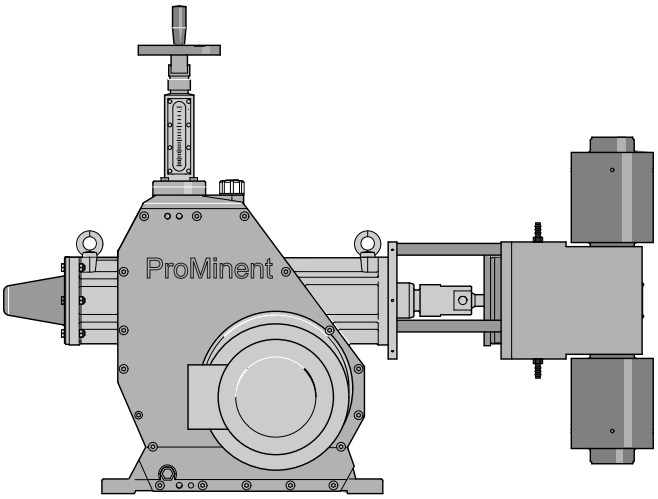
# Operating instructions

## Piston Metering Pump

## ProMinent® Makro/ 5 M5Ka




Two sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The product-specific operating instructions and the "General Operating Instructions for ProMinent® motor-driven metering pumps and hydraulic accessories".

Both sets of operating instructions are only valid when read together.

**Please carefully read these operating instructions before use! · Do not discard!**
**The operator shall be liable for any damage caused by installation or operating errors!**
**Technical changes reserved.**

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### Supplementary information

*Fig. 1: Please read!*

Read the following supplementary information in its entirety! Should you already know this information, you have an even greater need of the Operating Instructions.

The following are highlighted separately in the document:

- Enumerated lists

→ Instructions

⇨ Outcome of the handling instructions

- see (reference)

**Information**

*This provides important information relating to the correct operation of the device or is intended to make your work easier.*

**Safety notes**

Safety notes are identified by pictograms - see Safety Chapter.

### General user instructions

Two sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The product-specific operating instructions and the "General Operating Instructions for ProMinent® motor-driven metering pumps and hydraulic accessories".

Both sets of operating instructions are only valid when read together.

Please read these operating instructions carefully before use! Do not discard!

### State the identity code and serial number

Please state identity code and serial number, which you can find on the nameplate when you contact us or order spare parts. This enables the device type and material versions to be clearly identified.

### General non-discriminatory approach

In order to make it easier to read, this document uses the male form in grammatical structures but with an implied neutral sense. It is aimed equally at both men and women. We kindly ask female readers for their understanding in this simplification of the text.

# Table of contents

# 1 Identity code

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **M5Ka** | **Makro/ 5 piston metering pumps** | | | | | | | | | |
| | **Power end type** | | | | | | | | | |
| | H | Main power end | | | | | | | | |
| | D | Main power end, doubled | | | | | | | | |
| | A | Add-on power end | | | | | | | | |
| | B | Add-on power end doubled | | | | | | | | |
| | | **Type*** | | | | | | | | |
| | | 3200038 | 1400120 0500335 0250658 0121343 | | | | | | | |
| | | 3200048 | 1400151 0500419 0250822 0121678 | | | | | | | |
| | | 3200066 | 1400207 0500576 0251129 0122305 | | | | | | | |
| | | 3200085 | 1270267 0450744 0231458 0122977 | | | | | | | |
| | | 3200100 | 1000314 0350872 0181710 0103491 | | | | | | | |
| | | 2400070 | 0800214 0350483 0160970 0062269 | | | | | | | |
| | | 2400088 | 0800268 0350604 0161212 0062837 | | | | | | | |
| | | 2400121 | 0800368 0350829 0161665 0063896 | | | | | | | |
| | | 2160157 | 0700476 0301071 0162150 0065031 | | | | | | | |
| | | 1700184 | 0560558 0251257 0162522 0066000 | | | | | | | |
| | | | **Dosing head material** | | | | | | | |
| | | | SS | Stainless steel | | | | | | |
| | | | | **Seal material** | | | | | | |
| | | | | T | PTFE | | | | | |
| | | | | | **Displacement body material** | | | | | |
| | | | | | S | Stainless steel piston, chromium dioxide coated | | | | |
| | | | | | | **Dosing head version** | | | | |
| | | | | | | 0 | no valve spring | | | |
| | | | | | | 1 | With valve spring | | | |
| | | | | | | | **Hydraulic connector** | | | |
| | | | | | | | 0 | Standard connection | | |
| | | | | | | | 4 | Union nut and SS insert | | |
| | | | | | | | | **Version** | | |
| | | | | | | | | 0 | With ProMinent® logo, no frame | |
| | | | | | | | | 2 | Without ProMinent® logo, no frame | |
| | | | | | | | | A | With ProMinent® logo, with single frame | |
| | | | | | | | | B | With ProMinent® logo, with double frame | |
| | | | | | | | | C | With ProMinent® logo, with triple frame | |
| | | | | | | | | D | With ProMinent® logo, with quadruple frame | |
| | | | | | | | | M | Modified* | * order-related version, for pump features see order paperwork |
| | | | | | | | | | **Electric power supply** | |
| | | | | | | | | | S | 3 ph, 230 V/400 V 50/60 Hz (WBS) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **M5Ka** | **Makro/ 5 piston metering pumps** | | | | | | | | | | | | |
| | | | | | | | | | L | 3 ph, 460 V, 60 Hz, (Exe, Exd) | | | |
| | | | | | | | | | P | 3 ph, 230 V/400 V 50 Hz (Exe, Exd) | | | |
| | | | | | | | | | R | Variable speed motor 4 pole, 230/400 V (R 1:5) | | | |
| | | | | | | | | | N | 1 ph, 115 V, 60Hz | | | |
| | | | | | | | | | V(0) | Motor with integral Frequency converter | | | |
| | | | | | | | | | V(2) | Motor with integral frequency converter (Exd) | | | |
| | | | | | | | | | 5 | No motor, with gear IEC 100 | | | |
| | | | | | | | | | 6 | No motor, with gear IEC 112 | | | |
| | | | | | | | | | 0 | No motor, no gear | | | |
| | | | | | | | | | | **Motor version** | | | |
| | | | | | | | | | | 0 | IP 55 (Standard) ISO class F | | |
| | | | | | | | | | | 1 | Exe version ATEX-T3 | | |
| | | | | | | | | | | 2 | Exd version ATEX-T4 | | |
| | | | | | | | | | | A | Power end ATEX design | | |
| | | | | | | | | | | | **Stroke sensor** | | |
| | | | | | | | | | | | 0 | No stroke sensor | |
| | | | | | | | | | | | 1 | Stroke sensor (Namur), intrinsically safe | |
| | | | | | | | | | | | | **Stroke length adjustment** | |
| | | | | | | | | | | | | 0 | Stroke length adjustment, manual |
| | | | | | | | | | | | | 3 | Control drive 230 V 0-20 mA |
| | | | | | | | | | | | | 4 | Control drive 230 V 4-20 mA |
| | | | | | | | | | | | | 5 | Control drive 115 V 0-20 mA |
| | | | | | | | | | | | | 6 | Control drive 115 V 4-20 mAz |
| | | | | | | | | | | | | | **Applications** |
| | | | | | | | | | | | | | 0 standard |

* Figure 1 - 3=back pressure [bar]; figure 4 - 7=flow rate [l/h]

# 2 About this pump

**All pumps**

The ProMinent® Makro/ 5 piston metering pump is fitted as standard with a 3 kW wide range AC motor. The stroke length can be adjusted between 0...50 mm. The spheroidal graphite housing can be combined with up to 10 liquid end sizes and 5 gear reduction ratios (integrated in the spur geared motor). The liquid ends are available in various material combinations which can be matched to the feed chemicals being metered.

**Externally mounted pumps**

The ProMinent® Makro/ 5 externally mounted metering pump can be combined with the Makro/ 5 main power end to form a double or multiple pump. A main power end can be combined with up to four add-on power ends. One power end can be used both as a single or a double head version.

**Double head version**

The double head versions are fitted with a second liquid end which operates in push-pull mode (Boxer principle).

# 3 Safety chapter

## Identification of safety notes

The following signal words are used in these operating instructions to denote different severities of danger:

| Signal word | Meaning |
|---|---|
| WARNING | Denotes a possibly dangerous situation. If this is disregarded, you are in a life-threatening situation and this can result in serious injuries. |
| CAUTION | Denotes a possibly dangerous situation. If this is disregarded, it could result in slight or minor injuries or material damage. |

## Warning signs denoting different types of danger

The following warning signs are used in these operating instructions to denote different types of danger:

| Warning signs | Type of danger |
|---|---|
|  | Warning – hand injuries. |
|  | Warning – high-voltage. |
|  | Warning – flammable substances. |
|  | Warning – hot surface. |
|  | Warning – danger zone. |

## Correct and proper use

- The pump may only be used to meter liquid metering chemicals.
- In potentially explosive atmospheres in zone 1, device category II 2G of explosion group II C, the pump must only be operated according to the with the relevant nameplate (and the respective EC Declaration of Conformity) for pumps for potentially explosive atmospheres complying with Directive 94/9/EC in accordance with the European guidelines. The explosion group, category and degree of protection identified on the marking must correspond with or be better than the given conditions in the intended field of application.
- The pump may only be started up after it has been correctly installed and commissioned in accordance with the technical data and specifications contained in the operating instructions.
- The general limitations with regard to viscosity limits, chemical resistance and density must be observed - see also ProMinent resistance list (In the product catalogue or at *www.prominent.com*)!
- Any other uses or modifications are prohibited.
- Pumps without the relevant nameplate (and the respective EC Declaration of Conformity) for pumps for potentially explosive atmospheres must never be operated in potentially explosive atmospheres.

- The pump is not intended for the metering of gaseous media or solids.
- The pump is not intended for unprotected outside use.
- The pumps is not intended for the dosing of combustible fluids.
- The pump should only be operated by trained and authorised personnel, see also *'Qualification of personnel' on page 9*.
- You are obliged to observe the information contained in the operating instructions at the different phases of the device's service life.

In hazardous locations only the following combinations of identity code variants is permitted:

| Combi-nations | Identity code specification | values |
|---|---|---|
| 1 | Electric power supply | L, P |
| | Motor version | 1,2, V(2) |
| | Stroke length adjustment | 0, G, H |
| | | |
| 2 | Electric power supply | 0, 5.6 |
| | Motor version | A |
| | Stroke length adjustment | 0, G, H |

## Qualification of personnel

| Activity | Qualification level |
|---|---|
| Storage, transport, unpacking | Instructed person |
| Assembly, installation of hydraulic system | Technical personnel, service |
| Installation, electrical | Electrical technician |
| Operation | Instructed person |
| Maintenance, repair | Technical personnel, service |
| Decommissioning, disposal | Technical personnel, service |
| Troubleshooting | Technical personnel, electrical technician, instructed person, service |

**Explanation of the terms:**

**Technical personnel**

A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognise possible dangers based on his/her technical training, knowledge and experience, as well as knowledge of pertinent regulations.

Note:

A qualification of equal validity to a technical qualification can also gained by several years employment in the relevant work area.

**Electrical technician**

Electrical technicians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible dangers independently based on their technical training and experience, as well as knowledge of pertinent standards and regulations.

Electrical technicians should be specifically trained for the working environment in which the are employed and know the relevant standards and regulations.

Electrical technicians must comply with the provisions of the applicable statutory directives on accident prevention.

**Instructed person**

An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.

**Service**

Customer Service department refers to service technicians, who have received proven training and have been authorised by ProMinent or ProMaqua to work on the system.

## Safety notes

**WARNING!**

**Warning of dangerous or unknown feed chemical**

Should a dangerous or unknown feed chemical be used: It may escape from the hydraulic components when working on the pump.

- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Observe the safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

**WARNING!**

**Danger from hazardous substances!**

Possible consequence: Fatal or very serious injuries.

Please ensure when handling hazardous substances that you have read the latest safety data sheets provided by the manufacture of the hazardous substance. The actions required are described in the safety data sheet. Check the safety data sheet regularly and replace, if necessary, as the hazard potential of a substance can be re-evaluated at any time based on new findings.

The system operator is responsible for ensuring that these safety data sheets are available and that they are kept up to date, as well as for producing an associated hazard assessment for the workstations affected.

**CAUTION!**

**Warning of feed chemical spraying around**

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

CAUTION!

**Warning of feed chemical spraying around**

An unsuitable feed chemical can damage the parts of the pump contacted by the chemical.

– Take into account the resistance of the materials which will come into contact with the chemical when selecting the feed chemical - see the ProMinent product catalogue or under *www.prominent.com*.

CAUTION!

**Danger of personnel injury and material damage**

The use of untested third party parts can result in personnel injuries and material damage.

– Only fit parts to metering pumps, which have been tested and recommended by ProMinent.

CAUTION!

**Danger from incorrectly operated or inadequately maintained pumps**

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

– Ensure that the pump is accessible at all times.
– Adhere to the maintenance intervals.

CAUTION!

**Warning of illegal operation**

Observe the regulations that apply where the unit is to be installed.

## Information in the event of an emergency

In the event of an electrical accident, disconnect the mains cable from the mains or press the emergency cut-off switch fitted on the side of the system!

If feed chemical escapes, also depressurise the hydraulic system around the pump as necessary. Adhere to the safety data sheet for the feed chemical.

## Protective equipment

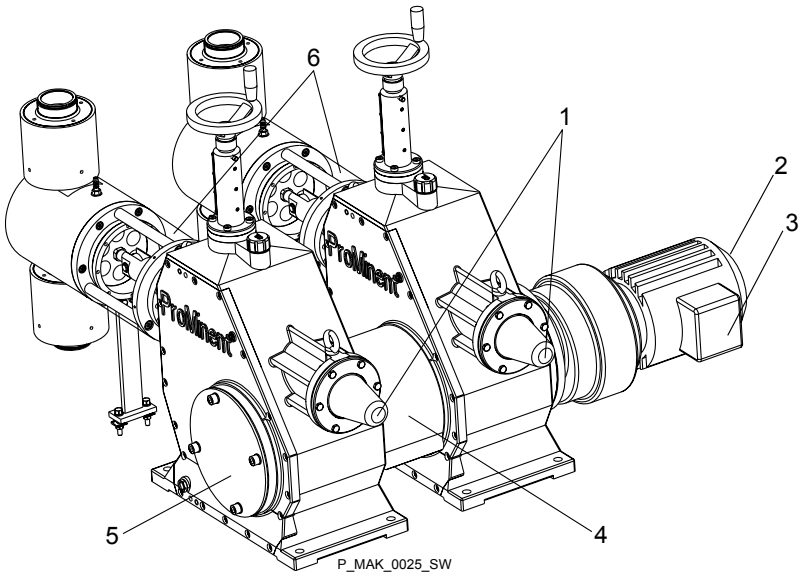


*Fig. 2: Isolating protective equipment Makro/ 5 with add-on power end (shown here for piston version)*

1 Cap (only single head version)
2 Fan impeller hood
3 Terminal box cover, motor
4 Cover plate (only with add-on power end)
5 Flange cover
6 Protective cover (only diaphragm and piston versions)

**WARNING!**

**Warning of personal injury and material damage**

– The customer must only remove the protective equipment if requested to do so by the operating instructions.
– The pump must not operate without fitted protective equipment.

## Sound pressure level

Sound pressure level LpA < 75 dB in accordance with EN ISO 20361:2010-10

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

# 4 Storage, transport and unpacking

## Safety notes

**WARNING!**

The transporting of pumps which have been used with radioactive feed chemicals is forbidden!

They will also not be accepted by ProMinent!

**WARNING!**

Only return metering pumps for repair in a cleaned state and with a flushed liquid end - refer to the section on decommissioning!

Only send metering pumps with a filled in Decontamination Declaration form. The Decontamination Declaration constitutes an integral part of an inspection / repair order. A unit can only be inspected or repaired when a Declaration of Decontamination Form is submitted that has been completed correctly and in full by an authorised and qualified person on behalf of the pump operator.

You can find the "Decontamination Declaration" form under *www.prominent.com* or on the CD.

**CAUTION!**

**Danger of environmental and material damage**

The unit can be damaged or oil may escape due to incorrect or improper storage or transportation!

- The unit should only be stored or transported in a well packaged state - preferably in its original packaging.
- Only transport the unit with the locking screw - not the bleed plug - fitted to the oil filling opening.
- The packaged unit should also only be stored or transported in accordance with the stipulated storage conditions.
- The packaged unit should be protected from moisture and the ingress of chemicals.

## Scope of supply

Compare the delivery note with the scope of supply:

- Metering pump with mains power cable
- Connector kit for tube/pipe connection
- Product-specific operating instructions with EC Declaration of Conformity
- CD with order information, exploded diagrams, performance diagrams, motor data sheet and dimension sheets
- Optional accessories if ordered

## Storage

Personnel: ■ Technical personnel

1. Place the caps on the valves.
2. Check whether the seal screw is screwed into oil filler opening instead of the vent screw.
3. Preferably place the pump standing vertically on a pallet and secure against falling over.
4. Cover the pump with a tarpaulin cover - allowing rear ventilation.

Store the pump in a dry, sealed place in the following ambient conditions.

### Ambient conditions

| Data | Value | Unit |
|---|---|---|
| Minimum storage and transport temperature | -10 | °C |
| Maximum storage and transport temperature | +50 | °C |
| Maximum air humidity * | 95 | % rel. humidity |

* non-condensing

# 5 Overview of equipment, control elements

**Power end, single head**

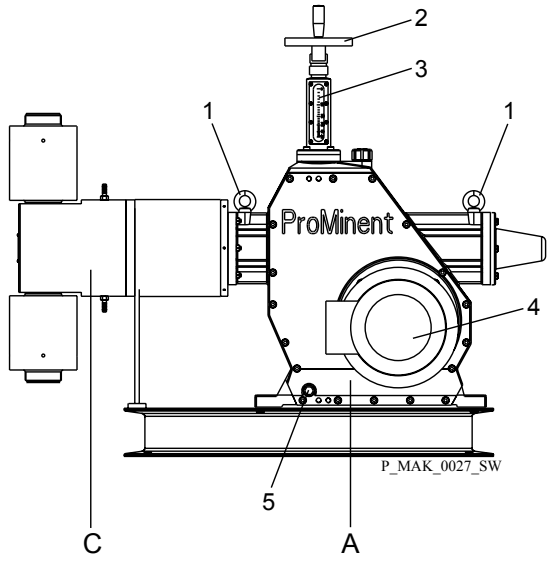


*Fig. 3: View from the motor side (here M5Ka H)*

A Power end
C Liquid end
1 Lifting eye
2 Stroke length adjustment wheel
3 Indicating dial
4 motor
5 Oil drain plug

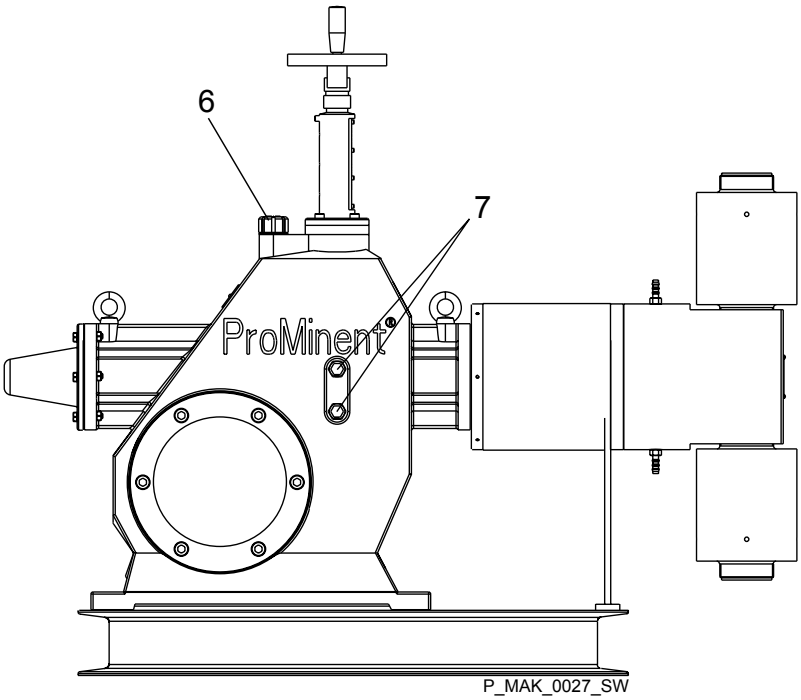


*Fig. 4: View away from the motor (here M5Ka H)*

6 Vent screw
7 Oil inspection window

### Power end, double head

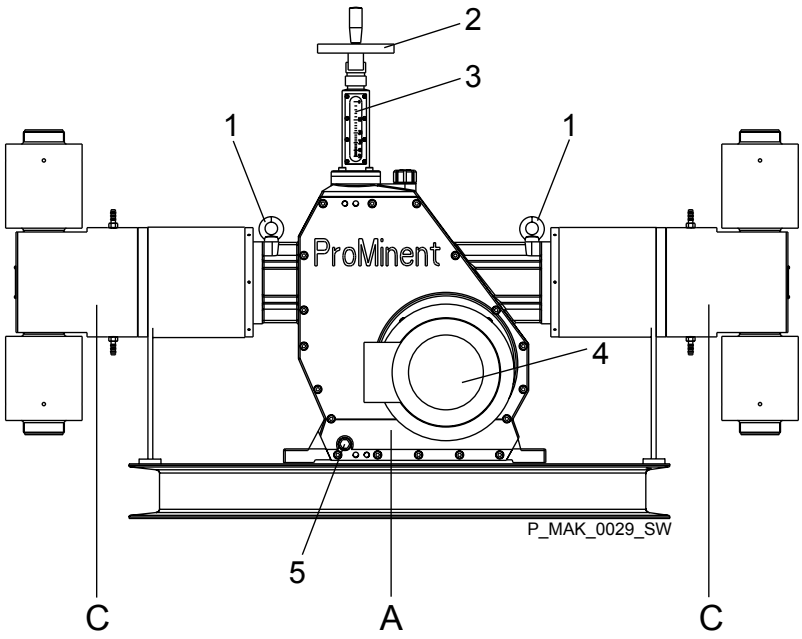


*Fig. 5: View from the motor side (here M5Ka D)*

A Power end
C Liquid end
1 Lifting eye
2 Stroke length adjustment wheel
3 Indicating dial
4 motor
5 Oil drain plug

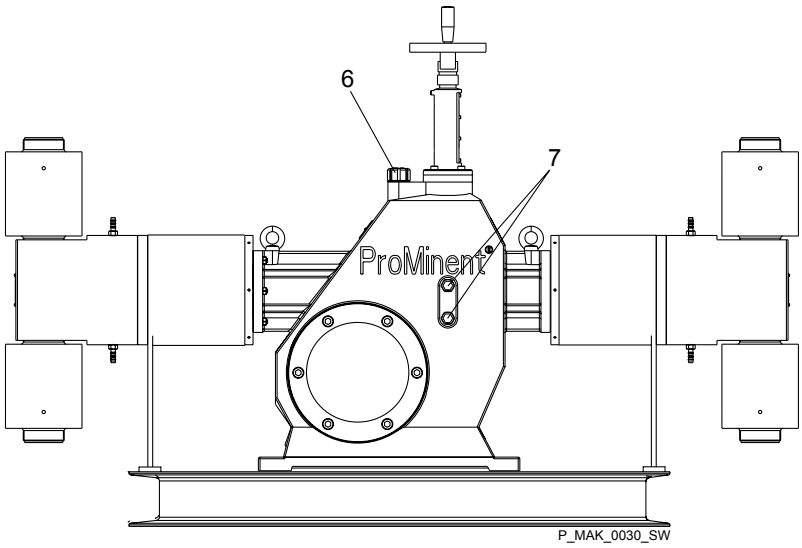


*Fig. 6: View away from the motor (here M5Ka D)*

6 Vent screw
7 Oil inspection window

## Liquid end

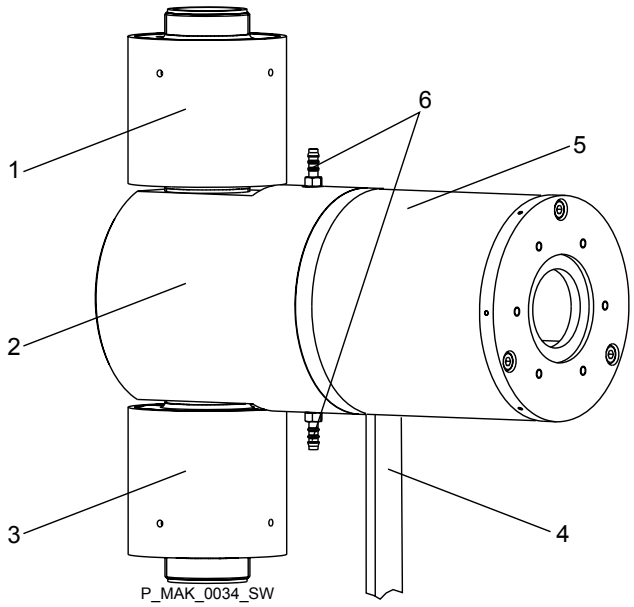


*Fig. 7*

1 Discharge valve
2 Dosing head
3 Suction valve
4 Support bracket
5 Protective cover
6 Tube nozzles for leakage/flushing connector

# 6 Functional description

## Power end functional description

The Makro/ 5 metering pump is a motor-driven metering pump with a kinematic gear.

A motor drives the cam shaft (1). A connecting rod (2) rests on the cam shaft (1) which allows the oscillating crank (4) to rotate about a variable pivot point, see Fig. 8. The lifting arm of the oscillating crank, which lies above the pivot point, moves the slide rod (8) which itself drives the liquid end.

The stroke is adjusted using the manual adjustment wheel (7). This causes a spindle (6) to move the fork (5; shown in cutaway view in the diagram). The fork (5) moves the sliding block (3) in a groove cut into the oscillating crank (4). The sliding block (3) determines the pivot point of the oscillating crank (4). This determines the stroke length. When the pivot point of the sliding block (3) is directly above the axle of the slide rod (8) the lifting arm of the oscillating crank above the pivot point is at zero and the slide rod stops. When the sliding block (3) is pushed down, the lifting arm of the oscillating crank (4) above the pivot point is greater than zero so that the slide rod (8) is driven

Liquid ends can be fitted to both ends of the slide rod. They then operate in push-pull mode (Boxer principle).

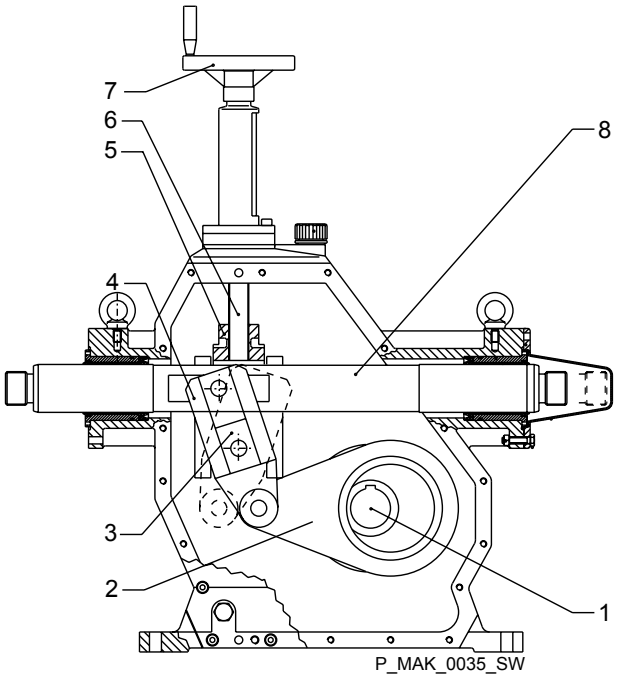


*Fig. 8: Cross-section through the power end*

1 Cam shaft
2 Connecting rod
3 Sliding block
4 Oscillating crank
5 Fork
6 Spindle
7 Manual adjustment wheel
8 Slide rod

## Functional description of the piston liquid end (for M5Ka)

The heart of the liquid end is a highly resistant piston (2) made from coated stainless steel. The suction valve (5) closes as soon as the piston (2) is moved in to the dosing head and the feed chemical flows through the discharge valve (1) out of the dosing head. The discharge valve (1) closes as soon as the piston moves in the opposite direction due to the vacuum pressure in the dosing head and fresh feed chemical flows through the suction valve (5) into the dosing head. The flushing collar (3) can be used to flush the sealing surfaces of the piston or lead-off leakage liquid.

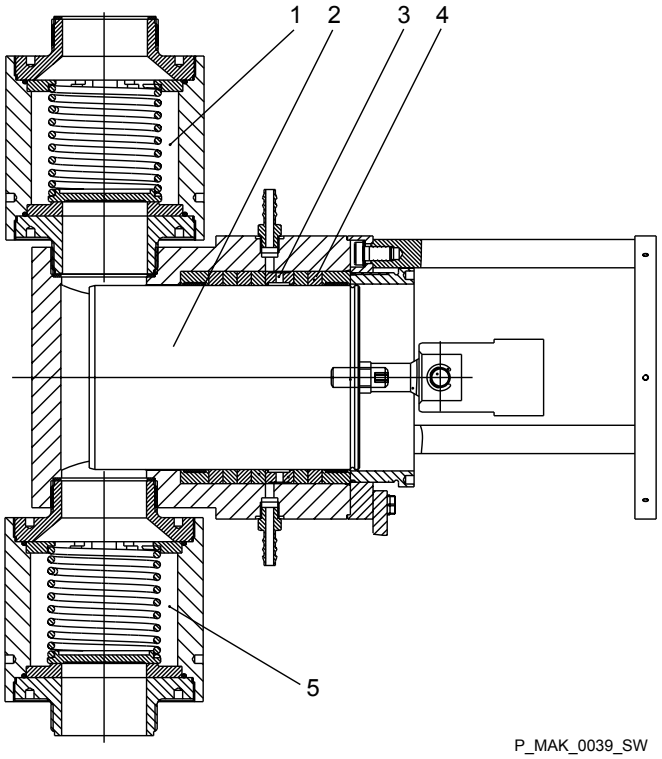


*Fig. 9: Cross-section through the liquid end*

1 Discharge valve
2 Piston
3 Flushing collar
4 Packing collar
5 Suction valve

# 7 Assembly

## Safety notes

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**CAUTION!**

**Warning about personal and material damage**

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

**CAUTION!**

**Danger of environmental and material damage**

The unit can be damaged or oil may escape due to incorrect or improper storage or transportation!

– The unit should only be stored or transported in a well packaged state - preferably in its original packaging.
– Only transport the unit with the locking screw - not the bleed plug - fitted to the oil filling opening.
– The packaged unit should also only be stored or transported in accordance with the stipulated storage conditions.
– The packaged unit should be protected from moisture and the ingress of chemicals.

**CAUTION!**

**Warning about personal and material damage**

Personal and material damage may be caused if the unit is operated outside of the permissible ambient conditions.

– Please observe the permissible ambient conditions - refer to the chapter entitled "Technical Data".

## Supporting floor

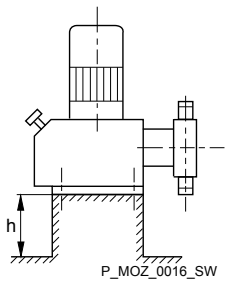


*Fig. 10*

**WARNING!**

**Risk of electric shock**

If water or other electrically conducting liquids penetrate into the drive housing, an electric shock may occur.

– Position the pump so that drive housing cannot be flooded.

**WARNING!**

**The pump can break through the supporting floor or slide off it**

– The supporting floor must be horizontal, smooth and permanently load-bearing.

***Capacity too low***

*Vibrations can disturb the valves of the liquid end.*

– *The supporting floor must not vibrate.*

## Space requirement

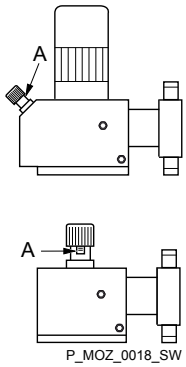


*Fig. 11*

**CAUTION!**

**Danger from incorrectly operated or inadequately maintained pumps**

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

– Ensure that the pump is accessible at all times.
– Adhere to the maintenance intervals.

Position the pump so that control elements such as the stroke length adjustment knob, the indicating dial A or the oil inspection window are accessible.

In so doing, ensure there is enough space to carry out an oil change (vent screws, oil drain plugs, oil trough ...).

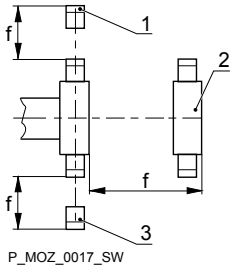


*Fig. 12*

1 Discharge valve
2 Dosing head
3 Suction valve

Ensure there is sufficient free space (f) around the dosing head as well as the suction and discharge valve so that maintenance and repair work can be carried out on these components.

## Liquid end alignment

***Capacity too low***

*If the valves of the liquid end do not stand upright, they cannot close correctly.*

– *The discharge valve must be upright.*

## Fastening

***Capacity too low***

*Vibrations can disturb the valves of the liquid end.*

– *Secure the metering pump so that no vibrations can occur.*

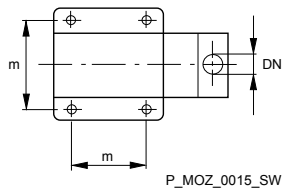


*Fig. 13*

Take the dimensions (m) for the fastening holes from the appropriate dimensional drawings or data sheets.

Fasten the pump base to the supporting floor using suitable screws.

**Instruction**

→ Screw the pump to a support surface with 4 sufficiently strong screws through the 4 holes in the frame.

Nothing more need be fitted to the pump itself: the pump is filled with gear oil and completely assembled on a frame.

# 8 Installation

**CAUTION!**

**Danger of personnel injury and material damage**

The disregard of technical data during installation may lead to personal injuries or damage to property.

– Observe the technical data- refer to chapter "Technical Data" and, where applicable, the operating instructions of the accessories.

## 8.1 Installation, hydraulic

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**WARNING!**

**Warning of feed chemical reactions to water**

Feed chemicals that should not come into contact with water may react to residual water in the liquid end that may originate from works testing.

– Blow the liquid end dry with compressed air through the suction connector.
– Then flush the liquid end with a suitable medium through the suction connector.

**WARNING!**

The following measures are an advantage when working with highly aggressive or hazardous feed chemicals:

– Install a bleed valve with recirculation in the storage tank.
– Install an additional shut-off valve on the discharge or suction ends.

**CAUTION!**

**Warning about personal and material damage**

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

**CAUTION!**

**Suction problems possible**

For feed chemicals with a particle size greater than 0.3 mm, the valves may no longer close properly.

– Install a suitable filter in the suction line.

**CAUTION!**

**Warning against the discharge line bursting**

With a closed discharge line (e.g. due to a clogged discharge line or by closing a valve), the pressure that the metering pump generates can reach several times the permissible pressure of the system or the metering pump. This could lead to lines bursting resulting in dangerous consequences with aggressive or toxic feed chemicals.

– Install a relief valve that limits the pressure of the pump to the maximum permissible operating pressure of the system.

**CAUTION!**

**Warning against the discharge line bursting**

Tube lines with insufficient pressure rating may burst.

– Only use tube lines with the required pressure rating.

**CAUTION!**

**Warning against lines disconnecting**

With suction, discharge and relief lines installed incorrectly can loosen / disconnect from the pump connection.

– Only use original tubing with the specified tube diameter and wall thickness.
– Only use clamp rings and tube nozzles that correspond with the respective hose diameter.
– Always connect the lines without mechanical tension.

– *Precise metering is only possible when the back pressure is maintained above 1 bar at all times.*
– *If metering at atmospheric pressure, a back pressure valve should be used to create a back pressure of approx. 1.5 bar.*

Personnel: ■ Technical personnel

**Route the leakage liquid drainage line**

The leakage liquid is drained off via the flushing collar and a tube nozzle, without other parts of the liquid end coming into contact with the medium.

1. Connect a tube to the lower tube nozzle.
2. Route the tube into a collection device for the leakage liquid.

## 8.2 Installation, electrical

**WARNING!**

**Danger of electric shock**

Unprofessional installation may lead to electric shocks.

– All cable cores cut to length must be provided with cable end sleeves.
– The Installation, electrical of the device may only be undertaken by technically trained personnel.

**WARNING!**

**Danger of electric shock**

In the event of an electrical accident, it must be possible to quickly disconnect the pump, and any electrical ancillaries which may possibly be present, from the mains.

– Install an emergency cut-off switch in the mains supply line to the pump and any electrical ancillaries which may be present or
– Integrate the pump and electrical ancillaries which may be present in the emergency cut-off management of the system and inform personnel of the isolating option.

**WARNING!**

**Danger of electric shock**

This pump is equipped with a protective earth conductor, to reduce the risk arising from an electric shock.

– Connect the PE conductor to "earth" with a clean and permanent electrical connection.

**WARNING!**

**Danger of electric shock**

A mains voltage may exist inside the pump housing.

– If the pump housing has been damaged, you must disconnect it from the mains immediately. It may only be returned to service after an authorised repair.

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**CAUTION!**

**Warning about personal and material damage**

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

Personnel: ■ Electrician

What requires electrical installation?

- motor
- External fan (option)
- Stroke control drive (Option)
- Stroke adjusting drive (Option)
- Stroke sensor (Option)
- Frequency converter (option)

## motor

**CAUTION!**

**Pump can be damaged**

The pump can be damaged if the motor drives the pump in the wrong direction.

– When connecting the motor, pay attention to the correct direction of rotation indicated by the arrow on the fan cover, as shown in Fig. 14.

**CAUTION!**

**The motor may be damaged**

The motor is not equipped with a fuse.

– Install a suitable motor protection switch.

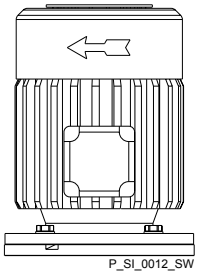


*Fig. 14: Direction of rotation of motor*

1. Use a suitable cable between the motor terminal box and power supply.
2. Install an emergency cut-off switch or include the motor in the emergency cut-off management of the system.

– *Key motor data can be found on the unit nameplate.*
– *Motor data sheets can be requested for more information.*
– *The terminal wiring diagram is located in the terminal box.*
– *Notes on the speed controlled motor with external fan and temperature monitoring can be found in the "General operating instructions for ProMinent® motor-driven metering pumps and hydraulic accessories"!*

*The external fan requires an independent mains connection.*

### Stroke sensor (Option)

→ Connect the stroke sensor to a suitable monitoring device according to the details in the chapter "Technical Data". Also observe its technical data.

### Other units

→ Install the other units according to their documentation.

# 9 Start up

## Safety notes

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**WARNING!**

**Hot surface**

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

**CAUTION!**

**Possible environmental and material damage**

The screw plug in the oil filler neck is factory-fitted and, during operation, prevents any pressure equalisation between the power end housing and the surroundings. This ensure that oil can be pushed from the power end housing.

– Replace the screw plug on the oil filler neck by the air vent plug supplied.
– Retain the sealing plug for subsequent transport of the unit.

**CAUTION!**

**Single head version only: Oil may escape**

The screw plug in the oil filler neck is factory-fitted and, during operation, prevents any pressure equalisation between the power end housing and the surroundings. This ensure that oil can be pushed from the power end housing.

– Ensure that the hole in the metal cap on the drive flange is always clear - see "Overview of equipment, control elements".

**CAUTION!**

**Warning about personal and material damage**

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

**CAUTION!**

**Liquid end may be damaged**

– For feed chemicals with a particle size greater than 0.3 mm, always fit a filter in the suction line

**Installing a vent screw**

Replace the sealing screw at the oil filler neck with the supplied vent screw - see chapter "Overview of equipment and control elements".

**Checking the oil level**

When the pump is idle, check whether the pump oil level slightly covers the lower oil inspection window.

This indicates that the pump has not lost oil and consequently been damaged.

**Checking the direction of rotation**

When commissioning the unit, check whether the drive motor is rotating correctly - check this against the arrow on the motor housing or the diagram in the chapter entitled "Electrical Installation."

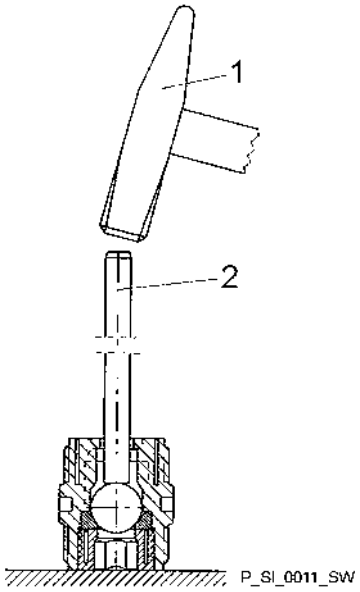


*Fig. 15: Tapping the valve set disc*

***Eliminating suction problems (only for single ball valves with PTFE ball seat)***

*For suction problems occurring during start up:*

- *Exclude the possibility that there are foreign bodies in the valve.*
- *Place the valve on a stable surface.*
- *Using a hammer (1) and a brass bar (2), gently tap the PTFE ball seat above the valve ball - see figure below.*
- *Then with the valve in a damp condition allow it to prime.*

**Adjusting the stroke length**

*Only adjust the stroke length when the pump is running. This is easier and also better for the pump.*

Correctly adjusting the pump:

- Select as large a stroke length as possible for viscous feed chemicals.
- Select as large a stroke length as possible for outgassing feed chemicals.
- Select as high a stroke rate as possible for good mixing.
- For precise metering using quantity-proportional metering, do not set the stroke length to less than 30 %.

**Checking the leakage**

Check whether the leakage for the feed chemical used is between 10 and 120 drops /min.

**The pump can now be released for operation.**

# 10 During use

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**WARNING!**

**Personnel injury and material damage may occur**

During use all units, protective equipment, additional devices must be fitted, operational and tightly closed.

**WARNING!**

**Hot surface**

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

**WARNING!**

**Sparking caused by dry running**

If the bearings in the power end run dry, sparks can be formed.

– Check for oil leaks.
– When the pump is idle, the pump oil level must slightly cover the lower oil inspection window.

*Observe the instructions in the "Start up" chapter and the operating instructions for the other machine components.*

# 11 Maintenance

## Safety notes

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**WARNING!**

It is mandatory that you read the safety information and specifications in the "Storage, Transport and Unpacking" chapter prior to shipping the pump.

**WARNING!**

**Hot surface**

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

**WARNING!**

**Warning of hazardous or unknown feed chemical**

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

**WARNING!**

**Risk of fingers being crushed**

Under unfavourable conditions, the stroke axle or displacement body can cause crushing of the fingers.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.

**WARNING!**

**Risk of injury from the fan impeller**

The fan impeller beneath motor's fan cowling can cause severe injuries while it is turning.

– The pump must only be connected to the mains voltage with the fan cowling closed.

**CAUTION!**

**Warning of feed chemical spraying around**

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

## Maintenance work

*Under heavy loading (e.g. continuous operation) shorter maintenance intervals are recommended than those given.*

*Keep a spare parts kit in stock ready for maintenance work.*

*Order numbers are contained on the CD.*

| Interval | Maintenance work |
|---|---|
| Quarterly* | EX pumps only: For special maintenance work see chapter "Important supplements for metering pumps in hazardous locations" of the "General Operating Instructions for ProMinent® motor-driven metering pumps and hydraulic accessories" |
| | Check the starting torque torques for the dosing head flange screws (1) (24 Nm) and the turret flange screws (2) (19 Nm). |
| | Check that the discharge valve and suction valve are correctly seated. |
| | Check the correct seating and state of the metering lines at both discharge and suction ends. |
| | Check the tightness of the entire liquid end - particularly around the leakage hole! |
| | Check the oil level. |
| | Single head versions only: Check that the hole in the metal cap on the drive flange is clear - see the figure in the "Safety Chapter". |
| | Check that the electrical connections are intact |
| | Check whether the pump is transporting media correctly - run briefly at high power. Observe the maximum permissible operating pressure! |
| | Check whether the leakage level is OK: 10 ... 120 drops / min. |

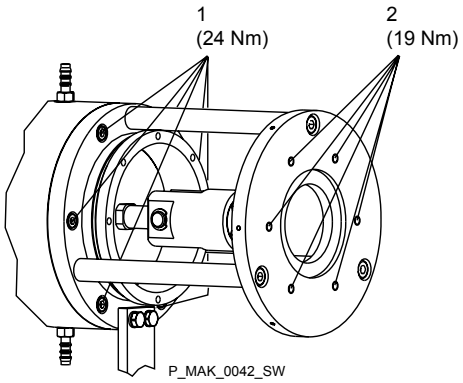


*Fig. 16: Liquid end torques*

1 Dosing head screws
2 Turret flange screws

| Interval | Maintenance work |
|---|---|
| After approx. 5,000 operating hours | Change the gear oil. |

* Under normal loading (approx. 30 % of continuous operation)

Under heavy loading (e.g. continuous operation): Shorter intervals.

## Changing the gear oil

**WARNING!**
**Risk of burns due to hot gear oil**
The gear oil may become very hot when the pump is heavily loaded

– When draining oil, avoid contact with the oil running out.

### Gear oil

| Gear oil | Supplied quantity | Part no. |
|---|---|---|
| Mobilgear 634 VG 460 | 20.0 l | 1006284 |

### Gear oil filling volumes

| Types | Volume, approx. |
|---|---|
| All | 16.5 l |

### Draining the gear oil:

1. Remove the vent screw (1).
2. Place an oil trough under the oil drain plug (2). Expected oil quantity - see filling volumes, above.
3. Unscrew the oil drain plug (2) out of the power end housing.
4. Allow the gear oil to run out of the power end.
5. Screw in the oil drain plug (2) with a new seal.

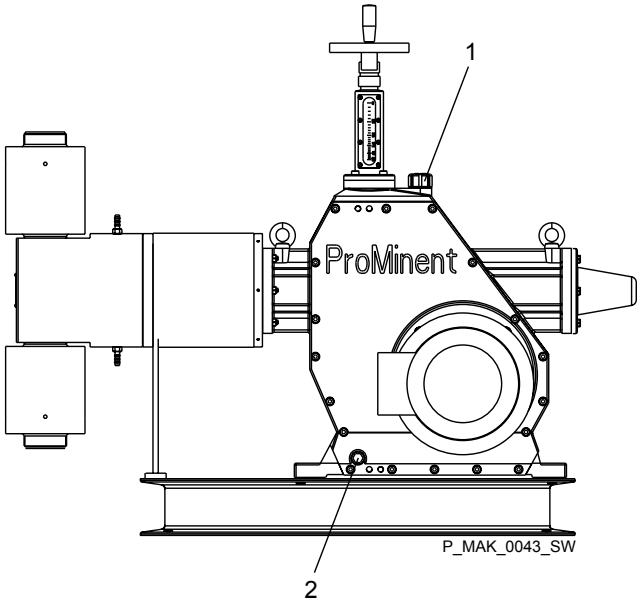


*Fig. 17: Oil change 1*

1 Vent screw
2 Oil drain plug

**Filling with gear oil:**

1. Start the pump.
2. Slowly pour gear oil through the vent screw (1) opening until the upper oil inspection window (3) is slightly covered.
3. Allow the pump to run for a further 1... 2 minutes.
4. Replace the vent screw (1).

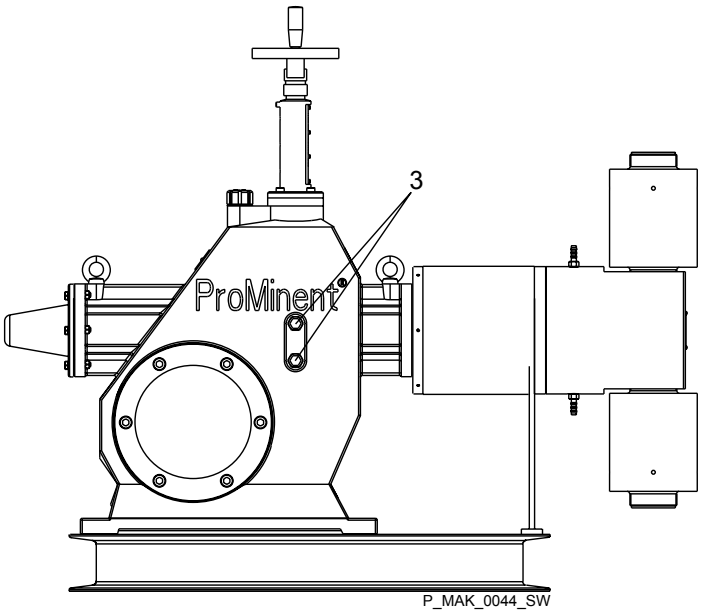


*Fig. 18: Oil change 2*

3 Oil inspection windows

# 12 Repairs

## Safety notes

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**WARNING!**

It is mandatory that you read the safety information and specifications in the "Storage, Transport and Unpacking" chapter prior to shipping the pump.

**WARNING!**

**Hot surface**

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

**WARNING!**

**Warning of hazardous or unknown feed chemical**

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

**WARNING!**

**Risk of fingers being crushed**

Under unfavourable conditions, the stroke axle or displacement body can cause crushing of the fingers.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.

**WARNING!**

**Risk of injury from the fan impeller**

The fan impeller beneath motor's fan cowling can cause severe injuries while it is turning.

– The pump must only be connected to the mains voltage with the fan cowling closed.

**CAUTION!**

**Warning of feed chemical spraying around**

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

## 12.1 Changing the piston

**WARNING!**

Observe the safety notes at the beginning of the chapter.

### Removing the liquid end

1. Flush the suction line, discharge lines and liquid end (activate flushing equipment or immerse suction lance in a suitable medium and pump for a while (consider the effect of the medium on your system first!)) or proceed, as described below.
2. Set the stroke length to 0 % stroke with the pump running.
3. Switch off the pump.
4. Secure the pump to prevent it being switched back on.
5. If the liquid end has not been flushed according to the above processes, then protect yourself against the feed chemical - protective clothing, safety glasses, ... .

   After dismantling immediately place parts that have been wetting with the medium in a trough with a suitable medium for flushing, in dangerous media were used flush and rinse thoroughly.
6. Unscrew the hydraulic connectors on the discharge and suction side.
7. Remove the protective cover (4) from the turret - see Fig. 19.
8. Remove a safety collar (2) from the bolt at the swivel head and pull out the bolt (1)
9. Place a sling around the liquid end and suspend from a crane.

   **WARNING!**

   **Heavy parts may fall**

   - A helper must steady the liquid end by hand.
   - Secure the piston to prevent it falling out.
10. If available: Remove the leakage or flushing tubes from the tube nozzles (6).
11. If available: Unscrew the support bracket (5) from the liquid end.
12. Remove the securing screws (3) from the turret flange
13. Remove the liquid end and place onto a solid, even surface

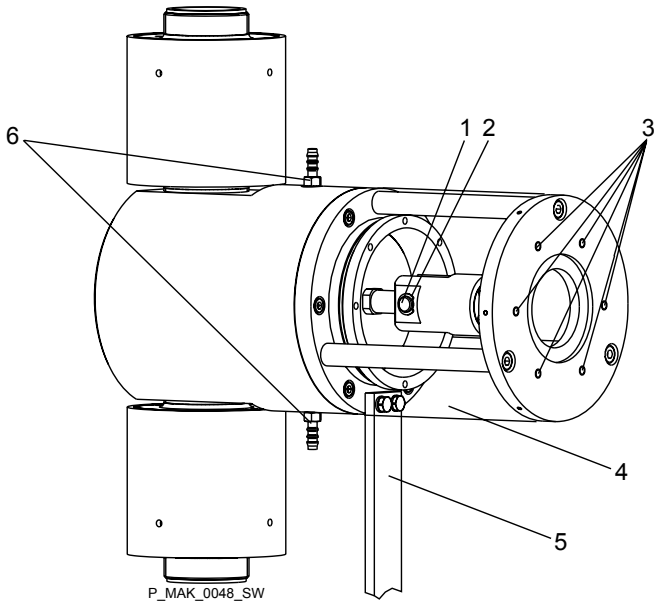


*Fig. 19: View of the liquid end*

1 Bolt
2 Safety collar
3 Securing screws
4 Protective cover
5 Support bracket (option)
6 Tube nozzles for leakage/flushing connector

## Repairing the liquid end

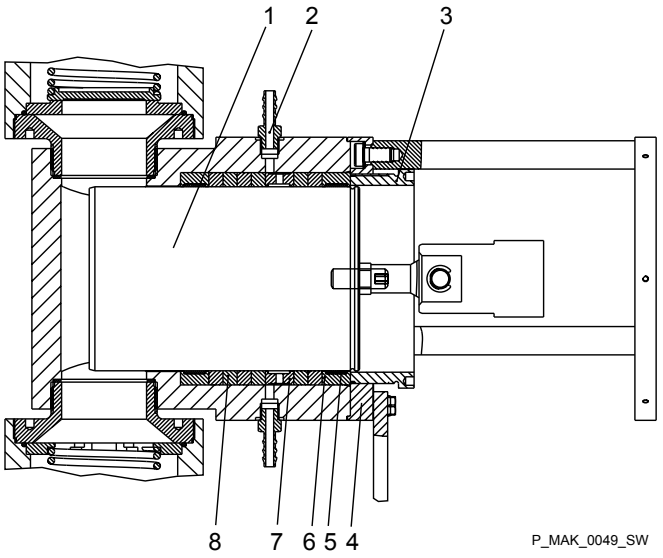


*Fig. 20: Cross-section through the liquid end*

1 Piston
2 Tube nozzle
3 Tensioning screw
4 Dosing head flange
5 Guide bands
6 Guide sleeves
7 Flushing collar
8 Packing collars

1. Loosen the tensioning screw (3) using the face spanner and remove - see Fig. 20.
2. Loosen the dosing head flange (4) screws and remove the dosing head flange.

3. Remove the piston (1)

*Now record the sequence of parts as your remove them ready for the reassembly.*

5. Remove the guide sleeves (6) and guide bands (5), the packing collars (8) and flushing collar (7).
6. Thoroughly clean the sealing area
7. Clean the piston (1), the guide sleeves (6) and the flushing collar (7)
8. Dispose of the packing collars and guide bands
9. Insert the piston (1)

Now reassemble the parts using a reverse sequence of steps:

1. Have new packing collars ready.

**CAUTION!**
**The piston may be damaged**
– Never push the packing collars on with a sharp object.

2. Evenly push in the guide sleeve (6) with a new guide band and a packing collar.
3. Insert the other packing collars with the cut ends alternately rotated through 180°.
4. Sequentially insert the flushing collar (7), two further packing collars and the guide sleeve (6) with a new guide band into the sealing area
5. Place the dosing head flange (4) on the liquid end and tighten.

| | |
|---|---|
| Tightening torque | 24 Nm |

**CAUTION!**
**The piston may be damaged**
– Only lightly tighten the tensioning screw.

6. Position the tensioning screw and only hand-tighten.

### Fitting the liquid end

1. Place a sling around the liquid end and suspend from a crane.

**WARNING!**
**Heavy parts may fall**
– A helper must steady the liquid end by hand.
– Secure the piston to prevent it falling out.

2. Place the liquid end on the drive flange and secure using the retaining screws.

| | |
|---|---|
| Tightening torque | 19 Nm |

### Positioning the liquid end

1. Align the holes of the swivel head and fork head - see Fig. 20.
2. Push the bolt through the holes and insert the safety collar in the bolt.
3. Clamp the protective cover over the turret.
4. If available: Screw the support bracket onto the liquid end.
5. If available: Fit the leakage or flushing tubes on to the tube nozzles.

### Installing of packing collars

***Correct pressure of the tensioning screw***

*Packing collars should limit, not prevent, the escaping of feed chemical. Leakage is necessary to reduce the friction and dissipate the resulting friction heat.*

*In Fig. 21 the feed chemical presses from the left through the packing collar a (drop on the right!). The tensioning screw A presses on the packing collar from the right.*

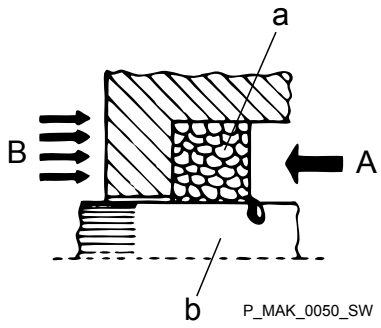


*Fig. 21: Correct pressure of the tensioning screw*

a Packing collar
b Piston
A Tensioning screw pressure
B Feed chemical pressure

Allow the pump to run for the first 10 ... 15 min with this leakage rate:

| | |
|---|---|
| Leakage in the first 10 ... 15 min | 50 ... 200 drops / min |

Then:

1. Stop the pump.
2. Remove the protective cover.
3. Carefully tighten the tensioning screw.
4. Clamp the protective cover over the turret.
5. Start the pump.
6. Check the leakage.

Repeat steps 1. – 6. until minimum leakage is achieved:

| | |
|---|---|
| Minimum leakage | 10 ... 120 drops / min |

*The minimum leakage is dependent on the feed chemical, the feed chemical pressure, the temperature and the piston speed.*

**CAUTION!**

**The piston may be damaged**

If the tensioning screw pressure is too high, dry running can occur and then damage to the piston and the packing collars.

– Do not overtighten the tensioning screw.

***The result of too high tensioning screw pressure***

*The feed chemical can no longer press though the packing collars - liquid lubrication is prevented. The piston runs dry. As a result the packing collars are scorched/burnt and the piston damaged. Leakage increases greatly.*

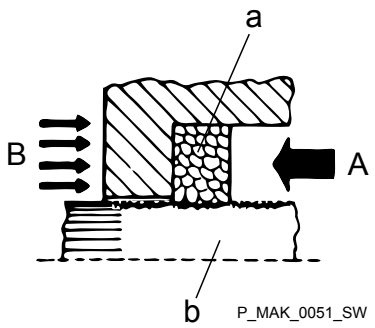


*Fig. 22: The result of too high tensioning screw pressure*

a Packing collar
b Piston
A Tensioning screw pressure
B Feed chemical pressure

## 12.2 Valve repair

*Unsuitable spare parts for the valves may lead to problems for the pumps.*

– *Only use new components that are especially adapted to fit your valve (both in terms of shape and chemical resistance).*
– *Use the correct spare part kits. In case of doubt, refer to the exploded views and ordering information contained in the "Supplementary information CD for ProMinent® pump operating instructions".*

*Clean the discharge and suction valves only one after another as they cannot be differentiated using the arrow markings.*

## 12.2.1 Double ball valves

### Cleaning a discharge valve

#### Taking the discharge valve apart

1. Unscrew the discharge valve from the dosing head and rinse out.
2. Dismantle the discharge valve.
3. Rinse and clean all parts.
4. Replace the worn parts and seals.

#### Assembling the discharge valve

*When assembling, take note of the orientation of the valve seats (3). The valve seats (3) are used as a ball seat on the fine machined side and as a ball cage and spring guide on the other side. The fine machined side must point in the flow direction with all valve seats.*

*When assembling the valves, take note of the sequence:*

*Teflon – Metal – Teflon – Metal - ...*

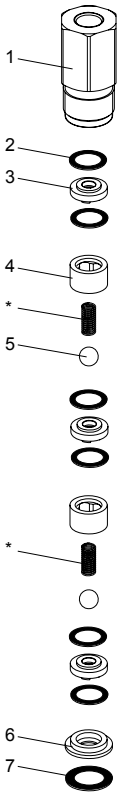


*Fig. 23: Discharge valve (double ball valve).*

1. Slide into the valve body (1) one after another:
   - one seal (2) and one valve seat (3) - correct!
   - one seal (2) and one valve bushing (4)
   - (If fitted: one spring (*) into the spring guide of the valve seat (3)
   - one ball (5) into the valve body (1)
   - one seal (2) and the second valve seat (3, correct!)
   - one seal (2) and the second valve bushing (4)
   - (If fitted: the second spring (*) into the spring guide of the valve seat (3))
   - the second ball (5) into the valve body (1)
   - one seal (2), the third valve seat (3) - (correct!) and a further seal (2)
2. Position the insert disc (6) with the flare on the packing.

   *The distance between the edge of the valve body and the insert disk (6) is due to the construction.*

3. Place the larger seal (7) between the insert disk (6) and the dosing head.
4. Screw in the valve until the stop.

### Cleaning a suction valve

A suction valve is dismantled, cleaned and assembled in the same way as a discharge valve.

*Please note, however, that when assembling, the valve seat (3) must be aligned in the other direction. The fine machined side must point in the flow direction with all valve seats (3).*

## 12.2.2 Single ball valves

1. Screw the valve cap (5) on to the suction side - see .
2. Carefully remove the parts from the valve body (2).
3. Replace the worn parts.
4. Clean the remaining parts.
5. Check all parts.
6. If available: Place the compression spring inside the valve body (2).
7. Insert the valve ball (3 and the valve seat (4).
8. Screw on the valve cap (5).

*Pay attention to the flow direction of the discharge and suction connectors when fitting the valve.*

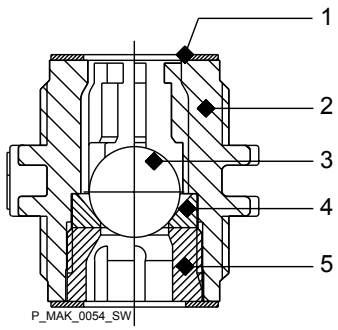


*Fig. 24: Cross-section through the single ball valve*

1 Seal
2 Valve body
3 Valve ball
4 Valve seat
5 Valve cap

## 12.2.3 Plate valves

*Do not scratch the finely machined sealing surfaces on the valve plates (5) and valve inserts (6).*

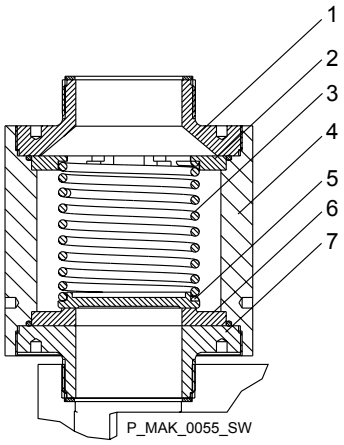


*Fig. 25: Section through a plate valve (DN65 shown)*

1 Valve cap II (only DN 65)
2 Perforated disc (only DN 65)
3 Compression spring
4 Valve body
5 Valve plate
6 Valve insert
7 Valve cap

1. Screw the valve cap (7) on to the suction side - see .
2. Carefully remove the parts from the valve body (4).
3. Replace the worn parts.
4. Clean the remaining parts.
5. Check all parts.
6. Only DN 65: Insert the perforated disc (2) in the valve body (4).
7. Place the compression spring (3) inside the valve body (4).

*Position the compression spring with the end (see figure: arrow N, at the bottom) as shown on one of the lugs in the valve body.*

*Otherwise the valve plate may knock when in operation.*

8. Insert the valve plate (5) and the valve insert (6).
9. Screw on the valve cap (7).

*Pay attention to the flow direction of the discharge and suction connectors when fitting the valve.*

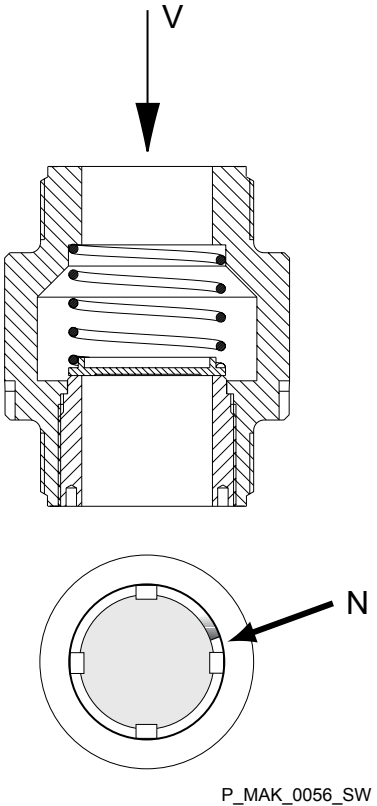


*Fig. 26: Inserting the compression spring*

# 13 Troubleshooting

## Safety notes

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**WARNING!**

**Fire danger**

Only with combustible media: These may start to burn when combined with oxygen.

– When filling and draining the liquid end, the feed chemical must not come into contact with oxygen.

**WARNING!**

**Hot surface**

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

**WARNING!**

**Danger of an electric shock**

Personnel working on electrical parts can be electrocuted if all electrical lines carrying current have not been disconnected.

– Disconnect the supply cable before working on the motor and prevent it from being reconnected accidentally.
– Any separately driven fans, servo motors, speed controllers or diaphragm rupture sensors fitted should also be disconnected.
– Check that the supply cables are de-energised.

**WARNING!**

**Warning of hazardous or unknown feed chemical**

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

**WARNING!**

**Risk of injury from the fan impeller**

The fan impeller beneath motor's fan cowling can cause severe injuries while it is turning.

– The pump must only be connected to the mains voltage with the fan cowling closed.

**CAUTION!**

**Warning of feed chemical spraying around**

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

**Tasks**

| Fault description | Cause | Remedy | Personnel |
|---|---|---|---|
| Pump does not prime in spite of full stroke motion and bleeding | The valves are dirty or worn. | Repair the valves - see chapter entitled "Repair". | Technical personnel |
| Pump does not reach high pressure rates. | The valves are dirty or worn. | Repair the valves - see chapter entitled "Repair". | Technical personnel |
| | The feed chemical has particles larger than 3 mm. | Install a suitable filter in the suction line. | Technical personnel |
| | The motor is wired incorrectly. | 1. Check the mains voltage and mains frequency.<br>2. Wire the motor correctly. | Electrician |
| | The mains voltage has failed. | Eliminate the cause. | Electrician |
| The diaphragm rupture warning system generates an alarm. | | | |
| No hydraulic oil flows through the tube at the bleed valve | - - - - | Immediately switch off the pump and inform customer service. | |
| The power end motor is very hot. | The discharge line is seriously constricted. | ■ Rectify any constriction of the discharge line.<br>■ Have the safety relief valve checked. | Technical personnel |
| All other faults. | Other causes. | Call ProMinent® or ProMaqua® service. | |

# 14 Decommissioning and disposal

## 14.1 Decommissioning

**WARNING!**

**Warning about personal and material damage**

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

**WARNING!**

**Danger of an electric shock**

When working on the motor or electrical auxiliary equipment, there is a danger of an electric shock.

– Before working on the motor, take note of the safety instructions in its operating instructions!
– Should external fans, servomotors or other auxiliary equipment be installed, these should also be disconnected and checked that they are voltage free.

**WARNING!**

**Danger from chemical residues**

There is normally chemical residue in the liquid end and on the housing after operation. This chemical residue could be hazardous to people.

– It is mandatory that the safety note relating to the "Storage, Transport and Unpacking" chapter is read before shipping or transporting the unit.
– Thoroughly clean the liquid end and the housing of chemicals and dirt. Adhere to the safety data sheet for the feed chemical.

**WARNING!**

**Warning of hazardous or unknown feed chemical**

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

**CAUTION!**

**Warning of feed chemical spraying around**

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

**WARNING!**

**Hot oil and hot components**

The hydraulic oil and the hydraulic end may become very hot when the pump is exposed to heavy loading.

– Allow the pump to cool before starting work.

**CAUTION!**

**Danger of damage to the device**

The device can be damaged by incorrect and improper storage or transportation.

– Take into account the information in the "Storage, Transport and Unpacking" chapter if the system is decommissioned for a temporary period.

## Final decommissioning

Personnel: ■ Technical personnel

1. Disconnect the pump from the mains power supply.
2. Depressurise and bleed the hydraulic system around the pump.
3. Flush the liquid end with a suitable medium - Observe the safety data sheet! Flush the dosing head thoroughly when using hazardous feed chemicals!
4. Drain the gear oil - refer to the chapter entitled "Maintenance".
5. Thoroughly clean the liquid end and the housing of chemicals and dirt.
6. Possible additional work - see chapter "Storage, Transport and Unpacking".

## Temporary decommissioning

In addition:

1. Place the caps on the valves.
2. Push the caps into place on the tube nozzles.
3. Preferably place the pump on a pallet.
4. Cover the pump with a tarpaulin cover - allowing rear ventilation!
5. Store the pump is a dry, sealed place under storage conditions according to the chapter "Storage, Transport and Unpacking".

## 14.2 Disposal

Personnel: ■ Technical personnel

**CAUTION!**

**Environmental hazard due to gear oil**

The pump contains gear oil, which can cause damage to the environment.

– Drain the gear oil from the pump.
– Note the local guidelines currently applicable in your country!

**CAUTION!**

Note the local guidelines generally currently applicable in your country!

# 15 Technical data

**Only for "M - modified" version:**

**WARNING!**

**Risk of personal injuries**

Please observe the ”Supplement for modified version“ at the end of the chapter!

It replaces and supplements the technical data!

## 15.1 Performance data

**Main pumps with motor 1500 rpm under 50 Hz operation**

| Type | Minimum pump capacity at maximum back pressure | | | Maximum stroke rate | Suction lift | Connector size | Shipping weight* | Piston Ø |
|---|---|---|---|---|---|---|---|---|
| | bar | l/h | ml/stroke | Strokes/min | m WS | G-DN | kg | mm |
| 3200038 | 320 | 38 | 11.3 | 60 | 3 | Rp 1/4- 8 | 300 | 17 |
| 3200048 | 320 | 48 | 11.3 | 75 | 3 | Rp 1/4- 8 | 300 | 17 |
| 3200066 | 320 | 66 | 11.3 | 103 | 3 | Rp 1/4- 8 | 300 | 17 |
| 3200085 | 320 | 85 | 11.3 | 133 | 3 | Rp 3/4- 10 | 300 | 17 |
| 3200100 | 320 | 100 | 11.3 | 156 | 3 | Rp 3/4- 10 | 300 | 17 |
| 2400070 | 240 | 70 | 20.7 | 60 | 3 | Rp 3/4- 10 | 300 | 23 |
| 2400088 | 240 | 88 | 20.7 | 75 | 3 | Rp 3/4- 10 | 300 | 23 |
| 2400121 | 240 | 121 | 20.7 | 103 | 3 | 1- 15 | 300 | 23 |
| 2160157 | 216 | 157 | 20.7 | 133 | 3 | 1- 15 | 300 | 23 |
| 1700184 | 170 | 184 | 20.7 | 156 | 3 | 1- 15 | 300 | 23 |
| 1400120 | 140 | 120 | 35.3 | 60 | 3 | 1- 15 | 302 | 30 |
| 1400151 | 140 | 151 | 35.3 | 75 | 3 | 1- 15 | 302 | 30 |
| 1400207 | 140 | 207 | 35.3 | 103 | 3 | 1- 15 | 302 | 30 |
| 1270267 | 127 | 267 | 35.3 | 133 | 3 | 1 1/4- 20 | 302 | 30 |
| 1000314 | 100 | 314 | 35.3 | 156 | 3 | 1 1/4- 20 | 302 | 30 |
| 800214 | 80 | 214 | 62.8 | 60 | 3 | 1 1/4- 20 | 303 | 40 |
| 800268 | 80 | 268 | 62.8 | 75 | 3 | 1 1/4- 20 | 303 | 40 |
| 800368 | 80 | 368 | 62.8 | 103 | 3 | 1 1/4- 20 | 303 | 40 |
| 700476 | 70 | 476 | 62.8 | 133 | 3 | 1 1/2- 25 | 303 | 40 |
| 560558 | 56 | 558 | 62.8 | 156 | 3 | 1 1/2- 25 | 303 | 40 |
| 500335 | 50 | 335 | 98.1 | 60 | 3 | 1 1/2- 25 | 303 | 50 |
| 500419 | 50 | 419 | 98.1 | 75 | 3 | 1 1/2- 25 | 303 | 50 |
| 500576 | 50 | 576 | 98.1 | 103 | 3 | 1 1/2- 25 | 303 | 50 |
| 450744 | 45 | 744 | 98.1 | 133 | 3 | 2- 32 | 303 | 50 |
| 350872 | 35 | 872 | 98.1 | 156 | 3 | 2- 32 | 303 | 50 |
| 350483 | 35 | 483 | 141.3 | 60 | 3 | 1 1/2- 25 | 311 | 60 |
| 350604 | 35 | 604 | 141.3 | 75 | 3 | 1 1/2- 25 | 311 | 60 |
| 350829 | 35 | 829 | 141.3 | 103 | 3 | 2- 32 | 311 | 60 |
| 301071 | 30 | 1071 | 141.3 | 133 | 3 | 2- 32 | 311 | 60 |
| 251257 | 25 | 1257 | 141.3 | 156 | 3 | 2- 32 | 311 | 60 |
| 250658 | 25 | 658 | 192.4 | 60 | 3 | 2- 32 | 311 | 70 |
| 250822 | 25 | 822 | 192.4 | 75 | 3 | 2- 32 | 311 | 70 |
| 251129 | 25 | 1129 | 192.4 | 103 | 3 | 2- 32 | 311 | 70 |
| 231458 | 23 | 1458 | 192.4 | 133 | 3 | 2 1/4- 40 | 311 | 70 |
| 181710 | 18 | 1710 | 192.4 | 156 | 3 | 2 1/4- 40 | 311 | 70 |
| 160970 | 16 | 970 | 283.7 | 60 | 3 | 2 1/4- 40 | 317 | 85 |

| Type | Minimum pump capacity at maximum back pressure | | | Maximum stroke rate | Suction lift | Connector size | Shipping weight* | Piston Ø |
|---|---|---|---|---|---|---|---|---|
| | bar | l/h | ml/stroke | Strokes/min | m WS | G-DN | kg | mm |
| 161212 | 16 | 1212 | 283.7 | 75 | 3 | 2 1/4- 40 | 317 | 85 |
| 161665 | 16 | 1665 | 283.7 | 103 | 3 | 2 1/4- 40 | 317 | 85 |
| 162150 | 16 | 2150 | 283.7 | 133 | 3 | 2 3/4- 50 | 317 | 85 |
| 162522 | 16 | 2522 | 283.7 | 156 | 3 | 2 3/4- 50 | 317 | 85 |
| 121343 | 12 | 1343 | 392.6 | 60 | 3 | 2 3/4- 50 | 331 | 100 |
| 121678 | 12 | 1678 | 392.6 | 75 | 3 | 2 3/4- 50 | 331 | 100 |
| 122305 | 12 | 2305 | 392.6 | 103 | 3 | 2 3/4- 50 | 331 | 100 |
| 122977 | 12 | 2977 | 392.6 | 133 | 3 | 2 1/2- 65 | 331 | 100 |
| 103491 | 10 | 3491 | 392.6 | 156 | 3 | 2 1/2- 65 | 331 | 100 |
| 62269 | 6 | 2269 | 663.6 | 60 | 3 | 2 1/2- 65 | 350 | 130 |
| 62837 | 6 | 2837 | 663.6 | 75 | 3 | 2 1/2- 65 | 350 | 130 |
| 63896 | 6 | 3896 | 663.6 | 103 | 3 | 2 1/2- 65 | 350 | 130 |
| 65031 | 6 | 5031 | 663.6 | 133 | 3 | 2 1/2- 65 | 350 | 130 |
| 66000 | 6 | 6000 | 663.6 | 156 | 3 | 2 1/2- 65 | 350 | 130 |

*** Stainless steel material version Shipping weight 340 kg**

**The permissible priming pressure at the suction side is 2 m WS.**

**All figures refer to water at 20 °C.**

**The suction lift applies to filled suction line and filled liquid end - when installed correctly.**

**The priming lift of 2 m applies for clean and moistened valves and a clear outlet**

Main pumps with motor 1800 rpm under 60 Hz operation

| Type | Minimum pump capacity at maximum back pressure | | | Maximum stroke rate | Suction lift | Connector size | Shipping weight* | Piston Ø |
|---|---|---|---|---|---|---|---|---|
| | bar | l/h | ml/stroke | Strokes/min | m WS | G-DN | kg | mm |
| 3200038 | 4640 | 44 | 11 | 71 | 3 | Rp 1/4- 8 | 300 | 17 |
| 3200048 | 4640 | 56 | 14 | 89 | 3 | Rp 1/4- 8 | 300 | 17 |
| 3200066 | 4640 | 78 | 20 | 123 | 3 | Rp 1/4- 8 | 300 | 17 |
| 3200085 | 4640 | 101 | 26 | 159 | 3 | Rp 3/4- 10 | 300 | 17 |
| 3200100 | - | - | - | - | 3 | Rp 3/4- 10 | 300 | 17 |
| 2400070 | 3480 | 82 | 21 | 71 | 3 | Rp 3/4- 10 | 300 | 23 |
| 2400088 | 3480 | 104 | 27 | 89 | 3 | Rp 3/4- 10 | 300 | 23 |
| 2400121 | 3480 | 144 | 38 | 123 | 3 | 1- 15 | 300 | 23 |
| 2160157 | 3132 | 187 | 49 | 159 | 3 | 1- 15 | 300 | 23 |
| 1700184 | - | - | - | - | 3 | 1- 15 | 300 | 23 |
| 1400120 | 2030 | 142 | 37 | 71 | 3 | 1- 15 | 302 | 30 |
| 1400151 | 2030 | 179 | 47 | 89 | 3 | 1- 15 | 302 | 30 |
| 1400207 | 2030 | 247 | 65 | 123 | 3 | 1- 15 | 302 | 30 |
| 1270267 | 1841.5 | 319 | 84 | 159 | 3 | 1 1/4- 20 | 302 | 30 |
| 1000314 | - | - | - | - | 3 | 1 1/4- 20 | 302 | 30 |
| 800214 | 1160 | 253 | 67 | 71 | 3 | 1 1/4- 20 | 303 | 40 |
| 800268 | 1160 | 318 | 84 | 89 | 3 | 1 1/4- 20 | 303 | 40 |
| 800368 | 1160 | 439 | 116 | 123 | 3 | 1 1/4- 20 | 303 | 40 |
| 700476 | 1015 | 569 | 150 | 159 | 3 | 1 1/2- 25 | 303 | 40 |
| 560558 | - | - | - | - | 3 | 1 1/2- 25 | 303 | 40 |
| 500335 | 725 | 396 | 104 | 71 | 3 | 1 1/2- 25 | 303 | 50 |
| 500419 | 725 | 497 | 131 | 89 | 3 | 1 1/2- 25 | 303 | 50 |
| 500576 | 725 | 687 | 182 | 123 | 3 | 1 1/2- 25 | 303 | 50 |
| 450744 | 652.5 | 889 | 235 | 159 | 3 | 2- 32 | 303 | 50 |
| 350872 | - | - | - | - | 3 | 2- 32 | 303 | 50 |
| 350483 | 507.5 | 571 | 151 | 71 | 3 | 1 1/2- 25 | 311 | 60 |
| 350604 | 507.5 | 716 | 189 | 89 | 3 | 1 1/2- 25 | 311 | 60 |
| 350829 | 507.5 | 989 | 262 | 123 | 3 | 2- 32 | 311 | 60 |
| 301071 | 435 | 1280 | 339 | 159 | 3 | 2- 32 | 311 | 60 |
| 251257 | - | - | - | - | 3 | 2- 32 | 311 | 60 |
| 250658 | 362.5 | 778 | 206 | 71 | 3 | 2- 32 | 311 | 70 |
| 250822 | 362.5 | 975 | 258 | 89 | 3 | 2- 32 | 311 | 70 |
| 251129 | 362.5 | 1348 | 357 | 123 | 3 | 2- 32 | 311 | 70 |
| 231458 | 333.5 | 1743 | 461 | 159 | 3 | 2 1/4- 40 | 311 | 70 |
| 181710 | - | - | - | - | 3 | 2 1/4- 40 | 311 | 70 |
| 160970 | 232 | 1147 | 303 | 71 | 3 | 2 1/4- 40 | 317 | 85 |
| 161212 | 232 | 1438 | 381 | 89 | 3 | 2 1/4- 40 | 317 | 85 |

| Type | Minimum pump capacity at maximum back pressure | | | Maximum stroke rate | Suction lift | Connector size | Shipping weight* | Piston Ø |
|---|---|---|---|---|---|---|---|---|
| | bar | l/h | ml/stroke | Strokes/min | m WS | G-DN | kg | mm |
| 161665 | 232 | 1988 | 526 | 123 | 3 | 2 1/4- 40 | 317 | 85 |
| 162150 | 232 | 2570 | 681 | 159 | 3 | 2 3/4- 50 | 317 | 85 |
| 162522 | - | - | - | - | 3 | 2 3/4- 50 | 317 | 85 |
| 121343 | 174 | 1589 | 421 | 71 | 3 | 2 3/4- 50 | 331 | 100 |
| 121678 | 174 | 1991 | 527 | 89 | 3 | 2 3/4- 50 | 331 | 100 |
| 122305 | 174 | 2752 | 729 | 123 | 3 | 2 3/4- 50 | 331 | 100 |
| 122977 | 174 | 3558 | 942 | 159 | 3 | 2 1/2- 65 | 331 | 100 |
| 103491 | - | - | - | - | 3 | 2 1/2- 65 | 331 | 100 |
| 62269 | 87 | 2684 | 711 | 71 | 3 | 2 1/2- 65 | 350 | 130 |
| 62837 | 87 | 3366 | 891 | 89 | 3 | 2 1/2- 65 | 350 | 130 |
| 63896 | 87 | 4652 | 1232 | 123 | 3 | 2 1/2- 65 | 350 | 130 |
| 65031 | 87 | 6014 | 1593 | 159 | 3 | 2 1/2- 65 | 350 | 130 |
| 66000 | - | - | - | - | 3 | 2 1/2- 65 | 350 | 130 |

*** Stainless steel material version Shipping weight 340 kg**

**The permissible priming pressure at the suction side is 2 m WS.**

**All figures refer to water at 20 °C.**

**The suction lift applies to filled suction line and filled liquid end - when installed correctly.**

**The priming lift of 2 m applies for clean and moistened valves and a clear outlet**

## 15.2 Accuracy

### 15.2.1 Reproducibility

| Data | Value | Unit |
|---|---|---|
| Reproducibility | ±0.5 | % * |

* for measurements taken under constant conditions, minimum 10 % stroke rate and water at 20 °C - when installed correctly, p< 1 bar

### 15.2.2 Metering precision

| Data | Value | Unit |
|---|---|---|
| Metering precision | ±1 | % * |

* at maximum stroke length and maximum back pressure

## 15.3 Viscosity

The liquid ends are generally suitable for the following viscosity ranges:

| Version | Range | Unit |
|---|---|---|
| no valve springs | 0 ... 200 | mPas |
| with valve springs | 200 ... 500 | mPas |
| with appropriately laid out installation | 500 ... 1000 | mPas |
| with appropriately laid out installation and advice from ProMinent | > 1000 | mPas |

* Only when the installation is correctly adjusted

## 15.4 Wetted materials

| Pump type | Liquid end | Suction/discharge connector | Valve seat/seals | Valve balls | Piston |
|---|---|---|---|---|---|
| 50 HK ...DN 8-DN 10 | Stainless steel 1.4571//1.4404 | Stainless steel 1.4571//1.44041.4404 | SS/PTFE | Oxide ceramic | Stainless steel/ceramic |
| 50 HK ...DN 15-DN 25 | Stainless steel 1.4571//1.4404 | Stainless steel 1.4581 | PTFE/PTFE | Stainless steel 1.4401 | Stainless steel/ceramic |
| 50 HK ...DN 32-DN 65 | Stainless steel 1.4571//1.4404 | Stainless steel 1.4571//1.44041.4404 | PTFE | Hast. C | Stainless steel/ceramic (valve plate) |

## 15.5 Ambient conditions

### 15.5.1 Temperatures

**Pump, compl.**

| Data | Value | Unit |
|---|---|---|
| Storage and transport temperature | -10 ... +50 | °C |
| Ambient temperature in operation (drive + motor): | -10 ... +40 | °C |

**SST liquid end**

| Data | Value | Unit |
|---|---|---|
| Max. temperature long-term at max. operating pressure | 90 | °C |
| Max. temperature for 15 min at max. 2 bar | 150 | °C |
| Minimum temperature | -10 | °C |

### 15.5.2 Air humidity

| Data | Value | Unit |
|---|---|---|
| Maximum air humidity *: | 95 | % rel. humidity |

*non-condensing (according to DIN IEC 60068-2-30)

## 15.6 Housing degree of protection

| Data | Value |
|---|---|
| Protection against contact and humidity* | IP 55 |

*according to DIN VDE 470 (EN IEC 60529)

## 15.7 Stroke sensor (option), intrinsically safe

**Namur sensor (identity code specification "Stroke sensor": 1)**

*Install the sensor according to the chapter "Installation, electrical".*

**Namur sensor (Specified for EX zones)**

5–25 V DC, in accordance with Namur or DIN 19234, potential-free design.

| Data | Value | Unit |
|---|---|---|
| Rated voltage * | 8 | VDC |
| Power consumption - active surface uncovered | > 3 | mA |
| Power consumption - active surface covered | < 1 | mA |
| Rated switching distance | 1.5 | mm |

* Ri ~ 1 kΩ

| Cable colour | Polarity |
|---|---|
| blue | - |
| brown | + |

## 15.8 Filling volumes

### 15.8.1 Gear oil

**Gear oil**

| Gear oil | Supplied quantity | Part no. |
|---|---|---|
| Mobilgear 634 VG 460 | 20.0 l | 1006284 |

**Required amount of oil**

| Pump type | Oil change, compl. |
|---|---|
| All: | 16.5 l |

## 15.9 Sound pressure level

**Sound pressure level**

Sound pressure level LpA < 75 dB in accordance with EN ISO 20361:2010-10

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

## 15.10 Compatibility

The hydraulic accessories of the Makro/ 5 metering pump Hydro are compatible with the Sigma and Makro TZ piston pumps.

The connecting dimensions of valves and dosing heads are the same size but have different materials. (This does not apply with different diaphragm materials).

## 15.11 Supplement for modified versions

(With Identcode specification "Version": "M" - "modified")

**Technical data**

Technical data of pumps in the modified version can deviate from those of the standard pumps. They can be queried by stating the details of the serial number.

**motor**

The motor data sheets for the modified version are valid. They may deviate from the standard motor data sheets.

**Spare parts**

With a modified version, it is absolutely necessary to specify the details of the serial number requesting and ordering the spare and replacement parts.

# 16 EC Declaration of Conformity

**For pumps without explosion protection:**

## - Original -
## EC Declaration of Conformity for Machinery

We,

**ProMinent Dosiertechnik GmbH**
**Im Schuhmachergewann 5 - 11**
**DE - 69123 Heidelberg**

hereby declare that the product specified in the following complies with the relevant basic health and safety rules of the EC Directive, on the basis of its functional concept and design and in the version marketed by us.
This declaration loses its validity in the event of a modification to the product not agreed with us.

| | |
|---|---|
| Description of the product: | ***Metering pump, Makro 5 series*** |
| Product type: | ***M5Ma..., M5Ka..., M5Ha...*** |
| Serial no.: | ***Please refer to nameplate on the device*** |
| Relevant EC Directives: | ***EC - Machinery Directive (2006/42/EC)***<br>***EC EMC Directive (2004/108/EC)***<br>***The safety objectives of the Low Voltage Directive 2006/95/EC are complied with***<br>***in accordance with Appendix I, No. 1.5.1***<br>***of the Machinery Directive 2006/42/EC*** |
| Harmonised standards applied, in particular: | ***EN ISO 12100, EN 809,***<br>***EN ISO 13732-1, EN 60034-5, EN 60034-6, EN 60034-9,***<br>***EN 60204-1, EN 61000-6-2, EN 61000-6-3*** |
| Technical documents have been compiled by documentation specialists: | ***Norbert Berger***<br>***Im Schuhmachergewann 5-11***<br>***DE-69123 Heidelberg*** |
| Date / Manufacturer's signature: | *05/10/2011* |
| Details of the signatory: | *Joachim Schall, Head of Development* |

**For pumps with explosion protection:**

The EC Declaration of Conformity for pumps for potentially explosive atmospheres is enclosed with the pump.

The EC Declaration of Conformity, the EC type-test reports and the operating instructions for the individual components are also enclosed with the pump.

# 17 Index