



UL 506

STANDARD FOR SAFETY Specialty Transformers

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UL Standard for Safety for Specialty Transformers, UL 506

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Summary of Topics

This revision of ANSI/UL 506 is being issued to reaffirm ANSI approval of the Standard.

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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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INTRODUCTION

1 Scope

1.1 These requirements cover ignition transformers for use with gas burners and oil burners and specialty step-up transformers used in applications such as insect electrocuting. Transformers incorporating overcurrent or over-temperature protective devices, transient voltage surge protectors, or power factor correction capacitors are also covered by these requirements. These transformers are intended to be used in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements do not cover liquid-immersed transformers, variable voltage autotransformers, transformers having a nominal primary rating of more than 600 volts, transformers having overvoltage taps rated over 660 volts, cord and plug connected transformers, garden light transformers, voltage regulators, swimming pool and spa transformers, or other special types of transformers covered in requirements for other electrical devices or appliances.

1.3 These requirements do not cover:

- a) Autotransformers used in industrial control equipment, which are evaluated in accordance with the Standard for Industrial Control Equipment, UL 508.
- b) Class 2 or Class 3 transformers, which are evaluated in accordance with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1, and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.
- c) Toy transformers, which are evaluated in accordance with the Standard for Toy Transformers, UL 697.
- d) Transformers for use with radio- and television-type appliances, which are evaluated in accordance with the Standard for Transformers and Motor Transformers for Use in Audio-, Radio-, and Television-Type Appliances, UL 1411.
- e) Transformers for use with high intensity discharge lamps, which are evaluated in accordance with the Standard for High-Intensity-Discharge Lamp Ballasts, UL 1029.
- f) Transformers for use with fluorescent lamps, which are evaluated in accordance with the Standard for Fluorescent-Lamp Ballasts, UL 935.
- g) Ventilated transformers for general use or non-ventilated transformers for general use (other than compound filled or exposed core types), which are evaluated in accordance with the Standard for Dry-Type General Purpose and Power Transformers, UL 1561.
- h) Dry-type distribution transformers rated over 600 volts, which are evaluated in accordance with the Standard for Transformers, Distribution, Dry-Type – Over 600 Volts, UL 1562.
- i) Transformers incorporating rectifying or waveshaping circuitry evaluated in accordance with the Standard for Power Units Other Than Class 2, UL 1012.
- j) Transformers of the direct plug-in type evaluated in accordance with the Standard for Class 2 Power Units, UL 1310.
- k) Transformers for use with electric discharge and neon tubing, which are evaluated in accordance with the Standard for Neon Transformers and Power Supplies, UL 2161.

- l) General purpose and industrial control transformers evaluated in accordance with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1, and the Standard for Low Voltage Transformers – Part 2: General Purpose Transformers, UL 5085-2.

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 When a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

2.2.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are root-mean-square (rms).

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 COMPOUND-FILLED TRANSFORMER – A transformer in which the windings are enclosed with an insulating fluid that becomes solid, or remains plastic, at intended operating temperatures.

3.3 ENCAPSULATED COIL – A coil that is enclosed with an insulating fluid that becomes solid.

3.4 EXPOSED CORE TRANSFORMER – A transformer with exposed core lamination.

3.5 NONVENTILATED DRY-TYPE TRANSFORMER – A dry-type transformer other than of the compound-filled or exposed core-type that is constructed so as to provide no intentional circulation of ambient air through the transformer and is intended to operate at normal ambient room air pressure.

3.6 VENTILATED DRY-TYPE TRANSFORMER – A dry-type transformer that is constructed so that ambient air may circulate through the enclosure to cool the transformer core and windings.

3.7 WINDING – A continuous conductor made up of a number of turns magnetically coupled to a magnetic core, to which a voltage is either applied or induced. Two or more such conductors that are permanently factory connected together to form intermediate voltage taps, current taps, or the like are considered to be a single winding. The winding can consist of single or parallel-wound conductors.

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4 Mechanical Assembly

4.1 A transformer shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected. A risk of fire, electric shock, or injury to persons shall not result from a reduction of spacings, loosening or displacement of parts, or other serious defect due to total or partial collapse of the transformer.

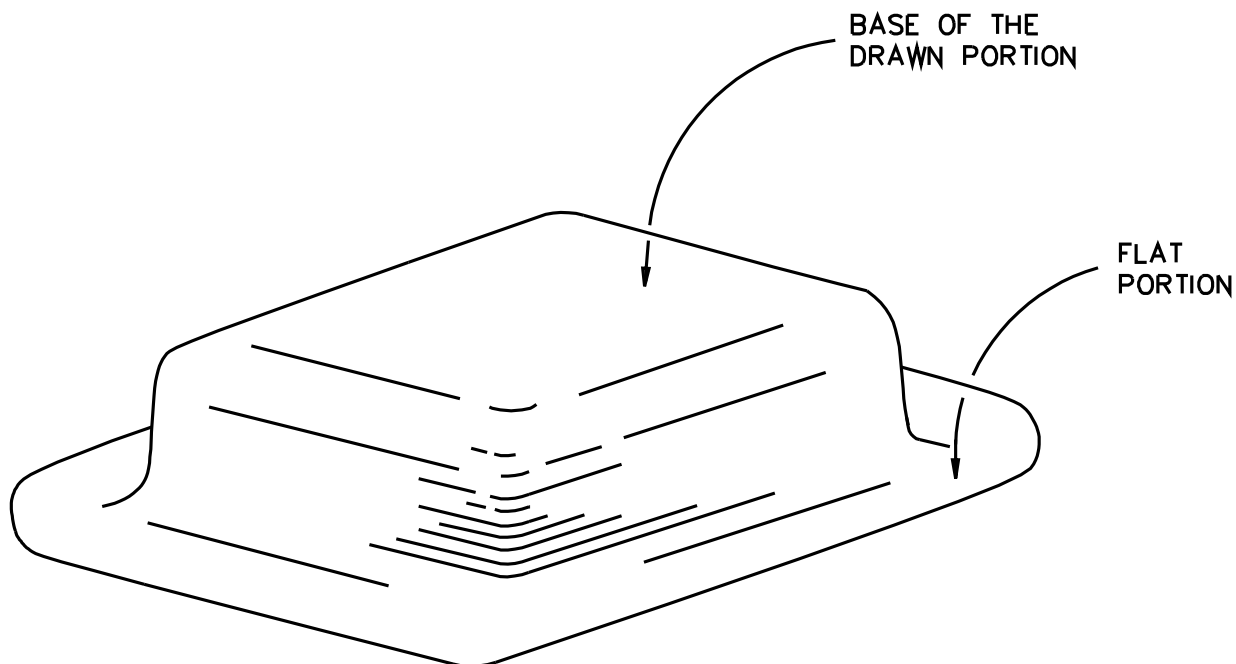
5 Enclosure

5.1 In addition to the overall enclosure, the requirements in 5.2 – 5.15 apply to those portions of an enclosure surrounding a terminal or wiring compartment.

5.2 A sheet steel enclosure shall be formed from stock having a thickness of not less than 0.026 inch (0.66 mm) if uncoated or not less than 0.029 inch (0.74 mm) if zinc coated.

Exception: Sheet steel having a thickness of not less than 0.020 inch (0.51 mm) if uncoated or not less than 0.023 inch (0.58 mm) if zinc coated may be used for drawn end bells having a maximum width or length of 2-1/4 inches (57.2 mm) on the flat portion and 1-1/2 inches (38.1 mm) at the base of the drawn portion. Figure 5.1 illustrates these portions of an end bell.

Figure 5.1
End bell



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5.3 A sheet aluminum enclosure shall be formed from stock having a thickness of not less than 0.040 inch (1.02 mm).

5.4 The thickness of a sheet steel enclosure is determined by taking the numerical average of five micrometer readings equally spaced across the full width of the sheet as rolled.

5.5 The thickness of an enclosure of nonferrous sheet metal shall provide strength and rigidity not less than that of an enclosure of sheet steel as described in 5.2.

5.6 A cast iron enclosure shall not be less than 1/8 inch (3.2 mm) thick at any point and of greater thickness at reinforcing ribs and edges of doors or covers.

5.7 A cast iron enclosure shall not be less than 1/4 inch (6.4 mm) thick at tapped holes for conduit.

5.8 If threads for the connection of conduit are tapped all the way through a hole in a transformer enclosure, or if an equivalent construction is used, there shall not be less than 3-1/2 or more than 5 threads in the metal. The construction shall enable the secure attachment of a standard conduit bushing.

5.9 If threads for the connection of conduit are tapped only part of the way through a hole in the enclosure, there shall not be less than 5 full threads in the metal. There shall be a smooth, well-rounded inlet hole to provide a passage equivalent to that provided by a standard conduit bushing.

5.10 A transformer intended to be supported by rigid metal conduit shall have conduit hubs with not less than 5 full threads or other equivalent supporting means of such strength that these parts would comply with the requirements specified in the Pullout, Bending, and Twisting Tests, Section 16.

5.11 A knockout for the connection of conduit to a wiring compartment of a transformer shall be constructed in accordance with Table 5.1.

Table 5.1
Dimensions of conduit bushings and diameter of knockouts and widths of flat surrounding surfaces

Trade size of conduit, inches	Bushings				Knockout diameter				Minimum width of flat surrounding surface, inch (mm)	
	Overall diameter, inches (mm)		Height, inches (mm)		Minimum, inches (mm)		Maximum, inches (mm)			
1/2	1	(25.4)	3/8	(9.5)	0.859	(21.82)	0.906	(23.01)	0.13	(3.4)
3/4	1-15/64	(31.4)	27/64	(10.7)	1.094	(27.79)	1.141	(29.98)	0.16	(4.1)
1	1-19/32	(40.5)	33/64	(13.1)	1.359	(34.52)	1.406	(35.71)	0.20	(5.0)
1-1/4	1-15/16	(49)	9/16	(14.3)	1.719	(43.66)	1.766	(44.86)	0.27	(7.0)
1-1/2	2-13/64	(56)	19/32	(15.1)	1.969	(50.01)	2.016	(51.21)	0.31	(7.8)
2	2-45/64	(68.7)	5/8	(15.9)	2.453	(62.31)	2.50	(63.50)	0.36	(9.2)
2-1/2	3-7/32	(81.8)	3/4	(19.1)	2.953	(75.01)	3.00	(76.20)	0.30	(7.8)
3	3-7/8	(98.4)	13/16	(20.6)	3.578	(90.88)	3.625	(92.08)	0.33	(8.3)
3-1/2	4-7/16	(113)	15/16	(23.8)	4.094	(103)	4.156	(105)	0.34	(8.6)
4	4-31/32	(126)	1	(25.4)	4.609	(117)	4.672	(118)	0.38	(9.7)
5	6-7/32	(158)	1-3/16	(30.2)	5.688	(144)	5.750	(146)	0.48	(12).2
6	7-7/32	(183)	1-1/4	(31.8)	6.781	(172)	6.844	(173)	0.56	(14.2)

5.12 There shall be space provided within a terminal or wiring compartment for a standard conduit bushing to be mounted on rigid metal conduit connected to the compartment.

5.13 Wires within an enclosure, compartment, raceway, or the like shall be located or guarded to reduce the risk of contact with any sharp edge, burr, fin, or moving part, that may cause damage to the conductor insulation.

5.14 Wiring space or other compartments provided for field wiring shall be free of any sharp edge, burr, fin, moving part, or sharp point of a sheet metal screw that may cause damage to the conductor insulation or cause a cut-type injury.

5.15 An edge, projection, or corner of an enclosure, opening, frame, guard, knob, or handle of a device shall be smooth and rounded and not sharp to cause a cut-type injury when contacted during intended use or maintenance.

6 Corrosion Resistance

6.1 The internal and external surfaces of an enclosure of iron or steel, other than stainless steel, shall be corrosion resistant. Examples of corrosion resistance means that comply with these requirements are galvanizing, plating, and enameling.

Exception No. 1: An interior surface covered by compound need not be additionally resistant to corrosion.

Exception No. 2: A Type 1 or Type 2 enclosure need not be additionally resistant to corrosion if it complies with the rust resistance test described in the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50.

7 Wiring Terminals

7.1 For these requirements, wiring terminals are those to which connections are made in the field when a transformer is installed.

7.2 When a transformer is intended for mounting on an outlet box, wiring terminals that will be inside the box after the transformer is installed shall be located or recessed so that contact between these terminals and wires would be unlikely after the transformer is installed.

8 Leads – Including Flexible Cords

8.1 The connection between a lead, including a flexible cord, and the winding or other part of the transformer shall be soldered, welded, or otherwise securely connected within the enclosure. A soldered joint shall be made mechanically secure before being soldered.

8.2 When a lead is rigidly held in place without the use of solder or if it is intended to be retained in place by compound or other means so as not to be subjected to appreciable motion, additional mechanical security shall not be required.

8.3 Strain relief shall be provided so that stress on a lead, including a flexible cord, will not be transmitted to the connection inside the transformer.

8.4 A strain relief means shall not depend solely on adhesion between the conductor and an asphalt-type compound. When epoxy- and polyester-type compounds are used for strain relief, the construction shall comply with the Strain Relief Test in the Standard for Low Voltage Transformers – Part 2: General Purpose Transformers, UL 5085-2.

8.5 The surface of an insulated lead intended for the connection of an equipment grounding conductor shall be green with or without one or more yellow stripes. No other lead shall be so identified.

8.6 Thermoplastic-insulated wire and flexible cord shall not be used for a transformer lead unless it has been investigated and determined to be acceptable for the application. The investigation is to normally include a consideration of the strain relief means used, as well as the effects of the varnishing and compounding operations of the insulation of the lead.

8.7 The types of flexible cord that may be used with an ignition transformer (Sections 38 – 54) are indicated in Table 8.1 from the lightest to the heaviest. Where these requirements specify any particular type of flexible cord, all of the heavier types following it in the table may also be used.

Table 8.1
Types of cords

C
SP-2, SPE-2
SPT-2
PD
SV, SVE
SVO, SVOO
SVT
SVTO, SVTOO
SJ, SJE
SJO, SJOO
SJT
SJTO, SJTOO
S
SO, SOO
ST
STO, STOO

9 Internal Wiring

9.1 The internal wiring of a transformer shall be rated for the temperature and voltage to which it will be subjected.

9.2 A splice or connection shall be mechanically secure and shall provide electrical contact.

9.3 A splice shall be provided with insulation equivalent to that on the wires involved if necessary to maintain permanence of spacing between the splice and uninsulated live parts.

9.4 Aluminum conductors, insulated or uninsulated, used for internal interconnections between current-carrying parts shall be terminated at each end by a method that has been determined to be acceptable for the combination of metals at the connection points.

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10 Bushings for Low Voltage Wiring – Nominal 600 Volts or Less

10.1 A bushing used in a transformer intended for outdoor use shall be of:

- a) Porcelain,
- b) Cold-molded or phenolic composition,
- c) Fiber that has been treated to render it resistant to moisture, or
- d) Other equivalent insulating material.

10.2 An untreated fiber bushing shall only be used in a transformer intended for indoor use.

10.3 A fiber bushing shall have a wall thickness of not less than 3/64 inch (1.2 mm) and shall be formed and secured in place so that it would not be adversely affected by conditions of moisture or intended use. A fiber plate not less than 1/32 inch (0.8 mm) thick, with a punched hole, may be used instead of a bushing when the cord or wire is rigidly held in position.

10.4 Bushings of rubber, wood, or hot-molded shellac or tar compositions shall not be used.

10.5 A cord- or wire-entry hole in an enclosure, a partition, or bushing shall be smooth, well-rounded, and without burrs or fins that might damage the conductor insulation.

10.6 A bushing shall be securely held in place.

10.7 An insulating bushing is not required at a point where a low-voltage wire or cord passes through:

- a) A hole in an interior metal wall or barrier,
- b) A hole in insulating material,
- c) A conduit nipple or hub, or
- d) An armored cable connector or the equivalent.

An insulating bushing is not required where a Type SV or heavier flexible cord enters the enclosure of a transformer.

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