

Approval Standard

for

Anti-Freeze Solutions for Sprinkler Systems in Environments Subject to Freezing

Class Number 5519

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Foreword

FM Approvals are intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of FM 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 Approval shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing and/or applications shall ensure a consistently uniform and reliable product or service. FM Approval Standards strive to be performance-oriented and to facilitate technological development.

For examining equipment, materials and services, FM 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 periodic follow-up audits of the manufacturing facility or service/application.

FM Approvals LLC reserves the right in its sole judgement 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 FM Approval criteria for anti-freeze solutions for sprinkler systems in environments subject to freezing.
- 1.1.2 FM 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 anti-freeze solutions for sprinkler systems in environments subject to freezing. The maximum operating temperature of anti-freeze solutions to be considered for Approval under this Standard is 10°F (-12.2°C). Approval is limited to usage in sprinkler systems utilizing FM Approved pendant automatic sprinklers with a nominal orifice diameter of 0.93 inches (23.6 mm) or greater. The Approval of the anti-freeze solutions discussed in this Approval standard is further limited to installations using dielectric unions between steel and brass, eliminating the negative effects of galvanic corrosion in the area where these components would otherwise be in direct contact.
- 1.2.2 This standard does not attempt to prescribe performance requirements which will insure public health. Specifically, the anti-freeze solutions tested and Approved to this standard have not been examined for environmental friendliness and toxicity. As such, the user assumes responsibility for determining that all local codes and environmental requirements are satisfied as well as insuring that all elastomeric seals and gaskets used in the fire protection system are compatible with the anti-freeze solution of choice.
- 1.2.3 FM 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.
- 1.2.4 Due to the vast number of anti-freeze solutions that may be submitted, a comprehensive fixed standard for the testing of anti-freeze solutions is not possible. Since each anti-freeze solution is unique in its fire extinguishing effectiveness, toxicity, viscosity, distribution characteristics through an automatic sprinkler and other properties, specific solution requirements shall be performed on a case-by-case basis. For anti-freeze solutions not currently addressed in this standard FM Approvals will prepare a customized examination and evaluation program for the specific anti-freeze solution submitted.
- 1.2.5 Knowledge of the long term properties, particularly fluid stability and corrosive properties, of anti-freeze solutions used in sprinkler systems is somewhat limited. As such, anti-freeze solutions Approved to this standard shall be monitored in the field for a number of years in accordance with the applicable FM Global Property Loss Prevention Data Sheet. The requirements of this Approval standard may change based on the results of this monitoring.

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 anti-freeze solutions for sprinkler systems in environments subject to freezing for the purpose of obtaining FM Approval. Anti-freeze solutions for sprinkler systems in environments subject to freezing having characteristics not anticipated by this standard may be Approved if performance equal, or superior, to that required by this standard is demonstrated, or if the intent of the standard is met. Alternatively, anti-freeze solutions for sprinkler systems in environments subject to freezing that meet all of the requirements identified in this standard may not be Approved if other conditions that adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for FM Approval

FM 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 An examination of the manufacturing facilities and audit of quality control procedures shall be made to evaluate the manufacturer's ability to produce the product which was examined and tested, and the marking procedures used to identify the product. These examinations are repeated as part of FM Approvals' product follow-up program.

1.5 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the product as currently Approved;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval Agreement;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Facilities and Procedures Audits (F&PA's) conducted as part of FM Approvals' product follow-up program.

Also, as a condition of retaining Approval, manufacturers may not change a product or service without prior authorization by FM Approvals.

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 Approved under a previous edition shall comply with the new version by the effective date or forfeit Approval.

The effective date of this standard is **(August 1, 2001)** 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 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing Materials (ASTM) SI 10-97, *Standard for Use of the International System of Units (SI): The Modern Metric System*. Two units of measurement (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 listed versions of the following standards, test methods, practices and reports are referenced in this standard:

ANSI/IEEE/ASTM SI 10 – 1997, *Standard for Use of the International System of Units (SI): The Modern Metric System*.

ASTM A29 – 1999, *Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for*.

ASTM A108 – 1999, *Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality*.

ASTM B16 – 2000, *Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines*.

ASTM G1 – 1990, *Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens*.

ASTM G30 – 1997, *Standard Practice for Making and Using U-Bend Stress-Corrosion Test Specimens*.

ASTM G31 – 1999, *Standard Practice For Laboratory Immersion Corrosion Testing of Metals*.

ASTM G46 – 1994, *Standard Guide for Examination and Evaluation of Pitting Corrosion*.

Arvidson, M. and Mansson, M., “An Evaluation of Anti-Freeze for Automatic Sprinkler Systems,” Brandforsk Project 631-961, SP Swedish National Testing and Research Institute, Borås, Sweden, August 1999.

Bard, A. J. and Faulkner, L. R., “*Electromechanical Methods*,” John Wiley & Sons, 1980.

de Ris, John L., Whitbeck, Michael, and Joseph B. Hankins, “K-25 Suppression Mode Sprinkler Protection for Areas Subject to Freezing,” FM Global Research J.I. 0003004619, April 2000

FM Global Property Loss Prevention Data Sheets

Finnerty, E. F., McGill, R. L., and Slack, W. A., “Water Based Halon Replacement Sprays,” Technical Report #ARL-TR-1138, Army Research Laboratory, July 1996.

International Organization for Standardization, (ISO) 9000-1 – 1994, *Quality Management and Quality Assurance Standards – Part 1: Guidelines for Selection and Use*.

ISO 9000-2 – 1997, *Quality Management and Quality Assurance Standards – Part 2: Generic Guidelines for the Application of ISO 9001, ISO 9002 and ISO 9003*.

ISO 9001 – 1994, *Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation and Servicing*.

ISO 9002 – 1994, *Quality Systems – Model for Quality Assurance in Production, Installation and Servicing*.

ISO 9003 – 1994, *Quality Systems – Model for Quality Assurance in Final Inspection and Test*.

Macdonald, J. R., “*Impedance Spectroscopy*,” John Wiley & Sons, 1987.