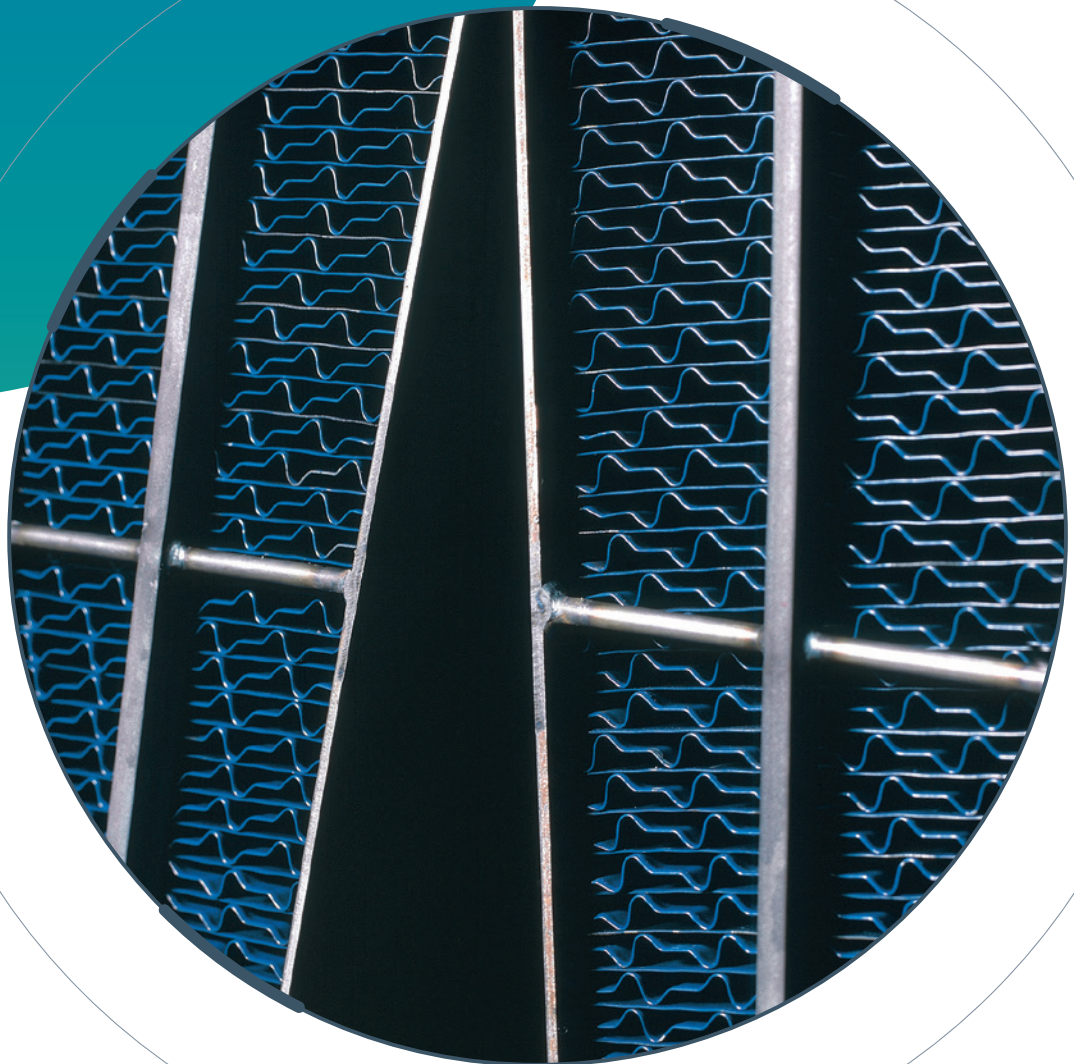


Heater Element Solutions

Delivering outstanding air preheater and gas heater performance optimised to specific operating conditions



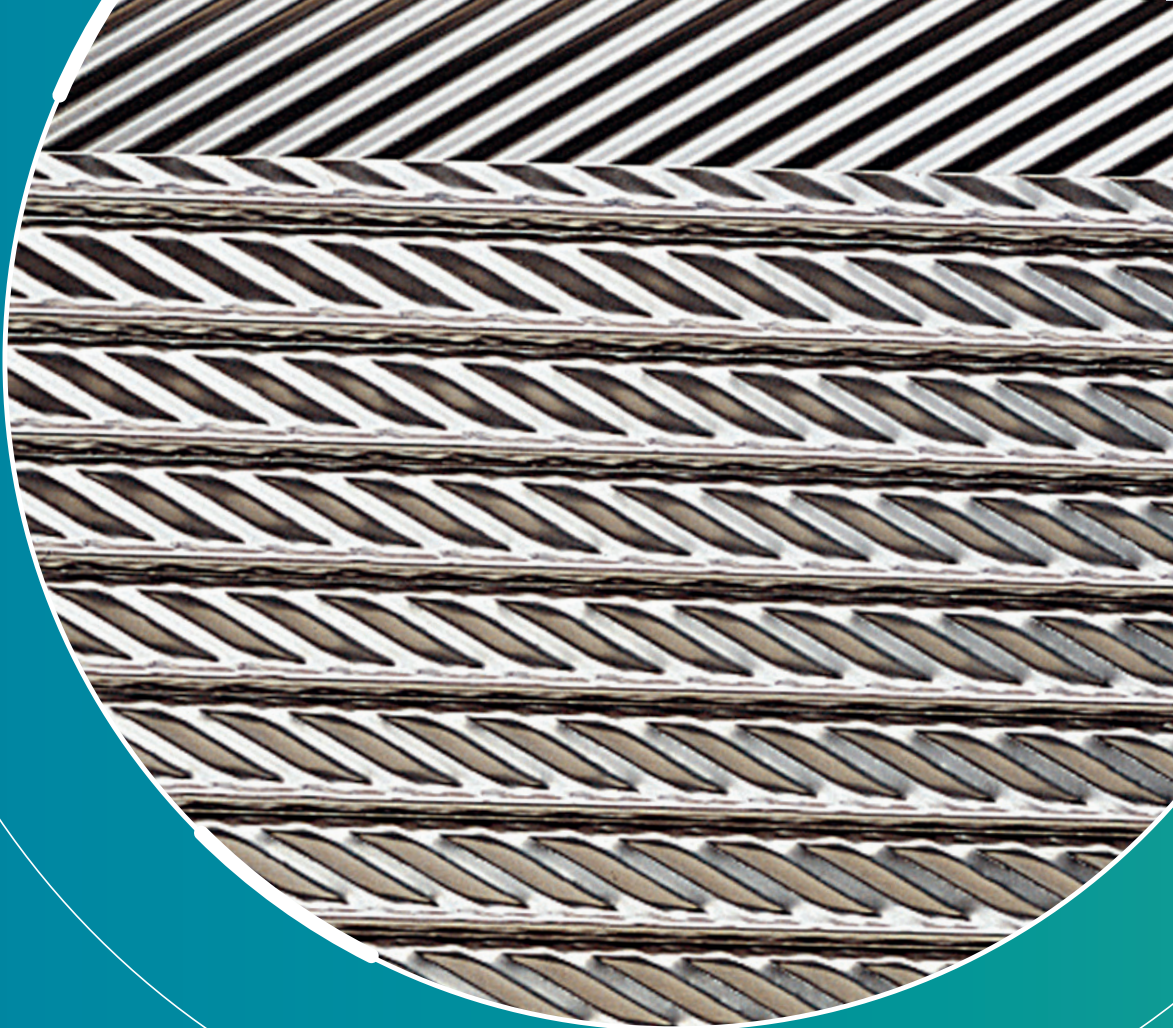
Howden's rotary heat exchangers, have been developing for over 100 years, since The Howden Ljungström Company Ltd was formed, with the inventor, Fredrik Ljungström.

Howden rotary heaters lead the way for high efficiency process heat transfer in boiler and fired equipment applications, and environmental control systems.

A key contributor to efficient performance is the range of highly developed heating elements providing the heat transfer through absorbing heat energy from the process stream and returning it to the process.

Howden has a commitment to continual research and development. Over 100 years of experience in rotary heater technology and thousands of installations have enabled great advances in material selection, coatings and element profile design; all of which results in an unmatched series of elements to meet the needs of any operating environment.





Meeting the needs of process operators

Process users may place an emphasis on availability or performance, or wish to improve both.

Across these processes the elements are subject to extreme attack from fouling and corrosion particularly those in gas-gas heaters for flue gas desulphurisation applications and on boilers firing high sulphur fuels, oil or coal.

Heater fouling and plugging leads to increased draught fan pressure drops and resultant fan power. In extreme cases the build-up of contaminants can lead to lost availability through unplanned outages and serious financial consequences.

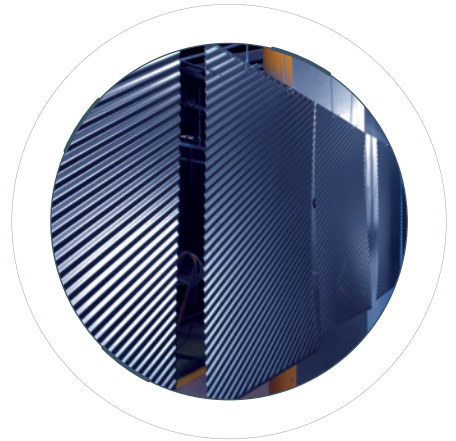
Howden's custom designed performance selection program allows us to simulate the

performance of any type of rotary regenerative heater under changing operating conditions. Skilful use of this program by experienced engineers allows us to balance performance, pressure drop and ease of cleaning to recommend the optimum element selection for present or future operating conditions.

New heaters	Operational heaters	
The latest element combinations and cleaning technology applied within the context of a whole heater.	Enhanced element upgrades to target performance improvements or meet new conditions.	Enhanced element upgrades and cleaning system targeting higher availability.

Applied application knowledge for optimised performance

Keeping maximum efficiency requires an in-depth knowledge of how the heater will perform over time with each particular fuel type.



Operational Issue	Implication	Design Solution
Fouling Occurs due to the build-up of material (potentially acidic) on the elements and is seen across the tiers depending on the fuel and application.	Increases the pressure drop across the heat exchanger resulting in increased fan output and power costs. Extreme fouling can result in the fans not being able to overcome the pressure drop resulting in de-rating of the boiler, and ultimately lost availability.	Standard elements are designed to retain fouling and acid condensation in cold end elements that are easy to clean. Advanced elements introduce uniform velocities and remove pinch points. This allows better penetration of sootblower jets for more effective cleaning. Enamel coatings also restrict fouling and increase cleanability.
Corrosion Occurs on the element due to the presence of corrosive components in the gas mix.	Reduces the performance of the element and its active lifespan.	Special steel alloy materials or enamel coatings can be used to provide protection. This is applied particularly to the cold end layer, where our selection software calculates an optimised material thickness balancing cost against target temperature.
Skew flow Where the element profile angles the air/gas flow through the pack. Also distorts the path cleaning steam/water takes through the elements.	- Can reduce the efficiency of heat transfer and lead to build up of fouling in cold corners of the container. - Can increase the turbulence and related pressure drop.	Standard elements use individual, physically closed channels to constrain flow and promote sootblower penetration.
Pressure drop A large pressure drop across the elements places an increased demand on the fans.	- Fans may reach the top of their operating level and air supply may need to be reduced to avoid damage. - Oversized fans may be specified to handle the larger pressure drop to allow for higher thermal performance.	Careful selection of element profiles can achieve the required pressure drop in line with existing or target fan output ranges.
Fatigue damage Formation of cracks in the elements caused by the force of repeated excessive steam sootblowing with supersonic jets.	Reduces the performance of the element as surface area is reduced, and its active lifespan.	Highly compressed, well supported element packs with regular form and plentiful contact points are highly resistant to fatigue damage from sootblowing.



Elements are designed to retain fouling and acid condensation in cold end elements that are easy to clean

The Element Range

There are a large number of element profiles available for use in our heaters. The best element for a particular application depends on several factors and requires experience in the selection process to understand which are most important. As the owner of the Rothemühle brand, we are also able to supply profiles of their origin.

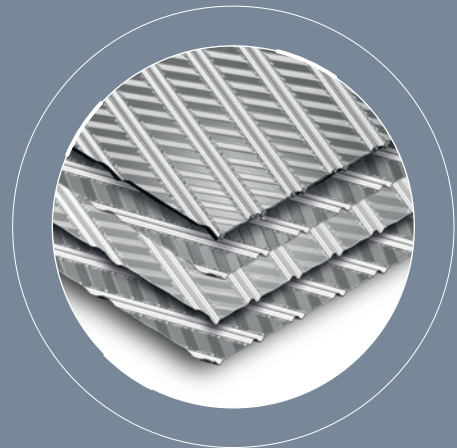
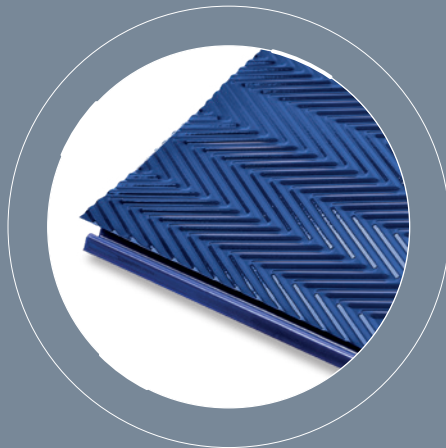
Advanced

HC Element™

Optimised profile design providing superior cleaning and heat transfer

NCU Element

For clean gas applications



Specialist

HCP Element™

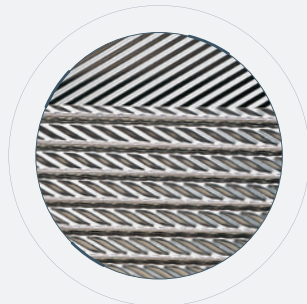
Combination of HC and CP profiles in one element. Particularly suited to severe fouling intermediate tier/cold end applications



Original

50 profiles based on:

Notched Flat NF
Notched Plain NP
Double Undulated DU
Corrugated Undulated CU
Corrugated Plain CP
Flat Notched Crossed





Optimised profile
design providing
superior cleaning and
heat transfer

Advanced profiles offering an unmatched balance between pressure drop and thermal performance

Advanced element profiles

HC Element™

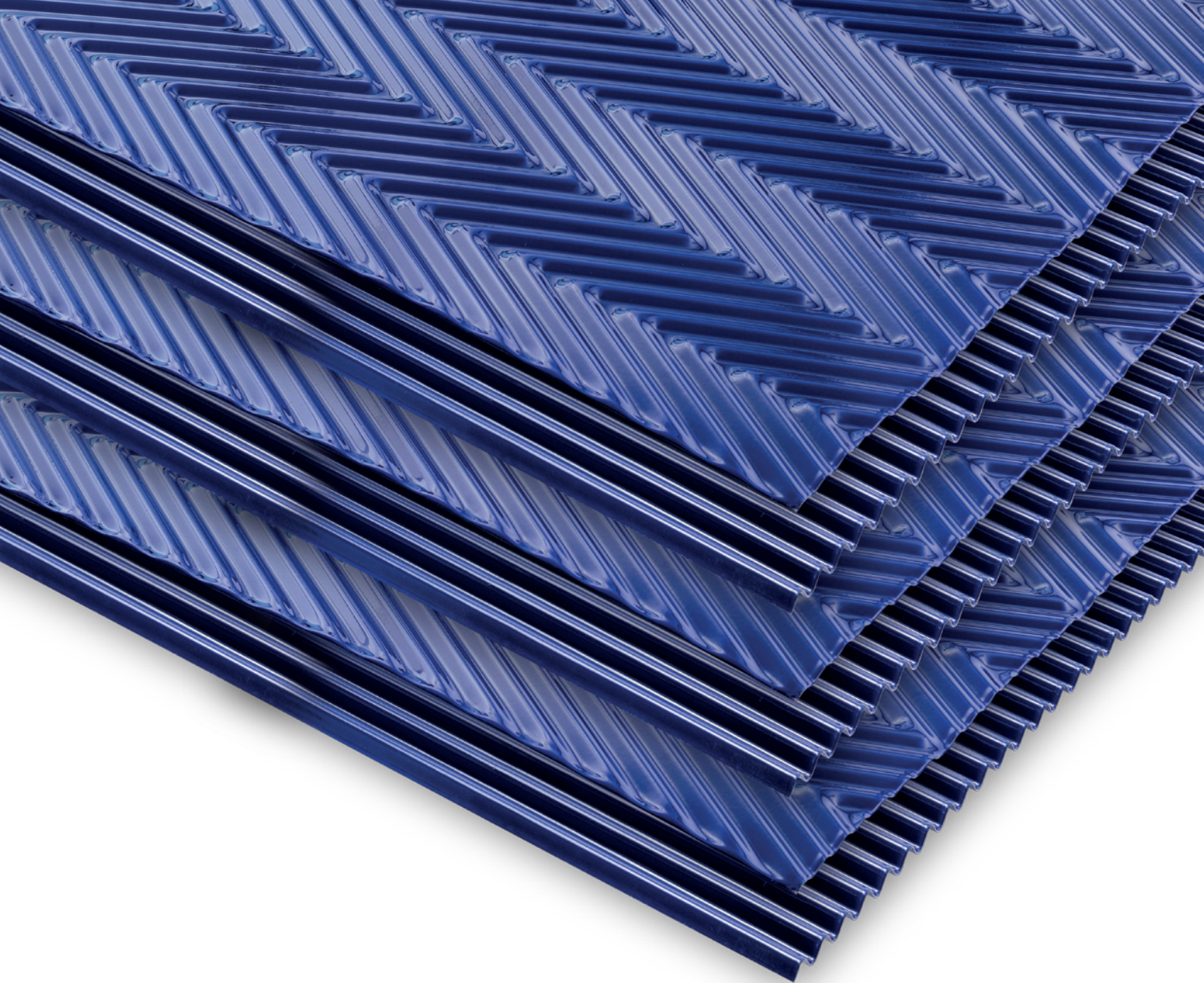
An advanced profile offering an unmatched balance between pressure drop and thermal performance using a corrugated profile with flow channels parallel to the axis of the heater. Proven in over 15 years of active use, it has been expanded with configurations meeting every fuel and performance requirement.

Performance	• High thermal performance can result in wider pitched or shallower elements. • The ratio of channel size to the height of the undulations is designed to produce enough turbulence to optimise heat transfer at minimal pressure drop.
Flow optimisation	• A revolutionary transverse herringbone sheet equalises flow across the elements. • Symmetrical design means all flow channels have equal area. • Eliminates cold corner problems and skew flow within each individual channel, optimising performance across the entire profile surface.
Anti-Fouling/Cleanability	• Reduced fouling as a result of uniform velocities and absence of pinch points. • Aerodynamically closed profile that promotes better penetration of soot blower jets. • Enamelled versions have a smooth and vitreous surface that reduces the adhesion of surface deposits and provides a high level of corrosion resistance. • Material specification and element design combine to make online cleaning by high pressure water jets a cost effective and viable solution.
Durability	• Dimensionally consistent allowing a much higher packing pressure for rigid, fatigue resistant packs. • More support points and high compression packing prevents enamel damage and maximises element life.

NCU Element™

The Notched-Crossed Undulated (NCU) element is specially designed for applications with natural gas firing or where the flue gases have been cleaned such as tail end emission processes. NCU Elements™ provide major heat transfer benefits in clean gas applications resulting in reduced first cost and through life costs.

Performance	• Optimised, reverse-crossed-undulations increase turbulence and thermal performance. • Extremely high thermal performance characteristics, without compromising pressure drop. • Lower pressure drops and draft fan margins are possible due to lighter elements used with no erosion/corrosion risk.
Flow optimisation	• The combined element pair eliminates cold corner problems. • Symmetrical design of element means all flow channels have equal area and no skew flow.
Anti-Fouling/Cleanability	• This element is not intended to be used if there is fouling expected.
Durability	• No fouling and no exposure of elements to corrosion, erosion or sootblower damage results in elements with long-life spans. • Reduced element depth and weight meaning a shallower and lighter overall heater. In turn, this reduces both the support bearing size and the size and cost of the supporting steelwork.



Specialist element profiles

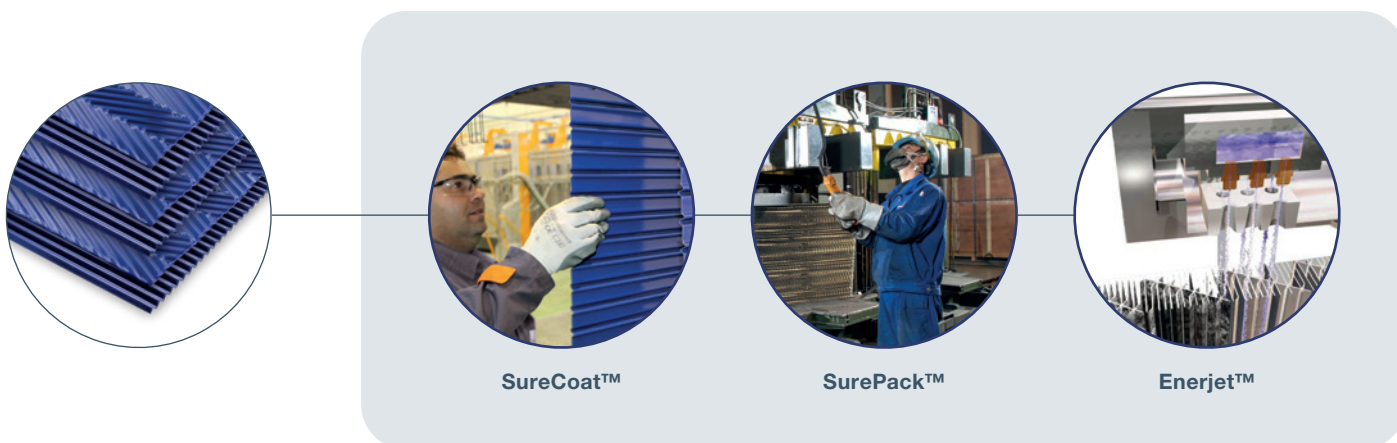
HCP Element™

A specialist element combining the benefits of cold end and intermediate elements in a single profile, while enhancing cleanability and efficiency. Suitable for air preheaters and gas-gas heaters.

Performance	• Excellent heat transfer characteristics. • Improved energy efficiency by operating at a reduced pressure drop and lowering fan demand.
Flow optimisation	• The HC and CP profiles are combined into one deep element, with the extent of each section optimised for flow by reducing dispersion.
Anti-Fouling/Cleanability	• Cleaning force penetrates deeper into the elements, making the cleaning process far more effective and the heat transfer process more efficient. • Enamelled versions have a smooth and vitreous surface that reduces the adhesion of surface deposits and provides a high level of corrosion resistance.
Durability	• Longer element life through more effective cleaning and enamelling (when selected).

A holistic approach for reliable optimised heater performance

Elements play a critical role in heater performance, but by taking a systematic view of the science of the contamination and cleaning cycle, we have evolved an integrated system that delivers far more than the sum of its parts.



SureCoat™

Our SureCoat™ enamelling process, developed through years of intensive research and development, allows us to enamel mild steel or Low Alloy Corrosion Resistant Steel (LACR) aimed at APH cold end enamelled elements. For FGD GGHs Decarburized Steels combined with the highest corrosion resistant GGH enamel is used, exceeding all requirements of EN ISO 28763:2019. This brings huge advancements in durability and cleanability, especially for cold end use, or where there is a high exposure to corrosive gases.

Key benefits	
Performance	• The smooth surface of enamel reduces adherence of fouling to maximise heat transfer. • Reduced pressure drop over the heater due to fouling reduces demands on FD and ID fans.
Durability	• Enamelled steels enable effective washing or sootblowing with reduced impact on element lifespan. • Greater strength and corrosion resistance increases element life.
Lead Times	• Standard mild steel is more widely available, so shorter lead times are possible.
Maintenance	• Reduced fouling and plugging increases intervals between downtime or outages.

Howden's custom designed performance selection program allows us to simulate the performance of any rotary regenerative air heater with any type of fuel, so we can recommend the best enamel option in each case based on the operating condition.

SurePack™

Howden elements are packed using our SurePack™ system. This uses optimised and automated packing technology to ensure maximum performance and mechanical stability. The SurePack™ system involves the use of computer controlled presses to ensure that the specified packing pressures for all elements are achieved before the basket is welded. This SurePack™ technique is even more critical for enamelled elements to ensure that the optimum 'tight pack' compression is achieved without damage to the enamel and goes beyond conformance with the packing requirements of EN ISO 28763:2019.



Computer controlled presses to ensure that the specified packing pressures for all elements are achieved

Enerjet™

The Howden Enerjet™ is a multi-fluid cleaning system incorporating soot blowing and water washing designed to provide effective and efficient cleaning of heat exchanger elements while the heater is in normal use. The high-pressure water system uses very small quantities of very high intensity water applied from the cold end only of the heater with normal operation at full load.

Key benefits

Performance	- Removes all types of deposits, acid enhanced, ammonium bisulphate, etc. with the cleaned deposits being carried downstream in the high gas mass flow to the electrostatic precipitator or bag filter. - Eliminates problems associated with low pressure water cleaning.
Flexibility	- Fully retractable or semi-retractable options. - Integrated soot blowing and washing, or standalone HP water washing. - Fully designed complete high pressure water delivery system. - Works with almost any element profile or manufacturer.
Payback	Typically repays investment in under one year by preventing the problems that arise when contaminants form deposits on the elements. Avoiding loss of availability and costs of external cleaning company to clean elements offline, more than pays for the system.
Operation	- Reduced service breaks due to comprehensive element cleaning. - Reduced fire risk by preventing dangerous build-up of inflammable contaminants.

Howden

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