

# IEEE Standard for the Design and Qualification of Class 1E Control Boards, Panels, and Racks Used in Nuclear Power Generating Stations

IEEE Power and Energy Society

Sponsored by the  
Nuclear Power Engineering Committee



**IEEE Std 420™-2013**

(Revision of  
IEEE Std 420-2001)

# **IEEE Standard for the Design and Qualification of Class 1E Control Boards, Panels, and Racks Used in Nuclear Power Generating Stations**

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**Nuclear Power Engineering Committee  
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IEEE Power and Energy Society**

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**Abstract:** Design requirements for new and/or modified Class 1E control boards, panels, and racks are specified, and methods to verify that these requirements have been satisfied are established in this standard. Methods for meeting the separation criteria contained in IEEE Std 384™ are addressed. Qualification is also included to address the overall requirements of IEEE Std 323™ and recommendations of IEEE Std 344™.

**Keywords:** cables, control boards, fiber optic cables, IEEE 420™, independence, isolation, nuclear, panels, qualification, racks, safety, separation, wiring

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**Paul L. Yanosy, Sr., *Chair***

Ijaz Ahmad

Patrick Grove  
Randy Jamison

Mark Walsh

Also, at the time this revised standard was completed, Subcommittee 6 (Safety Related Systems) under the Nuclear Power Engineering Committee had the following membership.

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Mark F. Santschi

Ed Schindhelm  
Rich Stattel  
Mark Stofko  
Masafumi Utsumi  
Nick Vilione  
Mark Walsh  
Michael Waterman  
Steve Wyman  
Paul L. Yanosy, Sr.  
Won Young Yun  
Deanna Zhang

\*Non-voting member

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**James Parello, *Vice Chair***

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Ijaz Ahmad  
Dheya Al-Othmany  
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Masafumi Utsumi  
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Edward Wenzinger  
John White  
Paul L. Yanosy, Sr.  
Won Young Yun  
Oon-Pyo Zhu

\*Non-voting member

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Satish Aggarwal  
George A. Ballassi  
Thomas Brewington  
Bill Brown  
Nissen M. Burstein  
Suresh Channarasappa  
Garry Chapman  
Dennis Dellinger  
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## Introduction

This introduction is not part of IEEE Std 420-2013, IEEE Standard for the Design and Qualification of Class 1E Control Boards, Panels, and Racks Used in Nuclear Power Generating Stations.

IEEE Std 420<sup>TM</sup> was originally prepared in 1973 and revised in 1982 by the Power Generation Committee of the IEEE Power Engineering Society. Based on the activities and scope of that committee and those of the IEEE Nuclear Power Engineering Committee (NPEC), in 1994 the responsibility for the standard was transferred to NPEC, specifically to NPEC Subcommittee 6, Working Group 6.5. The separation, isolation, and independence requirements in IEEE Std 420<sup>TM</sup> are maintained consistent with IEEE Std 384<sup>TM</sup>.

IEEE Std 420<sup>TM</sup> provides the requirements for the design and qualification of Class 1E control boards, panels, and racks. It may also be applied to modifications to control boards, panels, and racks installed in existing plants.

This standard is not intended to define the selection, design, or qualification of piping, modules, or other equipment mounted on the Class 1E control boards, panels, or racks. However, it is concerned with the effect that such mounted equipment has on the design and qualification of Class 1E control boards, panels, or racks. The selection, design, and qualification of piping, modules, and other equipment are covered by other standards.

The purpose of this revision is to address the following:

- a) Update the standard to reflect the separation and independence requirements from IEEE Std 384<sup>TM</sup>-2008 including fiber optic circuits
- b) update references
- c) address comments received during the reaffirmation ballot
- d) consider additional EMI/RFI wiring practices
- e) incorporate user feedback

The working group reviewed the fiber optic separation criteria changes in IEEE Std 384<sup>TM</sup>-2008 and concluded that no additional fiber optic separation criteria is required in IEEE Std 420<sup>TM</sup>. In addition, specific criteria were added to 4.7.

The working group reviewed the effects of electromagnetic interference/radio frequency interference (EMI/RFI) to determine the need for additional wiring practices. EMI/RFI was recognized as an effect that could be addressed through qualification of equipment, physical arrangement of equipment and systems in the plant, or maintenance and testing. A panel session was sponsored on January 26, 2005, by the Nuclear Power Engineering Committee (NPEC) including representatives from Electric Power Research Institute (EPRI), equipment manufacturers, the Nuclear Regulatory Commission (NRC), and an independent consultant in the field. Results of the panel session were reviewed by a committee of representatives from the Subcommittee on Qualifications (SC2), the Subcommittee on Operations, Maintenance, Aging, and Testing (SC3), and the Subcommittee on Safety Related Systems (SC6). The committee's final recommendation, as approved by NPEC on August 3, 2005, was that no new standard was warranted to address EMI/RFI. Instead, additional guidance for mitigating EMI/RFI should be included in Annex B of IEEE Std 603<sup>TM</sup> and referenced by other standards. Subclause 4.8 provides general guidance to address the effects of EMI/RFI. This revision now makes reference to IEEE Std 603<sup>TM</sup> for further specific guidance.

The qualification requirements have been updated to delete requirements that conflicted with or duplicated the requirements in IEEE Std 323<sup>TM</sup> and the recommendations in IEEE Std 344<sup>TM</sup> and maintained the recommendations that were specific to control boards, panels, and racks.

Other clauses of this standard have been reviewed, and many editorial improvements have been made including updating the standard to the latest IEEE Standards Style Manual.

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## 1. Overview

### 1.1 Scope

This standard applies to the design and qualification of Class 1E control boards, panels, and racks. It does not apply to individual components, modules, and external field-run cables except as they may affect the design and qualification of Class 1E control boards, panels, and racks.

### 1.2 Purpose

The purpose of this standard is to specify the design and qualification requirements for Class 1E control boards, panels, and racks and to establish the methods to verify that these requirements have been satisfied.