



UL 1655

STANDARD FOR SAFETY

Community-Antenna Television Cables

UL Standard for Safety for Community-Antenna Television Cables, UL 1655

Third Edition, Dated October 23, 2024

Summary of Topics

This new Third Edition of ANSI/UL 1655 dated October 23, 2024 incorporates editorial changes including renumbering and reformatting to align with current style.

The requirements are substantially in accordance with Proposal(s) on this subject dated August 2, 2024.

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1

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No Text on This Page

CONTENTS

INTRODUCTION

1 Scope 5

2 Units of Measurement 6

3 Referenced Publications 7

CONSTRUCTION

4 Materials 7

5 Center Conductor of Coaxial Members 8

6 Metal Coating of Center Conductor.....10

7 Insulation.....11

 7.1 Material and application 11

 7.2 Thicknesses.....12

8 Coaxial Members 13

9 Electromagnetic Shields 13

10 Optical-Fiber Members 14

11 Binders 15

12 Communications Conductor 15

13 Core Wrap 15

14 Assembly of a Multiple-Member Cable 15

15 Overall Cable Jacket 16

 15.1 General.....16

 15.2 Flexibility test.....16

 15.3 Physical properties test 17

 15.4 Jacket.....17

16 Metal Covering (Armor).....19

 16.1 General.....19

 16.2 Smooth metal sheath 19

 16.3 Welded and corrugated metal sheath 20

 16.4 Extruded and corrugated metal sheath 20

 16.5 Interlocked armor.....21

17 Jacket over Armor 22

18 Metallic Messenger 23

MANUFACTURING AND PRODUCTION TESTS

19 Production Line Testing (Spark and Dielectric) 23

 19.1 Alternative spark and dielectric voltage-withstand tests of all coaxial members 23

PERFORMANCE

20 Continuity Test of Center and Outer Conductors and Shields 24

21 D-C Resistance Test of Center Conductors 24

 21.1 Requirements.....24

22 Cold Bend Test of the Complete Cable 29

23 Smoke and Flame Testing of Plenum Cables.....29

24 Flame Testing of Riser Cables 30

25 VW-1 (Vertical-Specimen) Flame Test of Limited-Use Cables 30

26 Alternative Vertical-Tray Flame Tests of General-Purpose Cables 30

 26.1 Choice of test by the manufacturer 30

 26.2 Changes in construction.....30

26.3 UL test.....31

26.4 FT4/IEEE 1202 test.....31

27 Sunlight-Resistance Test 31

28 Crushing Resistance Test of Center-Conductor Insulation 31

29 Crushing Test of Cable Marked for Direct Burial 32

30 Copper Sulphate Test of Zinc Coating on Steel Strip for and from Interlocked Steel Armor 33

31 Tension Test of Interlocked Steel or Aluminum Armor 35

32 Flexibility Test of Cable Having Interlocked Armor or a Smooth or Corrugated Metal Sheath ...37

33 Durability Test of Ink Printing 38

MARKINGS

34 Intervals 38

35 Coding 38

36 Information on or in the Cable.....38

37 Information on the Tag, Reel, or Carton 41

38 Multiple Markings 41

39 Date of Manufacture 42

INTRODUCTION

1 Scope

1.1 This Standard states the construction, test, and marking requirements covering the safety of single and multiple coaxial and coaxial/optical-fiber cables for the distribution of radio frequency signals such as employed in a community antenna television system, and for supplying low-energy power at a potential not exceeding 60 volts to equipment directly associated with the signal distribution. These are power-limited cables and are of the following types for installation and use as the CATV cables specified in Article 820 and other applicable parts of the National Electrical Code (NEC), NFPA 70. Electrically nonconductive material separates each optical-fiber member from the rest of the cable.

a) **PLENUM CABLES** – Type CATVP (coaxial) and Type CATVP-OF (coaxial/optical-fiber). These cables are for installation as specified in Section 800.179(A) of the National Electrical Code, NFPA 70 in a duct, plenum, or other space used to transport environmental air without the cable being enclosed in raceway in that space.

b) **RISER CABLES** – Type CATVR (coaxial) and Type CATVR-OF (coaxial/optical-fiber). These cables are for installation as specified in Section 800.179(B) of the National Electrical Code, NFPA 70 in vertical runs in a shaft or for vertical runs that penetrate more than one floor.

c) **GENERAL-PURPOSE CABLES** – Type CATV (coaxial) and Type CATV-OF (coaxial/optical-fiber). These cables are general-applications commercial cables for use as specified in Section 800.179(C) of the National Electrical Code, NFPA 70.

d) **LIMITED-USE CABLES** – Type CATVX (coaxial) and Type CATVX-OF (coaxial/optical-fiber). These are limited use cables as specified in Section 800.179(D) of the National Electrical Code, NFPA 70.

1.2 This Standard does not specify the impedance or other signal-carrying characteristics of these cables. This Standard does not cover tests for the signal-carrying performance of these cables.

1.3 Armored cables are covered by interlocked metal strip or a smooth or corrugated metal sheath with or without a jacket over the armor. Cables for encasement in concrete, mortar, other masonry, plaster, or the like have metal armor and a jacket over the armor. Cables for direct burial in the earth (see markings in [1.8](#)) are subject to a 1000-pound crushing test. Cables for direct burial are not required to be armored. Cables for direct burial that are armored have a jacket over the armor. All other cables (unarmored, flat or round) have an overall jacket. Some overall jackets incorporate a nonmetallic messenger. A metallic messenger may be joined to the cable jacket by an interconnecting web.

1.4 Cables of a CATV type do not have a voltage rating.

1.5 Cables of materials that qualify for temperatures above 60 °C (140 °F) are marked with a temperature rating of 75, 90, 105, 125, 150, 200 °C or 250 °C (167, 194, 221, 257, 302, 392 °F or 482 °F). Temperature marking is not required for cables that qualify for a temperature rating of 60 °C (140 °F).

1.6 Cables that contain one or more electromagnetic shields in addition to the outer conductors of the coaxial members (these shields are identified as "additional" in [9.1](#)) are not required to be marked to indicate the presence of the additional shielding. A shielded cable that is marked has "shielded" on the tag and either on the overall cable jacket or legible through the jacket.

1.7 Cables that qualify for exposure to sunlight (720-hour sunlight-resistance test – see [27.1](#)) have the designation "sun res" or "sunlight resistant" on the tag and either on the overall cable jacket or legible through the jacket.

1.8 Cables that qualify for burial directly in the earth (1000-pound crushing test – see [29.1](#)) have the designation "dir bur", "direct burial", or "for direct burial" on the tag and either on the overall cable jacket or legible through the jacket.

1.9 Optical performance is not evaluated. Cables with optical fibers are to have a tag marking in accordance with [10.3](#) and [37.1\(d\)](#). Where there are conductive parts in an optical-fiber member or in a group of such members, a tag marking [[36.1\(e\)](#)] indicates the presence of these parts.

1.10 These requirements do not cover antenna-rotator or other coaxial/electrical cables – that is, coaxial cables with additional conductors for electric-light, power, control, non-power-limited fire-alarm, Class 1, Class 2, or Class 3 circuits.

1.11 Smoke and flame tests are as follows for the cables covered in these requirements:

a) PLENUM CABLES – All Type CATVP and Type CATVP-OF cables are tested for smoke and flame characteristics as specified in Smoke and Flame Testing of Plenum Cables, Section [23](#), which references the National Fire Protection Association Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces, NFPA 262. A cable that complies exhibits a maximum flame-propagation distance that is not greater than 5 ft, 0 in or 152 cm, a peak optical density of smoke produced of 0.50 or less, and an average optical density of smoke produced of 0.15 or less.

b) RISER CABLES – Jacketed Type CATVR and Type CATVR-OF cables that comply with the flame-propagation characteristics as specified in Flame Testing of Riser Cables, Section [24](#), which references the Standard for Test for Flame-Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts, UL 1666.

c) GENERAL-PURPOSE CABLES – Jacketed Type CATV and Type CATV-OF cables are to comply with one of the two 70,000 Btu/h (20.5 kW) vertical-tray flame tests specified in Alternative Vertical-Tray Flame Tests of General-Purpose Cables, Section [26](#). The cable manufacturer is to choose one of the following tests:

1) The UL test referenced in [26.1.1](#) – [26.3.2](#). These paragraphs apply the test method described as the UL Flame Exposure (smoke measurements are not applicable) in the Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, UL 1685 or the Standard for Wire and Cable Test Methods, UL 2556.

2) The FT4/IEEE 1202 test referenced in [26.1.1](#) and [26.4.1](#). These paragraphs apply the test method described as the FT4/IEEE 1202 Type of Flame Exposure (smoke measurements are not applicable) in the Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, UL 1685 or the Standard for Wire and Cable Test Methods, UL 2556. A cable that complies is eligible to be marked "FT4/IEEE 1202" or "FT4" on the surface or on a marker tape as indicated in [36.1\(h\)](#).

d) LIMITED-USE CABLES – All Type CATVX and Type CATVX-OF cables are subjected to the VW-1 flame test specified in VW-1 (Vertical-Specimen) Flame Test of Limited-Use Cables, Section [25](#), which references the test method described as the VW-1 (Vertical-Specimen) Flame Test in the Standard for Wire and Cable Test Methods, UL 2556. These cables are not marked "VW-1".

1.12 These requirements do not specify or test for the electrostatic/electromagnetic performance of a shield.

2 Units of Measurement

2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

3 Referenced Publications

3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3.2 The following publications are referenced in this Standard:

ANSI Z136, *American National Standard for Safe Use of Lasers*

ASTM B566, *Standard Specification for Copper-Clad Aluminum Wire*

ASTM B869, *Standard Specification for Copper-Clad Steel Electrical Conductor for CATV Drop Wire*

ASTM D5423, *Standard Specification for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation*

ASTM D5474, *Standard Guide for Selection of Data Elements for Ground-Water Investigations*

ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

NFPA 70, *National Electrical Code*

NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*

NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*

UL 13, *Power-Limited Circuit Cables*

UL 1424, *Cables for Power-Limited Fire-Alarm Circuits*

UL 1581, *Electrical Wires, Cables, and Flexible Cords*

UL 1666, *Test for Flame-Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*

UL 1685, *Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*

UL 1690, *Data-Processing Cable*

UL 2556, *Wire and Cable Test Methods*

UL 444, *Communications Cables*

UL 758, *Appliance Wiring Material*

CONSTRUCTION

4 Materials

4.1 Each material used in a cable shall be compatible with all of the other materials used in the cable.

4.2 Cables of a CATV type shall comply in all respects with the applicable requirements for construction details, test performance, and markings.

5 Center Conductor of Coaxial Members

5.1 The center conductor of each coaxial member shall be round and of solid 30 – 1 AWG soft-annealed copper, of stranded 30 AWG – 500 kcmil soft-annealed copper, of solid 30 – 6 AWG medium-drawn or hard-drawn copper, of solid 30 – 6 AWG copper-clad steel, of solid 30 – 1 AWG copper-clad aluminum, or of a smooth or corrugated copper tube. A stranded conductor shall consist of round strands with a right- or left-hand direction of lay. Seven strands, concentric, is the stranding assumed in these requirements; however, individual strand diameter, the number of strands, and the stranding type are not specified. See Metal Coating of Center Conductor, Section [6](#).

5.2 The nominal diameters indicated in [Table 5.1](#) for solid and stranded center conductors are to be used in calculating the dimensions needed for various parts of the cable when using [Table 15.1](#), [Table 15.2](#), [Table 16.1](#), and [Table 16.2](#). The length of lay of the wires (strands) of a stranded center conductor is not specified.

5.3 All solid, stranded, and tubular center conductors are to be identified as a particular AWG or circular-mil size in the marking on or in the cable and on the tag, reel, or carton. The size of a solid center conductor shall be verified either by determination of the d-c resistance or by determination of the diameter as described in [5.4](#). The size of a stranded or tubular center conductor shall be verified either by determination of the d-c resistance, as described in [5.5](#), or by determination of the cross-sectional area. Determination of the conductor size by measurement of the d-c resistance as described in D-C Resistance Test of Center Conductor, Section [21](#), is the referee method in all cases.

5.4 Where measured as the means of size verification (see [5.3](#)), the diameter of a solid center conductor shall not be smaller than the minimum diameter indicated for the size in [Table 5.1](#) when the diameter of the conductor is determined from measurements made as follows:

- a) Measurements of the diameter of a solid conductor are to be made over the metal-coated or uncoated conductor by optical means or by means of a machinist's micrometer caliper having flat surfaces both on the anvil and on the end of the spindle. In either case, the equipment is to be calibrated to read directly to at least 0.001 inch (0.01 mm), with each division of a width that facilitates estimation of each measurement to 0.0001 inch (0.001 mm). The maximum and minimum diameters at a given point on the solid conductor are each to be recorded to the nearest 0.0001 inch or 0.1 mil or 0.001 mm, added together, and divided by 2 without any rounding of the sum or resulting average.
- b) Each minimum diameter indicated in [Table 5.1](#) is an absolute minimum. The unrounded average of the two diameter readings is therefore to be compared directly with the minimum in the table for the purpose of determining whether the solid conductor does or does not comply with the diameter requirement.

5.5 Where measured as the means of size verification (see [5.3](#)), the cross-sectional area of a stranded or tubular center conductor shall not be smaller than the minimum area indicated for the size in [Table 5.1](#). The cross-sectional area of a stranded conductor is to be determined as the sum of the areas of its component round strands. However, where the sum of the strand areas does not comply, the conductor area is to be determined by the weight method outlined in Conductor Cross-Sectional Area by the Weight Method in UL 2556.

Table 5.1
Dimensions of Center Conductor of a Coaxial Member

Size of conductor	Diameter of solid conductor				Cross-sectional area of tubular or stranded conductor				Nominal diameter of stranded conductor (7 strands)	
	Nominal See 5.2		Minimum See 5.4(b) mils are 0.99 x nominal except where note ^a applies		Nominal		Minimum cmil = 0.98 x nominal			
	mils	(mm)	mils	(mm)	cmil	(mm ²)	cmil	(mm ²)	mils	(mm)
30 AWG	10.0	(0.254)	9.5 ^a	(0.241) ^a	100	(0.0507)	98	(0.0497)	11.3	(0.287)
29	11.3	(0.287)	10.7 ^a	(0.272) ^a	128	(0.0647)	125	(0.0633)	12.8	(0.325)
28	12.6	(0.320)	12.0 ^a	(0.305) ^a	159	(0.0840)	156	(0.0790)	14.3	(0.363)
27	14.2	(0.361)	13.5 ^a	(0.343) ^a	202	(0.102)	198	(0.100)	16.1	(0.409)
26	15.9	(0.404)	15.1 ^a	(0.384) ^a	253	(0.128)	248	(0.126)	18.0	(0.457)
25	17.9	(0.455)	17.0 ^a	(0.432) ^a	320	(0.162)	314	(0.159)	20.3	(0.516)
24	20.1	(0.511)	19.1 ^a	(0.485) ^a	404	(0.205)	396	(0.201)	22.8	(0.579)
23	22.6	(0.574)	21.5 ^a	(0.546) ^a	511	(0.259)	501	(0.254)	25.6	(0.650)
22	25.3	(0.643)	24.0 ^a	(0.610) ^a	640	(0.324)	627	(0.318)	28.7	(0.729)
21	28.5	(0.724)	27.1 ^a	(0.688) ^a	812	(0.412)	796	(0.404)	32.3	(0.820)
20	32.0	(0.813)	30.4 ^a	(0.772) ^a	1020	(0.519)	1000	(0.509)	36.2	(0.919)
19	35.9	(0.912)	34.1 ^a	(0.866) ^a	1290	(0.653)	1264	(0.641)	40.7	(1.03)
18	40.3	(1.02)	40.2	(1.016)	1620	(0.823)	1588	(0.807)	45.6	(1.16)
17	45.3	(1.15)	44.9	(1.140)	2050	(1.04)	2009	(1.02)	51.3	(1.30)
16	50.8	(1.29)	50.3	(1.278)	2580	(1.31)	2528	(1.28)	57.6	(1.46)
15	57.1	(1.45)	56.5	(1.435)	3260	(1.65)	3195	(1.62)	64.7	(1.64)
14	64.1	(1.63)	63.5	(1.613)	4110	(2.08)	4028	(2.04)	72.7	(1.85)
13	72.0	(1.83)	71	(1.81)	5180	(2.63)	5076	(2.58)	81.6	(2.07)
12	80.8	(2.05)	80	(2.03)	6530	(3.31)	6399	(3.24)	91.5	(2.32)
11	90.7	(2.30)	90	(2.28)	8230	(4.17)	8065	(4.09)	103	(2.62)
10	101.9	(2.588)	101	(2.56)	10380	(5.261)	10172	(5.16)	116	(2.95)
9	114.4	(2.906)	113	(2.88)	13090	(6.631)	12828	(6.50)	130	(3.30)
8	128.5	(3.264)	127	(3.23)	16510	(8.367)	16180	(8.20)	146	(3.71)
7	144.3	(3.665)	143	(3.63)	20820	(10.55)	20404	(10.34)	164	(4.17)
6	162.0	(4.115)	160	(4.07)	26240	(13.30)	25715	(13.03)	184	(4.67)
5	181.9	(4.620)	180	(4.57)	33090	(16.77)	32428	(16.43)	206	(5.23)
4 AWG	204.3	(5.189)	202	(5.14)	41740	(21.15)	40905	(20.73)	232	(5.89)
3	229.4	(5.827)	227	(5.77)	52620	(26.67)	51568	(26.14)	260	(6.60)
2	257.6	(6.543)	255	(6.48)	66360	(33.62)	65033	(32.95)	292	(7.42)
1	289.3	(7.348)	286	(7.27)	83690	(42.41)	82016	(41.56)	332	(8.43)
1/0	—	—	—	—	105600	(53.49)	103488	(52.42)	372	(9.45)
2/0	—	—	—	—	13310	(67.43)	130438	(66.08)	418	(10.62)
3/0	—	—	—	—	167800	(85.01)	164444	(83.31)	470	(11.94)
4/0	—	—	—	—	211600	(107.2)	207368	(105.1)	528	(13.41)

Table 5.1 Continued on Next Page



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Table 5.1 Continued

Size of conductor	Diameter of solid conductor				Cross-sectional area of tubular or stranded conductor				Nominal diameter of stranded conductor (7 strands)	
	Nominal See 5.2		Minimum See 5.4 (b) mils are 0.99 x nominal except where note ^a applies		Nominal		Minimum cmil = 0.98 x nominal			
	mils	(mm)	mils	(mm	cmil	(mm ²)	cmil	(mm ²)	mils	(mm)
250 kcmil	—	—	—	—	250 kcmil	(127)	245	(124.1)	575	(14.61)
300	—	—	—	—	300	(152)	294	(149.0)	630	(16.00)
350	—	—	—	—	350	(177)	343	(173.8)	681	(17.30)
400	—	—	—	—	400	(203)	392	(198.6)	728	(18.49)
450	—	—	—	—	450	(228)	441	(223.5)	772	(19.61)
500	—	—	—	—	500	(253)	490	(248.3)	813	(20.65)

^a Minimum diameter (0.95 x nominal) of a reduced-diameter solid conductor. See corresponding resistance (1.1 x nominal) in [Table 21.1](#).

5.6 Each center and outer conductor and each shield shall be continuous throughout the entire length of the finished cable as determined by the Continuity Test of Center and Outer Conductors and Shields, Section 20.

5.7 A joint in a solid center conductor or in one of the individual wires of a stranded center conductor shall be made in a workmanlike manner, shall be smooth, and shall not have any sharp projections. A joint in a stranded conductor is to be made by separately joining each individual wire or by machine brazing or welding of the conductor as a whole so that the resulting solid section of the stranded conductor is not longer than 1/2 inch (13 mm), there are no sharp points, and the distance between brazes or welds in a single conductor does not average less than 3000 feet (915 m) in any reel length of insulated single conductor. A joint made before insulation is applied to a center conductor shall not increase the diameter of the solid conductor or individual wire (strand). A joint made after insulating shall not increase the diameter of the solid conductor or individual wire (strand) by more than 20 %. Joints made after insulating shall be insulated by applying a bonded patch or by molding. The insulation shall comply with the requirements in this Standard. An individual member jacket or an overall cable jacket that is damaged to the point of exposing the underlying assembly or that is opened for the purpose of making any repair under the jacket either shall be stripped and replaced in its entirety or a second, duplicate jacket shall be applied over the first for the entire length of the member or cable. The total thickness of the two jackets shall not exceed any limitation determined for a particular cable in an applicable flame or smoke-and-flame test or other test specified in this Standard.

5.8 Any section of a center conductor that includes a factory joint shall have a tensile strength that is not less than 85 % of the tensile strength of an adjacent section of the conductor not having a joint.

6 Metal Coating of Center Conductor

6.1 Where the insulation adjacent to the copper center conductor or copper cladding on the steel or aluminum center conductor is of a material that corrodes unprotected copper in the test described in Conductor Corrosion in UL 2556, the copper conductor or copper cladding shall be covered with a coating of tin, a tin/lead alloy, nickel, silver, or of another (evaluation required) metal or alloy.

6.2 Use of a metal coating is not specified on a solid center conductor or the individual wires (strands) of a stranded center conductor on which a coating is not required for corrosion protection. The metal coating shall be on both the inside and outside of the copper tube when the metallic coating is used to increase the temperature rating of the conductor.

6.3 The maximum temperature rating of the cable is not specified relative to the small-diameter copper wires used in the outer conductor. The temperature rating of a cable in which the center conductor is of copper, copper tube, or copper-clad steel shall not exceed the temperature indicated in [Table 6.1](#) for the diameter and coating of the solid conductor or individual strands (see [15.3.1](#) regarding application of [Table 6.1](#)). The temperature rating of a cable in which the center conductor is aluminum shall not exceed 90 °C (194 °F).

Table 6.1
Maximum Temperature Rating of Cable Relative to Diameter and Coating of solid Copper Center Conductor or of Copper Center-Conductor Strands

Metal coating of copper strands or of solid copper conductor or tube, or copper-clad steel conductor	Diameter of each strand or of the solid conductor or thickness of copper tube	
	Smaller than 0.015 inch (0.38 mm)	At least 0.015 inch (0.38 mm)
Uncoated or coated with tin or a tin/lead alloy	150 °C (302 °F)	200 °C (392 °F)
Coated with silver	200 °C (392 °F)	200 °C (392 °F)
Coated with nickel	over 200 °C (392 °F)	over 200 °C (392 °F)

7 Insulation

7.1 Material and application

7.1.1 The center conductor of each coaxial member shall be insulated for its entire length. An air-gap dielectric shall be permitted. The insulation material is not specified. The insulation shall be solid or expanded (foamed) with or without a solid dielectric skin (a thin, solid, extruded layer that is or is not separable) applied over the solid or foamed insulation. A skin is not required to be of the same material as the insulation. An air-gap coaxial member shall consist of a solid spacer (thread) that has a nominally circular cross section and is applied to the center conductor helically in a continuous length (the length and direction of lay are not specified) with or without a solid insulating tube overall. Otherwise, the insulation shall be applied directly to the center conductor, shall have a circular cross section, and shall fit tightly to the conductor with no more than nominal adherence (a test is not specified). The insulation shall be uniform and shall not have any defects (bubbles, open spots, rips, tears, cuts, or foreign material) that are visible with normal or corrected vision without magnification.

7.1.2 Neither flexibility nor physical properties testing is specified for 60 °C (140 °F) insulation. Flexibility or physical properties testing in accordance with [7.1.3](#) – [7.1.5](#) is required for all insulations rated 75 °C (167 °F) or greater.

7.1.3 Specimens of solid single-layered insulations removed from finished insulated conductors shall comply with the values of unaged elongation and tensile strength shown in the applicable physical-properties table for the material referenced in Section 50 of UL 1581, and when tested in accordance with the test procedures in UL 2556. Specimens of solid single-layered insulations except PVDF rated 125 °C (257 °F) shall comply with the values of aged retention of elongation and tensile strength shown in the applicable physical-properties table for the material referenced in Section 50 of UL 1581, and when tested in accordance with the test procedures in UL 2556. PVDF rated 125 °C (257 °F), foamed, and multi-layered insulations shall comply with [7.1.4](#).

7.1.4 Solid or foamed 125 °C (257 °F) PVDF and PVDF copolymer insulations with or without a skin and other insulations with a skin shall comply with the flexibility test in [15.2](#) (conditioning per Table 50.185 of UL 1581) using specimens consisting of the insulated center conductor and wound onto a mandrel having a diameter equal to the diameter over the insulation (1 x OD). Solid or foamed 150 °C (302 °F) PVDF and PVDF copolymer insulations without a skin and all other solid insulations without a skin shall comply with