
AlphaGary

Market Leadership in Specialty Compounds

SMOKEGUARD® FP

Setting the standard for high-performance data communication cable jacket compounds



What happens when two world-class technology leaders collaborate? AlphaGary and DuPont have teamed up to develop and commercialize new fluoropolymer compounds for broadband data / video cable applications. By combining the processability of SMOKEGUARD® with the premium fire and smoke characteristics of TEFLON®, cable manufacturers now have value-added options for producing a variety of cables with superior safety and transmission performance capability.

SMOKEGUARD® is a registered trademark of AlphaGary Corporation.
TEFLON® is a registered trademark of DuPont. Only DuPont makes TEFLON®.

AlphaGary Corporation, 170 Pioneer Drive, Leominster, MA 01453
AlphaGary has manufacturing sites in the USA, UK, and Canada
www.alphagary.com

Phone +1-978-537-8071
Fax +1-978-840-0856
Email Info@alphagary.com

Why create SMOKEGUARD® FP?

AlphaGary and DuPont have historically developed leading-edge fire safety technologies for plastic materials used in data communications cables. The ever-increasing attention on public safety and the desire for safer office environments presented the unique opportunity to combine the best attributes of proven technologies.

Considering a typical office building fire scenario, the development of SMOKEGUARD® FP fluoropolymer compounds is a significant innovation that will greatly reduce the potential evolution of smoke and flame spread contributed by the large amount of cables used to support office computer networks. While SMOKEGUARD® FP is the result of an engineering balance of many important properties, the most significant advancement is the ability for cables utilizing this material to meet the challenging definition of "limited combustible" fire performance. Data communications cables of all types (copper twisted pair, coax, fiber optic, etc.) can utilize SMOKEGUARD® FP as a jacket (sheath) to meet the testing requirements established in codes and standards such as NFPA 90A (the Standard that governs the installation of cables in concealed environments).

The following is a description of several of the important attributes of SMOKEGUARD® FP demonstrating the superior performance it has over conventional technologies for low-smoke generation cable requirements for use in concealed environments.

What testing standards does SMOKEGUARD® FP meet?

UL Test Results

For decades, "traditional" SMOKEGUARD® low-smoke, flame retardant PVC compounds have performed as jacket and insulation materials for data communications cables meeting the plenum cable fire performance requirements of NFPA 262 (smoke optical density - OD; flame spread). The evolution to SMOKEGUARD® FP fluoropolymer compounds now allow a full matrix of cable designs to meet the "limited combustible" criteria for the low flame spread (flame spread index - FSI), smoke generation (smoke developed index - SDI), and fuel load per NFPA 255 (UL 723) and NFPA 259.

The following comparison data is based on typical 4-pair UTP datacable constructions (jacket / insulation):

	NFPA 262		
	Smoke AVG. OD	Smoke Peak OD	Flame Spread
Max Requirement	0.15	0.5	5 feet
LSFR PVC / FEP	0.12	0.35	2 feet
FEP / FEP	0.02	0.09	1 foot
SG FP / FEP	0.03	0.08	0.5 feet

	NFPA 255 (UL 723)		NFPA 259
	Smoke SDI	Flame FSI	Fuel Load BTU/lb. (kJ/kg)
Max Requirement	50	25	3500 (8.1)
LSFR PVC / FEP	850	5	2600 (6.0)
FEP / FEP	20	0	1400 (3.2)
SG FP / FEP	20	0	1300 (3.0)

What makes SMOKEGUARD® FP unique?

Processability



SMOKEGUARD® FP is designed to process at line speeds typically experienced with highly-filled PVC or PE materials. Conventional metallurgies for extruder barrels, screws, and tooling can be used. The following is a general guide for initial extruder set-up. These conditions should be modified based upon extruder size, control scheme and cable design as well as quality control parameters.

Screw Design	Standard Metering {no mixing head for less aggressive mixing}
L/D	24:1
Compression Ratio	2.5
Metallurgy	17-4 PH Stainless Steel {Based on Cursory Low Output Study} (Standard Jacketing Lines may experience a slight increase in replacement frequency for screws, barrels, etc.)
Tooling:	
Draw Down Ratio	6:1 - 20:1
Draw Ratio Balance	Neutral {1.0}
Land Length	0.5" - 1.0"
Screen Packs	Breaker Plate; 20-40-20 mesh {for back-pressure}
Zone Temp Profile	530 F - 590 F
Stock Temperature	590 F - 610 F {Measure melt w/pyrometer}
Air Gap	14 inches into cold circulating water flow

Store Material in Dry Conditions

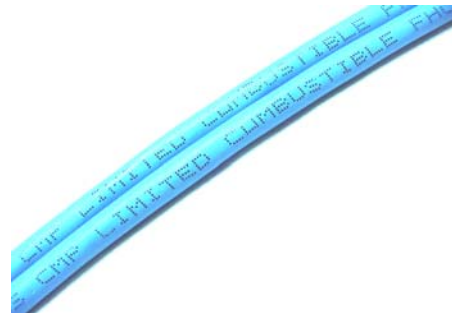
If material is exposed to humid conditions,
dry for 4 hours at 105°C / 220°F

What makes SMOKEGUARD® FP unique?

Colorability & Printability

The "anti-stick" nature of fluoropolymers make it difficult to apply conventional external marking techniques. SMOKEGUARD® FP is designed to eliminate the costly need for marking tapes and to allow for conventional non-contact ink marking systems. The stability of these markings can be further enhanced by the use of techniques such as plasma treatment.

In addition, a variety of colors are available in a SMOKEGUARD® FP masterbatch with the appropriate let-down and flame retardant properties.



What makes SMOKEGUARD® FP unique?

Acid Gas Generation

For decades, traditional PVC specialty flame retardant compounds have performed in both low-smoke generation and low flame spread applications such as measured in horizontal (NFPA 262) or vertical tray (UL 1666 or IEC 332.3) testing methods. PVC compounds are widely accepted and have been used for decades successfully in a wide variety of fire safety cable applications in all regions of the world. However, over the past few years, various organizations have raised concerns about the acid gas generation of traditional PVC, and certain countries or OEMs have opted to specify the use of halogen-free compounds.

SMOKEGUARD® FP has out-performed traditional PVC compounds in acid gas generation testing, and, as can be seen from the chart below, SMOKEGUARD® FP performs on-par with halogen-free compounds. So whether you are making cables for the US or for Europe, SMOKEGUARD® FP meets the highest standards of flame spread, smoke suppression, and acid gas generation.

The following data is from Standard MIL C-24643:

Material	% Acid	pH
FEP	27.2	1.7
ECTFE	23.9	1.6
PVDF	21.5	2.0
LSFR PVC	13.8	1.9
SMOKEGUARD® FP	1.5	3.0
48% LOI HFFR	0.35	3.4
34% LOI HFFR	0.24	3.9



How does SMOKEGUARD® FP compare with other materials?

Physical Property Comparison

Properties	SMOKEGUARD® FP "Limited Combustible"	Halogen Free		
		LSFR PVC NFPA 262	IEC 332.3 EuroClass C	IEC 332.1 EuroClass E
Specific Gravity, g/cc	2.80	1.65	1.61	1.53
Durometer D Aged, Inst./15 sec.	69 / 61	72 / 63	52 / 49	53 / 47
Tensile Strength, psi (20"/min)	2,250	2,500	1,750	1,750
Elongation, % (20"/min)	300%	180%	180%	180%
Oxygen Index, % (0.125")	100+%	53%	53%	35%
Brittle Point, °C	-46	-5	-22	-15
Flex Modulus, psi (0.03 in./min.)	202,000	56,000	41,000	49,000
UL Temp Rating, °C	125+	60	90	90
Dielectric Constant, (100 MHz)	2.92	3.25	3.87	3.57
Dissipation Factor, (100 MHz)	0.012	0.014	0.015	0.014
4pr UTP Jacket Thickness	8-11 mils	15-17 mils	30-40 mils	20-24 mils

What makes SMOKEGUARD® FP the right choice for fire safety?

Cable Fuel Load Reduction



Excessive fire contribution of exposed polyolefin cables in a real scale plenum fire test.

It is important to note the dramatic improvement SMOKEGUARD® FP provides in the fuel load that cables can contribute in an evolving fire. Limited Combustible Cables using SMOKEGUARD® FP achieve up to 5 times reduction in fuel load over the current European conventional fire performance levels and up to 3 times better than NFPA 262 plenum cable standards.

Cable Type (4pr UTP)	Insulation	Jacket	X-Web	Fuel Load	
				BTU/Meter	MJ/Meter
Cat 5e NFPA 262	FEP	LSFR PVC	None	~1,200	~1.27
Cat 5e LC	FEP	SMOKEGUARD® FP	None	~540	~0.57
Cat 6+ IEC 332.1	PE	Halogen Free (>36% OI)	None	~2,775	~2.93
Cat 6+ IEC 332.3	PE	Halogen Free (>45% OI)	None	~2,525	~2.65
Cat 6+ NFPA 262	FEP	LSFR PVC	FEP	~1,475	~1.56
Cat 6+ LC	FEP	SMOKEGUARD® FP	FEP	~590	~0.62

Why choose SMOKEGUARD® FP over FEP and other fluoropolymers for Limited Combustible Cable Jacketing?

Unique Balance of Cable Jacketing Properties

Limited Combustible Cables have traditionally used standard FEP fluoropolymer jackets. Cables that now use SMOKEGUARD® FP jacketing (such as DuPont™ Certified Limited Combustible Cables) have attributes that improve performance and are easier to install. Please contact us on how to modify your specifications to ensure you receive Limited Combustible Cables with SMOKEGUARD® FP. Here are some of the reasons you should specify Limited Combustible Cables to have SMOKEGUARD® FP jacketing instead of FEP or other fluoropolymers:

- Less Cable Memory (Ease of Installation)
- High Abrasion / Cut Thru Resistance
- Improved Flexibility / Slip Characteristics
- Full Range of Standard Colors
- Standard Marking (No Marker Tapes)
- Less Kinking
- Low Corrosivity / Low Acid Gas Generation
- Improved Strippability
- Remains Flexible at Low Temperatures
- Operating Temp Range from -40C to 150C
- Char Forming Characteristics
- Processability Similar to LSFR PVC
- Outstanding Resistance to Aging
- Good Chemical Resistance
- Available for All Cable Types
- No RoHS or WEEE Restricted Substances
- Thin-Wall Jackets
- Available from Most Cable Suppliers
- Excellent Economics vs Sprinklers in Concealed Spaces or Cable in Conduit

What are the physical requirements for SMOKEGUARD® FP?

UL 444 Standard for Communications Cable



Independent cable certification bodies such as Underwriters Laboratories, Inc. generate product Listings and characteristics to assure safety and continuous integrity and compliance to the Codes and Standards. UL has evaluated the initial grades of SMOKEGUARD® FP and established its physical properties requirements.

Subject: Limited Combustible Type CMP Cable employing FEP Insulation and Overall Fluoropolymer Jacket Compound SMOKEGUARD® FP 108 rated 125C

Dated: October 21, 2004

Based on the data obtained from tests conducted in accordance with UL 444, Standard for Communications Cable, UL has established the following Physical Properties requirements for the SMOKEGUARD® FP 108 jacket material:

As Received Tensile Strength 2,000 psi
As Received Elongation 250%
**75% Retention of Tensile Strength and Elongation After Aging for 7 Days
in an Air Oven @ 158C (125C temperature rating)**

Jacket thickness requirements will be based upon the fluoropolymer requirements in Table 7 of UL 444.

Jacket Thicknesses (Maximum based on cable submitted)

	<u>minimum average</u>	<u>minimum point</u>
<u>Core Diameter</u>		
up to 0.250"	8 mils	6 mils
0.250" - 0.350"	10 mils	8 mils
0.350" - 0.500"	13 mils	10 mils
>0.500"	15 mils	12 mils

For Coax (CaTV) constructions, the jacket thickness requirements are the same as listed above, EXCEPT if the jacket is directly over the braid (i.e. NO shield or MYLAR wrap, etc. between the braid and the jacket)

--> Per UL 444 / UL 1655 (CaTV), there is a 13 mils minimum average requirement for jackets directly over the braid

For Fiber Optic cables, there are NO physical requirements in the USA (UL 444), ONLY requirements for flammability

--> In Canada (CSA C22.2 No. 232), there are no absolute physical requirements, but there is an "Aged Retention" of 65% of originals at the conditions established for the temperature rating required (i.e. 10 Days in an Air Oven @ 100C for 60C temp rating)