

# BELLOWS PUMPS AS THE FOUNDATION FOR PROCESS AND EMISSIONS ANALYSIS SENDING SAMPLE GAS WELL ON ITS WAY

Reliable gas analysis with fast response times often requires a sample gas pump. Among the designs available on the market, the bellows pump principle is particularly durable and low maintenance. Criteria for choosing a model focuses heavily on whether it is an Ex or non-Ex application and the desired flow rate. Special versions with an integrated stainless steel bypass valve will also ensure an easier tube installation.

There are gas analysis applications which do not require a sample gas pump – namely if the overpressure in the process is sufficiently high and the analyser can be installed very close to the process. In other cases a sample gas pump is required as part of the analysis system to ensure an accurate measurement, particularly when fast response times are required. It is easy to overlook the importance of overpressure: with no overpressure there is no gas flowing to the analyser. Typically a sample gas delivery of about 60 L/h will suffice. Many overpressure applications still need a pump to deliver the sample gas from the sampling site to the analysis cabinet at a sufficient speed. Lines over 50 m long are not all that uncommon, so the gas to be analysed may take a significantly longer time to reach the analyser unless it is delivered by a pump at a sufficient flow rate.

## Minimal Response Times

In many applications with inadequate process pressure, sample gas pumps with 400 NI/h flow rates ensure the response time remains low and the process is therefore well controlled. Process gas analysis specialist Bühler Technologies offers a series of small, particularly cost-effective pumps, with 280 NI/h flow rate – and larger sizes with 700 and 800 NI/h flow rates. One model is even suitable for conveying 2 streams at a rate of 800 NI/h for applications with two separate gas paths or those requiring particularly high flow rates of about 1500 NI/h. The high flow rates enable fast response times even when using long lines, such as those required for safety-related process or emission measurements.

The second important criterion in choosing a pump is the application. If the pump is to be installed in a safe area and furthermore used to pump non-explosive gas, the choice of model is vast. There are far more restrictions when it comes to choosing pumps to be used in explosive areas. However, the options of suitable pump models with the relevant approvals are still vast. Bühler Technologies offer their own special pumps; the C-versions in several model ranges, are also suitable for transporting



1: Pumps with PTFE bellows also safely transport sample gas with condensate to the analyser if the process pressure is insufficient or the response time needs to be reduced.

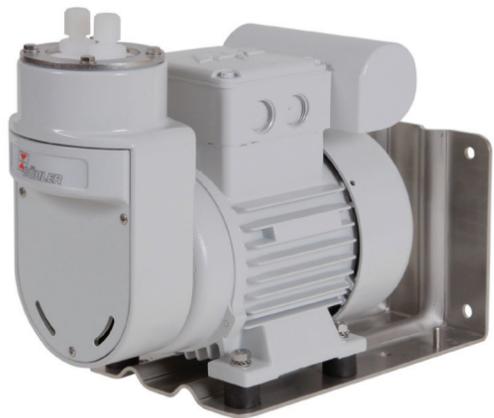
flammable gases, but must not be installed in Ex areas. In this case there is a cost saving potential for some users who can install the pump in the safe area.

## Condensate: The Enemy of Membranes

Sampling pumps are all created to serve the same function, however pumps using the bellows principle offer clear advantages over diaphragm pumps in certain areas of an industrial plant. Bühler Technologies' Product Manager Julian Kleineberg explains the reason for this: "Bellows technology has the advantage of eliminating sealants such as adhesives, etc. This improves the pump's chemical resistance considerably. Even if small amounts of

condensate accumulates in the pump, it will work properly."

With diaphragm pumps there is always a chance that condensate may dissolve the adhesive, which will then require service. The single piece PTFE bellows on the other hand is connected to the pump head, surface to surface, without the need for additional sealant. If condensate is to be expected, the pump can be delivered with a turned head. The durable design also allows customers to turn the pump head themselves in just a few steps if the analysis operation shows this is necessary. The gas connections are made face down so condensate can easily be discharged, aided by gravity.



2: The P2.3 sample gas pump with 400 NI/h flow rate has proven itself tens of thousands of times. Just as many other Buehler pumps, it's optionally available with PTFE or stainless steel bypass valve.

### PTFE or Stainless Steel Bypass Valve

Many of Buehler's pump models can be equipped with an integrated bypass valve so, when designing the analysis point, the external bypass can then be ignored. These bypass valves were available in PTFE, an ideal choice to prevent corrosion from aggressive gases. Buehler also offer models with a stainless steel bypass valve for pumps with 400 NI/h and 800 NI/h flow rates, for applications with low-corrosion gases. "This allows customers to use the tubing we would not recommend for a PTFE bypass", Kleineberg explains. Experience has shown the soft PTFE tubing will leak over time and after tightening the stainless steel connections several times. The pump body with stainless steel bypass valve eliminates this.

Buehler sample gas pumps are extremely durable and robust. Kleineberg states: "Our pumps are often used for ten, some even for 15 years and longer." Of course they require proper maintenance, but in the case of bellows pumps, this is essentially limited to the bellow and pump valves. These need to be inspected routinely and replaced as and when necessary. For ATEX rated pumps the maintenance schedule, with the specified



3: On version with separate drive, as the P2.4 ATEX here, the pump head can be installed inside the heated analysis cabinet with the motor remaining outside the cabinet.

intervals, is mandatory. To ensure safe use, the maintenance intervals vary greatly based on the respective process and ambient conditions, as well as the gas composition. The bellows, for example, should typically be checked after about 4,000 operating hours or every six months. Wear items on all pumps can be replaced by the end user in just a few steps. The bellow, inlet and outlet valves and the O-ring on a bypass valve, if needed, are quick and easy to replace. If necessary, the eccentric cam follower with ball bearing - the so-called crankshaft, are replaced as a complete assembly. This facilitates years of pump operation; only versions with Ex-approval require a manufacturer inspection after a few years based on the maintenance schedule.

Julian Kleineberg, Product Manager at Buehler Technologies Bellows technology has the advantage of eliminating sealants. This improves the pump's chemical resistance.



4: The largest model, the P4.83 sample gas pump, is intended for applications requiring a very high flow rate – or if two separate gas paths with 800 NI/h are desired.

### PRODUCT OVERVIEW

Online product finder

The product finder on the Buehler website (<http://www.buehler-technologies.com/en/gas-analysis/sample-gas-pumps/>) provides an overview of the sample gas pumps offered with ATEX Zone 1 and Zone 2 approval and for the North-American market with Class 1 Division 2 approval. Noteworthy is the latest addition to the product range is the P1.3 sample gas pump with FM-, ATEX-, IECEx- and Cl.1, Div.2 approval, suitable for 280 NI/h flow rates. This means these small versions can also be used for Zone 2 applications.

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