

NFPA 496

Standard for Purged and Pressurized Enclosures for Electrical Equipment

2003 Edition



NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 496
Standard for
Purged and Pressurized Enclosures for Electrical Equipment
2003 Edition

This edition of NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*, was prepared by the Technical Committee on Electrical Equipment in Chemical Atmospheres and acted on by NFPA at its May Association Technical Meeting held May 18–21, 2003, in Dallas, TX. It was issued by the Standards Council on July 18, 2003, with an effective date of August 7, 2003, and supersedes all previous editions.

This edition of NFPA 496 was approved as an American National Standard on July 18, 2003.

Origin and Development of NFPA 496

This standard was developed in two parts by the Technical Committee on Electrical Equipment in Chemical Atmospheres. The first part, addressing purged enclosures for electrical equipment in Class I hazardous (classified) locations, was adopted as a tentative standard at the 1966 NFPA Annual Meeting and as an official standard at the 1967 NFPA Annual Meeting. The second part, addressing pressurized enclosures for electrical equipment in Class II hazardous (classified) locations, was tentatively adopted at the 1970 NFPA Annual Meeting and officially adopted at the 1971 NFPA Annual Meeting.

The Technical Committee on Electrical Equipment in Chemical Atmospheres presented a complete revision of the entire standard in 1974. In 1980, the committee began another complete revision. This work culminated in the 1982 edition.

In 1983, the Technical Committee on Electrical Equipment in Chemical Atmospheres recognized the need for specific requirements applicable to process control analyzers that have internal sources of a flammable or combustible material, such as a direct connection to the process stream. Two chapters were added to address analyzer enclosures and analyzer rooms or buildings. Additional changes were also made to certain existing portions of the text specifically to address problems in the interpretation of the existing text. The 1986 edition of NFPA 496 was the result of this effort.

In 1987, the Technical Committee on Electrical Equipment in Chemical Atmospheres recognized a need for editorial revisions to the figures in Chapter 2 as well as some minor editorial changes in Chapters 2 and 9 and Appendix A. The 1989 edition was the result of this effort.

Beginning in 1990, an ad hoc committee consisting of members of the Technical Committee on Electrical Equipment in Chemical Atmospheres started a major rewrite of this document to develop a more comprehensive standard and to reduce redundancy in the text. Definitions were added for further clarity, and references to Class III were deleted, since the standard did not cover this application and could create some confusion. References to *purging* were replaced with *pressurizing*, and *protective gas* was introduced as a new term. The requirements based on gross internal volume were deleted and replaced with general and specific requirements for all pressurized enclosures used in Class I and Class II locations. The result of this rewrite was the 1993 edition.

In 1997, the Technical Committee on Electrical Equipment in Chemical Atmospheres entered NFPA 496 in the revision cycle to update the requirements. The standard was updated to include definitions and references to Article 505 in NFPA 70, *National Electrical Code*®, which deals with Class I, Zone 1, and Zone 2 locations. It also was changed to provide an exception for control rooms where doors and other openings used solely for equipment relocation are permitted to be excluded from the calculation for outward air velocity from the central room.

In 2001, the Technical Committee on Electrical Equipment in Chemical Atmospheres entered NFPA 496 into the May 2003 revision cycle. The 2003 edition has been significantly revised and reorganized for conformance with the 2000 NFPA *Manual of Style*. These organizational and editorial changes enhance the standard's usability. Additionally, technical changes include revision of the term *alarm* to clarify its function with protected enclosures, and a revision that permits the use of a means other than a timing device to ensure that electrical equipment within a protected enclosure is not energized until the specified amount of protective gas has passed through the enclosure.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on (1) developing data on the properties of chemicals enabling proper selection of electrical equipment for use in atmospheres containing flammable gases, vapors, or dusts; (2) making recommendations for the prevention of fires and explosions through the use of continuously purged, pressurized, explosion-proof, or dust-ignition-proof electrical equipment where installed in such chemical atmospheres.

Contents

Chapter 1 Administration	496- 4	5.5 Additional Requirements for Type X Pressurizing	496- 9
1.1 Scope	496- 4	Chapter 6 Pressurized Enclosures for Class II	496- 9
1.2 Purpose	496- 4	6.1 Applicability	496- 9
1.3 Application	496- 4	6.2 General Requirements	496- 9
1.4 Equivalency	496- 4	6.3 Markings	496-10
1.5 Units of Measurement	496- 4	6.4 Marking Information	496-10
1.6 Mandatory Rules, Permissive Rules, and Explanatory Material	496- 4	6.5 Additional Requirements for Type X Pressurizing	496-10
Chapter 2 Referenced Publications	496- 4	6.6 Additional Requirements for Ventilated Equipment	496-10
2.1 General	496- 4	Chapter 7 Pressurized Control Rooms	496-10
2.2 NFPA Publication	496- 5	7.1 Applicability	496-10
2.3 Other Publications	496- 5	7.2 Protective Gas	496-10
Chapter 3 Definitions	496- 5	7.3 Considerations Relating to Positive Pressure Ventilation	496-10
3.1 General	496- 5	7.4 Requirements for Positive Pressure Air Systems	496-10
3.2 NFPA Official Definitions	496- 5	Chapter 8 Pressurized Enclosures Having an Internal Source of Flammable Gas or Vapor	496-11
3.3 General Definitions	496- 5	8.1 Applicability	496-11
3.4 NEC® Extracted Definitions	496- 5	8.2 General Requirements	496-11
Chapter 4 General Requirements for Pressurized Enclosures	496- 6	8.3 Specific Requirements	496-11
4.1 Applicability	496- 6	Chapter 9 Pressurized Analyzer Rooms Containing a Source of Flammable Gas, Vapor, or Liquid	496-12
4.2 Enclosure	496- 6	9.1 Applicability	496-12
4.3 Pressurizing System	496- 6	9.2 General	496-12
4.4 Protective Gas System	496- 6	9.3 Specific Requirements	496-13
4.5 Determination of Temperature Marking	496- 7	Annex A Explanatory Material	496-13
4.6 Ventilated Equipment	496- 7	Annex B Informational References	496-17
4.7 Power Equipment	496- 7	Index	496-19
4.8 Type Z Pressurizing	496- 7		
4.9 Type Y Pressurizing	496- 8		
4.10 Type X Pressurizing	496- 8		
4.11 Markings	496- 8		
Chapter 5 Pressurized Enclosures for Class I	496- 9		
5.1 Applicability	496- 9		
5.2 General Requirements	496- 9		
5.3 Markings	496- 9		
5.4 Additional Requirements for Type Y or Type Z Pressurizing	496- 9		

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Standard for

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the technical change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, Annex B lists the complete title and edition of the source documents for both mandatory and nonmandatory extracts. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex B.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard applies to purging and pressurizing for the following:

- (1) Electrical equipment located in areas classified as hazardous by Article 500 or Article 505 of NFPA 70
- (2) Electrical equipment containing sources of flammable vapors or gases and located in either classified or unclassified areas
- (3) Control rooms or buildings located in areas classified as hazardous by Article 500 or Article 505 of NFPA 70
- (4) Analyzer rooms containing sources of flammable vapors or gases and located in areas classified as hazardous by Article 500 or Article 505 of NFPA 70

1.1.2* This standard does not apply to electrical equipment located in:

- (1) Areas classified as Class I, Zone 0
- (2) Areas classified as Class III
- (3) Areas where flammable liquids may be splashed or spilled on the electrical equipment

1.2 Purpose. This standard provides information on the methods for purging and pressurizing enclosures to prevent ignition of a flammable atmosphere. Such an atmosphere may be introduced into the enclosure by a surrounding external atmosphere or by an internal source. By these means, electrical equipment that is not otherwise acceptable for a flammable atmosphere may be utilized in accordance with Article 500 or Article 505 of NFPA 70.

1.3 Application.

1.3.1 Chapters 4, 5, and 6 of this standard apply to electrical instrument and process control equipment, motors, motor controllers, electrical switchgear, and similar equipment that is installed in Class I or Class II locations and that does not contain an internal source of flammable vapor, gas, or liquid.

1.3.2 Chapter 7 of this standard applies to control rooms that are located in Class I or Class II locations and that do not contain an internal source of flammable vapor, gas, or liquid.

1.3.3* Chapter 8 of this standard applies to electrical instrument and process control equipment and similar enclosed equipment, such as a gas chromatograph or a gas analyzer, that does contain an internal source of flammable vapor, gas, or liquid.

1.3.4 Chapter 9 of this standard applies to analyzer rooms and buildings.

1.4 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.4.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.5 Units of Measurement.

1.5.1 SI Units. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI).

1.5.2 Compliance. Compliance with the numbers shown in either the SI system or the inch-pound system shall constitute compliance with this standard.

1.6 Mandatory Rules, Permissive Rules, and Explanatory Material.

1.6.1 Mandatory Rules. Mandatory rules of this standard are those that identify actions that are specifically required or prohibited and are characterized by the use of the terms *shall* or *shall not*.

1.6.2 Permissive Rules. Permissive rules of this standard are those that identify actions that are allowed but not required, are normally used to describe options or alternative methods, and are characterized by the use of the terms *shall be permitted* or *shall not be required*.

1.6.3 Explanatory Material. Explanatory material is located in Annex A. The information contained in Annex A is explanatory only and is not enforceable as part of this standard.

Chapter 2 Referenced Publications

2.1* General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 70, *National Electrical Code*®, 2002 edition.

2.3 Other Publications.

2.3.1 ISA Publication. ISA-Instrumentation, Systems, and Automation Society, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, NC 27709.

ANSI/ISA 12.13.01-2000, *Performance Requirements for Combustible Gas Detectors*.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not included, common usage of the terms shall apply.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.3 General Definitions.

3.3.1* Alarm. A piece of equipment that generates a visual or audible signal that is intended to attract attention.

3.3.2 Analyzer Room or Building. A specific room or building containing analyzers, one or more of which is piped to the process.

3.3.3 Enclosure Volume. The volume of the empty enclosure without internal equipment. The enclosure volume for motors, generators, and other rotating electric machinery is the volume within the enclosure minus the volume of the internal components, e.g., rotors, stators, and field coils.

3.3.4 Ignition-Capable Equipment. Equipment that, under normal operation, produces sparks, hot surfaces, or a flame that can ignite a specific flammable atmosphere.

3.3.5* Ignition Temperature. The autoignition temperature of a flammable gas or vapor or the lower of either the layer ignition temperature or cloud ignition temperature of a combustible dust.

3.3.6 Indicator. A piece of equipment that shows flows or pressure and is monitored periodically, consistent with the requirement of the application.

3.3.7 Power Equipment. Equipment that utilizes power greater than 2500 VA or switches loads greater than 2500 VA.

3.3.8 Pressurization. The process of supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber.

3.3.8.1 Type X Pressurizing. Reduces the classification within the protected enclosure from Division 1 or Zone 1 to unclassified.

3.3.8.2 Type Y Pressurizing. Reduces the classification within the protected enclosure from Division 1 to Division 2 or Zone 1 to Zone 2.

3.3.8.3 Type Z Pressurizing. Reduces the classification within the protected enclosure from Division 2 or Zone 2 to unclassified.

3.3.9* Pressurizing System. A grouping of components used to pressurize and monitor a protected enclosure.

3.3.10 Protected Enclosure. An enclosure pressurized by a protective gas.

3.3.11 Protected Equipment. The electrical equipment internal to the protected enclosure.

3.3.12 Protective Gas. The gas used to maintain pressurization or to dilute a flammable gas or vapor.

3.3.13 Protective Gas Supply. The compressor, blower, or compressed gas container that provides the protective gas at a positive pressure. The supply includes inlet (suction) pipes or ducts, pressure regulators, outlet pipes or ducts, and any supply valves not adjacent to the pressurized enclosure.

3.3.14 Purging. The process of supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level.

3.3.15* Specific Particle Density. The density of individual dust particles, as opposed to the bulk density of the material.

3.3.16 Ventilated Equipment. Equipment, such as motors, that requires airflow for heat dissipation as well as pressurization to prevent entrance of flammable gases, vapors, or dusts.

3.4 NEC® Extracted Definitions.

3.4.1 Class I, Division 1. A Class I, Division 1 location is a location: (1) In which ignitable concentrations of flammable gases or vapors can exist under normal operating conditions, or (2) In which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage, or (3) In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors and might also cause simultaneous failure of electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition. [70:500.5(B)(1)]

3.4.2 Class I, Division 2. A Class I, Division 2 location is a location: (1) In which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems or in case of abnormal operation of equipment, or (2) In which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operation of the ventilating equipment, or (3) That is adjacent to a Class I, Division 1 location, and to which ignitable concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided. [70:500.5(B)(2)]

3.4.3 Class II, Division 1. A Class II, Division 1 location is a location: (1) In which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures, or (2) Where mechanical failure or abnormal operation of machinery or equipment

might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, through operation of protection devices, or from other causes, or (3) In which combustible dusts of an electrically conductive nature may be present in hazardous quantities. [70:500.5(C)(1)]

3.4.4 Class II, Division 2. A Class II, Division 2 location is a location: (1) Where combustible dust is not normally in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, but combustible dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment and (2) Where combustible dust accumulations on, in, or in the vicinity of the electrical equipment may be sufficient to interfere with the safe dissipation of heat from electrical equipment or may be ignitable by abnormal operation or failure of electrical equipment. [70:500.5(C)(2)]

3.4.5 Class I, Zone 0. A Class I, Zone 0 location is a location in which: (1) Ignitable concentrations of flammable gases or vapors are present continuously, or (2) Ignitable concentrations of flammable gases or vapors are present for long periods of time. [70:505.5(B)(1)]

3.4.6 Class I, Zone 1. A Class I, Zone 1 location is a location: (1) In which ignitable concentrations of flammable gases or vapors are likely to exist under normal operating conditions; or (2) In which ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or (3) In which equipment is operated or processes are carried on, of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of flammable gases or vapors and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition; or (4) That is adjacent to a Class I, Zone 0 location from which ignitable concentrations of vapors could be communicated, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided. [70:505.5(B)(2)]

3.4.7 Class I, Zone 2. A Class I, Zone 2 location is a location: (1) In which ignitable concentrations of flammable gases or vapors are not likely to occur in normal operation and, if they do occur, will exist only for a short period; or (2) In which volatile flammable liquids, flammable gases, or flammable vapors are handled, processed, or used but in which the liquids, gases, or vapors normally are confined within closed containers of closed systems from which they can escape, only as a result of accidental rupture or breakdown of the containers or system, or as a result of the abnormal operation of the equipment with which the liquids or gases are handled, processed, or used; or (3) In which ignitable concentrations of flammable gases or vapors normally are prevented by positive mechanical ventilation but which may become hazardous as a result of failure or abnormal operation of the ventilation equipment; or (4) That is adjacent to a Class I, Zone 1 location, from which ignitable concentrations of flammable gases or vapors could be communicated, unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided. [70:505.5(B)(3)]

Chapter 4 General Requirements for Pressurized Enclosures

4.1 Applicability. This chapter contains the general requirements for pressurized enclosures containing electrical equipment.

4.2 Enclosure.

4.2.1 The protected enclosure, including windows, shall be constructed of material that is not likely to be damaged under the conditions to which it may be subjected.

4.2.1.1 Precautions shall be taken to protect the enclosure from excessive pressure of the protective gas supply.

4.2.1.2 Excess-pressure-relieving devices, where required to protect the enclosure in the case of a control failure, shall be designed to prevent the discharge of ignition-capable particles to a Division 1 location.

4.2.2* Normal discharge of the protective gas from a designated enclosure outlet shall be to an unclassified location, unless the discharge meets the conditions specified in 4.2.2.1 or 4.2.2.2.

4.2.2.1 The discharge shall be permitted to be to a Division 2 or Zone 2 location if the equipment does not create ignition-capable particles during normal operation.

4.2.2.2 The discharge shall be permitted to be to a Division 1 or Division 2 location or to a Zone 1 or Zone 2 location if the outlet is designed to prevent the discharge of ignition-capable particles during normal operation.

4.2.3* In Division 1 and Zone 1 locations, where the conduit or raceway entry into a pressurized enclosure is not pressurized as part of the approved protection system, an explosion-proof conduit seal shall be installed as close as practicable to, but not more than 450 mm (18 in.) from, the pressurized enclosure.

4.2.4 In Division 2 and Zone 2 locations, an explosionproof conduit seal shall not be required at the pressurized enclosure.

4.3 Pressurizing System.

4.3.1* The protected enclosure shall be constantly maintained at a positive pressure of at least 25 Pa (0.1 in. of water) above the surrounding atmosphere during operation of the protected equipment.

4.3.2 Where the protective gas supply is used to supply other than Type X pressurized equipment, an alarm shall be provided to indicate failure of the protective gas supply to maintain the required pressure.

4.3.3 All pressurizing system components that may be energized in the absence of the protective gas shall be approved for the classified location in which they are installed.

4.3.4 Installation, operating, and maintenance instructions shall be provided for the pressurizing system.

4.4 Protective Gas System.

4.4.1* The protective gas shall be essentially free of contaminants or foreign matter and shall contain no more than trace amounts of flammable vapor or gas.

4.4.1.1 All protective gas supplies shall be designed to minimize chances for contamination.