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STANDARD TEST METHODS FOR EXTRUDED DIELECTRIC POWER, CONTROL, INSTRUMENTATION, AND PORTABLE CABLES FOR TEST

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Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation, and Portable Cables for Test

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Foreword

This Standard Test Methods Publication for Extruded Dielectric Power, Control, Instrumentation and Portable Cables was developed by the Insulated Cable Engineers Association, Inc. (ICEA) and was approved by the National Electrical Manufactures Association (NEMA).

ICEA/NEMA Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturers and the user and to assist the user in selecting and obtaining the proper product for his or her particular need. The user of this Standards Publication is cautioned to observe any health or safety regulations and rules relative to the use of the test procedures covered by this document.

Requests for interpretation of this standard must be submitted in writing to:

Insulated Cable Engineers Association, Inc.
P.O. Box 1568
Carrollton, GA 30112

An official written interpretation will be made by the Association.

Suggestions for improvements gained in the use of this publication will be welcomed by the Association.

Section 1
GENERAL

1.1 SCOPE

This standard applies to the testing of extruded dielectric insulated power, control, instrumentation, and portable cables.

1.2 REFERENCES

Included in this standard are many, but not all, of the test methods to which reference is made in ICEA/NEMA Standards for Cables. For undated references, the reference shall be to the latest issue. Copies of the following documents may be obtained from the appropriate source as follows:

1.2.1 Normative References

American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

ASTM B 193-02	*Resistivity of Electrical Conductor Materials, Test Method for*
ASTM D 257-99	*DC Resistance or Conductance of Insulating Materials, Test Method for*
ASTM D 412-98a(02)e1	*Vulcanized Rubber and Thermoplastic Elastomers — Tension*
ASTM D 471-98e2	*Rubber Property — Effect of Liquids, Test Method for*
ASTM D 746-04	*Brittleness Temperature of Plastics and Elastomers by Impact*
ASTM D 2132-03	*Dust-and-Fog Tracking and Erosion Resistance of Electrical Insulating Materials*, Test Method for
ASTM D 2275-01	*Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharge (Corona) on the Surface, Test Method for*
ASTM D 2765-01	*Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics, Test Method for*
ASTM D3349-99	*Absorption Coefficient of Ethylene Polymer Material Pigmented with Carbon Black, Test Method for*

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5776

ICEA T-28-562	*Measurement of Hot Creep of Polymeric Insulations, Test Methods for*
ICEA T-29-520	*Procedure for Conducting Vertical Cable Tray Flame Tests with a Theoretical Heat Input Rate of 210,000 B.T.U./Hour*
ICEA T-30-520	*Procedure for Conducting Vertical Cable Tray Flame Tests with a Theoretical Heat Input Rate of 70,000 B.T.U./Hour*
ICEA T-24-380	*Guide for Partial Discharge Test Procedure*
ICEA T-25-425	*Guide for Establishing Stability of Volume Resistivity of Conducting Polymeric Component of Power Cables*
ICEA T-26-465	*Guide for Frequency of Sampling Extruded Dielectric Power, Control, Instrumentation, and Portable Cables for Test*

ICEA T-28-562 *Test Method for Hot Creep of Polymeric Insulations*
ICEA T-31-610 *Guide for Conducting a Longitudinal Water Penetration Resistance Test for Sealed Conductor*
ICEA T-32-645 *Guide for Establishing Compatibility of Sealed Conductor Filler Compounds with Conducting Stress Control Materials*
ICEA T-34-664 *Guide for Conducting a Longitudinal Water Penetration Resistance Tests on Longitudinal Water Blocked Cables*

National Technical Information Service

U.S. Department of Commerce
Springfield, VA 22161

National Bureau of Standards
Handbook No. 100 *Copper Wire Tables (February 4, 1966)*

National Bureau of Standards
Handbook No. 109 *Aluminum Wire Tables (February 1972)*

Not all the tests mentioned above are relevant for a given cable design or a given application.

A few specialized test methods are described in ICEA Standard Publication S-94-649, *Standard For Concentric Neutral Cables Rated 5,000 – 46,000 Volts*.

When a procedure for measuring a specified parameter is not specified, that parameter shall be determined by any suitable means.

When another standard is referenced in this document, its title and date of issue may be found in Section 1. The reference is only to that specified document.

In this standard, temperatures are expressed in degrees Celsius, weights in grams, and metal resistivities in nanoohm-meter. Other properties are expressed in U.S. customary units throughout this standard. Approximate International System of Units (SI) equivalents are included for information only.
Room temperature is defined as 25 ± 5^{o}C. Where this temperature range cannot be maintained, (test) measurements may be made at the prevailing ambient room temperature, which shall be recorded.

The Fahrenheit equivalents for Celsius degrees may be calculated by the equation

$$\deg F = \left[1.8 \left(\deg \quad C \right) \right] + 32$$

The ounce equivalents to grams may be calculated by dividing the number of grams by 28.4.

The ohm cmil per ft equivalents to nanoohm•meter may be calculated by multiplying the nanoohm•meter value by 0.602.

Conductor size is expressed in cross-sectional area in thousand circular mils (kcmil). For convenience, in the text and tables, only the equivalent AWG size is used for 211.6 kcmil (4/0 AWG) and smaller. For kcmil values of AWG sizes see the following Table 1-1:

Table 1-1
kcmil Equivalent of AWG Conductor Sizes

AWG	kcmil	AWG	kcmil	AWG	kcmil
22	0.640	13	5.18	4	41.74
21	0.812	12	6.53	3	52.62
20	1.02	11	8.23	2	66.36
19	1.29	10	10.38	1	83.69
18	1.62	9	13.09	1/0	105.6
17	2.05	8	16.51	2/0	133.1
16	2.58	7	20.82	3/0	167.8
15	3.26	6	26.24	4/0	211.6
14	4.11	5	33.09		

To convert values in a non-metric unit to the approximate value in an appropriate metric unit, multiply the value in the non-metric unit by the appropriate number from the following Table 1-2:

Table 1-2
Conversion Table

From	To	Multiplier
inches (in)	millimeters (mm)	25.4
feet (ft)	meter (m)	0.305
ohms per 1000 feet (Ω/1000 ft)	milliohms per meter (mΩ/m)	3.28
square inch (in^2)	square millimeter (mm^2)	645.0
thousand circular mils (kcmil)	square millimeter (mm^2)	0.507
kilovolts per inch or volts per mil (kV/in or V/mil)	megavolts per meter or kilovolts per millimeter (MV/m or kV/mm)	0.0394
pounds per square inch (psi)	kilopascals (kPa)	6.89
pounds tension or force per inch (lb/in)	Newtons per meter (N/m)	175.0
megohms-1000 ft (MΩ-1000 ft)	megohms-meter (MΩ-m)	305.0
gigaohms-1000 ft (GΩ-1000 ft)	gigaohms-meter (GΩ-m)	305.0
liquid ounces (liq oz)	cubic centimeter (cm^3)	29.6

In this standard the following nomenclature is used:

Jacket- polymeric (nonmetallic) protective covering
Insulation Shield- semiconducting polymeric (nonmetallic) layer
Cable Shield-metallic layer
Sheath-metallic layer
Armor-metallic layer