

Leveled, cleaned hot band competes with CRS

By J. Neiland Pennington, Executive Editor

Toll processor introduces cut-to-size hot rolled blanks that are flat, have no shape memory, are ready to finish and resist corrosion. Cost, says the supplier, is below cold rolled, also temper mill and P&O processes.



Inset photograph courtesy of Red Bud Industries, Inc.; other photographs by the author.



Two 3200-ton hydraulic presses are the heart of The Material Works' larger Red Bud cut-to-length stretcher leveling line, which processes metal up to 72 in. wide and 5/16-in. thick. TMW also operates a 72-in. x 10-ga. multi-blanking stretcher leveling line with 800-ton presses.

For metals specifiers, it's the best of both worlds: hot rolled carbon steel with physical characteristics approaching cold rolled. This reduced-cost alternative to CRS is cut-to-size hot band processed through a patented combination of stretcher leveling and brush cleaning by The Material Works, Ltd. (TMW).

The Red Bud, Illinois toll processor calls its development Stretched Cold-Rolled Surface™ (SCS), and claims properties for hot rolled steel that are un-

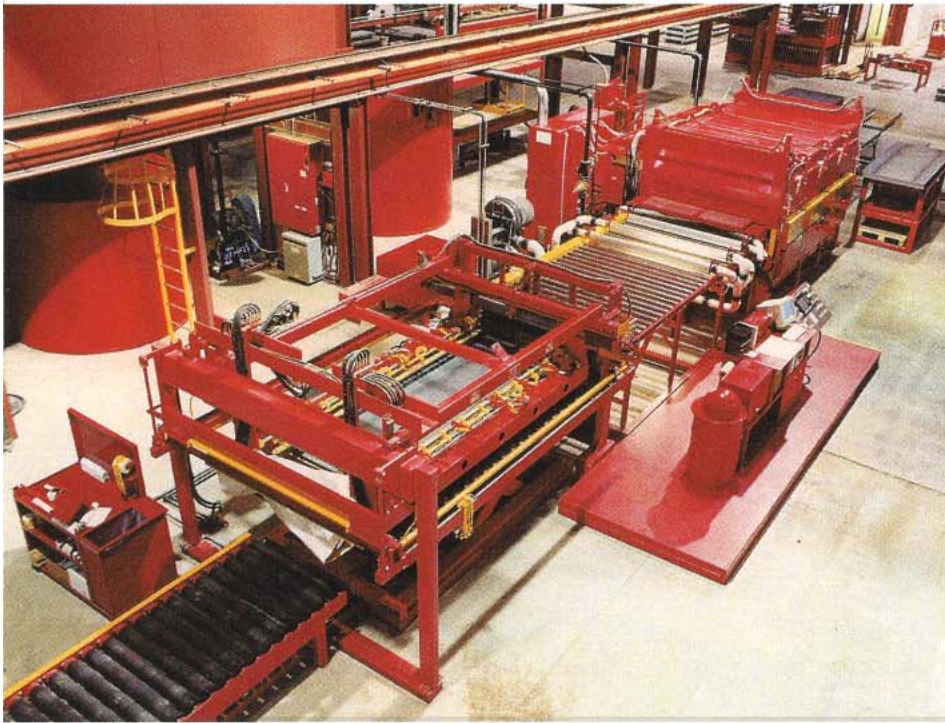
available elsewhere. "Our SCS sheets have features that can replace more expensive steel: cold rolled, pickled and oiled, pickled and dry, temper pass or shot-blasted," stated Kevin Voges, president of TMW. "The stretched metal is very stable—it has no shape memory—and the surface finish has the characteristics of cold rolled."

Production of SCS is currently 4000 tons/month, 40 percent of full capacity. TMW delivered its first commercial

shipments of SCS early this April, but development of the process officially began November 12, 1999. That was the date Voges visited 3M to inquire about Scotchbrite cleaning for hot band.

"When you clean small metal parts by hand, you generally do it with a Scotchbrite pad," he said. "I wanted to know if we could clean cut-to-size blanks using the same medium in a roll machine."

3M told Voges that other coil processors had tried Scotchbrite for hot rolled



The brushing line produces the paintable, corrosion-free surface in TMW's Stretched Cold-Rolled Surface process. The manual vacuum lift on the infeed table is being replaced by a robot destacker.

steel, but had trouble getting material flat enough in the heavier gauges for the rolls to work consistently. But they weren't holding TMW's trump card: A 72-in. wide Red Bud Industries multi-cut blanking line with a stretcher leveler.

"We met with 3M at our plant," Voges recalled, "and their representative said that our stretcher leveler was the first line they had seen that produced hot band flat enough for brushing. For the brush process, the metal can have no more than 1/8-in. of wave in 8 linear ft. Above that, roll contact is inconsistent.

"Temper mills and roll levelers can't remove 6- to 10-in. of edge wave and make the metal flat. Our stretcher levelers can."

Two stretcher leveling lines

Note that Voges said stretcher levelers—plural. Capacity of the original line

ranges from 0.010 to 0.142 in. (10 ga.), with two 800-ton hydraulic presses. TMW has just commissioned a second 72-in. Red Bud stretcher line, a cut-to-length installation with 3200-ton presses. The line processes metal thicknesses from 0.050 to 0.312 in. (5/16 in.).

Laser cutting and punch press fabricating are large markets for SCS sheet, according to Alan R. Mueth, TMW's vice president of production. "Flatness and the elimination of residual stresses are particularly important for these processes," he said. "Laser cutting and punching can release stresses that cause parts to distort, lose tolerances and have an unacceptable appearance. In laser cutting, the metal may spring up far enough to strike the cutting head. Hitting the nozzle is usually a \$7000 whack."

The stretcher leveler lines accommodate HSLA steels and other high-yield

metals. "The maximum yield strength we can process depends on the thickness," Mueth added. "We have processed 100-ksi yield material on the smaller line, but it was not 10 ga. We can go up to 140 ksi full-hard on the larger line."

The SCS process reduces hardness slightly. Stretching work-hardens the metal by about 2 points on the Rockwell B scale, but the cleaning process reduces hardness an average of 2.5 points.

More stable than temper passing

Kevin Voges compared SCS to hot rolled steel that has been processed in a temper mill. He pointed out that because the temper mill alternately works both sides of the strip, it can leave an axis in the cross section that has not been stretched beyond the yield point. "Temper mills do a good job of removing stresses," he said. "But they can't do the job that a stretcher leveler does. In stretching, the entire cross section is worked beyond the elastic limits."

Voges is so confident of the stretching process that he issues this double warranty for SCS: "We guarantee that we will stretch the material as flat as or flatter than a temper mill, or the processing is free. And we will meet or beat temper passing on stress elimination, or the processing is also free."

The clean finish and corrosion resistance of SCS result from the Scotchbrite brushing process that is a low-cost dry alternative to pickled-and-oiled metal. Voges has been told independently that the current variable cost of the P&O process averages \$0.75 per hundredweight. The variable cost of Scotchbrite brushing he places at \$0.11/hundredweight.

COMING TO A DISTRIBUTOR NEAR YOU

So far, The Material Works is the only source of Stretched Cold-Rolled Surface steel. If a customer is located in the St. Louis area, near TMW, the cost of transportation may be negligible. But for a distant user, shipping costs could erase the economic advantage of SCS, compared to temper-milled steel or CRS produced closer to the customer.

That will not happen if Kevin Voges' licensing plan materializes. He envisions a network of toll processors

and service centers that will produce and market SCS steel, using TMW technology and the SCS trade name. So far, seven companies have expressed interest, particularly in coil-to-coil strip processing.

Three levels of licenses will be issued. One is for the full process, both stretcher leveling and brush cleaning. For processors with stretcher lines, brushing can be licensed separately. And there will be a license for the yet-to-be-introduced strip technology.

The benefits of scale

Brushing turns mill scale, a fabricator's bugbear, into an asset. Mill scale causes tool wear, is dirty and flakes from the surface. But on SCS, a portion of the mill scale is retained. Kevin Voges explained:

"We remove the bad scale, the top two layers of hematite (Fe_2O_3) and magnetite (Fe_3O_4), and most of the third layer—the wustite (FeO). The remaining scale is mechanically bonded to the steel; it's clean and doesn't cause tool wear. And because the wustite is bonded, it can be painted without further cleaning and doesn't compromise paint adhesion."

Voges noted that stretcher leveling allows control of the mill scale. "Temper mills tend to work mill scale below the surface of the metal," he related. "The mill forces can roll hard scale into softer steel; our stretcher leveler process doesn't do that. Rolling scale into the steel results in point inclusions, and point inclusions cause rust."

Surface quality sold a customer of Straightline Source, Inc., on SCS. The Pittsburgh, Pennsylvania online metals supplier ships to "a large office furniture manufacturer [who] looked to us to provide a cost-effective solution to cold roll in a semi-exposed application," said Marc O'Neill, manager of outside processing. "We were able to replace temper-passed hot roll P&O with SCS. This not only saves time and expense in getting the steel to the customer, but it also improves the usability of the material, as it arrives free of surface oil and is ready for immediate integration into their production."

Natural corrosion protection

The intervals between SCS processing, fabricating and finishing are not critical because the bonded wustite inhibits corrosion on the dry metal. No oils or other liquid surface treatments are required.

Oil is a problem, according to Voges, because it has to be removed before blanks can be worked, and removal can be environmentally unfriendly. Oiled sheets

cling together, lubricants contaminate machinery, and there are problems with welding—including excess smoke.

The Steel Works, LLC, a Granite City, Illinois service center, cited smoke-free welding to market SCS to a fabricator that, according to Ted Cooper, Steel Works' owner, had "an objection to the smoke generated by the P&O product when welded." He credited TMW with "the foresight to bring to market a competitive alternative to the pickling process."

How long is the shelf life of SCS? "We do not know how long SCS can be inventoried," Voges stated. "We don't claim to be selling a substitute for stainless steel, but we have not heard of any sheets rusting, and we've had samples in the field for two years."

Cleaning up the cleaning process

A unique two-sided brushing machine designed and built by Red Bud Industries contains three pairs of progressively finer



TMW's Alan Mueth provides a hands-on demonstration of the difference in surface quality between unprocessed hot band and SCS steel.

Scotchbrite rolls that process sheets up to 72-in. wide by 200-in. long at 50 ft./min. Water flowing at 180 gal./min. flushes the scale from the metal, and the closed-loop filtration of the process water is included in TMW's patents.

"We have two 4000-gal. reservoirs," said Alan Mueth. "One supplies the system with makeup water, and the other is a filtered wastewater tank. The town of Red Bud has very strict wastewater disposal guidelines, and the iron content of our effluent is currently 5 percent of the allowable limit. "We have two Illinois EPA disposal permits," he continued. "One is for the water; the other is for the scale. Neither is a hazardous waste. The solids are non-hazardous because we add nothing to the removed scale."

"Our plant does not have a sewer connection. We collect the wastewater and haul it to town for disposal in the sewer system. The disposal cost in Red Bud is about \$100/month, and we are adding 4000 gal. of makeup water every three to four weeks."

So far, the Scotchbrite cleaning process is limited to blanks. But Kevin Voges said that not one customer for SCS has failed to ask about extending the process to coil stock.

"There is a huge demand," he said. "But the problem is to get coiled material as flat as the stretched metal that we cut into sheets. We are currently developing equipment designs for coil-to-coil leveling technology that will produce strip flat enough for brushing. We expect to have Scotchbrite cleaning of hot rolled coils in production by the first quarter of next year, running 72-in. wide coils up to 1/4-in. thick and a yield strength of 80 ksi." ■

The Material Works, Ltd., Red Bud, Illinois, 618/282-4200, fax: 618/282-8260, www.thematwks.com.

Red Bud Industries, Inc., Red Bud, Illinois, 800/851-4612, fax: 618/282-6178, www.redbudindustries.com.