An Alternative to 200°C UL/CSA FEP Wires

FEP insulated lead wire has been used in many markets and applications for well over 50 years. It is a very desirable material for insulating lead wire because of its outstanding attributes. It's strong, can be used in very thin walls, is highly fluid and flame resistant, and is very thermally robust with many UL/CSA products commercially available at -65°C to +200°C.

As with any wire insulation, FEP has some limitations as well. It does not let printing or potting materials stick to it very well, it is a thermo-plastic which means it can melt at elevated temperatures and also can deform / cold-flow when under stress at low temperatures, it is expensive, and there are occasional supply disruptions which can affect pricing (higher) and availability (less).

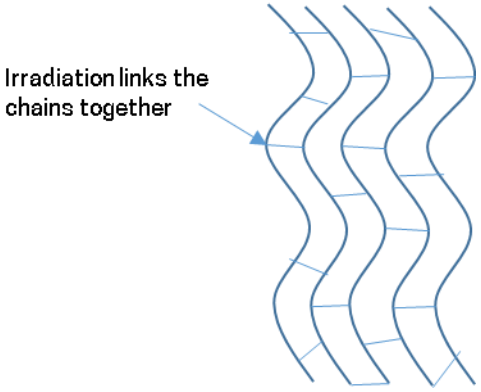
When weighing the pros and cons, FEP is an all-around excellent wire insulation. But all this performance comes at a cost, and what if your application doesn't need such a wide performance range? What other options are there that offer similar size and functionality in a UL/CSA recognized wire?

Irradiated wire insulations are an excellent blend of performance and price. The Irradiation process takes a generic insulation and modifies the molecules in a manner that links them together and sets them in place. This is where the terms "cross-linking" and "thermoset" come from.

This process improves many performance attributes that are useful in wires such as Dielectric strength, High and Low temperature performance, Cut-through resistance, Crush resistance, Fluid Resistance, Abrasion resistance, Useful Life, and other attributes.

Although the process to do this is complex, describing it is easy. Irradiation is the process of focusing very high energy (via electrons) on the wire insulation to create a molecular change in the insulation material. The change causes polymer chains of insulation to link together permanently so they can never again release. This visual may help:

Tiny polymer chains of thermo-plastic insulation. When +/- 120°C heat is applied, they will quickly deform and eventually melt apart.



Tiny polymer chains of Irradiated thermo-set insulation. Even when 200°C heat is applied, they will not melt.

Below is a comparison of common wire characteristics of 200°C FEP and also two thermal steps lower.

ATTRIBUTE	200°C FEP (1)	Irradiated 180°C Fluoroelastomer (1)	Irradiated 150°C Polyolefin (1)
Low Temp	-65°C	-40°C	-55°C
High Temp	+200°C	+180°C	+150°C
Short Term High Temp Resistance (6 hrs)	+225°C	+250°C	+240°C
Fluid Resistance	Superior	Superior	Excellent / Good
Insulation Thickness (UL, 600V, 18awg)	0.020"	0.016"	0.030"
Final OD (18awg)	0.087"	0.079"	0.106"
Flame Resistance	VW-1	VW-1	VW-1
Melt at Elevated Temps	Yes	No	No
Cold-Flow / Shrink-Back	Possible	No / Limited	No / Limited
Print Adhesion / Legibility	Poor	Excellent	Excellent
Price	Higher	Lower (Est 10%)	Lower (Est 20%)

(1): Generic comparisons. Consult specific manufacturer data sheets for their particular product attributes

Based on the commercial options available, Engineering and Purchasing Managers should review their UL/CSA FEP wire needs to determine if an alternative UL/CSA Irradiation Cross-Linked product might offer a better long-term cost and supply solution.