



*Member of the FM Global Group*

# **Approval Standard for Audible Notification Appliances for Automatic Fire Alarm Signaling**

**Class Number 3150**

**November 2003**

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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 periodic follow-up 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 FM Approval criteria for audible notification appliances (hereafter referred to as appliances) such as electrically powered bells and horns, but not speakers, used for automatic fire alarm signaling.
- 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. Evaluation for environmental or hazardous location ratings will require additional examination per other standards such as FM Approval Standard 3600 — *Electrical Equipment For Use In Hazardous (Classified) Locations*.

### 1.2 Scope

- 1.2.1 This standard sets performance requirements for electrically powered bells and horns to sound an alarm in the event of fire or other abnormal condition for the protection of occupants, building space, structure, area, or object.
- 1.2.2 FM Approval Standards are intended to verify that the product described will meet stated conditions of performance, safety and quality that are 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 national and international organizations. The advice of manufacturers, users, trade associations, jurisdictions, and loss control specialists has also been considered.
- 1.3.2 The requirements of this Standard reflect tests and practices used to examine characteristics of electrically powered bells and horns for the purpose of obtaining FM Approval. Meeting these requirements alone does not assure Approval; other factors may dominate. Appliances 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. These requirements are intended primarily as guides, and strict conformity is not always mandatory. Alternatively, appliances which do meet all the requirements identified in this standard may not be Approved if other conditions which adversely affect performance, safety and quality 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 facility(ies) and audit of quality control procedures. This examination 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 the FM Approvals' product follow-up program.

## 1.5 Basis for Continued Approval

1.5.1 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&PAs) conducted as part of the FM Approvals' product follow-up program.

1.5.2 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 January 1, 2005 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."

## 1.8 Applicable Documents

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

- NEMA 250 (1997) - Enclosures for Electrical Equipment
- IEC 60529 (1989) - 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

## 2. GENERAL INFORMATION

### 2.1 Product Information

An audible notification appliance is a fire alarm system component such as a bell or horn that provides an audible output actuated by an alarm signaling and/or fire extinguishing systems for the purpose of evacuation or relocation of the occupants or for providing information to occupants or staff.

### 2.2 Approval Application Requirements

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

Electrical Group Manager  
FM Approvals  
1151 Boston-Providence Turnpike  
Norwood, MA 02062 U. S. A.

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

- a complete list of all models, types, sizes, and options for the products or services being submitted for Approval consideration;
- brochures, sales literature, specification sheets, installation, operation and maintenance procedures; and
- the number and location of manufacturing facilities making the products submitted for Approval.

2.2.3 All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. Documents in other than the English language shall be provided with English translation.

### 2.3 Requirements for Samples for Examination

Following set-up and authorization of an Approval examination, the manufacturer shall submit samples for examination and testing. Sample requirements are to be determined by FM Approvals following review of the preliminary information. Sample requirements may vary depending on design features, results of prior testing, and results of the foregoing tests. It is the manufacturer's responsibility to submit samples representative of production. Any decision to use data generated utilizing prototypes is at the discretion of FM Approvals. Testing may be performed at FM Approvals, at a qualified manufacturer's test facility, or at a qualified third-party location, as mutually agreed.

### 3. GENERAL REQUIREMENTS

#### 3.1 Review of Documentation

During the initial investigation and prior to physical testing, the manufacturer's specifications, technical data sheets, and design details shall be reviewed to assess the ease and practicality of installation and use. The product shall be capable of being used within the limits of the Approval investigation.

#### 3.2 Physical or Structural Features

- 3.2.1 Appliances shall be mounted independently of their attachments to the circuit conductors and in accordance with the manufacturer's instructions.
- 3.2.2 The appliance shall be capable of withstanding the abuse of normal handling and installation.
- 3.2.3 Appliances intended for use in special environments, such as outdoors versus indoors, high or low temperatures, high humidity, dusty conditions, and hazardous locations shall have housing that adequately protects against the conditions of expected services.
- 3.2.4 Appliances intended for use in hazardous locations shall comply with FM Approval requirements for hazardous location electrical equipment in addition to this standard.
- 3.2.5 The appliance 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 Appliances rated at or above 30 V ac and 60 V dc require a proper ground terminal to be provided.
- 3.2.8 A terminal or lead shall be provided on each notification appliance circuit provided that the design and construction of the terminal does not permit an uninsulated section of a single conductor to be looped around the terminal and serve as two separate connections, thereby precluding supervision of the connection in the event that the wire becomes dislodged from under the terminal. A notched clamping plate under a single mounting screw is acceptable, only if separate conductors of an indicating circuit are intended to be inserted in each notch. This arrangement shall be supplemented by the following additional marking in the wiring area or on the installation wiring diagram specifying the intended connection to the terminals: "USE BOTH TERMINALS (OR LEADS) FOR CONNECTION, BREAK WIRE RUN TO PROVIDE ELECTRICAL SUPERVISION."

#### 3.3 Markings

- 3.3.1 The appliance shall be permanently and legibly marked with the manufacturer's name and address, the model designation, operating voltage, electrical load ratings, and the FM Approval Mark (see Appendix B).
- 3.3.2 The appliance shall be permanently marked to show the correct mounting position if critical to performance. *Exception:* No permanent marking is required if the correct mounting position is obvious.
- 3.3.3 The trade name or model designation shall correspond with the manufacturer's catalog designation and shall uniquely identify the product. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.

- 3.3.4 The FM Approval Mark (see Appendix B) shall be displayed visibly and permanently on the product. The manufacturer shall not use this Mark on any other product unless such product is covered by separate agreement with FM Approvals.

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

- 3.4.1 The product installation, operating, and maintenance instructions shall be reviewed for each type and model of audible notification appliance submitted for Approval; the instructions shall be complete and appropriate for the appliance. The installation instructions or manual must be marked with a document name, number, revision, and date.
- 3.4.2 The installation, operating, and maintenance instructions shall be included with each audible notification appliance shipped.

### **3.5 Calibration**

All examinations and tests performed in evaluation to this standard shall use calibrated measuring instruments traceable and certified to national standards.

## **4. PERFORMANCE REQUIREMENTS**

### **4.1 Audible Characteristics**

#### ***4.1.1 Public Mode Audible Requirements***

Audible notification appliances intended for operation in the public mode shall have a sound level of not less than 75 dBA at 10 ft (3 m) or more than 120 dBA at the minimum hearing distance from the audible appliance.

#### ***4.1.2 Private Mode Audible Requirements***

Audible notification appliances intended for operation in the private mode shall have a sound level of not less than 45 dBA at 10 ft (3 m) or more than 120 dBA at the minimum hearing distance from the audible appliance.

#### ***4.1.3 Test/Verification***

Each appliance sample shall be subjected to a sound level test to verify that the sound output for that appliance meets the requirements of 4.1.1 and 4.1.2 as applicable. The sample shall be mounted in its intended position within a semi anechoic chamber. The measurements shall be taken at a horizontal distance of 10 ft (3 m) on center using a calibrated sound pressure meter. The results shall be within  $\pm 3$  dBA of the documented manufacturer's claim. In addition, the audible appliance should produce the sound levels as described in 4.1.1 and 4.1.2 at a minimum.

## 4.2 Voltage Range

### 4.2.1 Requirement

The appliance shall operate between 85% and 110% of rated input voltage. If a specific operating voltage range is identified by the manufacturer beyond the 85% to 110% of nominal, then the unit shall be tested at the extremes of that range.

### 4.2.2 Test/Verification

Each appliance sample shall be subjected to a sound level test as described in 4.1.3 while the input power to each unit is varied from 85% to 110% of its rated input voltage, or at the extremes of the operating voltage range as described by the manufacturer.

## 4.3 Continued Operation

### 4.3.1 Requirement

The appliance shall operate properly during and after 24 hours continuous operation without undue heating or wear at any selected voltage between 85% and 110% of nominal, or the manufacturer's range (whichever is wider).

### 4.3.2 Test/Verification

A sound level test shall verify that the unit, with nominal rated voltage applied, can consistently produce at least the sound levels specified in Section 4.1 of this Standard and in accordance with manufacturer's claims after being subjected to 24 hours of continuous operation.

## 4.4 Temperature Extremes

### 4.4.1 Requirement

The appliance shall produce at least the sound levels specified in Section 4.1 of this Standard and in accordance with manufacturer's claims following exposure to temperature extremes described below.

### 4.4.2 Test/Verification

4.4.2.1 For indoor applications, the appliance 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 appliance shall be exposed to minimum limits of -40° to 120°F (-40° to 49°C) for at least 24 hours at each limit. The appliance is then to be operated at the test temperature while connected to a rated source of voltage and frequency. The unit shall produce at least the sound levels specified in Section 4.1 of this Standard and in accordance with manufacturer's claims at the conclusion of these tests.

4.4.2.2 In addition to the temperatures identified in Section 4.4.2.1, the appliance shall be exposed to 100°F (38°C) @ 90% Relative Humidity for a period of at least 24 hours. The appliance is to be operated at the test temperature while connected to a rated source of voltage and frequency. The unit shall produce at least the sound levels specified in Section 4.1 of this Standard and in accordance with manufacturer's claims at the conclusion of this test.

**Note:** APPLIANCES 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.

## 4.5 Vibration

### 4.5.1 Requirement

The appliance assembly, including housing and mounting hardware, shall withstand the effects of vibration.

### 4.5.2 Test/Verification

When energized at its rated voltage and mounted in its intended orientation, the appliance 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. There shall be no loosening of parts or permanent deformation as a result of this test.

## 4.6 Dielectric Strength

### 4.6.1 Requirement

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

### 4.6.2 Test/Verification

Within one hour following the humidity conditioning described in Section 4.4.2.2, a sample appliance shall successfully withstand for one minute a 60 Hz dielectric strength test of 1000 V ac plus twice the maximum rated voltage. Appliances 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, notification circuit conductors, ground connection, other output conductors, and appliance body.

## 4.7 Bonding

### 4.7.1 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 audible notification appliances 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.

### 4.7.2 Test/Verification

Measurements of bonding resistance, made with a calibrated multi-meter, between accessible conductive surfaces on the appliance and the Protective Ground Terminal shall be less than 1 ohm.

## 4.8 Surge Transient Tests

### 4.8.1 Requirement

Protection against line surge transients shall be a requirement for each audible notification appliance.

#### 4.8.2 Test/Verification

A powered sample appliance shall 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., notification appliance circuits, initiating appliance circuits, power circuits, and remote/auxiliary connections).

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#### EXCEPTION

*Circuits specified to be 20 ft. (6 m) or less in length and in conduit. The appliance is required to perform satisfactorily at the conclusion of the test, and it must not exhibit any instability such as false alarm signals and non-self-restoring trouble signals during testing.*

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### 4.9 Enclosure Requirements (including Plastic housings)

#### 4.9.1 Requirement

In accordance with NEMA 250-1997, the appliance enclosure constructed for indoor use must provide a degree of protection to personnel against incidental contact with the enclosed appliance and to provide a degree of protection against falling dirt. Additional claims made by the manufacturer shall be verified according to appropriate enclosure classifications.

#### 4.9.2 Test/Verification

The appliance enclosure shall be evaluated according to acceptable national, regional or international electrical codes.

## 5. OPERATIONS REQUIREMENTS

A quality control program is required to assure that subsequent audible notification appliances produced by the manufacturer at an authorized location shall present the same quality and reliability as the specific samples examined. Design quality, conformance to design, and performance are the areas of primary concern. Design quality is determined during the Approval examination and tests, and is covered in the Approval Report. Conformance to design is verified by control of quality and is covered in the Facilities and Procedures Audit (F&PA). Quality of performance is determined by field performance and by periodic re-examination and testing.

### 5.1 Demonstrated Quality Control Program

5.1.1 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
- handling and disposition of non-conformance materials.

In order to assure adequate traceability of materials and products, the manufacturer shall maintain records of all quality control tests performed, for a minimum period of two years from the date of manufacture.

#### 5.1.2 Documentation/Manual

There shall exist an authoritative collection of procedures and policies. Such documentation 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.

#### 5.1.3 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 Approval Report, must be reported to, and authorized by, FM Approvals prior to implementation for production. The manufacturer shall assign an appropriate person or group to be responsible for reporting proposed changes to Approved or Listed products to FM Approvals before implementation. The manufacturer shall notify FM Approvals of changes in the product or of persons responsible for keeping FM Approvals advised by means of FM Approvals' Form 797, *Approved Product/Specification-Tested Revision Report or Address/Main Contact Change Report*. Records of all revisions to all Approved products shall be maintained.

## 5.2 Facilities and Procedures Audit (F&PA)

- 5.2.1 An audit of the manufacturing facility is part of the Approval investigation to verify implementation of the quality control program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to insure a consistently uniform and reliable product. Inspections of facilities already producing similar Approved products may be waived at the discretion of FM Approvals.
- 5.2.2 Follow-up inspections shall be conducted once per calendar quarter by FM Approvals, or its designate, to determine continued compliance.
- 5.2.3 The client shall manufacture the product or service only at the location(s) audited by FM Approval and as specified in the Approval Report. Manufacture of products bearing the FM Approval Mark is not permitted at any other location without prior written authorization by FM Approvals.

## 5.3 Manufacturer's Responsibilities

The manufacturer shall notify and receive authorization from FM Approvals for changes in product construction, design, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation of such changes.

## 5.4 Manufacturing and Production Tests

Appliances 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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**APPENDIX A**  
**UNITS OF MEASUREMENT**

<b>LENGTH:</b>	in. – “inches” (mm – “millimeters”)  mm = in. $\times$ 25.4  ft – “feet” (m – “meters”)  m = ft $\times$ 0.3048
<b>AREA:</b>	ft <sup>2</sup> – “square feet” (m <sup>2</sup> – “square meters”)  m <sup>2</sup> = ft <sup>2</sup> $\times$ 0.0929
<b>TEMPERATURE:</b>	°F – “degrees Fahrenheit” (°C – “degrees Celsius”)  °C = (°F – 32) $\times$ 0.556
<b>FREQUENCY:</b>	Hz – “hertz” (Also the SI unit)

## APPENDIX B

### APPROVAL MARKS

#### REPRODUCTION ART: FM Approval Marks

**For use on nameplates, in literature, advertisements,  
packaging and other graphics.**



- 1) The FM Approvals diamond mark is acceptable to FM Approvals as an Approval mark when used with the word "Approved."
- 2) The FM Approval logomark has no minimum size requirement, but should always be large enough to be readily identifiable.
- 3) Color should be black on a light background or a reverse may be used on a dark background.



#### For Cast-On Marks

- 4) Where reproduction of the mark described above is impossible because of production restrictions, a modified version of the diamond is suggested. Minimum size specifications are the same as for printed marks. Use of the word "Approved" with this mark is optional.

NOTE: These Approval marks are to be used only in conjunction with products or services that have been FM Approved. The FM Approval marks should never be used in any manner (including advertising, sales or promotional purposes) that could suggest or imply FM Approval or endorsement of a specific manufacturer or distributor. Nor should it be implied that Approval extends to a product or service not covered by written agreement with FM Approvals. The Approval marks signify that products or services have met certain requirements as reported by FM Approvals.

Additional reproduction art is available through

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Norwood, Massachusetts 02062  
U.S.A.

