Case study

Sarnia Refinery, Canada

Custom designed to fit into existing mechanical interfaces, a new Howden regenerative air heater brings increased efficiency and performance to a major petrochemical processing plant.

When a 30-year old regenerative air heater installed on a fired heater in one of Canada's principal oil refineries was in need of replacement, the plant operators required an experienced engineering company who could do the work with the minimum change to the existing infrastructure and as little disruption and lost time as possible.

The challenge

Operated by Imperial Oil, the Sarnia, Ontario manufacturing site began operating in 1897 and today is part of the most integrated petrochemicals manufacturing and research facility in Canada. The Sarnia Chemical Plant produces a wide range of petrochemical products, including polyethylene, solvents, higher olefins, and aromatics using refinery and external feedstocks. These products are subsequently used to manufacture many of the products that people use around the world every day.

In 2011 the plant personnel decided that one of its rotary regenerative air heaters, installed in 1983, was in very poor condition and should be replaced. However, while they wanted to bring performance up to state-of-the-art levels of efficiency and reliability, they also needed to minimise the impact on the rest of the plant and keep the downtime as short as possible.

Figure 1: Peripheral drive configuration

The solution

A thorough dimensional survey of the existing heater was carried out along with an examination of all mechanical details and operating duties. A new custom engineered horizontal heater was precisely designed to suit the mechanical interfaces, including the duct flanges and base support plates.

While Howden rotary air heaters normally have a central drive, for Sarnia we fitted a peripheral drive to match the original configuration (Figure 1).

The air heater was pre-assembled in our factory and transported securely shrink-wrapped, at the request of the customer, to prevent damage in transit (Figure 2). Once on site, the installation work was a straightforward two-phase project. Firstly, the baskets and rotor seals were installed in the air heater, then the complete unit was installed and coupled up to the existing foundations and ductwork (Figure 3).

Internally, however, the air heater drew on many of our state-of-the-art innovations. For example, we used our specially-designed simulation software to model the operating conditions in the refinery and recommend the ideal heater element profiles for the thermal and pressure drop required. In the hot and intermediate layers we used HS20 elements, to give maximum efficiency in the gas-burning system, and we installed HC Element™ in the cold layer for their exceptional cleanability.

Within a few months of Howden replacing the unit, the plant personnel evaluated the new air heater very positively, reporting significant improvements in furnace operation and the performance of both the forced draft fan and the induced draft fan.

Howden has been at the forefront of rotary regenerative air heater technology for over 90 years. Our unique element profiles and coatings, SurePack Elements™, Enerjet™ cleaning systems and choice of sealing systems enable us to engineer the most efficient, reliable and long running air heaters available today.

Figure 2: The air preheater unit shrink-wrapped and ready for transit

Figure 3: Installing the fully assembled unit

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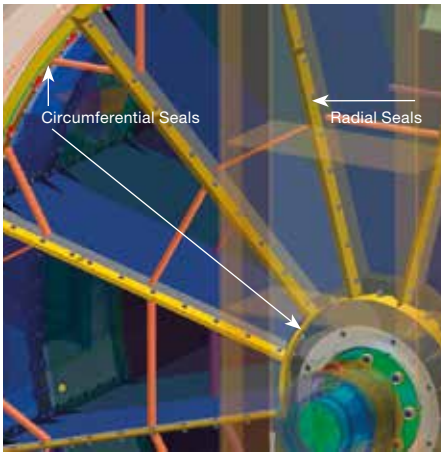

Figure 4: Radial and circumferential seal arrangements

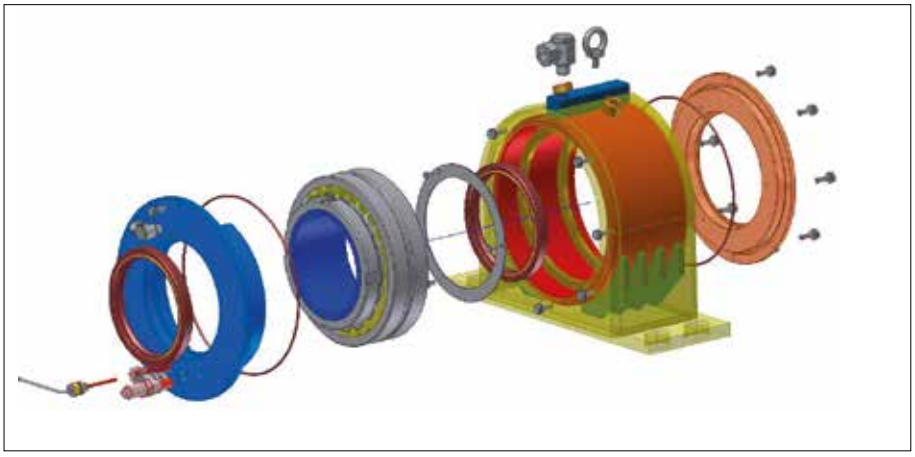

Figure 5: Exploded diagram of the bearing housing

Sealing systems

Howden's sealing systems, the product of long experience and proven over decades of industrial use, are highly effective and efficient. The system we installed at Sarnia consists of radial and circumferential seals (Figure 4), although where appropriate we can also install axial seals. Our seals are available in single or double sealing configurations, and designed as replaceable consumables easily changed on site so that extremely low leakage levels can be maintained over the lifetime of the air heater.

Bearings

We use only high-quality bearings from the most respected manufacturers. The bearings are housed in an oil-bath casing for effective lubrication (Figure 5) and are water cooled with temperature sensors in the housing to ensure cool running.

Fire detection and firefighting

To guard against fire, we place temperature sensors below the sector plate (Figure 6) and install pipe manifolds in the ducts. For fire fighting purposes, all inlet and outlet ducts are fitted with spray nozzles whose spray patterns cover the exposed heating surfaces in both the hot and cold end side of the air heater. These fire detection sensors and associated fire fighting capability devices provide fire protection capabilities that meet the requirements of NFPA 850.

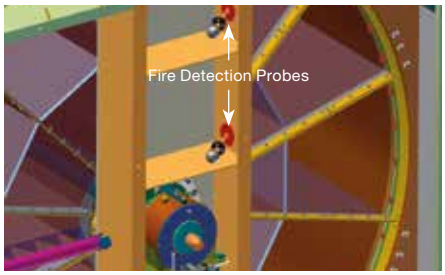

Figure 6: Location of fire detection sensors

Effective cleaning

The unit we installed at Sarnia did not require a sootblowing system because the risk of fouling was small, but we included a washing system to facilitate the cleaning of the heating elements during scheduled maintenance. This is a standard fitting on all of our air preheaters.

For situations where the level of fouling and plugging is more acute, however, we have developed the Enerjet™ cleaning system.

By redesigning the nozzle and delivery systems, and precisely controlling the volumes and pressures, we have eliminated the problems traditionally associated with water-based cleaning systems. Enerjet™ is designed for use while the unit is on line, giving safe, efficient cleaning while the unit is working normally and removing the fouling and plugging problems that can limit load generation or even halt operation.