

WE LEARN FROM YOU EVERY DAY –
AND THINK OUTSIDE THE BOX.

Ultra-precise process heat

Assured exact gas mixture for constant flame and plasma processes

When it comes to dealing with liquids and gases, Bürkert has become a sought-after partner all over the world. Why? Probably because we have been learning for and from our customers for more than 70 years now. This enables us to always think that crucial step ahead and around the bend.

For your added value. Let us prove it to you – we look forward to your challenge.

We make ideas flow.

bürkert
FLUID CONTROL SYSTEMS

Bürkert Fluid Control Systems

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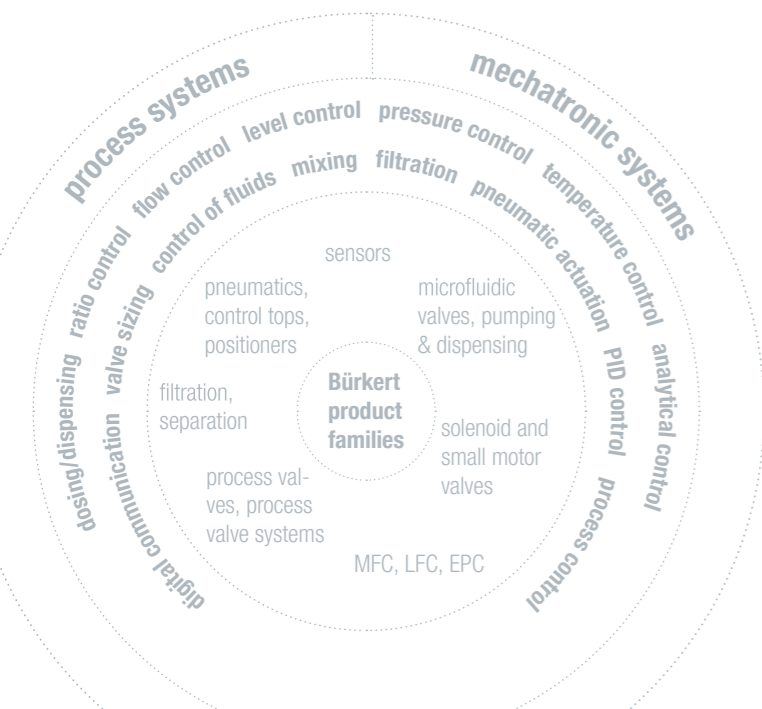
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WE SPEAK YOUR LANGUAGE. FLUENTLY.

We love a good challenge. That is because we are simply fascinated by everything that flows. No matter if our customers require solutions for measurement, control or both – we always find unconventional ways of developing individual solutions.

Whether it is about flow, level, pressure, dosing, analysis, filtration, temperature, mixing or the automation of processes – liquids and gases have to be measured and controlled. These are the fundamental fluidic variations upon which industrial process technology is based, and Bürkert's specialty with its expertise and entire range of solutions and services.

What makes us special? At Bürkert, we start with your fluidic challenge and draw on the basic physical principles. This way we make use of the fluidic relationships and our experience with physics, duplicating them across the most diverse applications and industries and hence solving the same or similar challenges. You in turn benefit from a deep pool of expertise, which we accumulate from multiple industries and apply individually to your needs. For the ideal solution to your specific challenge.



FLUID TECHNOLOGY SOLUTIONS FOR FLAME AND PLASMA PROCESSES

Whether forming, coating, joining or cutting materials: Flames or plasmas provide reliable services wherever needed. From manufacturing intricate glass bodies to cutting thick steel sheets. The machining of glass or metal materials benefits greatly from targeted and controllable heat input, even though the desired coating effects and requirements differ greatly from those when cutting. Bürkert's system solutions, in particular, guarantee precision and economic efficiency for all the said processes.

4 The fascination of forming

Ultra-precise mass flow controllers ensure exact gas mixtures and help to maintain material forming processes of the highest quality at all times.

8 Robust surfaces

Integrated and functional system technology for perfectly coated surfaces that are reliable, economic and durable.

12 A strong bond

Reliably controlled gas quantities and mixtures for the ideal welding of metals.

16 Perfect cutting

Economic and powerful cutting for accurate, repeatable results.

20 Product choice

Valves, mass flow controllers and digital communication technologies for an automated and unique process solution.

22 Systemhaus

Where systems take on form. This is where customer-specific solutions are crafted according to your requirements and ideas.

THE FASCINATION OF FORMING FOCUSSING ON FLAME CONTROL

The production of glass products involves many production steps before the final form is achieved. And each one must be executed precisely. The raw material is initially warmed up to make it formable by numerous small gas burners before being further processed in several steps at glass forming machines. During this process, automated control systems guarantee a precise supply of gas to the burners. This ensures that the permitted heat capacity – and thus quality – never falls below the high level demanded. Moreover, the automated control systems enable defined adjustment of the gas supply. This ultimately leads to a change in flame temperature which facilitates the manufacture of various products.

ADVANTAGES

- Precise gas supply for highly efficient burner systems
- Short cycle times due to exceptional measuring accuracy and fast gas control
- Robust processes due to automatic reactions to process changes, even under pressure and temperature fluctuations
- Consistently high product quality due to independent, reproducible processes and recipes

FORMING SYSTEMS FOR AN ACCURATE BURNER PROCESS

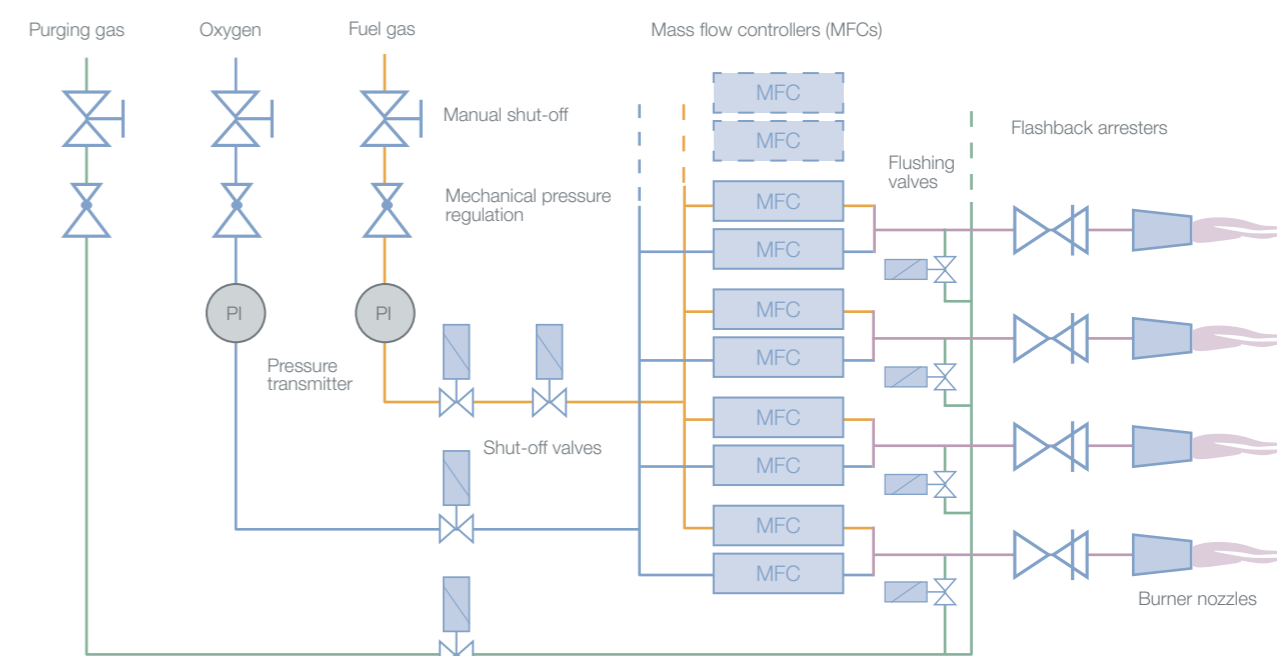
Since glass is formed through the targeted application of heat, the required heat capacity must be controlled precisely for each processing step. Mass flow controllers (MFCs) are used to control the fuel and oxidant gas in a precise and reproducible manner for each flame.

The level of pressure at the input of each gas line is adjusted mechanically to ensure effectiveness. If the gas supply is to be shut off fully, electromagnetic solenoid shut-off valves guarantee safe interruption. If required, the line can be purged with a purging gas (e.g. nitrogen) to ensure no fuel or oxidant gas remains, which would otherwise lead to an undefined status when restarting the system.

During operation, flashback arresters (also known as flame arresters) stop the flames flashing back into the line.

The basic design of the burner systems must guarantee that all the devices and materials in the fuel gas line and in the oxidant gas line are suitable for fuel gases and oxygen respectively.

At machines with lots of burners, it is recommended to use an economical multi-MFC solution, which is characterised by its compact and integrated design.



FORM FOLLOWS FUNCTION

This burner system has been designed and manufactured in response to the requirements of our customer. Adding to its appeal is the compact and modular structure of the MFCs (mass flow controllers). Each burner supply consists of one MFC for fuel gas and one for oxygen as well as one purging valve located on the rear of the system. Furthermore; the system features electromagnetic solenoid safety shut-off

valves and flame arresters at the central gas inlets that stop combustible gases and flames from re-entering the lines. Any number of modular burner supply units can be combined. Further flame arresters at the outlets prevent the transmission of flames to the gas mixed by the MFCs.



Burner system with secure valve technology

ADVANTAGES

- Small footprint due to compact design
- Modular design allows the number of burners to be increased endlessly
- Fast start-up, since pre-tested by Bürkert, and suitable software tools are available
- Saves time, since it can be integrated straight into the existing system



State-of-the-art electrical measuring and regulating technology for industrial glass manufacture.

RELIABLE HIGH GLASS QUALITY DUE TO MFCs AND INTELLIGENT PROCESS CONTROL

Forming the end product is one of the most complex processes of industrial glass manufacturing. The precise control of the gas quantity is crucial to achieve the highest levels of manufacturing quality while reducing the number of rejects.

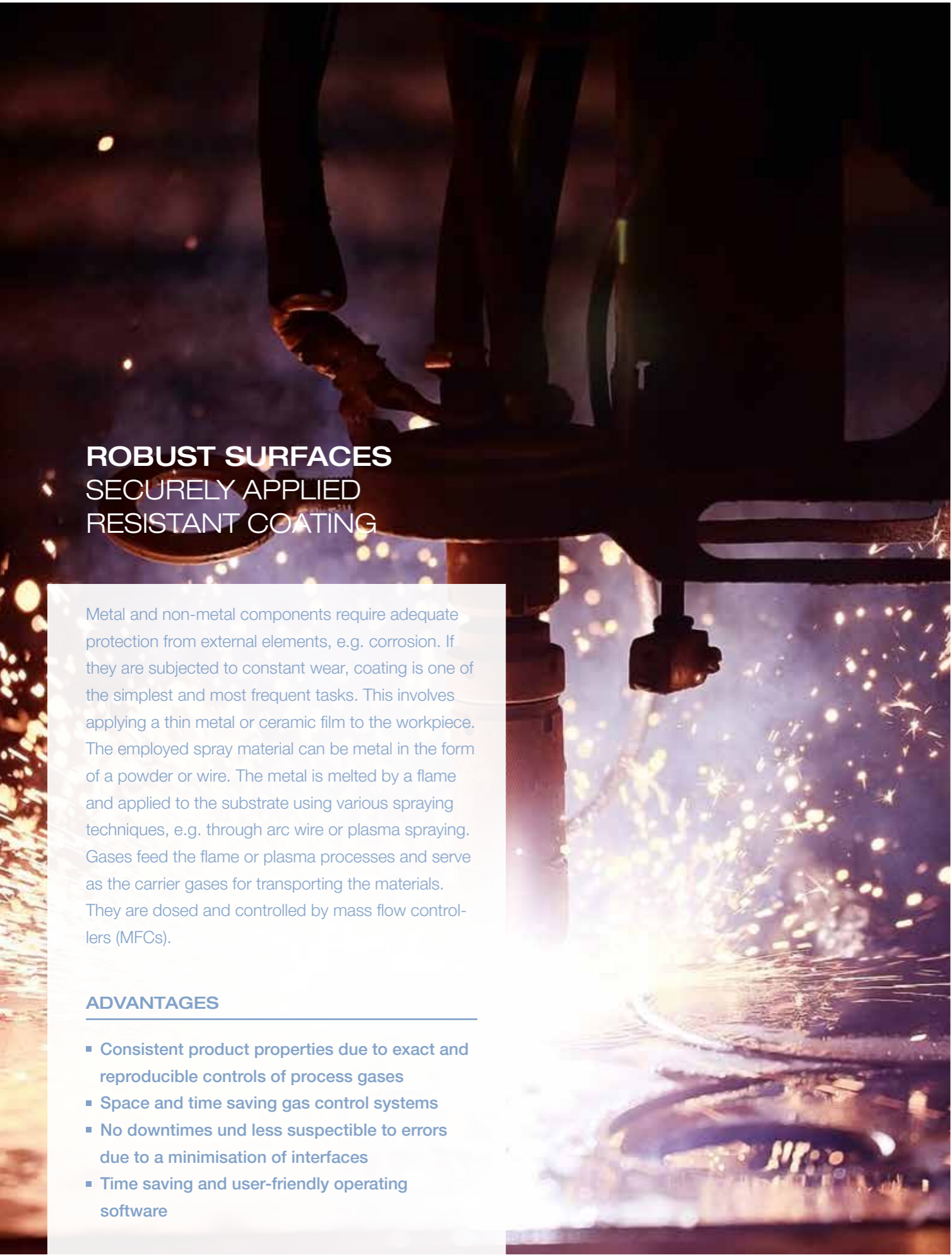
Our customer, a manufacturer of forming machines for producing quality pharmaceutical jars, has until now simply used shut-off valves and needle valves to control the supply of gas. With this technology, changing pressure and temperature conditions may lead to fluctuations in the gas supply and thus to fluctuating product quality which is demonstrated, for example, by varying degrees of wall thickness.

Bürkert solves this problem through a combination of intelligent mass flow controller (MFCs) and the EDIP program, a digital communication technology. The MFCs compensate any interferences while ensuring precise, dynamic flow control.

At each machine, roughly 50 to 100 MFCs with just 2 to 4 pre-configured fieldbus couplers are integrated into the upper control system. The fieldbus couplers can be flexibly adapted to the control (PLC) used by the customer. Optionally, additional pressure sensors and shut-off valves can be integrated into the system via I/O modules. This saves space, enhances precision and enables simple process changes at the push of a button.

AT A GLANCE

Application	Industrial glass manufacturing
Requirement	Reliable and robust gas supply for the gas burners
Solution	Intelligent Bürkert MFCs and digital communication technology EDIP
Added values	Simple start-up due to flexible integration and reliable product quality thanks to precise flow control



ROBUST SURFACES SECURELY APPLIED RESISTANT COATING

Metal and non-metal components require adequate protection from external elements, e.g. corrosion. If they are subjected to constant wear, coating is one of the simplest and most frequent tasks. This involves applying a thin metal or ceramic film to the workpiece. The employed spray material can be metal in the form of a powder or wire. The metal is melted by a flame and applied to the substrate using various spraying techniques, e.g. through arc wire or plasma spraying. Gases feed the flame or plasma processes and serve as the carrier gases for transporting the materials. They are dosed and controlled by mass flow controllers (MFCs).

ADVANTAGES

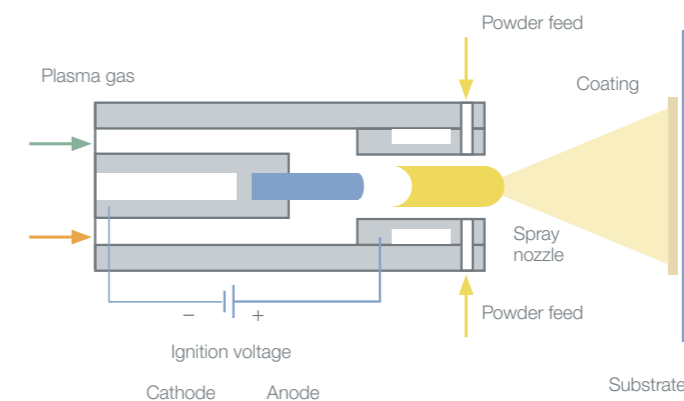
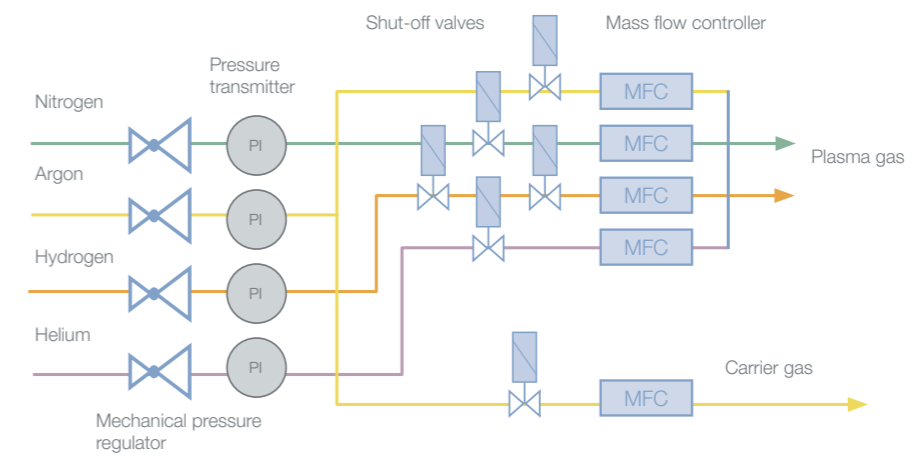
- Consistent product properties due to exact and reproducible controls of process gases
- Space and time saving gas control systems
- No downtimes und less susceptible to errors due to a minimisation of interfaces
- Time saving and user-friendly operating software

COATING APPLIED USING PLASMA OR FLAME SPRAYING

The coating material in the form of a powder is transported by a carrier gas to the nozzle, where it is melted by a flame or plasma jet and sprayed onto the workpiece (substrate) at high speed by high gas pressure. The substrate surface must be roughened in advance to improve adherence of the spray material. A precise and reproducible gas supply is guaranteed by mass flow controllers that control and

regulate the gas mass flows independent on pressure and temperature rates.

Burner and carrier gases are used for flame spraying, whereas plasma, shielding and carrier gases are used for plasma spraying. A plasma gas can be made up of various gases, thus enabling, for instance, control of the plasma beam temperature.



COMPREHENSIVE GAS CONTROL

With thermal spraying application, steady and reliable control of the gases is essential to generate a dense and homogeneous coating of the surfaces. This includes, for example, dosing and mixing of the gases for feeding the flames or controlling plasma processes and the control of carrier gases for powder feeding.

The system has a modular design, meaning both the individual lines and the system as a whole consisting of several lines. The main component, the mass flow controller, is responsible for getting the proper gas flow to the spot. The

gas shut-off valve allows the flow of gases to be interrupted or maintained. The mechanical pressure regulator reduces the gas pressure to a lower value for the subsequent process. The installed pressure gauge monitors this process visually. Digital monitoring through a pressure transmitter is also possible. The shut-off valve and MFC are connected to a central system control unit via a CAN network; optionally, a pressure transmitter can be connected to this CAN network and thus to the central control unit. This control unit can, in turn, be connected to the system control via standard fieldbus or Ethernet protocols.



Mass flow controller (MFC) line

ADVANTAGES

- Reduced installation space due to compact, space-saving design
- No leakages, since there are less fluid interfaces which have also been tested before leaving the factory
- High level of flexibility that allows the application of various gases at several lines
- Quick and simple installation due to easy-to-install devices
- No additional testing required thanks to pre-assembled and tested solutions



Coating system with fully automated gas control

DIGITALLY MONITORED GAS CONTROL SYSTEMS WORLDWIDE

Our customer manufactures thermal spraying systems for use around the globe. Full access to the system components at all times is particularly important for the service offering. To meet these demands, Bürkert delivers a complete digital system solution whose entire measurement and valve technology is coupled by a digital fieldbus. Remote maintenance access to the process data is thus unlimited.

In the past, the company used analogue field devices to control the gas flows; something that required intricate and complicated troubleshooting techniques in the event of a device failing. The customer can now monitor its system and, if necessary, take some preventive steps to try to avoid this problem. The control and monitoring signals are controlled by a system control unit based on Bürkert's EDIP concept (EDIP - Efficient Device Integration Platform), which is connected to the higher-level control system.

We were also able to meet the extensive measurement, flow and repeatability requirements of the customer through the application of Bürkert products. The highly automated solution combined with our system technology offers genuine added value to the company.

AT A GLANCE

Application	Gas controller for coating machines
Requirement	System that can be monitored and maintained from a central location
Solution	Fully automated and controllable gas control system
Added values	The system-based solution saves time and guarantees efficient and troublefree processes.

A STRONG BOND SEAMLESS GAS CONTROL WHEN WELDING

It must be possible to define and reproduce automated welding processes. Perfect shielding gas coverage must be guaranteed when welding high-alloy steels, aluminium, titanium or combination materials. Since the turbulent and unsteady flow pattern can lead to the intermixing of atmospheric gas and the shielding gas. Weld spatter, oxide deposits, burn marks and pores may be the result. If a sufficient quantity of shielding gas is unavailable because the gas flow rate is too low, the gas shield is contaminated through diffusion of the ambient air. To guarantee the required weld quality, optimum supply of gas and exact control of the welding flame are essential.

ADVANTAGES

- High and safe process velocity through precise and dynamic control of gas quantities
- Flawless quality of weld seams due to perfect control of welding flames and shielding gases
- Time saving processes thanks to an easy installation and a system taking over multiple functions

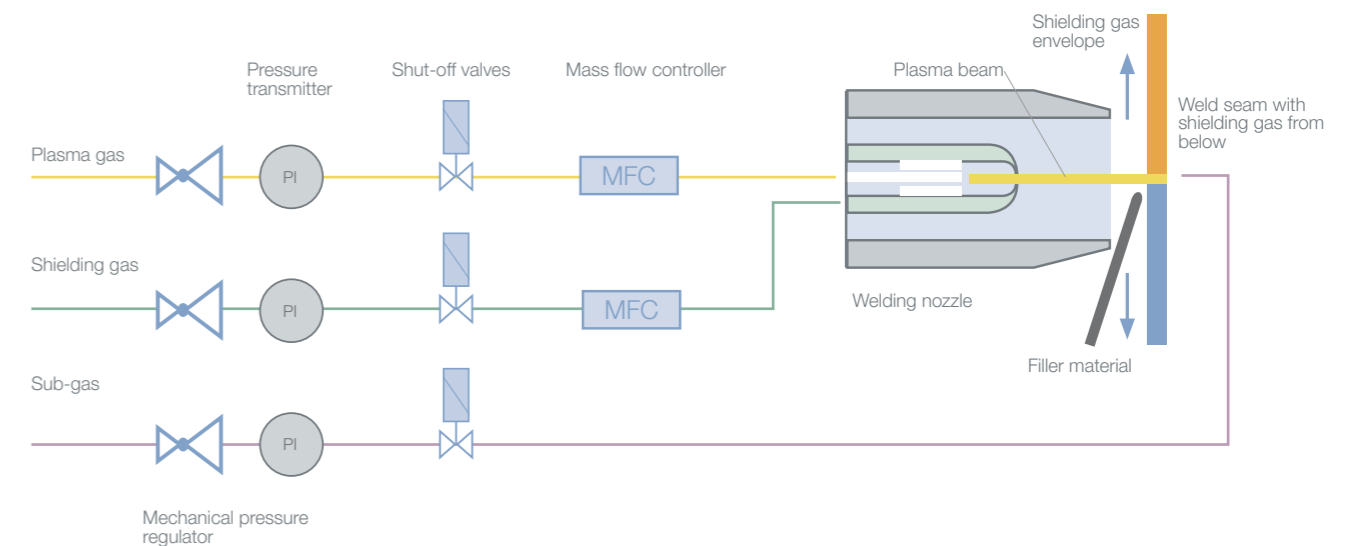
ARC OR PLASMA – THE WELDING PROCESS

MIG welding with metal inert gas and MAG welding with metal active gas are the most widely used welding methods. In both processes, a metal wire is fed through a wire feeding gun and melted by an electric arc. The wire acts as both the consumable electrode and the molten material. A nozzle supplies the shielding gas, which is either inert (MIG) or active (MAG). It protects the arc and the weld seam and brings together the molten material. Inert gas does not react with the molten material. Active gases are used in the process between the arc and the molten material and influence, e.g. the connection and / or the temperature of the weld puddle.

A different welding method, tungsten inert gas welding (TIG), was developed especially for joining magnesium and aluminium. In contrast to MIG and MAG welding, the elec-

trode is not consumed. The electric arc only heats up and melts the weld material, which is fed separately.

In addition to these arc welding methods, another popular process is plasma arc welding, which utilises a plasma arc instead of an electric arc. Once again, the electrodes are not consumed. The electrode and the weld puddle are protected by a shielding gas that flows through a gas nozzle. Further, the shielding gas has an impact on the characteristics of the weld seam. Plasma welding is very similar to TIG but more precise and faster.



PLASMA WELDING MADE SIMPLE

The very high temperature when plasma welding ensures an intensive and highly dynamic weld penetration and thus focussed component stress. This is due not simply to the actual process but also due to the technical implementation, as shown here in an example. The gases need to be controlled precisely and very quickly. Outstanding control technology and top-quality fluid technology are essential in this context. Digital communication between the process control and field devices via EtherCAT ensures excellent signal quality, simple connection, high bus speed and direct access to extensive process information from the field devices besides information about the set-point and actual value of the flow.

The three-channel system controls the requested gas mixtures for the plasma gas and the shielding gas. It utilises fast, direct-acting shut-off and proportional valves as well as dynamic flow sensors which measure directly in the gas according to the thermal measuring principle. The valve technology easily copes with changing levels of gas pressure and the measuring technology records changes to the flow rate in a fast and reliable way, no matter how much the set-point value jumps. This system guarantees the gases required for the process are available in the right quantity, in the right place, at the right time.



Gas control system with Ethernet-capable mass flow controllers

ADVANTAGES

- Integrated system ensures a reduced number of interfaces and compact gas controls
- State-of-the-art Ethernet communication for fast data transfer and access to other useful field devices (e.g. temperatures, total flow rate, operating duration, etc.)
- No additional expense in terms of time due to a durable and safe system
- Simple procurement and handling process



Complex welding system with ARC module for the MIG welding process

SHIELDING GASES UNDER CONTROL: ARC MODULE FOR THE MIG WELDING PROCESS

A leading German carmaker required a compact system for the welding robots at its production lines. In this case, a number of requirements had to be met to achieve a high level of weld quality: ultra-precise dosing of the shielding gas and, if required, a fast change to the amount of gas being dosed, monitoring of the shielding gas supply, a rinsing function for the burner system and a water cooling control feature to ensure ideal temperature control and cooling of the burner.

Bürkert responded to all these challenges successfully and developed the demanded system using the following products: Type 8741 mass flow controller (MFC) for shielding gas dosing, a pressure switch for monitoring the shielding gas supply, type 6011 switching valves for initiating the rinsing function and a temperature transmitter and flow meter for water cooling of the burner. All the components can be programmed via a central control.

AT A GLANCE

Application	Monitoring and controlling shielding gases as well as water cooling control
Requirement	Stable regulation of shielding gases, rinsing processes and the cooling system
Solution	Reliable MFCs, switching valves and flow meters
Added values	Automated dosing processes, rinsing processes as well as a controlled temperature simplify workflows and save time.

PERFECT CUTTING FLOWLESS CUTTING WITH A HIGH-STRENGTH GAS JET

There are many ways to cut materials: Laser, water jet, flame or plasma cutting. In principle, the metal at the cutting point must be melted quickly to ensure it can then be cut immediately with a powerful gas jet. Flame cutting enables the separation of thicker metal sheets. This mainly involves low-alloyed or unalloyed steel being melted by a very hot flame before a powerful stream of cutting oxygen is directed onto the area to be cut and oxidation of the steel takes place and material is removed. Typical fuel gases are acetylene, propane and natural gas.

Faster cutting is possible with laser and plasma cutting. With plasma cutting, the metal is melted by a very hot plasma jet and then separated by a powerful stream of inert gas. Typical plasma gases are nitrogen, oxygen, argon, air and hydrogen.

In all cutting processes, it is crucial that the gas is controlled intelligently and dynamically; this can be achieved in a reliable and sustainable way with the systems and components from Bürkert.

ADVANTAGES

- Space-saving, optimised installation ensured by compact, integrated gas control units
- Top-quality and consistent cutting results due to highly dynamic and precise gas control
- Full operational readiness guaranteed by a high automation degree of the system

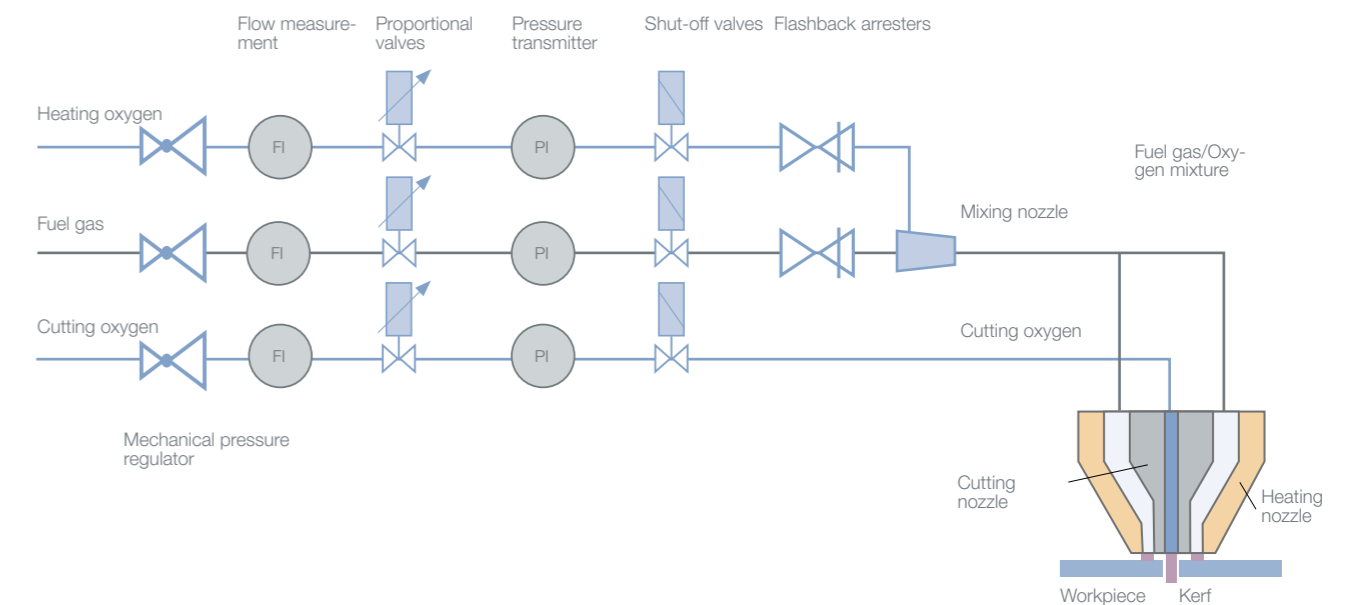


THE CUTTING PROCESS WITH OXYFUEL CUTTING

With this cutting method, there are three control loops for flame control: Heating oxygen, fuel gas and cutting oxygen (O_2). The appropriate part of the steel to be cut is raised to ignition temperature prior to flame cutting; however, the ignition temperature of the steel must be lower than its melting point. A heating oxygen/fuel gas flame heats up the material. The combustion heat released in this process then heats up the underlying layers of material, thus moving automatically (autogenous) deeper into the material. A jet of cutting oxygen is then directed into the preheated area instigating

a vigorous reaction with the preheated material and blowing away the liquid slag.

The choice of fuel gas influences the cutting process in terms of quality, preheating periods, thickness of the material that can be cut with good results, the achievable flame temperature and ignition speed. The mixing ratio of heating oxygen and fuel gas also plays a key role in terms of material preheating.



GAS SYSTEMS FOR GOOD CUTTING RESULTS

Gas control system for flame cutting



This gas supply unit was developed and implemented for a customer who employs to manage all the gas supply demands at the cutting heads of a flame cutting machine. The requirements that come with the extensive automation of cutting-edge oxyfuel cutting equipment were therefore met and the gas control system seamlessly integrated with the aid of fluid technology and electronics. At the same time, such an integrated system provides the basis for simplified logistical and manufacturing processes.

The central gas supply block for controlling the process gases of the oxyfuel cutting equipment supplies up to four flame cutters. The fuel gases acetylene and propane as well as ignition gas, heating oxygen and cutting oxygen are applied. The extremely compact unit features integrated bus electronics and ensures the decentralised control of functions.

Gas control system for plasma cutting



Our customer uses this gas control system for the provision of plasma gas and fluidising shielding gas volume flows as well as their mixtures for plasma cutting processes. The units consist of five independent gas control loops, each for various gas flow rates in a plasma cutting system. Each loop in turn consists of a pressure sensor for monitoring the primary pressure, a mechanical pressure regulator and a volume flow control. Process-independent, superimposed control functions are implemented by software.



Gas-flame cutting machine with automated system solution

THE PERFECT OVERLAP: YOUR REQUIREMENTS, OUR SYSTEM

A leading manufacturer of flame cutting machines designed to cut, e.g. up to 300 mm sheet steel wanted to supply several burners with the correct gas quantity at the push of a button. Along with our customer, Bürkert developed specific, individual systems for the customer's applications and challenges. In this case, the solution was implemented with bus systems that control the gas automatically. Furthermore, we used a suitable control to guarantee the cutting function of the burner.

To do so, Bürkert supplied the central gas supply unit for controlling and dosing the ignition, fuel and cutting gas as well as oxygen. Components of the gas supply unit are the electromagnetic solenoid proportional and shut-off valves with integrated fluid technology, electronics and flow measurement.

AT A GLANCE

Application	Gas mixing/ controlling for flame cutting machines
Requirement	Centrally controlled gas supply units
Solution	Automated system solution consisting of solenoid electromagnetic proportional and shut-off valves
Added values	Simple logistics and installation, as well as increased ease of service due to less interfaces

SUSTAINABLE PRODUCTS FOR YOUR GAS APPLICATION

Perfect gas control is characterised by the right choice of components. We offer you a tailored choice of products for your application to ensure you are ready for Industry 4.0.



Type 8741 and 8745 mass flow controllers

Compact mass flow controllers (MFCs) for gas flow rates of up to 2500 NI/min with analogue interface or Ethernet connection.

- Outstanding accuracy compared to other methods
- Excellent repeatability
- Can be integrated in a control system via analogue signals for the set-point and actual value or IT high-quality Ethernet communication



Type 8741, 8742 and 8746 mass flow controllers for multi-channel gas flow systems (multi-MFC)

Particularly efficient mass flow controllers for use in multi-MFC systems. These MFCs guarantee simple integration and a high level of efficiency if a machine is equipped with a higher number of flow control loops.

- Simple integration in a CAN network
- When used with the control unit/ type ME43 fieldbus coupler, it can be integrated in upper fieldbus and Ethernet systems



Type 8745 and 8746 mass flow controllers with integrated motor driven proportional valves

These devices demonstrate their full potential in areas with high flow rates at low supply pressures or conversely at high supply pressures with low flow rates.

- Minimum loss of pressure and high flow rates
- High levels of operating pressure up to 25 bar
- Efficient operating thanks to energy-saving motor valves



Type ME43 fieldbus coupler and type ME44 input/output modules

Either as a stand-alone ME43 or as a ME43 / ME44 combination, this type of system represents the central control unit for Bürkert products based on EDIP (Efficient Device Integration Platform).

- Central control unit that can be configured through the Bürkert Communicator for industrial Ethernet and fieldbus standards
- Connection of numerous Bürkert devices, including the device-specific definition of transmission data
- Simple integration in the process control level
- Graphical programming for the automation of sub-systems

powered by
EDIP

EDIP Efficient Device Integration Platform

EDIP provides a platform for intelligent networking and enables a sustainable digital process control.

- Standardised interfaces for simple device integration
- Graphical programming for individual process sequences
- ONE tool for start-up, diagnostics and service
- Less configuration work required for simple and fast start-up
- Intuitive user interface for ease of use and convenience



PERFECT GAS CONTROL WITH MATCHING VALVES

Wherever flames or plasma are controlled, it is necessary to be able to shut off, control or release gases quickly and safely. We offer you a wide range of product solutions to meet your specific demands.



Type 6011, 6013, 6027 direct-acting shut-off valves

Compact solenoid valves for secure and reliable shut-off of gases or liquids up to a 12 mm orifice.

- High degree of protection and external leak tightness
- Highly dynamic due to direct-acting plunger principle
- High-quality seat design guarantees a safe and long-lasting shut-off function with less leakage
- Suitable for fuel gases and oxygen



Type 0290, 5404, 6240, 6213 servo-assisted valves

Solenoid valves that utilise the power of the medium and thus remain very compact even with large orifices up to 50 mm.

- Types 0290 and 6213 open without the required differential pressure
- Types 5404 and 6240 are servo-assisted piston valves with lower power consumption
- High degree of protection and external leak tightness
- High seat tightness



Type 2871, 2873, 2875 solenoid proportional valves

Direct-acting proportional valves as control valves in process control loops. Thanks to their wide control range, they are particularly suited to complex control duties and use with gases.

- Outstanding repeatability
- Excellent sensitivity
- Orifices from DN 0.05 to 9.5 mm
- Excellent dynamics



Type 3280 and 3285 motor driven proportional valves

Stepper motor-controlled, direct-acting shut-off and control valves for dosing liquids and gases in closed and open control loops. The integrated electronics ensure the motor valves can be integrated easily into an existing system.

- Actuator is not wetted
- Low power consumption
- Various versions available: Shut-off valve, simple control valve without sensor equipment, position control valve and process control valve with sensor input

WHERE SYSTEMS TAKE SHAPE THE BÜRKERT SYSTEMHAUS

Bürkert has established an international engineering network that understands the challenges of your market and translates them into tailored system solutions based on concentrated competences. For you as a systems customer, Bürkert is not simply a developer of fluid technology, but also an expert in various other fields such as mechanical production, plastics technology and software development. This means that many areas of expertise are concentrated under one roof, resulting in valuable savings for you regarding time and money.

From the idea, development and initial testing, all the way to the production phase, the teams from various specialist departments work in an interdisciplinary way. They act autonomously in terms of technology to create your system solution. This way, cooperative partnerships produce solutions that exactly meet your requirements. Application experience gained over decades, combined with our comprehensive product range, forms the basis for innovative and customer-specific solutions. An existing platform hence serves as a basis for creating a customised solution quickly and efficiently – consequently reducing your time to market considerably.

For Bürkert, offering customer-specific answers means not only developing individualised systems, but also covering the associated production and logistics processes. This makes a Bürkert Systemhaus the ideal location to develop and produce tailor-made solutions efficiently and with a high level of creativity.

