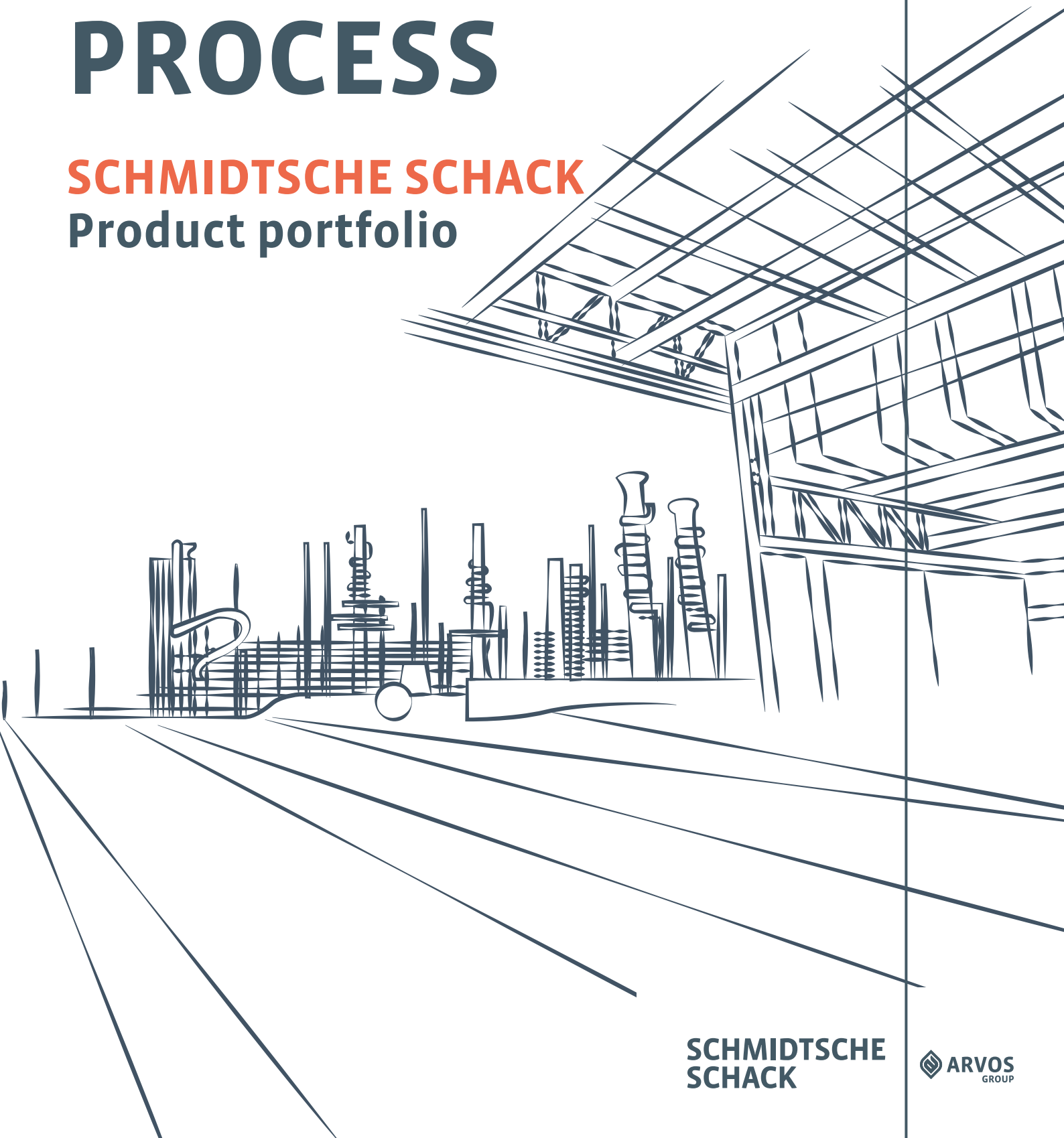


# OUR SHARE IN YOUR PROCESS

**SCHMIDTSCHESCHACK**  
Product portfolio



**SCHMIDTSCHESCHACK**

 **ARVOS**  
GROUP




# OUR SHARE

To SCHMIDTSCHESCHACK, partnership means taking our share of responsibility, challenges, solutions and sustainable success.

We promise: We will accompany you as a true partner. Sharing even your most ambitious objectives and making them ours.

Being part of your process, our system solutions are thought out to maximize your profitability – increasing efficiency, maximizing yields, reducing maintenance, optimizing safety, lasting for decades.

Partnership, passion, experience, expertise – rely on us.



**Reliability and innovative power, this is what SCHMIDTSCHE® and SCHACK® signify – centennial experience as a driving force for heat transfer solutions.**



# DISCOVER OUR PORTFOLIO

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# OUR PORTFOLIO. OUR SHARE.

## One stop. Infinite benefits.

SCHMIDTSCHESCHACK Heat Transfer Solutions represent reliable, highly sophisticated equipment of excellent quality. Our one stop principle has proved to be a recipe for this excellence. We take responsibility from the very first consultation and through the life cycle of our products:

We consult.

We analyze feasibility.

We design and engineer.

We integrate digital solutions for predictive maintenance with Zero.One®.

We provide project management.

We manage interfaces.

We fabricate on highest level in our own workshops.

We organize logistics.

We support operators with training, field service and supervision.

We provide maintenance.

We execute inspections.

We deliver spare parts.

We implement revamp studies.

## SCHMIDTSCHESCHACK BENEFITS

- Tailor-made full quench system solutions for individual process requirements
- Proprietary and scalable Double Tube & Oval Header technology platform
- Predictive digital solutions
- Unmatched track record in various industries
- Decades of heat transfer solution's experience for industrial processes
- Outstanding engineering capabilities



# BENEFITS AT A GLANCE

## How you benefit

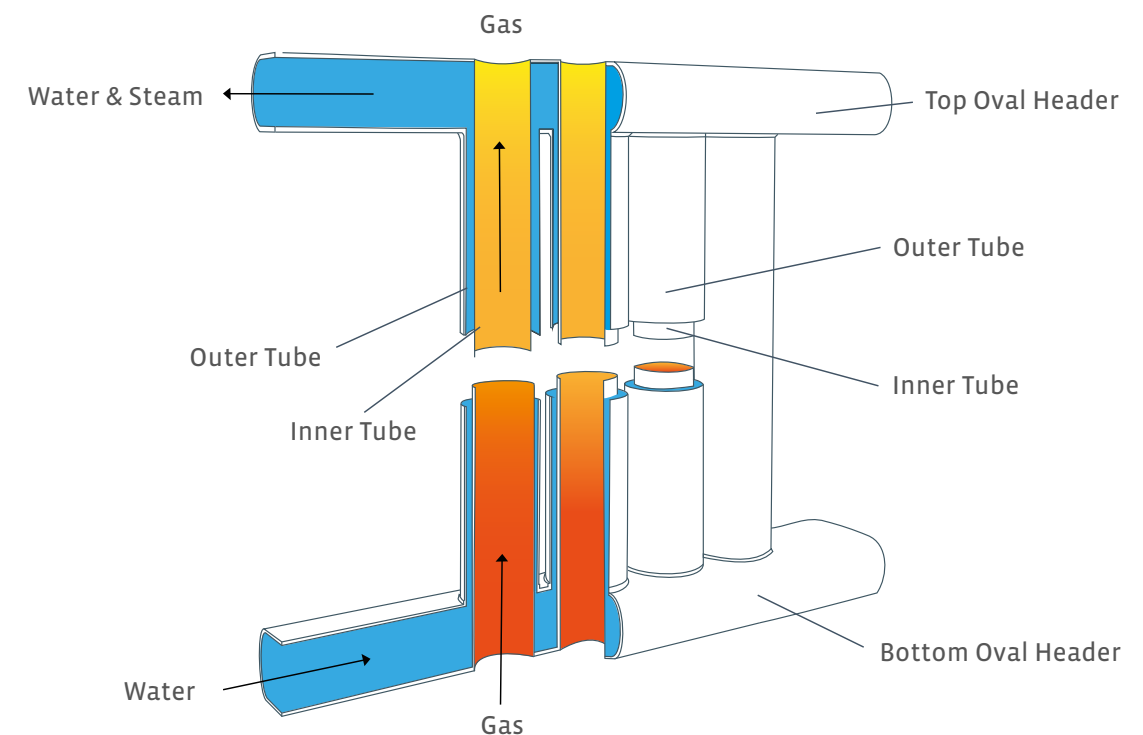
SCHMIDTSCHE SCHACK Heat Transfer Systems are designed to fulfill even the highest demands of our clients. They provide reliability and safety for the entire heat recovery solution.

Our unique SCHMIDT'SCHE® Double Tube & Oval Header technology platform results in outstanding reliability, highest yields and impressive operating life.

In 1959, our engineers designed the world's first Transfer Line Exchanger for ethylene plants. This high pressure steam generating Multi-Tube Transfer Line Exchanger was based on the Double Tube & Oval Header technology platform.

Since then we have continued to raise the benchmark in process efficiency and industrial safety with sustainable innovations. As the platform is flexible and scalable, we have adapted it for various additional heat recovery applications such as syngas cooling in gasification or steam reforming plants and carbon black production processes. Our clients from many different industries can therefore profit from this unique technology.

## UNIQUE TECHNOLOGY PLATFORM



SCHMIDT'SCHE® Double Tube & Oval Header technology platform

**It is the exceptional design of the SCHMIDT'SCHE® Double Tube & Oval Header technology platform which leads to beneficial features:**

- Perfect match for highly dust-loaded gases due to vertical and self-cleaning tube design
- High degree of system elasticity for easy accommodation of differential expansion between inner and outer tube
- Favorable stress patterns in areas subjected to high thermal loads
- Protecting the magnetite layer by low thermal and mechanical stress
- Long service life

# SOLUTIONS FOR ETHYLENE PLANTS

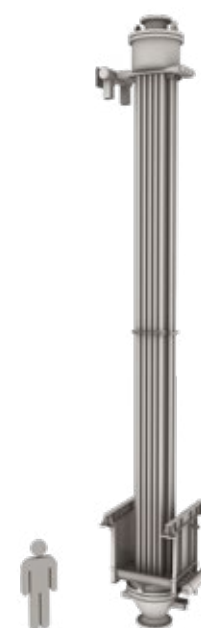
The evolution of SCHMIDT'SCHE® Transfer Line Exchangers (TLE) parallels the development of modern furnace technologies. Over 8,000 units have been shipped worldwide using the SCHMIDT'SCHE® Double Tube & Oval Header technology platform.

Today SCHMIDT'SCHE® TLE are located on the latest generation of ethylene furnaces. Each exchanger concept complies with specific furnace process requirements and provides the optimum match between furnace coil arrangement and Transfer Line Exchanger design.

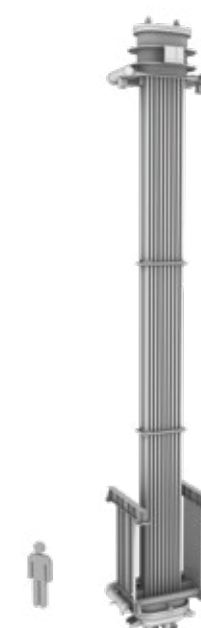
Each of our Transfer Line Exchangers is a unique custom-made unit. There are still some joint characteristics, which are in the DNA of the SCHMIDT'SCHE® TLE product family – such as reliability, durability and safety. It is the exceptional design of the SCHMIDT'SCHE® Double Tube & Oval Header platform which leads to these beneficial features.

## PRODUCTS

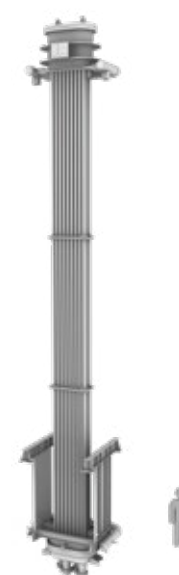
- SCHMIDT'SCHE® Primary Round-Type TLE
- SCHMIDT'SCHE® Primary Bathtub-Type TLE
- SCHMIDT'SCHE® Primary Quick Quencher-Type TLE
- SCHMIDT'SCHE® Primary Linear-Type TLE
- SCHMIDT'SCHE® Secondary and Tertiary Shell and Tube-Type TLE
- SCHMIDT'SCHE® Steam Drum and Piping



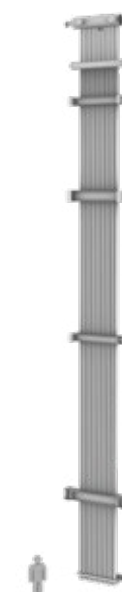
SCHMIDT'SCHE®  
Primary Round-Type TLE



SCHMIDT'SCHE®  
Primary Bathtub-Type TLE



SCHMIDT'SCHE®  
Primary Quick Quencher-Type TLE



SCHMIDT'SCHE®  
Primary Linear-Type TLE



SCHMIDT'SCHE®  
Secondary and Tertiary TLE Shell  
and Tube-Type TLE



SCHMIDT'SCHE®  
Steam Drum  
and Piping



# SOLUTIONS FOR ETHYLENE PLANTS

## INDUSTRIES

Petrochemical

## PROCESSES

Steam Cracking

## MILESTONES AND DESIGN FEATURES

- Development of world's first high pressure steam generating Multi-Tube TLE for olefin plants based on the Double Tube & Oval Header technology platform
- First ever design, fabrication and installation of Linear-Type TLE
- Bathtub-Type TLE design (exclusive)
- Quick Quencher-Type TLE (exclusive)
- TLE for mixed feed cracker
- TLE digitalization with Zero.One®

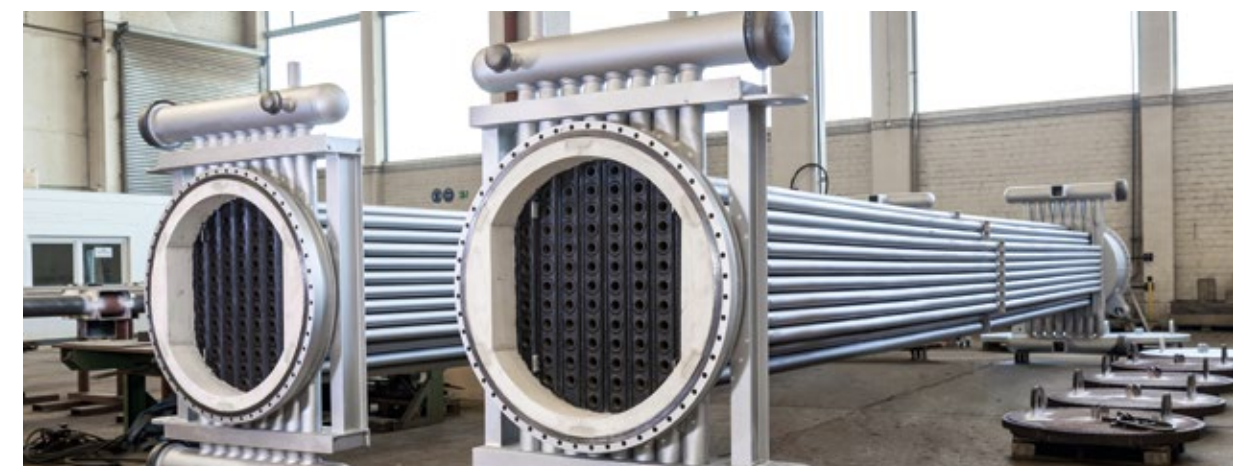
## BENEFITS

- SCHMIDT'SCHE® Double Tube & Oval Header technology platform
- Balanced heat transfer among the process gas tubes
- High yields of ethylene due to precise quench temperature
- Increased service life due to low thermal and mechanical stress
- Easy maintenance and high durability

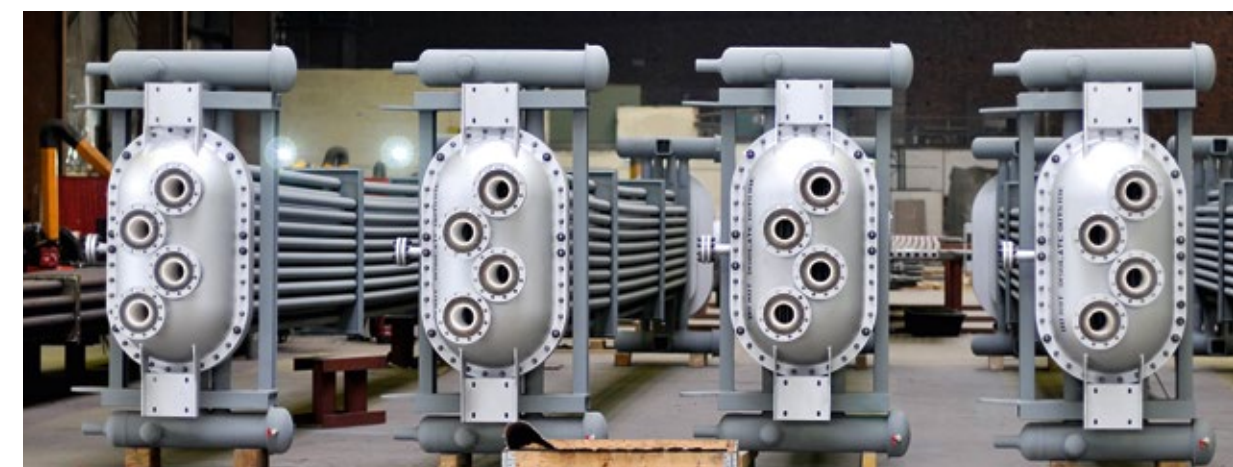
# IMPRESSIONS

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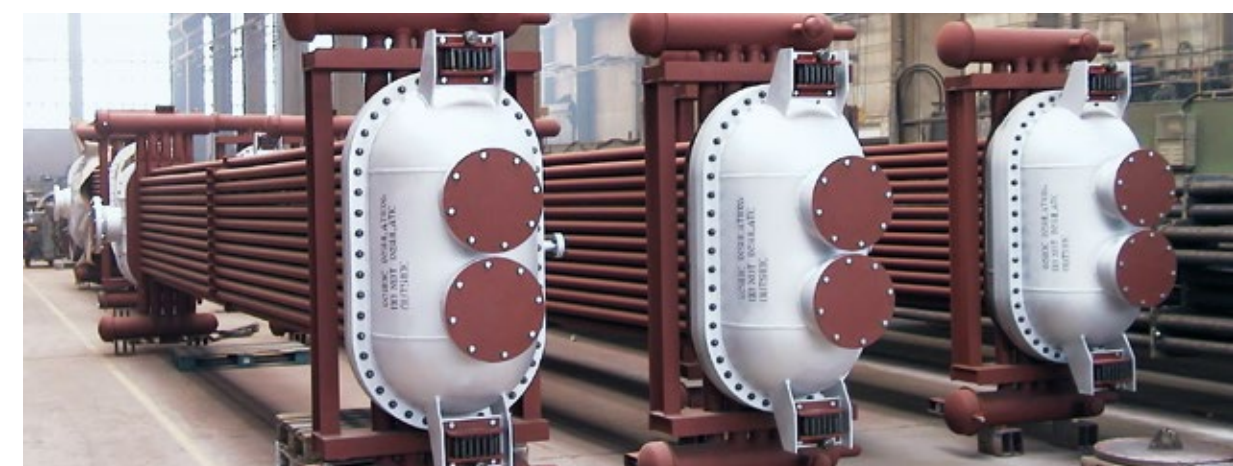
SCHMIDT'SCHE®  
Primary Round-  
Type TLE



SCHMIDT'SCHE®  
Primary Bathtub-  
Type TLE



SCHMIDT'SCHE®  
Primary Quick  
Quencher-Type TLE



SCHMIDT'SCHE®  
Primary Linear-  
Type TLE



# SOLUTIONS FOR GASIFICATION PLANTS

SCHMIDTSCHESCHACK engineers have had experience in designing solutions for gasification processes for decades. Depending on the feedstock, the process characteristics, downstream processing and a variety of additional factors, we select the most suitable technology for your individual project.

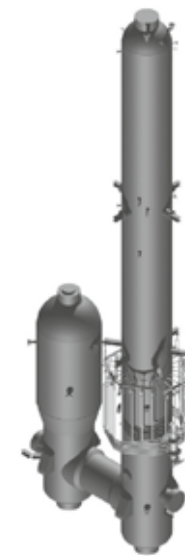
The combination of well-established and innovative reactor and syngas cooler technologies results in the most up to date and economic process solutions. Our unique SCHMIDT'SCHE® and SCHACK® technologies are applied for small size up to the world's largest-scale gasification plants.

SCHMIDTSCHESCHACK is a partner for the world's leading gasification process owners. Our company develops and manufactures reactors and syngas coolers for this industry. These are installed in many of today's most advanced gasification and partial oxidation plants worldwide. Generally, the equipment for gasification plants is developed in close cooperation with the process owner. The early interaction with the process owner enables us to define the special requirements for the process and the resulting equipment.

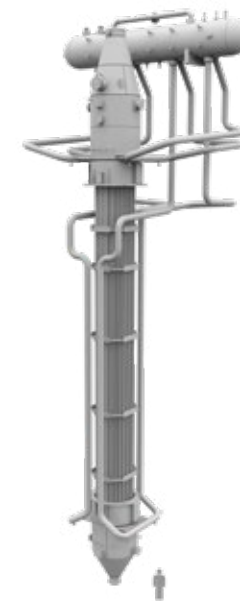
Early clarification of the equipment arrangement and requirements pertaining to the syngas composition must be incorporated into the final reactor and syngas cooler design.

## PRODUCTS

- SCHACK® Partial Oxidation Reactor
- SCHMIDT'SCHE® and SCHACK® Syngas Cooler: Radiant-Type and Convective-Type
- SCHMIDT'SCHE® Steam Superheater
- SCHACK® Gas Preheater
- SCHMIDT'SCHE® Steam Drum and Piping
- Additional Equipment



Partial Oxidation  
Reactor and  
Syngas Cooler



SCHMIDT'SCHE®  
Syngas Cooler



SCHACK®  
Syngas Cooler



SCHMIDT'SCHE®  
Steam Superheater



SCHACK®  
Gas Preheater



SCHMIDT'SCHE®  
Steam Drum and Piping



# SOLUTIONS FOR GASIFICATION PLANTS

## INDUSTRIES

Petrochemical, Pulp and Paper, Waste to Value

## PROCESSES

Gasification, Partial Oxidation

## MILESTONES AND DESIGN FEATURES

- Radiant and convective syngas coolers for world's first IGCC plant
- Metal dusting issue solved with technological innovation
- Patented solution to prevent high temperature H<sub>2</sub>S corrosion
- World's largest petcoke gasification plant with SCHMIDTSCHESCHACK Double Tube & Oval Header syngas cooler
- Design engineering for world's largest coal gasification plant
- World's largest heavy oil gasification plant with SCHMIDTSCHESCHACK syngas cooler
- Municipal solid waste gasification plant with SCHMIDTSCHESCHACK reforming and syngas cooling solutions

## BENEFITS

- Individual solutions and process design for dedicated applications
- Handling process gas temperatures up to 1,600 °C (2,912 °F)
- Appropriate design for high dust-laden gases
- Patented and unique SCHACK® gas inlet nozzle design to reduce corrosion and erosion attack
- Easy maintenance and high durability

## IMPRESSIONS

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SCHMIDT'SCHE®  
Syngas Cooler  
at the port on its  
way to the plant  
construction site



SCHACK®  
Syngas Cooler for  
partial oxidation



SCHACK®  
Gas Preheater



# SOLUTIONS FOR STEAM REFORMING PLANTS

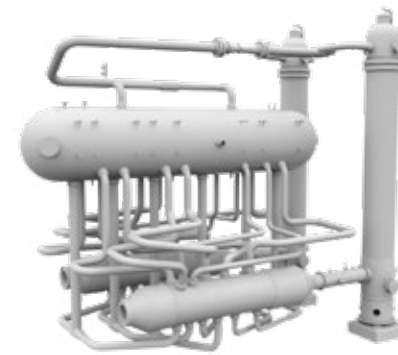
Steam reforming is a complex process which always creates several challenges. It features the risk of mechanical deformation, metal dusting and crevice corrosion. You have to protect the inlet tube when you want to prevent. In addition, controlling temperature is an important task. In order to maximize uptimes and efficiency of the steam reforming process, we have developed solutions which counteract these challenges.

Flexible tubesheets exceed by their robustness. Crevice-free welding technologies guarantee premium quality in the longrun. Intelligent design features like, the cold bypass and our proven unique Double Tube & Oval Header technology platform, lead to superior reliability for certain applications.

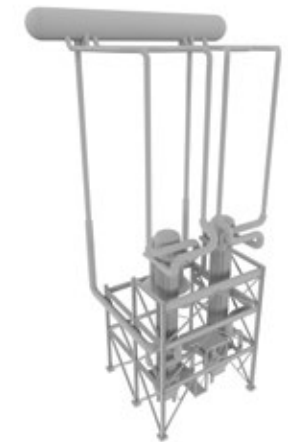
Being an integral component of the steam reforming process, our solutions contribute to the profitability of plants by optimizing the quality and quantity of the yields. If you want to therefore maximize efficiency, then let us talk about your tailor-made solution.

## PRODUCTS

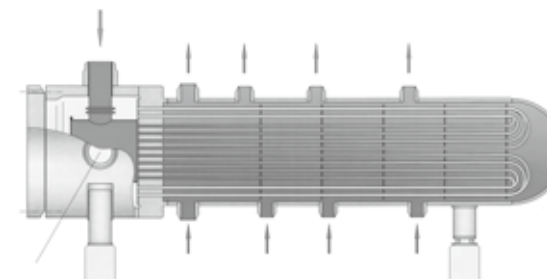
- SCHMIDT'SCHE® Process Gas Boiler
- SCHMIDT'SCHE® Vertical Process Gas Boiler
- SCHMIDT'SCHE® Steam Superheater
- SCHMIDT'SCHE® Synloop Boiler
- SCHACK® Waste Heat Recovery System
- SCHMIDT'SCHE® Steam Drum and Piping



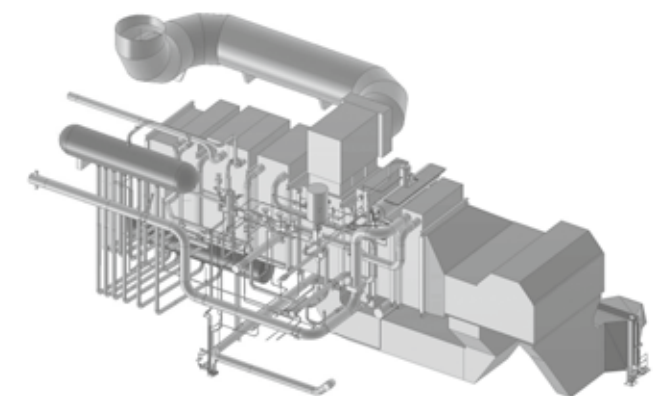
**SCHMIDT'SCHE®**  
Process Gas Boiler  
with Steam Superheater  
and Steam Drum



**SCHMIDT'SCHE®**  
Vertical Process  
Gas Boiler



**SCHMIDT'SCHE®**  
Synloop Boiler



**SCHACK®** Waste Heat  
Recovery System



# SOLUTIONS FOR STEAM REFORMING PLANTS

## INDUSTRIES

Petrochemical, Refinery

## PROCESSES

Steam Methane Reforming (Hydrogen, Ammonia, Methanol)

## MILESTONES AND DESIGN FEATURES

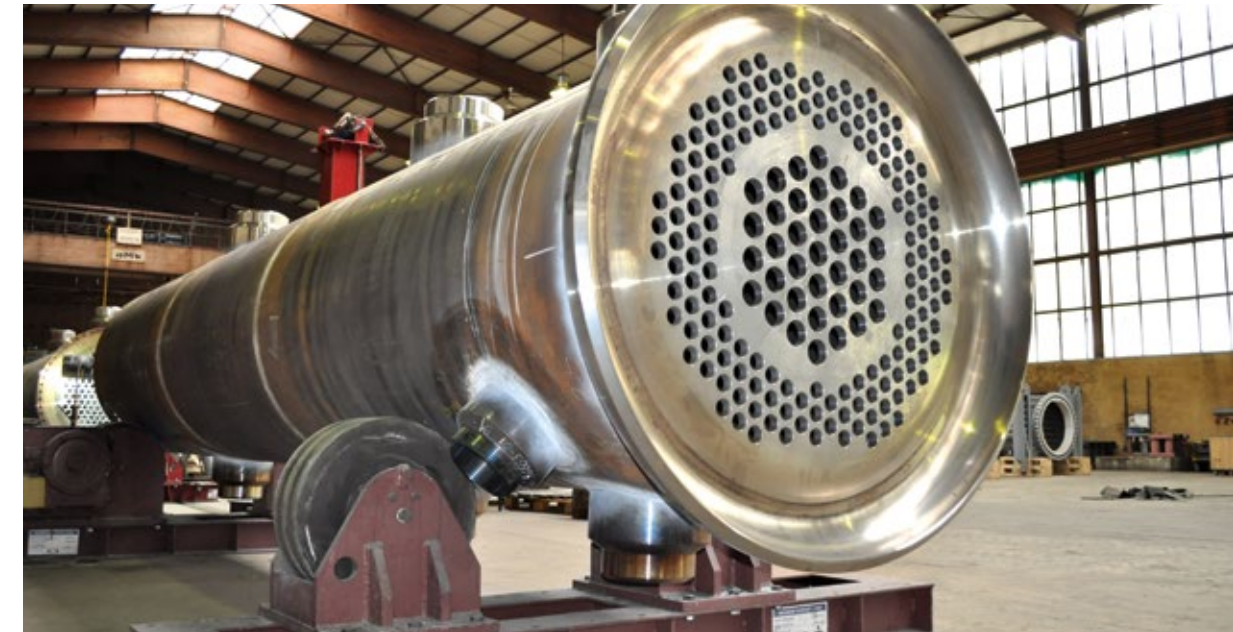
- First flexible tubesheet in 1979
- We invented the cold bypass to achieve metal-free dusting-free SCHMIDT'SCHE® Process Gas Boiler design
- Delivery of the first SCHMIDT'SCHE® Bayonet-Type Steam Superheater in 1981
- We introduced the Super Flexible Tubesheet SUPLEX®
- Based on the unique Double Tube & Oval Header technology platform, we launched the SCHMIDT'SCHE® Vertical Process Gas Boiler

## BENEFITS

- Complete solution including process gas boiler, steam drum and steam superheater
- Two bypass designs, cold and hot bypass, to control gas outlet temperature precisely
- Full penetration, crevice-free tube to tube sheet welding to prevent crevice corrosion
- Metal dusting resistance
- Vertical Process Gas Boiler based on approved SCHMIDT'SCHE® Double Tube & Oval Header technology platform

## IMPRESSIONS

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SCHMIDT'SCHE®  
Process Gas Boiler



SCHMIDT'SCHE®  
Process Gas Boiler



SCHMIDT'SCHE®  
Steam Superheater

# SOLUTIONS FOR CARBON BLACK PLANTS

The comprehensive solutions from SCHMIDTSCHKE SCHACK for the carbon black industry cover the most important aspects of the carbon black production process, starting with quenching of the reaction, preheating the air required for the process reaction and on to the drying of the final product and integration of heat utilization facilities.

We provide tailor-made solutions for different process challenges. SCHACK® Air Preheaters are based on an approved technology platform with unique elements enabling air flows which exceed 30,000 Nm³/h in one unit. The combination of advanced calculation and computer simulation, combined with the experience of hundreds of Air Preheaters in operation in carbon black plants around the world, makes SCHACK® technology platform valuable.

Energy Recovery and water consumption are amongst the main targets in the state-of-the-art carbon black plants. SCHACK® Heat Recovery Boilers serve to utilize process heat and save quench water, which otherwise would be used to reduce the gas temperatures before entering the process filter.

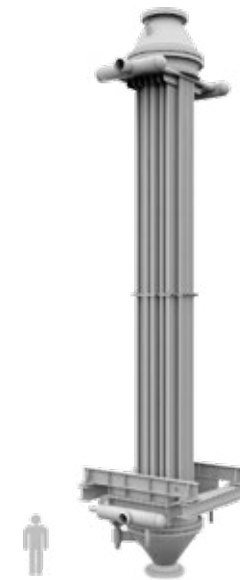
SCHMIDTSCHKE SCHACK's experience in the combustion of CO gas in tailgas boilers, combined with sophisticated examination methods, enable the optimization of the equipment, while still complying with all CO and NOx emissions requirements.

## PRODUCTS

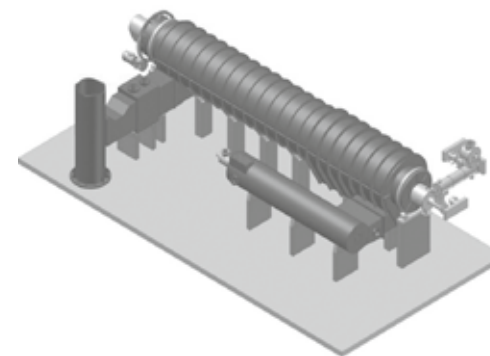
- SCHACK® Air Preheater
- SCHACK® Quench Boiler
- SCHACK® Rotary Dryer
- SCHACK® Reactor Boiler
- SCHACK® Oil Preheater
- SCHACK® Tailgas Boiler



SCHACK® Air Preheater



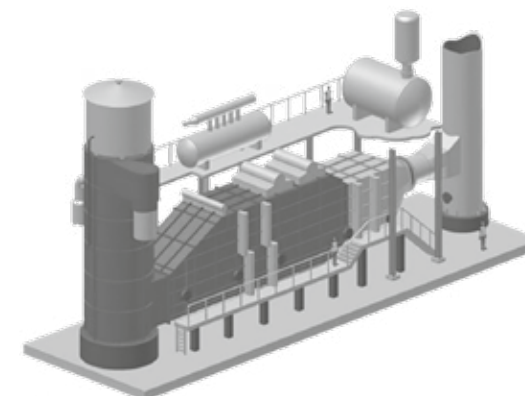
SCHACK® Quench Boiler



SCHACK® Rotary Dryer



SCHACK® Reactor Boiler



SCHACK® Tailgas Boiler



# SOLUTIONS FOR CARBON BLACK PLANTS

## INDUSTRIES

Chemical

## PROCESSES

Carbon Black

## MILESTONES AND DESIGN FEATURES

- First SCHACK® Air Preheater designed and delivered in 1957
- Double Bottom Tube Sheet (DBTS) design
- Air Preheater with up to 192 tubes for large furnace capacities
- 950 °C (1,742 °C) air preheater launched
- Introduction of low NO<sub>x</sub> SCHACK® Tailgas Boiler for carbon black process
- Saw tooth expansion joints for air preheater
- Heat transfer equipment goes digital with Zero.One®

## BENEFITS

- Solutions for up to 950 °C (1,742 °F) air preheating
- Complete heat transfer product portfolio for carbon black plants
- Double Bottom Tube Sheet (DBTS) design for the SCHACK® Air Preheater
- Economic and environmentally friendly energy transfer solutions for tailgas combustion
- Quench boiler based on the SCHMIDT'SCHE® Double Tube & Oval Header technology platform

## IMPRESSIONS

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SCHACK®  
Air Preheater



SCHACK®  
Quench Boiler



SCHACK®  
Rotary Dryer

# SOLUTIONS FOR NITRIC ACID PLANTS

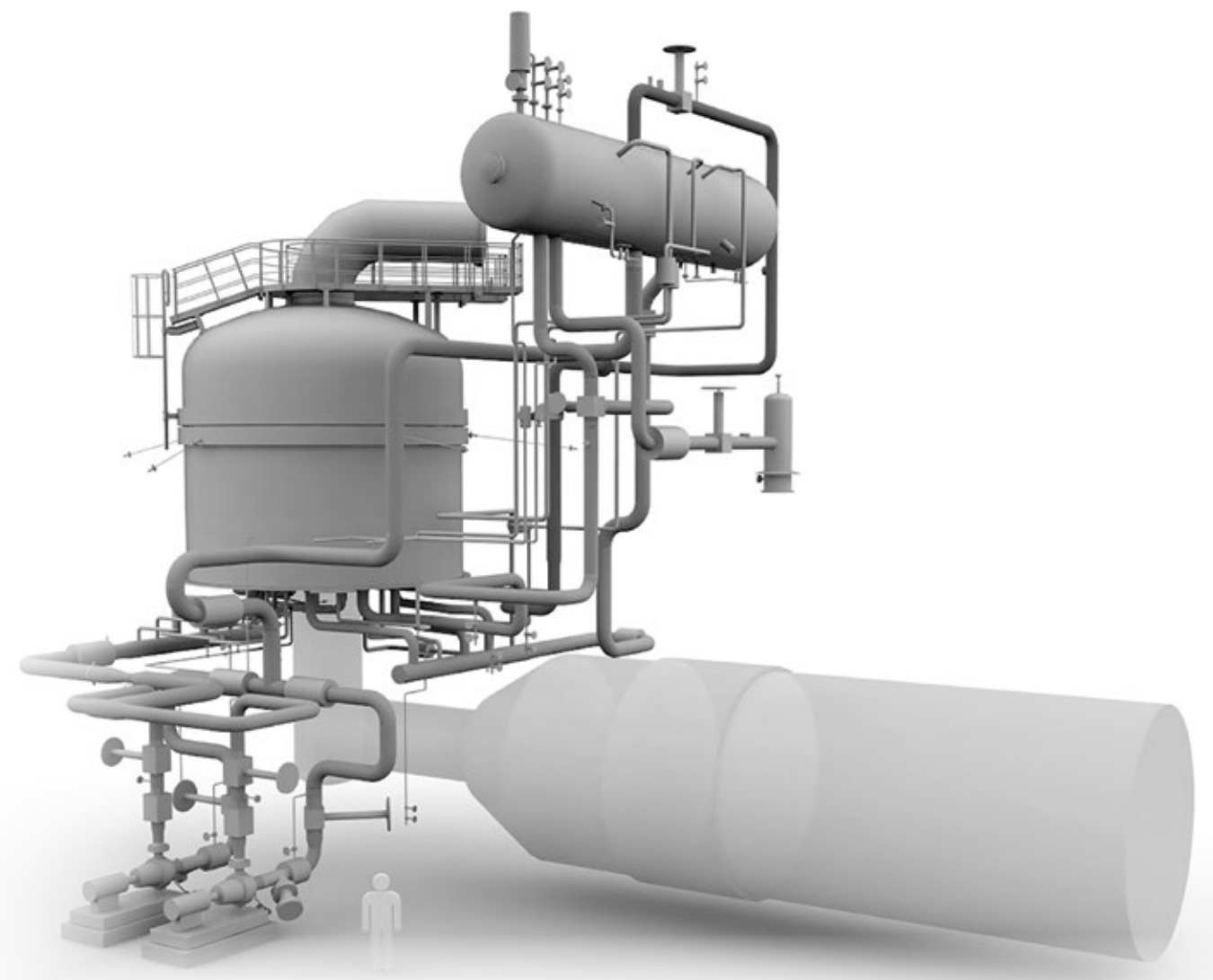
**SCHACK® Process Gas Coolers** are designed to fulfill even the highest demands of our clients. Solutions have to be able to cope with the challenging environment of nitric acid plants, which are associated with risks like thermal stresses and corrosion.

Our heat transfer solutions are based on specific design features, constantly to counter these hazards. Features like flexible tubesheets, gap free welding – and thereby crevice free – tube to tubesheet connections as well as our own control evaporator technology.

As a result, owners of nitric acid plants, who operate SCHACK® Process Gas Coolers and the perfectly aligned additional equipment, can rest assured back. Downtimes? Reduced to the minimum.

## PRODUCTS

- SCHACK® Forced Circulation Process Gas Cooler
- SCHACK® Natural Circulation Process Gas Cooler
- SCHACK® Combined Circulation Process Gas Cooler
- Special Equipment
- Auxiliaries and BoP



SCHACK® Forced Circulation Process Gas Cooler



# SOLUTIONS FOR NITRIC ACID PLANTS

## INDUSTRIES

Chemical

## PROCESSES

Ammonia Oxidation (Nitric Acid), Adipic Acid, Caprolactam

## MILESTONES AND DESIGN FEATURES

- First forced circulation waste heater boiler delivered in 1964
- SCHACK® Process Gas Coolers for first German caprolactam plant delivered
- Patented injector for optimized tube sheet cooling
- Externally accessible header technology solution
- Cooled catalyst basket support for DeN<sub>2</sub>O catalyst
- SCHACK® Process Gas Cooler for the world's largest mono-pressure 1100 MTPD process designed and delivered

## BENEFITS

- Complete heat transfer solutions for greenfield and revamp projects
- Reduced interfaces by providing integrated engineering and manufacturing
- Globally unrivaled SCHACK® Process Gas Coolers in size and durability
- SCHACK® control evaporator technology for stable catalyst cooling
- High plant efficiency by utilizing comprehensive heat transfer solutions

## IMPRESSIONS

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SCHACK®  
Forced Circulation  
Process Gas Cooler



SCHACK®  
Natural Circulation  
Process Gas Cooler

# SOLUTIONS FOR SLUDGE INCINERATION PLANTS

The eco-friendly SCHMIDTSCHKE SCHACK sludge disposal system supplies energy recovery systems for fluidized bed incinerators and multiple hearth incinerators. Depending on the incineration process we apply our heat recovery equipment in different stages.

Maximization of energy recovery from the sludge incineration results in optimized plant operation economics with near-zero fuel consumption. It also leads to plants performing as renewable green energy providers for various applications, with benefits to the constituents as well as to the environment.

SCHMIDTSCHKE SCHACK Heat Exchanger Solutions provide all the energy recovery requirements between the furnace outlet up to the inlet of the emissions control system. These options can range from air preheater to waste heat boilers for power generation (at larger plants) to hot oil heat exchangers for sludge drying or Organic Rankine Cycles (ORC's), plume suppression heat exchangers, or fume reheaters.

## PRODUCTS

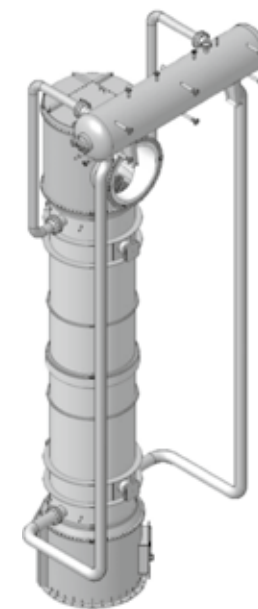
- SCHACK® Air Preheater
- SCHACK® Green Boiler (Fire Tube or Water Tube)
- SCHACK® Oil Heater
- SCHACK® Plume Suppressor
- SCHACK® Gas Reheater



SCHACK®  
Air Preheater



SCHACK®  
Green Boiler  
Water Tube



SCHACK®  
Green Boiler  
Fire Tube



SCHACK®  
Oil Heater



SCHACK®  
Gas Reheater



SCHACK®  
Plume Suppressor



# SOLUTIONS FOR SLUDGE INCINERATION PLANTS

## INDUSTRIES

Waste to Value

## PROCESSES

Municipal & Industrial Sludge Incineration

## MILESTONES AND DESIGN FEATURES

- First application of Flue Gas Through the Tubes (FGTT) fluidizing air heat exchanger for fluidized bed sludge incineration in 1968
- Replaceable tubular expansion joints for improved serviceability of heat exchangers
- Interstage bypass to enable control of furnace preheat
- SCHACK® Green Boiler market introduction
- Patented upper tubesheet support system for SCHACK® Air Preheater
- Double damper bypass to increase heat exchanger turndown rate from 10% to over 20%

## BENEFITS

- Patented SCHACK® tubesheet support preventing tubesheet deformation
- Handling of high particle-laden gases
- Self-cleaning designs for reduced maintenance efforts
- Modular heat transfer solutions for flexible plant setups
- Complete heat transfer solution provision from one source leading to reduced interfaces

## IMPRESSIONS

33



SCHACK®  
Air Preheater and  
Green Boiler



SCHACK®  
Oil Heater

# SOLUTIONS FOR SULFUR RECOVERY & COMBUSTION PLANTS

The Claus process is the most significant gas desulfurization process, recovering elemental sulfur from the gaseous hydrogen sulfide found in raw natural gas and from the oil refining by-product gases. The temperature inside a Claus furnace is often maintained above 1,050 °C (1,922 °F). The SCHMIDT'SCHE® Waste Heat Boiler downstream of the combustion furnace cools the hot gases and simultaneously recovers valuable energy.

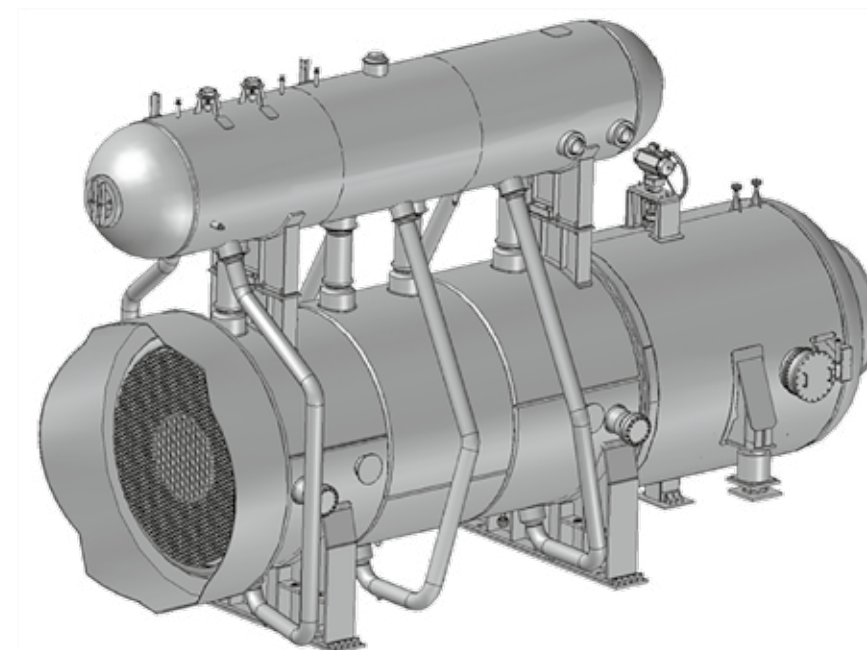
Another application of the SCHMIDT'SCHE® or SCHACK® Waste Heat Boiler is for the sulfuric acid process. Elemental sulfur is oxidized and then converted to sulfuric acid in a catalytic, exothermic process. Several hundred of these systems are in operation worldwide. In the cooling sections which are required, several heat exchangers cool the gases to the required temperatures - precisely tailored to the process requirements.

The SCHMIDTSCHE SCHACK waste heat boilers are specially designed for these process applications. The associated superheater and economizer heat exchangers additionally enable efficient cooling of the various heat flows to precisely specified temperatures. Every one of our waste heat boilers is a unique customized unit.

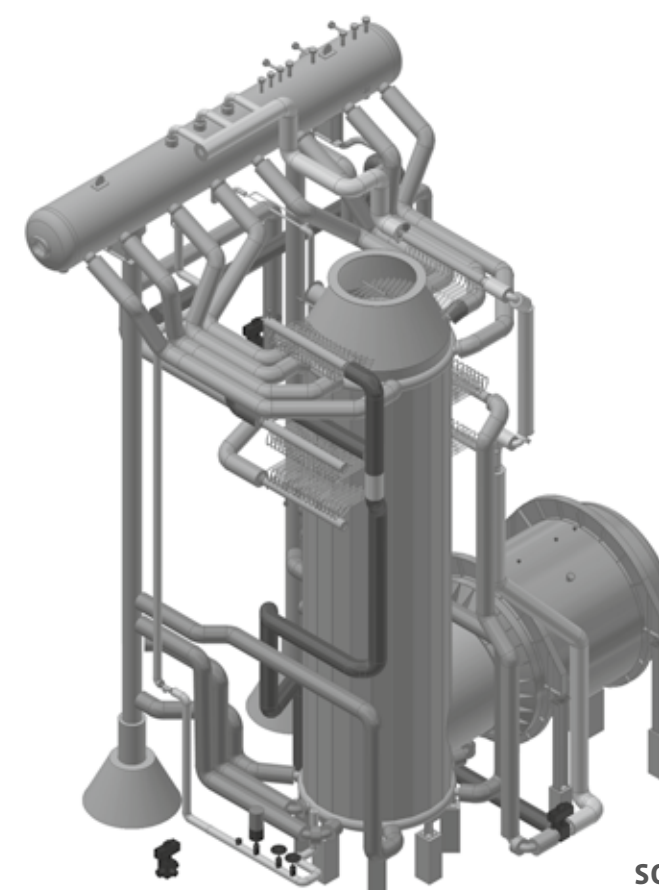
One of the biggest challenges with these processes is to maintain the waste heat boiler gas outlet temperature as constant, regardless of the load. This can be ensured with the support bypasses on the gas or steam side, which are provided with appropriate control devices.

## PRODUCTS

- SCHMIDT'SCHE® Waste Heat Boiler Fire Tube-Type
- SCHACK® Waste Heat Boiler Water Tube-Type
- SCHACK® Steam Superheater
- SCHACK® Economizer
- Steam Drum and Piping



**SCHMIDT'SCHE®**  
Waste Heat Boiler Fire Tube-Type



**SCHACK®** Waste Heat Boiler  
Water Tube-Type



# SOLUTIONS FOR **SULFUR RECOVERY & COMBUSTION PLANTS**

## INDUSTRIES

Petrochemical, Chemical, Metallurgical, Refinery

## PROCESSES

Sulfur Recovery (Claus), Sulfide Roasting, Sulfur Combustion (Sulfuric Acid Production)

## MILESTONES AND DESIGN FEATURES

- Delivery of first SCHACK® Waste Heater Boiler for the sulfuric acid process (sulfur combustion) in 1952
- Maximum prefabrication extended with piggyback steam drum
- Elimination of hot-end tube and tube sheet attachment failures caused by high temperature sulfide corrosion
- Handling temperatures up to 1,600 °C (2,912 °F)
- Safe operation and control of wide range of load cases
- High quality of fabrication in specialized workshops under full quality assurance from SCHMIDTSCHE SCHACK
- More than 500 units delivered worldwide

## BENEFITS

- Crevice-free weld for tube to tubesheet connection
- Thermal & mechanical design ensures reliable natural water circulation
- Highly resistant against corrosion issues by material selection
- Performance records which far exceed the industry average

## IMPRESSIONS

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SCHMIDT'SCHE®  
Waste Heat Boiler  
Fire Tube-Type for  
sulfur recovery  
(Claus) process



SCHACK®  
Steam Superheater



# FIRED HEATER SOLUTIONS

## For various plants

The chemical and petrochemical process industries mainly rely on several types of heaters which are utilized for various processes. Each medium to be preheated is slightly different in its components and principles. One thing which always remains the same is that heat energy is transferred to the liquid or gaseous medium which has to be processed.

SCHACK® Fired Heaters are designed to fulfill even the highest demands of our clients. Solutions have to be resistant in the challenging environment of chemical and petrochemical plants. Very high temperatures, aggressive media and also constant outlet temperatures and varying load conditions are just a few factors which can be mentioned.

Our customized fired heater solutions are based on specific design features, constantly to counter these challenges. Unique requirements need unique designs. Our proprietary SCHACK® Fired Heater design is the answer for even the most specific and challenging applications.

As a result, operators of plants equipped with SCHACK® Fired Heaters can rest assured. Reliability? Enhanced to the maximum.

### PRODUCT

#### • Fired Heater



SCHACK® Fired Heater



# FIRED HEATER SOLUTIONS

## For various plants

### INDUSTRIES

Chemical, Petrochemical, Refinery

### PROCESSES

Steam Methane Reforming, Titanium Dioxide, Acetylene, Sulfuric Acid and others

### MILESTONES AND DESIGN FEATURES

- Thermal and mechanical design from one source
- Unique and own SCHACK® design for improved efficiency
- API design for standard heating applications
- Standardized and customized for individual project and process requirements
- Maximum planning & implementation flexibility
- Hundreds of SCHACK® Fired Heaters in operation worldwide
- Low NOx emissions

### BENEFITS

- Customized SCHACK® design to fulfill challenging and individual requirements
- Heating temperatures of up to 960 °C (1,760 °F) and pressures up to 140 bar (230 psi)
- Flexible for a variety of processes, applications and challenging media (e.g. O<sub>2</sub>, H<sub>2</sub>)
- Heating efficiencies >90 % for optimized long term plant economics
- Modular design and maximum extension for prefabrication



SCHACK®  
Fired Heater



SCHACK®  
Fired Heater ready  
for shipment



SCHACK®  
Fired Heater  
internals

# SOLUTIONS FOR WASTE HEAT RECOVERY SYSTEM

## For various plants

**SCHACK® Waste Heat Recovery Systems are the solution for an efficient energy utilization and resource management – and answer to today's requirement of an eco-friendly plant.**

Flue gas heat recovery systems make industrial processes more efficient by capturing and re-using heat energy, which would otherwise have escaped into the environment.

All furnaces, which burn fuel to produce heat, also create exhaust gases and these need to be routed to the outside. However, as these gases are very hot, a large amount of energy can be recovered for process requirements or steam generation.

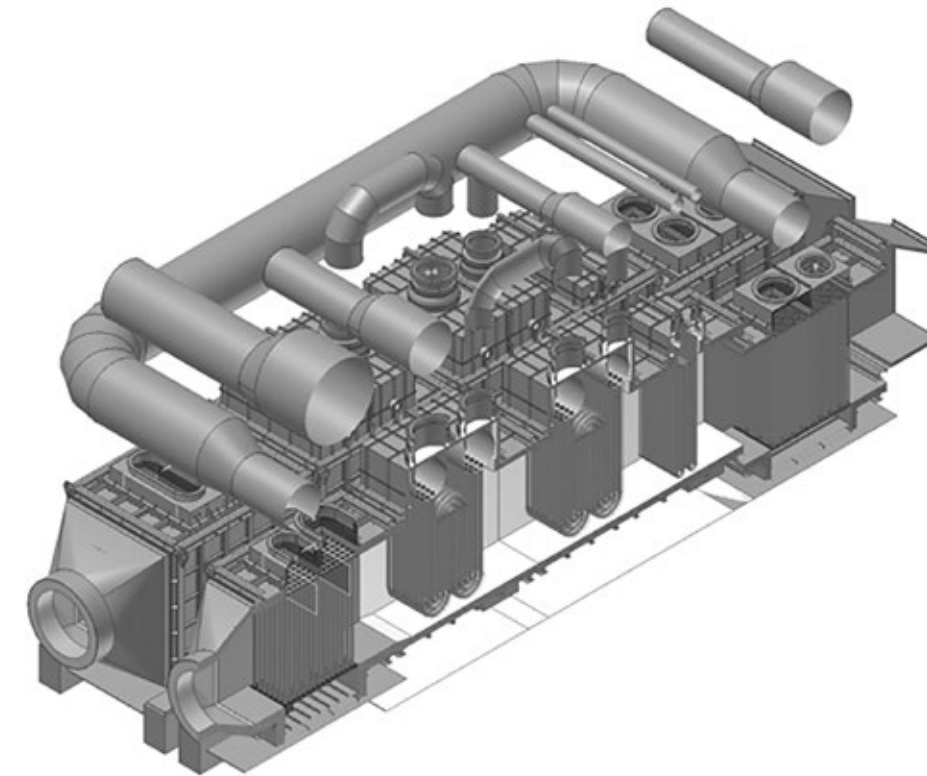
An integrated understanding of the production processes of the entire value chain is required in order to determine the most feasible solution for increasing energy efficiency.

Applying proprietary design methods, combined with long-term experience and dedicated manufacturing locations, enables SCHMIDTSCHKE SCHACK to support clients in achieving brilliant performance and operational excellence.

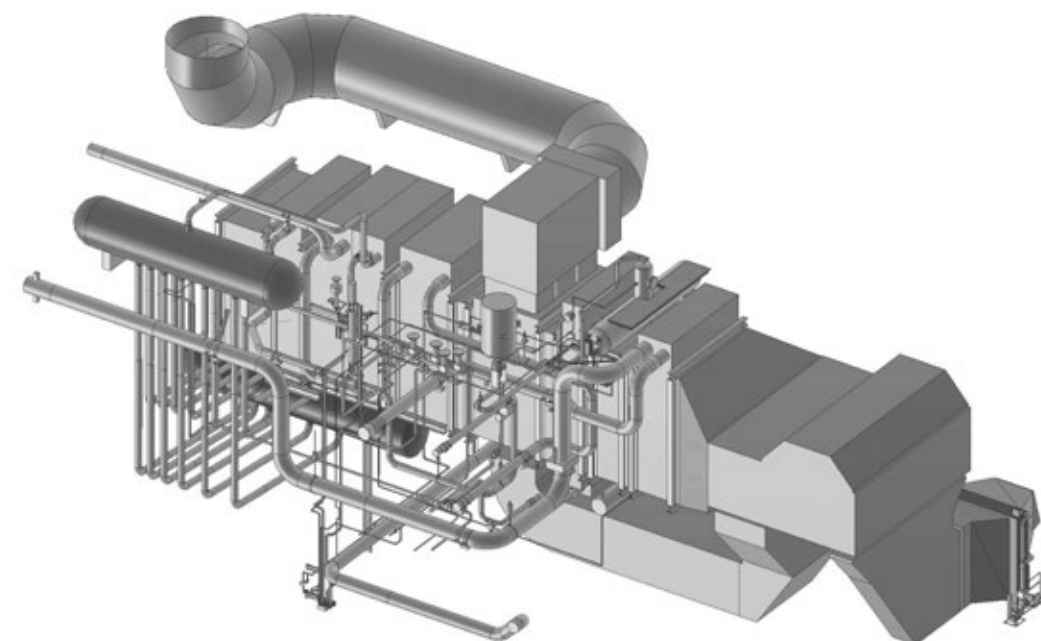
Our competences comprise thermal and mechanical design, numeric modeling and value engineering. We provide design, fabrication and supply for heat recovery systems, handling temperatures up to 1,100 °C (2,012 °F).

### PRODUCTS

- **SCHACK® Waste Heat Recovery System (Steam Generator, Air Preheater, Gas Preheater, Steam Superheater, Economizer)**



**SCHACK® Waste Heat Recovery Systems**





# SOLUTIONS FOR WASTE HEAT RECOVERY SYSTEM

## For various plants

### INDUSTRIES

Petrochemical, Chemical, Metallurgical

### PROCESSES

Steam Methane Reforming, Direct Reduction Iron

### MILESTONES AND DESIGN FEATURES

- First Waste Heat Recovery System design in 1960, which has been continuously improved since then
- Tubes welded to horizontal headers
- Tubes can freely expand downwards
- No tube sheets, only baffle and guiding plates
- Tube bundles are of modular design including refractory lined casing
- A DeNOx system can be optionally integrated

### BENEFITS

- Value engineering by applying dedicated thermal and mechanical designs
- Custom-made solutions to fulfill specific process requirements
- SCHACK® upside down DRI plant arrangements for easy maintenance
- Modular design with maximum extension for prefabrication enables minimum installation time
- Manufactured to handle flue gas temperatures up to 1,100 °C (2,012 °F)
- Services for installation, commissioning and operation

## IMPRESSIONS

45



Sections of  
SCHACK® Waste Heat  
Recovery Systems



# RECUPERATOR SOLUTIONS

## For various plants

We provide expert heat recovery solutions for a variety of applications. Our experienced engineers can supply exact thermal design, optimal temperature control, and an in-depth knowledge of corrosion dangers and thermal processes, ensuring effective and efficient performance in one reliable, long-lasting system.

The designs have been developed for cooling dust-laden gases in various processes with temperatures of up to 1,100 °C (2,012 °F). Energy is recovered by heating process air or process gas for the purpose of saving fuel and increasing yield. Preheat temperatures of 900 °C (1,652 °F) and higher are possible.

Our convection recuperators are used for heat recovery downstream of industrial furnaces, incinerators and other industrial thermal processes where high-temperature exhaust gases are generated.

Our radiation recuperators are best suited for the highest waste gas temperatures in systems where exhaust gases have high dust concentrations, such as foundries, melting furnaces, glass melters and kilns.

### PRODUCTS

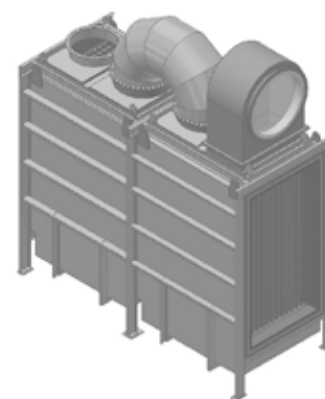
- SCHACK® Double Shell-Type Recuperator
- SCHACK® Tube Cage-Type Recuperator
- SCHACK® Flue Tube-Type Recuperator
- SCHACK® Channel-Type Recuperator
- SCHACK® Regeneration Gas Cooler



SCHACK® Double Shell-Type Recuperator



SCHACK® Flue Tube-Type Recuperator



SCHACK® Channel-Type Recuperator



# RECUPERATOR SOLUTIONS

## For various plants

### INDUSTRIES

Chemical, Petrochemical, Refinery, Glass, Waste to Value, Metallurgical

### PROCESSES

Sludge Incineration, Carbon Black, Glass Smelting, Foundry, Steel Production, Oil Refining, Gasification, Fly Ash Thermal Beneficiation and others

### MILESTONES AND DESIGN FEATURES

- Thermal and mechanical design from one source
- Own and unique SCHACK® designs
- Standardized and customized for individual project and process requirements
- Custom design for a uniform flow
- Maximum planning & implementation flexibility
- Self-cleaning designs for minimized maintenance efforts
- Hundreds of SCHACK® Recuperators in operation worldwide

### BENEFITS

- Various SCHACK® recuperator types for challenging industrial applications
- Able to handle heavily dust-laden waste gases
- Increased efficient energy recovery leading to decreased fuel consumption
- Reliable operation and tried and tested long service life

## IMPRESSIONS



SCHACK® Flue Tube-Type Recuperator



Shell of SCHACK® Recuperator



SCHACK® Tube Cage-Type Recuperator

# DIGITAL SOLUTIONS



**SCHMIDTSCHESCHACK possesses in-depth design and historical knowledge which is the base for our heat exchanger machine learning algorithms and our recommendation services.**

We have verified references with global leaders in the oil & gas industry. We provide tailor-made customer value – independent of specific technology platforms.

We know our products: spare parts logistics and service requirements are already part of our business and are at hand whenever and wherever you need them.

In order to fulfill your demands, as well as providing you with the best-possible results from our predictive maintenance solution, we have developed an exclusive non-standard sensor technology. Discover its share of plant efficiency.

We cannot promise you the world, but we can protect you against unpleasant surprises caused by an unplanned shutdown.

Our digital predictive maintenance platform, Zero.One®, provides increased transparency for your heat transfer system, helping you predict and manage your plant equipment more efficiently.

**Life-cycle monitoring to detect material deterioration and wear at an early stage**

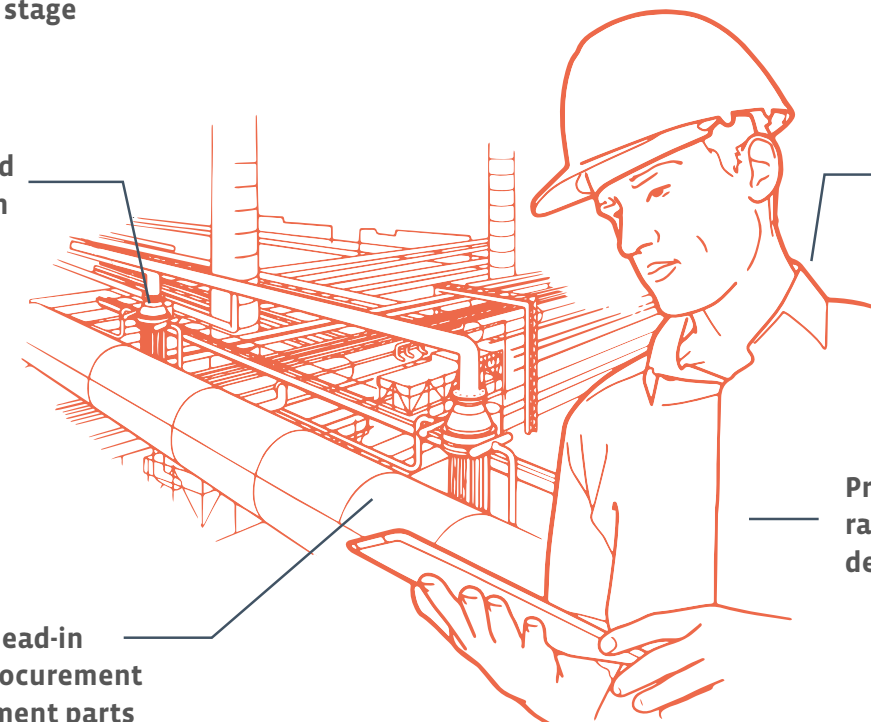
**Preparation of availability forecasts and upcoming maintenance work**

**Customized integration**

**Digital documentation regarding the heat exchanger condition**

**Sufficient lead-in time for procurement of replacement parts**

**Provision of comprehensible rational for maintenance decisions**





# SERVICE SOLUTIONS

## How we care for our customers.

Anyone who decides to invest in our solutions is committed to a collaboration for decades to come. We honor this trust by utilizing everything which constitutes a strong partnership: Responsibility. Presence. Loyalty. Being at your side – hands on. Right from the start. Oriented towards the future.

Every one of our products is unique, a customized solution, which is embedded in a network of collaborative services.

Development, engineering and manufacturing are just the first steps on our journey. With consulting, training, maintenance and spare parts supply, we accompany our products through the years.

The quality of a partnership is often only demonstrated when things are not going so well. In case of difficulties, we support you immediately with a dedicated team, high-quality parts and unique expertise. Wherever you are.

Pushing limits is our guiding principle: Both in terms of the products we develop and in terms of our down-the-line services and partnership.



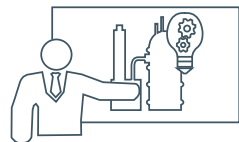
### ON-SITE SUPPORT



SUPERVISION  
ERECTION  
COMMISSIONING



MAINTENANCE  
EXECUTION



TRAINING  
SESSIONS &  
TROUBLESHOOTING

### SMART SERVICE



PREDICTIVE  
MAINTENANCE



REMOTE  
SUPPORT



RETROFITS &  
UPGRADES



# WE PROMISE QUALITY

**Constantly in our thoughts.  
In every movement. Always.**

We know about our responsibility: Our products are part of a highly sensitive environment. Mistakes can cost human lives. Downtimes simply additional costs every day. That is why we always initially place utmost priority at all levels of our organization.

Quality starts with the first customer pitch. It is in the way we listen to your demands and the way we transfer our understanding into your designs. It is in every thought and idea we invest for your process. It is in the neatness of our workshops. It is in the way we treat our suppliers. It is in how we select material. It is in each and every weld seam. It is the way we deal with challenges. It is deeply embedded in everyone who works for SCHMIDTSCH SCHACK.

## **Just one example: Our welders.**

Some people think a weld seam is just a weld seam, nothing more, nothing less. Not in our eyes. To us, each seam we weld is a promise of excellence, long-term efficiency and occupational safety.

Several trainers educate our welders to enable them to always achieve our exceptional internal standards. When we hire welders, they have to pass our corporate testing. This high claim serves as verification for superior standards.

Weld seams are just one indicator for our premium quality approach. However, we not only fulfill worldwide industrial standards. We are also involved in defining them by assuming the lead role in respective associations.







8

Locations  
worldwide

5

Engineering  
centers

2

In-house manufacturing  
facilities

20+

Global sales  
representatives

**SCHMIDTSCHESCHACK**  
Worldwide



# PASSIONATELY PUSHING LIMITS.

We value partners, we challenge us.

We are a reliable partner for the world’s leading engineering companies, contractors and operators in several industries. Being part of their process makes us proud.

## PRODUCT TYPE NAVIGATOR

Are you looking for a certain type of product? Here you go! Learn more about our core products and how we tailor these solutions exactly to your requirements.

|                   |                                |
|-------------------|--------------------------------|
| Economizer        | 10, 14, 26, 30, 34             |
| Fired Heater      | 38                             |
| Incinerator       | 22                             |
| Quench Boiler     | 10, 22                         |
| Reactor           | 14                             |
| Recuperator       | 14, 22, 30, 42, 46             |
| Steam Generator   | 10, 14, 18, 22, 26, 30, 34, 42 |
| Steam Superheater | 14, 18, 26, 34, 38, 42         |

## INDUSTRIES NAVIGATOR

We serve several industries. We have listed them here in order to assist you to locate the appropriate solution to fulfill your objectives. Are you looking for another industry? Just contact us and let us show you exactly what we can do for you.

|                |                            |
|----------------|----------------------------|
| Chemical       | 22, 26, 34, 38, 42, 46     |
| Metallurgical  | 34, 42, 46                 |
| Petrochemical  | 10, 14, 18, 34, 38, 42, 46 |
| Pulp and Paper | 14                         |
| Refinery       | 18, 34, 38, 46             |
| Waste to Value | 14, 30, 46                 |

## PROCESS NAVIGATOR

Special processes require made-to-measure quotations. We are an experienced partner in engineering and manufacturing process-optimized heat transfer solutions. Steam reforming? Sulfur recovery? Sludge incineration? Find the process you are interested in.

|                                  |            |
|----------------------------------|------------|
| Acetylene                        | 38         |
| Adipic Acid & Caprolactam        | 26         |
| Ammonia Oxidation (Nitric Acid)  | 26         |
| Carbon Black                     | 22         |
| Direct Reduction Iron            | 42         |
| Fly Ash Thermal Beneficiation    | 46         |
| Forging                          | 46         |
| Gasification & Partial Oxidation | 14         |
| Glass Smelting                   | 46         |
| Sludge Incineration              | 30         |
| Steam Cracking                   | 10         |
| Steam Methane Reforming          | 18, 38, 42 |
| Steel Production                 | 46         |
| Sulfide Roasting                 | 34         |
| Sulfuric Acid                    | 34, 38     |
| Sulfur Recovery (Claus)          | 34         |
| Titanium Dioxide                 | 38         |



# 1:1

One customer.  
One solution.

# 4.0

With Zero.One®  
we digitalize  
plant operation  
for Industry 4.0.

# 100

100 % customer  
satisfaction is  
always our goal.

**DISCOVER MORE.** Request our dedicated  
heat transfer solution e-papers:

**[WWW.SCHMIDTSCHESCHACK.COM](http://WWW.SCHMIDTSCHESCHACK.COM)**

**SCHMIDTSCHESCHACK**

 **ARVOS**  
GROUP