

Electrical conduit for food and beverage applications

Sponsored by: Electri-Flex Company
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Ask a design engineer in the food and beverage industry about his or her greatest on-the-job challenges, and the answer will almost certainly include the need to work around stringent health and safety guidelines to prevent contamination. Any points of weakness along the production line must be eliminated not only for the sake of maximizing operational efficiency, but also for protecting consumer health and safety.



Figure 1. Modern industrial food processing involves miles of electrical wiring, which must be safely routed within flexible conduit raceways. Source: Electri-Flex

Modern industrial food processing, moreover, involves miles of electrical wiring. These must be safely routed within flexible conduit raceways both to protect power and data cables from damage, and to prevent contact with nearby processing equipment and process areas. The choice of conduit is a crucial design element, as it fulfills three principal safety goals: inhibiting bacterial growth, safeguarding against foreign material contamination and providing resilience to wear.

As with many goals, success can be measured against a set of standards; as with many standards, there are significant differences that vary by region. Compared to other parts of the world, the United States has tended to take a more passive approach to ensuring safety — but the continued growth of multinational corporations has produced a changing landscape, which is trending toward the incorporation of more proactive measures.

U.S.-based manufacturers are, as a result, presented with both the opportunity and the challenge to adopt forward-facing standards that will enable them to stay ahead of the curve. Working with an expert solution provider, such as Chicago-area conduit innovator [Electri-Flex](#), can help. The company has recently introduced improvements to two of the key product lines in its food-grade steel conduit portfolio, [LAFG](#) and [LSSF](#). These include the integration of an antimicrobial additive, or biocide; the incorporation of blue plastic jacketing; and the strengthening of wear resilience.

Antimicrobial integration

When one considers the options for bacterial control, it is important to differentiate between two approaches that are related, but distinct: a passive conduit design, by which bacterial growth is merely not promoted; and a proactive design, by which it is actively inhibited.

The former approach can be illustrated through a closer look at conduit, which reveals a metallic inner core used to contain the electrical cabling within. If left unprotected, the core would offer multiple crevices on which bacteria could grow; surrounding it with a liquid-tight jacket offers a measure of protection. If the jacket becomes damaged, however, the conduit offers no further mitigation of bacterial spread. A proactive design, by contrast, might employ a biocide to inhibit the growth of any bacteria that does manage to take root.

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The antimicrobial additive used in the new Electri-Flex lines is an example of an active inhibition strategy. Importantly, it is not simply a surface coating that could be removed during the continual washdowns to which food processing equipment must be subjected; it is, instead, an element integrated directly into the design of the protective jacketing material. It will not diminish when exposed to extreme temperatures, such as steam or deep freezing, and it will neither react with the final product nor change its appearance. Effective against three major types of food-borne bacteria — E. coli, listeria and salmonella — it has shown the ability not only to inhibit their growth, but also to reduce the presence of microbes over a 24-hour period.

Blue jacketing

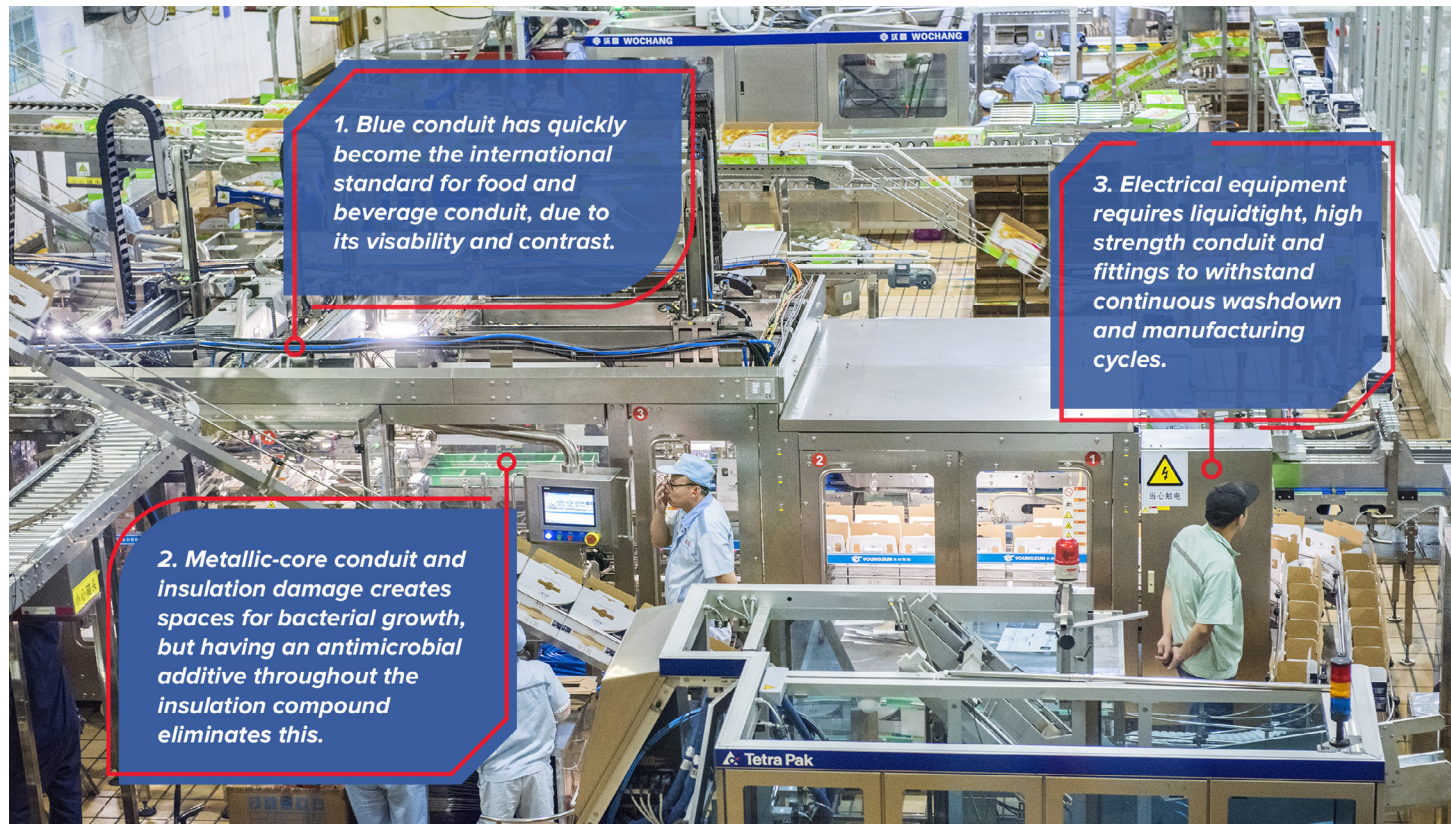
Outside of the U.S., blue jacketing is a big deal. It is being used for electrical conduit in food-processing plants throughout Europe, and it has made its way into North America by way of Canada. Some larger manufacturers and multinational corporations have begun to express interest on behalf of their U.S. plants, as well.

What is in a color? Against the backdrop of a food-processing facility, blue stands out: It is a high-visibility hue that does not occur naturally in the food chain.

As a result, any plastic contamination that gets introduced into the product stream by damaged jackets is easy to spot, and readily addressable. Blue jacketing also offers resistance to staining and discoloration, and high contrast to elements such as spores, mold and detergent residue — contamination that needs to be spotted and cleaned off. In addition, blue offers a lower reflectivity than standard white jacketing, resulting in less interference with any optoelectronic devices that may be incorporated into the plant production line.



Figure 2. Outside of the U.S., blue jacketing is a big deal in the food-processing industry. Source: Electri-Flex



1. Blue conduit has quickly become the international standard for food and beverage conduit, due to its visability and contrast.

2. Metallic-core conduit and insulation damage creates spaces for bacterial growth, but having an antimicrobial additive throughout the insulation compound eliminates this.

3. Electrical equipment requires liquidtight, high strength conduit and fittings to withstand continuous washdown and manufacturing cycles.

Figure 3. Blue, high-strength, antimicrobial conduit offers food and beverage manufacturers a durable and hygienic means to protect power and data wiring on the factory floor. Source: Adobe/Xiangli

Strengthening wear resilience

Electri-Flex has expanded the working temperature ranges for both the LAFG and LSSFG lines. In addition, the company recently had several of its products — including the new, blue-jacketed LAFG line — undergo a series of vigorous tests to receive CSA C22.2 No. 56-17 Annex A “Heavy-Duty” certification. This designation surpasses standard CSA and UL 360 ratings, as evidenced by tests including tension, cold flexibility, connector pull-out and crush. [This video](#) offers an illustration.

In a food-processing environment, improved capabilities such as these strengthen wear resilience in several important ways. The ability to withstand wider temperature ranges supports the rigorous washdown procedures — sometimes cleaning up to five times per day — that are needed to minimize the potential for microbial infection. Improved temperature resistance also makes the conduit better suited for applications involving heat, such as baking. Heavy-Duty rated jacketing offers resistance to other types of wear as well, such as impact and abrasion. Its improved dimensional stability translates to less likelihood of breakage, and therefore less potential for plastic contamination and greater protection to critical wiring.

Quality as a standard

Although the three improvements discussed above are the headlines, it should be noted that other product qualities that have made Electri-Flex a leader in the liquid-tight conduit industry were also carried into the new offerings. These include structural consistency; dimensional testing performed on each foot of conduit; and manufacturing by a company that has developed many of its own production tools and methods over a history of more than 65 years.

Each conduit in the company’s product portfolio also offers individual qualities designed to address various plant needs; customers often find that their builds can be simplified and streamlined by staying with a single conduit type. Those with existing stainless-steel systems can retain compatibility by choosing the LSSFG line; those with white-jacketed conduit can retain that aesthetic by choosing LAFG in white jacketing instead of blue.

Conduit specifications

Both the LAFG and LSSFG lines are flexible steel conduit types designed for a variety of installations requiring motion, vibration and bending on food-processing equipment. Both also feature liquid-tight, flexible PVC jacketing made with an FDA-approved compound formulated for “splash zone” food and beverage contact. Industries served include poultry processing; food product machinery manufacturing; pharmaceutical; and food packaging, canning and bottling.

Formerly available in standard sizes ranging from 3/8 in. to 2 in., the size ranges for both lines have been expanded to an upper size limit of 4 in. Working temperature ranges are:

LSSFG: -30°C to 105°C Dry / 60° Wet / 75°C Oil
 LAFG: UL: -30°C to 105°C Dry / 60° Wet / 75°C Oil
 CSA: -30°C to 105°C Dry / 75°C Oil

[LAFG](#) is a UL listed conduit with an inner core made from hot-dipped galvanized steel and encased in a blue liquid-tight jacketing. Blue-jacketed LAFG is also CSA certified, and sizes 0.5 in. through 2 in. are certified as CSA Heavy-Duty. LAFG is sunlight-resistant; resistant to bleach, oils and mild acids; capable of direct burial; and has flame-retardant properties. LAFG is also available with white jacketing, which is not CSA certified but retains its UL listing.

[LSSFG](#) is a non-UL conduit with an inner core made from a continuous strip of 316L stainless steel and encased in a blue liquid-tight jacketing. Its stainless-steel core imparts excellent resistance to galvanic corrosion, complementing its resistance to bleach, sunlight, oils and mild acids.

Both lines meet various additional certifications and compliances; visit their respective product pages to learn more. And, like all Electri-Flex products, both are “proudly made in the U.S.A.”

Systemic improvement

[According to the World Health Organization](#) (WHO), an estimated 600 million people fall ill each year after eating food contaminated with various microbes, parasites or chemical substances; that translates to nearly 1 in 10 people globally. Factoring in 420,000 deaths, the WHO calculates an annual loss of 33 million disability-adjusted life years (DALYs). In the U.S. alone, [according to the U.S. Department of Agriculture](#) (USDA), there are about 48 million annual episodes of foodborne illness, and 3,000 deaths; the most common foodborne pathogens cause an estimated economic burden of \$14 billion to \$36 billion each year. These numbers underscore the fact that safety in the food-processing industry is critically important not only for localized concerns such as operational efficiency and customer relations, but for big-picture economic and ethical reasons as well.



Figure 4. The antimicrobial additive used in the new Electri-Flex lines has shown the ability not only to inhibit their growth, but also to reduce the presence of microbes over a 24-hour period. Source: Electri-Flex

As stated earlier, the design of food and beverage processing facilities is challenging. Yet it also presents tremendous opportunities for manufacturers ready to embrace forward-facing standards — particularly in U.S. plants, which have historically lagged behind. In the midst of a shifting landscape, companies can stay ahead of the curve by putting increased emphasis on a few key safety goals such as those described above. Indeed, this can be a top priority in their overall strategy for marketplace success.

System improvement can be a daunting task, especially when systems are already in motion. But the ready availability of new system components designed to mitigate microbial and material contamination and strengthen wear resistance can make that task far more manageable, particularly when accompanied by the ready availability of an expert partner in the field.

[Contact Electri-Flex](#) to learn more.



Ready to modernize your food and bev operations?
[Contact Standard Electric](#) to get started today!

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ABOUT ELECTRI-FLEX COMPANY

Electri-Flex has 65 years of success manufacturing the highest quality flexible liquidtight conduit in the industry. Founded in 1955, Electri-flex has perfected the design and manufacture of its line of nearly 50 flexible electrical conduits. A true innovator in the liquidtight conduit industry. Making the best product doesn't create success without sales, service and marketing programs that meet the needs of our customers. Our partners can expect outstanding service from fast shipments on in-stock items, as well as developing a conduit for unique applications. Our team of salesmen, customer service agents and application engineers can assist at every stage of the buying process.