Packing

The C 2700 equipment is packed individually because of its size and variable accessories. Refer to the delivery note for the actual scope of delivery.

Notes on Installation

Before installation carefully check the location in which the chlorinator and tank are to be mounted, according to the directions of the local authorities. In general, the standardized safety rules for "Chlorination of Water" apply.

— Chlorine tank and chlorinator must be located in different rooms.
— The floors of these rooms must not be underground.
— Escaping chlorine gas must not enter other lower rooms, wells, mines or drains.
— The chlorine rooms must not be connected to other rooms. A fireproof and gastight separation is required. Make sure that the doors open outwards and always without a key from inside.
— Each room is to be provided with small ventilation openings in the floor and ceiling. These openings must directly lead outside, and their cross sections should not exceed 40 cm^2.
— In the case of unfavourable locations, e.g. near schoolyards or rest-cure meadows, gas warning devices with visual and acoustic signaling are to be installed instead of ventilation openings. They must be coupled with an automatic sprinkler system. Delayed activation is admissible.
— **It is important** to use always appropriate tools. Make sure that **two** fixed spanners are used for detaching and connecting chlorine lines in order to avoid unadmissible loading of the device components.

Ejector Water Supply

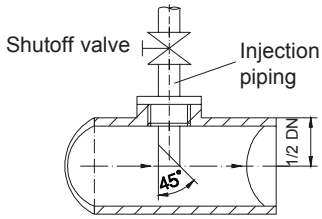
The numbers mentioned below refer to the schematic diagram on page 6.
In order to operate a full-vacuum chlorinator, the ejector (14) must be provided with the appropriate motive water pressure and the corresponding quantity of motive water. For the accurate values, see the characteristic curves for ejectors. If the existing water pressure is not sufficient according to the ejector data sheet, a booster pump (20) must be connected. The non-return valve (13) mounted on the ejector prevents the motive water to return to the chlorine gas vacuum line if the motive water supply is switched off or if the ejector is faulty.
As it cannot be excluded that the non-return valve leaks due to contamination, a motor ball cock (12) must be opened in dependence on the booster pump (20). Before entering the ejector, the line must be straight approx. 20 x DN in axial direction of the ejector. A dirt trap with a mesh aperture of less than 0.5 mm should be used in any case, no matter if a booster pump is part of the installation or not.

Chlorine Solution Line

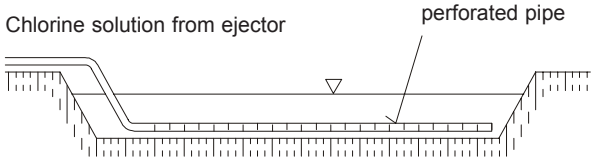
The chlorine solution produced in the ejector is led to the the injection nozzle (16) via a PVC piping and non-return valve (15). After the ejector, the line should be straight (5 x DN). In order to avoid pressure losses in the solution line, use as little bends and fittings as possible.

Injection Nozzle

The chlorine injection fittings or chlorine solution injectors are made from PVC and are fitted with a shutoff valve (ball cock) and injection piping, which, for installation, is shortened to half of its diameter with a 45° diagonal cut. The injection nozzles are integrated either in water-bearing lines or in open basins at such points where turbulences enable a good mixture.



For injection into open basins, drains or induction manifolds, long, perforated pipes closed at the end are suitable, which are tied to the bottom under water. Thus a fine and large-area distribution can be ensured.



e.g. cooling-water basin

Safety Blowoff Line

The PE tubing, which is part of the packing unit, is connected to the center chamber of the chlorinator and either laid outside with inclination or led to the sensor of the gas warning device (25), depending on the local conditions. The tubing is used to carry off chlorine gas, if the safety valve installed in the center chamber of the chlorinator has responded.

Gas Supply

Direct Gas Delivery

Chlorine is available in steel cylinders of 65 kg and steel barrels of 500 and 1,000 kg. Because of the large quantities required, we recommend to use always barrels, as only 1 % of the contents may be delivered hourly as gas at a temperature of 20° C. For chlorine deliveries of up to 25 kg/h, at least 3 barrels of 1,000 kg should be connected for direct gas supply.

Chlorine Evaporation

Liquid chlorine deliveries are recommended for quantities of more than 25 kg/h. With the help of an evaporator (see MB 2 05 01), the liquid chlorine is converted into gas by electrical heating and then led to the chlorinator as described before.

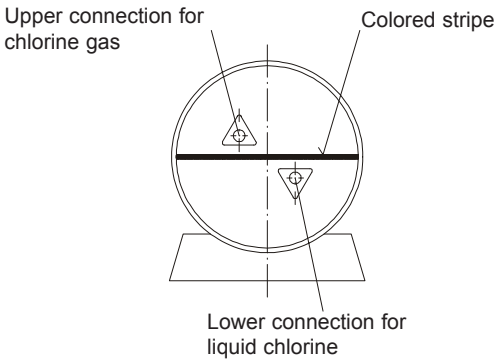
Storage of the chlorine barrels and connection of the chlorinators

The barrels have to be stored horizontally on supports. Remove the protective cap of the valve right before connection of the lines.

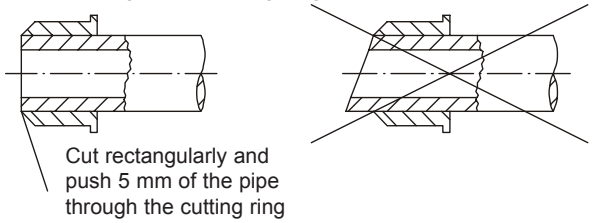
Caution:

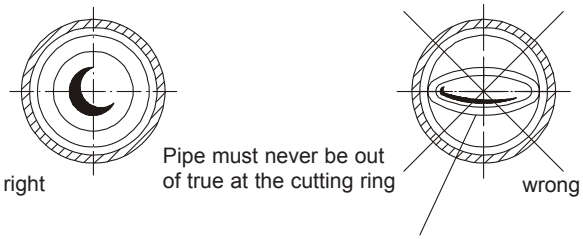
Make sure that the **gas supply** of the barrel is connected and not the liquid chlorine supply **if no evaporator** is used.

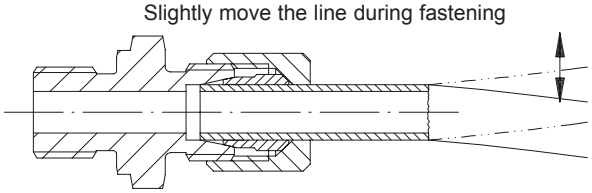
The barrels are marked with a stripe which must be horizontal when the barrel is positioned in the support. The upper connection is always used for chlorine gas, the lower connection delivers liquid chlorine for evaporator operation.



Use always new sealings for the connection of lines and fittings. The flexible copper lines must be cut off rectangularly at both ends and inserted very carefully into the screwings with cutting ring.



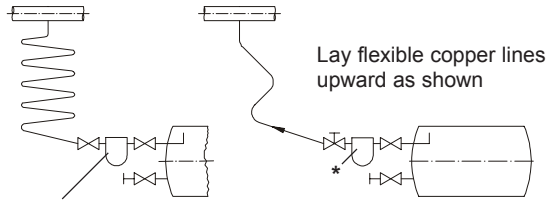




The threaded coupling is held tight with one fork wrench, another one is used to fasten the union nut of the screwed union. If only one barrel is used the line is connected directly to the inlet valve of the chlorinator as described before.

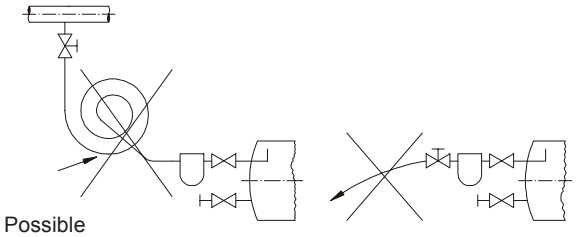
The line must always go **upward**.

Right installation



*The liquid separator is not required if the connected lines are dimensioned so that they can carry approx. 150 cm^3 of liquid chlorine without entering the chlorinator.

Wrong installation



Twist the flexible lines like a rising coil. Thus liquid chlorine can flow back to the barrel. If several barrels are connected, these are linked together first by means of a manifold (3). A main shutoff valve (4) is mounted on the output. A steel or copper pipe connects this valve to the inlet valve of the chlorinator. For automatic cutoff of the chlorine gas in the case of an alarm, a solenoid valve (6) can be installed which is controlled by the gas warning device (25). All lines and fittings in contact with chlorine gas must be sealed with DIACRYLAT liquid plastic. Never use organic substances such as hemp!

If the chlorine gas is highly contaminated, we recommend to integrate a commercial chlorine gas filter (9) in the line. For a continuous operation, it is appropriate to install an automatic chlorine barrel changeover device (5). It is mounted between two barrel batteries and, in connection with a chlorine gas contact vacuum gauge (7), ensures uninterrupted metering. A switch box supplied with the changeover device indicates the battery currently connected by means of LEDs. Chlorine barrels and chlorinators must be protected against direct sunlight and heating by radiators. The temperature along the gas line must never be lower than the cylinder temperature, because recondensation of chlorine gas severely damages the chlorinator. If chlorine recondensation is possible, a chlorine reducing valve (8) must be installed as close as possible to the chlorine barrels or after the changeover valve (5).

To avoid recondensation, make sure that the temperature of the room heating is **not** reduced at night because the chlorine gas lines cool off much faster than the barrels. Cool nights after warm summer days might have the same effect.

Chlorinators

The chlorinators are installed perpendicularly, because the measuring glass must be vertical for accurate indication. The motive water and solution lines have to be connected to the injection nozzles, in accordance with the ejector nominal widths and free of tension. In the case of long solution lines, the pressure loss must be considered as back pressure of the ejector.

Sprinkler System

All rooms storing chlorine should have a sprinkler system (24), which cleans the air if chlorine gas escapes. The system can be switched on outside the room by means of a hand valve (23) with an extended spindle or by a solenoid valve (22) controlled by the gas warning device (25).

Tests Before Startup And For Maintenance Purposes

Motive Water And Solution Line

If the existing motive water pressure is lower than 10 bar, the shutoff valve (16) can be closed for the pressure test. Open the motive water valve slowly and check for leaks. Fasten the screwed PVC joints manually. Leaking cemented connections must be renewed with balanced lines. At motive water pressures of more than 10 bar, the shutoff valve (16) must always be open in order to protect the ejector. The system pressure prevailing at the injection nozzle becomes effective.

Ejector Non-Return Valve

For pressure test, close shutoff valve (injection nozzle) and open motive water line slowly. Disconnect suction tubing at the joint of the non-return valve (13). The valve must not leak. If it is leaking, dismount the valve and eliminate the error.

Vacuum LeakageTest of the Chlorinator

Plunge the end of more than 3 m of transparent PE vent line (17) coming from the center chamber approx. 1.5 m below the chlorinator (10) into a water tank. Open shutoff valve (16) and motive water line. The chlorinator is then under vacuum. When the gas line is closed, a column of water is primed according to the displacement volume of the diaphragms and can be seen in the transparent tubing.

If the device is absolutely tight, the column of water will have a constant level. If there is a leak, the water will continue to rise. Interrupt the test, **before** water enters the chlorinator. See troubleshooting table.

Safety Valve

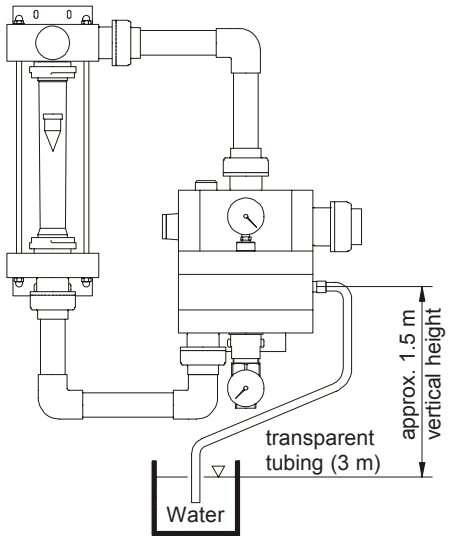
The safety valve installed in the center chamber of the chlorinator is closed if the chlorine gas inlet valve is operable. If it leaks due to contamination or wear, an excessive pressure is produced in the lower chamber. The safety valve opens at an excessive pressure of approx. 0.5 bar and, via the vent line, carries the chlorine gas outside or to the installed warning device. Check this line using a small amount of ammonia solution (liquid ammonia) when starting up the installation.

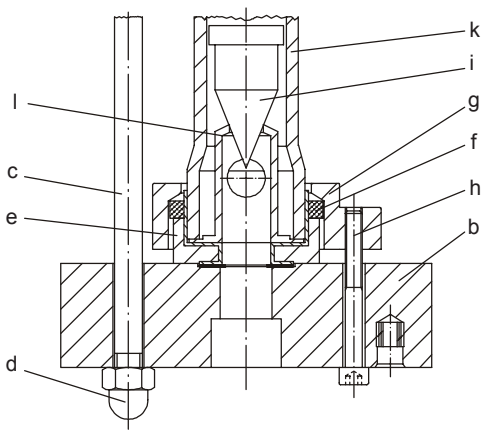
Replacing the Measuring Glass

For replacement, remove the measuring glass (k) together with the receiving blocks (b). The spacer bolts (c) can be dismounted after screwing off the cap nuts (d). After loosening the screws (h), the receiving blocks (b) can be removed. For assembly, proceed as follows:

Prepare both receiving blocks (b) by positioning the flange bushing (e) in the recess of the receiving block and by covering it with the rubber ring (f). Then the flange (g) (still without measuring glass) is fastened manually with screws (h). The measuring glass (k) is prepared by inserting the float (i) with the point showing downward and the fitting edges (l) into the measuring glas ends.

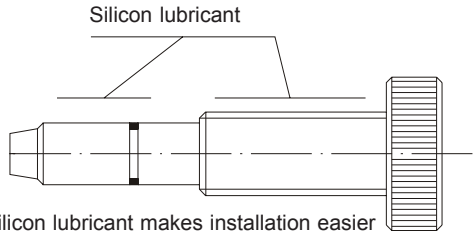
Then the preassembled blocks are slid onto the measuring glass ends. Insert the spacer bolts (c) and fasten with nuts (d) by turns so that the receiving blocks are parallel to each other. The prepared measuring set is fixed to the base plate. Now tighten the spacer bolts (c) gently by turns. Fasten the flanges (g) with the screws (h) and connect the lines.





Checking the Adjusting Screw

For sealing, the flow volume adjusting screw is fitted with an O-ring at the front end. During operation, it can be checked if this O-ring leaks. Move the adjustment knob laterally. As long as the O-ring is in the adapter, the display of the measuring glass must not change considerably. If it does, however, remove the adjusting screw and equip it with a new O-ring. Before screwing it in place again, coat it slightly with silicon lubricant.



Vaseline or Silicon lubricant makes installation easier

Gas Pressure Line

The leakage test of the parts in contact with chlorine gas is realized by blowing-in of the lines and especially the fittings with (liquid) ammonia. The chlorine tank must be shortly opened for this purpose in order to pressurize the system. If chlorine escapes, white smoke occurs. Due to the extreme corrosiveness of humid chlorine gas, leaks will grow larger in course of time.

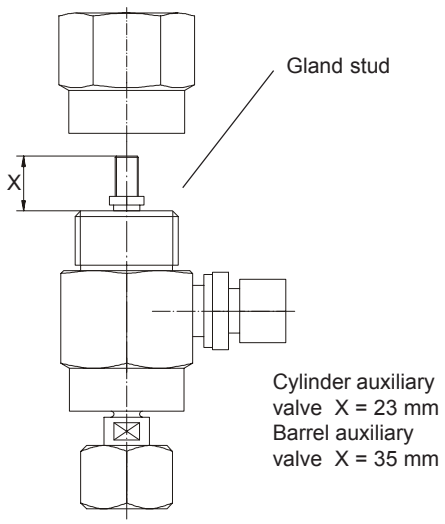
Consequently, even the smallest leak must be eliminated!

Barrel/Cylinder Connecting Valves

If the barrel connecting valve (2) leaks the gland stud must be retightened by about a quarter turn. For this purpose the handwheel of the valve must be removed. This can be done under gas pressure, as the valve stem cannot drop out. For detailed instructions, see ET 2 22 01.

Attention!

The valve stem has a very fine thread. Please make sure that it is not damaged when the handwheel of the valve is dismounted.

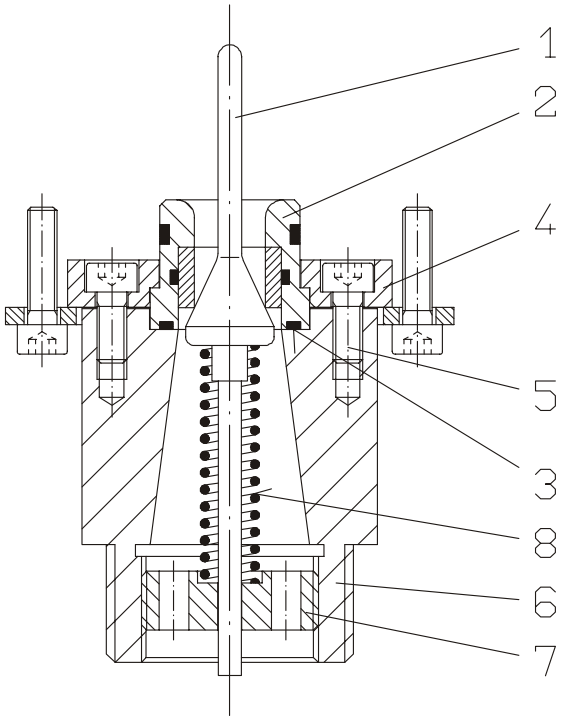


Inlet Valve

Plug the valve seat assembly incl. the PTFE bush (2) with O-ring (3) into part (6) and tighten it with part (4) and screw (5). Insert stem (1) with spring (8) and prestress it with the help of part (7) until the latter is countersunk in part (6) (approx. 5 mm).

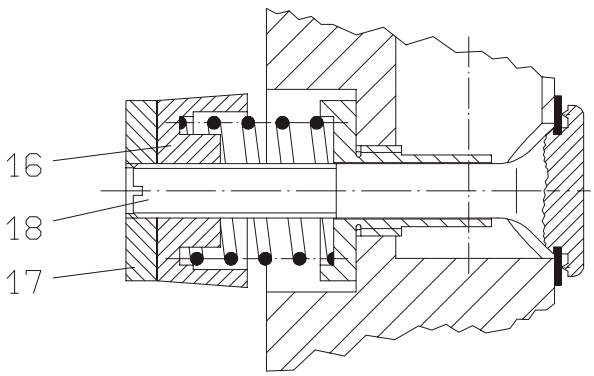
Test:

Connect the valve to compressed air (6 bar) and plunge it into water. Air bubbles must not occur.



Setting the External-Air Valve

The external-air valve is set so that the vacuum does not exceed 0.5 bar absolute. Detach part (17). Hold part (18) with a screw driver and turn part (16) (turn right to reduce the absolute suction pressure).



Operating the System

Before startup, check once again if the number of chlorine tanks connected is sufficient for the chlorine consumption. Then the flow meter can be fully opened. Rule of thumb: Maximally 1 % of the filling weight of a chlorine tank may be delivered as gas per hour. If an evaporator is used for gas supply, it must be preliminarily heated for operation. In this case, 20 % of the liquid chlorine contents may be taken from the tank per hour.

Startup

For startup, first open the main and auxiliary valves (2) of the chlorine tanks and then the shutoff valve (16) (injection nozzle) and motive water line. Under perfect operating conditions, a vacuum is produced in the ejector, which is propagated via the ejector non-return valve (13), the ball cock (12) and the suction line to the chlorinator and causes the chlorine gas inlet valve to open. Chlorine gas starts to flow and is mixed with motive water in the ejector. The exact chlorine gas quantitiy required can be set at the adjusting screw. The chlorine quantity is read at the top edge of the float.

Switching Off the System

The cylinder/barrel connecting valves (2) are closed. To switch off the system the float must be on zero level (and the system must not contain chlorine gas under excessive pressure anymore).

Caution!
Before longer periods of standstill, the lines and devices carrying gas must be flushed with nitrogen for about 5 minutes. All dismounted devices, lines and fittings in contact with chlorine must be cleaned and dried and protected against humid air by inserting plugs. Empty the water-carrying parts if there is danger of frost.

Maintenance

Regular maintenance avoids problems. We recommend a maintenance contract.
If there are no rules/specifications (e.g. GUV 8.15) or special annotations prescribing shorter maintenance intervals, all JESCO chlorinators have to be maintained and tested by an authorized specialist firm at least once a year. Preferably this should happen at the beginning of a high-rate period, prior to a downtime or a restart.

General
The vacuum systems described need little maintenance. Nevertheless, a chlorination installation must not be without observation. Even the smallest leak is growing larger within a short time due to the aggressiveness of humid chlorine gas and causes other parts to corrode. Therefore stop the installation immediately if a leak is detected and eliminate the error.

Working on the gas pressure line, replacing the cylinder/barrel
If a defective part has been detected, close the chlorine cylinder/barrel valves and suck off the gas by switching on the system. Dismount the defective part and protect the remaining gas line against humiditiy (e.g. put a dry cloth into the pipe end).

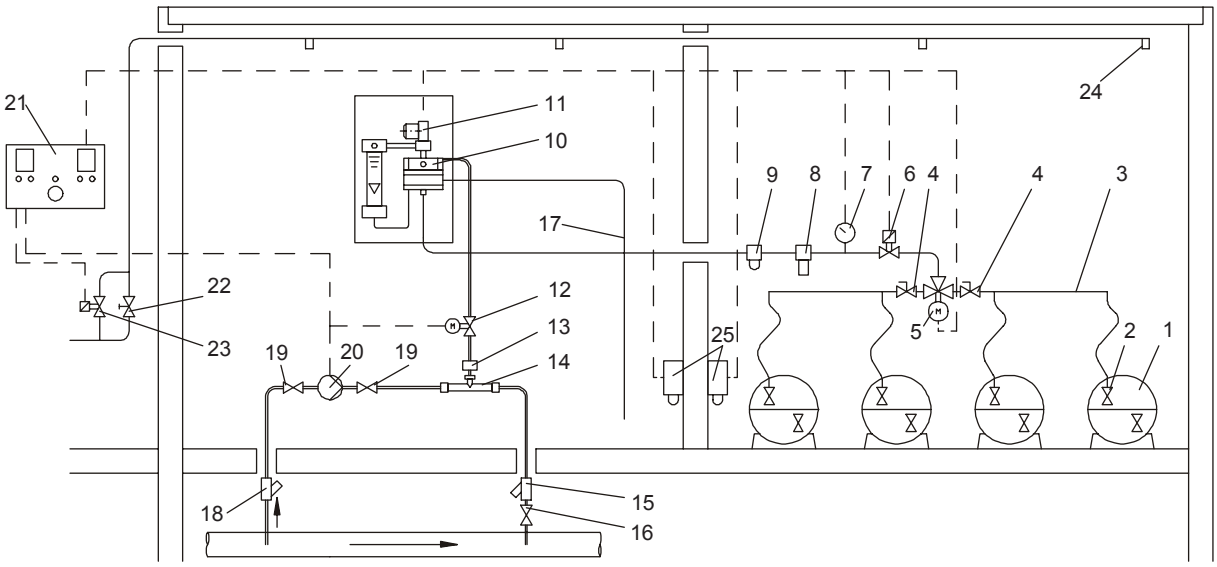
HUMIDITY IN THE PIPING CAUSES LOCALIZED CORROSION!

Close main valve tightly before exchanging the chlorine cylinder/barrel and disconnect it from the main valve using a fork wrench. Mount the protective cap of the chlorine cylinder/barrel. Do not bend the flexible copper line when dismounting it. Position full barrel on the support and remove protective cap. For further information, see item 1.8.
Provide the auxiliary valve with a new sealing and open the main valve shortly. Check with ammonia whether the connection is gastight. For recommissioning, make sure that the new cylinder/barrel has room temperature. and never exceeds it.

Cleaning the installation
Before working on the chlorination installation, it is absolutely necessary to close the chlorine cylinder/barrel valves and suck off the chlorine gas until the flow meter and chlorine pressure gauge show zero.

Disassembling the flow meter
Carefully remove the limiting plugs of the measuring glasses (observe float) and clean them with water only. The floats must not be damaged. Clean the glasses and floats with water or isopropyl alcohol. Dry parts completely! When assembling the flow meter, the upper and lower seals must be concentric.

Schematic Diagram



Legend

1.	Chlorine barrel	MB 2 21 01
2.	Chlorine barrel valve with flexible coupling	MB 2 22 01
3.	Manifold	MB 2 23 01
4.	Main shutoff valve	MB 2 24 01
5.	Electrical chlorine changeover valve	MB 2 24 01
6.	Safety solenoid valve	MB 2 25 01
7.	Pressure gauge for changeover device	MB 2 40 01
8.	Pressure reducing valve	MB 2 27 01
9.	Chlorine gas filter	MB 2 26 01
10.	**Chlorinator**	**MB 2 03 01**
11.	Electrical chlorine gas control valve	MB 2 07 10
12.	Shutoff ball cock	
13.	Ejector non-return valve	MB 2 32 01
14.	Ejector	MB 2 31 02
15.	Non-return valve	
16.	Shutoff valve with solution injection	MB 2 34 01
17.	Safety blowoff line	
18.	Filter	
19.	Shutoff valve	MB 2 29 04
20.	Booster pump	MB 2 29 01
21.	Control cabinet	
22.	Solenoid valve for sprinkler valve	MB 2 36 10
23.	Manual shutoff valve for sprinkler system accessible from outside	MB 2 36 10
24.	Sprinkler jet	MB 2 36 10
25.	Sensors of the gas warning device	MB 2 36 05

Note:
Not all of the system components shown are absolutely necessary. The scope of installation should be planned carefully by a specialist.

Chlorine deposits may cause servere problems. To avoid these, use a pressure reducing valve (8).

Troubleshooting

Type of fault	Possible cause	Remedy
No display or insufficient display on flow meter	Chlorine barrel empty, indicated by low chlorine gas pressure.	Connect new barrel.
	Connecting valve closed.	Open valve.
	Chlorine gas line bent or blocked.	Close chlorine barrel, drain off line and device, stop motive water supply, dismantle chlorine gas line and clean or replace it.
	Blocked filter before inlet valve, indicated by low chlorine volume despite high vacuum.	Clean or replace filter.
	Motive water pressure too low.	Compare ejector characteristics sheet with acutal pressure values, install booster pump, if necessary. Open reducing valve. Back pressure too high.
	Excessive pressure drop in dirt trap of motive water.	Remove dirt trap from reducing valve and clean filter. Also flush water lines.
	Ejector blocked, contaminated or encrusted by deposits (possibly caused by decarbonization in the diffusor).	Remove ejector, clean PVC inlet nozzle and outlet borehole using hypochloric acid and rinse well in water. If possible, apply higher concentration of chlorine (1...2g/m^3) in the solution to obtain more HCL. Set motive pressure before ejector as low as possible but make sure that the maximum chlorine still be metered.
	Block solution injection fitting.	Remove and clean solution injection fitting and check if the valve is fully open.
	Excessive back pressure caused by bent or blocked solution line. Excessive pressure losses due to friction in pipes or fittings.	Lay line with sufficiently large bends: PVC lines may have restricted cross-sections due to wrong gluing. Check joints.
	Float stuck in flow meter glass.	Clean flow meter as described under Maintenance.
	Components under vacuum prime external air.	Check the joints of the suction line, the ejector non-return valve and the flow meter glass holder.
Metered volume does not increase when adjusting screw is opened.	Inlet valve blocked.	Remove inlet valve as described under Maintenance.
	Vacuum primed by the ejector is too low.	See above.
	Float stuck in the flow meter glass.	Clean the flow meter glass as described under Maintenance.
Chlorine odor in the room.	Gas lines leak.	Close barrel connecting valve immediately and drain off lines using the ejector. Leakage test as described under Startup.
	Safety valve integrated in device blows off. Inlet valve is dirty or damaged.	Remove and clean inlet valve as described under Maintenance. Replace damaged parts.
Vent line primes constantly air.	Diaphragm suspension leaking or diaphragm torn.	Dismantle device and check all parts. Reassemble very carefully.
Water in the device.	Ejector non-return valve defective.	Remove and dismantle non-return valve. Clean it and replace defective parts. Install motor ball cock (see flow diagram, item 12).
	End of vent line not protected against entry of water.	Lay vent line correctly. Line end must show down.
Re-liquefied chlorine indicated by yellow liquid in measuring glass and decomposed PVC parts.	Temperature in eqiupment room too low in comparison to chlorine storage room.	Increase temperature in the equipment room. Install heating block or pressure reducing valve. Install drop separator.
Icing.	Chlorine consumption too high.	Connect more chlorine barrels.