



# UL 810B

## STANDARD FOR SAFETY

## Standard for DC Power Capacitors

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## UL Standard for Safety for DC Power Capacitors, UL 810B

First Edition, Dated May 25, 2016

### **Summary of Topics**

***This is the first edition of the Standard for DC Power Capacitors, UL 810B.***

The new requirements are substantially in accordance with Proposal(s) on this subject dated April 24, 2015 and September 25, 2015.

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MAY 25, 2016

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ANSI/UL 810B-2016

UL 810B

Standard for DC Power Capacitors

First Edition

May 25, 2016

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 810B as an American National Standard (ANSI) occurred on May 25, 2016. ANSI approval for a standard does not include the Cover Page, Transmittal Pages and Title Page.

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## INTRODUCTION

### 1 Scope

1.1 The requirements of this Standard apply to dc power capacitors with or without integral protection intended to reduce the risk of rupture and venting of the capacitor enclosure under internal fault conditions. These requirements apply to capacitors that are intended for use in dc power electronic applications such as switching circuits, dc filtering, and renewable energy systems.

1.2 Other types of capacitors may be investigated to establish compliance with these requirements and with such additional test criteria as may be found necessary.

1.3 This standard does not include requirements for electrochemical capacitors, motor capacitors or power factor correction capacitors.

### 2 Glossary

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

2.2 CAPACITOR ELEMENT – The layered and rolled interior electrode windings of a capacitor, which is also known as the roll.

2.3 COMPONENT CAPACITOR – A capacitor intended for building into other equipment. A component capacitor is also referred to as "capacitor."

2.4 DRY TYPE CAPACITOR – A capacitor that contains no liquid and utilizes a solid filling material other than wax.

2.5 ELECTRODE, FOIL TYPE – Capacitor plates consisting of thin metal or "foil" separated by a dielectric. This type of electrode is not self-healing.

2.6 ELECTRODE, METALLIZED – Capacitor plates consisting of dielectric material covered with metallic deposits such as aluminum on the surface. This type of electrode has a tendency to self-restore or "re-heal" after local breakdown of the dielectric and is often referred to as "self-healing".

2.7 FILLING MATERIAL – Substance located within a capacitor enclosure that may also form all or part of the enclosure and that may or may not serve as insulation. The filling material is typically oil, polyurethane or epoxy.

2.8 ENCLOSURE – Refers to the capacitor element housing. It may also be referred to as a casing.

2.9 LEAD – A conductor used to connect the capacitor roll to the means of termination. Typically wire, brass, copper either with integral insulating material or the addition of insulating material.

2.10 INTERNAL PROTECTION BRIDGE (EXPANSION TYPE PROTECTION) – An integral protection device that interrupts the circuit during expansion of the capacitor enclosure due to internal pressure build-up from overheating. It is also referred to as a PRESSURE SENSITIVE INTERRUPTER.

2.11 RATED VOLTAGE ( $U_{Ndc}$ ) – The specified maximum operating peak voltage for continuous operation for a dc capacitor.

2.12 RIPPLE VOLTAGE ( $U_R$ ) – peak-to-peak alternating component of the unidirectional voltage from a dc power source.

### 3 General

#### 3.1 Components

3.1.1 Except as indicated in 3.1.2, a component of a device 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.

3.1.2 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.

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

3.1.4 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.

#### 3.2 Units of measurement

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

#### 3.3 Undated references

3.3.1 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.

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## CONSTRUCTION

### 4 Enclosure

#### 4.1 General

4.1.1 A capacitor shall be provided within an enclosure that houses all live parts other than the supply leads, terminals, or discharge resistor.

#### 4.2 Metallic

4.2.1 A metal enclosure shall be 0.010 in (0.25 mm) thick minimum, if of steel, and 0.016 in (0.41 mm) thick minimum, if of aluminum, brass, or copper.

#### 4.3 Nonmetallic

4.3.1 A polymeric material used as part or all of an enclosure shall comply with the applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

4.3.2 A polymeric material used as part or all of an enclosure shall:

- a) Comply with the flammability test – 3/4-in (19.1-mm) flame, specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C; or
- b) Be classed V-2 minimum in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

4.3.3 The following are among the factors that shall be taken into consideration when using the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, to judge the acceptability of a nonmetallic material with respect to its intended application:

- a) Mechanical strength;
- b) Moisture-absorbent properties;
- c) Combustibility;
- d) Compatibility with dielectric mediums;
- e) Dielectric strength;
- f) Aging characteristics; and
- g) Resistance to distortion at maximum temperatures to which the enclosure may be subjected under conditions of normal or abnormal use.

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4.3.4 With regard to mechanical strength, aging characteristics, and resistance to distortion at maximum temperatures of operation described in 4.3.3(a), (f) and (g), a polymeric material used as an enclosure shall have a relative mechanical temperature index without impact of at least 70°C (158°F) or the marked temperature rating, whichever is greater, in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B. With regard to the moisture-absorbent and dielectric strength properties described in 4.3.3(b) and (e), a polymeric material shall meet the requirements for dielectric strength as described in Table 6.1 of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

4.3.5 A nonmetallic enclosure material that also functions as an insulator shall comply with Insulating Material, Section 6.

## 5 Internal Protection Bridge

5.1 A polymeric material used as an internal protection bridge/pressure interrupter shall have a relative mechanical temperature index without impact in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B, at least equal to that of the capacitor enclosure. See 4.3.4.

## 6 Insulating Material

6.1 A material used for the mounting of uninsulated capacitor terminals shall be a material rated for the application, and shall comply with the requirements specified in Table 6.1.

*Exception No. 1: A polymeric insulating material that is not rated for, or does not comply with, the hot wire ignition or high current arc resistance to ignition requirements in Table 6.1 shall not be used unless the part fabricated with the polymeric material complies with the applicable testing requirements outlined in the “additional consideration for materials not meeting pre-selection test performance levels” as prescribed in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, Table 6.2.*

*Exception No. 2: Products that have a minimum 1/2 in (12.7 mm) over surface spacing from terminal-to-terminal are not required to comply with the polymeric insulating material requirements of Table 6.1.*

**Table 6.1**  
**Polymeric insulating material**

| Application                                      | Properties                              |                                    |                                    |                                            |                                               |
|--------------------------------------------------|-----------------------------------------|------------------------------------|------------------------------------|--------------------------------------------|-----------------------------------------------|
|                                                  | Minimum flammability class <sup>a</sup> | Resistance to ignition             |                                    | Electrical                                 |                                               |
|                                                  |                                         | Hot wire (HWI) <sup>b</sup>        | High current (HAI) <sup>b</sup>    | Dielectric breakdown strength <sup>b</sup> | Comparative tracking index (CTI) <sup>b</sup> |
|                                                  |                                         | Maximum performance level category | Maximum performance level category | Minimum volts                              | Maximum performance level category            |
| Contact with insulated live parts <sup>c</sup>   | V-0                                     | 4                                  | 3                                  | –                                          | –                                             |
|                                                  | V-1                                     | 4                                  | 2                                  |                                            |                                               |
|                                                  | V-2                                     | 4                                  | 2                                  |                                            |                                               |
| Contact with uninsulated live parts <sup>d</sup> | V-0                                     | 4                                  | 3                                  | 5000                                       | 5                                             |
|                                                  | V-1                                     | 3                                  | 2                                  | 5000                                       | 5                                             |
|                                                  | V-2                                     | 2                                  | 2                                  | 5000                                       | 5                                             |