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## Enhancing rail performances: the Danieli RH2 - Rail Head Hardening process

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In recent decades, the rail transportation sector has undergone continuous progress. The increasing demands in rail transportation are particularly driven by higher train speeds and greater axle loads due to heavier cargo. To meet market demands, rail producers are improving rail strength to develop high-performance rails, particularly in terms of wear resistance. Head-hardened rails offer greater resistance to wear caused by faster, more frequent trains carrying heavier loads. Additionally, the head hardening process significantly improves the fatigue life of rails.

Building on this, the innovative Danieli RH2 - Rail Head Hardening process has been specifically designed and optimized since 2008. The RH2 process involves immersing the rail head in a tank filled with a water-based polymer solution immediately after rolling. This quenchant solution enables a wide range of cooling rates, spanning from those typical of oil to those of water, thereby adapting the cooling process to each specific rail grade, from pearlitic to bainitic.

To ensure optimal conditions and consistency, auxiliary systems regulate temperature, flow rate, solution concentration, and cleanliness, preventing mold and bacterial growth. High-quality rails produced using the Danieli RH2 system have the lowest possible transformation costs and minimal environmental impact in terms of CO<sub>2</sub> footprint.

Accurate measurements of metallurgical and mechanical properties have been conducted on RH2-treated rails over the past five years of industrial production. Results demonstrate the RH2 system's ability to exceed the most demanding global requirements. The foot residual stress is half the European limit. A high level of hardness uniformity can be achieved at the rail head. Consequently, the mechanical properties are more uniform, and the fatigue resistance is twice as high as the European standard requirement.

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