

THE SUPERVISION
& MAINTENANCE
OF LIQUID INSULATED
ELECTRICAL EQUIPMENT



EDEN
TRANSFORMER OIL

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SPECIALISING IN THE SUPERVISION AND MAINTENANCE OF ELECTRICAL OILS SINCE 1985



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INSULATING LIQUIDS

THE PURPOSE OF THE LIQUID IN ELECTRICAL EQUIPMENT IS TO PROVIDE A MEDIUM FOR COOLING THE UNIT'S CORE, TYPICALLY VIA EXTERNAL COOLING FINS, AND TO ELECTRICALLY INSULATE THE UNIT.

ELECTRICAL AND TRANSFORMER OIL ARE OFTEN USED AS COLLECTIVE TERMS FOR INSULATING LIQUIDS BUT THERE ARE INFAC T THREE TYPES OF COMMONLY USED INSULATING LIQUIDS.

MINERAL OIL

Mineral is the most commonly used insulating liquid and is suitable for a wide variety of applications. However it does have some limitations when used inside, near walls or where environmental concerns are a consideration.

The British standards applicable to mineral oils are:-
BS EN 60296:2012
BS EN 60422:2013

SYNTHETIC OIL

The most popular of the K class insulating liquids is MIDE L 7131. These liquids have superior tolerance to moisture and also benefit from a high fire point for safer use in buildings. MIDE L is also biodegradable and is not harmful to aquatic life.

The British standards applicable to synthetic oils are:-
BS EN 61099:2010
BS EN 61203:1995

SILICONE BASED LIQUID

Less common in the United Kingdom, silicone based liquids such as Dow Corning's Xiameter share many of the safety benefits of MIDE L 7131 but are not as moisture tolerant.

The British standards applicable to silicone liquids are:-
BS EN 60836:2005
BS EN 7713:1993



EXTENDING THE LIFE OF LIQUID INSULATED ELECTRICAL EQUIPMENT

MAINTAINING THE PAPER INSULATION AND CELLULOSE

The key component for the working life of a transformer is the paper insulation that contains cellulose, which begins to degrade from the day of manufacture. This degradation cannot be reversed, but it can be managed.

Moisture and heat accelerate the oxidation of the insulating liquid to form acidic compounds which then attack the cellulose and insulation papers.

Managing heat and moisture will extend the lifespan of both the insulating liquid and the insulating papers.

Research by Stanley Myers, Joseph Kelly and Robert Parrish for their book "A Guide To Transformer Maintenance" demonstrated that the working life of the insulation paper is halved by the doubling of moisture. They also found that an increase in temperature of just 8°C also halves the working life of the unit.



MANAGING MOISTURE

When a unit has been tested and found to contain excessive moisture it is often assumed that an oil change is required.

This is an incorrect assumption and can be an expensive mistake.

Replacing the insulating liquid does not remove the moisture from the transformer core and independent analysis* has shown that the total mass of water is distributed between the paper and the oil such that the bulk of the water is in the paper.

Therefore on-site treatment is more effective than changing the liquid and is typically more economical.

*BS EN 60422:2013 - Maintenance and supervision of oil filled equipment.



TECHNICAL BENEFITS OF ON-SITE TREATMENT

TREATMENT WHILST ENERGISED: AIDING THE PROCESS

Vacuum dehydration-filtration heats the oil for treatment and runs for several cycles, after the first pass through the treatment plant the process is actually treating the core of the transformer as much as the oil.

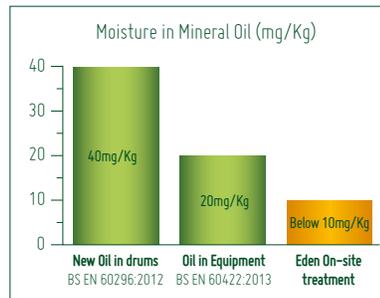
In the first pass through the plant the particles and gasses are removed and the moisture of the liquid is reduced to below 10mg/Kg.

Being heated to approx. 70°C the liquid then becomes the vehicle to liberate the moisture and sludge from the equipment's core and to transport it to the plant for removal.

A transformer that is energised actually aids the vacuum dehydration-filtration treatment processes due to the additional heat and vibration in the core.

BRITISH STANDARDS

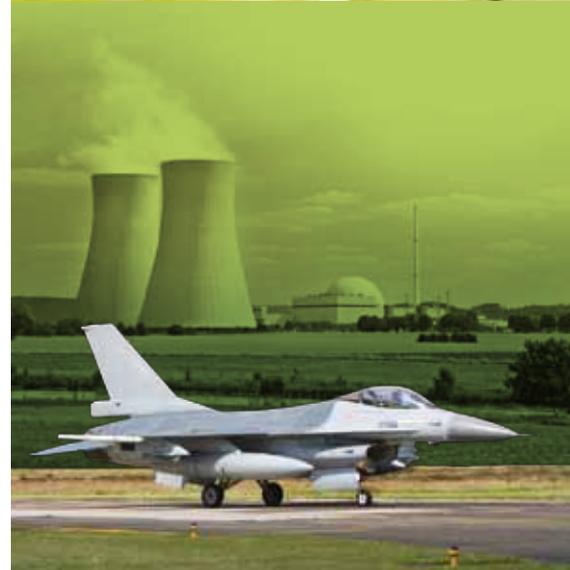
This chart demonstrates the differences in permitted moisture levels for new mineral oil in drums, oil in electrical equipment and the result of on-site vacuum dehydration treatment.



THE ENVIRONMENT: NO VIRGIN PRODUCTS USED – NO HAZARDOUS WASTE TO TRANSPORT

No oil is lost during the vacuum dehydration-filtration processes and so no virgin products are used, which is better for the environment. Independent research found that for every litre of new mineral transformer oil, the environmental impact for exploration, processing, shipping and distribution is actually the equivalent of one drum of oil.

With no waste, the risks and costs associated to the transportation of waste oil to an Environment Agency approved disposal site are also eliminated.



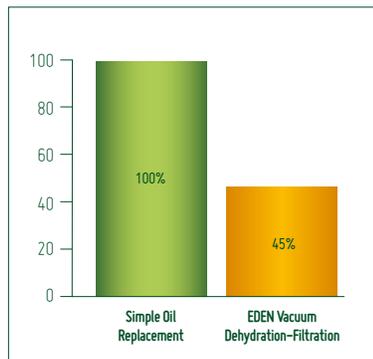
FINANCIAL BENEFITS OF ON-SITE TREATMENT

DIRECT FINANCIAL BENEFITS

The below example focuses solely on the direct financial saving achieved through vacuum dehydration-filtration, that is to say before transportation costs and loss of productivity is added to the overall cost of replacement oil.

The model is based upon a transformer containing 1,000 litres of mineral oil that is replaced and the waste oil removed to an Environment Agency approved facility.

Mineral oil has been chosen for this example because it is the cheapest of the insulating liquids and gives the 'best case' comparison. It should be noted that synthetic and silicone insulating liquids are over 2½ times more expensive, and larger volumes of insulating oil or liquid further strengthen the case for efficient on-site vacuum dehydration-filtration.



COST OF OIL REPLACEMENT

The costs of replacement oil includes: new oil, flushing oil, empty drums for waste, disposal of waste and labour of £500.

COST OF VACUUM DEHYDRATION-FILTRATION

The cost of vacuum dehydration-filtration includes all labour, plant and consumables. The only cost that could be added, if needed, is generator hire in the event site supplied power is not available.





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Eden is a family owned and operated business with over a quarter of a century's experience in the supervision and maintenance of electrical liquids in every business sector, and equipment from site transformers and switchgear to those fitted to trains and wind-farms.

We would welcome the opportunity to answer any questions and advise on the options available for sampling, testing and restoring the insulating and cooling properties of your insulating liquids.

Eden Transformer Oil was formed by Alan Denbow and Eddie Gregory in August 1985.

Former employees of Burmah Castrol, they realised that the vast majority of electrical engineers were simply replacing expensive insulating liquids without fully appreciating the additional technical benefits of on-site vacuum dehydration treatment to the electrical equipment, and that Eden could achieve a more convenient solution at a significantly lower cost.

In more recent years the treatment of transformer oil is the first choice for a cost effective and efficient maintenance program: the increasing cost of new oil, the importance of productivity and equipment downtime, coupled with the environmental benefits of avoiding the transportation of hazardous waste and use of virgin products, are all part of the equation.

As well as providing on-site treatment, if needed, Eden can supply and install new or reclaimed insulating liquids and provide all of the on and off site sampling and analysis to ensure transformers are supervised and maintained according to British Standards and insurance underwriters requirements.

We also run an online store for insulating liquids, spill care, gaskets and regularly used consumables. All products are tried and tested in the field and used by Eden staff on-site.

All products are sourced in the UK, and where possible manufactured in the UK too.



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