UNIGARD™ RE DFDA-1638 NT
Non-Halogen, Flame Retardant, Thermoplastic Jacket and Insulation Compound

Overview

UNIGARD™ RE DFDA-1638 Natural is a non-halogen, flame retardant, thermoplastic, low smoke, low corrosive, and low toxic compound. It has been designed for general purpose, medium and low voltage applications. If needed, standard color concentrates (EVA or PE based) can be used.

Used as jacket, it is designed to pass the IEC-332-3, the IEEE-383/UL-1685 vertical tray cable burn tests. Cable construction, of course, plays an important role in flame performance. DFDA-1638 Natural can be used as jacket for 90°C rated cables.

DFDA-1638 Natural is also designed to maximize processing and flame performance. This compound can sustain extrusion temperatures up to 362°F (200°C) and can be extruded in typical single-flight metering PE screws, barrier screws, Maddock screws, and screws with mixing pins.

Features

UNIGARD RE DFDA-1638 Natural provides the following features:

- Highly flame retardant (VW-1, IEC-332-3, IEEE 383 flame test ratings)
- Environmentally friendly (lead-free, halogen-free, sulfur/antimony-free)
- Low smoke, low corrosivity, and low toxicity
- UV stabilized
- Contains copper inhibitor
- Ease of extrusion and no special screw required
- Good electrical properties, moisture resistance, and fluid resistance
- Good balance of toughness and flexibility
- Excellent cut-through, crush, and abrasion resistance
- Colorable for insulation and jacket applications

Additive

- UV Stabilizer

Physical	Nominal Value	(English)	Nominal Value	(SI)	Test Method
Density	1.50	g/cm³	1.50	g/cm³	ASTM D1505
Mechanical Water Absorption - 7 days (158°F (70°C))	9.50	mg/in²	9.50	mg/in²	UL 1581
Environmental Stress-Cracking Resistance (ESCR) [1]					ASTM D1693
10% Igepal	720	hr	720	hr	
Mechanical	**Nominal Value**	**(English)**	**Nominal Value**	**(SI)**	**Test Method**
Tensile Strength [2]	1800	psi	12.4	MPa	ASTM D638
Tensile Elongation [2] (Break)	180	%	180	%	ASTM D638
Flexural Modulus - 1% Secant	31000	psi	214	MPa	ASTM D790
Taber Abrasion Resistance - 1000 cycle	2	%	2	%	ASTM D1044
Shrinkback - 4 hrs [3] (212°F (100°C))	1.0	%	1.0	%	REA 89
Elastomers	**Nominal Value**	**(English)**	**Nominal Value**	**(SI)**	**Test Method**
Tear Strength	35.0	lbf/in	6.13	kN/m	ASTM D470
Hardness	**Nominal Value**	**(English)**	**Nominal Value**	**(SI)**	**Test Method**
Durometer Hardness (Shore A)	89		89		ASTM D2240
Thermal	**Nominal Value**	**(English)**	**Nominal Value**	**(SI)**	**Test Method**
Brittleness Temperature	-13.0	°F	-25.0	°C	ASTM D746
Hot Deformation [3]					UL 1581
194°F (90°C)	2.8	%	2.8	%	
212°F (100°C)	10	%	10	%	
250°F (121°C)	48	%	48	%	
Oxidation Induction Time - Al pans, no crimping, no screen, 100 ml oxygen/min	25	min	25	min	ASTM D3895

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Aging	Nominal Value	(English)	Nominal Value	(SI)	Test Method
Retention of Tensile Elongation - 10 days [2]					ASTM D638
230°F (110°C)	89	%	89	%	
Retention of Tensile Strength - 10 days [2]					ASTM D638
230°F (110°C)	110	%	110	%	
Electrical	**Nominal Value**	**(English)**	**Nominal Value**	**(SI)**	**Test Method**
Volume Resistivity (73°F (23°C))	3.5E+14	ohms·cm	3.5E+14	ohms·cm	ASTM D257
Dielectric Constant					ASTM D150
60 Hz	3.42		3.42		
100 kHz	3.49		3.49		
1 MHz	3.42		3.42		
6 MHz	3.34		3.34		
Dissipation Factor					ASTM D150
60 Hz	3.7E-3		3.7E-3		
100 kHz	7.6E-3		7.6E-3		
1 MHz	0.014		0.014		
6 MHz	0.016		0.016		
Flammability	**Nominal Value**	**(English)**	**Nominal Value**	**(SI)**	**Test Method**
Oxygen Index	39	%	39	%	ASTM D2863
Acid Gas Emission Conductivity	No conductivity increase of the test fluid		No conductivity increase of the test fluid		IEC 754-2
Acid Gas Emission pH	4.50		4.50		IEC 754-2
Acid Gas Test - Generation	0.47	%	0.47	%	MIL C-24643
Smoke (0.10 in (2.54 mm))	5.30		5.30		NES 711
Smoke Density					ASTM E662
Flaming Mode - D1.5 : 0.10 in (2.54 mm)	0.62		0.62		
Flaming Mode - D4.0 : 0.10 in (2.54 mm)	1.0		1.0		
Flaming Mode - Dm, (corr.) : 0.10 in (2.54 mm)	82		82		
Non-flaming Mode - D1.5 : 0.10 in (2.54 mm)	0.24		0.24		
Non-flaming Mode - D4.0 : 0.10 in (2.54 mm)	16		16		
Non-flaming Mode - Dm, (corr.) : 0.10 in (2.54 mm)	290		290		
Temperature Index (Burning) - Critical	> 662	°F	> 350	°C	NES 715
Toxicity	1.40		1.40		NES 713

Additional Information

Fluid Resistance:

Diesel Fuel, MIL-F-16884, 24 hrs, 35°C

- #14 AWG (1.63 mm dia.) solid copper conductor with 0.045 in (1.1 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 77%
  - Elongation Retention: 101%

Hydraulic Fuel, MIL-H-5606, 24 hrs, 49°C

- #14 AWG (1.63 mm dia.) solid copper conductor with 0.045 in (1.1 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 61%
  - Elongation Retention: 93%

Hydraulic Fuel, MIL-H-17672, 24 hrs, 49°C

- #14 AWG (1.63 mm dia.) solid copper conductor with 0.045 in (1.1 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 73%
  - Elongation Retention: 111%

Lubricating Oil, MIL-L-23699, 24 hrs, 49°C

- #14 AWG (1.63 mm dia.) solid copper conductor with 0.045 in (1.1 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 80%
  - Elongation Retention: 124%

ASTM #2 Oil, 4 hrs, 70°C

- #14 AWG (1.63 mm dia.) solid copper conductor with 0.045 in (1.1 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 68%
  - Elongation Retention: 139%

Turbine Fuel, JP-4, MIL-T-5624, 24 hrs, 23°C

- #14 AWG (1.63 mm dia.) solid conductor with 0.030 in (0.76 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 76%
  - Elongation Retention: 160%

Turbine Fuel, JP-5, MIL-T-5624, 24 hrs, 23°C

- #14 AWG (1.63 mm dia.) solid conductor with 0.030 in (0.76 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 76%
  - Elongation Retention: 97%

Cleaner, Isopropyl Alcohol, TT-I-735, 24 hrs, 23°C

- #14 AWG (1.63 mm dia.) solid conductor with 0.030 in (0.76 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 82%
  - Elongation Retention: 103%

Coolant, Monsanto Coolanol 25, 24 hrs

- #14 AWG (1.63 mm dia.) solid conductor with 0.030 in (0.76 mm) insulation. Full immersion of tubular specimens.
  - Tensile Strength Retention: 92%
  - Elongation Retention: 89%

Extrusion Notes

DFDA-1638 Natural can be processed on a wide range of commercially available thermoplastic extrusion equipment. This material exhibits an ease of processing that is unique for highly filled non-halogen products now on the market. We suggest beginning with the recommended conditions listed below.

Extruder

- Extruder L/D: 20:1 to 24:1
- Screws Suggested: Single flight with metering section, Barrier screws, Maddock screw
- Screw Delivery End: Shallow rather than deep
- Compression Ratio: 2:1 to 3:1
- Screen Pack/Inch: 20/80/20 mesh

Temperature Profile

- Feed Zone: 300°F-325°F (149°C-162°C)
- Center Zones: 380°F-400°F (193°C-204°C)
- Head/Die Zones: 350°F-360°F (175°C-180°C)
- Conductor Preheat: 250°F (121°C)

Draw-Down Ratio (DDR)

- Core Diameter less than 0.5 in (13 mm) 1:1 to 1.25:1
- Core Diameter greater than 0.5 in (13 mm) 2:1

Tooling

- Semi-pressure tooling improves surface finish.
- Tube-on tooling: Retract guider-tip slightly into die.

Die

- Single tapered short land die is preferred.

Vacuum

- Though not usually necessary, on occasion may help obtain a tight jacket and offset any low DDR effect.

Air-Gap/Cooling Water

- Short air gap (such as 6 in [150 mm]) and ambient water

Pre-Drying

- Pre-drying at approximately 158°F (70°C) for 4 hours is recommended in commercially available dehumidifying dryers. Do not heat over 195°F (90°C).

Colorability

- UNIGARD RE DFDA-1638 Natural is a colorable compound. Color masterbatch materials designed for use with polyethylene or ethylene copolymer wire and cable products are recommended. Generally speaking, color masterbatch added at the level from 0.5 to 1.0% by weight gives adequate color and disperses well in the extrusion process.

Notes

These are typical properties only and are not to be construed as specifications. Users should confirm results by their own tests.

[1] No Cracks

[2] #14 AWG (1.63 mm dia.) solid copper conductor with 0.030 in (0.76 mm) insulation.

[3] #14 AWG (1.63 mm dia.) solid copper conductor with 0.045 in (1.1 mm) insulation.

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