

UL 1434

ISBN 0-7629-294-9

Thermistor-Type Devices

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333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety for Thermistor-Type Devices, UL 1434

First Edition, Dated April 3, 1998

Revisions: This Standard contains revisions through and including August 30, 2002

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This Standard consists of pages dated as shown in the following checklist:

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APRIL 3, 1998

(Title Page Reprinted: August 30, 2002)

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Standard for Thermistor-Type Devices

First Edition

April 3, 1998

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

ISBN 0-7629-294-9

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements apply to discrete thermistor-type devices constructed of ceramic or polymeric semiconductor material.

1.1 effective April 3, 2000

1.2 These thermistors are intended for use as:

- a) Self-limiting devices such as heaters;
- b) Control devices such as current limiters and inrush-current limiters; or
- c) Sensing devices.

1.2 effective April 3, 2000

1.3 These requirements apply to positive temperature coefficient (PTC) and negative temperature coefficient (NTC) type devices.

1.3 effective April 3, 2000

1.4 Control devices, such as current limiters are not intended to replace current interrupting devices such as fuses, but are intended to provide a level of overcurrent protection complying with the end-use equipment requirements.

1.4 effective April 3, 2000

1.5 These requirements do not apply to heating cables, such as self-regulating pipe heating cable, that are constructed with thermistor-type material.

1.5 effective April 3, 2000

1.6 *Deleted August 30, 2002*

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 used in the products covered by this standard.

2.1.1 effective April 3, 2000

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.

2.1.2 revised December 15, 2000

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

2.1.3 effective April 3, 2000

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.

2.1.4 effective April 3, 2000

2.1.5 Deleted December 15, 2000

2.1.6 Deleted December 15, 2000

2.1.7 Deleted December 15, 2000

2.2 Undated references

2.2.1 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.

2.2.1 effective April 3, 2000

2.3 Units of measurement

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

2.3.1 revised December 15, 2000

3 Glossary

3.1 For the purpose of this standard, the following definitions apply.

3.1 effective April 3, 2000

3.2 AMBIENT, ROOM – $25 \pm 2^{\circ}\text{C}$ ($77 \pm 3.6^{\circ}\text{F}$) or as specified by the manufacturer.

3.2 effective April 3, 2000

3.3 B VALUE – A NTC thermistor's index, which expresses the degree of resistance change when calculated from any two points specified by the manufacturer on the resistance/temperature (R/T) curve.

3.3 revised August 30, 2002

3.4 CIRCUIT, ISOLATED-LIMITED-ENERGY SECONDARY – A circuit derived from an isolated secondary winding of a transformer having a maximum capacity of 100 volt-amperes and an open-circuit secondary voltage rating not exceeding 1000 volts. A circuit derived from a line-voltage circuit by connecting resistance in series with the supply circuit as a means of limiting the voltage and current is not an isolated-limited-energy secondary circuit.

3.4 effective April 3, 2000

3.5 CIRCUIT, LINE-VOLTAGE – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of a low-voltage or isolated-limited-energy secondary circuit.

3.5 effective April 3, 2000

3.6 CIRCUIT, LOW-VOLTAGE – A circuit involving a potential of not more than 30 volts (42.4 volts peak) or 60 volts dc and supplied by a primary battery, by a standard Class 2 transformer, or by a combination of a transformer and a current limiting impedance that, as a unit, complies with all the performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit by connecting resistance in series with the supply circuit as a means of limiting the voltage and current is not a low-voltage circuit.

3.6 effective April 3, 2000

3.7 CIRCUIT, SAFETY – A primary or secondary circuit that contains a control relied upon to reduce a risk of fire, electric shock, or injury to persons. Examples include a circuit that limits the wattage to a limited-energy level or a circuit designed to limit temperatures.

3.7 effective April 3, 2000

3.8 CONTROL, SAFETY – An automatic control or interlock (including relays, switches, and other auxiliary equipment used to form a system) that is intended to reduce a risk of improper operation of the controlled equipment.

3.8 effective April 3, 2000

3.9 CURRENT, HOLD (I_H) – The maximum current a current limiting PTC thermistor is able to maintain in a low resistance "on" state at rated ambient for a period of time specified by the manufacturer.

3.9 effective April 3, 2000

3.10 CURRENT, INRUSH – As related to a PTC heater, the peak current measured following energization at rated voltage and at $25 \pm 2^\circ\text{C}$ ($77 \pm 3.6^\circ\text{F}$) or at the manufacturer's specified temperature.

3.10 effective April 3, 2000

3.11 CURRENT, FUNCTIONING (I_{fun}) OR TRIP (I_t) – For a current-limiting PTC thermistor, the minimum current value declared by the manufacturer at which a PTC thermistor switches from low to high resistance at a specified temperature or temperature range. $I_t = Y \times I_h$, where Y is the trip current multiplier declared by the manufacturer.

3.11 revised August 30, 2002

3.12 CURRENT, MAXIMUM (I_{max}) – The current value assigned by the manufacturer that complies with all the requirements of this standard. For the various devices, the associated current designated as I_{max} is shown in Table 3.1.

3.12 effective April 3, 2000

Table 3.1
Maximum current

Table 3.1 effective April 3, 2000

Device	Associated current designated I_{max}
PTC heater	Maximum steady-state current ^a
PTC control:	
Motor starting	Maximum start winding current
Other than motor starting	Maximum trip current ^b
NTC control	Maximum steady-state current
PTC or NTC sensor	Not applicable
^a For devices rated in watts by the manufacturer, I_{max} is calculated.	
^b For devices assigned a time-to-trip versus current curve by the manufacturer, the maximum current (I_{max}) shall be identified.	

3.13 CURRENT, SHORT-CIRCUIT (I_{sc}) – The maximum current available from the impedance limited source (such as a power supply).

3.13 effective April 3, 2000

3.14 CURRENT, STEADY-STATE (I_{ss}) – The current measured after a thermistor's temperature stabilizes in still air at $25 \pm 2^\circ\text{C}$ ($77 \pm 3.6^\circ\text{F}$) ambient, or at an ambient specified by the manufacturer while connected to rated voltage and while operating in its high-resistance state for PTC thermistors or low-resistance state for NTC thermistors. For some NTC thermistors, I_{ss} is the same as I_{max} .

3.14 effective April 3, 2000

3.15 ENVIRONMENT, CONTROLLED – An environment free of conductive contaminants— such as carbon dust, resulting from the end-use equipment in which the thermistor is installed or due to the environment of the end-use equipment— and provided with protection against humidity and the formation of condensation. A temperature and humidity controlled indoor area free of conductive contaminants is a controlled environment. An equivalent environment is provided by means of:

- a) A hermetically sealed enclosure;
- b) Encapsulation;
- c) A conformal coating;
- d) A gasketed, tight-fitting enclosure; or

e) A filter system that reduces the level of contamination used in conjunction with a system that reduces the level of condensation (for example, maintaining the surrounding air at constant temperature and low relative humidity).

3.15 effective April 3, 2000

3.16 ENVIRONMENT, GENERAL – An environment that is not controlled in accordance with 3.15.

3.16 effective April 3, 2000

3.17 POLARITY, OPPOSITE – The relationship between two live parts such that an interconnection between the parts results in a flow of current which is limited only by the impedance of the circuit.

3.17 effective April 3, 2000

3.18 RESISTANCE/TEMPERATURE (R/T) CURVE – The graphical representation of the characteristics of resistance versus temperature. See Figures 3.1 and 3.2 for typical curves. The significant portion of the curve for a PTC thermistor, as illustrated in Figure 3.1, is usually that portion of the curve representing the range of temperature over which the product is used. The R/T curve of some PTC thermistors has a negative slope from R_x (R_{25}) to R_{min} before the resistance begins to increase.

3.18 revised August 30, 2002