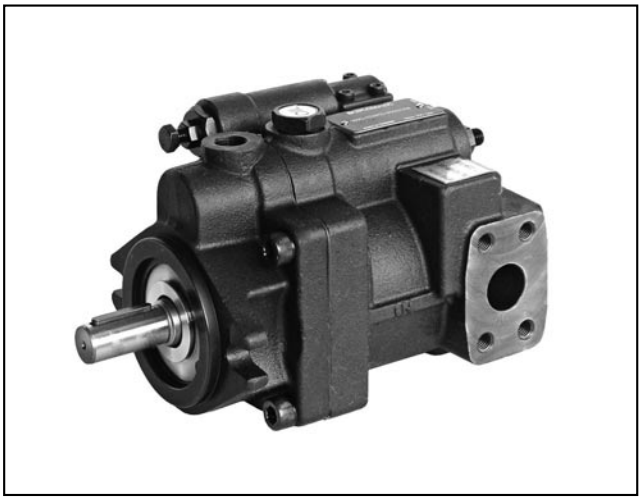
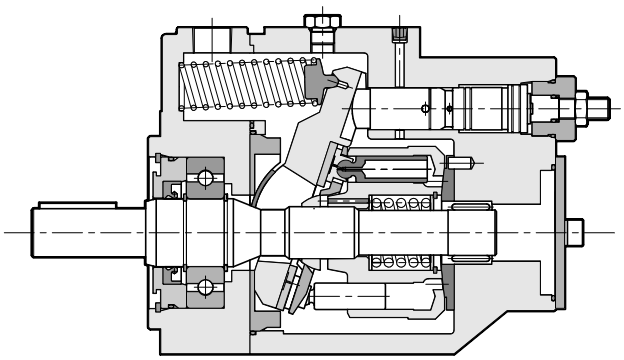


VPPL

VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS FOR MEDIUM PRESSURE

SERIES 20

OPERATING PRINCIPLE



— The VPPL are variable-displacement axial piston pumps with swash plate, suitable for medium-pressure open-circuit applications.

— They are available in seven sizes, with displacements of 8, 16, 22, 36, 46, 70 and 100 cm³/rev.

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

— The pumps are supplied with a 2-holes mounting flange and cylindrical keyed shaft in accordance with SAE J744 standard.

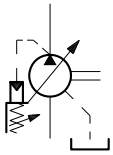
— Four types of regulators are available, to be selected according to the specific application requirements.

TECHNICAL SPECIFICATIONS

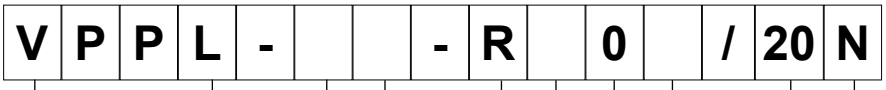
PUMP SIZE		008	016	022	036	046	070	100
Maximum displacement	cm³/rev	8	16	22	36	46	70	100
Maximum flow rate at 1500 rpm	l/min	12	24	33	54	69	105	150
Maximum operating pressure	bar	210					280	
Rotation speed	rpm	min 500 - max 2000					min 500 - max 1800	
Direction of rotation		clockwise						
Hydraulic connections		BSPP threaded ports / SAE flanges						
Type of mounting		SAE flange J744 - 2 holes						
Oil volume in the pump body	dm³	0,2	0,3		0,6		1	1,8
Mass (PC control)	kg	9	13	13	21	23	43	62

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

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE



Variable displacement axial piston pump for medium pressure

Pump size:
008 = 8 cm^3/rev
016 = 16 cm^3/rev
022 = 22 cm^3/rev
036 = 36 cm^3/rev
046 = 46 cm^3/rev
070 = 70 cm^3/rev
100 = 100 cm^3/rev

Control type:
PC* = pressure compensator
5 p max 210 bar for VPPL-008, 016, 022, 036, 046
6 p max 280 bar for VPPL-070 and 100
PCR = remote-controlled pressure compensator
PQC = pressure and flow compensator (load sensing)
PCX* = regulator prepared for pressure control devices
5 p max 210 bar for VPPL-008, 016, 022, 036, 046
6 p max 280 bar for VPPL-070 and 100

Clockwise rotation (seen from the shaft side)

Mounting flange:
0 = SAE-2 type for VPPL-008, 016, 022, 036 and 046
1 = SAE-4 type for VPPL-070 and VPPL 100
(dimensions of VPPL-070 are not standardized)

Shaft end type:
cylindrical keyed SAE J744

Hydraulic connection
S = suction / delivery with SAE flanged ports and metric bolts; drain port with BSP thread (not available for VPPL-008)
B = BSP threaded ports (only for VPPL-008)

Series no:
(the overall and mounting dimensions remain unchanged from 20 to 29)

NBR sealing rings for mineral oils

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 - Fluid contamination degree

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 recommended.

A degree of maximum fluid contamination according to ISO 4406:1999 class 20/16/13 is advised to ensure optimum pump service life. Accordingly, a filter with a $\beta_{10} \geq 100$ is recommended.

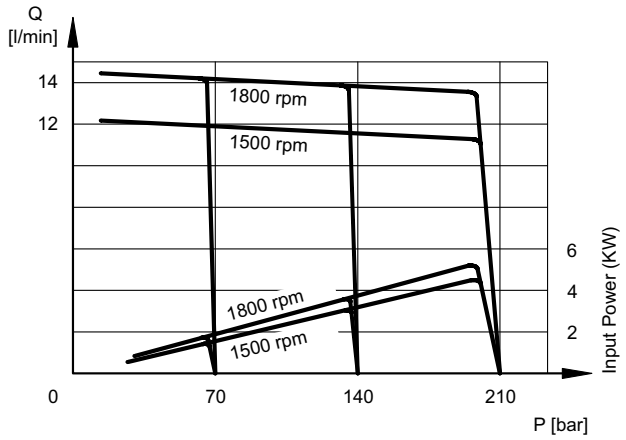
For the installation of a filter on the suction line, see point 10. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator, and it should be oversized to prevent cavitation issues.

3 - CHARACTERISTIC CURVES

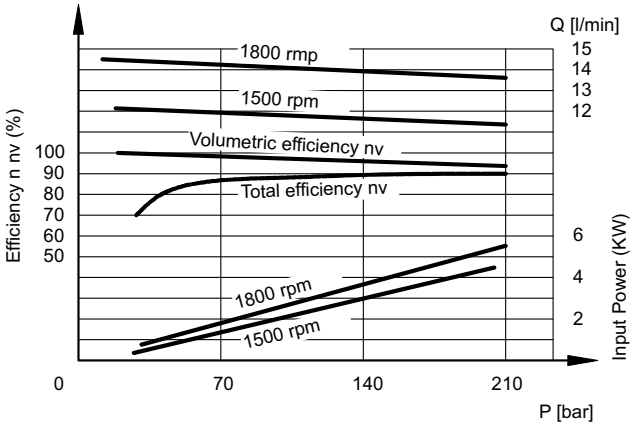
(values obtained with mineral oil with viscosity of 36 cSt at 50 °C)

3.1 - VPPL-008 pump characteristic curves

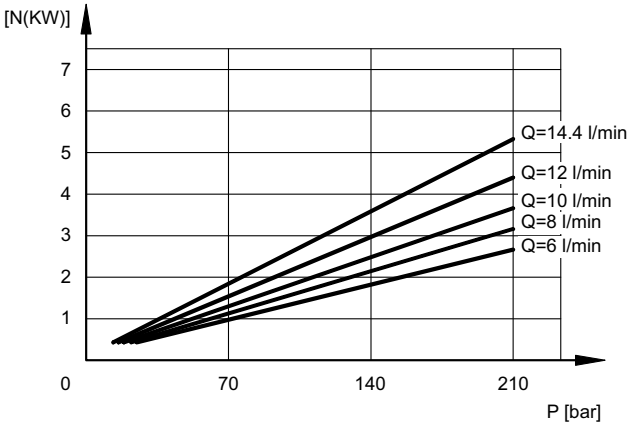
FLOW RATE / PRESSURE CURVES



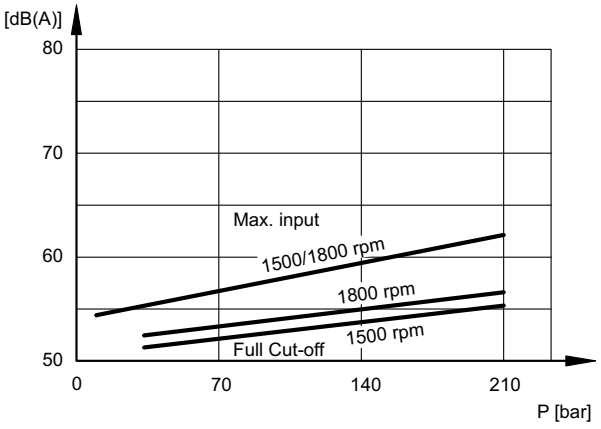
VOLUMETRIC AND TOTAL EFFICIENCY



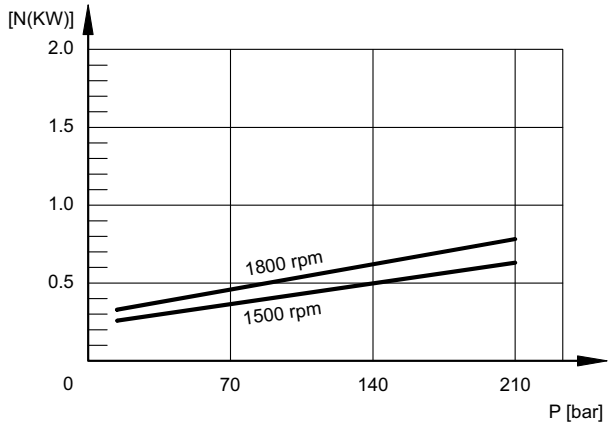
ABSORBED POWER



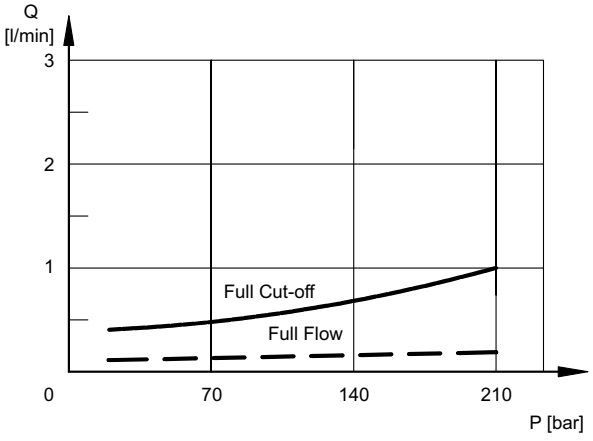
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

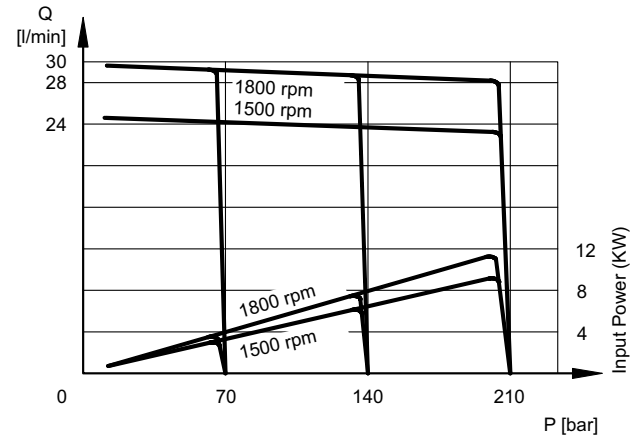


DRAIN FLOW RATE

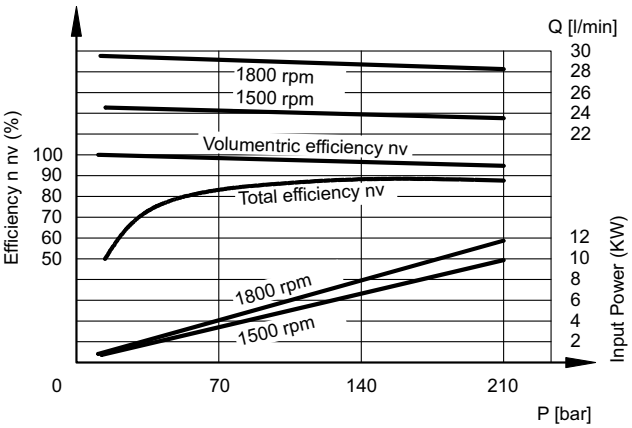


3.2 - VPPL-016 pump characteristic curves

FLOW RATE / PRESSURE CURVES



VOLUMETRIC AND TOTAL EFFICIENCY



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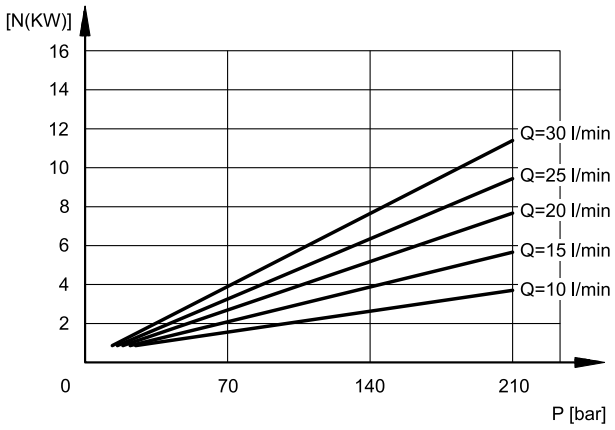
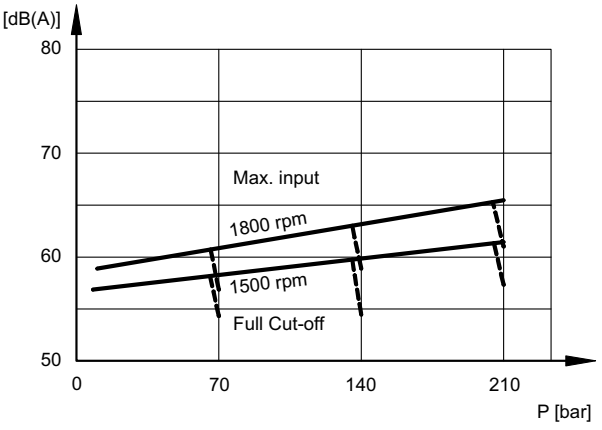
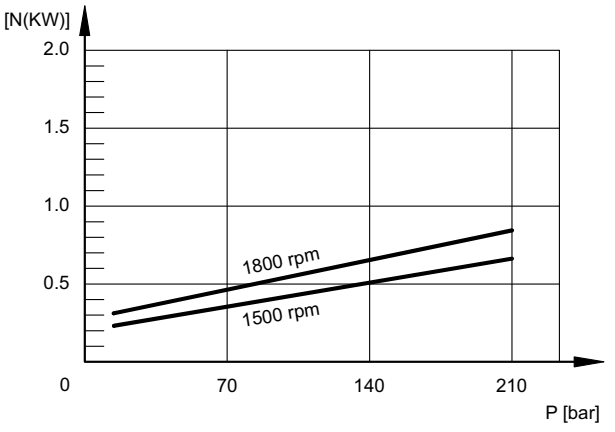


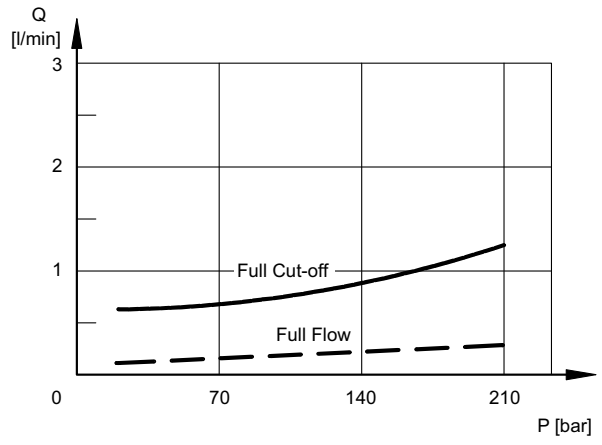
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

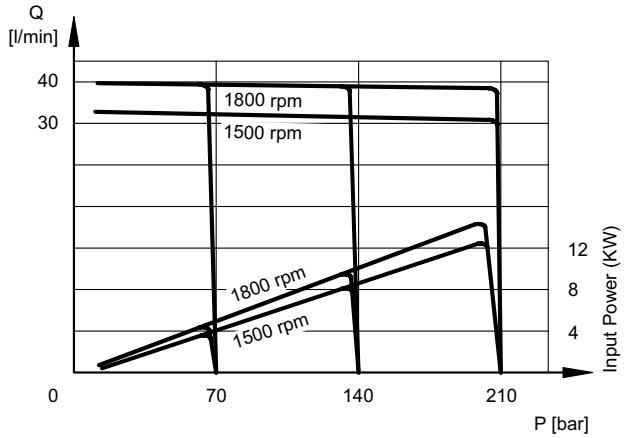


DRAIN FLOW RATE

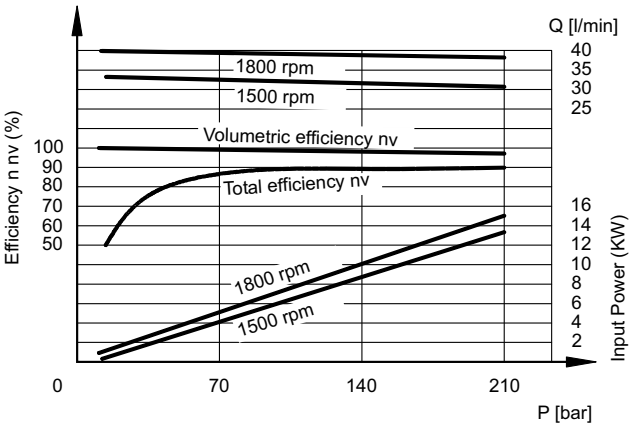


3.3 - VPPL-022 pump characteristic curves

FLOW RATE / PRESSURE CURVES



VOLUMETRIC AND TOTAL EFFICIENCY



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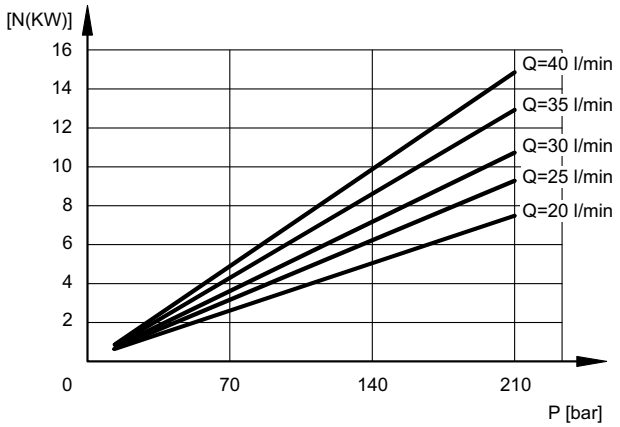
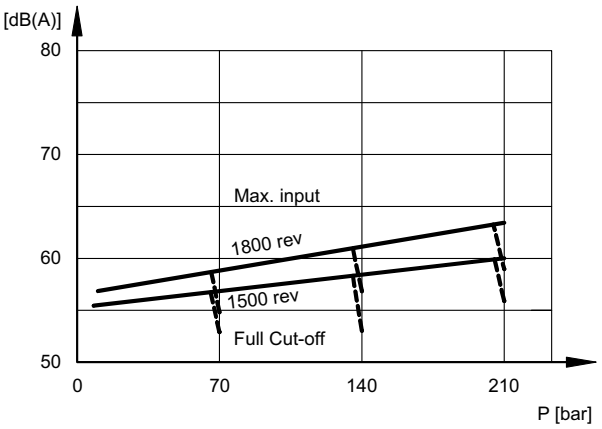
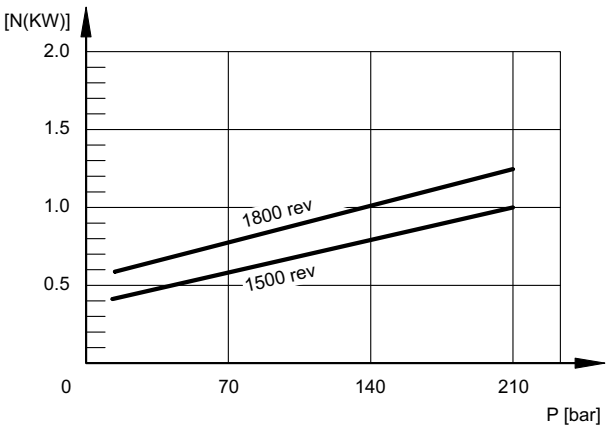


NOISE LEVEL



INPUT POWER AT FULL CUT-OFF



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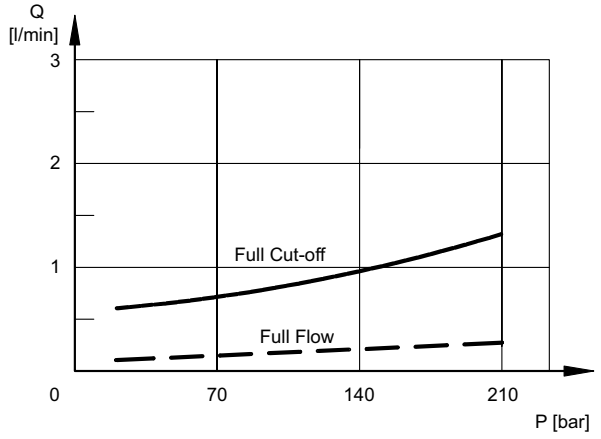
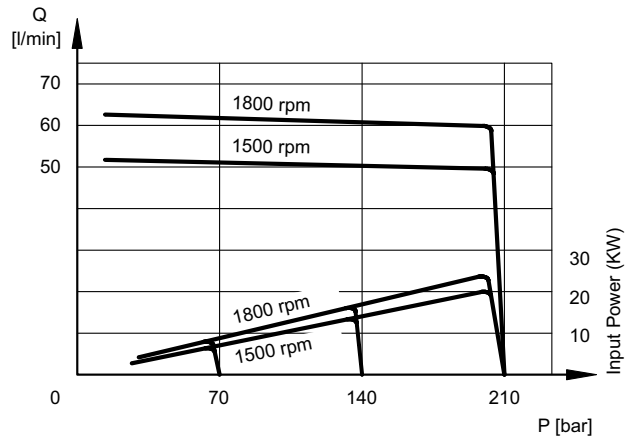
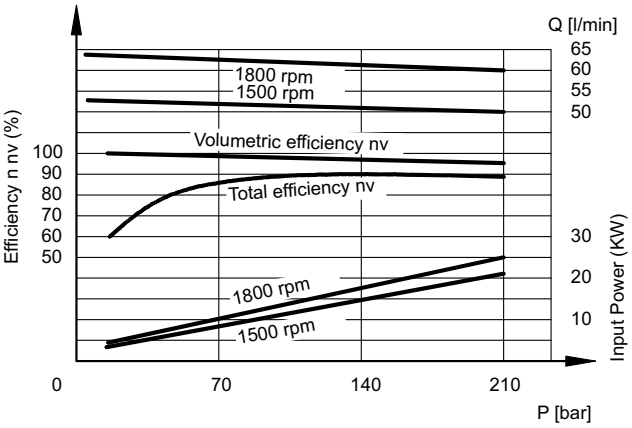


3.4 - VPPL-036 pump characteristic curves

FLOW RATE / PRESSURE CURVES



VOLUMETRIC AND TOTAL EFFICIENCY



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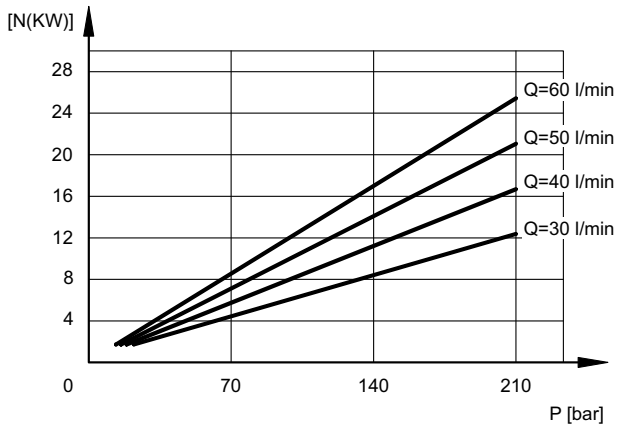
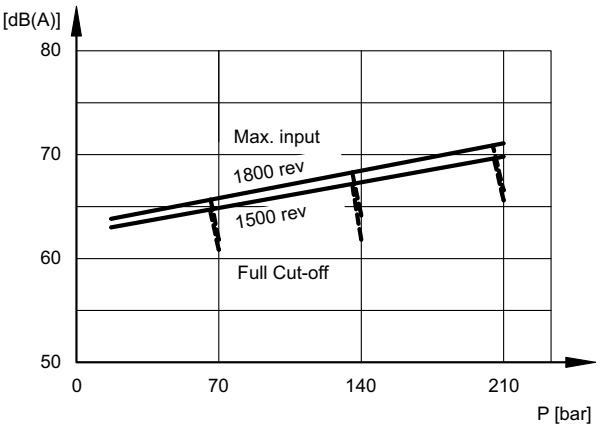


NOISE LEVEL



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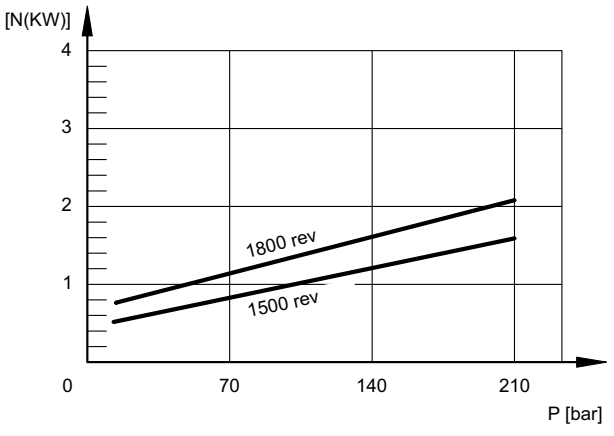
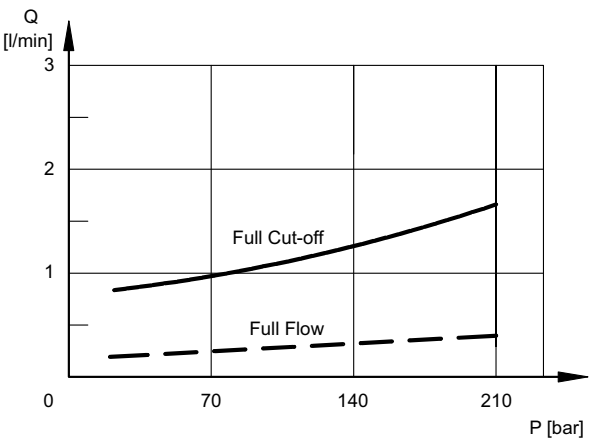
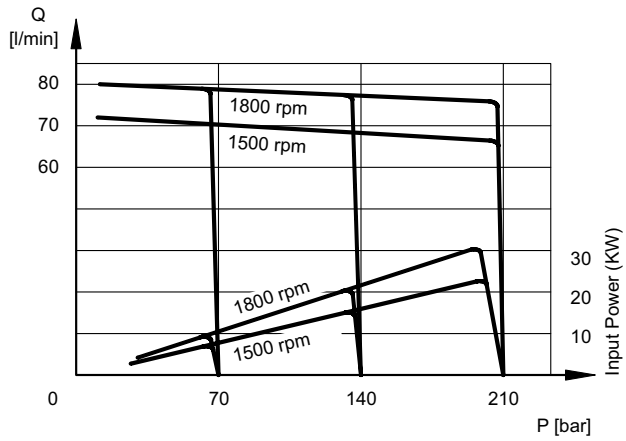


DRAIN FLOW RATE

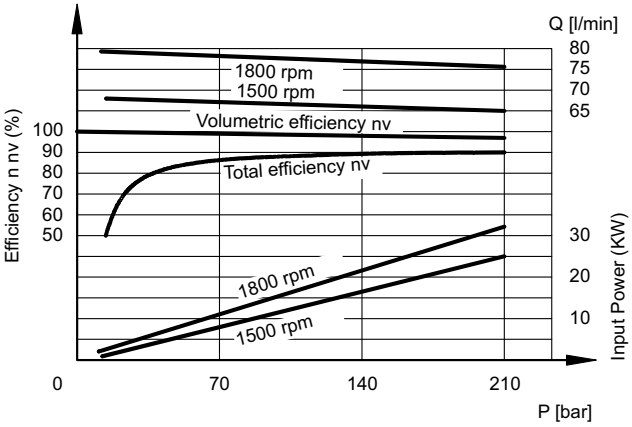


3.5 - VPPL-046 pump characteristic curves

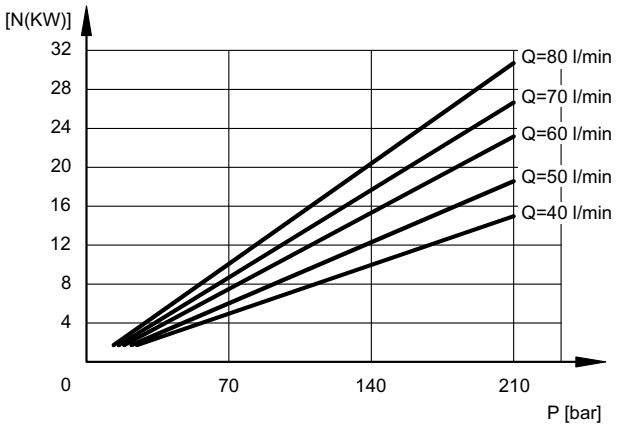
FLOW RATE / PRESSURE CURVES



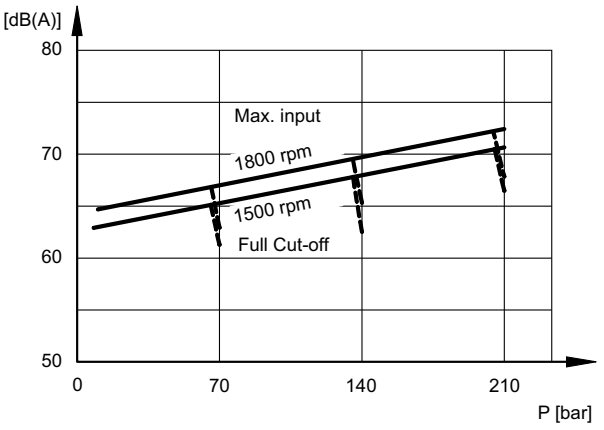
VOLUMETRIC AND TOTAL EFFICIENCY



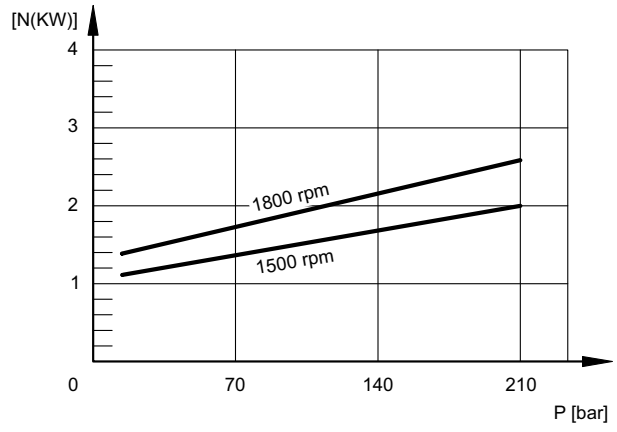
ABSORBED POWER



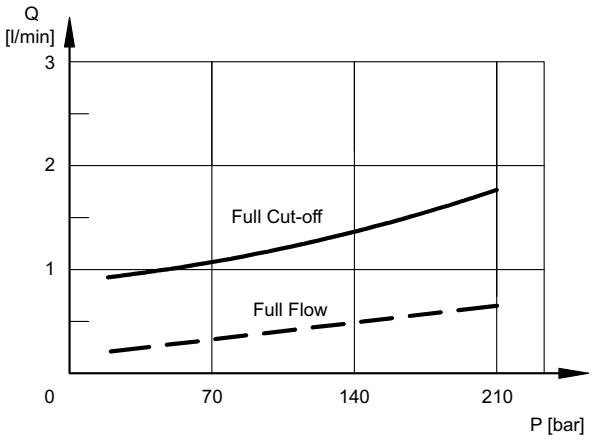
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

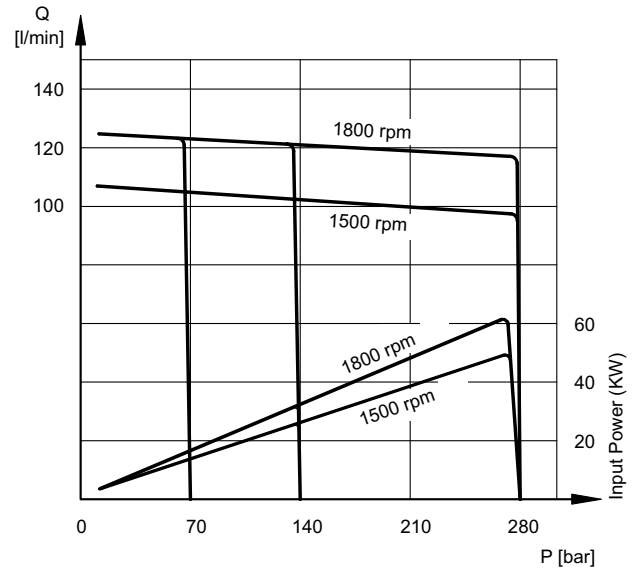


DRAIN FLOW RATE

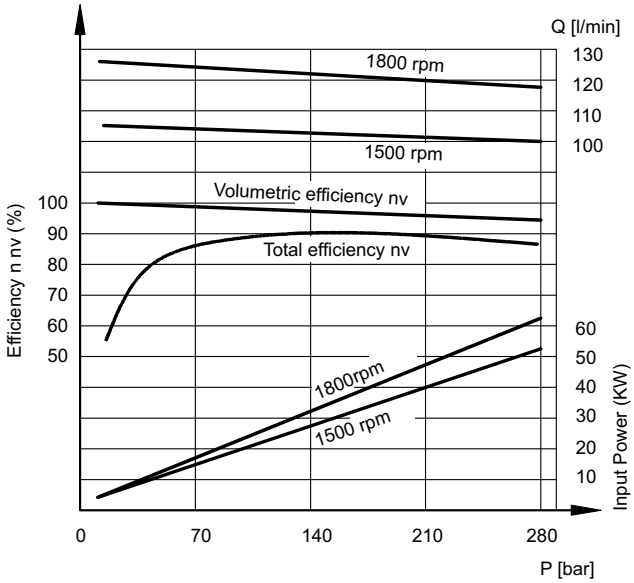


3.6 - VPPL-070 pump characteristic curves

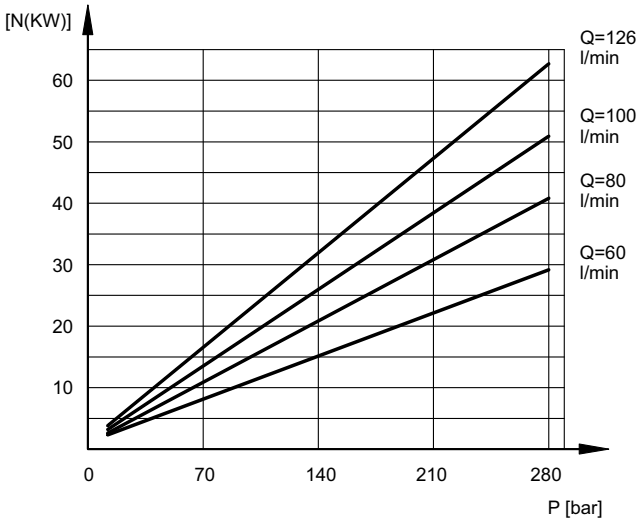
FLOW RATE / PRESSURE CURVES



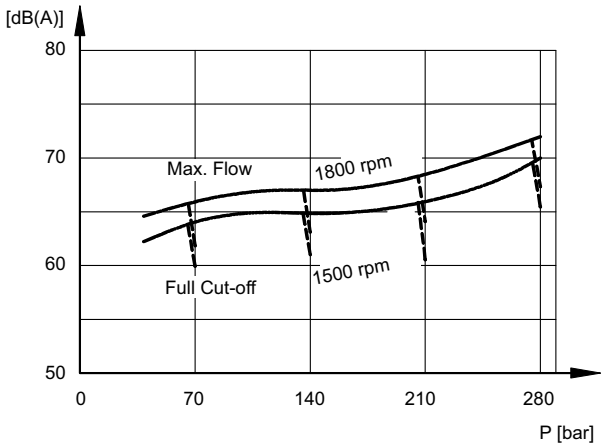
VOLUMETRIC AND TOTAL EFFICIENCY



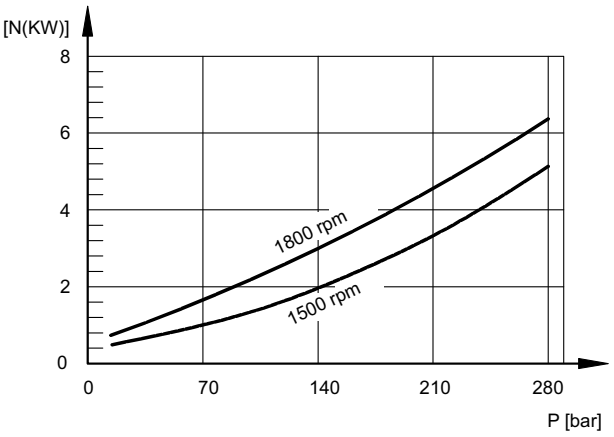
ABSORBED POWER



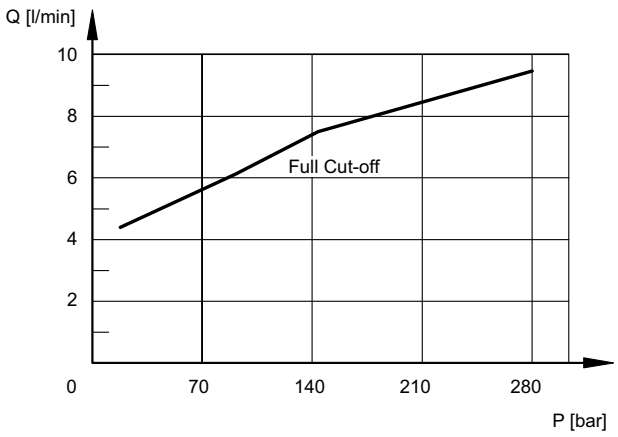
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

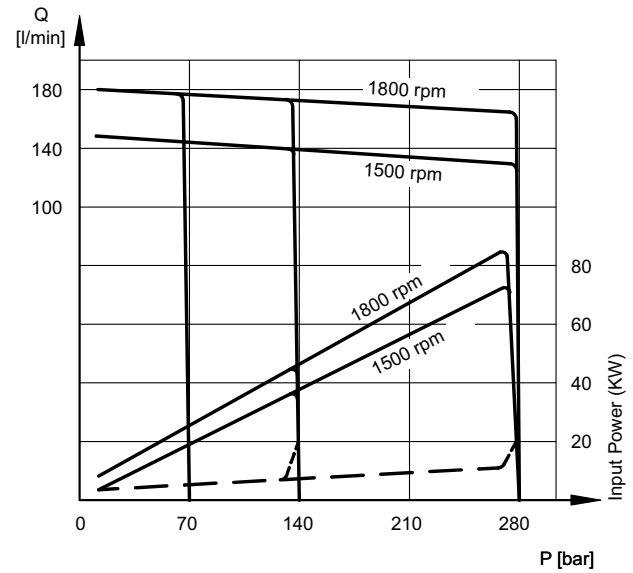


DRAIN FLOW RATE

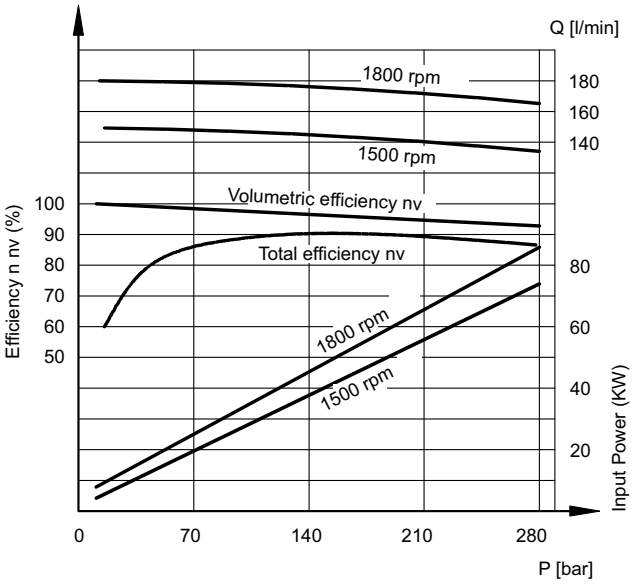


3.7 - VPPL-100 pump characteristic curves

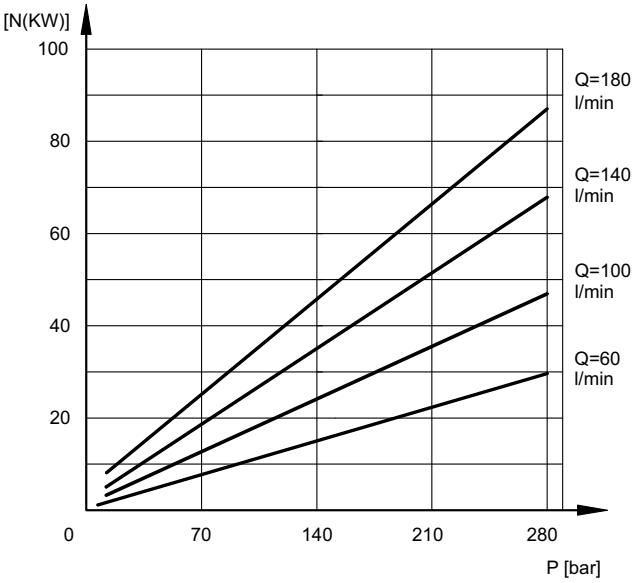
FLOW RATE / PRESSURE CURVES



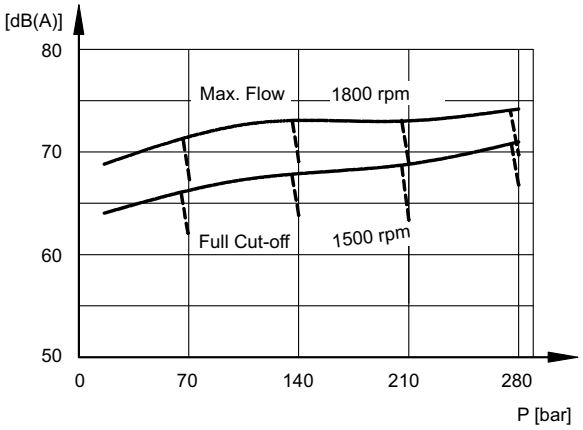
VOLUMETRIC AND TOTAL EFFICIENCY



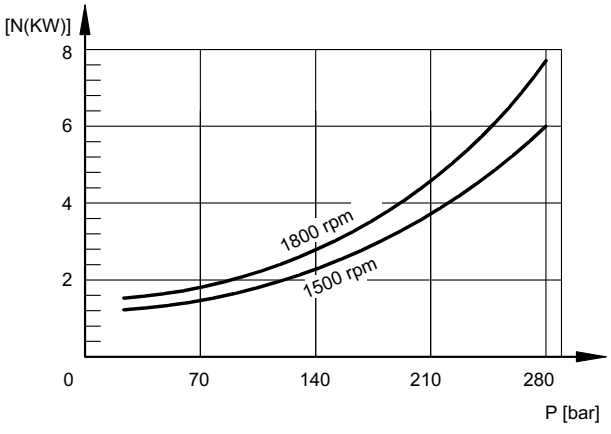
ABSORBED POWER



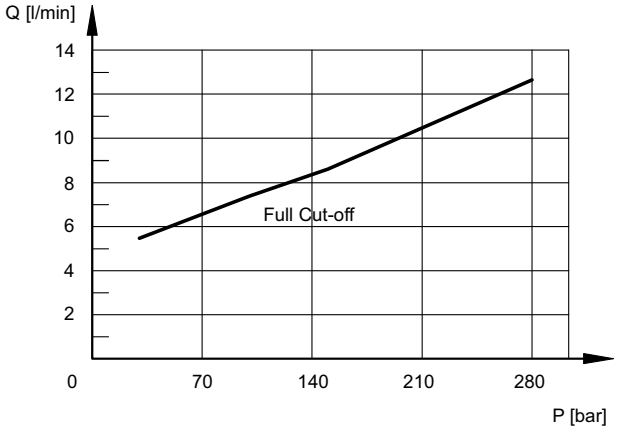
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

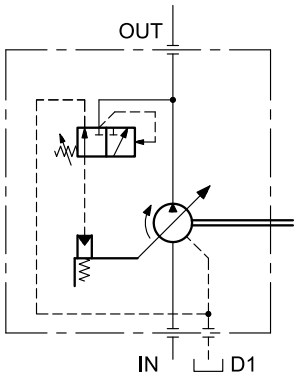


DRAIN FLOW RATE



4 - CONTROLS

4.1 - PC* pressure compensator



The PC* pressure compensator keeps the system pressure constant at the selected set value by automatically adapting the pump flow rate according to the actual system demand.

The desired pressure is set manually by turning the adjustment screw on the compensator.

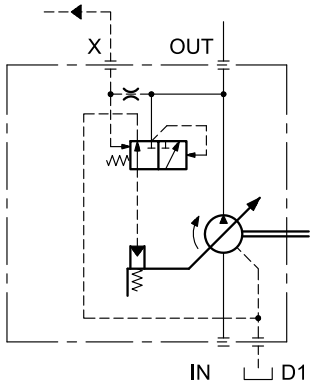
- clockwise rotation increases the set pressure.

- pressure adjustment range:
  PC5 = 30 ÷ 210 bar (for VPPL-008, 016, 022, 036 and 046)
  pressure increase per turn of the screw: 69 bar
  PC6 = 30 ÷ 280 bar (for VPPL-070 and VPPL-100)
  pressure increase per turn of the screw: 78 bar

- factory setting:
  minimum value of the pressure range, maximum displacement.

4.2 - PCR* remote-controlled pressure compensator

hydraulic diagram for displacements
008, 016, 022, 036 and 046



The PCR pressure compensator keeps the system pressure constant at the selected set value by automatically adapting the pump flow rate according to the actual system demand, through a remote control connected to port X of the pump ((a typical arrangement for submerged pumps).

The pressure is determined by the regulating valve installed in the external circuit; therefore, the adjustment screw on the compensator must not be modified

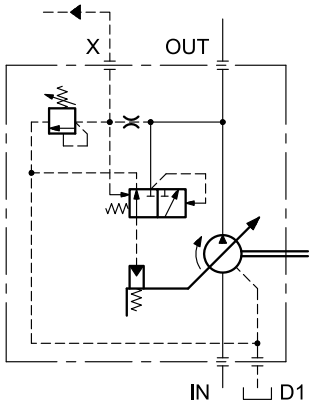
NOTE: If the remote control is implemented using a pressure-regulating valve, it is recommended to use a direct-acting type, properly sized for the pilot flow rate.

The length of the line between the remote control device and port X of the pump must not exceed 2 m.

PCR for VPPL-008, 016, 022, 036 and 046:

- pressure adjustment range = 30 ÷ 210 bar
- required flow rate for pilot signal at X port = 1,5 l/min (approx.)
- factory-set differential pressure: 15 bar

hydraulic diagram for displacements 070 and 100

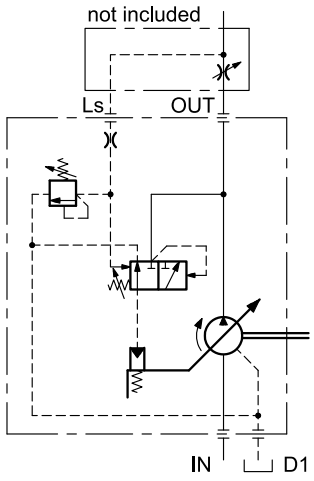


PCR for VPPL-070 and VPPL-100:

The VPPL-070 and VPPL-100 pumps also feature a pressure relief valve on the delivery line.

- pressure adjustment range = 30 ÷ 280 bar
- pressure increase per turn of the relief valve adjustment screw: 78 bar
- required flow rate for pilot signal at X port = 1,5 l/min (approx.)
- factory-set differential pressure: 15 bar

4.3 - PQC pressure and flow compensator (Load Sensing)



The PQC compensator, in addition to providing pressure control like the PC* type, regulates the pump flow rate according to the pressure drop (Δp) across a throttle (or valve) installed in the working line.

N.B. The connecting line between port X and the downstream side of the throttle (or valve) must always be arranged and installed by the customer.

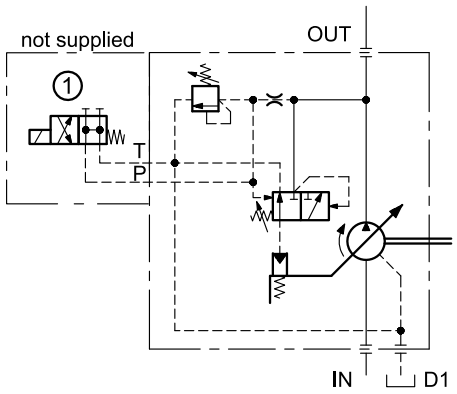
- pressure adjustment range:
  15 ÷ 210 bar for VPPL-008, 016, 022, 036 and 046
  15 ÷ 280 bar for VPPL-070 and VPPL-100
- pressure increase per turn of the adjustment screw: 78 bar
- factory-set differential pressure: 15 ÷ 16 bar (**NOTE**)
- minimum delivery pressure = 15 bar

NOTE: This factory setting ensures the delivery of the pump's nominal flow in most applications.

In circuits with high pressure drops or undersized valves, it may be necessary to increase the value (up to 28 bar) to guarantee maximum flow delivery.

4.4 - PCX* - Regulator prepared for pressure-control devices (unloading or proportional pressure control)

hydraulic diagram for electrical pump unloading at minimum pressure



The PCX* regulator, when combined with a two position solenoid valve with an ISO 4401-03 mounting surface (to be ordered separately and installed directly on the compensator), allows the pump to be electrically switched to zero displacement and with the minimum delivery pressure.

This function is designed to unload the pump during start-up or to operate at the minimum system pressure during idle phases of the cycle, ensuring significant energy savings.

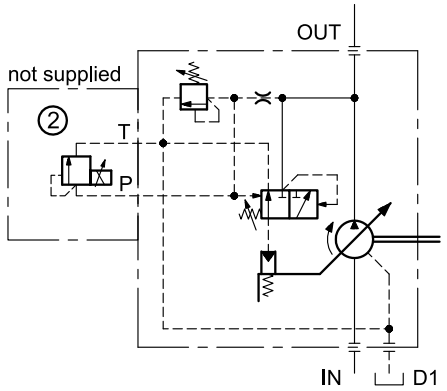
When combined with a proportional pressure control valve, the PCX* compensator provides continuous electro-proportional pressure control.

- factory setting:
  PCX5 = 210 bar for VPPL-008, 016, 022, 036 and 046.
  PCX6 = 280 bar for VPPL-070 and VPPL-100
- pressure increase per turn of the adjustment screw = 78 bar
- factory-set differential pressure: 15 ÷ 16 bar (**NOTE**)

NOTE: This factory setting ensures the delivery of the pump's nominal flow in most applications.

In circuits with high pressure drops or undersized valves, it may be necessary to increase the value (up to 28 bar) to guarantee maximum flow delivery.

hydraulic diagram for proportional pressure control



For the pressure selection function, order the switching valve (1) type DS3-SA2 (see catalogue 41 150)

- pressure adjustment range::
  PCX5 = 15 ÷ 210 bar for VPPL 008, 016, 022, 036 and 046
  PCX6 = 15 ÷ 280 bar for VPPL 070 and 100
- solenoid valve OFF = delivery pressure 20 bar and pump at zero displacement
- solenoid valve ON = delivery pressure set on the compensator and pump at maximum displacement

For proportional pressure control, order proportional pressure valve (2) type PDE3 in the desired pressure range (see catalogue 81 211)

- proportional pressure range:
  PDE3-070 20 ÷ 85 bar
  PDE3-210 20 ÷ 225 bar
  hysteresis = < 5% of p nom repeatability = < ±1,5% of p nom
  Available control card: EDM-M* catalogue 89 252

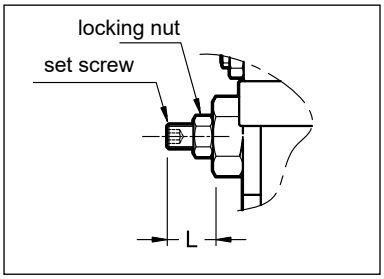
5 - MAXIMUM DISPLACEMENT ADJUSTMENT

The adjustment screw is placed on the pump back.

The pumps are factory-set to maximum displacement. Turn clockwise to decrease the pump displacement.

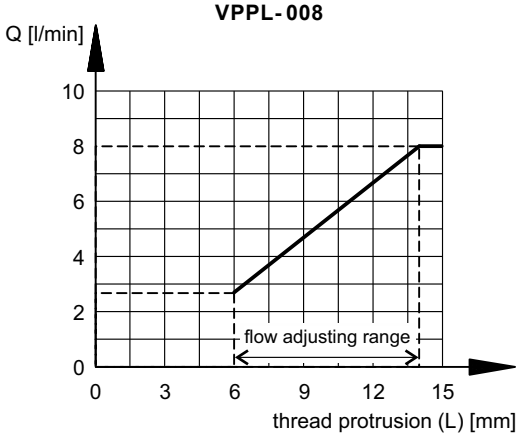
The delivery rate can be roughly judged from the protruding length of the adjusting screw (L).

Do not tighten the screw beyond the adjustment range.

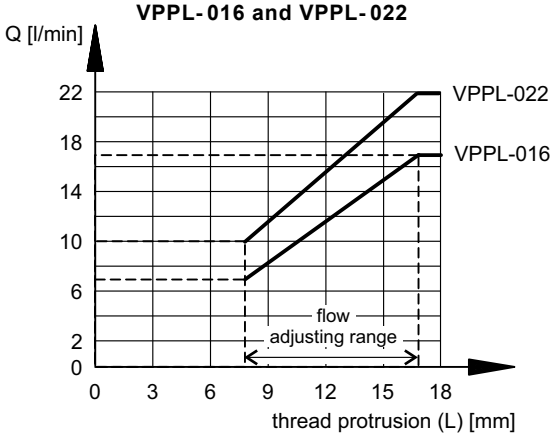


5.1 - Maximum delivery depending on the screw protrusion

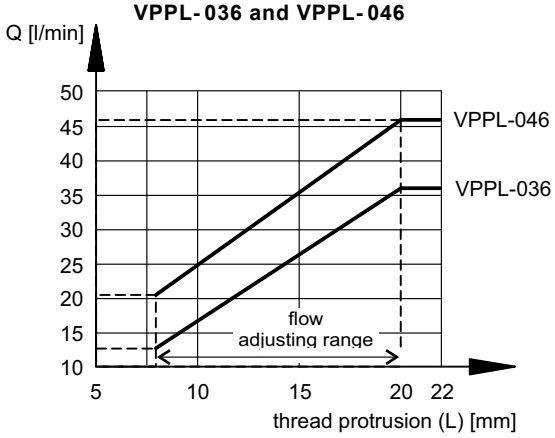
VPPL-008



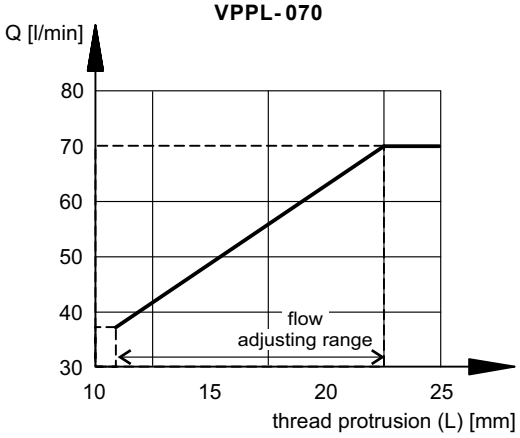
VPPL-016 and VPPL-022



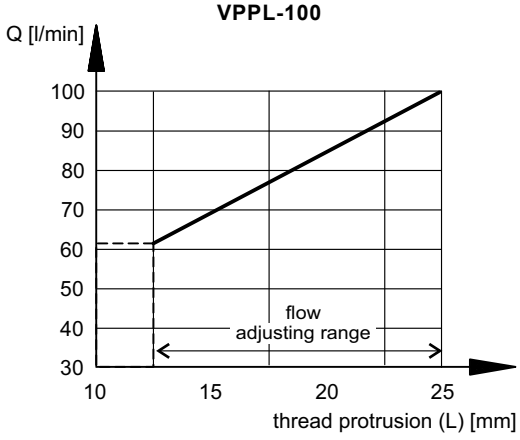
VPPL-036 and VPPL-046



VPPL-070



VPPL-100

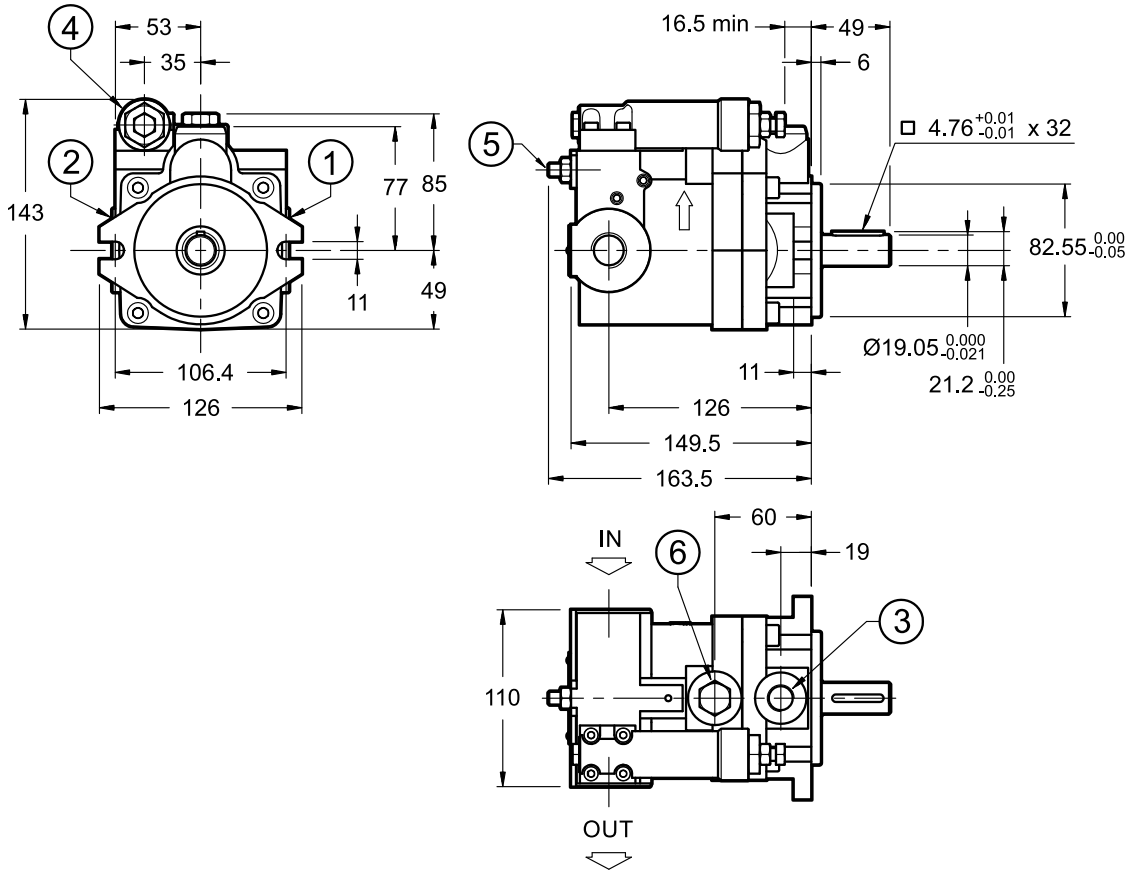


	Δ displacement / turn [cm³ / turn]
VPPL-008	0.8
VPPL-016	1.5
VPPL-022	2.0
VPPL-036	2.6
VPPL-046	3.2
VPPL-070	4.1
VPPL-100	5.1

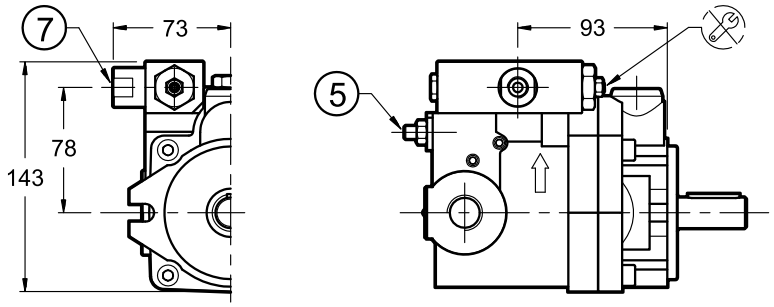
5 - VPPL-008 PUMPS OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

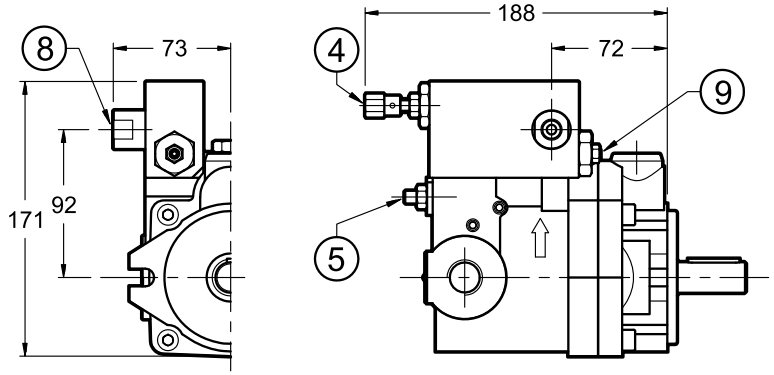
VPPL-008PC5



VPPL-008PCR



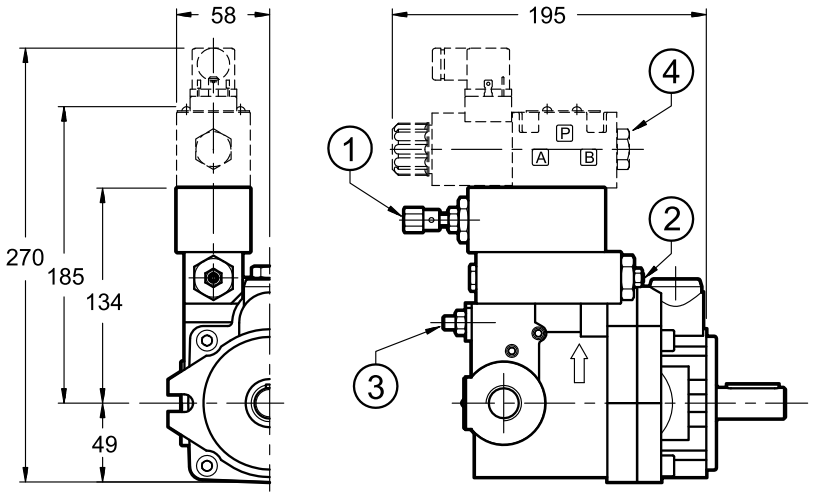
VPPL-008PQC



1	Suction port IN: 1/2” BSP
2	Delivery port OUT: 1/2” BSP
3	Drain port: 3/8” BSP
4	Pressure adjustment screw
5	Displacement set screw: Allen key 6 Locking nut: spanner 13
6	Oil filling port: 3/8” BSPT
7	Remote pressure control port: 1/4" BSP
8	Load sensing port: 1/4" BSP
9	Factory-set differential pressure, See NOTE p. 4.3

VPPL-008PCX5

dimensions in mm



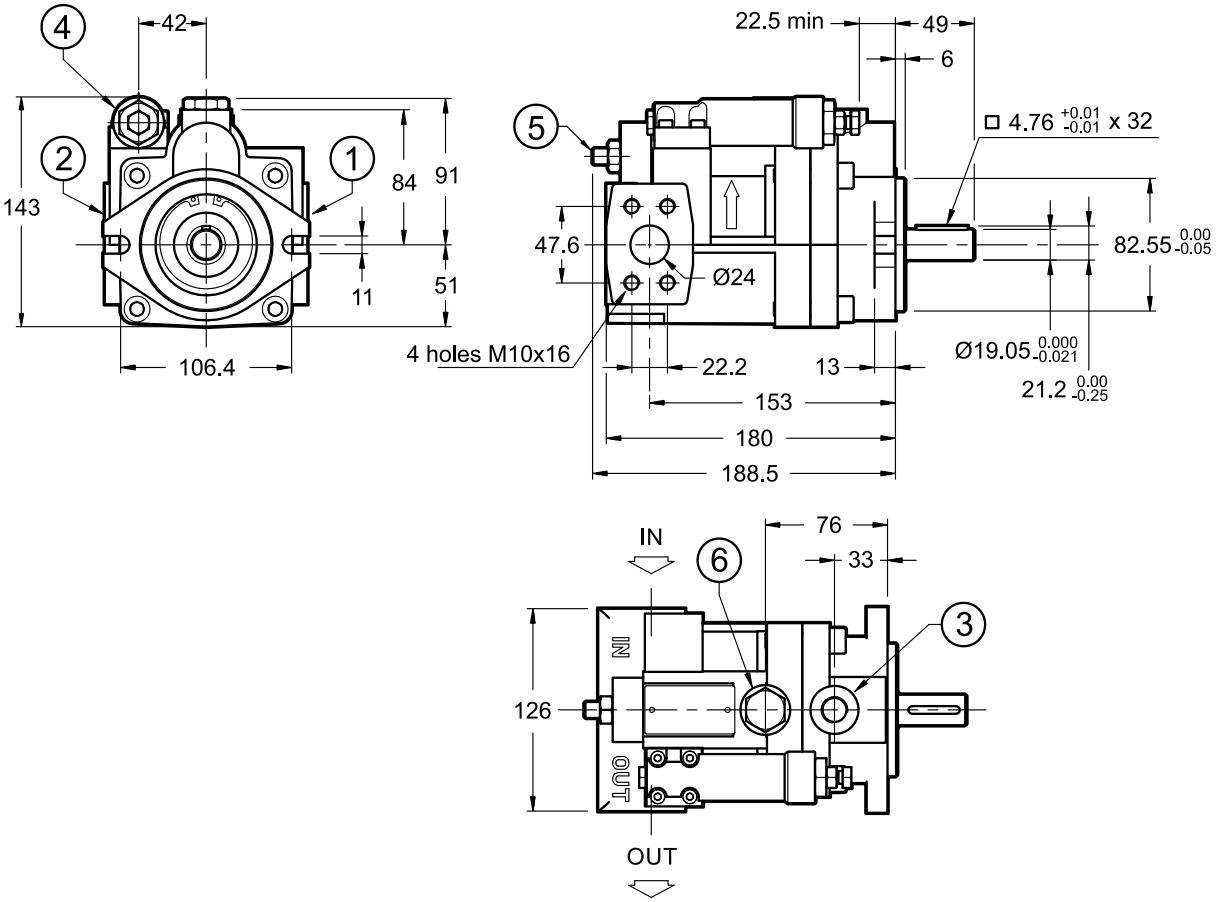
1	Pressure adjustment screw
2	Factory-set differential pressure. See NOTE p. 4.3
3	Displacement set screw: Allen key 6 Locking nut: spanner 13
4	Switching solenoid valve, DS3-SA2 type (to be ordered separately; see cat. 41 150)

NOTE: for missing dimensions, see drawing VPPL-008PC5

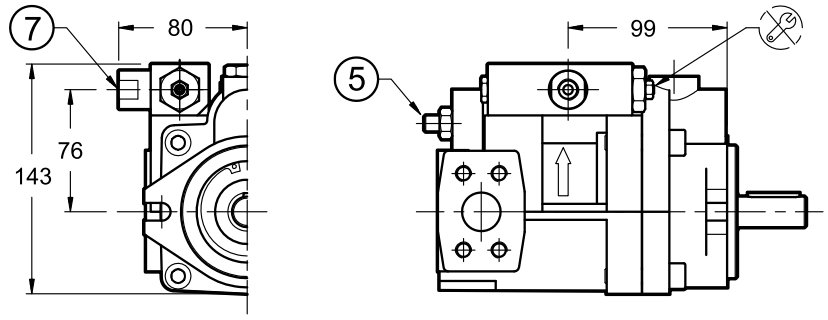
7 - VPPL-016 AND VPPL-022 PUMPS OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

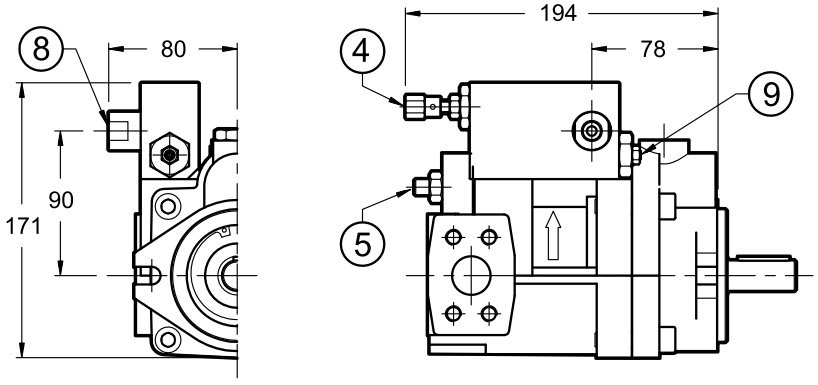
VPPL-016PC5 and VPPL-022PC5



VPPL-016PCR and VPPL-022PCR



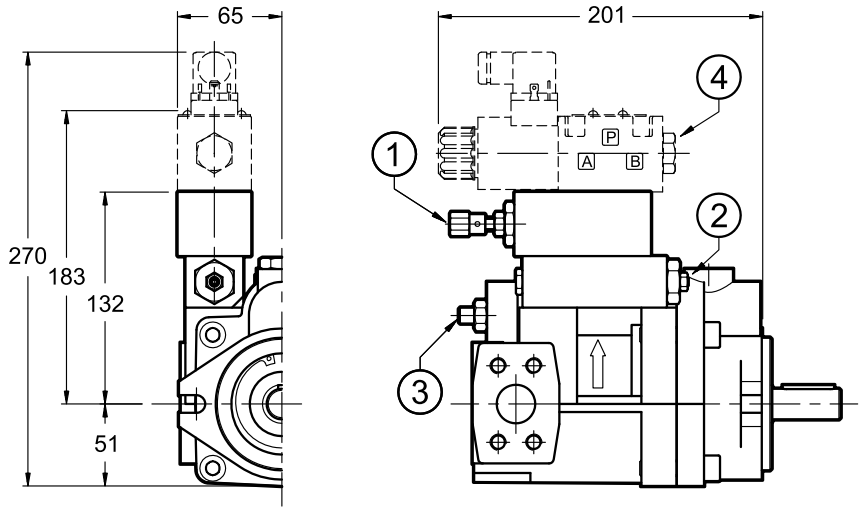
VPPL-016PQC and VPPL-022PQC



1	Suction port IN: SAE 3000 1” flange (see point 12)
2	Delivery port OUT: SAE 3000 3/4” flange (see point 12)
3	Drain port: 3/8” BSP
4	Pressure adjustment screw
5	Displacement set screw: Allen key 8 Locking nut: spanner 17
6	Oil filling port: 3/8” BSPT
7	Remote pressure control port: 1/4" BSP
8	Load sensing port: 1/4" BSP
9	Factory-set differential pressure. See NOTE point 4.3

VPPL-016PCX5 and VPPL-022PCX5

dimensions in mm



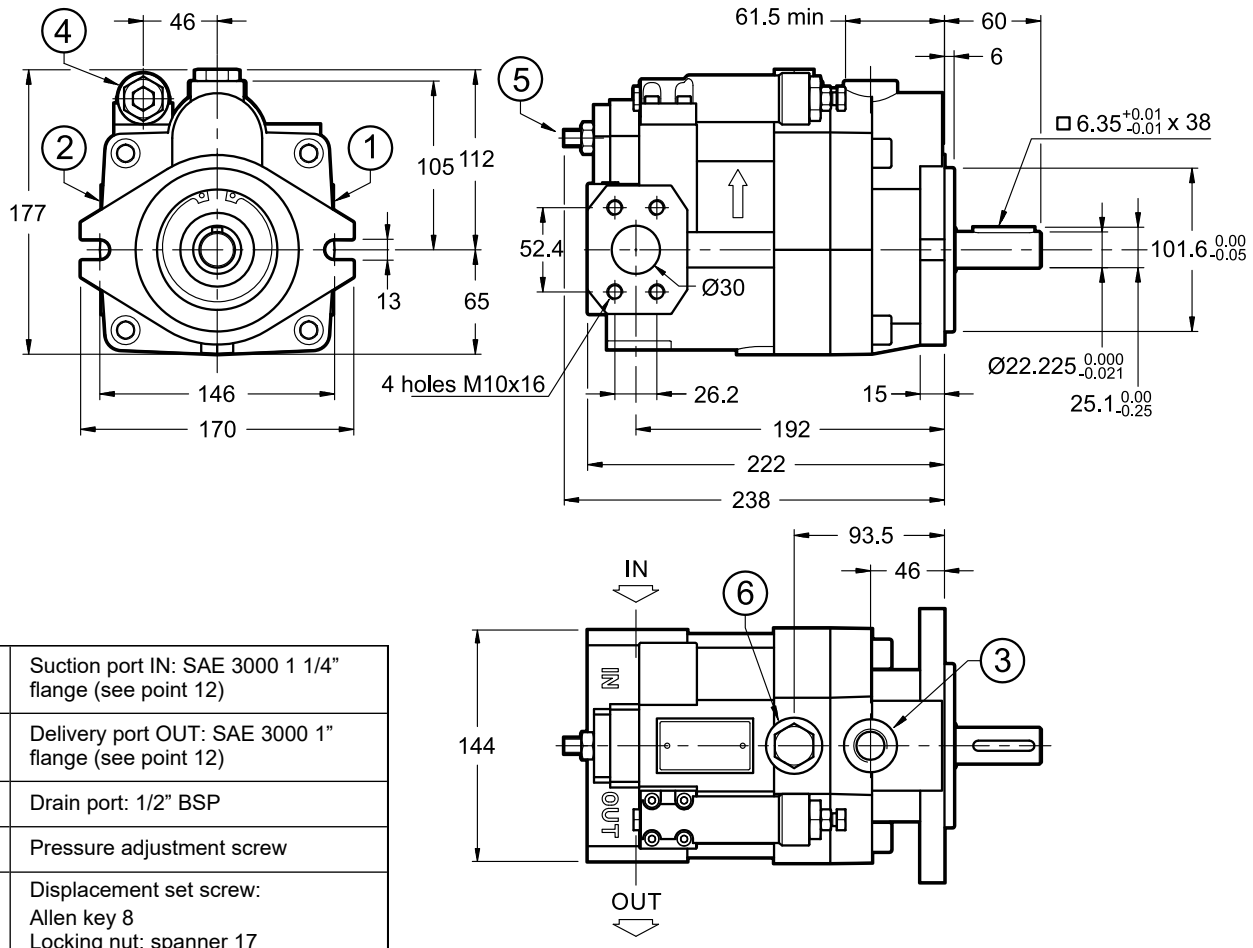
1	Pressure adjustment screw
2	Displacement set screw: Allen key 8 Locking nut: spanner 17
3	Factory-set differential pressure See NOTE p. 4.4
4	Switching solenoid valve, DS3-SA2 type (to be ordered separately; see cat. 41 150)

NOTE: see drawing on the previous page for missing dimensions,

8 - VPPL-036 AND VPPL-046 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-036PC5 and VPPL-046PC5

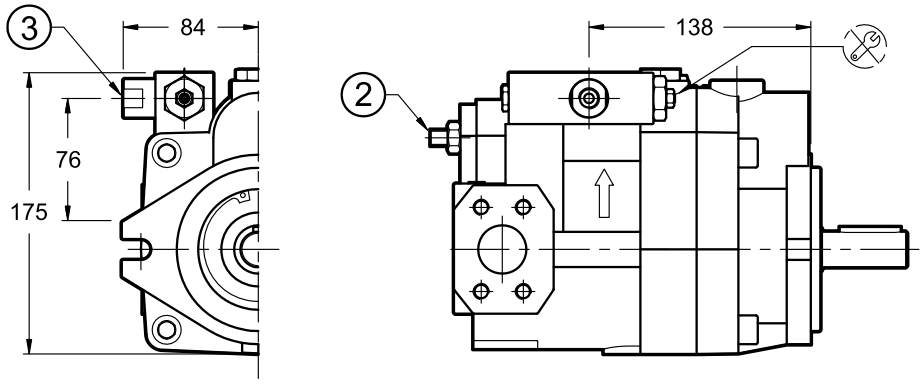
dimensions in mm



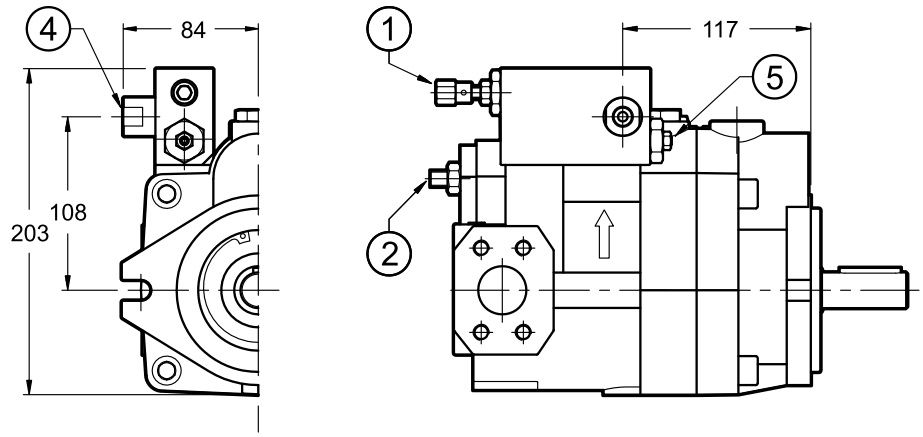
1	Suction port IN: SAE 3000 1 1/4" flange (see point 12)
2	Delivery port OUT: SAE 3000 1" flange (see point 12)
3	Drain port: 1/2" BSP
4	Pressure adjustment screw
5	Displacement set screw: Allen key 8 Locking nut: spanner 17
6	Oil filling port: 1/2" BSPT

VPPL-036PCR and VPPL-046PCR

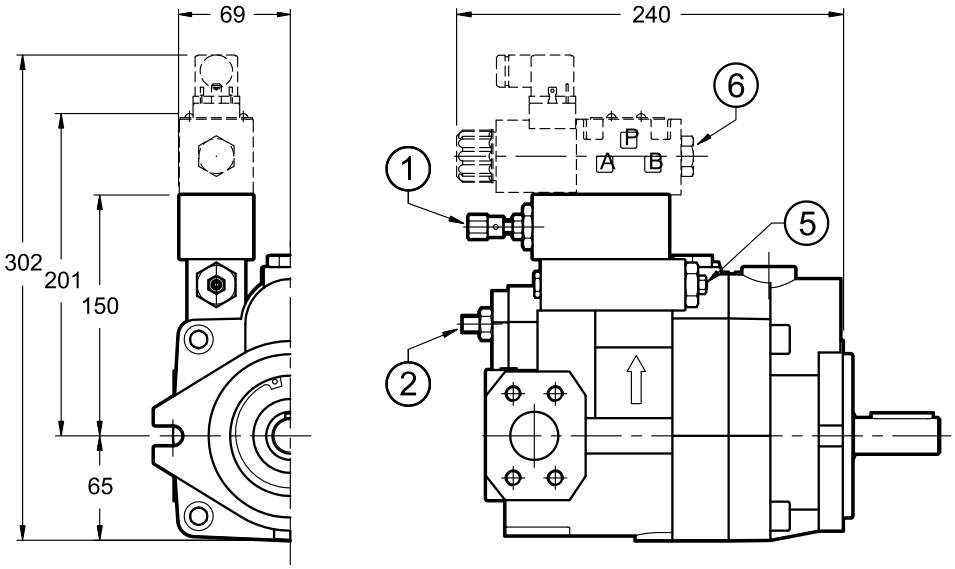
dimensions in mm



VPPL-036PQC and VPPL-046PQC



VPPL-036PCX5 and VPPL-046PCX5



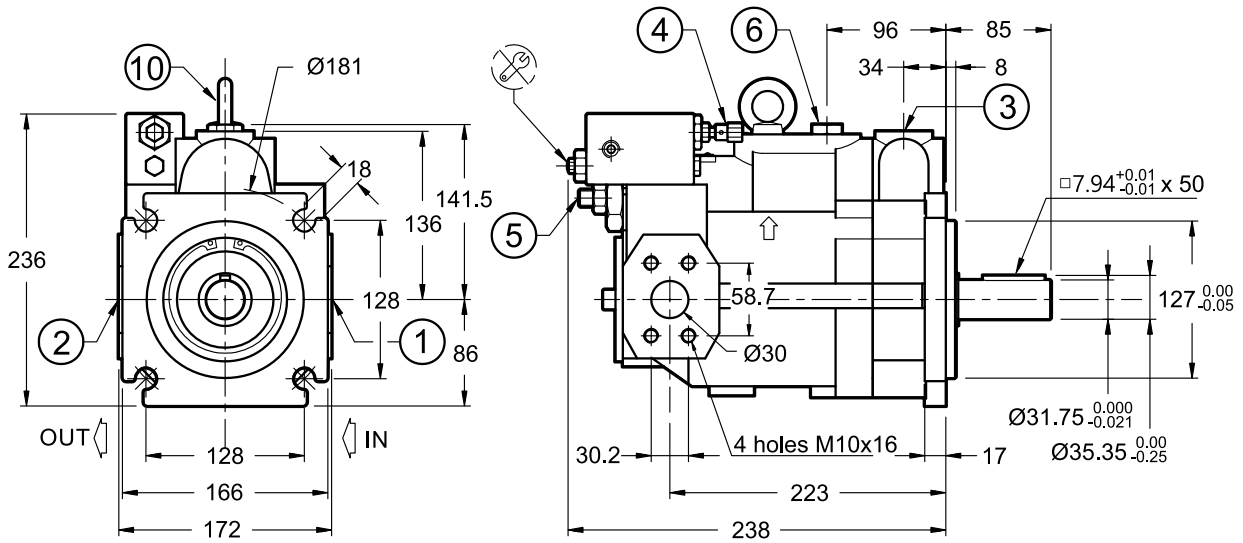
1	Pressure adjustment screw
2	Displacement set screw: Allen key 8 Locking nut: spanner 17
3	Remote pressure control port: 1/4" BSP
4	Load Sensing port: 1/4” BSP
5	Factory-set differential pressure. For PQC: see NOTE point 4.3 For PCX*: see NOTE point 4.4
6	Switching solenoid valve, DS3-SA2 type (to be ordered separately; see cat. 41 150)

NOTE: see drawing on the previous page for missing dimensions,

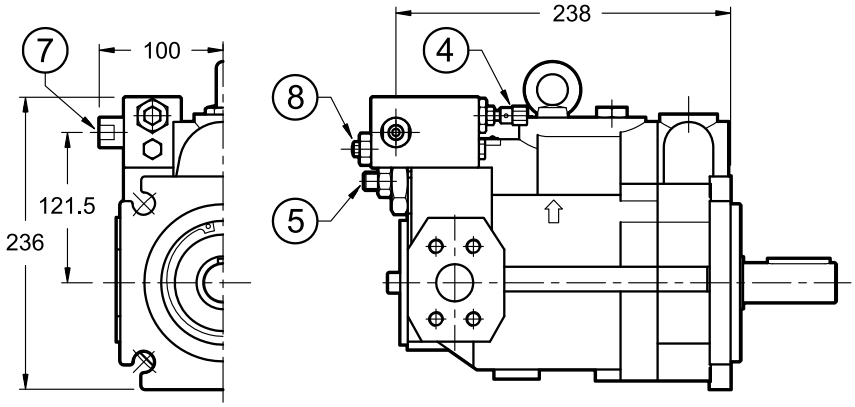
9 - VPPL-070 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-070PC6

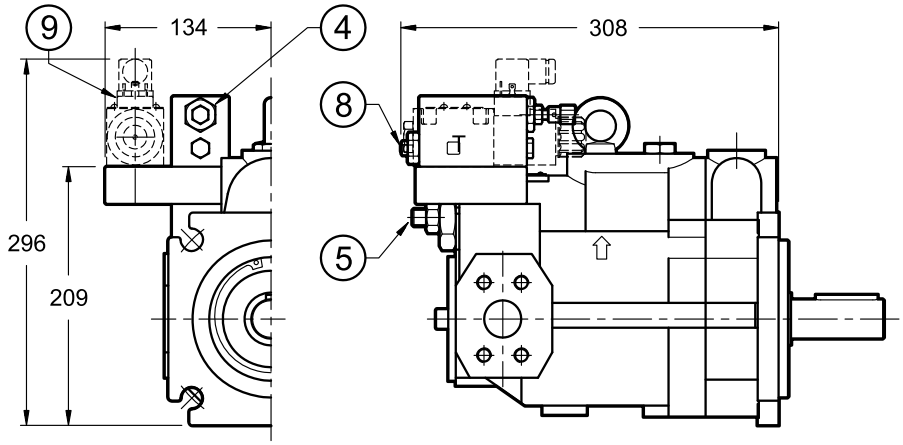
dimensions in mm



VPPL-070PCR and VPPL-070PQC



VPPL-100PCX6

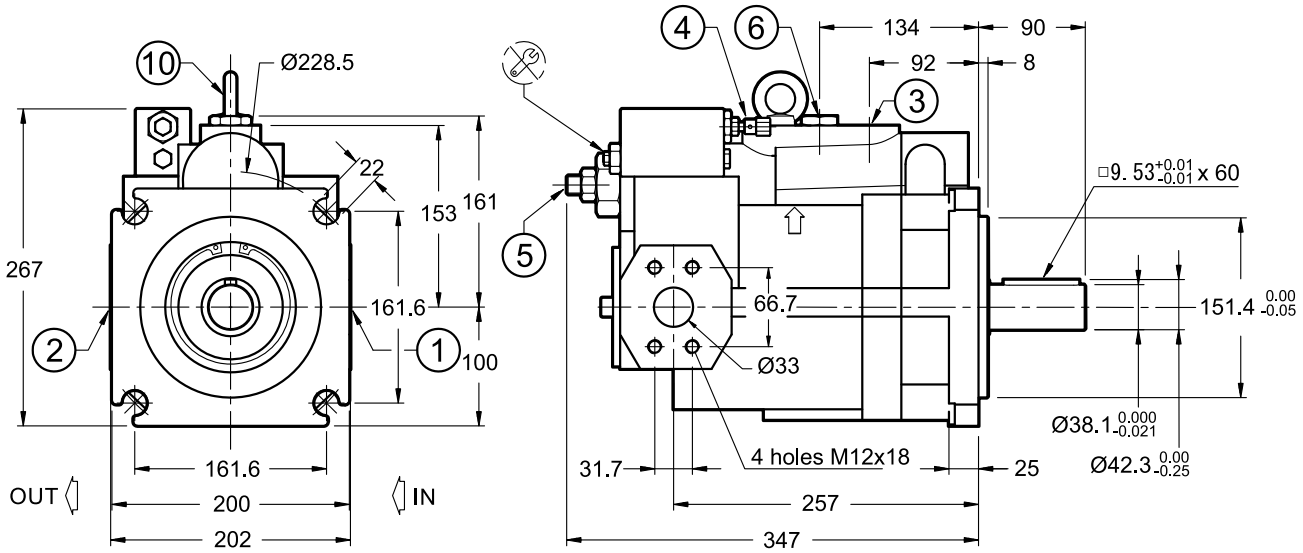


1	Suction port IN: SAE 3000 1 1/2" flange (see point 12)
2	Delivery port OUT: SAE 3000 1 1/4" flange (see point 12)
3	Drain port: 1/2" BSP
4	for PCR : adjustment of the pressure relief valve for PQC: pressure adjustment
5	Displacement set screw: Allen key 12 Locking nut: spanner 22
6	Oil filling port: 1/2" BSPT
7	Port 1/4" BSP: for PCR: remote pressure control port for PQC: load sensing port
8	Factory-set differential pressure. For PQC: see NOTE point 4.3 For PCX*: see NOTE point 4.4
9	Switching solenoid valve, DS3-SA2 type (to be ordered separately; see cat. 41 150)
10	Lifting eye bolt

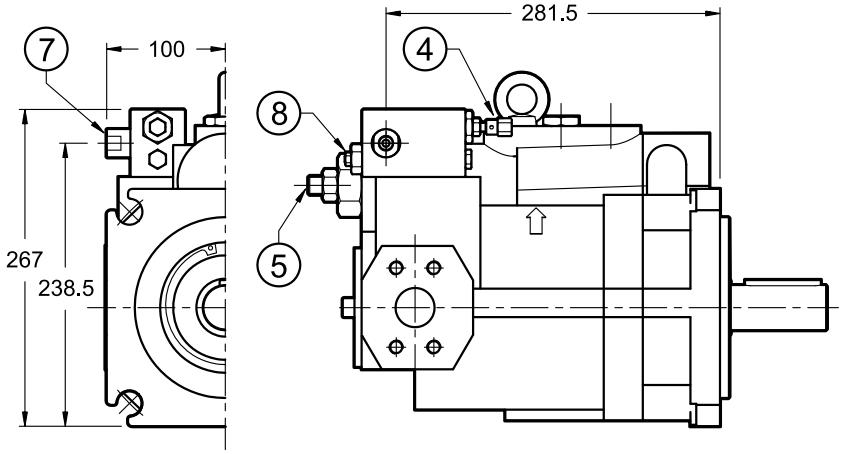
10 - VPPL-100 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-100PC6

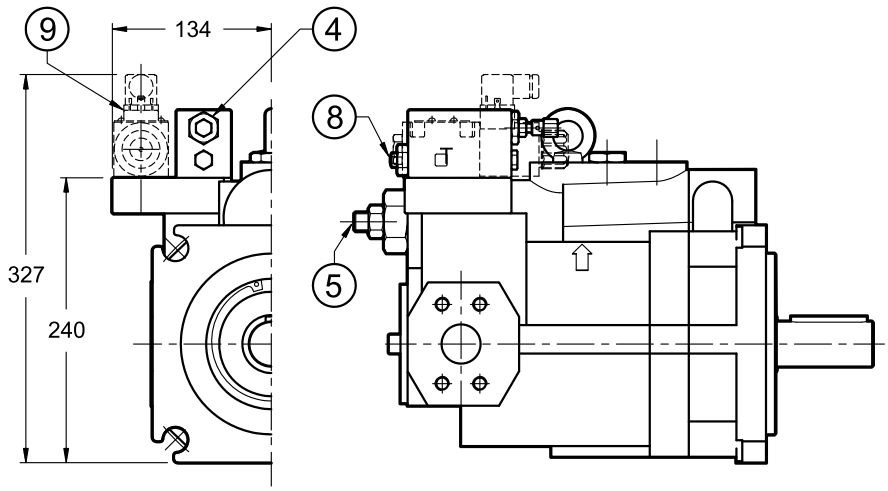
dimensions in mm



VPPL-100PCR and VPPL-100PQC



VPPL-100PCX6



1	Suction port IN: SAE 3000 2” flange (see point 12)
2	Delivery port OUT: SAE 6000 1 1/4” flange (see point 12)
3	Drain port: 1/2” BSP
4	for PCR : adjustment of the pressure relief valve for PQC: pressure adjustment
5	Displacement set screw: Allen key 14 Locking nut: spanner 24
6	Oil filling port: 1/2” BSPT
7	Port 1/4” BSP: for PCR: remote pressure control port for PQC: load sensing port
8	Factory-set differential pressure. For PQC: see NOTE point 4.3 For PCX*: see NOTE point 4.4
9	Switching solenoid valve, DS3-SA2 type (to be ordered separately; see cat. 41 150)
10	Lifting eye bolt

11 - INSTALLATION

- VPPL pumps can be installed in either horizontal or vertical position, with the shaft facing upward.

  NOTE: The drain port must be oriented so that the oil level inside the pump housing never falls below 3/4 of its internal volume.

- For installations above the free oil level, ensure that the minimum inlet (suction) pressure does not exceed –0.2 bar (relative). If low noise emissions are required, installation inside the tank is recommended.

  When installed inside the tank and the oil level does not ensure complete pump submersion, the drain line should be arranged so as to ensure constant lubrication of the upper pump bearing.

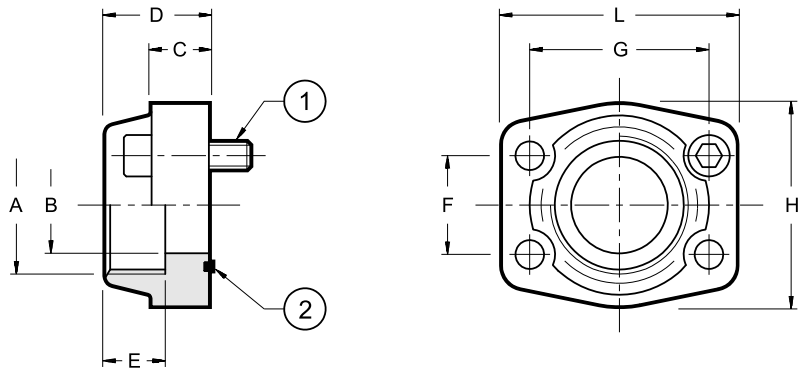
- **Before commissioning, fill the pump housing with the system fluid.**
- Verify that the direction of rotation is correct.
- During the first start-up, vent the air from the pressure line, keeping the line at free discharge. If the circuit has difficulty purging air, the use of a dedicated air-vent valve is recommended.

  Start-up, especially at low ambient temperatures, must be performed with the system at minimum pressure.

- The suction line must be properly sized so that the suction pressure does not exceed –0.2 bar (relative). Bends, restrictions, or excessive line length may further reduce suction pressure, leading to increased noise emissions and reduced pump service life.
- The drain pipe must be sized so that the pressure inside the pump housing always remains below 0.5 bar (relative), including during transient phases (speed/load changes and flow adjustments).The minimum line size is 3/8″ for pump types 008, 016, and 022; at least 1/2″ for types 036 and 046; and 3/4″ for types 070 and 100.
- The drain line must discharge inside the tank, away from the suction zone.
- Check valves are not allowed on the suction line. For filter elements characteristics and installation please refer to point 2.3.
- The motor–pump connection must be made using a flexible coupling in order to minimize axial and radial loads on the pump shaft. The shaft alignment error between motor and pump must be kept within 0.05 mm.

12 - 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)

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