



**MORGAN STELMOR CONTROLLED
COOLING CONVEYOR SYSTEM**
THE MOST EFFECTIVE COOLING
CONVEYOR ON THE MARKET

HIGHEST OPERATING SPEEDS GREATER PRECISION. GREATER FLEXIBILITY.

PROVEN TECHNOLOGY

Your customers demand a lot from you. There's no compromising when it comes to meeting specified coil material properties with precision. This is where the cooling system plays a key role. The questions you need to ask us are: How can you ensure consistently high quality throughout the coil? How can you provide sustainable results for your customers? Is there a cost-effective way to achieve these goals?

Your needs don't end there. It's just as important to receive support from the start to ensure your system's processing flexibility - and to give you a lasting competitive edge.

Since our 1960's invention of the Stelmor® process by Primetals Technologies' predecessor company Morgan Construction, we have led the way with the most versatile, reliable and effective controlled cooling conveyor available on the market.

The Morgan Stelmor is recognized throughout the industry as the benchmark for processing quality rod products, achieving desired uniformity and metallurgical and mechanical properties. A genuine Morgan Stelmor system ensures exceptional performance even at high speeds and production rates for fast-cooled products.

Once we deliver your new conveyor system, but before commercial operations begin, you can expect more from us.

With our expertise, your system will be up and running reliably and on time. Our depth of process know-how can help define your products' superior characteristics, and moves them faster to market.

Our latest modular design facilitates installation on new conveyors as well as on conveyor modernizations. New features improve conveyor performance and reduce maintenance.

Metallurgists and engineers at Primetals Technologies provide expertise and support at all stages of design, installation, operation and training. We also assist you with the improvement of existing rod products and the development of new ones.

ADVANTAGES OF MORGAN STELMOR® CONTROLLED COOLING CONVEYOR SYSTEM

- Achieves world-class levels and uniformity of metallurgical and mechanical product properties for all steel grades
- Tightly controls the around-the-ring tensile strength variations on fast-cooled products to a standard deviation within one percent of the average tensile strength
- Accommodates production of all conventional grades of steel as well as special product grades with alternative cooling modes
- Optional slow-cool pots, in-line quench tanks and heat treatment facilities are available
- Curved conveyor configurations can accommodate special mill layout requirements
- Optimizes processing of carbon and alloy steel grades when used in conjunction with the Morgan Reducing/Sizing Mill for low-temperature rolling and controlled cooling, producing the best possible combination of properties and dimensional control
- Performs exceptionally at high speeds and high tonnage rates
- Minimizes maintenance downtime and costs with our robust design
- Faster roller and sprocket replacement with modular roller design
- Reduces downtime for maintenance or upgrades with modular roller frame construction



Covers down for slow cooling mode

MORE GRADES - MORE OPTIONS

The Morgan Stelmor® Controlled Cooling Conveyor System facilitates processing in a wide range of conditions, including both fast- and slow-cooling modes within a single system. This capability enables mills to produce a broad spectrum of plain carbon and alloy steels, as well as stainless steels and other specialty grades. Installing the Morgan Stelmor system results in improved as-rolled rod properties, which enables the production of more grades in a directly usable condition, and reduces or eliminates downstream processes, such as spheroidize annealing.

UNIFORM COOLING - EXCEPTIONAL CONSISTENCY

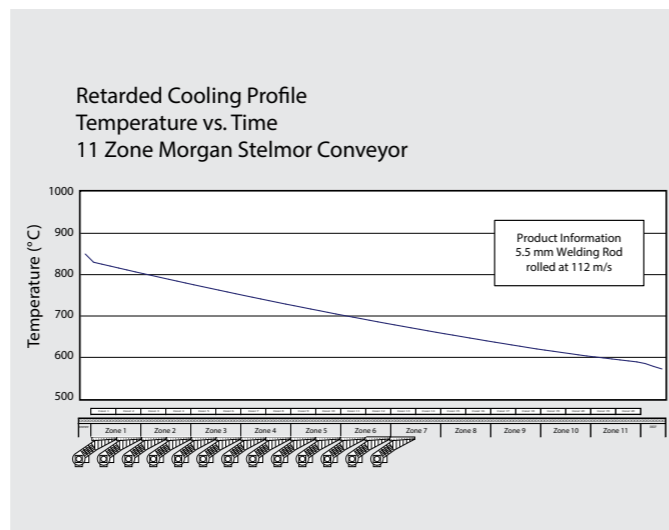
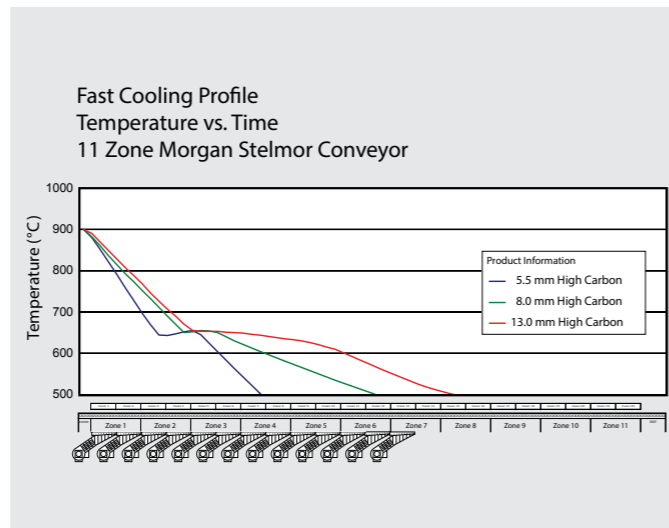
The fast-cooling mode incorporates high capacity fans located below the conveyor. These fans deliver air through pressurized plenum chambers to a series of nozzles that direct it to the hot rings on the conveyor. Inside the plenum, the use of our patented Optimesh system controls the air distribution across the width of the conveyor, ensuring uniform cooling of the rings for exceptional consistency of both mechanical properties and metallurgical structure.

SLOW COOLING - SWIFT BENEFIT

In the slow-cooling mode, some or all of the insulated covers over the conveyor can be closed to enable the mill operator to achieve the specific desired cooling rate. Special alloy rollers on the conveyor deck help dissipate heat from the rings during slow cooling, thus preventing roller distortion.

HYBRID COOLING - MORE VERSATILITY

By combining the fast-cool capabilities of the high-capacity fans, the slow-cool capabilities of the insulated covers and natural cooling, we can create customized processes for special products. We can fine-tune the microstructure and mechanical properties to meet your specific customer needs or to develop a new product for the marketplace.



Covers down for retarded cooling mode

METALLURGICAL ADVANTAGES

Thermomechanical rolling (TMR) refines the final grain size as a result of dynamic recrystallization. Combined with final in-line water cooling and the superior controlled cooling on a Morgan Stelmor® conveyor, TMR plays a significant role in determining final product properties. This is particularly beneficial for low- and medium-alloyed steel products that are subsequently spheroidize annealed during downstream processing. The ability to strongly control grain size also influences subsequent transformation to hard products such as bainite and martensite by shifting the transformation start time and temperature. Thus, thermomechanical rolling can minimize direct downstream cold working and reduce annealing times.

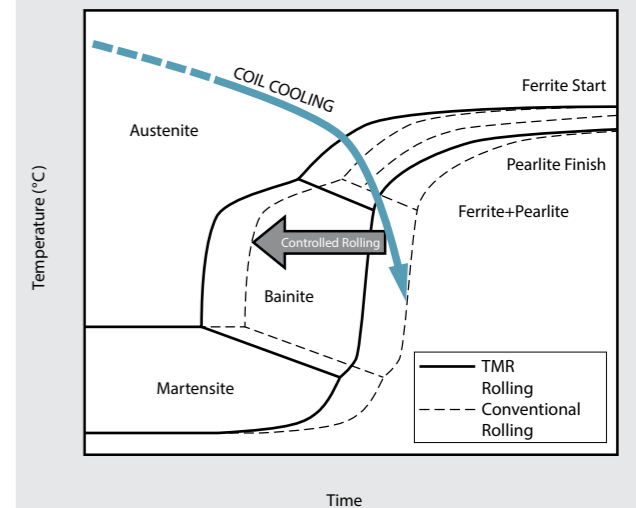
PROCESSING FOR WIRE DRAWING

The combination of Morgan Stelmor processing and low rolling temperatures provides the capability to reduce hardenability in some critical rod grades. Ultimately this promotes ferrite formation and retards the evolution to bainite and martensite. The refined grain size achieved through TMR improves diffusion during heat-treating and can result in reduced heat treatment times and temperatures. For those rods which are not heat-treated, the refined and complex structures increase tensile pickup during cold deformation, producing the following advantages:

- Reduced as-rolled tensile strength
- Improved downstream response
- Increased work hardenability

The improvements stem from grain refinement and microstructural control. The Morgan Stelmor conveyor's excellent control of the cooling process combined with the rod's reduced hardenability make your process very stable and reduces the chance of forming unwanted hard phases.

Effect of Thermomechanical Rolling on Transformation



CUSTOM OPTIONS FOR SPECIAL COOLING REQUIREMENTS

Additional components can be included in the Morgan Stelmor system for processing of special grades or for enhanced properties on conventional grades.

SLOW COOL POTS

A short distance after the laying head, a shifting section of the conveyor enables the coils to be collected into insulated pots, which are fitted with insulated lids and conveyed to a holding area for ultra-slow cooling. Cooling rates in the range of 0.02 to 0.20°C/sec can be achieved with this system, which benefits grades such as tool steels and martensitic stainless steels.

HEAT TREATMENT FACILITIES

As an alternative, or in addition to slow cool pots on the Morgan Stelmor line, coils can be moved via conveyor or elevator into a continuous heat treatment furnace. After the furnace, the coil can be either air cooled on the coil conveyor for grades like alloy steels, or rapid-quenched in a water tank to produce grades such as austenitic stainless steels.



Fans located beneath the Morgan Stelmor Conveyor



Steps for speed changes before reforming

IMPROVE COOLING, IMPROVE UNIFORMITY

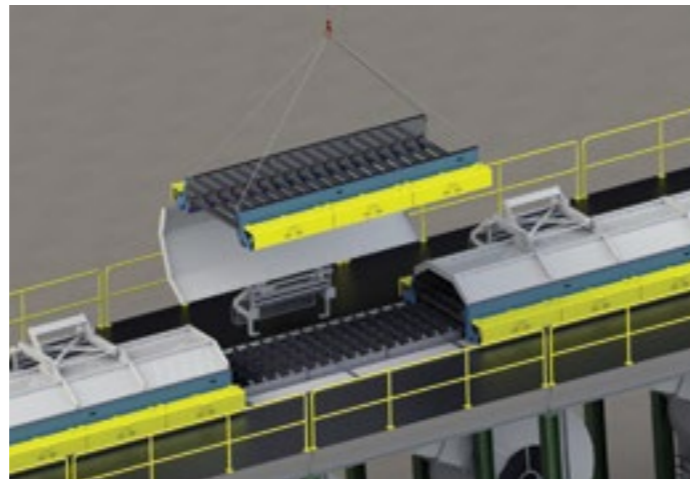
Many rod mills with aging cooling conveyors can greatly benefit from an upgrade to the latest Morgan Stelmor® Controlled Cooling Conveyor components, to help improve existing product properties and to enable production of new products. Upgrade possibilities include:

- Addition of larger capacity fans and plenum chambers
- Replacement of chain conveyor with roller conveyor
- New nozzle decks to improve cooling capacity
- Optimesh air distribution to improve cooling uniformity
- Insulated covers to enable slow cooling
- Addition of conveyor zones to add process capacity and flexibility

NEW DESIGN FEATURES

Our latest design incorporates numerous improvements for either new conveyor installations or conveyor upgrades:

- Modularization of the roller frames enables fast installation or removal of conveyor sections for maintenance or upgrades
- Unique roller design with modular ends for easy installation and replacement of sprockets
- Modular deck pan design facilitates expanded system with additional cooling zones



Modularized roller frames simplify maintenance and upgrades

EXCELLENCE FROM EXPERIENCE

SELECTED SUCCESS STORIES



MORE TONS OF QUALITY RODS

Customer

China Steel Corporation, Kaohsiung, Taiwan, Republic of China

Plant type

Two strand rod mill

Our solution

Supply a new two strand rod mill for the production of one million tpy of high quality rod products in a wide range of sizes.

Technical data

1,000,000 tpy, 110 m/s maximum speed, 5.0 mm – 20.0 mm plain rod in high quality carbon and alloy steels

The result

The new rod mill significantly increases the production capacity of the plant and enables China Steel to maintain success in the high quality rod market.



QUALITY PRODUCTS AT HIGH SPEEDS

Customer

Hyundai Steel Company, Dangjin, Republic of Korea

Plant type

Combination straight bar, bar-in-coil and wire rod mill

Our solution

Incorporates the latest high speed rolling equipment plus an 11-zone conveyor for production of 400,000 tpy of high quality rod products, intended primarily for automotive applications.

Technical data

110 m/s maximum finishing speeds, 160 tph, plain rod from 5.5 mm – 26.0 mm, plain carbon, spring steel, boron steels, free cutting, special alloys, bearing and cold heading qualities

The result

The new mills provide a wide variety of high quality products for the automotive market, meeting Hyundai's tight dimensional tolerance and excellent surface quality requirements, plus the best possible metallurgical quality and uniformity.



SUPERIOR ROD QUALITY AND SIZE TOLERANCE

Customer

CMC Poland, Zawiercie, Poland

Plant type

Rod outlet

Our solution

Addition of a rod outlet to an existing bar mill to expand rod production capacity beyond that of an existing two strand mill, and to produce superior size tolerance and metallurgical properties through thermomechanical rolling with a Morgan Rod Reducing/Sizing Mill.

Technical data

150 tph, 110 m/s maximum speed, 5.0 mm – 25.0 mm plain rod, 6.0 mm – 12.0 mm HYQST rebar; low to high carbon steel grades, plus alloy steels

The result

The rod outlet addition increases production of rod products with today's highest possible metallurgical properties and size tolerance.

Primetals Technologies USA LLC

A joint venture of Mitsubishi Heavy Industries and partners

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