



Shell
MIDEL
7131

July 2025

Synthetic ester transformer liquid

Fire-safe¹ and readily biodegradable²

Safety inside





Shell MIDEL helps protect the property,
environment and people surrounding the transformer.^{1,2,3}
It can help save money⁴ while enabling innovation.⁵
It's Shell MIDEL.

Shell MIDEL 7131 is a synthetic ester dielectric liquid. An alternative to conventional mineral oil and silicone fluid filled transformers, it is deployed in a wide range of distribution and power transformers, including transformers over 400 kV.⁶

First used in the 1970s,⁷ Shell MIDEL 7131 is used worldwide in new transformers, and in existing transformers as a retrofit fluid to replace conventional mineral oil.

Effectively installed in distribution and power transformers, Shell MIDEL 7131 also has a long track record in demanding applications such as wind turbines and rolling stock and is used in transformers over 400 kV.⁶ This tried-and-tested ester fluid delivers fire safety,¹ environmental protection,^{2,3} asset protection and the opportunity for cost savings.⁴





Fire safety¹

Transformer fires are a frequent occurrence in the world's power networks. Such fires are notoriously unforgiving, spreading very quickly and causing extensive damage. Shell MIDEL 7131 offers a real solution in terms of fire risk mitigation. Specified and used across the globe, Shell MIDEL 7131 has a **100% fire safety record** since its introduction in the 1970s.^{6,7}

High fire point (> 300°C, K Class) – significantly increasing transformer fire safety, mitigating risk and potential negative implications such as:

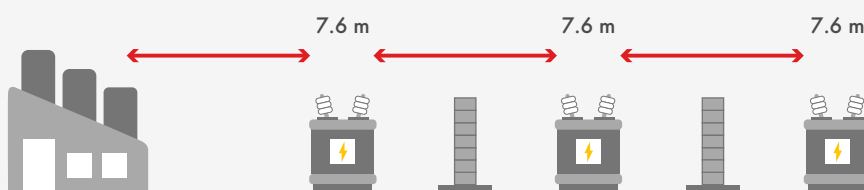
- downtime and lost production
- network loss, blackout
- increased insurance premiums
- remediation and clean-up
- asset repair and replacement costs
- reputational damage.





K3 classification (IEC 61039) –
reduces the need for fire-protection
equipment and saves space.⁸

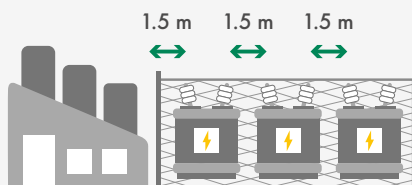
Minimum required clearances for an example transformer, fluid volume 2,000–19,000 L⁸



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 fluid⁸ in an advanced transformer: **0.9 m**
Potential substation footprint reduction⁶

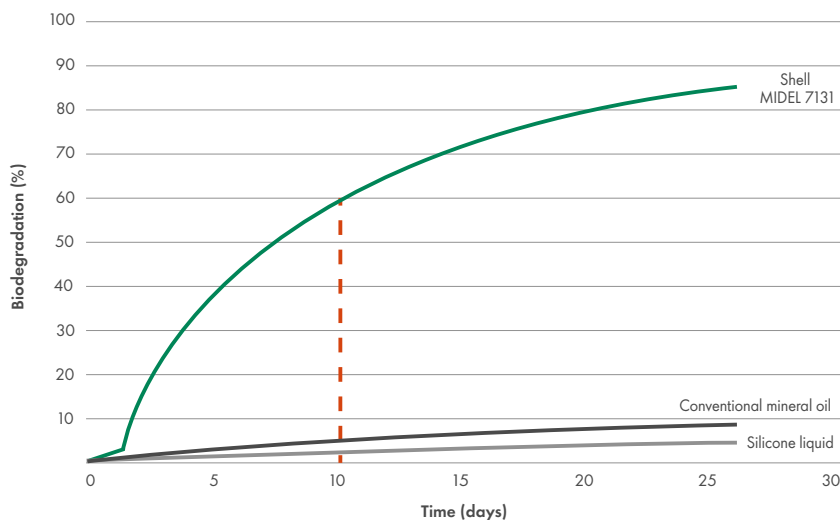
Blast/fire-wall requirements are determined by insulation thermal classification.



Environmental protection^{2,3}



Lower environmental impact
readily biodegradable² and
non-hazardous.³



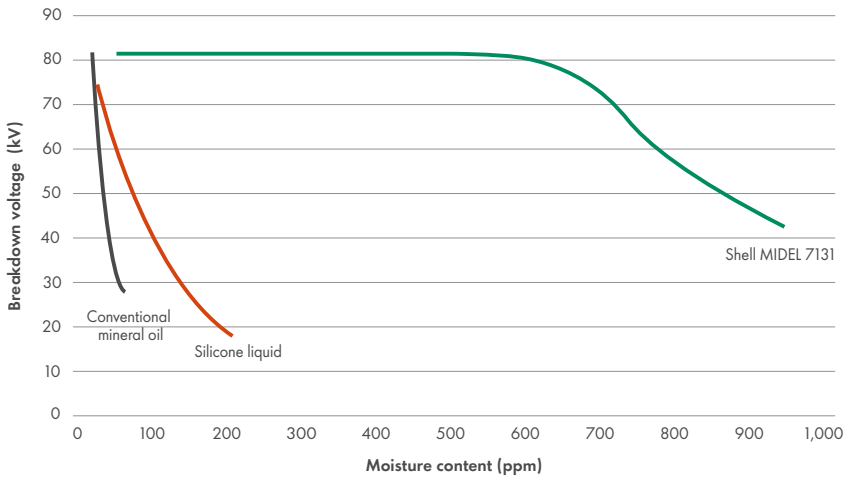
Line graph showing biodegradation over time of Shell MIDEI 7131, which is significantly higher than that of a conventional mineral oil or silicone liquid and meets the requirement for readily biodegradable classification as fully described in the text.

- May reduce containment requirements
- Not detrimental to activated sludge in biological treatment plants
- The chart shows that Shell MIDEI 7131 achieves 60% biodegradability well within the 28 days required by OECD 301 B test.²



Moisture tolerance

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



Effect of moisture on breakdown voltage at 20°C (IEC 60156, 2.5 mm).

A graph showing the effect of moisture on breakdown voltage of Shell MIDEI 7131, conventional mineral oil and silicone liquid, with breakdown voltage on the y-axis and moisture content on the x-axis, as fully described in the text.

Very high moisture saturation limit (2,700 ppm at 20°C), which makes precipitation of free water virtually impossible.

Compared to conventional mineral oil and silicone liquid, Shell MIDEI 7131 can:

- maintain its dielectric properties at much higher moisture contents (up to 600 ppm at 20°C)
- dissolve more water to potentially slow cellulose ageing
- avoid the risk of condensation associated with water in conventional mineral oil.





Cold weather protection⁶

- Extremely low pour point of -56°C
- Provides a highly effective solution for colder-climate installations



Oxidation stability⁶

- Excellent oxidation stability
- Perfectly suited for breathing and sealed transformers, located indoors, outdoors or underground



Enables innovation

- Enables compact transformer design
- Option to run at a higher temperature, for a standard lifetime for conventional mineral oil-filled systems
- Enables a higher transformer power output, without the need for high temperature insulation

Shell MIDEL's team of engineers, environmental chemists and technical experts have built close working relationships with end users and major transformer manufacturers. They are also active in ASTM, IEEE, IEC and CIGRÉ working groups, and regularly undertake extensive projects with industrial associations and academic bodies. This depth of experience means that the Shell MIDEL team is able to provide an exceptional level of technical support and guidance.



Shell MIDEL 7131 fluid properties

Properties	Method	ASTM D8240	IEC 61099	Shell MIDEL 7131 (typical values) ⁹
Colour (Hazen units)	ISO 2211 D2129	Max. 200	Max. 200	125
Appearance	Visual	Bright and clear	Clear, free from water, suspended matter and sediment	Clear, free from water, suspended matter and sediment
Density (kg/dm ³)	ISO 3675 D1298/D4052	Max. 1.00 @15°C	Max. 1,000 @20°C	0.97
Kinematic viscosity @100°C (mm ² /s)	D445	Max. 10		5.3
Kinematic viscosity @40°C (mm ² /s)	ISO 3104 D445	Max. 35	Max. 35	29
Kinematic viscosity @-20°C (mm ² /s)	ISO 3104 D445	Max. 3,000	Max. 3,000	1,440
Flash point (°C)	ISO 2719 D92	Min. 250	Min. 250	260
Fire point (°C)	ISO 2592 D92	Min. 300	Min. 300	316
Pour point (°C)	ISO 3016 D97	Max. -45	Max. -45	-56
Biodegradability ² (%)	OECD 301			Readily biodegradable
Breakdown voltage (kV)	IEC 60156		Min. 45	> 75
Breakdown voltage 1 mm (kV)	D1816	20		41
Breakdown voltage 2 mm (kV)	D1816	35		58
Impulse breakdown (kV)	D3300	110		134
Water content (bulk) (mg/kg)	IEC 60814 D1533	Max. 200	Max. 200	50
Dielectric dissipation factor @ 90°C and 50Hz (%)	IEC 60247		Max. 0.03	0.027
Dielectric dissipation factor @ 25°C and 60Hz (%)	D924	Max. 0.1		0.043
Dielectric dissipation factor @100°C and 60Hz (%)	D924	Max. 3.0		1.77
PCB content (mg/kg)	D4059	Not detectable		Not detectable
Acidity/neutralisation value (mg KOH/g)	IEC 62021-1 D974	Max. 0.03	Max. 0.03	< 0.03
Oxidation stability (164 hrs) - total acidity (mg KOH/g)	IEC 61125C	Max. 0.3	Max. 0.3	0.02
Oxidation stability (164 hrs) - sludge (% mass)	IEC 61125C	Max. 0.02	Max. 0.01	< 0.01

Why Shell MIDEL 7131?



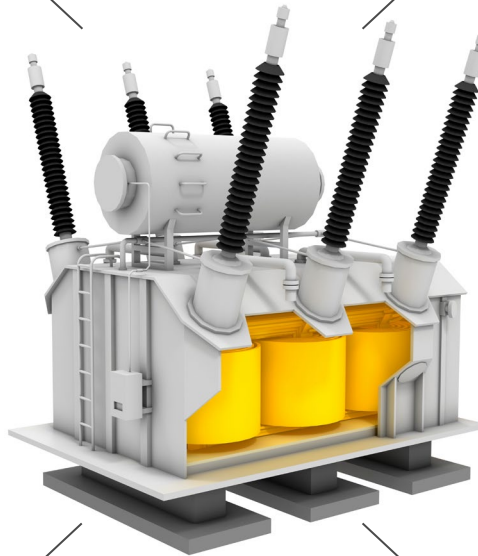
Helps reduce owner risk, land space and costs (construction and insurance)⁴

Fire resilience, personnel safety^{1,2,3}



Helps increase performance⁶

Hotter running, sustainable overloading



Lowers environmental harm^{2,3}

Readily biodegradable, non-hazardous



Helps deliver higher return on investment⁶

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 7131 can be claimed as readily biodegradable according to OECD 301 test (product).
- ³ Non-hazardous according to the CLP regulation and GHS guidance.
- ⁴ 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.
- ⁵ Allows for compact transformer design. Option to run at a higher temperature, for a standard lifetime, provides a higher output, without the need for high temperature insulation.
- ⁶ Shell MIDEL customer data. Please refer to properties table on page nine of this brochure for Shell MIDEL fluid specification values.
- ⁷ Shell MIDEL 7131 was first launched in 1978 and is specified and used by transformer manufacturers and utilities worldwide. In 2023 the MIDEL brand was acquired by Shell and is now known as Shell MIDEL.
- ⁸ FM Global Data Sheet 5-4 (April 2025), spacing based on fire clearances only. Advice should not override countries' local legislation and laws.
- ⁹ Shell MIDEL 7131 is supplied in accordance with IEC industry standard acceptance values and test methods. The displayed typical values do not form part of this specification.

Any recommendation or suggestion relating to the use, storage, handling or properties of the products supplied by Shell or any of its subsidiaries, either in sales and technical literature or in response to a specific enquiry or otherwise, is given in good faith but it is for the customer to satisfy itself of the suitability of the product for its own particular purposes and to ensure that the product is used correctly and safely in accordance with the manufacturer's written instructions. FM® is a registered trademark of Factory Mutual Insurance Company. UL® is a registered trademark of Underwriters Laboratories. UL classified as to fire hazard only. Classed 4 to 5 less hazardous than paraffin oil in respect to fire hazard. © Shell International Ltd.

<https://www.shell.com/investors/disclaimer-and-cautionary-note.html>