

Cable protection for increasing fire safety in rolling stocks as per EN 45545-2: 2013

Nearly 20 years of work in various European bodies were necessary that the new standardized EN 45545 = "Railway applications – Fire protection on railway vehicles" has been taken in force as of August 2013. The new EN 45545, which will find binding application in whole Europe in March 2016, is the most comprehensive set of fire safety standards for rolling stock ever developed. However in the meantime, the national standards remain valid in parallel, e.g. BS 6853, DIN 5510 or NF F-16101. But these national standards have to be finally withdrawn after this transitional period will expire. Then suppliers are obliged to approve their materials as per EN 45545-2 (Requirements for fire behavior of materials and components) for being allowed to supply the European market place.

New standards have always driven development of new materials and technologies, as it will be in the case of EN-45545. The new, fire retardant and self-extinguishing sleeve VSCF supplied by Relats 1) / Albert Schweizer 2) will be a good example. Since early stage of work in standards cable protection has been a special point of interest. In this process, areas such as traction system, brakes, driver's cab, air conditioning, bogies and converters will be particularly taken into account.

Not just fire protection but also operation under extreme conditions is becoming a critical issue in product development for new railway projects.

One good example is the high speed train project in Saudi Arabia to link cities of Medina and Mecca. Extreme environmental conditions under which the trains shall be operated complicate the implementation of this railway project significantly.

The track, the rolling stock and the complete infrastructure are designed to withstand temperatures ranging from 0 to 55 °C and high abrasion resulting from sand storms. All electrical systems (transformers, converters, sensors) will be equipped with a specific protection against these harsh environment conditions.

All necessary requirements have been listed in order to identify the specification of a new RELATS (A) sleeve:

- Resistant against direct flame
- High heat reflective
- Self-extinguishing
- Very resistant against sand abrasion
- Fully operational within a temperature range of -70°C up to +250°C



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A key point was to ensure that electrical cables remain intact and fully operational after 30 minutes of direct fire.

Relats developed in cooperation with company Albert Schweizer KG a special treated silicone rubber coating around a

Image 1: Self-extinguishing sleeve VSCF by Relats® / Albert Schweizer KG



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www.relats.com

2) Albert Schweizer KG, Mallastraße 79, D 68219 Mannheim, www.schweizer-net.com



Image 2: Operation under extreme environmental conditions

	EN ISO 4589-2 LOI (%)	EN ISO 5659-2 (25 kW/m ² -flaming) Ds max		NF X 70-100-1/-2 C _{TNLP}	
Revitex VSC	32.4	70		0.1	
Revitex VSCTF	45.6	232		0.03	
Periflex PLAI 7	34.2	147.7		0.09	
Periflex PS	35.6	114		0.1	
	for R22-R23	R22	R23	R22	R23
HL1	≧ 28%	≧ 600	—	≧ 1.2	—
HL2	≧ 28%	≧ 300	≧ 600	≧ 0.9	≧ 1.8
HL3	≧ 32%	≧ 150	≧ 300	≧ 0.75	≧ 1.5

Table 1: Test results of selected Relats@ insulating sleeves.

Table 2: Possible fields of operation

Railway vehicles, interior – HL3

Power supply technology (Cables and conductors, multimedia, communication, light conductor systems)	Periflex PS 1) Operating temperature from -40°C to +150°C Excellent abrasion resistance Periflex PLAI7 2) Operating temperature from -40°C to +150°C Free of halogens, very good mechanical and electromagnetic protection, self-sealing Revitex VSC 3) Operating temperature from -40°C to +235°C Free of halogens, very good thermal and diesel-electric protection
Cabins – driver's cab	Periflex PS Periflex PLAI7 Revitex VSC
Air conditioning	Periflex PS Revitex VSC
1) Braided mono-filament polyester sleeve 2) Woven mono-filament polyester sleeve 3) Fiber glass sleeve with silicone coating	

Railway vehicles, exterior – HL2

Braking system	Revitex VSCTF 4) Operating temperature from -40°C to +235°C Free of halogens, flame resistant, also self-sealing
Transformers, converters	Revitex VSC
Doors	Periflex PS Periflex PLAI7 Revitex VSC
Electrical safety equipment	Revitex VSC
Electric motors	Revitex VSCTF Revitex VSC Periflex PS Periflex PLAI7
Bogies	Revitex VSCTF Revitex VSC Periflex PS Periflex PLAI7
Fiber glass sleeve with silicone coating	

glass fiber braid, which provides the new sleeve with a very high temperature resistance and self-extinguishing capability. In case of direct fire, the Revitex VSCTF creates foam, which protects the inner cable.

There are several ways to characterize flammability of polymers. One of them is the Limiting oxygen index (LOI). This index refers to the oxygen concentration in percent which is needed to sustain combustion of the specimen under laboratory conditions.

A polymer with a low Limiting Oxygen Index will start to burn in usual ambient air conditions with an oxygen content of

approx. 21%; one polymer with a higher LOI will extinguish – unless the fire acts continuously on the polymer surface. As per EN ISO 4589-2 a Limiting Oxygen Index of 45.6% has been measured for the Revitex VSCTF, whereat this sleeve shows very good self-extinguishing properties.

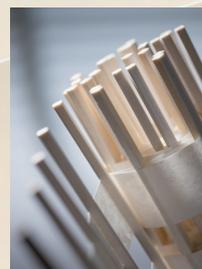
LOI	Flammability rating
Up to 16	Highly flammable
16-20	
21-24	Slowly burning
25-29	
30-43	Selfextinguising
Over 44	Revitex VSCTF

In case of fire, when temperature outside reaches 1000 °C the sleeve still protect electrical cables by keeping the temperature inside at only around 300 °C.

The sleeve Revitex VSCTF has been launched to the market in 2013 and is currently being used by car manufacturers in Europe, US and Asia.

Both Revitex VSCTF and further products of RELATS / Albert Schweizer KG already fulfilling the requirements³⁾ as per EN-45545-2 of HL1 – HL3. These very good results offer a wide range of applications. Generally speaking, the pan-European fire protection standard is going to contribute to make transport of passengers in railway vehicles safer and to ensure that it will be possible to evacuate people in the event of a fire. Of all the components present in railway vehicles, the author has chosen cable protection as an example illustrated in this article to show which influence the standard is going to have on flame-retardant and self-extinguishing product innovations.

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