

IEEE Standard for Nuclear facilities— Electrical Equipment important to safety— Qualification

IEEE Power and Energy Society

Developed by the
Nuclear Power Engineering Committee

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STANDARDS



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IEEE Standard for Nuclear facilities— Electrical equipment important to safety— Qualification

Developed by the

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

Approved 29 January 2016

IEEE SA Standards Board

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INTRODUCTION

a) Technical background, main issues and organisation of the Standard

This standard is applicable to electrical equipment important to safety and its interfaces that are necessary to perform a safety function, or whose failure could adversely affect the safety functions of other equipment.

Electrical equipment in nuclear facilities shall meet its safety functional requirements throughout its installed life. This is accomplished by a thorough programme of quality assurance, design control, quality control, qualification, production, transportation, storage, installation, maintenance, periodic testing, and surveillance. This IEC/IEEE standard specifically focuses on qualification.

Other aspects, relating to quality assurance, reliability, selection and use of electronic devices, design and modification of digital systems including V&V activities are not part of this standard.

Industry research in the area of equipment qualification and decades of its application have greatly benefited this standard. Future activities of the working group to update this standard will consider the following:

- Experience and knowledge gained by using condition monitoring techniques,
- Knowledge gained on ageing mechanisms and kinetics,
- Significance of refinements in ageing mechanisms, equipment sealing, interfaces, extrapolation, similarity, test sequence and parameters (such as ramp rates, time duration, timing of spray initiation and its duration), and qualification documentation.

It is intended that the Standard be used by operators of NPPs (utilities), systems evaluators, equipment manufacturers, test facilities, qualification laboratories and by licensors.

b) Situation of the current standard in the structure of the IEC SC 45A standard series

IEC 61513 is a first level IEC SC 45A document and gives guidance applicable to I&C at system level.

These documents are supplemented by guidance on functional classification (IEC 61226), hardware design (IEC 60987), software (IEC 60880 and IEC 62138), selection and use of HDL programmed integrated circuit (IEC 62566) and requirements in order to reduce the possibility and limit the impact of common cause failure of category A functions (IEC 62340).

IEC/IEEE 60780-323 is a second level IEC SC 45A document which focuses on environmental qualification of electrical equipment important to safety.

For more details on the structure of the IEC SC 45A standard series, see item d) of this introduction.

c) Recommendations and limitations regarding the application of this standard

This dual logo standard applies to all electrical equipment important to safety in accordance with IAEA terminology including Class 1E equipment in accordance with the IEEE classification scheme and Classes 1, 2 and 3 in accordance with IEC 61226 classification scheme.

For equipment that needs to be qualified for design extension conditions, including severe accident conditions, this international standard shall be applied after a new DBE profile covering these conditions has been fully defined. Conservatism taken into account to define this severe accident profile should nevertheless be adapted.

To ensure that the Standard will continue to be relevant in future years, the emphasis has been placed on issues of principle, rather than specific technologies.

d) Description of the structure of the IEC SC 45A standard series and relationships with other IEC documents and other bodies documents (IAEA, ISO)

The top-level document of the IEC SC 45A standard series is IEC 61513. It provides general requirements for I&C systems and equipment that are used to perform functions important to safety in NPPs. IEC 61513 structures the IEC SC 45A standard series.

IEC 61513 refers directly to other IEC SC 45A standards for general topics related to categorisation of functions and classification of systems, qualification, separation of systems, defence against common cause failure, software aspects of computer-based systems, hardware aspects of computer-based systems, and control room design. The standards referenced directly at this second level should be considered together with IEC 61513 as a consistent document set.

At a third level, IEC SC 45A standards not directly referenced by IEC 61513 are standards related to specific equipment, technical methods, or specific activities. Usually these documents, which make reference to second-level documents for general topics, can be used on their own.

A fourth level extending the IEC SC 45A standard series, corresponds to the Technical Reports which are not normative.

IEC 61513 has adopted a presentation format similar to the basic safety publication IEC 61508 with an overall safety life-cycle framework and a system life-cycle framework. Regarding nuclear safety, it provides the interpretation of the general requirements of IEC 61508-1, IEC 61508-2 and IEC 61508-4, for the nuclear application sector, regarding nuclear safety. In this framework IEC 60880 and IEC 62138 correspond to IEC 61508-3 for the nuclear application sector. IEC 61513 refers to ISO as well as to IAEA GS-R-3 and IAEA GS-G-3.1 and IAEA GS-G-3.5 for topics related to quality assurance (QA).

The IEC SC 45A standards series consistently implements and details the principles and basic safety aspects provided in the IAEA code on the safety of NPPs and in the IAEA safety series, in particular the Requirements SSR-2/1, establishing safety requirements related to the design of Nuclear Power Plants, and the Safety Guide SSG-39 dealing with instrumentation and control systems important to safety in Nuclear Power Plants. The terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

NUCLEAR FACILITIES – ELECTRICAL EQUIPMENT IMPORTANT TO SAFETY – QUALIFICATION

1 Scope and object

This International Standard describes the basic requirements for qualifying electrical equipment important to safety and interfaces (electrical and mechanical) that are to be used in nuclear facilities. The principles, methods, and procedures described are intended to be used for qualifying equipment, maintaining and extending qualification, and updating qualification, as required, if the equipment is modified. The qualification requirements in this standard, when met, demonstrate and document the ability of equipment to perform safety function(s) under applicable service conditions, including design basis events and certain design extension conditions, and reduce the risk of environmentally induced common-cause equipment failure.

This standard does not provide environmental stress levels or performance requirements.

Other aspects, relating to quality assurance, selection and use of electronic devices, design and modification of digital systems are not part of this standard.

Other IEC or IEEE standards that present qualification programmes for specific equipment, specific environments, or specific parts of the qualification programme may be used to supplement this standard, as applicable. The bibliography lists other standards related to equipment qualification.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60980, *Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations*

IEEE Std 344™-2013, *IEEE Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 age conditioning

process of subjecting equipment or a component to elevated stress conditions (environmental and operational) in order to render its physical and electrical properties similar to those it would have at a predetermined natural age when operating under expected operational conditions, corresponding at least to the qualified life

3.2 ageing

general process in which characteristics of a system or component gradually change with time or use

[SOURCE: IAEA Safety Glossary, 2007]

3.3

Class 1E

safety classification of the electrical equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or are otherwise essential in preventing significant release of radioactive material to the environment

[SOURCE: IEEE Standards Dictionary Online]¹

3.4

common cause failure

failure of two or more structures, systems or components due to a single specific event or cause

[SOURCE: IAEA Safety Glossary, 2007]

3.5

components

discrete elements of a system. Examples of components are wires, transistors, integrated circuits, motors, relays, solenoids, pipes, fittings, pumps, tanks and valves

[SOURCE: IAEA Safety Glossary, 2007]

3.6

condition-based qualification

qualification based on measurement of one or more condition indicators of equipment, its components, or materials for which an acceptance criterion can be correlated to the equipment's ability to function as specified during an applicable design basis event

[SOURCE: IEEE Standards Dictionary Online]

3.7

condition indicator

characteristic of equipment or its components that can be observed, measured and trended to infer or directly indicate the current and future ability of equipment to function within acceptance criteria in all specified service conditions (including DBE conditions)

3.8

design basis events

postulated events used in the design to establish the acceptable performance requirements for the structures, systems, and components

[SOURCE: IEEE Standards Dictionary Online]

3.9

design extension conditions

accident conditions that are not considered for design basis events, but that are considered in the design process of the facility in accordance with best estimate methodology, and for which releases of radioactive material are kept within acceptable limits. Design extension conditions include severe accident conditions.

¹ IEEE Standards Dictionary Online is available at:
<http://ieeexplore.ieee.org/xpls/dictionary.jsp>

[SOURCE: IAEA Safety Standards Series SSR2/1:2012]

3.10 end condition

value(s) of equipment condition indicator(s) at the conclusion of age conditioning

3.11 equipment

assembly of components designed and manufactured to perform specific functions

Note 1 to entry: Sensors, cables, electrically operated valves, I&C cabinet or racks are examples of equipment.

[SOURCE: IEEE Standards Dictionary Online]

3.12 equipment important to safety

equipment that is part of a safety group and/or whose malfunction or failure could lead to undue radiation exposure of the site personnel or members of the public. Equipment including:

- those structures, systems and components that prevent anticipated operational occurrences from leading to accident conditions;
- those features that are provided to mitigate the consequences of malfunction or failure of structures, systems and components.

A) For usage consistent with IEC 61226, equipment important to safety are as follows:

- all I&C equipment performing Category A to Category C functions (in accordance with the IEC 61226 categorisation scheme),
- all electrical equipment needed to ensure emergency energy supply to this equipment in case of a loss of normal power supply,
- all electrical equipment needed to ensure ultimate energy supply in case of total loss of on-site power (if selected as design extension condition to be mitigated).

B) For usage consistent with other IEEE documents and a Class 1E categorization; for equipment important to safety, qualification is essential to the following:

- electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or
- electric equipment that are otherwise essential in preventing significant release of radioactive material to the environment.

Note 1 to entry: Users of this standard are advised that Class 1E is a functional term. Equipment and systems are to be classified Class 1E only if they fulfill the functions listed in the definition. Identification of systems or equipment as Class 1E based on anything other than their function is an improper use of the term and should be avoided.

3.13 equipment qualification

generation and maintenance of evidence to ensure that equipment will operate on demand to meet system performance requirements during normal and abnormal service conditions and postulated design basis events

[SOURCE: IAEA Safety Glossary, 2007]

3.14 equipment similarity

demonstration of physical, operational and dynamic equivalency between equipment being qualified and equipment previously qualified

3.15

harsh environment

environment that significantly changes as a result of a design basis event, e.g., loss-of-coolant accident (LOCA), high-energy line break (HELB), and main steam line break (MSLB)

[SOURCE: IEEE Standards Dictionary Online]

3.16

interfaces

shared boundary between structures, systems and components that includes physical attachments, mounting, auxiliary components, and connectors (electrical and mechanical) to the equipment

3.17

margin

difference between service conditions and the conditions used for equipment qualification

[SOURCE: IEEE Standards Dictionary Online]

3.18

mild environment

environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences

3.19

qualified condition

condition of equipment, prior to the start of a design basis event, for which the equipment was demonstrated to meet the design requirements for the specified service conditions. This could include certain post accident cooling and monitoring systems that are expected to remain operational.

3.20

qualified life

period for which an equipment has been demonstrated, through testing, analysis and/or experience, to be capable of functioning within acceptance criteria during specific operating conditions while retaining the ability to perform its safety functions in accident condition or earthquake

Note 1 to entry: This note applies to the French language only.

[SOURCE: IAEA Safety Glossary, 2007]

3.21

service conditions

actual physical states or influences during the service life of equipment, including normal operating conditions, abnormal operating conditions, design basis event conditions and conditions following a design basis event and design extension conditions

Note 1 to entry: In 2007-edition of IAEA safety glossary, accident conditions include both design basis accident and beyond design basis accident. This second notion has been replaced within IAEA by the notion of design extension conditions (AIEA, SSR-2/1). It explains the need of changing the definition.

[SOURCE: IAEA Safety Glossary, 2007, modified]

3.22

service life

period from initial operation to final withdrawal from service of a structure, system or component

[SOURCE: IAEA Safety Glossary, 2007]

3.23

severe accident

accident conditions more severe than a design basis event and involving significant core degradation

[SOURCE: IAEA Safety Glossary, 2007]

3.24

significant ageing mechanism

ageing mechanism that, under normal and abnormal service conditions, causes degradation of equipment that progressively and appreciably renders the equipment vulnerable to failure to perform its safety function(s) during the design basis event conditions

[SOURCE: IEEE Standards Dictionary Online]

4 Symbols and abbreviations

DBE	Design Basis Event
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
HELB	High Energy Line Break
I&C	Instrumentation and Control
LOCA	Loss of Coolant Accident
MSLB	Main Steam Line Break
NPP	Nuclear Power Plant
RFI	Radio Frequency Interference

5 Principles of equipment qualification

5.1 Qualification objective

The primary objective of qualification is to demonstrate with reasonable assurance that equipment important to safety can perform its safety function(s) without experiencing common-cause failures before, during, and after applicable DBE.

Equipment important to safety, including its interfaces, shall meet or exceed the equipment specification requirements. This continued capability is ensured through a programme that includes, but is not limited to, design control, quality control, qualification, installation, maintenance, periodic testing, and surveillance. The focus of this standard is on qualification, although it affects the other parts of the programme.

For all items of equipment required to operate under design extension conditions, demonstrable evidence shall be provided that it is able to perform its function(s) under the applicable service conditions including design extension conditions.

Equipment located in normal and mild environments shall be specified, designed, and selected to perform their functions in their intended service conditions including anticipated operational occurrences. Requirements, including EMC, environmental/operational ageing and seismic requirements shall be specified in the design/purchase specifications.

A maintenance/surveillance programme based on a vendor's recommendations, which may be supplemented with operating experience, should ensure that equipment meets the specified performance requirements. A qualified life is not required for equipment located in a mild environment and which has no significant ageing mechanisms and is operated within the limits established by applicable specifications and standards. Qualification for equipment located in mild environments shall be demonstrated by providing evidence that equipment meets or exceeds the specified requirements, including those of recognized industry associations. When seismic testing is used to qualify equipment located in a mild environment, pre-ageing prior to the seismic tests is required only where significant ageing mechanisms exist (see 7.3.3).

5.2 Qualified life and qualified condition

Degradation with time followed by exposure to the applicable environmental extremes of temperature, pressure, humidity, radiation, vibration, chemical spray and submergence resulting from a DBE condition can precipitate failures of equipment important to safety. For this reason, it is necessary to establish a qualified life for equipment with significant ageing mechanisms. The qualified life determination shall consider degradation of equipment capability prior to, during and in post-accident conditions as applicable. Inherent in establishing a qualified life is that a qualified condition is also established. This qualified condition is the state of degradation for which successful performance during a subsequent DBE was demonstrated.

A qualified life is established in initial qualification by putting test sample(s) in the state of degradation expected at the end of the qualified life, followed by simulated DBE(s) in which the ability of the equipment to perform its function important to safety is demonstrated.

Adjustment and extension of qualified life of existing equipment may be achieved through the use of different techniques. These techniques are further described in 6.2.

5.3 Qualification elements

The preferred approach is qualification by type-testing. Other methods as described in 7.4.3 and 7.4.4 are also applicable.

Essential elements needed to demonstrate equipment qualification shall include the following:

- equipment specification including the required safety function(s),
- acceptance criteria,
- description of the service conditions, including DBEs and their duration,
- qualification programme plan,
- implementation of the plan,
- documentation demonstrating successful qualification.

5.4 Qualification documentation

The result of a qualification programme shall be documented to demonstrate the ability of equipment to perform its safety function(s) during its qualified life and applicable design basis events. All activities that are required to maintain qualification during the qualified life shall be included in the documentation. The documentation shall allow verification by competent personnel, other than the qualifier, that the equipment is qualified.

6 Qualification methods

6.1 Initial qualification

6.1.1 Type testing

A type test subjects a representative sample of equipment, including its interfaces, to a series of tests, simulating the effects of significant ageing mechanisms during normal operation. Equipment qualification testing shall be performed with equipment functioning in a state representative of its intended use in actual operation (including any software). The equipment is subsequently subjected to DBE's testing that simulates and thereby establishes the tested configuration for installed equipment service, including mounting, orientation, interfaces, conduit sealing, and expected environments. A successful type test demonstrates that the equipment at the end of its qualified life can perform the intended safety function(s) for the required operating time before, during, and/or following the DBE.

6.1.2 Operating experience

When qualification for mild environment is required, performance data from equipment of similar design that has successfully operated under known service conditions may be used in qualifying other equipment to equal or less severe conditions. Applicability of this data depends on the adequacy of documentation establishing past service conditions, equipment performance, and similarity against the equipment to be qualified. A demonstration of required operation during applicable design basis event(s) shall be included in equipment qualification programs based on operating experience, when DBE qualification is required.

6.1.3 Analysis

Analysis of data and tests for material properties, equipment rating, and environmental tolerance may be used to supplement the demonstration of qualification; however analysis alone shall not be used to demonstrate qualification. Qualification should comprise a logical assessment, similarity evaluation or a valid mathematical model of the equipment to be qualified. The bases for analysis typically include physical laws, results of test data (including those collected during type test performed on equipment from the plant see 6.2.3 and condition measurement) and operating experience.

6.1.4 Combined methods

Equipment may be qualified by combinations of type test, operating experience, and analysis. For example, where type test of a complete assembly is not possible, component testing supplemented by analysis may be used.

6.2 Reassessing qualified life

6.2.1 General

Environmental qualification may yield a qualified life that is less than the anticipated service life of the equipment. For example, the qualified life may be limited due to the use of moderate ageing acceleration factors to achieve realistic simulation of degradation in service during available testing time. Such moderate ageing acceleration factors may result in the condition of the equipment under test falling short of its required end-of-life condition and hence limiting service life.

The methods that follow may be used for reassessing and extending equipment qualified life. The method chosen shall be justified and the application shall be sufficiently documented to give confidence in the extended qualified life.

6.2.2 Method 1: Using conservatism

Evaluation of conservatisms in original assumptions for environmental conditions, failure criteria, and acceleration factors may identify that actual conditions are less severe, and the qualified life may be adjusted accordingly with due consideration of the required margins addressed in 7.3.5. Limitations of use of accelerating factors shall be considered (e.g. time period extrapolation, synergy between effect of temperature and radiation, dose rate effect). Ageing models shall be properly verified. Environmental conditions shall be properly assessed.

6.2.3 Method 2: Type test on aged samples from the plant

Install additional qualified equipment in identical service conditions or use qualified equipment aged in the plant. Remove before the end of the qualified life of equipment in-service and demonstrate its safety function performance during DBE(s) after further age conditioning to establish additional qualified life.

6.2.4 Method 3: Performing type test for longer qualified life

A longer qualified life can be achieved by either retain and continue ageing the test sample from the initial program for additional duration or begin ageing a new sample while the qualified equipment is in service. Equipment safety function is then demonstrated by successfully passing accident condition test.

6.2.5 Method 4: Component replacement

Identify age-sensitive components and replace them with new, identical components to extend qualification. Consideration shall be given to time required to have the component accessible for the replacement.

This method shall not be used if the disassembly of the equipment can alter its performance in service conditions (including accident conditions).

6.3 Condition monitoring

Condition monitoring for equipment qualification purposes monitors one or more condition indicators to determine whether equipment remains in a qualified condition. The trend of the condition indicator shall be determined during age conditioning of the test specimen for qualification testing or on another similar specimen (same model, same materials, same supplier, same hardware/software, etc.) submitted to the same age conditioning tests.

The condition indicator shall be measurable, change monotonically with time, be correlated with the safety function performance under DBE conditions, be linked to the functional degradation of the qualified equipment, and have a consistent trend from unaged through the limit of the qualified pre-accident condition.

Condition indicators are dependent on technology. Such condition indicators cannot always be defined in practice, even if such indicators would be beneficial.

Condition-based qualification is an adjunct to type testing.

To use condition-based qualification, age conditioning shall be performed incrementally and condition indicators shall be measured at each increment to establish data for comparison with observations of the same indicators during service. In particular, it is required to establish the condition of the condition indicator(s) at the conclusion of age conditioning, prior to testing to accident conditions. If the qualification programme has been completed, age conditioning may be replicated on another sample by performing incremental condition indicator measurements. Since measurements for condition indicators may be taken at one temperature, additional data may be required to provide a correlation with time and temperature. Condition indicators shall be leading indicators of adverse change in condition

directly related to the ability of equipment to function and directly related to the degree of ageing performed in the programme. Measured changes shall allow distinguishing the degree of ageing and shall be consistent enough to establish a qualified condition. The method used and performance of condition monitoring shall provide for high accuracy and reproducibility. If condition data is taken during type testing, the user may choose whether to base qualification on qualified life from the traditional methodology or on condition-based results. When condition-based qualification is used, the equipment remains qualified until it reaches a point prior to the end condition that takes into account margin.

Condition monitoring shall be performed during the whole operating life by adapting periodicity. As the qualified equipment approaches the qualified condition, periodic condition monitoring may be implemented at an increased rate to determine if actual ageing is occurring at a slower rate, and if further qualified service is possible based on the condition monitoring results.

The documentation for condition-based qualification shall contain a full description of the test methods, limitations on use of the results, and the age conditioning methods used.

NOTE Methods for condition monitoring of electrical equipment important to safety in nuclear power plants are available in the IEC/IEEE 62582 series of standards.

7 Qualification program

7.1 General

The essential programme elements are described in 5.3. This clause provides additional details for these elements.

7.2 Equipment specification

7.2.1 General

Equipment specification documentation shall provide essential information about the equipment to be qualified. At a minimum, it shall contain the items specified in 7.2.2, 7.2.3, 7.2.4, 7.2.5, and 7.2.6. The documentation shall include a statement of the acceptance criteria.

7.2.2 Equipment identification

A technical description of the equipment to be qualified, including applicable performance and qualification standards, shall be provided. The description shall identify the equipment and its internal design as comprehensively as necessary and shall include required performance of the device. It shall be detailed enough to allow evaluation of the identity between the equipment which has been type tested and the installed equipment. The drawings, bill of material and details that precisely explain the components/assembly, instructions, manual, etc., shall be part of the identification details.

7.2.3 Interfaces

The interface between the electrical (seals, gaskets, penetrations) and mechanical connections shall be specified. Interfaces between electrical or mechanical equipment (e.g., mechanical coupling between a motor or valve, or electrical link between interconnected electrical equipment) shall also be considered.

Loadings at interfaces [e.g., physical attachments, mounting, auxiliary components, connectors (electrical and mechanical) to the equipment at the equipment boundary] shall be specified. Motive power or control signal inputs and outputs, and the physical manner by which they are supplied (e.g., connectors, terminal blocks), shall be specified. Control, indicating, and other auxiliary components mounted internal or external to the equipment and

required for proper operation shall be included. Material incompatibilities at interfaces shall be considered and evaluated.

7.2.4 Qualified life objective

The equipment qualified life objective of the programme shall be stated.

7.2.5 Safety function(s)

The equipment specification shall identify the equipment's safety function(s) including the required operating times (duration and number of cycles of operation).

Components not involved in the equipment's safety function(s) may be excluded from the qualification process if it can be demonstrated and documented that assumed failures, including spurious operation, have no adverse effect on any and all safety functions, have no adverse effect on the safety function of interfaced equipment, would not mislead an operator, and shall not fail in a manner as to fail other electrical equipment important to safety.

Operational performance requirements under normal, abnormal and accident conditions shall be specified. If bounding requirements are not used, the performance requirements shall be specified with respect to the location(s) in the plant where equipment will be installed. These performance characteristics may include the range of voltage, frequency, load, output accuracy and stability, response time, electromagnetic interference and other electrical characteristics, such as insulation resistance, and dielectric withstand. If the equipment specification includes design provisions, they shall be identified.

7.2.6 Service conditions

7.2.6.1 Normal and abnormal service conditions

The service conditions for the equipment shall be specified. These conditions shall include the nominal values and their expected durations, as well as extreme values and their expected durations. Examples include, but are not limited to the following:

- a) ambient pressure and temperature,
- b) relative humidity,
- c) radiation environment,
- d) seismic and non-seismic vibration,
- e) operating cycles,
- f) electrical loading and signals (voltage/current and frequency variations),
- g) condensation, chemical spray, and submergence,
- h) EMI/RFI and power surges.

7.2.6.2 Design basis event conditions

The postulated DBE conditions including specified high-energy line break, loss-of-coolant accident, main steam line break, and/or seismic events taken into account for plant design, during or after which the equipment is required to perform its safety function(s), shall be specified. Equipment shall be qualified for the duration of its operational performance requirement for each applicable DBE condition, including any required post DBE operation period.

7.2.6.3 Design extension conditions

Some equipment needs to be qualified for conditions that are beyond design basis of the plant (e.g., extended station black out, extreme natural hazards, and severe accident). For such equipment plant specific accident profile may be used for component specific qualification requirements.