Program for APLAC T101

Winding temperature-rise test (resistance method)

1. Objective

Windings are used extensively in electrical and electronic products as a magnetoelectric conversion component. The safety of winding is an essential part of electronic product safety. Over heat of the windings could cause severe thermal burn injury of the human body. Winding temperature test encompasses a wide range of products, such as, audio, video devices, information technology equipment, house-hold appliances, motors, power tools, transformers, etc.

Most economies have laboratories capable of testing electrical products safety for regulatory compliance purposes. To prevent people suffer from thermal burn injury, winding temperature-rise test is one of the essential tests of electrical safety testing. Resistance method is the most commonly used method to measure the winding temperature-rise.

This program is intended to help participants to demonstrate their testing capabilities of the laboratories in different economies, understand the difference between the different laboratories, to make improvement, and try to establish a common understanding of the test.

2. Organization and Responsibilities

This program is organized by China National Accreditation Service for Conformity Assessment (CNAS), with Technical Center for Mechanical and Electrical Product Inspection and Testing of SHCIQ (SMEC) as the collaborator, under the auspices of Asia Pacific Laboratory Accreditation Cooperation (APLAC).

During this proficiency testing program, CNAS would be responsible for proposing this program for approval by the APLAC Proficiency Testing Committee, inviting participants, issuing interim report and final report to participants and acting as a contact point among APLAC, participating accreditation bodies / participants and SMEC. SMEC will be responsible for the preparing, packaging, dispatching of samples, handling participants' queries, receiving the test results,

receiving samples and make confirmation evaluation of the samples, statistical analysis, drafting interim and final report.

3. Points of contacts

The contact details are given below:

Coordinator of organising accreditation body CNAS:

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4. Selection of Participants

APLAC members as well as other non-APLAC accreditation bodies will be invited to participate in the programme. Invitations will be sent to all APLAC members and other accreditation bodies. Each accreditation body of APLAC members is invited to nominate up to a maximum of 2 laboratories from its economy to participate in this program. Each of others is invited to nominate up to a maximum of 1 laboratories to participate. Accreditation bodies will be asked to nominate laboratories for participation and indicate the accreditation status and priority of the nominated laboratories for the test. **The number of laboratories shall be preferably limited to 50**. Therefore, a restriction on the number of participating laboratories from each accreditation body may need to be imposed. When the number of enrolments exceeds the limit, participants will be selected on a ***first come first served*** basis. The organiser will, as far as possible, allow at least one laboratory to participate in this proficiency testing programme from each accreditation body. **Note that preference will be given to laboratories that are accredited for the proposed tests**.

5. Description of PTIs

The Proficiency Test Items (PTIs) for this program are patented electrical boxes to simulate the windings in various electrical and electronic appliances, such as house-hold appliances, motors and power tools. PTIs will be simultaneously distributed

Normative electrical components are utilized, including, high-accuracy COPPER

windings, accurate resistances, and PCBs. Well-defined manufacturing process is implemented. The samples are subjected to ageing treatment before sealing.

6. Properties Measured for Comparison and Requirement

The testing parameter to be measured is the winding temperature-rise of the sample tested and calculated using resistance method (Unit: K).

Winding temperature-rise test (resistance method) is an essential part of electrical safety testing for products such as, house-hold appliance, motors, power tools and electronic devices, etc. The reference standards are IEC 60335-1:2010, IEC 60034-1:2010, IEC 60745-1:2006, IEC 62841-1:2014, etc. However, the testing method of winding temperature-rise test (resistance method) is harmonized as follows.

The temperature-rise is obtained by resistance method, which may be obtained from the equation:

$$\Delta t = \frac{R_2 - R_1}{R_1} \times (k + t_1) + t_1 - t_2$$

Where,

Δt is the calculated temperature-rise of copper winding, K;

R1 is the resistance of the winding at temperature t1 (cold), Ω;

R2 is the resistance of the winding at the end of the thermal test t2; Ω;

t1 is the temperature (°C) of the winding (cold) at the moment of the initial resistance measurement, ℃;

t2 is the temperature (°C) of the winding at the end of the thermal test; ℃.

k is the reciprocal of the temperature coefficient of resistance at 0 °C of the conductor material, for copper winding, k=234.5

The main factors that influence the test results are,

1) Test apparatus, power supply, etc.
2) Stability of the environment
3) Understanding and execution of the standards.

Participants should also provide the testing parameters where necessary.

1) fitting curves used in calculation
2) RMS Voltage (V) and Current (A)
3) Stability and THD of power supply (%)

Measurement uncertainty is highly encouraged to be reported by the participants laboratories.

7. Homogeneity & Stability Study

A well-defined manufacturing process is used to guarantee the quality of the PTIs. After that, a screening procedure is used to ensure the precision accuracy of the sample is ±0.05Ω(20℃).

Finally, EACH sample is tested in duplicate for determining the homogeneity. Three samples will be taken randomly for monitoring the stability of the samples between dispatch and after submission of results.

8. Assigned Value & PTSD

Algorithm A in ISO 13528, the robust estimates of the mean and standard deviation of the data are quoted as the assigned value and the PTSD.

After evaluation of testing methods, the results of the participants will be calculated together. Meanwhile, if statistics base meet the requirement, the results will also be calculated separately according to the standards, for technical reference.

9. Evaluation of the Performance

Performance of the participating laboratories is assessed using z-score, which is calculated as follows,

$$z = \frac{x_i - X}{\sigma}$$

where

x_i is the reported result of the participant

X is the assigned value

σ is the PTSD.

This is in line with the ISO/IEC 17043 recommendations on the determination of assigned values for proficiency testing schemes.

z-Score is commonly interpreted as:

(i) $|z| \leqslant 2.0$ Satisfactory

(ii) $2.0 < |z| < 3.0$ Questionable

(iii) $|z| \geqslant 3.0$ Unsatisfactory

Laboratories having a |z| score equal to or larger than 3.0 shall thoroughly investigate their results for the discrepancy and those having a z-score in the range $2.0 < |z| < 3.0$ are also encouraged to review their results.

10. Reporting to the Participants

An interim report will be issued to participants and their respective accreditation bodies for checking the correctness of results submitted. The draft final report will then be prepared and submitted to APLAC PT Committee for comments and

approval. Upon approval, an electronic copy of the final report will be distributed to the participants and their respective accreditation bodies.

11. Confidentially

The concerned parties (APLAC, CNAS and SMEC) strive to maintain strict confidentiality with respect to composition of the proficiency test sample distributed and the performance of all participating laboratories. To preserve the confidentiality, participants receive reports giving all results for assessment but without identifying individual laboratories. The code number assigned to a participant in the proficiency testing programme is only made known to the contact person/authorized person of the participating laboratory and/or the respective accreditation body.

The proficiency testing programme is conducted in the belief that participants will perform the analysis and report results with scientific rigor. Collusion and falsification of results are clearly against the spirit of the proficiency testing programmes.

12. Program Schedule

The proposed time schedule for the various phases of the proficiency testing programme is as follows:

Event	Period	Responsible
Invitation of participants	Mar. – Jun. 2016	CNAS
Preparation and evaluation of PTIs	Mar. - Sept. 2016	SMEC
Dispatch of PTIs	Sept. 2016	SMEC
Testing and collecting of results	Oct. 2016	Participants
Interim report	Nov. 2016	CNAS/ SMEC
Feedback	Dec. 2016	Participants
Draft final report	Feb. 2017	CNAS/ SMEC

Note: the schedule is based on the estimation that the programme is to be approved and started in January 2016.

13. Reference

[1] ISO/IEC 17043:2010, Conformity assessment - General requirements for proficiency testing.

[2] APLAC PT002-2003, Testing interlaboratory comparisons.

[3] ISO 13528:2015, Statistical methods for use in proficiency testing by interlaboratory comparisons.