UL 539

STANDARD FOR SAFETY

Single and Multiple Station Heat Alarms

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL
--`,,```,,,,``-`-`,,`,,`,`,,`---
Documents
Document Sharing Hub
Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: UL 539 2017

UL Standard for Safety for Single and Multiple Station Heat Alarms, UL 539

Seventh Edition, Dated April 28, 2017

Summary of Topics

This revision of ANSI/UL 539 includes Graph Modification for Fire Test Temperature Profile.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated April 13, 2018.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of UL.

UL provides this Standard ″as is″ without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will UL be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold UL harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

No Text on This Page

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

APRIL 28, 2017
(Title Page Reprinted: May 22, 2018)

ANSI/UL 539-2018

UL 539

Standard for Single and Multiple Station Heat Alarms

The first edition was titled Fire Alarm Devices, Single and Multiple Station, Mechanically Operated Type.

The Second, Third, and Fourth editions were titled Fire Alarm Devices, Single and Multiple Station, Mechanically Operated Type.

The fifth edition was initially titled Single and Multiple Station Heat Detectors

First Edition – October, 1973
Second Edition – December, 1976
Third Edition – June, 1991
Fourth Edition – July, 1995
Fifth Edition – July, 2000
Sixth Edition – January, 2009

Seventh Edition

April 28, 2017

This ANSI/UL Standard for Safety consists of the Seventh Edition including revisions through May 22, 2018.

The most recent designation of ANSI/UL 539 as an American National Standard (ANSI) occurred on May 22, 2018. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

UL's Standards for Safety are copyrighted by UL. Neither a printed nor electronic copy of a Standard should be altered in any way. All of UL's Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of UL.

COPYRIGHT © 2018 UNDERWRITERS LABORATORIES INC.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

No Text on This Page

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

--`,,```,,,,````-`-`,,`,,`,`,,`---

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: UL 539 2017

CONTENTS

INTRODUCTION

1 Scope 7
2 Components 7
3 Units of Measurement 7
4 Undated References 8
5 Glossary 8
6 Installation and Operating Instructions 9
7 Temperature Classification 9
8 Electrically Operated Alarms 10
8.1 Alarm reliability prediction 10
8.2 Battery removal indicator 10

CONSTRUCTION

MECHANICALLY OPERATED

9 Mounting 11
10 Calibration 11
11 Materials 11
12 Operating Mechanisms 12
13 Mechanical Assembly 12
14 Power Supervisory Feature 12

ELECTRICALLY OPERATED

15 Accessories 12
16 Supplementary Signaling Features 12
17 Servicing and Maintenance Protection 13
17.1 General 13
17.2 Sharp edges 13
18 Enclosure 13
18.1 General 13
18.2 Cast metal enclosures 14
18.3 Sheet metal enclosures 15
18.4 Nonmetallic enclosures 16
18.5 Ventilating openings 16
18.6 Covers 17
18.7 Glass panels 18
18.8 Corrosion protection 18
19 Power Supply 19
19.1 Primary power supply 19
19.2 Secondary power supply 19
19.3 Batteries 20
19.4 Supplementary signaling circuits 21
20 Field Wiring 21
20.1 Permanent connection 21
20.2 Field-wiring compartment 21
20.3 Field-wiring terminals 21
20.4 Field-wiring leads 22

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL
Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017
Licensee=/, User=,
Not for Resale,

20.5 Grounded supply terminals and leads 22
20.6 Power supply cord 22
20.7 Equipment grounding 23
20.8 Remote power supply 24
21 Internal Wiring 24
21.1 General 24
21.2 Bonding for grounding 25
22 Electrical Components 26
22.1 General 26
22.2 Bushings 28
22.3 Lampholders and lamps 29
22.4 Protective devices 29
22.5 Printed-wiring boards 29
22.6 Switches 29
22.7 Transformers and coils 30
22.8 Dropping resistors 30
23 Spacings 30

PERFORMANCE

ALL ALARMS

24 General 32
25 Determination of Spacings 33
26 Oven Test 33
27 Fire Test 38
28 High Temperature Exposure Test 41
29 Corrosion Tests 42
30 Operating Temperature Test 44
31 Vibration Test 44
32 Humidity Test 45
33 Low Temperature Exposure Test 45
34 Audibility Test 45
34.1 General 45
34.2 Sound output measurement 46
34.3 Alarm Duration Test 47
34.4 Supplementary remote sounding appliances 47
35 Marking Tag Secureness Test 47
36 Normal Operation Test 47
36.1 General 47
36.2 Standardized alarm signal 48
37 Jarring Test 49
38 Effect of Shipping and Storage 50
39 Dust Test 50
40 Replacement Test, Head and Cover 50

MECHANICALLY OPERATED ALARMS

41 Endurance Test 51

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

ELECTRICALLY OPERATED ALARMS

42 Test Voltages 51
43 Electrical Supervision Test 51
43.1 General 51
43.2 AC powered units 52
43.3 Battery powered (primary or secondary) units 52
43.4 Component failure 53
43.5 External wiring 54
44 Circuit Measurement Test 54
44.1 Current input 54
44.2 Battery trouble voltage determination 54
45 Overvoltage and Undervoltage Tests 57
45.1 Overvoltage test 57
45.2 Undervoltage test 58
46 Temperature Test 58
47 Transient Tests 62
47.1 General 62
47.2 Supply line (high-voltage) transients 62
47.3 Internally induced transients 62
47.4 Extraneous transients 63
47.5 Supply line (low-voltage) circuit transients 64
48 Static Discharge Test 66
49 Abnormal Operation Test 67
50 Sensitivity Test Feature 67
51 Leakage Current Test 67
52 Dielectric Voltage-Withstand Test 69
53 Tests of Thermoplastic Materials 69
53.1 Accelerated air-oven aging test 69
53.2 Flame test (3/4 inch) 70
53.3 Flame test (5 inch) 71
54 Overload Test 72
54.1 Detector 72
54.2 Separately energized circuits 73
55 Endurance Test 73
55.1 Heat alarm 73
55.2 Separately energized circuits 73
55.3 Audible signaling appliance 74
55.4 Test means 74
56 Polarity Reversal Test 74
57 Electric Shock Current Test 74
58 Strain Relief Test 79
58.1 General 79
58.2 Power-supply cord 80
58.3 Field-wiring leads 80
59 Battery Tests 80
60 Power Supply Tests 81
60.1 General 81
60.2 Volt-amperes capacity 81
60.3 Burnout test 82
61 Conformal Coatings on Printed-Wiring Boards 82
61.1 Low voltage printed-wiring boards 82
61.2 High voltage printed-wiring boards 84

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

INSTRUCTIONS

62 General 85

MARKING

63 General 86

SUPPLEMENT SA - ELECTRONICALLY OPERATED HEAT ALARM RELIABILITY PREDICTION

SA1 Instructions for Determining a Reliability Prediction for heat Alarms SA1
SA2 Methods of Determining Failure Rate SA2
SA3 Maximum Heat Alarm Failure Rates SA11
SA4 General SA11
SA5 Quality Assurance Screening Program SA11
SA6 Determination of Failure Rate Number Supplemented by Burn-In Test SA13
SA6.1 General SA13
SA6.2 Determination sequence SA13
SA6.3 Test calculations and procedures SA16
SA6.4 Test conditions SA16
SA6.5 Failure rate number calculation SA17

APPENDIX A

A1 Test Oven A1
A1.1 Construction A1
A1.2 Test method A3

APPENDIX B

Standards for Components B1

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL
Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017
Licensee=/, User=,
Not for Resale,

INTRODUCTION

1 Scope

1.1 These requirements cover heat-actuated, single and multiple station heat alarms intended for indoor installation in accordance with the National Fire Alarm Code, NFPA 72, Chapter 11.

1.2 These requirements do not cover electrically operated single or multiple station smoke or heat alarms.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

3.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are root-mean-square (rms).

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

5.1 For the purpose of this standard the following definitions apply.

5.2 ALARM SIGNAL – An audible signal intended to indicate an emergency fire condition.

5.3 COMPONENT, LIMITED LIFE – A component that is expected to fail and be periodically replaced and whose failure is supervised. Typical examples of such components include incandescent lamps, electronic tube heaters, functional heating elements, and batteries. See also 43.4.

5.4 COMPONENT, RELIABLE – A component that is not expected to fail or be periodically replaced and is not supervised. A reliable component shall have a predicted failure rate of 2.5 or less failures per million hours.

5.5 HEAT ALARM, SINGLE STATION – A self-contained fire alarm system comprising of a heat alarm, an alarm sounding device, and a stored energy source (wound spring) incorporated in one integral package.

5.6 MECHANICALLY-OPERATED-TYPE – A heat alarm having a temperature sensitive bimetal or eutectic element and a spring-wound-type mechanism with clapper mounted within a bell housing. The snap action of the bimetal or melting of the eutectic element releases the spring mechanism resulting in a bell-type sound.

5.7 RISK OF ELECTRIC SHOCK – A risk of electric shock is determined to exist at any part, when:

a) The potential between the part and earth ground or any other accessible part is more than 42.4 volt peak and

b) The continuous current flow through a 1500 ohm resistor connected across the potential exceeds 0.5 milliampere.

5.8 RISK OF FIRE – A risk of fire is determined to exist at any point in a circuit where:

a) The open circuit voltage is more than 42.4 volt peak, and the energy available to the circuit under any condition of load, including short circuit, results in a current of 8 amperes or more after 1 minute of operation or

b) A power of more than 15 watts is deliverable into an external resistor connected between the two points.

5.9 STORY – That portion of a building included between the upper surface of a floor and upper surface of the next floor or roof above.

5.10 TROUBLE POINT – Any combination of battery voltage and series resistance that results in an audible trouble signal from a battery-operated alarm.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

5.11 TROUBLE SIGNAL – A visible or audible signal intended to indicate a fault or trouble condition, such as an open or shorted condition of a component in the device or an open or ground in the connected wiring, or depletion of the supply battery.

5.12 VOLTAGE CLASSIFICATION – Unless otherwise indicated, all voltage and current values specified in this standard are rms:

a) Extra-Low-Voltage Circuit – A circuit that has an AC voltage of not more than 30 volts alternating current (AC) (42.4 volts peak) and maximum power of 100 volt-amperes, such as supplied by a Class 2 transformer; or a circuit of not more than 30 volts direct current (DC) supplied by a primary battery; or a circuit supplied by a combination of a transformer and fixed impedance, that as a unit, complies with all the performance requirements of a Class 2 transformer. A circuit that is derived from a supply circuit of more than 30 volts by connecting resistance or impedance, or both, in series with the supply circuit to limit the voltage and current, is not identified as an extra-low-voltage circuit.

b) Hazardous-Voltage Circuit – A circuit having characteristics in excess of those of an extra-low-voltage circuit.

6 Installation and Operating Instructions

6.1 A copy of the installation and operating instructions, and related schematic wiring diagrams and installation drawings shall be used as a reference in the examination and test of the alarm. For this purpose, a printed edition is not required. The information is to be included in a homeowner's manual.

6.2 The instructions and drawings shall include such directions and information as deemed by the manufacturer to be required for proper and safe installation, testing, maintenance, operation, and use of the alarm.

7 Temperature Classification

7.1 Single and multiple station heat alarms are classified as to their temperature of operation. See Table 7.1.

Table 7.1
Temperature classifications

Temperature classification	Rating range, °F	(°C)	Maximum ceiling temperature, °F	(°C)
Low	115 – 134	(46 – 57)	90	(32)
Ordinary	135 – 174	(57 – 79)	100	(38)
Intermediate	175 – 225	(79 – 107)	150	(66)

7.2 The maximum rating of a heat alarm shall not exceed 225°F (107°C).

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL
--`,,```,,,,´´´´-`-`,,`,,`,`,,`---
Documents
Document Sharing Hub
Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: UL 539 2017

8 Electrically Operated Alarms

8.1 Alarm reliability prediction

8.1.1 The maximum failure rate for electrically operated alarm units shall be 4.0 failures per million hours as calculated by a full part stress analysis prediction as described in Section 2.0 of MIL-HDBK 217B (20 September 1974) or 3.5 failures per million hours as calculated by a simplified parts count reliability prediction as described in Section 3.0 of MIL-HDBK 217B, or equivalent. A ″Ground Fixed″ (GF) environment is to be used for all calculations. When actual equivalent data is available from the manufacturer, it shall be used in lieu of the projected data for the purpose of determining reliability.

8.1.2 Any component whose failure results in energization of an audible trouble signal, energization of a separate visual indication (orange or yellow), de-energization of a power-on light, or:

a) Does not affect the normal operation or

b) Is evaluated by specific performance tests included in this standard

does not require inclusion in the failure rate calculation. Examples include the audible signal appliance, thermostat, test switch, and battery contacts.

8.1.3 An integral or remote accessory, such as an integral transmitter or remote sounding appliance, is not required to be included in the reliability prediction except for those components whose failure affects the normal operation of the alarm.

8.1.4 A custom integrated circuit used in an alarm shall have a predicted failure rate of not greater than 2.5 failures per million hours. The failure rate is to be determined through evaluation of data in a 3000-hour burn-in test, or equivalent.

8.2 Battery removal indicator

8.2.1 Removal of a battery from a battery-operated (or AC with battery back-up) heat alarm shall result in a readily apparent and prominent visual indication. The visual indication shall consist of:

a) A warning flag that is exposed with the battery removed and the cover closed;

b) A hinged cover that is resistant to being closed with the battery removed or

c) An equivalent arrangement. (Such as an audible trouble signal on an AC with battery back-up).

8.2.2 Removal of a battery from a battery-operated (or AC with battery back-up) heat alarm that is intended to be removed from its mounting location for battery replacement, shall render the unit resistant to reinstallation.

8.2.3 When a warning flag, or equivalent, is employed to comply with the requirement of 8.2.1 or 8.2.2, it shall be marked as required in 63.2.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

CONSTRUCTION

MECHANICALLY OPERATED

9 Mounting

9.1 A heat alarm shall be provided with a means for mounting either to a ceiling or wall.

9.2 The means for mounting shall not result in any distortion of the heat alarm that alters its operating characteristics.

10 Calibration

10.1 Any means for calibration or adjustment shall be guarded or sealed to reduce the risk of manipulation by hand or ordinary tools. A thermal responsive element adjustment, if provided as part of a unit, shall not be readjustable after shipment from the factory.

10.2 A calibration means considered to be not accessible or apparent is one not exposed to manipulation by tools, or one not readily replaceable. The complete concealment of tool-engagement means in a screw, such as a slot, recessed head, and the like, by the use of solder or brazing material may be used for the purpose of reducing the risk of manipulation or replacement.

11 Materials

11.1 Diaphragms and spring parts shall be made of nonferrous material, such as phosphor bronze, nickel, silver, and the like or of ferrous materials. If ferrous materials are used, they shall be hermetically sealed or plated so as to protect against corrosion.

11.2 A heat sensing element, provided that it is used as the operating member of a heat alarm, shall be protected against conditions it is likely to be exposed to when in service, as represented by the tests described in Sections 24 – 63 of this standard.

11.3 All exposed parts whose required performance can be impaired by corrosion shall be protected by enameling, galvanizing, sherardizing, plating, or other means determined to be equivalent.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

12 Operating Mechanisms

12.1 The moving parts of a heat alarm shall have sufficient play at bearing surfaces to protect against binding.

12.2 A gear train driving spring shall be securely anchored at each end. The spring winding means shall be provided with a positive stop to limit the winding or shall withstand the maximum force likely to be applied without impairing the operation of the mechanism.

13 Mechanical Assembly

13.1 Any servicing or restoration operations intended to be made by the user shall be simple and capable of being accomplished with ordinary hand tools.

13.2 An alarm shall be so constructed that parts will not become displaced during or after installation.

13.3 An obstruction means, such as a wire mesh screen, shall be provided to protect against the entry of foreign bodies or materials into sounding devices that could prevent their operation. The maximum size of the openings shall be 1/8 inch (3.2 mm). The obstruction means is to be attached securely in place. See the Vibration Test, Section 31.

14 Power Supervisory Feature

14.1 A means shall be provided on a unit to automatically indicate that operating power is not available. The indication may be in the form of a flag, target, sight glass, change in mounting position of the heat alarm, or other means determined to be equivalent.

ELECTRICALLY OPERATED

15 Accessories

15.1 Unless specifically indicated otherwise, the construction requirements specified for an alarm shall apply also for any remote accessories with which it is to be employed.

16 Supplementary Signaling Features

16.1 A supplementary signaling feature, such as a transmitter for remote signaling, included integral with a single or multiple station heat alarm, is to be compatible with the device(s) with which it is intended to be employed, and the remote signaling device(s) shall be intended for fire alarm application.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

17 Servicing and Maintenance Protection

17.1 General

17.1.1 An uninsulated live part of a high-voltage circuit within the enclosure shall be located, guarded, or enclosed so as to minimize accidental contact by persons performing service functions suitably performed with the equipment energized.

17.1.2 An electrical component which requires examination, replacement, adjustment, servicing, or maintenance with the alarm energized shall be located and mounted with respect to other components and with respect to grounded metal so that it is accessible for such service without subjecting the user to an electric shock from adjacent uninsulated high-voltage live parts.

17.1.3 The following are not identified as uninsulated live parts:

a) Coils of relays, solenoids, and transformer windings, when the coils and windings are provided with insulating overwraps capable of being used for this purpose;

b) Terminals and splices with insulation rated for the intended application and

c) Insulated wire.

17.2 Sharp edges

17.2.1 An edge, or corner of an enclosure, opening, frame, guard, knob, handle, or other similar projection of a heat alarm shall be smooth and rounded, so as not to result in a cut-type injury when contacted during use or user maintenance.

18 Enclosure

18.1 General

18.1.1 The enclosure of an alarm shall be constructed to resist the abuses encountered in service. The degree of resistance to abuse inherent in the alarm shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other defects that, alone or in combination, present a risk of fire, electric shock, or injury to persons.

18.1.2 Enclosures for individual electrical components, outer enclosures, and combinations of the two are to be evaluated in determining compliance with the requirement of 18.1.1.

18.1.3 All electrical parts of an alarm, including a separate power supply, except for plug-in blades, shall be enclosed to provide protection against contact with uninsulated live parts. A separate enclosure for field-wiring terminals to be enclosed by a back box is not required.

18.1.4 The enclosure of an alarm shall be provided with means for mounting in the intended manner. Any fittings, such as brackets or hangers, required for mounting means shall be accessible without disassembling any operating part of the alarm. The removal of a completely assembled panel or cover to mount the alarm is not identified as disassembly of an operating part.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

18.1.5 When the unit is intended for permanent connection, the enclosure shall either have provision for the connection of metal-clad cable, conduit, or nonmetallic sheathed cable, or have provision for mounting on an outlet box.

18.2 Cast metal enclosures

18.2.1 The thickness of cast metal for an enclosure shall be as indicated in Table 18.1. When cast metal having a thickness 1/32 inch (0.8 mm) less than that indicated in Table 18.1 is employed, the surface under consideration is to be curved, ribbed, or otherwise reinforced, or the shape of the surface, size of the surface, or both, are such that equivalent mechanical strength is provided.

Table 18.1
Cast-metal enclosures

Use, or dimensions of area involved	Minimum thickness			
	Die-cast metal,		Cast metal other than die-cast,	
	inch	(mm)	inch	(mm)
Area of 24 square inches (155 cm^2) or less and having no dimension greater than 6 inches (152 mm)	1/16[a]	(1.6)	1/8	(3.2)
Area greater than 24 square inches (155 cm^2) or having any dimension greater than 6 inches (152 mm)	3/32	(2.4)	1/8	(3.2)
At a threaded conduit hole	1/4	(6.4)	1/4	(6.4)
At an unthreaded conduit hole	1/8	3.2	(1/8)	(3.2)

[a] The area limitation for metal 1/16 inch (1.6 mm) thick may be obtained by the provision of reinforcing ribs subdividing a larger area.

18.2.2 When threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, there shall not be less than 3-1/2 nor more than five threads in the metal, and the construction shall be such that a standard conduit bushing is capable of being attached.

18.2.3 When threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall not be less than 3-1/2 full threads in the metal, and there shall be a smooth, rounded inlet hole for the conductors which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

18.3 Sheet metal enclosures

18.3.1 The thickness of sheet metal used for the enclosure of an alarm shall not be less than that indicated in Table 18.2. When sheet metal of up to two gage sizes lesser thickness is used, the surface under consideration shall be curved, ribbed, or otherwise reinforced, or the shape of the surface, size of the surface, or both shall be such that equivalent mechanical strength is provided.

Table 18.2
Sheet metal enclosures

Maximum dimensions of enclosure				Minimum thickness of sheet metal								
				Steel						Brass or aluminum		
Length or width		Area		Zinc-coated			Uncoated					
inches	(mm)	inches^2	(cm^2)	inch	(mm)	GSG	inch	(mm)	MSG	inch	(mm)	AWG
12	(305)	90	(581)	0.034	(0.86)	20	0.032	(0.81)	20	0.045	(1.14)	16
24	(610)	360	(2322)	0.045	(1.14)	18	0.042	(1.07)	18	0.058	(1.47)	14
48	(1219)	1200	(7742)	0.056	(1.42)	16	0.053	(1.35)	16	0.075	(1.91)	12
60	(1524)	1500	(9678)	0.070	(1.78)	14	0.067	(1.70)	14	0.095	(2.41)	10
Over 60	(1524)	Over 1500	(9678)	0.097	(2.46)	12	0.093	(2.36)	12	0.122	(3.10)	8

18.3.2 At any point where conduit or metal-clad cable is to be attached, sheet metal shall have a thickness of not less than 0.032 inch (0.81 mm) when of uncoated steel, not less than 0.034 inch (0.86 mm) when of galvanized steel, and not less than 0.045 inch (1.14 mm) when of nonferrous metal.

18.3.3 A ferrous plate or plug closure for an unused conduit opening or other hole in the enclosure shall have a thickness not less than 0.027 (0.69 mm) or 0.032 inch (0.81 mm) nonferrous metal for a hole having a 1-3/8 inch (34.9 mm) diameter maximum dimension.

18.3.4 A closure for a hole larger than 1-3/8 inch (34.9 mm) diameter shall have a thickness equal to that required for the enclosure of the device or a standard knockout seal shall be used.

18.3.5 A knockout in a sheet metal enclosure shall be secured and shall be able to be removed without undue deformation of the enclosure.

18.3.6 A knockout shall be provided with a surrounding surface for seating of a conduit bushing, and shall be located so that installation of a bushing at any knockout used during installation does not result in spacings between uninsulated live parts and the bushing of less than those indicated in Spacings, Section 23.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

18.4 Nonmetallic enclosures

18.4.1 An enclosure or parts of an enclosure of nonmetallic material shall have the mechanical strength and durability and be formed so that operating parts are protected against damage. The mechanical strength of the enclosure shall be at least equivalent to a sheet metal enclosure of the minimum thickness specified in Table 18.2. See also the Tests of Thermoplastic Materials, Section 53.

18.4.2 The continuity of any grounding system to which an alarm is to be connected shall not rely on the dimensional integrity of the nonmetallic material.

18.4.3 Polymeric materials used for an enclosure shall comply with the following requirements:

a) Enclosures containing parts including a risk of fire - minimum flammability rating of V-0 and compliance with the Flame Test (5 inch) as described in 53.3.1 – 53.3.6.

b) Enclosures containing Class 2 and Class 3 circuits with a voltage not exceeding 30 volts AC, 42.4 volts-peak, or 60 volts DC – minimum flammability rating of HB and compliance with the Flame Test (3/4 inch), as described in 53.2.1 – 53.2.6.

c) Enclosures containing circuits powered by batteries with energy limited to 15 watts – minimum flammability rating of HB.

18.5 Ventilating openings

18.5.1 Ventilating openings in an enclosure for high-voltage circuits including perforated holes, louvers, and openings protected by means of wire screening, expanded metal, or perforated covers, shall be of such size or shape that no opening permits passage of a rod having a diameter of 9/64 inch (3.6 mm). An enclosure for a fuse(s) or other overload protective device provided with ventilating openings shall afford protection against the emission of flame or molten metal. Openings used to clean internal parts, shall be constructed to prevent damage to functional internal components during such cleaning operations.

18.5.2 Except as noted in 18.5.3, perforated sheet metal used for expanded metal mesh shall not be less than 0.042 inch (1.07 mm) in average thickness, 0.046 inch (1.17 mm) when zinc coated.

18.5.3 When the indentation of the guard or enclosure does not alter the clearance between uninsulated live parts and grounded metal so as to reduce spacings below the minimum values required [0.021 inch (0.53 mm) expanded metal mesh or perforated sheet metal, 0.024 inch (0.61 mm) when zinc coated], the following conditions shall be employed:

a) The exposed mesh on any one side or surface of the product has an area of not more than 72 square inches (465 cm^2) and has no dimension greater than 12 inches (305 mm) or

b) The width of an opening so protected is not greater than 3-1/2 inches (88.9 mm).

18.5.4 The wires forming a screen protecting high-voltage current-carrying parts shall not be smaller than AWG 16 (1.3 mm^2) and the screen openings shall not be greater than 1/2 square inch (3.2 cm^2) in area.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

18.6 Covers

18.6.1 An enclosure cover, other than the type usually employed over the sensing chamber, shall be hinged, sliding, pivoted, or similarly attached when:

a) It provides ready access to fuses or any other overcurrent protective device, the intended protective functioning of which requires renewal or

b) It is required that the cover be opened periodically in connection with the intended operation of the alarm.

For the purpose of this requirement, intended operation is determined to be operation of a switch for testing or operation of any other component of an alarm that requires such action in connection with its intended performance. This requirement does not apply to the battery replacement aspect of an alarm employing a battery as the main or standby supply.

18.6.2 A cover that is intended to be removed only for periodic cleaning of the sensing chamber shall be secured by any one of the following or equivalent means: positive snap catch, plug-in or twist action, snap tab with one screw, or two or more screws.

18.6.3 When an alarm cover is not intended to be removed for cleaning, maintenance, or both, and the alarm is intended to be returned to the factory for servicing, the cover shall be secured so that it is not readily removed. Exposed screw slots or nuts, other than a tamper-proof type, shall be sealed or covered. See 63.1(bb) for supplementary marking.

Exception: These requirements do not apply when the alarm cover is intended to be removed for cleaning, maintenance, or both, even though the alarm is intended to be returned to the manufacturer for servicing.

18.6.4 A hinged cover is not required where the only fuse(s) enclosed is intended to provide protection to portions of internal circuits, such as employed on a separate printed-wiring board or circuit subassembly, to prevent circuit damage resulting from a fault. The use of such a fuse(s) shall occur only when the word ″CAUTION″ and the following or equivalent marking is located on the cover of a alarm employing high-voltage circuits: ″Circuit Fuse(s) Inside - Disconnect Power Prior To Servicing.″

18.6.5 A hinged cover shall be provided with a latch, screw, or catch to hold it closed. An unhinged cover shall be securely held in place by screws or the equivalent.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

18.7 Glass panels

18.7.1 Glass covering an enclosure opening shall be held securely in place so that it is not capable of being displaced in service and shall provide mechanical protection of the enclosed parts. The thickness of a glass cover shall not be less than that indicated in Table 18.3.

18.7.2 A transparent material other than glass employed as a cover over an opening in an enclosure shall:

a) Be mechanically equivalent to that of glass,

b) Not distort and

c) Not become less transparent at the temperature to which it is subjected under normal or abnormal service conditions.

Table 18.3
Thickness of glass covers

Maximum size of opening				Minimum thickness	
Length or width		Area			
inches	(mm)	inches^2	(cm^2)	inch	(mm)
4	(102)	16	(103)	1/16	(1.6)
12	(305)	144	(929)	1/8	(3.2)
Over 12	(Over 305)	Over 144	(Over 929)	See footnote a	See footnote a

[a] 1/8 inch (3.2 mm) or more, based upon the size, shape, and mounting of the glass panel. A glass panel for an opening having an area greater than 144 square inches (929 cm^2), or having any dimension greater than 12 inches (305 mm), shall be supported by a continuous groove not less than 3/16 inch (4.8 mm) deep along all four edges of the panel.

18.7.3 A lens, light filter, or similar part of a heat alarm shall be constructed of a material whose transparency is not diminished by the conditions to which it is exposed in service, as represented by the Performance Tests of this standard. See Sections 24 – 61.

18.8 Corrosion protection

18.8.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means.

18.8.2 The requirement of 18.8.1 applies to all sheet steel or cast iron enclosures, and to all springs and other parts upon which mechanical operation depends. It does not apply to minor parts, such as washers, screws, bolts, and other parts, when the failure of such unprotected parts does not result in a risk of fire or electric shock or injury to persons or impair the operation of the alarm. Parts made of stainless steel, polished or treated when required, do not require additional protection. Bearing surfaces shall be of materials that prevent binding due to corrosion.

18.8.3 Metal shall not be used in combinations such as to result in galvanic action which adversely affects cabinets or enclosures.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

18.8.4 Hinges and other attachments shall be resistant to corrosion.

18.8.5 It is not prohibited for nonferrous cabinets and enclosures to be used without special corrosion protection.

19 Power Supply

19.1 Primary power supply

19.1.1 The primary power supply of a single station heat alarm shall be either a commercial light and power source available in a home or an integral battery or batteries. Connection to the commercial light and power source, when used, shall be in the form of permanent wiring to terminals or leads in a separate wiring compartment (see also 18.1.5) having provision for the connection of conduit, metal-clad or nonmetallic sheathed cable, by means of a power-supply cord and attachment-plug cap, or by means of a separate power supply.

19.1.2 When a separate power supply is provided, it shall have limited output energy consisting of an open circuit voltage not in excess of 30 volts rms, 42.4 volts peak or direct current (DC), and its output capacity shall be limited to a maximum of 100 volt-amperes. It is not prohibited for the energy to be limited by an energy limited transformer having an output rating of 100 volt-amperes or less, or by a transformer plus additional circuitry having characteristics equivalent to those of a 100 volt-amperes transformer.

19.2 Secondary power supply

19.2.1 The use of a secondary power supply is not prohibited. When a secondary power supply, such as a battery, is provided it shall have the capacity to supply the maximum intended power to the detector for 7 days in the standby condition and thereafter be able to operate the detector for an alarm signal for at least 4 minutes continuously. This capacity shall be measured using a fully charged battery or other applicable rechargeable energy storage media, or a fresh non-rechargeable battery, as appropriate. Refer to 43.3.

19.2.2 When a battery is used for the secondary power supply, it shall be of either a rechargeable or non-rechargeable type. For a rechargeable type battery, the maximum charging current, as well as the maximum trickle charging current available, shall not exceed the battery manufacturer's specifications. For a non-rechargeable type battery, data on battery life, including discharge curves, shall be provided for the investigation to evaluate battery shelf aging and performance characteristics.

19.2.3 When a non-rechargeable or rechargeable type battery is used as a secondary power supply, the marking on the unit shall include specified periodic battery replacement instructions.

19.2.4 The discharge condition of a non-rechargeable or rechargeable type battery shall be monitored where a trouble indication, as described in 43.1.3 is obtained. The monitoring shall take place whether the alarm is operating on the primary supply or on the standby supply.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

19.3 Batteries

19.3.1 General

19.3.1.1 When a battery or set of batteries is used as the main source of power of a single or multiple station heat alarm, it shall comply to the requirements of the Battery Tests, Section 59.

19.3.1.2 Batteries included as part of an alarm shall be so located and mounted that terminals of cells are prevented from coming in contact with uninsulated live parts, terminals or adjacent cells, or metal parts of the enclosure as a result of shifting.

19.3.1.3 A battery compartment intended for use with rechargeable batteries which emit gases during charging shall be provided with vent holes.

19.3.1.4 Ready access shall be available to the battery compartment to facilitate battery replacement, without damage to the alarm components or disassembly of any part of the alarm, except for a cover or the equivalent.

19.3.1.5 Connections of external wiring to a battery-operated single- or multiple-station heat alarm, or to a portable accessory, shall not be subjected to stress or motion during battery replacement, servicing, or both. Removal of the alarm or accessory from the mounting support to replace a battery or to service the unit shall occur only when the connected wiring is not subjected to flexing or stress.

19.3.2 Battery connections

19.3.2.1 Lead or terminal connections to batteries shall be identified with the proper polarity, (plus or minus signs), and provided with strain relief. It is not prohibited for the polarity to be indicated on the unit adjacent to the battery terminals or leads.

19.3.2.2 Connections to battery terminals shall be either by a lead terminating in a positive snap action type of clip, or a fixed butt type connection which applies a minimum of 1.5 pounds (6.6 N) force to each battery contact, or equivalent. The connection shall consist of an unplated or plated metal which is resistant to the corrosive action of the electrolyte.

19.3.2.3 Each lead of a clip-lead assembly used as part of a battery operated alarm shall be a minimum of AWG 22 (0.32 mm^2) stranded wire with a minimum 1/64-inch (0.4-mm) insulation.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

19.4 Supplementary signaling circuits

19.4.1 For a cord-connected or battery operated single station alarm employing a supplementary signaling circuit which is energized from a separate source of supply, the source of energy shall not exceed the energy limits defined in Section 60, Power Supply Tests.

19.4.2 For an alarm intended to be connected to a fixed wiring system and employing a separately energized signaling circuit, the source of energy shall not exceed the limits in Section 60, Power Supply Tests, unless the connections are made as a Class 1 wiring system as defined in the National Electrical Code, ANSI/NFPA 70.

20 Field Wiring

20.1 Permanent connection

20.1.1 General

20.1.1.1 A single station or multiple station heat alarm intended for permanent connection shall be provided with wiring terminals or leads for the connection of conductors of at least the size required by the National Electrical Code, ANSI/NFPA 70, corresponding to the rating of the unit.

20.2 Field-wiring compartment

20.2.1 The field-wiring compartment area is to be sized for completing all field-wiring connections as specified by the installation wiring diagram. There shall be space within the compartment to permit the use of a standard conduit bushing on conduit connected to the compartment when a bushing is required for installation.

20.2.2 Protection for internal components and wire insulation from sharp edges shall be provided by insulating barriers or metal barriers having smooth rounded edges, or by protection that has been determined to be the equivalent.

20.3 Field-wiring terminals

20.3.1 Terminal parts to which field connections are to be made shall consist of binding screws with terminal plates having upturned lugs or the equivalent to hold the wires in position. Other terminal connections when provided shall be found to be equivalent.

20.3.2 When a wiring-binding screw is employed at a field-wiring terminal, the screw shall not be smaller than a No. 6 (3.5 mm diameter).

20.3.3 Except as noted in 20.3.4, a terminal plate tapped for a wire-binding screw shall be of metal not less than 0.030 inch (0.76 mm) thick and shall not have less than two full threads in the metal.

20.3.4 It is not prohibited for a terminal plate to have the metal extruded at the tapped hole for the binding screw so as to provide two full threads. Other constructions, when employed, shall provide equivalent security.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

20.4 Field-wiring leads

20.4.1 Power supply leads provided for field connection shall not be less than 6 inches (152 mm) long; shall be provided with strain relief; and shall not be smaller than AWG 18 (0.82 mm^2). The insulation, when of rubber or thermoplastic, shall not be less than 1/32 inch (0.8 mm) thick.

20.4.2 Leads provided for field connection to power limited fire protective signaling circuits, such as employed for multiple station interconnection or for connection to remote signaling devices, shall not be smaller than AWG 16 (1.3 mm^2) for a single conductor, AWG 19 (0.65 mm^2) for two or more conductors, and AWG 22 (0.32 mm^2) for four or more conductors of a multi-conductor cable. The conductor shall be solid, bunch tinned stranded, or stranded copper. Stranded copper wire, consisting of not more than seven strands, shall be used only for AWG 18 (0.82 mm^2) and larger conductors.

20.5 Grounded supply terminals and leads

20.5.1 A field-wiring terminal for the connection of a grounded supply conductor shall be identified by means of a metallic plated coating substantially white in color and shall be readily distinguishable from the other terminals, or proper identification of the terminal for the connection of the grounded conductor shall be clearly shown in some other manner, such as on an attached wiring diagram.

20.5.2 A field-wiring lead provided for connection of a grounded supply conductor shall be finished to show a white or natural gray color and shall be readily distinguishable from other leads. No other leads, other than grounded conductors, shall be so identified.

20.5.3 A terminal or lead identified for the connection of the grounded supply conductor shall not be electrically connected to a single-pole manual switching device that has an OFF position or to a single-pole overcurrent (not thermal) protective device.

20.6 Power supply cord

20.6.1 A cord-connected single station heat alarm shall be provided with not less than 6 feet (1.83 m) nor more than 20 feet (6.10 m) of flexible cord and a two or three prong attachment plug of the type and rating for connection to the supply circuit.

20.6.2 The flexible cord shall be of Type SP-1, SPT-1, SP-2, SPT-2, SV, SVT, SJ, SJT, SPE, SVE, or equivalent, minimum AWG 18 (0.82 mm^2). It shall be rated for use at the voltage and ampacity rating of the detector, in accordance with the National Electrical Code, ANSI/NFPA 70.

20.6.3 Means shall be provided to prevent the flexible cord from being pushed into the enclosure through the cord-entry hole when it is possible for such displacement to:

a) Subject the cord to mechanical damage or to exposure to a temperature higher than that for which the cord is rated,

b) Reduce spacings below the minimum required values or

c) Result in damage in internal components.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

20.6.4 A smoothly rounded restraining means shall be provided for securing the attachment plug to the receptacle. The means shall withstand for 1 minute a pull of 5 pounds force (22.25 N) while installed as intended in service without any evidence of damage to the connection.

20.7 Equipment grounding

20.7.1 General

20.7.1.1 An equipment grounding terminal or lead, or equivalent, is required for a hazardous-voltage alarm provided with an overall nonmetallic enclosure and cover that:

a) Is intended to be serviced internally and

b) Employs internal dead metal parts that become energized under a fault condition.

20.7.1.2 An equipment grounding terminal or lead is not required for:

a) An extra-low-voltage alarm;

b) A hazardous-voltage alarm provided with an overall nonmetallic enclosure and cover, and that is not intended to be internally serviced or

c) A hazardous-voltage alarm provided with an overall nonmetallic enclosure and cover, where internal dead metal parts are not capable of either being energized under a fault condition nor being contacted during servicing.

20.7.2 Permanently connected units

20.7.2.1 The surface of an insulated lead intended solely for the connection of an equipment-grounding conductor shall be green, with or without one or more yellow stripes. No other leads visible to the installer, other than grounding conductors, shall be so identified. A field-wiring terminal intended for connection of an equipment-grounding conductor shall be plainly identified, such as being marked ″G,″ ″GR,″ ″Ground,″ ″Grounding,″ or the equivalent, or by a marking on a wiring diagram provided on the alarm. The field-wiring terminal shall be located so that it shall not be removed during servicing of the alarm.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

20.7.3 Cord connected units

20.7.3.1 The grounding means for a cord-connected alarm, having an overall nonmetallic enclosure and cover, that is intended to be serviced internally shall consist of a separate grounding lead integral with the supply cord and terminating in the grounding pin of a parallel blade attachment-plug cap.

20.8 Remote power supply

20.8.1 For an alarm that is intended to be connected to a separate remote power supply such as a transformer, the supply cord is not required to be factory wired to the alarm, or to the transformer terminals or leads, when the installation instructions provided with the unit are explicit regarding the method of connection. The minimum size conductors between the alarm and remote power supply shall not be less than AWG 18 (0.82 mm^2) and shall not be longer than 20 feet (6.1 m). The interconnecting wiring is to be provided with the alarm and the transformer by the manufacturer.

20.8.2 Where longer runs of interconnecting wiring are used in an installation, such as in a multiple station configuration, or where several alarms are supplied by a common power supply, the wiring is not required to be provided by the manufacturer. However, the installation wiring diagram or instructions shall be marked to specify that the wiring to be used shall be in accordance with the provisions of Articles 210 and 3003 (B) of the National Electrical Code, ANSI/NFPA 70. In addition, the resistance of the interconnecting wiring shall be a maximum of 10 ohms, unless otherwise specified by the manufacturer.

21 Internal Wiring

21.1 General

21.1.1 The internal wiring of an alarm shall consist of conductors having insulation rated for the potential involved and the temperatures to which it is subjected, and shall have the mechanical strength and current-carrying capacity for the service. The wiring shall be routed away from moving parts and sharp projections and held in place with clamps, string, ties, or equivalent, unless of rigidity that retains a shaped form.

21.1.2 Leads, or a cable assembly, connected to parts mounted on a hinged cover shall be of a length to permit the full opening of the cover without applying stress to the leads or their connections. The leads shall be secured or equivalently arranged to prevent abrasion of insulation and jamming between parts of the enclosure.

21.1.3 When the use of a short length of insulated conductor is not possible, such as for a short coil lead, electrical insulating tubing shall be employed. The tubing shall not be subjected to sharp bends, tension, compression, or repeated flexing, and shall not contact sharp edges, projections, or corners. The wall thickness of the tubing shall comply to the requirements for such tubing, except that the wall thickness at any point for polyvinyl chloride tubing of 3/8 inch (9.5 mm) diameter or less, shall not be less than 0.017 inch (0.43 mm). For insulating tubing of other types the wall thickness shall not be less than that required to at least equal the mechanical strength, dielectric properties, and heat and moisture resistance characteristics of polyvinyl chloride tubing having a wall thickness of 0.017 inch (0.43 mm).

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

21.1.4 Internal wiring of circuits operating at different potentials shall be separated by barriers or shall be segregated, unless the conductors of the circuits of lower voltage are provided with insulation equivalent to that required for the highest voltage involved. Segregation of insulated conductors shall be accomplished by clamping, routing, or equivalent means that provides permanent separation.

21.1.5 Stranded conductors clamped under wire-binding screws, or similar parts, shall have the individual strands soldered together or be equivalently arranged, to provide reliable connections.

21.1.6 Wireways shall be smooth and free from sharp edges, burrs, fins, and moving parts to avoid the possibility of abrasion of the conductor insulation.

21.1.7 All splices and connections shall be mechanically secured to preclude shorting to adjacent uninsulated current carrying parts in the event that an improper connection, such as a cold solder joint, is made.

21.1.8 A splice shall be provided with insulation equivalent to that of the wires involved, when permanence of electrical spacing between the splice and uninsulated metal parts is not assured.

21.1.9 Splices shall be located, enclosed, and supported so that flexing, movement, or vibration shall not damage the insulation or affect the integrity of the splice.

21.1.10 A metal barrier shall have a thickness at least equal to that required by Table 18.1, as determined by the size of the barrier. A barrier of insulating material shall not be less than 0.028 inch (0.71 mm) thick and shall be thicker when its deformation is readily accomplished so as to defeat its purpose. Any clearance between the edge of a barrier and a compartment wall shall not exceed 1/16 inch (1.6 mm).

21.2 Bonding for grounding

21.2.1 An exposed dead metal part of a hazardous-voltage alarm that becomes energized shall be bonded to the point of connection of the field-equipment grounding terminal or lead, when provided or required, and to the metal surrounding the knockout, hole, or bushing provided for field power-supply connections.

21.2.2 Uninsulated metal parts of electrical enclosures, transformer cores, mounting brackets, capacitors, and other electrical components are to be bonded for grounding when there is a possibility that they be contacted by the user or by a serviceman servicing or operating the equipment.

21.2.3 Metal parts as described below are not required to comply with the requirement of 21.2.2.

a) Adhesive attached metal foil markings, screws, handles, or similar items that are located on the outside of the alarm enclosure and isolated from electrical components or wiring by grounded metal parts so that they do not become energized.

b) Isolated metal parts, such as small assembly screws, that are positively separated from wiring and uninsulated live parts.

c) Panels and covers that do not enclose uninsulated live parts, when wiring is positively separated from the panel or cover so that it does not become energized.

d) Panels and covers that are insulated from electrical components and wiring by an insulating barrier of vulcanized fiber, varnished cloth, phenolic composition, or similar material not less than 1/32 inch (0.8 mm) thick and secured in place.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

21.2.4 A bonding conductor shall be of material capable of being used as an electrical conductor. When of ferrous metal, it shall be protected against corrosion by painting, plating, or the equivalent. The conductor shall not be smaller than the maximum size wire employed in the circuit wiring of the component or part. A separate bonding conductor or strap shall be installed in such a manner that it is protected from mechanical damage.

21.2.5 The bonding shall be by a positive means, such as by clamping, riveting, bolted or screwed connection, brazing, or welding or soldering of a mechanically secured component. The bonding connection shall penetrate nonconductive coatings such as paint. Bonding around a resilient mount shall not rely on the clamping action of rubber or similar material.

21.2.6 A bolted or screwed connection, that incorporates a star washer under the screwhead, is capable of being used for penetrating nonconductive coatings.

21.2.7 When the bonding means relies upon screw threads, two or more screws, or two full threads of a single screw, engaging metal is appropriate for use.

21.2.8 Metal-to-metal hinge-bearing members for doors or covers shall not be used as a means for bonding the door or cover for grounding unless a multiple bearing-pin type hinge is employed.

21.2.9 Splices shall not be employed in conductors used to bond electrical enclosures or components.

22 Electrical Components

22.1 General

22.1.1 Mounting of components

22.1.1.1 A switch, lampholder, attachment-plug receptacle, plug connector, or similar electrical component, and uninsulated live parts shall be mounted securely and shall be prevented from turning.

Exception No. 1: It is not required that a switch be prevented from turning when all four of the following conditions are met:

a) The switch is a plunger or other type that does not tend to rotate when operated. A toggle switch is determined to be subject to forces that tend to turn the switch during operation of the switch.

b) The means for mounting the switch shall be such that the operation of the switch loosens it.

c) The spacings are not reduced below the minimum required values when the switch rotates.

d) The operation of the switch is by mechanical means rather than by direct contact by persons.

Exception No. 2: It is not required that a lampholder of the type in which the lamp is not capable of being replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel be prevented from turning when rotation does not reduce spacings below the minimum values required. See Spacings, Section 23.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL
Documents
Document Sharing Hub
Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017
Licensee=/, User=,
Not for Resale,

22.1.1.2 Uninsulated live parts shall be secured to the base or mounting surface so that they are prevented from turning or shifting in position, where such motion results in the possibility of a reduction of spacings. Friction between surfaces shall not be relied upon as a means to prevent shifting or turning of live parts. A properly applied lock washer is accepted.

22.1.1.3 Uninsulated live parts, for example, field-wiring terminals, shall be secured to their supporting surfaces by methods other than friction between surfaces so that they are prevented from turning or shifting in position when such motion results in reduction of spacings below the minimum values required. This shall be accomplished by two screws or rivets; by square shoulders or mortises; by a dowel pin, lug, or offset; by a connecting strap or clip fitted into an adjacent part; or by an equivalent method.

22.1.2 Operating components

22.1.2.1 Operating components and assemblies, such as switches, relays, and similar devices, shall be protected by individual dust covers or dust tight cabinets, against the possibility of impaired operation due to dust or other material.

22.1.2.2 Adjusting screws and similar adjustable parts shall be prevented from loosening under the conditions of actual use. The use of a properly applied lock washer to prevent loosening is accepted.

22.1.3 Current-carrying parts

22.1.3.1 A current-carrying part shall be of metal such as silver, copper or copper alloy, or equivalent material.

22.1.3.2 Bearings, hinges, and other similar parts are not to be used for carrying current between fixed and moving parts.

22.1.4 Electrical insulating material

22.1.4.1 Material for the mounting of current-carrying parts shall be porcelain, phenolic composition, cold-molded composition, or equivalent material.

22.1.4.2 When vulcanized fiber is used for insulating bushings, washers, separators, and barriers it shall not be as the sole support for uninsulated current-carrying parts of other than extra-low-voltage circuits.

22.1.4.3 Polymeric materials shall not be used for the sole support of uninsulated live parts unless found to be equivalent to the materials indicated in 22.1.4.1.

22.1.4.4 The thickness of a flat sheet of insulating material, such as phenolic composition employed for panel-mounting of parts, shall not be less than 1/16 inch (1.6 mm) thick. Material less than 1/16 inch (1.6 mm) thick shall not be employed unless the panel is supported or reinforced to provide equivalent rigidity.

22.1.4.5 A terminal block mounted on a metal surface capable of being grounded shall be provided with an insulating barrier between the mounting surface and all live parts on the underside of the base unless the parts are staked, upset, sealed, or equivalently prevented from loosening so as to prevent the parts and the ends of replaceable terminal screws from coming in contact with the supporting surface or reducing spacings below the minimum values required.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

22.1.4.6 A countersunk sealed part shall be covered with a waterproof insulating compound which shall not melt at a temperature 15°C (27°F) higher than the maximum normal operating temperature of the assembly, and not less than 65°C (149°F) in any case. The depth or thickness of the sealing compound shall not be less than 1/8 inch (3.2 mm).

22.2 Bushings

22.2.1 When a lead or wire harness passes through an opening in a wall, barrier, or enclosing case, there shall be a metal or insulating type bushing, or the equivalent, which shall be substantial, secured in place, and have a smooth rounded surface against which the wire rests.

22.2.2 When the opening is in a phenolic composition or other nonconducting material, or in metal of thickness greater than 0.042 inch (1.07 mm), a smooth surface having rounded edges is determined to be the equivalent of a bushing.

22.2.3 Ceramic materials and some molded compositions are capable of being used for insulating bushings, separate bushings of wood and hot-molded shellac shall not be used.

22.2.4 Fiber shall be employed only where:

a) It is not subjected to a temperature higher than 90°C (194°F) under normal operating conditions;

b) The bushing is not less than 1/16 inch (1.6 mm) thick, with a minus tolerance of 1/64 inch (0.4 mm) for manufacturing variations and

c) It is not affected adversely by normal ambient humidity conditions.

22.2.5 When a soft-rubber bushing or similar material that deteriorates with age is employed in a hole in metal, the hole shall be free from sharp edges, burrs, or similar projections, which cut into the bushing and wire insulation.

22.2.6 When an insulating metal grommet is used in lieu of an insulating bushing, the insulating material used shall not be less than 1/32 inch (0.8 mm) thick and shall fill completely the space between the grommet and the metal in which it is mounted.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

22.3 Lampholders and lamps

22.3.1 A single station heat alarm intended to be connected to a commercial alternating current (AC) power source shall be provided with a ″power-on″ lamp to indicate energization of the unit. When pulsed, the lamp shall pulse at least once per minute.

22.3.2 Where more than one lamp is provided on the alarm, the ″power-on″ lamp shall be white or green, an alarm indicating lamp shall be red, and a trouble lamp shall be amber or yellow. When the ″power-on″ lamp is of a different color it shall be marked to identify the function.

22.3.3 A lampholder and lamp shall be rated for the circuit in which they are employed.

22.3.4 A lampholder in a hazardous-voltage circuit shall be wired so that the screw shell is connected to an identified (grounded circuit) conductor.

22.3.5 A lampholder shall be installed so that uninsulated hazardous-voltage live parts are not exposed to contact by persons removing or replacing lamps in service.

22.3.6 A lamp or equivalent means, such as a distinctive audible signal indication, shall be provided on an alarm intended for multiple-station interconnection to identify the unit from which the alarm was initiated.

22.4 Protective devices

22.4.1 Fuseholders, fuses, and circuit breakers shall be rated for the application.

22.5 Printed-wiring boards

22.5.1 The components of a printed-wiring board shall be secured in place and the spacings between circuits shall comply with the spacings requirements for rigidly clamped assemblies (Table 23.1). The board shall be mounted so that deflection of the board during servicing shall not result in damage to the board or risk of fire or electric shock.

22.6 Switches

22.6.1 A switch shall have a current and voltage rating not less than that of the circuit which it controls.

22.6.2 When a reset switch is provided, it shall be of a self-restoring type.

22.6.3 An alarm silencing switch or equivalent means shall be provided on a single or multiple station heat alarm only when its ″off normal″ position is supervised.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

22.7 Transformers and coils

22.7.1 A transformer shall be of the two-coil or insulated type.

Exception: An autotransformer shall only be employed in an alarm intended for permanent connection only, when the terminal or lead connected to the autotransformer winding which is common to both input and output circuits is identified, and the output circuits are located within the enclosure containing the autotransformer. See 29.5.

22.7.2 The insulation of coil windings of relays, transformers and similar components shall be such as to resist the absorption of moisture.

22.7.3 Film-coated or equivalently insulated wire is not required to be given additional treatment to prevent moisture absorption.

22.8 Dropping resistors

22.8.1 A carbon composition resistor shall not be used as a dropping resistor in the hazardous-voltage circuit of an alarm.

23 Spacings

23.1 Spacings shall be maintained between uninsulated live parts and dead metal parts, and between uninsulated live parts of opposite polarity. The spacings shall not be less than those indicated in Table 23.1.

23.2 The spacings between an uninsulated live part and:

a) A wall or cover of a metal enclosure;

b) A fitting for conduit or metal-clad cable and

c) Any dead metal part.

23.3 The ″Through-Air″ and ″Over-Surface″ spacings of Table 23.1 measured at an individual component part are to be judged on the basis of the volt-amperes used and controlled by the individual component. However, the spacings from one component to another, and from any component to the enclosure or to other uninsulated dead metal parts, excluding the component mounting surface, shall be judged on the basis of the maximum voltage and total volt-amperes rating of all components in the enclosure.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

Table 23.1
Minimum spacings

Point of application	Voltage range	Minimum spacings[a,b]			
		Through air,		Over surface,	
		inch	(mm)	inch	(mm)
To walls of enclosure					
Cast metal enclosures	0 – 300	1/4	(6.4)	1/4	(6.4)
Sheet metal enclosures	0 – 300	1/2	(12.7)	1/2	(12.7)
Installation wiring terminals					
With barriers	0 – 30	1/8	(3.2)	3/16	(4.8)
	31 – 150	1/8	(3.2)	1/4	(6.4)
	151 – 300	1/4	(6.4)	3/8	(9.5)
Without barriers	0 – 30	3/16	(4.8)	3/16	(4.8)
	31 – 150	1/4	(6.4)	1/4	(6.4)
	151 – 300	1/4	(6.4)	3/8	(9.5)
Rigidly clamped assemblies[c]					
100 volt-amperes maximum[d, e]	0 – 30	1/32	(0.8)	1/32	(0.8)
Over 100 volt-amperes [e]	0 – 30	3/64	(1.2)	3/64	(1.2)
	31 – 150	1/16	(1.6)	1/16	(1.6)
	151 – 300	3/32	(2.4)	3/32	(2.4)
Other parts	0 – 30	1/16	(1.6)	1/8	(3.2)
	31 – 150	1/8	(3.2)	1/4	(6.4)
	151 – 300	1/4	(6.4)	3/8	(9.5)

[a] An insulating liner or barrier of vulcanized fiber, varnished cloth, mica, phenolic composition, or similar material employed where spacings are otherwise insufficient, shall not be less than 0.028 inch (0.71 mm) thick; except that a liner or barrier not less than 0.013 inch (0.33 mm) thick shall be used only in conjunction with an air spacing of not less than one-half of the through air spacing required. The liner shall be located so that it is not affected adversely by arcing. Insulating material having a thickness less than that specified shall be used only when it complies with the requirements for the particular application.

[b] Measurements are to be made with solid wire of adequate ampacity for the applied load connected to each terminal. In no case is the wire to be smaller than AWG 16 (1.3 mm^2).

[c] Rigidly clamped assemblies include such parts as contact springs on relays or cam switches, printed-wiring boards, and similar assemblies.

[d] Spacings less than those indicated, and not less than 1/64 inch (0.4 mm), are appropriate for the connection of integrated circuits and similar components where the spacing between adjacent connecting wires on the component is less than 1/32 inch (0.8 mm).

[e] When spacings between traces on a printed-wiring board are less than the minimum specified, the boards shall be covered with a conformal coating, and the combination shall be evaluated to the requirements in Conformal Coatings of Printed-Wiring Boards, Section 61.

23.4 The spacing requirements in Table 23.1 do not apply to the inherent spacings inside motors, except at wiring terminals, nor to the inherent spacings of a component provided as part of the alarm. Such spacings are judged on the basis of the requirements for the component. The electrical clearance resulting from the assembly of a component into the complete device, including clearances to dead metal or enclosures, shall be those indicated in Table 23.1.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

23.5 The ″To Wall of Enclosure″ spacings of Table 23.1 are not to be applied to an individual enclosure of a component part within an outer enclosure.

23.6 Enameled or equivalently insulated wire is an uninsulated live part. Enamel is capable of being used as turn-to-turn insulation in coils.

23.7 Spacings on printed-wiring boards which are less than those indicated in Table 23.2 shall comply with the minimum spacings of Table 23.2 and shall be provided with a coating in compliance with Conformal Coatings on Printed-Wiring Boards, Section 61.

Table 23.2
Minimum over-surface spacings on printed-wiring boards

Voltage, volts[a]	Energy available, volt-amperes	Spacing		Coating program
		inch	(mm)	
0 – 30	100 maximum	13/64	(0.2)	61.1
0 – 30	Over 100	13/32	(0.4)	61.1
31 – 300	Over 100	13/16	(0.8)	61.2

NOTE – The minimum spacings are required between live parts of opposite polarity. Spacings between live parts and dead metal shall comply with Table 23.1.

[a] a RMS volts for sinusoidal waveform. The equivalent peak voltage is to be used for nonsinusoidal waveforms.

PERFORMANCE

ALL ALARMS

24 General

24.1 Representative samples of units in commercial form shall be subjected to the tests specified in Sections 26 – 61.

24.2 If a heat alarm(s) is required to be mounted in a definite position in order to function as intended it shall be tested in that position.

24.3 If a heat alarm is intended to be connected to tubing to function, it shall be connected to the maximum length of tubing specified by the manufacturer unless the length of tubing would not have a bearing on its operation.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,

25 Determination of Spacings

25.1 The sensitivity of a heat alarm is to be expressed in terms of spacing limitations. Spacing limitations refer to the maximum distance permitted between devices mounted on smooth ceilings.

25.2 Installation spacing limitations of a heat alarm are to be determined by the Fire Test, Section 27.

25.3 Heat alarms used to determine installation spacing limitations shall be units classified for the highest ordinary temperature ratings in accordance with 7.1. The minimum fire test spacing allocation shall be 50 feet (15.2 m). Spacing allocation for the intermediate degree temperature classification is based on tests conducted on the highest ordinary degree rating.

25.4 A heat alarm does not comply with these requirements if it fails to qualify for at least a 50-foot (15.2-m) spacing, for example, if it does not operate within 2 minutes when subjected to the Fire Test, Section 27.

26 Oven Test

26.1 Five heat alarms shall independently produce an alarm signal within 2 minutes or less when subjected to the time-temperature condition shown in Figure 26.1. If the five heat alarms produce the alarm signal within 2 minutes as specified, the product shall be eligible for a 15-foot (4.57-m) installation spacing.

26.2 Heat alarm samples shall be uniform in operation when mounted in the same position. They are to be tested in each of the different positions permitted by the design. Operation is considered uniform if the heat alarms operate within the applicable temperature range indicated in the tabulation under the Operating Temperature Test, Section 30. See Table 30.1.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL

Documents
Document Sharing Hub

Copyright UL
Provided by IHS Markit under license with UL
No reproduction or networking permitted without license from IHS
Full document details: UL 539 2017

Licensee=/, User=,
Not for Resale,