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Subject 340

333 Pfingsten Road
 Northbrook, IL 60062
 August 19, 1994

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Fire Council of Underwriters Laboratories Inc.,

SUBJECT: Transformer Fluid Category (EOVK)

This bulletin, addresses questions that have been raised regarding the method of evaluation and the use limitations applicable to less-flammable transformer fluid liquids. Products in the transformer fluid category are evaluated in accordance with the Standard for Tests for Comparative Flammability of Liquids, UL 340. Transformer fluids are liquids that are intended for use as dielectric and cooling mediums in electrical transformers. These products are Classified as to their fire hazard using UL's method for classification of the fire hazard of liquids and are rated numerically between 0 and 100, according to the schedule in which ether rates 100 and paraffin oil rates in the range of 10 to 20. These products are also Classified as either a "less-flammable liquid" or "nonflammable fluid" in accordance with Sections 450-23 or 450-24 of the National Electrical Code, ANSI/NFPA 70.

Section 450-23, Less-Flammable Liquid-Insulated Transformers, states how a transformer is to be installed, and also contains certain requirements for the insulating liquid. It should be noted that the liquid is to have a fire point (ASTM D92) of not less than 300°C and the installation is to comply with all restrictions specified in the listing of the liquid.

UL's requirements for "the listing of the liquid" specify no fire, explosion, leakage, or rupture of the transformer tank during extensive high and low current arc-fault testing of constructions representing a range of ratings for liquid cooled transformers. The manufacturer is to choose the transformer ratings as well as the means to prevent fire, explosion, leakage or rupture during our tests.

There are presently two products under UL's Transformer Fluids category which are Classified with respect to fire hazard as less-flammable liquids. Both products have been investigated for use with 3-phase transformers, 45 through 10,000 kVA, having a tank capable of withstanding an internal pressure of 12 psig without rupture. Both products have met UL's requirements under the specified "use-restrictions" that are indicated along with the Classification Marking on the product containers. These "use-restrictions" involve fusing and pressure relief devices. It is the fusing and the maximum allowable I^2t of the fuses which set these two Classifications apart. One specifies the use of current limiting fuses while the other specifies general overcurrent protection which could include expulsion type fuses. The maximum allowable fuse I^2t for each transformer size is also different for the two manufacturers.

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UL's first investigation of less-flammable liquids resulted in a report to the Electrical and Fire Councils in 1984. During that and subsequent investigations, the fusing was external to the transformer. UL has analyzed how large transformers operate, how they can malfunction and how the fuse can reduce, or possibly even add to the damage to the transformer, should a fault occur inside the transformer.

UL understands that in some transformer constructions, the fuses (i.e., expulsion fuse) may indeed be inside the transformer and under the fluid. Expulsion fuses are designed for installation in transformers so that the fluid flows through the fuse and around the fuse link. Thus, when the fuse link melts and arcs, the fuse vents directly into the fluid. There is a concern about the use of expulsion fuses inside transformers for the following reasons:

1. The venting of an under-fluid expulsion fuse into the transformer fluid adds to the pressure generated by an arc at a fault. This additional pressure might not be fully accounted for by testing with only an arc in the fluid during high arc-fault testing, since the fuses for the testing are external to the transformer tank.
2. I^2t is a measure of energy delivered per ohm of resistance. Thus, the energy delivered for a constant I^2t is not necessarily equal for an under-fluid expulsion fuse as for an arc alone. UL has reviewed data which indicate that the resistance of the fuse (while clearing) is higher than the resistance of the arc. Thus, for a constant I^2t , the fuse arc delivers a higher energy to the fluid. This additional energy may not be fully evaluated by testing with just an arc at a fault in the fluid.

Since the investigations did not cover internal fuses which vent into the fluid, UL is clarifying the Classification of these products by revising the Guide Information for the Transformer Fluids (EOVK) category in the Gas and Oil Equipment Directory to include the following statement:

Products Classified as "less-flammable liquid" have use restrictions on the product container. If such use restrictions include fuse requirements, the fuse must be either a type which does not vent under normal operation, or it shall be installed external to the transformer tank.

The complete Guide information including the added statement is listed below.

GUIDE CARDS

EOVK

Transformer Fluids[Dielectric Mediums]
June 22, 1994
(A Card)

These products are liquids intended for use as dielectric and cooling mediums in electrical transformers. These products have been Classified to their fire hazard using Underwriters Laboratories Inc.'s method for Classification of the fire hazard of liquids. They have been rated numerically according to the schedule in which:

Ether Rates	100
Gasoline	90 – 100
Alcohol (Ethyl)	60 – 70
Kerosene (100 F Flash)	30 – 40
Paraffin Oil	10 – 20

These products are also Classified as a "less-flammable liquid" or nonflammable fluid" in compliance with Sections 450-23 or 450-24 of the National Electrical Code, ANSI/NFPA 70.

Products Classified as "less-flammable liquid" may have use restrictions on the product container. If such use restrictions include fuse requirements, the fuse must be either a type which does not vent under normal operation, or it shall be installed external to the transformer tank.

Subject 340

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August 19, 1994

LOOK FOR CLASSIFICATION MARKING ON PRODUCT

Replaces guide card (A) of like title and guide designation dated August 19, 1992.

EOVK

August 19, 1992
(B CARD)
(Cont. from A card)

[Dielectric Mediums] Transformer Fluids

The Classification Marking of Underwriters Laboratories Inc. on the product container is the only method provided by Underwriters Laboratories Inc. to identify products under its Classification and Follow-Up Service. The Classification Marking for these products includes the Classification Marking for Dielectric Mediums (EOUV) and the statement:

CLASSIFIED BY UNDERWRITERS LABORATORIES INC. AS "LESS-FLAMMABLE LIQUID" IN COMPLIANCE WITH THE NATIONAL ELECTRICAL CODE WITH THE FOLLOWING "USE RESTRICTION" (AS APPROPRIATE).

OR

CLASSIFIED BY UNDERWRITERS LABORATORIES INC. AS "NONFLAMMABLE FLUID" IN COMPLIANCE WITH THE NATIONAL ELECTRICAL CODE

Should you wish to comment on the above information and the revisions to the Guide information, please address your comments to the attention of your respective Council Chairman as indicated below:

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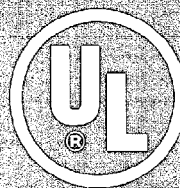
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Standard for Safety

UL 340

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Test for Comparative Flammability of Liquids



Underwriters Laboratories Inc.®

Standard



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UL Standards for Safety are developed under a procedure which provides for participation and comment from the affected public as well as industry. The procedure takes into consideration a survey of known existing standards and the needs and opinions of a wide variety of interests concerned with the subject matter of the standard. Thus manufacturers, consumers, individuals associated with consumer-oriented organizations, academicians, government officials, industrial and commercial users, inspection authorities, insurance interests and others provide input to UL in the formulating of UL Standards for Safety, to keep them consonant with social and technological advances.

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Standard for

UL 340, Third Edition

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

Revised and/or additional pages may be issued from time to time.

JUNE 3, 1993

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UL 340

Standard for

Test For Comparative Flammability Of Liquids

First Edition – March, 1972
Second Edition – July, 1979

Third Edition

June 3, 1993

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

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(1 – 06/03/93 – 06/03/93)

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