

UL 773A

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Nonindustrial Photoelectric Switches for Lighting Control



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August 30, 1995

Standard for

Nonindustrial Photoelectric Switches for Lighting Control

UL 773A, Fourth Edition

Accompanying this transmittal notice is a copy of the Fourth edition of UL 773A.

A CHANGE IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT EXCEPT FOR PARAGRAPHS 3.6 AND 3.7, SECTIONS 4 AND 5, AND FIGURE 3.1, WHICH BECOME EFFECTIVE AUGUST 30, 1998 AS INDICATED IN THE SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEMS.

THE CURRENT REQUIREMENTS IN EFFECT FOR THE REQUIREMENTS HAVING FUTURE EFFECTIVE DATES ARE LOCATED IN THE BACK OF THE STANDARD.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this standard unless the applicant specifically requests that the product be judged under the current requirements. However, should the applicant elect 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.

The requirements in this standard are substantially in accordance with UL's bulletin on this subject dated March 6, 1995. This bulletin is now obsolete and may be discarded.

Revised and/or additional pages may be issued from time to time.

AUGUST 30, 1995

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UL 773A

Standard for

Nonindustrial Photoelectric Switches for Lighting Control

First Edition – August, 1978

Second Edition – April, 1982

Third Edition – January, 1989

Fourth Edition

August 30, 1995

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 773A on June 13, 1989. 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 published set of revision pages.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover indoor and outdoor light-sensitive, motion (passive infrared)-sensitive, or both light- and motion (passive infrared)-sensitive control units rated 300 volts alternating current (ac) or less and 2000 watts or less that are intended for controlling indoor or outdoor electric lighting fixtures, and that are intended to be employed in accordance with the National Electrical Code, NFPA 70.

1.1 revised August 30, 1995

1.2 These requirements do not cover photoelectric switches, intended for industrial use, or controls of the plug-in, locking type, used for area or roadway lighting fixtures.

1.2 revised August 30, 1995

1.3 A solid-state device is investigated under these requirements and under such additional requirements as are applicable to the device under consideration.

1.4 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable 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 cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component.

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

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard; or
- b) Is superseded by a requirement in this standard.

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

2.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions, for which they have been recognized.

2.2 Units of measurement

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

2.3 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.

CONSTRUCTION

3 Enclosure

3.1 The enclosure of a unit shall be strong and rigid so as to resist the abuses likely to be encountered in the operation of the unit. The degree of resistance inherent in the unit shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other serious defects which alone or in combination may increase the risk of fire, electric shock, or injury to persons.

3.2 A cast-metal enclosure shall be at least 1/8 inch (3.2 mm) thick at every point, more than 1/8 inch thick at reinforcing ribs and door edges, and not less than 1/4 inch (6.4 mm) thick at tapped holes for conduit.

Exception: Other than at plain or threaded conduit holes, die-cast metal may be:

- a) Not less than 3/32 inch (2.4 mm) thick for an area greater than 24 square inches (155 square centimeters) or having any dimensions more than 6 inches (152 mm); and*
- b) Not less than 1/16 inch (1.6 mm) thick for an area of 24 square inches or less and having no dimensions more than 6 inches. The area limitation may be obtained by the provision of reinforcing ribs subdividing a larger area.*

3.3 The cast-metal enclosure described in 3.2 or an enclosure of sheet metal having the construction indicated in Table 3.1 or 3.2 will generally be considered to have an acceptable level of the factors indicated in 3.1.

Table 3.1
Minimum thickness of sheet metal for enclosures —
carbon steel or stainless steel, inches

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness	
Maximum width ^b	Maximum length of supported edge ^{c,d}	Maximum width ^b	Maximum length ^d	Uncoated	Zinc coated
4.0	Not limited	6.25	Not limited	0.020 ^e	0.023 ^e
4.75	5.75	6.75	8.25	0.020 ^e	0.023 ^e
6.0	Not limited	9.5	Not limited	0.026 ^e	0.029 ^e
7.0	8.75	10.0	12.5	0.026 ^e	0.029 ^e
8.0	Not limited	12.0	Not limited	0.032	0.034
9.0	11.5	13.0	16.0	0.032	0.034
12.5	Not limited	19.5	Not limited	0.042	0.045
14.0	18.0	21.0	25.0	0.042	0.045
18.0	Not limited	27.0	Not limited	0.053	0.056
20.0	25.0	29.0	36.0	0.053	0.056

NOTE — SI equivalents of the dimensions in this table are:

inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
0.020	0.51	0.053	1.35	7.0	178	12.0	305	21.0	533
0.023	0.58	0.056	1.42	8.0	203	12.5	318	25.0	635
0.026	0.66	4.0	102	8.25	210	13.0	330	27.0	686
0.029	0.74	4.75	121	8.75	222	14.0	356	29.0	737
0.032	0.81	5.75	146	9.0	229	16.0	406	36.0	914
0.034	0.86	6.0	152	9.5	241	18.0	457		
0.042	1.07	6.25	159	10.0	254	19.5	495		
0.045	1.14	6.75	171	11.5	292	20.0	508		

^a See 3.5.

^b The width is the smaller dimension of a rectangular sheet metal piece that is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels that are not supported along one side — for example, side panels of boxes — the length of the unsupported side shall be limited to the dimensions specified.

^d "Not limited" applies only if the edge of the surface is flanged at least 1/2 inch (12.7 mm) or fastened to adjacent surfaces not normally removed in use.

^e Sheet steel for an enclosure intended for outdoor use — raintight or rainproof — shall not be less than 0.034 inch thick if zinc coated and not less than 0.032 inch thick if uncoated.

Table 3.2
Minimum thickness of sheet metal for enclosures —
aluminum, copper, or brass, inches

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness
Maximum width ^b	Maximum length ^{c,d}	Maximum width ^b	Maximum length ^d	
3.0	Not limited	7.0	Not limited	0.023 ^e
3.5	4.0	8.5	9.5	0.023 ^e
4.0	Not limited	10.0	Not limited	0.029
5.0	6.0	10.5	13.5	0.029
6.0	Not limited	14.0	Not limited	0.036
6.5	8.0	15.0	18.0	0.036
8.0	Not limited	19.0	Not limited	0.045
9.5	11.5	21.0	25.0	0.045
12.0	Not limited	28.0	Not limited	0.058
14.0	16.0	30.0	37.0	0.058
18.0	Not limited	42.0	Not limited	0.075
20.0	25.0	45.0	55.0	0.075

NOTE — SI equivalents of the dimensions in this table are:

inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
0.023	0.58	3.5	89	8.5	216	14.0	356	25.0	635
0.029	0.74	4.0	102	9.5	241	15.0	381	28.0	711
0.036	0.91	5.0	127	10.0	254	16.0	406	30.0	762
0.045	1.14	6.0	152	10.5	267	18.0	457	37.0	940
0.058	1.47	6.5	166	11.5	292	19.0	483	42.0	1067
0.075	1.90	7.0	178	12.0	305	20.0	508	45.0	1143
3.0	76	8.0	203	13.5	343	21.0	533	55.0	1397

^a See 3.5.

^b The width is the smaller dimension of a rectangular sheet metal piece that is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels which are not supported along one side — for example, side panels of boxes — the length of the unsupported side shall be limited to the dimensions specified.

^d "Not Limited" applies only if the edge of the surface is flanged at least 1/2 inch (12.7 mm) or fastened to adjacent surfaces not normally removed in use.

^e Sheet copper, brass, or aluminum for an enclosure intended for outdoor use — raintight or rainproof — shall not be less than 0.029 inch thick.

3.4 Tables 3.1 and 3.2 are based on a uniform deflection of the enclosure surface for any given load concentrated at the center of the surface regardless of metal thickness.

3.5 With reference to Tables 3.1 and 3.2, a supporting frame is a structure of angle or channel or folded rigid section of sheet metal that is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and that has sufficient torsional rigidity to resist the bending moments that may be applied by the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure that is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes:

- a) Single sheet with single formed flanges – formed edges;
- b) A single sheet that is corrugated or ribbed;
- c) An enclosure surface loosely attached to a frame, for example, with spring clips; and
- d) An enclosure surface having an unsupported edge.

3.6 A polymeric enclosure shall comply with the applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

Exception No. 1: For an indoor use unit or an outdoor use unit that complies with the Raintightness Test, Section 27, with the lens removed, a polymeric lens that does not provide an enclosure for live parts as determined in accordance with Accessibility to Uninsulated Live Parts, Section 4, need not comply with the requirements in UL 746C.

Exception No. 2: For an outdoor use unit other than as described in Exception No. 1, a polymeric lens that does not provide an enclosure for live parts as determined in accordance with Accessibility to Uninsulated Live Parts, Section 4, need only comply with the requirements for exposure to ultraviolet light and water exposure and immersion as specified in UL 746C.

Revised 3.6 effective August 30, 1998

Figure 3.1 Test probe

Figure 3.1 deleted effective August 30, 1998

3.7 *3.7 deleted effective August 30, 1998*

3.8 The enclosure shall have provision for the connection of a wiring system acceptable for the application.

4 Accessibility of Uninsulated Live Parts

4.1 An uninsulated live part that may involve a risk of electric shock shall be located, enclosed, or guarded so that the part can not be contacted by persons.

Added 4.1 effective August 30, 1998

4.2 A live part is considered to involve a risk of electric shock unless it is in one of the following circuits:

- a) A circuit supplied by one or more isolated secondary windings of a transformer in which the maximum possible open circuit voltage at the transformer is less than:
 - 1) 30 volts (42.4 volts peak) where wet contact is not likely to occur, and

2) 15 volts (21.2 volts peak) where wet contact is likely to occur; or

b) A circuit derived from a source other than that described in (a) in which the available current is limited to 0.5 milliamperes, regardless of supply polarity. The current is to be measured between accessible points and from these points to earth ground through a 1500 ohm resistor. If circuit impedance is used to limit the current, the circuitry shall comply with the requirements specified in 4.3 and 4.4.

Added 4.2 effective August 30, 1998

4.3 The circuit impedance described in 4.2(b) shall be provided by two independent means. Either independent means shall limit the available leakage current to less than 0.5 mA.

Added 4.3 effective August 30, 1998

4.4 With respect to 4.3, the following components can be used for the application:

- a) Metal film, carbon film, wire wound, and metal glazed resistors;
- b) Metallized polyester film capacitors;
- c) Antenna-coupling capacitors, and line-by-pass capacitors that comply with the Standard for Across-the-Line, Antenna-Coupling, and Line-By-Pass Capacitors for Radio- and Television-Type Appliances, UL 1414; and
- d) Other components, if investigated and found acceptable for the application.

Added 4.4 effective August 30, 1998

4.5 For supplies of circuits of the types specified in 4.2(b), the minimum spacings shall be in accordance with Spacings, Section 12, or Alternate Spacings – Clearances and Creepage Distances, Section 13.

Added 4.5 effective August 30, 1998

4.6 The probe illustrated in Figure 4.1, when inserted through an opening in an enclosure, guard, or operator accessible barrier, shall not touch any uninsulated live part that involves a risk of electric shock. See 4.7. The probe is to be rotated with the movable sections straight or in any possible position resulting from bending one or more sections in the same direction. See 5.1.

Added 4.6 effective August 30, 1998

4.7 If any part of the enclosure must be opened or removed as part of normal operation, regular adjustment, or regular or required maintenance (set point adjustment, timer or time of day clock adjustment, battery replacement, and the like) with or without the use of tools, or can be opened or removed without the use of tools, the accessibility probe is to be applied without the part in place.

Added 4.7 effective August 30, 1998

5 Openings in Enclosure

5.1 Openings in an enclosure shall not have any dimensions large enough to permit the entrance of a 1 inch (25.4 mm) diameter rod, and shall comply with 5.2 – 5.8.

Added 5.1 effective August 30, 1998

5.2 An opening shall not be provided in a compartment or part of an enclosure that contains field-wiring splices in a line-voltage circuit.

Added 5.2 effective August 30, 1998

5.3 An opening shall not be located in a mounting surface of an enclosure.

Exception: *The following openings may be located in the mounting surface of an enclosure:*

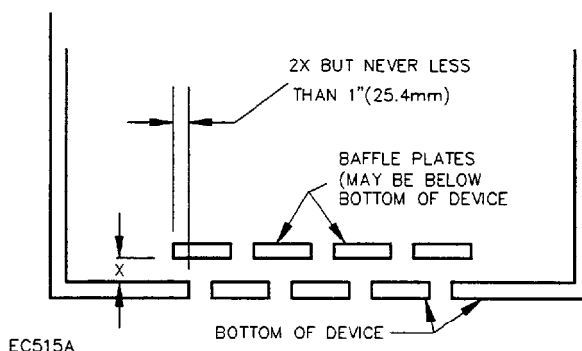
- a) *A mounting opening that complies with Provision for Mounting, Section 6.*
- b) *A maximum of four openings provided for the escape of air or paint during a painting process. The maximum dimension of such an opening shall not exceed 1/8 inch (3.2 mm).*
- c) *A maximum of four unused holes provided for mounting of internal components. The maximum dimension of such an opening shall not exceed 3/16 inch (4.8 mm).*

Added 5.3 effective August 30, 1998

5.4 An opening may be provided in the bottom surface of an enclosure if the opening does not permit materials to fall directly out from the interior of the unit. Figure 5.1 illustrates a construction that meets this requirement.

Added 5.4 effective August 30, 1998

Figure 5.1
Bottom surface opening of an enclosure



Added Figure 5.1 effective August 30, 1998

5.5 The shortest distance between an opening and the bottom of an enclosure or a wall-mounting surface shall be at least one-quarter of the enclosure height or depth, respectively, or 1 inch (25.4 mm), whichever is less.

Added 5.5 effective August 30, 1998

5.6 There shall be no emission of flame or molten material through an opening, or manifestation of risk of fire, during normal tests or during abnormal tests, such as transformer burnout.

Added 5.6 effective August 30, 1998

6 Provision for Mounting

6.1 Provision shall be made for securely mounting a permanently connected unit in position. Bolts, screws, or other parts used for assembling the unit shall be independent of those used for securing component parts of the unit to the frame, base, or panel. There shall be no more than four holes for mounting.

6.1 revised August 30, 1995

6.2 A cord-connected unit shall not include means for permanent mounting. One or two keyhole slots for wall hanging may be provided if the hanging screws, nails, and the like, are not accessible for tightening, and if long nails, hooks, or screws for hanging will not be likely to touch internal wiring, the operating mechanism, or live parts and will not result in spacings less than those required in 12.1.

6.2 added August 30, 1995

6.3 A unit having attachment-plug blades for direct plug-in connection to a receptacle outlet rated 15 A, 125 V, and having the Standard for Wiring Devices, ANSI/NEMA WD6-1988, slot configuration shall have a mass of 28 oz (0.79 kg) or less. The moment, center of gravity, and dimensions shall not exceed the limits specified in 6.4.

6.3 added August 30, 1995

6.4 The moment, center of gravity, and dimensions of a direct plug-in unit, see Figure 6.1, shall comply with each of the following:

- a) The quotient of WY/Z shall not exceed 48 oz (1.36 kg);
- b) The quotient of WY/S shall not exceed 48 oz;
- c) The product of WX shall not exceed 80 oz-in (0.56 N·m);
- d) The dimension Z_3 shall not exceed 3-1/4 inch (82.6 mm); and
- e) The dimensions S_1 , S_2 , Z_1 , and Z_2 shall not exceed 5 inch (127 mm).

6.4 added August 30, 1995