SPXFLOW

INSTRUCTION MANUAL

# ProCam MD

## METERING PUMP

FORM NO.: 95-04001 REVISION: 10/2015

READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.

Bran+Luebbe®

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# Table of Contents

# Spare Parts

## Ordering Spare Parts

Only the use of original Bran+Luebbe brand spare parts will ensure proper operation, reliability and long service life.

To ensure accurate and prompt parts delivery the following information must be provided when ordering parts:

- Serial number *(see nameplate of the pump)*
- Model number *(see nameplate of the pump)*

Recommended spares are listed in bold type on the pumphead part lists in section 9.

For spares and technical support, contact:

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611 Sugar Creek Road

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# 1 Safety

## 1.1 Safety Instructions

### Introduction

The metering pump is equipped with protective devices. This pump has been subjected to a safety test and acceptance inspection.
In case of incorrect operation or misuse, risks are imminent for

- Life and limb of the operator
- The pump and other material assets of the owner-operator
- The efficient operation of the pump

All persons involved in setting up, putting into service, operating, inspecting, servicing and repairing the pump must

- Be properly qualified, and
- Strictly observe these operating instructions.

Your safety is at stake!

### Symbols used

The following symbols are used in these operating instructions:

**DANGER!**

**Designates an imminent danger. In case of non-observance of this information, death or severe injuries are an imminent risk.**

**WARNING!**

**Designates a possibly dangerous situation. In case of non-observance of this information, death or severe injuries can occur.**

**CAUTION!**

**Designates a possibly dangerous situation. In case of non-observance of this information, severe injuries can occur.**

**ATTENTION!**

**Designates a possibly dangerous situation. In case of non-observance of this information, minor injuries can occur.**

**Designates important user tips and other useful information..**

## Proper Use

This metering pump is a reciprocating, positive-displacement pump. It serves the purpose of conveying, dosing, compressing or mixing and/or filling up liquids and suspensions.

Do not use this pump as:

- a generator, i.e. pressurized liquid is not allowed to drive the motor
- a device for cooling liquids
- a pulsator without a pressure valve
- a compressor for gases

The pump and these operating instructions are intended for commercial use exclusively.

**WARNING!**

**Severe skin injuries can result from dangerous (e.g. aggressive, toxic, caustic) media!**
**Unsuitable media can damage the pump and then escape into the surrounding area.**

**If you intend to use dangerous media, the materials used for the pump parts must have been designed for this kind of use.**

**Consult with SPX FLOW!**

Arbitrary modifications of the pump are prohibited for safety reasons!

Any form liability on the part of the manufacturer/supplier shall be excluded for any form of damage caused by arbitrary modifications.

If you intend to carry out any modifications on the pump, please note that each modification must be approved in writing by SPX FLOW.

When replacing defective parts, only use original spare parts or standard parts approved by the manufacturer.

## Emissions

The construction or design does not exclusively determine the sound emission of metering and process pumps. It also depends on the many different operations-related parameters, such as the type and size of the pulsation dampers being used, customer-specific piping, type of setup, ambient temperatures, and the physical properties of the medium being conveyed.

The highest “sound pressure level” the metering pump will produce is through the drive (motor or variable speed drive). For noise levels of drives see the manufacturer’s catalogue *(see section 10)*.

The determination of the exact A-rated, equivalent continuous sound level as a series-related limit value is therefore possible only to a limited extent.

| Gear unit type | L (A) dB | P Drive HP |
|---|---|---|
| G1 (MD15, MD50) | 70 | 0.25 |
| G2 (MD200) | 78 | 1.0 |
| | | |
| | | |
| | | |
| | | |
| L (A) = max. sound pressure level at 1-meter distance | | |
| P drive = max. rated drive power at 188 strokes/min. | | |

*Table 1.1: Continuous sound pressure level ProCam individual machines*

*Table 1.1* provides **reference values**, measured:

- At full capacity utilization of the machines,
- Under normal operating conditions,
- At room temperature,
- With water as the medium being conveyed.

The sound measurement was carried out in accordance with DIN 45635 Part 1.

The actual max. sound pressure level must be determined on site by the owner-operator.
The owner is responsible for proper observance of the local, legal safety regulations for noise.

Please note the following information whenever the determined sound pressure level exceeds 85 dB(A):

**CAUTION!**

**Auditory damage due to noise.**

**Noise can result in loss of hearing or in other physiological impairments (e.g. loss of equilibrium, inattentiveness).**

**Wear ear protection!**

## Sources of Danger

Bran+Luebbe brand metering pumps comply with all mandatory legal safety requirements. The dangers originating from the pump have been virtually reduced to a minimum by means of suitable construction and design measures. However, residual risks (explosive atmospheres and electrical, mechanical, thermal or biological hazards) cannot be excluded entirely during either transport, installation, maintenance and repair work or regular operation.

**IMPORTANT!**

**Please note the warning and safety information included in the following sections in order to prevent personal and property damage:**

**2 "Product Attributes"**

**3 "Assembly Groups"**

**4 "Installation"**

**5 "Operation"**

**6 "Maintenance, Inspection, Cleaning"**

**8 "Transport, Intermediate Storage, Preservation"**

## Workplaces

The workplaces of the operating personnel during the production operations can vary.

In the case of operating, maintenance and repair tasks, the area next to the pump and the pump itself must be considered as being a workplace.

## Authorized Operators

Only persons who have been properly authorized and trained by the owner-operator are allowed to work on the pump. The minimum age for operators is 16 years. The operator, versus others in the work area, is considered to be responsible for work on the pump.

The responsibilities for the various activities performed on the pump must be clearly defined and observed. Unclear competencies are a safety risk.

The owner-operator must

- make these operating instructions accessible to the operator and
- make sure that the operator has read and understood them.

**IMPORTANT!**

**Maintenance, upkeep and electrical tasks should only be performed by technically competent, trained and/or qualified personnel.**

Technically competent, trained and qualified personnel are defined as follows:

- possessing sufficient knowledge in a specific field based on their specialized training and experience
- familiar with work safety and accident prevention regulations (lock-out/tag-out safety procedures)

## Personal Protective Equipment

**CAUTION!**

**Oils, lubricants and cleaning agents can cause skin reactions and irritation.**

**Hot surfaces, hot oil and/or caustic media can cause severe burns or acid burns.**

**Avoid skin contact.**

**Wash your hands properly each time after coming into contact with these substances.**

**Wear protective equipment especially when you are performing any maintenance, inspection and cleaning tasks!**

## Safety Measures at Installation Location

Place the pump on a level, stress-free foundation or frame.

Secure piping sufficiently by means of supports or retaining clamps. Clean the piping.

Use appropriate local instructions and checks to ensure that the surrounding area of the workplace is clean and tidy at all times.

## Protective Devices

Do not allow the Plexiglas covers on the gear/drive unit and on the pump head to come in contact with any gear and/or hydraulic oil.

Protective panels on the couplings prevent access to rotating parts.

EMERGENCY-OFF switches on the pump can be used to shut down the pump immediately in the case of an emergency or malfunction.

**EMERGENCY-OFF switches are not part of the scope of delivery of SPX FLOW! The owner-operator must provide EMERGENCY-OFF switches and install them at suitable locations.**

The EMERGENCY-OFF switches should be readily accessible and clearly visible.

**Protective devices**

- are installed for the safety of operating personnel.
- are not allowed to be modified, removed or bypassed by means of any modifications on the pump.

## Behavior in Case of Emergency

An emergency exists whenever human life is endangered and/or other general risks exist. The source of danger can be the pump itself or originate from conditions in the surrounding area.

In the case of an emergency or malfunction, the pump must be switched off immediately.

The pump cannot be put into operation again until the malfunction has been identified and corrected, and corrective actions taken to prevent future occurrences.

In case of fires, use only suitable fire-extinguishing agents.

Warn other personnel in the case of any danger – even when the danger is only presumed.
Stay calm!

# 2 Product Attributes

## 2.1 ProCam MD

**CAUTION!**

**Gear unit damage possible!**

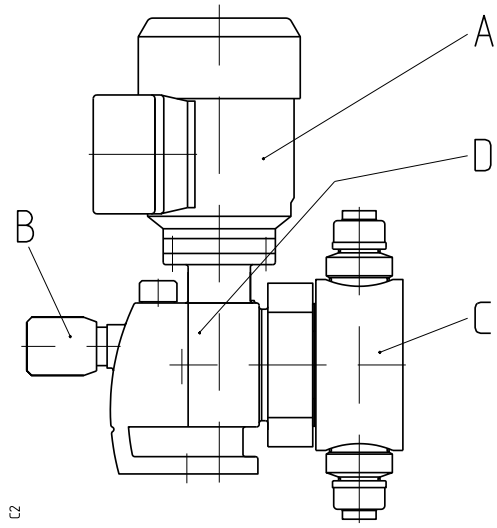
**Do <u>not</u> operate the pump in systems equipped with cathodic corrosion protection. Do <u>not</u> use the pump as a cooling unit for liquids, for the compression of gases or as a generator.**

### Construction of the Metering Pump

The metering pump is a reciprocating positive displacement pump.
Basic components are the drive (A), the stroke length adjustment (B), the pumphead (C), and the gear unit (D) *(Fig. 2.1).*

The functions of the components are described in section 3 *(Assembly Groups).*

**The design of the metering pump fulfills European safety and accident prevention regulations.**




*A Drive* *C Pumphead*
*B Stroke Length Adjustment* *D Gear Unit*

*Fig. 2.1: Metering Pump*

## Safety Instructions

**WARNING!**

**Burns and other forms of injury to health may occur due to hot, dangerous medium.**

**Also, Increased wear and tear on the pump head and on the gear unit can result.**

**Whenever the system design pressure is exceeded, the pipeworks can tear apart and hot or dangerous medium can then be sprayed out.**

**Take the necessary measures to prevent the permissible maximum design pressure from being exceeded, e.g. by installing a safety valve. *(see Section 4.3)***

Before starting to work on the metering pump check carefully that

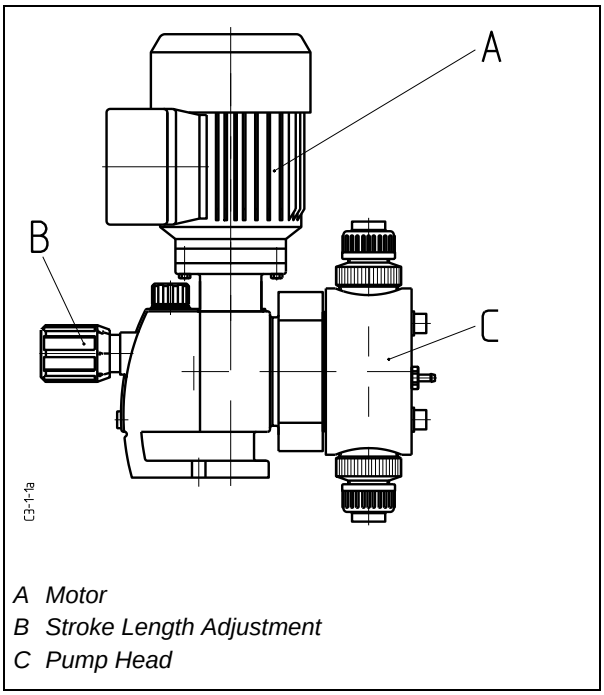
- all pressurized parts (pumphead, piping) are depressurized
- the drive is disconnected from the power source
- personal protection is carried out according to local regulations
- parts being used in contact with aggressive substances are flushed before handling
- For safe operation of the bleed valve *see section 3.5 (Bleed valve for product chamber).*

The maximum allowable operating temperature depends on the suitability of the materials and lubricants in use.

# 3 Assembly Groups

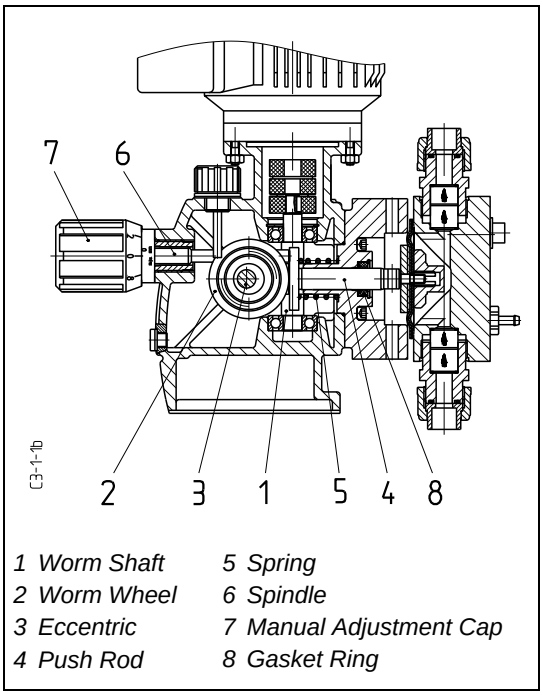
## 3.1 Gear Unit

### 3.1.1 Gear Models G1 and G2 for ProCam MD




*A Motor*
*B Stroke Length Adjustment*
*C Pump Head*

*Fig. 3.1: Plan View (Main Gear G1, G2)*




*1 Worm Shaft* *5 Spring*
*2 Worm Wheel* *6 Spindle*
*3 Eccentric* *7 Manual Adjustment Cap*
*4 Push Rod* *8 Gasket Ring*

*Fig. 3.2: Sectional View (Main Gear G1,G2)*

#### Construction and function

For the construction and function of models G1 and G2 *see Fig. 3.1 and 3.2.*

The rotary motion of the motor (A) is transmitted by the worm shaft (1) and the worm wheel (2) to the fixed eccentric (3) which shifts the push rod (4) to the front dead center. The spring (5) shifts the push rod back to the rear dead center. At full stroke setting the eccentric does not lose contact to the push rod.

Part-stroke settings are achieved with a "lost motion device" consisting of a spindle (6), which is connected to a manual adjustment cap (7). A clockwise rotation of the spindle displaces the rear dead center of the push rod and the eccentric temporarily loses contact to the push rod. At zero setting, the rear dead center coincides with the front dead center and consequently the push rod cannot be shifted by the eccentric. To prevent leakage of gear fluid, the push rod is sealed with a gasket ring (8).

Suction and discharge strokes are both positive mechanical movements, but the suction stroke could be limited if the return spring is damaged or broken.

## Stroke Length Adjustment (B)

*See section 3.2.*

## Oil Filling

**ATTENTION!**

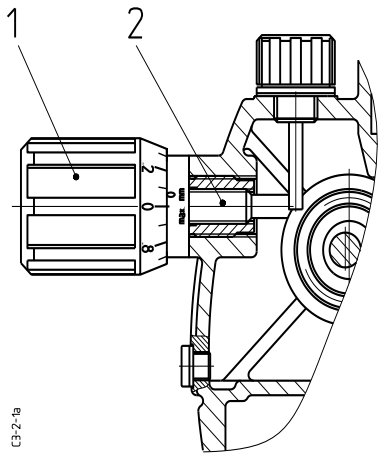
**Gear unit damage possible due to impermissible temperature rise and wear and tear!**

**The gear/drive units are delivered without being filled with oil.**

**Fill with oil prior to the putting into service procedure *(see Section 5.1 and 5.2).***

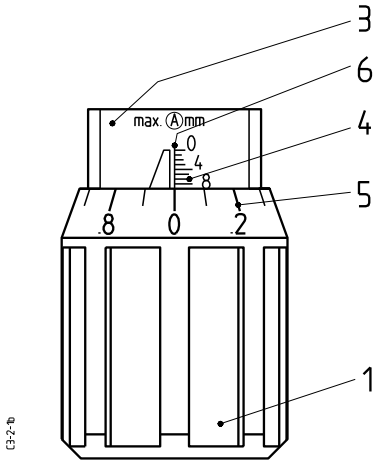
## 3.2 Stroke Length Adjustment

### 3.2.1 Manual Stroke Length Adjustment at Standstill and in Operation for Gear Models G1 and G2




*1 Adjustment Cap*
*2 Spindle*

*Fig.. 3.1: Sectional View*




*1 Adjustment Cap*
*3 Barrel*
*4 Graduation in mm*
*5 Graduation in 1/10 mm*
*6 Longitudinal Line*

*Ⓐ = 3 mm for G1 gears (D15 & D50) with Diaphragm pumphead*

*Ⓐ = 8 mm for G2 gears (D200) with Diaphragm pumphead*

*Fig. 3.2: Plan View*

#### Construction and Function

The micrometer adjustment cap (1) is connected to the spindle (2). A clockwise rotation of the adjustment cap (1) displaces the rear dead center of the push rod towards the front dead center via the spindle. As a result, the stroke length is reduced.
A counterclockwise rotation of the adjustment cap (1) increases the stroke length.
*(See Fig. 3.1).*

## Adjustment of the stroke length

**WARNING!**

**Damage in the gear unit possible.**

**Do not screw the micrometer adjustment cap beyond the zero or the displayed maximum setting!**

A rotation of the micrometer adjustment cap (1) varies the delivery setting of the pump. The setting can be changed with the pump operating or at rest.

The micrometer barrel (3) is inscribed with circumferential graduations (4), which indicate the stroke length in mm.

The micrometer adjustment cap is graduated in 1/10 mm (5).

To obtain, e.g. 6.8 mm stroke length setting, rotate the micrometer adjustment cap until the 6 mm graduation is just visible with the ".8" graduation on the adjustment cap coinciding with the longitudinal line on the barrel. It can similarly be set up to any stroke length required.
*(See Fig. 3.2)*

Adjustment of capacity *see section 5.4.*

# 3.3 Pump Head

## 3.3.1 Diaphragm Model

### Construction and Function

The double diaphragm (5, 6) clamped at the circumference between cover (1) and yoke (2) and in the center between medium side disc (7) and atmospheric side disc (8), separates hermetically the product chamber (A) from the atmosphere (B). The eccentric drives via the push rod (9) the double diaphragm (5, 6) and transmits its movement to the liquid in the product chamber (A).

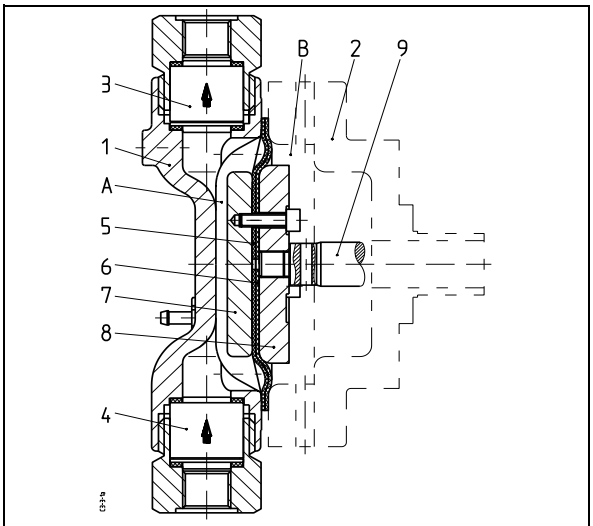
The suction (4) and discharge valves (3) are self-acting valves. They are operated by pressure differences of the product chamber (A) and the discharge and suction pressures.

- **Suction stroke:** Movement from front *(Fig. 3.1)* to rear dead center *(Fig. 3.2)*.

  During the suction stroke the difference between the suction pressure and the pressure in the product chamber (A) causes the suction valve (4) to open so that the product chamber (A) is filled with product.

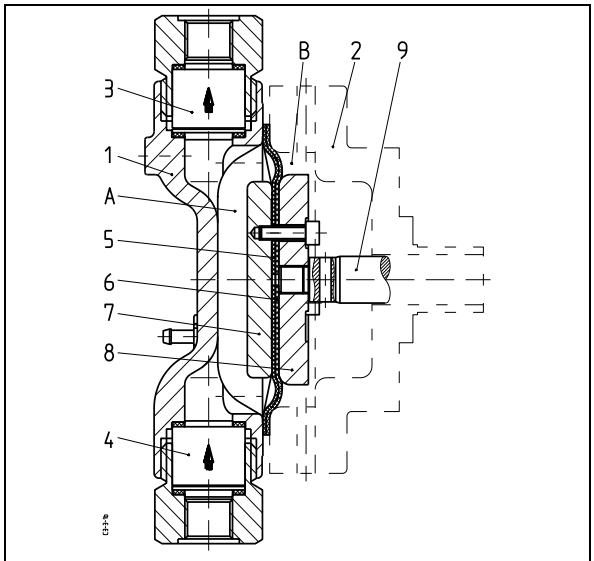
- **Discharge stroke:** Movement form rear *(Fig. 3.2)* to front dead center *(Fig. 3.1)*.

  During the discharge stroke the pressure in the product chamber (A) increases until it exceeds the discharge line pressure and the opening pressure of the discharge valve (3). Then the flow medium is discharged from the product chamber (A) into the discharge line.




| | | | |
|---|---|---|---|
| *1* | *Cover* | *7* | *Disc, Medium Side)* |
| *2* | *Pump Yoke* | *8* | *Disc, Atmospheric Side* |
| *3* | *Discharge Valve* | *9* | *Push Rod* |
| *4* | *Suction Valve* | | |
| *5* | *Diaphragm* | *A* | *Product Chamber* |
| *6* | *Diaphragm* | *B* | *Atmosphere* |

*Fig. 3.1: Diaphragm at Front Dead Center*




| | | | |
|---|---|---|---|
| *6* | *Cover* | *7* | *Disc, Medium Side* |
| *7* | *Pump Yoke* | *8* | *Disc, Atmospheric Side* |
| *8* | *Discharge Valve* | *9* | *Push Rod* |
| *9* | *Suction Valve* | | |
| *10* | *Diaphragm* | *A* | *Product Chamber* |
| *11* | *Diaphragm* | *B* | *Atmosphere* |

*Fig. 3.2: Diaphragm at Rear Dead Center*

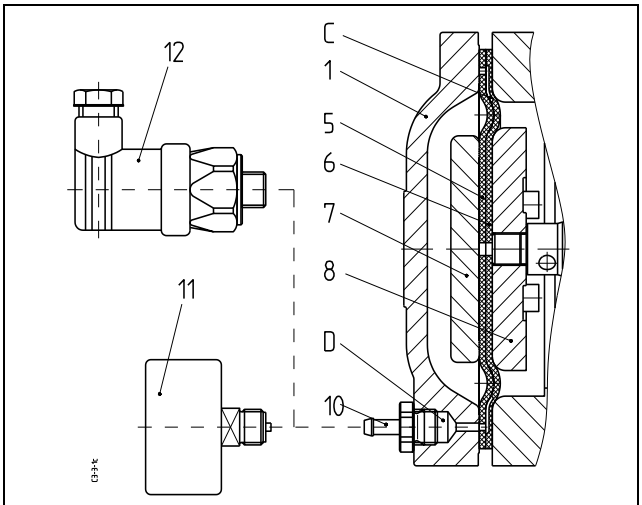
### 3.3.1.1 Double Diaphragm Assembly and Diaphragm Rupture Monitoring Device

The double diaphragm arrangement *(Fig. 3.3)* consists of two diaphragms (5, 6) clamped between medium side (7) and atmospheric side (8) discs.

Within the mounted pump head *(Fig. 3.3),* a connection exists from the inner contact area between the two diaphragms through the groove (C) in the atmospheric side diaphragm (6), a bore in the medium side diaphragm (5) and the bore (D) in the cover (1) to the hose nipple (10), the pressure gauge (11) or the pressure switch (12).

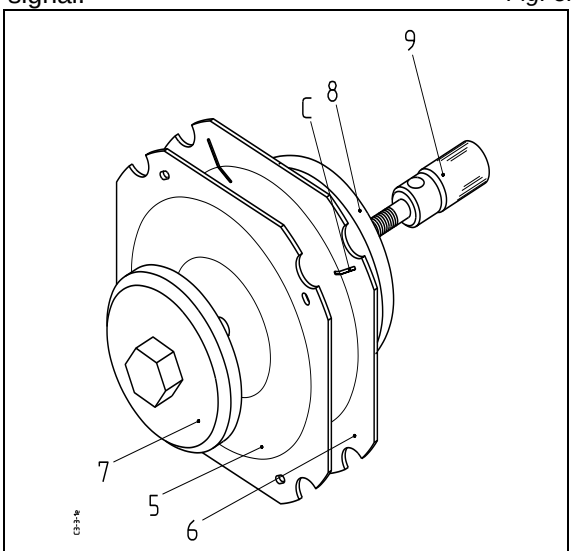
Damage of the medium side diaphragm (5) results in an increase of pressure between the diaphragms, thus causes liquid escape via the hose nipple (10) into a hose or indicates pressure increase at the pressure gauge (11) or pressure switch (12).

The signal of the pressure switch (12) can be used either to stop the metering pump or to have an audible signal.



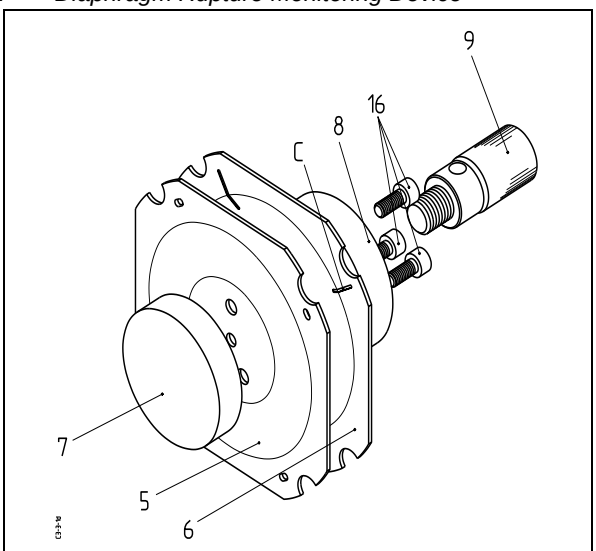

*1 Cover*
*5 Diaphragm, Medium Side*
*6 Diaphragm, Atmospheric Side*
*7 Disc, Medium Side*
*8 Disc, Atmospheric Side*
*10 Hose Nipple*
*11 Pressure Gauge*
*12 Pressure Switch*
*C Groove*
*D Bore*

*Fig. 3.3: Diaphragm Rupture Monitoring Device*




*9 Tappet*

*Fig. 3.2: Double Diaphragm arrangement for Pump Head (Gear Models G1: D15 & D50)*



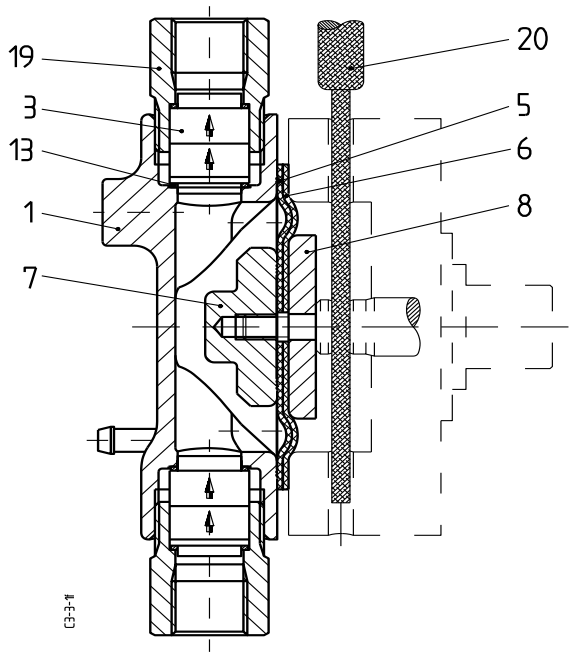

*16 Screw, bolt*

*Fig. 3.3: Double Diaphragm arrangement for Pump Head (Gear Models G2: D200)*

### 3.3.1.2 Replacement of the Diaphragm, Gear Model G1 (MD15, MD50)

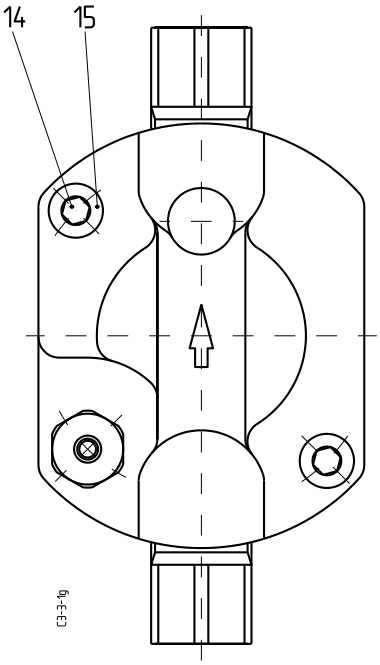
The replacement of the diaphragm from the gear models G1 is shown in *Fig. 3.6* and *Fig. 3.7.*

**See assembly drawings in section 9.**




*1 Cover*
*3 Valve*
*5 Diaphragm*
*6 Diaphragm*
*7 Disc*
*8 Disc*
*13 Sealing*
*19 Pipe Connection*
*20 Locking pin*

*Fig. 3.6: Sectional View*




*14 Screw*
*15 Washer*

*Fig. 3.7: Plan View*

## Removal

**Notice the safety instructions in section 2 *"Product Attributes"*!**

- Flush the pump head.
- Close the suction and discharge lines.
- Loosen the pipework.
- Extract the screws (14) uniformly and remove the cover (1).
- Set the gear to "0" mm stroke length and the rod will be in the top dead center position.
- To prevent movement of the push rod insert a screw driver or a locking pin through the bores in the yoke and push rod *(see Fig. 3.6).*
- Dismantle the double diaphragm by unscrewing the disc (7).
- Remove the connected rupture monitoring device. Check and clean. Replace if damaged

**ATTENTION!**

**In case of a diaphragm rupture the complete double diaphragm must be replaced!**

**ATTENTION!**

**If both diaphragm layers are ruptured, process fluid will have entered the yoke!**
**Please flush and clean carefully. Replace push rod, if corroded.**

## Assembly

- Set the gear to "0" mm stroke length.
- To prevent movement of the push rod insert a screwdriver or a locking pin through the locating bores in the yoke and push rod!
- Clean and make all concentric grooves in the cover (1) and disc (7) free of liquid!
- Relocate disc (8), double diaphragm (6, 5) and locking disc (7) consecutively. Locate the double diaphragm by inserting the screws (14).
- Tighten disc (7) to the required torque *(see assembly drawing, section 9)*.
- Remove screws (14).
- Fit the front cover (1), relocate screws (14) and tighten to the required torque (see assembly drawing).
- Fit the diaphragm rupture monitoring device.

**WARNING!**

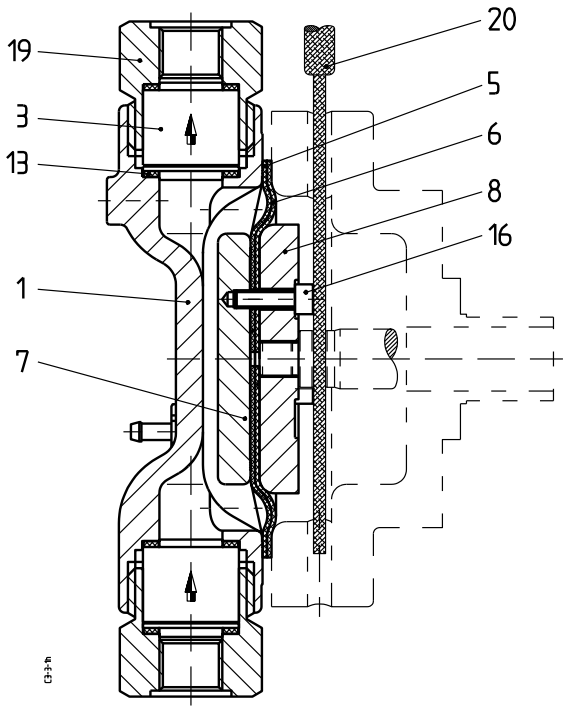
**Risk of injury caused by the loaded spring inside the gear.**

**If the pump yoke (2) is dismounted, the push rod (9) must be fixed to the yoke (2) by inserting a suitable tool (20) (screw driver or locking pin) through the locating bores in the yoke and the push rod (9).**

### 3.3.1.3 Replacement of the Diaphragm, Gear Model G2 (MD200)

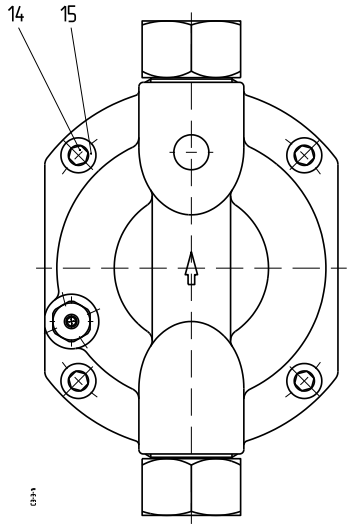
The replacement of the diaphragm from the gear unit models G2 is shown in *Fig. 3.8 and Fig. 3.9.*

**See assembly drawings in the section 9.**




| | | | |
|---|---|---|---|
| *1* | *Cover* | *8* | *Disc* |
| *3* | *Valve* | *13* | *Sealing* |
| *5* | *Diaphragm* | *16* | *Screw* |
| *6* | *Diaphragm* | *19* | *Pipe Connection* |
| *7* | *Disc* | *20* | *Locking pin* |

*Fig. 3.8: Sectional View*




| | |
|---|---|
| *14* | *Screw* |
| *15* | *Washer* |

*Fig. 3.9: Plan View*

## Removal

**Notice the safety instructions in section 2, *"Product Attributes"*!**

- Flush the pump head.
- Close the suction and discharge lines.
- Loosen the pipework.
- Extract the screws (14) with washers (15) uniformly and remove the cover (1).
- Set the gear to "0" mm stroke length and the rod will be in the top dead center position.
- To prevent movement of the push rod insert a screw driver or a locking pin (20) through the bores in the yoke and push rod. *(see Fig. 3.8).*
- Unscrew counterclockwise (CCW) the diaphragm assembly (5, 6, 7, 8, 16) and dismantle.
- Remove the connected rupture monitoring device. Check and clean. Replace if damaged.

**ATTENTION!**

**In case of a diaphragm rupture the complete double diaphragm must be replaced !**

**ATTENTION!**

**If both diaphragm layers are ruptured, process fluid will have entered the yoke!**

**Please flush and clean carefully.**
**Replace push rod, if corroded.**

## Assembly

- Set the gear to "0" mm stroke length.
- To prevent movement of the push rod insert a screwdriver or a locking pin through the locating bores in the yoke and push rod!
- Clean and make all concentric grooves in the cover (1) and disc (7) free of liquid!
- Assemble diaphragm assembly. Coat screw (16) with Loctite, insert and tighten to required torque *(see assembly drawing, section 9)*.
- Relocate diaphragm assembly to the push rod. Tighten clockwise (CW) finger-tight. At max. position, loosen until alignment with yoke bores.
- Fit the front cover (1), relocate screws (14) and tighten to the required torque (see assembly drawing).
- Fit the diaphragm rupture monitoring device.

**WARNING!**

**Risk of injury caused by the loaded spring inside the gear.**

**If the pump yoke (2) is dismounted, the push rod (9) must be fixed to the yoke (2) by inserting a suitable tool (20) (screw driver or locking pin) through the locating bores in the yoke and the push rod (9).**

## 3.4 Valves

Assignment: Pump head *(Fig. 3.1).*

For the valve used in the pump head *see "drawings and parts lists" in section 9.*

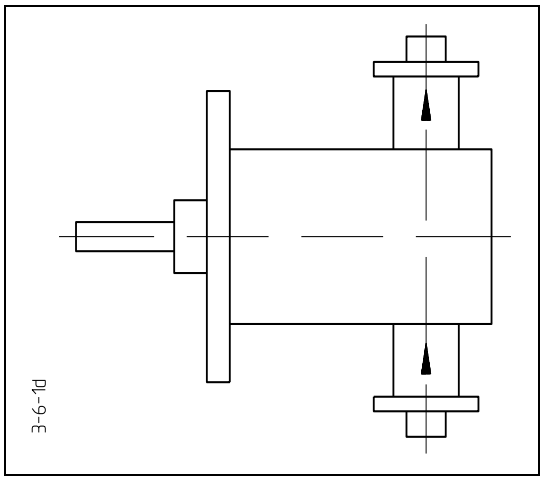


*Fig. 3.1: Pump Head*

### Function

Suction and discharge valves are self-acting valves. They are operated by pressure differences between the product chamber and the suction and discharge lines respectively.
*See also section 3.3*

### Mounting

**CAUTION!**

**Personal and property damage possible!**

**Incorrect installation of the valves will lead to diaphragm rupture or pump head failure.**

**Pay attention to the direction arrow of the valves (*see Fig. 3.1 to 3.6)***

Pay attention to the direction arrows on the valves when installing.

- **Suction valve:** arrow points to the product chamber
- **Discharge valve:** arrow points away from the product chamber

## 3.4.1 Ball Model

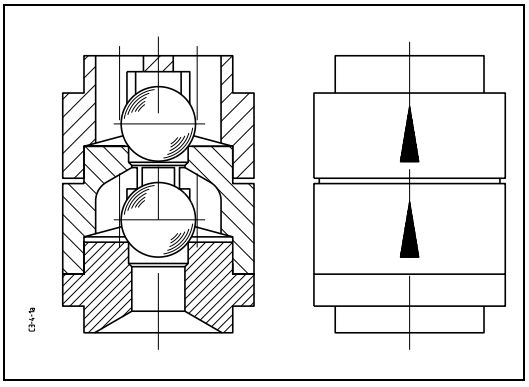


*Fig. 3.2: Double Ball Valve - Sectional and Plan View*

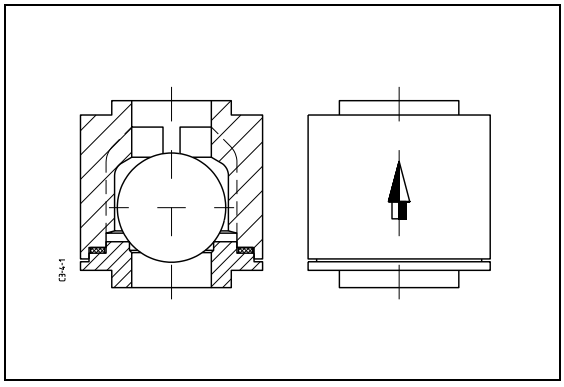


*Fig. 3.3: Single Ball Valve - Sectional and Plan View*

# 3.5 Bleed Valve for Product Chamber

## 3.5.1 Diaphragm Pumphead

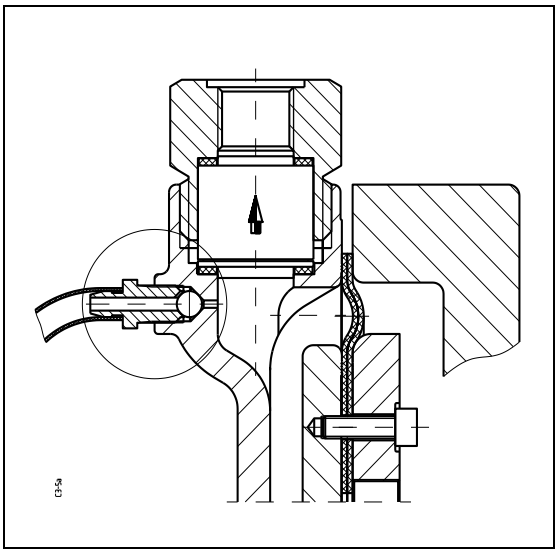
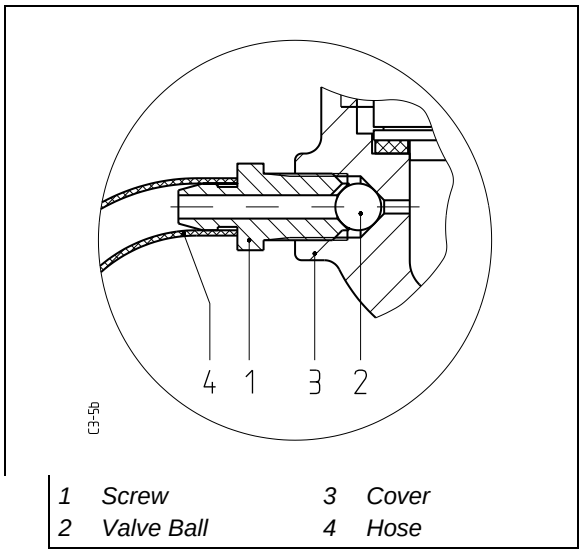


*Fig. 3.1: Fitting Position*




| | | | |
|---|---|---|---|
| *1* | *Screw* | *3* | *Cover* |
| *2* | *Valve Ball* | *4* | *Hose* |

*Fig. 3.2: Bleed Valve*

### Fitting Position

*Fig. 3.1* shows the fitting position of the bleed valve, which is located near the highest point of the product chamber. Any gas present in the product chamber can be discharged through the bleed valve.

**The screw (1) is sealed with PTFE-tape.**

### Function of the bleed valve

Gas existing in the product chamber can be discharged through the bleed valve *(Fig. 3.2)*:

- **Bleed valve shut:**

  Screw (1) presses the valve ball (2) into the valve seat in the cover (3). Gas or flow medium cannot discharge in this state.

- **Bleed valve in operation:**

  Loosen the screw (1) approx. 1/2 a turn. During the suction stroke, the valve ball (2) now closes the valve automatically. During the discharge stroke the bleed valve is opened so that gas or flow medium can discharge.

  When product discharges through the bleed valve, tighten the screw (1).

**WARNING!**

**Toxic or aggressive media to be conveyed can cause serious eye and skin injuries.**

**Gas or medium to be conveyed flows out whenever the bleed valve is opened.**

**Discharge this medium via the connection (4).**

**Use a suitable collecting container.**

**Avoid skin contact.**

**Wash your hands properly each time after coming into contact with these substances.**

**Wear protective equipment and, whenever necessary, a gas mask!**

# 4 Installation

## 4.1 Installation

### Prior to Installation

- Check the packing of the metering pump for external damage. Open the package.
- Check metering pump and accessories for external damage.

**SPX FLOW must be notified about any form of damage immediately.**

### Installation Location

Unless no other installation conditions have been agreed, the installation procedure must be carried out in dry rooms without aggressive atmospheres.
In the case of outdoor installation, a form of protection against precipitation, sandstorms and direct sunlight must be provided.

The ambient temperature is not allowed to be below -20°C or above +40°C.

### Foundation and Installation

The height of the foundation should be selected so that it is easy to carry out any operating and maintenance tasks.

Stroke length adjustment, stroke length display (if available), oil filling and oil draining, oil level inspection and plunger sealing must be easily accessible.

During the installation procedure, make sure that sufficient clear space for maintenance work (e.g. for lifting equipment for dismantling operations during repair work) is available around and above the metering pump.

- Place the metering pump *stress-free* on a foundation, frame, etc.

**ATTENTION!**

**Especially when at standstill, the roller bearings in the pump can become damaged by adjacent equipment units.**

**Protect these roller bearings against vibrations by means of a suitable (vibration-damping) foundation.**

- Use fastening screws to screw the pump onto the fastening holes. Adjust the pump so that the plunger axis is in horizontal position and the valve axis in vertical position.

## Electrical Connection

**DANGER!**

**Electric shocks can kill you!**

**All tasks on the electrical equipment are only allowed to be carried out by expert electrical personnel!**
**Electrical connections must comply with local regulations.**

- **Dangerous voltages can be present due to faulty ground connections. Carry out all these tasks only when the system is in de-energized condition.**
- **Prevent electrostatic charging.**
  **Connect all electrically conductive parts safely to the equipotential bonding device.**
- **If not included in the scope of supplies, install an EMERGENCY-OFF device. Without an EMERGENCY-OFF device, accident prevention is not sufficiently guaranteed in the case of malfunction or incorrect operation of the pump by the user.**
- **Use only those types of EMERGENCY-OFF switches that correspond to the equipment safety class.**
- **Provide overload protection or temperature monitoring.**

- Check the voltage, frequency, speed and output.
- Take the direction of rotation of the drive unit into account.

## Connection of the Pipeworks

- Clean the pipeworks properly before connecting them.
- Connect the pipeworks stress-free.
- Connect the pipeworks so that it is easy to remove the valve and dismantle the pump head.
- Support the pipe weights by means of retaining clamps.
- Compensate pipe expansions by means of pipe bends.

**CAUTION!**

**Personal and property damage possible!**

**Reciprocating positive-displacement pumps can cause vibrations in the case of freely suspended pipework sections. Pipeworks can tear off and could result in serious injury to personnel.**

**Fasten the pipeworks at a sufficient number of different points with supports and/or retaining clamps.**

**Do not use pipeworks as a climbing aid!**

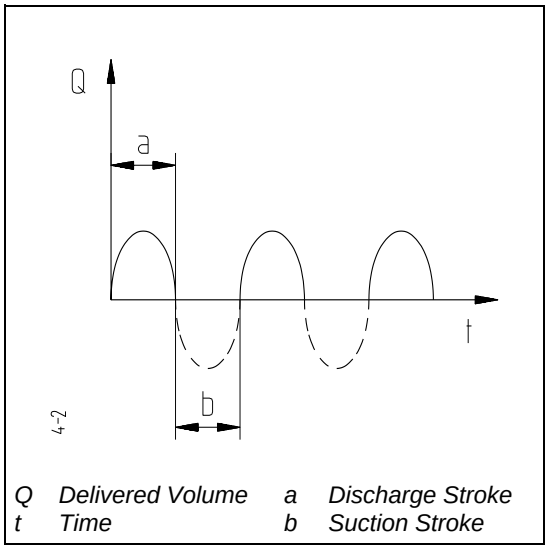
## 4.2 Suction and Discharge Lines

**WARNING!**

**The suction and discharge lines must be properly designed and connected to the pumphead.**

**Otherwise the pump can be seriously damaged!**

The suction and discharge lines should be designed so as to prevent cavitation, excess load or excess feeding, caused by the pulsating flow of the metering pump.




*Q Delivered Volume* *a Discharge Stroke*
*t Time* *b Suction Stroke*

*Fig. 4.1: Delivered Volume of a Single Pumphead*

| Prevent | Cause | Result | Remedy |
|---|---|---|---|
| Cavitation | • suction pressure falling below the vapor pressure of the product | • loud noise<br>• excessive valve wear<br>• excess load | • avoid high suction lifts<br>• keep the pipe length short<br>• sufficient nominal diameters<br>• use of pulsation dampers<br>• use of a pressure sustaining valve<br>• decrease viscosity |
| Excessive Load | • pressure peaks exceeding the operating pressure | • fatigue failure<br>• forced rupture | |
| Excessive Discharge | • suction or discharge line too long<br>• suction pressure is higher than discharge pressure<br>• pressure sustaining valve missing | • inaccurate metering<br>• loud noise<br>• excessive valve wear | |

If required, SPX FLOW will check the system isometrics. For this, the following information must be given:

**Product characteristics:**

- Density
- Vapor pressure at operating pressure
- Viscosity
- Settling speed, if product is a suspension

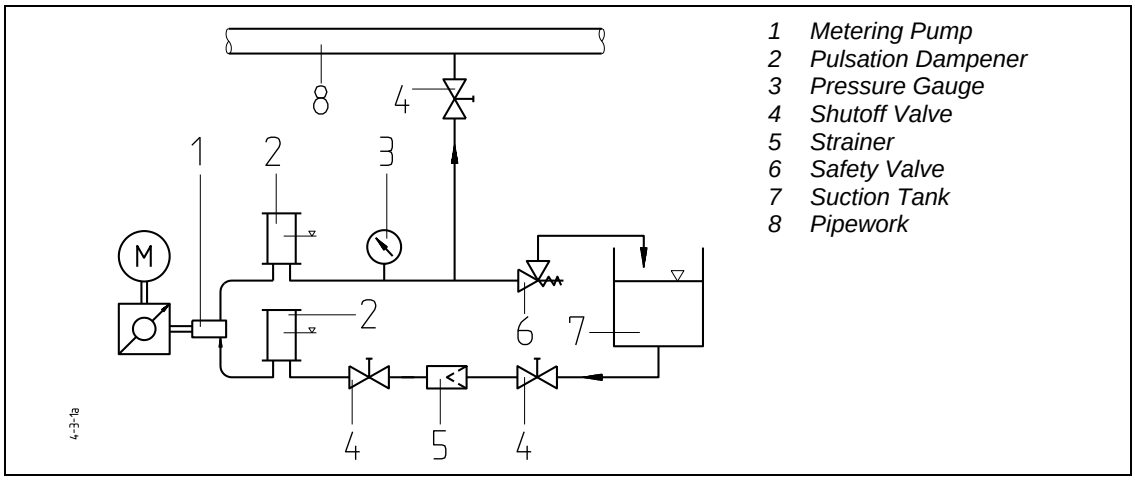
**Installation data:**

- Geodetic height
- Pressures on the suction and discharge side
- Length of the pipework
- Nominal diameter
- Number of pipe bends
- Fittings
- Isometrics

## 4.3 Installation - Examples

### 4.3.1 Suction and Discharge Piping

The recommended accessories for the installation on the suction and discharge side are listed *in Fig. 4.1*:




*1 Metering Pump*
*2 Pulsation Dampener*
*3 Pressure Gauge*
*4 Shutoff Valve*
*5 Strainer*
*6 Safety Valve*
*7 Suction Tank*
*8 Pipework*

*Fig. 4.1: Suction and Discharge Piping*

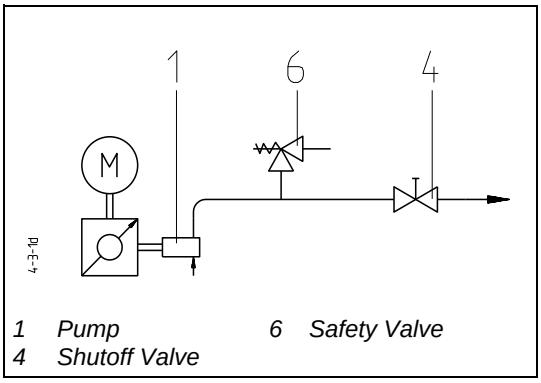
**ATTENTION!**

**To avoid personal injury and damage to the pump or related equipment, we recommend installing a safety valve!**

#### Installation of the Safety Valve *(Fig. 4.2)*

**Aim**:
Prevent overload of the pump.

**Position:**
Between the discharge flange and the *first* shutoff valve in the discharge line **or** behind the pulsation dampener if applicable.



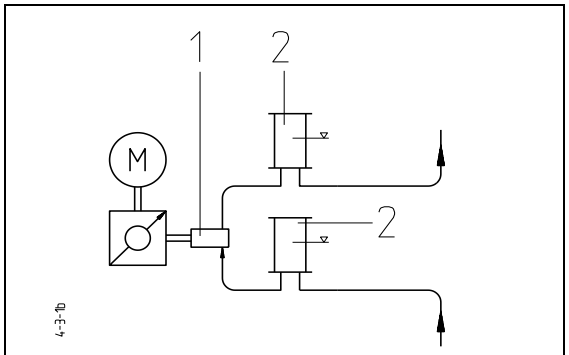

*1 Pump* *6 Safety Valve*
*4 Shutoff Valve*

*Fig. 4.2: Safety Valve*

## Mounting of Pulsation Dampers *(Fig. 4.3)*

**Aim**:
Dosing with less pulsations; prevent cavitation and overload.

**Position:**
Just in front of the suction flange and behind the discharge flange of the pumphead.



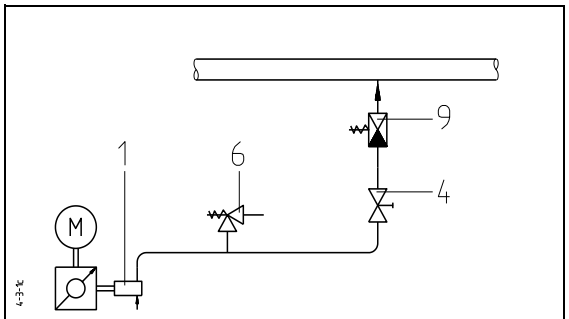

*1 Metering Pump 2 Pulsation Dampener*

*Fig. 4.3: Pulsation Dampener*

## Installation of the Pressure Sustaining Valve *(Fig. 4.4)*

**Aim**:
Prevent of excessive discharge and excessive mass acceleration.

**Position:**
Vertically at the end of the discharge line.



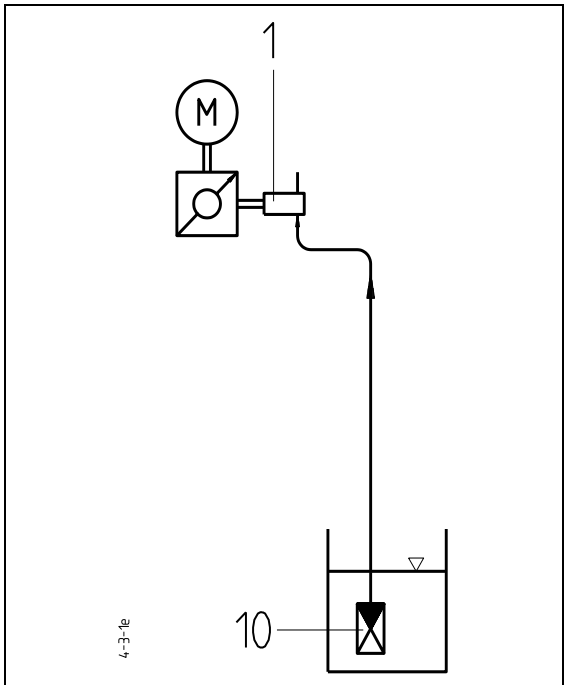

*1 Metering Pump*
*6 Safety Valve*
*4 Shutoff Valve*
*9 Pressure Sustaining Valve*

*Fig. 4.4: Pressure Sustaining Valve*

## Installation of a Foot Valve *(Fig. 4.5)*

**Aim:**
Prevent draining of a long suction line.

**Position:**
Vertically near the bottom of the reservoir.




*1 Metering Pump 10 Foot Valve*

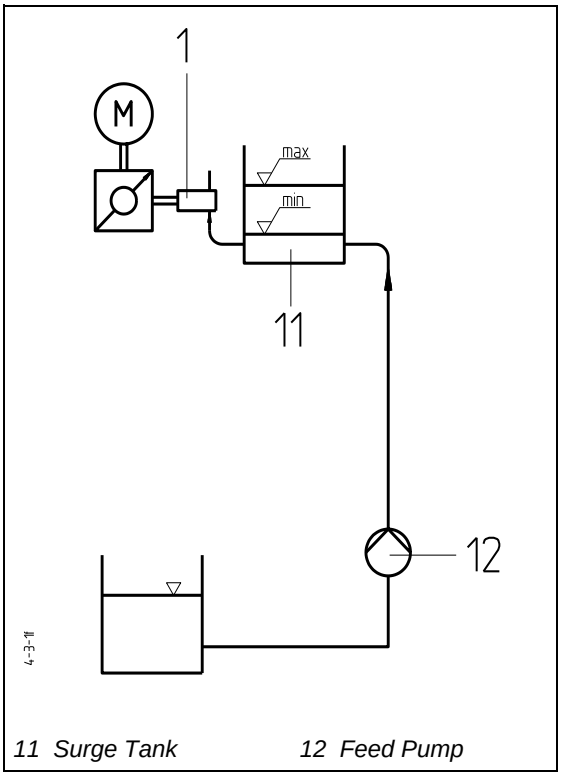
*Fig. 4.5: Foot Valve*

## Installation of a Surge Tank *(Fig. 4.6)*

**Aim:**
Prevent suction lift.

**Position:**
Same level as the metering pump.

**Filling:**
Using a feed pump (12) with max./min. control.




*11 Surge Tank* *12 Feed Pump*

*Fig. 4.6: Surge Tank*

# 5 Operation

## 5.1 Lubricant and Lubricant Change

### Gear Unit

**ATTENTION!**

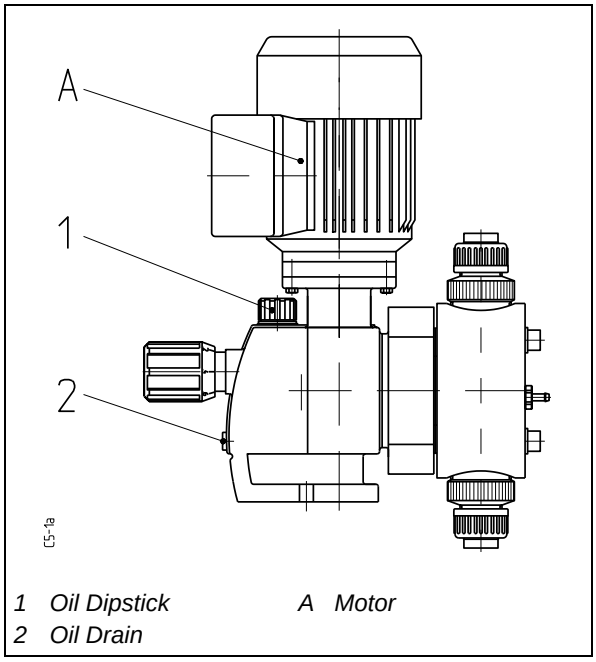
**Gear unit damage possible due to impermissible temperature rise and wear and tear!**

**The gear units are delivered <u>without oil.</u>**

**Fill with oil prior to putting pump into service**

***(see Section 5.1 and 5.2).***

For the following instructions *see Fig. 5.1 and 5.2*:




*1 Oil Dipstick*
*2 Oil Drain*
*A Motor*

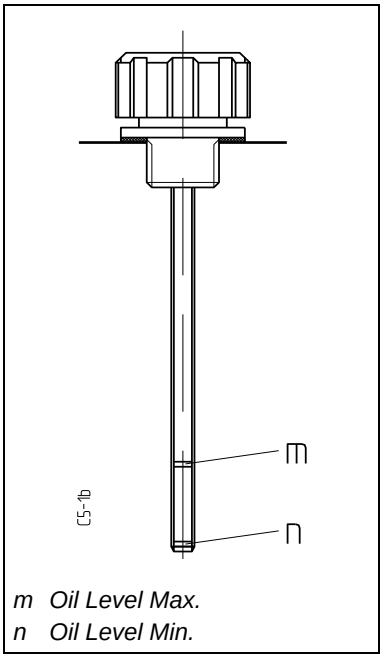
*Fig. 5.1: Plan View, e.g. Gear G1*

### First Filling

- Unscrew the oil dipstick (1).
- Fill with required amount of oil.
- Screw in the oil dipstick (1).
- Start motor (A) for a short period.

### Checking the Oil Level

- Shut off the motor (A).
- Unscrew the oil dipstick (1) and wipe off the oil.
- Screw in the oil dipstick (1) and unscrew it again.
- The oil level should be between max. and min. *Fig. 5.2).* *(see*
- In case of an oil gauge the oil level should be visible in the middle of the gauge.




*m Oil Level Max.*
*n Oil Level Min.*

*Fig. 5.2: Oil Dipstick*

## Oil Change

Change the oil after the first 300 hours of operation and then after every 4000 hours.

## Oil Draining

**CAUTION!**

**Gear oil heats up during normal operation and can be sprayed out when being drained. Severe burns in the face and on the hands possible.**

**Avoid skin contact.**

**Wash your hands properly each time after coming into contact with gear oil.**

**Wear protective equipment!**

**Use sufficiently large collecting containers.**

Open the oil drain (2) and drain the oil.

## Oil Filling

*See above "First Filling".*

## 5.2 Oil Quality and Quantity for Gear Unit G1 and G2

**ATTENTION!**

**The temperature of the gear oil should NOT exceed 90 °C (194 °F) during operation. If a higher oil temperature is reached during operation, the service life of the oil will be reduced!**

**Comply with the notes in *Section 5.1.***

| Model | Type | Vol – Ltr. (Qt.) |
|---|---|---|
| MD15 and MD50 | G1 | 0.5L (0.53Qt.) |
| MD200 | G2 | 0.8L (0.85Qt.) |

*Table 5.0: Oil Volume for Gear Unit*

### For ambient temperatures of between 0 °C and +40 °C (32 °F and 104 °F)

Suitable gear oils are mineral oil based gear oils with a nominal viscosity of approx. 100 to 220mm²/s (cSt) at 40 °C (104 °F). You will find examples of oil types in Table 5.1:

| Brand | Gear oil | mm²/s (cSt) at approx. 40 °C (104 °F) |
|---|---|---|
| ARAL | Aral Degol BG | 100<br>A nominal oil viscosity of 220mm²/s (cSt) is recommended for continuous ambient temperatures of between 30 °C and 40 °C (86 °F and 104 °F). |
| BP | BP Energol GR-XP | |
| ESSO | Spartan EP | |
| FUCHS | Renep Compound | |
| MOBIL | Mobilgear | |
| SHELL | Shell Omala Oil | |
| DEA | Astron HLP<br>Falcon CLP | |
| TEXACO | Meropa | |
| Wintershall | Ersolan | |

*Table 5.1: Gear oil*

### For ambient temperatures of between - 40 °C and + 50 °C (- 40 °F and 122 °F)

Suitable oils are multi-grade, mineral oil based gear oils with a nominal viscosity of approx. 70 to 100mm²/s (cSt) at approx. 40 °C (104 °F). You will find examples of oil types in Table 5.2:

| Brand | Gear oil | mm²/s (cSt) at approx. 40 °C (104 °F) |
|---|---|---|
| ARAL | HYP SYNTH | 78 |
| DEA | Deagear SX 75W-90 | 97 |
| ESSO | GX 75W-90 | 100 |
| SHELL | HD 75W-90 | 77 |

*Table 5.2: Gear oil*

## 5.3 Start-up Procedure

Consider the following points before starting the metering pump:

- Check oil filling *(see section 5.1).*
- Readjust stroke length, if necessary, e.g. after transport *(see section 3.2).*
- Check if the metering pump is protected against overload. For safety valves *see section 4.3.1.*

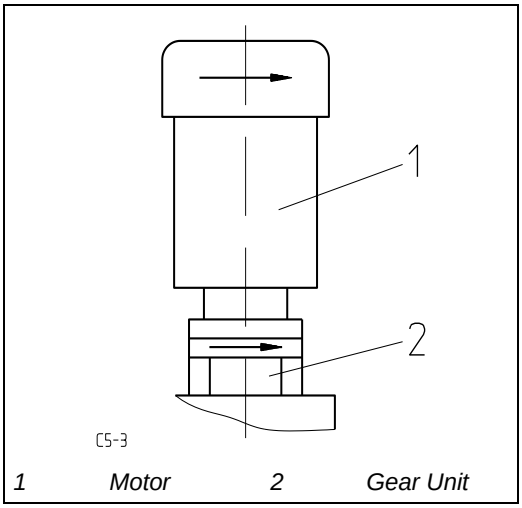
### Electrical Connection

**DANGER!**

**Electric shocks can kill you!**

**The motor must only be connected by qualified personnel!**

- Connect drive motor (1).
- Check the direction of rotation of the drive motor (1). An arrow on the fan cover of the motor and the gear unit indicates the direction of rotation *(see Fig. 5.1).*




*1 Motor 2 Gear Unit*

*Fig. 5.1: Direction of the Motor Rotation*

**ATTENTION!**

**An enormous rise in pressure can result in an impermissible build-up of heat in the pump head and cause damage to parts of the pump head.**

- **Do not start up the pump with closed shut-off valves in the pressure and suction piping.**
- **Install a safety valve in the pressure piping.**
- **Do not close the shut-off valves in the pressure and suction piping whenever the pump is still in operation.**

**For machines with frequency converters, the following information applies:**

**Do not change any data (frequency range and torque characteristics) adjusted by SPX FLOW until you have consulted with SPX FLOW first!**

## Start-up procedure

- Open all shutoff valves in the suction and discharge lines.
- If heating or cooling is necessary, open all shut-off valves in the supply lines.
- Make sure that there is sufficient product.
- Adjust the stroke length to "0".
- If the motor speed is variable, set motor (1) to lowest speed.
- Start drive motor.
- Slowly increase speed and stroke length to the maximum.
- If possible, operate the metering pump at minimum discharge pressure for good venting of the pipework.
- Check the pipework and the packing of the pump for leaks during the start-up procedure.

If the suction head is too high and the metering pump does not prime,

- increase the suction pressure or
- reduce the suction lift, *see section 4.3.1.*

When suction and discharge lines are filled and vented,

- slowly increase the pressure up to the operating pressure
- adjust speed and stroke length to the required values.

## 5.4 Adjustment of the Capacity

The stroke length to be adjusted for a required capacity is calculated from the max. stroke length, the capacity required and the max. capacity. The max. capacity is calculated from:

- an assumed volumetric efficiency of 98 % and
- the number of strokes that result from the nominal speed of the motor.

Under normal operating conditions, it is sufficient to calculate the stroke length according to the following equation:

$$\text{stroke length (mm)} = \text{max. stroke length (mm)} \times \frac{\text{capacity required (l/h)}}{\text{max. capacity (l/h)}}$$

**or**

$$\text{stroke length (\%)} = 100\,\% \times \frac{\text{capacity required (l/h)}}{\text{max. capacity (l/h)}}$$

| | |
|---|---|
| max. stroke length: | *refer to section 9, table 9.1* |
| max. capacity: | refer to *section 9, table 9.1* |
| capacity required: | given by the user of the metering pump |

**Example**

For the example, the following values are assumed:

| | |
|---|---|
| max. stroke length: | 8 mm |
| max. capacity: | 245 l/h |
| capacity required: | 200 l/h |

$$\text{stroke length} = 8\ \text{mm} \times \frac{200}{245} = \underline{\underline{6{,}53\,\text{mm}}}$$

**or**

$$\text{stroke length} = 100\,\% \times \frac{200}{245} = \underline{\underline{81{,}6\,\%}}$$

Under special operating conditions, however, such as

- high operating pressures and
- small diaphragm/plunger diameters,

the stroke length calculated above should be corrected since the actual capacity is dependent on operating conditions such as operating pressure, viscosity, length of suction and discharge lines, arrangement etc. Thus an exact relationship between stroke length and capacity can only be determined under operating conditions.

**In case of normal operating conditions you don't need to follow the procedure described below and can directly proceed with *section 5.4.1*.**

## Correction of Stroke Length by Determining the Actual Capacity

To determine the actual capacity, measure
- the volume per 100 strokes and
- the actual stroke frequency.

Two ways of measuring the volume are described below:

**Measuring the Volume on the Suction Side *(Fig. 5.1)***

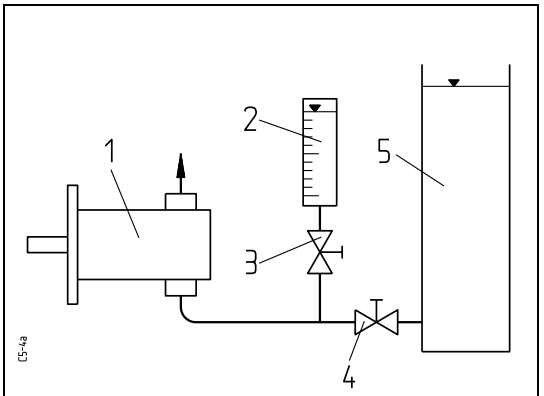
Prior to the measurement:

- Fill and vent the suction and discharge lines prior to measurement.
- Operate the pump for a short time
- Adjust the stroke length to 6,53 mm or 81,6 % as calculated in example 1.

Measurement

- Open shutoff valves (3) and (4).
- Fill up burette (2).
- Close shutoff valve (4).
- Read volume drawn from the burette (2) for 100 strokes.

  measured volume = $V_{100\ strokes}$ ($cm^3$)




*1 Pumphead* *4 Shutoff Valve*
*2 Burette* *5 Suction Tank*
*3 Shutoff Valve*

*Fig. 5.1: Measuring the Volume on the Suction Side*

**Measuring the Volume on the Discharge Side *(Fig. 5.2)***

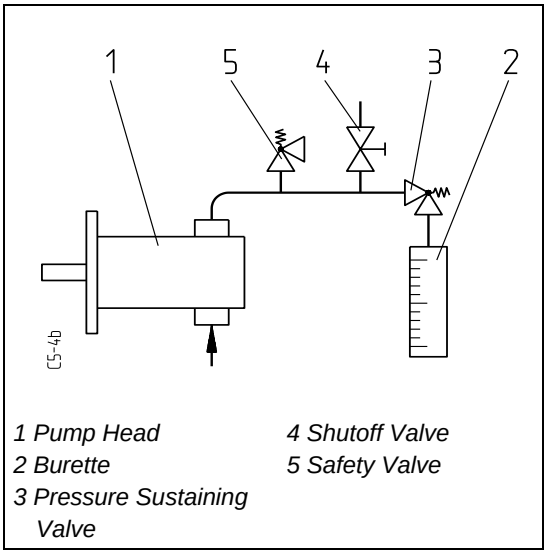
Prior to the measurement:

- Fill and vent suction and discharge lines.
- Operate the pump for a short time
- Adjust the stroke length to 6,53 mm or 81,6 % as calculated in example 1.

Measurement

- Close the shutoff valve (4).
- Adjust the pressure sustaining valve (3) to the operating pressure.
- Read the quantity delivered by 100 strokes.

  measured volume = $V_{100\ strokes}$ ($cm^3$)




*1 Pump Head* *4 Shutoff Valve*
*2 Burette* *5 Safety Valve*
*3 Pressure Sustaining Valve*

*Fig. 5.2: Measuring the Volume on the Discharge Side*

## Determining the Actual Stroke Frequency

The actual stroke frequency is needed for the calculation of the actual capacity:

- Count the actual number of strokes per minute.

### Actual capacity

With the volume $V_{100\ strokes}$ *(Fig. 5.1 or 5.2)* and the actual stroke frequency, the actual capacity can be calculated. $V_{100\ strokes}$ is assumed to be 2150 $cm^3$, stroke frequency 150 strokes/min:

$$\text{actual capacity} = V_{100\,\text{strokes}} \times \frac{\text{actual stroke frequency} \times 60}{100 \times 1000}\ (\text{l/h})$$

$$\text{actual capacity} = 2150 \times \frac{150 \times 60}{100 \times 1000}\ (l/h)$$

$$\text{actual capacity} = \underline{\underline{193{,}5\,\text{l/h}}}$$

## Correction of the stroke length under operating conditions

With the actual capacity *(see above)* and the stroke length the corrected stroke length adjustment can be calculated:

$$\text{stroke length corr.} = \text{stroke length} \times \frac{\text{required capacity}}{\text{actual capacity}}$$

$$\text{stroke length corr.} = 6{,}53\,\text{mm} \times \frac{200}{193{,}5} = \underline{\underline{6{,}75\,\text{mm}}}$$

**or**

$$\text{stroke length corr.} = 81{,}6\,\% \times \frac{200}{193{,}5} = \underline{\underline{84{,}3\,\%}}$$

## 5.4.1 Flow Rate Curve

Another way of determining the corresponding stroke length for the required capacity is to use a flow rate curve. Due to the linear pressure metering characteristics it is easy to plot the flow rate curve for your specific pump:

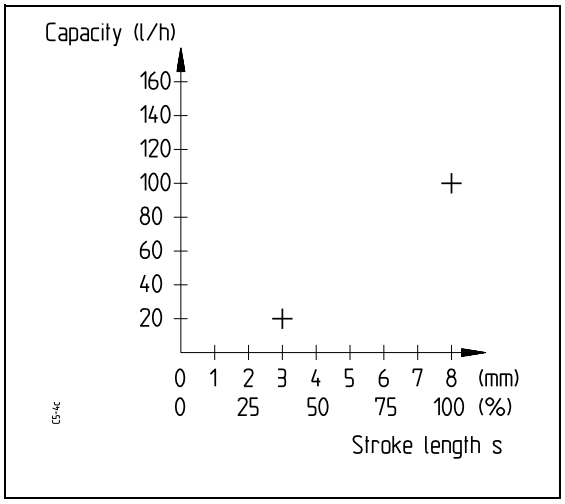
- Calculate the correct stroke length for a required capacity, following the procedure described under 5.4. Repeat this for one further required capacity.

  The values in *Table 5.1*, chosen as an example, are based on a max. stroke length of 8 mm and an operating pressure of 10 bar.

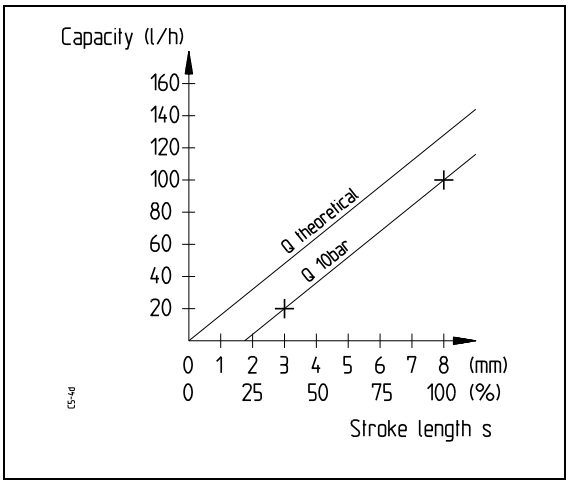
| required capacity (l/h) | 20 | 100 |
|---|---|---|
| corr. stroke length<br>in mm :<br>or in % : | <br>3<br>37.5 | <br>8<br>100 |

*Table 5.1: Example*

- Plot the values onto a graph showing the corrected stroke length on the x-axis against the capacity on the y-axis.




- Draw a line through the two points. The line does not meet the origin. A line meeting the origin would correspond to the optimal theoretical capacity not taking into account any operating conditions.




**The flow rate curve is only valid as long as the operating conditions (e.g. operating pressure and medium used) stay the same!**

# 6 Maintenance, Inspection, Cleaning

## General

The completion of regular, complete and properly performed maintenance, inspection and cleaning tasks by technically competent, trained and qualified personnel guarantees trouble-free operation of the pump, increases the product quality and prevents any unplanned disruption of production operations.

**CAUTION!**

**Improper maintenance of the pump can result in personal and property damage.**

**Let all maintenance, inspection and cleaning tasks be carried out by technically competent, trained or qualified personnel only.**

Always carry out all maintenance, inspection and cleaning tasks on the pump only with the pump in properly protected, safe condition.

**CAUTION!**

**Before performing any maintenance, inspection and cleaning tasks, all connections of the pump to sources of energy must be disconnected first.**

**In particular, separate the connections to the source of the electrical connection and / or compressed air.**

Make sure that all auxiliary systems, drive units and extra equipment systems (piping, pipeworks) of the pump to be maintained/repaired are switched off and depressurized.

Following the termination of the maintenance, inspection and cleaning tasks, all external objects such as tools, cleaning agents, cleaning rags, etc. must be removed from the pump area.

Following the maintenance, inspection and cleaning tasks, check whether all protective devices have been re-installed and are fully operational again.

In addition to the maintenance, inspection and cleaning tasks, inspections during the production process are also required. *(See Table 6.1 to 6.2)*

## Drive Motor

Since the drive motor is not a SPX FLOW product, please refer to the drive manufacturer’s manual for proper drive lubrication and frequency.

## Gear Unit

The following *Table 6.1* includes information regarding checks and maintenance.

| What | | When<br>*h = hours of operation* | Who | Reference (section) |
|---|---|---|---|---|
| **Oil level** | ***Check*** | weekly | Operator | 5.1. |
| **Surface temperature of the gear unit casing (Oil temperature)** | ***Check*** | weekly | Operator | 5.1. |
| **Oil change** | | half-yearly<br>every 4.000 h | Expert | 5.1. |

*Table 6.1: Maintenance Intervals Gear Unit*

## Pumphead

The following *Table 6.2* includes information regarding checks and maintenance.

| What | | When<br>*h = hours of operation* | Who | Reference (section) |
|---|---|---|---|---|
| **Plunger seals** | ***Check*** | monthly | Operator | 3.3. |
| | ***Change*** | yearly / every 8.000 h | Expert | |
| **Flange connection of suction and discharge valve** | ***Check for leakage*** | monthly | Operator | 3.3. |
| | ***Change*** | in case of permeability / leakage * | Expert | |
| **Diaphragm condition monitoring device** | ***Check*** | weekly | Operator | 3.3. |
| | ***Change*** | yearly<br>every 8.000 h | Expert | |

*Table 6.2: Maintenance Intervals Pump Head*

* ***Recommendation:*** Whenever the diaphragm is changed, always replace the seals with original spare parts.

## Cleaning

**CAUTION!**

**Aggressive cleaning agents can cause skin irritations, rashes, burns and other forms of injury to health. Corrosion damage to metal parts is possible.**

**Whenever you pump dangerous (caustic, aggressive, toxic) media, note the fact that there can still be residue in the pump head.**
**This residue can cause skin irritations, rash, burns and other forms of injury to health.**

**Avoid skin contact.**

**Wash your hands properly each time after coming into contact with these substances.**

**Wear protective equipment!**

**Clean the pump with chemically compatible cleaning agents only**

Clean the gear/drive unit or the gear/drive unit parts with cold cleaning agents. (e.g. WBC 16)

**CAUTION!**

**Risk of being burned due to hot surfaces of the gear /drive units.**
**Do not clean the gear/drive units until they have cooled off!**

Clean the pump head or pump head parts with water only.

**Protect the environment!**

**Handling and waste disposal of mineral oils and cleaning agents are subject to legal regulations.**

**Deliver old oil and cleaning waste materials to an authorized waste collection center.**

# 7 Trouble Shooting

| Problem | Possible Causes | Remedy |
|---|---|---|
| **No Flow** | • No voltage at the motor: | Check fuses and leads |
| | • Motor broken: | Repair or replace motor |
| | • Coupling broken: | Replace the coupling and eliminate the cause of the overload |
| | • No product: | Fill suction vessel |
| | • Suction or discharge line shut off | Open the shut off valves |
| | • Filter or pipe work clogged: | Clean filter or pipe work |
| | • Valves of pump head incorrectly fitted: | Fit the valves correctly (note the arrows!) *(See section 3.4)* |
| | • Pump valves damaged or dirty: | Clean or replace pump valves |
| | • Gas or air in the product chamber: | Vent and/or fill product chamber |
| | • Discharge pressure too high: | Check the adjustment of the safety valve, check discharge line for length and nominal width, carry out a calculation of the pipework *(see section 4.2)* |
| | • Suction lift too high: | Reduce suction head and, if necessary, increase supply pressure or install a surge tank *(see section 4.3.1)* |
| | • Stroke length adjustment on "0" mm: | Adjust stroke length *(see section 3.2).* |

| Problem | Possible Causes | Remedy |
|---|---|---|
| **Flow rate too high** | • Suction pressure higher than discharge pressure: | Mount pressure sustaining valve *(see section 4.3, fig. 4.5 and 4.6).* |
| **Excessive Discharge** | • Suction or discharge lines too long or nominal width too small: | Enlarge nominal width or install pulsation damper |
| **Flow rate too small** | • Pump valves are dirty or damaged: | Clean or replace the pump valves |
| | • Safety valve is leaking: | Clean safety valve; replace or rework damaged parts |
| | • Safety valve in operation because of excessive pressure loss in discharge line: | Enlarge nominal width or install pulsation damper |
| | • Gas or air in the product: | Increase suction pressure; vent and/or fill product chamber |
| | • Cavitation: | Increase suction pressure; vent and/or fill product chamber |
| | • Wrong stroke length: | Check and, if necessary, recalculate or adjust stroke length |
| **Flow rate unsteady** | • Impurity of the flow medium: | Flush pipework; if necessary, install strainer |
| | • Valve seat or valve ball damaged: | Lap or replace valve |
| | • Varying supply pressure or viscosity: | Check operating conditions |

# 8 Transport, Intermediate Storage, Preservation

## 8.1.1 Transport

During the trial run performed by the factory, the gear/drive unit is filled with a type of oil that acts as a preservative.
The oil is drained prior to the shipping procedure. However, the internal parts of the gear/drive unit remain covered by a thin oil protection coating.

Take the necessary measures to ensure proper transport in order to prevent damage to the pump in packaged and/or unpackaged condition.

**During transport and later during storage the pump must be protected against moisture, salt-water, rain, sand storms, and direct sunlight**

Only use suitable transport equipment, such as elevating trucks, fork-lift trucks and/or lifting cranes in order to transport the pump.

Dimensions and weights of the pump or pump parts → *see shipping order.*

### Preparations for Transport Procedure

- Upon delivery, check the packaging for any signs of damage. Complaints about external damage to the packaging must be reported to the respective transport company immediately.
- Remove the packaging.
- Undo and remove all fastening screws and fastening elements on the packaging elements.

Observe the following instructions **before** transporting the pumps:

**WARNING!**

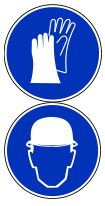
**Risk of injury due to falling load. Serious injury may result.**

**During the lifting or lowering operation, do not stand underneath the load.**

**Stay away from the danger zone.**

**During the transport operation, use a hoisting crane and fasten the lifting gear only at the eyelets provided for this purpose (ring screws).**

**Do not remove the tension from the suspending equipment until the pump has been securely fastened on the foundation.**



**Wear safety gloves and, whenever necessary, a safety helmet.**

**Do not use any steel cables or chains!**

**Make sure that the transport cables have been correctly fastened and that the load-carrying capacity is sufficient.**

- Lift up the pump slowly above its center of gravity.
- During the transport procedure, make sure that the pump remains in horizontal position and that it cannot slip out of the transport suspending equipment.
- Place the pump down slowly at the installation location. Make sure that the pump doesn't tip over.
- Line up the pump in its final position.
- Remove the transport cables and other auxiliary devices.
- Secure the pump firmly on the provided installation location.

## 8.1.2 Intermediate Storage

### 1. Storage in dry and well ventilated rooms

A storage period of up to 2 years is possible without any special precautionary measures.

### 2. Storage in rooms with high levels of air moisture

The pump must be sealed air-tight in plastic foil and be protected against condensation water by means of a suitable quantity of silica gel. Then a storage period of up to 2 years is possible.

### 3. Storage Outdoors

In addition to the measures mentioned in Item 2, a form of protection against precipitation, sandstorms and direct sunlight must be provided.

## 8.1.3 Preservation

### Preservation of installed pumps

Fill up the pump with oil of the recommended quality in the specified quantity
*(See section 5.1).*

If the start of operation is delayed, the metering pump must be switched on for approx. 1 hour every month with a stroke length of "0" mm in order to wet all the exposed locations in the gear/drive unit with oil again..

Change the oil once a year.

After extended storage, an oil change is required prior to start-up of the pump. Afterwards, the specified oil changes must be carried out *(see section 6 ).*

# 9 Data, Drawings and Parts Lists

## 9.1 Pump Data – Maximum Capacity

| Model No. | Max Pressure (psig) | Flowrate (GPH) @ _SPM | | | | Max Str. Length | Approx. Weight Lbs |
|---|---|---|---|---|---|---|---|
| | | 64 | 94 | 127 | 188 | | |
| MD15S, MS15A, MD15P, MD15K | 300<br>150 | 1.8 | 2.7 | 3.6 | 5.4 | 3mm | 40<br>37 |
| MD50S, MS50A, MD50P, MD50K | 150<br>150 | 6.0 | 9.0 | 12.0 | 18.0 | 3mm | 40<br>37 |
| MD200S, MS200A, MD200P, MD200K | 175<br>150 | 27.0 | 40.0 | 54.0 | 80.0 | 8mm | 65<br>64 |

*Table 9.1: Max. Capacity for ProCam MD*

## 9.2 Material of Construction

| Model / Type | MD15S MD50S | MD15A MD50A | MD15P MD50P | MD15K MD50K |
|---|---|---|---|---|
| **Component** | | | | |
| Gearbox | Cast Iron | Cast Iron | Cast Iron | Cast Iron |
| End Cover & Conn. | 316SS | Alloy 20 | PVC | PVDF |
| Diaphragm | PTFE | PTFE | PTFE | PTFE |
| Disc | 316SS | Alloy 20 | PVC | PVDF |
| Valve Housing | 316SS | Alloy 20 | PVC | PVDF |
| Valve Seat | 316SS | Alloy 20 | PVC | PVDF |
| Valve Ball | 316SS | Ceramic | Glass | Glass |
| Gaskets / O-rings* | 316SS | Alloy 20 | EPDM* | EPDM* |

* Gaskets and O-rings available in FPM (optional)

*Table 9.2a: Materials of Construction for MD15 and MD50*

| Model / Type | MD200S | MD200A | MD200P | MD200K |
|---|---|---|---|---|
| **Component** | | | | |
| Gearbox | Cast Iron | Cast Iron | Cast Iron | Cast Iron |
| End Cover & Conn. | 316SS | Alloy 20 | PVC | PVDF |
| Diaphragm | PTFE | PTFE | PTFE | PTFE |
| Disc | 316SS | Alloy 20 | PVC | PVDF |
| Valve Housing | 316SS | Alloy 20 | PVC | PVDF |
| Valve Seat | 316SS | Alloy 20 | PVC | PVDF |
| Valve Ball | 316SS | Ceramic | Ceramic | Ceramic |
| O-rings* | FD10 | PTFE | EPDM* | EPDM* |

* O-rings available in FPM (optional)

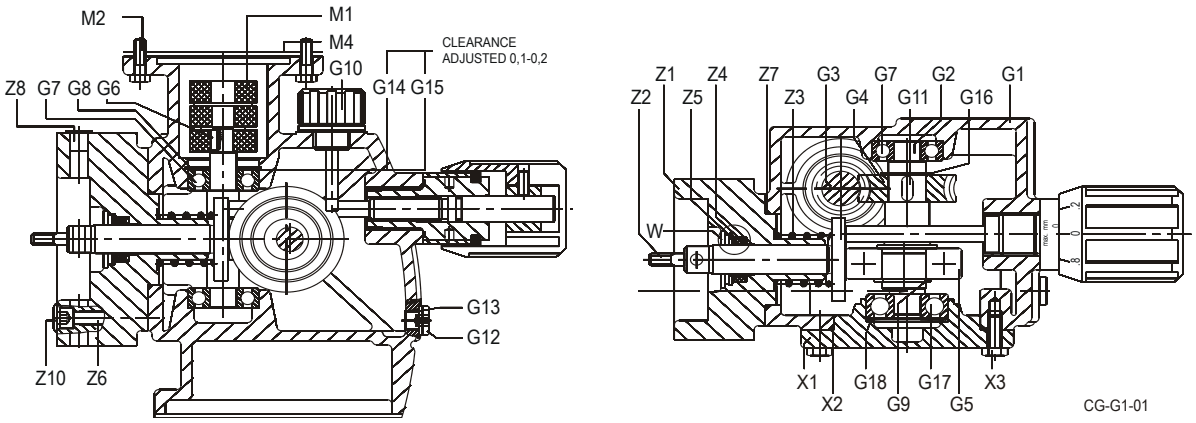
*Table 9.2b: Materials of Construction for MD200*

## 9.3 Drawings and Parts List

On the following pages you will find the drawings and parts lists of your pump. Confirm your pump model number(s) (e.g. MD15S) by checking the nameplate on each individual pump. The model number and material of construction are used to identify the correct part list for your pump.

If you need to order parts, select the position number of the part on the corresponding drawings, and identify the part number of the items you require.

| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group |
|---|---|---|---|---|---|---|
| Z1 | 1 | Pump Yoke, Spacer, D15 | CV - 122 | GGG 40 | 202049 | Yoke D015 |
| Z2 | 1 | Tappet | CV - 22 | 1.4034 | 303381 | |
| Z3 | 1 | Spring | CV - 140 | VD | 190238 | |
| Z4 | **1** | **Slot ring, 14 x 22 x 5,7** | | AU | **369608** | |
| Z5 | 1 | Retaining Ring, 24 x 1,2 | DIN 472 | ST | 101758 | |
| Z6 | 2 | Screw, M 6 x 40 | DIN 912 | 8.8 | 180045 | |
| Z7 | **1** | **O-ring, 45 x 2** | | NBR | **152175** | |
| Z8 | 1 | Cap | | PE | 170209 | |
| Z10 | 2 | Screening | | PE | 303453 | |
| G1 | 1 | Housing | CV - 3 | GG 20 | 229702 | Gearbox, G1 |
| G2 | 1 | Shaft | CV - 126 | C 45 | 251043 | (D015 & D050) |
| G3 | 1 | Worm Shaft 28/1 * | CV - 85 | C 45 | 224057 | |
| G4 | 1 | Worm Wheel 28/1 * | CV - 86 | 2.106 | 223021 | |
| G3 | 1 | Worm Shaft 19/1 ** | CV - 24 | C 45 | 224054 | |
| G4 | 1 | Worm Wheel 19/1 ** | CV - 19 | 2.106 | 223002 | |
| G5 | 1 | Bearing NUP 304 | | | 120150 | |
| G6 | 1 | Parallel Key, A 3 x 3 x 10 | DIN 6885 | ST 50-1K | 100708 | |
| G7 | 3 | Bearing 6201 | DIN 625 | | 120040 | |
| G8 | 1 | Retaining ring, 32 x 1,2 | DIN 472 | Spr. Stl | 101614 | |
| G9 | 1 | Retaining ring, 20 x 1,2 | DIN 471 | Spr. Stl | 101604 | |
| G10 | 1 | Screw, Bolt G 3/8 - B2 | CV - 73 | Kunstst. | 078557 | |
| G11 | 1 | Parallel Key, A 5 x 5 x 12 | DIN 6885 | ST 50-1K | 100709 | |
| G12 | 1 | Screw, Bolt G 1/8" | DIN 908 | A4 | 100097 | |
| G13 | 1 | Seal Ring, C 10 x 14 | DIN 7603 | FD12 | 150227 | |
| G14 | 2 | Shim, 22 x 32 x 0,1 | DIN 988 | ST | 101518 | |
| G15 | 1 | Shim, 22 x 32 x 0,3 | DIN 988 | ST | 101529 | |
| G16 | 1 | Retaining ring, 17 x 1 | DIN 471 | Spr. Stl | 101704 | |
| G17 | 1 | Bearing 6301 | DIN 625 | | 120070 | |
| G18 | 1 | Washer, Disc EPL 30 | | Spr. Stl | 101647 | |
| X1 | 1 | Cover | CV - 8 | GG 20 | 229705 | Cover Assy G1 |
| X2 | 1 | O-ring 66 x 2 | | NBR | 152178 | |
| X3 | 2 | Screw, Bolt M6 x 16 | ISO 4017 | 8.8 | 100230 | |

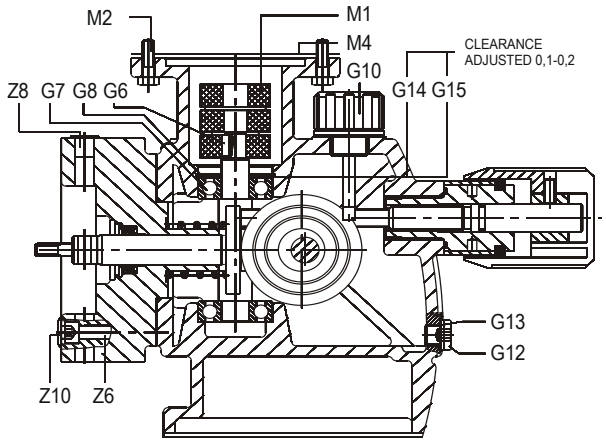


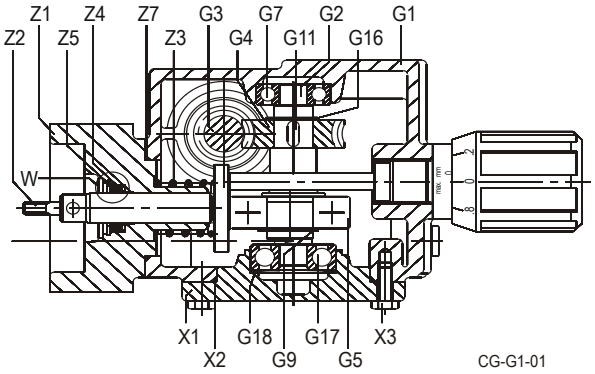

| Producer | Description | Drawing-No. | Ident-No. | |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Gearbox G1 / MD15 - Master Part List** | **CG-G1-01** | | |

Recommended Spares are indicated in **BOLD PRINT**.

* ** The worm shaft and worm wheel (items G3 & G4) must be matched together with the same reduction ratio (28:1 or 19:1). Your reduction ratio is stamped on the outside cover of your gearbox housing (position X1).

| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group |
|---|---|---|---|---|---|---|
| Z1 | 1 | Pump Yoke, Spacer, D50 | CV - 7 | GGG 40 | 202040 | Yoke D050 |
| Z2 | 1 | Tappet | CV - 22 | 1.4034 | 303381 | |
| Z3 | 1 | Spring | CV - 27 | VD | 190225 | |
| Z4 | **1** | **Slot ring, 14 x 22 x 5,7** | | AU | **369608** | |
| Z5 | 1 | Retaining Ring, 24 x 1,2 | DIN 472 | ST | 101758 | |
| Z6 | 2 | Screw, M 6 x 40 | DIN 912 | 8.8 | 180045 | |
| Z7 | **1** | **O-ring, 45 x 2** | | NBR | **152175** | |
| Z8 | 1 | Cap | | PE | 170209 | |
| Z10 | 2 | Screening | | PE | 303453 | |
| G1 | 1 | Housing | CV - 3 | GG 20 | 229702 | Gearbox, G1 |
| G2 | 1 | Shaft | CV - 126 | C 45 | 251043 | (D015 & D050) |
| G3 | 1 | Worm Shaft 28/1 * | CV - 85 | C 45 | 224057 | |
| G4 | 1 | Worm Wheel 28/1 * | CV - 86 | 2.106 | 223021 | |
| G3 | 1 | Worm Shaft 19/1 ** | CV - 24 | C 45 | 224054 | |
| G4 | 1 | Worm Wheel 19/1 ** | CV - 19 | 2.106 | 223002 | |
| G5 | 1 | Bearing NUP 304 | | | 120150 | |
| G6 | 1 | Parallel Key, A 3 x 3 x 10 | DIN 6885 | ST 50-1K | 100708 | |
| G7 | 3 | Bearing 6201 | DIN 625 | | 120040 | |
| G8 | 1 | Retaining ring, 32 x 1,2 | DIN 472 | Spr. Stl | 101614 | |
| G9 | 1 | Retaining ring, 20 x 1,2 | DIN 471 | Spr. Stl | 101604 | |
| G10 | 1 | Screw, Bolt G 3/8 - B2 | CV - 73 | Kunstst. | 078557 | |
| G11 | 1 | Parallel Key, A 5 x 5 x 12 | DIN 6885 | ST 50-1K | 100709 | |
| G12 | 1 | Screw, Bolt G 1/8" | DIN 908 | A4 | 100097 | |
| G13 | 1 | Seal Ring, C 10 x 14 | DIN 7603 | FD12 | 150227 | |
| G14 | 2 | Shim, 22 x 32 x 0,1 | DIN 988 | ST | 101518 | |
| G15 | 1 | Shim, 22 x 32 x 0,3 | DIN 988 | ST | 101529 | |
| G16 | 1 | Retaining ring, 17 x 1 | DIN 471 | Spr. Stl | 101704 | |
| G17 | 1 | Bearing 6301 | DIN 625 | | 120070 | |
| G18 | 1 | Washer, Disc EPL 30 | | Spr. Stl | 101647 | |
| X1 | 1 | Cover | CV - 8 | GG 20 | 229705 | Cover Assy G1 |
| X2 | 1 | O-ring 66 x 2 | | NBR | 152178 | |
| X3 | 2 | Screw, Bolt M6 x 16 | ISO 4017 | 8.8 | 100230 | |



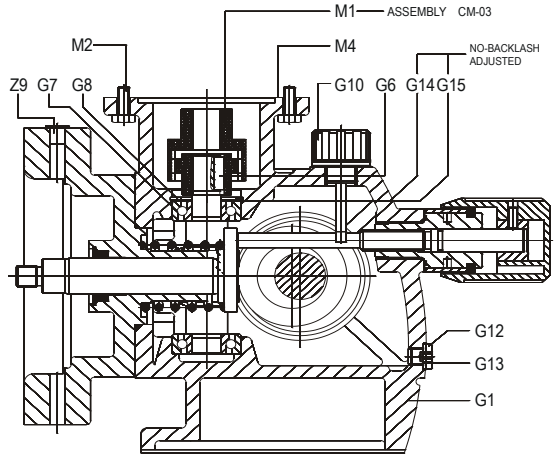



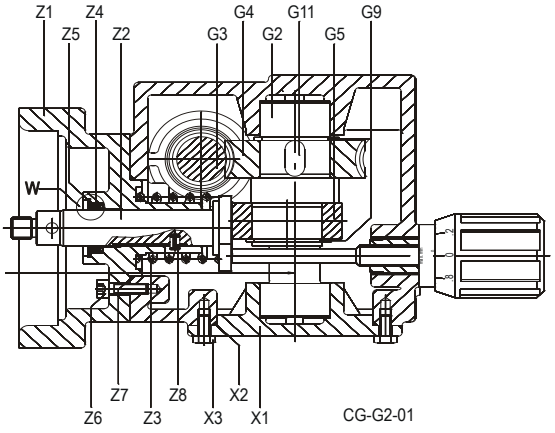

| Producer | Description | Drawing-No. | Ident-No. | |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Gearbox G1 / MD050 - Master Part List** | **CG-G1-01** | | |

Recommended Spares are indicated in **BOLD PRINT**.

* ** The worm shaft and worm wheel (items G3 & G4) must be matched together with the same reduction ratio (28:1 or 19:1). Your reduction ratio is stamped on the outside cover of your gearbox housing (position X1).

| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group |
|---|---|---|---|---|---|---|
| Z1 | 1 | Pump Yoke, Spacer, D200 | CV - 1 | GG 20 | 202037 | Yoke D200 |
| Z2 | 1 | Tappet | CV - 14 | 1.4112 | 303383 | |
| Z3 | 1 | Spring | CV - 151 | VD | 190254 | |
| Z4 | **1** | **Slot ring, 20 x 28 x 5,7** | | AU | **369609** | |
| Z5 | 1 | Retaining Ring, 31 x 1,2 | DIN 472 | Spr. Stl | 101648 | |
| Z6 | 4 | Screw, M 6 x 40 | DIN 912 | 8.8 | 100123 | |
| Z7 | **1** | **O-ring, 54 x 2** | | NBR | **152176** | |
| Z8 | 1 | Pin 5 x 8 | ISO 8752 | Spr. Stl | 102001 | |
| Z9 | 1 | Cap | | PE | 170209 | |
| G1 | 1 | Housing | CV - 17 | GG 25 | 229711 | Gearbox, G2/D200 |
| G2 | 1 | Shaft | CV - 124 | 16MnCr5 | 251041 | |
| G3 | 1 | Worm Shaft 28/1 * | CV - 84 | C 45 | 224056 | |
| G4 | 1 | Worm Wheel 28/1 * | CV - 83 | 2.1060 | 223020 | |
| G3 | 1 | Worm Shaft 38/2 ** | CV - 21 | C 45 | 224055 | |
| G4 | 1 | Worm Wheel 38/2 ** | CV - 20 | 2.1060 | 223006 | |
| G5 | 1 | Ring | CV - 37 | 16MnCr5 | 229713 | |
| G6 | 1 | Parallel Key, A 5 x 5 x 18 | DIN 6885 | ST 50-1K | 100531 | |
| G7 | 2 | Bearing 7202 BE | DIN 628 | | 120071 | |
| G8 | 1 | Retaining ring, 35 x 1,5 | DIN 472 | Spr. Stl | 101615 | |
| G9 | 2 | Retaining ring, 36 x 1,75 | DIN 471 | Spr. Stl | 101649 | |
| G10 | 1 | Screw, Bolt G 3/8 - B2 | CV - 73 | Kunststst. | 078557 | |
| G11 | 1 | Parallel Key, A 10 x 8 x 20 | DIN 6885 | ST 50-1K | 100710 | |
| G12 | 1 | Screw, Bolt G 1/8" | DIN 908 | A4 | 100097 | |
| G13 | 1 | Seal Ring, C 10 x 14 | DIN 7603 | FD12 | 150227 | |
| G14 | 2 | Shim, 25 x 35 x 0,1 | DIN 988 | ST | 101546 | |
| G15 | 1 | Shim, 25 x 35 x 0,3 | DIN 988 | ST | 101550 | |
| X1 | 1 | Cover | CV - 5 | GG 25 | 229704 | Cover Assy G2 |
| X2 | 1 | O-ring 80 x 2 | | NBR | 152180 | |
| X3 | 2 | Screw, Bolt M6 x 12 | ISO 4017 | 8.8 | 100229 | |

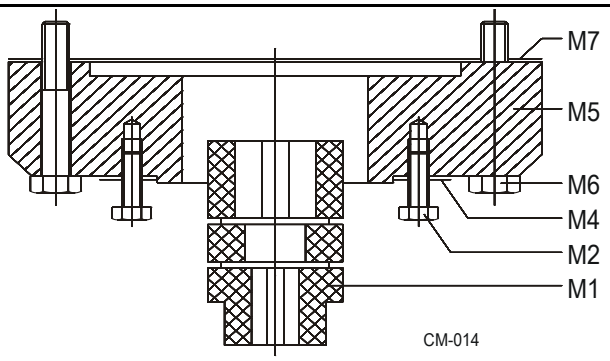



| Producer | Description | Drawing-No. | Ident-No. | |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Gearbox G2 / MD200 - Master Part List** | **CG-G2-01** | | |

Recommended Spares are indicated in **BOLD PRINT**.

* ** The worm shaft and worm wheel (items G3 & G4) must be matched together with the same reduction ratio (28:1 or 19:1). Your reduction ratio is stamped on the outside cover of your gearbox housing (position X1).

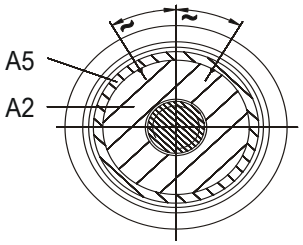


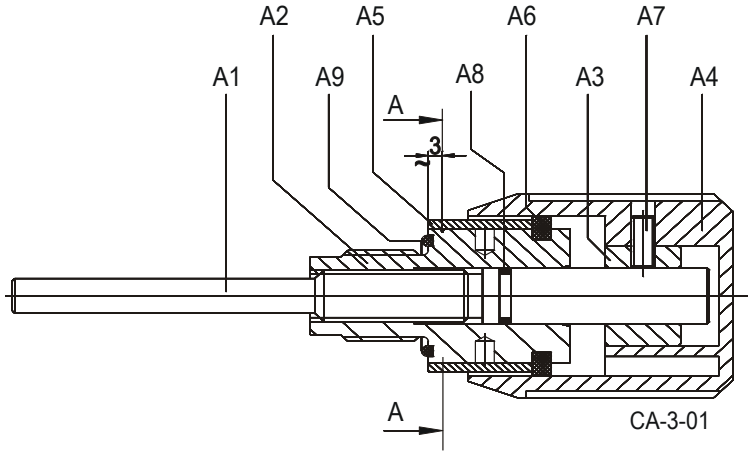

| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group |
|---|---|---|---|---|---|---|
| M1 | **1** | **Coupling 5/8" x 9** | ROTEX 14 | AL-H | **007250** | G1 56C MAFA |
| M2 | 4 | Screw, Bolt M5 x 16 | ISO 4017 | 8.8 Zn | 100225 | |
| M4 | 1 | Gasket, 0,25 thick | P - 20 | FD 3 | 150068 | |
| M5 | 1 | Flange, 56C NEMA | CV - 149 | C 45 | 007249 | |
| M6 | 4 | Screw, Bolt 3/8"-16 x 1-1/4" | | 8.8 Zn | 006832 | |
| M7 | 1 | Gasket | CV - 152 | FD 3 | 150494 | |

| Producer | Description | Drawing-No. | Ident-No. | |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Motor Adapater Assembly for G1 to 56C** | **CM - 014** | 078386 | |

DURING ASSEMBLY :
SET PUNCH MARK AT PART A2
TO PREVENT TORSION OF PART A5

A - A

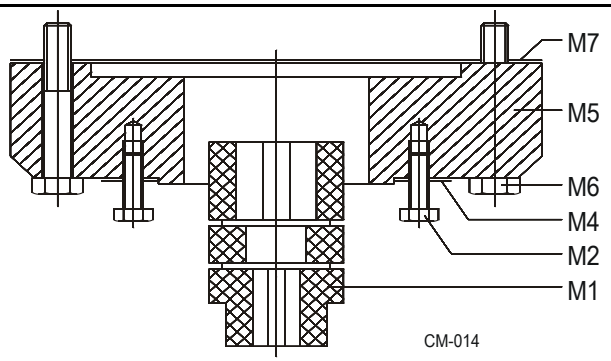



| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group |
|---|---|---|---|---|---|---|
| A1 | 1 | Spindle | CV - 25 | C 45 | 201695 | Stroke Adjustment |
| A2 | 1 | Gland, Screw Connection | CV - 23 | 9SMS28K | 303382 | |
| A3 | 1 | Bushing | CV - 29 | 9SMS28K | 201696 | |
| A4 | 1 | Cap | CV - 60 | PA | 170233 | |
| A5 | 1 | Scale | CV - 68 | PBT | 155076 | |
| A6 | 1 | Ring | CV - 71 | Zell-PUR | 220101 | |
| A7 | 1 | Set Screw M5 x 12 | DIN 916 | A4 | 102159 | |
| A8 | **1** | **O-ring, 10 x 2** | | NBR | **152119** | |
| A9 | **1** | **O-ring, 23 x 1,5** | | NBR | **152174** | |

| Producer | Description | Drawing-No. | Ident-No. | |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Stroke Adjustment Assy, Manual, 0- 3mm** | **CA - 3 - 01** | 440000 | |

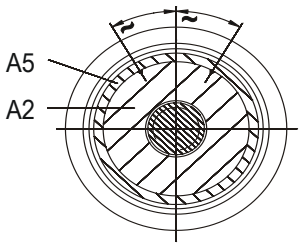
Recommended Spares are indicated in **BOLD PRINT**.

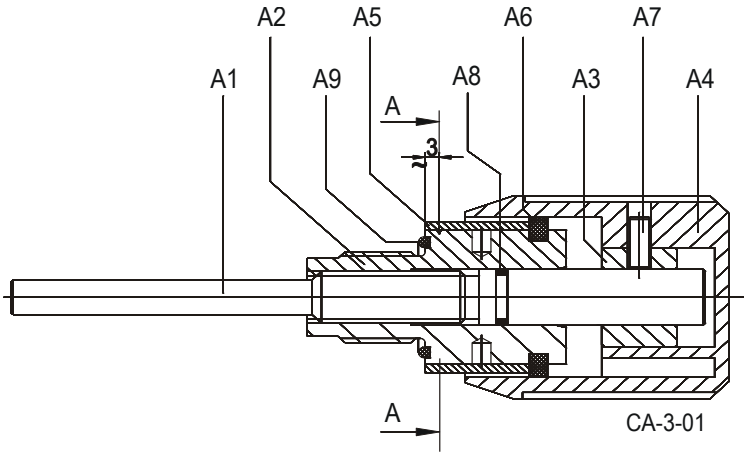



| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group |
|---|---|---|---|---|---|---|
| M1 | **1** | **Coupling 5/8" x 14** | | St / Kunst | **007271** | G2 56C MAFA |
| M2 | 4 | Screw, Bolt M6 x 16 | ISO 4017 | 8.8 | 100230 | |
| M4 | 1 | Gasket | CV - 50 | FD 3 | 150431 | |
| M5 | 1 | Flange, 56C NEMA | CV - 150 | C 45 | 007251 | |
| M6 | 4 | Screw, Bolt 3/8"-16 x 1-1/4" | | 8.8 Zn | 006832 | |
| M7 | 1 | Gasket | CV - 152 | FD 3 | 150494 | |

| Producer | Description | Drawing-No. | Ident-No. | |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Motor Adapater Assy for G2 - NEMA 56C** | **CM - 014** | 078385 | |

DURING ASSEMBLY :
SET PUNCH MARK AT PART A2
TO PREVENT TORSION OF PART A5



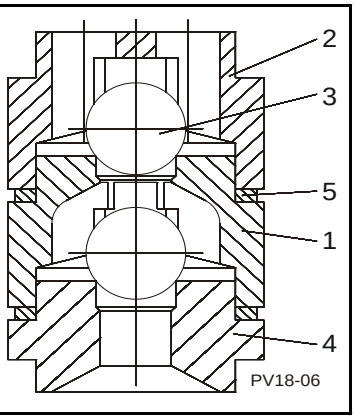

| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group |
|---|---|---|---|---|---|---|
| A1 | 1 | Spindle | CV - 25 | C 45 | 201695 | Stroke Adjustment |
| A2 | 1 | Gland, Screw Connection | CV - 23 | 9SMn28K | 303382 | |
| A3 | 1 | Bushing | CV - 29 | 9SMn28K | 201696 | |
| A4 | 1 | Cap | CV - 60 | PA | 170233 | |
| A5 | 1 | Scale | CV - 69 | PBT | 155077 | |
| A6 | 1 | Ring | CV - 71 | Zell-PUR | 220101 | |
| A7 | 1 | Set Screw M5 x 12 | DIN 916 | A4 | 102159 | |
| A8 | 1 | O-ring, 10 x 2 | | NBR | 152119 | |
| A9 | 1 | O-ring, 23 x 1,5 | | NBR | 152174 | |

| Producer | Description | Drawing-No. | Ident-No. | |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **G2 Stroke Adjustment Assy, Manual, 0- 8mm** | **CA - 3 - 01** | 440001 | |

Recommended Spares are indicated in **BOLD PRINT**.

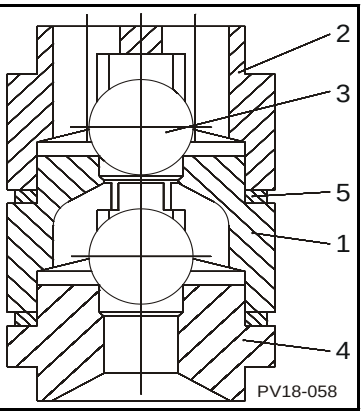
| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 001 | 1 | Housing | PV 18 - 20 | 1.4581 | 341495 |
| 002 | 1 | Housing | PV 18 - 21 | 1.4581 | 341496 |
| 003 | 2 | Ball, 7mm | DIN - 5401 | 1.4401 | 120501 |
| 004 | 1 | Seat, valve | PV 18 - 22 | 1.4571 | 341497 |
| 005 | 2 | Gasket | | 1.4571 | 150109 |

| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Dbl. Ball Valve, 316ss** | **PV18-06** | **540039** |



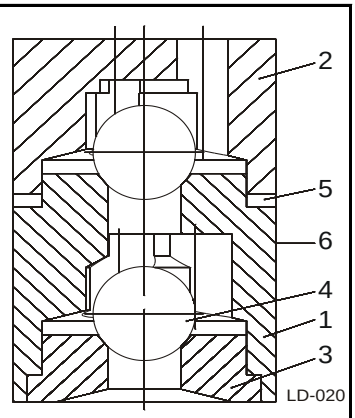

| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 001 | 1 | Housing | PV 18 - 37 | Alloy 20 | 077612 |
| 002 | 1 | Housing | PV 18 - 81 | Alloy 20 | 077613 |
| 003 | 2 | Ball, 7mm | | AL2O3 | 129720 |
| 004 | 1 | Seat, valve | PV 18 - 22 | Alloy 20 | 077614 |
| 005 | 2 | Gasket | | Hast B | 002637 |

| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Dbl. Ball Valve, Alloy 20 / Ceramic Ball** | **PV18-058** | **077611** |



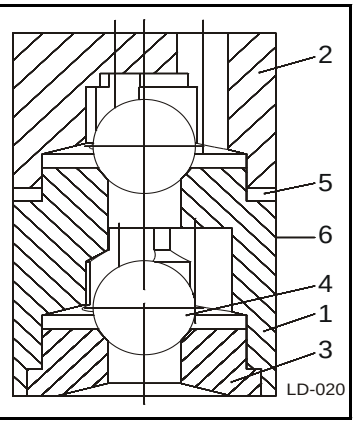

| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 01 | 1 | Housing | LD - 63 | PVC | 340766 |
| 02 | 1 | Housing | LD - 64 | PVC | 340767 |
| 03 | 1 | Valve Seat | LD - 62 | PVC | 340765 |
| 04 | 2 | Ball, 7mm | | Glas | 120513 |
| 05 | 1 | Gasket 14 x 17,5 x 1 | | FD11 | 150384 |
| 06 | 1 | Direction Arrow | PV 18- 135 | | 155035 |

| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Ball Valve, PVC/Ceramic** | **LD-020** | **540022** |



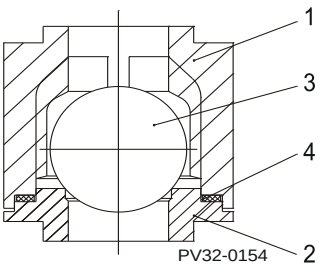

| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 01 | 1 | Housing | LD - 63 | PVDF | 075340 |
| 02 | 1 | Housing | LD - 64 | PVDF | 075341 |
| 03 | 1 | Valve Seat | LD - 62 | PVDF | 075342 |
| 04 | 2 | Ball, 7mm | | Glass | 120513 |
| 05 | 1 | Gasket, 14 x 17,5 x 1 | | EPDM | 150384 |
| 06 | 1 | Direction Arrow 20 x 10 | PV18 - 135 | | 155035 |

| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Ball Valve, PVDF/Ceramic** | **LD-020** | **075343** |



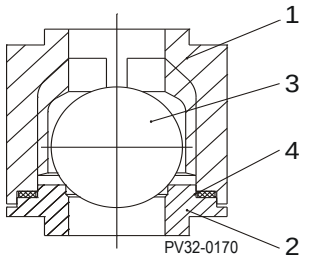
| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 01 | 1 | Housing | PV32 - 250 | 1.4581 | 341504 |
| 02 | 1 | Valve Seat | PV32 - 247 | 1.4571 | 341507 |
| 03 | 1 | Ball, 3/4" | ISO 3290 G28 | 1.4401 | 120517 |
| 04 | 1 | Gasket, 23,5 x 28,5 x 1 | | FD10 | 150300 |

| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Dbl. Ball Valve, 316ss** | **PV32-0154** | **540031** |



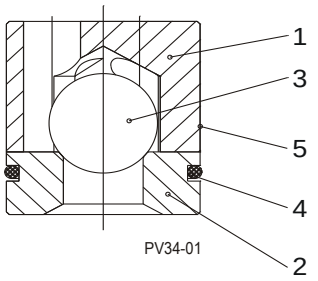

| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 01 | 1 | Housing | PV32 - 255 | Alloy 20 | 077567 |
| 02 | 1 | Valve Seat | PV32 - 247 | Alloy 20 | 077569 |
| 03 | 1 | Ball, 3/4" | | AL2O3 | 129726 |
| 04 | 1 | Gasket, 23,5 x 28,5 x 1 | | PTFE | 150362 |

| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Dbl. Ball Valve, Alloy 20 / Ceramic Ball** | **PV32-0170** | **340018** |




| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 01 | 1 | Housing | PV 34 - 2 | PVC | 340728 |
| 02 | 1 | Valve Seat | PV 34 - 1 | PVC | 340729 |
| 03 | 1 | Ball, 3/4" | | Al2O3 | 129726 |
| 04 | 1 | O-ring, 29 x 2,5 | | EPDM * | 152160 |
| 05 | 1 | Direction Arrow | PV 18- 135 | | 155035 |

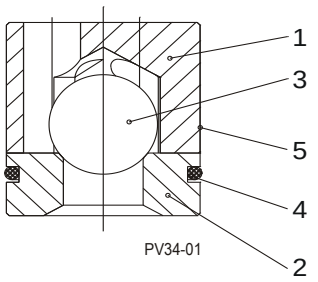
| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Ball Valve, PVC/Ceramic** | **PV34 - 01** | **540381** |



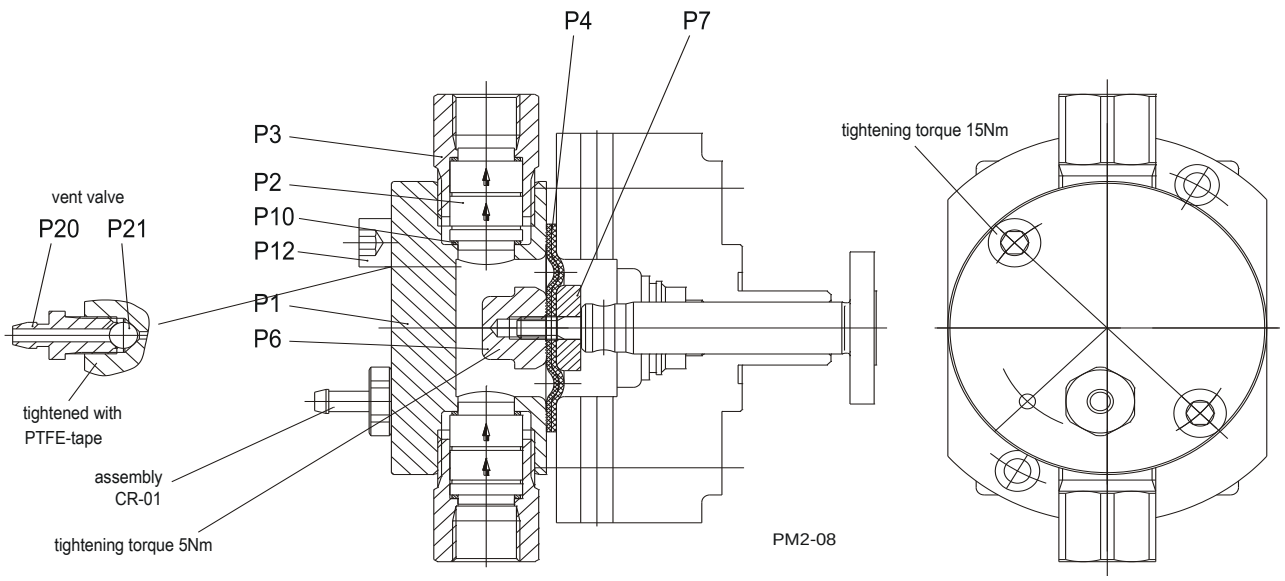

* Alternate O-ring material FPM available: replace o-ring with item # 078317

| Line | Qty | Description | Drawing- No. | Material | Part Number |
|---|---|---|---|---|---|
| 01 | 1 | Housing | PV 34 - 2 | PVDF | 075134 |
| 02 | 1 | Valve Seat | PV 34 - 1 | PVDF | 075135 |
| 03 | 1 | Ball 3/4" | | AL2O3 | 129726 |
| 04 | 1 | O-ring, 29 x 2,5 | | EPDM* | 152160 |
| 05 | 1 | Direction Arrow 20 x 10 | PV 18 - 135 | Spint FO | 155035 |

| Producer | Description | Drawing-No. | Ident-No. |
|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Ball Valve, PVDF/Ceramic** | **PV34 - 01** | **075136** |



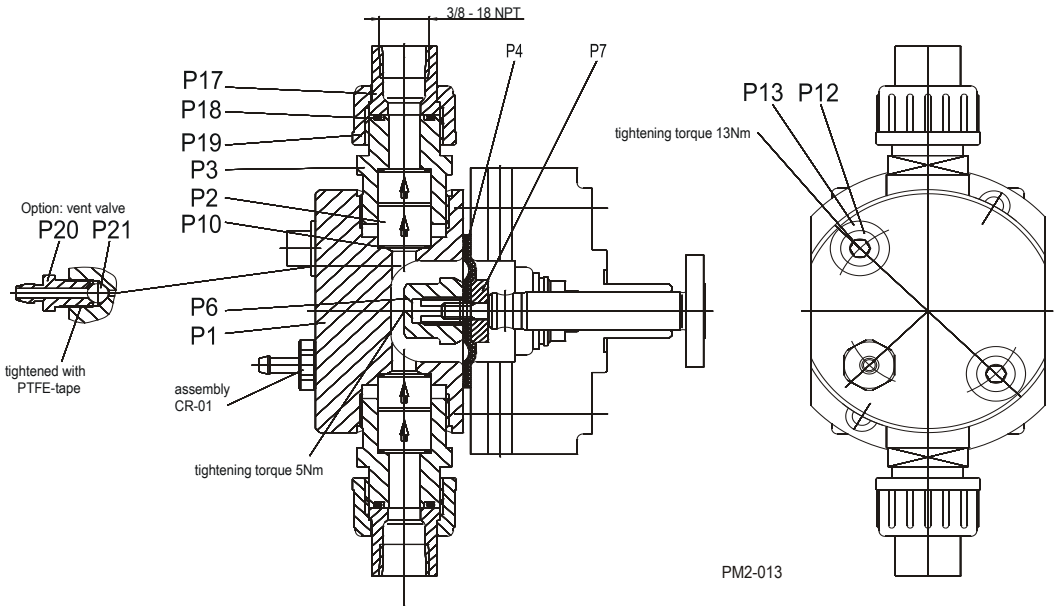

* Alternate O-ring material FPM available: replace o-ring with item # 078317




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| P1 | 1 | Cover | PM 2 - 58 | 1.4571 | 320075 | **Assy Drawing** | **MD15S = 316 ss** |
| P2 | **2** | **Valve** | PV 18 - 06 | 1.4581 | **540039** | **PM2-08** | |
| P3 | 2 | Connection, 3/8" NPTF | NI-1573 | 1.4571 | 326336 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 65 | PTFE | **320136** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 61 | 1.4571 | 320076 | **1103263** | |
| P7 | 1 | Plate | PM 2 - 62 | 1.4571 | 320077 | | |
| P10 | **4** | **Gasket** | | 1.4571 | **150109** | | |
| P12 | 2 | SHCS, M 8 x 50 | DIN 912 | A2 - 70 | 100590 | | |
| P1 | 1 | Cover | PM 2 - 58 | Alloy 20 | 320124 | **Assy Drawing** | **MD15A = Alloy 20** |
| P2 | **2** | **Valve** | PV 18 - 058 | Alloy 20 | **077611** | **PM2-08** | |
| P3 | 2 | Connection, 3/8" NPTF | NI-1573 | Alloy 20 | 324109 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 65 | PTFE | **320136** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 61 | Alloy 20 | 320122 | **440125** | |
| P7 | 1 | Plate | PM 2 - 62 | 1.4571 | 320077 | | |
| P10 | **4** | **Gasket 14 x 17 x 1** | | Alloy 20 | **150529** | | |
| P12 | 2 | SHCS, M 8 x 50 | DIN 912 | A2 - 70 | 100590 | | |
| 01 B | 1 | Press. Gauge, -1…25bar | NG 50 | 1.4571 | 600605 | **Diaphr. Rupture Assy** | |
| 01 C | 1 | Press. Switch (optional) | | | 707510 | **Drawing CR-01** | |
| 01 C | 1 | Adapter for Press. Switch (optional) | | | 707511 | | |

| Producer | Description | Drawing-No. | Ident-No. | Quantity |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Pumphead, MD15 Liquid End (316ss / Alloy 20)** | **PM2-08** | **Ref. Assy Group** | 1 |

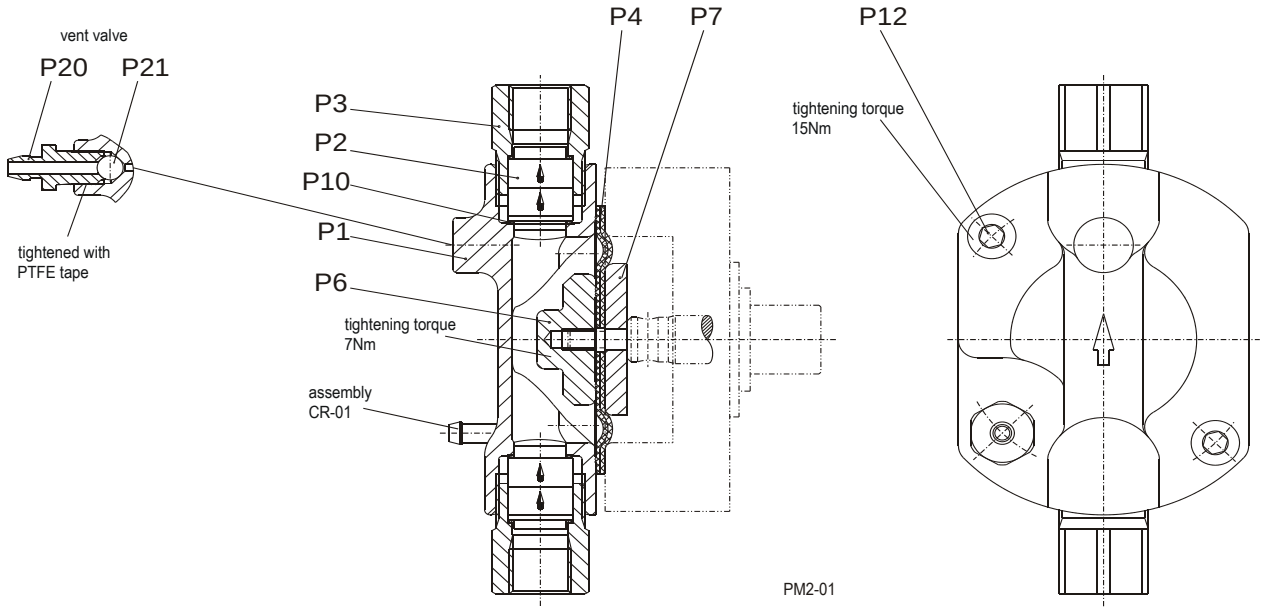
Recommended Spares are indicated in **BOLD PRINT**.




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| P1 | 1 | Cover | PM 2 - 64 | PVC | 320082 | **Assy Drawing** | **MD15P = PVC** |
| P2 | **2** | **Valve** | LD - 020 | PVC | **540022** | **PM2-013** | |
| P3 | 2 | Nipple, 10 | LD - 45 | PVC | 326311 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 65 | PTFE | **320136** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 63 | PVC | 320081 | **440129** | |
| P7 | 1 | Plate | PM 2 - 62 | 1.4571 | 320077 | | |
| P10 | **4** | **Gasket, 14 x 17,5 x 1** | | EPDM* | **150384** | * FPM Alt. = **077018** | |
| P12 | 2 | SHCS, M 8 x 65 | DIN 912 | A2 - 70 | 100592 | | |
| P13 | 2 | Washer, Disc 8,4 x 20 x 1,5 | | A 2 | 101645 | | |
| P17 | 2 | Nipple, 3/8" NPTF | PM 2 - 55 | PVC | 320072 | | |
| P18 | **2** | **O-ring, 15,5 x 2,6** | | EPDM* | **170160** | * FPM Alt. = **152043** | |
| P19 | 2 | Nut, D-16 | GF 21.69.00 | PVC | 170155 | | |
| P1 | 1 | Cover | PM 2 - 64 | PVDF | 078690 | **Assy Drawing** | **MD15K = PVDF** |
| P2 | **2** | **Valve** | LD - 020 | PVDF | **075343** | **PM2-013** | |
| P3 | 2 | Nipple, 10 | LD - 45 | PVDF | 075344 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 65 | PTFE | **320136** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 63 | PVDF | 078697 | **440130** | |
| P7 | 1 | Plate | PM 2 - 62 | 1.4571 | 320077 | | |
| P10 | **4** | **Gasket, 14 x 17,5 x 1** | | EPDM* | **150384** | * FPM Alt. = **077018** | |
| P12 | 2 | SHCS, M 8 x 65 | DIN 912 | A2 - 70 | 100592 | | |
| P13 | 2 | Washer, Disc 8,4 x 20 x 1,5 | | A 2 | 101645 | | |
| P17 | 2 | Nipple, 3/8" NPTF | PM 2 - 55 | PVDF | 091974 | | |
| P18 | **2** | **O-ring, 15,5 x 2,6** | | EPDM* | **170160** | * FPM Alt. = **152043** | |
| P19 | 2 | Nut, D-16 | GF 35.69.04 | PVDF | 078707 | | |
| 01 B | 1 | Press. Gauge, -1…25bar | NG 50 | 1.4571 | 600605 | **Diaphr. Rupture Assy** | |
| 01 C | 1 | Press. Switch (optional) | | | 707510 | **Drawing CR-01** | |
| 01 C | 1 | Adapter for Press. Switch (optional) | | | 707511 | | |

| Producer | Description | Drawing-No. | Ident-No. | Quantity |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Pumphead, MD15 Liquid End (PVC & PVDF)** | **PM2-013** | **Ref. Assy Group** | 1 |

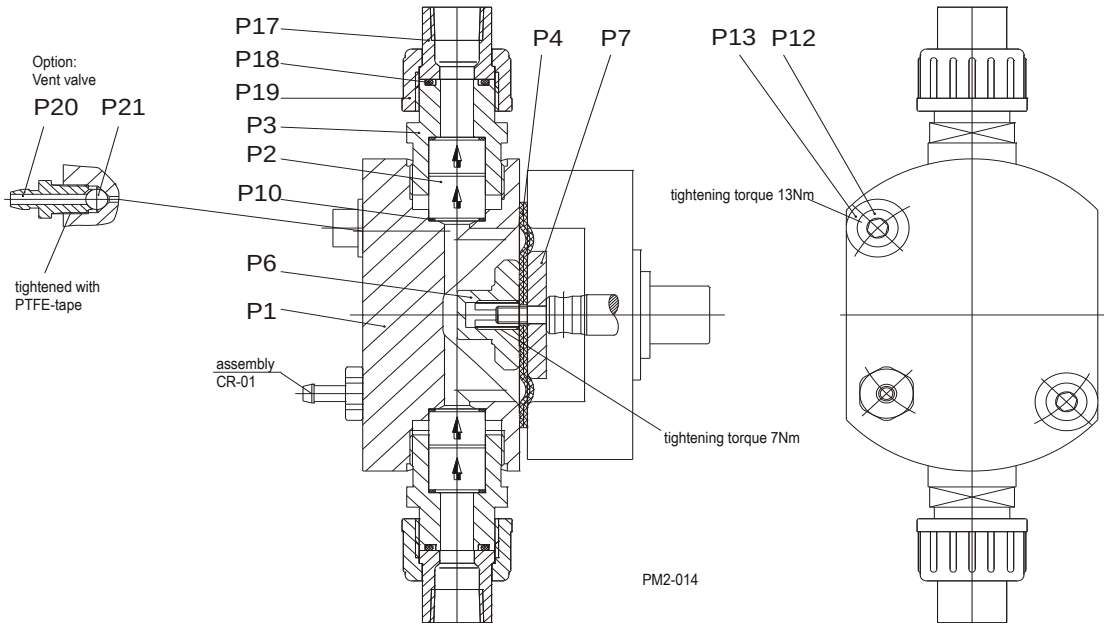
Recommended Spares are indicated in **BOLD PRINT**.




| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group | |
|---|---|---|---|---|---|---|---|
| P1 | 1 | Cover | PM 2 - 1 | 1.4571 | 320002 | **Assy Drawing** | **MD50S = 316 ss** |
| P2 | **2** | **Valve** | PV 18 - 06 | 1.4581 | **540039** | **PM2-01** | |
| P3 | 2 | Connection, 3/8" NPTF | NI-1573 | 1.4571 | 326336 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 66 | PTFE | **320137** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 19 | 1.4571 | 320003 | **1103264** | |
| P7 | 1 | Plate | PM 2 - 20 | 1.4571 | 320004 | | |
| P10 | **4** | **Gasket** | | 1.4571 | **150109** | | |
| P12 | 2 | SHCS, M 8 x 25 | DIN 912 | A4 - 70 | 100133 | | |
| P1 | 1 | Cover | PM 2 - 87 A | Alloy 20 | 320125 | **Assy Drawing** | **MD50A = Alloy 20** |
| P2 | **2** | **Valve** | PV 18 - 058 | Alloy 20 | **077611** | **PM2-01** | |
| P3 | 2 | Connection, 3/8" NPTF | NI-1573 | Alloy 20 | 324109 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 66 | PTFE | **320137** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 19 | Alloy 20 | 320123 | **440126** | |
| P7 | 1 | Plate | PM 2 - 20 | 1.4571 | 320004 | | |
| P10 | **4** | **Gasket, 14 x 17 x 1** | | Alloy 20 | **150529** | | |
| P12 | 2 | SHCS, M 8 x 50 | DIN 912 | A2 - 70 | 100590 | | |
| 01 B | 1 | Press. Gauge, -1…25bar | NG 50 | 1.4571 | 600605 | **Diaphr. Rupture Assy** | |
| 01 C | 1 | Press. Switch (optional) | | | 707510 | **Drawing CR-01** | |
| 01 C | 1 | Adapter for Press. Switch (optional) | | | 707511 | | |

| Producer | Description | Drawing-No. | Ident-No. | Quantity | |
|---|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Pumphead, MD50 Liquid End (316ss & Alloy 20)** | **PM2-01** | **Ref. Assy Group** | | |

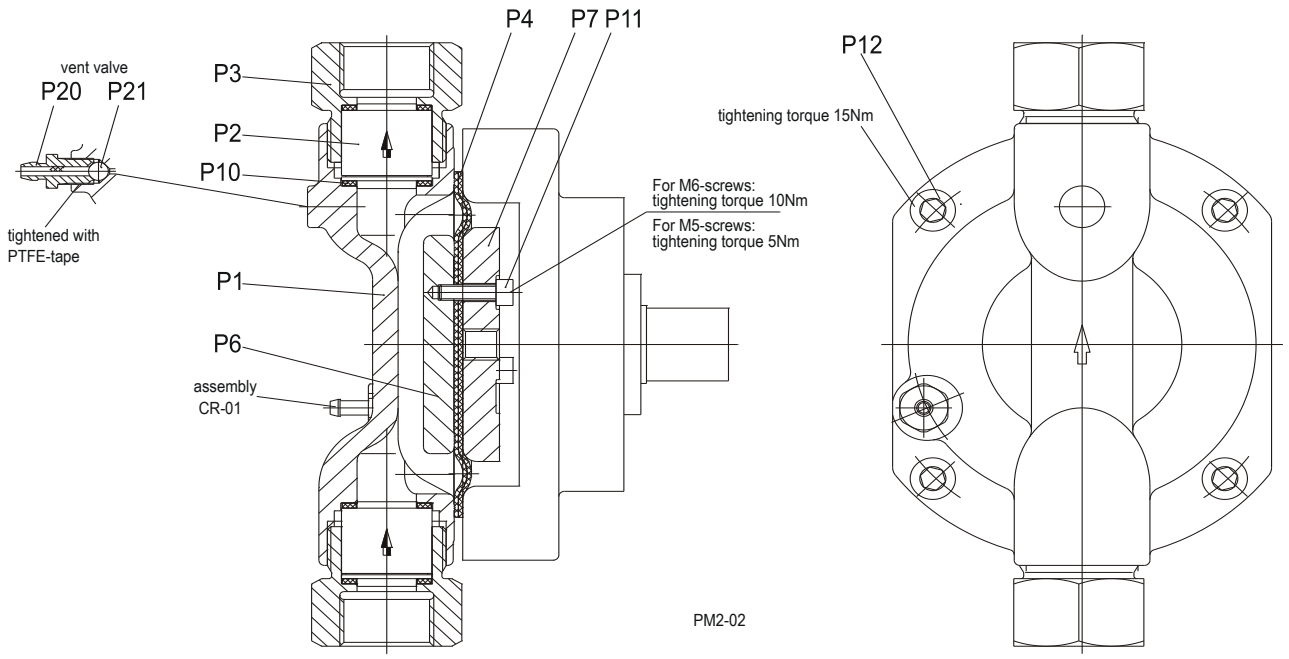
Recommended Spares are indicated in **BOLD PRINT**.




| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group | |
|---|---|---|---|---|---|---|---|
| P1 | 1 | Cover | PM 2 - 4 | PVC | 320019 | **Assy Drawing** | **MD50P = PVC** |
| P2 | **2** | **Valve** | LD - 020 | PVC | **540022** | **PM2-014** | |
| P3 | 2 | Nipple, 10 | LD - 45 | PVC | 326311 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 66 A | PTFE | **320137** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 27 | PVC | 320032 | **440131** | |
| P7 | 1 | Plate | PM 2 - 20 | 1.4571 | 320004 | | |
| P10 | **4** | **Gasket, 14 x 17,5 x 1** | | EPDM* | **150384** | * FPM Alt. = **077018** | |
| P12 | 2 | SHCS, M 8 x 65 | DIN 912 | A2 - 70 | 100592 | | |
| P13 | 2 | Washer, Disc 8,4 x 20 x 1,5 | | A 2 | 101645 | | |
| P17 | 2 | Nipple, 3/8" NPTF | PM 2 - 55 | PVC | 320072 | | |
| P18 | **2** | **O-ring, 15,5 x 2,6** | | EPDM* | **170160** | * FPM Alt. = **152043** | |
| P19 | 2 | Nut, D-16 | GF 21.69.00 | PVC | 170155 | | |
| P1 | 1 | Cover | PM 2 - 4 | PVDF | 078698 | **Assy Drawing** | **MD50K = PVDF** |
| P2 | **2** | **Valve** | LD - 020 | PVDF | **075343** | **PM2-014** | |
| P3 | 2 | Nipple, 10 | LD - 45 | PVDF | 075344 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 66 | PTFE | **320137** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 27 | PVDF | 078699 | **440132** | |
| P7 | 1 | Plate | PM 2 - 20 | 1.4571 | 320004 | | |
| P10 | **4** | **Gasket, 14 x 17,5 x 1** | | EPDM* | **150384** | * FPM Alt. = **077018** | |
| P12 | 2 | SHCS, M 8 x 65 | DIN 912 | A2 - 70 | 100592 | | |
| P13 | 2 | Washer, Disc 8,4 x 20 x 1,5 | | A 2 | 101645 | | |
| P17 | 2 | Nipple, 3/8" NPTF | PM 2 - 55 | PVDF | 091974 | | |
| P18 | **2** | **O-ring, 15,5 x 2,6** | | EPDM* | **170160** | * FPM Alt. = **152043** | |
| P19 | 2 | Nut, D-16 | GF 35.69.04 | PVDF | 078707 | | |
| 01 B | 1 | Press. Gauge, -1…25bar | NG 50 | 1.4571 | 600605 | **Diaphr. Rupture Assy** | |
| 01 C | 1 | Press. Switch (optional) | | | 707510 | **Drawing CR-01** | |
| 01 C | 1 | Adapter for Press. Switch (optional) | | | 707511 | | |

| Producer | Description | Drawing-No. | Ident-No. | Quantity |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Pumphead, MD50 Liquid End (PVC & PVDF)** | **PM2-014** | **Ref. Assy Group** | |

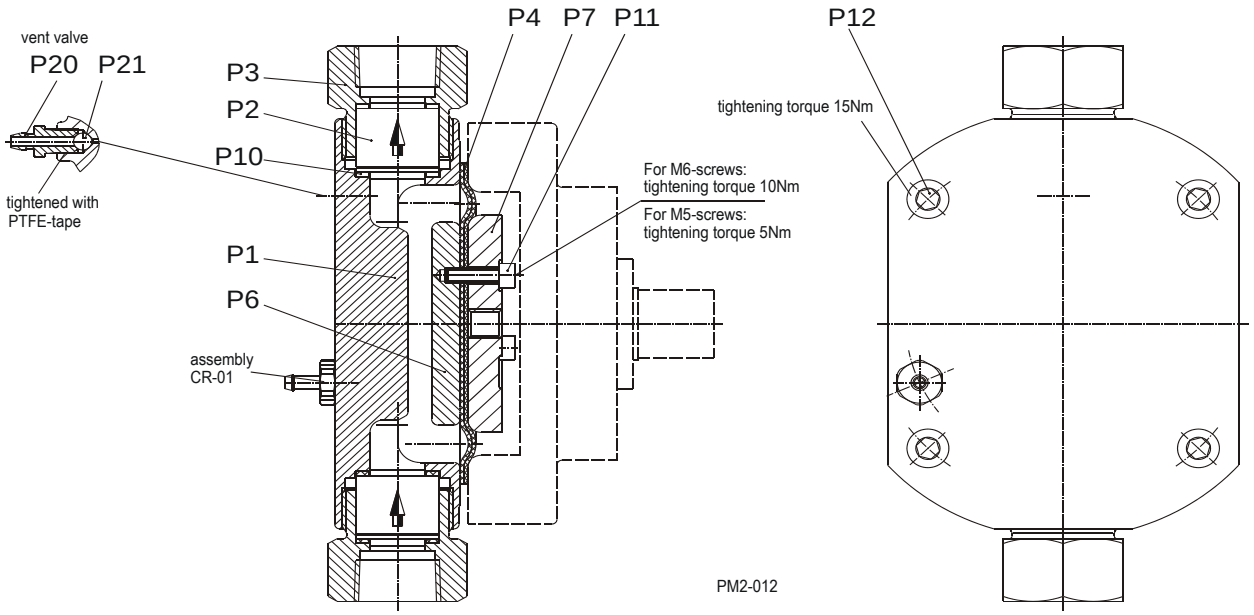
Recommended Spares are indicated in **BOLD PRINT**.




| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group | |
|---|---|---|---|---|---|---|---|
| P1 | 1 | Cover | PM 2 - 2 | 1.4581 | 320005 | **Assy Drawing** | **MD200S = 316 ss** |
| P2 | **2** | **Valve** | PV32 - 0154 | 1.4581 | **540031** | **PM2-02** | |
| P3 | 2 | Connection, 1/2" NPTF | PM 2 - 53 | 1.4571 | 078103 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 67 A | PTFE | **320139** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 23 | 1.4571 | 320010 | **440127** | |
| P7 | 1 | Plate | PM 2 - 24 | 1.4034 | 320009 | | |
| P10 | **4** | **Gasket** | | FD10 | **150120** | | |
| P11 | 3 | SHCS, M 5 x 16 | DIN 912 | 8.8 Zn | 100720 | | |
| P12 | 4 | SHCS, M 10 x 60 | DIN 912 | A2 | 100161 | | |
| 01 B | 1 | Press. Gauge, -1…25bar | NG 50 | 1.4571 | 600605 | **Diaphr. Rupture Assy** | |
| 01 C | 1 | Press. Switch (optional) | | | 707510 | **Drawing CR-01** | |
| 01 C | 1 | Adapter for Press. Switch (optional) | | | 707511 | | |

| Producer | Description | Drawing-No. | Ident-No. | Quantity | |
|---|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Pumphead, MD200 Liquid End (316ss)** | **PM2-02** | **440127** | | |

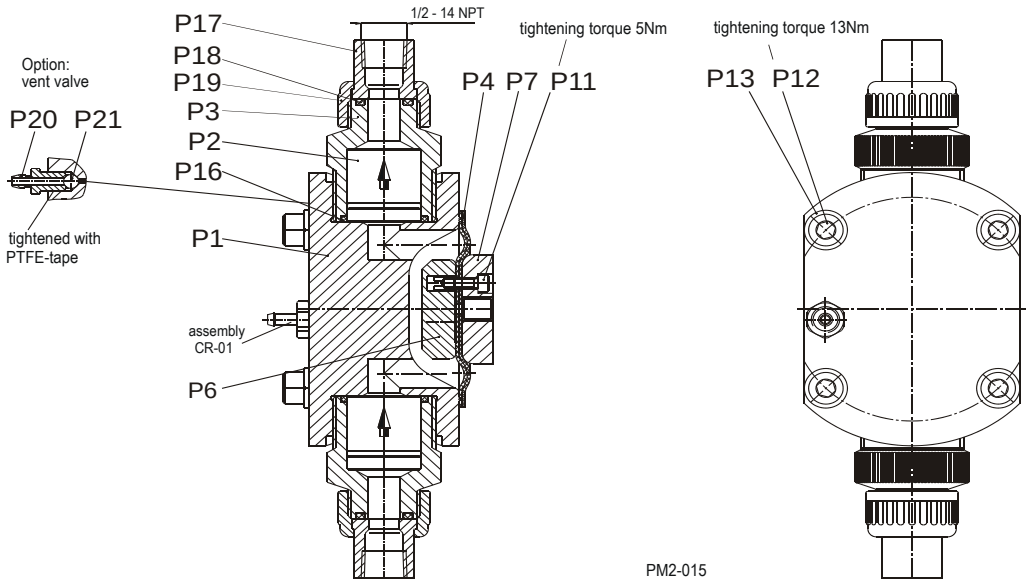
Recommended Spares are indicated in **BOLD PRINT**.




| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group | |
|---|---|---|---|---|---|---|---|
| P1 | 1 | Cover | PM 2 - 73 | Alloy 20 | 320127 | **Assy Drawing** | **MD200A = Alloy 20** |
| P2 | **2** | **Valve** | PV32 - 0170 | Alloy 20 | **340018** | **PM2-012** | |
| P3 | 2 | Connection, 1/2" NPTF | PM 2 - 53 | Alloy 20 | 320126 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 67 A | PTFE | **320139** | **Assy Number** | |
| P6 | 1 | Plate | PM 2 - 23 | Alloy 20 | 320128 | **440128** | |
| P7 | 1 | Plate | PM 2 - 24 | 1.4034 | 320009 | | |
| P10 | **4** | **Gasket** | | FD4 | **150141** | | |
| P11 | 3 | SHCS, M 5 x 16 | DIN 912 | 8.8 Zn | 100720 | | |
| P12 | 4 | SHCS, M 10 x 60 | DIN 912 | A2-70 | 065429 | | |
| 01 B | 1 | Press. Gauge, -1…25bar | NG 50 | 1.4571 | 600605 | **Diaphr. Rupture Assy** | |
| 01 C | 1 | Press. Switch (optional) | | | 707510 | **Drawing CR-01** | |
| 01 C | 1 | Adapter for Press. Switch (optional) | | | 707511 | | |

| Producer | Description | Drawing-No. | Ident-No. | Quantity | |
|---|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Pumphead, MD200 Liquid End (Alloy 20)** | **PM2-012** | **440128** | | |

Recommended Spares are indicated in **BOLD PRINT**.




| Line | Qty | Description | Drawing- No. | Material | Part Number | Assembly Group | |
|---|---|---|---|---|---|---|---|
| P1 | 1 | Cover | PM 2 - 6 | PVC | 320021 | **Assy Drawing** | |
| P2 | **2** | **Valve** | PV 34 - 01 | PVC | **540381** | **PM2-015** | |
| P3 | 2 | Connection Cover | PN - 1782 | PVC | 303342 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 67 A | PTFE | **320139** | **Assy Number** | **MD200P = PVC** |
| P6 | 1 | Plate | PM 2 - 50 | PVC | 320134 | **440134** | |
| P7 | 1 | Plate | PM 2 - 24 | 1.4034 | 320009 | | |
| P10 | 3 | SHCS, M5 x 16 | DIN 912 | 8.8 Zn | 100720 | | |
| P12 | 4 | SHCS, M 10 x 85 | DIN 912 | A2 - 70 | 100752 | | |
| P13 | 4 | Washer, Disc 10,5 | DIN 125 | A 2 | 101506 | | |
| P16 | **2** | **O-ring, 34 x 3,5** | | EPDM* | **152162** | * FPM Alt. = 083617 | |
| P17 | 2 | Nipple, 1/2" NPT | PM 2 - 56 | PVC | 320073 | | |
| P18 | **2** | **O-ring, 20,2 x 3,5** | | EPDM* | **170161** | * FPM Alt. = 152040 | |
| P19 | 2 | Nut, D-20 | GF 21.69.00 | PVC | 170190 | | |
| P1 | 1 | Cover | PM 2 - 6 | PVDF | 078408 | **Assy Drawing** | |
| P2 | **2** | **Valve** | PV 34 - 01 | PVDF | **075136** | **PM2-015** | |
| P3 | 2 | Connection Cover | PN - 1782 | PVDF | 075139 | | |
| P4 | **1** | **Diaphragm Assembly** | PM 2 - 67 A | PTFE | **320139** | **Assy Number** | **MD200K = PVDF** |
| P6 | 1 | Plate | PM 2 - 50 | PVDF | 078409 | **440133** | |
| P7 | 1 | Plate | PM 2 - 24 | 1.4034 | 320009 | | |
| P11 | 3 | SHCS, M5 x 16 | DIN 912 | 8.8 Zn | 100720 | | |
| P12 | 4 | SHCS, M 10 x 85 | DIN 912 | A2 - 70 | 100752 | | |
| P13 | 4 | Washer, Disc 10,5 | DIN 125 | A 2 | 101506 | | |
| P16 | **2** | **O-ring, 34 x 3,5** | | EPDM* | **152162** | * FPM Alt. = 083617 | |
| P17 | 2 | Nipple, 1/2" NPT | PM 2 - 56 | PVDF | 059695 | | |
| P18 | **2** | **O-ring, 20,2 x 3,5** | | EPDM* | **170161** | * FPM Alt. = 152040 | |
| P19 | 2 | Nut, D-20 | GF 35.69.04 | PVDF | 075137 | | |
| 01 B | 1 | Press. Gauge, -1…25bar | NG 50 | 1.4571 | 600605 | **Diaphr. Rupture Assy** | |
| 01 C | 1 | Press. Switch (optional) | | | 707510 | **Drawing CR-01** | |
| 01 C | 1 | Adapter for Press. Switch (optional) | | | 707511 | | |

| Producer | Description | Drawing-No. | Ident-No. | Quantity |
|---|---|---|---|---|
| Bran+Luebbe Delavan, WI | **Pumphead, MD200 Liquid End (PVC & PVDF)** | **PM2-015** | **Ref. Assy Group** | |

Recommended Spares are indicated in **BOLD PRINT**.

# 10 Drive Lubrication and Frequency

Refer to the drive manufacturer's manual for proper drive lubrication and frequency.

# ProCam MD

**METERING PUMP**

SPXFLOW

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ISSUED 10/2015