White Paper

7 Common Causes of Premature High-Flex Cable Failure

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High-flex cables are designed to cope with lots of stress, tight bend radii, and repeated movement. Unlike traditional cables, they're intended to withstand extreme flexing in industrial automation applications like robotics, packaging, animatronics, and conveying systems.

All cables—even high-flex cables—eventually wear out and need to be replaced, no matter how well they're designed or installed. But when high-flex cables are mishandled, improperly installed, or used in the wrong application, you'll be disappointed in their performance and they'll wear out faster than you anticipate.

The costs of unplanned interruption and repeated cable replacement far outweigh the time and money it takes to do things right the first time. Following simple guidelines can lengthen the lifecycle of your high-flex cables and avoid premature failure, preventing costly interruption and saving time and money in the long run.

Based on our decades of experience in designing and deploying cable systems to keep vital automation processes going, we created our own list of the most common causes of high-flex cable failure—along with tips to avoid these situations. Almost every time, premature failure is due to one of these seven problems.

1. A quiet zone that's too short

The quiet zone refers to the length of cable that's supported as it exits the cable track (C-Track, drag chain, etc.). Its purpose is to eliminate potentially damaging turns and bends. When a quiet zone is too short, cables experience corkscrewing as they compensate for an overload during the bending process.

In a multi-conductor cable (like a high-flex cable), small, tight twists are caused by the shifting or migration of conductors from their original position to a new position. This causes other elements to be displaced, creating the corkscrew effect. Corkscrewing becomes worse as the cable continues to flex.

Solution

Create an appropriate quiet zone. Because there are several factors to consider before determining the length of your quiet zone—number of conductors, AWG size, shielding, cable length, etc.—there isn't one single length we can share that will work in every application. In general, heavier cables with higher conductor counts call for longer quiet zones. For lighter cables with lower conductor counts, a shorter quiet zone can be created.

2. Improper handling

The terms "flex" or "flexible" can be deceptive, leading people to believe that these cables can put up with anything. While they will endure extreme flexing and rigorous conditions, they can still be damaged by too much twisting, dragging, or carelessness during the installation process.

Solution

When handling high-flex cables during installation, be gentle. Your cable will arrive with installation recommendations from the manufacturer; consult them right away. Unreel cables and give them time to relax for at least 24 hours before they're installed or terminated. This gives the cable time to regain its original characteristics. Once installation begins, avoid aggressively pulling or dragging cables across the floor or around equipment, which can lead to twisting.

How do you know if a cable is twisted? Use the print legend on the jacket as your guide. If it's facing up (12 o'clock position) in a track, it's situated correctly. If the print is turning or rotating along the cable, then the cable is twisting. If the cable is already twisted as it enters the track, make sure to address the issue first before continuing with the installation.

3. Putting too many cables in one track

Cable tracks support cables and protect them from damage, but overcrowding these tracks can break the structure, create heat buildup, and lead to component failure. Tracks that are too full can also prevent cables from moving freely and cause unnecessary bending or twisting.

Solution

The resolution here is pretty straightforward: Limit the number of high-flex cables you place in a track. Leave room for free movement so all the cables inside can freely flex without any friction or stress. Also ensure that the cables can lay flat in the track (instead of on top of one another) to avoid twisting and corkscrewing. All track manufacturers provide clear guidance on how to properly populate a track to help you prevent overcrowding and damage.

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4. Too much abrasion during movement

While high-flex cables are designed for movement, that doesn't mean they will survive constant abrasion or friction when rubbing up against another surface (such as other cables and hoses, cable tracks, or metal/plastic parts on a machine). Cables without a flex rating may have jackets and insulation that degrade quickly.

Solution

Always use a high-flex cable with an abrasion-resistant outer jacket. The materials and compounds used in these coatings create a durable (yet flexible) cable exterior that doesn't crack, swell, tear, or wear when it rubs against something else. This simple trick can buy you many more years of cable life.

5. Improper cable selection

Simply choosing a flexible cable may seem like enough of a safeguard against failure in an automation application, but there are key distinctions between different high-flex cables. Depending on their design and construction, they can be manufactured to move in many ways (rolling, torsional, etc.); each cable has its limits. Some are intended to be routed around gentle corners or curves, while others are meant to withstand constant twisting in the same direction.

Solution

Take time to fully understand the flex requirements of your application before choosing a flex cable. Will your cable be bent around something? Will it be moving back and forth in the same position? We often see cable failure result from the wrong types of cables being installed in high-movement applications. Make sure to select a cable designed to work in your specific situation. Material choices impact the performance of a cable, from stranding and conductor insulation to jacketing material. Making the right selections can increase flexibility and extend flex life. For example, cables with finely stranded conductors support more flexing cycles.

6. Ignoring other components that impact cable performance and wear

When a cable fails, it's easy to focus on the cable itself and ignore other aspects of the system that may impact performance. Clamps or tie wraps are good examples. When forces of compression and expansion travel down a cable, these forces are reflected in the opposite direction (back up the cable) when a clamp or cable tie is too tight and restricts the cable. Its geometry can also change (corkscrewing may happen) as a result of using clamps and ties, which negatively impacts performance.

Solution

Clamps should be tight enough to hold the cable in place without high compression that prevents conductors from moving during equipment operation. If possible, avoid cable ties—and don't place them on cables that move (doing so may create friction and abrasion).

7. Not following the guidance and advice provided by the manufacturer

Because we're often called to jobs to investigate potential cable failure, we've seen firsthand what happens when manufacturer recommendations aren't followed. For example: If you force a high-flex cable to bend at a smaller radius than the minimum radius specified, its insulation and conductors can crack while internal friction may wear down the protective insulation.

In a recent situation, we visited an industrial site that was experiencing premature cable failure. We quickly discovered that the quiet zones weren't the right lengths for the high-flex cable being used. Instead of supporting the cables as they left the robots and exited the tracks, the cables were spilling over into unsupported falls. Over an inch in diameter, the cables are heavy and were bending much more tightly than what we advised.

Solution

Make sure you follow the recommended guidelines provided by the manufacturer; they share this information with you for a reason. From adhering to the proper bend radius to respecting static and dynamic temperature ranges, you'll extend the life of your cable and avoid costly premature failure.

Conclusion

Premature cable failure can result in significant downtime and unplanned costs due to frequent replacement. Properly handling and installing high-flex cables—along with selecting the right cable for the job—will help you maintain crucial uptime and save time and money by making sure your cables last.

Partnering with Alpha Wire for High-Flex Cable

Manufacturing high-flex cables for over 95 years has taught us a few things about making these cables last. To ensure long-term performance, we do a few things differently:

- We use finely stranded conductors to support more flex and repeated bending.
- Our careful material selection ensures protection against jacket abrasion.
- Our broad portfolio ensures that you can find exactly what you need for any application, no matter how specific.

Because today's process-automation machines are much faster than those of previous generations, they can create even more cable stress. We take in-house testing very seriously to ensure that our cables are designed to last in these conditions. To continuously test the cables we manufacture, Alpha Wire designed and built its own testing machine so we can assess different scenarios and factors to make sure that the cables we send you will endure the rigors of your application.

Want to make sure you're doing all you can to avoid premature high-flex cable failure? Give us a call at 1-800-52-ALPHA or send us a note, and we can share some more helpful hints with you.

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