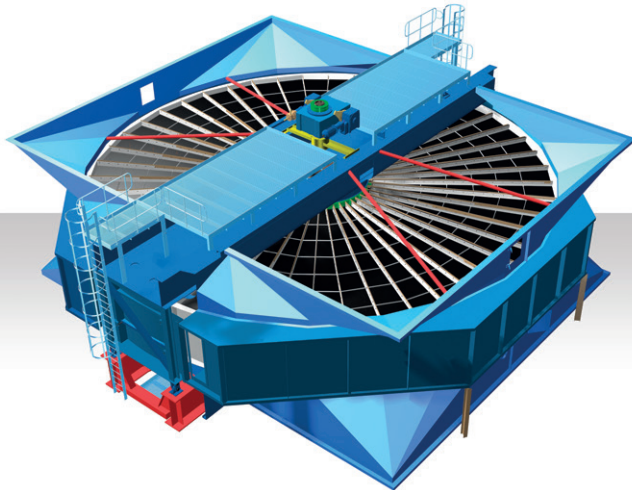


Case study

Rotary Gas Gas Heaters

For applications on coke plants



Design and supply of high performance rotary Gas Gas Heaters for operation on coke plant, coal charging gas DeSOx application.

Introduction

Cangzhou Zhongtie steel plant is a large-scale comprehensive iron & steel enterprise integrating coking, iron-making and steelrolling. The GGH application was within the coke production.

The challenge

Coking is a process in which coal is heated to above 1000°C in the absence of air to produce coke, an essential ingredient for smelting iron in a blast furnace. So far, there is no alternative to coke in large-scale steelmaking and the challenge was to remove the sulphurous emissions within the flue gas from slot type coke oven batteries, see **Figure 1**. The coking process has inherent emissions, the only solution is to remove the resulting emissions before they are released into the atmosphere.

This was a novel application for a rotary Gas Gas Heater (GGH). The unusual part of this process was the intermittent release of flue gas for only 3 minutes in every 10 as shown in the Process Flow Diagram in **Figure 2**. This is a result of each individual slot oven having the coke, which it has produced, being pushed out from the side door and then being re-charged with coal from the top.

The flue gases are drawn out under suction to avoid direct emissions whilst charging and are then treated in a dry Flue Gas Desulphurisation (FGD) with sodium bicarbonate, (NaHCO_3) to remove SO_x before going to the chimney. Similarly to sinter plant NO_x reduction systems, the GGH is used to minimise the required gas burn heat input in the DeSOx process.

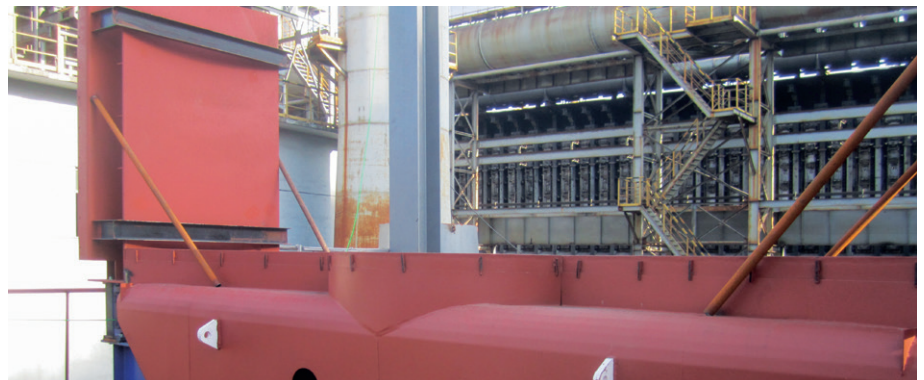


Figure 1: Slot type coke oven batteries with GGH under construction.

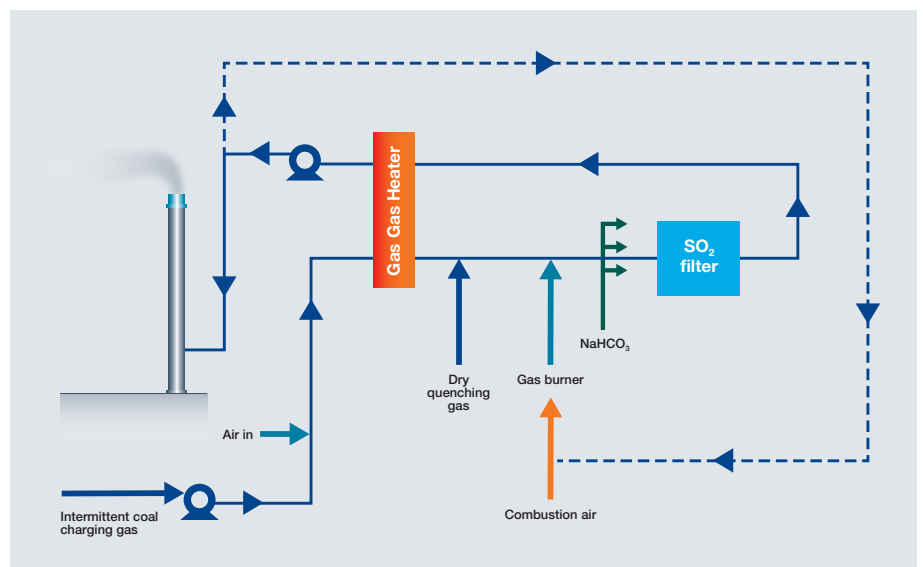


Figure 2: Process flow diagram.

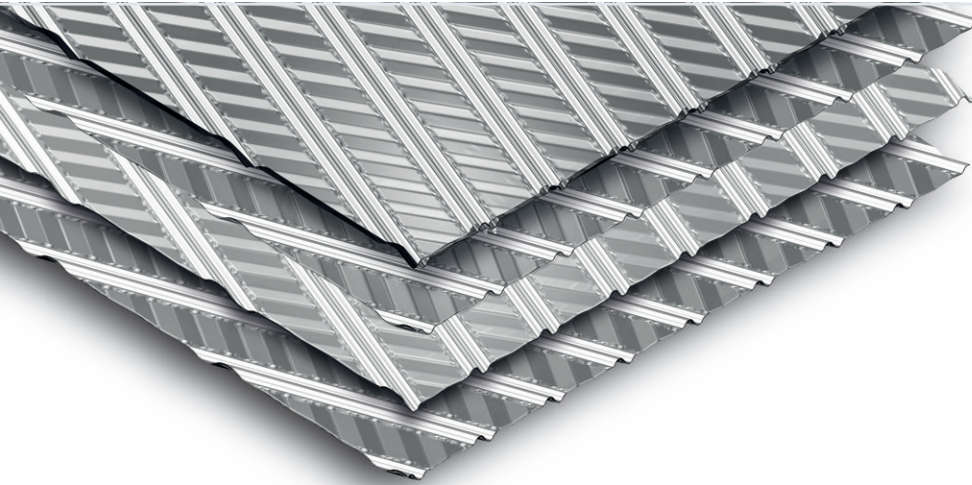


Figure 3: NCU elements.

For further information about
Howden air & gas handling
products and services for the
global iron & steel industry:
www.howden.com

Our solution

Howden collaborated and worked with the client, ACRE Coking & Refractory Engineering Consulting Corporation, to overcome the intermittent untreated gas supply to the heater by recirculating some flue gas and also inducing air and dry quenching gas before and after the heater. The order was placed in July 2018 and by November 2018 the two prototype heaters, (22GVN1500) had been custom designed by Howden and were being installed at the Cangzhou Zhongtie steel plant in China.

The two running coal gas charging GGHS are fitted with the newly developed clean application Notched-Crossed-Undulated (NCU) elements, see **Figure 3**. NCU elements, which are an extension of our earlier range of Flat-Notched-Crossed elements, produce an optimum combination of thermal performance and pressure drop characteristics. The resultant significant reduction in element surface and weight produces smaller, lighter and more cost-effective heaters.

Thermal performance and pressure drop are as-design predictions and no fouling problems have occurred. Since their launch in February 2018, NCU elements are installed, in over 165 new GGHS, in the steel industry, globally.

The outcome

Completion of the entire system, hot commissioning and successful operation of the first two coal gas charging heaters was achieved in October 2019, see **Figure 4**. The end user was very happy with the system's operation and the GGHS performance and repeat orders have followed from this client for other coke oven batteries at this site and another coke plant.

As international legislation increasingly requires all industrial processes to stringently control gaseous pollutants such as SO_x, NO_x and fine particulates (PM_{2.5}) to lower levels than previously specified, the international market for these systems for SO_x removal will inevitably continue to expand in the future

The use of rotary SCR GGHS for heat recovery plays a vital part in maximising the thermal efficiency of these DeSO_x systems and minimising the necessary support fuel burn required.

Each application is considered and custom designed according to its individual requirements, with Howden being able to draw upon an increasingly unparalleled amount of process application experience.

As the clear global leader in this application of GGHS technology for FGD and SCR systems and with a long-term presence in most of these industries with the supply of fans and compressors, Howden can be considered to be the supplier of choice for such equipment.



Figure 4: Coal gas charging GGHS operating.