

## Comparison to Alternative Technologies

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### MIDEL 7131 versus Alternative Fluids

MIDEL 7131 is a high performance fluid that offers the advantages of increased fire safety, greater environmental protection and excellent moisture

tolerance. Research carried out over many years by the Technical Department at M&I Materials Limited has proven the superior behaviour of MIDEL 7131 in comparison to other fluids.

Table 1 compares the main properties of MIDEL 7131 with mineral oil, natural ester and silicone fluid.

**Table 1 - Comparison of Main Properties of MIDEL 7131 with Alternative Fluids**

	Units	MIDEL 7131	Silicone Liquid	Mineral Oil	Natural Ester
<b>General Properties</b>					
Density at 20°C	kg/dm <sup>3</sup>	0.97	0.96	0.88	0.92
Specific Heat at 20°C	J/kg K	1880	1510	1860	1848
Thermal Conductivity at 20°C	W/m K	0.144	0.151 (@ 50°C)	0.126	0.177
Kinematic Viscosity at 20°C	mm <sup>2</sup> /s	70	50 (@ 25°C)	22	85
Kinematic Viscosity at 100°C	mm <sup>2</sup> /s	5.25	15	2.6	8.4
Pour Point	°C	-60	<-50	-50	-21
Expansion Coefficient	/°C	0.00075	0.00104	0.00075	0.00074
Flash Point to ISO 2719	°C	260	260	150	316
Fire Point to ISO 2592	°C	316	>350	170	360
Fire Hazard Classification to IEC 61100/ IEC 61039		K3	K3	O	K2
Biodegradability at 28 Days					
- OECD 301 F	%	89	N/A	N/A	97
- OECD 301 D	%	N/A	<5	<10	N/A
<b>Chemical Properties</b>					
Neutralisation Value	mg KOH/g	<0.03	<0.01	<0.03	<0.03
Net calorific Value	MJ/kg	31.6	28.0	46.0	37.5
<b>Dielectric Properties</b>					
Breakdown Voltage	kV	>75	50	>70	>75
Dielectric Dissipation Factor Tan δ at 90°C		<0.008	<0.001	<0.002	<0.003
Permittivity at 20°C		3.2	2.7 (@ 25°C)	2.2	3.1

Data quoted above are typical values, may be altered without notice and do not constitute a specification

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### MIDEL 7131 versus Cast Resin

Cast resin transformers are sold as a fire safe solution for indoor installations and used in applications such as wind turbines. Although these types of transformers have found wide application they do have some disadvantages and their reliability record has been called into question in some of the more demanding transformer applications. MIDEL 7131 filled transformers can offer a fire safe solution, without the drawbacks associated with cast resin transformers.

**Table 2 - Comparison of Main Properties of MIDEL 7131 with Cast Resin**

Property	MIDEL 7131	Cast Resin
Fire Resistance	Excellent	Moderate
Environmental Impact	Excellent	Moderate
Life Expectancy	High	Moderate
Efficiency	High	Low to Moderate
Sound Level	Low	Moderate
Operating Temperature	Low	Moderate
Contamination Resistance	Excellent	Moderate
Overload Capacity	Excellent	Moderate
Maintenance	*None on sealed transformers	Regular cleaning and crack detection
Fault Diagnosis (DGA)	Yes	No
Repair Possible	Yes	Difficult

\*Subject to transformer manufacturer's recommendations

**Table 3 - Efficiency and Recycling Cost Comparison of 20 kV Fluid Filled Compact Transformer Design with a Typical Cast Resin Transformer**

	Fluid Filled	Cast Resin
Dimensions, mm	2210 x 770 x 2200	2000 x 840 x 2170
Mass, kg	4500	4600
No Load Loss, kW	2.1	3.9
Load Loss @125°C, kW	19	19.2
Recycling Cost, €/kg	0.07	0.14