

# Choose the fluid that works harder and smarter.

Transform the way you think about dielectric fluid with FR3r<sup>™</sup> natural ester. Derived from over 95% rapeseed/canola oil, a renewable resource, FR3r<sup>™</sup> fluid is a higher performing, more reliable, and more sustainable dielectric fluid compared to mineral oil. Utilize FR3r fluid to more effectively power how communities live, play, work, and thrive.



**FR3r**  
a Cargill brand

Demand on the power grid has never been higher, with the rapid adoption of electric vehicles, integration of renewable energy sources, and the growth of other power-hungry applications like data centers placing new challenges and stress on transformers. Providing safe and reliable power has never been more vital - and designing and specifying transformers that can keep up with the growing demands placed on them, all while meeting increasingly aggressive sustainability goals, is essential.

FR3r™ fluid is backed by Cargill's over 150 years of innovative experience and made by the same trusted manufacturer of the original natural ester- FR3™ fluid. Similar to FR3 fluid, FR3r natural ester is a more reliable and more sustainable solution compared to mineral oil that meets or exceeds all IEC 62770 and IEEE C57.147 standards. The unique properties of plant based FR3r fluid allows for maintenance free transformers with up to 20% more loading capacity, superior fire safety with an over two times higher fire point, and a more sustainable solution compared to mineral oil. See what you've been missing and learn more about how FR3r fluid can help better power your businesses and communities.







## Exceptional Reliability

FR3r fluid is specifically formulated to operate in even the most demanding and harsh environments with no maintenance needed under normal operating conditions. This fluid's unique formulation easily handles high load fluctuations and high heat, with a top fluid temperature that can safely operate at up to 140°C<sup>1</sup> without impacting transformer life, which also makes the transformer less prone to a partial discharge.

FR3r fluid has unique moisture management properties that continuously dries paper insulation by absorbing moisture through a hydrolysis process without creating any damaging byproducts or sludge, helping make transformers robust enough to operate in even the most challenging and demanding conditions. This “self-drying” mechanism also helps increase paper insulation life up to 8X longer and extends the transformer's lifespan.

# 140°C

Easily handles high heat  
with 140°C<sup>1</sup> top fluid  
temperature limit

# 8x

Up to 8X longer paper  
insulation life\*



## Increased Loading Capacity

FR3r fluid's unique properties allow transformers to be more power dense and safely operate up to 20°C warmer than a mineral oil filled transformer to gain up to 20% additional loading capacity, all while extending the life and increasing the reliability of the transformer.\* This allows for the design of a smaller, more compact transformer with the same loading capacity, the same sized transformer with up to 20% more loading capacity, or any combination in between. Designing a transformer to be more power dense also helps reduce the use of expensive materials like aluminum, copper, and insulating paper, enabling better transformers at a cost equal to, or even lower than, mineral oil filled transformers.

# 20%

Up to 20% more  
loading capacity\*

\*Compared to mineral oil.

<sup>1</sup>According to IEC 60076-14, IEEE C57-154.





## More sustainable

Contribute to your company's sustainability commitments, help protect the environments where your transformers operate, and help reduce your carbon footprint by choosing FR3r fluid. Made from >95% rapeseed oil, along with performance enhancing additives, FR3r fluid has numerous environmental benefits over mineral oil, including:

- 100% biodegradable in as little as 10 days
- Non-toxic in water, soil, and to wildlife and humans
- Derived from rapeseed oil, a renewable resource

# 100%

biodegradable in  
as little as 10 days



## Superior Fire Safety

FR3r fluid has exceptionally high flash and fire points - in fact, more than 2X higher than mineral oil. This helps reduce the risk of explosion and fire—thus reducing the risk of damage to equipment and people, or expensive downtime. Because of its K-class certification, transformers using FR3r fluid may be able to eliminate or greatly reduce fire containment systems, including expensive fire remediation systems and fire walls.

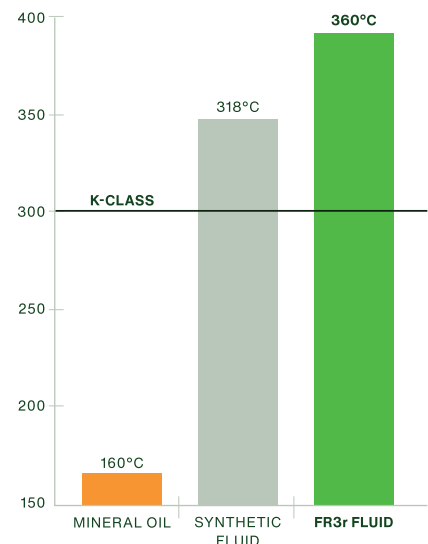
# 360°C

Exceptionally  
high fire point

# 2x

Over 2 times higher  
flash and fire points\*

Dielectric Fluid Fire Point Comparison



\*Compared to a mineral oil.



## **Cost Savings**

Save money and improve ROI by choosing FR3r fluid in your transformers instead of mineral oil.

With FR3r fluid's ability to safely run up to 20°C warmer than a mineral oil filled transformer, you can design a more power dense transformer that is more compact with the same loading capacity. Or you can use the same size transformer and gain up to 20% additional loading capacity compared to using mineral oil. Doing so helps reduce the use of expensive materials like steel, aluminum, copper, and insulating paper, enabling better transformers at a cost equal to, or even lower than, mineral oil filled transformers.

In addition, FR3r fluid's unique moisture handling capabilities and its ability to continuously absorb moisture from paper insulation means no maintenance is needed under normal operating conditions, saving valuable time and money.

Due to FR3r fluid's K-class fire certification and its 100% biodegradability, fire remediation and spill prevention systems can be reduced, including the elimination of fire walls and expensive containment systems helping save money, reduce complexity, and keep facilities and people safer.



**No maintenance needed  
under normal operating  
conditions**

## FAQs

### Do I need to worry about oxidation when using FR3r™ fluid?

**No. FR3r™ fluid is designed to be a robust solution** for use in non-free breathing transformers where it will last the complete lifespan of the transformer without the need for any maintenance. If there is a breach in the sealing system, FR3r fluid's oxidation is expected to require over 10 years to lead to a 10% increase in viscosity, and this will not negatively impact any characteristics of the fluid. The only effect will be the transformer running around 2°C hotter.

**Under free breathing conditions for both** natural and synthetic esters, the first maintenance limit to be surpassed is the allowable moisture content of the fluid. This may lead to a decrease in the breakdown voltage, which happens faster with synthetic fluids due to their higher moisture absorption and the lack of "self-drying" properties inherent to FR3r fluid. Also, acid content and dissipation factor maintenance limits will be reached in approximately five years, long before any impact on viscosity due to oxidation is detected.

### What's the difference between FR3™ fluid and FR3r™ fluid?

**Both natural ester dielectric fluids share many of the same properties** and exceptional benefits, including extremely high fire points, superior moisture management that helps keep transformers more reliable and maintenance free, and the ability to add up to 20% additional loading capacity, while also both offering a more sustainable, 100% biodegradable fluid.

**The main difference between the fluids is the base oil used,** which impacts pour point and viscosity. FR3r fluid uses rapeseed / canola oil as its base fluid, which has a pour point of -33°C and a viscosity of 37 cSt. FR3 fluid uses soybean oil as its base fluid.

### Are there diagnostic tools available for FR3r™ fluid?

**Yes. There is a complete set of standards** from both the IEC and IEEE with guidelines for maintenance based on physical-chemical analysis. All the traditional DGA tools such as basic ratios, simplified ratios, and CO<sub>2</sub>/CO can be used.

### Can I retrofill existing transformers with FR3r™ fluid?

**Yes, FR3r™ fluid can be used to retrofill** mineral oil filled and synthetic ester filled transformers.

**In fact, transformers filled with FR3r fluid can be re-rated** by increasing the temperature limits to take advantage of FR3r fluid's high temperature capabilities. It may be possible to increase the loading capacity of the transformer by up to 15% after a retrofill while also extending the life of the asset by up to 10 years.

### Can FR3r™ fluid be used in cold weather?

**Yes, FR3r™ fluid is recommended for all non-free-breathing transformers,** regardless of ambient temperature. FR3r fluid has an exceptionally low pour point of -33°C, making it a great insulating fluid even in very cold, harsh climates. FR3r fluid maintains breakdown voltage and the transformer's dielectric capacity down to -50°C (-58°F) and is qualified to be energized under normal operating conditions defined by IEC down to -25°C and IEEE down to -20°C.

**For very cold climates, Cargill recommends using the same cold start procedures** already defined by standards bodies and transformer OEMs - start with a reduced load for a certain period of time and after, use a linear increase up to full load. This will allow for a smooth temperature increase on the transformer and will guarantee suitable fluid flow inside it.

### Is FR3r™ fluid miscible with mineral oil?

**Yes, FR3r™ fluid is fully miscible with mineral oil, synthetic ester, and FR3™ fluid.** When retrofilling a mineral oil filled transformer, Cargill recommends that 7% or less of the total fluid be residual oil or FR3r fluid's benefits begin to decline. In a typical retrofill, Cargill would expect to see 3-5% residual oil remaining, which does not significantly impact FR3r fluid's performance.



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Learn more about how FR3r fluid can power your transformers more reliably and more sustainably at [FR3rfluid.com](https://FR3rfluid.com)