Table 38.1 Continued

Material and component parts		°C	(°F)
	Electrolytic	65[e]	(149)[e]
	Other than electrolytic	90[e]	(194)[e]
22.	Sealing compound	f	f
23.	Selenium rectifier	75[g, h]	(167)[g, h]
24.	Silicon rectifier	100[h]	(212)[h]
25.	Power switching semiconductor device	100[h]	(212)[h]
26.	A handle or knob that is grasped for lifting, carrying, or holding		
	Metallic[i]	50	(122)
	Nonmetallic[i]	60	(140)
27.	A handle or knob that is contacted but does not involve lifting, carrying, or holding and other surfaces subject to contact in operation and user maintenance		
	Metallic[i]	60	(140)
	Nonmetallic[i]	85	(185)
28.	A surface subject to casual contact		
	Metallic	70[j]	(158)[j]
	Nonmetallic	95[j]	(203)[j]

[a] At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature as measured by means of a thermocouple may be 5°C (9°F) higher than that specified if the temperature of the coil as measured by the resistance method is not more than that specified.

[b] The temperature limitations on phenolic composition and on rubber and thermoplastic insulation do not apply to a compound that has been investigated and found to have acceptable heat-resistant properties.

[c] A short length of rubber- or thermoplastic-insulated flexible cord inside the power unit may be exposed to a temperature of more than 60°C (140°F) if supplementary insulation acceptable for the measured temperature and of adequate dielectric properties is employed on each individual conductor.

[d] The maximum allowable temperature shall not exceed the temperature limit of the wire except as noted in (d).

[e] A capacitor that operates at a temperature of more than 65°C (149°F) for electrolytic and more than 90°C (194°F) for other types may be judged on the basis of its marked temperature limit.

[f] Unless a thermosetting compound, the maximum sealing compound temperature limit is 15°C (27°F) less than the softening point of the compound as determined in accordance with the Standard Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus, ASTM E28.

[g] A temperature limit of 85°C (185°F) is acceptable if the stack assembly is insulated with phenolic composition or other insulating material suitable for a temperature of 150°C (302°F).

[h] A component that operates at a temperature of more than 100°C (212°F) shall be judged on the basis of the manufacturer's rating.

[i] A handle, knob, or the like made of a material other than metal, that is plated or clad with metal having a thickness of 0.005 in (0.13 mm) or less, shall be judged as a nonmetallic part.

[j] A power unit may exceed the temperature limits for surfaces subject to casual contact if all of the following conditions are met:

1) The power unit is intended to be permanently installed so that it is not likely to be contacted by people;

2) The power unit is marked as required by 58.25; and

3) The power unit is provided with instructions as specified in 59.2.

38.1.2 A protective device shall not operate during the normal temperature test.

38.1.3 With reference to 38.1.1, the load shall be subdivided between the output circuits so that at least one circuit of each rating is loaded to 80% of its rating and the remainder of the load is distributed equally among the other circuits.

38.1.4 A unit designed for mounting or support in more than one position shall be tested in a manner representing the most severe conditions.

38.1.5 Unless investigated and found acceptable – see 7.13 – a supporting means formed of soft rubber or rubberlike material is to be removed prior to the temperature test. If the supporting means has a metal insert, such as a screw or rivet, the test is to be conducted with the unit supported by the metal insert. At the request of the manufacturer, the test may be conducted without any means of support.

38.1.6 Coil and winding temperatures are to be measured by thermocouples located on exposed surfaces, except the resistance method may be used for a coil that is inaccessible for mounting of these devices such as a coil:

a) Immersed in a sealing compound;

b) Wrapped with thermal insulation such as asbestos; or

c) Wrapped with more than two layers of material such as cotton, paper, or rayon more than 1/32-in (0.8-mm) thick.

In an alternating-current motor, the thermocouple is to be mounted on the integrally-applied insulation of the coil wire.

38.1.7 In using the resistance method, the windings are to be at room temperature at the start of the test. The temperature of a winding is to be calculated from the formula:

$$T_c = \frac{R}{r}(k + t\ 1) - k$$

in which:

Tc is the temperature of the winding at the end of the test in °C;

R is resistance of the winding at the end of the test in ohms;

r is resistance of the winding at the beginning of the test in ohms;

t1 is room temperature at the beginning of the test in °C; and

k is 234.5 for copper, 225.0 for electrical conductor grade (EC) aluminum. Values of the constant k for other grades must be determined.

38.1.8 All temperature values in Table 38.1 are based on an assumed ambient temperature of 25° C (77°F). However, with correction of temperature measurements, tests may be conducted in other ambients as described in Table 38.2.

Table 38.2
Temperature measurement correction

Ambient temperature rating of unit	Test ambient temperature	Correction of observed temperature
1. 25°C (77°F)	Range of 10 – 40°C (50 – 104°F)	See note a, item A
2. Range of 25 – 40°C (77 – 104°F)	Range of 20 – 40°C (68 – 104°F)	See note a, item B

Table 38.2 Continued on Next Page

Table 38.2 Continued

Ambient temperature rating of unit	Test ambient temperature	Correction of observed temperature
3. Above 40°C (104°F)	Rated ambient See note b	c

[a] Correction of temperature, as determined by item A or B below, shall not exceed the temperature limit specified in Table 38.1.

A. An observed temperature is to be corrected by addition if the test ambient temperature is lower then 25°C (77°F) or by subtraction if the test ambient temperature is higher than 25°C (77°F) of the difference between 25°C (77°F) and the test ambient temperature.

B. An observed temperature is to be corrected by addition (if the test ambient temperature is lower than the rated ambient temperature) or by subtraction (if the test ambient temperature is higher than the rated ambient temperature) of the difference between the rated ambient temperature and the test ambient temperature.

[b] Allowable tolerances are:

Minus – not less than 5°C (9°F) below rated ambient.

Plus – not specified.

[c] If the test ambient temperature equals rated ambient, no correction is to be made, and an observed temperature shall not exceed the temperature limit specified in Table 38.1. If the test ambient temperature is other than the rated ambient, correction is to be made as described in item B of note a.

38.1.9 Thermocouples shall consist of wires not larger than 24 AWG and not smaller than 30 AWG. When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of 30 AWG iron and constantan wire and a potentiometer-type instrument. Such equipment is to be used whenever referee temperature measurements by thermocouples are necessary. The thermocouples and related instruments are to be accurate and calibrated in accordance with good laboratory practice. The thermocouple wire is to conform with the requirements 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.

38.1.10 A thermocouple junction and the adjacent thermocouple lead wires are to be held securely in good thermal contact with the surface of the material of which the temperature is being measured. Usually adequate thermal contact will result from securely taping or cementing the thermocouple in place but, if a metal surface is involved, brazing or soldering the thermocouple to the metal may be necessary.

38.1.11 A temperature is considered to be constant when three successive readings taken at intervals of 10% of the previously elapsed duration of the test, but not less than 15 min, indicate no further increase.

38.2 Maximum output without fan operation

38.2.1 A unit employing a cooling fan, the operation of which is controlled by a thermostat or other thermal sensing device or component, is to be operated under the conditions described in 38.1.1 – 38.1.11 except that the load is to be reduced to the maximum load it can carry without resulting in operation of the cooling fan. The unit shall comply with the temperature limits specified in Table 38.1 and Table 38.2.

38.3 Zero clearance

38.3.1 A unit mounted in a wooden enclosure as described in 38.3.2 and 38.3.3 shall comply with the requirements in 38.1.1 – 38.2.1. In addition, the surface temperatures on parts exposed to contact on a unit for flush-wall installation shall not exceed those specified in Table 38.3.

Exception No. 1: A protective device may cycle during the test.

Exception No. 2: A temperature rise may be 20°C (36°F) greater than that specified in Table 38.1.

Table 38.3
Maximum acceptable temperature limits

		°C	(°F)
A.	Surfaces		
	Bare or painted metal	67	(153)
	Porcelain enamel	71	(160)
	Glass	78	(172)
	Plastic[a]	83	(181)
B.	Handles and knobs		
	Bare or painted metal	55	(131)
	Glass	65	(149)
	Plastic[a]	75	(167)

[a] Includes plastic with a metal plating not more than 0.005-in (0.13-mm) thick; and metal with a plastic or vinyl covering not less than 0.005-in thick.

38.3.2 A unit is to be mounted in an enclosure consisting of four vertical side walls at right angles to each other, and a horizontal top and base of 1/2-in thick plywood or soft pine with a nominal thickness of 3/4 in. The interior surfaces are to be painted flat black and the joints are to be tight or sealed. The unit is to rest on the base with the walls and top in as intimate contact with the unit as the configuration on the unit permits.

38.3.3 A unit intended for flush mounting is to be flush mounted on a vertical surface and the recessed portions are to be enclosed in accordance with 38.3.2.

38.4 Maximum overload without trip

38.4.1 A unit is to be operated under the conditions described in 38.1.1 – 38.3.3 at the maximum load it can carry without resulting in the protector required by 21.2.1 to open the circuit – ultimate trip current. During the test:

a) Transformer winding temperatures shall not exceed 140° C (284° F) for Class A insulation, or 165°C (329°F) for a Class B or F insulation, or 20°C (36°F) above the value specified in Table 38.1 for any other class of insulation.

b) The temperature of any component other than a transformer shall not exceed that specified in Table 38.1 by more than 20°C (36°F).

c) A flush-wall mounted unit shall also comply with the temperature limits specified in Table 39.1.

d) A fixed or stationary type unit shall not exceed the temperature limits specified in Table 39.1 by more than 20°C (36°F).

38.4.2 With reference to 38.4.1, readily accessible branch-circuit overcurrent-protective devices in a secondary circuit shall be shunted during the test if they would open the circuit prior to the opening of an internal protective device.

39 External Surface Temperature Limits Test

39.1 During the normal temperature test described in Section 38, Temperature Test, surface temperatures shall not exceed the applicable values specified in Table 39.1. The results of a test that is conducted at a room temperature of other than 25°C (77°F) is to be corrected to 25°C (77°F). See 38.1.8.

Table 39.1
Maximum acceptable surface temperatures

Location	Composition of surface[a]			
	Metal		Nonmetallic	
	°C	(°F)	°C	(°F)
A handle or knob and other surfaces subject to contact in operation and user maintenance	60	(140)	85	(185)
A surface subject to casual contact	70	(158)	95	(203)
Surfaces upon which a fixed or stationary unit may be mounted in service	90	(194)	90	(194)

[a] A handle, knob, or the like made of a material other than metal, that is plated or clad with metal having a thickness of 0.005 in (0.13 mm) or less is considered a nonmetallic part.

40 Dielectric Voltage-Withstand Test

40.1 A unit, at the maximum operating temperature reached in normal use, shall withstand for 1 min without breakdown the application of a 60 Hz essentially sinusoidal potential of:

a) One thousand volts plus twice the maximum rated voltage:

1) Between the primary circuit and dead metal parts;

2) Between the primary and secondary circuits; and

3) Between all secondary windings, including any ferroresonant winding.

b) Five hundred volts between a secondary circuit operating at 50 V or less and dead metal parts; 1000 V plus twice the maximum rated secondary circuit voltage between a secondary circuit, including any ferroresonant winding, operating at more than 50 V and dead metal parts.

c) One thousand volts plus the rated voltage of a capacitor between the terminals of a capacitor used across the line for radio-interference elimination or arc suppression.

40.1.1 A dc potential of 1.414 times the rms value of the ac potential specified in 40.1 may be used instead of the ac potential.

40.2 To determine whether a unit complies with the requirements in 40.1, the unit is to be tested using a 500 VA or larger capacity transformer, the output voltage of which can be varied. The applied potential is to be increased from zero to the required test value, and is to be held at that value for 1 min. The increase in applied potential is to be at a substantially uniform rate as rapid as is consistent with correct indication of its value by a voltmeter.

41 Induced Potential Test

41.1 If a 2-flange bobbin isolated power transformer is to be tested in accordance with (d) of the Exception to 18.2.3, the test specified in 41.2 – 41.4 shall be conducted without breakdown of insulation.

41.2 The primary winding of the 2-flange bobbin transformer is to be subjected to an alternating potential of twice the rated voltage with the ends of all other windings opened. The potential is to be applied for 7200 cycles or for 60 s. An essentially sinusoidal source is to be used, and the frequency of the source may be in the range of 120 – 1000 Hz if necessary to reduce the likelihood of saturation of the transformer core.

41.3 Primary- and secondary-circuit wiring connected to the transformer is to be disconnected for this test.

41.4 The test voltage required in 41.2 is to be initiated at one-fourth or less of the full value and brought up gradually to the full value in not more than 15 s. After being held for the time specified, the voltage is to be reduced slowly, but within 5 s, to one-fourth of the maximum value or less, and the circuit opened.

42 Testing on Transformer Insulating Materials

42.1 If required by note (c) or (g) of Table 18.1, the transformer insulating material shall be subjected to the test described in 42.2.

42.2 The insulating material is to be placed between two opposing electrodes. The electrodes are to be cylindrical brass or stainless steel rods 1/4 inch (6.4 mm) in diameter with edges rounded to a 1/32 in (0.8 mm) radius. The upper movable electrode is to weigh 50 ±2 g to exert sufficient pressure on the specimen to provide good electrical contact. The test potential is to be increased to the test value and the maximum test potential is to be maintained for 1 s. The result is acceptable if there is no dielectric breakdown.

43 Strain Relief Test

43.1 The strain relief means provided on a flexible cord shall withstand for 1 min without displacement a direct pull of 35 lbs (156 N) applied to the cord, with the connections within the unit disconnected. The strain relief is not acceptable if, at the point of disconnection of the conductors, there is such movement of the cord as to indicate that stress on the connections would have resulted.

43.2 A 35-lb (16-kg) weight is to be suspended from the cord and supported by the unit so that the strain-relief means will be stressed from any angle the construction of the unit permits.

43.3 A wiring lead intended for field connection (see 12.1.2.11 and 63.4) shall withstand without damage or displacement a direct pull of:

a) 20 lbs (89 N) for 1 min applied to a lead extending from the enclosure (such as through a knockout); and

b) 10 lbs (44.5 N) for 1 min applied to a lead within a wiring compartment.

44 Overload Test

44.1 Unless known to be acceptable for the application, a switch or other device in a secondary circuit shall perform acceptably when subjected to an overload test consisting of 50 cycles of operation making and breaking 150% of the rated secondary current. There shall be no electrical or mechanical breakdown of the device, undue burning or pitting of the contacts, or opening of the fuse in the grounding connections.

44.2 In a test to determine whether a switch or other control device complies with the requirements in 44.1, the unit is to be connected to a supply circuit of rated frequency and maximum test voltage – see Table 32.1. During the test, exposed dead metal parts of the unit are to be connected to the polarity opposite to that of the switching device through a 3-A fuse. The device is to be operated for 50 cycles at a rate of not more than 10 cycles per minute, except that a faster rate may be employed with the concurrence of those concerned.

45 Overcurrent Protection Calibration Test

45.1 A fuse, or a non-adjustable manual reset circuit protective device, provided in the primary of a transformer for protection of the secondary circuit in accordance with 14.8 shall operate to open the circuit

in not more than the time indicated in Table 45.1 when the transformer is delivering the specified secondary current.

45.2 To determine if a fuse or circuit protective device complies with the requirement in 45.1, the transformer is to deliver the test current to a resistance load. During the 2-min test, the load is to be adjusted continuously to maintain the required test current. During the 60-min test, the load is to be adjusted once after 15 min of operation and the test is to be continued without further adjustment.

45.3 If the fuse or circuit protective device is used to protect more than one secondary winding or taps, each winding or partial winding is to be tested as indicated in 45.1 or 45.2 with the remaining windings delivering rated load.

Table 45.1
Maximum acceptable time to open

Rated secondary potential, V	Secondary test current, A	Maximum time for overcurrent protective device to open, min
20 or less	10	2
20 or less	6.75	60
Over 20	200/V max	2
Over 20	135/V max	60

46 Ground-Fault Circuit-Interrupter Evaluation Test For Power Units

46.1 The ground-fault circuit-interrupter protection circuit of a power unit shall remain closed with a leakage current of 4 mA and shall open with a leakage current of 6 mA when tested in accordance with 46.2.

46.2 To determine if an unit complies with 46.1, the unit is to be connected to its rated source of supply and a variable resistor is to be connected between the ungrounded pole of the line voltage branch circuit output and the output circuit grounding connection. The resistor is to be adjusted to obtain the maximum value of leakage current possible without causing the ground-fault circuit-interrupter circuit to trip, and to obtain the minimum value of leakage current required to cause the ground-fault circuit-interrupter to trip.

47 Battery Charger Overcharge Test

47.1 When connected to a supply circuit adjusted to 106% of the test voltage specified in 32.1, a battery supply of a unit is to be subjected to 7 h of overcharging using a fully charged battery. Any user adjustable controls associated with the charger or charging circuit are to be adjusted for the most severe charging rate.

Exception No. 1: This requirement does not apply to a unit to be used with a battery supply that is not investigated with the unit.

Exception No. 2: This requirement does not apply to a unit provided with a regulating circuit preventing an increase in battery charging current when the ac input voltage is increased from rated value to 106% of rated value.

47.2 The most severe charging rate referred to in 48.1 is the maximum charging rate that does not cause a thermal or overcurrent protective device to open.

48 Abnormal Operation Test

48.1 General

48.1.1 A unit shall not emit flame or molten metal or become a risk of fire, electric shock, or injury to persons when subjected to the tests described in 48.1.3 – 48.9.3, 48.11.1 and 49.1.1 – 49.3.1. Separate samples may be used for conducting these tests.

48.1.2 Following each test, a dielectric voltage withstand test as specified in 40.1(a) is to be conducted.

Exception: If agreeable to all involved, more than one abnormal test may be conducted on a single sample, and the dielectric voltage withstand test may be conducted after completion of all the abnormal tests.

48.1.3 The unit is to be at room temperature at the start of the output-short-circuit, switch-position, and specific-value-overload tests.

48.1.3.1 A risk of fire, electric shock, or injury to persons is considered to exist if:

a) Flame, burning oil, or molten metal is emitted from the enclosure of the unit as evidenced by ignition, glowing, or charring of the cheesecloth or tissue paper,

b) The insulation breaks down when tested in accordance with 48.1.2, or

c) Live parts are made accessible (see Protection of Users – Accessibility of Uninsulated Live Parts, Film-Coated Wire, and Moving Parts, Section 9).

48.1.3.2 During these tests the unit is to be placed on a softwood surface covered with a white tissue paper and a single layer of cheesecloth is to be draped loosely over the entire enclosure. The cheesecloth is to be untreated cotton cloth 36 in (910 mm) wide, running 14 – 15 yds/lb (28 – 30 m/kg), and having, for any square inch, a count of 32 threads in one direction and 28 in the other direction (for any square centimeter, 13 threads in one direction and 11 in the other direction).

Exception: Units not having any bottom openings need not be placed on a softwood surface covered with tissue paper.

48.1.3.3 The supply circuit is to have branch circuit overcurrent protection, the size of which equals 125% of the input current rating (20 A minimum), except where this value does not correspond with the standard rating of a fuse or circuit breaker, the next higher standard device rating shall be used. The test voltage is to be adjusted to the value specified in 32.1.

Exception: If a marking on the product indicates the use of branch circuit protection exceeding 125% of the input current, such protection shall be used.

48.1.3.4 The enclosure of the unit is to be connected directly to ground.

48.1.3.5 Each test is to be continued until further change as a result of the test condition is not likely. If an automatically reset protector functions during a test, the test is to be continued for 7 h. If a manual reset protector functions during a test, the test is to be continued until the protector is operated for 10 cycles using the minimum resetting time, but not at a faster rate than 10 cycles of operation per minute. The following are considered as an acceptable termination of the test:

a) Opening or shorting of one or more components such as capacitors, diodes, resistors, solid state devices, printed wiring board traces, or the like.

b) Opening of the intended branch circuit overcurrent protection device.

c) Opening of an internal fuse.

Exception No. 1: If the manually reset protector is a circuit breaker that complies with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, it is to be operated for 3 cycles using the minimum resetting time but not at a rate faster than 10 cycles of operation per minute.

Exception No. 2: A manual reset protector that becomes inoperative in the open condition may be operated fewer than 10 cycles, but not less than 3 cycles.

48.1.4 The output short-circuit and specific-value-overload tests are to be conducted on the bench and under the conditions described in 38.3.2 and 38.3.3.

Exception: A unit that employs integral fuses need not be subjected to the short-circuit test under the conditions described in 38.3.2 and 38.3.3.

48.1.5 Each test is to be conducted on a separate sample unless the manufacturer requests that more than one test be conducted on the same sample.

Exception: For the overload tests, one sample may be used provided it is subjected to the tests in the following order: 200% of rated current, followed by short-circuit current.

48.1.6 A manually or automatically reset protector or other overload protective device in a unit shall open the output circuit within 2 min after initiation of the test, and within 30 s for subsequent cycles during the output-short-circuit, switch-position, and specific-value-overload tests.

Exception No. 1: The time required to open the output circuit may exceed the time specified provided the maximum temperatures attained do not exceed the limits specified in Table 39.1 for flush-wall mounted units, or 20°C (36°F) more than that specified in Table 39.1 for fixed or stationary stand-alone type units surfaces, and 20°C (36°F) more than that specified in Table 38.1 for components and materials.

Exception No. 2: The switch-position test may be waived if with the transfer switch in the battery position, the unit will not operate when connected as described for the input test – see Section 34, Power Input Test – and no risk of fire or electric shock is found to exist.

Exception No. 3: The time required to open the output circuit during the specific-value-overload test may exceed the time specified provided the unit does not emit flame or molten metal or become a risk of fire or electric shock while operating under the test condition described in 48.8.1 for 15 days.

48.2 Output short-circuit

48.2.1 The external output connections of a unit are to be short-circuited and the unit is to be connected to a source of supply adjusted to the test voltage specified in Table 32.1. The source of supply may be protected by a time-delay branch-circuit overcurrent-protective device rated not less than 20 A. During the test, the enclosure is to be connected directly to earth ground. A protective device such as an accessible fuse or circuit breaker provided as part of the unit is to remain in the circuit, and the largest fuse the fuseholder will accept is to be installed.

48.2.2 For the test described in 48.2.1, fuses or circuit breakers provided for individual low-voltage branch-circuit protection may remain in the circuit. If a fuseholder is provided, a fuse rated not less than 30 A is to be installed in the fuseholder. The short circuit may be applied across one individual low-voltage

circuit, which, for the purpose of this test, may employ output leads as described in 13.1.3 having a total length of 4 ft (1.22 m) that is, having positive and negative leads each 2 ft (610 mm) long.

48.2.3 The external output connections of an inverter are to be short-circuited and the unit is to be connected to a source of supply adjusted to the inverter rated nominal input dc voltage. The source of supply may be protected by a time-delay overcurrent-protective device rated no less than 150% of the rated inverter input current at full rated load. During the test, the enclosure is to be connected directly to earth ground. A protective device such as an accessible fuse or circuit breaker provided as part of the unit is to remain in the circuit, and the largest fuse the fuse holder will accept is to be installed. When an inverter circuit employs a microprocessor to shut down a unit due to an overload, that portion of the software shall be disabled for this test.

48.2.4 For the test described in 48.2.1 and 48.2.3, if acceptable results are based on the opening of an overcurrent-protective device, the overtemperature protective device shall be operable at the conclusion of the tests.

48.2.5 Power-inverters with three-phase AC outputs shall be subjected to three different short-circuit tests. The tests shall consist of a Line to Neutral test, a Line to Line test, and a Line to Line to Line test.

48.3 Switch position

48.3.1 A unit provided with a manual battery-to-unit transfer switch and a battery-charging circuit is to be operated as described in the input test except with the transfer switch in the battery position.

48.4 Component malfunction

48.4.1 Individual electronic components of a unit are to be, in turn, open-circuited and short-circuited.

48.4.2 The tests specified in 48.4.1 are to be conducted separately. Short circuits are to be applied between only two terminals of a multiterminal device at one time. The abnormal condition is to be introduced while the unit is operating under intended conditions. This may be accomplished by jumper leads and remote switches with consideration given to the effect these devices may have on the test.

48.5 Rectifier and capacitor short-circuit test

48.5.1 If a rectifier and an electrolytic capacitor are connected across a primary supply circuit in series with a resistance of less than 300 Ω, a risk of fire or electric shock shall not result with the capacitor or the rectifier being short-circuited.

Exception: If analysis of the test results and circuit indicates that the result obtained is the only one likely to occur, the test need be conducted only once.

48.5.2 The supply circuit of a power unit is to be protected by a branch-circuit overcurrent-protective device in accordance with 49.3.2.

48.6 Vibration test

48.6.1 After the unit is subjected to the vibration test described in 48.6.2:

a) The unit shall comply with the requirement in 48.1.1,

b) There shall be no loosening of parts, and

c) The unit shall operate normally.

48.6.2 The vibration test shall consist of vibration for 1 h at a frequency of 12.5 cycles per second with a displacement of 1/4 inch (6.4 mm) in a vertical plane. The unit is to be mounted as intended in accordance with the manufacturer's instruction manual during the test.

48.7 Surge protectors

48.7.1 A unit provided with a surge-protection device in the secondary circuit is to be subjected to the surge test described in 48.7.2.

48.7.2 A 1-µF capacitor is to be charged to 500 F. The capacitor is to be discharged directly into the secondary output network with the transformer secondary leads disconnected. The surge is to be repeated for a total of 50 times at 30 s intervals. After the surges, the unit shall operate normally at rated load. Proper polarities are to be maintained in conducting this test.

48.8 Specific value overload

48.8.1 A unit is to be operated using a load adjusted to 200% of the rated output current. The test is to be continued until the overload-protective device opens – see 48.1.6. If an automatically reset protector is provided, the test is to be continued for 15 days, or for 24 h if the protector has been evaluated for 6000 cycles at 200% of the measured current at the alternating or direct voltage value. A manually reset protector is to be operated for 50 cycles of operation, with the protective device being reset as rapidly as is possible. The protector shall be operative upon completion of the test.

48.8.2 With reference to the requirement in 48.8.1:

a) If the ultimate trip current mentioned in 38.4.2 is greater than 200% of the rated output current, the load is to be increased in increments of 100% of the rated output current.

Exception: If the next increment of rated output current is not obtainable, the maximum current value obtainable is to be used.

b) If the maximum load current obtainable is less than 200%, the maximum value obtainable is to be used.

c) If the increased load results in the opening of a fuse, the test is to be conducted with the load adjusted such that the circuit current is equal to the ampere rating of the fuse. The unit is to be operated continuously until ultimate conditions are observed.

48.9 Blanketing test

48.9.1 A unit that incorporates standoffs is to be subjected to a blanketing test. A double layer of blanket – see 48.9.3 – is to be loosely draped over the top and drawn in as close as possible against all sides of the unit. The blanket may fall or sag between any standoffs that are provided on the unit. The test is to be continued until the overload protective device opens – see 21.2.1. If an automatically reset protector is provided, the test is to be continued for 15 days. A manually reset protector is to be operated for 50 cycles of operation, with the protective device being reset as rapidly as possible. The protector shall be operative upon completion of the test.

Exception: The test may be conducted for 1 cycle if protection is provided by a fuse that is not accessible without the use of a tool.

48.9.2 Accessible secondary-circuit overcurrent-protective devices shall be shunted during the test, if they would open the circuit prior to opening of an internal protective device.