HIGHJET®TDI oxygen technologies.

Cupola furnace installations at Componenta B.V. Heerlen and M. Busch GmbH & Co. KG.

A true success story. HIGHJET®TDI oxygen technologies.

Have you truly realised the full potential of your furnace? With HIGHJET®TDI oxygen technologies, Linde has developed an innovative and eco-friendly solution specifically designed to meet the challenges facing the foundry industry of today. Take the easy way to boost productivity, ensure quality, reduce emissions and save costs. Use HIGHJET®TDI oxygen technologies.

With an optimised design and exactly measured blast and oxygen flow rates, HIGHJET®TDI provides the best possible oxygen utilisation in the furnace. Its key innovation is the multi-function oxygen injector nozzle. Furthermore, it can operate as a blending system for oxygen and combustion wind. Thus, it functions as a versatile boosting tool that allows for the exact adjustment of all significant operating parameters. As HIGHJET®TDI provides higher oxygen content within the blast, the main wind volume can be decreased by approximately 30 %. Consequently, as the wind volume is reduced, the flue gas volume is lowered as well. In addition to creating a potential for higher production and cutting emissions, HIGHJET®TDI is a valuable cost-saving tool. It allows for reduced cost of charged coke as expensive foundry coke can be partially substituted by lower-cost anthracite. As a result of better carburisation inside the cupola process, pig iron can be partly replaced by less expensive charge metals.

Get more out of your furnace. With more O_2.

HIGHJET®TDI oxygen technologies for cupola furnaces are the result of more than 20 years of technical cooperation with the foundry industry. Over 30 HIGHJET®TDI installations in cupola furnaces have demonstrated amazing results.

More flexible operating conditions

- Typical savings of 5–6 €/t of cast iron
- Up to 30 % increase in melt rate
- Up to 30 % lower hot blast air volume
- Up to 20 % coke reduction

Improved metallurgy

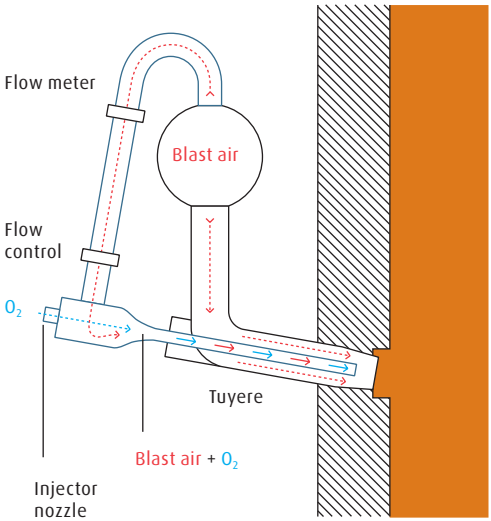
- Higher tapping temperature if desired
- Higher utilisation of steel scrap
- Decreased losses of Si and Mn
- Quicker start-up
- Improved tapping temperature control

Environmental benefits

- Off-gas volume reduced by up to 30 %
- Up to 70 % less dust in the off-gas
- CO/CO_2 emission reduced by up to 30 %
- SO_2 emission reduced by up to 20 %
- Reduction of bad smell around the cupola furnace

How are these benefits achieved?

In their jet nozzles, HIGHJET®TDI oxygen technologies convert pressure to velocity so that additional combustion air is mixed with the oxygen stream. This leads to a fundamental change in the gas flow conditions within the cupola furnace. In the horizontal direction, the velocity increases, but the stack velocity, in the vertical direction, decreases. It positions the main combustion and melting area into the middle of the cupola shaft, with all positive effects. The improvement in heat efficiency can be utilised to achieve a lower coke consumption, an increased production rate and a higher temperature of the tapped iron.



Highly appreciated flexibility. Installation of HIGHJET®TDI oxygen technologies at M. Busch.

The metal processing company M. Busch GmbH & Co. KG, which can look back on a history of 180 years, is located in Bestwig and Meschede-Wehrstapel in Germany. The company manufactures brake discs, brake drums, fly wheels, gear boxes and VB units, and owns a hot-blast cupola furnace with an annual output of approx. 110,000 tonnes of grey iron. Mr Schmidt, chief manager of M. Busch's melting plant, was kind enough to talk with us about how HIGHJET®TDI oxygen technologies improved the performance of the furnace.

Dear Mr Schmidt, M. Busch is a long-time customer of Linde and has so far used Linde's HIGHJET® lancing system for injecting oxygen. Why did you change to HIGHJET®TDI?
Our production lines have been constantly extended over the past few years. With a relatively high melt rate between 20 and 22 t/h, our hot-blast cupola furnace could not meet the new demand. In search of a cost-efficient solution that would increase the performance without constructional changes to the furnace, we came across the promising idea to use a more effective oxygen injection system.

What influenced your decision for HIGHJET®TDI?
Linde supplies us with technical gases and application technologies. Therefore, we were quickly informed about HIGHJET®TDI. However, we did not choose it right away and gathered information from the competitor. Furthermore, we gained knowledge about established oxygen injection processes at conferences and technical committees. Most of all, the possibility to visit reference sites was of great value. All these efforts confirmed our decision to install HIGHJET®TDI oxygen technologies.

What did you expect from the new technologies?
We wanted to increase the melt rate by at least 10 % and expected a high degree of flexibility in the scope of the melt rate. Moreover, we wanted to be able to change the charge make-up and hoped to reduce the environmental impact. Our primary goal was to achieve all these targets with lower production costs.

Has HIGHJET®TDI met these expectations?
Yes, we could increase the melt rate by over 15 %. Thanks to the more effective use of oxygen, we can now react more flexibly to changing requirements and can quickly vary the melt rate. The reduced hot blast air volume and coke rate enabled us to lower the amount of flue gas as well as the production costs.

What experiences did you make after the installation of HIGHJET®TDI oxygen technologies?
Of course, we had to get used to the new process parameters. In the start-up phase, Linde analysed our melting process so that we could see that the system operates successfully. Afterwards, however, we had to learn a lot of things by doing, for instance regarding the iron, as the chemistry requirements change with each new melt rate.

Are you fully satisfied with HIGHJET®TDI?
Yes, we especially appreciate the flexibility offered by HIGHJET®TDI oxygen technologies. The close cooperation with Linde also allows us to continue the optimisation of our melting process.

Major installation results
- 20 % increase of maximum melt rate
- 17 % coke reduction compared to previous system (oxygen lancing)
- 20 % reduction of hot blast air volume
- Lower production costs
- High flexibility (quick change of melt rate)
- Possibility to change the charge make-up
- Reduced emissions (dust, CO_2, SO_2)

Linde services
- Complete HIGHJET®TDI installation
- Oxygen control system including installation
- Technical consulting
- Documentation
- Maintenance and service contract

All targets achieved or exceeded.
Installation of HIGHJET®TDI oxygen technologies at Componenta B.V. Heerlen.

The Heerlen foundry in Hoensbroek, the Netherlands, was established in 1975 and has been part of the Componenta Group since 2004. Componenta B.V. Heerlen casts iron components in two moulding lines, which are served by one common melting shop, core shop and maintenance department. In 2007, the foundry replaced their existing oxygen injection system with HIGHJET®TDI. We have met with Mr Senden, process manager at Componenta B.V., to talk about his experiences with the new technologies.

Dear Mr Senden, you have successfully applied HIGHJET®TDI oxygen technologies for about three years now. What led you to the decision to install the Linde solution?
As we had increased our production capacity, we were in search of an innovative oxygen injection process with a higher performance. Our cupola furnace had reached its limit and could not achieve the required melt rate. At this point, the existing oxygen injection system just could not get more out of the furnace. We therefore applied the simple formula: more oxygen, higher melt rate.

How did you learn about Linde and the HIGHJET®TDI oxygen technologies?
Of course, we first obtained information about all alternative oxygen injection processes available on the market. By chance, an application engineer from Linde was visiting our foundry at that time. He was "just in time", so to speak, to give us information about Linde solutions. We then concentrated our efforts on three processes, i.e. asked around in the industry, visited reference sites and requested service offers. What no one else could offer was the so-called visualisation, a combination of a highly efficient oxygen injection process with an automatic control system for the performance parameters of the cupola furnace. That's what we wanted to have: a reproducible melting process or, in other words, "one way of working".

How was HIGHJET®TDI implemented at your foundry?
At the end of 2006, Linde performed an assessment of the current state of our furnace and calculated the profitability of a HIGHJET®TDI installation. Based on this analysis, Linde and Componenta B.V.

Mr Senden, process manager at Componenta B.V.

agreed upon the main targets. Moreover, Linde supported us during the start-up phase and gave us the chance to express our own ideas about the visualisation.

Has the installation of HIGHJET®TDI interfered with your production process?
No, the technologies were installed during a downtime of our furnace. The entire retrofitting of the furnace was carried out within a week.

What impressed you most about HIGHJET®TDI?
All targets have been achieved or exceeded. The visualisation, however, impressed me the most. Today, we only have to enter the melt rate and the oxygen volume, blast air volume and timing of the oxygen lances are automatically controlled. Operation no longer depends on the worker at the furnace alone. Theoretically, the cupola furnace could now be controlled from the office. This is also a great relief to our personnel.

Would you choose HIGHJET®TDI again?
Yes, we got exactly what we asked for and the investment has definitely paid off.

Major installation results
- → 20 % increase of maximum melt rate
- → 10 % coke reduction
- → 20 % reduction of hot blast air volume
- → 20 % lower off-gas volume
- → Oxygen demand increased by 20 %
- → High tapping temperature right at start-up or after downtimes
- → Economic operation at minimum and maximum melt rate

Linde services
- → Complete HIGHJET®TDI installation
- → Oxygen control system including installation
- → Technical consulting
- → Documentation
- → Maintenance and service contract

Getting ahead through innovation.

With its innovative concepts, Linde is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde offers more. We create added value, clearly discernible competitive advantages, and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardised as well as customised solutions. This applies to all industries and all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimisation, and enhanced productivity are part of daily business. However, we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

Linde – ideas become solutions.

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