TINPLATE COIL PACKAGING STRETCH WRAP METHOD

HISTORICAL BACKGROUND

Since the inception of packaging tinplate coils for shipment by the steel industry, two considerations have always been paramount. First, this high-end valued steel product must be protected from damage in shipment and handling. Secondly, the tinplate must be protected from corrosion until processed by the customer.

Packaging remained basically unchanged for nearly twenty-five years using various combinations of kraft paper, corrugated kraft, reinforced kraft papers with polyethylene laminates and coating, kraft fiberboard and metal fabricated containers. Due to the thin gauges of tinplate, large coils have been, and continue to be, shipped eye vertical on platform skids to prevent coil collapse and edge damage which could occur if shipped in rolling position.

End use applications make traditional methods of corrosion prevention such as slushing oils not feasible, and tinplate is generally considered as "dry" metal for shipment. To provide this "dry" packaging environment and avoid dew point condensation during storage and shipment, shippers specified and used materials that would prevent penetration of moisture from without while allowing humidity within the package to escape through the breathable tinplate wrap. Kraft paper, corrugated and fiberboard being hygroscopic, i.e., able to adsorb or condense moisture from the atmosphere, served a dual role with mixed results. The fibrous material could adsorb excess moisture to saturation, but also gave up moisture with temperature variation, and all without difficulty except for conditions when the atmosphere reached dew point or temperature at which condensation would occur. Through experience and planning, tinplate producers learned to cope with changing atmospheric conditions.

Following the disastrous economic conditions for the steel industry in the early 1980's and beyond, a new wave of cost consciousness enveloped the industry as a necessity to survive. The limited number of tinplate producers, all heavily invested, were pummeled by eroding markets, substitute materials, foreign competition on black plate as well as coated, and emerging mini-mills siphoning margin from primary steel operations. These pressures have been unrelenting and still drive the search for new packaging concepts and materials that might help alleviate the dilemma.

STRETCH WRAP CONCEPT

Use of polyethylene in the form of stretch wrap film has been around for over 25 years as a unitization and bundling type medium. Over the years, a number of steel packaging engineers gave this new material a quick, if not cursory, look for potential application, and then cast it aside when condensation developed and the film lacked expected handling protection. Sadly to say, there are some who remain skeptical due to limited users as knowledge and experience continue to expand.

A major breakthrough occurred in 1992 when Cortec® Corporation developed and patented VCI-126 Cor-Pak™ Stretch Film. This high performance LLDPE (Linear Low Density Polyethylene) stretch film incorporates Cortec® VCI multimetal corrosion inhibitors and moisture absorbing desiccants. Corrosion and excessive condensation associated with conventional packaging stretch films were virtually eliminated with this new patented product.

During development of VCI-126 Cor-Pak™ Stretch Film, Cortec® worked closely with BHP Steel and Australian Challenge to meet BHP's objectives for a material to effectively stop corrosion on cold rolled steel, protect against coil damage and be fully recyclable. Results at BHP Steel have been phenomenal, as they are using Cortec's patented film at 6 plants now and have virtually eliminated corrosion on packaged coils including export shipments.

TINPLATE STRETCH WRAP PACKAGING

Early 1993, the vision of Robert W. Kramer, a metals packaging specialist with Unisource, Inc. in Pittsburgh, PA, began putting the pieces together of the puzzle that had been eluding tinplate shippers for some time. He studied the results Cortec® was having with VCI-126 along with experience Sumitomo Light Metals of Nagoya, Japan was having shipping aluminum coils. International Packaging Machines, Inc. of Naples, Florida built the world's largest stretch wrapper for Sumitomo to handle 23 ton coils, 8/ft diameter, loaded eye vertical on 5,000/lb. steel platforms and stretch wrapped for domestic shipment without steel banding. Realizing the potential, Kramer undertook the arduous process of introducing and proving effectiveness of wrapping tinplate with VCI stretch wrap as a revolutionary new packaging method. Since Cortec's VCI-126 Cor-Pak™ Stretch Film prevents corrosion and there was proven experience of the strength to unitize 23 ton coils to skids, then why would it not work for tinplate? Thus began the Weirton Steel Stretch Wrap Project.

WEIRTON STRETCH WRAP PROJECT

Once independently owned and then a division of National Steel Corp., Weirton Steel always had a "can do" spirit. So it was no surprise when National chose to divest their Weirton holdings that Weirton believed they could go it alone. With the national economy at a low ebb and the American steel industry at rock bottom, Weirton's management and employees formed the largest ESOP (Employee Stock Ownership Plan) and took control of Weirton Steel on January 11, 1984. Their resolve to achieve success through dedication and cost effectiveness is perhaps unmatched anywhere in the world.

Weirton's Tin Mill is one of the largest tinplate producers in the U.S. and always a leader in packaging their output to customer satisfaction. As one of Weirton's top MRO suppliers, Unisource constantly searched for new materials and methods to fulfill an accepted responsibility to provide the most cost effective packaging for their business partner.

The concept to stretch wrap tinplate coils was floated through all levels of Tin Mill operations and sales at Weirton as potentially a significant cost reducing

alternative. As the industry continues to pursue packaging materials that could be fully recycled into other useful products, here was Cortec® VCI-126 Film, a viable proven product that stops corrosion, develops holding power of immense magnitude as a stretch film and is fully recyclable.

Further research by Kramer determined that the holding power of VCI stretch wrap through its elasticity curve was far greater than steel strapping. The normal cross pattern of two steel bands 1¼ inch width 0.031 hi-tensile steel strapping has a breaking strength of 10,500/lb. (2@ 5,250/lb.) and AAR approved for coils on skids. Projecting 60 wraps of 1 mil LLDPE Cortec® VCI-126 Cor-Pak™ Stretch Film around a 56 inch diameter coil achieves total holding force of 150,000/lbs. or break point.

Armed with overpowering data pointing toward feasibility of stretch wrapping coils on skids, Weirton's Tin Mill moved ahead scheduling trials early in 1994. A series of trials were conducted over a six month period with coils averaging 54 inch diameter on 56 inch skids in weights ranging from 10 to 12 tons. At this time, the skids were prepared with 0.083 solid fiberboard octagon on the skid for nail-pop protection, die cut corrugated outer sunburst, 4 mil VCI-126 mono film as a moisture barrier and a corrugated circle to cover the sidewall and prevent any cutting of the barrier film. The top surface of the coil was prepared in like manner except for elimination of the solid fiberboard when not required by specific customers. Starting with 30 inch film of 2 mil thickness, incredible force to load strength was achieved with 38 to 48 wraps. Later trials were conducted with 20 inch film, in both 1 mil and 1.5 mil, following the same wrap sequence and all with generally satisfactory results for holding force.

It started to become evident in the trials that coil size, as related to skid size, posed potential problems. The larger the gap between coil and skid corner - the greater propensity for film separation at the corner. Corner pads fashioned from corrugated or layered film appeared to alleviate the situation in trials, but corner gap variation developed into a critical issue later in full production.

Shipments of trial coils verified projected holding force, as well as handling and corrosion protection. Specific trials to evaluate dew point conditions developed some condensation situations, but the VCI-126 Cor-Pak™ Films prevented corrosion. No slippage of coils on skids was noted during truck movements. However, on a shipment of 8 coils via special rail car with coil straps, several straps pulled the stretch film up off corners and movement occurred leaving a few coils off center.

Following extensive trials wrapping and shipping coils with VCI-126 Cor-Pak™ Stretch Film, Weirton's senior management approved purchase of an IPM Model RO-88 fully automatic stretch wrapping machine, which was placed into production in January 1995. Utilizing rotary overhead stretch wrap technology provides a feasible means to install the equipment over and in-line with the existing conveyor system. This unit is equipped with fixed gear pre-stretch capability as did the semi-automatic Model RO-88SM used during the trials. Gear Ratios of 2.5:1 (250% yield), 3.0:1 (300% yield) and 3.5:1 (350%) yield) were evaluated and best performance achieved at 3.0:1 pre-stretch.

It was quickly learned in full production mode why pioneering poses greater risks than following prior knowledge. While the AISI approved standard skid design is specifically configured for steel banding, no changes were contemplated for stretch wrapping. Corners on the tinplate skids became a critical issue requiring some minor adjustments. Film force to load strength was so great that stretch film began migrating up off the corners. This condition became further exaggerated when the gap between coil and skid corner increased due to coil diameter variation. Without positive hold at all corners, holding strength was compromised greatly and coils began shifting on skids.

Various methods were tried to resolve the corner slippage, including padding with different materials, rounding corners, adhesive applications, varying film thickness and changing force to load. Ultimately, a slight adjustment in skid design to extend the lead platform board ½ inch beyond skid runners both on the leading edge and lateral sides made it possible to lock the film wraps securely to the corners.

The wrapping sequence program provided by IPM, Inc., and further enchanced by Weirton's Tin Mill engineers, minimized the corner gap problem while increasing film contact around the coils for improved hold with fewer wraps. By alternating the stretch wrap to cover two corners and then cycling up around the coil opposite the corners wrapped and repeating the sequence until all corners were covered became a major improvement. This program consists of 5 wrap cycles for each side of skid, 5 wraps cycling up, 8 wraps at top of coil, 5 down and 2 final wraps around the skid perimeter. These 40 wraps were found more than sufficient to hold 12 ton coils on a skid without movement.

In the continuing quest to reduce package costs, all components of the stretch wrap package were scrutinized. As corrugated kraft costs escalated in 1995 to their highest level ever following 10 years of depressed pricing, alternative products continued to beg examination. Attempts to use only VCI-126 barrier film next to solid fiberboard on the bottom thereby eliminating two corrugated die-cuts, resulted in coil slippage and a major safety issue. Another alternative approach to resolving the slippage led to padding materials of shredded fiber and reprocessed wool felt which were found to dampen vibration and nestle the coils. Using 5/lb. density of ¾ inch thickness, which subsequently has been reduced to ½", allowed elimination of corrugated as well as the 0.083 solid fiber octagon. While there is minimal trade-off in material costs, significant savings are realized from labor required in skid preparation.

During the initial trials with 48 wraps of 2 mil film, actual film use per coil was no greater than 2.5 pounds. When full production was attained with the up/down cycling in wrap sequence, film consumption was reduced to 1.7 pounds using 1.5 mil film.

The decision by Weirton Steel to move forward with stretch wrapping was to reduce packaging costs and improve profitability as previously noted. While some opportunities to reduce material costs have developed, the greater savings result from elimination of steel banding and labor cost associated with the previous wrapping process. Specific cost savings ultimately realized

would be proprietary, but a 50% overall reduction should be reasonably attainable.

Cost reduction potential for any tinplate producer would, of course, be dependent upon physical mill layout, coil handling and current packaging procedures.

INDUSTRY IMPACT

Stretch wrapping tinplate coils on skids is destined to set new standards for packaging in the steel industry. Although improved cost effectiveness would alone justify this new packaging concept, other advantages could become equally or perhaps even more significant.

Use of Cortec's environmentally safe VCI-126 Cor-Pak™ Films will stop corrosion, thereby eliminating claims and rejections due to corrosion experienced in the past. Containing no hazardous chemicals injurious to persons or the environment, Cortec® has been granted FDA approval for all Cor-Pak™ Films opening great opportunities for use. Additionally, this environmentally safe product line may be recycled without concern, whereas films containing nitrites would not qualify.

Waterproof tinplate wrap, historically the industry standard, is a co-mingled material of poly coated kraft that can only be disposed of by landfill or burning which is currently prohibited in some jurisdictions and eventually may be in all. By converting to Cor-Pak™ fully recyclable film, the industry can extend their commitment to the environment by using a recyclable material.

Perhaps by far the greatest advantage offered through using VCI-126 Cor-Pak™ Stretch Film is customer satisfaction! Those who have ever experienced unwrapping a tinplate coil banded to a skid will relate to the effort and frustration involved. With a simple slice by a razor cutting knife, the two pounds of stretch film securing the coil to the skid is easily removed and rolled into a ball for deposit in the recycling bin. Thus, the driving force for future development and use of stretch wrap to package tinplate will be customer specification.

Cortec® is proud to have led the way in new product development that made possible this exciting new packaging concept. The steel industry's objectives for cost effective applications that are environmentally friendly and increase customer satisfaction are shared by Cortec® Corporation and remains their mission for future development and growth.

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