

(2) Wireways shall be smooth and entirely free of sharp edges, burrs, fins, and moving parts that may abrade conductor insulation. Each splice and connection shall be mechanically secure, shall provide adequate and reliable electrical contact, and shall be provided with insulation at least equivalent to that of the wire involved unless adequate spacing between the splice and all other metal parts is permanently assured.

(3) A wire connector for making a splice in a toy shall be a type that is applied by a tool and for which the application force of the tool is independent of the force applied by the operator.

(4) Soldered connections shall be made mechanically secure before soldering.

(5) Current-carrying parts shall be made of silver, copper, a copper alloy, or other electrically conductive material suitable for the particular application.

(h) *Strain relief.* (1) A means of strain relief shall be provided to prevent mechanical stress on a flexible cord from being transmitted to terminals, splices, or interior wiring.

(2) If suitable auxiliary insulation is provided under a clamp for mechanical protection, clamps of any material are acceptable for use on Type SP-2 (as defined in the "National Electrical Code," chapter 4, article 400, pages 184-194 (1971)²) or equivalent rubber-insulated cord. For heavier types of thermoplastic-insulated cord, clamps may be without auxiliary insulation unless

²NFPA No. 70-1971, 1971 edition of National Electrical Code, Article 400, "Flexible Cords and Cables," pages 70-184 through 70-194, published by the National Fire Protection Association, which is incorporated by reference. Copies of this document are available from the National Fire Protection Association, 60 Batterymarch Park, Quincy, Massachusetts 02269. This document is also available for inspection at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC. This incorporation by reference was approved by the Director of the Federal Register. These materials are incorporated as they exist in the edition which has been approved by the Director of the Federal Register and which has been filed with the Office of the Federal Register.

the clamp may damage the cord insulation.

(3) A flexible cord shall be prevented from being pushed into the toy through the cord-entry hole if such displacement would result in a hazardous condition.

(4) A knot in the cord shall not be considered an acceptable means of strain relief, but a knot associated with a loop around a smooth, fixed structural component shall be considered acceptable.

(i) *Additional requirements.* Except for the electrodes of a replaceable incandescent lamp and its lampholder contacts, a potential of more than 30 volts r.m.s. (42.4 volts peak) shall not exist between any exposed live part in a toy and any other part or ground.

(Sec. 30(a), 86 Stat. 1231 (15 U.S.C. 2079(a)))

[38 FR 27032, Sept. 27, 1973, as amended at 43 FR 45552, Oct. 3, 1978; 46 FR 63251, Dec. 31, 1981]

§ 1505.6 Performance.

(a) *General.* Electrically operated toys and components thereof shall be tested by the appropriate methods described in this section and shall pass the tests in such a manner as to provide the necessary assurance that normal use and reasonably foreseeable damage or abuse will not produce a hazard or a potentially hazardous condition. The toy shall be capable of passing all applicable tests with any door, cover, handle, operable part, or accessory placed in any normal position. A toy shall not present a fire, casualty, or shock hazard when operated continuously for 6 hours under conditions of normal use and reasonably foreseeable damage or abuse, including the most hazardous position in which the toy can be left.

(b) *Enclosures.* For the purposes of this section, the term *enclosure* means any surface or surrounding structure which prevents access to a real or potential hazard. An enclosure shall withstand impact, compression, and pressure tests (see paragraphs (b)(1), (2), and (3) of this section) without developing any openings above those specified, reduction of electrical spacings below those specified, or other fire, casualty, or shock hazards, including the loosening or displacement of

components but excluding breakage of a lamp. After completion of each test, the toy shall comply with the requirements of the dielectric strength test described in paragraph (e)(2) of this section and, upon visual examination, shall not evidence the development of any hazards. Rupture of a fuse shall be considered a test failure.

(1) *Impact test.* A toy weighing 10 pounds or less shall be dropped four times from a height of 3 feet onto a 2½ inch thick concrete slab covered with 0.125 inch nominal thickness vinyl tile. The impact area shall be at least 3 square feet. The test shall be conducted while the toy is energized and operating and with all dead metal of the toy that may be energized connected together electrically and grounded through a 3-ampere plug fuse. The toy shall be dropped in random orientation. After each drop the test sample shall be allowed to come to rest and examined and evaluated before continuing.

(2) *Compression test.* Any area on the surface of the enclosure that is accessible to a child and inaccessible to flat-surface contact during the impact test shall be subjected to a direct force of 20 pounds for 1 minute. The force shall be applied over a period of 5 seconds through the axis of a ½-inch-diameter metal rod having a flat end with the edge rounded to a radius of one thirty-seconds of an inch to eliminate sharp edges. The axis of the rod shall be perpendicular to the surface being tested. During the test the toy shall rest on a flat, hard surface in any test-convenient position.

(3) *Pressure test.* If any portion of the top of a toy has a flat surface measuring 24 square inches or more and a minor dimension of at least 3 inches, that surface shall be subjected to a direct vertical pressure increasing to 50 pounds over a period of 5 seconds and maintained for 1 minute. The force shall be applied through a steel ball 2 inches in diameter. During the test the toy shall be in an upright position on a flat, horizontal solid surface.

(c) *Handles and knobs—(1) General.* For the purposes of tests in this paragraph, the parts of a lifting handle on a toy that are within seven-sixteenths of an inch of the surface to which the

handle is attached, or the parts of a lifting knob that are within one-fourth inch of the surface to which the knob is attached, are considered to be for support purposes, and the remainder of the handle or knob is considered to be generally functional in nature. A handle or knob shall withstand crushing and lifting tests (see paragraphs (c)(2) and (3) of this section) without fracture of the handle or knob, development of an opening that may pinch the hand, or breakage of the means used to fasten the handle or knob in place.

(2) *Crushing test.* The functional portion of a handle or knob shall be subjected to a crushign force increasing to 20 pounds over a period of 5 seconds and maintained for 1 minute. The force shall be applied through two flat and parallel hardwood blocks, each at least 2½ inches thick and each having dimensions slightly exceeding those of the handle or knob being tested. The crushing force between the blocks shall be exerted in any direction perpendicular to the major axis of the handle or knob.

(3) *Lifting test.* The support portion of a handle or knob shall be subjected to a force equal to four times the weight of the object it is intended to support. The direction of the lifting force shall be as intended by the design of the toy and shall be applied through a ½-inch-wide strap through or around a handle or by fingers or the equivalent on a knob. The force shall be applied over a period of 5 seconds through the center of gravity of the toy and maintained for 1 minute.

(d) *Stability.* A toy shall not overturn while resting in an upright position on a flat surface inclined 15° from horizontal. No spillage of molten material or hot liquids from containers shall occur while the toy is operating in this position under normal conditions of use. During this test, casters, if any, shall be in the position most likely to result in tipping, but shall not be artificially held in one position to prevent a natural rotation to another position.

(e) *Electrical—(1) Power input.* The actual current flow in a toy without a heating element shall not exceed 110 percent of the rated value, and shall not exceed 5.5 amperes, at rated voltage. The power input to a toy with a

heating element shall not exceed 105 percent of the rated value at rated voltage. The power input rating of a toy employing one or more incandescent lamps as the only power-consuming components shall be considered to be the total rated wattage of such lamps. The rated voltage shall be considered to be the mean value of a marked voltage range.

(2) *Dielectric strength.* (i) A toy shall be capable of withstanding without breakdown for 1 minute a 60-cycle-per-second (60 Hertz) essentially sinusoidal potential of 1,000 volts applied between live parts and any dead metal parts.

(ii) If a toy employs a low-voltage secondary winding (either in the form of a conventional transformer or as an insulated coil of a motor), the toy shall also be capable of withstanding without breakdown for 1 minute a sinusoidal test potential applied between the high-voltage and low-voltage windings. The test potential shall be applied at the rated frequency of the toy and shall have a value of 1,000 volts plus twice the rated voltage of the high-voltage winding. The test potential shall be supplied from a suitable capacity-testing transformer, the output voltage of which can be regulated. The waveform of the test voltage shall approximate a sine wave as closely as possible.

(iii) The applied test potential shall be increased rapidly and uniformly from zero until the required test value is reached and shall be held at that value for 1 minute. Unless otherwise specified, the toy shall be at the maximum operating temperature reached in normal use prior to conducting the tests.

(iv) The dielectric strength requirements of this subparagraph may also be determined by subjecting the toy to a 60-cycle-per-second (60 Hertz) essentially sinusoidal potential of 1,200 volts for 1 second. If the dielectric strength is determined by this method, the toy need not be in a heated condition.

(3) *Leakage current and repeated dielectric withstand tests.* (i) Both before and after being conditioned, a toy intended to operate from a source exceeding 42.4 volts peak shall:

(A) Not have a leakage current exceeding 0.5 milliamperes, except that

during the interval beginning 5 seconds and terminating 10 minutes after the toy is first energized, the leakage current of toys with heating elements other than lamps shall not exceed 2.5 milliamperes; and

(B) Comply with the requirements of a repeated dielectric withstand test both with and without preheating.

(ii) All accessible parts of a toy shall be tested for leakage current. If an insulating material is used for the enclosure or part of the enclosure, the leakage current shall be measured using a metal foil with an area not exceeding 10 by 20 centimeters in contact with accessible surfaces of such insulating material. Where the accessible surface of insulating material is less than 10 by 20 centimeters, the metal foil shall be the same size as the surface. The metal foil shall be so applied that it will not affect the temperature of the toy. The accessible parts shall be tested individually, collectively, and from one part to another.

(iii) Following the initial leakage current test, the toy shall be cooled down or heated up to 32 °C. (90 °F.). The toy shall then be conditioned for 48 hours in air at a temperature of 32° ±2 °C. (89.6° ±3.6 °F.) and with a relative humidity of 90-95 percent. The specified relative humidity shall be maintained inside a closed compartment in which a saturated solution of potassium sulphate is kept in a suitable container. Leakage current measurements shall be made, as specified in paragraph (e)(3)(ii) of this section and before the toy is energized, while the toy is in the humidity compartment.

(iv) With the connections intended for the source of supply connected thereto and then connected to the ungrounded side of a power supply circuit having a voltage equal to 110 percent of the rated voltage of the toy, the leakage current through a noninductive 1,500-ohm resistor connected between the grounded side of the supply circuit and each dead metal part (accessible and inaccessible) shall, when stable, be measured in accordance with the test provisions established in ANSI Standard C 101.1-1971, "American National Standard for Leakage Current for Appliances," approved November 17,

§ 1505.6

16 CFR Ch. II (1–1–04 Edition)

1970, which is incorporated by reference. Copies of this document are available from American National Standards Institute, 1430 Broadway, New York, New York 10018. This document is also available for inspection at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC. This incorporation by reference was approved by the Director of the Federal Register. These materials are incorporated as they exist in the edition which has been approved by the Director of the Federal Register and which has been filed with the Office of the Federal Register.

(v) For a toy whose outer enclosure consists wholly or partly of insulating material, the term *dead metal part* means metal foil tightly wrapped around the exterior of the enclosure in a manner that covers, but does not enter into, any enclosure openings.

(4) *Motor operation.* (i) A motor provided as part of a toy shall be capable of driving its maximum normal load in the toy without introducing any potentially hazardous condition. The performance of the toy shall be considered unacceptable if, during the test, temperatures in excess of those specified in § 1505.7 for Type D surfaces are attained on any accessible surface. The performance of the toy shall also be considered unacceptable if the rise in temperature during the test causes melting, scorching, embrittlement, or other evidence of thermal damage to the insulating material used to prevent exposure of live metal parts.

(ii) A motor-operated toy shall be tested with the motor stalled if the construction of the toy is such that any person can touch moving parts associated with the motor from outside the toy. The performance of the toy shall be considered unacceptable if, during the test, temperatures higher than those specified in § 1505.8 are attained or if temperatures higher than those specified for Type C surfaces in § 1505.7 are attained on any accessible surface of the motor. (See also § 1505.50.)

(5) *Overload*—(i) *Motor.* A motor-control switch that is a part of a toy shall be horsepower-rated to cover the load or shall be capable of performing acceptably when subjected to an overload

test consisting of 50 cycles of operation by making and breaking the stalled-rotor current of the toy at maximum rated voltage. There shall be no electrical or mechanical failure nor any visible burning or pitting of the switch contacts as a result of this test.

(ii) *Switch.* To determine if a motor-control switch is capable of performing acceptably when subjected to overload conditions, the toy shall be connected to a grounded supply circuit of rated frequency and maximum rated voltage with the rotor of the motor locked into position. During the test, exposed dead metal parts of the toy shall be connected to ground through a 3-ampere plug fuse such that any single pole, current-rupturing device will be located in the ungrounded conductor of the supply circuit. If the toy is intended for use on direct current, or on direct current as well as alternating current, the exposed dead metal parts of the toy shall be so connected as to be positive with respect to a single pole, current-rupturing device. The switch shall be operated at a rate of not more than 10 cycles per minute. The performance of the toy shall be considered unacceptable if the fuse in the grounding connection is blown during the test.

(f) *Hydrokinetic*—(1) *General.* Electrically operated toy steam engines shall be capable of performing acceptably when subjected to the tests described in this paragraph.

(2) *Preliminary test.* The ultimate strength of the boiler assembly shall first be determined by applying a hydrostatic pressure to the boiler with all openings blocked (the pressure-relief valve, steam exhausts, and any whistle or other accessory shall be removed and the resulting openings sealed); however, a water or other type of gage shall be left in place. The hydrostatic pressure shall be applied slowly and the ultimate value which is attained shall be recorded.

(3) *Pressure-relief test.* A pressure gage shall be connected to the boiler assembly which shall then be operated normally. The pressure at which the pressure-relief valve functions shall be noted while the engine is shut off (if a shutoff valve is provided) and with the whistle, if any, turned off. The test

shall be discontinued and shall be considered a failure if the observed pressure exceeds one-fifth the value attained in the preliminary test described in paragraph (f)(2) of this section.

(4) *Operating pressure test.* If the boiler is still intact and no failure has occurred, the pressure-relief valve shall then be rendered inoperable and all other valves (such as a whistle and exhaust from the assembly) shall be tightly closed. Operations shall be continued until the pressure becomes constant. This test shall be discontinued and shall be considered a failure if the observed pressure exceeds one-third the value attained in the preliminary test described in paragraph (f)(2) of this section. During this test, all valves, gaskets, joints, and similar components shall be sufficiently tightened to prevent leakage. Rupture of the boiler or of any other fittings supplied with the engine shall be considered a failure.

(5) *Hydrostatic test.* If there has been no failure, two previous untested toys shall withstand for 1 minute a hydrostatic pressure of 5 times the pressure at which the safety valve operated or 3 times the constant pressure observed with the pressure-relief valve inoperable, whichever is greater. During this test, all openings shall be blocked (the pressure-relief valve, steam exhaust from the assembly, and any whistle or other outlet); however, a water or other type of gage shall remain in place. Rupture of the boiler or of a gage shall be considered a failure.

(g) *Thermal—(1) General.* The normal operation of a toy includes performance in normal use and after being subjected to reasonably foreseeable damage or abuse likely to produce the highest temperatures or, in the case of motor-operated toys, the load that most closely approximates the severest conditions of normal use or reasonably foreseeable damage or abuse.

(2) *Classification.* Parts or surfaces of a toy are classified according to their use or function as follows (for the purposes of paragraph (g)(2) (v), (vi), and (vii) of this section, accessibility shall be defined as the ability to reach a heated surface with a ¼-inch-diameter rod 3 inches long as described in §1505.51(a)):

(i) *Type A.* A part or surface of a toy (such as a handle) likely to be grasped by the hand or fingers for the purpose of carrying the toy or lifting a separable lid.

(ii) *Type B.* A part or surface of a toy that is (a) part of a handle, knob, or similar component, as in Type A (described in paragraph (g)(2)(i) of this section), but which is not normally grasped or contacted by the hand or fingers for carrying (including parts of a handle within 7/16 inch of the surface to which the handle is attached and parts of a finger knob within ¼ inch of the surface to which the knob is attached, if the remainder of the knob is large enough to be grasped), or (b) a handle, knob, or part that may be touched but which need not be grasped for carrying the toy or lifting a lid, door, or cover (e.g., support part of a handle or knob).

(iii) *Type C.* A part or surface of a toy that can be touched by casual contact or that can be touched without employing the aid of a common household tool (screwdriver, pliers, or other similar household tool) and that is either (a) a surface that performs an intended heating function (e.g., the soleplate of a flat-iron, a cooking surface, or a heating element surface), or (b) a material heated by the element and intended to be used as the product of the toy, excluding pans, dishes, or other containers used to hold the material to be cooked or baked if a common utensil or other device is supplied with the toy and specific instructions are established for using such a device to remove the container from the heated area. (See also §1505.51(b))

(iv) *Type C marked.* A Type C surface which has been marked with a precautionary statement of thermal hazards in accordance with §1505.3(e)(2). (See also §1505.51(b))

(v) *Type D.* An accessible part or surface of a toy other than Types A, B, C or E (see paragraph (g)(2) (i), (ii), (iii) and (vii) of this paragraph).

(vi) *Type D marked.* A Type D surface which has been marked with a precautionary statement of thermal hazards in accordance with §1505.3(e)(2).

(vii) *Type E.* A heated surface in an oven or other article that is inaccessible or protected by an electrical-thermal safety interlock. Such interlocks shall prohibit the operation of a heating device whenever such surfaces are accessible and shall not allow accessibility to such surfaces until the temperatures of those surfaces have been reduced to levels below those established for Type D surfaces (paragraph (g)(2)(v) of this section).

(3) *Requirements.* When tested under the conditions described in paragraph (g)(4) of this section, a toy shall not attain a temperature at any point sufficiently high to constitute a fire hazard or to adversely affect any materials employed and shall not show a maximum temperature higher than those established by §§ 1505.7 and 1505.8. These maximum surface temperature requirements are not applicable to educational-or hobby-type products such as lead-casting sets and wood-burning tools which are appropriately labeled on the shelf pack or package as being intended only for children over 12 years of age provided that the maximum surface temperature of any such toy does not exceed that reasonably required to accomplish the intended technical effect. Such toys shall be provided with specific instructions and the warning statements required by and in accordance with § 1505.3 (d) and (e), and shall be appropriately identified as educational or hobby-type products.

(4) *Test conditions—(i) General.* Tests shall be conducted while the toy is connected to a circuit of 60-cycle-per-second (60 Hertz) current using the materials supplied with the toy or using materials otherwise intended to be used with the toy. Following such tests, the toy shall be energized for a 6-hour period to determine that no hazardous conditions would result from unattended use of the toy.

(ii) *Temperature.* Normally, tests shall be performed at an ambient (room) temperature of 25 °C. (77 °F.); however, a test may be conducted at any ambient temperature within the range of 21° to 30 °C. (69.8° to 86 °F.).

(iii) *Voltage.* The toy shall be tested at the voltage indicated in the manufacturer's rating or at 120 volts, whichever is greater.

(5) *Temperature measurements—(i) General.* Temperatures shall be measured by means of instruments utilizing thermocouples of No. 30 AWG (American Wire Gage) wire (either copper and constantan or iron and constantan) and potentiometer-type instruments that are accurate and are calibrated in accordance with current good laboratory practices. The thermocouple wire shall conform with the requirements for "special" thermocouples as listed in the table of limits of error of thermocouples (Table VIII) in ANSI Standard C 96.1-1964, "American Standard for Temperature Measurement Thermocouples," approved June 9, 1964, which is incorporated by reference. Copies of this document are available from American National Standards Institute, 1430 Broadway, New York, New York 10018. This standard is also available for inspection at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC. This incorporation by reference was approved by the Director of the Office of the Federal Register. These materials are incorporated as they exist in the edition which has been approved by the Director of the Federal Register and which has been filed with the Office of the Federal Register.

(ii) *Test procedures.* The thermocouple junction and adjacent thermocouple lead wire shall be securely held in good thermal contact with the surface of the material whose temperature is being measured. In most cases, good thermal contact will result from securely taping or cementing the thermocouple in place. If a metal surface is involved, brazing or soldering the thermocouple to the metal may be necessary. The surface temperatures of a toy shall be measured with the toy operating in any unattended condition (e.g., with and without opening and closing doors or covers) for a sufficient period of time to allow temperatures to become constant, or, in the case of a toy with a thermostatically controlled heating element, for a sufficient period of time to determine the maximum surface temperature attained. A temperature shall be considered to be constant when three successive readings taken at 15-minute intervals indicate no change.

(iii) *Heating devices.* Toy ovens, casting toys, popcorn and candy makers, and other toys requiring the insertion of any materials or substances shall be additionally tested by feeding crumpled strips of newspaper and tissue paper into or onto the toy in place of the intended materials or substances. The test strips shall be conditioned for at least 48 hours in air at a temperature of 25° ±4 °C. (77° ±7 °F.) and a relative humidity of 50 percent ±5 percent. The test strips shall be 2 inches wide by 8 inches long before crumpling. The crumpled paper shall occupy not more than 25 percent of the accessible volume. The performance of the toy shall be considered unacceptable if flaming occurs within a 60-minute period following the attainment of normal operating temperatures. If a light bulb is used for heating purposes, the test shall be conducted using the largest wattage bulb that can be easily inserted into the socket.

(h) *Strain-relief test.* (1) The strain-relief means provided on the flexible power cord of a toy shall be capable of withstanding a direct pull of 35 pounds applied to the cord for 2 minutes without displacement of the strain-relief unit or a deformation of the anchoring surface that would produce a stress which would result in a potentially hazardous condition. A 35-pound weight shall be attached to the cord and supported by the toy in such a manner that the strain-relief means is stressed from any angle that the construction of the toy permits. The test shall be conducted with the electrical connection within the toy disconnected.

(2) The initial 2-minute test shall be conducted with the force vector parallel to the longitudinal axis of the cord and perpendicular to the anchoring surface of the strain-relief unit. Each test at other angles of stress shall be conducted for periods of 1 minute. The strain-relief means is not acceptable if, at the point of disconnection of the cord, there is any movement of the cord to indicate that stress would have resulted on the connections.

(3) Except for toys weighing more than 10 pounds, the strain-relief unit and its support base shall be designed and constructed in such a manner that no indication of stress would result

which would produce a hazard when the cord is held firmly in place 3 feet from the strain-relief unit and the toy is dropped the 3 feet at any angle.

[38 FR 27032, Sept. 27, 1973; 38 FR 30105, Nov. 1, 1973, as amended at 43 FR 26428 June 20, 1978; 46 FR 63251, Dec. 31, 1981; 51 FR 34199, Sept. 26, 1986]

§ 1505.7 Maximum acceptable surface temperatures.

The maximum acceptable surface temperatures for electrically operated toys shall be as follows:

Surface type (as described—in § 1505.6 (g)(2))	Thermal inertia type ¹	Temperatures	
		°C.	°F.
A	1	50	122
A	2	55	131
A	3	60	140
B	1	55	131
B	2	65	149
B	3	75	167
C (unmarked)	1	65	149
C (unmarked)	2	75	167
C (unmarked)	3	85	185
C (unmarked)	4	95	203
C marked	1	70	158
C marked	2	90	194
C marked	3	110	230
C marked	4	130	266
D (unmarked)	1	55	131
D (unmarked)	2	70	158
D (unmarked)	3	80	176
D (unmarked)	4	90	194
D marked	1	60	140
D marked	2	75	167
D marked	3	100	212
D marked	4	125	257
E	(²)	(³)	(³)

¹ Thermal inertia types are defined in terms of lambda as follows:

Type 1: Greater than 0.0045 (e.g., most metals).

Type 2: More than 0.0005 but not more than 0.0045 (e.g., glass).

Type 3: More than 0.0001 but not more than 0.0005 (e.g., most plastics).

Type 4: 0.0001 or less (e.g., future polymeric materials).

The thermal inertia of a material can be obtained by multiplying the thermal conductivity (cal./cm./sec./degrees C.) by the density (gm./cm.³) by the specific heat (cal./gm./degrees C.).

² All types.

³ No limit.

§ 1505.8 Maximum acceptable material temperatures.

The maximum acceptable material temperatures for electrically operated toys shall be as follows (Classes 105, 130, A, and B are from "Motors and