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Instrument transformers –
Part 102: Ferroresonance oscillations in substations with inductive voltage transformers

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INSTRUMENT TRANSFORMERS – PART 102: FERRORESONANCE OSCILLATIONS IN SUBSTATIONS WITH INDUCTIVE VOLTAGE TRANSFORMERS

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IEC 61869-102, which is a technical report, has been prepared by IEC technical committee 38: Instrument transformers.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
38/440A/DTR	38/445/RVC

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Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 61869 series, published under the general title *Instrument transformers*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

During the last twenty years ferroresonance oscillations in substations with inductive voltage transformers according to IEC 61869-3 or with combined transformers according to IEC 61869-4 were discussed in the international Cigré working groups and in IEEE committees in the US.

The results were published in Cigré [1] technical report or IEEE [2] publications.

The reasons for these publications were the more frequent occurrence of ferroresonance oscillations in substations. As a consequence of the price pressure on the operating authorities and the component manufacturers such as instrument transformers, power transformers and grading capacitors for high-performance circuit breakers have led to an increasingly higher exploitation of the system and components.

This trend results in:

a) the shift from normal rated voltage U_{pr} in the direction of the maximum permitted highest voltage for equipment U_m (IEC 60071-1 [3]);
b) increasing the flux density $\vec{\hat{B}}$ by reducing the cross-section of the core of the inductive voltage transformer;
c) the reduction of the substation capacitance by using new components (e.g. MV and HV instrument transformers) leads to an increase of the excitation-voltage for the non-linear circuits;
d) reduction of the actual burden in the substation by using digital meters and relays with burden of approximately 1 VA, while still specifying the high nominal burden (50 VA to 400 VA) for the inductive voltage transformer. However, even these higher burdens are often not sufficient to prevent ferroresonance oscillations.

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PART 102: INSTRUMENT TRANSFORMERS – FERRORESONANCE OSCILLATIONS IN SUBSTATIONS WITH INDUCTIVE VOLTAGE TRANSFORMERS

1 Scope

This part of IEC 61869 provides technical information for understanding the undesirable phenomenon of ferroresonance oscillations in medium voltage and high voltage networks in connection with inductive voltage transformers. Ferroresonance can cause considerable damage to voltage transformers and other equipment. Ferroresonance oscillations may also occur with other non-linear inductive components.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61869-3, *Instrument Transformers – Part 3: Specific requirements for inductive voltage transformers*

IEC 61869-5, *Instrument Transformers – Part 5: Specific requirements for capacitive voltage transformers*