



UNIGARD™ HFDA-6525 NT Reduced Emission Compound

Non-Halogen, Flame Retardant, Peroxide Crosslinkable Insulation and Jacket Compound

UNIGARD RE HFDA-6525 NT is a non-halogen, flame retardant, peroxide crosslinkable compound for applications requiring UL VW-1 and vertical tray cable (IEEE-383/UL-1685/CSA Standard C22.2 No. 3) flame test rating. HFDA-6525 NT offers superior thermal, mechanical, electrical, and combustion properties with low smoke, low corrosivity, and low toxicity. This mineral-filled ethylene copolymer is designed to replace halogenated flame retardant crosslinkable polyolefins and halogenated rubbers (such as Hypalon®, Neoprene®, halogenated FR EPR or EPDM, halogenated FR TPE, and crosslinkable CPE) with reduced emissions for fire safety and good property balance.

Features

HFDA-6525 NT has the following features:

- Highly flame retardant (UL VW-1 and IEEE 383 flame test rating)
- Environmentally friendly (lead-free, halogen-free, and sulfur/antimony-free)
- Low smoke, low corrosivity, and low toxicity
- Good wet electrical properties as an insulation (at least 75°C wet rating)
- Voltage rating up to 2 kV
- Good electrical properties and moisture resistance
- Excellent cut-through, crush, and abrasion resistance
- Good tear strength and fluid resistance
- Good balance of toughness and flexibility
- Ease of extrusion and no special screw required
- Colorable for insulation or jacket applications

Specifications

HFDA-6525 NT meets the UL-44 (XHHW, RHH/RHW, and SIS) and UL-854 (USE) requirements as an insulation compound. It passes the UL-1685 limited smoke ("LS") vertical tray cable flame test. This compound may also meet the other UL standards and industry standards (such as NEMA/IECA, EC, IEEE 383-1974 (flame test), CSA, ASTM, mass transit specifications and military specifications) for insulation or jacket applications. Each manufacturer utilizing HFDA-6525 NT must contact the standards agency to determine what evaluations, if any, are required to receive application approvals.

Typical Physical Properties			
Property	Test Method ⁽¹⁾	Unit	Typical Value ⁽²⁾
Density at 23°C ⁽²⁾	ASTM D792	gm/cm ³	1.48
Tensile Strength	ASTM D638	psi (MPa)	≥1500 (10.4) [‡]
Tensile Elongation	ASTM D638	%	150
Retained Tensile/Elongation after heat aging 7 days at 121°C	UL-44	%	100/85
Retained Tensile/Elongation after heat aging 7 days at 158°C	UL-758	%	100/80
Deformation at 121°C	UL-44	%	10
Mechanical Water Absorption at 82°C	UL-44	mg/in ²	6
Low Temperature Brittleness*	ASTM D746	°C	-18.5
Durometer Hardness*	ASTM D2240	Shore A	89
Trouser Tear Strength*	ASTM D470	lb/in	57
⁽¹⁾ Tests are made in accordance with current ASTM or Dow Methods. ⁽²⁾ Values are typical, and not to be construed as specifications. [‡] The typical values of HFDA-6525 NT shown above are based on 30 mil insulation thickness on # 14 AWG solid copper (stranded conductor may result in lower values due to fallin), except for those marked by asterisk (*) which are based on the cured plaques.			

Typical Electrical Properties			
Property	Test Method ⁽¹⁾	Unit	Typical Value ⁽²⁾
SIC in 75°C water after 24 hours	UL-44	--	4.06
SIC, 1-14 day, % increase	UL-44	%	6.89
SIC, 7-14 day, % increase	UL-44	%	1.63
Stability Factor, 14 days in 75°C water	UL-44	--	0.1
Stability Factor, 1 to 14 day increase	UL-44	--	0.08
Insulation Resistance in 15.6°C water	UL-44	MΩ/1000 ft.	28,000
Insulation Resistance in 75°C water, 600V	UL-44	MΩ/1000 ft.	90
Glancing Impact at 15 kV	UL-44	--	no breakdown
Dielectric Constant at 1 k Hz*	ASTM D150	--	3.73
Dissipation Factor at 60 Hz*	ASTM D150	--	0.0027

Typical Combustion Properties			
Property	Test Method ⁽¹⁾	Unit	Typical Value ⁽²⁾
VW-1 Vertical Burn Test	UL-44	--	Pass
Vertical Tray Cable Flame Test	UL-1685	--	Pass
Limited Smoke "LS" Flame Test	UL-1685	--	Pass
Limited Oxygen Index*	ASTM D2863	%	40
Smoke Density on 110 mil plaque*	ASTM E662	--	--
Flaming Mode – D _s , 1.5 min./4.0 min.		--	1/5
– D _m		--	65
Non-flaming Mode – D _s , 1.5 min./4.0 min.		--	0.2/16
– D _m		--	300
Acid Gas Test* - HCl equivalent	MIL-C-24643	%	0.6
- Conductivity	IEC 754-2	μs/cm	90

Fluid Resistance			
Property	Test Method ⁽¹⁾	Unit	Typical Value ⁽²⁾
Retained Tensile/Elongation			
Turbine Fluid, JP-5, 24 hr, 50°C	MIL-C-24643	%	60/66
Hydraulic Fluid, MIL-H-5650, 24 hr, 50°C	MIL-C-24643	%	60/61
ASTM #2 Oil, 96 hr, 100°C	UL-44	%	80/100

(1) Tests are made in accordance with current ASTM or Dow Methods.

(2) Values are typical, and not to be construed as specifications.

† The typical values of HFDA-6525 NT shown above are based on 30 mil insulation thickness on # 14 AWG solid copper (stranded conductor may result in lower values due to fall in), except for those marked by asterisk (*) which are based on the cured plaques.

Extrusion Techniques

HFDA-6525 NT is a natural, peroxide crosslinkable material intended for processing on extrusion lines suitable for crosslinked polyethylene or ethylene copolymers. For melt homogeneity without scorching, the best stock temperature range of the extrudate is approved between 245 and 260°F. The pressures generally range from 2000 to 5000 psi (142-357 Bar). A tapered die, between 3 to 6 degrees, is recommended for a smoother surface. The typical clearance between the tip and the core is 1 to 2 mils (0.025- 0.05 mm) for the solid conductor and 3 to 4 mils (0.075-0.10) for others. Typical extrusion conditions are shown below as a guide.

EXTRUDER

Screw type	Single Flight Metering Screw
Screw L/D	15:1 to 24:1
Compression Ratio	2.5:1 to 3.5:1
Screen Pack	60/20, 40/20 or 20 mesh

TOOLING

Die	Pressure/or Tube-on
Draw-down ratio	1.0 to 2.5

TEMPERATURE PROFILE

BARREL:	
Feed Zone	230°F (110°C)
Center Zones	230°F (110°C)
Head Zones	230°F (110°C)
CROSSHEAD:	
Head	220°F (104°C)
Die	220°F (104°C)
Stock Temperature	245-260°F (118-127°C)
Screw Cooling	None

CV-Curing Techniques

Like all peroxide-crosslinkable products, the high performance characteristics of HFDA-6525 NT requires adequate residence time in the CV unit while maintaining sufficient extruder screw speeds for melt homogeneity. The residence time is equal to the steam leg length divided by the CV line rate. The minimum residence time to achieving the performance characteristics for each application, depending on the particular equipment used and the wire size/thickness required can only be determined by extrusion trials. The same property performance can be obtained at a higher CV line rate under a higher steam pressure or using a longer steam leg length. An extrusion trial for four different residence times (such as 2.0, 1.5, 1.0, and 0.5 minutes for 30 mil insulation on a No. 14 AWG wire size) is recommended to determine your own minimum residence time to achieve properties required for the application. The typical residence time for applications requiring 158°C aging and wet electrical properties is 2 minutes for 30 mil (0.75 mm) wall on 14 AWG (2.08 sq mm) solid copper at a steam pressure of 245 psi. The hot creep elongation is usually less than 5%. Typical conditions of a CV unit are summarized below.

Steam Leg.....At least 200 feet (longer is better)

Steam Pressure.....At least 245 psi (higher is better)

Residence Time.....Depending on your application and equipment

Water Leg/Temperature....Depending on your application and equipment (longer leg and lower temperature is better)

Colorability

UNIGARD™ RE HFDA-6525 NT is a colorable compound. The color master-batch materials recommended for use with polyethylene or ethylene copolymer wire and cable products are suitable for use in HFDA-6525 NT. Generally speaking, color master-batch added at the level from 0.5 to 1.0% by weight gives adequate color and disperses well in the extrusion process. For black jacket applications, UV resistance can be also achieved by adding a carbon black master-batch. However, the level may be higher, and depends on the type of carbon black master-batch and the test requirement for the application.

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