56.2.9 Each of three tags is to be tested after 24 hours of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by exposure to water and ultraviolet light using either of the following methods:

a) Twin enclosed carbon-arc Type D or DH, in accordance with the Standard for Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials, ASTM G 23. The tags are to be exposed for 720 hours. The operating cycle is to be 20 minutes consisting of 17 minutes of light exposure only and three minutes of water spray and light, or

b) Xenon-arc, Type B, in accordance with the Standard for Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure Of Nonmetallic Materials, ASTM G 26. The tags are to be exposed for 1000 hours. The operating cycle is to be 120 minutes consisting of 102 minutes of light exposures only and 18 minutes of exposure to water spray and light.

Testing in accordance with 56.3.1 and 56.3.2 shall be performed after 24 hours of exposure at 25 ±5°C (77 ±9°F).

56.3 Test method

56.3.1 The tag is to be tested with each cord size to which it is intended to be applied. The cord, with the attachment plug or current tap pointing up, is to be held tautly in a vertical plane. A force of 5 lbs (22.2 N) is to be applied for 1 minute to the uppermost corner of the tag farthest from the cord, within 1/4 inch (6.4 mm) of the vertical edge of the tag. The force is to be applied vertically downward in a direction parallel to the major axis of the cord. In determining compliance with 56.1.1(d), manipulation, such as straightening of the tag by hand, is permissible.

56.3.2 To determine compliance with 56.1.1(e), each cord tag assembly is to be scraped 10 times across printed areas and edges, with a force of approximately 2 lbs (8.9 N), using the edge of a 5/64 inch (2.0 mm) thick steel blade held at a right angle to the test surface. The portion of the blade contacting the test surface shall have a radius of curvature of 1.00 inch (25.4 mm) and the edges of the blade shall be rounded to a radius of approximately 1/64 inch (0.4 mm).

PRODUCTS EMPLOYING POLYMERIC ENCLOSURES

57 General

57.1 In addition to the other applicable requirements contained in this Standard, a product which employs a polymeric enclosure shall also comply with the requirements in Sections 58 – 63, in the order presented unless otherwise indicated.

Exception: An ornament which employs a polymeric enclosure shall instead comply with the applicable requirements in either General, Section 102, if electronically operated or General, Section 114, if non-electronically operated.

58 Enclosure Mold Stress Relief Test

58.1 When conditioned as described in 58.2 and 58.3, there shall not be any:

a) Softening of the material, as determined by examination immediately after the conditioning,

b) Shrinkage, warpage, or other distortion of the enclosure material resulting in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1, and

c) Cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons.

58.2 Component parts such as knobs, windows, or inserts that become distorted as a result of the test described in 58.3 may be removed if they interfere with the operation of the unit provided the removal of parts does not result in the inability of the unit to comply with the enclosure requirements in 10.1.1 and the accessibility of live parts requirements in 12.1.

58.3 Each of two previously untested units is to be tested. Each complete, unenergized unit is to be placed in a full-draft circulating air oven for a period of 7 hours at a temperature of 10°C (18°F) above the maximum operating temperature of the enclosure, measured at the hottest location on the inside of the enclosure during the Temperature Test, Section 43, but not less than 70°C (158°F).

59 Drop Test

59.1 After being tested as described in 59.2 and 59.3, a product shall comply with all of the following:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats, overload protective devices, waterseals, or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons;

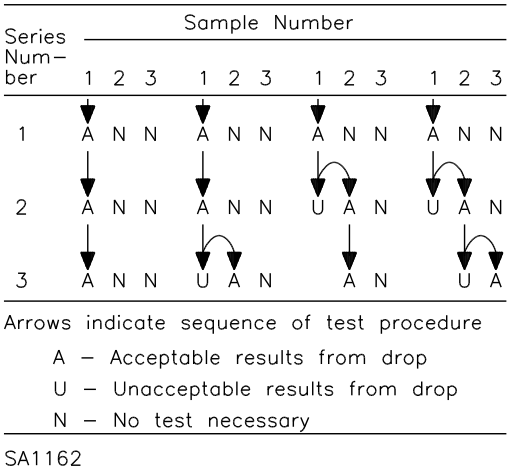
c) There shall not be any damage to the enclosure of the unit that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

59.2 Each of three complete, previously untested products is to be subjected to this test. Each unit is to be dropped three consecutive times from a height of 3 ft (0.92 m) to strike a flat hardwood surface in the positions most likely to produce adverse results. Each unit is to be oriented in such a manner so that a different surface of the enclosure of the unit strikes the hardwood surface for each of the three drops. If the product is intended for outdoor use, it is to be dropped onto a concrete surface. Any lamps may be removed from the unit before the test.

Exception: If the manufacturer so elects, fewer units may be tested in accordance with Figure 59.1, where each series consists of three drops of the unit. The overall performance is acceptable upon completion of any one of the procedures represented in the figure. If a unit does not comply on its first series of three drops, the results of the test are unacceptable.

Figure 59.1

Procedure for impact test



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59.3 The hardwood surface is to consist of a layer of nominal 1 inch (25 mm) tongue-and-groove oak flooring (actual size 3/4 by 2-1/4 inch or 18 by 57 mm) mounted on two layers of nominal 3/4 inch (19 mm) plywood. The assembly is to rest on a concrete floor or an equivalent non-resilient floor during the test.

60 Impact Test

60.1 After being tested as described in 60.2 and 60.3, a product shall comply with all of the following:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats, overload protective devices, waterseals, or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons;

c) There shall not be any damage to the enclosure of the unit that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

60.2 Each of three previously untested products is to be subjected to a single impact. The impact is to be produced by dropping or swinging a 2-inch (50.8-mm) diameter steel sphere, weighing 1.18 lbs (0.535 kg) from a height which will produce an impact of 5 ft-lbs (6.8 J). The unit is to be rigidly supported and the impact is to be made normal to the most vulnerable spots on the unit enclosure that may be exposed to a blow during intended use. The steel sphere is to strike a different surface of the unit for each impact. For surfaces other than the top of an enclosure, either the unit is to be supported on the side and subjected to the impact mentioned above, or the steel sphere is to be suspended by a cord and swung as a pendulum, dropping through the vertical distance necessary to cause it to strike the surface with the specified impact. Refer to Figure 60.1 with respect to the ball drop impact test or to Figure 60.2 for the ball pendulum impact test.

Exception: If the manufacturer so elects, fewer than three units may be used for the tests in accordance with Figure 59.1 wherein each series consists of one impact. The overall performance is acceptable upon completion of any one of the procedures represented in the figure. If a unit does not comply on its first series of three drops, the results of the test are unacceptable.

Figure 60.1

Ball drop impact test

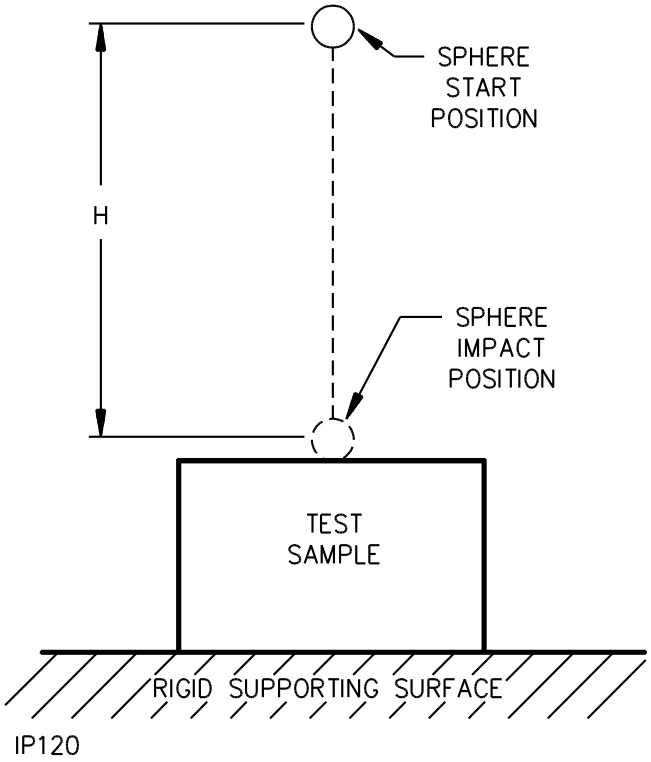
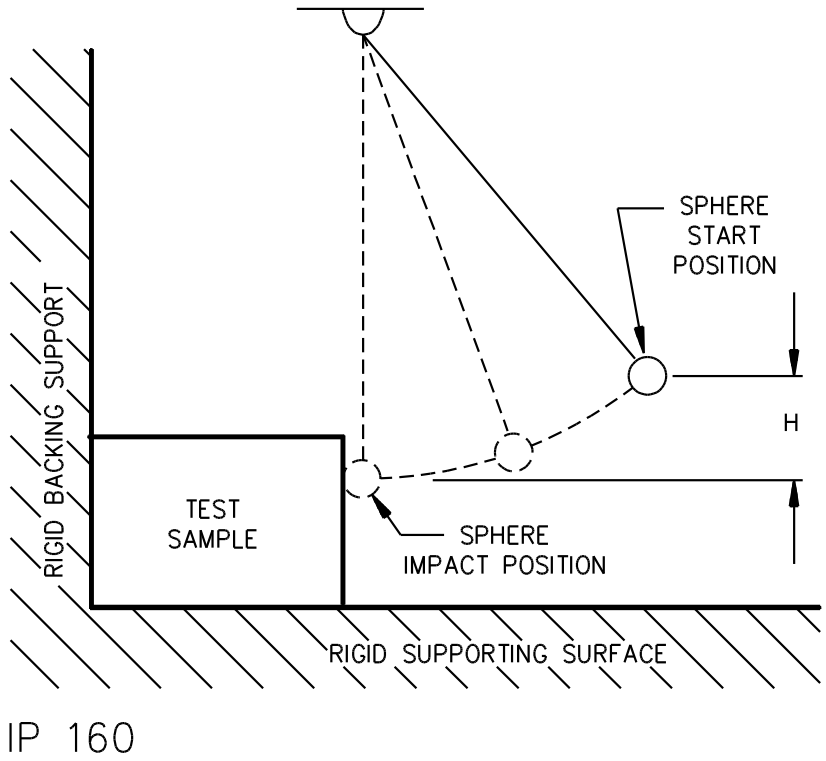


Figure 60.2

Ball pendulum impact test



60.3 With reference to Figure 60.1 and Figure 60.2, the "H" designation represents the vertical distance the sphere must travel to produce the desired impact. For the pendulum impact, the sphere is to contact the test unit when the string is in the vertical position. The supporting surface for the ball drop impact is to be as described in 59.3. The supporting surface for the pendulum impact is to consist of any rigid surface. The backing surface for the pendulum impact is to consist of 3/4 inch (19 mm) plywood over a rigid surface of concrete or an equivalent nonresilient backing surface may be used.

61 Cold Impact Test

61.1 In addition to the Impact Test, Section 60, a product intended for outdoor use shall comply with all of the following after being tested as described in 61.2:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats, overload protective devices, waterseals, or strain relief, or result in the exposure of moving parts capable of causing injury to persons;

c) There shall not be any damage to the enclosure that would result in the increase of the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

61.2 Each of three previously untested products is to be cooled to a temperature of -35.0 ±2.0°C (-31.0 ±3.6°F) and maintained at this temperature for a period of 3 hours. Within 30 seconds of removal from the chamber the units are to be subjected to the Impact Test, Section 60.

62 Resistance to Crushing Test

62.1 After being tested as described in 62.2, a product shall comply with each of the following:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats, overload protective devices, waterseals, or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons;

c) There shall not be any damage to the enclosure of the unit that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

Exception: A direct plug-in unit which complies with the applicable requirements described in Sections 18 and 34, need not be subjected to this test.

62.2 Each of two previously untested units is to be subjected to a steady crushing force of 75 lbs (334 N) for one minute. The unit is to be mounted between two parallel, flat, maple blocks, each not less than 1/2 inch (12.7 mm) thick. One block is to contain slots into which the blades of the unit, if provided, are to be fully inserted. The crushing force is to be applied gradually in a direction normal to the mounting surface.

63 Adhesive Test

63.1 A product which employs an enclosure or part of an enclosure which is held together by adhesive is to be subjected to this test. After the conditioning described in 63.2, there shall not be breakdown of the adhesive to the extent that parts of the product can be readily separated.

63.2 A product is to be placed in a circulating-air oven for a period of fourteen days at a temperature of 90 ±1.0°C (194 ±1.8°F) or 10°C (18°F) above the maximum operating temperature of the enclosure, whichever is higher. After removal from the oven, the product is to be placed in a humidity chamber that has been adjusted for 88 ±5 percent humidity at 32.0 ±2.0°C (89.6 ±3.6°F) for 7 days. Upon removal from the chamber, the product is to be examined to determine compliance with 63.1.

PRODUCTS EMPLOYING OVERCURRENT PROTECTIVE DEVICES

64 General

64.1 A product or wiring device employing an overcurrent protective device shall comply with the applicable requirements in Sections 65 – 69.

Exception: An in-line fuseholder with insulation-piercing terminals shall instead comply with the requirements for In-Line Fuseholders with Insulation-Piercing Terminals for Seasonal Products, Supplement SC.

65 Calibration Test

65.1 When tested in its holder as described in 65.2, an overcurrent protective device employed in a seasonal lighting product shall open:

a) Within 60 minutes when carrying 135 percent of its rated current, and

b) Within 2 minutes when carrying 200 percent of its rated current.

65.2 Each of six representative overcurrent protective devices is to be subjected to this test. One device in its holder is to be connected in series with a 120 V ac, 60 Hz supply source, a variable resistor, and an ammeter. A switch is to be placed across the overcurrent protective device to short it out of the circuit while the resistor is adjusted to supply a test current equal to 135 percent of the device's rating. The switch is then to be opened and the test current is to be monitored for 60 minutes or until the device opens, causing the current to stop flowing. The test is to be repeated on 2 of the 5 remaining devices. The test is then to be repeated on the three remaining devices at a current equal to 200 percent of the device's rating, for 2 minutes or until the device opens.

66 Fault Current Test

66.1 When an overcurrent protective device and holder employed in a seasonal lighting product is tested as described in 66.2, there shall not be ignition of cotton.

66.2 Each of six representative fuse assemblies is to be subjected to this test. A 120 V ac, 60 Hz supply source is to be connected in series with a calibrated circuit and a 20 A time-delay fuse. The calibrated circuit is to be adjusted to supply a test current of 200 A at a power factor of 0.75 to 0.80 without the assembly under test or the time-delay fuse in the circuit. One fuse is to be inserted into its holder and connected in series with the supply source, the calibrated circuit, and the fuse. Cotton is to be placed around the assembly. If the fuse is located within an attachment plug or current tap, the blades of the device are to be inserted into a receptacle and cotton is to be placed around the body of the device, not in contact with its face. The circuit is to be energized and the test current is to be monitored until the fuse opens, causing the current to stop flowing. The test is to be repeated on 2 of the 5 remaining assemblies. The test is then to be repeated at a current of 1000 A on the three remaining assemblies.

67 Fuseholder Temperature Test

67.1 When tested as described in this section, the temperature rise of an in-line fuseholder or an attachment plug, power inlet, current tap, or product incorporating a fuseholder shall not exceed the following:

a) 85°C (153°F) on the fuse clips;

b) 30°C (54°F) at the wiring terminals or cord connections;

c) The relative thermal index of the surrounding insulating material, minus an assumed ambient of 25°C (77°F); and

d) 60°C (108°F) on any exposed exterior surface.

67.2 The test is to be conducted on a set of six previously untested devices. The test is to be conducted with a live fuse.

Exception: If the live fuse opens at the rated fuse current, in the fuseholder to be tested, twice before temperatures are stabilized as indicated in 67.6, a dummy fuse may be employed for temperature testing in accordance with 67.8 and 67.9. The dummy fuse is to be made from a copper tube, identical to the length of the live fuse and diameter of the contact area of the live fuse.

67.3 The devices are to be wired in a series circuit with the blades of the attachment plug, power inlet, or current tap connected by the shortest possible length of solid copper wire soldered across the blades. For an attachment plug or current tap intended for use with flexible cord, each connection to the fuseholder being tested is to be made by means of a 6 inch (150 mm) or shorter length of the appropriate type of flexible cord that has an ampacity at least equal to that of the device. For a male inlet, Type RH or Type TW lead-in wires no more than 6 inches (150 mm) long are to be connected to the wiring terminals. Wire of

the intended ampacity is to be used regardless of the size of the cord which is intended to be used with the device.

67.4 Temperatures are to be measured by means of thermocouples attached to the fuse clips, the insulating material of the device body in proximity to the fuseholder, and the wiring terminals or cord connections and the exterior exposed surfaces.

Exception: If the wiring terminals or cord connections are not accessible for mounting thermocouples, the thermocouples are to be attached to the blades as close as possible to the face of the device.

67.5 The thermocouples are to consist of 28 – 32 AWG (0.08 – 0.032 mm^2) iron and constantan wires. It is a common practice to employ thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan wires with a potentiometer type of indicating instrument. This equipment will be used if a referee measurement of temperature is necessary.

67.6 The device is to be connected to a supply circuit of 120 V and a frequency of 60 Hz. The device is then to be operated continuously for a minimum of 3 hours, under representative intended service conditions that are likely to produce the highest temperature, until constant temperatures are attained. Constant temperatures are considered to exist when three consecutive readings, taken at 15 minute intervals, are within 1°C (1.8°F) of each other and indicate no further rise above the changes in ambient temperature.

67.7 Each device is to be tested with the rated fuse intended for use with the device installed and subjected to a test current equal to the maximum fuse ampere rating. The intended ampere rating of the fuse is to be 3 A for a 22 AWG (0.32 mm^2) wire connection and 5 A for 20 or 18 AWG (0.52 or 0.82 mm^2) wire connection. If the device is rated for multiple ranges of wire, it is to be tested at each current level with the corresponding wire sizes. A current tap shall have 15 A of test current through the female contacts and blades in addition to the test current in the fuse circuit specified above.

67.8 If the test is to be conducted with a dummy fuse in accordance with the Exception to 67.2, each device is to be subjected to a test current equal to the intended maximum ampere rating of the intended fuse. The correlation testing described in 67.9 is to be performed on the dummy fuse and the live fuse to determine the temperature correction factor. To represent the heating of a live fuse, the correction factor is to be added to the recorded temperature rise on the wiring terminals, cord connections, surrounding insulating materials, conductors, fuse clips, and exterior surfaces.

67.9 The dummy fuse and live fuse are to be tested in the fuseholder under identical conditions. In order to allow the live fuse to reach temperature stabilization without opening in the fuseholder, it may be necessary to remove the fuse cover, provide ventilation openings in the fuseholder, or both. Any modifications are also to be made to the dummy fuseholder. The difference in measured temperatures between the live fuse and the dummy fuse is the temperature correction factor.

68 Fuseholder Crush Test

68.1 As a result of the test described in 68.2, there shall not be any cracking of the fuseholder or exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1.

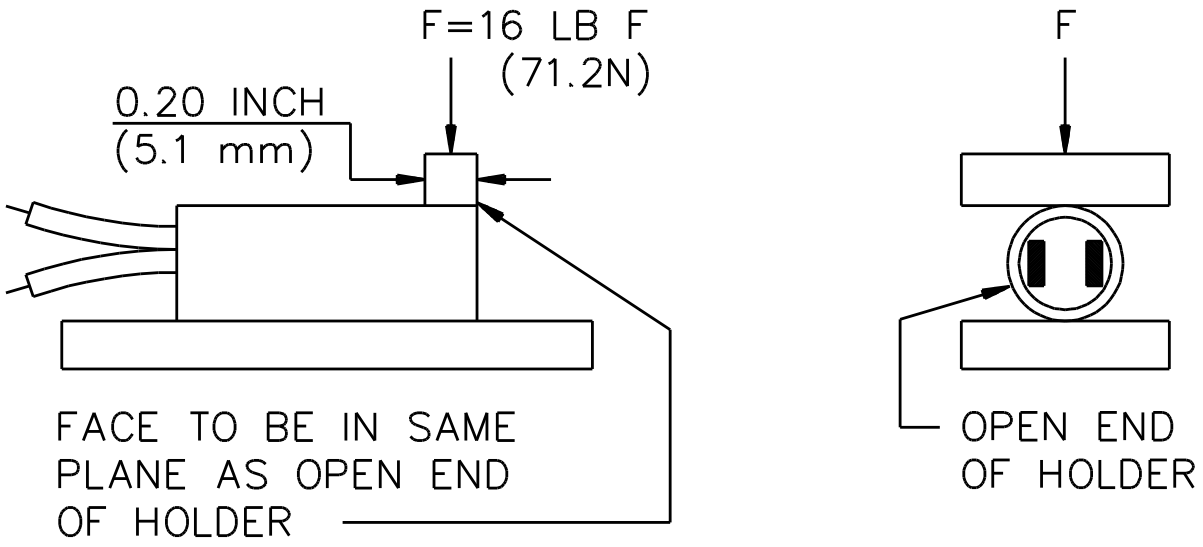
Exception: A fuse incorporated in an attachment plug or current tap need not comply with this requirement.

68.2 Each of three fuseholders is to be tested. Each fuse is to be removed from each fuseholder. The fuseholder is then to be placed between two flat surfaces parallel to each other and parallel to the major axis of the holder. A force of 16 lbs (71.2 N) is to be applied perpendicular to the major axis of the holder and to the plane of the flat surfaces for 1 minute. For holders with open ends for fuse insertion, the force is

to be applied over a distance of 0.20 inch (5.1 mm) as measured from the open end of the holder. See Figure 68.1.

Figure 68.1

Crush test on open-end fuseholder



69 Fuseholder Cover Test

69.1 When subjected to a force of 8 lbs (36 N) applied for 1 minute to an open cover in any direction that the cover may be removed, the open cover of a fuseholder, fused attachment plug, or current tap, or similar device, shall not detach from the body of the device. One fuseholder is to be tested.

PRODUCTS EMPLOYING CORD-CONNECTED WIRING DEVICES OR POWER INLETS

70 General

70.1 In addition to the applicable requirements contained elsewhere in this Standard, a product employing a cord-connected wiring device, such as an attachment plug or cord connector, or a power inlet shall also comply with the applicable requirements in Sections 71 – 76, in the order presented unless otherwise indicated.

71 Strain Relief Test

71.1 The connection of a pair of wires or the conductors of a cord to an attachment plug, a current tap, or a cord connector by a means other than binding-screw terminals shall, except as provided in the Strain Relief Test, Section 46, withstand the straight pull described in 71.2. As a result of the test:

a) Neither conductor of the pair shall become detached from the terminal to which it is connected,

b) There shall not be exposure of live parts as determined by contact with the probe illustrated in Figure 9.1,

c) There shall not be any breakage of the cord, and

d) The leads shall not be displaced more than 1/16 inch (1.6 mm) from the point of entry into the device.

71.2 One device is to be securely supported, such as by the blades in the case of an attachment plug or current tap, and the cord or pair of wires is to be subjected to a straight pull of 30 lbs (133 N) for an assembly with 18 AWG (0.82 mm^2) or larger conductors and 20 lbs (89 N) if the conductors are smaller than 18 AWG. The pull is to be applied by suspending a weight from the cord or wires in a direction normal to the plane of the cord-entry hole. The pull is to be gradually applied and maintained for a period of 1 minute.

72 Reliability of Conductor Connections Test

72.1 If the conductors of the flexible cord or wire are assembled to the blades or contacts of an attachment plug, a current tap, or a cord connector prior to the assembly of the blades or contacts in the device, each connection shall withstand for 1 minute, without breaking, a pull of 20 lbs (89 N) if the conductor is 18 AWG (0.82 mm^2) or larger and a pull of 8 lbs (36 N) if the conductor is smaller than 18 AWG. The pull is to be applied in a direction normal to the plane of the cord-entry hole. As a result of the test, the conductors shall not be displaced more than 1/16 inch (1.6 mm) from the point of entry into the device. The test is to be conducted prior to the assembly of the blades or contacts in the device.

73 Security of Blades Test

73.1 The blades of a wiring device, if they are not rigidly fixed prior to their being connected to the conductors of the cord, or the blades of a power inlet shall be subjected to this test. Each blade, and the parallel blades tested together, shall be capable of withstanding a straight pull of 20 lbs (89 N) for 2 minutes without loosening. For a device of nonrigid construction, where soft, molded material is employed, neither blade shall become displaced more than 3/32 inch (2.4 mm) when measured 2 minutes after removal of the weight.

73.2 One device is to be tested. The device is to be wired in the intended manner and then supported on a horizontal steel plate with the blades projecting downward through a hole having a diameter just large enough for the blades to pass through. The 20 lb (89 N) pull is to be applied by supporting a weight from each blade in succession, and then by the two blades tested together.

74 Security of Input Contacts Test

74.1 As a result of the tests described in 74.2 and 74.3, the blades of a power inlet shall not loosen to a degree such that the power inlet does not comply with the requirements in Spacings, Section 16. After completion of the test, the power inlet shall also comply with the Dielectric Voltage-Withstand Test, Section 45.

74.2 A power inlet is to be rigidly supported in the blades-up position. Each blade, in turn, is to be individually subjected to a force of 30 lbs (133 N) applied gradually along the longitudinal axis of the blade in a direction towards the face of the unit, for 1 minute.

74.3 The same power inlet is to be again positioned as described in 74.2. Both blades are then to be subjected, in combination, to a single applied force of 40 lbs (178 N) for 1 minute.

75 Security of Insulation Test

75.1 Cord and wires employed in a seasonal lighting product shall be secured within the attachment plug, current tap, or cord connector such that the conductor insulation does not slip away from the terminal connections. Unless a knot in the cord or wires inside the plug or other equivalent positive means provides security for the conductor insulation, the assembly shall be capable of withstanding the pull described in 75.2 without detachment of the insulation from the holding means within the device, or baring of the conductors at the entry to the device.

75.2 One device is to be wired as intended with at least a 6-inch (152-mm) length of flexible cord or wires. The insulation on each conductor of the cord or wires is to be slit, parallel to the conductor, for a short distance at a point approximately 1 inch (25.4 mm) from its entry into the device, and all strands of the conductor and the separator (if any) are to be severed at the slit portion. With the device securely held by its blades, a direct pull of 15 lbs (67 N) for 20 AWG (0.52 mm^2) or larger conductors and 10 lbs (45 N) for conductors smaller than 20 AWG is to be applied for 2 minutes at the free end of the cord or wires. The pull is to be applied in a direction normal to the plane of the cord-entry hole.

76 Accessibility Test

76.1 When a product employing a power inlet is tested as described in 76.3, the test probe described in 76.2 shall not contact any blade of the power inlet while the inlet is conductively connected to the cord connector. If the power inlet is removable without the use of a tool, then the test is to be conducted with the power inlet removed from the product.

76.2 The test probe is to be made of 0.06 inch (1.5 mm) thick metal that is 1.38 inches (35 mm) wide and not less than 1.38 inches long.

76.3 The product is to be tested with the detachable power-supply cord supplied with the product. If one is not provided, the cord connector used in this test is to comply with the requirements in the Standard for Attachment Plugs and Receptacles, UL 498. The cord connector is to be inserted as far as possible onto the power inlet blades. The cord connector is then to be withdrawn not more than the distance that is necessary to permit the test probe to be inserted between the power inlet body and the cord connector. The test probe is to be inserted with a maximum force of 4 lbs (17.8 N), until the probe contacts one blade of the power inlet. While the probe is in contact with the blade, the electrical continuity between the contacts of the cord connector and the test probe is to be determined by an ohmmeter or similar instrument. The test is then to be repeated for the other blade of the power inlet.

PRODUCTS EMPLOYING SERIES-CONNECTED LAMPHOLDERS

77 General

77.1 In addition to the applicable requirements contained elsewhere in this standard, a product employing series-connected lampholders shall comply with the requirements in Sections 78 – 84 in the order presented unless otherwise indicated.

78 Oven Test

78.1 As a result of the test described in 78.2, there shall not be exposure of live parts in a lampholder of polymeric composition other than phenolic or urea, as determined by contact with the accessibility probe illustrated in Figure 9.1.

78.2 Each of twelve lampholders, with unenergized lamps installed, is to be suspended by their leads in a circulating-air oven maintained at a uniform temperature of 120.0 ±1.0°C (248.0 ±1.8°F). Twelve additional lampholders, with unenergized lamps installed, are to be placed on their sides in the oven on a