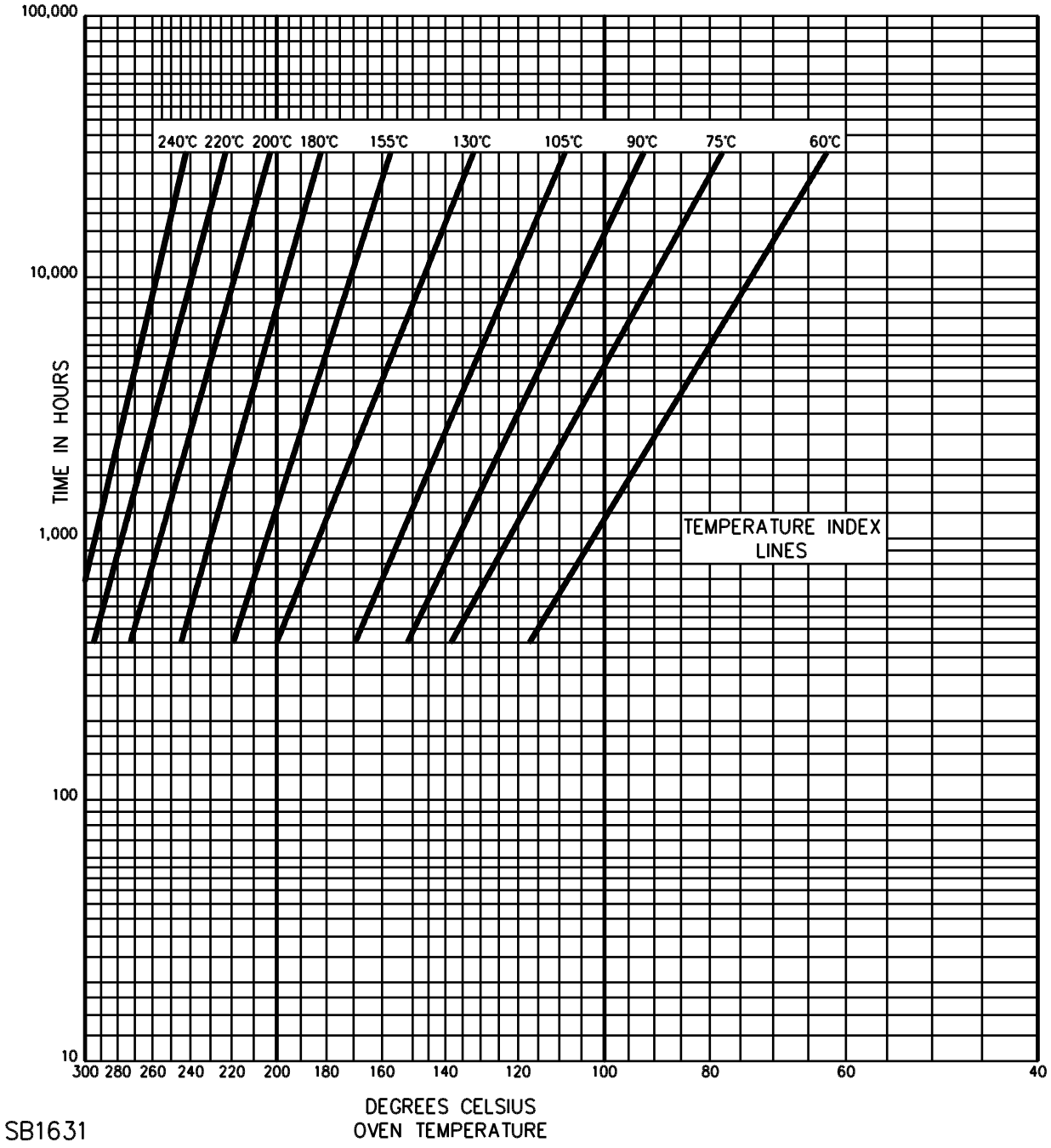
Figure 42.2

Conditioning time versus oven temperature for temperature index of conductive coatings



42.4 Short term aging

42.4.1 Five samples are to be conditioned for 56 days at 18.0 – 20.0°C (32.4 – 36.0°F) higher than the maximum measured normal use temperature of the coating determined in accordance with 44.5, but no less than 85°C (185°F) in any case.

42.5 Humidity conditioning

42.5.1 Five samples are to be conditioned for 56 days at 35.0 ±2.0°C (95.0 ±3.6°F) and a relative humidity of 90 ±5 percent.

43 Power Input Test

43.1 The power input to an appliance marked with a rating of 50 watts or less shall be within the inclusive range of 75 – 110 percent of that rating. If the marked rating is greater than 50 watts, the power input shall be within the inclusive range of 90 – 110 percent of that rating.

43.2 With respect to 43.1, the wattage of an appliance marked with its electrical rating only in amperes and volts will be assumed to be the product of those two values.

43.3 The power input to the appliance is to be measured with the appliance at operating temperature under full-load conditions, and while connected to a circuit of a voltage in accordance with 44.1.13. Control switches or the equivalent, if provided, are to be set to give the maximum power input. For an appliance having a preheat cycle of operation as defined in 5.33, the maximum input value measured during the preheat cycle, with the appliance at room temperature at the beginning of the measurement, is to be used to determine compliance with the requirement specified in 43.1.

Exception: The power input of an appliance that uses a positive temperature coefficient (PTC) heating element shall be measured 1 minute after it has become energized.

44 Normal Temperature Test

44.1 All appliances

44.1.1 An appliance tested under the conditions described in this test shall not attain temperature rises at any time during the test greater than those indicated in Table 44.1.

Exception: An initial peak temperature transient or the peak temperatures measured during preheat cycles not exceeding the temperature rise values specified in Table 44.1 by more than 20 percent are acceptable. If temperature excursions exceed the temperature rise values in Table 44.1 by more than 20 percent, the equivalent continuous normal use temperature is to be determined as described in 44.1.22. The equivalent continuous normal use temperature rises shall not exceed the values specified in Table 44.1.

Table 44.1
Maximum temperature rises

Materials and component parts	°C	(°F)
A. MOTORS		
1. Class 105 insulation systems on coil windings of DC and universal motors		
a. In open motors:		
Thermocouple method	65[a]	(117[a])
Resistance method	75[a]	(135[a])
b. In totally enclosed motors:		
Thermocouple method	70[a]	(126[a])
Resistance method	80[a]	(144[a])
2. Class 105 insulation systems on coil windings of AC motors having a frame diameter[b] of 7 inches (178 mm) of less (not including universal motors)		
a. In open motors (thermocouple or resistance method)	75[a]	(135[a])
b. In totally enclosed motors (thermocouple or resistance method)	80[a]	(144[a])
3. Class 130 insulation systems on coil windings for DC and universal motors:		
a. In open motors:		
Thermocouple method	85[a]	(153[a])
Resistance method	95[a]	(171[a])
b. In totally enclosed motors:		
Thermocouple method	90[a]	(162[a])
Resistance method	100[a]	(180[a])
4. Class 130 insulation systems on coil windings of AC motors having a frame diameter[b] of 7 inches (178 mm) of less (not including universal motors)		
a. In open motors (thermocouple or resistance method)	95	(171)
b. In totally enclosed motors (thermocouple or resistance method)	100	(180)
B. COMPONENTS		
1. Class 130 insulation systems except as indicated in subitems 3 and 4 of item A and subitem 2 of item B:		
a. Thermocouple method	85	(153)
b. Resistance method	95	(171)
2. Class 130 insulation systems on vibrator coils (thermocouple or resistance method)	95	(171)
3. Class 105 insulation systems on windings of relays, solenoids, or transformers	65[c]	(117[c])
4. Class 105 insulation systems on vibrator coils (thermocouple or resistance method)	75[a]	(135[a])
5. Sealing compounds	d	d
6. Capacitors		
a. Electrolytic	40[e]	(72[e])
b. Other types	65[f]	(117[f])
7. Phenolic composition (other than in a flatiron or appliance plug) used as electrical insulation or as a part whose breakdown would result in a condition risk	125[g]	(225[g])
8. Flatiron or appliance plugs	175	(315)
9. Black cellulose acetate photographic film (see 34.2)	85	(153)
C. CONDUCTORS		
1. Rubber- or thermoplastic-insulated wires and cords	35[g]	(63[g])

Table 44.1 Continued on Next Page

Table 44.1 Continued

Materials and component parts	°C	(°F)
2. Type HPN flexible cord	65	(117)
3. Copper or copper-base alloy conductors:		
a. Tinned or bare having:		
1. Diameter or thickness less than 0.015 inch (0.38)	125	(225)
2. A diameter of thickness 0.015 inch or more	175	(315)
b. Plated with nickel, silver, gold, or a combination of these metals	225	(405)
D. ELECTRICAL INSULATION – GENERAL		
1. Varnished cloth insulation	60	(108)
2. Fiber used as electrical insulation	65	(117)
3. Phenolic composition (other than in a flatiron or appliance plug used as electrical insulation or as a part)	125[g]	(225[g])
4. Glass fiber sleeving:		
a. Unimpregnated	225[h,i]	(405[h,i])
b. Coated	25°C less than its temperature rating[h,i]	
E. GENERAL		
1. Wood or other combustible material	65	(117)
2. Water in reservoir or electrode type appliances[j]	29[k]	(53[k])
3. Points on surface supporting a cord-connected appliance	125	(225)
4. Points on surface supporting a permanently-connected appliance	65	(117)
5. For a direct plug-in appliance, points on surface of receptacle and on surrounding wall surfaces	65	(117)

[a] See 44.1.3, 44.1.5, and 44.1.11.

[b] This is the diameter measured in the plane of the lamination of the circle circumscribing the stator frame, excluding lugs, boxes, and the like, used solely for motor mounting, assembly, or connection.

[c] The maximum rise is 85°C (153°F) by the resistance method.

[d] Except in the case of a thermosetting material, the maximum sealing compound temperature, when corrected to a 25°C (77°F) ambient temperature, is 15°C (27°F) less than the softening point of the compound as determined in the Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus, ASTM E28.

[e] For an electrolytic capacitor that is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure shall not exceed 65°C (117°F).

[f] A capacitor that operates at a temperature rise of more than 65°C (117°F) may be evaluated on the basis of its marked temperature limit.

[g] The limitations on phenolic composition and on rubber and thermoplastic insulation do not apply to compounds that have been investigated and found to have special heat-resistant properties.

[h] A higher temperature rise is acceptable when the appliance complies with the Extended Operation Test, Section 60.

[i] This requirement does not apply to sleeving installed where it is not folded nor subjected to compression or sharp bends.

[j] This requirement does not apply to an appliance complying with 83.2. See Table 44.3 for flow chart of acceptance criteria for an appliance in which the water temperature rise exceeds 29°C (53°F).

[k] See 44.1.20.

44.1.2 A temperature control that under intended operating conditions is relied upon to maintain temperatures within the limits specified in Table 44.1 and Table 44.2, shall comply with the requirements in 54.2.1 for a combination temperature-limiting and temperature-regulating control.

Table 44.2
Maximum temperature rise of surfaces of a hand-supported hair dryer that may be contacted by the user

Surface function and material[a]	°C	(°F)
1. A part of the appliance that is intended to be grasped for lifting, carrying, or holding the appliance		
a) Metal	30	(54)
b) Porcelain or vitreous material	40	(72)
c) Molded material, rubber, or wood	50	(90)
2. A handle or knob that is contacted but does not involve lifting, carrying, or holding the appliance, and any other surface normally subjected to contact during operation or user maintenance		
a) Metal	35	(63)
b) Porcelain or vitreous material	45	(81)
c) Molded material, rubber, or wood	60	(108)
3. A surface other than a heating surface whose function is known to be hot due to its proximity to the heating function surface, and the enclosure surface of a hair dryer spaced more than 1/2 inch (12.7 mm) from the outermost perimeter of the heated air outlet		
a) Metal	45	(81)
b) Other than metal	70	(126)

[a] A handle, knob, or the like made of a material other than metal, that is placed or clad with metal having a thickness of 0.005 inch (0.127 mm) or less, is to be evaluated as a nonmetallic part.

Table 44.3
Acceptability criteria for water reservoirs or boiling chambers of electrode-type appliances

<table>
<tr><td colspan="5">Does appliance have water temperature of < or > 29°C (53°F) Rise?</td></tr>
<tr><td colspan="4">If > 29°C</td><td>If < 29°C (53°F)</td></tr>
<tr><td colspan="4">Is capacity ≥ or < 8 ounces (23.7 mL)?</td><td>Acceptable</td></tr>
<tr><td colspan="2">If ≥ 8 ounces (23.7 mL)</td><td colspan="2">If < 8 ounces (23.7 mL)</td><td></td></tr>
<tr><td>Is marking in accordance with Exception to 83.2 ?</td><td colspan="2">Is ≤ or > 2 ounces (5.9 mL) spilled during Spillage Test (see Exception to 83.2)?</td><td colspan="2">Is ≤ or > 2 ounces (5.9 mL) spilled during Spillage Test (see Exception to 83.2)?</td><td></td></tr>
<tr><td>Acceptable</td><td>Is ≤ 2 ounces (5.9 mL) spilled?</td><td>Is > 2 ounces (5.9 mL) spilled?</td><td>Is ≤ 2 ounces (5.9 mL) spilled?</td><td>Is > 2 ounces (5.9 mL) spilled?</td><td></td></tr>
<tr><td></td><td>Acceptable</td><td>Unacceptable</td><td>Acceptable</td><td>Unacceptable</td><td></td></tr>
</table>

44.1.3 At coils, the preferred method of measuring temperatures is the thermocouple method; temperature measurements by either the thermocouple or change-of-resistance method may be used. When temperatures of a coil or winding are measured by means of thermocouples, they are to be mounted on the outside of the coil wrap. If the coil is inaccessible for mounting thermocouples (for example, a coil immersed in sealing compound) or if the coil wrap includes thermal insulation such as more than 1/32 inch (0.8 mm) of cotton, paper, rayon, or similar insulation, the change of resistance method is to be used. For the thermocouple-measured temperature of a coil of an alternating-current motor (other than a universal motor) having a frame diameter of 7 inches (178 mm) or less (Table 44.1, item A, subitems 2 and 4), the thermocouple is to be mounted on the integrally applied insulation of the conductor.

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

$$t = \frac{R}{r}(k + t_1) - (k + t_2)$$

in which:

t is the temperature rise, in °C;

R is the resistance of the coil at the end of the test, in ohms;

r is the resistance of the coil at the beginning of the test, in ohms;

k is 234.5 for copper, 225.0 for electrical conductor grade (EC) aluminum, and k for other grades shall be determined;

t_1 is the room temperature at the beginning of the test, in °C; and

t_2 is the room temperature at the end of the test, in °C.

44.1.5 At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature rise measured by means of a thermocouple may be higher than the maximum indicated in Table 44.1 by the following amount:

Reference in Table 44.1	Temperature rise, °C	(°F)
Subitem 2(a) of item A; subitem 4 of item B	5	(9)
Subitem 4(a) of item A; subitem 2 of item B	10	(18)
Subitem 3 of item B	15	(27)

44.1.6 With respect to 44.1.5, if the coil wrap is not caused to exceed its temperature limitation by radiation from an external source, the temperature of the coil may be measured by means of a thermocouple on the integral insulation of the coil conductors.

44.1.7 All values for temperature rises in Table 44.1 and Table 44.2 are based on an assumed ambient temperature of 25°C (77°F); however, tests may be conducted at an ambient temperature within the range of 20 – 30°C (68 – 86°F).

44.1.8 If the retention of the insulation of a heater cord depends upon a fabric braid, the braid shall not be removed nor subjected to a temperature rise of more than 65°C (117°F) unless other means are provided to hold the insulation in place. The jacket of Type HSJ or HSJO cord shall not be subjected to a temperature rise of more than 35°C (63°F) if the protection afforded by the jacket is required.

44.1.9 Certain special treatments, such as the use of an impregnant, have been determined to be acceptable for retaining the insulation around the conductors of a heater cord at elevated temperatures.

44.1.10 Thermocouples used to measure temperatures obtained by the thermocouple method are to consist of wires not larger than 24 AWG (0.221 mm^2). The temperature is considered to be stabilized when three successive readings, taken at intervals of 10 percent of the previously elapsed duration of the test but not less than 5 minutes indicate no change.

44.1.11 When thermocouples are used in the determination of temperatures in connection with heating of electrical equipment, it is common practice to use thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan wires and a temperature-indicating instrument. Thermocouples consisting of 30 AWG iron

and constantan wires and a potentiometer-type temperature-indicating instrument are to be used whenever referee temperature measurements by thermocouples are required.

44.1.12 To determine whether an appliance complies with the requirement in 44.1.1, it is to be operated as follows. If the voltage rating of the appliance is within the range of 110 – 120 volts (inclusive), the test voltage is to be 120 volts. If the voltage rating of the appliance is within the range of 220 – 240 volts (inclusive), the test voltage is to be 240 volts. For an appliance having a voltage rating other than those previously specified, the test voltage is to be the marked voltage rating. Unless a particular voltage or other test condition is specified, the test voltage is to be increased, if necessary, to cause the wattage input to the appliance to be equal to its marked wattage rating.

44.1.13 If an appliance uses a motor in addition to a heating element, the voltage applied to an integrally connected motor is to be 120 volts for an appliance rated at 110 – 120 volts, 240 volts for an appliance rated at 220 – 240 volts, or the rated voltage of the appliance for other cases. A motor supplied from a separate circuit is to be operated at a voltage (depending upon the motor rating) as specified for an integrally connected motor.

44.1.14 During the test, each general use receptacle, or a general use receptacle intended for a limited current load, shall be loaded with a 15-ampere resistive load or with a lesser load if marked in accordance with 72.1.6.

Exception: Each outlet of a duplex receptacle shall be loaded with a 10-ampere load.

44.1.15 The appliance is to be mounted or supported as in service and tested under conditions approximating those of intended operation. If a timer switch or the equivalent is provided as part of the appliance, an appropriate cycle of operation shall be used.

Exception: For requirements regarding hand-supported hair dryers, see 44.5.1.

44.1.16 A manually resettable thermal device or a thermal cutoff shall not operate during the normal temperature test.

44.1.17 In a hand-supported hair dryer, the motor circuit shall not become de-energized during the normal temperature test.

44.1.18 A means for adjusting the operating temperature is to be set to give maximum heating.

44.1.19 An electrical heating element intended for application to the hair is to be loaded with a moistened cloth and then operated until the moisture has been evaporated and the heating surface of the unit has attained a temperature of 204°C (400°F). Following a 2 minute period with the unit disconnected, during which it is to be reloaded with another moistened cloth, the heating and evaporating operation is to be conducted a second time. The complete cycle is then to be repeated again. Temperatures are to be measured throughout the test.

44.1.20 An appliance having a reservoir for heating water shall have the water temperature measured by means of a thermocouple floated approximately 3/16 inch (4.8 mm) beneath the surface of the solution and located midway between the outer surface of the electrode enclosure and the inner surface of the water reservoir. The unit is to be tested in a room ambient of 25°C (77°F).

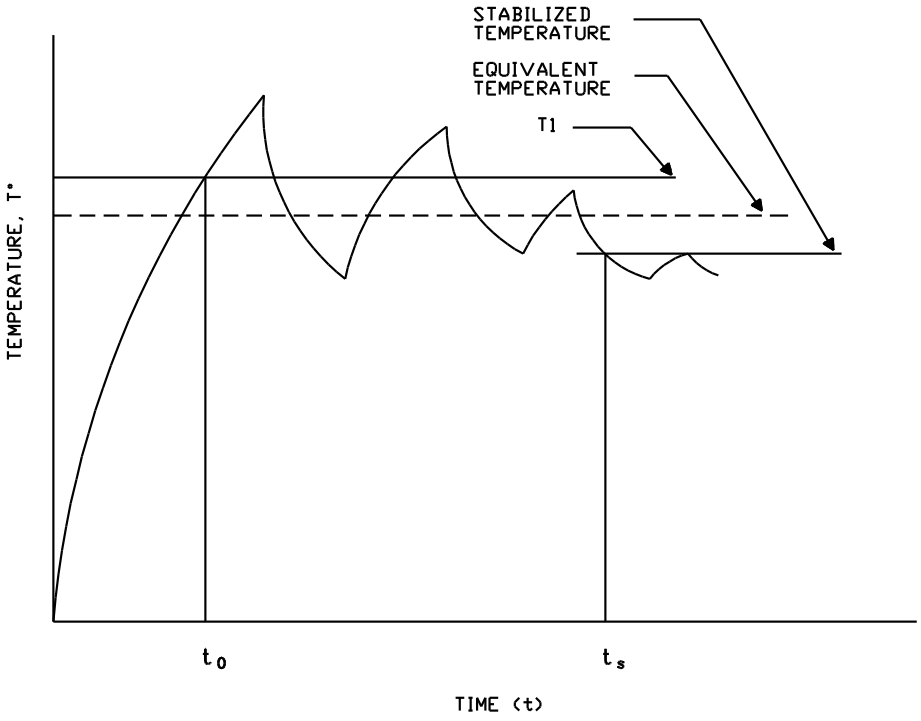
Exception: This requirement does not apply to electrode-type appliances with a water reservoir or boiling chamber having a capacity of 8 ounces (23.7 mL) or less and marked in accordance with 83.2.

44.1.21 For an appliance in which clips to be applied to the hair are heated by an external heater, the test is to consist of operation of the appliance until temperatures are constant, with the clips in place on the heater.

44.1.22 With regard to the Exception to 44.1.1, the equivalent continuous normal use temperature is to be determined as follows. The graph of the temperature plotted against time from the start of the test until a stabilized condition has been established is to be obtained, and the area under the curve over the period of time, ts minus t_0, is to be determined. Figure 44.1 shows t_0 as the time when the graph first crosses the line, TI, and t_s as the time when a stabilized temperature is obtained. (TI represents the temperature index or the temperature acceptable for the material or component in question.) The area under the curve, divided by the period of time (t_s minus t_0), will yield the equivalent continuous normal use temperature. The area under the curve may be determined mathematically (Simpson's Rule), graphically, or by using a planimeter.

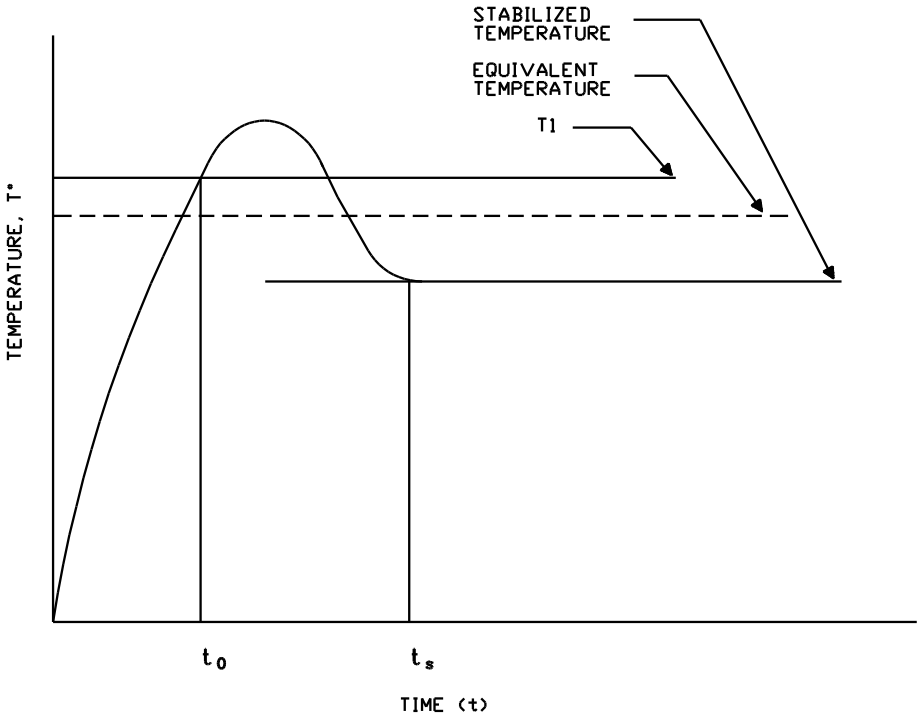
Figure 44.1

Determination of the equivalent continuous normal use temperature



Example using a thermostatically–controlled appliance

SM1168



Example using a preheat–type appliance

SM1170

44.2 Wax depilatory appliances

44.2.1 The appliance is to be loaded with the maximum recommended amount of wax and operated continuously until constant temperatures have been reached. An adjustable temperature control is to be set for maximum heating. If the appliance has several heat settings for different functions (as noted in 9.3.3), it is to be operated at the highest heat setting, as well as at the maximum setting intended to maintain the molten wax at the temperature for application to the skin.

44.2.2 The wax temperature is to be measured by means of a thermocouple immersed beneath the surface of the wax to a depth of approximately one-half of the total depth, at the approximate center of the reservoir. The wax is to be slowly and continuously stirred while temperatures are being recorded. For depilatory appliances having self-contained wax applicators (no open reservoirs), thermocouples are to be inserted into the wax applicators to a depth of approximately one-half of the total depth of the wax.

44.2.3 In addition to complying with the requirements specified in 9.3.1, 9.3.2, and 44.1.1, the visible overheat condition indicator, when required as specified in 9.3.3(b), shall function when the wax temperature exceeds 75°C (167°F).

44.3 Heated air curling irons and brushes

44.3.1 A heated air curling iron or brush is to be operated continuously with all air intake and outlet openings unrestricted until temperatures stabilize. The appliance is then to be operated through 30 cycles, with one cycle consisting of one minute of operation with the air intake and outlet openings blocked as described in 44.3.2, followed by 10 seconds of operation with all air openings open.

Exception: With the concurrence of all concerned, the cycling portion of the test may be replaced with 30 minutes of continuous operation with the openings blocked as described in 44.3.2.

44.3.2 With regard to 44.3.1, air intake openings provided in the gripping area of the handle that may be blocked by the user's hand, such as those shown in Figure 44.2, are to be blocked such that all openings in three or fewer quadrants of the handle circumference will be blocked. (If there are openings in all quadrants, those in one quadrant are to be left open. Openings provided in the base of a cylindrical handle, such as those shown in Figure 44.3, are not considered likely to be blocked by the user's hand and are not to be blocked.) Three-fourths of the air outlet openings in the barrel are also to be blocked. For example, in a unit provided with eight parallel rows of openings in the length of the barrel, two adjacent rows are to be left unblocked.

Figure 44.2

Example of a curling brush with air intake openings provided in the gripping area of the handle