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IEEE Guide for Grounding of Instrument Transformer Secondary Circuits and Cases

IEEE Power and Energy Society

Sponsored by the
Power System Relaying Committee

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USA

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Power System Relaying Committee
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Abstract: General and specific recommendations for grounding current and voltage transformer secondary circuits and cases of connected equipment are covered in this guide. Although most diagrams included in this guide show relaying applications, the recommended practices apply equally to metering and other areas where instrument transformers are used. Grounding practices presently used, and practices that were not previously reported, are included in this guide. Specifically, a review of other than North American grounding practices is included.

Keywords: Capacitive voltage transformer, combined metering unit, current transformer, grounding of cases of instrument transformers, grounding secondary circuits of instrument transformers, IEEE C57.13.3™, instrument transformer, linear coupler, low energy transducer, resistive voltage transformer, voltage transformer.

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Introduction

This introduction is not part of IEEE Std C57.13.3-2014, IEEE Guide for Grounding of Instrument Transformer Secondary Circuits and Cases.

The primary emphases of this guide are personnel safety and proper performance of relays at the electric power system frequencies. The grounding and shielding of cables and other grounding considerations are not addressed. However, references dealing with these and related subjects are included in the bibliography (see Annex D).

Historically, it has been a common practice in the U.S. to connect the secondary circuits of current transformers (CTs) and voltage transformers (VTs) to the station ground. The present preferred practice is to locate a ground on the instrument transformer secondary circuit, along with suitable ground isolation test facilities, at the first point of application (switchboard or relay panel). The circuit ground isolation facilities make it convenient to test the integrity of the insulation from ground.

Previous publications have made significant contributions toward making the grounding practices more consistent in some areas. This guide includes the contributions that are generally practiced today, makes revisions where present experience and practice show them to be desirable, and suggests grounding techniques in new areas of interest. Diagrams are included to illustrate the grounding techniques.

This guide contains general and specific recommendations for grounding CT and VT secondary circuits and cases of connected equipment. The recommended practices apply to all transformers of this type, including capacitive VTs and linear couplers, irrespective of the voltage of the primary circuit or whether the primary windings are connected to the power circuits or are connected to the secondary circuits of other transformers, such as auxiliary CTs or VTs. Most diagrams included in this guide show relaying applications, but the practices are equally relevant to metering and other areas where instrument transformers are used.

Exceptions to grounding are permissible or are sometimes required when advantages obtained by not grounding, in certain instances or in certain types of installations, are considered to outweigh the safety or other advantages obtained by grounding. Such exceptions should comply with the recommendations of the National Electrical Safety Code® (NESC®) (Accredited Standards Committee C-2).[a, b]

[a] The NEC is published by the National Fire Protection Association (http://www.nfpa.org/). It is also available from the IEEE at http://www.techstreet.com/ieeegate.html.

[b] The NESC is available from The Institute of Electrical and Electronics Engineers (http://standards.ieee.org/).

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1. Overview

1.1 Background

The practices described in this guide apply to all instrument transformers (ITs), including voltage transformers (VTs), capacitive voltage transformers (CVTs), resistive voltage transformers (RVTs), current transformers (CTs), linear couplers (LCs), and combined metering units (MUs), irrespective of primary voltage or whether the primary windings are connected to, or are in, power circuits or are connected in the secondary circuits of other transformers as auxiliary CTs or VTs. For the purpose of this document, CVTs, RVTs, and VTs will be referred to as VTs.

This guide does not discuss the grounding of some applications. For example, grounding of gas insulated substations and metal clad switchgear is not discussed in this guide; the reader will find these topics addressed in IEEE Std 242™.[1] The grounding of circuits of core-balance CTs is also not discussed in this guide. The reader can also find this information in IEEE Std 242. Another issue that is not discussed in this guide is the practice of using separate safety and control grounds. For discussion on this topic, the reader is directed to IEEE Std 665™.

[1] Information on normative references can be found in Clause 2.