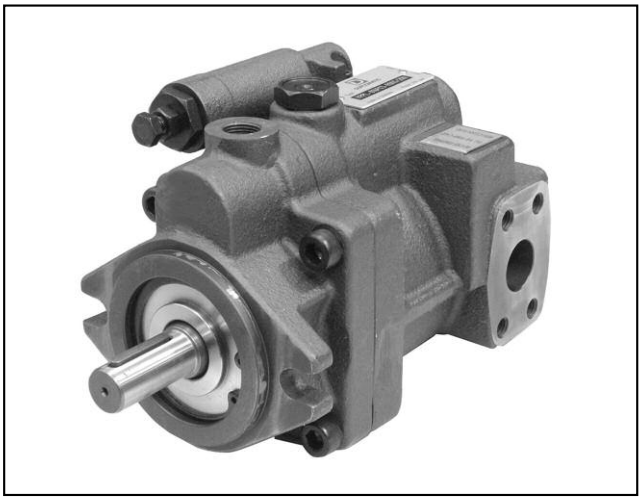
Зміст

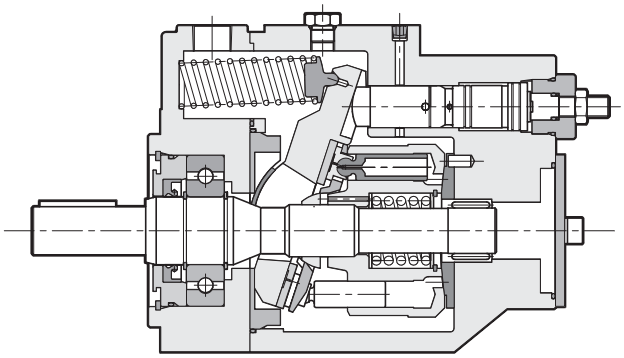


VPPL

VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS FOR INTERMEDIATE PRESSURE

SERIES 20

OPERATING PRINCIPLE



— The VPPL are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits and intermediate pressures.

— They are available in seven nominal sizes, with displacements of 8, 16, 22, 36, 46, 70 and 100 cm^3/rev.

— The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.

— They are usually supplied with a SAE J744 2-hole flange and a SAE J744 cylindrical with key shaft.

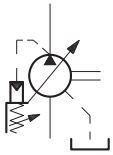
— They are available with four different types of regulating control, each according to the application needs.

TECHNICAL SPECIFICATIONS

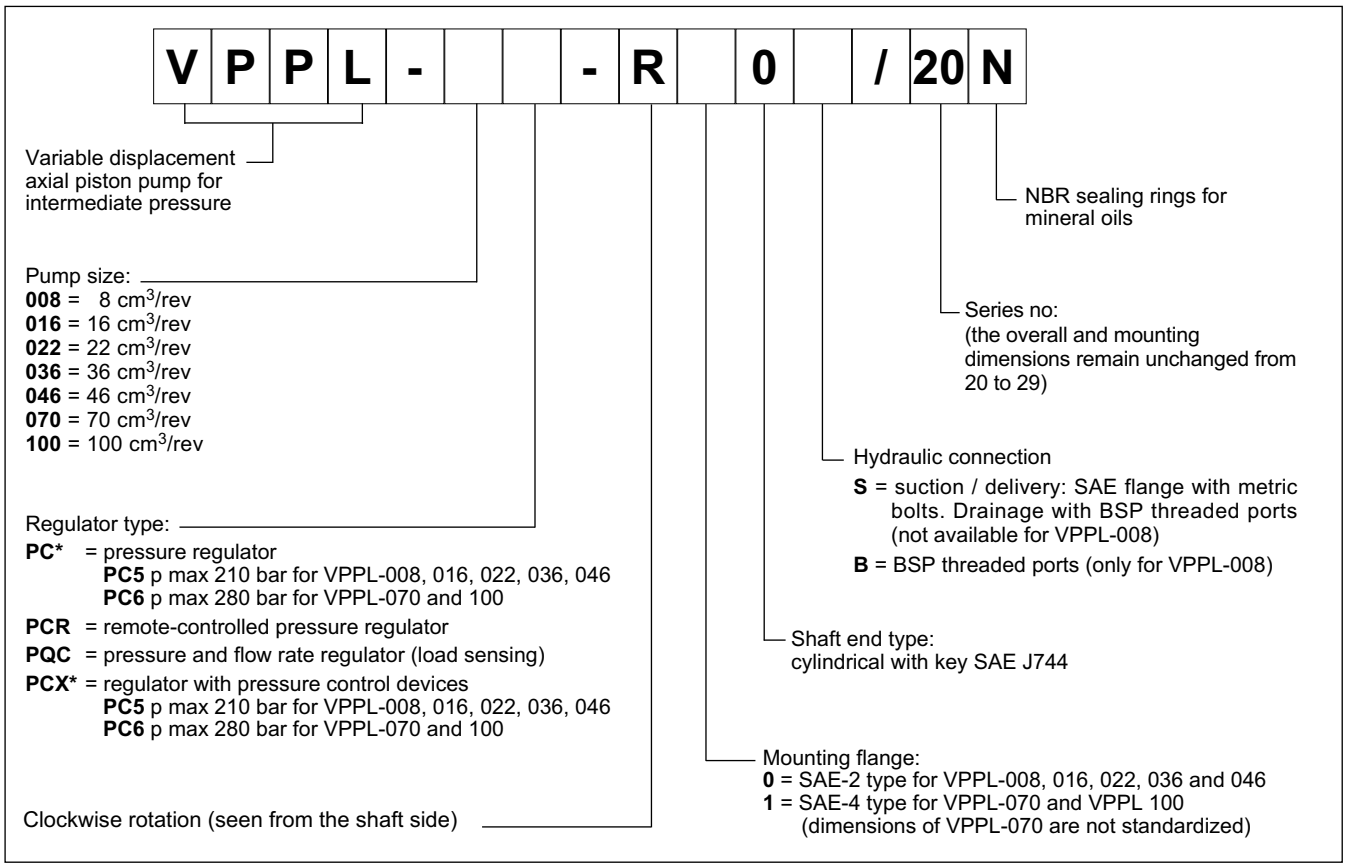
PUMP SIZE		008	016	022	036	046	070	100
Maximum displacement	cm^3/rev	8	16	22	36	46	70	100
Flow rate at 1500 rpm	lt/min	12	24	33	54	69	105	150
Operating pressures	bar	210					280	
Rotation speed	rpm	min 500 - max 2000					min 500 - max 1800	
Rotation direction		clockwise (seen from the shaft side)						
Hydraulic connection		SAE flange						
Type of mounting		SAE flange J744 - 2 holes						
Oil volume in the pump body	dm^3	0,2	0,3		0,6		1	1,8
Mass	kg	8	12	12	23	23	41	60

Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-10 / +70
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	20 ÷ 50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE



2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With these fluids use NBR seals. Using fluids at temperatures higher than 70 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	20 / 50 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

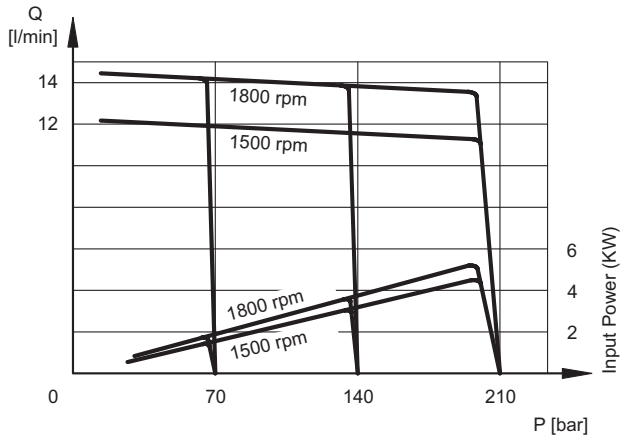
2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with $\beta_{20} \geq 75$ is suggested.
A degree of maximum fluid contamination according to ISO 4406:1999 class 20/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with $\beta_{10} \geq 100$ is recommended.
For the installation of filters on the suction line, see paragraph 10. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

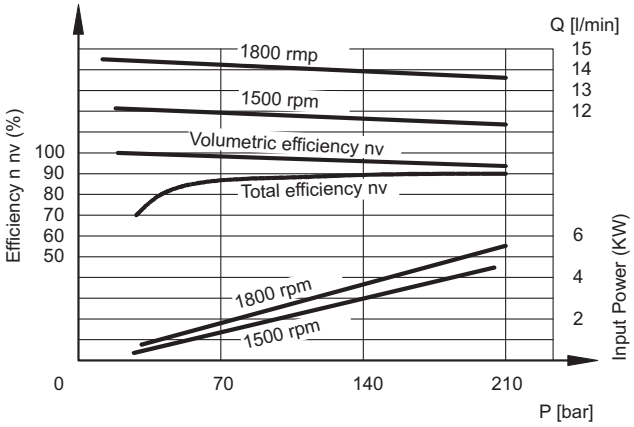
3 - CHARACTERISTIC CURVES

3.1 - VPPL-008 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

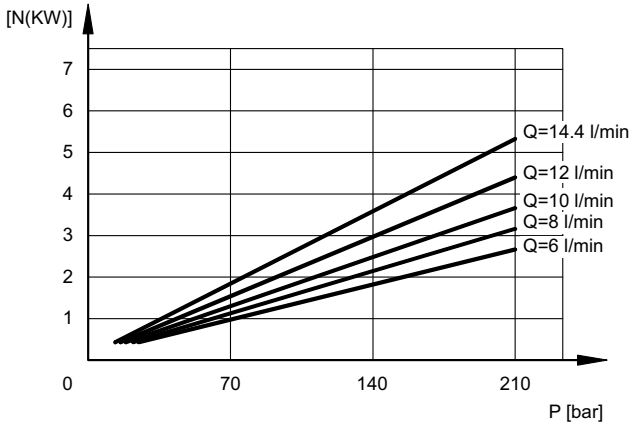
FLOW RATE / PRESSURE CURVES



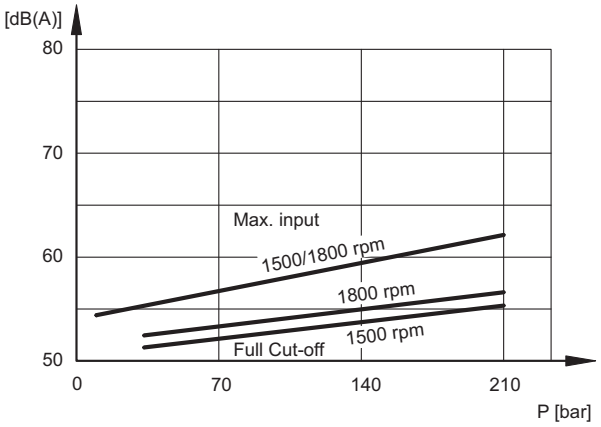
VOLUMETRIC AND TOTAL EFFICIENCY



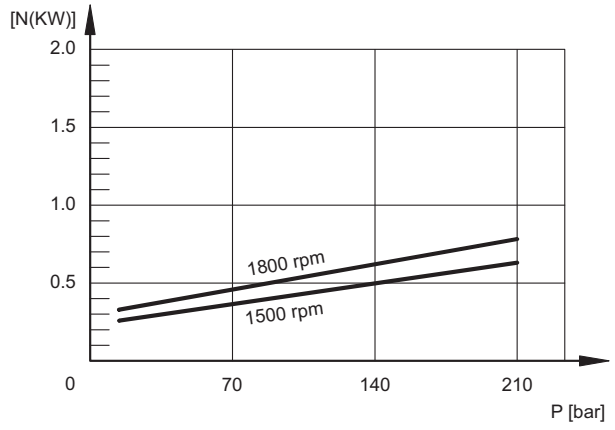
ABSORBED POWER



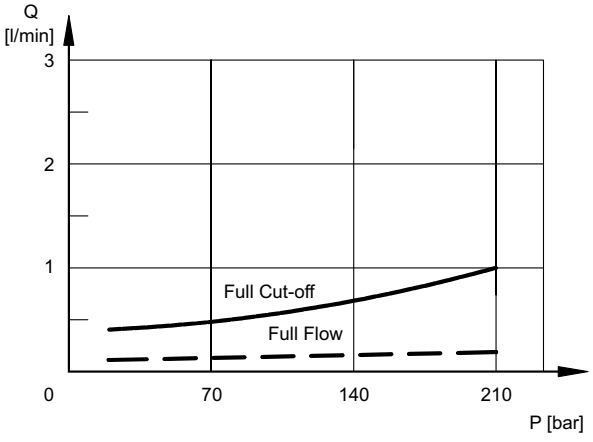
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

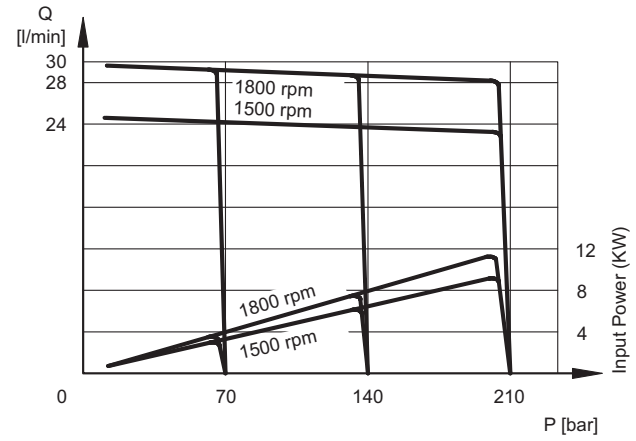


DRAIN FLOW RATE

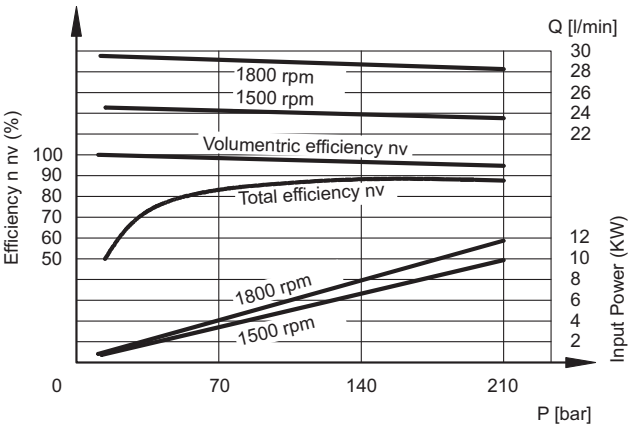


3.2 - VPPL-016 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

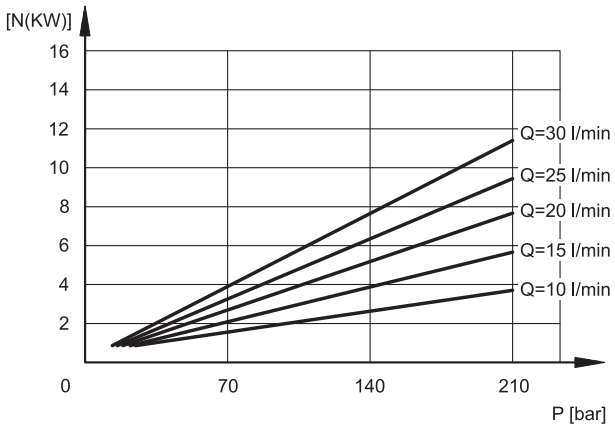
FLOW RATE / PRESSURE CURVES



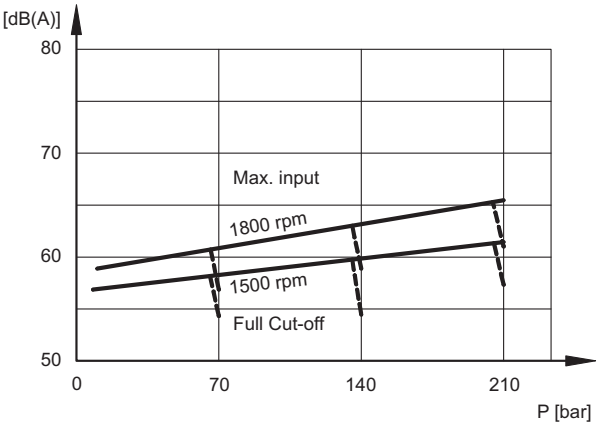
VOLUMETRIC AND TOTAL EFFICIENCY



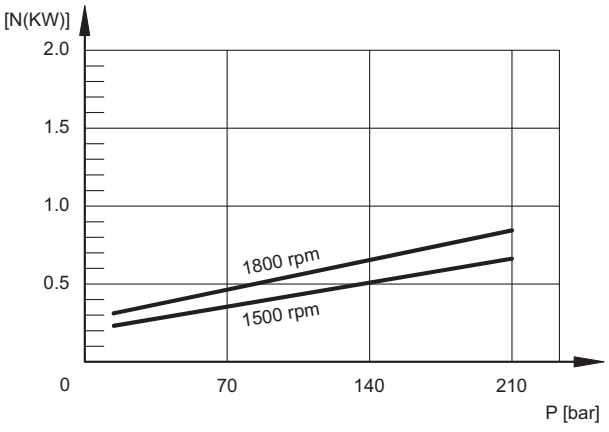
ABSORBED POWER



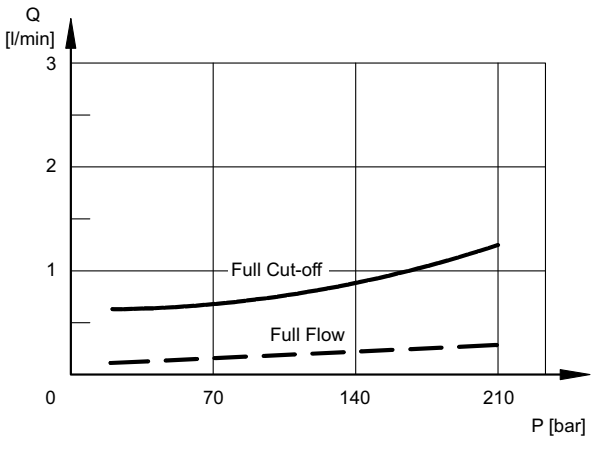
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

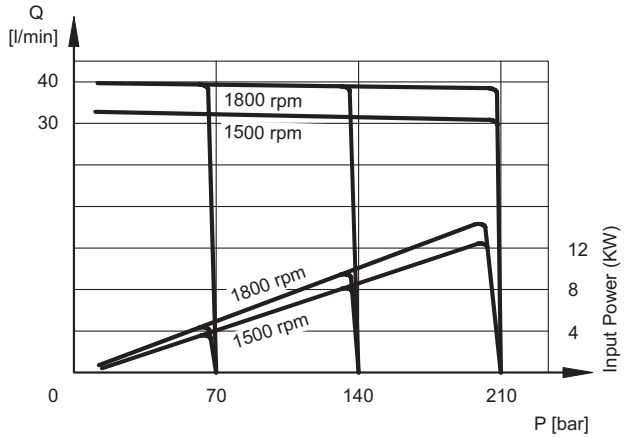


DRAIN FLOW RATE

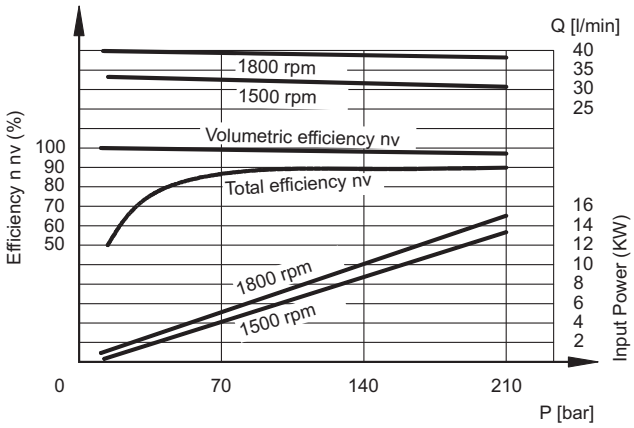


3.3 - VPPL-022 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

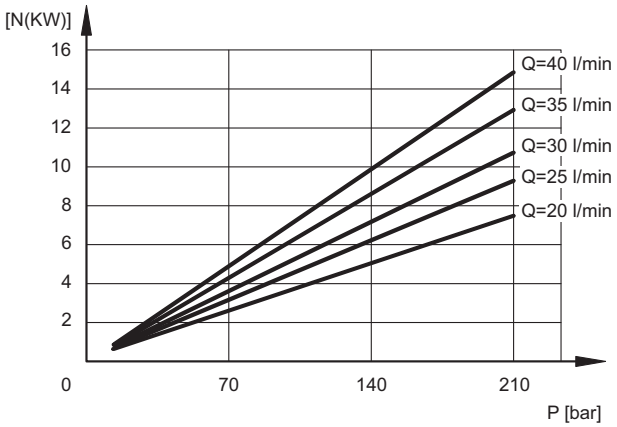
FLOW RATE / PRESSURE CURVES



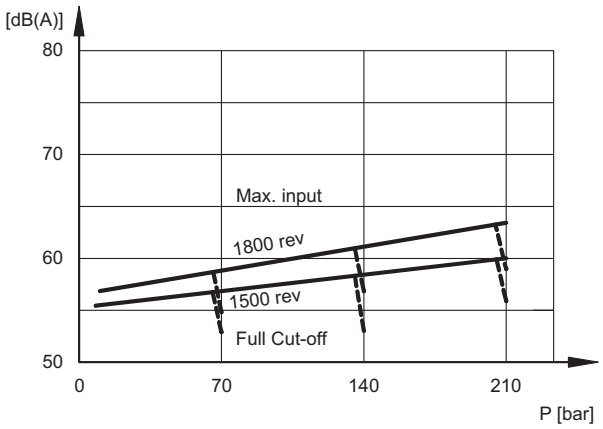
VOLUMETRIC AND TOTAL EFFICIENCY



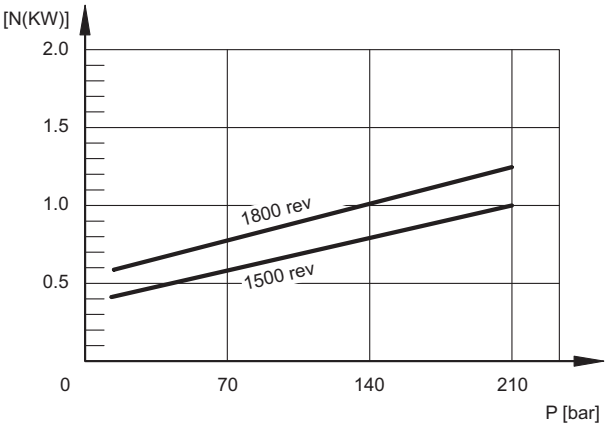
ABSORBED POWER



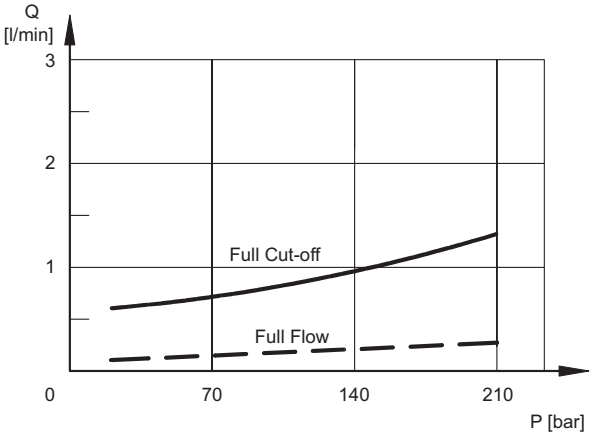
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

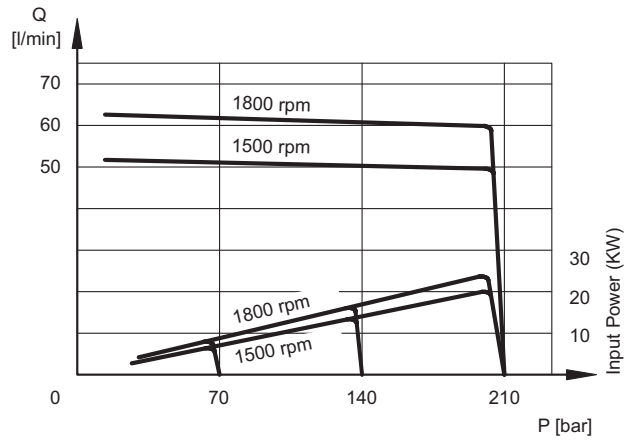


DRAIN FLOW RATE

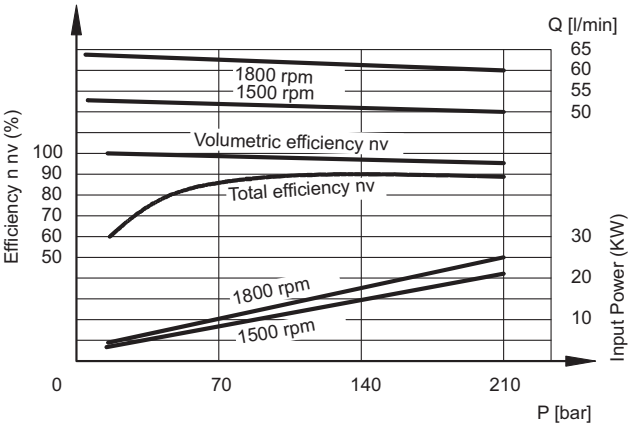


3.4 - VPPL-036 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

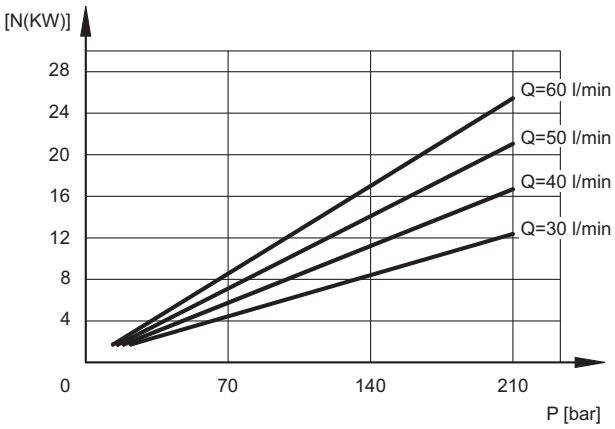
FLOW RATE / PRESSURE CURVES



VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



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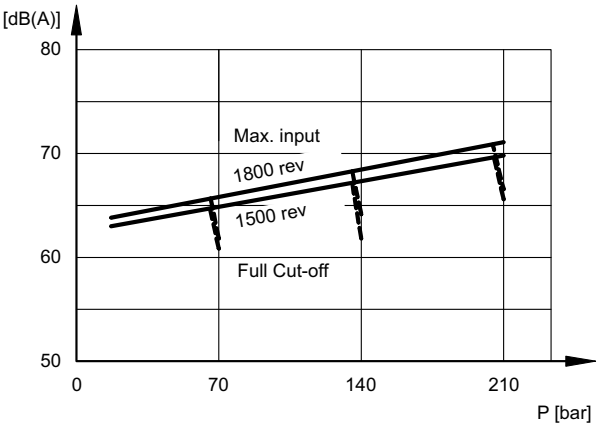

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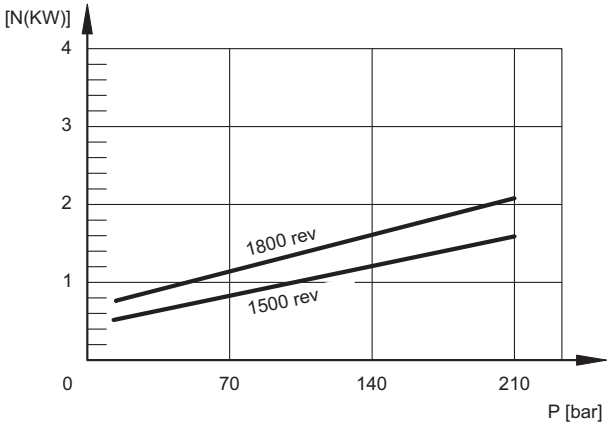
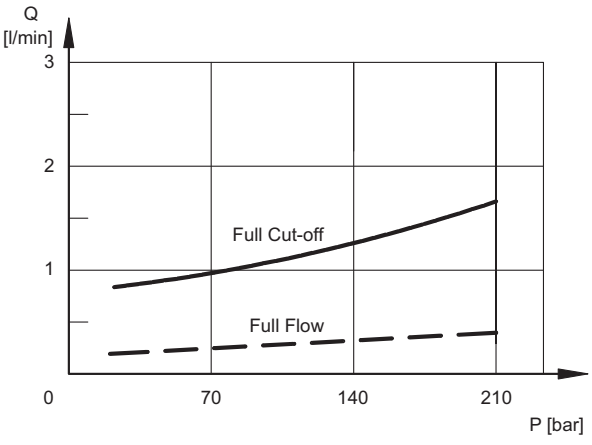
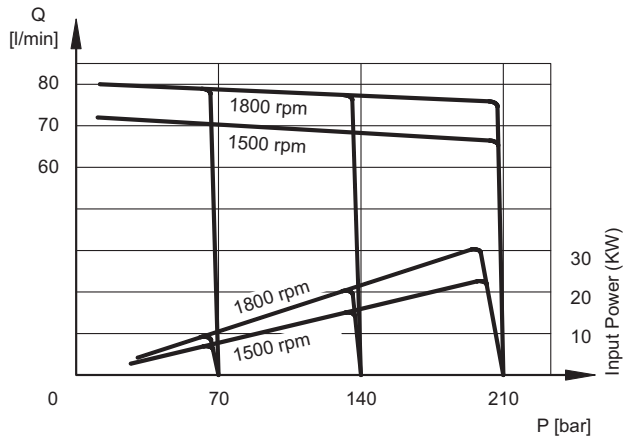


DRAIN FLOW RATE

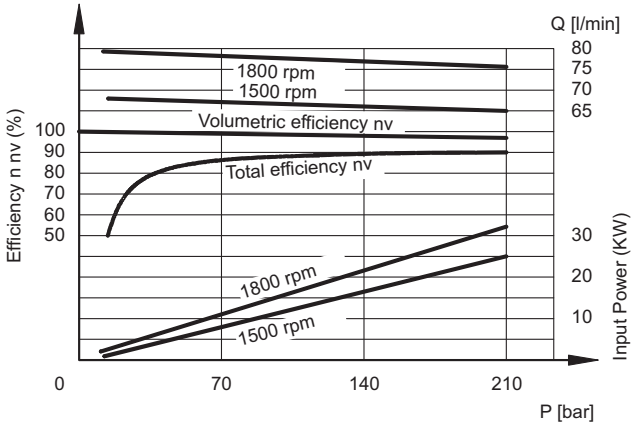


3.5 - VPPL-046 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

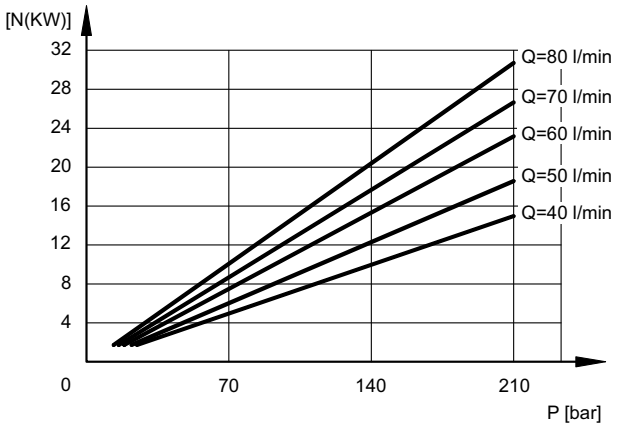
FLOW RATE / PRESSURE CURVES



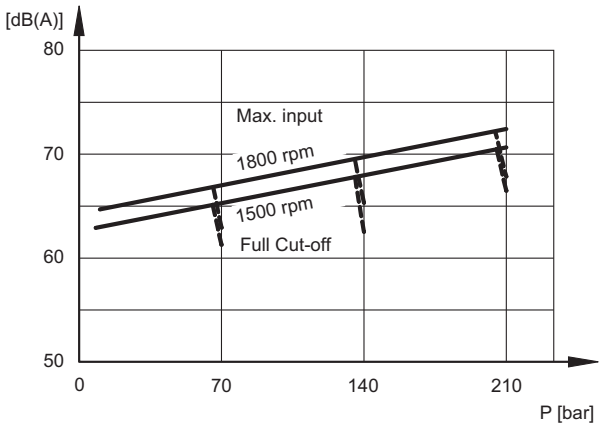
VOLUMETRIC AND TOTAL EFFICIENCY



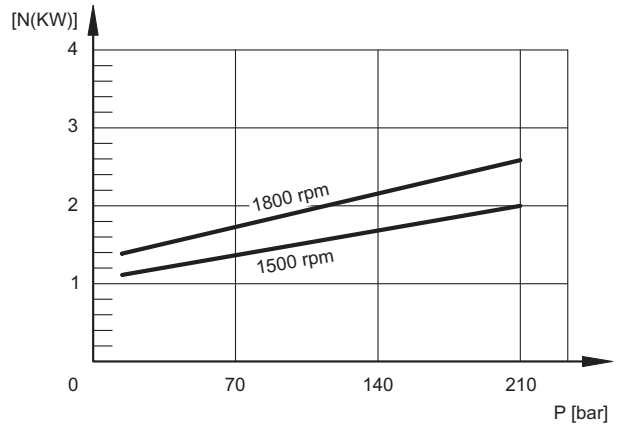
ABSORBED POWER



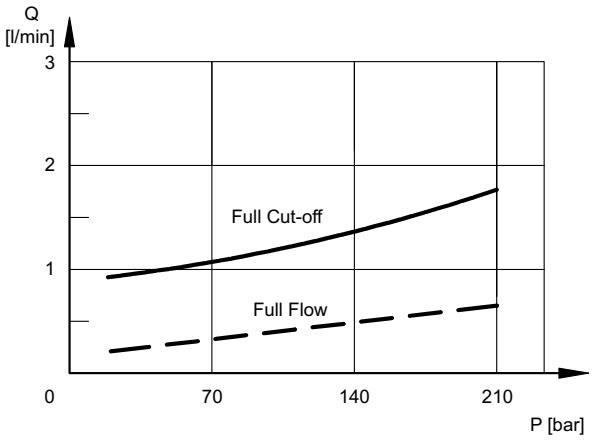
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

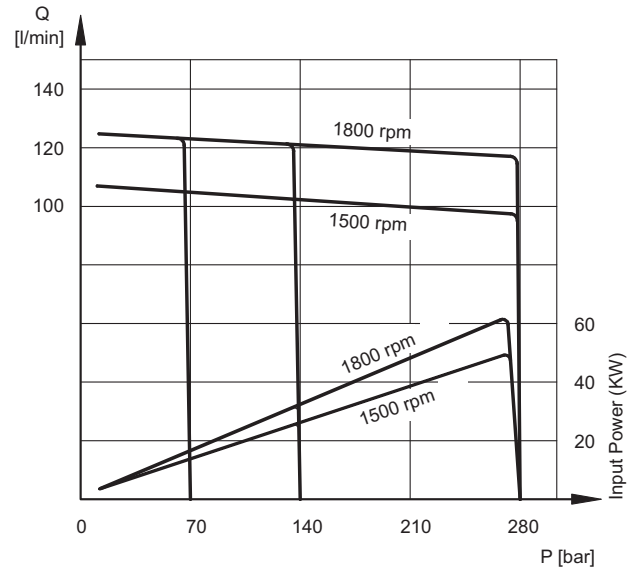


DRAIN FLOW RATE

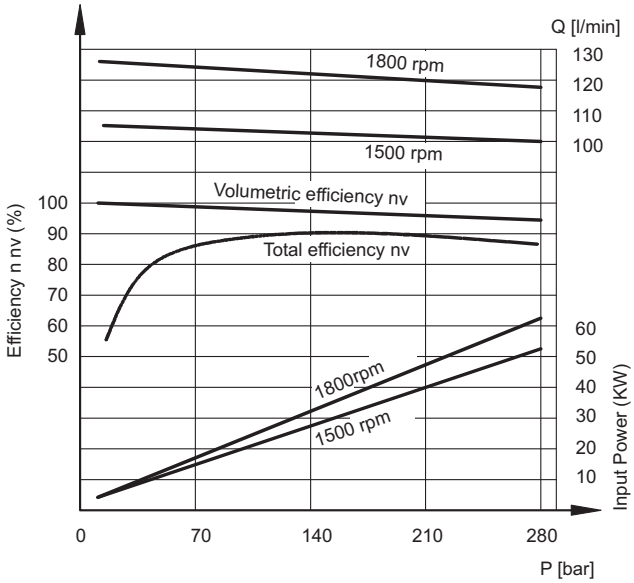


3.4 - VPPL-070 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

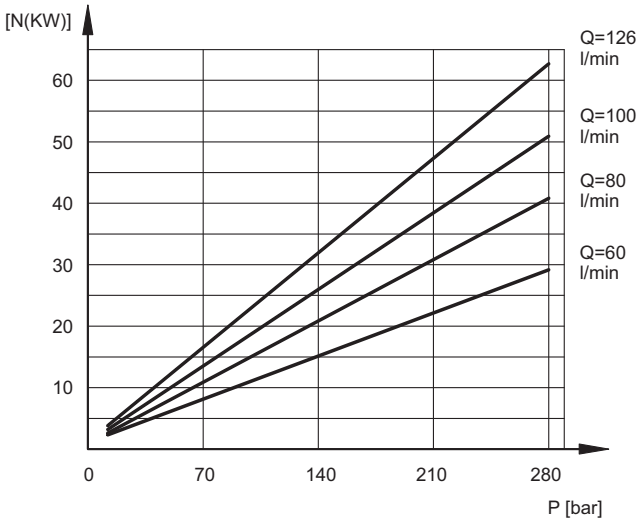
FLOW RATE / PRESSURE CURVES



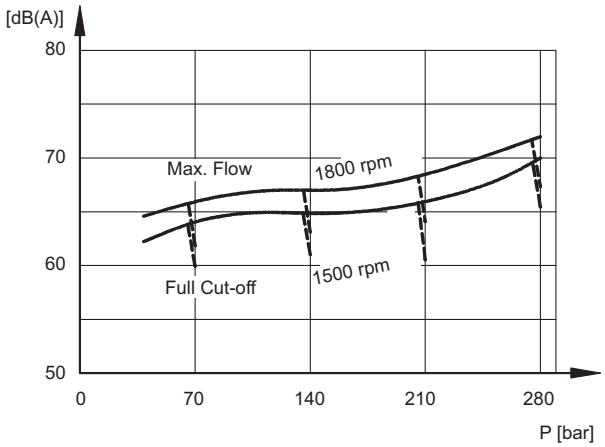
VOLUMETRIC AND TOTAL EFFICIENCY



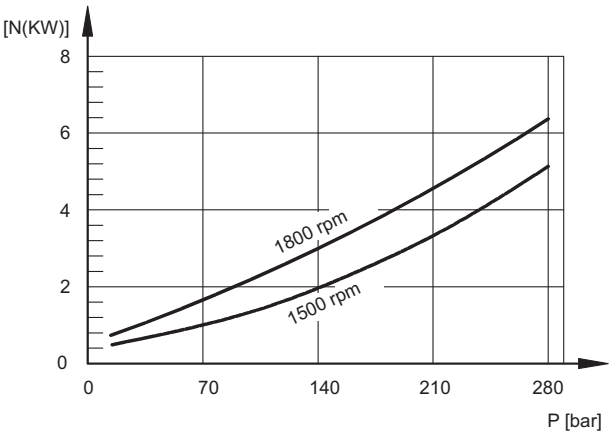
ABSORBED POWER



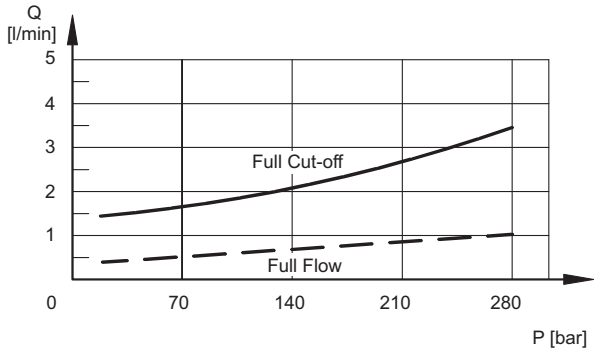
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

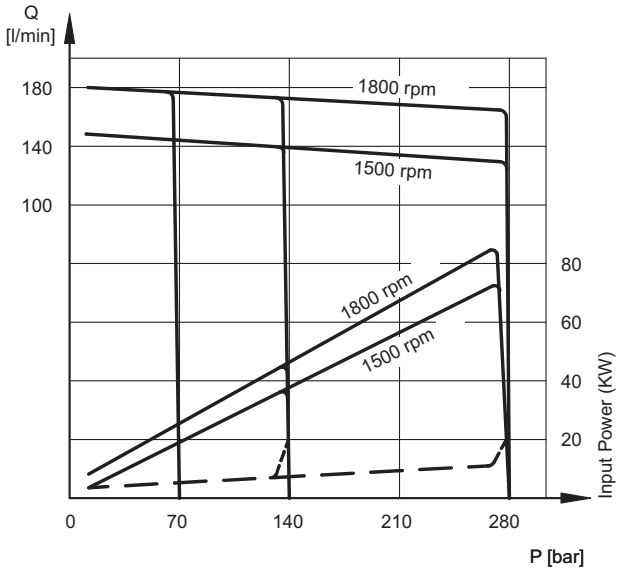


DRAIN FLOW RATE

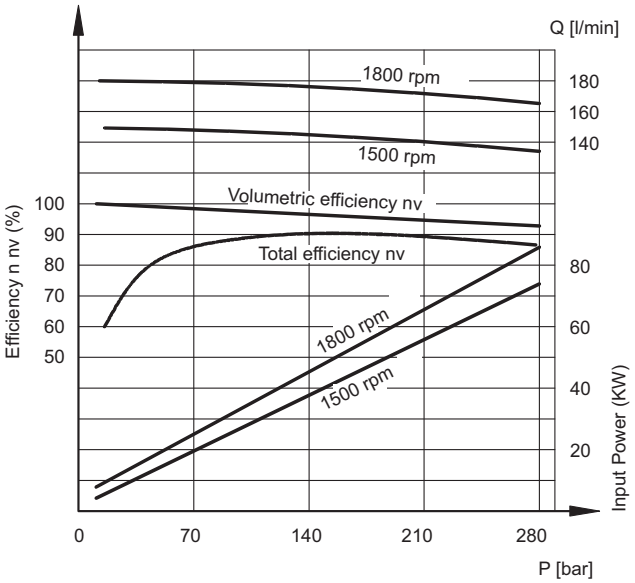


3.5 - VPPL-100 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

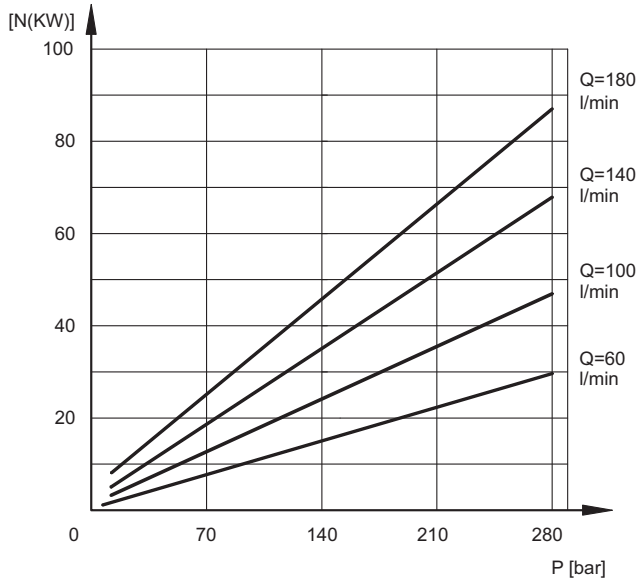
FLOW RATE / PRESSURE CURVES



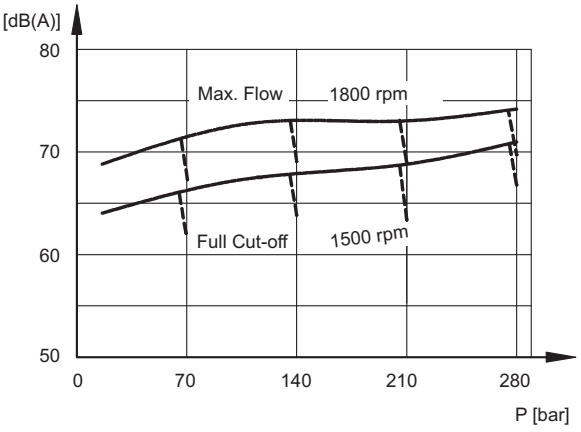
VOLUMETRIC AND TOTAL EFFICIENCY



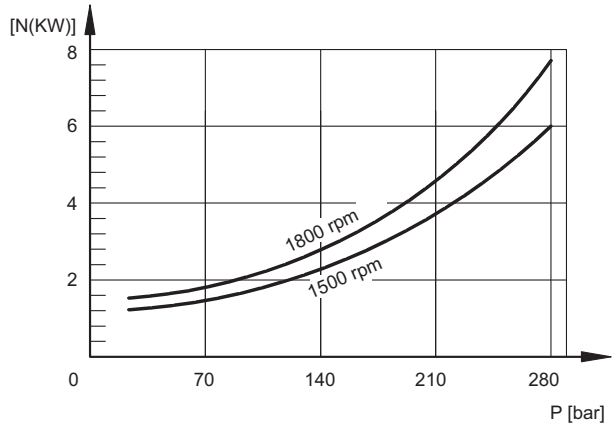
ABSORBED POWER



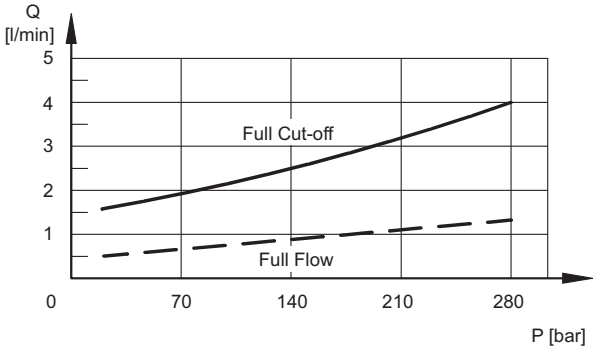
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

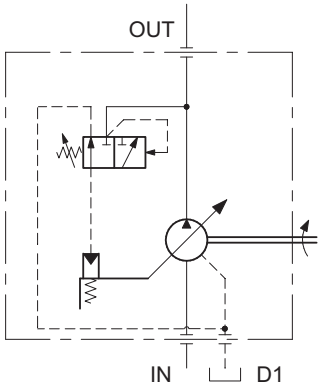


DRAIN FLOW RATE



4 - REGULATORS

4.1 - Pressure regulator: PC*



The PC* pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.
The desired pressure can be set by manually adjusting the P regulation valve. The clockwise rotation of the adjustment bolt makes the pressure increase.

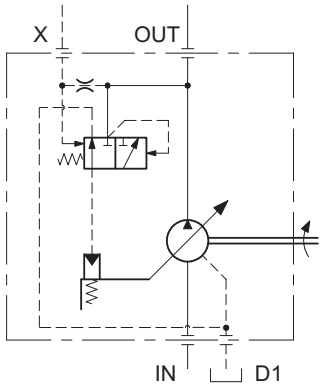
FEATURES OF THE PC REGULATOR:
- pressure adjustment range:
  PC5 = 30 ÷ 210 bar (for VPPL 008, 016, 022, 036 and 046)
  pressure increase/adjustment screw round: 69 bar
  PC6 = 30 ÷ 280 bar (for VPPL 070 and 100)
  pressure increase/adjustment screw round: 78 bar

4.2 - Remote-controlled pressure regulator: PCR

The PCR regulator allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps). If a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.
NOTE: The maximum length of the connection between the valve and X port of the pump must not be longer than 2 m.

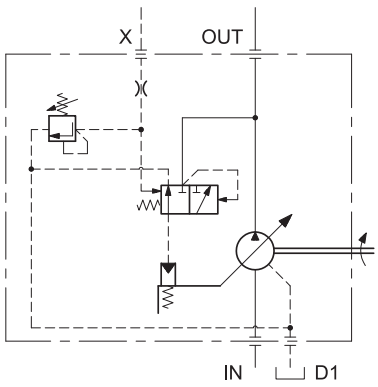
4.2.1 - Remote-controlled pressure regulator: PCR for VPPL 008, 016, 022, 036 e 046

FEATURES OF THE REGULATOR:
- remote-adjustment pressure = 20 ÷ 210 bar
- flow rate available on the X port
  for the remote-control = about 1,5 l/min (approx.)

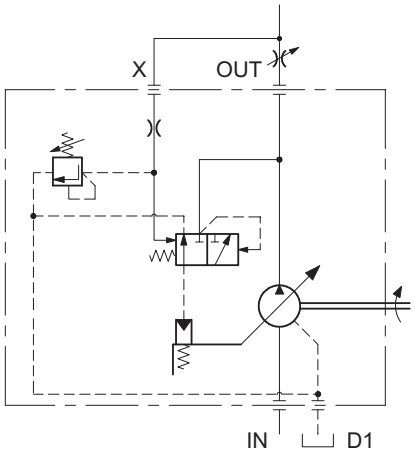


4.2.2 - Remote-controlled pressure regulator: PCR for VPPL 070 e 100

FEATURES OF THE REGULATOR:
It also limits the line maximum pressure.
- pressure regulating range 30 ÷ 280 bar
- pressure increase/adjustment screw round: 78 bar
- remote-regulated pressure range = 20 ÷ 280 bar
- flow rate available on the X port for the remote-control = about 1,5 l/min



4.3 - Pressure and flow rate regulator: PQC

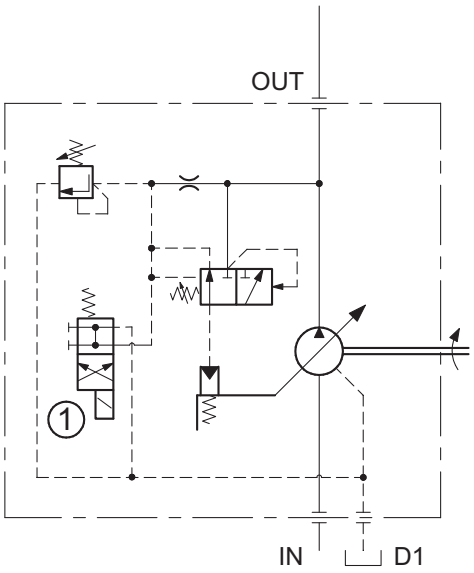


This regulator, in addition to the pressure adjustment (as for the PC* model), allows the pump flow rate control, according to the Δp pressure drop measured on either side of a throttle valve installed on the user line.
Note: The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

FEATURES OF THE PQC REGULATOR:
- pressure adjustment range:
  11 ÷ 190 bar (for VPPL 008, 016, 022, 036 and 046)
  13 ÷ 230 bar (for VPPL 070 and 100)
- pressure increase/adjustment screw round: 78 bar
- differential pressure adjustment range = 15 ÷ 28 bar
- minimum delivery pressure = 15 bar

4.4 - Regulator with pressure control devices: PCX*

4.4.1 - Electrical unloading



The PCX* regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

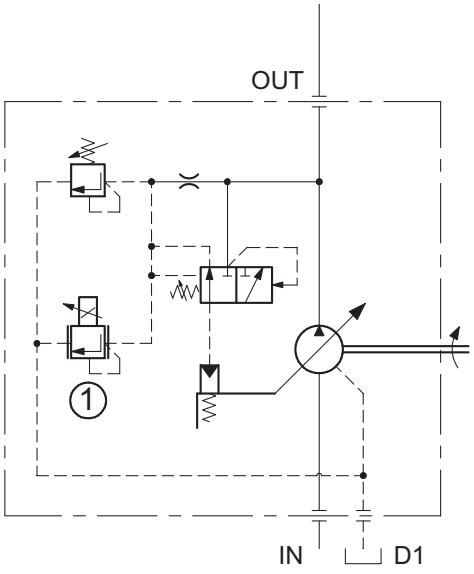
This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

PCX* FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 type
  (to be ordered separately - see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator.
- pressure regulating range:
  20 ÷ 210 bar for VPPL-008, 016, 022, 036 and 046
  20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default settings:
  210 bar for VPPL-008, 016, 022, 036 and 046
  280 bar for VPPL-070 and 100

4.4.2 - Pressure regulation with electric proportional control



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

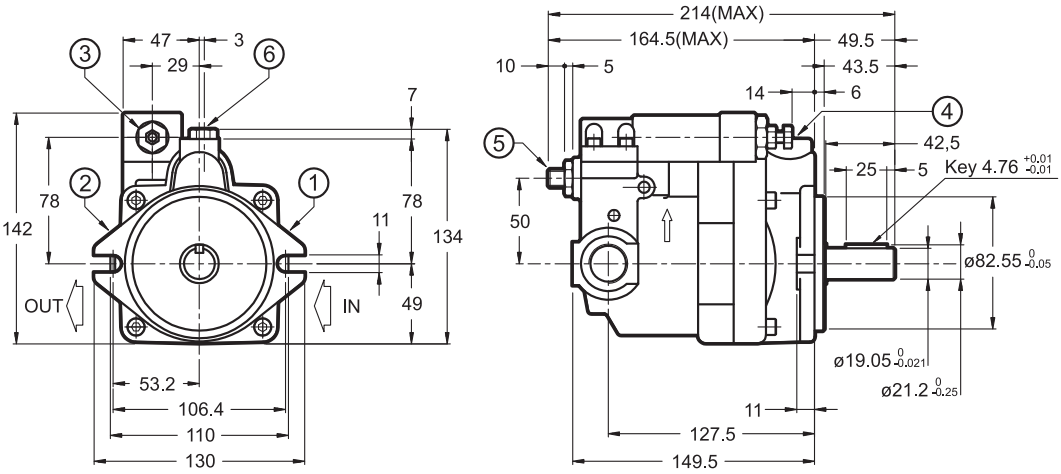
PCX* FEATURES (proportional pressure regulation):

- pressure regulating range:
  PCX5 = 20 ÷ 210 bar for VPPL-008, 016, 022, 036, 046.
  PCX6 = 20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default setting:
  PCX5 = 210 bar for VPPL-008, 016, 022, 036 and 046
  PCX6 = 280 bar for VPPL-070 and 100
- proportional pressure relief valve (1) = PRED3 type
  (to be ordered with the relative control card separately - see cat. 81 210)
- proportional pressure regulating range :
  PRED3-070 20 ÷ 85 bar
  PRED3-210 20 ÷ 225 bar

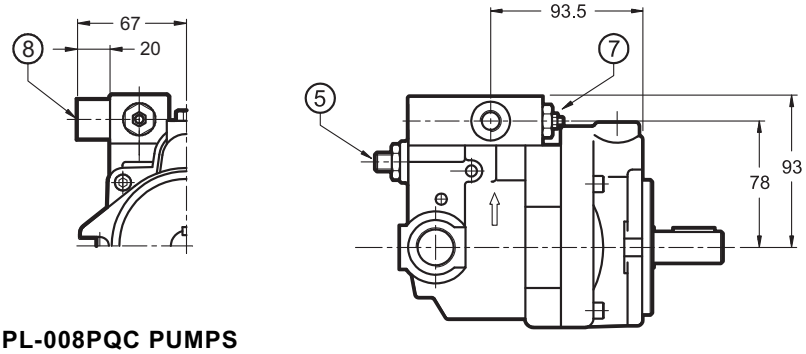
Hysteresis = < 5% of p nom
Repeatability = < ±1,5% of p nom

5 - VPPL-008 PUMPS OVERALL AND MOUNTING DIMENSIONS

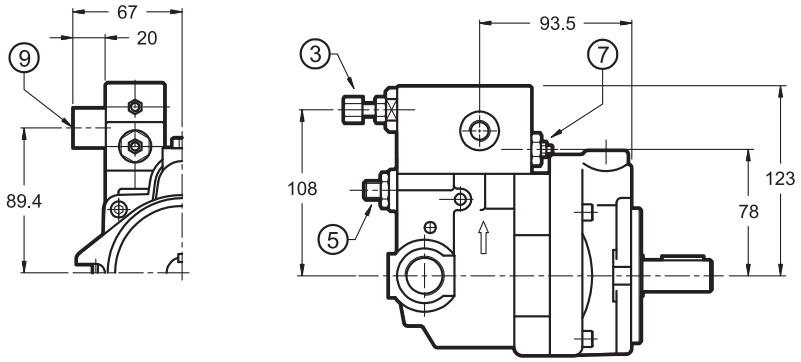
VPPL-008PC5 PUMPS



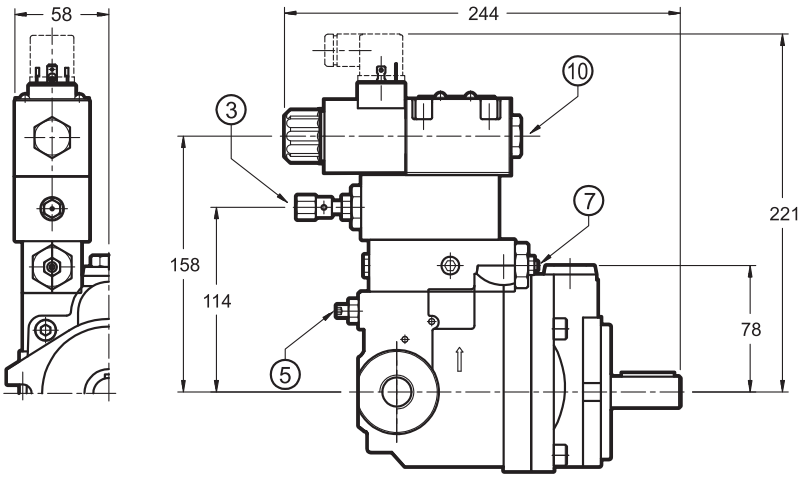
VPPL-008PCR PUMPS



VPPL-008PQC PUMPS



VPPL-008PCX5 PUMPS

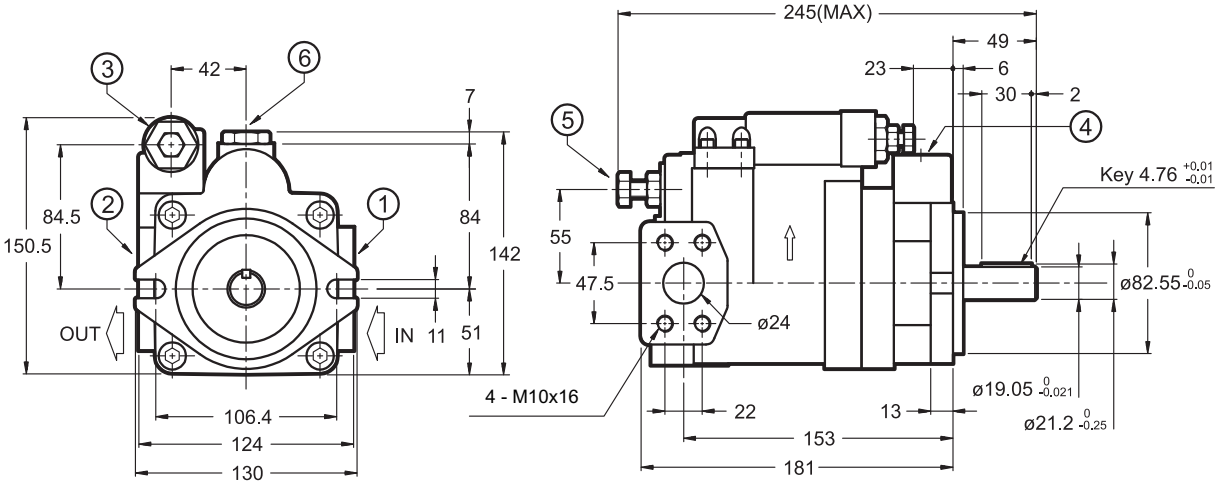


dimensions in mm

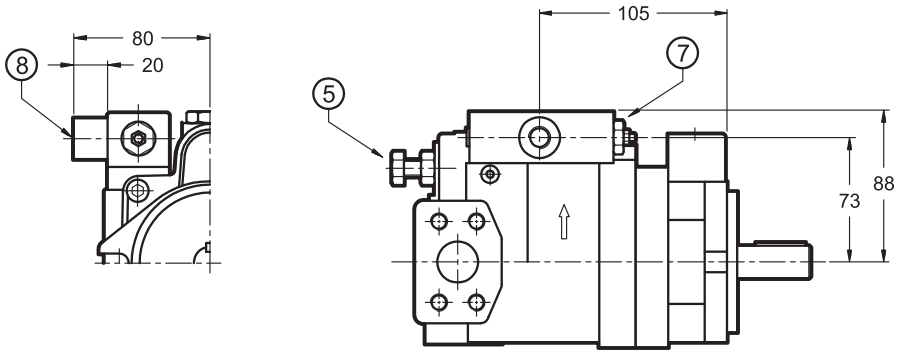
1	Suction port IN: 1/2” BSP
2	Delivery port OUT: 1/2” BSP
3	Pressure adjustment screw
4	Drain port: 3/8” BSP
5	Flow adjustment screw Δ displacement/round = 0,8 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP
10	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

6 - VPPL-016 and VPPL-022 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-016PC5 and VPPL-022PC5 PUMPS

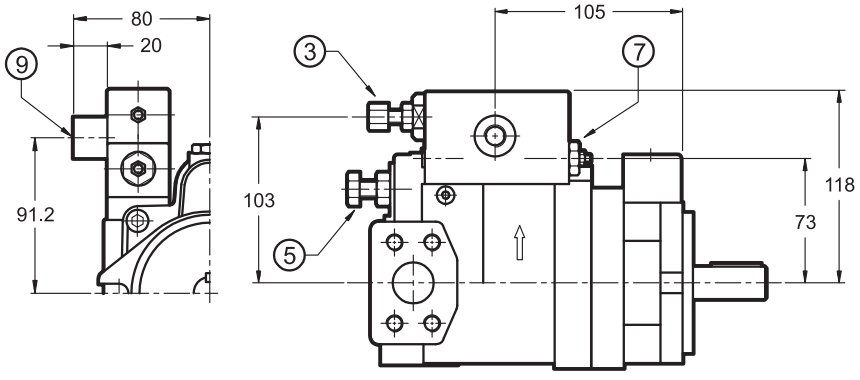


VPPL-016PCR and VPPL-022PCR PUMPS



dimensions in mm

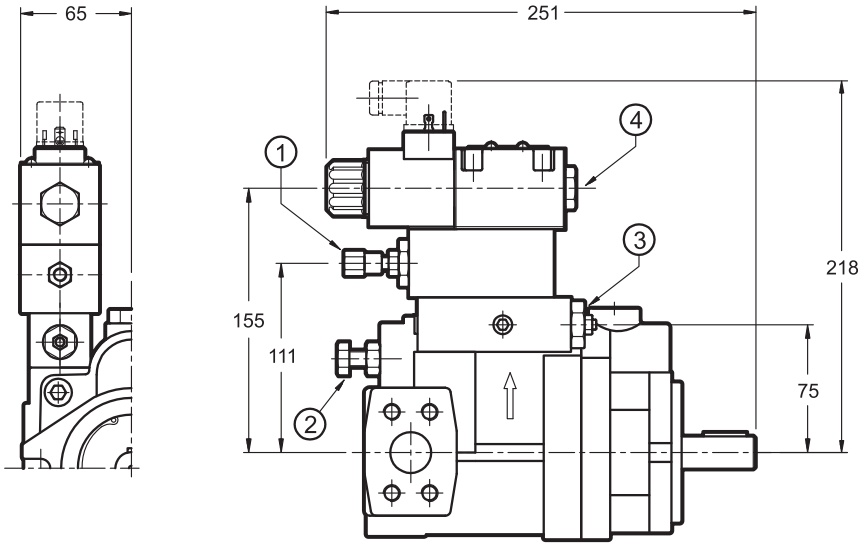
VPPL-016PQC and VPPL-022PQC PUMPS



1	Suction port IN: SAE 3000 1” flange (see par. 11)
2	Delivery port OUT: SAE 3000 3/4” flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 3/8” BSP
5	Flow adjustment screw Δ displacement/round: 1,5 cm³ (for VPPL-016) 2,0 cm³ (for VPPL-022)
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP

VPPL-016PCX5 and VPPL-022PCX5 PUMPS

dimensions in mm

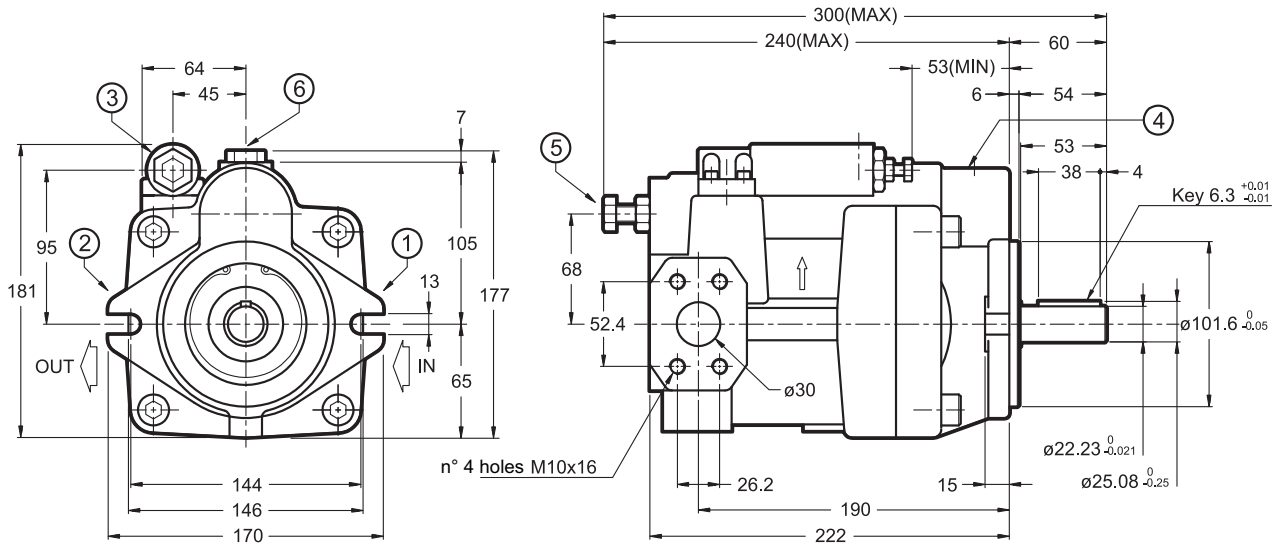


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round: 1,5 cm³ (for VPPL-016) 2,0 cm³ (for VPPL-022)
3	Differential pressure (not adjustable)
4	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

7 - VPPL-036 and VPPL-046 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-036PC5 and VPPL-046PC5 PUMPS

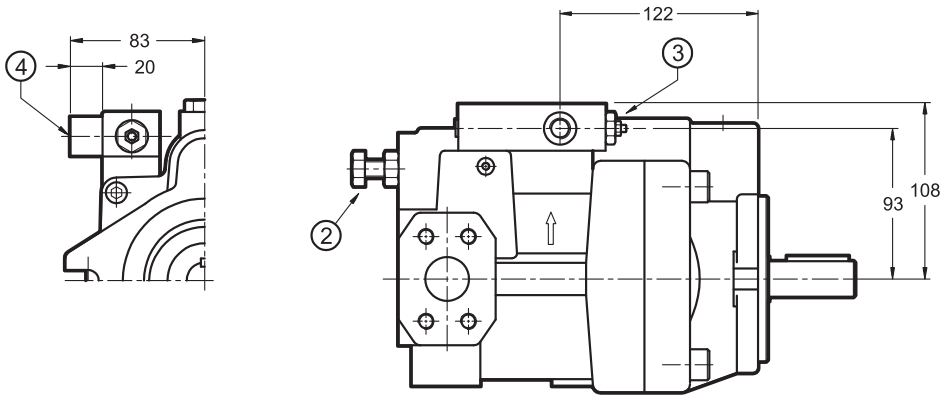
dimensions in mm



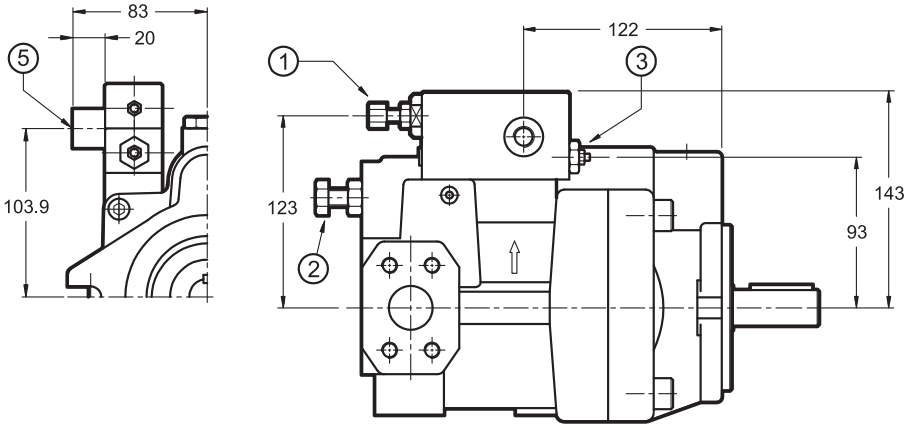
1	Suction port IN: SAE 3000 1 ¼" flange (see par. 11)
2	Delivery port OUT: SAE 3000 1" flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 1/2" BSP
5	Flow adjustment screw Δ displacement/round: 2,6 cm³ (for VPPL-036) 3,2 cm³ (for VPPL-046)
6	Oil supply port

VPPL-036PCR and VPPL-046PCR PUMPS

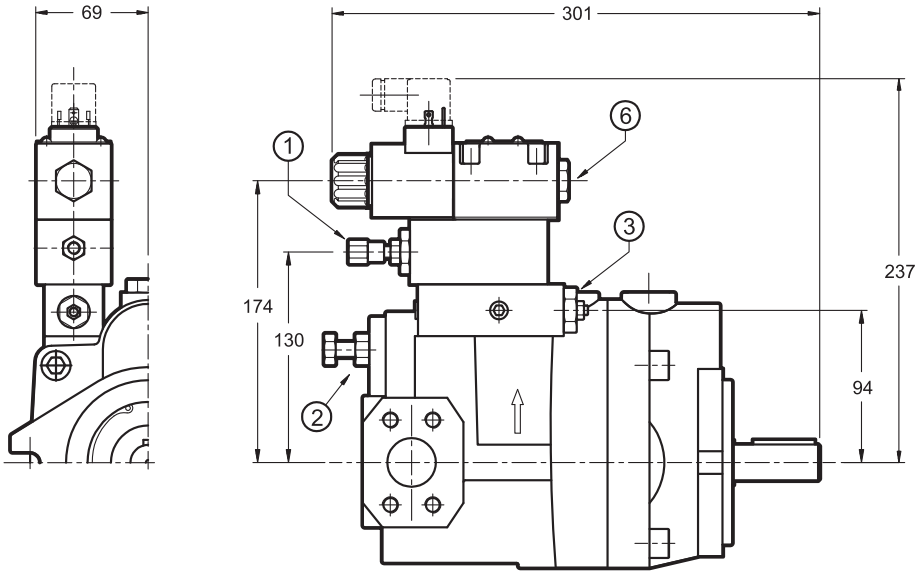
dimensions in mm



VPPL-036PQC and VPPL-046PQC PUMPS



VPPL-036PCX5 and VPPL-046PCX5 PUMPS

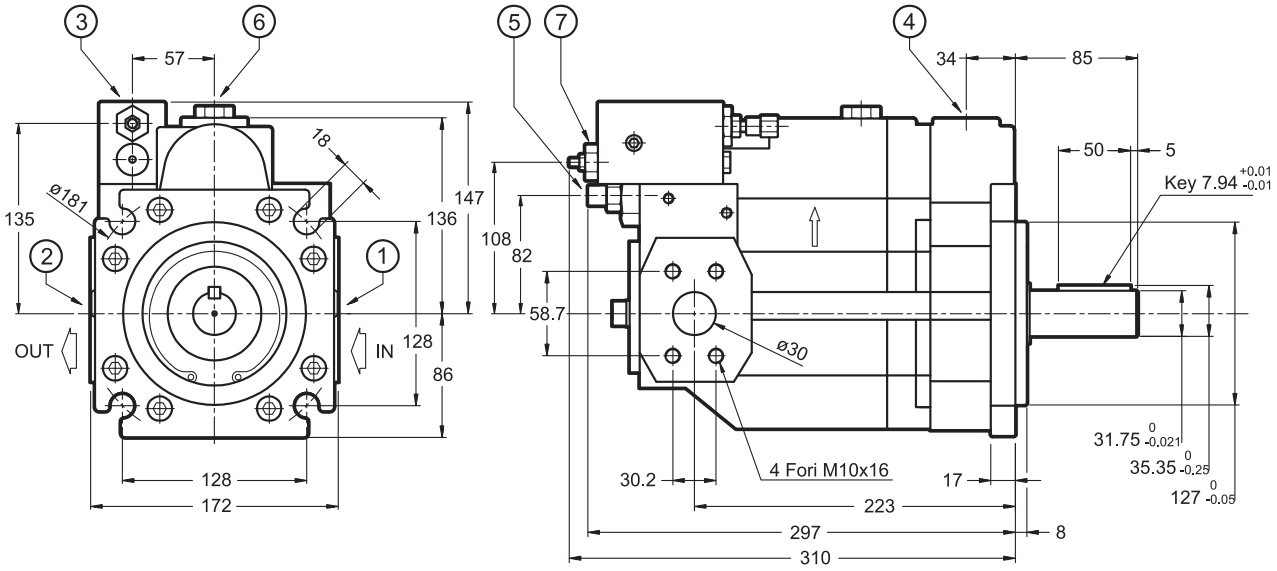


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round: 2,6 cm³ (per VPPL-036) 3,2 cm³ (per VPPL-046)
3	Differential pressure (not adjustable)
4	Remote pressure control port: 1/4" BSP
5	Load sensing port: 1/4" BSP
6	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

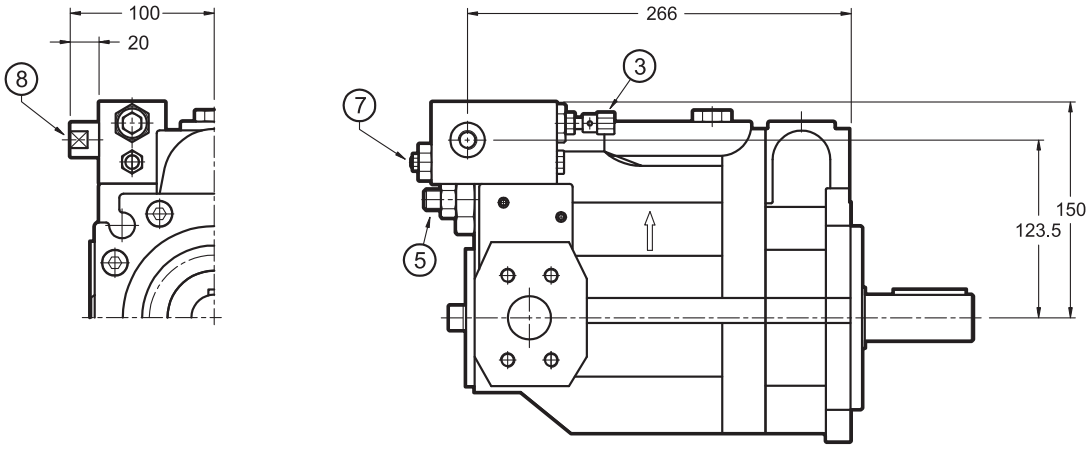
8 - OVERALL AND MOUNTING DIMENSIONS VPPL-070 PUMPS

VPPL-070PC6 PUMP

dimensions in mm



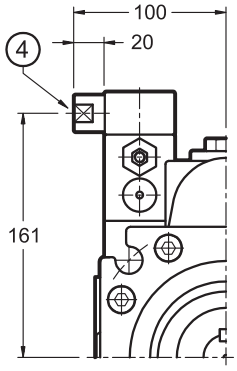
VPPL-070PCR PUMP

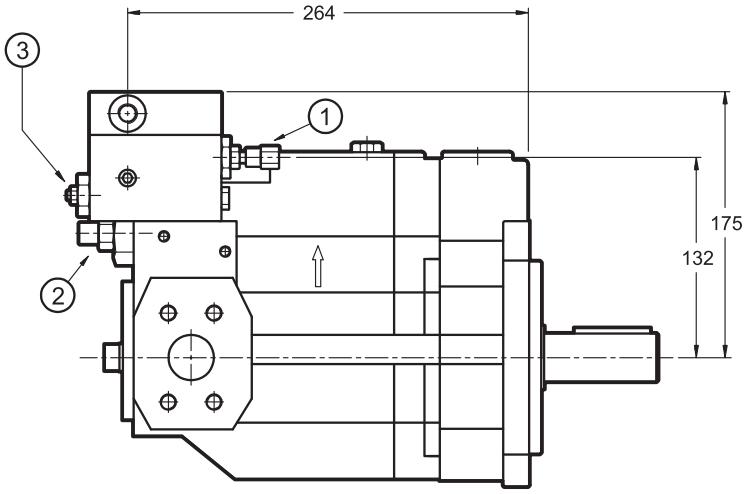


1	Suction port IN: SAE 3000 1 ½" flange (see paragraph 11)
2	Delivery port OUT: SAE 3000 1 ¼" flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4" BSP
5	Flow adjustment screw Δ displacement/round = 4,1 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

dimensions in mm

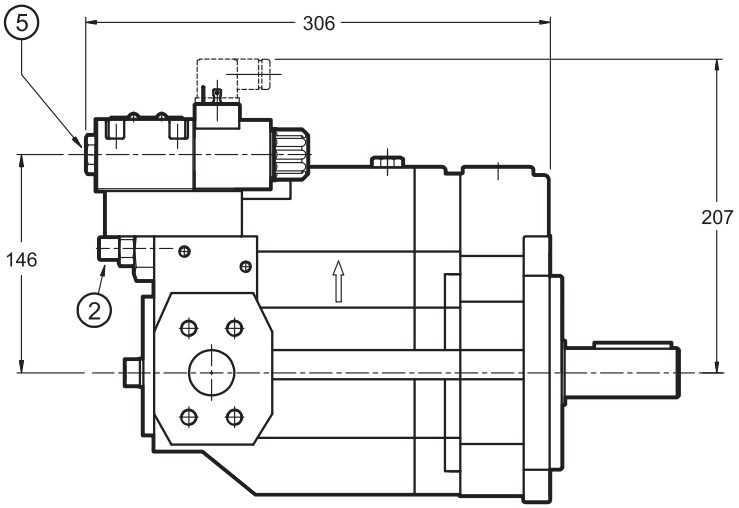
VPPL-070PQC PUMP



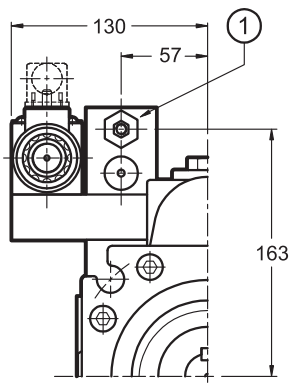


VPPL-070PCX6 PUMP

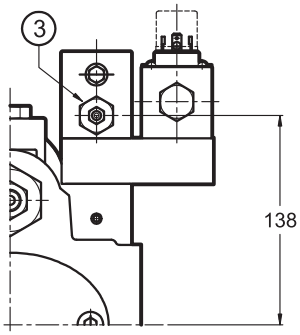
1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round = 4,1 cm³
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150



Shaft side view



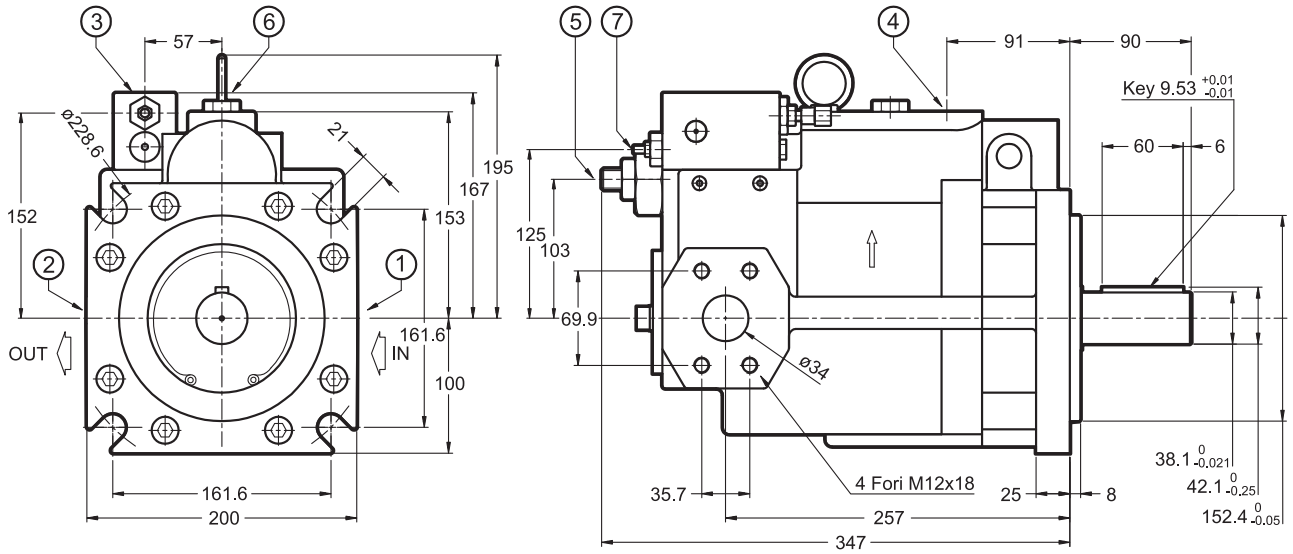
Regulator side view



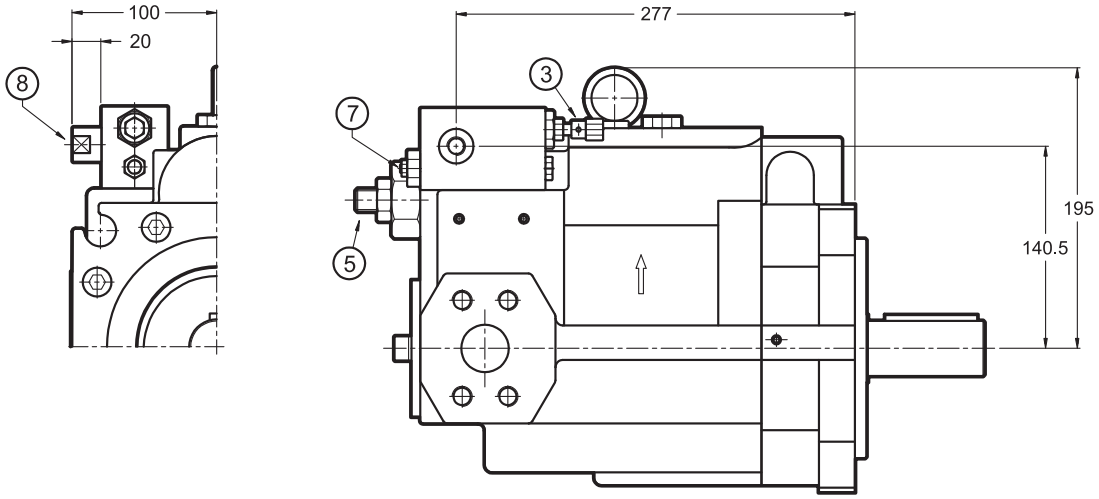
9 - OVERALL AND MOUNTING DIMENSIONS VPPL-100 PUMPS

VPPL-100PC6 PUMP

dimensions in mm



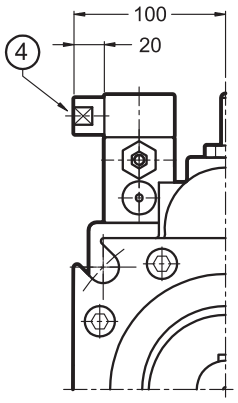
VPPL-100PCR PUMP

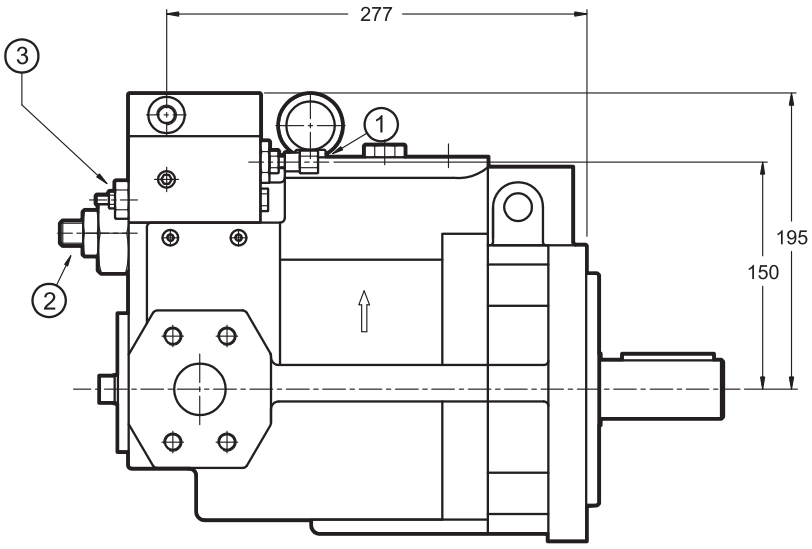


1	Suction port IN: SAE 3000 2” flange (see paragraph 11)
2	Delivery port OUT: SAE 6000 1 ¼” flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4” BSP
5	Flow adjustment screw Δ displacement/round = 5,1 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

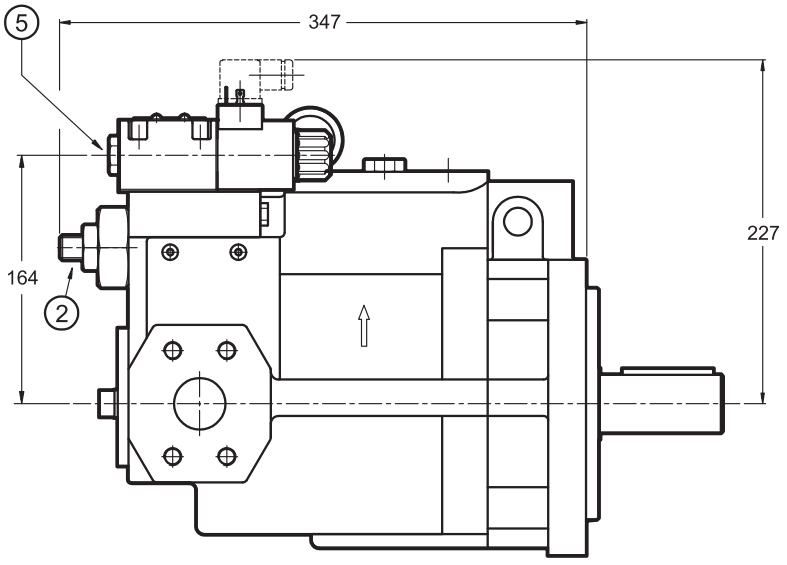
VPPL-100PQC PUMP

dimensions in mm



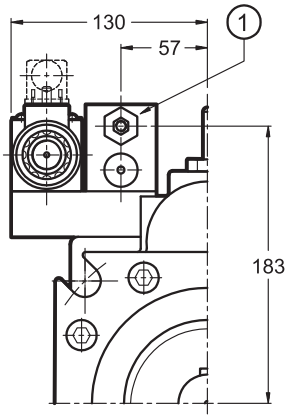


VPPL-100PCX6 PUMP

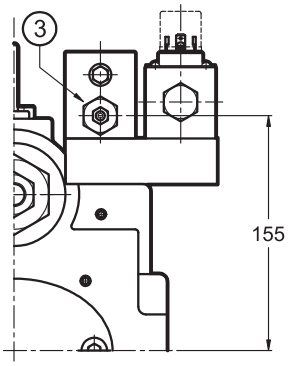


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round = 5,1 cm³
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150

Shaft side view



Regulator side view



10 - INSTALLATION

- The VPPL pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.

  Note: the drain port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume.

- In the case of installation above the oil level, check that the minimal inlet pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.

  In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested to adjust thee drain tube so that the pump higher bearing can be always lubricated.

- **Before starting, the pump body has to be filled with the fluid.**

- Check the pump direction of rotation.

- It is necessary to vent the air from the delivery connection before operating it the first time. If the air venting should be difficult, the use of a venting valve is recommended.

  The pump start up should occur with the plant at minimum pressure, especially with low temperatures.

- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.

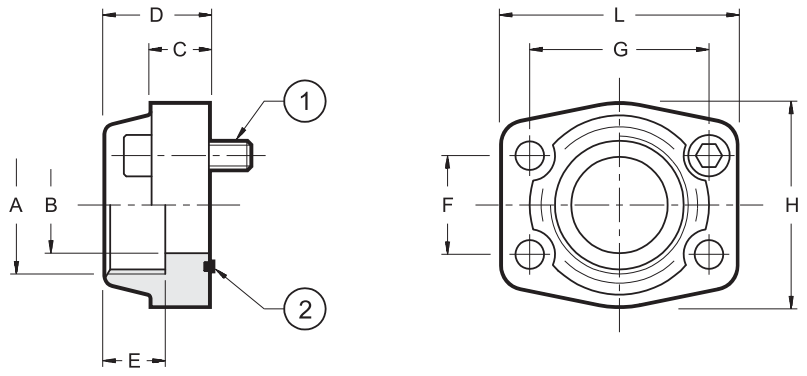
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.5 bars (relative), even during the dynamic change and flow rate phases. The minimum piping size is 3/8” for the pump type 008, 016 and 022, while it should be at least 1/2” for the pumps type 036 and 046, 3/4” for the 070 and 100 pumps type.

  The drain tube has to unload inside the tank far from the suction area.

- No check valves allowed on the suction line. As for details and the installation of filter elements, see paragraph 2.3.

- The motor-pump connection must be carried out directly with a flexible coupling, to reduce at the minimum the axial and radial loads on the pump shaft. The alignment tolerance between the two shafts must be within 0.05 mm.

11 - CONNECTION FLANGES



dimensions in mm
Bolts and O-rings must be ordered separately.

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 SHC bolts ISO 4762	2
SAE 3000	0610719	SAE - 3/4”	345	3/4” BSP	19	18	36	19	22,2	47,6	50	65	n° 4 - M10x35	OR 4100 (24.99x3.53)
	0610713	SAE - 1”	345	1” BSP	25	18	38	22	26,2	52,4	55	70		OR 4131 (32.93x3.53)
	0610720	SAE - 1 ¼”	276	1 ¼” BSP	32	21	41	22	30,2	58,7	28	79		OR 4150 (37.69x3.53)
	0610714	SAE - 1 ½”	207	1 ½” BSP	38	25	45	24	35,7	69,9	78	93	n° 4 - M12x45	OR 4187 (47.23x3.53)
	0610721	SAE - 2”	207	2” BSP	51	25	45	30	42,9	77,8	90	102	n° 4 - M12x45	OR 4225 (56.74x3.53)
SAE 6000	0770106	SAE - 1 ¼”	420	1 ¼” BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	OR 4150 (37.69x3.53)

DUPLOMATIC MOTION SOLUTIONS

DUPLOMATIC MS S.p.A.
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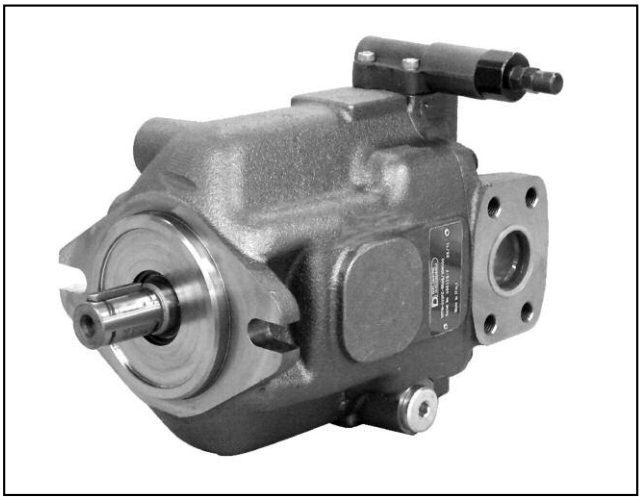
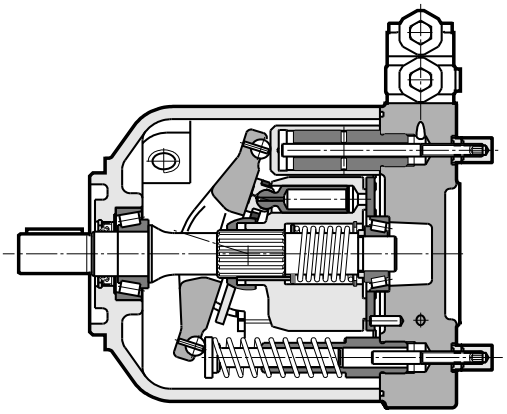
tel. +39 0331.895.111 ▪ www.duplomatic.com ▪ e-mail: sales.exp@duplomatic.com



VPPM
VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS

OPERATING PRINCIPLE



— The VPPM pumps are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits.

— They are available in three different frame sizes with maximum displacements up to 29, 46, 73 and 87cm^3/rev.

— The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.

— The pumps feature medium-high working pressures (up to 280 bar constant and 350 bar peak). Thanks to some particular design features, these pumps are able to bear high axial and radial loads on the shaft.

— They are usually supplied with a ISO 3019/2 mounting flange, with the exception of the rear and intermediate pumps, if multiple pumps, which are only available with a SAE J744 2-holes flange and a SAE J744 splined shaft (see paragraph 16).

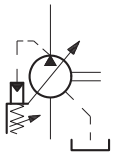
— They are available with seven different types of regulating control, each according to the application needs (see paragraphs 8 ÷ 14).

TECHNICAL SPECIFICATIONS

PUMP SIZE		**029**	**046**	**073**	**087**
Maximum displacement	cm^3/rev	29	46	73	087
Max. delivery pressure (relative): - continuous - intermittent (**NOTE 1**) - peak	bar		280 315 350		250 280 315
Maximum rotation speed at maximum displacement (**NOTE 2**)	rpm	3000	2600	2200	1850
Rotation direction		clockwise or anticlockwise (looking at the drive shaft)			
Hydraulic connection		SAE flange fittings (see paragraph 24)			
Type of mounting (single pump)		ISO 3019/2 flange			
Mass (empty single pump)	kg	18	24	33	33

Ambient temperature range	°C	-15 / +70
Fluid temperature range	°C	-25 / +80
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	15 ÷ 35

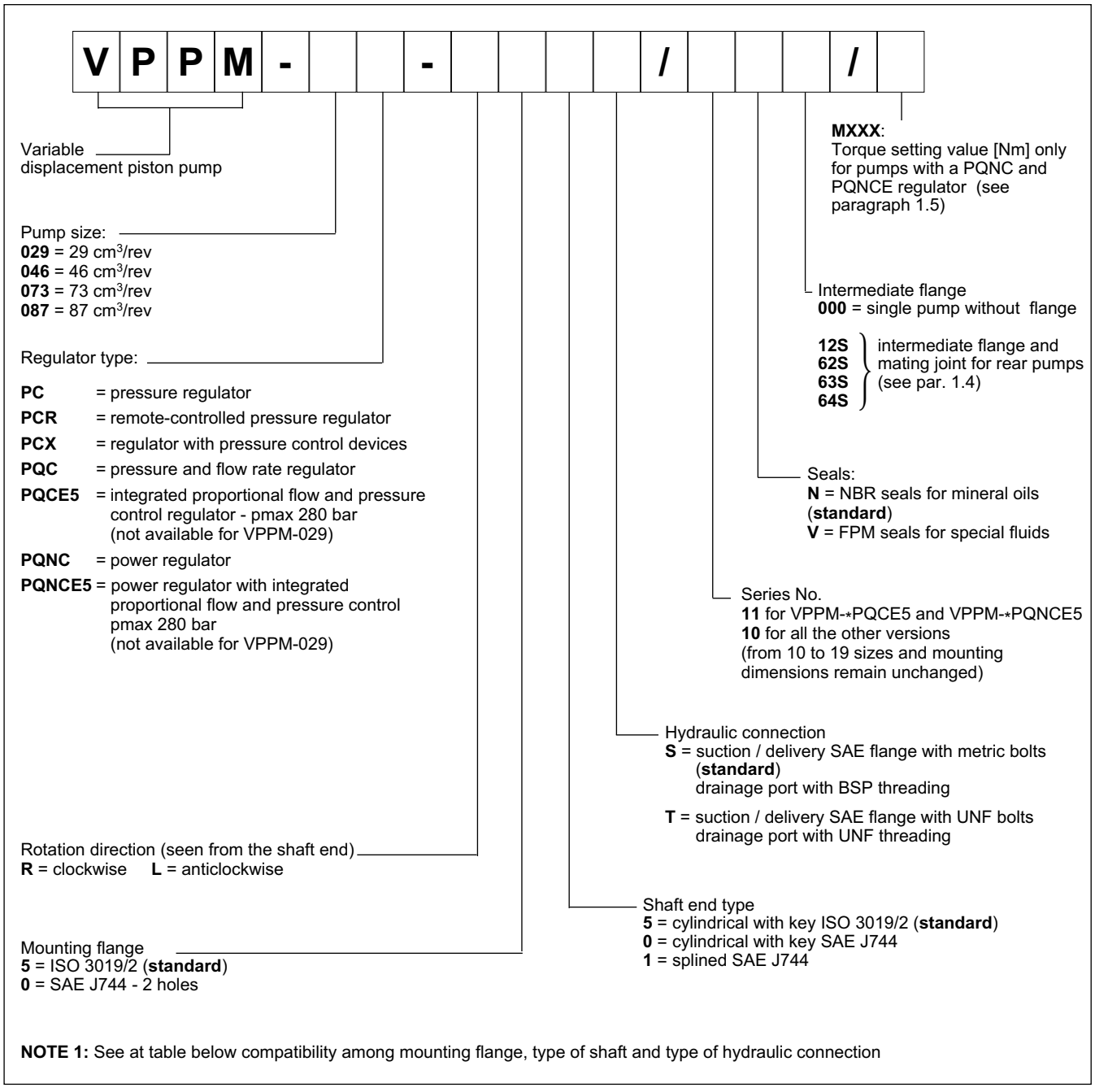
HYDRAULIC SYMBOL



NOTE 1: Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.
NOTE 2: Values referring to a zero bar pressure (relative) on the suction port.

1 - IDENTIFICATION CODES

1.1 - Identification code for single and front pumps with a through output shaft



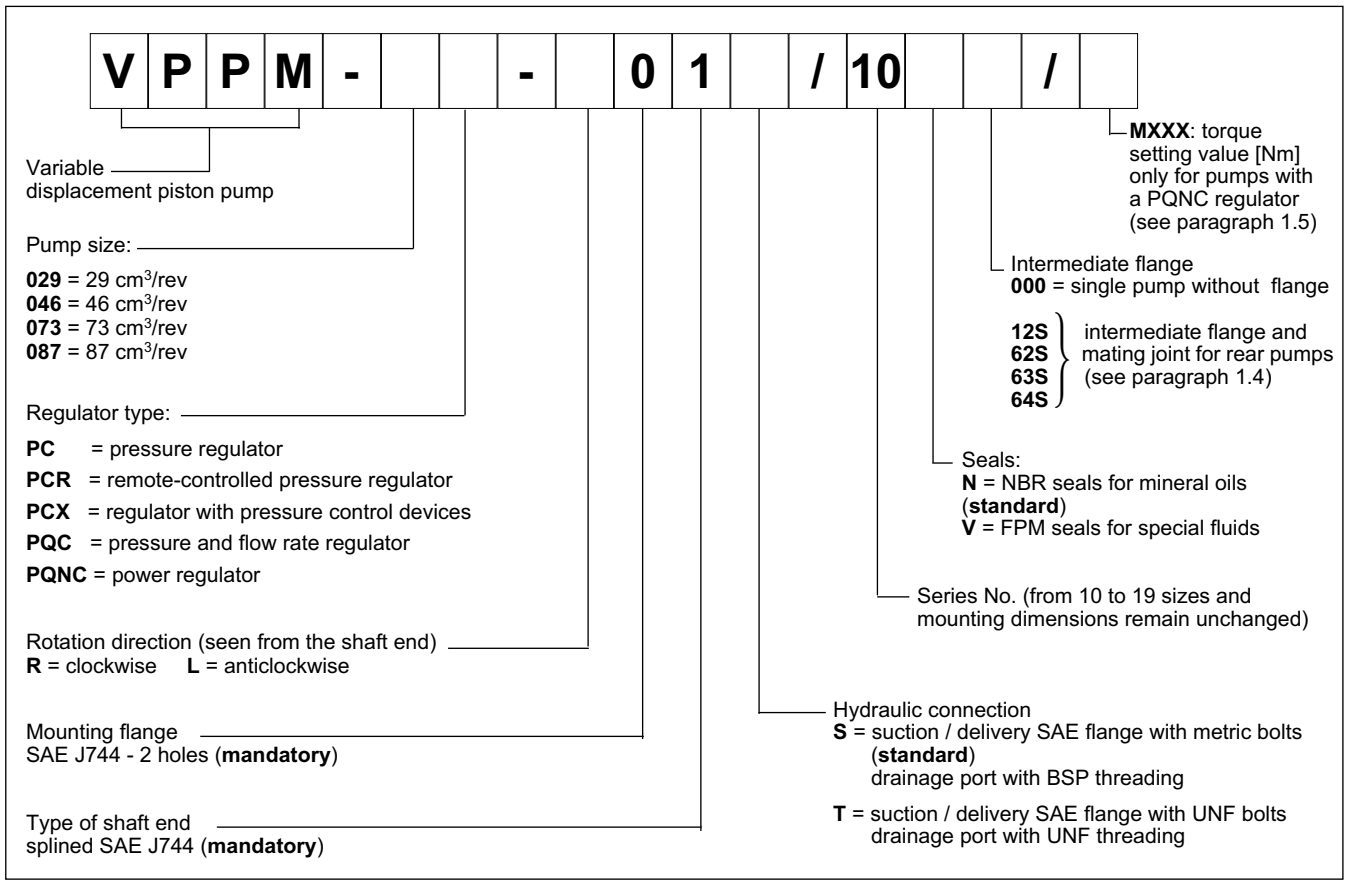
NOTE 1: See at table below compatibility among mounting flange, type of shaft and type of hydraulic connection

Compatibility among mounting flange, type of shaft and type of hydraulic connection

FLANGE CODE	SHAFT CODE			HYDRAULIC CONNECTION CODE	
	5	0	1	S	T
5	yes	no	no	yes	no
0	no	yes	yes	yes	yes

VPPM pumps are supplied as standard with mechanical minimum and maximum displacements limit controls.
These devices are not available for front and intermediate pumps with a through output shaft.

1.2 - Identification code for intermediate pumps with a through output shaft and rear pumps



1.3 - Identification code for double pumps

identification code + identification code
1st pump 2nd pump

1.4 - Identification code for intermediate flange and mating joint for pumps with a through output shaft

According to the pump to be coupled, it is necessary to define, into the identification code, the flange and mating joint type to be applied to the pump with a through output shaft.
The following table states the flange and joint reference code according to the different pump types to be pulled, stating also the possible coupling combinations.

Identification code for intermediate flange + mating joint	intermediate flange	mating joint	pump to be mated	possible combinations for VPPM pump with a through output shaft			
				29	46	73	87
12S	SAE J744 2 holes - type “A”	SAE J744 splined 16/32 D.P. - 9T	GP 2 external gear	yes	yes	yes	yes
62S	SAE J744 2 holes - type “B”	SAE J744 splined 16/32 D.P. - 13T	GP 3 external gear VPPM-029	yes	yes	yes	yes
63S	SAE J744 2 holes - type “B”	SAE J744 splined 16/32 D.P. - 15T	VPPM-046	no	yes	yes	yes
64S	SAE J744 2 holes - type “C”	SAE J744 splined 12/24 D.P. - 14T	VPPM-073	no	no	yes	yes
64S	SAE J744 2 holes - type “C”	SAE J744 splined 12/24 D.P. - 14T	VPPM-087	no	no	no	yes

NOTE: For the flange type and dimensions see paragraph 20.

1.5 - Standardized torque values for PQNC and PQNCE regulators

ELECTRICAL MOTOR 4 POLES		VPPM-029		VPPM-046		VPPM-073		VPPM-087	
Power [kW]	N [rpm]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]
4	1425	**26 (#)**	46	**-**	-	**-**	-	**-**	-
5,5	1440	**36 (#)**	62	**36 (#)**	41	**-**	-	**-**	-
7,5	1450	**50**	84	**50 (#)**	56	**-**	-	**-**	-
9,2	1460	**60**	103	**60 (#)**	68	**60 (#)**	44	**-**	-
11	1455	**72**	124	**72**	82	**72 (#)**	53	**-**	-
15	1460	**98**	168	**98**	111	**98 (#)**	72	**-**	-
18,5	1460	**-**	-	**122**	137	**122**	89	**-**	-
22	1465	**-**	-	**144**	163	**144**	105	**-**	-
30	1470	**-**	-	**-**	-	**196**	143	**196**	126
37	1470	**-**	-	**-**	-	**240**	175	**240**	156
45	1470	**-**	**-**	**-**	**-**	**-**	**-**	**293**	190
55	1475	**-**	**-**	**-**	**-**	**-**	**-**	**356**	231

(#) With this adjustment value the pump is in venting position with a pressure lower than 280 bar.

1.6 - Identification examples

a) 29 cm^3/rev single pump with pressure regulator - ISO mounting flange and shaft (standard)
VPPM-029PC-R55S/10N000

b) 46 cm^3/rev single pump with pressure regulator with remote control - SAE mounting flange and SAE splined shaft
VPPM-046PCR-R01S/10N000

c) 73 cm^3/rev single pump with pressure control devices - ISO mounting flange and shaft (standard)
VPPM-073PCX-R55S/10N000

d) 46 cm^3/rev single pump with integrated proportional flow and pressure control regulator - pressure regulation up to 280 bar
VPPM-046PQCE5-R55S/11N000

e) 46 cm^3/rev single pump with power regulator set at 18,5 kW at 1460 rpm (torque = 122 Nm)
VPPM-046PQNC-R55S/10N000/M122

f) 73 cm^3/rev single pump with power regulator with integrated proportional flow and pressure control - power regulator set at 98 Nm - pressure regulation up to 280 bar
VPPM-073PQNCE5-R55S/11N000/M098

g) 73 cm^3/rev front pump with pressure regulator, ready to mate to a VPPM-029 pump
VPPM-073PC-R55S/10N62S

h) double pump made of:
- 46 cm^3/rev front pump with pressure and flow rate regulator
- 29 cm^3/rear pump with pressure regulator
VPPM-046PQC-R55S/10N62S + VPPM-029PC-R01S/N000

i) triple pump made of:
- 73 cm^3/rev front pump with flow rate and pressure regulator
- 46 cm^3/rev intermediate pump with pressure regulator
- 14 cm^3/rev rear gear pump group 2
VPPM-073PQC-R55S/10N63S + VPPM-046PC-R01S/10N12S + GP2-0140R01F/20N

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives according to the DIN 51524 norm.
For use with other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows: max continuous pressure: 170 bar max peak pressure: 200 bar max rotation speed: VPPM-029 = 2100 rpm VPPM-046 = 2000 rpm VPPM-073 and VPPM-087 = 1700 rpm - The suction pressure must be lower than 0,8 absolute bars (-0,2 relative bars) - The fluid maximum temperature must be between 0°C and 50°C. - Use NBR seals only.
HFD (phosphate esters)	Such fluids do not require any particular performance limitation. It is suggested to operate with continuous duty pressures not higher than 200 bar and pressure peaks not higher than 240 bar. - The operating temperature must be between -10°C and 90°C. - Use VITON seals

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	15÷ 35 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with $\beta_{10\,(c)} \geq 75$ is suggested.

A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with $\beta_{10\,(c)} \geq 100$ is recommended.

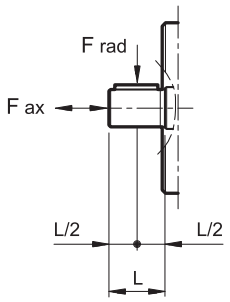
In the event that the filter is installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in the table of paragraph 3.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

3 - PERFORMANCES (measured with mineral oil with viscosity of 36 cSt at 50°C)

PUMP SIZE		029	046	073	087
Maximum displacement	cm^3/rev	29	46	73	87
Maximum flow rate: - at 1500 rpm - at max rotation speed	l/min	43,5 87	69 119,6	109,5 160,5	131,9 162,6
Input pressure (absolute): - min - max	bar (abs)	0,8 25			
Max. delivery pressure (absolute): - continuous - intermittent (**NOTE 1**) - peak		280 315 350			250 280 315
Max pressure on drainage port	bar (abs)	2			
Maximum power (Δp = 280 bar): - at 1500 rpm - at max rotation speed	kW	20,3 40,6	32,2 55,8	51,1 74,9	54,9 67,8
Max velocity at maximum displacement	rpm	3000	2600	2200	1850
Moment of inertia on the shaft	kgm^2	0,0020	0,0030	0,0080	0,0080
Max absorbed torque: - Δp = 100 bar - Δp = 280 bar	Nm	46,2 129,3	73,2 205	116,2 325,3	139,9 349,8
Max operating pressure with NBR seals - minimum - continuous - peak	°C	-25 80 100			
Max operating pressure with Viton seals - minimum - continuous - peak	°C	-10 110 125			
Oil volume in the pump body	lt	0,7	0,9	1,5	1,5

NOTE 1: Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.

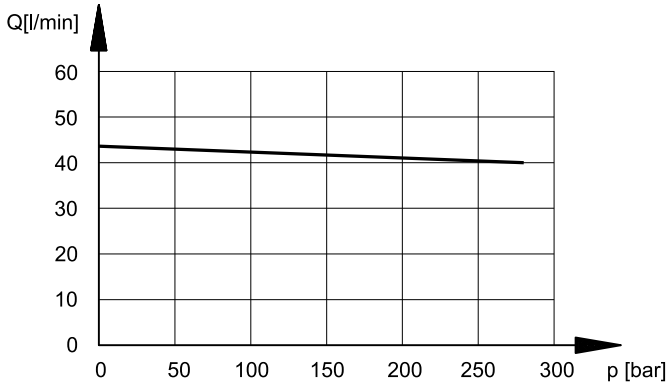


Loads on the shaft: - axial load (F_{ax}) - radial load (F_{rad})	N	1000 1500	1500 1500	2000 3000	2000 3000

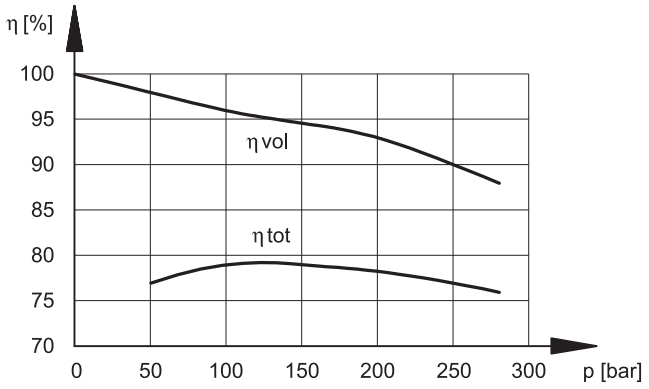
4 - VPPM-029 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

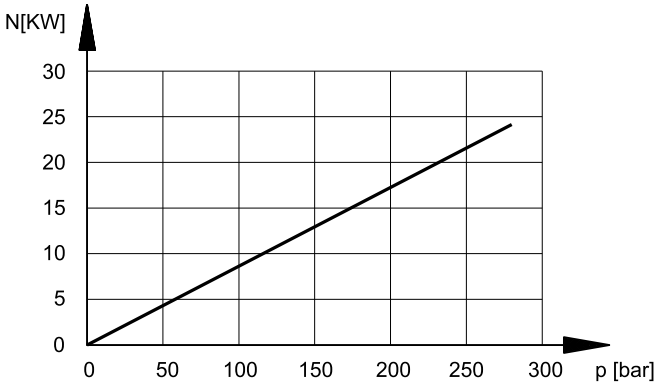
FLOW RATE/PRESSURE CURVES



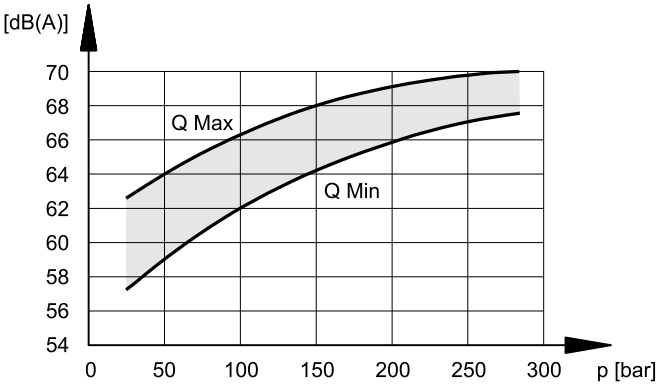
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

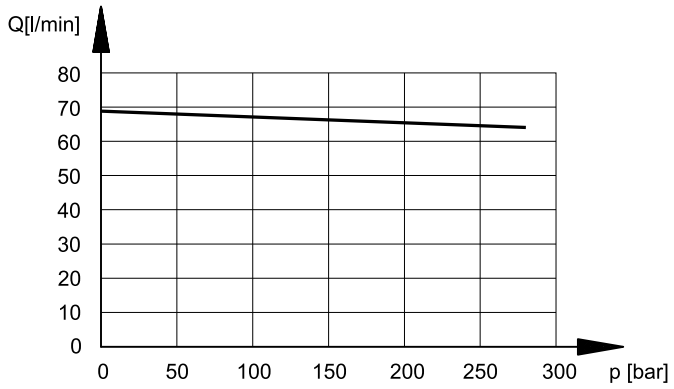


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

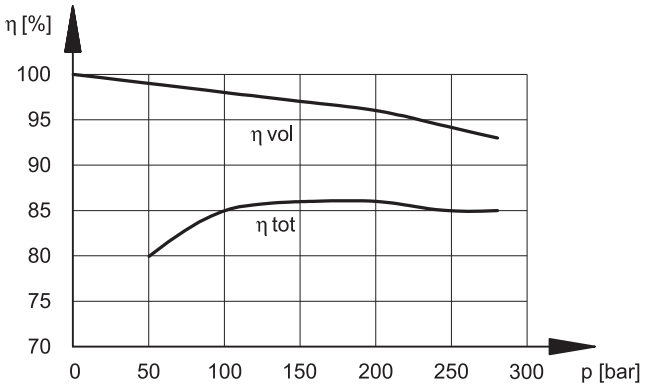
5 - VPPM-046 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

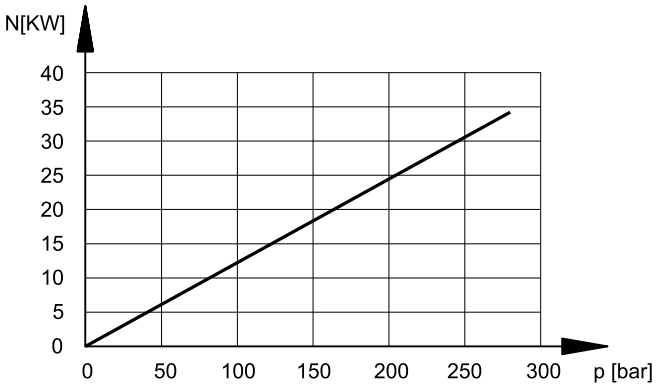
FLOW RATE/PRESSURE CURVES



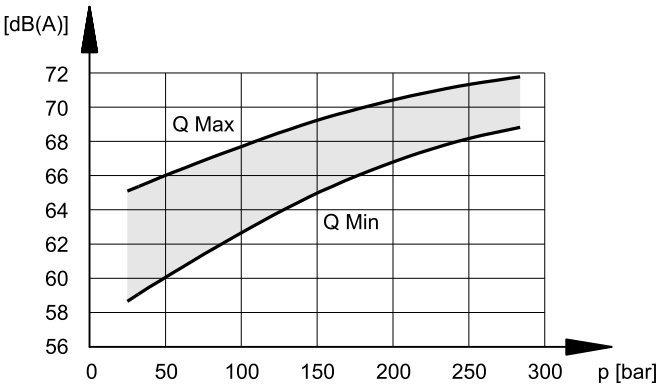
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

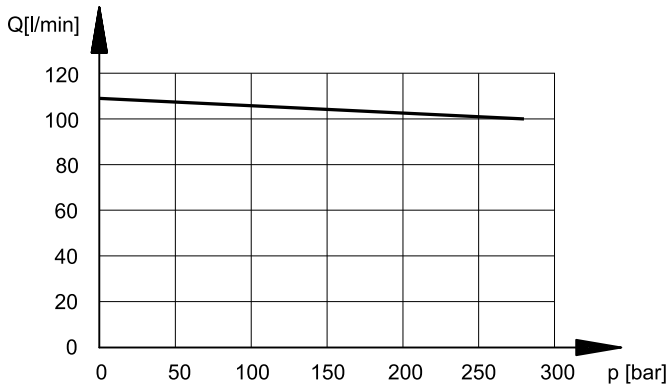


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

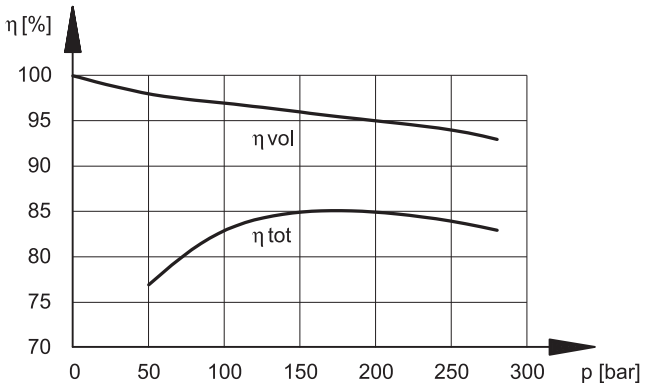
6 - VPPM-073 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

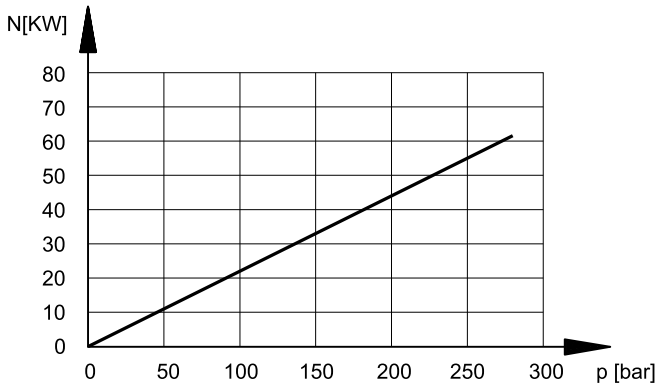
FLOW RATE/PRESSURE CURVES



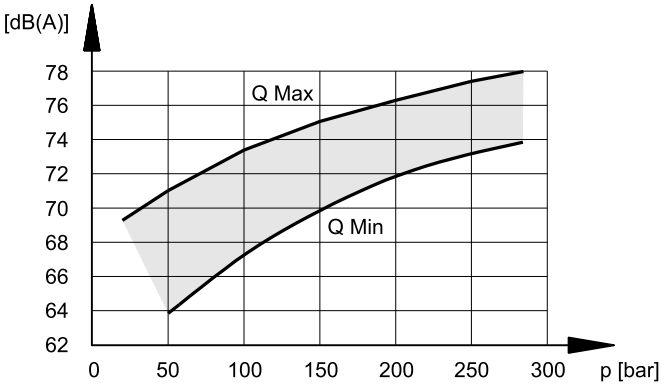
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

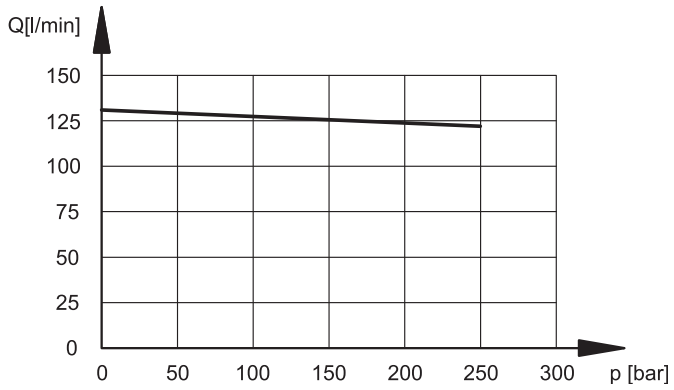


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

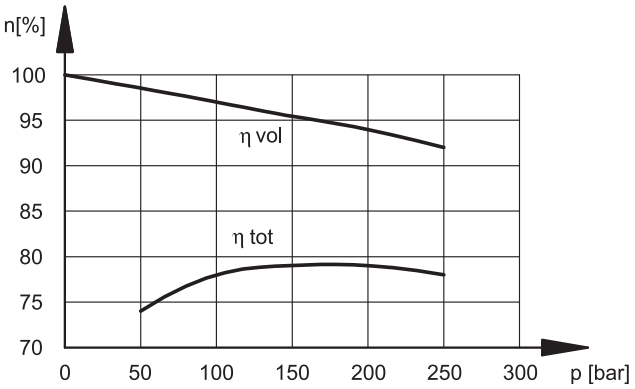
7 - VPPM-087 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

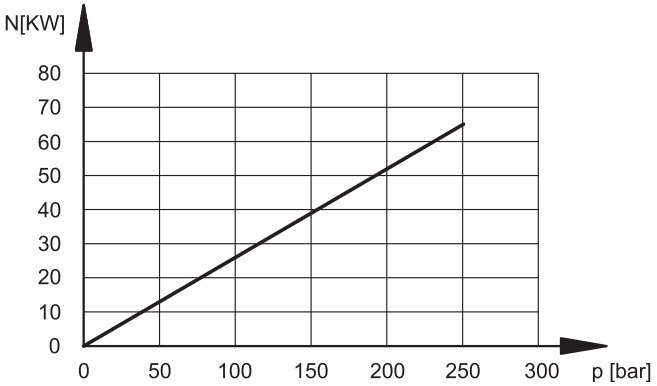
FLOW RATE/PRESSURE CURVES



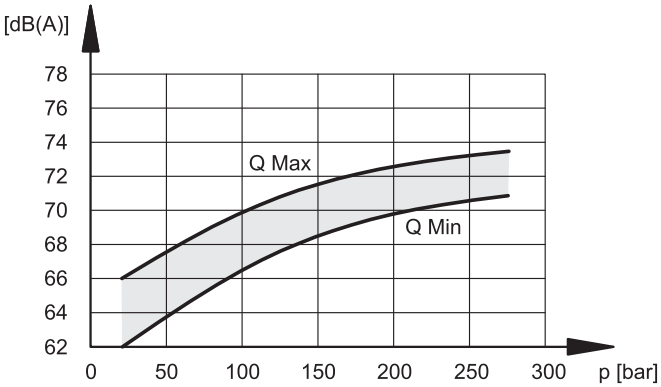
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



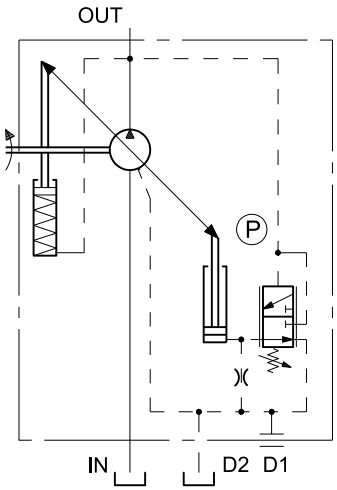
NOISE LEVEL



The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

8 - PRESSURE REGULATOR: PC

FUNCTIONAL DIAGRAM



The PC pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.
The desired pressure can be set by manually adjusting the (P) regulation valve.

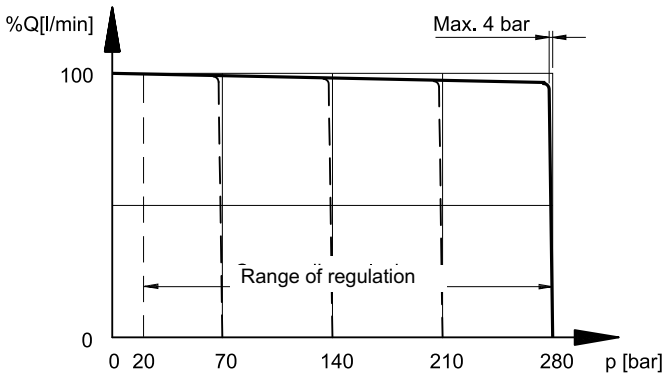
FEATURES OF THE PC REGULATOR:

- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars

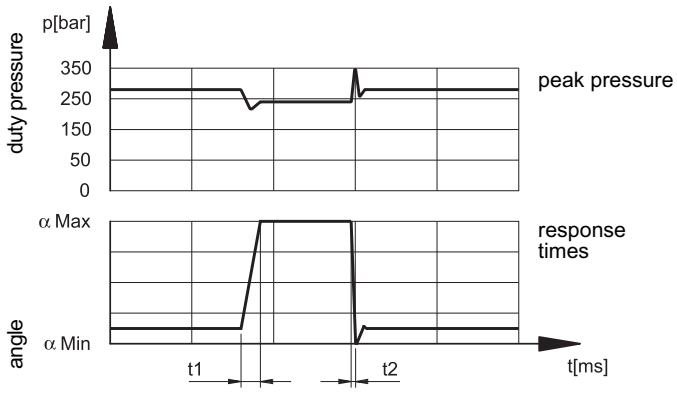
8.1 - Characteristic curves of the PC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

FLOW RATE/PRESSURE FEATURE



RESPONSE TIMES AND PEAK PRESSURE



t1 = response time for a change from a min. to a max. displacement.
t2 = response time for a change from a max. to a min. displacement.

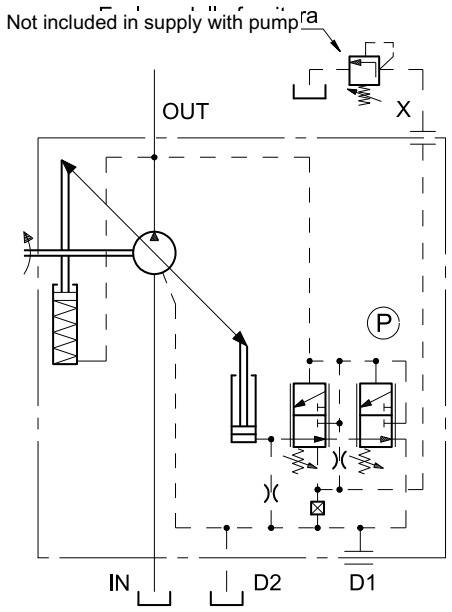
PC pressure regulator set at 280 bars

pump size	t1 [ms]	t2 [ms]
029	30	20
046	45	25
073	50	30
087	53	28

The values stated in the table are obtained from the opening until the instant the delivery level is achieved, by using a maximum pressure valve set at 350 bars for a load simulation, placed at a distance of 1 m from the pump delivery port.

9 - REMOTE-CONTROLLED PRESSURE REGULATOR: PCR

FUNCTIONAL DIAGRAM



The PCR regulator, apart from limiting the line maximum pressure (P valve), allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps). In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.

N.B. The maximum length of the connection between the valve and the pump X port must not be longer than 2 m.

PCR FEATURES:

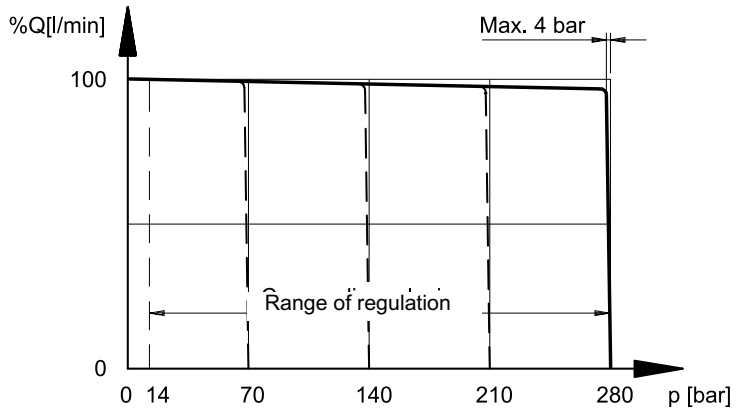
- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars

- remote-regulated pressure range = 14 ÷ 315 bars
- flow rate available on the X port for the remote-control = about 1,5 l/min

9.1- Characteristic curves of the PCR regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

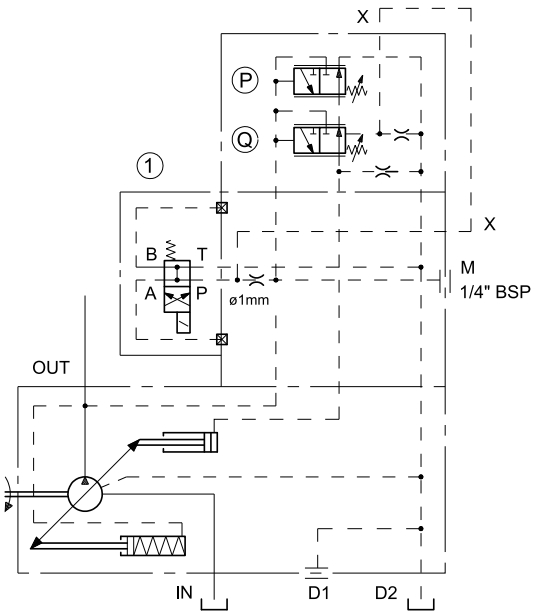
FLOW RATE / PRESSURE FEATURE



10 - REGULATOR WITH PRESSURE CONTROL DEVICES: PCX

10.1 - Electrical unloading

FUNCTIONAL DIAGRAM



The PCX regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

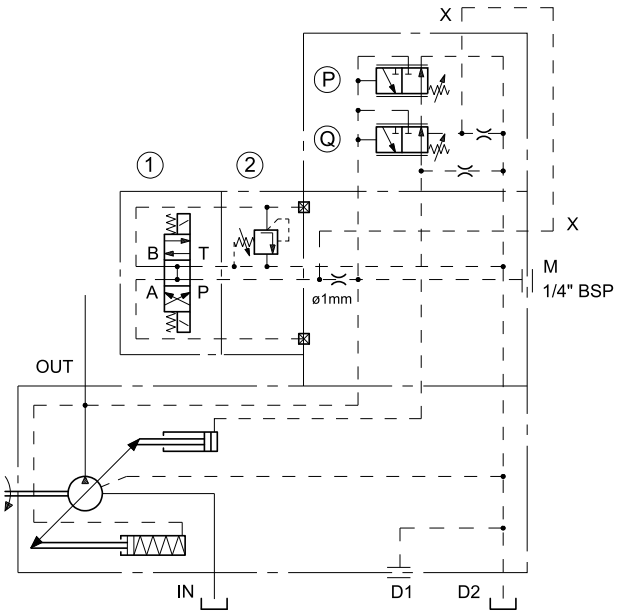
The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

PCX FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 (to be ordered separately see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator (P).
- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

10.2 - Two pressure settings + unloading

FUNCTIONAL DIAGRAM



This type of regulator allows to select, by means of a three-position solenoid valve, two different working pressures; it allows also the pump unloading.

The solenoid valve (1) and the relief valve (2) for the intermediate pressure setting are directly installed on the pump regulator and they are to be ordered separately.

PCX FEATURES (two pressure settings + unloading):

- solenoid switching valve (1) = DS3-S2 (to be ordered separately see catalogue 41 150)
- solenoid valve OFF = pump unloading - delivery pressure = 20 bar
- solenoid side “a” ON = maximum displacement and delivery pressure set on relief valve (2) (intermediate value)
- solenoid side “b” ON = maximum displacement and delivery pressure set on regulator (P) (maximum value)

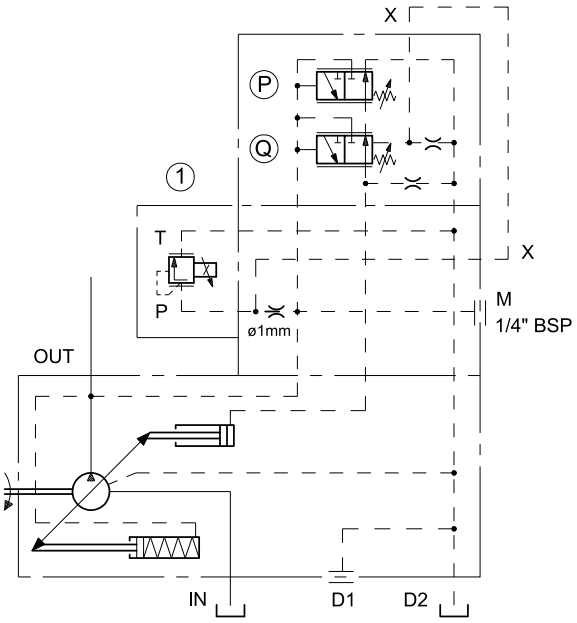
- pressure relief valve (2) = MCI*-SBT (to be ordered separately - see cat. 61 200)
- pressure regulating range (2) = MCI3-SBT 20 ÷ 100 bar
  MCI5-SBT 20 ÷ 250 bar

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

NOTE: For PCX regulators characteristic curves (with two pressure settings + unloading functions), see PC regulator diagrams at paragraph 8.1.

10.3 - Pressure regulation with electric proportional control

FUNCTIONAL DIAGRAM



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

PCX FEATURES (proportional pressure regulation):

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

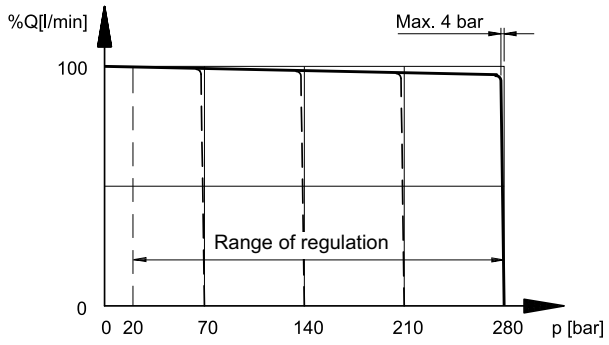
- proportional pressure relief valve (1) = PRED3 (to be ordered separately with its relative electronic control unit - see catalogue 81 210)
- proportional pressure regulating range:
  PRED3-070 20 ÷ 100 bar
  PRED3-210 20 ÷ 240 bar

Hysteresis = < 5% of p nom
Repeatability = < ± 1,5% of p nom

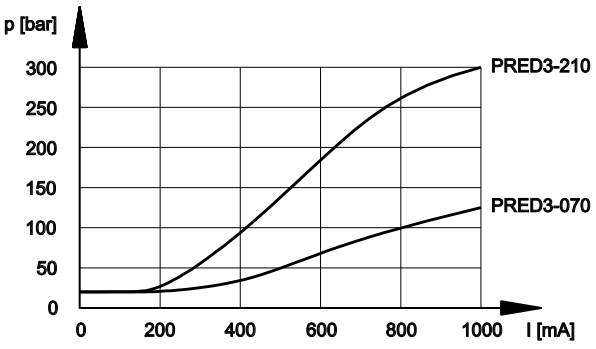
10.3.1 - Characteristic curves (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

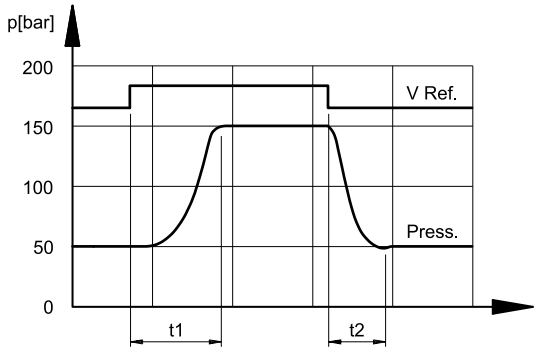
FLOW RATE / PRESSURE FEATURE



CURRENT / PRESSURE FEATURE



RESPONSE TIME

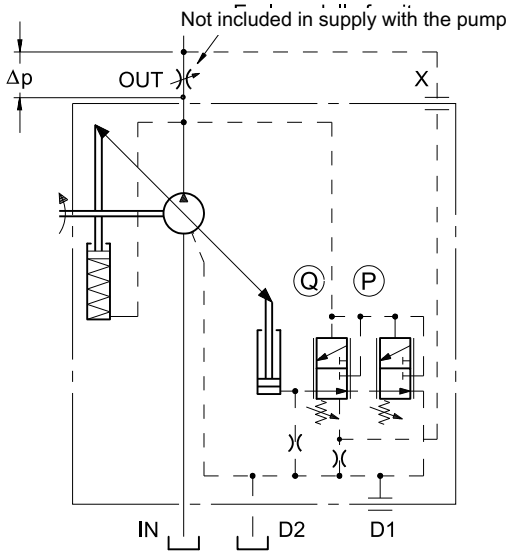


The response times are obtained with a VPPM-046 pump, by changing the reference signal (V Ref) on the proportional valve in order to have a line pressure variation from 50 to 150 bar and vice versa, with an oil volume of 5 lt.

t1 = 80 ms (response time for an increasing pressure change)
t2 = 60 ms (response time for a decreasing pressure change)

11 - FLOW RATE AND PRESSURE REGULATOR: PQC

FUNCTIONAL DIAGRAM



This regulator, apart from regulating the pressure (as for the PC model), allows the pump flow rate to be regulated according to the Δp pressure drop measured on either side of a throttle valve installed on the user line. The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

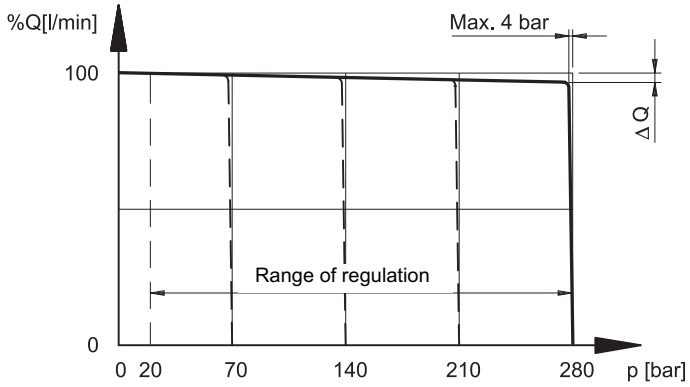
PQC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar
- differential pressure regulating range (Q) = 10 ÷ 40 bars
- default setting = 14 bar
- Min. discharge head = 18 ± 2 bar
  (with a zero flow rate, X discharge pilot and with a default (Q) setting of the differential regulator)

11.1 - Characteristic curves of the PQC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

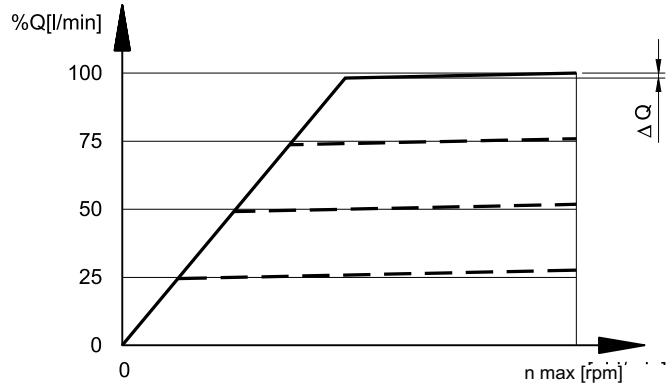
FLOW RATE / PRESSURE FEATURE



Flow variation between minimum and maximum pressure with pump set at max displacement

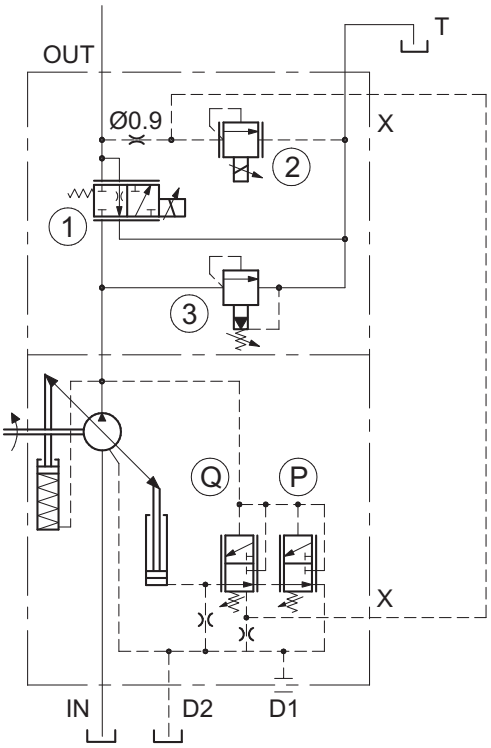
pump size	ΔQ max [l/min]
029	0.9
046	1.7
073	2.5
087	2.5

FLOW RATE / ROTATION SPEED STATIC FEATURE



12 - INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL REGULATOR: PQCE5

FUNCTIONAL DIAGRAM



This regulator allows an independent regulation of the pump flow and pressure, both with an electric proportional control.

The pump flow is regulated through the proportional valve (1) which operates directly on the pump delivery, while the system pressure is controlled by means of the proportional relief valve (2) working as a pilot stage of the differential regulator (Q).

The maximum system pressure is limited by the regulator (P). The regulator is also equipped of a built-in pressure relief valve (3) with manual adjustment, which limits the pressure peak due to quick flow variations in the system.

PQCE5 FEATURES

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar

- proportional pressure regulating range:
  20 ÷ 250 bar (for VPPM-*PQCE5 pump)

- proportional flow regulating range:
  0 ÷ 69 l/min (for VPPM-046 PQCE5 pump)
  0 ÷ 109,5 l/min (for VPPM-073 PQCE5 pump)
  0 ÷ 132 l/min (for VPPM-073 PQCE5 pump)

PERFORMANCES and ELECTRICAL CHARACTERISTICS

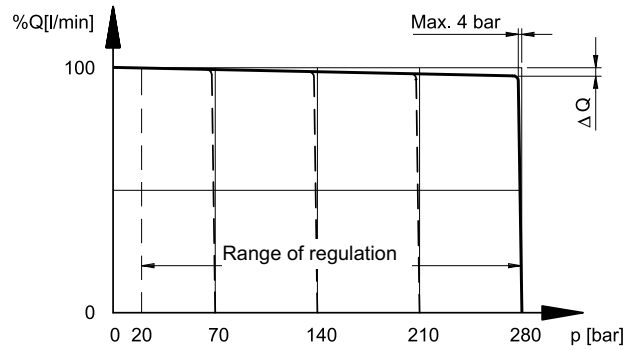
	FLOW REGULATION (1) (DSE5 valve)	PRESSURE REGULATION (2) (CRE valve)
HYSTERESIS	< 6% of Q max	< 5% of p nom
REPEATABILITY	< ±1,5% of Q max	< ±1,5% of p nom
NOMINAL VOLTAGE	24 VDC	24 VDC
COIL RESISTANCE (at 20°C)	8,65 Ω	16,6 Ω
MAXIMUM CURRENT	1,6 A	0,85 A
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU	
DEGREE OF PROTECTION : Atmospheric agents (CEI EN 60529)	IP 65	
ELECTRONIC CONTROL UNITS for proportional valves	EDM-M3312 see cat. 89 250	

12.1 - Characteristic curves of the PQCE5 regulator

(values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

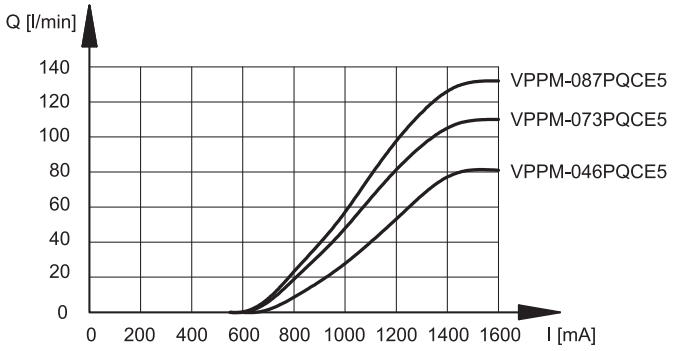
FLOW RATE / PRESSURE CURVE



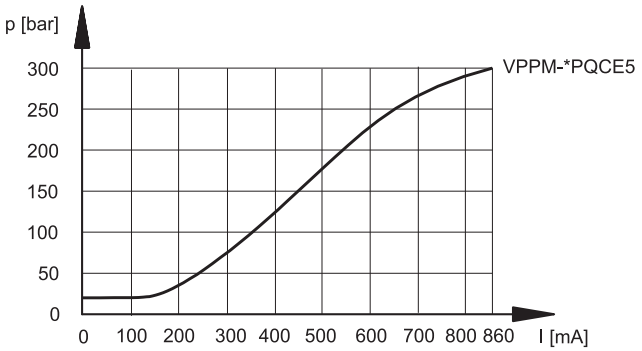
Flow variation between minimum and maximum pressure with pump set at max displacement

pump size	ΔQ max [l/min]
046	1.7
073	2.5
087	2.5

CURRENT / FLOW CURVE

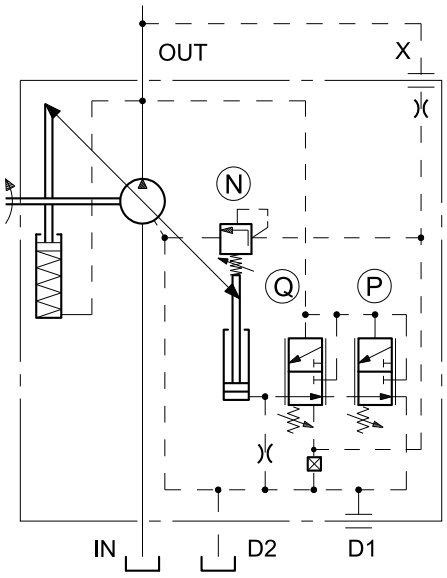


CURRENT / PRESSURE CURVE



13 - POWER REGULATOR: PQNC

FUNCTIONAL DIAGRAM



Such regulator keeps the pump torque at a constant level by changing the displacement according to the delivery pressure, so that the ratio p x (Q) (absorbed power) remains unchanged. The functions limiting the (P) maximum pressure and regulating the (Q) flow rate are always present, if a restrictor has been installed on the user line.

In the 1/8" BSP coupling supplied for the X port, there is a restrictor of Ø0,8 orifice.

Note: The connection pipe between the X port and the pump outlet must always be made (customer charge).

PQNC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar

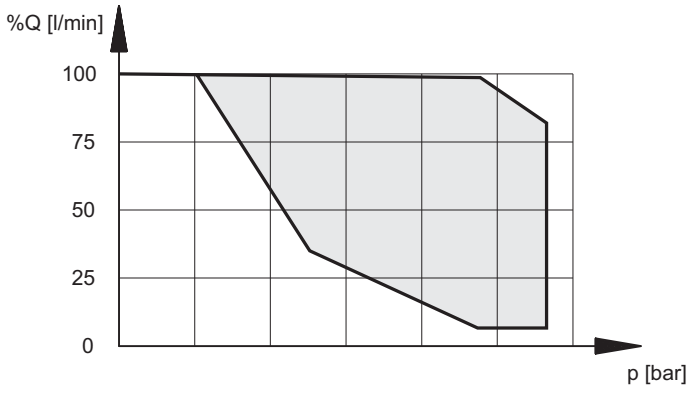
- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar

- min. discharge head = 18 ± 2 bar
  (with a zero flow rate, X discharge pilot and with a default Q setting of the differential regulator)
- the power regulator is factory set. The setting value has to be specified with the order, by stating into the identification code the Nm torque value (see paragraph 1).
- Start of the regulation: looking at values table of paragraph 1.5

13.1 - Characteristic curves of the PQNC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

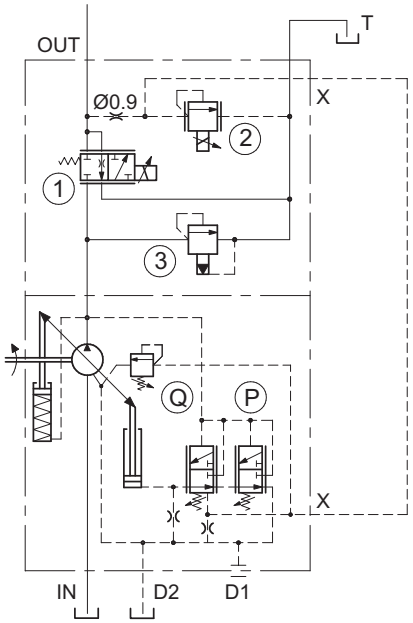
The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

FLOW RATE / PRESSURE CURVE



14 - POWER REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL: PQNCE5

FUNCTIONAL DIAGRAM



This system combines all the functions of the constant power control as a standard PQNC5 regulator, and moreover it allows the independent proportional regulation of the pump flow and pressure at values behind the power curve characteristic set on the regulator (N).

PQNCE5 FEATURES

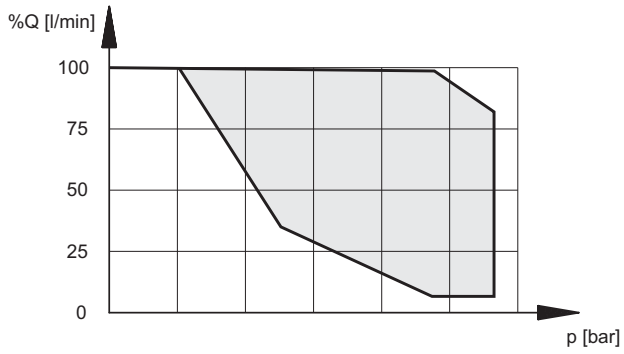
For technical characteristics and settings of regulator, see paragraph 13.

14.1 - Characteristic curves of the PQNCE5 regulator

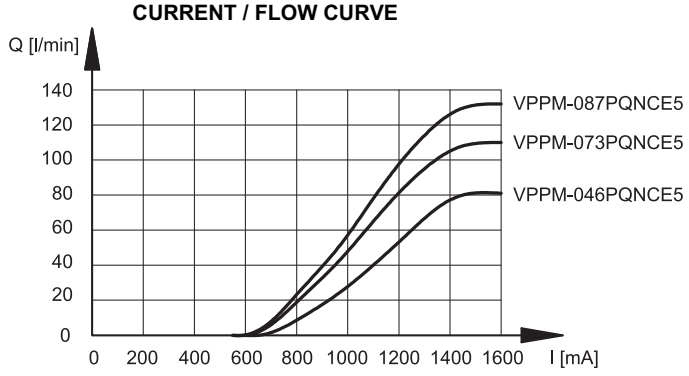
(values obtained with mineral oil with viscosity of 36 cSt at 50°C with driver EDM-M3312)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

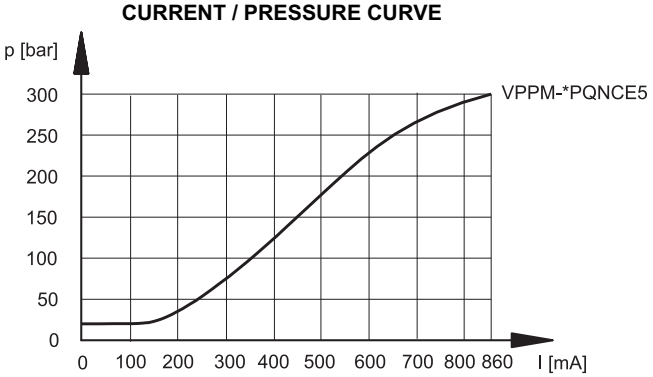
FLOW RATE / PRESSURE CURVE



CURRENT / FLOW CURVE

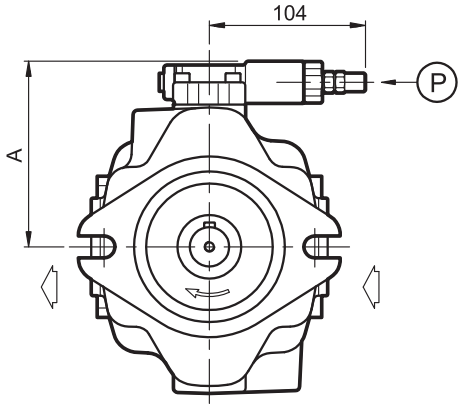


CURRENT / PRESSURE CURVE



15 - REGULATOR OVERALL DIMENSIONS

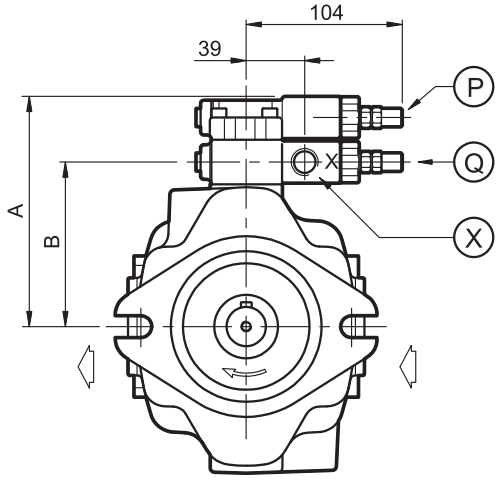
dimensions in mm



PRESSURE REGULATOR PC

pump size	A [mm]
029	114
046	123
073 / 087	136

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13

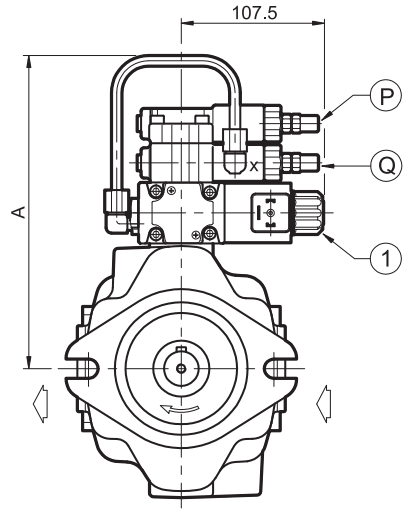


REMOTE-CONTROLLED PRESSURE REGULATOR PCR

pump size	A [mm]	B [mm]
029	144	100
046	153	109
073 / 087	165	122

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilot port for remote control X: 1/8” BSP

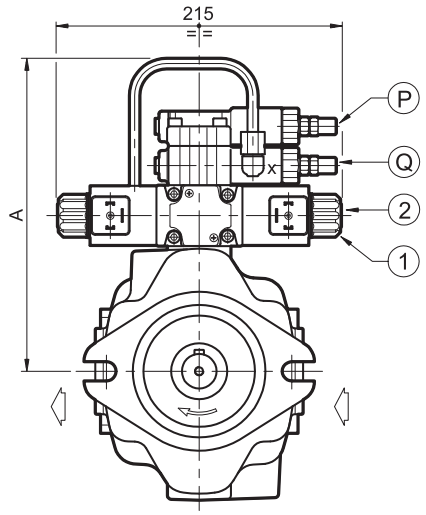
dimensions in mm



PCX REGULATOR WITH ELECTRICAL UNLOADING

pump size	A [mm]
029	244
046	253
073 / 087	265

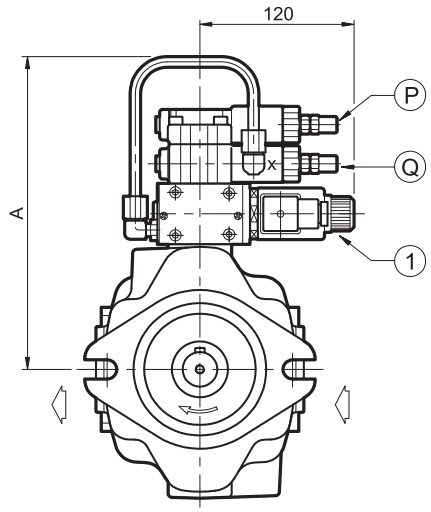
P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-SA2



PCX REGULATOR WITH TWO PRESSURE SETTINGS + UNLOADING

pump size	A [mm]
029	244
046	253
073 / 087	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-S2
2	Relief valve for the intermediate pressure setting MCI*-SBT

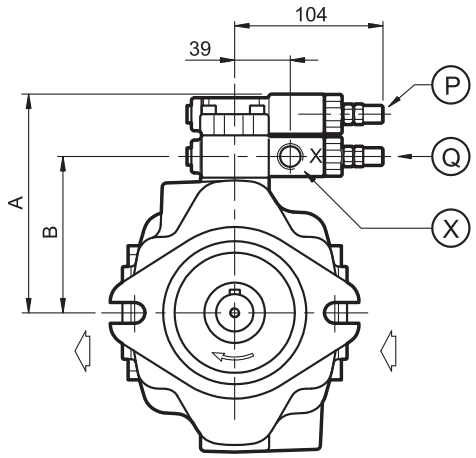


PCX REGULATOR FOR PRESSURE REGULATION WITH ELECTRIC PROPORTIONAL CONTROL

pump size	A [mm]
029	244
046	253
073 / 087	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional pressure relief valve PRED3 type

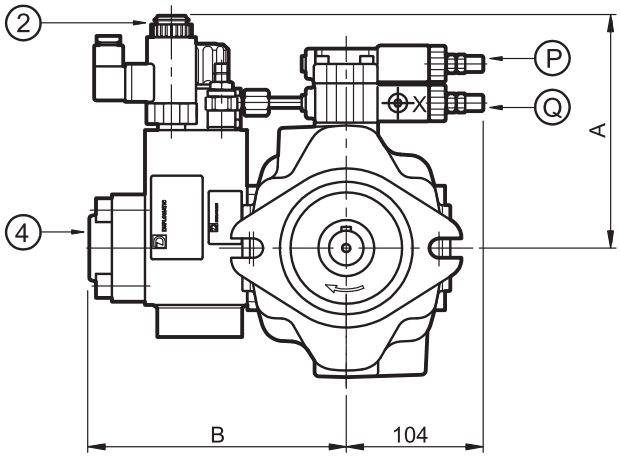
dimensions in mm



FLOW RATE AND PRESSURE REGULATOR PQC

pump size	A [mm]	B [mm]
029	144	100
046	153	109
073 / 087	165	122

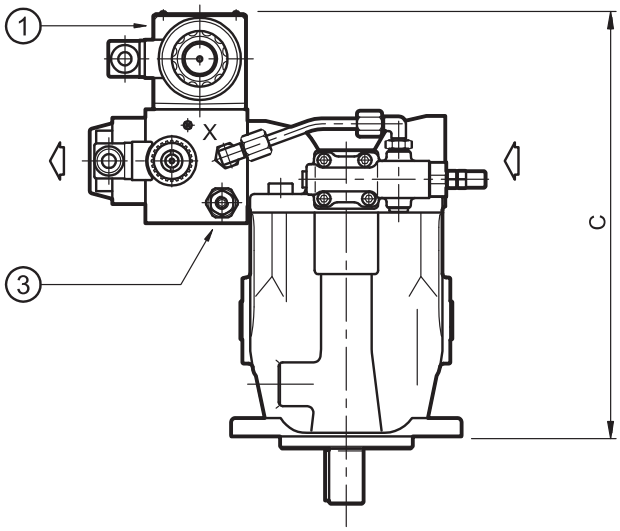
P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8” BSP (see paragraph 11)



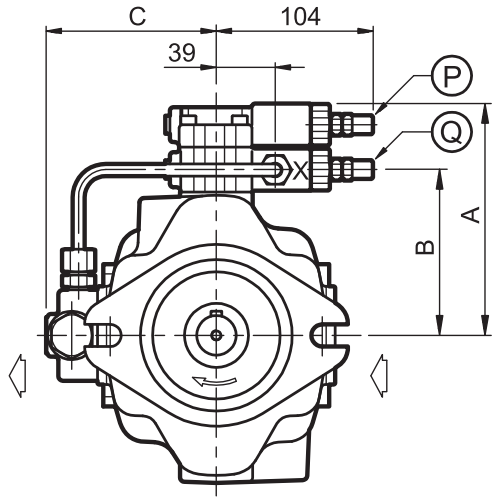
PQCE REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL

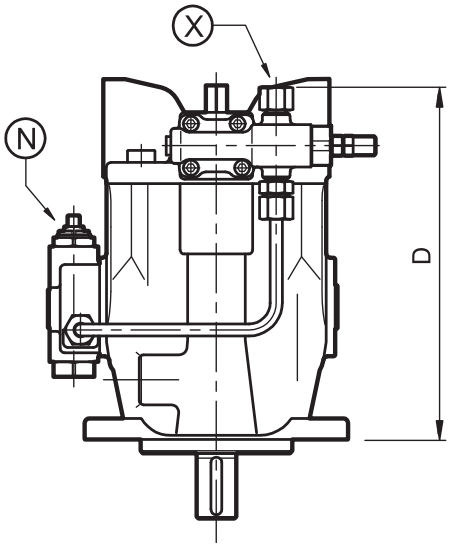
pump size	A [mm]	B [mm]	C [mm]
046	175	194	337
073 / 087	181	207	345

P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional flow control valve type: DSE5-P070B - DSE5-P110SB
2	Proportional pressure valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange 1” for VPPM-046 - 1 ¼” for VPPM-073 and -087



dimensions in mm





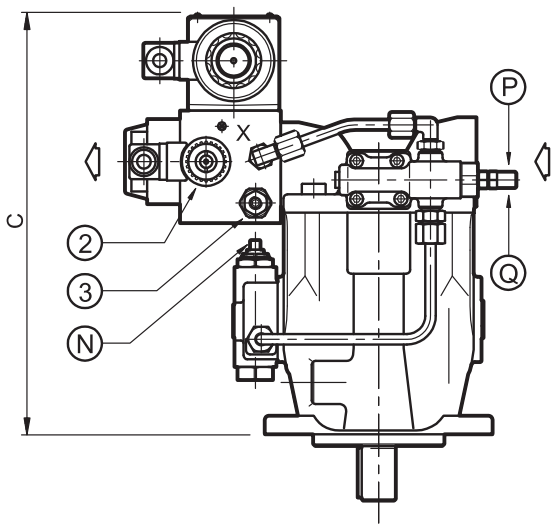
POWER REGULATOR PQNC

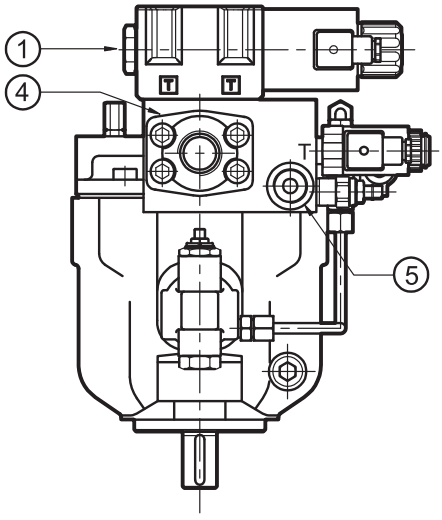
pump size	A [mm]	B [mm]	C [mm]	D [mm]
029	144	100	104	211
046	153	109	111	235
073 / 087	165	122	120	258

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8" BSP (restrictor with Ø0,8 orifice included - see paragraph 13)
N	Power regulator

POWER REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL PQNCE5
(for dimensions see PQCE5 page 22)

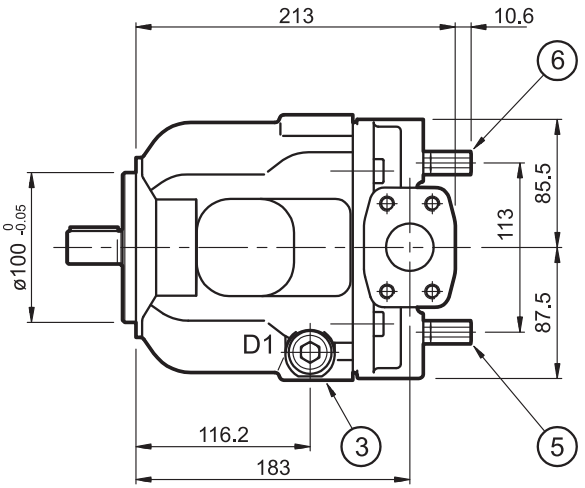
P	Pressure regulator countersunk hex adjustment screw: spanner 4. Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
N	Power regulator
1	Proportional flow control valve type: DSE5-P070SB - DSE5-P110SB
2	Proportional pressure control valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange: 1" for VPPM-046 - 1 ¼" for VPPM-073 and -087
5	Outlet port T: 3/4" BSP

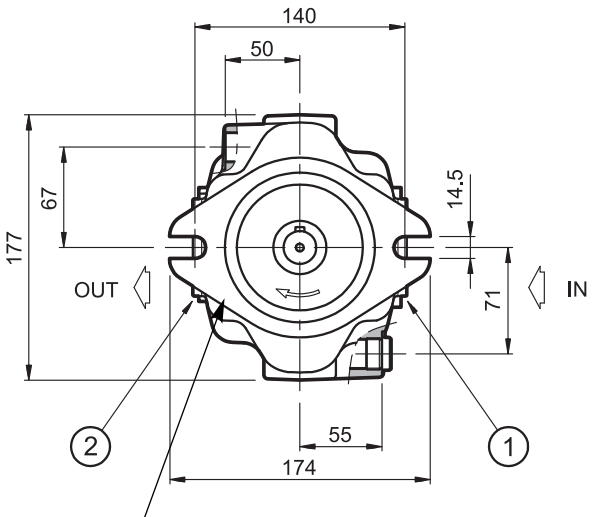




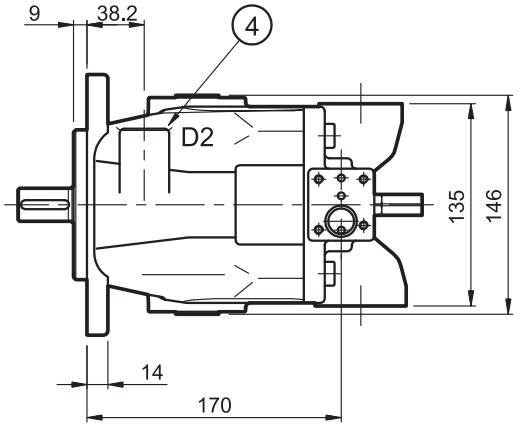
16 - VPPM-029 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



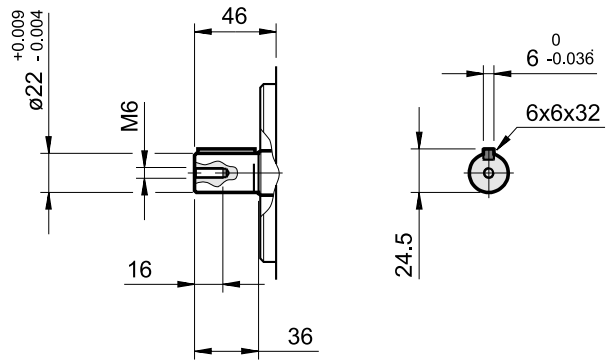


ISO 3019/2 fitting flange
(standard, identification code **5**)



1	Suction port: IN flange SAE 3000 1¼” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 3/4” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - torque: 10 Nm - displacement regulation range: 100 ÷ 70% max. displacement Δ displacement / screw round = 1,5 cm^3

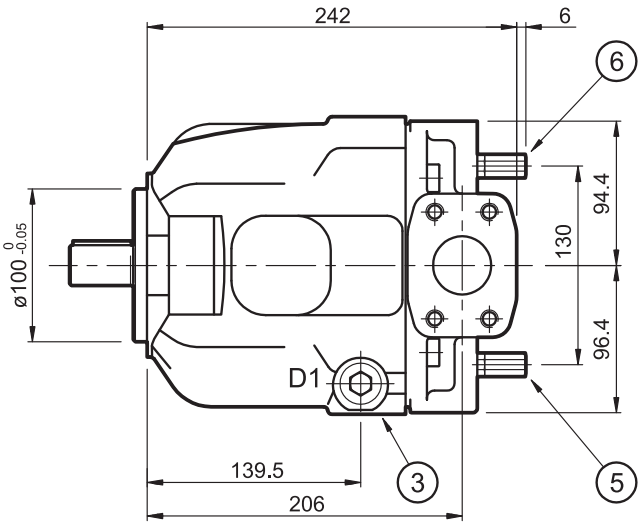
Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)

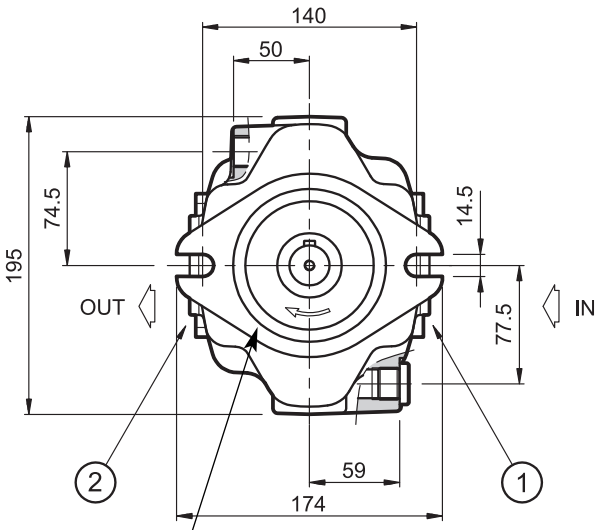


NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

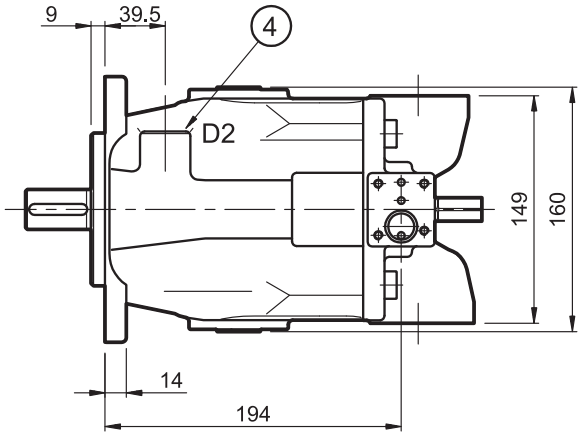
17 - VPPM-046 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



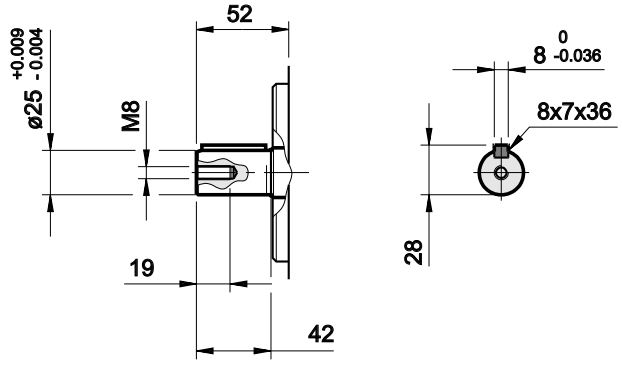


ISO 3019/2 fitting flange
(standard, identification code **5**)



1	Suction port: IN flange SAE 3000 1½” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 1” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - torque: 10 Nm - displacement regulation range: 100 ÷ 70% max. displacement Δ displacement / screw round = 2,2 cm^3

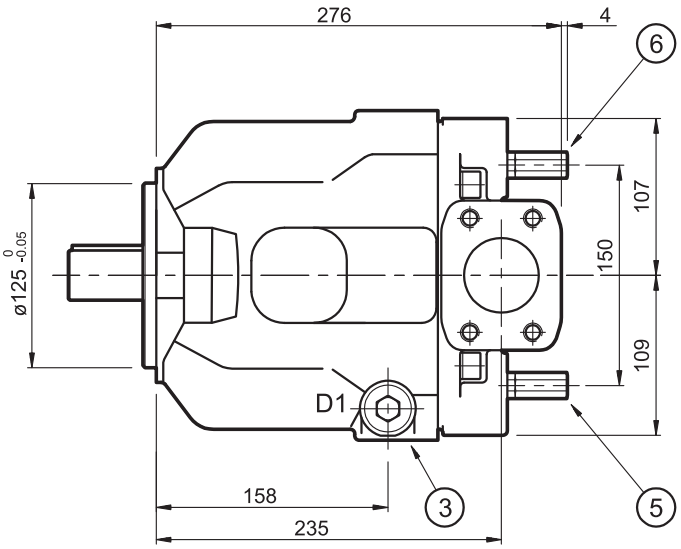
Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)

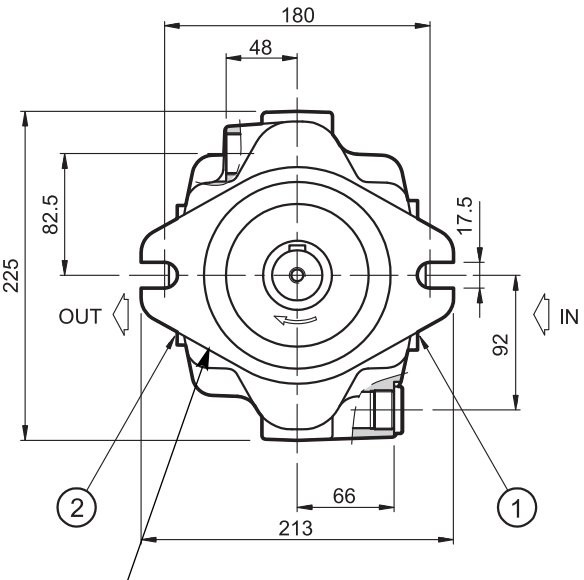


NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

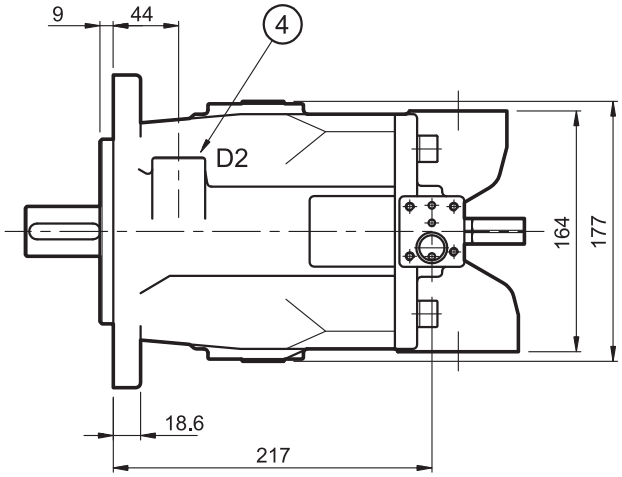
18 - VPPM-073 AND VPPM-087 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

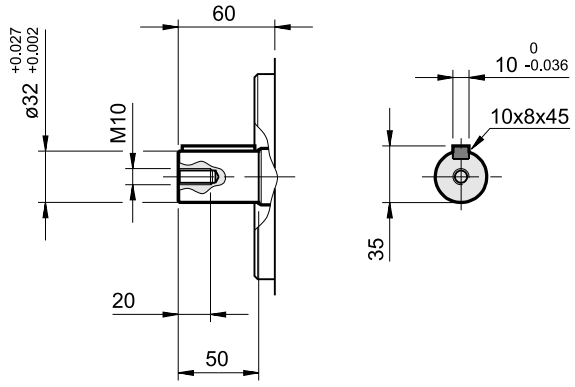




ISO 3019/2 fitting flange
(standard, identification code **5**)



Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)

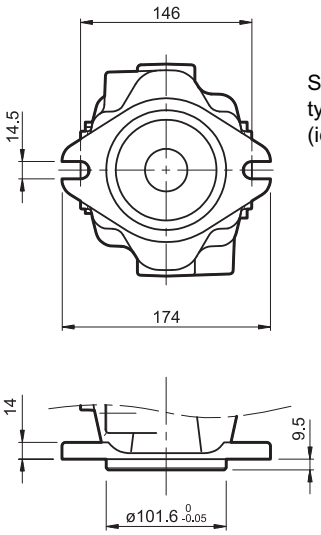


1	Suction port: IN flange SAE 3000 2” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 1 ¼” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 17 - countersunk hex adjustment screw: spanner 5 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 17 - countersunk hex adjustment screw: spanner 5 - torque: 10 Nm - displacement regulation range: 100 ÷ 50% max. displacement Δ displacement / screw round = 3,9 cm^3

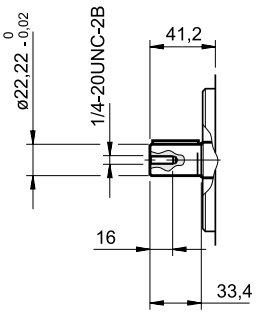
NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

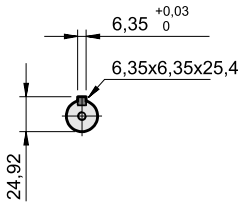
19 - OVERALL DIMENSIONS FOR FLANGES AND SHAFTS TYPE SAE J744

VPPM-029



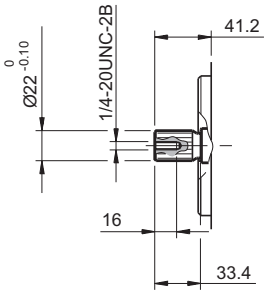
SAE J744 - 2-hole fitting flange
type “B”
(identification code: **0**)





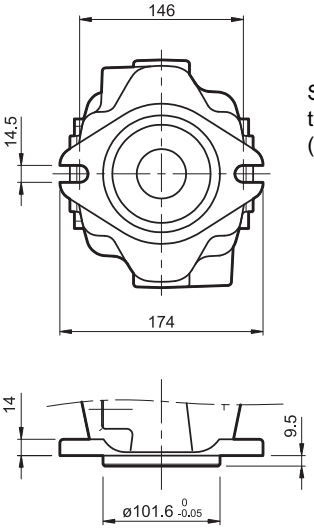
cylindrical with key shaft end
SAE J744
(identification code: **0**)

SAE J744 splined shaft end
16/32 d.p. - 13T
(identification code: **1**)

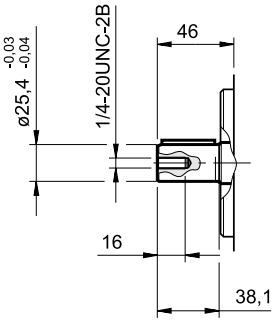


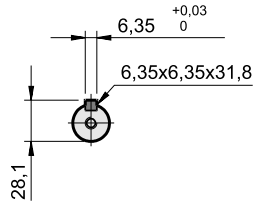
dimensions in mm

VPPM-046



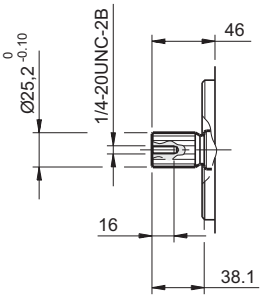
SAE J744 - 2-hole fitting flange
type “B”
(identification code: **0**)





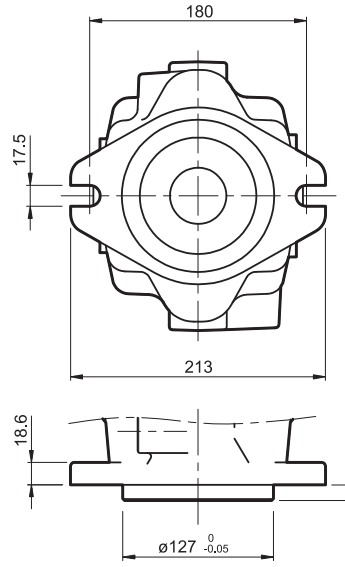
cylindrical with key shaft end
SAE J744
(identification code: **0**)

SAE J744 splined shaft end
16/32 d.p. - 15T
(identification code: **1**)

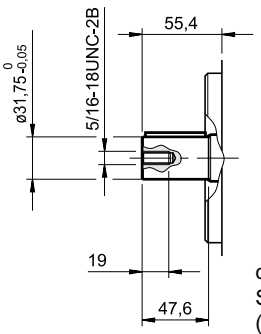


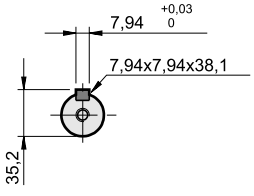
dimensions in mm

VPPM-073
VPPM-087



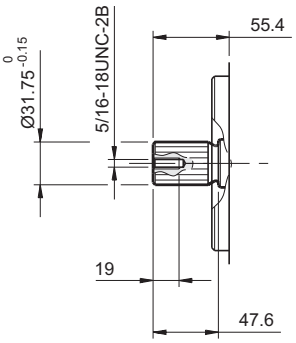
SAE J744 - 2-hole fitting flange
type “C”
(identification code: **0**)





cylindrical with key shaft end
SAE J744
(identification code: **0**)

SAE J744 splined shaft end
12/24 d.p. - 14T
(identification code: **1**)



dimensions in mm

20 - INSTALLATION

- The VPPM pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.

  N.B.: The drainage port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume (according to the installation use the D1 or D2 drainage ports).

- Installation below the oil reservoir is suggested. As for an installation above the oil level, check that the min. suction pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.

  In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested that the drain tube is adjusted so that the pump higher bearing can be always lubricated.

- **Before starting, the pump body has to be filled with the fluid.**

- It is necessary to vent the air from the delivery connection before operating it the first time. The pump start up, especially at a cold temperature, should occur with the plant at minimum pressure.

- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.

- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 2 bar (absolute), even during the dynamic change and flow rate phases. The drainage tube has to unload inside the tank far from the suction area. We suggest to interpose a screen between the two lines.

- The drain pressure can be max 0.5 bar higher than the suction pressure but it can never exceed the max of 2 bar of absolute pressure.

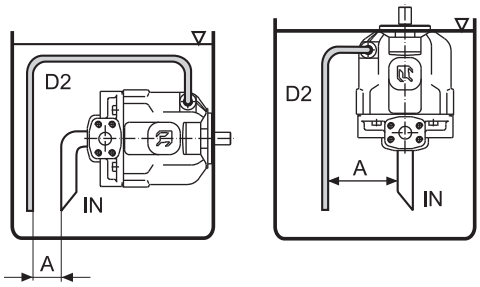
- No check valves allowed on the suction line.

- The motor-pump connection must be carried out directly with a flexible coupling. Radial and axial loads have to be lower than the values specified in the table at paragraph 3.

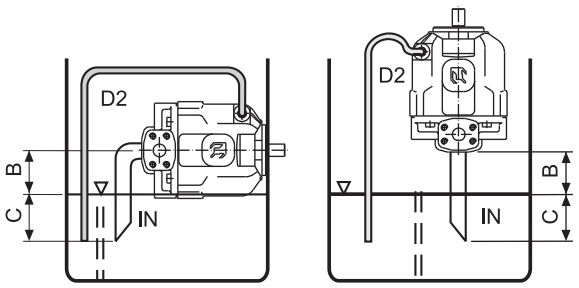
- As for details and the installation of filter elements, see par. 2.3.

MOUNTING INSIDE THE TANK

Minimum level of oil in the tank at or above the surface of the pump flange
A ≥ 200 mm

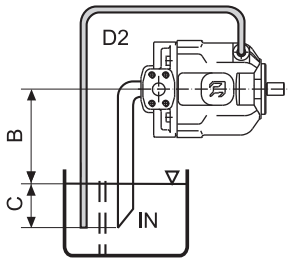


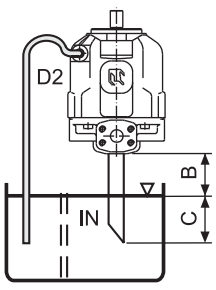
Minimum level of oil in the tank below the surface of the pump flange
Minimum inlet pressure = -0,2 bar (relative)
B ≤ 800 mm C = 200 mm



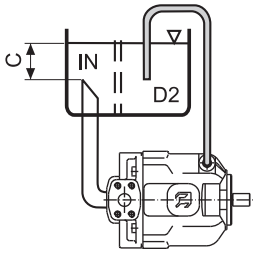
MOUNTING OUTSIDE THE TANK

Minimum inlet pressure = -0,2 bar (relative)
B ≤ 800 mm C = 200 mm





C = 200 mm



21 - THROUGH OUTPUT SHAFT

The VPPM pumps can be supplied with a through output shaft, which allows coupling with other pump models.

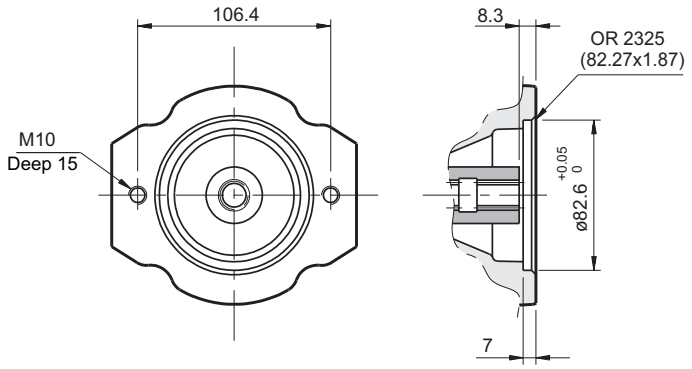
N.B.: The pumps with a through output shaft are supplied with an intermediate 2-hole flange type SAE J744 - and with a mating joint for splined shaft type SAE J744.

The mechanical adjustment for the min and max displacement are not available on these front or intermediate pumps: VPPM-029 with flange 62S, VPPM-073 with flange 64S, VPPM-087 with flange 64S.

As for identification see par. 1 “Identification code”. For the pump overall dimensions (intermediate flange included) see paragraph 23 “overall dimensions for multiple pumps”.

FLANGE + JOINT FOR THE COUPLING OF A GEAR PUMP GROUP 2

identification code **12S**

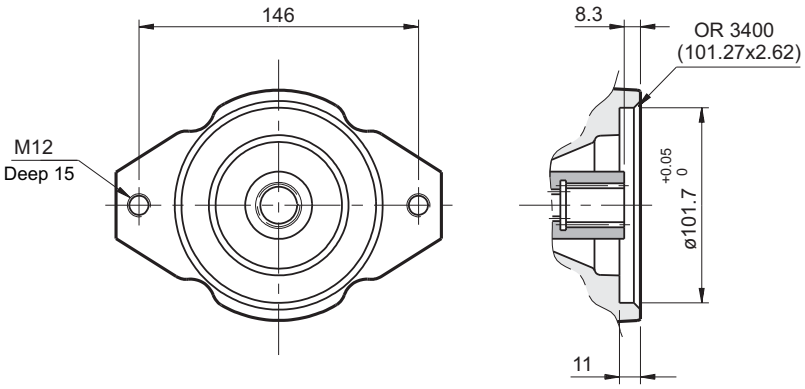


SAE J744 - 2-hole intermediate flange
type “A”

mating joint for a SAE J744 splined shaft
16/32 D.P. - 9T

FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-029
OR OF A GEAR PUMP GROUP 3

identification code **62S**

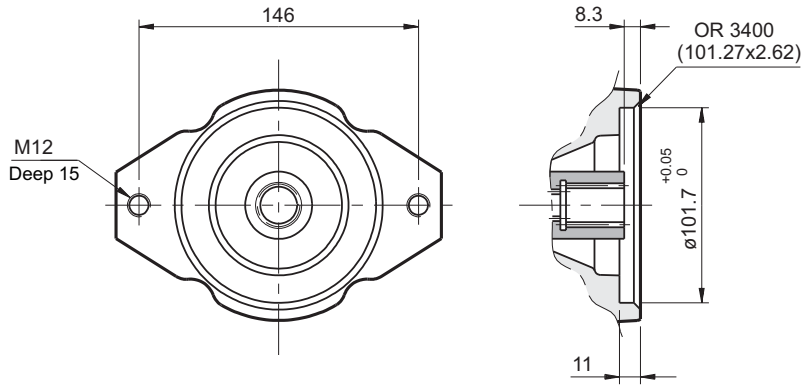


SAE J744 - 2-holes intermediate flange type “B”

mating joint for a SAE J744 splined shaft 16/32 D.P. - 13T

FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-046

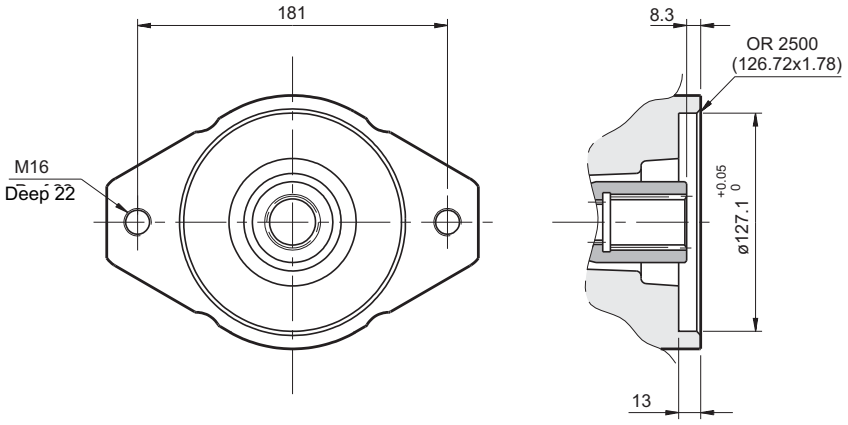
identification code **63S**



SAE J744 - 2-holes intermediate flange type“B”

mating joint for a SAE J744 splined shaft 16/32 D.P. - 15T

FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-073
identification code **64S**



SAE J744 - 2-holes intermediate flange type “C”

mating joint for a SAE J744 splined shaft 12/24 D.P. - 14T

22 - MULTIPLE PUMPS

The possibility to couple several pumps makes it possible to create multi-flow groups with independent hydraulic circuits. While sizing coupled pumps, it’s necessary to make reference to the following conditions:

- The coupling can be carried out between pumps with the same dimensions or to a size of decreasing order.
- The max. rotation speed is determined by the pump with the lowest speed.
- The values of the max. applicable torque can not be exceeded.

22.1 - Max. applicable torque

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [Nm]$$

where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{tot}} = [kW]$$

n = rotation speed [rpm]

Q = flow rate [l/min]
Δp = differential pressure between the pump suction and delivery [bar]
η_{tot} = total efficiency (obtainable from the diagrams in par. 4-5-6)

or it can be obtained from the diagrams ABSORBED POWER (see par. 4 - 5 - 6 -7).

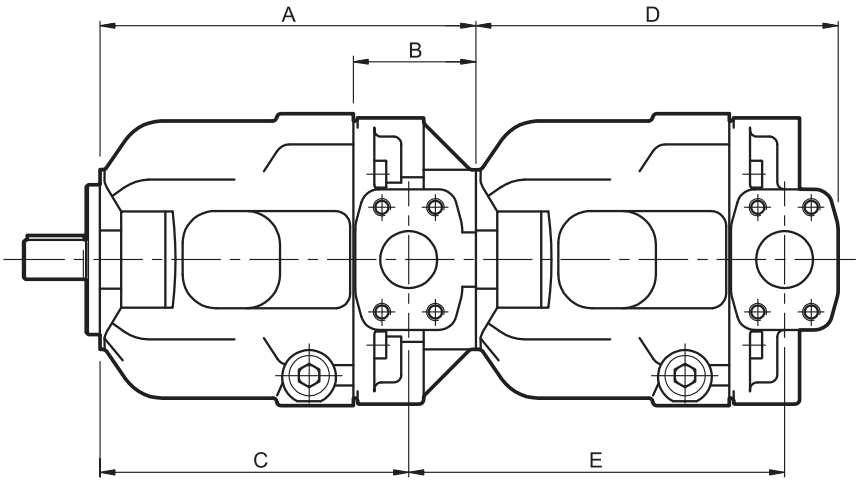
If several pumps are coupled, the torque of each single pump has to be added to the torque of subsequent pumps when they are loaded simultaneously.
The obtained torque value for each pump has to be lower than the value specified in the table below :

pump with a through output shaft	MAXIMUM TORQUE APPLICABLE AT THE FRONT PUMP SHAFT [Nm]			MAXIMUM TORQUE APPLICABLE AT THE PUMP TO BE COUPLED [Nm] (not simultaneously to the front pump)					
	cylindrical ISO 3019/2 (cod. 5)	cylindrical SAE J744 (cod. 0)	splined SAE J744 (cod. 1)	GP2 external gear	GP3 external gear	VPPM-029	VPPM-046	VPPM-073	VPPM-087
VPPM-029	170	200	190	100	135	135	-	-	-
VPPM-046	220	230	330	135	250	250	250	-	-
VPPM-073	450	490	620	135	330	330	400	440	-
VPPM-087	450	490	620	135	330	330	400	440	440

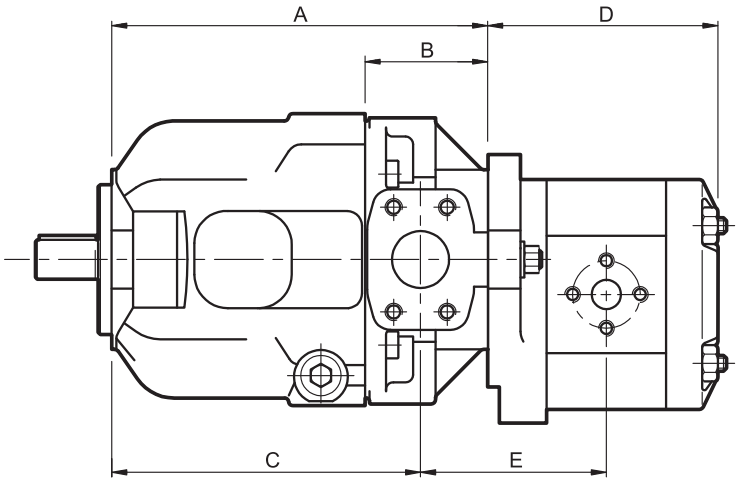
The maximum transmissible torque for those pumps with a through output shaft is determined by the coupling used for the transmission. If the obtained torque values are higher than the ones stated in the table, it is necessary to reduce the working pressure value or to replace the overloaded pump with a pump suitable to bear the required torque.

23 - OVERALL DIMENSIONS FOR MULTIPLE PUMPS

dimensions in mm



	REAR PUMP														
	VPPM-029					VPPM-046					VPPM-073 / 087				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
VPPM-029	222	77	183	213	222	-	-	-	-	-	-	-	-	-	-
VPPM-046	251	82	206	213	220	251	82	206	242	251	-	-	-	-	-
VPPM-073 VPPM-087	291	99	235	213	226	291	99	235	242	249	296	104	235	276	296



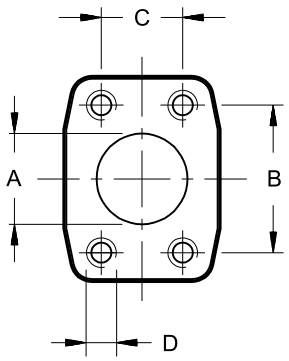
	REAR PUMP									
	external gear GP2					external gear GP3				
	A	B	C	D	E	A	B	C	D	E
VPPM-029	222	77	183	99 ÷121	86 ÷ 97	-	-	-	-	-
VPPM-046	251	82	206	99 ÷121	85 ÷ 96	251	82	206	132 ÷ 147	103 ÷ 110
VPPM-073 VPPM-087	291	99	235	99 ÷121	91 ÷ 102	291	99	235	132 ÷ 147	109 ÷ 116

NOTE: The D and E values in the table make reference to the dimensions of the gear pumps according to the available min. and max. displacement range. For further details apply to our Technical department.

24 - SUCTION AND DELIVERY PORTS DIMENSIONS FOR SAE FLANGES

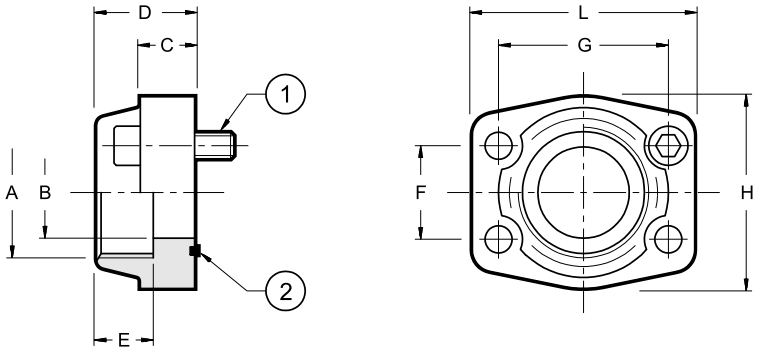
SUCTION PORT: "IN" (SAE 3000)						
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** threading and depth (mm) METRIC	UNC
VPPM 029	1 ¼"	32	58,7	30,2	M 10x28	7/16-14 UNC-2B 28
VPPM 046	1 ½"	38,1	70	35,7	M12x26	½ -13 UNC-2B 26
VPPM 073 VPPM 087	2"	50,8	77,8	43	M12x25	½ -13 UNC-2B 25

DELIVERY PORT "OUT" (SAE 6000)						
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** threading and depth (mm) METRIC	UNC
VPPM 029	3/4"	19	50,8	23,8	M10x24	⅜ - 16 UNC-2B 24
VPPM 046	1"	25,4	57,1	27,7	M12x20	7/16-14 UNC-2B 20
VPPM 073 VPPM 087	1 ¼"	32	66,7	31,7	M14x23	½ - 13 UNC-2B 23



25 - CONNECTION FLANGES

dimensions in mm
The fastening bolts and the O-Rings must be ordered separately



	Flange code	Flange description
SAE 3000	0610720	OR 4150 (37.69x3.53)
	0610714	OR 4187 (47.22x3.53)
	0610721	OR 4225 (56.74x3.53)
SAE 6000	0770075	OR 4100 (24.99x3.53)
	0770092	OR 4131 (32.93x3.53)
	0770106	OR 4150 (37.69x3.53)

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 metric SHCS	1 UNC SHCS
SAE 3000	0610720	SAE - 1 ¼"	280	1 ¼" BSP	32	21	41	22	30,2	58,7	68	79	n° 4 - M10x35	n° 4 - 7/16 UNC x 1 ½"
	0610714	SAE - 1 ½"	210	1 ½" BSP	38	25	45	24	35,7	70	78	94	n° 4 - M12x45	n° 4 - ½ UNC x 1 ¾"
	0610721	SAE - 2"	210	2" BSP	51	25	45	30	43	77,8	90	102	n° 4 - M12x45	n° 4 - ½ UNC x 1 ¾"
SAE 6000	0770075	SAE - 3/4"	420	3/4" BSP	19	21	35	22	23,8	50,8	55	71	n° 4 - M10x35	n° 4 - ⅜ x 1 ½"
	0770092	SAE - 1"	420	1" BSP	25	25	42	24	27,7	57,1	65	81	n° 4 - M12x45	n° 4 - 7/16 x 1 ¾"
	0770106	SAE - 1 ¼"	420	1 ¼" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	n° 4 - ½ x 1 ¾"

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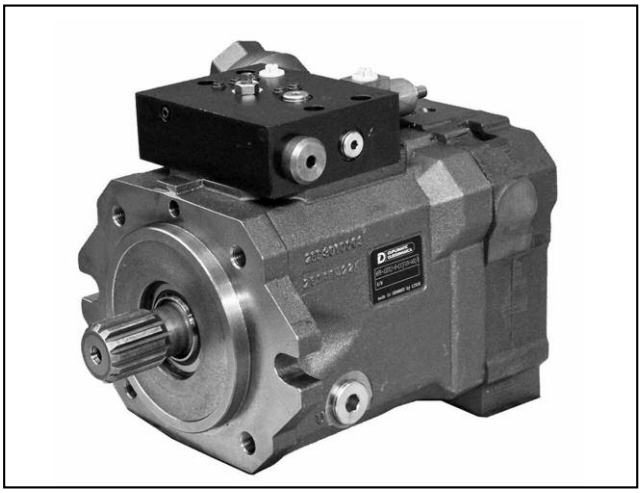
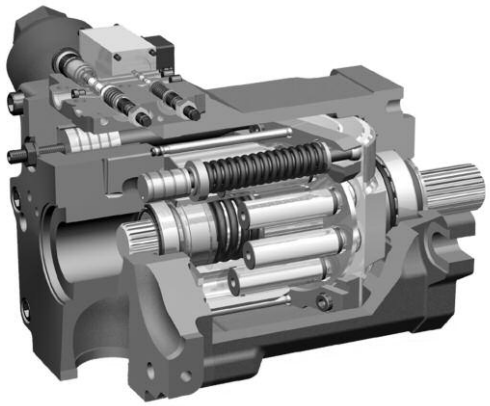


HPR

HIGH PRESSURE SELF-REGULATING PUMP FOR OPEN LOOP OPERATION

SERIES 10

OPERATING PRINCIPLE



— HPR pumps are variable displacement axial-piston pumps with swash plate design, suitable for applications with open circuits.

— Seven frame sizes are available, from 55 up to 280 cm^3/rev.

— The pump flow rate is proportional to the shaft speed and to the swash plate angle, which can be continuously modulated. The maximum angle can be limited mechanically by means of an adjustment screw.

— Due to the special design, these pumps are able to operate at high working pressures (420 bar continuously and 500 bar peak)

— All the pumps are equipped with a noise reduction device.

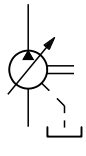
TECHNICAL SPECIFICATIONS

PUMP SIZE		**55**	**75**	**105**	**135**	**165**	**210**	**280**
Maximum displacement	cm^3/rev	55	75,9	105	135,7	165,6	210,1	281,9
Maximum operating pressure	bar	420						
Rotation speed and operating flow rate		see table 3 - Performances						
Rotation direction		clockwise						
Loads on the shaft: axial load radial load	N	2000 on request						
Hydraulic connection		flange fittings - SAE 3000 suction / SAE 6000 pressure						
Type of mounting		SAE J744						
Mass (empty single pump)	kg	39	39	50	65	89	116	165

Ambient temperature range	°C	-15 / +70
Fluid temperature range	°C	-20 / +80
Fluid recommended viscosity	cSt	15 ÷ 30
Fluid contamination degree (ISO 4406:1999)	18/16/13	

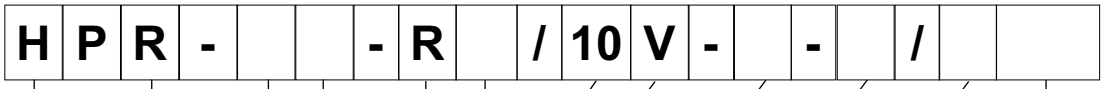
NOTE: Values referring to 1 bar absolute on suction port.

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODES

1.1 - Identification code for single pumps and pumps with power take-off



Self-regulating piston pump for high pressure

Pump size:
055 = 55 cm³/rev
075 = 75,9 cm³/rev
105 = 105 cm³/rev
135 = 135,7 cm³/rev
165 = 165,6 cm³/rev
210 = 210,1 cm³/rev
280 = 281,9 cm³/rev

Pump controls:
LP6 = load sensing with pressure cut-off adj. range 230-350 bar (**standard**) Other ranges are available upon request. See section 5.
TL2 = load sensing with power control (not available on sizes 055, 075 and 165)
ET6 = electro-proportional displacement control with power limiter and pressure cut-off adj. range 230-350 bar (**standard**) Other ranges are available upon request. See section 7. (not available on sizes 055, 075 and 165)

Rotation direction (seen from the shaft end):
R = clockwise (**standard**)
Anticlockwise rotation direction on request. (**NOTE**)

Mounting flange / splined shaft (see section 13)
HPR 55:
C14 = SAE C flange - 2 holes - shaft 12/24 14t
HPR 75:
C14 = SAE C flange - 2 holes - shaft 12/24 14t (**standard**)
C21 = SAE C flange - 2 holes - shaft 16/32 21t
HPR 105:
C17 = SAE C flange - 2 holes - shaft 12/24 17t (**standard** for TL2)
C23 = SAE C flange - 2 holes - shaft 16/32 23t (**standard** for LP6)
HPR 135 and HPR 165 :
D13 = SAE D flange - 2 holes - shaft 8/16 13t (**standard** for 135)
D27 = SAE D flange - 2 holes - shaft 16/32 27t (**standard** for 165)
HPR 210 and HPR 280
E15 = SAE E flange - 4 holes - shaft 15t 8/16

Keyed shaft available on request, on HPR280 only.

Series No.
(from 10 to 19 size and mounting dimensions remain unchanged)

FPM seals

Options for ET6 control
(Omit for other controls)
D12K2 = 12V DC supply and AMP Junior connection
D24K2 = 24V DC supply and AMP Junior connection

PTO - power take off / through drive shaft
A00 = SAE A flange - no shaft coupling (**standard**) (single pump)

A09 = SAE A flange - coupling 16/32 9t
B13 = SAE B flange - coupling 16/32 13t
B15 = SAE B flange - coupling 16/32 15t (not available on HPR 135 and 210)
C14 = SAE C flange - coupling 12/24 14t
D27 = SAE D flange - coupling 16/32 27t (not available on HPR 135, 165 e 210)
E27 = SAE E flange - coupling 27t 16/32 (not available on HPR 210)

Option:
Torque
Omit if not required (see par 6.1)

(Duplomatic reserved field)

NOTE: Pumps with anticlockwise rotation are available from HPR55 to HPR210 with limited options, such no noise reduction device. Please contact our technical dept. for availability.

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids HLP with anti-foam and antioxidant additives according to the DIN 51524-2 standard. For use with other types of fluid, keep in mind the limitations shown here below or consult our technical department for authorization of use.

2.2 - Fluid viscosity

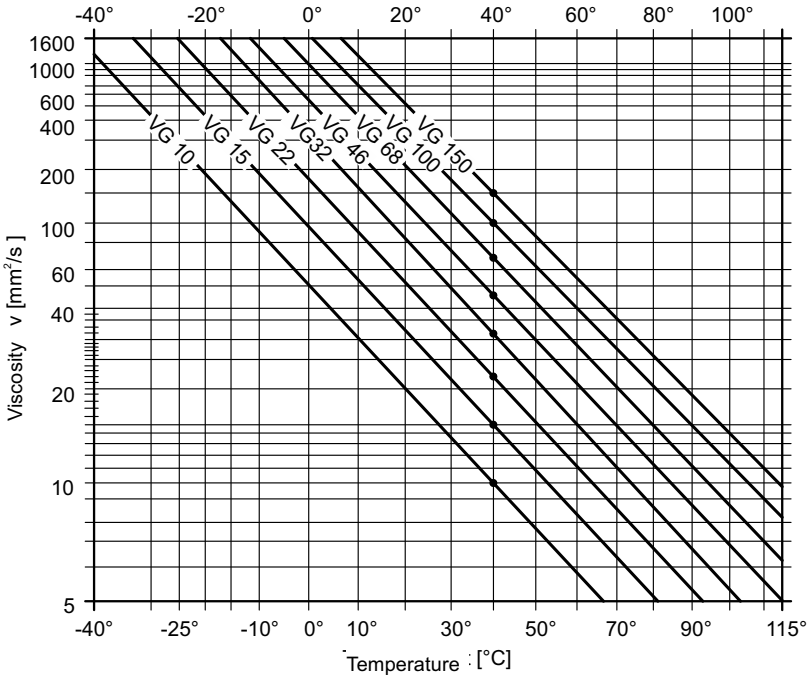
The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 80°C for the drain line
optimum viscosity	15 ÷ 30 cSt	referred to the fluid operating temperature in the tank.
maximum viscosity	1000 cSt	limited to the cold start-up of the pump only, which has to be carried out with the circuit at minimum pressure.

When selecting the fluid type, check its viscosity is within the range specified above at the operating temperature.

Recommended viscosity values are indicated in the table and diagram.

Operating temperature [°C]	Viscosity class [cSt at 40°C]
from 30 to 40	22
from 40 to 60	32
from 60 to 80	46 or 68



2.3 - Degree of fluid contamination

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the purity of the operating fluid must comply with the following class according to the ISO 4406:1999. High purity oil can extend the service time of the hydraulic system significantly.

For reliable proper function and long service life	18/16/13
Minimum requirements	20/18/15
Commissioning	The minimum purity requirement for the hydraulic oil is based on the most sensitive system component. For commissioning we recommend a filtration in order to achieve the required purity
Filling and operation of hydraulic systems	The required purity of the hydraulic oil must be ensured during filling or topping up. When drums, canisters or large-capacity tanks are used the oil generally needs to be filtered. We recommend the implementation of suitable measures (e.g. filters) to ensure the required minimum purity of the oil is also achieved during these tasks.

3 - PERFORMANCES

(values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

PUMP SIZE		055	075	105	135	165	210	280
Max displacement	cm^3/rev	55	75.9	105	135.7	165.6	210.1	281.9
Max flow: - at 1500 rpm - at max rotation speed	l/min	82.5 148.5	113.9 189.8	157.5 262.5	203.5 318.9	248.2 364.1	315.5 441.2	422.9 563.8
Minimum operating speed	rpm	500						
Maximum operating speed	rpm	2700	2500	2500	2350	2200	2100	2000
Max delivery pressure: - continuous - intermittent	bar	420 500						
Inlet pressure:	bar abs	from 0.8 up to 20 bar (see par. 12)						
Max housing pressure	bar	1,5						
Max power (Δp = 420 bar): - at 1500 rpm - at max rotation speed	kW	57.8 104	79.7 132.8	110.3 183.8	142.5 223.2	173.8 254.9	220.6 308.8	296 394.7
Max absorbed torque: Δp =100 bar Δp = 420 bar	Nm	87 368	121 507	167 702	216 907	263 1106	334 1404	446 1884
Moment of inertia on the shaft	$kgm^2 x10^{-2}$	0,79	0,79	1,44	2,15	3,41	4,68	8,34

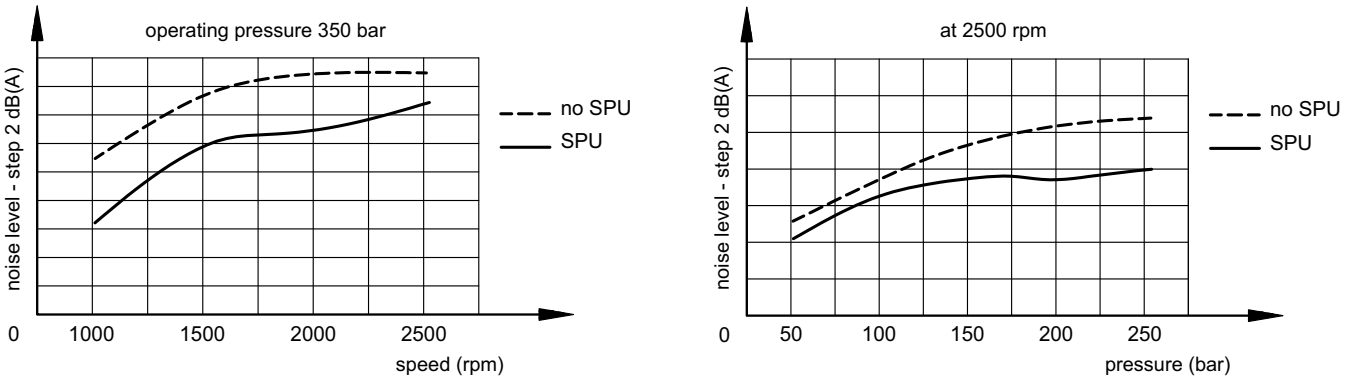
4 - NOISE REDUCTION DEVICE

All the HPR-02 hydraulic pumps are optimized with respect to pulsation characteristics and therefore noise generation. In addition to common primary measures such as exclusive use of noise-optimized port plates, the SPU noise reduction device is available.

Without affecting the functionality and efficiency of the pump, this system reduces pressure noise by up to 70%, irrespective of pressure, speed or temperature.

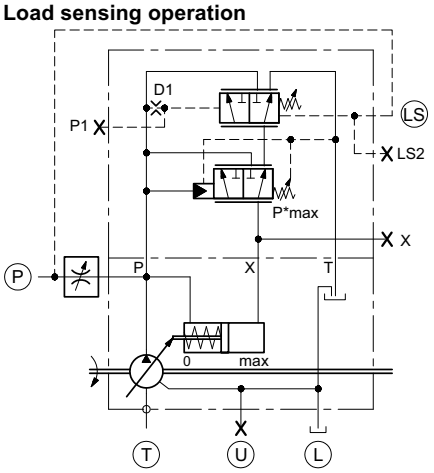
The SPU system is adaptive over the entire operating range. No setting up or maintenance is required.

Comparison of noise pressure levels for a HPR 75 pump with and without SPU



5 - LP6 - LOAD SENSING WITH PRESSURE CUT-OFF CONTROL

Load sensing operation



This load sensing control allows the pump flow rate to be regulated according to the Δp pressure drop measured on both the sides of a throttle valve installed on the working line.

NOTE: The connection pipe between the LS port and the flow line downstream the restrictor (or valve) is always in customer's charge. **The restrictor is not supplied.**

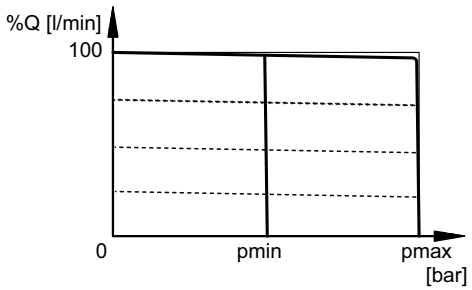
The maximum operating pressure can be set manually adjusting the P*max valve.

LP* FEATURES:

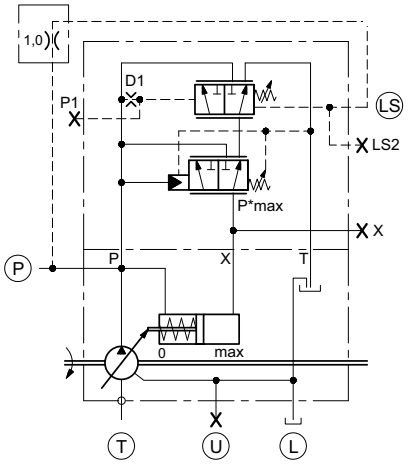
- pressure adjustment range:
  LP6 = 230 ÷ 350 (**standard**)
  default setting = 350 bar

  LP5 = 125 ÷ 230 (upon request)
  LP7 = 350 ÷ 420 (upon request)

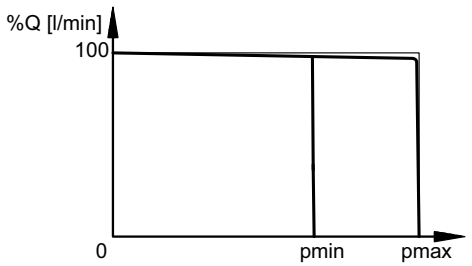
- differential pressure regulating range = 16 ÷ 27 bar
- default setting = 20 bar



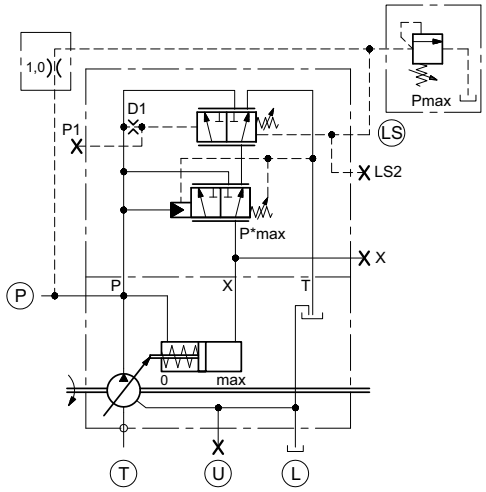
Pressure control operation



Bypassing both P and LS ports with an external connection and an orifice (both in customer's charge) the pump will operate as pressure control that works at maximum displacement up to the set pressure P*max.

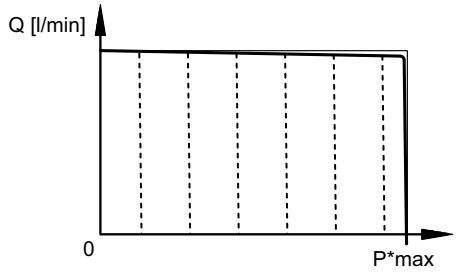


Remote pressure operation

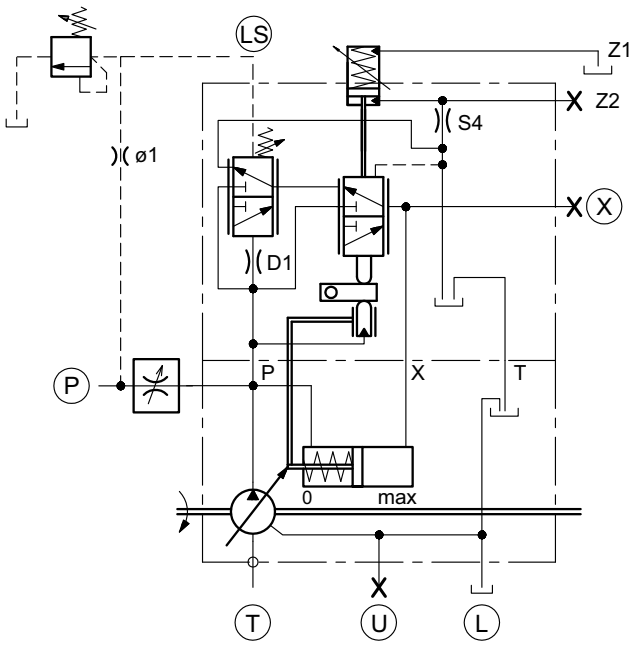


It is possible to create a remote pressure control by means of both an external pressure relief valve and an orifice (both in customer's charge) as shown in the schema.

This configuration allows to regulate remotely the maximum pressure up to P*max. When the pressure it's lower than the set value P*max the pump is at its maximum displacement.



6 - TL2 - LOAD SENSING WITH POWER CONTROL



The TL2 control is available for pumps HPR105, HPR135, HPR210 and HPR280.

This control combines the load sensing function typical of LP control with a power limiter with hyperbolic characteristic. Such limiter keeps the pump torque at a constant level by changing the displacement according to the delivery pressure, so that the absorbed power remains unchanged (at constant pump speed).

The Z1 port must always be connected to the tank separately and without back pressure. The Z2 port is plugged.

NOTE: The pipe connection between the LS port and the delivery of the pump, the orifice and the external pressure relief valve are always charged to the customer.

NOTE: The feature of the pressure cut-off is not present on this control, it is necessary to provide suitable external valve, as shown in the diagram at side.

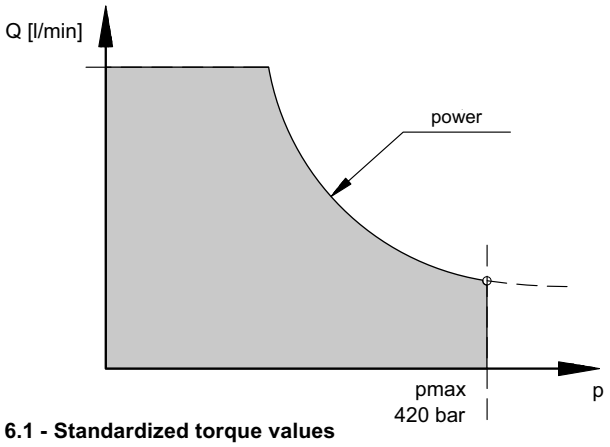
TL2 FEATURES:

- differential pressure adjustment range = 16 ÷ 27 bar
  default setting = 20 bar

- pressure adjustment range for torque regulation:
  HPR105, HPR135 = 60 ÷ 250 bar
  HPR210, HPR280 = 80 ÷ 250 bar
  default setting = 250 bar

The power control is factory set. The setting value has to be specified with the order, by stating into the identification code the Nm torque value.

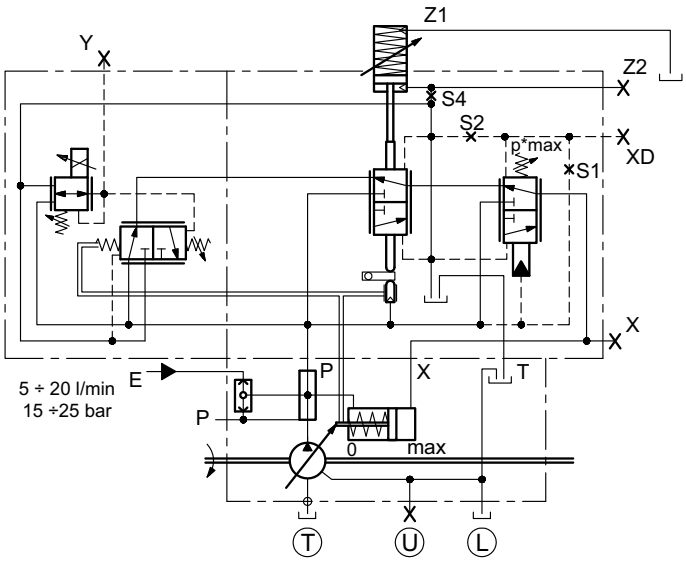
Start of the regulation: looking at values table below.



6.1 - Standardized torque values

PUMPS	ELECTRICAL MOTOR 4 POLES (at 50 Hz)										
	Power [kW]	**18.5**	**22**	**30**	**37**	**45**	**55**	**75**	**90**	**110**	**132**
	N [rpm]	1500									
	torque [Nm]	**118**	**140**	**191**	**236**	**286**	**350**	**477**	**573**	**700**	**840**
105	start of pressure regulation [bar]	63	75	103	127	154	189	-	-	-	-
135		-	-	80	98	119	146	199	239	-	-
210		-	-	-	-	-	94	129	154	188	226
280		-	-	-	-	-	-	96	115	140	169

7 - ET6 - ELECTRO-PROPORTIONAL DISPLACEMENT CONTROL WITH POWER LIMITER AND REMOTE PRESSURE CUT-OFF



The ET6 control is available for pumps HPR105, HPR135, HPR210 and HPR280.

It combines a pump displacement regulation proportional to the current supplied to the solenoid with a constant input torque control. The limitation of maximum pressure is also available.

With no current the pump is in null displacement, so it is required a supply pressure on port E (located on the pump body) for the start of the control.

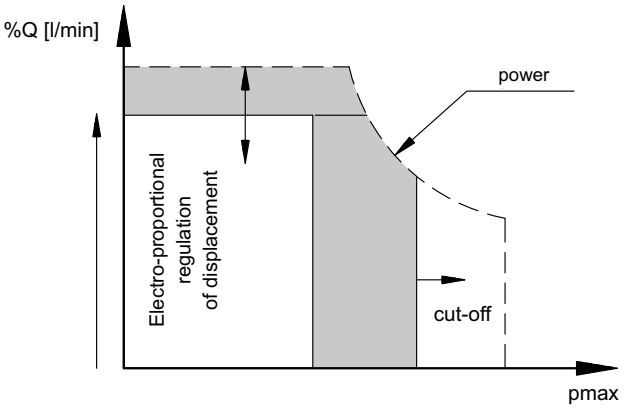
Once the P port is pressurized, then the shuttle valve on the pump excludes the piloting of port E and picks the fluid directly from the pump delivery line.

ET6 FEATURES:

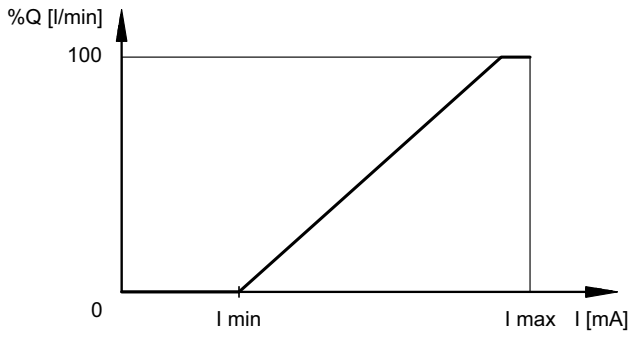
- pressure adjustment range:
  ET6 = 230 ÷ 350 (**standard**)
  default setting = 350 bar

  ET5 = 125 ÷ 230 (on request)
  ET7 = 350 ÷ 420 (on request)

- pressure adjustment range for torque regulation:
  HPR105, HPR135 = 60 ÷ 250 bar
  HPR210, HPR280 = 80 ÷ 250 bar
  default setting = 250 bar



		D12K2	D24K2
Nominal voltage	V CC	12	24
Coil connection	AMP Junior (2 pin)		
Power consumption	W	15,6	
Nominal current	A	1,2	0,6
Relative duty cycle	100%		
Protection class (EN 60529)	IP 67		



regulation	pump	ET1	ET2
I min	**105, 135**	464 mA	232 mA
	210	490 mA	245 mA
	280	524 mA	262 mA
I max	**ALL**	1200 mA	600 mA

8 - PUMPS WITH LP6 CONTROL - OVERALL DIMENSIONS

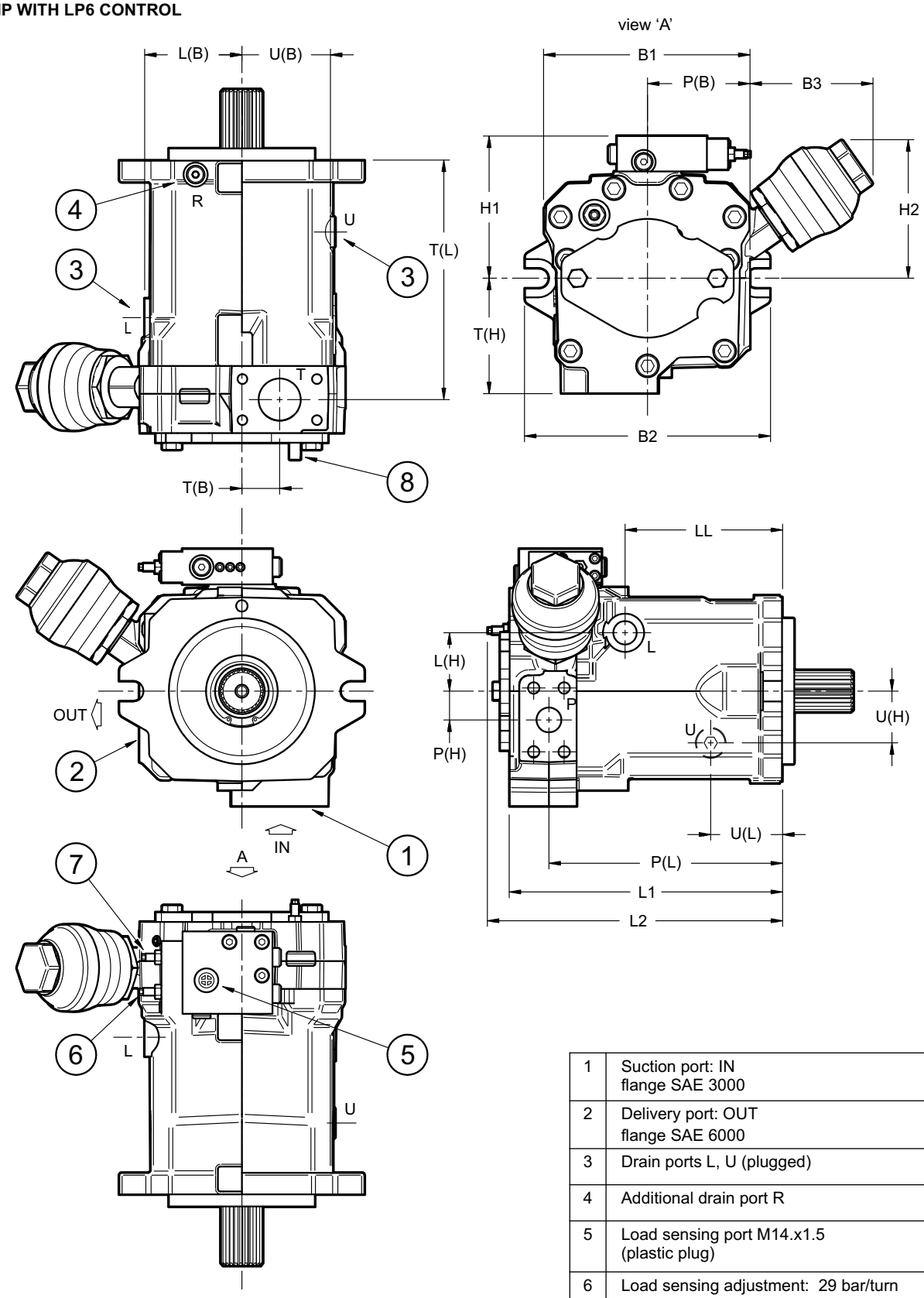
dimensions in mm

PUMP	55	75	105	135	165	210	280
Ø of flange	127			152.4		165.1	
L1	220.3	231.8	262	284.5	333.1	348	403
L2	259.3	270.8	301	323.5	372.1	387	442
H1	137	139	140.5	148.5	165.5	171.5	189
H2	146	146	136	145.5	152.4	143.5	238
B1	11	190.3	199.6	216	251.5	268	306.1
B2	208		207	256	269	268.8	314.5
B3	120	111	122	129	128.9	126.5	125.1

PUMP	55	75	105	135	165	210	280
P delivery (SAE)	3/4”		1”	1¼”		1½”	
P (L)	182.8	194.3	218	243.5	283.1	295	344.5
P (H)	23.5		26	30	43	27	46
P (B)	91	90.5	100	107	134.5	134.5	149.5
T suction (SAE)	1½”		2”	2”	2½”	3”	3½”
T (L)	189.8	201.3	227	249.5	285.6	298	344.5
T (H)	94		103.5	120	119	149	167
T (B)	21		25	30	0	57	
L, U drain ports	M22x1.5			M27x2			M33x2
L (L)	112.8	124.3	142	164	180.6	197.5	215.5
L (H)	52		53	61	65	71.5	80.5
L (B)	86.5		85	101.5	108	128	145
U (L)	72		72	74.5	81.1	83	109
U (H)	44		54	54	62	60	68
U (B)	78.5		92.5	92.5	101	118	129.5
R - additional drain port	M14x1.5, 13 deep (**NOTE**)						

NOTE: If the pump is set vertically with shaft upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

PUMP WITH LP6 CONTROL



1	Suction port: IN flange SAE 3000
2	Delivery port: OUT flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	Load sensing port M14.x1.5 (plastic plug)
6	Load sensing adjustment: 29 bar/turn
7	P*max adjustment: 22.8 bar/turn
8	Max displacement limit adjustment see par. 11

9 - SINGLE PUMPS WITH TL2 CONTROL - OVERALL DIMENSIONS

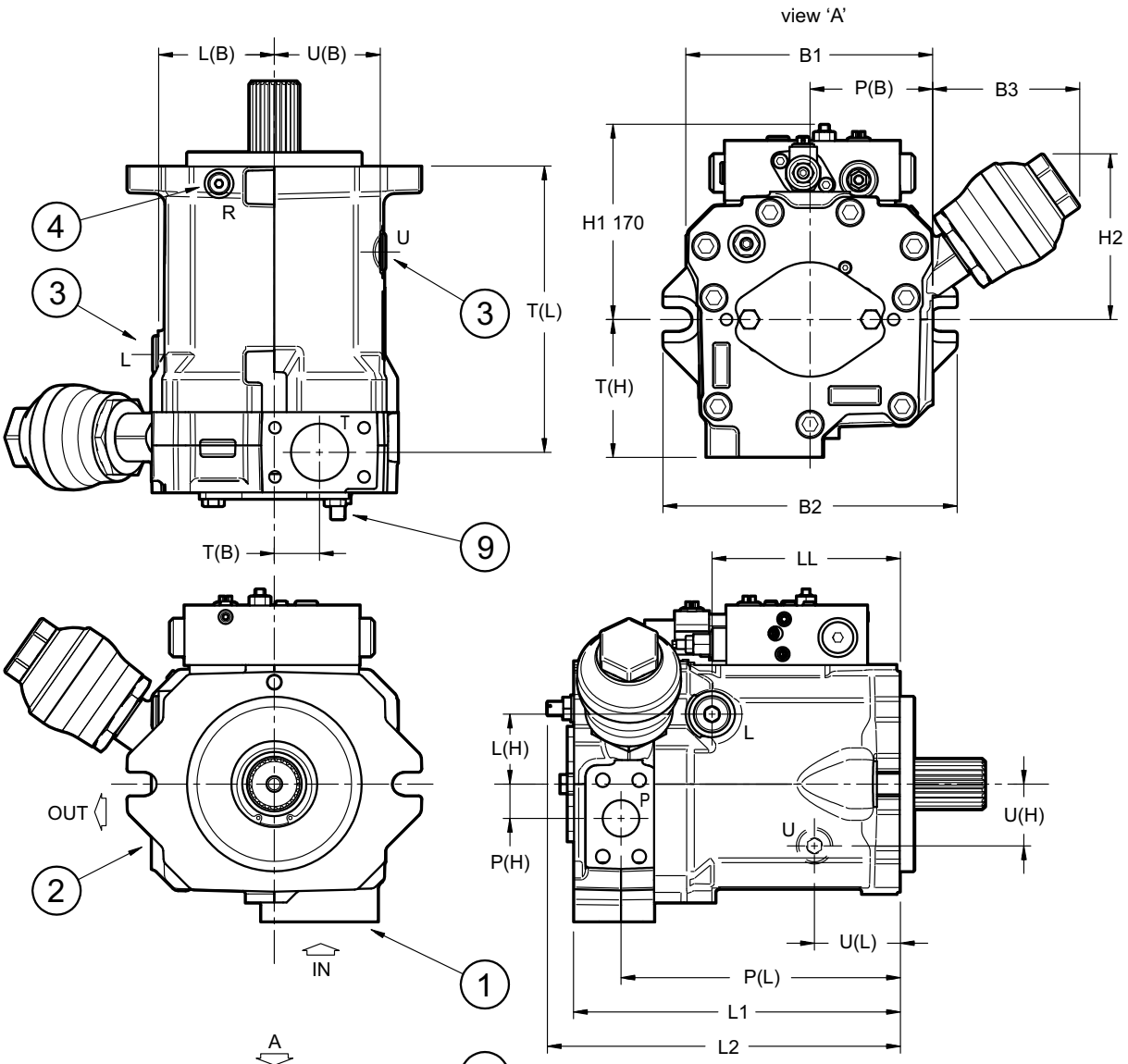
dimensions in mm

PUMP	105	135	210	280
Ø flange	127	152.4	165.1	165.1
L1	262	284.5	348	403
L2	301	323.5	387	442
H1	163	170	193	210.5
H2	134	144	144.3	200.7
H3	104.5	104	135	135
B1	194.5	214.8	266.3	314.5
B2	208	256.5	269	272
B3	118	106.7	102.4	119.5

PUMP	105	135	210	280
P delivery (SAE)	1”	1¼”	1½”	
P (L)	218	243.5	295	344.5
P (H)	26	30	27	46
P (B)	100	107	144.5	154.1
T suction (SAE)	2”	2”	3”	3½”
T (L)	227	249.5	298	344.5
T (H)	104	120	149	167
T (B)	25	39.5	27	44
L, U drain ports	M22x1.5	M27x2	M27x2	M33x2
L (L)	142	164	191	215.5
L (H)	53	61	97.5	80.5
L (B)	92.5	101	128	129.5
U (L)	72	74.5	83	109
U (H)	54	54	60	68
U (B)	85	92	118	159.5
R - additional drain port	M14x1.5 deep 13 (**NOTE**)			

NOTE: If the pump is set vertically with shaft upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

PUMP WITH TL2 CONTROL



1	Suction port: IN flange SAE 3000
2	Delivery port: OUT flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	Load sensing port M14.x1.5 (plastic plug)
6	Z1 port to be connected to the tank. M14.x1.5 (plastic plug)
7	Load sensing adjustment: 18.8 bar/turn
8	Power adjustment: 18.8 bar/turn
9	Max displacement limit adjustment see par. 11

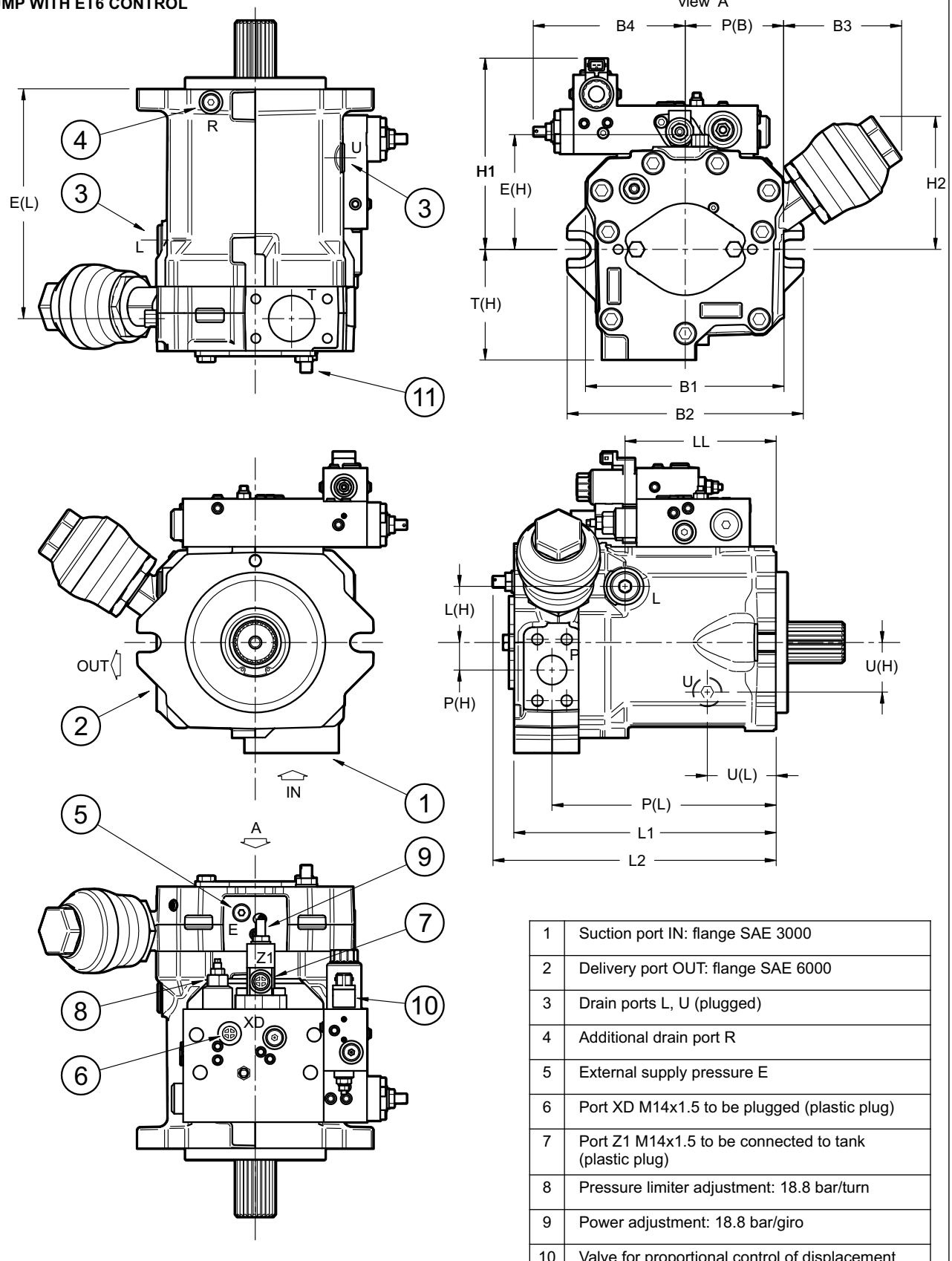
10 - SINGLE PUMPS WITH ET6 CONTROL - OVERALL DIMENSIONS

PUMP	105	135	210	280
Ø flange	127	152.4	165.1	165.1
L1	262	284.5	348	403
L2	301	323.5	387	442
L3	108.9	82.8	138.5	168
H1	200.5	207.5	230.5	248
H2	134	144	144.3	200.7
H3	104.5	104	135	135
B1	194.5	214.8	266.3	314.5
B2	208	256.5	269	272
B3	118	106.7	102.4	119.5
B4	165	165	165	146.5

PUMP	105	135	210	280
P delivery (SAE)	1”	1¼”	1½”	
P (L)	218	243.5	295	344.5
P (H)	26	30	27	46
P (B)	100	107	144.5	154.1
T suction (SAE)	2”	2”	3”	3½”
T (L)	227	249.5	298	344.5
T (H)	104	120	149	167
T (B)	25	39.5	27	44
L, U drain ports	M22x1.5	M27x2	M27x2	M33x2
L (L)	142	164	191	215.5
L (H)	53	61	97.5	80.5
L (B)	92.5	101	128	129.5
U (L)	72	74.5	83	109
U (H)	54	54	60	68
U (B)	85	92	118	159.5
R - additional drain port	M14x1.5 deep 13 (**NOTE**)			
E - external supply pressure	M14.x1.5			
E (L)	240.8	249.5	303	375
E (H)	135.6	142.6	165.6	183.1
E (B)	15	16	20	20

NOTE: If the pump is set vertically with shaft pointing upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

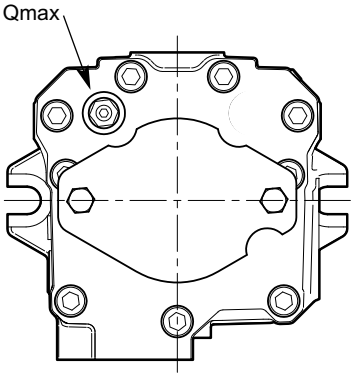
PUMP WITH ET6 CONTROL



1	Suction port IN: flange SAE 3000
2	Delivery port OUT: flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	External supply pressure E
6	Port XD M14x1.5 to be plugged (plastic plug)
7	Port Z1 M14x1.5 to be connected to tank (plastic plug)
8	Pressure limiter adjustment: 18.8 bar/turn
9	Power adjustment: 18.8 bar/giro
10	Valve for proportional control of displacement AMP Junior connection
11	Max displacement limit adjustment see par. 11

11 - MAXIMUM DISPLACEMENT LIMITATION

The max angle for the swash plate is adjustable. The adjustment screw is placed on pump back. Values for pumps with rotary clockwise.

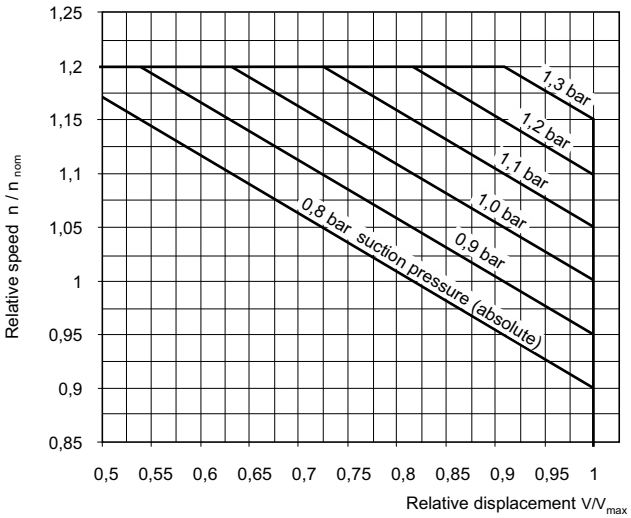


	Q max (cm^3/turn)	displacement range (cm^3)
55	4.9	35 - 55
75	5.2	50 - 75
105	6.2	75 - 105
135	7	105 - 135
165		135 - 165
210	9.4	165 - 210
280		210 - 280

12 - INSTALLATION AND START-UP

It is recommended to install the pump below the oil level and horizontally as shown. For installations above oil level and / or vertically, contact our. technical dept. The maximum allowed input speed is also directly dependent on the suction pressure.

The temperature should not exceed 80 °C in any part of the system.



Suction

- Provide suction/inlet line continuously rising towards the tank.
- Avoid cavitation events providing adequate flooded suction or pressurized inlet should be of adequate supply as to guard against cavitation.
- On designing the suction line attention must be paid to a straight, short conduct largely avoiding bends. If bends are required, the bending radius must be as large as possible. The suction inlet in the hydraulic tank must have as largest section as possible.
- The suction line itself must be installed in such a way that it ends more than ≥100 mm above the tank bottom. In order to enlarge the entry diameter of the suction boss in the hydraulic tank, its end must be cut under 45°. The distance between entry and oil surface must be large enough to avoid air suction, recommended ≥ 200 mm.
- Take care of the tightness of the pipe/hose so that air is not drawn in.

Case drain

- Positive venting is vital for the correct operation of the hydraulic system.
- **The pump must be always filled with oil, both at start-up and during stops, also long term stops.**
- All case drain lines must be mounted continuously rising towards the tank. This allows any entrapped air to escape freely from the pump housing.
- **The highest case drain port of the pump housing (ports U, L and R) must be connected separately to the tank.** As a rule drain lines have to be kept separate from the main return line. The drain line has to enter the hydraulic tank below the oil level.
- The dimension must be ample enough that even at low temperatures the return flow pressure of the leak oil will be near zero. The case pressure (build-up) should not rise and stay higher than 2.5 bar(absolute) during operation.

Piping

- Pipe work should be seamless drawn precision steel tube or hoses of suitable pressure rating.
- During installation, attention should be paid to cleanliness. The pipes must be deburred, washed and blown through.
- Scaled or rusted pipes must be scoured and then neutralized - Hoses must be brushed and flushed through when contaminated.

Cleanliness

- Oil tank and installation have to be checked again for cleanliness before the hydraulic medium is added. This procedure has to be performed immediately before pouring takes place. It may even be expedient to flush the entire installation! Make sure that the pressure fluid corresponds to the required grade of cleanliness.

Drive rotation

- **Before starting the engine** make sure that the HPR-02 pump will be driven with the correct direction of rotation. With electric motors, it must be checked that the electrical connections are correct.

Filling pump and circuit:

- The initial filling of the system must be carried out in such a way that all of the air can escape from the high pressure circuit and from the pump housing before the hydraulic units are operated.
- **The suction port and the casing of the HPR-02 are not related to each other.** Before the hydraulic components may be exposed to load, the entire circuit must be filled and vented.

- Manually fill the HPR-02 pump at the most accessible case drain port with filtered oil. Manually fill the high pressure line with filtered oil. Fill the oil tank to the maximum level with filtered oil and fill all motor housings to the maximum level via the most accessible case drain port with filtered oil.

Start-up

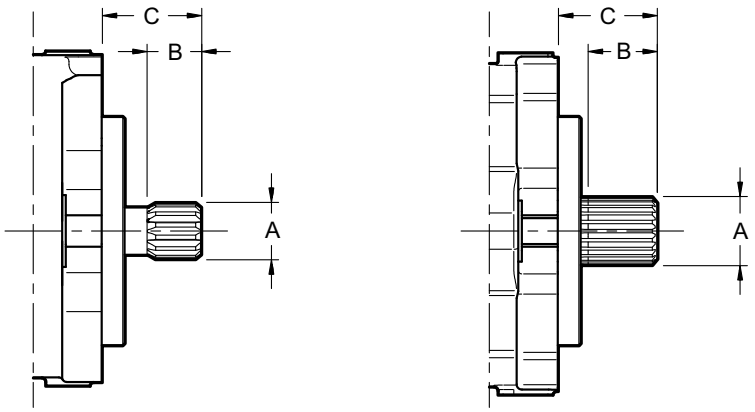
- If there is an on/off valve in the suction line, make sure it is completely open before starting the engine.
- Start the electric motor and allow the HPR-02 to rotate for 5 seconds.
- Switch engine off and check fluid level in the tank. Top off if necessary. Before restarting the engine, check the installation for tightness.
- Repeat previous steps at least four more times.
- Start the electric motor, then slowly actuate the pump function to allow the pump to increase to maximum displacement. Leave the function fully actuated for 30 seconds, and then repeat the step three times.
- Warm the system up by steadily increasing the pressure so as to allow any air to be purged from the fluid.
- Check the HPR-02 stand-by pressure, load sense margin pressure, pressure compensator setting (if applicable) and maximum flow setting when the hydraulic oil reaches its normal operating temperature.
- Check the oil level in the tank and refill with filtered oil if necessary before delivery of the machine.

13 - FLANGES AND SHAFTS

13.1 - Mounting flanges and splined shafts available as standard (SAE J774)

PUMP	**55**	**75**	**105**	**135**	**165**	**210**	**280**
Front mounting flange	SAE C - 2 holes			SAE D - 2 holes (**NOTE**)		SAE E - 4 holes	
Pilot diameter	127			152,4		165,1	
Shaft	SAE C 14 t 12/24 DP		SAE C-C 17 t 12/24 DP	SAE D 13 t 8/16 DP		SAE F 15t 8/16 DP	
	-	21t 16/32	23t 16/32	27t 16/32		-	

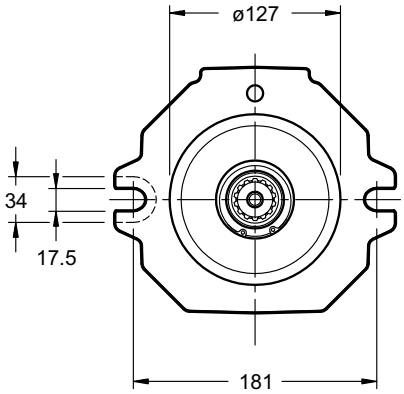
NOTE: HPR165 has also 4 additional holes Ø17.5



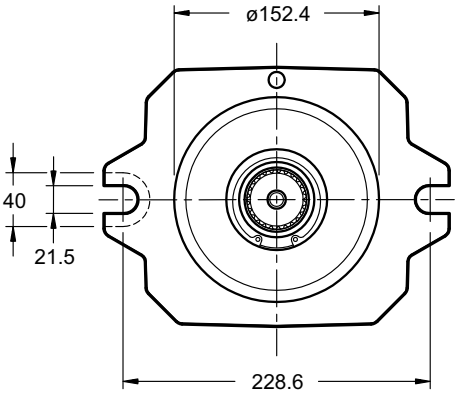
Shaft	**SAE- J744 code**	**Type**	**A**	**B**	**C**				
					HPR 55	**HPR 75**	**HPR 105**	**HPR 135 /165**	**HPR 210 / 280**
14 T 12/24 DP	SAE C	with undercut	31.22	30	54	55	-	-	-
21t 16/32		no undercut	34.51	39.5	-				
17 t 12/24 DP	SAE C-C	with undercut	37.68	30		-	55		
23t 16/32		no undercut	37.68	38.5					
13 t 8/16 DP	SAE D	with undercut	43.71	50			-	75	
27t 16/32		no undercut	44.05	62					
15t 8/16 DP	SAE F	no undercut	50.06	58				-	75

13.2 - Flanges

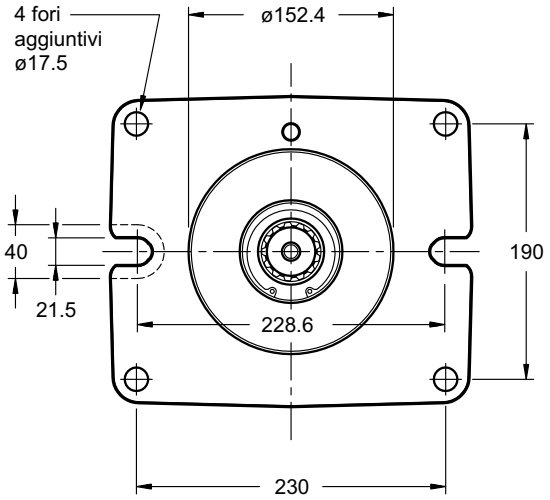
SAE C, 2 holes
for HPR 55, 75, 105



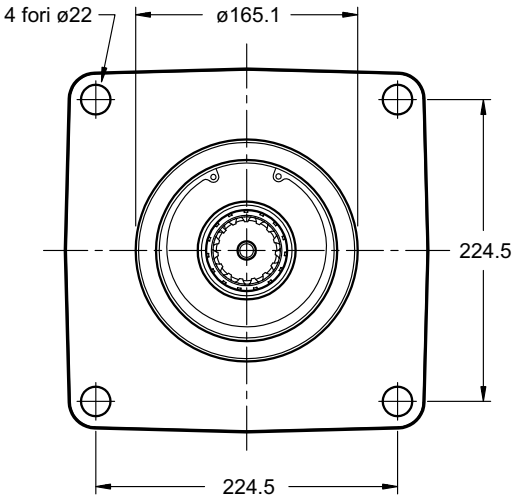
SAE D, 2 holes
for HPR 135



SAE D, 2 +4 holes
for HPR 165



SAE E - 4 holes
for HPR 210 and 280



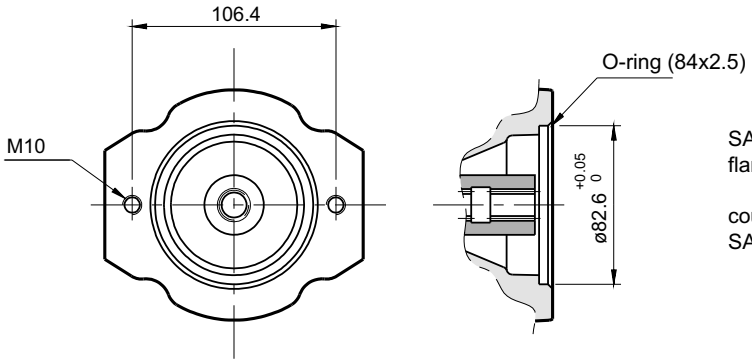
PUMP	55	75	105	135	165	210	280
flange thickness near fastening holes (mm)	20				25	26	30

14 - PTO - POWER TAKE OFF

The HPR pumps can be supplied with a power take-off SAE J744 type, which allows coupling with other pumps models. As for identification see par. 1 “Identification code”.

SAE A

identification code **A09**

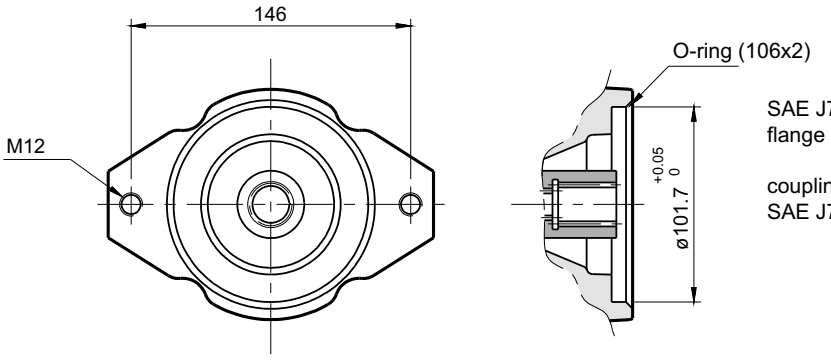


SAE J744 - 2 holes intermediate flange type “A”

coupling for splined shaft SAE J744 16/32 D.P. - 9T

SAE B

identification code **B13**

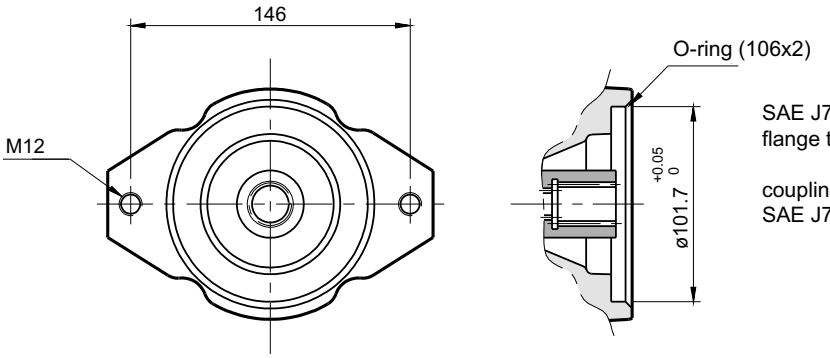


SAE J744 - 2 holes intermediate flange type “B”

coupling for splined shaft SAE J744 16/32 D.P. - 13T

SAE BB

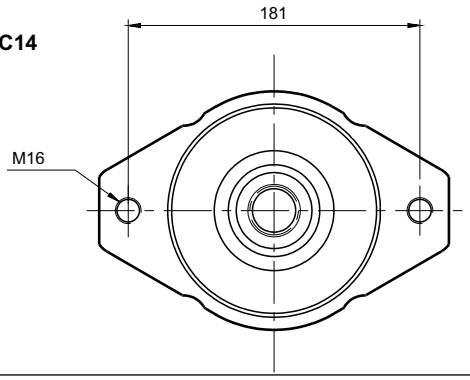
identification code **B15**

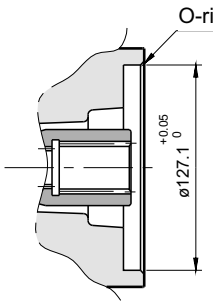


SAE J744 - 2 holes intermediate flange type “B”

coupling for splined shaft SAE J744 16/32 D.P. - 15T

SAE C
identification code **C14**



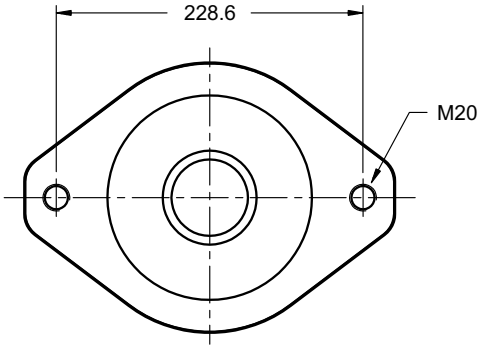


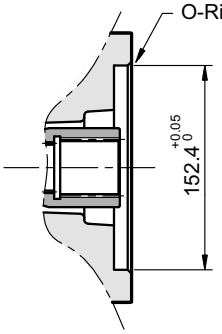
SAE J744 - 2 holes intermediate flange type “C”

coupling for splined shaft
SAE J744 12/24 D.P. - 14T

SAE D
identification code **D27**

HPR 135

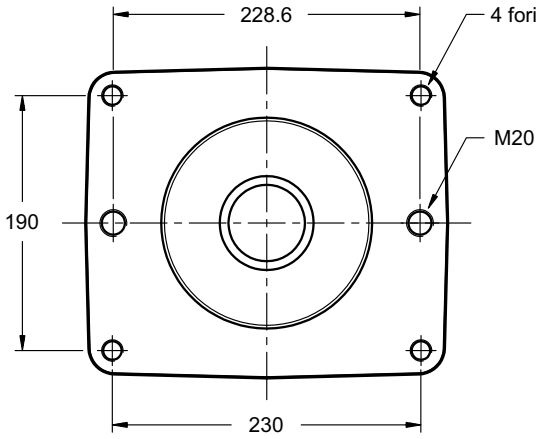


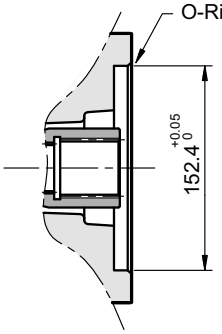


SAE J744 - 2 holes intermediate flange type “D”

coupling for splined shaft
SAE J744 16/32 D.P. - 27T

HPR 165 / 210

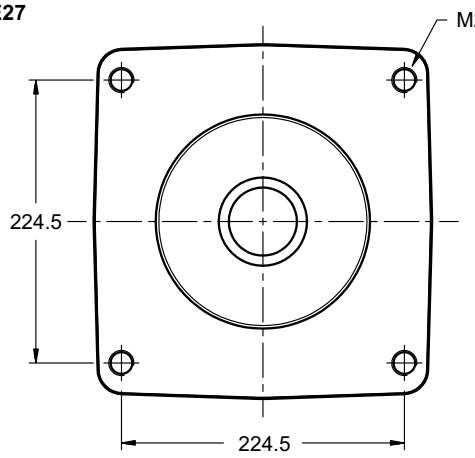


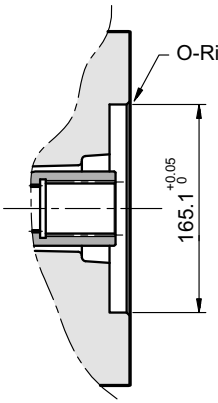


SAE J744 - 2 holes intermediate flange type “D”

coupling for splined shaft
SAE J744 16/32 D.P. - 27T

SAE E
identification code **E27**





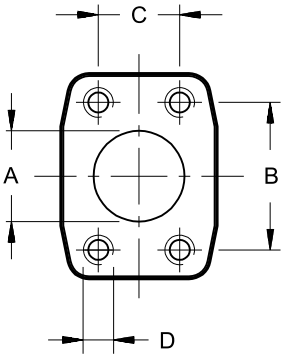
SAE J744 - 4 holes intermediate flange type “E”

coupling for splined shaft
SAE J744 16/32 D.P. - 27T

15 - SUCTION AND DELIVERY PORTS DIMENSIONS FOR SAE FLANGE WITH METRIC BOLTS

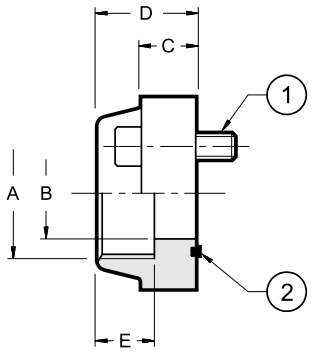
T - SUCTION (SAE 3000)					
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** Threading and depth mm
55, 75	1 ½”	38	69.9	35,7	M12x16
105	2”	50	77,8	42.9	M12x16
135	2”	50	77,8	42.9	M12x17
165	2 ½”	64	88,9	50,8	*M12x21.5
210	3”	76.2	106,4	61,9	M16x28.5
280	3 ½””	90	120.7	69,9	M16x29

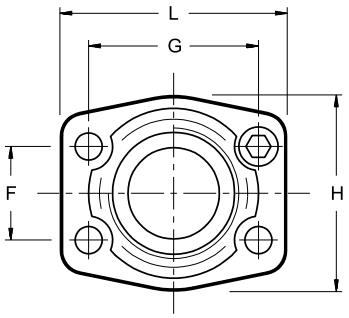
P - DELIVERY (SAE 6000)					
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** Threading and depth mm
55, 75	3/4”	19	50,8	23,5	M10x17
105	1”	21	57,2	27,8	M12x17
135	1 ¼”	32	66.7	31.8	M14x19
165	1 ¼”	32	66,6	31.8	*M12x18.5
210	1 ½”	38.1	79,3	36,5	M16x25.5
280	1 ½”	38.1	79,3	36,5	M16x29



(*) deviation from standard

16 - CONNECTION FLANGES





dimensions in mm
The fastening bolts and the O-Rings must be ordered separately

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 SHC screws	2
SAE 3000	0610714	SAE - 1 ½”	210	1 ½” BSP	38	25	45	24	35,7	70	78	94	n° 4 - M12x40	OR 4187 (47.22x3.53)
	0610721	SAE - 2”	210	2” BSP	51	25	45	30	43	77,8	90	102	n° 4 - M12x40	OR 4225 (56.74x3.53)
	0610722	SAE - 2 ½”	172	2 ½” BSP	63	25	50	30	50,8	89	105	116	n° 4 - M12x45	OR 4275 (69,44x3.53)
	0610723	SAE - 3”	138	3” BSP	73	27	50	34	61,9	106,3	124	134	n° 4 - M16x55	OR 4337 (85.32x3.53)
	0610724	SAE - 3 ½”	34	3 ½” BSP	89	27	48	34	69,8	120,6	136	152	n° 4 - M16x55	OR 4387 (98,02x3.53)
SAE 6000	0770075	SAE - 3/4”	420	3/4” BSP	19	21	35	22	23,8	50,8	55	71	n° 4 - M10x35	OR 4100 (24.99x3.53)
	0770092	SAE - 1”	420	1” BSP	25	25	42	24	27,7	57,1	65	81	n° 4 - M12x40	OR 4131 (32.93x3.53)
	0770106	SAE - 1 ¼”	420	1 ¼” BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x45	OR 4150 (37.69x3.53)
	0773462	SAE - 1 ½”	420	1 ½” BSP	38	30	94	26	36,5	79,3	94	112	n° 4 - M16x55	OR 4187 (47.22x3.53)

DUPLOMATIC MOTION SOLUTIONS

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