



# UL 231

## STANDARD FOR SAFETY

### Power Outlets

[ULNORM.COM](https://www.ulnorm.com) : Click to view the full PDF of UL 231 2022

[ULNORM.COM](https://www.ulnorm.com) : Click to view the full PDF of UL 231 2022

UL Standard for Safety for Power Outlets, UL 231

Tenth Edition, Dated October 5, 2016

### **SUMMARY OF TOPICS**

***This revision of ANSI/UL 231 dated March 29, 2022 includes requirements for Metallic Mounting Posts and Pedestals; [7.1.1](#), [7.1.3](#), and [7.1.4](#)***

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 new and revised requirements are substantially in accordance with Proposal(s) on this subject dated December 24, 2021 and February 18, 2022.

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 UL.

UL 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 UL 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 UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL'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 UL 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.

No Text on This Page

[ULNORM.COM](https://ulnorm.com) : Click to view the full PDF of UL 231 2022

**OCTOBER 5, 2016**  
(Title Page Reprinted: March 29, 2022)



**ANSI/UL 231-2022**

1

## **UL 231**

### **Standard for Power Outlets**

First Edition – February, 1967  
Second Edition – June, 1970  
Third Edition – November, 1972  
Fourth Edition – May, 1977  
Fifth Edition – September, 1982  
Sixth Edition – September, 1988  
Seventh Edition – May, 1994  
Eighth Edition – June, 1998  
Ninth Edition – August, 2008

### **Tenth Edition**

**October 5, 2016**

This ANSI/UL Standard for Safety consists of the Tenth Edition including revisions through March 29, 2022.

The most recent designation of ANSI/UL 231 as an American National Standard (ANSI) occurred on March 29, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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>.

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

**COPYRIGHT © 2022 UNDERWRITERS LABORATORIES INC.**

No Text on This Page

[ULNORM.COM](https://ULNORM.COM) : Click to view the full PDF of UL 231 2022

## CONTENTS

### INTRODUCTION

1	Scope .....	7
2	General .....	7
	2.1 Components .....	7
	2.2 Units of measurement .....	8
	2.3 Undated references .....	9
3	Glossary .....	9

### CONSTRUCTION

4	General .....	10
5	Enclosure .....	11
	5.1 General .....	11
	5.2 Enclosure of switches and circuit breakers .....	15
	5.3 Enclosure of fuses .....	18
	5.4 Opening for cord .....	18
	5.5 Nonmetallic enclosures .....	18
	5.6 Dead front .....	18
	5.7 Doors and covers .....	19
	5.8 Meter socket base .....	20
	5.9 Ventilation openings .....	21
6	Connections for Wiring Systems .....	23
7	Mounting Posts and Pedestals .....	24
	7.1 General .....	24
	7.2 Cover .....	24
	7.3 Electrical connections .....	25
	7.4 Wire opening .....	25
	7.5 Bonding .....	25
	7.6 Overlap .....	25
	7.7 Instructions .....	25
	7.8 Pedestal .....	25
8	Wiring Devices .....	25
	8.1 General .....	25
	8.2 Receptacles .....	26
	8.3 Operating mechanism .....	31
	8.4 Switches .....	32
	8.5 Ground-fault circuit protection (GFCI) for personnel and ground-fault protection of equipment (GFPE) .....	32
9	Insulating Material .....	33
10	Current-Carrying Parts .....	34
	10.1 General .....	34
	10.2 Terminals .....	38
	10.3 Spring washers .....	40
11	Service Equipment Use .....	41
	11.1 General .....	41
	11.2 Mobile home service equipment .....	42
12	Disconnecting Means .....	43
13	Alternate Source Switching Means .....	43
14	Overcurrent Protection .....	44
15	Spacings .....	45
	15.1 General .....	45
	15.2 Insulating barriers .....	47

16	Wiring Space .....	50
	16.1 General.....	50
	16.2 Wire-bending space .....	51
	16.3 Barriers.....	54
	16.4 Bushings.....	54
17	Grounding and Bonding .....	54
	17.1 Ground bus .....	54
	17.2 Terminal for neutral service conductor .....	55
	17.3 Grounding electrode conductor terminal .....	56
	17.4 Main bonding jumper .....	56
	17.5 Grounding electrode conductor and main bonding jumper when sub-feed terminals are provided .....	56
	17.6 Equipment grounding terminal for 100-ampere rated mobile home .....	56
	17.7 Receptacle grounding .....	57
	17.8 Bonding .....	58
	17.9 Bonding means for metallic conduit .....	58
	17.10 Grounding and bonding connections .....	59
18	Luminaires.....	59

## PERFORMANCE

19	Bonding Resistance and Conductor Tests .....	61
	19.1 Plug-in grounding means.....	61
	19.2 Reduced size bonding conductor .....	61
	19.3 Bonding connection .....	61
20	Strength Test of Insulating Base and Support .....	62
21	External Operating Mechanism Test .....	62
22	Rain and Splash Test.....	62
	22.1 General.....	62
	22.2 Test description .....	63
23	Spray Test .....	66
24	Dielectric Test of Clamped Joint.....	66
25	Dielectric Voltage-Withstand Test .....	66
26	Short-Circuit Current Test.....	66
	26.1 General.....	66
	26.2 Testing of receptacles .....	66
	26.3 Short circuit procedure .....	67
	26.4 Evaluation of test results .....	67
27	Conduit Connection Tests .....	68
	27.1 General.....	68
	27.2 Pullout .....	68
	27.3 Torque .....	68
	27.4 Bending .....	68
	27.5 Knockouts.....	69
28	Short Time Fault Current Test.....	69
29	Torque Deformation Test.....	70
30	Beam Loading Deflection Test .....	72

## RATINGS

31	General .....	72
32	Current.....	73
33	Short Circuit Current.....	73
34	Voltage.....	74

**MARKINGS**

35 Details ..... 74  
36 Permanence of Marking ..... 85

**INSTALLATION INSTRUCTIONS**

37 Mounting in Concrete ..... 86  
38 Mounting of Marina Type Equipment ..... 86

**APPENDIX A**

Standards for Components ..... 87

ULNORM.COM : Click to view the full PDF of UL 231 2022

No Text on This Page

[ULNORM.COM](https://ulnorm.com) : Click to view the full PDF of UL 231 2022

## INTRODUCTION

### 1 Scope

1.1 These requirements cover power outlets, with or without integral mounting posts or pedestals, and power outlet fittings for use in accordance with the National Electrical Code, NFPA 70.

1.2 A power outlet covered by these requirements, although not restricted to such use, is intended for use:

- a) At outdoor locations such as on farms, at building sites, and the like, where power is required to operate portable, mobile, or temporarily installed equipment,
- b) To supply power to a mobile home or a recreational vehicle, and
- c) To supply shore power to boats.

1.3 A power outlet may contain:

- a) Attachment plug receptacles,
- b) Circuit breakers,
- c) Fuseholders,
- d) Fused switches and facilities for watt-hour meters, and
- e) Provisions for field installed circuit breakers or switches and fuses.

1.4 Power outlet fittings covered by these requirements are intended for factory or field assembly into or in conjunction with power outlets designed for such assembly. Fittings may be panels or combination units incorporating receptacles, disconnecting means, overcurrent protection or other devices that have been determined to be equivalent. A separable mounting post or pedestal to which power outlets are to be mounted is also a fitting.

1.5 In addition to or instead of mounting to a post or pedestal fitting as mentioned in [1.4](#), a power outlet may be constructed for mounting on and connection to a mounting post or pedestal also designed to be used with other types of distribution equipment.

1.6 Some power outlets may have special features and markings to indicate their acceptability for use as service equipment.

1.7 A power outlet with a mounting post is intended for mounting in concrete. A power outlet with a mounting pedestal is intended for mounting on a concrete slab. Unless marked otherwise, a mounting post or pedestal fitting is not intended to serve as the sole support of a mast for overhead wiring.

### 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.

2.1.5 A component not marked with a short-circuit current rating is considered rated for use in a circuit having a maximum available fault current as shown in [Table 2.1](#).

2.1.6 The short-circuit current available in the secondary circuit of a transformer rated 10 kVA or less is considered to be 5000 amperes or less.

2.1.7 The short-circuit current available on the load side of a 15 ampere current-limiting circuit breaker or Class CC, G, J, RK1, RK5, or T fuse is considered to be 5000 amperes. In a single phase 120-volt circuit, the short-circuit current available on the load side of a 20 ampere circuit breaker or Class CC, G, J, RK1, RK5, or T fuse is considered to be 10,000 amperes or less.

2.1.8 For a power outlet having a short circuit rating exceeding 5000 amperes rms symmetrical, a luminaire as covered in item 4 of [Table 2.1](#) shall be located in the secondary circuit of a maximum 10 kVA transformer as specified in [2.1.6](#) or on the load side of a 15 ampere current-limiting circuit breaker or fuse as specified in [2.1.7](#) that is provided in the power outlet or power outlet fitting.

*Exception: The transformer, circuit breaker, or fuse may be remotely located if the power outlet or power outlet fitting is marked as specified in [35.73](#).*

## 2.2 Units of measurement

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

**Table 2.1**  
**Assumed maximum short-circuit current rating for unmarked components**

Component	Short-circuit current rating, kA
1. Circuit breaker (including GFCI type)	5
2. Clock-operated switch	5
3. Fuseholder	10
4. Lighting fixture (circuit) internal	5
5. Miniature fuse	10 <sup>a</sup>
6. Plug fuse	10
7. Industrial control equipment:	
a. Auxiliary device	5

Table 2.1 Continued on Next Page

Table 2.1 Continued

Component	Short-circuit current rating, kA
b. Motor controllers or switches (other than mercury tube type)	5
c. Mercury tube switches:	
Rated over 60 amperes or over 250 volts	5
Rated 250 volts or less, 60 amperes or less, and over 2 kVA	3.5 <sup>b</sup>
Rated 250 volts or less and 2 kVA or less	1 <sup>b</sup>
8. Meter socket base	10
9. Photoelectric switches	5
10. Receptacle (GFCI type)	2 <sup>c</sup>
11. Receptacle (other than GFCI type)	10
12. Snap switch	5
13. Terminal block	10
14. Thermostat	5
<sup>a</sup> The use of these fuses is limited to 125-volt circuits as specified in the Exception to <a href="#">14.5</a> . <sup>b</sup> This rating is below the minimum specified in <a href="#">Table 33.1</a> and the component shall either: 1) Be investigated for the minimum short-circuit current rating specified in <a href="#">Table 33.1</a> or 2) Be located on the load-side of a suitable current-limiting overcurrent protective device. <sup>c</sup> A GFCI type receptacle is restricted for use in power outlets rated no more than 20 amperes (See <a href="#">32.1(d)</a> ) unless: 1) The power outlet and GFCI type receptacle comply with the short-circuit current test specified in the Short-Circuit Current Test, Section <a href="#">26</a> or 2) The receptacle is located in the 120-volt secondary circuit of a transformer rated 5 kVA or less (a circuit considered to have a short-circuit current available of 2 kA or less) and is provided with suitable overcurrent protection.	

2.2.2 Unless otherwise indicated, all voltage 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.

### 3 Glossary

3.1 For the purposes of these requirements, the following definitions shall apply.

3.2 COVER – An unhinged, removable covering part.

3.3 DOOR – A hinged, sliding, or similarly attached covering part that can be removed only by the use of a tool.

3.4 FILLED OPENING – An opening that has been closed with a filler plate.

3.5 FILLER PLATE – A part intended for closing an opening that would otherwise be closed by subsequent installation of a circuit breaker or other device.

3.6 KNOCKOUT – A factory closed opening with a nonreplaceable closure provided for subsequent installation of a:

a) Conduit,

- b) Circuit breaker,
- c) Other device, or
- d) Wiring system.

3.7 LOOP FEED – An installation arrangement whereby an electrical supply circuit is wired in series to a string of power outlets. In this arrangement, the supply circuit conductors connect to the power outlet and then continue on to the next power outlet in the loop. Each power outlet is connected to the loop feed by means of a tap conductor.

3.8 RESTRICTING BARRIER – A barrier used to prevent the entry of rain or direct access to a live part through a ventilation opening in the enclosure.

## CONSTRUCTION

### 4 General

4.1 A power outlet shall not have provision for the mounting of additional receptacles unless the receptacles are part of a power outlet fitting.

4.2 A knockout or filled opening may be provided in a power outlet only if intended to accommodate:

- a) A circuit breaker or fused switch;
- b) A combination unit as described in [4.6](#); or
- c) Specific additional equipment that has been determined to be equivalent.

4.3 A knockout or filled opening that is intended to accommodate a receptacle shall not be used in a power outlet or power outlet fitting.

4.4 A panel (power outlet fitting) shall not require the use of a tool or the provision of wiring for connecting the supply or ground. The grounding connection shall comply with [17.8.1](#).

*Exception No. 1: A metal dead front or cover that does not include a receptacle may be grounded by the mounting screws.*

*Exception No. 2: A panel (power outlet fitting) marked as noted in [35.78](#) may be constructed such that the use of a tool or the provision of wiring is required for connecting the supply or ground.*

4.5 A mounting means shall be provided for connecting:

- a) A panel to a power outlet and
- b) A power outlet to a mounting post or pedestal.

Such means shall be determined for equivalence in security to that provided by four machine screws.

*Exception: A panel that is not more than 6 inches (152 mm) in width or length may be secured with two machine screws.*

4.6 A combination unit (power outlet fitting) consisting of a receptacle and overcurrent protection and intended to be field or factory installed in a power outlet shall not require the use of a tool or the provision of wiring for effecting supply and grounding connections and shall be provided with a mounting means at

the receptacle that does not depend solely upon the plug-in connection. The grounding connection shall comply with [17.8.1](#).

*Exception No. 1: A metal cover that is not part of the grounding path for a receptacle may be grounded by the mounting screws.*

*Exception No. 2: A combination unit (power outlet fitting) marked as noted in [35.78](#) may be constructed such that the use of a tool or the provision of wiring is required for connecting the supply or ground.*

4.7 Field installation of an individual circuit breaker or fused switch in a power outlet shall not require the use of a tool or the provision of wiring in making supply connections directly to the circuit breaker or switch and shall be intended only for field connection to a permanently wired load circuit.

4.8 A circuit breaker or fused switch intended for field connection to a permanently wired load circuit shall be mounted to the panel dead front only if all electrical connections to the panel are made by stabs and jaws.

4.9 A power outlet or panel (power outlet fitting) with provision for the field installation of additional circuit breakers or fused switches shall contain a dead front with filled openings or knockouts for the circuit breaker handles or fused switches that will cover all wiring and live parts.

4.10 A power outlet marked for use with a power outlet fitting described in [4.4](#), [4.6](#), and [4.9](#) shall be shipped:

- a) With a power outlet fitting installed;
- b) With a dead front having knockouts or filled openings for the field installation of additional circuit breakers or fused switches; or
- c) With a blank dead front without knockouts or openings for circuit breakers or fused switches that will cover all wiring and live parts and prevent the entrance of rain above live parts.

4.11 A filler plate shall be judged according to the Standard for Panelboards, UL 67. Marking requirements for dead fronts using filler plates are contained in [35.32](#).

4.12 A power outlet intended for mounting to a separable field-installed mounting post or pedestal may be provided with an opening for the mounting post or pedestal. If the power outlet can be mounted so that field-installed conduit could interfere with access to field-wiring terminals, the mounting post shall be marked in accordance with [35.30](#).

## 5 Enclosure

### 5.1 General

5.1.1 Unless specified otherwise in this standard, a metallic enclosure shall comply with the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50. A non-metallic enclosure shall comply with [5.5.1](#) and [5.5.2](#). Provisions for a conduit hub need not be provided if the enclosure is marked in accordance with [35.53](#).

5.1.2 A power outlet, including any 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 [35.2](#). The enclosure type selected from UL 50E shall be a type that is suitable for outdoor use.

5.1.3 A power outlet marked in accordance with [35.2](#) with a Type 3S or Type 3SX enclosure designation and provided with an external operating mechanism shall be capable of supporting the weight of any ice build-up, being operated as intended, and withstanding removal of the ice by a tool or auxiliary means to gain access to the interior of the enclosure. Determination of these characteristics is to be made in accordance with [21.1](#) for each maintained position of the external operating mechanism.

5.1.4 Internal wiring and live parts, other than those associated with exposed parts of fuseholders and receptacles, shall not be exposed during fuse replacement or insertion or removal of attachment plugs as specified in [14.11](#).

5.1.5 In addition to withstanding the environmental tests as specified in [5.1.2](#), the enclosure shall be constructed to withstand beating rain and splashing water as determined by application of the requirements specified in the Rain and Splash Test, Section [22](#). The Rain and Splash Test in Section [22](#) replaces the Rain Test requirements from the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E. A power outlet marked for marine use, shall additionally be subjected to the Spray Test, Section [23](#). If there is an opening for a ringless type meter without a viewing pane in front of the meter, the enclosure shall be provided with a permanent structural system to channel any accumulation of water to the outside of the enclosure. During the tests specified in the Rain and Splash Test, Section [22](#), and the Spray Test, Section [23](#), a meter having the dimensions specified in [Figure 5.1](#) shall be installed in place.

5.1.6 A receptacle or circuit breaker, including a handle opening, that is located in the bottom end wall of the enclosure shall be shielded by an extension of each side of the enclosure. The shielding shall extend a minimum of 1/2 inch (12.7 mm) below the face of any receptacle or circuit breaker (excluding the handle).

*Exception: A minimum of 1/8 inch (3.2 mm) extension of any side of the enclosure may be provided if no part of a receptacle or circuit breaker face is closer than 1 inch (25.4 mm) to that vertical side of the enclosure.*

5.1.7 The various parts of a power outlet as covered in these requirements are illustrated in [Figure 5.2](#).

5.1.8 Means for mounting shall be external to the enclosure.

*Exception No. 1: A metal enclosure designated as Type 3R or Type 3RX may be provided with internal means for mounting consisting of no more than two openings above the level of any live part or any terminal for a neutral or grounding conductor. More openings may be provided if all such openings:*

- a) Are closed at the factory; and*
- b) While in the as-received condition, exclude water when subjected to the test described in the Rain and Splash Test, Section [22](#).*

*Exception No. 2: Internal mounting means may be provided in a nonmetallic enclosure if the construction is in accordance with Exception No. 1 and if means to reduce the risk of contact between internal conductors and the mounting means is provided in accordance with [5.1.9](#).*

5.1.9 To reduce the risk of contact between a supporting screw and conductors within an enclosure as required in Exception No. 2 to [5.1.8](#), a hole in an enclosure for a screw shall be located in a recess constructed so that there will be a spacing of not less than 1/32 inch (0.8 mm) between the plane of the top of the recess and the head of the largest screw that is provided with the enclosure. If a screw is not provided with the enclosure, this spacing shall be measured using the largest round-head screw, as specified in [Table 5.1](#), that can be inserted in a hole that is not chamfered; or the largest flat-head screw that can be inserted in a hole that is chamfered.

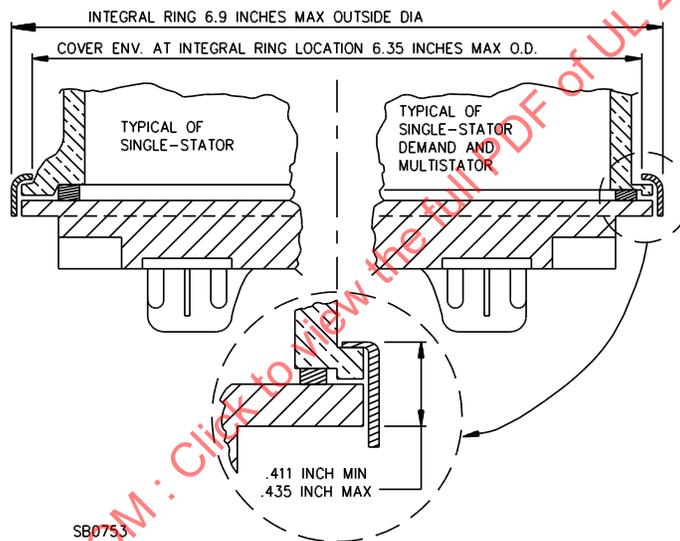
5.1.10 In a power outlet marked for marina and boatyard use, internal mounting holes located above live parts shall be gasketed.

5.1.11 There shall be provision for drainage of the enclosure. In a mounting post the drain hole shall be located directly above the moisture seal and shall drain to the outside.

5.1.12 An edge, projection, or corner of an enclosure, opening, frame, guard, knob, handle, or the like of a power outlet shall not be sufficiently sharp to constitute a risk of injury to persons during intended use or user maintenance.

5.1.13 Metals shall not be used in such combination as to cause galvanic action that will affect adversely any part of the device.

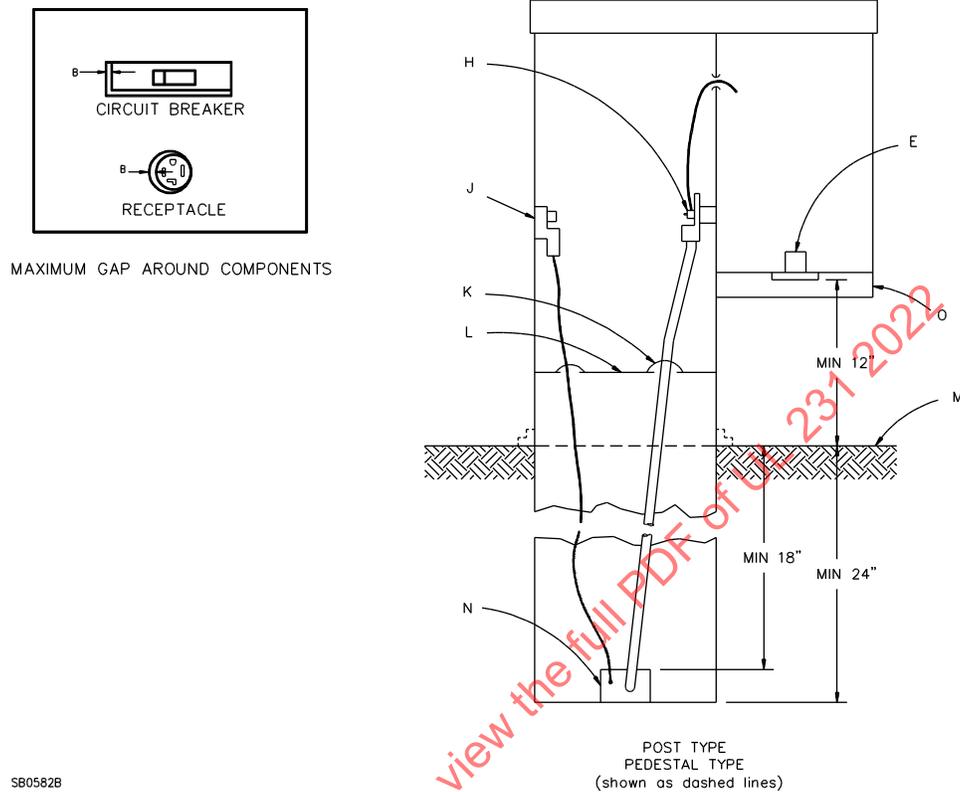
**Figure 5.1**  
**Dimensions of test meter**



inches	(mm)
6.9	175
6.35	161
0.411	10.4
0.435	11.0

Figure 5.2

## Typical power outlet construction features



- A – Maximum 1/8-inch (3.2-mm) gap, top of dead front to edge of open door (see 5.6.7).
- B – Maximum gap 3/32 inch (2.4 mm) each side (maximum 1/8 inch total) between component and edge of opening in dead front, or between dead front and wall of enclosure (see 5.6.3 and 5.6.8).
- C – Fuseholder in compartment (see 5.3.2).
- D – Barrier (see 5.3.3).
- E – Receptacle.
- F – 1- by 1-inch (25.4- by 25.4-mm) end wall extension (see 5.6.5).
- G – 1/2-inch (12.7-mm) wall extension (see 5.6.5).
- H – Line terminals (see 7.3.1 and 10.2.1).
- J – Enclosure grounding terminal (see 7.3.1).
- K – Sealing material, applied during installation (Optional).
- L – Sealing provision (Optional).
- M – Marked grade level (see 35.13).
- N – Conductor entrance (see 7.4.1).
- O – Receptacle or circuit breaker rain shield extension (see 5.1.6).
- P – Distance between a receptacle or a live part and grade level (see 7.3.1 and 12.6).