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IEEE Guide for Seismic Qualification of Class 1E Metal-Enclosed Power Switchgear Assemblies

IEEE Power and Energy Society

Sponsored by the
Switchgear Committee

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IEEE Std C37.81™-2017
(Revision of IEEE Std C37.81-1989)

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Abstract: Requirements and guidance for the seismic qualification of metal-enclosed power switchgear assemblies including switching, interrupting, control, instrumentation, metering, and protective and regulating devices mounted therein are provided in this guide. As used in this guide, the word switchgear shall mean metal-enclosed power switchgear assemblies with the requirements as defined in IEEE Std C37.20.1™, Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear, IEEE Std C37.20.2™, Standard for Metal-Clad Switchgear, and IEEE Std C37.20.3™, Standard for Metal-Enclosed Interrupter Switchgear. By definition, metal-enclosed power switchgear assemblies include metal-clad switchgear, metal-enclosed interrupter switchgear, and low-voltage power circuit breaker switchgear. Metal-enclosed bus or control switchboards are not covered in this guide.

Keywords: class 1E metal-enclosed power switchgear assemblies, generic response spectrum (GRS), IEEE C37.81™, performance requirements, seismic criteria

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Introduction

This introduction is not part of IEEE Std IEEE Std C37.81–2017, IEEE Guide for Seismic Qualification of Class 1E Metal-Enclosed Power Switchgear Assemblies.

This guide complements IEEE Std 344™, Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations by providing specific requirements and guidance for seismic qualification of metal-enclosed power switchgear assemblies.[1]

Changes include IEEE Std C37.81 include the following:

a) Added definitions and guidance for Seismic Category I and Seismic Category II equipment. Seismic Category I equipment is equivalent to equipment defined as Class 1E in the previous revision.

b) Added guidance on sites with high frequency content, including a fourth Generic Response Spectra (GRS).

c) Added definitions for functional failure, structural damage and triaxial test

d) Revised the definitions for:

   1) Biaxial test

   2) Malfunction

Metal-enclosed power switchgear assemblies fall into the category of complex devices as described in IEEE Std 344; therefore, basic seismic qualification is dependent upon test data. Analysis may be used in data reduction, reconciling response spectra, and evaluating changes. A method of combined test and analysis may also be used in justifying seismic qualification of similar equipment to the tested samples.

It should be noted that while the primary purpose of this guide is for the application of metal-enclosed power switchgear assemblies in nuclear power generating stations, it is not restricted to this application. This guide may also be used as a guide in other applications in which the seismic response of metal-enclosed power switchgear assemblies is a consideration.

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

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IEEE Guide for Seismic Qualification of Class 1E Metal-Enclosed Power Switchgear Assemblies

1. Overview

1.1 Scope

This guide provides requirements and guidance for the seismic qualification of metal-enclosed power switchgear assemblies including switching, interrupting, control, instrumentation, metering, and protective and regulating devices mounted therein.

This guide may be used by equipment manufacturers to establish procedures that will yield data to substantiate performance or by equipment users to evaluate and verify performance of representative devices and assemblies as part of an overall qualification effort.

As used in this guide, the word switchgear shall mean metal-enclosed power switchgear assemblies with the requirements as defined in IEEE Std C37.20.1™, IEEE Std C37.20.2™, IEEE and Std C37.20.3™.[2,3,4] By definition, metal-enclosed power switchgear assemblies include metal-clad switchgear, metal-enclosed interrupter switchgear, and low-voltage power circuit breaker switchgear. This guide does not cover metal-enclosed bus or control switchboards.

Metal-enclosed power switchgear assemblies fall into the category of complex devices as described in IEEE Std 344™. Therefore, basic seismic qualification is dependent on test data. Switchgear assemblies have many different types and arrangements of devices and components. It is neither practical nor necessary to test each unique configuration of devices and components, nor is it necessary to test a given configuration for every possible seismic environment. However, it is essential that each switchgear assembly used in Seismic Category I and Seismic Category II applications be seismically qualified for its environment, and Seismic Category I qualification must be based on data obtained by test. Analysis may be used in data reduction, reconciling response spectra, evaluation of changes and Seismic Category II qualification.

A method of combined test and analysis may also be used in justifying seismic qualification of equipment similar to the tested sample. A combination of testing and analysis may also be used to justify the seismic qualification of equipment with removable elements and drawout-mounted devices in various positions (connect, test, disconnect, and removed).

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