

UL 1020

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Thermal Cutoffs for Use in Electrical Appliances and Components

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UL Standard for Safety
for
Thermal Cutoffs for Use in Electrical Appliances and Components, UL 1020

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The revisions dated November 10, 1998, were issued to make editorial corrections.

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Recognition and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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HISTORICAL NOTE

Products covered by this Standard were previously evaluated as part of the end-use product in which they were used. The requirements of this Standard originated from electric discharge lamp protector requirements developed in the mid 1960's.

UL 1020

Standard for

Thermal Cutoffs for Use in Electrical Appliances and Components

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Fifth Edition

October 17, 1994

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated November 10, 1998. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

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

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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.

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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 employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the 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 thermal cutoffs intended to be embedded in windings or for freestanding use in end products.

1.2 The acceptability of a thermal cutoff in any particular device or appliance depends upon its acceptability for continued use under the conditions that prevail in actual service. For a particular application, a thermal cutoff may be affected by the requirements for the device or appliance in question, and it may be necessary to employ a thermal cutoff having features in addition to those specified in this standard. Compliance of a thermal cutoff with the requirements in this standard does not determine that the thermal cutoff is acceptable without further evaluation for use as a component in an end product.

1.3 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, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements to determine that the level of safety as originally anticipated by the intent of this standard is maintained. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard shall not be judged to comply with this standard. Where appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

1.3 revised November 10, 1998

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.

2.1.2 A component need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed 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 effective October 17, 1994

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

2.1.3 effective October 17, 1994

2.1.4 Specific components are recognized as being 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 for which they have been recognized.

2.1.4 effective October 17, 1994

2.2 Units of measurement

2.2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

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.

3.2 ELECTRICAL CIRCUITS:

- a) Line-Voltage Circuit – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage or an isolated-limited-secondary circuit.
- b) Low-Voltage Circuit – A circuit involving a potential of not more than 30 volts rms alternating current, 42.4 volts peak, or 42.4 volts direct current which is supplied by a primary battery or by a standard Class 2 transformer, or by a combination of transformer and fixed impedance that, as a unit, complies with all the performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit, using resistance in series with the supply circuit as a means of limiting the voltage and current, is neither a low-voltage nor an isolated-limited-secondary circuit.
- c) Safety-Control Circuit – A circuit involving one or more safety controls.
- d) Isolated-Limited-Secondary Circuit – A circuit of limited energy derived from an isolated-secondary winding of a transformer having a maximum capacity of 100 volt-amperes and open-circuit secondary voltage not exceeding 1000 volts.

3.3 FIELD-WIRING TERMINAL – Any terminal to which a supply or other wire can be connected by an installer in the field is a field-wiring terminal unless the wire is provided as part of the appliance and a pressure terminal connector, soldering lug, soldered loop, crimped eyelet, or other means for making the connection is factory-assembled to the wire.

3.4 HOLDING TEMPERATURE (T_H) – The maximum temperature at which a thermal cutoff can be maintained while conducting rated current for a period of time specified by the manufacturer which will not cause a change in state of conductivity to open circuit.

3.5 EXTENDED HOLDING TEMPERATURE (T_{H-100}) – The maximum temperature at which a thermal cutoff can be maintained while conducting the rated load current at the rated voltage for a period of 100 weeks which will not cause the thermal cutoff to open circuit in accordance with Extended Holding Temperature Evaluation, Section 23. This is a rating for user consideration during the investigation of the end product.

3.6 MAXIMUM TEMPERATURE LIMIT (T_M) – The maximum temperature at which a thermal cutoff which has changed its state of conductivity can be maintained for a given period of time during which its mechanical and electrical properties will not be impaired.

3.7 PILOT DUTY RATING – A rating based upon an electromagnetic load, such as a contactor, relay, or other magnetically operated device.

3.8 RATED FUNCTIONING TEMPERATURE (T_F) – The temperature at which a thermal cutoff changes its state of conductivity to open circuit with detection current as the only load.

3.9 SAFETY CONTROLS – Automatic controls and interlocks – including relays, switches, and other auxiliary equipment used in conjunction therewith to form a safety-control system – that are intended to reduce the risk of unsafe operation of the controlled equipment.

3.10 THERMAL CUTOFF – A temperature or temperature- and current-sensitive device incorporating a thermal element for protecting a circuit by opening the protected circuit when the device reaches a predetermined temperature. It is intended to (1) reduce the risk of fire, electric shock and injury to persons due to overheating of a product during abnormal operation and (2) operate only once – that is, it cannot be reset or reconditioned for reuse.

3.11 THERMAL CUTOFF, CONDUCTIVE HEAT (CH) RATED – A thermal cutoff evaluated for use in an appliance which has performed acceptably in the Conductive Heat Aging Test, Section 24, and identified by a CH rating. This rating is for user consideration during the investigation of the end-use product.

3.12 THERMAL ELEMENT – A metallic or nonmetallic fusible material that is part of a thermal cutoff and is responsive to temperature by a change of state at the temperature for which it is calibrated.

CONSTRUCTION

4 General

4.1 A thermal cutoff shall be constructed so that it will have the strength and rigidity necessary to:

- a) Withstand conditions likely to be encountered during normal use,
- b) Resist the abuses to which it is likely to be subjected, and
- c) Reduce the risks of fire, electric shock, and injury to persons.

4.2 A product that complies with the requirements in Sections 5 – 24 is considered to comply with the requirement in 4.1.

5 Protection Against Corrosion

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

Exception No. 1: Corrosion protection is not required if it is impracticable.

Exception No. 2: Corrosion protection is not required for small minor parts of iron or steel, such as washers, screws, bolts, and the like, that are not current carrying, if the deterioration or breakage of such unprotected parts would not be likely to result in risk of fire, electric shock, or injury to persons.

Exception No. 3: Corrosion protection is not required for parts made of stainless steel.

5.2 The requirement of 5.1 applies to all enclosing cases whether or not of sheet steel, and to all springs and other parts upon which the intended mechanical operation may depend.

6 Insulating Material

6.1 Insulating material, including barriers between parts of opposite polarity and material that may be subject to an arc formed by the opening of the interrupting mechanism, shall be acceptable for the particular application.

6.2 In order to determine acceptability of an insulating material, consideration is to be given to such properties as:

- a) Mechanical strength,
- b) Resistance to combustion and ignition,
- c) Dielectric strength,
- d) Insulation resistance,
- e) Thermal aging,
- f) The degree that a material is enclosed or protected,
- g) Resistance to arcing,
- h) Resistance to distortion and creep under conditions of normal and abnormal use, and
- i) Any other properties in conjunction with conditions of service.

6.3 An insulating material, such as mica, a cold-molded compound, or a refractory material is usually acceptable for use as direct support of live parts without further evaluation.

6.4 If it is necessary to investigate an insulating material, the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, is to be used for evaluation of the properties itemized in 6.2.

Exception: Instead of the thermal aging considerations of standard UL 746C, seals and potting compounds not relied upon for contact alignment or securement of leads may be subjected to the aging of seals conditioning specified in Extended Holding Temperature Evaluation, Section 23.

6.5 If a comparative tracking index is assigned to an insulating material, the index shall be determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A, and may be within one of the following ranges:

- a) 120 to 174,
- b) 175 to 249, or
- c) Above 250.

See 31.2.

7 Spacings

7.1 Line-voltage circuits

7.1.1 The spacings in a thermal cutoff shall not be less than the applicable values specified in Table 7.1.

7.1.2 The volt-ampere equivalent is to be the product of the voltage specified in Table 17.2 and the maximum normal input current value in accordance with Tables 430-147, -148, and -150 of the National Electrical Code, ANSI/NFPA 70-1993.

7.1.3 In a multicomponent device, 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 are based on the maximum voltage and total volt-ampere rating of the complete equipment, and not on the individual component ratings. The inherent spacings within an individual component, including spacings from a live part to the mounting surface other than the enclosure, are judged on the basis of the volt-ampere load controlled by the individual component.

7.1.4 An insulating barrier or liner that is used to provide spacings, including spacings in conjunction with the required over surface spacings, shall be at least 0.028 inch (0.7 mm) thick.

Exception No. 1: A barrier or liner for spacings through air or oil that is used in conjunction with at least one-half the required spacing shall be at least 0.013 inch (0.3 mm) thick provided the barrier or liner:

- a) Is an acceptable insulating material,*
- b) Is resistant to moisture,*
- c) Has mechanical strength for the application if exposed or otherwise subjected to mechanical damage,*
- d) Is held in place, and*
- e) Is located so that it will not be adversely affected by operation of the equipment in service, including the effects of arcing.*

Exception No. 2: See 7.1.6 and 7.1.7.

7.1.5 An insulating barrier or liner used as the sole separation between live parts and grounded parts or between live parts of opposite polarity shall be acceptable for the mounting of uninsulated live parts and at least 0.028 inch (0.7 mm) thick. Otherwise, a barrier shall be used in conjunction with at least a 1/32-inch (0.8-mm) air spacing.

Exception: See 7.1.6 and 7.1.7.

7.1.6 Insulating material having a thickness less than that specified in 7.1.4 and 7.1.5 may be used if investigated and found

- a) To be acceptable for the particular application, and
- b) Equivalent in all respects to materials of the specified thicknesses.

7.1.7 Mica shall be at least 1/64 inch (0.4 mm) thick if used in place of the through-air spacing required in Table 7.1, provided the mica is fixed in position by the parts between which the spacing is involved.