



QF5K

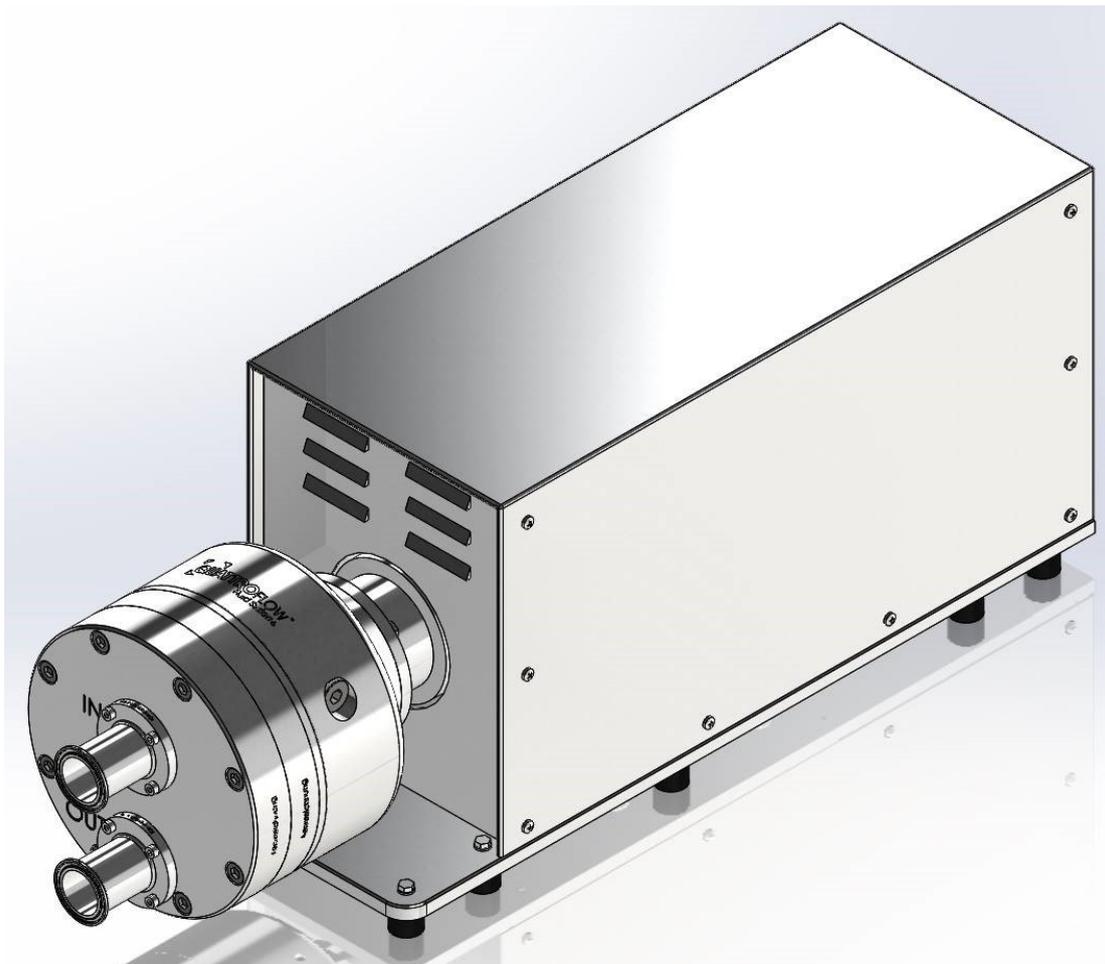
QF5K-HT

QF5KQcon

QF5KCD

Stainless Steel 4-Piston Diaphragm Pump

Operating Manual



Translation of original operating manual

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1 General information

Read this operating manual carefully before putting the pump into operation. Observe the instructions in this operating manual. Keep the operating manual close at hand in the vicinity of the pump.

PSG Germany GmbH also manufactures pumps according to specific customer requirements and adapted to special applications. The descriptions in this operating manual can deviate from your actual pump.

Also observe the operating manuals for the motor and other installed components or optional accessories.

1.1 Manufacturer and Service

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1.2 Exclusion of liability

All warranty rights will be void in case of incorrect operation or misuse, failure to observe the information in the operating manual - especially the safety notes - as well as unauthorised modification of the pump or installation of non-genuine spare parts. The manufacturer will accept no liability for damages and consequential damages resulting from this.

Quattroflow is a trade name of PSG Germany GmbH.

PSG Germany endeavours to continuously improve the product and reserves the right to make modifications to the technology and/or design without prior notice.

1.3 Presentation conventions

This operating manual uses the following presentation conventions:

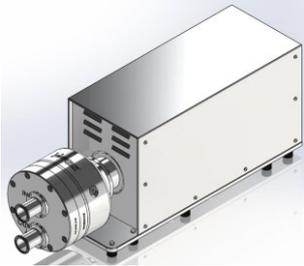
Running text contains descriptions and explanations.

- First level lists list elements preceded by a dot.
 - Second level lists list elements belonging to a first level element, preceded by a circle.
- ▶ Handling instructions provide guidance for working on the pump.

▲ WARNING SIGNS – Warning signs warn against dangers and provide handling instructions for avoiding the danger (see chapter 2.5 Warning signs on page 6).

1.4 Pumps

This instruction applies for the following pumps:



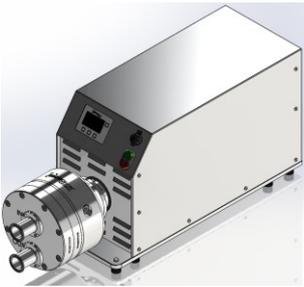
Pump QF5K

- Standard motor
- Drive: Three-phase current motor 2.2 kW, 400 V
- Speed control: external frequency converter (not included in standard scope of delivery)
- Eccentric shaft: 5°
- Flow rate: 200 - 6000 lph



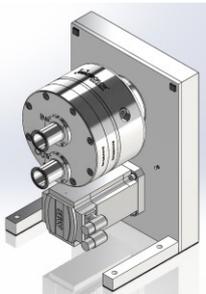
Pump QF5K-HT

- Integrated control panel
- Drive: Servo motor 230V / 400 V
- Speed control: Control panel or external via analogue input
- Eccentric shaft: 5°
- Flow rate: 50 - 6000 lph



Pump QF5KQcon

- Integrated control panel
- Drive: Servo motor 230V / 400 V
- Speed control: Control panel or external via analogue input
- Eccentric shaft: 5°
- Flow rate: 50 - 6000 lph



Pump QF5KCD

- Compact design
- Drive: Servo motor 230V / 400 V
- Speed control: optional external frequency converter (not included in standard scope of delivery)
- Eccentric shaft: 5°
- Flow rate: 50 - 5000 lph

1.5 Version history

Edition

2021-10

Contents and revisions

- First edition

2 Safety

This chapter contains important information for safe operation of the pump.

2.1 Intended use

Pumping water-like fluids for industrial applications in batch mode.

2.2 Improper use

- Pumping of unsuitable media or fluids, especially media which attack the diaphragm or other parts of the pump. Consult the Material-and-Certification-Guide or contact Service if in doubt.
- Operation outdoors and in private households.
- Operation in in-vitro diagnostics.
- Operation in explosion-protected areas.

2.3 Residual hazards

Observe the applicable accident prevention regulations and protection measures.

2.3.1 Pressure

The pump can be operated up to a maximum permissible pressure. The maximum permissible pressure depends on the temperature of the fluid. The values for the maximum permissible pressure are specified in the technical data and on the pump.

On exceeding the maximum permissible pressure, the diaphragm can burst and injure people.

- Always maintain the maximum permissible pressure.
- Make sure that the suction and pressure lines are adequately dimensioned and fastened.
- Only apply pressure to the pump chamber when the the pump chamber is mounted on the drive.

2.3.2 Hot surfaces

The pump can deliver hot fluids. Strong and hot alkaline solutions are used for cleaning (CIP, SIP). These can heat up parts of the pump and the lines (>72°C). There is a risk of burns when touching.

- Do not touch the pump chamber when the pump is in operation.
- Allow hot parts to cool down.
- Keep the air vents and filter free. Make sure that heat can escape.

2.3.3 Fluid

The pump can deliver fluids which are toxic, caustic, aggressive or otherwise harmful to humans or the environment. Strong and hot alkaline solutions are used for cleaning (CIP, SIP). There is a risk of serious damage to health by contact.

- Observe the safety data sheet of the fluid and wear the personal protective equipment and take the safety precautions prescribed there.
- Take preparations for possible leakages. When working on the pump, always behave as if there were fluid in the pump.
- Avoid chemical and biological reactions in the pump (mixing of different substances).
- Avoid freezing of the fluid.
- Avoid contact of corrosive media (e.g. NaCl; HCl) with the outer stainless steel surfaces of the pump (e.g. shroud, base plate).

2.3.4 Electric current

Touching electrical parts can cause a fatal electric shock.

- Disconnect the pump from the power supply before working on the pump:
 - Pull out the mains plug.
 - Disconnect all phases of the pump from the mains.
- Never open the motor or control panel housings or change any electrical components in the pump.
- Make sure that all cables are undamaged.

2.3.5 Crushing and cutting

The eccentric shaft rotates in a housing. There is a risk of crushing in the space in between.

- Only operate the pump with the pump chamber mounted.
- Disconnect the power supply to the pump when working on the pump.

There is a danger of being cut by sharp edges and corners and being crushed by falling, heavy parts during maintenance and assembly.

- Wear cut-proof protective gloves for maintenance and assembly work.
- Wear safety shoes.

2.3.6 Noise

The pump can cause noise pollution (<80 dB).

- It is recommended to wear suitable hearing protection.

2.4 Personnel requirements

Persons who work with the pump must meet the following requirements:

- Competent planning and execution of processes according to the pumped fluid.
- Competent application of instrumental-analytical working methods according to the pumped fluid.
- Competent handling of the pumped fluid.

Persons who maintain and service the pump must meet the following requirements:

- Competent assembly and disassembly of mechanical, electrical and electronic components.
- Understanding of the interaction and assembly of the components.

The owner must ensure that all the information in this operating manual is constantly and fully available to all persons who work with the pump.

2.5 Warning signs

These warning signs warn against dangers. Observe the warning signs to avoid dangers.

- ⚠ DANGER** – Danger of fatal or severe injuries.
- ⚠ WARNING** – Warning of potentially fatal or severe injuries.
- ⚠ CAUTION** – Beware of minor injuries.
- ATTENTION** – Property damage.

3 Description

The pump is a machine for pumping fluids that is particularly insensitive to permanent stress and contaminations in the fluid. Designed as a piston diaphragm pump, the pump delivers the fluid in self-enclosed volumes.

The diaphragm consists of 4 segments. A connecting ring that is moved back and forth from its centre position by an eccentric shaft activates the segments and creates the stroke movement. An electric motor drives the eccentric shaft.

The motor speed determines the pump performance. The direction of flow of the pump is independent of the direction of rotation of the motor.

The pump is self-priming and dry run-protected. The pump head contains no rotating parts that rub together. As a displacement pump, the pump already builds up the required pressure at low speeds.

The single-use pump chambers are intended for single use.

3.1 Water-like fluids

The pump only delivers water-like fluids such as:

- Solutions containing protein (albumin, IgG, clotting factors, monoclonal antibodies, enzymes, vaccines)
- Solutions or suspensions of polymers
- Cell suspensions (bacteria, yeast, algae, fungi, mammalian cells)
- Colloidal solutions
- Virus suspensions, phage suspensions

3.2 Labelling

The type label is affixed to the housing or the base plate.
The serial number is affixed to the top.

3.3 Technical data

The technical data refer to a standard version of the pump. Special pump versions (e.g. special connectors) may have different data. See the extended documentation.

Description	Unit	QF5K	QF5K-HT	QF5KQCon	QF5KCD
Flow rate eccentric shaft 5°					
max.	lph	6000			5000
min.	lph	200	50		
Pressure according to temperature of fluid					
< 40°C	bar	6 (4 continuous)			
> 40°C	bar	4			
Maximum temperatures					
Pumped fluid	°C	80 (short-term)			
CIP	°C	90 (short-term)			
SIP	°C	130			
Autoclave	°C	130			
Suction lift dry at optimum speed					
Lift	m	2 at 1000 rpm			
Volume specifications					
Approximated volume per revolution at free output	ml	91			
Filling volume without connectors	ml	~788			
Residual volume (after idle with high-speed motor)	ml	~6			
Product wetted surface (approx.)					
Surface	cm ²	1586			
Product wetted materials (standard):					
Pump housing		1.4435			
Valve plate		1.4435			
Diaphragms		Santoprene			
Valves		EPDM			
O-rings		EPDM			

Description	Unit	QF5K	QF5K-HT	QF5KQCon	QF5KCD
Non-product wetted materials (standard):					
Diaphragm housing cover				1.4404	
Bearing housing				1.4404	
Base plate				1.4301	
Hood				1.4301	
Pump speed range	rpm	30-1200	13-1200		13-1050
Connection specification (standard):					
Connector	"			1.5" TC	
Flange diameter	mm			50.5	
Internal diameter	mm			34.8	
Position of connectors				Front	
Drive shaft diameter	mm			28h7	
Pump dimensions with motor and housing					
Length [L]	mm	870	851	950	310
Width [W]	mm	250	275	275	320
Height [H]	mm	333	384	405	440
Pump weight incl. chamber	kg	95	110	115	70
IP protection class (entire pump):	IP	55	54	54	55
Operating temperature	°C	-20...40	10...30		
Operating humidity		max. 55%	30...75% (non-condensing)		
Storage and transport temperature	°C	-20...50	-10...55		
Storage and transport humidity		max. 60%	10...95% (non-condensing)		
Customs tariff number		84138100			
Certificates/proofs (optional):					
Elastomers (product wetted)		USP <87>, USP<88> Cl. VI; FDA21CFR177; BSE/TSE Safe			
Stainless steel parts (product wetted)		3.1; surface roughness; ferrite (EN10204)			

Description	Unit	QF5K	QF5K-HT	QF5KQCon	QF5KCD			
Motor/gear:								
Manufacturer (standard)		Siemens	SEW					
Type		1LE1003	CMP80M		CMP71M			
Rated speed	rpm	1435 (50 Hz)	3000		3000			
Voltage	V	230/400	230	400	230	400		
Nominal current	A	7.7/4.4	23.5	13.4	23.5	13.4	13.1	7.5
Power	KW	2.2	-					
Shaft diameter	mm	28	25		24			
IP protection class	IP	55	65					
Colour	RAL	7030	9005		9001			
Forced ventilation		Mounted on motor	Integrated into hood		-			
Coupling		KTR (Rotex-GS24)			-			
Gear ratio		-			1 : 2.67 (belt drive integrated into housing)			
Motor fan								
Manufacturer (standard)		Siemens	-		-			
Type		B32 IL-2-2	-		-			
Voltage	V	1 ~ Δ 220-277 3 ~ Δ 200-303 3 ~ Y 346-525	-		-			
Nominal frequency	Hz	50-60	-		-			
Nominal current	A	0.29 0.37 0.21	-		-			
Nominal power	W	62 80 80	-		-			
Max. air flow rate	m ³ ph	-	-		-			
IP protection class	IP	66	-		-			

Description	Unit	QF5K	QF5K-HT	QF5KQCon	QF5KCD			
Control panel/frequency converter:								
Type		Optional: Control Separate Control Box (PQ44P)	Control Integrated into the housing			Optional: Control Separate Control Box (PQ50T)		
Nominal voltage	V	400	200- 240	380- 500	200- 240	380- 500	-	380- 500
Nominal power	kW	2.2	3.7	4	3.7	4	-	3
Nominal frequency	Hz	50-60						
Nominal current	A	10.6	14	9.5	14	9.5	-	7
Net shape		TN-S						
Power supply		3L+N+PE	3L+PE					
Fuse	A	16						
Length, cross section power supply cable	m, mm ²	5, 5x2.5						
Mains connector		16A CEE plug	Free cable end	16A CEE plug	Free cable end	16A CEE plug	-	16A CEE plug
Length connecting cable for pump	m	5	-				5 (Resolver + Motor)	
Analogue input		4-20 mA (standard) 0- 10 V (optional)	4-20 mA (standard) 0- 10 V (optional)	4-20 mA 0- 10 V		4-20 mA (standard) 0- 10 V (optional)		
IP protection class	IP	54	See IP protection class (entire pump)			54		
Dimensions (L x W x H)	mm	210x380x390	Pump dimensions with motor and housing			540x450x220		
Weight	kg	20	See pump weight incl. chamber			20		
Housing material		1.4301	See Non-product wetted materials			1.4301		

3.4 Performance charts

The performance charts show the approximate flow rates depending on the pump speed.

The pump speed is equal to the motor speed when the motor is coupled directly to the pump. With gear motors, the pump speed is equal to:

$$n_P = n_M * i$$

- n_P pump speed
- n_M motor speed
- i ratio

Conditions

- Test fluid water at room temperature
- Eccentric shaft 5°
- Pressures 0 to 6 bar
- New diaphragms and new valves
- under standard conditions

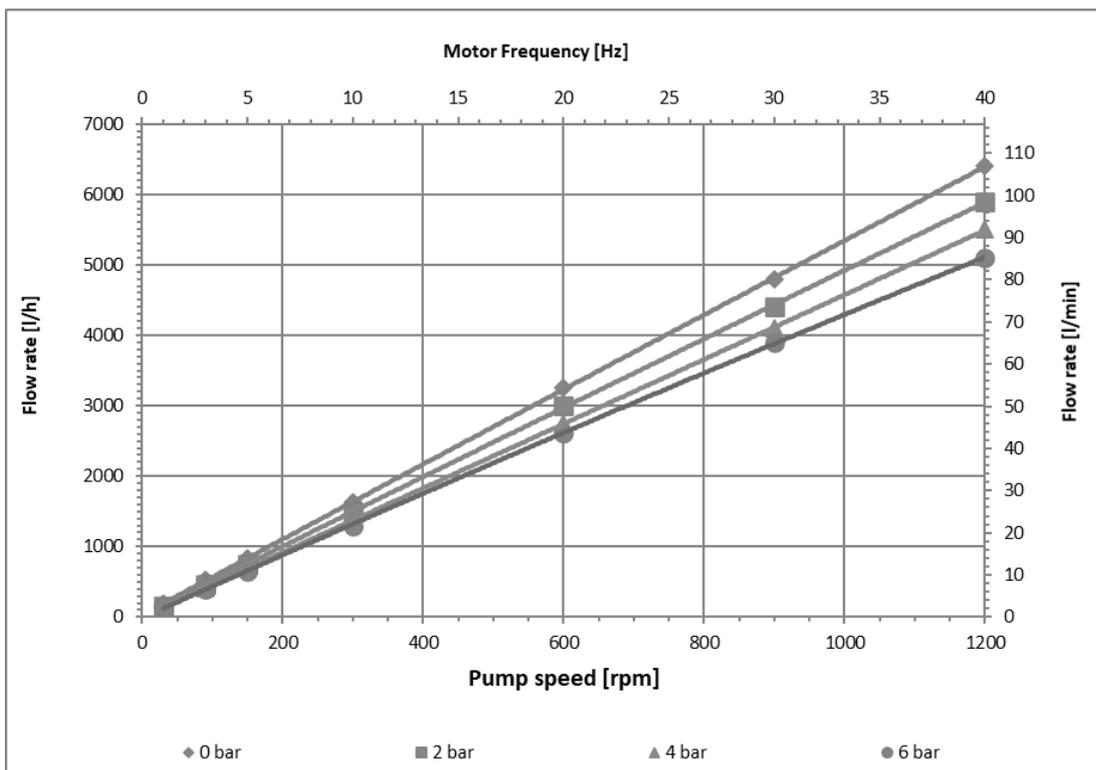


Figure 1 Performance chart QF5K

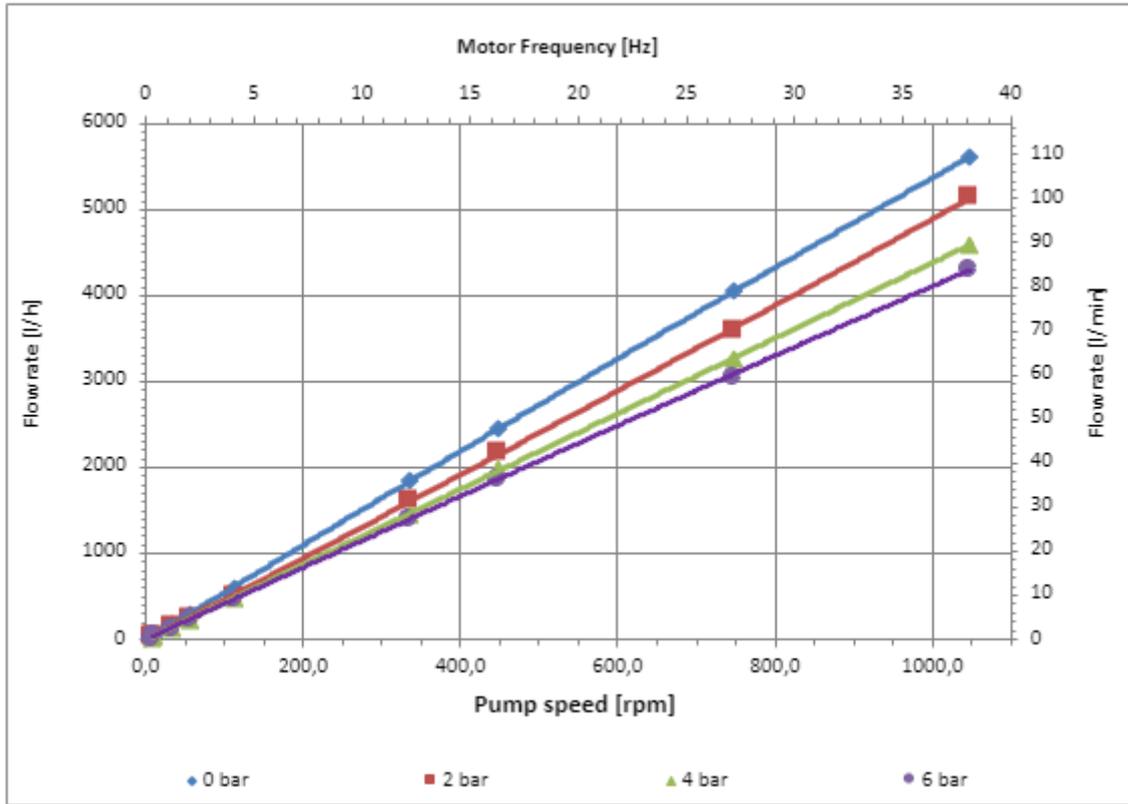


Figure 2 QF5KCD

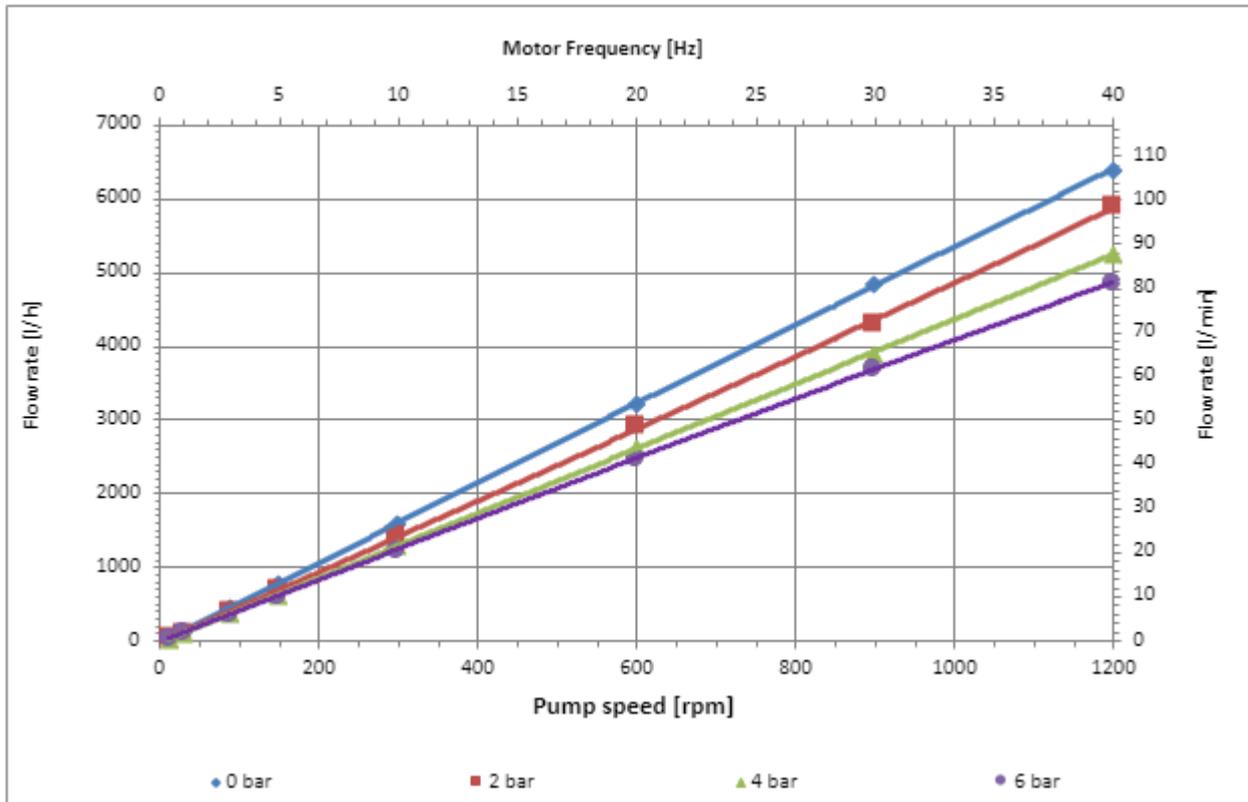


Figure 3 QF5HT and QF5QCON

3.5 Sub-assemblies

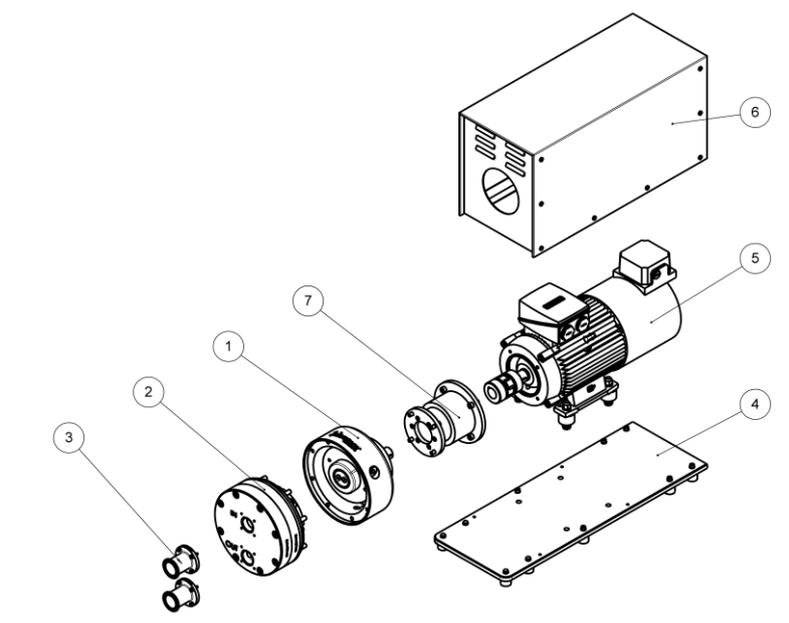


Figure 4 Sub-assemblies QF5K - QF5KACUEGNT

Item	Designation	
1	PQ5A	Ring drive (Figure 8 Sub-assembly ring drive PQ5A)
2	QF5C	Pump chamber (Figure 9 Sub-assembly pump chamber QF5C)
3	PQ5U	Connecting nozzle (Figure 10 Sub-assembly connecting nozzle PQ5U)
4	PQ5E	Base plate (Figure 11 Sub-assembly base plate PQ5E, PQ5E-HT, PQ5E-Q)
5	PQ5G	Drive unit (Figure 13 Sub-assembly drive unit PQ5G)
6	PQ5N	Housing (Figure 16 Sub-assembly housing PQ5N)
7	PQ5T	Motor flange (Figure 19 Sub-assembly motor flange PQ5T)

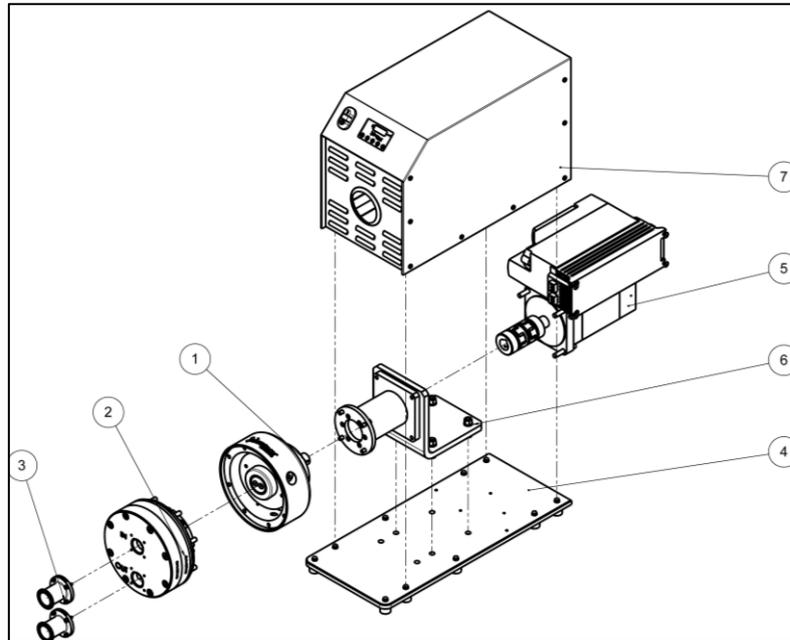


Figure 5 Sub-assemblies QF5K-HT - QF5KHT-ACUEGNT

Item	Designation	
1	PQ5A	Ring drive (Figure 8 Sub-assembly ring drive PQ5A)
2	QF5C	Pump chamber (Figure 9 Sub-assembly pump chamber QF5C)
3	PQ5U	Connecting nozzle (Figure 10 Sub-assembly connecting nozzle PQ5U)
4	PQ5E-HT	Base plate (Figure 11 Sub-assembly base plate PQ5E, PQ5E-HT, PQ5E-Q)
5	PQ5G-HT	Drive unit (Figure 14 Sub-assembly drive unit PQ5G-HAT)
6	PQ44N-HT	Housing (Figure 17 Sub-assembly housing PQ44N-HAT)
7	PQ5T-HT	Motor flange (Figure 20 Sub-assembly motor flange PQ5T-)

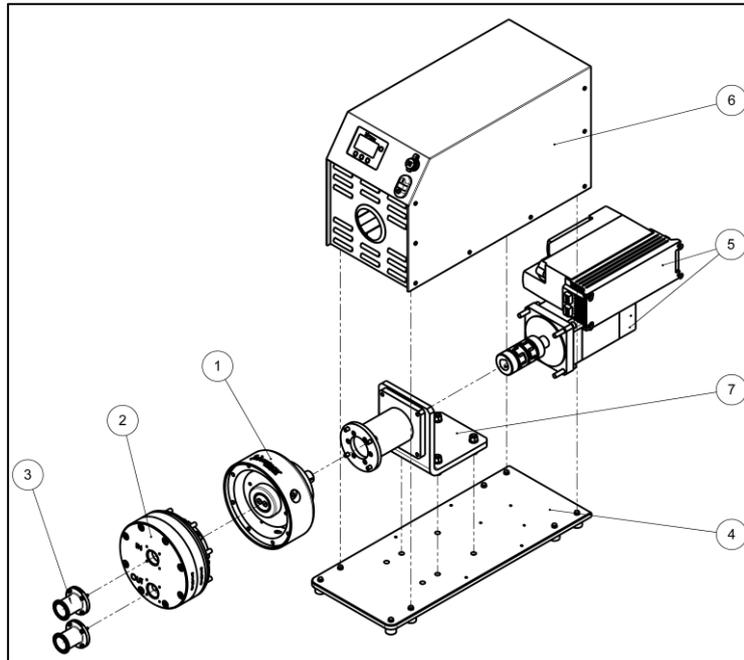


Figure 6 Sub-assemblies QF5KQCon - QF5KQCON-ACUEGNT

Item	Designation	
1	PQ5A	Ring drive (Figure 8 Sub-assembly ring drive PQ5A)
2	QF5C	Pump chamber (Figure 9 Sub-assembly pump chamber QF5C)
3	PQ5U	Connecting nozzle (Figure 10 Sub-assembly connecting nozzle PQ5U)
4	PQ5E-Q	Base plate Sub-assembly drive unit PQ5G
5	PQ5G-HT	Drive unit (Figure 20 Sub-assembly motor flange PQ5T-)
6	PQ44N-Q	Housing (Figure 18 Sub-assembly housing PQ44N-Q)
7	PQ5T-HT	Motor flange (Figure 20 Sub-assembly motor flange PQ5T-)

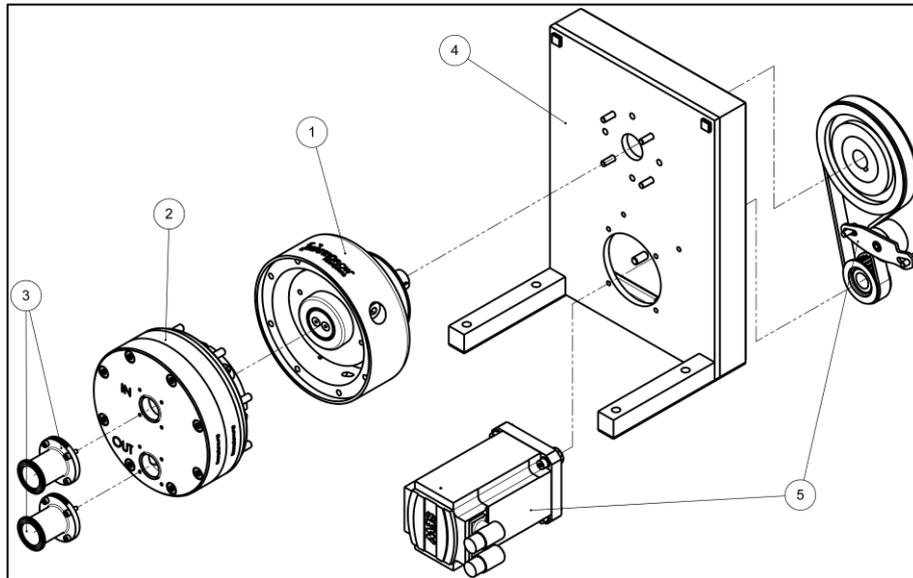


Figure 7 Sub-assemblies QF5KCD - QF5KCD-ACUHG

Item	Designation	
1	PQ5A	Ring drive (Figure 8 Sub-assembly ring drive PQ5A)
2	QF5C	Pump chamber (Figure 9 Sub-assembly pump chamber QF5C)
3	PQ5U	Connecting nozzle (Figure 10 Sub-assembly connecting nozzle PQ5U)
4	PQ50H	Rack (Figure 12 Sub-assembly rack PQ50H)
5	PQ50G	Drive unit (Figure 13 Sub-assembly drive unit PQ5G)

3.5.1 Ring drive PQ5A

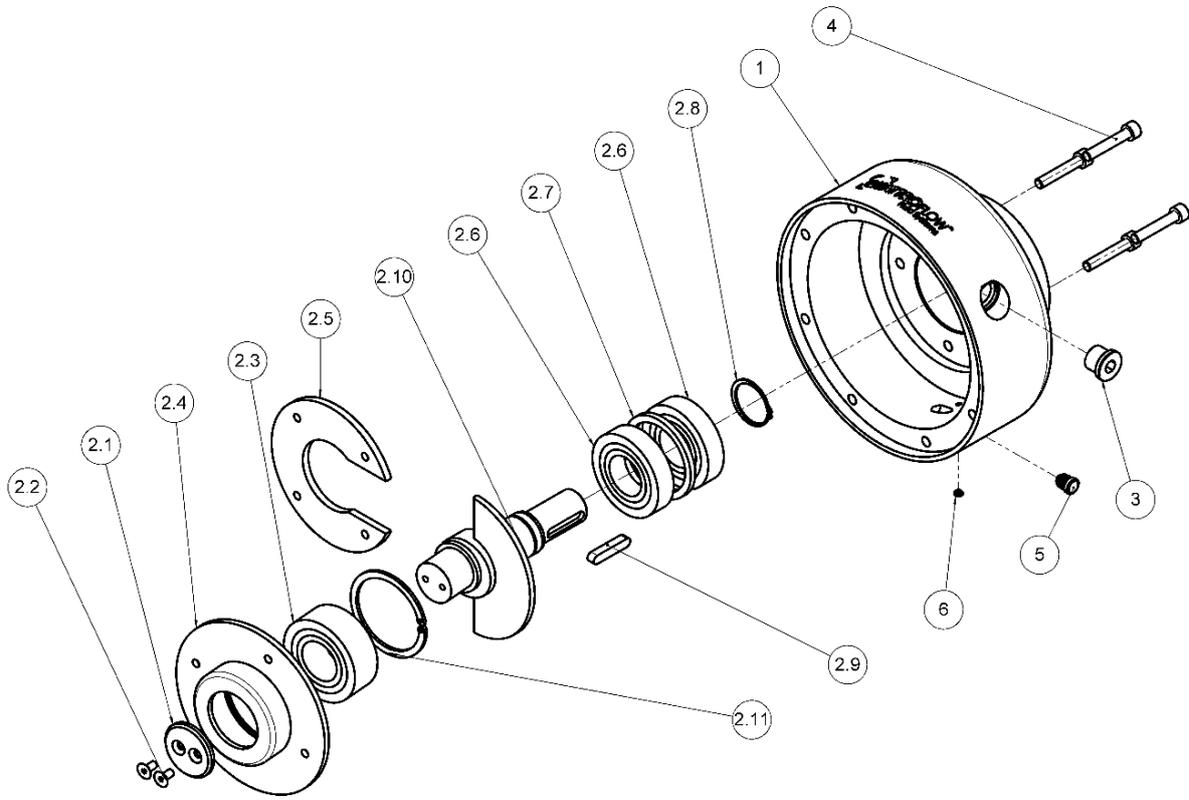


Figure 8 Sub-assembly ring drive PQ5A

Designations correspond to the included parts list

3.5.2 Pump chamber QF5C

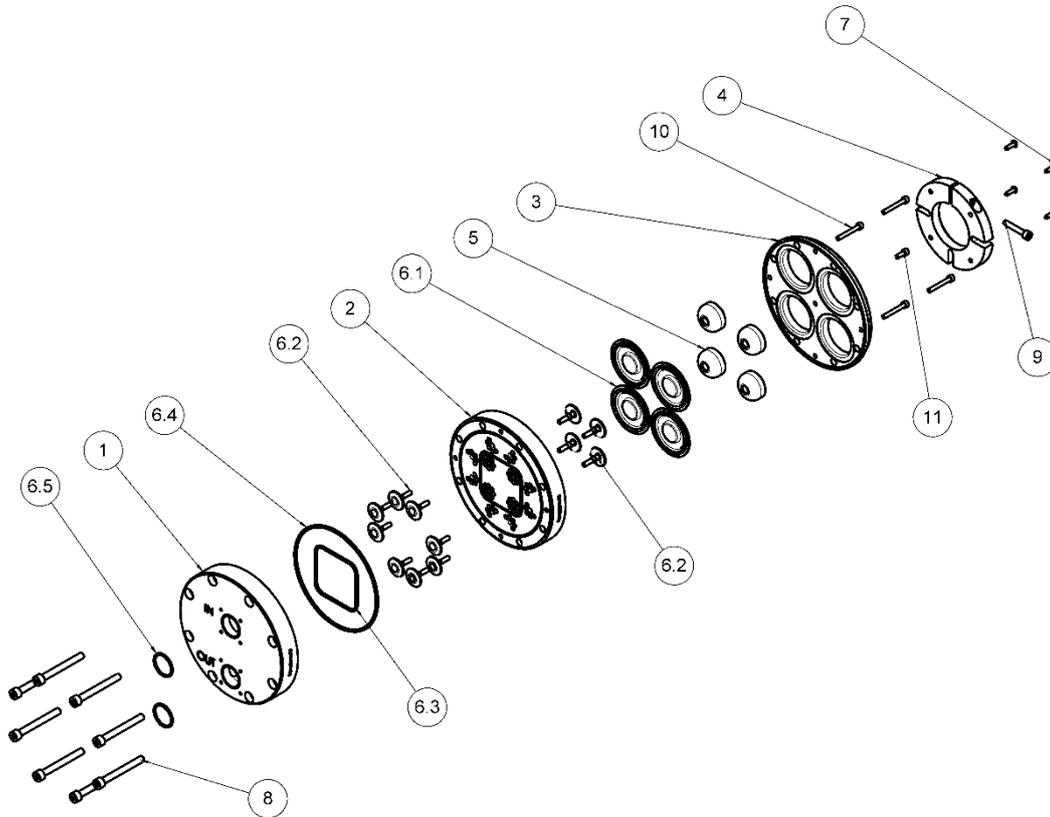


Figure 9 Sub-assembly pump chamber QF5C
Designations correspond to the included parts list

Torques

Figure 9 Sub-assembly pump chamber QF5C

Item	Designation	Nm
9	Clamping ring	18
8	Pump housing	35
7	Diaphragm support screw	6
10	Diaphragm housing cover to pump housing	10
11	Diaphragm housing cover to valve plate	10

3.5.3 Connecting nozzle PQ5U

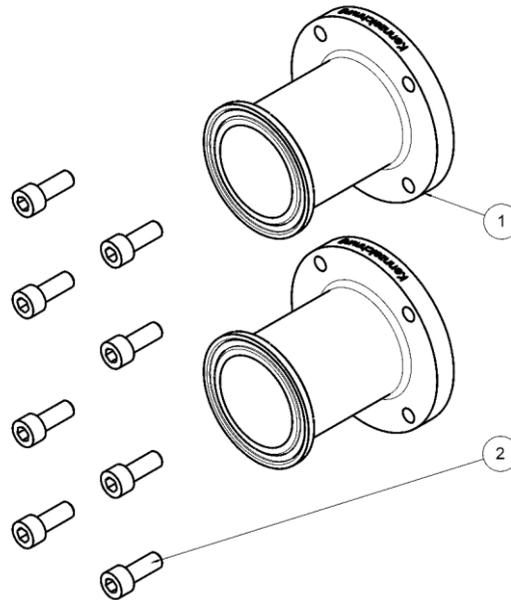


Figure 10 Sub-assembly connecting nozzle PQ5U
Designations correspond to the included parts list

Base plate PQ5E, PQ5E-HT, PQ5E-Q

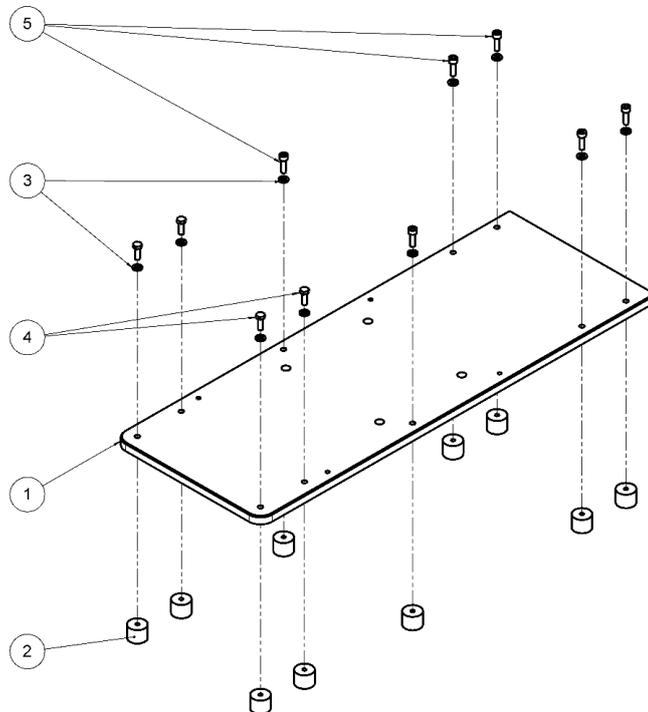


Figure 11 Sub-assembly base plate PQ5E, PQ5E-HT, PQ5E-Q
Designations correspond to the included parts list

3.5.4 Rack PQ50H

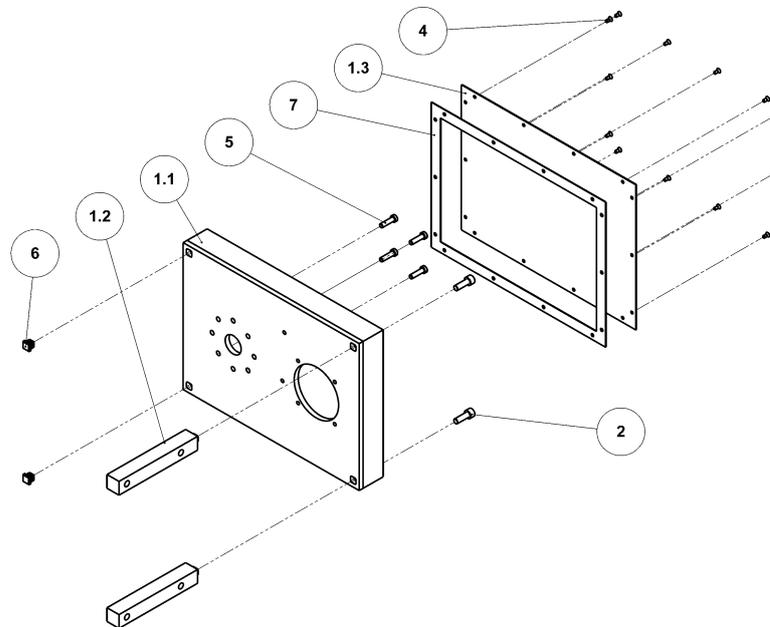


Figure 12 Sub-assembly rack PQ50H
Designations correspond to the included parts list

3.5.5 Drive unit PQ5G

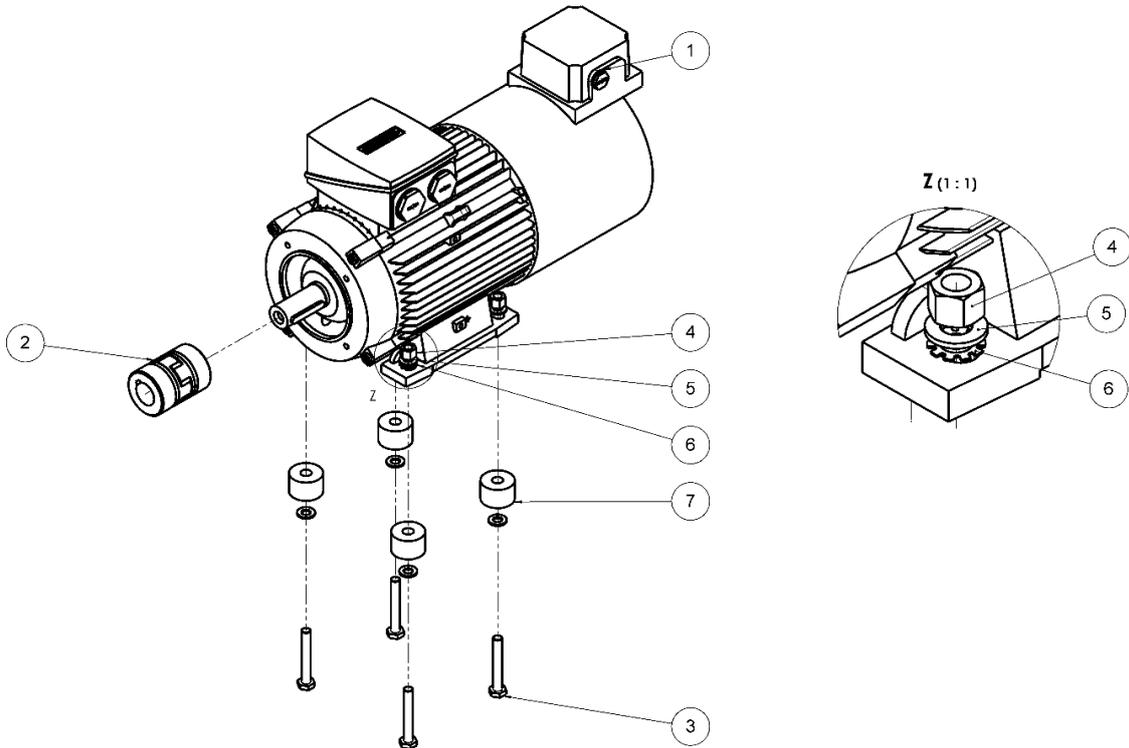


Figure 13 Sub-assembly drive unit PQ5G
Designations correspond to the included parts list

3.5.6 Drive unit PQ5G-HT

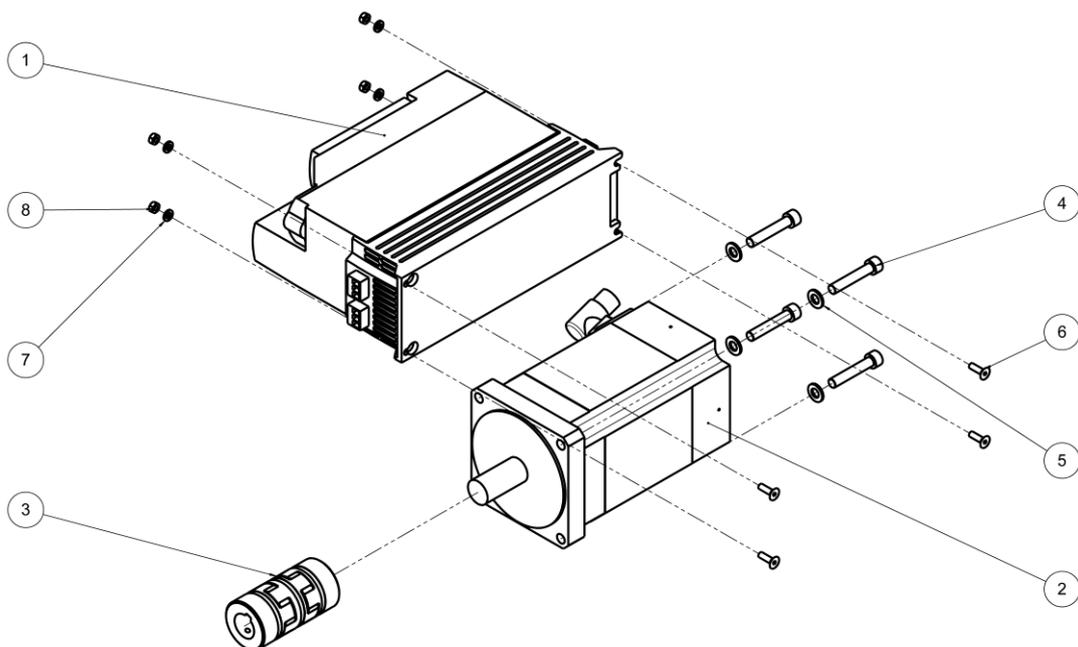


Figure 14 Sub-assembly drive unit PQ5G-HAT
Designations correspond to the included parts list

3.5.7 Drive unit PQ50G

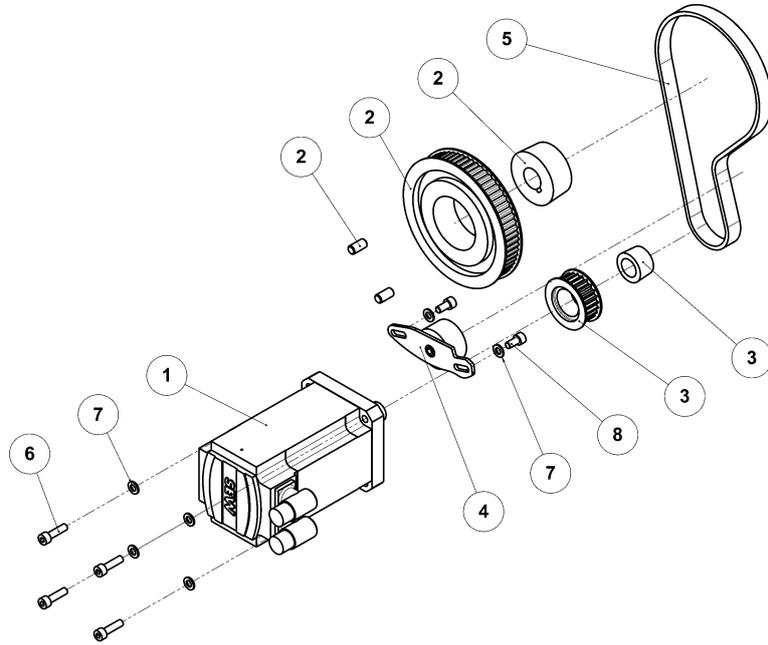


Figure 15 Sub-assembly drive unit PQ50G
Designations correspond to the included parts list

3.5.8 Housing PQ5N

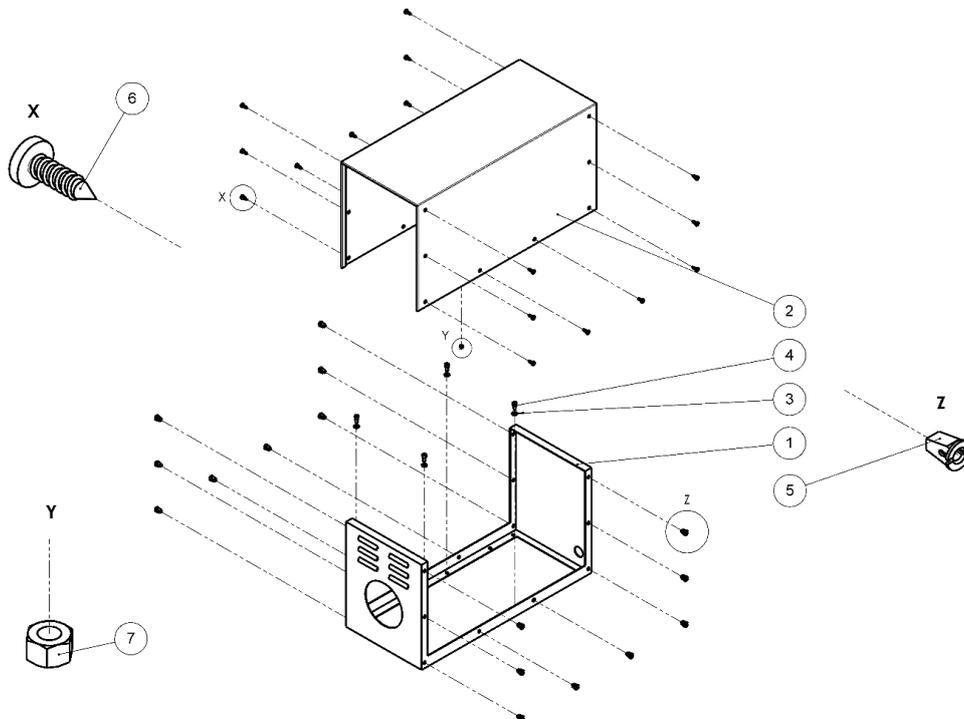
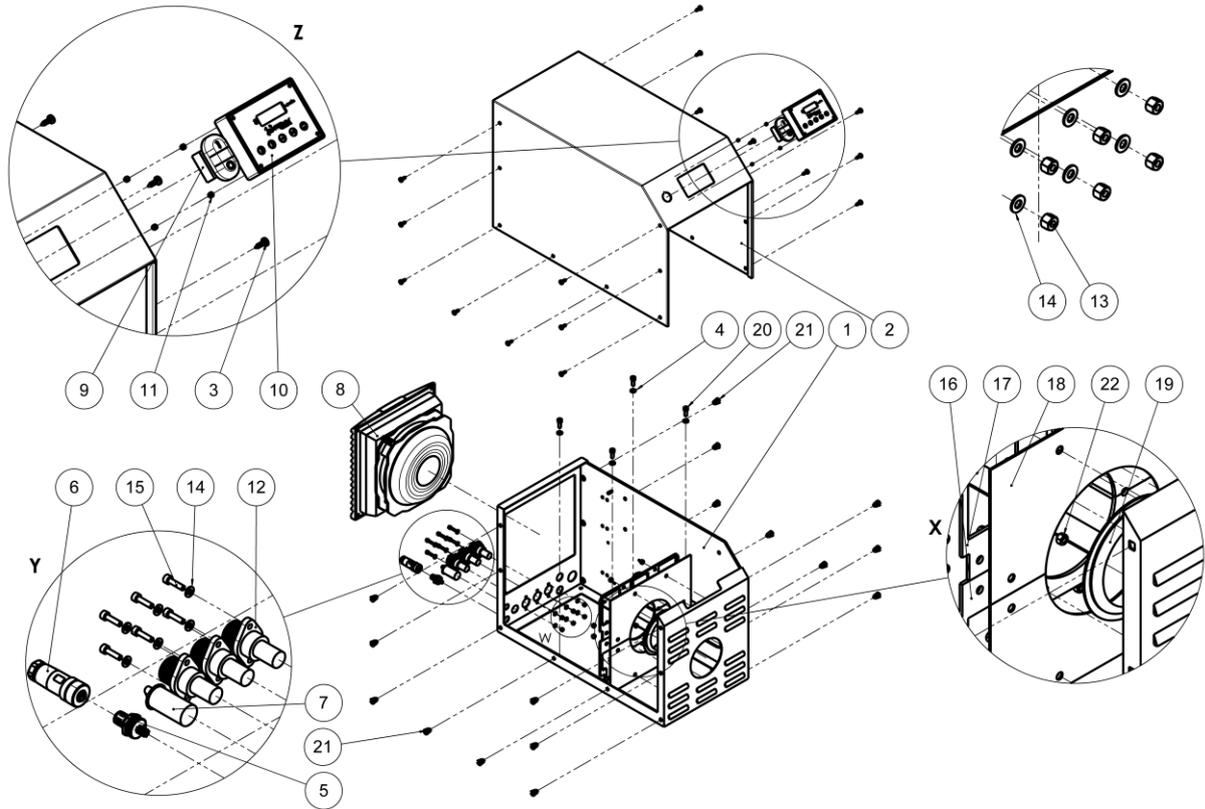


Figure 16 Sub-assembly housing PQ5N
Designations correspond to the included parts list

3.5.9 Housing PQ44N-HT



*Figure 17 Sub-assembly housing PQ44N-HAT
Designations correspond to the included parts list*

3.5.10 Housing PQ44N-Q

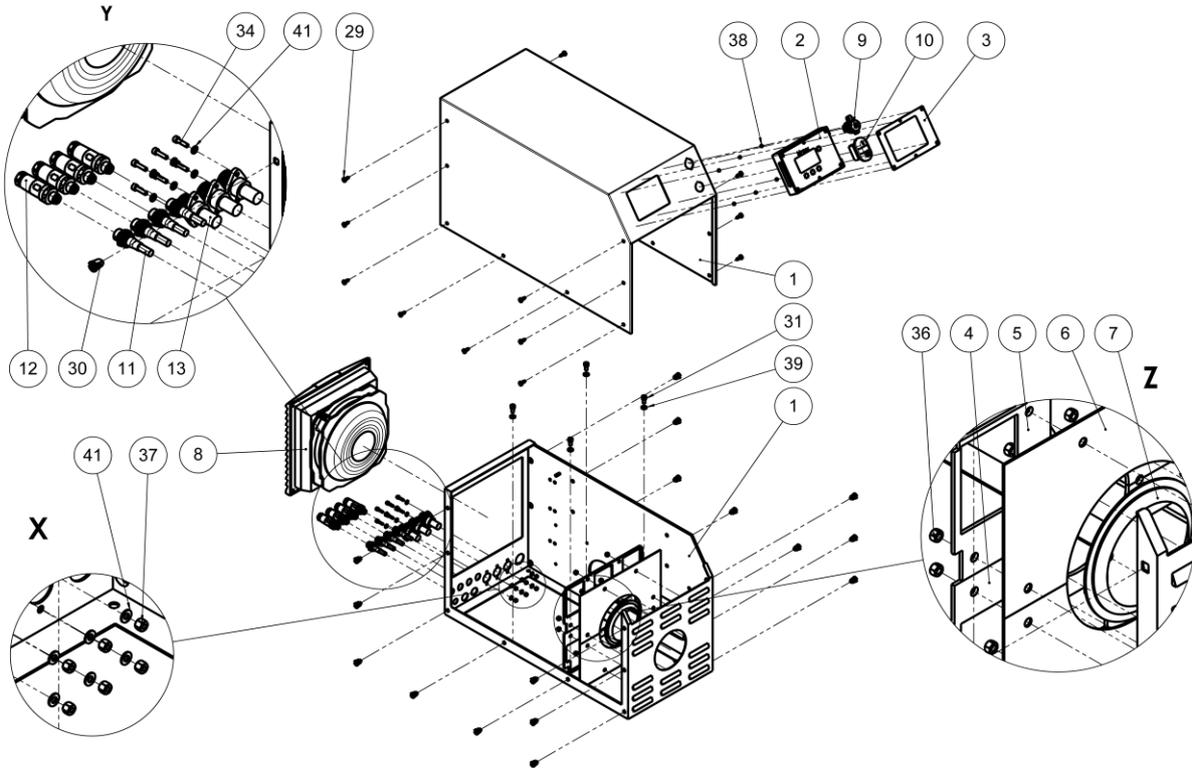


Figure 18 Sub-assembly housing PQ44N-Q
Designations correspond to the included parts list

3.5.11 Motor flange PQ5T

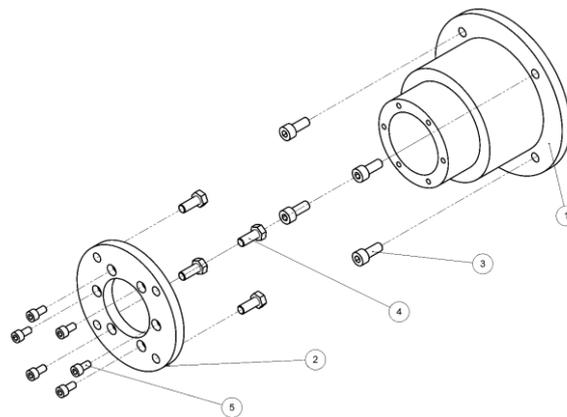


Figure 19 Sub-assembly motor flange PQ5T
Designations correspond to the included parts list

3.5.12 Motor flange PQ5T-HT

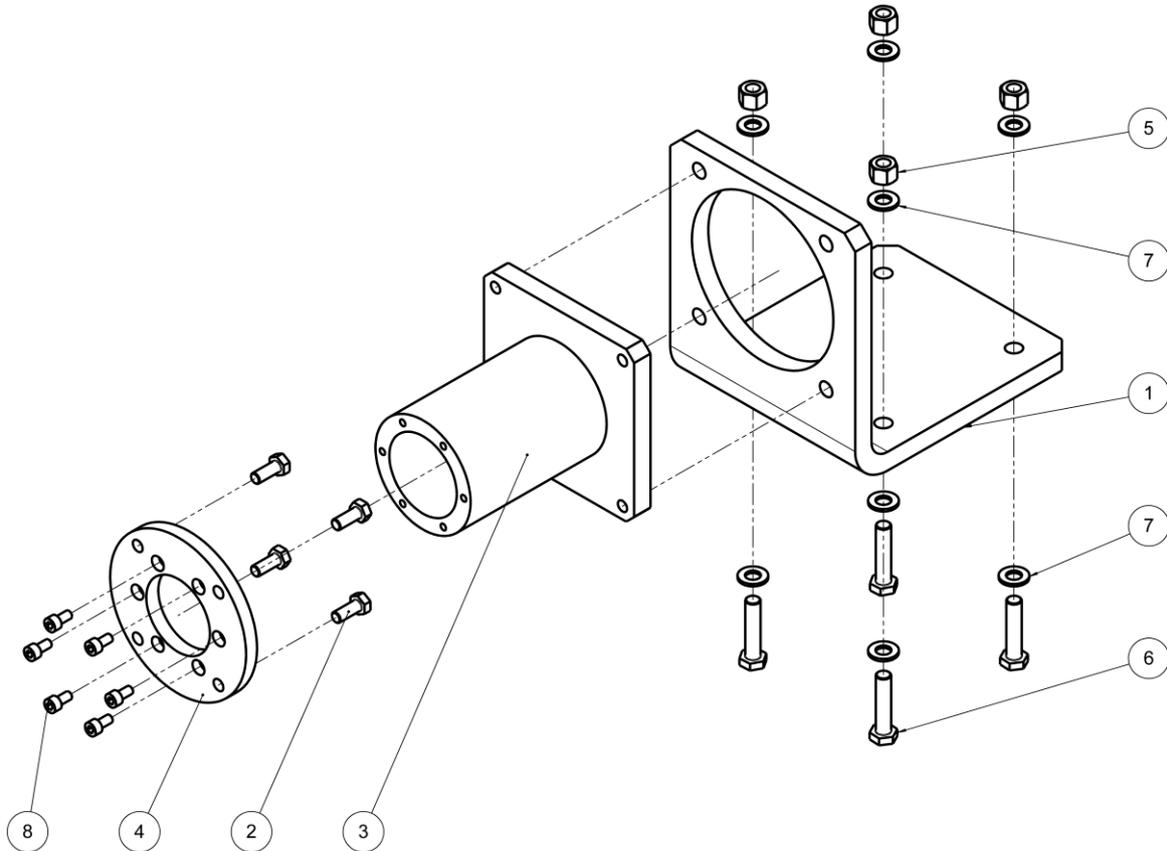


Figure 20 Sub-assembly motor flange PQ5T-HT
Designations correspond to the included parts list

3.6 Control panels

Pumps can be delivered with or without a separate control panel. In addition, compact versions with Code HT and QCON with integrated control panel are available.

3.6.1 Control panel HT

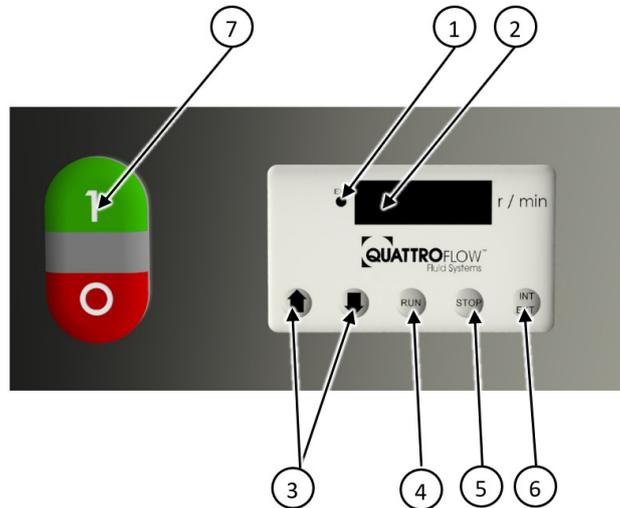


Figure 21 Control panel HT

Item	Designation
1	External LED
2	Display shows actual speed in rpm
3	Arrow buttons UP/DOWN
4	RUN button
5	STOP button
6	Control source INT/EXT
7	Main switch I/O

3.6.2 QControl

All pumps with “QCON” in the article code are equipped with the “QControl” control panel. The control panel is covered by a separate operating manual, therefore see the “QControl manual” for further information.

3.7 Optional accessories

These optional accessories are available for the QF5K and QF5KCD:

- Leakage sensor (diaphragm monitoring)
- External control panel with integrated frequency converter (FC)

3.8 Information on the pump

This information is attached to the pump:

- Maximum pressure and hot surfaces
- Labelling of the connectors
- Labelling of the flow direction
- Connecting cables, fuses, digital/analogue inputs and outputs (only HT/QControl)

Always keep this information in a perfectly legible condition.

4 Assembly/installation

- ▲ WARNING** – The eccentric shaft rotates in a housing. There is a risk of crushing in the space in between. Disconnect the power supply to the pump.

Install the pump in this way:

- Securely and stably on a non-slip surface able to bear the weight of the pump.
- Outside a humid or aggressive atmosphere (e.g. in air containing steam, salt or acid) to avoid corrosion on the motor and the control panel.

4.1 Transport and storage

The pump is generally shipped ready to use and packed.

- ▶ Leave the pump in the packaging until it is used.
- ▶ Protect the pump against the wet, cold, soiling, UV radiation and mechanical influences.
 - Uniformly ventilated room free from dust and vibrations
 - Ambient temperature between 10°C and 55°C at a relative humidity below 65%
 - No exposure to heat (sun, heaters)
- ▶ Lift the pump evenly at the base plate. The pump is heavy. Carry the pump together with another person or with suitable lifting gear.

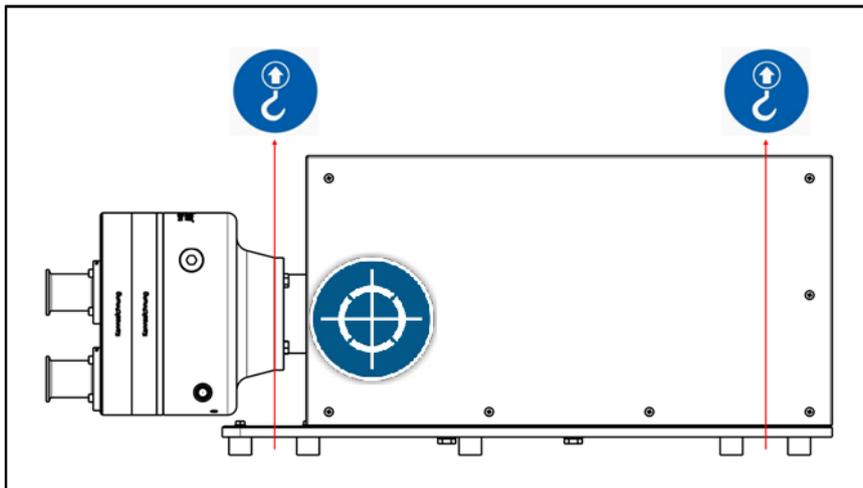


Figure 22 Attachment points and centre of gravity of the pump

4.2 Space requirement

Leave enough room around the pump for operation and maintenance. Observe the space required for assembly and disassembly of the pump chamber (see chapter 6.5 Replacing on page 32).

Leave enough room for bleeding the pump.

Position the control panel in a place where it can be easily reached. Protect the control panel from damp (splashing or jets of water) and heat.

4.3 Installation

The pump is mounted on a stainless steel base plate. If the pump is not to be operated on this base plate but, for example, in a rack, make sure that the drive unit and feeder unit are aligned correctly.

4.4 Connections

4.4.1 Pipes

▲ WARNING – If the the pressure can rise above the maximum permissible pressure of the pump, a pressure relief valve or automatic pressure cut-out is required.

Connect the pump with pipes and hoses like this

- Suction side
 - Pipes are sufficiently dimensioned. Too small a pipe cross-section can lead to a reduced pump performance and to cavitation.
 - Pipes withstand the vacuum pressure and do not collapse.
 - Pipes withstand the temperatures of the fluid and the cleaning (CIP and SIP).
- Pressure side
 - Pipes are sufficiently dimensioned.
 - for the pumping and operating pressure
 - the operating and fluid temperature

4.4.2 Electric cables

NOTE – Operate the pump only with the specified mains voltage and mains frequency to avoid damage to the control panel and the pump drive (see chapter 3.2 Labelling on page 7).

▲ DANGER – Electric current, fatal electric shock. Have the pump connected only by specialised personnel and disconnect the power when working on the electrical system.

- ▶ Connect the pump to a protective earth system.
 - Minimum cross-section 2.5 mm² (AWG14)
 - Protected against mechanical damage over the entire length.
- ▶ Install the pump with a suitable preliminary fuse.
- ▶ RCCBs must be type B or B+.
- ▶ Plug connections must be suitable for industrial applications in accordance with IEC 60309.
- ▶ If the risk analysis demands, integrate the pump into an emergency stop system via its electrical connection.

4.4.3 Collection vessel

CAUTION – Fluid can spill if the diaphragm bursts. The fluid escapes through a hole in the ring drive. Place a collection vessel under the ring drive.

If the pump is operated unsupervised for a long period of time, the special leakage sensor accessory is recommended for diaphragm monitoring. This applies especially for pumping dangerous fluids.

4.5 Test run

NOTE – A test run is recommended before using the pump for the first time:

- ▶ Carry out a test run with a safe fluid, e.g. water. In this way you can acquaint yourself with the function of the pump.
- ▶ Check the suitability of the pump by representative preliminary tests.
- ▶ Check the compatibility of the pump with the fluid to be pumped. Fluids containing oil or solvents can lead to swelling or destruction of the elastomer materials. Especially check these parts:
 - QF5C (chapter Connecting nozzle PQ5U3.5.2): Item 1, item 2, items 6.1 – 6.5
 - PQ5U (chapter 3.5.3): Item 1
- ▶ Consult the Material-and-Certification-Guide or contact our Service if in doubt.

4.6 Parameter settings

A separate operating manual is available for pumps with the QCON control panel.

5 Commissioning

Before using for the first time, it might be useful to fill the pump with 0.1 N to 0.5 N NaOH alkaline solution and allow it to soak in. The soaking time depends on the desired result (e.g. depyrogenisation 10 - 20 hours). Adapt the flushing and cleaning procedure to the respective application and check the effect by suitable analytical processes.

6 Operation

6.1 Safety

⚠ WARNING – The pumped fluid and cleaning products can be dangerous. There is a risk of serious damage to health by contact. Observe the safety data sheet of the fluid and wear the appropriate protective equipment.

⚠ WARNING – The pumped fluid and cleaning products can be hot and heat up parts of the pump. There is a risk of burns when touching. Allow hot parts to cool down.

Only operate the pump with the pump chamber and housing mounted. Do not operate the pump if the pump or one of its components is damaged.

6.2 Switching on

⚠ WARNING – Overpressure can lead to leakages and spillage of the fluid. You could expose yourself to a dangerous fluid or suffer scalding. Never switch the pump on if the pressure side might be closed.

- ▶ Check the system beforehand - especially for possible leakages and visible damage.
- ▶ Open the pressure line.
- ▶ Flush the pump thoroughly and condition the pump with a product-compatible solution (e.g. buffer) if necessary.

6.3 Operation

6.3.1 Control panel QF5KHT

You can operate the QF5KHT pump in 2 ways:

- Manual operation (speed setting and start/stop) of the pump by the control panel (see chapter Figure 21 Control panel HT on page 27)
- External operation of the pump by means of an analogue signal (4 - 20 mA). The buttons of the control panel are locked.

6.3.1.1 Starting the pump

Manual operation

See Figure 21 Control panel HT on page 27.

- ▶ Press the main switch.
- ▶ Press the control source button (6) until the external LED (1) no longer lights.
- ▶ Press the arrow buttons (5) to set the desired speed. The desired speed appears as a target value on the display (2).
- ▶ When you have set the desired speed, press the RUN button (4).
- ▶ Press the STOP button (5) to stop the pump.

External operation

- ▶ Press the main switch.
- ▶ Press the control source selection button (6) until the external LED (1) lights.
- ▶ Signal connector (8-pin plug) 4-20mA \Rightarrow 0-1200 rpm + start/stop signal
Note! The start and stop signal must always be used!

6.3.1.2 Stopping the pump

- ▶ Press the STOP button (5).
- ▶ Wait until no more fluid is pumped.

6.3.1.3 Switching off the pump

- ▶ Stop the pump.
- ▶ Empty the pump.
- ▶ For QF5K-HT and QF5KQcon pumps: Switch the pump off with the main switch (7).

The display switches off.

⚠ WARNING – The fluid can heat up parts of the pump. You could suffer burns!

- ▶ Allow the pump to cool down if necessary.
- ▶ Clean the pump.

6.3.1.4 Speed control panel HT

Arrow up (Figure 21 Control panel HT item 3) increases the speed.

Arrow down (Figure 21 Control panel HT item 3) reduces the speed.

The flow rate is shown in the diagram (Figure 1 Performance chart QF5K).

6.3.2 Operation with the frequency converter

The pump is started, controlled and stopped with the external frequency converter.

6.4 Cleaning

The cleaning process must be adapted accordingly depending on the used products and the existing requirements. The user is responsible for checking the cleaning result.

⚠ DANGER – Depending on the conditions and frequency of cleaning, it may be necessary to check and replace the elastomers more frequently.

6.4.1 CIP (cleaning)

The pump chamber is cleaned when the pump chamber is installed on the drive.

⚠ DANGER – The alkaline solutions used for cleaning are strong. They could cause burns. Wear protective goggles, protective gloves and safety clothing. Observe the safety data sheet.

⚠ WARNING – Strong alkaline solutions are pumped when cleaning. They could cause burns in case of leakages. Make sure that the whole system withstands maximum pressure.

⚠ WARNING – Cleaning can heat up parts of the pump. You could suffer burns. Do not touch the pump. Allow the pump to cool down.

- ▶ Pre-flush the pump until fluid residues are removed.
- ▶ Clean with 0.5 M NaOH (approx. 50°C) at 80% of the maximum speed for 30 min.
- ▶ Flush the pump with water afterwards until neutrality is achieved (by measuring the pH value or conductivity of the flushing water).

6.4.2 SIP (steaming)

The pump chamber is steamed when the pump chamber is installed on the drive.

The pump may not be operated during the SIP process and while it is cooling down.

⚠ WARNING – Cleaning can heat up parts of the pump. You could suffer burns!

- ▶ Only perform this with the pump chamber installed.
- ▶ Do not touch the pump.
- ▶ Allow the pump to cool down.
- ▶ Steam at a maximum temperature of 130°C and not for longer than 30 minutes.
- ▶ Allow the pump chamber to cool down slowly.

6.4.3 Autoclaving of the pump chamber

Autoclaving is sterilisation by thermal treatment under overpressure. The pump chamber may only be autoclaved when the pump chamber has been removed.

- ▶ Empty the pump completely.
- ▶ Clean the pump according to the fluid.
- ▶ Disassemble the pump chamber (see chapter 6.5.2 Disassembling the pump chamber on page 33).
- ▶ Close the inlet and outlet openings of the pump, e.g. by connecting hoses. Make sure that a free gas and steam is possible directly or indirectly via a sterile barrier (e.g. sterile filter) at the inlet and outlet openings.

ATTENTION – The diaphragms can be deformed in the autoclave. Do not exert pressure on the clamping ring (Figure 23) during autoclaving.

- ▶ Position the pump chamber in the autoclave as shown.

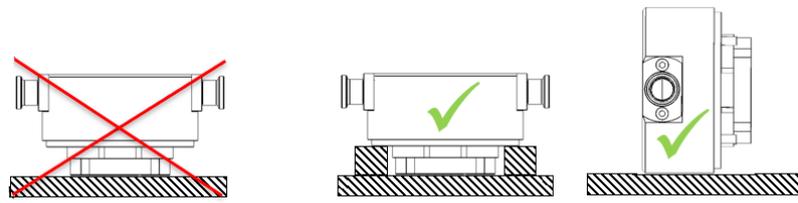


Figure 23 Position of the disassembled pump chamber in the autoclave

- ▶ Autoclave the pump chamber in the vacuum autoclave at maximum 130°C and for maximum 30 min. Follow the instructions of the autoclave manufacturer.

6.5 Replacing elastomers

Required maintenance kit: PSKITQF5K.

6.5.1 Safety

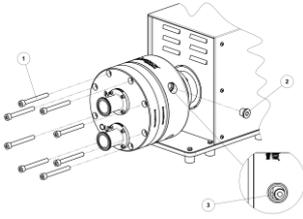
⚠ WARNING –Electrical and mechanical hazards. Establish a safe condition of the pump:

- emptied
- flushed
- depressurised
- cooled
- voltage-free

The suction and pressure side lines are closed and emptied if necessary.

If the pump is removed, a note about the last pumped fluid or a decontamination certificate must be enclosed.

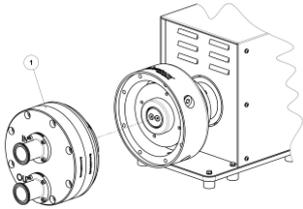
6.5.2 Disassembling the pump chamber



⚠ DANGER – Touching electrical parts can cause a fatal electric shock. Disconnect the power supply to the pump.

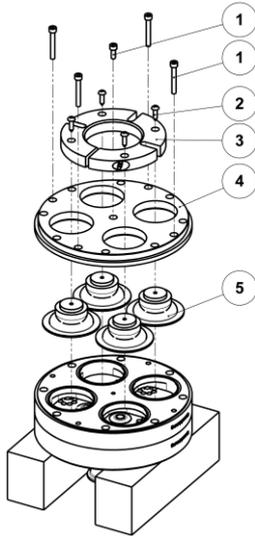
⚠ WARNING – The fluid can heat up parts of the pump. You could suffer burns. Allow the pump to cool down.

- ▶ Remove the screws (1 / QF5C item 8 Figure 9) from the housing.
- ▶ Remove the locking screw (2 / PQ5A, item 3 Figure 8).
- ▶ Loosen the clamping ring screw (3 / QF5C, item 9 Figure 9).



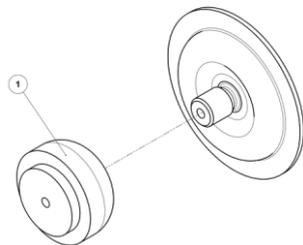
- ▶ Remove the pump chamber (1).

6.5.3 Replacing the elastomers



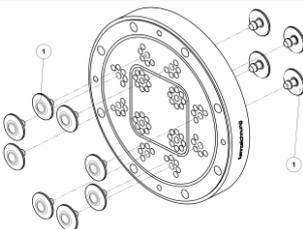
⚠ DANGER – The alkaline solutions used for cleaning are strong. They could cause burns. Wear protective goggles, protective gloves and safety clothing. Observe the safety data sheet.

- ▶ Disassemble the pump chamber (see chapter 6.5.2 Disassembling the pump chamber on page 33).
- ▶ Set down the pump chamber so that there is no load on the connecting nozzles.
- ▶ Remove the screws (1 / QF5C, item 10; 11 Figure 9).
- ▶ Remove the screw (2 / QF5C, item 7 Figure 9).
- ▶ Remove the clamping ring (3 / QF5C, item 4 Figure 9).
- ▶ Remove the diaphragm housing cover (4 / QF5C, item 3 Figure 9).
- ▶ Remove the diaphragm together with the diaphragm support (5 / QF5C, item 3; 6.1 Figure 9).

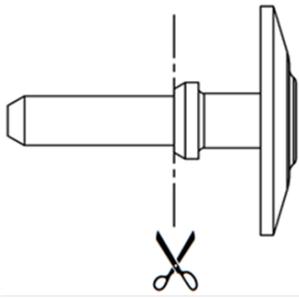


Replacing the diaphragm

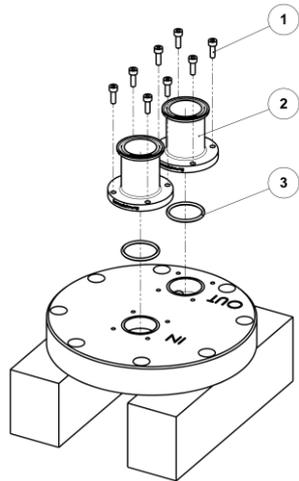
- ▶ Turn out the diaphragm.
- ▶ Tighten the diaphragm support (1 / QF5C, item 3; 6.1 Figure 9).



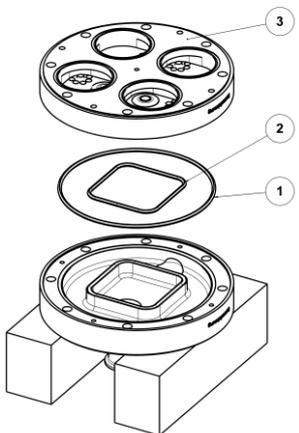
- ▶ Replace the valves (1). Use the assembly shaft valve (QF5C, item 6.2 Figure 9).



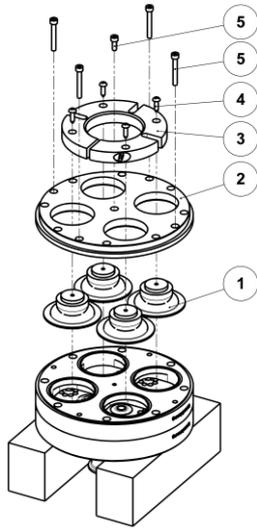
- ▶ Cut off the assembly shaft at the marked position on the valve (✂ / QF5C, item 6.2 Figure 9).



- ▶ Remove the screws (1 / PQ5U, item 2 Figure 10).
- ▶ Remove the connecting nozzles (2 / PQ5U, item 1 Figure 10).
- ▶ Replace the O-rings (3 / QF5C, item 6.5 Figure 9).
- ▶ Mount the connecting nozzles (2 / PQ5U, item 1 Figure 10).
- ▶ Fasten the screws (1 / PQ5U, item 2 Figure 9).

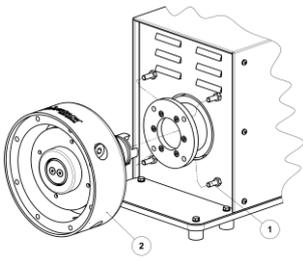


- ▶ Mount the O-ring (1 / QF5C, item 6.4 Figure 9).
- ▶ Mount the profile O-ring (2 / QF5C, item 6.3 Figure 9).
- ▶ Mount the valve plate together with the valves (3 / QF5C, item 2; 6.4 Figure 9).



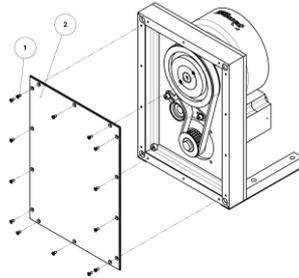
- ▶ Mount the diaphragm together with the diaphragm support (1 / QF5C, item 3; 6.1 Figure 9).
- ▶ Mount the diaphragm housing cover (2 / QF5C, item 3 Figure 9).
- ▶ Fasten the screws (5 / QF5C, item 10; 11 Figure 9).
- ▶ Mount the clamping ring (3 / QF5C, item 4 Figure 9).
- ▶ Fasten the screw (4 / QF5C, item 7 Figure 9).

6.5.4 Replacing the WLC

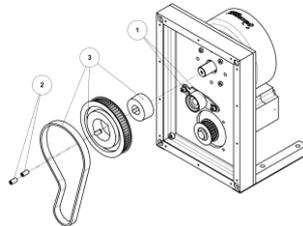


- ▶ Disassemble the pump chamber (see chapter 6.5.2 Disassembling the pump chamber on page 33).
- ▶ Remove the screws (1 / PQ5T, item 4 Figure 19).
- ▶ Disassemble the ring drive together with the coupling half (2 / PQ5A; PQ5G, item 2 Figure 13).

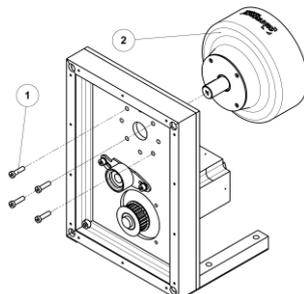
For QF5KCD pump:



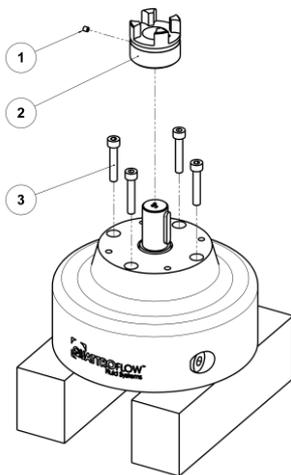
- ▶ Remove the screws (1 / PQ50H, item 4 Figure 12).
- ▶ Disassemble the cover together with the seal (2 / PQ50H, item 1.3, 7 Figure 12).



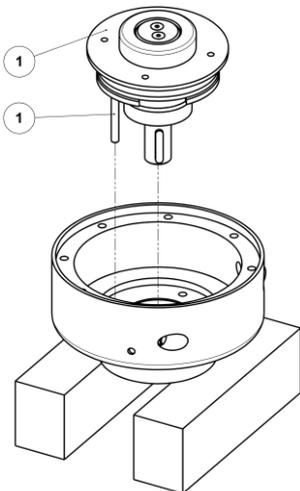
- ▶ Loosen the screws (1 / PQ50G, item 8 Figure 15).
- ▶ Unscrew the threaded pins (2 / PQ50G, item 2 Figure 15).
- ▶ Disassemble the toothed disc incl. bush and toothed belt (3 / PQ50G item 2; 5 Figure 15).



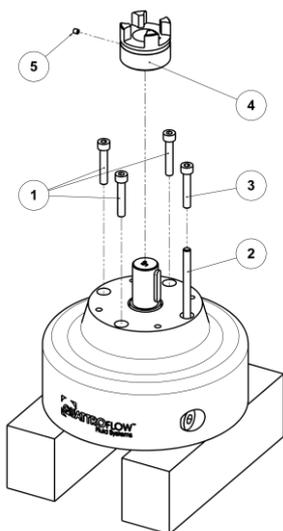
- ▶ Loosen the screws (1 / PQ50H, item 5 Figure 12).
- ▶ Disassemble the ring drive (2 / PQ5A-CD Figure 8).



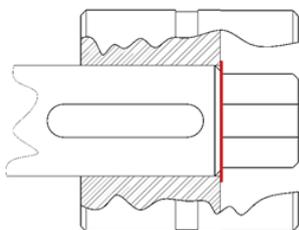
- ▶ Remove the threaded pin (1 / PQ5G, item 2 Figure 13) from the coupling half (2).
- ▶ Disassemble the coupling half (2 / PQ5G, item 2 Figure 13).
- ▶ Remove the screws (3 / PQ5A, item 4 Figure 8).



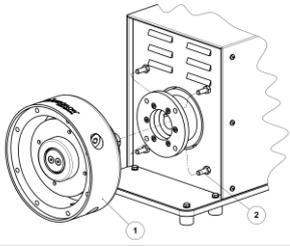
- ▶ Turn the ring drive over.
- ▶ Set down the ring drive so that there is no load on the shaft.
- ▶ Replace the maintenance kit WLC unit (1).
- ▶ Mount the assembly bolt (PQ5A, item 2 Figure 8) on the new unit.
- ▶ Insert the new unit into the ring drive.



- ▶ Fasten the first three screws (1 / PQ5A, item 4 Figure 8).
- ▶ Unscrew the assembly bolt (2).
- ▶ Fasten the last screw (1 / PQ5A, item 4 Figure 8).
- ▶ Fasten the screws (3 / PQ5A, item 4 Figure 8).
- ▶ Mount the coupling half (4 / PQ5G, item 2 Figure 13).
- ▶ Fasten the coupling half with the threaded pin (5 / PQ5G, item 2 Figure 13).

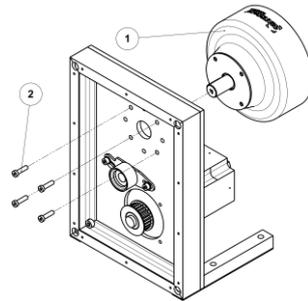


- ▶ Align the coupling.
The end face of the shaft should be in line with the end face of the coupling half if possible (red marking).

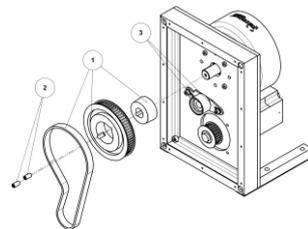


- ▶ Mount the ring drive together with the coupling half (1 / PQ5A Figure 8; PQ5G, item 2 Figure 13).
- ▶ Fasten the screws (2 / PQ5T, item 4 Figure 19).
- ▶ Mount the pump chamber (see chapter 0
- ▶ Mounting the pump chamber on page 38).

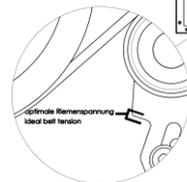
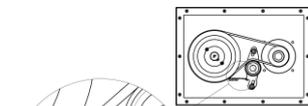
For QF5KCD pump:



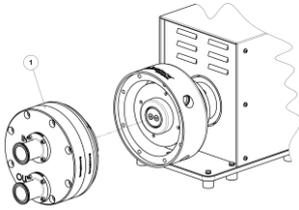
- ▶ Mount the ring drive (1 / PQ5A-CD Figure 8).
- ▶ Fasten the screws (2 / PQ50H, item 5 Figure 12).



- ▶ Mount the toothed disc incl. bush and toothed belt (3 / PQ50G item 2; 5 Figure 12).
- ▶ Tighten the threaded pins (2 / PQ50G, item 2 Figure 12).
- ▶ Align the tensioning roller. Observe the "optimum belt tension" marking on the base plate.
- ▶ Fasten the screws (3 / PQ50G, item 8 Figure 12).



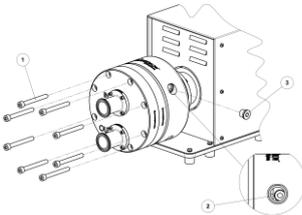
6.5.5 Mounting the pump chamber



- ▶ Disconnect the power supply to the pump.
- ▶ Mount the pump chamber (QF5C Figure 9).

NOTE – You can turn the pump chamber (QF5C Figure 9) in 90° steps so that the position of the connectors on the suction and pressure side fit optimally in the machine. Hereby, also turn the clamping ring (QF5C, item 4 figure 9) so that the clamping ring screw (QF5C, item 9 figure 9) is accessible.

Optimum emptying of the pump only exists in standard alignment (outlet connector facing downwards), however.



- ▶ Fasten the screws (1 / QF5C, item 8 Figure 9).
- ▶ Fasten the clamping ring screw (2 / QF5C, item 9 Figure 9).
- ▶ Fasten the locking screw (3 / PQ5A, item 3 Figure 8).

7 Maintenance

Wearing parts such as, e.g., the diaphragms, valves and O-rings must be checked at regular intervals and replaced regularly in the course of preventive maintenance.

The recommended intervals were determined under standardised conditions (fluid water, fluid temperature 20°C, ambient temperature 20°C, flow rate 5000 lph, 4 bar counter-pressure). Different conditions (e.g. higher fluid temperatures, aggressive fluids) and all after-treatments of the parts (e.g. CIP, SIP) influence the service life.

- ▶ Check the intervals close to the process and adapt the recommended intervals to the application and the pumped fluid.
- ▶ Only use genuine spare parts.

Recommended interval	Component	Activity
After opening the pump chamber	Elastomers <ul style="list-style-type: none"> • Diaphragm • Valves • O-rings 	Replace (available as a replacement kit)
After diaphragm breakage	Elastomers <ul style="list-style-type: none"> • Diaphragm • Valves • O-rings 	Replace (available as a replacement kit)
	Bearing unit <ul style="list-style-type: none"> • Eccentric shaft • Bearing • Connector plate 	Replace (available as a pre-assembled replacement kit)
1000 operating hours or at least once a year	Elastomers <ul style="list-style-type: none"> • Diaphragm • Valves • O-rings 	Replace (available as a replacement kit)
	Bearing unit <ul style="list-style-type: none"> • Eccentric shaft • Bearing • Connector plate 	Check and replace if necessary (available as a pre-assembled replacement kit)

See the maintenance instructions in the respective operating instructions for the following components

- Motor
- Coupling
- Gear (if available)

8 Troubleshooting

8.1 Troubleshooting

Does the pump start?	
YES	NO
	Is the display off or does it show an error code?
	NO
	YES
	Is the motor too hot?
	NO
	YES
	The thermal circuit breaker in the motor has tripped.
	<ul style="list-style-type: none"> ▶ Allow the motor to cool down. ▶ Reduce the pump performance.
	Parts are defective.
	<ul style="list-style-type: none"> ▶ Check the power cables, power supply and fuse (6.3 A slow-blow) in the control panel. ▶ Replace the defective parts.
	The parameters of the control panel are wrong.
	<ul style="list-style-type: none"> ▶ Check the basic settings. ▶ Reset the basic settings.
Are operating noises getting louder?	
NO	YES
	The ball bearings on the eccentric shaft are defective.
	<ul style="list-style-type: none"> ▶ Renew the ball bearings on the eccentric shaft.
	▶ Contact Service (see chapter 1.1 Manufacturer and Service on page 3).
Is the pump priming?	
YES	NO
	Is delivery obtained?
	NO
	YES
	Is the pump leaking?
	NO
	YES
	The screws connecting the individual components are not tightened properly.
	<ul style="list-style-type: none"> ▶ Re-tighten the screws.
	The pump has wrong direction of flow.
	<ul style="list-style-type: none"> ▶ Turn the pump head.
Is pressure reached?	
NO	YES
	The pump is drawing air, e.g. due to a leaking TC seal.
	<ul style="list-style-type: none"> ▶ Check the seals.
	The fluid is too viscous.
	<ul style="list-style-type: none"> ▶ Check the viscosity.

	<ul style="list-style-type: none"> ▶ Dilute the fluid. <p>Foreign bodies in the pump or pipes.</p> <ul style="list-style-type: none"> ▶ Check whether foreign bodies have gotten into the pump. ▶ Remove any foreign bodies.
Is the pump leaking or is the delivery even?	
NO	YES
	<p>The O-rings between the valve plate and the pump housing are defective.</p> <ul style="list-style-type: none"> ▶ Replace the O-rings.
<p>The components in the suction side are wrong.</p> <ul style="list-style-type: none"> ▶ Check all pipes, hoses and valves. ▶ Replace the components accordingly. 	
Are operating noises getting louder?	
NO	YES
Is delivery obtained?	
YES	NO
	<p>The screw of the clamping ring is not tightened properly.</p> <ul style="list-style-type: none"> ▶ Tighten the screw.
<p>The coupling halves are too close together.</p> <ul style="list-style-type: none"> ▶ Mount the coupling with the necessary clearance. <p>The connecting element of the coupling is worn.</p> <ul style="list-style-type: none"> ▶ Replace the coupling. <p>The pump and motor are not correctly aligned.</p> <ul style="list-style-type: none"> ▶ Align the pump to the motor. 	
Is delivery obtained?	
YES	NO
Is there an even delivery?	
YES	NO
	Is pressure reached?
	NO
	YES
	<ul style="list-style-type: none"> ▶ Check components in the pressure side.
	<ul style="list-style-type: none"> ▶ Avoid air in the fluid. ▶ Tighten all terminals.
<p>The pipe cross-sections are too small.</p> <ul style="list-style-type: none"> ▶ Make sure that the pipes are adequately dimensioned. 	
<p>The pressure side is sealed.</p> <ul style="list-style-type: none"> ▶ Check all valves and the diaphragm. <p>The diaphragm is burst (usually pumping pressure too high).</p> <ul style="list-style-type: none"> ▶ Replace the diaphragm. <p>The pump has cooled down too fast after SIP.</p> <ul style="list-style-type: none"> ▶ Allow the pump to cool down slowly to room temperature. 	

If the pump does not work perfectly after full troubleshooting, contact Service (see chapter 1.1 Manufacturer and Service on page 3).

8.2 Return

- ▶ Fully decontaminate the pump.
- ▶ Fill in the decontamination certificate.
Enclose the decontamination certificate with the pump.
Observe the safety notes on the decontamination certificate.
The manufacturer will not accept return of the pump without the decontamination certificate.
- ▶ Contact Service (see chapter 1.1 Manufacturer and Service on page 3).

9 Disposal

The pump consists basically of the following materials:

- Steel and stainless steel
- Non-ferrous metals
- Plastic - especially elastomers
- Electronic modules

Improper disposal of materials (e.g. metals, plastics, electrical and electronic modules) leads to environmental pollution. Hand over materials for environmentally friendly recycling.

Consult the manufacturer about taking them back.

See chapter 8.2 Return

Alternatively, you can also have disposal performed by a commercial disposal company and according to national regulations.

10 Glossary

- **4-piston diaphragm pump**
Pump with a diaphragm containing 4 enclosed volumes which deliver one after another in a revolution to reduce the pulsation.
- **CIP**
The term Cleaning in Place (CIP) describes a process for cleaning process plants.
- **Dosing pump**
Displacement pumps deliver defined volumes per revolution independently of the pressure conditions at the input and output of the dosing pump.
- **Depyrogenisation**
Removal of pyrogens from a solution
- **Pump chamber**
Parts of the pump that come into contact with the fluid.
- **Enclosed volume**
Space created by movement of the diaphragm which serves to displace the fluid.
- **Diaphragm**
Force-transmitting seal to deliver liquid media
- **Diaphragm support**
Component mounted on the back of the diaphragm and connecting the clamping ring to the diaphragm.
- **Residual volume**
Medium volume that can remain in the pump after running empty.
- **Recirculation pump**
Pump for delivering and circulating certain media
- **Single-/Multiple-Use**
Single-Use, single use of the pump chamber.
Multiple-Use, multiple use of the pump chamber.
- **SIP**
Sterilisation in Place (SIP) Describes a cleaning process in process plants, especially in pharmaceutical product plants and biological plants. This sterilises all product-wetted areas of the plant without significant disassembly.
- **Suction lift dry**
Suction lift of the pump when the pump chamber is not filled.
- **Displacement pump**
Displacement pump is the generic term for all pumps that work according to the displacement principle. It is also referred to as volumetric pump and delivers the fluid in a self-enclosed volume.