

GEA heat exchanger systems for gas/gas applications with HX-Factor

High thermal performance with the compact and efficient REKUGAVO and REKULUVO plate heat exchangers



No less than the optimum

When we develop heat exchanger solutions, we are always thinking one step ahead. And this allows us to offer future-safe results today. With products featuring cost-savings, low energy input, high thermal heat recovery and excellent operational reliability.

Alfred Ernst, GEA engineer

GEA Heat Exchangers: Masters of Efficiency

Heat exchangers for maximum operational reliability and minimum energy input

Success knows no compromises. And this is especially true in industry, where rising costs for energy and materials, stricter safety and environmental protection regulations combined with increased competition throughout the world, call for ever-improved standards regarding efficiency and functionality. And these are standards that can only be achieved quickly, simply and sustainably by high quality. Heat exchangers are the best example of this. Across the world an increasing number of industrial facilities – from chemical plants through power stations and other industrial facilities, from waste incineration units through to refineries – are operated using tailor-made heat recovery systems by GEA. For each application heat exchangers of the correct size, using the most suitable materials, with the right surface patterns, flow configurations and connection possibilities are available. An intelligent modular system that can be matched to individual requirements.



With our warmest recommendations

GEA plate heat exchangers (PHEs) for gas/gas applications are designed with efficiency as priority. In figures: our PHEs are capable of recovering more than 90 % of the input energy. The extremely high operational reliability is an additional benefit; guaranteed by the combined project expertise and process know-how of the GEA engineers, by the high quality of the materials and their processing, coupled with comprehensive project management. GEA supports projects at every stage, from planning, erection and start-up through to service, maintenance and repair.

A level that makes GEA both market leader and technology leader in the heat transfer sector – and we strive to improve this further. At our globally networked manufacturing locations our specialists work on the development of new plate materials and welding technologies, developing thinner plates to offer improved wear resistance, new surface structures for better flow configurations and further improvements to continuously optimize the application stability of GEA products in the future.

GEA plate heat exchanger specialists ...

- ... provide sophisticated solutions combined with reactor housings, channels, steel structures, etc.
- ... support you as early as the project stage with in comprehensive engineering, process know-how and market expertise
- ... supply PHE components perfectly tailored to your overall plant configuration
- ... accompany you from the planning of your heat recovery system through to after-sales service



Fossil-fuel power stations, waste incineration plants

Combustion air preheating using the REKULUVO is especially suited for environmental protection applications aiming at denitrification. The heat exchanger can be installed above or attached to the catalytic converters to save space.

Gigantic performance

Modest space requirements



Experienced GEA engineers accompany you throughout all project stages

Whether in fossil-fuel power stations, in waste incineration and chemical plants, in refineries, steelworks, in wood processing and papermaking, whether in cement works or many other branches of industry: the recuperative GEA REKUGAVO (gas preheater) and REKULUVO (air preheater) heat exchangers are capturing the markets, particularly thanks to the significant technological advantages in comparison with conventional solutions. For example in increased operational reliability: the fully welded passive and static GEA systems, in contrast to conventional regenerative active systems, have no need for bearings or motors because there is no motion at all. This minimizes maintenance and installation expenditure as well as wear.



Chemical plants, refineries

Wide range of applications: Combustion air preheating, denitrification or post-combustion system in the environmental protection sector or cooling of flue gas or product gas.

Other branches of industry

- Steelworks
- Cement
- Wood processing
- Papermaking

Systems for denitrification, gas cooling or heating

Space-saving at every location

Thanks to their no-compromise compact design REKUGAVO and REKULUVO can be perfectly adapted to every process-engineering or space situation. The space-saving design allows fast installation, with short, vertical flow channels to simplify cleaning. Easy handling and considerable potential savings – meaning genuine progress.

At the forefront of heat recovery

Generally speaking, REKUGAVO and REKULUVO are suited for both small and very large flow rates involving air, flue gas or other gases. Both systems demonstrate their strengths in particular as heat recovery units between two gaseous media, e.g. for combustion air preheating, for catalytic denitrification plants in low-dust ranges, thermal gas scrubbing, drying, gas cooling or gas heating. Efficiency rates in excess of 90 % and leak tightness rates of 99.9 % are possible.

Your benefits at a glance

- Low energy input
- Maximum leakage tightness
- Highly compact and space-saving design
- High thermal efficiency
- Modular assembly, resulting in fast installation and optimum adaptation to processing and facility situation
- Easy cleaning thanks to short, vertical flow channels



We ensure perfect connections ...

... using the following welding methods: roller seam welding, spot welding, manual GTAW, partially mechanical GTAW, microplasma, laser welding, FCAW, manual, etc.

Manufacturing quality and production competence

Certified safety you can rely on

By definition welding means "the permanent bonding of components". And this is a claim that does not provide for any exceptions or permit any weaknesses – and why absolute perfection is called for. That "permanent bonding" does not necessarily have to be a permanent problem is demonstrated impressively by our experts in the widest variety of tasks they solve using a wide range of welding methods, always selected to match the specific process demand, but never without a maximum of diligence and experience. Whether roller seam welding, spot welding or laser welding, either manual or partially mechanised GTAW, manual FCAW or microplasma: the art of welding is very diverse at GEA. Performed by highly qualified employees with an extraordinary level of expertise, skill and experience in every area – for example in the welding of housings, vessels and pressure parts. And this know-how is continuously expanded by further training and experience. This is also guaranteed by a consistent quality management system to ensure that both our expertise and our products continue to reliably achieve the highest quality level. On-going personal certifications to DIN EN ISO 9001 guarantee that the processes mentioned above and many others are implemented at the highest level of precision. With an accuracy that means that even X-rays cannot identify any inclusions.

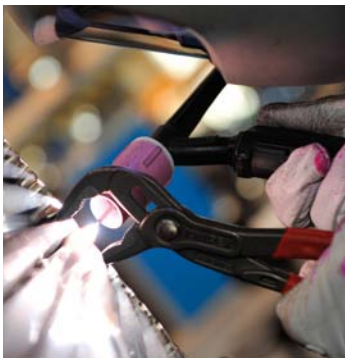
REKULUVO: Manufacture and engineering at the highest level

Manufacturing the REKULUVO plates demands the utmost from the vast know-how and precision of the GEA welding specialists. For example, the REKULUVO cassettes made of plates welded to each other must guarantee a gas tightness of 99.9 %, which of course calls for the highest manufacturing quality. Another example for major challenges is the welding of formed sheets, such as are used for the embossed REKULUVO plates. The objective here is to ensure reliable and permanent operation of the heat exchangers with no-compromise quality. Such superb welding craftsmanship is also to be found in all other GEA manufacturing sectors – maintained and encouraged by a quality management system confirmed by numerous certifications that represents a central pillar of the GEA corporate philosophy.





Fully automatic pressing lines ensure consistent product quality



Highest manufacturing know-how guarantees tight weld seams

Certified safety

- DIN 18800-7
- Eurocode 3
- ASME
- AD-Merkblatt 2000 HPO (complies with Pressure Equipment Directive PED 23/97)
- ASME VIII, I
- ASME U-Stamp, S-Stamp, R-Stamp
- DIN-EN1090-2

REKUGAVO and REKULUVO materials

Quality for ultimate process reliability

Quality through individuality

To ensure efficiency and sustainability in every imaginable operating situation, REKUGAVO and REKULUVO systems are also tailored precisely to their intended application in terms of material selection. Criteria for material selection include temperature, pressure, gas composition and naturally the specific features of both the plant and its environment. This data is used to decide which metallic material should be used: carbon steel or stainless steel, heat-resistant and highly corrosion-resistant steels or nickel-based materials (Hastelloy). Basically only first-class materials from certified European suppliers are used in making REKUGAVO and REKULUVO systems. Material quality, selection and actual manufacturing also meet highest standards. All joints within the modules and in the housing are welded. GEA PHE offers a future-proof combination of material diversity, know-how and quality awareness to guarantee reliable and sustainable fulfilment of even the most stringent demands.



Co-current

Is used to prevent temperature falling below the dew point thanks to:

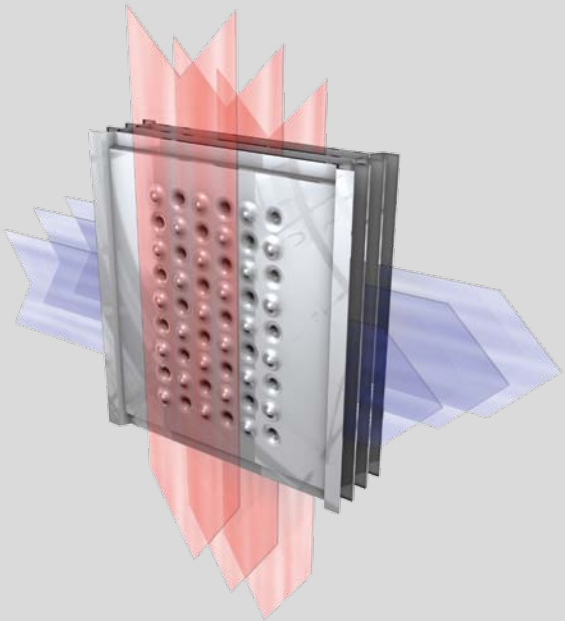
- Highest possible plate temperature
- Equal distribution of plate temperature



Counter-current

Designed for:

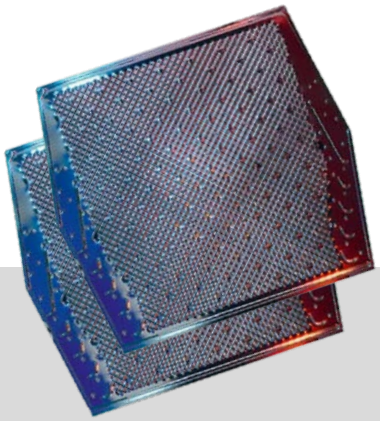
- Pure performance
- Highest thermal efficiency
- Maximum heat recovery of up to over 90 %
- Medium to very large flow rates
- Ultra-compact design



Cross-current

Ideal for:

- Small to medium flow rates
- Very high particle loading on one side
- Low to medium heat recovery rate
- High operating temperatures



Technical data

	Minimum value	Maximum value
Suitable for a volume flow of approx.	5,000 m³/h STP humid	2,500,000 m³/h STP humid
Heat transfer surface approx.	400 m²	300,000 m²
Thermal performance approx.	250 kW	200 MW
Operating pressure	-400 mbar	400 mbar
Difference pressure		400 mbar
Utility space approx.	1.5 m²	500 m²
Overall height total system approx.	1.5 m	20 m
Shipping weight total system approx.	1 t	2,000 t
Transport sizes (width x depth x height) approx.	(1.5 x 1 x 1.5) m	(3.5 x 12 x 4) m
Transport weights approx.	1 t	150 t

STP = Standard Temperature and Pressure conditions (T = 0 °C; p = 1 bar)

Plate materials

	Materials								
DIN	1.0338	1.4301 1.4307	1.4404 1.4401	1.4547	1.4571	1.4539	1.4958	2.4602	1.8965
Alloy UNS		S30400	S31600 S31603	S31254	S31635	N08904	N08810	N06022	ASTM A588 M Grade C
Trade name	DC04	304	316	254SMo	316TI	904L	800H	Hastelloy C22	COR-TEN B
Plate thickness (mm)	0.8, 1.0	0.6, 0.8	0.6, 0.8	0.6, 0.8	0.6, 0.8	0.6, 0.8	0.8, 1.0	0.37 - 0.60	0.8, 1.0
Max. design temp. (°C)	490	650	620	500	620	500	800	450	400

Use of REKULUVO as combustion air preheater

Cutting back on primary energy, but not on performance: the REKULUVO combustion air preheater recovers valuable heat from the waste gas line and feeds it directly back into the system. An efficient, but complex process that GEA makes really easy for clients using comprehensive project management with maximum know-how and commitment.

REKULUVO (recuperative air preheater)

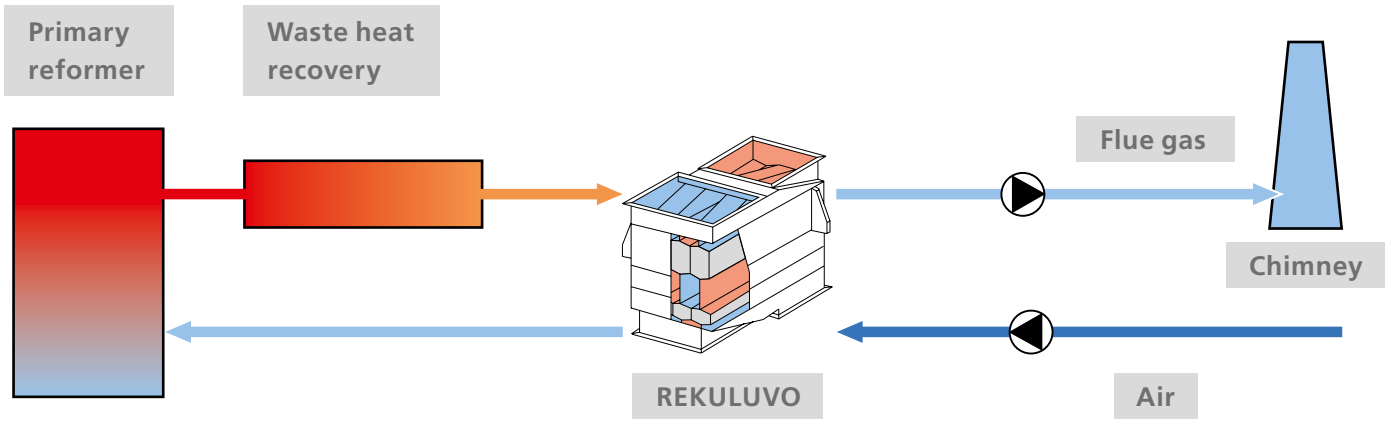
More than just hot air



REKULUVO with reactor and duct in a methanol plant

Energy is becoming synonymous with success. When a company manages to reduce its primary energy consumption, the positive effect on the balance sheet is very evident – as are the benefits to the environment. Heat recovery has proved to be the most effective way of exploiting existing energy in secondary systems and processes, thus minimizing primary energy input. The REKULUVO recuperative air preheater features maximum performance – developed for systems where at least one of the two media is ambient air. In the waste gas line the REKULUVO, using a channel system with integrated shell-and-tube heat exchangers (waste heat recovery duct), transfers the waste gas heat to the combustion air, which is recycled directly to the combustion process.

Supplementary high-pressure flue gas/water heat exchanger



A healthy cycle offering primary energy savings for a wide range of applications: in power stations using fossil fuels (hard coal and lignite, natural gas, oil, waste, wood and industrial gases); in production plants for ammonia, methanol, ethanol or other combustion plants. Depending on the plate geometry selected for the heat transfer surface this heat exchanger model is also suitable for high ash content in the flue gas.

GEA Project Management: Perfect Connections

Heat recovery plants are systems made up of innumerable different components from a range of manufacturers. This complexity requires perfect synchronization of the individual elements. GEA meets this challenge with an engineering and logistical project management to accompany, coordinate and implement every detail and every stage necessary for just-in-time installation of a REKULUVO heat recovery unit. This includes planning, construction and start-up, as well as service, maintenance, repair and competent consulting – also with regard to matters not directly concerning the REKULUVO.

Supplementary channel equipment

- Pipe support plates and end plates
- Headers and socket supports
- Pipe bends and accessories
- Housing and steel structures
- Floor anchor plates
- Internal insulation
- Welding metal for manufacturing and assembly
- Lifting beams and gear



High-pressure flue gas/water heat exchanger

Efficient waste gas cleaning with REKUGAVO

Heat recovery on a large scale: In the Rohrdorf cement factory near the German city of Rosenheim the world's first SCR unit ensures significant reduction in emissions. The heat transfer surface as the central component is the REKUGAVO, welded from five modules to form a single unit.

REKUGAVO (recuperative gas preheater)

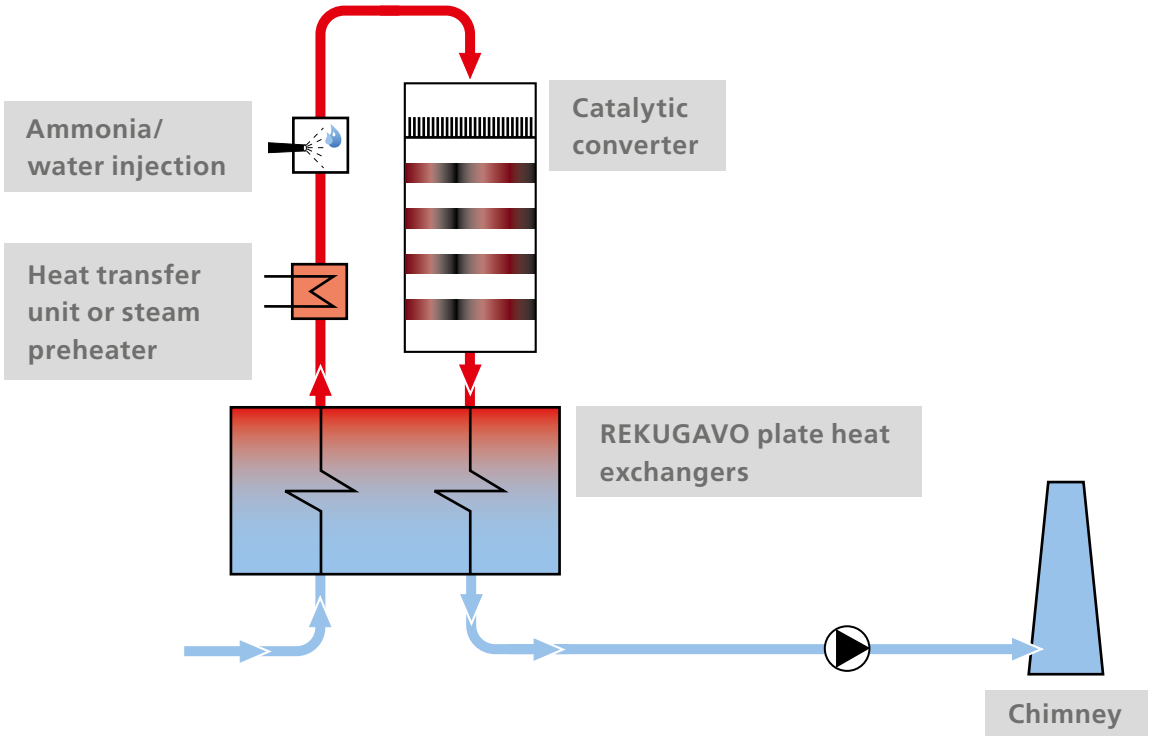
Exemplary efficiency



Proven use in waste incineration plants

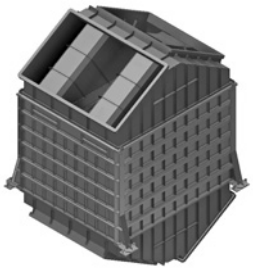
Emission impossible

A fine example of how complex technology can effectively benefit nature and the industry at the same time: The REKUGAVO provides both budgetary and environmental advantages with its astonishing flexibility. Suitable for use wherever both media streams are flue gases or industrial gases, this powerful gas preheater (flow rates of up to 2,500,000 m^3) is used in a wide variety of industrial applications: in power stations, steelworks and cement factories, refineries, in waste incineration, etc. Both the REKUGAVO and the REKUGAVO DeNOx (see pages 14/15) were developed to handle heat recovery in catalytic denitrification and thermal waste gas cleaning.



Practically indispensable

In the meantime this technology has proven its practical value on a large scale. The Rohrdorf cement works in southern Germany – an innovation leader in this industry – features a 450 tonne, fully welded REKUGAVO plate heat exchanger as the central unit in a special flue gas purification plant. In order to install the new equipment without interrupting production and to achieve optimum matching of the system components arranged on top of each other, a new 34-metre high operating tower was erected on an area measuring over 200 square metres on the facilities. This tower accommodates central components such as the REKUGAVO plate heat exchanger, a downstream heat transfer unit, and injection of the reducing agent ammonia (NH_3) and the catalyst. Using selective catalytic reduction (SCR) the nitrogen oxides are converted to nitrogen and water by adding ammonia – with minimum input of primary energy. The major share of energy for this process is recovered from waste heat, with the reliable support of the REKUGAVO. The result is a cut in the annual emissions of around 800 tonnes NOx and 300 tonnes NH_3, which is equivalent to a reduction of 60 % and 95 % respectively. The heat recovery rate is 85 %. These are figures that speak for themselves – and for the efficiency and innovative performance of the REKUGAVO.



Single-stage heat exchanger for flow rates up to 2,500,000 m^3/h



Two-stage heat exchanger for flow rates up to 2,500,000 m^3/h



Space-saving, and still a giant

In the Linz steelworks reference facility of the Voestalpine Group simply everything is XXL. And this includes the process gas denitrification performance in the sintering plant.

REKUGAVO – Compact DeNOx

The powerhouse



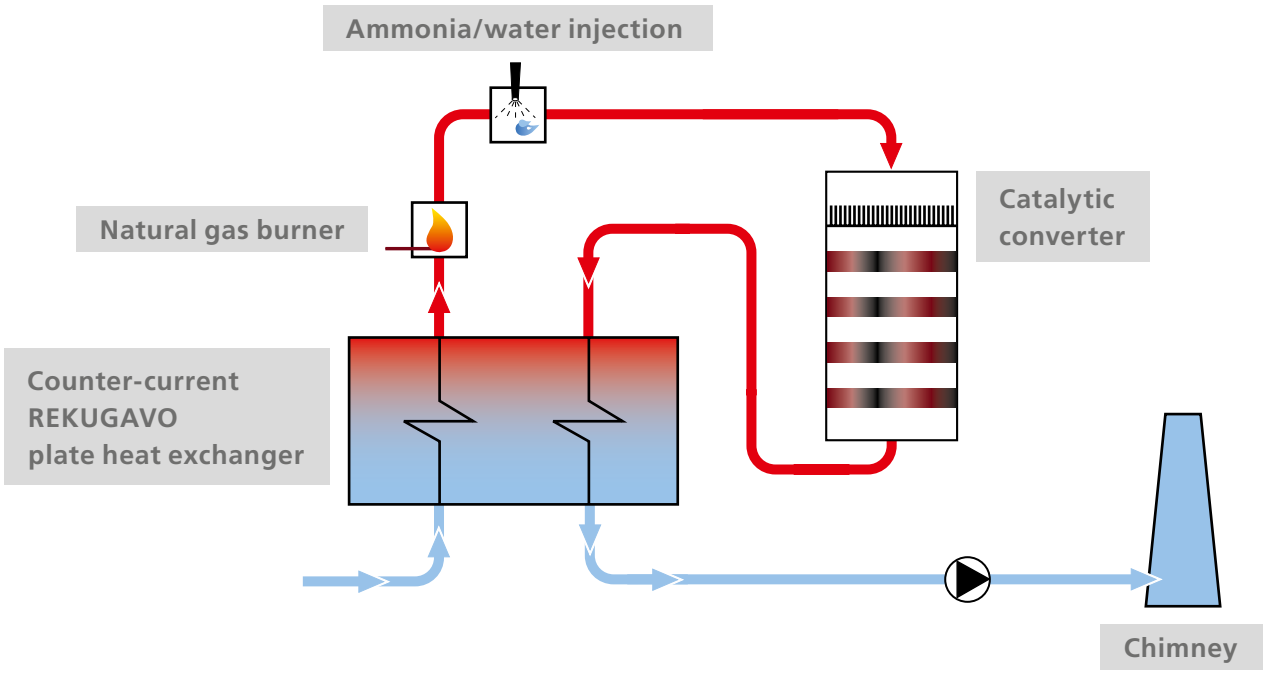
Transport and erection demand maximum commitment and expertise

The REKUGAVO DeNOx, combined with a reactor housing for catalytic denitrification, offers huge benefits on a minimum of space. With its integrated design the system saves space, material and costs, but without making any concessions with regard to performance or safety. The perfect design down to the last detail guarantees maximum tightness. This reliably prevents any contamination of the scrubbed flue gas, caused for example by hot gases penetrating to the cold side.

Versatility in the smallest space

As far as space is concerned the compact DeNOx offers a wide range of opportunities: The catalytic converter housing can be positioned directly on top of the heat exchanger. Or the heat exchanger can be fitted directly below the housing. Another possibility is to install the reactor housing either above or below the REKUGAVO. A further option is installing the compact DeNOx in a separate, self-supporting housing. Platforms, ladders and stairs can be affixed directly to the warm housing, which mostly dispenses with the need for further cold steel structures. Offering variations in power and flexibility.

DeNOx plant



Convincing properties

How a heat exchanger can reliably and efficiently reduce harmful nitrogen oxides is demonstrated by a REKUGAVO unit in an innovative denitrification plant, developed and implemented in the Linz Steelworks of the Voestalpine Group. An ambitious project in every respect, demanding the highest quality and performance on the minimum of space, plus optimised investment and operating costs. The plate heat exchanger could convince across the board. In contrast to shell-and-tube heat exchangers it offers simpler installation and maintenance. This solution also offers 80 % space savings with the same performance, a reduced operating weight, and therefore much simpler integration into existing systems – a major argument for its use for this project. With the extremely high specific density the REKUGAVO is also capable of heating up raw gas by 135 °C within a distance of just under three metres only. A perfect example of energy efficiency with reduced material input.



Smooth erection processes: sub-assemblies are delivered just-in-time

Gigantic logistics

Heat exchangers are no different to any other equipment: size is relative. The delivery and faultless installation of the 700 tonne heat exchanger alone in the steelworks in Linz, in spite of the extreme space constrictions, was both an engineering and a logistical challenge of the finest degree. For example, the lower hood for the inflow section of the heat exchanger had to be pre-assembled to a single 70 tonne unit on the floor and then raised to a height of 32 metres, aligned and positioned as a single unit. The building roof, originally designed for loads of 300 tonnes, had to be strengthened so that it could bear not only the heat exchanger but also the catalyst unit. Our expert GEA team handled both the complex heavy-load transport and the on-site installation without any problems or delays.



Catalytic denitrification and desulphurization

Triple performance: In the SNOX unit at the Schwechat OMV Refinery the REKUGAVO provides a perfect combination of heat recovery, catalytic denitrification and desulphurization.

OMV refinery, Schwechat

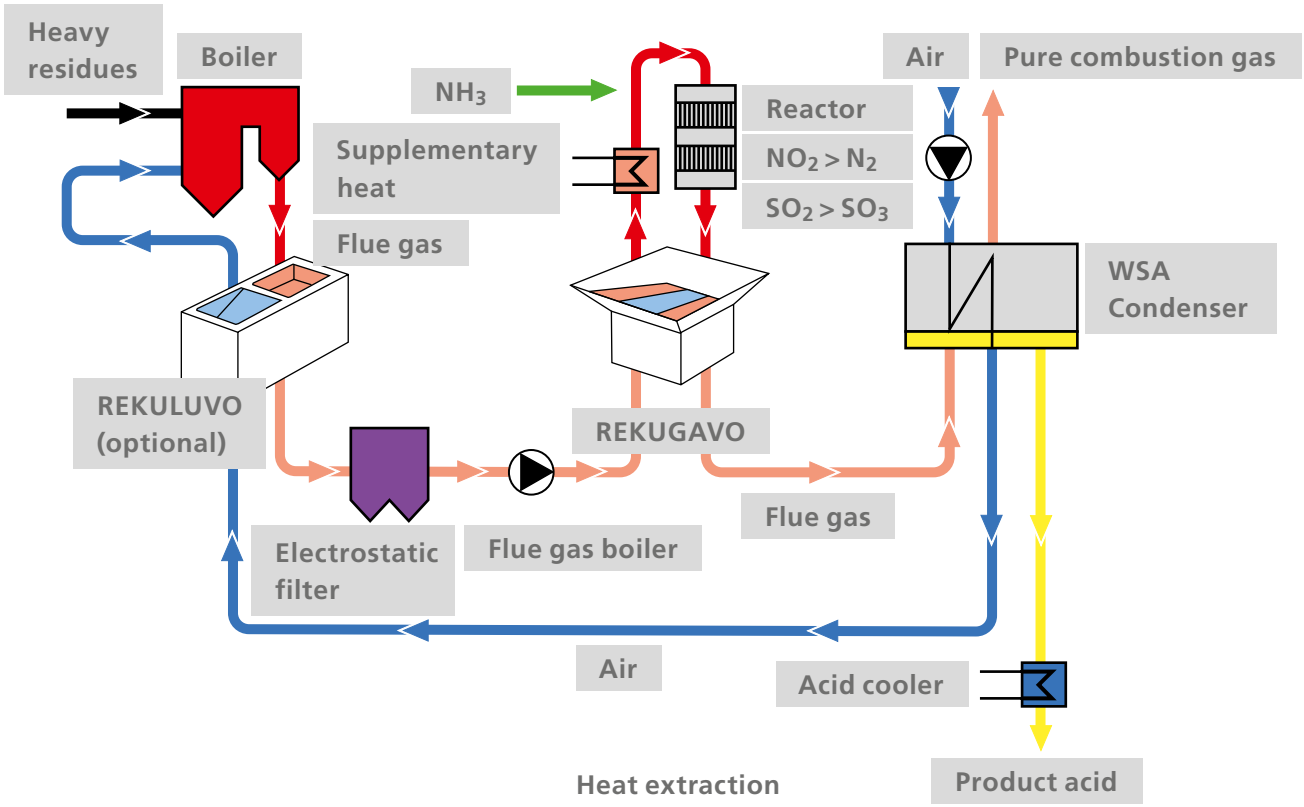
- Heat recovery rate over 86 %
- Heat output 56,4 MW
- Flue gas flow rate per side approx. 900,000 m³/h standard condition/wet
- Temperatures over 400 °C
- Heat transfer area approx. 95,000 m²
- Heat exchanger construction volume: approx. 4,200 m³
- Weight of heat exchanger: approx. 1,100 t
- Reactor weight incl. auxiliary components: approx. 2,000 t

REKUGAVO – DeSNOx

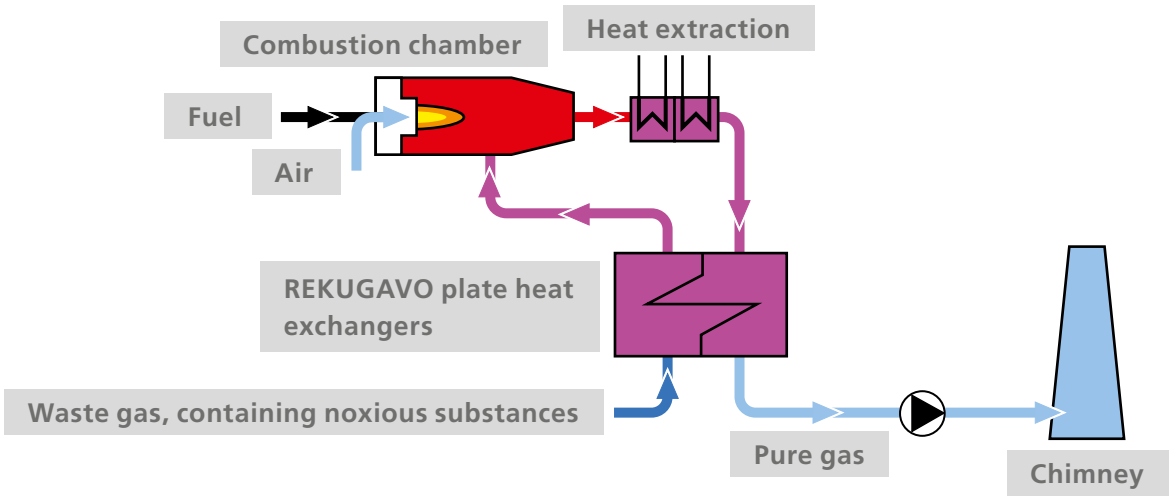
Built for major tasks

Sometimes only the best is good enough: The REKUGAVO DeSNOx, as a combined downstream heat recovery, flue gas desulphurization and denitrification plant, is the solution for three highly complex processes at the same time. The core components for the plant at the OMV refinery in Schwechat, one of Europe's largest inland refineries are: gas/gas heat recovery system, NOx reactor, SO_2/SO_3 converter and a sulphuric acid condenser. With the installed recuperative REKUGAVO plate heat exchanger around 900,000 m³/h of standard condition/wet cold flue gas are fed to the NOx reactor and the SO_2/SO_3 converter. In the heat recovery stage this gas is heated to 380 °C, then it flows through the plate heat exchanger again and is cooled. The plate heating surface of 95,000 m² (more than 15 football pitches) transfers the heat from the hot flue gas to the cold flue gas – at a performance of 61,000 kW and a heat recovery rate of 86 %. Furthermore the REKUGAVO DeSNOx also provides an astonishing physical performance: This gigantic system supports the weight and loading of the NOx reactor and the SO_2

SNOX plant



Thermal post-combustion plant



converter, in total more than 2,000 tonnes! A wide range of applications – and a top performance in every regard.

Clean solution: thermal post-combustion

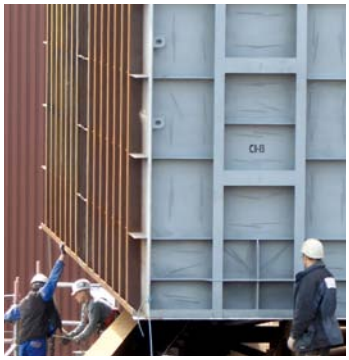
The high-efficiency waste gas cleaning process is a key factor in removing hazardous organic substances. In a combustion chamber noxious substances are oxidized at high temperatures (in the range from 750 to 1,000 °C) and converted to carbon dioxide and water. The use of a range of heat utilization stages and heat recovery systems leads to clear savings in primary energy.



REKUGAVO for an oil refinery

Service from A to Z

From project planning to after-sales service





Perfect engineering is not enough and this is why GEA matches its pioneering qualities in plate heat exchanger production with an equally outstanding service. This includes all standard and specialised after-sales and service packages: from erection, servicing and spare parts supply right up to preventative maintenance checks. A global network of service locations ensures immediate availability. But any service is only as good as the people behind it. And this is where quality is paramount for GEA: All of our employees are experts, experienced, creative and fast. They work in the interests of our customers, independent of manufacturer, and reliability is guaranteed in every single case. GEA customers benefit from permanent functionality, reliable efficiency and sustainable system availability. Making cost factors transparent and eliminating stress factors.

Pro-active perfection

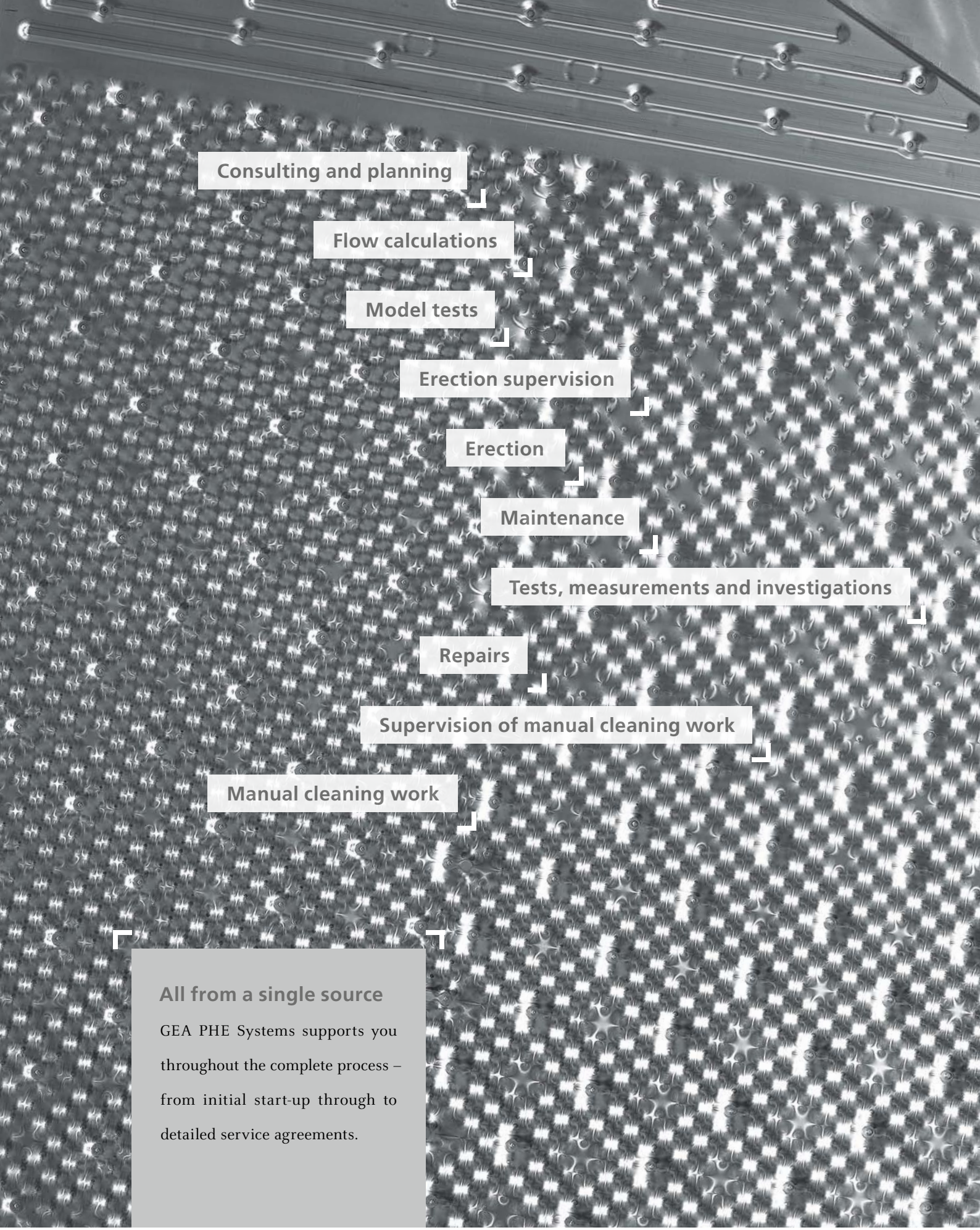
GEA Service emphasises prevention – and this begins as early as with careful planning, component selection and precise erection, a fundamental prerequisite for long-term functionality and reliability of the system. Pro-active checks such as our innovative leakage tightness testing or visual inspections of the heat exchangers detect any soiling or wear in good time. Our GEA experts rectify minor faults such as these on the spot. They also prepare individual maintenance schedules, adapted to match the specific heat exchanger loading and offer expert consulting with regard to the condition of the heat exchanger and make recommendations for replacements before a defect has occurred. A complete all-round service. Throughout the world.

All-inclusive: Spare parts supply and accessories

Good service is essentially a question of time: GEA places great emphasis on being able to supply every spare part for plate heat exchangers of all series quickly, reliably and on time to any location in the world. Highest product quality and absolute fitting accuracy are self-evident.

High-quality extras

- Primer coat
- Measuring nozzles
- Manholes
- Insulation spikes
- Heat insulation
- Steel structures
- Stairs and platforms
- Channels
- Reactor housing
- Fan
- Flaps
- Stationary soot-blowers
- Manual cleaning jets
- High-temperature/ high-pressure tubular heat exchangers for heat extraction
- Vapour preheaters



All from a single source

GEA PHE Systems supports you throughout the complete process – from initial start-up through to detailed service agreements.

We live our values.

Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

GEA Heat Exchangers

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