ILFC TF Continuous Revisions to IEEE C57.12.90 Clause 11

Temperature-rise Tests

March 29' 2022 Denver, CO

TF - Temperature-rise Tests		
Chair: Dinesh Sankarakurup	**Vice-Chair: Ajith M. Varghese**	**Secretary: Open**
Room: Centennial H	Date: March 29th 2022	Time: 1:45 am to 03:00 pm
Total TF Members: 43	Members present at the Quorum: 10	Attendance Per Roster : 19
Guests present: 22	Membership requested: 1	Membership accepted: 0

Chair's Remarks

The Chair welcomed members and guests to the spring 2022 meeting. The Chair briefly highlighted the requirement that while introducing one need to state their employer/ company and sponsor if the difference from the company.

Chair made the call for the patent and shared the IEEE SA slides on patent policy and copyright.

Chair informed the TF the John Reagan has stepped down from the role of secretary and for this meeting Vice Chair will also be acting as secretary. If anyone interested in taking up the role of secretary can contact the chair.

Quorum, Approval of Minutes and Agenda

At the time of quorum only 10 of the 43 members were present. Chair mentioned that, all those requested membership during first meeting was granted membership but only 19 members were present during the last meeting and this has further reduced to 10. TF has requested a different timeslot for next meeting as current slot have conflict with RLFT, which is also a TF on continuous revision of C57.12.90.

The Unapproved minutes from the Spring 2021, Fall 2021 meetings and the agenda for Spring 2022 meeting was presented but due to lack of quorum was not approved. These will be emailed to members for the approval.

TF Discussions and Motion passed.

Results of two surveys were presented

- **Survey 1** : **Replacing the word "Ultimate" with "Stabilized" in C57.12.90 clause 11.3.2**

Present wording (C57.12.90- 2021) : Liquid temperature rise is the difference between liquid temperature and ambient temperature. The ultimate liquid temperature rise above ambient shall be considered to be reached when the top liquid temperature rise does not vary more than 2.5% or 1 °C, whichever is greater, during a consecutive 3 h period.

Proposed Wording: Liquid temperature rise is the difference between liquid temperature and ambient temperature. The stabilized liquid temperature rise above ambient shall be considered to be reached when the top liquid temperature rise does not vary more than 2.5% or 1 °C, whichever is greater, during a consecutive 3 h period

Response rate - 22/43 - 50%
Approve – 19/22 = 86%

TF Discussion/ Decision: Due to absence of Quorum, No motion was made to take this forward to ILSC.

- **Survey 2,** Adding a sentence to section 11.3.2 to clarify **ultimate/stabilized liquid temperature rise shall not be averaged**, returned with 95% approval

Present wording (C57.12.90- 2021): Liquid temperature rise is the difference between liquid temperature and ambient temperature. The ultimate temperature rise above ambient shall be considered to be reached when the top liquid temperature rise does not vary more than 2.5% or 1 °C, whichever is greater, during a consecutive 3 h period.

Proposed Wording: Liquid temperature rise is the difference between liquid temperature and ambient temperature. The ultimate temperature rise above ambient shall be considered to be reached when the top liquid temperature rise does not vary more than 2.5% or 1 °C, whichever is greater, during a consecutive 3 h period. The Ultimate liquid temperature rise determined at the end of the total loss run shall not be averaged over time
**Note: Results of Survey # 1 and subsequent decision taken by TF will be incorporated into final draft of this change*

Response rate - 22/43 - 50%
Approve – 21/22 = 95%, 1 Abstained

TF Discussion/ Decision: Discussed one of the comment to change C to K since its temperature rise (over ambient) and not absolute. After discussion it was agreed to leave it as surveyed since C is used at lot of different places in C57.12.00 and C57.12.90. **Due to absence of Quorum, No motion was made to move forward to ILSC.**

- **Exponents to be used for K and L Type Cooling Medium**

  TF had sought information/data from SC members and guest about m and n exponents to be used for K and L type cooling medium, as C57.12.90 sub clause 11.4.1 and 11.4.2 currently only cover O type cooling medium. However, the TF did not receive any data to support values to be used. In the absence of supportive data, there was a suggestion to add a note to this section, for user/manufacture to agree to values based on provide design/other data, but the general consensus was to leave section as is for now.

  TF Discussion/Decision: TF doesn't plan to pursue this further, unless there are adequate data to support any change.

Old/ Unfinished Business

- **Negative Altitude Correction (Transformers tested at factories located > 1000 m)**

  Steve Antosz: Sub clause 11.4.3. Correction of liquid temperature rises for differences in altitude. This clause says to make an adjustment to oil rise when a transformer is tested at 1000 m or less and is to be operated at a higher altitude. But it does not say to make an adjustment when the opposite situation applies, such as when a transformer is tested above 1000 m and is to be operated at 1000 m or less. Currently some manufacturers are using their own formula to correct. I propose that we add verbiage to allow the reverse correction when such a situation applies.

  TF Discussion/Decision: Chair reported that current IEEE formula if used for reverse correction give different temperatures for Forward and Reverse correction. Ajith Varghese volunteered to review the formula and will present the findings during next meeting.

- **Tap Selection for Temp Rise Test:**

  Steve Antosz: sub clauses 11.1.2.1 and 11.1.2.2 say, "Transformer shall be tested with the combination of connections and taps that give the highest average winding temperature rise." This may be good for two-winding transformers, but (for example) for an autotransformer with a loaded tertiary, there may be cases of allowable loading that produce higher total losses (and rises), such as arithmetic or Vectorial step-up and step-down loading cases, if specified.

  a) Stipulate the measurement (determination) of maximum total losses for three-winding transformers which is dependent on the combination of connection, taps, and loading case. These losses would have to injected or adjusted for using corrections in sub clause 11.4.2.

  b) For an autotransformer the maximum common winding current should be circulated (or adjusted) for the measured winding temperature gradient and winding rises to be determined. If the maximum current cannot be circulated, the results should be adjusted using corrections in sub clause 11.4.1

  c) Temperature rise test tap selection. Once total losses are determined, the selection of a tap position for temperature rise test should allow the current to flow in as many as possible turns and windings to avoid any possible thermal issues in untested turns and cables. In some cases, this might apply to involve series and PA transformers, if provided

TF Discussion/Decision: Hakan Sahin, Steve Antosz and Ajith Varghese volunteered to review these items and come up with proposals for the next meeting.

- **Hot spot rise calculation for OFAF /OFWF cooler transformer**

Bertrand Poulin: C57.119-2018 guide for overload tests shows typical profile, with differences in top oil temperature for OFAF and OFWF compared to ONAN and ONAF. Later in document shows calculations for difference, but in 12.90 there is no mention of the differences. Propose to ensure 12.90 makes this reference to difference between OFAF and others

TF Discussion/Decision: Juan Castellanos to review C57.119 and make a recommendation to TF during next meeting.

- **Ambient measurement location**

Ajith Varghese: Standard allows ambient measured between 1 to 2 meters away from transformer. That is large tolerance allowed which can affect rises by 0.25 to 0.5 C. Suggest standardizing to 1 Meter, which seems to be most common practice

TF Discussion/Decision: Had some discussion but no decision was made. In general agree that 1 to 2 meter is quote large. User prefer 2 meters, Manufactures likes 1 meter. Discussion to continue.

- **Clarification to Hottest spot Rise calculation using Fiber Optics**

Ajith Varghese: It was reported that some manufacturers are incorrectly reporting/Calculating Fiber optic HSR as the Difference in Fiber Optic Temp during gradient run and ambient. This is not correct as during gradient run, current is correct but Top Oil Temp have cooled down from Temp at total loss heat run. So, the drop in oil temp from total loss to gradient should be added to the fiber optic HSR arrived at gradient run. Difference will be 1-2 Degree C.

TF Discussion/Decision: Not discussed

- **Standardize Method for Hot resistance extrapolation**

Ajith Varghese: Different manufacturers use different methods to extrapolate. IEEE does not have a formula or method specified. Depending on different methods, temperature can vary by 1-3 degree

TF Discussion/Decision: Not discussed

New Business

Ewald Schweiger brought up a safety concern regarding resistance measurement done during temperature rise test. Though Standard allow first measurement to be taken within 4 minutes, many customer specification is reducing the limit. Since there is risk of losing order, many manufacturers are accepting reduced time and this indirectly is causing pressure on operators performing hot resistance measurement, with potential of safety mishap.

Problem statement
Current IEEE C57.12.90 [clause 11] regulations require achieving the as quickly as possible time between power shut-off at heat run end and installation of resistance measurement devices.
Current IEEE Standard C57.12.90 [clause 11] limits the period from finalization of heat run test to start of hot resistance measurement to 4 minutes.

Further to this requirement, we frequently are faced with requests from particular customers to achieve transition times between both tests to below 4 minutes (supported by IEEE base "as quickly as possible" "short-time" requirement),.

This has the following consequences:

- test field engineers are under pressure to take additional risks in order to further reduce the transition time
- test field professionals might get exposed to high voltage - potentially causing severe harm (electroshock)
- the testing procedures could be reverted applying state-of-the-art technology including direct winding temperature measurement.

Request for modification
Integrate safety aspects into next revision of IEEE standard C57.12.90 clause 11 to help to establish an intrinsically safe testing process, including technical and engineering controls:

- Prohibited zone should be clearly marked with physical barriers
- Clear signals and verbal communication to start interactions on the product
- At no time possible to approach the energized test object
- Use the directly measured hot-spot temperature based on fiber optics as a basis and calculate the winding temperature rise based on the measured hot-spot temperature and on the measured oil temperatures. Reliable technologies/products were not available years ago for direct hot-spot temperature measurement, but are now available for use in the industry.
- Add a note in paragraph 11.2.2 which allows this alternative method for determination of the winding rise in cases where the direct measurement of the hot-spot temperature is possible. Describe the new procedure in detail.

TF Discussion/Decision:

Due to shortage of time, TF could not discuss this topic during S22 meeting.
Chair noted that the Scope of the proposal/Concern go beyond Section 11 of C57.12.90. So he will discuss with ILSC Chair to bring this up as topic during Adcom and to make decision which is most appropriate forum to discuss and take action on this item.

Adjournment

Meeting adjourned 03.06 PM.

Attendees

First	Last	Membership	Affiliation	S22
Dinesh	Sankarakurup	Chair	Duke Energy	X
Ajith	Varghese	Vice-Chair	SPX Transformer Solutions, Inc.	X
Bruce	Forsyth	Member	Bruce Forsyth and Associates PLLC	X
Cihangir John	Sen	Member	Duke Energy	X
David	Wallach	Member	Duke Energy	X
Dennis	Marlow	Member	DenMar TDS Transformers	X
Gary	King	Member	Howard Industries	X
Gilles	Bargone	Member	FISO Technologies Inc.	X
Hakan	Sahin	Member	Virginia/Georgia Transformer	X
Jaber	Shalabi	Member	VanTran Industries, Inc.	X
Jason	Varnell	Member	Doble Engineering Co.	X
Juan	Castellanos	Member	Prolec GE	x
Marc	Taylor	Member	JFE Shoji Power Canada Inc.	X
Sam	Sharpless	Member	Rimkus Consulting Group	X
Steve	Antosz	Member	Stephen Antosz & Associates, Inc	X
Timothy	Raymond	Member	Electric Power Research Institute (EPRI)	X
William	Boettger	Member	Boettger Transformer Consulting LLC	X
William	Whitehead	Member	H2scan Corporation	X
Yaquan (Bill)	Li	Member	BC Hydro	X
Alex	Alahmed	Guest	Evergy-Wolf Creek	X
David	Burto	Guest	Xcel Energy	X
Egon	Kirchenmayer	Guest	Siemens Energy	X
Ewald	Schweiger	Guest	Siemens Energy	X
Florin	Faur	Guest	Prolec GE Waukesha	X
Hampton Allen	Steele	Guest	Tennessee Valley Authority	X
Hakim	DulaC	Guest	Qualitrol	X
Jean Noel	Berube	Request	Rugged Monitoring	X
Kris	Zibert	Guest	Allseir Martin	X
Kyle	Zemorovic	Guest	Eaton	X
Mama	Mbouombouo	Guest	Hitachi Energy	X
Mana	Yazdani	Guest	Trench Ltd	X
Mario	Alonzo	Guest	Georgia Transfromer	X
Mark	Tostrud	Guest	Dynamic Rating	X
Michael	Shannon	Guest	REA Magnet ire	X
Muhammad Abdul	Sohail	Guest	Trench Ltd	X
Paul	Dolloff	Guest	East Kentucky Power	X
Saramma	Hoffman	Guest	PPL Electric Utilities	X
Scott H	Digby	Guest	Duke Energy	X
Tauhid	Ansari	Guest	Hitachi Energy	X
Tom	Aikens	Guest	Virginia Transformers	X
Zachary	Hutchinson	Guest	East Kentucky Power	X

Minutes respectfully submitted by:

Ajith M. Varghese
Vice Chair and Acting Secretary