



Model 74000-53

Operating and Installation Manual:
QUATTROFLOW 1200S
MULTIPLE-USE STAINLESS STEEL
QUATERNARY PUMP 4 PISTON
DIAPHRAGM PUMP

Model No.

74000-53

Preface

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ORIGINAL INSTRUCTIONS PUMP FOR LIQUIDS

Explanation of Symbols

Please read this manual carefully before start-up of the pump and take note of the appropriate instruction in the operating manual. See SECTION 3 for detailed safety instruction. See drive manual for more safety instructions.



CAUTION: Risk of danger. Consult operator's manual for nature of hazard and corrective actions.



CAUTION: Risk of injury. Keep fingers away from the coupling while shaft is rotating. Do not operate without pump head installed.



CAUTION: Hot surface. Do not touch.



CAUTION: Risk of electric shock. Consult operator's manual for nature of hazard and corrective actions.



CAUTION: Please follow the general guidelines and safety instructions when handling with chemicals.



CAUTION: During all maintenance work it has to be ensured that no explosive atmosphere can arise. Appropriate protection equipment is recommended. The Quattroflow 1200 S must not be operated in explosion-proof areas. Special versions for "ATEX" applications are available. Please contact manufacturer.

WARNING: Product Use Limitation



This product is not designed for, nor intended for use in patient connected applications; including, but not limited to, medical and dental use, and accordingly has not been submitted for FDA approval.

This product is not designed for, nor intended for use in hazardous duty areas as defined by ATEX or the NEC (National Electrical Code); including, but not limited to use with flammable liquids. Consult the factory for products suitable for these types of applications.

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Section 1 General

Introduction

These operating instructions are valid for the Quattroflow 1200S pump. No liability will be undertaken for any damages caused by non-compliance with the operating instructions and service conditions! Original spare parts serve safety purposes. The use of other parts may cancel the liability for the consequences and secondary failures resulting there of.

Drive Manufacturer: **Cole-Parmer**

650 East Bunker Ct
Vernon Hills, IL 60061 USA
Phone: 1-800-323-4340
Email: techinfo@coleparmer.com
Internet: www.coleparmer.com

Pump Manufacturer: **ALMATEC** Maschinenbau GmbH

Carl-Friedrich-Gauss-Str. 5
D-47475 Kamp-Lintfort, Germany

Quattroflow quaternary diaphragm pumps are constructed according to the state of the art and they are reliable. Imminent danger by operating error or misuse can lead to damages of properties and/or persons. The pumps are to be applied for the intended use in a safety-related proper condition only.

Storage

In general the Quattroflow pump is delivered operational and packaged. If the unit is not installed right away, proper storage conditions are important for trouble free operation later. The pump has to be protected from wetness, coldness, dirtying, UV-radiation and mechanical influences. The following storage conditions are recommended:

- Steady ventilated, dust and vibration free storage room
- Ambient temperature between 15°C (59°F) and 25°C (77°F) with a relative humidity below 65%.
- Prevention of direct thermal influences (sun, heating).

Labeling of the Pump

The ALMATEC Maschinenbau GmbH is certified as a modern, quality-orientated enterprise according to DIN EN ISO 9001: 2008 and 1400: 2009. Before release for sale, any Quattroflow pump has to undergo an extended final control. The performance data registered during this are archived in our records and can be read back at any time.

As a general rule in the countries of the EU only such machines are allowed to be placed into operation, which are determined to meet the regulations of the EU machinery directive, the harmonized standards, European standards and the respective national standards. Hence the operator has to verify whether the Quattroflow pump manufactured and delivered properly according to the customers order meets the mentioned requirements.

Therefore make sure, before putting the pump into operation, that the pump and the used materials of construction are suitable for the provided application and the installation site.

The type label of each Quattroflow pump can be seen on the bottom of the pump. The serial number of the pump head is fixed the bottom of the pump.

Masterflex Pump Drive

For further information on the pump drive system see within this flash drive or on the web.

Section 2 QF1200 S Pump Description

Appropriate Use

The Quattroflow 1200S is a 4 piston-diaphragm pump, which is mainly used to pump water-like fluids that are typically handled in research, pilot plant or production facilities of the pharmaceutical, biotech, food or cosmetic research centers or plants.

Examples:

- Solutions containing protein (albumin, IgG, Clotting factors, monoclonal, enzymes, vaccines.)
- Solutions of polymers or suspensions (silicon, latex, chromatography media)
- Cell suspensions (bacteria, yeast, algae, fungi, mammalian cells)
- Colloidal solutions
- Suspensions of viruses or phage
- Dairy products
- Gelatin
- Supplements and ingredients for cosmetic and food

Typical applications for the QF1200 S

- Filtration technology:
 - To recirculate feed/retentive (e.g. membrane cassettes, hollow fibre, spiral wound, ceramic elements).
 - Feed Pump for filter cartridges or plate and frame depth filters
- Chromatography:
 - Packing of chromatography columns
 - Feed pump to mix gradients
- Feed pump for centrifuges or separators
- Feed pump for homogenizers
- Feed pump for filling machines

General Description of the Machine

The Quattroflow 1200 S pump is a 4 piston-diaphragm pump. The four segments of the pump diaphragm oscillate back and forth. This alternate movement is created by a connector plate that is arranged on a ball bearing. The ball bearing sits on an eccentric shaft. The connector plate does not turn!

The stroke of the piston is determined by the angle of the eccentric. There are eccentric shafts with 5° available.

Range of flow rate:

5°eccentric shaft: approximate 20-11200 L/hr

In Gallons:

5° eccentric shaft: approximate 5.3- 317 gph

General Description of the Machine (continue)

Please note:

The direction of flow can be adjusted by turning the pump chamber in 90° steps.

The Quattroflow 1200 S is self-priming and can run dry. Inside the pump chamber there are no rotating parts that might cause heating up of the product or shed particles.

The pump-motor unit is mounted on a stainless steel base plate. In case that the pump will not be operated on the base plate but for example in a frame, a perpendicular mounting position is possible.

Start-Up

Before start-up of the pump one should acquaint oneself with the explanations of the troubleshooting. Only by doing this can defects be quickly realized and eliminated in case of trouble. Problems which cannot be solved or with an unknown reason should be passed on to the manufacturer.

Prior to each use we recommend to flush the pump with a proper fluid (e.g. water or buffer).

Prior to the very first use it might make sense to clean and sanitize the pump chamber. A commercial caustic clear and/or 0.1 to 0.5N NaOH can be applied. The chosen cleaning agent can be recirculated and also stored inside the pump chamber. For Flushing out of any cleaning agent do not recirculate! Check with appropriate analytical methods the success of the flushing procedure.



Recommendation: Test run prior first use!

Before using your pump in your process perform a test run to get used to the specific properties of the pump.



Pay attention to have sufficiently dimensioned piping. Too small of for the suction line can cause cavitation as well as a loss of performance.

If hoses are used in the suction line, make sure that they do not collapse due to the negative pressure.

When installing the pump please insure that around the pump enough space is available for the operation and maintenance. Pay attention to the required space needed for assembly and disassembly of the pump chamber.

During start-up pay attention to the warning and safety instructions of this manual.

Cleaning (CIP)

Depending on the products in contact with the pump and given requirements the cleaning procedure needs to be adapted accordingly. It is the responsibility of the user to verify the cleaning efficiency. Safety rules and safety measures like protective glasses, gloves, and protective clothing have to be followed and used when working with chemicals like sodium hydroxide (NaOH).

As a general rule we recommend to clean the pump according to the following procedure.

1. Pre rinse the pump with pure water, until residual amounts of product have been removed.
2. Cleaning step with 0.5 M NaOH (ca 50°C) at 80% of the maximum RPM for approximately 30 min. Check before, if surrounding conditions (e.g. pipe diameter, system pressure rating) allow to operate the pump at this speed.
3. Final rinse with pure water, until neutrality has been achieved (e.g. by measuring conductivity or pH of the rinse water).

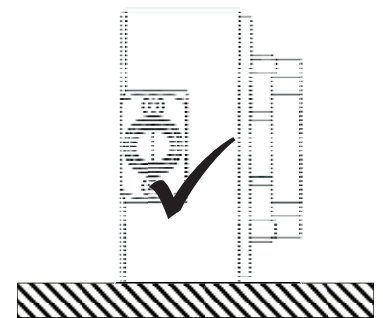
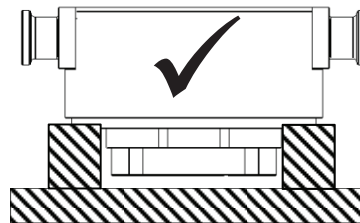
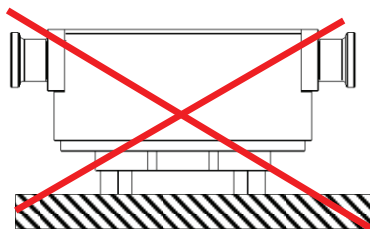
Autoclave

For sterilization of the pump chamber we recommend the following steps.

1. CIP of the pump chamber according to 2.4 or any other suitable process.
2. Empty the pump
3. Remove the pump chamber from the pump drive.
4. Close the in and outlet of the pump (e.g. by connecting hoses). Make sure that there is free interchange available of gas and steam over a sterile barrier (e.g. sterile filter) at the in and outlet.
5. Autoclave the prepared pump chamber in a vacuum at max 130°C (266°F) for max 30 min. Follow the instructions from the autoclave manufacturer.



Please make sure that the pump chamber is not placed on the clamp ring during the autoclave process. The clamp ring should not be loaded during autoclaving.



Section 2

QF1200 S Pump Description

Steaming in Place (SIP)

For steaming in place the pump chambers need to be installed on the pump drive. During the steaming process, the temperature in the pump must not exceed 130°C (266°F) and should not last longer than 30 min. The cooling of the pump chamber should be against air. Depending on the SIP conditions it may be necessary to shorten the maintenance intervals for the elastomers significantly. Tightening torques (10 Nm, 7.4 lb-ft) of the front bolts of the pump chamber must be checked after each SIP cycle.

Section 3 Safety

These operating instructions contain basic hints to be observed during installation, operation and maintenance. Therefore, prior to mounting and commissioning, these operating instructions must by all means be read by the fitter as well as the pertinent expert personnel/customer and must always be available at the place of installation of the pump. Not only are the general safety hints listed under this item "Safety" to be observed, but also the special safety hints in other sub sections.

Labels on the Pump



Marking labels at the pump e.g.

- P max 6 bar
- Fluid connections
- Direction of flow

Must not be removed and has to be readable.

Qualified Personnel

The customer is responsible for ensuring that all maintenance, inspection and mounting operations are performed by authorized and qualified expert personnel who have sufficiently informed themselves by thoroughly studying the operating instructions.

Safety Guidelines

Please follow strictly the safety guidelines of this manual, as well as all national and possible regulations (e.g. the handling of chemicals, like caustic or acid, the handling of biological materials, the handling of tubing, instrumentation, fittings etc.).

Failure to Follow Safety Instructions

Any case of non-compliance with the safety instructions may cause danger to personnel, equipment and environment.

It Can Cause for Example:

- Failure of the proper function of the pump/system
- Failure of required procedures for maintenance
- Danger to personnel by electrical, mechanical, chemical, biological impacts
- Danger to equipment and environment through leakage of dangerous substances

Safety Hints for the Operator

- In case of hot parts (e.g. while CIP or SIP) protective measures must be taken.
- Protecting covers of moving parts (e.g. coupling, cover of motor) must not be removed.
- Leakages of dangerous products have to be handled without any danger for persons and environment. Statutory regulations must be observed.
- Dangers by electrical energy are to be excluded (for details please refer to the regulations of the VDE and the local energy supply associations).

Safety Maintenance, Inspection and, Mounting Operations



- Basically, operations at the pump must be performed during standstill only. The motor has to disconnect from the power supply, e.g. by pulling out the power plug or using a repair switch, and has to be secure against unintentional switch-on. This can be realized by a lockable emergency switch. To prevent an accidental re-starting a danger sign should be installed.



- The operator must ensure that all maintenance, inspection and installation work is performed by authorized and qualified skilled personnel acquainted themselves with this manual.
- Before starting to disassemble the pump, take care that the pump has been emptied, rinsed, depressurized and disconnected at all phases of the power supply. Both ports piping are to be closed and drained if applicable. If the pump is being removed from the plant, a reference about the delivered liquid has to be attached.
- Pumps or aggregates handling noxious fluids (e.g. caustic, biohazards) must be decontaminated. Immediately following completion of the work, all safety relevant and protective devices must be re-installed and/or re-activated before being put back into operation, take care of the mentioned instructions of the chapter “start-up” and check the tightness of the pump.
- Please respect the relevant additional security advises, if the pump has been used for aggressive, dangerous or toxic liquids (e.g. suitable protective equipment according to the safety data sheet of the liquid). In case of a diaphragm rupture, it is possible that residues of the liquid remain behind the diaphragms and in the area of the ring drive. Hence, appropriate safety equipment according to the safety data sheet of the liquid is indispensable.
- Especially when delivering critical liquids, wear parts, like diaphragms, should be replaced within a preventive maintenance.
- Procedure for pump return: According to the requirements of our 14001 certification, every unit which is sent to Masterflex or ALMATEC for diagnosis or maintenance reasons has to be accompanied by a filled out decontamination-sheet. Otherwise a processing is not possible. The decontamination-sheet is enclosed in this manual. Please pay attention to the further safety regulations.

Unauthorized Modifications

The use of non-original Quattroflow spare parts or non authorized accessories and reconstructions lead to the void of the warranty immediately. When operating such a pump, damages of properties and/or persons cannot be excluded.

Invalid Modes of Operation

A safe operation of the pump is ensured only by an appropriate use according to the specific data of the enclosed pump data sheet. The values limitations given in the data sheet must not be exceeded.

Additional Safety Warnings

These warning hints are to prevent the user from an inadmissible mode of operation. These warning hints are to be strictly followed to avoid any damage to the pump and/or any danger to personnel.



The maximum allowed discharge pressure depends on the temperature of the fluid: P max at room temperature = 6 bar (>40°C = 4 bar [=87 psi (>104°F = 58 psi)]. Exceeding of the maximum allowed discharge pressure must avoided in any case (do not remove the warning sign at the pump). As a result even if only temporarily – exceeding the allowed discharge pressure, the diaphragm can be damaged. The resulting leakage may lead to a loss of the pumping fluid and damages of properties and/or persons. Pay attention to a sufficiently dimensioned piping on the suction and discharge line to prevent too high of pressure in the pump. The pump chamber may not be set under pressure when it is not mounted on the drive.



- The free cross section of the suction side as well as the length must be measured in such a way to avoid cavitation.
- The use of a safety device (e.g. pressure switch) can be necessary.
- Please make sure that prior to the start of the pump the discharge line is checked. Make sure that there is no flow restriction in the discharge line to avoid any over pressure (e.g. closed valve).
- Flush the pump prior to use with appropriate fluid (e.g. buffer).
- Foundation design: The foundation must be designed so that it can take the weight of the pump aggregate on the entire surface.
- Please make sure that the pump is operated with the proper mains voltage and frequency to avoid damages and electrical danger.
- Make sure that the slots for the cooling air are not blocked
- Due to the versatile possibilities to use the Quattroflow pump it is highly recommended to check case by case if the pump will be the right tool for the specific application. The user/operator is responsible to perform a proper method of testing if the pump should be applied for his specific application. The chemical and thermal compatibility of the elastomeric parts of the pump with the fluid that will be pumped are to be checked by the operator before the first process run. E.g. Oily, fatty fluids or solvents might cause a swelling and/or destruction of the elastomeric components. If in doubt, please contact the manufacturer!
- Operating the pump in humid or aggressive air can cause damages to the motor and control box.
- The control box should not be exposed to spray/splash water or to heat sources.

Additional Safety Warnings (Continue)

- Depending on the conditions of operation, the liquid conveyed might escape from the pump in case of a diaphragm rupture. For further safety requirements the optional equipment diaphragm monitoring is recommended.
- Pools of liquid which appear in the near outer area of the pump have to be inspected on danger potential, if necessary safety measures are to be taken.
- Chemical and biological reactions in the product chamber of the pump (mixture of different substances) and the freezing of the liquid have to be avoided.
- To avoid corrosion the contact of aggressive solutions (e.g. NaCl, HCl) with the outer stainless steel surfaces of the pump (e.g. hood, base plate) has to be prevented.
- The Quattroflow pump is a positive displacement pump and can theoretically generate an infinitely high pressure even at low speed (rpm). Prior to each start of the pump check and make sure that the discharge line is not closed or restricted. The design of the discharge line must not build up a pressure of > 6 bar (78 psi).
- If suction and/or discharge line are flexible tubing, then make sure that these tubing do have the proper pressure rating for the full range of temperatures that are applied.
- Please follow the general safety guidelines when handling chemical fluids (wear gloves and/or glasses) before the pump chamber will be opened.
- Never operate the pump without coupling protection and motor housing.
- Quattroflow pumps can lead to bruises when lifting, sinking or assembling them. Appropriate accessories and safety equipment are to be used. Big and heavy modules have to fixed and secured to lifting gears when transporting/replacing them.
- Disconnect mains before doing any maintenance! The housing of the control box or the motor is to be opened only by skilled personnel. Check the electrical cables before connecting to mains supply.
- During all maintenance work it has to be ensured that no explosive atmosphere can arise. Appropriate protection equipment is recommended. The Quattroflow 1200 S **must not be operated in explosion-proof areas**. Special versions for “ATEX” applications are available. Please contact the manufacturer.



Attention!- Inadmissible modes of operation, arbitrary reconstruction, spare parts production and/or any changes of the design (without permission of the manufacturer) may cancel the liability resulting there from.

Section 4 Maintenance/ Servicing

Due to the robust construction the Quattroflow pump are widely maintenance free. The ball bearings do not need any extra lubrication.

The diaphragms, valves, and O-rings should be checked in regular intervals and if needed they have to be replaced. We recommend the following maintenance intervals for the different pump parts:

Component	Maintenance Interval	Action
Elastomer parts (diaphragm, valves, and O-rings)	1000 h operating hours, at least once a year	Replacement of the elastomer parts (Contact Masterflex for order number).
Shaft-bearing-cap unit	1000 h operating hours, at least once a year	Replacement of the complete unit (Contact Masterflex for order number).
Motor	Refer to the maintenance information of the manual of the Drive	
Coupling	Refer to the maintenance information of the manual of the Drive	
Gear	Refer to the maintenance information of the manual of the Drive	

Depending on the operation conditions (pressure, temperature, flow rate, SIP, etc.) it may be necessary to shorten the maintenance intervals for the elastomers significantly.

In case that the diaphragm is broken the pump chamber should be replaced. At that time is also recommended to check the ball bearings. For corrosion reasons or a clearly audible operating noise the parts of the bearing service kit should be also replaced.



Please follow the general guidelines and safety advise when handling with chemicals.



Disconnect mains supply before opening the pump housing!
Basically, operations at the pump must be performed during standstill only. The motor has to be disconnected from the power supply, e.g. by pulling out the power plug or using a repair switch, and has to be secure against unintentional switch-on. This can be realized by a lockable emergency switch. To prevent an accidental re-starting a danger sign should be installed.

Maintenance/Serviceing (Continue)



After purging the pump with air there might be a small residual amount of fluid inside the pump chamber. Flush the pump chamber thoroughly and check the rinse fluid.

The dismounting and mounting of the pump should be done on a rigid table or work bench. Please note: the pump is heavy.

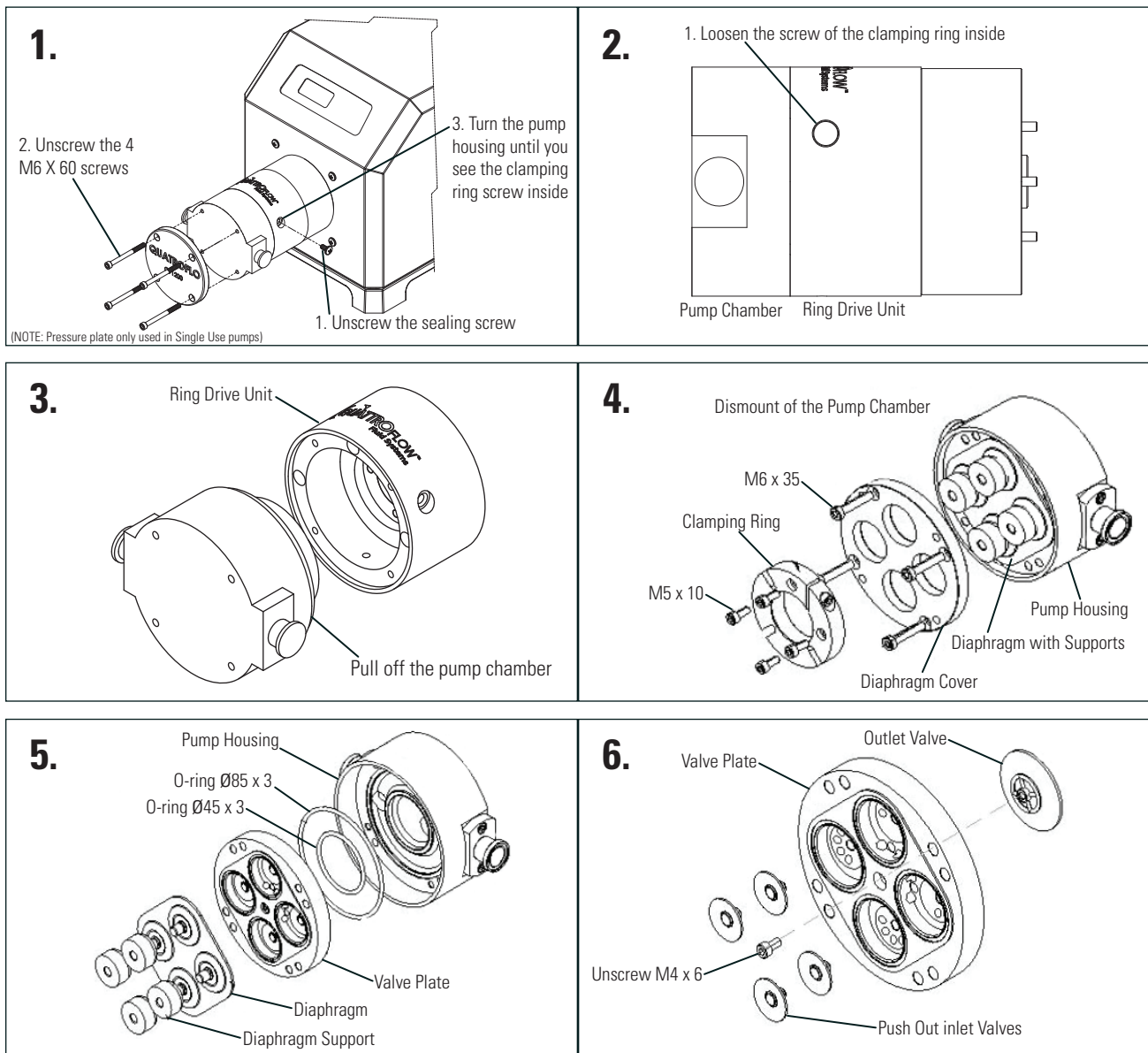
All further warning and safety instructions of Section 3 must be respected.

Replacing Diaphragm, Valves, and O-rings

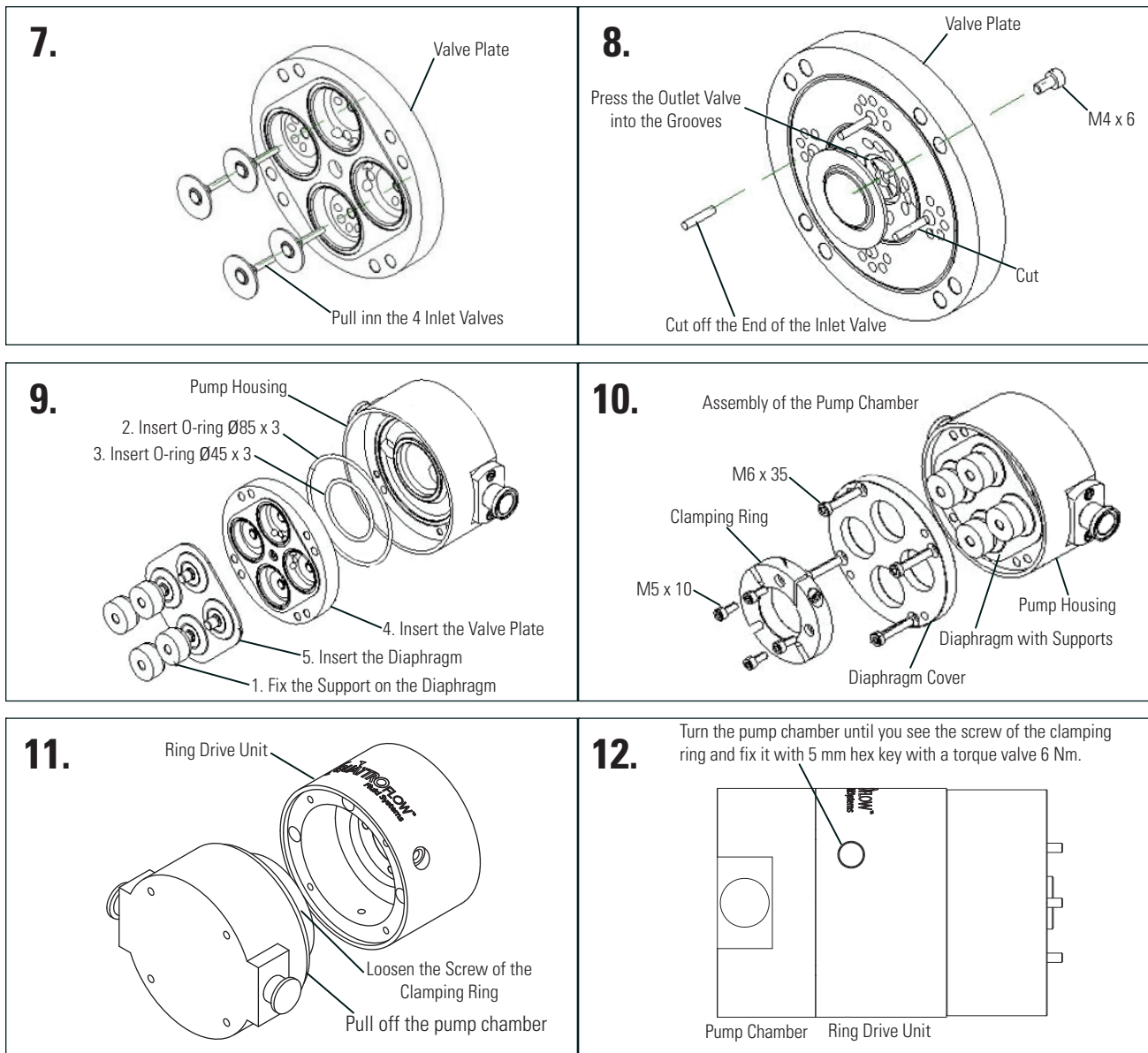
The replacement of the diaphragm and the valves can be conducted by the operator. The following drawings describe it step-by-step.

In case of bursting diaphragms by overpressure we advise also to change the bearing unit.

Disassembling the Pump Chamber



Assembling Pump Parts



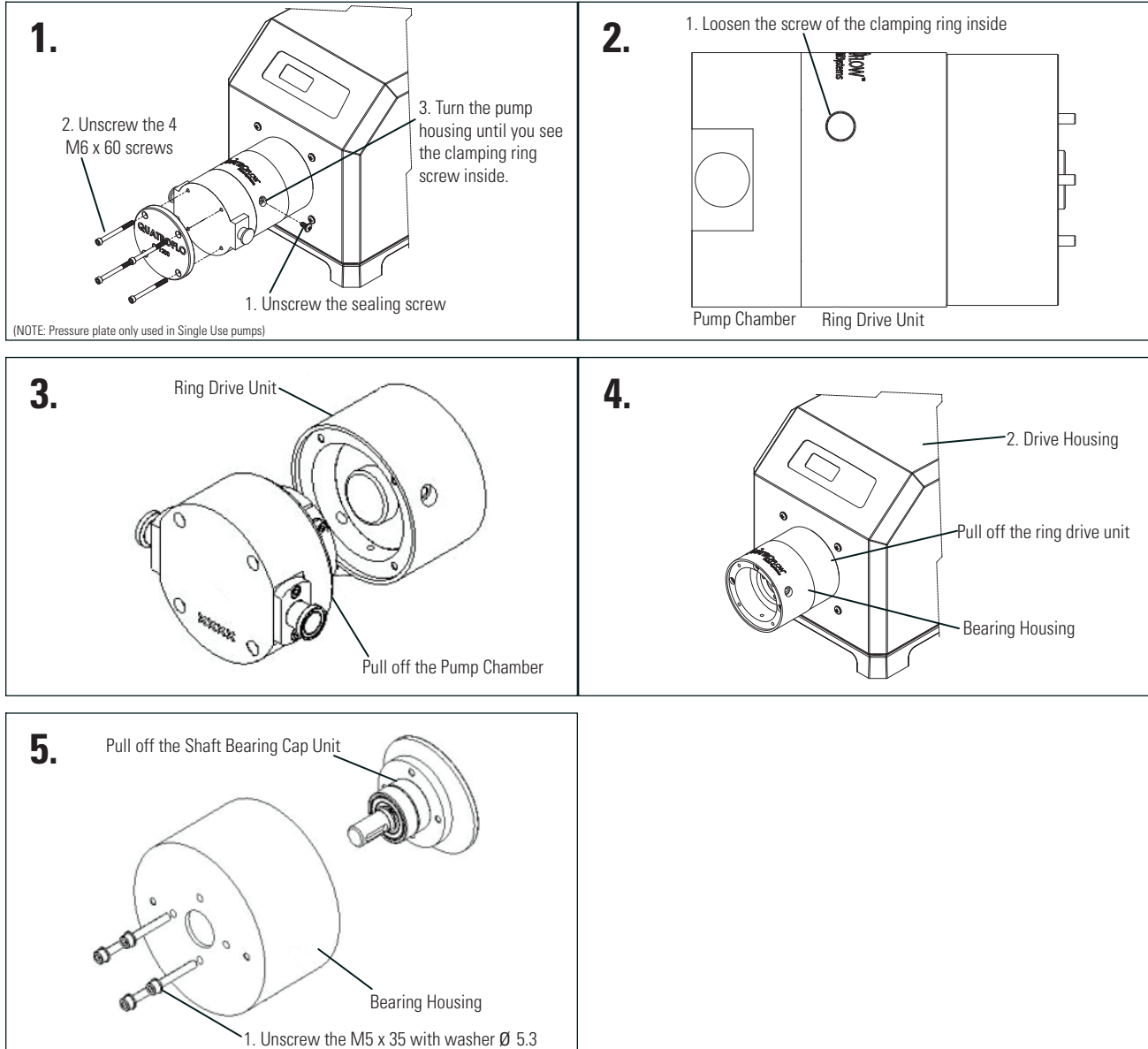
Pay attention to the following torque values:
 Image 10: Bolts pump chamber 10 Nm (7.4 lb-ft)
 Image 10: Bolts diaphragm cover housing 5 Nm (3.7 lb-ft)
 Image 12: Bolt clamping ring 6 Nm (4.4 lb-ft)

Replacement Bearing Unit

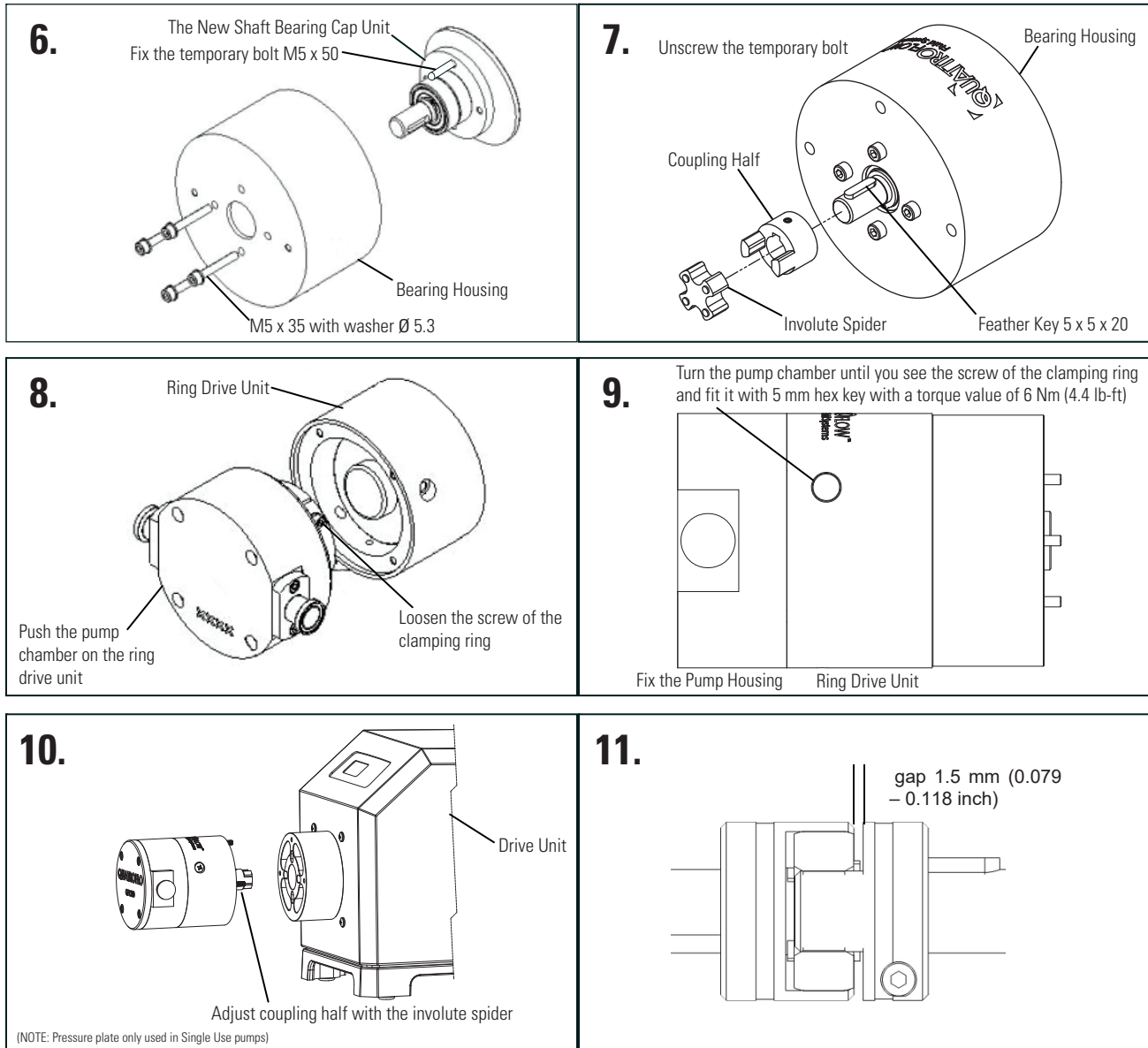
Contact Masterflex for the maintenance kit (5° eccentric shaft) for QF1200 S

The replacement of the bearing unit can be conducted by the operator. The following drawings describe it step-by-step.

Disassembly of the Ring Drive Unit



Assembling Ring Drive Nut



Pay attention to the following torque values:
Image 8: Bolts pump chamber 10 Nm (7.4 lb-ft)
Image 9: Bolt clamping ring 6 Nm (4.4 lb-ft)

After the installation of the pump head (figure 10), between both coupling halves has to be a gap of 1.5 mm (0.079 - 0.118 in)

Section 5 Troubleshooting

Troubleshooting Operations										
Item #	Pump Does Not Start	Pump Does Not Prime	Delivery is Not Obtained or Reduced	Pressure Head is Not Obtained	Irregular Pump Delivery	Pump Operates Noisily	Pump is Leaky	Motor Gets too Warm	Display Shows Error Code	Causes and Remedial Action
1		X					X			The screws of the pump-chamber maybe not tightened enough. Fix it!
2		X								Check the direction of flow showed by the arrow on the pump, in case of wrong way, turn the pump head.
3		X	X		X					Check suction pipeline and TC-Seals for tightness.
4		X	X	X	X					Check suction head-increase suction line cross section.
5		X	X		X					Check viscosity of liquid pumped.
6	X								X	See Drive Manual
7			X	X	X					Avoid air inclusions in the liquid to be pumped.
8			X		X					Check pressure head-open valve in discharge line completely, remove obstruction in discharge line.
9							X			Pressure line completely or partly clogged, diaphragm maybe broken, change diaphragm!
10			X							The diameter of the pipes in suction or pressure line are too small.
11						X				Check the coupling halves. They must be fixed with 2-3 mm space.
12						X				Check longitudinal play of coupling rod pins. The spider might be worn.
13		X	X		X					Check whether foreign bodies in pump. Disassemble pump, remove foreign bodies, replace defective parts.
14	X							X	X	See Drive Manual
15	X					X				Bearings are worn or defective Disassemble pump, replace the shaft – bearing – cap unit (PSKITWLC155)
16		X								The valves are dry (e.g. not in use for a long time), deformed or worn. Change valve or wet the pump
17							X			The diaphragm is burst (the discharge pressure was too high) – replace the pump chamber
18		X	X	X			X			O-rings between valve plate and pump housing are defective
19						X				Align coupling accurately
20			X			X				The clamping ring screw got loose – fix it!
21	X								X	See Drive Manual
22							X			Pump after SIP cooled down too fast slow cooling room temperature.

Section 6 Performance Charts

Performance Charts of the QF1200 S

Test media: Water at ambient temperature
 Type of eccentric shaft: 5°
 Discharge pressure: 0 to 6 bar (0 to 87 psi)

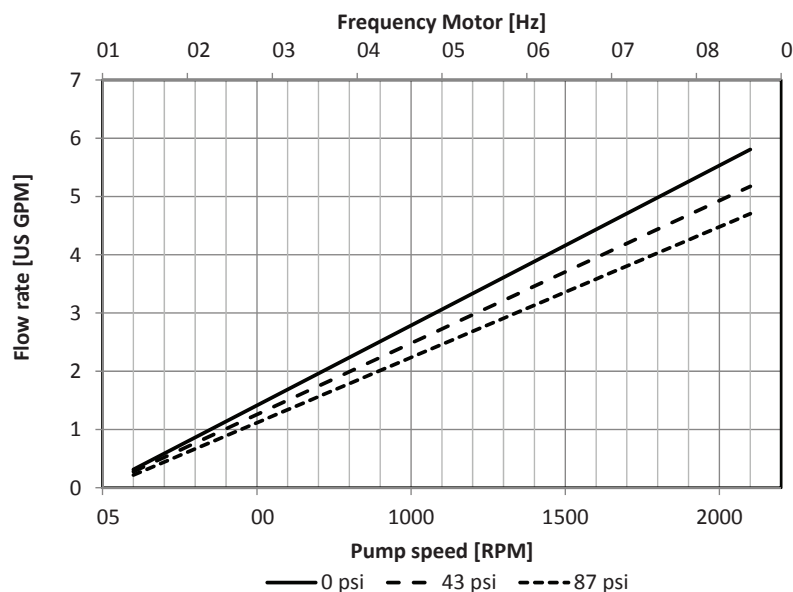
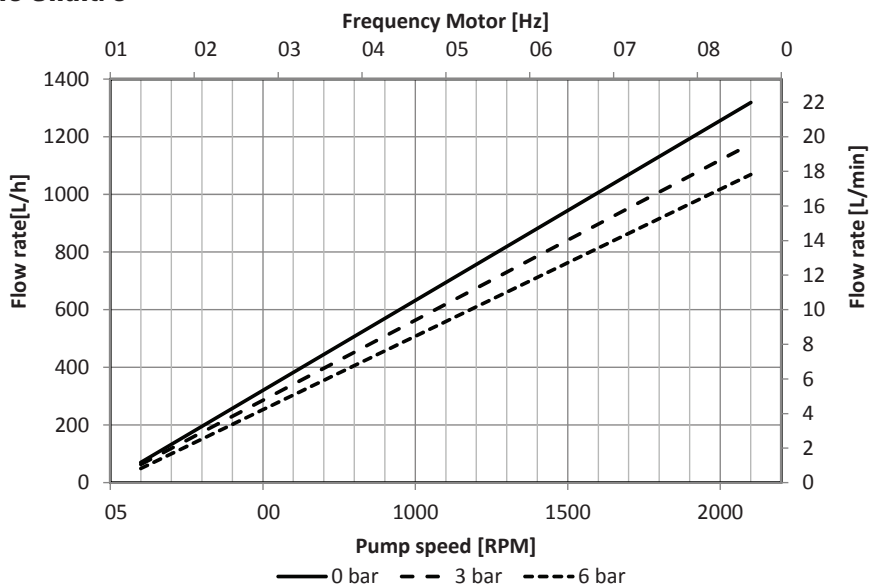
Shows approximate flow rates as function of pump rpm.

Please note:

Motor is directly coupled to pump: Pump rpm = Motor rpm

If reducer gear drives are used: Pump rpm = motor rpm x reduction ratio

Eccentric Shaft: 5°



Section 7 Technical Data

Description	QF1200 S Standard Motor
Flow Rate MAX:	
Eccentric Shaft 5°	960 l/h (254 gph)
Flow Rate min:	
Eccentric Shaft 5°	2.8 l/h (0.73 gph)
Pressure:	
Temperature of Fluid < 40°C	6 bar (87 psi)
Temperature of Fluid > 40°C	4 bar (58 psi)
Temperature MAX:	
Fluid	80°C (176°F)
CIP	90°C (194°F)
SIP	130°C (260°F)
Autoclave	130°C (260°F)
Suction Lift Dry at:	1800 rpm
Eccentric Shaft 5°	24-4.5 m (13.1-14.7 ft)
Volume Specifications:	
Approximated Volume per Revolution at Free Output	9.6 ml
Filling Volume without Connectors	75 ml
Residual Volume (After Idle with High-Speed Motor)	8-26 ml
Product Wetted Surface (approx.)	367 cm ² (57 in ²)
Speed Range Pump	5-1700 rpm
Connection Specification Inlet (standard)	
Connector	3/4" TC
Flange Diameter	25 mm
Internal Diameter	15.75 mm
Connection Specification Outlet (standard)	
Connector	3/4" TC
Flange Diameter	25 mm
Internal Diameter	15.75 mm
Position of Connectors	In-line
Number of Flow Directions	4
Diameter Drive Shaft	17 mm

Technical Data of the QF1200 S (Continue)

Description	QF1200 S Standard Motor
Product Wetted Materials (Standard):	
Pump Housing	SS316L
Valve Plate	SS316L
Diaphragms	TPE
Valves	EPDM
O-rings	EPDM
Non-Product Wetted Materials (Standard):	
Pump Housing	SS316L
Bearing Housing	SS316L
Base Plate	SS316
Hood	SS316
Dimensions Pump with Motor and SS Housing:	
Length	445 mm (17.5 in)
Width	280 mm (11 in)
Height	330 mm (13 in)
Weight Pump with Motor and Housing:	
Pump with Motor and SS Housing	49.3 kg (22.4 lbs)

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