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# **Examination Standard for Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling**

**Class Number 3260**

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# 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

<b>1 INTRODUCTION</b> .....	<b>1</b>
1.1 Purpose.....	1
1.2 Scope.....	1
1.3 Basis for Requirements.....	1
1.4 Basis for FM Approval.....	1
1.5 Basis for Continued Approval.....	2
1.6 Effective Date.....	2
1.7 System of Units.....	2
1.8 Normative References.....	2
<b>2. GENERAL INFORMATION</b> .....	<b>3</b>
2.1 Product Information.....	3
2.2 Approval Application Requirements.....	3
2.3 Requirements for Samples for Examination.....	3
<b>3. GENERAL REQUIREMENTS</b> .....	<b>5</b>
3.1. Review of Documentation.....	5
3.2. Required Features.....	5
3.3. Markings.....	5
3.4. Manufacturer’s Installation and Operation Instructions.....	6
3.5. Calibration.....	6
3.6. Installation and Maintenance.....	7
3.7. Specifications.....	7
3.8. Software Requirements.....	8
<b>4. PERFORMANCE REQUIREMENTS</b> .....	<b>9</b>
4.1. Baseline Sensitivity Test.....	9
4.2. Flame Response Sensitivity Test.....	9
4.3. False Stimuli Response Test.....	9
4.4. Field of View.....	10
4.5. Switching.....	10
4.6. Humidity Cycling and Conditioning.....	10
4.7. Voltage Range.....	11
4.8. Temperature Extremes.....	11
4.9. Vibration.....	11
4.10. Dielectric Strength.....	12
4.11. Bonding.....	12
4.12. Durability.....	12
4.13. Stability.....	12
4.14. Extraneous Transients.....	13
4.15. Surge Transient Tests.....	13
4.16. Spark/Ember Detectors.....	13
4.17. Enclosure Requirements (including Plastic housings).....	14
<b>5. OPERATIONS REQUIREMENTS</b> .....	<b>15</b>
5.1 Demonstrated Quality Control Program.....	15
5.2 Surveillance Audit.....	16
5.3 Manufacturing and Production Tests.....	16
<b>6. BIBLIOGRAPHY</b> .....	<b>16</b>

# 1 INTRODUCTION

## 1.1 Purpose

- 1.1.1 This standard states testing and certification requirements for radiant energy-sensing fire detectors used 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. Evaluation for environmental or hazardous location ratings will require additional examination per other standards such as FM Examination Standard 3600 – *Electrical Equipment for Use in Hazardous (Classified) Locations General Requirements*.

## 1.2 Scope

- 1.2.1 This standard sets performance requirements for radiant energy-sensing fire detectors for the protection of occupants, building space, structure, area, or object.

## 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 loss control specialists was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of radiant energy-sensing fire detectors for the purpose of obtaining certification. 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 facility(ies) and an audit of quality control procedures may be made to evaluate the manufacturer's ability to 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 an examination standard mandates that all products tested for certification after the effective date shall satisfy the requirements of that standard. Products certified under a previous edition shall comply with the new version by the effective date or forfeit certification.

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..

### 1.8 Normative References

The following referenced 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/UL 50 *Enclosures for Electrical Equipment*

FM 3600 *Electrical Equipment For Use In Hazardous (Classified) Locations General Requirements*

ANSI/NFPA 72 *National Fire Alarm & Signaling Code*

## 2. GENERAL INFORMATION

### 2.1 Product Information

2.1.1 Radiant energy sensing detectors fall into two (2) general categories: flame detectors and spark/ember detectors, depending upon the source of radiant energy they are intended to detect and the ambient in which they are to be used. Flame detectors are intended to respond to the radiant emissions from a flame and are expected to operate in normally illuminated environments. Spark/ember detectors are intended to respond to embers in a fuel stream flowing past them within a sheet metal pneumatic conveyance duct, chute, conveyor, or other location of limited illumination.

2.1.2 All radiant energy sensing detectors have a limited field of view and rely on a line-of-sight transmission of radiant energy from the source to the detector. Radiant energy sensing detectors employ infrared, visible, and/or ultraviolet sensors or combinations of sensors, selected to match the radiant emissions expected from the source to be detected. Since each fuel emits a unique spectra, not all detectors are capable of detecting all fuels.

### 2.2 Certification Application Requirements

2.2.1. 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;
- brochures, sales literature, specification sheets, installation, operation and maintenance procedures; and
- the number and location of manufacturing facilities.

2.2.2. 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:

- Sample requirements are to be determined by the certification agency.

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

2.3.3. The manufacturer shall submit samples representative of production. Any decision to use data generated utilizing prototypes is at the discretion of the certification agency.

2.3.4. General: for functional tests outlined below, the manufacturer shall provide at least four detectors which are deemed to be representative of the manufacturer's normal production with regard to construction and calibration. All four detectors will be subjected to the baseline, flame response sensitivity, and false alarm tests; the remainder of the tests will be spread over the four samples as outlined in Table 1.

Table 1: Test Assignments

<i>Test</i>	<i>Paragraph</i>	<i>Sample 1</i>	<i>Sample 2</i>	<i>Sample 3</i>	<i>Sample 4</i>
Baseline Sensitivity	4.1.2	x	x	x	x
Flame Response	4.2.2	x	x	x	x
False stimuli	4.3.2	x	x	x	x
Field of view	4.4.2	x			
Switching	4.5.2	x			
Humidity cycling & conditioning	4.6.2		x		
Voltage variation	4.7.2			x	
Temperature extremes	4.8.2		x		
Vibration	4.9.2			x	
Dielectric strength	4.10.2		x		
Bonding	4.11.2		x		
Durability	4.12.2				x
Stability	4.13.2				x
Extraneous transients	4.14.2				x
Surge transient tests	4.15.2				x
Spark/Ember Detector	4.16.2	x	x	x	x

### 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 examination results may further define the limits of the final certification.

#### 3.2. Required Features

- 3.2.1. Means shall be provided to mount the detector securely and independently of the wiring.
- 3.2.2. The detector shall be capable of withstanding normal handling and installation.
- 3.2.3. Means shall be provided to identify a detector in alarm. If the detector is equipped with an integral alarm indicator LED, it shall be red in color.
- 3.2.4. Radiant energy-sensing fire detectors intended for use in hazardous locations shall comply with the certification agency's requirements for hazardous location electrical equipment in addition to this standard.
- 3.2.5. 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.
- 3.2.6. The unit shall accommodate secure wiring methods in accordance with NFPA 72.
- 3.2.7. The detector shall be compatible with a certified fire alarm control unit that will produce an alarm response when the detector is in alarm and that produces a distinctive trouble signal when a power failure disables the detector.
- 3.2.8. Response may be in milliseconds; however, alarm initiation shall be no greater than 30 seconds from the initial flame exposure.
- 3.2.9. Detectors rated at or above 30 V ac and 60 V dc require a proper ground terminal to be provided.
- 3.2.10. Duplicate terminals or leads, or their equivalent, shall be provided on each radiant energy-sensing fire 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.

#### 3.3. Markings

3.3.1. Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the follow information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification
- operating voltage, electrical load ratings

When hazard warnings are needed, the markings should be universally recognizable.

3.3.2. The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.

3.3.3. The certification agency's mark of conformity shall be displayed visibly and permanently on the

product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.

**3.3.4.** All markings shall be legible and durable

### **3.4. Manufacturer's Installation and Operation Instructions**

**3.4.1.** The manufacturer shall:

- prepare instructions for the installation, maintenance, and operation of the product;
- provide facilities for repair of the product and supply replacement parts, if applicable; and
- provide services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance.

**3.4.2.** The instructions shall be reviewed for each type and model of detector submitted for certification; the instructions shall be complete and appropriate for the detector. The installation instructions or manual must be marked with a document name, number, revision, and date. The following items are required:

- Operating temperature
- Humidity
- Voltage
- Enclosure ratings
- Fuel, size of fire, distance from detector
- False alarm sources as enumerated in paragraph 4.3
- Instructions for determining detector sensitivity, e.g. calibrated test method, calibrated sensitivity test instrument.

**3.4.3.** The instructions shall be included with each detector or installation as required.

**3.4.4.** All wiring terminal designations and adjustment controls shall be clearly labeled. Instructions for connection and settings shall be included in the installation and operation manual. All field adjustments shall be in accordance with this document.

### **3.5. Calibration**

**3.5.1.** Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.

**3.5.2.** When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of this equipment.

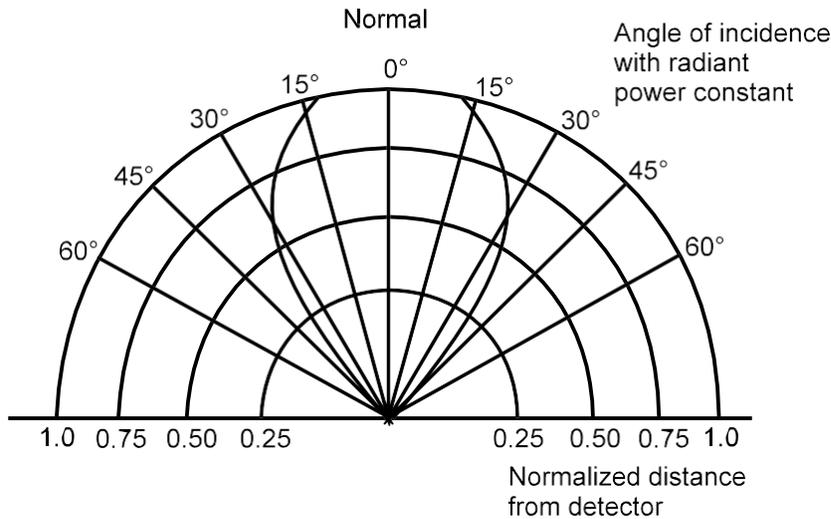
### 3.6. Installation and Maintenance

- 3.6.1. Detectors are adversely affected by accumulations of dust or other coatings on the lens or sensitive element. The product literature shall include cleaning and maintenance instructions, and stress the need for regular response tests.
- 3.6.2. The product literature shall specify a device or a readily reproducible technique for checking the response of an installed detector. The device or technique shall be evaluated during the examination of the detector for reliability, accuracy of calibration, and, if applicable, suitability for hazardous location use.
- 3.6.3. The response test shall be equivalent or proportional to the radiant emissions from the test sources (flames or embers) used to establish the sensitivity of the detector during the course of the examination. The response test shall not employ a radiator of either unknown emittance or uncontrolled distance.

### 3.7. Specifications

- 3.7.1. All manufacturer-specified sensitivities, i. e. fuel, size, distance, and response time shall be tested during the examination. The sensitivity shall be expressed as the maximum distance from the fire center at which the flame detector will give consistent alarm responses in a specified time not to exceed thirty seconds. The manufacturer shall identify the sensitivity of a flame detector to one or more of the fires defined below.
  - a) 12 x 12 in. (0.3 x 0.3 m) N-heptane pan fire;
  - b) 12 x 12 in. (0.3 x 0.3 m) alcohol (type specific) pan fire;
  - c) 5 in. (127 mm) propane flame from a 0.021 inch (0.53 mm) orifice;
  - d) 4 in. (102 mm) and/or 8 in. (203 mm) diameter pan of polypropylene pellets for wet bench applications.
- 3.7.2. For a spark/ember detector, the manufacturer shall specify the minimum size and velocity of the spark or ember of the given fuel that the detection system is to detect.

3.7.3. An algebraic, graphical or statistical description of the sensitivity of the detector shall illustrate the relationship between the distance from the fire center and time -- the average response time at a given distance throughout the specified field of view for the detector. (See example below)



3.7.4. The product literature shall specify the field of view of the radiant energy detector within which sensitivity is at least 50% of the on-axis sensitivity.

**3.8. Software Requirements**

3.8.1. For radiant energy detectors dependent on software/firmware programs for normal operation:

- All software and firmware shall be identified by release level which is clearly marked on, or capable of being displayed by, the product for ease of identification;
- All changes to software/firmware shall result in a revision to the release level;
- The operating software/firmware shall not be accessible for any changes or modifications beyond what it has been certified for; and
- Any software failure that renders the detector inoperable shall result in a trouble condition at the detector and be appropriately transmitted to the fire alarm control (e.g. watchdog timer).

## 4. PERFORMANCE REQUIREMENTS

### 4.1. Baseline Sensitivity Test

#### 4.1.1 Requirement

Certain detector samples will be subjected to a baseline sensitivity test to establish sensitivity by which the results of other tests in the program will be measured.

#### 4.1.2 Test/Verification

Each detector sample shall be subjected to a small-scale sensitivity test, specified by the manufacturer, with specified fuel, size, and distance. This will establish baseline sensitivity equivalent to the full-scale testing in the Flame Response Sensitivity testing. The results of that test will be documented and used to evaluate any deviation following those tests outlined below. A shift in measured sensitivity in response to the test conditions shall not exceed 10%. This shift is defined as a reduction in the distance to the fire center with respect to that used in the baseline sensitivity test. The sample detector must respond at a distance equal to 90% of that used for the baseline sensitivity test.

### 4.2. Flame Response Sensitivity Test

#### 4.2.1 Requirement

The flame detector shall respond to all of the manufacturer specified fires as described previously in Section 3.7.1.

#### 4.2.2 Test/Verification

The test shall be set up in an area which will minimize the effects of outside stimuli such as reflection of flame, wind conditions, and artificial lighting. At least three tests of each fuel at each specified distance shall be conducted in order to get a consistent response. Distance from the detector will be measured to the center of the pan when a pan fire is involved. Response times to each type of fire will be documented, along with the size of fire and distance from the detector to the fire.

### 4.3. False Stimuli Response Test

#### 4.3.1 Requirement

The flame detector shall respond to radiation of the intended wavelength (infrared, visible and/or ultra- violet) without false alarm due to modulated and non-modulated direct and reflected sunlight, or to various modulated and non-modulated sources of artificial light when installed in accordance with the manufacturer's instructions. The chop rate is defined in the test procedure.

#### 4.3.2 Test/Verification

The flame detector will be tested in the presence of modulated and non-modulated direct and reflected sunlight, arc welding, heated bodies such as electrical heaters, and various sources of artificial light such as incandescent, fluorescent, and halogen. The arc welding will use a 1/8 in. (0.3 cm) or 3/16 in. (0.5 cm) type 7014, 7013 or 6012 rod, 1/4 in. (0.6 cm) to 1/2 in. (1.3 cm) steel plate, and a 180-200 Ampere setting. Distances from these sources will vary according to manufacturer's claims or the type of detector. The detector will produce no trouble or false alarm signal in the presence of these false stimuli, and it will continue to respond satisfactorily to a test fire in the presence of these sources.

#### 4.4. Field of View

##### 4.4.1. Requirement

For all fuels claimed in the specifications, the flame detector will be tested to confirm the manufacturer's claims for field of view.

##### 4.4.2. Test/Verification

Tests will be conducted using at least one of the fires described in Section 3.7.1 above. Within the specified field of view, the detector response shall be at least 50% of the on-axis sensitivity (measured in units of distance) in at least four directions (left, right, up, and down).

#### 4.5. Switching

##### 4.5.1. Requirement

The detector's alarm signal to the control shall occur within the manufacturer's specified response time not to exceed 30 seconds.

##### 4.5.2. Test/Verification

A test sample shall be exposed to flame radiation, and its response shall be monitored to ensure actuation according to the manufacturer's specifications (the manufacturer's specified source may be used for the radiation source).

#### 4.6. Humidity Cycling and Conditioning

##### 4.6.1. Requirement

- a) The detector shall remain functional and produce no false indication of fire when subjected to a change from 50% relative humidity at 70°F (21°C), to 90% relative humidity at 100°F (38°C) in 15 minutes.
- b) The detector shall remain functional, with no trouble signal or change in operating characteristics, shall have less than 10% shift in measured sensitivity, and shall produce no false indication of fire when subjected to a humidity test as follows:
  - 1) For detectors intended solely for indoor dry environments, a relative humidity of 93%±2% and temperature of 90°F±3°F (32°C±2°C) for a period of 24 hours.
  - 2) For detectors intended for indoor/outdoor damp or wet environments, a relative humidity of 95%±3% and temperature of 140°F±3°F (60°C±2°C) for a period of 24 hours.

##### 4.6.2. Test/Verification

- a) After conditioning at 50% relative humidity and 70°F (21°C), the test sample shall remain functional and produce no false indication of fire when subjected to a change in environmental conditions to a relative humidity of 90% and temperature of 100°F (38°C) within 15 minutes.
- b) The test sample will be conditioned in a relative humidity and temperature as noted in paragraph 4.6.1b (above) for a period of 24 hours. There shall be no trouble signal and no false indication of fire during this exposure. At the end of the conditioning period, while still exposed to the test conditions, the sample shall be exposed to the baseline sensitivity radiation source and shall produce less than 10% shift in measured sensitivity.

#### 4.7. Voltage Range

##### 4.7.1. Requirement

The device shall produce no trouble signal or false indication of fire and less than 10% shift in measured sensitivity when operated between 85% and 110% of rated input voltage. If an absolute voltage range, beyond the 85% and 110% of nominal, is specified by the manufacturer, the unit will be tested at the extremes of the range.

##### 4.7.2. Test/Verification

The unit, with nominal rated voltage applied, shall be exposed to a flame radiation source. The input voltage shall then be varied from 85 to 110% of nominal, or the manufacturer's range (whichever is wider), and the unit again exposed to the radiation source at both of these voltage extremes. The unit shall produce less than 10% shift in measured sensitivity, no trouble signal, and no false indication of fire during these tests.

#### 4.8. Temperature Extremes

##### 4.8.1. Requirement

The device shall produce less than 10% shift in measured sensitivity, no trouble signal, and no false indication of fire following exposure to temperature extremes described below.

##### 4.8.2. Test/Verification

For indoor applications, the device shall be exposed to minimum limits of 32° and 120°F (0° and 49°C) for a period of at least 24 hours at each limit. For outdoor applications, the device shall be exposed to minimum limits of -40° to 140°F (-40° to 60°C) for at least 24 hours at each limit. The device shall then be exposed to a flame radiation source at the end of each conditioning period while still exposed to the test conditions. The unit shall produce less than 10% shift in measured sensitivity based upon flame radiation distance and shall produce no trouble signal or false indication of fire during and at the conclusion of these tests.

**Note:** DETECTORS INTENDED FOR USE AT HIGHER OR LOWER TEMPERATURES THAN THOSE SHOWN ABOVE SHALL BE TESTED AT THE SPECIFIED TEMPERATURE EXTREMES AND SPECIALLY MARKED FOR USE AT THE SPECIFIED TEMPERATURES.

#### 4.9. Vibration

##### 4.9.1. Requirement

The detector assembly, including base and mounting hardware, shall withstand the effects of vibration.

##### 4.9.2. Test/Verification

With rated input voltage applied and mounted in its intended orientation the detector shall be subjected to a 4-hour vertical vibration test of 0.02 in. (0.5 mm) total displacement at a linear frequency sweep of 10 to 30 Hz, at a sweep rate of approximately two cycles per minute. The unit shall produce no false indication of fire, no trouble signal, and less than 10% shift in measured sensitivity at the conclusion of this test. There shall be no loosening of parts or permanent deformation as a result of this test.

**4.10. Dielectric Strength****4.10.1. Requirement**

The device shall provide the required degree of protection from electrical shock.

**4.10.2. Test/Verification**

A sample detector shall successfully withstand for one minute a 60 Hz dielectric strength test of 1000 V ac plus twice the maximum rated voltage. Detectors whose voltage ratings are less than 30 V ac or 60 V dc shall successfully withstand 500 V ac or 710 V dc for one minute. The dielectric strength test shall be conducted between all applicable combinations of the following: power supply conductors, signaling circuit conductors, ground connection, other output conductors, and detector body.

**4.11. Bonding****4.11.1. Requirement**

Any accessible conductive surface which is likely to become energized in the event of a fault shall be bonded to a ground terminal with a circuit resistance of less than or equal to 1.0 ohm. This requirement applies to those radiant energy-sensing fire detectors in which the maximum voltage is greater than 30 V rms or 60 V dc. The bonding conductor(s) shall be green or green with one or more yellow stripes. The size of the bonding conductor(s) shall be at least equivalent in size to the primary circuit conductors.

**4.11.2. Test/Verification**

The detector sample shall be evaluated according to Section 4.11.1 requirements. Measurements of bonding resistance shall be made with a calibrated multimeter.

**4.12. Durability****4.12.1. Requirement**

The unit shall be tested for durability.

**4.12.2. Test/Verification**

One or more sample detectors shall be cycled through 500 power on/off cycles. Any detector susceptible to the wearing of parts (i.e., a mechanical relay) shall be cycled through 500 operate-reset functions under maximum rated load. The detector shall continue to operate and there shall be less than 10% shift in measured sensitivity based upon flame radiation distance at the conclusion of this test.

**4.13. Stability****4.13.1. Requirement**

The detector shall be able to withstand an extended period in standby operation.

**4.13.2. Test/Verification**

One or more detector samples, adjusted to maximum sensitivity, will be energized for normal standby operation in a clean-air (working-office type) atmosphere for a period of at least 30 days. There shall be no false signal nor any evidence of instability.

#### 4.14. Extraneous Transients

##### 4.14.1. Requirement

No false signal will be generated when the radiant energy detector is subjected to extraneous transients from sources which are described below.

##### 4.14.2. Test/Verification

One powered sample of the detector will be subjected to extraneous transients described below.

- a) radio frequency transmissions with radiation power levels equivalent to 5 Watts at 24 inches (0.6 m) in the 27 MHz, 150-174 MHz, 450-467 MHz, 850-870 MHz, and 900-920 MHz bands.
- b) A sequential arc (Jacob's ladder) generated between two 15 in. (0.4 m) long, No. 14 AWG (2.1 mm) solid copper conductors attached rigidly in a vertical position to the output terminals of an oil burner ignition transformer or gas tube transformer rated 120 volts, 60 hertz primary; 10,000 volts, 60 hertz, 23 mA secondary. The two wires are to be formed in a taper, starting with a 1/8 in. (3.2 mm) separation at the bottom (adjacent to terminals) and extending to 1.25 in (32 mm) at the top.
- c) operation of an electric drill rated 120 V, 60 Hz, 2.5 A.
- d) operation of a soldering gun rated 120 V, 60 Hz, 2.5 A.
- e) Operation of a 6 in (150 mm) diameter solenoid-type vibrating bell with no arc suppression and rated 24 V dc.

The detector will produce no false alarm or trouble signal in the presence of these extraneous transients, and it will respond satisfactorily to a test fire source in the presence of the extraneous transients.

#### 4.15. Surge Transient Tests

##### 4.15.1. Requirement

Protection against line surge transients will be a requirement for each submitted radiant energy detector.

##### 4.15.2. Test/Verification

One powered sample of the detector will be subjected to transient waveforms having peak levels of 100, 500, 1000, 1500, and 2400 V dc, as delivered into a 200 ohm load. This test applies to all field wiring terminals that have a possibility of being subjected to line-induced voltage (i.e., initiating device circuits, power circuits, and remote/auxiliary connections). *Exception:* Circuits specified to be 20 ft (6 m) or less in length and in conduit. The device is required to perform satisfactorily at the conclusion of the test, and it must not exhibit any instability such as alarm signals and non-self-restoring trouble signals during testing.

#### 4.16. Spark/Ember Detectors

##### 4.16.1. Requirement

The spark/ember detector must meet the minimum sensitivity requirements specified by the manufacturer using a source specified by the manufacturer.

##### 4.16.2. Test/Verification

The test must be performed in accordance with the manufacturer's instructions in a suitable environment. Testing will include response to the minimum size and velocity of the spark or ember as specified by the manufacturer. Using the manufacturer's recommended source, determine the

maximum on-axis distance at which the spark detector under test can reliably respond to the test source. Tests will be conducted to confirm the manufacturer's field of view claim. Within this field of view, the detector response shall be at least 50% of the on-axis sensitivity (measured in units of distance) in at least four directions (left, right, up, and down).

**4.17. Enclosure Requirements (including Plastic housings)**

**4.17.1. Requirement**

The detector enclosure must meet ANSI/UL 50 Type 1 enclosure ratings as a minimum for indoor applications. It is not necessary to mark the product for Type 1 enclosures. Additional claims made by the manufacturer will be verified according to appropriate enclosure classifications.

**4.17.2. Test/Verification**

The detector enclosure will be evaluated according to acceptable national, regional or international electrical codes.

## 5. OPERATIONS REQUIREMENTS

### 5.1 Demonstrated Quality Control Program

**5.1.1** A quality assurance program is required to assure that subsequent equipment produced by the manufacturer shall present the same quality and reliability as the specific equipment examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests, and is documented in the certification report
- Continued conformance to this standard is verified by the certifier's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing.

**5.1.2** The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines;
- incoming quality assurance, including testing;
- in-process quality assurance, including testing;
- final inspection and tests;
- equipment calibration;
- drawing and change control;
- packaging and shipping; and
- handling and disposition of non-conforming materials.

#### 5.1.3 Documentation/Manual

There shall be an authoritative collection of procedures/policies. It shall provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system shall require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

#### 5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

#### 5.1.5 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the certification report, must be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

## 5.2 Surveillance Audit

- 5.2.1 An audit of the manufacturing facility may be part of the certification agency's surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.
- 5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

## 5.3 Manufacturing and Production Tests

Detectors rated at 30 V rms or 60 V dc and above shall be dielectric tested on 100% of production. The power leads and/or relay terminal leads and associated circuitry shall withstand, for one minute with no insulation breakdown, the application of 1000 V ac, 60 Hz, or 1400 V dc with respect to the protective ground lead. Alternatively, test potentials 20% higher may be applied for at least one second.

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### WARNING

The dielectric test required may present a hazard of injury to personnel and/or property and should be performed only under controlled conditions, and by persons knowledgeable of the potential hazards of such testing to minimize the likelihood of shock and/or fire.

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## 6. BIBLIOGRAPHY

ANSI/NFPA 70 *National Electrical Code*  
ANSI/IEC 60529 *Degrees of Protection provided by Enclosures (IP Code)*  
ISO/IEC 17025: 2017 *General Requirements for the Competence of Testing and Calibration Laboratories*  
FM 3615 *Explosionproof Electrical Equipment General Requirements*