UL 414

STANDARD FOR SAFETY

Meter Sockets

UL Standard for Safety for Meter Sockets, UL 414

Ninth Edition, Dated January 5, 2016

SUMMARY OF TOPICS

This revision of ANSI/UL 414 dated December 14, 2020 includes a revision to the dielectric test after short-circuit interruption test; SA5.2.12

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated October 9, 2020.

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JANUARY 5, 2016
(Title Page Reprinted: December 14, 2020)

ANSI/UL 414-2020

UL 414

Standard for Meter Sockets

First Edition – October, 1957
Second Edition – May, 1973
Third Edition – August, 1974
Fourth Edition – January, 1979
Fifth Edition – December, 1986
Sixth Edition – May, 1994
Seventh Edition – March, 1999
Eighth Edition – December, 2009

Ninth Edition

January 5, 2016

This ANSI/UL Standard for Safety consists of the Ninth Edition including revisions through December 14, 2020.

The most recent designation of ANSI/UL 414 as an American National Standard (ANSI) occurred on November 12, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 414 on November 20, 1987. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover meter sockets for use with:

a) Watthour and similar meters;

b) Test switches;

c) Metering transformer cabinets; and

d) Metering transformer cabinet interiors

for installation in accordance with the National Electrical Code, NFPA 70.

1.2 Meter sockets are marked with a continuous duty ampere rating and may in addition have a maximum use (intermittent) ampere rating of 125 percent or less of the continuous duty ampere rating.

1.3 A meter socket, as covered by these requirements, is an assembly of wiring terminals and jaw type contacts for one or more plug-in watthour meters in an enclosure having provisions for securing the meter to the socket.

1.4 Some meter sockets may be housed in a metal pedestal enclosure intended for mounting on a concrete slab or in a metal post enclosure intended to be sunk in the ground with or without concrete poured around the post at ground level and either self-supported or intended for separate support. Such posts or pedestals are not intended to serve as the sole support of masts for overhead wiring.

1.5 Some meter sockets may be intended for mounting on a mounting post or pedestal for distribution equipment.

1.6 Except as indicated in 1.10, as covered by these requirements, a meter socket does not include:

a) A meter,

b) An overcurrent device,

c) An instrument transformer,

d) An arcing or switching part, or

e) A similar component.

A meter socket does not have provision for installation of instrument transformers within the meter socket enclosure.

1.7 These requirements cover meter sockets rated:

a) 300 volts alternating current or less, or 600 volts alternating current and

b) 400 amperes maximum per meter position.

1.8 These requirements cover metering transformer cabinets and metering transformer cabinet interiors rated maximum 6000 amperes at maximum 600 volts.

1.9 As covered by these requirements, a metering transformer cabinet or metering transformer cabinet interior does not include the current transformers.

1.10 This Standard contains requirements in Supplement SA that cover meter socket adapters, including adapters with provisions for connection of alternative energy sources, that may contain overcurrent protection.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

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

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

2.2 Units of measurement

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

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

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

ALL METER SOCKETS AND METERING TRANSFORMER CABINETS

CONSTRUCTION

3 General

3.1 Unless otherwise noted specifically in this standard, all parts shall be assembled in place when the equipment is shipped from the factory. Internal connections between factory installed components shall be completed.

3.2 If a meter socket, metering transformer cabinet, or metering transformer is intended for use with or without an accessory assembly, the accessory assembly need not be shipped from the factory with the product if:

a) The accessory assembly is shipped from the factory assembled as far as practicable, together with mounting screws, barriers, or the like, and installation instructions;

b) The assembly itself is complete and needs no parts to make it ready for installation; and

c) The accessory assembly is identified in accordance with 27.6.1 – 27.6.3.

3.3 For posts and pedestal type meter sockets, the requirements of Sections 29 – 40 apply in addition to the requirements for all meter sockets.

3.4 A meter socket provided with a circuit closer or disconnect shall be marked, as applicable, in accordance with 27.7.1 – 27.7.3.

4 Enclosure

4.1 An enclosure shall comply with the requirements of the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50 and the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E, unless modified by additional requirements as specifically described in this standard and shall be marked in accordance with 27.4.1.

4.2 In a cast metal enclosure intended for one meter, there may be an indication of location in the rear wall for an additional conduit connection. This indication may be in the form of a breakout with a reduced thickness to not less than 0.020 inch (0.51 mm), but shall not be a knockout nor shall it be for more than one size of conduit.

Exception: A concentric type breakout for a 1-1/4 inch trade size conduit and for one smaller trade size conduit may be provided in a cast metal enclosure.

4.3 Breakouts and knockouts shall be located so as not to result in interference with terminals or mounting screw holes or to cause reduction in minimum spacings when conduit fittings are in place.

4.4 In a single-meter sheet metal enclosure, a single non-concentric knockout may be located above the line of the lowest live part, provided the knockout, after formation is pushed back essentially flush with the wall.

4.5 In a single-meter enclosure a single concentric knockout may be located above the line of the lowest live part provided that such a knockout after formation is pushed back essentially flush with the wall. The concentric knockout shall also be subjected to the Concentric Knockout Rain Test, Section 18.

4.6 An external operating mechanism, such as for a disconnect, mounted on or through the enclosure shall withstand the environmental tests specified in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E, for the enclosure type marked in accordance with 27.4.1.

4.7 An enclosure not exceeding 185 square inches (1194 cm^2) frontal area may be formed of 0.060 inch (1.52 mm) thick aluminum, if the aluminum hardness is grade H14, and if a meter socket is provided, the distance from the edge of the meter opening does not exceed 5 inches (127 mm) to an unflanged edge nor 10 inches (254 mm) to a flanged edge.

4.8 The cover over a socket for an individual meter shall be secured to the assembly by at least two fastenings. A latch or overlapping flange shall be considered as a fastening.

4.9 If required for a specific need, such as to provide for latching, the overlap between the cover and box may be less than 1/2 inch (12.7 mm) but not less than 1/4 inch (6.4 mm). The length of the reduced overlap shall not exceed 1-1/2 inches (38.1 mm).

4.10 The enclosure socket shall be tight, and shall have no opening other than:

a) The opening necessary to accommodate a watthour meter.

b) Openings for hubs, latches, drainage, mounting, ventilation and such, only as specifically described in this standard.

c) If applicable, an open bottom to accommodate the entry of underground conductors as in a post or pedestal construction.

d) A special opening intended for connection to other equipment if marked as specified in 27.4.3, and if the construction complies with 4.18.

4.11 The enclosure of the equipment shall enclose all live parts.

Exception: This requirement does not apply to ventilating openings, an open bottom for underground conductors, and the like, or if an intended meter is not in place.

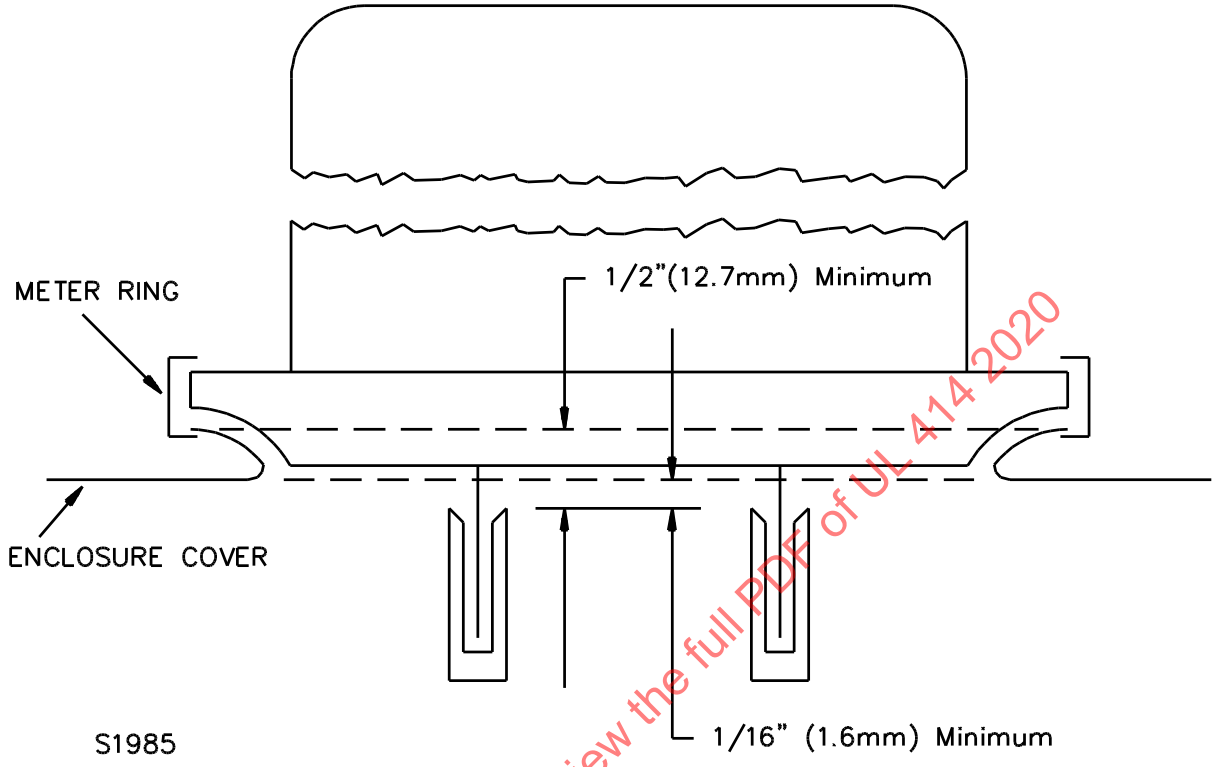
4.12 All live parts within a 3-inch (76.2-mm) radius of the center of the meter socket base shall be recessed not less than 1/2 inch (12.7 mm) behind the front plane of:

a) The meter mounting rim of a ring type meter socket as shown in Figure 4.1 or

b) The meter support of a ringless type meter socket.

Figure 4.1

Ring type meter socket



4.13 The construction of a ring type meter socket shall be such that removal of the cover necessitates a procedure tending to guide the cover clear of any uninsulated live part.

Exception: The guide or insulation of a live part is not required if the jaws or other live part of the meter socket are recessed at least 1/16 inch (1.6 mm) behind the front plane of the meter socket cover as shown in Figure 4.1.

4.14 In a meter socket intended to mount up to three meters and having up to three unit covers of flanged or flanged and offset overlap construction or other features intended to strengthen the assembly, the maximum length of an enclosure of 0.053 inch (1.35 mm) thick steel or 0.060 inch (1.52 mm) thick aluminum may exceed 24 inches (610 mm) but may not be greater than 30 inches (762 mm) provided that the width does not exceed 10 inches (254 mm) and the depth does not exceed 5 inches (127 mm).

4.15 If the performance of a meter socket depends on an operation applying clamping pressure to the jaws, it shall not be possible to complete the installation until the clamping pressure has been applied to the jaws. Completion of the installation is defined as follows:

a) For ringless type meter sockets, installation of the cover and

b) For ring type meter sockets, installation of the cover, meter, and sealing ring.

4.16 The diameter of the watthour meter opening in a ringless type meter socket shall not be less than 6.55 inches (166 mm).

4.17 An enclosure may be provided with removable ends or plates to facilitate ganging with other cooperating enclosures.

4.18 Equipment of the gangable type shall be provided with means to:

a) Ensure bonding continuity between adjacent enclosures.

b) Secure enclosures together by at least one fastening bolt for each joined edge not over 4 inches (102 mm) in length. For joints longer than 4 inches, fastenings shall be located not more than 1-1/2 inches (38.1 mm) from each end and not more than 6-1/2 inches (165 mm) apart.

c) Close the gap at the joint between enclosures with metal of the same gauge as required for the enclosure. There shall be an overlap of 1/2 inch (12.7 mm) on each side of the gap.

d) Close the end of an enclosure with an available fitting. Openings for fastenings shall be provided with upturned edges to retain the fitting when the screws are loosened.

e) Identify gangable enclosures by marking.

f) Ensure proper connection of live parts of ganged enclosures.

4.19 Each enclosure shall be provided with at least two mounting means not more than 5 feet (1.52 m) apart and not more than 12 inches (305 mm) from either end unless intended for mounting as a post or pedestal.

4.20 If internal mounting means are in the form of openings in the enclosure and are located above the level of any live part or terminal for a grounding connection, not more than two such openings shall be provided unless:

a) All other openings are closed at the factory and

b) The closing means when undisturbed excludes the beating rain in the test described in 17.1.

4.21 A ventilating opening in an enclosure shall comply with the requirements specified in Ventilation Openings, Section 31.

4.22 An enclosure of the semi-flush type shall be marked as an enclosure Type 3R and shall additionally be marked as specified in 27.4.2.

4.23 A meter socket not intended to be wired from either the top feed (overhead feed) or bottom feed (underground feed) shall be marked in accordance with 27.5.1.

5 Bases – Insulating Material

5.1 A base for the mounting of uninsulated live parts shall not be easily ignited, moisture resistant insulating material. The base shall be constructed so that it is able to withstand the most severe conditions likely to be met in service.

5.2 An insulating material shall have a Performance Level Category (PLC) that does not exceed the value specified in Table 5.1. The specified values are derived from the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. The Relative Thermal Index (RTI) of the material shall be at least 105°C (221°F).

Exception No. 1: A material may be accepted based on end-product testing as specified in UL 746C.

Exception No. 2: The RTI may be 90°C (194°F) for material that is spaced at least 1/2 inch (12.7 mm) from insulated or uninsulated live parts.

Table 5.1
Maximum performance level category (PLC) for insulating material

Test specified	Flammability rating of material[a,b]			
	V-0	V-1	V-2	HB
Comparative Tracking Index Under Moist Conditions (CTI)[c,d]	3[e]	3[e]	3[e]	3[e]
High Current Arc Resistance to Ignition (HAI)[b,c]	3	2	2	1
Hot Wire Ignition (HWI)[c,d]	4	4	4	4

NOTE – The additional parameters specified in Table 5.2 shall be considered.

[a] As specified in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

[b] If the material is used for indirect support and is spaced from uninsulated live parts by at least 1/2 inch (12.7 mm), the flammability rating may be HB if the PLC level for this test (HAI) is 4.

[c] See the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

[d] If the material is used for indirect support and is spaced from uninsulated live parts by at least 1/2 inch (12.7 mm), this test (CTI or HWI) is not required.

[e] A material having a comparative tracking index PLC of 4 may be used if the voltage involved is 250 volts or less.

Table 5.2
Additional parameters

Property	Test	Method	Units	Minimum levels related to flammability classification
Distortion under load and mold stress relief	Heat deflection temperature, or	UL 746A	Minimum °C	10°C greater than use temperature, but not less than 90°C, or
	Vicat softening point, or	UL 746A	Minimum °C	25°C greater than use temperature, but not less than 105°C, or
	Ball pressure temperature	UL 746A	Minimum °C	(40°C minus the ambient temperature) greater than the use temperature, but not less than 95°C

5.3 A base of insulating material shall be secured to its supporting surface so that it will comply with the conditions of the tests described in 19.1 and 23.1.

5.4 A live part, rivet, screw head or nut on the underside of a base designed for surface mounting shall be countersunk no less than 1/8 inch (3.2 mm) in the clear and covered to a depth of not less than 1/8 inch (3.2 mm) with a waterproof, insulating sealing compound that will not soften at a temperature of 15° C (27°F) higher than the temperature observed at the point where it is used but not lower than 65°C (149°F).

Exception: A sealing compound is not required for constructions complying with 5.5.

5.5 Live parts mentioned in 5.4, which are not covered with a sealing compound, shall comply with through air and over surface spacing requirements noted in Table 8.1. Insulating materials used to provide the necessary spacings shall comply with:

a) Requirements for Bases – Insulating Materials, Section 5 or

b) Requirements for Insulating Barriers, Section 9.1 or

In addition to complying with these spacing requirements, threaded fasteners which are not covered with a sealing compound shall be reliably prevented from loosening by being staked or upset, by a lock washer, a spring washer, or by other means.

5.6 A determination of the softening point of a sealing compound shall be made by use of the ring and ball apparatus described in the requirements for Polymeric Materials – Short Term Property Evaluations, UL 746A.

5.7 The base of a meter socket having line or load terminals supported directly by the base shall be secured to its mounting surface so as to prevent rotation by means other than friction between surfaces.

5.8 The mounting or alignment of a wire connector or a jaw, the integrity of the base material of the equipment, the electrical or mechanical connection between a wire connector and a jaw of the equipment, or the spacings shall not be adversely affected by the application of the maximum tightening means.

5.9 With respect to the Test of Insertion and Withdrawal Force on Meter Base, Section 23, the mounting of the base of a meter socket shall withstand insertion and withdrawal forces without permanent deformation or damage to the insulating base. The rigidity of the assembly shall be such that after seating a typical watthour meter to the maximum depth permitted by the jaws or flange, the clearance between the meter and flange shall not exceed 1/16 inch (1.6 mm) and a sealing ring or cover can be installed.

5.10 A meter socket base shall not be solely dependent on the cover for support unless it is intended to be used with current transformers such that conductors no larger than 8 AWG (8.4 mm^2) will be used.

Exception: The requirement does not apply to backwired devices mounted in switchboards or similar equipment.

6 Current-Carrying Parts

6.1 General

6.1.1 All current-carrying parts, including those associated with a potential jaw assembly shall be of:

a) Silver;

b) A silver alloy;

c) Copper;

d) A copper alloy;

e) Aluminum; or

f) Aluminum alloy.

Exception No. 1: A current-carrying part used only to bypass a meter may be plated steel if determined to be acceptable for the purpose in accordance with the Heating Test, Section 14.

Exception No. 2: A plated No. 10 (4.8 mm diameter) or larger wire-binding screw or nut and stud terminal may be fabricated of iron or steel.

6.1.2 The plating of steel wire-binding screws, nuts, and stud terminals, meter bypasses, and components of pressure wire connectors, shall be made of cadmium, nickel, zinc, tin, or silver.

6.1.3 A plated iron or steel member, if not depended upon to carry current, may be used with a pressure wire connector.

6.1.4 The surface of an aluminum bus bar shall be coated at a clamped joint with:

a) Tin;

b) Silver;

c) Nickel; or

d) Cadmium.

Exception: Other coatings may be used for aluminum bus bars if investigated for the application in accordance with the requirements in 14.2, 14.25, and 14.27.

6.1.5 Among the factors taken into consideration when the acceptability of coating as mentioned in the Exception to 6.1.4 is being determined are its adherence to aluminum and its resistance to corrosive environment. These factors are considered with respect to conductivity and thermal aging.

6.1.6 A multiple meter socket assembly shall be provided with all internal line conductors or busing or both.

Exception: The line conductors connecting not more than six sockets may be omitted where the main terminals are of the lay-in type.

6.1.7 Instructions or markings or both shall be provided to facilitate the proper interconnection of current carrying parts of gangable meter socket units. A link, jumper, or other hardware necessary to effect the connection shall be identified by part designation or other means. Instructions shall refer to the size of interconnecting conductors necessary to ensure compliance with 26.2 and 27.9.1 and Table 26.1.

6.1.8 An insulated wire provided as a part of a meter socket is judged under the requirements for such material, considering its use in the particular application.

6.1.9 A current-carrying part shall be secured so that spacings shall not be reduced below the minimum required spacings specified in Spacings, Section 8.

6.1.10 Friction between surfaces may not be used as the sole means to restrict turning of an uninsulated live part.

6.1.11 If parts are held together by screws, a threaded part shall have not fewer than two full, clean cut threads engaged. If the screw does not extend all the way through a threaded part, the taper or lead thread and the first full thread are to be disregarded in a determination of a number of threads engaged.

6.1.12 A current-carrying part of a meter socket shall be constructed so that the part will not be permanently deformed by intended service.

6.1.13 If current-carrying conductors pass or may pass through an opening in a partition of magnetic material, all conductors of that circuit shall either be included in the same opening, or openings shall be joined by slotting or other means to break the magnetic path.

Exception: If one or more conductors of a circuit are separated by a complete path of magnetic material from the remainder of the circuit conductors, the construction shall be tested as required in 14.14 to determine that no adverse conditions result.

6.2 Washers

6.2.1 Each riveted connection involving current-carrying parts shall have a spring washer at one end and either a spring washer or a flat washer or equivalent at the other end.

Exception No. 1: The washers are not required in a riveted construction that has been tested in accordance with 14.25.

Exception No. 2: The washers are not required in a connection rated 225 amperes or less employing copper bus bars only.

6.2.2 A spring washer shall be used at one end of a bolt securing current-carrying parts together.

Exception No. 1: A spring washer is not necessary in a construction that has been tested in accordance with 14.25.

Exception No. 2: A spring washer may be replaced with a split ring lock washer and flat washer if each aluminum bus in the joint has a tensile yield strength of at least 20,000 pounds per square inch (138 MPa).

Exception No. 3: A flat washer, a split-ring lock washer, or a bolthead that complies with 6.2.4 may be used in place of a spring washer if the joint does not include any aluminum or if aluminum bolts are used with aluminum bus bars.

Exception No. 4: A type of fastening equivalent to that used for investigating the suitability of a wire connector used as a component in accordance with the requirements for wire connectors may be used.

Exception No. 5: A spring washer is not required at a bolted contact of an aluminum alloy conductor used in the grounding circuit for an application such as the service-grounding electrode, a neutral-bonding conductor, or an equipment-grounding conductor.

6.2.3 A spring washer as mentioned in 6.2.1 and 6.2.2 shall:

a) Be a dished washer of stainless or hardened and tempered steel;

b) Have an outer diameter not less than 150 percent of the bolt or rivet shank diameter and a thickness not less than 1/8 of the bolt diameter or rivet shank diameter; and

c) Be dished not less than 3-1/2 percent of the bolt diameter.

6.2.4 A flat washer as mentioned in 6.2.1 and 6.2.2 shall have a thickness at least 1/6 the diameter of the rivet shank or bolt and an outer diameter at least 150 percent of that of the rivet shank or bolt, but not less than the outer diameter of the spring washer.

6.3 Test blocks

6.3.1 A test block disconnect assembly shall be provided with a spring washer of the type described in 6.2.3. A typical test block construction is shown in Figure 6.1.

6.3.2 A stud for a test block disconnect nut assembly shall be restricted from rotating and shall be tested in accordance with the Test of Torque and Force on Test Block, Section 25.

6.3.3 A meter socket provided with a test block assembly shall be marked in accordance with 27.11.1.