UL 508

STANDARD FOR SAFETY

Industrial Control Equipment

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

UL Standard for Safety for Industrial Control Equipment, UL 508

Nineteenth Edition, Dated October 28, 2024

Summary of Topics

This new Nineteenth Edition of ANSI/UL 508 dated October 28, 2024 includes the following changes in requirements:

– Revisions to Address Changes to UL 869A; Section 133.

– Clarification of Ambient for Tests; 44.3 and 44.4.

– Remove Exception to 72.5 for Definite Purpose Motor Controllers.

– Move Pressure Test to General Section 71 and Table 102.1.

– Remove Programmable Controllers from UL 508; 1.3, 1.12, 37.1, Table 77.1, and Index.

– Correction to Section 50; 50.2, Table 50.1, 73.41, and Table 77.1.

– Correction to UL 50 References; 7.3.1, 7.4.7, 7.5.2, 7.15.3, 7.15.14, 8.2.1, 9.2 – 9.4, 9.7, 9.8, 12.1, 12.2, 12.18, A2.4, A2.5, and A2.7.

– Editorial Update to Remove Standard for Components Appendix; 4.1, and Section 5.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated August 11, 2023, June 7, 2024, and September 20, 2024.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of ULSE Inc. (ULSE).

ULSE provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will ULSE be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if ULSE or an authorized ULSE representative has been advised of the possibility of such damage. In no event shall ULSE's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold ULSE harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

ULNORM.COM : Click to view the full PDF of UL 508 2024

No Text on This Page

ULNORM.COM : Click to view the full PDF of UL 508 2024

OCTOBER 28, 2024

ANSI/UL 508-2024

UL 508

Standard for Industrial Control Equipment

Ninth Edition – December, 1962
Tenth Edition – September, 1964
Eleventh Edition – August, 1971
Twelfth Edition – May, 1977
Thirteenth Edition – December, 1983
Fourteenth Edition – August, 1984
Fifteenth Edition – September, 1989
Sixteenth Edition – February, 1993
Seventeenth Edition – January, 1999
Eighteenth Edition – March, 2018

Nineteenth Edition

October 28, 2024

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

The most recent designation of ANSI/UL 508 as an American National Standard (ANSI) occurred on October 28, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 508 on June 5, 1989. 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 ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

Our Standards for Safety are copyrighted by ULSE Inc. Neither a printed nor electronic copy of a Standard should be altered in any way. All of our Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of ULSE Inc.

© 2024 ULSE Inc. All rights reserved.

ULNORM.COM : Click to view the full PDF of UL 508 2024

No Text on This Page

ULNORM.COM : Click to view the full PDF of UL 508 2024

CONTENTS

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

DEVICE PERFORMANCE

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

ULNORM.COM : Click to view the full PDF of UL 508 2024

No Text on This Page

ULNORM.COM : Click to view the full PDF of UL 508 2024

INTRODUCTION

1 Scope

1.1 These requirements cover industrial control devices, and devices accessory thereto, for starting, stopping, regulating, controlling, or protecting electric motors. These requirements also cover industrial control devices or systems that store or process information and are provided with an output motor control function(s). This equipment is for use in ordinary locations in accordance with the National Electrical Code, NFPA 70. These requirements do not include requirements for the evaluation of equipment intended for use in functional safety applications.

1.2 These requirements cover devices rated 1500 volts or less. Industrial control equipment covered by these requirements is intended for use in an ambient temperature of 0 – 40 °C (32 – 104 °F) unless specifically indicated for use in other conditions.

1.3 Examples of industrial control devices described in 1.1 are:

a) Solid-state starters and controllers.

b) Pushbutton stations, including selector switches and pilot lights.

c) Control circuit switches and relays.

d) Float, flow, pressure, and vacuum-operated switches.

e) Resistors and rheostats.

f) Proximity switches.

g) Time-delay relays and switches.

h) Resistors and rheostats intended for industrial heating and lighting, including those for motor generator fields.

i) Control devices intended for industrial heating and lighting.

j) Solid-state time-delay relays.

k) Numerical control systems.

l) Lighting dimmer systems and controls.

m) Mercury-tube switches.

n) Solid-state logic controllers.

o) Industrial microprocessor/computer systems.

p) Variable voltage autotransformer.

q) Motor starting autotransformer.

1.4 Industrial control panels are covered by the requirements in the Standard for Industrial Control Panels, UL 508A.

1.5 Fire pump controllers are covered by the requirements in the Standard for Fire Pump Controllers, UL 218.

ULNORM.COM : Click to view the full PDF of UL 508 2024

1.6 An adjustable-speed drive and accessories or modules for use with an adjustable-speed drive are covered by the Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal, and Energy, UL 61800-5-1.

1.7 Equipment intended for use in hazardous locations as defined by the National Electrical Code, NFPA 70, are covered by the Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations, UL 1203.

1.8 Devices that regulate temperature and/or control refrigeration equipment are covered by the Standard for Temperature-Indicating and -Regulating Equipment, UL 873, and other applicable standards. Compliance with the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

1.9 Electrical instruments are covered by the Standard for Electrical Analog Instruments– Panel Board Types, UL 1437.

1.10 Products consisting of interlocked controllers and similar assemblies, intended to transfer power to a common load or output between multiple inputs or sources, are covered by the Standard for Transfer Switch Equipment, UL 1008.

1.11 Magnetic motor controllers, manual motor controllers, combination motor controllers, and overload relays are covered by the Standard for Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and Motor-Starters – Electromechanical Contactors and Motor-Starters, UL 60947-4-1.

1.12 Programmable controllers are covered by the Standard for Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-201: Particular Requirements for Control Equipment, UL 61010-2-201.

2 Glossary

2.1 For the purpose of this Standard, the following definitions apply.

2.2 AMBIENT TEMPERATURE – The temperature of the air medium into which the heat of the equipment is dissipated. See 45.12.

2.3 AMBIENT TEMPERATURE RATING – A rating assigned to equipment that refers to the maximum ambient temperature of the room or space outside of the device enclosure or intended enclosure. See 45.13.

2.4 CLOSED-OPEN OPERATION – An operation of closing the test device on the circuit. The letters "CO" signify this operation.

2.5 COMBINATION CONTROLLER – An open or enclosed device containing both a magnetic or solid-state controller and a disconnecting means. The controller may or may not contain overload protection, short circuit protection, or both. Where an individual controller is enclosed, it includes an external means for operating the disconnecting means.

2.6 COMBINATION MOTOR CONTROLLER – A controller intended for motor service that provides a disconnecting means, branch circuit (short-circuit and ground fault) protection, motor controller, and motor overload protection. In addition, where an individual controller is enclosed, it includes means for locking the disconnecting device in the "OFF" position.

ULNORM.COM : Click to view the full PDF of UL 508 2024

2.7 COMPONENT FOR GROUP INSTALLATION – A motor control, overload relay, or other switching device evaluated for use in group installation. See 2.18.

2.8 CONTACTOR – A two-state (ON-OFF) device for repeatedly establishing and interrupting an electric power circuit. Interruption is obtained by introducing a gap or a very large impedance.

2.9 CONTROL CIRCUIT – A circuit that carries the electric signals directing the performance of a controller, but which does not carry the main power circuit (see IEEE Standards Dictionary of Electrical and Electronic Terms). A control circuit is generally limited to 15 amperes.

2.10 CONTROLLER – A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

2.11 COVER – An unhinged portion of an enclosure that covers an opening.

2.12 DOOR – A hinged portion of an enclosure that covers an opening.

2.13 END-OF-LINE ENCLOSURE – An enclosure that is intended to be connected at the end of a run of conduit.

2.14 FEEDER CIRCUIT – The conductors and circuitry on the supply side of the branch circuit overcurrent protective device.

2.15 FUNCTIONAL SAFETY – Part of the overall safety of equipment or systems that depends on the correct functioning of the process, equipment, and/or safety-related control system to prevent potentially-hazardous conditions from arising or provide mitigation to reduce the severity of the hazard.

2.16 GENERAL PURPOSE RATING – This term is synonymous with "General Use Rating."

2.17 GENERAL USE RATING – A rating expressed in volts and amperes assigned to a device that is intended to control:

a) A load with a continuous or inrush ampere rating not exceeding the ampere rating of the device;

b) If AC rated, a load that has a power factor of 0.75 to 0.80 (inductive); and

c) If DC rated, a load that is resistive (noninductive).

2.18 GROUP INSTALLATION – A motor branch circuit for two or more motors, or one or more motors with other loads and protected by a circuit breaker or a single set of fuses.

2.19 ISOLATED SECONDARY CIRCUIT – A circuit derived from an isolating source (such as a transformer, optical isolator, limiting impedance or electro-mechanical relay) and having no direct connection back to the primary circuit (other than through the grounding means). A secondary circuit that has a direct connection back to the primary circuit is considered part of the primary circuit.

2.20 MANUAL CONTROLLER – A hand-operated switching device whose contacts are controlled by the position of a mechanical actuator.

2.21 MANUAL CONTROLLER WITH INSTANTANEOUS TRIP – A manual controller provided with an instantaneous trip element for short circuit protection only and optionally provided with an overload relay.

2.22 MOTOR CONTROL DEVICE – Any product or equipment rated in horsepower and/or full load-locked rotor current capable of interrupting the maximum operating overload current of a motor of the

ULNORM.COM : Click to view the full PDF of UL 508 2024

same horsepower or full load-locked rotor current rating as the product or equipment at the rated voltage. Such devices may include, but is not limited to, contactors, controllers, starters, and switches.

2.23 NON-COMBINATION MOTOR CONTROLLERS – Motor control devices of the non-combination type are for use with separate protective devices, such as fuses or inverse-time circuit breakers, installed in the supply side of the motor control device.

2.24 OPEN OPERATION – An operation of closing the circuit on the test device. The letter "O" signifies this operation.

2.25 PILOT DUTY – The rating assigned to a relay or switch that controls the coil of another relay or switch.

2.26 POLE LEAST LIKELY TO STRIKE GROUND – A pole that is referenced to ground or by virtue of its position or potential or both relative to other poles of the device to be less likely than any other to strike ground. In a three pole device, this pole would usually be the middle pole. It is possible for several poles to be equally least likely to strike to ground. In this case any may be used for the test.

2.27 POLLUTION DEGREE 1 – No pollution or only dry, nonconductive pollution occurs. The pollution has no influence.

2.28 POLLUTION DEGREE 2 – Normally, only nonconductive pollution occurs; however, temporary conductivity caused by condensation may be expected.

2.29 POLLUTION DEGREE 3 – Conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation that is expected.

2.30 POWER CIRCUIT – Conductors and components of branch and feeder circuits.

2.31 PRIMARY CIRCUIT – A circuit in which the wiring and components are conductively connected to the branch circuit.

2.32 RECOVERY VOLTAGE – The voltage impressed upon the equipment under test after a circuit is cleared.

2.33 SELF-PROTECTED – A qualifying term applied to a controller that contains coordinated overload and short circuit protection. A self-protected controller is evaluated as a complete unit whether comprised of a single or multiple components. Coordinated protection is able to be inherent or obtained by correct selection of components or accessory parts in accordance with the manufacturer's instructions.

2.34 STARTER – A form of controller that includes the switching means necessary to start and stop the connected load in combination with suitable overload protection.

2.35 SURROUNDING AIR TEMPERATURE RATING – A rating assigned to open type equipment that refers to the maximum ambient temperature of air immediately surrounding the equipment inside of the ultimate enclosure. See 45.13.

2.36 SWITCH – A device for opening and closing, and for changing the connections of a circuit. A switch is understood to be manually-operated, unless otherwise stated.

2.37 TRANSIENT SUPPRESSIVE DEVICE – A component or assembly that limits the transient voltage such as an overvoltage protective device, a transformer with isolated windings, or a damping impedance suitably located.

ULNORM.COM : Click to view the full PDF of UL 508 2024

3 Units of Measurement

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

4 Components

4.1 Except as indicated in 4.2, a component of a product covered by this Standard shall comply with the requirements for that component.

4.2 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.

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

4.4 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.

5 Referenced Publications

5.1 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.

5.2 The following publications are referenced in this Standard:

ANSI C82.11, *Lamp Ballasts – High-Frequency Fluorescent Lamp Ballasts*

ANSI C82.14, *Lamp Ballasts – Low-Frequency Square Wave Electronic Ballasts*

ASTM E230, *Standard Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples*

IEC 60584-2, *Standard for Thermocouples Part 2: Tolerances*

IEEE 4, *Techniques for High-Voltage Testing*

IEEE C37.09, *Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis*

JIS C 1602, *Standard for Tolerances*

NEMA 410, *Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts*

NEMA ICS2, *Controllers, Contactors and Overload Relays Rated 600 V*

NEMA ICS5, *Control Circuit and Pilot Devices*

ULNORM.COM : Click to view the full PDF of UL 508 2024

NEMA WD6, *Wiring Devices – Dimensional Requirements*

NFPA 70, *National Electrical Code*

NFPA 79, *Electrical Standard for Industrial Machinery*

UL 50, *Enclosures for Electrical Equipment, Non-Environmental Considerations*

UL 50E, *Enclosures for Electrical Equipment, Environmental Considerations*

UL 62, *Flexible Cords and Cables*

UL 94, *Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 248 Series, *Low-Voltage Fuses*

UL 310, *Electrical Quick-Connect Terminals*

UL 486A-486B, *Wire Connectors*

UL 486E, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*

UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures*

UL 514B, *Conduit, Tubing, and Cable Fittings*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 746B, *Polymeric Materials – Long Term Property Evaluations*

UL 746C, *Polymeric Materials for Use in Electrical Equipment Evaluations*

UL 746D, *Polymeric Materials – Fabricated Parts*

UL 796, *Printed Wiring Boards*

UL 840, *Insulation Coordination Including Clearance and Creepage Distances for Electrical Equipment*

UL 845, *Motor Control Centers*

UL 869A, *Reference Standard for Service Equipment*

UL 1059, *Terminal Blocks*

UL 1097, *Double Insulation Systems for Use in Electrical Equipment*

UL 1310, *Class 2 Power Units*

UL 1446, *Systems of Insulating Materials – General*

UL 1557, *Electrically Isolated Semiconductor Devices*

ULNORM.COM : Click to view the full PDF of UL 508 2024

UL 1577, *Optical Isolators*

UL 1581, *Electrical Wires, Cables, and Flexible Cords*

UL 1642, *Lithium Batteries*

UL 1973, *Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications*

UL 2054, *Household and Commercial Batteries*

UL 2111, *Overheating Protection for Motors*

UL 2237, *Outline of Investigation for Multi-Point Interconnection Power Cable Assemblies for Industrial Machinery*

UL 2238, *Cable Assemblies and Fittings for Industrial Control and Signal Distribution*

UL 5085-1, *Low Voltage Transformers – Part 1: General Requirements*

UL 5085-2, *Low Voltage Transformers – Part 2: General Purpose Transformers*

UL 5085-3, *Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*

UL 60086-4, *Primary Batteries – Part 4: Safety of Lithium Batteries*

UL 60384-14, *Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains*

UL 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*

USCG Title 46, *Electrical Engineering Regulations*

6 Installation and Operation Instructions

6.1 Literature intended to accompany a product, such as installation, rating, operation, and user-maintenance instructions or manuals shall be reviewed in the investigation of the product if the safe use of the product is dependent on the instructions. Since the literature is to be reviewed in the examination and test of the product, a draft copy of the literature may be used instead of a printed copy.

PART I – ALL EQUIPMENT

ENCLOSURE CONSTRUCTION

7 Frames and Enclosure

7.1 General

7.1.1 An enclosure of industrial control equipment shall be constructed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without total or partial collapse resulting in a risk of fire, electric shock, or injury to persons due to reduction of spacings, loosening or displacement of parts, or other serious defects.

ULNORM.COM : Click to view the full PDF of UL 508 2024

7.1.2 Industrial controls with incomplete or partial enclosures are considered as open devices with respect to the performance requirements in this Standard.

7.1.3 An enclosure shall be constructed so as to reduce the risk of unintentional contact with enclosed electrical devices, and to provide internal devices with protection from specified external conditions.

7.2 Cast metal

7.2.1 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 at least 1/4 inch (6.4 mm) thick at tapped holes for conduit.

Exception: Other than at plain or threaded conduit holes, reinforcing ribs, and door edges, malleable iron and die-cast or permanent mold cast aluminum, brass, bronze, or zinc shall be:

a) At least 3/32 inch (2.4 mm) thick for an area greater than 24 square inches (155 cm^2) or having any dimension more than 6 inches (152 mm); and

b) At least 1/16 inch (1.6 mm) thick for an area of 24 square inches or less having no dimension more than 6 inches. The area considered may be bounded by reinforcing ribs subdividing a larger area.

7.2.2 The above thicknesses may be reduced if the enclosure complies with the Crushing Resistance Test and Resistance to Impact Test in accordance with UL 746C, except that the required ball impact force is 13.6 J (10 lb-ft) for enclosure surfaces greater than 40 in^2, and the Polymeric Enclosure Rigid Metallic Conduit Connection Tests per UL 50.

7.3 Sheet metal

7.3.1 The thickness of a sheet-metal enclosure shall not be less than that specified in Table 7.1 and Table 7.2, except that at points to which a wiring system is to be connected, uncoated steel shall be at least 0.032 inch (0.81 mm) thick, and nonferrous metal at least 0.045 inch (1.14 mm) thick.

Exception: Enclosure thickness at points other than where a wiring system is to be connected may be less than 0.032 inch (0.81 mm) if the enclosure complies with the comparative deflection test (enclosure) and deflection test (doors and covers) in UL 50.

7.3.2 Table 7.1 and Table 7.2 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.

ULNORM.COM : Click to view the full PDF of UL 508 2024

Table 7.1
Thickness of Sheet Metal for Enclosures – Carbon Steel or Stainless Steel

Without supporting frame[a]				With supporting frame or equivalent reinforcement[a]				Minimum acceptable thickness, Uncoated	
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length			
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(mm)
4.0	(10.2)	Not limited		6.25	(15.9)	Not limited		0.020[d]	(0.51)
4.75	(12.1)	5.75	(14.6)	6.75	(17.1)	8.25	(21.0)		
6.0	(15.2)	Not limited		9.5	(24.1)	Not limited		0.026[d]	(0.66)
7.0	(17.8)	8.75	(22.2)	10.0	(25.4)	12.5	(31.8)		
8.0	(20.3)	Not limited		12.0	(30.5)	Not limited		0.032	(0.81)
9.0	(22.9)	11.5	(29.2)	13.0	(33.0)	16.0	(40.6)		
12.5	(31.8)	Not limited		19.5	(49.5)	Not limited		0.042	(1.07)
14.0	(35.6)	18.0	(45.7)	21.0	(53.3)	25.0	(63.5)		
18.0	(45.7)	Not limited		27.0	(68.6)	Not limited		0.053	(1.35)
20.0	(50.8)	25.0	(63.5)	29.0	(73.7)	36.0	(91.4)		
22.0	(55.9)	Not limited		33.0	(83.8)	Not limited		0.060	(1.52)
25.0	(63.5)	31.0	(78.7)	35.0	(88.9)	43.0	(109.2)		
25.0	(63.5)	Not limited		39.0	(99.1)	Not limited		0.067	(1.70)
29.0	(73.7)	36.0	(91.4)	41.0	(104.1)	51.0	(129.5)		
33.0	(83.8)	Not limited		51.0	(129.5)	Not limited		0.080	(2.03)
38.0	(96.5)	47.0	(119.4)	54.0	(137.2)	66.0	(167.6)		
42.0	(106.7)	Not limited		64.0	(162.6)	Not limited		0.093	(2.36)
47.0	(119.4)	59.0	(149.9)	68.0	(172.7)	84.0	(213.4)		
52.0	(132.1)	Not limited		80.0	(203.2)	Not limited		0.108	(2.74)
60.0	(152.4)	74.0	(188.0)	84.0	(213.4)	103.0	(261.6)		
63.0	(160.0)	Not limited		97.0	(246.4)	Not limited		0.123	(3.12)
73.0	(185.4)	90.0	(228.6)	103.0	(261.6)	127.0	(322.6)		

[a] See 7.3.3.

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

[c] 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.

[d] Sheet steel for an enclosure intended for outdoor use – raintight or rainproof – shall not be less than 0.032 inch thick.

ULNORM.COM : Click to view the full PDF of UL 508 2024

Table 7.2
Thickness of Sheet Metal for Electrical Enclosures– Aluminum, Copper, or Brass

Without supporting frame[a]				With supporting frame or equivalent reinforcement[a]				Minimum acceptable thickness,	
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length			
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(mm)
3.0	(7.6)	Not limited		7.0	(17.8)	Not limited		0.023[d]	(0.58)
3.5	(8.9)	4.0	(10.2)	8.5	(21.6)	9.5	(24.1)		
4.0	(10.2)	Not limited		10.0	(25.4)	Not limited		0.029	(0.74)
5.0	(12.7)	6.0	(15.2)	10.5	(26.7)	13.5	(34.3)		
6.0	(15.2)	Not limited		14.0	(35.6)	Not limited		0.036	(0.91)
6.5	(16.5)	8.0	(20.3)	15.0	(38.1)	18.0	(45.7)		
8.0	(20.3)	Not limited		19.0	(48.3)	Not limited		0.045	(1.14)
9.5	(24.1)	11.5	(29.2)	21.0	(53.3)	25.0	(63.5)		
12.0	(30.5)	Not limited		28.0	(71.1)	Not limited		0.058	(1.47)
14.0	(35.6)	16.0	(40.6)	30.0	(76.2)	37.0	(94.0)		
18.0	(45.7)	Not limited		42.0	(106.7)	Not limited		0.075	(1.91)
20.0	(50.8)	25.0	(63.5)	45.0	(114.3)	55.0	(139.7)		
25.0	(63.5)	Not limited		60.0	(152.4)	Not limited		0.095	(2.41)
29.0	(73.7)	36.0	(91.4)	64.0	(162.6)	78.0	(198.1)		
37.0	(94.0)	Not limited		87.0	(221.0)	Not limited		0.122	(3.10)
42.0	(106.7)	53.0	(134.6)	93.0	(236.2)	114.0	(289.6)		
52.0	(132.1)	Not limited		123.0	(312.4)	Not limited		0.153	(3.89)
60.0	(152.4)	74.0	(188.0)	130.0	(330.2)	160.0	(406.4)		

[a] See 7.3.3.

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

[c] 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.

[d] Sheet copper, brass, or aluminum for an enclosure intended for outdoor use – raintight or rainproof – shall not be less than 0.029 inch (0.74 mm) thick.

ULNORM.COM : Click to view the full PDF of UL 508 2024

7.3.3 With reference to Table 7.1 and Table 7.2, 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. A structure that is as rigid as one built with a frame of angles or channels is considered to have equivalent reinforcing. Constructions considered to be without supporting frame include:

a) A single sheet with single formed flanges – formed edges;

b) A single sheet that is corrugated or ribbed;

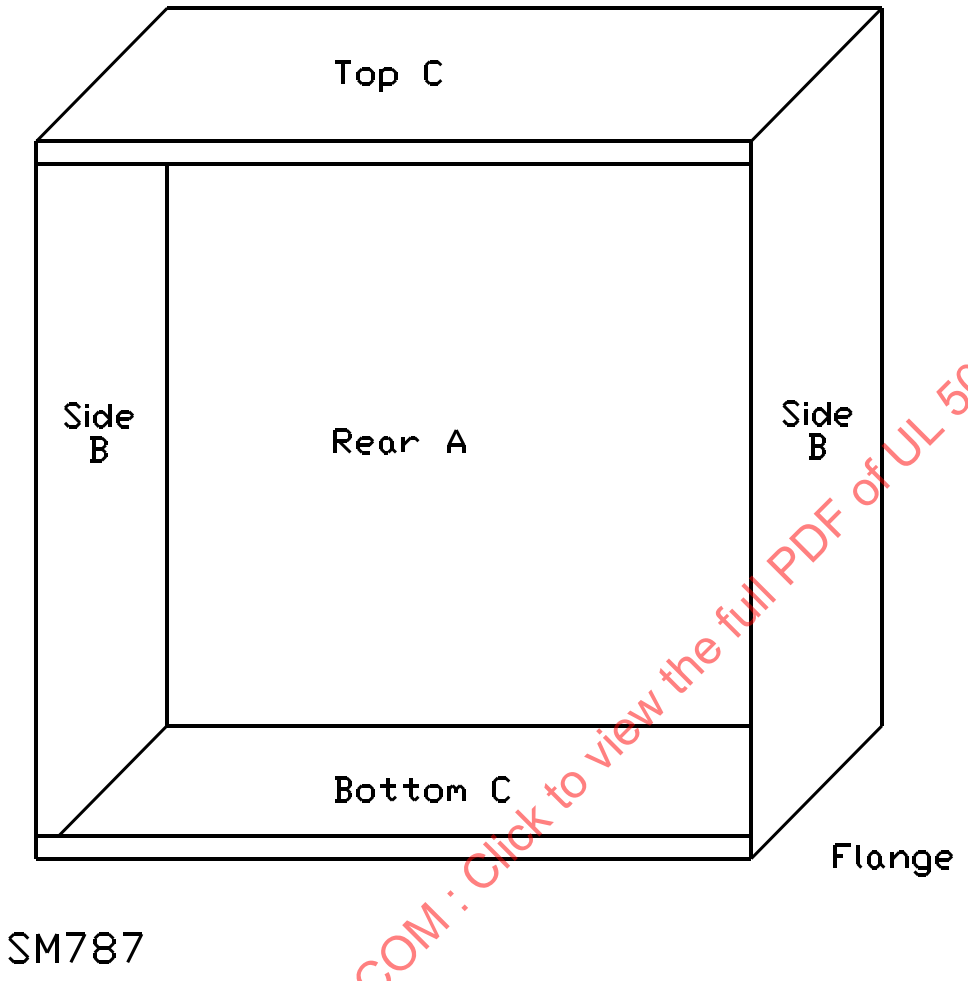
c) An enclosure surface loosely attached to a frame, for example, with spring clips; and

d) An enclosure surface having an unsupported edge.

See Figure 7.1 for evaluation of supported and unsupported enclosure surfaces. This figure further defines the means of selecting the required metal thickness from either the "with supporting frame" or "without supporting frame" columns in Table 7.1 and Table 7.2.

Figure 7.1

Determination of Required Metal Thickness from Table 7.1 and Table 7.2 for Supported and Unsupported Enclosure Surfaces



ULNORM.COM : Click to view the full PDF of UL 508 2024

NOTES:

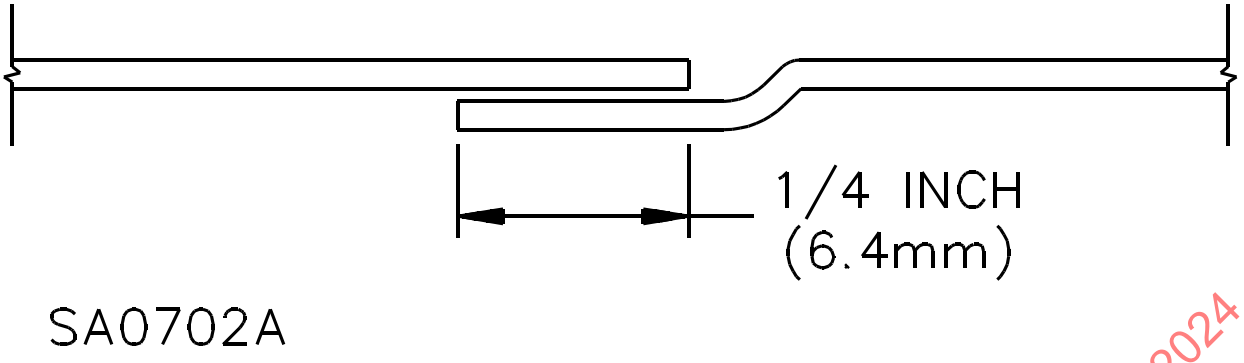
Each enclosure surface is evaluated individually based on the length and width dimensions. For each set of surface dimensions, A, B or C, the width is the smaller dimension regardless of its orientation to other surfaces. In Table 7.1 and Table 7.2, there are two sets of dimensions that correspond to a single metal thickness requirement and the following describes the applicable procedure for determining the minimum metal thickness for each surface:

1. For a supported surface, all of the table dimensions, including the "not limited" lengths, are able to be applied. The rear surface "A", top and bottom surfaces "C", are supported either by adjacent surfaces of the enclosure or by a 1/2 inch (12.7 mm) wide flange. To determine required metal thickness for supported surfaces, the width is to be measured and compared with the table value in the maximum width column that is equal to or greater than the measured width. When the corresponding length in the maximum length column is "Not limited", the minimum thickness in the far right column is to be used. When the corresponding length in the maximum length column is a numerical value, and the measured length of the side does not exceed this value, the minimum thickness from the far right column is to be used. When the measured length of the side exceeds the numerical value, the next line in the table is to be used.

2. For an unsupported surface, only the table dimensions that include a specific length requirement are applied. The dimensions with a "not limited" length do not apply. The front edge of the left and right surfaces "B", are not supported by an adjacent surface or by a flange. An edge that is rabbeted, as shown in Figure 7.2, is also evaluated as an unsupported surface. To determine the required metal thickness for unsupported surfaces, the length is to be measured and compared with the table value in the maximum length column that is not less than the measured length, ignoring the "not limited" entries. When the corresponding width in the maximum width column is not less than the measured width, the minimum thickness from the far right column is to be used. When the measured width of the surface exceeds the value in the maximum width column, the next line in the table is to be used.

Figure 7.2

Rabbet



ULNORM.COM : Click to view the full PDF of UL 508 2024

7.4 Doors and covers

7.4.1 A part of an enclosure, such as a door or a cover, shall be provided with a means – such as latches, locks, interlocks, or screws – for firmly securing it in place.

Exception: A snap-on cover that complies with the requirements in Section 10 need not have additional securing means.

7.4.2 An enclosure shall be provided with a door when it gives access to a fuse or any other overload protective device that requires renewal or when it is required to be opened in connection with the normal operation of the device.

Exception: A door is not required for an enclosure:

a) To which access is required only in the event of burnout of a current element or similar device on short circuit;

b) In which the only fuse enclosed is a control-circuit fuse, when the fuse and control-circuit load – other than a fixed control-circuit load, such as a pilot lamp – are within the same enclosure; or

c) In which a means is provided for resetting all overload-protective devices from outside the enclosure, or kits are available to provide a means for resetting all overload-protective devices from outside the enclosure and a marking is provided in accordance with Details, Section 76.

7.4.3 Other than as noted in 7.4.5, a door provided in accordance with the requirement in 7.4.2 shall be provided with a snap latch or a captive multiturn or partial-turn fastener. Such securing means shall be located or used in multiple so as to hold the door closed over its entire length. A captive fastener shall be operable by hand or by a simple hand tool such as a screwdriver.

7.4.4 A door more than 48 inches (1.2 m) long on the hinged side shall be provided with one of the following:

a) A multipoint latch operated by a single knob or handle;

b) Two or more snap latches or captive fasteners; or

c) One knob-operated latch and one snap latch or captive fastener.

7.4.5 An enclosure that is not required to comply with 7.4.2 is able to use a door with noncaptive fasteners.

7.4.6 A door giving access to a fuse or any portion of a circuit breaker other than the operating handle shall shut closely against a 1/4-inch (6.4-mm) rabbet as illustrated in Figure 7.2 or the equivalent.

7.4.7 A cover giving access to a fuse or any portion of a circuit breaker other than the operating handle shall have flanges for the full length of the four edges. Flanges on a cover shall fit closely with the outside walls of the enclosure, and shall comply with Figure 7.3 and Table 7.3. An acceptable combination of flange and rabbet may be used.

Exception No. 1: The flange width may be less than that specified if the construction complies with the Deflection Test (doors and covers) in UL 50.

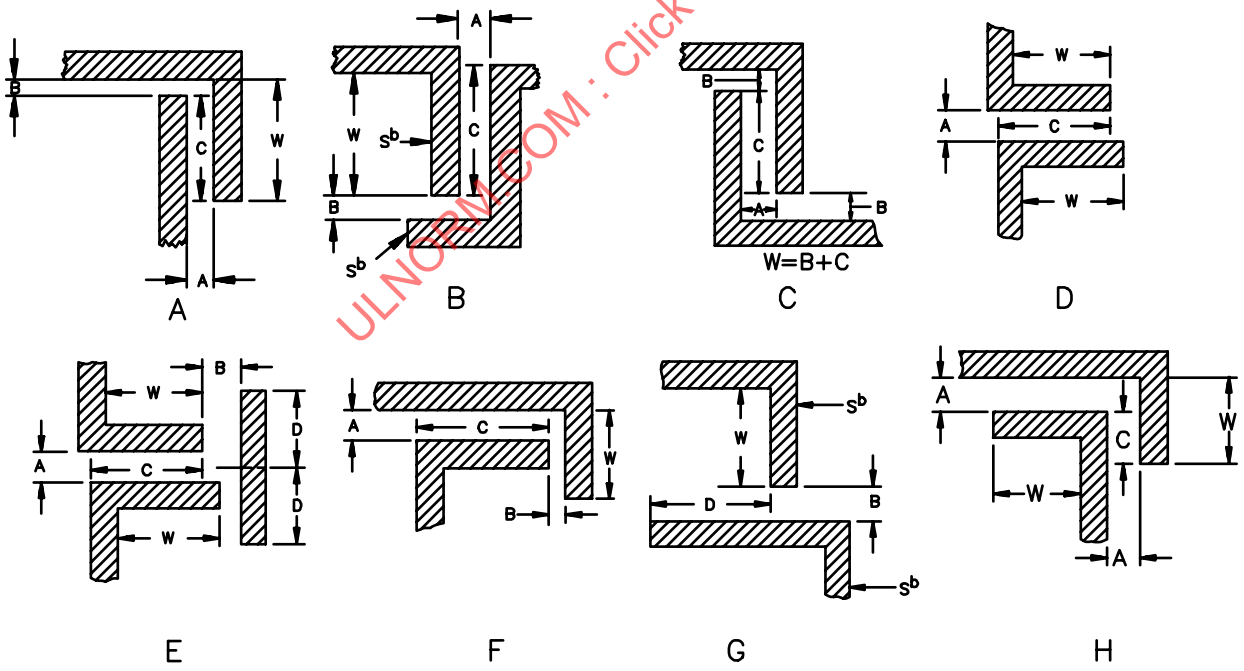
Exception No. 2: The flanges on the cover are not required to fit closely on the outside wall if a gasket suitable for the application provides the intended tight fit. The gasket shall comply with the Gasket Tests in UL 50E.

Exception No. 3: For equipment incorporating an enclosure rated Type 1 only, the gap distance between the flanges on the cover and the outside wall are not required to comply with those specified in Table 7.3 when the equipment complies with the Short Circuit Test – General, Section 52 (and cotton is used as a fire indicator) and Accessibility of live parts, 7.17.

ULNORM.COM : Click to view the full PDF of UL 508 2024

Figure 7.3

Flanged Cover Constructions[a]



[a] See Table 7.3 for dimensions for sketches A – H.

[b] The surfaces "S" may be in line with one another – not as shown.

Table 7.3
Dimensions for Flanged Cover Constructions

Sketch – see Figure 7.3	Dimensions									
	W Minimum flange width[a]		A Maximum space between parts		B Maximum gap		C Minimum overlap		D Minimum barrier extension	
	Inches	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)
A	1/2	(12.7)	1/8	(3.2)	1/8	(3.2)	7/16	(11.1)	–	–
A	3/4	(19.1)	3/16	(4.8)	3/16	(4.8)	5/8	(15.9)	–	–
A	1	(25.4)	1/4	(6.4)	1/4	(6.4)	7/8	(22.2)	–	–
B	1/2	(12.7)	1/8	(3.2)	1/8	(3.2)	7/16	(11.1)	–	–
B	3/4	(19.1)	3/16	(4.8)	3/16	(4.8)	5/8	(15.9)	–	–
B	1	(25.4)	1/4	(6.4)	1/4	(6.4)	7/8	(22.2)	–	–
C	1/2	(12.7)	3/16	(4.8)	3/16	(4.8)	1/4	(6.4)	–	–
C	3/4	(19.1)	1/4	(6.4)	1/4	(6.4)	7/16	(11.1)	–	–
D	1/2	(12.7)	3/32	(2.4)	–	–	7/16	(11.1)	–	–
E	1/2	(12.7)	1/8	(3.2)	1/8	(3.2)	7/16	(11.1)	1/4	(6.4)
F	1/2	(12.7)	1/8	(3.2)	1/4	(6.4)	7/16	(11.1)	–	–
G[b]	1/2	(12.7)	–	–	1/32	(0.8)	–	–	1/2	(12.7)
H	1/4	(6.4)	1/8	(3.2)	–	–	3/16	(4.8)	–	–

[a] Tolerance: minus 1/16 inch (1.6 mm)

[b] Equipment within the enclosure must be located on the side of the barrier extension D that is opposite the gap B.

7.4.8 To determine whether a flanged cover complies with the requirement in 7.4.7 regarding width of flange, the distance between the flat portion of the cover – clear of forming radii, beads, draws, and the like – and a straight edge placed anywhere across any two flanges at any points is to be measured.

7.4.9 A construction involving a gasketed joint that provides the intended tight fit shall be investigated to determine whether it is acceptable for the application. See Section 7.15.14.

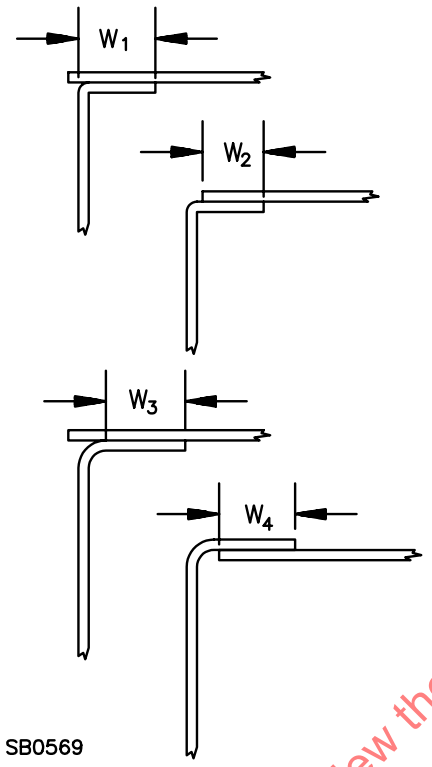
7.4.10 Figure 7.4 illustrates the method of determining the amount of overlap between a flat cover and a flanged box wall and the amount of overlap at a corner or box seam. If the radius of the flange bend is small, the flange width and overlap are considered to be W1 or W2, depending upon the actual construction, and shall be at least 1/2 inch (12.7 mm). If the radius of the flange bend is excessive or if the flat sheet is on the inside of the flange, the overlap, W3 or W4, is to be measured over only that portion where the two pieces of metal are actually in contact with each other, and shall be at least 1/2 inch.

7.4.11 To determine the overlap of a telescoping cover, the enclosure is to be placed on its back on a bench, with the cover in its normally closed position, and a mark is to be scribed on all walls of the box along the edge of the flange. The overlap is the measured distance between the scribe marks and the edges of the box walls, noted as W4 in Figure 7.4. In scribing the marks, the cover is to be held in a fixed position with sufficient firmness to prevent displacement of the cover by the scribing tool, but without bending or distorting any portion of the box, cover, or other part of the enclosure.

ULNORM.COM : Click to view the full PDF of UL 508 2024

Figure 7.4

Overlap Between Flat Cover and Box Flange and at Corner or Box Seam



ULNORM.COM : Click to view the full PDF of UL 508 2024

7.4.12 A flat strip used to provide a rabbet, or an angle strip fastened to the edges of a door giving access to a fuse or any portion of a circuit breaker, other than the operating handle, shall be at least 60 percent of the required thickness of the metal of the box proper, but not less than 0.042 inch (1.07 mm) if of uncoated steel, and not less than 0.058 inch (1.47 mm) thick if of nonferrous metal. It shall be secured at no fewer than two points. There shall not be more than 1-1/2 inches (38 mm) between an end of the strip and a point at which it is secured, and the distance between adjacent points at which the strip is secured shall not be more than 6 inches (152 mm).

7.4.13 The enclosure shall be constructed so that doors and panels that are hinged vertically and that provide access for installation, servicing or replacement of internal energized components shall be capable of being opened to a minimum of 90 degrees from the closed position when fully installed as intended. Doors and panels that provide access solely for operation or control are not included in this requirement. The 90 degree minimum is to be measured from the primary plane of the cover opening, to the corresponding plane of the door in the open position. Door mounted devices are allowed to reside within this 90 degree sweep.

7.5 Polymeric

7.5.1 A polymeric electrical enclosure shall comply with the applicable requirements in UL 746C, and also with the additional requirements specified in this Standard. See also 7.5.5 and 7.5.6.

Exception: With respect to requirements in UL 746C, devices marked for connection to a Class 2 source only in accordance with 73.31 and containing no other external connection to additional circuits, are not required to comply with the flame, impact, mold stress and crush tests.

7.5.2 A polymeric enclosure intended for connection to a rigid conduit system shall comply with the Polymeric Enclosure Rigid Metallic Conduit Connection Tests in UL 50.

Exception: Polymeric enclosures marked or provided with instructions as noted in 12.18 are not required to be subjected to the torque test described in Polymeric Enclosure Rigid Metallic Conduit Connection Tests in UL 50.

7.5.3 A polymeric part assembled to an electrical enclosure or a polymeric part of an open-type component intended to be installed through an opening in an enclosure shall be made of a material rated in accordance with UL 94, and shall comply with the following:

a) The polymeric part shall close an opening in the enclosure having an area of not more than 1.2 square inches (775 mm^2) and shall be:

1) A pilot light lens classed 5VA, 5VB, V-0, V-1, V-2, or HB;

2) Rated V-0, V-1, or V-2; or

3) Rated HB and comply with the flammability test requirements in UL 746C.

b) The polymeric part shall close an opening in the enclosure having an area of more than 1.2 square inches (775 mm^2) and having no dimension greater than 12 inches (304.8 mm), shall be rated V-0, V-1, V-2, or HB, and shall comply with the flammability and impact test requirements in UL 746C.

Exception: The polymeric part is not required to be subjected to the flammability test when it encloses only parts that do not pose a risk of fire, as in Section 30, and is protected from exposure to fire by an internal metal barrier or polymeric barrier that complies with the flammability test. A printed wiring board rated V-0 may serve as a polymeric barrier when the assembly complies with the flammability test.

c) The polymeric part shall close an opening in the enclosure having any dimension greater than 12 inches (304.8 mm), shall comply with the flammability and impact requirements in (b) above and also comply with requirements for the crush resistance test in UL 746C.

7.5.4 For an adhesive that secures a polymeric part closing an opening in an enclosure, the adhesive shall comply with the requirements for adhesives in UL 746C.

Exception: A polymeric part of a component is not required to comply with this requirement when:

a) It only encloses parts which do not pose a risk of fire or electric shock; or

b) The device complies with 7.17.1 for the accessibility of live parts with the polymeric part removed and any internal parts that do pose a risk of fire or electric shock are enclosed by barriers that comply with 7.5.1 or 7.5.3, and 9.2.

7.5.5 In addition to the requirements in 7.5.1 and 7.5.3 (b) and (c), polymeric materials used for Types 3, 3R, 3RX, 3S, 3SX, 3X, 4, and 4X enclosures or polymeric materials used for closures, fastenings, or hinges for these enclosures, or as a polymeric part of an open-type component for installation on these enclosures shall comply with the Ultraviolet Light Exposure test in UL 746C.

7.5.6 In addition to the requirements in 7.5.1 and 7.5.3 (b) and (c), polymeric materials used for Types 6 and 6P enclosures or polymeric materials used for closures, fastenings, or hinges for these enclosures, or as a polymeric part of an open-type component for installation on these enclosures shall comply with the Ultraviolet Light Exposure Test and the Water Exposure and Immersion Tests in UL 746C.

ULNORM.COM : Click to view the full PDF of UL 508 2024

7.6 Bonding

7.6.1 An enclosure made of insulating material, either wholly or in part, shall have an acceptable bonding means to provide continuity of grounding between all conduit openings. The bonding means may be either completely assembled on the product or provided as separate parts for field installation. See 12.15 and 75.6.

Exception No. 1: A bonding means is not required for the enclosure of a pushbutton station or a selector switch that is intended to be connected to a single conduit. See 12.16.

Exception No. 2: A bonding means is not required to be provided with each enclosure if such means is available in the form of a kit from the manufacturer and the equipment complies with the marking requirements in 76.1.

7.6.2 The continuity of a conduit system shall be provided by metal-to-metal contact not relying on a polymeric material.

Exception: The continuity of the grounding system may rely on the integrity of the polymeric enclosure if samples have been subjected to the creep test requirements in UL 746C. Overcurrent Tests shall be conducted at 200 percent of the rated current of the branch circuit-protective device.

7.6.3 A separate bonding conductor whether in a plastic or metal enclosure shall be copper, a copper alloy, or other material acceptable for use as an electrical conductor. Ferrous metal parts in the grounding path shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means. A separate bonding conductor shall:

a) Be protected from mechanical damage or be located within the confines of the outer enclosure or frame; and

b) Not be secured by a removable fastener used for any purpose other than bonding unless the bonding conductor is unlikely to be omitted after removal and replacement of the fastener.

7.6.4 The size of a separate component bonding conductor shall not be less than the applicable size specified in Table 7.4 or the size of the conductor supplying the component, whichever is smaller.

Exception: A bonding conductor may be smaller than the specified size if:

a) It does not open when carrying for the time specified in Table 7.5, a current equal to twice the branch-circuit overcurrent-device rating – see Table 7.4 – but at least 40 amperes; and

b) None of three samples of the bonding conductor opens during a limited-short-circuit test with a current as specified in Table 7.6 when in series with a fuse as described in 7.6.5.

ULNORM.COM : Click to view the full PDF of UL 508 2024

Table 7.4
Size of Bonding Conductor

Maximum rating or setting of automatic overcurrent device in circuit ahead of equipment, amperes	Minimum acceptable size of bonding conductor[a]			
	Copper wire		Aluminum wire	
	AWG	(mm^2)	AWG or kcmil	(mm^2)
15	14	(2.1)	12	(3.3)
20	12	(3.3)	10	(5.3)
30	10	(5.3)	8	(8.4)
40	10	(5.3)	8	(8.4)
60	10	(5.3)	8	(8.4)
100	8	(8.4)	6	(13.3)
200	6	(13.3)	4	(21.2)
300	4	(21.2)	2	(33.6)
400	3	(26.7)	1	(42.4)
500	2	(33.6)	1/0	(53.5)
600	1	(42.4)	2/0	(67.4)
800	1/0	(53.5)	3/0	(85.0)
1000	2/0	(67.4)	4/0	(107.0)
1200	3/0	(85.0)	250	(127.0)

[a] Or equivalent cross-sectional area.

Table 7.5
Duration of Current Flow for Bonding-Conductor Test

Overcurrent device rating amperes	Minimum duration of current flow minutes
30 or less	1
31 – 60	4
61 – 100	6

Table 7.6
Bonding Conductor Short-Circuit Test Capacity

Controller rating			Circuit capacity amperes
Horsepower	(kW Output)	Volts	
1/2	(0.373)	0 – 250	200
1/2	(0.373)	251 – 600	1,000
over 1/2 to 1	(0.374 – 0.746)	0 – 600	1,000
1 to 3	(0.747 – 2.24)	0 – 250	2,000
over 3 to 7-1/2	(2.25 – 5.59)	0 – 250	3,500
over 7-1/2 to 50	(5.60 – 7.46)	0 – 250	5,000
over 1 to 50	(7.47 – 37.3)	251 – 600	5,000

Table 7.6 Continued on Next Page

ULNORM.COM : Click to view the full PDF of UL 508 2024

Table 7.6 Continued

Controller rating			Circuit capacity amperes
Horsepower	(kW Output)	Volts	
over 50 to 200	(37.4 – 149)	0 – 600	10,000
over 200	(over 150)	0 – 600	a

[a] See Table 53.3.

7.6.5 The circuit for the test required by the Exception to 7.6.4 is to have a power factor of 0.9 – 1.0 and is to be limited to the current specified in Table 7.6. The open-circuit voltage of the test circuit is to be 100 to 105 percent of the specified voltage. The circuit is to be connected through a nonrenewable fuse that will conduct twice its rated current for at least 12 seconds. The fuse rating is to be that of the branch-circuit overcurrent device to which the equipment will be connected but at least 20 amperes. One test is to be performed on each of three samples of the bonding conductor.

7.7 Resistance measurement

7.7.1 The resistance between two parts connected by a bonding conductor shall not be more than 0.1 ohm. The resistance is to be determined by a resistance measuring instrument, except that if unacceptable results are recorded, an alternating or direct current of at least 20 amperes from a power supply of not more than 12 volts is to be passed from the point of connection of the equipment grounding means to the metal part in the grounding circuit. The resulting drop in potential and the test current are to be measured between the two points. The resistance in ohms is to be determined by dividing the drop in potential in volts by the current in amperes.

7.8 Openings in enclosure

7.8.1 No covering is required across the bottom of Type 1, 2, 3R, or 3RX enclosures of a floor-mounted controller if the enclosure is within 6 inches (152 mm) of the floor or less and if uninsulated live parts within the device are at least 6 inches above the highest portion of the lower edge of the enclosure.

7.8.2 Openings in enclosures shall be filled by devices with suitable environmental ratings as specified in Table 7.7.

Table 7.7
Openings in Enclosure

Enclosure type	Openings shall be closed by equipment rated for enclosure types
2	2, 3, 3R, 3RX, 3S, 3SX, 3X, 4, 4X, 5, 6, 6P, 12, 12K, 13
3	3, 3S, 3SX, 3X, 4, 4X, 6, 6P
3R	3, 3R, 3RX, 3S, 3SX, 3X, 4, 4X, 6, 6P
3RX	3RX, 3SX, 3X, 4X
3S	3, 3S, 3SX, 3X, 4, 4X, 6, 6P
3SX	3SX, 3X, 4X
3X	3SX, 3X, 4X
4	4, 4X, 6, 6P
4X	4X

Table 7.7 Continued on Next Page

ULNORM.COM : Click to view the full PDF of UL 508 2024

Table 7.7 Continued

Enclosure type	Openings shall be closed by equipment rated for enclosure types
5	3, 3R, 3RX, 3S, 3SX, 3X, 4, 4X, 5, 6, 6P, 12, 13
6	6, 6P
6P	6P
12, 12K	12, 12K, 13
13	13

7.9 Ventilating openings

7.9.1 A ventilation opening in an enclosure that contains power circuit switching devices, such as a disconnect switch, circuit breaker, motor controller or an overload relay shall be constructed and located to comply with 7.9.2 – 7.11.2. Ventilation openings in enclosures that do not contain power circuit switching devices noted above shall comply with 7.9.3 – 7.9.8 and 7.11.1 – 7.11.2.

7.9.2 A ventilation opening in an enclosure that contains power circuit switching devices as in 7.9.1 shall comply with the requirements in 7.9.3 – 7.9.8 and 7.11.1 – 7.11.2 and:

a) The construction shall comply with the requirements in 7.10.1 – 7.10.4; or

b) The opening is located at least 12 inches (305 mm) from power circuit switching components; or

c) The opening shall be so constructed and located that flame or molten metal is not emitted during the operation of power-circuit switching devices while subjected to overload and short circuit test conditions.

7.9.3 A ventilation opening in the top of a Type 1 enclosure shall be covered by a hood or protective shield spaced above the opening when there are uninsulated components below the opening, and shall be in accordance with 7.9.4.

7.9.4 Any ventilating opening in a Type 1, 2, 3R, or 3RX enclosure shall comply with 7.17.1(a).

7.9.5 A louver shall not be more than 12 inches (305 mm) long.

7.9.6 The area of an opening covered by a louver, a perforated or an expanded-metal mesh panel that is thinner than the enclosure shall not exceed 200 square inches (0.129 m^2).

7.9.7 The diameter of the wires of a screen shall be at least 0.051 inch (1.30 mm) if the screen openings are 0.500 square inch (32.3 mm^2) or less in area, and shall be at least 0.081 inch (2.06 mm) for larger screen openings.

7.9.8 Perforated sheet steel and sheet steel employed for expanded-metal mesh shall be at least 0.042 inch (1.07 mm) thick uncoated steel for mesh openings or perforations 0.500 square inch (3.2 cm^2) or less in area, and shall be at least 0.080 inch (2.03 mm) thick uncoated steel for larger openings.

Exception: In a small device where the indentation of a guard or enclosure will not alter the clearance between uninsulated, movable, live parts and grounded metal so as to adversely affect the performance or reduce the spacings below the minimum value specified in Table 37.1, expanded-metal mesh of uncoated steel not less than 0.020 inch (0.51 mm) thick is able to be employed when:

ULNORM.COM : Click to view the full PDF of UL 508 2024

a) The exposed mesh on any one side or surface of the device so protected has an area not more than 72 square inches (464 cm^2) and has no dimension greater than 12 inches (304.8 mm), or

b) The width of the opening so protected is not greater than 3.50 inches (88.9 mm).

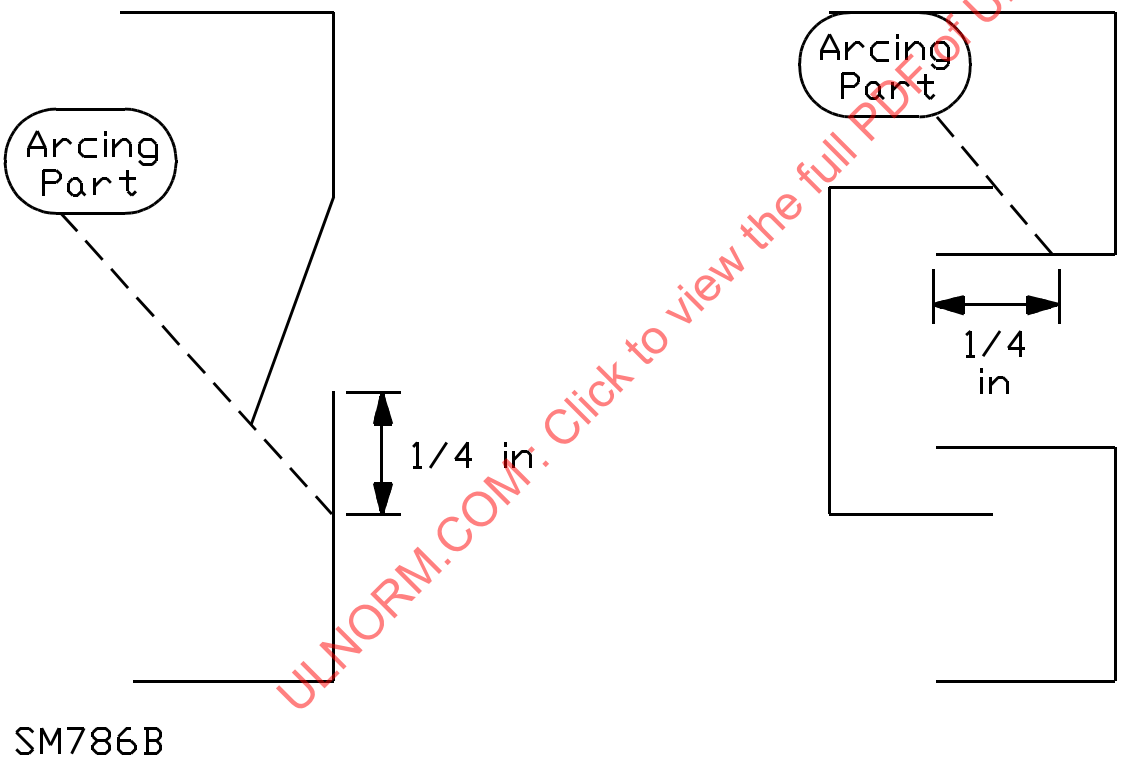
7.10 Barriers used with ventilation openings

7.10.1 A barrier interposed between ventilation openings and power circuit switching devices to prevent the emission of flames or molten metal from an enclosure shall comply with 7.10.2 – 7.10.4.

7.10.2 The barrier shall be of such dimensions and so located that any straight line drawn from any arcing part past the edge of the barrier intersects a point in the ventilating opening plane that is at least 0.25 inch (6.4 mm) outside of the edge of the ventilation opening. See Figure 7.5.

Figure 7.5

Barriers for Ventilation Openings



ULNORM.COM : Click to view the full PDF of UL 508 2024

7.10.3 A sheet-metal barrier shall be at least 0.053 inch (1.35 mm) thick uncoated steel, or 0.075 inch (1.91 mm) thick aluminum.

Exception: A metal barrier may be of thinner metal provided its strength and rigidity are not less than that of a flat sheet of steel having the same dimensions as the barrier and of the specified thickness.

7.10.4 A nonmetallic barrier shall be at least 0.250 inch (6.35 mm) thick and shall be supported to provide mechanical strength and rigidity.

Exception: A nonmetallic material less than 0.250 inch thick shall be located so that it is not subjected to mechanical damage during installation, and supported to provide mechanical strength and rigidity.

7.11 Forced ventilation

7.11.1 When ventilation is fan forced – that is, ventilation is accomplished by one or more blowers within the enclosure that provide a positive intake and exhaust – the ventilation openings shall comply with the requirements in 7.11.2 in addition to the requirements in 7.9.2.

7.11.2 When operator controls are provided on the enclosure, the air outlet shall not direct air at the area occupied by the operator. The area occupied by the operator shall be 30 inches wide (horizontal) centered on any operator control, display, or disconnect handle over the entire (vertical) height of the enclosure for wall mounted equipment or up to 6-1/2 feet above the floor for floor mounted equipment.

7.12 Observation windows

7.12.1 Glass covering an observation opening and forming a part of the enclosure shall be reliably secured in such a manner that it cannot be readily displaced in service and shall provide mechanical protection of the enclosed parts. Glass for an opening not more than 4 inches (102 mm) in any dimension shall not be less than 0.055 inch (1.40 mm) thick; and glass for an opening having no dimension greater than 12 inches (305 mm) shall not be less than 0.115 inch (2.92 mm) thick. Glass used to cover a larger opening shall comply with the Crush Resistance and Resistance to Impact tests in accordance with UL 746C, and shall otherwise be acceptable for the purpose.

7.13 Transformer or autotransformer

7.13.1 If a transformer or autotransformer is oil filled, means shall be provided for inspection and renewal of the oil.

7.14 Motor controller wire bending space

7.14.1 The space between the end of the soldering lug or pressure wire connector for the connection of field-installed wire and the wall of the enclosure toward which the wire will be directed upon leaving the lug or connector shall be at least that specified in Table 7.8.

ULNORM.COM : Click to view the full PDF of UL 508 2024

Table 7.8
Wire Bending Space at the Terminals of Enclosed Motor Controllers

Size of wire[a]		Minimum bending space, terminal to wall, inches (mm)						
		Wires per terminal						
AWG or kcmil	(mm^2)	1		2		3		4 or more
14 – 10	(2.1 – 5.3)	–		–		–		–
8 – 6	(8.4 – 13.3)	1-1/2	(38)	–		–		–
4 – 3	(21.2 – 26.7)	2	(51)	–		–		–
2	(33.6)	2-1/2	(64)	–		–		–
1	(42.4)	3	(76)	–		–		–
1/0	(53.5)	5	(127)	5	(127)	7	(178)	–
2/0	(67.4)	6	(152)	6	(152)	7-1/2	(191)	–
3/0	(85.0)	7	(178)	7	(178)	8	(203)	–
4/0	(107.2)	7	(178)	7	(178)	8-1/2	(216)	–

Table 7.8 Continued on Next Page

Table 7.8 Continued

Size of wire[a]		Minimum bending space, terminal to wall, inches (mm)							
		Wires per terminal							
AWG or kcmil	(mm^2)	1		2		3		4 or more	
250	(127)	8	(203)	8	(203)	9	(229)	10	(254)
300	(152)	10	(254)	10	(254)	11	(279)	12	(305)
350	(177)	12	(305)	12	(305)	13	(330)	14	(356)
400	(203)	12	(305)	12	(305)	14	(356)	15	(381)
500	(253)	12	(305)	12	(305)	15	(381)	16	(406)
600	(304)	14	(356)	16	(406)	18	(457)	19	(483)
700	(355)	14	(356)	16	(406)	20	(508)	22	(559)
750 – 800	(380 – 405)	18	(457)	19	(483)	22	(559)	24	(610)
900	(456)	18	(457)	19	(483)	24	(610)	24	(610)

[a] The wire size is to be based on 26.5.1(b).

7.14.2 The space specified in 7.14.1 is to be the length of a straight line extending from the end of the soldering lug or pressure wire connector where the wire would be connected toward and perpendicular to the enclosure wall toward which the wire would be initially directed.

7.14.3 If a wire is restricted by barriers or other means from being bent where it leaves the connector, the distance required by 7.14.1 and Table 7.8 is to be measured from the end of the barrier. A terminal lug or connector that is not prevented from turning as described in the exception to 18.2 is to be repositioned anywhere within the limits to obtain the shortest distance for measurement.

7.14.4 The wire size used to determine the wire bending space is based on 125 percent of the motor full-load current rating. See Table 47.2 or Table 47.3 for the full-load current rating of horsepower rated motors.

7.15 Specific enclosures

7.15.1 An enclosure shall comply with the construction requirements applicable to an enclosure of the type number or numbers with which it is marked. See 12.1.

7.15.2 An enclosure provided with multiple compartments is able to be evaluated to different enclosure type requirements when the compartments are completely separated by a wall or barrier and:

a) The assembly is intended for indoor use and the compartments are rated Type 1, 2, 4, 4X, 5, 6, 6P, 12, 12K, 13; or

b) The assembly is intended for outdoor use and the compartments are rated Type 3, 3R, 3RX, 3S, 3SX, 3X, 4, 4X, 6, or 6P.

7.15.3 An environmental type connection, such as a watertight connection at a conduit entrance, shall be a conduit hub or the equivalent, such as a knockout or fitting, located so that when conduit is connected and the enclosure is mounted in the intended manner, the enclosure is found to be acceptable when subjected to the tests specified in the table for Enclosure Types in UL 50E.

7.15.4 TYPE 1 – A Type 1 enclosure shall comply with the requirement in 26.2.1.

ULNORM.COM : Click to view the full PDF of UL 508 2024

7.15.5 TYPE 2 – A Type 2 enclosure shall have provision for drainage of water and shall have a threaded conduit hub or the equivalent for the connection of conduit at the top or sidewalls.

Exception No. 1: If the conduit connection opening is wholly below the lowest terminal lug or other live part intended for use within the enclosure, a threaded conduit hub or the equivalent need not be provided. See 12.14.

Exception No. 2: Provisions for a conduit hub or fitting need not be provided if information is provided in accordance with 12.11.

7.15.6 TYPE 3 or 3X – A Type 3 or 3X enclosure shall have:

a) A conduit hub or the equivalent for a watertight connection at conduit entrances – see 7.15.3;

b) A mounting means external to the equipment cavity; and

c) When a door is provided, the enclosure shall have provisions for locking the door or require the use of a tool to gain access to the equipment cavity.

Exception: Provision for a conduit hub or fitting is not required to be provided when information is provided in accordance with 12.11.

7.15.7 TYPE 3R or 3RX – A Type 3R or 3RX enclosure shall have:

a) A conduit hub or the equivalent for a watertight connection at conduit entrances – see 7.15.3;

b) Provision for drainage of water; and

c) When a door is provided, the enclosure shall have provisions for locking the door or require the use of a tool to gain access to the equipment cavity.

Exception No. 1: When the conduit connection opening is wholly below the lowest terminal lug or other live part intended for use within the enclosure, a threaded conduit hub or the equivalent is not required to be provided. See 12.14.

Exception No. 2: Provision for a conduit hub or fitting is not required to be provided when information is provided in accordance with 12.11.

7.15.8 TYPE 3S or 3SX – A Type 3S or 3SX enclosure shall have:

a) A conduit hub or the equivalent for a watertight connection at conduit entrances – see 7.15.3;

b) A mounting means external to the equipment cavity;

c) When a door is provided, the enclosure shall have provisions for locking the door or require the use of a tool to gain access to the equipment cavity; and

d) Operating mechanisms that will support the additional weight of ice and withstand removal of ice by a hand tool to gain access to the interior of the enclosure. Auxiliary means may be provided to break the ice and to permit operation of external mechanisms.

Exception: Provision for a conduit hub or fitting is not required to be provided when information is provided in accordance with 12.11.

7.15.9 TYPE 5 – A Type 5 enclosure shall have:

ULNORM.COM : Click to view the full PDF of UL 508 2024

a) A conduit hub or the equivalent for a connection at conduit entrances – see 7.15.3; and

b) When a door is provided, the enclosure shall have provisions for locking the door or require the use of a tool to gain access to the equipment cavity.

Exception: Provisions for a conduit hub or fitting are not required when information is provided in accordance with 12.11.

7.15.10 TYPES 4, 4X, 6, AND 6P – A Type 4, 4X, 6, or 6P enclosure shall have a conduit hub or the equivalent mounted in place to provide a watertight connection at conduit entrances and shall have mounting means external to the equipment cavity – see 7.15.3.

Exception No. 1: The watertight conduit connection provision need not be mounted in place if information is provided in accordance with 12.13.

Exception No. 2: A hub or a fitting need not be provided or installed on a Type 4 or 4X enclosure if instructions are provided as specified in 12.17.

7.15.11 TYPE 12 – A Type 12 enclosure shall have no conduit knockout or conduit opening and no hole through the enclosure other than a hole for a Type 12 mechanism, or the equivalent. A gasket, if provided, shall be oil resistant.

Exception: A Type 12 enclosure may employ a conduit opening if the instructions required by 75.12 are included on the enclosure.

7.15.12 TYPE 12K – A Type 12K enclosure is as specified in 7.15.11, except it has knockouts located in the top or bottom walls, or both.

7.15.13 TYPE 13 – A Type 13 enclosure shall have oil-resistant gaskets and, if intended for wall or machine mounting, shall have a mounting means external to the equipment cavity. There shall be no conduit knockout or unsealed opening providing access to the equipment cavity. All conduit openings shall have provisions for oiltight connections.

7.15.14 A gasket of an elastomeric or thermoplastic material or a composition gasket utilizing an elastomeric material employed to comply with the requirements for a Type 2, 3, 3R, 3RX, 3S, 3SX, 3X, 4, 4X, 5, 6, 6P, 12, 12K, or 13 enclosure shall comply with the Gasket Tests in UL 50E.

7.16 Components for use on specific enclosures

7.16.1 A component, such as a pilot light, a disconnect, a pushbutton, or similar component, intended for use with a type designated environmental enclosure, meets the requirements for use with a specific type enclosure when all of the following are met:

a) The component has been evaluated for its intended use installed on a representative enclosure.

b) All hardware, gaskets, or other parts needed to complete the installation are provided with the component.

Exception: Hardware, gaskets, or other parts are not required to be provided with the component when they are available from the component manufacturer in the form of a kit and the component is marked as specified in 76.1.

c) Installation instructions including such information as mounting hole location, opening configuration, and similar information, are provided either on the component, in the component package, or on a stuffer sheet.

ULNORM.COM : Click to view the full PDF of UL 508 2024

d) The component, its carton, or accompanying instruction sheet is marked in accordance with the requirement in 73.9.

7.17 Accessibility of live parts

7.17.1 To reduce the likelihood of unintentional contact that may involve a risk of electric shock from an uninsulated live part, electrical energy - high current levels, or injury to persons from a moving part, an opening in an enclosure shall comply with either (a) or (b).

a) For an opening that has a minor dimension (see 7.17.4) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 7.6.

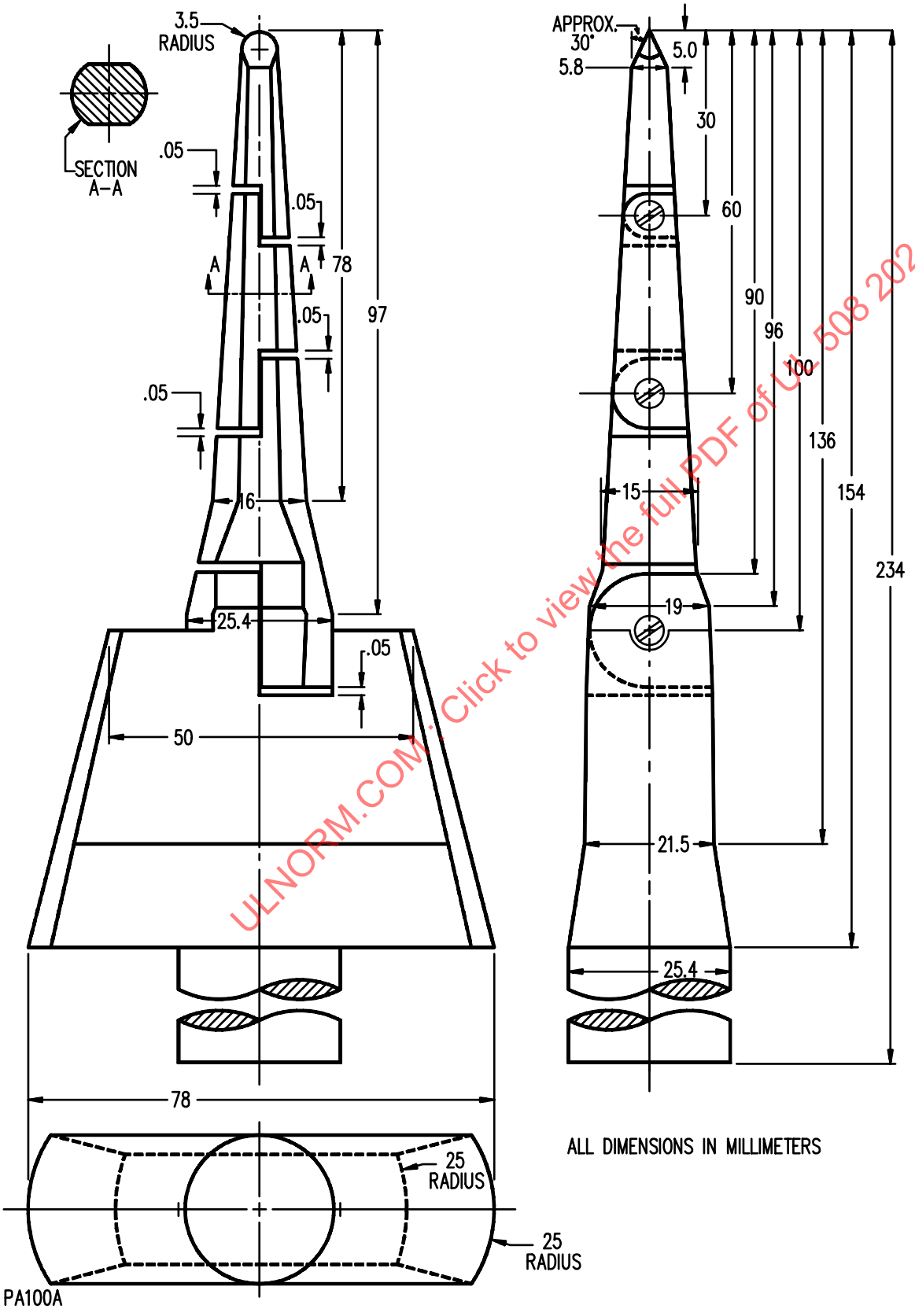
Exception: As an alternative to 7.17.1(a), the probe illustrated in Figure 7.7 may be used to determine accessibility.

b) For an opening that has a minor dimension of 1 inch or more, such a part or wire shall be spaced from the opening as specified in Table 7.9.

ULNORM.COM : Click to view the full PDF of UL 508 2024

Figure 7.6

Articulate Probe with Web Stop



ULNORM.COM : Click to view the full PDF of UL 508 2024

Figure 7.7

IEC Articulate Probe

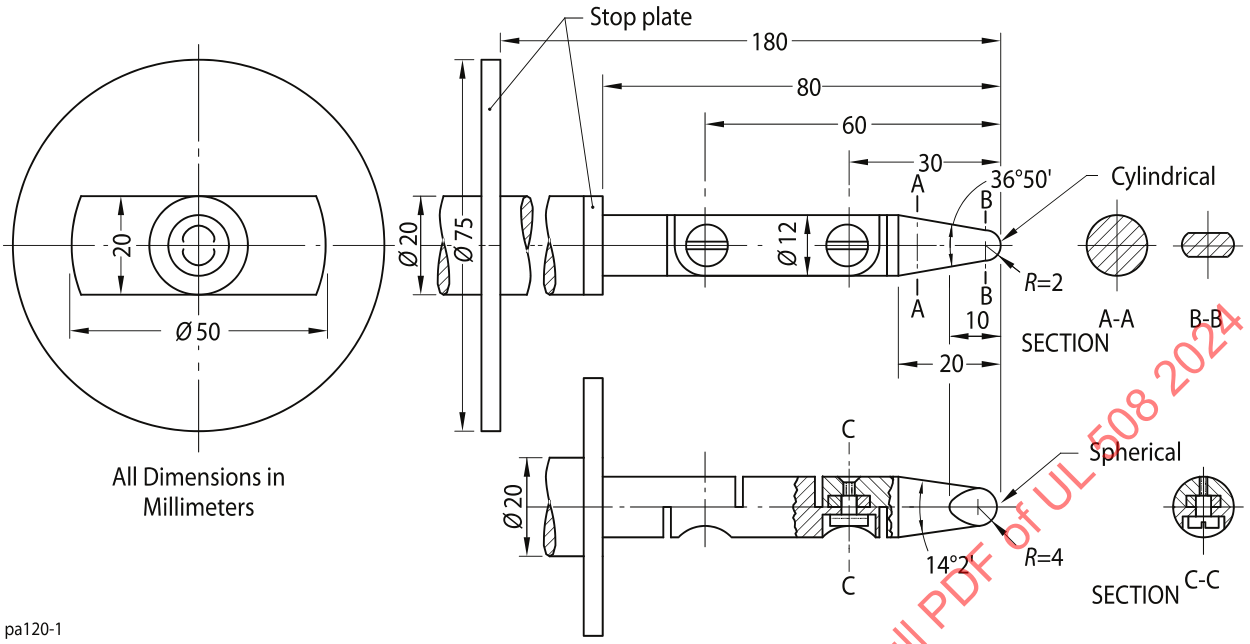


Table 7.9
Minimum Acceptable Distance from an Opening to a Part That May Involve a Risk of Electric Shock, Electrical Energy-High Current Level, or Injury to Persons

Minor dimension of opening[a,b]		Minimum distance from opening to part[b]	
Inches	(mm)	Inches	(mm)
1	(25.4)	6-1/2	(165.0)
1-1/2	(38.1)	8-3/8	(212.7)
2	(50.8)	11-5/8	(295.3)
Over 2 but not more than 3	(Over 50.8 but not more than 76.2)	30	(762.3)

[a] See 7.17.4.

[b] Interpolation is to be used to determine a value between values specified in the table.

7.17.2 The probe specified in 7.17.1(a) shall be applied in any possible configuration; and, if necessary, the configuration shall be changed after insertion through the opening.

7.17.3 The probe specified in 7.17.1(a) shall be applied with a force not to exceed 2.2 pounds (10 N). The probe is to be used to determine the accessibility provided by an opening, and not as an instrument to determine the strength of a material.

7.17.4 With reference to 7.17.1, the minor dimension of an opening is the diameter of the largest cylindrical probe that can be inserted through the opening.

ULNORM.COM : Click to view the full PDF of UL 508 2024