

# How to handle critical surface coil

Suggestions for slitting and blanking painted, polished or surface-treated metals.

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**F**or most coil processors, particularly service centers and toll operations, slitting and blanking painted, polished, anodized or other critical surface metals are all but inevitable. Applications for coil that has been finished or that goes directly to a postfinishing process without additional surface refinement have increased by up to 50 percent in the last decade.

Surface sensitive materials are used throughout the automotive industry; metals that have a high quality finish—regardless of end use—are frequently called automotive exposed materials. The furniture and appliance industries are using much more prepainted and polished metal. So it is essential for coil processors to develop the skills for handling critical surface materials. Sooner or later they will need them.

These materials are not limited to demanding surface finishes. Also considered critical are electrical steels for transformer, motor and generator laminations. They are metallurgically and mechanically sensitive, and their electrical performance depends on avoiding induced stresses.

Michael J. McGuire, sales executive with Chicago Slitter in Itasca, Illinois, spoke on surface-sensitive materials to the Society of Manufacturing Engineers' coil processing technologies conference last February in Chicago, and also shared his suggestions with *Modern Metals*.

"Whenever the finished sur-



▲ Immaculate UHMW plastic runout table surface and chrome-plated rolls on low-friction bearings protect enameling and silicon electrical steels at Mapes & Sprowl Steel, Elk Grove Village, Illinois. New line slits, levels and blanks; was built by Chicago Slitter. (Photographs by the author.)

face of the material touches another surface, there is the possibility of damage," he stated. "Equipment and process deficiencies can damage the finish during operations such as slitting, recoiling or cutting to length. Scratches can be caused by improper braking on the uncoiler, or any increase or decrease in tension on the coil that leads to movement within the coil."

## Warehousing and transfer

Damage prevention begins with correct coil storage and transfer. McGuire recommends wrapping coils in paper, vinyl (usually for stainless steel) or stretch films. Coils should be stored on polyurethane saddles or mats to isolate them from the floor. High-density felt or conveyor belting are also suitable cushioning materials.

"Do not use wood saddles," he advised. "They produce dents in the outer wraps of the coil. You can use timbers to prevent coils from rolling, but wood should not be used to support the coils."

The contact surfaces of C-hooks and coil grabs should always be padded, generally with a polyurethane coating or thick felt. Many coil processors use Wiker lifters, whose free-floating hooks are suspended from chains. Their design permits stacking coils closer together than do rigid C-hooks, but Wiker lifters drag against the edges of the coils to engage the eye. Molded polyurethane boots are available for Wiker lifters to prevent edge damage.

The support surface of turnstile arms frequently be-



▲ Phenolic boards cushion the vee platform of Mapes & Sprowl's uncoiler. Material is impervious to lubricants as long as surface glaze is unbroken.

so there is no friction against the metal surface. The stand has screw jacks, like a slitter head, so that you apply equal pressure to the metal.

Polyurethane rolls are generally used for dry metal, and nonwoven felt rolls are the usual choice for oiled stock. The nonwoven rolls are compressed fabric discs, and require occasional dressing and periodic replacement.

McGuire does not recommend drag stands for critical surface metals. "They are simply carpet or felt pads that are squeezed against the moving strips with hydraulic or air pressure, and are guaranteed to scratch unless the pads are perfectly maintained. The pressure surface can become contaminated with metal fines, oxidation or lubricants. One metal fragment can ruin an entire coil."

### Recoiler

Cinch marks can be avoided by maintaining tension at a relatively constant rate throughout the recoiling process. The accepted standard for critical surface materials is no visible reel marks after one wrap, and inspection by stoning should reveal no marks after five to seven wraps.



**"Whenever the finished surface of the material touches another surface, there is the possibility of damage."**

**—Michael J. McGuire  
Chicago Slitter**

Some recoilers have segment risers on the shaft to permit processing coils with various IDs. The risers can emboss the inner wraps of the coil, which is frequently heard as a thumping sound as the coil winds. "You can detect problems by

ear," McGuire said. "You can hear the strip being damaged." He suggests winding critical surface coils onto plastic or cardboard cores to isolate the inner wraps from the recoiler shaft.

Chicago Slitter manufactures an expanding recoiler drum that is said to eliminate damage to the inner wraps of slit mills without the use of cores. The interchangeable drums are made in standard sizes for 16, 20 and 24 in. coil IDs and can be retrofitted to any existing recoiler, regardless of manufacturer.

The gripper bar has an involute curve that eliminates bulges in the strip where the end of the coil is secured, and the clamshell design of the drum makes it effectively seamless when expanded. One operator can change drums in 10-15 minutes, exchanging the units with a coil car or a crane and sling.

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come nicked, which can mark the ID of coreless coils. Inspect the supports and replace them when irregularities can be detected by touch.

Cushion the coil car contact surface. "You can buy felt that sheds water, so you can avoid a potential source of corrosion," McGuire noted. "Phenolic pads can also be used, but they are subject to wear and will retain oil when the surface glaze is broken."

### Payoff practices

Tension scratches, also called pull or cinch marks, result from movement between adjacent wraps of a coil. Either insufficient or excessive braking can cause movement in the coil and produce tension scratches. The best way to avoid marking is to uncoil with the same tension that was used to wind the coil, remembering that uncoiler brake pressure must be reduced as the coil is processed.

A simple but effective way to monitor tension is to draw a straight line with a felt marker or chalk on one end of the master coil from the ID to the OD, and watch for curving of the line. It will move away from the direction of pull if the strip tension is too low, and toward the direction of pull if the tension is too high. When tension is constant, the line remains straight. It's an effective way, McGuire said, to avoid both clock-springing and cinching.

### Peeler rolls

Peeler or hold-down rolls on the uncoiler place the outer wraps of a coil in jeopardy if they are not properly operated and maintained. On slitting lines, the best practice is to feed the strip into the slitter head slowly, and once the metal is fully engaged, lift the peeler roll out of the way. Do not leave the peeler in contact with the coil any longer than is absolutely necessary.

Peeler rolls are frequently powered, and the motor must be synchronized with the uncoiler drive. If the hold-down roll turns faster than the strip is moving, it will skid

on the coil surface; too slow, and the metal will drag against the hold-down roll. In either case, the result is coil marking.

Chrome-plated steel peeler rolls are the best for critical surface metals. They are the most durable, and contaminants do not adhere to chrome. Maintenance is merely wiping with a clean cloth.

"Polyurethane-covered steel rolls are an acceptable alternative," McGuire pointed out, "but in time they can become worn, chipped and gouged. Metal fines and other debris can bond to the polyurethane or become imbedded in the surface, and that can damage a fin-

any banding groove, whether it is on a chrome plated or polyurethane coated roll, must have chamfered edges. This prevents the groove from embossing parallel lines down the length of the metal."

The peeler roll should be counterbalanced so that it does not press into the coil. Pressure should be sufficient only to keep the end of the coil under control. Too much force, and the banding groove will leave a mark, even with chamfered edges.

Many peeler rolls are scored with a diamond pattern to accommodate oily material; lubricants are channeled into the grooves. These rolls



▲ Staggered skate wheels on inspection table downstream of Herr-Voss leveler prevent strip sagging; hold metal flatter than full-width rolls. Wheel material is non-marking polyurethane.

ished or polished coil. Polyurethane works well as long as it is maintained, but requires more diligence in removing foreign materials."

The cost of polyurethane rolls is 30-40 percent less than chrome plated rolls, but the polymer material requires more frequent replacement. The surface is more easily soiled, and the resilient material is subject to cracking and chipping.

Grooving in peeler rolls can be a source of trouble. "Peeler rolls frequently contain banding grooves, which allow clearance for rebanding a master coil if you don't slit the entire length," McGuire explained. "The key point here is that

are not compatible with dry metal, because they will transfer oil to the strip.

### Runout tables

"Any table that transports metal from one operation to another should have a lot of thought put into it," McGuire advised. "The material should be supported on idler rolls, and chrome plated rolls again are the best because they are hard, smooth and easily cleaned. The dark spots that form on polyurethane rolls will in time mark the metal."

"We recommend bridges of ultra-high molecular weight—UHMW—plastic between the rolls on the ta-



▲ Tension stand uses nonwoven fabric rolls to prevent scratching steel that will be coated with porcelain enamel for home appliances and related products.

bles. You can also use phenolic, but it is more fragile and less easily cleaned. UHMW can be kept in pristine condition by wiping with solvent."

McGuire recommends lubricating the bearings on runout tables with oil, which offers less resistance than most greases and allows the idler rolls to turn more freely. "If the idler rolls offer resistance, the metal can skid and be marked. There are ultra-low friction bearings available for idler rolls that were developed for the paper converting industry."

### Feed rolls

For feed rolls, the choice continues to be between chrome plating and polyurethane coating. Chrome is more durable and demands less maintenance, but polyurethane has a higher coefficient of friction with the strip.

Polyurethane's grip makes it superior for starting and accelerating the line, and chrome is preferred for continuous operation once the line is up to speed. If you slit or cut large numbers of small coils with frequent changeovers, polyurethane may be the better choice. For large coils and more continuous opera-

tion, consider chrome.

There should always be a support roll at the crop shear to prevent the strip from contacting the bottom knife.

### Slitter

A powered slitter is a must for critical surface materials, McGuire declared. "You cannot slit them correctly in a pull-through slitter. There is too much stress at the point of cut. There should be no stress on the strip at the point of slitting. No forward or back tension; no side-to-side tension. Pull-through slitters can stretch the metal and induce camber."

Shimless tooling is essential to clean slitting of finished surfaces. "It is the best way," McGuire said, "to produce a finished edge without burrs."

To get the maximum benefit from shimless slitting knives, which have a thickness tolerance of 0.00004 in., shoulder runout of the slitter arbor should be no more than 0.0002 in. TIR, and the head should be parallel and square to 0.001 in. per foot. Slitter shaft parallelism should be 0.002 in. across the entire width.

"Slitter runout is controlled by the bearings, and with good ma-

chine design and proper maintenance, you can get near zero runout on the slitter," McGuire related. "You cannot effectively run shimless tooling on an old slitter head that has high bearing runout."

When setting up slitter knives, the male/female relationship of the stripper rings must be maintained. The male ring diameter should be the same as or slightly greater than the OD of the knife. The female ring should be slightly less than the knife OD, so that all the pressure is into the female side of the cut. If the pressure is into the male side, the inside edges of the knives can emboss two parallel lines.

Stripper rings are available in both polyurethane and Buna N rubber, and McGuire reviewed the performance of each.

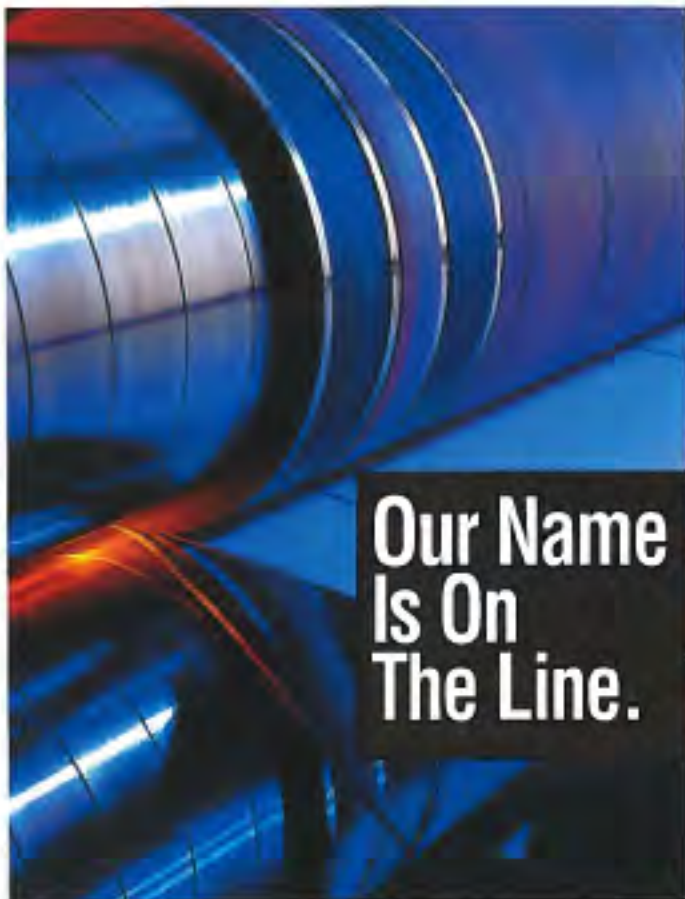
"Polyurethane rolls absorb oil at 1-3 percent by volume. Buna N's rate is 3-7 percent. Buna N stretches and becomes loose on the spacers faster than polyurethane. That may result in knife marks or rippling of the strip edges if the stripper rings become elliptical."

The separator discs that hold the slit mullets apart are generally either saw blade steel or 5200 bearing steel, and should be double-beveled so that the strips are guided apart rather than forced. The spacers between the discs should be phenolic or nylon, and the latter is generally the preferred material. The tooling bar on which the separators rotate needs to be far enough from the slitter that the strip fanout angle does not cause camber in the mullets.

### Tension stand

The tension stand has greater potential for scratching the metal than any other component in the coil line, according to McGuire. "Coil users want tightly wound coils, and tight winding carries the risk of surface damage.

"Roll-only tension stands are by far the most forgiving for painted or polished metal," he continued. "The strips pass between two opposed rolls which rotate with the strip,



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