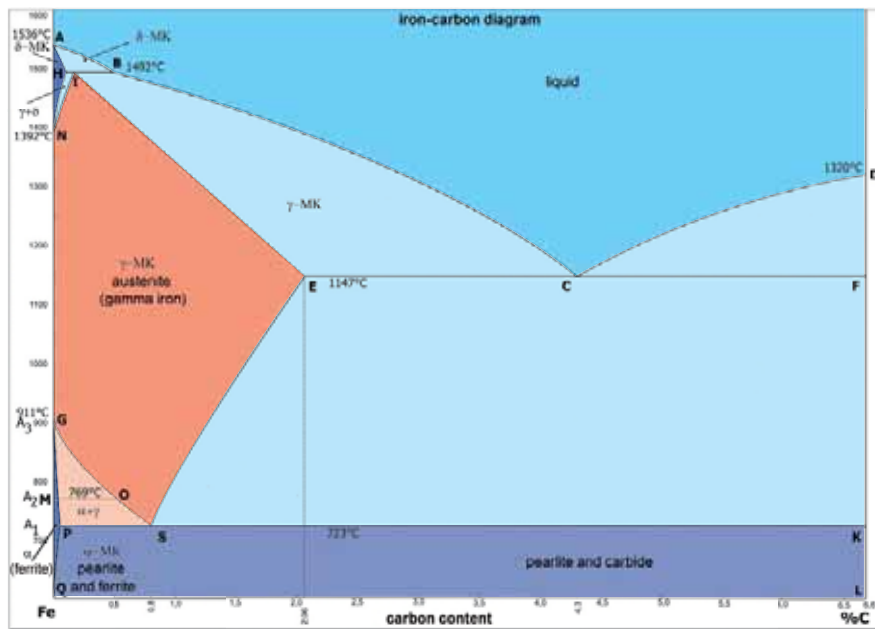


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# FROM IRON ORE TO STEEL

Process burners, lance systems, manipulators  
and heating systems for precise steel qualities





## Customised firing solutions for precise steel qualities



### Global centre of competence

Within the Clyde Bergemann Power Group, Clyde Bergemann Brinkmann is the global centre of competence for process burners and turnkey heating systems. The complete range of modern firing technology products is combined under the business field "Firing Solutions".

Since 1883, our business has been the development and production of solutions which guarantee ideal heat transfer from the flame to the process and maintain the desired temperature. Our particular strength is to provide "Firing Solutions" for special and complex industrial process conditions, such as ...

- Fluctuating pressures or pressure ratios, which can range from vacuum to very high pressures
- High temperatures, such as in steel production, with temperatures of over 1600°C
- Inert gas atmospheres, e.g. using nitrogen
- Combustion with pure oxygen or air enriched with oxygen

Our burners are designed for high to low calorific solid, liquid and gaseous fuels. We make a contribution to the cost-effectiveness of your production through optimised combustion of low calorific process gases.

### Partner for the steel industry

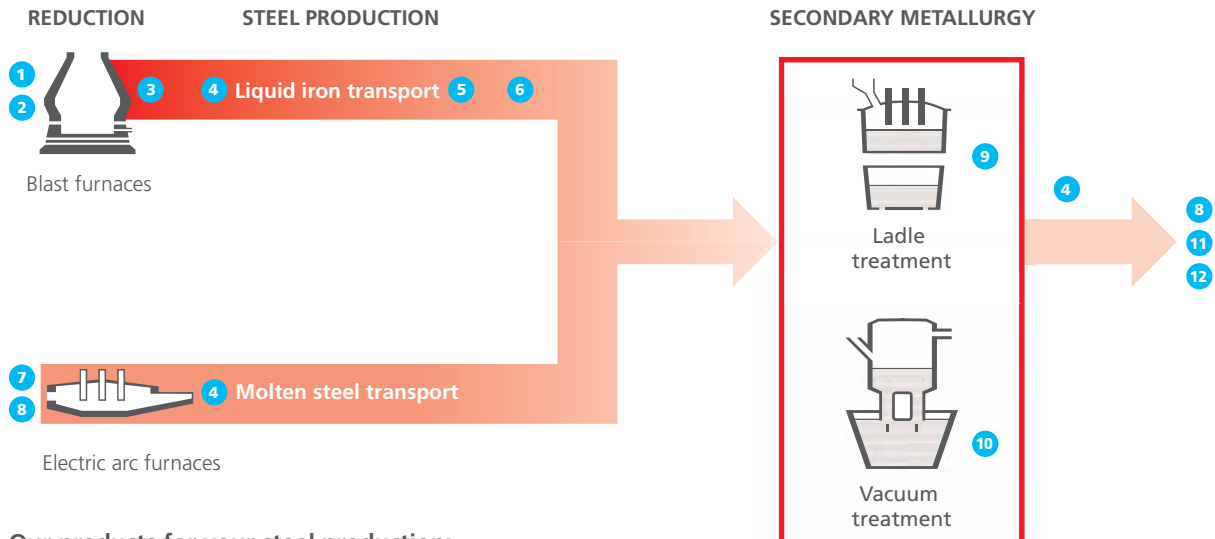
Across the world, reputable steel producers and makers of special steels put their trust in us. We are in demand as a development partner wherever solutions for specific requirements are needed. For example, the first burner lance for the FINEX reduction process came from our company. We are renowned for the reliability of our products, which are designed for smelting works.

With installations in more than 2.500 plants, we are totally familiar with the steel manufacturing process and are aware of the special requirements in this area. This is why our L-HOB combination lances for heating and metallurgical oxygenation offer outstanding oxygen supply rates and a long life cycle.

When developing low calorific gas burners, the utilisation of process gases was important to us. The patented burner technology has a large control range combined with low emissions.



## Our product range for the steel industry



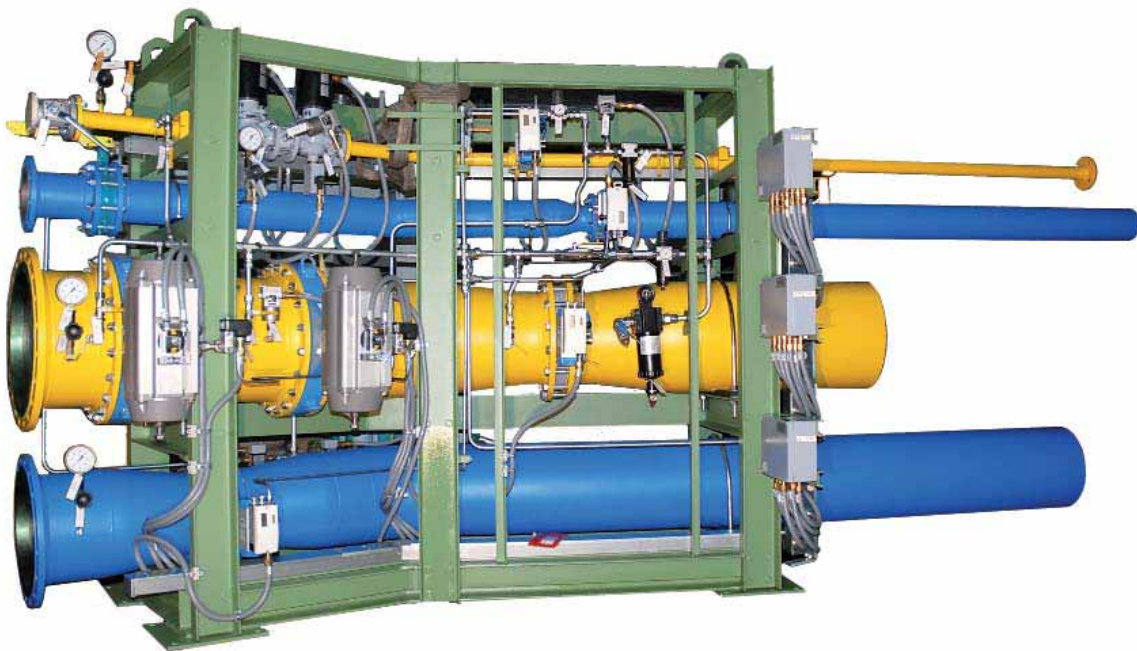
### Our products for your steel production:

- 1 Burners for sintering and pelleting
- 2 Injecting reducing agents
- 3 Drying and heating of launder
- 4 Ladle solutions for drying and heating the lining
- 5 Torpedo ladle heater
- 6 Burner for pig iron mixer
- 7 Oxygen side wall burner
- 8 Lance manipulators
- 9 Lance injection and bottom purging systems
- 10 L-HOB lance systems, bottom purging systems, flare systems, hot off driers
- 11 Tundish heater and dryer/stopper rod heating
- 12 Burner for heat treatment

### We can use these fuels and offer these services:

<b>Fuels</b>	all solid, liquid and gaseous fuels
<b>Calorific values</b>	~ 1 kWh/unit up to ~ 30 kWh/unit
<b>Power range burners</b>	50 kW up to 300,000 kW

Oxy-fuel solutions are also possible in combination with multi-fuel concepts



## Blast furnace reduction: hot gas generators for PCI & systems for heavy oil injection



### By means of reduction from iron ore to pig iron

We supply hot gas generators for PCI (pulverised coal injection) and systems for heavy oil injection for the reduction process.

Our hot gas generators support this key process step in the coal milling and drying field. The required temperature profile can be achieved at any time through the ability to adjust the burner precisely. This very important process step is required to guarantee the desired pig iron quality.

You have freedom of choice where the fuel is concerned. Coal dust or blast furnace gas can be used separately or combined. You gain the flexibility to decide according to availability and fuel price.

The controlled valve system provides exact injection of the reducing agent in accordance with the targets for mass flow and temperature. This is customised designed and in compliance with EU standards. Integration with the central control system is possible, as is manual operation at the local unit, for example during maintenance or during the start-up process.

Patented multiple lance burner (MLB) for process gases with a low calorific value





## Torpedo ladle heater for pig iron transport

### Reach and maintain temperature profiles

Our torpedo ladle heaters are designed for the most adverse conditions and therefore are also weatherproof for outside use.

The symmetrical flame geometry of the T-burner is particularly well suited for use in torpedo ladles. The resultant hot gas flow has been optimised to circulate evenly through the refractory material and in this way achieves the required temperature profile. The available process gases, such as CO gas, Corex etc. can be used as fuel. The T-burners can be designed as horizontal or vertical heaters.

Thanks to independent and safety-monitored programs, the torpedo ladle burners can also be operated disconnected from the control centre.



T-burner being moved into the working position



## Blast lance & bottom purging systems



### Reliability where it matters

Whether it is the decarbonisation process in the converter, heating or the directed injection of materials into the molten metal in an electric arc furnace or in a special procedure – steel quality is crucially affected by the use of lance systems.

This is why we place particular value on functional reliability and design precision for our lances. Systems have been designed in such a way that even difficult process conditions do not invalidate this claim.

One example of our capability is a lance system developed for the FINEX reduction method. With an output of 300 MW the diameter of the lance results in merely 220 mm.

Because of the power density achievable, our lances can be used both for oxyfuel applications and for oxygen and argon treatment.

### Controlled feed of argon and nitrogen for bottom purging

In this context it is crucial to meet both the quantity and the purging duration precisely, and thus to introduce the exact quantities of argon and nitrogen. To achieve this precision, we exclusively use mass flow controller.

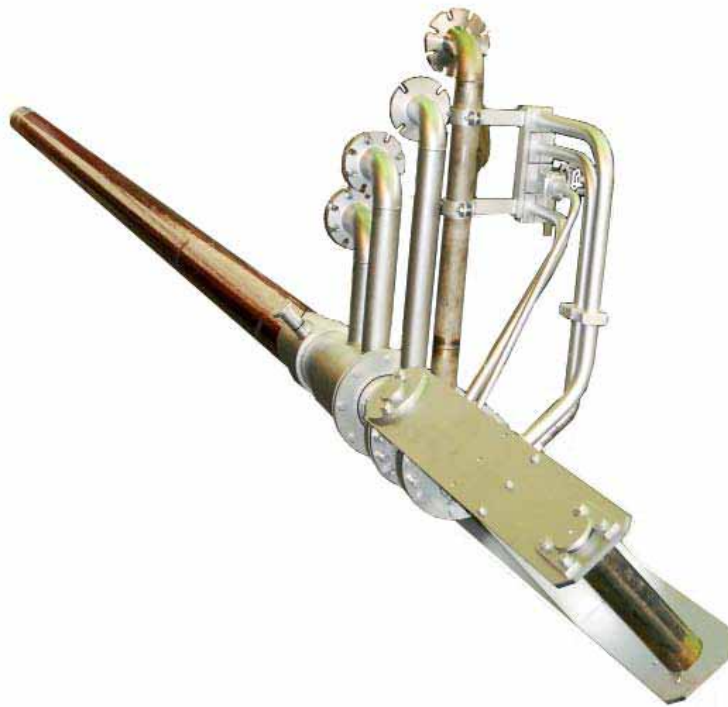
Measurement and control take place continuously and in a common control cycle. There is accordingly a near-real time reaction to process fluctuations. In addition, the admission of argon and nitrogen for the individual purging openings can be controlled separately.

The purging system is itself checked continuously for wear and blockages via pressure measurement. Blockages are cleared via a secondary feed line. If the bottom purger fails, the emergency lance is used automatically.

With an eye to over-oxidation and slag formation, the combined use of bottom purging systems with blower lances is recommended for comprehensive steel bath treatment.

The controller unit is equipped with dust- and temperature-protected controls and instruments. The controller can be integrated into the central control unit if required.

Technical data on page 14.



## 2 in 1: Combination lances for vacuum treatment

### Efficient heating and decarbonisation

The requirements for availability and metallurgical results have grown in recent years. We measured ourselves against these and were in from the very start of the development of combination lances.

The result: The L-HOB lance. L-HOB stands for "Lance for Heating and Oxygen-Blowing". All the necessary ignition and monitoring functions are integrated in the lance head. The L-HOB lance achieves high heating and oxygen introduction rates for an improved smelting behaviour from the slag. The camera integrated in the lance head supplies pictures for monitoring the process and the refractory material.

A wide range of fuels and process gases can be used. Our lances can be produced up to a length of 20 metres. Apart from top lance configuration, side fitting is also a mounting option.

It is not unusual for the lances to have a working life of 1,000 smeltings.



All necessary ignition and monitoring functions are integrated into the head of the L-HOB combination lance



## Lance manipulators



### Repeated precision

The capability to reproduce functions again and again is crucial for lance manipulators. Only if the temperature is measured or the sample taken at exactly the same spot in the steel melt can this data be valid and verifiable. This precision applies equally to the introduction of additives required for metallurgical purposes and for the desired slag formation.

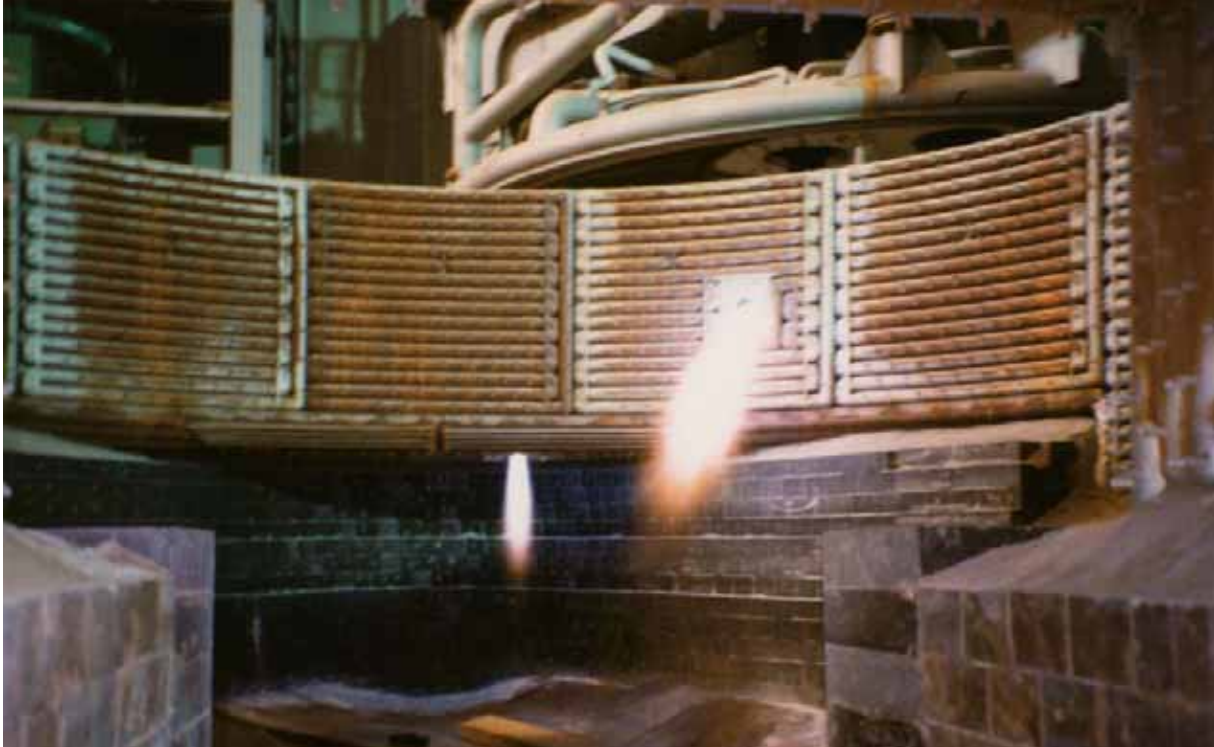
In close collaboration with the customer, a team of experienced engineers takes care of the individual design. Qualified commissioning experts monitor assembly and repairs and are the guarantors of reliable system function.

As rotary, kinked or gateway versions, manipulators can be equipped with several lances, with water-cooled supersonic lances or with self-absorbing blower lances according to the requirements.

### 🔴 Your advantages:

- Best possible slag formation through even temperature of the steel bath
- Efficient use of oxygen and coal through more effective use of the lance
- Shortened runout time
- Increased productivity
- Lower consumption of electrodes and refractory materials
- Short amortisation periods
- Designed for smelting works, capable of handling even high thermal stresses
- Improved protection for operators, e.g. by reducing manual interventions

Technical data on page 15.



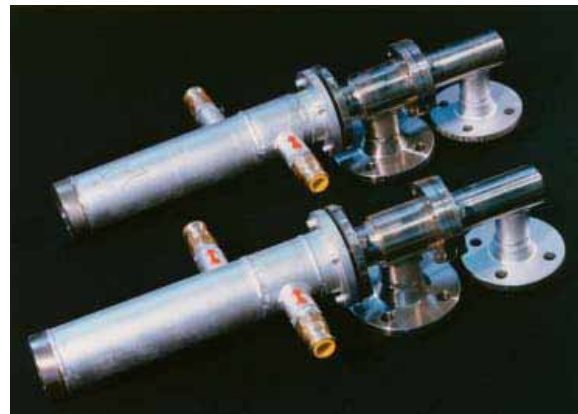
## Accessories for electric arc furnaces

### Proven for process support

We offer a range of accessories proven for many years. Lance manipulators for fresh oxygen lances and for coal and lime injection have simplified work on electric arc furnaces significantly.

Semi-automatic manipulators with a lance or several lances arranged in parallel have already proved successful in use worldwide. They are characterised by a solid design and ease of use.

Water-cooled gas-oxygen burners as wall or door burners with the associated control stations are also a part of our accessories program. Various flame shapes are available. Each performance class can be supplied.



O<sub>2</sub>-side wall burner



# Ladle heating systems

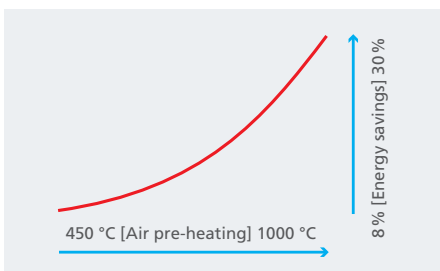


## Drying and heating economically

Worldwide, in the iron and steel industry, our ladle heating systems are a byword for sound design in accordance with good engineering practice and exemplary reliability. A high technical standard has been demonstrated in more than 600 systems.

As a partner of the steel industry, we are aware that energy-efficient steel production is becoming increasingly important, in order to remain competitive. Our vertical and horizontal ladle heaters can therefore be fitted with recuperators, which feed energy from the hot exhaust gas back into the process as pre-warmed burner air. This can achieve high fuel savings.

## Effect of recuperator on energy savings



The use of recuperators pays for itself quickly and leads to lower emissions with fuel savings, especially of CO<sub>2</sub>.

## Quality is the standard

We make it simple for you: You simply give us the key data – and we will deliver to you standardised quality at a good price and with a short lead time. We will of course check your details with our fire and heating engineering experts and will, if necessary, come back to you with different recommendations.

This is all we need to know:

<b>Ladle heater for:</b>	<input type="checkbox"/> Drying
	<input type="checkbox"/> Heating
	<input type="checkbox"/> Drying & heating
<b>Fuel:</b>	<input type="checkbox"/> Natural gas
	<input type="checkbox"/> Coke oven gas
	<input type="checkbox"/> LPG
<b>Connected load [kW]:</b>	_____
<b>Connected load [Nm<sup>3</sup>/h]:</b>	_____
<b>Ladle heater design:</b>	
horizontal with travel path [mm]:	_____
vertical with vertically lifting cover and mill floor clearance [mm]:	_____
vertical with vertically tilting cover and mill floor clearance [mm]:	_____
<b>Ladle diameter [mm]:</b>	_____
<b>Drive:</b>	<input type="checkbox"/> electromechanical
	<input type="checkbox"/> electrohydraulic

Of course we will also be pleased to advise you with our expertise, if a special solution is requested.

Technical data on page 15.



## Tundish heating systems

### Reliable drying and heating

Tundish heating systems are available both for drying and for heating previously dried distribution channels. They will be equipped with a freely programmable controller for a precise temperature realisation which allows heating as well as eliminary drying.

Even heating of tundishes is one of the key functions in modern continuous casting plants. Our heating systems are suitable for a very wide range of tundish shapes and sizes. The integrated burners are designed in accordance with the fuel to be used.

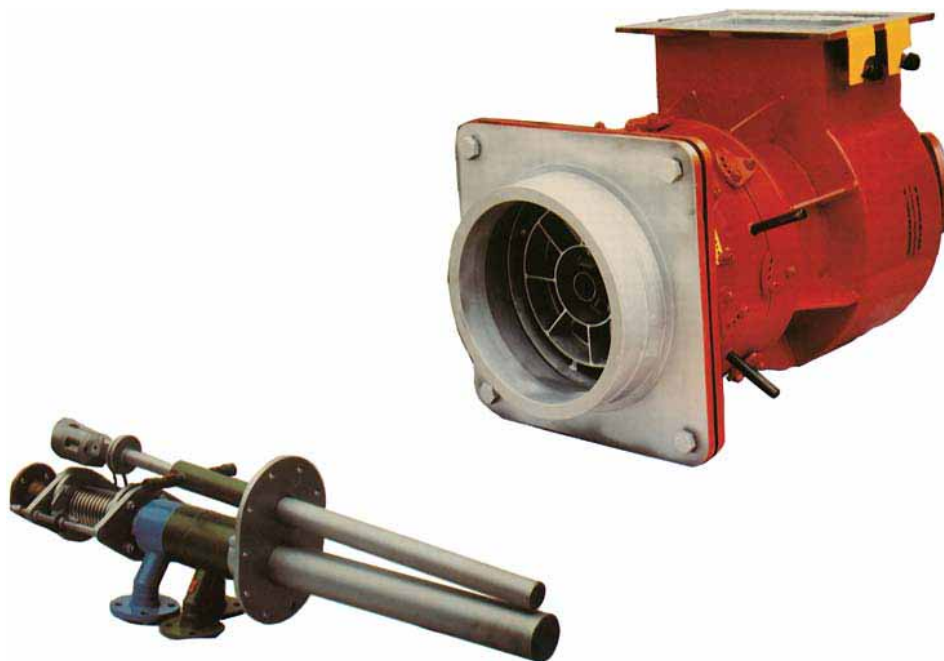
Depending on the geometry of the tundish, the heating requirement for each zone is calculated exactly, in order to achieve the ideal heating time.

Our tundish heating systems can be fitted with recuperators for improved energy efficiency.



Stopper rod heating

Technical data on page 15.



## Comprehensive burner range



### Large range of fuels

Our burner range covers a wide range of fuels: solid, liquid and gaseous. Complete control systems and supply stations complement the product range. The products convince by virtue of their wide control range and a calm, stable combustion pattern. The burners are more than compliant with all the emission figures set out in the TA-Luft (Germany's air pollution law). Fuel combinations and/or flame characteristics are tailor-made.

Special designs are available on request.

### Coal dust burner

This type of burner is available as a conventional design or as a rotation burner for burning pulverised coal dust.

In a conventional dust burner, variable rotary inserts circulate the primary and secondary air to control flame length.

In rotary burners, fuel and combustion air are injected tangentially, thereby causing the desired rotary motion in the burner chamber. This allows to achieve long burn-out times in the smallest possible space. This is a prerequisite for burning test fuels contaminated with pollutants with long dwelling times.

### Hot gas generators

Can be used for a multitude of industrial heating tasks, with a commensurably large range of usable fuels.

These include, for example:

- All types of combustible gases
- Light oil
- Heavy oil
- Coal, coke, sewage sludge and other dusts

In order to reach the desired process temperature, dust-laden gases can also be fed as mixed gases. Various constructions and installation positions can be chosen for integrating a hot gas generator into new or existing systems. Complete measurement and control units complete the system concept.

### Proven standard burners

Our burners in cast or welded design provide you with proven technique for your heating requirements. The flame geometry can be matched to your requirements. The standard burners are complemented by a range of appropriately matched accessories for fuel and air. The control system, fitted with its own control unit, can be integrated into the DCS.

Technical data on pages 14/15.



## Service

### **Training**

We'll get you ready with respect to the process engineering relationships when burning gases and the effect on flame temperatures, the compliant design of gas and air control paths in accordance with the EN standard, or with respect to safety equipment issues. We offer a flexible range of training courses – current dates are to be found on our homepage or simply ask us.

### **CE installation declaration**

We check the current status, work out recommendations for adaptation, implement these and provide final certification.

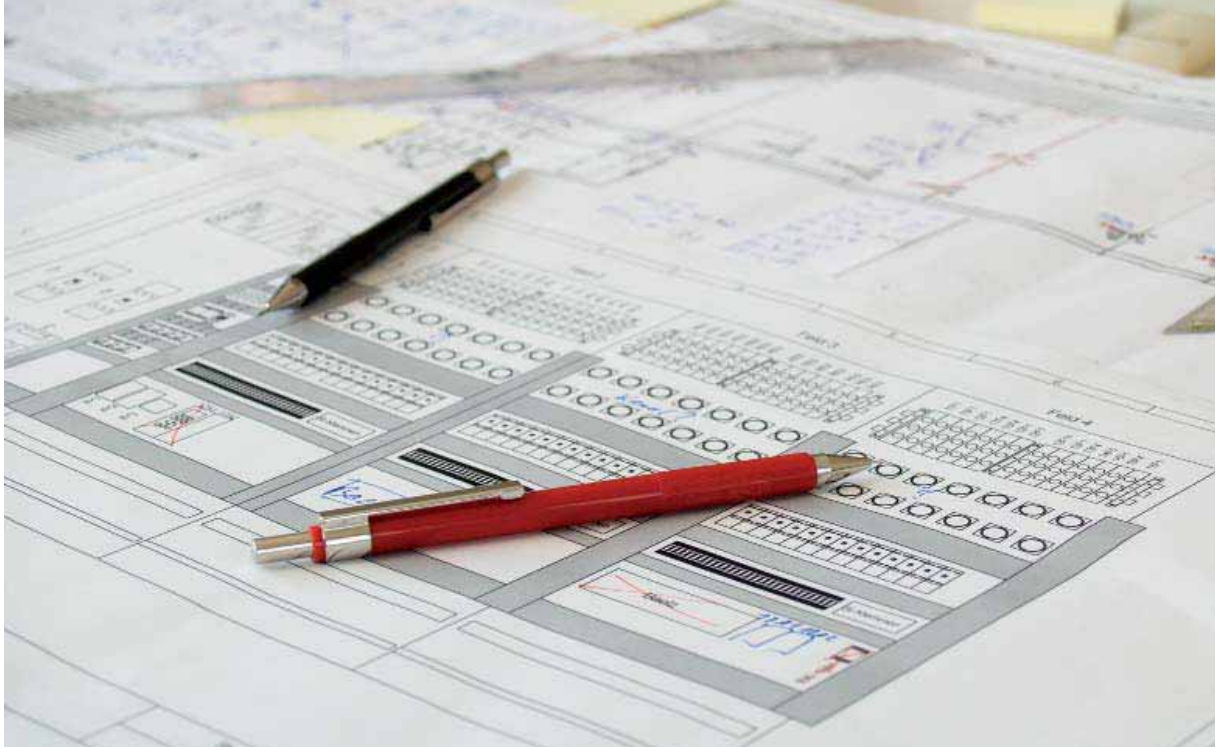
### **Spare parts & servicing**

We offer spare parts and servicing for our products, as well as for those from other manufacturers.

### **Heating optimisation**

Cost pressures are getting stronger, quality requirements are rising – and fortunately, we continue to develop our products to meet future challenges. In this way, new technical solutions can occur at any time, whereby underlying optimisation potentials can be exploited. Our watchwords are emission figures, temperature accuracy and energy consumption.

Our qualified engineers will be more than pleased to take on your challenges!



## Technical data



Hot gas generators for PCI	
<b>Fuels</b>	gaseous – in particular blast furnace gas, mixed gases, converter gas, coal dust, light or heavy oil
<b>Control range</b>	1:80
<b>Output range</b>	2 to 60 MW

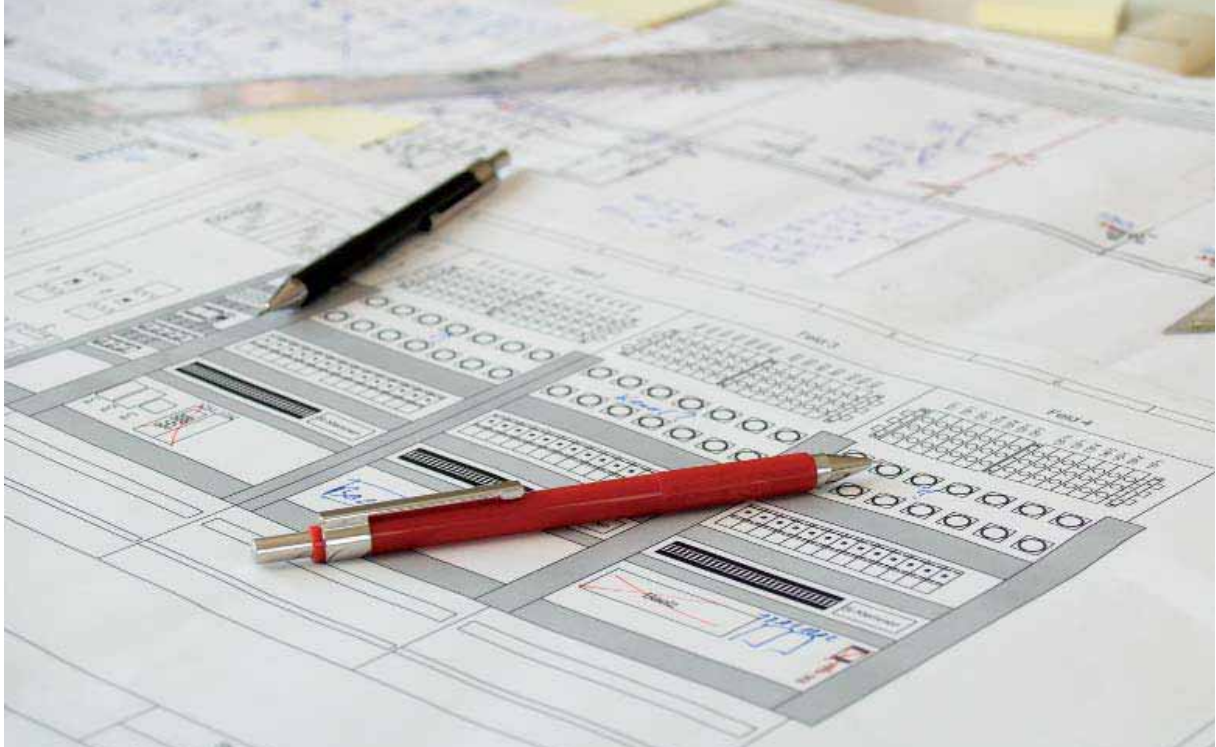
Systems for heavy oil injection	
<b>Medium</b>	heavy oil
<b>Volumes</b>	1000 to 3000 kg/hour
<b>Control</b>	temperature and mass flow control

Torpedo ladle heaters	
<b>Fuels</b>	gaseous – in particular blast furnace gas, mixed gases, converter gas
<b>Burner design</b>	T-shaped
<b>Burner output</b>	2.5 to 6 MW
<b>Alternative designs</b>	horizontal or vertical heater

Blast lance systems	
<b>Medium</b>	oxygen, argon, nitrogen
<b>Volumes</b>	1500 to 10000 Nm <sup>3</sup> /hour
<b>Control</b>	mass flow control

Bottom purging systems	
<b>Medium</b>	oxygen, argon, nitrogen
<b>Volumes</b>	500 to 2500 Nm <sup>3</sup> /hour
<b>Control</b>	mass flow control

L-HOB combination lances	
<b>Fuels</b>	gaseous – in particular blast furnace gas, mixed gases, converter gas
<b>Burner output</b>	2.5 to 6 MW
<b>Blasting medium</b>	oxygen
<b>Volumes</b>	1500 to 10000 Nm <sup>3</sup> /hour
<b>Install. dimensions</b>	up to 20 m
<b>Install. position</b>	vertical or side wall



## Technical data

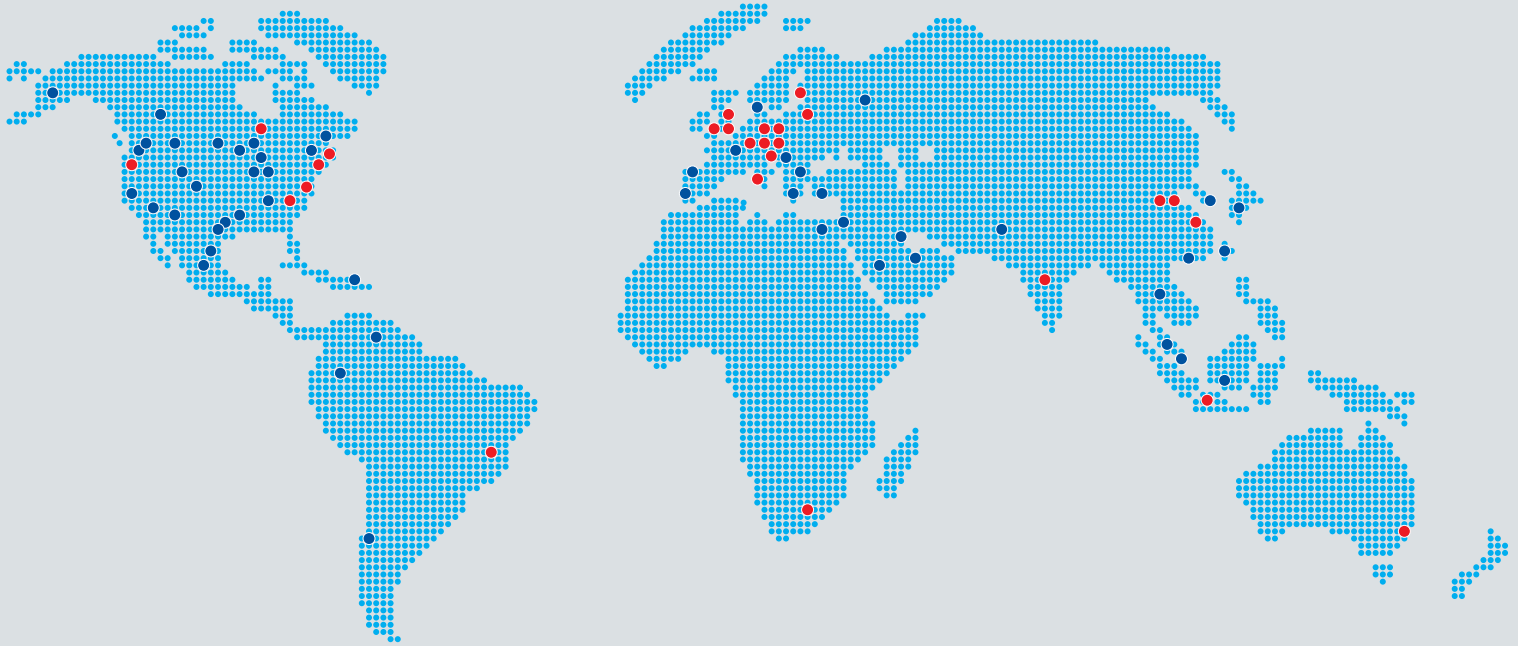
Lance manipulators	
<b>Injection media</b>	coal dust, oxygen, nitrogen
<b>Lances</b>	all consuming or water-cooled
<b>Function</b>	temperature measurement, sampling and injecting
<b>Design</b>	rotating column, bend or gate-way construction

Standard burner	
<b>Fuels</b>	gaseous (natural gas, coke furnace gas, LPG), diesel oil
<b>Burner output</b>	50 to 4000 kW
<b>Design</b>	welding or casting

Customized burner solutions					
Fuels		gaseous	liquid	solid	Combinations
<b>Oxidiser</b>	Air	●	●	●	Combinations
	O <sub>2</sub>	●	●	●	
<b>Production process</b>	Vacuum	●	●	●	Combinations
	Overpressure Inert atmospheres (N <sub>2</sub> , Ar)	●	●	●	
<b>Burner output</b>	50 kW to 300,000 kW				

Ladle & tundish heating systems	
<b>Fuels</b>	gaseous – in particular blast furnace gas, mixed gases, converter gas, coke furnace gas, diesel oil
<b>Burner output</b>	2.5 to 6 MW
<b>Oxygen</b>	O <sub>2</sub> enriched air or 100 % O <sub>2</sub>
fitted with recuperator on request	

Clyde Bergemann is represented in over 40 countries worldwide.



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- Clyde Bergemann Associates



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