The Application of Packaging Lines to Coil Slitting Lines

Packaging lines have often been referred to as a luxury rather than a necessity. After all, what do they do for a slitting operation?

A review of current slitting operations indicates:

1. Today's slitting lines have become increasingly sophisticated to achieve operating economics through greater productivity and to produce a higher quality product that is demanded in today's competitive market.
2. Depending on such factors as strip gauge, parent coil weight, mult width, frequency of setup changes, etc., many steel slitting lines can produce an average of 15 to 50 tons per hour, which translates to average mult production rates of 20 to 60 per hour and more. Of course, the average production rates are frequently exceeded for short periods since the nature of slitting is "batch" production.

Many slitting operations package slit mults on the exit turnstile using a coil car to separate the mults and using manual strapping tools to place the radial bands and circumferential band.

This method is suited for low-production slitting lines; however, high-production lines may be "choked" without an efficient method of removing slit mults from the turnstile.

Instead of going directly into a packaging line, one alternative is to remove the slit mults from the turnstile by C-Hook and place them in storage for packaging later. This alternative involves double handling, so labor costs may increase. It also allows more opportunity for production damage and requires in-process storage of material.

The Just-In-Time (JIT) or "continuous" production philosophy favors going from a slitting line through a storage turnstile and straight into a packaging line, with all the production data, including packaging specifications, being on-hand for the operator.

As with other equipment, justifying a coil packaging line is not based on cost alone. It involves consideration of the range of packaging standards applicable to each customer's slitting business and the most cost-effective way of achieving such packaging standards to obtain and/or maintain the business.

In terms of cost justification, the lack of a packaging line can reduce the output of a slitting line, depending on factors such as the quantity of mults produced from each parent coil and the efficiency of the slitting line operation.

The loss of yield through not having a packaging line can be quantified for each slitting program to establish a cost justification.

This article examines some of the many equipment choices available in a packaging line.

Typical Equipment Choices

Turnstile. A turnstile is usually the first component in the packaging line. It is often a four-arm turnstile with powered rotate and positive latching for precise location of the arms. The turnstile usually receives coils from the slitting line by coil transfer car, although some processors prefer a remotely located banding line with the coils transferred from the slitting line by overhead crane and C-Hook.

Since it is becoming necessary to avoid any marking of the slit mults, including the bore, attention should be paid to the shape of the hardened rails on the turnstile arms and to the way in which slit coils are loaded and unloaded at the turnstile.

Coil Downlayer. A traveling downlayer can be used to remove slit mults from the turnstile arm. This prevents sliding the mults along the turnstile arm and helps reduce the risk of mult bore marking and the "telescoping" of adjacent mults. Mult width data can be entered into the controls via a keyboard at the downlayer, by data transfer from the slitter tooling program (shimless tooling), or by a bar code system.

A fixed downlayer with hydraulic push-off of mults from the turnstile arm can also be used. It is often chosen for heavier gauge lines on which the risk of mult telescoping is reduced and mult bore marking may be less critical.

Downlayers may discharge in-line with the turnstile arm or at 90 degrees to the arm, depending on plant layout considerations.

Storage Conveyors. Space and price considerations frequently dictate the quantity of conveyors selected. The quantity can vary from none at all to five or six. A higher

quantity provides extra storage to free up the turnstile arm as soon as possible without waiting for all the mults in a batch to be eye-banded.

Each storage place is individually driven to permit the conveyors to automatically fill up and empty.

Banding Table. Eye banding is often done with 5/8- or 3/4- inch steel strapping, usually with seals, although sealless strapping is also used.

Strapping heads can be semiautomatic (requiring an operator) or automatic. When considering separation of the stacked mults with lumber or fiber fingers or inserting "corner" protectors with the strapping, the semiautomatic strapping head is often chosen, because the operator is there to place these items manually. An automatic strapping head is usually considered along with automatic placement of separators.

For coil processing or to meet the packing requirements of heavier gauge material, 1-1/4 inch eye bands are often applied. A good, average mult strapping cycle time at the banding table is one minute, although 40-second cycle times can be achieved under certain circumstances.

Stacking. Small-diameter coils (up to 42 inches in diameter) are often picked up for stacking with a head incorporating coil bore forks only. Large- diameter coils can be picked up with two-point coil outside diameter (OD) forks. The four-point stacker can handle a range of coil sizes. It has two coil bore forks and two coil OD forks. Most stackers adjust automatically to suit changes in coil bore and coil OD.

The stacker can have in-line discharge or 90-degree discharge, depending on plant layout requirements. The single-carriage stacker has a multi pick-up option that permits up to five mults to be picked up together for speed stacking.

Stacking is usually accomplished with separator fingers between adjacent mults, but there is often a need for some mults to be stacked metal-to-metal without separators. For such stacking, an alternative fork withdrawal system can be used to help ensure an accurate stack is built-up.

Alternative stacking arrangements -- with magnet or vacuum cup pick-up -- are also available, as are turret-type stackers.

Sortation Tables. With sortation tables, the minimum requirement is usually for a two-position shuttle car to give an option for sorting mults into burr-up/burr-down, to sort two different mult sizes, or to pick out reject mults.

Three-position shuttle cars provide these options and are able to sort mults into two positions and to separate any reject mults into a third stack. Also available are four-, six-, and eight-position tables.

The quantity of sorting positions required depends on the processor's product mix. Pallets with runners are placed under the stacking position, and loaded pallets are usually pushed off the sortation table by hydraulic cylinder.

Finishing Operations

Skid Strapping. Securing the stacked mults to the skids involves additional radial bands, usually using suspended strapping tools. Rotary skid banding conveyors rotate the skid in front of the operator.

Skid Wrapping. Paper wrapping or plastic film wrapping of the stacked coils may be required. Dispensers are available for semiautomatic application of plastic film.

Weighing. One section of conveyor usually incorporates weighing equipment to allow the skidded stack to be weighed in-line. Weight indicators, ticket printers, and data links to plant production control systems are usually incorporated.

Skidded Coil Storage and Coil Tipping. Accumulation of completed skids involving three to eight storage stations is common to allow the packaging line to continue operating with intermittent unloading service.

Some coils may need to be tipped into an eye-horizontal position to suit a customer's handling practice. This can be achieved with an in-line tipper.

Unloading the Packaging Lines. For coils "eye to sky," it is common to unload the line by overhead crane with a fork attachment or with a motorized telescopic pallet lifter attachment. Coils may also be removed by forklift truck if there is no other alternative.

Whatever method is used to remove skidded coils from the line must be efficient. Many packaging and slitting lines are choked because of neglect in this area.

For coils tipped to the eye-horizontal position, removal can be by overhead crane with a fork attachment or C-Hook or by a forklift truck.

Control Equipment

Programmable logic control (PLC) - based equipment is used in many of today's packaging lines. Soft-start roller table drives can help reduce the risk of coil edge damage. Non-contact sensors help minimize moving parts and associated maintenance.

Packaging line control systems can be interfaced with slitting line control systems to provide coil and mult tracking through the line for quality and quantity assurance requirements and for shop/production/stock control systems.

Bar coding systems used in conjunction with a computerized stock control system provide continuous updating of inventory and automated billing.

Determining Packaging Line Content

The basic elements in the line -- downlayers, banding station, and stacker -- are relatively easy to specify.

Without considering space limitations, what is an efficient quantity of storage conveyors ahead of the banding table? How many positions are needed on the sortation table? How many skidded coil storage positions are required?

These needs are established after considering the nature of the slitting line and the market being serviced.

Toll Processing. For example, the toll processing business is characterized by long runs and few, if any, mult width changes within a coil. This type of business will likely be satisfied with a two- or three-position shuttle car, whereas a typical short-run service center processing many mult widths will need a six- or eight-position sortation table.

Having several storage positions ahead of the banding table provides time for the turnstile to index without stopping the flow of coils to the banding table, since the banding table is usually the bottleneck in the line.

The quantity of skidded coil storage positions required depends on the availability of crane or lift truck service to unload the line. The more intermittent the line unloading service, the more storage positions will be needed.

Therefore, the choice of a bare-bones line or an automated line is dictated by the nature of the slitting line business and the production rates required.

As mentioned previously, one of the characteristics of toll processing is long production runs with few mult width changes within a coil. The coil processor's usual choice of packaging standards will likely have to be modified to suit the packaging standards of the toll customer -- usually very exacting and varying from company to company.

Many toll customers specify the use of 1-1/4-inch-wide strapping with seals at the banding stations. An investment in a fully automated 5/8- to 3/4-inch sealless banding station is not appropriate in these circumstances.

Other finishing operations, such as skid construction, strapping, bar coding, and paper/plastic film wrapping, may need to be customized for toll processing.

Aluminum Coils. The evolution of packaging lines has been focused toward steel slitting operations, which constitute the majority of the market. Therefore, packaging of slit aluminum coils is a special case. Many aluminum operations involve thinner gauges

with the outer wrap secured by tape instead of radial bands. Unfortunately, steel-type packaging lines are not particularly suitable for aluminum, mainly because of the more delicate nature of the edge of each slit mult.

There is really no need to downlay each slit mult. They can be simply sorted into eye-horizontal stacks with or without separators. After sorting, the horizontal stack is upended onto a skid and finish packaged. This minimizes the exposure of each mult face and the risk of edge damage and avoids a slit mult traveling down a roller conveyor on its delicate edge.

Conclusion

Some slit coil packaging lines in operation today incorporate conveyor and stacker features that can inflict damage on a product. However, packaging lines have received much engineering attention in recent years because of increased needs to package a product more efficiently and without product marking.