IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations

IEEE Power & Energy Society

Sponsored by the
Substations Committee

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Abstract: Service conditions, electrical ratings, thermal ratings, and environmental testing requirements are defined for communications networking devices to be installed in electric power substations. This standard establishes a common reproducible basis for designing and evaluating communications networking devices and the communications ports of protective relays for use in this harsh environment.

Keywords: auto dialers, bridges, communications networking device, communications ports, derating, dielectric test, electrostatic discharge (ESD) test, environmental requirements, Ethernet hubs, fast transient test, firewalls, humidity, impulse test, insulation test, modems, power apparatus, radio frequency (RF) test, routers, serial device, surge withstand capability (SWC) test, switches, temperature range, temperature rise, voltage rating

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Introduction

This introduction is not part of IEEE Std 1613-2009, IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations.

The scope of this revision now includes the performance testing of the communication ports of protective relays.

This document has been compiled from the relevant clauses of IEEE Std C37.90™-2007 [B8],[a] IEEE Std C37.90.1™-2002 [B9], IEEE Std C37.90.2™-2004 [B10], and IEEE Std C37.90.3™-2001 [B11]. In addition, it establishes more stringent requirements than exist in these IEEE or relevant IEC standards in the following areas:

- Clause 3 requires the operational ambient temperature testing of the device with Protocol 3 communications as defined in Table 8 and Table 9. It also requires startup after storage at the temperature extremes (not required in IEC 60255-6-1988 [B2]).
- Clause 6 through Clause 8 define the communications required during these transient tests and two performance classes. Class 1 allows communications errors or interruption during the defined transient but requires automatic recovery. Class 2 requires communication without errors or interruption. (Neither are defined in these IEEE or IEC standards.)
- Clause 7 requires testing at a field strength level of 35 V/m, as defined in IEEE Std C37.90.2-2004 [B10] and reflects North American experience. This is more severe than IEC 60255-22-3, 2007 [B3], which requires only 10 V/m maximum. The test method is defined by IEC 60255-22-3, 2007 [B3].
- Clause 8 requires testing at voltage levels corresponding to a relative humidity less than 35%, which is identical to IEEE Std C37.90.3-2001 [B11]. (Not required by IEC 61000-4-2, 2003 [B4].)
- Clause 10 explicitly excludes the use of fans or forced air cooling.

Those who work on future revisions of IEEE Std 1613 are encouraged to maintain close coupling with the latest versions of these four IEEE standards to preserve the minimal need to reference other IEEE standards.

The protection of metallic communications circuits into electric power substations is not covered by this standard. That is the specific topic of IEEE Std 487™-2007 [B13]. The following paragraph was copied from IEEE Std 487-2007 [B13]:

1. Overview

> Wire-line telecommunication facilities serving electric supply locations often require special high voltage protection against the effects of fault-produced ground potential rise or induced voltages, or both. Some of the telecommunication services are used for control and protective relaying purposes and may be called upon to perform critical operations at times of power system faults. This presents a major challenge in the design and protection of the telecommunication system because power system faults can result in the introduction of interfering voltages and currents into the telecommunication circuit at the very time when the circuit is most urgently required to perform its function. Even when critical services are not involved, special high-voltage protection may be required for both personnel safety and plant protection at times of power system faults. Effective protection of any wire-line telecommunication circuit requires coordinated protection on all circuits provided over the same telecommunication cable.

The protection of metallic communications network circuits inside the substation nor the selection of copper or fiber communication network media are covered by this standard but are topics in IEEE Std 1615™-2007 [B14].

[a] The numbers in brackets correspond to those of the bibliography in Annex E.

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IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations

1. Overview

Communications networking devices are being installed in electric power substations. Examples include radios, encryption devices, port switches, auto dialers, modems, Ethernet hubs and switches, routers, gateways, and firewalls. This standard establishes a common reproducible basis for designing and evaluating communications networking devices and the communications ports of protective relays for this harsh environment.

1.1 Scope

This document specifies standard service conditions, standard ratings, environmental performance requirements, and testing requirements for communications networking devices and communications ports in protective relays installed in electric power substations. It does not cover such equipment designed for operation in other environments, such as office locations. Other than their communications ports, it does not cover such equipment used in protective relaying applications, for which IEEE Std C37.90™-2007 [B8],[1,2] IEEE Std C37.90.1™-2002 [B9], IEEE Std C37.90.2™-2004 [B10], and IEEE Std C37.90.3™-2001 [B11] shall apply.

1.2 Purpose

The purpose of this standard is to define the environmental conditions present in electric power substations and to establish a common reproducible basis for designing and evaluating communications networking devices to be installed in those substations. It is a freestanding document, with no normative references to other standards.

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