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## Work Roll Cooling Optimization

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This paper presents an optimization study of a hot strip mill first finishing stand (F1) top work roll cooling system, which was done in cooperation between Danieli (Buttrio, Italy) and Heat Transfer and Fluid Flow Laboratory (BUT Brno, Czech Republic). The target of the study was to decrease water consumption by more than 25% on the top work roll, maintaining the same (or better) cooling efficiency.

This study was divided into three phases. Phase 1 focused on analyzing the current cooling configuration using laboratory measurements with a unique rotary stand embedded with temperature sensors. The experimental setup involved heating a test segment to 320°C and cooling it to ambient temperature, collecting heat transfer coefficient data for different roll diameters and water pressures.

Phase 2 was focused on the study of several parameters, such as water pressure, nozzle size and positions, spray distance, etc., on the heat transfer coefficient. Obtained data were evaluated and two optimized cooling systems were proposed: one with two cooling headers and the other with three, both on the top roll exit side. Detailed experiments comparing the original and new configurations under various conditions demonstrated the possibility of significant water savings and improved cooling efficiency, with the first configuration achieving 34% water savings and the second up to 46%.

The third phase was done by Danieli by designing and installing the new cooling system in a finishing stand of a continuous hot strip mill. The validation of the new cooling configuration required the implementation of a work rolls temperature measure system in line for continuous rolling mill to evaluate the cooling performances. A 40% reduction in the cooling water flow rate has been achieved, maintaining the work rolls temperature during rolling unchanged.

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