

An American National Standard

IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations

Sponsor

**Nuclear Power Engineering Committee
of the
IEEE Power Engineering Stations**

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Foreword

(This Foreword is not a part of IEEE Std 323-1983, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.)

The requirements for qualification of Class 1E equipment are included in the Code of Federal Regulations. Among them are the following:

- 1) 10 CFR Part 50, Appendix B, Quality Assurance Criteria, III *Design Control*. This requires that design control measures be established and that such measures provide for verifying or checking the adequacy of design. One of the methods of design verification is *by the performance of a suitable testing program*.
- 2) 10 CFR Part 50, Appendix B, Quality Assurance Criteria, XI *Test Control*. This requires that a test program be established and that testing be performed under suitable environmental conditions. These requirements, at least in part, can be met by suitable qualifications.
- 3) 10 CFR Part 50.55 Codes and Standards, Protection System. This requires that the protection system meet the requirements set forth in ANSI/IEEE Std 279-1971 (R 1978), Criteria for Protection Systems for Nuclear Power Generating Stations, (see section 4.4).

Information pertinent to developing designs and their qualification requirements may be found in the above mentioned documents and in 10 CFR Part 50, Appendix A, General Design Criteria 1, 2, 4, and 23.

Qualification is addressed by other IEEE standards for nuclear power generating stations, for example: ANSI/IEEE Std 497-1981, Standard Criteria for Post Accident Monitoring Instrumentation for Nuclear Power Generating Stations, (see section 6.1.8), ANSI/IEEE Std 308-1980, Criteria for Class 1E Power Systems for Nuclear Power Generating Stations, 5.9, and IEEE Std 603-1980, Criteria for Safety Systems for Nuclear Power Generating Stations, (see section 4.4).

This standard is written to serve as a general standard for qualification of all types of Class 1E equipment in nuclear power generating stations. Additional guidance for qualifying specific types of equipment may be found in various equipment qualification standards that are now available or being prepared. This standard gives generic requirements and methods for qualifying Class 1E equipment. Daughter standards may include unique test requirements or methods that are not specifically discussed in this standard, but that fall within the generic requirements of this standard. The unique requirements, determined by applicable experience for the equipment covered by daughter standards, should not be construed to apply to all equipment. For example, IEEE Project 572 for Class 1E connection assemblies discusses qualification methods such as generic qualification, pacing, and ongoing qualification. These methods are not specifically discussed in this standard, but do fall within its generic requirements.

Adherence to this standard may not assure public health and safety because it is the integrated performance of the structures, fluid systems, instrumentation systems, and electrical systems of the station that limits the consequence of accidents. Each user is responsible for assuring that this standard, if used, is pertinent to his application.

Class 1E equipment in nuclear power generating stations must meet its safety functional requirements throughout its installed life. This is accomplished by a thorough program of quality assurance, design, qualification, production, transportation, storage, installation, maintenance, periodic testing, and surveillance. This standard is for the qualification portion of the program.

The user should note that while this standard covers Class 1E equipment qualification, other documents such as ANSI/IEEE Std 279-1971 (R 1978) and IEEE Std 603-1980 also require *system integrity*. Therefore, attention needs to be given to equipment performance specifications and interfaces to ensure their adequate performance in a system.

The nuclear power generating station safety analysis, in part, considers the station and its safety system design in terms of postulated service conditions including events such as submersion, hydrogen burn, radiation plate-out, etc. Inherent to each such analysis are two presumptions that must be evaluated. First, designs must be such that equipment can

actually perform designated safety functions in postulated service environments. Second, in-service aging must not degrade Class 1E equipment to the point where it cannot perform designated safety functions when required.

Production testing, normal service testing, and surveillance may not be able to determine whether the equipment is vulnerable to failure, either as a result of inadequate design or in-service time and environment because of the special environment stresses associated with some postulated service conditions included in the station safety analysis. Under these circumstances, common cause failure of redundant Class 1E equipment might occur just at the time its safety function(s) is required. It is the fundamental role of qualification to provide reasonable assurance, with due recognition given to the established technology, that design, manufacture, and age related common cause failures do not exist and that the design and manufacture are adequate to permit the equipment to perform its safety function(s) during postulated service conditions.

Synergistic effects and ionizing radiation dose-rate effects have become a concern within the industry. Preliminary results indicate that synergistic effects can be either positive or negative. Some limited work, Underwriters Laboratories, has been done, however, synergistic and ionizing radiation dose-rate effects remain the subject of research programs. Where known, such effects should be considered in developing a qualification program but are not, at this time, part of the requirements of this standard.

IEEE Std 323 was issued on a *Trial Use* basis in 1971 as the first of a series of qualification documents for electric equipment in nuclear power generating stations. It was revised and reissued as an IEEE standard in 1974. A supplement to the Foreword was issued in 1975. In late 1975 the ANSI/Nuclear Standards Management Board requested that a joint IEEE/ASME group a general qualification document for electrical and mechanical equipment. This initiated IEEE Project 627. In 1977 a joint ASME/IEEE agreement established responsibility for qualification and quality assurance standards preparation. The agreement reaffirmed that IEEE (in conjunction with ASME) was to prepare a generic qualification standard. That document is IEEE Std 627-1980, Standard for Design Qualification of Safety Systems Equipment Used in Nuclear Power Generating Stations. IEEE Std 323-1983 is the overall qualification standard for Class 1E equipment.

Electrical equipment qualified in accordance with either IEEE Std 323-1974 or IEEE Std 323-1983 will meet the requirements of IEEE Std 627-1980 which provides the basic principles for design qualification for all safety systems equipment for use in Nuclear Power Generating Stations. This revision to IEEE Std 323-1974 was made to clarify its requirements and imposes no additional requirements for qualifying Class 1E equipment.

This standard defines requirements that are adequate to qualify Class 1E equipment located in all areas of the Nuclear Power Generating Station including *harsh* and *mild* environment areas. At this time, it appears that the seismic is the only design basis event with potential for common cause failure in otherwise mild environments; however, other environmental service conditions may also be contributors.

The user of this standard should be aware that other methods to demonstrate qualification may be valid and more cost-effective than the above. Methodology should be reviewed at the time the qualification.

The working group will continue to evaluate the results of on-going research and knowledge gained from operating experience.

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