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GB/T 20840.102-2020

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

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Foreword

GB/T 20840 "Transformer" is divided into the following parts.

--- Part 1. General technical requirements;

--- Part 2. Supplementary technical requirements for current transformers;

--- Part 3. Supplementary technical requirements for electromagnetic voltage transformers;

--- Part 4. Supplementary technical requirements for combined transformers;

--- Part 5. Supplementary technical requirements for capacitive voltage transformers;

--- Part 6. Supplementary general technical requirements for low power transformers;

--- Part 7. Electronic Voltage Transformer;

--- Part 8. Electronic Current Transformer;

--- Part 9. Digital Interface of Transformers;

--- Part 102. Ferromagnetic resonance in substations with electromagnetic voltage transformers;

--- Part 103. Application of transformers in power quality measurement.

This part is Part 102 of GB/T 20840.

This section was drafted in accordance with the rules given in GB/T 1.1-2009.

This part uses the redrafting method to modify and adopt IEC TR61869-102..2014 `` Transformers Part 102. With Electromagnetic Voltage

Ferromagnetic resonance in transformer substations. "

This part is structurally adjusted compared with IEC TR61869-102..2014. Appendix A lists this part and IEC TR61869-

A comparative list of 102,2014 chapter, article and figure numbers.

There are technical differences between this part and IEC TR61869-102..2014, and the terms involved in these differences have been adopted on the outside page

The vertical single line (|) at the margin is marked. Appendix B gives a list of corresponding technical differences and their causes.

This section also made the following editorial changes.

--- The serial number 6.3 mentioned in 9.3 is wrong, correct it to 7.3;

--- Change the two kinds of three-phase terminal signs "L1, L2, L3" and "R, S, T" in IEC TR61869-102..2014 to "A, B, C";

--- Change the neutral point-to-earth capacitor voltage symbol UC to UeC. ;

--- Change the neutral point voltage from "en" to "3U0";

--- Change the fractional expression with remainder to the fractional expression without remainder, such as "162/3Hz" to "50/3Hz";

--- Change the line cross-section icon in Figure 17 of IEC TR61869-102..2014 from colored fill to pattern fill (see Appendix C, Figure C.4);

--- Adjusted references and added IEC 61869-3 and IEC 61869-4;

--- Change the IEC standard cited in A.2 of IEC TR61869-102..2014 to the corresponding national standard (see D.2);

--- The primary and secondary terminal signs of the voltage transformers of IEC TR61869-102..2014 were changed to "A, N" and "a, n";

--- Change the primary and secondary terminal signs of current transformers of IEC TR61869-102..2014 from "K, L" and "k, l" to "P1, P2"

And "s1, s2".

This part is proposed by China Electrical Equipment Industry Association.

This part is under the jurisdiction of the National Transformer Standardization Technical Committee (SAC/TC222).

This section was drafted by. State Grid Shaanxi Electric Power Research Institute, Shenyang Transformer Research Institute Co., Ltd., China Power

Science Research Institute Co., Ltd., Yunnan Power Grid Co., Ltd. Electric Power Research Institute, TBEA Kangjia (Shenyang) Transformer Co., Ltd.

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Introduction

Since the first half of the 20th century, many scholars have carried out research on the phenomenon of ferromagnetic resonance. R. Rüdenberg mainly studied fundamental harmonics

Vibration [1], other scholars have studied high frequency and crossover resonance. Afterwards K. Heuck and KDDettmann [2] made a detailed summary of this phenomenon

General introduction. Bergmann [3,4] conducted various basic ferromagnetic resonance experiments, and their research results are widely cited. GermayN.,

MasteroS. And VromanJ. Published related review articles at the 1974 CIGRE conference [5].

In the past 20 years, electromagnetic voltage transformers according to IEC 61869-3 and combined transformers of IEC 61869-4 have been

The problem of ferromagnetic resonance in the station has been discussed in the International Large Grid Working Group and the IEEE Committee in the United States. The results of the discussion were published in Dadian

Internet technical report [5] and IEEE publication [6].

The publication of these publications is due to the frequent occurrence of ferromagnetic resonance in the substation, so it is necessary to develop more efficient systems and equipment.

This development trend will lead to the following results.

a) The rated voltage Upr of the equipment is transferred to the highest voltage Um allowed by the equipment (IEC 60071-1 [7])

b) Increase the magnetic flux density B by reducing the iron core cross section of the electromagnetic voltage transformer;

c) By using new equipment (such as medium-voltage and high-voltage transformers) to reduce the capacitance of the substation and cause the excitation voltage of the non-linear circuit

improve;

d) Using digital instruments and relays with a load of about 1VA, the actual load of the substation is reduced, and the electromagnetic voltage mutual inductance

The device has always specified a higher secondary load (from 50VA to 400VA). However, in fact these high loads are usually not

Enough to cause ferromagnetic resonance.

Transformers. Part 102. With electromagnetic voltage

Ferromagnetic resonance in transformer substation

1 Scope

This part of GB/T 20840 gives the principles, examples, analysis and suppression of ferromagnetic resonance phenomena in substations with electromagnetic voltage transformers

Introduction of manufacturing methods. Electromagnetic voltage transformers and other non-linear inductive components will cause ferromagnetic resonance, which will give electromagnetic voltage

Transformers and other equipment cause great harm.

This part is applicable to guide the calculation, simulation, experiment, measurement and prevention and suppression measures of ferromagnetic resonance in the power grid.

2 Normative references

The following documents are essential for the application of this document. For dated references, only the dated version applies to this article

Pieces. For the cited documents without date, the latest version (including all amendments) applies to this document.

GB/T 20840.3-2013 Transformers Part 3. Supplementary technical requirements for electromagnetic voltage transformers (IEC 61869-3.

2011, MOD)

GB/T 20840.5 Transformers Part 5. Supplementary technical requirements for capacitive voltage transformers (GB/T 20840.5-2013,

IEC 61869-5..2011, MOD)

3.1 Basic principles

Ferromagnetic resonance is a kind of non-linear oscillation, which is switched on and off in