



Member of the FM Global Group

Approval Standard for Nitrogen Generators

Class Number 1035

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Foreword

The FM Approvals certification mark is intended to verify that the products and services described will meet FM Approvals' stated conditions of performance, safety and quality, useful to the ends of property conservation. The purpose of Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

- a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on surveillance audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

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1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states Approval criteria for nitrogen generators for use in dry pipe and preaction fire protection systems. Nitrogen generators provide pressurized nitrogen to the sprinkler piping to minimize interior pipe corrosion.
- 1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up program.

1.2 Scope

- 1.2.1 This standard encompasses the design and performance requirements for nitrogen generators.
- 1.2.2 Nitrogen generators may use membranes or pressure swing adsorption as the nitrogen separation mechanism. Other technologies may be evaluated on a case-by-case basis. The use of nitrogen storage bottles or plant nitrogen is allowed by FM Global, but not in the scope of this standard.
- 1.2.3 Approval Standards are intended to verify that the product described will meet stated conditions of performance, safety and quality useful to the ends of property conservation.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions, and/or loss control specialists was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of nitrogen generators for the purpose of obtaining Approval. Nitrogen generators having characteristics not anticipated by this standard may be FM Approved if performance equal, or superior, to that required by this Standard is demonstrated, or if the intent of the standard is met. Alternatively, nitrogen generators which meet all of the requirements identified in this Standard may not be FM Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

- 1.4.1 Examination and tests on production samples shall be performed to evaluate:
 - The suitability of the product;
 - The performance of the product as specified by the manufacturer and required by FM Approvals; and, as far as practical,
 - The durability and reliability of the product.
- 1.4.2 A first audit shall be conducted to evaluate the manufacturer's ability to consistently produce the product that was examined and tested as part of the Approval project. The audit shall review the facility and in-place quality control procedures used in the manufacturing of the product. Typically, areas of review are incoming inspection, work in progress, production testing, final quality control, marking, calibration of equipment, shipping procedures, and document and drawing control. These audits are repeated periodically for as long as the product remains FM Approved, as part of FM Approvals' Surveillance Audit program. (Refer to Section 5.2, Surveillance Audit Program.)

1.5 Basis for Continued Approval

- 1.5.1 Continued Approval is based upon:

- Production or availability of the product as currently FM Approved;
- The continued use of acceptable quality assurance procedures;
- Satisfactory field experience;
- Compliance with the terms stipulated in the Master Agreement;
- Satisfactory re-examination of production samples for continued conformity to requirements; and
- Satisfactory Surveillance Audits conducted as part of FM Approval's product surveillance audit program.

1.5.2 Also, as a condition of retaining Approval, manufacturers may not change an FM Approved product or service without prior authorization by FM Approvals. (Refer to Section 5.1.4 for further details regarding changes.)

1.6 Effective Date

The effective date of an Approval standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or else forfeit Approval.

The effective date of this Standard is the **Issue Date** for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in accordance with the Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing Materials (ASTM) SI10-2010, *American National Standard for Metric Practice*.

Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection and are used in this Standard.

1.8 Applicable Documents

The following standards, test methods, and practices are referenced in this standard:

American Society of Mechanical Engineers (ASME) B16.5 - 2013, *Pipe Flanges and Flanged Fittings: NPS ½ through NPS24 Metric/Inch Standard*
American National Standards Institute (ANSI)/American Water Works Association (AWWA) C606 - 2011, *Grooved and Shouldered Joints*
ASME B1.20.1 - 2013, *Pipe Threads, General Purpose (Inch)*
ASME Boiler and Pressure Vessel Code - 2013, Section VIII, Division 1 – *Rules for Construction of Pressure Vessels*
FM Global Property Loss Prevention Data Sheet 2-0 - January 2014, *Installation Guidelines for Automatic Sprinklers*
IEEE/ASTM SI 10-10, *American National Standard for Metric Practice*
International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) 17025 - 2005, *General Requirements for the Competence of Testing and Calibration Laboratories*
National Fire Protection Association (NFPA) 13, 2013 Edition, *Standard for the Installation of Sprinkler Systems*
FM Global Property Loss Prevention Data Sheet 8-29, May 2007, *Refrigerated Storage*
SAE International J10-2013, *Automotive and Off-Highway Air Brake Reservoir Performance and Identification Requirements – Truck and Bus*
Code of Federal Regulations Title 49, Section 178.61 – *Specification 4BW welded steel cylinders with electric-arc welded longitudinal seam*

1.9 Definitions

Accepted

This term refers to installations acceptable to the authority enforcing the applicable installation rules. When the authority is FM Global, such locations are termed “FM Global Accepted.” Acceptance is based upon an overall evaluation of the installation. Factors other than the use of FM Approved equipment impact upon the decision whether to accept the product. Acceptance is not a characteristic of a product. It is installation specific. A product accepted for one installation may not be acceptable elsewhere. (Contrast with ***FM Approved***.)

Air Pressure Maintenance Device

This term refers to a device that automatically maintains the air pressure within a dry pipe or pre-action sprinkler system within pre-set limits. These devices may also be used with pressurized nitrogen in a nitrogen filled system.

Bypass Mode

Most nitrogen generators can not produce enough nitrogen to completely fill the sprinkler system in 30 minutes. Therefore, they contain valves that allow the nitrogen separator to be bypassed so the system can be filled with compressed air. For the purposes of this standard the valve settings that bypass the nitrogen separator is called Bypass Mode. (Contrast with ***Nitrogen Generating Mode***)

Control Panel

The control panel is the portion of the nitrogen generator that contains the controls. Minimum requirements for the control panel are found in Section 3.2.4.

Conditioning Equipment

For the purposes of this standard, conditioning equipment refers to all filters and other devices used to condition the compressed air before it enters the nitrogen separating mechanism.

End Connections

The term “End Connections” refers to the method of connecting components of a fire protection system. Typical end connections in fire protection service are flanged, grooved, threaded, and welding end.

FM Approvals Certification Marks

The FM Approvals Certification Marks are detailed in Appendix B. Their use is mandatory on all units of FM Approved products. These registered marks cannot be used except as authorized by FM Approvals via the granting of Approval to a specific product.

FM Approved

This term refers to products FM Approved by FM Approvals. Such products are listed in the *Approval Guide*, an on-line resource of FM Approvals (see Appendix D). All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. This form obligates the manufacturer to allow re-examination of the product and surveillance audits at FM Approvals’ discretion. It further requires the manufacturer not to deviate from the as-FM Approved configuration of the product without review by and agreement of FM Approvals. Approval is product specific.

Pressure Swing Adsorption (PSA)

A method of generating nitrogen using the process of adsorption by which a thin layer of molecules temporarily adheres to the surface of another material. A PSA nitrogen generator consists of two or more towers filled with

adsorbent material. Air is drawn into one tower and oxygen adheres to the adsorbent material. The remaining atmospheric gas, which is mostly nitrogen, passes through. The towers are cycled so that waste oxygen is being “cleaned” from one tower while the other is used to produce nitrogen, and the two are switched periodically.

Membrane nitrogen generator

A method of generating nitrogen using the process of passing compressed air through a membrane. Different gases have different rates of permeation and this can be used to separate nitrogen from the other atmospheric gases. The resulting product is mostly nitrogen.

Nitrogen Generating Mode

Most nitrogen generators can not produce enough nitrogen to completely fill the sprinkler system in 30 minutes. Therefore, they contain valves that allow the nitrogen separator to be bypassed so the system can be filled with compressed air. For the purposes of this standard, the valve settings that include the nitrogen separator is called ***Nitrogen Generating Mode***. (Contrast with ***Bypass Mode***)

Purging

Purging is defined as the removal of air/nitrogen from the sprinkler system via a purge valve. The purge valve allows some gas to escape from the system, which then requires the nitrogen generator to supply nitrogen to maintain system pressure. This process therefore increases the nitrogen concentration within the system piping over time. The purge valve and any associated controls are not within the scope of this standard. The control panel may, but is not required to, accept signals from an automatic purging valve/system.

Rated Working Pressure

This is the maximum sustained pressure at or below which the device shall operate trouble free for its entire design life. This value sets the basis for the testing described in Section 4. The rated working pressure will be different for different parts of the nitrogen generator. For example, the rated working pressure of the conditioning filters would be the maximum output of the compressor, but the rated working pressure of a valve downstream of the nitrogen separator may be lower due to pressure drops between it and the compressor.

Regeneration

The process where a portion of the air flow is used to regenerate one adsorption tower, preparing it to enter a new period of operation. At atmospheric pressure the bond between the oxygen and the adsorbent material is broken and the waste oxygen can be removed.

System Pressure

The maximum output pressure the system is rated for. This pressure is chosen by the manufacturer and listed in the *Approval Guide*, an on-line resource of FM Approvals.

Sprinkler System Capacity

This capacity is listed in the *Approval Guide*, an on-line resource of FM Approvals. The nitrogen generator must be capable of producing a minimum of this volume of compressed air at 40 psi (275 kPa) in 30 minutes in bypass mode and a minimum of this volume of nitrogen at atmospheric pressure in 24 hours in nitrogen generating mode.

2. GENERAL INFORMATION

2.1 Product Information

- 2.1.1 Nitrogen generators provide compressed nitrogen to dry pipe and preaction sprinkler systems. Replacing oxygen with nitrogen minimizes the corrosion in the sprinkler system.