



# DRAFT REGULATORY GUIDE

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## DRAFT REGULATORY GUIDE DG-1149

(Proposed New Regulatory Guide)

# 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.

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that

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This regulatory guide is being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. It has not received final staff review or approval and does not represent an official NRC final staff position.

Public comments are being solicited on this draft guide (including any implementation schedule) and its associated regulatory analysis or value/impact statement. Comments should be accompanied by appropriate supporting data. Written comments may be submitted to the Rulemaking, Directives, and Editing Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; emailed to [NRCREP@nrc.gov](mailto:NRCREP@nrc.gov); submitted through the NRC's interactive rulemaking Web page at <http://www.nrc.gov>; faxed to (301) 415-5144; or hand-delivered to Rulemaking, Directives, and Editing Branch, Office of Administration, US NRC, 11555 Rockville Pike, Rockville, MD 20852, between 7:30 a.m. and 4:15 p.m. on Federal workdays. Copies of comments received may be examined at the NRC's Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by September 19, 2008.

Electronic copies of this draft regulatory guide are available through the NRC's interactive rulemaking Web page (see above); the NRC's public Web site under Draft Regulatory Guides in the Regulatory Guides document collection of the NRC's Electronic Reading Room at <http://www.nrc.gov/reading-rm/doc-collections/>; and the NRC's Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML072760149.

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the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required.

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 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 the 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. The 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 the 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).

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1 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/>.

Applicants and licensees should accomplish these objectives by using qualification methods (type testing, operating experience, analysis as a supplement to type testing and operating experience, ongoing qualification, or any combination thereof). However, the preferred method of qualification is type testing.

### **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. The operational aging of transformers (control power and distribution) should be considered for "Test per 5 year aging period" (Table 1 of IEEE Standard 649-2006), if the motor control centers are located in "harsh environments."
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 do not have a specific functional test during and after a harsh environment test.
3. Typical functional tests for "timing devices" for direct current application in Table 2 of IEEE Standard 649-2006 states, "Devices shall not drop out at or above 70% rated coil voltage." This test should be consistent with the plant-specific voltage analysis.
4. 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 draft regulatory guide. The NRC does not intend or approve any imposition or backfit in connection with its issuance.

The NRC has issued this draft guide to encourage public participation in its development. The NRC will consider all public comments received in development of the final guidance document. In some cases, applicants or licensees may propose an alternative 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.

## **REGULATORY ANALYSIS**

### **1. Statement of the Problem**

The nuclear industry has used IEEE Standard 649-1980, "Standard for Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations" (Ref. 4), for qualification of safety-related motor control centers since issuance of the standard in 1980. IEEE revised this standard and issued it with the same title in 1991 as IEEE Standard 649-1991. The NRC staff has never endorsed its use. However, over

the ensuing years, the staff has been working with IEEE to revise this standard, and the revised version, IEEE Standard 649-2006, is generally consistent with the NRC's regulatory requirements.

Since the issuance in 1980 of IEEE Standard 649-1980, nuclear power plant licensees have used either the 1980 standard or IEEE Standard 649-1991 for qualification of safety-related motor control centers for nuclear power plants, subject to NRC staff review on a case-by-case basis. This approach is time consuming.

## **2. Objective**

The objective of this action is to provide clear guidance on qualification of safety-related motor control centers. Issuing a regulatory guide is consistent with the NRC policy of evaluating the latest versions of consensus safety standards in terms of their suitability for endorsement by regulatory guides. This approach would also comply with the NRC's directive to use standards developed by consensus bodies in accordance with Public Law 104-113, "National Technology and Transfer Act of 1995."

## **3. Alternative Approaches**

The NRC staff considered the following alternative approaches:

- Do not issue a regulatory guide endorsing IEEE standard 649-2006.
- Issue a regulatory guide endorsing IEEE standard 649-2006.

### **3.1 Alternative 1: Do Not Issue a Regulatory Guide Endorsing IEEE Standard 649-2006**

Under this alternative, the NRC would not issue additional guidance, and the current ad hoc guidance for qualifying motor control centers would be retained. If NRC does not take action, there would not be any changes in costs or benefit to the public, licensees or NRC. However, the "no-action" alternative would not address identified concerns with the current lack of guidance. This alternative provides a baseline condition from which any other alternatives will be assessed.

### **3.2 Alternative 2: Issue a Regulatory Guide Endorsing IEEE Standard 649-2006**

Preparing and issuing this regulatory guide will provide the industry with clearer guidance and understanding of the methodology the NRC staff will use to establish the basic principles, requirements, and methods of qualifying safety-related motor control centers for applications in both harsh and mild environments in nuclear power plants. IEEE Standard 649-2006 is an acceptable standard which reflects the current state of technology. The technical approach discussed in the revised standard is consistent with the NRC's regulatory requirements.

The impact to the NRC would be the costs associated with preparing and issuing the regulatory guide. The impact to the public would be the voluntary costs associated with reviewing and providing comments to NRC during the public comment period. The value to NRC staff and its applicants would be the benefits associated with enhanced efficiency and effectiveness in using a common guidance document as the technical basis for license applications and other interactions between the NRC and its regulated entities.

#### 4. Conclusion

The NRC should issue this regulatory guide to enhance the licensing process. The staff has concluded that the proposed action will reduce unnecessary burden on both the NRC and its licensees and will result in an improved and more uniform process for qualifying safety-related motor control centers. Moreover, the staff sees no adverse effects associated with issuing this regulatory guide.

### REFERENCES

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," U.S. Nuclear Regulatory Commission, Washington, DC.<sup>2</sup>
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.
4. IEEE Standard 649-1980, "Standard for Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations," The Institute of Electrical and Electronics Engineers, Inc., Piscataway, NJ.

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<sup>2</sup> All NRC regulations 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, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone (301) 415-4737 or (800) 397-4209; fax (301) 415-3548; and email [PDR@nrc.gov](mailto:PDR@nrc.gov).

<sup>3</sup> IEEE standards listed herein are available electronically through the IEEE Standards Web site at <http://www.ieee.org/web/standards/home/find.html>. Copies are also available for purchase from the IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854-4141, telephone (732) 981-0060.