

IEEE Standard for Qualifying Class 1E Protective Relays and Auxiliaries for Nuclear Power Generating Stations

Sponsor
**Power Systems Relaying Committee
of the
IEEE Power Engineering Society**

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USA

Foreword

(This foreword is not a part of IEEE C37.105-1987, IEEE Standard for Qualifying Class 1E Protective Relays and Auxiliaries for Nuclear Power Generating Stations.)

ANSI/IEEE Std 323-1983 provides general guidance for demonstrating and documenting the adequacy of electrical equipment used in all Class 1E and interface systems. IEEE C37.105-1987 has been prepared to deal specifically with protective relays and auxiliary equipment, using ANSI/IEEE Std 323-1983 as the parent document for guidance.

Safety systems equipment in nuclear power generating stations must meet or exceed its performance requirements throughout its installed life. This is accomplished by a program of design qualification and quality assurance of design, production, installation, maintenance and surveillance. This standard is for the design qualification portion of the program only.

The nuclear power generating station safety analysis, in part, considers the station and its safety system design in terms of a set of postulated service conditions. Inherent to each such analysis are two requirements that must be evaluated to assure overall technical validity. First, designs must be such that equipment is capable of actually performing designated safety functions in postulated service environments. Second, in-service aging must not degrade safety systems equipment from its original design condition to the point where it cannot perform designated safety functions, when required.

The special environmental stresses associated with some postulated service conditions promote the possibility that 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 aging. Under these circumstances, simultaneous failure of redundant safety equipment might occur just at the time safety functions are required. It is the fundamental role of qualification to provide reasonable assurance that design and age related common failure modes do not exist and that the equipment design is adequate to permit the equipment to perform its safety function during postulated service conditions.

Adherence to this standard alone may not suffice for assuring public health and safety since it is the integrated performance of the structures, fluid systems, instrumentation systems, and electric systems of the generating station that establishes safe operating conditions. Each applicant has the responsibility to establish that this standard, if used, is pertinent to the particular requirements of the generating station of concern and that the integrated performance of the station is adequate.

This standard was prepared by Working Group II (Relay Qualified Life) of Subcommittee I (Relay Practices) of the Power Systems Relaying Committee. The members of the working group are

L. Scharf, Chair

H. J. Calhoun
D. M. Clark
R. Conrad
A. T. Giuliente

M. E. Kuczka
R. Lamothe
E. Leszczak
W. M. Mello

J. E. Waldron
M. A. Xavier

The following persons were on the balloting committee that approved this document for submission to the IEEE Standards Board:

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H. J. Calhoun	L. E. Landoll	E. F. Troy
J. W. Chadwick	J. R. Latham	J. R. Turley
D. M. Clark	W. A. Lewis	E. A. Udren
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D. H. Colwell	W. R. Lund	C. L. Wagner
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R. J. Fernandez	R. J. Moran	D. Zollman
C. M. Gadsen	W. K. Morrison	J. A. Zulaski
A. T. Giuliente	J. J. Murphy	
S. E. Grier	T. J. Murray	

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1. Scope and References

1.1 Scope

This standard describes the basic principles, requirements, and methods for qualifying Class 1E protective relays and auxiliaries such as test and control switches, terminal blocks, and indicating lamps for applications in nuclear power generating stations. When properly employed it can be used to demonstrate the design adequacy of such equipment under normal, abnormal, design basis event and post design basis event conditions in accordance with ANSI/IEEE Std 323-1983 [5].¹ When protective relays and auxiliaries are located in areas not subject to harsh environments, environmental qualification is not required.

Protective relays and auxiliaries located inside primary containment in a nuclear power generating station present special conditions beyond the scope of this document.

The qualification procedure presented is generic in nature. Other methods may be used at the discretion of the qualifier, provided the basic precepts of ANSI/IEEE Std 323-1983 [5] are satisfied.

1.2 References

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

[1] ANSI/IEEE C37.90-1978 (R1983), IEEE Standard Relays and Relay Systems Associated with Electric Power Apparatus.²

[2] ANSI/IEEE C37.98-1978, IEEE Standard Seismic Testing of Relays.

¹The numbers in brackets correspond to those of the references listed in 1.2.

²ANSI/IEEE publications are available from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, or the Service Center, The Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

- [3] ANSI/IEEE Std 43-1974 (R1985), IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
- [4] ANSI/IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms.
- [5] ANSI/IEEE Std 323-1983, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.
- [6] ANSI/IEEE Std 344-1975 (R1982), IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.
- [7] ANSI/IEEE Std 381-1977 (R1984), IEEE Standard Criteria for Type Tests of Class 1E Modules Used in Nuclear Power Generating Stations.
- [8] ANSI/IEEE Std 494-1974 (R1983), IEEE Standard Method for Identification of Documents Related to Class 1E Equipment and Systems for Nuclear Power Generating Stations.
- [9] ANSI/IEEE Std 650-1979, IEEE Class 1E Battery Chargers and Inverters for Nuclear Power Generating Stations.
- [10] ANSI/NEMA ICS-1 1983, General Standards for Industrial Controls and Systems.³
- [11] ANSI/NEMA ICS-4 1983, Terminal Blocks For Industrial Use.
- [12] ANSI/UL 508-1983, Standard for Industrial Control Equipment.
- [13] IEEE Std 101-1972, IEEE Guide for the Statistical Analysis of Thermal Life Test Data.
- [14] IEEE Std 467-1980, IEEE Standard Quality Assurance Program Requirements for the Design and Manufacture of Class 1E Instrumentation and Electric Equipment for Nuclear Power Generating Stations.
- [15] U/L 1059-1975 (R1986), Electrical Terminal Blocks.⁴

2. Purpose

The purpose of this standard is to

- 1) Define specific qualification methods for Class 1E protective relays and auxiliaries in accordance with the more general qualification requirements of ANSI/IEEE Std 323-1983 [5].
- 2) Provide guidance in establishing a program for demonstrating the design adequacy of Class 1E protective relays and auxiliaries in nuclear power generating stations applications.

Related standards such as ANSI/IEEE C37.98-1978 [2], shall be used to supplement this document.

3. Definitions

aging: The effects of operational, environmental, and system conditions on equipment during a period of time up to, but not including design basis events, or the process of simulating these effects.

³NEMA publications are available from the National Electrical Manufacturers Association, 2101 L Street, NW Washington, DC 20037.

⁴UL publications are available from the Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60020.