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Halogen-Free Cables: Raising the Bar on Safety and Sustainability

Why low smoke zero halogen technology is becoming the preferred choice for cable applications.

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Halogens can be very reactive and combustible substances if exposed to other environmental factors. Engineers should be aware of risks inherent in older cable materials and the options available to them when considering halogen-free or low-smoke products. The use of halogen-free cables is particularly important in public buildings, railway vehicles, or any area where the general safety requirements for cables are very high.

This white paper will explore the benefits of going halogen-free and how engineers can select cables that best fit their needs.

What does "Halogen-free" mean?

A closer look at the properties of halogens can shed light on their reactive properties. The term "halogen" comes from the Greek roots hal- ("salt") and -gen ("to produce"). When halogens mix with other elements, such as sodium, they produce salt. Halogens have their own group on the periodic table because in their natural state they are very volatile and highly reactive with other substances. The elements that form the halogen group are fluorine, chlorine, bromine, iodine and astatine. Fluorine, chlorine and bromine are the common elements found in cable.

"Halogen-free" means the product doesn't contain any of the elements listed in the halogen group.

The Hazards of Halogens

Why is the use of halogen-free materials so important? Halogen cables can cause serious health and safety issues in the event of a fire. That's because during a fire halogens react with hydrogen to form a hydrogen halide. In an aqueous solution, a hydrogen halide builds hydrofluoric acid, hydrochloric acid or hydrobromic acid. Those substances have a toxic effect, especially when someone inhales the corrosive gases. Potential health impacts include severe irritation or swelling of the eyes, nose and throat.

In addition, the acids may damage building structures, technical installations or machines. One of the earliest and most significant events occurred in 1987 in London's King Cross subway station. The fire, which killed 31 people, is considered one of the first recognized instances of thick, black, toxic smoke produced by products containing halogens causing more casualties than the fire itself. Another notable incident occurred in 1996 when a PVC cable fire in the Düsseldorf Airport corroded escalators and released hydrochloric acid. The fumes also led to 17 deaths related to dioxin contamination.[1]

In the decades following these incidents, engineers have been much more mindful of the risk involved with using non-halogen-free materials in confined or high-traffic facilities. Some of the fastest adopters of halogen-free cables were the military and ship builders. Ship and submarine passengers are particularly vulnerable to halogen-related risks because they're limited to such confined areas.

These are the types of intended uses for halogen-free materials because both passengers and builders can be assured that in the event of a fire, they will be exposed to significantly less smoke and toxic gazes filling up their space-restricted areas. The use of halogen-free materials is also critical for the transportation industry, including rail and air travel.

Low Smoke vs. Halogen-Free

The benefits of halogen-free cables are clear, but people sometimes confuse halogen-free, or zero halogen, cables with other types of "low-smoke" cables. Engineers and builders have several options to consider with the safety properties of cables. The primary low-smoke or halogen-free cables include low smoke, zero halogen (LSZH), low smoke and fume (LSF) and fire retardant and noncorrosive (FRNC).

[1] Plastics News, "German Panel Clears PVC in Fire Deaths," Aug. 18, 1997

The chart below provides a breakdown of each low-smoke option and some of the key characteristics to consider during the selection process.

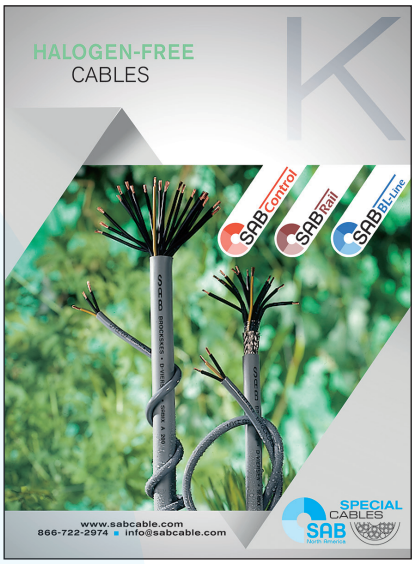
Option	Characteristics	Pros	Cons
Low Smoke, Zero Halogen (LSZH)	▪ Not more than 0.5% hydrogen chloride ▪ No toxic gases produced ▪ Not flame retardant, but burns clearly ▪ Some smoke still produced (clear smoke)	▪ 100% halogen-free ▪ No toxic gases produced ▪ Little smoke produced	▪ Still some smoke produced ▪ Not flame retardant
Low Smoke and Fume (LSF)	▪ Classification undefined ▪ Produces less smoke and fumes than standard products ▪ Version of PVC ▪ Emits black smoke and hydrogen chloride when burned	▪ Produces less smoke and fumes than standard products	▪ Not 100% halogen-free ▪ Produces some black smoke/toxins ▪ Not flame retardant
Flame Retardant and Noncorrosive (FRNC)	▪ Flame retardant ▪ Self-extinguishing ▪ Prevents flame spreading ▪ Low fire load ▪ Low production of smoke ▪ No more than 0.5% hydrogen chloride ▪ No acids produced during a fire	▪ Most effective at preventing flames from spreading ▪ No melting/dripping of product	▪ Not necessary in all applications ▪ Higher cost vs. LSZH

The SAB Advantage

SAB is ready to meet the LSZH and FRNC demands of engineers and installers with more than 50 different products, including lines with certifications for most applications. SAB's LSZH (FRNC) products are constructed from SAB's special SABIX® material which provides:

- Enhanced flexibility
- Heat resistance up to +90°C (125°C)
- Low smoke density acc. to DIN VDE, IEC and EN
- Flame-retardant and self-extinguishing acc. to DIN VDE and IEC+EN
- Halogen-free acc. to DIN VDE + IEC

SAB has also developed an improved version, SABIX Ultra, that is even more flexible and demonstrates the highest fire protection features by the standards EN 60332-1-2, EN 60332-3 Cat C or D, IEC 0754-1, IEC 60754-2, EN 61034, DIN EN 50306, DIN EN 60684, NF C 32-070 C1, and NF X 70-100.



UL Certification: What You Need to Know

As of 2015, Underwriters Laboratories offers certification for halogen-free and low-smoke cables based on the IEC 62821 standards. IEC 62821 establishes all of the requirements for halogen-free, low-smoke thermoplastic insulated and sheathed cables of rated voltages up to and including 450/750 volts. UL also specifies that the industry should not associate halogen-free with IEC 60754, which tests harmful gas emission, because it does not specify the presence of halogens.

UL offers the optional halogen-free (HF) and low smoke halogen free (LSHF) markings for a wide range of wire and cable categories including:

- Appliance wiring material
- Communications cable
- Optical fiber
- Flexible cords
- Power and control tray cable

In addition, UL has expanded its Component Recognition program (AATJ2) under UL 2885 to include the halogens assessments under IEC 62821. The expanded program is for suppliers of insulation and jacket compounds and other cable components including fillers, tapes and wraps. UL-certified HF and LSHF cables also meet all other UL requirements for the general certification. Combustible materials such as insulation, fillers and jackets that are used in HF and LSHF cables that are UL certified under UL's Recognized Component program are published in UL's Online Certifications Directory (www.ul.com/database). [2]

SAB's SABIX® line is available for CAT 5e, CAT 6, CAT 6A, and CAT 7A applications as well as control and connection cables often used in control panels for tool-working machines, assembly lines and rail technologies; data cables used for the transmission of signals, measuring values and control signals; data, control and power cables for shipbuilding; and rail data and rail control cables tested acc. to DIN EN 45545-2.

Other industry-specific applications include use as a festoon cable for polar cranes, sensor cable at the vehicle chassis, flexible control cable at train doors and cable chain applications with moderate mechanical stress.

Conclusion

The use of LSZH cables will likely grow as more industries adopt environmental and safety initiatives. In addition to the rail and shipbuilding industries, other sectors that will see continued adoption of LSZH or FRNC cables include modern data centers that contain large amounts of cabling, industrial facilities and nuclear power plants.[3]

As more certification organizations, such as Underwriters Laboratories, recognize the importance of LSZH cables, implementation will continue to expand. Environmental awareness will also play a role in the adoption of LSZH cables, which are considered more environmentally friendly than older designs.

They also offer many features that can improve efficiency and performance for various structures. For instance, SAB's SABIX BL cables meet requirements in shipbuilding for low-weight, high-efficiency construction. The cables are highly flexible so they can be installed in narrow spaces and are lighter.

With LSZH cables, engineers and installers have the peace of mind that they're working with the safest, most reliable cables on the market.

For more information about SAB's halogen-free cables, visit our website.

[2] Wire Talk (Underwriters Laboratories), "Low Smoke Halogen Free – What Does It Mean?" August 2015

[3] Anixter, "Low Smoke Zero Halogen Wire and Cable Best Practices," 2012