



## PISTON PUMP PCP P2CG



## OPERATING MANUAL

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## **1. Use and function**

The high-pressure pump PCP P2CG is designed for the delivery of corrosive liquids that do not attack stainless steel class 17246 according to Czech standard ČSN (AISI 316), polytetrafluoroethylene (PTFE), polyetheretherketone (PEEK), high-molecular-weight polyethylene and polycrystalline carbon. Flowrate control by variable motor speed (the pistons operate at maximum stroke without idle periods during the entire flowrate range) and a system of two pumping heads substantially reduce pressure pulses in the hydraulic circuit. Accordingly, the pump can be used in high-performance liquid chromatography, but also in all other instances where its characteristics as an accurate dosing pump are appropriate.

## **2. Description**

PCPI P2CG motion transferring mechanics is used to change motor rotation movement to axial pistons movement. The pistons are actuated by means of cams with connecting shafts mounted in ball bearings. Cams axis is connected to the motor via belt. Motion is transferred to the pistons by means of piston rods made of flat steel profiles mounted in guide ball bearings. Swinging shafts are attached to one side of the profiles and the pistons to the other side.

The pump contains one piston-rod block actuating two pumping heads. The cam shaft is driven by an asynchronous motor 750 VA *via* a belt (speed reduction 60 : 190). The motor speed is controlled by means of a frequency converter within 15 % and 200 % of the rated motor speed. Motor is cooled by a ventilator.

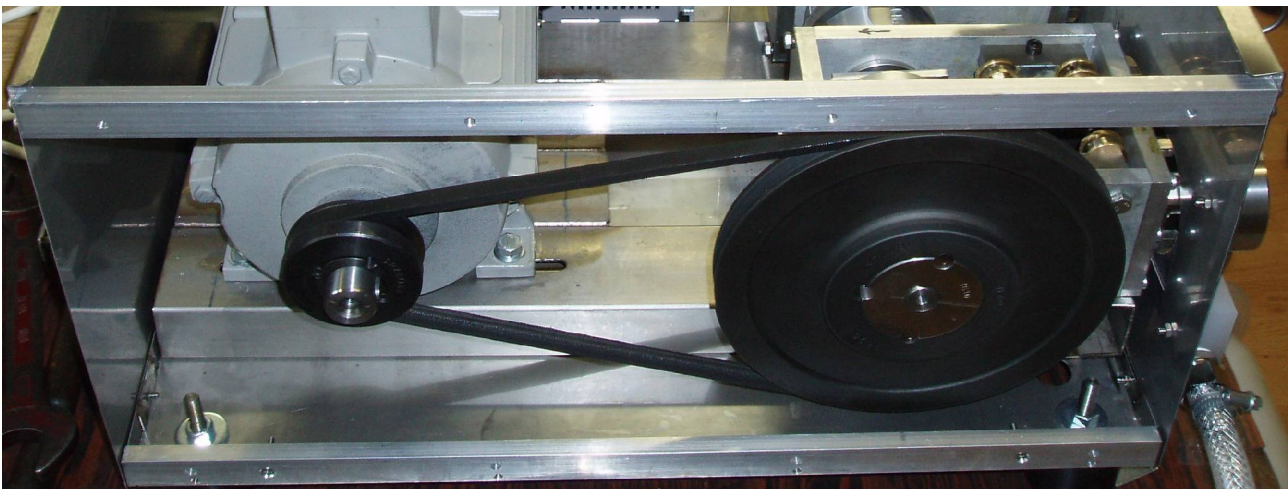


Fig. 1 Motor transmission

The pumping heads are schematically shown on Fig. 2. They are made of stainless steel. The conical pistons seals proper consist of three rings (high-molecular-weight, abrasion-resistant polyethylene (green) and polytetrafluoroethylene (yellow)). The pumping heads are designed in a manner that enables the piston behind the main seal to be rinsed by means of a PEEK adapter mounted in the pumping head behind the main seal ring, containing a compartment with inlet and outlet openings situated at the rear end of the pumping head and connected to the inlet and outlet of the rinsing liquid.

The seal/adapter assembly contains an additional, low-pressure seal preventing leakage of the rinsing liquid. The seals are pressed onto recesses in the pumping head by a set of disc springs and the pump thus does not require any adjustment of the sealing force. Polished stainless steel pistons with external diameter 16 mm are covered with hard polycarbon layer.

The ball valves consisting of ceramics seats and balls are mounted in inlet and outlet cartridges lined with PEEK inserts. Inlet and outlet valves have dimension 1/8".

The inlet piping is made of a PTFE, external diameter 10 mm, the outlet piping connecting the heads to the pressure sensor attachment are made of stainless steel 1/8" (3,3 mm) capillaries; stainless-steel capillary of external diameter 1/4" (6,4 mm) is used as the outlet piping proper. The pumping heads protrude from the pump front panel and can be easily removed (four attachment screws).

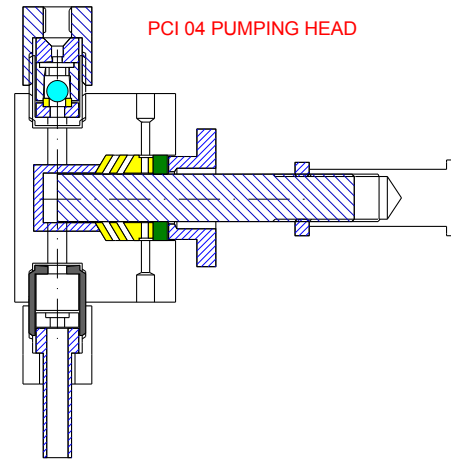


Fig. 2 Piston head



Fig. 3: Back side of the pump

Pump is controlled from keyboard and display which are situated on the right top side of front panel (see Fig. 4). There are two modes of control – one is to set pump parameters, next is to control pumping process. Both are described in next part of the manual.

The mechanical parts, the motor and the frequency converter are mounted on a rugged frame stainless steel profiles. The sliding attachment of the motor enables the belt to be tightened properly. The power cord passes through the rear panel of the pump (Fig. 3) where is situated main switch and external control connector too. Besides the main input are three connectors for gradient valves and a connector for external control /RS 232). The unit is encased by steel covers and a front stainless steel panel.



Fig. 4 Display and keyboard

### 3. Control programme

Gradient pump PCP P2CG has two modes – programming and working. When switched on, the pums is automatically in working mode. There is the information about actual flow rate on the display.

**Act. speed**  
**0.00 l/min**

User can listed in displayed values using arrows (  ) up and down. Going down an information about actual pressure is displayed.

**Act. Pressure**  
**0 bar**

Next listing shows information about gradient composition (A,B,C) and about time since gradient programmme was started and about actual gradient step.

**Time 0 s no = 0**  
**A10% B20% C70 %**

Pressing button SHIFT you change to programming mode. Firs seting parameter is a flow rate

**Speed =**  
**0.12 l/min**

Values are to be set using horizontal arrows (  and  ) Holding arrow button longer time causes increasing of value change speed. Set value has to be confirmed by botton ENTER. Listing on the lispay you can set pressure limit the same way.

**Pres. limit**  
**200 bar**

The sensitivity of pressure limit (the range in which the pump is switched off and on again) is called hysteresis and can be set in next step.

**Pres. hyst.**  
**30 bar**

Next listing opens gradient programming section. Gradient can be programmed in ten linear steps.

On the beginning is necessary to introduce inicial values of gradient composition (percenage of A phase and B phase, C phase is counting automatically).

**Step 0**  
**Liquid A 10 %**

Se value has to be again confirmed with ENTER.

**Step 0**  
**Liquid B 20 %**

Next pushing of  start the setting of first step time and first step final composition values:

**Step 1**  
**step time 0**

(If the first step time is zero, gradient setting will be cancelled and the pump will use starting composition without change).

**Step 1**  
**step time 300 s**

**Step 1**  
**Liquid A 20 %**

**Step 1**  
**Liquid B 45 %**

The same way is used to programme next gradient steps. If not all ten steps are necessary, zero time value is set on the first undesirable step. Next listing comes to setting of such values which are not recommended to be preprogrammed by user and are reserved for servicemen. The

### **Service password**

is displayed and service password number introduced by horizontal arrows allows to set pressure sensor and flow rate correction. Flow rate is corrected due the correction factor (in %), then transducer value for zero pressure is selected and on the last the transducer value for given pressure which is at the moment measured by calibrated Bourdon or special electronic manometer.

## **4. How to work with PCP P2CG**

### **4.1 Work without gradient**

1. On the inputs of pumping heads is installed a T piece with output for 1/2" tube. Tube diameter can be reduced when expecting lower flow rate. For nominal rate about 250 ml/min it is 3,5 mm I.D., for flow rate 500 ml/min 5 mm I.D. and for 1000 ml/min 8 mm I.D. or more. The inlet piping is attached by means of two through-bolts to T-connector and input valve cartridges. When working with a liquid containing a dissolved solid (buffer solution), it is advisable to connect the inlet and outlet of the piston flush system to a pure liquid source (say distilled water).
2. The pump is switched on by the power switch on rear panel. The motor is switched on/off by the START/STOP buttons situated on the keypad on the front panel.
3. Pump is switched on, using SHIFT bottom a programming mode is selected and operation parameters are set. Pump is switched to working mode.

4. The mobile is introduced nearly to pump heads and pump is started. After few seconds a liquid is going through pumping heads.

**CAUTION: DO NOT USE THE PUMP WITHOUT LIQUID IN HEADS MORE THAN 30 SECONDS**

5. If liquid is not sucked into heads automatically a 20 ml syringe is used and liquid is injected into pump cylinders.
6. It is necessary to pump the liquid through the pump for 10 min or more to avoid bubbles in pump valves and cylinders.
7. Pump output is connected to chromatography column and pump is used.

#### **4.2 Work with gradient**

1. Pump is connected and start the same way as without gradient. A set of gradient valves with one output is then connected to the pump and 100 % A is used for few minutes, then 100 % B and finally 100 % C in order to remove all bubbles from the system.
2. Gradient is programmed as described.
3. Pump is started by START button and initial composition is delivered. Repeated use of START button caused that own gradient mixing process in time is started.
4. Using STOP button you change into the „hold“ regime and the liquid composition is not more changed in time. Using START gradient changes continue, using STOP, the gradient is definitely stopped and composition is going back to initial values but the pump is still running.
5. The third use of STOP causes the pump stop liquid delivery.

#### **5. Technical specifications**

Pump type :	plunger/piston
Number of pumping heads:	2
Piston stroke [mm]:	7,5
Piston diameter [mm]:	16,0
Flowrate control:	by variable motor speed
Pump drive:	asynchronous 3-phase, 4-poles motor
Method of speed control :	frequency convertor
Flowrate range [ml/min]:	200 - 1700
Maximum rated pressure [bar]:	200
Power:	200 - 230 V, 50 - 60 Hz
Power input [VA]:	800
Weight (kg):	27

## **6. Possible defects and remedies**

### **6.1 Seal leak**

The seals are pressed via plate springs and adjusted for optimum performance by the manufacturer. The sealing surfaces are however subject to wear and deformation of the plastic materials takes place during operation. The delivered liquid leaking at the outlet of the piston flush system is indicative of a necessity to replace the seals.

Disconnect pumping head from inlet and outlet tubes. Remove four screws fixing the pumping head in place and slip off the pumping head from the piston by exercising moderate force. Remove the worn-out seals and replace with new ones. Observe the order indicated by seal colours: green flat, white flat, green conus, insert, green flat (additional sealing). Fit the pumping head and tighten the fixing screws gently. Také care to assembled all heads parallely with front panel of cam box (head has to have the same distance from all four hexagonal separators on the panel). Connect all imput and output capillaries and start to pump. If necessary tighten more fixing screws.

If pressing the start/stop button fails to start the motor also with a higher flowrate set, contact your service organisation and entrust the repair to the manufacturer. It is recommended to replace the seals after some 500 hours of operation.

### **6.2 Defective valve operation**

First check whether the valves are not fouled. Loosen the inlet/outlet end piece by a spanner. Carefully remove the end piece and detach the valve cartridge. Flush the cartridge with clean pumped liquid, allow it to dry and check whether the ball moves freely and fits against the seat. Use ultrasonic bath to clean cartridges if necessary. Fit the clean valve cartridge into the head and screw it. Add the insert and end piece. Tighten with a spanner using only moderate force. Connect tube and start the pump; continue to tighten until liquid stops leaking. The sapphire/ruby valves exhibit exceptionally long service life; nonetheless, their wear might lead to defective function. Replacement of the valves is easy as the whole cartridge is replaced.

## **7. Manufacture and servicing:**

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