Selas-Linde.
The furnace experts.

Collaborate. Innovate. Deliver.

Selas-Linde is part of the Linde Engineering Division – a leading player in the international plant engineering business. Across the globe, Linde Engineering has delivered more than 4,000 plants and covers every step in the design, project management and construction of turnkey industrial facilities.

Selas-Linde is a world-leading engineering contractor for process furnaces, fired heaters, vaporisers and incinerators for the chemical and petrochemical industries. These furnaces are used for ethylene and EDC cracking and for hydrogen and synthesis gas reforming. Fired heaters support petroleum refining and special chemical processing. Traditional and flameless thermal oxidation systems offer the most flexible, efficient, reliable and, in some cases, the only means of destroying hazardous and toxic chemical waste. And Selas-Linde vaporisers set the standards for low-emission vaporisation of liquid natural gas (LNG).

Having already constructed over 2000 of these plants worldwide, the company offers its customers a single point of accountability for technology, engineering, procurement and construction (T-EPC) projects, backed up by an extensive after-sales service.

Discover how we can contribute to your success at www.linde-engineering.com/selas-linde

Get in touch with our furnace and heater team:
Phone: +49 89 7445-0, e-mail: selas-linde@linde-le.com

Core competencies at a glance

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Core competencies at a glance
Our company.

Selas-Linde has a long tradition in furnace design, dating back to the early 1980s in the United States. The original company, Selas Corporation of America, was involved in the technology of fired process furnaces at an early stage. Over the years, the company worked continuously on developing this technology.

In 1948, the Ernst Kirchner company in Hamburg started developing its product line for fired industrial furnaces. After the death of the company’s founder in 1970, the fired industrial furnaces product line was spun off and sold to Selas Corporation of America. This acquisition was then renamed Selas-Kirchner GmbH. In 1973, Selas Corporation of America and the Linde AG Process Engineering and Contracting Division signed a license agreement for the planning, manufacturing and erection of pyrolysis furnaces to produce olefins. This move also combined Selas, Kirchner and Linde technologies in the field of fired process-furnace plants for the chemical and refinery industries. Over the following years, Linde’s Process Engineering and Contracting gradually acquired ever-larger shares of Selas-Kirchner and of the fired process-furnace plant division of Selas Corporation of America.

In 1985, Linde AG became the sole owner of Selas-Kirchner, Germany and of the process furnaces division of Selas Corporation. This division now operates under the name Selas-Linde North America based in Blue Bell, Pennsylvania, USA. On 1 January 1999, Selas-Kirchner GmbH was renamed Selas-Linde GmbH. Selas-Linde GmbH and Selas Fluid Processing Corporation now market the entire, bundled know-how of Selas, Kirchner and Linde furnace technology know-how exclusively throughout the world under the Selas trademark. Since its acquisition of 1-Thermal in 1992, Selas-Linde now complements its environmental engineering technology with extensive know-how and leading technology in the thermal oxidation of gaseous and liquid waste. Furthermore, Selas-Linde designs, supplies and constructs plants for the vaporisation of cryogenic liquids. Today, Selas-Linde is one of the leading global contractors in all of the above-mentioned fields.

Our portfolio.

Process furnaces for the chemical and petrochemical industry
- Cracking furnaces for ethylene production
- EDC cracking furnaces
- Cracking furnaces for special chemicals, such as acetic acid and freon

Reformers
- Steam reformer for hydrogen and synthesis gas production

Fired heater units for refineries
- Crude oil heaters
- Vacuum oil heaters
- Usines
- Platformers
- HDS heaters
- Reboilers
- Superheaters

Special-purpose furnace equipment
- Furnaces for iron direct-reduction processes
- Steam superheaters
- Waste heat recovery units for gas turbines

Environmental technology
In addition to these fields, Selas-Linde is also a leader in the design and construction of plants for oxidizing gaseous and liquid waste, including waste heat recovery, flue gas treatment and by-product recovery in the handling of:
- Halogenated hydrocarbons
- PCBS – polychlorinated biphenyls
- Pesticides
- Dioxins
- Pharmaceutical waste
- Aqueous salt-laden waste
- Nitrogen-bound organics

Vaporization of cryogenic fluids
- Submerged combustion vaporiser systems (Sub-X®) for:
  - LNG
  - LPG
  - Nitrogen
  - Ethylene
  - Others

Range of services
Selas-Linde offers a wide range of services tailored to customer needs:
- Studies
- Project management
- Basic and detail engineering
- Procurement of services and materials
- Construction, revamps and commissioning
- Supervision of fabrication and construction
- Start-up supervision
- After-sales service
- Project financing

Cracking furnaces for ethylene production.

In ethylene plants, pyrolysis or ethylene cracking furnaces are key building blocks in the production of basic chemicals such as ethylene, propylene, butadiene, etc. for the plastics industry.

In designing such cracking furnaces based on Linde’s PYROCRACK® technology, Selas-Linde can draw on its experience in the construction of more than 450 cracking furnaces.

Depending on available feedstocks and product distribution plans, Selas-Linde recommends an appropriate PYROCRACK cracking coil system. Highlights of these furnaces include vertically arranged coils for high product output, long furnace runtimes and robust mechanical design.

Firing is via a pure bottom/sidewall or combined bottom/sidewall burner arrangement. Integrated flue-gas heat recovery allows furnace efficiency rates of over 92%.

Extensive know-how and leading technology

Cracking furnace, Rafnes Norway, Novatyl AS.
Steam reformers.

Many processes in the chemical industry are based on the use of hydrogen or synthesis gas. The most important industrial method of generating hydrogen and synthesis gas is by steam reforming hydrocarbons. This is carried out in top-fired primary reformers.

Selas-Linde has developed a special reaction model of the reforming process to support the design of reformers. This computer program calculates the composition of the reformed gas, and the firebox is dimensioned for a wide feedstock envelope.

Selas-Linde’s experience in designing and building reforming furnaces dates back to 1957.

The design of the waste-heat recovery system for the flue and process gases takes into account the customers’s specific requirements and allows furnace efficiency rates of over 92%.

EDC cracking furnaces.

Vinyl chloride (VCM) is one of the most important monomers for producing a wide range of polymers today.

The vinyl chloride monomer is produced by thermal cracking ethylene dichloride (EDC) in a box-type furnace at temperatures of around 500°C and pressures of up to 30 bar.

Selas-Linde has designed and built EDC cracking furnaces for various processes. Worldwide customers include Goodrich, Stauffer, DOW, EVC, PPH, Hoechst and Atochem.

The coils and the fire box are designed by means of a special computer model for reaction kinetics. This allows the furnace design to be optimised with respect to the temperature/heat flux profile, residence time and pressure loss. Both main and secondary reactions are taken into account.

EDC furnaces are fired by natural-draft or forced-draft sidewall burners.

The residual heat of the flue gases is utilised for generating steam or preheating the air so that efficiency rates of over 90% can be achieved.
Refinery heaters.

All major processes in refineries require the heating and sometimes vaporisation of the hydrocarbons in direct fired heaters.

Selas-Linde has more than sixty years of experience in designing and building refinery heaters, and the company has constructed more than 450 heaters around the world.

Refinery heaters are designed according to the requirements of the process with pressures ranging from 0.05 to 150 bar and temperatures from 200°C to 900°C. Selas-Linde heaters cover fired duties from 3 MW to more than 100 MW.

These heaters come in single-cell, double-cell box or cylindrical designs. They are fired by natural-draft or forced-draft bottom or sidewall burners. Efficiency rates of over 90% are achieved through preheated air, hot oil and steam generation.

Furnaces for direct-reduction steel plants.

The demand for sponge iron (DRI = direct-reduced iron) as the feedstock for steel production in electric melting furnaces is growing. Selas-Linde supplies DRI gas heaters tailored to the specific process for the newly developed methods of direct reduction (Finmet, Circored, Midrex plant using COREX gas, Danarex, Hylsamex).

Circored
DRI is produced in a circulating and a stationary fluidised bed using almost pure hydrogen. Selas-Linde supplied the three reducing-gas heaters for the first industrial-scale plant using this technology.

Finmet
DRI is produced in four stationary fluidised-bed reactors using a mixture of hydrogen and carbon monoxide. The reducing gas is heated from a minimum of 50°C to a maximum of 935°C.

Midrex plant using COREX gas
DRI is produced in a conventional Midrex shaft but using purified COREX gas as the reducing gas, which is a mixture of hydrogen and carbon monoxide heated up with a 2-stage heater. Tail gas from another part of the plant with an extremely low heat value, which would otherwise have to be flared off, can be used to preheat the reducing gas. This provides a considerable increase in the overall efficiency of the process.
Steam superheaters for styrene plants
When dehydrogenating ethylbenzene to styrene, process steam is superheated to about 800°C in a furnace before being fed into the dehydrogenation reactor together with the ethylbenzene.

The furnace is based on a double-cell design with a common convection section to utilise the waste heat.

The tube system is gas-fired from both sides by means of natural-draft or forced-draft floor burners.

Gas-turbine waste-heat recovery unit (WHRU)
This method combines gas-turbine operation with that of a conventional refinery furnace. Combinations such as this provide an alternative use for the exhaust from the gas turbine. Depending on process requirements, this type of plant can also be built with auxiliary firing equipment to increase steam production, for instance.

The exhaust gases from a gas turbine are used in the horizontal waste-heat train to heat and partially vaporise crude oil in several tube bundles connected in series. The exhaust gases can also be used to heat process water.

Environmental technology
The Selas-Linde/T-Thermal environmental technology disposes of almost all kinds of gaseous and liquid pollutants, particularly halogenated hydrocarbons and salt-laden aqueous waste.

Selas-Linde/T-Thermal has many years of experience in designing and building incinerators for treating waste materials from the following industries:
- Pharmaceutical
- Chemical
- Refinery
- Pesticides
- Plastics

Typical plants consist of vertically or horizontally arranged combustion sections with own proprietary burner technology and Sub-X quench systems, plus sections for heat recovery, flue-gas treatment and by-product recovery, depending on the application. Selas-Linde/T-Thermal has more than sixty years of experience in building plants and over 500 references all over the world.

+60 Years of experience all over the world.
99.99% destruction efficiency guaranteed

Thermal oxidation.

A pollution-free environment
Selas-Linde is committed to provide the equipment, service and technical support required to resolve complex disposal problems. Using tailor-made combustion technology, Selas-Linde can safely destroy nearly any kind of liquid and gaseous waste encountered in industry.

Since building our first thermal waste oxidation system in 1949, we have supplied over 1000 installations worldwide to many of the leading process and manufacturing companies. In a technology where experience and expertise are critical, Selas-Linde is an acknowledged world leader.

Guaranteed destruction efficiencies
Thermal oxidation is the most direct, efficient, complete and final method for the disposal of particularly hazardous liquid and gaseous industrial waste. For some forms of waste, it is the only practicable solution.

Destruction efficiencies enabled by Selas-Linde waste oxidation systems are guaranteed to meet European legislation and exceed the most demanding requirements anywhere in the world. We have successfully dealt with virtually every kind of hazardous and toxic waste. One example of many: A specially designed thermal system was selected for the US Army’s program to destroy the nation’s stockpile of obsolete chemical weapons, including nerve agents. A destruction efficiency of 99.999999% was achieved.

Submerged combustion vaporiser systems.

T-Thermal invented the submerged combustion vaporiser (Sub-X), filed it for patent protection and installed the first design unit at Alabama Gas in 1965. Since the acquisition of T-Thermal in 1992, Selas-Linde has continued to develop and supply a range of specialised units for heating and vaporising cryogenic fluids such as LNG, LPG, liquid nitrogen, oxygen, ammonia and ethylene. The technology has been applied in LNG terminals worldwide, for both base-load and peak-shaving duties.

Selas-Linde is the global market leader in the supply of submerged combustion vaporiser systems.

The Sub-X vaporiser is an assembly with the following major components:
- Vaporiser tank constructed in epoxy-coated carbon steel, stainless steel or concrete
- Sub-X burner complete with distribution duct and sparging system
- Heat exchanger coil
- Weir assembly
- Combustion air fan, motor, inlet and outlet silencer and acoustic housing as required
- Control panel and instrumentation package for hazardous area classification
- Optional cogeneration hot water distribution system

LNG vaporisers, Belgium.
Main advantages of the submerged combustion Sub-X vaporiser system.

**Operational safety**
The process tubes are submerged in a water bath and the tube wall temperature therefore does not exceed 55°C. There is no risk of flame impingement with LNG contact.

**High thermal efficiency**
With high heat flux and narrow temperature approach, high gross thermal efficiency rates approaching 100% can be achieved.

**Fast response**
Rapid start-up and shut-down without process disruptions.

**Heat transfer rate**
The bubble formation by direct contact heating and the use of a patented weir arrangement provides a high level of turbulence and excellent recirculation over tubes containing the cryogenic fluid, thus maintaining temperature uniformity. Observations of unit operations have indicated no ice build-up, even when operating with low bath temperatures.

**High operational reliability**
With the exception of facilities that have closed, all Sub-X LNG vaporisers installed since 1965 are still in operation.

**Environmental impact**
These units are designed to meet the new regulatory standards with very low NOx emission values.

Dedicated to ease of business.

At Selas-Linde, we offer a lot more than the design and delivery of state-of-the-art plant components and process technologies. Our ultimate aim is to make doing business with us as easy and pleasant as possible.

As a world-leading engineering contractor for steam reformers, cracking furnaces, fired heaters, LNG vaporisers and incinerators, we offer our customers a streamlined, single interface for all technology, engineering, procurement and construction (EPC) services. We also work collaboratively with our clients to fulfil their project needs and agreed timelines – always taking operability, maintenance and regulatory requirements into account.

Whether revamp or greenfield projects, customers can thus rely on us for a one-stop, hassle-free project management service that covers every step in the solution lifecycle – from initial feasibility studies through basic and detail engineering to procurement and supervision of assembly, construction and start-up.
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Core competencies at a glance

Process technologies
- Cracking furnaces for ethylene production
- Steam reformer furnaces
- Fired heaters and waste heat recovery units
- DRI heaters and special crackers
- Incinerators and thermal oxidisers
- Cryogenic vaporisers

Services
- Feasibility studies
- Project management
- Basic and detail engineering
- Procurement of services and materials
- Construction, revamps and commissioning
- Supervision of fabrication and construction
- Start-up supervision
- After-sales service
- Project financing