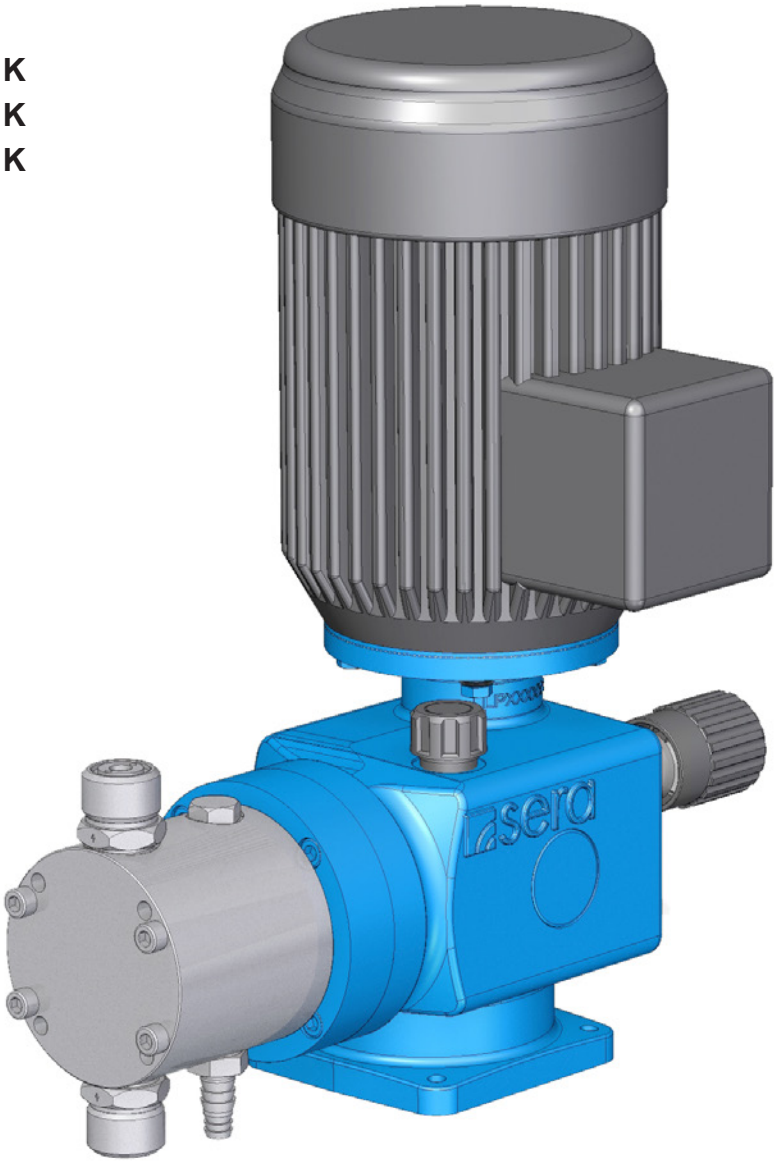
Piston pump

409.2-...K

Operating Instructions

M... RF...

...409.2 - 8 K
...409.2 - 12 K
...409.2 - 18 K



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Keep the operating manual for future use!	
Record the exact type and serial number here. (can be read off the type plate on the pump)	
Type	:
Serial No.	:
These data are important in the case of queries or for ordering spare and/or wear parts and must always be stated.	

Content

1. General

1.1 General user information

Before commissioning and during operation of the **sera** dosing pump the respective regulations valid at the place of installation are to be observed.
The **sera** dosing pump is delivered ready for installation. Carefully read these instructions and especially the safety instructions herein contained before installation and initial start-up of the pump.

1.2 Symbols and notes used in these operating instructions

Special notes in these operating instructions are marked with text and danger symbols.

Designation of the note (Text and symbol)	Danger type: Danger of fatal injury	Danger type: Risk of injury	Danger type: Damage to property	Definition of the note (in the operating instructions)
DANGER! 	X	X	X	Identifies an imminent danger that results in fatal or severe injuries if not avoided.
WARNING! 	X	X	X	Designates a potentially dangerous situation There might be danger to life or serious injury and damage to property if it is not avoided.
CAUTION! 		X	X	Designates a potentially dangerous situation There might be slight or minor injury or damage to property if it is not avoided.
ATTENTION! 			X	Designates a potentially dangerous situation that could lead to damage to property if not avoided.
NOTE! 				Designates information which helps to make work easier and is useful for trouble-free operation.

1.3 Notes attached to the product

Symbols which are directly attached to the pump, e.g. arrows for direction of rotation or symbols for fluid connections are to be observed and kept in legible condition.

1.4 Quality instructions

Observance of these operating instructions and, in particular, the safety instructions, helps to

- avoid dangers to persons, machines and environment.
- increase reliability and service life of the product and the complete system.
- reduce repair cost and downtime.

The **sera** quality management and quality assurance system for pumps, systems, valves and fittings and compressors is certified according to ISO 9001:2008.
The **sera** product meets the valid safety and accident prevention regulations.

ATTENTION!

Always keep these operating instructions within reach at the place of installation.

DANGER!

Pay attention to the safety data sheet of the medium! The owner must take corresponding accident prevention measures to protect operating personnel from danger through the delivery media used!

2. Safety instructions

2.1 Personnel qualification and training

The personnel for operation, maintenance, inspection and installation must be suitably qualified for their tasks. The owner must clearly define responsibility and supervision of the personnel.
If the personnel do not have the knowledge required, then personnel is to be trained and instructed correspondingly. Such training can be provided by the manufacturer / supplier upon order of the owner. In addition, the owner has to ensure that personnel have understood the operating instructions completely.

2.2 Dangers in case of inobservance of the safety instructions

Inobservance of these safety instructions can result in danger to persons, hazards to the environment and damage to the product.
Inobservance of the safety instructions may lead to:

- Failure of important functions of the product/system.
- Inobservance of prescribed methods for maintenance and servicing.
- Danger to persons through electrical, mechanical and chemical influences.
- Hazards to the environment through leaking dangerous media.

2.3 Safety conscious working

The safety instructions specified in this operating manual, the national regulations for accident prevention, the safety regulations for the pumped medium valid at the place of installation as well as internal working-, operating-, and safety instructions of the owner are to be observed.

2.4 Safety instructions for owner / operator

Leaking hazardous delivery media and operating supplies are to be disposed off in such a way that any danger to persons and the environment is excluded. The legal regulations are to be observed.

Danger caused by electrical energy is to be avoided.

2.5 Safety instructions for maintenance, servicing and installation work

The owner must ensure that any maintenance-, servicing- and installation work is only entrusted to authorized and suitably qualified personnel who have carefully read and understood the operating instructions.

Only those spare parts and operating supplies are to be used which meet the requirements of the specified operating conditions.

Threaded joints and connections may only be disconnected when the system is not under pressure.

2.6 Arbitrary modification and production of spare parts

Modifications of or changements to the pump are only permitted after previous agreement of the manufacturer. Original spare parts and accessories which were approved by the manufacturer are essential for safety reasons.

CAUTION!

If the pumps (e.g. drive motor) are modified without au-thorization of the manufacturer or spare parts are used which are not approved, any warranty claim becomes null and void.

2.7 Improper operations

Operating safety of the supplied product is only guaranteed if the product is used as intended, according to the descriptions in Chapter 2.8 of these operating instructions.

2.8 Intended use

The **sera** product is only to be deployed according to the intended purpose stated in the product description and the acceptance test certificate.
If the product is to be used for other applications, then the suitability of the product for the new operating conditions must be discussed with sera beforehand!
Criteria for operation in accordance with the intended use:

- Observe characteristics of the medium (please see safety- and product data sheet of the delivery medium – the safety data sheet is to be provided by the supplier / owner of the medium).
- Resistance of the materials which come into contact with the medium.
- Operating conditions at the place of installation.
- Pressure and temperature of the medium.
- Voltage supply.

2.9 Operating conditions

- Ambient temperature: -10°C to +40°C
- Climate: relative air humidity < 90%
- Installation altitude: max 1000m above sea level
- Pump design data for dosing and its temperature can be found in the order confirmation.

2.10 Personal protection for maintenance and service

The provisions of the German Ordinance on Hazardous Substances (GefStoffV) (§14 Safety Data Shee) and relevant national safety regulations for the pumped medium must strictly be adhered to.

In case of accidents check whether the following substances are emitted:

- Leaking fluids.
- Leaking vapours.
- Noise emissions (sound level).

Emissions are to be monitored by corresponding controly systems of the total installation.

ATTENTION!

Wear protective clothing, gloves, breathing mask and a face protecting mask.

NOTE!

Personal protective equipment must be provided by the owner!

NOTE!

2.11 Utilities/Lubricants

If not agreed otherwise in the contract conditions, the **sera** dosing pump will always be supplied with the necessary utilities. (For type and quantitiy of utilities/lubricants, see Chapter 11.1 „Working materials“).

2.12 Foreseeable misuse

The following misuse is assigned to the life cycles of the machine.

DANGER!

Misuse can result in danger to the operating personnel!

2.12.1 Transport

- Tipping behavior during transport, loading and unloading ignored.
- Weight for lifting underestimated.

2.12.2 Assembly and installation

- Power supply not fuse protected (no fuse/fuse too large, power supply not conforming to standards).
- No or improper fastening material of the pump.
- Improper connection of the pressure pipes, wrong material i.e. PTFE tape and unsuitable connection pieces.
- Liquid pipes confused.
- Threads overturned/damaged.
- Pipes bent during connection in order to compensate for alignment errors.
- Supply voltage connected without earthed conductor.
- Socket for safe disconnection of the power supply difficult to reach.
- Wrong connecting cables for supply voltage (cross-section too small, wrong insulation).
- Parts damaged (e.g. vent valve, flow meter broken off).
- Wrongly dimensioned pressure and suction pipe.
- Incorrect dimensioned and improperly fastened pump panel (panel broken off).

2.12.3 Start-up

- Cover on vent openings (e.g. motor).
- Suction or pressure pipes closed (i.e. foreign matters, particle size, stop valves).
- Start-up with damaged system.

2.12.4 Operation

- Fault message ignored ► faulty dosing / process error.
- Pipes hit, pulsation damper not used ► damage to the pipes, medium is leaking.
- Pumped medium contains particles or is contaminated.
- External fuse bridged ► no cut off in case of an error.
- Ground wire removed ► no cut off by fuse in case of an error, supply voltage directly at the housing.
- Insufficient lighting of the working place.
- Suction height too high, pump capacity too low ► process error.
- Arbitrary modification of the pump (valves, internal fuse, …).

2.12.5 Maintenance/Repair

- Works carried out which are not described in the operating instructions (works on the stroke mechanism and the assembly pump, electronics opened).
- Prescribed maintenance schedules ignored.
- Use of wrong spare parts/oils (e.g. no sera original spare parts, wrong viscosity).
- Improper mounting of spare and wearing parts (e.g. wrong tightening torque for pump body).

- Oil level not checked.
- Use of cables with damaged insulation.
- No shut down / no protection against a restart before maintenance work.
- Pumped medium or utilities during an oil change insufficiently removed.
- Restart without sufficient fastening.
- Valves confused.
- Sensor pipes confused.
- Pipes not connected (e.g. suction- and pressure pipes, gas pipes).
- Gaskets damaged, medium is leaking.
- Gaskets not fitted, medium is leaking.
- Wearing of unsuitable protective clothing / no protective clothing at all.
- Operation of an uncleaned system.
- Pumped medium contaminated with oil.
- Poorly ventilated room.

2.12.6 Cleaning

- Wrong rinsing medium (material changed, reaction with the medium).
- Wrong cleaning agent (material changed, reaction with the medium).
- Cleaning agent remains in the system (material changed, reaction with the medium).
- Protective clothing insufficient or missing.
- Use of unsuitable cleaning utensils (material changed, mechanical damage by high pressure cleaner).
- Untrained personnel.
- Vent openings clogged.
- Parts torn off.
- Sensors damaged.
- Non-observance of the safety data sheet.
- Control elements actuated.
- Poorly ventilated room.

2.12.7 Shut-down

- Pumped medium not completely removed.
- Disassembly of pipes with the pump running/with residual pressure.
- Disconnection of the electrical connections in a wrong sequence (ground wire first).
- Disconnection from the power supply not ensured ► danger through electricity.
- Poorly ventilated room.

2.12.8 Disassembly

- Residues of the pumped medium and utilities in the system.
- Use of wrong disassembly tools.
- Wrong or no protective clothing at all.
- Poorly ventilated room.

2.12.9 Disposal

- Improper disposal of the pumped medium, utilities and materials.
- No marking of hazardous media.

3. Transport and storage

3.1 General

sera products are checked for perfect condition and function previous to shipment.
Check for transport damage immediately after arrival of goods. If damage is found, this is to be reported immediately to the responsible carrier and the manufacturer.

NOTE!

The packaging material must be disposed of appropriately!

3.2 Transport

Select a hoist which is adapted to the weight of the pump and attach it to the motor flange of the pump.

3.3 Storage

An undamaged packaging protects the unit during storage and should only be opened when the product is installed.

Proper storage increases the service life of the product and includes prevention of negative influences such as heat, moisture, dust, chemicals etc.

The following storage specifications are to be obsered:

- Storage place: cool, dry, dustfree and slightly ventilated
- Storage temperature between -10°C and +45°C
- Relative air humidity not more than 50 %.
- The maximum storage time for the standard system is 12 months.

If these values are exceeded, metal products should be sealed in foil and protected from condensation water with a suitable desiccant.

Do not store solvents, fuels, lubricants, chemicals, acids, disinfectants and similar in the storage room.

4. Product description

4.1 Types

4.1.1 Type key

Type of drive (combinations possible)

C	Controllable
M	Mechanical not adjustable (without stroke length adjustment)
R	Mechanical adjustable (with stroke length adjustment)
F	Motor suitable for frequency converter operation
i	Frequency converter, mounted on the motor
P	Pole-changing motor
K	Stroke mechanism with side drive shaft and connected to the drive via a clutch
Z	Twin design
X	Stroke mechanism with two opposite pump heads, combined suction and pressure side
Y	Stroke mechanism with two opposite pump heads

Series

204	(solenoid driven pumps)
409	(motor driven pumps)
410	(motor driven pumps)
411	(motor driven pumps)

Revision index

max. Nominal capacity (litre/hour (each pump head))

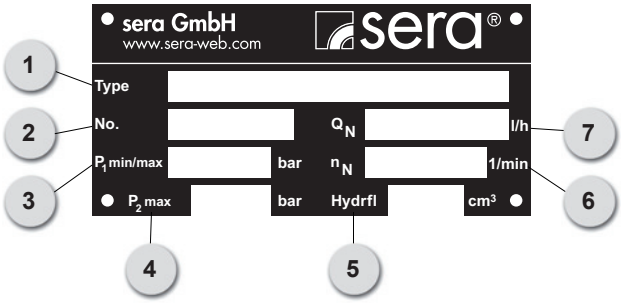
Displacer (type of construction)

(without)	Double diaphragm
e	Single diap hragm
ML	Multy layer diaphragm
KM	Piston diaphragm
K	Piston

1	2	3	4	5	
R	**409**	**. 2**	**- 12**	**K**	*(example)*

4.1.2 Type plate

Each **sera** dosing pump is factory provided with a type plate.
The following information can be found on this type plate.



No.	Designation
1	**Pump type**
2	**Serial number of the pump**
3	**Minimum/maximum permissible pressure in the pump inlet** Minimum/maximum permissible pressure in the inlet cross section which the pump can be used for. Please consider that pressure depends on rotation speed, delivery rate, temperature and static pressure at the inlet.
4	**Maximum permissible pressure in the pump outlet** Maximum permissible pressure in the outlet cross section which the pump can be used for. Please consider that pressure depends on rotation speed, delivery rate, temperature and static pressure at the outlet.
5	**Buffer fluid** Quantity of buffer fluid in the diaphragm ring (in the case of double diaphragm pumps).
6	**Nominal stroke frequency**
7	**Nominal delivery rate** Delivery rate which the pump was ordered for, based on the nominal rotation speed n_N, the nominal delivery height p2max. and the delivery medium stated in the supply contract.

4.2 Materials

The materials used are stated in the order confirmation and the product description.

4.3 Viscosity, pumped medium

The pump is suitable for fluids with viscosities < 100 mPas.

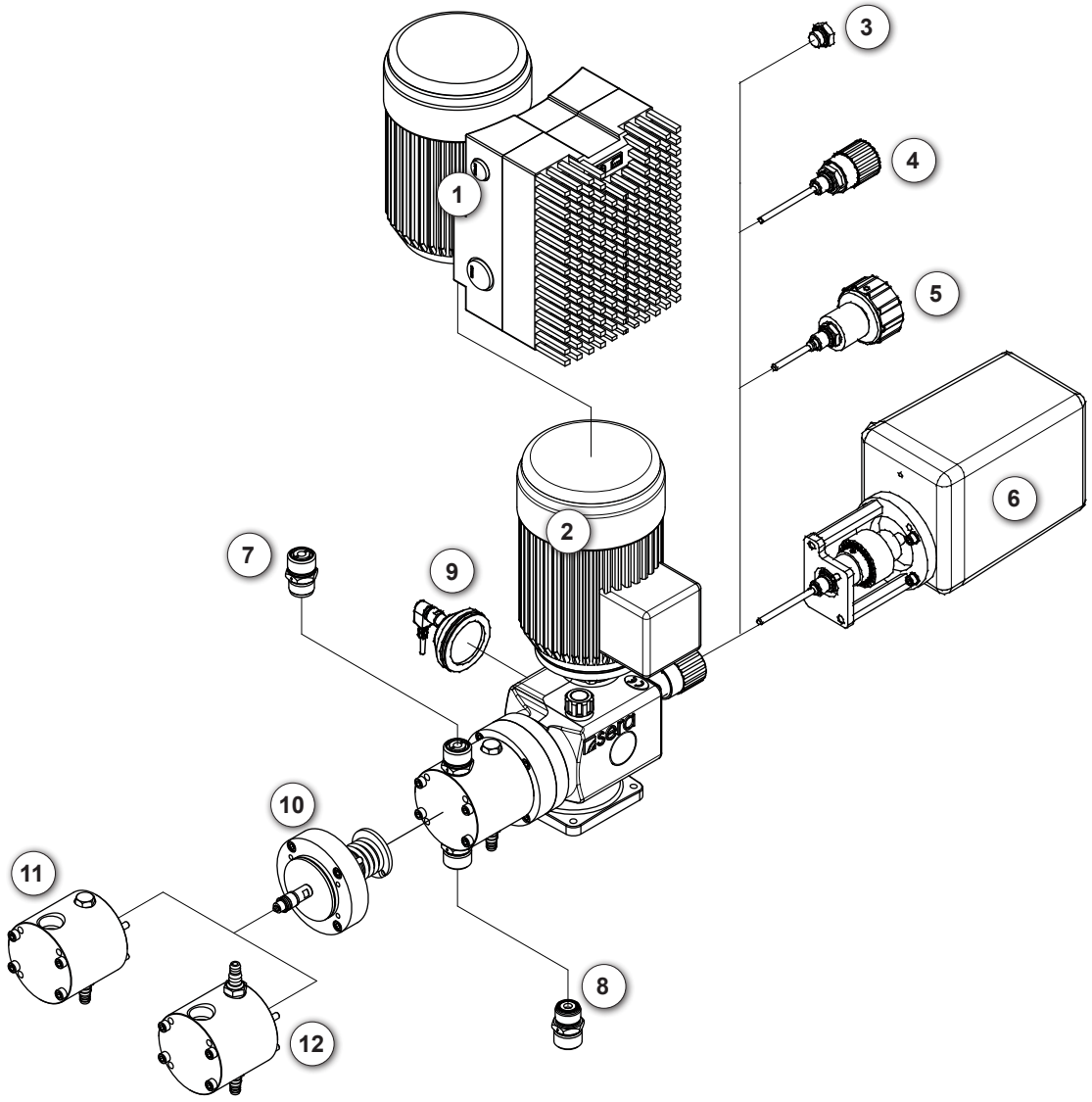
4.4 Dosing range

The delivery rate of the pump can be set manually via the stroke length adjustment (0…100%).
The linear dosing range is between 20% and 100%.

4.5 Noise measurement

According to DIN 45635 the sound pressure level measured of the pumps is between 50 and 65 dB (A).

4.6 Components of the piston pump



No.	Designation	Remark
1	Drive motor with attached frequency converter	option
2	Drive motor (suitable for operation with frequency converter)	option
3	Blind plug (M-design)	
4	Manual stroke length adjustment	
5	Manual stroke length adjustment with position indicator	option
6	Stroke length adjustment with actuator	option
7	Pressure valve	
8	Suction valve	
9	Stroke frequency transmitter (with inductive contact)	option
10	Assembly pump	
11	Pump body	
12	Pump body with rinsing connection	option
not illustrated	Actuator for Ex-area	option
	EExeIIT4 - motor	option
	Pneumatic actuator	option

4.7 Functional description

4.7.1 General

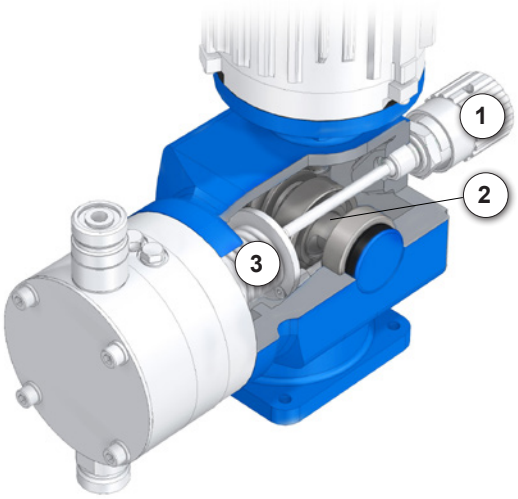
sera dosing pumps are run-dry safe oscillating displacement pumps that are characterised by high tightness of the dosing head. The fluid is conveyed by a deformable diaphragm.

Dosing pumps consist of the following (main) components:

- Drive motor
- Stroke mechanism
- Stroke length adjustment
- Assembly pump
- Pump body
- Suction and Pressure valve

4.7.2 Stroke mechanism

Piston diaphragm pumps of this type series use a rotary cam drive to transmit the rotation of the drive motor to the displacement body.
In case of the rotary cam drive, the eccentric (**2**) provides the pressure stroke while the suction stroke is performed by a pressure spring (return spring) (**3**).
The effective stroke length can be changed by means of an adjustable scale knob (**1**) which prevents the connecting rod from following the rotary cam up to the rear dead centre during suction stroke (see stroke length adjustment).



4.7.3 Driving motor

sera - dosing pumps are driven either by a three-phase motor.
(Information about connecting the drive motor, see Chapter „Electrical connection / Interfaces“).

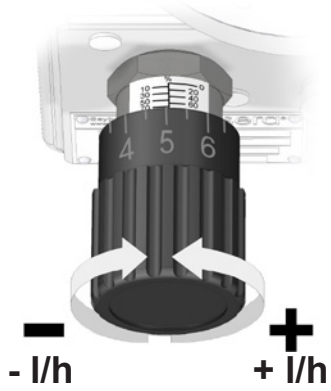
4.7.4 Stroke length adjustment

The delivery rate of the pump is set by changing the stroke length. The stroke length is infinitely variable between 0% and 100%.

A linear dosing behaviour is achieved with stroke length adjustments between 20% and 100%.

4.7.4.1 Manual stroke length adjustment (standard)

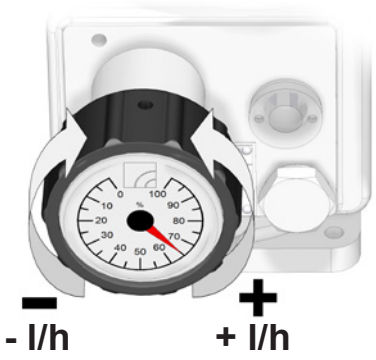
The effective stroke length of the connecting rod is changed by turning the scale knob.
The stroke length should be adjusted during operation of the pump.
The set stroke length can be read off a scale, e.g. 75% (see Fig.).
With the 20-steps adjustment on the scale knob, the stroke length can be set individually with a tolerance of 0.5%.



4.7.4.2 Manual stroke length adjustment by a dial scale with indication of percent (option)

The stroke length is adjusted by turning the hand wheel. The stroke length shuold be adjusted during operation of the pump.

The set stroke length can be read off the percent scale (the example shows a set stroke length of 65%).
In delivery state, the stroke length adjustment is factory set to 50%.

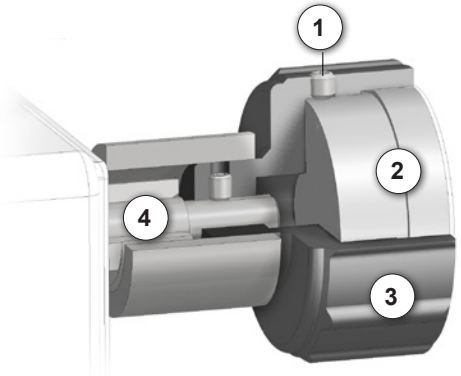


ATTENTION!

The dial scale with indication of percent may become misadjusted during transport.
If the indicator does not match the 50% setting, then the percent scale must be re-adjusted during operation (!) of the pump!

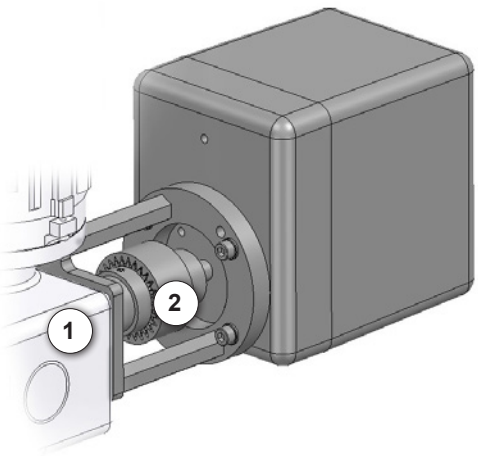
Adjusting the percent scale:

- Switch on the piston diaphragm pump.
- Loosen setscrew (**1**).
- Remove percent scale (**2**) from the hand wheel (**3**).
- Manually turn the percent scale to 0% setting.
- Use the hand wheel to set the stroke length to 0%. Turn hand wheel clockwise until there is no further stroke movement (connecting rod does no longer hit the adjusting spindle (**4**)).
- Insert percent scale again.
- Use the setscrew to secure the percent scale to the hand wheel.
- Adjust desired stroke length.



4.7.4.3 Automatic stroke length adjustment by means of an electrical actuator

The electrical actuator is directly mounted to the stroke mechanism (**1**) of the dosing pump. A clutch transmits the rotary motion of the actuator drive shaft to the adjusting spindle. The axial displacement is compensated in the clutch (**2**).
In case of dosing pumps with electrical actuator, a manual adjustment of the stroke length on the pump is no longer possible.
(Exception: actuator with hand wheel)
The actuator is equipped with two integrated limit switches as well as a position potentiometer for position feedback as standard.
Both limit switches are factory set so that the drive will switch off at a stroke length of 0% and 100%, even if a control voltage is applied.
This guarantees that adjustments can only be made within the permissible range. The position potentiometer is driven by a safety clutch which prevents damage caused by incorrectly adjusted limit switches.
Activation is performed by appropriate control units
(see **sera** - accessories)



The set stroke length can be read off on the pump (percent scale)
Information on the electrical connection is given inside the cover of the actuator.

ATTENTION!

The adjustment is only possible when the pump is running.

4.7.4.4 Automatic stroke length adjustment by means of an electrical actuator with integrated positioner (PMR3)

same as Chapter 4.7.4.3, additionally:

- PMR3 positioner

This PMR3 positioner which is integrated in the actuator enables an actuator setting from 0…100% that is proportional to the connected input signal.
As an option, the actuator can also be provided with a collective interference signal.
Information on the electrical connection is given inside the cover of the actuator.

4.7.4.5 Automatic stroke length adjustment by means of an electrical actuator (Ex-design)

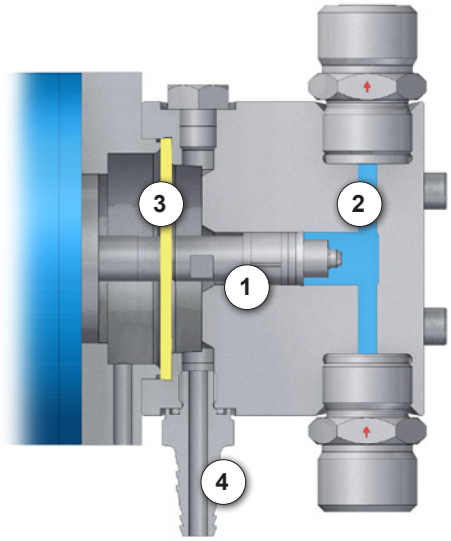
Pay attention to the documents attached to the actuator.

4.7.4.6 Automatic stroke length adjustment by means of a pneumatic actuator

Pay attention to the documents attached to the actuator.

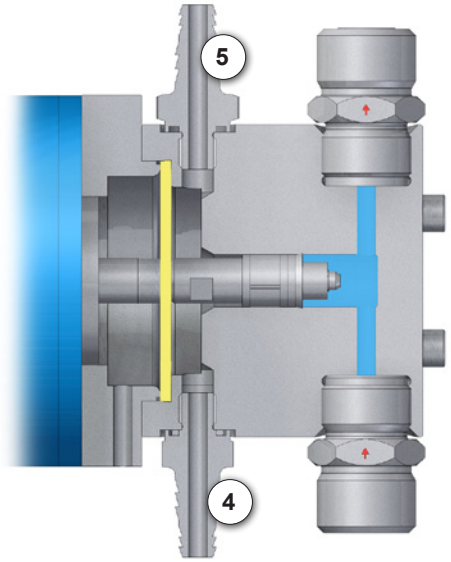
4.7.5 Assembly pump / Pump body

The piston (**1**) connected to the drive via the connecting rod transmits the stroke movement directly to the pumped medium (**2**). Suction- and pressure valves open and close depending on the stroke cycle of the piston.
The piston seal guaranteed lowest leakage at maximum wear resistance and low friction at high sealing quality.
The protection diaphragm (**3**) between dosing head and stroke mechanism prevents leaking media from penetrating the stroke mechanism.
Leaking media flow out at the leaking nozzle (**4**) where they can be collected or returned in the dosing tank (when the pump is mounted on top).
A transparent hose allows a visual check.



Piston pump with rinsing connection (5) (option)

In case of media which are lightly crystallizing the area after the piston is to be rinsed at regular intervals.
Rinsing should be carried out in intervals (for appr. 2 minutes once an hour) while the pump is operating or again for appr. 3 minutes after the pump was switched off and restarted again.
The rinsing pressure must not exceed 0.1 bar i.e. a suitable pressure reducer is to be provided in addition to the shut-off valves and the automatic valves.
The volume flow of rinsing liquid should be between 0.5 and 1 l per rinsing process.
The rinsing liquid must be drained without pressure (free drainage downward) via the leaking nozzle (**4**).
Only non-aggressive, chemically neutral, liquid rinsing media without any solid matters are to be used.



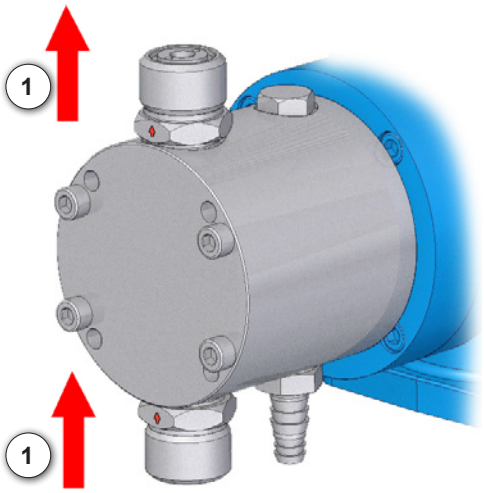
4.7.6 Suction / Pressure valve

The pump valves are ball valves that only work properly in a vertical position. The condition of the valves has a deciding effect on the operating capability of the pump.
Valves must be exchanged as complete units.

When replacing the valves it is important to check the flow direction (**1**).

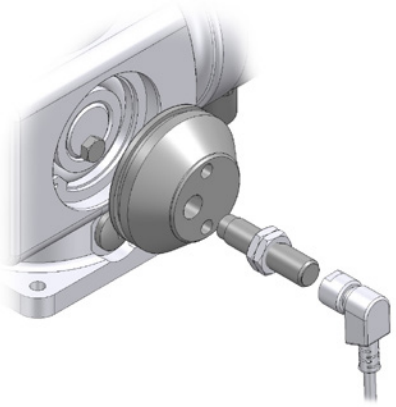
ATTENTION!

Pressure valve above; Suction valve below!



4.7.7 Stroke frequency transmitter (option)

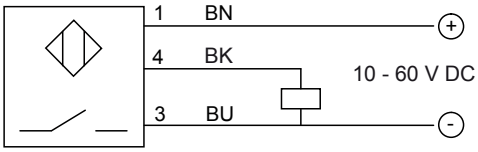
sera dosing pumps are oscillating displacement pumps with an exactly defined stroke volume per each pump stroke.
If these dosing pumps should be used for automatic filling processes or charge dosing, then the single pump strokes must be determined and converted into electrical signals.
For this purpose, a stroke frequency transmitter (inductive contactor (**1**)) is added to the pump (the option cannot mounted additionally) and reports each single pump stroke to the evaluation unit (e.g. preselection counter, SPC-control unit, etc.).



Technical data

Rated voltage:	10 - 60 V DC
Constant current:	< 200 mA
short circuit-proof	
Connection mode:	plug connector with 2 m cable
LED (green):	indicates supply voltage
LED (yellow):	indicates switching status

Wiring diagram



ATTENTION!

When switching inductive loads (protectors, relays, etc.), surge protectors (varistors) must be fitted owing to the high self-induction voltage.

WARNING!

When the pump is deployed in exlosion-hazardous areas a NAMUR type stoke frequency transmitter (II2G EExia IICT6, gem. ATEX95) is to be provided.

5. Technical Data

5.1 Output data

Typ	Nominal capacity adjustable by changing lift of strokes Q_N l/h		Maximum permissible pressure in the pump outlet p_2 max.	Min./max. permissible pressure in the pump inlet p_1 min./max.	Max. suction height [1] WS	recommended nominal diameter of the connecting pipes DN	Nominal stroke frequency min^{-1}		Max. stroke length h100	Piston diameter	Motor size (standard design) FS
	50Hz	60Hz	bar	bar	m	mm	50Hz	60 Hz	mm	mm	
...409.2 – 8 K	8	9,6	140	-0,3/0	3	8	100	120	10	14	71
...409.2 – 12 K	12	14,4	140	-0,3/0	3	8	150	180	10	14	71
...409.2 – 18 K	18	21,6	80	-0,3/0	3	8	100	120	10	20	71

[1] Achievable height with media similar to water and filled suction line.

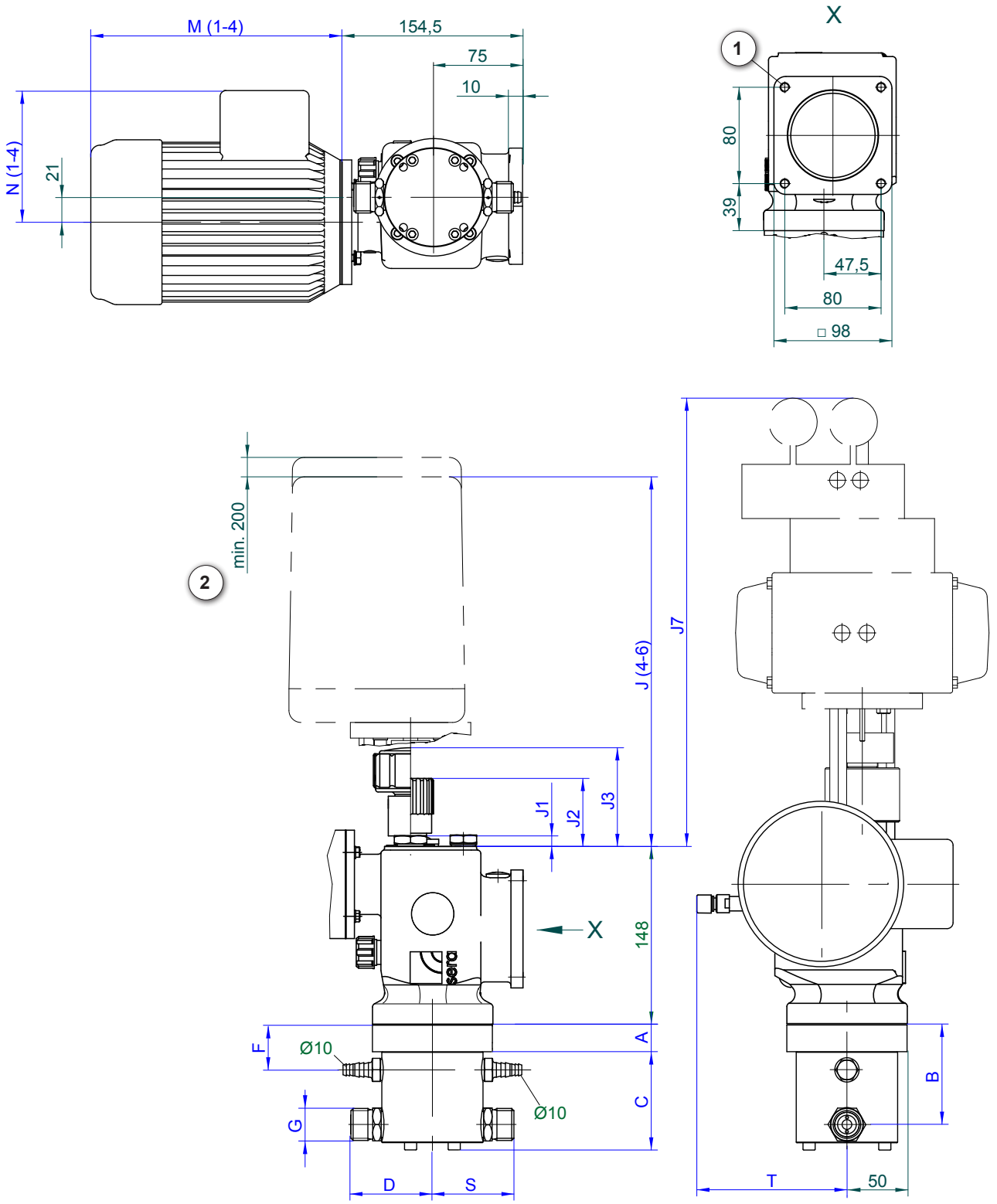
The nominal data refer to water, 20°C and nominal pressure. With lower counterpressure it can come to be soaked off achievements.

5.2 Motor data

BG71									
Motor type	Output kW	Motor speed min-1 50Hz	Motor speed min-1 60Hz	Mains frequency Hz	Voltage range V	Nominal current A	Protection category IP	Thermal class	ATEX-design
Standard	0,37	1.500	1.800	50/60	**Observe the type plate!** [1]		55	F	---
AC motor	0,37	1.500	---	50			55	F	---
EExeIIT4- motor	0,25	1.500	---	50			54	F	II2G EExe IIT4
EExdeIIT4-motor (pressure-tight enclosed)	0,37	1.500	---	50			54	F	II2G EExde IICT4

[1] The data can be read off the type plate on the drive motor of the respective pump!

5.3 Dimensions



1	Mounting holes, M8 d=6,5
2	for removing the actuar cover

All dimensions in mm!			...409.2-8 K	...409.2-12 K	...409.2-18 K
	S	Double valves 1.4571	67	67	67
	D	Double valves 1.4571	67	67	67
	G	Connection thread Suction/pressure valve	G3/4	G3/4	G3/4
	A	Assembly pump	22	22	22
	B	Centre of valve thread	82	82	82
	C	Pump body	81	81	81
	F	Centre of leakage joint	37	37	37
	F	Centre of flushing joint (option)	37	37	37
Stroke length adjustment (SLA)	**J1**	Blind flange for pump without SLA	8	8	8
	J2	Manual stroke length adjustment (max.)	70	70	70
	J3	Manual SLA with position indicator	110	110	110
	J4	Electric actuator	240	240	240
	J5	Electric actuator with PMR3	320	320	320
	J6	Electric actuator, Ex-design	413	413	413
	J7	Pneumatic actuator	372	372	372
Drive motor	**M1**	Standard motor	210	210	210
	N1		111	111	111
	M2	Motor for frequency converter operation	210	210	210
	N2		111	111	111
	M3	AC motor	219	219	219
	N3		112	112	112
	M4	EExeIIT4 - motor	176	176	176
	N4		122	122	122
	T	Stroke frequency transmitter	125	125	125
Stroke mechanism		a.o. Dimensions for fastening of the pump	see dimensional drawing		

6. Assembly / Installation

- The standard model of the pump is only approved for installation in dry rooms in a non-aggressive atmosphere, at temperatures between -10°C and +40°C and at permitted humidity until approx. 90%, altitude 1000 m above sea level.

DANGER!

In case of operation in explosion-hazardous areas, the instructions in Chapter „Operation in explosion-hazardous areas“ must also be followed!

DANGER!

When toxic, crystal-forming or corrosive liquids are being delivered, the pipe system must be equipped with devices so that it can be emptied, cleaned and, if necessary, rinsed with a suitable medium.

ATTENTION!

If the system is operated on a 60Hz mains it is essential to consider the possible higher stroke frequency when designing the pipe geometry.

WARNING!

The dosing pump must be installed in such a way that no damage can be caused if medium is leaking out.

- Protect the pump against any sources of heat and against the direct irradiation of sun and ultraviolet light.
- For dimensions of the pump connections and fixing holes, see Chap. „Dimensiones“.
- Install the pump in such a way that there is no vibration and no tension and that it is aligned precisely.
- Install the pump at the optimum possible operating height. Mount the pump in such a way that the valves are vertical.
- Ensure that there is sufficient space around the pump body and the suction and pressure valve so that these parts may be easily dismantled, if required.
- The stroke length adjustment and indicator scale must be easily accessible and readable.
- Design the nominal diameters of the downstream pipes and of the connections built into the system to be the same size or larger than the nominal inlet and outlet diameters of the pump.
- To check the pressure ratios in the pipe system, we recommend to provide for connections for pressure gauges (e.g. manometers) near the suction and pressure sockets.
- Drain cocks are to be provided.
- Prior to connecting the pipes, remove the plastic caps on the suction and pressure sockets of the pump.
- Check that the fixing screws for the pump body are tightly fitted and, if necessary, retighten (please see Chapter “Overview of the tightening torques”).
- If the pump is equipped with an actuator provide for sufficient space to remove the cover (please see Chapter “Dimensions”).
- Connect pipes to the pump in such a way that there are no forces acting on the pump, such as e.g. misalignment, weight or stress of the pipe.
- Keep the suction lines as short as possible.
- Use pressure- and medium-resistant hoses / pipes.
- All pipes and containers connected to the pump must comply with the regulations and must be cleaned, tension-free and intact.
- Provide for a dry-running protection for the pump.
- Provide for a collecting tank for leaking media.
- In case of piston pumps with rinsing connection a suitable drain-off line for the rinsing liquid is to be installed.

In order to avoid cavitation, overloading and excessive delivery, the following points should be noted:

- Avoid high suction heights.
- Keep pipes as short as possible.
- Choose sufficiently large nominal diameters.
- Avoid unnecessary choke points.
- Install a pulsation damper.
- Install a pressure relief.
- Install a pressure keeping valve, if necessary.
- In the case of degassing media, provide for a supply.

WARNING!

The operator must take suitable precautions on the supply side (collecting tray, diaphragm rupture electrode) to ensure that the container does not run dry in the event of a diaphragm rupture.

NOTE!

Illustrations in this chapter!
The names of the shown modules/components are based on the following assignment:

i 33

1	Dosing pump
2	Tank
3	Main line / process line
4	Suction line
5	Pressure line
6	Feedback line
7	Check valve
8	Vent valve (ball valve)
9	Injection fitting
10	Shut-off valve
11	Strainer

12	Tank empty alarm
13	Drain fitting
14	Priming aid / Siphon vessel
15	Hand vacuum pump
16	Pulsation damper
17	Flushing medium
18	Safety valve
19	Diaphragm relief valve
20	Pressure keeping valve
21	Dosing pump with integrated relief valve

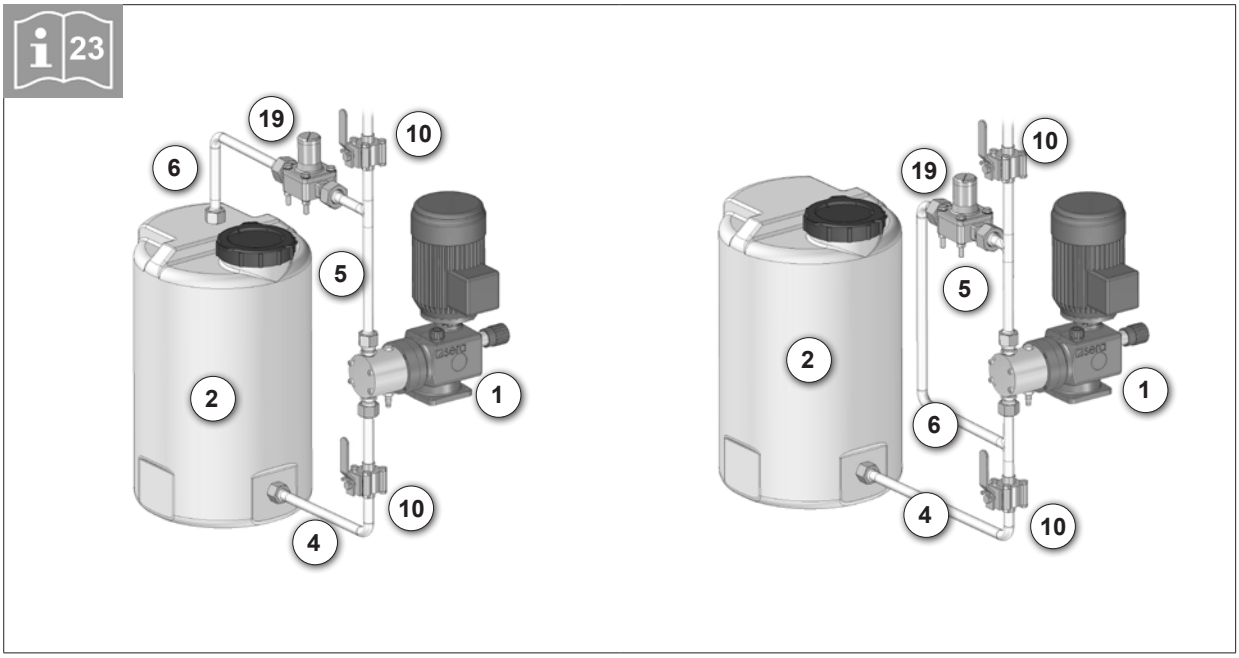
6.1 Provide for an overpressure protection

If the permissible pressure in the system may be exceeded, e.g. when a shut-off valve is closed or if the line is blocked:

- Install the overflow valve (**19**).

When using an external relief valve the following is valid for the feed back pipe:

- Lead the overflow line with descending gradient in the store tank which is under atmospheric pressure or in an open drain gutter.
- Or connect the overflow line directly to the pump suction line, but only if there is no check valve inside the suction line (e.g. foot valve of a suction lance).



ATTENTION!

Shut-off valves must not be closed when the pump is running!

CAUTION!

Provide an overpressure protection (e.g. overflow valve) if the permissible operating pressure may be exceeded.

ATTENTION!

If the permissible operating pressure is exceeded and the pump is not equipped with an overpressure protection the pump can get damaged.

DANGER!

The pumped medium may spout out if the pump is damaged.

6.2 Preventing a backflow of the pumped medium

If the dosing line is linked with a main line:

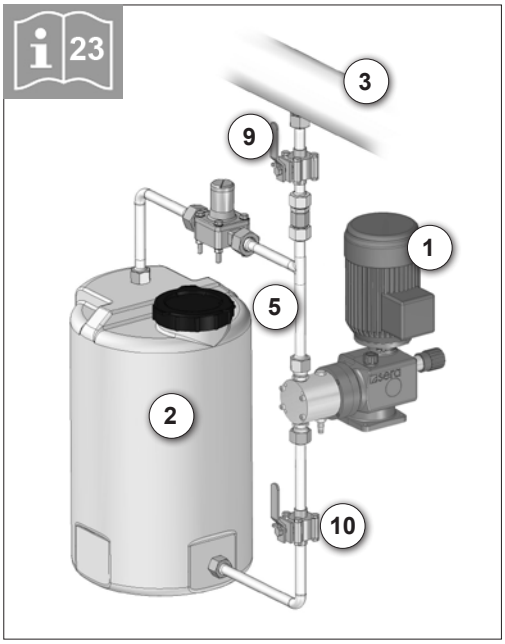
- Install an injection fitting (**9**).

DANGER!

There will be an unintentional mixture in the dosing line if a possible backflow from the main line is not prevented.

DANGER!

Pay attention to / avoid chemical reactions arising from a backflow of the pumped medium.



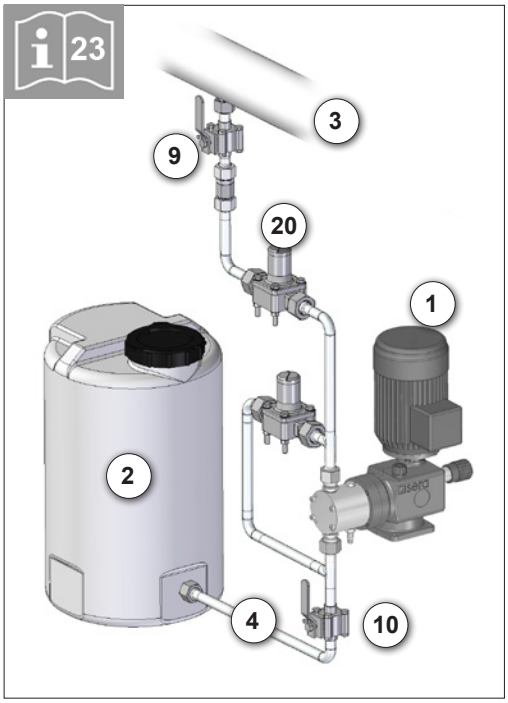
6.3 Eliminating undesired siphoning

When dosing into a main line with negative pressure:

- Install a pressure keeping valve (**20**) into the dosing.

ATTENTION!

When installing a pressure keeping valve, make sure that an uncontrolled dosing is prevented (by a positive pressure difference (≥ 1 bar) between pressure and suction side).

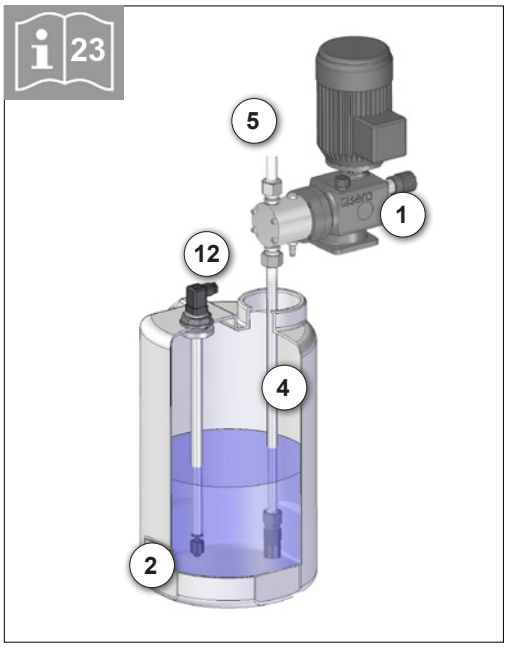


6.4 Install a dry-running protection

It must always be ensured that the piston pump is not operated without any medium.

NOTE!

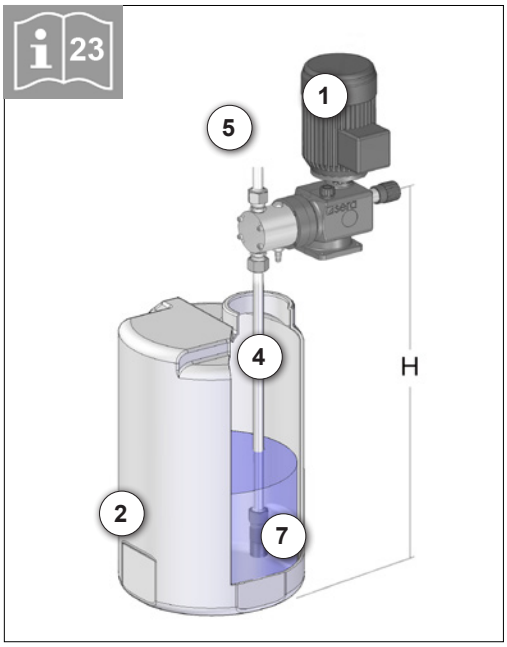
The pump may be seriously damaged if the system is op-erated without pumped medium.



6.5 How to avoid an emptying of the suction line

- Install a foot valve at the end of the suction line.

Based on calculations, the dimension ‘H’ may not exceed the number that is equal to the specified maximum suction height of the pump divided by the density of the pumped medium and in consideration of mass acceleration and viscosity of the medium.

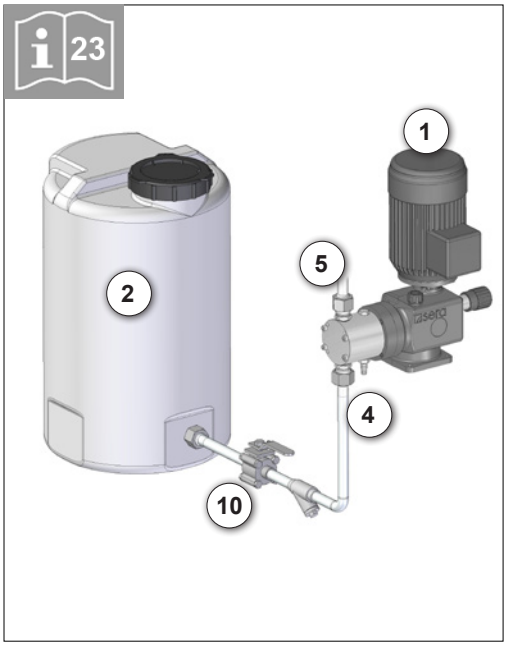


6.6 Line strainer

- Connect the suction line slightly above the bottom of the tank and install a line strainer (0.1 – 0.5mm aperture size – depending on nominal width of the valve).

ATTENTION!

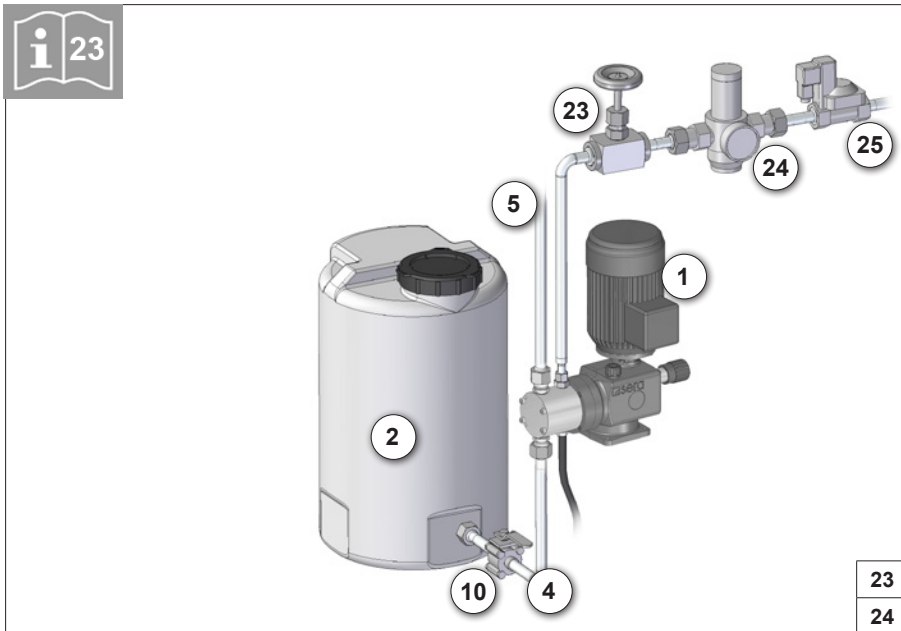
Pump and system may not function properly if contami-nates are not collected.



6.7 Piston pump with rinsing connection

ATTENTION!

The maximum permissible rinsing pressure and the volumentric flow and characteristics of the rinsing liquid are to be observed.

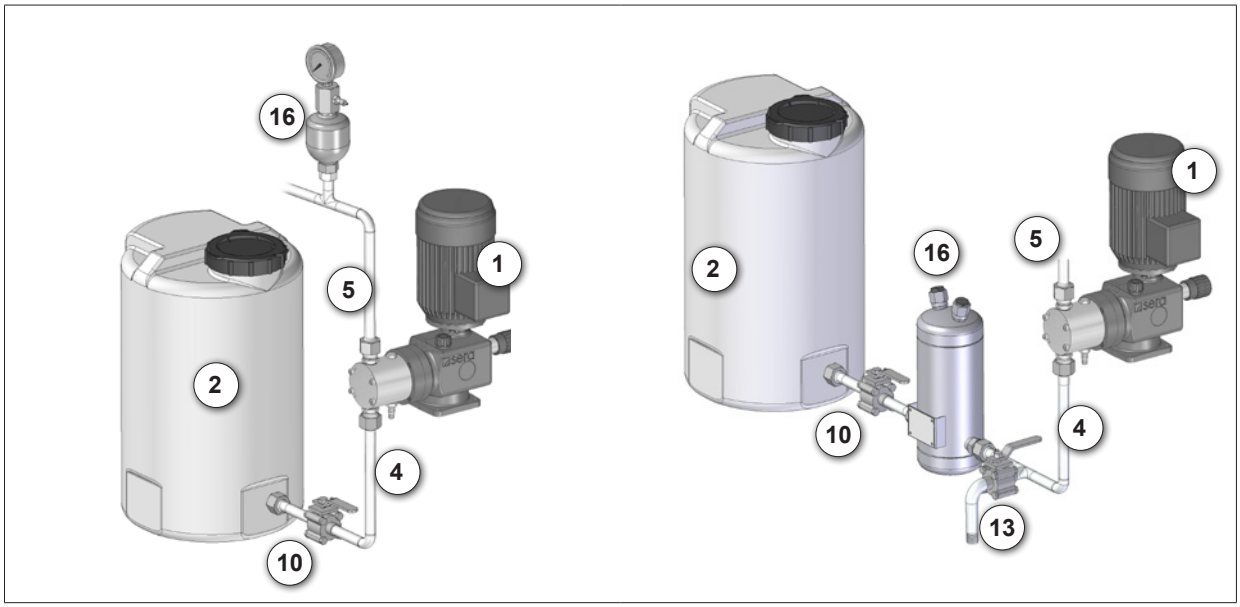


23	Needle valve
24	Pressure reducer
25	Solenoid valve

6.8 Damping of the pulsation

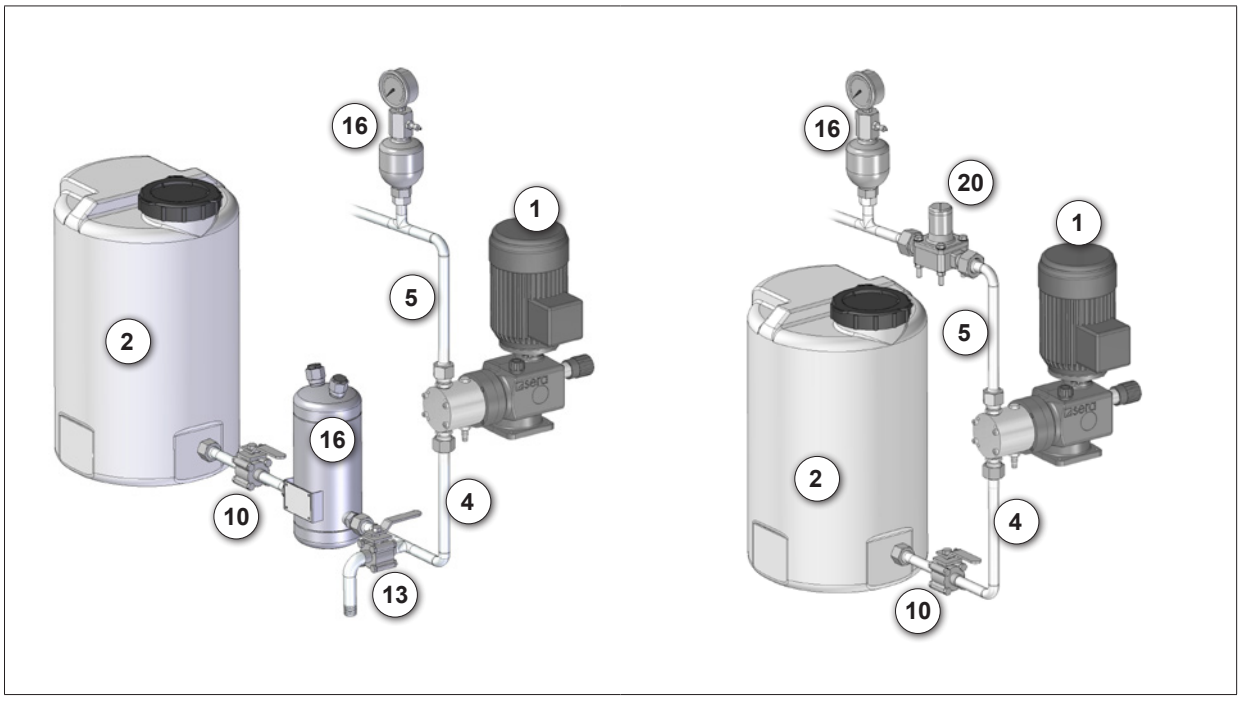
By installing pulsation dampers if:

- for procedural reasons, a pulsation-poor flow rate is desired,
- accelerating forces which arise due to the pipe geometry must be reduced.



Installation of suction and/or pressure pulsation dampers near the pump head.

- If both pulsation damper and pressure keeping valve (**20**) should be integrated install the pressure keeping valve between pump and pulsation damper.



WARNING!

Undamped accelerating forces can cause the following malfunctions / damage:

- **Fluctuations of the delivery rate,**
- **dosing errors,**
- **pressure thrusts,**
- **valve wobbles,**
- **increased wear on the suction- and pressure side of the pump.**
- **Mechanical breakdown of the pump, leakage and valve wobbles as a result of the maximum pressure on the pressure side of the pump being exceeded.**
- **Damage to the pipe and in the pipe installed fittings.**

7. Electrical connection / Interfaces

sera diaphragm pumps are driven either by a three-phase motor or an AC motor.
Standard: three-phase motor (with PTC thermistor; suitable for operation with frequency converter)

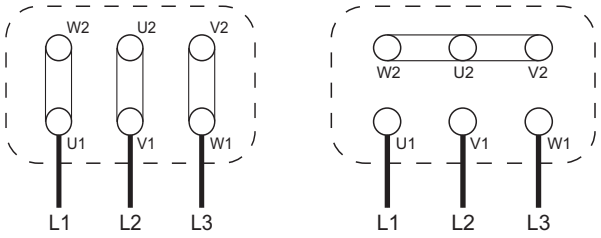
7.1 Motor connection

In case of a three-phase motor

The motor connection depends on the voltage indication on the type plate and the applied supply voltage.

Example:
Indication on the type plate: 230/400 V
Three-phase power system on site: 400 V

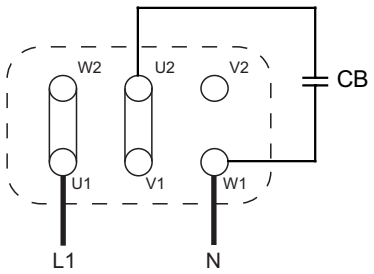
Correct motor connection:
Star connection (Y)



Δ *Delta connection* Y *Star connection*

In case of an AC motor

The AC motor has a main and an auxiliary winding. The running capacitor is switched in series to the auxiliary phase.



7.2 Direction of rotation

The direction of rotation of the drive motor is arbitrary.

7.3 Terminal box

Before closing the terminal box, please check that:

- all terminal connections are tightly fitted.
- the interior is clean and free of foreign bodies.
- unused cable entries are closed and screw plugs are tightened.
- the sealing is correctly inserted in the cover of the terminal box; check proper condition of all sealing surfaces so that the demands of the protection category are fulfilled.

7.4 Motor protection

Provide for adequate motor protective equipment in order to protect the motor from overload (e.g. motor protection switch with thermal overcurrent release).
Connect the ground wire to the marked earth screw in accordance with VDE 0100.

CAUTION!

Fuses do not protect the motor!

8. Operation in explosion-hazardous areas

DANGER!

The prerequisite for the use in explosion-hazardous areas is an appropriate design of the pump.

The product supplied by sera meets the requirements of directive 2014/34/EU if it is correspondingly marked. This guarantees safe operation in explosion-hazardous areas.

DANGER!

It is the operator's task to define the field of application and to check whether the pump is suited for this application. He/she must clearly define the zone, the device category, the explosion group and the temperature class.

DANGER!

Avoid build up electrostatic conditions!

ATTENTION!

To avoid contamination of the valves strainers in the suction line have to be installed.

8.1 Identification

The pump has a label stating the zone/device category /explosion group/temperature class in compliance with directive 2014/34/EU.

- **Ex II2G c IIBT4** or
- **Ex II2G c IICT4**

(note special specifications in the confirmation of order).

8.2 Installation

The intended operating conditions in explosion-hazardous areas according to directive 2014/34/EU are stated in the confirmation of order or the product description. The indicated limit values should not be fallen below or exceeded.

Installation regulations given in the operating instructions must be adhered to.

DANGER!

Use only suitable tools for performing assembly and maintenance work on machines or plants in explosion-hazardous areas.

Directive 99/92/EC must be observed.

8.3 Potential equalization

After mounting the pump the proper connection to the site potential equalization is to be ensured.
The max. bleed resistor (1MΩ) has to be checked and documented.

8.4 Start-up

After installation, the pump must immediately be used for the suction of fluids, i.e. the pump must immediately be started after the tank has been installed and filled.

8.5 Operation

The intended operating conditions in explosion-hazardous areas according to directive 2014/34/EU are stated in the confirmation of order or the product description. The indicated limit values should not be fallen below or exceeded.

Details about explosion zone, device category, explosion group and temperature class can be seen from the Declaration of Conformity.

8.5.1 Degassing of the pumped medium

Never let the pump run dry. Check the liquid level in the tank during operation of the pump. Make sure that the pump is switched off when the liquid level in the tank falls below the minimum level required (explosive atmosphere may be carried over).

Vapour bubbles from the pumped medium are harmless as they have no explosive potential.

DANGER!

Formation of an explosive gas mixture must be prevented.

8.5.2 Temperature indications

Permissible ambient temperature

-10°C ≤ Ta ≤ +40°C

8.6 Maintenance

The maintenance notes listed in Chapter 10 are generally applicable.

Exception:

CAUTION!

The oil level in the stroke mechanism of the pump and the level of the hydraulic fluid of the pump must be checked once a week!

9. Start-Up

9.1 Driving Motor

Preconditions:

Make sure that voltage and frequency correspond with the indications on the type plate of the motor.
Permissible voltage tolerance (DIN VDE 0530)

for rated voltage	+ 10 %
for rated voltage range	± 5 %

The connecting cable must be dimensioned according to the motor characteristics.
Secure connecting cable with a strain relief.

The nominal motor power refers to an ambient temperature of 40°C and an installation site below 1000m above sea level. Motor output will be reduced if these values are exceeded (see VDE 0530).

Adapted for “moderate” groupe of climates according to IEC 721-2-1.

NOTE!

The drive motor will heat by operation of the pump.
Do not touch the motor during operation!

9.2 Initial start / Restart

Controls for start-up

- Check whether all connections for tightness; if applicable, retighten.
- Check that the fixing screws for the pump body are tightly fitted and, if necessary, retighten (see table Chap. „Overview of the tightening torques“).
- Check whether all electrical connections are correct.
- Check whether the information of the mains voltage on the type plate with the local circumstances agrees.

10. Operation

10.1 General

NOTE!

As soon as the drive motor is supplied with voltage the pumps starts to work.

The (standard) dosing pump is without an I/O switch. Any devices to switch the dosing pumps on or off have to be installed by the operator.

10.2 Setting the delivery rate

The flow capacity of the dosing pump is set via the stroke length control (see chapter „Stroke length adjustment“).

NOTE!

When using an electrical actuator or frequency converter please take note of the separate operating instructions!

11. Maintenance

The following safety instructions apply to all service and are sure to follow.

WARNING!

Carry out all maintenance work only on non-pressurized system!

WARNING!

Repairs on the stroke mechanism may only be performed by sera!

WARNING!

Before starting maintenance make sure that the wearing parts and the spare parts required are available.
Deposit the parts so that they will not get damaged.

WARNING!

All wearing parts are to be checked for prefect condition at regular intervals and exchanged if necessary.

WARNING!

Prior to replacing parts from the dosing unit, empty the pump and, if necessary, rinse it with appropriate fluid in order to avoid contact with aggressive and/or toxic media!

Dosing pump with a suitable detergent rinse so that no delivery medium remains in the pump body. Otherwise, steps out on dismantling pumped. The flushed fluid absorb contact and disposed of safely!

This measure must also take place before any delivery to a dosing pump repair purposes.

WARNING!

During maintenance or repair work, switch off the drive motor of the dosing pump and secure it against inadvertent or unauthorised reactivation!

WARNING!

Take appropriate protective measures:
Wear protective clothing, breathing protection and safety goggles. Prepare a container with appropriate fluid right beside the pump to be able to remove splashes of the pumped medium

Check the following at regular intervals:

- Check oil level regularly (oil eye)
- Tight fit of piping.
- Tight fit of pressure and suction valve.
- Proper condition of the electrical connections.
- Tight fit of the screws for fastening the pump body (check this at least every three months).
  For the tightening torques of the mounting screws, please see Chapter „Overview of the tightening torques“.

11.1 Working materials

	Pump type	Specification	sera use	Quantity
LUBRICANT	...409.2-...K	CLP VG220 DIN51517-3	ARAL Degol BG220	0,3 Litres

11.2 Drive unit

11.2.1 Drive motor

The electric motor should always be kept clean so that neither dust, dirt, oil nor other contaminates may affect the correct operation.

In addition, we recommend to ensure that:

- the motor does not produce strong vibrations
- suction and blowing openings for the supply of cooling air are not closed or restricted (may lead to unnecessary high temperatures in the windings).

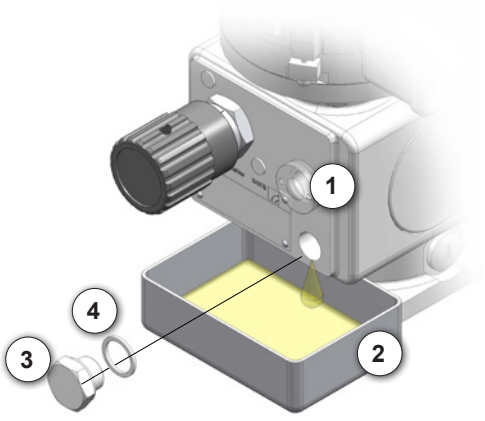
The ball bearings inserted in the motor are lubricated for life.

11.2.2 Oil change

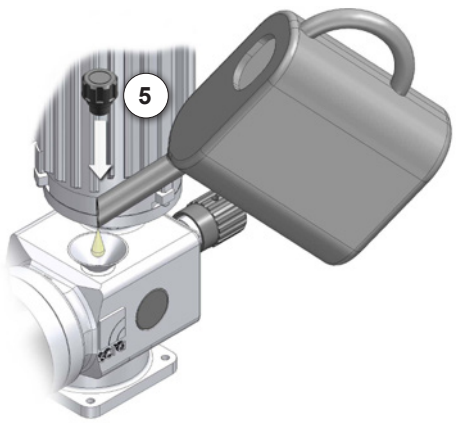
- Check oil level at regular intervals (oil sight glass (**1**))

Perform an oil change once a year.
To do so, proceed as follows:

- Unscrew the venting screw (**5**).
- Prepare an appropriate container (**2**).
- Open the screw plug (**3**) and drain off oil.
- Close hole with screw plug
  (pay attention to the sealing ring (**4**)!).

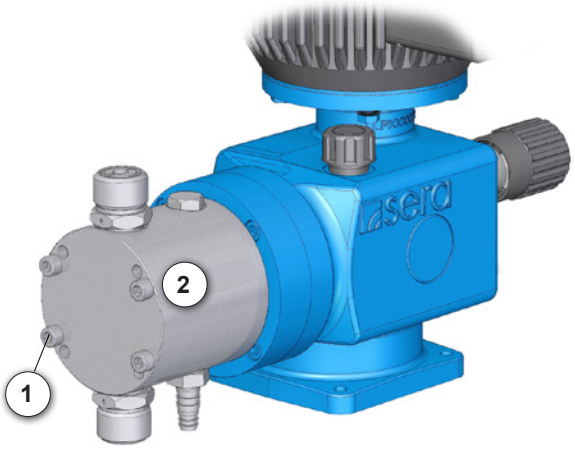


- Fill oil in threaded hole of the venting screw.
- For type and quantitiy of the gear oil, please see Chapter “Working materials“.
- Screw in venting screw (**5**).



11.3 Dosing unit

11.3.1 Overview of the tightening torques



Pump type	TIGHTENING TORQUES OF THE FIXING SCREWS (1) Nm
...409.2-8 K	8
...409.2-12 K	8
...409.2-18 K	8

11.3.2 Changing the piston seal and protective diaphragm

In order to ensure a correct function of the pump and to fulfil the required safety and protective provisions it is absolutely necessary to check and replace the diaphragm at regular intervals.

WARNING!

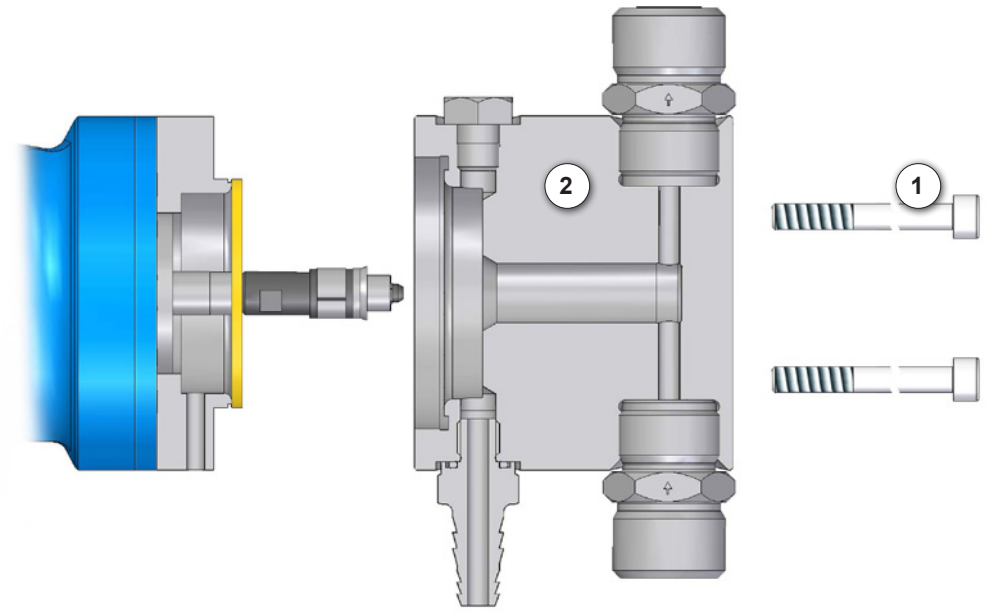
Observe and follow the safety instructions in Chapter 11 „Maintenance“ by all means.

Man, machine and environment are endangered if the safety instructions are not observed.

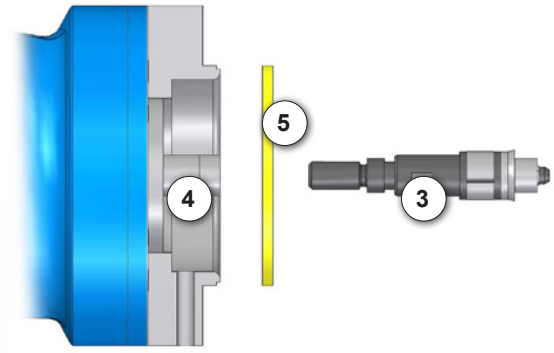
WARNING!

For the changing the system must be depressurised!

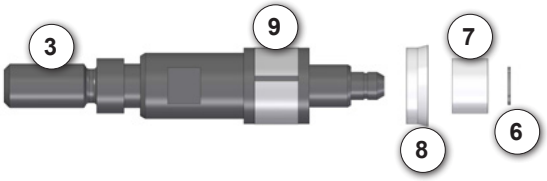
- Loosen the connections on the suction- and pressure side.
- Loosen the leaking nozzles and pipe connections at the rinsing connection, if installed.
- Set the stroke length adjustment to a stroke length of 0% (front position).
- Loosen fixing screws (**1**) on the pump body (**2**).
- Remove pump body to the front.



- Remove piston (**3**) out of the connecting rod (**4**).
- Pull protective diaphragm (**5**) off the piston.

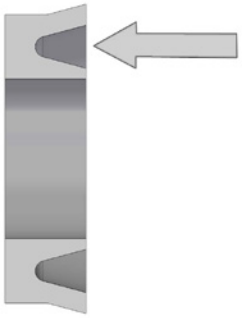


- Remove locking ring (**6**).
- Pull support ring (**7**) off the piston (**3**).
- Pull of piston seal (**8**) (piston V-sealing ring) and exchange.
- Replace piston guide ring (**9**).
- Replace protective diaphragm.

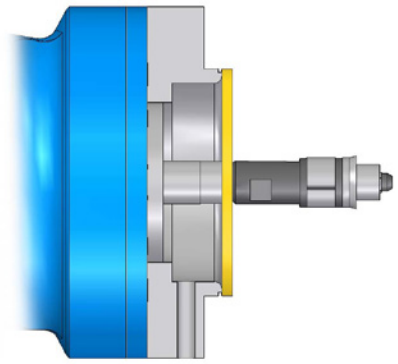


Assemble the pump in reversed order

- Make sure that the open side of the piston seal is always pointing towards the pressure- or medium side when the pump is assembled.



- Set the stroke length to 50%. Move protective diaphragm to the base ring – the diaphragm must be in the middle position.
- If the pump is not equipped with a stroke length adjustment (M-design), move the diaphragm to the middle position by turning the fan blade of the drive motor.
- When assembling the pump body, please note: suction valve below, pressure valve above!
- Observe the tightening torques (see Chapter „Overview of the tightening torques“).



Add the suction and pressure line and connect pump to the power supply. The piston pump is then again ready for operation.

12. Spare and wearing parts

12.1 Wearing parts

The following parts are considered as wearing parts of the pump:

- Protective diaphragm
- Piston seal
- Suction valve
- Pressure valve

Depending on their use and period of use, wearing parts must be replaced at regular intervals in order to ensure a safe function of the pump.

We recommend to replace the wearing parts after 3000 operating hours or at least once a year.

A worn-out seal may result in damage to the pump body.

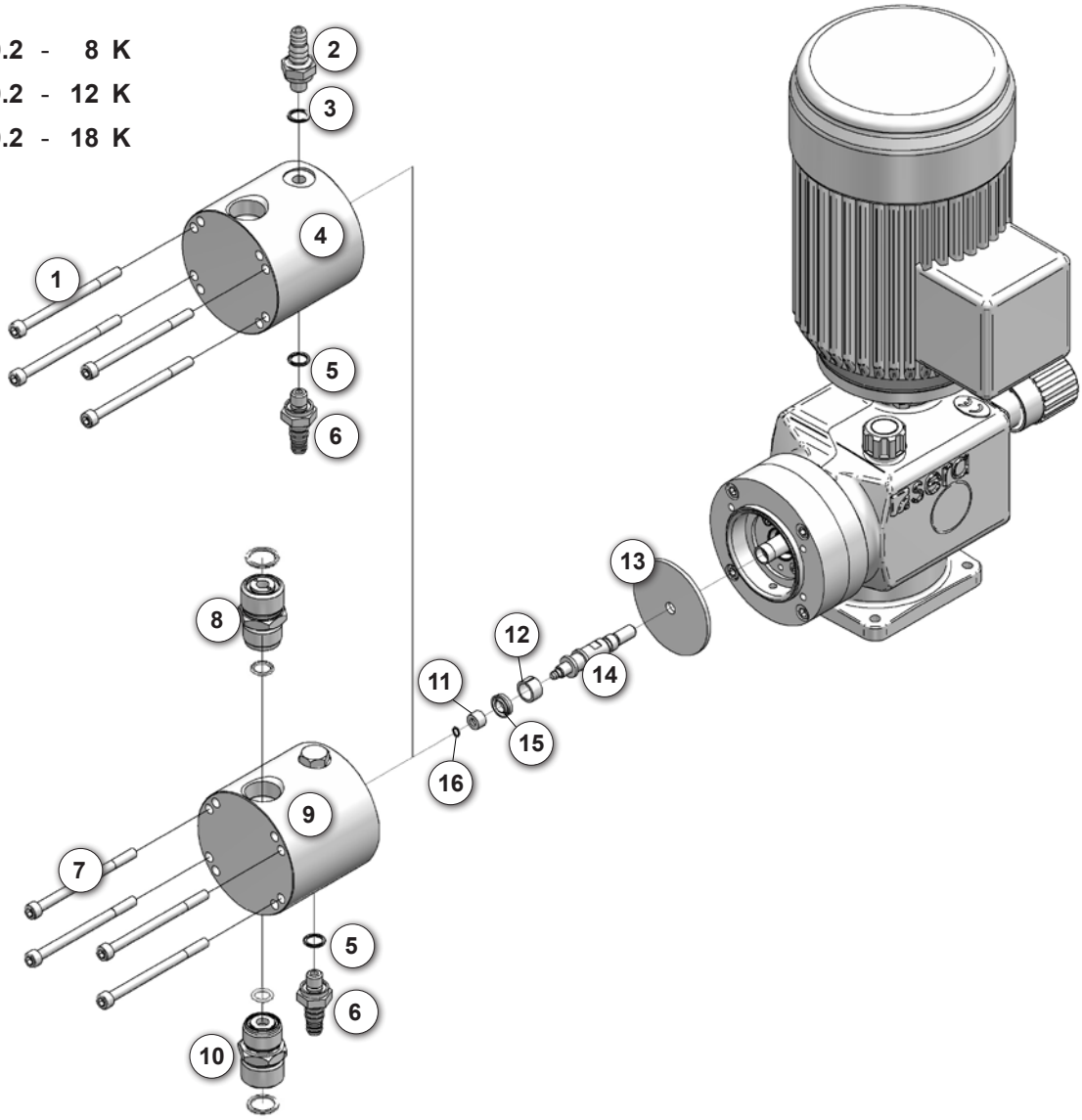
12.2 Spare parts

The following parts are considered as spare parts of the pump:

- Pump body

12.3 Spare and wearing parts

...409.2 - 8 K
...409.2 - 12 K
...409.2 - 18 K



Suction valve (kit)	
Pos.	*consisting of*
10	Suction valve (incl. o-rings)

Pressure valve (kit)	
Pos.	*consisting of*
8	Pressure valve (incl. o-rings)

Pump body kit	
Pos.	*consisting of*
7	Screw(s)
9	Pump body

Pump body kit with rinsing connection (option)	
Pos.	*consisting of*
1	Screw(s)
4	Pump body

Piston kit	
Pos.	*consisting of*
16	Locking ring
11	Support ring
15	Piston seal
12	Piston guide ring
14	Piston
13	Protective diaphragm

Leaking connection kit	
Pos.	*consisting of*
5	O-ring
6	Leaking nozzle

Rinsing connection kit (option)	
Pos.	*consisting of*
3	O-ring
2	Rinsing nozzle

13. Fault analysis and corrective action

sera products are proven technical products which are only shipped after an extensive final test in our works.
Should any malfunctions occur, these can be located and corrected easily with the help of the following reference guide.

Type of fault													Possible cause of problem	Rectifiying the problem
Great wear at piston seal	Pump does not prime	Pump does not deliver	Capacity not attained	Delivery pressure not reached	Capacity fluctuates	Capacity greater than specified	Motor does not start	Too much vibration in piping	Pump too noisy	Motor is overloaded	Damage to stroke mechanism / drive	Leaks at pumphead		
	■	■	■										Suction height too great.	Reduce suction height or suction resistance.
	■	■	■		■								Suction connection not tight.	Check pipe seals and tighten connections.
	■	■					■					■	Closed shut-off valve in pipe.	Open shut-off valves resp. check opening status ► dismount pump and check on poss. damages replace damaged parts
	■	■	■										No liquid in dsing tank.	Fill supply tank.
	■	■	■	■	■								Pump valves leaking.	Remove and clean pump valves.
	■	■		■	■								Pump valves (valve seats) damaged.	Remove pump valves ► check replace if necessary.
	■	■											Valves wrongly mounted or valve ball missing.	Check against sectional drawing to ensure correct assembly. Replace or refit faulty parts.
	■	■											Filter in suction pipe clogged.	Clean suction filter.
							■			■			Electrical data of the drive motor do not comply with the network.	Check order data. Check electrical installation. Adjust motor to the network on site.
			■	■	■		■	■	■	■		■	Delivery pressure too high.	Check pressure directly above pressure valve with manometer and compare order data resp. with perm. counterpressure.
	■	■	■	■	■								Foreign bodies in valves.	Remove pump valves and clean.
					■	■							Delivery on suction side is greater than pressure at the end of delivery line.	Check geodesic conditions and insert float valve or pressure retaining valve.
			■	■	■	■	■	■	■	■	■	■	Velocity too high owing to geometry of pipework.	With a pressure gauge check the velocity on the suction and pressure side of the pump. Compare with order data. If necessary fit pulsation damper.

	Type of fault												Possible cause of problem	Rectifiying the problem
Great wear at piston seal	Pump does not prime	Pump does not deliver	Capacity not attained	Delivery pressure not reached	Capacity fluctuates	Capacity greater than specified	Motor does not start	Too much vibration in piping	Pump too noisy	Motor is overloaded	Damage to stroke mechanism / drive	Leaks at pumphead		
												■	Contact materials not resistant and unsuitable.	Check medium against original order and quote. If necessary select different wetted parts.
	■		■	■	■								Viscosity too high.	Check viscosity and compare with order confirmation. If necessary reduce concentration and/or raise temperature.
		■	■		■								Medium gasses off in suction line.	Check geodesic conditions (pipework layout). Increase suction pressure and/or reduce temperature of medium.
	■												Air in suction pipe whilst pressure is present in delivery line.	Ventilate pressure side.
	■	■	■	■	■							■	Pipe connection leaking.	Retighten connections according to the type of material. Take care with plastic parts and do not fracture.
	■	■	■									■	Temperature too low.	Check flowability of the dosing medium. Temperature of the medium may not be lower than –10°C.
	■	■					■				■	■	Medium frozen in pipe.	Dismount pump from system and check for damages ► raise temperature.
	■	■	■									■	Piston seal defective.	Replace piston seal
■													No dry-running protection installed.	Provide for a dry-running protection.
■													Solid matters in medium.	Install line strainer.

14. Shut-down

- Switch off piston diaphragm pump.
- Rinse pump head and remove pumped medium; make sure that the rinsing agent is suitable for pumped medium and pump head.

15. Disposal

- Shut-down system. Please see “Shut-down“.

15.1 Dismantling and transport

- Shut-down system. Please see “Shut-down“.
- Remove all fluid residues from pump body, clean thoroughly, neutralize and decontaminate.
- Package unit and ship.

NOTE!

A clearance certificate must be filled in when systems are returned to the manufacturer (see Chapter 16).

Acceptance will be rejected if this clearance certificate is not attached.

WARNING!

The consignor is responsible for leaking lubricants or fluids!

15.2 Complete disposal

- Remove all fluid residues from unit.
- Drain off lubricants and dispose of according to regulations!
- Dismount materials and send them to a suitable waste disposal company!

WARNING!

The consignor is responsible for leaking lubricants or fluids!

16. Clearance Certificate

NOTE!

Inspection / repair of machines and machine parts is only carried out after the opposite clearance certificate was filled in correctly and completely by authorized and qualified personnel.

NOTE!

Acceptance will be refused if parts are returned to the manufacturer without a proper clearance certificate.

All industrial companies are obligated by the legal provisions for occupational health, e.g. the workplaces ordinances, the Ordinance on Hazardous Substances, the regulations for prevention of accidents and the environmental protection regulations such as the Waste Management Act and the German Household Water Act to protect their employees or man and the environment from detrimental effects when handling hazardous substances.

Should special safety precautions be necessary despite careful draining and cleaning of the product the necessary information are to be provided.

Machines which are operated with radioactive media shall only be inspected and/or repaired in the safety area of the owner by a sera specialized fitter.

The clearance certificate is part of the inspection-/repair order.
sera reserves the right to refuse acceptance of the order for other reasons.

NOTE!

Please make a copy and leave the original with the operating instructions!
(can also be downloaded from: www.sera-web.com)

Clearance Certificate

Product

Type _____ Serial-No. _____

the product was carefully emptied before shipping / delivery, and cleaned inside and outside. ☐ **YES**

Conveying medium

Designation _____ Concentration _____ %

Properties

Please tick!

If either of the listed properties, then enclose the appropriate safety and handling instructions.

☐ Harmless

☐ Toxic ☐ Corrosive ☐ Flammable ☐ Oxidising ☐ Unhealthy

☐ Explosive ☐ Dangerous for the environment ☐ Irritant ☐ Bio-hazardous ☐ Radioactive

The product was used with health or water-polluting substances and came up with labeling requirements and pollution prone media in contact. ☐ **YES** ☐ **NO**

Special security arrangements with respect to health or water-hazardous media are in the further handling ☐ **not required** ☐ **required**

The following safety precautions regarding rinsing, residual liquids and waste disposal are required:

Process data

The product was used with the following operating conditions described conveying medium:

Temperature _____ °C Pressure _____ bar

Sender

Company: _____ Telephone: _____

Contact person: _____ FAX: _____

Address: _____ E-mail: _____

Zip code, City: _____ Your order No: _____

We confirm that we have the information in this safety certificate (Clearance Certificate) have been correctly and completely and that the returned parts were carefully cleaned.

The parts are sent free of residues of dangerous amount.

Place, Date _____ Department _____ Signature (and company stamp) _____

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NOTE