28.2 The sheath, or the strip forming the armor, shall be continuous throughout the length of the cable. A sheath shall not have flaws that affect its integrity – that is, a sheath shall not have any weld openings, cracks, splits, foreign inclusions, or the like. The strip from which armor is formed may be spliced (see 28.13) but there shall not be any cut or broken ends. In a multiple-conductor cable, a metal covering shall be applied over the assembly covering (non-conductive assembly jacket or a tape separator) required in 25.1. In a shielded single-conductor cable, a continuous smooth or corrugated metal covering shall constitute the nonmagnetic metal component of the insulation shielding and shall comply with the conductance and application requirements in Table 18.1 (applied directly over the conductive nonmetallic covering portion of the insulation shielding). A metal covering shall not be used on a nonshielded single-conductor cable.

28.3 The number of corrugations per unit length of a welded or extruded corrugated metal sheath is not specified but is to be judged on the basis of the performance of the finished cable in the tests specified in this standard.

28.4 SMOOTH METAL SHEATH – A smooth metal sheath shall be of an aluminum-base alloy having a copper content of 0.40 percent or less, of commercially pure lead, or of an alloyed lead. The sheath shall be tightly formed around the underlying cable.

28.5 The average thickness and the minimum thickness at any point of the smooth sheath shall not be less than indicated in Table 28.1 (lead) or Table 28.2 (aluminum). The thicknesses of the smooth sheath are to be determined by means of a machinist's micrometer caliper that has a hemispherical surface on the anvil, has a flat surface on the end of the spindle, and is calibrated to read directly to at least 0.001 inch or 0.01 mm. The spindle shall be round.

28.6 A smooth sheath that does not comply with the requirements in this standard may be stripped from the entire length of the cable and the cable may be resheathed.

28.7 WELDED AND CORRUGATED METAL SHEATH – A welded and corrugated metal sheath shall be of an aluminum-base alloy having a copper content of 0.40 percent or less, of bronze, or of electrolytic copper. The sheath shall be tightly formed around the underlying cable and shall be welded and corrugated.

28.8 The minimum thickness at any point of the unformed metal tape from which the welded and corrugated sheath is made shall not be less than indicated in Table 28.3. The thickness of the unformed tape is to be determined by means of a machinist's micrometer caliper having an anvil and spindle that are round and are not larger than 0.200 inch or 5.1 mm in diameter, with flat surfaces on each.

28.9 EXTRUDED AND CORRUGATED METAL SHEATH – An extruded and corrugated metal sheath shall be of an aluminum-base alloy having a copper content of 0.40 percent or less. The sheath shall be tightly formed around the underlying cable.

28.10 The minimum thickness at any point of the unformed metal tube from which the extruded and corrugated sheath is made shall not be less than indicated in Table 28.3 when determined as indicated in the second sentence of 28.8.

28.11 INTERLOCKED ARMOR – Armor shall consist of interlocked steel or aluminum strip and shall comply with 28.2 and 28.11 – 28.19. Dimensions of the metal strip shall comply with 28.20.

28.12 The strip shall be made of steel or of an aluminum-base alloy with a copper content of 0.40 percent or less. Steel strip shall be protected against corrosion by a coating of zinc on all surfaces, including edges and splices. The coating on each surface shall be evenly distributed, shall adhere firmly at all points, and shall be smooth and free from blisters and all other defects that can diminish the protective value of the coating.

28.13 The steel or aluminum strip shall be uniform in width, thickness, and cross section and shall not have any burrs, sharp edges, pits, scars, cracks, or other flaws that can damage the underlying cable or any supplementary jacket. Splices shall not materially increase the width or thickness of the strip nor shall they lessen the mechanical strength of the strip or adversely affect the formed armor.

28.14 Zinc-coated steel strip shall have a tensile strength of not less than 40,000 lbf/in^2 or 276 MPa and not more than 70,000 lbf/in^2 or 483 MPa. The tensile strength shall be determined on longitudinal specimens consisting of the full width of the strip when practical and otherwise on a straight specimen slit from the center of the strip. The test shall be made prior to application of the strip to the cable.

Table 28.1
Thicknesses of smooth lead sheath

Calculated diameter under lead[a]	Lead over which there is no supplementary jacket		Lead over which there is a supplementary jacket	
	Minimum thickness at any point	Maximum thickness at any point	Minimum thickness at any point	Maximum thickness at any point
inches	mils			
0 – 0.425	40	75	40	75
Over 0.425 but not over 0.700	60	95	50	85
Over 0.700 but not over 1.050	70	105	65	100
Over 1.050 but not over 1.500	85	135	75	110
Over 1.500 but not over 2.000	100	150	85	135
Over 2.000 but not over 3.000	115	170	100	150
Over 3.000	125	185	115	170
mm	mm			
0 – 10.80	1.02	1.91	1.02	1.91
Over 10.80 but not over 17.30	1.52	2.41	1.27	2.16
Over 17.30 but not over 26.70	1.78	2.67	1.65	2.54
Over 26.70 but not over 38.10	2.16	3.43	1.91	2.79
Over 38.10 but not over 50.80	2.54	3.81	2.16	3.43
Over 50.80 but not over 76.20	2.92	4.32	2.54	3.81
Over 76.20	3.18	4.70	2.92	4.32

[a] The insulation thickness used in calculating the diameter is to be the specified average insulation thickness where an average is specified and is to be the specified minimum thickness at any point of the insulation where an average thickness is not specified.

Table 28.2
Thicknesses of smooth aluminum sheath with or without a supplementary jacket over the sheath

Calculated diameter under aluminum		Minimum average thickness	Minimum thickness at any point	Minimum average thickness	Minimum thickness at any point
inches	mm	mils		mm	
0 – 0.400	0 – 10.16	35	32	0.89	0.81
Over 0.400 but not over 0.740	Over 10.16 but not over 18.80	45	41	1.14	1.04
Over 0.740 but not over 1.050	Over 18.80 but not over 26.67	55	50	1.40	1.27
Over 1.050 but not over 1.300	Over 26.67 but not over 33.02	65	59	1.65	1.50
Over 1.300 but not over 1.550	Over 33.02 but not over 39.37	75	68	1.90	1.73
Over 1.550 but not over 1.800	Over 39.37 but not over 45.72	85	77	2.16	1.96

Table 28.2 Continued on Next Page

Table 28.2 Continued

Calculated diameter under aluminum		Minimum average thickness	Minimum thickness at any point	Minimum average thickness	Minimum thickness at any point
inches	mm	mils		mm	
Over 1.800 but not over 2.050	Over 45.72 but not over 52.07	95	86	2.41	2.18
Over 2.050 but not over 2.300	Over 52.07 but not over 58.42	105	95	2.67	2.41
Over 2.300 but not over 2.500	Over 58.42 but not over 64.77	115	104	2.92	2.64
Over 2.550 but not over 2.800	Over 64.77 but not over 71.12	125	113	3.18	2.87
Over 2.800 but not over 3.050	Over 71.12 but not over 77.47	135	122	3.43	3.10
Over 3.050 but not over 3.300	Over 77.47 but not over 83.82	145	131	3.68	3.33
Over 3.300 but not over 3.550	Over 83.82 but not over 90.17	155	140	3.94	3.56
Over 3.550 but not over 3.800	Over 90.17 but not over 96.52	165	149	4.19	3.78
Over 3.800 but not over 4.050	Over 96.52 but not over 102.9	175	158	4.45	4.01
Over 4.050	Over 102.9	–	–	–	–

[a] The insulation thickness used in calculating the diameter is to be the specified average insulation thickness where an average is specified and is to be the specified minimum thickness at any point of the insulation where an average thickness is not specified.

Table 28.3
Minimum thickness at any point of unformed metal tape from which corrugated sheath is welded or extruded

Metal	Calculated diameter under sheath		Thickness of unformed metal tape	
	inches	mm	mils	mm
Aluminum	0 – 2.180	0 – 55	22	0.56
	Over 2.180 but not over 3.190	Over 55 but not over 81	29	0.74
	Over 3.190 but not over 4.200	Over 81 but not over 107	34	0.87
Bronze or electrolytic copper	0 – 2.365	0 – 60	17	0.43
	Over 2.365 but not over 3.545	Over 60 but not over 90	21	0.53
	Over 3.545 but not over 4.200	Over 90 but not over 107	25	0.64

[a] The insulation thickness used in calculating the diameter is to be the specified average insulation thickness where an average is specified and is to be the specified minimum thickness at any point of the insulation where an average thickness is not specified.

28.15 Zinc-coated steel strip shall have an elongation of not less than 10 percent in 10 inches or not less than 10 percent in 254 millimeters. The elongation shall be determined as the permanent increase in length of a marked section of the strip (originally 10 inches or 254 mm in length) measured after the specimen has fractured. The test shall be made prior to application of the strip to the cable.

28.16 Unformed zinc-coated steel strip shall comply with the test for weight of zinc coating described in 51.1 – 51.7.

28.17 Finished zinc-coated steel strip, prior to being applied to the cable, shall have a zinc coating that remains adherent without flaking or spalling when the strip is subjected to a 180° bend over a mandrel that is 1/8 inch or 3.2 mm in diameter. The zinc coating is to be considered as complying with this requirement if, when the strip is bent around the specified mandrel, the coating does not flake and none of it can be removed from the strip by rubbing with the fingers.

28.18 Neither loosening or detachment during the adherence test nor superficial (small) particles of zinc formed by mechanical polishing of the surface of the zinc-coated steel strip is to constitute reason for rejection.

28.19 Unformed and formed zinc-coated steel strip shall comply with the copper sulphate test of the zinc coating described in Copper Sulphate Test of Zinc Coating on Steel Strip for and from Steel Armor, Section 50.

28.20 The width of unformed aluminum strip or of unformed zinc-coated steel strip shall not be greater than indicated in Table 28.4. The minimum thickness at any point of the formed metal strip removed from the finished cable shall not be less than indicated in Table 28.4 when measured by means of a machinist's micrometer caliper having an anvil and spindle that are round and are not larger than 0.020 inch or 5.1 mm in diameter, with flat surfaces on each.

Table 28.4
Dimensions of metal strip

Calculated diameter under armor[a]	Maximum width of unformed strip[b]	Minimum thickness at any point of the formed strip removed from the finished cable	
		Steel	Aluminum
inches	mils		
0 – 0.500	500	17	22
Over 0.500 but not over 1.000	750	17	22
Over 1.000 but not over 1.500	875	17	22
Over 1.500 but not over 2.000	875	22	27
Over 2.000	1000	22	27
mm	mm		
0 – 12.7	12.7	0.43	0.55
Over 12.7 but not over 25.4	19.0	0.43	0.56
Over 25.4 but not over 38.1	22.2	0.43	0.56
Over 38.1 but not over 50.8	22.2	0.56	0.69
Over 50.8	25.4	0.56	0.69

[a] The insulation thickness used in calculating the diameter is to be the specified average insulation thickness where an average is specified and is to be the specified minimum thickness at any point of the insulation where an average thickness is not specified.

[b] The tolerances for the width of steel strip are plus 10 mils and minus 5 mils or plus 0.2 mm and minus 0.1 mm. The tolerances for the width of aluminum strip are plus and minus 10 mils or plus and minus 0.2 mm.

29 Supplementary Jacket over Metal Covering

29.1 A supplementary jacket is required over a metal sheath or armor on a cable that is marked [see 73.1 (a), (b), (c), and (d)] for direct burial. A supplementary jacket is not required over a metal sheath or armor on other cables. When used, a supplementary jacket shall consist of one of the materials indicated in Table 27.1 that has properties that comply with 27.2 (see 14.4 for the long-term evaluation of a non-conductive jacket material not named in Table 27.1 or not complying with the short-term tests specified in 27.2). A supplementary jacket shall not have defects (bubbles, open spots, rips, tears, cuts, or foreign material) that are visible with normal or corrected vision without magnification. A supplementary jacket shall be tight and shall be applied directly over the sheath or armor. The sheath or armor shall be completely covered and shall be well centered in the supplementary jacket. Impressions of the sheath corrugations or of the armor convolutions in the outer surface of a supplementary jacket shall not show depressions caused by unfilled spaces beneath the supplementary jacket.

29.2 The average thickness of a supplementary jacket and the minimum thickness at any point of a supplementary jacket shall not be less than indicated in Table 29.1 when measured as described in 27.4 (basic optical method) or 27.5 (direct measurement) or, in case of doubt, by means of the referee method described in 27.6.

Table 29.1
Thicknesses of supplementary jacket over a metal sheath or armor and thickness of non-conductive assembly jacket under metal covering on multiconductor cable

Calculated diameter under jacket[a]	Jacket over or under smooth metal sheath		Jacket over or under corrugated metal sheath or interlocked armor	
	Minimum average thickness	Minimum thickness at any point	Minimum average thickness	Minimum thickness at any point
inches	mils			
0 – 0.750	50	35	50	35
Over 0.750 but not over 1.500	65	46	50	35
Over 1.500 but not over 2.250	80	56	60	42
Over 2.250 but not over 3.000	95	67	75	52
Over 3.000	110	77	85	60
mm	mm			
0 – 19.05	1.27	0.89	1.27	0.89
Over 19.05 but not over 38.10	1.65	1.17	1.27	0.89
Over 38.10 but not over 57.15	2.03	1.42	1.52	1.07
Over 57.15 but not over 76.20	2.41	1.70	1.90	1.32
Over 76.20	2.79	1.96	2.16	1.52

[a] The insulation thickness used in calculating the diameter is to be the specified average insulation thickness where an average is specified and is to be the specified minimum thickness at any point of the insulation where an average thickness is not specified.

PERFORMANCE

30 Test or Examination for Integrity and Continuity of Non-conductive Jacket Over Insulation Shielding or Over a Metal Sheath or Armor

30.1 A visual examination is specified in 30.2 for jackets for which a spark test is inappropriate. Otherwise, the integrity and continuity of non-conductive jacket over insulation shielding or over a metal sheath or over armor shall be demonstrated by the finished jacket withstanding, without electrical breakdown, the application of a 50, 60, 100, 400, 1000, 3000, or 4000 Hz essentially sinusoidal rms test potential of the magnitude indicated in Table 30.1. The a-c spark test is to be made as described in 30.3 – 30.11. One hundred percent of production shall be tested by the cable manufacturer at the cable factory.

30.2 The following finished jackets shall be examined for physical defects (bubbles, open spots, rips, tears, cuts, and foreign material) that are visible with normal or corrected vision without magnification:

a) A conductive jacket combining the functions of insulation shielding and overall single-conductor jacket.

b) An overall jacket of non-conductive neoprene of any dielectric strength.

c) An overall jacket of any non-conductive material having a dielectric strength too low to withstand the spark potential specified in Table 30.1.

d) An overall jacket (of any non-conductive material) applied over an assembly jacket of any material or over a polyester, polypropylene, or similar non-conductive binder tape having a dielectric strength greater than that of the overall jacket.

The visual examination that is required after the jacket is applied serves this purpose and need not be repeated.

30.3 A spark tester shall include a voltage source, an electrode, a voltmeter, a fault-signal device or system, and the necessary electrical connections. The ability of the equipment to comply with the requirements in 30.4 – 30.10 shall be certified at least annually by an accredited independent calibration service or its equivalent, such as checking the test potential with a voltmeter whose calibration is traceable. Calibration shall be traceable to a National Institute of Standards and Technology (USA) Standard or to other national physical measures recognized as equivalent by NIST.

30.4 The voltage source of a spark tester shall maintain the test voltage indicated in Table 30.1 under all normal conditions of leakage current. The voltage source shall not be connected to more than one electrode.

30.5 The electrode shall be of a link-chain or bead-chain or other acceptable type and shall make intimate contact throughout its entire length with the surface of the jacketed construction being tested.

30.6 The bottom of the metal electrode enclosure shall be U- or V-shaped, the chains shall have a length appreciably greater than the depth of the enclosure, and the width of the trough shall be approximately 1-1/2 inches or 40 mm greater than the diameter of the largest-diameter construction that is being tested.

30.7 For a bead-chain electrode, the longitudinal and transverse spacings of the chains and the diameter of each bead shall comply with Table 30.2.

Table 30.1
A-C spark-test potential in kilovolts for a non-conductive jacket over insulation shielding, a metal sheath, or armor

Specified average thickness of jacket		Jacket[a] of CP, thermoset CPE, or NBR/PVC	Jacket[b] of PE, thermoplastic CPE, or PVC
mils	mm		
25	0.64	1.0	2.0
30	0.76	1.5	2.5
45	1.14	2.0	4.0
50	1.27	2.0	4.5
60	1.52	2.5	5.5
65	1.65	2.5	6.0
75	1.90	3.0	6.5
80	2.03	3.0	7.0
85	2.16	3.5	7.5
95	2.41	4.0	8.5
110	2.79	4.5	10.0
140	3.56	5.5	12.5

[a] For a thermoset jacket of a thickness that is not shown, the test voltage is to be calculated on the basis of 40 kilovolts per inch of jacket thickness or 1.575 kilovolts per millimeter of jacket thickness, rounded to the nearest 0.5 kV.

[b] For a thermoplastic jacket of a thickness that is not shown, the test voltage is to be calculated on the basis of 90 kilovolts per inch of jacket thickness or 3.543 kilovolts per millimeter of jacket thickness, rounded to the nearest 0.5 kV.

Table 30.2
Maximum center-to-center spacings of bead chains

Diameter of a bead[a]		Longitudinal spacing[a]		Transverse spacing[a]			
				Chains staggered		Chains not staggered	
inch	mm	inch	mm	inch	mm	inch	mm
3/16	5.0	1/2	13	1/2	13	3/8	10
3/32	2.5	The chains shall be staggered and shall touch one another in the longitudinal and transverse directions.					

[a] A diameter and spacings other than indicated are acceptable if investigation shows that the chains contact an equal or greater area of the outer surface of the insulated conductor.

30.8 The electrode shall be provided with an earth-grounded metal screen or another guard that protects operating personnel against electric shock from the electrode and associated parts.

30.9 The voltmeter shall be connected to the circuit to indicate the actual test potential at all times.

30.10 The spark-test equipment shall include a light, counter, or other device or system that gives a visible signal in the event of a fault. When a fault is detected, the signal shall be maintained until the indicator is reset manually.

30.11 The length of the electrode is not specified, but the rate of speed at which the jacketed construction travels through the electrode shall result in every point on the jacketed construction being in contact with the electrode for not less than a total of 18 positive and negative crests of the supply voltage (the equivalent of 9 full cycles of the supply voltage). The maximum speed of the jacketed construction is to be determined by means of whichever of the following formulas is applicable:

feet per minute = 5/9 × frequency in hertz × electrode length in inches,

or

meters per minute = 1/150 × frequency in hertz × electrode length in millimeters.

For convenience, Table 30.3 shows the formulas for each of the frequencies mentioned in 29.1.

Table 30.3
Formula for maximum speed of jacketed construction in terms of electrode length L

Nominal supply frequency in hertz	Formula for feet per minute (L in inches)	Formula for millimeters per minute (L in millimeters)
50	$27.8L_{in}$	$0.333L_{mm}$
60	$33.3L_{in}$	$0.400L_{mm}$
100	$55.6L_{in}$	$0.667L_{mm}$
400	$222L_{in}$	$2.67L_{mm}$
1000	$556L_{in}$	$6.67L_{mm}$
3000	$1667L_{in}$	$20.0L_{mm}$
4000	$2222L_{in}$	$26.7L_{mm}$

30.12 The metal component of the insulation shielding or the metal sheath or armor of the jacketed construction and the conductor or conductors shall be earth-grounded during the spark test. An earth-ground connection shall be made at either or both the pay-off and take-up reels. In any case, a reel at which an earth-ground connection is made shall be bonded directly to the earth ground on the transformer or other voltage source in the spark tester.

31 Physical Properties Tests

31.1 The methods of preparation of samples, of selection and conditioning of specimens, and of making the measurements and calculations for tensile strength and elongation of extruded materials that are employed as conductor shielding, conductor insulation, insulation shielding, and jackets are to be as indicated (beginning with 400.1) under the heading PHYSICAL PROPERTIES TESTS OF INSULATION AND JACKET in UL 1581. All specimens shall be die-cut; tubular specimens shall not be used. Specific limits for individual materials are in Table 13.3 (conductor shielding), Table 14.1 – Table 14.4 (insulation), Table 17.1 and Table 17.2 (insulation shielding), and Table 27.2 – Table 27.15 (jackets).

32 Corrosion of Uncoated Copper Conductors

32.1 Uncoated copper conductors are to be removed from one unaged specimen of the finished cable and from one specimen aged at the elevated temperature for the length of time indicated in Table 13.3 for the ultimate-elongation test of the conductor-shielding material used in the cable. None of the two specimens of the uncoated copper shall show any evidence of corrosion in a close visual examination with normal or corrected vision without magnification. Normal oxidation or discoloration that is not caused by the conductor-shielding material is to be disregarded.

33 Adhesion (Stripping-Tension) Test of Extruded Insulation Shielding

33.1 The tension necessary to remove extruded insulation shielding from the insulation shown in Table 14.1 and Table 14.4 shall not be less than 3 lbf or 13.3 N or 1.36 kgf when samples from the finished cable are tested as described in 33.2 – 33.5. This requirement does not apply to insulation in Table 14.10. Removal of the shielding shall not damage the insulation and the insulation shall not retain any conductive material that cannot readily be removed.

33.2 This test is to be made on conductors from finished cable that contains insulation shielding whose conductive nonmetallic covering consists of an extrusion that is in contact with the insulation shown in Table 14.1 and Table 14.4. On each of three samples of the conductor (s) from such cable, the metal component of the insulation shielding and any jacket over it are to be removed.

33.3 Two parallel longitudinal cuts 1/2 inch or 13 mm apart and not less than 12 inches or 305 mm long are to be made through the extruded insulation shielding at one end of each sample starting at the end of the sample. Each sample is then to be rotated 180° and two additional, identical cuts are to be made starting from the same end. Starting tabs are to be made by peeling back both of the two resulting 1/2-inch or 13-mm strips from the starting end of each sample for a distance of 2 inches or 50 mm.

33.4 A sample is to be held securely at both of its ends. The free end of one of the starting tabs is to be gripped firmly so that the 1/2-inch or 13-mm strip can be pulled at an angle of 90° to the longitudinal axis of the conductor. The strip is to be peeled from the insulation at a rate of approximately 1/2 in/s or 13 mm/s for a distance of not less than 10 inches or 254 mm. The angle of pull is to be maintained as close as possible to 90° throughout the test. The tension necessary to remove the strip is to be monitored continuously and the minimum value is to be recorded.

33.5 The test is to be repeated with the second strip on the first sample. If neither of the following occur with either of the two strips on the first sample, the extruded insulation shielding is acceptable and the two remaining samples need not be tested:

a) The minimum peeling tension is less than 3 lbf or 13.3 N or 1.36 kgf.

b) The insulation is damaged by the peeling.

If (a) or (b) occurs, the test is to be repeated on each of the two remaining samples for a total of four additional strips tested. The extruded insulation shielding is not acceptable if any of the four additional strips experience (a) or (b).

34 Deformation Test of EPCV or XLPE Insulation

34.1 EPCV or XLPE insulation (the insulation plus the conductor shielding in the case of conductors that are too small to provide for flat, rectangular specimens) from finished cable shall not decrease more in thickness than the following percentage (this is indicated for the conductor size and round or flat specimen style in Table 14.7 (IV) (for EPCV) or in Table 14.1 (IV) (for XLPE) when specimens are subjected to the load indicated in Table 34.1 while being maintained at a temperature of 121.0 ±1.0°C (249.8 ±1.8°F):

Round specimens with conductor in place from 8 – 4/0 AWG conductors	25 percent maximum distortion
Flat, rectangular specimens from 250 – 1000 kcmil conductors	15 percent maximum distortion

Table 34.1
Specimen load

Size of conductor	Load[a] exerted on a specimen by the foot of the rod[a]	
	gf	N
8 AWG	500	4.90
7 – 1	750	7.35
1/0 – 4/0	1000	9.81
250 – 2000 kcmil	2000	19.61

[a] The specified load is not the weight to be added to each rod in the test apparatus but rather the total of the weight added and the weight of the rod. Because the weight of the rod varies from one apparatus to another, specifying the exact weight to be added to a rod to achieve the specified load on a specimen is impractical in all cases except for an individual apparatus.

34.2 Finished XLPE-insulated circuit conductors are to be removed from the finished cable, and any insulation shielding and other coverings over the insulation are to be removed without damage to the insulation.

34.3 The diameter D_1 over the XLPE insulation and the conductor shielding on each of five 1-inch or 25-mm specimens of 8 – 4/0 AWG circuit conductors is to be measured to the nearest 0.001 inch or 0.01 mm. In each case, the measurement is to be made at a marked position by means of a dead-weight dial micrometer whose presser foot puts a load of 85 ±3 gf or 0.84 ±0.02 N or 3.0 ±0.1 ozf on the specimen. The presser foot is to have a flat, round face whose diameter is 0.250 ±0.010 inch or 6.4 ±0.2 mm. The anvil of the instrument is to be round, is to be at least 1.5 inches or 38 mm in diameter, and is to be parallel to the face of the presser foot. In each case, the diameter d over the conductor is to be measured by means of the same dial micrometer. The original thickness T_1 of the insulation and conductor shielding is then to be calculated to the nearest 0.001 inch or 0.01 mm from the following formula.

$$T_1 = \frac{D_1 - d}{2}$$

34.4 For 250 – 2000 kcmil circuit conductors, five samples approximately 8 inches or 200 mm long are to be prepared with a thickness of 0.050 ±0.010 inch or 1.27 ±0.25 mm, with both surfaces smooth. From each of these samples, a flat, rectangular test specimen of the insulation 1 inch long and 9/16 inch wide or 25 mm by 14 mm is to be prepared. At a marked position, the original thickness T_1 of each of these specimens of insulation is to be measured to the nearest 0.001 inch or 0.01 mm by means of the dead-weight dial micrometer described in 34.3. The entire surface of the presser foot is to be in contact with the rectangular specimen during measurement.

34.5 The apparatus and test method are to be as described in 560.3 – 560.7 of UL 1581.

35 Deformation Test of Non-conductive Thermoplastic Jackets

35.1 Each circuit-conductor, assembly, overall, and supplementary jacket that is of a non-conductive thermoplastic material and is taken from the finished cable shall not decrease more in thickness than the following percentage (this and the test temperature are indicated for the particular material in the applicable properties table) when specimens are subjected to a load of 2000 gf or 19.61 N while being maintained at the following temperature:

Non-conductive thermoplastic CPE	25 percent maximum distortion	121.0 ±1.0°C (249.8 ±1.8°F)	item III Table 27.4
Non-conductive PE	25 percent maximum distortion	90.0 ±1.0°C (194.0 ±1.8°F)	item II Table 27.10
Non-conductive PVC	50 percent maximum distortion	121.0 ±1.0°C (249.8 ±1.8°F)	item II Table 27.12
Non-conductive TPE	50 percent maximum distortion	150.0 ±1.0°C (327.6 ±1.8°F)	item II Table 27.14

35.2 Each circuit-conductor, assembly, overall, and supplementary jacket of non-conductive thermoplastic CPE, non-conductive PE, non-conductive PVC, and non-conductive TPE is to be removed from the finished cable without damage to the jacket. Five samples of each jacket approximately 8 inches or 200 mm long are to be prepared with a thickness of 0.050 ±0.010 inch or 1.27 ±0.25 mm, with both surfaces smooth. From each of these samples, a flat, rectangular test specimen 1 inch long and 9/16 inch wide or 25 mm by 14 mm is to be prepared.