

ANSI C119.6-2011

American National
Standard for Electric
Connectors - Non-Sealed,
Multiport Connector
Systems Rated 600 Volts
or Less for Aluminum
and Copper Conductors





ANSI C119.6-2011

American National Standard

**For Electric Connectors—
Non-Sealed, Multiport Connector Systems
Rated 600 Volts or Less
for Aluminum and Copper Conductors**

Secretariat:

National Electrical Manufacturers Association

Approved May 5, 2011

American National Standards Institute, Inc.

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.

ANSI standards and guidelines publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together volunteers and/or seeks out the views of person who have interest in the topic covered by this publication. While NEMA administers the process to promote fairness in the development of consensus, it does not write the document and 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.

NEMA disclaims liability for any 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. 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 of your particular purposes or needs. NEMA 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, 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 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.

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.

**AMERICAN
NATIONAL
STANDARD**

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

Caution Notice: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

**National Electrical Manufacturers Association
1300 North 17th Street, Rosslyn, VA 22209**

© Copyright 2011 by National Electrical Manufacturers Association.

All rights reserved 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 Pan American Copyright Conventions.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Printed in the United States of America.

< This page intentionally left blank. >

Contents

Foreword.....	v
1 Scope and Purpose.....	1
1.1 Scope.....	1
1.2 Purpose.....	1
2 Referenced Standards	1
3 Definitions	1
4 Performance Requirements	2
4.1 General	2
4.2 Mechanical Tests.....	3
4.3 Electrical Tests	3
4.4 Reusability	5
5 Sampling	6
5.1 General	6
5.2 Mechanical.....	6
5.3 Electrical Tests	6
5.4 Reusability	6
6 Test Methods	6
6.1 General	6
6.2 Mechanical.....	7
6.3 Electrical	8
6.4 Reusability	12
7 Test Report	12
8 Marking.....	13
9 Assembly Instructions	13

Annexes

A Applicable Standards	23
B Test Configurations	24
C Suggested Thermocouple Locations	31
D Heat Cycle Data Sheet.....	32

Tables

Table 1 Tensile Load, AWG Cable	14
Table 2 Tensile Load, Metric Cable	14
Table 3 Tightening Torque.....	15
Table 4 Test Duration.....	15
Table 5 Resistance and Temperature Measurement Intervals.....	16
Table 6 Length of Exposed Conductor	16
Table 7 Conductor Lengths for Current Cycle Tests, AWG Sizes	17
Table 8 Conductor Lengths for Current Cycle Tests, Metric Sizes.....	17
Table 9 Suggested Initial Test Current to Raise AWG Control Conductor Temperature 100°C (212°F) ...	18
Table 10 Suggested Initial Test Current to Raise Metric Control Conductor Temperature 100°C (212°F).19	
Table 11 Current Cycle Periods for AWG Control Conductors.....	19
Table 12 Current Cycle Periods for Metric Control Conductors.....	20

Figures

Figure 1 Heat Cycle Schematic 21
Figure 2 Copper System Stability Test 22

Foreword

(This Foreword is not part of American National Standard C119.6-2011)

This standard describes current cycle and mechanical tests used to establish performance characteristics of non-sealed, multiport distribution connectors used to join aluminum-to-aluminum, aluminum-to-copper, or copper-to-copper conductors.

This revision has been reorganized to follow international formatting, and to improve the organization of information throughout the document when compared to the previous version.

Substantive changes to the standard have been made in the C119.6-2011 version of the standard. A substantive change is one that directly and materially affects performance of a product and which requires testing or retesting to meet the current edition of a standard. The substantive changes to the standard are:

This version of the standard requires retesting the performance of a product if there have been substantive changes made to the product.

This revision includes the addition of spreadsheet files in Annex D which can be used to collect current cycle test data, calculate connector stability, and generate graphs of the data and print the data to provide test results as part of the test report. The spreadsheets are provided to give test laboratories a standardized method to collect, calculate and report test data and prepare test reports. These spreadsheets were not part of earlier editions.

This standard incorporates an alternate, accelerated current cycle test method, henceforth referred to as the current cycle submersion test (CCST). The CCST method differs from the traditional current cycle test in that test conductors are rapidly cooled by immersion in chilled water at the beginning of the current-OFF cycle and requires fewer total current-ON and current-OFF cycles. The CCST method differs from the traditional current cycle test (CCT) in that test connectors are rapidly cooled by immersion in chilled water at the beginning of the current-OFF cycle. Comparative testing has demonstrated that the CCST method will provide essentially the same performance test results as the traditional current cycle test (CCT) in fewer test cycles. The current cycle test remains the preferred test method recommended for qualification of a connector.

The Subcommittee on Multiport Connectors of the Accredited Standards Committee on Connectors for Electric Utility applications, C119, in its constant review of the publication, continues to seek out the views of responsible users that will contribute to the development of better standards.

Suggestions for improvement of this standard will be welcome. They should be sent to the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1752, Rosslyn, Virginia 22209.

This standard was processed and approved for submittal to American National Standards Institute (ANSI) by the Accredited Standards Committee on Connectors for Electrical Utility Applications, C119. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time the committee approved this standard, the ANSI ASC C119 Committee had the following members:

Douglas Harms, Chairman

Ronald Lai, Vice Chairman

Paul Orr, Secretary

Organization Represented:

Aluminum Association

Jean-Marie Asselin

Electric Utility Industry

Michael Dyer

	Warren Hadley Douglas Harms James Harris Harry Hayes Alan Kasanow Curt Schultz James Sprecher Gerald Wasielewski David West Michael Zaffina
National Electrical Manufacturers Association	Jason Bundren Scott Casler David Dembowski Barry Johnson Ronald Lai John Makal Colin McCullough Greg Nienaber Wayne Quesnel Carl Tamm Carl Taylor James Zahnen
Rural Utilities Service (RUS)	Trung Hiu
Tennessee Valley Authority	Jeffrey Nelson
Testing Laboratories	Jake Killinger Chris Morton Craig Pon Paul Springer Giovanni Velazquez
Other	Peter Bowers Tip Goodwin Stanley Hodgins John Olenik Joe Renowden Allen Wilcox

The C119.6 Subcommittee on Non-Sealed, Multipoint Connector Systems Rated 600 Volts or Less for Aluminum and Copper Conductors, which developed the revisions of this standard, had the following members:

Harry Hayes III, Chairman

James Zahnen, Vice Chairman

Paul Orr, Secretary

Peter Bowers

Jason Bundren

Scott Casler

Michael Dyer

Warren C. Hadley
Douglas P. Harms
Harry Hayes
Trung Hiu
Barry Johnson
Alan Kasanow
Jake Killinger
Ronald Lai
John Makal
J.C. Mathieson
Colin McCullough
Richard Morin
Greg T. Nienaber
Wayne Quesnel
Jesus Rodriguez
Curt Schultz
Paul Springer
Carl R. Tamm
Carl Taylor
Giovanni Velazquez
Richard (Jeff) J. Waidelich
Gerald Wasielewski
David West
Allen Wilcox
Michael Zaffina
James Zahnen

< This page intentionally left blank. >

**For Electric Connectors—
Non-Sealed, Multiport Connector Systems Rated 600 Volts or Less for Aluminum
and Copper Conductors****1 Scope and Purpose****1.1 Scope**

This standard covers non-sealed, multiport distribution connectors rated 600 volts or less used for making electrical connections between aluminum-to-aluminum, aluminum-to-copper, or copper-to-copper conductors for above grade, electric utility applications.

This standard establishes the electrical and mechanical test requirements for connectors used at normal operating temperatures not to exceed 90°C (194°F) and is not intended to recommend any other operating conditions.

1.2 Purpose

The purpose of this standard is to give reasonable assurance to the user that connectors meeting the requirements of this standard will perform in a satisfactory manner, provided they have been properly selected for the intended application and are installed in accordance with the manufacturer's recommendations. The service operating conditions and the selection of the connector is the responsibility of the user.

2 Referenced Standards

This standard is intended to be used in conjunction with the following standards. When a referenced standard is superseded by a revision approved by the American National Standards Institute, Inc., the referenced revision shall apply.

ASTM E4-10 *Standard Practices for Force Verification of Testing Machines*

IEEE 837-2002 *Standard for Qualifying Permanent Connections Used in Substation Grounding*

3 Definitions

Bolted-type connector: A connector in which the contact between the conductor and the connector is made by pressure exerted by one or more clamping bolts.

CCT (Current Cycle Test): Current cycle heating and cooling are done in air.

CCST (Current Cycle Submersion Test): Current cycle heating is done in air and cooling is done using water submersion.

Conductor: Conducting material used as a carrier of electric current.

Connector: A device joining two or more conductors for the purpose of providing a continuous electrical path.