



SES "SuperLeveler" with BTU Bridles, capable of generating 1,245 kN of strip tension in only 15.24 meters (Picture: SES Engineering)

Strip processing lines

Umlauf Bridles make pickle line at Steel Dynamics future-proof

SES Engineering LLC has upgraded a pickle line for Steel Dynamics Flat Roll Group (SDI) with the latest generation of Umlauf Bridles engineered by BTU. The SDI pickle line is the first in the world to use exclusively Umlauf Bridles for the strip transport. Umlauf Bridles build up strip tension high enough to ensure that also thick-gage and high-strength strip will leave the pickle line in a perfectly levelled condition.

Modern high-strength steels, such as AHSS (Advanced High Strength Steel) grades, feature high strength and good formability at the same time. This combination of properties calls for distinctly higher strip tension to achieve effective descaling and levelling before pickling of strip made of these steels. In order for their pickle line in Columbus/Mississippi to come up to the demands posed by advanced high-strength steels and be fit for growing future quality requirements, the management of Steel Dynamics Inc. (SDI) decided to have the entry section of the line revamped.

The existing pinch roll units, consisting of five rollers each and arranged ahead and after the tension leveler, were unable to produce the required strip tensions, especially when dealing with thick gage strips. Also threading of the strip was rather com-

plicated, and the existing leveler required a great deal of maintenance.

The objective

The main objective of the project was to achieve a fundamental improvement in the descaling and levelling result. At the same time, higher yield, shorter threading times and higher availability were to be achieved – the latter primarily by reducing the time and effort of maintenance and repairs. The strip velocity was to be retained at the original level of 150 m/min (500 FPM).

One important constraint of the project was that the new equipment was not to use any more space than the existing one. Another challenge was the available time window: between the disassembly of the existing equipment and the restart of the line, less

than three weeks were scheduled to perform all installation and associated activities.

When screening the market for a new tension leveler, it soon turned out that all common technologies were unable to successfully cope with the requirements of advanced steel grades. Some machines failed to produce the required strip tensions, others were not able to reliably prevent slippage of the strip, a potential risk of surface damage. With some designs, threading proved to be rather cumbersome and the drives required intensive maintenance. None of the systems evaluated met SDI's requirements for high-strength and thick-gage steel strips.

The solution

Therefore, SES Engineering proposed to install a new tension leveler and Umlauf

Ian Bowman, Dan Cullen, SES Engineering LLC, Alliance, OH, USA; Michael Umlauf, Member of the Management Board, BTU Bridle Technology, Hagen, Germany – Contact: www.btu-bridle.de

Bridles from BTU. The latter would be used to produce the high strip tension required for advanced steel grades. Thanks to their specific design, Umlauf Bridles can apply much higher forces onto the strip than e.g. conventional bridle rolls – while requiring less installation space. What is more, they apply the strip tension uniformly over the entire strip width and rule out the risk of lengthwise scratching of the strip surface. Umlauf Bridles have been in operation in several European plants for more than 25 years, with operators reporting very good performance and low equipment maintenance.

Due to the convincing concept of an integrated solution and the good experience with Umlauf Bridle technology reported by other steel companies, SDI's management chose the solution proposed by SES: a 140 ton SuperLeveler provided by SES and two Umlauf Bridles – one arranged ahead and one after the leveler.

The scope of supply additionally included a third Umlauf Bridle arranged in the run-out section of the pickle line. This configuration has made the line in Columbus the world's first pickle line to use exclusively Umlauf Bridle technology to move the strip through a pickle line.

SDI placed the order for the project with SES as general contractor in February 2018. Project work on site started on 25 January 2019: SES disassembled the complete entry section equipment between the pay-off reel and the pickling tank entry, as well as the pinch roll unit at the line exit. They then installed and commissioned the three Umlauf Bridles and the levelling machine complete with the associated electrical and automation systems. After successful hot commissioning, the pickle line went back on stream on 10 February – i.e. only 17 days from the start of the disassembling work.

Ahead of the leveler, the first Umlauf Bridle performs as a braking unit and the second one, arranged behind the leveler, as a pulling device. In this set-up, the Umlauf Bridles – each requiring an installation length of only 2,200 mm – generate strip tensions of up to 1,250 kN to level the strip. The first Umlauf Bridle in the line bites the head of the up to 13 mm thick and up to 1,880 mm wide strip, guiding it directly into the tension leveler.

The third Umlauf Bridle arranged at the run-out of the pickling section bites the head of the pickled strip and guides it into

The Umlauf principle

Umlauf Bridles consist of two crawler-type chain units featuring an elastic padding. One unit is arranged above and one below the strip. They guide and transport the strip linearly, i.e. without any deflection, at different stages of strip processing lines. Thanks to their extreme compactness, Umlauf Bridles can be arranged at basically any position within the line.

By applying the force over an area – and not concentrated in one point – any local concentrations of forces or relative movements between the crawler unit and the strip surface are prevented. Therefore, the risk of surface damage is ruled out, making this technology highly suitable for delicate strip surfaces.

A single Umlauf Bridle unit may be used to apply large forces to the strip, for example, in order to pull it through side trimmers or slitting lines. This aspect is of particular interest especially when processing thick strip. The unit may also be installed to decouple the strip tension of a line section from upstream processes or even reduce the strip tension to "zero". By reducing strip back-tension to "zero", an Umlauf Bridle makes it possible, for example, to measure the flatness of the strip without any interfering effects.

As the Umlauf Bridles are arranged within the strip processing line, they build up the strip tension before the coiler bites the strip head. This significantly increases the usable coil length, in other words the yield. In certain strip processing lines this may lead to a plus of 20 meters per coil. Umlauf Bridles can be rotated very precisely through their vertical axis. This feature allows them to reduce strip camber during stretch leveling and correct the strip run so as to achieve highly precise trimming or recoiling.



Entry section of the BTU Umlauf Bridle (Picture: SES Engineering)



An Umlauf bridge shortly before installation (Picture: SES Engineering)

the recoiler, adjusting a back-tension that is optimal for the specific recoiling process. A special feature of the Umlauf Bridge is that it can rotate through its vertical axis. This ensures perfectly straight-edged recoiling.

First experience

The line currently produces pickled & oiled, mild steel, high-carbon, HSLA and

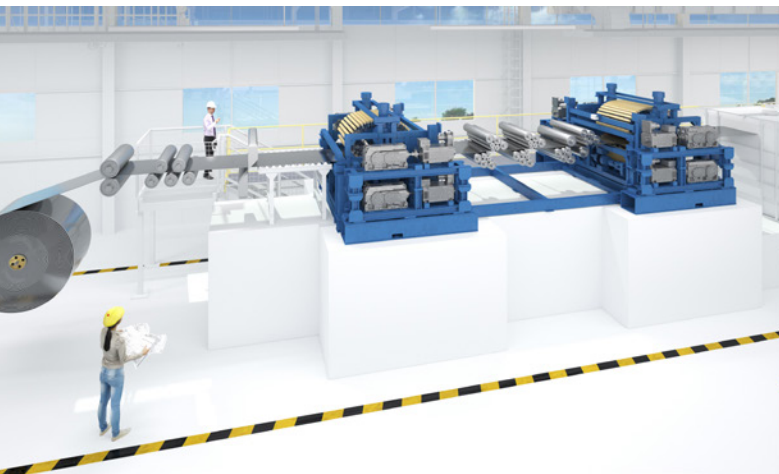
tension leveler. It is also extremely uniformly distributed over the entire strip width. The new line achieves up to 1.5% strip elongation normally and up to 3.0% on some products, an amount high enough to ensure effective levelling and descaling. Strip flatness has also been impressively improved: for example, strip of over 300 l Units flatness was levelled to just 10 l Units.

A further advantage is that the strip is subjected to the correct strip tension as soon as

Also the threading process has become much more reliable: the rotating crawler-type chains of the Umlauf Bridges securely “catch” the strip head – even if the heads bend up or downwards (ski formation). With the old equipment, threading usually took about 2 to 3 minutes. Sometimes manual intervention was required, often extending the time needed for threading to up to 30 minutes. Now every strip is threaded fully automatically within 45 seconds at a speed of up to 45 m/min (150 FPM).

As the second Umlauf Bridge actively pulls the strip through the leveler, the leveler does not require any drive equipment of its own. This reduces investment and maintenance costs and prevents the rollers from slipping. While strip tension is being built up, the first Umlauf Bridge operates in generator mode.

Jeffery McLain, Finishing Mill Manager SDI is sure that the company took the right decision when opting for Umlauf technology: “Almost all our objectives have been fulfilled: we reach the high strip tensions needed to achieve excellent descaling results and to be able to level high-strength, thick-gage strips with the same high precision. We have reduced the time needed for strip threading dramatically. Our customers and downstream operations have reported that they prefer to run



At the entry section (left) the two Umlauf Bridges produce strip tensions of up to 1,250 kN, whereas at the line run-out (right), the third Umlauf Bridge creates the back-tension needed to produce exactly wound coils (Picture: BTU Bridge Technology)

AHSS steels in gages between 1.5 mm (0,060”) and 12.7 mm (0,500”) with yield strengths between 1,700 and 7,500 N/mm² (25,000 to 110,000 PSI). Strip tension is now triple the value it used to be with the old

the second Umlauf Bridge bites the head of the strip. This means that, apart from about two meters at the head and tail, the strip is stretched immediately and over its complete length exactly with the tension required.

material that has run through the Super-Leveler with the BTU Bridges. The sum of all these achievements has made our pickle line fit for the growing future challenges of the market.”