PRODUCT DATA SHEET

Polyethylene

Visico" FR4451/LE4439

Silane Crosslinkable Halogen Free Flame Retardant Compound

Description

Visico FR4451/LE4439 is a natural UV stabilized, halogen free moisture-induced crosslinkable polyethylene compound that is designed for use in photovoltaic cables.

The combination of Visico FR4451 base resin and LE4439 catalyst provides a highly scorch retardant compound system with excellent thermal stability and good flame retardant properties. Visico FR4451/LE4439 contains a patented scorch retardant additive that increases the processing window for a silane crosslinkable compound and minimizes the tendency for premature crosslinking in the extruder, head or die.

Cable insulation with a proper mixture of Visico FR4451 and LE4439 exhibits excellent thermo-oxidative stability in contact with aluminium or copper. A ratio of 5 parts LE4439 in 95 parts FR4451 is recommended for best crosslinking performance. The LE4439 can also be reduced to 4 parts in 96 parts FR4451.

Visico FR4451/LE4439 can be readily pigmented to a variety of colors using standard wire & cable color concentrates designed for thermoplastic or crosslinked polyethylene.

Typical characteristics

Visico" FR4451/LE4439 can be described with following typical characteristics:

Low smoke and toxic gas emissions

Suitable for colouring

Excellent processing properties

Applications

Visico" FR4451/LE4439 is intended for following applications:

Flexible low voltage insulation

Visico FR4451/LE4439 is recommended for use as insulation and jacket of flexible single-core cables (cords) at the DC-side of photovoltaic systems with maximum permissible voltage of DC 1.5 kV.

Specifications

Visico FR4451/LE4439 and/or articles produced from it, are expected to meet the applicable requirements included in the below mentioned standards provided it is processed using sound material handling and processing practices as well as appropriate testing procedures.

DIN VDE 0818

EN 50618

EN 50290-2-26

IEC 62930

EN 50363-5 EI5

TÜV 2 PfG 1169/08.2007

DIN VDE 0100-510 - AD8 classification

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Physical properties

Property	Typical value *	Unit	Test method
Base resin density [1]	1150	kg/m³	ISO 1183
Density [2]	935	kg/m³	ISO 1183
Melt flow rate (190 °C/2.16 kg)	0.6	g/10min	ISO 1133-1
Tensile strength [3]	15	MPa	IEC 60811-501
Elongation at Break [3]	400	%	IEC 60811-501
Hot set test - Elongation under load (250 °C, 0.20 MPa) [4]	<100	%	IEC 60811-507
Hot set test - Permanent deformation (250 °C, 0.20 MPa) [4]	<5	%	IEC 60811-507
Pressure test at high temperature (140°C, 240 h) [4]	Pass	-	IEC 60811-508

* Data should not be used for specification work

[1] *Visico FR4451*

[2] *LE4439*

[3] *Value refers to cured specimens, 5% catalyst added. Measured at 50 mm/min*

[4] *Value refers to cured specimens, 5% catalyst added.*

Electrical properties

Property	Typical value *	Unit	Test method
Dissipation factor (50 Hz)	0.011	-	IEC 62631
Relative permittivity (50 Hz)	3	-	IEC 62631
DC volume resistivity	10	P&cm	IEC 62631

* Data should not be used for specification work

Other properties

Property	Typical value *	Unit	Test method
Limiting Oxygen Index	35	%	ISO 4589-2
Corrosivity of combustion fumes, Conductivity	<10	µS/mm	IEC 60754-2
Corrosivity of combustion fumes, pH	>4.3	-	IEC 60754-2
Single vertical flame test	Pass	-	IEC 60332-1

* Data should not be used for specification work

Processing setting	Typical value/range
Barrel temperature	130 - 140 - 145 - 150 - 150 °C
Die temperature	150 °C
Conductor preheating temperature	90 °C

Crosslinking
Visico FR4451/LE4439 can be crosslinked in room temperature, by immersion in hot water or exposed to low pressure steam with a typical temperature range of 60°C to 90°C. The time period for crosslinking may be varied due to humidity, thickness of insulation, reel size, catalyst dosage and temperature.

Drying
Unopened packages of Visico FR4451 should not require drying, as it will destroy the drying agent that has been added to prevent the material to take up moisture. However, if the moisture level of opened packages rises to more than 400 ppm, then drying for 4 hours at 60°C in a dehumidifying type dryer is recommended.
LE4439 should not be dried. It should always be used from a fresh package.

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Processing techniques

The actual conditions will depend on the type of equipment used.
Visico FR4451 and LE4439 are typically mixed directly in the extruder hopper using a volumetric or gravimetric masterbatch feeder. Most equipment designed for PVC or PE extrusion is equally suitable for Visico FR4451/LE4439.
For appropriate mixing and homogenisation of the melt, we recommend using a flat temperature setting of 130-150°C without screw cooling for most types of extruders.
A conductor preheater is recommended to ensure good mechanical properties and this should be at approximately 90°C.

As the FR4451 is charged with fillers, we do not recommend to use screens, only breaker plate to create some pressure.

Packaging and storage

Storage
Visico FR4451 and LE4439 can be stored for 18 months after production, at 10-30°C (50-85°F) in unopened original packages, without significant deterioration in the quality of the material. Visico FR4451 and LE4439 should be stored in dry conditions and protected from direct sunlight. LE4439 is sensitive to moisture and is therefore delivered with low moisture content, ready to be used. Once a bag is opened, we recommend to fully use it; otherwise, the bag must be properly resealed between uses, as even short periods of storage in humid conditions may cause scorch during extrusion.

Product compliance documents

Latest versions of product safety information sheets (PSIS), product safety data sheets (SDS) and other product liability documents are available in our website www.borealisgroup.com.

Sustainability aspects

Borealis is ever mindful of the impact of our products on the planet. We promote Design for Circularity (DfC) and Design for Recycling (DfR) to conserve natural resources and to reduce the environmental impact of products over their entire lifetime (including production, use phase and after phase). DfR helps ensure that material can be effectively recycled while maximizing the material performance efficiency.

Further information on sustainability and Design for Recycling (DfR) can be found from our websites www.borealisgroup.com and www.borealiseverminds.com.

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