Operating Instructions

Gas Odorization System
GOE-SO

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WORLDWIDE

Foreword

Dear customer,

You have received a gas odorization system from us which we customized according to your requirements using components from RMG's modular system.

The operating instructions describe the basic gas odorization system. All possible features are described as options. We have chosen this structure as it is the only way to draft operating instructions with acceptable effort and expense despite the great variety of possible combinations and allow an adaptation of the operating instructions to be made if the system is customized using products from third parties.

Therefore, it is unfortunately unavoidable that you have to read more than one passage in the text in order to get all the information you need.

Please appreciate our position.

RMG MESSTECHNIK GMBH
Wieser Systeme

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1 Introduction

Due to the fact that natural gas by its very nature is odourless or can hardly be smelled, it is essential to odorize it in order to ensure that accidentally escaping gas is detected in time before an explosive gas-and-air mixture can form.

In accordance with Code of Practice G 280 of the German Association of Gas and Water Technology (DVGW), all gases as per DVGW Code of Practice G 260 which are used in public gas supply and have no sufficient inherent smell (warning smell) must be odorized. Odorization means adding to the gas an odorous substance what is called an odorant.

Special proportioning methods are necessary to add the odorant to the natural gas. On the one hand, a safe and constant odour intensity is desired, but on the other hand, adding too much odorant must be avoided to prevent unnecessary and unpleasant smells.

In order to achieve this purpose, the injection method has become widely accepted. With this method, precisely proportioned quantities of odorant are added to the natural gas. To do this, the volume pulses from a volumetric meter, e.g. a volume corrector, are used which are proportional to the gas quantity. This ensures an absolutely constant odorant concentration which is independent of the variations of the gas flow rate.

2 Functional Description

2.1 Odorization system

The odorization system operates according to the injection method and is fitted with a stationary odorant tank ***(26)*** with a capacity of 200 or 400 litres. As a standard, the complete system has been designed for use with the odorants THT or mercaptan mixtures. As an option, it is also possible to use sulphur-free odorants. Please see your purchase documents to find out whether your system has been designed for using sulphur-free odorants or not. Moreover, there is a label on the base plate of the gas odorization system which tells you whether your system can be used with such odorants or not. When in doubt, please contact RMG Messtechnik GmbH.
The odorant tank is unpressurized and vented through an activated carbon filter ***(12)***. Optionally, the odorant tank can be fitted with an overflow controller. The latter comprises a limit transmitter ***(10)*** and a solenoid valve ***(9)*** installed in the suction pipe which prevents overflow if the maximum level is exceeded inadvertently. The stopcock ***(7)*** in the filling pipe is closed during operation. An odorant filter ***(11)*** sized 140 µm is installed upstream of the solenoid valve ***(9 option)***.

The odorant level indicated by the level indicator ***(18)*** is identical to the odorant level of the odorant tank. The level indicator is fitted with a measuring burette for checking if the proportioning quantity set is delivered. The odorization system can be fitted with up to three proportioning pumps ***(13.I - III)*** and injection pipes for odorizing three separate gas pipes.

Solenoid-actuated proportioning pumps (reciprocating diaphragm pumps) are used to inject the odorant into the gas flow. Volume-proportional pulses from a meter measuring the volume at base conditions which are processed by a control unit cause the proportioning pump to perform strokes.

To protect the non-return valves (suction and discharge valves) of the proportioning pumps and injection nozzles, a common fine filter sized 60 µm ***(14)*** is installed in the suction pipe upstream of the proportioning pumps.

A flow monitor ***(15.I - III)*** installed in the injection pipes monitors the correct functioning of the proportioning pumps.

An odorization measuring device (ODM) ***(24)*** can optionally be used to measure the quantity of odorant injected. A solenoid valve ***(25)*** installed upstream of the ODM fills the ODM with odorant when it opens. After each filling, the quantity of odorant injected per standard cubic metre is measured and outputted on the display of the OSG 2000 control unit and made available with a 4-20 mA signal for remote data transmission.

In the case of maintenance or repair work to be done, the flushing and venting device ***(16)*** can be used to flush and vent the odorization system from the filter ***(14)*** up to the injection nozzles using a flushing agent (e.g. spirit, benzine or methanol) up to a maximum back pressure of 80 bar.

Depending on the size of the odorant tank, the odorization system is located on a collector ***(17)*** with a capacity of 225 or 440 litres which collects the whole content of the odorant tank if there are leaks and prevents odorant from entering the ground.

The whole piping is equipped with *SWAGELOK* fittings.
For any work to be done on parts of the piping, the enclosed installation instructions (see Sec. 8.1) must be followed.

2.2 Equipment

2.2.1 Odorant tank ***(26)*** with drain connection and stopcock ***(1)***, filling connection with odorant filter ***(11)*** and stopcock ***(7)***

2.2.2 Collector ***(17)*** with grid and supporting feet

2.2.3 Level indicator ***(18)*** with measuring burette, scale and stopcock ***(2)***

2.2.4 **Option:** Overflow controller with limit transmitter ***(10 option)*** and solenoid valve ***(9 option)*** in the filling pipe for [EEx i]

2.2.5 Level detector [EEx i] ***(19)*** in the odorant tank

2.2.6 Proportioning pump I MH- ....(type depends on the application) ***(13.I)*** with stopcock ***(5.I)*** and regulating valve ***(4.I)***

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2.2.8 **Option:** Proportioning pump III MH- ... (type depends on the application) ***(13.III)*** with stopcock ***(5.III)*** and regulating valve ***(4.III)***

2.2.9 Odorization measuring device ***(24)*** with solenoid valve ***(25)*** and stopcock ***(8)***

2.2.10 Odorant filter sized 140 µm ***(11)*** in the filling pipe

2.2.11 Odorant filter sized 60 µm ***(14)*** in the suction pipe upstream of the proportioning pumps

2.2.12 Activated carbon filter ***(12)*** of 1,000 grams with stopcock ***(6)***

2.2.13 High-pressure flushing and venting device ***(16)*** and stopcocks ***(3.I - III)***

2.2.14 Flow monitor [EEx i] ***(15.I - III)*** in the injection pipes

2.2.15 Injection nozzle ***(20.I - III)*** with shut-off valve ***(21.I - III)*** and non-return valve ***(22.I - III)*** in the gas pipes

2.3 Control unit

A control unit belongs to every odorization system. There are five design variants available:

a) Wall-mounting unit →Type 7IG4
b) 19" rack-mounting unit →Type 7EU4
(For further information, please see the enclosed operating instructions for the 7IG4 / 7EU4)
c) Wall-mounting unit →Type OSG 2000-W-P 3.2
d) 19" rack-mounting unit →Type OSG 2000-E-P 3.2
e) Decentralized installation →Type OSG 2000-M-P 3.2
with the program versions P1, P2 and P3.2. (For further information, please see the enclosed operating instructions for the OSG 2000.)

2.4 Odorant tank with a capacity of 200 or 400 litres

The odorant tank ***(26)*** has been designed as a stationary container which is replenished via the filling pipe.

There are the following connections available at the odorant tank:

- 1 G 1/2" with SWAGELOK fitting, dia. 12 mm, for the upper connection of the level indicator
- 1 G 1/2" with SWAGELOK fitting, dia. 12 mm, for the filling connection
- 1 G 1/2" with screw plug ***(23)*** (connection option for venting when filling the odorant tank)
- 1 G 1½" for level detector ***(19 option)***
- 1 G 1 for limit transmitter ***(10 option)***
- The drain connection with stopcock ***(1)*** is located at the bottom of the tank.

2.5 Collector

The collector ***(17)*** prevents the odorant from entering the ground if there are leaks. To avoid contact corrosion and inspect the underside, the collector is provided with feet. The odorant tank stands on a grid. It is not permitted to store any objects in the collector, since these would reduce its capacity.

2.6 Activated carbon filter

The activated carbon filter ***(12)*** prevents odorant vapours from the odorization system from escaping into the atmosphere.

2.7 Level indicator

The level indicator ***(18)*** consists of a measuring burette with scale division. The measuring burette is used to check the quantity delivered by the pump. A minor scale line corresponds to a volume of 100 mm³ (= 100 mg with THT).
The contents between two broad scale lines corresponds to a volume of 1,000 mm³.
Next to the measuring burette, there is a scale showing the odorant level (residual contents) in litres.

2.8 Proportioning pumps

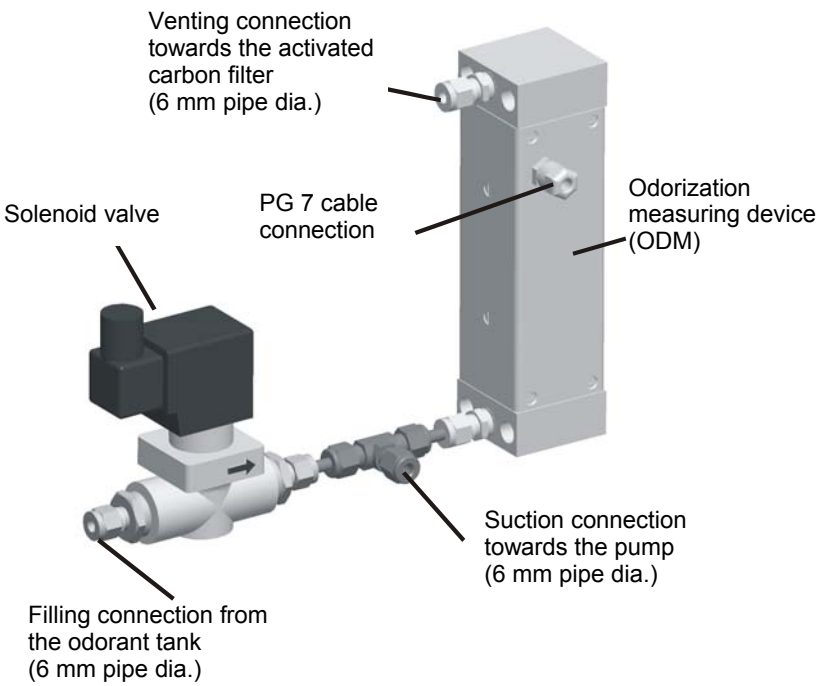
Reciprocating diaphragm pumps actuated by explosion-protected solenoids [EEx e II T4] (200 VDC) are used as proportioning pumps ***(13.I - III).*** For the technical data of the solenoid actuators, see the data plate. A stainless steel diaphragm separates the odorant from the hydraulic compartment.

The delivery rate in mm³/stroke is to be set through a continuous stroke adjustment feature by means of a scale (in the case of an MH pump) or a counting mechanism (in the case of an MHO pump). The materials used are resistant against the standard odorants, i.e. tetrahydrothiophene and mercaptans.
If resistance against sulphur-free odorants is required, there is a special pump design available (option).

Technical data

Pump type	Pump data		Solenoid data		
	Max. pump pressure [bar,g]	Displace-ment [mm³/ stroke]	Max. stroke frequency [pulses/h]	Pulse length [s]	Inter-pulse period [s]
MH–6–47	40	10 to 80	7200	0.35	0.15
MH–6–65	20	15 to 150	7200	0.35	0.15
MHO–15–300–M11	50	30 to 280	5000	0.55	0.16
MHO–15–300–M13	80	30 to 280	4300	0.66	0.18
MHO–15–500–M11	25	60 to 550	5000	0.55	0.16
MHO–15–500–M13	40	60 to 550	4300	0.66	0.18

2.9 Odorization measuring device (ODM)



The ODM ***(24)*** is installed in the unpressurized section upstream of the pump. After each measuring cycle, the ODM is filled with odorant through a solenoid valve ***(25)*** installed upstream of the ODM. The solenoid valve is controlled by sensors of the ODM. The sensor cables are identified by "min." and "max.". The volume of the ODM is 21,000 mm³ which is indicated on the data plate of the ODM and has to be entered into the control unit prior to the first start-up. The duration of a measuring cycle depends on the quantity of odorant injected into the gas pipe. In addition, the density of the odorant used is to be entered into the control unit. For further details concerning the density, see Sec. 4.5.1. When in doubt, please contact your odorant supplier.

2.10 Flow monitor of type FS-01 for [EEx i]

The flow monitor ***(15.I - III)*** is installed vertically in the injection pipe downstream of the proportioning pump. It monitors the pulses from the control unit to the pump by means of the pulses returned by the flow monitor.

In the case of a pulse difference of 5 pulses (value set in the factory), an alarm will be outputted ("Fault - Pulse Comparison"). This alarm will persist until it is acknowledged by activating the reset function.

2.11 Level monitoring for [EEx i] in the odorant tank

The level detector or level switch for monitoring the odorant level ***(19)*** is installed in the odorant tank. For the relevant technical data, please see the enclosed operating instructions.

2.12 Limit transmitter for [EEx i] in the odorant tank

The limit transmitter ***(10 option)*** is installed in the odorant tank.
It has been approved as an overflow controller and closes the solenoid valve ***(9)*** in the filling pipe.

NOTE: It is necessary to perform an annual functional test of the limit transmitter in compliance with Sec. 4.7.

For further technical data, please see the enclosed operating instructions for the limit transmitter used.

2.13 High-pressure flushing and venting device

This device ***(16)*** is used to flush the suction and injection pipes including the valves and fittings installed (e.g. proportioning pump with suction and discharge valves, odorant filter, flow monitor and injection nozzle)[1)] and to vent the proportioning pump. All conventional flushing agents (e.g. spirit, benzine or methanol) can be used.

[1)] **NOTE:** The flushing process reduces odours, for instance, when removing or reinstalling valves or fittings in the case of revision work.

3 Installation

3.1 Place of installation

For installation of the mechanical parts, it is essential to observe the guidelines of the relevant DVGW Codes of Practice (e.g. G280).

Odorization systems have to be installed in separate rooms with sufficient **ventilation**.

They must not be installed in controller rooms which are normally explosion-protected for explosion zone 2 only. The place of installation of the odorization system has to fulfil the requirements for hazardous areas of zone 1.

The control unit has to be installed in an area free from explosion hazards.

The ambient temperature of the place where the odorization system is installed must be in a range from +5°C to + 40°C, otherwise the functioning of the pump can be adversely affected.

3.2 Mechanical installation

The complete odorization system has been installed on the collector and tested for leaks and correct functioning in the factory.

3.2.1 The following parts have to be installed on site:

- Filling pipe (in compliance with operator's instructions)
- Injection nozzle ***(20.I - III)*** with shut-off valve ***(21.I - III)*** and non-return valve ***(22.I - III)***.
  If possible, installation should be made vertically from above into a horizontal gas pipe.
- Injection pipes between the odorization system and the injection nozzle.

3.2.2 After the whole installation has been terminated, the injection pipes are to be tested for leaks.

Important: If sulphur-free odorants such as "*GASODOR S – free*" are used, all sealants, stopcocks, etc. used must be suitable for sulphur-free odorants.

3.3 Electrical installation

The odorization compartment is subject to **explosion hazards of "zone 1 - temperature class T4".**

As to the electrical installation, the applicable regulations of the country where the odorization system is used must be complied with.

The standards VDE 0100, VDE 0165 (EN 60079-14) and VDE 0170/0171 (EN 50014, EN 50019, EN 50020) apply to the installation of the electrical equipment.

Cable connections are to be made in accordance with the electrical connection diagram.

4 Start-up

4.1 *Initial state:*

- ♦ All shut-off devices of the odorization system and the injection nozzles ***(21.I - III)*** are closed.
- ♦ All automatic circuit breakers in the distribution box are switched on.
- ♦ All control units are switched off.

- ♦ Filling the odorant tank

4.1.1 Open screw plug ***(23)*** and **connect the venting or suction hose of the odorant truck.**

NOTE: During the time the odorant tank is filled up, do not bleed the venting gases or vapours via the internal activated carbon filter. Otherwise the filter element is used up and would have to be replaced.

4.1.2 **Close stopcock *(6)*.** Open stopcocks ***(1)***, ***(2)*** and ***(7)***. You can now read the odorant level from the level indicator if odorant is filled up[2)] or is still available.

[2)]**Important**: **For safety reasons, the operating staff must monitor the odorant level during the time the odorant tank is filled up. This also applies if there is a limit shut-off feature operated by a solenoid valve.**

4.1.3 Close stopcock ***(7)*** after the odorant tank has been filled. The operating staff has to make sure that there remains no odorant in the filling line between the odorant truck and the stopcock ***(7)*** before the filling line is removed. Reinstall screw plug ***(23)***.

4.2 *Venting and flushing - proportioning pumps (12.I - III) (odorant section) with injection pipe system*

Initial position of the valves on start-up (prior to flushing):

- ♦ Stopcocks ***(3.I-III)*** and ***(8)*** are closed.
- ♦ Fill flushing pump tank with approx. 0.5 litres of flushing agent ***(see Sec. 2.13)***.
- ♦ Open stopcocks ***(1 and 2)***.
- ♦ Open stopcocks ***(5.I - III)***.
- ♦ Open the regulating valve ***(4.I - III)*** of the relevant line.
- ♦ Open the shut-off valve ***(21.I - III)*** of the relevant line.
- ♦ Close stopcocks ***(1), (2)*** and ***(5)***.
- ♦ Prior to pumping, open the screw cap of the flushing agent tank approx. 1 turn.
- ♦ Switch off all control units at the mains switch.

4.2.1 Venting using the flushing pump *(16)*

NOTE: Each proportioning line must be vented individually.

- Open the stopcock of the line to be vented ***(3.I - III)***.
- Operate the flushing pump several times[3)] using the hand lever.

[3)]**NOTE:** Flushing pump (output: approx. 6 cm³/stroke, i.e. depending on the length of the injection pipe, it is necessary to perform at least the number of strokes below. Examples:
- Pipe dia. 6 × 1 mm: 5 strokes per 1 m of pipe;
- Pipe dia. 12 × 1 mm: 13 strokes per 1 m of pipe;
permissible max. gas back pressure: 80 bar,g).

- After venting, close the stopcock of the vented line ***(3.I - III)***.
- Perform venting for all available lines.
- After venting, close the screw cap of the flushing agent tank again.
- Open stopcocks ***(1)***, ***(2)***, ***(5)*** and ***(6)***, if you want to start odorization afterwards. Set the control units as described in the operating instructions and switch them on.
  Now the proportioning system injects the preset quantity of odorant through the injection pipe into the gas flow. You can check the functioning if you close stopcock ***(1)*** of the odorant tank and observe the measuring burette. The level of the measuring burette falls with each pump stroke.

  NOTE: Do not completely empty the measuring burette, otherwise you must repeat the venting process.

- If you want to measure the quantity of odorant injected with the ODM measuring device **(option)**, first close stopcock ***(5)*** and only then open stopcock ***(8)***. If you do not proceed in this sequence, the ODM measuring device ***(25)*** can be overfilled. This will increase the duration of the first measuring cycle of the ODM measuring device.

4.3 Venting the proportioning pumps MH 6-47 / 6-65 (hydraulic section)

Usually, the pump has been vented in the factory. Due to transport, it may be necessary to vent the hydraulic section of the pump again at the place of installation. To do this, proceed as follows:

4.3.1 Open the vent screw (hexagon socket screw SW 4) for the hydraulic section approx. 1 turn.

4.3.2 Set the proportioning pump to its maximum output.

4.3.3 Make the following settings on the associated control unit ***(I, II or III)***:

- ♦ Mains voltage "ON"
- ♦ Pulse generator "Internal"
- ♦ The hydraulic oil must come out of the vent screw without any bubbles. If necessary, repeat the venting process after 5 minutes.

4.3.4 Close the vent screw for the hydraulic compartment.

4.3.5 Switch the control unit off at the mains switch and reset the pulse generator to "External".

4.3.6 Check the oil level. → To do this, unscrew the black plastic screw SW 19 and, if necessary, top up **oil***) until the level reaches the lower edge of the threads.

4.4 Venting the proportioning pumps MHO 15-300 / MHO 15-500 (hydraulic section)

4.4.1 Open the vent screw for the hydraulic section until approx. 2 turns are left.

4.4.2 Set the proportioning pump to its maximum output.

4.4.3 Perform pump strokes by operating the automatic/manual changeover switch ("Manual" position) at intervals of approx. 1 second at maximum output until no more air bubbles are visible.

4.4.4 Make the following settings on the associated control unit ***(I to III)***:

- ♦ Mains voltage "ON"
- ♦ Pulse generator "Internal"
- ♦ The hydraulic oil must come out of the vent screw without any bubbles. If necessary, repeat the venting process after 5 minutes.

4.4.5 Close the vent screw for the hydraulic compartment.

4.4.6 Switch the control unit off at the mains switch.

4.4.7 Tighten the vent screw again when the solenoid is in its discharge position. Check the oil level and, if necessary, top up oil*) until the level reaches the middle of the sight glass.

***) Use only special hydraulic oil NDT2, RMG ref. No. 50.27.003.00.**

4.5 Setting the displacement on the proportioning pump

4.5.1 Calculation of pump settings

In order to convert working cubic metres [m³] to standard cubic metres [sm³], it is sufficient if only the absolute operating pressure is used for the following calculations.

Density and volume data for the most important odorants:

Odorant	Density in kg/dm³	Volume of 1 mg in mm³ at 20°C
Tetrahydrothiophene (THT)	~ 0.99	~ 1.0
Mercaptans	~ 0.82	~ 1.22
GASODOR S-Free	~ 0.933	~ 1.072

Symbols and conversions used:

$Q_{b,max}$ = Max. gas flow rate, standard cubic metres [sm³/h] ⇒ $sm^3/h = m^3/h \times p_a$

$Q_{m,max}$ = Max. gas flow rate, working cubic metres [m³/h]

I1 = Input pulse value [sm³/pulse]:
(Value which is specified by the existing gas volume corrector or directly by a turbine meter, for example)

P_p = Pulse value, pump [sm³/pulse]:
(Gas flow rate which the pump must supply with odorant with each stroke. This value can be adjusted on the control unit.)

p_g = Operating gauge pressure [bar]

p_a = Absolute operating pressure [bar] ⇒ $p_a = p_g + 1$

f_{pump} = Max. stroke frequency of the proportioning pump [pulses/h], see Sec. 2.8

V_{pump} = Max. output of the proportioning pump [mm³/stroke], see Sec. 2.8

ρ (rho) = Density of the odorant [kg/dm³] or [mg/mm³]

c = Desired odorant concentration [mg/sm³]

$V_{setting}$ = Setting of the proportioning pump [mm³/stroke]

Calculation of the output (quantity to be set)

$$V_{setting} = \frac{c \times P_p}{\rho} \text{ [mm³/stroke]}$$

Calculation of the stroke frequency

$$f_{pump} = \frac{Q_b}{P_p} \text{ [strokes/h]}$$

When you make your calculations, make sure that the maximum stroke setting (V_{pump}) and the maximum stroke frequency (f_{pump}) of the proportioning pump are not exceeded (see Sec. 2.8).

Example 1: ⇒ Odorant – GASODOR S-Free
Input pulses from a gas volume corrector
Proportioning pump: MH-6-47

Q_b = 25,000 [sm³/h]
I1 = Input pulse value [sm³/pulse] :
P_p = 8 [sm³/pulse] :
ρ (rho) = 0.933 [kg/dm³]
c = 9 [mg/sm³]
$f_{pump,\ max}$ = 7,200 [strokes/h]
$V_{pump,\ max}$ = 80 [mm³/stroke], adjustable from 10 to 80 mm³

Calculation of the output (quantity to be set)

$$V_{setting} = \frac{c \times P_p}{\rho} = \frac{9 \times 8}{0.933} = 77.2\ [mm^3/stroke]$$

Calculation of the stroke frequency

$$f_{pump} = \frac{Q_b}{P_p} = \frac{25{,}000}{8} = 3{,}125\ [strokes/h]$$

Example 2: ⇒ Odorant – GASODOR S-Free
Input pulses from a turbine meter
Proportioning pump: MH-6-65

Q_m = 5,000 [m³/h]
Q_b = $Q_m \times p_a$ = 5,000 × 7.0 = 35,000 [sm³/h]
$I1_m$ = 1.0 [m³/pulse]
$I1_b$ = $I1_m \times p_a$ = 1.0 × 7.0 = 7.0 [sm³/pulse] :
p_g = 6 bar
p_a = p_g + 1 = 6 + 1 = 7 bar
P_p = 12.0 [sm³/pulse] :
ρ (rho) = 0.933 [kg/dm³]
c = 10 [mg/sm³]
$f_{pump,\ max}$ = 7,200 [strokes/min]
$V_{pump,\ max}$ = 150 [mm³/stroke]

Calculation of the output (quantity to be set)

$$V_{setting} = \frac{c \times P_p}{\rho} = \frac{10 \times 12}{0.933} = 128.6\ [mm^3/stroke]$$

Calculation of the stroke frequency

$$f_{pump} = \frac{Q_b}{P_p} = \frac{35{,}000}{12} = 2{,}916\ [strokes/h]$$

4.6 Starting up the control unit

4.6.1 The parameterization and configuration of the control unit is to be made in compliance with the operating instructions for the "7IG4 / 7EU4" or "OSG 2000".

4.6.2 After you have inputted or selected the parameters, the start-up process of the entire odorization system has been terminated.

- Mains voltage "ON"
- Pulse generator "External"

4.6.3 All the setting data should be recorded in a list.

4.7 Testing the limit transmitter *(10 option)*

4.7.1 Necessary working steps:

- Disconnect the system from the mains supply.
- Remove the limit transmitter (if necessary, disconnect the connecting cable).
- The solenoid valve of the filling pipe ***(9)*** will open as soon as the control unit is switched on. (Perform an acoustic or even better, if possible, a pneumatic check with air for permeability.)
- Immerse the limit transmitter ***(10)*** with its tuning forks in the flushing agent (see Sec. 2.13).
- The solenoid valve of the filling pipe ***(9)*** must close. (Perform an acoustic or even better, if possible, a pneumatic check with air to test the shut-off performance.)
- Install the limit transmitter and, if necessary, connect it again.
- Document the testing process.

5 Operation

5.1 Service settings

5.1.1 The following shut-off devices are closed:

- Stopcock ***(8)***
- Stopcock ***(7)***
- Stopcock ***(3.I - III)***

5.1.2 The following shut-off devices are open:

- Stopcock ***(1)***
- Stopcock ***(2)***
- Stopcock ***(6)***
- Stopcocks ***(5.I - III)***
- Regulating valves ***(4.I - III)***
- Shut-off valves ***(21.I - III)***

5.2 Removing or installing the suction and discharge valves of the pump head

MAKE SURE THAT YOU WORK UNDER EXTREMELY CLEAN CONDITIONS!

5.2.1 To remove or install the valves, you should refer to the relevant sectional drawings of the valves.

5.2.2 The parts belonging to the discharge valves must not be confused with the parts belonging to the suction valves.

5.2.3 When you install the discharge valves, insert the individual parts centrically into the pump head and then screw in the valve housing. When you screw in the valve housing, make sure that the valve parts do not get out of place.

5.3 Checking the output of the proportioning pump via the level indicator

5.3.1 Set the automatic/manual changeover switch ***(27)*** to its "Manual" position.

5.3.2 Close stopcocks ***(1)*** and ***(8)***. Only then open stopcock ***(5)***.

5.3.3 Mark the odorant level on the level indicator (e.g. with adhesive tape or a water-soluble felt-tip pen).

5.3.4 Use the green manual button ***(27)*** to initiate pump strokes at intervals of approx. 2 seconds.

5.3.5 The volume between two minor scale lines is 100 mm³ and between two broad scale lines 1,000 mm³.

5.3.6 The volume discharged in the measuring burette divided by the number of pump strokes is the displacement of the pump.

Example:

Volume in the measuring burette = 1,600 mm³ (16 minor scale lines).
Number of pump strokes = 20

Displacement of the proportioning pump = 1,600 mm³ / 20 strokes = 80 mm³

NOTE!

Do not completely empty the measuring burette, otherwise it is possible that air enters the proportioning pump.

5.3.7 The calculated value should be identical to the displacement of the proportioning pump set.
If the deviation is larger, refer to the "Troubleshooting Table".

5.4 Odorization measuring device

5.4.1 To measure the quantity of odorant injected using the ODM measuring device (option), first close stopcock ***(5)*** and only then open stopcock ***(8)***. If you do not proceed in this order, the ODM measuring device ***(25)*** can be overfilled. This will increase the duration of the first measuring cycle of the ODM.

5.5 Shutting down the overall system

5.5.1 Switch off the mains supply (230VAC) at the associated control units.

5.5.2 Close shut-off valves ***(4.I - III)*** and ***(21.I - III)*** in the injection pipe downstream of the proportioning pump and close stopcocks ***(5.I - III)***, ***(3)*** and ***(8)*** or leave them closed.

5.5.3 Close stopcock ***(2)*** of the level indicator.

5.5.4 Close stopcock ***(1)*** of the extraction line from the odorant tank.

5.6 Shutting down the proportioning pump

This is necessary, for example, if revision work has to be done on a gas line.

5.6.1 Switch off the associated control unit.

5.6.2 Close the associated stopcocks ***(5.I / II or III)***.

5.6.3 Close the associated shut-off valves ***(4.I / II or III)*** and ***(21.I / II or III)***.

6 Maintenance and Functional Checks

6.1 Functional checks

6.1.1 Possible disturbances must be eliminated at once.

6.1.2 Check the delivery of the proportioning pump in compliance with Sec. 5.3 (on a monthly basis).

6.2 Maintenance work

6.2.1 Check the odorant level of the odorant tank (once a week).

6.2.2 Check the oil level of the proportioning pump (once a month).

6.2.3 Change the activated carbon (once a year or earlier, if necessary).

6.2.4 Carry out maintenance of the complete odorization system (once a year).***)**

6.2.5 Check the overflow controller (limit transmitter) ***(10 option)*** with cut-off function (once a year).

***) Such maintenance is to be carried out by specialist staff only. On request, we will gladly offer you an appropriate maintenance contract.**

7 Troubleshooting

7.1 Troubleshooting table

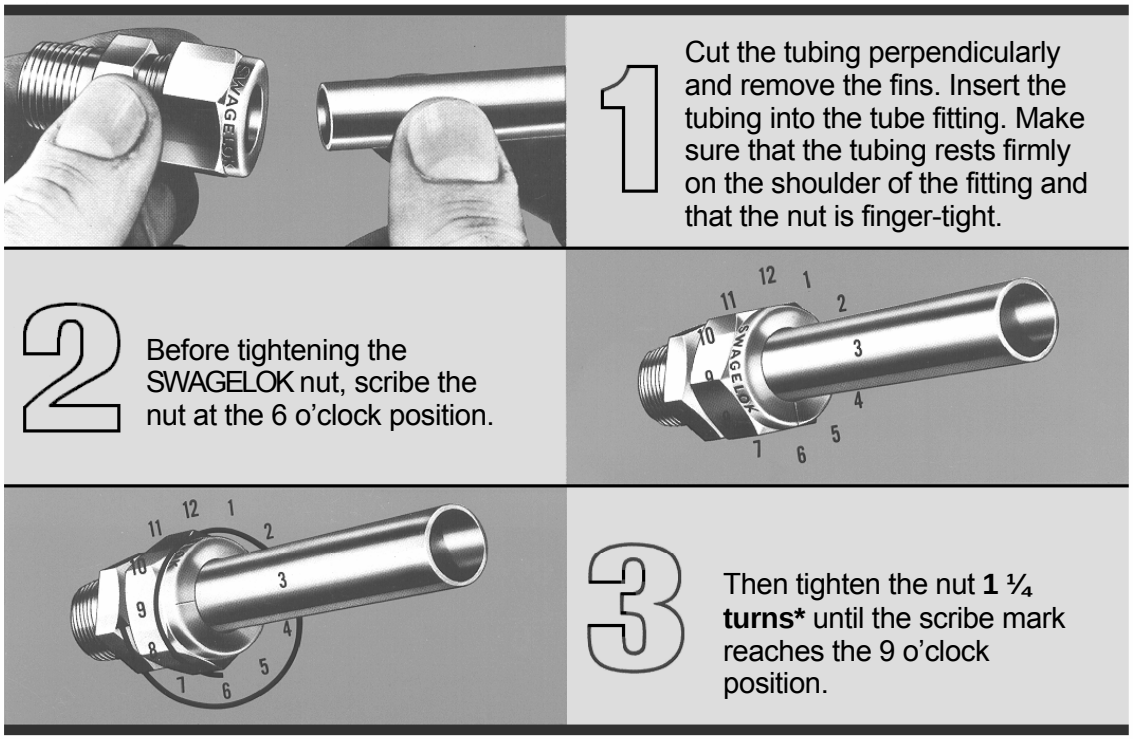
Fault		Cause	Remedy
7.2	The initial output of the proportioning pump is no longer achieved.	7.2.1 Air in the odorant section of the pump head.	♦ Vent the odorant section of the pump head **(see Sec. 4.2)**.
		7.2.2 Air in the hydraulic section of the pump head.	♦ Vent the hydraulic section of the pump head **(see Sec. 4.3 or 4.4)**.
		7.2.3 Valves of the proportioning pump are leaky.	♦ Check delivery as described in Sec. **5.3**: If the level rises in the measuring burette during the delivery stroke, the suction valve is leaky. If the displacement set at the proportioning pump is not sucked away during the suction stroke, the discharge valve is leaky. ♦ Remove valves **(see Sec. 5.2)** and replace the parts.
		7.2.4 Odorant filter is soiled.	♦ Clean or replace the filter element of the filter ***(14)***. ♦ Clean or replace the filter element of the filter ***(11 option)***.
7.3	Fault - Pulse comparison	7.3.1 Flow monitor is not properly adjusted.	♦ Adjust the operating point of the flow monitor.
		7.3.2 The initial output of the proportioning pump is no longer achieved.	♦ Take measures as described in Sec. 7.2.
		7.3.3 Flow monitor is soiled.	♦ Disassemble the flow monitor and clean all parts.
		7.3.4 Odorant filter is soiled.	♦ Clean or replace the filter element of the filter ***(14)***. ♦ Clean or replace the filter element of the filter ***(11 option)***.
7.4	Level detector ***(19)*** of the odorant tank reports minimum level; the odorant tank is empty (contents ≤ 10 litres).	7.4.1 Odorant tank is empty.	♦ Fill up the odorant tank.
		7.4.2 Level detector ***(19)*** is defective.	♦ Check the level detector ***(19)*** and the isolating amplifier (transmitter supply unit) (see the technical documentation). ♦ Check the electrical connections!

8 Annex

8.1 Installation instructions for SWAGELOK fittings

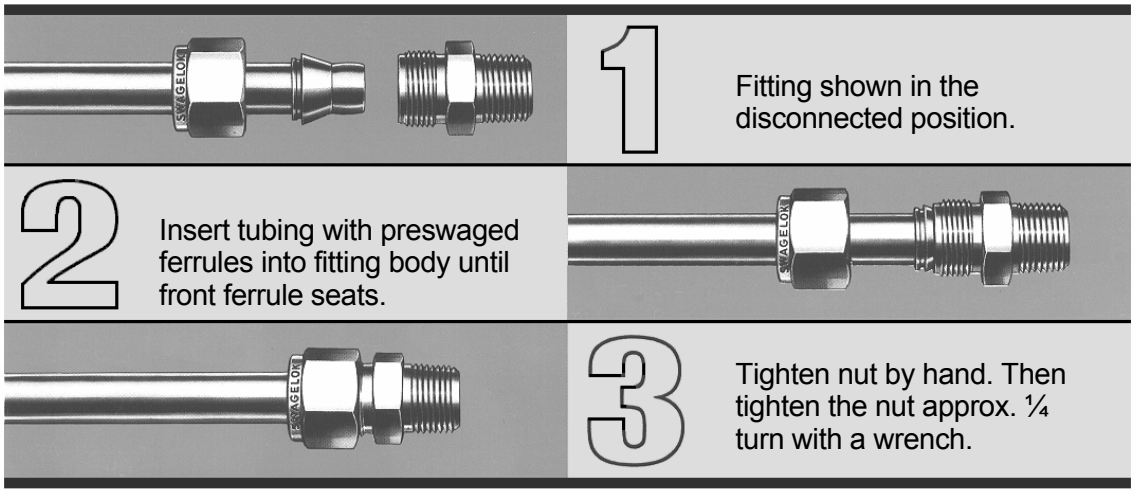
INSTALLATION INSTRUCTIONS FOR Swagelok® TUBE FITTINGS

INITIAL INSTALLATION

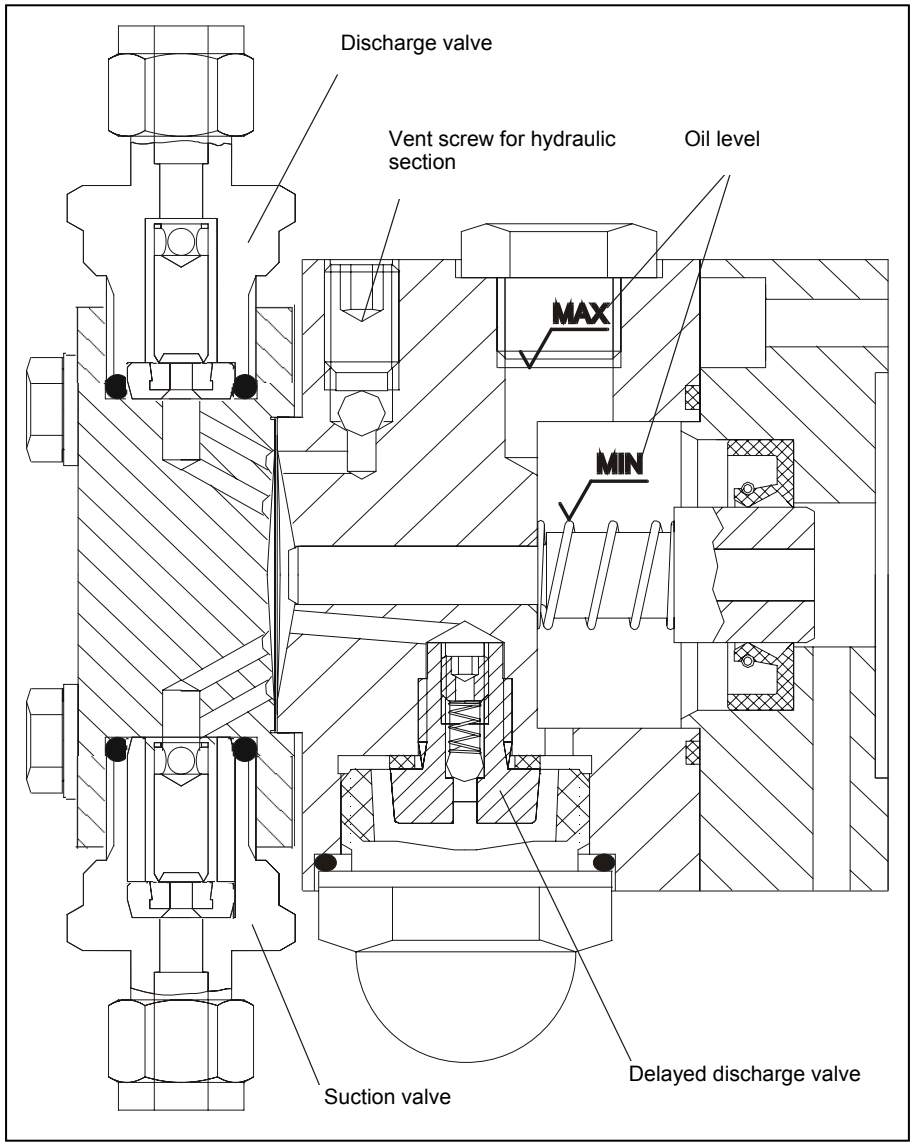


* For 2, 3, 4 mm or 1/16, 1/8, 3/16 in. size tube fittings, tighten the nut ¾ turn on initial installation.

RETIGHTENING INSTRUCTIONS

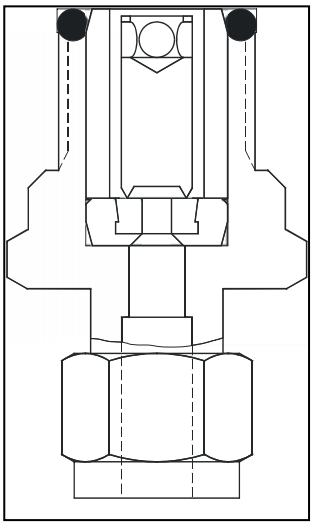


8.2 Sectional diagrams – proportioning pump MH-6-47/65

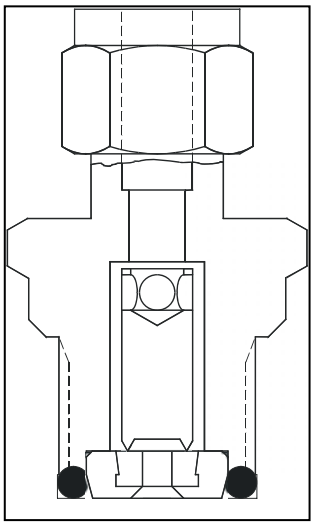


Pump head

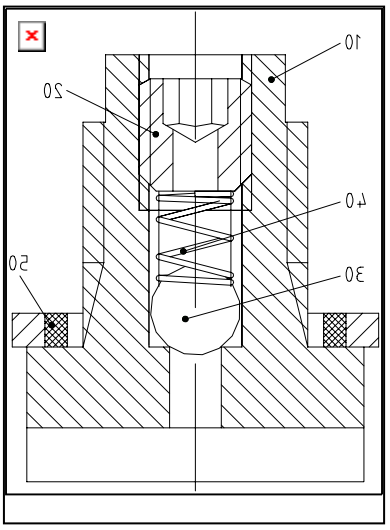
Suction valve



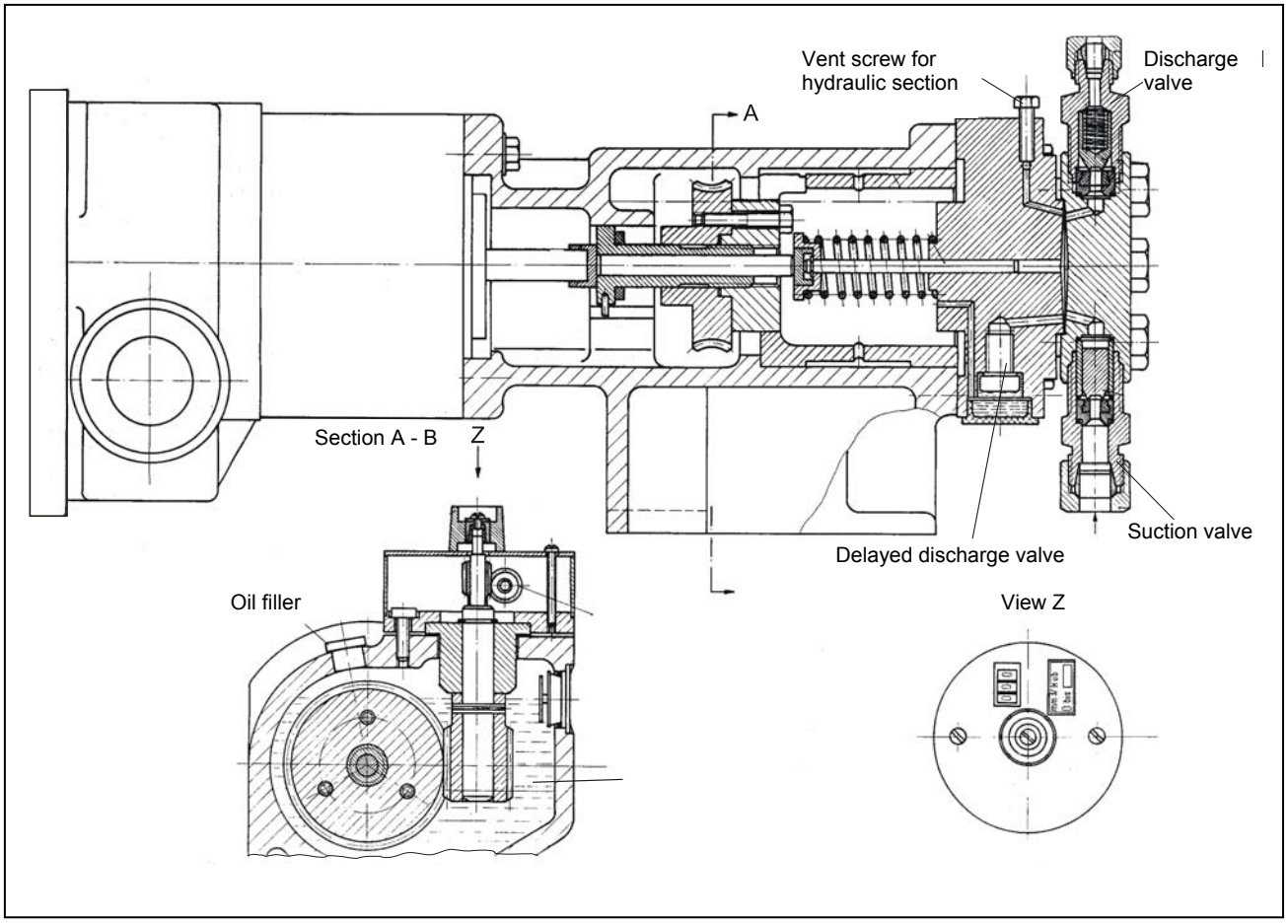
Discharge valve



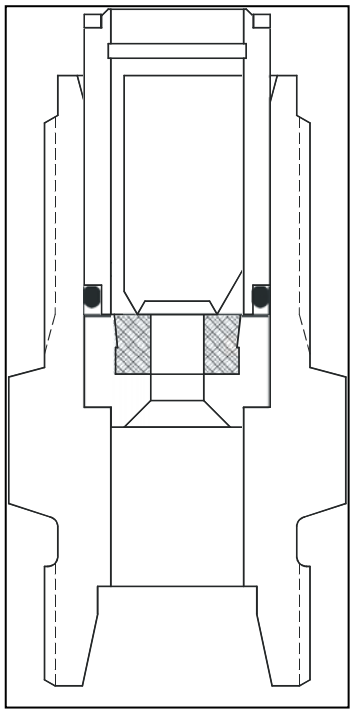
Delayed discharge valve



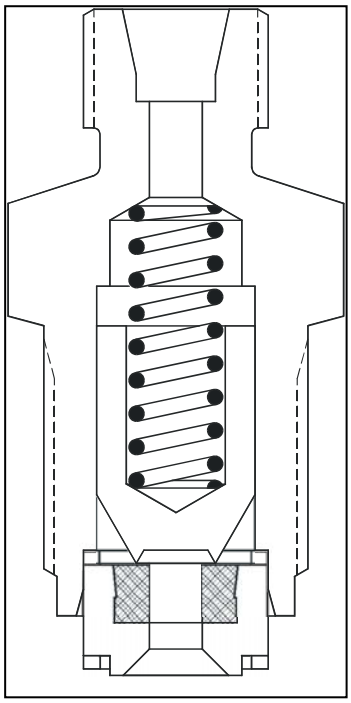
8.3 Sectional diagrams – proportioning pump MHO 15-300 11 / 13



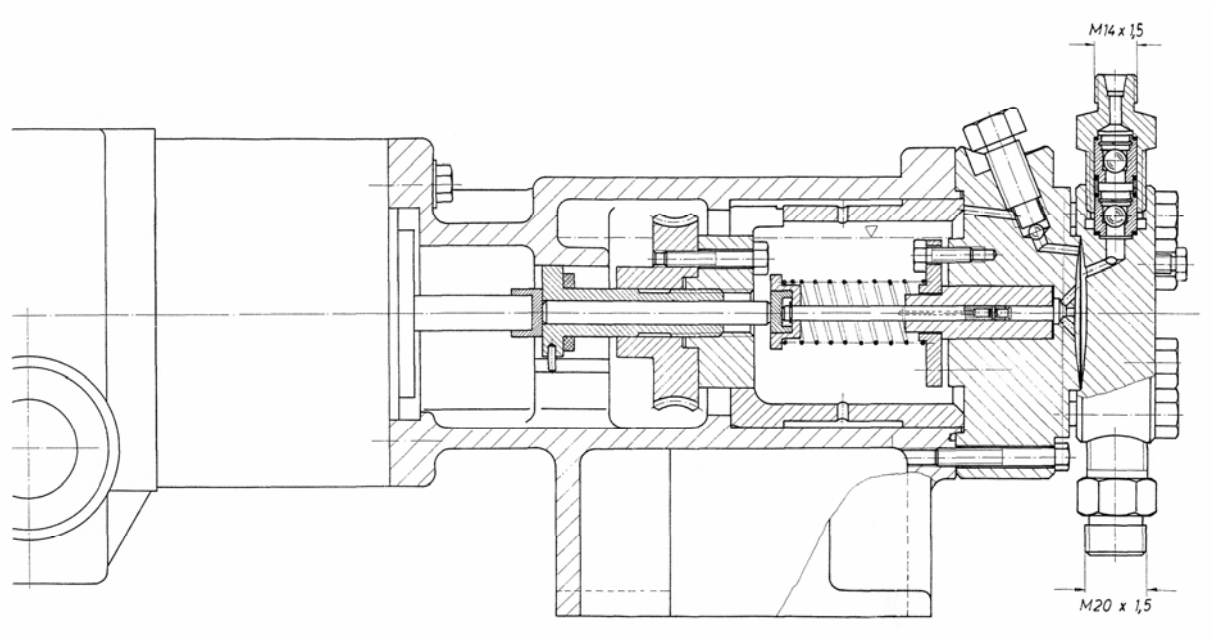
Suction valve



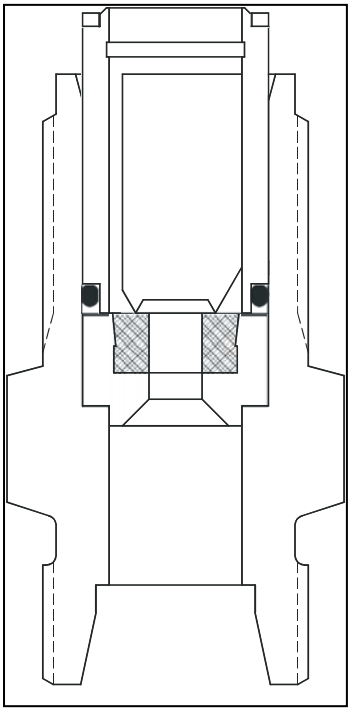
Discharge valve



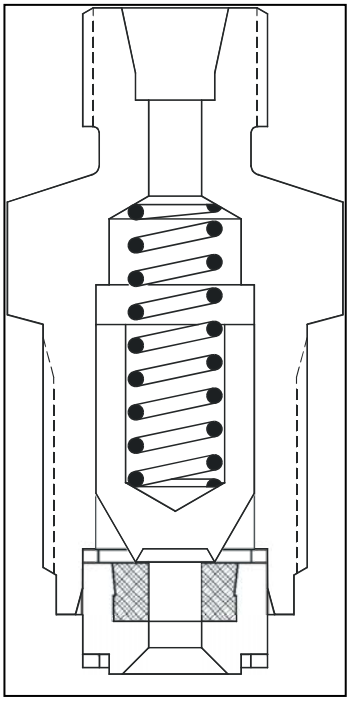
8.4 Sectional diagrams – proportioning pump MHO-15-500-M11 / 13



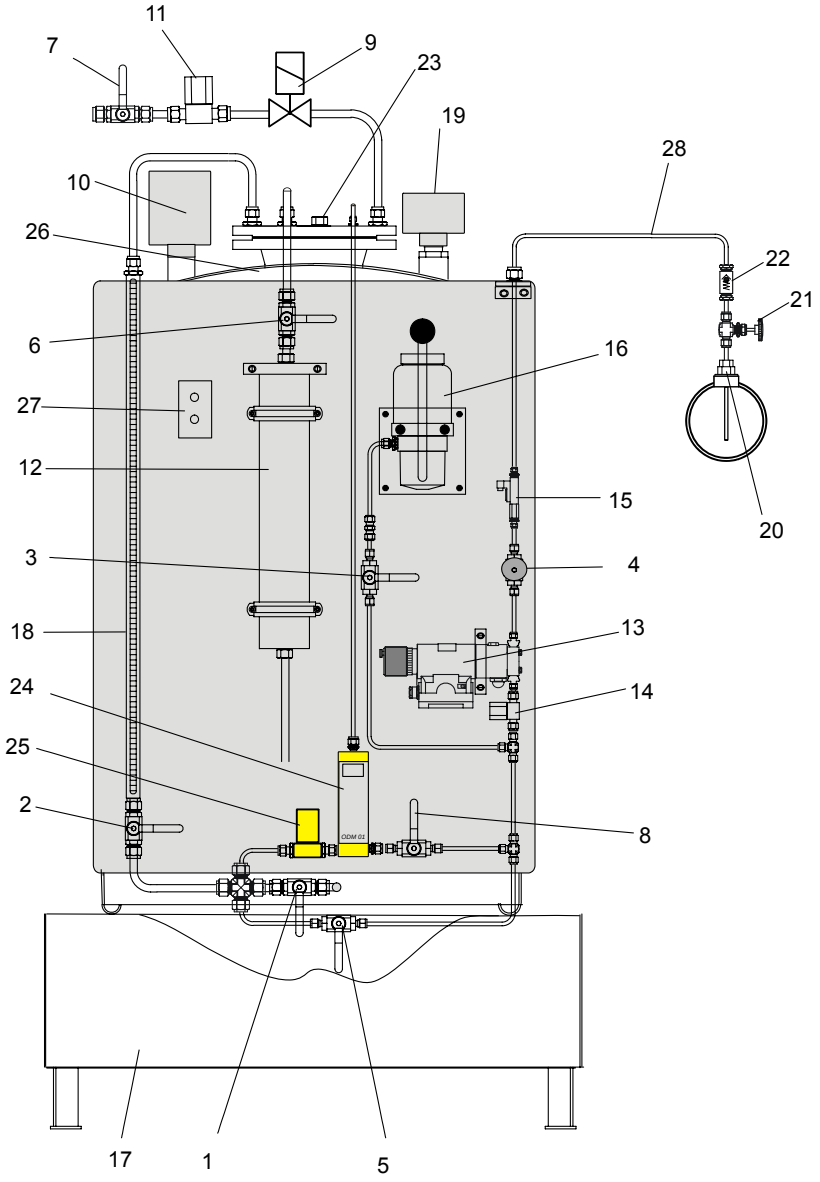
Suction valve



Discharge valve



9 Schematic Diagram (mechanical construction)



1) Stopcock, odorant supply	15) Flow monitor
2) Stopcock, measuring burette	16) Flushing and venting device
3) Stopcock, flushing and venting device	17) Collector
4) Regulating valve, injection pipe	18) Level indicator (measuring burette)
5) Stopcock, proportioning pump	19) Level switch / level detector (option)
6) Stopcock, activated carbon filter	20) Injection nozzle
7) Stopcock, filling pipe	21) Shut-off valve, injection nozzle
8) Stopcock, ODM (option)	22) Non-return valve
9) Solenoid valve, overflow controller (option)	23) Connection of external vent pipe
10) Limit transmitter, overflow controller (option)	24) ODM odorization measuring device (option)
11) Odorant filter (140 µm)	25) Solenoid valve for the ODM (option)
12) Activated carbon filter	26) Odorant tank
13) Proportioning pump	27) Automatic/manual changeover switch with pushbutton
14) Odorant filter (60 µm)	28) Injection pipe