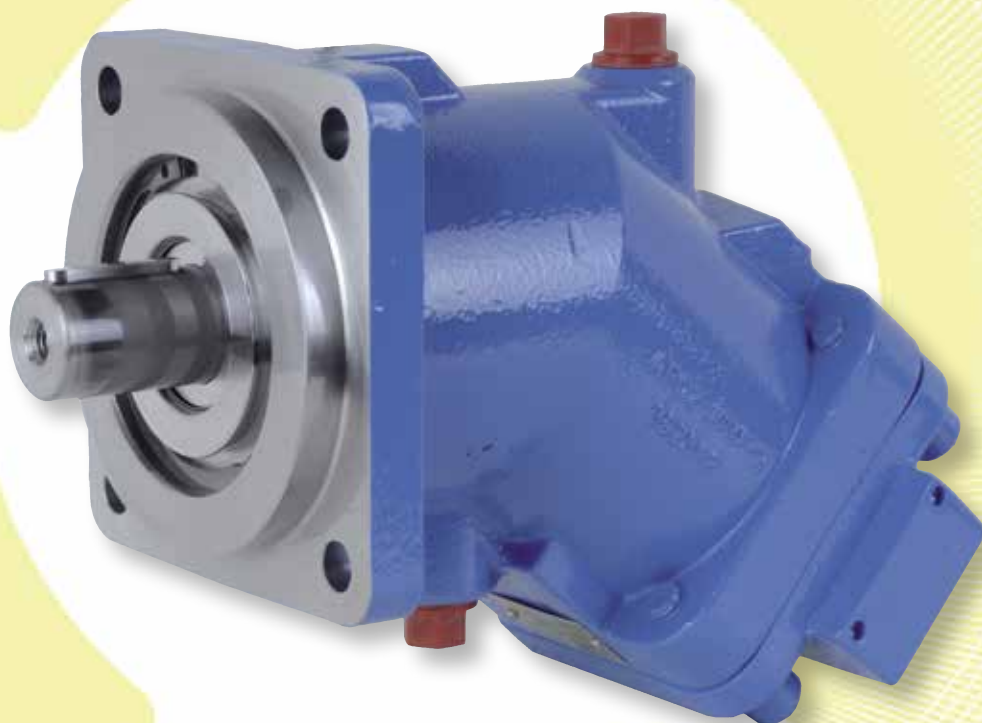


Bent axis hydraulic motors

MA
Series



 **HYDRO
LEDUC**

Contents

MA series motors

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LEDUC hydraulic motors of the MA series are of bent axis design, with an angle of 40°. They combine high performance and reduced size envelope:

- global efficiency of over 90% (guaranteed in most applications);
- suitable for use at operating speeds between 50 and 8,000 rpm;
- optimized weight and size.

Available in displacement from 0.61 to 11 Cu.in (10 to 180 cc),

MA motors are suitable for all the main fixed and mobile applications.

They are designed for use in either closed or open loop systems. To ensure the best service life from your motors, please take care to follow the installation and start-up recommendations (see pages 2 and 23).



HYDRO LEDUC also manufactures a range of semi-integrated (plug-in) motors: the MSI series. Literature on request or on our website : www.hydroleduc.com



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Advantages of MA series motors

■ Definition of function

Hydraulic motors transform hydraulic flow into rotating speed and hydraulic pressure into mechanical torque.
Motor rotating speed is proportional to the flow which is supplied to it.
Torque produced is proportional to the hydraulic pressure the motor receives.

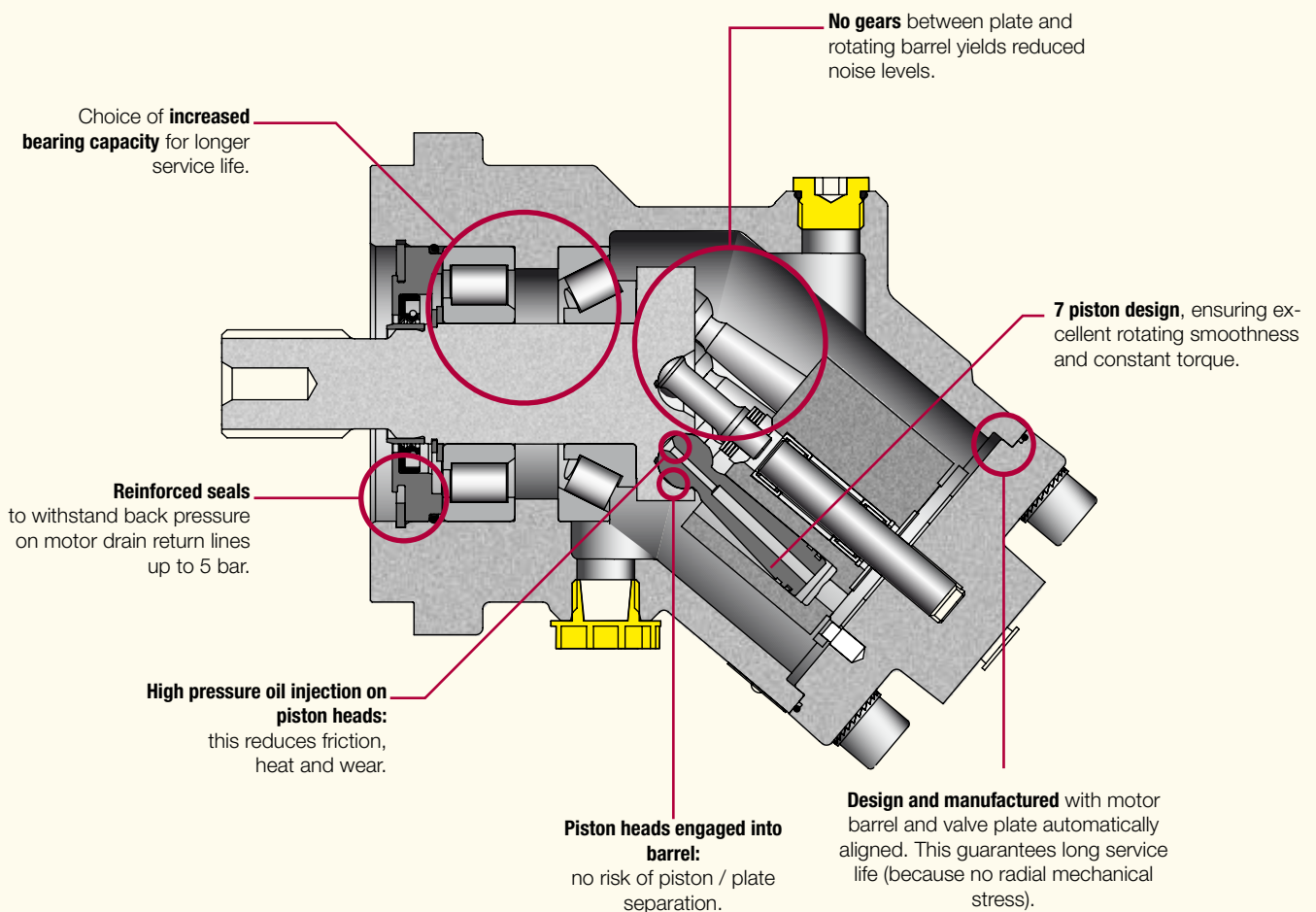
■ Main applications of hydraulic motors

Typical applications are those requiring high torque within a small size.
The hydraulic motor is essential for rotations where:

- mechanical solutions are complex or even impossible,
- electrical or pneumatic power sources are not available,
- environments are dangerous (i.e. risk of explosion or extreme temperatures).

■ Advantages of LEDUC motors

All structural components are made from similar materials resulting in consistent thermal expansion and exceptional reliability.



Operating conditions of MA series motors

Hydraulic fluid

LEDUC motors are designed to be powered with mineral based hydraulic fluid. Using other fluids is possible but may require a modified motor. Please contact us with details of fluid.

Recommended viscosity:

- Ideally : between 15 and 200 cSt;
- Maximum range: between 5 and 1600 cSt.

Filtration of hydraulic fluid

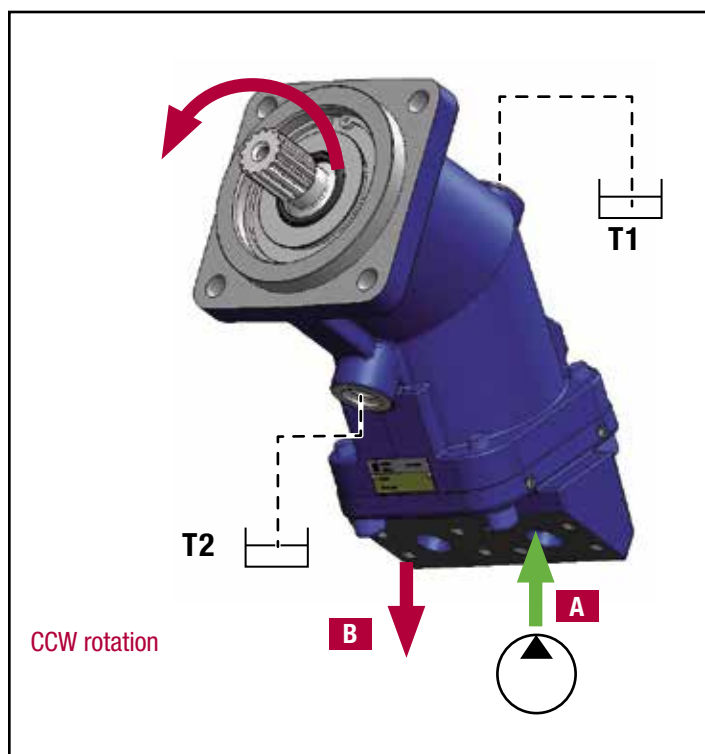
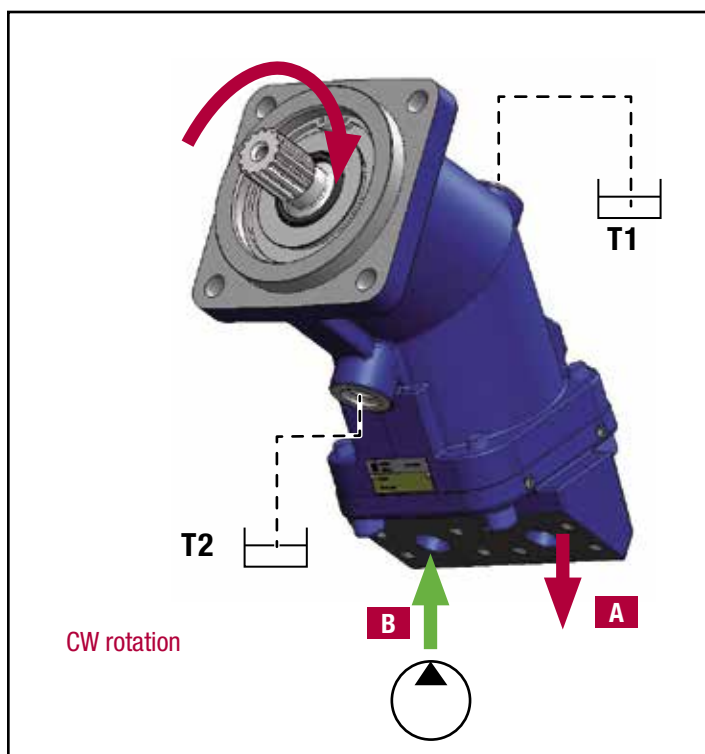
The service life of the motors depends greatly on the quality and the cleanliness of the hydraulic fluid.

We recommend minimum cleanliness as follows:

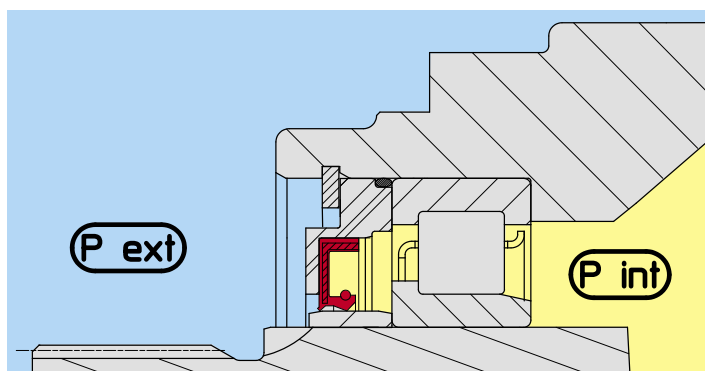
- NAS 1638 class 9
- SAE class 6
- ISO/DIS 4406 class 18/15

Direction of rotation

The motors rotate clockwise or counter-clockwise depending on the direction of hydraulic flow entering the motor.



Drain pressure



Rotating speeds

Minimum rotating speed to obtain continuous rotation is 200 rpm (however, in certain conditions, the motor can run at speeds as low as 50 rpm).

Maximum rotating speed is given for each model of motor (see page 4).

Installation positions

LEDUC motors are made to operate in all positions.

Important note : before start up, ensure the motor is filled with hydraulic fluid. (See section on installation and start-up, page 20).

It is essential to drain the motor, T1 or T2, to avoid excessive pressures on the shaft seal.

Maximum acceptable internal pressure depends on motor rotating speed.

However, following these guidelines will avoid problems during operation:

- maximum internal pressure (**P int**) regardless of rotating speed (continuous): 4 bar (60 PSI);
- maximum internal pressure (**P int**) regardless of rotating speed (peak): 5.5 bar (80 PSI);
- minimum pressure in the motor housing: must be greater than ambient (external) pressure (**P ext**).

Determination MA series motors

How to determine the correct motor for your application

Calculations:

N = rotating speed (rpm)
 C = torque (in.lbs)
 P = pressure supplied by the hydraulic pump in (PSI)
 ΔP = pressure difference between A and B in (PSI)
 $Disp.$ = displacement (in^3/rev)
 Q = flow (gpm)
 E = efficiency (%)

1. Torque supplied by the hydraulic motor

Theoretical torque $T_{th} = (\Delta P \times Disp) / 2\pi$

Actual torque $= T = T_{th} \times E$

For example a $3.07 \text{ in}^3/rev$ motor with a ΔP of 3.625 PSI will supply a theoretical torque of 1770 in.lbs

Average global efficiency of the motor is 90% , actual torque is: 1.594 in.lbs

2. Rotating speed of the motor

The rotating speed of the hydraulic motor depends on the flow Q which goes through it, and on the displacement of the motor.

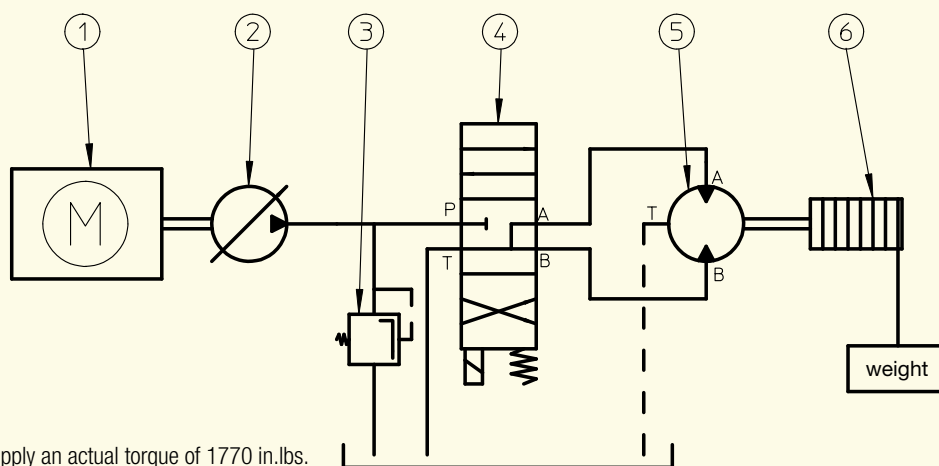
$N = (Q \times 231 \text{ in}^3/gal) / Disp$

test bench for motors



Example

- ① Motor
- ② Variable displacement pump
- ③ Pressure relief valve
- ④ Valve
- ⑤ Hydraulic motor
- ⑥ Winch and load



The receiving organ (winch) ⑥ needs to rotate at $N = 400 \text{ rpm}$ and supply an actual torque of 1770 in.lbs.

The hydraulic pump ① is capable of operating at pressure P up to 5075 PSI.

1. Calculating the displacement of the hydraulic motor:

$Disp = (T_{th} \times 2\pi) / \Delta P$ thus **Disp = 2.19 in^3** In the LEDUC range, choose a motor with a displacement of **1.95 in^3** or **2.5 in^3** .

2. Calculating the flow Q which the pump needs to supply:

$Q = (N \times Disp) / 231 \text{ in}^3/gal$ thus **Q = 3.79 gpm**

Corresponding flow :

- for **1.95 in^3** motor, $Q = 3.38 \text{ gpm}$
- for **2.5 in^3** motor, $Q = 4.33 \text{ gpm}$

Characteristics of the MA series motors

MA series motors are suitable for intensive long duty requirements. Designed for both mobile and industrial installations.

Typical applications are:

- vehicle transmissions;
- high power crushers;
- forestry equipment;
- heavy duty winches...

These motors are built to suit all applications with SAE (J744) mounting configurations.

* For wider extreme temperatures, please contact us.

(1) for higher speeds, please contact us.

For special fluids, please contact us.

Displacement		continuous max. speed ⁽¹⁾	Intermittent max. speed ⁽¹⁾	Max. flow absorbed		Torque		Torque at 5100 PSI (350 bar)		Motor max./min. temperature*	Max. allowable pressure continuous/peak	weight	
Cu.In	cc	(rpm)	(rpm)	gpm	(l/mn)	lbf.ft/PSI	m.N/bar	lbf.ft	m.N	°F (°C)	PSI (bar)	lbs	kg
0.62	10.16	8000	8800	21.5	81.3	0.0082	0.16	42	57	-13/230 (-25/110)	5800/6525 (400/450)	14.3	6.5
0.74	12.05	8000	8800	25.5	96.4	0.0097	0.19	50	67	-13/230 (-25/110)	5800/6525 (400/450)	14.3	6.5
1.10	18	8000	8800	37.9	143.6	0.0145	0.29	74	100	-13/230 (-25/110)	5800/6525 (400/450)	14.3	6.5
1.52	24.9	6300	6900	41.5	157.1	0.0201	0.40	103	139	-13/230 (-25/110)	5800/6525 (400/450)	25	11.5
1.96	32.1	6300	6900	53.4	202.0	0.0259	0.51	132	179	-13/230 (-25/110)	5800/6525 (400/450)	25	11.5
2.51	41.1	5600	6200	60.8	230.2	0.0332	0.65	169	229	-13/230 (-25/110)	5800/6525 (400/450)	25	11.5
2.77	45.4	5000	5500	59.9	226.8	0.0366	0.72	187	253	-13/230 (-25/110)	5800/6525 (400/450)	40	18
3.07	50.3	5000	5500	66.4	251.5	0.0406	0.80	207	280	-13/230 (-25/110)	5800/6525 (400/450)	40	18
3.85	63.0	5000	5500	83.3	315.2	0.0509	1.00	259	351	-13/230 (-25/110)	5800/6525 (400/450)	40	18
4.91	80.4	4500	5000	95.6	361.8	0.0649	1.28	331	448	-13/230 (-25/110)	5800/6525 (400/450)	51	23
5.49	90.0	4500	5000	107.0	405.2	0.0727	1.43	371	502	-13/230 (-25/110)	5800/6525 (400/450)	51	23
6.61	108.3	3400	4500	97.3	368.3	0.0874	1.72	446	603	-13/230 (-25/110)	5800/6525 (400/450)	77	35
7.65	125.4	3400	4500	112.6	426.4	0.1012	2.00	516	699	-13/230 (-25/110)	5800/6525 (400/450)	77	35
9.76	160.0	3600	4000	152.2	576.0	0.1291	2.55	659	891	-13/230 (-25/110)	5800/6525 (400/450)	99 to 107	45 to 48.5
11.02	180.6	3600	4000	171.8	650.2	0.1458	2.87	744	1006	-13/230 (-25/110)	5800/6525 (400/450)	107	48.5

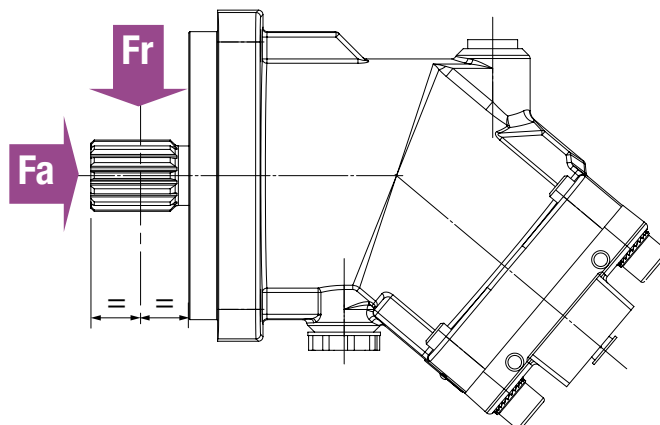
Acceptable forces applied to motor shaft

Fr : radial force measured at mid point of length of shaft.

Fa : axial force which tends to push the shaft inwards.

Displacement	Cu.In	0.61	0.73	1.1	1.52	1.95	2.50	2.78	3.07	3.84	4.90	5.49	6.61	7.65	9.8	11
	cc	10	12	18	25	32	41	45	50	63	80	90	108.3	125.4	160	180
Fr	lbf	528	630	900	1350	1462.5	1574	900	900	1125	1462.5	1507.5	2812	3262	4050	4500
	N	2350	2800	4000	6000	6500	7000	4000	4000	5000	6500	6700	12500	14500	18000	20000
Fa	lbf / PSI	0.19	0.23	0.31	0.42	0.46	0.62	0.62	0.62	0.77	0.93	1.03	1.24	1.33	1.32	1.47
	N/PSI* (N/bar)	0.83 (12)	1.03 (15)	1.37 (20)	1.86 (27)	2.06 (30)	2.75 (40)	2.75 (40)	2.75 (40)	3.44 (50)	4.14 (60)	4.62 (67)	5.52 (80)	5.93 (86)	5.86 (85)	6.55 (95)

* differential pressure between A and B. For other forces, please contact us.



Order code system MA series motors

Order code system for MA type motor

MA	...	C	..	..	U2	.	.	..	..
01	02	03	04	05	06	07	08	09	10

To obtain the code for your motor, complete the different parameters 02, 04, 05, 07, 08, 09 and 10 in the table on the left, according to the options you require (see table below).

Motor

01	Motor	MA
----	-------	----

Displacement

02		12	18	25	32	41	45	50	63	80	90	108R	125	160	180	
----	--	----	----	----	----	----	----	----	----	----	----	------	-----	-----	-----	--

Mounting flange

03		SAE B 2 Bolts	SAE C 4 Bolts	SAE D 4 Bolts	C
----	--	---------------	---------------	---------------	---

Shaft end

04	Splined SAE J498b	13 T 16/32 DP SAE B	13 T 16/32 DP SAE B	14 T 12/24 DP SAE C	14 T 12/24 DP SAE C	14 T 12/24 DP SAE C	14 T 12/24 DP SAE C	14 T 12/24 DP SAE C	14 T 12/24 DP SAE C	14 T 12/24 DP SAE C	14 T 12/24 DP SAE C	13 T 8/16 DP SAE D	13 T 8/16 DP SAE D	13 T 8/16 DP SAE D	13 T 8/16 DP SAE D	S1
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	S2
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	S3
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	DIN 6885	—	—	—	—	—	—	—	—	—	—	—	—	—	—	D1
	Keyed SAE J744	Ø 1"	Ø 1"	Ø 1¼"	Ø 1¼"	Ø 1¼"	Ø 1¼"	Ø 1¼"	Ø 1¼"	Ø 1½"	Ø 1½"	Ø 1¾"	Ø 1¾"	—	—	K1
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	K2

Inlet ports A and B

05	SAE flange ports	bottom	0	—	—	—	●	●	●	●	●	●	●	●	●	L0
		rear	0	—	—	●	●	●	●	●	●	●	●	●	●	M0
		side	0	—	—	●	●	●	●	●	●	●	●	●	●	N0
		side	1	—	—	●	●	●	●	●	●	●	●	●	●	N1
	Threaded	rear	0	●	●	●	●	●	—	—	—	—	—	—	—	P0
		side	0	●	●	●	●	—	—	—	—	—	—	—	—	Q0
		side	1	—	—	●	●	—	—	—	—	—	—	—	—	Q1

Drain ports T1 and T2

06		2	2	2	2	2	2	2	2	2	2	2	2	2	2	U2
----	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----

Suitable for use of speed sensor

07	yes	1
	no	0

Speed sensor

08	yes	1
	no	0

Valves

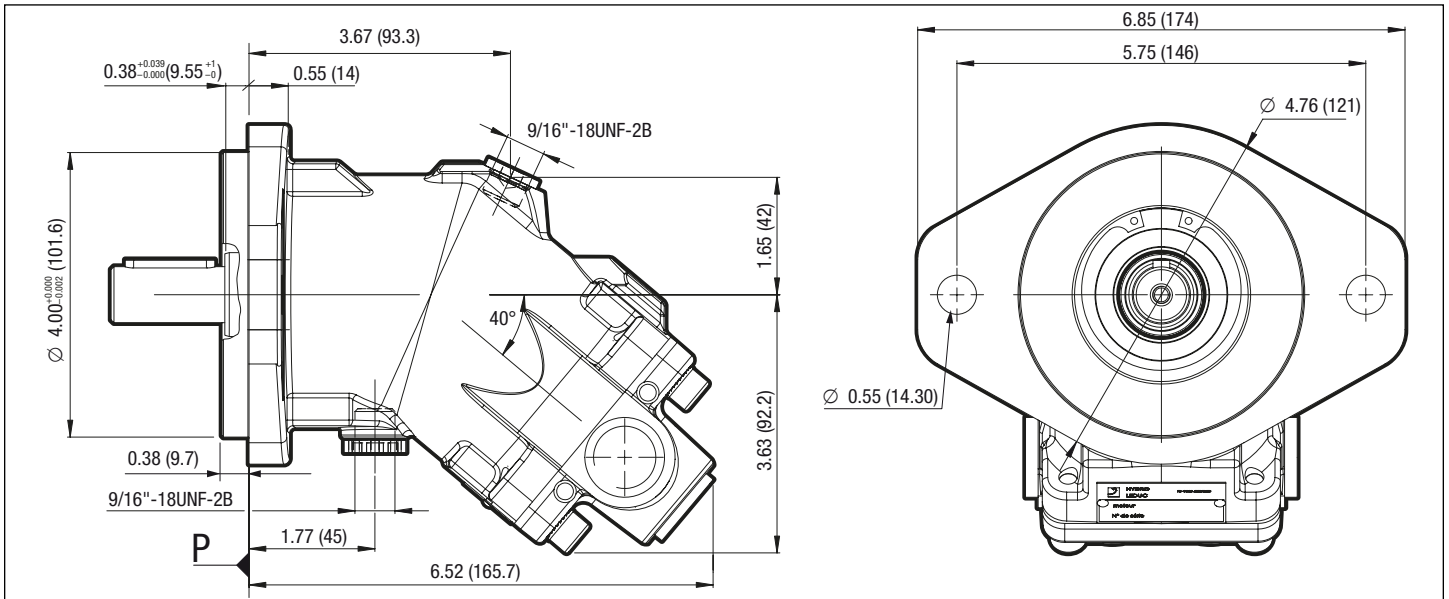
09	without	SV
	with flushing valve	VB

Low temperature option

10	yes (NBR)	N
	no (FKM)	F

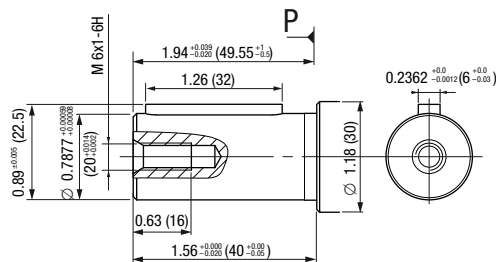
Suitability for valves: no= 0 / compatible with flushing valve =1

Dimensions



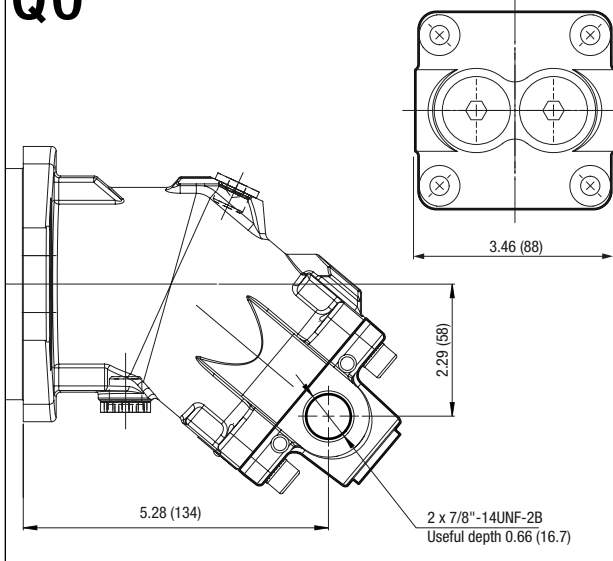
Shaft end

D1 Cylindrical keyed shaft Ø 20 mm DIN 6885
AS 6 x 6 x 32 mm

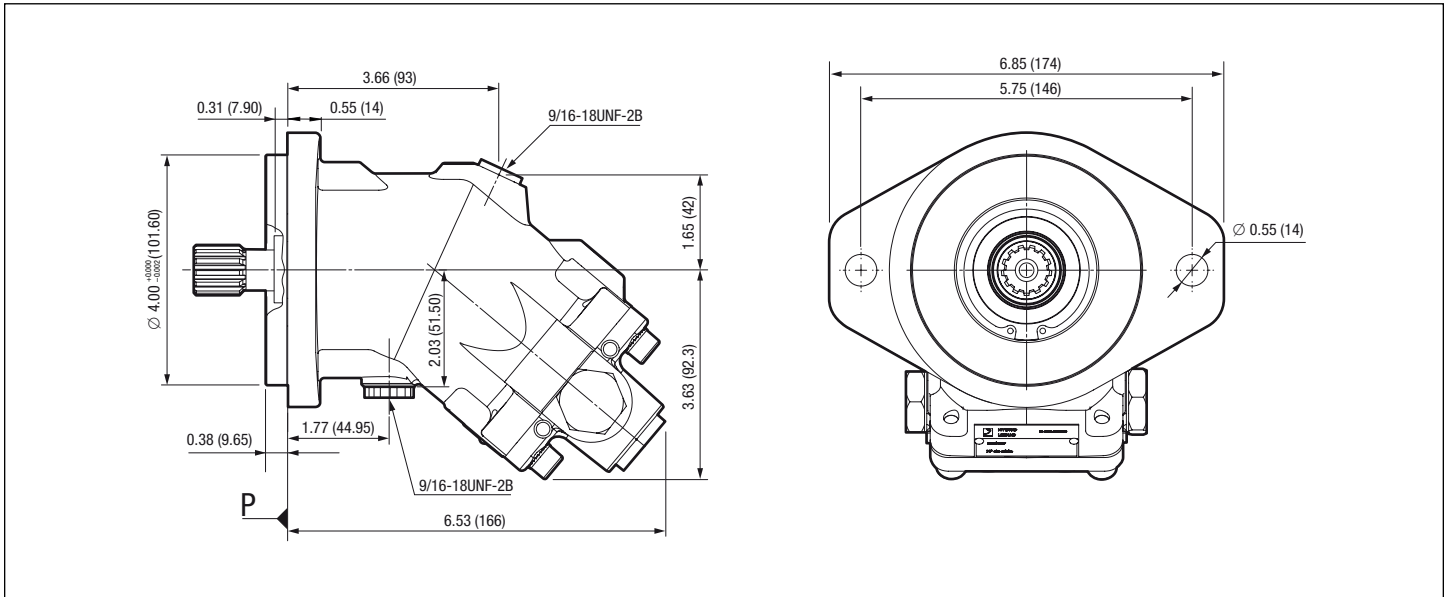


Inlet ports

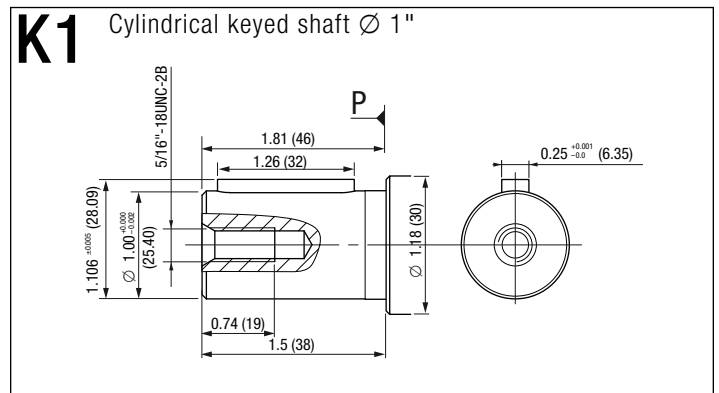
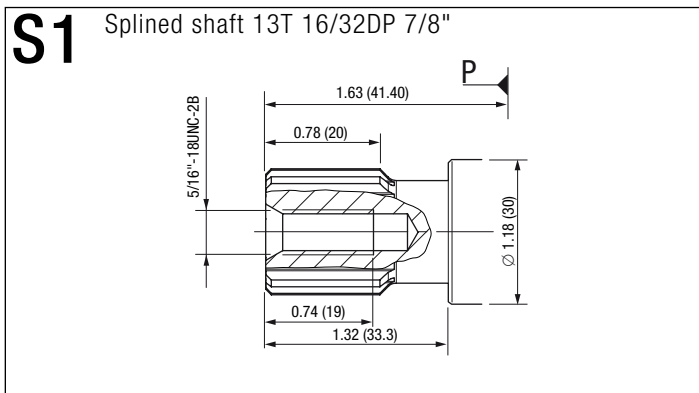
Q0 Side threaded ports A et B



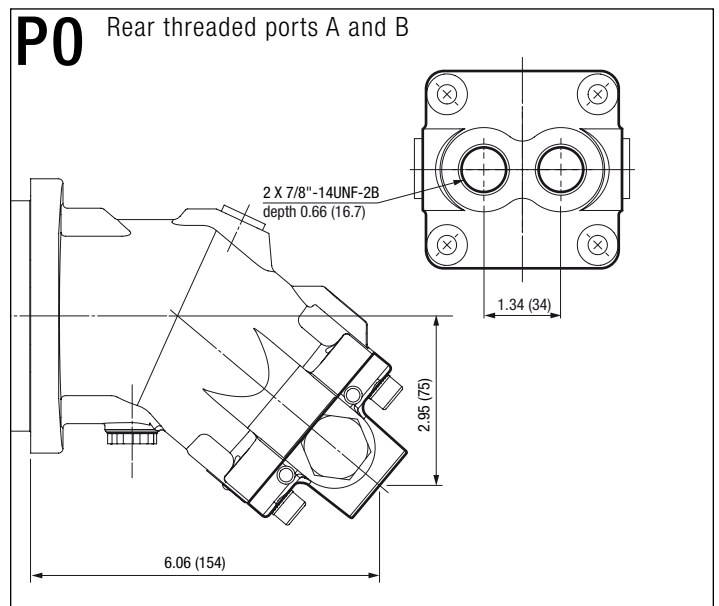
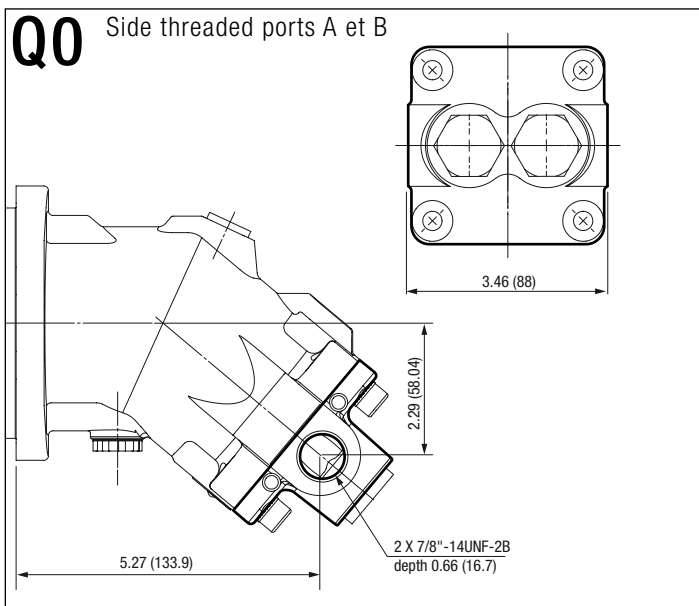
Dimensions



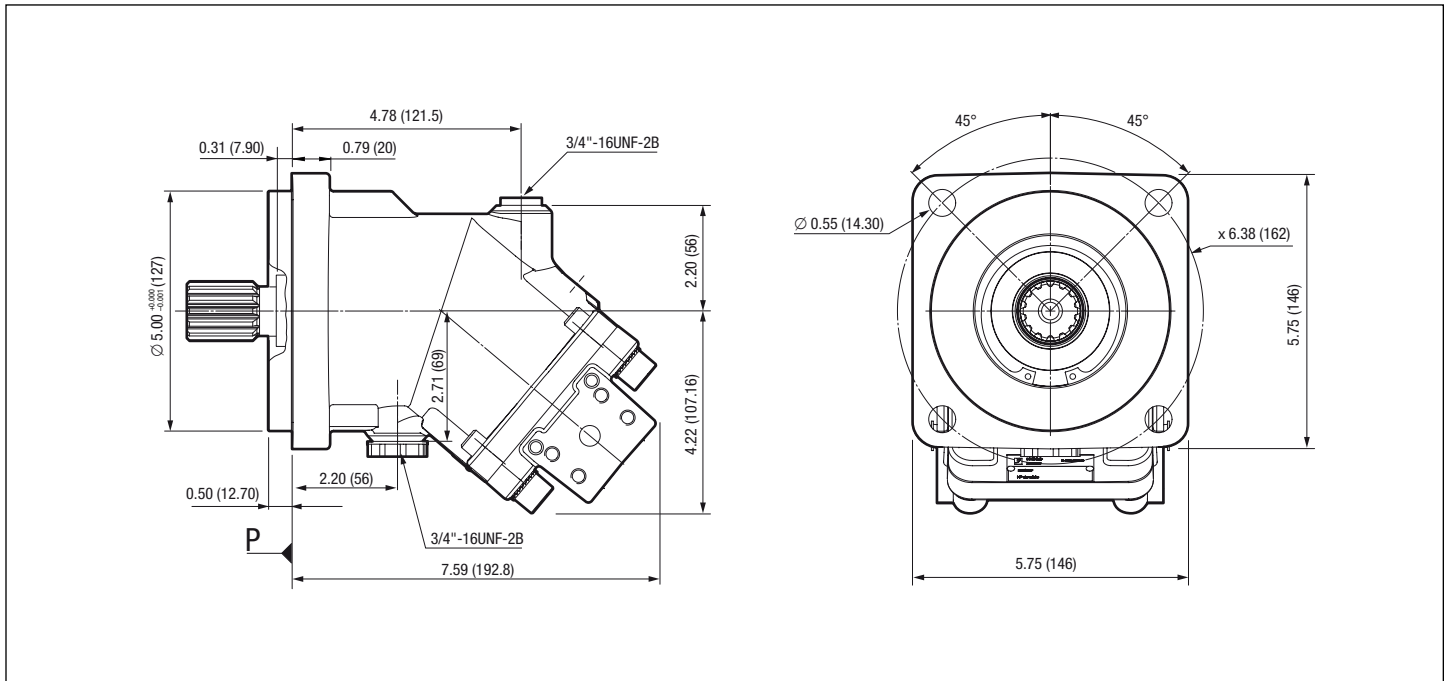
Shaft end



Inlet ports

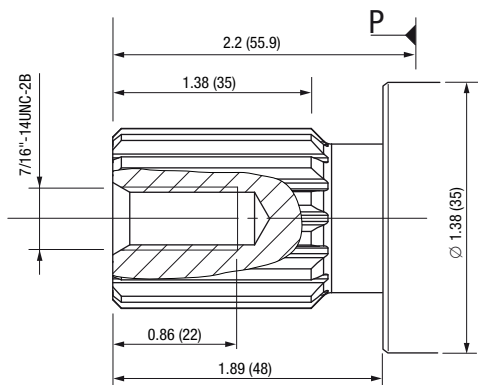


Dimensions

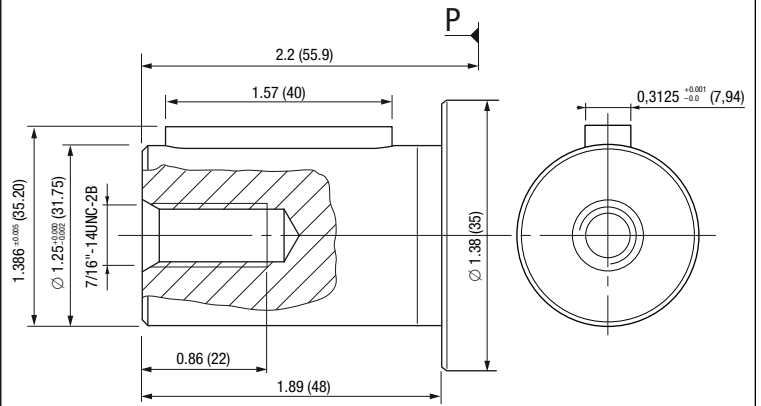


Shaft end

S1 Splined shaft 14T 12/24DP 1 1/4"

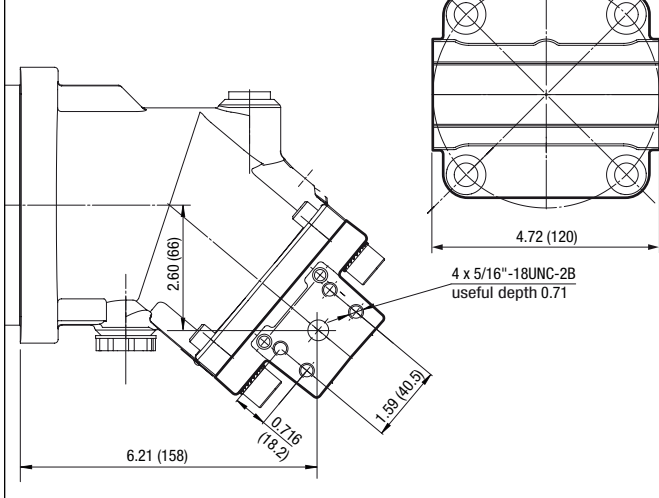


K1 Cylindrical keyed shaft $\varnothing 1 1/4"$

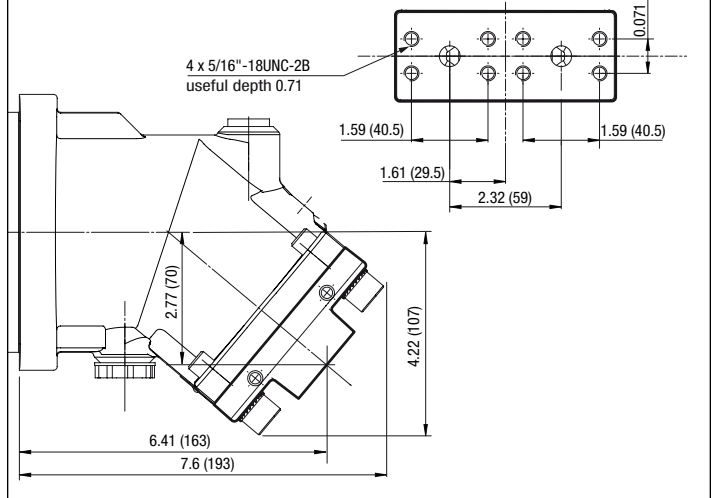


Inlet ports

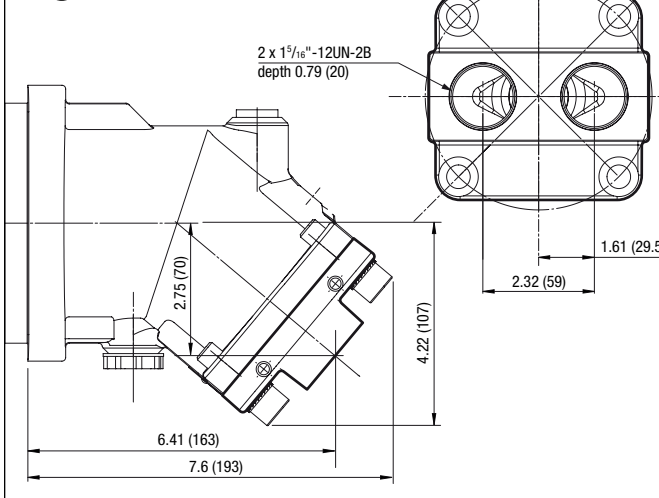
N0 or N1 Side SAE flange ports A and B
SAE 1/2" 6000 PSI



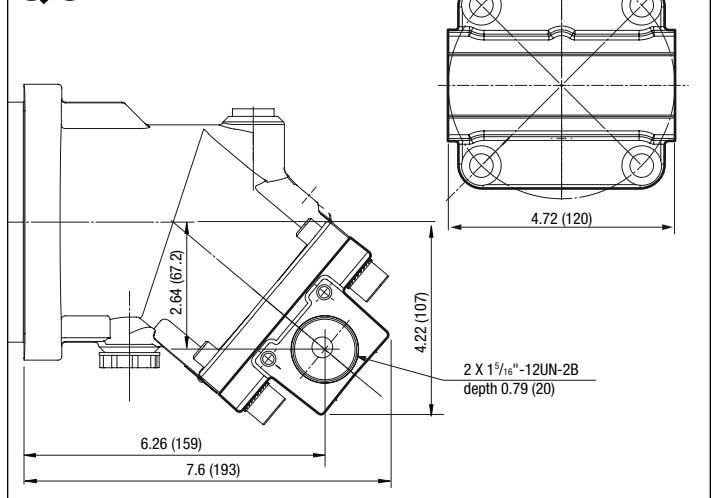
M0 Rear SAE flange ports A and B
SAE 1/2" 6000 PSI



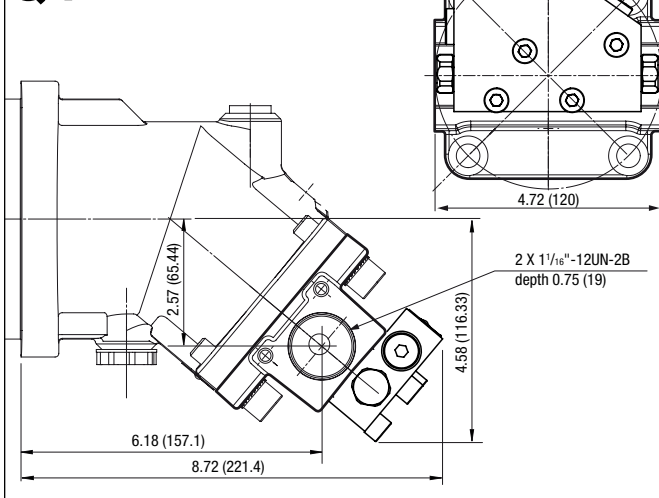
P0 Rear threaded ports A and B



Q0 Side threaded ports

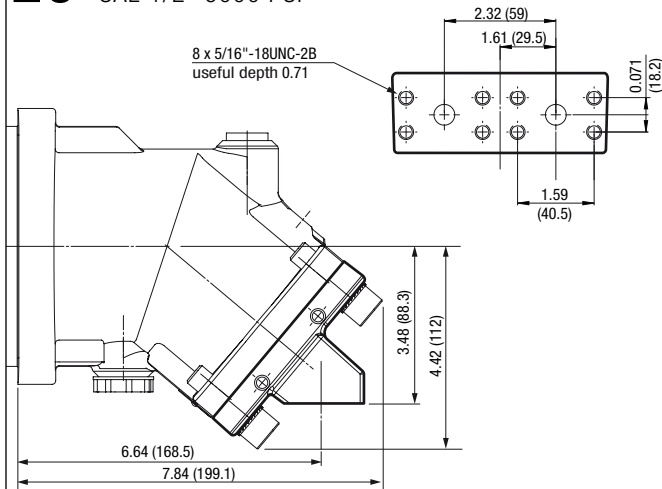


Q1 Side threaded ports

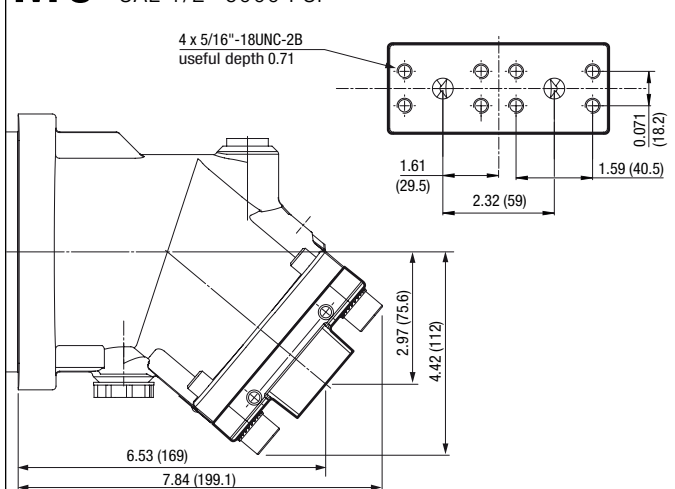


Inlet ports

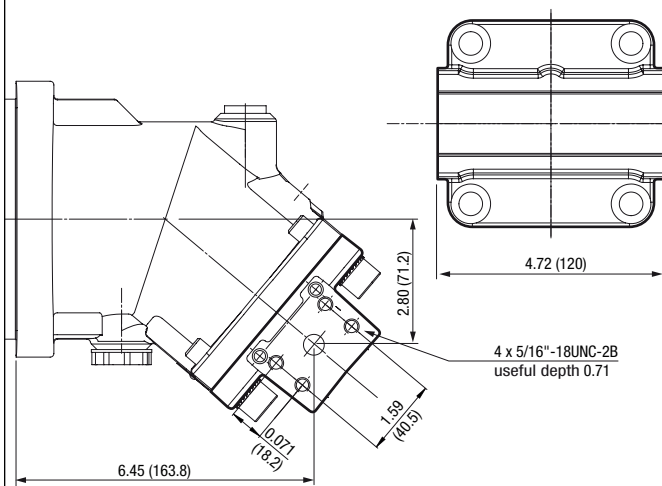
L0 SAE flange ports, bottom SAE 1/2" 6000 PSI



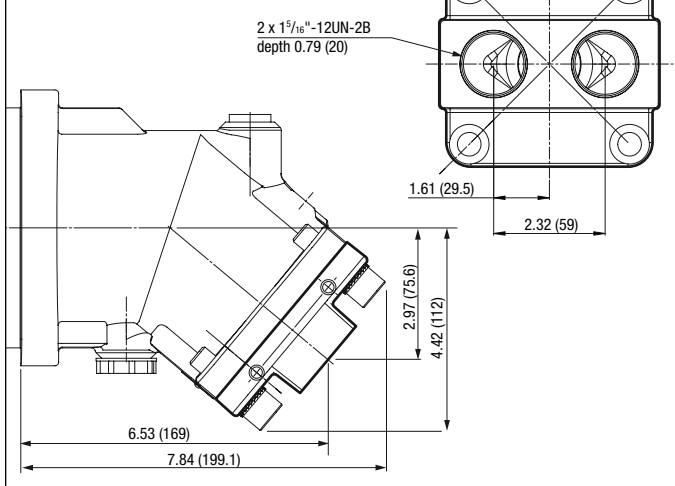
M0 Rear flange ports SAE 1/2" 6000 PSI



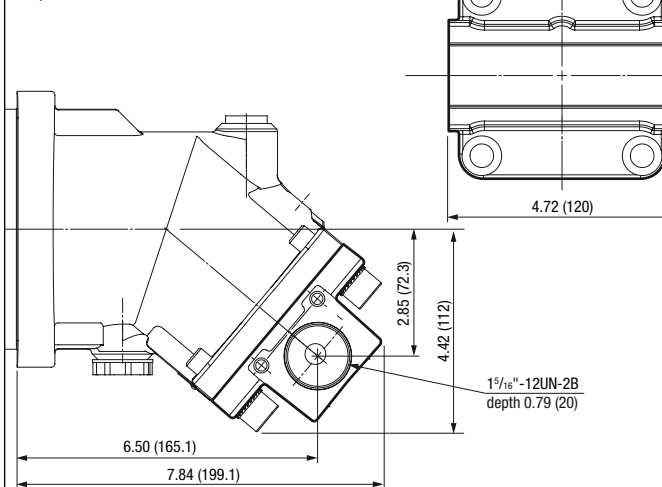
N0 or N1 Side flange ports A and B SAE 1/2" 6000 PSI



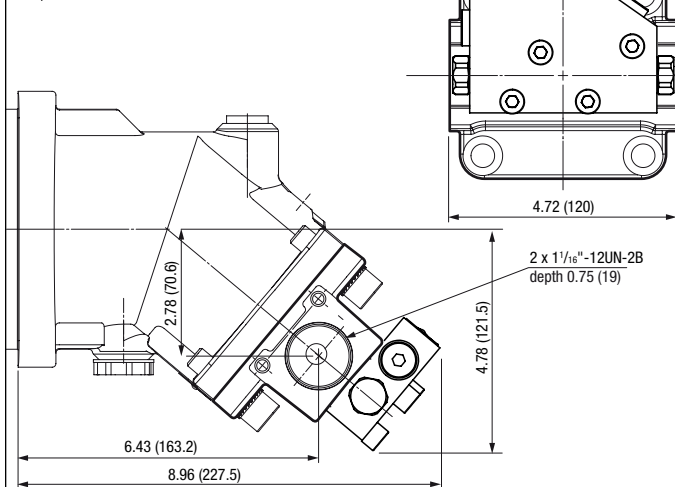
P0 Rear threaded ports



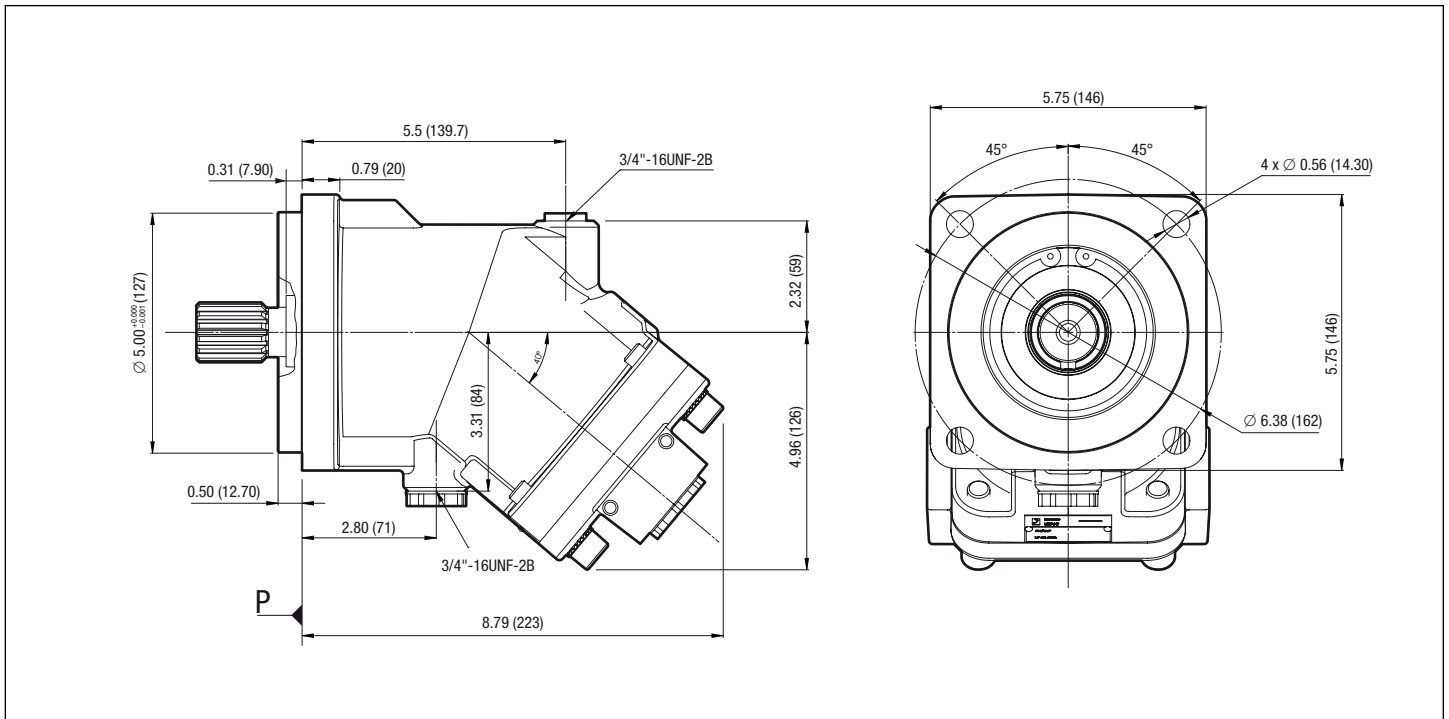
Q0 Side threaded ports A et B



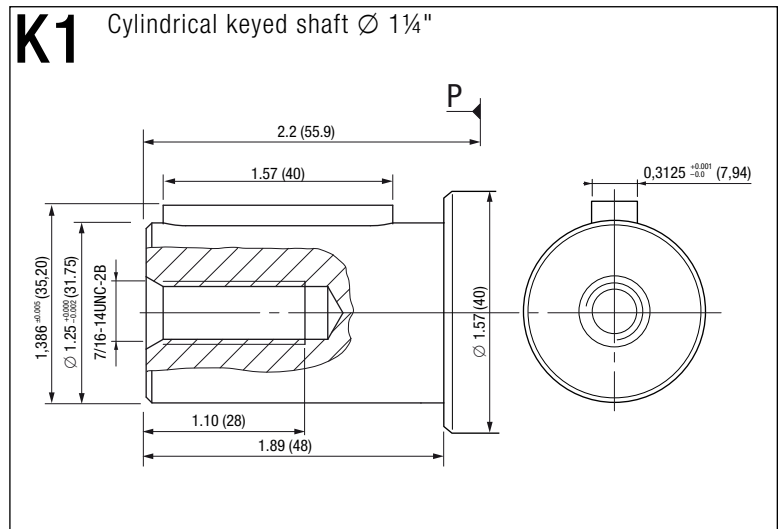
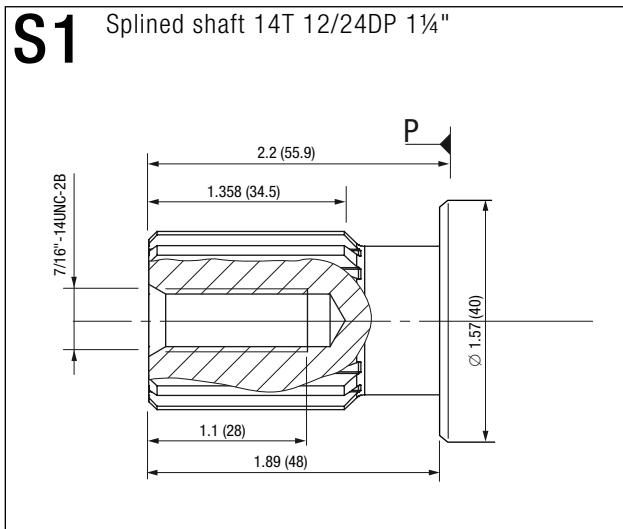
Q1 Side threaded ports A et B



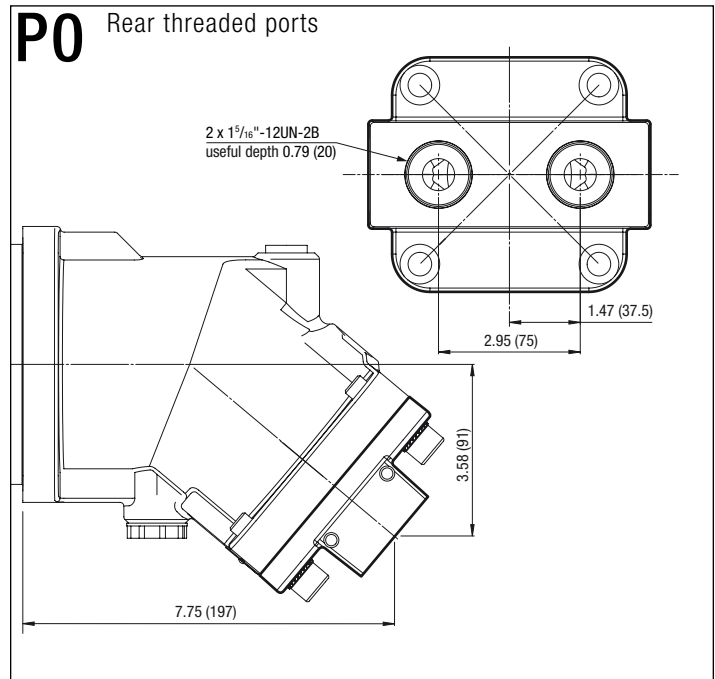
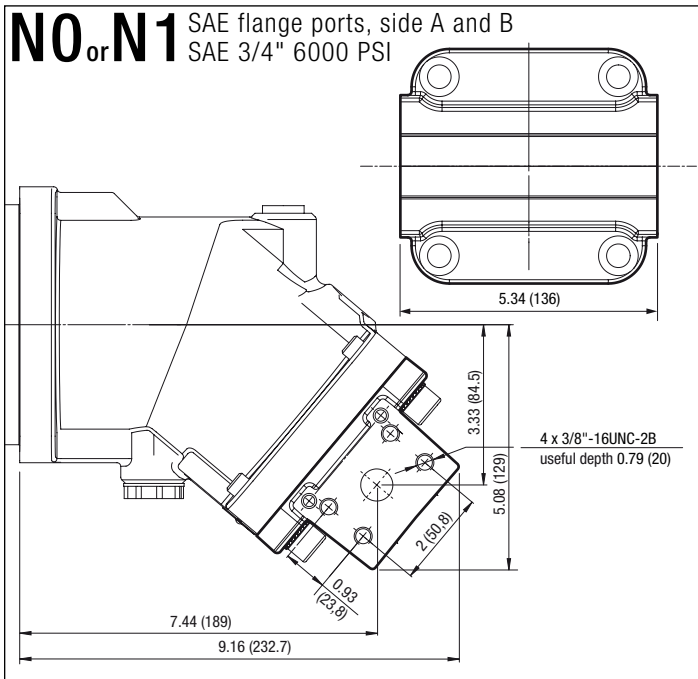
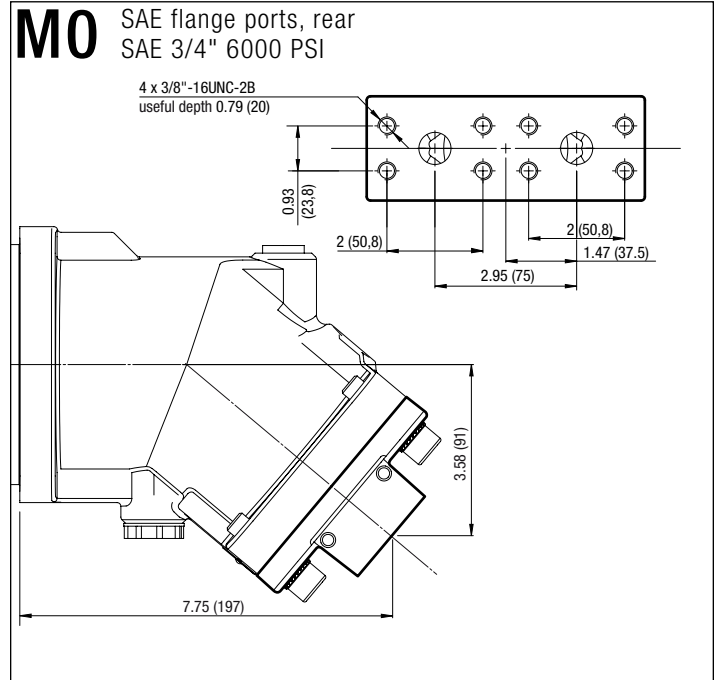
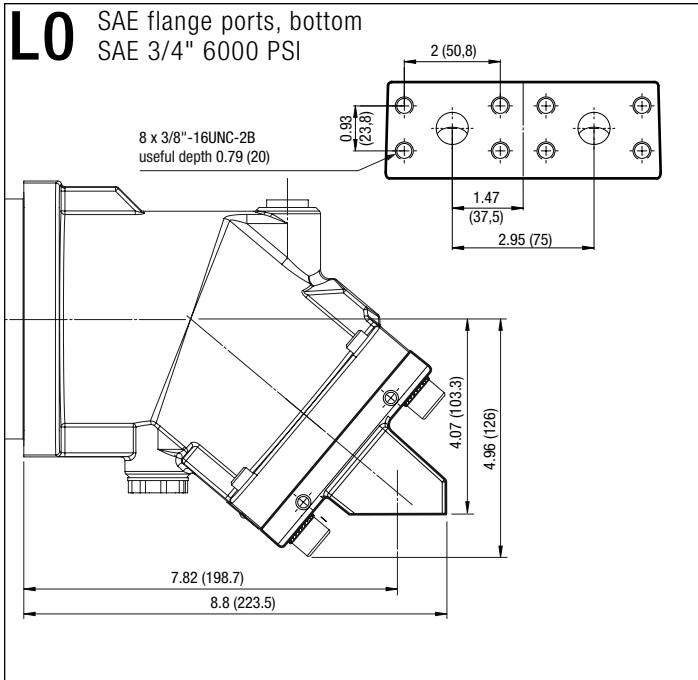
Dimensions



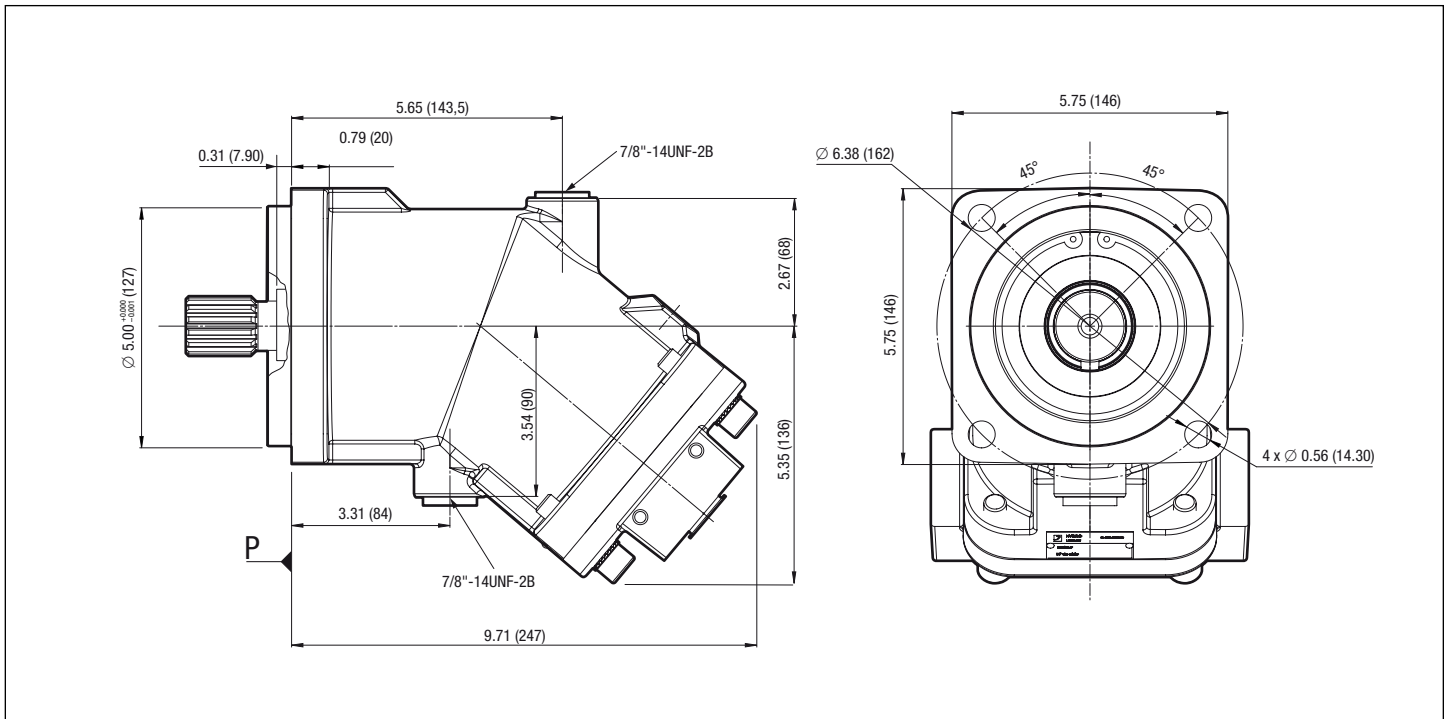
Shaft end



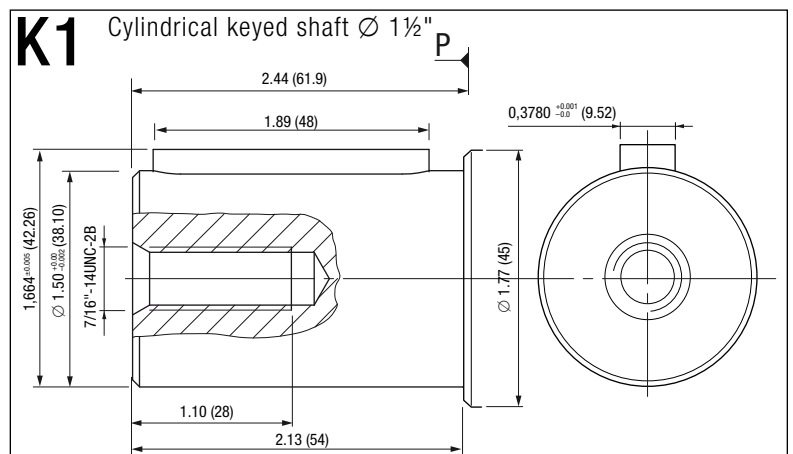
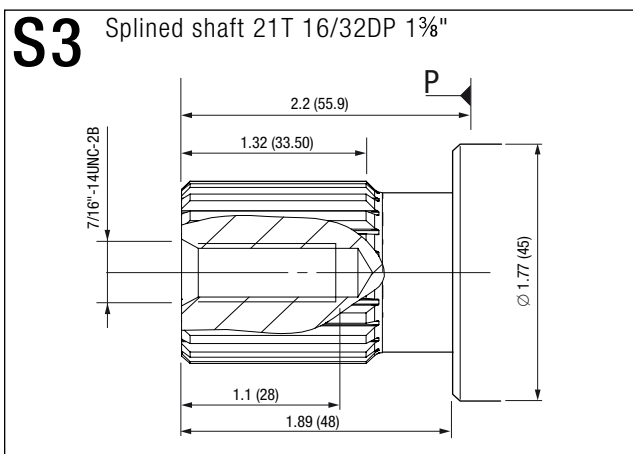
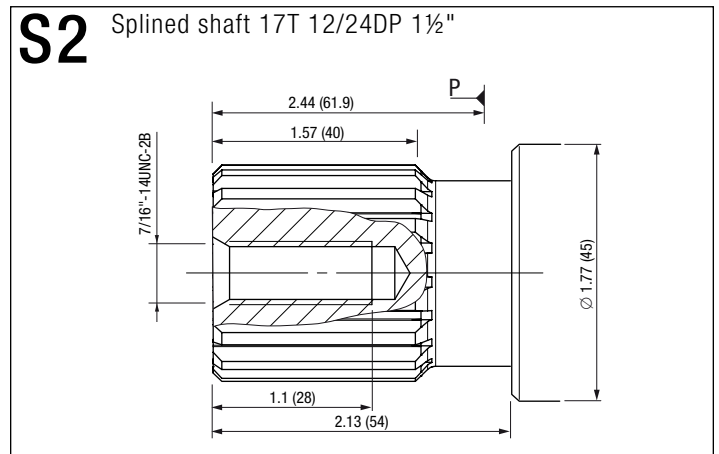
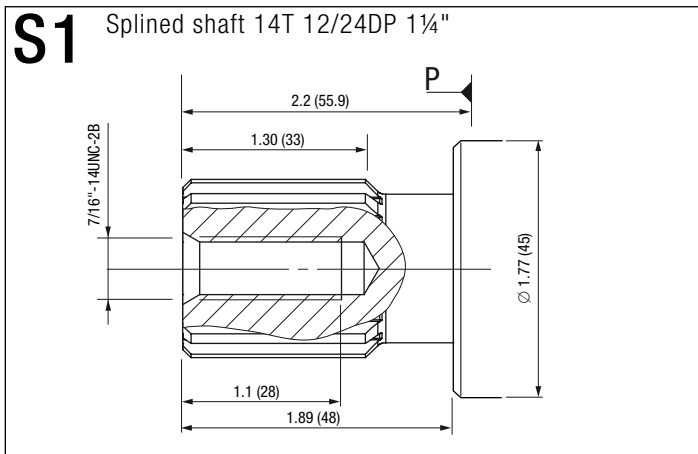
Inlet ports



Dimensions

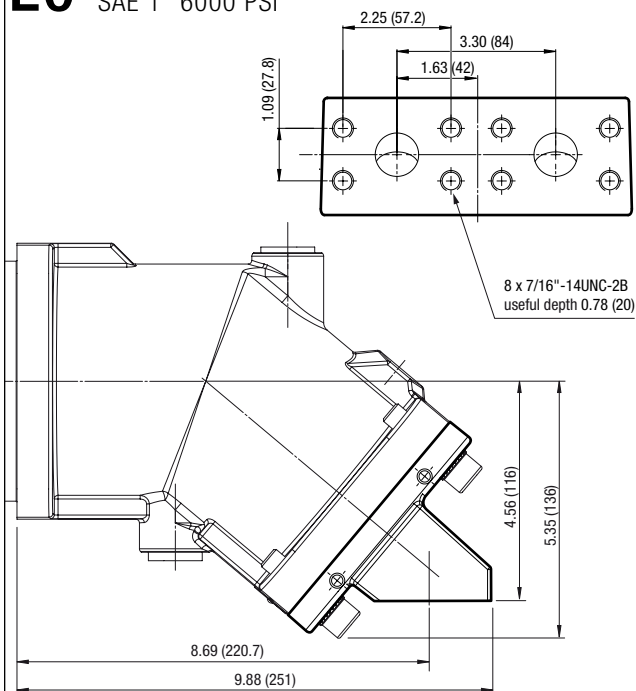


Shaft end

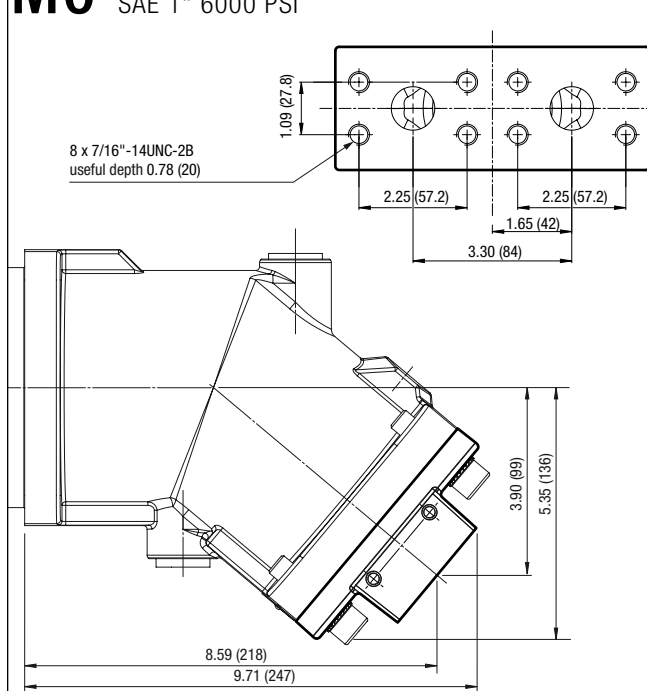


Inlet ports

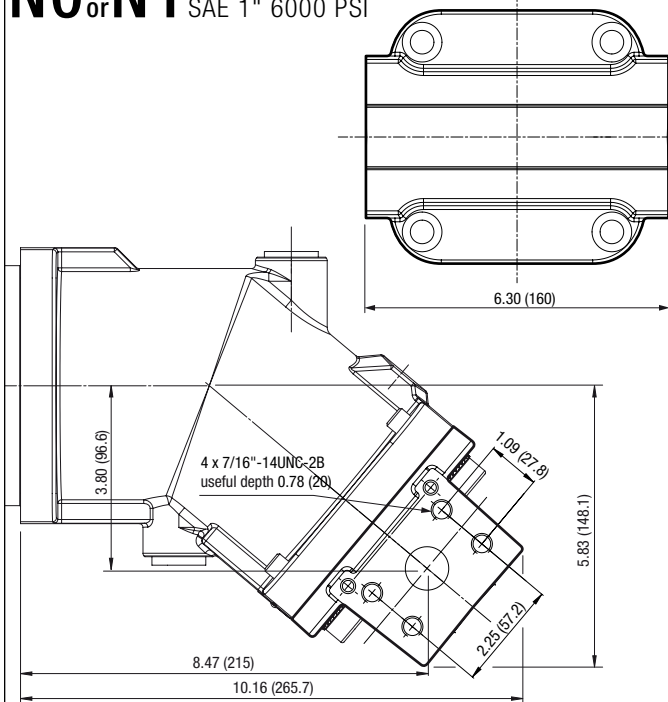
L0 SAE flange ports, bottom SAE 1" 6000 PSI



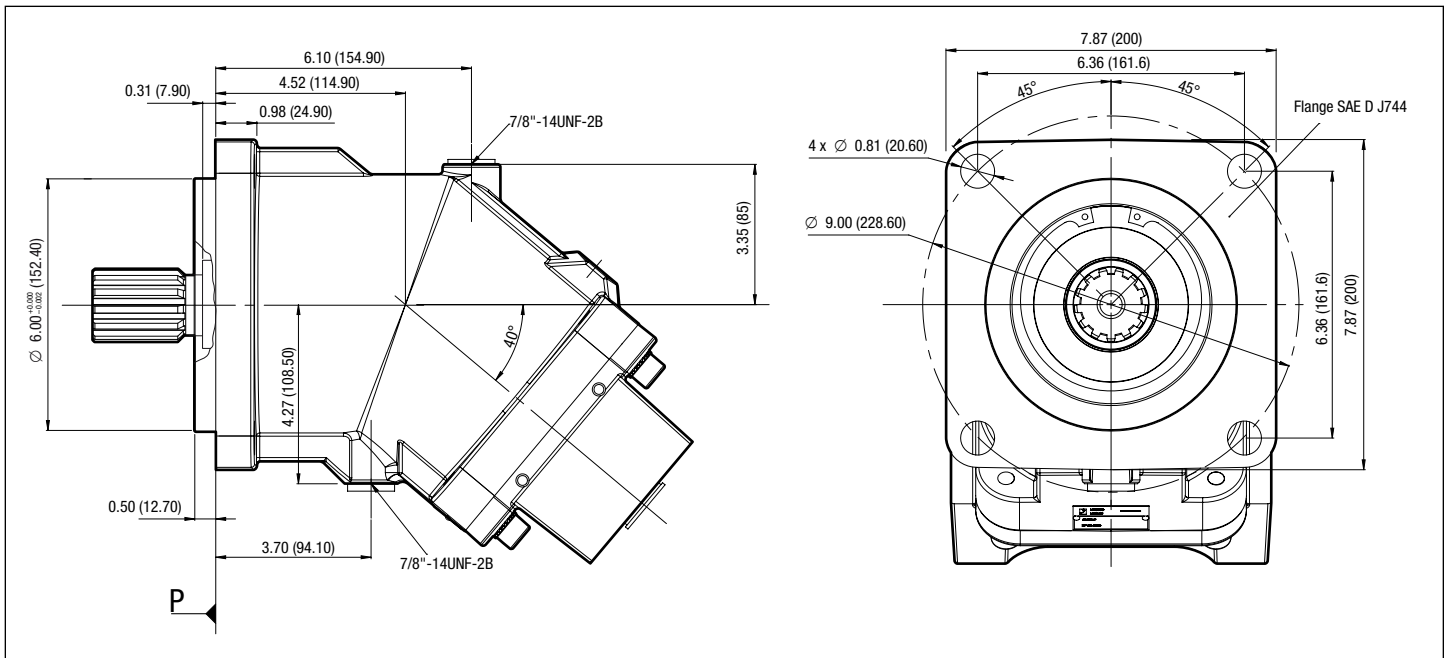
M0 SAE flange ports, rear SAE 1" 6000 PSI



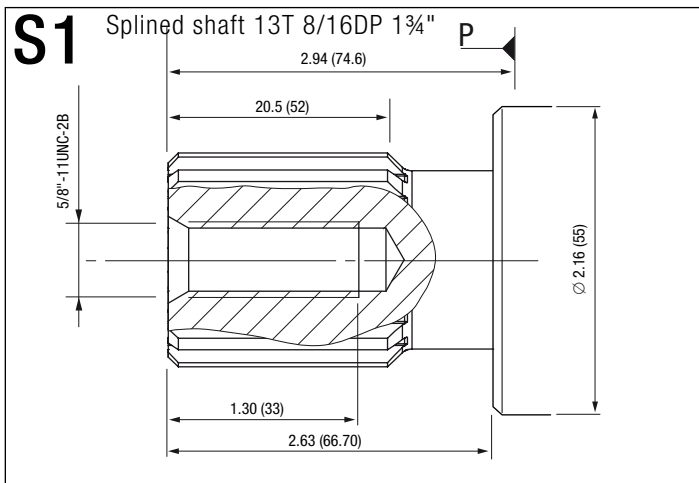
N0 or N1 SAE flange ports, side A and B SAE 1" 6000 PSI



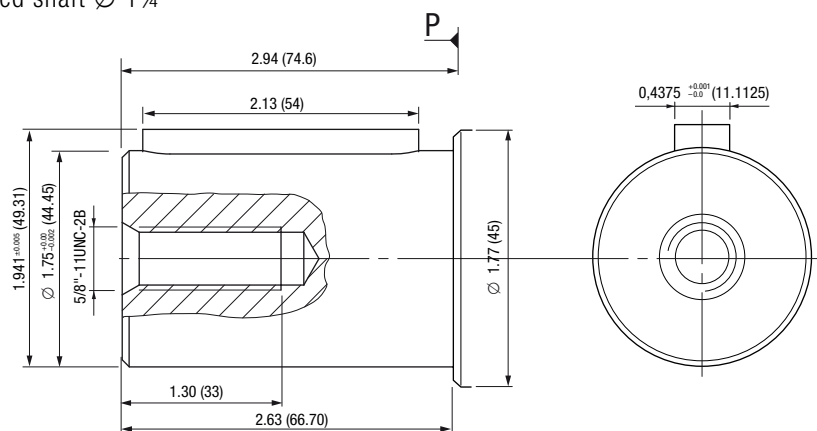
Dimensions



Shaft end

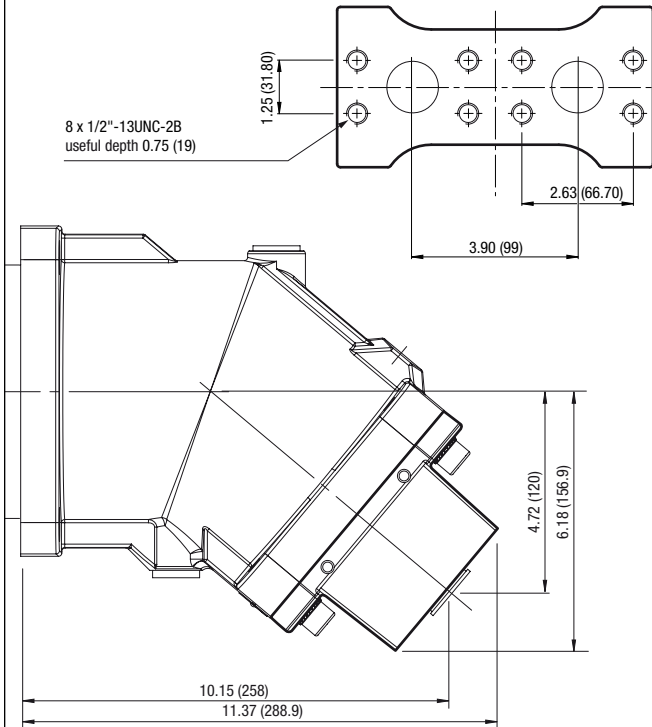


K1 Cylindrical keyed shaft $\varnothing 1 3/4"$

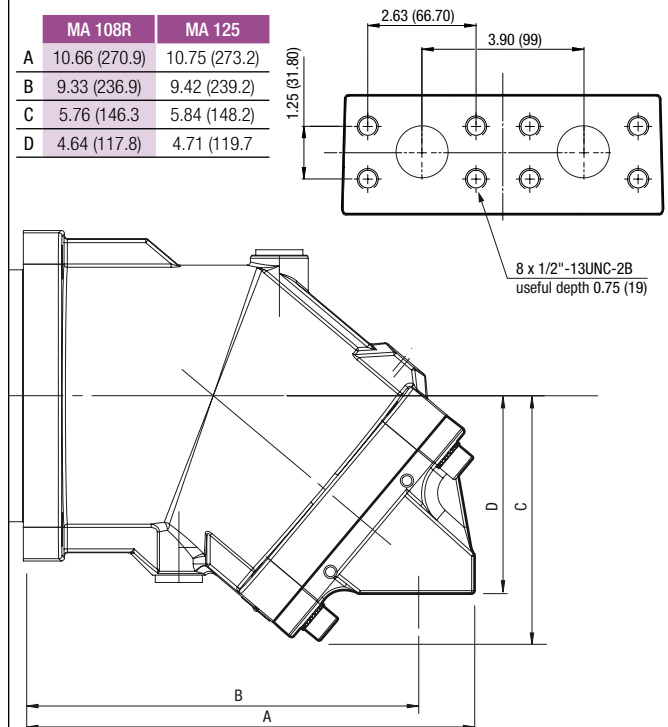


Inlet ports

M0 SAE flange ports, rear SAE 1 1/4" 6000 PSI

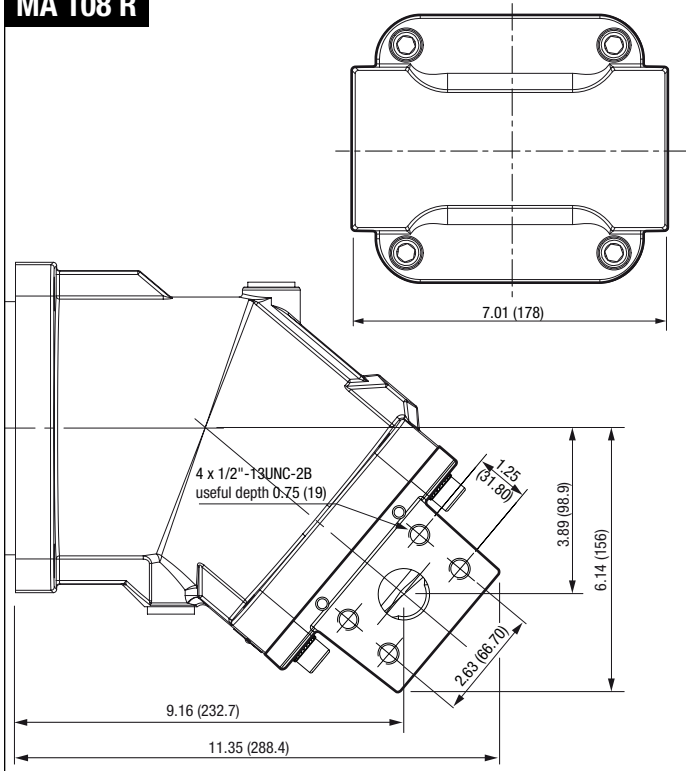


L0 SAE flange ports, bottom SAE 1 1/4" 6000 PSI



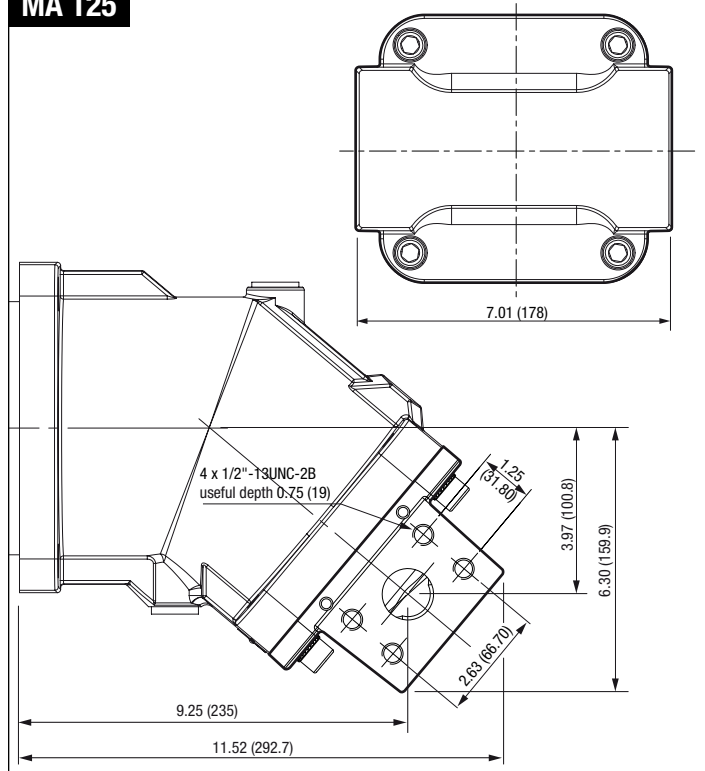
N0 or N1 SAE flange ports, side A and B SAE 1 1/4" 6000 PSI

MA 108 R

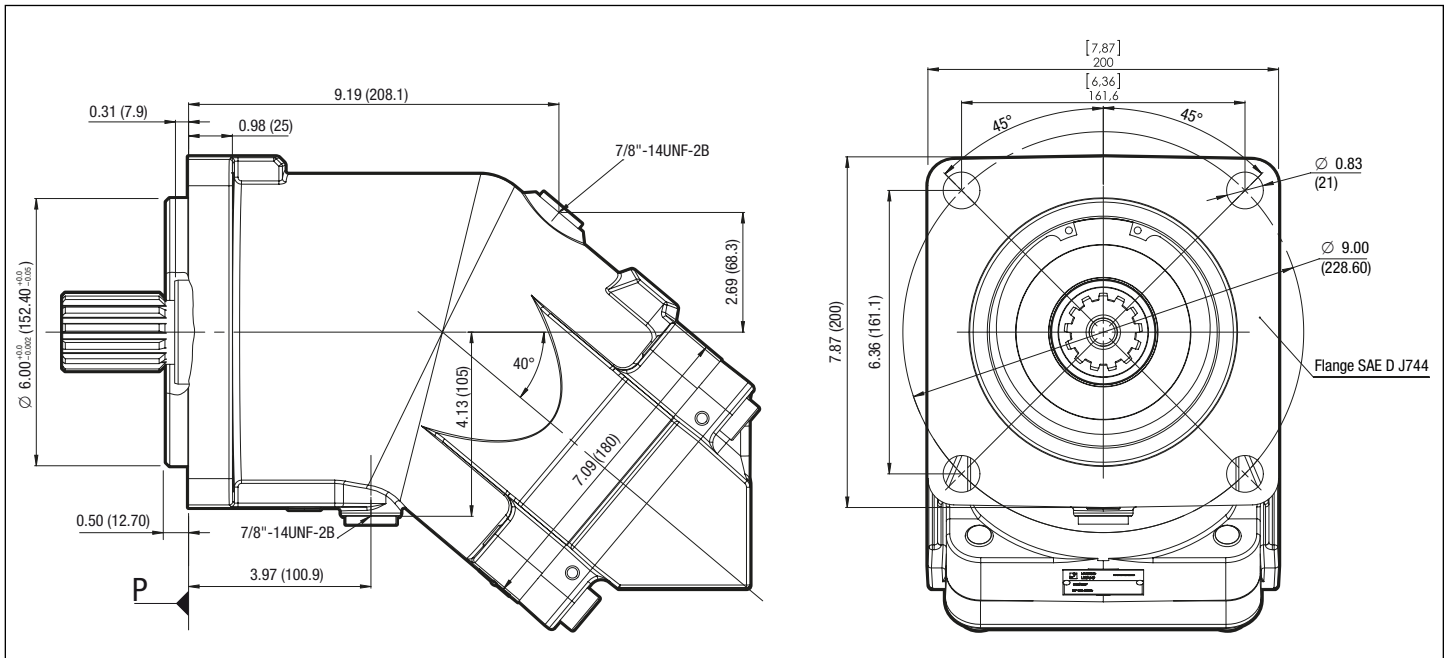


N0 or N1 SAE flange ports, side A and B SAE 1 1/4" 6000 PSI

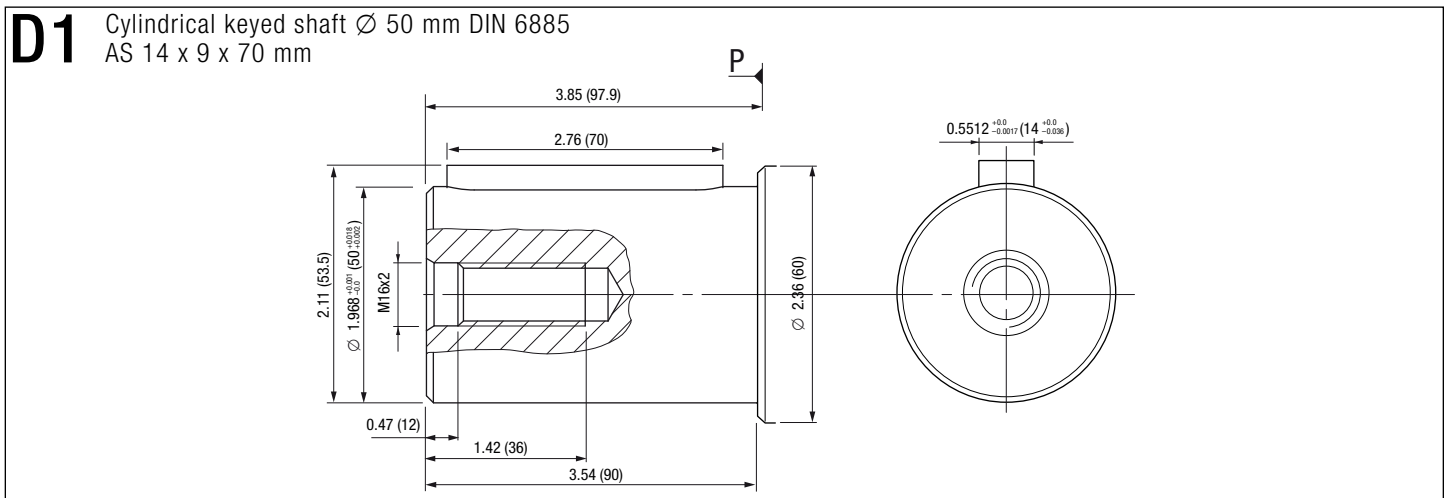
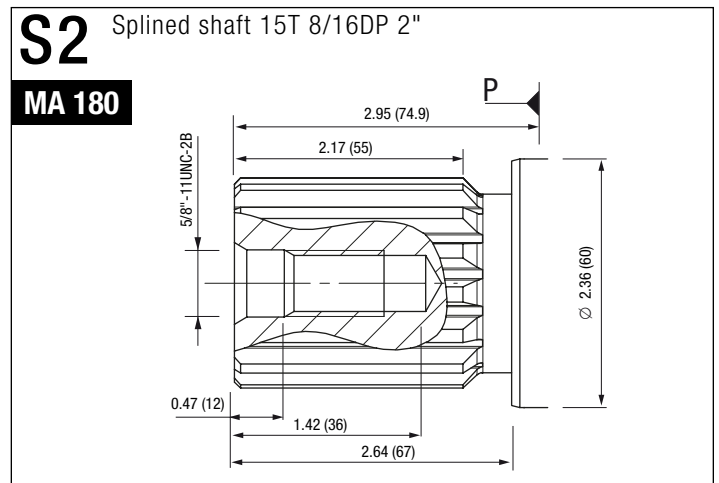
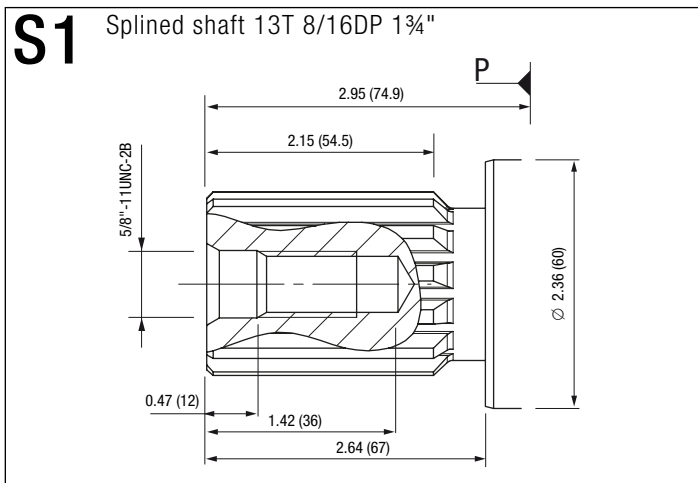
MA 125



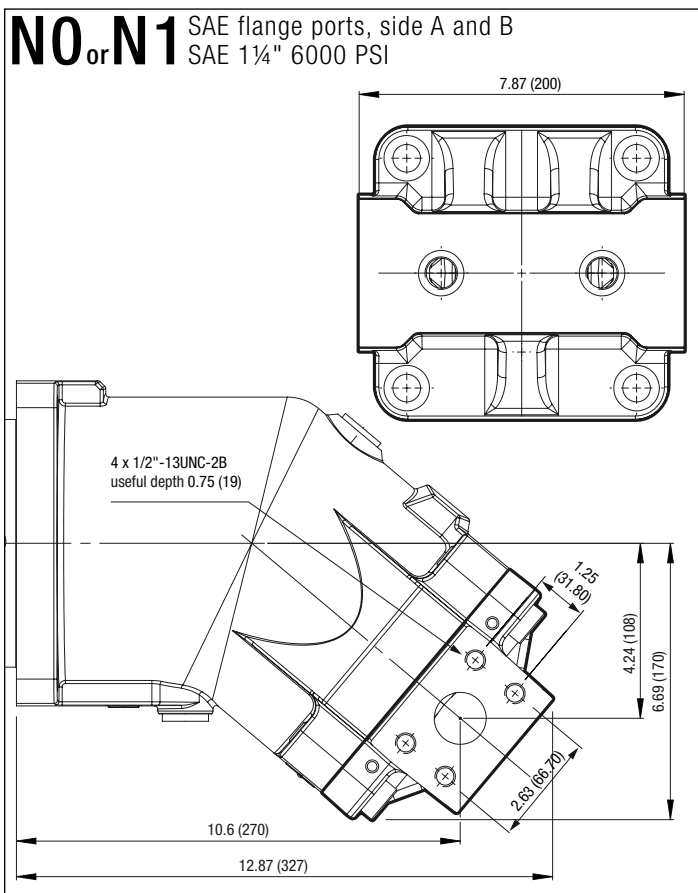
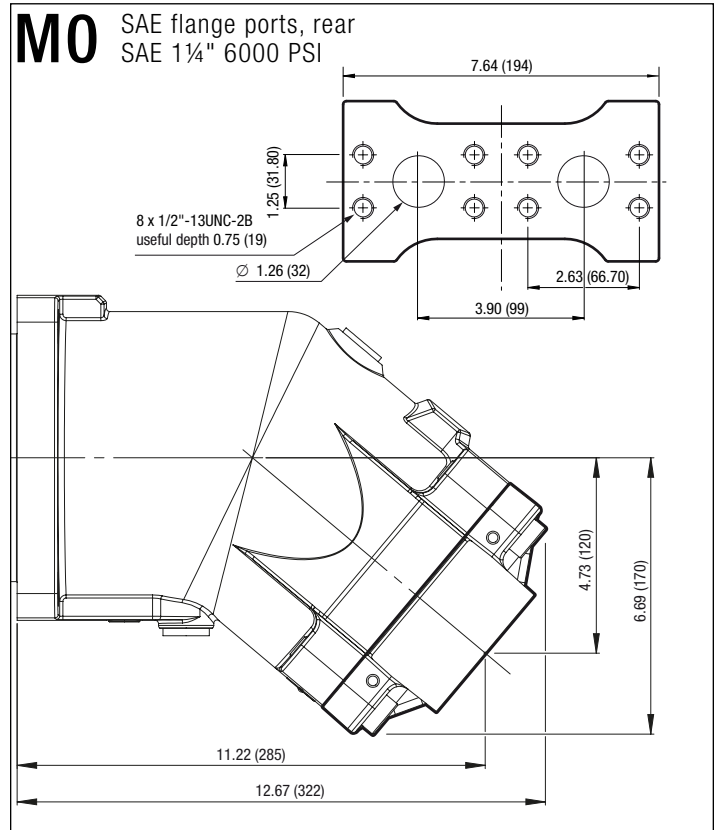
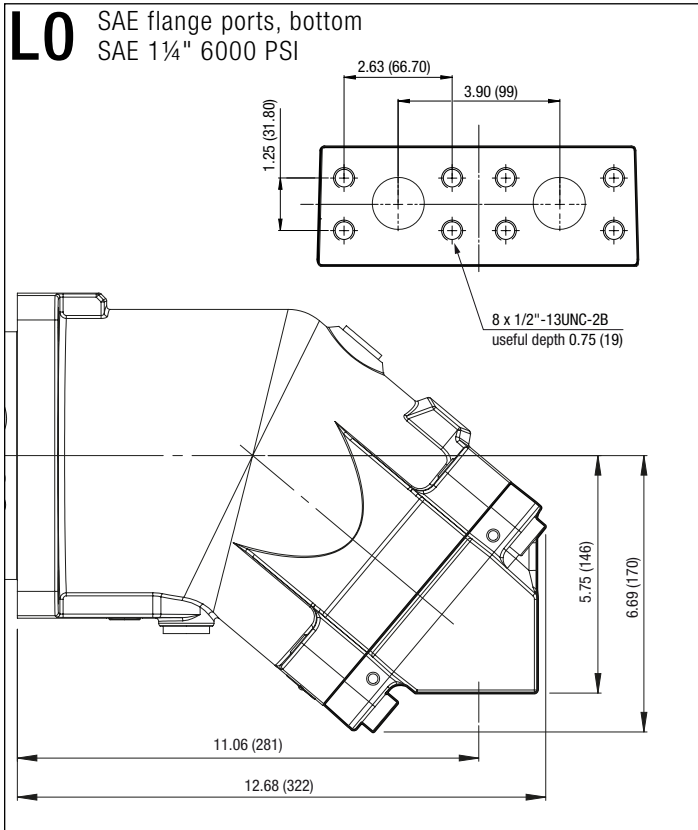
Dimensions



Shaft end



Inlet ports

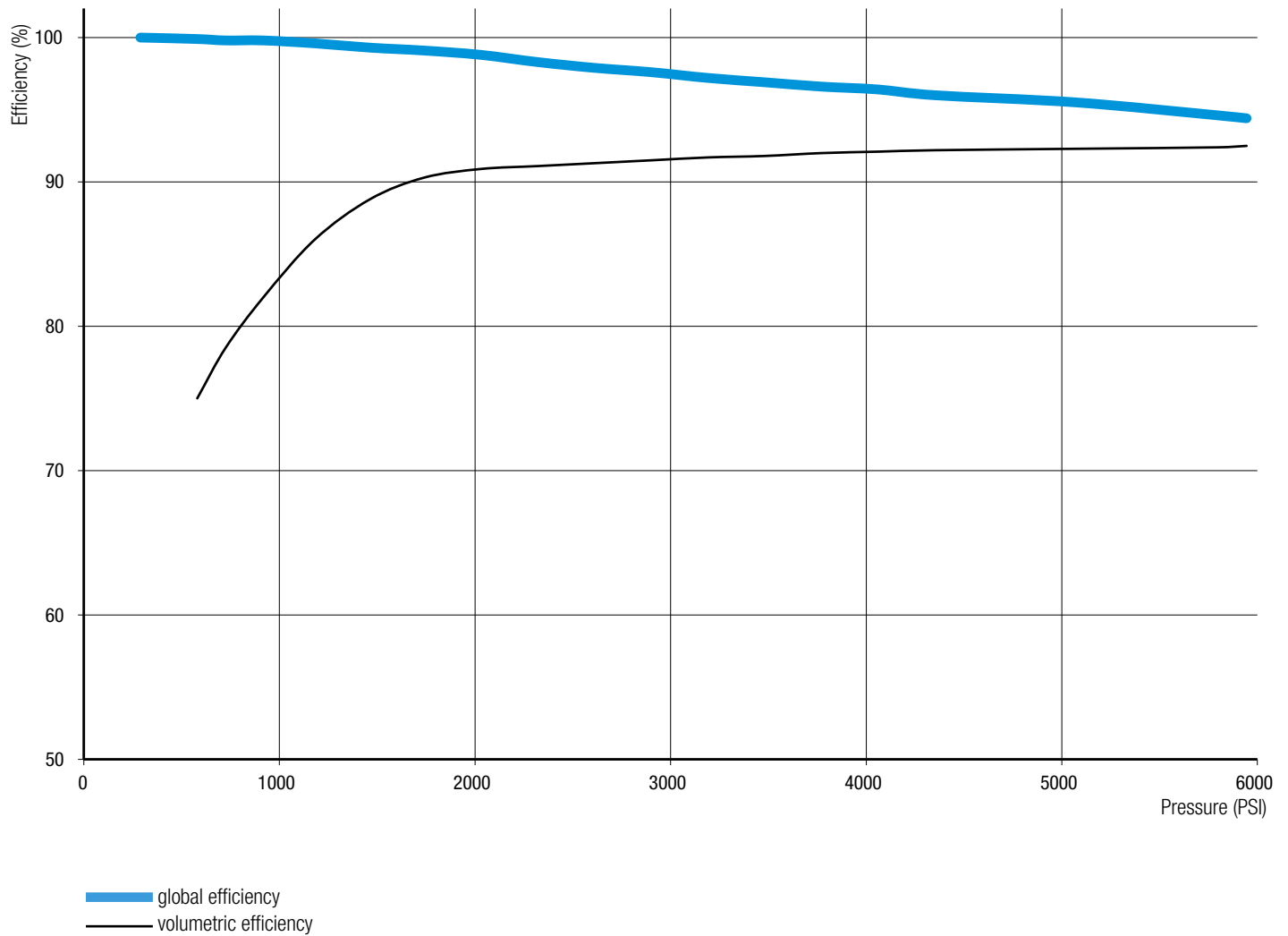


Efficiency MA series motors

■ Efficiency of motors $f(\text{displacement})$

N of motor = 1000 rpm

ISO46 fluid at 25°C



Accessories MA series motors

Flushing and resupply valve

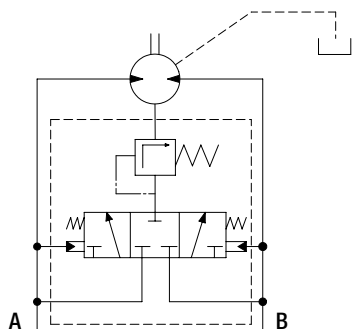
Used to create flow to cool the motor. This valve is essential for all intensive uses of motors and contributes to long service life, particularly in closed loop transmission applications.

The valve takes some hydraulic fluid internally from the return connection port (low pressure) and reinjects it into the motor housing. This is then evacuated via the motor drain line.

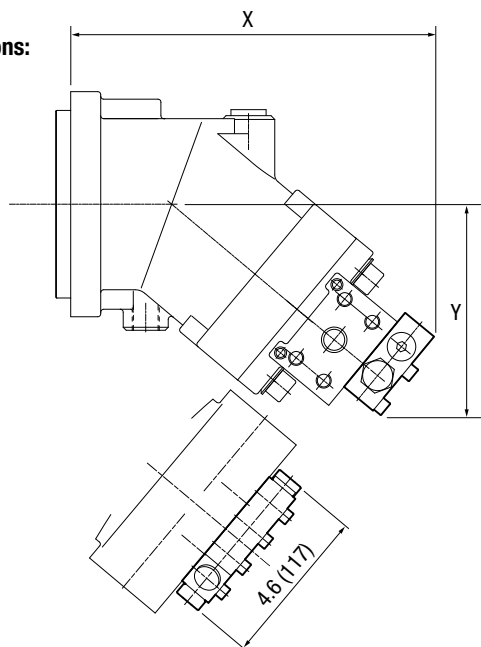
The flushing and resupply valve is only available for use on motors with side ports (N1 or Q1 in order code).

HYDRO LEDUC reference: VBS 091180.

Schematic:



Dimensions:



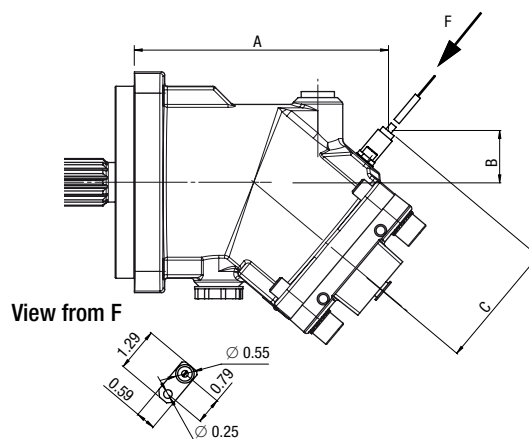
Motor displacement (Cu.In)	X inches (mm)	Y inches (mm)
1.52	8.72 (221.4)	4.58 (116.3)
1.95	8.96 (227.5)	4.78 (121.5)
2.78 - 3.07 - 3.84	10.07 (255.8)	5.41 (137.4)
4.90 - 5.49	11.26 (286)	6.02 (153)
6.61	12.01 (305)	6.17 (156.6)
7.65	12.10 (307.3)	6.24 (158.5)
9.8 - 11	13.6 (345)	6.69 (170)

Speed sensor

The MA series motors can be fitted with an induction type speed sensor, to measure rotating speed and also direction of rotation.

This accessory may only be used on motors which are suitably adapted to take it (see order code system on page 6, parameter no. 7).

HYDRO LEDUC reference: 093327.



Motor displacement (Cu.In)	A inches (mm)	B inches (mm)	C inches (mm)	Sensor number of tooth
0.73 - 1.1	6.38 (162)	1.26 (32)	3.43 (87)	30
1.52	6.81 (173)	1.61 (41)	3.62 (92)	35
1.95 - 2.50	6.81 (173)	1.61 (41)	3.62 (92)	35
2.78 - 3.07 - 3.84	7.6 (193)	1.38 (35)	3.78 (96)	39
4.90 - 5.49	8.78 (223)	1.18 (30)	3.98 (101)	44
6.61 - 7.65	9.88 (251)	1.77 (45)	4.8 (122)	64
9.8 - 11	11.09 (282)	1.85 (47)	4.96 (126)	68

Note: maximum tightening torque = 7 lbf ft (10 m.N)

For further information, please contact us.

Technical data for the sensor:

Supply voltage**	5...32 V DC
Current consumption	maximum 6 mA without load
Output frequency	0 Hz...6kHz
Protection type	IP 69 k
Operating temperature	- 40°C...+ 125°C
Weight	around 65 g

■ LEDUC motors are certified ATEX.

As standard, all LEDUC motors are classed in **Group II category 2 D TX**.

On request, motors may be supplied for:

- **Group II category 2G;**
- **Group II category D T4.**

As all the motors must be delivered unpainted (due to static electricity), it is necessary to pay attention to the risk of the motor corrosion.

Explanation of the different groups:

- **Group II category 2** means it is possible to operate in an ATEX 1 zone (Probable gas atmosphere) or ATEX 21 zone (probable dusty atmosphere).
- **G** = may operate in a gas zone.
- **D** = may operate in a dusty atmosphere.
- **TX**: maximum surface temperature.

■ Precautions regarding ATEX

It is necessary to check the following recommendations:

- The operating temperatures of the motors must be guaranteed by the end user.
- Facilities on which our products are assembled should be ground-connected (static electricity).
- Check all parts connected to the motor for conformity with ATEX.

■ Markings on motors

The marking of our product will be: Group II category 2GD c TX (where TX replaces T3 and T4).

Our products are **TX** registered (based on product surface temperature) and can therefore be certified **T4** or **T3** according to the following recommendations (Hot area):

Surface temperature:

- T4 (135°C) for fluid temperature < 70°C
- T3 (200°C) for fluid temperature < 110°C

■ Example of ATEX marking on motors:

CE  II 2 GD c TX HL1

If you have different requirements, please contact us.

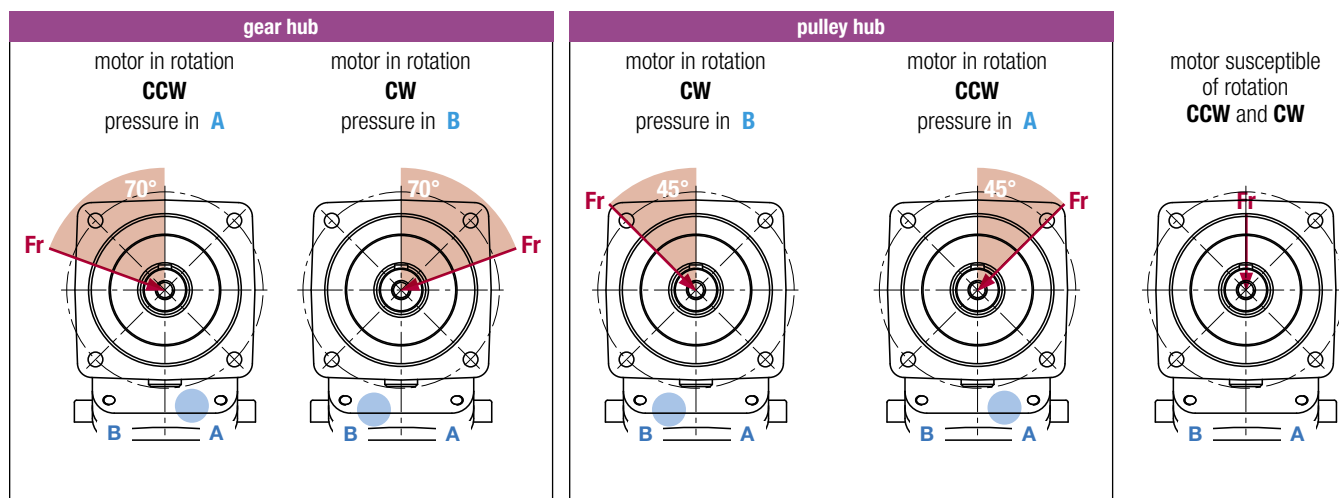


- 1 Dimensional control of motor housing
- 2 Assembly of motor
- 3 Spline cutting (shaft)
- 4 MA motors

Installation and start-up MA series motors

■ Maximizing service life of bearings

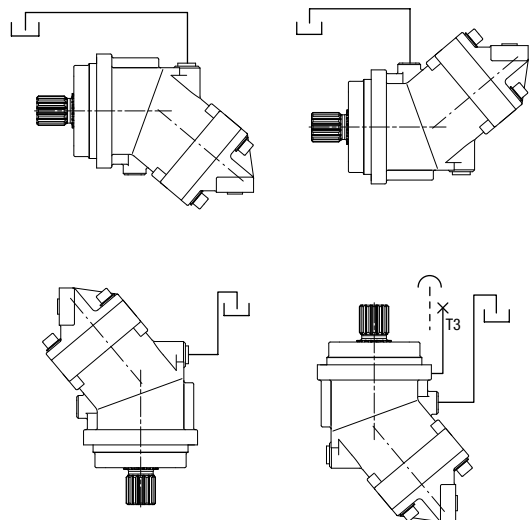
In cases where there is a radial force on motor shaft, keeping the direction of that force within the shaded areas shown below will improve service life of the motor. For acceptable radial and axial forces, see page 4.



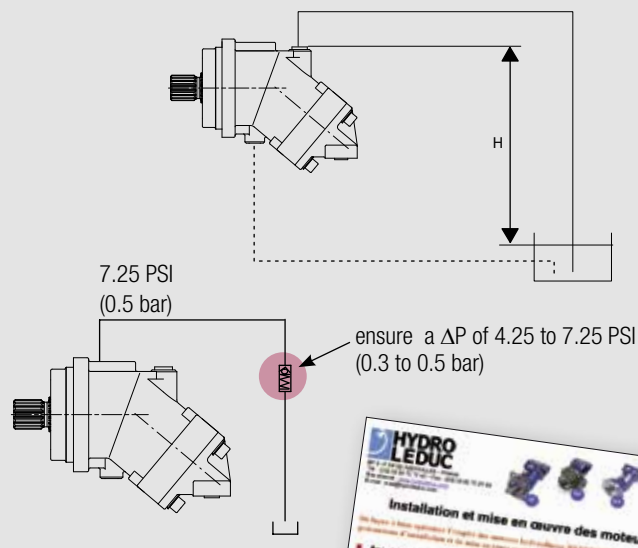
■ Mounting position of motors

LEDUC motors can be used in any position.

In position «shaft upwards», make sure that the motor housing is completely filled with fluid.



In installations where the position of the motor (H) is above the tank for the drain return, be sure the drain line is always submerged in fluid. If this is not the case, it is necessary to add a check valve on the drain line following the figure below.

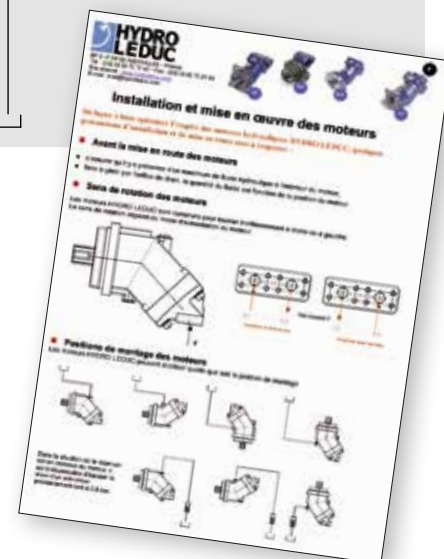


■ Operating conditions

See page 2.

■ Instructions for use

Each motor is supplied with an instruction leaflet, also available via e-mail on request mail@hydroleduc.com.



other product lines

piston pumps for trucks

HYDRO LEDUC offers 3 ranges of piston pumps perfectly suited to all truck, construction equipment, and PTO-mount applications. Fixed and variable displacement from 12 to 150 cm³ (0.73 to 9.25 Cu.In).

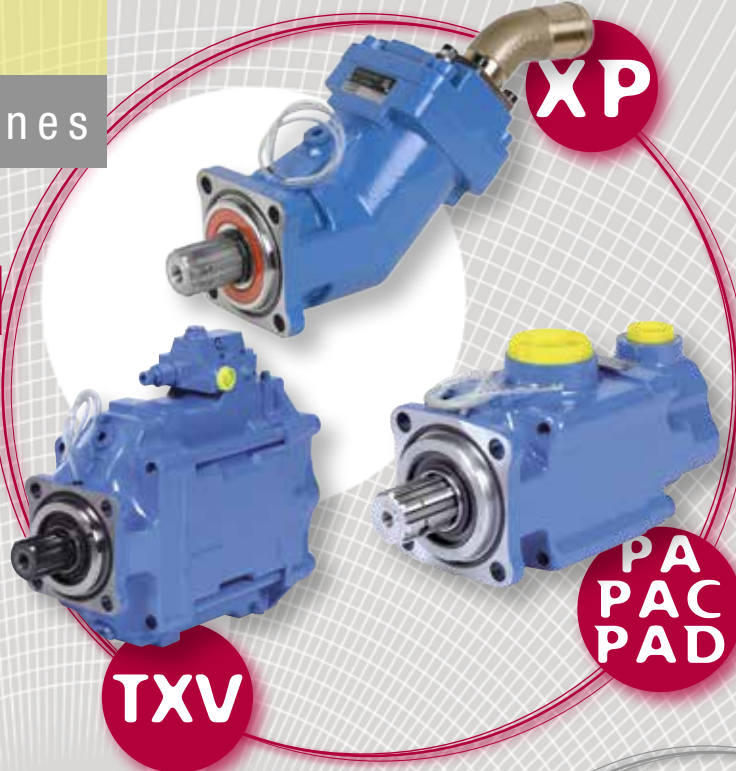


mobile and industrial pumps

Fixed displacement pumps, the W series, and variable displacement pumps, the DELTA series. High pressure capabilities within minimal size.

W series: flanges to ISO 3019/2, shafts to DIN 5480.

DELTA series: SAE shafts and flanges.



micro-hydraulics

This is a field of exceptional HYDRO LEDUC know-how:

- axial and radial piston pumps, of fixed and variable displacement,
- axial piston micro-hydraulic motors,
- micro-hydraulic units incorporating pump, electric motors, valving, controls, etc.

To users of hydraulic components which have to be housed in extremely small spaces, HYDRO LEDUC offers complete, original and reliable solutions for even the most difficult environments.



hydro-pneumatical accumulators

Bladder, diaphragm and piston accumulators.

Spherical and cylindrical accumulators.

Volume capacities from 1.22 Cu.In to 13.21 gallons (20 cc to 50 liters).

Pressures up to 7250 psi (500 bar).

Accessories for use with hydraulic accumulators.



**we are passionate
about hydraulics...**

**HYDRO
LEDUC**

A dedicated R&D team means HYDRO LEDUC is able to adapt or create products to meet specific customer requirements. Working in close cooperation with the decision-making teams of its customers, HYDRO LEDUC optimizes proposals based on the specifications submitted.

A passion for hydraulics

HYDRO LEDUC

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Complete catalogues available at:
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