Paris Session 2022

Necessity and operational experience of ZnOs in OLTCs

A2

PS3 Question 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? It is there a way to evaluate varistor condition during the transformer lifetime?

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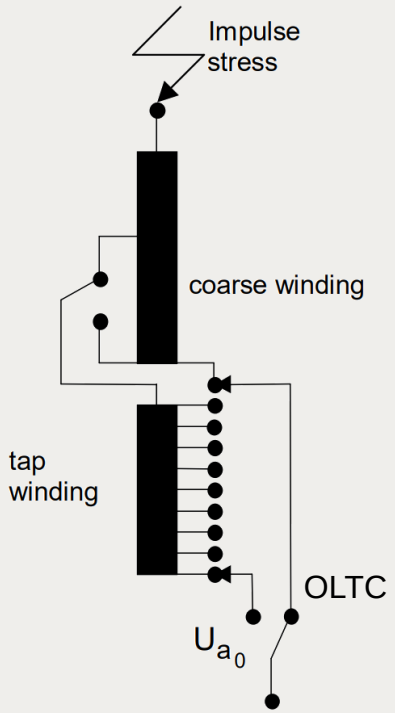
***Question 3.6**: What are the factors to determine the need of varistor in the regulating windings or in the tap changer? Is it possible to avoid it? Are there feedbacks on the long-term reliability of such components? It is there a way to evaluate varistor condition during the transformer lifetime?*

Remarks:

- the content of this presentation refers to application of ZnOs varistors in on-load tap-changer (OLTC) only. Application of varistors in transformers is not covered.
- A much more detailed paper regarding this topic is available: P. Heinzig, A. Krämer, et al. „Long-Time Experiences of ZnO Varistor Application in Power Transformers and OLTC's" (Cigre 2006, A2 – 303)

Why is a certain dielectric capability necessary in diverter switches:

- Both under normal operation and when testing the transformer with lightning impulse voltages, transient over voltages can appear on the insulation distance of the OLTC in general.
- These transient over voltages will also occur between the tap in service and the pre-selected tap and must therefore be controlled also by the diverter switch.
- Especially winding arrangements with coarse/fine winding and with OLTC in mid position might leads to high voltage stresses.



Winding arrangement (coarse/fine) with OLTC in mid position

Measures to avoid a too high dielectric stress

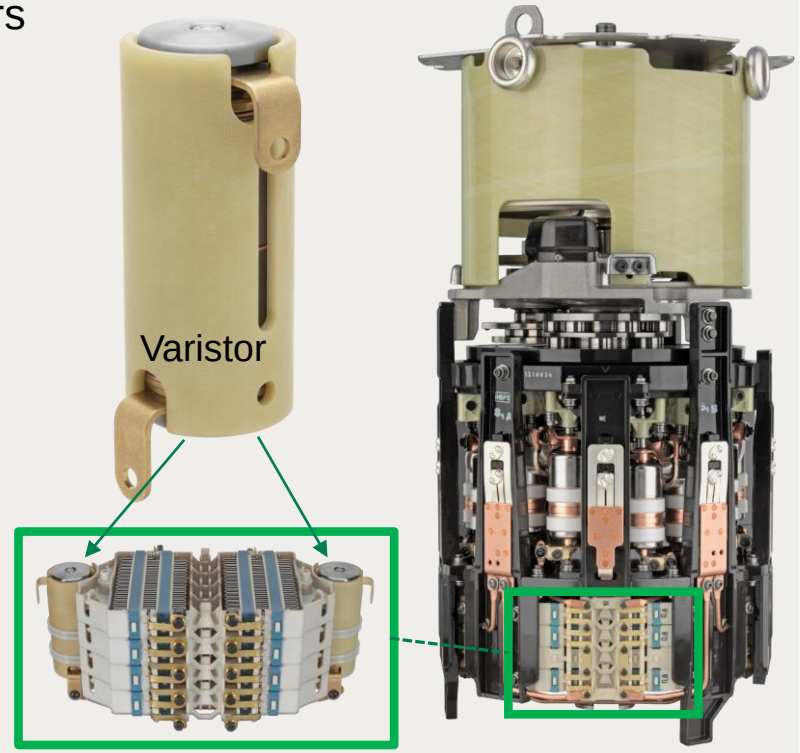
- Large geometric dimension in the diverter switch → no economic solution
- Limiting the max. dielectric stress
  - **Spark gap**: mainly used in the past for small and medium power transformers
  - **Varistor** (ZnO): by now used in almost all power transformer classes

Longtime experience of ZnO Varistor application in OLTCs

- During the last **40 years** non-linear resistors made of Zinc Oxide (**ZnO)** have been in **use in OLTCs** for power transformers with a **very good service experience**.

- For an **excellent long time behavior** of varistors a **design rule** and **continuous quality monitoring of the ZnO elements** is important.

- In OLTC application the **ZnO varistor** is **easily accessible** during regular maintenance work. The **1 mA DC voltage can be measured** and **compared** to the **initial values**.



Assembly of transition resistor and varistor

Diverter switch insert