Paris Session 2022

Varistors in Transformers

A2

PS3 Question Number 3.6

What are the factors to determine the need of varistor in the regulating windings or in the tap changer? Is it possible to avoid it? Are there feedbacks on the long-term reliability of such components? Is there a way to evaluate varistor condition during the transformer lifetime?

Dharam Vir, USA

Need of Varistors in Transformers

- In Regulating Windings
  - When step voltage or voltage across the winding exceed the voltage limits of the tap changer.
  - There is a retrofit requirement with identical or higher capacity transformer with site dimensional and shipping limitations (As per the agreement between manufacture and the user)

- In Tap Changers
  - Varistors made of ZnO elements are used in vacuum type tap changers because no switching resistors may be included in the protective circuit due to its switching principle
  - ZnO elements of the varistor realize a short circuit for specific overvoltage in order to protect the tap changer for damages.

Can we avoid Varistors in Transformers?

- Sometimes use of varistors can be avoided by
  - Changing the transformer design to change the RLC network
  - Different winding arrangements or winding designs to change the series and ground capacitances of the windings
- However, sometimes use of varistors is unavoidable
  - Due to the size of the transformer and/or other specification requirements which may dictate particular winding arrangements due to impedance or other performance parameters.
- For tap changers, this is a part of protective circuit and may be unavoidable for a given tap changer design / technology

Reliability & Condition Monitoring of Varistors

- Lifetime of ZnO elements in Varistors is determined by load current size occurring in transient overvoltage of the varistors
- Load current magnitude depends on the expected voltage level and surge impedance of the transformer.
- With the induction of ZnO technology, most of the operating / maintenance issues reported earlier with SiC have been largely eliminated .
- There is no existing practice known to evaluate varistor condition during the transformer lifetime. However, online condition monitoring of ZnO varistors in transformers may use the same principles as those used for electronic circuits.
- Conventional inspection /maintenance schedule as followed for the transformers is found to be sufficient for the successful operation of these varistors as well .