REHEAT FURNACES AND HEAT TREATMENT TECHNOLOGY
Advanced combustion solutions
ECONOMICAL AND ENVIRONMENT-FRIENDLY FURNACE TECHNOLOGY FROM THE SYSTEM SUPPLIER

SMS group is able to deliver nearly all thermal processing equipment which is required to produce modern steel and aluminum products. SMS designs, erects and commissions furnaces for the different production steps of carbon steel, electrical silicon-steel, stainless steel, and aluminum. This includes furnaces for heat treatment of strip and hot-formed materials like heavy plates, tubes and bars as well as reheating furnaces. Common to all furnaces is high cost-effectiveness that results from constant improvement, quality consciousness, and a focus on saving resources. Drawing on the combined strength of SMS group, the furnaces can be supplied from one single source.

KEY FACTOR FURNACE TECHNOLOGY

Furnace technology is considered to be the core process for the production of modern materials, since it determines the material properties and the quality of the final product. Controlled heating or cooling is the only way for the manufactures to produce high-quality, marketable final goods. Often, cooling is more important than heating but at the same time more difficult. With SMS as a technology partner the complete know-how for heating and cooling throughout the complete process chain can be supplied from one source and high material quality can be ensured.

In this brochure you’ll find comprehensive information about our products, technologies, services and references of furnace technology.
Numerous References

Since 2000, SMS group has attracted orders for more than 150 furnaces for carbon steel silicon steel, stainless steel and aluminum to produce high quality strips, plates, bars or tubes including all important types of furnaces and cooling technologies.

Steel and NF-Metal Producers Using Furnaces from SMS (Examples)

- Acroni
- Amag Rolling
- AMNS Calvert
- Angang Steel Company
- Aperam
- ArcelorMittal
- ASAC Aluminyum
- Baosteel
- Baixin
- Bangang
- Big River Steel
- China Steel Corporation
- Deutsche Edelstahlwerke
- Handan Iron & Steel
- Henan Zhongfu
- Hyundai Steel
- Iva
- Jsp
- Ma’aden-Alcoa Joint Venture
- Maanshan Iron & Steel
- MMK
- NAS North American Stainl.
- NLMK
- Nucor Steel
- Outokumpu
- Posco
- PRO-TEC Coating Company
- Salzgitter Flachstahl
- Severstal
- Shagang Group
- Shandong Nanshan
- Shougang Jingtang
- Shougang Corporation
- SSAB
- Stelana
- Taigang
- TKAS Temi
- ThyssenKrupp Steel
- Tianjin Tiantie
- Tianjin Zhongwang
- Timken
- TMK Artrom
- Toscelik
- US Steel
- Voestalpine
- Wuhan Iron & Steel

Market Leadership
The majority of market leading steel and NF-metal producers rely on SMS group’s technology.

High Product Quality
Significant to all furnaces is the high quality of the final product. Thus, the furnaces are especially designed to ensure flawless surfaces and homogenous material characteristics.

Flexible Production
Flexible production conditions allow a quick reaction to changing market demands with the greatest economic efficiency. SMS group has developed several furnace solutions for highest flexibility.

System Supply
SMS group is capable to deliver almost all furnaces completely from one single source. This means, you get everything you need out of one hand and without any interface problems.

Production Know-How
SMS group offers process support for all materials and qualities. This covers both metallurgical and design activities as well as support during commissioning, operation, quality control and certification.

EcoPlants
All furnaces are designed to keep resource consumptions as low as possible. All technologies and processes are continuously evaluated in order to improve their eco-friendliness.

Project Management
A professional project management aligned with latest knowledge and international standards ensures in combination with modern design methods, a consistent and reliable fulfillment.

Manufacturing
The set-up includes several modern and well equipped manufacturing locations worldwide to ensure a high level of quality control and proximity to the customers.

Modernizations
SMS possesses rich experience and offers comprehensive services for refittings and upgrades. Starting from the exchange of a single parts up to major modernizations of complete furnaces with several measures.

Industry 4.0
The furnaces use production and process models which are deeply integrated in the automation system and linked with other systems.
Besides those main furnace types and heat treatment processes, SMS group offers various other concepts or variations of processes depending on the individual customer requirements.

Modernizations – from small improvements to vast revamps – are also a part from SMS group’s product portfolio.
SMS-FLAME®
High-efficiency burners for varied application.
A new concept in burner development

SMS applies a new concept in burner design and development and is capable for offering a full line of advanced SMS-Flame® burners. These are available in a wide range of power sizes and in different models suitable for varied application:

SMS-ZERO Flame®, the new frontier of natural gas-flameless combustion. Extra-Low NOx emissions at any rating and combustion air temperature

SMS-ECO Flame®, a reliable unit combining low NOx capability and high efficiency, available for any gas or liquid fuel – also available in radiant configuration for roof installation

SMS-DUAL Flame®, capable of dual fuel utilization, gaseous fuel and oil

EFFICIENT BY DESIGN
A strong synergic approach between research and experience in furnace realization allows designing burners suitable for any kind of furnace.

“Flexibility” is the keyword of the research approach, based on field tests, performed in combustion laboratory, and Computational Fluid Dynamics (CFD).

Before manufacturing and testing the prototypes in the laboratory, SMS identifies the most promising design using detailed CFD-based modelling. Prediction of flame reaction zone profile, temperature gradients and pollutants generation are only some of the aspects that are modelled and optimized with CFD software before starting the test campaign on a real burner.

VERSATILE BURNERS FOR OPTIMISED COMBUSTION
Different products require different temperature profiles. With SMS-FLAME® burners, plant engineers can flexibly adapt the combustion parameters to diverse process conditions.

The shape and temperature control of the flame outline helps to contain the overall emissions: when firing in flameless mode, the SMS-ZERO Flame® burners not only dramatically decrease the NOx formation, (<70 mg/Nm³ at 3% O₂ DFG), but also improve the temperature homogeneity inside the furnace chamber.

Burners are studied and developed by means of most advanced techniques: the first phase foresees CFD modelling, often followed by 3D printer proto-typing.

Later the burners need to go through extensive laboratory tests, in order to assess their genuine capability to steadily meet the emission parameters foreseen by the software simulations.
SMS group pays great attention to design and component features that allow for the lowest possible energy consumption. The furnace specialists continuously test new materials, components and concepts. The results are self-explanatory: energy requirements below 260 kcal of heat input per kilogram of steel reheated from 20 to 1,200 °C minimise energy costs in long product rolling mills. Another example is a total fuel energy consumption of less than 280 kcal per kilogram required in a quench and temper cycle, where the workpieces are heated from ambient temperature to 900 °C for hardening then, having been quenched, reheated again to over 500 °C to complete the tempering process.

**ADVANCED LINING**
Refactories play a key role in containing energy dissipation and in improving the efficiency of old furnaces. In extensive field tests SMS examined different lining materials and their impact on energy efficiency. Based on the test results, the furnace specialists select the best material for each furnace.

**FORM FOLLOWS FUNCTION**
When designing a new reheating furnace or a heat treatment plant, the experienced SMS engineers use both their know-how and advanced computational modelling tools. With state-of-the-art CAD and FEM software they create smooth, fast and precise mechanical designs for any heating task.

3D modelling is also an invaluable benefit for the field engineers and erection crews on site, as all details can be clearly understood at a glance. One example is pipe routing detail engineering with 3D CAD programs: it simplifies and speeds up the erection works so costs are reduced and the plants can be commissioned earlier.

The digital modelling of a walking beam frame is an efficient tool in removing interferences and quota errors from the design. Loads and forces are calculated rapidly with no risk of errors.

**OPTIMIZED RESISTANCE**
Improvements in material quality, durability and safety allow for the utilisation of modern light-weight fibre insulations for applications traditionally reserved for castable and plastic refractories. Low thermal inertia and optimised resistance to repeated thermal cycles make this class of lining materials especially beneficial for heat treatment furnaces. The modern fibres are characterised by an enhanced resistance to higher temperature conditions and by a certified absence of hazardous compounds, compared to similar linings available in the past.
With SMS-Prometheus™, plant operators are able to boost their furnace’s overall performance. The advanced combustion optimisation system improves those parameters that can make the difference in special steel quality production. SMS-Prometheus™ allows for targeted improvements of the metallurgical properties, for example increased temperature uniformity or minimised negative effects such as steel decarburisation or high scale formation.

**FUEL – ONLY AS MUCH AS YOU NEED**

SMS-Prometheus™ helps to reduce fuel consumption by adopting those heating strategies that minimise the temperature set points and yet guarantee the required final stock target temperature. The core of the program is a sophisticated mathematical model capable of simulating the heating curves inside the furnace for each stock loaded. The system shows the overall furnace efficiency by visualising heating balance diagrams. It also provides consumption and emission trends that can be correlated to actual production data.

SMS-Prometheus™ constantly monitors the heating history parameters of each single workpiece. The system works predictively, meaning it makes consistent projections to estimate the development of the heating path. On this basis, SMS-Prometheus™ continuously chooses and modifies the temperature set points. When coupled with SMS-Digiburn®, the system also optimises the digital firing pattern.

**ENERGY SAVINGS – EVEN DURING NONPRODUCTIVE TIME**

SMS-Prometheus™ is highly efficient in optimising the combustion parameters during events like sudden stoppages, furnace heating-up time or changes to the product campaign. This tool ensures proper heating repeatability, even with inexperienced operators, although even highly experienced staff benefit substantially from the mathematical model guidance during transitory events.

**EFFICIENCY INDEX**

SMS-Prometheus™ tracks the consumption and the other efficiency related parameters and stores the trends over time in order to allow prompt monitoring.

**ADVANCED FEATURES – SKID MARKS EFFECT PREDICTION**

This function allows to monitor the “skid marks effect” by means of a specific algorithm which simulates cold spot effect generated by water cooled skids, managing different parameters of the automation and combustion system according to the process requirements.

**ADVANCED FEATURES – ROUGHING MILL PYROMETER FEEDBACK**

This function adapts the mathematical model according to the roughing mill pyrometer measurements. The temperature of the piece measured by the pyrometer is compared to the expected one and adapts the model accordingly.

**ADVANCED FEATURES – PACING MODEL**

The model forecasts the time in which each piece inside the furnace will be ready to be discharged to fulfill the minimum heating/soaking time requirement of each piece inside the furnace and get the maximum productivity.

**FROM DETAILED INFORMATION TO COMPREHENSIVE OVERVIEW**

The overview screen shows the furnace loading pattern and provides the main data relevant to the temperature set points of the different heating zones.

By selecting a specific billet, the engineer obtains the real-time heating status of any single workpiece.
Every rolling mill is different and the same should apply to every furnace. The SMS furnace experts offer tailored solutions for any process and layout. The design capability includes in general the following furnaces.

- Roller Hearth Furnaces page 16
- Chamber Furnaces page 18
- Walking Beam Furnaces page 20
- Walking Hearth Furnaces page 24
- Pusher Furnaces page 26
- Rotary Hearth Furnaces page 30

REHEAT FURNACES FOR SLABS, BARS AND TUBES
EFFICIENT HEATING OF HEAVY PLATES

The roller hearth furnace is often used in a continuous heat treatment process for heavy plate. Its strengths are, on the one hand, different speeds for the individual heat treatment of plates and, on the other, a high maximum speed, which is important, in the first place, when it comes to transporting the plates to the quench.

The furnace housing of a roller hearth furnace has the shape of a long tunnel. The hearth itself consists of rollers arranged transversely to the direction of transport. The distance between the rollers must not exceed a maximum dimension, as otherwise there would be a risk of the plates “diving” below one of the rollers. This maximum dimension is thus determined by the bending behavior of the thinnest plate at the highest possible temperature. The roller hearth divides the furnace into a top and a bottom section which provides the possibility of heating from both sides.

The hearth usually consists of high-alloy centrifugal cast rollers and which is the core component. On the one hand, the rollers are a decisive factor as regards the costs of such a furnace system, which again depend to a large extent on the price fluctuations, especially for the main constituents of Cr and Ni. On the other hand, the rollers may also impose restrictions on the system design. A sufficient lifetime of the rollers can only be guaranteed if the hearthload as a combination of temperature, plate load per roller and bearing center distance (which again is directly linked to the plate width) does not exceed certain limits.

Heating is accomplished either by open or indirect firing through radiant tube burners with the furnace chamber being rendered inert by flushing with nitrogen. The indirect heating method results in less scale on the plates, but requires considerably higher investment and operating costs. The radiant tubes of indirectly heated furnaces are equipped with recuperator burners.

For open fired furnaces, however, it is recommended to use high speed burners with a central recuperator for preheating the air.

SMS delivers two roller hearth furnaces for the Slovenian steelmaker Acroni, which are integrated into heat treatment lines for heavy plates. The furnaces will be designed for 4 to 13 meter plates with thicknesses ranging from 3 to 100 millimeters and a width ranging from 700 to 2,560 millimeters. The maximum weight of the plates is 16 tons. The range of materials includes high-strength carbon steels, stainless and tool steels as well as a range of special grades.

SMS supplies a roller hearth furnace for hardening, normalizing and solution annealing and another roller hearth furnace for tempering, as well as a quenching system and all auxiliary facilities. These will include the complete plate conveying equipment, all systems for the water supply and water treatment as well as the automation of the systems.

Reference: Acroni, Slovenia

TWO ROLLER HEARTH FURNACES FOR SPECIAL GRADES

The roller hearth furnace for hardening and solution annealing will be equipped with two chambers, in which the plates will be annealed in a nitrogen-based inert gas atmosphere. Heating to up to 1,100 °C will be carried out indirectly using radiant heating tubes with recuperator burners. The total furnace length is 33.6 meters.

The roller hearth furnace for tempering is only slightly shorter with a length of 32.3 meters. In this open fired furnaces, however heating takes place via high-speed burners which heat the furnace up to 800 °C. The achieved plate temperature lies between 400 °C and 780 °C.
CHAMBER FURNACES

BATCH OPERATED FURNACES WITH A FIXED HEARTH

Chamber furnaces are batch-operated furnaces with a fixed hearth. These furnaces are characterized by their high degree of flexibility and are thus typically used in the case of low capacity requirements and frequently changing batches. Depending on the case of application, the hearth can be subdivided such that heating of the plate bottoms can be implemented at least in parts of the furnace. On the longitudinal side, the furnaces are equipped with a large door. Through this door, the plates are introduced into batch type furnace and discharged from the furnace by means of a machine. For plate transfer to the furnace and away from the furnace, a conventional roller table is installed along the longitudinal side of the furnace.

The chamber furnace is often used for normalizing or solution annealing at elevated temperatures in the case of high plate loads and large plate widths. Concerning the combination of plate load and temperature, this furnace has almost no restrictions.

As part of a complete heat treatment line, SMS delivered two chamber furnaces to Outokumpu Stainless in Degerfors, Sweden. The two batch-type were delivered completely with charging machines and connecting roller tables as well as all the accompanying electrical and automation equipment.

The new furnaces are used for heavy plates and high heat-treatment temperatures, as well as for small batch sizes of niche products. The loading machine introduces a stainless steel plate into the furnace. The furnace plant consists of two batch type furnaces, both of which have two doors. The reason for this is that every furnace can be further divided into two chambers using a special separation gate. In this way, Outokumpu can occupy a furnace with either one long plate or two short plates. If two plates are in the furnace, then these can be heat-treated individually using differing annealing temperatures times, provided that the separation gate is closed. This offers a high degree of flexibility and thus optimal hearth utilization at all times, which guarantees energy-efficient plant operation. In this way, Outokumpu can occupy a furnace with either one long plate or two short plates.

The batch type furnaces can heat plates to more than 1,200 °C. With such high temperatures, Outokumpu is capable of manufacturing sophisticated steels such as high-alloy grades for special applications. The furnaces meet the high environmental protection requirements and are equipped with a modern heat-recovery system. A further special feature is the processing of very thin plates. The plate lengths range from 3,000 to 16,000 millimeters and the widths from 400 to 3,500 millimeters. The loading and unloading machine conveys at approximately 2 meters per second.

Reference: Outokumpu, Sweden

TWO CHAMBER FURNACES WHICH CAN BE CONNECTED

With the help of loading machines all plates are introduced separately into the batch type furnaces.

The large doors on the longitudinal side of the furnace opens and a glowing plate is discharged out of the furnace.

Solution annealing takes place via high-speed burners in the open fired batch furnace at Outokumpu.
**WALKING BEAM FURNACES**
High productivity combined with operational flexibility

Walking beam furnaces, both top and bottom-fired, allow for high production rates and top quality steel grades. Billets, heavy blooms, slabs and beam blanks can be charged. Walking beam furnaces feature many cooled elements as well as special alloy parts which endure high temperatures and mechanical stresses. SMS group continuously works on the development and integration of new designs and materials. Thanks to the advanced combustion system, all SMS walking beam furnaces are highly flexible in operation.

**FAST AND RELIABLE MATERIAL HANDLING MACHINES**
SMS sturdy discharging machines avoid any misalignment in the discharging area, even when handling workpieces of very different sizes and shapes. They virtually eliminate vibrations and positioning errors. The possibility of reverse movement in emergency situations as well as the choice of manual handling are further key advantages. SMS group offers a wide range of kick-in and kick-off machines, both electromechanically and hydraulically operated – so even the most challenging demands are met.

**RAPID DISCHARGE RATE**
The record-setting machine delivers one billet every 24 seconds. It is installed in the high-capacity walking beam furnace at KSC Nohseserginsky Metallurgichesky Zavod – ZAO “NSMMZ”.

**BENCHMARK EFFICIENCY**
The 180/220 tons per hour walking beam furnace at United Steel Company, Bahrain, is equipped with ultra-low NOx burners. It sets benchmarks in efficiency and low emissions.
ArcelorMittal Ruhrort operates one of the world’s most modern wire rod mills. The plant was supplied by SMS group and produces a wide range of special steel grades for the premium market, primarily the automotive sector. The walking beam furnace adequately supports the slender billets with the fixed and movable skid. The result: 110 tons of billets with a thickness of 155 millimeters and a length of 16.5 meters are optimally heated every hour, meaning ArcelorMittal can reliably deliver premium quality products. The double-stage recuperative system allows for benchmark efficiency and minimum emissions: a specific natural gas consumption of 250 kcal/kg and less has been achieved very early after lighting of the furnace. The waste gas evacuation system is equipped with special filter units which effectively reduce the release of particulate matter. The walking beam geometry guarantees perfect overall heating quality:

- Faster reheating ensures better control of decarburisation, vital for high-quality rods.
- The temperature homogeneity is enhanced by a large battery of low-NOx radiant burners in the heating and soaking top roof, and by the digitally controlled long-flame burners installed in the bottom soaking zone.
Walking hearth furnaces are the optimum choice for many long products mills with production rates of up to 140 tons per hour. Due to the layout with top heating only, these are recommended for products with a maximum thickness of 160 millimeters. A major advantage of this furnace type is that it allows for very low specific consumption figures, achieved thanks to the absence of water-cooled elements inside the furnace.

Stefana S.p.A. set up a 700,000 ton per year bar mill under a project entitled “Dream Steel”, located in Ospitaletto, Italy. The furnace specialists designed a furnace capable of reheating billets with a length of 16 meters, with the result that Stefana can profit from the market demand for large coils with a weight of more than three tons, as well as from the overall benefits of improved yield. This target was achieved by constructing a walking hearth furnace with a suspended 16.8 meter wide roof. A battery of 90 radiant burners guarantees optimum temperature homogeneity of the reheated workpieces.

The heat maintenance zone, a series of small burners that retain the furnace temperature during weekend stoppages and prolonged mill downtimes, helps Stefana to reduce energy costs. The reheating furnace is able to supply the mill with a continuous output of 120 tons per hour starting with cold billets, or 140 tons per hour when hot charged.

**RECORD-BREAKING PERFORMANCE:**

**16 M SLENDER BILLETs UNDER A RADIANT ROOF**

Stefana S.p.A. set up a 700,000 ton per year bar mill under a project entitled “Dream Steel”, located in Ospitaletto, Italy. The furnace specialists designed a furnace capable of reheating billets with a length of 16 meters, with the result that Stefana can profit from the market demand for large coils with a weight of more than three tons, as well as from the overall benefits of improved yield. This target was achieved by constructing a walking hearth furnace with a suspended 16.8 meter wide roof. A battery of 90 radiant burners guarantees optimum temperature homogeneity of the reheated workpieces.

The heat maintenance zone, a series of small burners that retain the furnace temperature during weekend stoppages and prolonged mill downtimes, helps Stefana to reduce energy costs. The reheating furnace is able to supply the mill with a continuous output of 120 tons per hour starting with cold billets, or 140 tons per hour when hot charged.
PUSHER FURNACES  
Low investment costs combined with robust design

When it comes to heavy duty and straightforward design furnaces for billet reheating, the pusher type furnace is often the perfect choice. Pusher furnaces are typically suitable for low-production mills for common steel grades, for example rebar mills.

ADAPTABLE TO VARIOUS NEEDS  
Top-fired pusher type furnaces combine the benefits of a sturdy construction and simplicity in design with low consumption. Top and bottom-fired pusher type furnaces are capable of high production rates. Pusher type furnaces are an inexpensive alternative to more sophisticated walking hearth furnaces or walking beam furnaces for the production of simple products.

FIELD OF APPLICATION:  
LONG PRODUCTS  
Larger furnaces for greater profit

SMS group has decades of experience in the design and construction of rolling mills for bars, sections and wire rod. The same goes for reheating furnaces. Over the years the furnace experts have developed many benchmark solutions to meet the increasing demands of the long products market.

One example is the ability to produce coils which have a weight of 3 tons and more and a higher market value per ton. For this purpose, billets much longer than the traditional 12 meters are used as starting stock. Billets above 12 meters in length are the market standard today. SMS group offers furnaces for even longer billets – the engineers can deliver whatever their business partners need to improve their competitiveness.

The demands in terms of heavy section mills and rail mills are similar: by using starting blooms longer than the traditional 12 meters, the plant owners profit from increased metal yield by reducing crop ends.
FIELD OF APPLICATION:
FLAT PRODUCTS
Reheating furnaces for optimum slab quality

Quick Comissioning, Short Cycle Time
The enormous kick-off machine for a 30 ton slab treatment furnace at Outokumpu in Degerfors, Sweden, was preassembled in the SMS group workshop to ensure a minimum commissioning time. Cycle times are short too: the machine can unload one slab every 20 seconds.

SMS group offers highly productive walking beam furnaces for slab reheating with capacities of up to 400 tons per hour. They are equipped with a set of fixed and movable water-cooled skid beams. In order to minimise skid marks both fixed and movable skids are staggered between the heating and the soaking area. Heat losses through the cooling water are minimised using composite double-layer insulation for the complete skid system.

High Quality Through Optimised Temperature Distribution
A set of special alloy skid riders is placed on top of the fixed and movable skids over the entire length of the furnace chamber. The furnace engineers calculate the height of the riders precisely so the slabs are at a sufficient distance from the water-cooled skid. The results: skid marks and dark spots on the slab are minimised as the temperature of the skid’s contact spot is very close to the temperature of the heated slab.

Wide Range of Combustion Systems
SMS group equips all walking beam furnaces with highly efficient, digitally controlled combustion systems and conventional, hybrid or fully regenerative burners that work using all widely available fuels.

Small in Capacity but Great on Flexibility
SMS group also offers special walking hearth furnaces for small slabs. These compact solutions are characterised by smart loading diagrams which allow high loading flexibility. They process a wide range of slab sizes and thicknesses.
FIELD OF APPLICATION:
PIPES AND TUBES
Fully integrated furnaces for any process
INTELLIGENT ENERGY RECOVERY
Whenever SMS engineers design a plant, they consider the whole production process and combine the individual process stages to produce the best results for their business partners. One example is the further utilisation of the heat energy that exits the rotary hearth furnace, which is by far the most energy-demanding unit in a seamless pipe mill. Using a completely automated fume recirculation system, SMS rotary hearth furnaces satisfy all the energy requirements of the mandrel reheating furnace. Plant operators save all energy costs for mandrel reheating and reduce emissions here to zero.

ZERO EMISSIONS AND ZERO ENERGY CONSUMPTION
The energy required for the mandrel reheating furnace is fully obtained by exploiting the excess heat from the rotary hearth furnace exhausts.
FIELD OF APPLICATION: FORGED PRODUCTS
Furnaces as versatile as the product mix

SMS group has set new standards in forged product reheating, in terms of both operational flexibility and reheating efficiency. The furnace experts transferred and optimised the comprehensive experience gained to high-productivity rotary hearth furnaces for pipe mills. On this basis, they developed advanced dedicated reheating solutions for forged plants. With SMS group furnaces, forging plant operators gain a competitive edge due to increased productivity and a wide product mix combined with reduced energy and maintenance costs.

FLEXIBLE, EFFICIENT AND COST-EFFECTIVE
An impressive example of the SMS approach is the new type of rotary hearth furnace: it is charged and discharged through two separate doors by a single elevated-type swivelling machine. This design, combined with state-of-the-art combustion and control systems, allows for the perfect combination of high energy efficiency and proper operational flexibility. At the same time, plant operators benefit from low investment and maintenance costs.

ONE FURNACE, MULTIPLE TEMPERATURE ZONES
SMS group developed a special furnace design for forging plants with small to medium capacity and a wide product range: multi-chamber furnaces which allow for simultaneous heating of different products at different temperatures. In these highly flexible furnaces every product is heated precisely according to its specific requirements. The temperature zones are regulated by a digitally controlled single combustion system. Regenerative burners guarantee high efficiency.

THE FORGE MILL FURNACE AT TOSCELIK
The furnace for heavy blooms and ingots at Toscelik, Montenegro: a single motorised machine, swivelling on a 25° arc, handles both charging and discharging.

MULTI-CHAMBER FURNACE
One control system, multi-stage heating: the capability of three separate furnaces combined into one.
Highly demanding applications require exceptional qualities guaranteed for every single plate, tube or bar. SMS’s heat treatment specialists design and construct benchmark setting heat treatment solutions combining the sophisticated heating technology with advanced and proven cooling systems.
HEAT TREATMENT OF TUBES AND PIPES
Premium quality pipes that satisfy even the most demanding requirements

Over recent years, the tube industry has enjoyed a boost from the worldwide upturn in oil and gas exploration. Deeper conventional wells and non-conventional oil and gas exploration require a huge number of quality tubes which are often exposed to extreme conditions. In this field, the failure of one single pipe can make the difference between a highly profitable business and a considerable money loss.

To guarantee the high quality and desired mechanical properties required for Oil Country Tubular Goods (OCTG) applications, sophisticated heat treatment is necessary. The pipes must be heated and cooled in accordance with strictly controlled process cycles.

IN-DEPTH CONTROL FROM SINGLE TUBES TO PROCESS OVERVIEW
An intelligent tracking system ensures traceability of each tube through the line. It enables tracking of the heat treatment performed on the single tube lots, in order to keep a record of the achieved results.

THE PRODUCTION INPUT MASK:
each lot or tube can be identified and assigned to a specific heat treatment recipe.

LAYOUT OVERVIEW:
the operator can monitor the functionality of every single machine and control the position of any workpiece inside the plant.
CENTURY LONG EXPERIENCE IN SEAMLESS TUBES PRODUCTION
SMS group has already more than 125 years of experience in the production of seamless tubes: Its roots go back to 1885, when brothers Reinhard and Max Mannesmann obtained the first patent for the manufacture of seamless tubes – a pioneering invention. In the past 50 years alone SMS group has implemented over 2,000 seamless tube plant projects.

HEAT TREATMENT: THE COMPLETE RANGE
The heat treatment specialists complement the company’s tube rolling expertise with a wide range of advanced heat treatment plants, from quenching and tempering through normalising to annealing. SMS group offers benchmark solutions like the SMS-Quench® system, which enables pipe manufacturers to achieve the desired quality and to enhance process consistency from the billet to the pipe fit for sale.

DESIGN FEATURES FOR PREMIUM TUBE QUALITY
SMS hardening and tempering furnaces guarantee the tightest temperature tolerances. This is how plant operators can ensure consistent properties over the whole tube length. In most cases, the furnace specialists install high-speed burners that generate strong turbulence inside the furnace chamber. The result is a consistent and homogeneous skin temperature which leads to homogeneous mechanical properties over the whole pipe length and cross-section.

EFFICIENT HANDLING SYSTEMS FOR A SMOOTH PROCESS
SMS individually designs the pipe handling equipment for each heat treatment line. The fully integrated systems guarantee a proper material flow that avoids any bottlenecks. Scratch-free pipe handling machines help to prevent defective tubes.

MINIMUM NOx EMISSIONS
Self-recuperative burners, available in both visible flame and flameless configurations, minimise NOx emissions.
When it comes to adding value to the pipe

To achieve the desired structure transformation effectively during the quenching process, it is essential that the cooling down parameters are accurately controlled. Especially when it comes to OCTG pipes, deviations from the demanding mechanical properties dictated by the relevant norms cannot be tolerated. The difference between a premium quality pipe and a failure often comes down to just a few seconds or degrees. With SMS-Quench®, tube manufacturers can reliably control and monitor all quenching parameters and thus adjust every tube’s qualities with maximum precision.

TAILOR-MADE QUENCHING SOLUTIONS
SMS-Quench® is an integrated system individually designed for each tube plant. Based on bain curves developed by specialized SMS metallurgists, every tube manufacturer benefits from a tailor-made cooling system that fully covers the specific quenching requirements of any tube size and steel grade in the product portfolio.

Despite the fact that single tubes differ from each other before heat treatment, SMS quenching machines guarantee a predictable, properly controlled and repeatable process that generates the targeted quality precisely. This is especially important as even the slightest difference in the chemical composition may lead to wide variations in the final properties.

ALWAYS RIGHT ON SPOT
The quenching head is the core element of SMS-Quench®. It is one of the most effective solutions
available for outside quenching and guarantees a fail-proof process. The quenching head is a ring-type device which allows for automatic regulation of the spray nozzles’ angle according to different pipe outside diameters. It also automatically aligns the pipe pass line with the head axis. This ensures that the water streams strike the pipe in the direction of travel. The SMS-Quench® system also accurately controls water pressure and flow and thus ensures the desired depth and uniformity of the martensitic structure. A sophisticated automation system is a key process feature: the quenching head set-up parameters are managed automatically by the control system of the upstream austenitising and hardening furnace.

SMS-Quench® also features devices such as the quenching lance for internal pipe quenching and the quenching tank for treating heavy-walled pipes by complete submersion.

HIGH PERCENTAGE OF MARTENSITE EVEN IN LOW CARBON STEEL
When treating low carbon steel grades, which are often used for welded tubes, a considerable and well-directed water flow is necessary from the very first sprayer module. This is the only way to ensure a fast transformation and thus a high percentage of martensite. The results tube manufacturers achieve with SMS Quenching Head speak for themselves: the Grossmann quench severity factor, the so called “H-factor”, is reliably above an index of 2.
TUBE BRIGHT ANNEALING LINES

TUBE ANNEALING IN A PROTECTIVE GAS ATMOSPHERE
Tube bright annealing lines are used to produce tubes made of stainless steel, nickel and titanium alloys (e.g. Inconel). In these lines annealing takes place in an oxygen-free, inert atmosphere with high hydrogen content. The tubes are characterized by a shiny, reflective appearance and a high corrosion resistance. Typical areas of application are nuclear and power plants, aerospace industry or chemical processes and some other areas where, in addition to the characteristics of the material itself, high-grade, reflective surfaces and increased corrosion resistance are required.

The lines are designed for tubes in a length up to 30 meters and diameters up to 60 millimeters. Tube thickness is up to 6 millimeters. Three different types of furnaces can be integrated in these lines: mesh belt furnaces, multi muffle furnaces or roller hearth furnaces.

Since the mesh belt furnace offers several advantages, this type is normally integrated in lines built by SMS. The main advantage of this furnace is the minimal risk of tube defects. This is very important because the tubes are often used for safety relevant processes and some other areas where, in addition to the characteristics of the material itself, high-grade, reflective surfaces and increased corrosion resistance are required.

MESH BELT FURNACE WITH IMPROVED MESH BELT TRANSPORTATION SYSTEM
The line consists of a charging table with fixed rollers to carry the bundles (set of tubes) to the entry tunnel, a heating, soaking and cooling section as well as an exit tunnel and an exit purge. Further important components are atmosphere analyzing and control systems.

In the heating and soaking section the tubes are heated up to more than 1,000 °C and soaked for several minutes. The section consists of an electrically or gas heated muffle. A newly developed system improves the mesh belt transportation inside the muffle. This system uses ceramic rolls. It increases the lifetime of the mesh belt, reduces furnace stops for maintenance and last but not least minimizes surface defects during thermal processing. Especially at the last point is very sensitive to process final Inconel 690 tubes for nuclear application.

The heat treatment process takes place in a protective atmosphere (pure hydrogen, hydrogen/nitrogen-mix or argon depending on the process). At both, entry and exit section of the furnace, two heaters are installed to ignite and burn the atmosphere gas escaping from the tunnel. This is for safety reasons.

CONVECOOL SYSTEM FOR HIGH SPEED COOLING
The slow cooling section provides a buffer zone between furnace and rapid cooling section to achieve stable pressure distribution. Furthermore, it is responsible for initial cooling of the belt and work load by means of a water jacket so that the cooling in the rapid cool section is alleviated. The function of the CONVECOOL rapid cooling section is to cool down the belt and tube load to their final temperature to achieve required mechanical properties. It utilizes the principle of convection cooling with recirculated atmosphere gas. High velocity convection impingement allows the cooling down of the tube temperature rapidly and uniformly from annealing temperature to below 400 °C. The system provides the best product quality while at the same time using less space for cooling than conventional systems (water jacket cooling).

The system is a single zone unit. The cooled atmosphere gas is discharged at high velocity to impinge on both top and bottom of the load through a pair of slot type plenums. The returning gas will be cooled down by the gas-water exchanger before entering the recirculating fan.

Several references worldwide
12 TUBE BRIGHT ANNEALING LINES DELIVERED
SMS delivered altogether 12 tube bright annealing lines mostly with mesh belt furnaces, but also with roller hearth furnaces. Most lines have been delivered to customers in Europe (France, Sweden, Germany, Czech Republic) but there are also references on the Asian continent (China, Turkey). The last two lines were delivered in 2010 to Vallourec, France. These lines feature mesh belt furnaces, CONVECOOL cooling system and the improved mesh belt transportation system. Vallourec became world’s first supplier to hold NSQ-100 certification (Nuclear Safety and Quality Management System), which is considered to be the strictest standard of its kind worldwide.

For Baosteel, China, a tube bright annealing line with mesh melt furnace was erected in 2009.

For safety reasons the escaping atmosphere out of the furnace is burned at entry and exit section.

A mesh melt furnace is the best choice for the production of tubes where surface quality is crucial, which is mandatory for most bright annealed tubes.

The CONVECOOL cooling system reaches high cooling rates due to convection cooling with recirculated atmosphere gas.
HEAT TREATMENT OF BARS

NOT ONLY TUBES REQUIRE HEAT TREATMENT.
Solid bars for numerous different applications need to be hardened, quenched, tempered or annealed to improve their mechanical properties. SMS offers a full range of different heating solutions ranging from bogie to tunnel furnaces to the more productive walking beam furnaces, always coupling the combustion expertise with a smooth design of the complete process line.

TOP CUSTOMERS DESERVE GROUNDBREAKING SOLUTIONS
Working together with the worldwide top players in special steel production has always been a key to SMS for being at the avantgarde of innovation.

SMS designed a new heat treatment directly connected to the rolling line, enabling for the first time to treat bars up to the range of 250 millimeters without stopping the process and saving a large proportion of the heating energy. Stainless, acid and heat resistant steel as well as high-grade structural or tool steel are produced, each deserving a heating/cooling precisely controlled sequence, managed by the SMS Controlled Cooling Technology (CCT®) simulation model.

The core of the line is represented by a high-alloyed skids walking beam furnace, equipped with self-recuperative burners to enhance the energy saving, and by a tailor made Quenching Head.
SERVICE

Taking care of everything

Whether you want spare parts, modernizations, tailor-made maintenance procedures, or customized training programs, the Technical Service Division of SMS group is ready at 50 locations around the world to offer you service packages geared to your requirements along the entire metallurgical process chain. It’s due to the know-how of the entire SMS group that our employees provide the services you require – on schedule, within budget, and in the right quality.

That means you can rely on the quality of our services as well as our global presence to reduce downtimes, increase productivity, and ensure the lasting value of your machinery and plants.

UPGRADES & MODERNIZATION
- Mechanical & hydraulic
- Electric & automation
- Value added components

CONSULTING & TRAINING
- Fast finding
- Maintenance audits
- Feasibility studies
- TECademy

THE RIGHT PARTS IN THE RIGHT PLACE AT THE RIGHT TIME
The right spare parts have to be available at all times so that production doesn’t come to a standstill. At the same time, capital tie-up and storage costs have to be kept low. That is why SMS group delivers spare and wear parts for all machines quickly and reliably.

A web-based, machine-specific parts catalogue makes the ordering process even easier. On request, SMS group also takes care of the whole spare part and stock management. The differing parts stocking concepts are always geared to the customers’ individual needs.

CONTINUOUS HIGH PERFORMANCE
Whether one-off fact-finding, continuous monitoring via remote service or regular plant inspections. The SMS group Service experts analyse and service the plants. Not only this, the complete maintenance can be taken over by SMS on request. Plant owners thus ensure maximum plant availability and optimum production results.

ALWAYS UP-TO-DATE
Plant owners are engaged in dynamic markets. The demands on profitability, product quality and productivity have risen steadily for plant owners in recent years. New technologies and plants arrive on the market in ever shorter innovation cycles. Tailored and customised modernisation concepts from SMS group ensure that the plants run for decades and that with reduced operating costs, higher productivity and improved product quality.

FIELD SERVICE
Even in emergencies, customers can rely on SMS group Service. The Service technicians help with troubleshooting and the necessary repairs. With short reaction times and high availability, they ensure that the plant is up and running again as quickly as possible.

CORPORATE SUCCESS DUE TO TECHNICAL KNOW-HOW
Whether individual or standardised trainings – our experts plan individually tailored training programmes and implement these together with the customer. The plant operators gain valuable know-how through time-tested formats and special e-learning offerings for more operational reliability and more efficient processes.

HIGHER PROFITABILITY DUE TO THE RIGHT ADVICE
More efficient processes, optimised technology and more effective use of resources – those are the goals of our consulting concepts. SMS group carries out feasibility studies to establish a sound basis for management decisions, or develops strategies and concepts for the optimisation of existing plants and processes.

EXAMPLES OF SERVICE PARTS
- CSP® Rolls
  - Dry rolls
  - Water cooled rolls with fiber insulation
- Furnace rolls for strip processing lines
- Isolation materials
- Energy saving concepts
- Consulting for optimal integration of the furnace operation into the overall process

Water-cooled furnace rolls with fireproof insulation made of aluminum oxide wool allow higher temperatures and at the same time low energy losses in a CSP® Furnace.

50

51
WORKSHOP
R&D testing, equipment pre-assembly and inspection under one roof

SMS group runs a fully equipped workshop for the assembly and testing of key components in Tarcento, Italy. Prototypes, special equipment and machines which require extremely accurate tolerances are assembled here. The workshop operates in close conjunction with the R&D and technical departments. A constant and precise exchange of information and ideas is the basis for the continuous further development of all components.

PREASSEMBLY FOR FASTER COMMISSIONING
Most machines are completely preassembled – including hydraulics, lubrication and cooling water units. The engineers pay great attention to the details, especially to the electrical pre-wiring of the sensors and components to the terminal boxes. Before being disassembled and shipped, each component and module is marked for fast and error-free reassembly at the business partner’s site.

FUNCTIONALITY TESTS ENSURE MAXIMUM RELIABILITY
The workshop is equipped with testing motors, switchboards and Programmable Logic Controllers (PLCs) so the SMS group engineers can simulate production conditions for factory dynamic tests. All the hydraulic equipment is checked during cold test runs with hydraulic units and benches.

OPEN FACTORY POLICY
SMS business partners are invited to visit the Tarcento workshop. They can assure themselves of the strict quality assurance standards and take a close look at the machines during all assembly phases according to inspection schedules.

PREASSEMBLY SAVES TIME AND MONEY
SMS preassembles and tests even large components so its business partners save commissioning time and labour costs at the erection site.
The information provided in this brochure contains a general description of the performance characteristics of the products concerned. The actual products may not always have these characteristics as described and, in particular, these may change as a result of further developments of the products. The provision of this information is not intended to have and will not have legal effect. An obligation to deliver products having particular characteristics shall only exist if expressly agreed in the terms of the contract.