

Task Force on Partial Discharge Testing of Class I Power Transformers

IEEE/PES Transformers Committee
Fall 2019 – Columbus, Ohio

Agenda

- 1. Welcome and call to order**
- 2. Approval of agenda**
- 3. Membership and quorum**
- 4. Patent announcement**
- 5. Approval of scope and purpose of task force**
- 6. Thanks for submittals of ideas**
- 7. Discussion of PD test alternatives submitted**
- 8. Voting on various options on test elements**
- 9. Approval to adjourn**

Membership Requirements

- 1. Voting membership shall be granted automatically to those participants attending the meeting of a newly chartered Task Force upon their request.**
- 2. Voting membership may be requested and granted after attending two consecutive meetings. Voting membership is granted after the second consecutive meeting.**
- 3. If a voting member misses two consecutive meetings, his or her voting privileges may be revoked. Notification will be sent if voting privileges are revoked.**
- 4. Voting privileges may be reinstated and granted after attending two consecutive meetings.**

Membership

Make sure you have badged in at the automatic attendance system. If not, do it now.

A physical roster will be circulated at this meeting so that attendees can indicate their desire to be a voting member of the task force.

Hopefully, in the future, the automated attendance system will be used exclusively.

Participants have a duty to inform the IEEE of Essential Patent Claims

Participants shall inform the IEEE (or cause the IEEE to be informed) of the identity of each holder of any potential Essential Patent Claims of which they are personally aware if the claims are owned or controlled by the participant or the entity the participant is from, employed by, or otherwise represents

Participants should inform the IEEE (or cause the IEEE to be informed) of the identity of any other holders of potential Essential Patent Claims

Scope

This task force will define the partial discharge testing procedure of liquid-immersed power transformers, autotransformers and regulating transformers, classified as Class I by IEEE Std. C57.12.00, Clause 5.10

Definition of Class I Power Transformer

IEEE Std. C57.12.00, 5.10 Insulation Levels

... power transformers are separated into two different classes as follows:

- a) Class I power transformers are any that are not categorized as Class II, described in item b).
- b) Class II power transformers shall include power transformers with high-voltage windings rated for 115 kV nominal system voltage and above, and also power transformers with high-voltage windings rated 69 kV through 115 kV nominal system voltage, having a top nameplate rating of at least 15 000 kVA for three-phase transformers or 10 000 kVA for single-phase transformers.
- c) Scope will not include transformers designated as distribution transformers.

Purpose of Task Force

The task force is to establish the methodology, procedures and performance requirements for partial discharge testing on Class I Power Transformers.

Thank You For Contributors

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John John

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Alexander Winter

Tauhid Ansari

Question Submitted

In an effort to make the first meeting productive, we are soliciting proposed test procedures in advance so that we can discuss at the first meeting.

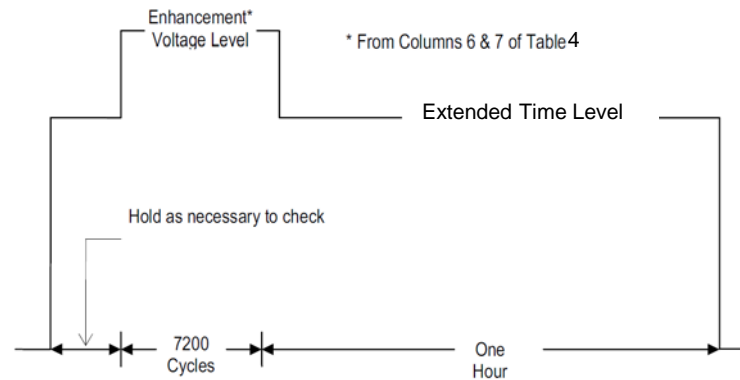
In detailing your procedure please define the voltage steps, the time duration of each step as well as the acceptable PD level to pass the test plus any other steps that are taken to ensure a successful test.

Summary of Responses

# Responses	Proposal
15	Essentially same as existing Class II procedure
4	No long time measurements
2	Record on inception and extinction levels
2	Perform during applied test (Dry-type method)

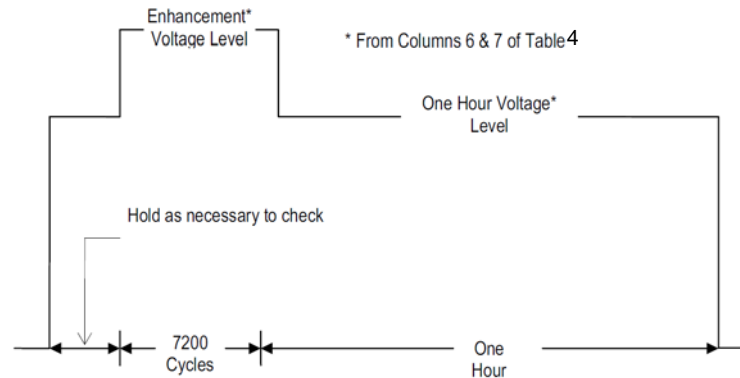
Test Procedure for Class I Transformers

(Similar to Class II Methodology)



Proposal #	Start Level	Enhanced Level	Extended Time Level	Duration	Acceptance Criteria
1	150% NSV	200% NSV	150% NSV	1/2 hour	500 pC @ 150% NSV
2	158% NSV	200% NSV	158% NSV	1 hour	500 pC @ 158% NSV
3	120% NSV	200% NSV	120% NSV	1 hour	500 pC @ 120% NSV
4	100% NSV	200% NSV	150% NSV	30 sec.	Xxx pC @ 150% NSV pC Free @ 100% NSV

Test Procedure for Class II Transformers



Enhanced Level – $1.80 \times \text{NSV}$

One-hour Level – $1.58 \times \text{NSV}$

NSV = Nominal system voltage

10.8.2 Test procedure

The voltage shall first be raised to the 1 h level and held for a minimum of 1 min or until a stable partial discharge level is obtained to verify that there are no partial discharge problems. The level of partial discharges shall be recorded just before raising the voltage to the enhancement level. The voltage shall then be raised to the enhancement level and held for 7200 cycles. The voltage shall then be reduced directly to the 1 h level and held for 1 h.

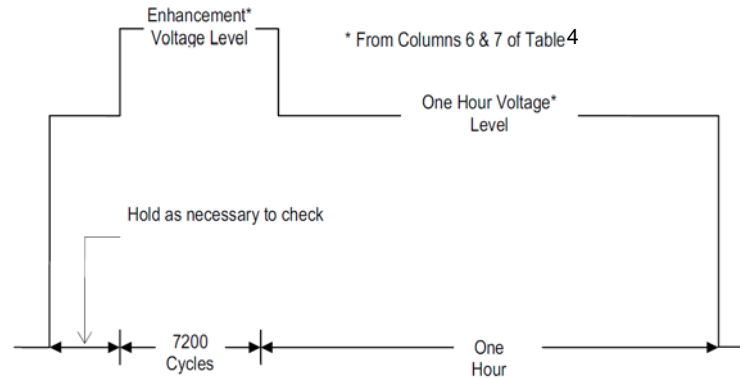
During this 1 h period, partial discharge measurements shall be made at 5 min intervals. Partial discharge acceptance criteria shall be based on each line terminal rated 115 kV and above. These measurements shall be made in accordance with 10.9.

10.8.5 Failure detection (Acceptance)

- The **magnitude** of the partial discharge level **does not exceed 500 pC** during the 1-h test period.
- The **increase** in partial discharge levels **during the 1-h period does not exceed 150 pC**.
- The partial discharge levels during the 1-h period **do not exhibit any steadily rising trend**, and **no sudden sustained increase** in the levels occurs **during the last 20 min** of the test.

Test Procedure for Class I Transformers

(Based on Class II Methodology)



Enhanced Level – **2.00 x NSV**

One-hour Level – **1.58 x NSV**

NSV = Nominal system voltage

10.8.2 Test procedure

The voltage shall first be raised to the 1 h level and held for a minimum of 1 min or until a stable partial discharge level is obtained to verify that there are no partial discharge problems. The level of partial discharges shall be recorded just before raising the voltage to the enhancement level. The voltage shall then be raised to the enhancement level and held for 7200 cycles. The voltage shall then be reduced directly to the 1 h level and held for 1 h.

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Subjects to Consider

(One at a time)

- Enhanced Voltage Level
- Voltage Level of Extended Time test
- Length of Extended Time test
- Voltage Level of first reading
- Acceptance levels (pC and/or μV)
- Overall methodology
- Verbiage and location in standards
- Required test or optional