



ICEA STANDARD FOR  
COAXIAL AND COAXIAL/TWISTED PAIR  
COMPOSITE AERIAL SERVICE WIRES  
TECHNICAL REQUIREMENTS

Approved by  
AMERICAN NATIONAL STANDARDS INSTITUTE  
February 1, 2012  
Publication # ANSI/ICEA S-92-675-2011

©2011 by  
INSULATED CABLE ENGINEERS ASSOCIATION, Inc.



**ICEA STANDARD FOR  
COAXIAL AND COAXIAL/TWISTED PAIR  
COMPOSITE AERIAL SERVICE WIRES  
TECHNICAL REQUIREMENTS**

Published By  
**INSULATED CABLE ENGINEERS ASSOCIATION, INC.**

**Post Office Box 1568  
Carrollton, Georgia 30112, U.S.A.**

**ICEA S-92-675-2011**

© 2011 by ICEA

Approved July 20, 2011 by  
Insulated Cable Engineers Association, Inc.

Approved February 1, 2012 by  
American National Standard Institute, Inc.

Copyrighted by the ICEA  
Contents may not be reproduced  
in any form without permission of the  
INSTRUMENT CABLE ENGINEERS ASSOCIATION, INC.

Copies of this publication may be obtained from

INSTRUMENT ENGINEERING COMPANY  
15 Inverness Way East  
Englewood, CO 80111-5776, U.S.A.  
Telephone 303-577-7179  
www.ihs.com

## 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 judgments 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 judgment 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 certifications or other statements 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.

□ page intentionally left blank □

## FOREWORD

ICEA Standards are published in the public interest and are intended to promote uniformity and quality throughout the industry. Existence of an ICEA publication does not in any respect preclude the manufacture or use of products not conforming to this Standard.

The user of this Standard is cautioned to observe any applicable health or safety regulations and rules relative to the manufacture and use of cable made in conformity with this Standard. This Standard hereafter assumes that manufacture, testing, installation, and maintenance of cables defined by this Standard will be performed only by properly trained personnel using suitable equipment and employing appropriate safety precautions.

Questions for interpretation of ICEA Standards can only be accepted in writing and the reply shall be provided in writing. Suggestions for improvements in this Standard are welcome. Questions and suggestions shall be sent to

Secretary  
Insulated Cable Engineers Association, Inc.  
Post Office Box 156  
Carrollton, GA 30112, U.S.A.  
United States of America

Alternatively, you can contact ICEA by utilizing the contact link in the ICEA web site

[www.icea.net](http://www.icea.net)

This Standard was approved by ICEA on July 20, 2011. The members of the ICEA Communications Cable Division, forming Group 675, who participated in this project were

J. J. Baer J. Gould P. Fraley J. Jorna

## TABLE OF CONTENTS

| CONTENTS | SECTION                                      | PAGE |
|----------|----------------------------------------------|------|
| 1        | <u>GENERAL</u>                               |      |
| 1.1      | Purpose.....                                 | 1    |
| 1.2      | Scope.....                                   | 1    |
| 1.3      | Options and Information .....                | 2    |
| 1.4      | Units and Tolerances .....                   | 2    |
| 1.5      | References.....                              | 2    |
| 1.6      | Quality Assurance .....                      | 2    |
| 1.7      | Safety Considerations .....                  | 3    |
| 2        | <u>CONDUCTORS</u>                            |      |
| 2.1      | Listed Pair Conductors .....                 | 3    |
| 2.1.1    | Requirements .....                           | 3    |
| 2.1.2    | Factory Joints .....                         | 3    |
| 2.2      | Conductors of Coaxial Unit.....              | 3    |
| 2.2.1    | Center Conductor of Coaxial Unit .....       | 3    |
| 2.2.1.1  | Resistance Requirements .....                | 3    |
| 2.2.1.2  | Tensile and Elongation Requirements.....     | 3    |
| 2.2.1.3  | Factory Joints .....                         | 3    |
| 2.2.2    | Outer Conductor Shield of Coaxial Unit ..... | 3    |
| 2.2.2.1  | Shielding Tape .....                         | 5    |
| 2.2.2.2  | Braid .....                                  | 5    |
| 2.2.2.3  | Outer Shield .....                           | 6    |
| 2.2.2.4  | Outer Braid .....                            | 6    |
| 3        | <u>CONDUCTOR INSULATION</u>                  |      |
| 3.1      | Conductor Insulation for Listed Pairs .....  | 6    |
| 3.1.1    | Insulation Material.....                     | 6    |
| 3.1.2    | Insulation Type .....                        | 6    |
| 3.1.3    | Insulation Dimensions and Colors.....        | 6    |
| 3.1.4    | Splices.....                                 | 7    |
| 3.1.5    | Insulation Physical Requirements .....       | 7    |
| 3.1.5.1  | Adhesion.....                                | 7    |
| 3.1.5.2  | Elongation.....                              | 7    |
| 3.1.5.3  | Cold Bend .....                              | 7    |
| 3.1.5.4  | Shrinkback.....                              | 7    |
| 3.1.5.5  | Thermal Oxidative Stability. ....            | 8    |
| 3.1.5.6  | Heat Exposure Aging.....                     | 8    |
| 3.1.6    | Splice Test .....                            | 8    |
| 3.1.7    | List Length and Color Coding.....            | 8    |

## TABLE OF CONTENTS

| CONTENTS | SECTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | PAGE |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|          | <ul style="list-style-type: none"> <li>2.2 Conductor Insulation for Center Conductor of Coaxial Unit..... 9 <ul style="list-style-type: none"> <li>2.2.1 Insulation Material..... 9</li> <li>2.2.2 Insulation Type ..... 9</li> <li>2.2.3 Insulation Dimension ..... 9</li> <li>2.2.4 Insulation Physical Requirements ..... 9 <ul style="list-style-type: none"> <li>2.2.4.1 Adhesion..... 9</li> <li>2.2.4.2 Thermal Oxidative Stability of IPEST of Foam Dielectric .... 10</li> <li>2.2.4.3 Shrinkage..... 10</li> </ul> </li> </ul> </li> </ul> |      |
|          | <u>SECTION 3: ELECTRICAL ESSENTIALS</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |
|          | <ul style="list-style-type: none"> <li>3.1 Strength Member / Messenger Options..... 10</li> <li>3.2 Steel Reinforcement..... 10 <ul style="list-style-type: none"> <li>3.2.1 Galvanized Steel Messenger ..... 10</li> <li>3.2.2 Tensile Strength..... 10</li> <li>3.2.3 Splicing..... 11</li> </ul> </li> <li>3.3 Synthetic Reinforcement ..... 11 <ul style="list-style-type: none"> <li>3.3.1 Non Metallic Strength Member..... 11</li> <li>3.3.2 Splicing..... 11</li> </ul> </li> </ul>                                                          |      |
| 5        | <u>JACKET CONFORMANCE</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |
|          | <ul style="list-style-type: none"> <li>5.1 Design Options..... 11 <ul style="list-style-type: none"> <li>5.1.1 Single Coaxial Unit ..... 11</li> <li>5.1.2 Joint Core ..... 11</li> <li>5.1.3 Composite/Hybrid or Butterfly Design ..... 11</li> </ul> </li> <li>5.2 Core Wrap..... 11</li> <li>5.3 Zip Cord..... 11</li> </ul>                                                                                                                                                                                                                      |      |
| 6        | <u>JACKET</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |
|          | <ul style="list-style-type: none"> <li>6.1 Jacket Material ..... 11</li> <li>6.2 Jacket Thickness..... 11</li> <li>6.3 Jacket Eccentricity..... 11</li> <li>6.4 Diameter over Coax-Jacket..... 11</li> <li>6.5 Completed Wire Jacket Requirements ..... 11 <ul style="list-style-type: none"> <li>6.5.1 Tensile Strength..... 15</li> <li>6.5.2 Elongation..... 15</li> <li>6.5.3 Heat Exposure Aging..... 15</li> <li>6.5.4 Moisture Absorption..... 15</li> </ul> </li> </ul>                                                                      |      |

## TABLE OF CONTENTS

| CONTENTS | SECTION                                               | PAGE |
|----------|-------------------------------------------------------|------|
| 7        | <u>ELECTRICAL REQUIREMENTS OF LISTED Pairs</u>        |      |
| 7.1      | Electrical Requirements of Listed Pairs .....         | 15   |
| 7.1.1    | Continuity.....                                       | 15   |
| 7.1.2    | Conductor Resistance.....                             | 15   |
| 7.1.3    | Resistance Imbalance .....                            | 15   |
| 7.1.4    | Mutual Capacitance .....                              | 15   |
| 7.1.5    | Pair-to-Pair Capacitance Imbalance .....              | 16   |
| 7.1.6    | Pair-to-Ground Capacitance Imbalance .....            | 16   |
| 7.1.7    | Attenuation-Carry.....                                | 16   |
| 7.1.8    | Attenuation-Set .....                                 | 16   |
| 7.1.9    | Crosstalk.....                                        | 16   |
| 7.1.10   | Insulation Resistance-Set .....                       | 16   |
| 7.1.11   | Dielectric Strength-Carry.....                        | 17   |
| 7.1.12   | Fusing Coordination.....                              | 17   |
| 7.2      | Electrical Requirements of Coaxial Unit.....          | 17   |
| 7.2.1    | Continuity.....                                       | 17   |
| 7.2.2    | Conductor Resistance.....                             | 17   |
| 7.2.3    | Insulation Resistance.....                            | 17   |
| 7.2.4    | Dielectric Strength .....                             | 17   |
| 7.2.5    | Characteristic Impedance .....                        | 17   |
| 7.2.6    | Structural Return Loss .....                          | 18   |
| 7.2.7    | Shielding Effectiveness.....                          | 18   |
| 7.2.8    | Attenuation .....                                     | 18   |
| 7.2.9    | Velocity of Propagation .....                         | 18   |
| 7.2.10   | Heat Aging Test.....                                  | 18   |
| 8        | <u>MECHANICAL REQUIREMENTS</u>                        |      |
| 8.1      | Impact Test-Damaged.....                              | 19   |
| 8.2      | Impact Test-Aged.....                                 | 20   |
| 8.3      | Static Load Test .....                                | 20   |
| 8.4      | Plasticizer Compatibility.....                        | 20   |
| 8.5      | Compatibility of Jacket and Fiber Adhesive (N/A)..... | 20   |
| 8.6      | Abrasion Resistance .....                             | 20   |
| 8.7      | Cold Temperature Handling-Damaged.....                | 21   |
| 8.8      | Cold Temperature Handling-Aged .....                  | 21   |
| 8.9      | Peel Separation .....                                 | 22   |
| 8.9.1    | Room Temperature Separation.....                      | 22   |
| 8.9.2    | Cold Temperature Separation.....                      | 22   |
| 8.10     | National Electrical Code .....                        | 22   |

## TABLE OF CONTENTS

| CONTENTS | SECTION                                | PAGE |
|----------|----------------------------------------|------|
| 9        | <u>APPENDIX A PACKAGING</u>            |      |
|          | 9.1 Jacket Marking .....               | 22   |
|          | 9.2 Length Marking .....               | 23   |
|          | 9.3 Jacket In-Marking Durability ..... | 23   |
|          | 9.4 End-Sealing .....                  | 23   |
|          | 9.5 Packaging .....                    | 23   |

## TABLES

|           |                                                                             |    |
|-----------|-----------------------------------------------------------------------------|----|
| Table 2-1 | Conductivity and DC Resistance of Center Conductor Coaxial Unit .....       | 4  |
| Table 2-2 | Elongation and Tensile Strength of Center Conductor Coaxial Unit .....      | 4  |
| Table 2-3 | Diameter of Outer Conductor Coaxial Unit .....                              | 5  |
| Table 3-1 | Conductor Insulation Color of Twisted Pairs .....                           | 7  |
| Table 3-2 | Twisted Pair Color Code .....                                               | 7  |
| Table 3-3 | Diameter and Eccentricity of Center Conductor Insulation Coaxial Unit ..... | 9  |
| Table 3-4 | Center Conductor Insulation Adhesion Coaxial Unit .....                     | 9  |
| Table 4-1 | Diameter of Galvanized Steel Messengers .....                               | 10 |
| Table 6-1 | Diameter over Jacket Coaxial Unit .....                                     | 11 |
| Table 7-1 | Loop Resistance Coaxial Unit .....                                          | 17 |
| Table 7-2 | Attenuation Requirements Coaxial Unit .....                                 | 19 |
| Table I   | Specifications referenced in this Standard .....                            | 23 |
| Table 1-1 | Test Current and Current Duration Fusing Coordination Test .....            | 23 |

## FIGURES

|            |                                                                                |    |
|------------|--------------------------------------------------------------------------------|----|
| Figure 5-1 | Hybrid Composite and Butterfly Designs .....                                   | 12 |
| Figure 5-2 | Figure 5 Design .....                                                          | 12 |
| Figure 6-1 | Jacket Thickness Measurement Method Standard and Shielded Coaxial Cables ..... | 13 |
| Figure A-1 | Twisting Test Configuration .....                                              | 23 |
| Figure 1-1 | Fusing Coordination Test Configuration .....                                   | 23 |

## APPENDICES

|            |                                                                                      |    |
|------------|--------------------------------------------------------------------------------------|----|
| Appendix A | Test Procedure For Twisting and Hygroscopicity .....                                 | 27 |
| Appendix B | Jacket Zip Cord Test .....                                                           | 29 |
| Appendix C | Solution Method to Determine Apparent Absorption Coefficient for PVC Materials ..... | 30 |
| Appendix D | Fusing Coordination Test .....                                                       | 32 |

**TABLE OF CONTENTS**

| CONTENTS | SECTION | PAGE |
|----------|---------|------|
|----------|---------|------|

**INFORMATIVE ANNEXES**

|                     |                                               |     |
|---------------------|-----------------------------------------------|-----|
| Informative Annex A | Product Guide .....                           | A-1 |
| Informative Annex B | ICEA Telecommunications Cable Standards ..... | B-1 |

**ACRONYMS, ABBREVIATIONS AND SYMBOLS**

|                  |                                                |
|------------------|------------------------------------------------|
| A                | apparent absorption coefficient                |
| ac               | alternating current                            |
| ANSI             | American National Standards Institute          |
| AS <sub>TM</sub> | American Society for Testing and Materials     |
| A <sub>W</sub>   | American Wire Gauge                            |
| °C               | degrees of temperature, Celsius scale          |
| CAS              | Chemical Abstract Services                     |
| dB               | decibels                                       |
| dc               | direct current                                 |
| EIA              | Electronics Industry Alliance                  |
| °F               | degrees of temperature, Fahrenheit scale       |
| ft               | foot or feet                                   |
| g                | gram(s)                                        |
| Hz               | hertz                                          |
| ICEA             | Insulated Cable Engineers Association          |
| IS <sub>DN</sub> | Integrated Services Digital Network            |
| ISO              | International Organization for Standardization |
| in               | inch or inches                                 |
| kg               | kilogram                                       |
| kHz              | kilohertz                                      |
| km               | kilometer                                      |
| kPa              | kilopascal                                     |
| LAN              | Local Area Network                             |
| lb               | pound of force                                 |
| m                | meter                                          |
| Mb               | megabits                                       |
| mg               | milligram                                      |
| MHz              | megahertz                                      |
| min.             | minimum                                        |
| ml               | milliliter                                     |
| mm               | millimeter                                     |
| mm <sup>2</sup>  | square millimeter                              |
| MPa              | megapascal                                     |
| N                | Newton                                         |
| NESC             | National Electrical Safety Code                |
| NFPA             | National Fire Protection Association           |
| nF               | nanofarad                                      |
| NI <sub>1</sub>  | Network Interface Device                       |
| NI <sub>2</sub>  | Network Interface Unit                         |
| %                | percent                                        |
| pF               | picrofarad                                     |
| POTS             | Plain Old Telephone Service                    |
| psi              | pounds per square inch                         |
| PVC              | polyvinyl chloride                             |
| RF               | radio frequency                                |
| rms              | root-mean-square                               |

## **ACRONYMS, ABBREVIATIONS AND SYMBOLS - continued**

|      |                                                                    |
|------|--------------------------------------------------------------------|
| SCSE | Society of Cable Telecommunication Engineers                       |
| sec  | second                                                             |
| 1    | North American Digital Hierarchy Line Code Equivalent to 1.5 b/sec |
|      | Underwriters Laboratories                                          |
|      | volt                                                               |
| AN   | Wide Area Network                                                  |
|      | approximation symbol                                               |
| °    | degrees symbol, temperature or angle                               |
| "    | inches or inch symbol                                              |

## COAXIAL AND COAXIAL/TWISTED PAIR COMPOSITE AERIAL SERVICE WIRES TECHNICAL REQUIREMENTS

### SECTION 1 GENERAL

- 1.1 PURPOSE The purpose of this Standard is to establish generic technical requirements that may be referenced by individual telecommunications wire specifications covering products intended for the aerial outside plant use. The parameters covered provide material, construction, and performance requirements.

Because this Standard does not cover all details of individual wire designs, it cannot be used as a single document for procurement of product. This Standard is intended to be used in conjunction with an individual product specification that provides complete design details for the specific wire type and designates the applicable performance requirements. Such individual wire specifications may be prepared either by the user or the manufacturer. The specification designated for procurement is at the option of the user.

- 1.2 SCOPE This Standard covers mechanical and electrical requirements of service wires containing at least one coaxial core and optionally up to twisted pairs, used for service applications to extend the telephone/multimedia circuit from the distribution terminal to the subscriber's station protector NI (Network Interface Device) or protected NI (Network Interface Unit).

Furthermore, a distinction between **Type I** and **Type II** is made with regard to transmission characteristics and shielding materials of the coaxial unit.

Aerial Service wire is intended to be self-supporting and shall contain strength members to accommodate the appropriate requirements of this Standard. The self-supporting properties may be accomplished by utilizing a zinc coated steel strength member or synthetic fibers as strength members embedded in a suitably shaped jacket.

The coaxial unit is intended to be used for either RF or compressed digital video and radio transmissions. This unit shall also allow bi-directional traffic. The coaxial unit should also be capable of carrying high speed digital signals for LAN/WAN applications such as T1, ISDN, etc. as well as POTS (Plain Old Telephone Services). The network supporting these protocols will be based upon physical lines having a characteristic impedance of 75 ohms. The coaxial units are specified in three and four common sizes for **Type I** and **Type II** respectively, to accommodate different drop lengths.

The twisted pair wires are intended for voice and data transmission and their characteristics are based upon existing system requirements and protected application needs.