Up to Speed on Conveyor Chains

Key Principles in Evaluating Chains for Packaging Applications

Depending on the application, there are different types of conveyor chain or belting that fit specific application requirements. In some cases, there is more than one solution. In other applications, the chain selection may be limited. Belting material and construction will define its performance advantages.

The importance of selecting the right conveyor chain, however, goes beyond functional requirements. It is also a strategic decision that will affect the productivity of the entire conveyor line. Manufacturers are pushing higher rates of output from their production line and at the same time focusing on decreasing downtimes. The proper selection of the best chain for the application can provide increased efficiency of the line. Failure to choose the best chain can cost valuable production time and reduce line output.

Described in this article is an in-depth look at the criteria that affects the chain selection and strategies relating to the specific conveying application.

OPERATING ENVIRONMENT

Operating environment refers to the factory conditions that exist for the conveying application. Chain material selection is very important to withstand the effects of the environment.

General. An environment that does not have significant product or manufacturing related effects during production is considered a general application. This category has the widest variety of chain choices and allows for more economical options. Further, standard conveyor components also provide for a cost effective conveyor purchase.

Washdown. High pressure water and chemical cleaning procedures create a wet and caustic environment, which affects chain selection. For example, chloride or peroxide will attack

Acetal chains. Polypropylene material, however, will be able to withstand a wash-down environment. The pin material in the chain must also be a consideration. In a wet environment, nylon pins absorb water, causing functional problems and overall weakening of the pins. The MSDS (Material Safety Data Sheet) provides chemical breakdowns of cleaning compounds which can then be compared to the chain manufacturer's material recommendations.

Freezer Room System

This sanitary freezer room system was engineered for handling bulk frozen food in a -20°F manufacturing environment. The chain used was Intralox Series 800, made from Acetal material with polyethylene pins.

Cold: The cold criteria temperatures range from 32°F down to zero degrees. While these temperatures require special chain selection, there are still more choices than in a freezer room application. Acetal chain material and pins are rated for cold temperatures.

Freezer: For temperatures between zero degrees and -20°F, Acetal chain material is preferred. Nylon is also an affective choice for the pin material in extreme cold temperatures. Proper chain selection is especially critical in freezer rooms to prevent manual intervention and to reduce maintenance.

Warm: This environment is defined in temperatures ranging from 70°F to 200°F. Applications in warm environments include conveyors for heat tunnels, steam tunnels and shrink banders. A variety of metal chains including wire mesh chains are available in this temperature range. There are also some heat resistant nylon chains available for use in warm environments, depending on the exposure to heat.

Elevated Temperature: For applications that are engineered for a hot environment of over 220°F, such as shrink tunnel

Anti-Static Conveyor System

This system was designed for various types of hair care products. The flammable nature of the hair products and the aerosol packaging created the demand for an anti-static system. The Rexnord AS880TAB-K 3-1/4" tabletop chain was used, as well as anti-static guide rails, wear strips and explosion proof motors.

conveyors, metal chains are required. The conveyor components themselves are also specified for extreme heat, such as brass wear-strips.

Chemical: Production lines where products have chemical spillage or when chemicals are used in the cleaning process are both examples of a chemical environment. For constant chemical exposure, stainless steel chain and pins are preferred. The MSDS provides chemical breakdowns which can be used in consultation with the chain manufacturer for proper chain material selection.

Electro-static: Static build-up is caused by friction, especially on production lines running a plastic container on plastic chain. Static causes safety hazards in the plant. Anti-static (electrically conductive) chain material allows the static to safely discharge through the conveyor to the floor. Also lubricating or adding moisture to the conveyor running surfaces is another method used in reducing static.

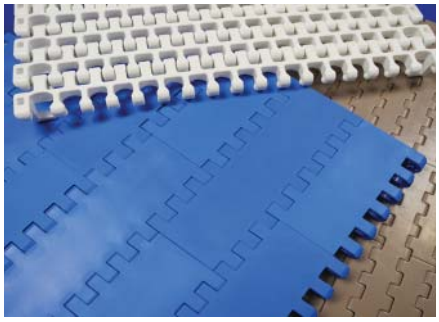
Explosive: Product fumes in an electro-static environment could lead to a dangerous explosive situation. In addition to chemical fumes, particles like sugar or flour dust can also provide an accelerant for static arcs. Also, products themselves that have an explosive make-up such as ammunitions also fit this category. Steel chain is preferred as well as a different metal material in the wear-strips such as brass. Other explosion proof conveyor components, like motors for example, are all part of an explosion proof system.

Abrasive: Whether caused by the product running on the conveyor, or a condition of the plant, abrasive environments also require special chain consideration. Cardboard build-up, broken glass, baking flours, cocoa powder and cereals are also examples of abrasive materials.

This matter will wear away any chain material, but stainless steel sprockets and abrasion resistant rods will help to increase belt life.

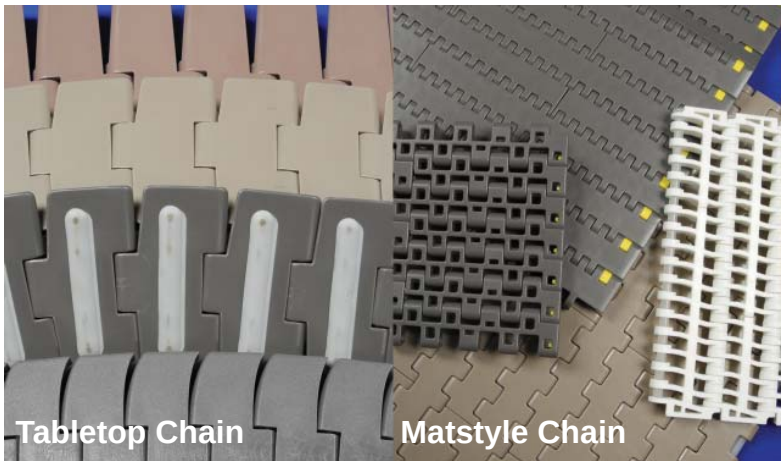
PRODUCT HANDLING REQUIREMENTS

Product handling requirements will also guide the chain selection process, particularly with the surface of the chain. For example, products that require low pressure conveying will benefit from LBP (Low Back Pressure) chain. Vacuum required to stabilize products will need to utilize a perforated chain. Another example is a high-friction (rubber top) chain that assists packages through an incline.



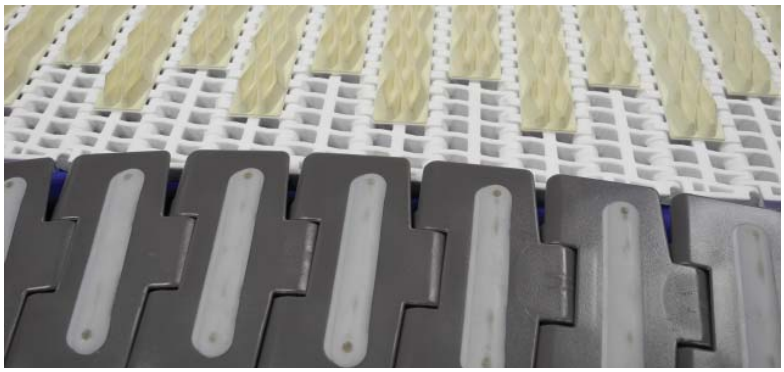
The color of the chain is often chosen according to the product and application specifics. A particular chain color may be used when conveyors are integrated with Vision systems to provide product placement or rejecting. And sometimes chain color is a plant preference.

Chain Identifiers



Tabletop Chains: Are popular for package and product handling. Common widths start at 3 1/4" through 12".
Plastic Matstyle Chains: Come in a wide variety of closed or open designs and their construction allows application flexibility.

Chain Tab: Under Tabletop chain, tabs guide and drive the chain.
LBP (Low Back Pressure) Chain: Spinning rollers are integrated into Tabletop chain designs to relieve back-pressure.



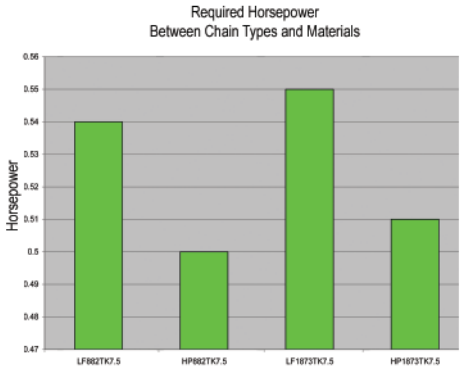
Friction Chain: Friction inserts are available on both tabletop and matstyle chains - used to prevent product slipping.

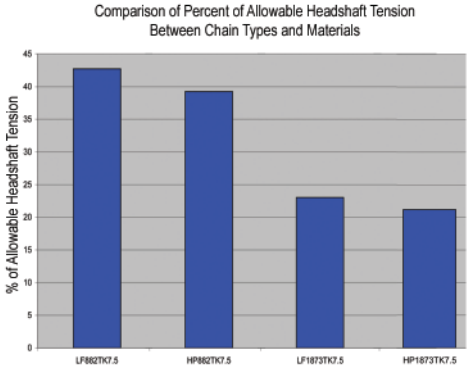
CHAIN STRENGTH

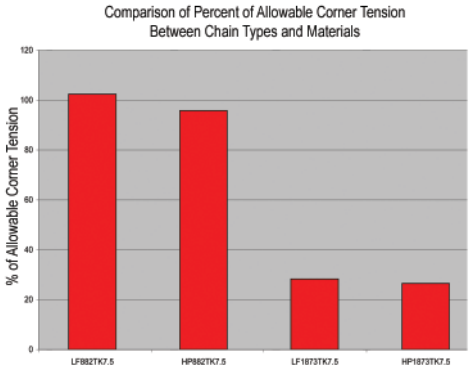
Speed and Load

The size of the product and the weight of products travelling on the chain must also be considered. Chain pull is the capacity under the load and speed of the application that is a measurement (in lbs. of force) provided in percentage of chain strength.

The load calculation will provide information about the overall tension of the chain. First of all, it will define whether the chain will work for the application. And secondly, it will provide insight on the life expectancy of the chain. For example, if one type of chain calculation yields a chain pull of 80% and another chain yields 50%; then the chain using 50% pull will have longer life expectancy than the chain using 80% of its strength. The stronger chain may be more expensive, but will provide longer life and less maintenance for the application. It should also be noted that every type of chain and every application is different, so the chain pull calculation must be considered on every chain selection scenario. Further, the chain pull used in the application must not exceed the chain manufacturers recommendations. Nercon works closely with leading chain manufacturers on the engineering requirements of chains on projects. Visit the chain manufacturer's web site for on-line chain pull calculators and more information.







This chart, courtesy of Rexnord Industries, compares two types of chain materials, a low friction series (LF) and a high performance (HP) series. In this comparison example, both HP series chains have less horse power requirements than the low-friction chain. It is interesting to note that the material in HP chain has high slip properties; greater than the LF material.

When comparing the tension of the chain at the head-shaft (drive), the LF1873 and the HP1873 both show lower tension than the 882 styles. In the corner tension analysis, the results are similar with the 1873 styles showing lower tension. The 1873 chain types are both constructed with a steel base, which provides strength around the shaft and at the corners, resulting on low percentage of allowable tension for this application example.

Plastic Chain Material

Polypropylene: A standard, relatively strong chain material for general applications. It has chemical resistance to many acids, bases, salts and alcohols. It may be somewhat brittle used in cold temperatures.

Polyethylene: Offers high impact strength and flexibility with resistance to fatigue. It is also chemically resistant to many acids, bases and hydrocarbons.

Acetal: Is stronger than polypropylene and polyethylene with a good balance of mechanical, thermal and chemical properties. Acetal thermoplastics also have a low coefficient of friction.

Nylon: Can be used in place of standard Acetal for impact intensive applications. Nylon, however, does absorb water and is more susceptible to damage than Acetal.

Coefficient of Friction

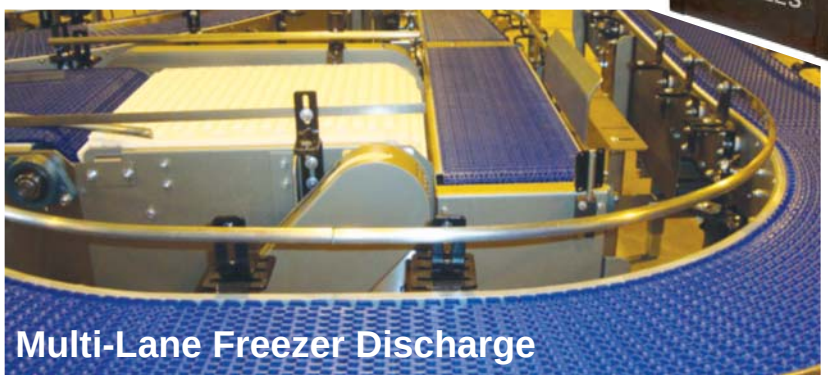
Two surfaces that rub together create friction. Friction creates drag on the belt sliding on the conveyor frame or under the product. When possible, look into chain material with a low coefficient of friction. It is advantageous to reduce friction on conveyors which helps to reduce belt pull and power required for the line.

Durability and Maintenance

Some chain material is stronger than others, but overall chain strength is affected by the weights and speeds (chain pull), and environmental factors. The more extreme conditions of high speeds, heavy loads and abrasive matters will cause faster belt surface wear than in general environmental conditions.

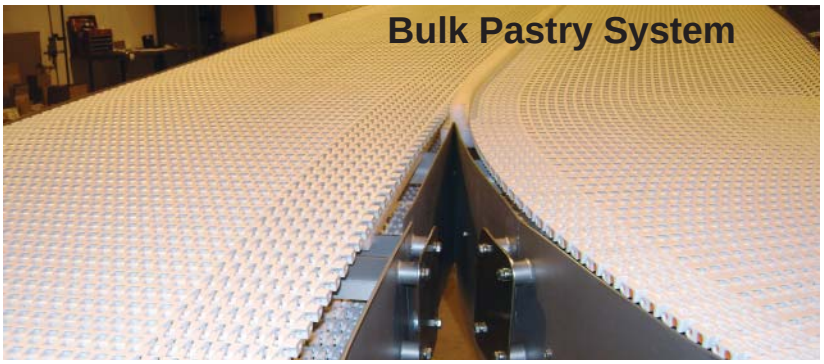
Chain pins and sprockets are also wearable components. Shorter chains wear faster than longer chains running at the same speed because they have increased travel around the sprockets. Sprocket and tooth wear is also increased with higher speeds. Sprockets with more teeth cause less hinge rotation and wear less compared to sprockets with fewer teeth.

Case Histories



Multi-Lane Freezer Discharge

In this three lane freezer discharge conveyor application, Intralox series 2400 matstyle chain was specified. The acetal chain, rated for freezer room temperatures, operates in a -20°F room. The 12" wide, side flexing chain carries bundles of ice cream to downstream operations. Nylon pins were specified for this application.



Bulk Pastry System

This system was engineered to convey small, bulk pastries at 50 FPM (feet per minute.) A small pitch was required around nosers and limited floor space demanded tight side flexing chain. Rexnord chain WSM1285 was specified for the application. The 30" wide, white chain was sanitation friendly.

LBP Conveyors

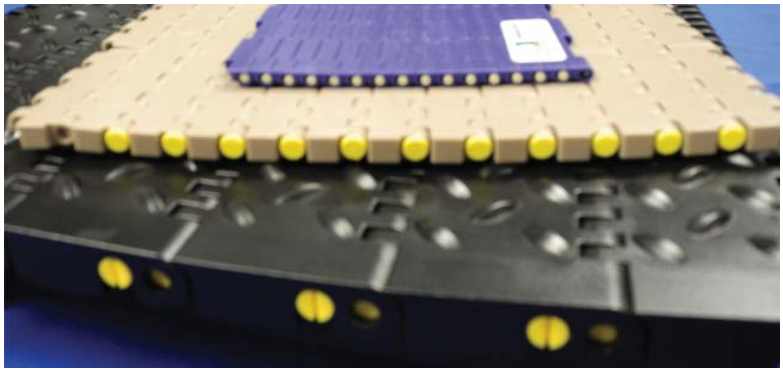
The application called for 30 feet of conveyor feeding case packing operations. The product was a liquid filled PET bottle, labeled and shrink wrapped into 4-pack bundles. Rexnord's LBP821 provided low back pressure during accumulation for short case packer downtimes. The chain reduces motor requirements and product damage.

Chain stretch occurs eventually on all conveyor systems. It is caused by the continuous tension on the chain. Over time, the pin housings stretch from a round to an oval shape. Depending on the amount of chain used in the application, the chain length will increase over use. It is recommended to remove chain lengths when this occurs. Over extended periods, chain stretch can become so extreme that the pins no longer match up with the sprocket, causing tracking and slip problems. Then it is time to replace the chain.

Some companies have specific strategies for chain replacement driven by operations or maintenance managers. Maintenance departments often replace original chain selections with more durable chain to reduce repairs. When these changes are made, however, chain selections are limited to chains in a series. Swapping out chains between families may require alterations to the conveyors and components. Another strategy we have seen is using a different color of chain in a different area of the plant, which leaves the guesswork out of which chain goes where.

Chain Terms

Load: The load is the maximum weight of all the products on the chain. Load may include accumulation and back pressure conveying conditions.



Pitch: Pitch is the measurement between pins. The black chain above has a large pitch that might be used for handling cartons or cases. The blue chain above that has a small pitch is used for a noser conveyor.

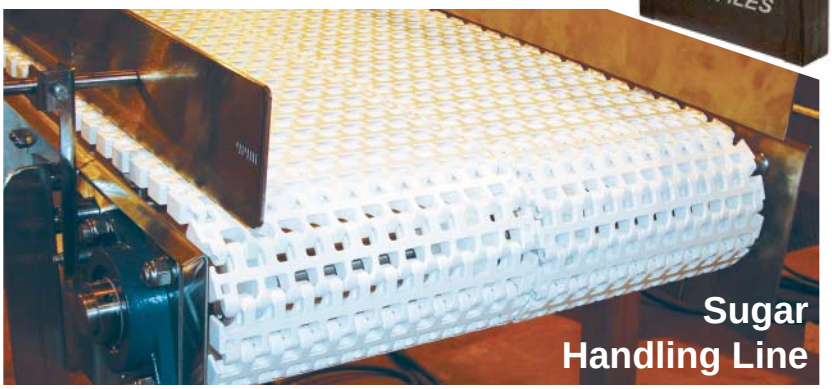
Chain Stretch: Over time, the pin housings stretch from a round to an oval shape causing the entire chain length to grow.
Wear-strip: A wear-strip is the supported guide of the chain and is also a consideration of the application. Wear-strips can be made of plastic, wood, steel or brass.

In conclusion, this article is just an overview of major considerations when choosing chain. There are more than 50,000 types of packaging chain in the marketplace today with new technology being engineered every day. Nercon has its favorites based on performance, customer satisfaction and economics which we specify on general applications. However, in some cases there is much more in terms of discovery in choosing the best chain for the packaging application. Our engineers work closely with the top chain manufacturers, Rexnord, Habasit, Uni and Intralox to assist customers in the best chain selections that meet production, maintenance and energy goals for each project.

NERCON ENG. & MFG., INC.

Nercon Eng. & Mfg., Inc. is a designer and manufacturer of packaging and process conveyors and material handling equipment. Nercon is a 35 year old company that provides modular as well as engineered conveyor systems to manufacturers of consumer products throughout North America. For more information, visit www.nercon.com, or call 920-233-3268.

Case Histories



Handling bags of sugar, this chain was an open-grid architecture so sugar could drop out of the conveyor when bags were damaged or leaking. The Habasit chain M3840 was made from abrasion resistant material, including pins and sprockets.

This conveyor was used to transport tissue cartons to a high speed divert system (440 fpm). The high speed pusher required package spacing to direct individual packages into different lanes. The rubber top UNI (PP-PA66-SNB-M2-20) chain maintained the stability of package spacing while being controlled at high speeds.

On this slow to moderate speed case handling line; the conveyor shown on the right uses Rexnord LF882, a side flexing chain with low friction properties needed during case accumulation. The chain in the left is Rexnord LF1873 with similar side flexing and low-friction properties, but allows for greater loads needed on that line.