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## **Magnetic diaphragm metering pumps gamma/ X and XL Exact dosing quantities even with outgassing media**

*Disruptions in the production process not only lead to delays, but also cause costs through a reduction in quality and rejects. Media that are not dosed or that are dosed in the wrong quantity have a decisive influence on the quality of the end product. When dosing liquids, gas bubbles in particular have a negative impact on the conveying process or even block it completely. Conventional ways of avoiding this often lead to metering inaccuracies. The analysis of different solution approaches ultimately leads to technological advances in metering pumps as well. The article shows how gas inclusions in the dosing head can be detected with automatic, intelligent functions. This enables new solutions that sustain optimized filling; even at back pressure up to 10 bar.*

During the dosing process, gas bubbles can occur in the suction line or in the dosing head. This is the case when dosing outgassing media such as sodium hypochlorite, especially when very small quantities are dosed. Longer dosing breaks, such as over a weekend, or changing the liquid container while the process is running can also lead to air bubbles in the suction line, e.g. by briefly removing the suction hose from the medium.

If there is too much gas in the dosing head of a diaphragm pump, the dosing process can be disrupted. This means that less liquid is dosed due to the proportion of gas in the dosing head. In the worst case, and most frequently, the pump can “air lock” and does not meter at all. If the ratio of gas to liquid in the dosing chamber is too high, the gas is compressed during the pressure stroke and the pressure increase is no longer sufficient to open the pressure valve against the system pressure and no more liquid is dosed. In order to avoid this so-called “air lock”, the gas must be detected in good time so that

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the necessary measures can be initiated; ideally, it should be ensured that the dosage is not only uninterrupted, but also with the exact amount required.

### **Intelligent air bubble detection**

Reliable air bubble detection is a prerequisite for intelligent, automatic ventilation. The solenoid driven diaphragm metering pumps gamma/ X and XL use all the advantages of their patented, regulated solenoid drive. The power consumption of the solenoid coil (pressure information), and the position of the diaphragm, allow direct conclusions to be drawn about the dosing behavior at any time during the pressure and suction strokes. By comparing target values with the measured values, problems such as cavitation (with higher viscous media), over-pressure or under-pressure in the system line, or even gas bubbles can be precisely identified and selectively monitored. In this way, for example, gas bubbles can be detected and selectively monitored due to a slow pressure rise (as the gas is compressed).

### **Solutions for outgassing media**

In practice, various solutions are used to eliminate the negative influence on the process caused by gas inclusions. All with the aim that the pump carries out the dosing process independently, without the intervention of the operating personnel, even with high back pressure in the pressure line; if possible without interruption and the required dosage. To do this, the compressibility of the liquid-air mixture must be restored, i.e. the gas must be removed from the process or the dosing head; the working space is partially or completely filled until the compressibility to counter pressure is reached. Active systems ensure that the gases are conveyed through or removed via a bypass. For example, electromagnetically controlled valves which, triggered by a control signal, open a bypass to an alternative container. As soon as the trapped or emerging gases are pumped out of the work area, dosing can

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continue without any problems; the disadvantage of this solution is that additional components such as sensors, actuators and solenoid valves are required. This not only means a higher number of sources of interference and higher costs, but also dosing inaccuracies. Even with other solutions, such as time-controlled venting or continuous bypass, the required dosing accuracy is not guaranteed.

### **Dosing precisely despite air detection**

Due to the fact that trapped air bubbles reduce the liquid volume and conventional pumps therefor dose less, the gamma/ X and XL detects the trapped air bubbles and compensates them for a short time by increasing the strokes per minute. This ensures that the dosing accuracy is maintained within seconds, even with outgassing media.

### **Intelligent compensation = dosing accuracy**

For outgassing media, the Heidelberg based manufacturer uses the model-based control behavior of its solenoid diaphragm metering pump and also a special pressure valve. The highlight of this simple and effective solution: an inconspicuous groove in the valve seat. The groove, which is precisely defined in terms of its dimensions, allows the pressure in the dosing head to be adjusted through low backflow. Air bubbles are therefore already pre-compressed by the system pressure before the actual pressure stroke and released into the metering line during the pressure stroke.

The main advantage of this dosing head venting is that the required amount will be exactly dosed during pressure compensation. The intelligent control ensures this by adapting the number of strokes and the duration of compensation to the number and size of the gas inclusions currently occurring. For example, through several gas bubbles that occur one behind the other in the suction line.

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### **Trouble-free and very precise dosing**

Compared to conventional and state of the art technologies, the solution from the Heidelberg manufacturer ProMinent offers several advantages. On the one hand, the dosing head can be vented in the event of gas inclusions in the dosing head, even at back pressures of up to 10 bar; the suction behavior of the pump also remains almost unchanged. On the other hand, depending on the self-bleeding variant, the dosing rate of the pump remains unchanged too.

In any case, users benefit from a trouble-free and very precise dosing process; failures or dosing errors are reliably prevented as soon as air bubbles form in the suction line or in the working area of the dosing head. Compared to conventional solutions, the required dosing quantity and accuracy is always sustained.



Solenoid diaphragm metering pump gamma/ X and XL ensure precise metering quantities even with outgassing media (Image source: ProMinent GmbH)

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Solenoid diaphragm pump gamma/ X and XL detect air bubbles and react to them with an adapted delivery rate (image source: ProMinent GmbH)