



Examination Standard for Heat Detectors for Automatic Fire Alarm Signaling

Class Number 3210

October 2021

Foreword

This standard is 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 this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	Purpose.....	1
1.2	Scope.....	1
1.3	Basis for Requirements.....	1
1.4	Basis for Certification.....	1
1.5	Basis for Continued Certification.....	2
1.6	Effective Date.....	2
1.7	System of Units.....	2
1.8	Normative References.....	2
1.9	Term and Definitions.....	2
2	GENERAL INFORMATION.....	4
2.1	Product Information.....	4
2.2	Certification Application Requirements.....	4
2.3	Requirements for Samples for Examination.....	4
3	GENERAL REQUIREMENTS.....	5
3.1	Review of Documentation.....	5
3.2	Physical or Structural Features.....	5
3.3	Marking.....	6
3.4	Manufacturer's Installation and Operation Instructions.....	6
3.5	Calibration.....	6
4	PERFORMANCE REQUIREMENTS.....	8
4.1	Storage Temperature Pre-Conditioning.....	8
4.2	Elevated Ambient Temperature Test – (Oven Test).....	8
4.3	Humidity Tests.....	8
4.4	Set-Point Accuracy (Oven Tests) – Fixed and Rate Compensated Devices.....	8
4.5	Set-Point Accuracy (Oven Tests) – Rate-of-Rise Devices.....	8
4.6	Sensitivity Spacing Test – (Plunge Tunnel or Full Scale Fire Test).....	9
4.7	Alternate Full-Scale Spacing Test for Non-Spot Types of Heat Detection.....	12
4.8	Voltage Range.....	12
4.9	Vibration.....	12
4.10	Jarring.....	12
4.11	Dielectric Strength.....	13
4.12	Bonding.....	13
4.13	Durability.....	13
4.14	Reverse Polarity.....	13
4.15	Dust Test.....	14
4.16	Static Discharge Test.....	14
4.17	Extraneous Transients.....	14
4.18	Surge Transient Tests.....	15
4.19	Enclosure Requirements (Including Polymeric Housings).....	15
5	OPERATIONS REQUIREMENTS.....	16
5.1	Demonstrated Quality Control Program.....	16
5.2	Surveillance Audit.....	16
5.3	Installation Inspections.....	17
5.4	Manufacturer's Responsibilities.....	17

6 BIBLIOGRAPHY.....	18
APPENDIX A: Figures.....	19
APPENDIX B: Examples of RTI used for Maximum Detector Spacing.....	23
Examination Standard Addendum Number: 1 August 2011.....	25

1 INTRODUCTION

1.1 Purpose

- 1.1.1** This standard states testing and certification requirements for heat detectors for automatic fire alarm signaling.
- 1.1.2** Testing and certification criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance 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 dependent 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 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 heat detectors for the purpose of obtaining certification. Heat detectors having characteristics not anticipated by this standard may be certified if performance equal, or superior, to that required by this standard is demonstrated.

1.4 Basis for Certification

Certification 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 for certification; 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. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 Basis for Continued Certification

The basis for continual certification may include, but is not limited to, the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this certification standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this Standard is eighteen (18) months after the publication date of the standard 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. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

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 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies.

- ANSI/IEEE/ASTM SI 10 - American National Standard for Metric Practice
- ANSI/NFPA 72, National Fire Alarm & Signaling Code®
- ANSI/NEMA 250 – Enclosures for Electrical Equipment (1,000 Volts Maximum)

1.9 Term and Definitions

For purposes of this standard, the following terms apply:

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 $(\text{ft.s})^{1/2}$ or $(\text{m.s})^{1/2}$.

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.

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 certification.

2.2 Certification Application Requirements

The manufacturer shall provide the following preliminary information with any request for certification consideration:

- A complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- General assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, electrical schematics, nameplate format, brochures, sales literature, spec. sheets, installation, operation and maintenance procedures, etc.; and
- the number and location of manufacturing facilities.
- All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.

2.3 Requirements for Samples for Examination

2.3.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing based on the following:

- For functional testing described below, the manufacturer must provide a minimum quantity of 12 of each detector type which are deemed to be representative of the manufacturer's normal production regarding construction and calibration.

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production.

2.3.4 Any decision to use data generated using prototypes is at the discretion of the certification agency.

2.3.5 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the product(s).

3 GENERAL REQUIREMENTS

3.1 Review of Documentation

During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The certification investigation shall define the limits of the final certification.

3.2 Physical or Structural Features

3.2.1 Required Features

3.2.1.1 Means shall be provided to mount the detector securely and independently of the wiring.

3.2.1.2 The detector shall be capable of withstanding normal handling and installation.

3.2.1.3 Means shall be provided to identify that a detector is in alarm. If the detector is equipped with an integral alarm indicator LED, it shall be red in color.

“Exception: Resettable mechanical contact only type detectors”

3.2.1.4 Heat detectors intended for use in hazardous (classified) locations shall comply with certification requirements for hazardous (classified) location electrical equipment in addition to this standard.

3.2.1.5 The detector and enclosure shall be suitable for the intended environmental exposures as determined by testing in accordance with acceptable national, regional, or international electrical codes.

3.2.1.6 The detector shall accommodate secure wiring methods in accordance with NFPA 72.

3.2.1.7 The detector shall be compatible with a certified fire alarm control unit that will produce an alarm and a distinctive trouble signal.

3.2.1.8 Spot Type Heat Detectors shall have a Response Time Index as defined below

a) Fixed Temperature and Rate Compensated Devices – Less than $125 \text{ (ft}\cdot\text{s)}^{1/2}$ ($68 \text{ [m}\cdot\text{s)}^{1/2}$)

b) Rate of Rise Devices – Less than $1,400 \text{ (ft}\cdot\text{s)}^{1/2}$ ($770 \text{ [m}\cdot\text{s)}^{1/2}$)

c) Rate Compensated – Less than $138 \text{ (ft}\cdot\text{s)}^{1/2}$ ($76 \text{ [m}\cdot\text{s)}^{1/2}$)

3.2.1.9 Other forms of Heat Detection that cannot conform to the RTI testing parameters of this document shall have specific spacing guidelines in accordance with this standard.

3.2.1.10 Detectors rated at or above 30 V ac and 60 V dc require a proper ground terminal to be provided.

3.2.1.11 Duplicate terminals or leads, or their equivalent, shall be provided on each heat detector for the express purpose of connecting into the fire alarm system to provide supervision of the device and termination in accordance with NFPA 72 requirements.