Gas mixers – benefits, technologies, applications

Basics of mixing gases

Mixed gases are used in numerous industrial applications. Many standard mixed gases are already available premixed. Often, however, it is better to mix the required gases on site. Especially when having high consumption, unusual mixtures or frequent changes in the gas mixture. For this gas mixers are used.

Gas mixers have been in use for decades and have proven themselves in countless applications. The technology is mature and reliable. Depending on the requirements, various technologies and device classes are available, from mechanical mixing valves to mass flow controllers, from small mobile gas mixers to complex large-scale gas mixing systems.

This white paper summarizes the benefits of gas mixers, gives an overview of the different gas mixing technologies and describes some of the most common applications for gas mixers.

Key benefits of choosing gas mixers

Quality / Homogeneity

Gas mixers offer the highest mixture quality. The user always receives absolutely homogeneous mixtures. This uniformity provides optimum process reliability.

Flexibility

Gas mixers offer the highest possible flexibility for required mixing ratios, gas volumes and application location. Operating a system with variable gas compositions is not a problem with gas mixers. The gas mixture settings can be changed at any time to gain just the right gas mixture in a matter of seconds. Even mobile use is possible with the right gas mixers.

Profitability

Generating gas mixtures by yourself means to benefit from lower purchase prices for standard products. Especially with frequent mixture change eliminates the time-consuming storage for the numerous required mixtures. The handling of gas cylinders is also a thing of the past with the use of gas mixers.

Gas mixing technologies - how do gas mixers work?

There are essentially four types of gas mixers:

1. Gas mixers with mechanical mixing valve

Mechanical gas mixers with mixing valves form the cornerstone of gas mixing technology, having proven their merit in countless installations over many decades. Mixtures can be produced reliably from almost all gases using this process – precisely and with longterm stability. A proportional mixing valve is generally used for 2-gas mixtures. The valve has 2 gas inlets and an outlet for the mixing gas. The flow rates

of the individual gases are regulated proportionally in an interaction of orifices and pistons by turning the valve to create the required gas mixture. If mixtures comprising 3 or more gases are required, individual mixing valves are used instead of proportional valves. The flow rate of the individual gases is

determined separately with a mechanical mixing valve. The mixture therefore comprises separately dosed individual gases. A uniform inlet pressure of the individual gases is crucial for the perfect functioning of the gas mixers. To prevent pressure fluctuations, high class gas mixers have a uniform pressure regulation. Gas mixers with mechanical mixing valve are suitable for continuous extraction or also discontinuous extraction (with a gas tank), depending on the application. They are extremely sturdy and require only a low level of maintenance. The systems can optionally be extended, e.g. with gas analysis modules or an inlet pressure monitor with alarm functions.

2. Gas mixers with electrical mixing valve

Gas mixers with electrical mixing valves are suitable for practically all popular gases and a large number of applications. Proportional or individual mixing valves – depending on whether 2 or more gases are mixed – form the core of this mixing process, similar to the mechanical mixing process. The functioning of the mixing valves is ingeniously simple: a moving piston in conjunction with different orifices controls the flow rate of the gases, thereby producing the desired mixture. The technical genius lies in the high-quality materials and precise production of the individual components, coupled with correct calculation of the relevant piston-orifice combination. In contrast to mixers with mechanical mixing valve, the electrical mixing valves are not operated manually via a rotary knob but instead via small electric motors. The electric motors are operated via an electronic controller. Benefits: First and foremost, the mixers can be regulated more finely electrically than by hand, thus resulting in a more exact gas mixture. The electronic control also allows easy reproducibility of gas mixtures. With remote operation, the mixing systems can be integrated in a network, where they can be controlled and monitored conveniently from a central point. And not to be overlooked is the constant pressure regulation by dome-loaded pressure regulators integrated into gas mixers with electrical mixing valves. The gas mixers are suitable for continuous extraction or also discontinuous extraction (using a gas tank), depending on the application.

3. Gas mixer with pneumatic flow rate controller

Besides conventional mixing valves, there is a further, innovative gas mixing process. With this design, the continuous mixing occurs purely pneumatically via a porous body. Depending on the required mixing ratio, a differently sized surface of the sintered body is made available to each individual gas. The process is essentially unaffected by fluctuations in gas pressure and extraction volume. Nor do you need a power supply or pressure vessel for the mixing gas. As a result, users gain a high-quality stable mixing process, while benefiting from a very cost-efficient gas supply. This innovative design provides sturdy, compact and low-maintenance mixing systems for 2 or 3 defined gases. These gas mixers are also scalable in their size with this design, and can be used for a broad range of mixing gas volumes and applications.

4. Gas mixer with flow rate controllers (Mass Flow Controller = MFC)

MFC mixers produce gas mixtures by regulating the mass flow of each individual gas involved. A mass flow controller is used for each gas. The volumetric flow rate of the gases is logged in the relevant mass flow

controller by means of thermal conductivity and then regulated. The volumetric flow rates of the individual gases are then combined into a mixture. The fully electronic control optimises the mass flow rate of the gases, compensates disturbances such as pressure fluctuations or temperature effects and keeps the parameters stable over the entire production period. Numerous additional pressure control devices or temperature measurements are not necessary. The storage and easy reproducibility of product-specific flow rate parameters result in minimum turnaround times when converting products. Precise logging of the flow rates of the individual gases enables an effective quality and cost control. MFC gas mixers can be used in remote operation via digital control units and integrated into broader site control systems seamlessly, via bus interfaces. Exact gas mixing and dosing is ensured by MFC technology. Gas mixers with MFC technology are suitable for mixtures comprising 2 or more gases. Depending on the application, multiple MFCs can be connected quickly and easily to form compact units and combined with all necessary components for operation-ready mixing directions.

Typical applications for gas mixers

Metalworking

In industrial metal processing, whether it be in automotive, rail rolling-stock, ship-building or in the steel industry, the quality of the gas supply is of crucial importance for precise welding, cutting and smelting processes. Gas mixers stand out thanks to their easy operation, continuous mixture settings and high flow rates. Precisely tailored control technology and a uniform pressure control that compensates for pressure fluctuations ensure exact and constant mixing ratios.

Medical applications

Gas mixers for ”synthetic air“, a mixture of pure oxygen and nitrogen, have been in use in numerous medical applications throughout the world for years. As such, they are distinguished by the highest supply reliability, low investment and maintenance costs, simple integration and low energy consumption.

Helium leak test

Leak tests using helium have become established for testing sensitive products that have to be absolutely leak tight. Systems with which this valuable inert gas can be mixed (for example with nitrogen) make the use of helium viable. After testing, the gas mixture used is collected, analysed and, if need be, corrected – all fully automatically.

Food industry

MAP gas mixers ensure constant control of gas quality and safety in your inert gas packaging process (Modified Atmosphere Packaging). Gas mixing and gas metering systems are available for any type of packaging machine in the food industry, no matter whether it’s a vacuum, deep drawing, sealed bag or a hand-chamber packaging machine.

Glass working

State-of-the-art control systems for the exact composition of fuel gas/oxygen mixtures enable the necessary precision and a constant supply to burner systems in glass processing. Exact gas mixing and dosing is ensured by MFC technology (MFC = Mass Flow Controller). The fully electronic control optimises the mass flow rate of the fuel gases, compensates for disturbances such as pressure fluctuations or temperature effects, and maintains the parameters stable over the entire production period, thereby reducing rejection rates.

Diving technology

Gas mixtures comprising oxygen and helium (Heliox) or oxygen, nitrogen and helium (Trimix) are called for in professional diving applications. There are special gas mixers with integrated O2 analysis for submersible boats, filling diving tanks or supplying diving bells. These can be used to produce various mixtures safely and flexibly depending on requirements.

Laser technology

The performance and quality of laser systems for welding and cutting metals is critically influenced by the composition of the gases used. Gas mixers not only guarantee the reliable provision of gases in the required volume and exact mixing ratio, but are also specially optimised for as high a purity as possible.

Individual applications

Besides conventional applications, gas mixing systems are nowadays typically used in forming technology, for odorising gases, in double-glazing manufacture, for the production of airbags or in ripening chambers for bananas.