

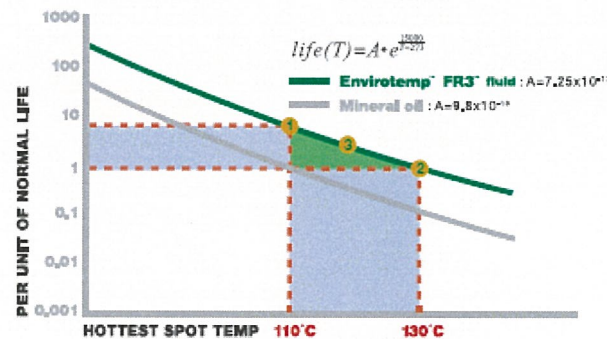
With FR3<sup>®</sup> fluid's unique capabilities to extend insulation life and increase load capacity, organizations now have the flexibility to optimize their transformer fleet loading profiles in order to gain cost savings without sacrificing reliability.

### Leverage higher thermal capability with FR3 fluid.

Historically, standards were written to accommodate a 95°C or 110°C hot spot for cellulose and Thermally Upgraded Kraft (TUK), respectively. However, published high temperature insulation system standards - IEC (60076-14) and IEEE (C157.154) – accommodate a 15°C or 20°C increase in hot spot without sacrificing the life or reliability of the transformer, when immersed in natural ester fluid.

Paper	Dielectric Fluid	Thermal Class	Hot spot	IEEE AWR	IEC AWR
TUK	Mineral Oil	120	110°C	65°C	75K
TUK	Natural Ester	140	130°C	85°C	95K

TUK life curves



**OPTION 1:** Extend asset life at current 110° hotspot.

**OPTION 2:** Increase load capability up to 20% with 130°C hotspot.

**OPTION 3:** Incrementally extend asset life and increase load capability with 120°C hotspot.

IEC 60076-14 Part 14. Liquid-immersed power transformers using high-temperature insulation materials. Edition 1.0 September 2013.

IEEE C57.154 Standard for the Design, Testing, and Application of Liquid-Immersed Distribution, Power, and Regulating Transformers Using High-Temperature Insulation Systems and Operating at Elevated Temperature. Published October 30, 2012.

# Improve fire safety. Add more sustainability to your sustainable supply chain.



## Reduce costs while increasing fire safety.

FR3™ fluid has the highest fire point of any dielectric fluid (360°C compared to 160°C for mineral oil) making it the ideal choice for densely populated areas where transformers are positioned indoors, underground or in close proximity to buildings and other equipment. FR3 fluid is a K-class, less flammable fluid as certified by Underwriters Laboratory and approved by FM Global.

- Reduce clearance to buildings which saves precious real estate, particularly in space-constrained areas.
- Retrofill older transformers with FR3 fluid instead of replacing or moving them to help comply with current fire code regulations.
- For power transformers, potentially eliminate the need for expensive fire walls and deluge systems (and their ongoing maintenance costs).



## “Being green” also benefits your bottom line.

FR3 fluid not only has best-in-class environmental properties, but with its enhanced thermal capabilities enabling smaller transformer designs, your supply chain just got a whole lot more sustainable.

- Smaller, more efficient transformer designs:
  1. Use less fluid and construction materials.
  2. Are typically lighter which could make installations easier for work crews and could reduce transportation costs.



### Envirotemp® FR3® fluid properties: standard acceptance values and typical values

	Standard test methods		ASTM D6871/IEEE C57.147	IEC 62770	Envirotemp FR3 fluid	
PROPERTY	ASTM	ISO/IEC	As-received new fluid property requirements	Unused new fluid property requirements	TYPICAL	
Physical						
Color	D1500	ISO 2211	≤1.0	—	0.5	
Flash Point PMOC (°C)	D93	ISO 2719	—	≥250	256	
Flash Point COC (°C)	D92	ISO 2592	≥275	—	320-330	
Fire Point (°C)	D92	ISO 2592	≥300	≥300	350-360	
Pour Point (°C)	D97	ISO 3016	<-10	≤-10	-18 - -23	
Density at 20°C (g/cm³)	—	ISO 3675	—	≤1.0	0.92	
Relative Density (Specific Gravity) 15°C	D1298	—	≤0.96	—	0.92	
Viscosity (mm²/sec)						
	100°C	D445	ISO 3104			
	40°C			≤15	≤15	7.7 - 8.3
	0°C			≤50	≤50	32 - 34
			≤500	—	190	
Visual Examination	D1524	IEC 62770 4.2.1	Bright and clear	clear, free from sediment and suspended matter	clear, light green	
Biodegradation	OECD 301		readily biodegradable	readily biodegradable	readily biodegradable	
Electrical						
Dielectric Breakdown (kV)	D877	—	≥30	—	47	
Dielectric Breakdown (kV)						
1mm gap	D1816	—	≥20	—	28	
2mm gap	D1816	—	≥35	—	48-75	
2.5mm gap	—	IEC 60156	—	≥35	73	
Gassing Tendency (mm³/min)	D2300	—	≤0	—	-79	
Dissipation Factor						
25°C (%)	D924	—	≤0.20	—	0.010 - 0.15	
90°C (tanδ)	—	IEC 60247	—	≤0.05	0.02	
100°C (%)	D924	—	≤4.0	—	0.41 - 3.85	
Chemical						
Corrosive Sulfur	D1275	IEC 62697	non-corrosive	non-corrosive	non-corrosive	
Water Content (mg/kg)	D1533	IEC 60814	≤200	≤200	4 - 50	
Acid Number (mg KOH/g)	D974	IEC 62021.3	≤0.06	≤0.06	0.013 - 0.042	
PCB Content (mg/kg)	D4059	IEC 61619	not detectable	free from PCBs	not detectable	
Total Additives	—	IEC 60866	—	Max weight fraction 5%	<2%	
Oxidation Stability (48 hrs, 120°C)	—	IEC 61125C	—	—	—	
Total Acidity (mg KOH/g)	—	IEC 62621.3	—	≤0.6	0.1	
Viscosity at 40°C (mm²/sec)	—	ISO 3104	—	≤30% Increase over Initial	17.1% Increase	
Dissipation Factor at 90°C (tanδ)	—	IEC 60247	—	≤0.5	0.1	

NOTE: Specifications should be written referencing only the defined ASTM or IEC industry standard acceptance values and test methods. The listed 'typical' values are average values summarized from a significant number of data points over many years; they are not to be identified as acceptance values.

ASTM D6871 Standard Specification for Natural (Vegetable Oil) Ester Fluids Used in Electrical Apparatus.

IEC 62770: Fluids for electrotechnical applications – Unused natural esters liquids for transformers and similar electrical equipment.

A transformer filled with FR3® fluid complies with the transformer temperature operating range requirements defined in IEEE C57.12.00 and IEC 60076-1.

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- Made from a renewable source with global, reliable supply.
- Carbon neutral (according to BEES 4.0 lifecycle analysis).
- Non-toxic and non-hazardous in soil and water.
- Readily Biodegradable per OECD 301.
- Contains no petroleum, halogens, silicones or sulfurs.
- Recyclable.





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**Safety Data Sheet**  
acc. to ISO and GHS

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Printing date: 03.04.2014

Reviewed on: 03.04.2014

**1 Identification**

**Product identifier**

Trade name: **ENVIROTEMP™ FR3™ Fluid**

SAP Material Numbers: 100088941; 100089128; 100089127; 100089129

CAS Number: 8001-22-7

Application of the substance / the mixture: Dielectric coolant

**Details of the supplier of the Safety Data Sheet**

**Manufacturer/Supplier:**

Cargill, Incorporated  
Cargill Industrial Specialties  
9320 Excelsior Blvd.  
Hopkins, Minnesota 55343  
Tel: 1-952-984-9122

E-mail: CIS\_CustomerService@Cargill.com



Emergency telephone number: 1-800-255-3924 (ChemTel)

**2 Hazard(s) identification**

**Classification of the substance or mixture:**

The product is not classified as hazardous according to the Globally Harmonized System (GHS).

**Label elements**

GHS label elements: Not Regulated.

Hazard pictograms: Not Regulated.

Signal word: Not Regulated.

Hazard-determining components of labeling: None.

Hazard statements: Not Regulated.

**Hazard description**

WHMIS-symbols: Not hazardous under WHMIS.

**Classification system:**

NFPA ratings (scale 0 - 4)

Health = 0  
Fire = 1  
Reactivity = 0



HMIS ratings (scale 0 - 4)

Health = 0  
Fire = 1  
Reactivity = 0



**Other hazards**

Results of PBT and vPvB assessment

PBT: Not applicable.

vPvB: Not applicable.

**3 Composition/information on ingredients**

Chemical characterization: Mixture.

CAS No.: 8001-22-7

Description: Soybean Oil with nonhazardous additives.

Hazardous components: None.



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#### 4 First-aid measures

**Description of first aid measures**

**General information:**

No special measures required.

**After inhalation:**

Supply fresh air; consult doctor in case of complaints.

**After skin contact:**

Generally the product does not irritate the skin.

Clean with water and soap.

If skin irritation continues, consult a doctor.

**After eye contact:**

Remove contact lenses if worn.

Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

**After swallowing:**

Rinse out mouth and then drink plenty of water.

Do not induce vomiting; immediately call for medical help.

**Most important symptoms and effects, both acute and delayed:**

Gastric or intestinal distress when ingested.

**Danger: None**

**Indication of any immediate medical attention and special treatment needed:**

No additional information.

#### 5 Fire-fighting measures

**Extinguishing media**

**Suitable extinguishing agents:**

Foam.

Fire-extinguishing powder.

Carbon dioxide.

Gaseous extinguishing agents.

**For safety reasons unsuitable extinguishing agents: Water**

**Special hazards arising from the substance or mixture:**

In case of fire, the following can be released: Carbon monoxide (CO)

**Advice for firefighters**

**Protective equipment:**

Wear self-contained respiratory protective device.

Wear fully protective suit.

**Additional information: No additional information.**

#### 6 Accidental release measures

**Personal precautions, protective equipment and emergency procedures:**

Particular danger of slipping on leaked/spilled product.

Wear protective equipment.

**Environmental precautions: Do not allow to enter sewers/ surface or ground water.**

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**Methods and material for containment and cleaning up:**

Send for suitable recovery and/or disposal authorities.  
Contain and control the leaks or spills with non-combustible absorbent materials such as sand, earth, vermiculite, or diatomaceous earth in drums for waste disposal.  
Clay materials (Fuller's earth, oil dry products) saturated with Envirotemp FR3 fluid can, under certain conditions, undergo a slow oxidation that releases heat. If the heat so released cannot escape, it is possible that the temperature may increase.

**Reference to other sections:**

See Section 7 for information on safe handling.  
See Section 8 for information on personal protection equipment.  
See Section 13 for disposal information.

**7 Handling and storage**

Precautions for safe handling: None

Information about protection against explosions and fires: No special measures required.

Conditions for safe storage, including any incompatibilities

**Storage**

Requirements to be met by storerooms and receptacles:

Avoid storage near extreme heat, ignition sources or open flame.  
Protect from humidity and water.

Information about storage in one common storage facility: Store away from oxidizing agents.

Further information about storage conditions: Store in cool, dry conditions in well sealed receptacles.

Specific end use(s): No additional information.

**8 Exposure controls/personal protection**

Additional information about design of technical systems: No additional information.

**Control parameters**

Components with limit values that require monitoring at the workplace: Not required.

Additional information: The lists that were valid during the creation were used as basis.

**Exposure controls**

Personal protective equipment:

General protective and hygienic measures: No additional information.

Breathing equipment:

Not required under normal conditions of use.

Protection of hands:

Wash hands after use. For extended skin contact, gloves are recommended.



Protective gloves

The glove material has to be impermeable and resistant to the product. Selection of the glove material should be based on the penetration time, rates of diffusion and the degradation of the glove material. Wear protective gloves to handle contents of damaged or leaking units.

**Material of gloves:**

The selection of a suitable gloves does not only depend on the material, but also on the quality, and varies from manufacturer to manufacturer.

**Penetration time of glove material:**

The exact break through time has to be determined by the manufacturer of the protective gloves. DO NOT exceed the breakthrough time set by the Manufacturer.