



Using Cooled Mirror Hygrometers to optimize Cold & Hot Blast Furnace processes

Application Background

The purpose of a blast furnace is to chemically reduce and physically convert iron oxides into liquid iron. The blast furnace is a huge, steel stack lined with brick. Iron ore, coke and limestone are dumped into the top, and preheated "hot blast" air is blown into the bottom. The raw materials gradually descend to the bottom of the furnace where they become the final products of liquid slag and liquid iron. These liquid products are drained from the furnace at regular intervals. The hot air that was blown into the bottom of the furnace ascends to the top in 6 to 8 seconds after going through numerous chemical reactions.

These hot gases exit the top of the blast furnace and proceed through gas cleaning equipment where particulate matter is removed from the gas and the gas is cooled. This gas has a considerable energy value so it is burned as a fuel in the "hot blast stoves" which are used to preheat the air entering the blast furnace to become "hot blast". Any of the gas not burned in the stoves is sent to the boiler house and is used to generate steam which turns a turbo blower that generates the compressed air known as "cold blast" that comes to the stoves.

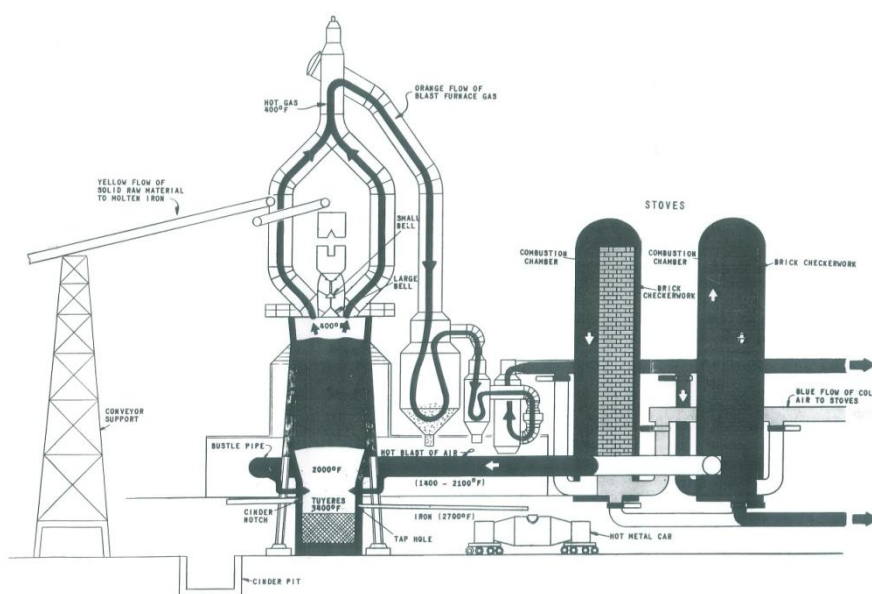


Cold Blast, Hot blast & Stoves

Why is Moisture Critical?

This process can be optimized by proper control of the flame temperature, which is in turn affected by the moisture content of the blast air. Monitoring and controlling this will improve the combustion and production efficiency of the furnace. The savings incurred by the reduction of the amount of coke required can add up to millions of dollars.

In addition to this, uncontrolled excessive moisture ingress can result in serious damage to a furnace, which can cost huge amounts to repair and also will result in extended downtime, which will cost a great deal in lost production.



Typical Blast Furnace Layout



Measurement Technique

Measurements can be carried out with most Michell Cooled mirror instruments; the Optidew is ideal for this application. Measurements are commonly taken at three points in the process: Firstly the ambient dew point feeding the power house turbo inlets. The gas is then injected into the cold blast (where it is heated to 176°C) prior to the stoves where the second measurement is taken, followed by further heating in the hot blast (1200°C), where the final measurement is taken before the gas is injected into the furnace to control the flame temperature.

It is important to install the sensors in sampling systems to regulate flow, particularly in the case of the hot blast point, where the sampling system must also include a heat exchanger, to reduce the sample heat from 1200°C to a more acceptable level for the sensor (>90°C).



Power house

Reference Users

Arcelor Mittal, Corus Steel, Hoogovens



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