UL 1567

STANDARD FOR SAFETY

Receptacles and Switches Intended for Use with Aluminum Wire

UL Standard for Safety for Receptacles and Switches Intended for Use with Aluminum Wire, UL 1567

Fifth Edition, Dated March 16, 2012

Summary of Topics

This revision of ANSI/UL 1567 dated July 2, 2020 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

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 requirements are substantially in accordance with Proposal(s) on this subject dated May 8, 2020.

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UL 1567

Standard for Receptacles and Switches Intended for Use with Aluminum Wire

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March 16, 2012

This ANSI/UL Standard for Safety consists of the Fourth Edition including revisions through July 2, 2020.

The most recent designation of ANSI/UL 1567 as a Reaffirmed American National Standard (ANS) occurred on June 23, 2020. 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.

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INTRODUCTION

1 Scope

1.1 These requirements cover wire binding screw terminals of receptacles and switches rated 15 or 20 A intended for use with solid conductor aluminum building wire, and that require direct connection of wiring conductor(s) to the binding head screw terminal(s) prior to insertion of the device in an outlet box.

1.2 These performance requirements for wire binding screw terminals are in addition to the requirements for the products covered by the Standard for Attachment Plugs and Receptacles, UL 498, and the Standard for General-Use Snap Switches, UL 20.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this Standard shall comply with the requirements for that component.

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

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

b) Is superseded by a requirement in this Standard.

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

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

3 Units of Measurement

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

4 References

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

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5 General

5.1 Test Wire Size – Products rated 15 or 20 A shall be investigated for use with 12 (3.3 mm^2) and 10 AWG (5.3 mm^2) aluminum conductors when they are intended for use on branch circuits protected by overcurrent protection rated either 15 or 20 A in accordance with the National Electrical Code (NEC) ANSI/NFPA-70. Products rated 20 A shall be investigated for use with 10 AWG wire. Products rated 15 A that are not intended for use on a 20-A branch circuit shall be investigated with 12 AWG wire.

5.2 Test Wire Characteristics – The aluminum test wire shall be thermoplastic insulated building wire, Type TW or THW. The conductor shall be EC alloy 1350 aluminum having the characteristics indicated in Table 5.1 with an ultimate tensile strength of 17000 – 21000 lbf/in^2 (117.2 – 144.8 MPa), a minimum percentage elongation of 7 and a maximum percentage elongation of 10. The test conductor shall be drawn from 3/8 inch (9.5 mm) diameter rod to the finished size without any intermediate annealing. The conductor shall be batch annealed with air atmosphere to obtain the physical characteristics.

Table 5.1
Chemical sample analysis (percentage by weight – EC alloy 1350)

Element	Nominal	Minimum	Maximum
Iron	–	0.25	0.40
Gallium	–	0.001	0.014
Silicon	–	0.03	0.06
Vanadium	–	0.002	0.005
Boron	–	0.004	–
Sodium	–	0.012	–
Aluminum	–	99.50	–
Nickel	0.001	–	–
Zinc	0.01	–	–
Manganese	0.003	–	–
Chromium	0.001	–	–
Titanium	0.002	–	–
Magnesium	0.001	–	–
Copper	0.001	–	–

5.3 Device Mounting – Receptacles and switches are to be mounted with the major axis of the device in a vertical position. The ground pin slot of a receptacle is to be at the top. The devices shall be secured to special test frames in a normal position of mounting, arranged to minimize the transfer of heat from adjacent terminals. The position of the terminal surface shall be vertical so as to permit free air flow across the terminal when consistent with the normal mounting position. Any specific marked mounting position of the device shall be observed. The device's mounting strap shall be thermally insulated from the test frame to minimize heat transfer from the terminals. (See 6.10).

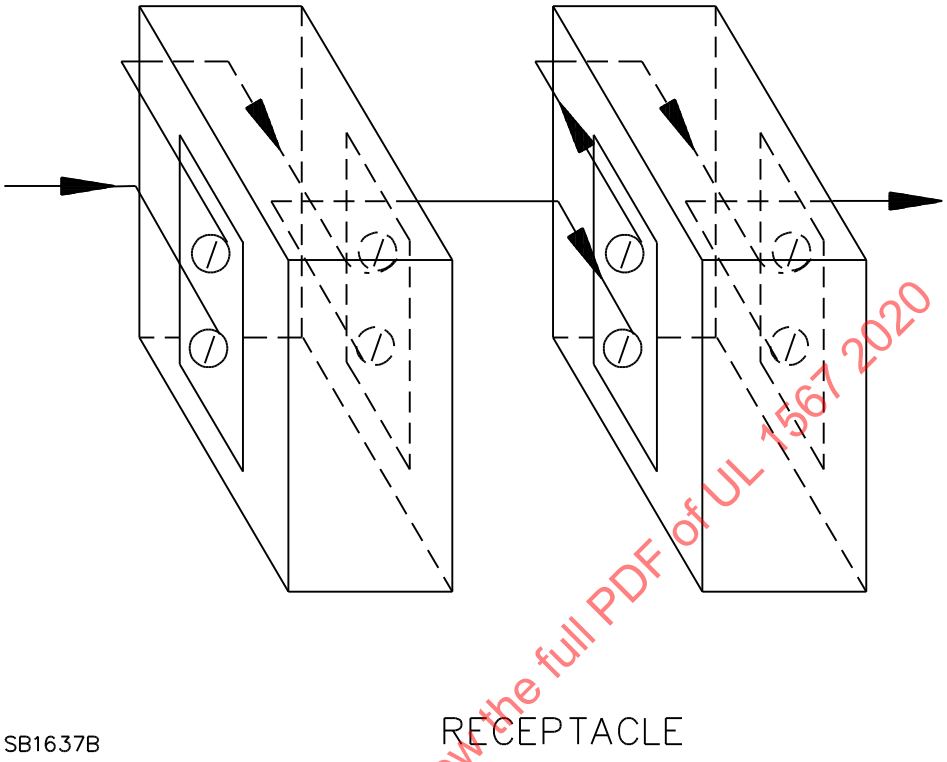
5.4 Test Connections – The devices are to be connected in a circuit using the appropriate gauge and interconnecting lead lengths specified in the individual tests.

5.5 The test circuit is to be connected to a regulated 60 Hz power supply using supply conductors having an ampacity at least that of the test current.

5.6 Where the construction of the product terminals meets the intent of the requirement for through connection, such as a duplex receptacle with two terminal screws per terminal, the product terminals shall be utilized for connection of feed-through conductors. See Figure 5.1.

Figure 5.1

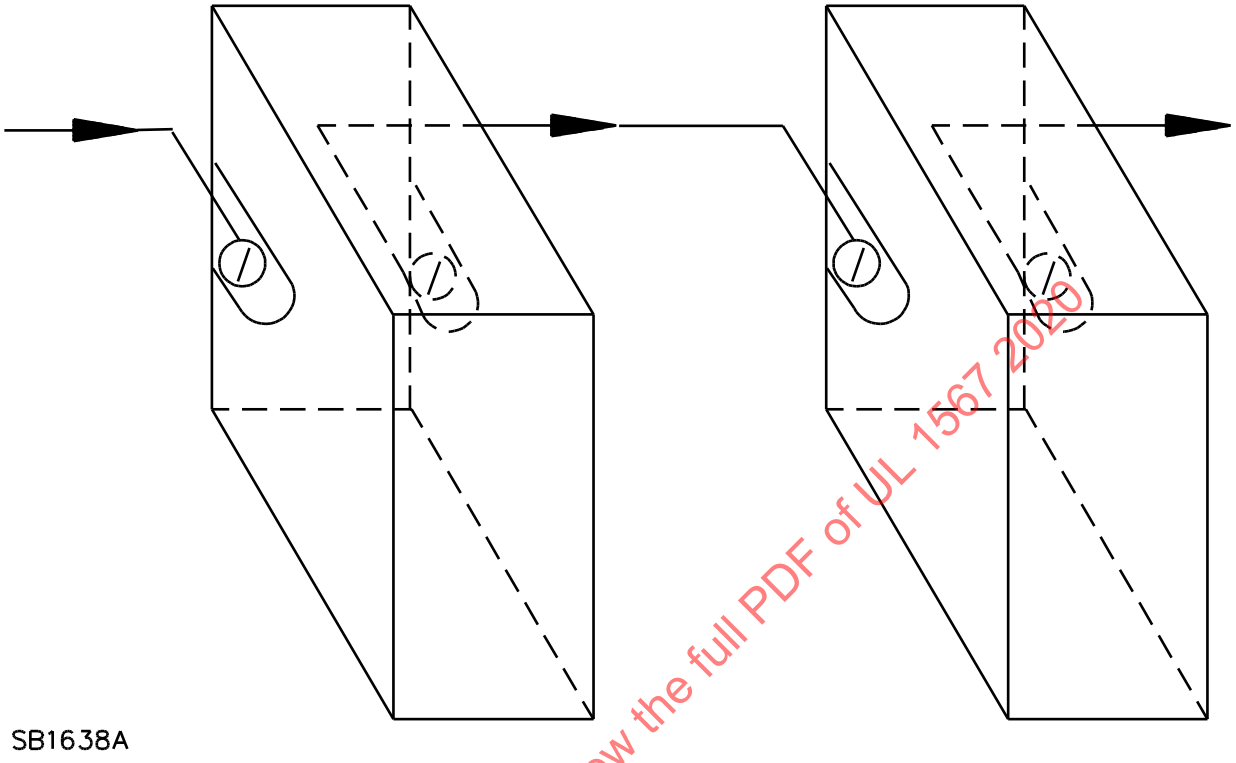
Wiring for through connection terminal examples



5.7 When the product terminal construction precludes through connection of wiring, such as a switch with a single terminal screw per terminal, the test wires shall be connected to the product such that the product performs its normal function. See Figure 5.2

Figure 5.2

Wiring for single screw terminal examples

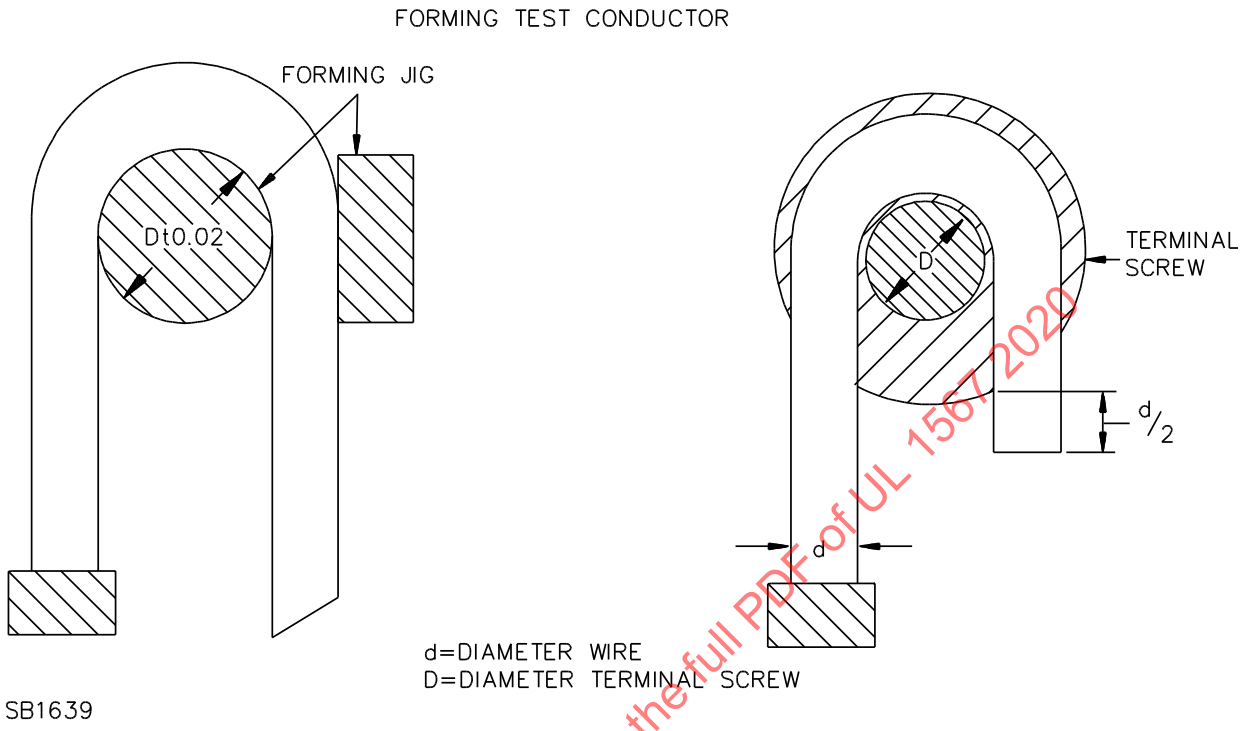


5.8 In order to evaluate a device mentioned in 5.7, modified devices are not prohibited when unrelated variables influence the test results. For example, in order to obtain a through connection, switch contacts and internal current carrying parts of a receptacle bonded, jumpered by a soldered 14 AWG (2.1 mm^2) copper wire or equivalent means, meet the intent of the requirement. Modifications are not to provide any increase in overall thermal or electrical conductivity, mechanical strength and so forth, beyond that of the basic unmodified device construction.

5.9 The end of the aluminum test wires to be connected to the device wire binding screws shall be formed in a plane to have a 180 degree bend. The inside diameter of the bend shall be equal to 0.02 inch (0.5 mm) more than the nominal diameter of the device terminal screw. The end of the conductor shall not project from under the head of the screw more than approximately 1/2 of the diameter of the test conductor. A conductor forming jig shall be used to facilitate wiring in a reproducible fashion (see Figure 5.3).

Figure 5.3

Forming test conductor



5.10 The insulation of the test wire shall be removed in order to expose 1/4 inch (6.4 mm) of conductor beyond the head of the binding screw.

Exception: When the device incorporates provisions, such as wire guides or channels, intended to minimize the transmission of wire bending forces to the terminals, as in the case of a device that is wired and then moved into place, the length of the exposed conductor beyond that necessary to make the connection shall be selected so as to result in the least favorable test condition for the wire disturbance test. For example, a wire guide intended to accept an insulated conductor is to be tested with the wire insulation stripped back beyond the wire guide, and a wire guide intended to accept a 12 (3.3 mm^2) and a 10 AWG (5.3 mm^2) uninsulated conductor is to be tested with the 12 AWG (3.3 mm^2) conductor wire insulation not removed in the area of the guide when the guide accepts the insulated conductor.

5.11 Temperature Measurements – Those parts of the test program that require measurement of the terminal temperatures generated by current flow through the device shall be conducted in a substantially draft-free location. The room ambient temperature shall be maintained between 20 and 35° C (68 and 95°F).

5.12 Temperatures shall be measured using thermocouples as described in 5.14 and an appropriate indicating instrument. A potentiometer type of indicating instrument is to be used whenever referee temperature measurements are required. Thermocouples shall be placed close to the point of maximum heating of the terminal.

5.13 In applying 5.12, exploratory tests to determine the accessible point where maximum heating occurs are not prohibited. Thermocouples are to be located so as not to interfere with any wire disturbance test. On devices that meet the intent of the requirement for through connections, the thermocouple is to be placed on the break-off strap (if provided) or between the terminal screws of a solid plate. When the

terminal plate is recessed or otherwise inaccessible, placing the thermocouple on the terminal screw or conductor, whichever results in the highest temperature rise, meets the intent of the requirement.

5.14 Thermocouples are to consist of 30 AWG (0.05 mm^2) iron and constantan wire. The thermocouple wire shall conform with the requirements specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.

5.15 All temperature measurements shall be made after thermal equilibrium has been achieved. Thermal equilibrium occurs within the first 2-3/4 hours of the 3-1/2 hour "on" part of the heat cycle. The ambient temperature shall be measured in the immediate vicinity of the device under test at a point that is not affected by the heat from the device and its wiring.

6 Heat Cycling

6.1 A wire binding screw terminal shall be subject to a heat cycling test. Twenty-four wire binding screw terminal connections shall be tested:

a) Using 10 AWG (5.3 mm^2) test wire with a test current of 53 A for device terminals rated 20 A.

b) Using 12 AWG (3.3 mm^2) test wire with a test current of 40 A for device terminals rated 15 A.

Exception: When a product terminal rated 15 A is such that it is also capable of being connected to a 20 A branch circuit, as in a duplex receptacle, a second set of 24 terminal connections shall be tested using 10 AWG (5.3 mm^2) test wire at 53 A.

6.2 The test current through the terminals shall be cycled 3-1/2 hours "on" and 1/2 hour "off" for 500 cycles. The temperature rise at any time during the heat cycling on a terminal shall not exceed 100° C (180° F) and the stability factor (see 6.7) shall not exceed 10 (18 when temperatures are measured in degrees F).

Exception: When the temperature rise exceeds 100°C (180°F) on any one or more terminals and does not exceed 125°C (225°F), the heat cycling shall be continued until 1000 cycles are completed as intended. When the temperature rise exceeds 125°C (225°F) and does not exceed 150°C (270°F), the heat cycling shall be continued until 1500 cycles are completed as intended. The temperature rise at any wiring terminal in no case shall exceed 150°C (270°F).

6.3 For a receptacle or switch that is wired prior to insertion in an outlet box, a wire disturbance test shall be conducted at the 25th and 125th cycle of the heat cycling test. The wire disturbance test is to be conducted during the "off" period. The cycle selected is to be based on normal working hours and the off period is capable of being extended to complete the disturbance testing. There shall be a minimum of 100 cycles between the disturbance tests.

6.4 In conducting the wire disturbance test, the test wire is to be bent in a smooth motion through an arc of 90 degrees and then returned to its original position. The bending operation shall be repeated. The motion is to simulate motion that occurs in mounting the device in or on an outlet box.

6.5 On a receptacle or switch having side wiring terminals, the test wire connected to each device terminal is to be gripped 4 inches (102 mm) from the terminal. The test wire is then to be moved firmly and with a smooth motion downward from the horizontal plane through the 90 degree arc so that the wire assumes a vertical orientation. The wire is then to be moved upward so that the wire is returned to the horizontal position. The bending operation is to be repeated. Care is to be exercised so that during the manipulation no pulling or twisting forces are applied to the wire and adjacent test devices are not to be disturbed.

6.6 The temperature at each terminal is to be measured at least once each working day to determine if the temperature rise exceeds the maximum required value.

6.7 The stability factor mentioned in 6.2 is defined as the maximum temperature rise of any data point above the average temperature rise of 11 specific data points for a particular connection. The 11 data points to be used in calculating the stability factor are to be selected from the measured daily temperature rise at each connection for a total of 11 data points as follows:

a) The 25th cycle and every 25th cycle for five measurements (125 cycles),

b) Every 40th cycle for three measurements (120 cycles), and

c) Every 80th cycle for three measurements (240 cycles).

The first and the fifth data points are to be obtained during the first heat cycle following each wire disturbance test (25th and 125th cycle) when the wire disturbance test is required.

Exception: When cycles are to be extended beyond 500 cycles in accordance with the Exception to 6.2, additional data points are to be obtained every 80th cycle for six measurements between the 500th and 1000th cycles. When continued for 1500 cycles, four additional data points are to be obtained by measurements every 125th cycle beyond the 1000th cycle.

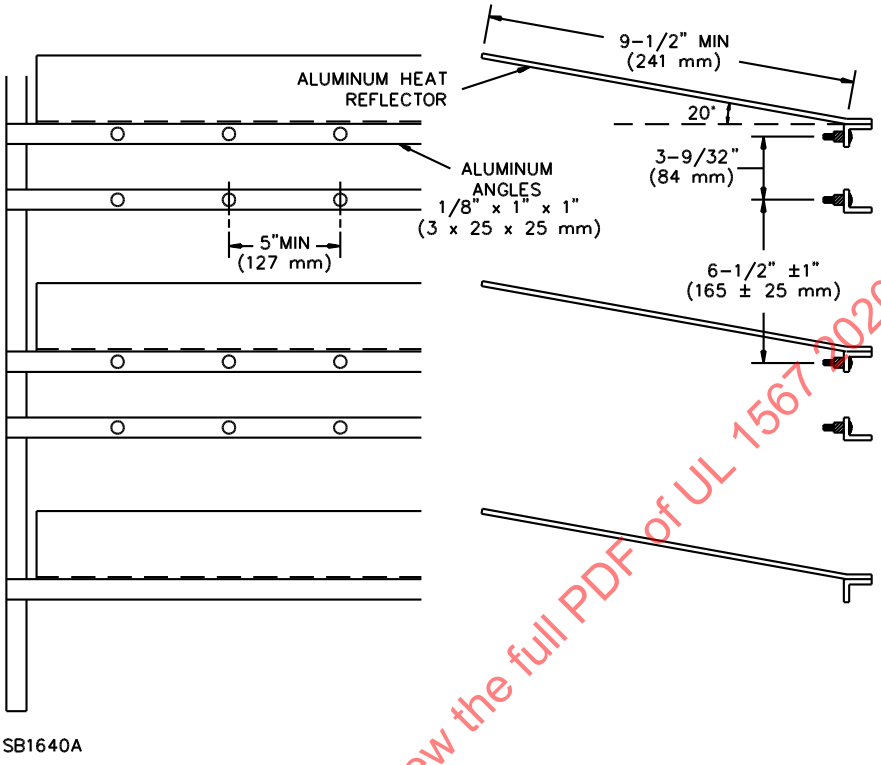
6.8 The length of the test wires between terminals is to be 24 – 27 inches (610 – 686 mm) and the test wire is to project straight back from the device terminals for 3-1/2 to 4-1/2 inches (88.9 – 114 mm), at which point the test wire is to project straight back or is to be formed in vertical coils 1 inch (25 mm) in diameter. The spacing between coils is to be varied to permit connections to terminals.

6.9 The device terminals, following attachment of the test wires, are to be tightened by application of a 6 lbf-in (0.68 N·m) torque. A variable torque type driver provided with a dial indicator is to be used. There is to be no subsequent tightening of the screws.

6.10 For receptacles and switches intended to be mounted in standard 4-inch (102-mm) rectangular outlet boxes, a test rack is shown in Figure 6.1. Extension of the frame vertically or horizontally for any number of devices meets the intent of the requirement when adequate support members are employed. The horizontal aluminum angles are to be secured at each end and at intermediate points to provide a rigid support. Studs for mounting the device are to be attached to the frame and are to be thermally insulated from it and so arranged to space the device mounting yoke 1/2 inch (12.7 mm) from the frame using 1/2 inch diameter, 1/2 inch long insulators. The vertical spacing of the mounting screws is 3-9/32 inches (83.3 mm) standard outlet box mounting. The aluminum heat reflectors minimize the transfer of heat from adjacent rows by controlling the flow of air over the devices. The lowest row of devices is to be at least 18 inches (457 mm) above the floor or supporting surface. The construction shown allows for easy access to device terminals and unrestricted motion of the test conductor for any wire disturbance test.

Figure 6.1

Temperature cycling rack



7 Vibration

7.1 Sixteen wire binding screw terminal connections shall be tested. When the device is rated 15 or 20 A and is capable of being used on a 20 A branch circuit, the test wire shall be 10 AWG (5.3 mm^2) and the test current 53 A. When the device is rated 15 A and is not intended to be connected to a 20 A branch circuit, the test wire shall be 12 AWG (3.3 mm^2) and the test current 40 A.

7.2 Each device is to be mounted to a special test rack constructed of cast iron angles 1/8 by 1-1/4 by 1-1/4 inch (3.2 by 31.8 by 31.8 mm), welded to form a rigid assembly. Bottom mounting holes are to be provided for mounting to the vibration platform. Insulating strips are to be provided on the top of the rack to secure the test wires. Each device is to be mounted so as to achieve thermal isolation either as described in 6.10, or by equivalent means. See Figure 7.1 for test rack intended for flush wiring devices.