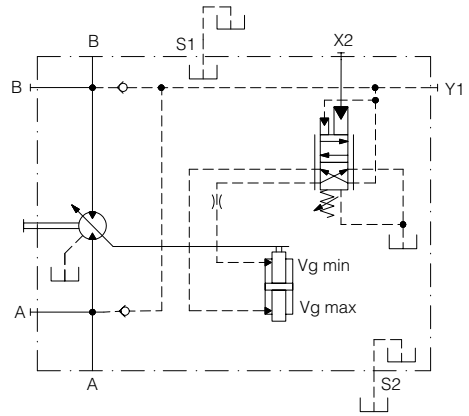
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

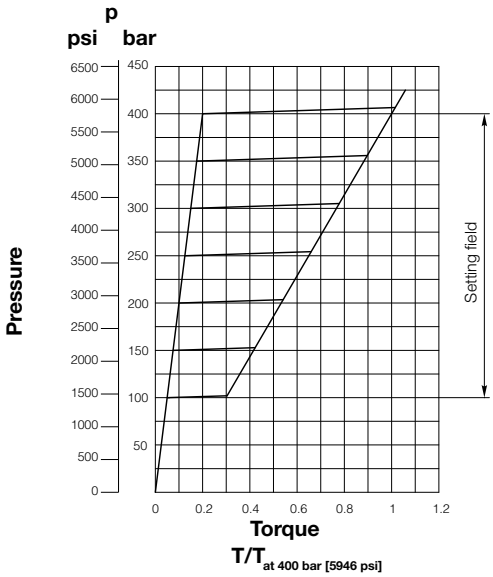


The hydraulic limiting device makes possible to reduce the pressure setting of RPE control by means of an external pilot pressure applied at port X2. The RPE control pressure setting is reduced proportionally to the pilot pressure in the ratio of 1/17 (for each pilot pressure bar, the preset operating pressure is reduced of 17 bar) [170 psi each 10 psi of pilot pressure]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].
Example: preset operating pressure of RPE control = 300 bar [4350 psi]. By applying at port X2 a pilot pressure of 10 bar [145 psi] , the pressure setting comes to 130 bar [1885 psi] (300-(10x17)=130) (4350- (145X17)=1885). Should it be required to swivel the motor to $V_{g\,max}$ independently from the operating pressure, a pilot pressure of 20 bar [290 psi] should be applied at port X2. Swivel range from $V_{g\,min}$ to $V_{g\,max}$ (assembly type 2 as per our ordering code). Start of control adjustable between 100 and 400 bar [1450 and 5800 psi].

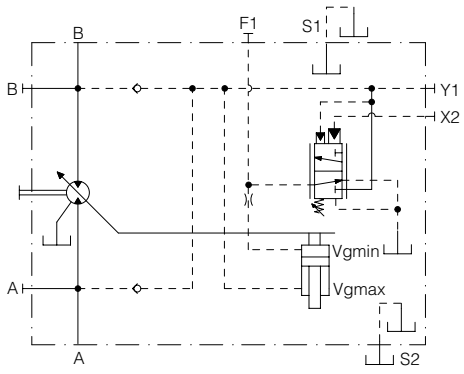
When ordering please clearly state:
Control pressure setting.

Size:
085 - 115

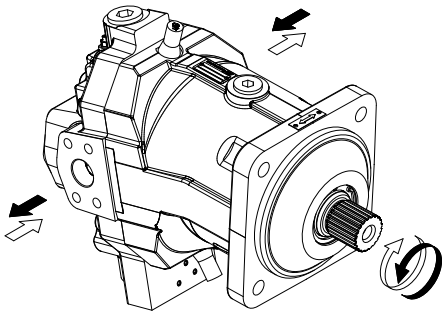




Size:
215



The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



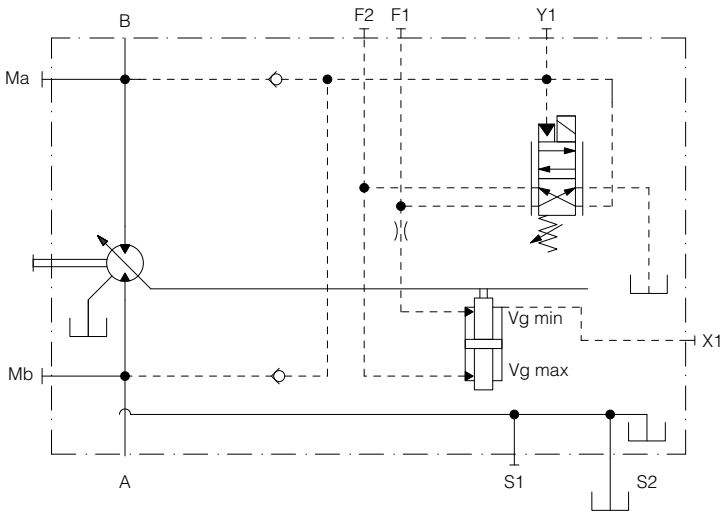
Working pressure control with electrical override

RPS

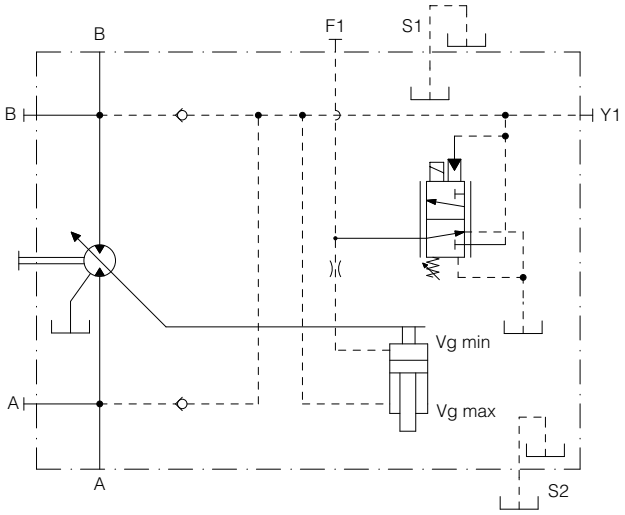
RPS control is a pressure related control which permits the changing of displacement $V_{g\ min}$ to $V_{g\ max}$ when working pressure exceeds setting threshold, so that the motor works at $V_{g\ min}$ when low torque and high speed are required and at $V_{g\ max}$ when high torque and low speed are required. The motor stands at $V_{g\ min}$ till working pressure reaches setting threshold.
Δp of working pressure that allows the changing of diaplacement from minimum to maximum is around 10 bar (such as RPE control).
This pressure related control can be overridden by an electrical signal; when solenoid is energized , the motor reaches maximum displacement without stopping in an intermediate position. Swivel range from $V_{g\ min}$ to $V_{g\ max}$ (assembly type 2 as per our ordering code).
Setting pressure range is 100-300 bar.

When ordering please clearly state:
Control pressure setting.

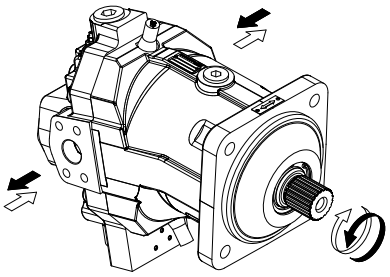
Size:
085 - 115



Size:
215



The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

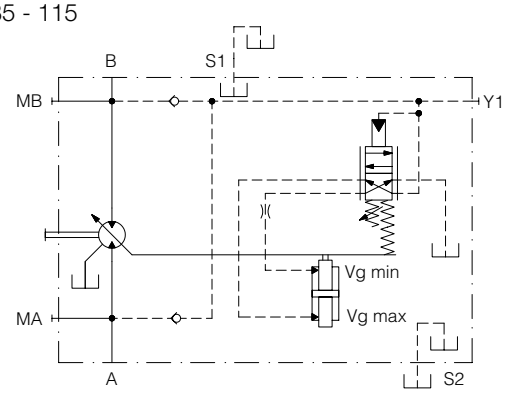


The “ROE” control allows a larger pressure range for displacement variation in comparison to “RPE” control. The increase of pressure range for variation from Vg_{min} to Vg_{max} allows a smoother working of the motor during displacement variation. The “ROE” allows the displacement variation with the pressure range show in the table.

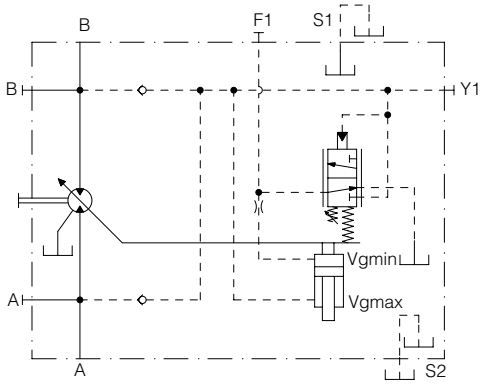
Δp bar [psi]	**P_{min}** bar [psi]	**P_{max}** bar [psi]
100 [1450]	100 [1450]	350 [5075]

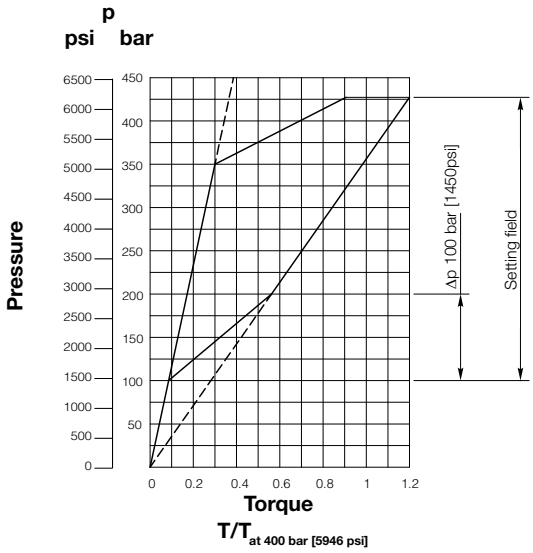
Where:
- Δp is the working pressure range that allows the displacement variation.
- P_{min} is the minimum pressure at which displacement variation starting can be set.
- P_{max} is the maximum pressure at which displacement variation starting can be set.

Size:
085 - 115



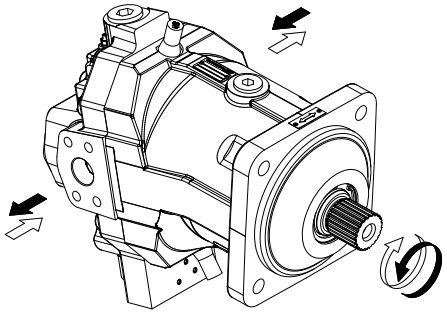
Size:
215





Warning:
in case of displacement limitation, the control shall vary of a reduced Δp with respect to its standard one. Please contact Dana for more info.

The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.

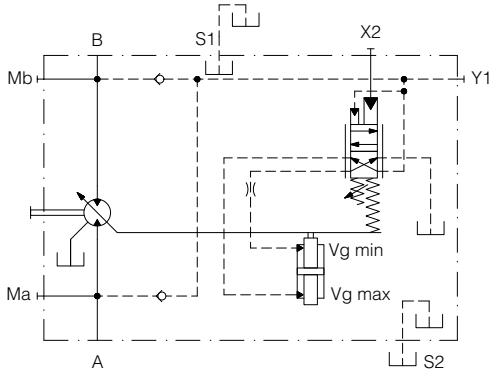


Working pressure control Δp 100 bar with hydraulic override

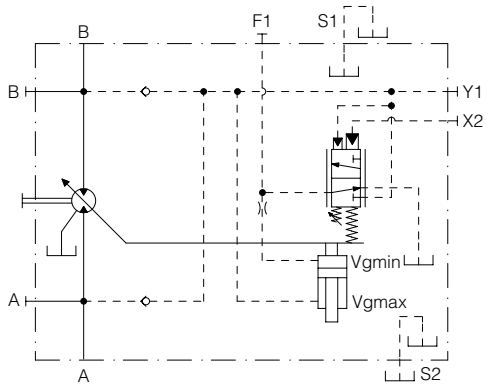
The hydraulic limiting device makes possible to reduce the pressure setting of ROE control by means of an external pilot pressure applied at port X2. The ROE control pressure setting is reduced proportionally to the pilot pressure in the ratio of 1/17 (for each pilot pressure bar, the preset operating pressure is reduced of 17 bar) [170 psi each 10 psi of pilot pressure]. Max permissible pilot pressure at port X2 = 100 bar [1450 psi].
Example: preset operating pressure of ROE control = 300 bar [4350 psi]. By applying at port X2 a pilot pressure of 10 bar [145 psi] , the pressure setting comes to 130 bar [1885 psi] (300-(10x17)=130) (4350- (145X17)=1885). Should it be required to swivel the motor to $V_{g\ max}$ independently from the operating pressure, a pilot pressure of 20 bar [290 psi] should be applied at port X2.
Swivel range from $V_{g\ min}$ to $V_{g\ max}$ (assembly type 2 as per our ordering code). Start of control adjustable between 100 and 350 bar [1450 and 5000 psi].

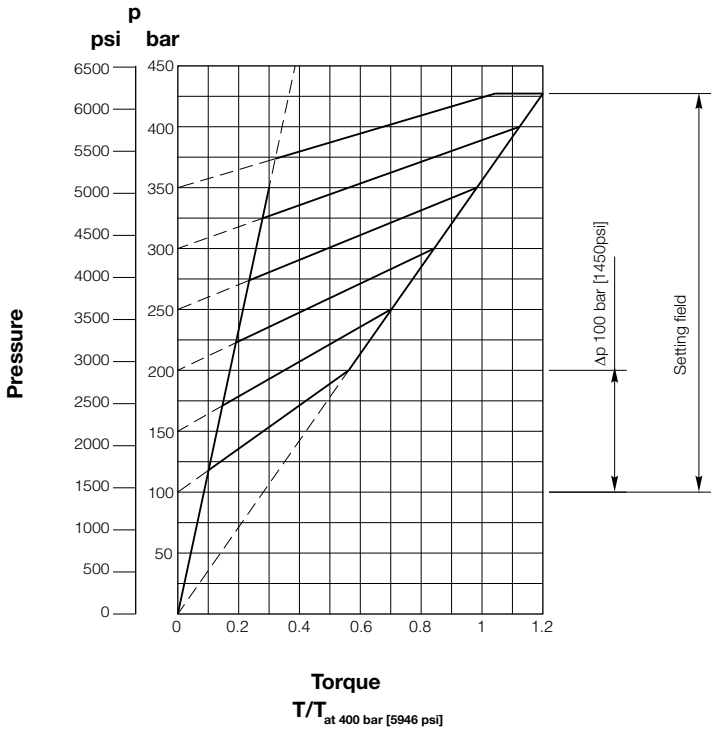
When ordering please clearly state:
Control pressure setting.

Size:
085 - 115

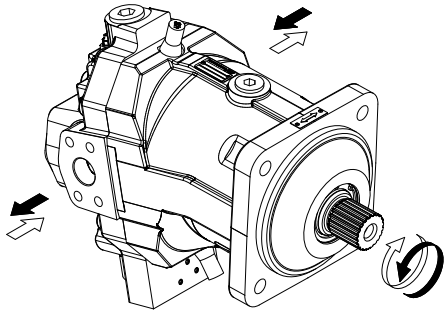


Size:
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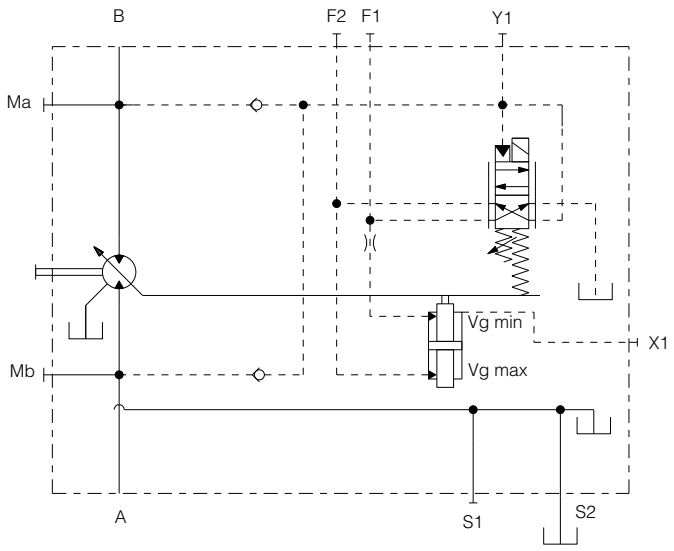
The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



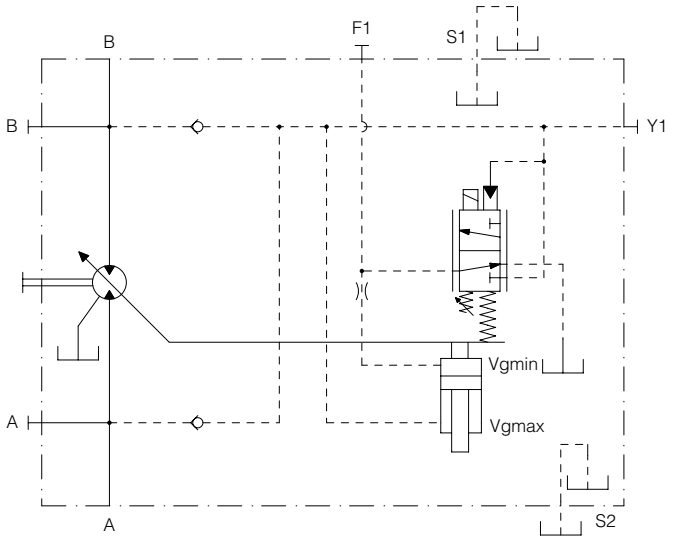
ROS control is a pressure related control which permits the changing of displacement $V_{g\,min}$ to $V_{g\,max}$ when working pressure exceeds setting threshold, so that the motor works at $V_{g\,min}$ when low torque and high speed are required and at $V_{g\,max}$ when high torque and low speed are required. The motor stands at $V_{g\,min}$ till working pressure reaches setting threshold. Δp of working pressure that allows the changing of diaplacement from minimum to maximum is 100 bar (such as ROE control).
This pressure related control can be overridden by an electrical signal; when solenoid is energized , the motor reaches maximum displacement without stopping in an intermediate position. Swivel range from $V_{g\,min}$ to $V_{g\,max}$ (assembly type 2 as per our ordering code).
Setting pressure range is 100-300 bar.

When ordering please clearly state:
Control pressure setting.

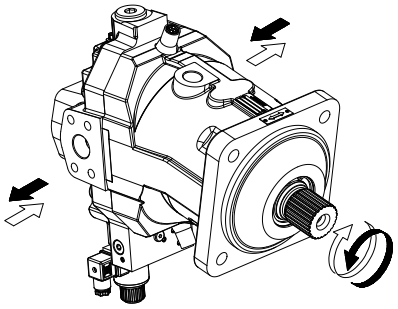
Size:
085 - 115



Size:
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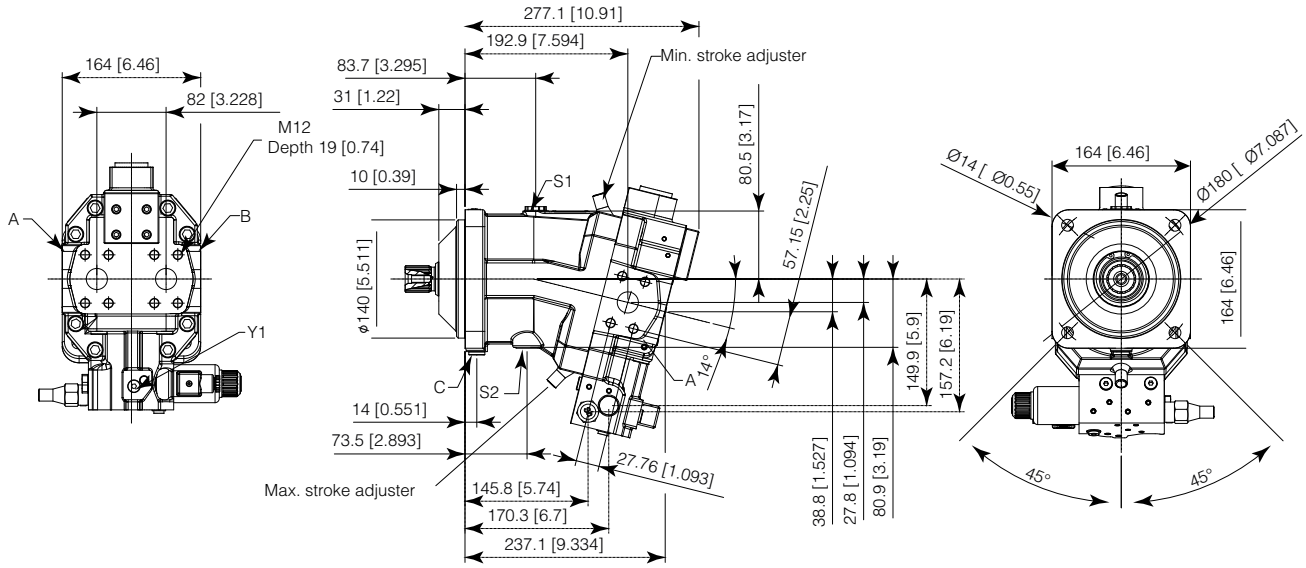


The relation between direction of rotation of shaft and direction of flow in SH9V motor is shown in the picture below.



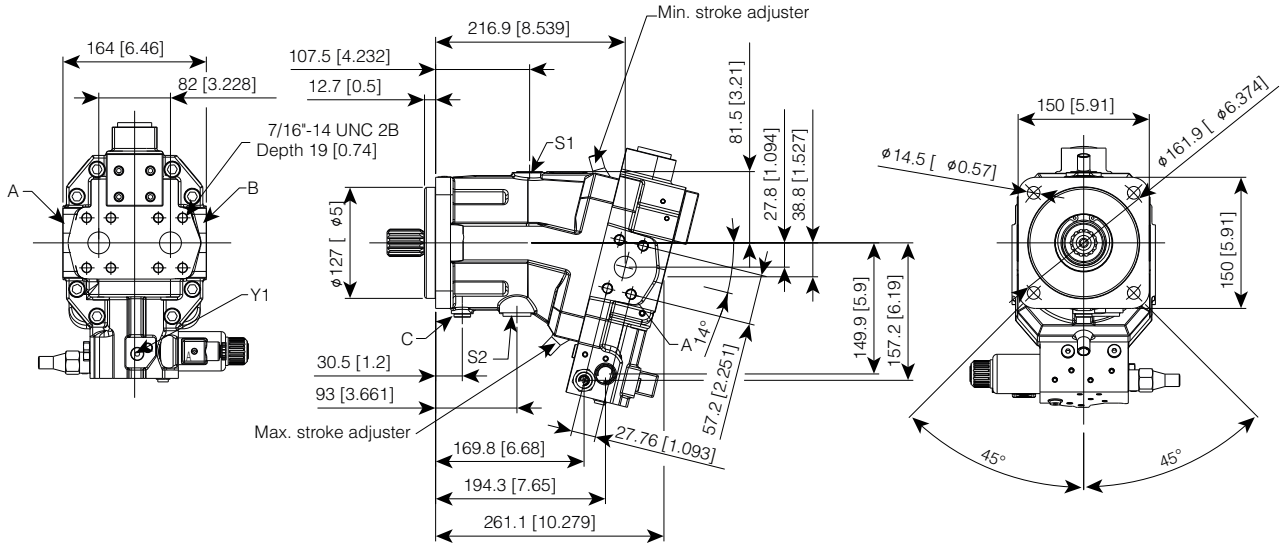
SH9V 085 - Motor dimensions

SH9V 085 Motor - Mounting flange ISO 4 Bolts (OD)



A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 1/4 G (BSPP)
S1-S2: Case drain port - 1/2 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

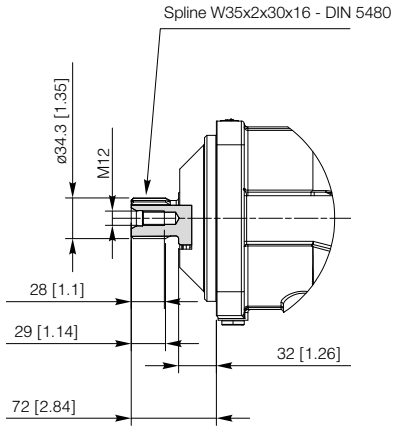
SH9V 085 Motor - Mounting flange SAE-C 4 Bolts (O5)



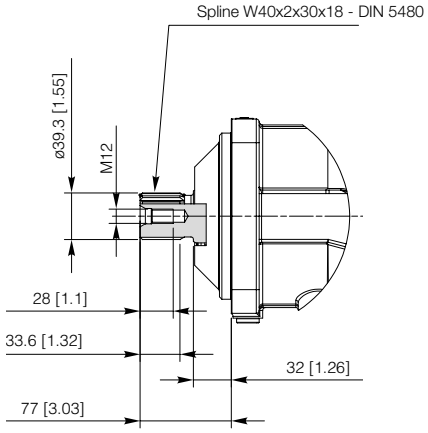
A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 7/16”-20 UNF
S1-S2: Case drain port - 1” 1/16 - 12 UN 2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

7 Shaft end

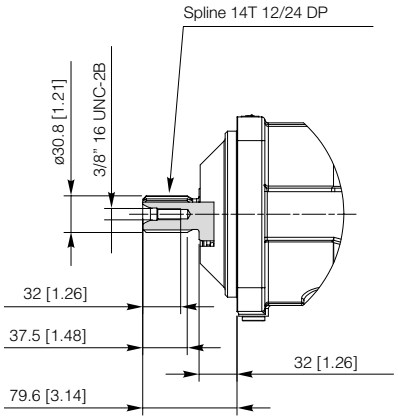
SAM Splined shaft



SAO Splined shaft



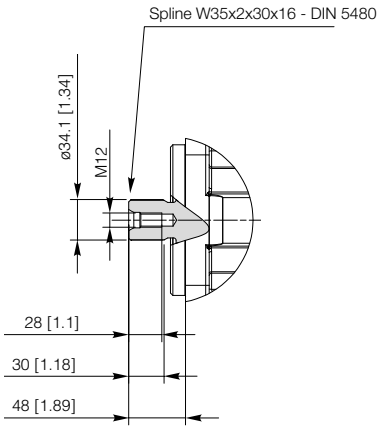
S12 Splined shaft



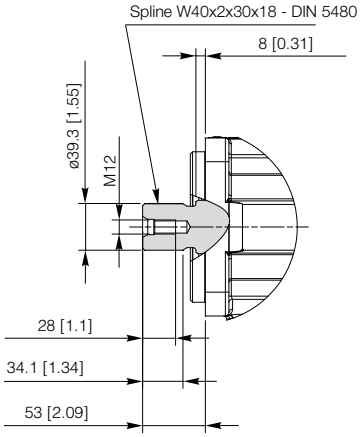
SH9V 085 - Shafts dimensions for mounting flange SAE-C 4 bolts (O5)

7 Shaft end

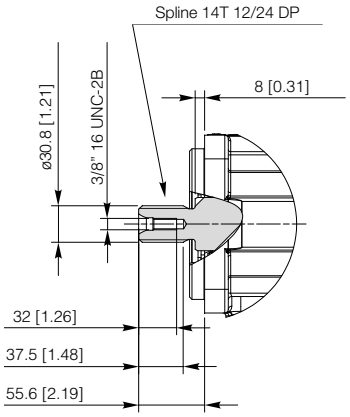
SAM Splined shaft



SAO Splined shaft

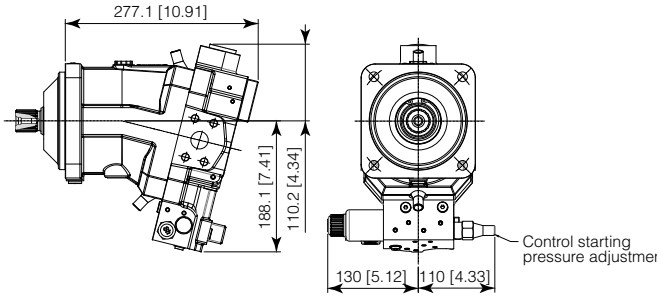


S12 Splined shaft

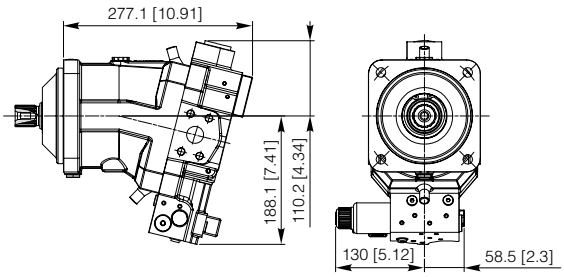


10 Control

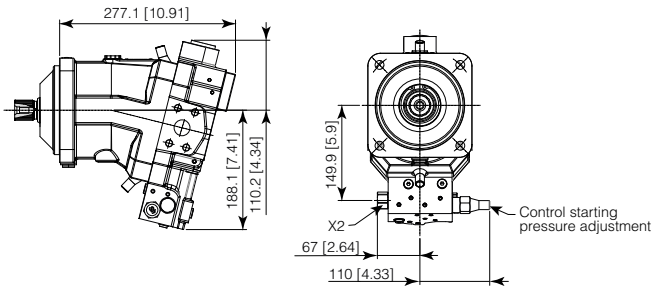
2EE Control



2EN Control

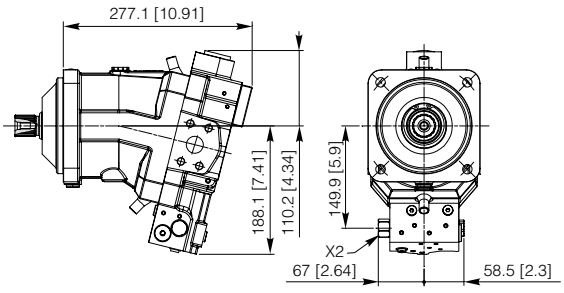


2IE Control



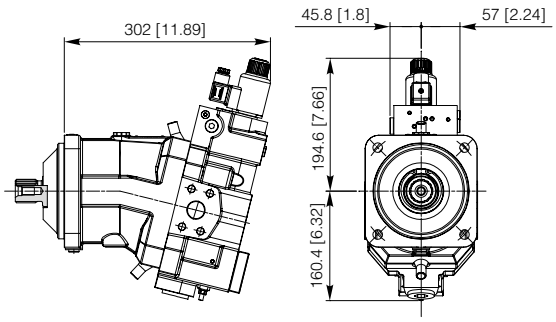
X2: Piloting port - 1/4 G (BSPP)

2IN Control

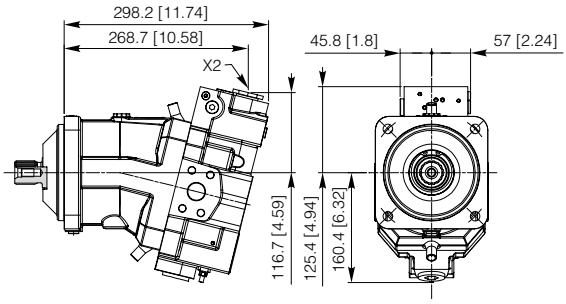


X2: Piloting port - 1/4 G (BSPP)

REN Control



RIN Control

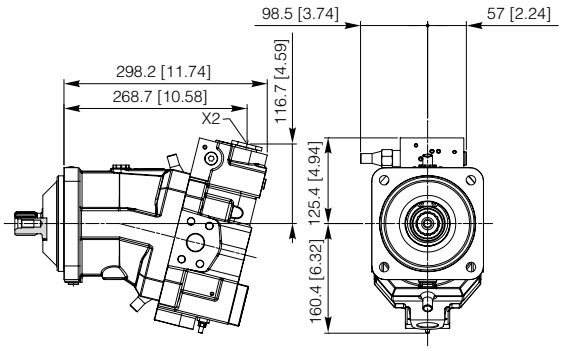


X2: Piloting port - 1/4 G (BSPP)

SH9V 085 - Control dimensions for mounting flange ISO 4 bolts (OD) (Displ. setting 1)

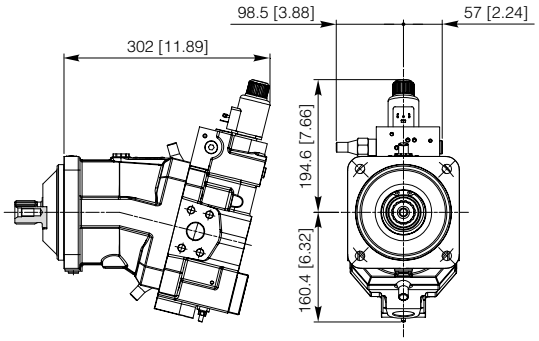
10 Control

RIE Control

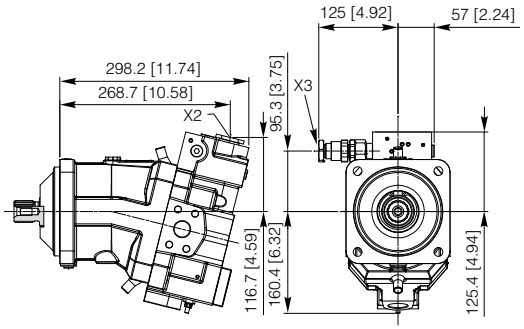


X2: Piloting port - 1/4 G (BSPP)

REE Control

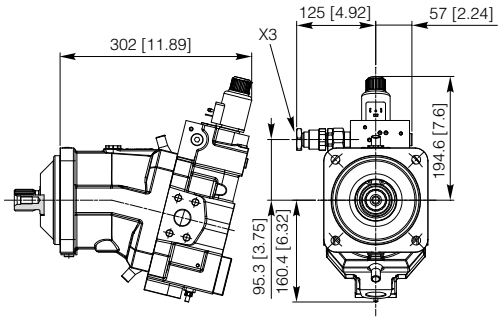


RID Control



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

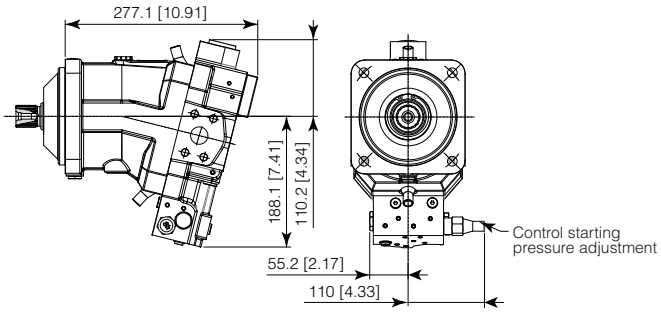
RED Control



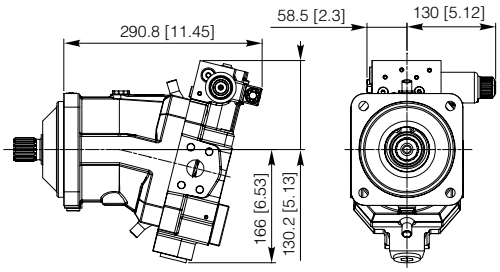
X3: Double step piloting port - 1/4 G (BSPP)

10 Control

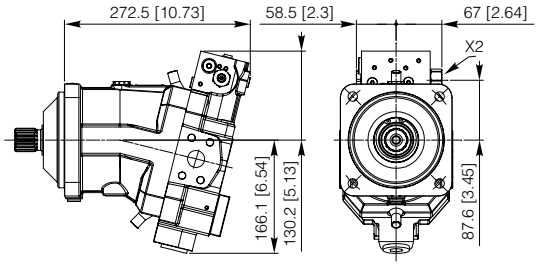
RPE Control



2EN Control

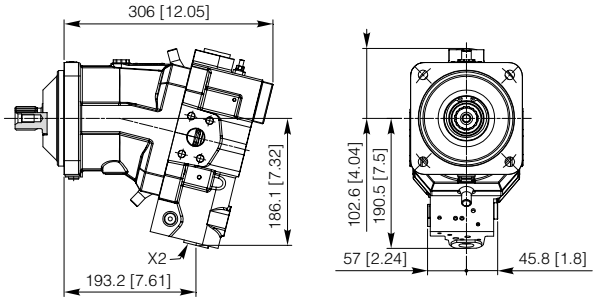


2IN Control



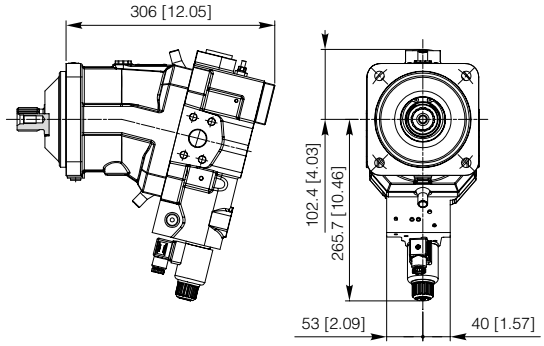
X2: Piloting port - 1/4 G (BSPP)

RIN Control

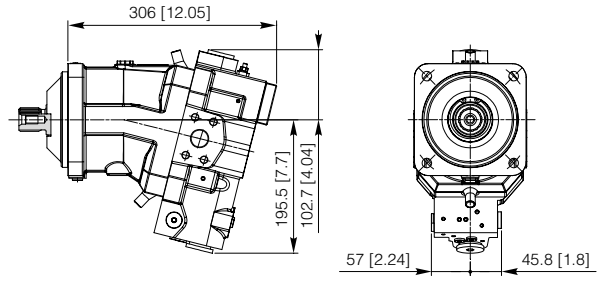


X2: Piloting port - 1/4 G (BSPP)

REN Control



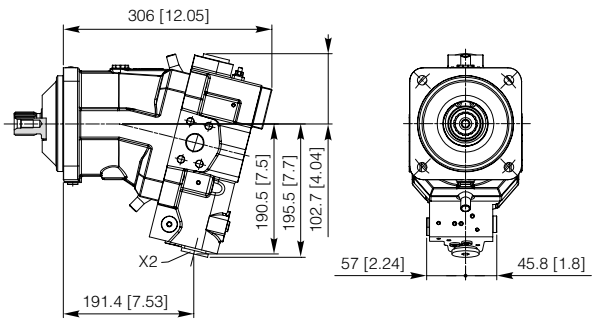
ROE Control



SH9V 085 - Control dimensions for mounting flange ISO 4 bolts (OD) (Displ. setting 2)

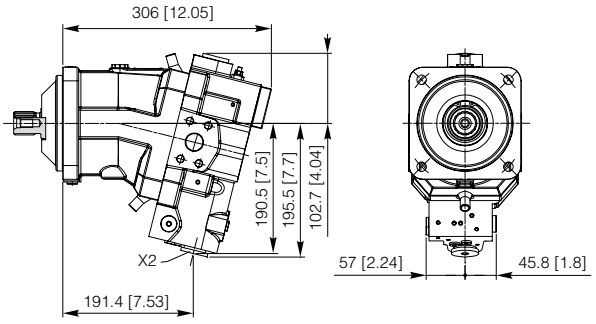
10 Control

ROI Control



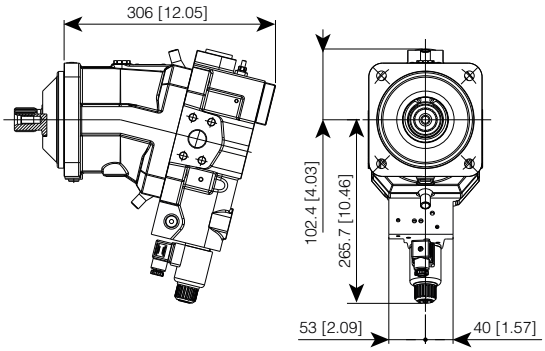
X2: Piloting port - 1/4 G (BSPP)

RPI Control

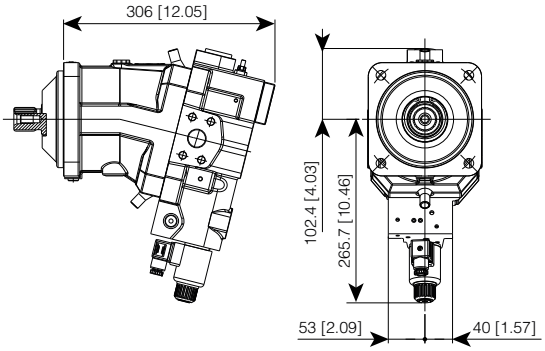


X2: Piloting port - 1/4 G (BSPP)

ROS Control

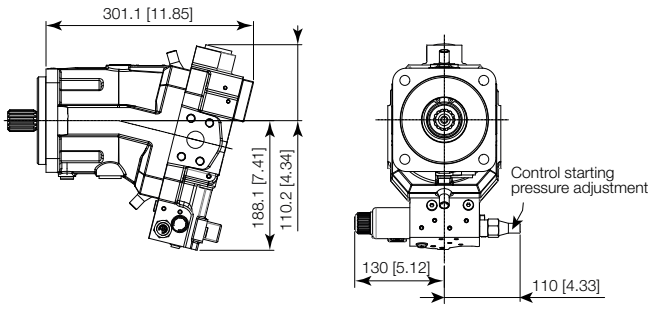


RPS Control

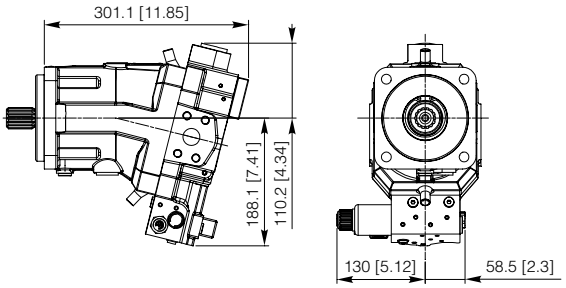


10 Control

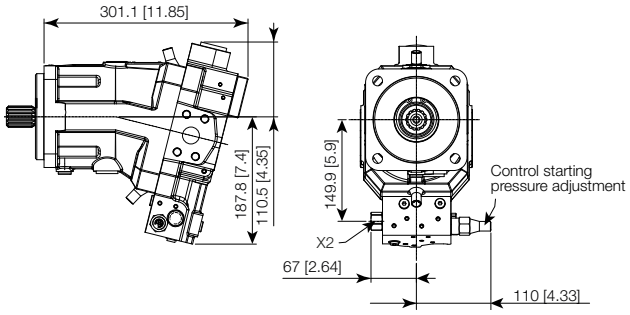
2EE Control



2EN Control

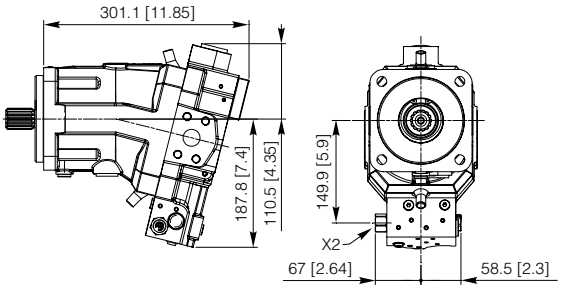


2IE Control



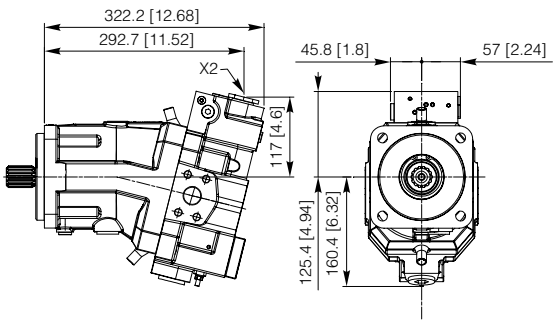
X2: Piloting port - 7/16”-20 UNF

2IN Control



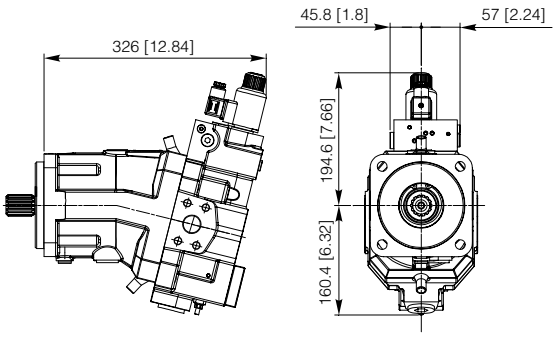
X2: Piloting port - 7/16”-20 UNF

RIN Control



X2: Piloting port - 7/16”-20 UNF

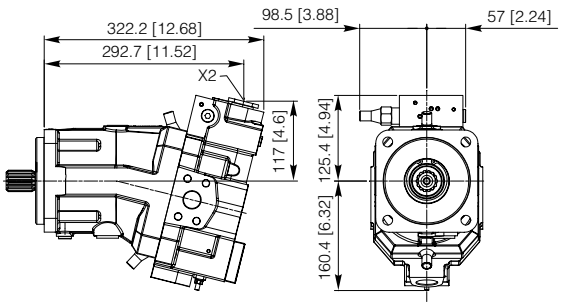
REN Control



SH9V 085 - Control dimensions for mounting flange SAE-C 4 bolts (05) (Displ. setting 1)

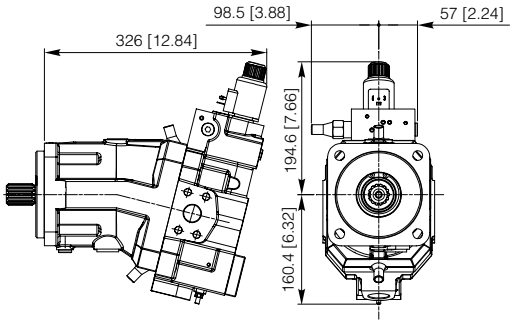
10 Control

RIE Control

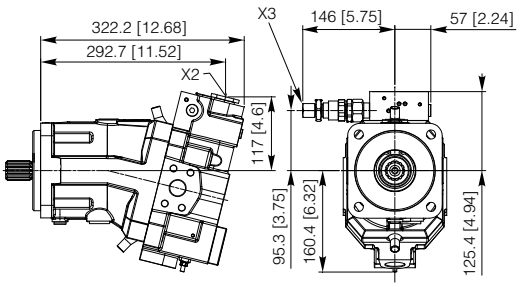


X2: Piloting port - 7/16”-20 UNF

REE Control

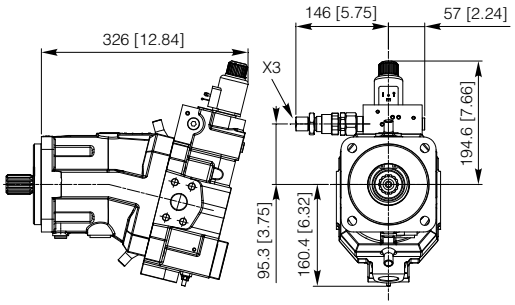


RID Control



X2: Piloting port - 7/16”-20 UNF
X3: Double step piloting port - 7/16”-20 UNF

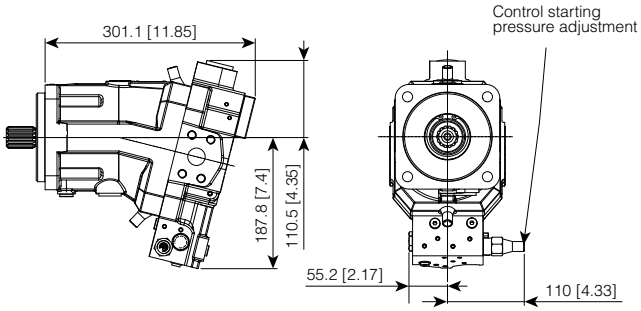
RED Control



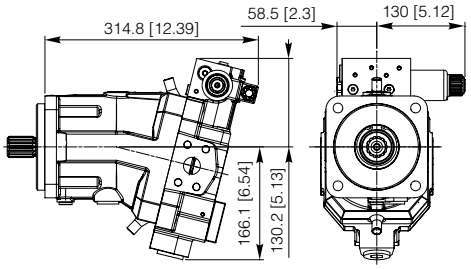
X3: Double step piloting port - 7/16”-20 UNF

10 Control

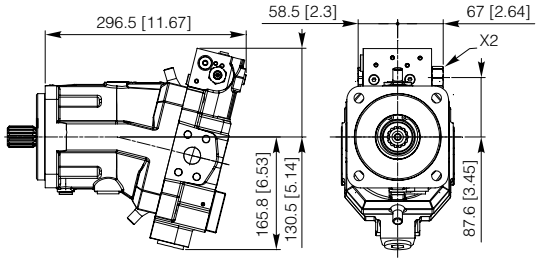
RPE Control



2EN Control

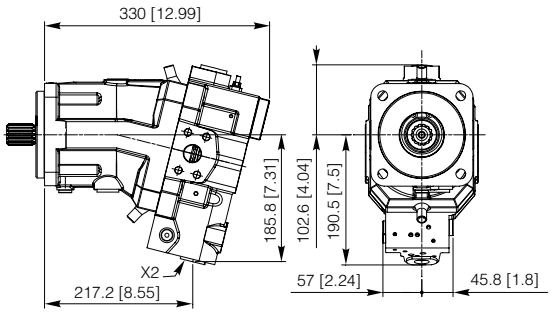


2IN Control



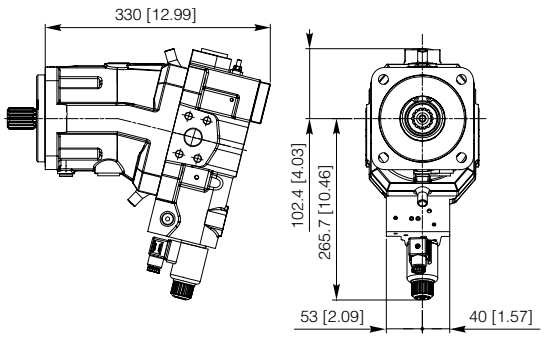
X2: Piloting port - 7/16”-20 UNF

RIN Control

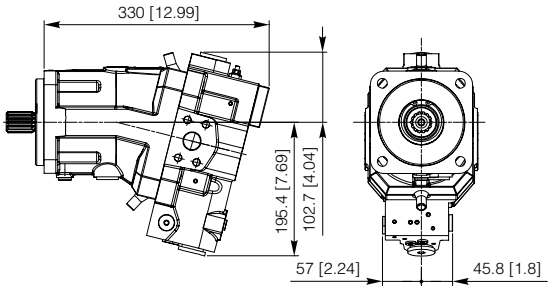


X2: Piloting port - 7/16”-20 UNF

REN Control



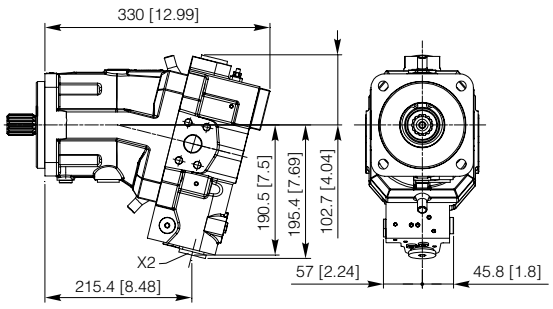
ROE Control



SH9V 085 - Control dimensions for mounting flange SAE-C 4 bolts (05) (Displ. setting 2)

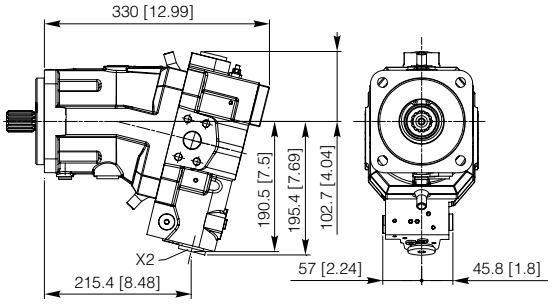
10 Control

ROI Control



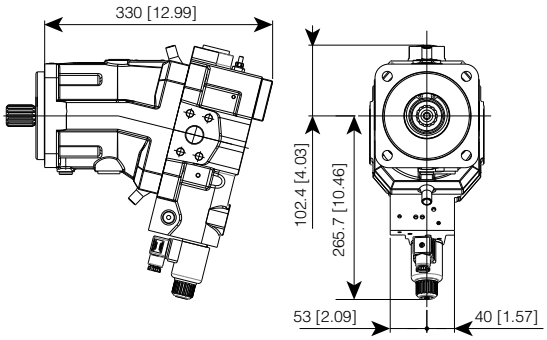
X2: Piloting port - 7/16”-20 UNF

RPI Control

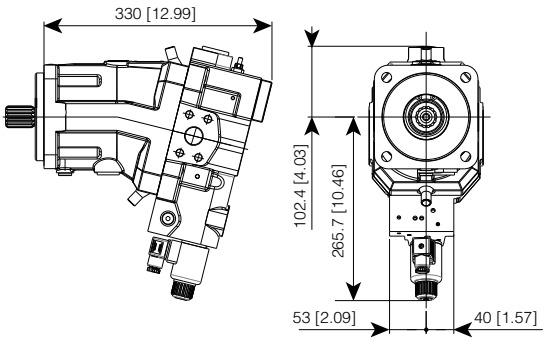


X2: Piloting port - 7/16”-20 UNF

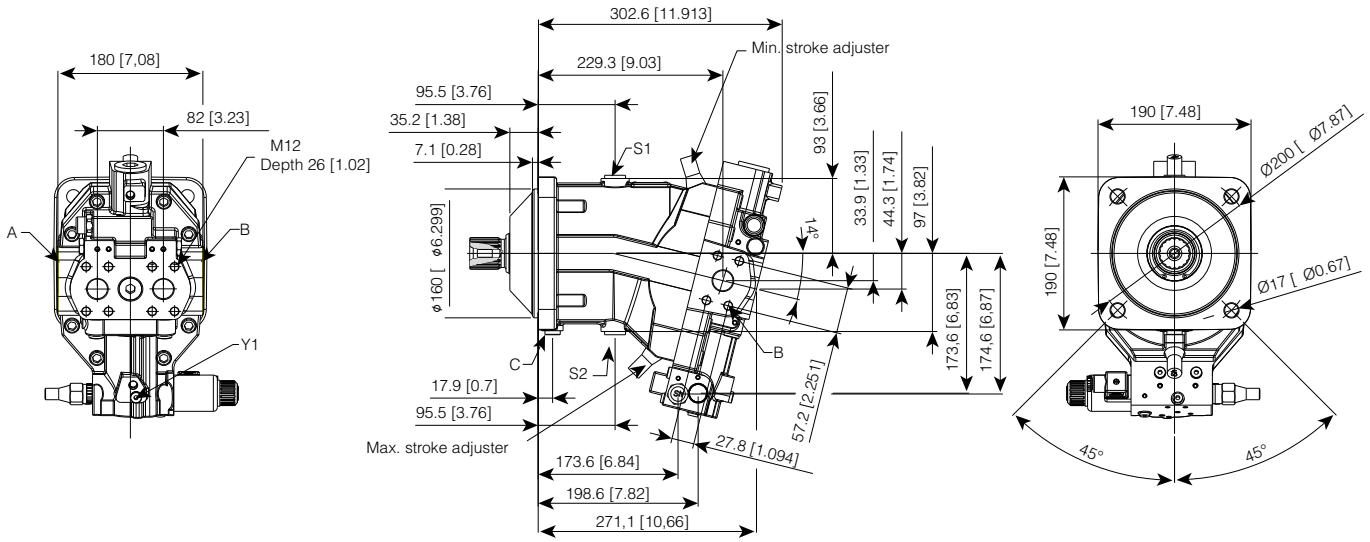
ROS Control



RPS Control

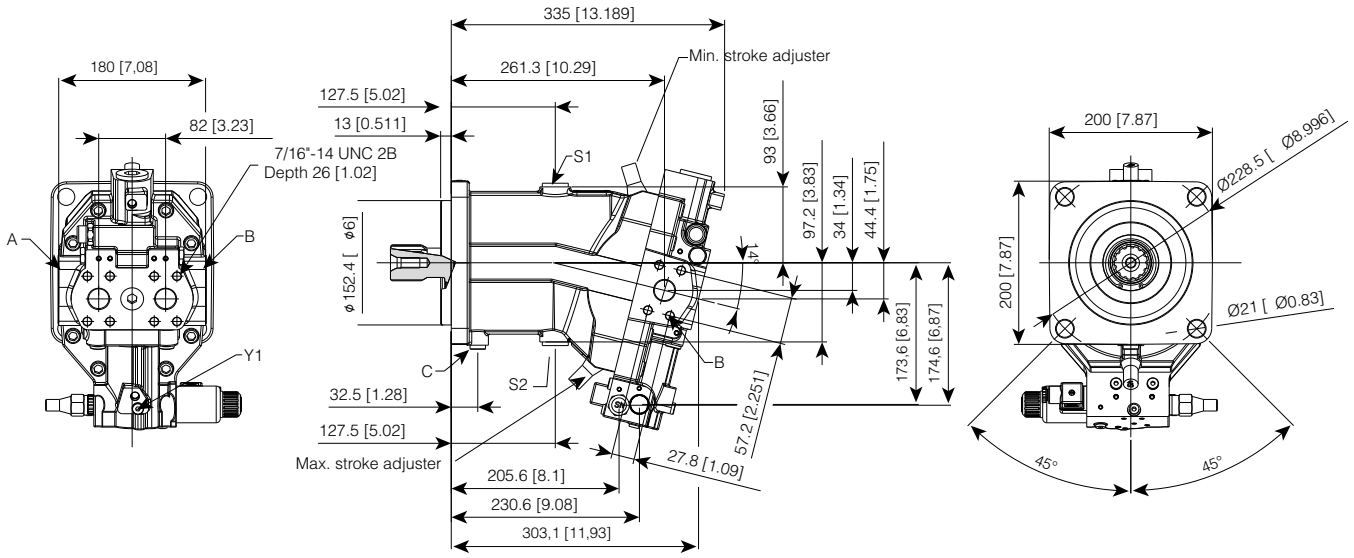


SH9V 115 Motor - Mounting flange ISO 4 Bolts (OE)



A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 1/4 G (BSPP)
S1-S2: Case drain port - 1/2 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

SH9V 115 Motor - Mounting flange SAE-D 4 Bolts (08)

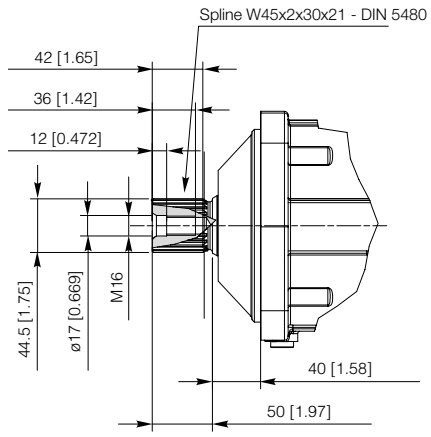


A-B: Service line ports - 1” SAE 6000
C: Air bleed bearings flushing port - 7/16”-20 UNF
S1-S2: Case drain port - 1” 1/16 - 12 UN 2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

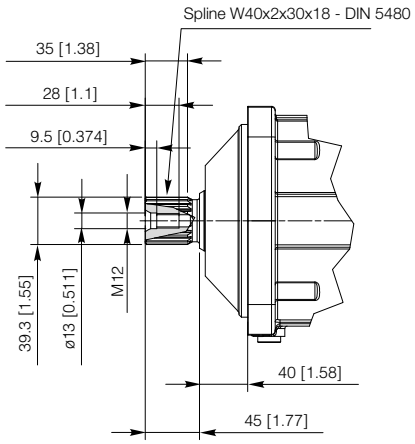
SH9V 115 - Shafts dimensions for mounting flange ISO 4 bolts (OE)

7 Shaft end

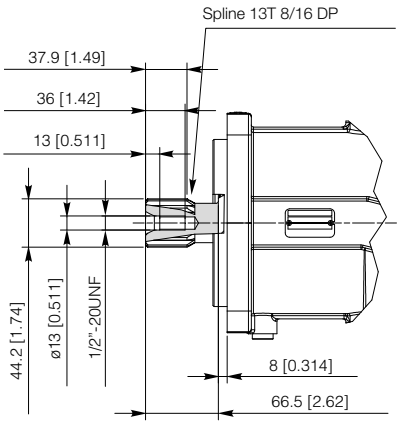
SAP Splined shaft



SAO Splined shaft

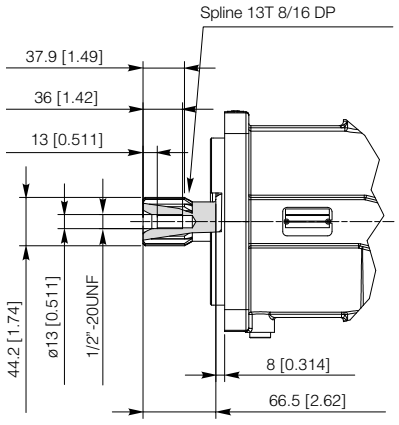


S15 Splined shaft



7 Shaft end

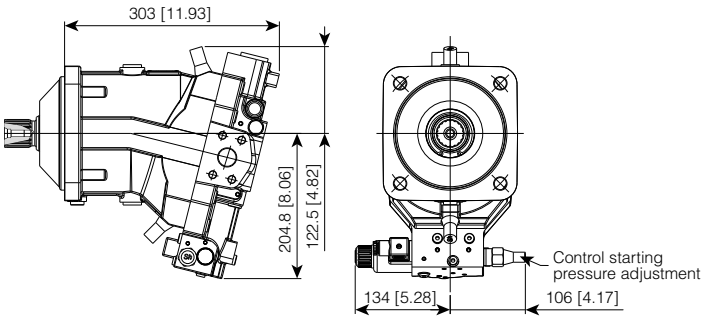
S15 Splined shaft



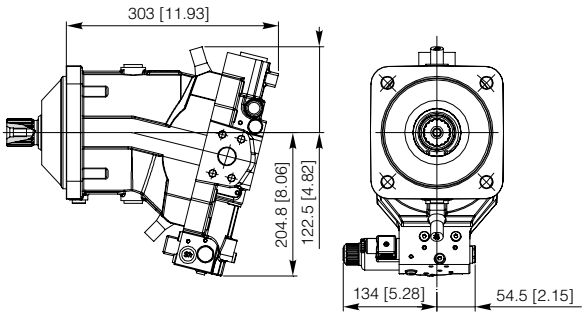
SH9V 115 - Control dimensions for mounting flange ISO 4 bolts (OE) (Displ. setting 1)

10 Control

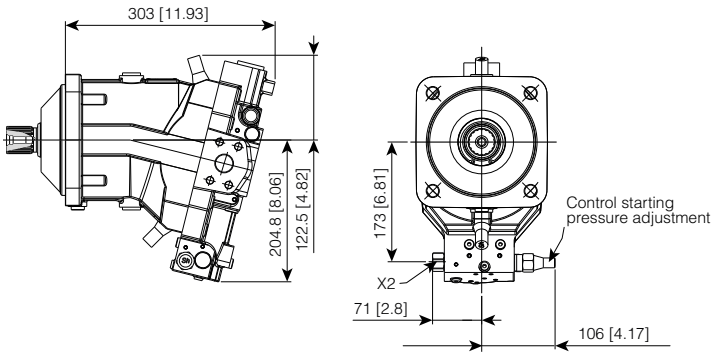
2EE Control



2EN Control

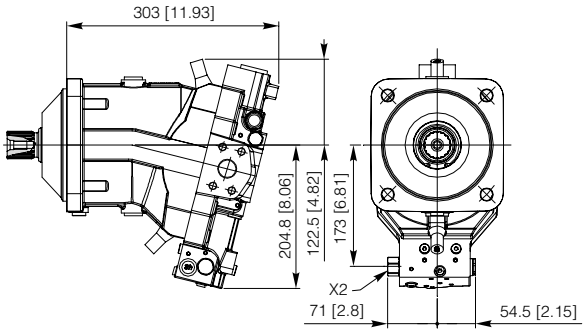


2IE Control



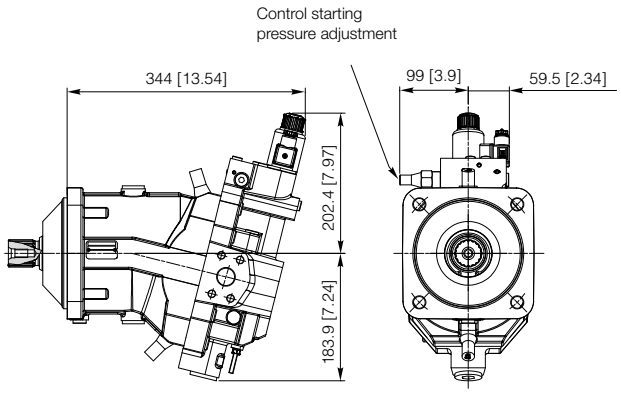
X2: Piloting port - 1/4 G (BSPP)

2IN Control

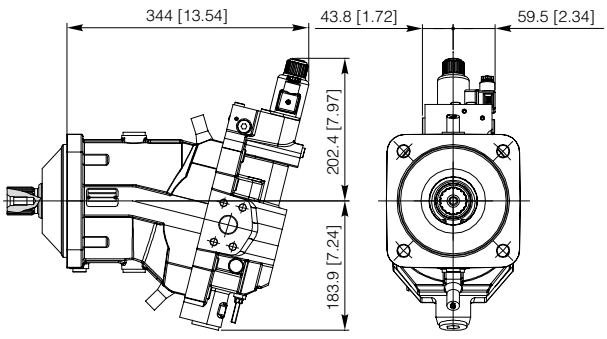


X2: Piloting port - 1/4 G (BSPP)

REE Control

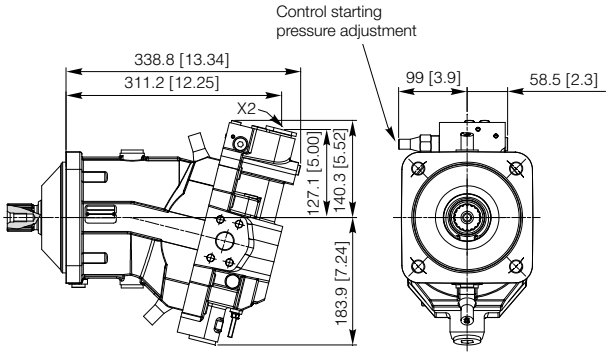


REN Control



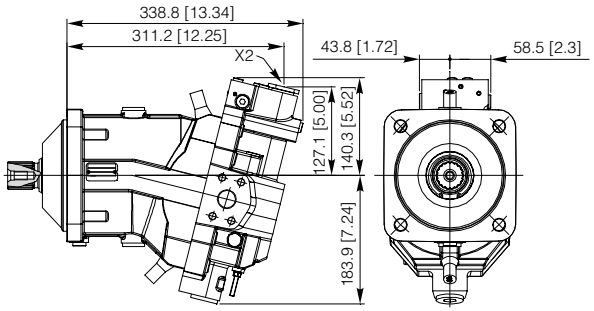
10 Control

RIE Control



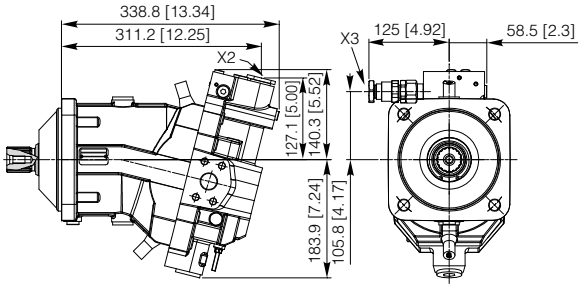
X2: Piloting port - 1/4 G (BSPP)

RIN Control



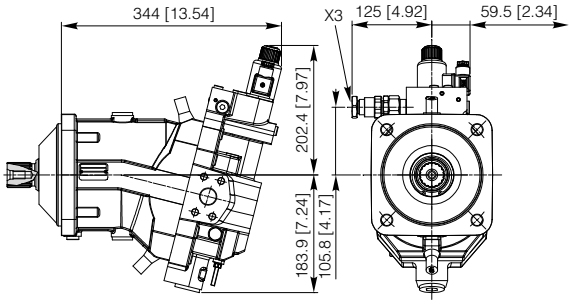
X2: Piloting port - 1/4 G (BSPP)

RID Control



X2: Piloting port - 1/4 G (BSPP)
X3: Double step piloting port - 1/4 G (BSPP)

RED Control

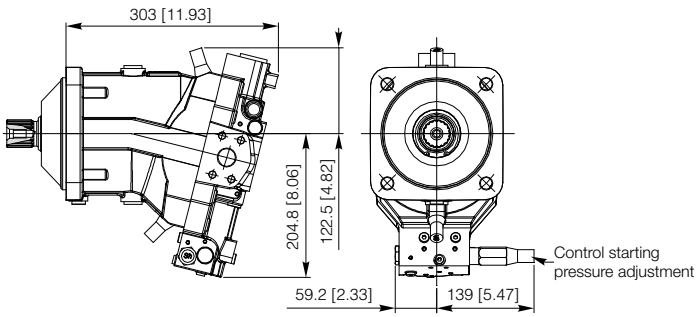


X3: Double step piloting port - 1/4 G (BSPP)

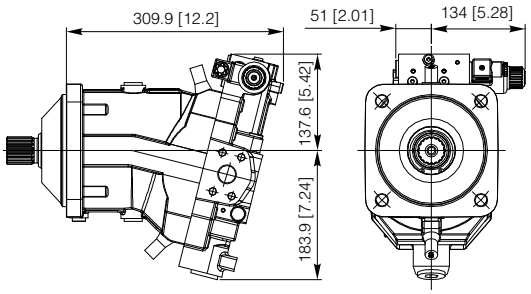
SH9V 115 - Control dimensions for mounting flange ISO 4 bolts (OE) (Displ. setting 2)

10 Control

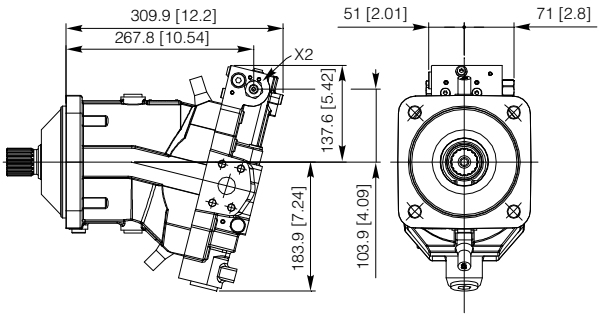
RPE Control



2EN Control

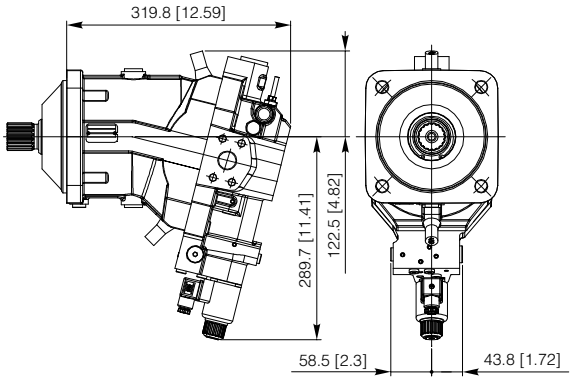


2IN Control

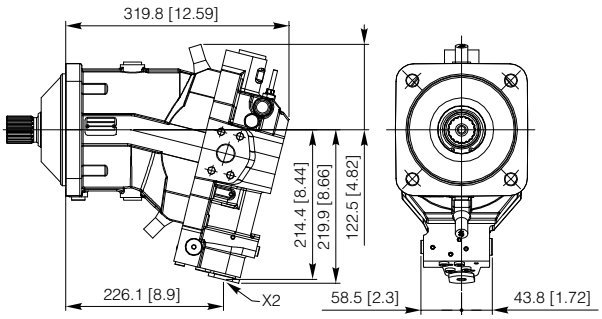


X2: Piloting port - 1/4 G (BSPP)

REN Control

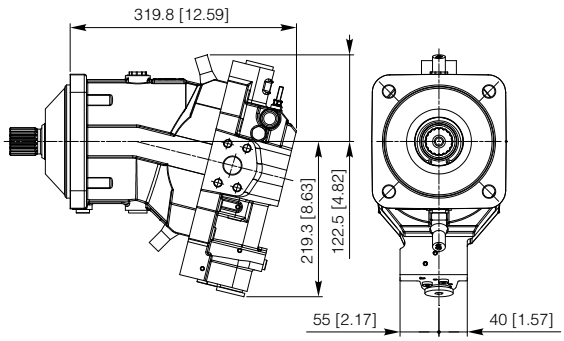


RIN Control



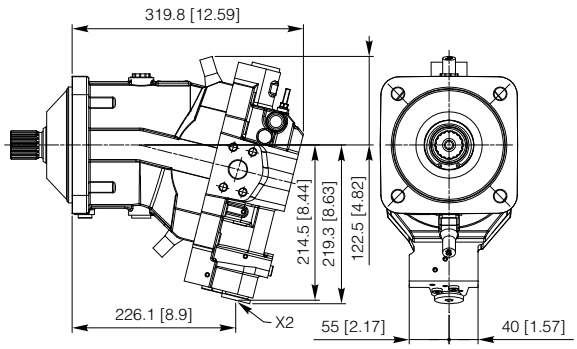
X2: Piloting port - 1/4 G (BSPP)

ROE Control



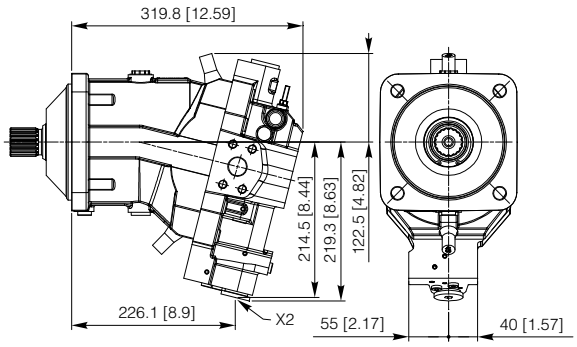
10 Control

ROI Control



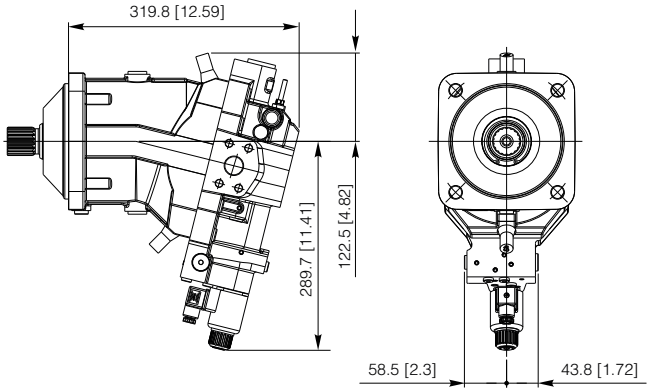
X2: Piloting port - 1/4 G (BSPP)

RPI Control

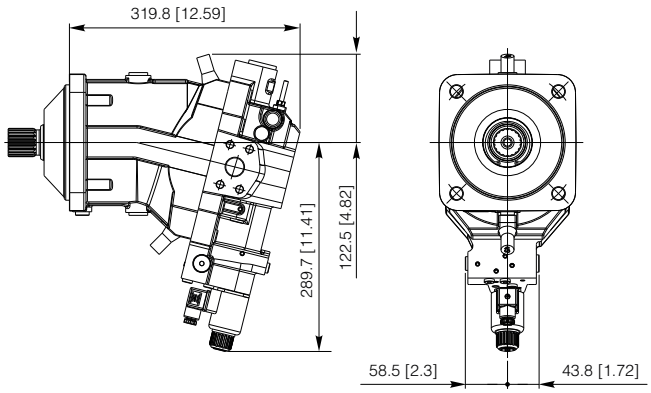


X2: Piloting port - 1/4 G (BSPP)

ROS Control



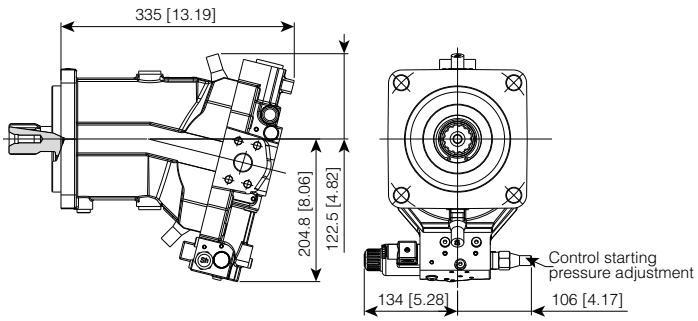
RPS Control



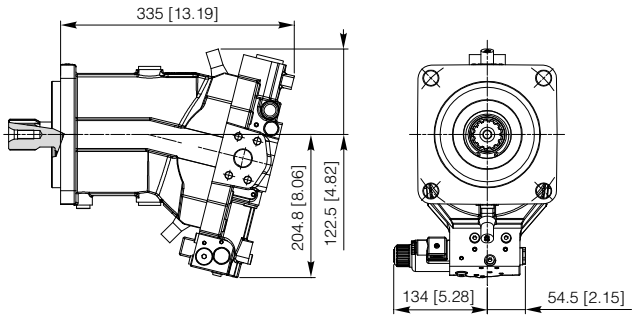
SH9V 115 - Control dimensions for mounting flange SAE-D 4 bolts (08) (Displ. setting 1)

10 Control

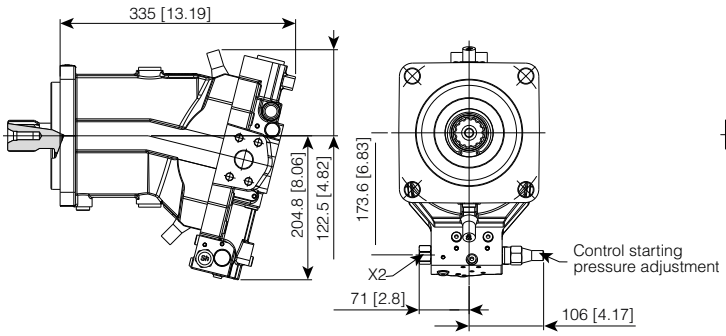
2EE Control



2EN Control

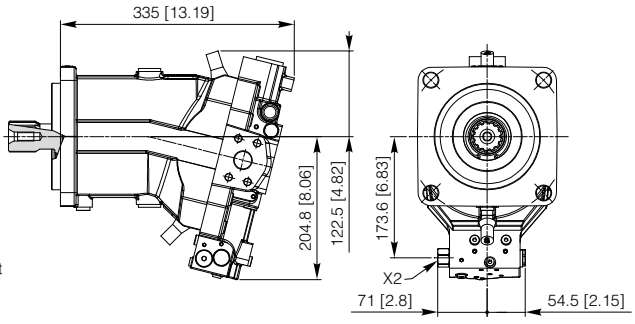


2IE Control



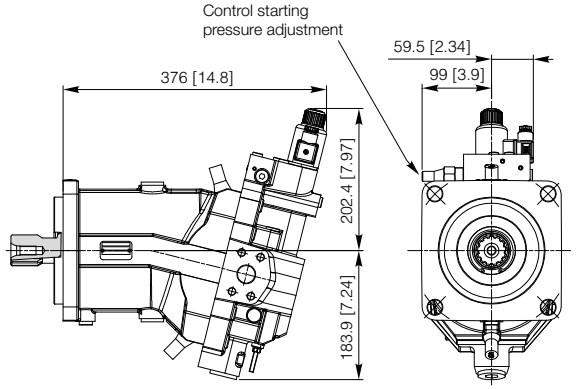
X2: Piloting port - 7/16”-20 UNF

2IN Control

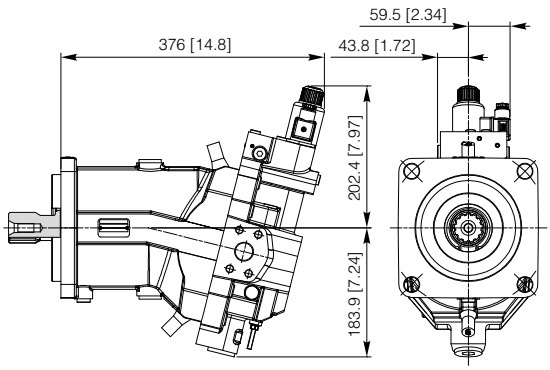


X2: Piloting port - 7/16”-20 UNF

REE Control

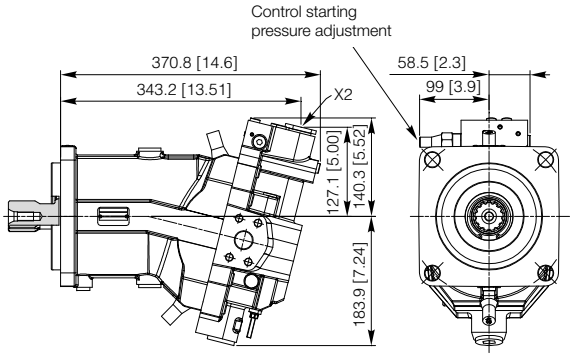


REN Control



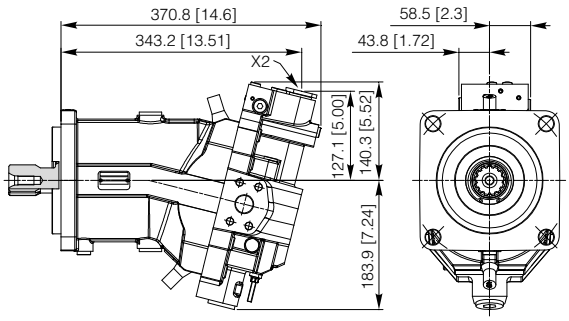
10 Control

RIE Control



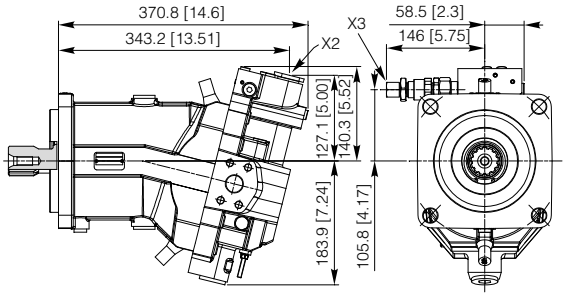
X2: Piloting port - 7/16”-20 UNF

RIN Control



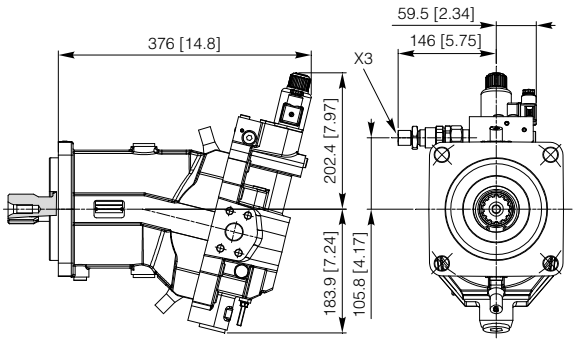
X2: Piloting port - 7/16”-20 UNF

RID Control



X2: Piloting port - 7/16”-20 UNF
X3: Double step piloting port - 7/16”-20 UNF

RED Control

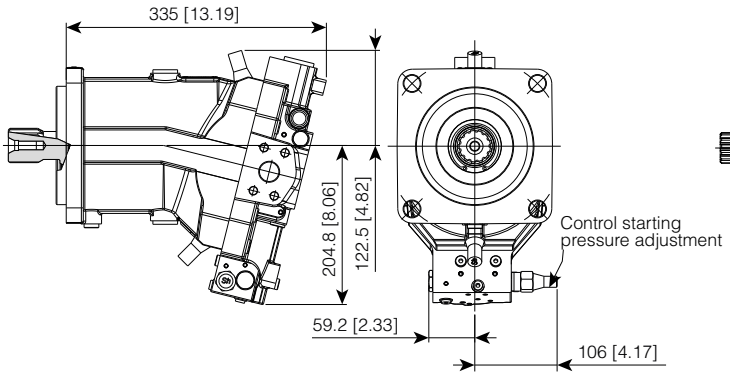


X3: Double step piloting port - 7/16”-20 UNF

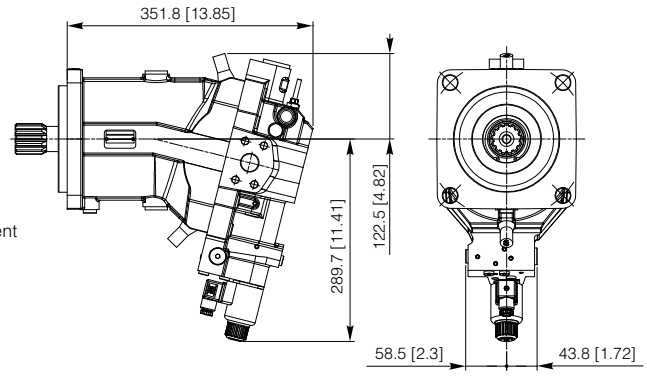
SH9V 115 - Control dimensions for mounting flange SAE-D 4 bolts (08) (Displ. setting 2)

10 Control

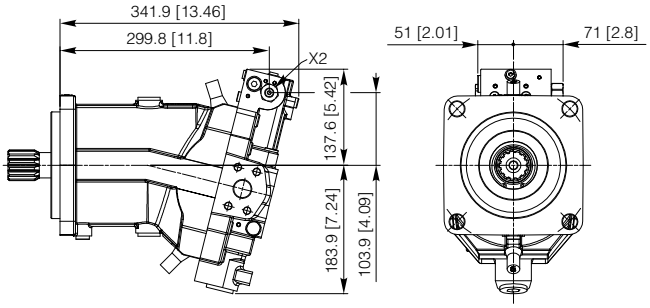
RPE Control



2EN Control

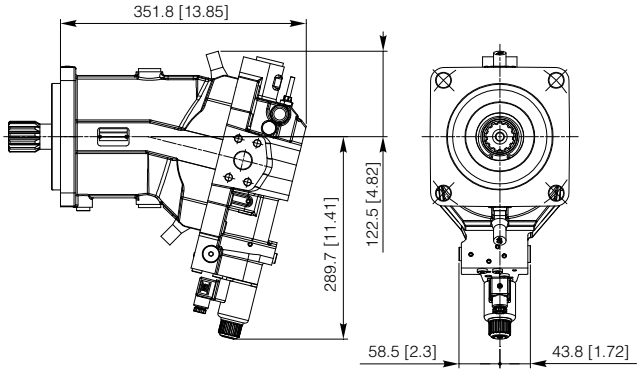


2IN Control

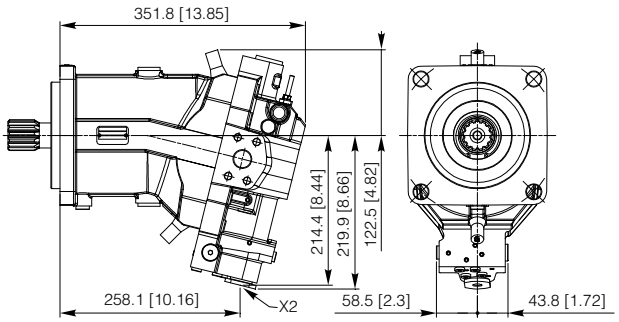


X2: Piloting port - 7/16”-20 UNF

REN Control

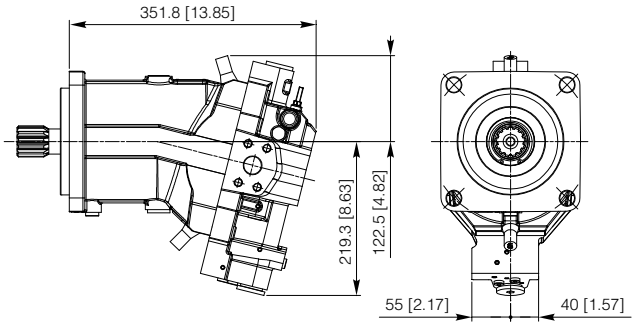


RIN Control



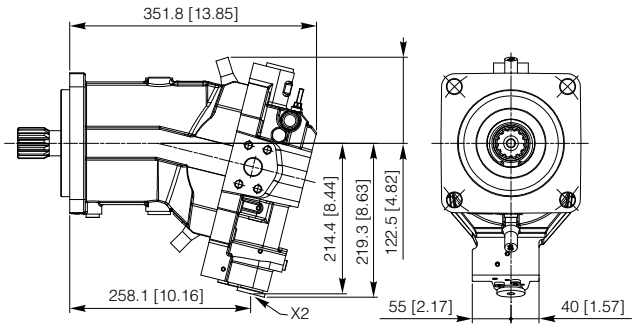
X2: Piloting port - 7/16”-20 UNF

ROE Control



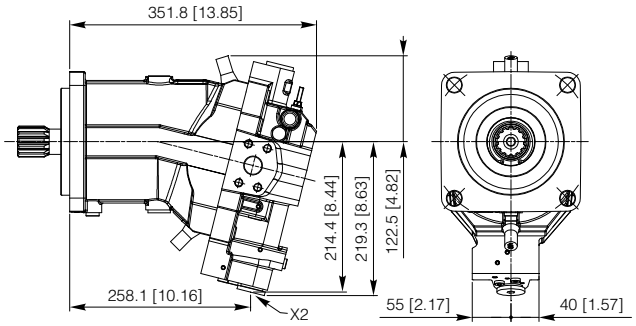
10 Control

ROI Control



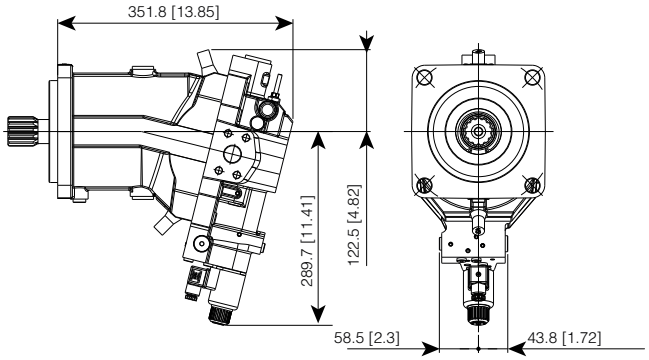
X2: Piloting port - 7/16”-20 UNF

RPI Control

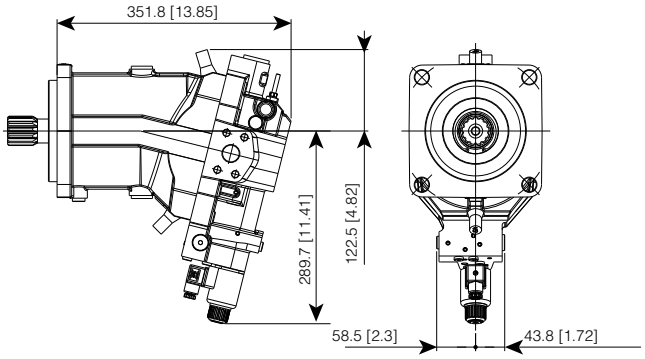


X2: Piloting port - 7/16”-20 UNF

ROS Control

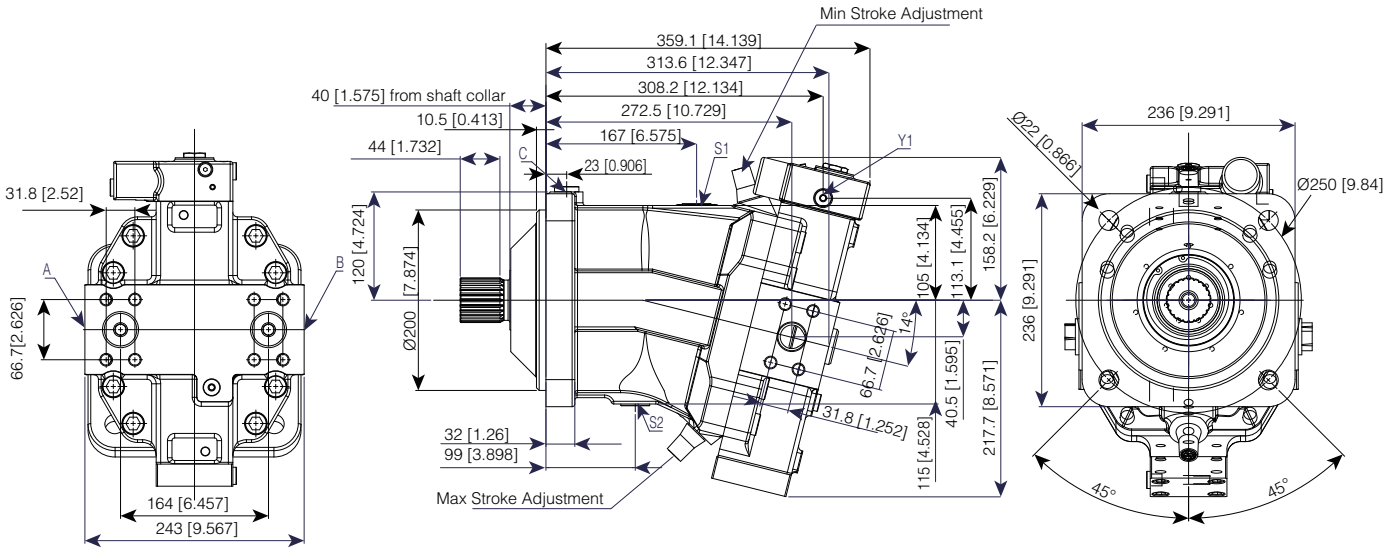


RPS Control



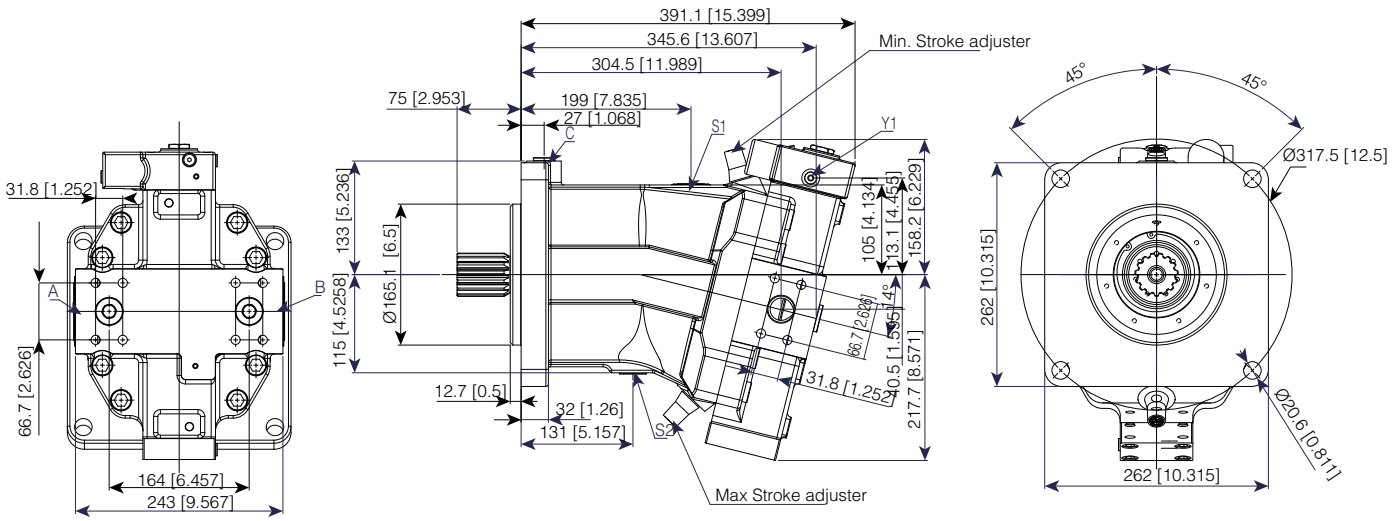
SH9V 215 - Motor dimensions

SH9V 215 Motor - Mounting flange ISO 4 Bolts (OG)



A-B: Service line ports - 1”1/4 SAE 6000
C: Air bleed bearings flushing port - 1/2 G (BSPP)
S1-S2: Case drain port - 3/4 G (BSPP)
Y1: Working pressure piloting port - 1/8 G (BSPP)

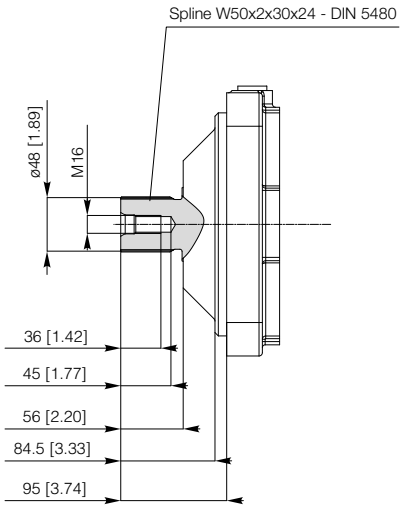
SH9V 215 Motor - Mounting flange SAE-E 4 Bolts (10)



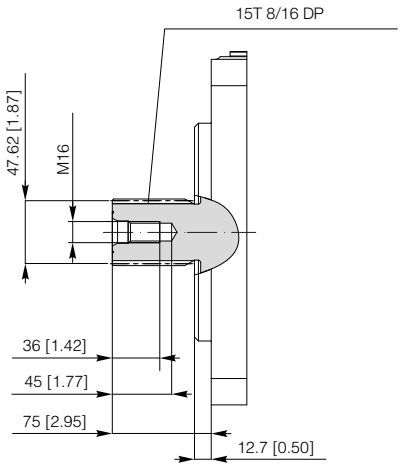
A-B: Service line ports - 1”1/4 SAE 6000
C: Air bleed bearings flushing port - 3/4”-16 UNF-2B
S1-S2: Case drain port - 1” 1/16 - 12 UN-2B
Y1: Working pressure piloting port - 7/16”-20 UNF-2B

7 Shaft end - for mounting flange ISO 4 bolts (OG)

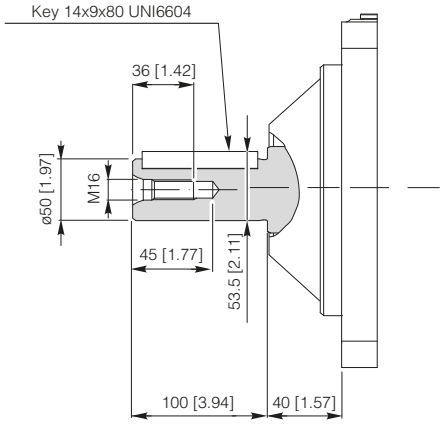
SAR Splined shaft



S19 Splined shaft



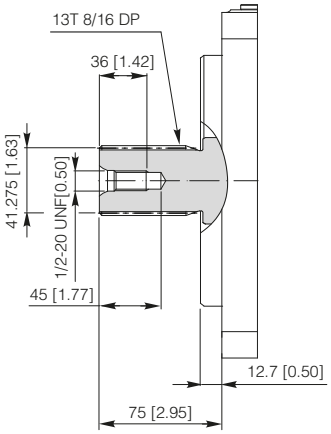
CAX Parallel keyed shaft



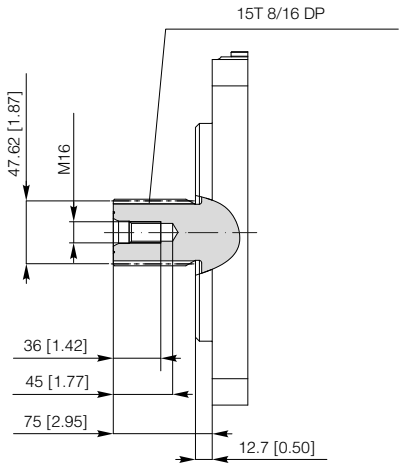
SH9V 215 - Shafts dimensions

7 Shaft end - for mounting flange SAE-E 4 bolts (10)

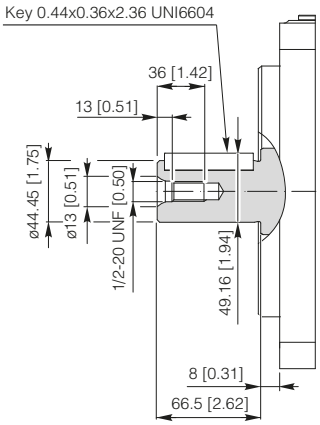
S15 Splined shaft



S19 Splined shaft

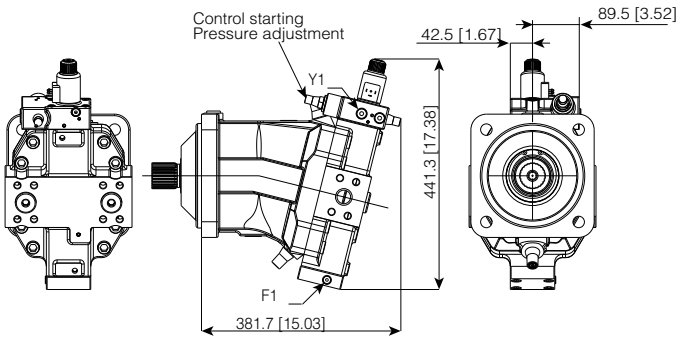


C18 Parallel keyed shaft

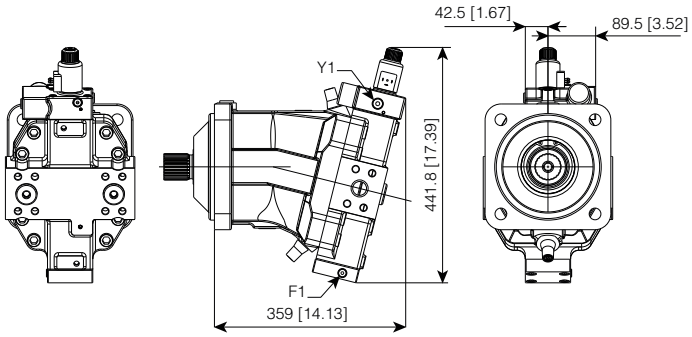


10 Control

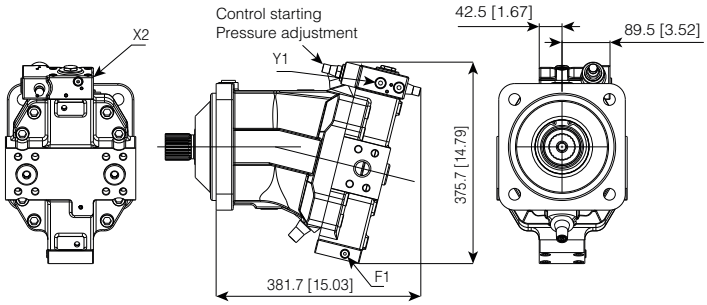
2EE Control



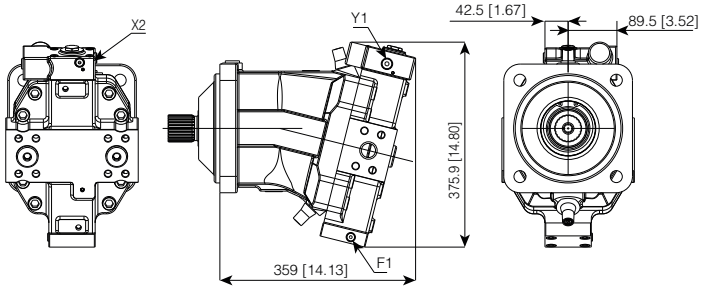
2EN Control



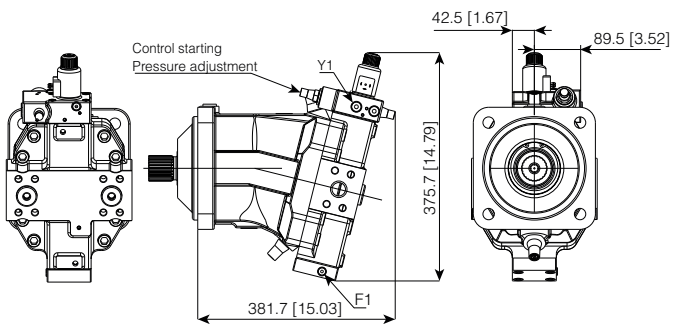
2IE Control



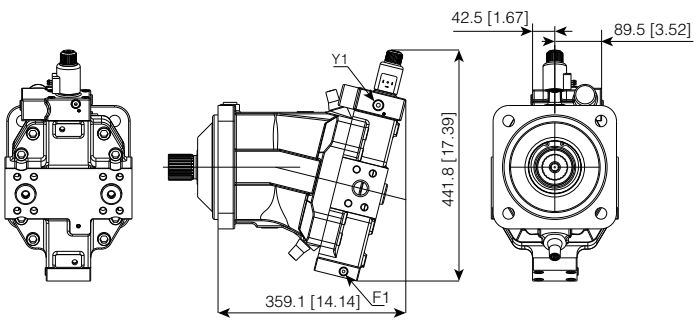
2IN Control



REE Control



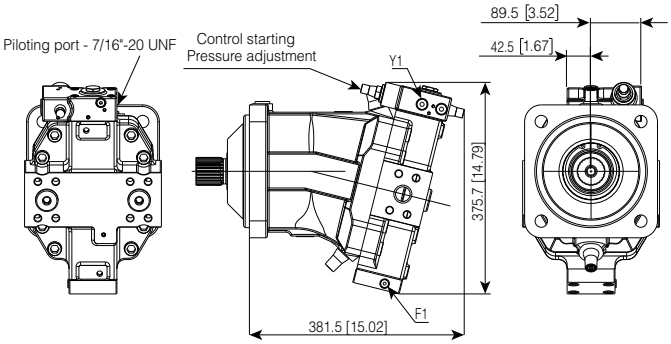
REN Control



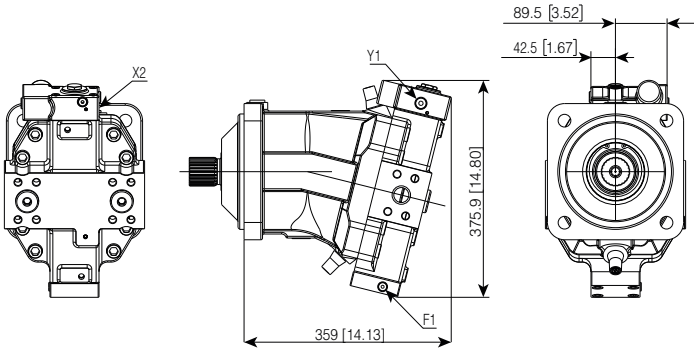
SH9V 215 - Control dimensions for mounting flange ISO 4 bolts (OG) (Displ. setting 1)

10 Control

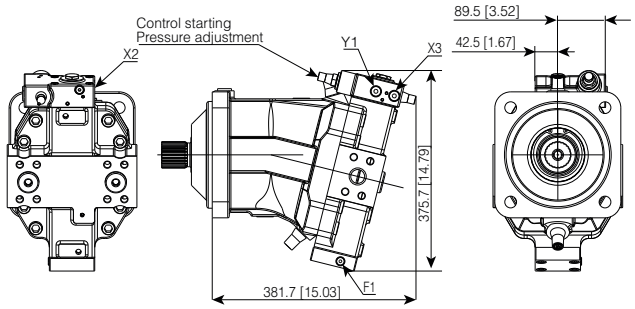
RIE Control



RIN Control

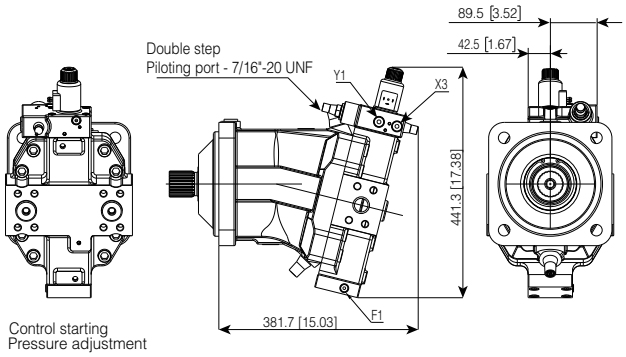


RID Control



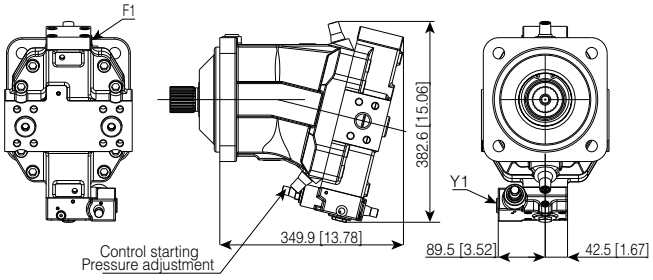
X2: Piloting port - 7/16"-20 UNF
X3: Double step Piloting port - 7/16"-20 UNF

RED Control

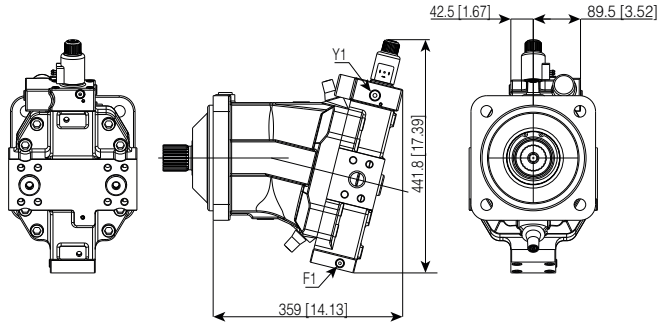


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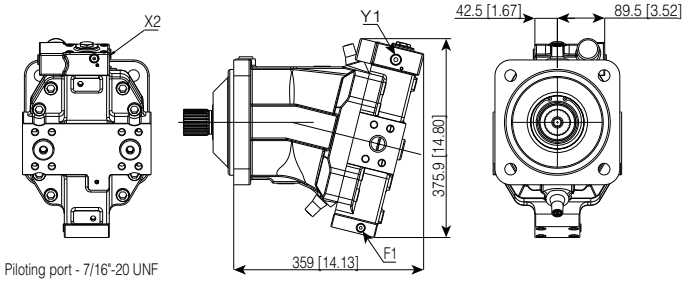
RPE Control



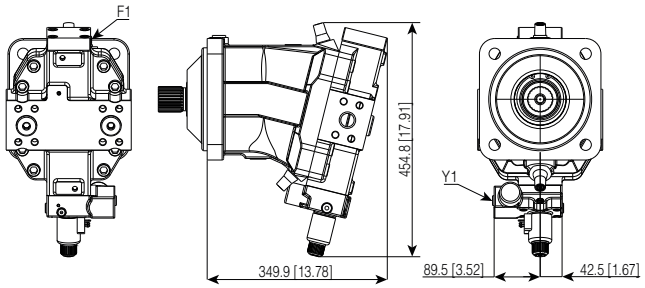
2EN Control



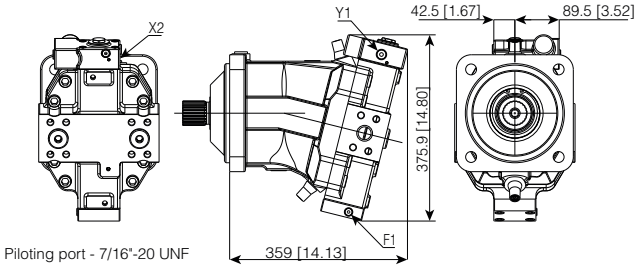
2IN Control



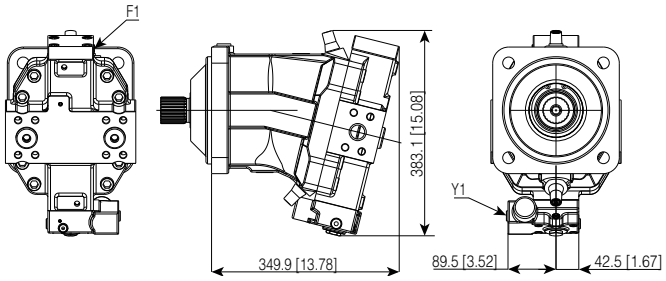
REN Control



RIN Control



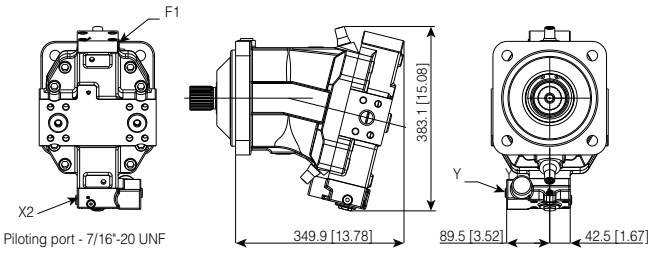
ROE Control



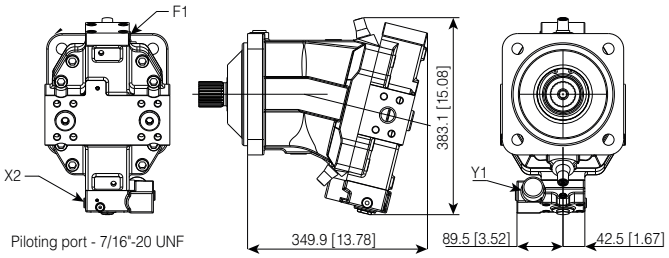
SH9V 215 - Control dimensions for mounting flange ISO 4 bolts (OG) (Displ. setting 2)

10 Control

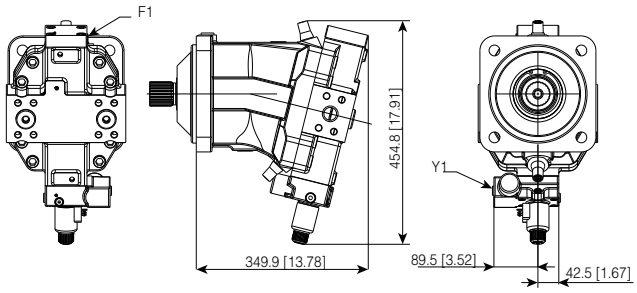
ROI Control



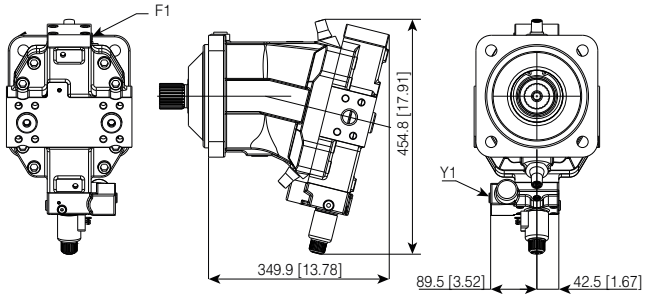
RPI Control



ROS Control

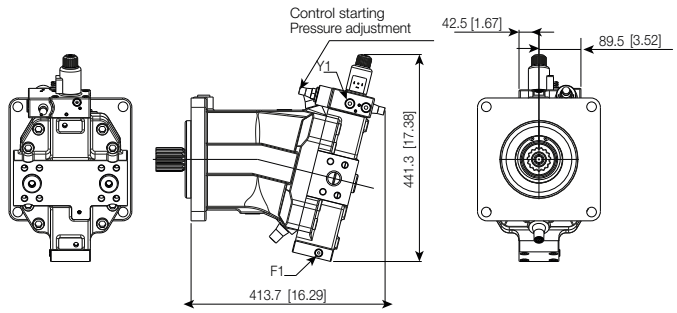


RPS Control

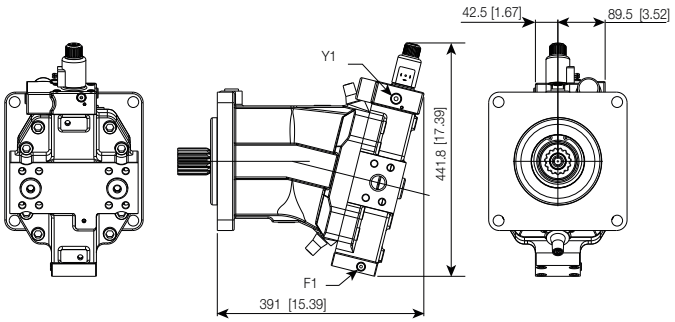


10 Control

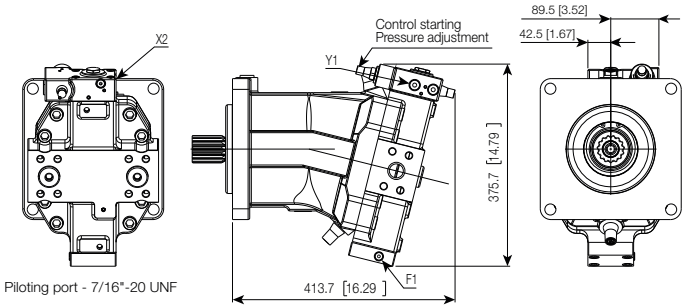
2EE Control



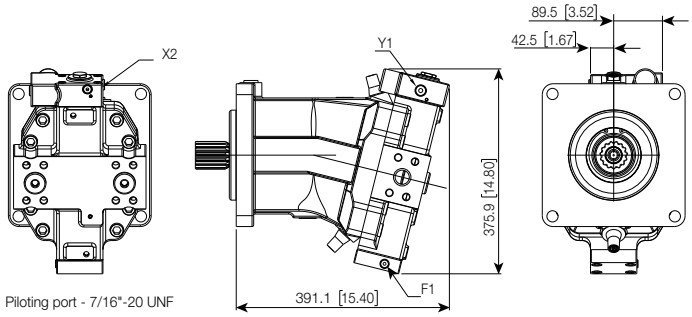
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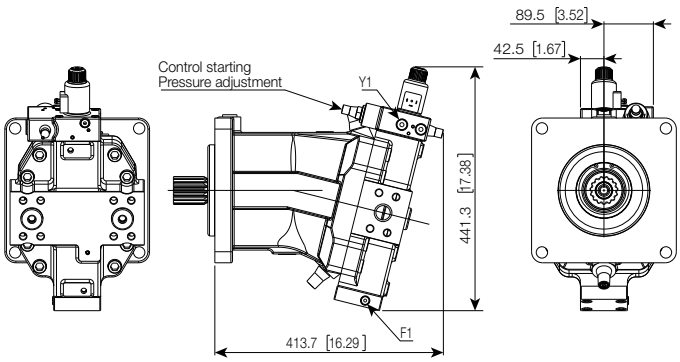
2IE Control



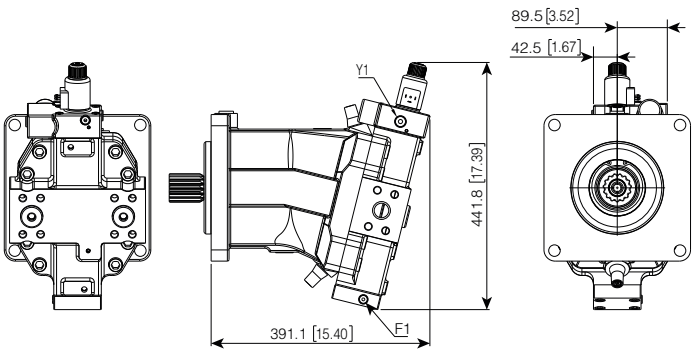
2IN Control



REE Control



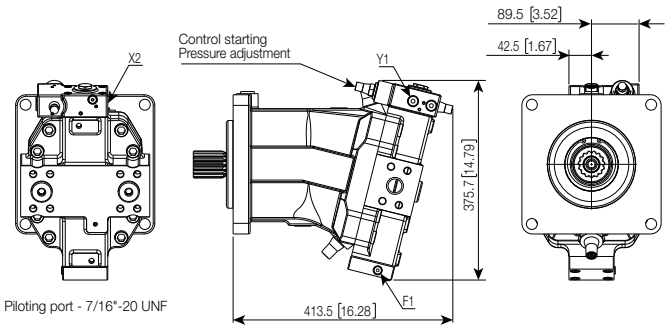
REN Control



SH9V 215 - Control dimensions for mounting flange SAE-E 4 bolts (10) (Displ. setting 1)

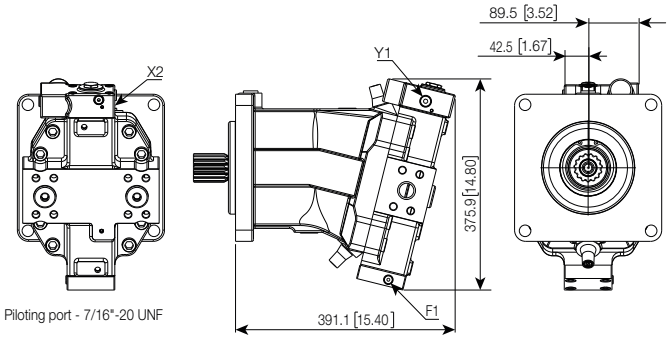
10 Control

RIE Control



Piloting port - 7/16"-20 UNF

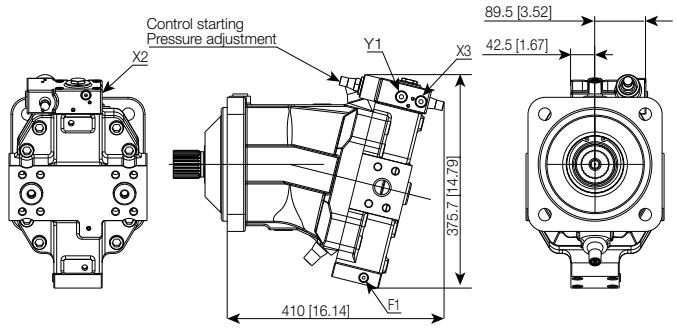
RIN Control



Piloting port - 7/16"-20 UNF

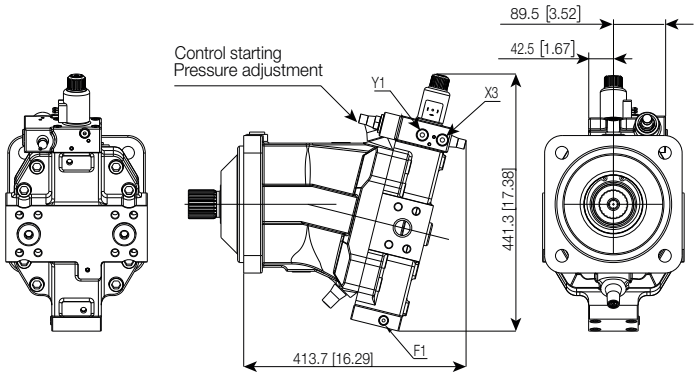
X2: Piloting port - 7/16”-20 UNF-2B

RID Control



X2: Piloting port - 7/16"-20 UNF
X3: Double step Piloting port - 7/16"-20 UNF

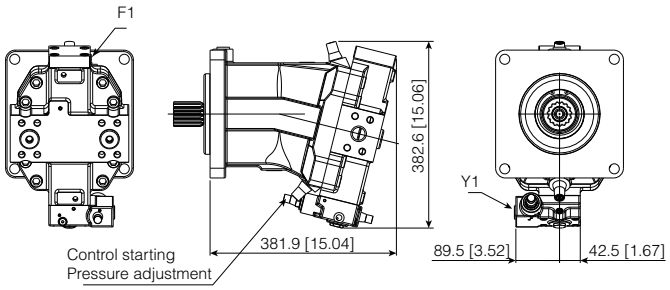
RED Control



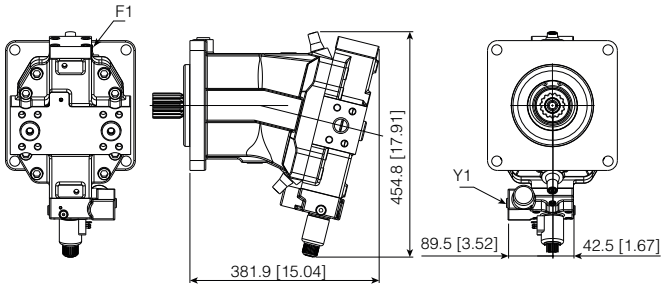
Double step Piloting port - 7/16"-20 UNF

10 Control

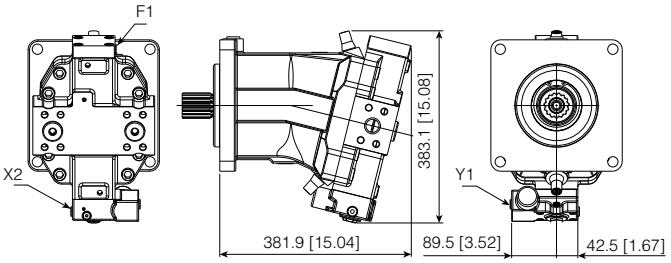
RPE Control



2EN Control

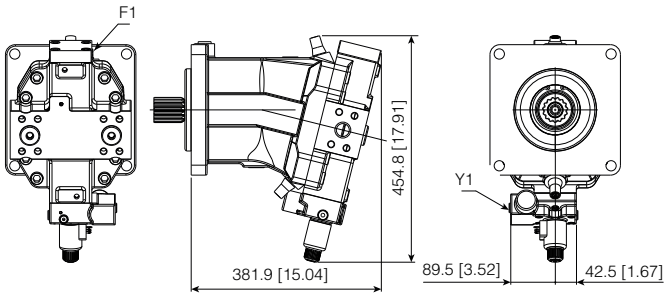


2IN Control

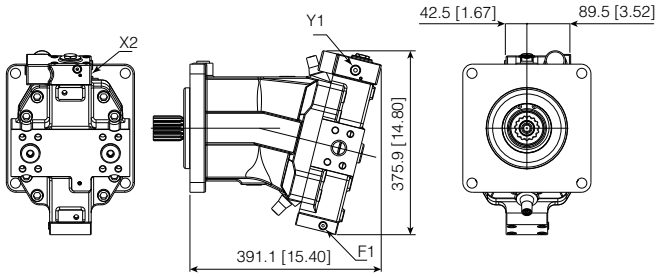


Piloting port - 7/16" - 20 UNF

REN Control

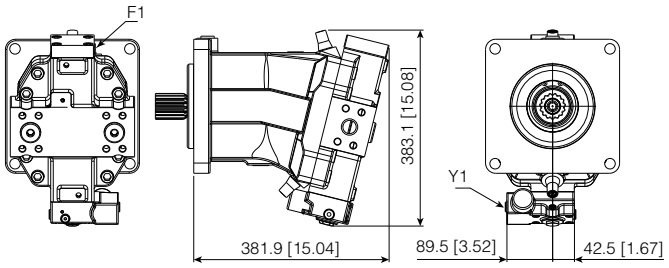


RIN Control



Piloting port - 7/16"-20 UNF

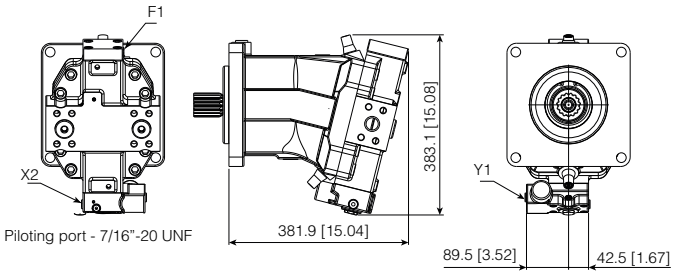
ROE Control



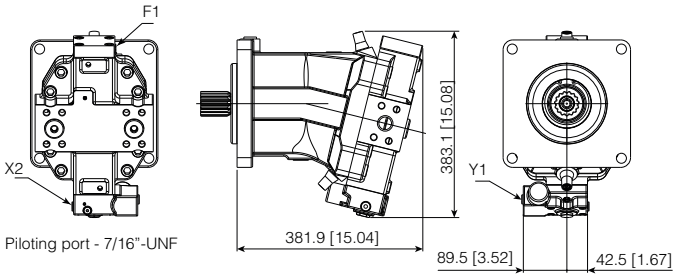
SH9V 215 - Control dimensions for mounting flange SAE-E 4 bolts (10) (Displ. setting 2)

10 Control

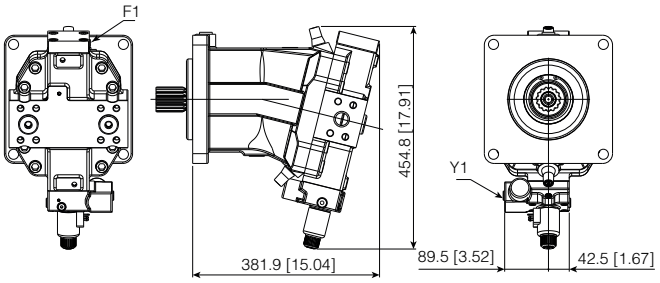
ROI Control



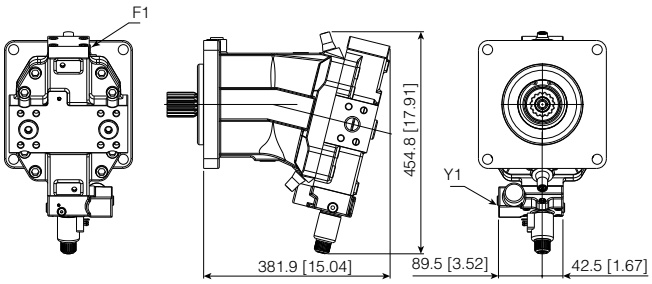
RPI Control



ROS Control

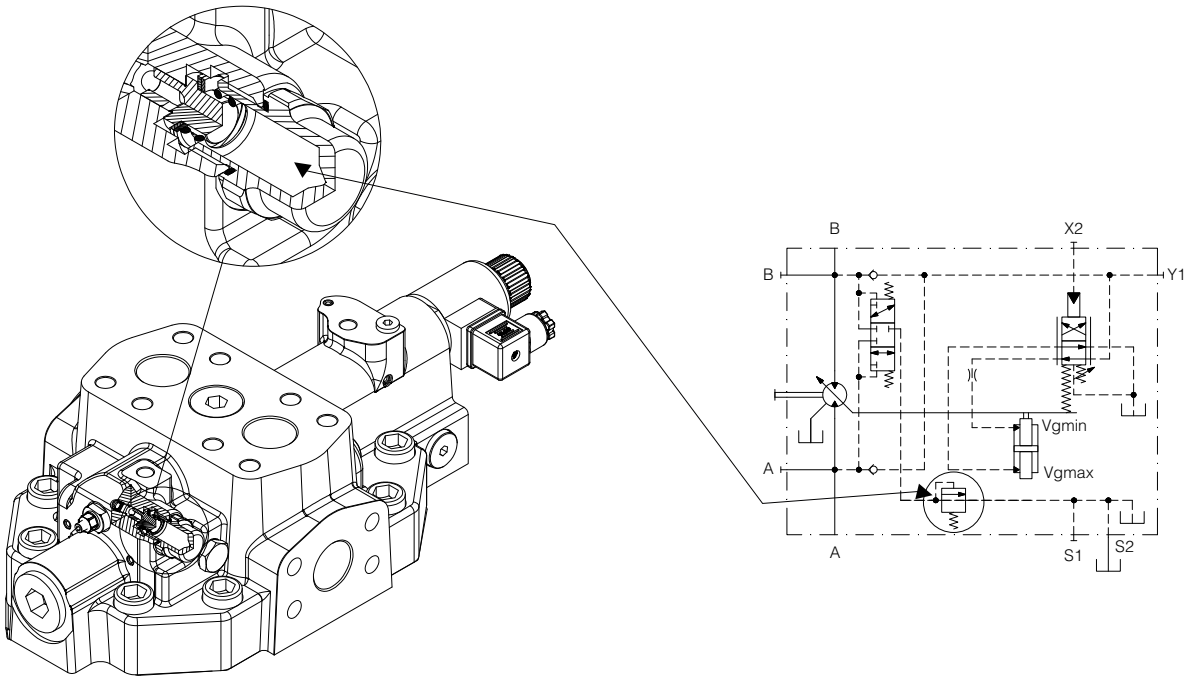


RPS Control

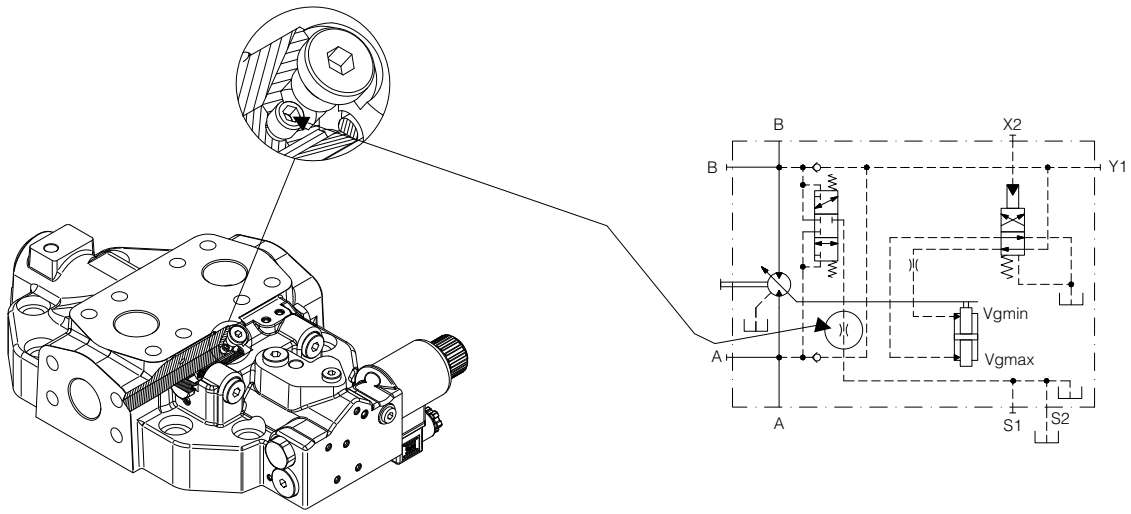


For closed circuit operation, the motors can be equipped with built in flushing valve.

Only for SH9V 115 - 165

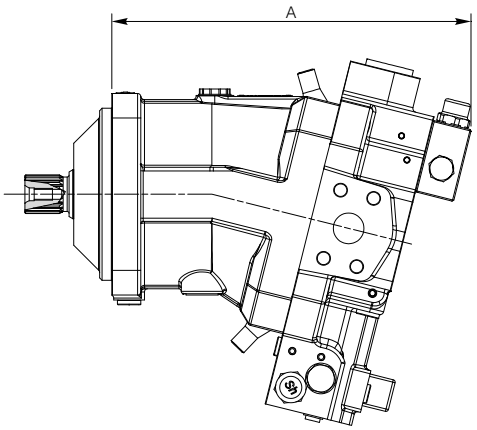


Only for SH9V 165 with two positions controls



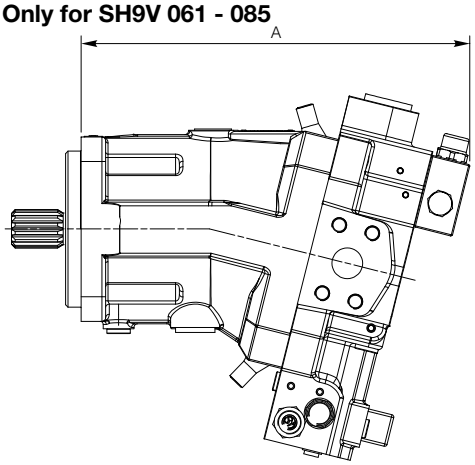
SH9V 061-085 Motor - Mounting flange ISO

Only for SH9V 061 - 085

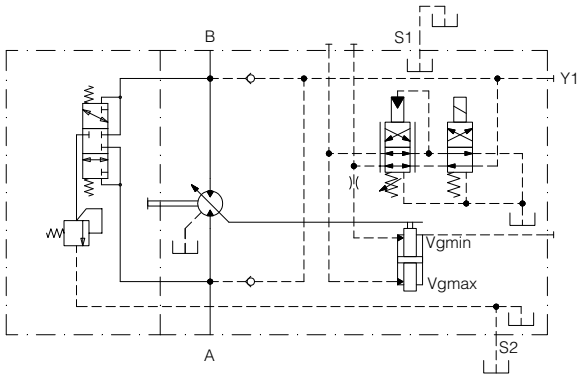


SH9V 061 - 085 Motor - Mounting flange SAE

Only for SH9V 061 - 085

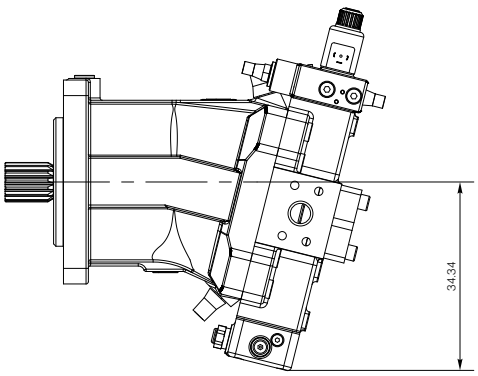


	Size			
	SH9V 061 ISO	**SH9V 085 ISO**	**SH9V 061 SAE**	**SH9V 085 SAE**
A mm [in]	268.3 [10.56]	292.6 [11.51]	323 [12.72]	316.6 [12.46]



SH9V 215 Motor

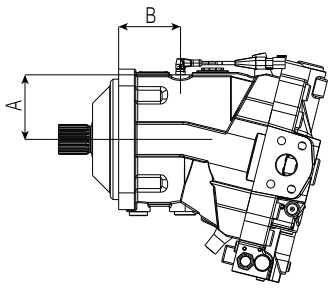
Only for SH9V 215

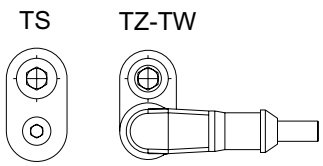


TS - TW - TZ

TS: Tachometer predisposition. Supplied with phonic wheel assembled on rotating group **without sensor**.

TW-TZ: With tachometer. Supplied with phonic wheel and sensor.





	Size									
	SH9V061 ME	**SH9V085 ME**	**SH9V115 ME**	**SH9V165 ME**	**SH9V215 ME**	**SH9V061 SE**	**SH9V085 SE**	**SH9V115 SE**	**SH9V165 SE**	**SH9V215 SE**
A mm	64 [2.52]	79.9 [3.14]	88.9 [3.49]	96.9 [3.81]	101.9 [4.01]	88 [3.46]	79.9 [3.14]	88.9 [3.49]	96.9 [3.81]	101.9 [4.01]
B mm	75.5 [2.97]	76.5 [3.01]	86.5 [3.40]	92.5 [3.64]	105 [4.13]	75.5 [2.97]	100.5 [3.95]	120.5 [4.74]	124.5 [4.90]	105 [4.13]

TW
2-Channel differential-hall effect operating principle (1 square wave -1 digital for direction of rotation) Output signal PNP
Power supply 4.5-16 VDC
Frequency 0 - 20.000 Hz
Operating temperature -40°C - +110°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

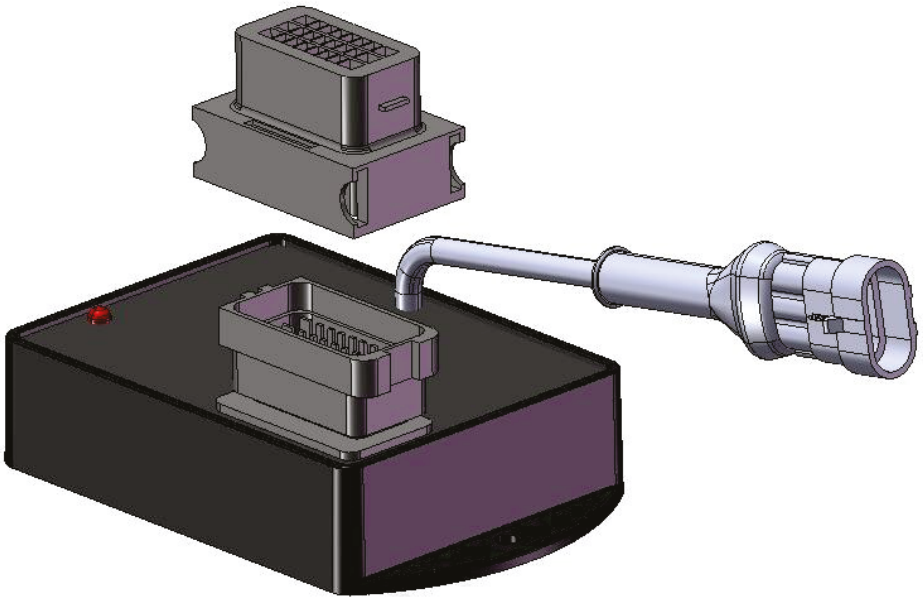
TZ
2-Channel differential-hall effect operating principle Sensor with dual-channel output (90°)
Power supply 8-32 VDC
Frequency 0-20.000 Hz
Operating temperature -40°C +125°C
Degree of protection IP67
Sensor connector Deutsch DT04-4P
Electromagnetic compatibility according to EN 60947-5-2
Resistence to schock and vibration in accordance with IEC 68-2-17 IEC 68-2-6

	Size				
	SH9V061	**SH7V 075**	**SH7V 108**	**SH7V 160**	**SH7V 200**
Number of pulses per revolution	54	58	67	75	80

DANA BREVINI® Motion Systems

Index

General information - Features Q2
Technical data Q3
Ordering code Q4
Contacts description Q5
Dimensions Q6
Working modes Q7



General information - Features

The MAV4211SH controller unit is used for the control of variable displacement pumps and motors and additional switching functions. The proportional solenoid outputs are pulse -width-modulated (PWM) and optimally adapted for electric proportional control of Dana products. The switched outputs are designed for the direct switching of relays, lamps and switching solenoids. The MAV4211SH unit can managed up to 2 analog input signal and 4 PWM current output. Connecting the card properly, can be used in at least 5 different applications.
The RS232 serial interface and BPE software tool enables the connection of PC for service functions, such as diagnostics, parameter setting or display of process variables. The software is free downloadable from internet site:

https://www.brevinifluidpower.com/products/bpeterminal-software/

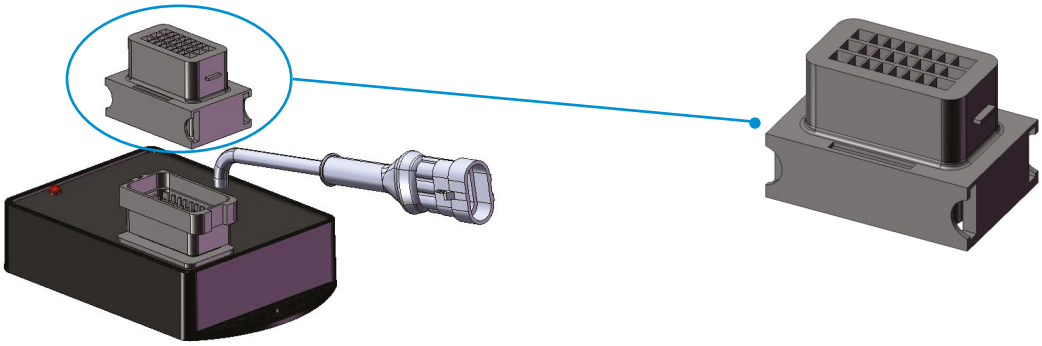
Adjustment parameters by RS232 link :
- Frequency PWM
- Offset current
- Gain current
- Ramp up time current
- Ramp down time current
- Analog input configuration (0÷5V, 0÷10V, 0÷20mA).

Main features:
- CE requirements: European norms: EN61000-ElectroMagnetic Compatibility (EMC) - industrial environment.

Additional features:
- Aerial platforms
- Mobile cranes
- Agricultural machines
- Handling machines

Nominal voltage		12V - 24V
Operating supply voltage		9 ÷ 33Vdc
Current consumption	With load, max	9 A
Protection Fuse	Only external	Rapid fuse 10A
Constant voltage source	For joystick supply	5V
Analog inputs	N°2 polarized at 2.5V	0 ÷ 2.5V ÷ 5V
	N° 2 selectable from Voltage to current	0 ÷ 10V
		0 ÷ 20mA
Switch input	High or low active	Low< 1.5V; high > 6V
Proportional PWM output		0 ÷ 2A
PWM frequency range		70Hz ÷ 250Hz
On/off output (mosfet)	Max load	3A
Led indicator		Green / Red / Yellow
Interfaces		RS232
Number of switch inputs	MAV - Enable	1
	Enable the motor displacement variation	1
	Forward / Reverse	2
Number of PWM output		4
Number on/off output	Motor Brake Release	2
Protection against short circuit	Input and output	Yes
Reverse connect protection	Power supply	Yes
Operating temperature		-40 ÷ 70°C
IP protection	With mounted mating connector	IP67
Mating connector	FCI - SICMA	24 poles

Ordering code



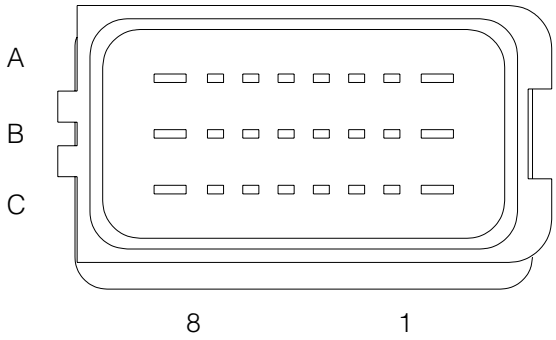
Ordering code [1] :
7-365-1185

[1] The card will be supplied in configuration 1 as “Control of one circuit closed pump”. For more information, please to consult the instruction manual.

Plug-in connector to separate order under material:
- 24 poles FCI - SICMA
Ordering code:
7-003-054

Plug-in connector to 24 poles FCI – SICMA with 1 mt. cable length.
Ordering code:
7-180-403

SICMA 2



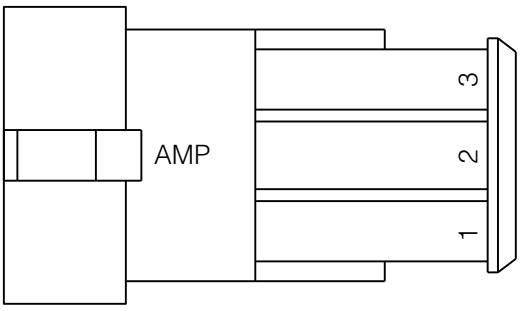
pin	8	7	6	5	4	3	2	1
A	On/off output Brake 1	Input EMDV	Return PWM 1 A and B	PWM out A2	Input Fw / Rw			Pos (+) Supply

pin	8	7	6	5	4	3	2	1
B	PWM out B1	Return PWM A3	Return PWM A2	input enable	Analog input CH1	Analog input CH3		PWM out A3

pin	8	7	6	5	4	3	2	1
C	PWM out A2	5V joystick supply	PWM out A1	On/off output Brake 2	Analog input CH2	Analog input CH4	Input Fw/Rw	Neg (-) Supply

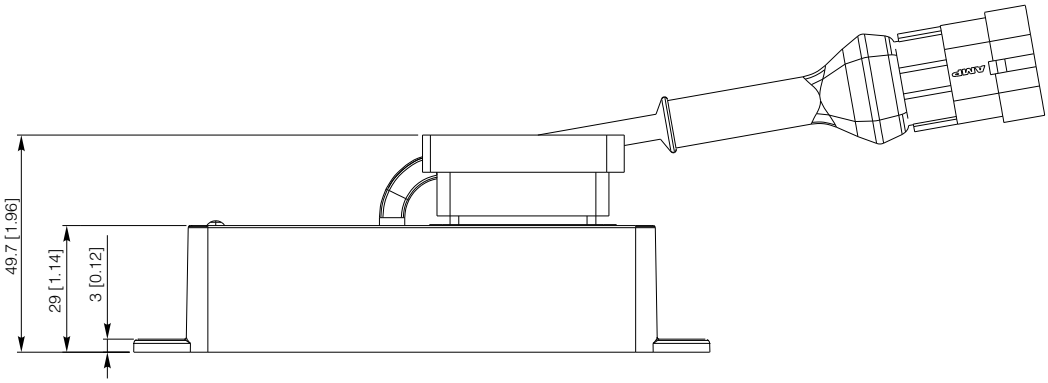
Note:
The negative (0V) of joysticks supply or pedal has to be connected to the negative of battery.

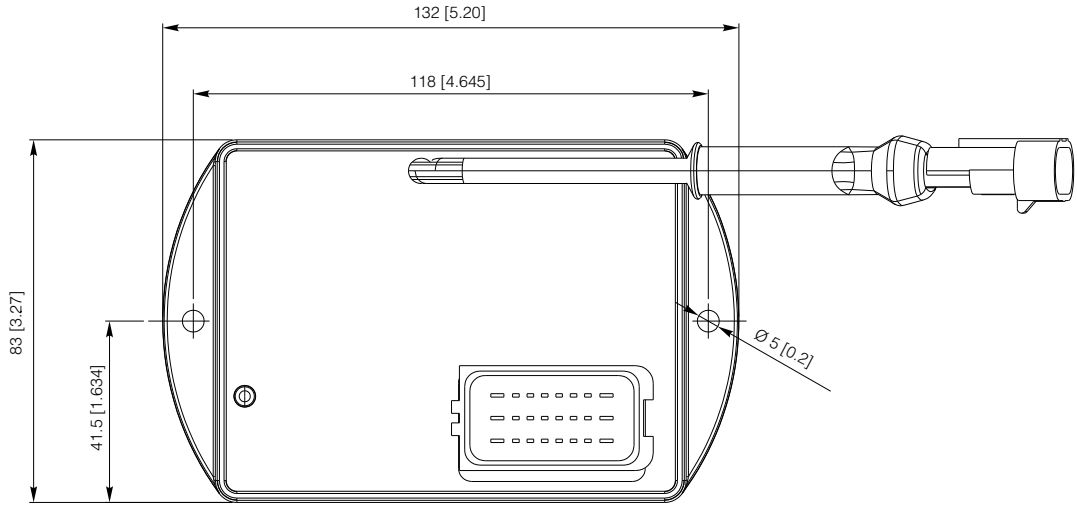
Serial Link RS232 connector : AMP superseal 1.5



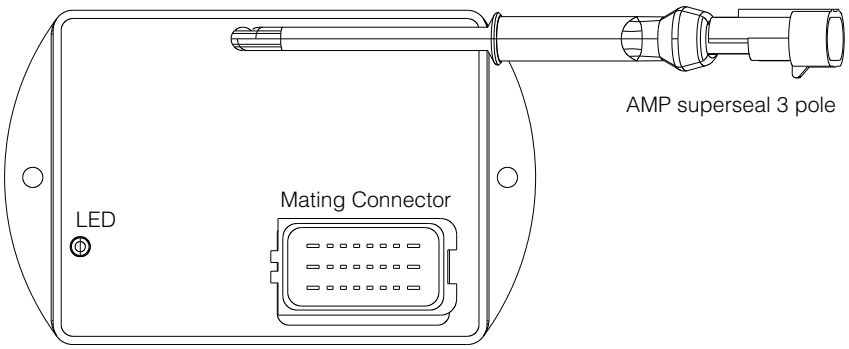
Pin 1	Pin 2	Pin 3
GND	RX	TX

Dimensions



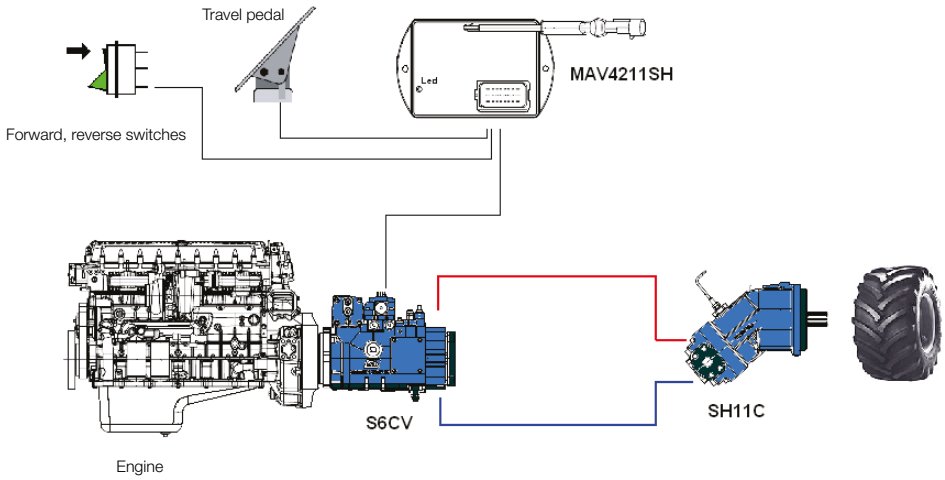


LAYOUT



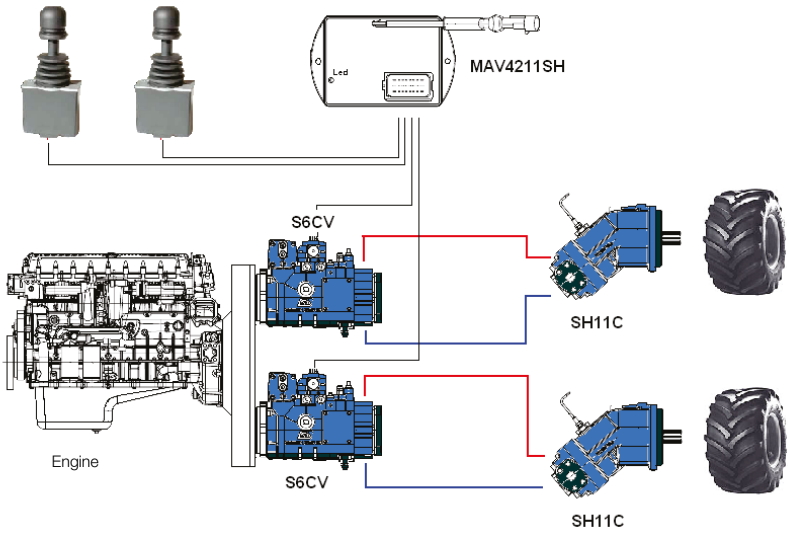
MODES 1

Control of one circuit closed pump



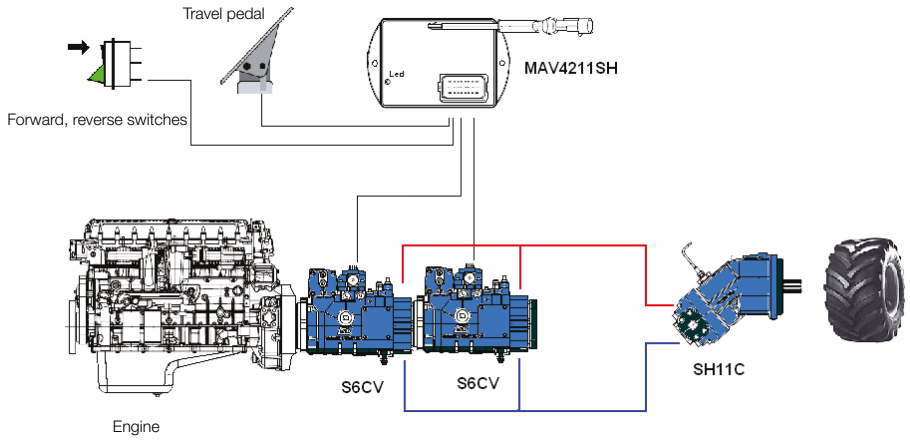
MODES 2

Control of two independent closed circuit pumps.



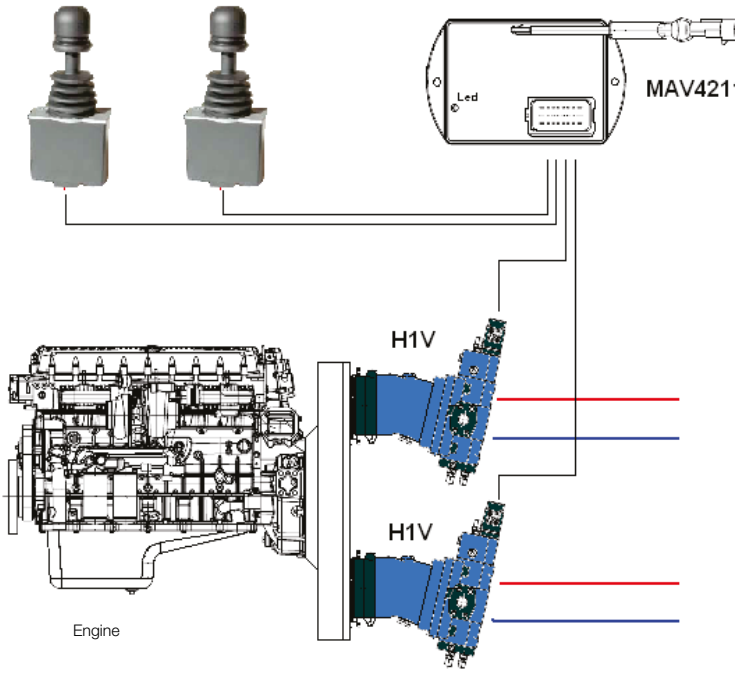
MODES 3

Control of two closed circuit pumps in tandem configuration.



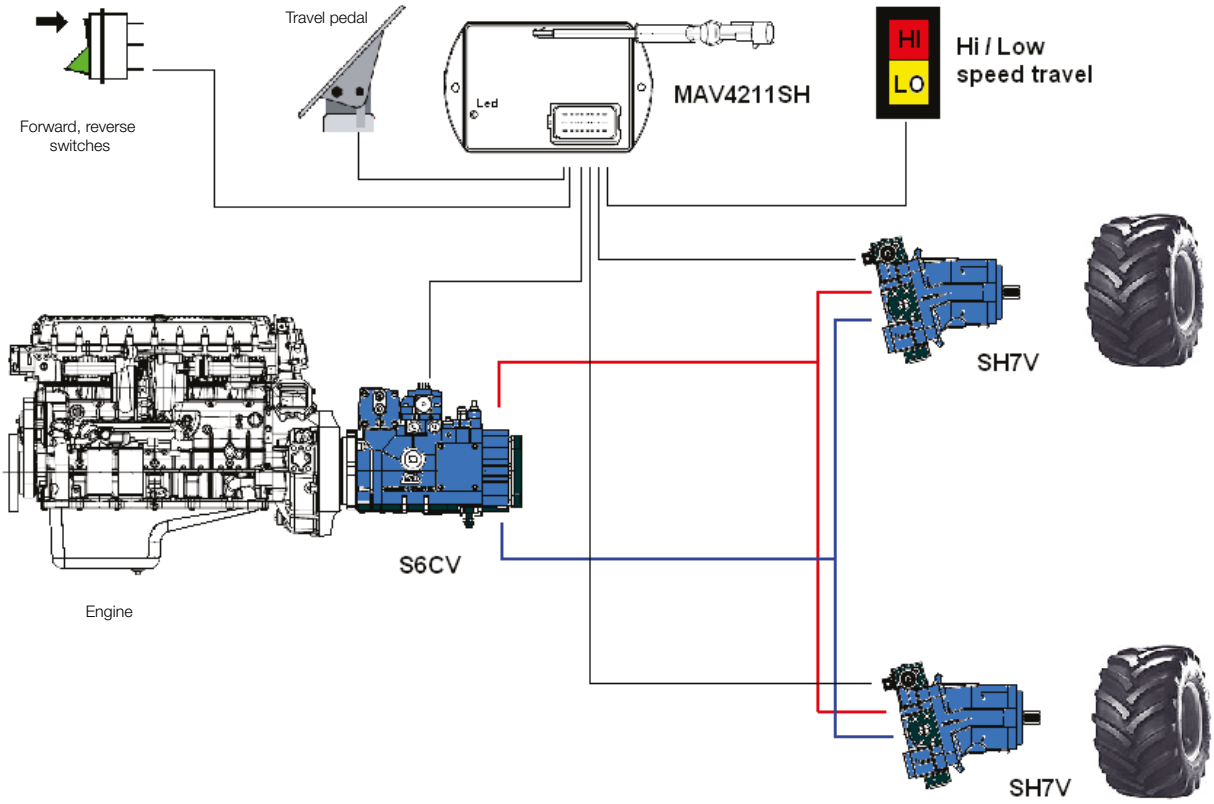
MODES 4

Control of two independent (motors) or open circuit pumps.



MODES 5

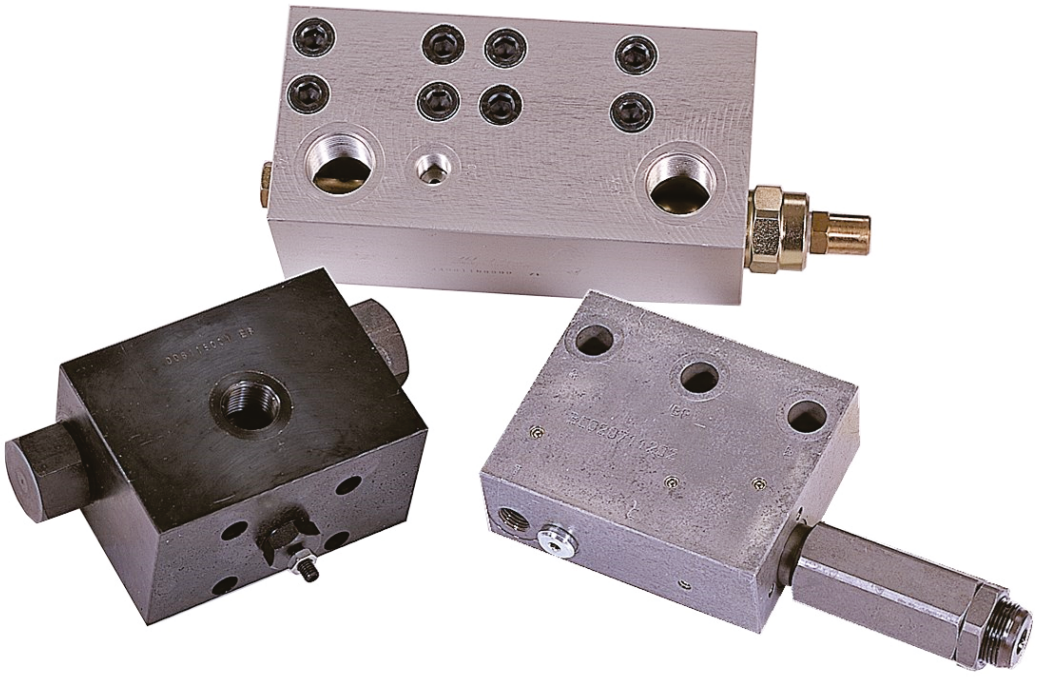
Control of one circuit closed circuit pump and one or two variable displacement motors.



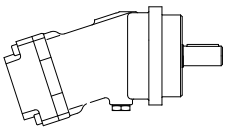
DANA BREVINI® Motion Systems

Index

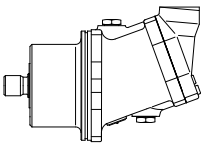
General information - Features R2
Technical data R3
Flushing valves dimensions R4
Motors predisposition R5
Pilot assisted overcentre valves for motors R7
Internal piloting sequence valve R12
Motion control valve R13
Check valve and Anti-Shock valve R18



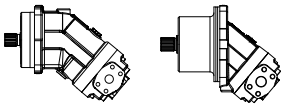
H1C



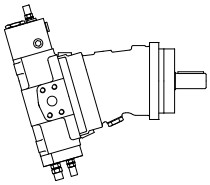
H1CR



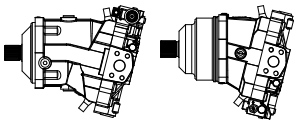
SH11C **SH11CR**



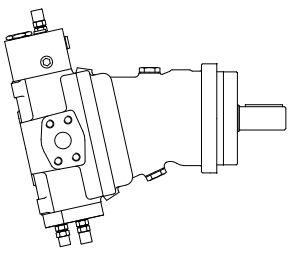
H2V

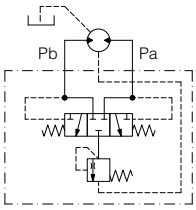


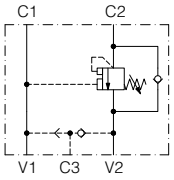
SH7V **SH7VR**

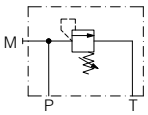


H1V

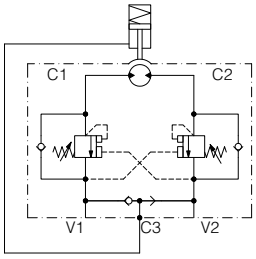


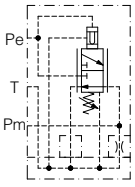












Flushing valves

VSC

VSC20L

Overcentre valves

VCD/M

VCD/1

VCD/2

Anti-shock valves

VSD 120

Check valves

VU165

Overcentre valves

VCR1 D/AF

VCR2 D/AF

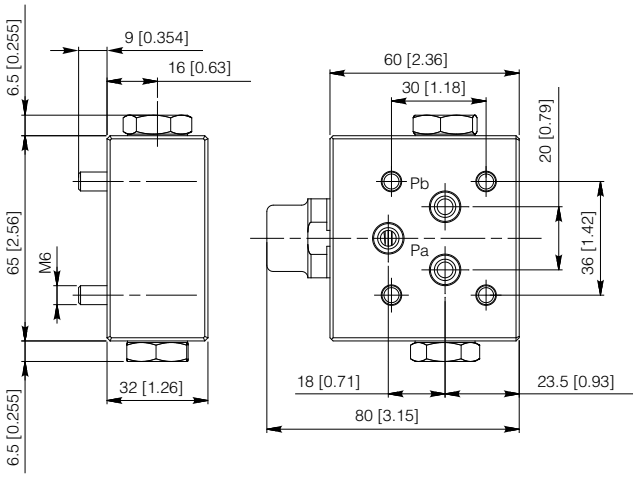
VCR3

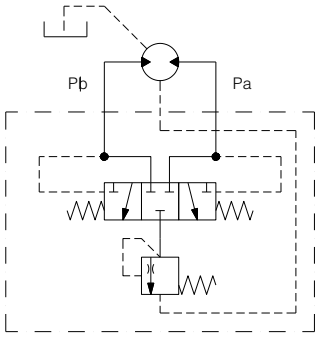
VCR4

Sequence valves

VSI

The VSC flushing valve allows an oil cooling action, which is recommended when operating at high speed and power. The unit is made by a three positions - three way spool valve that allows a small oil flow from the low pressure line of the circuit into the motor casing without external piping (only H2V 226 still need an external line), then into the tank. For a correct operation it is necessary to connect the drain port of the motor with the tank.



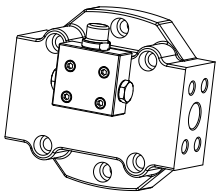


The shuttle valve can be fitted in the following versions:

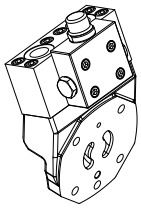
Code	Valve description	Thoretical flow (at 22 bar/319 psi) l/min [U.S. gpm]	Orifice Diameter mm [in]
52152000000	VSC 06F	6 [1.5]	1.5 [0.05]
52152100000	VSC 09F	10.5 [2.7]	2 [0.07]
52152200000	VSC 15F	15 [3.9]	2.5 [0.09]

The valves can be flanged on the following motors:

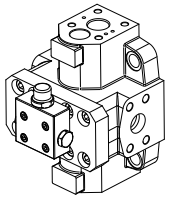
H1C/H1CR/SH11C/SH11CR (Cover LM2) motors



H1C/H1CR/SH11C/SH11CR (Cover VM2) motors

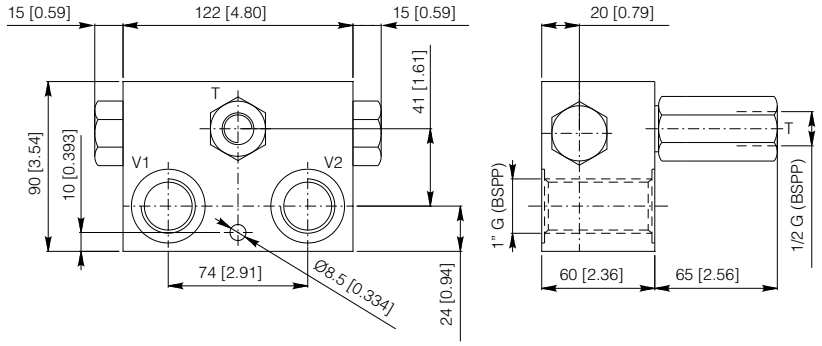


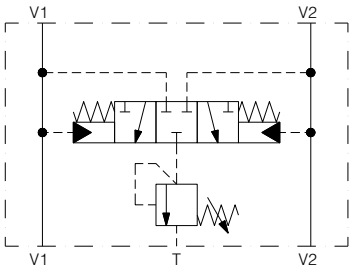
H2V/SH7V 075/SH7VR 075 motors



Flushing valves dimensions

VSC20L





Valve code	Weigth kg [lbs]
44081720000	4.4 [9.70]

VSC20L - Flushing valves with flow ~ 20 l/min [5.28 U.S. gpm] at 21 bar [304 psi] - (in line version).

LM2 H1C-H1CR motors

To mount the flushing valve on H1C-H1CR motors with LM2 ports cover, it is necessary to provide the covers below indicated:

Nr.	Code	Description	Motor type
1	**34012770000**	Port cover LM2 for flushing valve	H1C/H1CR 020/030
2	**34012780000**	Port cover LM2 for flushing valve	H1C/H1CR 040
3	**34012820000**	Port cover LM2 for flushing valve	H1C 226

VM2 H1C-H1CR motors

To mount the flushing valve on H1C-H1CR motors with VM2 ports cover, it is necessary to provide the covers below indicated:

Nr.	Code	Description	Motor type
1	**34012940000**	Port cover VM2 for flushing valve	H1C/H1CR 020/030
	SPA00000372	Mounting plate valve Kit	
2	**34012850000**	Port cover VM2 for flushing valve	H1C/H1CR 040
	SPA00000373	Mounting plate valve Kit	

L2 H2V motors

To mount the flushing valve on H2V motors with L2 ports cover, it is necessary to provide the covers below indicated:

Nr.	Code	Description	Motor type
1	**65015350000**	Mounting flange Kit	H2V 226 *

(*) An external line for the flushing valve output flow is required
- not provided

SH11C-SH11CR / LM2

To mount the flushing valve on SH11C-SH11CR motors with LM2 ports cover, it is necessary to provide the covers below indicated:

Nr.	Code	Description	Motor type
1	**31760800000**	Port cover LM2 VSC SH11C 20/28/32 ISO (ME)	SH11C/SH11CR 020/030 ME
	31760950000	Port cover LM2 VSC SH11C 20/28/32 SAE (SE)	SH11C/SH11CR 020/030 SE
2	**31754750000**	Port cover LM2 ISO (ME) for flushing valve	SH11C/SH11CR 055/063 ME
	31756900000	Port cover LM2 SAE (SE) for flushing valve	SH11C/SH11CR 055/063 SE
3	**31755400000**	Port cover LM2 ISO (ME) for flushing valve	SH11C/SH11CR 075/090 ME
	31729150000	Port cover LM2 SAE (SE) for flushing valve	SH11C/SH11CR 075/090 SE
4	**31756500000**	Port cover LM2 ISO (ME) for flushing valve	SH11C/SH11CR 108/125 ME
	31759700000	Port cover LM2 SAE (SE) for flushing valve	SH11C/SH11CR 108/125 SE
5	**31757700000**	Port cover LM2 ISO (ME) for flushing valve	SH11C/SH11CR 160/180 ME
	31703900000	Port cover LM2 SAE (SE) for flushing valve	SH11C/SH11CR 160/180 SE

SH11C-SH11CR / VM2

To mount the flushing valve on SH11C-SH11CR motors with VM2 ports cover, it is necessary to provide the covers below indicated:

Nr.	Code	Description	Motor type
1	**31760850000**	Port cover VM2 VSC SH11C 20/28/32	SH11C/SH11CR 020/030 ME/SE
	31761100000	Port cover VM2 VSC SH11C 20/28/32 SAE (SE)	
	SPA00000372	Plate valve kit VSC H1C/H1CR 20/30 VM2	
2	**31757000000**	Port cover VM2 ISO for flushing valve	SH11C/SH11CR 055/063 ME/SE
	31757150000	Port cover VM2 SAE for flushing valve	
	SPA00000373	Mounting plate valve kit	
3	**31729200000**	Port cover VM2 ISO for flushing valve	SH11C/SH11CR 075/090 ME/SE
	31729250000	Port cover VM2 SAE for flushing valve	
	SPA00000653	Mounting plate valve kit	
4	**31759900000**	Port cover VM2 ISO for flushing valve	SH11C/SH11CR 108/125 ME/SE
	31759950000	Port cover VM2 SAE for flushing valve	
	SPA00000686	Mounting plate valve kit	
5	**31705500000**	Port cover VM2 ISO for flushing valve	SH11C/SH11CR 160/180 ME/SE
	31706300000	Port cover VM2 SAE for flushing valve	
	SPA00000686	Mounting plate valve kit	

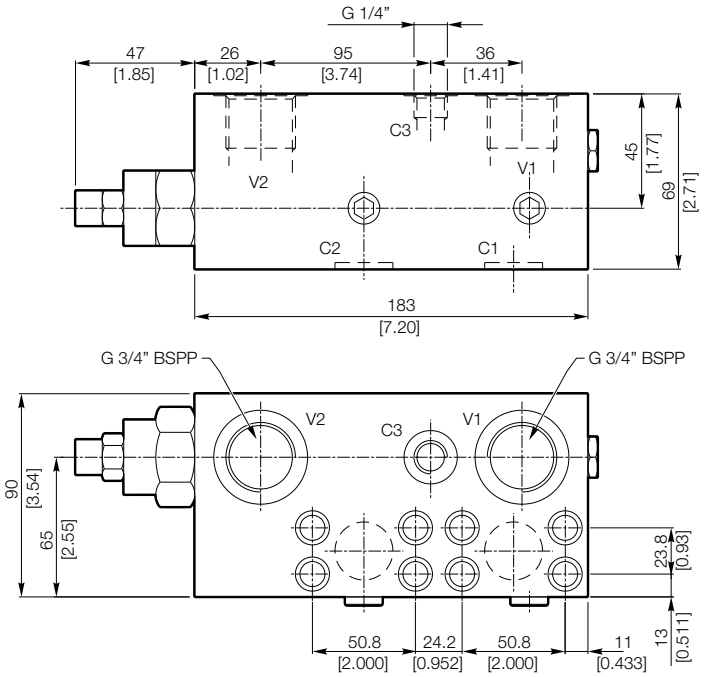
VCD H1C-H1CR-SH11C-H2V motors

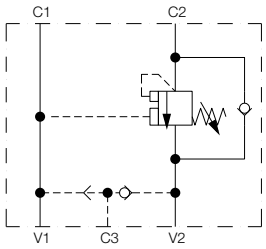
The pilot assisted overcentre valves prevent the motor from “running ahead” pulled by a driving load and allow cavitation free operation. The relief section limits the pressure shocks. These valves incorporate also a shuttle valve to release the fail safe brake. These valves are supplied flangeable on H1C-SH11C-SH11CR/LM2, H1C-H1CR-SH11C-SH11CR/VM2, or H2V/L2 ports covers. The setting pressure value must be approx. 1.3 times the load induced pressure.To allow the descent of the load, a minimum pilot pressure must be supplied to the control valve. This is usually determined with the following formula:

$$PP = \frac{PS - PL}{R + 1}$$

where:
PP = pilot pressure
PS = pressure setting of relief valve section
PL = load induced pressure
R = piloting ratio

VCD/M H1C-H1CR-SH11C-SH11CR VM2/FM2 motors



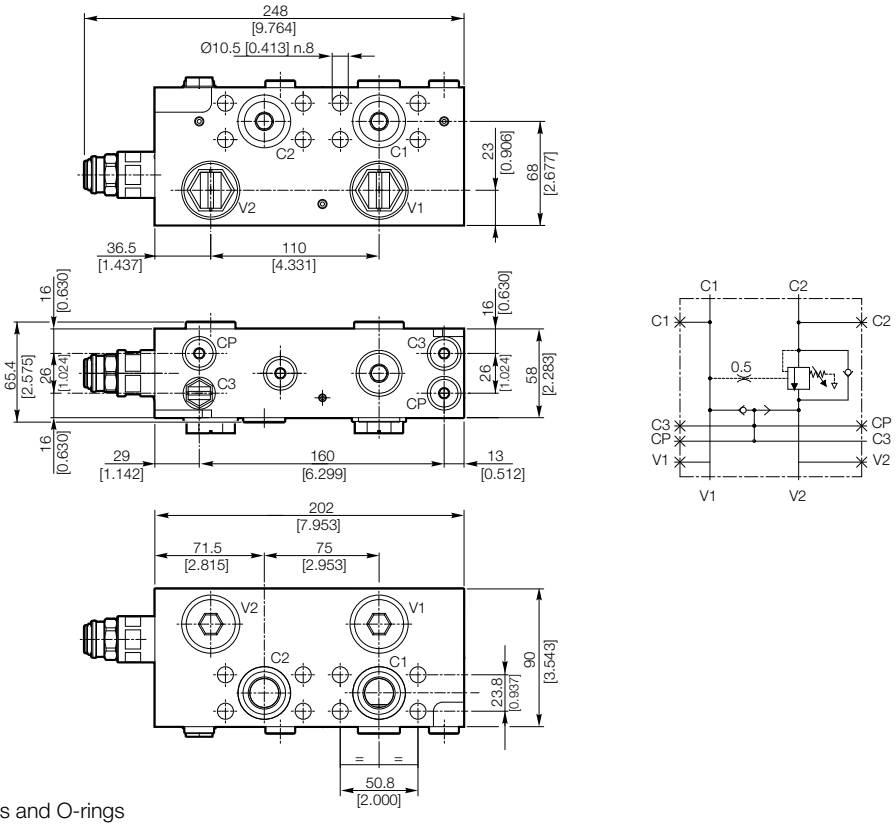


Valve is supplied with screws and O-rings

Valve	Piloting ratio	Setting range bar [psi]	MAX flow rate l/min [U.S.gpm]	Material	Motor type		Weight kg [lbf]
					H1C H1CR VM2	SH11C SH11CR VM2/FM2	
SPA00000369*	6.2:1	30 ÷ 350 [435 ÷5075]	350 [92.4]	Aluminium	040/045	055/063	3.5 [7.71]

(*) Corrosion protected

VCD/M H1C-H1CR-SH11C-SH11CR VM2/FM2 motors

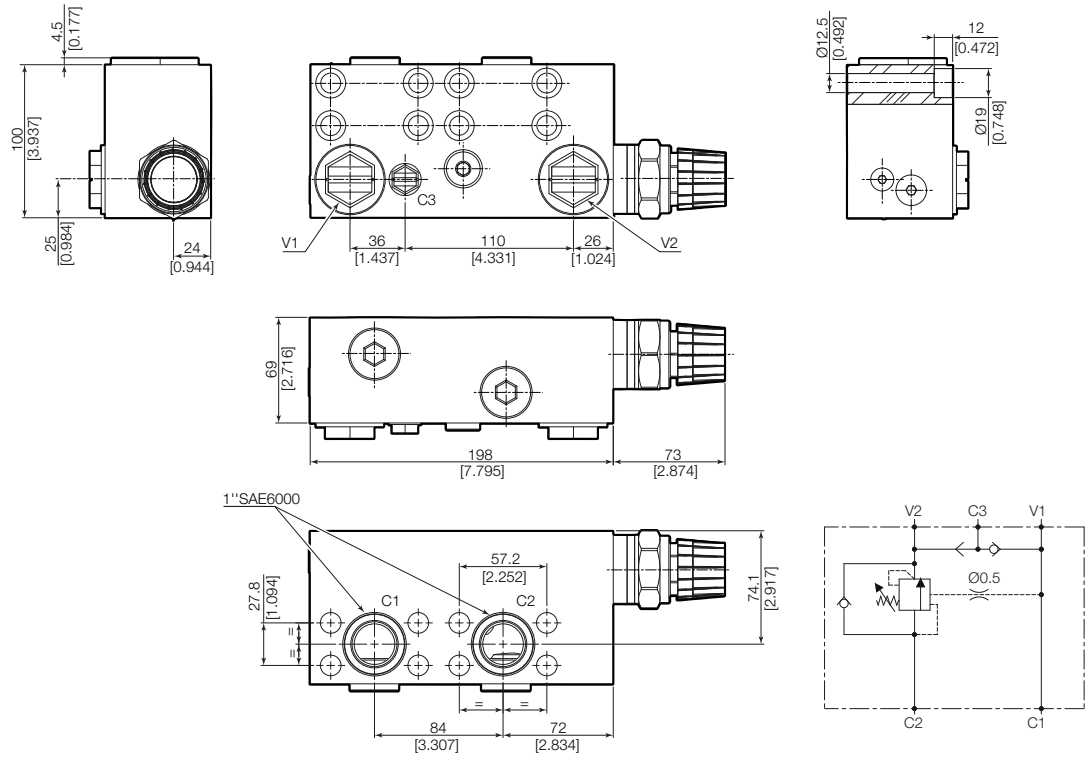


Valve is supplied with screws and O-rings

Valve	Piloting ratio	Setting range bar [psi]	MAX flow rate l/min [U.S.gpm]	Material	Motor type H1C H1CR VM2	Motor type SH11C SH11CR VM2/FM2	Weight kg [lbf]
SPA00000368*	6.2:1	100 ÷ 350 [1450 ÷5075]	130 [34.3]	Steel	020/030	020/030	7.2 [15.9]

(*) Corrosion protected

VCD/M SH11C-SH11CR VM2/FM2 motors

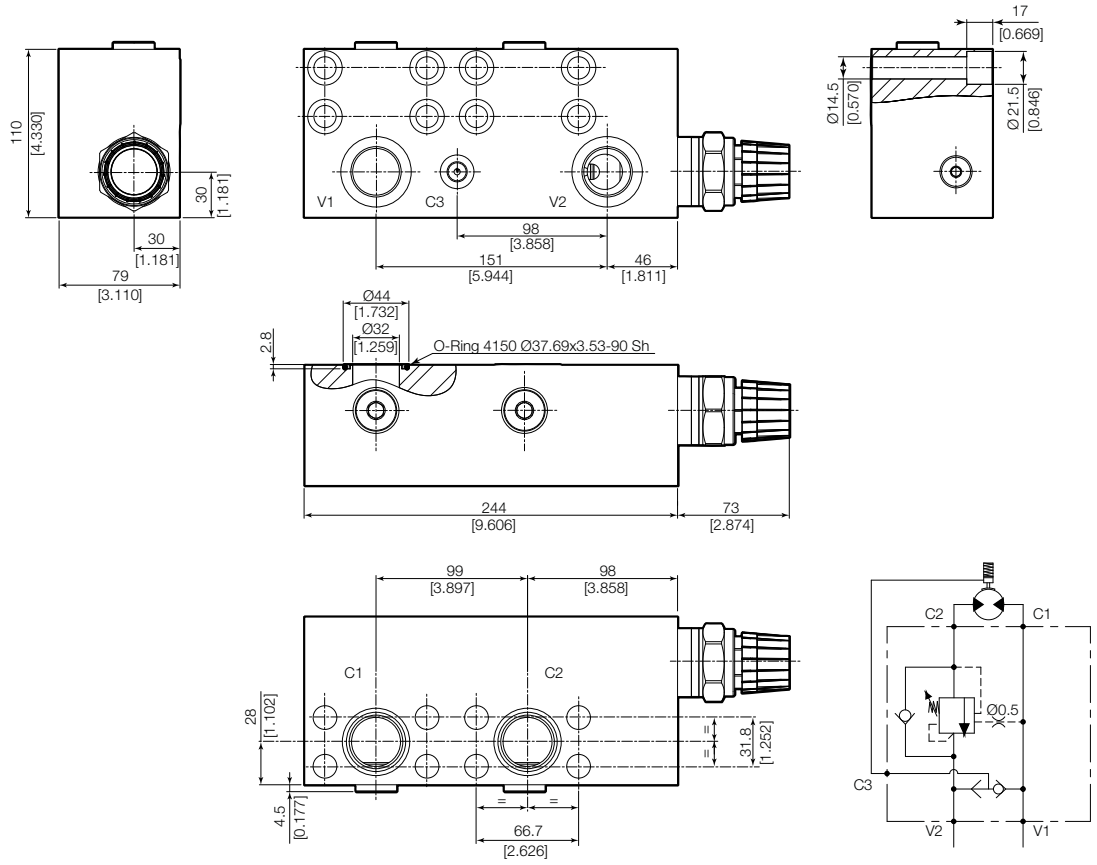


Valve is supplied with screws and O-rings

Valve	Piloting ratio	Setting range bar [psi]	MAX flow rate l/min [U.S.gpm]	Material	Motor type **SH11C** **SH11CR** VM2/FM2	Weight kg [lbf]
SPA00000370*	6:1	250 ÷ 500 [3625 ÷ 7250]	350 [92.4]	Steel	075/090	9.3 [20.5]

(*) Corrosion protected

VCD/M SH11C-SH11CR VM2/FM2 motors

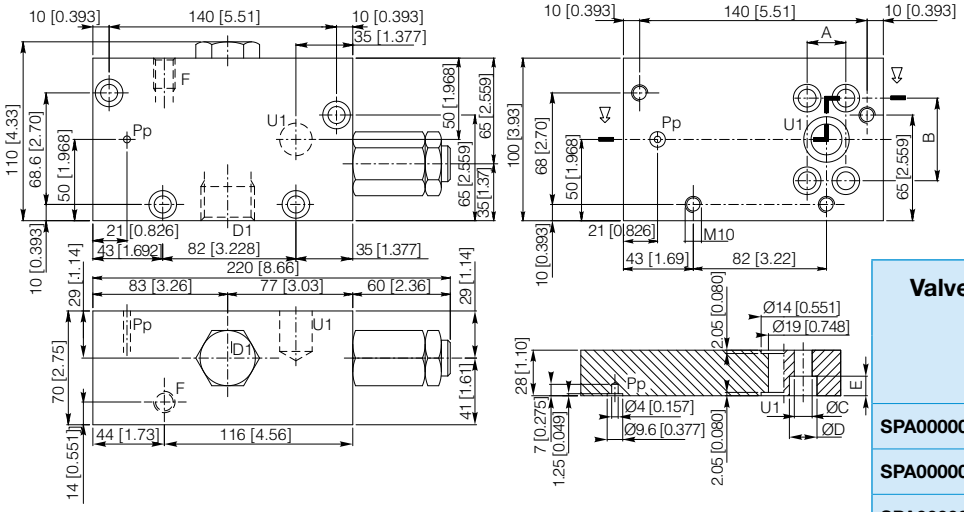


Valve is supplied with screws and O-rings

Valve	Piloting ratio	Setting range bar [psi]	MAX flow rate l/min [U.S.gpm]	Material	Motor type SH11C SH11CR VM2/FM2	Weight kg [lbf]
SPA00000756*	4:1	100 ÷ 500 [1450 ÷ 7250]	300 [79.2]	Steel	108/125 160/180	14.3 [31.5]

(*) Corrosion protected

VCD/1

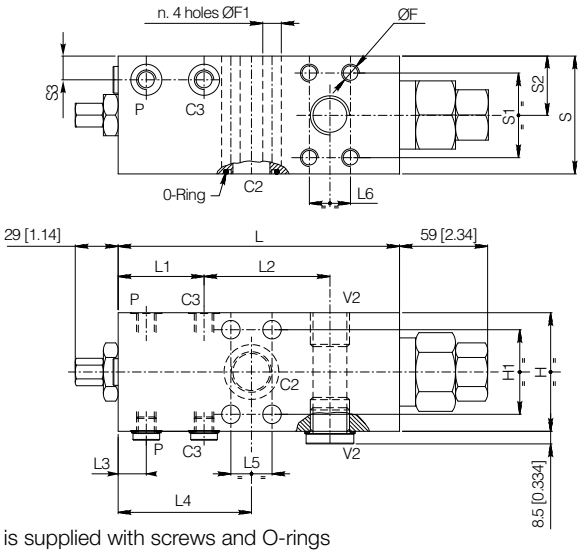


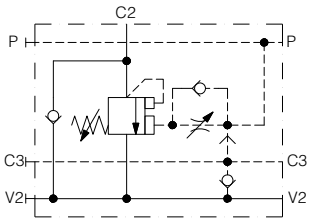
Valve is supplied with screws and O-rings

Valve	Piloting ratio	Setting range bar [psi]	MAX flow rate l/min [U.S.gpm]	Material
SPA00000365	2.9:1	0 ÷ 350 [0 ÷ 5075]	180 [47.5]	Steel
SPA00000366	2.9:1	0 ÷ 350 [0 ÷ 5075]	180 [47.5]	Steel
SPA00000367	2.9:1	0 ÷ 350 [0 ÷ 5075]	180 [47.5]	Steel

Valve	Motor type SH11C Sh11CR LM2	H1C LM2	SH7V SH7VR LM	H2V L2	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	D1 in	F/Pp in	Weigth kg [lbf]
SPA00000365	055/063	020/030 040	055	-	23.8 [0.937]	50.8 [2.000]	11 [0.433]	17 [0.66]	12 [0.472]	1" G (BSPP)	1/4" G (BSPP)	4.7 [10.4]
SPA00000366	075/090	-	075/108	-	27.8 [1.094]	57.1 [2.248]	13 [0.511]	19 [0.74]	14 [0.551]	1" G (BSPP)	1/4" G (BSPP)	4.7 [10.4]
SPA00000367	108/125 160/180	226	160	226	31.6 [1.244]	66.7 [2.625]	15 [0.590]	22 [0.86]	16 [0.62]	1" G (BSPP)	1/4" G (BSPP)	4.7 [10.4]

VCD/2





Valve	Piloting ratio	Setting range bar [psi]	MAX pressure bar [psi]	MAX flow rate l/min [U.S.gpm]	Material
SPA00000371	13:1	250 ÷ 500 [3625 ÷ 7250]	350 [5075]	350 [92.4]	Steel
SPA00000597	13:1	250 ÷ 500 [3625 ÷ 7250]	350 [5075]	350 [92.4]	Steel

Valve is supplied with screws and O-rings

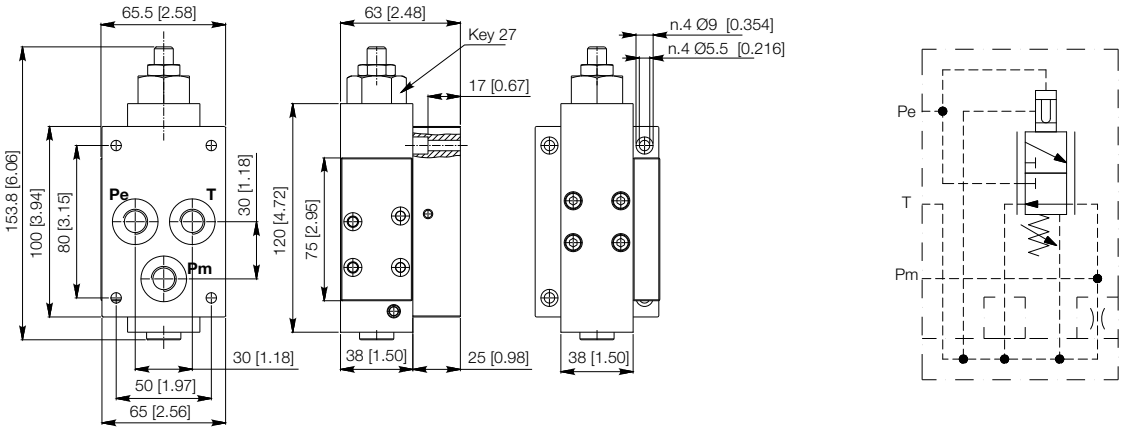
Valve	Motor type H1C LM2	H2V L2	SH7V SH7VR LM	SH11C SH11CR LM2	S3 mm [in]	S2 mm [in]	S1 mm [in]	S mm [in]	L6 mm [in]	L5 mm [in]	L4 mm [in]	L3 mm [in]	L2 mm [in]	L1 mm [in]	L mm [in]	H1 mm [in]	H mm [in]	F1 mm [in]	F mm [in]	C2-V2 in	C3-P in	O-ring -	Weight kg [lbf]
SPA00000371*	075/108	075/108	075/108	075/090	16 [0.62]	40 [1.57]	57.1 [2.248]	79.5 [3.12]	27.8 [1.094]	27.8 [1.094]	91 [3.58]	20 [0.78]	85 [3.34]	59 [2.32]	191 [7.51]	57.1 [2.248]	80 [3.14]	12.5 [0.492]	M12	1" SAE 6000	1/4" G (BSPP)	2-219	8.8 [19.4]
SPA00000597	160/226	160/226	160/226	108/125 160/180	21 [0.83]	49 [1.93]	66.7 [2.625]	99 [3.90]	31.8 [1.252]	31.8 [1.252]	77 [3.03]	11 [0.433]	94.5 [3.72]	36 [1.41]	176 [6.93]	66.7 [2.625]	99 [3.90]	14.5 [0.571]	M14	1 1/4" SAE 6000	1/4" G (BSPP)	2-221	13 [28.65]

(*) The mounting on SH7VR, needs an additiona flange. For more information please contact Dana Brevini.

The internal piloting sequence valve is meant to add a constant pressure control on the pumps standard controls with displacement setting 1 ($V_{g\,max} \rightarrow V_{g\,min}$).

VSI x CR

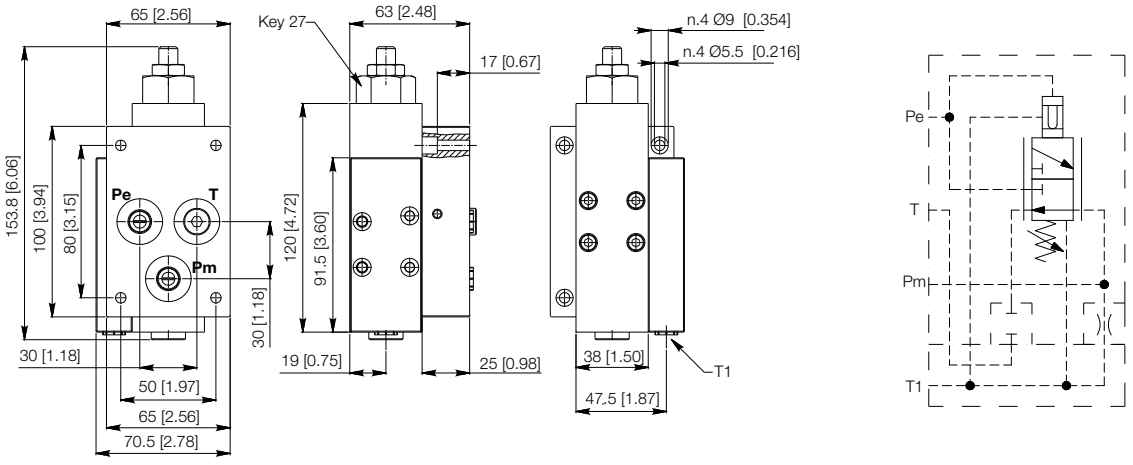
The valve VSI x CR (code 65002210000) is used only for CR controls.



P_e = Working pressure port 1/4" G (BSPP) depth 13mm [0.511 in]
P_m = Control pressure port 1/4" G (BSPP) depth 13mm [0.511 in]
T = Drain port 1/4" G (BSPP) depth 13mm [0.511 in]

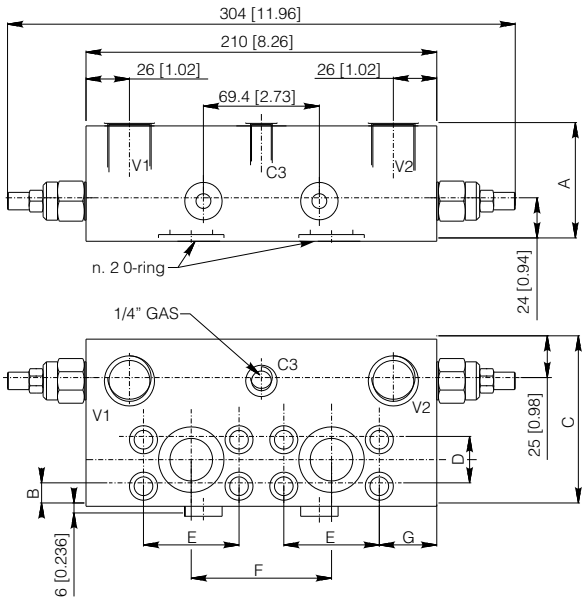
VSI 2

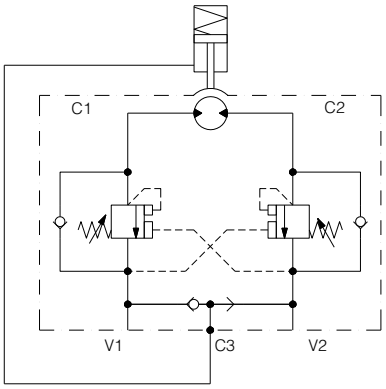
The valve VSI 2 (code 65009020000) is used only as a spare part for valves (code 44081520000) used on the old PCR and +PC controls.
For more informations, see the Service Bulletin 03-0094-A01.



P_e = Working pressure port 1/4" G (BSPP) depth 13mm [0.511 in]
P_m = Control pressure port 1/4" G (BSPP) depth 13mm [0.511 in]
T_1 = Drain port 1/8" G (BSPP) depth 13mm [0.472 in]

VCR1 D/AF H1C-H1CR-SH11C-SH11CR VM2/FM2 motors



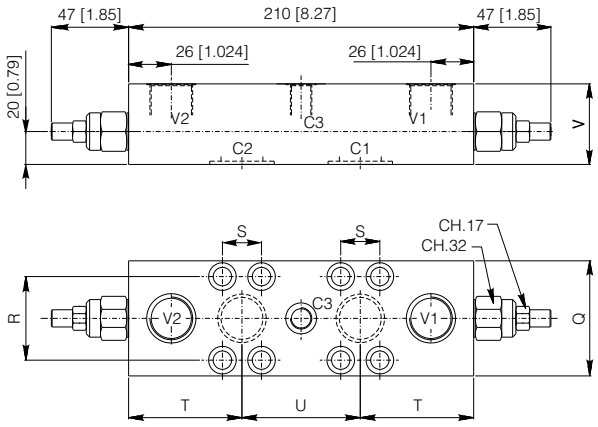


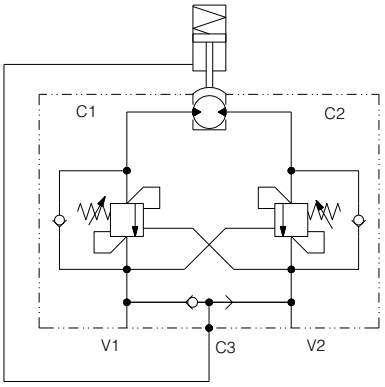
Valve	Piloting ratio	Setting range bar [psi]	Standard setting bar [psi]	Standard flow rate l/min [U.S.gpm]	Material
SPA00000362	6.2:1	30 ÷ 350 [435 ÷ 5075]	150 ÷ 170 [2175 ÷ 2465]	5 [1.32]	Aluminium

Corrosion protected

Valve	Motor type H1C H1CR VM2	Motor type SH11C SH11CR LM2-FM2	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	F mm [in]	G mm [in]	V1-V2 in	O-Ring -	Weight kg [lbf]
SPA00000362	020/030	020/030	59 [2.32]	16.8 [0.66]	80 [3.14]	18.2 [0.716]	40.6 [1.598]	59 [2.322]	55.2 [2.17]	1/2" G (BSPP)	2-115	4.7 [10.4]

VCR2 D/AF H2V F2-SH7V-SH7VR FM motors



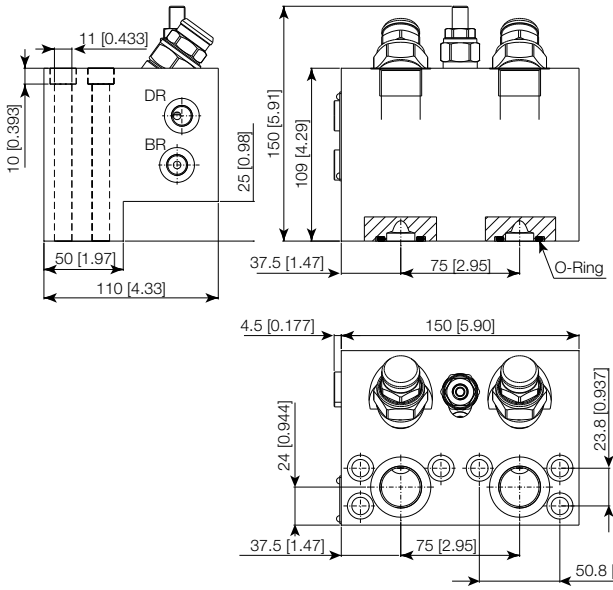


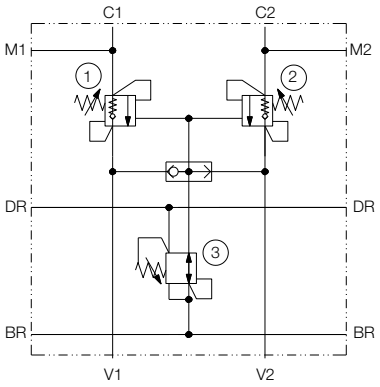
Valve	Piloting ratio	Setting range bar [psi]	Material
SPA00000708	6.2:1	60 ÷ 350 [870 ÷ 5075]	Aluminium

Corrosion protected

Valvola	Tipo motore H2V F2	Tipo motore SH7V SH7VR FM	Q mm [in]	R mm [in]	S mm [in]	T mm [in]	U mm [in]	V mm [in]	C1-C2 mm [in]	V1-V2 in	C3 in	Max Flow l/min [U.S. gpm]
SPA00000708	-	055	70 [2.75]	50.8 [2.000]	23.8 [0.937]	69 [2.716]	72 [2.835]	49 [1.93]	Ø15 [Ø0.59]	3/4" G (BSPP)	1/4" G (BSPP)	120 [31.68]

VCR3 H1C-H1CR-SH11C-SH11CR VM2/FM2 motors

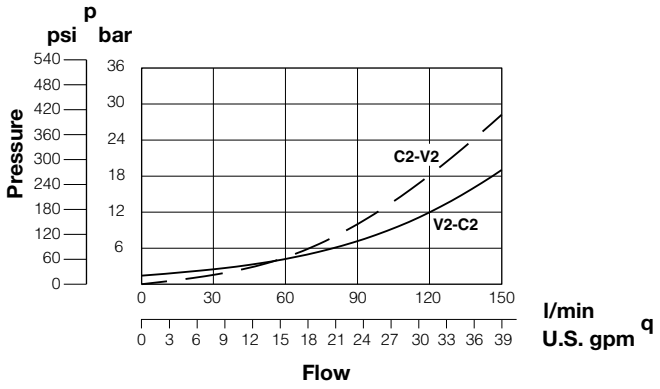




Valve	Piloting ratio	Pressure MAX bar [psi]	Nominal flow rate l/min [U.S.gpm]	Standard setting bar [psi]	Standard flow rate l/min [U.S. gpm]	Setting range bar [psi]	Pressure increase bar/rev [psi/rev]	Casing material
SPA00000816	8:1	420 [6090]	150 [39.6]	Valves ① ② 380 [5510] Valves ③ 30 [435]	5 [1.32]	Valves ① ② 100 ÷ 420 [1450 ÷ 6090] Valves ③ 10 ÷ 60 [145 ÷ 870]	Valves ① ② 82 [1189] Valves ③ 62 [899]	Steel

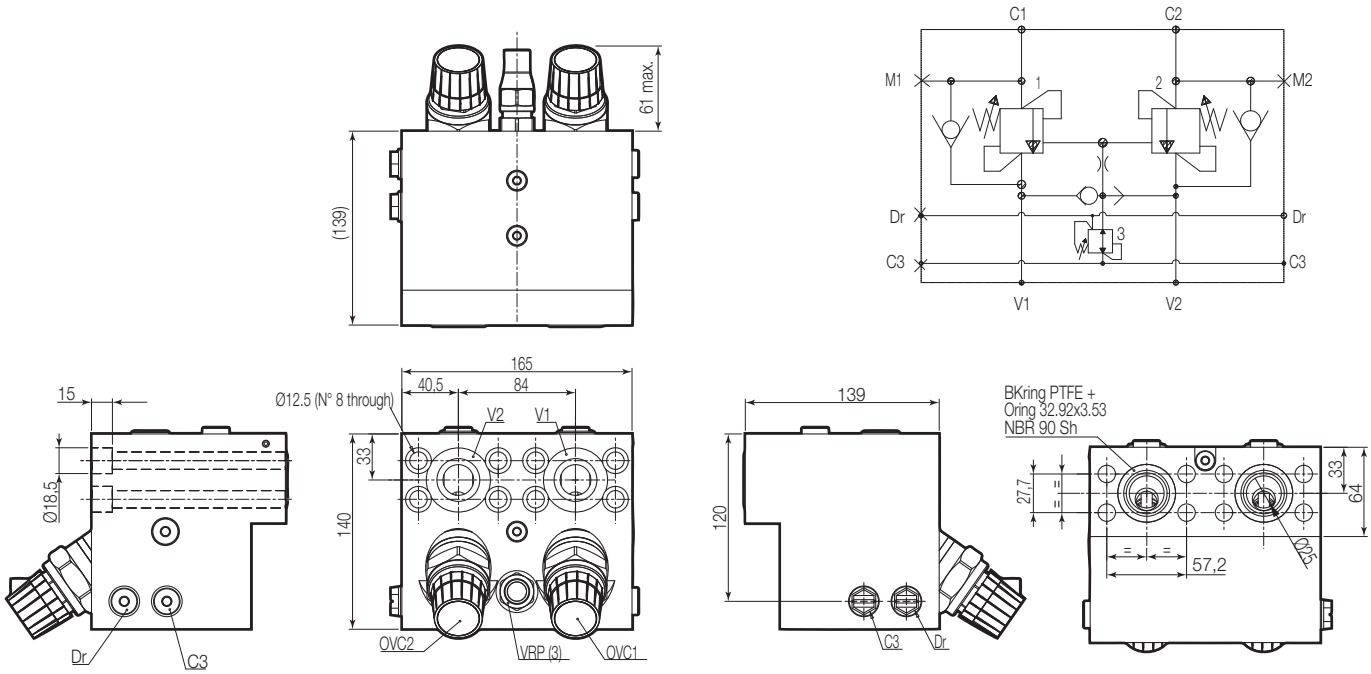
Valve	Type motor		BR-DR	V1-V2	C1-C2	O-ring	Weight
	H1C H1CR VM2	**SH11C SH11CR** VM2/FM2	in	in	in	-	kg [lbf]
SPA00000816	**040/045**	**055/063**	1/4" G (BSPP)	3/4" G (BSPP)	3/4" SAE 6000	2-213	11.11 [24.48]

Setting: at least 1.3 times the induced pressure



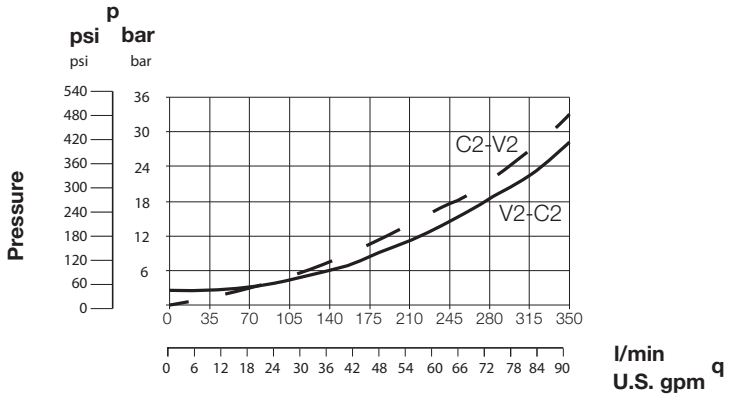
VCR3

H1C-H1CR-SH11C-SH11CR VM2/FM2 motors

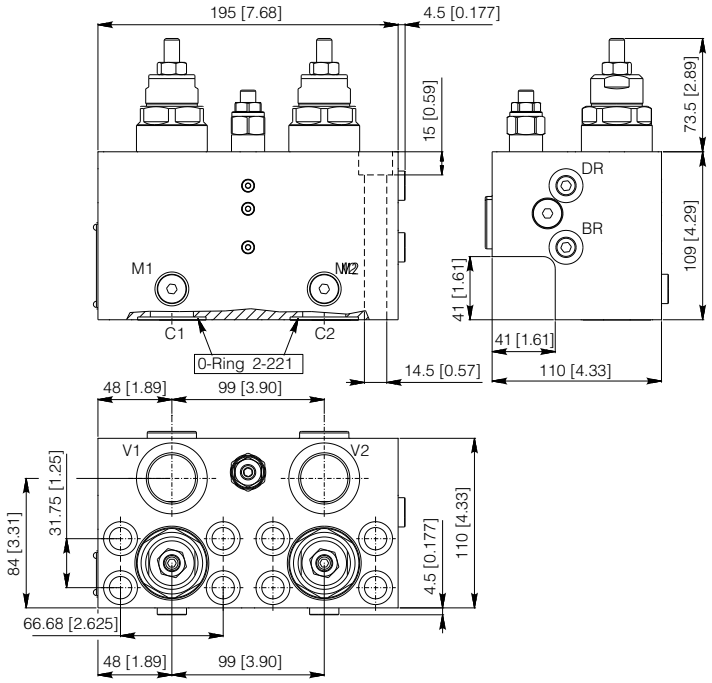


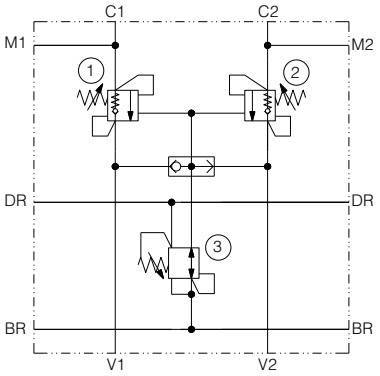
Valve	Piloting ratio	Pressure MAX bar [psi]	Nominal flow rate l/min [U.S.gpm]	Standard setting bar [psi]	Standard flow rate l/min [U.S. gpm]	Setting range bar [psi]	Pressure increase bar/rev [psi/rev]	Casing material
SPA00000817	6:1	420 [6090]	300 [79.2]	Valves ① ② 380 [5510] Valves ③ 30 [435]	5 [1.32]	Valves ① ② 150 ÷ 420 [2175 ÷ 6090] Valves ③ 15 ÷ 45 [218 ÷ 653]	Valves ① ② 9.5 [138] Valves ③ 11 [160]	Steel

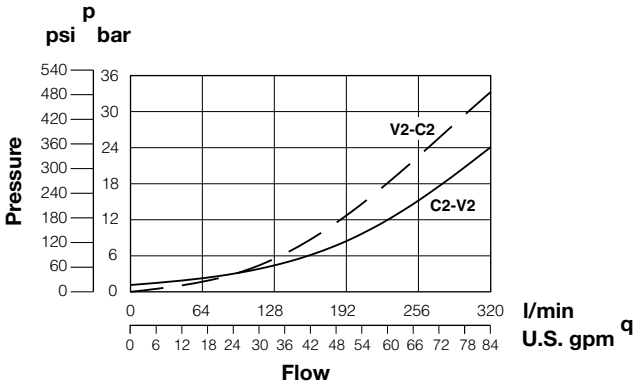
Valve	Type motor		Dr-C3	V1-V2	C1-C2	O-ring	Weight
	H1C H1CR VM2	**SH11C SH11CR** VM2/FM2	in	in	in	-	kg [lbf]
SPA00000817	**90/108**	**75/90**	1/4" G (BSPP)	1" G (BSPP)	1" SAE 6000	2-219	15 [33.07]



VCR3 H1C-H1CR-SH11C-SH11CR VM2/FM2 motors





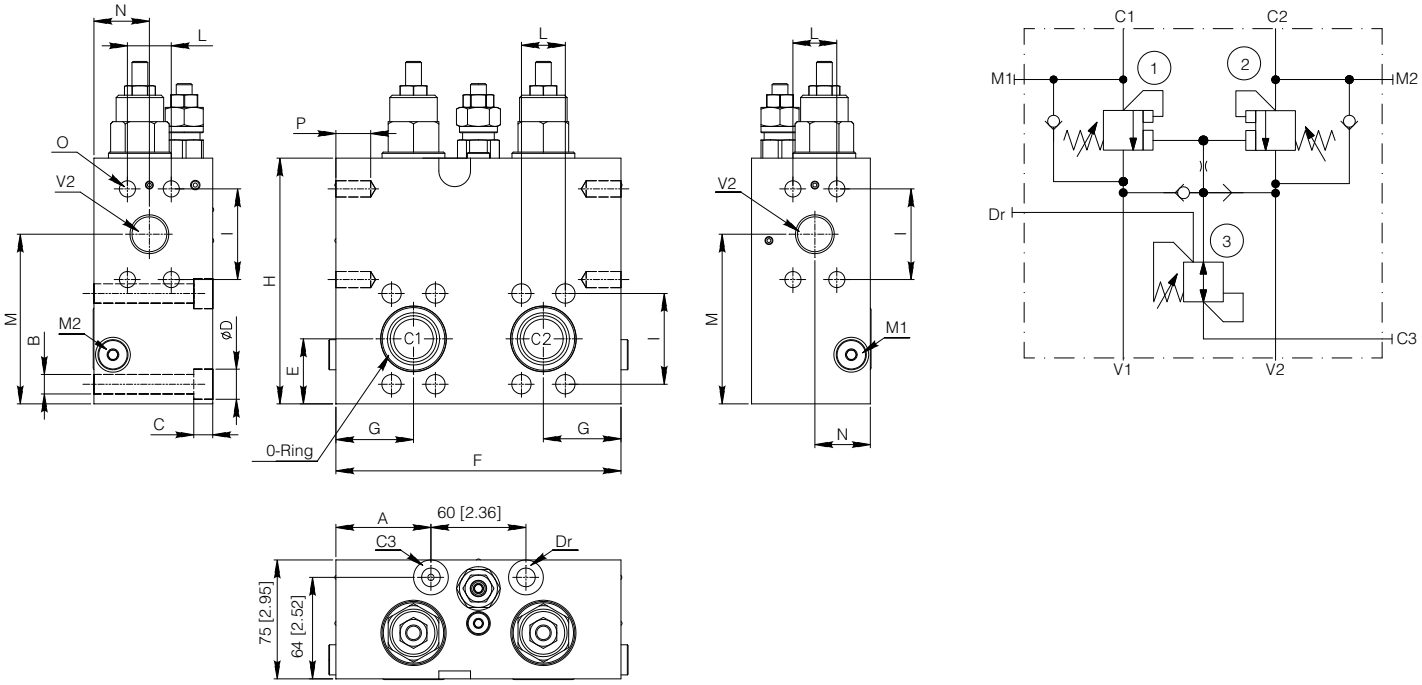


Valve	Piloting ratio	MAX pressure bar [psi]	Nominal flow rate l/min [U.S.gpm]	Standard setting bar [psi]	Standard flow rate l/min [U.S. gpm]	Setting range bar [psi]	Pressure increase bar/rev [psi/rev]	Material
SPA00000794	8:1	420 [6090]	320 [84.48]	Valves ① ② 350 [5075] Valves ③ 40 [580]	5 [1.32]	Valves ① ② 140 ÷ 350 [2030 ÷ 5075] Valves ③ 10 ÷ 60 [145 ÷ 870]	Valves ① ② 56 [812] Valves ③ 6.5 [92.3]	Steel

Valve	Type motor		BR-DR	V1-V2	C1-C2	O-ring	Weight
	H1C H1CR VM2	**SH11C SH11CR** VM2/FM2	in	in	in	-	kg [lbf]
SPA00000794	**-**	**108/125 160/180**	1/4" G (BSPP)	1" G (BSPP)	1 1/4" SAE 6000	2-221	13.8 [30.41]

Setting: at least 1.3 times the induced pressure

VCR4 SH7V-SH7VR FM motors



Valve	Piloting ratio	MAX pressure bar [psi]	Nominal flow l/min [U.S.gpm]	MAX flow rate l/min [U.S.gpm]	Standard setting bar [psi]	Standard flow rate l/min [U.S. gpm]	Setting range bar [psi]	Pressure increase bar/rev [psi/rev]	Material
SPA00000818	4.5:1	350 [5075]	250 [66]	300 [79.2]	Valve ① ② 350 [5075] Valve ③ 20 [290]	5 [1.32]	Valve ① ② 140 ÷ 350 [2030 ÷ 5075] Valve ③ 5 ÷ 70 [72.5 ÷ 1015]	Valve ① ② 130 [1885] Valve ③ 16.5 [239.25]	Zinc plated steel
SPA00000819	4.5:1	350 [5075]	250 [66]	300 [79.2]	Valve ① ② 350 [5075] Valve ③ 20 [290]	5 [1.32]	Valve ① ② 140 ÷ 350 [2030 ÷ 5075] Valve ③ 5 ÷ 70 [72.5 ÷ 1015]	Valve ① ② 130 [1885] Valve ③ 16.5 [239.25]	Zinc plated steel

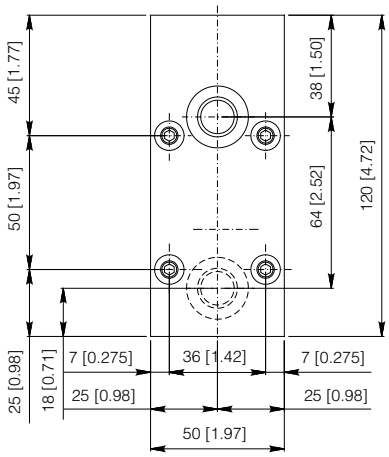
Valve	Motor type SH7V SH7VR FM	A mm [in]	B mm [in]	C mm [in]	D mm [in]	E mm [in]	F mm [in]	G mm [in]	H mm [in]	I mm [in]	L mm [in]	M mm [in]	N mm [in]	O mm [in]	P mm [in]
SPA00000818	**075/108**	60 [2.36]	12.25 [0.48]	12 [0.47]	19 [0.75]	41 [1.614]	180 [7.08]	49 [193]	155 [6.10]	57.15 [2.25]	27.76 [1.093]	107 [4.212]	35 [1.378]	M12	20 [0.78]
SPA00000819	**160**	70 [2.75]	14.5 [0.57]	14 [0.55]	22 [0.86]	44 [1.732]	200 [7.87]	54 [2.12]	160 [6.30]	66.68 [2.625]	31.75 [1.25]	112 [4.409]	36 [1.417]	M14	22 [0.86]

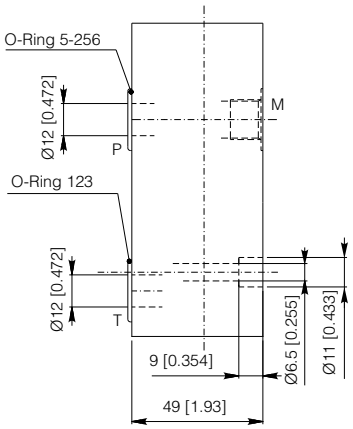
Valve	Motor type **SH7V SH7VR** FM	C1-C2	V1-V2	C3-Dr	M1-M2	O-Ring	Weight kg [lbf]
SPA00000818	**075/108**	1” SAE 6000	1” SAE 6000	1/4” G (BSPP)	1/4” G (BSPP)	2-219	15 [33.06]
SPA00000819	**160**	1 1/4” SAE 6000	1 1/4” SAE 6000	1/4” G (BSPP)	1/4” G (BSPP)	2-221	17 [37.468]

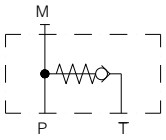
Click i button to return to main index
Click Dana button to return to Section index

VU165 Check valve

The valve is used in unidirectional applications when the motor is subject to high inertial loads, avoiding cavitation during the motor decelerations.
To mount the check valve on H1C-SH11C motors with LM2 ports cover, it is necessary a dedicated cover.



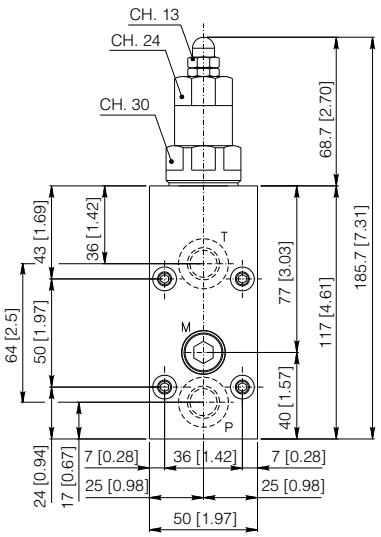


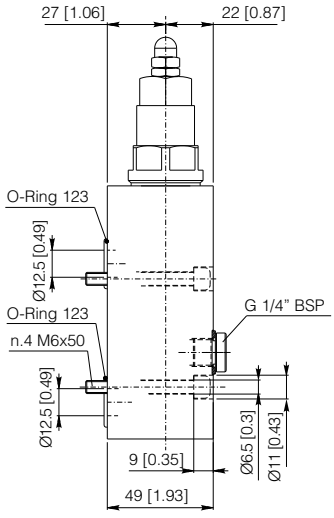


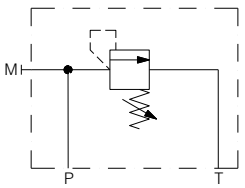
Valve	MAX pressure bar [psi]	MAX flow l/min [U.S. gpm]
SPA00000361	350 [5075]	65 [17.2]

VSD 120 Anti-Shock valve

These valves have the purpose to protect the motor from pressure spikes. The response time is very short, being this valves directly operated. When the pressure in the system exceeds the setting of the valve, the spool opens and discharges an amount of flow to the low pressure side.
To mount the anti-shock valve on H1C226 motors with LM2 ports cover, it is necessary a dedicated cover.



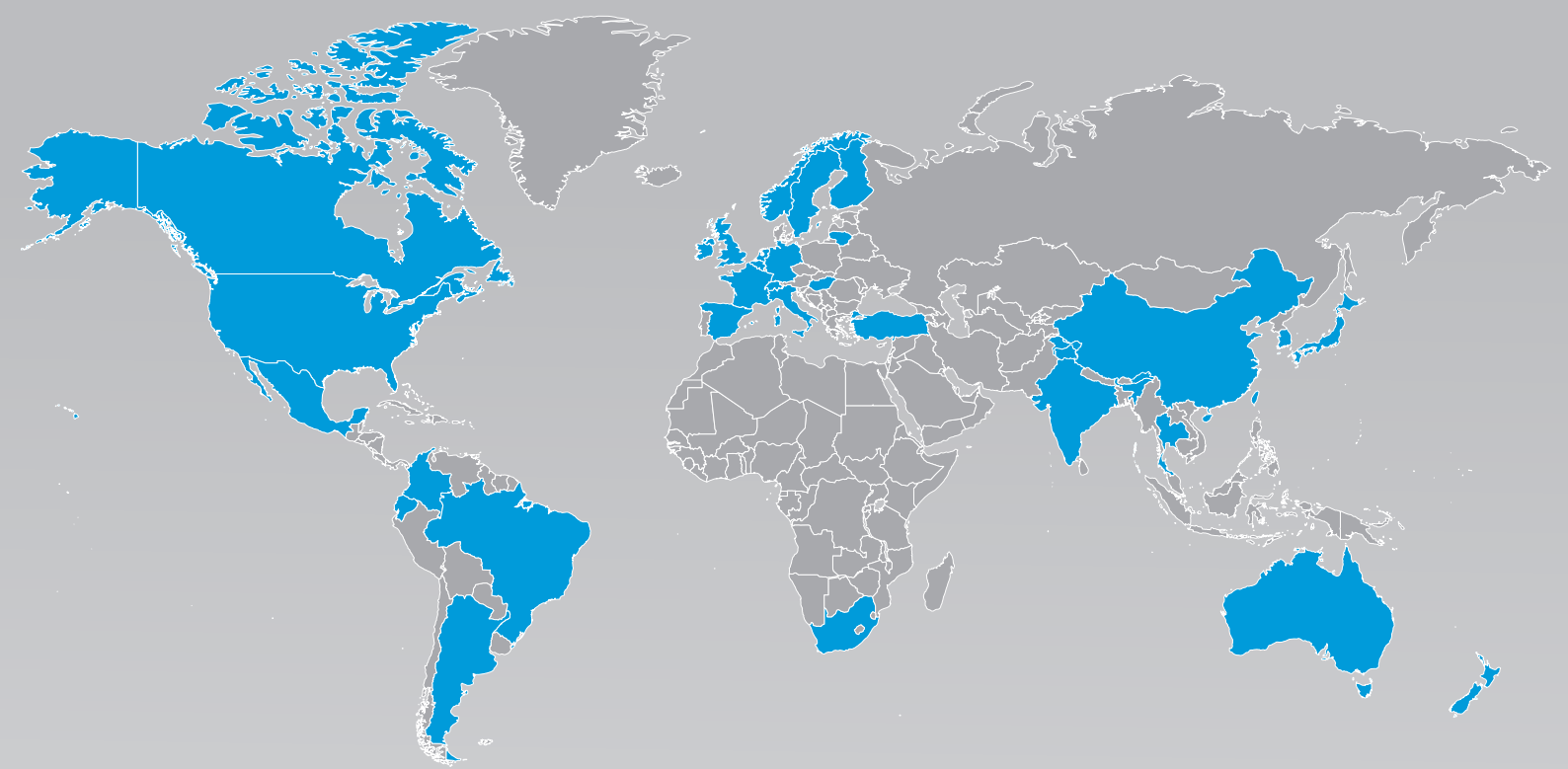




Valve	MAX pressure bar [psi]
52123000120	350 [5075]

DANA BREVINI® Motion Systems

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