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IEEE Standard for the Qualification of Switchgear Assemblies for Class 1E Applications in Nuclear Power Generating Stations

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of the
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Foreword

(This Foreword is not a part of ANSI/IEEE C37.82-1987, IEEE Standard for the Qualification of Switchgear Assemblies for Class 1E Applications in Nuclear Power Generating Stations.)

ANSI/IEEE Std 323-1984, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations, was developed to provide qualification requirements for Class 1E (safety-related) electrical equipments that would confirm the adequacy of such equipments to perform their safety functions on a continuing basis throughout their installed life. This document is based on ANSI/IEEE Std 323-1983 and is intended to present specific qualification procedures for switchgear assemblies in Class 1E application.

In approaching the task of developing a standard for these procedures, the authors noted that

1) Standards for switchgear assemblies have been developed over a long period of time through the efforts of IEEE, AEIC, EEI, NEMA, and other interested parties under the auspices of the American National Standards Institute (ANSI).
2) The switchgear assembly products that have been produced in accordance with these standards and that have been properly manufactured, applied, handled, installed, operated, and maintained, have had long and successful performance records.
3) Because switchgear assemblies are protective equipments, the standards are conservative and provide ample margin with respect to normal application. Design and application also tend to be conservative.
4) The application of switchgear assemblies is always outside the containment in a nuclear power generating station. Normal service conditions are not severe. The only unusual requirements sometimes presented are
    a) The need to meet safety-related performance demands during a design basis event (DBE) at any time, up to and including the end of a stipulated period known as the *qualified life*.
    b) Qualification to the requirements of the DBE, which is usually a specified seismic event but may include severe environmental conditions for stipulated periods of time subsequent to the seismic and other DBE.
5) Switchgear assemblies are not cataloged "off-the-shelf" items as are motors, valves, pumps, etc. They are built from standardized components and subassemblies but in varied arrangements to satisfy the needs of different applications. The complements of devices such as relays, etc, are rarely the same from assembly to assembly and are subject to modification during production and even after installation.

In order to precisely define the task, it is important to understand what is meant by *qualification*. As described in ANSI/IEEE Std 323-1983, qualification is only one part of an overall quality assurance program that includes design, qualification, production quality control, installation, maintenance, and periodic testing. The overall program is required to assure that the equipment will meet or exceed its performance requirements throughout its installed life.

Qualification is that part that establishes the capability of the equipment to meet such requirements. Put another way, the qualification procedure must establish that the equipment *can*; the overall program is required to assure that it *will*.

Qualification programs should identify design and material characteristics that, after a period of time and during a DBE, may precipitate common failure modes due to aging of redundant equipment. The concept of *aging* must be included in the qualification procedure in order to investigate the possibility that aging degradation might be the source of common failure modes in redundant Class 1E equipments. In order to provide maximum assurance that the equipment can meet its safety-related performance requirements on a continuing basis throughout its installed life and for the stipulated DBE, it may be necessary to limit the installed life or establish a maintenance program for replacement of some components whose qualified life is shorter than the desired qualified life for the total equipment.

Based on the foregoing considerations, the authors of this document have developed a standard that is in accordance with the *combined qualification* procedure, as described in 5.4 of ANSI/IEEE Std 323-1983. The details of this procedure are covered in Section 7 of this document. Basically, it consists of using the standard design tests as prescribed by industry standards to establish the capability of the equipment in an "as new" condition, and to supplement this with tests and other data on critical components and materials to evaluate long-term performance. Analysis is used to determine the performance requirements, identify the critical components and materials, and relate

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the aging data to the performance requirements in order to project a qualified life for the total assembly. Note that this approach to qualification provides the necessary flexibility to respond to the variations and modifications that are characteristic of switchgear assemblies.

Tests on complete assemblies have been used in this qualification procedure when it could be reasoned that the interrelationship of components in the complete assembly was important for realistic test results. Examples are the dielectric, continuous current, and short-circuit current tests required by industry standards, and the seismic tests required by ANSI/IEEE Std 344-1975, IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

However, the authors reasoned that accelerated aging tests (particularly thermal aging) in a complete assembly would not provide valid results. Many materials and components respond differently, relatively speaking, to accelerated aging than they do to natural aging. This changes the interrelationships and may produce unrealistic test results when accelerated aging is attempted on combinations of materials. Therefore, this standard requires aging data only for components and materials, rather than for complete assemblies.

It should be noted that this approach makes it desirable to define *margin* as the difference between demonstrated capability and required capability. The capability of switchgear assemblies is demonstrated by the design tests prescribed by relevant industry standards that show that the assemblies meet the ratings required by those standards. Because the equipment is rarely, if ever, applied up to its full rating, it is usually possible to show ample margin even when the equipment has aged. The *usual service conditions* defined in 4.1 of this standard are consistent with application practices for Class 1E assemblies in nuclear power generating stations and, hence, ensure margin for such applications. They are not derating factors.

Note that the end result of the qualification procedure is the projection of a qualified life for the switchgear assembly. There must be adequate documentation to support the projection.

The realization of the projected qualified life requires a joint effort by the manufacturer and the user. The manufacturer is responsible for the design and production of the equipment. In order to support the qualification of the equipment, he must provide and maintain documentation showing that it is capable of meeting specified performance requirements in specified service conditions throughout its qualified life. The documentation must also show that the equipment is capable of performing its safety function during and, if required, for a specified time after exposure to a DBE, which might occur at any time during the life of the equipment. In order to satisfy this latter requirement, the manufacturer must provide documentation relative to the long-term performance of components and materials that are critical with respect to the capability of performing the safety function. The manufacturer must provide guidance on the proper application, handling, storage, installation, and maintenance of the equipment. The maintenance guidance must include identification of components and materials whose long-term characteristics are not adequate, so that a replacement program can be developed.

The user is responsible for identification of the Class 1E equipment and components specifically requested by him. He must specify service conditions and performance requirements that are safety-related. He is responsible for proper application, handling, storage, installation, and maintenance in accordance with the guidance provided by the manufacturer. Proper application includes the maintaining of a generally favorable service environment that contributes greatly to successful long-term performance. A favorable service environment is defined by the usual service conditions listed in 4.1 of this standard.

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An American National Standard

IEEE Standard for the Qualification of Switchgear Assemblies for Class 1E Applications in Nuclear Power Generating Stations

1. Scope and Purpose

This document describes the methods and requirements for qualifying switchgear assemblies for indoor areas outside of the containment in nuclear power generating stations. These assemblies include

1) Metal-enclosed low-voltage power circuit breaker switchgear assemblies, as defined in ANSI/IEEE C37.20.1-1987 [12],[1]
2) Metal-clad switchgear assemblies, as defined in ANSI/IEEE C37.20.2-1987 [13],
3) Metal-enclosed bus, as defined in ANSI/IEEE C37.23-1987 [15], and
4) Metal-enclosed interrupter switchgear assemblies, as defined in ANSI/IEEE C37.20.3-1987 [14].

The purpose of this document is to provide amplification of the general requirements of ANSI/IEEE Std 323-1983 [19] as they apply to the specific features of Class 1E switchgear assemblies. Where differences exist between this document and ANSI/IEEE Std 323-1983 [19], this document takes precedence insofar as switchgear assemblies are concerned.

[1]The numbers in brackets correspond to those of the references listed in Section 3.

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2. Definitions

2.1

The following definitions establish the meaning of the words in the context of their use in this standard:

components: Items from which the switchgear assemblies are made (for example, power circuit breakers, instrument transformers, protective relays, control switches, primary insulation, etc).

maintenance interval: The period, defined in terms of real time, operating time, number of operating cycles, or a combination of these, during which satisfactory performance is expected without maintenance or adjustments.

margin: The difference between the demonstrated capability of the equipment and that required in service for specific conditions.

2.2

The following terms are defined in either ANSI/IEEE Std 627-1980 [21] or ANSI/IEEE Std 100-1984 [18], and the user is referred to the definitions given therein:

ANSI/IEEE Std 627-1980 [21]

aging
auditable data
containment (nuclear power generating stations)
operating experience
service conditions

ANSI/IEEE Std 100-1984 [18]

analysis (nuclear power generating stations)
Class 1E (nuclear power generating stations)
common failure mode
containment (nuclear power generating stations)
design basis events (DBE) (nuclear power generating stations)
design tests (general)
equipment qualification (nuclear power generating stations)
installed life (nuclear power generating stations)
interface (nuclear power generating stations) (Class 1E equipment)
nuclear power generating station
qualified life (Class 1E equipment)

3. References

The following publications shall be used in conjunction with this standard:

[1] ANSI C37.06-1979, American National Standard Preferred Ratings and Related Required Capabilities for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.[2]

[2]ANSI publications can be obtained from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018.

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[2] ANSI C37.16-1980, American National Standard Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors.

[3] ANSI C37.17-1979, American National Standard Trip Devices for AC and General Purpose DC Low-Voltage Power Circuit Breakers.

[4] ANSI C37.32-1972, American National Standard Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide for High-Voltage Air Switches, Bus Supports, and Switch Accessories.

[5] ANSI C37.33-1970, American National Standard Rated Control Voltages and Their Ranges for High-Voltage Air Switches.

[6] ANSI C37.34-1971, American National Standard Test Code for High-Voltage Air Switches.

[7] ANSI C37.50-1981, American National Standard Test Procedures for Low-Voltage AC Power Circuit Breakers Used in Enclosures.

[8] ANSI/IEEE C37.04-1979, IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.[3]

[9] ANSI/IEEE C37.09-1979, IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

[10] ANSI/IEEE C37.13-1981, IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.

[11] ANSI/IEEE C37.14-1979, IEEE Standard for Low-Voltage DC Power Circuit Breakers Used in Enclosures.

[12] ANSI/IEEE C37.20.1-1987, IEEE Standard for Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear.

[13] ANSI/IEEE C37.20.2-1987, IEEE Standard for Metal-Clad and Station-Type Cubicle Switchgear.

[14] ANSI/IEEE C37.20.3-1987, IEEE Standard for Metal-Enclosed Interrupter Switchgear.

[15] ANSI/IEEE C37.23-1987, IEEE Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus.

[16] ANSI/IEEE C37.27-1987, IEEE Standard Application Guide for Low-Voltage AC Nonintegrally Fused Power Circuit Breakers (Using Separately Mounted Current-Limiting Fuses).

[17] ANSI/IEEE C37.30-1971, American National Standard Definitions and Requirements for High-Voltage Air Switches, Insulators, and Bus Supports.

[18] ANSI/IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms.

[19] ANSI/IEEE 323-1983, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

[20] ANSI/IEEE 344-1975, IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

[21] ANSI/IEEE Std 627-1980, IEEE Standard for Design Qualification of Safety Systems Equipment Used in Nuclear Power Generating Stations.

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[3]ANSI/IEEE publications can be obtained from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, or from the Service Center, The Institute of Electrical and Electronics Engineers, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331.

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4. Service Conditions

The service conditions below are significant to the qualification of switchgear assemblies and included components.

4.1 Usual Service Conditions

The values given as usual service conditions represent the anticipated average conditions for switchgear assemblies in nuclear power generating stations. These values are recommended for use in generic qualification programs and do not imply a derating of the equipment.

4.1.1 Ambient Temperature

A yearly average ambient temperature of 30 °C with temperature excursions to 10 °C and 40 °C is considered usual.

4.1.2 Relative Humidity

Relative humidity variations between 10% and 90% are considered usual.

4.1.3 Altitude

Altitudes of up to 6600 ft (2000 m) above sea level for metal-enclosed low-voltage power circuit breaker switchgear and up to 3300 ft (1000 m) for metal-clad switchgear and metal-enclosed interrupter switchgear are considered usual.

4.1.4 Radiation

Radiation exposure of up to 10^4 rads equivalent gamma total integrated dose over the qualified life is considered usual.

4.1.5 Line Voltage

The line voltage shall be specified for the application. Voltage ratings as specified in ANSI/IEEE C37.20.1-1987 [12], ANSI/IEEE C37.20.2-1987 [13], ANSI/IEEE C37.20.3-1987 [14], and ANSI/IEEE C37.23-1987 [15] are considered usual. Switching surges of up to twice peak line-to-neutral voltage may occur occasionally, but Class 1E switchgear installations are usually not exposed to lightning surges.

4.1.6 Frequency

A nominal frequency of 60 Hz is considered usual for ac equipment.

4.1.7 Control Voltages

The nominal control voltages shall be specified for the application. Control voltage variations within the ranges given in the standards below are considered usual:

ANSI C37.06-1979 [1] — high-voltage circuit breakers.

ANSI C37.16-1980 [2] — low-voltage circuit breakers.

ANSI C37.33-1970 [5] — high-voltage interrupter switches.

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4.1.8 Control Currents

The maximum control auxiliary circuit currents to be made, carried, and interrupted by auxiliary contacts of breakers and other components shall be as specified for the application.

4.1.9 Continuous Current

The average loading shall be estimated for the application. The qualified life of switchgear components is dependent on the average loading. Considering duty and available power distribution options in nuclear Class 1E systems, the average loading rarely, if ever, approaches the continuous current rating of the equipment.

4.1.10 Short-Circuit Current

The maximum short-circuit current shall be specified for the application.

4.1.11 Mechanical Operations

In order to provide a basis for qualified life demonstration, circuit breaker mechanical operations shall be specified. A cumulative number of mechanical operations not greater than that corresponding to two maintenance intervals, as defined in applicable circuit breaker standards, is considered usual.

4.1.12 Mechanical Interface Loading

It is considered usual that the mechanical loads from incoming cables, conduits, other interfacing hardware, or equipment such as transformers are separately supported or isolated so as not to impose significant mechanical loading on the switchgear assembly structure.

4.2 Unusual Service Conditions

When switchgear assemblies are applied where the service conditions are not within the range given as usual service conditions, the applicable service conditions shall be specified and the switchgear assemblies shall be qualified for these conditions. Where qualification to unusual conditions becomes impractical, improvement of the service conditions may be necessary.

4.3 Design Basis Events (DBEs)

The DBE that usually applies to switchgear assemblies is a seismic event. Other DBEs, such as the severe environmental conditions associated with a loss-of-coolant accident and high-energy line break, are not normally applicable.

4.3.1 Seismic Excitation

Due to the seismic variations between sites and building structural differences, seismic loading in the form of required response spectra shall be specified for each switchgear assembly application. The switchgear assemblies shall be qualified in accordance with ANSI/IEEE Std 344-1975 [20].

4.3.2 Other Design Basis Events (DBEs)

If DBEs or unusual requirements in addition to the seismic event are applicable to switchgear assemblies, detailed conditions shall be specified and considered.

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5. Performance Requirements

Switchgear assemblies in Class 1E applications shall be capable of performing the required safety-related functions during the projected qualified life of the assembly and during and subsequent to a seismic disturbance or any other applicable DBE. Performance requirements described below are considered usual. Additional requirements, if any, shall be specified.

1) Primary conductors shall withstand operating voltages and transient overvoltages.
2) Circuit breakers and equipment shall make, carry, and interrupt the load currents specified for the applications.
3) Circuit breakers and equipment shall make, carry, and interrupt the short-circuit current specified for the application.
4) Circuit breakers shall operate on command only, to open or close primary and secondary circuits.
5) Protective devices, control, and auxiliary systems and instrumentation shall operate to the extent specified for safety-related functions.

6. Margin

The purpose of applying margin in the qualification of equipment is to account for normal variations in commercial production of equipment and reasonable errors in defining satisfactory performance.

6.1 Demonstration of Margin

The qualification procedures shall include a demonstration of margin. Testing of switchgear in accordance with current industry standards provides this margin for the usual service conditions specified in Section 4 The margin demonstrated by this testing is shown by the following examples:

1) *Voltage* — Margins are demonstrated by low-frequency voltage withstand tests. Example: 15 kV assemblies have a design test voltage of 36 kV rms (50 kV peak) for 1 min compared to a maximum expected switching surge of less than twice the line-to-neutral voltage (24 kV peak) lasting less than 0.1 s.
2) *Continuous Current* — Margins are demonstrated by the difference between the average loading and the rated continuous current levels as established by design tests.
3) *Short-Circuit Current* — Margins are demonstrated by momentary and short-time current tests of greater duration than normally experienced in service; for example, 3 s (180 cycles) duration of short-time current versus 5–10 cycles duration of short-circuit current.
4) *Control Voltage* — Production tests at minimum and maximum control voltage provide margin with respect to nominal values of control voltage.

6.2 Aging

Margins are not applied to aging evaluations performed as a part of component qualification programs.

6.3 Seismic

The seismic qualification methods in ANSI/IEEE Std 344-1975 [20] provide adequate margin.

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6.4 Margin for Unusual Service Conditions

Where unusual service conditions are specified, the qualification procedure shall include a demonstration of margin.

7. Qualification Procedure

The procedure to be used for qualification of switchgear assemblies should provide appropriate documentation while assuring needed flexibility to encompass variations in equipment arrangement and device complement. The following procedure will provide the above; however, other qualification methods as described in ANSI/IEEE Std 323-1983 [19] may also be appropriate.

7.1 Assembly Qualification

Qualification of switchgear assemblies can be achieved by a combination of analysis and tests on assemblies and individual components. For this procedure the following steps shall be completed, not necessarily in the order listed:

1) Service conditions of the switchgear shall be specified (refer to Section 4).
2) Safety-related performance requirements shall be defined (refer to Section 5).
3) The components and their performance requirements that are essential to meeting the assembly safety-related performance requirements shall be identified (critical components).
4) The operating conditions applied to critical components shall be determined. For example, average temperature (4.1.1) and average loading (4.1.9) provide a basis for estimating the qualified life of components subject to thermally induced failure.
5) The possible failure modes of critical components shall be determined based on operating conditions, available test data, and experience.
6) Interface relationships shall be evaluated to identify failure modes that may jeopardize a safety-related function:
   a) Among Class 1E components,
   b) Between Class 1E and non-Class 1E components, and
   c) Between the switchgear assembly and external systems and structures.
7) Evidence shall be developed to document the capability of critical components to meet successfully their performance requirements over their projected qualified life. This shall include a determination of the need for simulated aging before DBE testing based on an evaluation of the design and application of the equipment (refer to 7.2).
8) A switchgear assembly that is representative of the equipment to be qualified shall be tested in accordance with industry standards, as described in 7.3.
9) Inspection and maintenance programs necessary to assure the realization of projected qualified life shall be delineated. When the projected qualified life of a component is less than the required installed life of the switchgear assembly, the maintenance program shall include appropriate remedial action. Component replacement shall be in accordance with 7.5.
10) When design modifications are made to previously qualified switchgear components, the revised design shall be reviewed, the necessary analysis and testing performed, and the documentation revised accordingly.

7.2 Component Qualification

The purpose of component qualification is to project a qualified life for critical components. Components shall be qualified, depending on functional requirements, by any of the following methods:

1) Analysis of materials test data with respect to functional requirements.
2) Previous operating experience, where the service conditions of prior operation can be documented.

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3) Functional testing (in accordance with existing industry standards or specially developed test procedures where necessary).
4) Environmental or operational preconditioning, or both, followed by functional testing (in accordance with existing industry standards or specially developed test procedures where necessary).
5) Appropriate combinations of the above.

7.2.1 Aging

The effects of aging mechanisms shall be addressed in the qualification of each component. As a minimum, the aging effects of operational cycles, time-temperature, and radiation shall be evaluated. If any of these mechanisms is shown to have no adverse effect on functional capability, including during any applicable DBE, documentation of that fact satisfies the aging requirement for that aging mechanism.

7.2.1.1 Operational Cycles

7.2.1.1.1

Each power circuit breaker or interrupter switch shall be qualified by evaluation of data from design tests made to establish mechanical and electrical operational capability. For specific operational requirements, refer to the following standards:

ANSI C37.06-1979 [1] — ac high-voltage circuit breakers

ANSI C37.16-1980 [2] — low-voltage power circuit breakers

ANSI C37.34-1971 [6] — high-voltage air interrupter switches

NOTE — Operating life expectancy of interrupter switches is a design parameter of the manufacturer not specified in the standard.

7.2.1.1.2

Other components subject to mechanical cycling, such as relays, shall be tested in accordance with applicable industry standards.

7.2.1.2 Time-Temperature Effects

Thermal aging effects shall be evaluated by considering the aging characteristics of the nonmetallic materials under the operating conditions determined in 7.1(4) above.

1) Nonmetallic materials used in the component shall be identified.
2) Arrhenius time-temperature data or curves, or both, for the nonmetallic materials may be used if available. The criteria (properties) used to develop the data (curves) shall pertain to the design requirements of the equipment (for example, dielectric strength, flexural strength, etc). Other data may be used if it is sufficient to permit evaluation of time-temperature dependent degradation of the material.
3) The extent of thermal degradation of each material due to the anticipated service conditions over the desired period of time shall be determined. The thermal degradation shall be based on the operating temperatures expected for each nonmetallic material as determined by load current tests.
4) The resulting capabilities of the equipment at these degraded levels shall be compared with their functional requirements and DBE stresses either by analysis or by test. Each material shall have retained a sufficient amount of its design properties to assure proper operation of the components during and after a DBE, and the documentation shall demonstrate margin for this capability.

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7.2.1.3 Radiation

The radiation aging effects on a component or system shall be evaluated by consideration of the aging characteristics of the nonmetallic materials and the radiation doses to which they are subjected.

1) Nonmetallic materials used in the component shall be identified.
2) A literature search shall be conducted for information on radiation effects based on the threshold damage level of the parts and materials.
3) Consideration of radiation/thermal synergistic effects may be neglected if threshold effects are found to occur at levels above the required radiation dose.
4) Where available data fails to disclose radiation effect information for a material, radiation testing to determine such effects shall be conducted.
5) The resulting capabilities of the equipment at these degraded levels shall be compared with their functional requirements and DBE stresses either by analysis or by test. Each material shall have retained a sufficient amount of its design properties to assure proper operation of the equipment during and after a DBE, and the documentation shall demonstrate margin for this capability.

7.3 Assembly Tests

The following tests shall be performed on switchgear assemblies that are representative of the equipment to be qualified (performing all tests on the same assembly is not required):

1) Design and production tests in accordance with the following:
   ANSI/IEEE C37.20.1-1987 [12], ANSI/IEEE C37.20.2-1987 [13], and ANSI/IEEE C37.20.3-1987 [14] — switchgear assemblies
   ANSI/IEEE C37.23-1987 [15] — metal-enclosed bus
   ANSI/IEEE C37.09-1979 [9] — test procedure for ac high-voltage circuit breakers
   ANSI/IEEE C37.14-1979 [11] — low-voltage dc circuit breakers used in enclosures
   ANSI C37.34-1971 [6] — test code for high-voltage air switches[4]
   ANSI C37.50-1981 [7] — test procedures for low-voltage ac circuit breakers
2) Seismic tests in accordance with ANSI/IEEE Std 344-1975 [20].

NOTE — Where sufficient data exists, individual components such as relays may be individually seismically tested and qualified for use in a switchgear assembly by a suitable analysis.

7.4 Field Modifications

When field modifications are required, the modifications shall be analyzed and tests performed as necessary, in accordance with 7.1 and 7.2, to assure continued satisfactory performance of the switchgear assembly. In addition, documentation of the modifications in accordance with Section 8 shall be prepared and maintained as a supplement to the original documentation for the switchgear assemblies.

7.5 Replacement of Critical Components

1) When critical components must be replaced, the replacement components shall be identical to the original components, if available. Documentation shall demonstrate that proper replacement parts have been obtained.
2) When critical components must be replaced and identical components are not available, the use of alternate components shall be treated as a field modification, and the documentation supplement shall be as described above in 7.4.

[4]Limited applicability for metal-enclosed switches.

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8. Documentation

The documentation brings together the evidence generated in the qualification program into a comprehensive auditable summary that provides the desired assurance. The qualification report shall include the following information:

1) Identification of the equipment being qualified.
2) Listing of the Class 1E performance requirements.
3) Definition of service conditions, including DBEs for which equipment is to be qualified.
4) Identification of the critical components and the basis for such judgments.
5) Summary of data and projected qualified life for each component.
6) Summary of test reports applicable to the qualification of the complete assembly.
7) Analysis and projected qualified life for the complete switchgear assembly.
8) Outline of qualification method used.
9) Source references or other means by which the evidence supporting the conclusions can be audited.
10) Recommended maintenance, tests, and replacements as required to maintain qualification.
11) Review/approval signature and date.

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