



UL 521

STANDARD FOR SAFETY

Heat Detectors for Fire Protective
Signaling Systems

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UL Standard for Safety for Heat Detectors for Fire Protective Signaling Systems, UL 521

Seventh Edition, Dated February 19, 1999

Summary of Topics

This revision of ANSI/UL 521 dated March 24, 2021 is being issued to incorporate the following changes:

Stability Test Revisions; Section [40](#) (title), [40.6](#), Section [40A](#)

Minimum Size for Programmable Heat Detector Symbol; [53.8](#)

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 new and revised requirements are substantially in accordance with Proposal(s) on this subject dated January 22, 2021.

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Seventh Edition

February 19, 1999

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The most recent designation of ANSI/UL 521 as an American National Standard (ANSI) occurred on March 24, 2021. 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>.

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CONTENTS

INTRODUCTION

1	Scope	7
2	General	7
	2.1 Components	7
	2.2 Units of measurement	7
	2.3 Undated references	7
3	Glossary	7
4	Installation and Operating Instructions	8
5	Compatibility Information	9
	5.1 General	9
	5.2 Method of evaluation	9
	5.3 Changes affecting compatibility	9
6	Temperature Designation	10

CONSTRUCTION

GENERAL

7	Mounting	10
8	Servicing and Maintenance Protection	10
9	Materials	11

FIELD-WIRING CONNECTIONS

10	Leads	11
11	Terminals	11

COMPONENTS – ELECTRICAL

12	General	12
	12.1 Insulating material	12
	12.2 Current-carrying parts	12
13	Contacts	12

SPACINGS – ELECTRICAL

14	General	13
----	---------------	----

PERFORMANCE

GENERAL

15	Test Units and Data	14
	15.1 General	14
	15.2 Component reliability data	14
	15.3 Miscellaneous data	15
16	Test Voltages	15
17	Test Samples	15
18	Sensitivity-Spacing Allocation	16

TESTS

19	Oven Test	17
20	Fire Test	21
21	High-Temperature Exposure Test	24
22	Operating Temperature Test	24
23	Rate-of-Rise Operation Test	25
24	Low-Temperature Exposure Test	25
25	Corrosion Tests	25
	25.1 General	25
	25.2 Indoor-use heat detectors	26
	25.3 Outdoor-use heat detectors	26
26	Determination of Stress Cracking Test	27
	26.1 General	27
	26.2 Ammonia stress cracking test	27
	26.3 Salt immersion cycling test	27
27	Bond Secureness Test	28
28	Humidity Test	28
29	Transient Tests	28
	29.1 General	28
	29.2 Internally induced transients	28
	29.3 Extraneous transients	29
	29.4 Supply line (high-voltage) transients	29
	29.5 Supply line (low-voltage circuit) transients	30
30	Vibration Test	32
31	Overload Tests	32
	31.1 Electronic heat detector	32
	31.2 Separately energized circuits and non-electric type heat detectors	33
32	Endurance Tests	33
	32.1 Electronic heat detector	33
	32.2 Separately energized circuits and non-electric type heat detectors	33
33	Rain Test	33
34	Dielectric Voltage-Withstand Test	37
35	Marking Label Adhesion Tests	37
	35.1 General	37
	35.2 Air oven-aging test	37
	35.3 Immersion test	38
	35.4 Standard-atmosphere test	38
	35.5 Unusual condition exposure test	38
36	Circuit Measurement Test	38
37	Overvoltage and Undervoltage Tests	39
	37.1 General	39
	37.2 Undervoltage test	39
38	Component Temperature Test	39
39	Electrical Supervision Test	42
40	Stability Test (Electronic Heat Detectors)	43
40A	Determination of Stability Test for Mechanical Heat Detectors	44
41	Dynamic Load Immunity Test	44
42	Polarity Reversal Test	45
43	Replacement Test, Head and Cover	45
44	Jarring Test	45
45	Static Discharge Test	46
46	Dust Test	47
47	Tests on Polymeric Materials	49
	47.1 General	49
	47.2 Temperature test	49
	47.3 Flame test	49
	47.4 Impact test	50

48	Strain Relief Test	50
49	Abnormal Operations Test.....	50

MANUFACTURING AND PRODUCTION TESTS

50	General	51
51	Production Line Dielectric Voltage-Withstand Test for High-Voltage Products	51
52	Sensitivity Calibration Tests.....	52
52.1	Rate-of-rise heat detectors	52
52.2	Fixed-temperature heat detectors	52

MARKING

53	General	52
54	Installation Instructions – Wiring Diagram.....	54
54.1	General.....	54
54.2	Four-wire detectors.....	55
54.3	Two-wire detectors.....	56
55	Technical Bulletin	56

SUPPLEMENT SA – INSTRUCTIONS FOR DETERMINING A RELIABILITY PREDICTION OF ELECTRONIC COMPONENTS AND MICROELECTRIC CIRCUITS

SA1	Methods of Determining Failure Rate	57
-----	---	----

SUPPLEMENT SB – CRITERIA FOR ACCEPTANCE OF MICROELECTRONIC DEVICES

SB1	General.....	65
SB2	Part I – Quality Assurance Screening Program.....	65
SB3	Part II – Determination of Failure Rate Number Supplemented by Burn-In Test.....	66
SB3.1	General	66
SB3.2	Determination sequence	66
SB3.3	Test calculations and procedures.....	69
SB3.4	Test conditions	69
SB3.5	Failure rate number calculation	69

APPENDIX A Standards for Components

No Text on This Page

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INTRODUCTION

1 Scope

1.1 These requirements cover heat detectors for fire protective signaling systems intended to be installed in ordinary indoor and outdoor locations in accordance with the Standard for Automatic Fire Detectors, NFPA 72E.

1.2 Heat detectors covered by these requirements employ either normally open contacts or normally closed contacts, provide an electronic signal, or consist of a heat-sensitive cable. The requirements do not cover heat detectors for journal-alarm or unit-alarm devices.

1.3 Deleted

2 General

2.1 Components

2.1.1 Except as indicated in [2.1.2](#), a component of a product covered by this standard shall comply with the requirements for that component. See Appendix [A](#) for a list of standards covering components generally used in the products covered by this standard.

2.1.2 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.

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

2.1.4 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.

2.2 Units of measurement

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

2.3 Undated references

2.3.1 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.

3 Glossary

3.1 For the purpose of this standard the following definitions apply. Heat detectors may combine two or more of the following characteristics in one device, such as a fixed-temperature, a spot-type capable of repeated operation, or a rate-of-rise type also employing a fixed-temperature element.

3.2 COMPONENT, LIMITED-LIFE – A component that is expected to fail and be periodically replaced and the failure of which is supervised, if failure of the component affects the intended operation, sensitivity, or both. Typical examples of such components include incandescent lamps, electronic tube heaters, and functional heating elements.

3.3 COMPONENT, RELIABLE – An electrical 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 fewer failures per million hours as determined for a "Ground Fixed" (GF) environment by MIL-HDBK 217B, or equivalent (see Supplement [SA](#)).

3.4 ELECTRONIC-TYPE HEAT DETECTOR – A device that uses electronic circuitry to respond to an abnormal high temperature or rate of temperature rise.

3.5 FIXED-TEMPERATURE TYPE HEAT DETECTOR – A device that will respond when its operating element becomes heated to a predetermined level. The temperature of the air surrounding the device at the moment of operation will vary, depending on the rate at which the temperature is rising.

3.6 HEAT DETECTOR – A device that detects an abnormal high temperature or rate of temperature rise.

3.7 HEAT-SENSITIVE CABLE – A line-type device whose sensitive element comprises two current-carrying wires held separated by a heat-sensitive insulation that softens at the rated temperature, thus allowing the wires to make electrical contact.

3.8 LINE-TYPE HEAT DETECTOR – A device in which detection is continuous along a path.

3.9 NONRESTORABLE HEAT DETECTOR – A device whose sensing element is intended to be destroyed by the process of detecting a fire.

3.10 RATE-COMPENSATION HEAT DETECTOR – A device that will respond when the temperature of the surrounding air reaches the predetermined level, regardless of the rate of temperature rise.

3.11 RATE-OF-RISE HEAT DETECTOR – A device that will respond when the temperature rises at a rate exceeding a predetermined amount.

3.12 RESTORABLE HEAT DETECTOR – A device whose sensing element is not destroyed during intended service by the processes of detecting a fire. Restoration may be manual or automatic.

3.13 SELF-RESTORING HEAT DETECTOR – A restorable detector whose sensing element is intended to be returned to normal automatically.

3.14 SPOT-TYPE HEAT DETECTOR – A device whose detecting element is concentrated at a particular location.

3.15 TWO-WIRE DETECTOR – A detector that signals over and obtains its power from the initiating device circuit of a fire alarm system control unit. Additional terminals or leads may be provided for annunciation or control of supplementary functions.

4 Installation and Operating Instructions

4.1 A copy of the installation and operating instructions and related schematic wiring diagrams and installation drawings shall be used as a guide in the examination and test of the detector. For this purpose, a printed edition is not required. The information may be included in a manual or technical bulletin.

4.2 The instructions and drawings shall include such directions and information as deemed by the manufacturer to be necessary for installation, testing, maintenance, operation, and use of the detector.

5 Compatibility Information

5.1 General

5.1.1 Compatibility between a two-wire electronic heat detector that receives its power from the initiating device circuit of a fire alarm system control unit is dependent upon the interaction between the circuit parameters, such as voltage, current, frequency, and impedance, of the detector and the initiating device circuit.

5.1.2 A detector that does not receive its power from the initiating device circuit of a control unit (conventionally a detector having four or more wires for field connection or a heat detector with dry contacts) may be employed with any electrically compatible fire alarm system control unit without the need for compatibility consideration as its connection does not impose any load on the initiating circuit. Under an alarm condition, the four-wire detector acts as a switch (similar to a manual station) to place the system in alarm.

5.1.3 As a two-wire detector obtains its power from the initiating device circuit of a system control unit, its operation is dependent on the characteristics of the circuit to which it is connected as the detector imposes a resistive and capacitive load on the circuit. Similarly, the load imposed upon the initiating circuit by a connected detector must not prevent alarm response by a control unit to a detector in alarm, nor prevent a trouble response to an open circuit after the last detector.

5.1.4 The connection of a two-wire electronic heat detector is restricted to the specific control units with which a compatibility evaluation has been made.

5.1.5 A supplementary signaling device [such as an audible appliance, relay, or annunciator lamp (LED)] that is integral with a two-wire heat detector and that is also powered from an initiating device circuit of a fire alarm system control unit shall not be used if its operation, including level of audibility and light output, is inhibited by the operation limitation of the initiating device circuit.

5.2 Method of evaluation

5.2.1 In accordance with [5.1.1](#) – [5.1.5](#), to determine whether any combination of control unit and electronic heat detector or detectors is compatible, whether the detectors are the same model or a mixture of one or more models or types, the tests indicated in (a) and (b) are to be conducted:

- a) The Dynamic Load Immunity Test, Section [41](#).
- b) The Two-Wire Smoke Detector Compatibility Tests in the Standard for Control Units for Fire-Protective Signaling Systems, UL 864.

For the test in (b), a load representing the maximum number of detectors intended to be connected to the control unit initiating device circuit, whether one model or a mixture of several models, is to be employed.

5.3 Changes affecting compatibility

5.3.1 To maintain compatibility integrity after installation of a compatible combination that can be affected by replacement detectors or a modification of either the detectors or the control unit, the product that is changed shall be assigned a different model number, or change in compatibility identification marking.

5.3.2 A compatibility identifier marking consists of any six-digit or less alphanumeric combination, such as a date code, part number, model number, or the like used to identify the latest revision that has not resulted in a new model number, but that impacts compatibility.

6 Temperature Designation

6.1 Heat detectors of the fixed-temperature spot type are designated according to temperature of operation as indicated in [Table 6.1](#).

Table 6.1
Temperature rating

Temperature rating	Temperature rating range,	
	°F	(°C)
Low	100 – 134	37.8 – 56.7
Ordinary	135 – 174	57.2 – 78.9
Intermediate	175 – 249	79.4 – 120.6
High	250 – 324	121 – 162.2
Extra High	325 – 399	163 – 203.8
Very Extra High	400 – 499	204 – 259.4
Ultra High	500 – 575	260 – 302

6.2 Low-degree rated heat detectors apply only to self-restoring type detectors. Low-degree heat detectors are intended only for installation in controlled ambient conditions, such as in a computer room.

CONSTRUCTION

GENERAL

7 Mounting

7.1 A heat detector shall be provided with means for mounting.

7.2 The mounting means shall be electrically insulated from current-carrying parts of the device.

7.3 The intended means of mounting shall not result in any distortion of the device so as to alter the operating temperature adjustment.

7.4 A heat detector shall be supported independently of its connection to the installation wiring.

8 Servicing and Maintenance Protection

8.1 The thermoresponsive element adjustment shall not be capable of being readjusted after shipment from the factory. The means for calibration, if accessible or apparent, shall be modified, guarded, or sealed such that the means for calibration are not subject to manipulation by hand or ordinary tools subsequent to the factory calibration.

8.2 A calibration means is considered not accessible or apparent when it is not showing, not exposed to manipulation by conventional tools, or not readily displaced. The complete concealment of conventional tool-engaging means in a screw, such as a slot, recessed head, and the like, by the use of solder or

brazing material is considered to prevent manipulation if the calibration means cannot be changed by gripping with conventional tools, and engagement or manipulation is prevented at all other locations.

8.3 An uninsulated live part of a high-voltage circuit and moving parts that can cause risk of injury to persons within the enclosure shall be located, guarded, or enclosed to reduce the risk of unintentional contact by persons performing service functions that may be performed with the equipment energized.

8.4 An electrical component that may require examination, adjustment, servicing, or maintenance while energized shall be located and mounted with respect to other components and with respect to grounded metal parts so that it is accessible for service without subjecting the user to a risk of electric shock from adjacent uninsulated live parts.

9 Materials

9.1 If a sealing compound is used, its melting point shall be at least 15° F (8.3° C) higher than the temperature rating of the thermostat, but not less than 149° F (65° C).

9.2 Diaphragms and spring parts shall be made of a nonferrous material such as phosphor bronze, nickel silver, or the equivalent. If ferrous materials are employed, they shall be hermetically sealed or plated so as not to be affected by corrosion.

9.3 A fusible alloy, if used as the operating member of a heat detector, shall not be affected by the conditions to which it will be exposed in service, as represented by the tests described in the Performance section of this standard.

9.4 All exposed parts that could be affected by corrosion shall be protected by enameling, galvanizing, sherardizing, plating, or equivalent means.

9.5 Polymeric materials of a detector shall be constructed to resist the abuses likely to be encountered in service. The degree of resistance to abuse inherent in the detector shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other serious defects, which alone or in combination result in an increase in the risk of fire, electric shock, or injury to persons.

FIELD-WIRING CONNECTIONS

10 Leads

10.1 If wire leads are used in lieu of wiring terminals, the leads shall not be smaller than No. 18 AWG (0.82 mm²). The leads shall not be less than 6 inches (152 mm) in length, shall be provided with strain relief, and shall employ a minimum 1/32-inch (0.8-mm) wall of insulation, or the equivalent. A separate lead shall be provided for each incoming and outgoing wire of a spot-type heat detector having normally open contacts. For a heat sensitive cable, the stripped ends of each wire shall be used for field connections. See [12.2.1](#).

11 Terminals

11.1 A wire binding screw shall not be smaller than No. 6 (3.5 mm diameter) for connection of not more than one No. 14 AWG (2.1 mm²) or smaller conductor. A terminal screw intended for connection of a conductor larger than No. 14 AWG shall not be smaller than No. 8 (4.2 mm diameter).

11.2 A terminal plate tapped for a wire binding screw shall be of metal not less than 0.050 inch (1.27 mm) thick for a No. 8 (4.2 mm diameter) or larger screw, not less than 0.030 inch (0.76 mm) thick for a No. 6 (3.5 mm diameter) screw and shall have not less than two full threads in the metal.