

IEEE Std 420™-2001
(Revision of
IEEE Std 420-1982)

IEEE Standards

420™

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

IEEE Power Engineering Society

Sponsored by the
Nuclear Power Engineering Committee



Published by
The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

8 February 2002

Print: SH94955
PDF: SS94955

Recognized as an
American National Standard (ANSI)

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**Nuclear Power Engineering Committee
of the
IEEE Power Engineering Society**

Reaffirmed 27 March 2008

Approved 10 October 2001

IEEE-SA Standards Board

Abstract: This standard specifies the design requirements for new and/or modified Class 1E control boards, panels, and racks and establishes the methods to verify that these requirements have been satisfied. Methods for meeting the separation criteria contained in ANSI/IEEE Std 384-1992 are addressed. Qualification is also included to address the overall requirements of ANSI/IEEE Std 323-1983 and ANSI/IEEE Std 344-1987.

Keywords: cabling, control boards, independence, isolation, nuclear, panels, qualification, racks, safety, separation, wiring

The Institute of Electrical and Electronics Engineers, Inc.

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

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Print: ISBN 0-7381-3007-9 SH94955

PDF: ISBN 0-7381 3008-7 SS94955

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Introduction

(This introduction is not a part 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.)

IEEE Std 420 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.

IEEE Std 420-2001 provides the requirements for the design, manufacture, and qualification of Class 1E control boards, panels, and racks. It may also serve for 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, IEEE Std 420-2001, is to address the following:

- a) Separation requirements as related to the requirements of ANSI/IEEE Std 384-1992^a
- b) References as listed in ANSI/IEEE Std 420-1982
- c) Comments received on ANSI/IEEE Std 420-1982

The separation criteria contained in ANSI/IEEE Std 384-1992 were used in the preparation of this revision, IEEE Std 420-2001. It is the intent of the Working Group that these two documents be consistent. The Working Group received comments regarding the need for specific separation requirements for fiber-optic cabling. Until further guidance is provided, separation requirements for fiber-optic cabling should be in accordance with ANSI/IEEE Std 384-1992.

The qualification of Class 1E control boards, panels, and racks is included in this standard to address the overall requirements of ANSI/IEEE Std 323-1983 and ANSI/IEEE Std 344-1987. The qualification areas covered consist mainly of environmental and seismic requirements that specifically relate to control boards, panels, and racks. Other IEEE standards have been referenced as necessary to provide applicable qualification information, such as aging methodology.

One of the issues discussed by the Working Group was that of commercial grade dedication. After much discussion, it was agreed that there is nothing unique about the commercial grade dedication process as it applies to the design and qualification of control boards, panels, and racks. Therefore, no reference to this process is included in the body of the standard.

^aInformation on references can be found in Clause 2.

Participants

At the time this revised standard was completed, the Working Group had the following membership:

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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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Moreover, at the time this revised standard was completed, the Nuclear Power Engineering Committee had the following membership:

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

1. Overview~~General~~

1.1 Scope

This standard ~~specifies those design requirements which are unique~~applies to the design and qualification of Class 1E control boards, panels, and racks ~~and provides standards for qualification tests to verify that these design requirements have been satisfied.~~ It does not apply to: ~~Non-Class 1E~~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.

~~2) — Qualification and test of individual Class 1E control board components and modules~~

1.2 Purpose

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

2. References

This standard shall be used in conjunction with the following publications. If the following publications are superseded by an approved revision, the revision shall apply.

~~[9]~~ ANSI/IEEE Std 323-~~1983-1974~~, (Reaff 1996), IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.¹

^{1,2} ANSI publications documents are available from the Sales Department, American National Standards Institute, ~~1430 Broadway~~25 West 43rd Street, 4th Floor, New York, NY ~~10018~~10036, USA (<http://www.ansi.org/>).

~~[1] ANSI N45.2-1977, An American National Standard Quality Assurance Program Requirements for Nuclear Facilities.²~~

ANSI/IEEE Std 338-~~1987~~ (Reaff 2000), ~~1977~~, IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems.

~~[3] ANSI/IEEE Std 100-1977, IEEE Standard Dictionary of Electrical and Electronics Terms.~~

ANSI/IEEE Std 344-~~1975~~,1987 (Reaff 1993), IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

~~[5] ANSI/IEEE Std 331-1977, IEEE Standard Criteria for Type Tests of Class 1E Modules Used in Nuclear Power Generating Stations.~~

ANSI/IEEE Std 383-1974 (Reaff 1992), IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.

~~[7] ANSI/IEEE Std 567,384-1992 (Reaff 1998), IEEE Trial-Use Standard Criteria for Independence of Class 1E Equipment and Circuits the Design of the Control Room Complex for a Nuclear Power Generating Station.~~

ANSI/IEEE Std 518-1982 (Reaff 1996), IEEE Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources.

~~[8] ANSI/UL 94-1979~~1993, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

~~[10] IEEE Std 384-1981, IEEE Standard criteria for Independence of Class 1E Equipment and Circuits.~~

~~[11] IEEE Std 566-1977, IEEE Recommended Practice for the Design of Display and Control Facilities for Central Control Rooms of Nuclear Power Generating Stations.~~

ASME NQA 1-2001, Quality Assurance Requirements for Nuclear Facilities Applications.²

~~[12]~~ IEEE Std 603-~~1980~~¹⁹⁹⁸, IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations.³

[IEEE Std 1023-1988 \(Reaff 1995\), IEEE Guide for Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations.](#)

[IEEE Std 1050-1996, IEEE Guide for Instrumentation and Control Equipment Grounding in Generating Stations.](#)

3. Definitions

[For the purposes of this standard, the following terms and definitions apply. IEEE 100, The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition \[B1\],⁴ should be referenced for terms not defined in this clause.](#)

3.1 control board: An assembly of panels on which are installed components and modules for monitoring, measuring, and controlling remotely operated systems and equipment. It provides a visual and physical interface between the operator and the systems. A control board is also known as a control switchboard (~~(ANSI/IEEE Std 100-1977 [2])~~), control panel, benchboard, or console.

3.2 panel: A unit of one or more sections of ~~flat~~^{flat} material suitable for mounting electrical devices (~~(ANSI/IEEE Std 100-1977 [2])~~).

3.3 rack: A framework, constructed of rails or steel members, for mounting an assembly of modules for monitoring, measuring, and controlling remotely operated systems.

²[ASME publications are available from the American Society of Mechanical Engineers, 3 Park Avenue, New York, NY 10016-5990, USA \(<http://www.asme.org/>\).](#)

³[IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA \(<http://standards.ieee.org/>\).](#)

⁴[The numbers in brackets correspond to those of the bibliography in Annex A.](#)