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IEEE Standard for Qualifying Class 1E Protective Relays and Auxiliaries for Nuclear Power Generating Stations

IEEE Power and Energy Society

Sponsored by the
Power System Relaying Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

29 October 2010

IEEE Std C37.105™-2010
(Revision of
IEEE Std C37.105-1987)

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Approved 30 September 2010
IEEE-SA Standards Board

Abstract: Basic principles, requirements, and methods for qualifying Class 1E protective relays and auxiliaries in nuclear power generating stations including digital and analog devices, but excluding devices located inside the primary containment, are covered.
Keywords: aging, auxiliaries, Class 1E, margin, nuclear, power plants, qualifying, radiation, relays, seismic, tests, thermal

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PDF: ISBN 978-0-7381-6503-5 STD97040
Print: ISBN 978-0-7381-6504-2 STDPD97040

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Introduction

This introduction is not part of IEEE Std C37.105-2010, IEEE Standard for Qualifying Class 1E Protective Relays and Auxiliaries for Nuclear Power Generating Stations.

IEEE Std 323™[a] provides general guidance for demonstrating and documenting the adequacy of electrical equipment used in all Class 1E and interface systems. This standard has been prepared to deal specifically with protective relays and auxiliary equipment, using IEEE Std 323 as the parent document for guidance. Relays and auxiliary equipment shall meet the applicable requirements of IEEE Std C37.90™, IEEE Std C37.90.1™, IEEE Std C37.90.2™, and IEEE Std C37.90.3™.

IEEE Std 7-4.3.2™ shall be used to address the use of Digital computer software and firmware used in all safety systems for nuclear generating stations. Safety systems equipment in nuclear power generating stations must meet or exceed its performance requirements throughout its installed life. This is accomplished by a program of design qualification and quality assurance of design, production, installation, maintenance and surveillance. This standard is for the design qualification portion of the program only.

The nuclear power generating station safety analysis, in part, considers the station and its safety system design in terms of a set of postulated service conditions. Inherent to each such analysis are two requirements that must be evaluated to assure overall technical validity. First, designs must be such that equipment is capable of actually performing designated safety functions in postulated service environments. Second, in service aging must not degrade safety systems equipment from its original design condition to the point where it cannot perform designated safety functions, when required.

The special environmental stresses associated with some postulated service conditions promote the possibility that production testing, normal service testing, and surveillance may not be able to determine whether the equipment is vulnerable to failure, either as a result of inadequate design or aging. Under these circumstances, simultaneous failure of redundant safety equipment might occur just at the time safety functions are required. It is the fundamental role of qualification to provide reasonable assurance that design and age related common failure modes do not exist and that the equipment design is adequate to permit the equipment to perform its safety function during postulated service conditions.

Adherence to this standard alone may not suffice for assuring public health and safety since it is the integrated performance of the structures, fluid systems, instrumentation systems, and electric systems of the generating station that establishes safe operating conditions. The user has the responsibility to establish that this standard is pertinent to the particular requirements of the generating station of concern and that the integrated performance of the station is adequate.

IEEE Std C37.105 was issued in 1987 and reaffirmed in December 1999. This revision incorporates current nuclear industry practices for qualification of protective relays and auxiliaries.

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

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Contents

IEEE Standard for Qualifying Class 1E Protective Relays and Auxiliaries for Nuclear Power Generating Stations

1. Overview

This standard describes the basic principles, requirements, and methods for qualifying Class 1E protective relays and auxiliaries for applications in nuclear power generating stations. When properly employed it can be used to demonstrate the design adequacy of such equipment under normal, abnormal, design basis event (DBE), and post=design basis event (post-DBE) conditions in accordance with IEEE Std 323™.[1] Static relays that utilize analog and digital electronic components require additional considerations and applicable requirements of IEEE Std C37.90™, IEEE Std C37.90.1™, IEEE Std C37.90.2™, and IEEE Std C37.90.3™. Microprocessor-based relays may require additional consideration of software and firmware qualification to comply with the requirements of IEEE Std 7-4.3.2™, IEEE Std 1012™, and IEEE Std 1028™.

The qualification procedure presented is generic in nature. Other methods may be used at the discretion of the qualifier, provided the basic precepts of IEEE Std 323 are satisfied.

1.1 Scope

This standard covers qualification of Class 1E protective relays and auxiliaries to be used outside the primary containment in the nuclear power generating stations. Protective relays and auxiliaries located inside the primary containment in a nuclear power generating station present special conditions beyond the scope of this document.

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