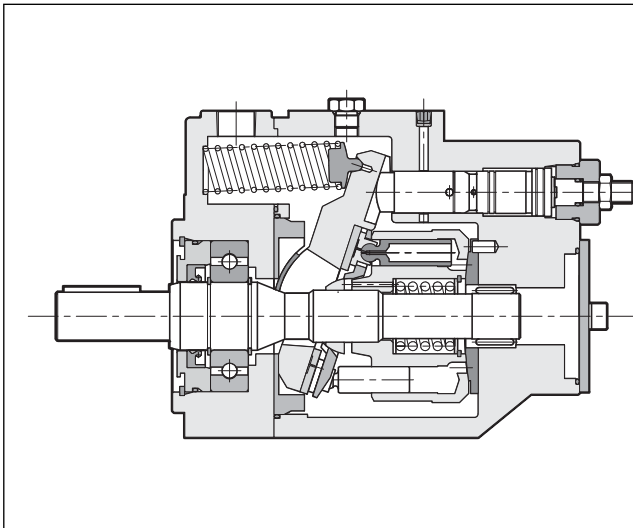


# VPPL

## VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS FOR INTERMEDIATE PRESSURE SERIES 20

### OPERATING PRINCIPLE

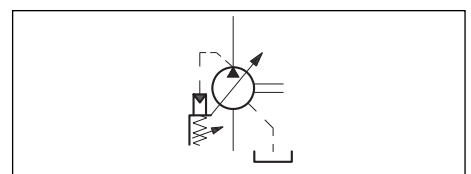


- The VPPL are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits and intermediate pressures.
- They are available in seven nominal sizes, with displacements of 8, 16, 22, 36, 46, 70 and 100 cm<sup>3</sup>/rev.
- The pump flow rate is proportional 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

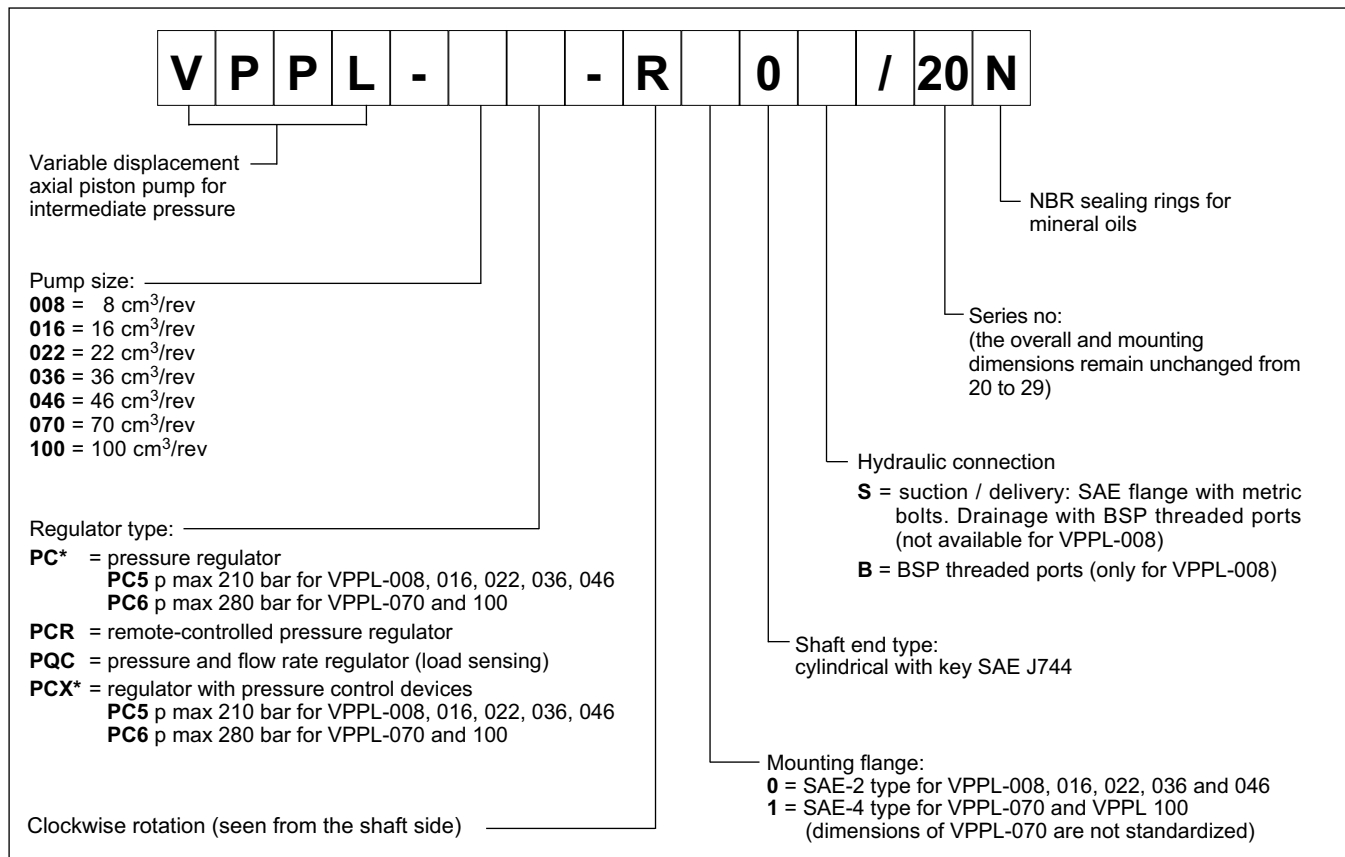
PUMP SIZE		008	016	022	036	046	070	100	
Maximum displacement	cm <sup>3</sup> /rev	8	16	22	36	46	70	100	
Flow rate at 1500 rpm	lt/min	12	24	33	54	69	105	150	
Operating pressures	bar	210					280		
Rotation speed	rpm	min 500 - max 2000						min 500 - max 1800	
Rotation direction		clockwise (seen from the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

### HYDRAULIC SYMBOL



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

### 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.

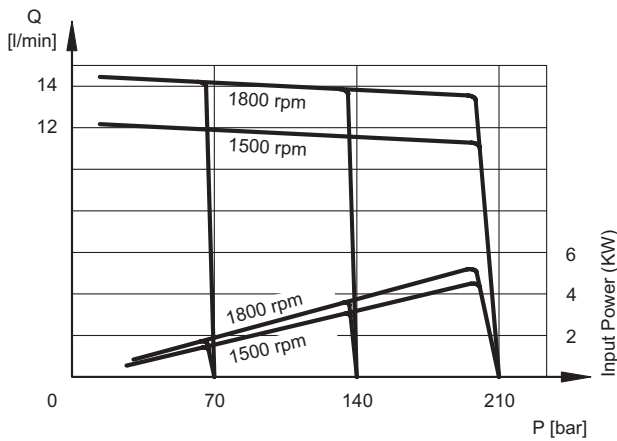
For the installation of filters on the suction line, see paragraph 10. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.



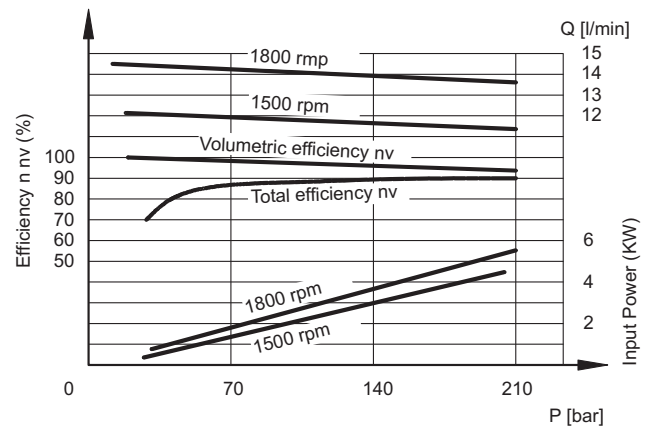
### 3 - CHARACTERISTIC CURVES

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

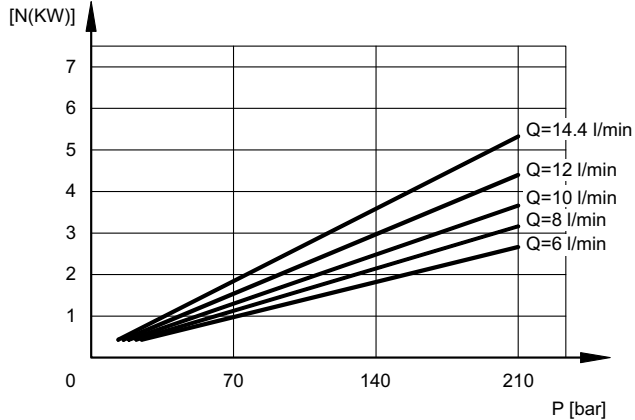
##### FLOW RATE / PRESSURE CURVES



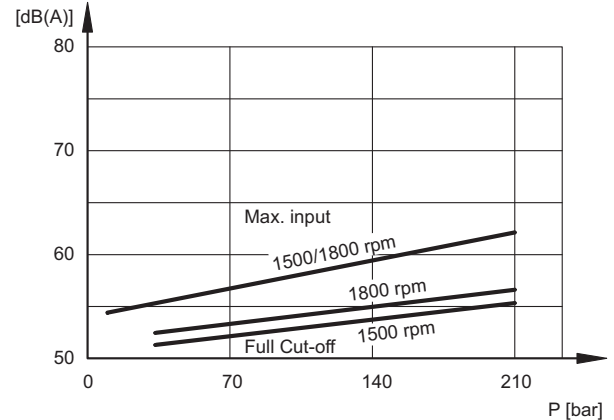
##### VOLUMETRIC AND TOTAL EFFICIENCY



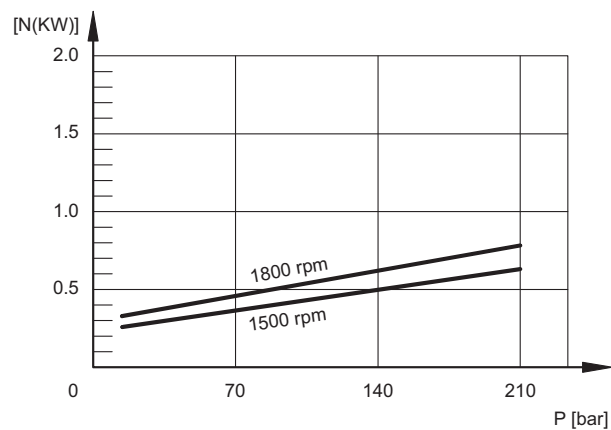
##### ABSORBED POWER



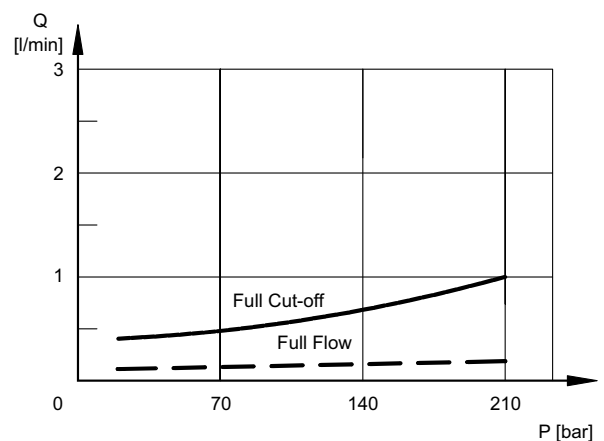
##### NOISE LEVEL



##### INPUT POWER AT FULL CUT-OFF



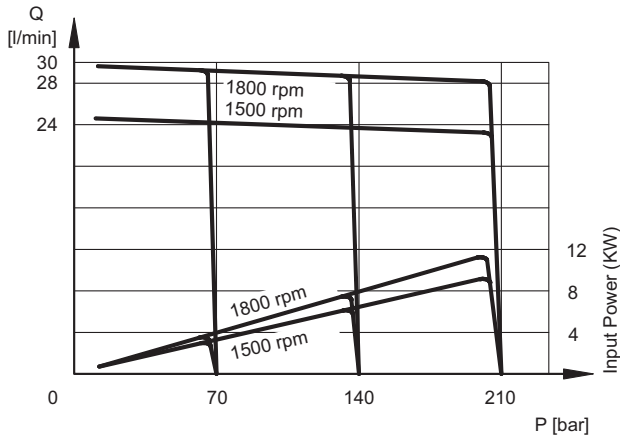
##### DRAIN FLOW RATE



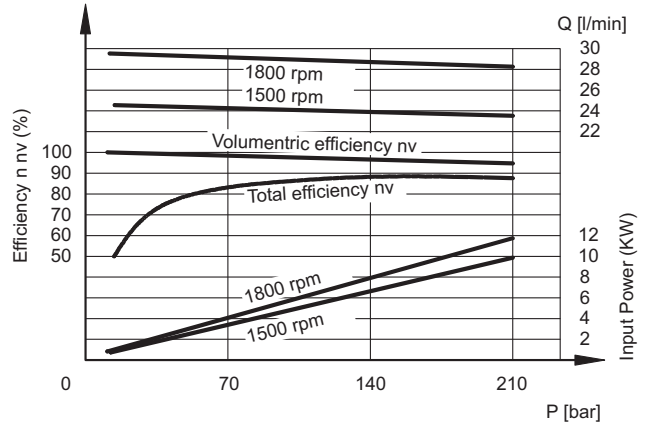


### 3.2 - VPPL-016 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

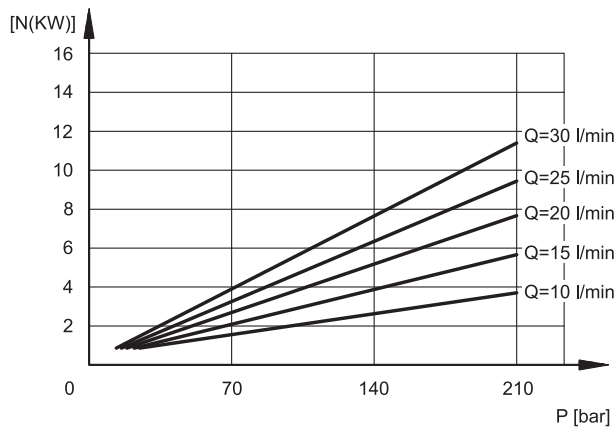
#### FLOW RATE / PRESSURE CURVES



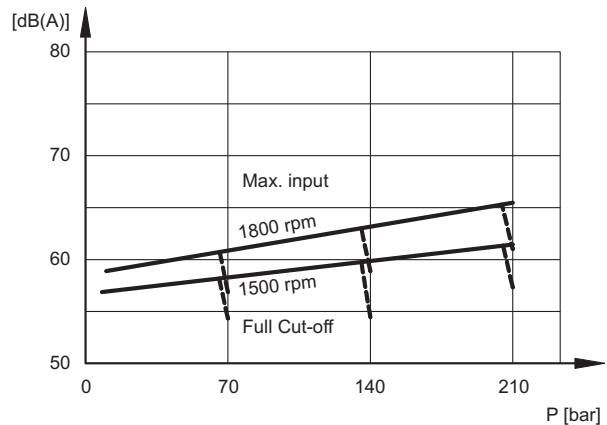
#### VOLUMETRIC AND TOTAL EFFICIENCY



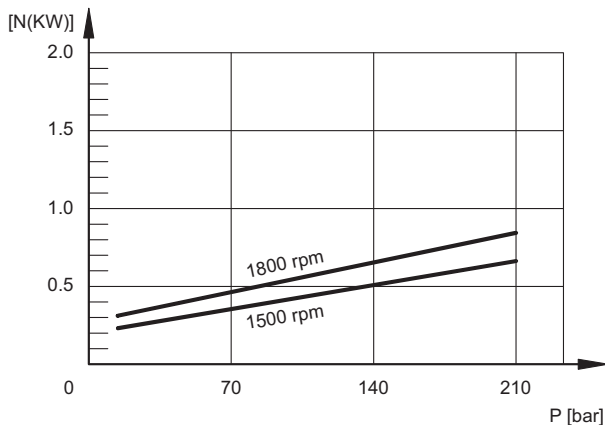
#### ABSORBED POWER



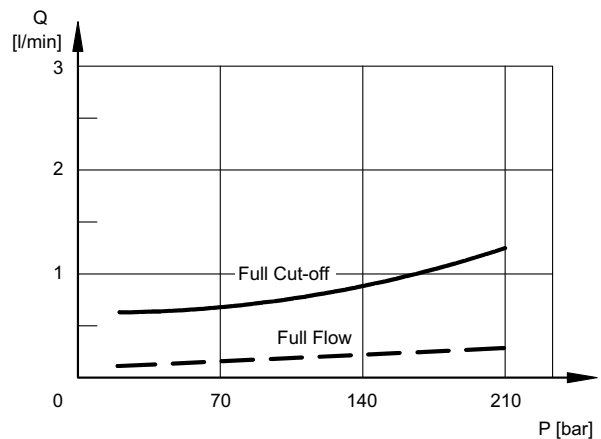
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

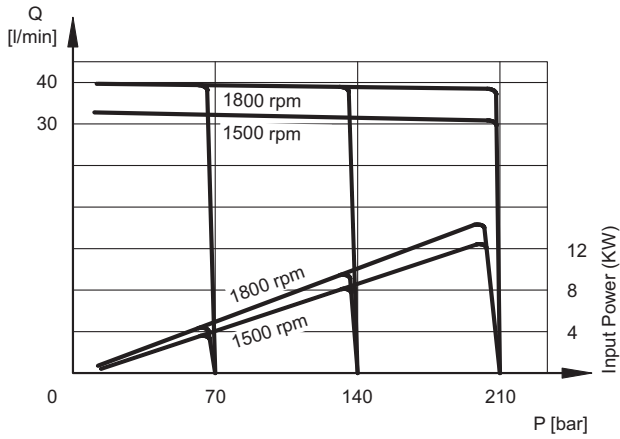


#### DRAIN FLOW RATE

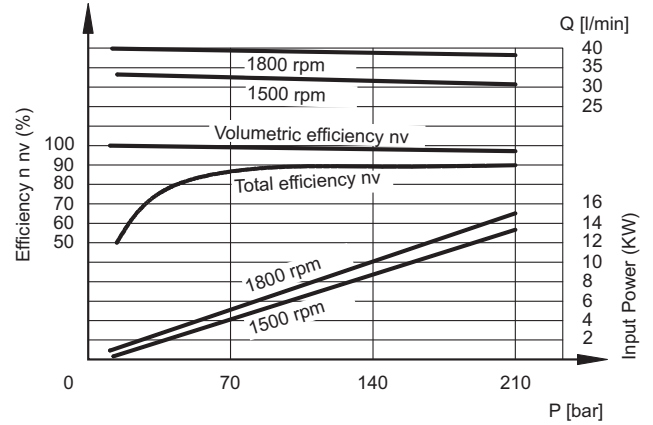


### 3.3 - VPPL-022 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

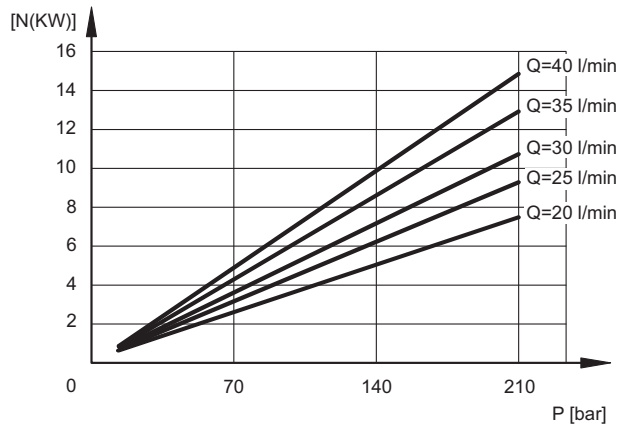
#### FLOW RATE / PRESSURE CURVES



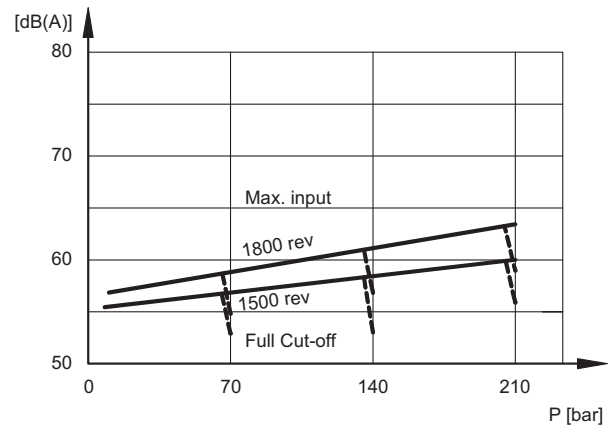
#### VOLUMETRIC AND TOTAL EFFICIENCY



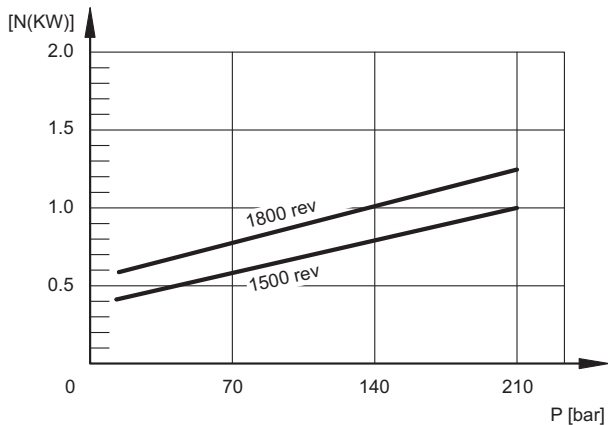
#### ABSORBED POWER



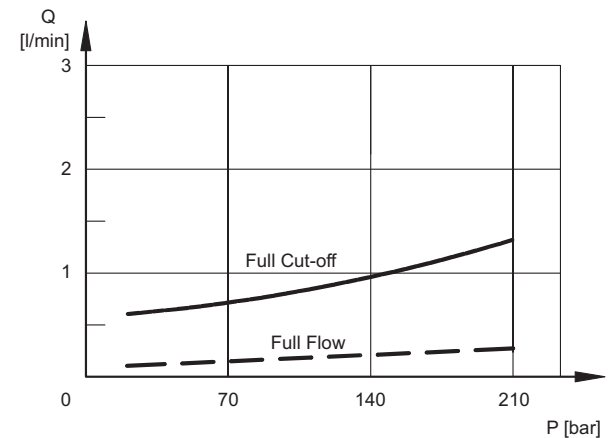
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF



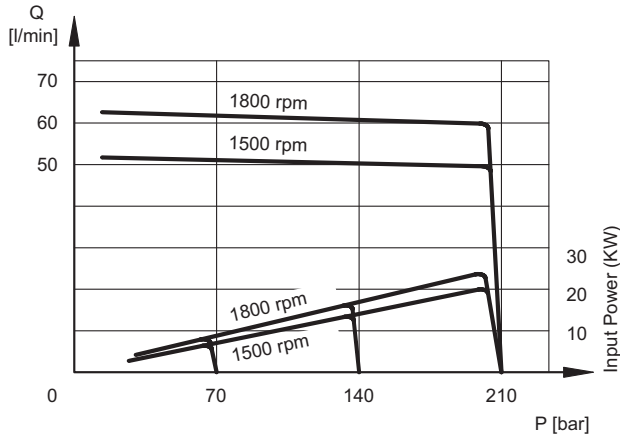
#### DRAIN FLOW RATE



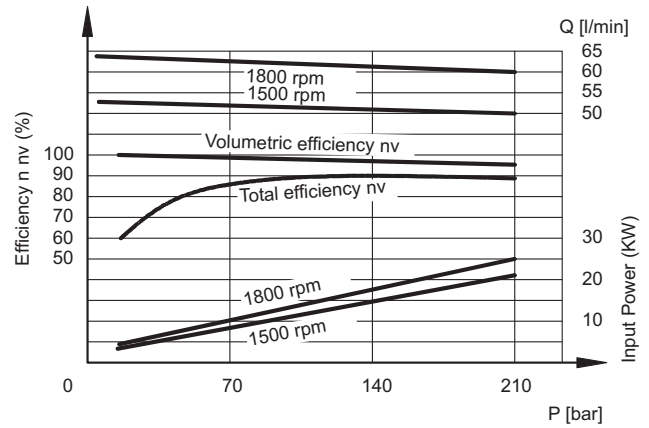


### 3.4 - VPPL-036 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

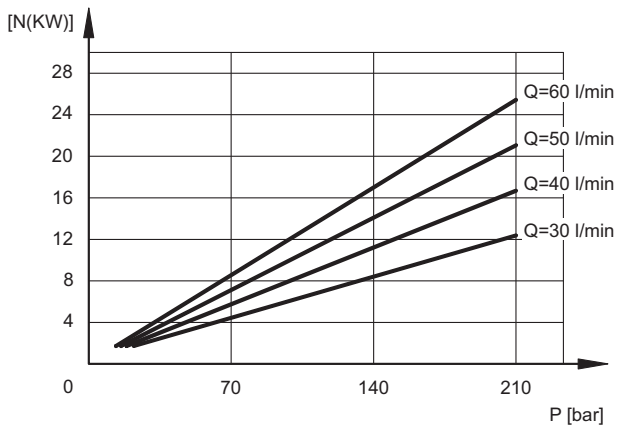
#### FLOW RATE / PRESSURE CURVES



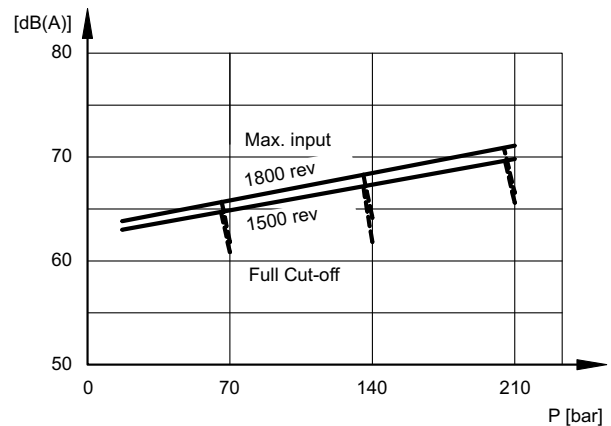
#### VOLUMETRIC AND TOTAL EFFICIENCY



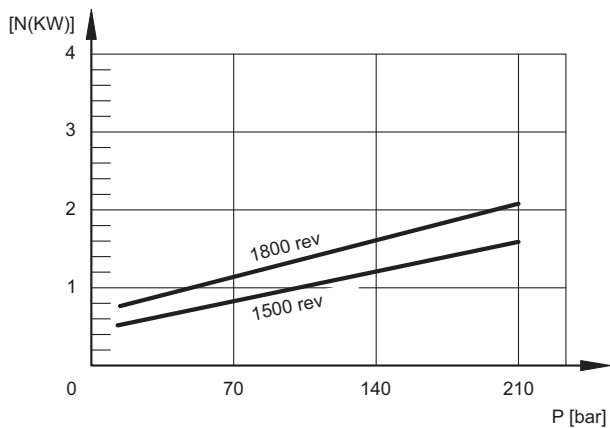
#### ABSORBED POWER



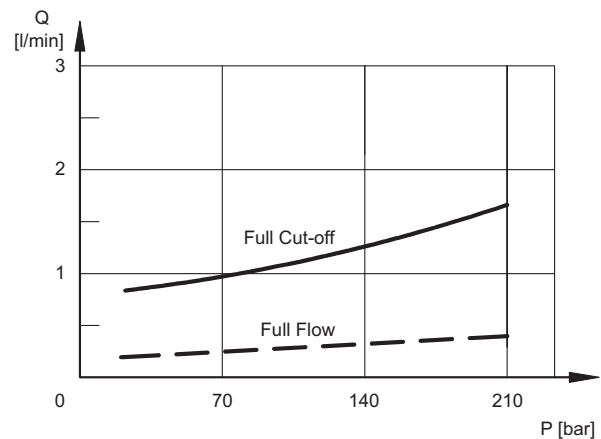
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF



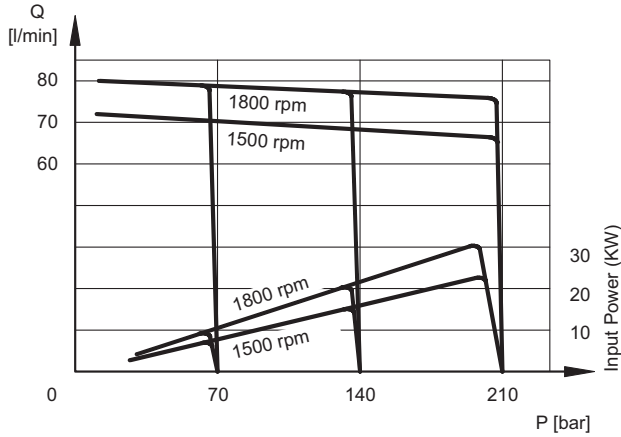
#### DRAIN FLOW RATE



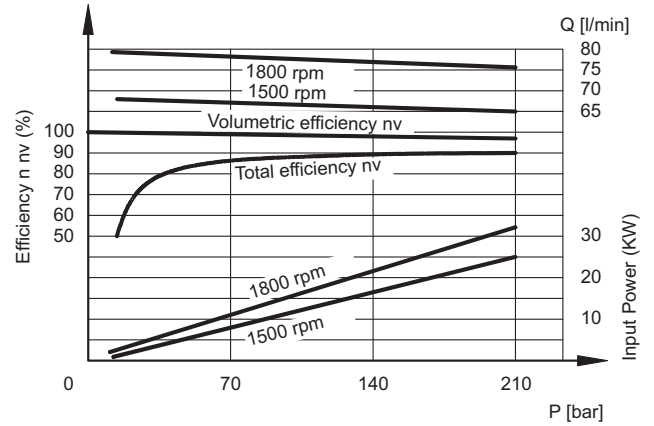


### 3.5 - VPPL-046 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

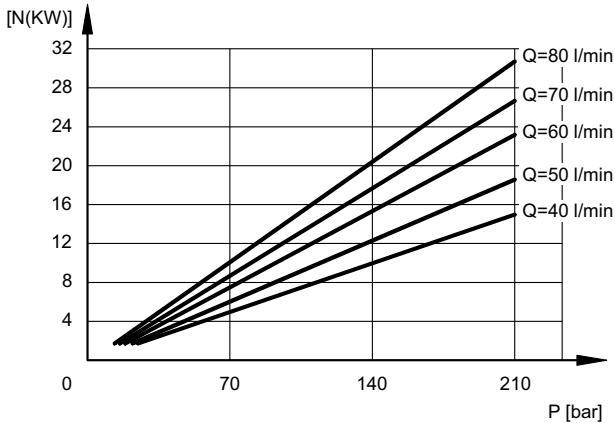
#### FLOW RATE / PRESSURE CURVES



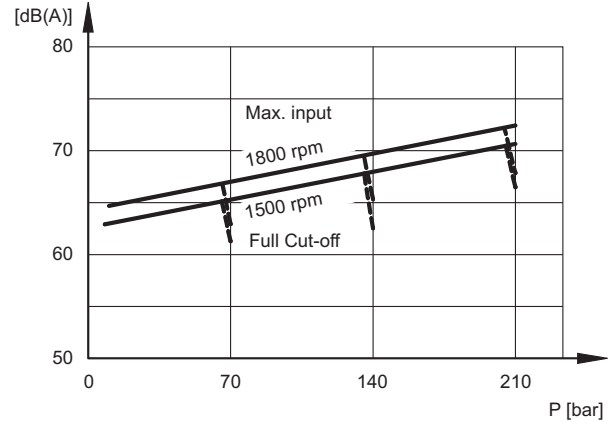
#### VOLUMETRIC AND TOTAL EFFICIENCY



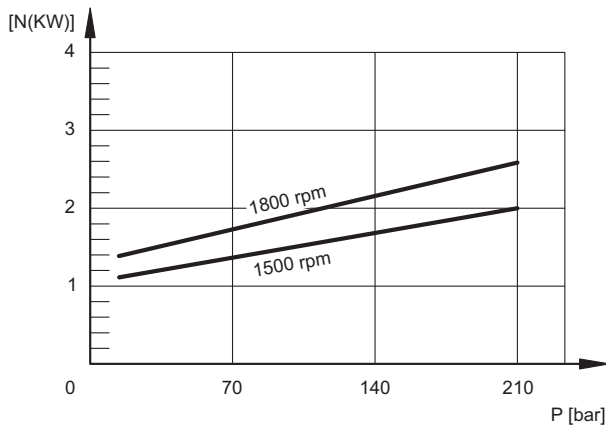
#### ABSORBED POWER



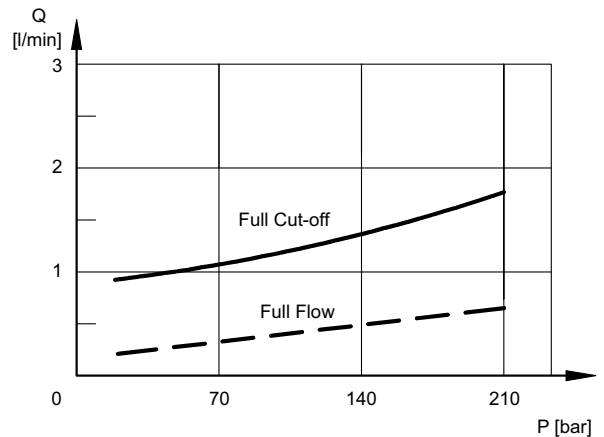
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF



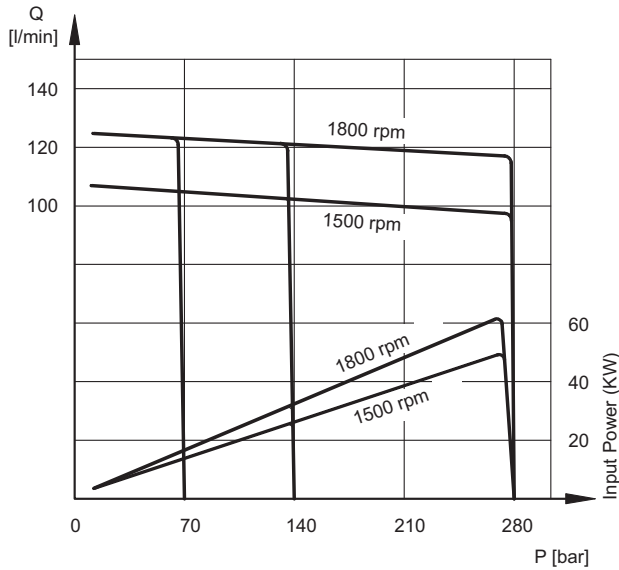
#### DRAIN FLOW RATE



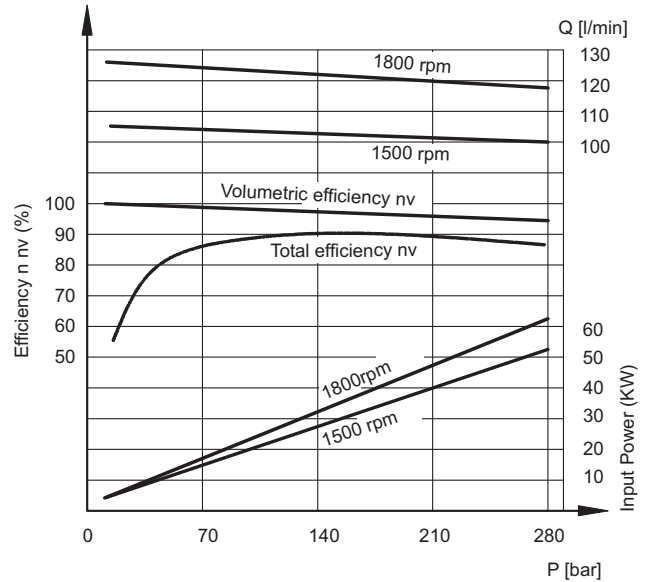


**3.4 - VPPL-070 pump characteristic curves** (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

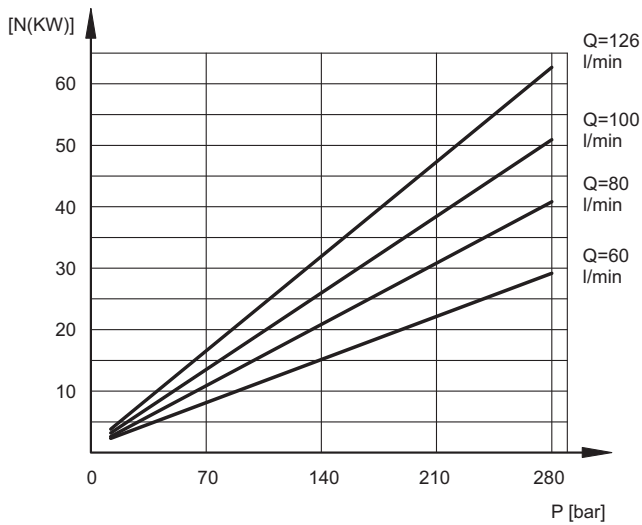
**FLOW RATE / PRESSURE CURVES**



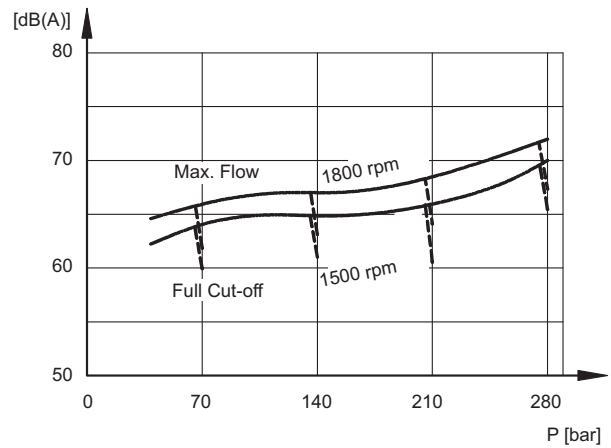
**VOLUMETRIC AND TOTAL EFFICIENCY**



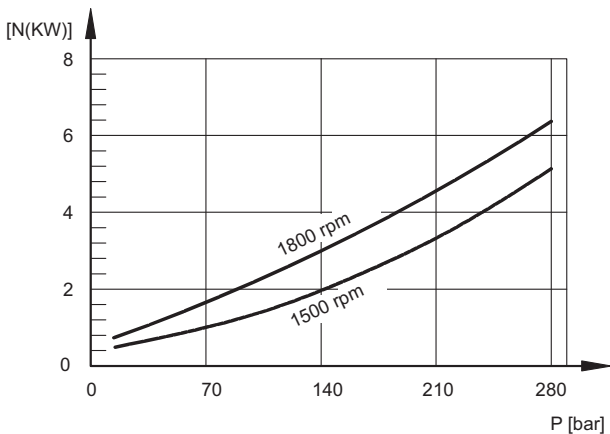
**ABSORBED POWER**



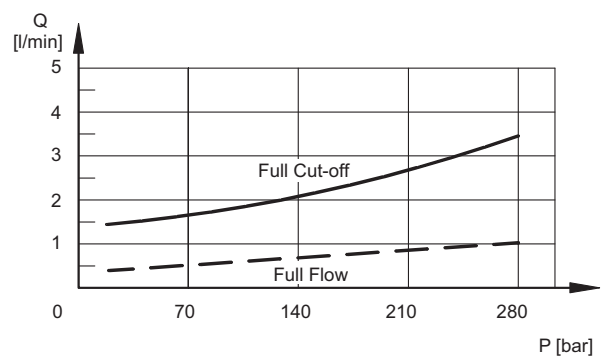
**NOISE LEVEL**



**INPUT POWER AT FULL CUT-OFF**



**DRAIN FLOW RATE**

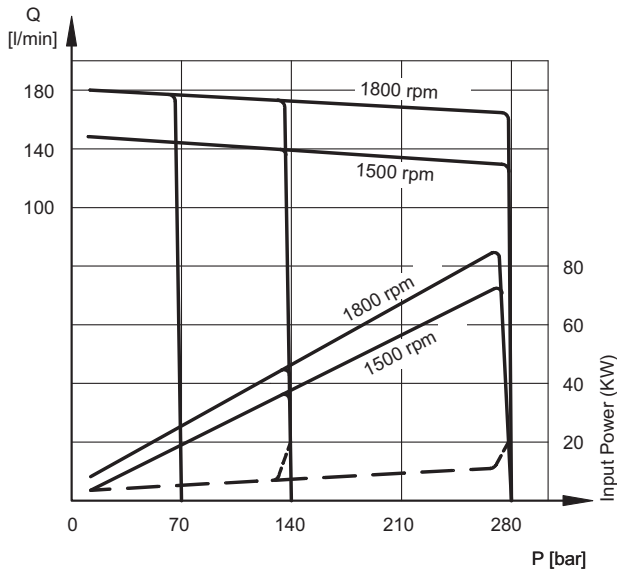




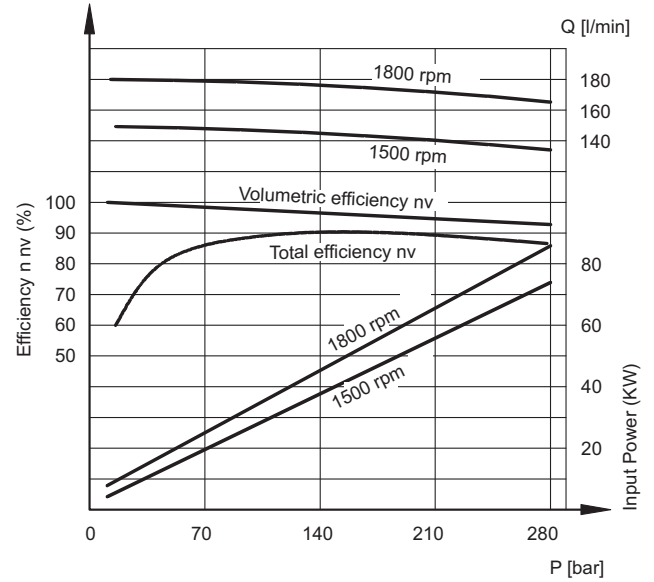


### 3.5 - VPPL-100 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

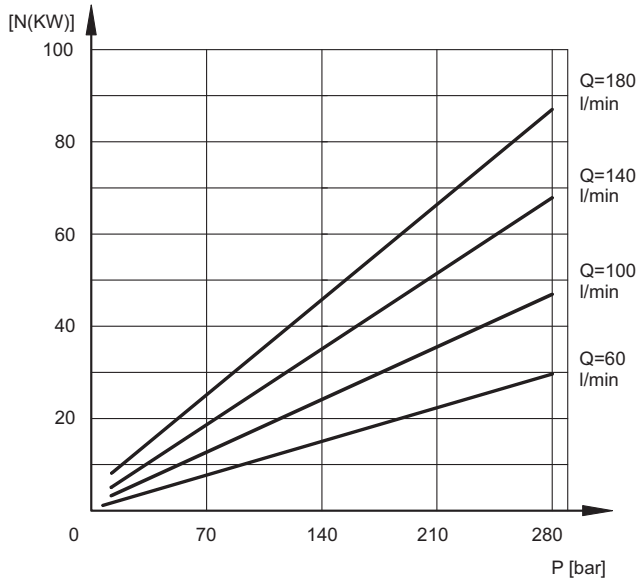
#### FLOW RATE / PRESSURE CURVES



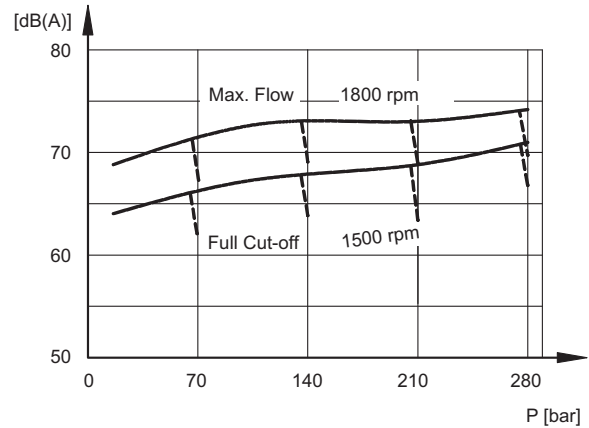
#### VOLUMETRIC AND TOTAL EFFICIENCY



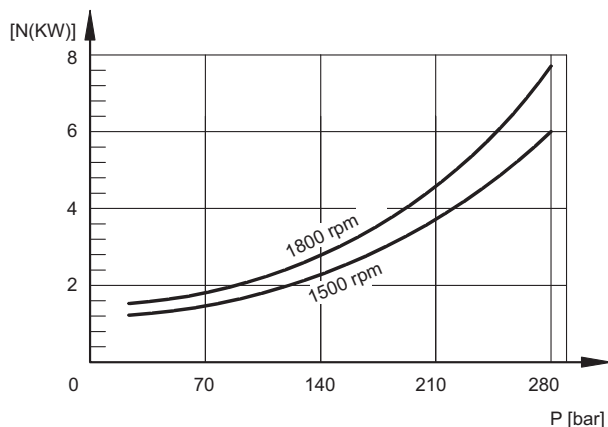
#### ABSORBED POWER



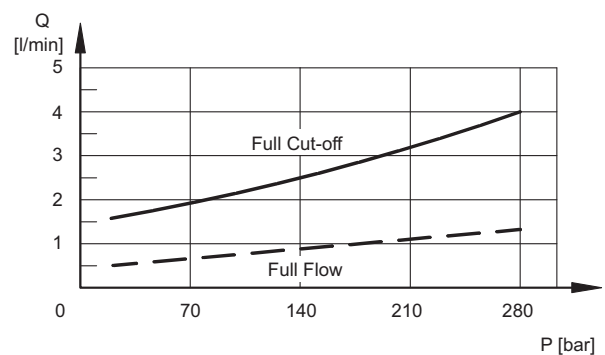
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

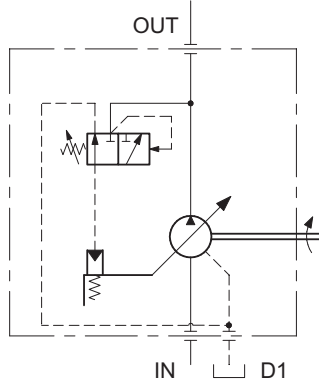


#### DRAIN FLOW RATE



## 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).

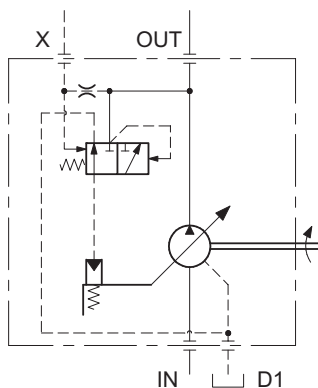
In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.

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:

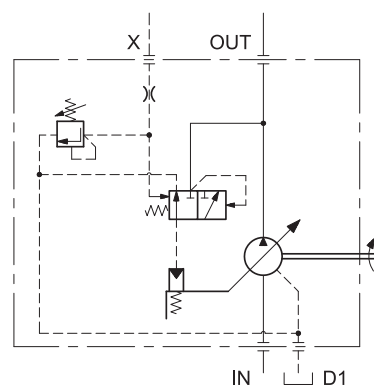
- remote-adjustment pressure = 20 ÷ 210 bar
- flow rate available on the X port for the remote-control = about 1,5 l/min (approx.)



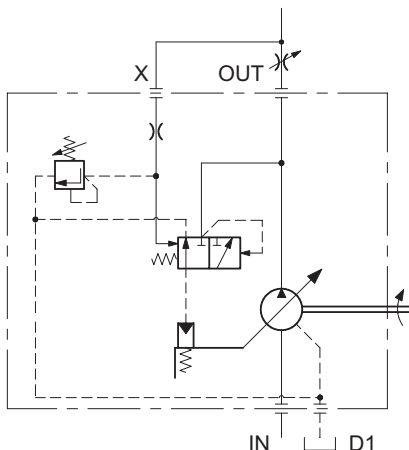
#### 4.2.2 - Remote-controlled pressure regulator: PCR for VPPL 070 e 100

##### 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  $\Delta p$  pressure drop measured on either side of a throttle valve installed on the user line.

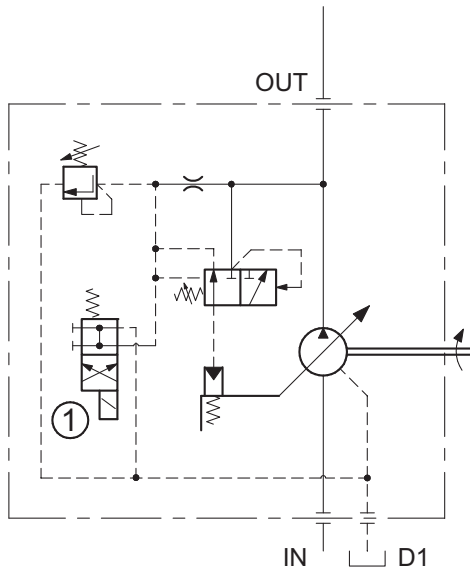
Note: The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

#### 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.

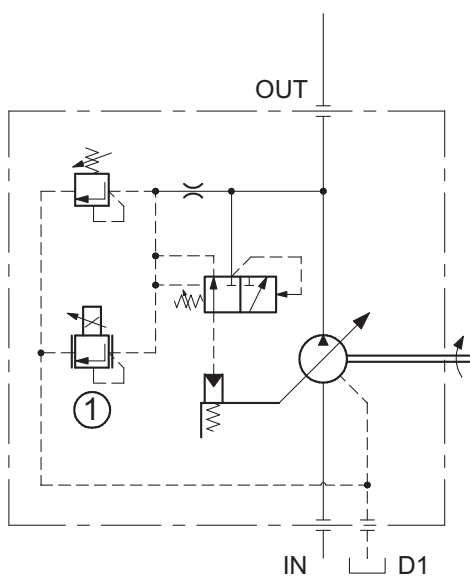
This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

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.

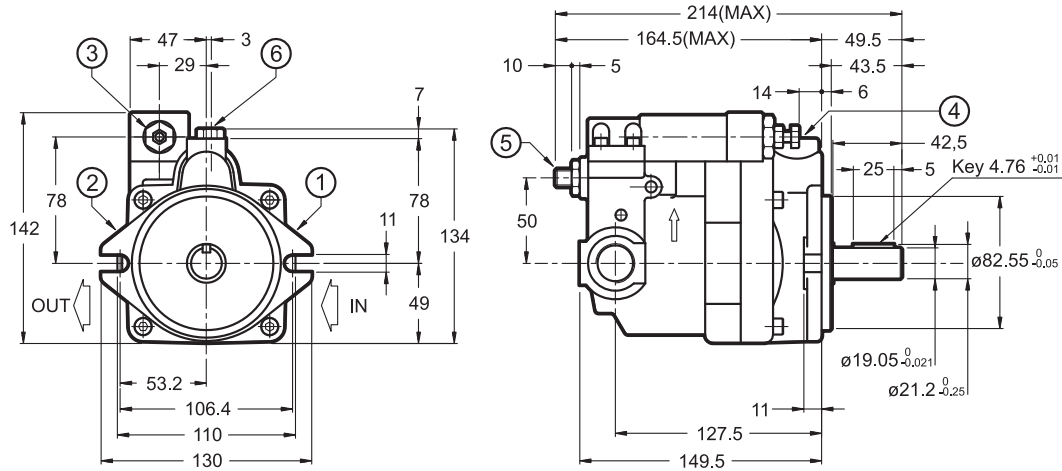
#### PCX\* FEATURES (proportional pressure regulation):

- 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 :
 

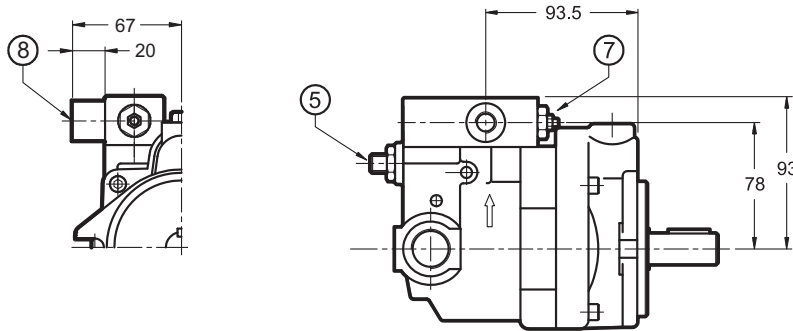
PRED3-070	20 ÷ 85 bar
PRED3-210	20 ÷ 225 bar
- Hysteresis = < 5% of p nom  
 Repeatability = < ±1,5% of p nom

## 5 - VPPL-008 PUMPS OVERALL AND MOUNTING DIMENSIONS

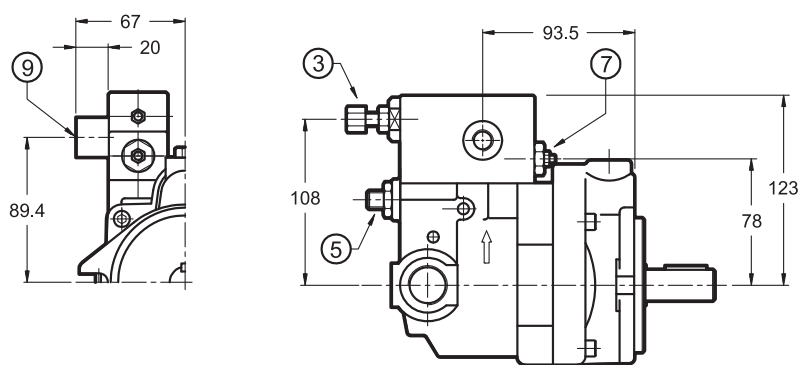
### VPPL-008PC5 PUMPS



### VPPL-008PCR PUMPS

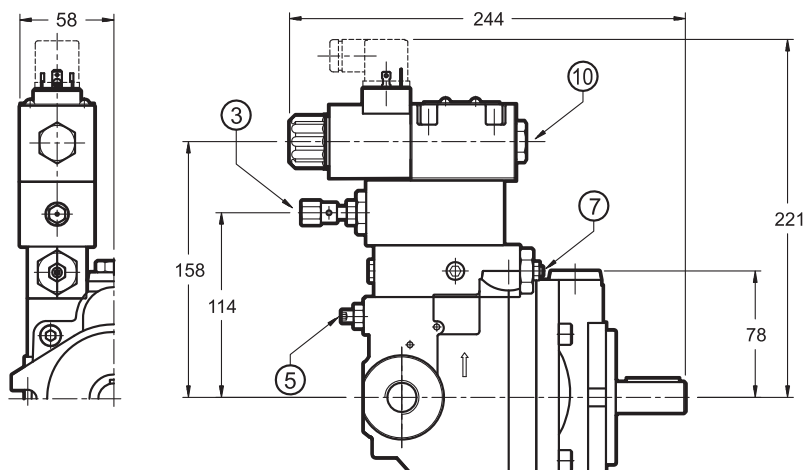


### VPPL-008PQC PUMPS



dimensions in mm

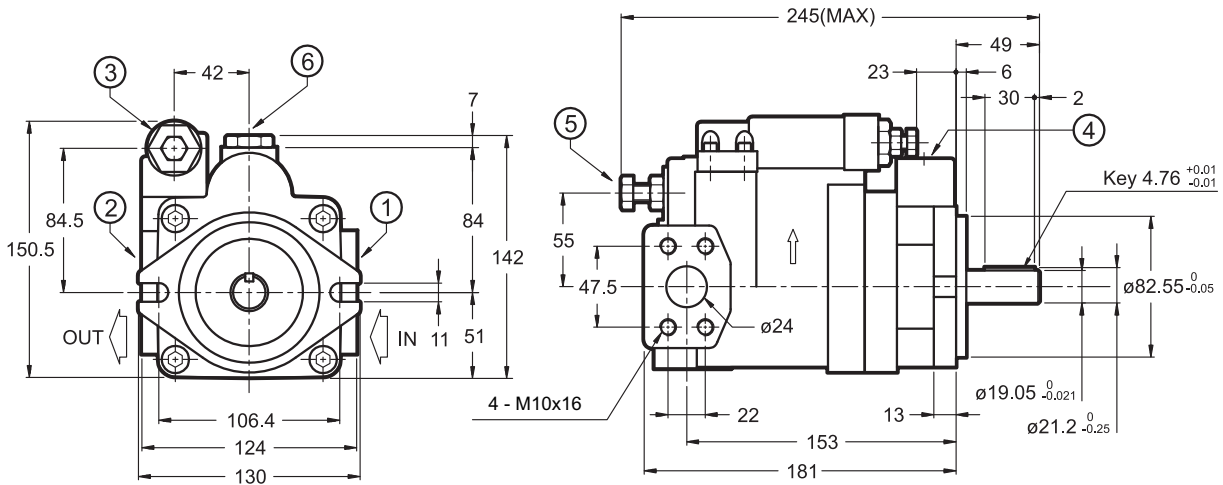
### VPPL-008PCX5 PUMPS



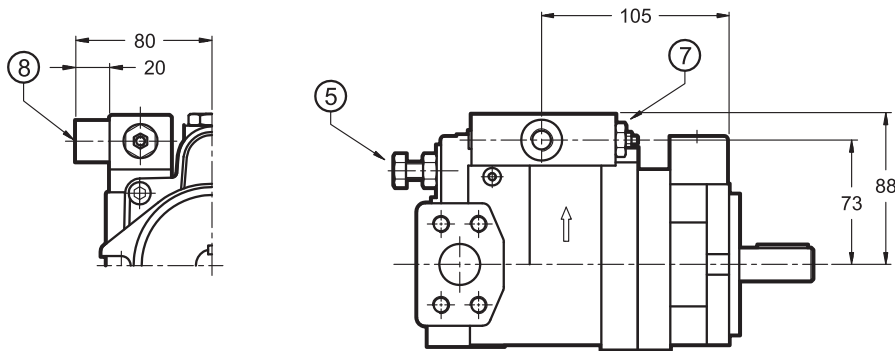
1	Suction port IN: 1/2" BSP
2	Delivery port OUT: 1/2" BSP
3	Pressure adjustment screw
4	Drain port: 3/8" BSP
5	Flow adjustment screw $\Delta$ displacement/round = 0,8 cm <sup>3</sup>
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 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

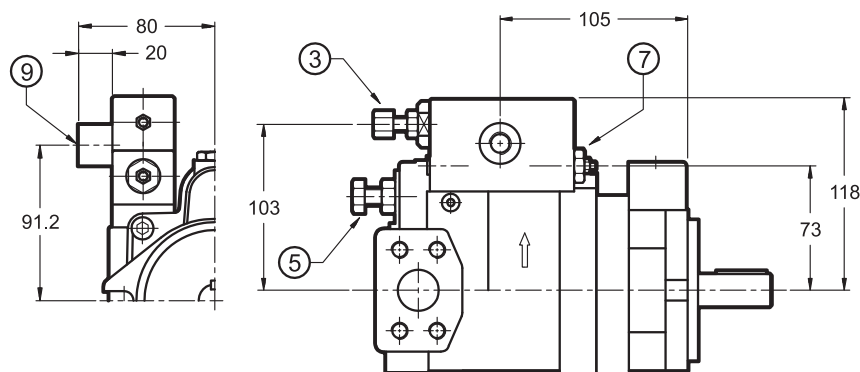


### VPPL-016PCR and VPPL-022PCR PUMPS



dimensions in mm

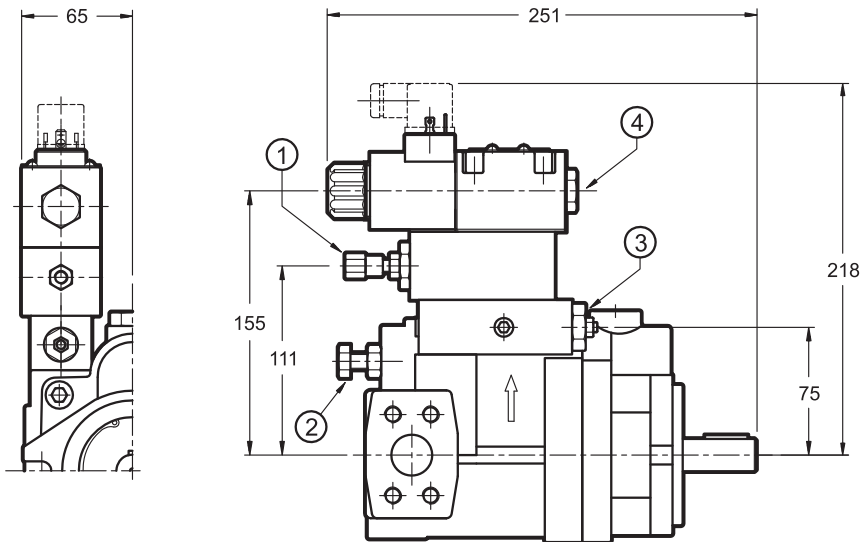
### VPPL-016PQC and VPPL-022PQC PUMPS



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 $\Delta$ displacement/round: 1,5 cm <sup>3</sup> (for VPPL-016) 2,0 cm <sup>3</sup> (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

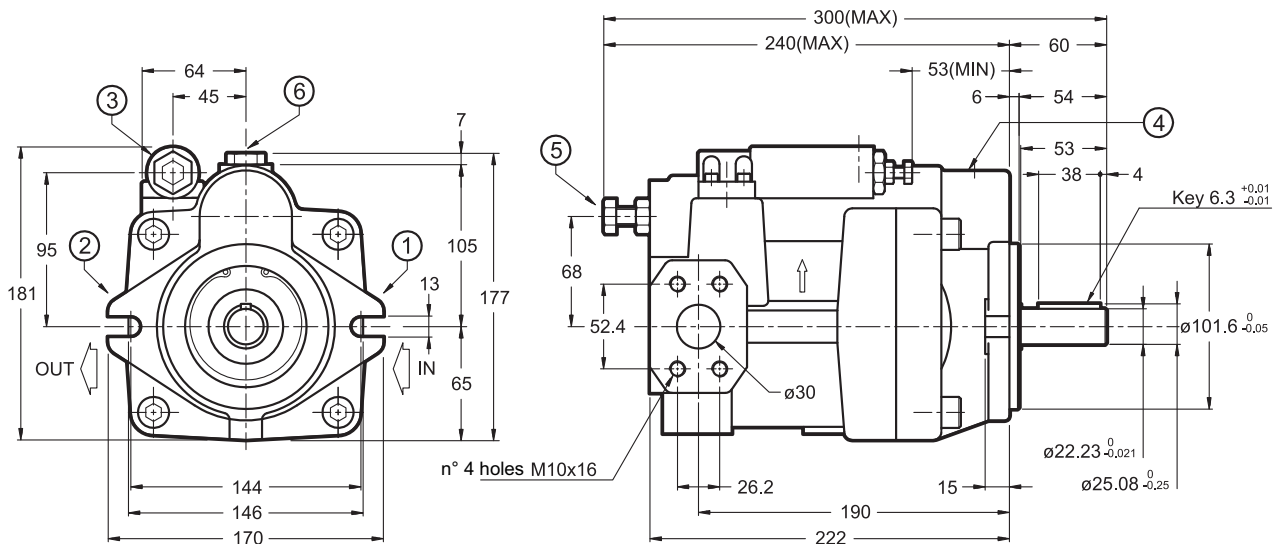


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round: 1,5 cm <sup>3</sup> (for VPPL-016) 2,0 cm <sup>3</sup> (for VPPL-022)
3	Differential pressure (not adjustable)
4	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

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

#### VPPL-036PC5 and VPPL-046PC5 PUMPS

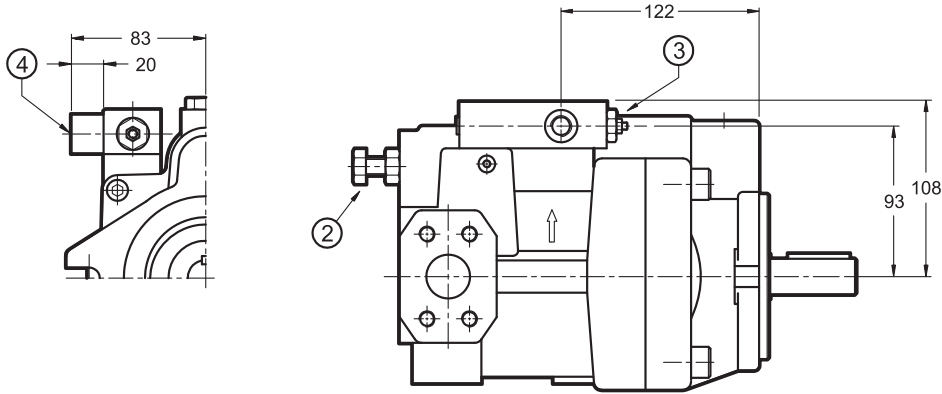
dimensions in mm



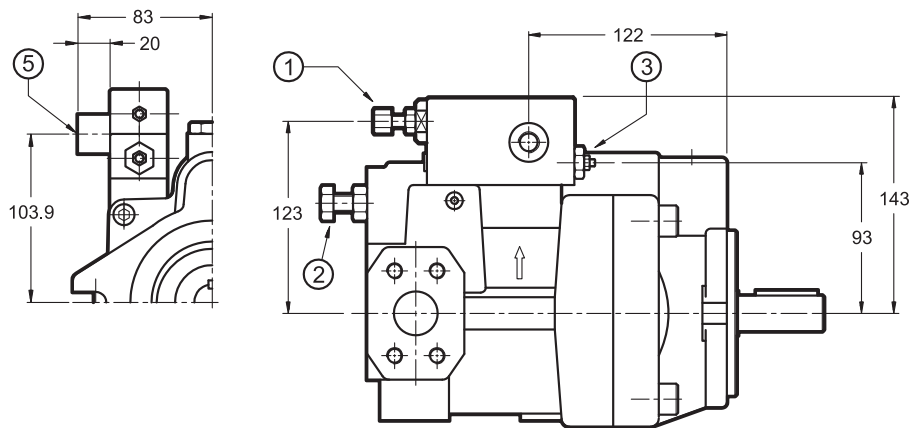
1	Suction port IN: SAE 3000 1 1/4" flange (see par. 11)
2	Delivery port OUT: SAE 3000 1" flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 1/2" BSP
5	Flow adjustment screw Δ displacement/round: 2,6 cm <sup>3</sup> (for VPPL-036) 3,2 cm <sup>3</sup> (for VPPL-046)
6	Oil supply port

### VPPL-036PCR and VPPL-046PCR PUMPS

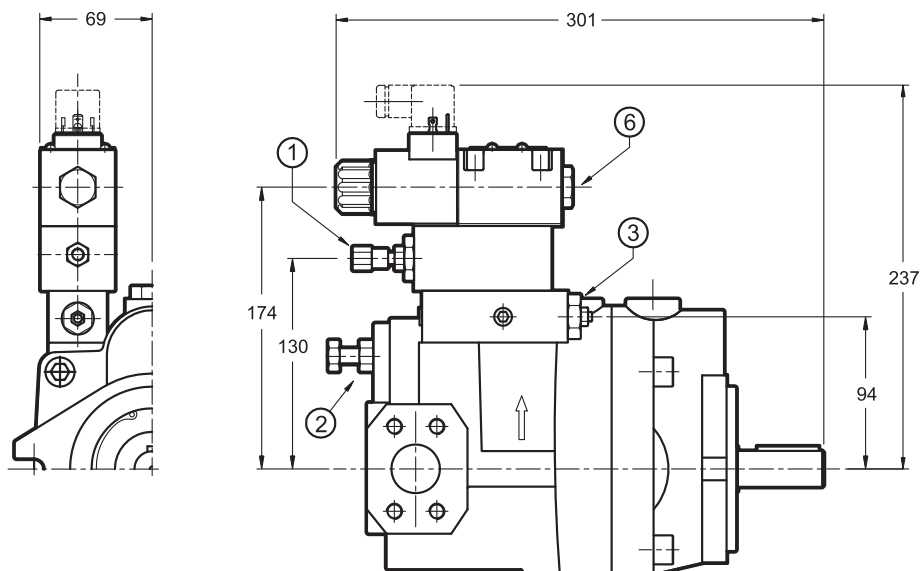
dimensions in mm



### VPPL-036PQC and VPPL-046PQC PUMPS



### VPPL-036PCX5 and VPPL-046PCX5 PUMPS

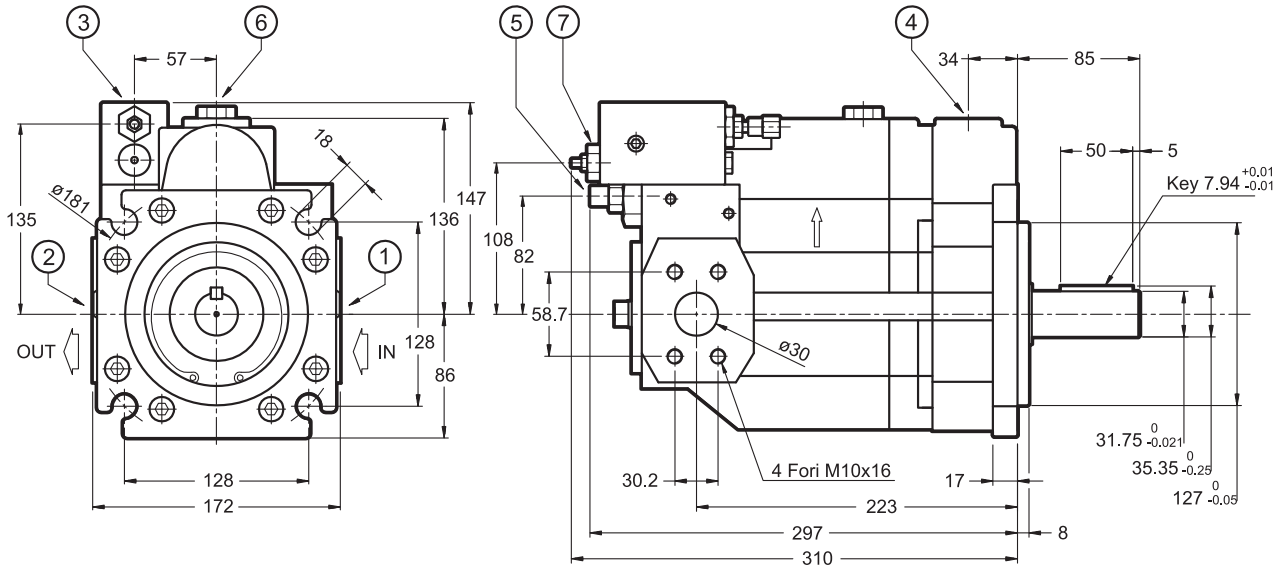


1	Pressure adjustment screw
2	Flow adjustment screw $\Delta$ displacement/round: 2,6 cm <sup>3</sup> (per VPPL-036) 3,2 cm <sup>3</sup> (per VPPL-046)
3	Differential pressure (not adjustable)
4	Remote pressure control port: 1/4" BSP
5	Load sensing port: 1/4" BSP
6	Solenoid switching valve DS3-SA2 type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

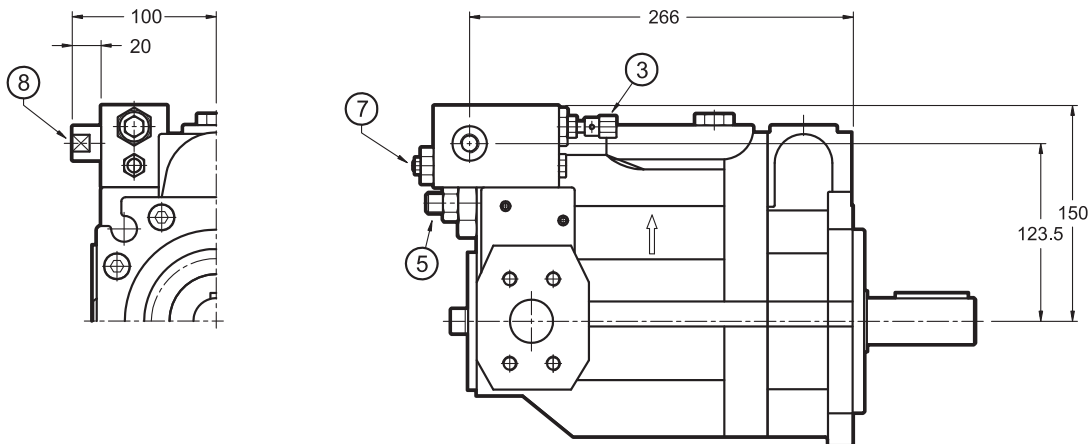
## 8 - OVERALL AND MOUNTING DIMENSIONS VPPL-070 PUMPS

### VPPL-070PC6 PUMP

dimensions in mm



### VPPL-070PCR PUMP

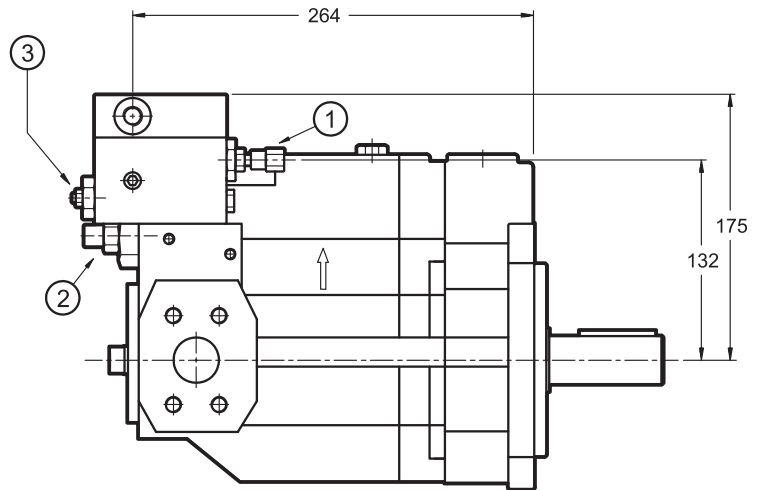
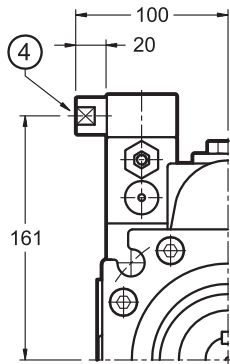


1	Suction port IN: SAE 3000 1 1/2" flange (see paragraph 11)
2	Delivery port OUT: SAE 3000 1 1/4" flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4" BSP
5	Flow adjustment screw $\Delta$ displacement/round = 4,1 cm <sup>3</sup>
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP



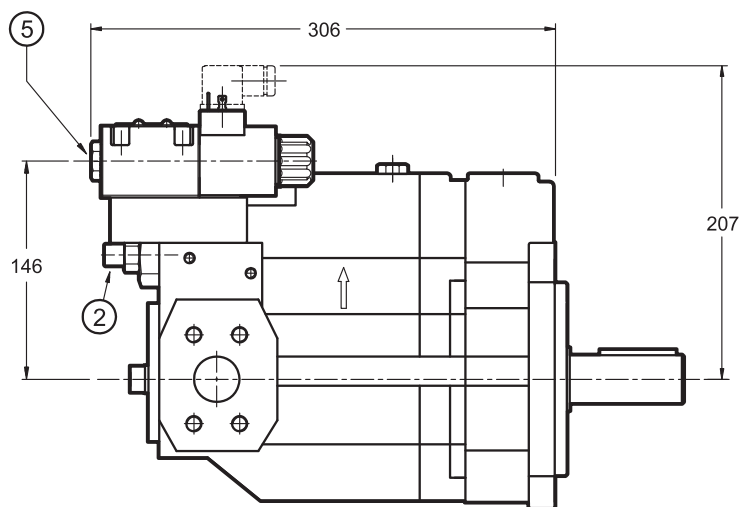
dimensions in mm

### VPPL-070PQC PUMP

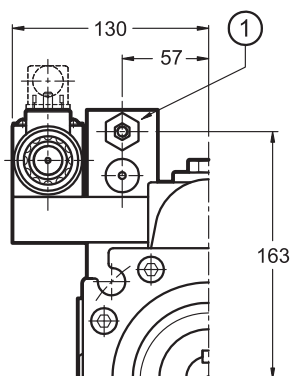


### VPPL-070PCX6 PUMP

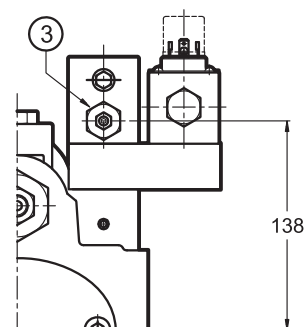
1	Pressure adjustment screw
2	Flow adjustment screw $\Delta$ displacement/round = 4,1 cm <sup>3</sup>
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)



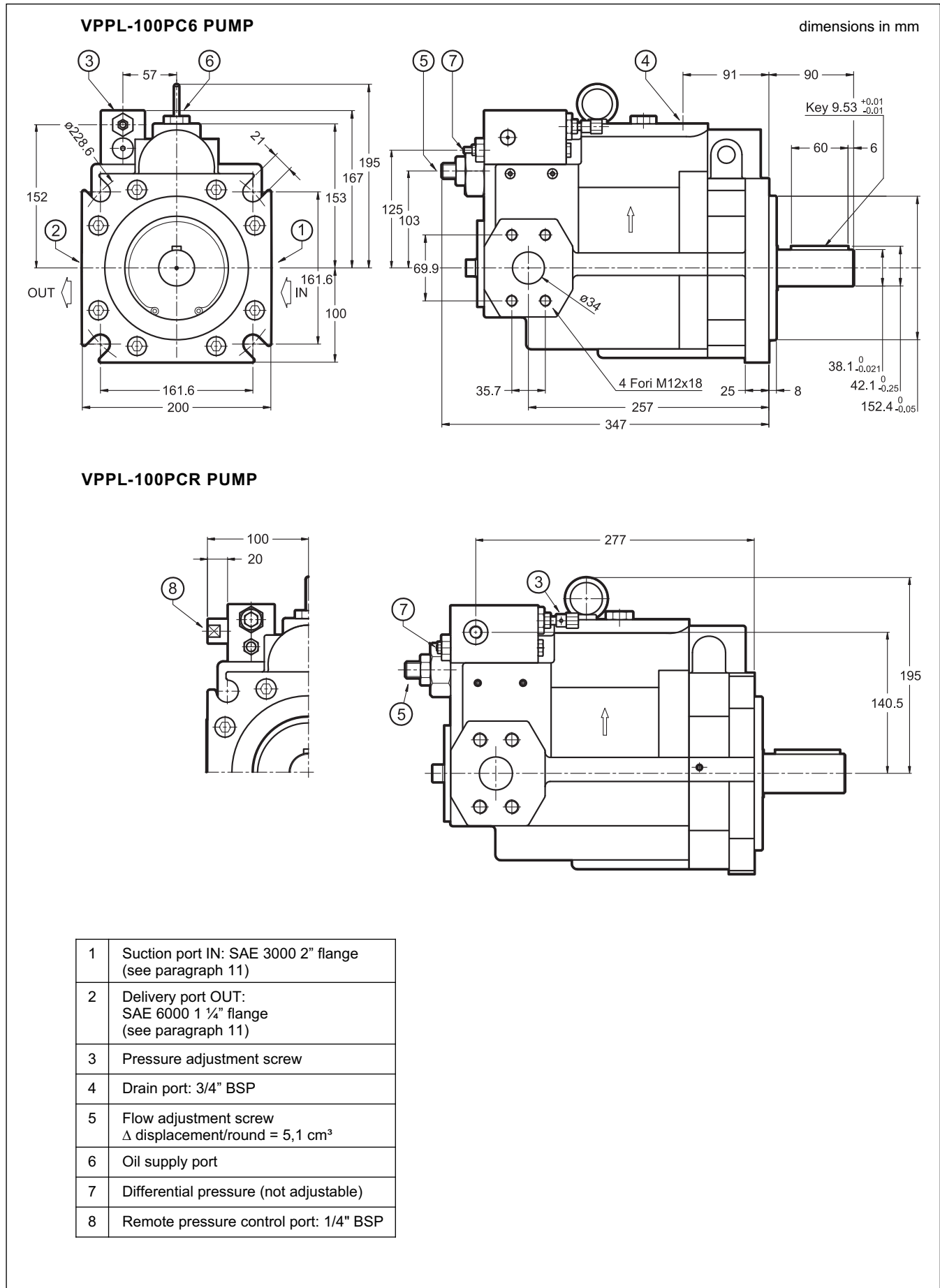
Shaft side view



Regulator side view

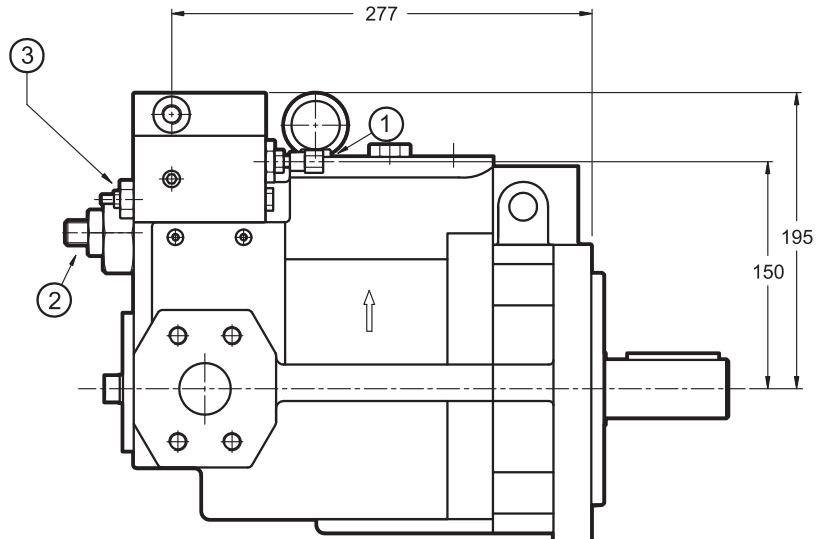
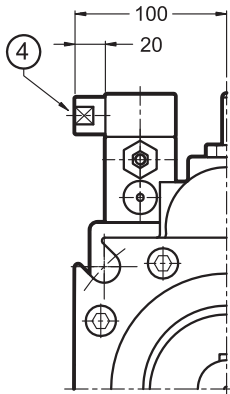


## 9 - OVERALL AND MOUNTING DIMENSIONS VPPL-100 PUMPS



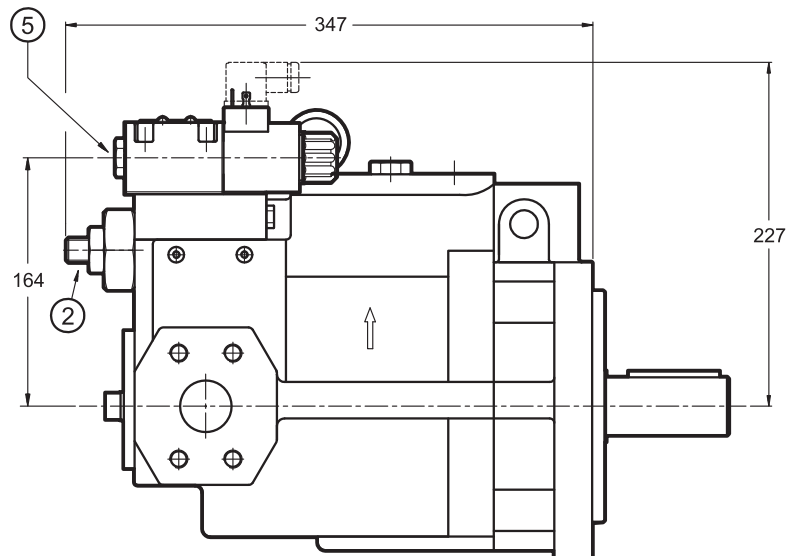
### VPPL-100PQC PUMP

dimensions in mm

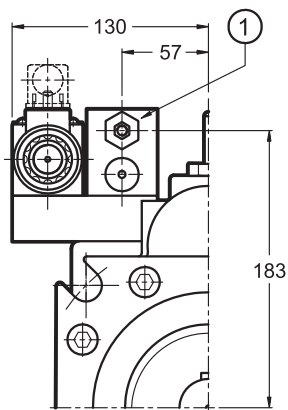


### VPPL-100PCX6 PUMP

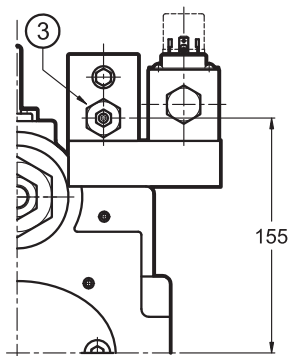
1	Pressure adjustment screw
2	Flow adjustment screw $\Delta$ displacement/round = 5,1 cm <sup>3</sup>
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)



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 the 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.

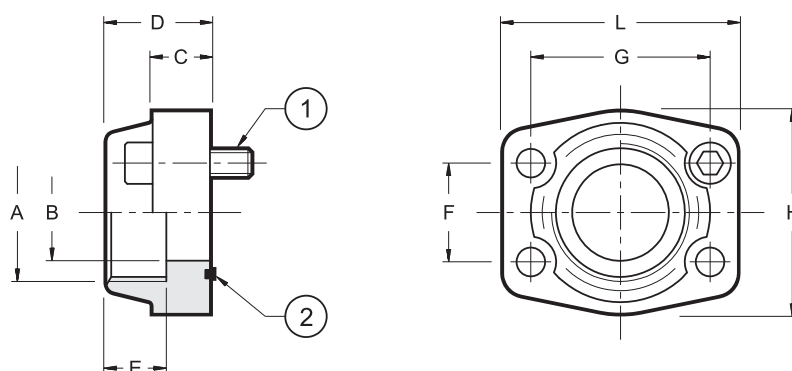
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.5 bars (relative), even during the dynamic change and flow rate phases. The minimum piping size is 3/8" for the pump type 008, 016 and 022, while it should be at least 1/2" for the pumps type 036 and 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]	$\varnothing A$	$\varnothing B$	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 1/4"	276	1 1/4" BSP	32	21	41	22	30,2	58,7	28	79		OR 4150 (37.69x3.53)
	0610714	SAE - 1 1/2"	207	1 1/2" 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 1/4"	420	1 1/4" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	OR 4150 (37.69x3.53)



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