Process-Line Z-High® Mill for Strip-Cast Steel

T. Sendzimir Inc.—originator of the cluster mill design—is modifying its existing Z-High® Mill to make it compatible with operating conditions within the continuous casting environment. Company officials believe the potential for this new design is “exciting.”

They are looking beyond thin-slab casting, which is now operational for low-carbon steels in many parts of the world. Slabs, usually of about 2 inches (50 mm) thick, exit from a caster into multiple four-high stands to be converted into hot-rolled strip. Significant economies are realized with thin-slab casting because steps like holding and roughing are eliminated. But to make the thin-slab-casting product suitable for many applications, it still must be cold-rolled.

Strip casting, on the other hand, has the potential for producing hot band that can be transformed in one operation into a high-value-added product. That's because cast carbon strip is usually about 0.06 in (1.5 mm) thick—already of cold-rolling dimensions.

Sendzimir officials claim that standard rolling-mill equipment has difficulty obtaining the high-value gages, strip profiles, and surface qualities that the Z-High customarily achieves. However, to satisfy the constraints of the continuous casting environment, the Z-High design also must be fully compatible with process-line conditions. Thus, the new Process-Line Z-High.

This new design is based on development work done in 1986–90, when Avesta Sheffield engaged Sendzimir to co-develop with its Nyby Bruk, Sweden, Works management an economical, continuous interface between its outsourced hot-rolling operation, which produced material of varying quality, gage, and width on five different mills, and Nyby Bruk's existing in-house cold-rolling equipment. They wanted a processing operation to roll all grades of stainless strip—up to 6.0 mm (0.24 in) thick, and from 800 to 1,550 mm (32 to 61 in) wide. They also wanted it to take a maximum reduction (25% in one stand, if possible) while improving shape and gage. Sendzimir's solution, developed with Nyby Bruk, led to the first roll/anneal/pickle line for stainless steel. The ZR 613A-61 Z-High mill stand, built under license by Sundwig, was retrofitted into a pair of existing four-high mill housings. Installation took three weeks and required only 28 hours of downtime for the A/P line while the equipment was put in place.

The results of the Nyby Bruk development hint at the potential for the new Process-Line Z-High design when installed in-line with a strip-casting facility. At Nyby Bruk, the Sendzimir mill’s small work rolls, its AGC system, the axial shifting of intermediate rolls, and the bending ability of the rolls permitted a thickness tolerance of ±8 µ (±0.0003 in) and 33% reductions in one pass on 18-8 stainless steel (from 3 mm down to 2 mm [0.12 in to 0.08 in]). A standard four-high mill stand would have required three passes to effect such a reduction. Just as important, the quick work-roll-change system and mill-adjustment systems allowed the Z-High to maintain production schedules on a continuous rolling basis.

With the new Process-Line Z-High mill, whether in single or multiple stands, prior annealing and furnaces normally used to maintain rolling temperatures will not be necessary, company officials state, because Sendzimir's small work rolls can reduce even work-hardened material down to

final gages at ambient temperatures. Company engineers foresee high-value-added, thin-gage strip of very high surface quality and strip profile being produced continuously and directly from a continuous thin-strip caster. Coils of indefinite length will be possible, since the entire system will be capable of synchronization. Sendzimir officials predict that when stainless steels are strip cast, the Process-Line Z-High mill will be essential, because it will be the only mill capable of reducing and finishing such hot-rolled material directly to thin gages in an in-line process.