UL 542

STANDARD FOR SAFETY

Fluorescent Lamp Starters

UL Standard for Safety for Fluorescent Lamp Starters, UL 542

Ninth Edition, Dated July 11, 2005

Summary of Topics:

This revision to ANSI/UL 542 is being issued to reflect the recent reaffirmation as an American National Standard. No changes have been made to the requirements within this standard.

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 requirements are substantially in accordance with Proposal(s) on this subject dated October 19, 2018.

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UL 542

Standard for Fluorescent Lamp Starters

The First through Eighth editions were titled the "Standard for Lampholders, Starters, and Starter Holders for Fluorescent Lamps."

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This ANSI/UL Standard for Safety consists of the Ninth Edition including revisions through December 11, 2018.

The most recent designation of ANSI/UL 542 as a Reaffirmed American National Standard (ANS) occurred on December 11, 2018. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 542 on April 26, 1984. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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 automatic and manual starters intended for use with fluorescent lamps in accordance with the National Electrical Code. Starters for use with simple reactance-type fluorescent-lamp ballasts are intended for use in circuits involving a potential of 125 V maximum. Manual starters incorporating a line switch are rated either 125 or 250 V.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 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b) Is superseded by a requirement in this standard.

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

2.4 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 Units of Measurement

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

4 References

4.1 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.

AUTOMATIC STARTERS

CONSTRUCTION

5 General

5.1 An automatic starter is a device that completes the circuit through the lamp filaments and the ballast when the line switch is closed to energize the circuit, and then opens this circuit automatically, after a time delay, to impress voltage across the lamp.

6 Mechanical Assembly

6.1 An automatic starter shall be enclosed so that no live parts are exposed for persons to contact while the starter is installed as intended in a holder, and shall have the strength and rigidity necessary to withstand the abuses to which it is likely to be subjected.

7 Enclosure

7.1 An automatic starter shall be enclosed in a housing that, as measured on the flat surface, shall not be less than 0.010 inch (0.25 mm) thick if of steel, not less than 0.015 inch (0.38 mm) thick if of other metal, and not less than 1/32 inch (0.8 mm) thick if of phenolic composition.

7.2 An enclosure of iron or steel shall be protected against corrosion.

7.3 A metal enclosure shall be lined with insulating material. Fibrous material shall not be less than 0.008 inch (0.20 mm) thick, and mica shall not be less than 0.004 inch (0.10 mm) thick.

Exception: Where permanent spacings of not less than 3/64 inch (1.2 mm) are maintained between uninsulated live parts and a metal enclosure, the liner need not be provided.

7.4 The enclosure may be formed with either:

a) One hole not more than 1/8 inch (3.2 mm) in diameter or more than 1/8 inch wide if slotted, provided that a lining such as described in 7.3 covers the opening, is securely held in place, and extends at least 1/8 inch beyond the edges of the opening on all sides; or

b) One hole that is not larger than 1/8 inch in diameter, provided that only a glass-enclosed glow switch, either with or without a parallel-connected capacitor, is housed.

8 Electrical Assembly

8.1 A current-carrying part shall be of brass, copper, or other metal acceptable for the particular application.

8.2 The requirement in 8.1 does not preclude the use of iron or steel in bimetallic parts and otherwise if such parts are necessary for the proper operation of an automatic starter in accordance with its intended use.

8.3 An uninsulated live part shall be permanently mounted and secured in place so that there can be no turning or shifting in position that would result in any reduction of the spacing required in 9.1.

8.4 Phenolic composition or the equivalent not less than 1/32 inch (0.8 mm) thick may be used for the mounting of live parts; but fiber is not acceptable.

9 Spacings

9.1 A spacing of not less than 3/64 inch (1.2 mm) shall be maintained between live parts and a metal enclosure.

PERFORMANCE

10 Endurance Test

10.1 An automatic starter shall control a circuit that consists of ballasts and lamps of the type for which the starter is intended when subjected to an endurance test of 6000 cycles of operation.

10.2 The lamp and ballast are to have characteristics that result in the preheat current and the ballast output voltage shown in Table 10.1.

Table 10.1
Ballast output voltage and preheat current

Rating of lamp in watts	Nominal diameter of lamp	Nominal length of lamp	Minimum output voltage of ballast in volts	Minimum and maximum preheat current in amperes
	Inches (mm)	Inches (mm)		
4	5/8 (16)	6 (150)	118	0.16 – 0.25
6	5/8 (16)	9 (230)	118	0.16 – 0.25
8	5/8 (16)	12 (305)	118	0.16 – 0.25
14	1-1/2 (38)	15 (380)	118	0.44 – 0.65
15	1 (25)	18 (460)	118	0.44 –0.65
15	1-1/2 (38)	18 (460)	118	0.44 – 0.65
20	1-1/2 (38)	24 (610)	118	0.44 – 0.65
22	1-1/8 (29)	8-1/4[a] (210)	118	0.50 – 0.70
25	1-1/2 (38)	33 (840)	118	0.45 – 0.85
30	1 (25)	36 (915)	200	0.40 – 0.65
32	1-1/4 (32)	12[a] (305)	150	0.55 – 0.75
40	1-1/2 (38)	48 (1220)	200	0.55 – 0.75
90	2-1/8 (54)	60 (1520)	150	1.45 – 2.20

[a] For a circular lamp consider this dimension to be the outside diameter.

10.3 To determine whether an automatic starter switch complies with the requirement in 10.1, six samples are to be tested with lamps as specified, and using two-lamp, high-power-factor ballasts if commercially available. A starting compensator is to be used if and as specified by the manufacturer of the ballasts.

10.4 During the endurance test, an automatic arrangement is to be used for opening and closing the line supply switch. In each case, the supply voltage is to be applied for a period of 20 seconds, during which time the automatic starting switch is required to operate successfully. The off period for the line switch is to be determined from the inherent characteristics of the automatic starter, and is to be long enough to enable the starter to function, but short enough to achieve maximum speed of operation on the endurance test. The off period for the glow type of automatic starter usually is 40 seconds, whereas other types of construction may require a considerably longer time (in the order of 100 seconds).

10.5 The performance of an automatic starter during the endurance test is determined to be acceptable by observing operation of the six samples for a total of 100 applications of line voltage (starting attempts) to each starter – with the 100 starting attempts being observed in groups of 20 attempts at five different intervals during the complete test. Normally, the observations are to be made for the first 20 cycles, the last 20 cycles, and approximately at 1440 – 1459 cycles, 2880 – 2899 cycles, and 4320 – 4339 cycles. The performance of a sample is unacceptable if the lamp is not started within a 20-second interval more than ten times for the 100 observations. Overall performance of the starter is acceptable if five of six samples are found to be acceptable.

11 Deactivated-Lamp Test

11.1 Unless repeated functioning is limited by means of a thermally operated control, automatic cutout, or the like, an automatic starter shall be capable of performing its intended function following 5 hours of continuous operation through the starting cycle in a circuit that simulates a deactivated-lamp condition.

11.2 If an automatic starter includes a cutout or similar device to discontinue flickering of a deactivated lamp, this test shall consist of ten periods, of not less than 2 hours each, of operation under simulated deactivated-lamp conditions, conducted in conjunction with the Endurance Test, Section 10.

11.3 The ten periods of operation are to be arranged to occur at approximately equally spaced intervals during the Endurance Test.

11.4 The simulated deactivated-lamp condition may be obtained by using unactivated-filament lamps; or it may be obtained by using two lamps with a pair of lampholders wired in the intended manner, with one end of one lamp inserted in one lampholder and one end of the other lamp inserted in the second lampholder, the other ends of the lamps being free.

11.5 The Deactivated-Lamp Test is to be made under the same conditions as the Endurance Test, except that the line switch is to be left on continuously. Samples which have been subjected to the Endurance Test shall be used.

11.6 If not less than five of the six samples perform acceptably, the overall performance for the deactivated lamp test is acceptable provided the five samples have successfully completed the Endurance Test described in 10.1 – 10.5.

12 Dielectric Voltage-Withstand Test

12.1 An automatic starter shall withstand without breakdown the application of a 60-Hz essentially sinusoidal potential of 1000 V for 1 minute between live parts and dead metal parts.

12.2 To determine whether an automatic starter complies with the requirements in 12.1, the device is to be tested by means of a 500-VA or larger capacity transformer whose output voltage is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test voltage is reached, and is to be held at that level for 1 minute. The increase in the applied potential is to be at a uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter.

12.3 A 0.020-µF capacitor, or one with less capacity, used as a component of an automatic starter shall withstand for 1 minute without breakdown a 60-Hz essentially sinusoidal potential applied between the capacitor terminals. If the capacitor is metal-enclosed, it shall also withstand the same test between its terminals and the metal enclosure. In either case, the test potential shall be three times the maximum root-mean-square voltage to which the capacitor is subjected during operation, but not less than 900 V.

12.4 Six samples previously subjected to the Endurance Test and Deactivated-Lamp Test are to be used for the Dielectric Voltage-Withstand Test.

MARKINGS

13 Details

13.1 An automatic starter shall be marked on the exterior of the enclosure with the:

a) Manufacturer's name, trade name, trademark, or other descriptive marking by which the organization responsible for the product can be identified,

b) The catalog number or the equivalent, and

c) The lamp wattage.

MANUAL STARTERS

CONSTRUCTION

14 General

14.1 A manual starter is a momentary-contact switch that is intended to be used to close the filament circuit when starting a fluorescent lamp, and may include a line switch in the same unit.

14.2 A momentary-contact starter switch shall be so made that it cannot be left in the position in which the circuit is maintained.

15 Enclosure

15.1 General

15.1.1 A manual starter shall be provided with an enclosure that shall house all live parts, except for wiring terminals and for live parts recessed to reduce the likelihood of contacting wires or flexible cord.

15.1.2 A nipple (male or female) through which wires may pass shall have no fewer than five full clean-cut threads of standard pitch as indicated in Table 15.1.

Table 15.1
Threads for nipples

Pipe trade size in inches	Threads per inch (per 25.4 mm)
1/8	27
1/4	18
3/8	18
1/2	14
3/4	14

15.1.3 Except as indicated in 15.1.4, a female nipple shall be provided with a No. 8-40 setscrew.

15.1.4 The setscrew may be omitted from a 1/2-inch (trade size) or larger pipe size nipple that has a tapered thread and is designed to be tightened with a wrench.

15.1.5 A nipple that is not integral with the body of the device shall be secured so that it cannot turn relative to the enclosure, and so that mechanical strength equivalent to that of a unit piece is provided.

15.1.6 A manual starter that has a threaded nipple for attachment to rigid metal conduit of the 1/2-inch (trade size) or larger shall be provided with a positive end stop for the conduit and a bushing or equivalent smooth, rounded surface to permit entry of the insulated conductors to the switch enclosure from the conduit without damage to the insulation.

15.2 Lining

15.2.1 If the enclosure of a manual starter is wholly or partly of conducting material, the inside surface of all such material shall be lined completely with insulating material and firmly secured in place so that it cannot become displaced under conditions of ordinary service. This lining shall keep live parts from contact with the enclosure, even though wires inside the switch loosen or become detached from their positions under the terminal screws.

15.2.2 The lining of a manual starter shall not be less than 1/64 inch (0.4 mm) thick.

15.3 Bushings

15.3.1 The cord-inlet hole in a pendant type of manual starter shall provide an opening of not less than 9/32 inch (7.1 mm) in diameter for flexible cord without a jacket, and not less than 13/32 inch (10.3 mm) in diameter for a jacketed type of cord. An oblong opening shall accommodate an 18 AWG (0.82 mm^2), Type SP-2 or heavier parallel construction flexible cord.

15.3.2 The cord-inlet hole in a pendant-type manual starter that has a metal enclosure shall be provided with an insulating bushing or the equivalent. The insulating material of the bushing shall be porcelain, phenolic or cold-molded composition, or other equivalent insulating material.

15.3.3 Hard fiber is acceptable for an insulating bushing if it is not less than 3/64 inch (1.2 mm) thick and is so formed and secured in place that it cannot be affected by conditions of ordinary moisture.

15.3.4 A threaded insulating bushing used in a threaded nipple shall not be smaller than the 3/8-inch (trade size) pipe size.

15.4 Strain relief

15.4.1 Strain relief shall be provided in a pendant-type manual starter so that a mechanical strain on the flexible cord cannot be transmitted to the wiring terminals. If strain relief is provided for by space within the enclosure for a knot in the flexible cord, the surface against which the knot may bear or with which it may come in contact shall be well insulated and free from projections, sharp edges, burrs, fins, and the like, which may damage the cord.

15.4.2 A metal cord grip to provide strain relief may be employed on a pendant-type manual starter intended particularly for use with a jacketed type of flexible cord such as Types S, ST, SJ, or SJT, if the diameter of the cord-inlet hole in the clamp is not less than 5/16 inch (7.9 mm).

16 Bases and Bodies

16.1 A base or body for the support of live parts shall be of cold-molded, phenolic, or urea composition, or other insulating material determined to be acceptable for the particular application.

16.2 The material for any part of a base or body shall not create a risk of fire or electric shock by warping, creeping, or distorting under conditions of arcing, temperature, or mechanical stress that are likely to occur in service.

16.3 The material used to support live parts shall be acceptable with respect to flammability, resistance to arc tracking, ignition from electrical sources, and moisture absorption. The material shall have acceptable dielectric and physical strength. The material shall not display a loss of these properties beyond the minimum acceptable level as a result of aging.

16.4 Insulating materials relied upon for the support of live metal or for insulating barriers shall be rated for continuous operation at 90°C (194°F).

17 Sealing

17.1 A live nut or screw head shall be recessed to a depth of not less than 1/8 inch (3.2 mm) in a hole, and shall be covered with sealing compound having a depth or thickness not less than 1/16 inch (1.6 mm).

17.2 A sealing compound shall not soften at the temperature to which it is likely to be subjected during operation.

18 Live Parts

18.1 General

18.1.1 All current-carrying parts shall have ample metal for stiffness and to limit the temperature rise to not more than 30°C (54°F) on any part while carrying rated current.

18.1.2 A metal part that holds contact jaws shall be securely fastened to the supporting base or mounting surface by means other than friction between surfaces so that it will not turn or shift in position.

18.1.3 Iron or steel, plain or plated, shall not be used for parts which are depended upon to carry current.

18.1.4 A steel which is corrosion resistant (stainless) or a steel which is protected against corrosion by cadmium plating, zinc plating, or an equivalent protective coating may be used for wire-binding nuts and screws when these parts are not depended upon to carry current.

18.1.5 A live part shall not turn relative to the surface on which it is mounted.

18.2 Terminals

18.2.1 A manual starter shall be provided with wiring terminals or leads for the connection of conductors that have an ampacity not less than the rating of the device.

18.2.2 A binding-screw terminal shall be provided with upturned lugs or the equivalent to hold a wire under the head of the binding screw. The setscrew form of wiring terminal shall not be used.

18.2.3 A terminal plate that has a tapped hole for a binding screw shall be of metal not less than 0.030 inch (0.76 mm) thick and shall have no fewer than two full threads in the metal.

18.2.4 For a binding screw with 32 or more threads per inch (per 25.4 mm), a terminal plate formed from stock 0.030 inch (0.76 mm) thick may have the metal extruded at the tapped hole for the binding screw to provide two full threads.

18.2.5 A binding screw shall thread into metal and shall be recessed or located so that it is unlikely that wires can contact it after installation.

18.2.6 A binding screw shall be no smaller than No. 6 (3.5 mm), and shall have no more than 36 threads per inch (per 25.4 mm).

18.3 Leads

18.3.1 Except as noted in 18.3.2, a soldered connection shall be made mechanically and electrically secure before soldering. The connection shall be insulated unless spacings are provided that are not less than those indicated in 9.1.

18.3.2 If mechanical security of a soldered joint cannot readily be accomplished, the joint may be made without mechanical security before soldering, provided that both sides of the joint are secured in a manner that makes a strain on the connection unlikely during the manufacturing process or thereafter.

18.3.3 Wire leads provided in place of wiring terminals shall not be less than 3 inches (76 mm) long and shall comply with 18.3.4 – 18.3.8.

Exception: The lengths of the wire leads are not specified for starters intended for factory assembly on fixtures or appliances.

18.3.4 A lead shall employ stranded conductors not smaller than 18 AWG (0.82 mm^2), and shall be provided with insulation rated for the voltage involved and for the temperature to which it is likely to be subjected, but not less than 75°C (167°F) if provided with an outer braid, not less than 90°C when not provided with an outer braid. See also 18.3.5.

18.3.4 effective September 1, 2006

18.3.5 A thermoplastic-insulated lead shall:

a) Be specifically for use in an electric fixture; or

b) Be a type that has a potential rating of 600 or more volts.

18.3.6 The connection of a lead shall not break when subjected to a pull of 20 lbf (89 N) for 1 minute.

18.3.7 A lead shall be finished to show a color other than green or green and yellow and shall also be other than white or grey.

18.3.8 Wires of different colors shall be used to identify the circuits of a multiple-circuit device. If a line switch is included in the assembly, the leads for this circuit shall be black and the leads for starting switches shall be of a distinctly different color, preferably blue for the first starter circuit and red for the second.