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IEEE Standard for Qualification of Class 1E Static Battery Chargers, Inverters, and Uninterruptible Power Supply Systems for Nuclear Power Generating Stations

IEEE Power and Energy Society

Sponsored by the
Nuclear Power Engineering Committee

IEEE
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USA

IEEE Std 650™-2017
(Revision of IEEE Std 650-2006)

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Approved 6 December 2017

IEEE-SA Standards Board

Abstract: Methods for qualifying static battery chargers, inverters and uninterruptible power supply (UPS) systems for Class 1E installations outside containment in nuclear power generating stations are described in this standard. Similar electronic equipment for use in applications outside containment, where specific standards for such equipment are not available, may also be qualified using these methods. A combination of type testing and analysis, the latter including a justification of methods, theories, and assumptions used, are employed in the qualification methods set forth. Requirements of IEC/IEEE 60780-323 are met by these procedures.

Keywords: battery charger, IEEE 650™, inverter, qualification, uninterruptible power supply (UPS) systems

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PDF: ISBN 978-1-5044-4500-9 STD22884
Print: ISBN 978-1-5044-4501-6 STDPD22884

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Introduction

This introduction is not part of IEEE Std 650-2017, IEEE Standard for Qualification of Class 1E Static Battery Chargers, Inverters, and Uninterruptible Power Supply Systems for Nuclear Power Generating Stations.

This standard provides the methods of qualifying Class 1E static battery chargers, inverters, and uninterruptible power supply (UPS) systems in accordance with IEC/IEEE 60780-323. The static battery chargers, inverters, and UPS systems discussed in this standard are Class 1E. This document, however, addresses this equipment only as a subsystem in the safety-related electrical system.

The techniques and information contained in this standard may be applied to other similar electronic equipment.

The reliability analysis requirements of IEEE Std 577™ and the methods described in IEEE Std 352™ have been used along with statistical data.

The standard was updated to change title to include UPS systems, normative references, definitions, and editorial type changes. A few new clauses were added to address software analysis and transient testing. Figures were modified to be consistent with the added new clauses. Clarification was added to mechanical cycling requirements of connectors and functional monitoring required during environmental and seismic testing and acceptable methods for seismic testing. A new informative annex was added to address design basis transient voltage considerations. The efforts of the working group on this standard and its annexes will continue for the purpose of updating and disseminating more information regarding qualification techniques. The subjects of aging and the use of surveillance/maintenance techniques to address aging will continue to be investigated and will be among the areas considered by the working group in future revisions of this standard.

Contents

IEEE Standard for Qualification of Class 1E Static Battery Chargers, Inverters, and Uninterruptible Power Supply Systems for Nuclear Power Generating Stations

1. Overview

1.1 Scope

This standard describes methods for qualifying static battery chargers, inverters, and uninterruptible power supply (UPS) systems for Class 1E installations outside containment in nuclear power generating stations, and is not intended for qualification under harsh environment (e.g., inside containment) design basis conditions.

1.2 Purpose

The purpose of this standard is to provide specific procedures to meet the equipment qualification requirements of IEC/IEEE 60780-323 for static battery chargers, inverters, UPS systems, and the associated ancillary equipment.[1] This standard is not intended for qualification under harsh environment design basis conditions.

1.3 Applicability and general information

The application of this equipment in the plant's electrical system is not within the scope of this standard as other industry standards, such as IEEE Std 308™ [B7], IEEE Std 603™ [B11], and IEEE Std 946™ [B13], exist for this purpose. IEEE Std 535™ [B9] is applicable for qualification of the battery power sources that are used in the UPS systems. In addition, industry standards exist for equipment performance, such as

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