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CASE STUDY

for the Factory Automation & Machinery market

Developing a PFAS-free silicone cable

for a monitoring sensor in factory automation

Introduction

Factory automation places a wide range of demands on industrial communication components. To ensure that the installed cables can withstand the sometimes extreme operating conditions, they must resist millions of bending cycles in drag chains, tensile cable guides on robot arms, temperatures of up to 200 °C, and contact with chemicals, oil, or other lubricants without damage. Ultimately, the trouble-free operation of production systems also depends on avoidable cable breaks and, therefore, on the durability and robustness of the cables in their application.

Many properties that a cable must fulfill over its entire installation length in a harsh industrial environment can only be achieved by using fluoropolymers, which are PFAS materials.

Using the example of the cabling of a monitoring sensor along a production line, this case study is intended to show how the transformation of a PFAS-containing cable to a PFAS-free cable can be achieved with the help of silicone.

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Challenge

A manufacturer of monitoring sensors for factory automation wanted to avoid using PFAS-containing materials for the cabling of its systems in the future and wanted to replace the existing cable sheath material with silicone.

PFAS-free PP was already used as the material for the core insulation in the previous design of the four-core cable. However, the cable sheath was made of PFAS-containing FEP.

To connect one or more sensors along a production line or a conveyor belt, the cable was routed individually or in a bundle parallel to the line and permanently installed. Accordingly, there were no requirements for increased mobility or a maximum cable diameter. Depending on the production area, however, there might be high heat radiation from adjacent machines, so a certain heat resistance of the cable was required.

Project Execution

Based on the customer's specifications, the BizLink team opted for HTV silicone, so-called "hard silicone", as the material for the new outer sheath. It is very robust and can be exposed to much higher temperatures than 105 °C without losing its positive properties. It is also resistant to chemicals and has good electrical insulation. The major goals for the new development were:

1. **PFAS-free Solution:**
   Develop a PFAS-free silicone cable solution that meets the requirements of the former cable but without specific outer dimensions or flexibility needs.
2. **Heat-Resistance:**
   Ensure the new cable solution withstands temperatures of up to 105 °C in the harsh industrial environment.
3. **Reliable Electrical Insulation:**
   Maintain or exceed the electrical insulation properties of traditional PFAS-containing cables to ensure safe and efficient operation.

Solution

The new cable made of HTV silicone is PFAS-free and can be used for a long time in the desired application in harsh industrial environments.

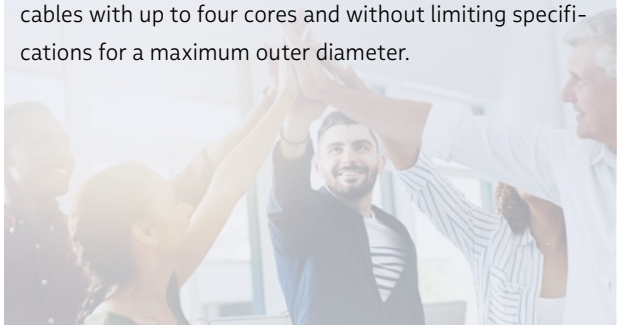
As the new silicone outer sheath had to be heated during the production process to harden it, which is problematic for the PP core insulation inside the cable, this was also replaced by HTV silicone in consultation with the customer without changing the electrical or mechanical properties of the cable.

A positive side effect ›
Although not required, the cable has improved flexibility. The price of the finished cable remains the same, as silicone is cheaper than FEP but more expensive than PP.

Results & Benefits

The customer's requirements were implemented to their complete satisfaction. Thanks to the additionally improved flexibility and chemical resistance, the customer can now also offer its sensors for monitoring functions in more angled placements along production lines and for monitoring purposes in chemical plants.

Silicone is a suitable PFAS-free replacement material in the industrial environment for permanently installed cables with up to four cores and without limiting specifications for a maximum outer diameter.



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Problem Identification
› The PFAS problem in cable manufacturing

PFAS ›
PERFLUORINATED & POLYFLUORINATED ALKYL SUBSTANCES

PFAS have been at the center of public and political debate for some time. These so-called "forever chemicals" are contained in numerous everyday products due to their special properties, such as water and dirt repellency.

However, their use also poses considerable risks to people and the environment, which is why a complete ban on all PFAS or only certain particularly problematic substances is being debated. Numerous countries, including Germany, have already taken measures to restrict the use of PFAS. For example, the use of PFAS-containing fluoroprotein foams in firefighting is increasingly being restricted, and the textile industry today is relying on PFAS-free impregnations. In both cases, PFAS-containing particles were previously released directly into the environment.

In cable production, PFAS-containing fluoropolymers are used exclusively in solid form. They are used as a material for outer sheaths, inner sheaths, core insulation, or (in the case of PTFE) as tapes to improve the sliding behavior of several elements within a cable.

As long as no PFAS-free alternative has been researched that can fully replace all material properties, cable manufacturers, and manufacturers of production equipment, are faced with the challenge of replacing the versatile fluoropolymers with existing PFAS-free materials at the customer's request without compromising the desired properties.

About BizLink

Founded in 1996 and headquartered in Silicon Valley, USA, BizLink is dedicated to making transformative connections that bring visionary ideas to life.

We specialize in providing essential components such as wire harnesses, connectors, and cables to a broad spectrum of industries including IT Infrastructure, Client Peripherals, Optical Fiber Communications, Telecom & Networking, Electrical Appliances, Medical Equipment, Factory Automation & Machinery, Semiconductor Technology, Healthcare, Motor Vehicles, Mobility, Marine, Industrial, and Solar Energy.

Our global presence, with flexible production resources and R&D teams across America, Europe, and Asia, allows us to proactively drive innovation and enable future possibilities.

At BizLink, our customer-centric approach and commitment to relentless advancement empower us to deliver zero-distance service and continual performance optimization, making a positive and meaningful impact worldwide.
We turn possibilities into reality; furthermore, we connect possibilities to world-changing visions.