



STANDARD FOR  
600 VOLT RATED CABLES OF RUGGEDIZED DESIGN  
FOR DIRECT BURIAL INSTALLATIONS AS SINGLE  
CONDUCTORS  
OR ASSEMBLIES OF SINGLE CONDUCTORS

Approved by  
AMERICAN NATIONAL STANDARDS INSTITUTE  
7/19/2012  
Publication # ANSI/ICEA S-81-570-2012

©2012 by  
INSULATED CABLE ENGINEERS ASSOCIATION, Inc.

[Purchase Now](#)

Purchase Now

**ANSI/ICEA Publication S-81-570-2012**

*Standard For 600 Volt Rated Cables of Ruggedized Design  
For Direct Burial Installation As Single Conductors  
Or Assemblies Of Single Conductors*

*7/19/2012 ANSI approval Date*

*Prepared and Published by*

**Insulated Cable Engineers Association  
P. O. Box 1568  
Carrollton, Georgia 30112, USA**

©Copyright 2012 by the Insulated Cable Engineers, Incorporated. All rights including translation into other languages, reserved under the Universal Copyright Convention, the Berne Convention for the Protection of Literary and Artistic Works, and the International and PanAmerican Conventions.

## NOTICE AND DISCLAIMER

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among every person participating in the development of this document.

The Insulated Cable Engineers Association, Inc. (ICEA) standards and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together persons who have an interest in the topic covered by this publication. While ICEA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgements contained in its standards and guideline publications.

ICEA disclaims liability for personal injury, property, or other damages of any nature whatsoever, whether special, indirect consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. ICEA disclaims and makes no guaranty or warranty, expressed or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any of your particular purposes or needs. ICEA does not undertake to guarantee the performance of any individual manufacturer or seller's products or services by virtue of this standard or guide.

In publishing and making this document available, ICEA is not undertaking to render professional or other services for or on behalf of any person or entity, nor is ICEA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgement or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

ICEA has no power, nor does it undertake to police or enforce compliance with the contents of this document. ICEA does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety-related information in this document shall not be attributable to ICEA and is solely the responsibility of the certifier or maker of the statement.

## Foreword

This standard publication for 600 Volt rated cables of ruggedized design for direct burial installations as single conductors and assemblies of single conductors, ICEA S-81-570 was developed by the Insulated Cable Engineers Association, Inc. (ICEA)

ICEA standards and guides are adopted in the public interest and are designed to eliminate misunderstanding between the manufacturer and the user and to assist the user in selecting and obtaining the proper product for his particular need. Existence of an ICEA standard or guide does not in any respect preclude the manufacture or use of products not conforming to the standard or guide. The user of this standard is cautioned to observe any health or safety regulations and rules relative to the manufacture and use of the cable made in conformity with this standard.

Request for interpretation of this standard must be submitted in writing to the Insulated Cable Engineers Association, Inc. Box 1568, Carrollton, Georgia, 30112. An official written interpretation will be provided. Suggestions for improvements gained in the use of this standard will be welcomed by the Association.

## Contents

page

	Foreword .....	ii
<b>Section 1</b>	<b>GENERAL</b>	
1.1	SCOPE.....	1
1.2	CONSTRUCTIONS.....	1
1.3	DESIGN OPTIONS .....	1
	1.3.1 Conductors.....	1
	1.3.2 Insulation.....	1
	1.3.3 Assembly .....	1
1.4	OPERATING CONDITIONS .....	1
	1.4.1 Normal Service Temperature .....	2
	1.4.2 Emergency Overload Temperature .....	2
	1.4.3 Short Circuit Temperature.....	2
1.5	QUALIFICATION .....	2
1.6	TESTING.....	2
1.7	TEST METHODS .....	2
1.8	STANDARDS AND SPECIFICATIONS.....	3
<b>Section 2</b>	<b>CONDUCTOR</b>	
2.0	GENERAL.....	4
2.1	PHYSICAL AND ELECTRICAL PROPERTIES.....	4
	2.1.1 Copper Conductors .....	4
	2.1.2 Aluminum Conductors .....	4
2.2	CONDUCTOR SIZE UNITS .....	4
2.3	CONDUCTOR DC RESISTANCE PER UNIT LENGTH.....	5
	2.3.1 Direct Measurement of dc Resistance per Unit Length .....	5
	2.3.2 Calculation of dc Resistance per Unit Length .....	5
2.4	CONDUCTOR DIAMETER .....	9
<b>Section 3</b>	<b>INSULATION</b>	
3.1	INSULATION	
	3.1.1 75 °C Normal Service Operation Insulation.....	12
	3.1.2 90 °C Normal Service Operation Insulation.....	12
	3.1.3 Alternate Insulation.....	12
3.2	THICKNESS AND VOLTAGE REQUIREMENTS.....	13

	page
<b>3.3 ELECTRICAL REQUIREMENTS .....</b>	<b>13</b>
3.3.1 Insulation Resistance .....	13
3.3.2 Voltage Test .....	14
3.3.2.1 Single Conductors .....	14
3.3.2.2 Twisted Assemblies .....	14
3.3.2.3 Parallel Assemblies .....	14
<b>3.4 PHYSICAL REQUIREMENTS .....</b>	<b>15</b>
<b>Section 4 ASSEMBLIES AND IDENTIFICATION</b>	
4.1 ASSEMBLIES .....	16
4.2 IDENTIFICATION.....	16
4.2.1 Conductor Identification.....	16
4.2.2 Neutral Identification.....	16
<b>Section 5 TEST METHODS</b>	
5.1 TEST TEMPERATURES .....	17
5.2 METHODS FOR MEASURING INSULATION PHYSICAL PROPERTIES.....	17
5.3 METHOD FOR MEASURING INSULATION HOT CREEP AND HOT SET .....	17
5.4 METHOD FOR MEASURING THE ABSORPTION COEFFICIENT OF BLACK 75 °C INSULATION WALL OUTER LAYER MATERIAL.....	17
5.5 METHOD OF MEASURING INSULATION HEAT DEFORMATION (DISTORTION) (THERMOPLASTIC MATERIALS 75 °C RATED) .....	17
<b>Section 6 QUALIFICATION TEST</b>	
6.1 SUITABILITY OF INSULATION FOR USE ON AC CIRCUITS IN WET LOCATIONS .....	18
6.1.1 Qualification.....	18
6.1.2 Insulation Resistance Stability.....	18
6.1.2.1 Minimum Insulation Resistance at Rated Temperature .....	18
6.1.2.2 Maximum Rate of Decrease.....	19
6.2 MECHANICAL ABUSE RESISTANCE OF INSULATION .....	19
6.2.1 Qualification .....	19
6.2.2 Sharp Impact.....	19
6.2.3 Blunt Impact .....	20
6.2.4 Abrasion .....	20
6.2.5 Crush .....	21
6.2.6 Puncture .....	21
6.2.7 Scoring .....	21

	page
<b>6.3</b>	<b>METHOD FOR DETERMINING THE RESISTANCE TO ENVIRONMENTAL STRESS CRACKING OF 75 °C INSULATION WALL OUTER LAYER MATERIAL ...23</b>
6.3.1	Test Specimens .....23
6.3.2	Test Procedure .....23
<b>6.4</b>	<b>THERMAL CRACK RESISTANCE OF CABLE WITH 90°C INSULATION .....23</b>
<b>6.5</b>	<b>ACCELERATED ELECTRICAL REQUIREMENTS IN WATER .....24</b>
<b>6.6</b>	<b>SUNLIGHT RESISTANCE OF INSULATIONS .....24</b>
6.6.1	Qualification.....24
6.6.2	Sunlight Resistance.....24
6.6.2.1	Carbon Arc Weather-O-Meter .....25
6.6.2.2	Xenon-Arc Weather-O-Meter.....25
6.6.2.3	Absorption Coefficient.....25
<b>Section 7</b>	<b>ENGINEERING INFORMATION</b>
7.1	FLEXURE.....26
7.2	INSULATION RESISTANCE CONSTANT .....26

## APPENDICES

<b>A</b>	<b>CONVERSION OF ENGLISH TO METRIC .....27</b>
<b>B</b>	<b>RECOMMENDED BENDING RADII FOR INSULATED CONDUCTORS AND CABLE ASSEMBLIES .....27</b>
<b>C</b>	<b>MINIMUM DRUM DIAMETERS OF REELS FOR SINGLE CONDUCTORS AND ASSEMBLIES.....27</b>
<b>D</b>	<b>TITLE AND DATE OF INDUSTRY STANDARDS REFERENCED IN THIS DOCUMENT.....28</b>
<b>E</b>	<b>FLEXURE TEST SET-UP .....29</b>



## LIST OF TABLES

	page
1-1 Maximum Operating Temperature .....	1
2-1 Schedule for Establishing Maximum Direct Current Resistance per Unit Length of Completed Cable Conductors.....	6
2-2 Nominal Direct Current Resistance in Ohms per 1000 ft at 25 °C of Solid and Concentric Lay Stranded Conductor.....	7
2-2 (Metric) Nominal Direct Current Resistance in Ohms per Kilometer at 25 °C of Solid and Concentric Lay Stranded Conductor .....	8
2-3 Nominal Diameters for Copper and Aluminum Conductors.....	9
2-3 (Metric) Nominal Diameters for Copper and Aluminum Conductors .....	10
2-4 Factors for Determining Nominal Resistance per 1000 Feet at 25 °C of Stranded Conductors.....	11
2-5 Weight Increment Factors .....	11
3-1 Conductor Sizes, Insulation Thickness and Test Voltages .....	13
3-2 Insulation Physical Requirements.....	15
6-1 Insulation Resistance .....	18
6-2 Abuse Resistance Properties .....	22
6-3 Insulation Physical Requirements (Qualification) .....	23
6-4 Accelerated Electrical Requirements.....	24

## **Section 1 GENERAL**

### **1.1 SCOPE**

This standard applies to the materials, constructions, and testing of single conductor cables and assemblies of completed single conductor cables used for the distribution of electrical energy at phase-to-phase voltages not exceeding 600 volts or phase to ground not exceeding 480 V, and at temperatures not exceeding 75 °C or 90 °C, as applicable to the construction. It requires the use of ruggedized extruded insulations to improve the resistance of the cable to certain forms of mechanical damage associated with their intended use as directly buried Secondary Distribution and Service Cables. These cables, when operated within the voltage and temperature limits stated herein, are also suitable for use in other types of installations under the conditions normally associated with those installations.