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1
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Advanced automation system for Dragon Steel's new hot strip mill

Cover photo:
110-MN open-die forging press with four prestressed columns and a welded steel structure, at Fomas Group, Italy

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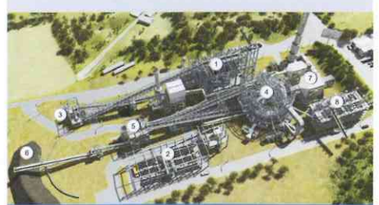
Editorial

Columns

Topical themes

Raw materials



3-D view of a CPT plant

Steelmaking

Continuous casting

Hot rolling

Roughing mill in H/V configuration

Automation

Advertisers' index

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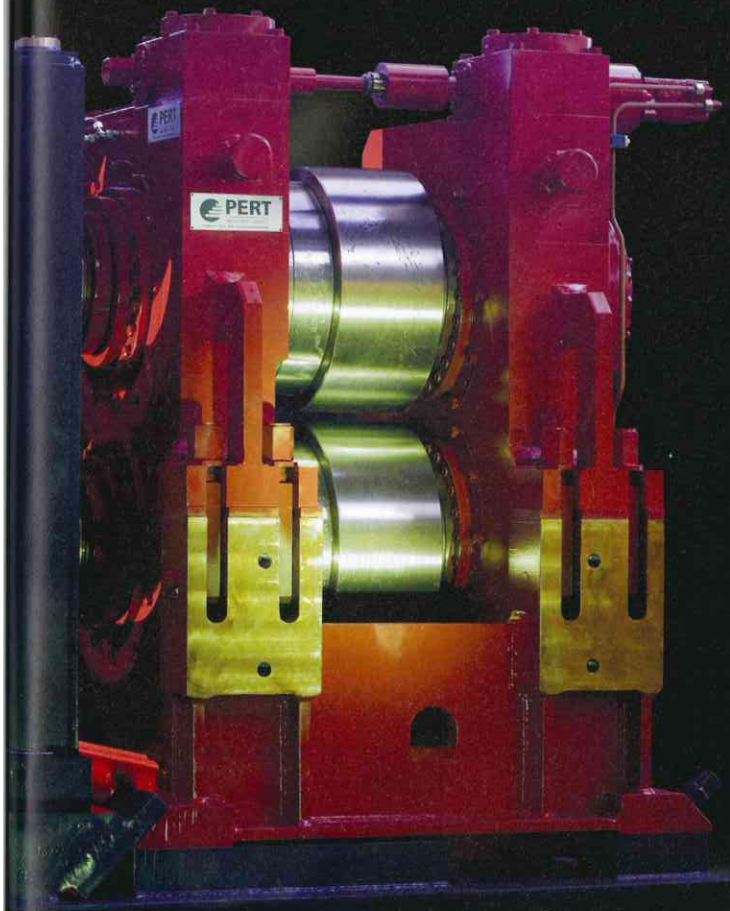

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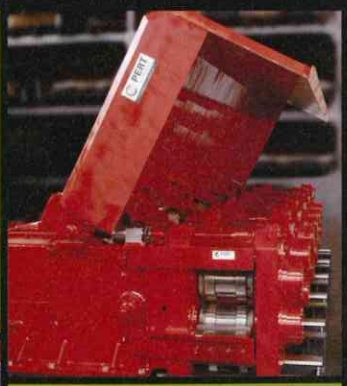

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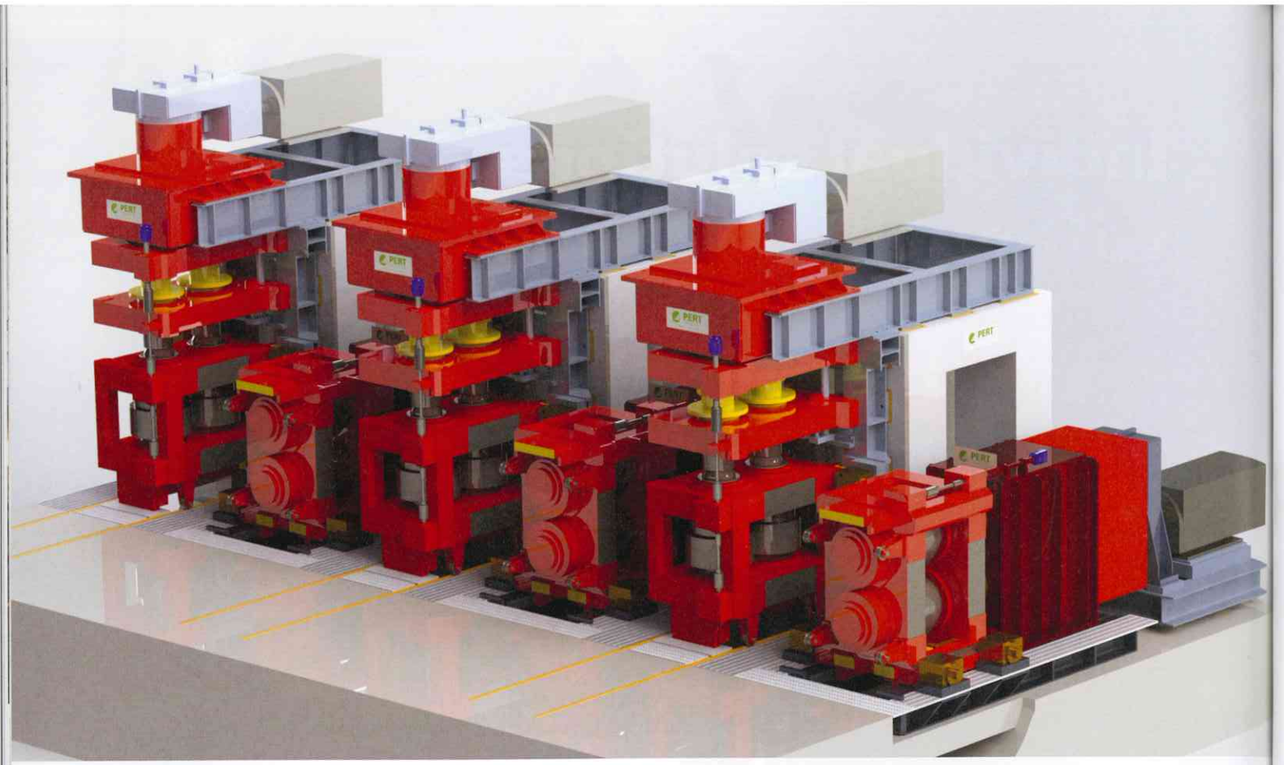

Figure 1. 3D illustration of a roughing mill in H/V configuration

Second generation of Bi-Support rolling stands

Today's long steel products market with ever smaller profit margins and stronger competition requires the use of rolling mills with minimized operational cost and the capability of assuring a final product of very high quality. Starting from these considerations, Pert has developed the second generation of its Bi-Support rolling stands.

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For various years, the first generation of Pert Bi-Support rolling stands has been working successfully in many steel production plants worldwide. Pert, which is committed to continuously improving and further developing its equipment and plants, is now offering a new generation of its Bi-Support rolling stands (figure 1). The innovative features of these new Bi-Support stands are based on the enhanced concept of the rolling stands that have become a milestone in rolling technology for long products. While maintaining the benefits of the first generation, the new Bi-Support rolling stands provide the following innovative advantages:

- absence of spindles, chocks and onboard piping,
- use of rings instead of rolls (less groove wear per t of production),
- smaller dimension for easier handling,
- high stiffness,
- 85% less spare parts,
- increased working life of bearings (min. 50,000 h),
- ring gap regulation starting from 5 µm,
- horizontal and vertical stands of the same design and fully interchangeable,
- mono-groove (roughing mill) and multi-groove (intermediate and finishing mill) design,
- roll gap regulation with eccentric system,
- easy maintenance.

All in all, the second-generation Bi-Support stands provide the possibility of improving the quality of the final product, cutting changeover times and downtimes for maintenance, reducing civil works and spare parts cost.

Improvement of final product quality

It is commonly known that in housingless stands the rolling load is concentrated on the tie rods, subjecting the adjusting screws to mechanical stress. This results in roll wear and mechanical yielding.

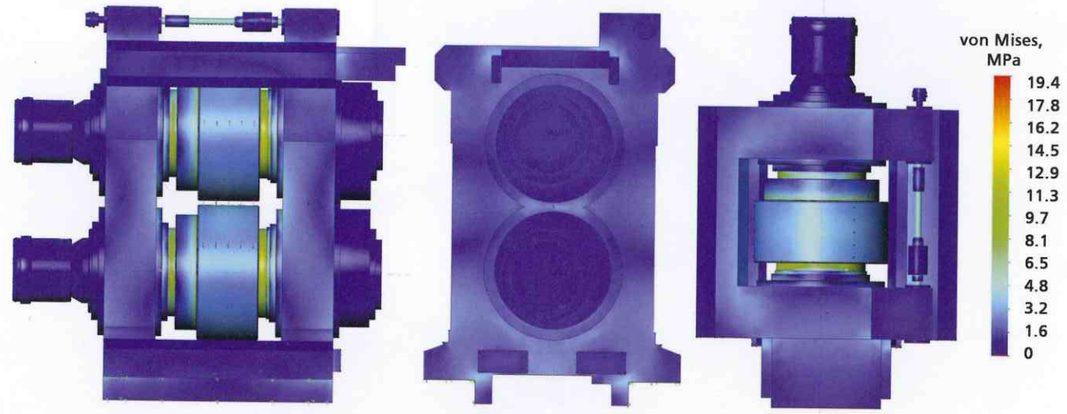

Figure 2. Pert Bi-Support stand under rolling load (P = 1,850 kN)

The Bi-Support stands, however, feature higher stiffness and better load distribution into the housing (figure 2), reducing mechanical yielding (deflection). As a consequence, dimensionally stable products can be manufactured reliably within the standard tolerances or even better.

The Bi-Support stands are designed to provide a force transmitting surface that is five times bigger than in housingless stands. Hence, housing elongation under load variation is reduced down to one fifth compared to common housingless stands. Further, Bi-Support stands have a stress path of approximately half the length of common housingless stands; hence, also the elongations are reduced proportionately.

Constraints are designed very near to the rolling load, so the rigidity of the stand is high and, consequently, the deflection of the ring-holding shaft is small. In comparison with common housingless stands, flexion is reduced to one third. Compared to a cantilever stand, it is halved.

Considering the above mentioned facts, the rigidity of the Bi-Support stands is approximately three times higher than that of the other types of rolling stands currently available on the market. This guarantees a very high quality to the final product.

Reduced downtimes of the plant for changeover and maintenance

Changing the stands involves approximately ten minutes from motor stop to restart, including changing the ring-holding shaft. When a complete stand is available as a spare, changeover time goes down to approximately 2.5 minutes. Such reduced changing times are possible thanks to the reason that the second-generation Bi-Support stand does not have a container or piping on board, as typical of the housingless stand. Unlocking, lifting, replacement and re-locking of the rolling unit are fully automated, in both horizontal and vertical configuration.

Savings on buildings, cranes and civil works

Major efforts have been dedicated to containing the total stand size and reducing the stand height in the vertical configuration. As an example, the Bi-Support 650 vertical stand, being part of a roughing mill, has a height of just 4.3 m, against the average height of 7 to 8 m of common housingless stands.

There are several advantages due to the smaller stand dimensions. The rolling mill bay can be built less high, so the structure can be smaller and lighter. Thanks to the reduced height of the second-generation Bi-Support stand, the runways of the cranes are at a height of just 7.50 m. The crane capacity is only 60% of that required by a standard mill. All in all, civil works for the roughing, intermediate and finishing mills are reduced by 60%. For plants on ground level, the building can be made of prefabricated concrete; this option allows the initial investment to be reduced and construction of the production site to be speeded up.

Low spare part cost

The new Bi-Support stands have no moving machined parts directly in contact with water or scale, as e. g. the tie rods in common housingless stands. All moving parts are positioned on the shoulder and protected by adequate gaskets.

The Bi-Support stands do not need any operator intervention in the rolling line, as with cantilever stands where the ring changes are to be performed in the working area of the plant. These changing operations are very difficult to perform with the risk of damaging the stand shafts.

The Bi-Support stand consists of only half the number of components in comparison with a common housingless stand. This allows the number of spare parts to be drastically reduced and, last but not least, also the stand weight.

In the Bi-Support stand the rolling rings are assembled on a heat-treated shaft made of alloyed steel (figure 3). This avoids any cracking due to overloading during rolling. Furthermore, when grooves have reached their end of life and there is no possibility of re-machining, only the worn rolling ring will be replaced, as the steel shaft on which the rings are installed can be re-used. In housingless stands the whole roll must be replaced.

The Bi-Support stand bearings have an increased working life, which is 2.5

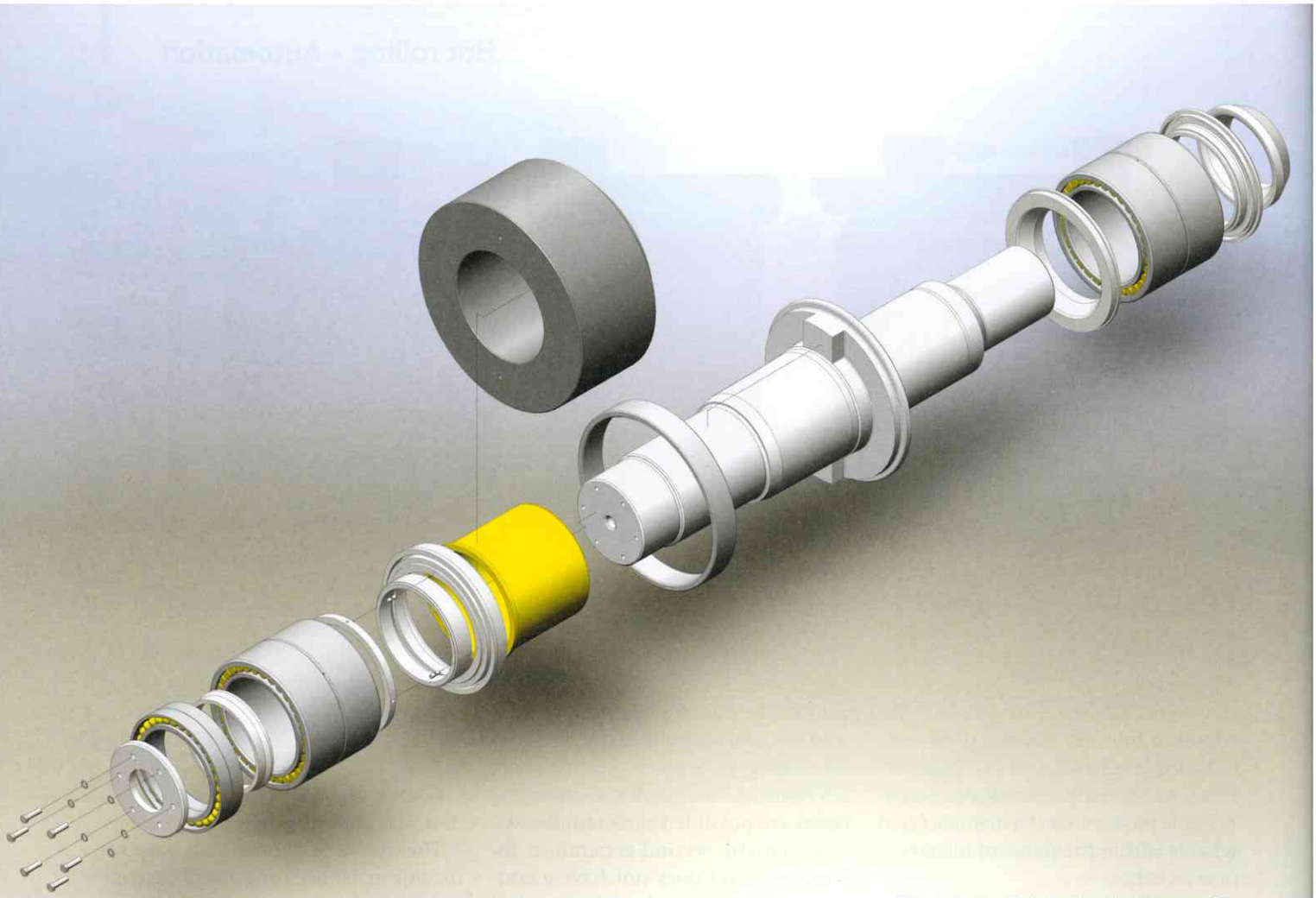

Figure 3. **Typical shaft and ring assembly**

times longer (min. 50,000 h) than in common housingless stands. The reason for this is the fact that in the housingless stand the rolling load is always fixed at the external ring of the bearing.

The second generation of Bi-Support stands has been designed and developed with the objective to avoid the use of cardanic spindles. Instead of cardanic spindles, gear couplings have been installed, which, under appropriate working conditions, are not subject to wear. Therefore there is no need to replace them or keep any spare parts.

Figure 4. **Pert Bi-Support stand**

The lubrication system of Bi-Support stands is very simple, like a lubrication system of a normal gear box. Bi-Support stands do not need a special skimming device for separating water from oil, such as cantilever stands.

Conclusion

The new Bi-Support stands **(figure 4)** have been designed for use in rolling mills that produce rebars, rounds and sections in SBQ (special quality bar) steel grade, wire rod as well as light and medium sections. They are also suitable for special steel plants. Bi-Support stands can be supplied in different configurations: horizontal, vertical or convertible, mono-groove (roughing mill) or multi-groove (intermediate and finishing mill). Each component group of the stands (basement, gear box and stand proper) is tested in the assembled condition in the Pert workshops to be "ready to roll" when shipped.

The use of second-generation Bi-Support stands results in multiple technological and economic advantages. Net savings on the initial investment result from the reduced expenditure on building and civil works. The small quantity of spare parts offers additional savings on production cost. Plant productivity increases thanks to the short changeover times and minimized downtimes for maintenance. The dimensional quality of the final products is very high. In general, the plant can be more efficiently operated, needing little maintenance and low manpower. Finally, also the costs of re-machining are minimized. ■