flamco

Flexcon M

ENG Installation and operating instructions

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aalberts hydronic flow control

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1. Limitation of liability

All technical information, data, and instructions for executable and executable actions contained in this operating manual correspond to the latest status at the time of printing. They contain our current knowledge and experience to the best of our knowledge.

We reserve the right to make technical changes to the product described in this operating manual as a result of further development. Therefore, no claims can be derived from the technical data, descriptions, and illustrations. Technical illustrations, drawings, and graphics do not necessarily correspond to the actual delivery of the assembly, individual parts, or replacement parts. Drawings and images are not to scale and also contain symbols for the sake of simplicity.

2. Warranty

The relevant information is contained in the General Terms and Conditions (GTC) and is not part of these instructions.

3. Copyright protection

4. General

"**M**" expansion vessels are steel pressure containers with replaceable membranes. The access flange construction in the bottom (up to 800 liters) or in the top and bottom (from 1000 liters) allows the membrane to be replaced.

The membrane ensures that the sealed system water is separated from the cushion (nitrogen or air). The compressibility of this gas cushion allows the absorption of system water, which expands as the temperature rises. The gas can be compressed up to the maximum permissible operating pressure of the vessel. The maximum permissible operating pressure must be protected by a corresponding pressure relief valve, which must be installed in the heating system

4.1. Intended Use

In sealed (closed) water-based heating and cooling systems, volume fluctuations in the operating fluid caused by temperature changes can be compensated for by using separate expansion vessels. Water-based heating systems are subject to DIN EN 12828, BS7074. If the maximum permissible operating temperature of the heating system exceeds 105°C and/or the maximum possible heat output exceeds 1 MW, further regulations and provisions must be observed and agreed with a designated body and the system designer.
Use in similar systems (such as in heat transfer systems in process engineering or for technologically-related heat transport) may require special safety measures. In such cases, the necessary information must be obtained from the system designer and supplementary documentation.

If the maximum temperature in the expansion line exceeds 70°C, the use of an intermediate vessel is required. Intermediate vessels are available from Flamco in sizes ranging from 50 to 2000 liters.

4.2. Terms and conditions

The design, manufacture, and testing of "**M**" pressure expansion vessels are carried out in accordance with the Pressure Equipment Directive 2014/68/EC in accordance with the German "AD2000 data sheets".
The CE mark of the competent notified body is affixed to the type plates of the vessels. This certifies that the vessels have undergone a conformity assessment procedure in accordance with Article 10 of Directive 2014/68/EC of the European Parliament and of the Council on the harmonization of the laws of Member States relating to pressure equipment.

EC Member States may not prohibit, restrict, or impede the distribution and commissioning of vessels under the conditions defined by the manufacturer on the grounds of pressure risks.

4.3. Program overview

The following versions are available as standard:

M 400 - 8000 liters	**M 80 - 8000 liters**
maximum permissible operating pressure 6 / 10 bar; maximum permissible operating temperature of the diaphragm 70 °C of the vessel body 120 °C	maximum permissible operating pressure 16 bar; maximum permissible operating temperature of the diaphragm 70 °C of the vessel body 120 °C

5. Product description

1. Steel container
2. Replaceable diaphragm made of butyl rubber in accordance with DIN EN 13831
3. System connection
4. Adapter for flange connection (on customer request)
5. Float vent (on customer request)
6. Inspection opening
7. Nitrogen/compressed air filling valve
8. Type plate
9. Pressure gauge connection with pressure gauge secured by a bracket
10. Plug for condensate drain
11. Feet (with height adjustment from 2800 liters)
12. Expansion water
13. Gas cushion

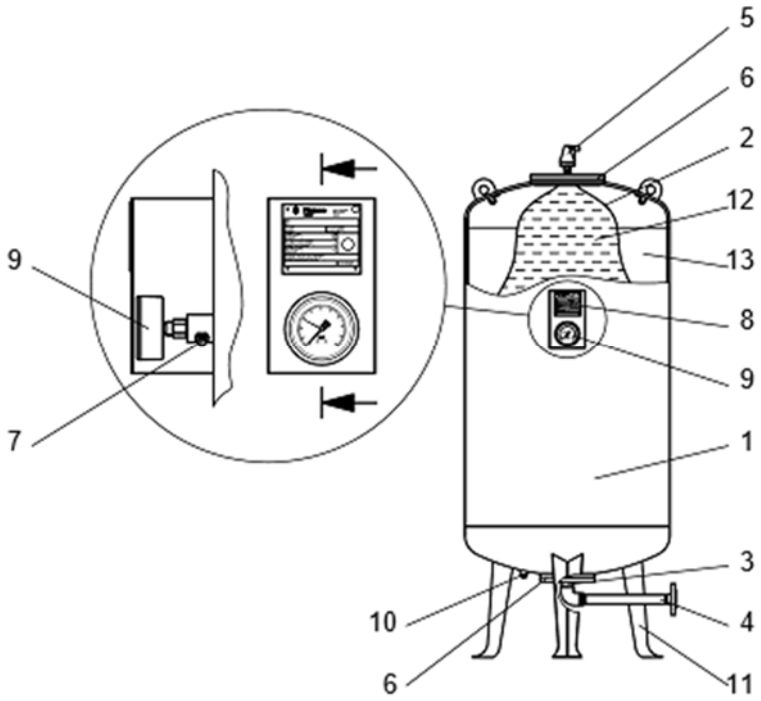

Image 1

Figure 1 shows the "**M**" diaphragm pressure expansion vessel. The membrane (**2**) located in the vessel (**1**) is used to collect and store the expansion water. The flange openings (**6**) are used both to replace the membrane and as inspection openings. When heated, the water in the system expands and is moves into the membrane via the system connection (**3**) at the bottom. The nitrogen in the vessel is further compressed (see point 1.3) (see section 7 "Commissioning / Operation").

When the system requires water again during cooling, this is transferred from the "**M**" membrane pressure expansion vessel, while at the same time the compressed gas cushion returns to its original setting.

When the entire system is functioning properly, the pressure on the water side of the system and on the gas side of the diaphragm pressure vessel is equal.

The "**M**" diaphragm pressure vessel is delivered ready for connection.

The connection to the system is located in the inspection opening in the lower tank base.

Tank size	System connection	
	Pipe thread DIN 299	Flange PN 16 / DIN 1092-1
80 l to 800 l 1000 l to 1600 l 2000 l 2800 l to 5200 l 6700 l and 8000 l	Rp 1 ¼" / DN 32 Rp 1 ½" / DN 40 Rp 2" / DN 50 Rp 2 ½" / DN 65 -	- - - - DN 100

Options for diaphragm pressure expansion vessels
On customer request, an adapter with flange connection PN 16 according to EN 1092-1 is available for tank sizes 400 l to 5200 l.
Furthermore, the "**M**" diaphragm pressure expansion vessel can be equipped with a "diaphragm rupture indicator" to detect possible diaphragm damage.

A diaphragm rupture indicator and the diaphragm rupture probe cannot be retrofitted to existing supplied vessels. It is necessary to order the diaphragm rupture indicator at the same time as ordering an M vessel.

Diaphragm rupture detector (MBM), electrical connection
If ordered, the vessel contains the electrical equipment for the conductive sensor. This device must be electrically connected to a wall or coupling socket provided by the customer via the existing plug connection cable. (Use of plug systems type E / CEE 7/5 and type F / CEE 7/4; 16A / 250 V)
This plug and socket combination (mains disconnection device) must comply with the requirements at the installation site (operating room, ambient conditions) and the applicable regulations. Install protective potential equalization and a residual current device (RCD).

Note: The plug connection cable has a protective conductor that is insulated from conductive and non-active parts in the existing device (PE open).

Extended signal evaluation

The device contains additional interfaces for installing remote signaling. Observe the illustrations and technical data in Figure ...W Z.... The necessary

Must be carried out by a qualified electrician. The signal cables must be dimensioned and installed in accordance with the requirements at the installation site (operating room, ambient conditions) and the applicable regulations.

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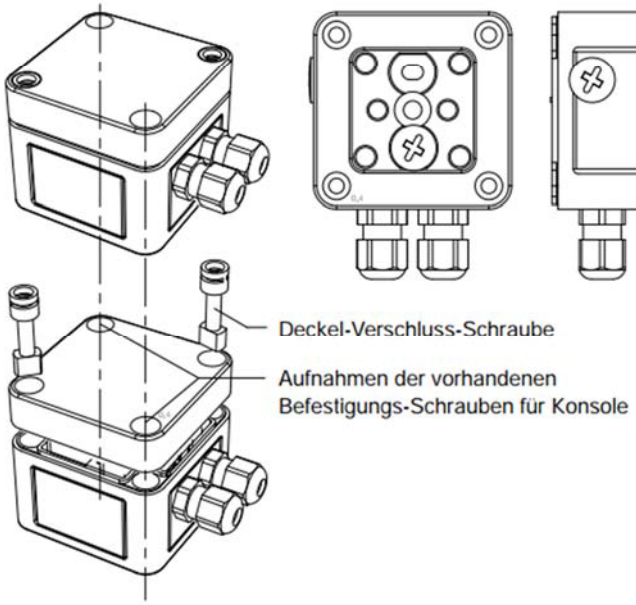

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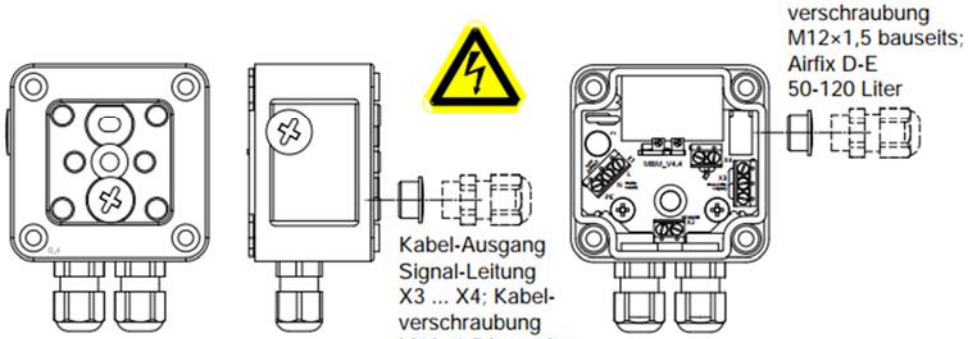

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Steuerung
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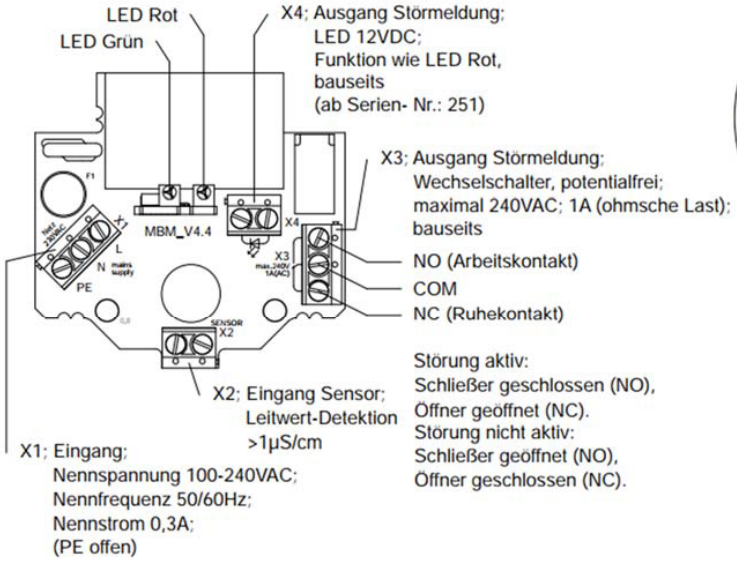

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Kennzeichnung
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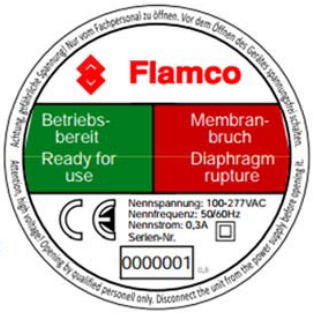
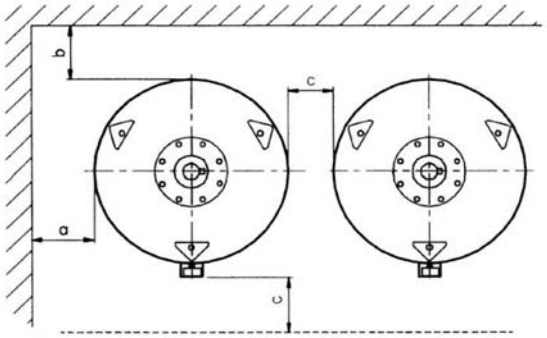


6. Installation and assembly

The "**M**" diaphragm pressure expansion vessels are supplied fully assembled on disposable pallets or in transport crates.
The "**M**" diaphragm pressure expansion vessels must be installed in closed, frost-free rooms (ambient temperature 3 - 50 °C), and protected from adverse environmental conditions in such a way that they can be easily maintained, checked, and operated at all times.
The following sketches and table contain the necessary minimum clearances:



Tank size (l)	a (mm)	b (mm)	c (mm)
<1600	500	650	800
>1600	500	1000	800

Above the upper inspection opening, there must be a free space of:

- min. 650 mm for container sizes < 1600 l
- min. 1000 mm for container sizes > 1600 l

the system connection must be made as a connection to the heating system.

The design of the system connections is shown in section 5 "**Product description**.".

The connection is made from the return pipework of the system's heat generator, whereby a direct connection to the heat generator must be uninterrupted.

The following must also be observed for the system connection:

- For maintenance and repair work "**M**" diaphragm pressure expansion vessels must be isolated from the sealed system. These shut-off devices must be secured against accidental closure (e.g., Lockshield valve with wire and seal, lockable in the open position).
- A drain device must be provided between the shut-off device and the expansion vessel.
- Welding work must be carried out in such a way that no weld metal can get onto or into the expansion vessel.
- The operating temperature must not exceed 70°C at the system connection. (Complete insulation of the expansion pipe increases risk of premature membrane failure!)

Residual risks
Residual risks during operation of the "**M**" diaphragm pressure expansion vessels may result from:

- Incorrect installation
- Failure to comply with the operating parameters
- Misuse of the device
- Failure to observe safety requirements

Caution!
There is a risk of burns. Never touch a hot vessel without protective gloves, as the shell temperature may exceed 50 °C.

Installation recommendation for "M" diaphragm pressure expansion vessels
One or more heat sources can be connected to one or more expansion vessels. The planning, installation, and operation of closed heating systems must be carried out in accordance with DIN EN 12828 or BS7074

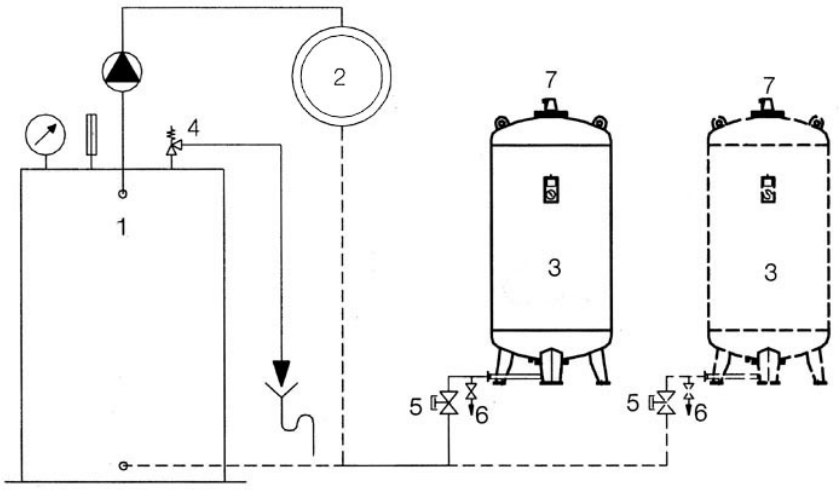


Image 2

Heating system without mixer/valve with variable boiler temperature (e.g., in the low-temperature range).

1. Thermal source
2. Thermal circuit
3. "M" diaphragm pressure expansion vessel
4. System safety relief valve
5. Lockshield valve (with wire and seal)
6. Drain valve
7. Air Vent valve

7. Commissioning / Operation

Safe operation of "**M**" diaphragm pressure expansion vessels in existing thermal systems can only be ensured with protective equipment against excessive flow temperatures and system pressures. The main features are:

- Each thermal source must have a suitable temperature control system to adjust the output to the actual thermal demand.
- Each indirect thermal source must have its own temperature monitoring device with a built-in sensor.
- Each direct thermal source must have its own suitable overrun protection switch with integrated temperature sensor.

The thermal source(s) used must be protected against excessive operating pressures by separate and dedicated safety devices. These safety valves must be located at:

- easily accessible locations,
- at the highest point of the thermal source and/or
- in the immediate vicinity of the supply (flow) line.

Each heat generator with a rated heat output of more than 300 kW must be equipped with a maximum pressure limiter. This pressure limiter must be set so that it responds before the safety valve. Every closed heating system must be equipped with a water level limiter (water shortage safety device) or a corresponding device (e.g., minimum pressure limiter or flow limiter) which switches off the heat generator to protect the system from an excessive temperature rise. "**M**" diaphragm pressure expansion vessels must be operated in accordance with national regulations for protection against damage caused by pressure and temperature.

Both heat generation systems and cooling systems may only be installed by authorized, trained and competent personnel. The entire thermal system must be checked before initial first commissioning. The correct condition of the thermal source, sealed system, and safety devices must be ensured and verified, as well as demonstrating compliance with the requirements of national legislation.
These inspections must be carried out by authorized personnel in accordance with the applicable national regulations of the respective country of operation.
The installer and/or system owner is/are responsible for the correct setup and commissioning of the system.

7.1. Commissioning

1.	Do not fill the "**M**" diaphragm pressure expansion vessel with water or disconnect the container from the mains (Lockshield valve closed!) before commissioning
2.	The gas pre-pressure is set at the factory according to the purchase order specifications. Without pre-pressure specification, the gas pre-pressure in the standard state is: - 6 bar version = max. 4 bar - 10 bar version = max. 6 bar **Attention!** Excessive or insufficient gas pre-pressure impairs the Operation of the «M» diaphragm pressure expansion vessel.
3.	After checking (and adjusting if necessary) the gas pre-pressure with the Lockshield closed and drain valve open, fill and vent the sealed system.
4.	Fill the "**M**" diaphragm pressure expansion vessel with the required amount of water via the filling and draining valve in the expansion pipe.

4.1 Filling the diaphragm pressure expansion vessel when the system is cold
The water reserve ($_{VV}$) to be added to compensate for leakage losses must be at least 0.5% according to DIN EN 12828

at least 0.5% of the water content of the system (VA) or **3.0 liters** as detailed in DIN EN 12828.
A water supply (VV) of **0.5% to 1.0%** of the water content of the system
($_{VA}$)

$$V_V\ [Liter] = \frac{5 * V_A\ [Liter]}{1000}$$

This results in a minimum water level ($_{VV}$ min) of:

$$V_{V\,max}\ [Liter] = \frac{V_A\ [Liter]}{1000}$$

This results in a maximum water level ($_{VV}$ max) of:

$$p_F\ [bar] \geq \frac{(p_0\ [bar] + 1\ [bar]) * V_{MAG}\ [Liter]}{V_{MAG}\ [Liter] - V_V\ [Liter]} - 1\ [bar]$$

The required filling pressure ($_{pF}$) is calculated from the initial pressure ($_{p0}$), the tank size ($_{VMAG}$) and the water level ($_{VV}$) as follows:

4.2 Filling the diaphragm pressure expansion vessel when the system is heated

The water head ($_{VV}$) to be introduced is increased by an additional amount ($V_{TÜ}$) depending on the overshoot temperature ($T_Ü$).
The additional water supply (VTÜ) is calculated from the water content of the system (V_A) and a coefficient ($\alpha_{TÜ}$) that depends on the overshoot temperature ($T_Ü$)

$$V_{TÜ}\ [Liter] = \frac{\alpha_{TÜ} * V_A\ [Liter]}{1000}$$

and ensures that sufficient service water can be returned to the system when the system cools down to the permissible minimum temperature. The coefficient $\alpha_{TÜ}$ can be found in the following table:

Overtemperature $T_Ü$ during commissioning in °C	**Coefficient $\alpha_{TÜ}$**
30	6,6
40	9,3
50	12,9
60	17,1
70	22,2

This results in the minimum total water supply ($_{VV}$ min +$_{VTÜ}$) of:

$$(V_{V\,min} + V_{TÜ})\ [Liter] = \frac{(5 + \alpha_{TÜ}) * V_A\ [Liter]}{1000}$$

This results in the maximum total water supply ($_{VV}$ max +$_{VTÜ}$) of:

$$(V_{V\,max} + V_{TÜ})\ [Liter] = \frac{(10 + \alpha_{TÜ}) * V_A\ [Liter]}{1000}$$

The required filling pressure ($_{pF}$) is calculated from the inlet pressure ($_{p0}$), the tank size ($_{VMAG}$) and the total water level ($_{VV}$ +$_{VTÜ}$) as follows:

$$p_F\ [bar] \geq \frac{(p_0\ [bar] + 1\ [bar]) * V_{MAG}\ [Liter]}{V_{MAG}\ [Liter] - (V_V + V_{TÜ})\ [Liter]} - 1\ [bar$$

5. 5. Open the Lockshield to the system.

6.	vent the "**M**" diaphragm pressure expansion vessel (MAG) via the vessel vent. (not applicable if a "Flexvent Super" float vent is installed).

Set the gas pre-pressure to > 6 bar!

Instruction
All pressure specifications in these instructions are relative pressures.

The maximum permissible gas pre-pressure in the delivery state is 6 bar.
This pressure must be set to the required value according to the system requirements 6 bar before filling with water.
If a value > 6 bar is required, please follow the instructions below.

If it is necessary to commission an expansion vessel with a gas charge pressure greater than 6 bar, the pressure must be increased using nitrogen, and only when there is a counter (water) pressure on the wetted side of the diaphragm.
When increasing up the gas charge pressure to a value above 6 bar the difference between the water and gas pressures should be a maximum of 3 bar.

So to raise the gas charge to 10 bar, for example, the procedure is as follows:

1. Install the vessel in its intended final location, but with no water pressure on the 'wetted' side of the diaphragm
2. Increase the gas charge to 6 bar
3. Introduce water to the 'wetted' side of the vessel, gradually increasing the water pressure to 9 bar
4. Increase the gas charge to 10 bar
5. Increase the water pressure, gradually to 10 bar

So to raise the gas charge to 22 bar, for example, the procedure is as follows:

1. Install the vessel in its intended final location, but with no water pressure on the 'wetted' side of the diaphragm
2. Increase the gas charge to 6 bar
3. Introduce water to the 'wetted' side of the vessel, gradually increasing the water pressure to 9 bar
4. Increase the gas charge to 12 bar
5. Increase the water pressure, gradually to 15 bar
6. Increase the gas charge to 18 bar
7. Increase the water pressure, gradually to 21 bar
8. Increase the gas charge to 22 bar
9. Increase the water pressure, gradually to 22 bar

8. Maintenance / Recurring inspection

To comply with the European Pressure Equipment Directive (2014/68/EC), annual maintenance and inspection of diaphragm pressure expansion vessels (MAG) is mandatory. In addition to the external condition of the vessel and the functionality of the equipment parts, the gas pre-pressure of the MAG must be checked. The gas cushion can only be checked when the water side of the vessel is depressurized. Once the water has been drained, check the gas pressure and refill if necessary. As long as no water pressure builds up in the container, the pressure gauge will indicate the current gas pre- pressure.

If the gas pressure is > 6 bar, depressurize the container (release gas) until the gas pressure is < 6 bar after the water has been drained. After further checks and/or repair work, set the required gas pre-pressure as described in section 7 "Commissioning / Operation" - Setting the gas pre-pressure > 6 bar!

Attention!
Only the following may be used to refill the gas cushion:

- Dried compressed air (class 4 – pressure dew point 3 °C

or

- Dried compressed air (class 4 – pressure dew point 3 °C / 10 bar) must be used!

8.1. Venting

During operation, air can collect in the water-side space of the membrane. MAG has the following "venting options" to allow this air to escape:

80 liters / 16 bar	Under a plastic cap, there is a VG-8 valve. Pressing in the pin allows the air to escape.
400 to 8000 liters/ 6-10-16 bar	Under a plastic cap, there is a VG-8 valve. Pressing in the pin allows the air to escape.

8.2. Installation of an automatic air valve

MA vessels of type "**M**" with a nominal capacity of 400 liters or more can be equipped with Automatic Air Float valve.

1. To do this, the vessel is disconnected from the system. Both the compressed gas and the service water in the diaphragm are drained.
2. The VG-8 valve is removed.
3. The float valve is attached to the head of the diaphragm holder using a ½" male thread x ⅜" female thread reducing nipple.

Instruction
The use of an anaerobic adhesive and sealant is recommended to seal the screw connection. The factory uses the product from WEICON.

Universal pipe and thread seal AN 305-77

- highly viscous
- medium strength
- can be dismantled normally
- Temperature resistance -60°C to +150°C

8.3. Maintenance and inspection intervals

For recurring inspections in accordance with Operational Safety Regulation, the following intervals are recommended:

External inspection	yearly	(maintenance; correction of gas pre-charge pressure; leak test on container connection; functional test; check external condition / corrosion, deformations, damage, etc.)
Internal inspection	5 years	(inspection of internal vessel walls /visible corrosion, deformation, damage, etc.)
Water pressure test	10 years	(Water pressure test of the container with permissible test overpressure)

The inspection is carried out by trained and competent engineers, and fully documented for the system owner.
All local and national regulations must be observed.

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Aalbert's hydronic flow control

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