

Approval Standard

Heat Detectors for
Automatic Fire Alarm
Signaling

Class Number 3210
April 2007

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Approval Standard for Heat Detectors for Automatic Fire Alarm Signaling

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Foreword

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 Approval Standards is to present the criteria for 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. Approval Standards strive to be performance-oriented and 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 Master 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 Approval requirements for Heat Detectors for Automatic Fire Alarm Signaling.
- 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 applies to heat detectors intended for use in fire alarm signaling or extinguishing system applications that operate via the transfer of convected heat energy. This standard employs test protocol dependant on the transfer of heat via convection and not that of radiated energy. The types of heat detectors normally covered by this standard include but are not limited to spot or location specific devices.
- 1.2.2 Other types of commercially available heat detectors may or may not be applicable to the test protocol described in this document.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on field experience, research and testing. 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 heat detectors for the purpose of obtaining Approval. Heat detectors 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, heat detectors 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 An examination of the manufacturing facilities and audit of quality control procedures is made to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. These examinations may be 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 FM Approved;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval report;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Facilities and Procedures Audits (F&PAs) 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 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 **July 1, 2008** 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 (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:

- NEMA 250 (2003) – Enclosures for Electrical Equipment
- ANSI/IEC 60529 (2004) – Degree of Protection Provided by Enclosures (IP Code)
- National Fire Protection Association (NFPA) 70 (2002) – National Electrical Code
- National Fire Protection Association (NFPA) 72 (2002) – National Fire Alarm Code
- FM Global Data Sheet/Operating Standard 5-48

1.9 Definitions

For purposes of this standard, the following terms apply:

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 to accept, or not to accept. 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.)

FM Approval Mark – The FM Approval Mark is detailed in Appendix B. Its use is mandatory on all Approved products for fire protection. 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 Approved by FM Approvals. Such products are listed in the FM Approval Guide. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned an Approval Agreement to FM Approvals. This agreement obligates the manufacturer to allow re-examination of the product and audit of the manufacturing facilities and procedures at the discretion of FM Approvals. It further requires the manufacturer not to deviate from the as-Approved configuration of the product without review by and agreement from FM Approvals. FM Approval is product specific.

Orientation, Best Case – The orientation of a detector relative to the air stream which results in the fastest operating time, or the lowest Response Time Index (RTI).

Orientation, Worst Case – For use in this standard, the worst case orientation of a detector relative to the air stream which results in the slowest operating time, or the highest Response Time Index (RTI). Testing shall verify that no more than a 50% variation is allowed when compared to the Best Case RTI when the detector orientation to the air stream is rotated through four 90 degree quadrants.

Response Time Index – A measure of heat detectors sensitivity expressed as $RTI = \tau (u)^{1/2}$ where τ is the time constant of the heat responsive element in units of seconds, and u is the gas velocity expressed in feet per second (or meters per second). The quantity relates the properties of the heat responsive element and the heated gas flow. RTI can be used to predict the response of a heat detector in fire environments defined in terms of gas temperature and velocity versus time. RTI is expressed in units of $(ft \cdot s)^{1/2}$ or $(m \cdot s)^{1/2}$.

Heat Detectors for Automatic Fire Alarm Signaling – An automatic, heat actuated, electrical switching device used to detect accidental fires via an abnormally high temperature. A heat detector in service is usually ceiling mounted and operates with other equipment as part of a fire alarm signaling or extinguishing system.

Heat Detector, Spot Type – A heat detector with a sensing element that is concentrated in a particular location, or spot. These devices usually fall into three categories;

Fixed Temperature Heat Detector – A heat detector that responds when the operating element of the detector reaches a specified temperature. The actual air temperature surrounding the sensing element is often much greater than the rated temperature due to thermal lag

Rate-Compensated Heat Detector – A heat detector that responds to a specified fixed temperature, regardless of the rate-of temperature rise.

Rate-of-Rise Heat Detector – A heat detector that responds when the rate-of temperature rise exceeds a specified design threshold.

Heat Detector, Line Type – A heat detector in which the “detection” capability is continuous along the entire length (or line) of the device.

Heat Detector, Heat Sensitive Cable – A Line Type of Detector that has a heat sensitive element whose characteristic (often electrical resistance) changes depending on the air temperature surrounding the cable.

Cr – Rate of Rise Temperature Activation Point – The calculated Rate-of-Temperature Rise that causes actuation in a Rate-of-Rise heat detector element when tested in accordance with the plunge tunnel guidelines described in section 4.6.1.2 of this standard.

K – Change Rate – The rate of temperature rise that the plunge tunnel is set to when measuring or defining the activation point Cr above.

Trv – Virtual Temperature Rating – The measured actuation temperature of a Rate Compensated heat detector when tested in accordance with the plunge tunnel guidelines described in section 4.6.1.3 of this standard.

1.10 References

1. October 2005 – Validation of Methods Determining Response Time Index of Rate of Rise and Rate Compensated Heat Detectors from Plunge Tunnel Test Data – S. Nam
2. June 2003 – Establishing Heat Detectors Thermal Sensitivity Index Using Plunge Tunnel Test – S. Nam
3. G. Heskestad and H.F. Smith, Investigation of a New Sprinkler Sensitivity Approval Test: The Plunge Test, FMRC, J.I. 22485, 1976
4. Response Time Index/Rate of Rise Plunge Test Tunnel by Archer Enterprises Pty Ltd – Sydney N.S.W. Australia

2. GENERAL INFORMATION

2.1 Product Information

Heat detectors fall into three (3) general categories: fixed temperature, rate-of-rise and rate compensated. They are intended to detect (respond to) changes in the temperature of the ambient air. They are installed through heat convection or the transfer of heated air to the sensing element of the detector. Other designs meeting the criteria of this standard may also be considered for Approval.

2.2 Approval Application Requirements

To apply for an Approval examination the manufacturer, or its authorized representative, should submit a request to

Electrical Group – Director
FM Approvals
1151 Boston-Providence Turnpike
PO Box 9102
Norwood, MA 02062
U.S.A.