

Voltage Transformer Protection Principles

INTER-TEKNIK FUSES FOR MV VOLTAGE TRANSFORMERS



Overview

Voltage transformers are designed to convert a primary high voltage of a power grid into an acceptably lower voltage to feed measuring and protective devices. Voltage transformer are low power high impedance items that operate at low current levels. In contrast to the low operating currents, fault currents in case of insulation failure may be extremely high as voltage transformers are often installed at the substation bus.

Therefore, HV current-limiting fuses having **high breaking capacity** will preferably be used to isolate failed voltage transformers from the power system and to prevent potentially catastrophic consequences. Inter-Teknik fuses combine **low continuous current ratings** with **high rated maximum breaking current**.

Fuse Selection Criteria

- Optimum protection against damage to other equipment in the event of an insulation failure of the voltage transformer requires selecting a possibly small current rating.
- Major fuse selection criterion is **to withstand magnetizing inrush currents** in order to avoid nuisance tripping. As a rule, this condition excludes effective overload protection of a voltage transformer.

Practical Tools for Selection

- The pre-arcing I^2t of the fuse should be at least 5 times greater than the inrush I^2t . This will give a reasonable safety margin for preventing nuisance tripping of the fuse.
- If inrush I^2t values are unavailable, the fuse rated current may be selected 15 to 20 times the voltage transformer rating.

To Avoid Failures

Fuse-element design of fuses at very low rated currents, are by nature susceptible to mechanical and inrush damage. Certain precautions should be taken as follows;

1. In small metal-enclosed grounded fuse compartments, the effect of sustained partial discharges - "**corona**" - generated by high electric stress at the fine fuse-wire, need to be considered as electro-erosion that will degrade the delicate fuse-element with time.

Solution: Partial discharge measurement with the fuse installed is recommended to avoid that risk.

2. In some applications, particularly in networks with isolated neutral, there is a risk that the inherent capacitance of the circuit will give rise to a discharge current through the primary windings of the voltage transformer that triggers relaxation oscillations; also known as **ferroresonance**. Such chaotic oscillations may last until destruction of the voltage transformer.

Solution: Precautions, such as damping resistors installed at the LV windings, should be taken ensuring that the fuse would not operate under these conditions.

3. Risks of mechanical damages during transport or operation should be minimized.

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