

## UNAPPROVED MINUTES

### WORKING GROUP ON THERMAL EVALUATION OF POWER AND DISTRIBUTION TRANSFORMERS (C57.100)

March 20, 2006

Costa Mesa, CA

Roger Wicks, Chairman

#### 1.0 Introduction and Rosters

The working group met on Monday, March 20, 2006 at 11:00 AM with 14 members and 50 guests attending. One guest requested membership in the working group.

#### 2.0 Approval of minutes from October 24, 2005 meeting

The minutes of the October 24, 2005 meeting in Memphis were approved as written.

#### 3.0 Patent Disclosure

The chairman asked if anyone knew of any patents which could pertain to this project. There were none.

#### 4.0 Discussion of two methods in existing C57.100 document – Lockie Tests and Sealed Tube Tests.

Patrick McShane provided a short summary of their Aging work recently conducted which utilized the Lockie Tests and Sealed Tube Tests, which will be reviewed in more detail on the 21<sup>st</sup>, in the Tutorial titled “Aging Rate of Kraft Paper Insulation Immersed in Natural Ester Based Dielectric”. This overview solicited some questions from the audience related to the makeup of the cells, as well as the moisture content of the papers in the cell. Patrick addressed the questions, and noted that they obtained a very good correlation between historical values and their testing for thermally upgraded kraft (within 2°C).

Patrick also noted that their testing showed longer aging than predicted from the classic aging curves, especially for the ester-based fluids. Their Lockie tests were conducted with hot spot temperatures at 168, 175 and 183°C, all of which ran significantly longer than the required aging times at these temperatures (up to 3 to 4X).

#### 5.0 Discussion of DuPont-Weidmann test of Model using Thermally Upgraded Kraft

The chair and secretary then reviewed the joint work being conducted by their companies to utilize the new IEC test method (62332) which involves model cells designed to simulate the thermal performance of a power transformer. To date, this testing has been conducted with non-upgraded kraft insulation, and life curves are being generated which look to show longer life for this material than seen in either of the existing C57.100 methods.

In this testing, the bulk oil temperature is controlled at 115°C, and the conductor temperature is independently controlled at higher temperatures. This current set of aging is being conducted with a Nitrogen blanketed cell and well-dried paper-oil insulation system, which may explain the superior life. The chair noted that subsequent work will be conducted with air blanketing and also to look at the effect of moisture.

The testing has just started with upgraded papers as well (2.74% Nitrogen) and based on a limited sample base, the incremental benefit of these papers vs. the non-upgraded papers is in the range of 10 to 15°C. Due to the lengthy aging periods (in some cases a factor of 10 over historical sealed tube work), an original test plan to have completed this work with four different nitrogen content papers was not accomplished prior to the meeting. This testing will continue, and the other variations mentioned above will be considered as well.

The working group dealing with the gas guide expressed interest in some of the oil data from this testing, as well as the working group dealing with the loading guide. The chair will finish updating the information in the presentation, and then send it out to members of the working group. He expects to receive data on 4 or 5 additional cells during the next couple of days.

The working group seemed pleased with this work, and some good discussion points were provided, especially around the need to evaluate moisture and oxygen effects. Patrick McShane offered to help the chair understand methods to provide a controlled amount of moisture content for the start of the aging cycles. Haase Nordman provided some insight into a Finnish study which looked at moisture content vs. transformer life.

## 6.0 Work Going Forward

The aging work from the IEC Model aging will continue. Additionally, the secretary will work with IEEE (Jodi Haasz) to obtain permission to distribute copies of IEC 62332 to the working group members to help our efforts in developing a power transformer model.

The chair also noted, that as a group we need to evaluate both the existing model as well as the proposed model to understand test criteria for evaluation. During the meeting, it was noted that DP is a much more predictable indicator of remaining life than tensile strength, but the chair cautioned that not all materials can use this method (non-cellulosic as an example). We also need to consider how one qualifies a system – do all parameters have to pass, or only the solid. Is there two sets of criteria – one if the fluid is good, one if not so good, etc. Perhaps these decisions can only be made after more extensive aging is completed.

## 7.0 Adjournment

The meeting adjourned at 12:15PM.