

# Discussion on Class I & II Terminology

IEEE PES Transformers Committee  
Fall Meeting 2011 – Boston, MA

# What is Class I & II?

**C57.12.00-2010 is the only document we have that defined these terms.**

## 5.10 Insulation levels

Transformers shall be designed to provide coordinated low-frequency and impulse insulation levels on line terminals and low-frequency insulation levels on neutral terminals. The primary identity of a set of coordinated levels shall be its *maximum system voltage* and basic lightning impulse insulation level (BIL). BIL will be selected dependent on the degree of exposure of the transformer and characteristics of the overvoltage protection system.

# What is Class I & II?

The system voltage and the type of transformer may also influence insulation levels and test procedures.

Therefore, **power transformers** are separated into two different classes as follows:

**a) Class I** power transformers shall include power transformers with **high-voltage windings of 69 kV and below.**

**b) Class II** power transformers shall include power transformers with **high-voltage windings from 115 kV through 765 kV.**

# Why?

- The use of Class I & II terminology in the past served to distinguish the different needs of insulation levels between smaller and larger power transformers due to different low frequency and impulse test levels and the neutral terminal insulation level based on the degree of exposure of the transformer and characteristics of the overvoltage protection system.

# Why this discussion??

- With the new standards there is a diminished need for these distinctions
  - C57.12.10 (power transformers) covers 833 kVA and above single-phase, 750 kVA and above three-phase.
  - C57.12.36 (distribution substation transformers) covers distribution application up to 10MVA, 69kV
- Class I **Power** and **Distribution** requirements are grouped together
- Confusions for power transformers test requirements (e.g. low frequency test requirements – induced voltage test w/ PD measurements)

# Background & Relevant Considerations

- Definition of “distribution” and “power” (C57.12.80)

**3.105 distribution transformer:** A transformer for transferring electrical energy from a **primary** distribution **circuit** to a secondary distribution circuit or **consumer's service circuit**. *See also:* power transformer.

**3.327 power transformer:** A transformer that transfers electric energy in any part of the circuit between the **generator** and the distribution **primary circuits**. *See also:* distribution transformer.

- Differentiating low frequency and impulse test levels and the neutral terminal insulation level based on the degree of exposure of the transformer and characteristics of the overvoltage protection system.
- There are xfmr's between 69kV and 115kV
- Traditional “distribution” xfmr's are being applied for “power” applications

# Additional Considerations

- Additional requirements for Class II power transformers
  - Control/aux losses measured and recorded
  - Chopped wave min. time to flashover (2.0 $\mu$  sec minimum for power transformers)
  - Induced voltage tests:
    - Class I – 2.0 x nominal voltage
    - Class II – 1.8 x enhanced level for 7200 cycles, 1.58 x one hour and
  - Zero-phase sequence impedance voltage and load loss on the rated tap connection
  - Dissolved gas in oil analysis
  - Winding and core insulation resistance
  - Insulation power factor and capacitance
  - Low-frequency test on auxiliary devices and control and current transformer circuits
  - Lightning impulse test

# Impacted Standards

- If the terminology of Class I and Class II is eliminated, the following portions of the standards will be impacted
- C57.12.00
  - Clause 5.9, 5.10
  - Tables 4, 5, 6, 18
- C57.12.90
  - Clause 10.1, 10.5, 10.7, 10.8,
  - Tables 2 (may be moved to PC57.152)



# Action Items

- Please consider the information presented
- Interested parties to present concrete proposal on what changes are needed
- Be prepared to carry on a meaningful discussion at the next meeting
- Impacted Subcommittees:
  - Power Transformers
  - Dielectric Test
  - Performance Characteristics