Improving the life expectancy of glass conveying chains

Silent conveying chains are frequently used to transport glassware in both hot and cold end applications.

Silent conveying chains are used extensively in the transportation of glass bottles and jars. In most production settings, efforts made to prolong conveyor chain life can yield significant cost savings and improvement in bottle production. William Hall* discusses the factors influencing chain service life and the steps manufacturers can take towards this.

As bottle production speeds have increased, silent conveying chains have become the preferred method of transporting bottles in both hot and cold end applications. Providing a flat, stable, smooth and heat-resistant surface, such chains are available in many widths and with a wide array of construction options. Ramsey Products Corporation, based in the USA, is one of the leading manufacturers of industrial silent chains, with more than 90 years' experience.

Factors influencing chain life

In most conveying applications, chain life is limited by one of two factors: Wear or catastrophic failure events. The least common of these modes is catastrophic failure, which is where the chain either fails in tension or begins to come apart. This type of failure can be quite sudden and it always requires the conveyor to be shut down for repairs or replacement. Chain snagging or hanging on lateral guides or other obstructions is a common cause of this type of failure.

However, a far more common factor limiting conveyor life is wear, specifically abrasive or sliding wear of chain components. Wear occurs in three main areas of a conveying chain, each having different effects on the conveyor.

Chain joints

Each chain joint contains one or more pins, which rotate as the chain moves around the conveyor sprockets. As the pins rotate within the chain links, some amount of sliding wear occurs on both the pins and the links. As this occurs, the chain will increase in length. This is often referred to as chain stretch, even though no actual stretching of components is occurring.

The rate of link and pin wear depends on a number of factors, including the steel alloy, manner of heat treatment, quality of link stampings, chain tension, chain construction, lubrication, and cleanliness of conditions. This type of wear causes a conveying chain to travel progressively further out on the diameter of the sprockets, thus causing the conveyor speed to increase. As this happens, drive motor speed must be reduced to maintain a constant conveyor speed.

It may also be necessary to remove sections of the chain, to keep the overall length manageable. Eventually, the chain may elongate to the extent that it will no longer wrap sprockets properly and it must be replaced.

Link bearing surfaces

In most glass conveying applications, hardened wear plates support conveying

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chains as the conveyor travels from the tail to the head sprocket. The bottom surfaces of the chain links, which are in contact with the wear plates, are susceptible to sliding wear as the conveyor moves. This type of wear causes the overall height of the chain to gradually decrease, as link material is worn away. Over time, the decrease in chain height may be sufficient to create problems with the smooth transfer of glassware to and from the conveyor. When this occurs, chain replacement is necessary. Similar to joint wear, the rate of link surface wear depends on the link steel alloy, manner of heat treatment, chain tension, chain construction, lubrication, and cleanliness of conditions.

Lateral wear of pin heads

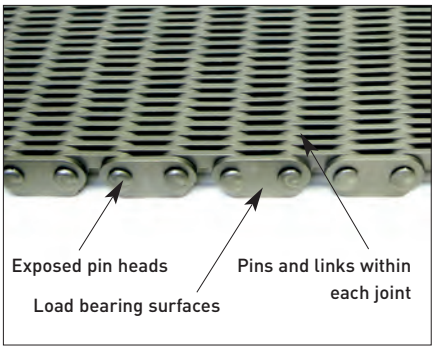
Conveying chains are typically bordered by lateral guides, which can rub against the outermost chain links and the headed ends of pins as the chain moves. This rubbing increases chain loading and may eventually wear away most, or all, of the pin heads. When the pin heads wear away, there is nothing to hold the chain together and both links and pins will begin to fall out. At that stage, conveyor operation becomes impossible and repair, or replacement, is required. A chain's susceptibility to this kind of wear depends on: Machine alignment, lateral guide design and guide spacing, chain link and pin material and the type, or style, of chain used.

Improving conveyor chain life

Considering the above discussion, the key to prolonging conveying chain life is to address the factors contributing to the various types of chain wear and also to prevent catastrophic chain failure. The best way to achieve these objectives is to first make wise choices when selecting and purchasing a conveying chain, and then to follow up with proper installation and maintenance practices. Below is a discussion of the detailed steps to take.

Manufacturers

Not all conveying chains are equal. There are no common industrial standards that apply to silent conveying chains and the quality of products can vary considerably between manufacturers. When buying a conveying chain, research the chain's manufacturer. Most reputable manufacturers will have established



▲Typical conveying chains wear in three primary areas: The load bearing surfaces of links, the chain joints and the exposed pin heads.

all link, link and spacer, multi-guide, single-pin and two-pin designs. Each of these styles has its merits and a chain supplier can help to select which style is best for the application. For example, all link chain constructions will weigh more than link and spacer chains, but an all link design will usually elongate less rapidly due to the higher number of links sharing the chain load. In situations where it is desirable to minimise the wear of link bearing surfaces, it may be beneficial to choose a multi-guide chain design, which has more bearing area in contact with wear plates than other chain constructions.

Wear-resistant chains

Some conveying chains are designed specifically to decrease susceptibility to certain types of wear. For example, Ramsey's line of Allguard chains has fully recessed pin heads, which work to eliminate lateral wear of pin heads. These chains are also less susceptible to wear and damage caused by chain snagging on lateral guides. For maximum chain protection, the Lifeguard chain (patent pending) features recessed pin heads, as well as a smooth, gap-free side and top profile. This is suitable for applications involving small bottles, where close proximity to lateral guides is required.

Chain installation checks

Check the following during chain installation:

- **Align sprockets and guides** - In order for a conveying chain to run straight, with a uniform distribution of loading, sprockets must be aligned with one another, and the shafts they rotate on must be parallel. Misalignment of sprockets creates non-uniform, higher loading in one side of the chain and forces the chain to track to one side of the conveyor. Lateral guides may constrain the chain, but this type of non-uniform chain loading accelerates lateral wear and reduces life. When sprockets are correctly aligned, the chain will tend to run naturally in a straight line. Also, lateral guides should be aligned with one another, and with the chain. Misaligned guides can cause the chain to snag, or create pinch points where chain motion is restricted.
- **Check wear plates for grooves and excessive wear** - The wear plates that support conveying chains can develop grooves and other surface irregularities that cause incorrect chain tracking and accelerated chain wear. It is a good idea to carefully inspect wear plates before installing a new conveying chain.
- **Check wear plates for flatness and undesirable gaps** - Large gaps between adjacent wear plates can create edges where the conveying chain may snag or hang up; this can produce chain jerking and surging, as well as chain failure. Avoid this problem by minimising the gap between adjacent wear plates and making sure that all wear plates are flat and level.
- **Don't over-tension chains** – Over-tensioning is one of the most common causes of accelerated chain wear and reduced life. As a rule of thumb, Ramsey recommends as little tension as is needed to produce satisfactory chain operation; the exact amount of tension required will vary between different machines and production set-ups. A correctly tensioned chain will typically have a good deal of sag, or slack, in the return span. If the return span is straight with no sag, it is often a sign of excessive tension. Rapid chain elongation is also a sign of excess tension. If manufacturers are having to frequently re-adjust chain tension or remove elongated sections of chain, it is advised to check if the conveyor is over-tensioned.
- **Verify chains are connected correctly** - Conveying chains are typically supplied in 10ft lengths, which must be joined, or connected, at the time of chain installation. At each chain connection point, it is

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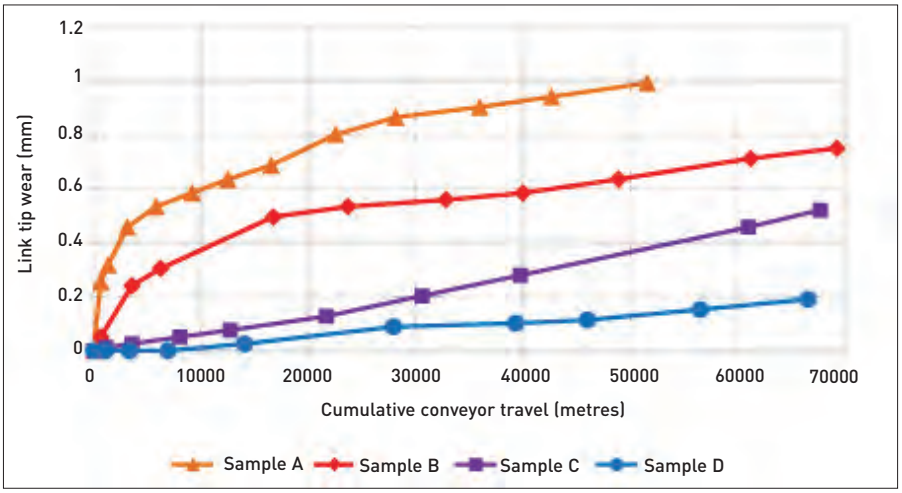

▲ Not all chains are equal. Ramsey test results show the quality of chain components can have a significant effect on conveyor wear rates.

▶ Lifeguard chain provides maximum protection with recessed pin heads in interlocking side links. The gap-free profile (patent pending) prevents snagging and promotes smooth bottle transport.

essential that chain links be correctly laced together, with the guide links in each section aligned. It is also very important that the connecting pin be secured in such a way that it will not come out and that it does not project beyond the end of adjacent pins. Connecting pins are most often secured by peening a head on the end of the connecting pin. The peened head should be large enough to keep the pin in the chain, yet not so large that the chain becomes stiff or inflexible. Check for proper connection by manually flexing the chain at the connection; it should move freely and not bind.

Follow-up inspection

Periodic examination of chains and sprockets is very important for the early detection and correction of problems that cause accelerated wear and reduced service life. Some of the important things to look for during an inspection include:

- Chain jerking or surging during operation
- Inconsistent chain speed
- Wear of link tips or pin heads
- Damaged or missing links at the sides of the chain.

Conclusion

The service life of glass conveying chains is most commonly limited by wear and less often by catastrophic failure events. The good news is that chain life can usually be improved by giving appropriate attention to chain selection, installation, and maintenance. Additional improvements can also be gained by using chains that are specifically designed for enhanced wear resistance. ■

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