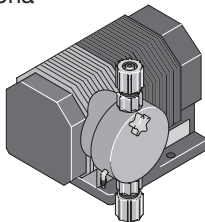


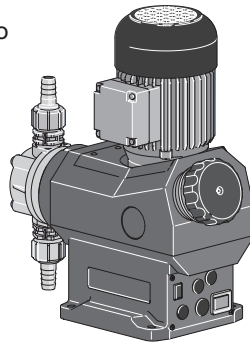
# General Operating Instructions

## ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories

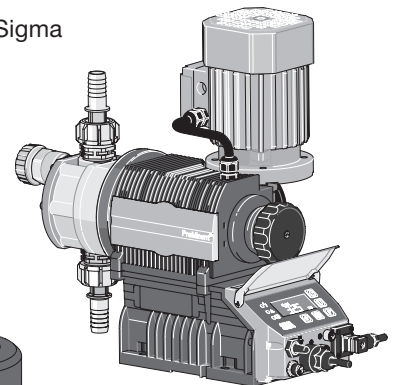
alpha



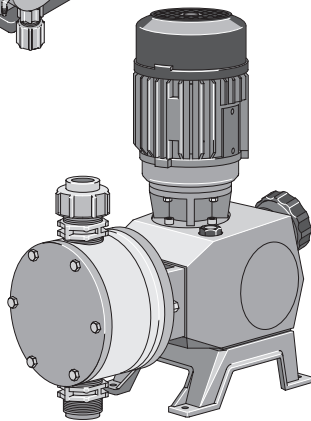
Vario



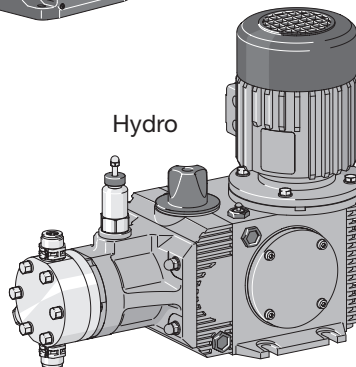
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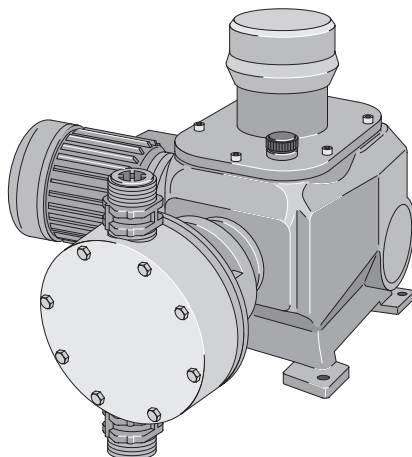
Meta



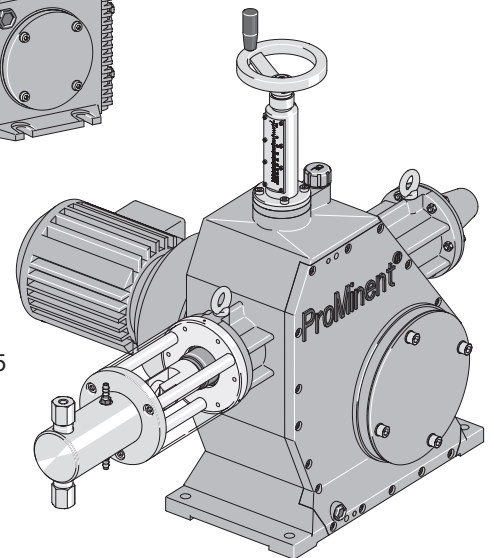
Hydro



Makro TZ



Makro/ 5



Two sets of operating instructions are necessary to ensure safe operation of the metering pumps corresponding to their intended purpose: The product-specific operating instructions (e.g. for Sigma) and the general operating instructions for ProMinent® motor-driven metering pumps.

**Both are only applicable in conjunction with each other.**

**Please completely read through these operating instructions first! Do not discard!**  
**The warranty shall be invalidated by damage caused by operating errors!**

**Legal notice:**

General Operating Instructions for  
ProMinent® Motor-Driven Metering Pumps  
© ProMinent Dosiertechnik GmbH, 1995

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**Subject to technical modifications.**

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### User Information

Please read through the following user guidelines. Familiarity with these points ensures optimum use of the operating instructions.

Key points in the text are indicated as follows:

- Enumerated points,
- ▶ Hints

Working Guidelines:

#### **NOTE**

**Notes on operation.**

Safety Guidelines:



#### **WARNING**

**There is a danger to life or the risk of serious injury if the notes on safety are disregarded!**



#### **CAUTION**

**There is a danger of slight injury and damage to property if the notes on safety are disregarded!**



#### **IMPORTANT**

**There is a danger of damage to property if the notes on safety are disregarded.**

These general operating instructions for motor-driven metering pumps and hydraulic assemblies apply only in conjunction with the product-related pump operating instructions for e.g. alpha, Vario, Meta, Sigma, Hydro, Makro/ 5 and Makro TZ motor-driven metering pumps.

## 1 Application of Motor-Driven Metering Pumps

ProMinent® motor-driven metering pumps and accessories are to be used solely for the purpose of metering liquid media!

In explosion-threatened workplaces in zone 1, device category II 2G of explosion group II C the pump may not be operated without the corresponding rating plate (and the corresponding EC conformity declaration) for pumps for explosion-threatened workplaces in accordance with guideline 94/9/EC of the European guidelines. The explosion group, category and type of protection shown on the marking must correspond to or exceed the conditions prevailing in the intended area of application.

All other uses or modifications are prohibited!

Pumps may never be operated in explosion-threatened workplaces without a corresponding rating plate (and the corresponding EC conformity declaration) for pumps for explosion-threatened workplaces.

ProMinent® motor-driven metering pumps and accessories are not to be used for the purpose of metering gasses and solids!

Refer to the relevant product-related operating instructions and product catalogue for the technical data of the type of motor-driven metering pump used!

Decisive criteria relating to the intended use of the pumps are

- EX-protection of the pump
- Resistance of parts coming in contact with metered medium
- Pressure and temperature of metered medium

## 2 Safety Notes



### WARNING

- **Explosion-proof pump only:** it is essential that you observe the contents of section 9!
- **Immediately switch off the pump in case of emergency! Use the power switch on the pump or an emergency switch in your immediate operating environment!**
- **Pumps for radioactive medium must not be shipped through standard channels!**
- **Observe applicable national regulations for installation abroad!**



### CAUTION

- **Do not obstruct or block access areas!**  
Pumps must be accessible at all times to facilitate operation and maintenance.
- **Only specially trained and authorized persons are permitted to carry out maintenance and repairs on metering pumps and their periphery!**
- **Always depressurize the liquid end first before carrying out any work on the pump!**
- **If hazardous or unknown metering media are used, discharge and flush the liquid end before carrying out any work on the pump!**
- **Observe safety specifications for liquid metered media! Corresponding protection and emergency measures must be implemented prior to initial operation.**
- **Always wear protective clothing (safety goggles, gloves,...) when handling hazardous or unknown liquid media! This applies particularly when working on the liquid end!**
- **Do not use parts which have not been tested and approved by ProMinent for assembly of ProMinent® motor-driven metering pumps since this can result in damage to persons and property, for which no liability will be accepted!**
- **Install safety devices in the system, e.g. overflow valves!**  
ProMinent® motor-driven pumps are oscillating displacement pumps. Irrespective of whether the delivery line is closed, e.g. by closing off the delivery line or by closing a valve, the pressure produced by the pump can reach a multiple of the permissible working pressure of the system or of the metering pump. This can result in lines bursting with dangerous consequences particularly in the presence of aggressive or toxic media!
- **Piston pumps must always be equipped with a dry-run protection facility to avoid the pump packing running dry as this may cause overheating and thus premature wear.**



### IMPORTANT

- Based on state-of-the-art technology, the manufacturer carefully selects the materials for parts coming into contact with the medium as specified by the customer. The manufacturer shall not be liable for any damage caused by metering other media or media which has been modified with regard to its properties (concentration, density, temperature, additives, impurities etc.).
- Avoid over-feed with positive pressure difference (at least 1 bar) between discharge and suction sides.
- Only specially trained personnel are permitted to operate the metering pump. The operator must ensure by applying appropriate accident prevention measures that operating personnel are not endangered under given operating conditions (pressure, temperature, aggressivity etc.).

## 3 Mounting



### IMPORTANT

- Mount the metering pump upright with the feet on a horizontal base. Refer to the corresponding data sheets for the dimensions (m) of the securing holes.
- The frame or the foundation for mounting the pump must be designed such as to ensure the unit is free of vibration and stable.

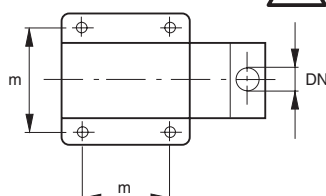


fig. 1

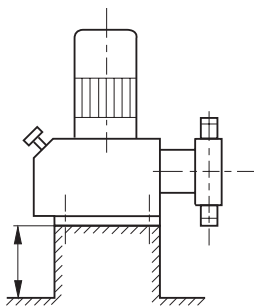


fig. 2

- Install pump at convenient operating level and mount such that the valves are vertical: head valve always at top and intake valve always at bottom.

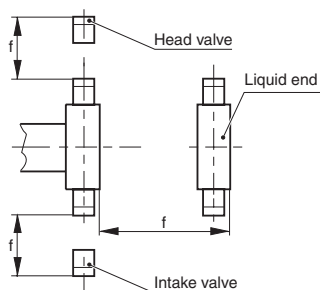


fig. 3

- Ensure adequate clearance (f) in area of liquid end as well as intake valve and head valve so that these parts can be easily removed if required.

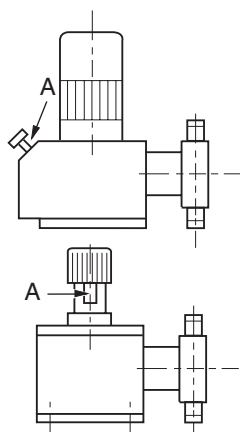


fig. 4

- Set up the pump such that the stroke length adjustment, indicator scale A, oil level indicator, oil filler and drain plugs as well as the valves are easily accessible for servicing.

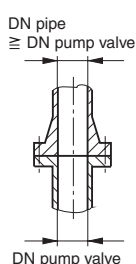


fig. 5

- Ensure nominal diameters of pipes and installed fittings are the same size or larger than the nominal diameters of the pump valves (intake and head valves).

## 4 Installation, hydraulic



### WARNING

- Explosion-proof pump only: it is essential that you observe the contents of section 9!



### IMPORTANT

- Observe the relevant national directives with regard to installation!
- In order to verify the pressure conditions in the piping system it is recommended to provide connection options for manometer close to the suction and pressure port.

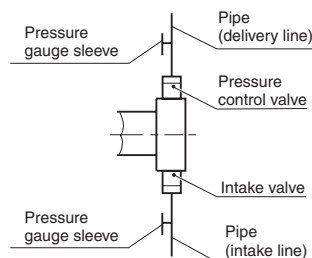


fig. 6

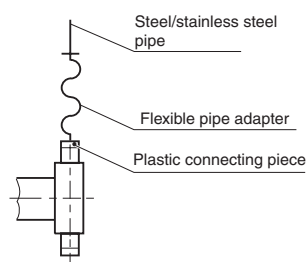


fig. 7

- Connect pipes to the pump such that there is no stress or strain whatsoever acting on the pump, such as offset, weight or expansion of the pipe. Only use a flexible pipe adapter for connecting steel/stainless steel pipes to plastic pump housings.

4.1 Standard Installation

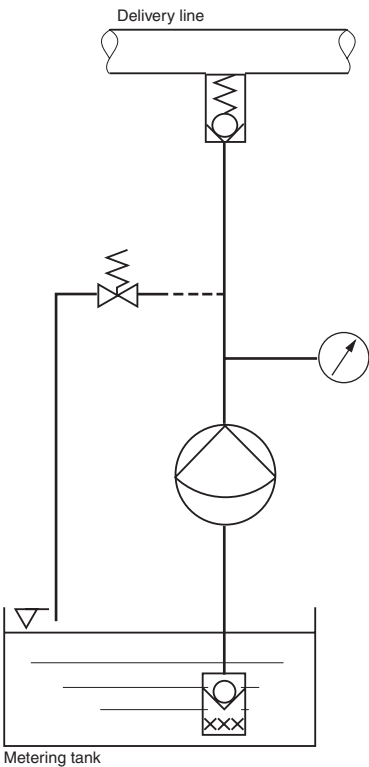















Diagram 8

	Metering pump		Dirt trap
	Metering valve		Solenoid valve
	Adjustable pressure control valve (Overflow valve)		Pulsation damper
	Foot valve with sieve filter		Float valve
	Pressure gauge		Filler device
	Ball check valve		Siphon vessel
	Shut-off cock valve		



## 4.2 Notes on Installation on Intake Side

### NOTE

Avoid the intake line running empty:

- Install foot valve at end of intake line when the pump is higher than the max. liquid level in the intake tank.
- The calculated size  $h$  (see diagram) must not be greater than the specified pump suction head divided by the density of the delivered medium.
- Use short intake line and avoid thin-walled hoses.

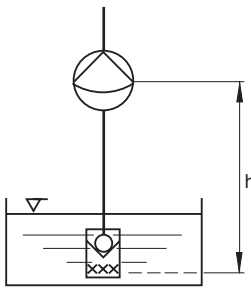


fig. 9

### NOTE

Connect intake line to tank slightly above the base of the tank.

### IMPORTANT

Provide suitable means for retaining impurities!

Otherwise they can cause faults in the pump and system!

E.g. install a dirt trap (mesh size 100–400  $\mu\text{m}$  depending on medium and type of metering pump).

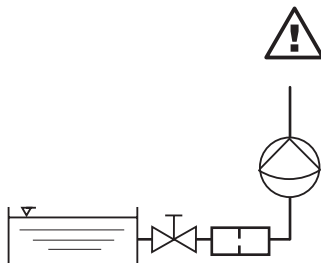


fig. 10

### NOTE

Install pump with inlet on intake side for gas-emitting media.

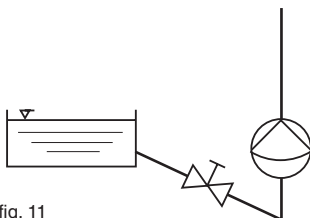


fig. 11

### NOTE

Intake via siphon line for high-level tanks without connection facilities at base of tank:

- Install filler facility for siphon line (intake line).
- Observe acceleration pressures due to the longer intake line.

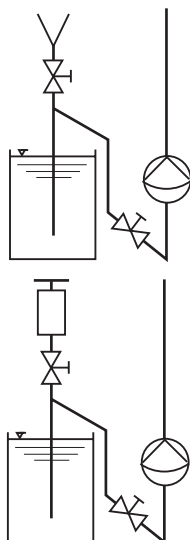


fig. 12

### 4.3 Notes on Installation on Delivery Side

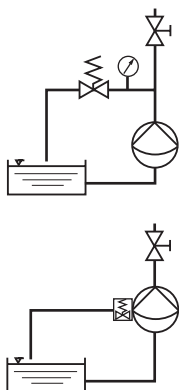


fig. 13



#### **IMPORTANT**

Do not exceed permissible nominal pressure! Otherwise the pump may be damaged! Provide an overpressure facility if the permissible pressure in the pump head can be exceeded, e.g. by closing a shut-off element or a blockage in the line:

- Install overflow valve in the delivery line or
- use an overflow valve integrated in the pump housing (depending on type, refer to data sheet of the type of pump used).

The following points must be observed with regard to the overflow line when using an overflow valve:

- Route the overflow line with a drop into the supply tank under atmospheric pressure or into an open runoff channel.

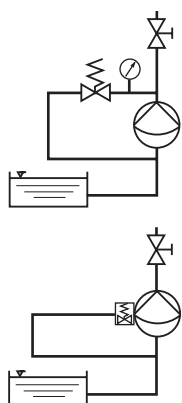


fig. 14



#### **IMPORTANT**

Do not use a non-return check valve on the intake side for the overflow return as it may cause the intake line to tear off.

- Connect the overflow line to the intake line, however, only if there is no check valve in the intake line.

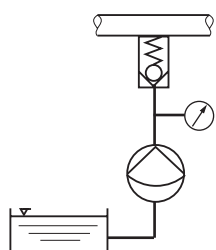


fig. 15



#### **IMPORTANT**

Cut off the return flow from the main line! Otherwise unwanted mixing in the metering line can occur.

- Install the metering valve at the injection point.



#### **IMPORTANT**

Dampen pulsation by installing pulsation dampers if

- low-pulsation delivery flow is required for process reasons;
- acceleration forces have to be reduced due to the geometry of the piping system.

The following can occur if acceleration forces are not dampened

- Fluctuations in delivery, metering faults, pressure surges, valve knocking and wear as a result of cavitation on the intake and delivery side of the pump.
- Mechanical destruction of pump, leakages and knocking of valves as a result of the permissible maximum pressure being exceeded on the pump delivery side.

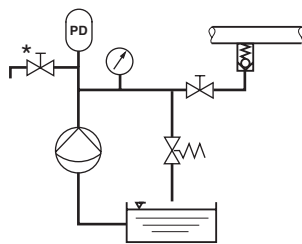


fig. 16

**Pulsation damper in delivery line  
(refer to section 5.3)**

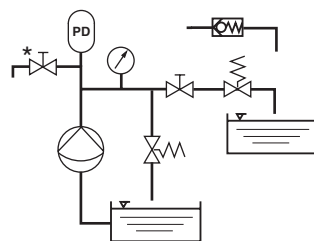


fig. 17

**Pulsation damper for free outlet:**

- Install pressure control valve or metering valve at end of metering line.

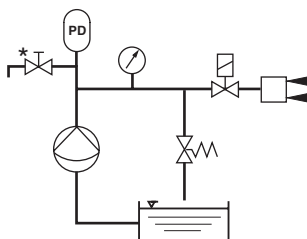


fig. 18

**Pulsation damper without trails  
(e.g. together with nozzles):**

- Interlock the solenoid valve electrically with the voltage supply of the metering pump.

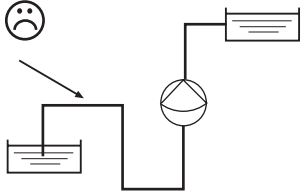
\* Accumulators without diaphragm: fit a vent valve

### 4.4 How not to install pumps



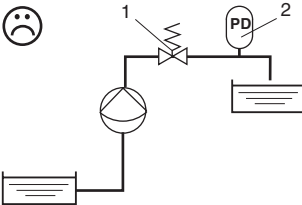
#### **IMPORTANT**

Intake line cannot be bled



- Air pocket in intake line.

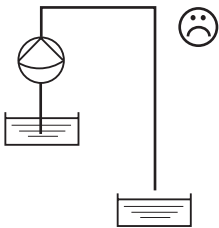
fig. 19



#### **Pulsation damper not effective**

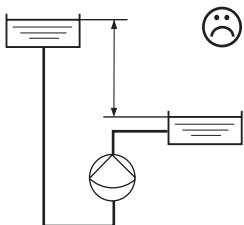
- Arrangement of pulsation damper (2) and pressure retention valve (1) incorrect.

fig. 20



#### **Siphon effect**

fig. 21



#### **Admission pressure on intake side too high**

fig. 22

## 4.5 Special Notes on Installation



### IMPORTANT

Avoid overloading by positive pressure difference between delivery side and intake side:

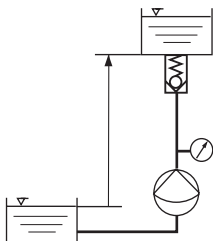


fig. 23

- Install end of delivery line higher than the liquid level in the intake tank.

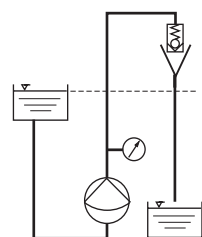


fig. 24

or:

- Install the discharge line outlet of the pump such that its position is higher than the level of liquid in the chemical storage tank

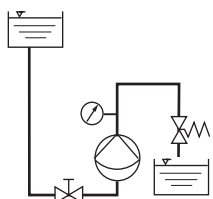


fig. 25

or:

- Install pressure control valves in the pump delivery line.



### IMPORTANT

Ensure constant pressure in the intake line!

Irregular pump flow can occur if the pressure from the take-off line or the intake tank is transmitted.

- Ensure constant supply height when pump intake is from pressurized lines!

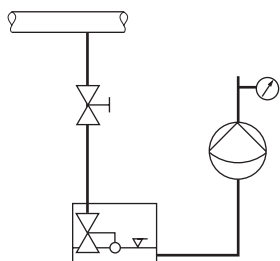


fig. 26

- Ensure constant supply level if intake is from high supply level!

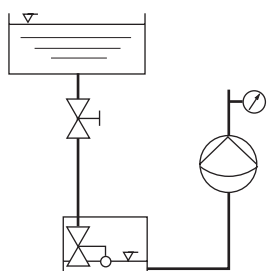


fig. 27

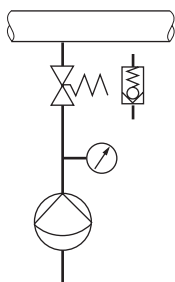


fig. 28

- Avoid siphon (suction) effect when metering into a main line under vacuum:  
Install pressure control valve (DHV-SR) or metering valve in the metering line!

### NOTE

When metering suspensions it is necessary to flush the pump head in order to avoid deposits forming

- as intermittent flushing or
- flushing after switching off the pump.



### IMPORTANT

Switch off metering pump before flushing!  
Maximum permissible flushing pressure: 2 bar

### Manual flushing device

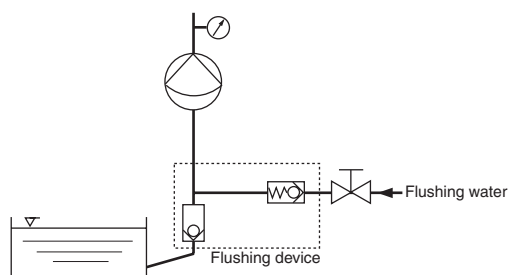


fig. 29

### Automatic flushing device

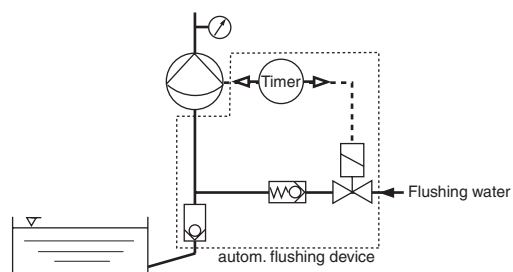


fig. 30

## 5 Installation, electrical



### WARNING

- Explosion-proof pump only: it is essential that you observe the contents of section 9!

### 5.1 Motor



### IMPORTANT

- Connect electric motor in accordance with VDE regulations as illustrated in the circuit diagram provided.
- Check that the mains voltage and frequency agree with the values specified on the motor ratings plate.
- Provide corresponding motor protection devices in order to protect the motor from overload (e.g. motor protection switch with thermal overcurrent release). Fuses are not motor protection devices!
- The specified rated motor output applies at a maximum ambient temperature of 40 °C and installation altitudes below 1000 m above sea level. The motor output will be reduced if these values are exceeded (refer to VDE 0530).
- Ensure unobstructed supply of cooling air!
- Installation in wet rooms or in the open:
  - ▶ Arrange terminal box such that the cable lead-ins point downwards (can be taken into account when ordering).
  - ▶ Select PG screw glands suitable for the supply line, use reducer if necessary. Seal cable lead-in well otherwise all other measures will be of little use.
  - ▶ Apply sealing compound to PG screw glands and thread of dummy plugs, firmly tighten and coat once again with sealing compound.
  - ▶ Thoroughly clean sealing surfaces of terminal box and terminal box cover before re-installing. Seals must be bonded on one side. After a longer operating period, replace brittle seals by new ones.

Different types of motors are used depending on the application and required output. ProMinent will send you the motor data sheets for the desired motor versions on request.

### Motors connected to three-phase AC network

Three-phase squirrel-cage motor

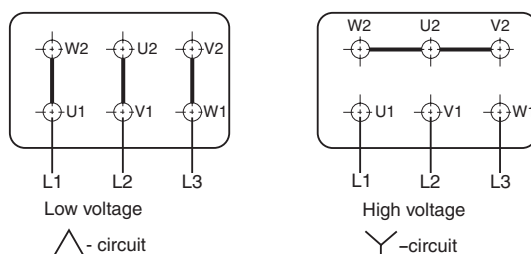


fig. 31

Example:

Specified rating	230/400 V
Three-phase network available	400 V:
Correct motor connection	Y-circuit
Direction of rotation reversal:	Interchange 2 supply lines

Pole-changing three-phase AC motor (2 speeds in Dahlander circuit)

When changing over speed with pole selector switch, the star bridge 1U-1V-1W is realized externally (in switch).

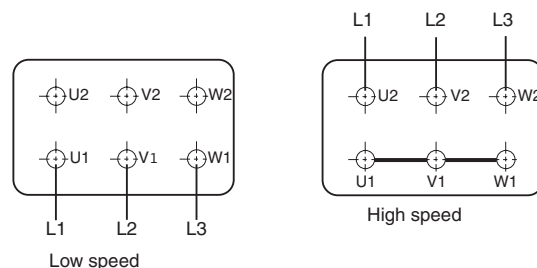


fig. 32

### Motors connected to alternating current network

Any three-phase AC motor can be operated in conjunction with a corresponding running capacitor on the alternating current network. However, care must be taken to ensure that the starting torque is only approx. 30 % of the rated torque.

Three-phase AC motor with running capacitor (Steinmetz circuit)

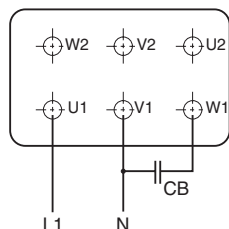


fig. 33

### Motors with electronic speed adjustment

Refer to the circuit diagram of the control system for connection of the motor if electric motors are driven by electronic control devices, e.g. three-phase AC motors by frequency converters or DC motors by thyristor controllers.

### External fans



#### IMPORTANT

For motors with separate cooling fan (identification code feature “R” or “Z”), a separate power supply is used for the separate cooling fan!

### Actuators/servomotors for stroke length adjustment

Electrical connection of the motors is shown on the enclosed terminal connection diagram and on the connection diagram provided on the inside of the housing.



#### IMPORTANT

Stroke length adjustment/control drives must only be operated with the pump running!



## 6 Start-Up



### **WARNING**

- Explosion-proof pump only: it is essential that you observe the contents of section 9!



### **IMPORTANT**

- Based on state-of-the-art technology, the manufacturer carefully selects the materials for parts coming in contact with the medium as specified by the customer.  
The manufacturer shall not be liable for any damage caused by metering other media or media which has been modified with regard to its properties (concentration, density, temperature, additives, impurities etc.).
- Only specially trained personnel are permitted to operate the metering pump.  
The operator must ensure by applying appropriate accident prevention measures that operating personnel are not endangered under given operating conditions (pressure, temperature, aggressivity etc.).
- Refer to the information provided in the product-specific operating instructions.
- Before starting up, check correct connection of the drive motor as well as the corresponding additional equipment!
- Check intake and delivery lines for leaks!
- Check whether necessary flushing lines are connected!
- Provide suitable type of safety overflow valves in all delivery lines!
- ▶ Bleed delivery side:  
Switch on pump and run at 100 % stroke length until liquid end is full.  
Switch off pump.
- ▶ Close bleeder on delivery side.  
Pump is now ready for operation.
- ▶ Open shut-off valve in metering line, operate pump.
- ▶ Check cut-in pressure of overflow valve.
- ▶ Check delivery capacity and correct if necessary.



### **IMPORTANT**

- If a compressed air vessel is installed on the delivery side, vent at regular intervals!
- Ensure the correct gas admission pressure (approx. 60–80 % of the mean operating pressure).
- Observe the information provided in the operating instructions of the frequency converter if using pumps with speed control.

## 7 Maintenance



### WARNING

- **Explosion-proof pump only: it is essential that you observe the contents of section 9!**



### IMPORTANT

- **Refer to notes in product-specific operating instructions!**
- **If metering pumps are sent for repair to the manufacturer or a ProMinent dealer, clean all parts which come into contact with the medium before shipping.**

Essentially, maintenance is restricted to checking the metering capacity and for leaks.

#### Diaphragm failure:

- Change diaphragm as described in Section “Diaphragm-type metering unit” in the product-specific operating instructions.

#### Impermissibly high leakage from piston-type liquid ends:

- Replace packing as described in Section “Piston-type metering unit” and “Notes on packing seal” in the product-specific operating instructions.

Replace packing as described in Section “Piston-type metering unit” and “Notes on packing seal” in the product-specific operating instructions. In order to maintain the delivery unit, we recommend to keep a spare parts kit in stock, consisting of the wearing parts such as diaphragm or piston packing and the necessary valve parts, balls and seals. We can quote a spare parts package for your metering system.

## 8 Troubleshooting



### WARNING

- **Explosion-proof pump only: it is essential that you observe the contents of section 9!**



### IMPORTANT

**Follow instructions in the product's operating manual!**

Fault	Cause	Corrective measures
No metering pump intake (during initial operation)	Suction head too high	► Install pump closer to intake tank
	Backpressure in metering line (delivery side)	► Eliminate backpressure (e.g. via bypass line)
No metering although drive is running (after longer period of operation)	Stroke setting 0 %	► Increase stroke length (→ 100 %)
	Intake tank empty	► Top up medium and restart
	Gas cushion in intake line and liquid end	► Bleed intake line, check for leaks and restart
Metered liquid emerges from leakage opening of delivery unit	Diaphragm defective	► Replace diaphragm
Loss of metering capacity (after longer period of operation)	Wearing parts in valves defective	► Replace wearing parts
	Deposits in valves	► Clean or replace valve parts

## 9 Other important considerations for dosing pumps in ex-zones

### 9.1 Application in accordance with regulations

- In areas of operation where there is a risk of explosion, the pump may only be operated with the appropriate nameplate and the corresponding EU declaration of conformity for areas of operation where there is a risk of explosion in accordance with directive 94/9/EU concordant with the European directives. The explosion group, category and protection system stated on the label must be equivalent to or better than the conditions specified in the designated area of application.
- Any other application or modification is prohibited!
- Pumps which do not have the appropriate nameplate and the corresponding EU declaration of conformity for areas of operation where there is a risk of explosion may under no circumstances be operated in areas of operation where there is a risk of explosion.

### 9.2 Safety instructions



#### WARNING

- **When installing and operating equipment in ex-zones in Europe, you must observe the European directive 99/92/EU (ATEX 137). In Germany this is incorporated within the occupational safety regulations and German regulations on hazardous materials.**
- You must observe the European standards EN 1127-1, EN 60079-10, EN 60079-14, EN 60079-17 as well as EN 50020 and EN 50039 for intrinsically safe electrical circuits. (In Germany, these standards are partly covered by VDE 0165 and VDE 0118.)
- For countries outside the EU, you should observe the appropriate national directives.
- Installations in ex-zones must be checked by a “recognised qualified” person. This particularly applies to intrinsically safe electrical circuits.
- The information detailed below chiefly refers to particular features found in ex-zones. It does not replace the standard information in the operating instructions manual!
- When cleaning plastic components, you should ensure that no electrostatic charge is created through excessive friction. - see warning sign

#### 9.2.1 Safety equipment



#### WARNING

- **Please adhere to the following safety instructions for pumps containing non-conductive components.**



### ATTENTION

Because of electrostatical flammable danger, use damp cloth only to wipe off plastic parts !

#### 9.2.2 EU declaration of conformity / certification

The EU declaration of conformity is attached for the whole pump (also for pumps without motors).

The EU declarations of conformity, EU design inspection reports and the operating instructions manuals for the individual components are attached.

### 9.3 Assemble

No specific notes.

### 9.4 Installation, hydraulic



#### **WARNING**

- Dosing pumps used in ex-zones must be fitted with an appropriate safety relief valve on the output side of the dosing pump (serves to protect against overheating resulting from overloading and arcing due to interruption of drive components as a result of overloading.)
- Piston dosing pumps are designed for use in temperature class T3. The pumps can be used in T4 if they are fitted with an additional flow controller on the output side (serves to protect against a rise in temperature resulting from dry running) or with an appropriate temperature controller.
- Similarly, dosing pumps whose diaphragm is driven hydraulically must be fitted with a temperature or flow controller for use in T4. (The internal relief valve protects against overheating in the event of extended operation.) Without this protection, temperature class T3 is applicable.
- With different temperature classes being available for different components, the possible application of the entire pump corresponds to the component with the lowest temperature class.
- Combustible media may only be extracted using stainless steel dosing heads. In exceptional circumstances, where stainless steel is not available, PTFE with carbon can also be used. Our TT designs are manufactured from this conductive synthetic material. The operator should take special care in this instance due to reduced mechanical stability.
- Piston dosing pumps may not be used for combustible media. Where it is impossible to avoid the use of piston pumps, additional control measures should be implemented to ensure the required level of safety. This includes flow controller + piston leakage controller, and an additional temperature controller on the dosing head for media with critical friction characteristics.
- Hydraulic diaphragm pumps are perfectly suitable, however it is compulsory to have those whose construction includes diaphragm-rupture controller Ex “i” and flow controller.
- Diaphragm pumps with mechanically linked diaphragm, e.g. Zt. MTMa..., TZMa..., Sigma’s S1Ba..., S2BaHM..., S3Ba: no additional measures are required, although it is essential to use the construction with diaphragm-rupture indicator, in the Ex “i” construction.
- Installations in ex-zones must be checked by a “recognised qualified” person.
- The following applies to all dosing pumps when metering combustible media: Start up and drain only under the supervision of an appropriately qualified person.
- Observe the relevant national directives with regard to installation!

### 9.5 Installation, electrical



#### **WARNING**

- Zero-volts switches can be rated as simple electrical equipment (EN 60079-14 or EN 50020).
- Both zero-volts and extra-low voltage circuit-breaking accessories such as diaphragm –rupture indicator, stroke rate equipment, etc. may only be connected to an intrinsically safe electrical circuit in ex-zones.
- If several electrical components are connected together, the safety of the entire connection needs to be tested and confirmed in accordance with safety regulations. This can be evidenced by means of a declaration of conformity from the supplier (ProMinent) for the equipment in its entirety, or if components are delivered individually, by means of a document from the operator confirming the components to be explosion-proof.
- For electrical components in ex-zones you may only use the approved motor protection switch, mains switch and fuses in accordance with the manufacturer's specifications for the application in the relevant ex-zone!
- Observe the documentation attached for the individual electrical components!
- Observe the relevant national directives with regard to installation!

For hydraulic equipment switches in macro-hydraulic diaphragm dosing pumps (diaphragm rupture sensor, excess pressure sensor):

These switches may be used in areas where there is a risk of gas explosions, category II 2G.



#### **WARNING**

- The switches may only be connected to an intrinsically safe electrical circuit! Only use switches with a blue connection cable!
- The data in the operating instructions manuals is specific to the design of the switches! Lower values apply in an intrinsically safe electrical circuit, according to the ex-zone!

#### **NOTE**

You may disregard the inductivity and capacity of the cable (cable length less than 10m).

### Motor



#### **WARNING**

- Drive motors should be protected by a suitable motor protection switch. For Ex"e" motors you should use a motor protection that has been approved for this application. (Protection against overheating due to overload)
- Motors may only be installed and checked in ex-zones by a "recognised qualified" person!
- Observe the attached operating instructions manual for EX motors!

### 9.6 Commissioning



#### **WARNING**

- The following applies to all dosing pumps when metering combustible media: Start up and drain only under the supervision of an appropriately qualified person.
- Combustible media may only be extracted with stainless steel dosing heads. In exceptional circumstances, where stainless steel is not available, PTFE with carbon can also be used. Our TT designs are manufactured from conductive synthetic material. The operator should take special care in this instance due to reduced mechanical stability.

- Piston dosing pumps may not be used for combustible media.  
Where it is impossible to avoid the use of piston pumps, additional control measures should be used to ensure the required level of safety: flow controller + piston leakage controller, and an additional temperature controller on the dosing head for media with critical friction characteristics.
- Hydraulic diaphragm pumps are perfectly suitable, however it is compulsory to have those whose construction includes diaphragm-rupture controller Ex "i" and flow controller.
- Diaphragm pumps with mechanically linked diaphragm, e.g. MTMa..., TZMa..., Sigma's S1Ba..., S2BaHM..., S3Ba: no additional measures are necessary, although it is essential to use the construction with diaphragm-rupture indicator, in the Ex "i"\* construction.
- Dosing pumps used in ex-zones must be fitted with an appropriate safety relief valve on the output side of the dosing pump (serves to protect against overheating resulting from overloading and arcing due to interruption of drive components as a result of overloading).
- Piston dosing pumps are designed for use in temperature class T3.  
The pumps are suitable for use in T4 if they are fitted with an additional flow controller on the output side (serves to protect against a rise in temperature resulting from dry running) or with an appropriate temperature controller.
- Similarly, dosing pumps whose diaphragm is driven hydraulically must be fitted with a temperature or flow controller for use in T4. (The internal relief valve protects against overheating in the event of extended operation.) Without this protection, temperature class T3 is applicable.
- With different temperature classes being available for different components, the possible application of the entire pump corresponds to the component with the lowest temperature class.

### 9.7 Maintenance



#### WARNUNG

- You should make regular checks (on leakages, noise, temperatures, odours, etc.) to ensure general regular operation, particularly with regard to the actuator and bearing.
- Do not allow the pump to overheat due to a lack of oil!  
For lubricated dosing pumps, you should make regular checks to ensure sufficient lubricant is present, e.g. by checking the level of lubricant, visual check for leakages, etc. If oil is leaking, you must locate the point of leakage immediately and eliminate the cause of the leak.
- Check the regular operation of the relief valve behind the pump!  
In the event of a fault in areas of operation where there is a risk of explosion, the relief valve must prevent the gears from being overloaded and overheating!
- When cleaning plastic components, you should ensure that no electrostatic charge is created through excessive friction. - see warning sign
- The following applies to all dosing pumps when metering combustible media: Start up and drain only under the supervision of an appropriately qualified person.
- Expendable parts, such as bearings, must be replaced when there are visible signs of unacceptable wear. (It is not possible to calculate the nominal service life for lubricated bearings.)
- Original spare parts must be used as replacements.
- Inspection and repair must be carried out in compliance with DIN EN IEC 60079-17 and should only be done by "experienced personnel with the necessary expertise" (section 4.2).
- These measures are prescribed by ProMinent as the minimum required for protection. If the operator is aware of other risks, it is his responsibility to eliminate these by implementing the appropriate measures.

### 9.8 Troubleshooting



#### **WARNING**

- You should make regular checks (on leakages, noise, temperatures, odours, etc.) to ensure general regular operation, particularly with regard to the actuator and bearing.
- Do not allow the pump to overheat due to a lack of oil!  
For lubricated dosing pumps, you should make regular checks to ensure sufficient lubricant is present, e.g. by checking the level of lubricant, visual check for leakages, etc. If oil is leaking, you must locate the point of leakage immediately and eliminate the cause of the leak.
- When cleaning plastic components, you should ensure that no electrostatic charge is created through excessive friction. - see warning sign
- The following applies to all dosing pumps when metering combustible media: Start up and drain only under the supervision of an appropriately qualified person.
- Expendable parts, such as bearings, must be replaced when there are visible signs of unacceptable wear. (It is not possible to calculate the nominal service life for lubricated bearings.)
- Original spare parts must be used as replacements.
- Inspection and repair must be carried out in compliance with DIN EN IEC 60079-17 and should only be done by “experienced personnel with the necessary expertise” (section 4.2).

### 9.9 Repair



#### **WARNING**

- The following applies to all dosing pumps when metering combustible media: Start up and drain only under the supervision of an appropriately qualified person.
- You should make regular checks (on leakages, noise, temperatures, odours, etc.) to ensure general regular operation, particularly with regard to the actuator and bearing.

### 9.10 Decommissioning



#### **WARNING**

- The following applies to all dosing pumps when metering combustible media: Start up and drain only under the supervision of an appropriately qualified person.

## 10 Hydraulic Accessories

### 10.1 Overview and Notes on Accessories

To ensure trouble-free operation of metering systems, not only is correct selection of the metering pump decisive but also of the individually compiled hydraulic and electrical accessories. On the following pages, many accessories are illustrated which are not always necessary but which provide a general overview of the various possibilities.

We would be pleased to be of assistance in selecting the right accessories for your metering task and e.g. offer our advisory services for calculating the piping system.

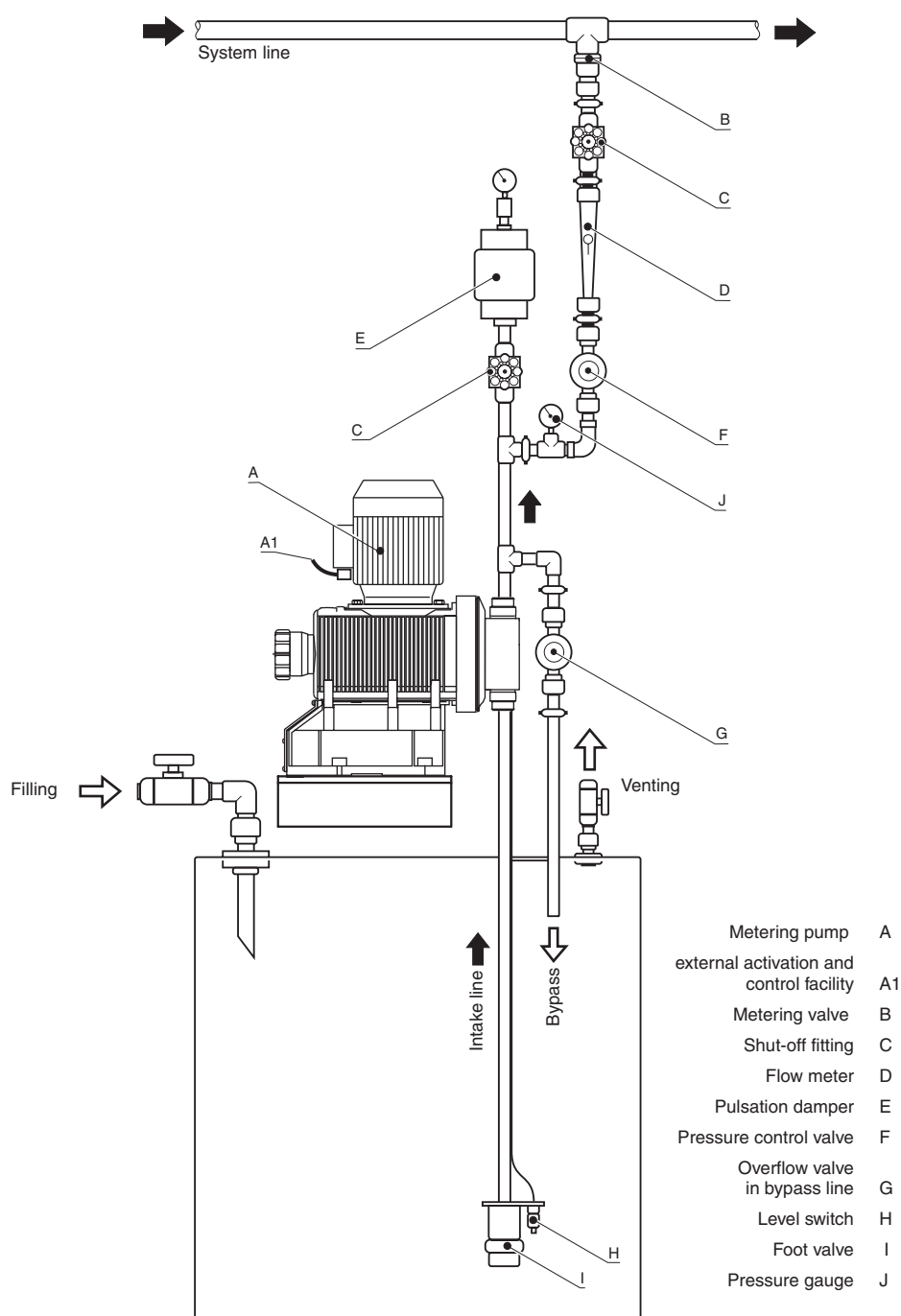


fig. 34



### System Components

		Function	Application
Metering pump*	A	Metering of a defined quantity of liquid in a system; Activation: Manual or automatic (external signal)	Variable adjustment of metered quantity and external activation facility enable optimum adaptation to any metering applications.
Metering valve*	B	Check valve (non-return valve)  As backpressure generator	...in closed piping system, to prevent mixing and return flow in delivery line. ...in systems with free outlet in order to produce a defined backpressure.
Shut-off fittings	C	To cut off the pipe system in individual sections (function sections)	...for maintenance, conversion or repair work in order to shut down parts of the system.
Visual flow meter	D	Visual indication of metered quantity ((volumetric flow)	...for control of the adjusted metering volume.
Pulsation damper compressed air vessel	E	Elimination of pulsation in piping system (delivery side), produces low-pulsation flow	...in long piping systems in order to keep pressure loss at a minimum. ...for producing a continuous flow (metering). ...for avoiding troublesome vibrations in the piping system.
Pressure control valve*	F	Produces a defined backpressure (adjustment range as specified in technical data)	...in piping systems with free outlet to ensure trouble-free operation of the metering pump. ...use together with a pulsation damper in order to produce a constant backpressure.
Overflow valve*	G	Opens a bypass line at a set pressure limit value	...as safety device for protecting the metering system or metering pump from overload.
Level switch	H	Signals level of supply tank One-stage or (with early warning) two-stage version	...for trouble-free operation of the system. ...to indicate when the intake tank needs to be topped up or a tank change. ...to protect the system from running empty.
Foot valve*	I	Check valve (non-return valve)  With integrated sieve as coarse filter	...to protect the intake line from running empty (e.g. during tank change). ...to protect the metering pump from coarse solid particles.
Pressure gauge	J	Indicates the actual pressure in the metering line	...absolutely necessary for setting of pressure control valve resp. overflow valve. ...for determining actual operating pressure in metering line.
Intake air vessel		Elimination of pulsation in piping system (intake side), produces low-pulse flow	...for avoiding pressure loss in long intake line. ...as intake aid together with a vacuum pump.
Filter		Filters coarse solid particles out of intake flow	...to protect metering pump and system from dirt and increased wear.
Solenoid valve		Automatic shut-off fitting Activation: e.g. electrically interlocked with power supply of metering pump	...as safety device for shutting off (tight) delivery line when system at standstill.



### IMPORTANT

\* Not absolutely tight-closing shut-off elements.

### 10.2 Back pressure valve / relief valve

ProMinent® DHV-DL (DHV-S, DHV-S-DL, DHV-SR, DHV-RM)

Pressure control/overflow valves for installation in metering line:

- Adjustable pressure control valve for installation in metering lines.
- Used to produce a constant backpressure to ensure precision delivery when metering with free outlet, for admission pressure on intake side, for fluctuating backpressure or metering to vacuum.
- Also used as safety overflow valve.
- If used as pressure control valve for avoiding resonance:  
Installation at end of metering line or set pressure (set pressure / line pressure) loss.



#### IMPORTANT

**Pressure control/overflow valves are shut-off elements which do not close absolutely tight.**

The DHV-S, DHV-S-DL series is used in conjunction with pulsation dampers only with free outlet and a short metering line.

The DHV-SR/RM series is not subject to the effect of backpressure and is therefore particularly suitable for use in cases of fluctuating backpressure at the pipe outlet and for use in conjunction with pulsation dampers or longer metering lines. The DHV-SR/RM series can be installed at any point along the metering line.

Type DHV-RM 1-10 bar

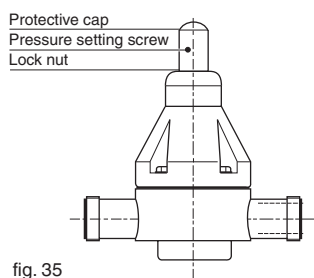


fig. 35

- ▶ Remove protective cap.
- ▶ Prior to pump operation:  
Unscrew pressure setting screw for pressure relief until it turns easily.
- ▶ During pump operation: Produce required operating pressure by turning in pressure setting screw:  
Read off set pressure at pressure gauge installed in pipe system.
- ▶ Secure pressure setting screw:
- ▶ Tighten lock nut.
- ▶ At required pressure relief, release lock nut and unscrew pressure setting screw until it moves easily.

### 10.3 Pulsation Dampers

Pulsation dampers are often used in conjunction with oscillatory displacement pumps. They are necessary when:

- Low-pulsation flow is required, for example, for process reasons.
- Depending on the piping situation, it is necessary to reduce impermissibly high pressure peaks during operation of oscillatory displacement pumps or pressure loss must be avoided; in this case, it is necessary to use pulsation dampers both on the intake side as well as the delivery side.

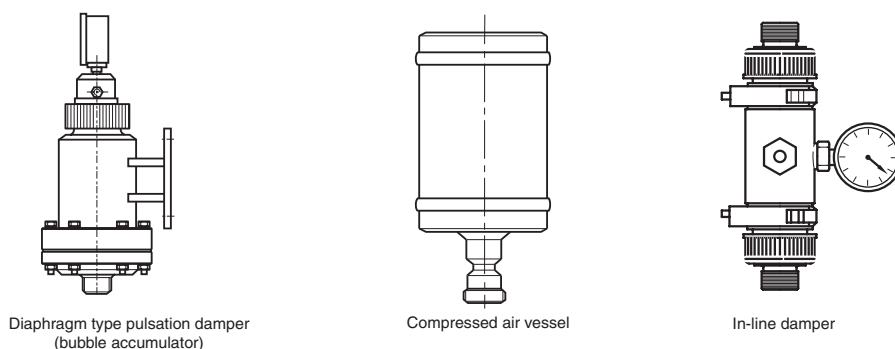
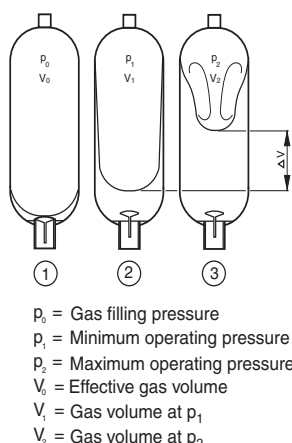


fig. 36

Schematic:  
Diaphragm-type pulsation damper



$\Delta V$  = Change in volume for  
pulsation compensation

fig. 37

### Function

Their function is based on compression and expansion of a gas cushion in order to release energy.

As the pressure increases, a part of the medium to be delivered is stored and then released to the pipe network as the pressure decreases.

In principle, a differentiation is made between pulsation dampers with and without a separating diaphragm.

In pulsation dampers without a separating diaphragm (e.g. air tank), the medium has direct contact with the gas cushion which is formed by feeding in compressed air. After start-up, the compressed air is compressed to the damping volume. Since the compressed air is gradually released in the medium, venting is necessary from time to time with the system depressurized.

This disadvantage is avoided by using pulsation dampers with a separating diaphragm.

In this case, the damping gas cushion is separated from the delivered medium by a flexible diaphragm and thus protected from absorption.

### Installation

#### IMPORTANT

Observe the regulations valid at the place of installation prior to initial operation and during operation of pulsation dampers!

The Pressure Vessel Ordinance (Druckbeh.V.) is applicable in the Federal Republic of Germany.

#### IMPORTANT

Pulsation dampers can only fulfil their task of damping pressure peaks and pulses if they are installed correctly.

- Integrate pulsation dampers in the system so that they are well accessible and free of vibration!
- Install pulsation damper in the immediate vicinity of the point where pressure peaks are to be dampened. For metering pumps this means installation at the shortest possible distance after the head valve of the liquid end (or immediately before the intake valve if a suction-air vessel is installed).
- Install connection line straight and corresponding to the connection diameter of the pulsation damper in order to avoid unnecessary deflection and pipe friction losses.

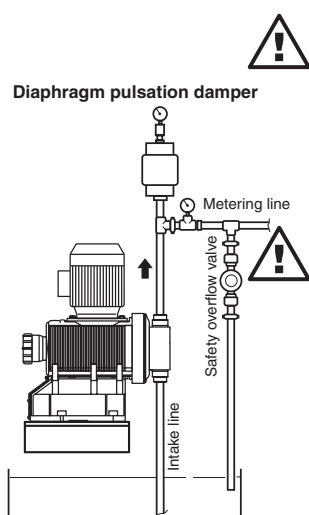


fig. 38

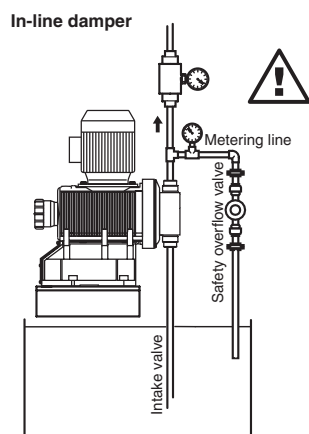


fig. 39

#### IMPORTANT

Do not use oxygen for preloading diaphragm-type pulsation dampers (or bubble accumulators) for air or nitrogen!

The greatest efficiency of pulsation dampers is achieved when the preload pressure is approx. 60–80 % of the subsequent mean operating pressure.

If the pulsation damper is not equipped with a pressure gauge, it is recommended to check the preload pressure (pv):

- After 500 hours of operation.
- Before resuming operation after a prolonged downtime.

A regular check every three months is recommended.

No.: .....

**Please fill in completely!**

Company: .....

Tel.No.: ..... Date: .....

Address: .....

Compiler (customer): .....

Order No.: ..... Date of delivery: .....

Pump type/  
Identity code: ..... Serial No.: .....

**Short fault description:** .....

.....

.....

**Type of fault:**

**1 Mechanical fault**

- ☐ Abnormal wear
- ☐ Wearing parts
- ☐ Breakage/other damage
- ☐ Corrosion
- ☐ Damage during transport

**2 Electrical fault**

- ☐ Connections (connector or cable) loose
- ☐ Operating element (e.g. switch)
- ☐ Control

**3 Leaks**

- ☐ Connections
- ☐ Liquid end

**4 None or poor delivery capacity**

- ☐ Diaphragm defective
- ☐ Others

**Operating conditions of ProMinent® pumps:**

Location/system description: .....

Pump accessories used: .....

.....

.....

Commissioning (initial operation/date): .....

Operating period (approx. operating hours): .....

Installation data/system schematic (provided by customers)

**(Please completely fill in enclosed form "Data for calculating metering line"!)**

Customer: .....

Project No.: .....

Date : .....

☐ Diagram/remarks

**Metering pump**

Type	—	.....
Capacity	l/h	.....
Stroke rate	stroke/min	.....
Type of valve (ball/plate)	—	.....
Valve spring pressure, intake side	bar	.....
Valve spring pressure, delivery side	bar	.....
Max. permissible operating pressure	bar	.....

**Medium**

Designation, concentration	%	.....
Proportion of solids/grain size	%/mm	.....
Material solids/hardness	(Mohs Scale)	.....
Dynamic viscosity	mPa s (cP)	.....
Density	kg/m <sup>3</sup>	.....
Vapour pressure at operating temp.	bar/°C	.....

**System intake side**

Pressure in intake tank		.....
Nominal diameter intake line	DN/mm	.....
Intake height min/max.	m	.....
Outlet height min/max.	m	.....
Intake line length	m	.....
Pipe condition**	<input type="checkbox"/>	Smooth and clean plastic
	<input type="checkbox"/>	Seamless, smooth steel
	<input type="checkbox"/>	Galvanized steel pipe
Number of brackets/valves		.....
Pulsation damper	<input type="checkbox"/>	Diaphragm accumulator ..... ltr.
	<input type="checkbox"/>	Compressed air vessel ..... ltr.

**System delivery side**

Static system pressure min/max	bar	.....
Nominal diameter delivery line	DN/mm	.....
Delivery line length	m	.....
Delivery height*	m	.....
Pipe condition**	<input type="checkbox"/>	Smooth and clean plastic
	<input type="checkbox"/>	Seamless, smooth steel
	<input type="checkbox"/>	Galvanized steel pipe
Number of brackets/valve		.....
Pulsation damper	<input type="checkbox"/>	Diaphragm accumulator ..... ltr.
	<input type="checkbox"/>	Compressed air vessel ..... ltr.

\* When calculating:  
 Observe sign, tank level below liquid end = negative intake head H  
 Metering line outlet level under liquid end = negative delivery head HD

\*\* The pipe properties should be specified for precise calculation at viscosities below 50 mPas.

Installing Drawing

Customer: .....

Project No.: ..... Date: .....



## Safety declaration form

**A completed form must always be returned with the equipment!**

**This declaration must only be completed and signed by an authorized member of the technical staff!**

The equipment or its parts will only be repaired or serviced if it is accompanied by a correctly completed and signed safety declaration form. The work could be delayed if no form is returned.

### Legally binding declaration

**We hereby assure that:**

**1. The enclosed equipment**

Type: \_\_\_\_\_

Serial No.: \_\_\_\_\_

is free from any

- ☐ toxic
- ☐ corrosive
- ☐ microbiological
- ☐ carcinogenic
- ☐ explosive
- ☐ radioactive substances
- ☐ or other substances that may be harmful to health.

**2. The equipment was thoroughly cleaned before being shipped.**

**3. There is no hazard due to residual contamination.**

**4. The details given in this form are correct and complete.**

Company / Institute: \_\_\_\_\_

Street: \_\_\_\_\_

Postcode, Town: \_\_\_\_\_

Tel: \_\_\_\_\_

Fax: \_\_\_\_\_

Surname, First name: \_\_\_\_\_

Position: \_\_\_\_\_

Date: \_\_\_\_\_

\_\_\_\_\_  
Legally binding signature

\_\_\_\_\_  
Company stamp



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