American National Standard

Electrical and Electronic Cross-linked, Modified Polyethylene (XLPE) Insulated 125°C Hook-Up Wire, Types L (600 V), LL (1000 V), and LX (3000 V)

Secretariat:
National Electrical Manufacturers Association

Approved: September 26, 2013

Published: July 25, 2014

American National Standards Institute, Inc.
NOTICE AND DISCLAIMER

The information in this publication was considered technically sound by a consensus among persons engaged in its development at the time it was approved. Consensus does not necessarily mean there was unanimous agreement among every person participating in the development process.

The American National Standards Institute (ANSI) standards and guideline publications, of which the document herein is one, are developed through a voluntary standards development process. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this publication. Although NEMA administers the process and establishes rules to promote fairness in the development of consensus, it does not write the documents, nor does it 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.

NEMA disclaims liability for any personal injury, property, or other damages of any nature, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. NEMA disclaims and makes no guaranty or warranty, express 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 particular purpose(s) or need(s). NEMA does not undertake to guarantee the performance of any individual manufacturer’s or seller’s products or services by virtue of this standard or guide.

In publishing and making this document available, NEMA is not undertaking to render professional or other services for or on behalf of any person or entity, nor is NEMA 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 circumstance. 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.

NEMA has no power, nor does it undertake to police or enforce compliance with the contents of this document. NEMA 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 NEMA and is solely the responsibility of the certifier or maker of the statement.
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>GENERAL</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>SCOPE</td>
<td>2</td>
</tr>
<tr>
<td>1.3.1</td>
<td>REFERENCED STANDARDS AND SPECIFICATIONS</td>
<td>2</td>
</tr>
<tr>
<td>1.3.2</td>
<td>RECOMMENDED USES OF WIRE TYPES</td>
<td>2</td>
</tr>
<tr>
<td>1.3.3</td>
<td>PART IDENTIFICATION NUMBER (PIN)</td>
<td>2</td>
</tr>
<tr>
<td>1.4</td>
<td>CONDUCTORS</td>
<td>4</td>
</tr>
<tr>
<td>2.1</td>
<td>CONDUCTOR MATERIALS</td>
<td>4</td>
</tr>
<tr>
<td>2.2</td>
<td>CONDUCTOR COATINGS</td>
<td>4</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Tin-Coated Conductors</td>
<td>4</td>
</tr>
<tr>
<td>2.2.2</td>
<td>Silver-Coated Conductors</td>
<td>4</td>
</tr>
<tr>
<td>2.3</td>
<td>STRANDING</td>
<td>4</td>
</tr>
<tr>
<td>2.4</td>
<td>MINIMUM WIRE DIAMETER</td>
<td>4</td>
</tr>
<tr>
<td>2.5</td>
<td>CONDUCTOR SPLICES</td>
<td>4</td>
</tr>
<tr>
<td>3.1</td>
<td>GENERAL</td>
<td>5</td>
</tr>
<tr>
<td>3.2</td>
<td>XLPE INSULATION</td>
<td>5</td>
</tr>
<tr>
<td>4.1</td>
<td>WIRE IDENTIFICATION</td>
<td>8</td>
</tr>
<tr>
<td>4.1.1</td>
<td>CIRCUIT IDENTIFICATION</td>
<td>8</td>
</tr>
<tr>
<td>4.2</td>
<td>IDENTIFICATION BY PRINTING</td>
<td>8</td>
</tr>
<tr>
<td>4.2.1</td>
<td>Identification of Product</td>
<td>8</td>
</tr>
<tr>
<td>5.1</td>
<td>PHYSICAL AND ELECTRICAL REQUIREMENTS</td>
<td>9</td>
</tr>
<tr>
<td>5.2</td>
<td>QUALITY CONFORMANCE INSPECTION OF FINISHED PRODUCT</td>
<td>9</td>
</tr>
<tr>
<td>5.2.1</td>
<td>Definitions</td>
<td>9</td>
</tr>
<tr>
<td>5.2.2</td>
<td>Sampling Inspection</td>
<td>9</td>
</tr>
<tr>
<td>5.3</td>
<td>WORKMANSHP</td>
<td>9</td>
</tr>
<tr>
<td>5.4</td>
<td>MATERIALS CERTIFICATION</td>
<td>9</td>
</tr>
<tr>
<td>6.1</td>
<td>TEST PROCEDURES</td>
<td>11</td>
</tr>
<tr>
<td>6.1.1</td>
<td>PHYSICAL TESTS</td>
<td>11</td>
</tr>
<tr>
<td>6.1.2</td>
<td>Test Temperature</td>
<td>11</td>
</tr>
<tr>
<td>6.1.3</td>
<td>Heat Resistance</td>
<td>11</td>
</tr>
<tr>
<td>6.1.4</td>
<td>Insulation Tensile Strength and Elongation</td>
<td>11</td>
</tr>
<tr>
<td>6.1.5</td>
<td>Dimensional Inspection</td>
<td>11</td>
</tr>
<tr>
<td>6.1.6</td>
<td>Shrinkage</td>
<td>11</td>
</tr>
<tr>
<td>6.1.7</td>
<td>Flammability</td>
<td>12</td>
</tr>
<tr>
<td>6.1.8</td>
<td>Heat Aging Test</td>
<td>12</td>
</tr>
<tr>
<td>6.1.9</td>
<td>Fungus Resistance</td>
<td>12</td>
</tr>
<tr>
<td>6.1.10</td>
<td>Cold Bend</td>
<td>12</td>
</tr>
</tbody>
</table>

© 2014 National Electrical Manufacturers Association
6.2 ELECTRICAL TESTS
   6.2.1 Conductor Resistance
   6.2.2 Spark or Impulse Test
   6.2.3 Dielectric Strength
   6.2.4 Insulation Resistance

Section 7 NOTES
   7.1 PACKAGING REQUIREMENTS
   7.2 LABELING
   7.3 LENGTHS

Section 8 ORDERING DATA
   8.1 ORDERING INFORMATION

TABLES
   1-1 CONDUCTOR MATERIAL AND COATING
   1-2 AWG NOMINAL CONDUCTOR SIZE
   1-3 NUMBER OF STRANDS
   1-4 COLOR
   3-1 DIMENSIONS-TYPE WIRES
   4-1 LENGTH OF LAY OF STRIPES
   5-1 PHYSICAL AND ELECTRICAL REQUIREMENTS FOR TYPE L, LL, AND LX WIRES
   7-1 MINIMUM LENGTHS
FOREWORD

This standards publication was developed by the NEMA High Performance Wire and Cable Section. It was developed to ensure that these types of hook-up wire can be procured and that they will meet requirements associated with high reliability commercial electrical and electronic equipment in which it is used. Compliance with provisions of this standards publication is strictly voluntary and any certification of compliance is left to the discretion of the buyer and seller.

This standards publication was designed as a non-government standard for replacement of MIL-W-16878 XLPE insulated wire slash sheets (/14, /15, /16,).

This standards publication was developed by the High Performance Wire and Cable Section of NEMA. Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Section was composed of the following members:

AFC Cable Systems
Apical Division, Kaneka North America
Belden Inc.
Berk-Tek a Nexans Company
Cable USA LLC.
Champlain Cable Corporation
Coleman Cable Inc.
Comtran Cable LLC
Electrolock, Inc.
Freeport McMoRan Copper & Gold
General Cable
Harbour Industries LLC.
IWG High Performance Conductors
Lockheed Martin MS2
Marine Tech Wire and Cable, Inc.
Nexans AmerCable
Quirk Wire Company, Inc.
Radix Wire Company
RSCC Aerospace and Defense
SEA Wire and Cable, Inc.
Southwire Company
The Monroe Cable Company, Inc.
The Okonite Company
TE Connectivity
Wiremasters, Inc.

© 2014 National Electrical Manufacturers Association
Section 1
GENERAL

1.1 SCOPE
This standards publication covers specific requirements for cross-linked, modified polyethylene insulated solid and stranded wire designed to the internal wiring of high reliability electrical and electronic equipment. This document addresses 600 V (Type L), 1000 V (Type LL), and 3000 V (Type LX) wire and permits continuous conductor temperature ratings of −65°C to +125°C with either tin-coated, or silver-coated conductors. These types of hook-up wire are used when the following requirements are called for:

- Moderate temperature resistance
- Low temperature resistance
- Moderate dielectric constant
- Good flexibility and flex life when stranded conductors are used
- Solder iron resistance for easier solder terminations without potential damage
- Good fire resistance

1.2 REFERENCED STANDARDS AND SPECIFICATIONS

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

B3
Soft or Annealed Copper Wire

B33
Tinned Soft or Annealed Copper Wire

B286
Copper Conductors for Use in Hook-up Wire for Electronics

B298
Silver Coated Soft or Annealed Copper Wire

B624
High-Strength, High Conductivity Copper-Alloy Wire for Electronic Application

D3032
Methods of Testing Hook-Up Wire Insulation

G21
Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

American Society for Quality Control
611 E. Wisconsin Ave.
Milwaukee, WI 53202

ANSI/ASQC Z1.4
Sampling Procedures and Tables for Inspection by Attributes

Electronics Industries Association
2500 Wilson Blvd.
Arlington, VA 22201

EIA-359-A-85
EIA Standard Colors for Color Identification and Coding

© 2014 National Electrical Manufacturers Association