

Unapproved Minutes of Spring 2019 Meeting of TF “Audible Sound Revision to Test Code C57.12.90”, in Anaheim, CA

The TF met at 1:45 PM, on Monday, March 25, 2019. Chairman Dr. Ramsis Girgis presided over the technical part of the meeting and Secretary Barry Beaster handled the administrative duties of the meeting.

After the Fall 2018 meeting, the membership was adjusted to 48 members. This meeting was attended by 26 of the 48 members and 54 guests for a total of 102 participants. A quorum was established after the final attendance was recorded in the AMS system due to some initial issues with the Cloud-In-Hand badging system. During the meeting, a call was made for any objections for a tentative unanimous approval of the Fall 2018 TF minutes; no objections were raised so we have a post-meeting official approval. The proposed agenda was presented without objections for approval. The circulated attendance sheets had thirteen requests for TF membership; which will be reviewed based on previous meeting attendance.

The first item presented was the proposed revisions to Table 17 and Annex C in C57.12.00; which were recently approved through a Survey at the PCS Subcommittee level. These proposed revisions are as follows:

- Incorporated NEMA TR1 Tables 1 & 2 for No-load sound levels into Annex – C with improvements (Tables C1 & C2)
- Replaced the formulas presently in Annex – C, for calculating reference load Sound Power levels, with tables of corresponding Sound Pressure levels (Table C3)
- Modified reference to the revised Annex – C in Table 17

These items were recently submitted by the Chairman to Mr. Steve Snyder to be included in the 2020 Revision of C57.12.00.

Prior to this TF meeting, a survey was issued to TF members on proposed text on “Impact of temperature on core noise” and on “Impact of temperature & tap position on load noise” to be added to Clauses (13.3.3.1 *No-load audible sound level*) and (13.3.3.2 *load audible sound level*) in C57.12.90; respectively. The results of the survey had 14 returned ballots, 8 approved, and 6 approved with comments. The proposed text on “Impact of core temperature on core noise” was as follows:

- *Generally, core temperature has a small impact on core noise. However, cores made of core materials that have lower quality coating with lower surface tension have been seen to experience an increase in core sound level of several dBs at higher core temperatures. This is more noticeable for high loss core steels at high operating flux densities.*

Other than editorial suggestions, the main comments received on this proposed text are as follows:

- Need for more quantitative description of words like: Small impact, lower quality coating, higher core temperatures, high loss core steels, and high operating flux densities
- Wouldn't such information belong to a Guide?
- Is there a need to perform the core noise test at a higher core temperature?

Based on some of the comments from the TF members, the following revised text was proposed in the meeting:

“Generally, core temperature has no, or small (1 – 2 dB), impact on core noise. However; depending on the type of core steel and the core lamination coating, several decibels (dB) higher core noise levels are likely at core temperatures that are higher than design values”.

The Chairman then opened the forum for a discussion of this item requesting feedback from core steel suppliers, transformer manufacturers, and transformer purchasers in attendance.

Some of the main feedback received were as follows:

- The present test code doesn't state a temperature for the sound test, so, **at** what temperature should core noise be tested at?
- Operating at 110 % voltage excitation at no load is part of the Standard requirements for transformer designs

- Is the effect of core temperature on core noise the same when the whole transformer core temperature is higher during regular operation?
- Since impact of core temperature on core noise cannot be defined better, perhaps this should be in a guide rather than in the Standard?
- How is the magnitude of this “effect of temperature on core noise” dependent on the B800 value (value that defines the degree of magnetic grain orientation of core steel)?

The Chairman answered to these questions / comments. He suggested that the TF will need to first understand how the magnitude of this effect, as observed at core noise test in the factory, compares with that when the transformer is in operation with the whole core temperature elevated. The Chairman also requested transformer manufacturers to conduct the following test in order to quantitatively evaluate this phenomenon:

- Perform the no-load test at 110 % excitation and measure core loss & core noise over a period of 4 hours, record the measured values at intervals of 15 minutes for the first hour, and every hour for the remaining 3 hours.
- Repeat the core loss & core noise test at 110 % excitation after the heat-run test (s) with the oil temperature elevated and compare measurements with the original measurements made at room temperature.
- Perform above tests on transformers with cores made of core steels from different suppliers.

The first priority would be to perform above tests on 3-phase core-form transformers with the 3-limb core and, if possible, perform the same tests on 3-phase core-form transformers with the 5-limb core type, and on at least one 1-phase transformer. Manufacturers are to share this test data with the chairman on a proprietary basis. No design information of these transformers will need to be shared with the Chairman.

As the meeting time had expired, the meeting was adjourned at 3:00 PM.

Respectively submitted,

Ramsis Girgis, TF Chairman

Barry Beaster, TF Secretary