DANIELI AUTOMATION
INDUCTION HARDENING & TEMPERING IN-LINE TREATMENTS

High Quality Reheating Systems for the Metals Industry

DANIELI AUTOMATION

Induction heating system

Based on the experience of endless and hot charging process and the know-how in converters units, Danieli Automation has developed a new induction heating system, called Q-Heat. The induction heating furnace is the most environmentally friendly solution for heating ferrous and non-ferrous materials. No gas or smoke emissions, drastically reduced scale formation. Additionally, the induction heating furnace is ready in real time: no need for long start or stop sequences, as with traditional reheating furnaces.

Nowadays the steel bars Producers are more and more interested in providing extra added value to their high quality products.
By using induction heating system, it is possible to include heat treatment process “in-line” at a reduced cost and with high quality result.
Heat treated steel bars meet the market quality demands and increase the profits.
On January 2015 Danieli has been awarded the contract from ABS for the supply of an innovative hardening and tempering heat treatment line for round bars using Danieli Automation induction heating system.
Induction hardening and tempering process, applied to heat treatable steel grades, involves multiple stages:
> Induction heating: according to steel grade, the bar is heated uniformly up to austenitic range, in order to obtain the complete transformation into austenitic phase;
> “DQS” (Direct Quenching System): from the fully austenitic phase, the bar is immediately quenched by a sequence of independently controlled water cooling boxes;
> Tempering stage: when exiting the DQS, the bar enters into another induction heating equipment, to temper the crude martensitic structure;
> Final cooling stage: the bar is cooled down in a cooling bed. Additional water cooling stage can be required immediately after tempering process for steel grades sensitive to tempering brittleness.

With the same equipment, it is also possible to apply the normalizing heat treatment, consisting in heating up to the austenitic range -specifically selected depending on size and grade, typically around 950°C-, and than air cooling.
The mechanical and handling equipment will be designed and supplied by Danieli Centro Maskin, meanwhile the induction heating system and the complete electrical and automation system will be designed and supplied by Danieli Automation.

The innovative Danieli Automation induction furnace is composed by power converters based on the most modern IGBT’s technology that feed the induction coils using the capacitors matching circuit to generate high frequency current.

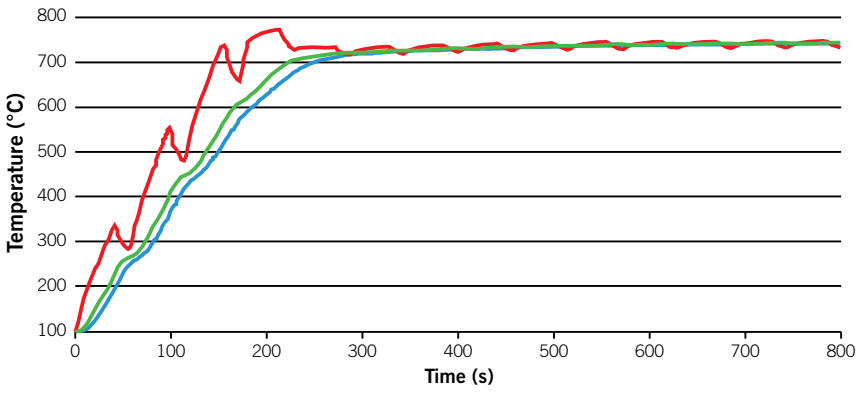
The high performance Danieli Automation Controller DAPAC perfectly controls the high frequency system. To ensure the best possible supply network impact, the AC/DC conversion system is realized with a 12 pulse thyristors bridge rectifier configuration with water cooled components.

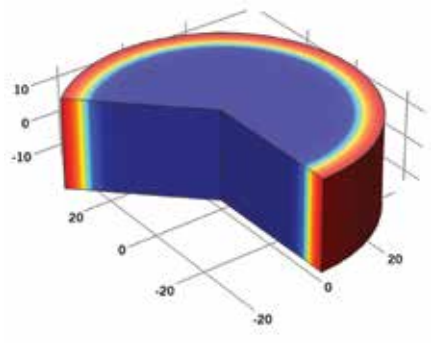
The Danieli Automation medium frequency converter are voltage source H bridge IGBT's converter type, with water cooled components, and guarantees a constant power factor of 0,95 with benefit also for the current harmonic content. The power converter is modular: one 12 pulse converter supplies several independent inverter units. The total power can therefore be modulated accordingly to the required temperature distribution. This is very important especially for the tempering process. There are a total of 7 inverter units for the austenitizing and tempering sections. The modular construction is also very friendly for the maintenance.

In order to optimize the heating efficiency for the complete production diameter range, for the austenitizing induction system, there are four sets of induction heating coils. For the tempering system only two sets are necessary.
Five pyrometers, displaced along the line, allow to monitor and control the bar temperature and the heating profile, very important for the tempering zone.
L2 system is used to set the line for production and to record the process data for the finished material.
The line it's equipped with fences and safety gates controlled by safety PLC in accordance with EU safety rules.

Main advantages

> Optimized consistency: induction heating eliminates the quality issues associated with open flame, torch heating and similar methods; no scale formation and no surface decarburization (even more important for high quality steel grades);
> Maximized productivity: heat is developed directly and instantly inside the part;
> Improved product quality: there is no contact for the part to be heated with a direct flame;
> Environmental friendly: induction heating does not burn traditional fossil fuels. As a consequence, it's a safer process because smoke, waste heat, emissions, and loud noise are eliminated;
> Improved process quality with in-line immediate temperature control, using a continuous power reference. E.g., it's possible to equalize head and tail temperature of each bar;
> Reduced energy consumption: compared to gas-fired furnaces at high heating temperatures;
> Increased efficiency;
> Power factor compensation not required.





Line and material data

Round bar diameter range	20-120 mm
Bar material	Alloyed steel
Bar length	12 m max
Max heating temperature	950 °C
Max speed	13.5 m/min
Productivity	3 tph
Induction frequency range	2-8 kHz

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