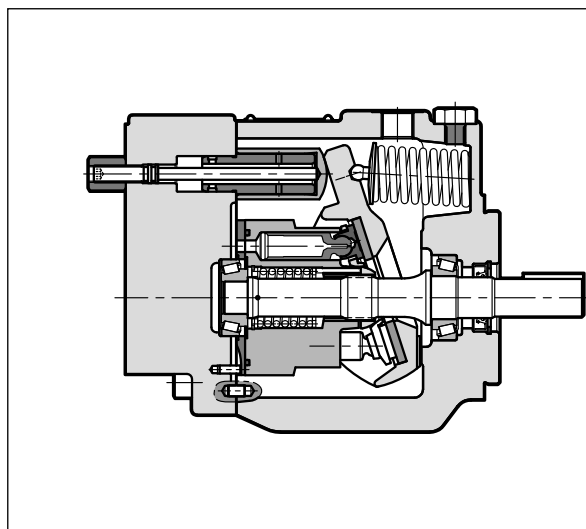




VPPD

VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS FOR INTERMEDIATE PRESSURE SERIES 10

OPERATING PRINCIPLE



- VPPD pumps are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits and intermediate pressures.
- They are available in three displacements of 15, 23 and 38 cm³/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 angle can be limited mechanically via a suitable regulating screw.
- They are supplied with a SAE J744 2-holes pilot flange and cylindrical keyed shaft end, with BSPP threaded ports.
- They are available with three types of regulating control, each according to the application needs.

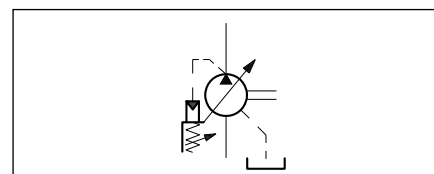
TECHNICAL SPECIFICATIONS

PUMP DISPLACEMENT		015	023	038
Maximum displacement	cm ³ /rev	14.8	23.0	37.7
Maximum flow rate at 1500 rpm (NOTE)	l/min	22.2	34.5	56.6
Maximum operating pressure	bar	210	250	250
Rotation speed	rpm	min 500 - max 1800		
Rotation direction		clockwise / counterclockwise		
Hydraulic connection		BSPP threaded ports		
Type of mounting		SAE flange J744 - 2 holes		
Oil volume in the pump body	dm ³	0.5		0.9
Mass (side ports)	kg	14.5 ÷ 16.0	21.5 ÷ 23.0	26.0 ÷ 28.7

NOTE: theoretical value.

HYDRAULIC SYMBOL

Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	0 / +60
Fluid contamination degree	see point 2.3	
Recommended viscosity	cSt	20 ÷ 50





1 - IDENTIFICATION CODE

V	P	P	D	-	R			-		-	B	S	/	10	
---	---	---	---	---	---	--	--	---	--	---	---	---	---	----	--

Variable displacement axial piston pump for intermediate pressure

Rotation (seen from the shaft side)

R = clockwise (**standard**)

L = counterclockwise (on request)

Displacement

015 = 14.8 cm³/rev

023 = 23.0 cm³/rev

038 = 37.7 cm³/rev

Pump controls:

PC* pressure compensator

4 = 15 to 140 bar

5 = 35 to 210 bar (for VPPD-*015 only)

6 = 35 to 250 bar (for VPPD-*023 and VPPD-*038 only)

PCR* remote pressure compensator

5 = 15 to 210 bar (for VPPD-*015 only)

6 = 15 to 250 bar (for VPPD-*023 and VPPD-*038 only)

PQC* pressure and flow compensator (load sensing)

4 = 15 to 140 bar

5 = 35 to 210 bar (for VPPD-*015 only)

6 = 35 to 250 bar (for VPPD-*023 and VPPD-*038 only)

Seals:

N = NBR seals for mineral oils (**standard**)

V = FPM seals for special fluids

Series No. (overall and mounting dimensions do not change from 10 to 19)

Hydraulic ports position

S = side (**standard**)

R = rear (on request)

Hydraulic connections: BSPP threaded

See drawings

Mounting flange and shaft end:

SAE J744 flange 2-holes and cylindrical keyed shaft

A034P = SAE A for VPPD-*015

B078P = SAE B for VPPD-*023 and VPPD-*038

2 - PERFORMANCE RATINGS

(values obtained with mineral oil with viscosity of 46 cSt at 40 °C)

NOMINAL DISPLACEMENT	DISPLACEMENT [cm ³ /rev]	MAX FLOW RATE at 1500 rpm [l/min]	MAX OPERATING PRESSURE at 1500 rpm [bar]	SPEED [rpm]		MIN SUCTION PRESSURE [bar]
				max	min	
015	14.8	22.2	210	1800	500	- 0.17
023	23.0	34.5	250			
038	37.7	56.6	250			

NOTE: The pressure inside the pump case must not exceed 0.35 bar.

3 - HYDRAULIC FLUID

3.1 - 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 60 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

Phosphate ester- based hydraulic fluids may be used. Following limitations apply:

HYDRAULIC FLUID TYPE	SPEED [rpm]	MAX FLUID TEMPERATURE [°C]	MAX OPERATING PRESSURE [bar]	MIN SUCTION PRESSURE [bar]	SEALS
Phosphate ester hydraulic fluids	800 ÷ 1800	+50	210	-0.10	VITON

3.2 - Fluid viscosity

The operating fluid viscosity must be within the following range: 15 ÷ 400 cSt, with fluid operating temperature range 0 ÷ 60 °C.

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

3.3 - 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 pressure or a 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, make sure to comply with the min. suction pressure values indicated in this document. The suction filter should be oversized to avoid cavitation issues, it must be equipped with a by-pass valve and, if possible, with a clogging indicator.

4 - CHARACTERISTIC CURVES

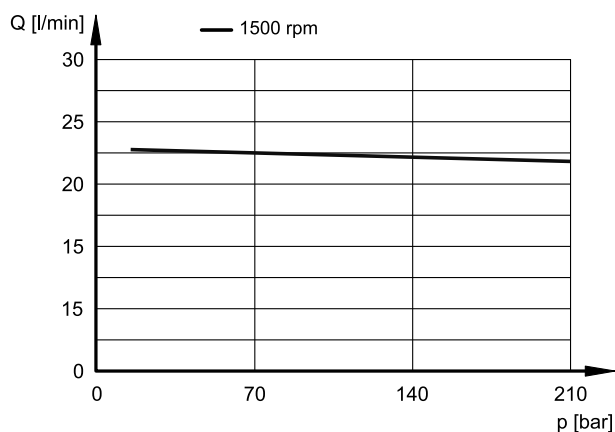
(values obtained with mineral oil with viscosity of 36 cSt at 50 °C)

Unless otherwise stated, values are valid for both 1500 rpm and 1800 rpm.

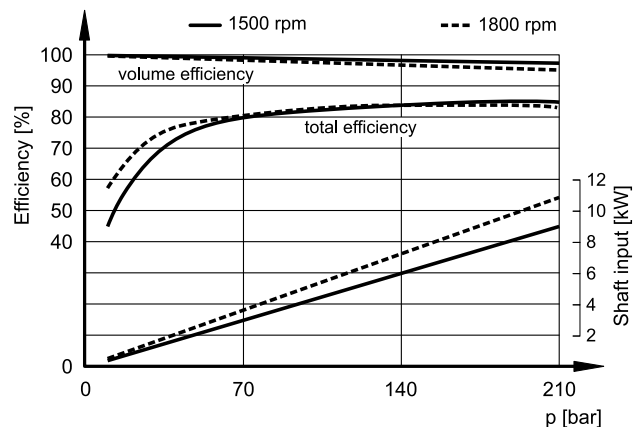
The efficiency varies depending on the delivery rate setting. In order to select the right motor capacity, refer to absorbed power characteristics.

4.1 - VPPD*015 pump characteristic curves

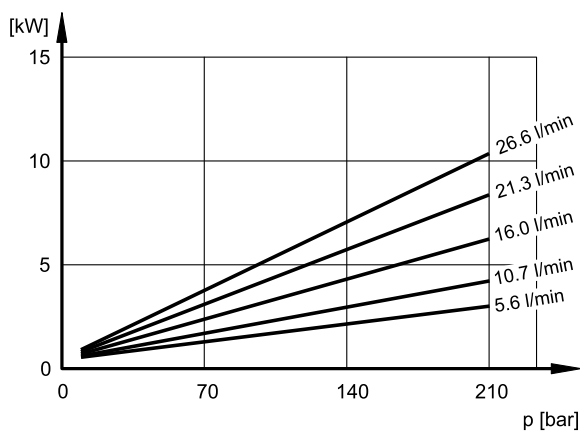
FLOW RATE / PRESSURE CURVES



VOLUMETRIC AND TOTAL EFFICIENCY

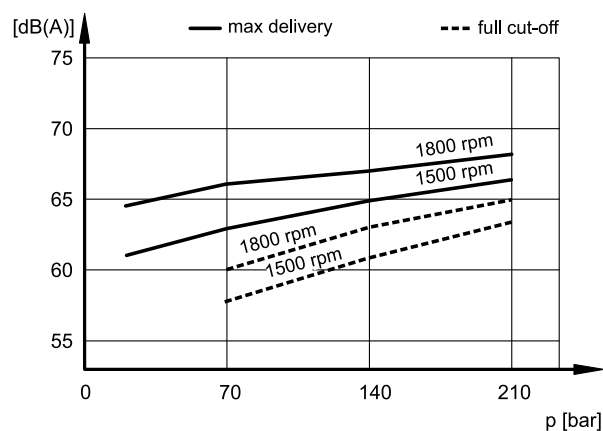


ABSORBED POWER

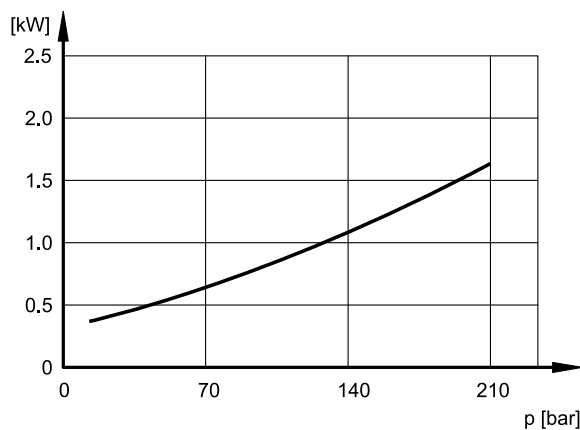


NOISE LEVEL

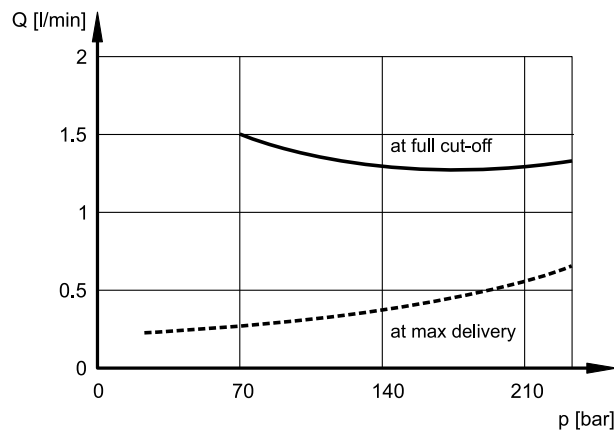
(detection at 1 m from the pump)



INPUT POWER AT FULL CUT-OFF

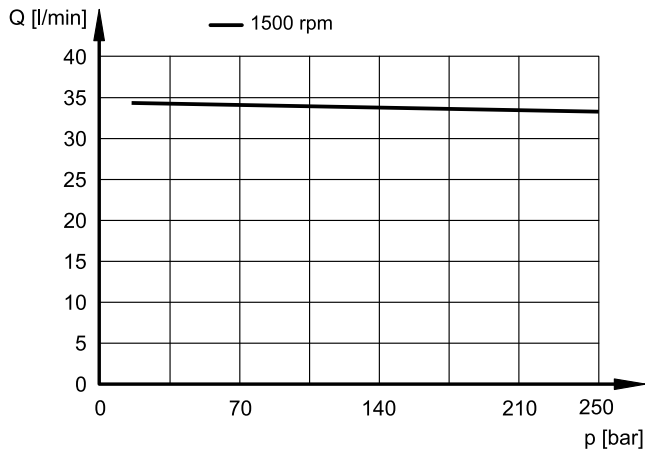


DRAIN FLOW RATE

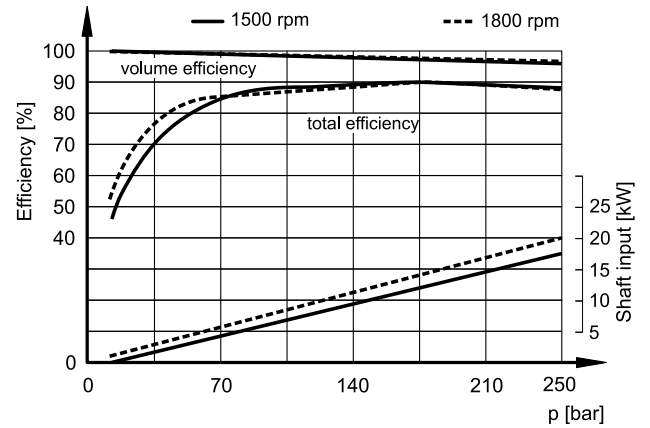


4.2 - VPPD-*023 pump characteristic curves

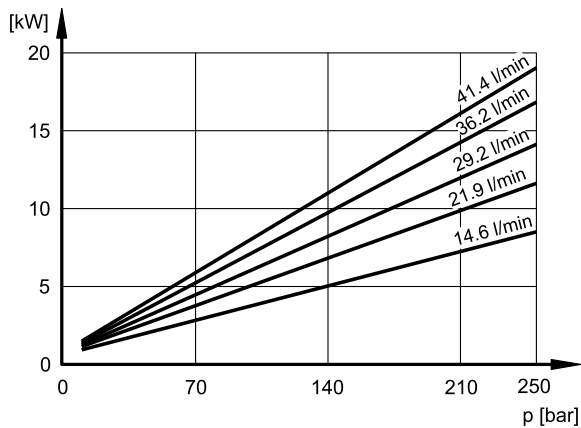
FLOW RATE / PRESSURE CURVES



VOLUMETRIC AND TOTAL EFFICIENCY

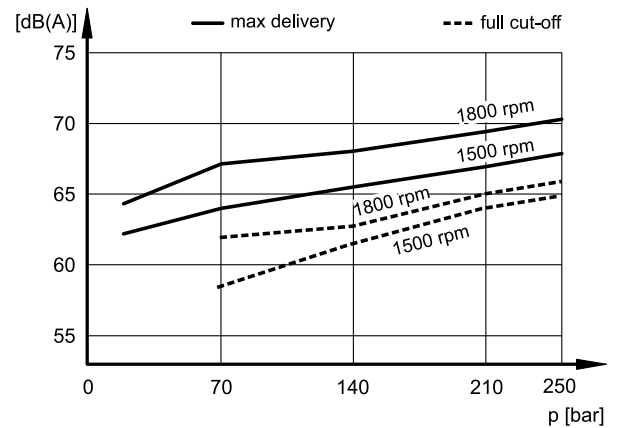


ABSORBED POWER

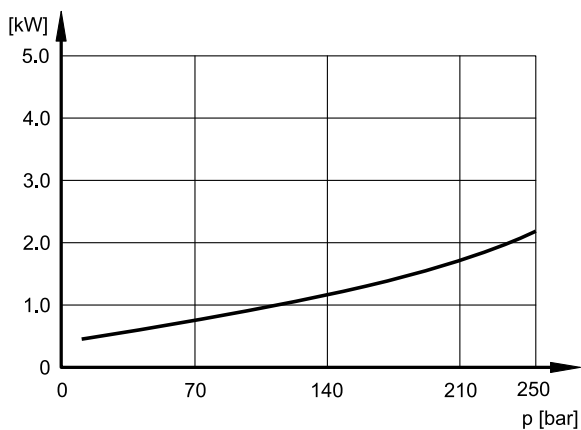


NOISE LEVEL

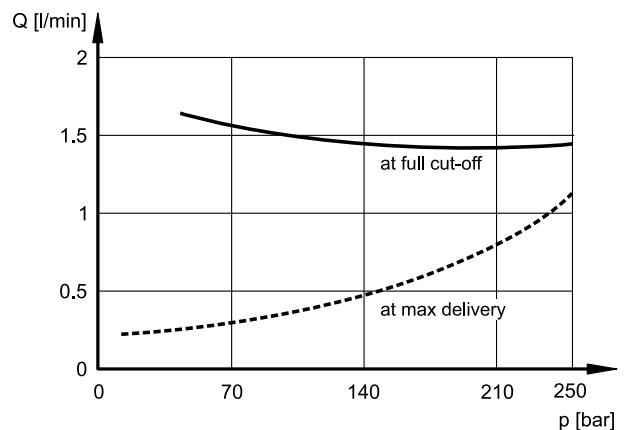
(detection at 1 m from the pump)



INPUT POWER AT FULL CUT-OFF



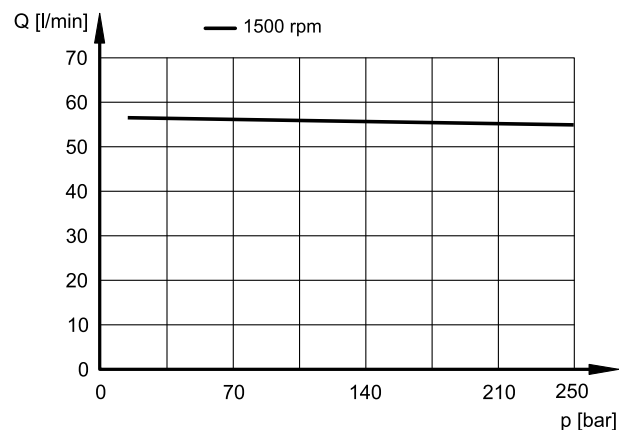
DRAIN FLOW RATE



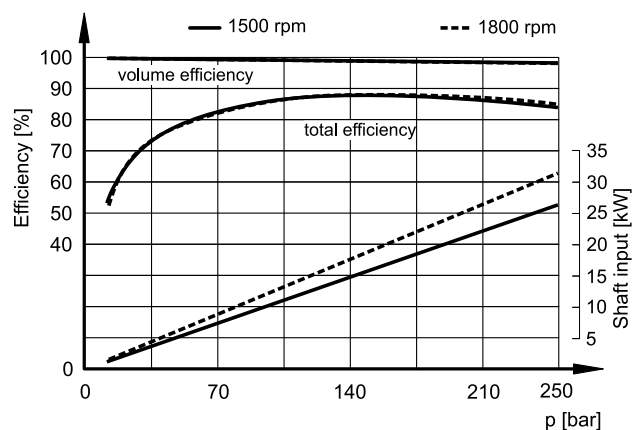
4.3 - VPPD-*038 pump characteristic curves

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

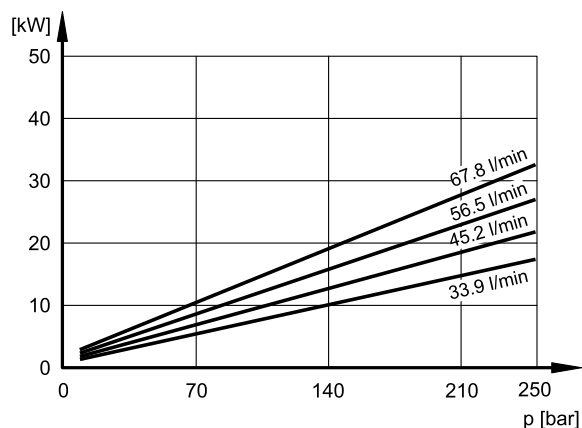
FLOW RATE / PRESSURE CURVES



VOLUMETRIC AND TOTAL EFFICIENCY

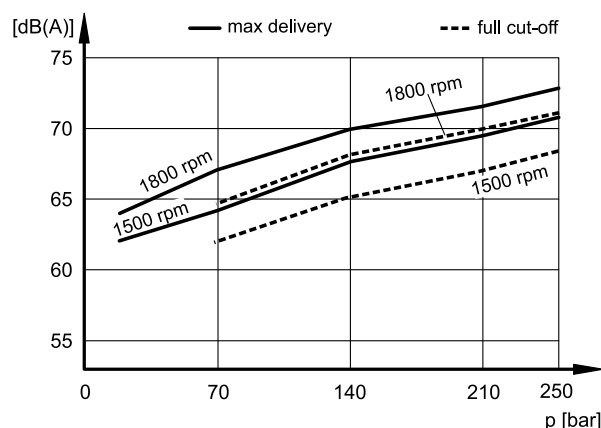


ABSORBED POWER

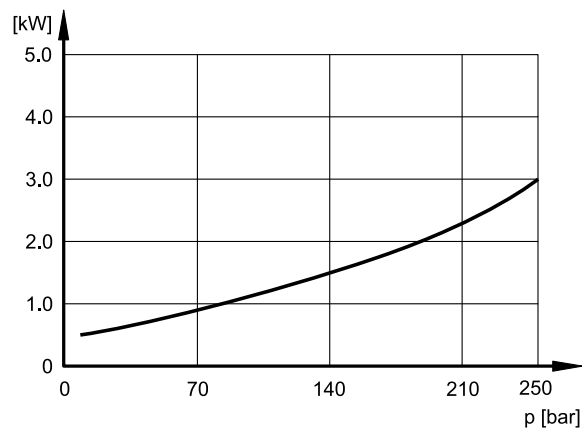


NOISE LEVEL

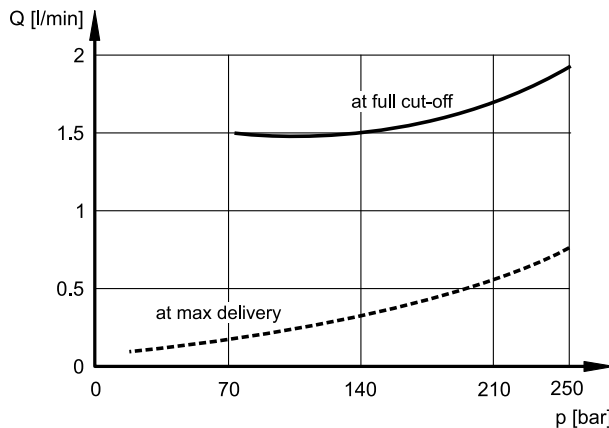
(detection at 1 m from the pump)



INPUT POWER AT FULL CUT-OFF

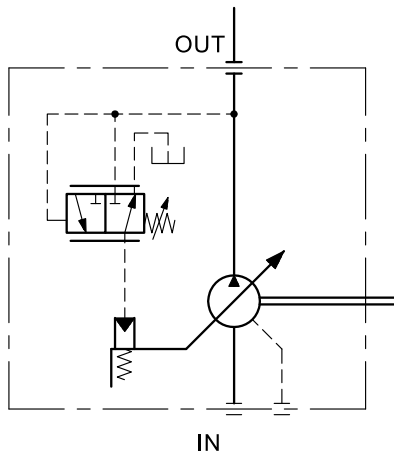


DRAIN FLOW RATE



5 - CONTROLS

5.1 - PC* pressure compensator



The PC* pressure compensator keeps the pressure constant at the set level in the system, thus adjusting automatically the pump delivery according to the actual requirements from the system.

The delivery pressure can be set to the desired value by turning the pressure adjusting screw of the PC valve

Clockwise rotation increases the set pressure.

- pressure adjustment range:

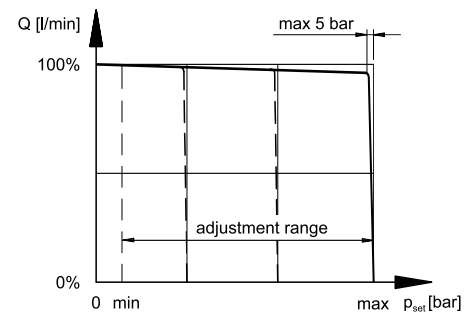
PC4 = 15 to 140 bar

PC5 = 35 to 210 bar (for VPPD-*015 only)

PC6 = 35 to 250 bar (for VPPD-*023 and VPPD-*038 only)

- default setting:

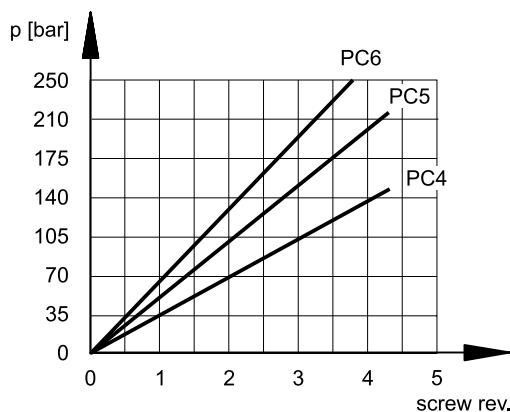
highest value of the pressure range at max displacement.



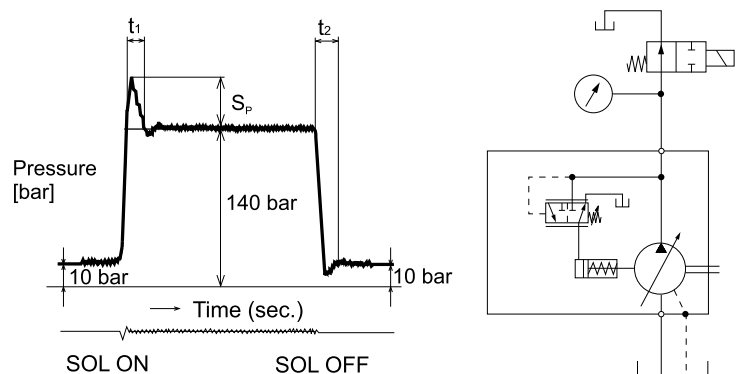
5.1.1 - Characteristic curves

(values obtained with mineral oil with a viscosity of 36 cSt at 50 °C, 1500 rpm)

PRESSURE ADJUSTMENT BY TURNING SCREW



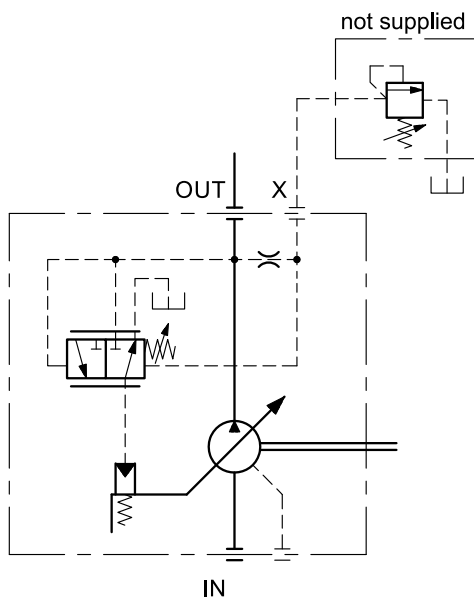
RESPONSE CHARACTERISTICS



NOTE: Excessive loosening of the pressure adjusting screw may cause oil to leak from the threaded section or parts to fall out. Do not loosen the screw beyond the pressure adjustment range.

pump displacement	t1 [ms]	t2 [ms]	Sp surge pressure [bar]
015	40 ÷ 50	50 ÷ 70	25 ÷ 40
023	50 ÷ 60		35 ÷ 70
038	50 ÷ 90		55 ÷ 90

5.2 - PCR* remote-controlled pressure compensator



The PCR pressure compensator keeps the pressure constant at the set level in the system, thus adjusting automatically the pump delivery according to the actual system requirements, via a remote control (pressure relief valve) connected to the X port of the pump (typical application for immersed pumps).

NOTE: The maximum flow rate of the remote valve should be max. 2 l/min. The maximum length of the piping between the valve and the X port of the pump must not exceed 2 m.

Clockwise rotation increases the set pressure.

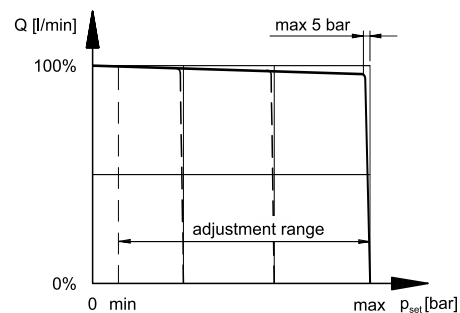
- pressure adjustment range:

PCR5 = 15 to 210 bar (for VPPD-*015 only)

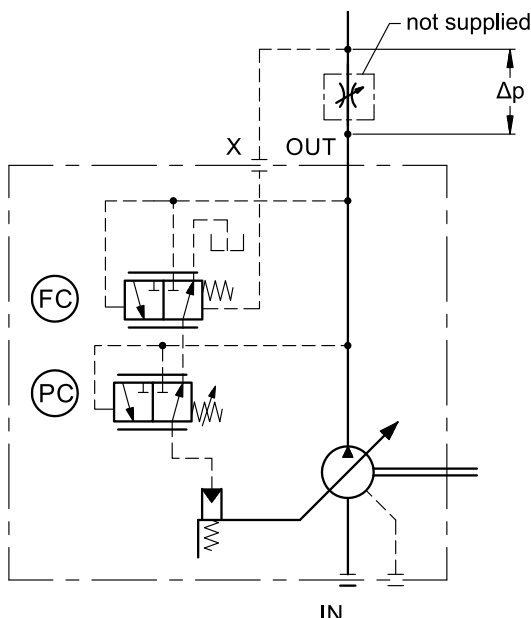
PCR6 = 15 to 250 bar (for VPPD-*023 and VPPD-*038 only)

- differential pressure screw (PC valve): factory set

- required flow rate for pilot signal at X port = 1 l/min approx.



5.3 - PQC* flow and pressure compensator (Load Sensing):



Besides to the pressure adjustment (as for the PC* control), this compensator allows to control the pump delivery according to the pressure drop measured upstream and downstream a throttle valve installed in the working line.

Combining this control method with a proportional control valve achieves energy efficient control of the pump, where the minimum pressure and flow rate to operate the actuator are supplied.

Clockwise rotation on PC valve increases the set pressure.

NOTE: The piping between the X port and the delivery line downstream the restrictor (or valve) is in the Customer's charge

- pressure adjustment range (PC valve):

PQC4 = 15 to 140 bar

PQC5 = 35 to 210 bar (for VPPD-*015 only)

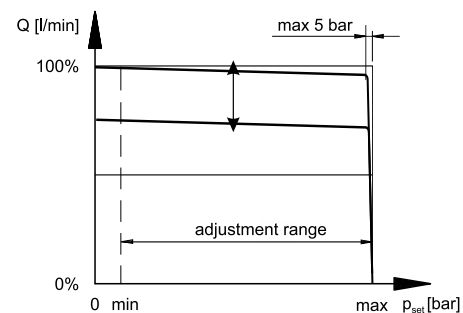
PQC6 = 35 to 250 bar (for VPPD-*023 and VPPD-*038 only)

- default setting (PC valve):

highest value of the pressure range at max displacement.

- differential pressure (FC valve, factory set): 14 bar

- minimum delivery pressure = 22 bar

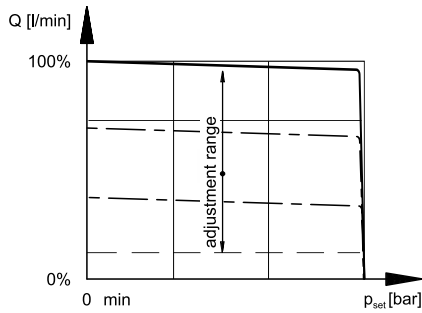
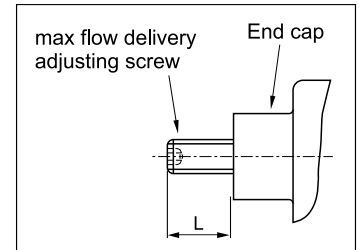


6 - MAXIMUM DISPLACEMENT ADJUSTMENT

The adjustment screw is placed on the pump back. Turn clockwise to decrease the pump displacement.

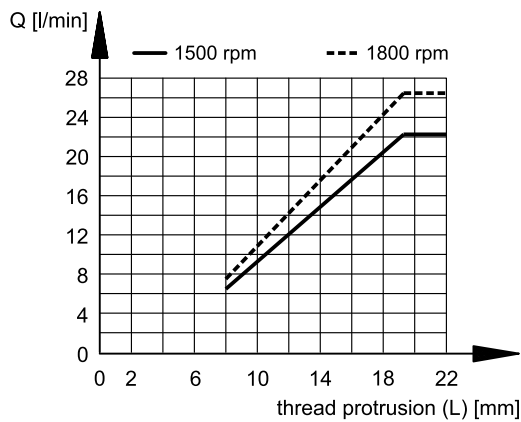
The delivery rate can be roughly judged from the protruding length of the adjusting screw (L).

Overtightening of the adjusting screw may cause oil to leak from the threaded section. Do not tighten the screw beyond the adjustment range.

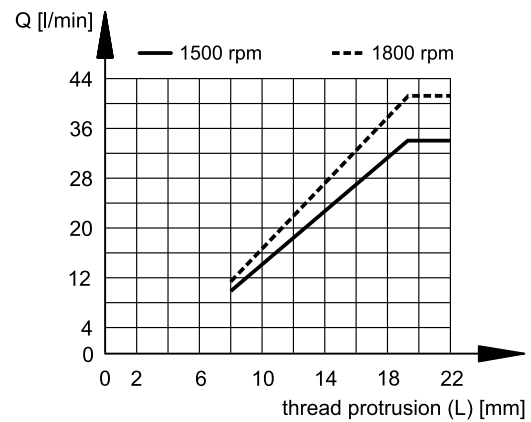


6.1 - Maximum delivery as a dependency of the thread protrusion

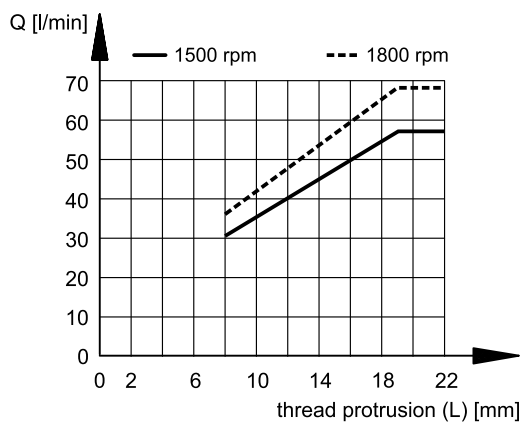
VPPD-*015



VPPD-*023



VPPD-*038

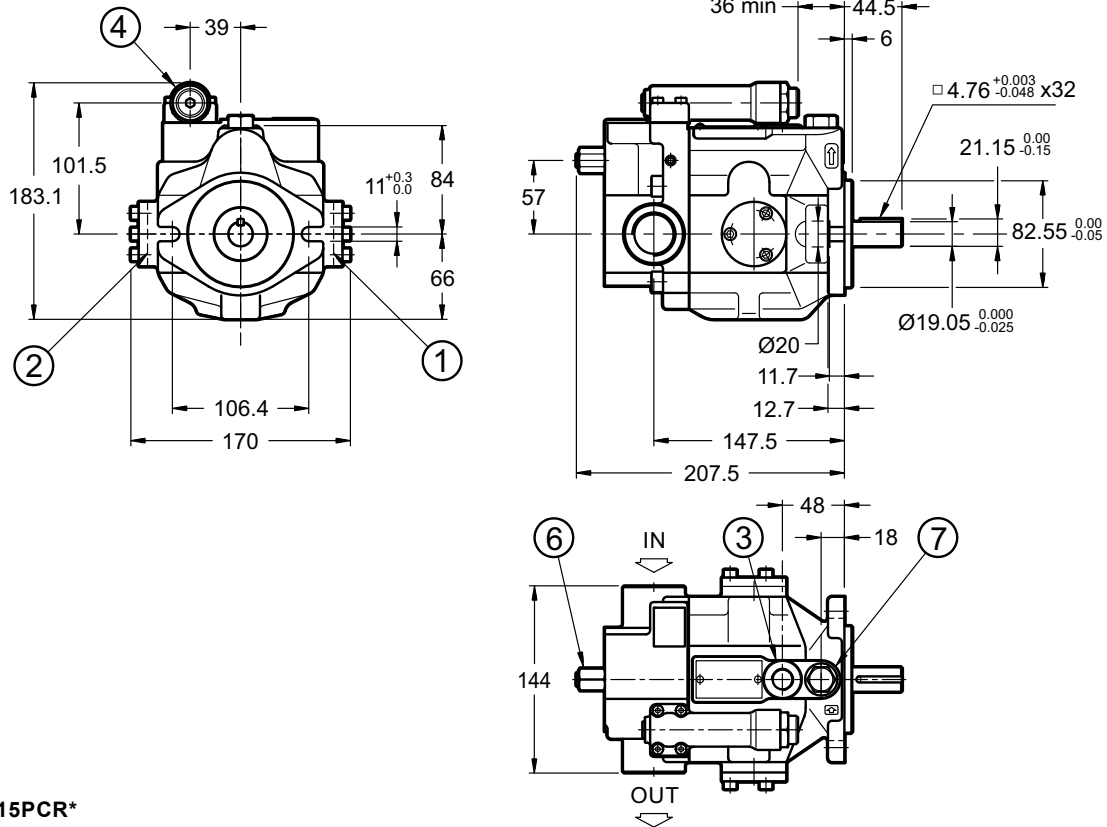


Min / max delivery at 1500 rpm		
	min	max
VPPD-*015	6.3	22.2
VPPD-*023	10.0	34.5
VPPD-*038	30.4	56.6

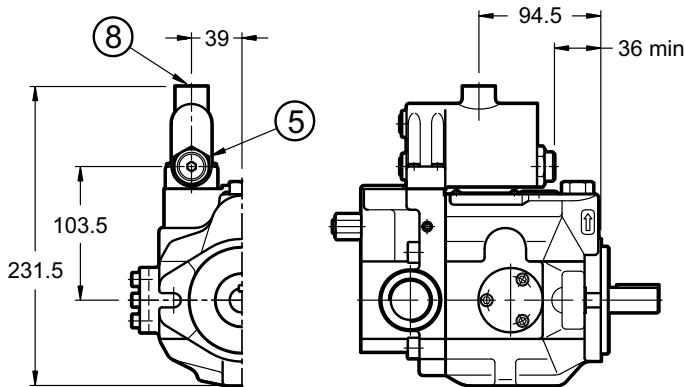
7 - VPPD-*015 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPD-*015PC*

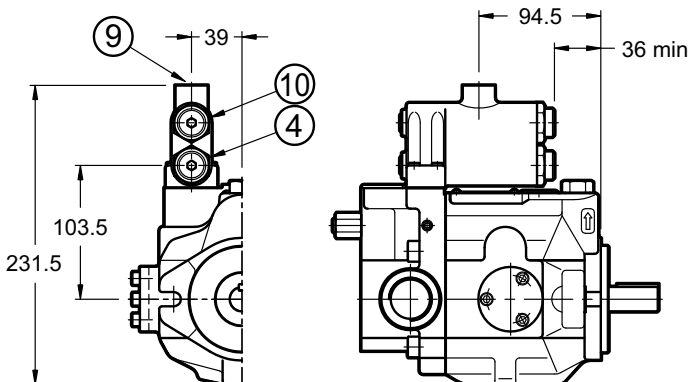
dimensions in mm



VPPD-*015PCR*



VPPD-*015PQC*



NOTE: Clockwise rotation is shown.

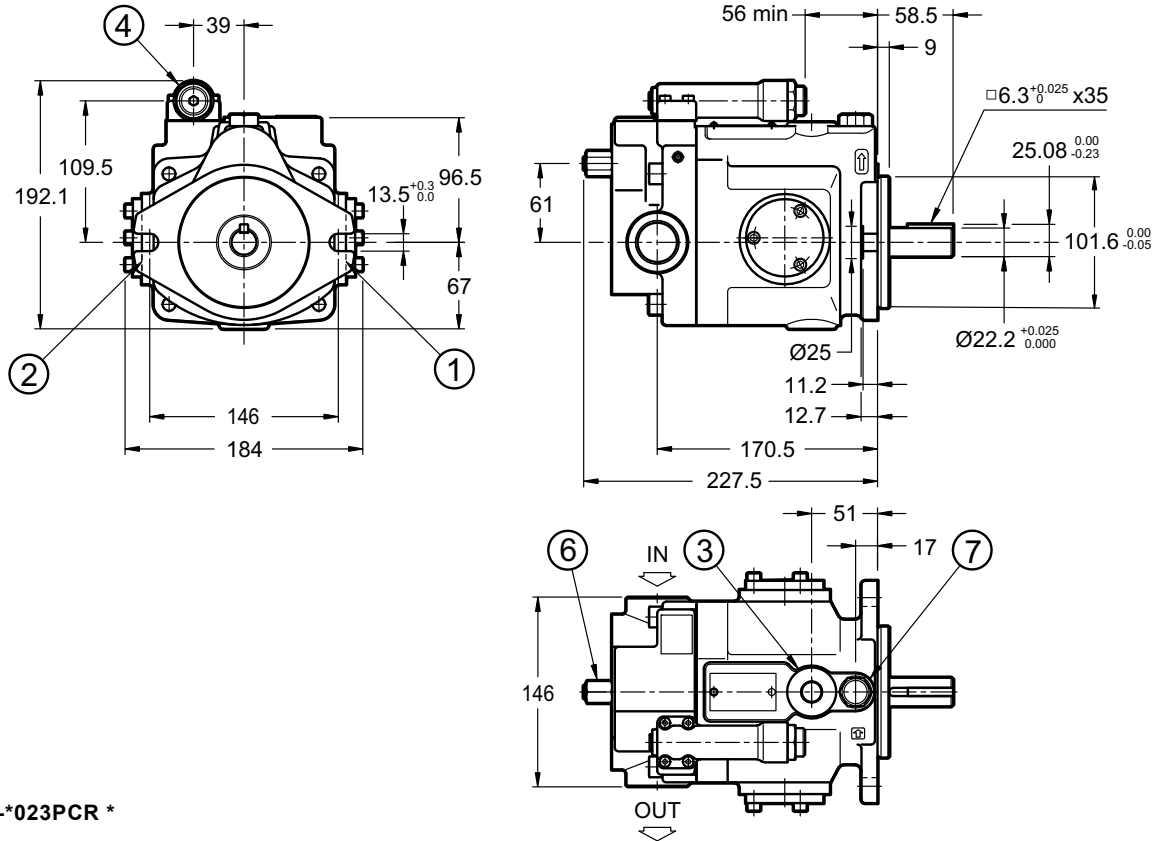
Suction and delivery are reversed in counterclockwise rotating pumps, and the controls are on the right side of the pump (shaft side view).

1	Suction port IN: 1" BSPP
2	Delivery port OUT: 1" BSPP
3	Drain port: 3/8" BSPP
4	Pressure adjusting screw PC: Allen key 6.5 Locking nut spanner 27 Turning clockwise increase the pressure
5	Differential pressure screw PC (factory-set)
6	Displacement set screw: Allen key 5 Locking nut spanner 17 Turning clockwise decrease the displacement See point 6
7	Oil filling port
8	Remote pressure control port: 1/4" BSPP
9	Load pressure port: 1/8" BSPP
10	Differential pressure screw FC (factory-set)

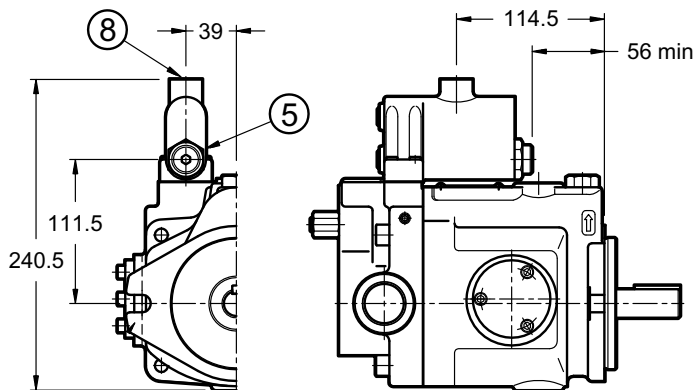
8 - VPPD-*023 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPD-*023PC*

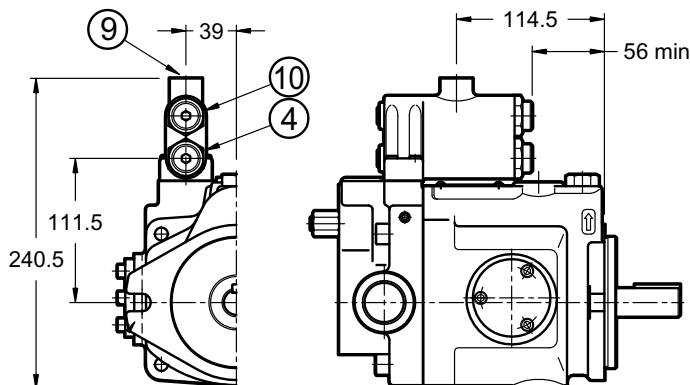
dimensions in mm



VPPD-*023PCR *



VPPD-*023PQC*



NOTE: Clockwise rotation is shown.

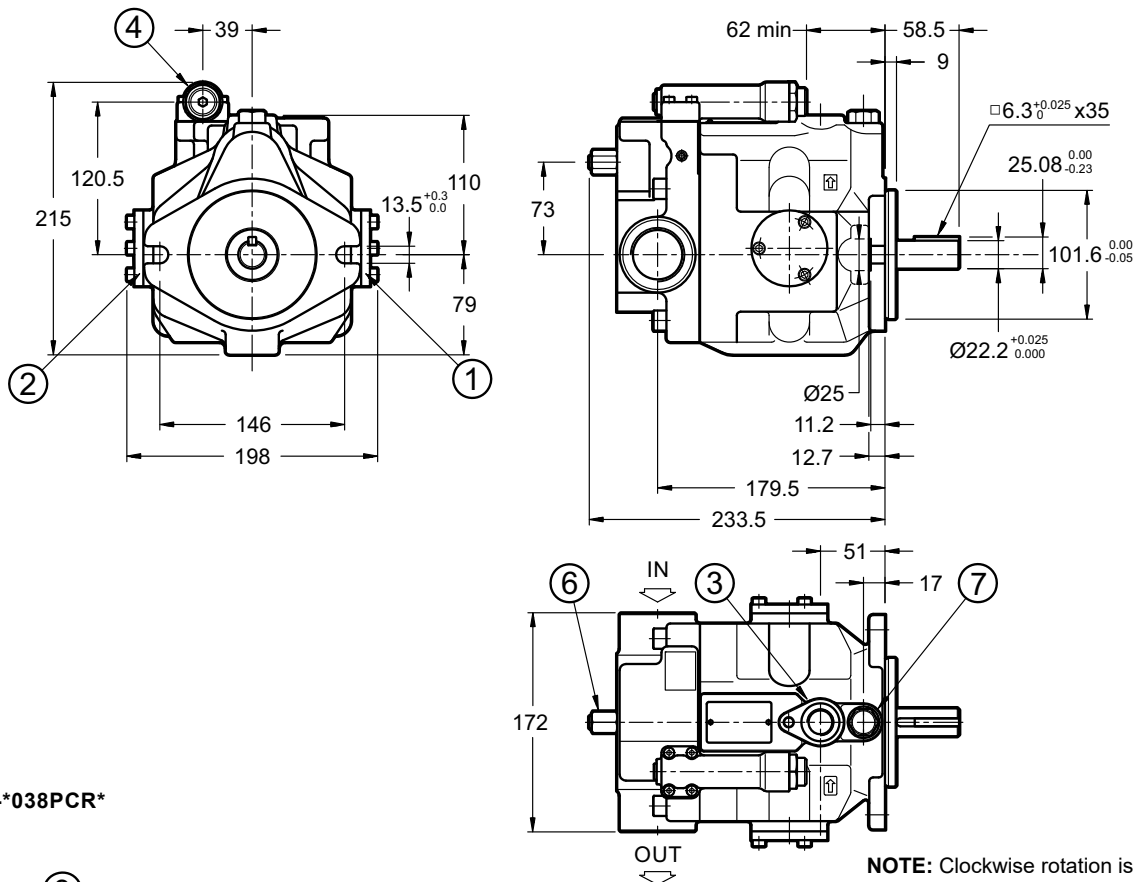
Suction and delivery are reversed in counterclockwise rotating pumps, and the controls are on the right side of the pump (shaft side view).

1	Suction port IN: 1" BSPP
2	Delivery port OUT: 1" BSPP
3	Drain port: 3/8" BSPP
4	Pressure adjusting screw PC: Allen key 6.5 Locking nut spanner 27 Turning clockwise increase the pressure
5	Differential pressure screw PC (factory-set)
6	Displacement set screw: Allen key 5 Locking nut spanner 17 Turning clockwise decrease the displacement See point 6
7	Oil filling port
8	Remote pressure control port: 1/4" BSPP
9	Load pressure port: 1/8" BSPP
10	Differential pressure screw FC (factory-set)

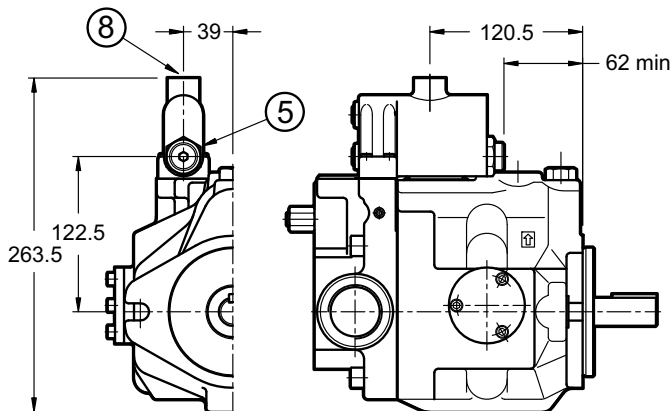
9 - VPPD-*038 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPD-*038PC5

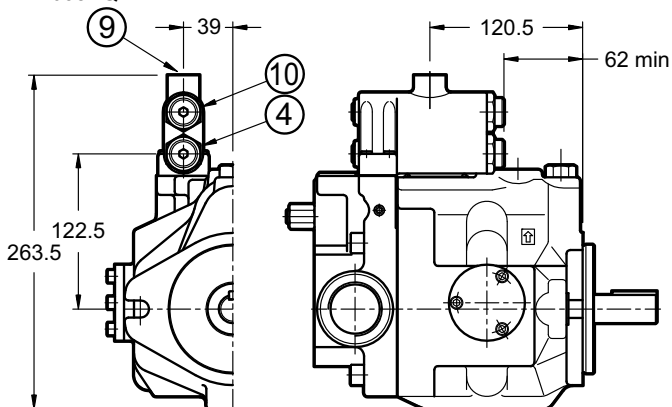
dimensions in mm



VPPD-*038PCR*



VPPD-*038PQC*



NOTE: Clockwise rotation is shown.

Suction and delivery are reversed in counterclockwise rotating pumps, and the controls are on the right side of the pump (shaft side view).

1	Suction port IN: 1 1/4" BSPP
2	Delivery port OUT: 1 1/4" BSPP
3	Drain port: 1/2" BSPP
4	Pressure adjusting screw PC: Allen key 6.5 Locking nut spanner 27 Turning clockwise increase the pressure
5	Differential pressure screw PC (factory-set)
6	Displacement set screw: Allen key 5 Locking nut spanner 17 Turning clockwise decrease the displacement See point 6
7	Oil filling port
8	Remote pressure control port: 1/4" BSPP
9	Load pressure port: 1/8" BSPP
10	Differential pressure screw FC (factory-set)



10 - INSTALLATION

VPPD pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position. Using steel pipes for piping, take care not to force the pump off center. Forcing the pump off center with pipes may cause abnormal noise.

NOTE: The drainage port should be oriented so that the oil level inside the pump body never drops below 3/4 of the total volume required to fill the pump body.

- 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.
- In the case of installation above the oil level, check that the minimal inlet pressure is not lower than -0.17 bar (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 oil level which does not grant the complete pump submersion, arrange the drain line so that the higher pump bearing is always lubricated.
- Properly size the suction piping to comply with the minimum suction values given in Sections 2 and 3 of this document. Bends or restrictions or excessive pipe length could further reduce the suction pressure value resulting in increased noise emissions, cavitation issues and reduced pump life.
- Isolate the drain piping from other returning lines as it discharges direct inside the tank far from the suction area. Size the drainage line so that the pressure inside the pump casing is always less than 0.35 bar (relative), even during dynamic phases of flow rate variations. The drain piping size is minimum Ø12 mm for the VPPD-*015 and VPPD-*023, while it should be at least Ø15 mm for VPPD-*038. Maximum piping length 1 meter.
- Check that the pump direction of rotation is the same of that of the motor.
- Before starting, the pump body has to be filled with the fluid. Pump case filling volume is 500 cm³ for VPPD-*015 and VPPD-*023, while is 900 cm³ for VPPD-*038.
- The pump start up should occur with the system at minimum pressure, with no load, especially with low temperatures. When the pump is driven for the first time, turn the power switch to the motor on and off a few times to let the air out of the piping and then run it continuously at full speed. Noise may be observed until the air has been completely removed but this is not abnormal.



VPPD
SERIES 10

DUPLOMATIC
MOTION SOLUTIONS
*a member of **DAIKIN** group*

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