Rail milling as a sustainable strategy for modern rail asset management

Rail milling is a relatively young technology, introduced approximately 25 years ago by LINMAG'S sister company LINSINGER. Rail milling is a rotational cutting process that results in the formation of metal chips which are collected and stored on the train for recycling.

THE TARGET profile is defined by the shape of the milling tool and is fixed for each set of tools. To change to a different rail profile, a different milling wheel with the new target profile needs to be installed on the train, which is a very fast process. Larger milling trains with multiple milling units per rail can have different profiles installed on each set of milling units. This allows an uninterrupted transition from one profile to another. Achievable profile quality is typically at least half of the required tolerances of EN 13231-3:2012.

The milling process is completely spark and dust free which enables the process to be applied with limited or no special precautions in environmentally sensitive areas such as tunnels, stations or zones with general fire restrictions/bans. The generated process heat is transferred into the milling tool and the metal chips. The machined rail surface experiences no significant heat input. Therefore, any unwanted material transformation like 'white etching layers' is presumably prevented.

The milling process produces a distinctive surface pattern that can sometimes cause temporary noise effects in a transit environment. For this reason, milling trains are equipped with a longitudinal grinding wheel with a slight offset angle in reference to the longitudinal rail axis. This polishing process provides an extremely smooth surface finish of the final rail profile. This polishing wheel is completely enclosed ensuring almost 100 per cent of the sparks and dust are collected on the train. The process speed of rail milling may vary between 400m/h up to 2,000m/h of finished rail (dependent on machine type). This is generally slower than a typical grinding process. However, this is compensated by the higher one pass damage removal capabilities of the milling technology. Moreover, a milling machine can process main track as well as special track work such as switches and crossings. No dedicated switch-milling machine is required for such a task. Milling is perfectly suited for corrective maintenance needs due to its restorative capabilities (complete damage removal and high-quality profile restoration) and can also be used as a preventive maintenance strategy. However, economic considerations might favour rail grinding due to higher process speeds for this low metal removal environment. Nevertheless, factors such as achievable surface quality or machine availability might ask for rail milling instead of rail grinding for specific preventive tasks.

LINMAG's rail milling train MG31 at the headquarters in Steyrermuehl, Austria

In summary, LINSINGER high performance rail milling can be applied reliably and efficiently nearly independent of the level of initial rail degradation. Systematic examinations and simulations of the technology confirmed empirical observations about the milling process with respect to surface quality and process heat transfer. Finally, application examples from satisfied customers around the world confirm that rail milling can be successfully used as a complementary solution to prevent premature rail exchange and economically treat mainline track, switches and crossings resulting in a significant extension of rail life.

It is very important to recognise rail milling as one of several influencing factors in the wheel-rail system. Only by applying a holistic approach that considers all these key factors (maintenance, target profiles, track geometry, friction management) and their interaction, can a sustainable and economic life extension of the whole system be achieved.

LINMAG Rail service by milling and grinding

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