

**StaSo Transformer Oils are miscible and compatible with all insulating oils in the same class, the same group and with the same value for LCSET.**

Classification StaSo Transformer Oil I: L-NTIO-2960131

Classification StaSo Transformer Oil U: L-NTUO-2960131

On the subject of miscibility of insulating oils the IEC 60296:2012 says the following:

*"5.3 Miscibility*

*Unused mineral insulating oils in the same class, the same group and with the same value for LCSET and the same types of additives are considered as intermixable and compatible (see also IEC 60422:2013)".*

LCSET = Lowest Cold Start Energizing Temperature

The default value of LCSET is -30 °C according to the IEC 60296.

Regarding miscibility / compatibility of insulating oils the IEC 60422 says in item 5.12 additionally:

*"Unused oil complying with IEC 60296 and with the same classification (class, group and LCSET as stated in IEC 60296) as that already in service should be used for topping up and/or refilling electrical equipment.*

*Field experience indicates that problems are not normally encountered when unused oil is added in small percentage, e.g. less than 5 %, to used oils classified as 'good' (see 9.4), though larger additions to heavily aged oil may cause sludge to precipitate.*

*A compatibility test may be needed to determine the feasibility of mixing unused oils of different origins with oil in service. For mixing used oils, a compatibility study is strongly recommended. Reference to the oil supplier is recommended if any doubts concerning compatibility arise.*

*In the compatibility study, as described below, the characteristics of the mixture should not be less favourable than those of the worse individual oil.*

*Oils should be mixed in the same proportions as in the application, or if not known in a 50/50 ratio.*

*The following functional tests are recommended for each individual oil and for the mixture:*

- *Foaming*
- *Oxidation stability according to IEC 61125:1992, Method C, including acidity, sludge and DDF after ageing. Test time should be according to the oil group as stated in IEC 60296*
- *Corrosive sulphur and/or potential corrosivity after ageing according to IEC 61125:1992 Method C*

*Experience is very limited regarding the use of oil containing pour point depressants to top-up naturally low pour point oils. However, laboratory investigations suggest that no significant deterioration of low temperature behaviour is likely to occur.*

*Compatibility tests are particularly necessary in the case of oils containing additives. Again, reference to the oil supplier or to the equipment manufacturer is recommended."*

Questions about miscibility & compability targeting a filling up of transformers must be carefully answered in advance, especially following must be observed in order to provide the best possible testimony:

- Which oil is filled in the transformer already?
- Which standard type of oil and what specification is in use ? (possibly let pass data sheets)
- Contains the oil any additives? Has additives been added after the original first fill?
- Is the current performance level of the oil known? Any analysis available, especially regarding the aging of the oil?

Are there any uncertainties and no answers given to the questions above, a copmpatibility test is recommended.