



# Latest Technology in Stainless Steel Long Rolling Mills

- RAVI MAHAJAN, General Manager - Sales, Danieli India Ltd.

A modern rolling mill needs to operate in a competitive and profitable manner, which means

to produce the best product quality at minimum costs based on the following key points:

- High production capacity of the plant.
- Excellent and constant quality of the final product at minimum production costs, avoiding as much as possible the off-line treatment.
- Accurate layout design aimed at reducing the overall dimensions of the processing plant without sacrificing process facilities.

## Rolling Mill Stands

In the rolling mill area we provide a solution which employs our most refined design of

housingless stands with advantages that can be summarized as following:

- High reliability and optimized, simplified components to reduce the maintenance cost.
- High axial and radial rigidity to enable low temperature rolling.
- Very close tolerances on the rolled products, even under very high rolling loads, thanks to extremely limited deflections.

**D**ANIELIMORGÅRDHAMMAR process technology embraces considerable knowledge of roll pass design and its impact on mill configuration. A rolling line for the production of Stainless Steel designed by DANIELIMORGÅRDHAMMAR employs unique features of its equipment with a specific design based on the higher standards required by such steel grades.



- Short changing times for the units in the mill and for the rolls and guides in the workshop.

The mill stands are our well-known DANIELIMORGÅRDHAMMAR Housingless type.

The design offers unique advantages to our customers when compared to any other available technology. The design is implicitly focused upon achieving the shortest possible stress path and eliminates any clearances at

areas of stress transfer from one element to another whilst providing the roller bearing with the most rigid support possible. The two load carrying main screws, connecting the upper and lower bearing housings, are closer to each other and the load carrying area of the deflection resisting bulk of the bearing housing is much greater than in comparable design.



These main screws are completely free to align themselves in pure tension to resist the rollseparating forces. These forces are

transmitted over generous large radius spherical surfaces between the main nuts and the bearing housing. The distribution of forces around the main nut compresses this elastically into the main screw ensuring the most intimate transfer of stress in this critical area.

The location of the roll unit and its rolls is made through the axial bearing and its substantial yoke located along the axis of the roll thus distributing all the forces equally around the bearing circumference. All load carrying interfaces are pre-loaded and clearance free, greatly reducing the nonlinear part of the stand deflection curve.

The careful exploitation of these simple mechanical principles enables **DANIELIMORGÅRD SHAMMAR** stands to exhibit the premium of performance. For instance roll units exploiting eccentric sleeves as a means of roll gap adjustment cannot offer such equivalent stiffness. The stand design is harmonized around the chosen roll neck diameter and its relevant cylindrical roller bearing thus defining the ultimate capacity of the stand.

### Rolling Mill Stands Configurations

#### Reversible Shiftable Stand P600 Series

**DANIELIMORGÅRD SHAMMAR** reversible and shiftable concept is developed for supreme surface quality, with the possibility of finish rolling and low investment and production cost in comparison with any other continuous train with the same number of passes.



With the high rolling speed (2,5 – 5 m/s), a fully automated rolling with no operators, and with straight bars in a fixed pass line, an excellent surface quality is obtained.

The **DANIELIMORGÅRD SHAMMAR** reversible and shiftable arranged stands gives a possibility of using different billet sizes while always keeping the rolling speed at the optimal level.

The main improvements achieved with the

**DANIELIMORGÅRD SHAMMAR** reversible and shiftable concept are the following:

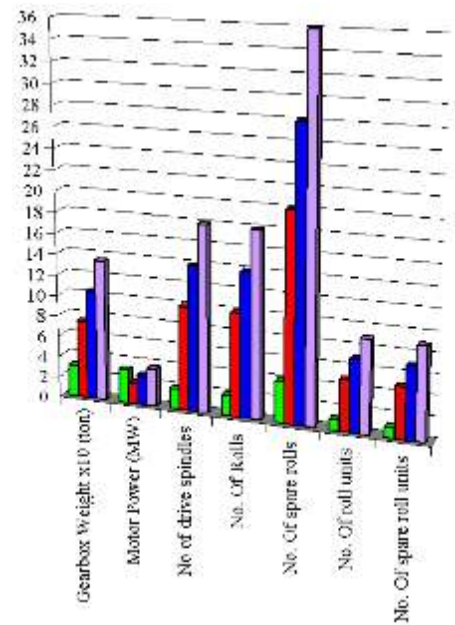
- Low investment cost, due to one stand, one gear box and one drive motor
- Low total power installation
- Simple speed control
- Good dimensional tolerances due to tension free and temperature wedge free rolling
- High flexibility regarding entry billet dimensions
- Finishing stand capability
- Excellent surface quality thanks to:
  - Short contact time between rolls and billet.
  - Always "free" billet in each pass.
  - Straight stock, no shifting / moving of the bar
  - Ramping up and down with the entire system, resulting in no slipping on the roller table to brake the bar before reversing.
  - Friction free manipulating of the bar by means of bar turners and guide guards provided with rollers.
  - Guides that follows the rolls symmetrically during gap adjustment, ensuring always the correct clearance

The **DANIELIMORGÅRD SHAMMAR** duo reversible shiftable stand is made of a two housingless roll unit of the P-600 type equipped with specially designed restbars, to not interfere with the strain, accommodating features of the P-600 roll unit. The restbars are mounted on both top and bottom roll chocks to hold the combined entry guides and exit strippers.

By mounting **DANIELIMORGÅRD SHAMMAR** combined entry static guide and exit stripper makes it possible to roll in the same groove in both directions with different roll gaps.

When rolling finishing rounds it is also possible to mount a roller guide on the bottom restbar in front of the finishing groove.

**DANIELIMORGÅRD SHAMMAR** reversible and shiftable concept is not only optimizing the production in process manors, as shown in the table below the no. of necessary spare roll units and consumables spares are significantly lower with the Duo reversible and shiftable roughing stand.



- Duo Reversible shiftable rougher
- 5 stand Continuous rougher
- 7 stand Continuous rougher
- 9 stand Continuous rougher

#### Horizontal Stand Arrangement



**DANIELMORGÅRD SHAMMAR** horizontally arranged mill stand can be equipped with a fixed combined reduction gear and pinion stand with telescopic drive spindles to allow for groove changing.

To be able to use fixed spindles the gearbox can be mounted on a sliding frame and be movable together with the roll unit supporting post.

### Vertical Stand Arrangement

**DANIELMORGÅRD SHAMMAR** top driven vertical stands can be built on either a concrete foundation or a steel frame.



The telescopic spindle couplings are held by a coupling holder that is mounted on a vertical sledge actuated by a hydraulic driven screw jack. When rolling the sledge is connected to the supporting post with roll unit.

### Wire Rod Block

The **DANIELMORGÅRD SHAMMAR** block is of unique design and was conceived as a result of the input received from our experience as a supplier of roller guides equipment. This experience was gained during prolonged periods of guide testing at high speed on the blocks, which provided invaluable information of all operational conditions.

The main highlights of the **DANIELMORGÅRD SHAMMAR DELTA** type wire rod block are the following:

- Easy access for roll ring & guide changing.
- Rolling units with oil film bearings always pre-loaded.
- Housingless concept of the wire rod rolling stands specifically made for tough grades.
- Rolling unit with modular system.
- Low speed transmission shafts from the gearbox to the modules each with same bevel gear.
- Roll ring with radial stress free mounting

for high quality Tungsten Carbide rings.

- Unique feature for Stainless Steel applications with intermediate shear inside the wire rod block.

The **DANIELMORGÅRD SHAMMAR** block has several design features that are proven in practice to contribute to the reliable production of close tolerance product and facilitate the rolling of sophisticated steel grades.

These are specifically:

- A roll shaft of larger diameter than that of our competitors that results in less deflection under load and hence superior stock control.
- The roll shafts are supported by the Housingless Stand Principle with roll forces contained within preloaded tension screws.
- This system is clearance free and further contributes to low deflections and particularly to long component life.
- No maintenance demanding eccentric sleeves are used thereby considerably reducing the service required for continuous production.



- Our design provides for individual gearboxes with torque limiting couplings to connect with the mating roll units. This enables routine maintenance to be carried out on the roll unit sleeve bearings without disturbing any of the precision gearing, as well as perfectly protecting the gear train from any overload situation. This is not the case when safety couplings are applied between the primary gearbox and the drive line.

- Our roll ring mounting method developed in cooperation with SKF and Sandvik, ensures accurate radial stress free mounting with torque transmission solely by axial force.

- Ring removal is by oil injection which fully lubricates and protects the roll shaft from cumulative damages.

**DANIELMORGÅRD SHAMMAR** has converted several competitors' blocks to this system.

- Easily accessible axial adjustment is provided on all block stands thus perfect axial groove alignment is attainable regardless of roll ring and component tolerances.

- **DANIELMORGÅRD SHAMMAR DELTA** block is unique having such excellent ergonomic access.

This facility provides quicker and reliable performance for roll ring and guide changing.

- Roll ring and guide changing is made easy and reliable by adopting an ergonomic level allowing intimate access in a natural way to the components to be handled at every change. This approach has been initially applied to the horizontal / Vertical arrangement and later also to the new DELTA arrangement.

- For rolling materials such as free cutting stainless steel that are sensitive to front end splitting, an interstand cropping and cobble shear was developed for Ugine Savoie. Solution that become a standard for all **DANIELMORGÅRD SHAMMAR** 10-passes blocks intended for stainless rolling and the only wire rod block in the world having such design.



In the cooling lines area we adopt a well proven design for cooling elements which provides excellent results in terms of quality control, user friendly set-up and production performance.

Several of our blocks, cooling lines and laying heads are regularly producing dimensions smaller than 5.5mm, even 4.5mm is offered to customers in a wide range of steel grades.

### Cooling Bed Area

A further significant feature of the project equipment is the design of the cooling bed, ejection and braking system. As shown in the drawing below of the run-in roller table the inclination angle of the rollers and the three position brake-slide is reduced compared to other brake-slide designs. This means less friction and load on the static side wall, the table roller taking the major share of the load.



During braking and ejection the lifting flaps move radially about turning point until sliding of the bar into the first notch occurs. This system reduces scratching of the bar, very important for stainless steel or carbon steel for cold heading or drawing as well as greatly reducing the continual repair of the surfaces subject to “edge” friction.

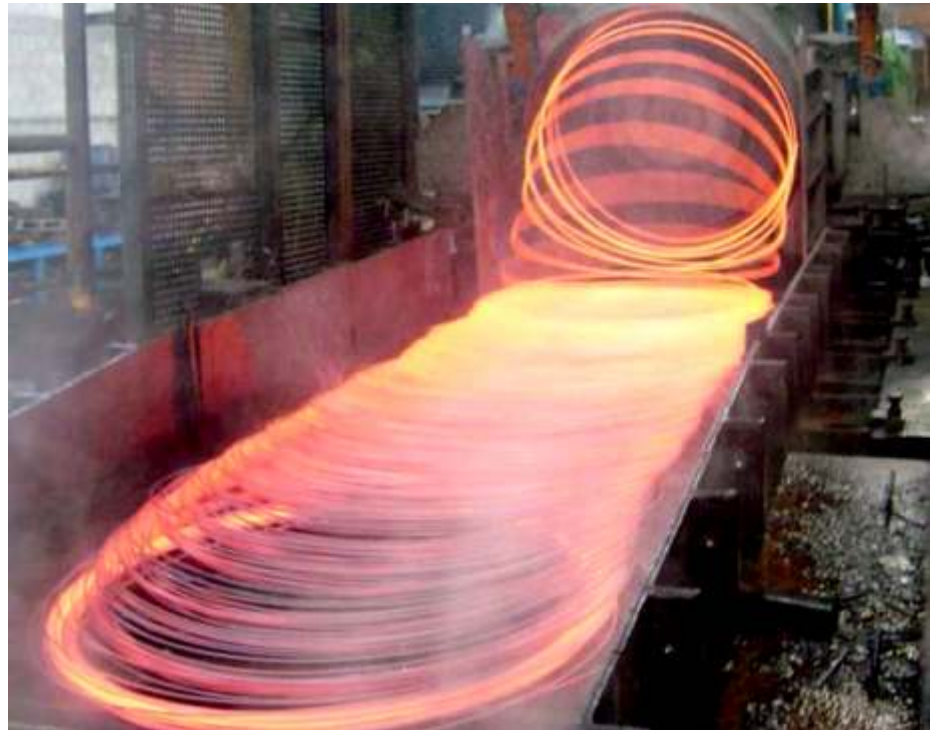
### Guides

Since 1940's when Morgårdshammar invented the ROLLER GUIDE the company has been continuously working with the design as well as with the material selection in order to have the best tool for the guiding of long products. This has made



**DANIELMORGÅRD SHAMMAR ROLLER GUIDES** to be the world STANDARD. Our Guides have been awarded the trust of the majority of steel producers for the following main reasons:

- Simplicity, “simple is better” it has been the key of success since the beginning of guides history with **DANIELMORGÅRD SHAMMAR**.



- Common components for different sizes and type of guides.

- Strong design
- Resistent to hostile working conditions
- Unique design of roller holder allowing a spring effect resulting in high stability of the rolled material
- Single point adjustment and easy to access all setting points
- Durable roll material allowing longer life of guiding rollers
- Full spectrum of guides for all different shapes and steel grades
- Custom-fit guides arrangement to satisfy all possible ways of rolling
- Worldwide assistance of qualified expertise in process, guides setting and maintenance

### Process Highlights

In a 10 - pass **DANIELMORGÅRD SHAMMAR** wire rod block with Low Reduction 16% the setup is typically 3 stands P820D + 7 stands P815D, respectively with ring diameter 223mm and 170mm. The deformation ratio, described as ring diameter to stock height has a favorable low value in the small rolling diameter stands. The spread is less, the rolling load, torque and power is smaller.

Applying 16% area reduction is to reduce the energy input per pass to allow high alloy to

be rolled in a wire rod block configuration.

**DANIELMORGÅRD SHAMMAR wire rod blocks are found where the rolling is toughest, stainless steels, nickel alloys, carbon steels and rebar are produced to the closest industrial tolerances.**

With the selection of **DANIELMORGÅRD SHAMMAR** superior technological level our customers will benefit of an essential tool to dominate the production of special steel in the worldwide market.

The enhanced and ultimate technology of **DANIELMORGÅRD SHAMMAR** Sweden is achieved with the direct experience with partners like Acerinox Group USA (North American Stainless, USA and Roldan, Spain), Outokumpo Stainless (Alloy Steel Rods UK, Degerfors Sweden, Teledyne Allvac USA), Sandvik Stainless (Fagersta Stainless Sweden, Sandvik Technology Sweden, Kanthal Sweden), Eramet group (Ugine Savoie France, Erasteel Sweden), PCC Group USA (Special Metals Wiggung UK, Special Metals Huntington USA), Talley Metal, USA, Sumitomo, Japan, Baosteel Group Shanghai Nr.5 and Huchang China, Ruipu Qingtian China, Jiangyin Xing Cheng China, Daye China and as well as the most representative Special Steel Producers in India such as Mukand, Sunflag, Bhushan Steel and Usha Martin just to name some of therecent references.