

## GAS SUPPLY IN STEELMAKING PROCESS

**In steelmaking, blast furnaces convert iron ore into crude iron by the reducing action of carbon at high temperatures. This crude iron or 'pig iron' still contains a lot of carbon and other impurities that need to be removed, partially or totally, by a reaction with oxygen.**

In the basic process pure oxygen is blown from above into the pig iron bath at a certain location using a water-cooled lance. It is important to keep the pig iron melt agitated, for a homogeneous reaction between the blown-in oxygen and carbon from the melt. Inert gases as nitrogen and argon are blown into the melt at the bottom of the converter in which the basic oxygen steelmaking process takes place, to get a well-agitated melt. Especially argon is an expensive gas. As a process dependent control of the gas is important, a company involved in manufacturing of special equipment for the steel industry requested the help of Bronkhorst.



Iron and steel production

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### Application requirements

The iron melt has to be in movement continuously, so there has to be sufficient supply of argon. On the other hand, as argon is expensive, the supply has to be limited and well-controlled. Furthermore, as the pressure in the converter is varying, the gas supply control equipment has to be able to compensate for that.

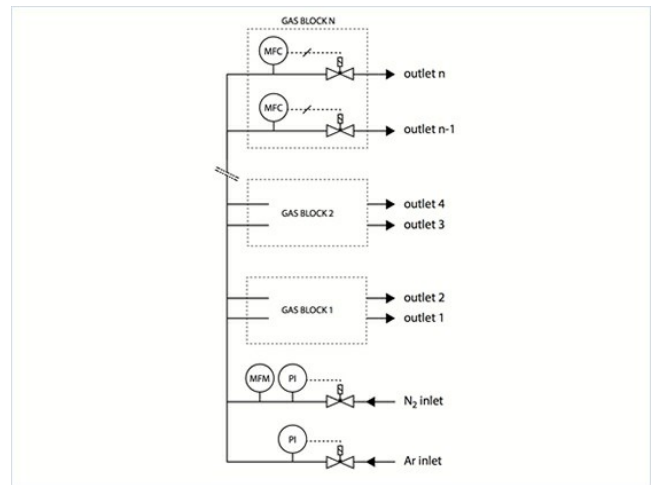
### Important topics

- Accurate control of argon gas supply
  - Compensating for varying back pressure
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## Process solution

The inert gas supply system of the customer consists of two gas supply lines, one for argon and one for nitrogen. Bronkhorst delivered the thermal mass flow controllers (of the [EL-FLOW series](#)) and their valves; the control unit, the enclosure, the gas lines and the shut-off valves are arranged by the customer. For an optimum agitation of the iron melt, there is a considerable number of inlets in the converter bottom where the inert gas can enter, via porous or gas-channel-containing stone bricks. Each inert gas supply system usually contains between 6 and 14 mass flow controllers. During testing, PID settings were optimised for this process to handle the varying back-pressure in the converter, and to stop the system from oscillating.

Due to extreme process requirements, system pressures of more than 16 bars at maximum flows of 1600 liters per minute have to be dealt with. Only a few manufacturers can fulfil these requirements, and that's why Bronkhorst has been chosen as supplier. Furthermore, compactness of the mass flow controllers was an advantage as there was not much space for the inert gas supply system. If had been chosen for gas supply control equipment of other manufacturers, then a further modification of the system would be required, which would have made the solution much more expensive.



Flow Scheme

## Recommended Products



EL-FLOW SELECT F-200CV

Min. flow 0,014...0,7 mln/min  
Max. flow 0,18...9 mln/min  
Drukklasse PN64  
Compact design  
Hoge nauwkeurigheid en herhaalbaarheid



IN-FLOW F-110CI

Min. flow 0,014...0,7 mln/min  
Max. flow 0,06...9 mln/min  
Drukklasse 100 bar  
Compact IP65-ontwerp  
Hoge nauwkeurigheid



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