



Raychem

INCREASING BUILDING SAFETY

WITH LOW SMOKE ZERO HALOGEN CABLES FOR PIPE-FREEZE PROTECTION

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INTRODUCTION

In the event of a fire, every second counts. As buildings become more complex and architects push the boundaries of design, it is vital to consider at the concept design stage which fire safety measures will be used.

Successful fire safety design requires an understanding of a wide range of issues and considerations such as fire source, smoke movement, heat transfer to the building structure, detection, human behavior and toxicity. These requirements must also comply with industry regulations and regional standards.

Today's engineers must embrace a number of standards commissioned by the International Electrotechnical Commission (IEC) and other European regulations. With the majority focusing on general cables and their reaction towards fire, there are few, if any, mandatory requirements for heat-tracing technology. However, with the increased demand for safety in public areas and buildings, engineers are now being advised to install non-hazardous materials in the event of a fire.

The wire and cable industry has been using low smoke zero halogen (LSZH) materials for many years. A greater adoption of LSZH cables followed notable fires over recent years such as the incident in the Mont Blanc Tunnel in France and the King's Cross fire in London. Although heat-tracing applications are a small part of the overall building material mass, their performance in the event of a fire should not be overlooked.



LOW SMOKE ZERO HALOGEN

Uses of halogen cables

Historically, most cables were insulated with polyvinyl chloride (PVC) or similar materials but these resulted in a number of issues. When exposed to fire, these types of insulation materials release chlorine gas harmful to people.

In addition, forms of hydrochloric acid present in halogens can have devastating effects on adjacent equipment when they come into contact with water, and produce a thick black smoke which can create major issues during the evacuation of a building.

Halogens also bind with moisture to create acid, harming people and causing corrosion, thus impacting costly equipment.

Building regulations for LSZH

LSZH cable jacketing is composed of thermoplastic or thermoset compounds that emit limited smoke and no halogens when exposed to high sources of heat. Today's regulations dictate that all aspects of modern buildings have to be safe.

Where cables are concerned, the primary danger in the event of a fire is not the fire itself, but the smoke and gases produced. Official statistics released by the fire and rescue service in the United Kingdom in January 2015 (DCLG, 2015) showed that the major cause of death and injury in 2013/14 fires in the UK was toxic smoke inhalation¹.

It is therefore vital that cables produce as little gas and smoke as possible when burnt.

The European Commission issued two directives in 2002 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. As a result, most polybrominated diphenyl ethers (PBDEs) have been banned in the region. The IEC 60332-1 standard governs the flame retardant grade specifications for cables for local-area network (LAN) and wireless local-area networks (WLANs) as well as other networking systems.

This regulation applies to the majority of medium and large-scale installations in Europe, and requires LSZH jackets for cables installed near places where people congregate or anywhere there is exposed wire. Building Regulations Part B (fire safety) states that "Measures designed to provide safe means of escape must therefore provide appropriate arrangements to limit rapid spread to smoke and fumes"².

Reviewing the standards

To be classified LSZH, a cable needs to pass a series of stringent tests. It first needs to be compliant with the BS EN 61034-2, a smoke density test, which is also known as the three-metre cube test and lasts for 40 minutes.

During this test, a metre cable sample is burnt and must achieve over 60 per cent light visibility through the smoke. For the zero halogen test, in accordance with the BS EN 50267-2-1, the material must emit less than 0.5 per cent halogen acid when burnt.

Each heat tracing application imposes unique demands on the designer to achieve the desired performance in a safe manner.

As part of a variety of flame-resistance standards, a cable needs to be compliant with the flammability section of the IEC62395 standard. This provides detailed recommendations for the system design, installation, maintenance and repair of electrical resistance trace heating systems in industrial and commercial applications.

During the test, a flame source is applied to the heating cable at intervals. A paper label is applied at the top of the vertically positioned cable.

If the fire reaches the paper at the top, the cable fails the test. Conversely, if the cable extinguishes itself and does not conduct the fire, it passes the test and allows for a safer environment.

LEADING ON INNOVATION

One of the main challenges with LSZH cables is temperature range and the temperature swings the cables face in applications, which play a huge role in denaturing the polymer. Most of the cable jackets currently available work in different temperature bands – some perform better at high temperature but lack flexibility, while others are more pliable but are hygroscopic and so don't perform well at higher temperatures (+50°C).

Pentair has launched a new self-regulating heating cable range, featuring advanced materials technology and offering full LSZH protection.

10XL2-ZH
Plum

15XL2-ZH
Green

26XL2-ZH
Blue

31XL2-ZH
Purple



Superior reliability and lifecycle

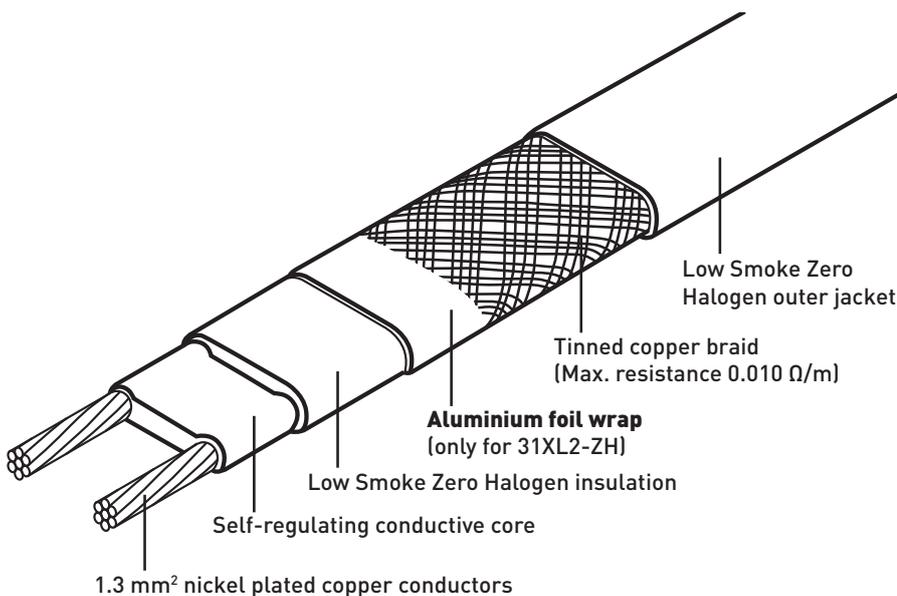
Pentair's Raychem brand has been at the forefront of innovation in self-regulating technology for more than 40 years, offering high performance systems users can rely on to keep people and critical assets safe. XL-Trace LSZH is no exception.

The XL-Trace LSZH range is built on Raychem's long-standing legacy of using radiation chemistry to produce

extremely reliable products. The new solution is available in various thermal power outputs (10, 15, 26 and 31 W/m) for use with multiple pipe sizes and different installation requirements. It features high-performance, radiation cross-linked materials whereby molecular chains of polymers are linked together leading to increased polymer performance and a lifespan beyond 25 years.

The cables also offer increased mechanical properties such as tensile strength and scratch resistance, allowing for effective performance at variable temperature. This is further supported by an IEC60068-2-5 and IEC60068-2-9 UV resistant material, which remains colorfast under UV exposure, increasing product life expectancy.

Raychem XL-Trace LSZH cable



Improved energy efficiency

While demand for environmentally-friendly products is still an emerging trend in the construction industry, an understanding of the benefits of LSZH for better sustainability is significant. ISO 14000 is a series of standards that comply with applicable laws and aim to minimize the negative effect equipment has on energy efficiency.

The Restriction of Hazardous Substances Directive (RoHS) restricts the use of hazardous materials in the production of various electronic and electrical equipment.

The Waste Electrical and Electronic Equipment (WEEE) directive sets collection, recovery and recycling targets for electrical goods and is part of a legislative to solve toxic e-waste issues³.

Pentair's innovative Raychem cables minimize energy consumption. Unlike constant wattage series heaters and zone heating cables that produce the same amount of energy all the time, its self-regulating cables only emit heat when and where needed (figure 1). As the temperature rises,

electrical resistance increases, and cables reduce power output. They achieve this by reacting to ambient temperature, reducing output when it is warm and increasing it when it is cold. As a result, the cables do not overheat.

Figure 1: A self-regulating cable



Easy-to-use and install

The construction supply chain is increasingly looking for products that are both safer and easier to use. The XL-Trace LSZH range is compatible with the unique RayClic fast connection system, resulting in an extremely easy-to-use solution, with limited need for wire stripping or special tools. By having differentiated jacket colors, users can easily recognize each cable.

The colored inner insulation also makes the insertion into the RayClic more visible. In addition, with the insulation displacement connector making the electrical connection, installation time and total installed costs are also significantly reduced compared with heat shrink alternatives.

Available in extended heating circuit lengths up to 215m, the cables feature a low bend radius of only 10mm which helps users to tightly fit the cable on pipe runs with many angles. Highly flexible, the self-regulating cables can also be cut to any length on-site to mitigate design variations. The result is fewer electrical connections, controls, connection wiring and electrical safety devices, generating further cost saving opportunities.

As four different types of cables are available to users, the technology is tailored to meet various installation requirements. For instance, the XL-Trace 31XL2-ZH provides protection of larger pipes and valve

freeze protection or temperature maintenance of greasy waste pipework and higher temperature flow maintenance applications.

Alternatively, XL-Trace 10 XL2-ZH has been designed for small pipes diameters.

PROVIDING UNPARALLELED BUILDING SAFETY

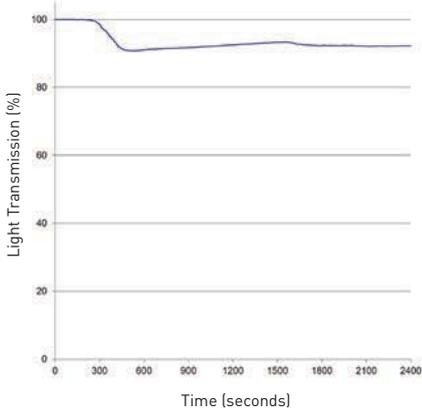
In addition to meeting the need for innovative cable design, Pentair's Raychem LSZH technology features increased safety without compromising on durability or energy efficiency, making it the safest and most reliable solution for modern buildings.

Smoke test

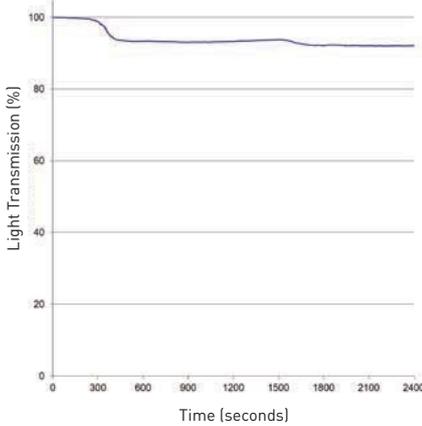
When tested in accordance with IEC61034-2 (figure 2), the XL-Trace LSZH range emitted up to 90 per cent less smoke than modified polyolefin (CR) jacket materials. Across the entire portfolio, XL-Trace LSZH showed consistent and positive results compared with conventional products (figure 3).

Figure 2: IEC61034-2 XL-Trace LSZH results

**Transmission Percentage vs. Time –
EWF No: 376139 Specimen No: 1**



**Transmission Percentage vs. Time –
EWF No: 375019 Specimen No: 1**



**Transmission Percentage vs. Time –
EWF No: 375015 Specimen No: 1**

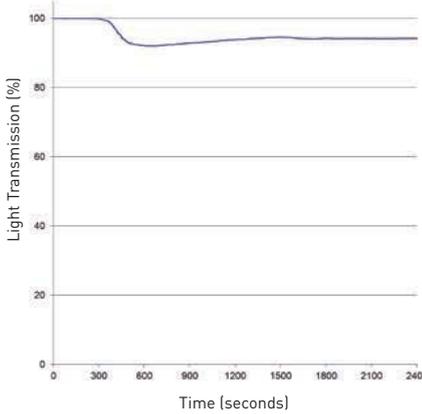
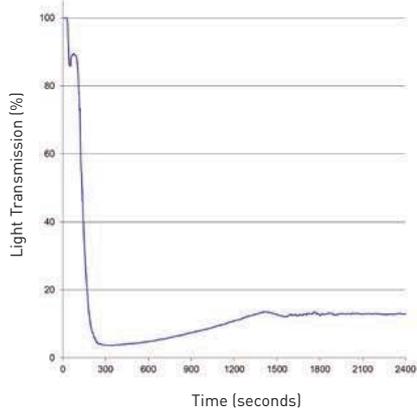
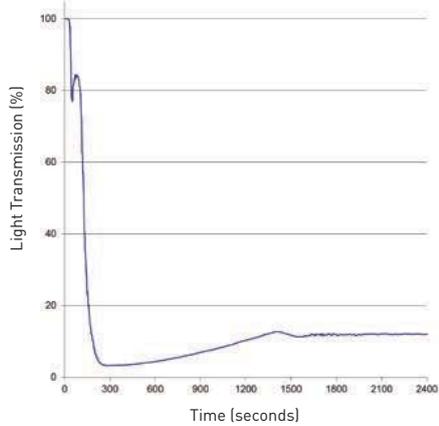


Figure 3: IEC61034-2 Conventional product results

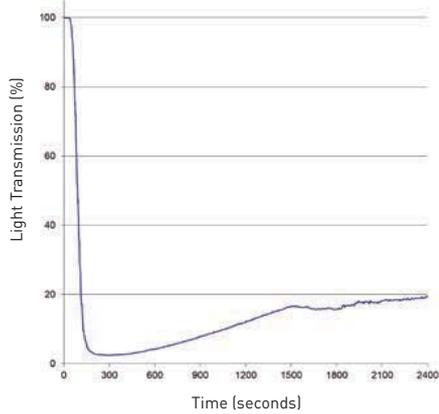
**Transmission Percentage vs. Time –
EWF No: 375017 Specimen No: 1**



**Transmission Percentage vs. Time –
EWF No: 375016 Specimen No: 1**



**Transmission Percentage vs. Time –
EWF No: 375014 Specimen No: 1**



Flammability test

The materials are also tested and compliant with IEC60754-1 and zero halogen tests. Added to this, it provides extreme resistance under the IEC62395 flammability test and is immediately self-extinguishing, exceeding the highest test standards.

The vertical flame test included in IEC62395 is designed to test a heating cable's resistance to fire as well as its ability to prevent proliferation of the fire to other areas of the building. XL-Trace LSZH exceeds the performance of any other tested solution (Figure 4).

The flame is immediately extinguished when the flame source is removed, and the material science of the polymer prevents any flaming droplets falling as well as any vertical flame development – and all this without smoke generation.

Figure 4: XL-Trace LSZH flammability test results



CR Jacket

LSZH Jacket

PARTNERING WITH A HEAT-TRACING EXPERT

Safety in public places is one of the most important considerations for today's architects, engineers and contractors. With an increasing number of regulations focusing on fire safety, ensuring that technologies are compliant with the latest building regulations has become key to success for today's manufacturers working in the wire and cables industry. The Raychem XL-Trace LSZH range from Pentair fully complies with the IEC62395 edition 2 (2013) requirements as well as the latest low-smoke and fire safety regulations, thus offering unparalleled performance for building services.

Pentair has developed a solution that is adapted to meet specific needs, whether it is resistance to temperature variation, reliability, safety or longevity. Through its Raychem brand, the company has been the pioneer of self-regulating technology and driving innovation for more than 40 years. With its unique properties, it is the safest and most reliable choice for modern buildings, providing superior security and peace of mind to engineers, installation contractors and building owners, without compromising durability and energy efficiency.

For more information on Pentair's wide range of pipe freeze protection solutions, please visit: [ProtectPipesFromFreezing.pentairthermal.co.uk](https://www.pentairthermal.co.uk/ProtectPipesFromFreezing)



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