



Shell
MIDEL
eN 1204

July 2025

Natural Ester Transformer Liquid (Rapeseed/Canola)

Fire-safe¹ and readily biodegradable²

Safety Inside







Shell MIDEI eN 1204

is our rapeseed/canola oil based
natural ester transformer liquid

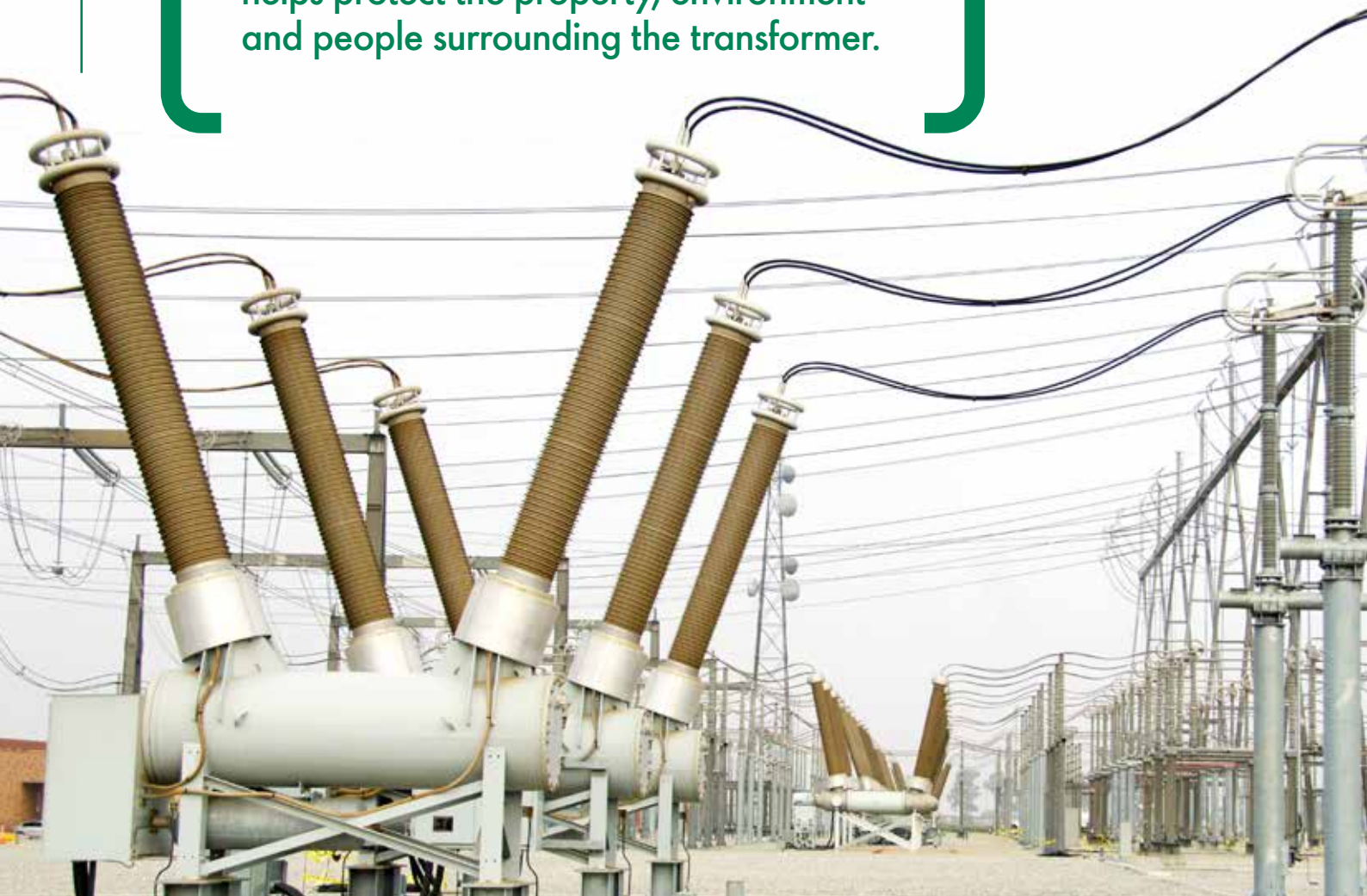
Shell MIDEI is used in hundreds of thousands of installations worldwide,³ providing fire safety,¹ environmental protection,² asset life extension⁴ and the opportunity for cost savings.⁵ Shell MIDEI eN 1204 is a natural ester dielectric liquid designed to provide an alternative to conventional mineral oil and silicone-liquid-filled transformers.



When a conventional mineral-oil-filled transformer ruptures due to a catastrophic event and the oil ignites, the resulting transformer fire is notoriously unforgiving, spreading very quickly in a pool fire scenario and causing extensive damage. Shell MIDELE eN 1204 offers a real solution in terms of fire risk mitigation.¹

Shell MIDELE's engineers, environmental and technical chemists have built close working relationships with end users and the major transformer manufacturers. They are also active in ASTM, IEEE, IEC and CIGRE working groups and regularly undertake extensive projects with industrial associations and academic bodies. Such depth of experience allows the Shell MIDELE team to provide reliable, timely and expert technical guidance.

Shell MIDELE eN 1204 – manufactured using renewable vegetable oil – is readily biodegradable,² provides fire safety¹ and helps protect the property, environment and people surrounding the transformer.



Shell MIDEL eN 1204 fluid properties

Property	Standard test method		Requirement		Shell MIDEL eN 1204
	ASTM	ISO/IEC	ASTM D6871	IEC 62770	
Physical					
Colour	D1500	ISO 2049	≤ 1.0	≤ 1.0	0.5
Flash point PMCC (°C)	D93	ISO 2719	—	≥ 250	≥ 260
Flash point COC (°C)	D92	ISO 2592	≥ 275	≥ 250	≥ 315
Fire point (°C)	D92	ISO 2592	≥ 300	≥ 300	≥ 350
Pour point (°C)	D97	ISO 3016	≤ −10	≤ −10	−31
Density at 20°C (g/cm³)	—	ISO 12185	—	≤ 1.0	0.92
Relative density (specific gravity) (15°C/15°C)	D1298	—	≤ 0.96	—	0.92
Viscosity (mm²/s)	D445	ISO 3104			
at 100°C			≤ 15	≤ 15	8.3
at 40°C			≤ 50	≤ 50	37
at 0°C			≤ 500	—	230
Visual examination	D1524	—	Bright and clear	—	Bright and clear
Appearance	—	IEC 62770:2024 Ch 4.2.1	—	Clear, free from water and suspended matter and sediment	Clear, free from water and suspended matter and sediment
Biodegradation – OECD 301 B, C, F²	—	—	—	Readily biodegradable	Readily biodegradable
Electrical					
Dielectric breakdown (kV) 1-mm gap	D1816	—	≥ 20	—	≥ 30
Dielectric breakdown (kV) 2-mm gap	D1816	—	≥ 35	—	≥ 55
Dielectric breakdown (kV) 2.5-mm gap	—	IEC 60156	—	≥ 35	≥ 75
Gassing tendency (µl/min)	D2300	—	≤ 0	—	−93.6
Power factor at 25°C (%)	D924	—	≤ 0.2	—	≤ 0.2
Power factor at 100°C (%)	D924	—	≤ 4.0	—	≤ 4.0
Dissipation factor at 90°C (tan delta)	—	IEC 60247	—	≤ 0.05	< 0.03
Chemical					
Corrosive sulphur	D1275	IEC 62535	Non-corrosive	Non-corrosive	Non-corrosive
Water content (mg/kg)	D1533	IEC 60814	≤ 200	≤ 200	50
Acid number (mg KOH/g)	D974	IEC 62021.3	≤ 0.06	≤ 0.06	≤ 0.04
PCB content (mg/kg)	D4059	IEC 61619	Not detectable	—	Not detectable
Oxidation stability (48 h)	D2440	IEC 61125	—	—	—
Total acidity (mg KOH/g)	—	IEC 62021.3	—	≤ 0.6	≤ 0.1
Viscosity at 40°C (mm²/sec)	—	ISO 3104	—	≤ 30% over initial	8%
Dielectric dissipation factor at 90°C	—	IEC 60247	—	≤ 0.5	≤ 0.1

The displayed typical values are not to be identified as acceptance values.



Fire¹ and environmental protection² in a natural ester liquid

Shell MIDELE EN 1204 is an effective dielectric liquid. It has a high fire point, making it demonstrably safer than conventional mineral oil. Manufactured using renewable vegetable oil (rapeseed/canola), it is readily biodegradable.² In addition, Shell MIDELE EN 1204 offers a higher level of moisture tolerance compared to conventional mineral oil, with the potential to increase the life of cellulose-based solid insulation, which, in turn, can extend transformer life.⁴

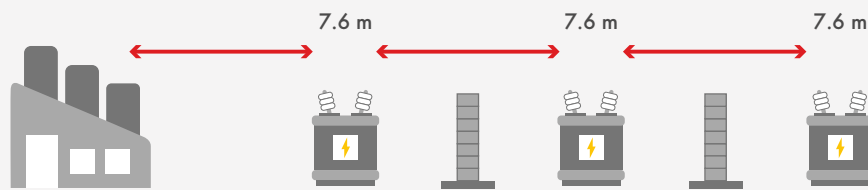


Increased fire safety¹

- 100% fire safety record³
- High fire point (> 300°C)
- K Class classification: less-flammable fluid
- For indoor and outdoor installations
- Significantly increased fire safety of your transformers
- Reduced need for fire-protection equipment⁶

K2 classification (IEC 61039) – reduces the need for fire-protection equipment and saves space.⁶

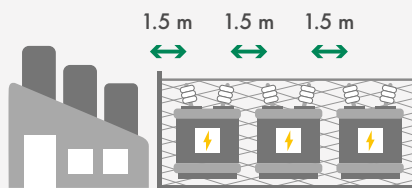
Minimum required clearances for an example transformer, fluid volume 2,000–19,000 L⁶



O Class: 7.6 m

Reinforced concrete, which is

- expensive
- carbon intensive to manufacture and transport.



K Class: 1.5 m

- unrated walls
- no blast walls/shared containment
- no fire suppression system
- minimal concrete and land use

- smaller bill of materials
- lower financial and carbon costs
- faster, simpler substation build.

Graphic illustrating the smaller required clearance of 1.5 metres between transformers using a K Class fluid, in comparison with a required clearance of 7.6 metres and the need for reinforced concrete blast walls for transformers using an O Class fluid.

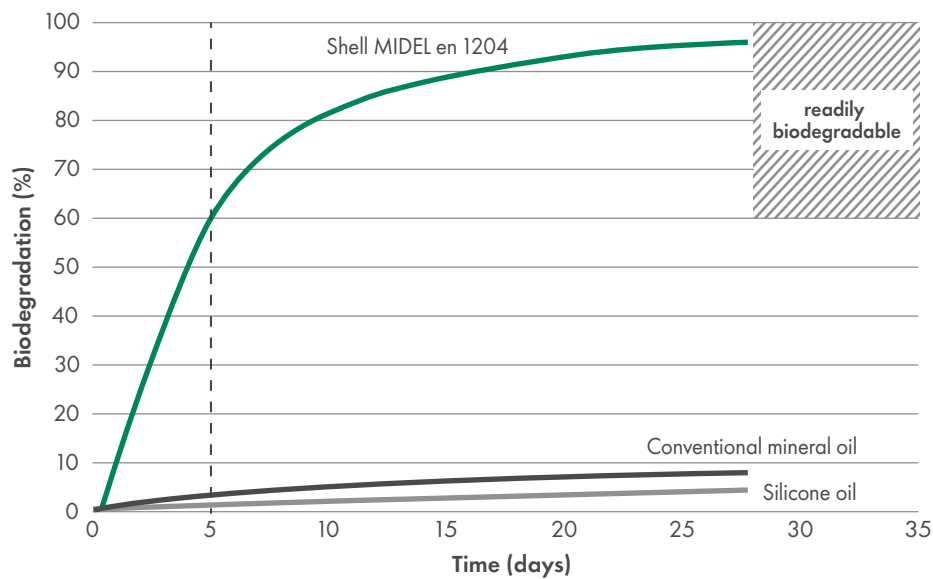
Minimum required clearance for an FM Approved less-flammable fluid⁶ in an advanced transformer: **0.9 m**
Potential substation footprint reduction³

Blast/fire-wall requirements are determined by insulation thermal classification.





Environmental protection



Comparative degradation rates of transformer fluids.

A graph of biodegradation against time for three fluids. Conventional mineral oil and silicone oil are less than 10% biodegraded after 28 days. Shell MIDELEN 1204 is biodegraded by 60% after five days and more than 95% after 28 days.

- Renewable vegetable oil
- Lower carbon footprint than conventional mineral oil⁷
- Bio-sourced⁸
- The chart shows that Shell MIDELEN 1204 achieves 60% biodegradability well within the 28 days required by the OECD 301 B test.²
- May enable reductions in containment measures
- Classed as non-hazardous⁹





Enables innovation

- Allows for compact transformer design
- Permits flexibility and temporary overload resilience



Natural ester for cold climates³

- -31°C pour point, performs better than soybean natural ester, especially in colder climates



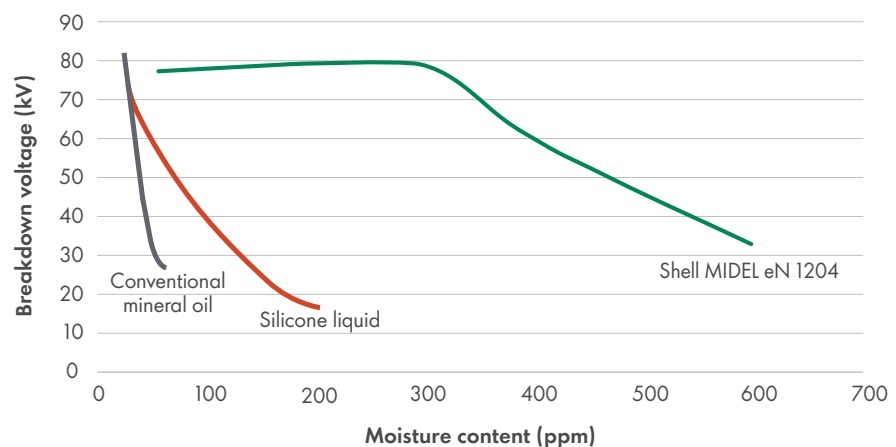
Asset life extension

- Slower rate of cellulose ageing than conventional mineral oil
- Longer cellulose life at standard temperatures
- Option to run at a higher temperature for a standard lifetime for conventional mineral-oil-filled systems
- Enables a higher output of a transformer, without the need for high-temperature insulation.



Excellent moisture tolerance³

- Thin-film oxidation rate half that of soybean-based natural ester liquids, offers greater tolerance if exposed to air
- Absorbs large amounts of moisture with no reduction of breakdown voltage (up to 300 ppm)
- High moisture saturation limit (1,100 ppm at 20°C), making precipitation of free water virtually impossible
- Effective solution for non-breathing transformers



Excellent high moisture tolerance enables the extension of cellulose insulation life.

A graph of breakdown voltage (IEC 60156) at room temperature against moisture content for three liquids. All start at a breakdown voltage of about 80 kilovolts. Conventional mineral oil and silicone liquid show rapid decreases in breakdown voltage. Shell MIDELE EN 1204's breakdown voltage is stable up to 300 ppm water content, then falls to about 33 kilovolts at 600 ppm.

Why Shell MIDELE eN 1204?



Helps reduce owner risk, land space and costs (construction and insurance)^{1,5}

Fire resilience, personnel safety^{1,2,9}



Lowers environmental harm^{2,9}

Readily biodegradable, non-hazardous



Helps increase performance³

Hotter running, sustainable overloading



Helps deliver higher return on investment^{3,10}

Improved transformer reliability, longer asset life







For more information, please contact your Shell representative or visit [Shell.com/ShellMIDEL](https://www.shell.com/ShellMIDEL)

References

- ¹ Shell MIDEL fluids are classified as K Class, with high fire and flash points, and are less flammable. These properties can prevent a transformer fire and save the property, people and environment in its surroundings. FM Approved, UL classified.
- ² Shell MIDEL eN 1204 can be claimed as readily biodegradable according to OECD 301 test (product).
- ³ Shell MIDEL customer data. Please refer to properties table on page 5 of this brochure for Shell MIDEL fluid specification values.
- ⁴ Slower rate of cellulose ageing than conventional mineral oil. Longer cellulose lifetime at standard temperatures. Option to run at a higher temperature, for a standard transformer lifetime. Provides a higher power output, without the need for high temperature insulation.
- ⁵ May reduce insurance premiums due to proven fire safety and FM Approval. Potential reduction in fire barriers leading to cost reductions for construction and land space. Can reduce asset downtime related to fire issues and moisture ingress. Advice should not override countries' local legislation and laws.
- ⁶ FM Global Data Sheet 5-4 (April 2025), spacing based on fire clearances only. Advice should not override countries' local legislation and laws.
- ⁷ Natural ester in a typical transformer application has a lower carbon footprint of production than conventional mineral oil. Comparison of cradle-to-grave carbon footprint of dielectric fluids: Shell MIDEL eN 1204 against conventional mineral oil. Scope of the comparative assessment includes transformer, engineering works, land use, safety structures and replacement (owing to fire) of transformer assets. Southwest Environmental Limited, Comparative Life Cycle Analysis: Bio-Ester, Synthetic Ester and Mineral Based Transformer Oils, report, 2020. <https://www.shell.com/investors/disclaimer-and-cautionary-note.html>
- ⁸ Shell MIDEL eN 1204 has 100% Biobased Carbon Content. Tested according to ASTM D6866-21 method. Reported results are accredited to ISO/IEC 17025:2017 Testing Accreditation PJLA #59423 standards and all chemistry was performed at Beta Analytic testing laboratory and counted in their accelerators in Miami, Florida, Aug 2021.
- ⁹ Non-hazardous according to the CLP regulation and GHS guidance.
- ¹⁰ Allows for compact transformer design. Permits flexibility and temporary overload resilience.

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