



# 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 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 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.

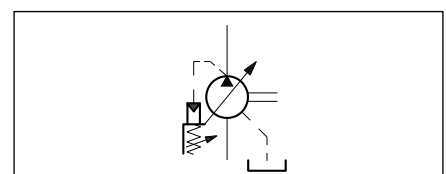
### TECHNICAL SPECIFICATIONS

| PUMP DISPLACEMENT                    |                      | 015                          | 023         | 038         |
|--------------------------------------|----------------------|------------------------------|-------------|-------------|
| Maximum displacement                 | cm <sup>3</sup> /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 <sup>3</sup>      | 0.5                          |             | 0.9         |
| Mass                                 | kg                   | 14.5 ÷ 16.0                  | 21.5 ÷ 23.0 | 26.0 ÷ 28.7 |

**NOTE:** theoretical value.

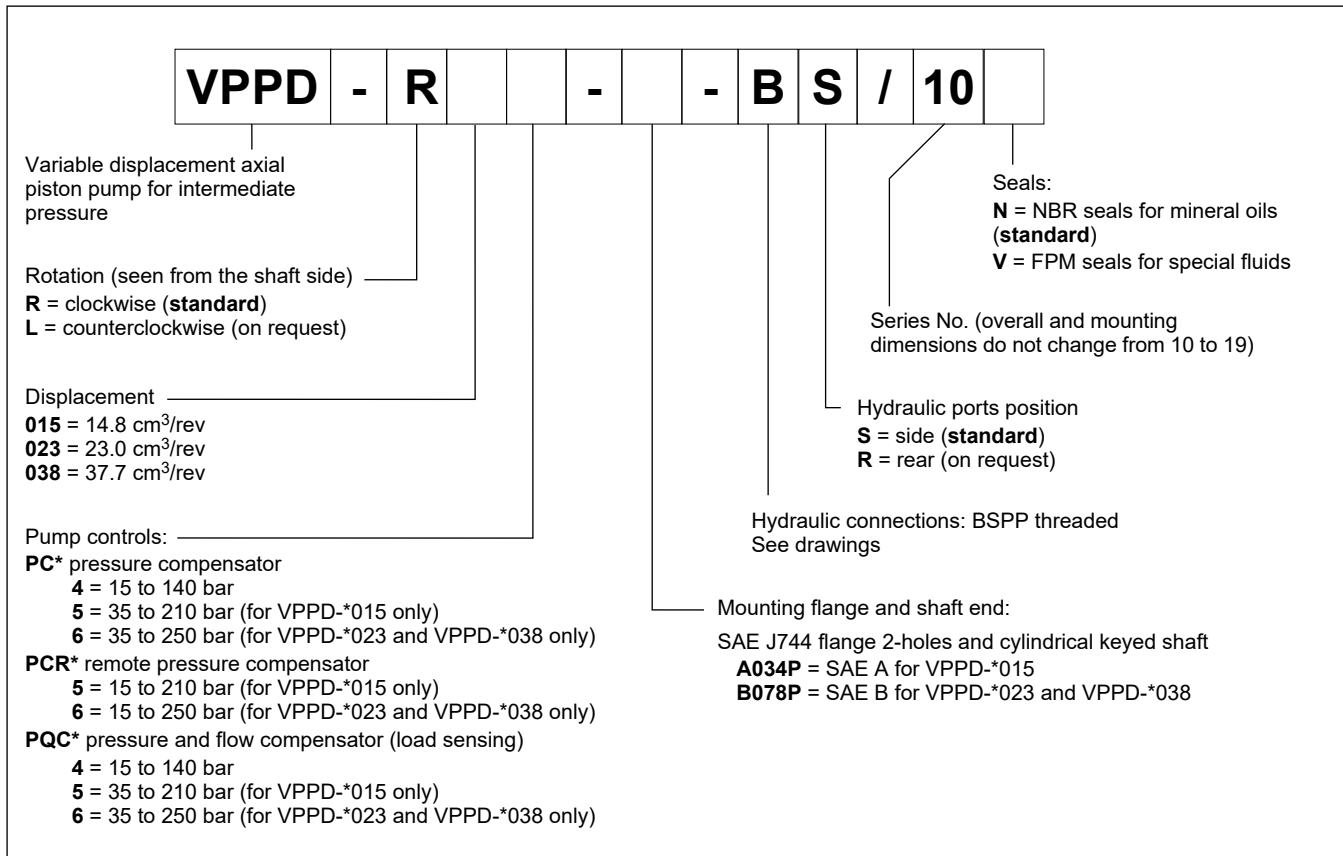
|                            |               |           |
|----------------------------|---------------|-----------|
| Ambient temperature range  | °C            | -10 / +50 |
| Fluid temperature range    | °C            | 0 / +60   |
| Fluid contamination degree | see point 2.3 |           |
| Recommended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

### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE



## 2 - PERFORMANCE RATINGS

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

| NOMINAL DISPLACEMENT | DISPLACEMENT [cm <sup>3</sup> /rev] | MAX FLOW RATE at 1500 rpm [l/min] | MAX OPERATING PRESSURE at 1500 rpm [bar] | SPEED [rpm] |     | MIN SUCTION PRESSURE [bar] |
|----------------------|-------------------------------------|-----------------------------------|--|-------------|-----|----------------------------|
|                      |                                     |                                   |  | max         | min |                            |
| <b>015</b>           | 14.8                                | 22.2                              | 210                                      | 1800        | 500 | - 0.17                     |
| <b>023</b>           | 23.0                                | 34.5                              | 250                                      |             |     |                            |
| <b>038</b>           | 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<br>[rpm] | MAX FLUID<br>TEMPERATURE<br>[°C] | MAX OPERATING<br>PRESSURE<br>[bar] | MIN SUCTION<br>PRESSURE<br>[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

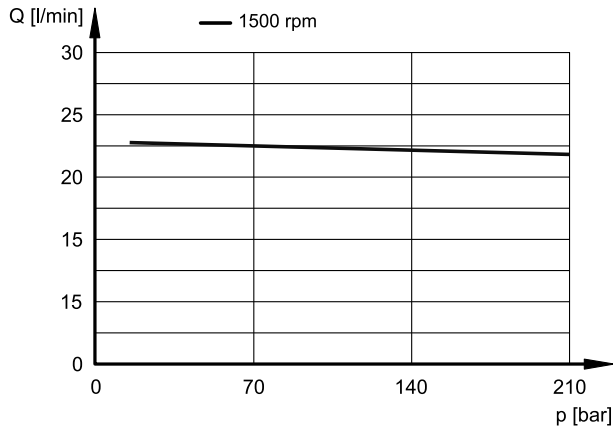
(values obtained with mineral oil with viscosity of 36 cSt at 50 °C)

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

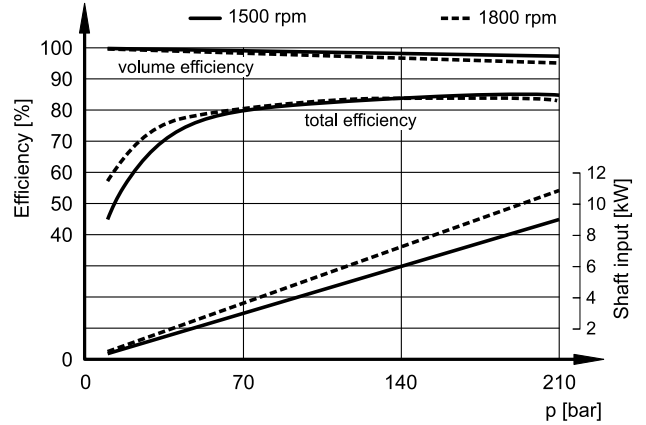
The efficiency varies depending on the delivery rate setting. In order to select the right motor capacity, refer to absorbed power characteristics.

### 4.1 - VPPD-\*015 pump characteristic curves

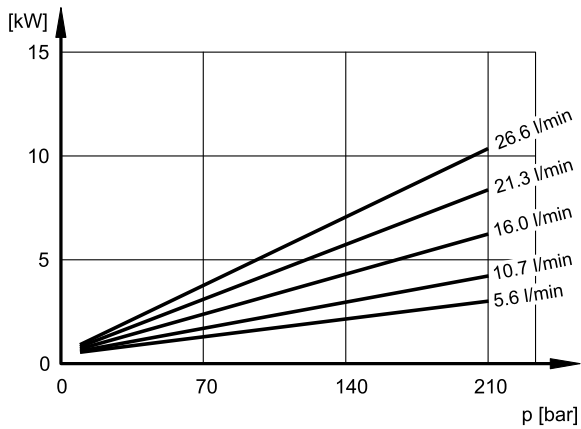
#### FLOW RATE / PRESSURE CURVES



#### VOLUMETRIC AND TOTAL EFFICIENCY

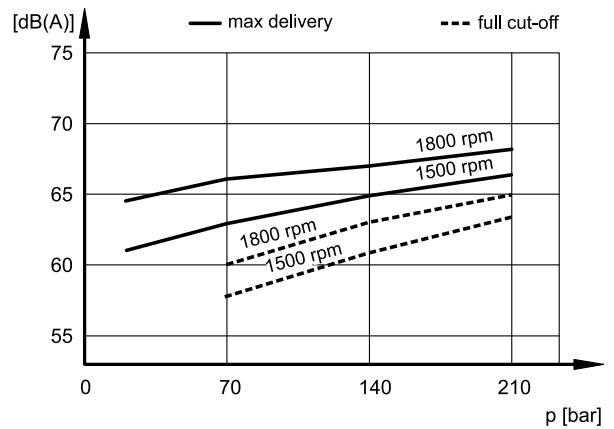


#### ABSORBED POWER

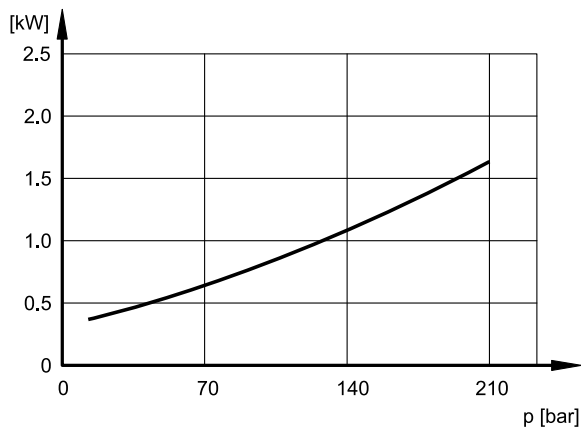


#### NOISE LEVEL

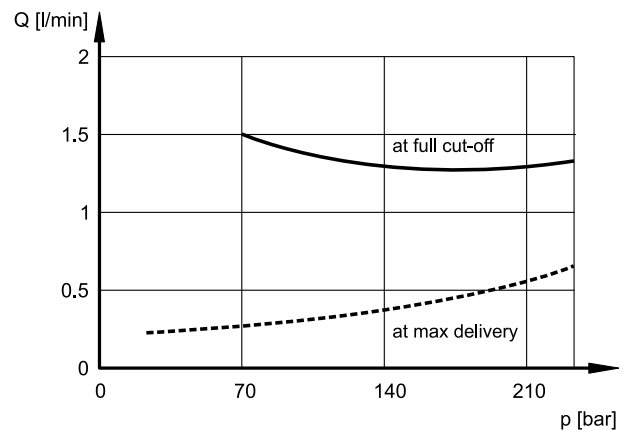
(detection at 1 m from the pump)



#### INPUT POWER AT FULL CUT-OFF



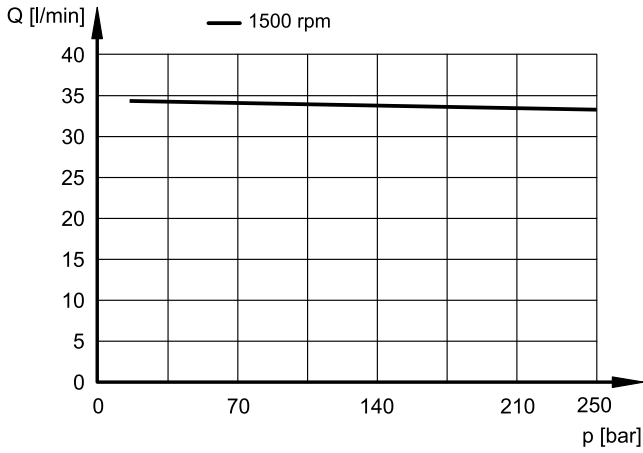
#### DRAIN FLOW RATE



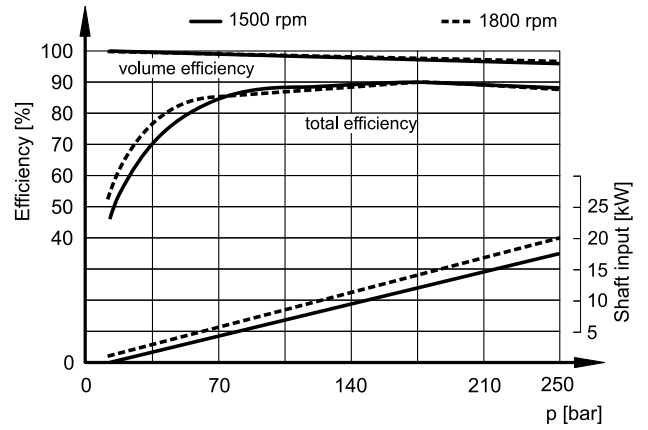


## 4.2 - VPPD-\*023 pump characteristic curves

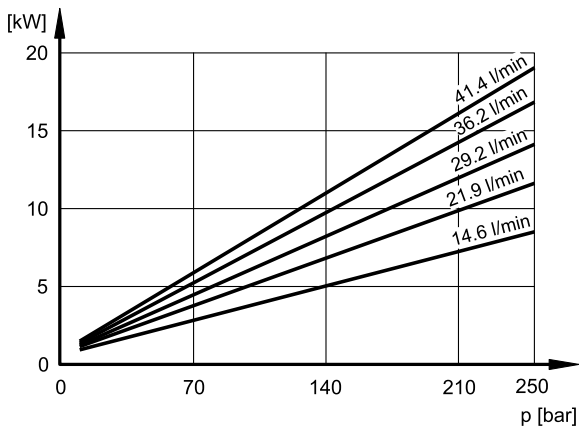
### FLOW RATE / PRESSURE CURVES



### VOLUMETRIC AND TOTAL EFFICIENCY

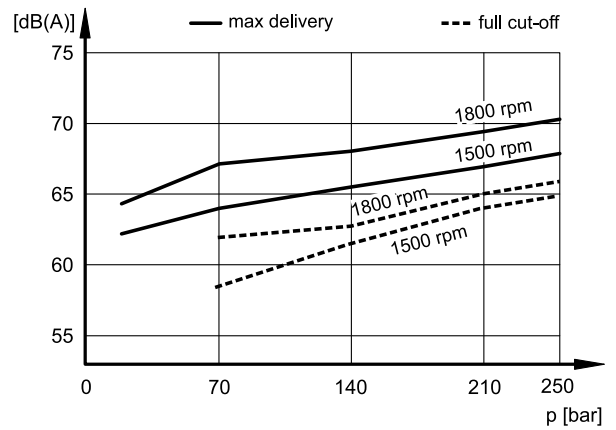


### ABSORBED POWER

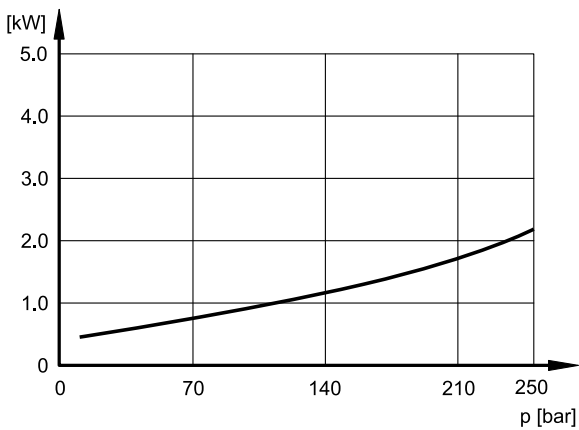


### NOISE LEVEL

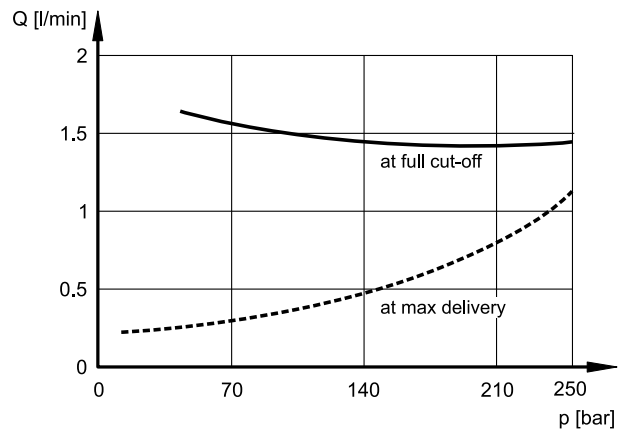
(detection at 1 m from the pump)



### INPUT POWER AT FULL CUT-OFF



### DRAIN FLOW RATE

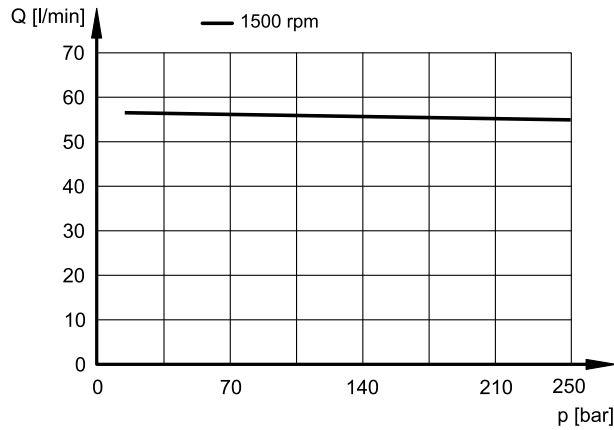




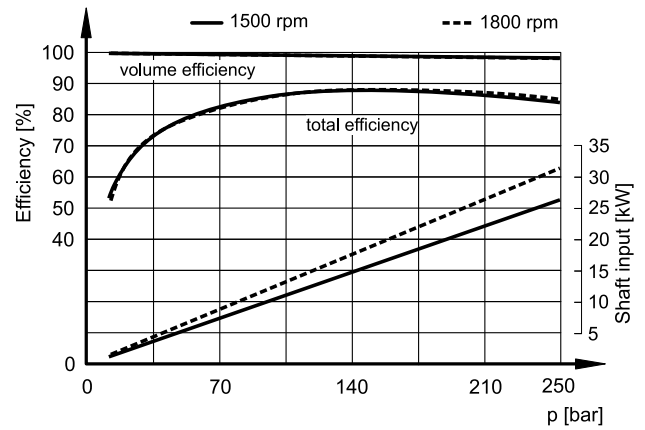
### 4.3 - VPPD-\*038 pump characteristic curves

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

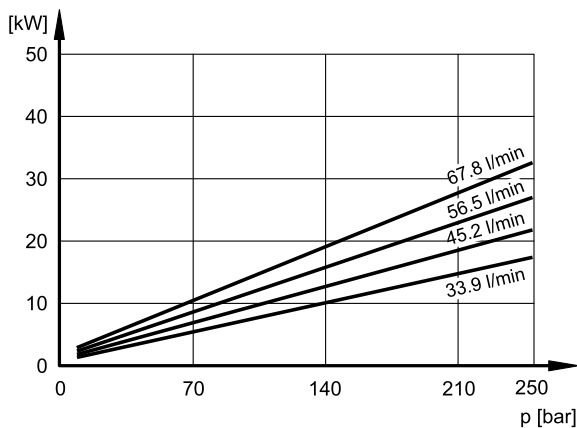
#### FLOW RATE / PRESSURE CURVES



#### VOLUMETRIC AND TOTAL EFFICIENCY

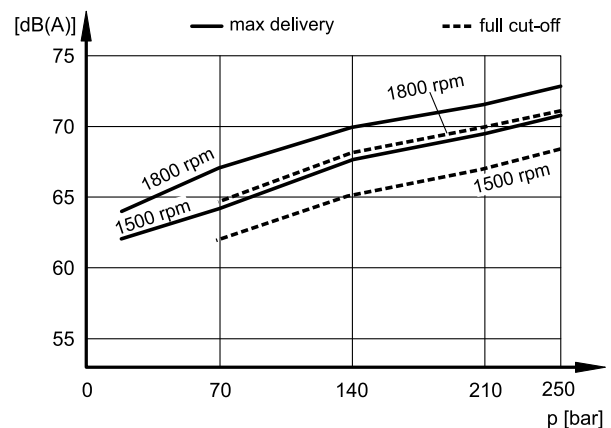


#### ABSORBED POWER

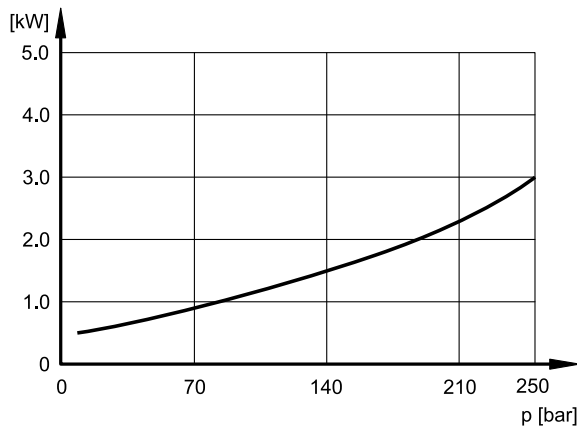


#### NOISE LEVEL

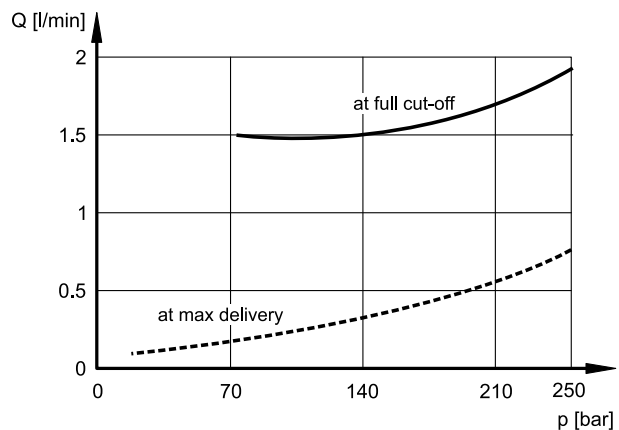
(detection at 1 m from the pump)



#### INPUT POWER AT FULL CUT-OFF

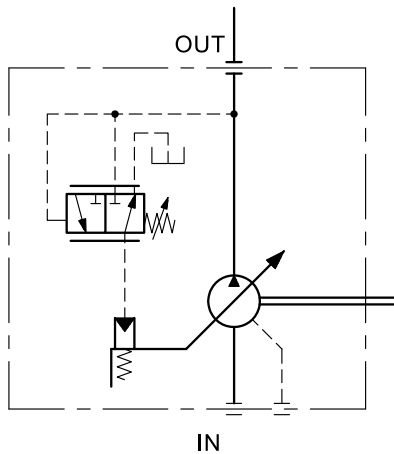


#### DRAIN FLOW RATE



## 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:

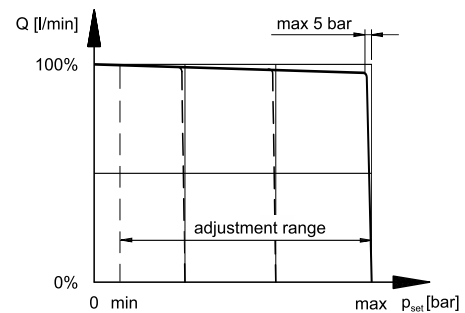
**PC4** = 15 to 140 bar

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

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

- default setting:

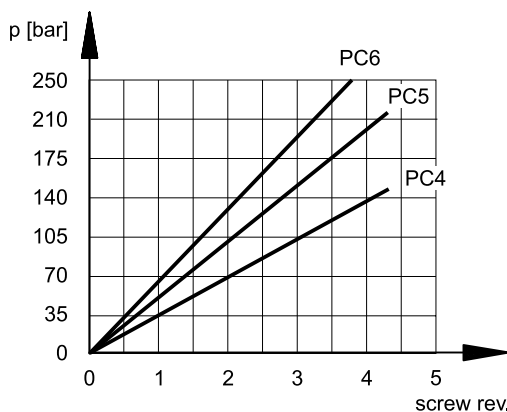
highest value of the pressure range at max displacement.



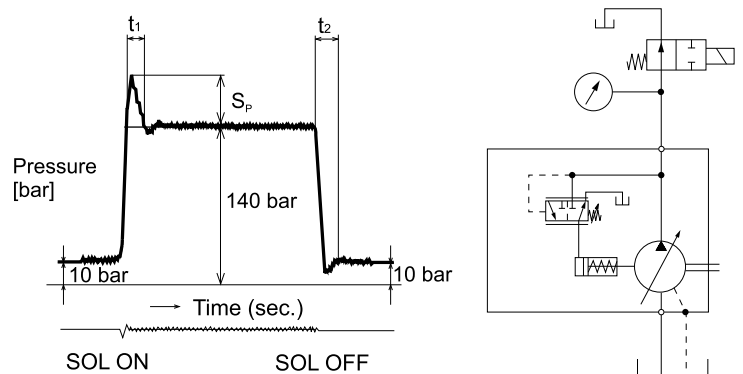
### 5.1.1 - Characteristic curves

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

#### PRESSURE ADJUSTMENT BY TURNING SCREW



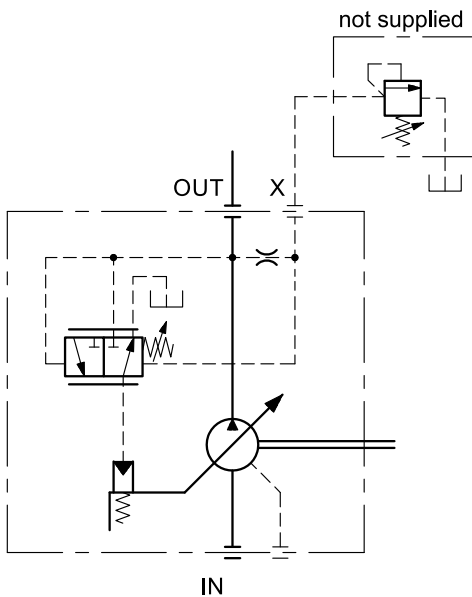
#### RESPONSE CHARACTERISTICS



**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] | S <sub>p</sub> surge pressure [bar] |
|-------------------|---------|---------|-------------------------------------|
| <b>015</b>        | 40 ÷ 50 | 50 ÷ 70 | 25 ÷ 40                             |
| <b>023</b>        | 50 ÷ 60 |         | 35 ÷ 70                             |
| <b>038</b>        | 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.

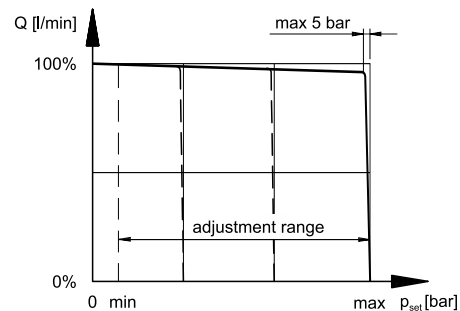
- pressure adjustment range:

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

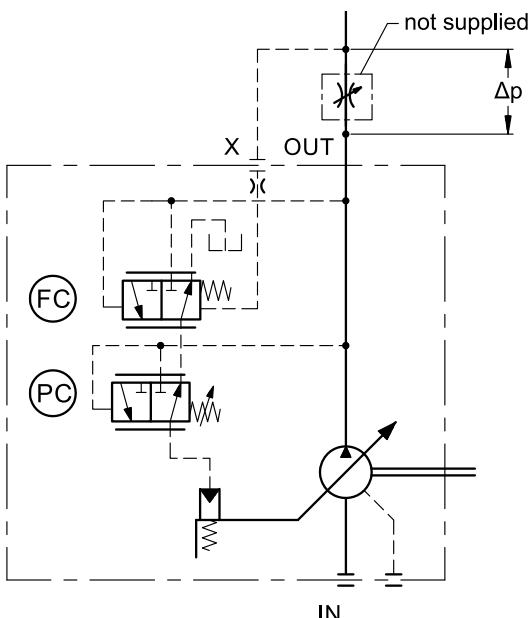
**PCR6** = 15 to 250 bar (for VPPD-\*023 and VPPD-\*038 only)

- 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)

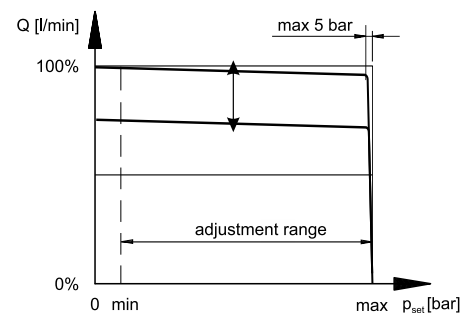
**PQC6** = 35 to 250 bar (for VPPD-\*023 and VPPD-\*038 only)

- 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

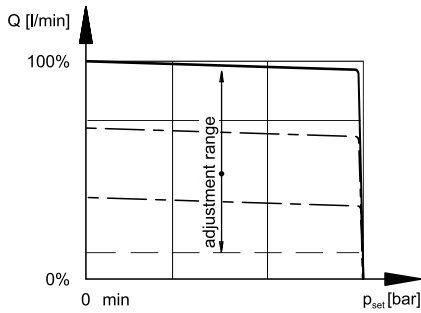
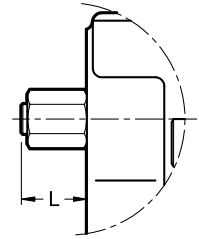


## 6 - MAXIMUM DISPLACEMENT ADJUSTMENT

The adjustment screw is placed on the rear of the pump. Turn it clockwise to decrease the pump displacement.

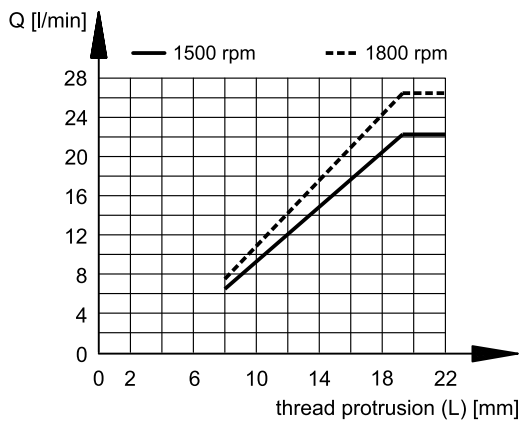
The delivery rate can be roughly estimated from the protruding length of the adjusting screw (L).

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

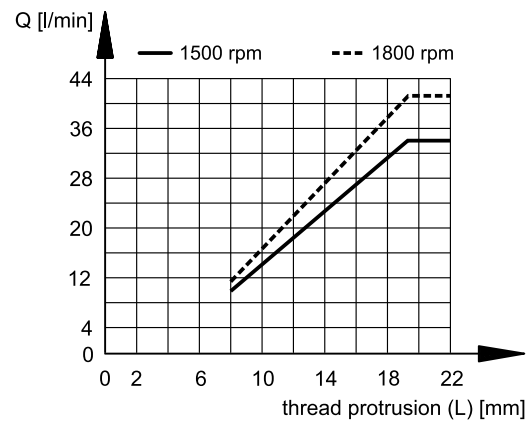


### 6.1 - Maximum delivery as a dependency of the thread protrusion

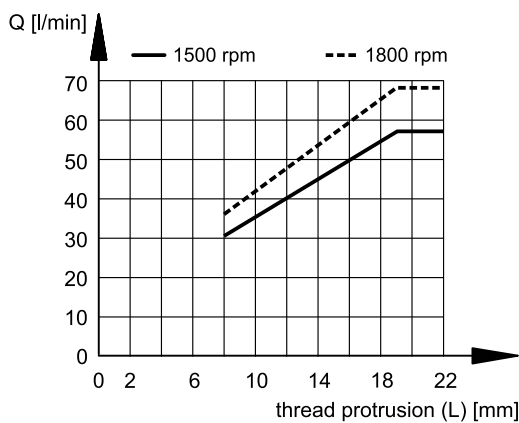
VPPD-\*015



VPPD-\*023

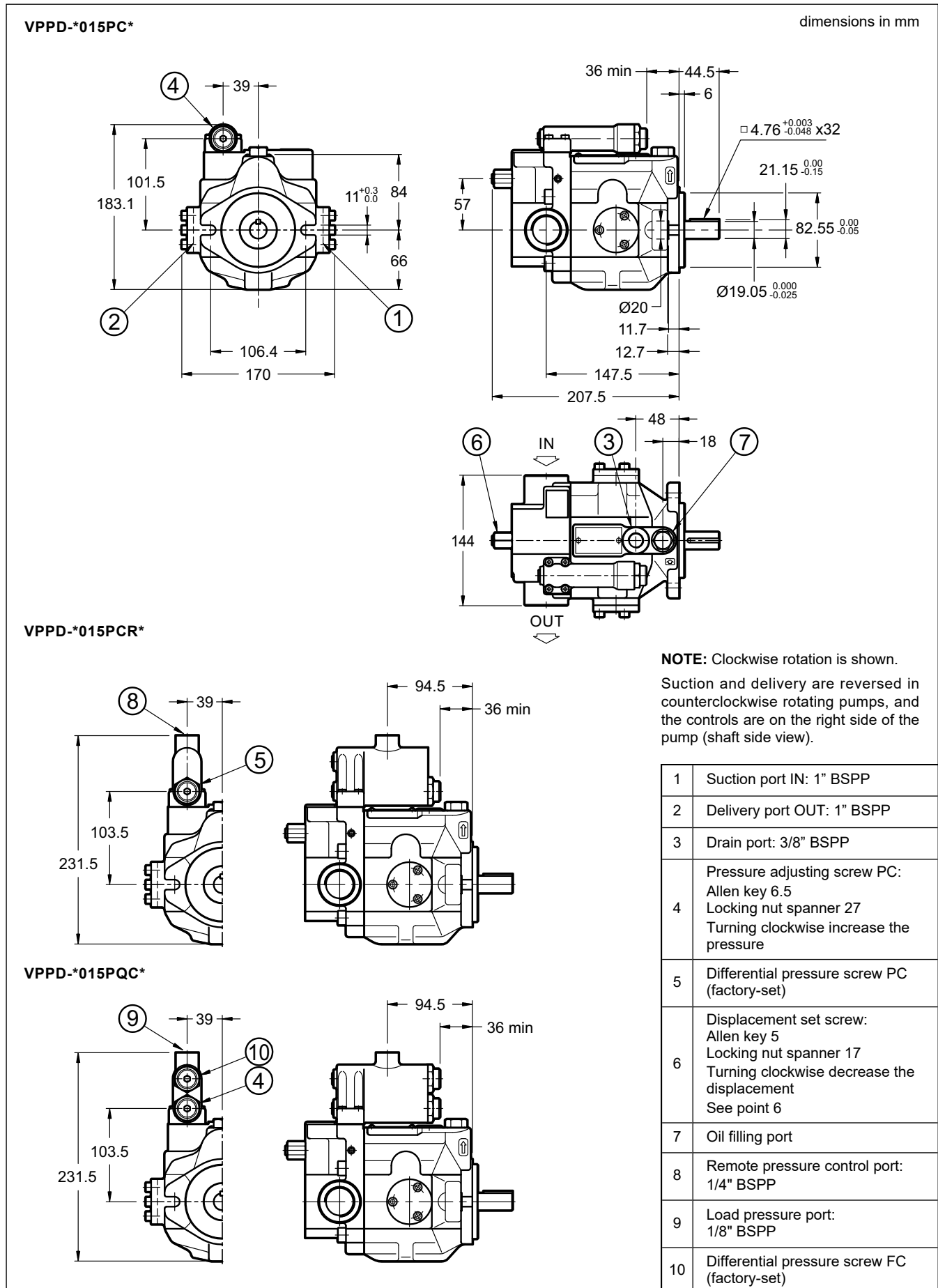


VPPD-\*038

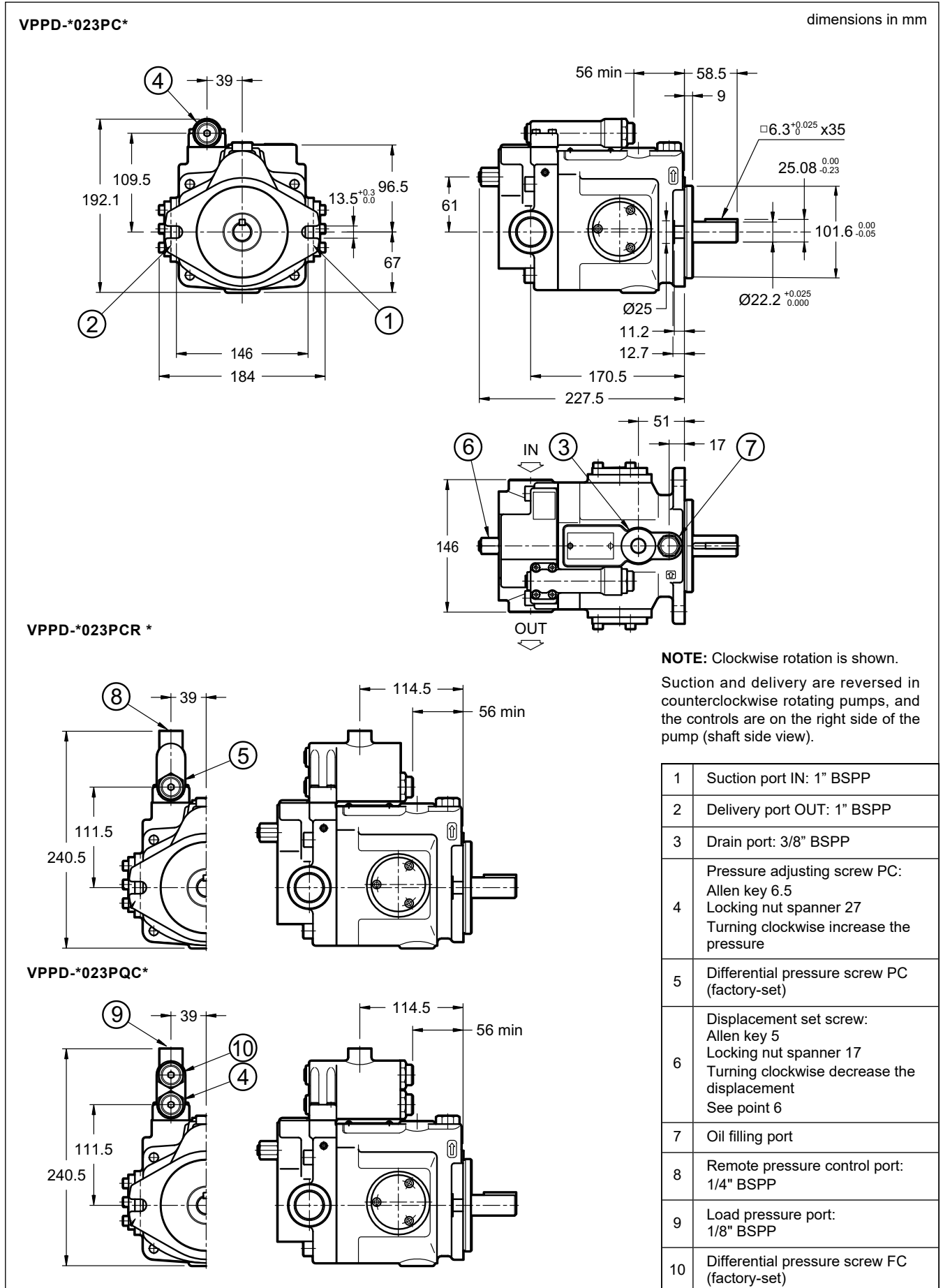


| Min / max delivery at 1500 rpm |      |      |
|--------------------------------|------|------|
|                                | min  | max  |
| VPPD-*015                      | 6.3  | 22.2 |
| VPPD-*023                      | 10.0 | 34.5 |
| VPPD-*038                      | 30.4 | 56.6 |

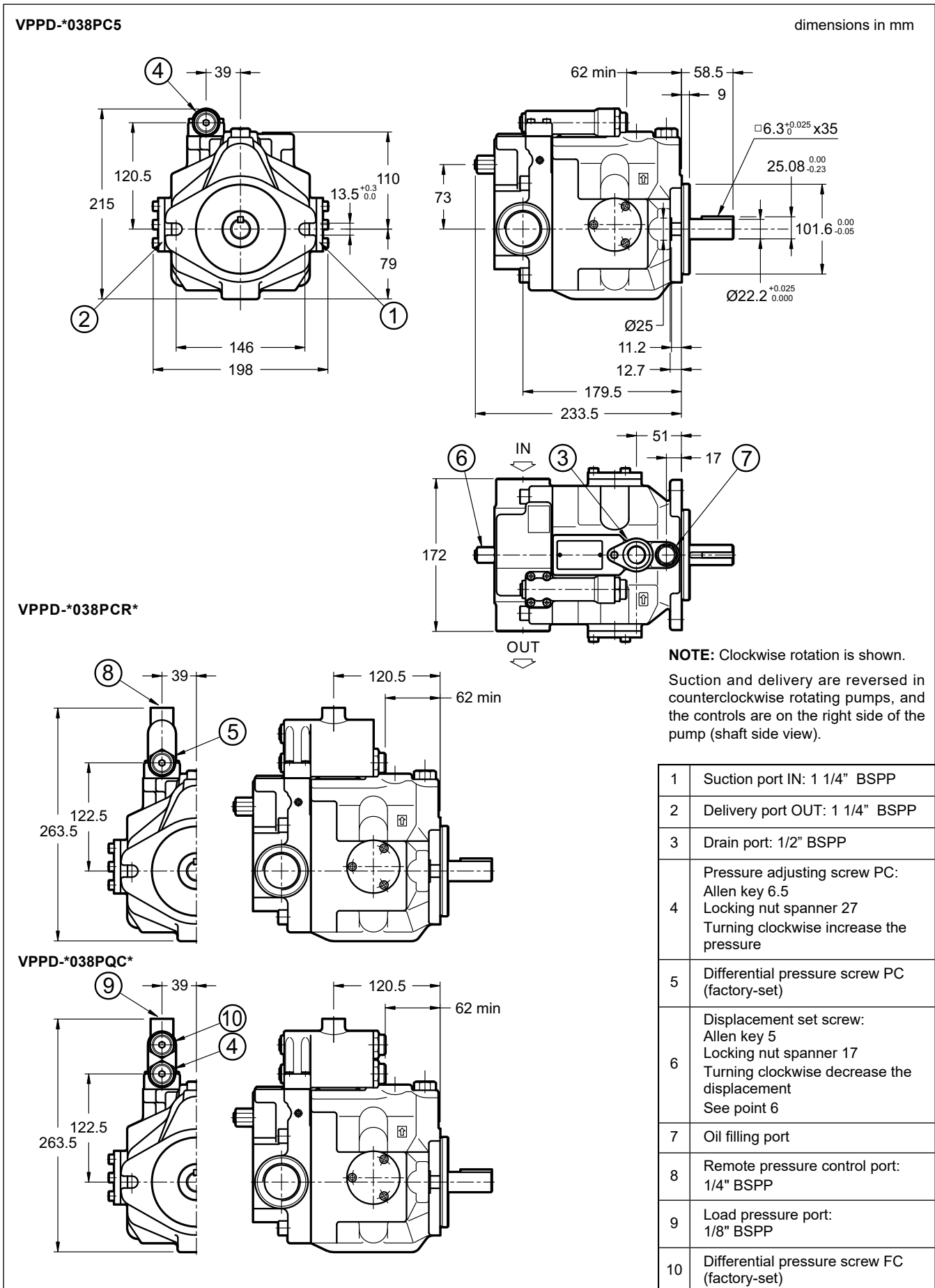
### 7 - VPPD-\*015 PUMPS OVERALL AND MOUNTING DIMENSIONS



### 8 - VPPD-\*023 PUMPS OVERALL AND MOUNTING DIMENSIONS



### 9 - VPPD-\*038 PUMPS OVERALL AND MOUNTING DIMENSIONS





## 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 cm<sup>3</sup> for VPPD-\*015 and VPPD-\*023, while is 900 cm<sup>3</sup> 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.



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