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Chain Elongation: Measuring for Prevention

Industrial chain is made up of a series of pins and bushings that act as journal bearings. As the chain articulates — wraps and unwraps around the sprocket for extended periods of time — wear between the pins and bushings eventually occurs. Chain material is removed due to this articulation and the overall pitch of the chain elongates. This is commonly referred to as stretched chain, however, this is a misnomer as the chain is not actually stretched. Chain elongation is very much a naturally occurring wear phenomena, while a chain that has been stretched is the result of overload and an indicator of operating beyond recommended capacity. The rate of wear is dependent on several factors, including lubrication, load and the amount of articulation between the pins and bushings. The amount of articulation a chain can provide and the rate that it happens are a function of the materials and heat treatment. If the individual components are not of a high quality, the wear life of the chain will suffer and inevitably fail.

Preventative vs. Planned Maintenance

Numerous factors are involved that vary the life of an industrial chain, including operation, material handling and load. Elongation is one of many conditions that may limit the life of a chain, but it is relatively easy to check and can be a valuable evaluation tool. Establishing a schedule to routinely measure your chain assists with maintenance, while also providing a more accurate prediction of the life of the chain. Reliability engineers should closely note the importance of measuring a chain for elongation, as it provides a better understanding of when the chain will ultimately need to be replaced. Routinely taking this preventative step also helps to avoid unnecessary downtime due to unexpected failures.

Each industry's chain requirements will be slightly different. This alone justifies the need to capture these elongation data points to accurately determine when the chain will need to be replaced. However, it is up to the individual end user to determine if these measurements are required weekly, monthly or yearly. Consistently updating and recording these elongation measurements also provides a useful resource when preparing for upcoming budget planning.

Methods of Measurement

Chain elongation measurements can be easily obtained in the field as they generally do not require chain disassembly. To accommodate for the most accurate results, measurements must be done when the chain is in tension:

- The selected strand must be under load to “pull out” internal clearances
- The chain should be supported to ensure it lies in a straight line
- If measured while still on the sprockets, the system must be completely turned off and all safety procedures followed
- The selected strand should include as many pitches (pins) as possible, with a minimum of four pitches included.
- To measure use a steel ruler, calipers, tape measure, etc.

- Determine the distance from a spot on the first pitch to the same spot on the last pitch
- The ideal target for measurement is approximately a 10-foot length of chain to provide a better average
- When comparing the used measurement to the nominal new measurement, the greater the differential the greater the percentage of elongation

The allowable elongation of a chain can be tricky. For roller chain and engineered class drive chains, the products are dimensionally proportionate, and the 2.5 to 3.0 % limitation is an average. For other engineered chains the pitch varies more significantly for a given pin and bushing size and the amount of allowable elongation can vary tremendously — from as little as 0.5% for long pitch chains and nearly 3.5% on short pitch chains.

The second part of an allowable chain elongation assessment is to understand if the elongation is limited by the ability of the sprocket to accommodate elongation (about 3% for roller chain)



or if the elongation is limited by the case depth of some of the parts. For most of the engineered class chains, the allowable elongation is limited by the case depth of the components (usually bushings). Once the case hardened layer is consumed, the rate of wear accelerates and the chain would be considered worn, requiring the user to have additional chain readily available.

The current method for measuring chain elongation is widely known and available throughout the industry. However, this process is rapidly evolving to accommodate for both electronic and digital measurements, allowing for continuous and ongoing data analysis. Where once there was the requirement to power down the operation to obtain these calculations, the future of chain elongation measurements have the potential to be much more simplified, easier to accomplish, and quicker to process.

Potential Warning Signs

Warning signs of chain failure due to elongation are often specific to the product and, potentially, the application. Standard roller chain, for example, will begin to jump the teeth of the sprocket. Once this occurs, the chain and the sprocket rapidly deteriorate. The positive side to this is knowing that the replacement/repair for a roller chain is often readily available with “acceptable costs” associated with it.

Regardless of the type of chain that has failed due to elongation, production and cost issues also become a concern. An operation that is forced to shut down will likely see a loss in production, resulting in lost revenue and additional, unexpected or planned for costs.

Repair vs. Replace

In limited scope, repairing an industrial chain is fairly common. Repairing a chain that is clearly exhibiting elongation issues can be viewed as simply applying a bandage to the situation. This never solves the problem with any amount of certainty, but rather temporarily delays the inevitable. The idea of repairing an industrial chain over replacing it is generally not recommended as a viable option or reasonable solution. Aside from the potential hazards involved with repairing and rebuilding a chain — in addition to the considerable safety concerns and numerous opportunities for worker injuries to occur — this activity generally voids any and all warranty associated with the chain.

Regular inspection of your industrial chain is equally as important as the inspection of other pieces of mechanical equipment. Routinely measuring your chain as a means of identifying any signs of elongation is essential for operational efficiency and a necessary step to avoid unexpected failure. Productivity is often dictated by performance, and an industrial chain that has failed due to lack of proper maintenance will often cause as much downtime as any other application component.



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