

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 (95 parts) and LE4439 (5 parts) exhibits excellent thermo-oxidative stability in contact with aluminum or copper.

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

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.

EN 50290-2-26
 EN 50363-5 EI5
 EN 50618

IEC 62930
 TÜV 2 PFG 1169/08.2007

Visico™ is a trademark of the Borealis Group



Polyethylene

Visico™ FR4451/LE4439

Physical properties

Property	Typical value *	Unit	Test method
Base resin density ¹	1190	kg/m ³	ISO 1183
Density ²	940	kg/m ³	ISO 1183
Melt flow rate (190 °C/2.16 kg)	0.5	g/10min	ISO 1133-1
Flexural modulus (2 mm/min)	100	MPa	ISO 178
Elongation at Break ³	400	%	IEC 60811-501
Tensile strength ³	16	MPa	IEC 60811-501
Hardness, Shore D	40	-	ISO 868
Hot set test - Elongation under load (200 °C, 0.20 MPa ⁴)	<50	%	IEC 60811-507
Hot set test - Permanent deformation (200 °C, 0.20 MPa ⁴)	<5	%	IEC 60811-507
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
Dielectric constant (50 Hz)	3	-	IEC 60250
DC volume resistivity	10	PΩcm	IEC 62631-3-2
Dielectric strength	>20	kV/mm	IEC 60243

* Data should not be used for specification work

Other properties

Property	Typical value *	Unit	Test method
Limiting oxygen index (specimen IV)	32	%	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

Visico™ is a trademark of the Borealis Group



Polyethylene

Visico™ FR4451/LE4439

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 required 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.

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 exposure to low pressure steam, with a typical temperature range of 60°C to 90°C. The time required to obtain full crosslinking will vary depending on humidity, thickness of insulation, reel size and temperature.

Drying

Unopened packages of Visico FR4451 should not require drying. Once packages of Visico FR4451 have been opened, aluminum liner needs to be resealed as soon as possible to prevent moisture uptake. If the moisture level of opened packages rises above 400 ppm, 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. Opened packages of LE4439 needs to be resealed as soon as possible to prevent moisture uptake, which can cause potential pre-crosslinking during the extrusion step.

Packaging and 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. Pre-drying is not recommended, as it will destroy the drying agent that has been added to prevent the material to take up moisture. The bags 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.

Visico™ is a trademark of the Borealis Group



Polyethylene

Visico™ FR4451/LE4439

Disclaimer

The product(s) mentioned herein are not intended to be used for medical, pharmaceutical or healthcare applications and we do not support their use for such applications.

To the best of our knowledge, the information contained herein is accurate and reliable as of the date of publication; however we do not assume any liability whatsoever for the accuracy and completeness of such information.

Borealis makes no warranties which extend beyond the description contained herein. Nothing herein shall constitute any warranty of merchantability or fitness for a particular purpose.

It is the customer's responsibility to inspect and test our products in order to satisfy itself as to the suitability of the products for the customer's particular purpose. The customer is responsible for the appropriate, safe and legal use, processing and handling of our products.

No liability can be accepted in respect of the use of any Borealis product in conjunction with any other products and/or materials. The information contained herein relates exclusively to our products when not used in conjunction with any other material unless as specifically provided for in the test methods stated above.