

An American National Standard

IEEE Standard Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations

Sponsor
**Nuclear Power Engineering Committee
of the
IEEE Power Engineering Society**

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Foreword

(This Foreword is not a part of ANSI/IEEE Std 628-1987, IEEE Standard Criteria for the Design, Installation, and Qualification of Raceway System for Class IE Circuits for Nuclear Power Generating Stations.)

This standard sets forth the minimum requirements and guidelines in the design and installation of raceway systems for Class IE circuits and describes acceptable means that can be used to demonstrate that such raceway systems are properly qualified. Although this standard asserts that raceway systems are not Class IE, it stipulates that raceway systems, including supports, are designed as seismic Category I. The supports are considered to be a structure type whose function is to restrain and provide structural stability to raceways. Guidance with respect to Class IE cable systems may be obtained by referring to ANSI/IEEE Std 690-1984, IEEE Standard for the Design and Installation of Cable Systems for Class IE Circuits in Nuclear Power Generating Stations.

The IEEE will maintain this standard current with the state of the technology.

Comments on this standard as well as suggestions for additional material that should be included in future revisions are solicited. These should be addressed to:

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The Working Group would also like to express its appreciation to the Working Group on Wire and Cable Installations, Station Design Subcommittee of the Power Generation Committee, for its contribution to this standard. Certain portions of what is now ANSI/IEEE Std 690-1984 were deleted from that document during its preparation and are now included within ANSI/IEEE Std 628-1987 because they more appropriately fall within the scope of the present document.

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IEEE Standard Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations

1. Scope

This standard contains the requirements for the design, installation, and qualification of raceway systems for Class 1E circuits external to electric equipment and components for nuclear power generating stations. Since aging and radiation have no known detrimental effects upon metallic raceway systems, and since non-metallic raceway systems are limited to underground or embedded applications, these two environmental conditions are not considered in this document. The embedments or structural members to which a support is attached are beyond the scope of this document.

2. Purpose

The purpose of this standard is to provide criteria for the minimum requirements in the selection, design, installation, and qualification of raceway systems for Class 1E circuits for nuclear power generating stations. It also prescribes methods for the structural qualification of raceway systems for Class 1E circuits.

3. Definitions

The following definitions apply specifically to the subject matter of this document.

accessories (raceway): Devices that are used to supplement the functions of raceway systems. These include such items as dropouts, covers, conduit adapters, fastening devices (items such as conduit clamps, support connections, and cable tray cover clamps), adjustable connectors, and dividers.

anchorage (raceway): The connection between the building structure and the raceway support.

cable tray: A prefabricated metal raceway with or without covers consisting of side rails and bottom support sections. Bottom support sections may be ladder, trough, or solid.

cable tray system: An assembly of metallic cable tray sections, fittings, supports, anchorages, and accessories that form a structural system to support wire and cables.

combination support: A support that serves either raceways of different types or raceway(s) and other mechanical or electric systems such as heating, ventilating, and air-conditioning (HVAC)¹ ducts, piping, and lighting fixtures.

conduit system: Any assembly of conduit sections, fittings, supports, anchorages, and accessories that form a structural system to support wire and cable.

failure (raceway): The termination of the ability of the raceway system to perform its function. The level of damage done to the raceway system is such that either collapse is imminent or an electrical circuit is interrupted or degraded to an unacceptable level, or both.

fittings (raceway): Raceway sections that are joined to other raceway sections for the purpose of coupling together or changing the size or direction of the raceway system. These include such items as couplings, elbows, tees, wyes, pulling sleeves, and pull boxes.

qualification (raceway system): Demonstration in the form of certificates of compliance, analysis reports, or testing reports that the raceway system meets the design requirements.

raceway: Any channel that is designed and used expressly for supporting wires, cables, or bus bars. Raceways consist primarily of, but are not restricted to, cable tray, conduits, and wireways.

raceway penetration: An opening for a raceway in a floor or wall to permit passage of cables from one side to the other. The raceway may or may not be continuous through the opening.

raceway system: An integrated assembly of raceways, fittings, supports, accessories, and anchorages.

support (raceway): An assembly of structural members whose function is to restrain and provide structural stability for raceways.

ultimate deformation or displacement: The maximum deformation or displacement an element can undergo without failure.

ultimate load: The maximum load an element can carry without failure as obtained from failure load tests or manufacturer's recommendations, whichever is less.

underground duct system: Metallic or non-metallic conduit enclosed in reinforced concrete or directly buried, including access points.

wireway: Sheet-metal troughs with hinged or removable covers to house and protect wires and cables external to panelboards and cabinets.

4. References

This standard shall be used in conjunction with the following publications:

- [1] ANSI C80.1-1983, American National Standard Specification for Rigid Steel Conduit, Zinc Coated.²
- [2] ANSI C80.3-1983, American National Standard Specification for Electrical Metallic Tubing, Zinc Coated.
- [3] ANSI C80.5-1983, American National Standard Specification for Rigid Aluminum Conduit.
- [4] ANSI/ACI 349-80, Code Requirements for Nuclear Safety-Related Concrete Structures.
- [5] ANSI/ASME 1986 Boiler and Pressure Vessel Code, Section 9.
- [6] ANSI/ASME NQA-1-1983, Quality Assurance Program Requirements for Nuclear Facilities.

¹For convenience and quick reference, Appendix A contains an alphabetical listing of abbreviations and acronyms used in this document.

²ANSI publications are available from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018.

- [7] ANSI/ASME NQA-2-1983, Quality Assurance Requirements, Part 2.2.
- [8] ANSI/AWS D1.1-85, Structural Welding Code—Steel.
- [9] ANSI/AWS D1.3-81, Structural Welding Code—Sheet Steel.
- [10] ANSI/IEEE Std 344-1975 (R1980), IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.
- [11] ANSI/IEEE Std 384-1981, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits.
- [12] ANSI/IEEE Std 634-1978, IEEE Standard Cable Penetration Fire Stop Qualification Test.
- [13] ANSI/IEEE Std 690-1984, IEEE Standard for the Design and Installation of Cable Systems for Class 1E Circuits in Nuclear Power Generating Stations.
- [14] ANSI/NEMA FB1-1977, Fittings and Support for Conduit and Cable Assemblies.
- [15] ANSI/NEMA TC2-1983, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- [16] ANSI/NEMA TC3-1982, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- [17] ANSI/NEMA TC6-1983, PVC and ABS Plastic Utilities Duct for Underground Installation.
- [18] ANSI/NEMA TC8-1983, Extra-Strength PVC Plastic Utilities Duct for Underground Installation.
- [19] ANSI/NFPA 70-1987, National Electrical Code.
- [20] ANSI/UL 1-1985, Safety Standard for Flexible Metal Conduit.
- [21] ANSI/UL 797-1983, Safety Standard for Electrical Metallic Tubing.
- [22] ASTM A 123-1984, Specification for Zinc (Hot-Dip) Galvanized Coatings of Iron and Steel Products.³
- [23] ASTM A 165-1980, Specification for Electro-Deposited Coatings of Cadmium on Steel.
- [24] ASTM A 525-1986, Specification for General Requirements for Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process.
- [25] ASTM B 633-1985, Specification for Electro-Deposited Coatings of Zinc on Iron and Steel.
- [26] IEEE Std 665-1987, IEEE Guide for Generation Station Grounding.⁴
- [27] NEMA TC9-1983, Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.⁵
- [28] NEMA VE1-1984, Metallic Cable Tray Systems.
- [29] UL 6-1983, Rigid Metal Electrical Conduit.⁶

³ASTM publications are available from Sales Service, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

⁴IEEE publications are available from the Sales Department, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

⁵NEMA publications are available from the National Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.

⁶UL publications are available from Publications Stock, Underwriters Laboratories, Inc, 333 Pfingston Rd, Northbrook, IL 60020.