

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

Functional process gases – controlled with high repeatability

Automated process control of supporting auxiliary gases

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 – or even sideways.

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

Christian-Bürkert-Strasse 13–17
74653 Ingelfingen
Germany

Phone: +49 7940 100
Fax: +49 7940 1091204

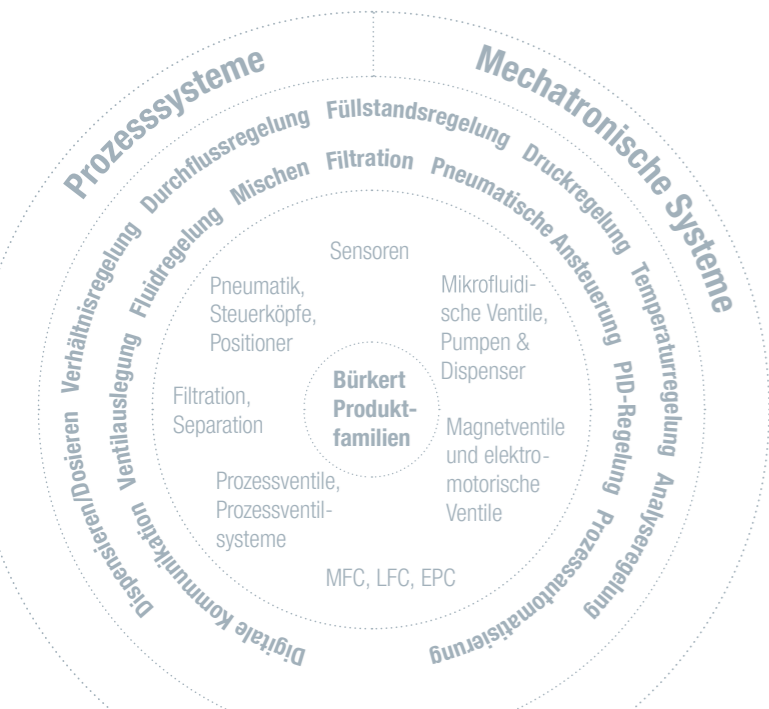
info@burkert.com
www.burkert.com

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.



GASES UNDER CONTROL – SYSTEMATIC REGULATION

Optimum use of protective and process gases only works out well with components that guarantee automated process control and repeatable results. If these components are integrated in complete solutions, gases can be controlled well-directed and efficiently within the processes. Bürkert systems employ industrial communication technologies to offer state-of-the-art process communication, feature highly dynamic sensor and actuating elements and deliver adaptable fluid technology functions.

4 Controlling heat treatment dynamically

Modern gas control technology makes sure your processes can be repeated, documented and easily digitised.

8 Melting innovation and technology into one

Perfectly controlled gases are the key to influencing the subsequent product quality of molten metals and achieving the desired material properties.

12 Everything from a single cast

When the atmospheric ambient parameters are ideal for casting and the pressure and flow are controlled precisely, the quality of the final product is also spot on.

16 Product choice

Valves, mass flow controllers (MFCs) and digital communication technology for individual and automated process solutions.

19 Systemhaus

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

CONTROLLING HEAT TREATMENT DYNAMICALLY REPEATABLE, DOCUMENTABLE, DIGITAL

The precise control of heat treatment processes is the key to high quality and robust materials. At the same time, the trend towards automation demands repeatability, documentation and digital networking. As a globally recognised expert for gas flow control, Bürkert guarantees the maximum level of precision, dynamically controlled flows and seamless integration into automated process control systems. Thanks to EDIP – the Efficient Device Integration Platform – Bürkert flow controllers can be very easily integrated into existing systems. This ensures that complex procedures can be monitored and controlled entirely. In short: Your heat treatment process becomes a fully transparent production process. Irrespective of whether it involves ammonia control, small quantities of methanol or endothermic gas generators – Bürkert transforms challenges into efficient solutions. With exact device configurations for results with a high level of repeatability.

YOUR BENEFITS

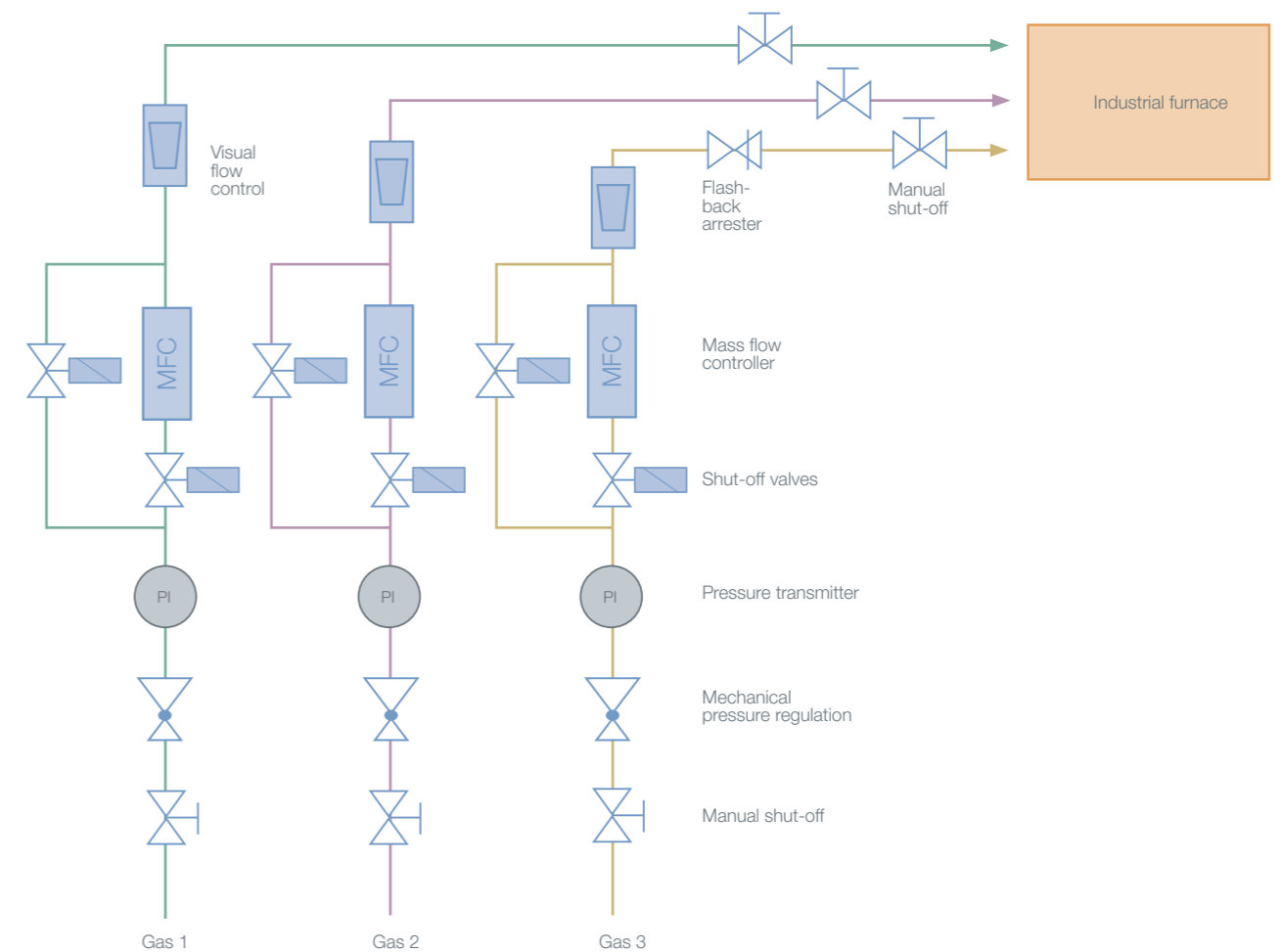
- Reproducible processes due to extensive process data
- Economic plant upgrade thanks to easy integration of fluid technology components
- Complete documentation through continuous data availability
- Process reliability due to rapid identification and elimination of process failures



EVERYTHING FLOWS SMOOTHLY TO ACHIEVE THE DESIRED QUALITY

Nitrogen and carbon-based gases as well as liquids are the driving forces of heat treatment processes. However, irrespective of the fluid introduced into the industrial furnace, the procedure must be automated and completely capable to be documented. Electronic mass flow controllers (MFCs) guarantee a constant predetermined flow rate. Furthermore, electric solenoid valves integrated in the automation system open and close gas lines safely and reliably. Most plant configurations enable both nitriding in a nitrogen rich environ-

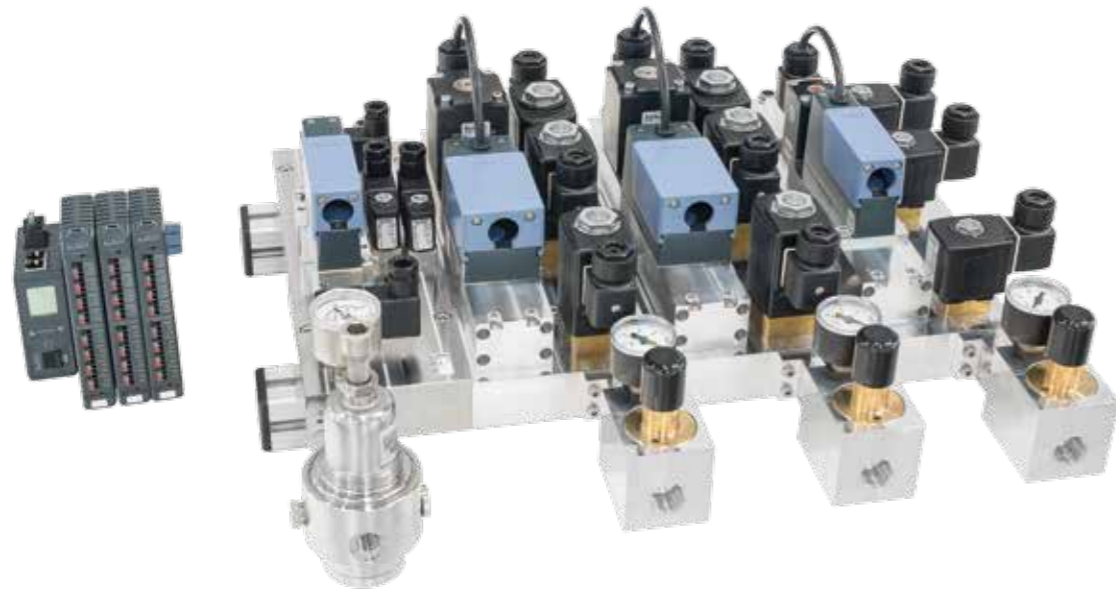
ment and carburising in a carbon dioxide environment, or a combination of both. Consequently, eight to ten gas control loops are usually required for the N and C-releasing gases or liquids. If an oxygen probe is then additionally used to measure the oxygen partial pressure inside the furnace, the nitriding hardness depths or C levels can be established and adjusted precisely and perfectly. Desired levels of material hardness are achieved in line with determined technical characteristics at all times using process controllers.



PERFECTLY TREATED SURFACES

Efficient and sustainable heat treatment of surfaces demands the precise control of process media. During carburisation processes, the modular gas supply system controls and regulates the coordinated supply of methanol, nitrogen, air and propane via system integrated mass flow controllers (for gases) and liquid flow controllers. The complete system

is easy to install and commission. The system control unit with gateway for Ethernet communication can already be easily programmed and configured in advance. Depending on the respective requirements, it is also possible to process further input/output signals which can be recorded or output by appropriate modules.



Modular gas supply system

YOUR BENEFITS

- Easy to extend and adapt to specific plant conditions due to the modular design
- Easy to handle thanks to user-friendly system configuration via the Bürkert Communicator
- Reduced logistics expenditure and short delivery times due to the pre-assembled and tested system



System engineering know-how enables easy start-up of a new roller hearth furnace

OPTIMUM FURNACE ATMOSPHERE

For the development of a new roller hearth furnace, which needs to be at the cutting edge of efficiency and flexibility, an automotive supplier required easy integration of the process technology in the existing operating levels. The current plant control had to remain unaltered; otherwise, there would have been a risk of plant-specific and plant-wide processes no longer functioning properly. In addition to the mechanical integration and supply of the valve and flow controller components, Bürkert was chosen due to its offerings and experience in the area of communication technology. The final result of the furnace and process expertise of the supplier and the automation technology expertise of Bürkert is a system solution that guarantees both a higher level of integration and tailored implementation. The key requirements for the successful contribution of Bürkert were, on the one hand, the proven device technology and, on the other, the variety of possible connections of these devices. The connectivity to the entire system setup is possible via a

single point of access. Carburisation with methanol, subsequent surface hardening with ammonia as well as the control of auxiliary gases were integrated smoothly into the existing structures.

AT A GLANCE

Application	Carburisation and subsequent surface hardening in the roller hearth furnace
Requirement	Maintaining the existing control periphery
Solution	System solution that can be integrated during on-going operation using existing interfaces
Added values	Efficient plant utilisation, as processes do not have to be interrupted for integration

MELTING INNOVATION AND TECHNOLOGY INTO ONE MOLTEN METAL TREATMENT

Not every steel is the same. In order to produce steel in varying qualities, molten metal treatment requires precise process control. As the correct steel formula needs to be used for each requirement, a high level of flexibility is demanded from the steelmaker. In particular, steel qualities must be achieved that are comparable to the properties of aluminium products. Steel production thus faces the challenge of achieving material qualities that withstand this comparison. The correct supply of process gases plays a decisive role in this respect. Bottom stirring with noble gases, such as argon, supports the treatment of the molten metal effectively. Furthermore, combined methods, e.g. oxygen blowing and bottom stirring with argon or nitrogen, are also wise depending on the desired material grade. The refining steps result in highly resistant or predefined stainless steels.

YOUR BENEFITS

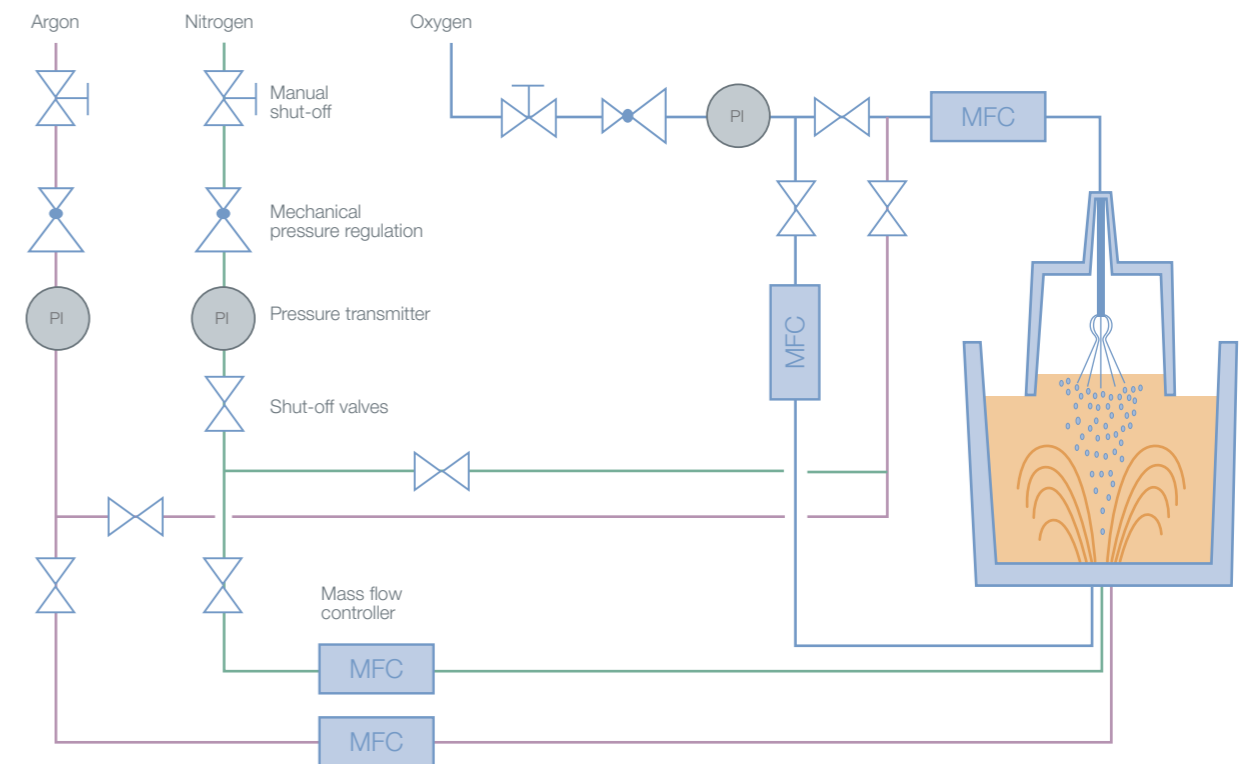
- Process reliability during maintenance and in case of an emergency due to seamless switching between MFCs
- Easy modernisation, fast extension thanks to the modular system design
- Reduced installation time due to directly operable components
- Smooth processes, even with changing operating parameters, thanks to adaptive devices



FROM MOLTEN STEEL TO HIGH QUALITY STAINLESS STEEL

If molten steel is to be decarburised to a certain level and subsequently desulphurised, the AOD method is used. When using this argon oxygen decarburisation treatment for producing austenite stainless steel, oxygen is initially introduced into the molten metal from the top. Subsequently, nitrogen and argon are added which reduces the oxygen partial pressure. This has the advantage that the alloying element, chromate, is not excessively removed from the

molten metal, and it also facilitates oxidation of the carbon. The state of the molten metal is key during the entire process. This is decisive for determining which process gases need to be adapted. Argon is either introduced into the converter from the side or from the bottom. This ensures improved decarburisation and desulphurisation, thus making the process even more efficient.



ACHIEVING STABLE GAS DOSING WITHOUT PRESSURE

The entire line supplies the system depicted here, consisting of three gas control loops. A shut-off valve at the front switches a gas control loop on or off safely. A mass flow controller (MFC) for gases, which features a motor-driven proportional valve as the control valve, is installed downstream of the shut-off valve. This system is used wherever it is important for gases, e.g. nitrogen or argon, to be dosed constantly into the crucible, irrespective of pressure fluctuations at the system outlets. The gases are blown into the molten metal to be circulated and mixed at several positions

of the ladle so that foreign substances and other lighter components accumulate at the top of the slag. Typically, the gas pressures that have a retroactive effect from the ladle on the system can increase significantly. Therefore, higher input pressures must be available. The MFC thus needs to operate both at high operating pressures of up to 25 bar and at smaller or greater differential pressures between the input and output pressure. This requirement on the flexibility of the MFC when handling various pressures represents the special challenge this design faces.



Gas system for molten metal treatment

YOUR BENEFITS

- Minimised cycle times due to precise gas dosing
- Safe process sequences, as the motor valve remains in its position even in the event of a power loss
- Quick reconfiguration of existing plants thanks to the short time required for installation and start-up
- Low space requirement due to the compact system design
- Service-friendly design



Persuasive through its adaptability and easy integration.

PRECISE GAS CONTROL FOR PERFECT MOLTEN METAL

Our customer, a plant and steelwork engineer, planned an electric arc furnace (EAF) for a steelworks in Tula, Russia. Automated and mobile ladle stirring was intended to keep the temperature distribution within the molten metal constant and stable at all times. This way, it was possible to make the steel treatment process more efficient to allow operators of the steelworks to increase their annual steel production. The Bürkert system for argon and nitrogen stirring in the proper control cabinet met the demands of the customer and comes with the necessary approval of the Eurasian Economic Union, the EAC mark. Moreover, the components have to work reliably under adverse conditions, as for instance at pressures up to 22 bar and in very dusty atmospheres. In the course of cooperation, the plant and steelwork engineer became firmly convinced of the ability of the system solution to adapt to conditions at other plants, such as a BOF, VOD or AOD plant. Fast and smooth integration is fundamentally ensured by adapting the control

parameters and adding additional I/O modules. Customers particularly value the array of functions and the flexibility of the systems that improve the efficiency of mobile ladle treatment systems.

AT A GLANCE

Application	Mobile gas control system for ladle treatment
Requirement	"Plug & Play" solution, high pressure compatible MFC up to 22 bar
Solution	Modular MFC solution that can be integrated easily into an existing system
Added values	Improved efficiency and enhanced steel production due to ease of maintenance and fast start-up

EVERYTHING FROM A SINGLE CAST UNIFORM CASTING PROPERTIES FOR OPTIMUM PRODUCT QUALITY

Continuous casting relies on a uniform flow of molten metal. This is the only way steelmakers can guarantee high levels of purity for their products. The liquid steel that flows from a ladle into a tundish during the continuous casting process and ultimately – controlled by a stopper – into a nozzle must demonstrate excellent fluidity throughout the entire transfer. This can be achieved by applying a precisely controlled quantity of gas (argon) that is blown into the molten steel. Exact dosing is a key factor for success, as it prevents the formation of bubbles that would otherwise contaminate the steel and reduce the product quality. The challenge is to supply the exact amount of argon for the fluidity of the molten metal to be sufficient. The mass flow controllers (MFCs) from Bürkert meet this task. Such precision instruments allow steel-makers to control the time-dependent flow of argon very accurately.

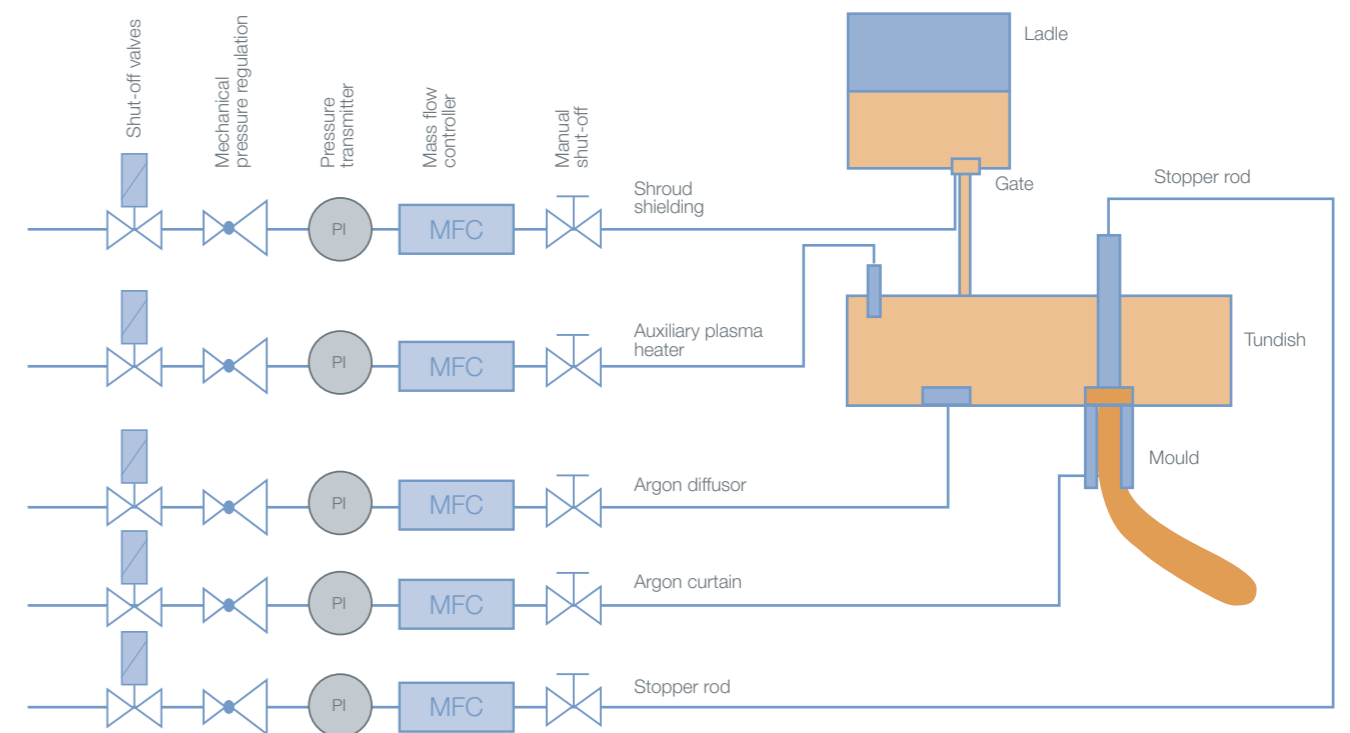
YOUR BENEFITS

- Optimum process continuity through improved casting quality
- Uniform flow of molten metal thanks to precise gas control loops
- Maximum steel quality without bubbles and crystals
- High productivity due to faster cycle times with greater fluid flow behaviour of the cast strand
- Time saving thanks to optimum flow characteristics and the avoidance of blockages

HIGH LEVEL CONTINUOUS CASTING QUALITY

Once the molten steel for the continuous casting process has been refined, it is transferred from the ladle into the tundish through a shroud. Opening of the gate valve is the most critical step when casting, as the molten metal flows – from a fluidic point of view – into the shroud in a turbulent way. This inevitably results in a pressure drop and air enters the gate valve from the outside. This is prevented through pressurisation with argon. After being poured into the tundish, the molten metal is stored there temporarily. It must be kept at a certain temperature level and the formation of

empty spaces must be avoided through heterogeneous temperature distribution. An argon diffuser helps to keep the mass of molten metal moving. Additionally, a plasma burner can be used to maintain the molten metal at a specific temperature level. Another critical task is the opening of the stopper before the molten metal flows into the nozzle and the actual continuous casting process commences. At this point, argon is introduced into the stopper mechanism to improve the flow characteristics of the molten metal. The quality of the continuous casting process is thus optimised.



COMPREHENSIVE GAS CONTROL

At critical points where the quality of the molten steel is at risk during the continuous casting process, functionally-integrated, decentrally controlled systems offer significant advantages over individually controlled solutions. When the molten metal flows through the shroud into the tundish, both pressure and flow control are required. One system can react to both requirements here. The operator does not have to interfere for each setting, as only the digital, already integrated information indicating the necessity of a different control mode is required. Exact control of the gas is also key to ensuring metal fluidity when the molten metal flows from the tundish into the nozzle. Information on the pressure

conditions of the ceramic-based stopper is fed back and the gas flow adapted accordingly. The system warns the operator upon reaching certain pressure limits. Once again, the on-site networking of the individual components plays a crucial role, for instance to detect whether the stopper control is still effective and action is needed. The system of an MFC line depicted here guarantees exact pressure and flow control as well as safe shut-off, even at high pressure. All it takes is a few steps to network this line with other components and to connect it to a higher-level controls via a common intelligent and data-specific configurable node node.



Mass flow controller (MFC) line

ADVANTAGES

- Compact and space saving design allows installation and removal even in the tightest of spaces
- Continuous processes due to leakage-free, pre-assembled and tested solutions
- High level of flexibility when applying various gases at several lines
- Recovery of production time through short maintenance periods



Cutting-edge pressure and flow control prevents argon and air inclusions.

PRECISE PRESSURE AND FLOW CONTROL

A steelmaker faced the challenge of having to avoid argon and air inclusions during the continuous casting process. The product quality needed to be improved and the process steps optimised. Previously, excessive scale build-up had been detected on the cast steel. This was caused by the liquid steel coming into contact with air and oxygen atoms thus settling on the surface. It then required a laborious manual process to remove this oxide layer. The use of argon to prevent contact with oxygen in the air also led to increased argon inclusions or cavities in the cast product, which obviously had a major impact on quality. The solution was finally provided by an integrated pressure and flow control system for the necessary process gases that our customer can use to interfere in the casting processes. The casting quality can thus be controlled by known processes. In normal operation, the system guarantees constant pressure conditions. However, if operators recognise that the casting process is not going to plan, they are able to switch

from pressure to flow control. The system reacts to changes in pressure, thus ensuring a constant target volume of flow. This ability to switch to an adjustable flow of argon guarantees sufficient fluidity of the molten metal. Seeing as the quantity of argon can be measured, the processes are traceable.

AT A GLANCE

Application	Gas control during the continuous casting process
Requirement	Increased product quality, process optimisation
Solution	Integrated pressure and flow control system
Added values	More efficient production without complex removal of the oxide layer and thus maximum product quality

SUSTAINABLE PRODUCTS FOR YOUR GAS APPLICATION

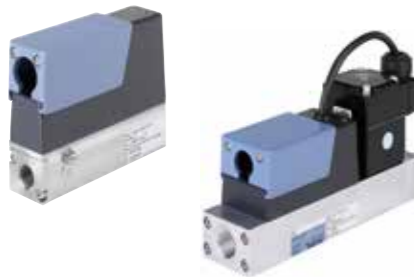
Perfect gas control is characterised by the right choice of components. We offer you a tailored choice of products for your application to ensure you are ready for Industry 4.0.



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 when compared with other flow measurement technologies
- Excellent repeatability
- Can be integrated in a process control via analogue signals for set-point and actual value or a high-quality Ethernet communication



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

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

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



Type 8718 and 8719 liquid flow controllers

Compact flow controller for low flow controls (in the range of litres per hour) according to the differential pressure principle. Since the measuring principle does not require moving parts, these devices are characterised by a low level of wear.

- Space-saving due to compact design
- Precision controller for small flow rates
- Extremely chemically resistant design



Type ME43 gateway and Type ME44 input/output modules

Either as a stand-alone Type ME43 or as a Type 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
- Easy integration in process controls
- 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 easy 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



SUITABLE VALVES AND FLOW METERS – PERFECT FOR SUPPLYING GAS IN A CONTROLLED MANNER

Your gas control must work reliably and act as independently as possible. These components ensure automated process control and guarantee repeatable results.



Type 3280, 3285 and 3361 electromotive process 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 put into an existing system easily.

- High precision and dynamic control
- Weather, shock and vibration-resistant design
- No downtime thanks to maintenance-free operation



Type 2101 and Type 8802 pneumatically operated process valves

The valves are specially optimised for decentralised process automation and meet all the relevant criteria, even in harsh process environments. The fieldbus interface enables easy integration into an existing system.

- Optimised for decentralised process automation
- Unrivalled life time and sealing integrity, as well as a compact design
- High chemical resistance



Type 8007, 8008 and 8750 flow meters and controllers

Type 8750 (DN15 to DN100) is suitable as a flow controller, incl. flow measurement, while Type 8007 (sensor for integration into pipelines) and Type 8008 (with pipe, up to DN50) are both used for the flow measurement of large gas flows.

- Measurement of very high flow rates
- High degree of ingress protection (IP65)
- Type 8750 for automatically adjusting flow control, in case pressure values change

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 system 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.

