

DANIELI QLP[®]
QUALITY
LONG PRODUCTS

DANIELI



Featuring Danieli Universal
Direct Rolling Technology

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QLP® Just one powerful casting strand for the most flexible and competitive production

Danieli Universal Direct Rolling technology sets a new standard in the production of long products.

The unique capability of Danieli Octocaster to cast billets at speeds up to 10 m/min for quality rebar, and with 99% plant yield achieved at industrial installations, makes possible productivities up to 250 tph per strand.

Danieli Universal Direct Rolling technology is the only technology where up to three rolling modes are performed in a single line: billet-to-billet, semi-continuous or continuous, with production capacities ranging from 100,000 to over 2,000,000 tpy.

Danieli QLP® casting and rolling plants are available as:

> **NANO QLP®**

> **REGIONAL QLP®**

> **JUMBO QLP®**

> **TWIN QLP®**

High Product Quality And Competitiveness

Uniform chemical and physical characteristics along the whole rolled stock are achieved thanks to a highly stable, endless casting and rolling process, and semi-endless process featuring induction heating.

Danieli QLP® delivers the highest product quality for straight and spooled bars, wirerod and light sections at the most competitive costs thanks to the patented endless casting and rolling process, heat treating and finishing technologies.

Octocaster® delivers endless billets at speeds up to 10 m/min making it possible to produce up to 230 tph with a single casting strand, reaching annual capacities up to 1.5 Mtpy.

The achieved yield with Danieli QLP® endless casting and rolling lines –from liquid steel to finished products– is 99%.

Rebar is competitively produced through the DRB® – Direct Rolling and Bundling system for precise, hot cutting to final bar lengths and perfect bundles, for additional added-value in terms of sales price.

Twist-free spooled bars in coils and wirerod are produced in custom-weight, perfect-shape coils up to 8 and 3 tons, respectively.

Thanks to the stability of QLP® endless casting and rolling technology, spooled bars and wirerod are produced with a controlled and uniform final product quality and with comprehensive control

of tolerance fluctuations, making it possible to produce minimum-tolerance products through light rolling.

The exclusive Danieli technology means that light sections can now also be produced in endless casting and rolling mode. This is achieved with a patented layout, also featuring advanced digital mill solutions to allow flexible and quick product changes.



BAR BUNDLES

Dimensions and weights	8 to 75 mm-dia bars in 6 to 24 m-long bundles.
QLP® technology highlights	High-quality bundles, perfectly aligned and headed-up.



WIREROD

Dimensions and weights	5 to 25 mm-dia wirerod in coils up to 3 tons.
QLP® technology highlights	Minimum and steady size and ovality tolerance. 130-m/s day-to-day operating speeds.



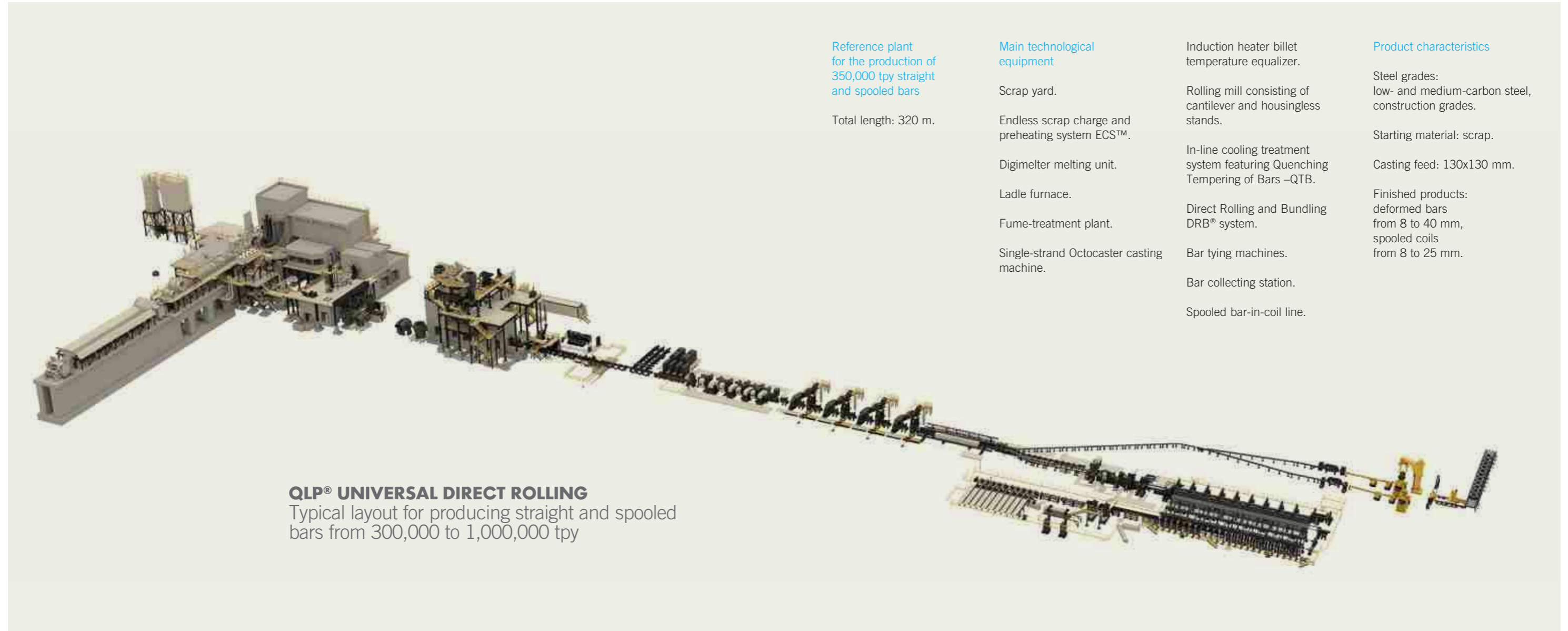
SPOOLED BARS

Dimensions and weights	8 to 25 mm-dia bars in spooled coils up to 8 tons.
QLP® technology highlights	Twist-free rolling, perfect-shape added-value coils.



LIGHT SECTIONS

Dimensions and weights	Up to 4" for angles, up to 6" for channels and flats, up to 3 1/2" for squares and rounds.
QLP® technology highlights	Perfect bar shape and optimal thermal control along the process.



QLP® UNIVERSAL DIRECT ROLLING
 Typical layout for producing straight and spooled bars from 300,000 to 1,000,000 tpy

Reference plant for the production of 350,000 tpy straight and spooled bars

Total length: 320 m.

Main technological equipment

- Scrap yard.
- Endless scrap charge and preheating system ECS™.
- Digimelter melting unit.
- Ladle furnace.
- Fume-treatment plant.
- Single-strand Octocaster casting machine.

Induction heater billet temperature equalizer.

Rolling mill consisting of cantilever and housingless stands.

In-line cooling treatment system featuring Quenching Tempering of Bars –QTB.

Direct Rolling and Bundling DRB® system.

Bar tying machines.

Bar collecting station.

Spooled bar-in-coil line.

Product characteristics

Steel grades: low- and medium-carbon steel, construction grades.

Starting material: scrap.

Casting feed: 130x130 mm.

Finished products: deformed bars from 8 to 40 mm, spooled coils from 8 to 25 mm.

The Danieli MIDA QLP® layout ensures maximum production efficiency in the minimum footprint. The entire plant is a single production unit, with continuous scrap feeding into the Digimelter via a horizontal conveyor (ECS), heating scrap to about 400 °C using furnace exhaust fumes. The Digimelter is equipped with the most advanced technology packages for safe, automatic and green operations, followed by LMF with dual ladle cars, ladle lifting and automatic inert-gas hook-up for faster cycles and safer operation. The single-strand continuous caster with ultra-

high-speed FCC® and the Octocaster® technology guarantees smooth operation at high casting speeds, while the typical rolling mill consists of cantilever-type roughing and intermediate stands and the latest housingless stands for finishing. A quick-change car ensures that the whole mill can be changed over in less than 10 minutes. A bar quenching and tempering system (QTB) is located at the rolling mill delivery side. The finishing end incorporates the Direct Rolling and Bundling (DRB) system for cutting high-tensile rebars to length directly off the last finishing stand.

After bundling, bars are run through two wire-tying machines and then collected onto a chain transfer table for final removal by forklift truck. Spooler coil production with twist-free, perfectly-shaped coiled rebar in coils weighing up to 8-t and sizes from 8 to 25-mm- dia is also performed, bringing added value to the product mix. The compactness of the MIDA QLP® process layouts is a relevant technological advance. Steel from the Digimelter flows into the refining station and then into the caster, and continues until rebars are bundled or spooled for shipping.

Danieli QLP® casting and rolling plants are available as:

> NANO QLP®	> REGIONAL QLP®
> JUMBO QLP®	> TWIN QLP®



Nucor Steel Frostproof, Florida, USA,
MIDA QLP® Universal Direct Rolling
minimill.
ECS continuous scrap preheating
and charging into the EAF featuring
Q-Melt™ furnace management system,
endless casting and rolling process,
no gas-reheating furnace
for efficient and clean steelmaking.



Nucor Steel Sedalia, Missouri, USA,
MIDA QLP® Universal Direct Rolling
minimill.
Single-strand high-speed Octocaster®,
ultra-compact rolling mill consisting
of 16 rolling units, Direct Rolling
and Bundling –DRB® system and twist-
free spooler line.

Choose your QLP® layout configuration

QLP® ADDED-VALUE PRODUCTS AND LAYOUT SOLUTIONS

Available in four configurations –Nano, Regional, Jumbo and Twin– Danieli QLP® Universal Direct Rolling plants produce straight and spooled bars, wirerod and light sections in capacities from 100,000 to more than 2,000,000 tpy.

Any product combination is possible in steel grades, ranging from ULC to mild steels and up to SBQ, with quality and production consistency. Featuring Danieli Universal Rolling, each configuration offers the most competitive CapEx and OpEx, giving tangible advantages over traditional minimills.

Energy savings up to 1.2 GJ/t, and maximized efficiency up to 99% yield, along with 5% runlight as well as less manpower, lead to operating cost savings of about 20%.

The absence of reheating furnace makes it possible to generate zero NO_x, SO_x and CO₂ direct

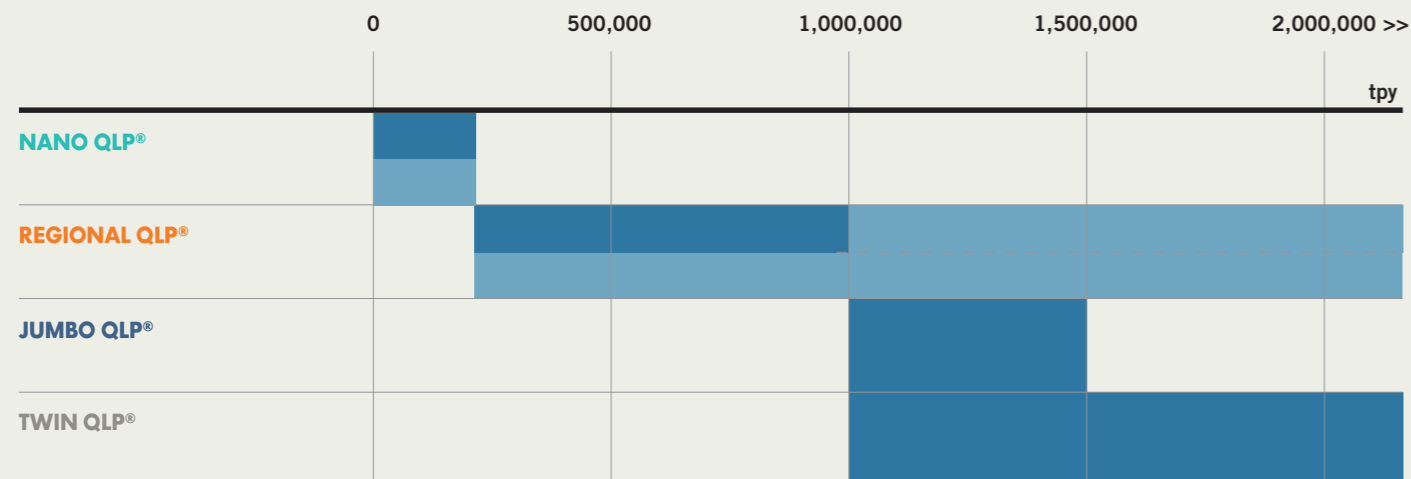
emissions during casting-rolling. No billet stocking or handling, along with smaller plant dimensions, contribute to lower capital costs.

QLP® plants are available as endless, semi-endless and billet-to-billet casting and rolling that are chosen based on the customer requirement and market demand.

In endless casting and rolling, the steel billet flows from a single-strand caster and is directly rolled after solidification, without any interruption or delay in the process.

Semi-endless production is still performed on a single-strand caster, where the billet is cut in customized lengths before entering the in-line rolling mill.

Billet-to-billet mode is performed by a multi-strand caster feeding the rolling mill, still without the need for a reheating furnace or intermediate billet storage.

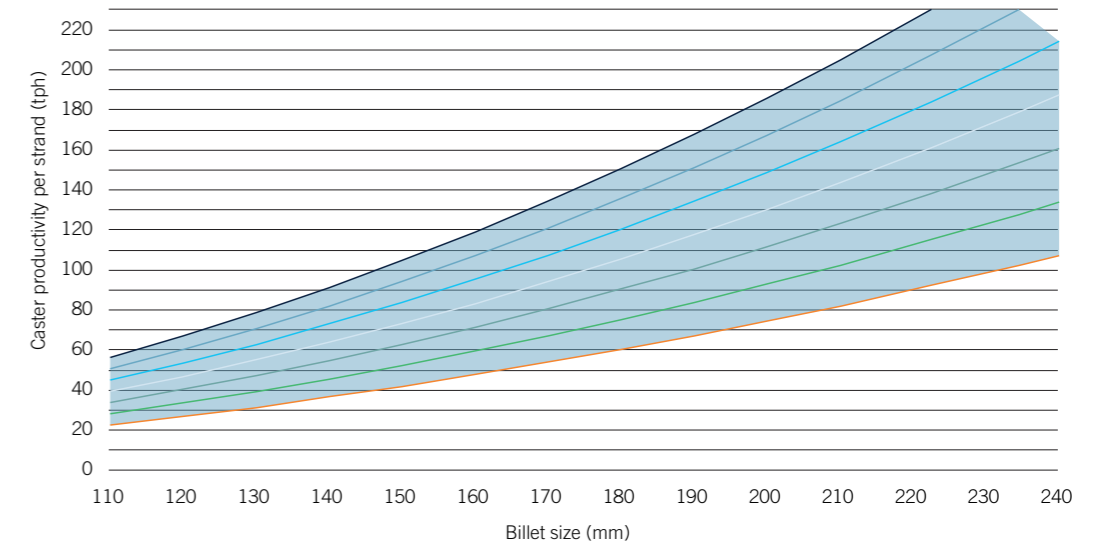


QLP® Universal Direct Rolling configuration diagram: plant capacities and rolling modes.

Endless casting and rolling mode (single-strand)

Semi-endless casting and rolling / billet-to-billet mode (single/multi-strand)

QLP® Universal Direct Rolling configuration diagram: plant capacities and rolling modes.



In all three cases an induction heater can be provided at the rolling mill entry for billet temperature equalization when required by the process.

Endless casting and rolling mode is the preferred solution, providing the highest operational savings and the lowest emissions, together with the best process stability and final product quality. However, semi-endless mode can be selected when process requirements of casting and rolling speed cannot match each other, or when the logistics of the meltshop and rolling mill do not allow the direct connection between the caster and the rolling mill. Finally, billet-to-billet mode is an effective option for revamping programs that involve space constraints.

Most Danieli QLP® plants are based on single-strand casters –endless or semi endless– as they

can produce up to 1.5 Mtpy with one strand only. Up to 200,000 tpy, NANO QLP® provides the most cost-effective solution starting from small billet sections, typically 100x100 mm.

From 300,000 to 1,000,000 tpy, single-strand REGIONAL QLP® performing in endless or semi endless mode, offers the lowest OpEx and emission solution at very competitive CapEx.

Above 1 Mtpy and up to 1.5 Mtpy, single-strand JUMBO QLP® performing in endless or semi endless mode, operates with larger billet sections. TWIN QLP®, featuring two casting and rolling lines performing in endless or semi endless mode, produces up to 2 Mtpy.

Finally, billet-to-billet multistrand casters are typically selected with commercial-size billets from 130x130 to 165x165 mm, to cover the production range from 300,000 tpy to over 2 Mtpy.

Each configuration offers the most competitive CapEx and OpEx, giving tangible advantages over traditional minimills.

Danieli Universal Rolling

Three rolling modes without billet gas reheating



ENDLESS CASTING AND ROLLING

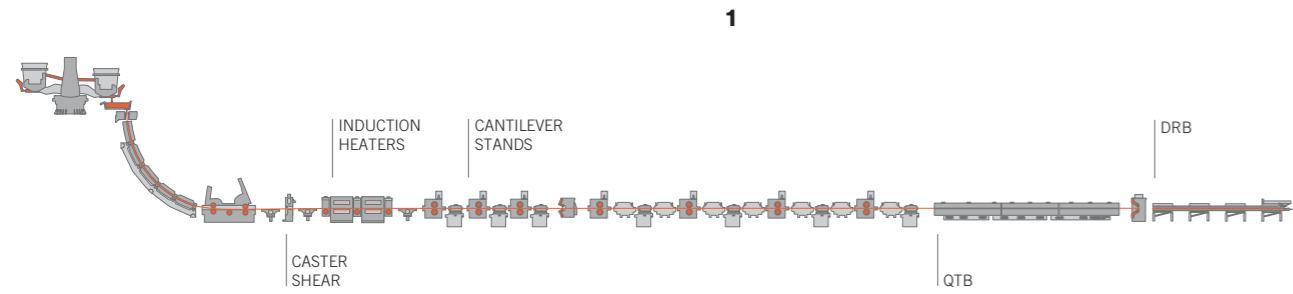


SEMI-ENDLESS CASTING AND ROLLING



BILLET-TO-BILLET CASTING AND ROLLING

Choose your QLP® layout configuration

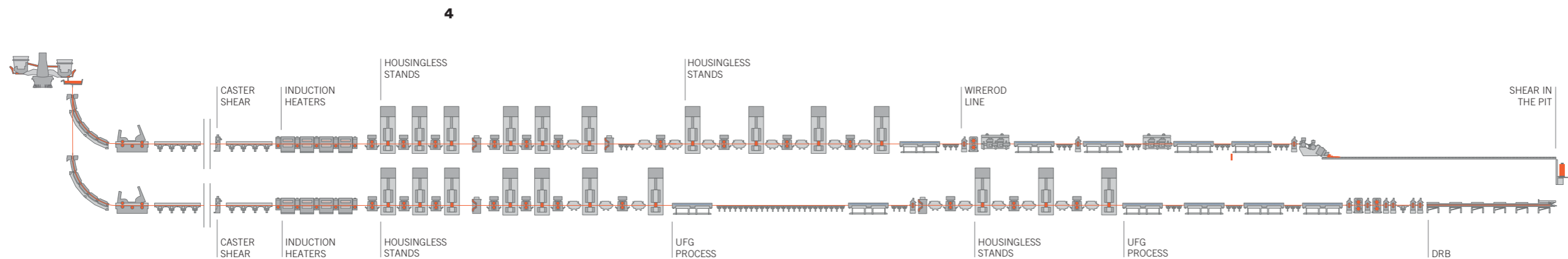
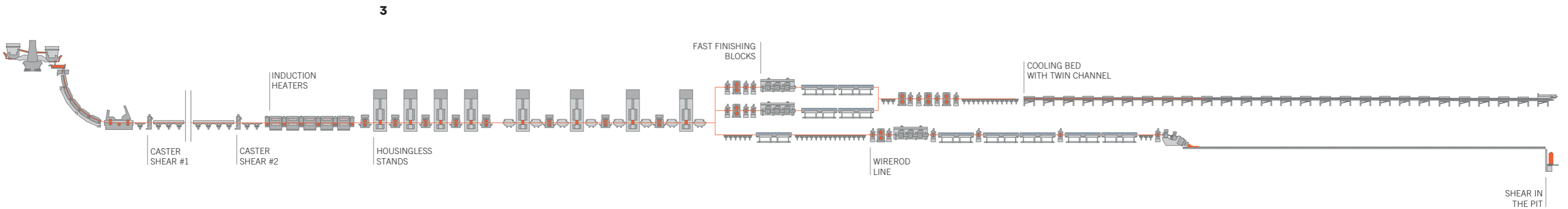
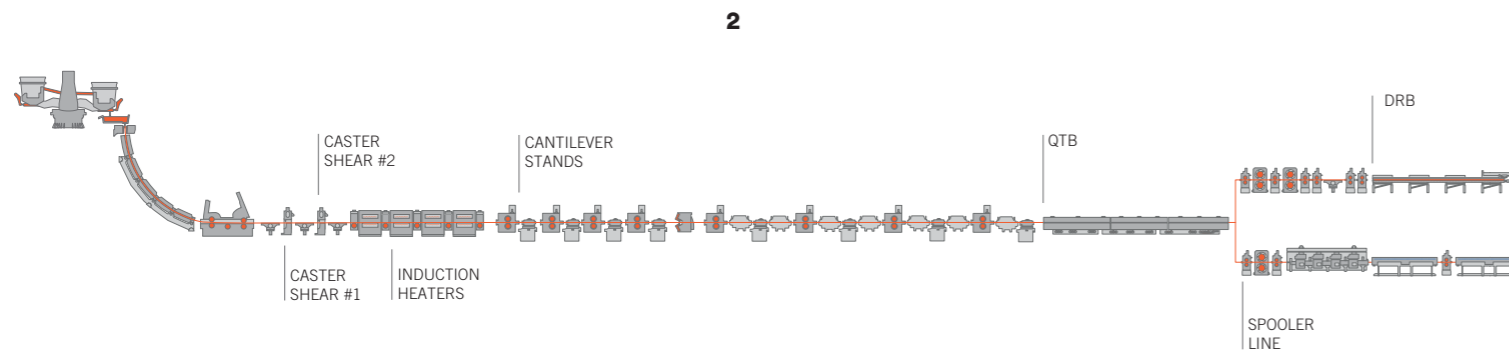


1
NANO QLP®
Endless or semi-endless
— 1 strand: 200,000 tpy
— bars (applicable to all products)

2
REGIONAL QLP®
Endless, semi-endless, or billet-to-billet
— 1 strand: 200,000-1,000,000 tpy
— 1+ strands: 200,000-2,000,000+ tpy
— straight and spooled bars (applicable to all products)



3
JUMBO QLP®
Endless or semi-endless
— 1 strand: 1,000,000-1,500,000 tpy
— bars and wirerod (applicable to all products)

4
TWIN QLP®
Endless or semi-endless
— 2 strands: 1,000,000-2,000,000+ tpy
— bars and wirerod (applicable to all products)



Choose your QLP® layout configuration




NANO QLP®

-  Endless casting and rolling
-  Semi-endless casting and rolling

This is the entry-level solution for quality long products production. This arrangement consists of a single-strand caster working in endless or semi-endless casting and rolling mode. Billet sizes are up to OCT 127

mm (equivalent to 115 mm square). The configuration is a 5-to 7-m caster and a 12- to 14-stand rolling mill working in single or slitting mode.

REGIONAL QLP®



-  Endless casting and rolling
-  Semi-endless casting and rolling
-  Billet-to-billet casting and rolling

This is the basic and most typical solution for quality long products production. It is generally proposed with one strand working in endless casting and rolling mode. Alternatively, it is proposed with a semi-endless process, with a single- or multi-strand caster. Billet sizes range from OCT 132 mm to OCT 209 mm (equivalent to 120 and 190 mm squares). A billet welder can be also

considered to gain the benefit of endless rolling. For endless and semi-endless casting and rolling mode the configuration is a 9- to 12-m, single-strand caster and a 16- to 26-pass rolling mill. For billet-to-billet mode the configuration is a 9- to 12-m, multi-strand caster with 2 to 5 strands and a 16- to 26-pass rolling mill.

> See reference plants
Sidenor Sovel, Greece
 > p.50
Egyptian Steel IIC, Egypt
 > p.56
Nucor Sedalia and Frostproof, US
 > p.62
Hoa Phat Dong Quat I, Vietnam
 > p.68
Unnamed customer, USA
 > p.78

JUMBO QLP®



-  Endless casting and rolling
-  Semi-endless casting and rolling

This is the typical solution for steelmakers serving countries requiring high volumes of finished product and where minimills are usually supplied on a large scale. It involves a single strand working in endless casting and rolling mode.

Billet sizes range from OCT 220 mm to OCT 264 mm (equivalent to 200 and 240 mm squares). The configuration is a 14-m caster followed by a 20- to 30-pass rolling mill.

> See reference plant
Bashundhara, Bangladesh
 > p.76

TWIN QLP®




-  Endless casting and rolling
-  Semi-endless casting and rolling

This is the typical endless layout for productivities up to 2.0 Mtpy and maximum product flexibility, which cannot be covered by JUMBO QLP®. Featuring two endless casting and rolling lines, TWIN QLP® can conveniently produce straight bars, spooled bars and wirerod

on separate rolling lines. Billet sizes range from OCT 132 mm to OCT 209 mm (equivalent to 120- and 190-mm squares). The configuration is a 12-m twin-strand caster followed by two 16- to 26-pass rolling mills.

> See reference plant
Pinggang, China
 > p.72

Characteristics comparison table

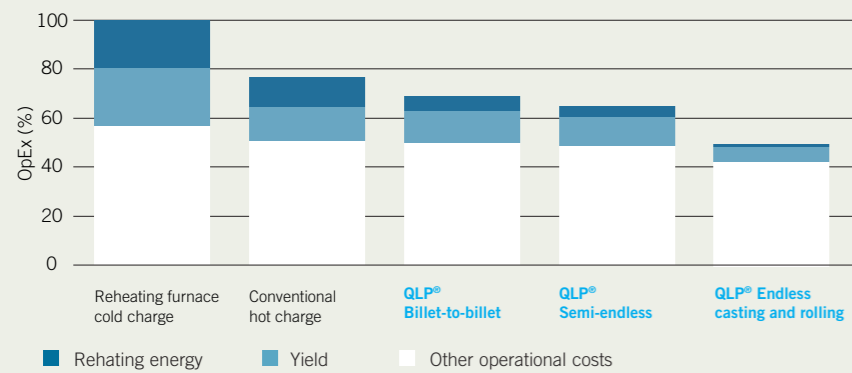
Characteristics comparison table	Reheating furnace Cold charge	Conventional Hot charge	QLP® DANIELI UNIVERSAL DIRECT ROLLING		
			Danieli billet-to-billet casting and rolling	Danieli Semi-endless casting and rolling	Danieli endless casting and rolling
MAIN PLANT FEATURES					
Multistrand caster	●	●	●		
Single-strand caster				●	●
FastCast technology			●	●	●
Reheating furnace	●				
Induction heater		●	●	●	(●)
Direct hot charge		●	●	●	●

MAIN PLANT ADVANTAGES

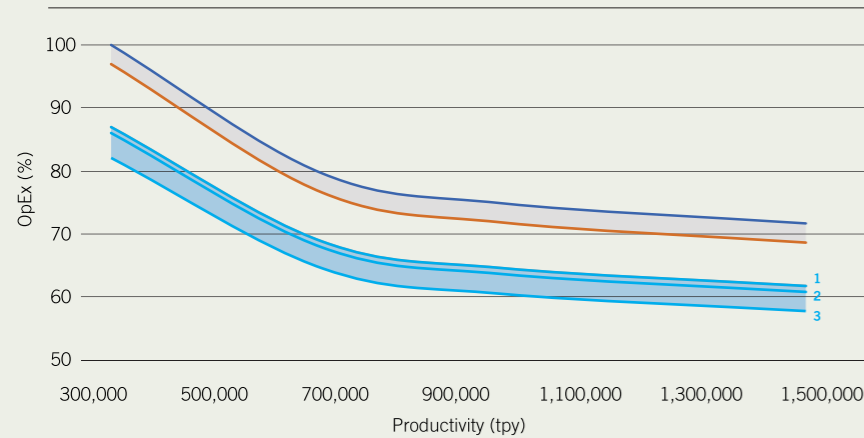
Thermal energy savings	+	++	+++	++++	+++++
Media consumption savings	+	++	+++	++++	+++++
Consumable savings	+	+	+	+++	+++++
Manpower savings	+	++	+++	++++	+++++
Maintenance savings	+	++	++	++	++
Yield	+	+	++	+++	+++++
Billet inventory and handling optimization	+	+++	+++	++++	+++++
Environmentally friendly	+	++	+++	++++	+++++
Light rolling	+	+	+	++	+++++
Quality uniformity	+	+	+	+++	+++++

Danieli QLP® advantages

OpEx comparison among conventional and Danieli QLP® processes.



OpEx composition (reheating, yield and others) presenting savings comparison for conventional and Danieli QLP® processes.



OpEx comparison for conventional and Danieli MIDA QLP® minimills as a function of plant sizes. A small-size MIDA QLP® minimill can compete with large-size conventional minimills.

Danieli QLP® process incorporates about 30 patents covering technological layouts, production equipment and Danieli Automation solutions as power, instrumentation and intelligent digital controls. Their combination leads to the lowest energy consumptions and CO₂ emissions, highest yield and product quality, production consistency and quick plant startups.

Danieli QLP® minimills guarantee tangible advantages versus conventional minimills. This applies to the full range of QLP® installations, starting from small capacity towards conventional minimills, even those having larger capacities.

OPERATING COST SAVINGS

Compared to traditional plants which use the reheating furnace to heat the billets stocked in storage for subsequent rolling, or those processed by direct-charging casting and rolling with low-speed casting machines, QLP® plants guarantee major savings, as shown in the diagrams. Such savings significantly increase from the billet-to-billet process to the semi-endless process, up to endless casting and rolling process.

THE VALUE OF DANIELI MIDA QLP® MINIMILL FOR ANY PLANT PRODUCTIVITY FROM 100,000 TO 2,000,000 TPY

The MIDA QLP® minimill featuring endless casting and rolling process guarantees maximum competitiveness in production costs, with around 20% of OpEx savings for any plant size. It is equally true to say that the same transformation costs can be obtained by running plants having smaller production capacities, thus ideal for small investments and regional markets. The factors that most influence the transformation cost savings are the overall high mill yield, up to 99%; absence of gas reheating furnaces, because of no cold-billet production; and reduced consumables for caster and rolling mill, because one long billet is produced without interruption instead of hundreds of billets per sequence.

SUMMARY OF DANIELI QLP® ADVANTAGES

— HIGH ENERGY SAVINGS
UP TO 1.2 GJ / TON

— ZERO NO_x, SO_x, CO₂
DURING CASTING-ROLLING

— MAXIMIZED EFFICIENCY
UP TO 99% YIELD, 5% RUNLIGHT

— OPERATING COST SAVINGS
UP TO 20% COMPARED TO CONVENTIONAL MINIMILL

— HIGHEST PRODUCT QUALITY
IN BAR BUNDLES, SPOOLED BARS, WIREROD AND LIGHT SECTIONS

— SMALLER PLANT AREA
AND RELATED CONSTRUCTION

— NO BILLET STOCK / HANDLING
AND WORKING CAPITAL COSTS

— LESS MANPOWER
IN CASTING AND ROLLING

— QUICK PLANT STARTUP
AND PROCESS STABILITY

QUICK PRODUCTION STARTUPS

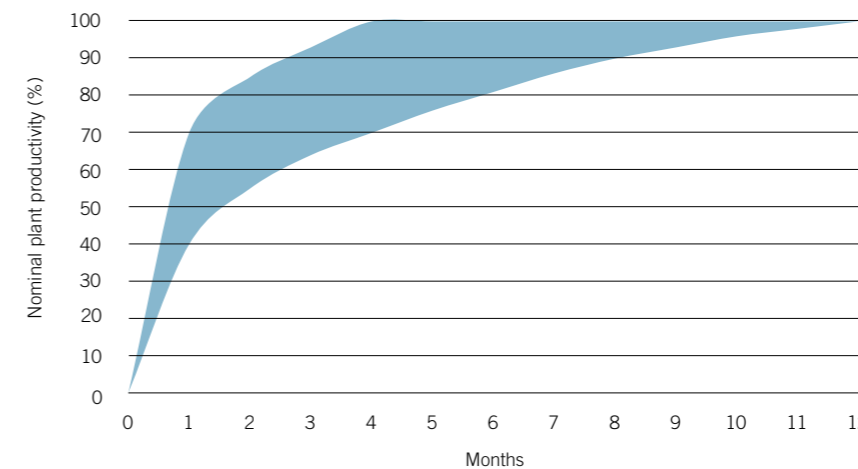
Danieli has decades of experience in starting up MIDA minimill plants and the knowledge from more than one hundred minimills supplied worldwide.

The experience gained, along with the technology and the automation process control reliability, guarantees smooth and fast plant startups. Recent MIDA QLP® endless casting and rolling minimills have started production in automatic

mode from the very first heats.

Dedicated post-commissioning teams make it possible to reach nominal and stable production quickly.

Full production can be reached within a few months of operation thanks to the strong collaboration between Danieli and customer personnel, plug-and-play equipment installation, and “just-in-time” availability of all consumables, based on the Danieli DMMS production forecast platform.



Learning curve of MIDA QLP® minimills featuring endless casting and rolling

Recent MIDA QLP® endless casting and rolling minimills start production in automatic mode from the very first heats and have an impressive production ramp-up, reaching and maintaining 100% of capacity in a range of 5 to 8 months, depending on plant configuration.

Danieli QLP® advantages

More than 40 Euro/ton in OpEx savings thanks to MIDA QLP® technology including 2.0 Euro/ton general benefits related to maintenance, administration and inventory

-7 Euro/t

DIGIMELTER® MELTING UNIT

High performances, low emissions and reduced network disturbances

-2.5 Euro/t

SINGLE-STRAND OCTOCASTER®

Mould and refractory duration, and yield savings

-12 Euro/t

INDUCTION HEATERS

No gas-reheating furnace nor emissions, lower scale formation

-4 Euro/t

ROLLING MILLS

High yield, maximized mill utilization factors and consumable savings

-10 Euro/t

SURFACE TREATMENTS

Controlled-cooling, quenching and self-tempering for microalloy savings

-5 Euro/t

FINISHING FACILITIES

Hot cutting-to-length without any cold-cutting or cropping losses



AN ECONOMICAL AND ECOLOGICAL SOLUTION

High process efficiency and stability are achieved thanks to patented solutions like Q-One® digital power feeder that overcomes the limitations of traditional feeding circuits, with minimal disturbance to electrical networks. ECS continuous horizontal charging and preheating systems satisfy raw material flexibility, low energy consumption, high availability and high productivity, with less noise and polluting emissions. Eco-Pro design reduces NO_x and CO₂ emissions thanks to controlled post-combustion management. Finally, Q-Melt™ adaptive process control system guarantees the best process conditions.

ECO POWER MOULD® AND FASTCAST CUBE®

Thanks to a special copper tube design featuring new water-cooling channels, Eco Power Mould® allows lower meniscus temperatures and lower media consumption in the mould. Its combination with the FCC FastCast Cube® oscillator and reliable automation process controls make it possible to reach the record casting speed of 10 m/min. The octagonal shape used by Octocaster® gives considerable advantages over square and round sections. With Octocaster® it is possible to produce up to 1.5 Mtpy with one strand only. High productivity and stable operation conditions are key in direct casting and rolling process.

DANIELI AUTOMATION Q-HEAT

Q-Heat homogenizes billet temperatures to guarantee the proper rolling process. Its use is directly linked to the true casting speed: the higher the casting speed, the lower will be the electrical power requirements, due to the higher billet inlet temperature. Generally, the use of induction heating is required only in the transient phases, when the speed must be much lower than the cruise speed (sequence start, online roll changes, ...). Billet temperature is monitored continuously and Q-Heat is dynamically regulated according to process. Compared with a gas reheating furnace scale formation is considerably reduced due to a lower residence time at high temperatures.

CANTILEVER AND CARTRIDGE STANDS

Rolling mills are fitted with 16 to 20 stands. Generally, ESS cantilever stands are used in roughing mill sections, minimizing building height, civil works impact and rolls storage. ESS cantilever and GCC / SHS cartridge stands for intermediate and finishing sections are selected depending on final product applications. By performing endless billet rolling, head and tail cropping are no longer required, thus improving rolling mill yield. Moreover, the smooth and stable rolling process given by the endless casting and rolling operation further reduces OpEx of consumables like rolls, rings and roll guides.

QTB / QTS / QTR / UFG / SQ / DSC PROCESSES

These processes confer high mechanical properties while maintaining optimal product ductility and weldability. Controlled-cooling, quenching and self-tempering are performed on straight bars (QTB), spooled coils (QTS, SQ) and wirerod coils (QTR, DSC); ultra-fine grain (UFG) is available for martensitic-free markets. They produce a composite microstructure for final properties comparable to those traditionally reached with microalloying. Since the starting chemical composition is very poor -compared to untreated rebar with similar final properties- significant savings in production costs are obtained.

ENDLESS ROLLING AND FINISHING

High-quality final products are ensured for the entire range of rolled stock, in terms of surface and mechanical characteristics, thanks to high process stability and finishing services. No head or tail cropping for rebar, merchant bar, wirerod and spooled bar in coils, along with a hot cut-to-length, makes it possible to reach the highest yield. DRB® Direct Rolling and Bundling system forms benchmark rebar bundles in very compact spaces. Wirerod and spooler lines produce custom-fit coil weights with a high utilization-factor. Small merchant sections are now produced in endless casting rolling mode using the unique Danieli technology.

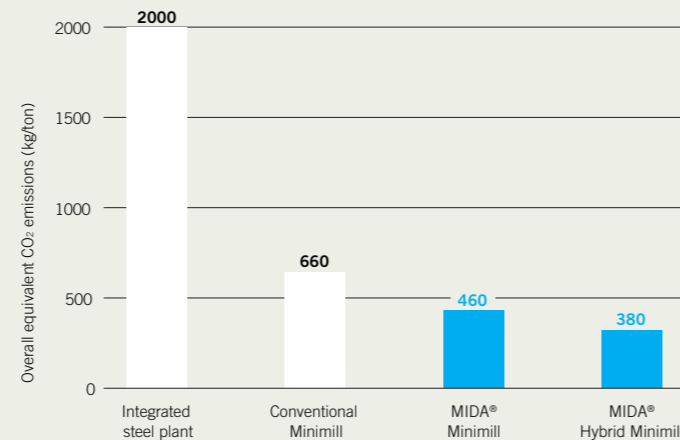
Danieli Green Metal and MIDA Hybrid



Up to 330 kWh/ton savings with MIDA endless casting and rolling, additional 90 kWh/ton savings with Hybrid

ENVIRONMENTALLY FRIENDLY PRODUCTION

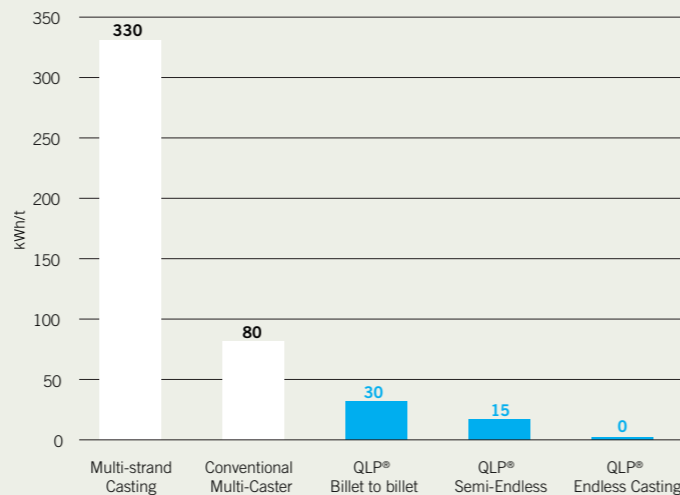
In accordance with the Paris 2015 agreement and zero-emissions roadmap 2050, the steelmaking community is asked to take steps towards clean steel production. Carbon taxes and other regulations on GHG Green House Gasses emissions are creating a strong incentive for steelmakers to adopt low-emission, energy-saving processes, along with renewable energy sources like solar and wind power. Danieli endless casting and rolling, the sealed Digimelter continuously fed by preheated scrap, together with Q-Jenius "hybrid" power sources and Q3-Jenius dynamic energy management, are the answers for these new challenges. CO₂ emission savings directly result in OpEx savings as tax/ton and this has to be taken in due consideration when considering investments for new plants or plant upgradings. For more information on Danieli Green Metal –mass and energy flows, digital scrap management, fume reduction, water treatment and more– please refer to the Danieli MIDA minimill brochure.



Steelmaking process overall GHG emissions.
The benefits of the minimill route vs integrated, particularly for MIDA QLP® endless casting rolling process and MIDA Hybrid, exploiting renewable energies with Digimelter and induction heating.

DANIELI UNIVERSAL ROLLING

Thanks to Danieli MIDA QLP® endless casting and rolling process, liquid steel is transformed into finished product in less than 15 minutes. The process is continuous and stable, and the never-ending billet is rolled for hours and hours, achieving high efficiency in terms of yield, energy savings and environmental sustainability. Danieli endless casting and rolling minimizes CO₂ emissions up to 100 kg/ton of steel produced, saving up to 100% of energy lost to reheating compared to traditional cold-charging practice.



Billet reheating energy requirements.
Energy savings achievable with QLP® processes, improving from billet-to-billet through semi-endless casting and rolling, to endless casting and rolling.

CO₂ emissions per ton of finished product.

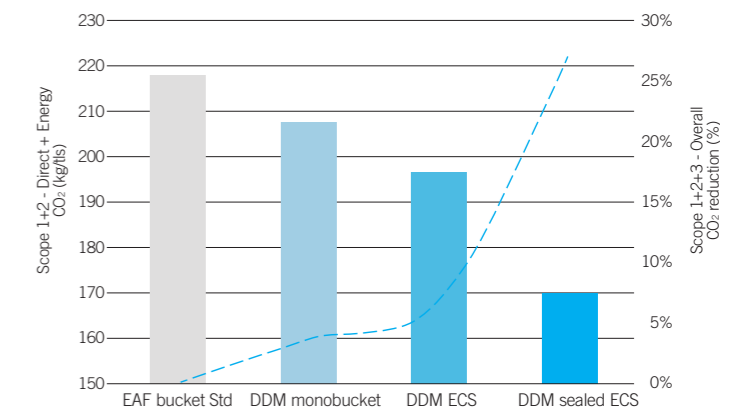
Minimal CO₂ emission results achievable by operating a MIDA Hybrid QLP® minimill, by technological areas:

MIDA Hybrid QLP®	CO ₂ emissions
Meltshop	250 kg CO ₂ /ton
Caster	7 kg CO ₂ /ton
Rolling mill	50 kg CO ₂ /ton
Auxiliaries	18 kg CO ₂ /ton
Cranes and materials handling	50 kg CO ₂ /ton

Note: Kg CO₂/ton emissions [kg/ton] = Used energy [kWh/ton] x 350 [g CO₂/kWh] / 1000 [g/kg]

DIGIMELTER®

Digimelter®, the Danieli digital melting unit, hybrid by design, allows the most efficient and economical electric steelmaking, to reach 15,000 heats/year. There, preheated scrap or hot DRI is continuously charged in the furnace through patented ECS or Hytemp systems. Special Digimelter Eco-Pro airtight design drastically reduces airborne pollutants and minimizes the CO₂ equivalent. Furthermore, the combination and integration of three scrap-treatment processes, such as densification, cleaning and chemical control, along with Q-Melt™ process optimizer makes it possible to improve EAF performances, thus reducing energy use and costs.

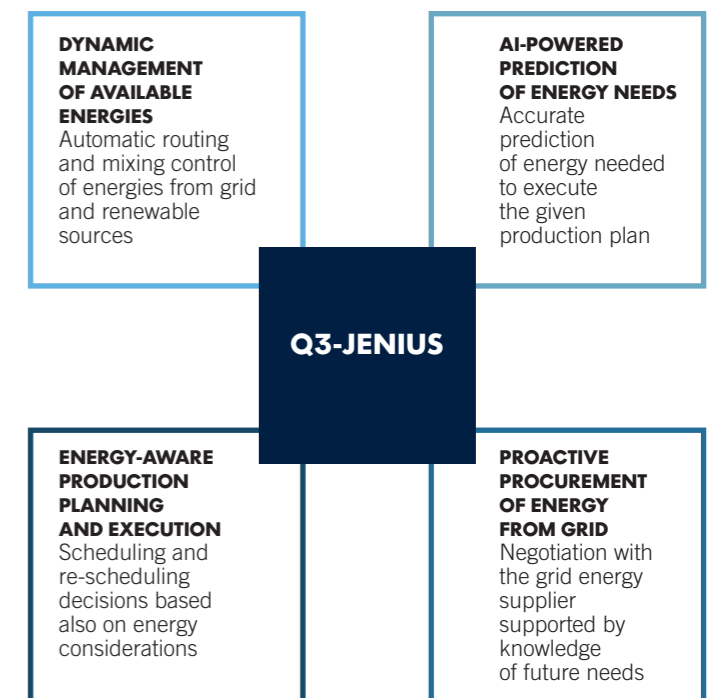


Scrap melting GHG emissions.
Digimelter® cuts by half the direct CO₂ footprint and reduces by 25% the overall carbon emissions (scope 3 - GHG protocol)

Q-JENIUS FLEXIBLE "HYBRID" FEEDING

Danieli Q-Jenius flexible and efficient "hybrid" feeding, together with Danieli Q3-Jenius dynamic energy management for least-cost production, addresses the requirement for efficient handling of the variability of the energy from such sources and their transfer, without the losses caused by the regular AC power grid. Energy managers benefit from overall and detail views of how energy is consumed, provided by the Q3-DEMS system. In particular, Q-Jenius allows the electrical feeding of Digimelter and ladle furnace through Q-One power feeder, as well as of Q-Heat induction heaters and rolling mill stand motors, fume-treatment plant fans and more, elevating a MIDA minimill into a MIDA Hybrid minimill.

Q3-Jenius dynamically manages available energy sources, including renewable energy with "energy-aware" production scheduling, also enabling a proactive negotiation with the grid energy supplier.



DIGIMELTER® intelligent melting unit

Danieli developed and patented the Digimelter®, a revolutionary melting unit consisting of a unique combination of power, intelligence, and environmentally friendly equipment to achieve 15,000 heats per year with minimal OpEx, lowest environmental impact, and high flexibility for raw materials.

Power is generated by the innovative Danieli Q-One® digital power-feeding system, which overcomes the limitations of traditional transformers. Q-One® digitally controls both current and voltage, independently for each electrode, providing the highest power factor and lowest disturbances, with unmatched advantages towards both the feeding line and to the furnace process.

Q-Melt™ intelligent automation minimizes OpEx and provides consistency of operation. It controls automatically and in real time each chemical and electrical working parameter in a consistent and adaptive way, achieving the best performances with reduction of process variability.

Flexibility on raw materials is ensured by the Zerobucket system. In combination with the new concept of sealed “Eco-Pro” furnace design, it drastically reduces by half the direct CO₂ footprint and by 25% the overall carbon emissions, optimizing transformation costs compared to conventional EAFs.



Zerobucket® continuous scrap charge



Hytemp continuous hot DRI charge



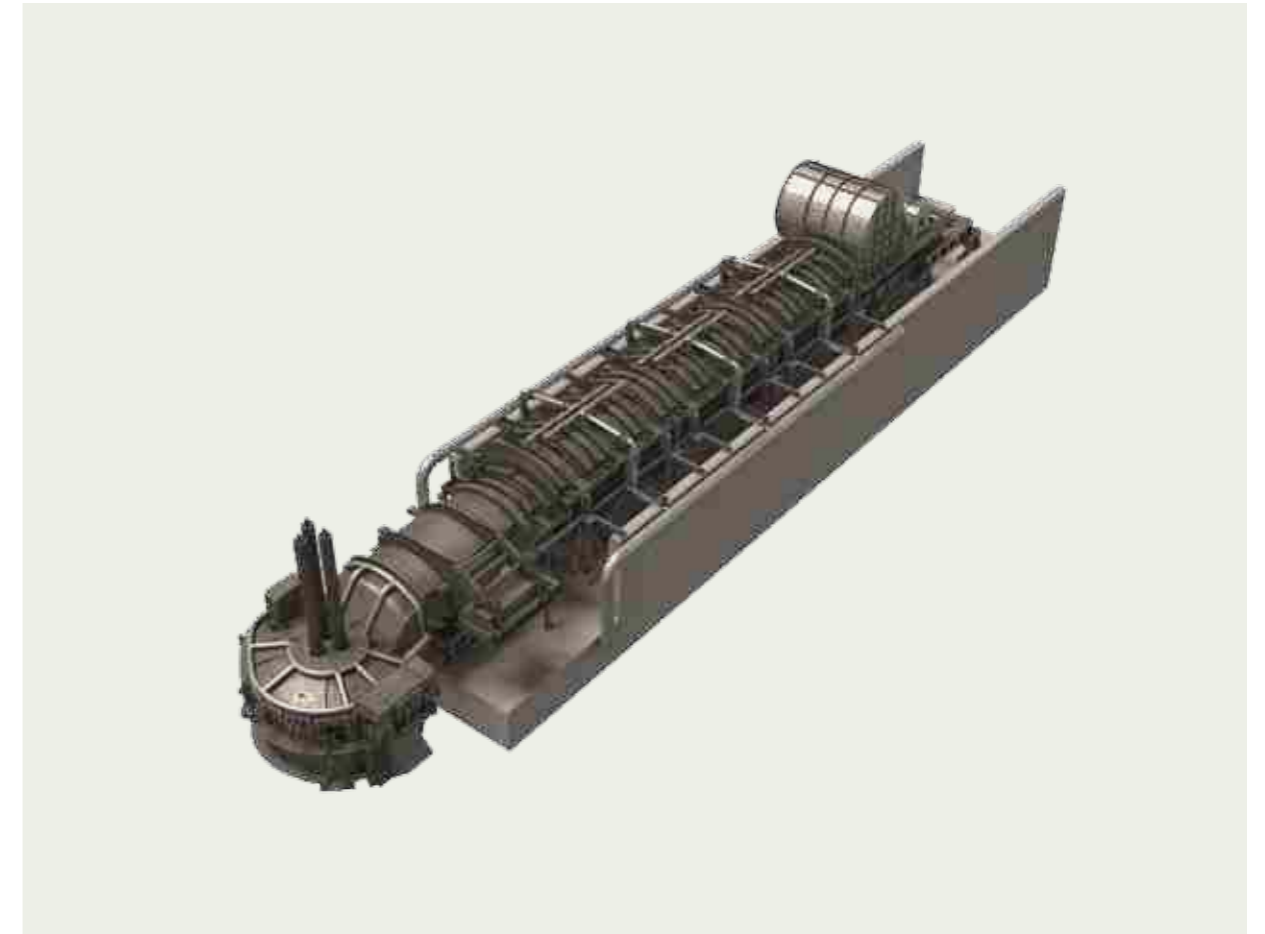
Q-Melt™ automatic furnace

DIGIMELTER® PERFORMANCES COMPARED TO CONVENTIONAL EAFs

-25%
OVERALL CARBON EMISSIONS (CO₂ E)

-5%
ELECTRIC ENERGY CONSUMPTION

-15%
ELECTRODE CONSUMPTION



THE DANIELI ECO-PRO AIRTIGHT SOLUTION

The Digimelter Eco-Pro airtight design is conceived to reduce to the minimum the emissions of pollutants and to minimize the CO₂ equivalent. Every detail of the Digimelter has been carefully optimized in order to minimize air inlet to the melting area. The furnace is kept always sealed, thanks also

to the Thor 3K automatic slag door and improved sealing between the furnace and the ECS conveyor. The process itself is controlled automatically by Q-Melt™, leading to a minimization of oxygen and carbon injection, ensuring the most efficient melting at the lowest CO₂ footprint. Compared to a conventional EAF with the same charge mix, Digimelter Eco-Pro reduces the CO₂ direct emissions (Scope 1) by more than 50% and overall CO₂ emissions (scope 2) by 25%.

Low emissions of an ultra-modern Danieli meltshop for 500,000 tpy compared with a conventional meltshop.

	With Digimelter Eco-Pro	With conventional EAF
Collected dust	10-15 kg/ton	15-25 kg/ton
PM10 at stack	< 1 mg/Nm ³	5-10 mg/Nm ³
Carbon monoxide	100 mg/Nm ³	100 mg/Nm ³
NO _x	23 g/tls	90 g/tls
SO ₂	< 30 mg/Nm ³	< 40 mg/Nm ³
Dioxins I – TEQ	< 0.1 ng/Nm ³	< 0.1 ng/Nm ³

QLP® Technologies

Octocaster® The key feature of the QLP® process

A single-strand, high-speed continuous casting machine is the core of the Danieli endless casting and rolling process. Equipped with patented FastCast Cube (FCC), Eco-Power Mould® copper tube and a new octagonal section, Octocaster® produces quality endless billets at speeds up to 10 m/min, making it possible to reach productivities up to 1.5 Mtpy with a single casting strand.

These unique performances are available just through technologies Danieli developed in 20 years of endless casting and rolling experience that allow continuous and stable production. The octagon-shaped mould and the Q-Cool solidification model –part of the Danieli Automation process control package– are the latest developments. The sum of these patented technological solutions makes it possible to produce at high-speed / high production rates, minimizing bulging phenomena happening when the solidified shell is so thin that it bends outward due to ferrostatic pressure.

FASTCAST CUBE

The FastCast Cube –FCC is the patented mould oscillator that allows excellent casting performances. FCC has a low inertia due to the “bearing-free” technology, very compact design and very limited weight for the oscillating part. Two hydraulic actuators installed at the sides of the mould guarantee the center of gravity in axis with the oscillating masses, drastically reducing lateral deviations. The cartridge-design of the mould featuring foot rolls and automatic water connections allows a quick and easy installation. Danieli FCC achieves an oscillation range 50% wider than a conventional oscillator design and an acceleration up to 6 m/s². FCC operates with high precision and reliability, decreasing maintenance activities and costs compared to conventional oscillators.

ECO-POWER MOULD®

The Eco-Power Mould® is the latest development of the Danieli Power Mould®. The thermal exchange and temperature distribution are improved thanks to a new channel design (Danieli patent). The new manufacturing methods increase the copper tube rigidity for a higher contact stability with the product. Due to a longer lifetime the OpEx of Eco-Power Mould® is comparable to that of conventional copper tubes.

Q-COOL

Q-Cool is a software model developed to monitor and dynamically control the cooling parameters and product solidification. This allows process stability under any operating condition, resulting in smooth production-sequences and a higher product quality. Based on meshless (pointillization) method, the Danieli Automation model is proven to offer highly accurate and fast calculation of process parameters, over slabs, blooms and billets in different steel grades. An offline functions allows metallurgists to test the new casting practices virtually, simulating the relevant effects on the billets.

Danieli patented Eco-Power Mould® copper tube featuring built-in, water-cooling system for optimal heat extraction.

Patented FastCast Cube, compact mould oscillator for ultra-precise mould guidance and maintenance-free operation.

Octagonal billet produced by a high-productivity, single-strand Danieli Octocaster®.



The advantages of the Danieli octagonal mould



Danieli Automation Q-Cool solidification model based on proprietary algorithms for the dynamic control of product cooling.

SELF-CONTAINING

The square shape is affected by bulging deformation due to ferrostatic pressure, and so it is necessary to install roll sections along the caster curve to contain the deformation; in contrast, octagonal and round billets do not require this, because the ferrostatic pressure is better distributed and the deformation does not show.

PRODUCT GUIDING

The product guiding along the curve (copper tube, foot rolls and cooling zones) is a basic requirement for process stability. The square has a good attitude on this, compared to rounds, thanks to the flat sides; the octagon, with its 8 sides, enhances this characteristic, even compared to square.

SELF-ADAPTING INSIDE COPPER TUBE

Solidification starts inside the copper tube billet shell. Constant contact between copper tube and product is mandatory for growth of a uniform shell. Corners improve this adapting characteristic, which is maximized by the octagonal section and its eight corners. Round sections show the worst attitude.

TEMPERATURE DISTRIBUTION

This is directly linked to the rate of external surface and volume, with lower temperatures offering better distribution. On this basis the best shape is the round, with a minimum rate, and the octagon is very close to this rate. Better temperature uniformity allows more stable and higher quality rolling.

Table comparing the different “attitudes” and “effects” of different billet shapes, highlighting the overall advantages of the octagon shape produced by Danieli Octocaster versus traditional shapes.



	Square section	Round section	Octagonal section
Section self-containing No bulging effect	++	+++++	+++++
Section guiding along copper tube, foot rolls and curve Solidification stability	++++	+	+++++
Section self-adapting inside copper tube Uniform contact between copper tube and product	++++	+	+++++
Temperature distribution across the cast section Improved stability and quality on rolling product	++	+++++	++++
Overall rating	++++	+++	+++++

QLP® Technologies

Rolling mill stands

ENERGY-SAVING STANDS®

Danieli ESS, energy-saving compact stands with cantilever rings and oil-film bearings, efficiently and economically perform as roughing, intermediate and finishing mill stands for the production of bars, wirerod and small sections in commercial and special steel grades. The main benefits given by ESS stands are:

- Compactness: small kinematic chain and lower number of components granting a compact plant layout (-30% in width), lower buildings (-3 m on "crane top of rail") as compared to conventional stands.
- Energy saving: the lower weight of the

components gives electrical savings of 10-15%.

- Easy access: simpler equipment set-up and faster stand-cleaning.
- Reduced spares: fewer and standardized machine components for minimized maintenance and spare parts demand, resulting in 60% saving on spares. Consequent smaller space requirement for the rolling mill workshop.

A patented "sandwich" system for semi-automatic or fully-robotized, simultaneous fast-replacement of rings and guides along the mill is available. "Ready-to-roll" is guaranteed due to the fully preassembled spare sandwich prepared off-line in the workshop.

Energy-saving and housingless stands: the choice of the right rolling mill stands, based on the desired products, productivity, production flexibility and equipment maintainability, is backed by the Danieli experience of more than 500 long-product rolling mills supplied. Both stands and finishing blocks are conceived for easy integration into "Industry 4.0" smart factory programs for production, service and energy consumption.



Energy-saving cantilever rolling mill in operation at Acciaierie Venete, Italy.

STAR HOUSINGLESS STANDS®

Danieli SHS, new housingless stands are characterized by heavy-duty design and manufacturing for production of superior-quality long products, achieving very strict product tolerances. Lower maintenance and operating costs thanks to high reliability and standardized components are reduced by 15% compared to previous SHS design. Improved plant efficiency is achieved thanks to automatic cartridge change performed in only 4 minutes.

The "Ready-to-roll" quick-program changing system is based on automatic stand replacement with spare units fully pre-assembled in the workshop. This can be performed during production sequences –for product changes or roll wearing– or plant stoppages. In addition, SHS stands are designed with media-supply quick-connection block for fast and easy stand changes, according to "hands-free" concept. Furthermore, SHS stands perform Automatic Gap Control with both radial and axial adjustments under load.



Housingless stand rolling mill in operation at voestalpine Donawitz, Austria.

FINISHING BLOCKS

Danieli finishing solutions include Fast Finishing Block –FFB, designed for high-quality straight or spooled bars and wirerod, whilst the Twin Module Block –TMB is dedicated to ultra-high quality wirerod production. Fast Finishing Block allows the production of straight or spooled bars coils at finishing speeds up to 120 m/s, at low operating costs. These blocks are designed for product tolerances down to ±0.1 mm on 5.5-mm-dia, with 70% ovality. According to rolling mill configuration they feature from 2 to 10 passes equipped with single or multidrive configuration to enhance ring usage.

The Twin Module Block is made up of an 8-pass pre-finishing block followed by a 4 (2+2)-pass finishing / sizing block running up to 130 m/s. Tolerance of ±0.1 mm with 50% ovality on the whole range and of ±0.075 mm with 50% ovality on 5.5-mm-dia are achieved. Both FFB and TMB blocks are modular designs that integrate a quick-car changing system for on-line module changes in less than 4 minutes, for the highest plant utilization factor. Hi-section and Hi-profile measuring devices installed before and after the blocks continuously monitor product tolerances and block performances.



Fast-finishing blocks in operation at wirerod mill at Acciaierie di Verona, (Pittini Group), Italy.

QLP® Technologies

Finishing services

STRAIGHT BARS

The patented Direct Rolling and Bundling –DRB® system is applied to all new, complete MIDA plants to produce straight bars from 6 to 24 m final bar commercial lengths. Superior bundle formation is based on a unique operating concept, whereby bars are regularly deposited and stacked in subsequent layers to form the regular bundle. High-quality bundles are made-up of perfectly aligned and headed-

up bars, neither twisted nor entangled. Production of customized bar bundles is order-based, with extreme flexibility to change final bundle size (weight, number of bars, bar length), without interrupting the production. The final bundle supply, organized on “ready-to-sell” basis, minimizes the product storage requirements with additional economical and logistical benefits.



Typically, MIDA QLP® plants produce:

- straight bars,
- straight bars and spooled bars in coil,
- straight bars and wirerod,
- straight bars and small sections.

Danieli MIDA QLP® technology allows the savings of endless casting and rolling process for the production of different finished long products. Its technological layouts enable any product combination requested for straight bars and small sections in bundles, spooled bars and wirerod in coils.

WIREROD

Ultra-high-speed finishing rolling of endlessly rolled wirerod will be performed through a pre-finishing block plus a finishing block performing over the whole range of product sizes. This configuration grants high quality rolling at very high speed for extra-small size wirerod with very close tolerances, down to ± 0.1 mm over the whole product range.

Tolerance stability is guaranteed mainly thanks to the endless casting and rolling process. High plant efficiency is made possible thanks to the single-pass sequence throughout the whole mill (including the 8-pass pre-finishing block) and the automatic quick changing system of the finishing block rolling modules (taking less than 5 minutes).



SPOOLED BARS IN COIL

Thanks to endless casting and rolling technology, it is possible to consistently improve rolling performances in terms of productivity, efficiency, energy savings and reduction of cobbles by providing higher stability of the whole process due to better steady-state operational conditions. All sizes of MIDA plants can feature the latest Danieli K-Spool lines producing twist-free,

perfectly shaped, compact bars in coils. The continuous casting and rolling process ensures a reduction of spread in the mechanical and geometrical characteristics compared to single or dual billet rolling, and the production of coils up to 8 tons of fully optimized rebar in sizes from 8 to 25 mm.



SMALL SECTIONS

Merchant bar production takes huge benefits from the MIDA endless casting and rolling in terms of yield and energy savings. The patented MIDA Merchant mill reduces to almost zero the short tail in the cooling bed, which is one of the most significant factors of yield losses in a conventional billet-to-billet merchant mill. Thanks to all the latest advanced

technologies applied on this kind of process, uptime can be greatly improved, up to 20%, allowing higher production of finished products compared to corresponding conventional merchant mill with reheating furnace. Typical products are small angles, channels, flats, rounds and squares processing all the most common grades for merchant applications.



QLP® Technologies

Cooling treatments

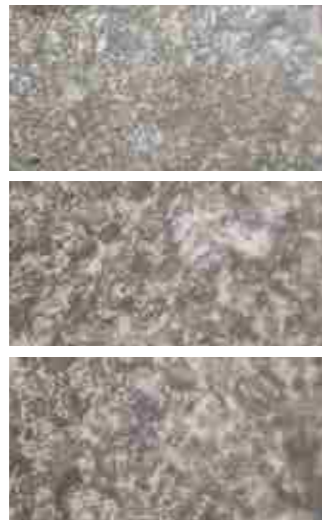


Danieli Quenched and Tempered processes for bars, spooled bars and wirerod, Ultra-Fine Grain process for ribbed bars and wirerod, Structure Control for wirerod, and Soft Quenching for spooled coils, guarantee high mechanical properties even with a poor starting chemical composition, resulting in significant OpEx savings.



QTB/S/R

Surface quenching and self-tempering process for ribbed bars, spooled bars and wirerod



50 μm

This process can be divided into three stages, executed directly from the rolling heat.

- Quenching stage: the bar surface is quenched in a water-cooling box while the core temperature is maintained in the austenitic range.
- Self-tempering stage: the residual bar heat flows from core to surface and tempers the crude martensite formed there during the quenching stage. The retained austenite eventually transforms to bainite.

- Final cooling stage: the bar is cooled down to room temperature in the cooling bed. The austenite at the core transforms into ferrite+pearlite. The composite microstructure of the final product is defined by three different areas:
 - An external layer of tempered martensite with a high hardness level.
 - An intermediate, annular area consisting of a mixture of bainite and tempered martensite.
 - The core zone, where the structure is still composed by a mixture of ferrite and pearlite.

From top:
 — Surface layer of tempered martensite, hardness from 280 to 300 HV;
 — Annular zone of bainite+ martensite, hardness from 220 to 240 HV;
 — Core zone of ferrite+ pearlite, hardness from 190 to 210 HV.

UFG

Ultra-Fine Grain -UFG process for rebar



50 μm

UFG process allows a very fine microstructure and enhanced final mechanical properties, minimizing or even avoiding the need for alloying elements, starting from low-carbon and low-manganese steel through low surface-temperature rolling. This is necessary to comply with the Chinese regulations (GB/T 1499.2 – 2018 “Steel for the Reinforcement of Concrete”) for structural steel, i.e. martensitic-free structural products with higher ductility, which can guarantee better performances in seismic zones. Grain-size-controlled grades can ensure high stress ratios

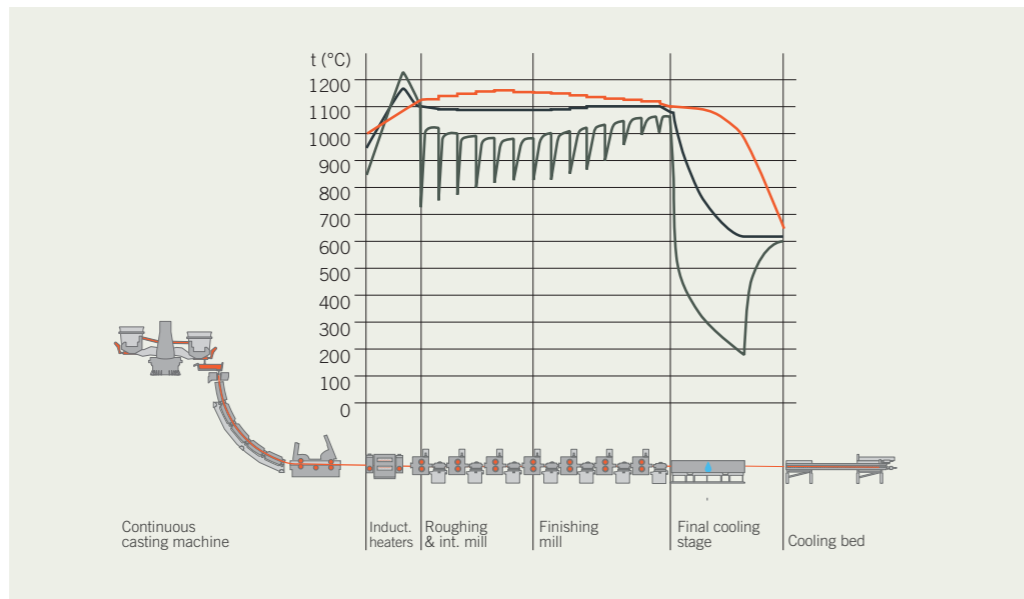
and AGT values, thanks to a dedicated controlled-temperature rolling strategy (hardness difference between surface and core should be less than 40 HV). With the UFG process it is possible to obtain a grain size definition from 5 to 1 μm, which makes it possible to have a material with higher ductility (with the conventional quenching process QTB, the material is more brittle than with the UFG), because the lower grain size prevents any potential crack from propagating.

From top:
 — Surface layer of ferrite+ pearlite, hardness 190 HV;
 — Annular zone of ferrite+ pearlite, hardness 180 HV;
 — Core zone of ferrite+ pearlite, hardness 170 HV.

Distance – Temperature curves along the RM

Rebar 25 mm dia on stand #16, at 10.61 m/s, from 130x130-mm-billet

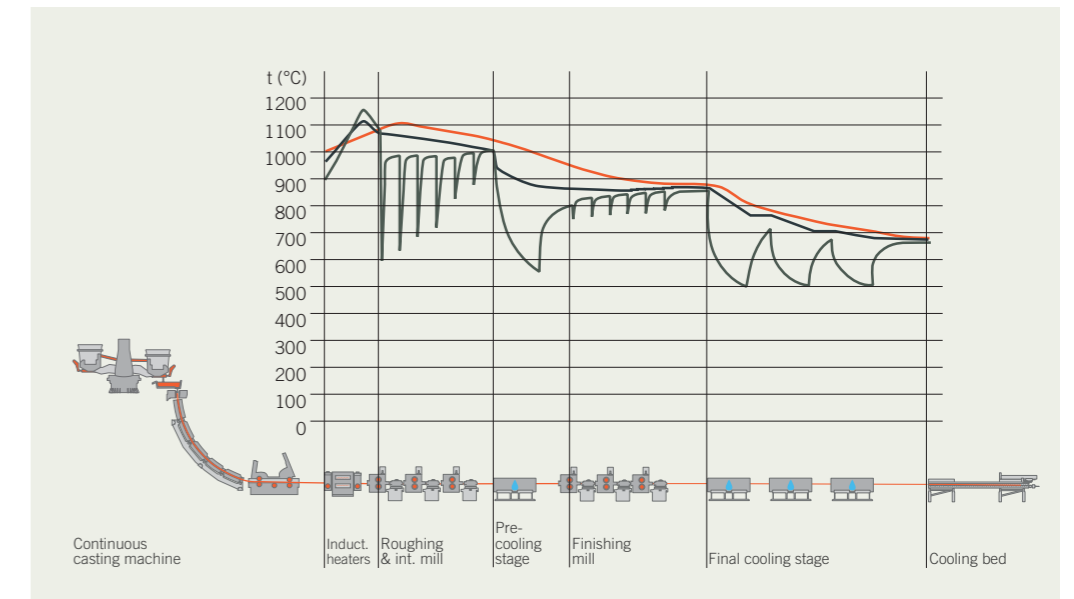
— Core temperature
 — Surface temperature
 — Average temperature



Distance – Temperature curves along the RM

Rebar 2x16 mm dia on stand #20, at 9.24 m/s, from 190x190-mm-billet

— Core temperature
 — Surface temperature
 — Average temperature



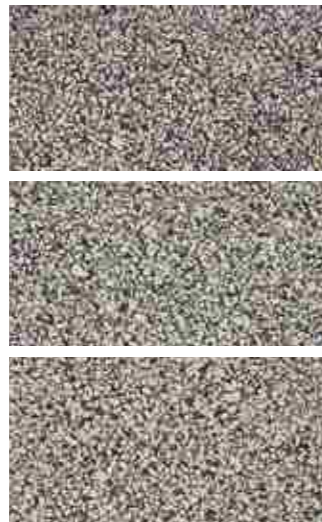
QLP® Technologies

Cooling treatments



DSC

Danieli Structure Control process



100 μm

The aim of the DSC system is to control and maintain the thermal profile of the bar well within the optimal temperature range, and uniform from head to tail. This is done to obtain:

- Optimal and very uniform technological characteristics on the product;
- Constant strain loads;
- Very accurate dimensional tolerances.

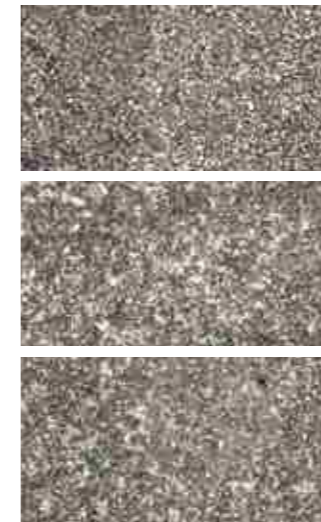
The small temperature difference between surface and core is obtained through a suitable length of the

temperature re-equalizing zone provided between pre-boxes and Fast-Finishing Block / Twin Module Block. Temperature variation through bar length not greater than ± 10 °C is ensured by adopting the “in-line self-adjusting system (called closed-loop control)” to control the cooling capacity of the waterboxes. The “in-line self-adjusting system” is implemented in the automation system as part of the process control itself.

From top:
 — Surface layer of ferrite+pearlite, hardness 220 HV;
 — Annular zone of ferrite+pearlite, hardness 195 HV;
 — Core zone of ferrite+pearlite, hardness 170 HV.

SQ

Soft Quenching process



100 μm

The finest temperature control for optimal ductility and downstream cold working.

- Pre-cooling stage at a temperature of 800-900 °C. In this first stage there are no microstructural modifications. The whole bar section remains in the austenitic temperature range.
- Fast-cooling stage to the desired coiling temperature. Alternating cooling and self-tempering stages, the bar is cooled down to the desired coiling temperature.

The final microstructure is different in respect to QTS standard treatment (the surface microstructure is comprised of 80-90% bainite and 10-20% martensite).

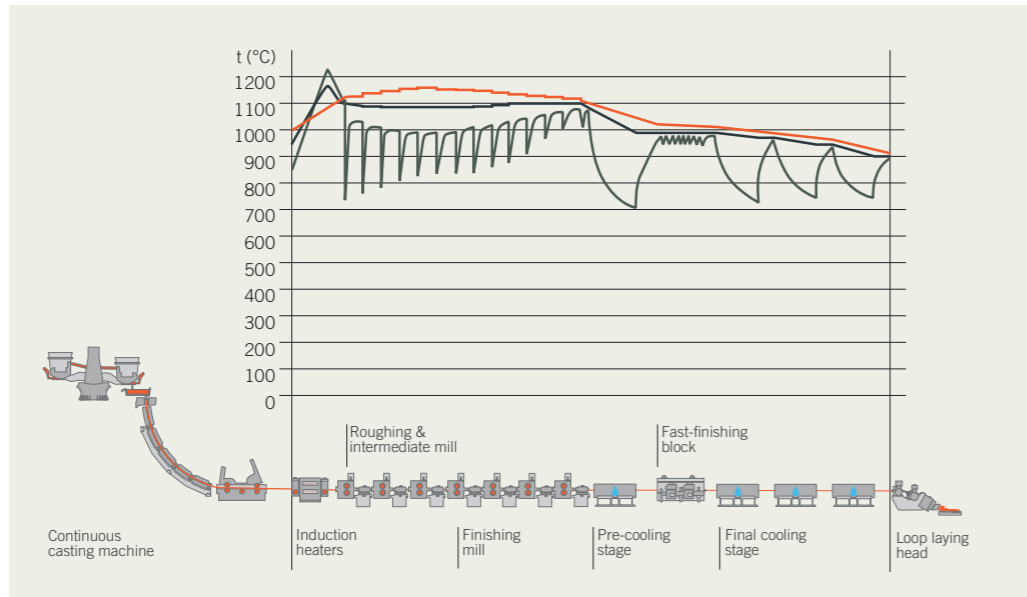
- Final-cooling stage. The coil is cooled down to room temperature in free air. With the SQ process it is possible to obtain a product which has higher ductility and lower surface hardness compared to those produced with the hard quenching process, and with similar mechanical characteristics to recoiled ribbed wire rod.

From top:
 — Surface layer traces of tempered martensite+lower bainite+ferrite+pearlite, hardness 225 HV;
 — Annular zone of ferrite+pearlite, hardness 215 HV;
 — Core zone of ferrite+pearlite, hardness 210 HV.

Distance – Temperature curves along the RM

Smooth wire rod AISI 1010
 5.5 mm dia
 on FFB, at 120.00 m/s,
 from 150x150-mm-billet

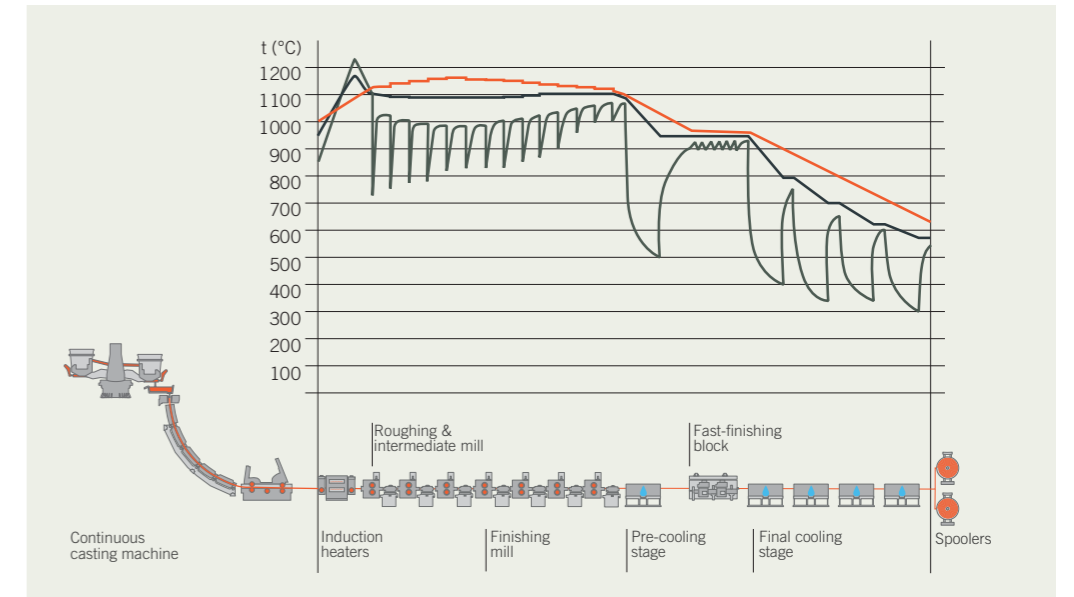
— Core temperature
 — Surface temperature
 — Average temperature



Distance – Temperature curves along the RM

Rebar 16 mm dia
 on FFB, at 20.00 m/s,
 from 160x160-mm-billet

— Core temperature
 — Surface temperature
 — Average temperature



QLP® Technologies

I 4.0 AUTOMATION, robotics, power and control systems

The new Danieli control room for the Danieli Intelligent QLP adopts an IIOT platform and advanced technologies that revolutionize the control of a minimill. An entire plant can be controlled from a single pulpit, which no longer needs to be in the production area, with the assurance given by having an autopilot to check and run it.

The Danieli Automation system proactively interacts with the operator, focusing his attention just on what it is needed at that precise moment, not only for the controls on the HMI page or on the Operator Assistant replacing obsolete pushbuttons, but also on plant images displayed on LED walls.

Supported by advanced instrumentation, the QLP dimensional and qualitative parameters are always monitored.

Power electronics are widely used in the melting area (Q-One) and rolling section (Q-Heat and Q-Drive), to improve also the carbon footprint of the plant.

Robotics are designed for different applications, limiting the presence of operators on the floor and increasing overall plant safety.

Quality (Q3-Premium) and production software solutions (Q3-Met) can further push performances of the plant ahead, by monitoring quality performances along the entire production chain and identifying root causes for defects and by improving machines utilization, time to market, yards management and scheduling of production.

DEDICATED DANIELI AUTOMATION DIGITAL AND POWER TOOLS FOR MINIMILLS

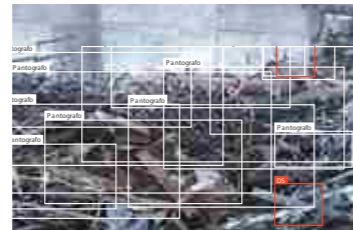
The most advanced process control solutions and technological packages have been adopted for the Danieli Universal Direct Rolling minimills featuring endless casting and rolling. From liquid steel to final product, processes are optimized and under control with minimal workforce at the most competitive OpEx, using innovative process control models, new technologies and intelligent instruments, in line with the Industry 4.0 paradigm.

Following here, a presentation arranged per technology areas and related benefits of the main digital and power tools operating in Danieli competitive minimills.

SCRAP MANAGEMENT AND CHARGING

Automated scrap yards for efficient, safe scrap classification, tracking and handling.

Q-SYM2 AUTOMATIC SCRAP YARDS



Digitalization begins when scrap arrives at the scrap yard, as images are stored and the scrap automatically classified for its category and quality, independent from operator.

Then the scrap is tracked through the yard, identifying its type and relative position for automatic crane handling.

Data of scrap characteristics and layers in buckets are automatically transferred to the process control system.

Q-ST5 SCRAP LASER SCANNING



A 3D display of scrap status on the conveyor based on laser scanning of continuous scrap-charging systems allows for optimized scrap distribution along the belt and consequently the best furnace-feeding rate. The benefits of this are reduced OpEx for scrap handling, scrap tracking, improved control of scrap quality and resulting steel quality.



ABS Wire 4.0, Italy, the new benchmark installation for production of quality wirerod. Control room featuring new generation of Danieli Automation Q3 pulpits is conceived to maximize the application of I4.0 principles for easy, efficient, automatic plant operation. Q3 pulpits are applicable to steelmaking, long and flat product plants.

POWER

Power-electronic solutions are provided to meltshops, casters and rolling mills, including inverters, to minimize carbon impact.

**Q-ONE
DIGITAL POWER FEEDER**



Power electronics control arc furnace current and voltage, to improve arc stability throughout the melting process for a minimized impact on electrical networks, with power factor at 0.97 and not requiring SVC.

This also allows control of frequency and independent control of electrodes, resulting in operational flexibility.

Built-in system redundancy enables operation with reduced power or with just two electrodes.

Hybrid power feeding is a further possibility.

The benefits of this are reduced power-on time (10%), reduced electrode consumption (up to 15%) and reduced specific energy (up to 5%), with a typical payback time of 1-2 years.

**Q-HEAT
INDUCTION HEATERS**



Modular and maintenance-friendly induction heating systems ensure high power-efficiency for casting and rolling. Powered by HiPAC high-performance controller featuring native integration with Danieli L1 and L2 automation, they provide feedforward / feedback bar-temperature control.

The benefits of this include flexible heating with zero CO₂ emissions and accurate temperature control across the transfer bar length.

**Q-DRIVE POWER
SYSTEMS**



Modular and maintenance-friendly, 3-level NPC medium-voltage inverter solutions are provided for synchronous and induction motors.

Powered by HiPAC high-performance controllers, they guarantee high reliability and highly dynamic performances with active front-end design for best energy exchange and safe torque-off functionality.

The benefits of this include accurate torque and speed control across the entire speed range and power factor at unity.

ROBOTICS

Dedicated robotic solutions are supplied for fully automated operations, to increase plant safety according to the “zero men on the floor” concept.

Q-ROBOT MELT

For meltshops, robots perform temperature sampling and chemical analysis for EAFs and LFs, and execute EBT cleaning on electric arc furnaces. The same robot can measure refractory thicknesses to predict maintenance needs.

Q-ROBOT CAST

Casting floor robotic applications allow automatic cartridge loading and unloading, tundish sampling, oxygen lancing, ladle shroud manipulation and slidegate connection.

In-mould automatic casting powder dosage and feeding also are possible. Furthermore, robots are used for marking, labelling or tagging.

The benefits of this include plant safety level improved to 100%, tap-to-tap time reduced to 1 minute and improved refractory maintenance.

Q-ROBOT ROLL TAG



Tag application on bundles or coils is performed thanks to a precise tracking of production and use of robotic applications and artificial vision tools to ensure reliable operation.

**SENSORS AND
INSTRUMENTATION**

Smart sensors and instrumentation provide on-line product dimensional / quality detection and control.

**INFRARED
IMAGING SYSTEMS**

IR imaging technology determines slag presence in the tapping area, monitors steel levels in the ladle during tapping, and verifies actual speed during casting and rolling.

**ARTIFICIAL
VISION SYSTEMS**

This technology presents graphic images in real time for surface defect detection of bars in quality steel production.

3D IMAGING TECHNIQUES

On-line laser profiling performs accurate dimensional measuring of long product sections.

EDDY CURRENT



HiSection performs instant calculation of rolled stock cross-sections to ensure continuous monitoring of rolled stock size, even between rolling mill stands.

The benefits include up to 33% reduction in roll wear and up to 300% increase in roller guide service life with HiSection. Improved quality of final products and better process knowledge are further advantages.

**HIGH-SPEED
CONTROL PLATFORM**

Powerful high-speed platform to maintain real-time control of all steel production processes.

DANIELI HIPAC



This solution features powerful industrial PC hardware, IEC-compliant programming languages, high-speed Ethernet-based fieldbus (EtherCAT), open connectivity through OPC UA and third-party SCADA integration.

A single control platform oversees process automation (Q-One), main drives (Q-Drives) and induction heaters (Q-Heat) for efficient plant operations.

The benefits of this include high performance standards, simplified application development and maintenance, quick troubleshooting and high plant availability.

**INTELLIGENT
CONTROL ROOMS**

Empowered operator recognition and event-enforced learning improve plant control, supported by artificial intelligence.

DANIELI Q3-PULPITS



“Soft desks” are based on computer screens with data-driven process controls. Plant and area performance indicators and operator assistance promote operational reliability. Smart, flexible and ergonomic support augments the quality of human labor with CCTV systems supervising all plant areas.

The benefits of this include reduced manpower, a common repository of company know-how and reduced delays in production.

References and records worldwide

Trust from the market



● Endless ● Billet-to-billet

MIDA was initially designed as a regional, EAF minimill capable of producing up to 300,000 tpy from local scrap. It was designed to meet customer demand in a limited area, with more competitive operating costs compared to larger, traditional minimills with lower investment costs. Today, through technological advancements in casting speed, steady

conditions and billet size, Danieli single-strand endless casting-rolling technology provides productivity improvements up to 1.5 Mtpy. MIDA Universal Direct Rolling clearly surpasses the conventional minimill concept. Furthermore, thanks to the introduction of the twin-strand application, it is possible to produce up to 2.0 Mtpy of finished products.

DANIELI QLP® RECORD-BREAKING TECHNOLOGY

MAX. PRODUCTIVITY

111 tph in sequence

MAX. STABLE CASTING SPEED

9.0 m/min

LONGEST SEQUENCE

53 heats

EARLIEST ENDLESS MODE DURING COMMISSIONING

In the first heat of plant startup

LONGEST BILLET ROLLED

11 km, 130x130-mm-section

31 QLP® reference plants worldwide, 19 of which featuring endless casting and rolling technology, and five three repeat orders

Customer	Country	Year of startup	Operational mode
Bashundhara	Bangladesh	2023	Endless
Unnamed customer	USA	2023	Endless
Jai Raj ISPAT	India	2022	Endless
KOSCO	Korea	2022	Billet-to-billet
ETRHB	Algeria	2022	Endless
JianBang Group	China	2022	Endless
Agha Steel	Pakistan	2022	Endless
Pinggang Group	China	2021	Endless
Unnamed customer	MENA	2021	Endless
Hoa Phat Dong Quat III	Vietnam	2021	Billet-to-billet
Chien Shun	Taiwan	2021	Billet-to-billet
Nucor Steel Frostproof	USA	2020	Endless
Unnamed customer	MENA	2020	Endless
Nghi Son I	Vietnam	2020	Billet-to-billet
Nucor Steel Sedalia	USA	2019	Endless
Hoa Phat Hung Yen	Vietnam	2019	Billet-to-billet
Tue Minh	Vietnam	2019	Billet-to-billet
Nghi son II	Vietnam	2019	Billet-to-billet
VIJA	Vietnam	2018	Endless, billet-to-billet
Hoa Phat Dong Quat II	Vietnam	2018	Billet-to-billet
Hoa Phat Dong Quat I	Vietnam	2018	Billet-to-billet
Feng Hsin	Taiwan	2018	Billet-to-billet
Dana Y	Vietnam	2017	Endless
Egyptian Steel NPSS	Egypt	2017	Endless
CMC Steel Oklahoma	USA	2017	Endless
Unnamed customer	MENA	2017	Endless
Egyptian Steel IIC	Egypt	2016	Endless
Lo Toun	Taiwan	2014	Billet-to-billet
Sidenor Thessaloniki	Greece	2013	Billet-to-billet
CMC Steel Arizona	USA	2009	Endless
Sidenor Sovel	Greece	2007	Endless, billet-to-billet

Note: all endless plants can perform in semi-endless mode whenever requested.

References and records worldwide



2009
CMC Steel
Arizona

CMC Steel Arizona MIDA QLP® endless casting and rolling plant. CMC is the first American steel producer operating an endless casting rolling minimill. The total length of the plant is just 286 m.

Supplied in 2009, it produces more than 350,000 metric tons/year of rebar in bundles and spools. CMC also is first in the USA producing added-value, twist-free spooled rebar in perfectly shaped coils.

References and records worldwide

2009 CMC Steel Arizona

First complete MIDA endless casting and rolling minimill.
The Arizona mill is where the first 10-km billet was cast and rolled.
After that CMC ordered a second MIDA minimill that was constructed and commissioned in Oklahoma.



References and records worldwide

Endless casting and rolling evolution

More than 20 years of continuous, proven technology achievements

High-speed, high-capacity continuous casting is the basis of the endless casting and rolling evolution. Today, thanks to the patented Octocaster® technology, by casting larger, octagon billet sections it is possible to achieve productivities up to 1.5 Mtpy with one strand only.

The year 2000 recorded the startup of the first endless casting and rolling industrial pilot installation at ABS, Italy, which showed great potential in terms of product quality and OpEx savings, for products allowing high casting-speed.

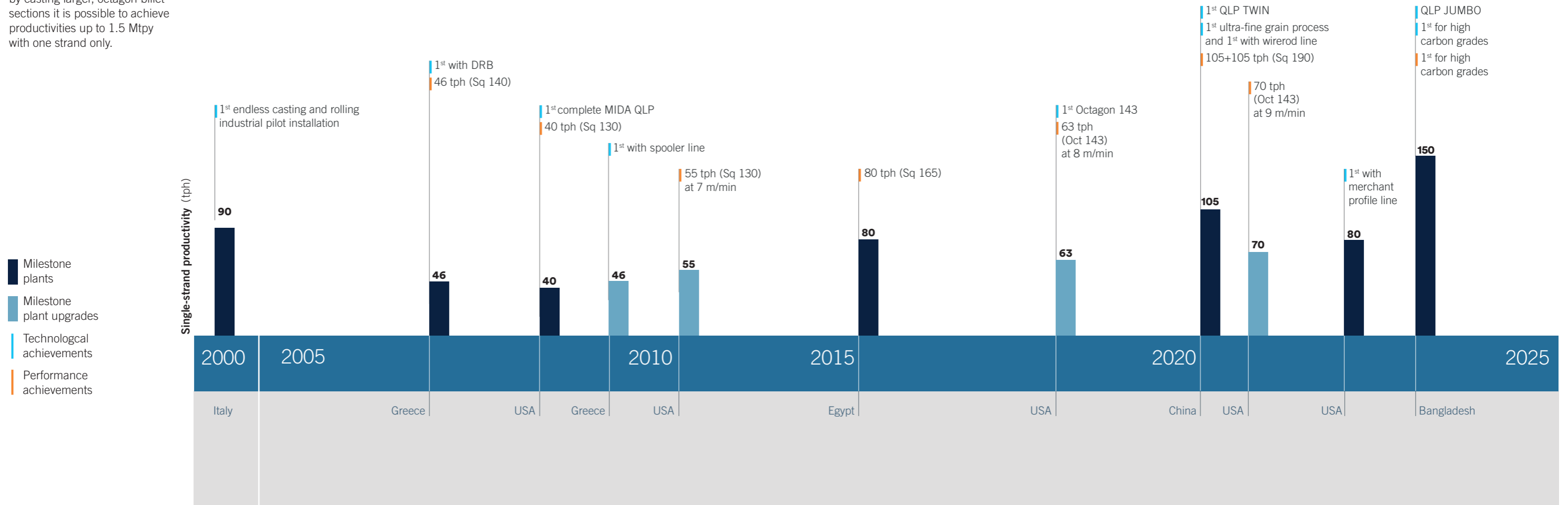
In 2007, Sovel Sidenor was the first steelmaker to operate FastCast Cube and Power Mould® technologies for high-productivity billet casting, as well as the compact Direct Rolling Bundling® system for bar finishing. This was followed by the installation of the first spooler line for endless spooled bar-in-coil production.

Since 2009, CMC has been the pioneer, developer and advanced-user of endless casting and rolling technology with three Danieli MIDA QLP® minimills, breaking production records, and again first in choosing hybrid technology.

Egyptian Steel hit 80 tph productivity with its two MIDA QLP® minimills in 2016. By using the octagon-shaped mould, the casting speed of 8 m/min was reached in 2019 in the USA, followed by 9 m/min the year after, with high process stability.

In China, in 2021 Guilin Pinggang started the world-first TWIN QLP®, which is also the first QLP® producing wirerod at 105 tph per strand.

To come, in 2023 Bushandara will produce at 150 tph on a single casting-strand by operating the first MIDA JUMBO QLP®, including high-carbon products. Furthermore, the first MIDA QLP® producing light sections in endless casting and rolling mode will be put in operation.



References and records worldwide

Reference plants

in industrial production since 1997

In operation

REGIONAL QLP®

Sidenor Sovel,
Greece

First industrial minimill equipped with endless casting and rolling technology

The first bundle of rebar produced at Sovel's QLP® in 2007 marked the official start of the new generation of Danieli MIDA minimills.

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REGIONAL QLP®

Nucor Sedalia
and Frostproof, USA

Top quality rebar grades in bundles and spooled coils

Third and fourth QLPs in operation in North America. They produce rebar grades in bundles and spooled coils with single-strand endless casting and rolling technology.

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REGIONAL QLP®

Hoa Phat Dung Quat,
Vietnam

The most advanced direct-charge casting and rolling plant in SEA

1-Mtpy smooth and ribbed wire rod billet-to-billet casting and rolling plant, part of a multi-line integrated steel complex for the production of 6 Mtpy of long and flat products.

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REGIONAL QLP®

Egyptian Steel #1 and #2,
Egypt

First ECR minimills producing 500,000 tpy of rebar in bundles

The first two QLP® minimills in the MENA region. Egyptian Steel relied on Danieli and QLP® technology to enter the steelmaking business.

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TWIN QLP®

Guilin Pinggang,
China

World-first MIDA Twin and first QLP® plant in China

The most efficient and environmentally friendly QLP® casting and rolling plant for the production of 1.3 Mtpy of wire rod and rebar in China.

68

Under construction

JUMBO QLP®

Bashundhara,
Bangladesh

Danieli's first "Green Steel" Jumbo QLP® minimill

150-tph minimill to produce rebar and wire rod with a single-strand endless casting and rolling process. Featuring Q-One technology, this will be the most environmental friendly minimill in SEA.

76

REGIONAL QLP®

USA

The first plant in the world to produce merchant bars in endless mode

500,000-tpy hybrid minimill for rebar and MBQ grades having the flexibility to produce about 200 different products in endless mode. Featuring Q-One technology for solar energy use.

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REGIONAL QLP®
Sidenor Sovel,
Greece

First industrial minimill equipped with endless casting and rolling technology

In 2007, Sovel Sidenor was the first steelmaker to operate FCC® FastCast Cube and Power mould for high productivity billet casting. In 2010, Sovel Sidenor became the first European steelmaker to operate endless casting and rolling technology (QLP). The minimill has a production capacity of 1.16 Mtpy, of which 370,000 tpy are rebars and spooled coils produced with endless casting technology, and 790,000 tpy of rebars are produced in direct rolling mode. The six-strand caster is equipped with one strand dedicated to endless casting and rolling, ➤

Plant location
Almyros, Greece

Plant startup
2007

Productivity
1,160,000 ton

Process mode
Endless, semi-endless, billet-to-billet

Billet size

Octagon	154 mm
Square	130x130 and 140x140 mm

Finished products / Endless line

Deformed bars	From 8 to 20 mm dia, 6 to 18 m length, up to 5 t weight
Spooled coils	From 8 to 20 mm dia, up to 3 t

Finished products / Direct rolling mill

Deformed bars	From 8 to 20 mm dia, 4 to 14 m length, up to 3 t weight
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Steel grades

Grades	Low and medium carbon
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Meltshop

Productivity	175 tph
EAF charging method	Endless charge
EAF dimensions	Shell diameter 7,000 mm
EAF Size	Tapped steel 130 t - Hot heel 20 t
EAF Transformer	67 MVA + 10%
LF Transformer	12 MVA + 20%

Caster

Ladle size	130 t
Caster type	Curved geometry, 9-m radius 1 endless strand 5 direct-charge strands
Casting speed	Endless strand: 6.0 m/min Other strands: 3.9 m/min
Productivity	Endless strand: 55 tph Other strands: 36 tph each
Oscillator type	Endless strand: FCC® Other strands: electromechanical oscillator
Mould type	Power Mould®
Cutting device	Oxy cutting on all strands, vertical hydraulic shear on endless strand
Billet evacuation	14-m cooling bed

Rolling mill (endless line)

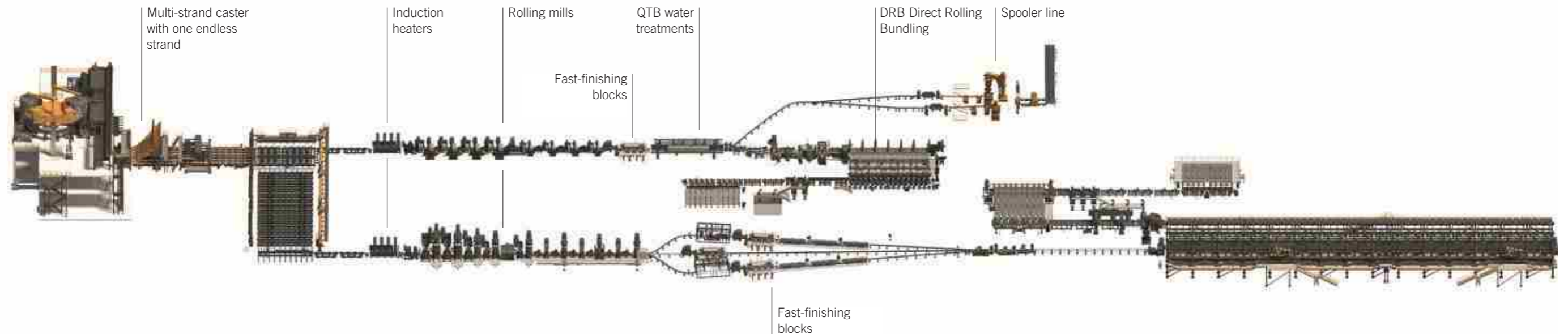
Productivity	55 tph
Induction heater	4x1 MW
Rolling mill	6+8 ESS cantilever stands 8-pass fast-finishing block
In-line treatment	QTB (bar line), QTS + DSC (spooler line)
Bar finishing area	DRB 21.6 m, max speed 35 m/s
Spooler finishing area	Two 4-ton horizontal spooler machines, max speed 32 m/s

Rolling mill (billet-to-billet rolling)

Productivity	120 tph
Induction heater	20x1 MW Q-Heat technology
Rolling mill	4+6+6 housingless stands 2x8-pass Delta wirerod block
In-line treatment	QTB
Bar finishing area	Double Twin-channel HTC 84x9.5 m, max speed 40 m/s

Electric and automation

Whole plant	L1 and L2 by Danieli Automation
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REGIONAL QLP®

Sidenor Sovel,
Greece

- ▶ whilst the others are used to produce billets for the direct-charge rolling mill. The endless line features FastCast technology and it is directly linked to a 22-stand rolling mill with a maximum finishing speed of 35 m/s for the rebar line and 32 m/s for the spooler line. The other five strands produce billets which are fast-delivered to another rolling mill, where they are thermally optimized by an induction heater before entering the 24-pass mill and then discharged via HTC technology at a speed exceeding 40 m/s. Again, Sovel Sidenor was first in Europe operating without billet gas reheating.



175 tph EAF+LF meltshop



Six-strand FastCast caster
equipped with FCC® and Power Mould®



Induction line made of 20 Q-Heat units



Roughing and intermediate mills with ESS energy-saving cantilever stands



DRB Direct Rolling and Bundling system

First 3-t coils spooled line operating in endless mode



1.16 Mtpy MIDA QLP® minimill for rebar in bundles and spooled coils

REGIONAL QLP®
 Egyptian Steel
 #1 and #2,
 Egypt

First endless casting and rolling
 minimills producing
 500,000 tpy of rebar in bundles

Egyptian Steel awarded Danieli the order for two MIDA QLP® minimills. The first of the two twin minimills, located in Beni Suef, Egypt, was commissioned in 2016, and followed by the second, in Al Ain Al Sokhna, still in Egypt, which started production in late 2017. Each plant has a total capacity of 830,000 tpy of long products. 530,000 tpy of rebar in bundles are produced in endless casting and rolling mode through a single line, and 300,000 tpy are cast through two additional ➤

Plant location

Beni Suef
 and Al Ain Al Sokhna,
 Egypt

Plant startup

2016 #1, 2017 #2

Productivity

830,000 tpy each

Process mode

Endless rolling and billet production

Billet size

Octagon	165 mm
Square	130x130 and 165x165 mm

Finished Products

Deformed bars	From 10 to 25 mm dia, 6 to 18 m length, up to 5.5 t weight
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Steel grades

Grades	Medium carbon
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Meltshop

Productivity	115 tph
EAF charging method	Endless charge
EAF dimensions	Shell diameter 6,100 mm
EAF size	Tapped steel 80 t - Hot heel 40 t
EAF transformer	67 MVA + 10%
LF transformer	12 MVA + 20%

Caster

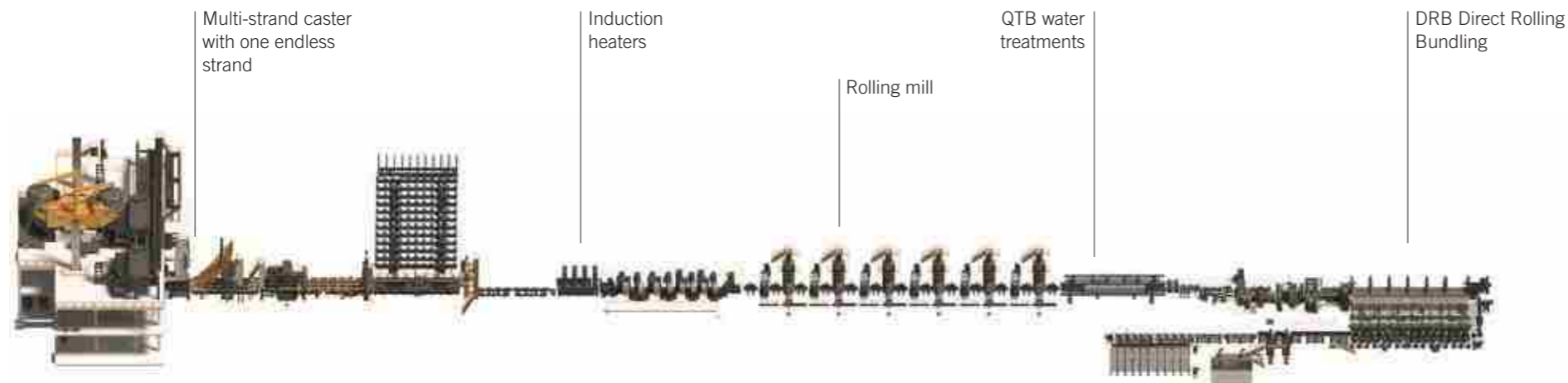
Caster type	Curved geometry, 10-m radius 1 endless strand 2 billet strands
Casting speed	Endless strand: 6.0 m/min Other strands: 4.5 m/min
Productivity	Endless strand: 76 tph Other strands: 41 tph each
Oscillator type	Endless strand: FCC® Other strands: conventional hydraulic oscillator
Mould type	Power Mould®
Cutting device	Oxy cutting on all strands, vertical hydraulic shear on endless strand
Evacuation	14-m cooling bed with transfer car

Rolling mill (endless line)

Productivity	76 tph
Induction heater	6x1 MW Q-Heat technology
Roughing mill	8 ESS cantilever stands
Intermediate mill	6 housing-less stands
Finishing mill	6 housing-less stands
In-line treatment	QTB
Bar finishing area	DRB® 27.6 m, max speed 17 m/s

Electric and automation

Meltshop	L1 and L2 by Danieli Automation
Caster	L1 and L2 by Danieli Automation
Rolling mill	L1 and L2 by Danieli Automation



REGIONAL QLP®

Egyptian Steel
#1 and #2,
Egypt

- casting strands in 130-mm-square billets. The billet of the endless line is cast at a speed in excess of 6 m/min and continuously rolled by a 20-stand rolling mill in 10 to 25-mm-dia rebars. There, the rebar is quenched, finished and directly cut-to-length in 6 to 18-m-long perfect bundles. As confirmation of the reliability and stability of the casting and rolling process, those minimills hold the world record for MIDA QLP® plants of 53 heats in a single casting sequence, without changing slidegate and snorkel.



80-t EAF+LF meltshop managed by Q-Melt



Three-strand billet caster featuring one FCC® for endless casting and rolling



Endless casting and rolling line with Q-Heat inductors



Six housingless-stand finishing mill



Cut-to-length area preceding DRB building unit



Finishing services and rolling mill overview



830,000 tpy MIDA QLP® minimill for rebar

REGIONAL QLP®
Nucor Sedalia
and Frostproof, USA

Top quality rebar grades in bundles and spooled coils

Two two MIDA QLP minimills were ordered by Nucor Steel and commissioned during 2020. Located in Sedalia (Missouri) and in Frostproof (Florida), each having a production capacity of 350,000 tpy, they produce rebar and spooled coils starting from 143-mm-octagonal billets. Both minimills feature an electric arc furnace including ECS continuous scrap charge technology, a ladle furnace and a single-strand caster directly connected to a 16-stand rolling mill operating in endless mode. Two different finishing lines produce straight rebar through DRB

Plant location
Sedalia (MO)
and Frostproof (FL), USA

Plant startup
2020

Productivity
350,000 tpy, each

Process mode
Endless, semi-endless

Billet size

Octagon	143 mm
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Finished Products

Deformed bars	From 12.7 to 40 mm dia, 6 to 18 m length, up to 5.5 t weight
Spooled coils	From 10 to 20 mm dia, up to 5 t weight

Steel grades

Grades	Medium carbon
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Meltshop

Productivity	55 tph
EAF charging method	ECS® endless charge
EAF dimensions	Shell diameter 6,100 mm
EAF size	Tapped steel 39 t - Hot heel 20 t
EAF transformer	33 MVA + 8%
LF transformer	8 MVA + 20%

Caster

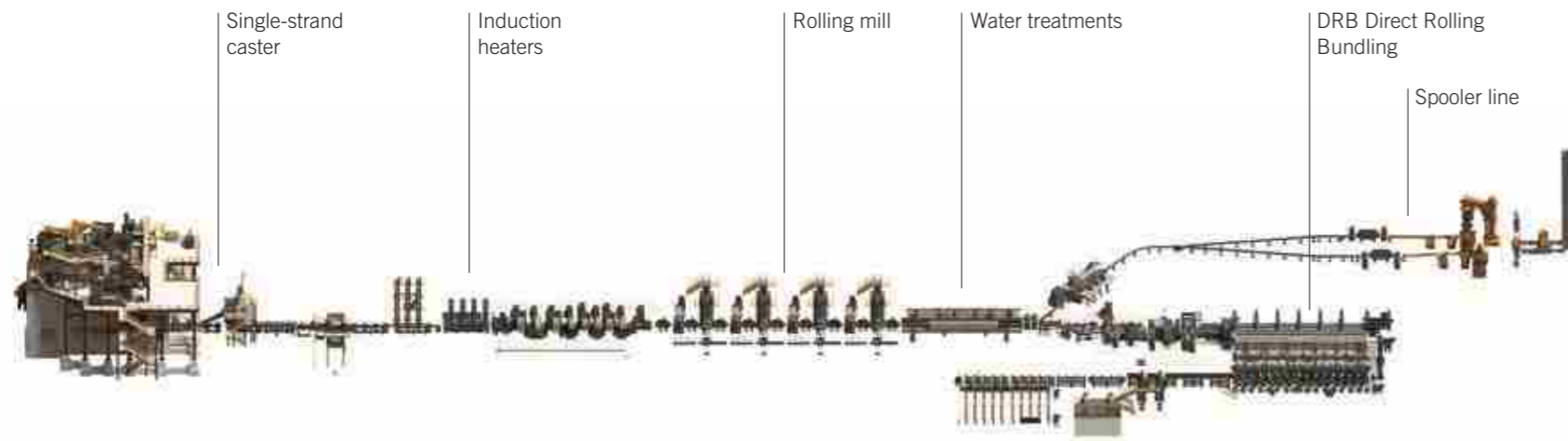
Caster type	Curved geometry, 9-m radius 1 endless strand
Casting speed	7 m/min
Productivity	55 tph
Oscillator type	FCC®
Mould type	Eco Power Mould®
Cutting device	Vertical hydraulic shear
Evacuation	12-m emergency cooling bed

Rolling Mill configuration

Productivity	55 tph
Induction heater	4x1 MW Q-Heat technology
Roughing mill	8 ESS cantilever stands
Intermediate and finishing mill	8 housing-less stands
Finishing mill	4-pass Delta-type fast finishing block (spooler line)
In-line treatment	QTB (bar line), QTS + DSC (spooler line)
Bar finishing area	DRB® 26.1 m, max. speed 17 m/s
Spooler finishing area	Two 5-ton horizontal spooler machines, max. speed 30 m/s

Electric and automation

Meltshop	L1 and L2 by Danieli Automation
Caster	L1 and L2 by Danieli Automation
Rolling mill	L1 and L2 by Danieli Automation



REGIONAL QLP®
Nucor Sedalia
and Frostproof, USA

- Direct Rolling and Bundling, and spooled bar in coils. The plants produce rebars from 12.7 to 38.1-mm-dia in lengths from 6 to 18 meters, while spooled bar coils are produced in the range of 9.5 to 19-mm-dia for ribbed bars, and from 8 to 16 mm for smooth rounds in coils weighing up to 5 tons. The startup and commissioning of both minimills was quite fast. The minimills started producing in endless casting and rolling mode from the first heats, in each case recording “more than 1-km-long billet” produced on the fifth day. These are the third and fourth Danieli MIDA QLPs in the USA.



EAF meltshop continuously fed by preheated scrap through ECS®



Single-strand FCC® caster operating at 7 mpm



Q-Heat induction heating system (4x1 MW)



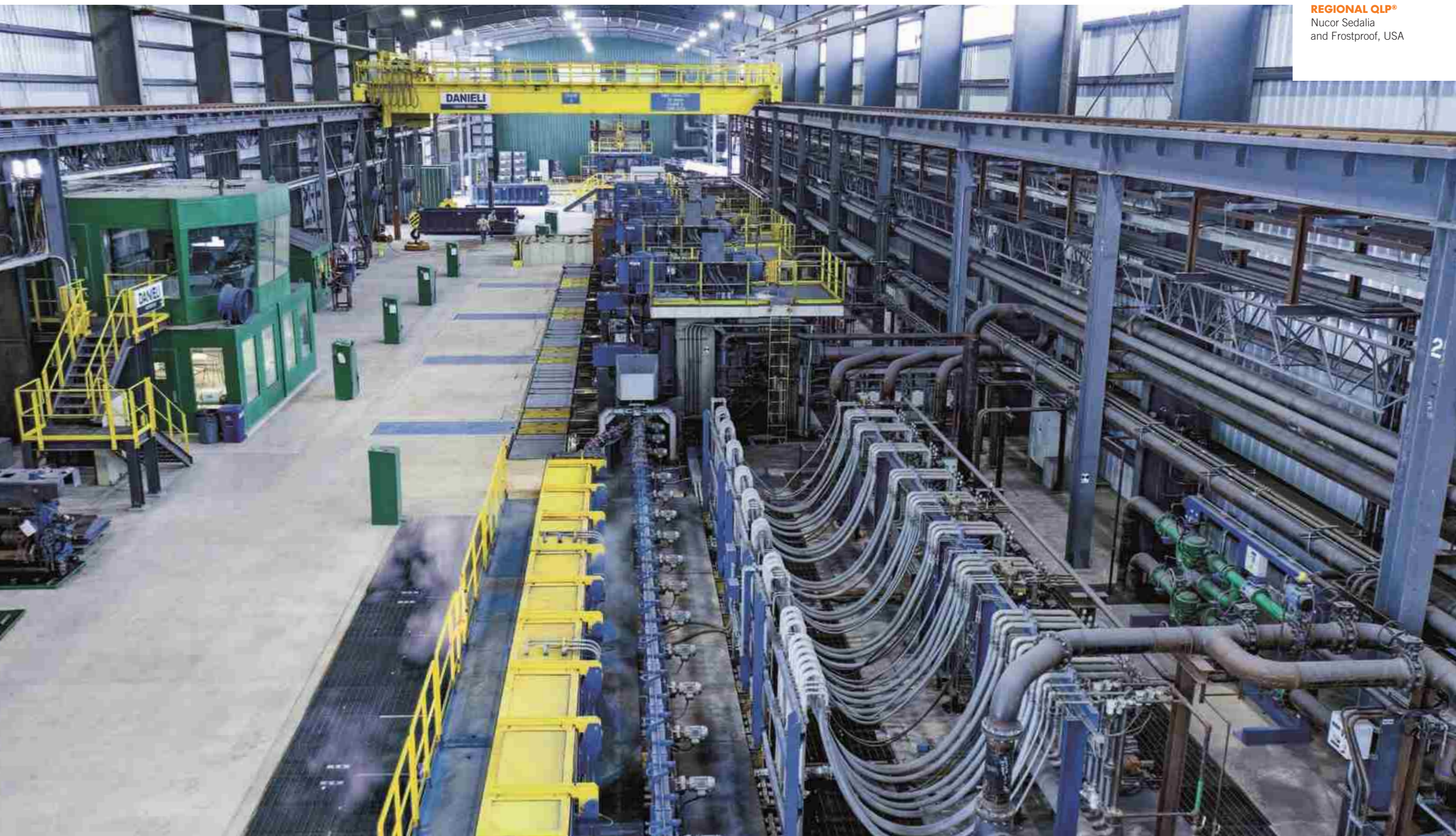
Housing-less stands on finishing mill



Cooling bed and bundling area



Twin bar-in-coil spooler line for coils up to 5 t



Endless casting and rolling line featuring in-line QTB heat treatments

TWIN QLP®
Guilin Pinggang,
China

World-first MIDA Twin and first QLP® plant in China

Guilin Pinggang Iron and Steel awarded Danieli the order for a MIDA TWIN QLP endless casting and rolling plant for the production of 1.3 Mtpy of rebar and wirerod in an energy-efficient and sustainable way. Installed nearby Guilin City, in the Guanxi province, China, the plant started up smoothly in late 2020 and it is ramping-up at a fast pace. Danieli plants featuring endless casting and rolling technology use short induction heaters for billet temperature equalization (no reheating), ensuring the highest plant yield and constant quality along the entire finish-rolled stock. ➤

Plant location	Productivity
Guilin City, China	1,300,000 tpy
Plant startup	Process mode
2020	Endless, semi-endless

Billet size	
Octagon	209 mm
Square	190x190 mm

Finished Products	
Deformed bars	From 10 to 28 mm dia from 6 to 24 m length, up to 5.5 t weight
Ribbed wirerod	From 6 to 10 mm dia, up to 3 t weight

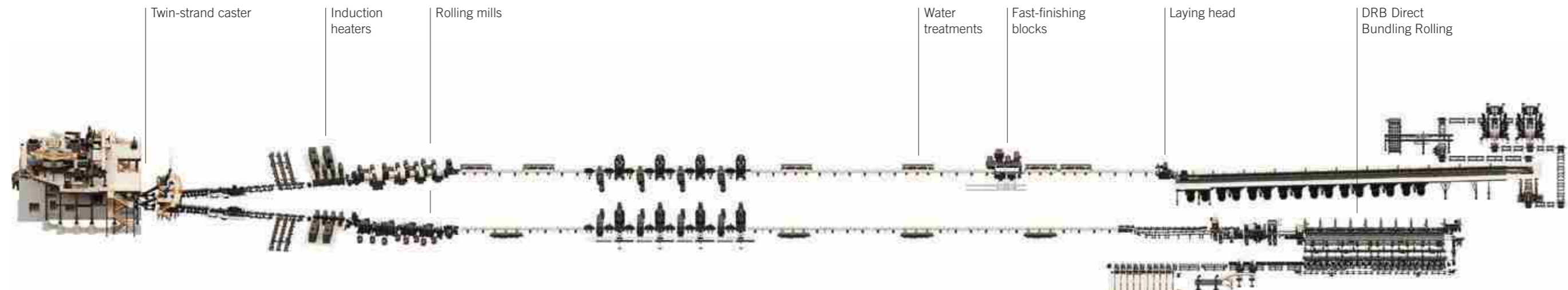
Steel grades	
Grades	Medium carbon

Caster	
Caster type	Curved geometry, 12-m radius 2 endless strands
Casting speed	6.25 m/min
Productivity	210 tph
Oscillator type	FCC®
Mould type	Eco Power Mould®
Cutting device	Vertical hydraulic shear
Evacuation	7.5-m emergency cooling bed

Bar mill (endless line)	
Productivity	105 tph
Induction heater	3x1 MW Q-Heat technology
Roughing mill	6 housingless stands
Intermediate	8 housingless stands
Finishing mill	6 housingless stands
In-line treatment	UFG
Bar finishing area	DRB® 27.6 m, max. speed 17 m/s

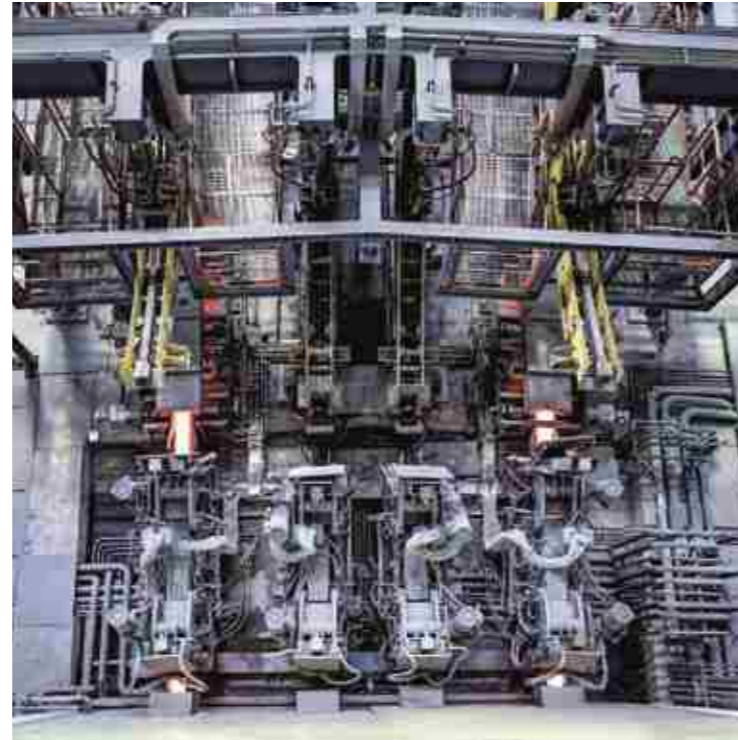
Wirerod mill (endless line)	
Productivity	105 tph
Induction heater	3x1 MW Q-Heat technology
Roughing mill	6 housingless stands
Intermediate	6 housingless stands
Pre-finishing mill	8 housingless stands
Finishing mill	2x4 pass Twin Module Block
In-line treatment	UFG
Wirerod finishing area	Loop laying head, max. speed 105 m/s, pit shear

Electric and automation	
Caster	L1 and L2 by Danieli Automation
Rolling mill	L1 and L2 by Danieli Automation



TWIN QLP®
Guilin Pinggang,
China

- The two-strand FastCast caster continuously feeds the two mills with billets at high speed. The two mills consist of 20 housingless stands each, and produce 10 to 28-mm-dia rebar and 6 to 12-mm-dia wirerod respectively. The UFG Ultra-Fine Grain process guarantees reliable high-quality products for construction purposes, whilst allowing considerable alloy savings. Patented DRB Direct Rolling and Bundling permits the cutting of rebar to final length directly off the last stand. This is the minimill with the highest single-strand productivity in the world.



Twin-strand billet caster featuring FCC® power mould



Twin rolling mill flexibly producing deformed bars and wirerod



Fast-finishing block running at 105 m/sec



Bearing-free loop laying head for ribbed wirerod



DRB - Direct Rolling and Bundling station

REGIONAL QLP®
Hoa Phat Dung Quat,
Vietnam

Plant location	Dung Quat, Vietnam
Plant startup	2021
Productivity	1,000,000 tpy
Process mode	Billet-to-billet

Billet size	
Square	150x150 mm

Finished Products	
Smooth wirerod	From 5.5 to 16 mm dia, 2 t weight
Ribbed wirerod	From 8 to 16 mm dia, 2 t weight

Steel grades	
Grades	Medium carbon

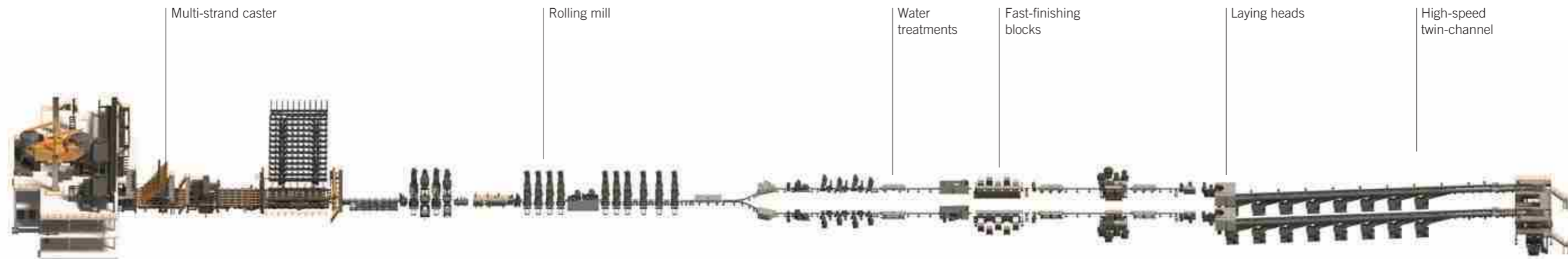
Caster	
Ladle size	120 t
Caster type	Curved geometry, 9-m radius 6 direct-charge strands
Casting speed	4.1 m/min
Productivity	260 tph
Oscillator type	FCC®
Mould type	Power Mould®
Cutting device	Oxy-cutting device
Evacuation	12-m cooling bed

Rolling mill (billet-to-billet rolling)	
Productivity	170 tph
Roughing mill	4 housingless stands
Intermediate	4 housingless stands
First pre-finishing mill	4 housingless stands
Second pre-finishing mill	4 ESS cantilever stands
Finishing mill	10-pass Delta-type fast finishing block
In-line treatment	QTR + DSC
Finishing area	Loop laying head, max speed 105 m/s

Electric and automation	
Caster	L1 and L2 by Danieli Automation
Rolling mill	L1 and L2 by Danieli Automation

The most advanced direct-charge casting and rolling plant in SEA

1 Mtpy wirerod billet-to-billet casting and rolling line, part of a multiple order for three billet continuous casters and three high-capacity rolling mills to operate in direct-charge rolling mode, ordered by Hoa Phat in 2017. The new lines were for the Dung Quat 6-Mtpy integrated steel complex in Vietnam's central Quang Ngai province (a greenfield Danieli project). Each of the three, six-strand casters is equipped with FastCast technology and the most modern design for hot-charging, allowing fast-delivery of hot-billets –in less than 30 seconds– to the relevant rolling



REGIONAL QLP®

Hoa Phat Dung Quat,
Vietnam

- mill through an induction heater for temperature equalization. Fast billet-handling does not require a gas-reheating furnace, allowing OpEx savings and reducing GHG emissions. Rolling mill #1 produces 0.6 Mtpy of deformed bars from 10 to 25-mm-dia at 28 m/s, with small sizes on a two-strand rolling mill through the HTC High-speed Twin-Channel system, and wirerod from 5.5 to 16 mm at 105 m/s. Rolling mill #2 produces 1.4 Mtpy of deformed bars from 10 to 40-mm-dia at 44 m/s, again with small sizes on a two-strand rolling mill through the HTC system, reaching a production capacity of 235 tph. Rolling mill #3 produces 1.0 Mtpy from 5.5 to 25 mm-dia wirerod at 44 m/s, in low-, medium- and high-carbon grades, with a production capacity of 170 tph.



Six-strand billet caster featuring FCC® oscillators



4+4+4 housingless stand mill followed by 2x 4 ESS cantilever stands and a 10-pass finishing block



Twin-strand wirerod line with Fast-Finishing Blocks



170-tph wirerod line for smooth and ribbed wirerod



Perfect coil formation followed by Sund-Birsta coil compactor

JUMBO QLP®
Bashundhara,
Bangladesh

Danieli's first "Green Steel"
Jumbo QLP® minimill

Bashundhara minimill is designed with the latest, highly efficient and environmentally friendly technologies. Danieli Digimelter –ready for connection to renewable energies– will melt scrap continuously charged and preheated by Danieli ECS system. 1 Mtpy of straight rebar, ribbed and smooth wirerod will be produced in endless casting and rolling mode through a single-strand, 150-tph Octocaster featuring FCC® and octagonal section.

Plant location	Chittagong, Bangladesh	Productivity	1,000,000 tpy
Plant startup	2023	Process mode	Endless, semi-endless

Billet size	
Octagon	198 mm (smooth wirerod)
Octagon	242 mm (rebar and ribbed wirerod)

Finished Products	
Deformed bars	From 8 to 50 mm dia, 12 m length, 5 t weight
Smooth wirerod	From 5.5 to 13 mm dia, 2.5 t weight
Ribbed wirerod	From 8 to 20 mm dia, 2.5 t weight

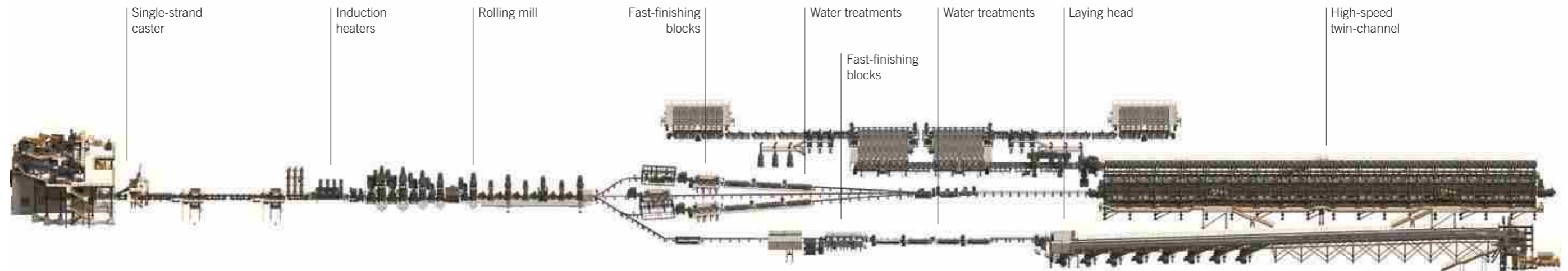
Steel grades	
Grades	Low, medium, high carbon

Meltshop	
Productivity	150 tph
EAF charging method	ECS® endless charge
EAF dimensions	Shell diameter 6,500 mm
EAF size	Tapped steel 100 t - Hot heel 60 t
EAF transformer	Q-One power system: 100 MVA + 10%
LF transformer	15 MVA + 20%

Caster	
Ladle size	100 t
Caster type	Curved geometry, 14-m radius 1 endless strand
Billet size	Octagon 198 and 242 mm
Casting speed	7.0 m/min
Productivity	150 tph (rebar grades)
Oscillator type	FCC®
Mould type	Eco Power Mould®
Cutting device	Vertical hydraulic shear
Evacuation	6-m emergency cooling bed

Mill configuration	
Productivity	150 tph
Bar line	150 tph
Wirerod line	105 tph
Induction heater	5x1 MW Q-Heat technology
Nr. of stands	26 (bar line), 30 (wirerod line)
Rolling mill	8+6+6 housingless stands
Finishing mill (bar) / pre-finishing mill (wirerod)	6-pass Delta-type fast finishing block
Finishing mill (wirerod)	4-pass Delta-type fast finishing block
In-line treatment	QTB (bar line) QTR + DSC (wirerod line)
Bar finishing area	High-speed Twin-channel HTC 102x14 m, max. speed 42 m/s
Wirerod finishing area	Loop laying head, max. speed 105 m/s, pit shear

Electric and automation	
Meltshop	L1 and L2 by Danieli Automation
Caster	L1 and L2 by Danieli Automation
Rolling mill	L1 and L2 by Danieli Automation



The first plant in the world to produce merchant bars in endless mode

It is designed to produce 500,000 tpy of rebar and small merchant sections. Hybrid-ready, it will melt local scrap by the innovative Danieli Digimelter (Q-One, Zero-bucket, Q-Melt) and produce in endless casting and rolling mode. It will feature a patented layout specifically developed to fully match the needs of merchant products in terms of high plant uptime and excellent yield.

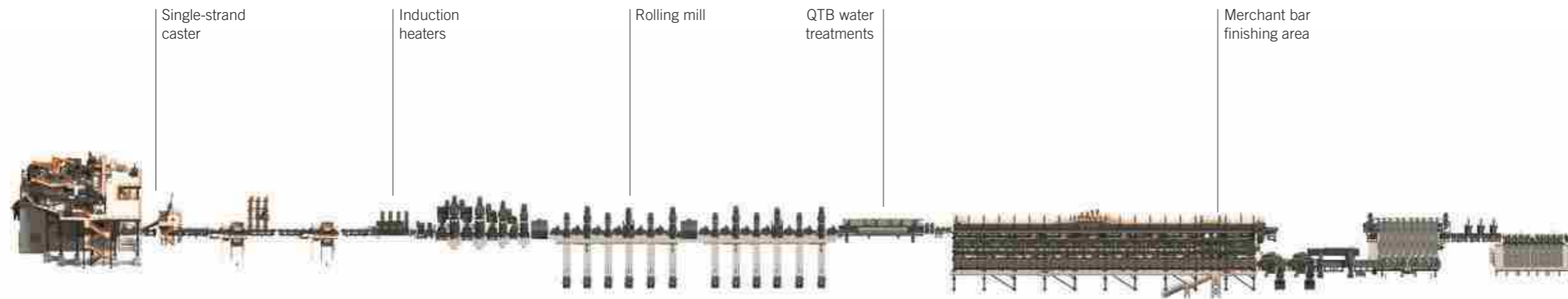
Plant location	USA	Productivity	500,000 tpy
Plant startup	2023	Process mode	Endless, semi-endless
Billet size			
Octagon	198 mm		
Finished products			
Deformed bars	Up to 75 mm dia		
Equal / unequal angles	Up to 120x14 mm		
Channels	Up to 160x60 mm		
Flats	Up to 160 mm		
Squares and rounds	Up to 75 mm		
Steel grades			
Grades	Low and medium carbon		

Meltshop	
Productivity	80 tph
EAF charging method	ECS® endless charge
EAF dimensions	Shell diameter 5,300 mm
EAF size	Tapped steel 55 t
EAF transformer	Q-One power system: 48 MVA + 10%
LF transformer	Q-One power system: 9 MVA + 20%

Caster	
Ladle size	55 t
Caster type	Curved geometry, 10 m radius 1 endless strand
Billet size	Octagon 198 mm
Casting speed	Up to 6 m/min
Productivity	80 tph
Oscillator type	FCC®
Mould type	Eco Power Mould®
Cutting device	Vertical hydraulic shear
Evacuation	6-m emergency cooling bed

Rolling mill (endless line)	
Productivity	80 tph
Induction heaters	Q-Heat technology
Roughing mill	8 housingless stands
Intermediate	6 housingless stands
Finishing mill	6 housingless stands
In-line treatment	QTB
Merchant bar finishing area	Cooling bed 60 m

Electric and automation	
Meltshop	L1 and L2 by Danieli Automation
Caster	L1 and L2 by Danieli Automation
Rolling mill	L1 and L2 by Danieli Automation



DANIELI HEADQUARTERS



Via Nazionale, 41
33042 Buttrio (UD) Italy
Tel (39) 0432.1958111
info@danieli.com

www.danieli.com
info@danieli.com

DANIELI WORLDWIDE

ARGENTINA

Yerba Buena T4107GRS,
Tucumán
Tel. (54) 9351 5514390
service.argentina@danieli.com

AUSTRIA

Max Planck Strasse, 5
A - 9100 Völkermarkt
Tel. (43) 4232.51440.6101
info@austria.danieli.com

BRAZIL

Rua George Rexroth, 609 Diadema
CEP 09951-270 Sao Paulo
Tel. (55) 11.39953150
info@brazil.danieli.com

CHINA

No. 19, Xing Gang Road, CEDZ
Changshu, Jiangsu 215513
Tel. (86) 512 52267000
infodcs@china.danieli.com

CROATIA

Vinez 601,
Labin 52220
Tel. (385) 52 884 130
sinfo.hr@systec.danieli.com

EGYPT

Millennium Building, No.69, Sect 1
5th Settlement 11835 New Cairo
Tel. (202) 2.8133698
info@egypt.danieli.com

FRANCE

Les Mercuriales
F-93176 Bagnolet Cedex
Tel. (33) 1.49722269
info@danieli-rotelec.fr

GERMANY

Schifferstrasse 166
D-47059 Duisburg
Tel. (49) 203.98567000
info@germany.danieli.com

INDIA

Danieli India Ltd
7205, Central Expy, Sricity,
Andhra Pradesh 517646
Tel. (91) 857.6304000
info@india.danieli.com

INDONESIA

Office 8 Building, 17th Floor SCBD
Lot 28 Jl. Jenderal Sudirman Kav.
52-53
12190 Jakarta
Tel. (62) 21.29333750
service.indonesia@danieli.com

JAPAN

42F, Yokohama Landmark Tower
2-2-1, Minatomirai, Nishi-ku,
Yokohama-City
220-8142 Japan
Tel. (81) 45.651.7077
info@japan.danieli.com

KOREA

602 6th Fl., Yeondang Bldg., 439
Teheran-Ro, Gangnam-Gu,
06158 Seoul
Tel. (82) 2.5626622
info@korea.danieli.com

KSA

Silver Tower 6th floor
P.O. Box 4867
Al-Khobar 31952
Tel. (966) 3.8993145
info@ksa.danieli.com

MEXICO

Edificio Sierra Madre
Ave. Vasconcelos Oriente 310
Colonia del Valle
66250 Garza Garcia, N.L.
Tel. (52) 81.83781055
info@mexico.danieli.com

RUSSIA

Leningradskiy Prospekt 31A
Building 1, 24th Floor
125284 Moscow
Tel. (7) 495.9819073
info@russia.danieli.com

SPAIN

Poligono Sondikalde
Calle Portu Bidea, 2
48150 Sondika - Vizcaya
Tel. (34) 94.4872800
info@spain.danieli.com

SWEDEN

Nya Ågatan, 23
SE-77782 Smedjebacken
Tel. (46) 240.668500
mh@morgardshammar.se

TAIWAN

26F-1, No. 31
Hai-Bian Road
Kaohsiung City, Taiwan 802
Tel. (886) 7.3358655
info@taiwan.danieli.com

THAILAND

Land Plot N. K11
The Eastern Seaboard Ind. Estate
Tambol Pluakdaeng, Amphur
Pluakdaeng, 21140 Rayong
Tel. (66) 38.929000
info@thailand.danieli.com

THE NETHERLANDS

Rooswijkweg 291, 1951
ME Velsen-Noord
Tel. (31) (0) 251.500500
info@danieli-corus.com

TURKEY

1. OSB Istiklal Mahallesi
1. Cadde No. 15
Beykoy - Duzce
Tel. (90) 3805537110
info@turkey.danieli.com

UAE

Late Ahmed Masood building
Office 1102, 11th floor Nadja
Street, Abu Dhabi
Tel. (971) 0 6749 619
service.uae@danieli.com

UKRAINE

Glinky Street 2, Office 301
49000 Dnipropetrovs'k
Tel. (380) 56.7904301
info@ukraine.danieli.com

UNITED KINGDOM

4 Ignite, Magna Way
Rotherham S60 1FD
Tel. (44) 1709.724300
info@uk.danieli.com

USA

600 Cranberry Woods Drive
Suite 200
Cranberry Township, PA 16066
Tel. (1) 724.7785400
info@usa.danieli.com

VIETNAM

Lot A4b Industrial Park
Tan Thuan EPZ (E-Office Park)
Tan Thuan Dong Ward, District 7
Ho Chi Minh City
Tel. (84) 28.37929400
info@vietnam.danieli.com



DANIELI THE RELIABLE
AND INNOVATIVE PARTNER
IN THE METALS INDUSTRY