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Howden
A Chart Industries Company

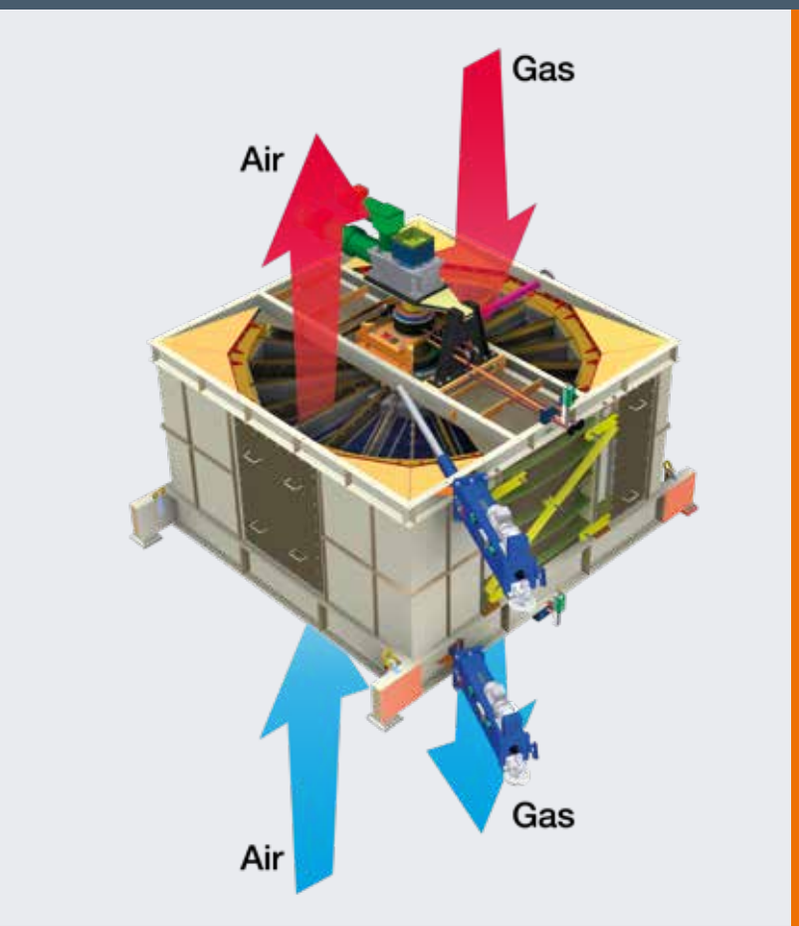
Pre-engineered Air Preheaters & Gas Heaters

Maximising energy recovery throughout production and environmental processes

Revolving Around You™

Compact air and gas heaters delivering high efficiency with low maintenance

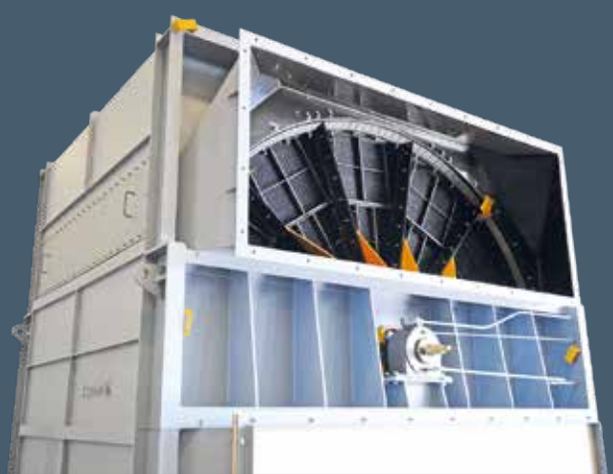
Howden, a Chart Industries company, is a world leading manufacturer of air and gas handling equipment with over 160 years of experience. Our heaters are based on the original rotating regenerative heater design developed in collaboration with the inventor in 1923. Since then the design has been continually enhanced to reach our industry leading levels of thermal efficiency and performance enabling our customers' vital processes. This underlines Howden's vision of supporting the world's industries with sustainable solutions.



The principle of regenerative heaters

Regenerative heaters work by removing heat from flue gases and using this recovered energy to preheat air going into combustion process.

This significantly increases the energy efficiency of the process, avoids heat lost to the atmosphere and reduces environmental impact by lowering CO_2 emissions. The same principle is at work when used as a gas/gas heater, with the heat of flue gas being raised to achieve maximum efficiency and reduce alternative heating requirements.



Our advantage

High thermal efficiency maximising **recovered energy and cost savings**

Compact design benefitting installation requirements

Heat transfer **not affected by fouling enabling performance** to be maintained even when using ‘dirty’ fuels

Very low rotational speed requiring **limited maintenance**

Lower CO_2 emissions **reducing carbon footprint and related costs**

Global service support minimising downtime and ensuring reliable long-term performance

Why Howden?

Howden products are designed to achieve maximum efficiency and long reliable operational life through our focus on engineering excellence. This has been established and enhanced across a large base of air preheaters and gas/gas heaters installed globally.

Our manufacturing facilities maintain the highest levels of excellence with modern equipment and strict quality controls accredited to international standards. A comprehensive test capability across our entire range ensures confidence in the performance quality of each unit.

As a leading manufacturer of axial and centrifugal fans we are also able to supply related fans for heater projects simplifying sourcing activities and future maintenance requirements.

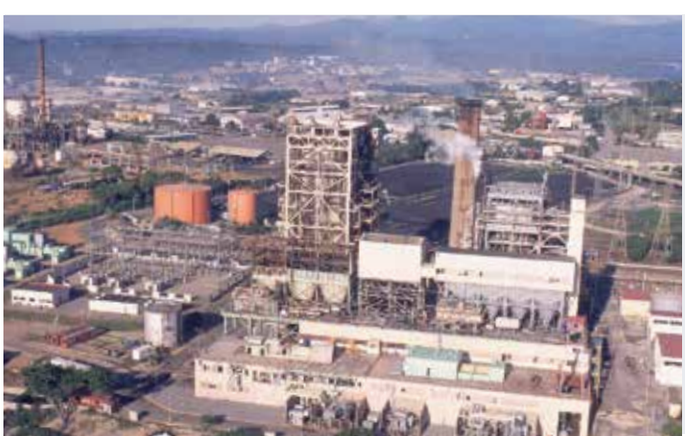
With over 50 manufacturing and service sites globally we have the largest coverage for sales and service. This means we can respond swiftly to our customers’ needs in the project stages as well as through the operational lifetime of equipment.

Fields of application

Fired boilers	Fired heaters/furnaces	Other fired equipment	FGD/SCR Systems
Combustion air preheating	**Combustion air preheating**	**Combustion air preheating**	**Gas reheating**
Typically within:	Typically within:	Typically within:	Typically within:
Refining	Refining (hydrocrackers, distillation, reformers)	Metals	Power (fossil fuelled)
Petro/chemicals	Petrochemicals (crackers, superheaters)	Pulp and paper	Metals
Power - coal/biomass/waste	Metals (blast furnaces)	Chemicals	Chemicals
General Industry		General industry	

Imperial Oil, Sarnia Refinery, Canada

As an integrated refining and petrochemical facility, Sarnia has a number of production critical heaters. The Howden air preheater was provided for a gas cracker and fitted with optimised element profiles for the thermal and pressure drop required based on condition modelling. Significant improvements in furnace operation and the performance of both the forced draft fan and the induced draft fan have been reported.



AES, Itabo Power Plant, Dominican Republic

A two-unit 260MW plant using coal and oil fired boilers. Originally air preheating was carried out using plate heat exchangers, but fouling had resulted in fire risk as well as performance degradation. Howden's regenerative APH delivered significant efficiency gains and safer operation with the added security of a fire detection system.

Cangzhou Zhongtie Steel Plant, China

Driven by the need to control nitrous tail gas emissions from their coal based process, the plant installed 2 Howden heaters in their Tail Gas SCR system as gas/gas heaters. The GGHs are critical equipment within the process system and enable the recovery of waste heat, giving the most economic fuel consumption to meet the process reaction temperature requirements. Howden's proprietary NCU components are used to maximise heat exchange efficiency, contributing to reduced initial investment costs and lower routine operational expenses.

Heater design optimised for performance and long term costs

The regenerative design provides high thermal efficiency, which maximises the amount of recovered energy back to the process.

High thermal efficiency | Low CO_2 | Resistant to fouling | Low maintenance

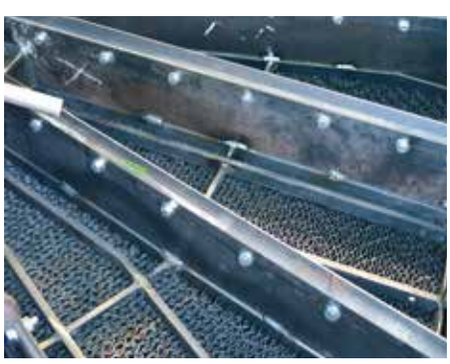
This ensures long term cost savings based on reduced fuel and fan power requirements (particularly against recuperative technologies). As a result there are also lower related CO_2 emissions, which promotes more sustainable production as well as minimising environmental taxes. Overall the Howden heaters provide outstanding return on investment and lowest through life costs.

Regenerative heaters are not affected by fouling, which is of particular interest when using 'dirty' fuels such as coal, off gases or pet coke. In addition, an integrated cleaning system is in place to combat fouling.

Together this means that the heater can maintain thermal efficiency and performance despite potential occurrence of fouling.

Pressure drop across the regenerative heater is lower than any other technology for the same efficiency levels. This means power savings and no need to oversize fans based on potential leakage concerns.

Despite being in essence rotating machinery, it requires limited levels of maintenance due to the very low rotational speeds (1-2 RPM). Maintenance can be kept within standard schedules and overall long life-cycles can exceed 40 years.



In many industries, recuperative type heaters are used as well as regenerative.

Howden's design is a strong choice delivering substantial life time value particularly when considered against alternative technologies.

Key decision factor	Driver	Regenerative vs recuperative APH
APH efficiency (thermal performance)	Gas outlet temperature	Best in class – Lowest pressure drop and lowest footprint at a given temperature
Fan sizing/consumption	Pressure drop	Best in class – Lowest gas outlet temperature and lowest footprint at a given pressure drop
Space constraints	Unit footprint/volume	Best in class – Lowest gas outlet temperature and pressure drop for a given footprint

The design advantage

Design options enabling the heater to be configured to meet technical and commercial demands

Our expertise in regenerative heater exchange means that we can offer a large range of potential heat transfer profile shapes and suitable materials in a highly cost effective manner.

This allows adjustment according to fuel types and expected fouling and can lead to cost savings and reliability gains over competitive solutions. Layout is adaptable to customer specifications and standards enabling the heater to more easily integrate into the wider system design.

Range of elements

Flexible layout

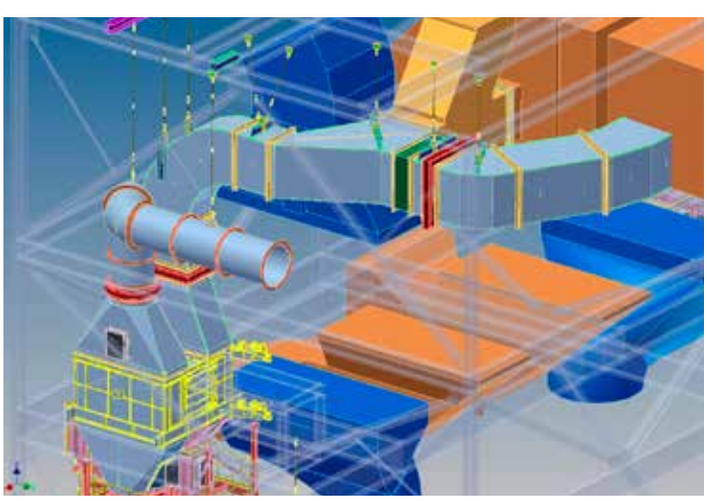
Comprehensive package designed around project specifics

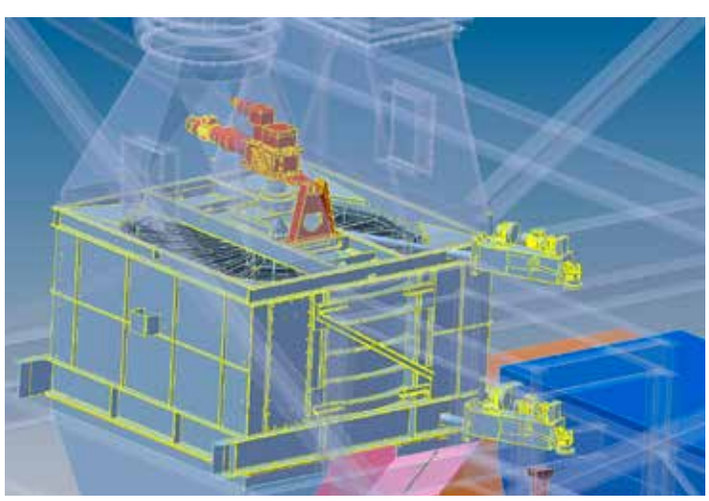
Howden's heaters are pre-engineered based upon 3D parameterised design. This approach reduces lead time for drawings and equipment and means that 3D models and drawings are available to customers at very early stages of the project to assist project engineering and meet project timelines. Modelling supports the design integration of the heater within the full plant model and can provide clearer identification of different design alternatives and ensure an optimised solution with a clearly defined scope of supply.

Howden heaters are very compact being designed to minimise their footprint for easier installation. This can be especially important in constrained sites (whether new or existing) and means less site preparations and costs associated with foundations and steelwork. Being compact, they can be shipped as a single unit or in limited parts, which also contributes to speed of delivery and installation.

Strong project support

Compact design





Adherence to industry specifications

Within most demanding industries standards and specifications are a key aspect.

Howden serves high regulation industries with many products and can comply with all required standards (for example API within the oil andgas industry).

Compliant solutions

Aftermarket: full life service coverage

Howden offers a range of services in support of regenerative heaters as well as replacement of alternative technologies within operational sites.

Howden has a well-established global aftermarket network providing a permanent presence across every continent.

With access to specialist engineers, we can bring quick resolutions to unexpected issues minimising downtime and ensuring reliable long-term performance through expert O&M services. Upgrades required due to changes in operating duty or environmental legislation can also be met to maximise heater service life.

Site service activities

- Site surveys, inspection and plant evaluation
- Turnkey supply of design, material, site management, site installation
- Preventive maintenance and maintenance advice
- Medium and long-term planned outage management and support for unplanned outages
- Performance upgrades
- Performance and function tests and the relevant problem solution/implementation
- Refurbishments and upgrade of any regenerative heat exchangers to latest technology
- Custom-made replacement spares, upgrade spares for any air and gas movement equipment as well as air preheaters

Howden Uptime

Howden Uptime is also available providing a unique and innovative platform for gathering, interpreting and analysing equipment data.

We have built Uptime on the foundation of our 160 years of OEM experience with air and gas handling equipment, and combined that with partnerships with Microsoft (utilising their Azure platform) and PTC (suppliers of leading IoT solution - ThingWorx).

It offers a radical step forward in managing equipment performance, and is remarkably easy to install and use.

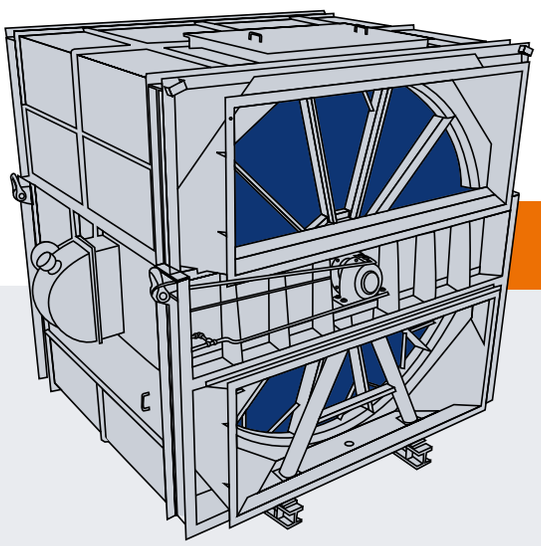
The major benefits of Uptime include:

- A single access point which provides a unified view, anytime and anywhere, of the equipment health
- Direct personal connection with Howden product specialists
- Reduction in operational costs and risks through the implementation of maintenance strategy tools, which also serve to increase understanding of efficient and reliable equipment operation
- Immediate access to the asset auxiliary information (drawings, CAD models, parts lists, equipment manuals).
- Data intelligence and visibility allow proactive and pre-emptive action to be taken to avoid failure
- 24/7 data analysis

Product range

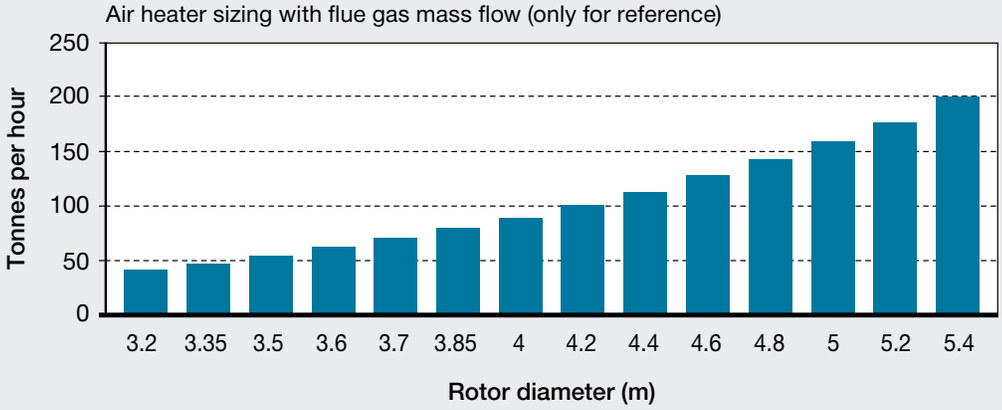
Howden's APH and GGH pre-engineered products can handle flue gas flows of under 50 tonnes per hour to around 200 tonnes per hour.

Recovered energy can extend to over 15MW depending on gas temperature drop.

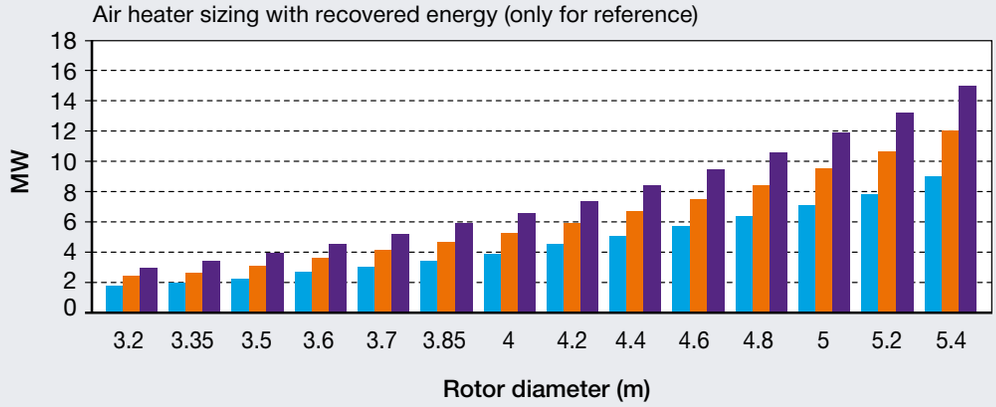


A wide range of heaters to match process demands

Air heater sizing with flue gas mass flow (only for reference)



Air heater sizing with recovered energy (only for reference)



Gas temperature drop 150˚C

Gas temperature drop 200˚C

Gas temperature drop 250˚C

Notes: Flow and MW recovered are based on normal operating conditions.

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At the heart of your operations

Howden people live to improve our products and services and for over 160 years our world has revolved around our customers. This dedication means our air and gas handling equipment adds maximum value to your operations. We have innovation in our hearts and every day we focus on providing you with the best solutions for your vital operations.

Howden

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