

FR3™ dielectric fluid for data centers

The natural ester that future-proofs data center power demand

Used for nearly **30 years** in over **3.5 million** transformers globally, and validated through hundreds of field and laboratory tests, FR3™ fluid is proven for use in distribution and power generation transformers.

Smart AI demands smarter transformers:

5 ways FR3™ fluid powers efficient, reliable operation

1



K-class fluid for superior fire safety

A K-class, high-fire-point natural ester that significantly reduces a leading cause of catastrophic transformer fires. FM approved.

ZERO reported fires in nearly 30 years

2



Design without limits

FR3 transformer fluid enables data centers to either shrink the transformer footprint or increase capacity, improving redundancy and handling higher peak loads.

20% increase in load capacity*

*Compared to transformers filled with mineral oil

3



Lower total cost of ownership

Reduces operations and maintenance requirements and supports fewer, more load-flexible transformers, without the added cost of synthetic ester or dry-type transformers.

17% average total cost of ownership savings*

*Compared to transformers filled with mineral oil

4



Sustainability benefits

FR3 fluid is >99% bio-based according to ASTM D6866, readily biodegradable per OECD 301B and non-hazardous according to GHS. FR3 fluid helps reduce heat output and increases efficiency vs dry-type transformers.

100% biodegradable in as little as 10 days*

*According to OPPTS 835.3100

5



Supports performance without compromise

Slows insulation paper ageing, improves efficiency, and extends asset life, all while operating longer, without disruptions.

UP TO 50% extended asset life*

*Compared to transformers filled with mineral oil



Learn more:
[FR3fluid.com](https://www.FR3fluid.com)



Acceptable limits for receipt of shipments of FR3™ fluid

FR3™ fluid acceptance limits

Property	Standard test methods		ASTM D6871/IEEC C57.147	IEC 62770	FR3™ fluid
	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 PMCC (°C)	D93	ISO 2719	-	≥ 250	260-270
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	-21
Density at 20 °C (g/cm ³)	-	ISO 3675	-	≤ 1.0	0.92
Relative density (Specific gravity) 15 °C	D1298	-	≤ 0.96	-	0.92
Viscosity (mm ² /s)					
100 °C	D445	ISO 3104	15	≤ 15	7.7 - 8.3
40 °C			≤ 50	≤ 50	32 - 34
0 °C			≤ 500	-	190
-20 °C	-	-	-	-	650*
Visual examination	D1524	IEC 60247 4.2.1	Bright and clear	Clear, free from sediment and suspended matter	Clear, light green
Biodegradation	OECD 301B		Readily biodegradable	Readily biodegradable	Readily biodegradable
Aquatic and oral acute toxicity	OECD 202, 203, OECD 420		Non-toxic	Non-toxic	Non-toxic
Electrical					
Dielectric breakdown (kV)	D877	-	≥ 30	-	>45
Dielectric breakdown (kV)					
2mm gap	D1816	-	≥ 35	-	60-70
2.5mm gap	-	IEC 60156	-	≥ 35	70-80
Dielectric breakdown under impulse (kV) 25.4mm gap	D3300	-	> 130	-	140
Gassing tendency (ml/min)	D2300	-	≤ 0	-	-79
Dissipation factor					
25 °C (%)	D924	-	≤ 0.20	-	0.010 - 0.15
90 °C (tan δ)	-	IEC 60247	-	≤ 0.05	0.01 - 0.03
100 °C (%)	D924	-	≤ 4.0	-	1.00 - 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	0.01 - 0.05
PCB content (mg/kg)	D4059	IEC 61619	Not detectable	Free from PCBs	Not detectable
Total additives	-	IEC 60666	-	Max weight fraction 5%	< 2%
Oxidation stability (48 h, 120 °C)	-	IEC 61125 IEC 62770	-	-	-
Total acidity (mg KOH/g)	-	IEC 62621.3	-	≤ 0.6	0.1 - 0.3
Viscosity at 40 °C (mm ² /s)	-	ISO 3104	-	≤30% increase over initial	17% - 23% increase
Dissipation factor at 90 °C (tan δ)	-	IEC 60247	-	≤ 0.5	0.1
Oxidation induction time 130 °C/500psi (min)	D6186	-	-	-	62+2 min

*Measurement of viscosity near pour point may be inaccurate.

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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