



UL 1434

STANDARD FOR SAFETY

Thermistor-Type Devices

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

First Edition, Dated April 3, 1998

Summary of Topics

The revisions of UL 1434 dated May 18, 2021 include the following changes in requirements:

- Matching [Table 11.3](#) and [Table 22.1](#) to IEC 60730-1 Table J.7.***
- For a sensing thermistor, corrections to use the same temperature terminology in the document; [12.2](#), [14.4](#), [15.1](#), [17.2](#)***

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 November 11, 2020 and March 9, 2021.

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CONTENTS

INTRODUCTION

1	Scope	5
2	General	5
2.1	Components	5
2.2	Undated references	6
2.3	Units of measurement	6
3	Glossary	6

CONSTRUCTION

4	General	11
5	Protection Against Corrosion	11
6	Insulating Material	12
7	Spacings	12
7.1	Line-voltage circuits	12
7.2	Low-voltage and isolated-limited-energy secondary circuits	13
8	Alternative Spacings – Clearances and Creepage Distances	14
9	Live Parts	15

PERFORMANCE – PTC THERMISTORS

10	General	15
11	Calibration Tests	17
11.1	General	17
11.2	R/T measurement for PTC thermistors – all types	18
11.3	R/T measurement for PTC heaters	18
11.4	Hold current (I_h) test for PTC current limiters	18
11.5	Time-to-trip test for PTC current limiters	19
11.6	Surface temperature test	19
12	Aging Test	19
13	Heat-Cold-Humidity Cycling Test	20
14	Overload Test	21
15	Endurance Test	21
16	Cold Operational Cycling Test	22
17	Cold Thermal Cycling Test	22
18	Limited Short-Circuit Test	22
18.1	General	22
18.2	Primary circuit applications	23
18.3	Other than primary circuit applications	24
19	Thermal Runaway Test	25
20	Dielectric Voltage-Withstand Test (For Insulated Thermistors Only)	25

PERFORMANCE – NTC THERMISTORS

21	General	25
22	Calibration Tests	27
22.1	General	27
22.2	R/T measurement for NTC thermistors	27
22.3	Surface temperature test (inrush-current limiting only)	28
22.4	Resistance (R_{25}) and beta value (B) test for NTC thermistors	28
23	Aging Test	28

24	Heat-Cold-Humidity Cycling Test	29
25	Overload Test.....	29
26	Endurance Test	30
27	Cold Operational Cycling Test	31
28	Cold Thermal Cycling Test	31
29	Dielectric Voltage-Withstand Test (For Insulated Thermistors Only)	31

MANUFACTURING AND PRODUCTION TESTS

30	General	31
----	---------------	----

RATING

31	General	32
----	---------------	----

MARKING

32	General	33
----	---------------	----

APPENDIX A

Standards for Components	34
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INTRODUCTION

1 Scope

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

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.

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

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.

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

1.6 *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 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.

2.1.5 *Deleted*

2.1.6 *Deleted*

2.1.7 *Deleted*

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.

2.3 Units of measurement

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

3 Glossary

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

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

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.

3.4 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.

3.5 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.

3.6 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.

3.7 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.

3.8 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.

3.9 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.

3.10 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.

3.11 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.

3.12 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](#).

Table 3.1
Maximum current

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).

3.14 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 $I_{\max}$.

3.15 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:

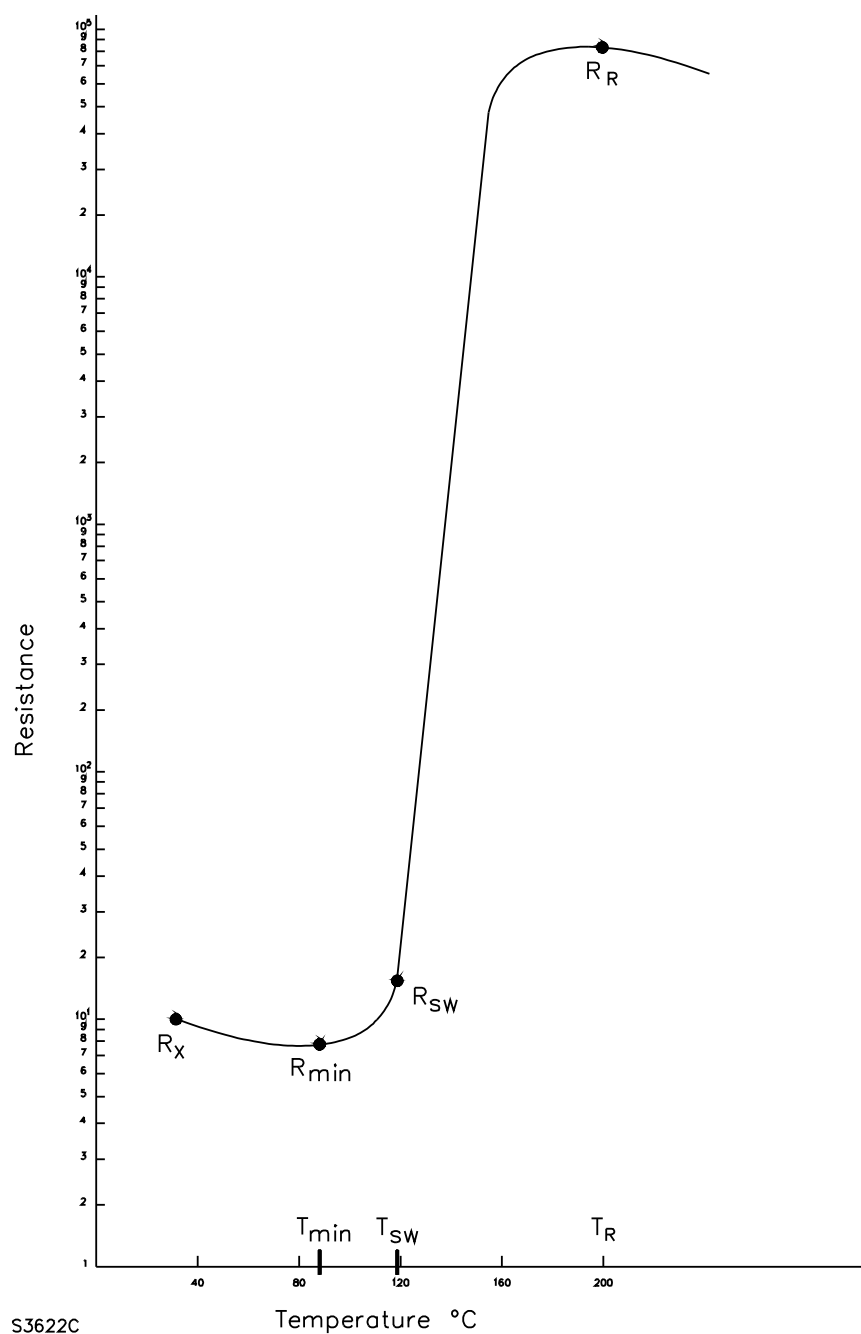
- a) A hermetically sealed enclosure;
- b) Encapsulation;
- c) A conformal coating;
- d) A gasketed, tight-fitting enclosure; or
- e) A filter system that reduces the level of contamination used in conjunction with a system that reduces the level of condensation (for example, maintaining the surrounding air at constant temperature and low relative humidity).

3.16 ENVIRONMENT, GENERAL – An environment that is not controlled in accordance with [3.15](#).

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.

3.18 RESISTANCE/TEMPERATURE (R/T) CURVE – The graphical representation of the characteristics of resistance versus temperature. See [Figure 3.1](#) and [Figure 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.

Figure 3.1
Typical R/T curve for a ceramic PTC thermistor



NOTES:

R_{min} – The point of minimum resistance.

R_x (R_{25}) – Resistance at a temperature specified by the manufacturer for R_x or at $25 \pm 2^{\circ}\text{C}$ ($77 \pm 3.6^{\circ}\text{F}$) for R_{25}

T_{sw} – Switching temperature at which the resistance (R_{sw}) begins to increase sharply with temperature increases.

T_R – Thermal runaway temperature where resistance R_R starts to decrease.