

# UL 542

ISBN 0-7629-0484-4

## Lampholders, Starters, and Starter Holders for Fluorescent Lamps



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UL Standard for Safety for Lampholders, Starters, and Starter Holders for Fluorescent Lamps, UL 542

Eighth Edition, Dated November 29, 1999

Revisions: This Standard contains revisions through and including February 20, 2003.

**SUMMARY OF TOPICS:**

***This revision of UL 542 is being issued to add a rating of 120 Watts for 65 Miniature Bi-Pin Fluorescent Lampholders.***

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Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The new and revised requirements are substantially in accordance with UL's Bulletin(s) on this subject dated September 3, 2002. The bulletin(s) is now obsolete and may be discarded.

The revisions dated February 20, 2003 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

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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 Listing, Recognition, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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This Standard consists of pages dated as shown in the following checklist:

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22-22B .....	February 20, 2003
23-24 .....	November 29, 1999
SA1-SA6 .....	November 29, 1999

No Text on This Page

**NOVEMBER 29, 1999**

(Title Page Reprinted: February 20, 2003)

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**UL 542**

**Standard for Lampholders, Starters, and Starter Holders for Fluorescent  
Lamps**

First Edition – September, 1958

Second Edition – March, 1966

Third Edition – October, 1969

Fourth Edition – June, 1974

Fifth Edition – April, 1979

Sixth Edition – May, 1985

Seventh Edition – September, 1994

**Eighth Edition**

**November 29, 1999**

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

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.

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.

**ISBN 0-7629-0484-4**

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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 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 or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this 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 cover starters, starter holders, and lampholders 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. Starter holders are for use in circuits involving a maximum of 250 V. Lampholders are intended for use with fluorescent lamps involving a potential of 2500 V or less during either starting or operating conditions.

1.2 These requirements also cover lampholders intended for use with low-pressure sodium lamps.

1.3 *Deleted February 20, 2003*

### 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 <sup>a</sup> (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 <sup>a</sup> (305)	150	0.55 – 0.75

Table 10.1 Continued on Next Page

Table 10.1 Continued

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)		
40	1-1/2 (38)	48 (1220)	200	0.55 – 0.75
90	2-1/8 (54)	60 (1520)	150	1.45 – 2.20

<sup>a</sup> 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 or a manual starting switch complies with the requirements in 12.1 and 23.1, 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- $\mu$ F 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 a No. 18 AWG (0.82 mm<sup>2</sup>), 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 28.2.1.

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 No. 18 AWG (0.82 mm<sup>2</sup>), 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). See also 18.3.5.

18.3.5 A thermoplastic-insulated lead shall:

- a) Have a braid covering,
- b) Be specifically for use in an electric fixture, or
- c) 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, except for lampholders, shall also be other than white or natural 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.

### 19 Actuating Members

19.1 An actuating member shall be substantial and securely, but not necessarily rigidly, attached to the operating mechanism that it is intended to control.

19.2 An actuating member of insulating material shall not soften or become damaged when it is used to operate the mechanism after having been exposed to a temperature of 65°C (149°F).

19.3 An electrically conductive member shall be insulated from live parts.

## 20 Assembly

20.1 A manual switch shall be capable of being readily wired as intended.

20.2 Assembly screws that must be loosened or removed to wire or install a manual starter shall thread into metal.

20.3 The chain of a manual starter that has a pull-type mechanism shall not become energized nor shall it cause the mechanism to jam if the chain is released suddenly.

## PERFORMANCE

### 21 General

21.1 A manual starting switch shall be subjected to the Endurance Test, Section 22, followed by the Dielectric Voltage-Withstand Test, Section 23.

21.2 Unless stated otherwise, six starters are to be used for the Endurance Test and Dielectric Voltage-Withstand Test.

### 22 Endurance Test

22.1 A manual 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 (see 10.2 and Table 10.1 ). If the starter includes a line switch, the test shall be conducted with the line switch in operation as intended.

22.2 A starter intended for use only with alternating current shall be tested with alternating current. If a manual starter is intended for use with either alternating or direct current, one set of six starters shall be tested with alternating current and an additional set of six starters shall be tested with direct current.

22.3 For the alternating-current test, a starter, with or without a line switch and intended to control two lamps is to be tested with a two-lamp power-factor-corrected ballast, with compensators in the circuit if and as specified by the manufacturer of the ballast. A starter, with or without a line switch added to control a single lamp, is to be tested with a low-power-factor ballast. Any convenient ballast arrangement may be used for the direct-current test.

### 23 Dielectric Voltage-Withstand Test

23.1 A manual starting switch shall withstand without breakdown the application of a 60-Hz essentially sinusoidal potential of 1000 V applied for 1 minute between live parts at different potentials, and between live parts and dead metal parts that are exposed for persons to contact or that may be grounded in service. See 12.2.

23.2 A 0.020- $\mu$ F capacitor, or one with less capacity, used as a component of a manual 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 potential for 60 seconds 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.

## RATINGS

### 24 Details

24.1 The rating of a manual starter shall include the number and wattage of the lamps to be controlled. A starter that incorporates a single-pole line switch shall be rated at not more than 125 V, and one that includes a double-pole line switch shall be rated at not more than 250 V.

## MARKINGS

### 25 Details

25.1 A manual starter shall be legibly and permanently marked 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) Catalog number or the equivalent, and
- c) Electrical ratings.

A switch that is for use only on alternating current shall be so marked.

## LAMP HOLDERS AND STARTER HOLDERS

## CONSTRUCTION

### 26 General

26.1 An electric-discharge lampholder is a device for supporting the terminals of an electric-discharge lamp and providing a means of connection to them. A starter holder performs a similar function for an automatic starter for an electric-discharge lamp. Unless specifically stated in each case, the requirements in Sections 27 – 31 apply equally to lampholders, starter holders, and combinations of lampholders and starter holders.

### 27 Enclosure and Insulating Materials

#### 27.1 General

27.1.1 The body of a holder shall be of porcelain, glass, phenolic or urea composition, or other equivalent insulating material.

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

27.1.3 The material used to enclose 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 properties. The material shall not display a loss of these properties beyond the minimum acceptable level as a result of aging.

27.1.4 The material used to enclose live parts shall be a thermoplastic material having a flame classification of V-2, V-1, V-0, 5VA, or 5VB, determined in accordance with the requirements for tests for flammability of plastic materials for parts in devices and appliances, UL 94, or a thermoset material such as phenolic or urea.

27.1.5 Insulating materials:

- a) Relied upon for the support of the lamp or other current-carrying parts,
- b) For the enclosure of current-carrying parts, or
- c) For insulating barriers

shall be rated for continuous operation at 90°C (194°F).

27.1.6 The body of a holder shall completely enclose all live parts of the device.

*Exception No. 1: Wiring terminals need not be enclosed by the holder body.*

*Exception No. 2: Live parts at an opening intended to accommodate a lamp or starter need not be enclosed by the holder body.*

*Exception No. 3: A small opening is acceptable in the insulating body of a holder if live parts that are exposed through such an opening are inaccessible and spacings from the live parts to the surface of the insulating body (measured at the hole) are equivalent to the spacings to a mounting surface indicated in 28.2.1.*

27.1.7 The construction of a lampholder intended for use in dwellings shall be such that, when the probe described in 27.1.8 is applied externally to the lamp contact opening:

- a) There is no contact between the probe and live metal in a lampholder rated at 600 V or less.
- b) There is a spacing of not less than 1/8 inch (3.2 mm) between the probe and live metal for a lampholder rated at more than 600 V but not more than 1000 V.

27.1.8 The probe mentioned in 27.1.7 is to be in the form of a cylinder having a radius of 0.205 inch (5.21 mm). The end of the probe which is used in exploring to determine the accessibility of live parts is to be rounded into a hemisphere with a radius of 0.205 inch (5.21 mm).

27.1.9 A lampholder that is intended for use in other than dwellings and is marked in accordance with 31.3 shall comply with (a) or (b) for a rating of 1000 V or less, and with (a) for a rating of 2500 V:

- a) The diameter of the opening for insertion of the lamp shall not be more than 1-1/8 inches (28.6 mm); and the spacing between the plane of the opening and any uninsulated live parts behind the opening within the lampholder shall not be less than 3/8 inch (9.5 mm).
  - i) If applied externally to the opening intended to accommodate the lamp, the probe mentioned in 27.1.8 shall not make contact with uninsulated live parts, and
  - ii) The spacing between such live parts and the plane of the opening shall not be less than 1/16 inch (1.6 mm).



27.1.10 Except for a lampholder having recessed inaccessible contacts and intended for use with a lamp that also has recessed inaccessible contacts, it is necessary that a lampholder, capable of being wired to open the primary circuit of the ballast when the lamp is removed, be available for use in conjunction with a lampholder rated at 600 or 1000 V.

27.1.11 Except as noted in 27.1.12, insulating material used for the support of, or as the retaining means for live parts shall be porcelain, glass, urea composition, or other equivalent insulating material.

27.1.12 In addition to the materials mentioned in 27.1.11, phenolic composition may be used in a lampholder that is rated at not more than 1000 V.

27.1.13 A holder shall be provided with a means for mounting and a means to render it incapable of turning that is equivalent to a two-screw mounting.

27.1.14 In place of a 2-screw mounting, one screw with an additional means provided to restrict rotation is acceptable. A mounting hole tapped to receive a screw is acceptable if it contains no fewer than two threads for the screw if in metal, or no fewer than five threads if in insulating material. Spring clips, clamps, or other means that provide equivalent support and restriction of rotation may also be used.

## 27.2 Insulating materials – outdoor use

27.2.1 Insulation that encloses, supports, or touches live parts of an outdoor-use lampholder shall be of glass or ceramic or shall be of a material having a Comparative Tracking Index not lower than indicated in Table 27.1 in accordance with the method for determining the Comparative Tracking Index of solid insulating material under moist conditions in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

**Table 27.1**  
**Comparative tracking index**

Lampholder voltage rating	Minimum acceptable comparative tracking index
250 or 600	175
1000 or 2000	250

## 28 Electrical Assembly and Spacings

### 28.1 Electrical assembly

28.1.1 Current-carrying parts shall be of copper, copper alloy, or other corrosion-resistant metal that has equivalent conductivity and mechanical strength. A current-carrying part shall not turn relative to the surface on which it is mounted.

28.1.2 Wiring terminals or leads shall be provided on a holder for the connection of supply conductors.

28.1.3 Wiring terminals, if provided, shall comply with the requirements in 18.1.3 and 18.2.2 – 18.2.6.

28.1.4 A lead for a holder shall be at least 4-1/2 inches (114 mm) long and, except as noted in 28.1.5, shall comply with the requirements in 18.3.4 – 18.3.8.

*Exception: The length of a wire lead is not specified for holders intended for factory assembly on fixtures or appliances.*

28.1.5 A lead for a lampholder rated at 2500 V shall not be smaller than No. 14 AWG (2.1 mm<sup>2</sup>). A braided lead on an outdoor lampholder shall be sealed in place with an acceptable sealing compound or by equivalent means.

## 28.2 Spacings

28.2.1 Except as noted in 28.2.2, the spacings between uninsulated live parts of opposite polarity and between an uninsulated live part and a dead-metal part (including a metal surface on which the holder is mounted) that is likely to be grounded or exposed to contact when the device is installed in the intended manner shall not be less than those shown in Table 28.1.

**Table 28.1**  
**Minimum acceptable spacings in inches (mm)**

Rating of holder in volts	Holder for outdoor use				Holder not for outdoor use			
	At wiring terminals		At points other than wiring terminals		At wiring terminals		At points other than wiring terminals	
	Through air	Over surface	Through air	Over surface	Through air	Over surface	Through air	Over surface
250	3/8 ( 9.5)	1/2 (12.7)	3/8 ( 9.5)	1/2 (12.7)	1/4 ( 6.4)	1/4 ( 6.4)	3/64 ( 1.2)	3/64 (1.2)
600	3/8 ( 9.5)	1/2 (12.7)	3/8 <sup>c</sup> ( 9.5)	1/2 <sup>c</sup> (12.7)	1/4 ( 6.4)	1/4 ( 6.4)	1/8 ( 3.2)	1/8 (3.2)
1000	3/8 ( 9.5)	1/2 (12.7)	3/8 <sup>c</sup> ( 9.5)	1/2 <sup>c</sup> (12.7)	3/8 ( 9.5)	1/2 <sup>a</sup> (12.7)	3/8 ( 9.5)	1/2 <sup>a</sup> (12.7)
1500	1/2 (12.7)	5/8 (15.9)	1/2 (12.7)	5/8 (15.9)	1/2 (12.7)	5/8 (15.9)	1/2 (12.7)	5/8 (15.9)
2500	3/4 (19.1)	3/4 (19.1)	3/4 <sup>b</sup> (19.1)	3/4 <sup>b</sup> (19.1)	3/4 (19.1)	3/4 (19.1)	3/4 <sup>b</sup> (19.1)	3/4 <sup>b</sup> (19.1)

<sup>a</sup> This spacing may be not less than 3/8 inch (9.5 mm) if the insulating material involved is porcelain, glass, urea formaldehyde, or other material that is not readily carbonized.

<sup>b</sup> On spring-contact lampholders, it is necessary that this distance be maintained either with the lamp in place, or removed, and in any position up to 1/8 inch (3.2 mm) from the fully-depressed position of the spring.

<sup>c</sup> This spacing may not be less than 3/16 inch (4.8 mm) for lampholders for use with low-pressure sodium lamps.

28.2.2 A spacing between an uninsulated live part (at a point other than a wiring terminal) and a dead-metal part that is exposed to contact but is not likely to be grounded when the lampholder is installed may be less than that indicated in Table 28.1, as follows: if the value in the table is 1/8 inch (3.2 mm) or more, the spacing in question may be half that value, or 3/32 inch (2.4 mm), whichever is larger.

28.2.3 A dead metal part, such as the head of a screw or rivet, is not to be considered to be exposed to contact if it is recessed not less than 3/16 inch (4.8 mm), in the clear, in a hole not more than 9/32 inch (7.1 mm) in diameter.

28.2.4 An isolated dead-metal part interposed between uninsulated parts of opposite polarity, or between an uninsulated live part and a dead-metal part, reduces the spacing by an amount equal to the dimension of the isolated dead metal part in the direction of the measurement.

28.2.5 Except as noted in 28.2.6, in a lampholder rated at 1000 V, there shall be a spacing through air and over surface between an uninsulated live part and the outer surface of the lampholder. The spacing shall not be less than 3/16 inch (4.8 mm) if the body of the holder is of glass, porcelain, urea formaldehyde, or other material that does not carbonize readily. For other materials, this spacing shall be no less than 1/4 inch (6.4 mm).

28.2.6 The requirement in 28.2.5 does not apply at an opening into which it is intended that a terminal of a lamp be inserted, nor does it apply to an uninsulated live part if the part is enclosed (in a fixture enclosure, for example) while the lampholder is mounted in the intended manner.

28.2.7 The spacing mentioned in 28.2.5 is to be measured while a lamp is in place in the holder. If the holder involves a telescoping section that abuts the lamp, this section is to be depressed 1/16 inch (1.6 mm) while the measurement is being made. The spacing is also to be measured without a lamp in place, unless the lampholder is of a type for which all parts are de-energized in absence of the lamp.

28.2.8 For a miniature bipin lampholder rated 75 W, 600 V, the spacing through air and over surface between an uninsulated live part and a dead-metal part is to be measured while a lamp is in place in the holder. The spacing is also to be measured without a lamp in place, unless the lampholder is of a type for which all parts are de-energized in absence of the lamp.

## PERFORMANCE

### 29 Dielectric Voltage-Withstand Test

29.1 A lampholder for use with low-pressure sodium lamps shall be capable of withstanding for 1 minute without breakdown a 60-Hz essentially sinusoidal potential following exposure to moist air for 48 hours. The moist air shall have a relative humidity of  $88 \pm 2$  percent at a temperature of  $32.0 \pm 2.0^\circ\text{C}$  ( $89.6 \pm 3.6^\circ\text{F}$ ). The test potential shall be applied between parts of opposite polarity and between live parts and dead-metal parts. The test potential shall be 1000 V plus twice the rated voltage.

29.2 To determine compliance with 29.1, six samples of the lampholder are to be mounted on a metal plate in the intended manner and placed in the humidity test chamber for 48 hours. Immediately following the humidity conditioning, each sample is to be subjected to the dielectric voltage-withstand potential by means of a 500-VA or larger-capacity testing transformer, the output voltage of which is essentially sinusoidal and can be varied. The applied potential is to be increased gradually from zero until the required test voltage is reached, and held at that value for 1 minute. The increase in the applied potential is to be at a uniform rate and as rapid as consistent with its value being correctly indicated by the voltmeter.

## RATINGS

### 30 Details

30.1 A starter holder shall be rated at 660 W and 250 V.

30.2 A combination lampholder-starter may be assigned the single rating for the lampholder.

30.3 A lampholder shall be rated in accordance with Table 30.1.

**Table 30.1**  
**Lampholder ratings**

Table 30.1 revised February 20, 2003

Type of lampholder	Watts	Volts
Miniature bi-pin	75 or 120	250 or 600
Medium bi-pin and mogul bi-pin	660	250, 600, or 1000
Recessed double-contact	660	600 or 1000
Single-pin	660	250, 600, or 1000
Recessed single-pin	660	600 or 1000
Ferrule-cap	660	250, 600, 1000, or 2500
Low-pressure-sodium	660	600 or 1000
4-pin circline	660	250 or 600

## MARKINGS

### 31 Details

31.1 A holder shall be legibly and permanently marked with:

- a) The manufacturer's name, trade name, trademark, or other descriptive marking by which the organization responsible for the product can be identified,
- b) The electrical ratings, and
- c) The catalog number, for other than bipintype lampholders and starter holders.

31.2 If the catalog or equivalent designation is not marked on the holder, it shall appear on the carton or other container in which the holder is packaged.

31.3 A lampholder of the type described in 27.1.9 shall be marked "Not for residential use " or with an equivalent statement. The marking shall be in letters at least 1/8 inch (3.2 mm) high.

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31.4 A lampholder that is intended for outdoor application and meets the requirements in 27.2.1 shall be marked with a statement such as "For outdoor use " or "For outdoor and indoor use " on the lampholder itself, or on the smallest carton or container in which the lampholder is packaged, or on a sheet in the smallest carton or container in which the lampholder is packaged.

31.5 A lampholder that is intended for use with low-pressure sodium lamps and meets the requirements in 27.2.1 shall be marked with a statement such as "For outdoor use " or "For outdoor and indoor use " on the lampholder itself, or on the smallest carton or container in which the lampholder is packaged, or on a sheet in the smallest carton or container in which the lampholder is packaged.

## **MANUFACTURING AND PRODUCTION TESTS**

### **32 Production-Line Dielectric Voltage-Withstand Test**

32.1 Each automatic starter and manual starting switch shall withstand without breakdown, as a routine production-line test, the application of a 40 – 70 Hz potential between the live parts and dead metal.

32.2 The test potential shall be 1200 V applied for 1 second except that the test voltage may be reduced to 1000 V if the time of application is increased to 1 minute.

32.3 The device may be in a heated or unheated condition for the test.

32.4 The test equipment shall include a transformer having an essentially sinusoidal output, an audible or visual indicator of dielectric breakdown, and either a manually resettable device to restore the equipment after breakdown or an automatic feature that rejects any unacceptable unit.

32.5 If the output of the test equipment transformer is less than 500 VA, the equipment shall include a voltmeter in the output circuit to directly indicate the test potential.

32.6 If the output of the test equipment transformer is 500 VA or larger, the test potential may be indicated by a voltmeter in the primary circuit or in a tertiary winding circuit, by a selector switch marked to indicate the test potential, or by a marking in a readily visible location to indicate the test potential of equipment having a single test potential output. When marking is used without an indicating voltmeter, the equipment shall include a positive means, such as a power-on lamp, to indicate that the manual reset switch has been reset following a tripout.

32.7 Test equipment, other than those described by 32.4 – 32.6, may be used if found to accomplish the intended factory control.

**MARKINGS****33 All Devices**

33.1 If a manufacturer produces or assembles automatic starters, manual starters, or lampholders and starter holders at more than one factory, each finished starter shall have a distinctive marking— which may be in code – by means of which it can be identified as the product of a particular factory.



**SUPPLEMENT SA - NAVAL USE LAMPHOLDERS AND STARTER HOLDERS FOR FLUORESCENT LAMPS****SA1 Scope**

SA1.1 These requirements cover lampholders and starter holders for fluorescent lamps for use on military Naval ships. A lampholder shall comply with all the applicable requirements of the preceding sections of this Standard, except as modified or added to the requirements specified in this supplement.

SA1.2 The requirements in this supplement do not cover starters for fluorescent lamps or low-pressure sodium lamps for use on Naval ships.

**SA2 General**

SA2.1 Self tapping screws and sheet metal screws shall not be used.

SA2.2 Molded-in metallic inserts, sleeves, or the like shall be provided for screw threads in insulating material.

SA2.3 A lampholder or starter holder shall be constructed in accordance with Figures SA2.1 – SA2.4 as applicable, or the equivalent.

SA2.4 Wire leads shall be at least 6 inches (152.4 mm) long.

**SA3 Materials**

SA3.1 Aluminum, aluminum alloys, and cadmium plating shall not be used.

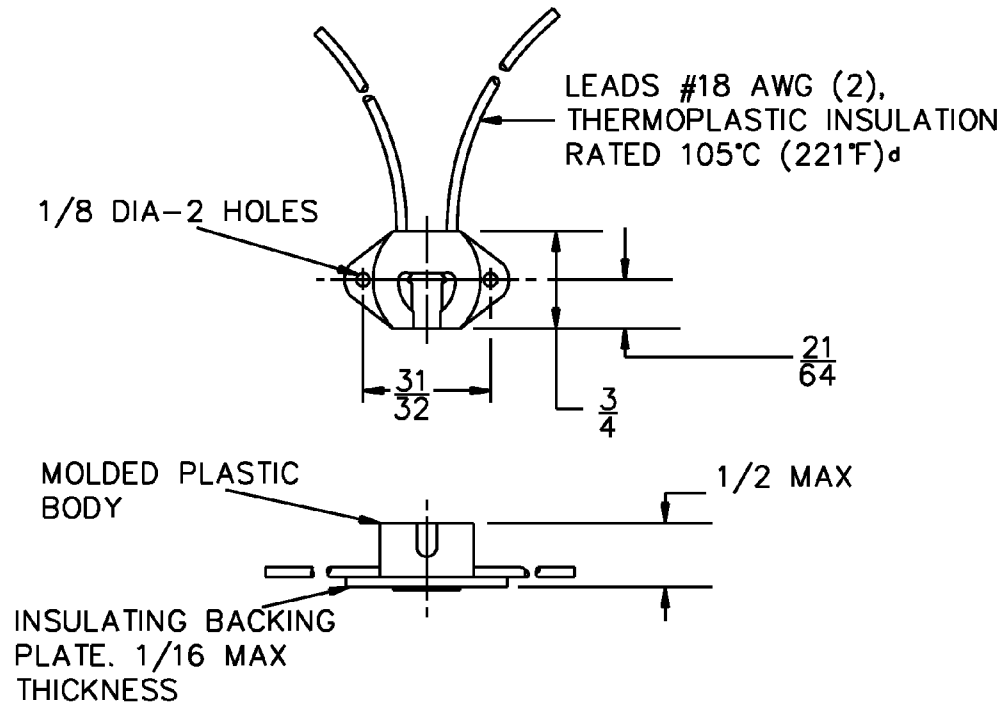
SA3.2 In addition to the requirements in 18.3.4, wire leads shall be stranded copper conductors with an insulation rated for the voltage involved and for the temperatures to which it is likely to be subjected to, but not less than 105°C (221°F). See the notes to Figures SA2.1 – SA2.4 for additional information on wire leads.

SA3.3 Metals shall be used in combinations that are galvanically compatible.

SA3.4 A lampholder or starter holder shall consist of the materials specified in the preceding sections of this standard, or the equivalent. Among the additional factors taken into consideration when judging an equivalent material are:

- a) Mechanical strength,
- b) Resistance to impact,
- c) Combustibility, and
- d) Resistance to distortion at temperatures to which the material may be subjected under conditions of normal and abnormal use.

Figure SA2.1  
Miniature bipin<sup>a,b,c,d,e,f</sup>  
(250 V, 75 W)



SM272

<sup>a</sup> All dimensions are in inches. Unless otherwise specified, tolerances for fractions are  $\pm 1/64$  inch.

<sup>b</sup> Alternative constructions will be investigated.

<sup>c</sup> 1 inch = 25.4 mm.

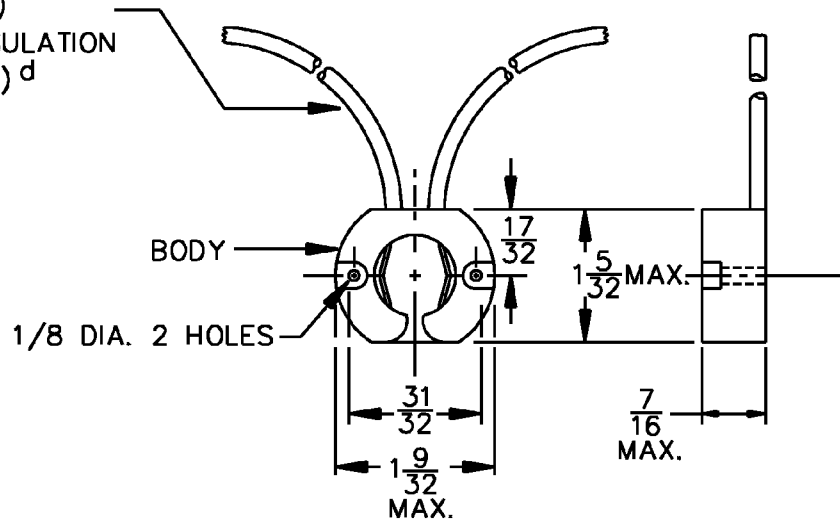
<sup>d</sup> The packaging material of a lampholder rated 105°C (221°F) shall be marked "M970/10-1." For high temperature applications, the insulation on wiring leads shall be rated for 150°C (302°F); all other materials shall be heat resistant as determined in accordance with the High Temperature Test, Section SA4, and the packaging material shall be marked "M970/15-1."

<sup>e</sup> Requirements formerly covered under Military Standard MS16567, Drawing 9000-S6401-73939, MIL-L-970/10 and MIL-L-970/15.

<sup>f</sup> A lampholder shall conform with the requirements in Lampholders for Electric Lamps, ANSI C81.62-1993.

Figure SA2.2  
Medium bipin<sup>a,b,c,d,e,f</sup>  
(600 V, 660 W)

LEADS #18 AWG (2)  
THERMOPLASTIC INSULATION  
RATED 105°C (221°F)<sup>d</sup>



SM273

<sup>a</sup> All dimensions are in inches. Unless otherwise specified, tolerances for fractions are  $\pm 1/64$  inch.

<sup>b</sup> Alternative constructions will be investigated.

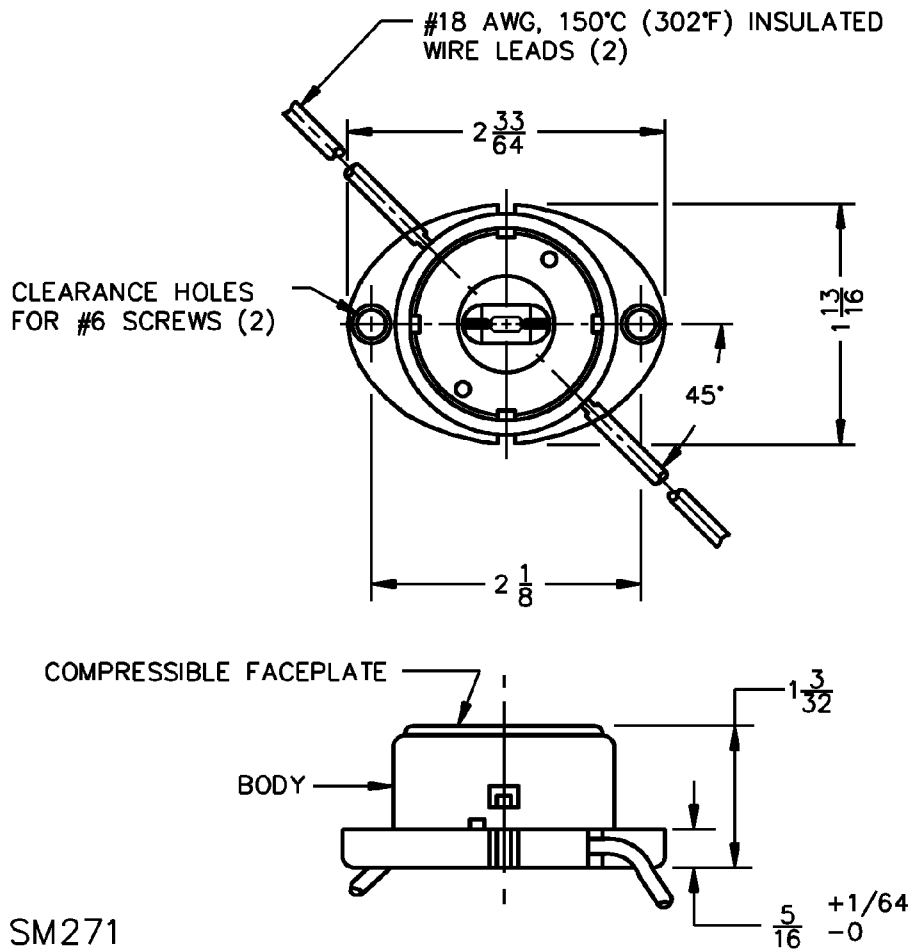
<sup>c</sup> 1 inch = 25.4 mm.

<sup>d</sup> The packaging material of a lampholder with leads rated 105°C (221°F) shall be marked "M970/11-1." For high temperature applications, the insulation on wiring leads shall be rated for 150°C (302°F); all other materials shall be heat resistant as determined in accordance with the High Temperature Test, Section SA4, and the packaging material shall be marked "M970/18-1."

<sup>e</sup> Requirements formerly covered under Military Standard MS16566, Drawing number 9000-S6401-73939, MIL-L-970/11 and MIL-L-970/18.

<sup>f</sup> A lampholder shall conform with the requirements in Lampholders for Electric Lamps, ANSI C81.62-1993.

**Figure SA2.3**  
**Recessed double contact<sup>a,b,c,d,e,f</sup>**  
 (600 V, 660 W)



<sup>a</sup> All dimensions are in inches. Unless otherwise specified, tolerances for fractions are  $\pm 1/64$  inch. Tolerances for angles are  $\pm 1/2$  degrees.

<sup>b</sup> Alternative constructions will be investigated.

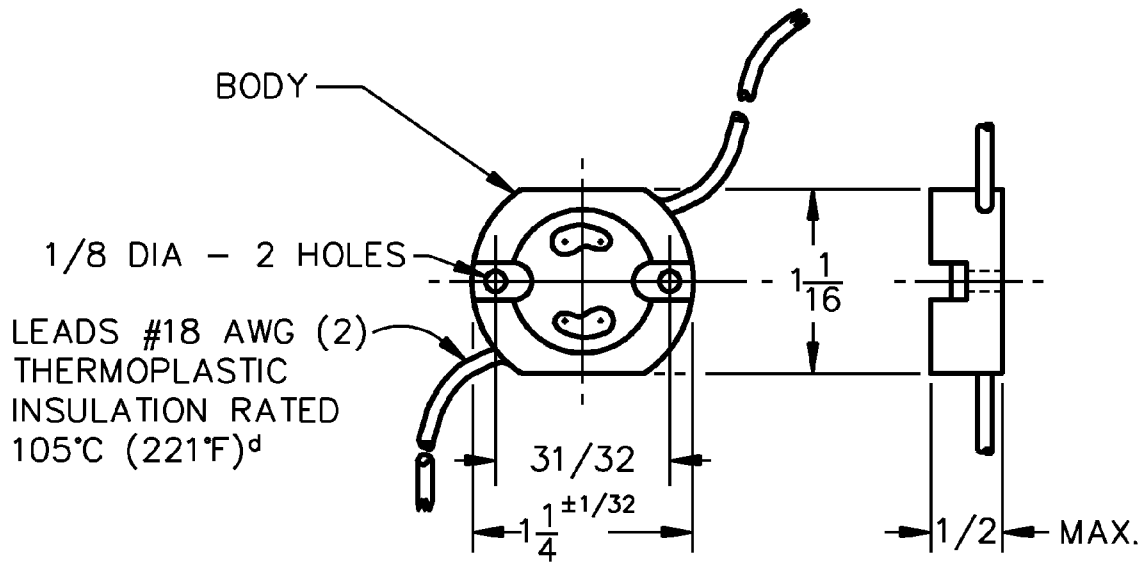
<sup>c</sup> 1 inch = 25.4 mm.

<sup>d</sup> Materials shall be heat resistant as determined in accordance with the High Temperature Test, Section SA4, and the packaging material shall be marked "M970/12-1."

<sup>e</sup> Requirements formally covered under MIL-L-970/12B(SH).

<sup>f</sup> A lampholder shall conform with the requirements in Lampholders for Electric Lamps, ANSI C81.62-1993.

**Figure SA2.4**  
**Medium bipin starter socket<sup>a,b,c,d,e,f</sup>**  
 (250 V, 75 W)



SM274

<sup>a</sup> All dimensions are in inches. Unless otherwise specified, tolerances for fractions are  $\pm 1/64$  inch.

<sup>b</sup> Alternative constructions will be investigated.

<sup>c</sup> 1 inch = 25.4 mm.

<sup>d</sup> The packaging material of a lampholder with leads rated 105°C (221°F) shall be marked "M970/13-1." For high temperature applications, the insulation on wiring leads shall be rated for 150°C (302°F); all other materials shall be heat resistant as determined in accordance with the High Temperature Test, Section SA4, and the packaging material shall be marked "M970/19-1."

<sup>e</sup> Requirements formerly covered under Military Standard MS16568, Drawing 9000-S6401-73939, MIL-L-970/13, and MIL-L-970/19.

<sup>f</sup> A starter holder shall conform with the requirements in Lampholders for Electric Lamps, ANSI C81.62-1993.

#### SA4 High Temperature Test

SA4.1 There shall be no burning, charring, or deterioration of materials to the extent that the lampholder or starter holder is inoperable following 100 hours of exposure in an air oven maintained at  $150 \pm 2^\circ\text{C}$  ( $302 \pm 3.6^\circ\text{F}$ ). The sample is to be connected to a power supply of rated voltage during the conditioning and the highest wattage bulb, in accordance with the rating of the lampholder or starter holder, is to be inserted.

*Exception: This test need not be conducted on lampholders or starter holders designated M970/10-1, M970/11-1, and M970/13-1.*

#### SA5 Dielectric Voltage-Withstand Test

SA5.1 A lampholder or starter holder shall withstand without breakdown the application of a 60-Hz essentially sinusoidal potential of 1000 volts plus 2 times the rated voltage of the product for 1 minute between live parts and dead metal parts.

SA5.2 The lampholder or starter holder 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.

#### SA6 Pull Test—Leads

SA6.1 Each lampholder or starter holder lead shall withstand for 1 minute without separation, breakage, or loosening from the lampholder a 20-pound (9-kg) dead-load static pull perpendicular to the plane of the lead entry hole.

#### SA7 General

SA7.1 The smallest container, box, or the like used to ship a naval lampholder or starter holder shall additionally be marked with the applicable military part identification number (PIN) as specified in Table SA7.1.

**Table SA7.1**  
**Naval lampholder marking designations**

Lampholder type	Temperature rating	Shipping container marking (PIN)
Figure SA2.1 Miniature Bipin 250 V, 75 W	105°C (221°F) 150°C (302°F)	M970/10-1 M970/15-1
Figure SA2.2 Medium Bipin 600 V, 660 W	105°C (221°F) 150°C (302°F)	M970/11-1 M970/18-1
Figure SA2.3 Recessed Double Contact 600 V, 660 W	150°C (302°F)	M970/12-1
Figure SA2.4 Medium Bipin Starter Socket 250 V, 75 W	105°C (221°F) 150°C (302°F)	M970/13-1 M970/19-1