THE WORLD OF FURNACE TECHNOLOGY
Reheating and Heat Treatment Plants and Services
Tenova LOI Thermprocess is your global partner in the world of industrial furnace technology. Our clients appreciate our know-how and experience backed by thousands of references and a history of over 100 years in the furnace sector. We offer highly advanced process technologies, high reliability, high-quality products and services, and a wide range of custom-tailored solutions for reheating and heat treatment plants for the metal industry.

Tenova LOI Thermprocess is a member of the Tenova Group, leveraging a total staff of more than 2,500 forward-thinking employees located in 19 countries across 5 continents. Tenova works alongside clients to design and develop innovative technologies and services that help mining and metal companies reduce costs, save energy, limit environmental impact and improve working conditions for their employees.
Metals are high-performance materials and can be produced with a wide range of properties. Thermal processes in industrial furnaces are the key processes for defining these properties.

LOI Thermprocess GmbH as part of the Tenova Metals Group is the world market leader for reheating and heat treatment plants for high-performance materials.

Tenova LOI Thermprocess offers everything from a single source: comprehensive process know-how, design, scheduling and installation as well as maintenance and service.

100 YEARS OF HEAT TREATMENT INNOVATIONS

Tenova LOI Thermprocess offers the process know-how required for the world of furnace technology.

“Safety, reliability and above all reproducibility of the complex heat treatment processes are the basis for market leadership in modern materials.”

Erik Micek
CEO LOI Thermprocess GmbH

Experience and mathematical models for heating and cooling processes as well as material models for microstructure and mechanical properties result in recipes which represent 100 years of thermal process know-how.
REHEATING OF LONG OR FLAT PRODUCTS AND FORGINGS

As supplier, main contractor or in cooperation with other companies, we deliver the mechanical and electrical design of industrial furnaces and complete plants or lines together with Tenova Italimpianti. Key competences include highly advanced burner technologies as well as production automation and optimization. We manufacture and source locally and globally. We offer reheating furnaces for hot formed materials, furnaces in casting and rolling lines for thin slabs and heat treatment plants for heavy plates and forged products.

Tenova Italimpianti Walking Beam Furnaces are suitable for heavy plates and heavy loads, especially if quenching is required.
CHAMBER/BOGIE HEARTH FURNACES
Reheating of large and heavy blocks or ingots

WALKING HEARTH FURNACES
Reheating of billets, blooms, beam blanks

ROLLER HEARTH FURNACES
Heating and holding of slabs

PUSHER TYPE FURNACES
Reheating of blooms, slabs, billets, intermediate products/pre-shaped blanks

WALKING BEAM FURNACES
Reheating for hot forming of long and flat products made from C steel, stainless steel, copper, grain oriented steel, titanium, special alloys

ROTOR HEARTH FURNACES
Reheating for hot rolling and forging of blooms and billets of C steel and stainless steel

Tenova Italimpianti is the world’s leading supplier of Rotary Hearth Furnaces for a variety of process applications and product types (up to 67 m in diameter), with over 300 references in its portfolio.

In the forging industry, Tenova LOI Thermprocess Bogie Hearth Furnaces represent well-known technology as well as solutions that have been tried and tested in industry.

Tenova LOI Thermprocess Rotary Hearth Furnace for long products with zone separation

ROLLER HEARTH FURNACES FOR THIN SLABS

Intermediate heating and holding for thin slab casting and rolling with slab lengths of 30-50 m and a thickness between 40 to 90 mm, endless rolling of bar lengths up to 300 m.

Tenova Italimpianti has supplied
- the longest furnace,
- the furnace with the highest temperature (up to 1,250 °C),
- the first operating furnace with three lines.
The key to the definition of the microstructure of metals is the cooling of the material. The behavior is described in TTT diagrams like the one shown below.

DETERMINE THE MICRO-STRUCTURE OF METALS
Tenova LOI Thermprocess heat treatment furnaces feature advanced process technology which
• precisely meets the requirements for the microstructure,
• achieves a homogenous temperature distribution inside the parts,
• prevents shape distortion of the material and
• avoids high internal stresses.

DETERMINE THE SURFACE QUALITY
Tenova LOI Thermprocess heat treatment technology offers tailor-made surface quality.

MODIFY THE SURFACE BY METALLIC AND NONMETALLIC COATINGS
Tenova LOI Thermprocess heat treatment furnaces galvanize, aluminize or coat.

MODIFY THE SURFACE LAYERS BY CHEMICAL PROCESSES
Several hundred Tenova LOI Thermprocess heat treatment furnaces for case hardening or austenitizing have been installed for the automotive industry.

▼ The key to the definition of the microstructure of metals is the cooling of the material. The behavior is described in TTT diagrams like the one shown below.
Tenova LOI Thermprocess Portfolio

**Hot Formed Materials**
- Reheating furnaces
- Furnaces in casting and rolling lines for thin slabs
- Heavy plate heat treatment lines
- Heat treatment lines for forged components

**Rod, Wire and Tube**
- Heat treatment plants for tubes and bars
- Heat treatment plants for rods and wire

**Strip**
- \( \text{H}_2 \) Bell-type Annealing Furnaces HPH®
- Processing lines for electrical steel strip
- Continuous strip galvanizing lines

**Components**
- Atmosphere furnaces
- Protective gas furnaces
- Galvanizing plants

**Aluminium**
- Melting and casting furnaces
- Twin-Chamber Melting Furnaces TCF®
- Heat treatment plants for Al components
- Heat treatment plants for strip coils and foils

**Customer Service**
- Modernization
- Retrofit
- Relocation
- Technological service
- Spare parts
- Service
Q&T Quenching and Tempering Lines for Heavy Plates

C steel, stainless steel

Tenova LOI Thermprocess Q&T Lines for Hardening, Normalizing and Tempering are ideal for mass producers as well as niche producers with small lots. The key equipment is the water quench. Our quenching technology is precisely tailored to customers’ growing requirements for process security, quality and flexibility. Tenova LOI Thermprocess has been the leading company in this field since the 1990s with more than 30 quench installations and more than 50 furnace installations throughout the world. Tensile strengths of more than 1,500 MPa can be achieved by our Q&T technology. Reaching material hardness higher than 500 HBW, a Q&T Line is also the right tool for producing abrasion-resistant steel. Plates can be produced with widths up to 5 m, thicknesses from 3 mm up to more than 150 mm and lengths up to 30 m.

▲ Tenova LOI Thermprocess heat treatment lines (austenitizing, quenching, tempering) for heavy plates

▲ With the iQuench® tailored quenching technology Tenova LOI Thermprocess offers a wide variety of quenching modes and the full range of heat transfer combined with a powerful and unique mathematical material model and overall automation.

▲ Tenova LOI Thermprocess NF Roller Hearth Furnace for normalizing of heavy plates
The whole system is combined with auxiliary transportation and quality assurance systems and highly automated. It operates practically in line with a forging press, which means that a typical output of 70 wheels per hour can be reached. Different furnace dimensions and numbers of Hardening Tables are possible, depending on the customer’s needs.

In order to reach a long service life, railway wheels must have a fine perlitic structure over a certain depth under the contact surface with the rails. A highly complex quenching process is necessary with a dedicated system of nozzles spraying water onto the wheel with different flows depending on the position of the wheel and time. A mathematical model adapts the quenching process to each individual type of wheel.
Heat Treatment Plants for Tubes and Bars

Carbon steel, stainless steel, non-ferrous metals for long products and coils

ROLLE R HEARTH FURNACES
Tenova LOI Thermprocess offers continuous and semi-continuous Roller Hearth Furnaces with protective and reactive gas atmospheres as well as heat treatment processes to meet the highest requirements regarding chemical composition and mechanical properties.

The controlled atmosphere meets the requirements for bright annealing and prevents unwanted reactions like decarburization. Tenova LOI Thermprocess Roller Hearth Furnaces are also in accordance with the CQI-9 standards for products used in the automotive industry.

STAINLESS STEEL
- up to 100 % H₂
- annealing temperatures up to 1,200 °C
- jet cooling gradient up to 5 K/sec between 900 - 400 °C

CARBON STEEL
- activity controlled carbon atmospheres
- annealing temperatures up to 1,050 °C
- highly efficient heat recovery systems available, if required

WALKING BEAM FURNACES
Tenova LOI Thermprocess provides tempering furnaces, hardening furnaces and innovative quenching systems.
Heat Treatment Plants for Rod and Wire

High quality rod and wire coils

ROLLE HEARTH FURNACES
Carbon, alloyed and stainless steel, copper wire

Tenova LOI Thermprocess market share over the past 10 years approx. 50 %

Both multi-stack and single stack plants available

\[ N_2 \text{, } HNx \text{ or } 100 \% \text{ H}_2 \] atmosphere

Plants with recirculation up to material temperature of 900 °C

High-performance atmosphere gas recirculation system

Stack height up to 5,600 mm

Charge weight: up to 90 t

Patented HPH® Jet Cooling Hood

HPH® BELL-TYPE ANNEALING FURNACES
Carbon, alloyed and stainless steel, copper wire

These furnaces are equipped with HPH® (High Performance Hydrogen) technology. High-quality annealing results can be reliably reproduced. Uniform mechanical and metallurgical properties lay an excellent foundation for cold working.
**Heat Treatment Plants for Steel Strip**

**HPH® BELL-TYPE ANNEALING FURNACES BAF FOR STEEL STRIP**  
**Material:** Hot and cold rolled, CQ to EDDQ, HSQ, high carbon steel, tinplate T1 – T4, AISI 400, stainless steel

Throughout the world, more than 8,500 Tenova LOI Thermprocess annealing bases have been installed. About 5,000 of these bases operate with HNx controlled atmosphere. More than 3,500 bases use HPH® (High Performance Hydrogen) annealing technology with a pure hydrogen annealing atmosphere.

Tenova LOI Thermprocess is therefore also the market leader in the field of high performance Bell-type Annealing Furnaces.

Tenova LOI Thermprocess HPH® technology ensures atmosphere dew points below -60 °C. An extremely pure hydrogen annealing atmosphere and precise temperature control bring considerable quality benefits with a wide variety of steel grades. The temperature uniformity inside the total stack at the end of soaking will be within a range of +/- 5K.

**HPH® BELL-TYPE ANNEALING FURNACES FOR NON-FERROUS STRIP**

The atmosphere used depends on the specific alloys and the annealing process which is required. The gases which are available include pure hydrogen, nitrogen or mixtures of the two.

- Sophisticated plant design and process technology for high productivity and material quality
- References: first reference from 1949
- Both single-stack and multi-stack bases available
- Very high process quality: dew points below -60 °C
- Useful diameters 800 to 2,400 mm

Tenova LOI Thermprocess HPH® Bell-type Annealing Furnace plant for non-ferrous metals  
**Material:** non-ferrous metals, mainly copper and copper alloys
MULTI STACK BELL-TYPE ANNEALING FURNACES MBAF FOR SILICON STEEL STRIP

The requirement for reduced losses in the transmission and transformation of electric power has created a huge demand for electrical steel (silicon steel). Especially the production of grain-oriented GO silicon steel requires various heat treatment routes in different continuous processing lines and high temperature batch-type plants.

Tenova LOI Thermprocess is the only company able to supply all types of heat treatment equipment required for silicon steel production.

BELL-TYPE ANNEALING FURNACE PLANTS FOR SILICON STEEL STRIP

- MBAF Multi-Stack Plants (up to four stacks per heating hood)
- Tenova LOI Thermprocess references: > 400 bases
- Single and double layer design available
- Process temperatures up to 1,250 °C
- Electrically powered and gas fired heating hoods
- Annealing in a nitrogen, hydrogen or mixed atmosphere
- Cooling by cooling systems integrated in heating hood
Continuous Heat Treatment Lines for Carbon and Silicon Steel Strip

Carbon and silicon steel

CONTINUOUS GALVANIZING LINE CGL
The heat treatment process for the strip includes heating, soaking, slow cooling and rapid cooling before it enters the coating pot containing the liquid zinc.

ANNEALING AND PICKLING LINE APL
The hot-rolled strips (non grain oriented NGO and GO) are initially annealed in a continuous process line. During annealing, the microstructure is changed in order to reduce brittleness and increase ductility before cold rolling. The annealing process is followed by
a controlled cooling stage with cooling rates tailored to the steel grade.

**DECARBURIZING AND COATING LINE DCL**
Cold-rolled GO silicon steel strip is annealed in a continuous process line for primary recrystallization and decarburization. After the steel strip has passed through the DCL furnace, it is coated with magnesium oxide and dried.

**FLATTENING AND COATING LINE FCL**
For the final heat treatment process the silicon steel strip is coated with insulating varnish in an in-line process, then dried in an indirectly heated furnace and straightened using the integrated hot stretching equipment. This stage is followed by a slow cooling process.

**ANNEALING AND COATING LINE ACL**
NGO strip is annealed in a radiant tube furnace using a continuous process after cold rolling to ensure recrystallization and controlled grain growth. Top-quality steel requires strip temperatures above 1,100 °C and a very dry atmosphere with a high hydrogen content.
Heat Treatment Plants for Automotive and Structural Parts

Since 1950 Tenova LOI Thermprocess has supplied several hundred case hardening lines for automotive parts with carburizing furnace, quench, washing machine, tempering furnace and fully-automated material handling: Comprehensive practical knowledge of carburizing, decarburizing, quenching, nitriding and other processes is combined with a wide range of mathematical models developed in-house.

ROLLER HEARTH FURNACE FOR AUSTENITIZING

Tenova LOI Thermprocess Roller Hearth Furnace for heat treatment of metal blanks to be press-hardened.
ROTOR HEARTH FURNACE WITH ZONE SEPARATION FOR CASE HARDENING

Tenova LOI Thermprocess’s original heat treatment technology for case hardening as well as for quenching and tempering steels has been continuously improved and developed into the Tenova LOI Thermprocess Rotary Hearth Furnace featuring zone separation, which allows optimum process control.

GALVANIZING PLANTS

Galvanizing furnace for high temperature
Galvanizing furnaces with ceramic application areas are used for galvanizing small parts.

Galvanizing furnace with kettle
Galvanizing furnaces with kettle are used for galvanizing large structural steel components.

Drying furnace
The drying furnace is an integral part of the production line and is adapted to the overall material flow concept of the galvanizing workshop.

Zinc bath housing
The zinc bath housing collects all the fumes arising when the products are dropped into the liquid zinc. From the housing the fumes are extracted to the fume purification plant.

Tenova LOI Thermprocess high-temperature Galvanizing Furnace with Zinc Bath Housing
ALUMINIUM – LIGHTWEIGHT, INNOVATIVE AND COMPLETELY RECYCLABLE

Due to its unique properties and the optimal recyclability of used aluminium components, aluminium is a trend-setting material in the automotive, mechanical engineering and aviation industries. Aluminium outclasses alternative materials with regard to many future-oriented solutions.
Aluminium Melting, Casting and Recycling Furnaces

TCF® RECYCLING TECHNOLOGY
Contaminated scrap is recycled without pre-treatment. Organics are pyrolyzed and burned inside the furnace. The pyrolysis gas, which contains combustibles, contributes to heating the furnace. The salt-free melting process allows the environmentally compatible recycling of aluminium scrap.

TWIN-CHAMBER MELTING FURNACE TCF®
The Tenova LOI Thermprocess Twin-Chamber Melting Furnace TCF® provides a process for recycling end-of-life and production return scrap with high metal yield. Typical liquid metal production rates are in the range of 80 to 180 t/day.

MELTING CASTING HOLDING FURNACES
These furnaces can be tilted for the controlled and reliable transfer of liquid metal to the casting equipment. The furnace chambers are heated by ambient air or regenerative hot air burners and can be equipped with porous plugs, rotary gas injectors or electromagnetic stirrers.

▼ Melting Furnaces MCF with a bath capacity of 55 t each
Heat Treatment of Aluminium Automotive Components

HEAT TREATMENT LINES FOR CAST ALUMINIUM PARTS
The heat treatment of castings like engine blocks and suspensions is a combination of solution annealing, quenching and ageing.

HEAT TREATMENT LINES FOR FORGED ALUMINIUM PARTS
The heat treatment of forgings is a combination of solution annealing, quenching and ageing, where accurate quenching of individual parts is required.

HEAT TREATMENT LINES FOR ALUMINIUM STRUCTURAL PARTS
For thin structural parts for automobiles, air quenching is applied. This ensures less distortion and less residual stress. Sensitive cooling and adequate quenching technologies are required.

All lines can be offered as continuous or batch type.
Heat Treatment of Aluminium Strip Coils and Foils

FINAL ANNEALING LINES FAL

FAL are used for the heat treatment of aluminium foil rolls. The multi-chamber furnace design combines several individual chambers in one furnace casing. One furnace consists of up to five individual chambers, which operate independently.

**FURNACES FOR ALUMINIUM COILS**

Single-coil annealing improves the flexibility of production schedules and avoids complex batches of different coils.

For larger batches of the same coils, the Multi-Coil Annealing Line MCL is the right choice. Furnaces are loaded automatically with one batch consisting of several coils.
Controls for Furnaces and Thermal Processes

*Fully automated control systems are indispensable. Modern control systems ensure:*

- High safety
- Optimized processes
- Constant, high product quality
- High plant availability
- High productivity
- Optimum conditions for operation and maintenance
- Minimal energy and utility consumption
- Lower pollutant emissions

Tenova LOI Thermprocess offers control systems including all the hardware and software required from the switchgear assembly to the supervisory control system.

- Comprehensive expertise in process electronics, control system engineering and automation
- Switchgear assemblies, components
- Automation
- Supervisory systems
- Mathematical modelling online and offline
- Throughput and material flow optimization
Services backed by the expertise developed by Tenova LOI Thermprocess are available to our customers at all times and places. The world-wide presence of Tenova offers our customers direct access to our maintenance and modernization specialists.

SERVICES
We provide our customers with tailor-made maintenance programs, regular technological updates, operation assessment and personnel training.

SPARE PARTS
The right spare parts can be supplied within the shortest time (e.g. 24 h). On request, a web-based catalog for new and old equipment can be created, which facilitates the identification of spare parts and simplifies procurement considerably.

MAINTENANCE AND REPAIR
Our experts are available for maintenance work on process control systems including mathematical models and on systems including mechanical and electrical elements, refractory linings, burners, heating/cooling systems, controllers and automation devices.

MODEM AND TELEPHONE SERVICE
Control systems and connected plants can also be inspected online by remote diagnosis.

RETROFIT AND MODERNIZATION
Our specialized service solutions allow customers to operate at the highest possible productivity and efficiency levels at the same time as focusing on safety and sustainable development.

CONSULTANCY
Our process engineers and our commissioning and control systems specialists are available to provide advice to customers either on-site or via remote diagnosis.