



# REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

## REGULATORY GUIDE 1.213

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### QUALIFICATION OF SAFETY-RELATED MOTOR CONTROL CENTERS FOR NUCLEAR POWER PLANTS

#### A. INTRODUCTION

This regulatory guide describes a method that the staff of the U.S. Nuclear Regulatory Commission (NRC) deems acceptable for complying with the Commission's regulations for qualification of safety-related motor control centers for nuclear power plants.

The Commission's regulations in Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," of the Code of Federal Regulations (10 CFR Part 50) (Ref. 1), require that structures, systems, and components in a nuclear power plant that are important to safety be designed to accommodate the effects of environmental conditions (i.e., they must remain functional under postulated design-basis events (DBEs)). Toward that end, General Design Criteria 1, 2, 4, and 23 of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 contain the general requirements. Augmenting those general requirements are the specific requirements pertaining to qualification of certain electrical equipment important to safety that appear in 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." In addition, Criterion III, "Design Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, requires that test programs, when used to verify the adequacy of a specific design feature, should include suitable qualification testing of a prototype unit under the most severe DBE.

This regulatory guide contains information collections that are covered by 10 CFR Part 50 that the Office of Management and Budget (OMB) approved under OMB control number 3150-0011. The

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The NRC issues regulatory guides to describe and make available to the public methods that the NRC staff considers acceptable for use in implementing specific parts of the agency's regulations, techniques that the staff uses in evaluating specific problems or postulated accidents, and data that the staff needs in reviewing applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public.

Regulatory guides are issued in 10 broad divisions—1, Power Reactors; 2, Research and Test Reactors; 3, Fuels and Materials Facilities; 4, Environmental and Siting; 5, Materials and Plant Protection; 6, Products; 7, Transportation; 8, Occupational Health; 9, Antitrust and Financial Review; and 10, General.

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NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

## **B. DISCUSSION**

The Working Group on Motor Control Centers (Subcommittee (SC 2.14)) of the Nuclear Power Engineering Committee of the Institute of Electrical and Electronics Engineers, Inc. (IEEE) developed Standard 649 2006, "IEEE Standard for Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations." The IEEE Standards Association approved this standard on September 15, 2006, and it was published December 29, 2006 (Ref. 2). This standard provides basic principles, requirements, and methods for qualifying safety-related motor control centers for applications in both harsh and mild environments in nuclear power plants. The demonstration that an installed motor control center will meet its design specification requires many steps (a program of quality assurance, design, qualification, production quality control, installation, maintenance, periodic testing, and surveillance). The scope of IEEE Standard 649-2006 is limited to qualification.

The purpose of qualification is to provide assurance that the motor control center is capable of performing its required safety functions with no failure mechanisms that could lead to common mode failures under the postulated conditions stated in the equipment specification.

Based on recent operating experience, the NRC staff has concluded that: (1) aluminum buses are more prone to oxidation than the copper buses in motor control centers; and (2) the ground fault protection for motor control centers is recommended to reduce the damage to the electrical equipment caused by fire initiated by a ground fault. Applicants and licensees should give appropriate considerations to these findings when designing motor control centers for new nuclear power plants.

Clause 9.5 of IEEE Standard 649-2006 references IEEE Standard 344-2004, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," published January 1, 2005 (Ref. 3), and provides additional guidance for seismic qualification of motor control centers. The vast majority of seismic qualification tests on motor control centers for operating plants were performed with input frequencies up to only 33 hertz (Hz). As a result of improved understanding gained in the high frequency seismic input motions, the NRC staff does not consider attempts to use past testing data for seismic qualification of motor control centers to be adequate for new nuclear power plants.<sup>1</sup> Recent studies related to early site permit applications at certain east coast hard-rock-based plants indicate that the site-specific spectra may exceed the certified design spectra of new proposed plants in the very high frequency range (from 20 Hz up to 100 Hz). Plants located in the central and eastern United States on hard rock should evaluate whether high-frequency earthquake ground motion could affect motor control center components (such as digital components).

Applicants and licensees should accomplish these objectives using qualification methods (type testing, operating experience, analysis as a supplement to type testing and operating experience, ongoing qualification, or any combination thereof) identified in IEEE Standard 649-2006. However, the preferred method of qualification is type testing because other methods may be based on older or dissimilar equipment that may not be comparable to the equipment being qualified.

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<sup>1</sup> The safety of the operating plants is being addressed through the Generic Issues Program, document number GI-199, "Implementations of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants." Additional information is available electronically through the Electronic Reading Room on the NRC's public Web site, at: <http://www.nrc.gov/reading-rm/doc-collections/generic-issues/open-gis/>.

## **C. REGULATORY POSITION**

The NRC staff considers conformance with the requirements of IEEE Standard 649-2006 an acceptable method for use in satisfying the Commission's regulations with respect to qualification of safety-related motor control centers, subject to the following:

1. In addition to the typical functional tests specified in Table 2 of IEEE Standard 649-2006, the alternative criteria a, b, and c should be performed on all motor control center components that do not have a specific functional test during and after a harsh environment test.
2. In addition to the typical functional tests specified in Table 2 of IEEE Standard 649-2006, the alternative criteria a, b, and c should be performed on all motor control center components that support or impact the intended safety function of the motor control center and that do not have a specific functional test during and after a harsh environment test.
3. IEEE Standard 649-2006 references several industry codes and standards. If the NRC's regulations separately incorporate a referenced standard, licensees and applicants must comply with the standard as set forth in the regulations. By contrast, if the NRC staff has endorsed a referenced standard in a regulatory guide, that standard constitutes an acceptable method of meeting a regulatory requirement as described in the regulatory guide.

## **D. IMPLEMENTATION**

The purpose of this section is to provide information to applicants and licensees regarding the NRC's plans for using this regulatory guide. The NRC does not intend or approve any imposition or backfit in connection with its issuance.

In some cases, applicants or licensees may propose or use a previously established acceptable alternative method for complying with specified portions of the NRC's regulations. Otherwise, the methods described in this guide will be used in evaluating compliance with the applicable regulations for license applications, license amendment applications, and amendment requests.

## REFERENCES<sup>2</sup>

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," U.S. Nuclear Regulatory Commission, Washington, DC.
2. IEEE Standard 649-2006, "Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations," The Institute of Electrical and Electronics Engineers, Inc., Piscataway, NJ.<sup>3</sup>
3. IEEE Standard 344-2004, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," The Institute of Electrical and Electronics Engineers, Inc., Piscataway, NJ.

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<sup>2</sup> Publicly available NRC-published documents, such as Regulations, Regulatory Guides, NUREGs, and Generic Letters, listed herein are available electronically through the Electronic Reading Room on the NRC's public web site at: <http://www.nrc.gov/reading-rm/doc-collections/>. Copies are also available for inspection or copying for a fee from the NRC's Public Document Room (PDR) at 11555 Rockville Pike, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail [PDR.Resources@NRC.GOV](mailto:PDR.Resources@NRC.GOV).

<sup>3</sup> Copies of the non-NRC documents included in these references may be obtained directly from the publishing organizations.