MIDEL®

MIDEL® 7131

Dielectric Insulating Fluid Overview

MIDEL 7131 Product Overview

MIDEL 7131 is a synthetic ester-based dielectric fluid that has been serving the global transformer market for over 30 years. MIDEL 7131 has been specifically formulated to provide a safe, superior alternative to traditional fluid and dry-type transformers and can be used in indoor or outdoor locations.

MIDEL 7131 is a high performance fluid that offers increased fire safety, greater environmental protection and superior moisture tolerance. Testing has also proven that MIDEL 7131 has excellent dielectric properties.

IEC 61099 Conformity

MIDEL 7131 conforms to IEC 61099 “Specifications for Unused Synthetic Organic Esters for Electrical Purposes”. It is classified as type T1, a halogen-free pentaerythritol ester.

Areas of Application

MIDEL 7131 filled transformers are available from all major transformer manufacturers. MIDEL 7131 is suitable for a wide range of transformer applications, including sealed and breathing.

- Distribution transformers
- Power transformers
- Traction transformers
- Rectifier transformers
- Pole-type transformers
- Tapchangers
- Thyristor cooling

Retrofilling

MIDEL 7131 has been used to retrofill thousands of distribution transformers to improve service life, reduce environmental hazards or increase fire safety.

Corrosive Sulphur

MIDEL 7131 has been tested by independent laboratories to ASTM D1275 B and IEC 62535, it was found to be non-corrosive.

Increased Fire Safety

MIDEL 7131 has a high fire point and a low net calorific value (<32 MJ/kg) and is therefore classified as a K3 class liquid.

- 100% fire safety record
- High fire point (>300°C)
- K-class to IEC 61100 / 61039
- FM Global® approved transformer fluid
- Reduced fire safeguarding costs

Greater Environmental Protection

MIDEL 7131 is an environmentally friendly alternative to conventional transformer fluids because it is classified as readily biodegradable and non-water hazardous.

- Readily biodegradable (OECD 301)
- Fully biodegradable (IEC 61039)
- Classified as non-water hazardous by (UBA)
- Non-toxic
- Will not evaporate into the environment
- Not detrimental to activated sludge in biological treatment plants
- RoHS compliant

High Performance

MIDEL 7131 is an extremely robust fluid that delivers long-term stability even when exposed to extreme temperature variations. MIDEL 7131 also has excellent oxygen stability allowing it to be used in breathing transformers.

- Robust and stable at high temperatures over long periods
- Suitable for compact transformer design
- Superior oxygen stability
- Excellent lubricant
- No sludge formation

Moisture Tolerance

MIDEL 7131 is moisture tolerant and can absorb far more water than alternative fluids, without compromising the breakdown voltage.

- No reduction of breakdown voltage (up to 600ppm / 20°C)
- Allows moisture to migrate from cellulose into the fluid
- Potentially keeps the cellulose drier and slows the rate of ageing
- Very high saturation limit making condensation virtually impossible
- Reduced risk of bubble formation

Delivery

MIDEL 7131 can be delivered in 24.5kg, 195kg or 1000kg sealed containers; bulk tanker deliveries available for >20 tonnes.

Disposal

For disposal, it is recommended that used MIDEL 7131 or remains of the insulating fluid be burnt in a suitable installation.

Dielectric Insulating Fluid Overview

Table 1 - Characterisation of Type T1 Transformer Ester According to IEC 61099 and DIN VDE 0375

	Unit	Test Method	Requirement	MIDEL 7131
Physical Properties According to IEC 61099				
Colour	HU	ISO 2211	max. 200	125
Appearance	-	IEC 61099 7.1.2	clear, free from suspended matter and sediment	clear, free from suspended matter and sediment
Density at 20°C	kg/dm^3	ISO 3675	max. 1.00	0.97
Kinematic Viscosity at 40°C	mm^2/s	ISO 3104	max. 35.0	28
Kinematic Viscosity at -20°C	mm^2/s		max. 3000	1400
Flash Point	°C	ISO 2719	min. 250	260
Fire Point	°C	ISO 2592	min. 300	316
Pour Point	°C	ISO 3016	max. -45	-60
Crystallisation	-	IEC 61099 (2010) Annex A	No crystals	No crystals
Chemical Properties According to IEC 61099				
Water Content	mg/kg	IEC 60814	max. 200	50
Neutralisation Value	mg KOH/g	IEC 62021-2	max. 0.03	<0.03
Oxidation Stability - Total Acid Content - Total Sludge Content	 mg KOH/g % mass	IEC 61125	 max. 0.3 max. 0.01	 0.01 <0.01
Net Calorific Value	MJ/kg	ASTM D 240-02	<32	31.6
Dielectric Properties According to IEC 61099				
Breakdown Voltage	kV	IEC 60156	min. 45	>75
Dielectric Dissipation Factor Tan δ at 90°C and 50 Hz	-	IEC 60247	max. 0.03	<0.008
Volume Resistivity DC at 90°C	Gohm-m	IEC 60247	min. 2	>30

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

MIDEL SAFETY INSIDE

MIDEL® 7131

Storage and Handling Guidance

Introduction

MIDEL 7131 is a very robust liquid and studies have demonstrated its long term stability, even at elevated temperatures. For years, it has been successfully used worldwide in breathing and sealed transformer systems. However, it is still necessary to take precautions when handling and storing MIDEL 7131 to ensure that it is kept in optimum condition.

Miscibility

Miscibility gives an indication of the compatibility between different liquids. MIDEL 7131 is fully miscible with transformer mineral oil, high molecular weight hydrocarbons and other transformer ester liquids. It is not miscible with Silicone oil. If unsure about the miscibility of a specific insulating liquid with MIDEL 7131, please contact M&I Materials for recommendations.

Receiving New MIDEL 7131

We deliver MIDEL 7131 in a range of industry-approved packaging/sizes. Please contact customer service to discuss your requirements. Prior to filling containers, MIDEL 7131 is dried and degassed.

With the IBCs/ totes it is possible that users may notice a slight deformation of the containers. This is due to the degassed liquid absorbing the small amount of air in the headspace, thus creating a vacuum. This is perfectly normal and a good indication that the seal has not been compromised. In contrast drums of MIDEL 7131 are not likely to deform. This lack of deformation does not mean that the drum seal has been compromised.

The vacuum seal in IBCs needs to be broken and the recommendation is to contact IBC supplier Schütz to obtain the correct lid removal tool (part no.16659).

It is recommended that MIDEL 7131 not be stored for a period greater than 6 months in the flexitanks, but instead transferred to a suitable tanker truck or fixed storage tanks.

Storage

If properly stored indoor in temperature climate of - 40°C to + 40°C and away from direct exposure to sunlight, unopened containers of MIDEL 7131 have a shelf life of 10 years. Once opened precautions should be taken to avoid contact with moist air for prolonged periods because the liquid is hygroscopic and will absorb atmospheric moisture. If a partially emptied container is used for storage the head space should ideally be back-filled with dry nitrogen or dry air prior to resealing. If this is not possible, then ensuring the lid is properly sealed will help keep the liquid dry.

It should be noted that MIDEL 7131 is a very robust dielectric liquid which has proven to give many years of service in the harshest of transformer applications and the shelf life figure of 10 years is given as a guideline only. This not a strict limitation on the length of time that MIDEL 7131 can be stored for and if stored beyond this time users can establish the suitability of the liquid for service by checking properties such as water content and breakdown voltage. It is fully expected that in a well maintained transformer, the Midel liquid will provide many years of good dielectric performance, and that the length of the Midel working life is not limited to the stated shelf life.

If the liquid is kept in intermediate bulk containers the ideal location will be indoors to avoid extremes of temperature and exposure to the weather. Where outdoor storage is unavoidable exposure to direct sunlight should be prevented using a simple covering.

Storage tanks which are suitable for standard transformer mineral oil can be used for MIDEL 7131. It is recommended that the tank headspace has a dry nitrogen blanket to keep out moisture. If this is not possible then dry air should be used in the headspace and a suitable breather unit fitted to any vent system. If a silica gel breather is used to dry the headspace air then this must be properly maintained to ensure that the liquid quality is preserved.

STORAGE TANK & TANKER TRUCK HANDLING

Cleaning:

For a storage tank or tanker truck previously filled with transformer mineral oil, it is recommended to thoroughly clean it before filling it with MIDEL 7131. If steam cleaning is performed, ensure that the storage tank or tanker truck is completely dry before filling it with MIDEL 7131. If MIDEL 7131 is used to flush remaining transformer mineral oil from a storage tank or tanker truck then the user must ensure that a sufficient volume of MIDEL 7131 is used to remove all residual transformer mineral oil. A rinse of MIDEL 7131 of the bottom pipe lines and valve and or pump on the storage tank or tanker truck system is also recommended.

Storage and Handling Guidance

Inspection:

The storage tanks and tanker trucks should be inspected to ensure that the tank is clean and free of contaminants. Contaminants may include but not limited to dust, paint, rust, fabrication debris, oil sludge or water. Inspection of MIDEL 7131 should be done to similar methods as transformer mineral oil. Before filling the tanker, certificate of compliance by the supplier should be checked to make sure that MIDEL 7131 meets all the specification requirements.

Headspace:

The headspace of the tank should ideally be filled with dry nitrogen or dry air. If this is not possible, then ensuring the valves are properly shut off and covered will help keep the liquid dry.

Unloading:

MIDEL 7131 should be unloaded in similar method as transformer mineral oil but attention should be paid to the filters, pumps, valves, seals and hoses. Dedicated equipment for MIDEL 7131 will yield optimal performance.

Filtration:

MIDEL 7131 should be filtered before filling the tanker truck and after unloading it in the storage tank or in a transformer. The filters recommended for MIDEL 7131 are 1 micron of a type suitable for use with transformer oil. A cartridge type filter with a synthetic filter medium may be used. If unsure about a particular filter, please contact M&I Materials for recommendation. A good general practice is to filter MIDEL 7131 every time it is transferred.

Table 1 - Viscosity Values Versus Temperature

Temperature °C	Absolute Viscosity mPa s	Kinematic Viscosity mm^2/s
0	229	233
20	73	75
40	28	29
60	13	14

Data quoted above are typical values

Hoses, Seals, Pumps and Valves:

All the hoses, seals, pumps and valves should be compatible with MIDEL 7131. A material compatible list is available on the M&I Materials website. The link is provided below:
http://www.midel.com/productsmidel/midel-7131/materials-compatibility

The recommended hoses to use for pumping MIDEL 7131 are: Goodyear SAE J30R3 (Inner only compatible), Gates Premoflex, Trelleborg Chemikler D-UPE (Inner only compatible). If the user is interested in using any other hoses, please contact M&I Materials to check for compatibility prior to use.

The seals recommended for use with MIDEL 7131 are: Nitrile Rubber (BS2751), Silicone Rubber, Polyurethane Rubber, Fluorocarbon Rubber (Viton), PTFE (Teflon), Nylon and Fluorosilicone. If the user is interested in using any other seals, please contact M&I Materials to check for compatibility prior to use.

Valves suitable for use with transformer mineral oil should be suitable for use with MIDEL 7131. If unsure about a particular valve, please contact M&I Materials.
Any power take-off (PTO) pump attached to the tanker truck or any auxiliary pump that is suitable for operation with transformer mineral oil may be suitable for MIDEL 7131.

The viscosity of MIDEL 7131 is slightly higher than transformer mineral oil at ambient temperatures and this must be taken into account when specifying pumping systems. A higher capacity pump will be needed to maintain the same flow rate as transformer mineral oil at a given temperature. Table 1 shows viscosity values versus temperature for reference.

As with any dielectric liquid there is a possibility of static charge build up when MIDEL 7131 is flowing through the pipes. The user should ensure that all pumps, lines and vessels are adequately bonded and earthed during pumping operations. It is highly recommended to have dedicated hoses and pumps for MIDEL 7131. This will prevent cross-contamination. In the case where same hoses and pumps are used for transformer mineral oil and MIDEL 7131, it is recommended to thoroughly flush the hoses and pumps with MIDEL 7131 prior to use and to discard the liquid used for flushing.

Storage and Handling Guidance

Transformer Filling and Cellulose Impregnation

To avoid air entrapment in the transformer cellulose the tank should be filled from the bottom or if possible under vacuum.

In order to aid impregnation of the cellulose it is recommended that MIDEL 7131 be heated to approximately 60°C when filling. At 60°C the viscosity of the liquid is very close to that of transformer mineral oil at 20°C, and a similar impregnation rate has been observed in laboratory testing. It is further recommended that the transformer is filled slowly to aid impregnation and left for at least 24 hours prior to energising for the first time.

Throughout all stages of the filling operation it is essential that the introduction of moisture or particulate matter be avoided. The outlet side of any pump used during filling should be protected by a fine mesh or paper element filter. The use of degassing and vacuum filling is possible with MIDEL 7131, using the same type of equipment and methods employed with transformer mineral oil.