STD.NEMA WC 72-ENGL 1999 ■ 6470247 0520710 T42 ■

NEMA STANDARDS PUBLICATION

WC 72

CONTINUITY OF COATING TESTING FOR ELECTRICAL CONDUCTORS

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

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STD.NEMA WC 72-ENGL 1999 ■ 6470247 0520711 989 ■

NEMA Standards Publication WC 72-1999

Continuity of Coating Testing for Electrical Conductors

Published by

National Electrical Manufacturers Association
1300 N. 17th Street
Rosslyn, Virginia 22209

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Foreword

This standard has been developed by the Polysulfide Task Force of the Aerospace Subcommittee (members as listed below) of the High Performance Wire and Cable Section of NEMA in close coordination between manufacturers, users, third party certifying agencies and others having specialized experience. The Aerospace Subcommittee of the High Performance Wire and Cable Section of NEMA periodically reviews this standard for any revisions necessary to keep it up to date. Proposed revisions or comments should be submitted to:

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Barcel/CDT—Irvine, CA
BICC Brand-Rex Company—Willimantic, CT
Cable USA—Naples, FL
Judd Wire Inc.—Turner Falls, MA
Montrose/CDT—Auburn, MA
Phelps Dodge PHC— Lexington, SC
Quirk Wire—W. Brookfield, MA
Radix Wire—Cleveland, OH
Raychem Corp.—Menlo Park, CA
Rockbestos-Surprenant Corp.—Clinton, MA
Tensolite Company—St. Augustine, FL

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Section 1
GENERAL

1.1 SCOPE

This standards publication contains a review of the problems that have occurred when polysulfide testing has been improperly imposed on tin, silver and nickel coated copper and copper alloy *stranded* conductors or on tin, silver or nickel coated copper and copper alloy single or stranded conductors after insulating. The Sodium Polysulfide Test is a materials inspection test, not a finished wire or cable test, and should only be imposed on a single strand/conductor prior to stranding or insulating. A new test, called the "white card" continuity of coating test, is presented as a solution to these problems and can also be utilized on shield wires. This new test is referenced in ANSI/NEMA WC 67.

1.1 REFERENCED STANDARDS

American Society of Testing Materials
100 Barr Harbor Drive
West Conshohocken, Pennsylvania 19428-2959

ASTM B33-94	*Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes*
ASTM B298-94	*Standard Specification for Silver-Coated Soft or Annealed Copper Wire*
ASTM B355-95	*Standard Specification for Nickel-Coated Soft or Annealed Copper Wire*

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ANSI/NEMA WC 67-1997	*Standard for Uninsulated Conductors Used in Electrical and Electronic Applications*

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Section 2
BACKGROUND FOR DEVELOPMENT OF WC 72

The Sodium Polysulfide Test is the standard continuity of coating described in ASTM Standards such as B33, B298 and B355. The only purpose of this test is to evaluate the tin, silver or nickel coating of a single strand/conductor after the drawing process. However, this test has a variety of problems and limitations:

a. This test is performed in a laboratory and is not practical for use on a production floor.

b. This test uses corrosive chemicals that require special handling, safety precautions and proper hazardous waste disposal.

c. The coating of stranded conductors can not be properly evaluated.

d. The coating of an *insulated* single or stranded conductor can not be properly evaluated.

e. The Sodium Polysulfide Test can not be used to evaluate the coating of braided or served shields, whether round or flat.

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Section 3
INDUSTRY PROBLEMS AND OBSERVATIONS

The Sodium Polysulfide Test for continuity of coating has been the primary method for evaluating the coatings of tin, silver and nickel coated copper and copper alloy wires for many years. In the referenced ASTM Standards, the proper application is to test single strands/conductors prior to any stranding or insulating. Over the years, however, this test has been misapplied in attempts to evaluate the coating of stranded conductors, of insulated single and stranded conductors, of wires after humidity tests and of braided and served shield wires. Although these wires can be physically tested, the act of preparing the samples for testing can damage the coating, thus creating false readings. In addition, the effects of lighting and reflectance on stranded conductors can be misinterpreted as failures.

Magnification has also been incorrectly used to examine wires as part of the polysulfide test. While strand/conductor coatings inherently have a degree of porosity, microscopic examination is beyond the scope of this test. To the best knowledge of those who developed this standard, there is no known evidence of microscopic coating discontinuities having been a source of wire failures in service.

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Section 4
THE "WHITE CARD" CONTINUITY OF COATING TEST

4.1 PROCEDURE

Check the wire in a well-lighted area (using white light whenever possible). Look at the wire on the spool with an unaided eye and also by holding a white index card against the surface of the wire. Roll the spool to make sure that the entire exposed surface of the wire is examined. Check for exposed copper or base metal along one side of the specimen. Due to excessive localized abrasion during stranding, shielding or cabling, any patterns of exposed copper or continuous lines shall be grounds for rejection.

The examination is intended to detect excessive damage. Random point failures shall not be cause for rejection.

4.2 EXAMINATION OF FINISHED/INSULATED PRODUCT

If this procedure is used for examination of insulated or finished product, a 4" test specimen of product shall be available for examination. Care should be taken to ensure that any failure pattern was not generated by the specimen preparation. Note that spurious readings can occur due to reflections from any non-white surface.

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Section 5
SUMMARY AND CONCLUSIONS

The "white card" test addresses the limitations and problems with the Sodium Polysulfide Test, as presented in Sections 2 and 3, while maintaining the expected quality of the coating continuity. Those who have utilized this test at their facilities have found it to be simple, reliable and a valid test for stranded conductors and shields.

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