

TechTopics No. 07

Current transformers (CTs) - Use of 600 V CTs in metal-clad switchgear

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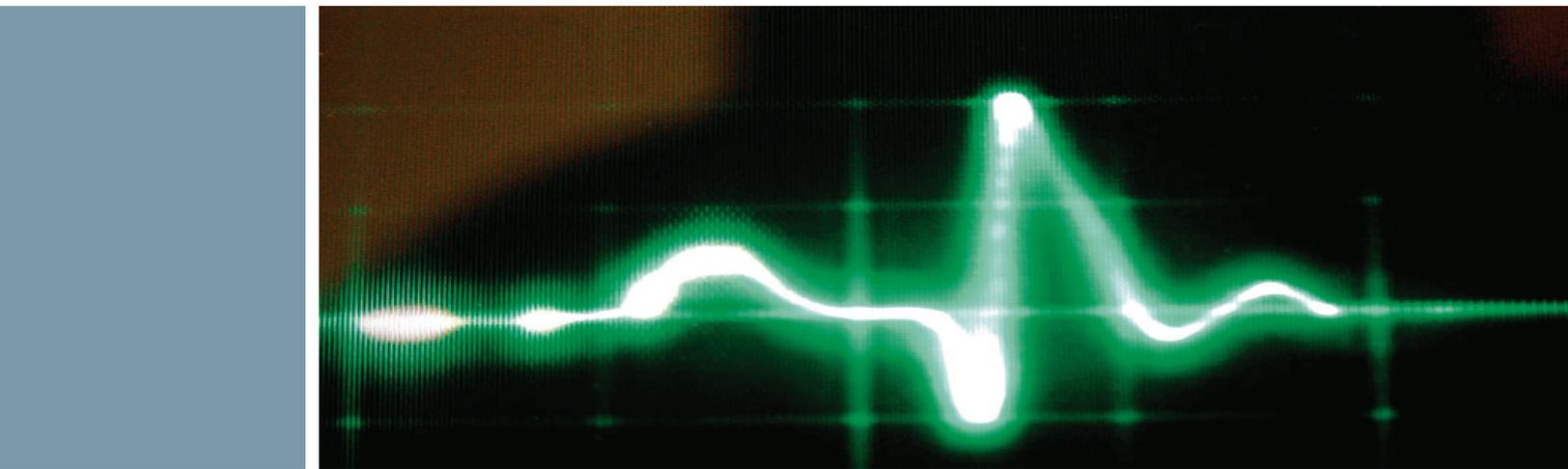
For many decades, it has been common practice to use 600 V window ('donut' or toroidal) current transformers (CTs) in metal-clad switchgear rated through 38 kV. Conceptually, use of 600 V CTs in switchgear is exactly analogous to use of 600 V bushing CTs in outdoor high-voltage circuit breakers or in large power transformers.

Occasionally, we are asked to explain why such a practice is justified. The simple answer is the voltage rating of the current transformer (by itself) is irrelevant. The important question is whether the complete system, of which the CT is a part, meets the performance requirements for the system. The dielectric capability of the complete system is established by the combination of air surrounding the circuit breaker primary runback conductor, the insulating tube incorporated in the primary disconnect assembly, the air between the CT and the primary disconnect assembly tube, plus the insulation of the CT.

For metal-clad switchgear constructed to ANSI/IEEE C37.20.2, the complete system must meet the dielectric test requirements (power frequency withstand as well as lightning impulse withstand) for the completely assembled switchgear.

To demonstrate the dielectric capabilities, C37.20.2 requires that the switchgear be tested using a normal circuit breaker compartment equipped with the maximum complement of current transformers installed. Typically, our designs are similar for 1,200 A, 2,000 A and 3,000 A current ratings. Accordingly, the arrangement tested is the configuration with the highest continuous current circuit breaker and compartment. This arrangement is appropriate because it has the largest physical conductors used in the design, which, in turn, dictates that the dielectric stress is more severe than for lower continuous current ratings having smaller conductors.

Our types GM-SG (up to 15 kV) and type GM38 (up to 38 kV) switchgear designs have successfully passed all required design tests, demonstrating that the integrated system meets the ratings required by the standards.



Why are 600 V window CTs commonly used in metal-clad switchgear?

- Window-type CTs are less costly than molded high-voltage CTs, resulting in a more economical product for users.
- Window-type CTs do not incorporate the primary conductor as an integral component of the CT itself, thus isolating the CT from major dielectric as well as thermal stresses.
- The primary conductor bracing for short-circuit forces is provided by the switchgear structure and the circuit breaker primary runback conductor, instead of by the CT, which allows higher short-circuit levels.
- Since the CTs are not located directly in the high-voltage bus structure, they are more accessible for maintenance, inspection, changeout (for example, if a ratio change is needed) or for addition of CTs after initial installation.
- Window CTs are readily available in multi-ratio configuration.
- Lead-times for window CTs are generally a fraction of those for high-voltage CTs.
- Use of window CTs allows the CTs to be installed in the circuit breaker compartment, around the primary disconnect assembly, which saves space in both the bus compartment and in the cable compartment.

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