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Tech Note
Technical Notes from the Technical Committee, NIBA – The Belting Association

#25 The Basics of Lightweight Conveyor Belting

The overall belting market share for lightweight conveyor belting has increased modestly over the past couple of decades. The primary reasons for the increase are process automation, market globalization, and competition. Process automation has resulted in increased demands on belting that often require the properties of a lightweight belt design. Globalization and competition have influenced equipment manufacturers to keep up with the latest in lightweight, low cost and energy efficient designs. The move toward faster process and transport speeds, combined with compliance to increasingly strict standards in areas such as noise and sanitation, has favored the growth of lightweight belting.

Lightweight Belt Categories

The lightweight belting market is primarily made up of thermoplastic covered, solid plastic, lightweight rubber and non-woven belting. Each of these categories offers unique properties and advantages as summarized below.

Thermoplastic Covered

Thermoplastic coatings that can be melted and re-hardened while retaining the material physical properties characterize this segment of belting. This property provides the unique advantage of high quality heat welded splices and the ability to configure belts for specific applications by adding a variety of belt accessories (discussed in more detail in a later section). This style of belt excels in a diverse range of applications due to the variety of cover and fabric combinations available. The most common covers are PVC, polyurethane and polyolefin. These cover materials provide a wide range of properties such as cut/abrasion resistance, chemical resistance, oil/fat resistance, product release, high/low friction, impact resistance and sanitation. The thermoplastic property also facilitates a wide range of surface profiles allowing specialized process functions. The major fabric used is polyester due to low stretch/shrink, low cost, and availability in a wide range of styles including laterally stable (monofilament), laterally flexible, and low noise. Cotton fabrics are also common, particularly in the bakery industry where product release and absorption properties are utilized. The most significant industries and advantages for this style belting are highlighted below:

Food Processing: Industries such as *bakery*, *confectionery*, *snack foods*, *meat and poultry*, *dairy*, *fruits and vegetables*, and *seafood* are just some examples of where lightweight belting is utilized. Automation of the manufacturing processes has led to small pulleys and process conditions that lend themselves to the flexibility and versatility of lightweight belting. The thermoplastic, heat welded splices provide superior reliability, flexibility and sanitary properties. Other key belt properties for this market segment are low stretch/shrink, cut and abrasion resistance, oil/fat resistance, good product release/grip properties, easily cleanable/hygienic constructions, lateral flexibility/stability and conformance with FDA/3A/USDA standards.

Unit Package Handling: Conveyors in post offices, distribution centers and airports are becoming lighter and faster, while requirements for noise are becoming more stringent. This favors the longitudinally flexible, low friction/low noise polyester fabrics used in certain lightweight belt constructions. Cover materials offer a range of performance characteristics such as high friction (incline/decline/metering), low friction (accumulation, side

loading), flame retardant properties and durability (heavy PVC and PU). The thermoplastic, heat welded splices are becoming increasingly used in logistics for their longevity and elimination of product damage sometimes caused by mechanical lacing.

Other Industries: Other major industries that utilize lightweight belting are pharmaceutical, treadmill, electronics, plastics, bottling/canning, textile, wood/paper, and tobacco.

Solid Plastic

Solid extruded plastic belts offer unique advantages for a number of industries. Since they are offered with no reinforcing fabric, they exhibit the highest hygiene level of any belt available. They are available in extremely durable and cut resistant versions that together with the hygienic qualities make this belt ideal for many meat and poultry applications.

This style belt can be spliced onsite by a very quick method that minimizes downtime. The combination of properties (durability, hygiene, splicing) makes this style useful in other industries such as bakery, cereal, general food processing, glass, brick and many other related industries.

Lightweight Rubber

These belts have thermoset rubber covers that differentiate themselves from the thermoplastic covers. Typical rubber types used are natural, SBR, neoprene, and nitrile. These belts are used in many of the same applications as the thermoplastic belts; however, the rubber properties such as low temperature flexibility, grip characteristics, durability, and other physical properties make them suitable for a variety of applications. Some of these applications are historical in nature and there is a trend towards more thermoplastic styles. The disadvantage of this type of belt versus thermoplastic is generally lower flexibility and no thermoplastic splicing option.

Lightweight rubber belts can be found in many industries including unit package handling (general material transfer, metering, incline/decline, etc.), food processing, corrugated industry, and general industrial use.

Non-woven Belting

The fabric bases in the belts described above are standard woven types. Needle punched (non-woven) fabrics offer additional belt properties. A base of non-woven material creates an impact-resistant construction. Uncoated versions also offer a gentle surface for handling sensitive products. Non-woven belts with needled construction exhibit very low noise as well as low fraying characteristics.

The unit package handling industry utilizes high volumes of this belt style for the low noise, low fray and impact resistance. The low fray properties also make these belts ideal for some food processing applications.

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Splicing Techniques

One of the significant advantages of lightweight belting is the splicing versatility and excellent properties of the splices. In particular, the thermoplastic category of belts utilizes that property to allow heat-welded splices that exhibit a high percentage of the original belt flexibility and strength. Typical splices possible in the lightweight category are:

1. ***Mechanical (metal)***: For all lightweight belt types. Offers quick installation and low cost but some potential disadvantages may be reduced flexibility, noise, pollution, and product damage.
2. ***Finger and Double Finger***: Primarily used on thermoplastic belts. These heat welded splices offer excellent flexibility and high strength particularly with the double finger. The double finger is also more reliable in polluted environments, v-guided belts and in side loading circumstances.
3. ***Step***: This splice retains the highest percentage of the belt strength and is used in heavier applications. It is also more reliable for trough applications. Hot or cold (glued) splices are used on the thermoplastic belt style while a glued cold bond is most commonly used on the rubber belts.
4. ***Skive***: This is a common splice for non-woven belts and is an alternate splice for thermoplastic and rubber belting. This splice can be done as a hot or cold-glued splice.
5. ***Plastic spiral***: Nonmetallic plastic lacing is mostly used with thermoplastic belting. A main use is in the food industry for metal detectors or wherever you want to avoid metal. It also is quieter and more reliable than metal lacing in many high-speed applications and is, therefore, finding wider use in the logistics industry.
6. ***Quick butt weld***: A convenient and quick butt weld is possible with the solid plastic belts using specialized splice equipment.

Accessories

A wide variety of accessories can be applied to lightweight belting to enhance performance. The general purposes of the accessories are to:

1. Ensure capacity
2. Increase capacity
3. Track belt
4. Position product
5. Improve hygiene
6.

Typical types of accessories are tracking strips (mostly v-guides), carriers/cleats, corrugated-sidewalls/spill edges, and sealed edges. Accessories can be heat welded to thermoplastic belts providing a homogeneous, very reliable connection.

Belt performance is also enhanced through perforation. These belts can be found primarily in vacuum and dewatering applications.

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Tracking

One of the most important aspects of using lightweight belting is proper belt tracking. Improper tracking leads to short belt life, increased downtime, equipment damage (over-tensioning) and product damage. The major causes for mistracking are the *conveyor*, the *application*, and the *belt*.

Conveyor

- Pulleys: out of square, not horizontal, having a taper, polluted, failed bearings
- Slider bed: not horizontal, high or uneven coefficient of friction
- Support frame: unstable
- Others: improperly installed scrapers, side skirts, knife edge transfers

Application

- Product loading: asymmetrical, side loading and unloading, diversion
- Processes: various processes carried out on the belt
- Environmental changes
- Pollution

Belt

- Belt tension too high or too low
- Not square splice
- Not cut straight or fabric camber
- Unequal length side to side
- Not constant thickness

Options available to correct tracking problems fall into one of two categories: fixed tracking techniques and variable tracking techniques.

Fixed Tracking Techniques

These are solutions that are fixed in place or adjustable manually.

- Crowning: Lightweight belting can make use of pulley crowning to aid in tracking. The crowns are typically trapezoidal and smaller than in heavyweight rubber belt. As a rule of thumb, the difference in the largest and smallest pulley diameter is generally near 1%. Large crowns can result in the belt not conforming to the crown, particularly with laterally stiff monofilament fabrics. If a lightweight belt does conform to an overcrowned pulley, there is the possibility that the belt will buckle or fold over.
- Tracking roller: One or more rollers in the return section can be provided with side-to-side adjustment to track the belt. In trough conveyors, adjustable trough assemblies can be used for tracking.
- Fixed on belt: Guide ropes such as tracking strips or v-guides can be heat welded or bonded to the belt.
- Fixed on installation: Edge guides or flanges can be mounted on the conveyor to track the belt. This method is generally not recommended for lightweight belting due to the high potential for belt damage.

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Variable Tracking Techniques

These solutions automatically adjust to changing tracking conditions.

- Automatic tracking systems, which adjust tracking rollers by sensing the belt edges using a point of reference such as mechanical finger, air actuated or optical sensor.

Conveyor Design Rules of Thumb

The following is a brief guide regarding conveyor design important to the proper functioning of lightweight conveyor belting.

Roller Support

- Flat carrying rollers
  - Pitch for bulk transport: 1x the belt width with a maximum linear distance of 1 meter
  - Piece goods: maximum 0.5x product length
  - Length of carrying rollers: belt width + 50mm
- Trough assemblies
  - Pitch: 1x belt width with maximum linear distance of 1 meter
  - At loading point adjust pitch as a function of loading height, product size and loading method
  - Maximum trough angle: V-trough assembly= 25 degrees; Three part= 40 degrees
  - Transition length: 1- 1.5 x belt width

Slider Support

- Construction: Low friction surface such as steel, stainless steel, or hard plastic, never painted
- Width of support: belt width + 50mm

Belt Support Return Section

- Pitch of return rollers: 2-3 meters

Drive Drum

- Position: preferably at the head of the conveyor resulting in a pulling arrangement
- Arc of contact with belt: as large as possible; > 180 degrees
- Coefficient of friction: as high as possible; use lagging material if needed

Tensioning Device

- Method: Tail Drum
  - For pulling arrangement directly after drive drum
  - For pushing arrangement directly before tail drum
- Amount of tensioning: based on calculations of frictional forces

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Lightweight Belting

- Belt width
    - For bulk goods: 1.1x the width of the product flow + 50mm
    - For piece goods: width of item + 100mm
- Running direction: always try to achieve pulling arrangement; in case of two directions try to achieve pulling arrangement for most important running direction

Knife Edge Transfer

- Arc of contact: as small as possible; preferably < 135 degrees
- Friction: as low as possible; polished low friction material