

Comparison of Induced Test Clauses for single-phase transformers.

Existing clause 6.1 from C57.12.23-2018

No applied-potential test is required on high-voltage windings of units designed for use phase-to-ground. Phase-to-phase units shall require an applied-potential test as described in IEEE Std C57.12.00.

Induced-potential tests shall be performed as specified in IEEE Std C57.12.90. The voltage induced between the high-voltage terminals and ground shall be the lesser of:

- 3.46 times the rated high-voltage plus 1000 V, or
- The low frequency test voltage specified in IEEE Std C57.12.00 for the applicable high-voltage BIL rating

For this test, the neutral terminals (if applicable) shall be grounded.

Existing clause 10.5 from C57.12.90-2021

For single-phase transformers with a BIL of 150 kV or less that have only one high-voltage bushing, the high-voltage neutral terminal permanently connected to ground, and no secondary windings permanently grounded, no applied-voltage test is required. These transformers shall receive an induced-voltage test between the high-voltage terminal and ground with duration of 7200 cycles but not less than 15 s. This voltage shall be 1000 V plus 3.46 times the rated transformer winding voltage, but in no case shall the line-to-ground voltage developed exceed 40 000 V for 125 kV BIL or 50 000 V for 150 kV BIL. An applied-potential test shall be applied to all windings that are not permanently grounded.

Proposed clause 6.2 for C57.12.23/D3

For transformers that have the high-voltage winding neutral permanently connected to ground, the applied-voltage test is not required. These transformers shall receive an induced-voltage test with duration of 7200 cycles but not less than 15 s. The line-to-ground voltage induced at the high-voltage line terminals shall be 1000 V plus 3.46 times the rated transformer line-to-ground voltage, but in no case shall the induced voltage exceed 40 000 V for 125 kV BIL or 50 000 V for 150 kV BIL. An applied-voltage test shall be applied to all windings that are not permanently grounded.

--- Other single-phase standards for reference ---

From C57.12.38-2014 Clause 6.2 Note, 12.38 does not include phase-phase connected ratings.

No applied-voltage test is required on the high-voltage winding. Induced-voltage tests shall be performed by applying between the terminals of one winding a voltage that will be developed from the high-voltage terminals to ground. This voltage shall be 1000 V plus 3.46 times the rated transformer winding voltage, but in no case shall the line-to-ground voltage developed exceed 40 000 V for 125 kV BIL or 50 000 V for 150 kV BIL. For this test, the neutral terminal shall be grounded. The voltage in the induced voltage test shall be applied on the low-voltage winding.

From C57.12.20-2023 Clause 6.2

For single-phase transformers with a high-voltage BIL of 150 kV or less that have one high-voltage bushing and a high-voltage terminal permanently connected to ground, no applied-voltage test is required. Induced-voltage tests shall be performed by applying between the terminals of one winding a voltage that shall be developed from the high-voltage line terminals to ground. This voltage shall be 1000 V plus 3.46 times the rated transformer winding voltage, but in no case shall the line-to-ground voltage developed exceed 40 000 V for 125 kV BIL or 50 000 V for 150 kV BIL. For this test, the neutral terminal shall be grounded. An applied voltage test shall be applied on the low-voltage winding.

Commented [AT1]: This clause outlines exceptions to C57.12.00 and 12.90. This statement is not needed here.

Commented [AT2]: The table in 12.00 does not assign low frequency test voltage by BIL.

Commented [AT3]: This clause only pertains to permanently grounded windings so this statement is not needed.

Commented [AT4]: Should be high-voltage BIL

Commented [AT5]: GrdY loop feed transformer has two HV bushings. This condition can be deleted, "the high-voltage winding neutral permanently connected to ground" is the only needed condition.

Commented [AT6]: There is no "neutral terminal". Should be "winding neutral"

Commented [AT7]: 240/120 LV often has X2 permanently grounded. This condition can be deleted. The special induced test applies if the low-voltage neutral is permanently grounded or not.

Commented [AT8]: Rated transformer winding voltage should be rated high-voltage

Commented [AT9]: Voltage developed at the high-voltage terminals

Commented [AT10]: Should be applied-voltage as stated in 12.90 clause 10.6