ADVANCE TECHNOLOGIES for STRIP PROCESSING and REHEATING FURNACES

Giovanni Astengo
R&D Manager Strip Processing

Esfahan, September 28th, 2016
Techint Group

✓ Techint Group is a group of companies that act worldwide, global or regional leaders in their fields, with deep roots in the countries where they operate, each with its own aims and strategies but all partaking an original philosophy of long term presence, commitment to local development, quality and technology

✓ Annual revenues: US$ 19 billion

✓ Total Employees: 73,200

Tenaris
A leading global manufacturer and supplier of steel tubes and related services for the world’s energy industry and certain other industrial applications

Ternium
One of the leading steel companies in Latin America, manufacturing and processing a wide range of flat and long steel products. Its main operations are in Mexico and Argentina

Techint Engineering & Construction
The company provides worldwide engineering, procurement, construction, operation and management for high complexity, large-scale projects

Tenova
A worldwide supplier of advanced technologies, products and engineering services for the metals and mining & minerals industries

Tecpetrol
An oil and gas exploration and production company, that promotes and manages natural gas transmission and distribution networks in Latin America

Humanitas
A network of hospitals in Italy, focused on research, promoting a patient-oriented management and the use of integrated state-of-the-art technology systems
Employees and Revenues Evolution

**PERMANENT EMPLOYEES**

**REVENUES (in USD million)**
Techint Group Revenues

Aggregate sales of the main six companies: over **USD 19 billion**
Tenova

Tenova Overview

Advanced Technologies for Metals and Mining & Minerals Industries

www.tenova.com
Tenova: Who We Are

Tenova is a worldwide partner for innovative, reliable solutions for the metal and mining industries. Building on over decades of experience, we work alongside our client-partners to design and implement services that improve their business today and tomorrow as well. From roll grinders to industrial furnaces, excavation equipment, port conveyers and more, we evaluate and innovate, providing solutions that help them reduce costs, save energy, limit environmental impact and improve working conditions for their employees.
Four core pillars inspire our daily operations, informing every decision we make both inside and outside the company:

**INNOVATION**
We believe that innovation should improve the efficiency and quality of production of our clients, and so we increase the level of automation and digitization of our solutions.

**RELIABILITY**
Our products are made to last, but above all our people are completely personally invested in each project they undertake.

**SAFETY**
We ensure that any technology or solution that we develop makes the most secure environment, both for ourselves and for our customers and partners.

**SUSTAINABILITY**
We work with our customers to enable them to reduce the consumption of energy and raw material, limiting the environmental impact and developing a sustainable business.
## Tenova Today: Main Products, Organization and Brands

### Products

<table>
<thead>
<tr>
<th>Mining Products</th>
<th>Upstream</th>
<th>Downstream</th>
<th>Pomini Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining equipment</td>
<td>DRI plants</td>
<td>Re-heating furnaces</td>
<td>Roll grinding machine and roll texturing</td>
</tr>
<tr>
<td>Bulk material handling</td>
<td>Pyrometallurgy solutions for ferroalloys, base metals</td>
<td>Heat treatment furnaces</td>
<td>Cold rolling mills</td>
</tr>
<tr>
<td>Solid/liquid separation</td>
<td>Electrical steelmaking and secondary metallurgy</td>
<td>Strip Processing line for steel and aluminum</td>
<td>Heat Treatment for Components</td>
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<tr>
<td>Yard equipment</td>
<td></td>
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<tr>
<td>Load-out stations</td>
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<tr>
<td>Terminal equipment including ship loaders and unloaders</td>
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### Organization

<table>
<thead>
<tr>
<th>Products</th>
<th>Upstream</th>
<th>Downstream</th>
<th>Pomini</th>
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</thead>
<tbody>
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<td>Mining</td>
<td>DRI plants</td>
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<td>Roll grinding machine and roll texturing</td>
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<tr>
<td>Metals</td>
<td>Pyrometallurgy solutions for ferroalloys, base metals</td>
<td>Heat treatment furnaces</td>
<td>Heat treatment furnaces for aerospace and automotive components</td>
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<tr>
<td>Upstream</td>
<td>Electrical steelmaking and secondary metallurgy</td>
<td>Strip Processing line for steel and aluminum</td>
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<tr>
<td>Downstream</td>
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### Brands

- **TAKRAF**
- **TENOVa HYL**
- **TENOVa DELKOR**
- **TENOVa PYROMET**
- **TENOVa BATEMAN TECHNOLOGIES**
- **TENOVa LOI THERMPROCESS**
- **Pomini**
- **tenova I2S**
- **Mahrler**
- **IVA**
Key Financial

**REVENUES**

<table>
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<th>m€</th>
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<tr>
<td>07/08</td>
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<tr>
<td>08/09</td>
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<tr>
<td>09/10</td>
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<td>1.190</td>
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<td>14/15</td>
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<td>15/16</td>
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**ORDER INTAKE**

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<tr>
<td>15/16</td>
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</table>

**HEADCOUNT**

<table>
<thead>
<tr>
<th>Year</th>
<th>Metals</th>
<th>Mining &amp; Minerals</th>
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</thead>
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<tr>
<td>Jun '15</td>
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*Note: Tenova fiscal year is from 1 July to 30 June. From 2016 starting from January to December*
Strip Processing: Tenova process lines portfolio

**Aluminium**
- Continuous Annealing & Surface Treatment
- Color Coating
- Tension Levelling & Recoiling
- Finishing

**Carbon Steel**
- Pickling
- Acid Regeneration
- Electrolytic Cleaning
- Tin and Chrome Plating
- Galvanizing & Galvalume
- Color Coating
- Tension Levelling & Recoiling
- Finishing

**Stainless Steel**
- Annealing and Pickling
- Bright Annealing
- Tension Levelling & Recoiling
- Finishing

**Silicon Steel (GO & NGO)**
- Annealing & Pickling (GO and NGO)
- Coating (GO)
- MgO Coating (GO)
- Flattening and Coating (GO)
- Annealing and Coating (NGO)
- Finishing
Carbon steel – Continuous and Push-Pull Pickling Lines

Continuous, Semicontinuous or Push-Pull Pickling Lines are designed with advanced technological solutions

Capacity up to 750,000 ton/year - PPPL
Capacity of up to 2,200,000 ton/year - CPL

Extra wide production flexibility:
- Process speed up to 350 m/min
- Entry/Exit sections speed up to 800 m/min
- Thickness up to 12 mm

Innovative Pickling section complete with:
- shallow-type and high-agitation pickling tanks
- multi-cascade system of Hydrochloric Acid & rinsing system
- accurate control of acids, effluents and fumes
- Turret-type Side Trimmer with Scrap Chopper

State-of-the-art automation

Tension Leveler/Scale Breaker for more efficient pickling and strip shape improving
Latest Technologies - Pickling Line

Unique Advantages:
- Fully automatic process control with largely intuitive video pages
- Accurate control of effluents and fumes
- On-line acid management system
- Potentially zero waste in combination with a dedicated Acid Regeneration Plant

Latest improvements: 
*High turbulence* generated by *high-speed staggered injection nozzles* ensuring:
- Top pickled quality
- Perfect scale removal with no over-pickling
- Variable flow rate as a function of strip picklability

Potential Savings: 
Requirement of less personnel, reduced operating and production costs

Additional Benefits: 
Advanced acid management system with proprietary waste acid analyzer for the maximum benefits, zero waste when used in combination with an Acid Regeneration Plant
Acid Regeneration Plants (ARP) for Carbon and Stainless Steel

**Capacity** from 750 l/h up to 15,000 l/h

**Customized designed and European engineered innovative process technologies:**

- Spray Roaster or Fluidized Bed Technology
- Patent on Stainless Steel Regeneration (REMAC)
- Silica Removal Plant (SRP) designed for individual requirements
- Latest state-of-the-art BLUEdriven© Technology including ZEROWaste Process

**Unique Automation algorithm for higher stability in operation and for reduction of energy consumption**

**Low Emission and optimized consumption values**

**Upgrade availability for future extensions**

**Long term After Sales Service & Support**
Acid Regeneration Technology for new plants, upgrade and revamping

**General Features:**
- Life-cycle cost (LCC) consideration
- Based on ISO 15686-5
- Latest art-of-technology
- Suitable for upgrades and revamping
- Highly attractive Return of Investment
- International References
- Personalized After Sales Service

**Unique technologies:**

**BLUEdriven® Pyrolysis:**
Optimized Operation by reducing maintenance time and simultaneously increase of Oxide Quality

**BLUEdriven® Liquid Treatment:**
Maintenance free Liquid Treatment System combined with highest efficiency leads to the latest art-of-technology

**ZERO© Waste Technology:**
Acid Recovery efficiency increase due to no-rinse water waste treatment in combination with our Pickling Line

**BLUEdriven® Emission Control:**
Reduction of operation costs by simultaneously optimizing the emissions
Carbon Steel, Silicon Steel, Stainless Steel - Strip Cleaning

**Efficient, compact and ecological Strip Cleaning line**
R&D: Cleaning

**Pilot Machine** to carry out R&D and continuously improve of our Cleaning sections and determine the effect of each single section: *alkaline spray – brushing, spray rinse*:

Electrolytic tank for test at high current density and solution venturi injection
HTHE design: High Turbulence High Efficiency

Latest improvements:

**HTHE Electrolytic cleaning design**
- Reduced overall electrolytic section length
- Reduced electrical consumption and operational costs
- Improved operator safety, less maintenance and cleaning required
- Improved catenaries and reduction of voltage drops
- Anode shape (vertical) and Venturi injection allows gas and sludge evacuation from the gap
- Bottom design allows easy continuous sludge removal

**BRUSHING unit**
- Reduced space (1/2 of traditional)
- Low maintenance (No Back Up rolls)
- Shift able for reduced and uniform bristle consumption
- High bristle density – increased cleaning power
Pre-treatments – Post treatments

Spray Coater / Dipping Coater / Roll coater.

- For Carbon Steel
- For Silicon Steel
- For Aluminium
- For Stainless Steel

It enables two coating processes (spraying and dipping)
Carbon steel - Tin and Chrome Plating

**Capacity up to 350.000 ton/year**

**Extra wide production flexibility:**
- Width: up to 1.400 mm
- Thickness: from 0,1 to 0,6 mm (up to 1)
- Process speed: up to 600 m/min
- Total chromium coating: 35 to 140 mg/m²
- Chromium oxide coating: 7 to 35 mg/m²
- Tin coating: 0,6 to 15,2 g/m²

**State-of-the-art technology**
- PSA or MSA electrolyte (tin plate)
- Both soluble tin anodes and insoluble titanium anodes
- Tension leveller with multi-rolls technology
- Side trimmer with rotating turret heads
- Inductive, conductive or combined reflow technology
- Improved quenching process after tin reflow
- Cr(VI) free passivation (under development)

**State-of-the-art Automation and reliable automated procedure**
Carbon steel - Tin Plating with soluble & insoluble anodes

Latest improvements by TENOVA:

- Tension Leveler with multi-roll design
- Optimum current density control
- A mathematical model to calculate anodes consumption as a function of deposited tin (g/m²)
- Both tapered and flat soluble anodes arrangements are possible
- Flexible reflow solutions (Induction-Conduction)
- Advanced quench control with proprietary header design (variable level)
- State-of-the-art Cr(VI)-free passivation

Potential Savings: Lower production costs and higher quality due to continuous R&D activities to improve performances in respect of safety and environment

Additional Benefits: Extensive experience coming from the installation of more than 40 Tinning Lines, 5 new ETLs and several upgrades in the last few years.
Carbon steel - Tin Plating with INSOLUBLE ANODES

Patented Low sludge tin dissolution process for Electrolytic Tinning Lines with Insoluble Anodes

Top level in strip quality, operating costs & Safety because:
- Lowest tin consumption
- More uniform coverage, better edges
- Advanced Edge Masks design and control
- Lowest coating thickness
- Less drainage of electrolyte
- Electrolyte always available
- More flexible production campaigns
- No anodes casting plant - No anodes handling
- No operators around the plating cells

Potential Savings: Increased tinplate production, requirement of less personnel, reduced operating & production costs and electricity consumption.

Additional Benefits: Reduction of manpower for anode handling and therefore increase in safety during operation, top level coating quality, better process control and elimination of phenol vapors in the plating cell areas.

Return on investment: 2-2.5 years (insoluble anodes system and tin dissolution plant)
Galvanizing Lines

Cost-effective and high-performance Galvanizing Lines for architectural and structural applications

Products:
• Galvanized and Galvannealing
• Galvalume®, Galfan®

Features:
• Speed up to 190 m/min
• Production up to 400.000 ton/year

Complete process know-how including Annealing Furnace and air knife

Any type of surface coating by means of no-rinse application or Roll Coater

Combined and in-line Colour Coating Section

Technological know-how transfer and operational training
**Unique Advantages:**

- High efficiency cleaning sections
- Different line configurations for application of zinc and several types of metal coatings based on zinc-aluminium alloys:
  - Zinc coating for different thicknesses and paintability (cost-effective material)
  - Zinc-aluminium for better weldability, formability and corrosion resistance
- Skin Pass Mill (dry or wet type), Tension Leveller

**Additional Benefits:**

- Advanced passivation coaters for no-rinse passivation (continuous Cr contaminated waste waters eliminated)
- The line can be equipped with an in-line Colour Coating Section
Colour Coating Lines

Environmentally friendly processes for treating baths and solvent cleaning with heat recovery

Speed up to 200 m/min

Wide range of income material:
- thin and heavy gauge, narrow and wide strip
- aluminium, carbon steel, silicon steel and even stainless steel

Conventional chemical conversion process and advanced “dry-in-place” process with roll coaters

Specifically designed Paint Coaters equipped for automatic layer control:
- 2-roll and 3-roll type
- horizontal and vertical type
- S- and T-type

Curing ovens (catenary or flotation)
Unique technology: Environmentally friendly process for treating baths and solvent cleaning with heat recovery and specifically designed Paint Coaters.

Latest improvements:

- Advanced “dry-in-place” process with chemical roll coaters
- Conventional chemical conversion by dip or spray tanks
- Most modern concept of coaters (heavy duty, vibration-free mechanical design, interchangeable heads)
- Special Catenary or Flotation curing ovens

Potential Savings: Investment and management cost reduction; Environmental impact reduction

Additional Benefits: Plant simplification; Process streamlining; Flexibility; Coaters can be fully automatic and moved off line for maintenance purposes; Quality of final product in conformity with international standards
Tenova Electrical & Automation: Business Profile

All Electrical & Automation services in one hand for new lines and revamping projects.

We are full-integrated and work hand-in-hand with the mechanical and process team

**Electrical:**
- Complete Detail and Erection Engineering or Turn-Key
- Equipment supply: transformers, MV/LV distribution, MCC’s, VVVF boards, drives, motors, sensors, desks, cables, etc.
- Tenova Packages supply: side trimmer, coater, etc.
- Erection Supervision, Commissioning & Tuning

**Level 1 automation:**
- PLC boards and RIO for Real-time control
- Strip handling speed and tension master (drives coordination)
- Process control (pickling, cleaning, etc.)
- Logics and interlocks
- Tracking, operation and automatic sequence control
- Auxiliary control, safety system

**HMI:**
- Plant visualization, alarms: multi-language, user-friendly, self-explaining, running on different platforms, etc.

**L2:**
- Recipes management, reports, interfaces to furnace / L3: high standardization in the respect of customer requirement
Tenova Electrical & Automation: Advantages

Our strengths:

- Knowledge of the technological processes
- Worldwide experience
- Up-to-date technology
- Components from leading brand manufacturers: SIEMENS, ABB, ANSALDO, etc.
- Complete electrical and automation design: detailed design, turn-key, revamping
- PLC, HMI, L2 Application Software developed in-house
- Training, Tuning and After-Sales Service
- Resources of a big international group

Standardization: For perfect integration we are using well-defined standards for Hardware and Software. Same standards must be followed by our sub-suppliers.

Flexibility: Our focus is the Customer – we are developing tailor-made solutions to fulfill your requirements
Lines for Stainless Steel

- Annealing and Pickling lines for Hot material
- Annealing and Pickling lines for Cold material
- Annealing and Pickling lines for Hot and Cold
- Bright Annealing Lines

**Incoming material:**
AISI 2XX, 3XX, 4XX series and Titanium

New environmentally friendly pickling section with low acid consumption and reduced pollution

Pickling tanks with **high-turbulence** and **shallow design** ensuring high efficiency and reliability, low operating and maintenance costs

Improving camber steering rolls at the Furnace exit

**Accurate tracking and tension control along the line**
Lines for Stainless Steel : Hot APL, Cold APL, BAL

**Unique technologies:**
- *Eco⁴ Process (ECOLOGICAL AND ECONOMIC)*

**Latest improvements:**
- High turbulence Sulfuric acid tanks, Sulfuric acid electrolytic DC and AC for high descaling efficiency and top pickled quality
- High efficiency cleaning section for HOT and Cold APL
- No Chromium 6+
- Mixed acid consumption minimized
- NOx in the fumes and nitrates in the waste waters reduced or completely eliminated
- Waste and fume treatment minimized

**Potential Savings:**
- Reduced electrical consumption, reduced acid consumption, reduced cost for fumes treatment and waste waters

**Additional Benefits:**
- Top quality pickled surface, improved operator and maintenance health condition in all pickling section, reduced storage quantity of dangerous acids (HF)
Annealing & Pickling Lines for GO and NGO Silicon Steel

Integrated thermal, mechanical and process lines designed with Tenova-LOI

Typical line basic data:
• Material: GO & NGO hot & cold rolled strip (Si 3.5 %)
• Yearly capacity: 100 - 400 kt/y
• Process speed: 40 - 85 m/min
• High turbulence shallow pickling tanks
• Special multiple cascade rinsing section with controlled acidity for high surface quality
• Side trimmer with rotating turrets

GO Process technology suitable for ARMCO, Russian or HGO cycle

Silica desludging plants

Models for automatic process control
Decarburizing - MgO Coating (DCL) for GO Si Steel

Unique technologies:
- Cleaning section with special high-turbulence high-efficiency density (HTHE) electrolytic cleaning tank
- Special steering rolls improving camber at furnace exit
- Special 3-roll coaters with hydrodynamic tray for MgO insulation coating
- Strip cooling sections before coating (four-channel cooling rolls)

Last improvements:
- High efficiency quick maintenance brushing unit (brush-to-brush type)
- MgO slurry preparation system designed with high shearing model

Potential Savings:
Lower operational costs (electricity) compared with traditional electrolytic cleaning; lower investment and maintenance costs (shorter cleaning section, brush back up and relevant drives eliminated)

Additional Benefits:
Top level coating uniformity, high cooling uniformity preventing material tensioning, improved strip camber and tracking along the line
Flattening and Coating lines (FCL) for GO Si Steel

Unique technologies:

- Special Uncoiler Suction Hoods, Dry brushes, filtering unit to eliminate detached MgO during uncoiling
- MgO brushing-rinsing unit with special settling tanks
- Special 4-roll coaters (double in standby) for insulation coating (Carlite or S3 tensioning coating)
- Special steering rolls at Furnace exit improving camber

Latest improvements:

- Light pickling unit to eliminate residual MgO
- Accurate tension control; Insulating varnish recirculation systems at controlled temperature
- Laser Scribing units (in-line or off-line)

Potential Savings:

- Reduced consumption of rinse water
- Reduced waste waters (contaminated with MgO and relevant salt)

Additional Benefits:

- Improved safety conditions in Entry section
- Suitable for High Grade GO
- Improved Magnetic properties
Annealing and Coating Lines (ACL) for NGO Si Steel

**Latest improvements:**
- Cleaning section with special high-turbulence high-efficiency density (HTHE) electrolytic cleaning tank
- High efficiency quick maintenance brushing unit (brush-to-brush type)
- Camber improving special steering rolls at Furnace exit
- Roll coaters for NGO insulation coating with on-line coating control system (closed loop)
- Insulating varnish preparation and recirculation systems
- Strip cooling sections before coating

**Potential Savings:** Lower operational costs (electricity) compared with traditional electrolytic cleaning; lower investment and maintenance costs (shorter cleaning section, brush back up and relevant drives eliminated)

**Additional Benefits:** Top level coating uniformity (with closed loop for NGO), high cooling uniformity preventing material tensioning, improved strip camber and tracking along the line
Tenova ITALIMPIANTI

Advanced Technologies for
Reheating Furnaces

www.tenova.com
Tenova Italimpianti has a great variety of reheating furnaces for steel and other metals, for flat and long products, from the traditional technology (WB Furnaces) up to the thin slab technology.

The furnace FlexyTech® Tenova is the reference container for all the innovative activities carried out by Tenova Italimpianti and applied to reheating and heat treatment furnaces.
The FlexyTech® furnace is Tenova answer to the MARKET REQUIREMENTS

- High product quality (large temperature uniformity, minimal thermal stress, minimum scale generation, low decarburization ...).
- Minimal energy consumption (also linked to CO₂ emissions).
- Minimization of emissions (mainly NOx) in compliance with environmental regulations.
- Compliance with safety criteria.
- High production flexibility.
- Minimizing operating costs.
- Minimizing Investment costs.
Reheating Furnaces
Rotary Hearth Furnaces
Roller Furnaces for CSP (Compact Strip processing)
Furnaces for pipes with quenching
Horizontal Continuous Galvanizing Lines
Continuous Colour Coating Lines
Specialty Furnaces
STC (Short Time Cycle) Furnaces
Combustion Technologies and Burners
Automation Level 1 and Level 2
Reheating Furnaces

Recent realizations:

- USIMINAS (former Cosipa) Brazil 440 t/h WBF for HSM
- HYUNDAI Steel- Korea 350 t/h WBF for HSM & Plate mill
- TKS Alabama - USA 3x420 t/h WBF for HSM
- JSW India 3x350 t/h WBF for HSM
- Acominas Gerdau - Brazil 300t/h WBF for HSM
- Tata Steel KPO - India 350 t/h WBF for HSM
- Bhushan Steel - India 350 t/h WBF for HSM

Type of Charge: Slabs, Blooms, Billets, Beam Blanks
Type of Materials: Carbon Steel, Stainless Steel, Oriented Grain Steel, Special Alloys, Titanium, Copper

- Walking Beam Furnaces for flat and long products
- Walking Hearth Furnaces for flat and long products
- Pusher type Furnaces for flat and long products
Reheating Furnaces

Points of Strength

- Optimized Skid Design
- High Performance Riders
- Compact Walking Beam Frame Design
- Charging and Discharging Machines
- Burners and Combustion System
- Level 1 and Level 2 Control Systems
Reheating Furnaces

Optimized Skid Design

Square rectangular shape of horizontal beams for:
- Compact design with the same resistance module
- Higher view factor
- Possibility of adoption of vertical posts natural cooling
Reheating Furnaces

High Performance Riders

New rider arrangement with updated shape and improved clamping
Reheating Furnaces

Compact Walking Beam Frame Design

Triple Wheel Frame

Double Wheel Frame
Reheating Furnaces

Charging and Discharging Machines

Optimized mechanical solutions of charging and discharging handling operations for fulfilling any requirement of layout arrangement
Rotary Hearth Furnaces

Tenova Italimpianti is the world’s leading supplier of rotary hearth furnaces for a variety of process applications and product types.

Tenova Italimpianti has installed some of the largest-diameter and highest capacity rotary hearth furnaces in the world.

Its rotary hearth furnace technology is adopted for specialized applications including bloom reheating, iron processing and waste reclamation processes.

Recent realizations:

- VSB Brasil 240 t/h
- Tenaris Dalmine Italy 180 t/h (revamping)
- Arcelor Mittal Jubail KSA 200 t/h

Type of Charge: Blooms, Billets, Pellets
Type of Materials: Carbon Steel, Stainless Steel, Waste Products
Roller Furnaces for CSP

Tenova Italimpianti roller hearth furnaces implementing latest-generation direct rolling technology are suitable for slab lengths of 30-50 m and, in special cases, for endless rolling of bar lengths up to 300 m.

With a constant focus on critical components such as rollers and burners, Tenova Italimpianti designs outstanding roller hearth furnaces.

Milestones include the **longest furnace**, the furnace with the highest temperature and the first operating furnace with **three** lines.

Recent realizations:
- TATA Steel India 2 furnaces 280 t/h
- ESSAR Steel India 3 furnaces 267 t/h
- BHUSHAN Ltd India 2 furnaces 246 t/h

Type of Charge: Thin Slabs
Type of Materials: Carbon Steel, Stainless Steel
Roller Furnaces for CSP

Rollers

- Long Life – 18 months guaranteed on metallic parts, 15 months on refractory life
- Special features: Tires in Super Alloy and Refractory insulation made of low cement castable without drying
- Easy Maintenance: Roll change during production in less than 10 minutes
Roller Furnaces for CSP

Roll Cleaning System

RCS (Roll Cleaning System) is a patented solution for achieving the best performance on the thin slab surface in terms of pick-up removal.

Front Roller with Cleaning System Activated
Counter Current Action for DEEP TYRE CLEANING

ON LINE Roller Cleaning System Activated
for CONTINUOUS TYRE CLEANING
Tenova Italimpianti is able to design Tailor-made engineering solution also by means of the in-house developed simulation tool for predicting the plant behaviour in any operating condition.
Furnaces for Pipes

Recent realizations:

- Tenaris Silcotub Romania 80 t/h WBF
- Vallourec & Mannesmann LLC Ohio USA
  - Hardening and Tempering including quenching facilities
- Tenaris Tamsa Mexico Hardening and Tempering furnaces
- Tenaris Tuca Colombia Hardening and Tempering Furnaces
tamsa Mexico 65 t/h WBF for tempering
- Vallourec & Sumitomo Tubos Brazil Hardening and Tempering furnaces
- AM Jubail hardening and tempering furnaces including quenching facilities

Type of Charge: Pipes
Type of Materials: Carbon Steel, Stainless Steel

- ✓ Tempering Furnaces
- ✓ Hardening Furnaces
- ✓ Normalizing Furnaces
Furnaces for Pipes

Quenching Unit

In-line quenching system for pipes for achieving the best quality performance of the pipes
Horizontal Continuous Galvanizing Lines

- Horizontal & Vertical Non-Ox Furnaces
- All Radiant Tube Horizontal Furnaces
- Gas, oil, electric heated Pot Furnaces
- Air knives & Jet Wiping Machines
- After Pot Cooling Systems
- Spray type Chromating Machine
Continuous Colour Coating Lines

- Direct Inject Ovens Systems
- Clean Oven Systems
- Ultra Clean Oven Systems
- Recuperative Thermal Oxidizers
- Strip Dryers
- Heat Recovery Systems
Specialty Furnaces

Recent realizations:

Sinosteel Zheijang Changxing - China
- 3 car bottom type furnaces
- Central waste gas incinerator system
- 4 furnaces car and one transfer car.

Shida carbon group - China
- 3 car bottom type furnaces
- 4 furnaces car

Showe Denko carbon USA
- 11 car bottom type furnaces

✓ Furnaces for Calcining
✓ Furnaces for Carbon Baking
STC® (Short Time Cycle) Furnaces

Available through a license agreement with Daido Steel

Roller hearth batch and/or continuous furnace for a wide variety of annealing processes of wire and rod coils, bar stock, parts for the cold forging
Combustion Technologies and Burners

- Ultra Low NOx Flameless Burners
- Regenerative Flameless Burners
- Burners for Heat Treatment Furnaces
- Optimized Combustion Techniques for Reheating and Heat Treatment Furnaces

Thousands of flameless burners installed on the reheating and heat treatment furnaces.
• FlexyTech® Burners: lowest NOx and highest efficiency.

• Tenova combustion control techniques: quicker and more accurate.
Combustion Technology solutions from Tenova Italimpianti:

- Are customized for any type of reheat furnace.
- Are implemented for any type of fuel (from NG to BFG)
- Are optimized for achieving at the same time: maximum energy saving, minimum environmental impact and the best quality of the product.
FlexyTech® Regenerative Flameless Burners are the latest generation of combustion systems from Tenova. Regenerative technology allows air preheating up to 1200°C thus achieving a thermal efficiency ranging from 0.8 to 0.9. Flameless combustion reduces NOx emissions down to 35 ppm at 3% of O₂.

- Wide range of reheating furnaces: walking beam, pusher type, walking hearth, rotary hearth.
- Dual combustion mode: flame and flameless.
- Different regenerative solutions: honeycomb or ceramic balls.
- Increased production on existing furnaces or shorter length on new furnaces.
Combustion Technologies and Burners

**FlexyTech® Self-Regenerative Flameless Burners** cover a wide range of thermal processes operated at temperatures from 400°C to 980°C. Energy saving is the first goal achieved with low emissions and high quality reheating of the products.

**NOx emissions** in flame mode are below 60 ppm while in flameless mode are below 20 ppm at 3% of O₂.

- Main field of application: heat treatment furnaces for pipes.
- Very compact design.
- Dual combustion mode: flame and flameless.
- Air preheating by means of ceramic honeycomb: about 150°C below the furnace temperature.
Tenova Italimpianti thanks to its extensive experience provides solutions for the optimization of the PID control parameters through:

- Dedicated software packages based on advanced algorithms for a complete self-tuning of the system
- Preventive maintenance contracts based on: regular furnace check-up (field instrumentation and software).
Thank you