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STANDARDS PUBLICATION / NO. RN 1-1980

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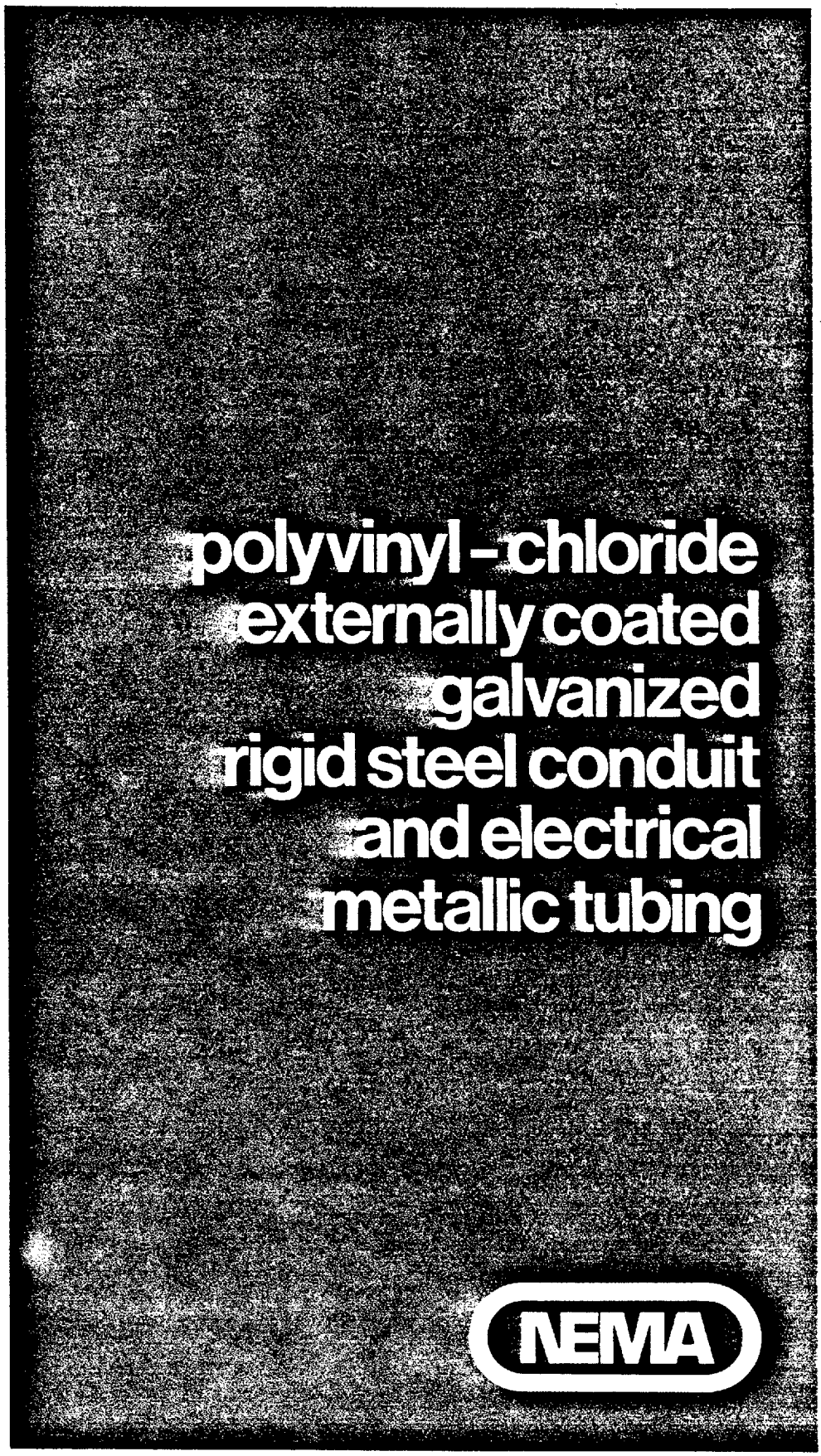

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POLYVINYL-CHLORIDE EXTERNALLY COATED GALVANIZED RIGID STEEL CONDUIT AND ELECTRICAL METALLIC TUBING

Foreword

User needs have been considered in the development of this Standards Publication.

This Standards Publication is reviewed periodically by the Steel Rigid Conduit and EMT Section of NEMA for changes which may be necessary to keep it up to date with advancing technology. Proposed or recommended revisions should be submitted to:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

* * *

Publication No. RN 1-1980 revises and supersedes RN 1-1976. The NEMA Standards and Authorized Engineering Information which appear in this publication unchanged since their appearance in RN 1-1976 were reaffirmed. Those which have been revised are followed by the appropriate classification and the date "3-19-1980."

Purpose

The purpose of this Standards Publication is to describe external plastic coatings which are applied to galvanized rigid steel conduit and galvanized steel electrical metallic tubing.

It covers the properties and dimensions of these coatings and should aid in selecting and obtaining the proper coating for added corrosion protection in various applications of these electrical raceways.

Scope

These standards cover continuous polyvinyl-chloride exterior coatings and the galvanized rigid steel conduit, threaded couplings and elbows, and steel electrical metallic tubing to which they may be applied.

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Part 1
CONDUIT AND EMT

RN 1-1.1 GALVANIZED RIGID STEEL CONDUIT

Galvanized rigid steel conduit, threaded couplings and elbows are defined in and shall conform to American National Standard C 80.1-1977.

NEMA Standard 3-19-1980.

RN 1-1.2 ELECTRICAL METALLIC TUBING (EMT)

Galvanized steel electrical metallic tubing is defined in and shall conform to American National Standard C 80.3-1977.

NEMA Standard 3-19-1980.

RN 1-1.3 THREAD PROTECTORS

Thread protectors may be used on the exposed threads of the coated conduit.

Authorized Engineering Information 11-8-1973.

Part 2
COATINGS

RN 1-2.1 CLASSIFICATION

Polyvinyl-chloride (PVC) coatings shall be classified according to their nominal applied thickness as follows:

Type 20—nominal 20 mils thick.

Type 40—nominal 40 mils thick.

	Thickness of Coating			
	Nominal		Minimum	
Type	Mils	Inches	Mils	Inches
20	20	0.020	15	0.015
40	40	0.040	35	0.035

NEMA Standard 3-19-1980.

RN 1-2.2 COATING MATERIAL

The PVC coating shall have the properties specified in Table 2-1.

NEMA Standard 3-19-1980.

RN 1-2.3 APPLICATION OF COATING

A. Cleaning

The exterior surface that is to receive the coating shall be free of grease, oil, dirt, and other extraneous matter. The surface shall be cleaned in such a manner that the galvanized surface of the conduit is not harmed or eroded.

Table 2-1
PROPERTIES OF PVC COATING

Property	Minimum Requirement	ASTM Test Method (See Appendix A)
Hardness: Shore A Shore D	75 25	D 2240-75
Tensile strength, psi	2000	D 638-77a
Elongation, percent	200	D 638-77a
Dielectric strength, volts per mil	325	D 149-75
Brittleness temperature, degrees F	5	D 1790-62 (1976)

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B. Priming

The cleaned exterior surface shall be primed with an adhesive primer suitable for use with the PVC coating material to be applied.

C. Coating

The PVC material shall be applied in powder, plastisol, or pellet form by a manufacturing method which will produce a finished product conforming to these standards.

NEMA Standard 3-19-1980.

RN 1-2.4 ELBOWS

Coated elbows shall be used with coated conduit and EMT. The thickness of the coating on elbows shall be at least equal to the thickness of the coating on the conduit or EMT.

NEMA Standard 11-8-1973.

RN 1-2.5 COUPLINGS

Coated couplings shall be used with coated conduit.

A. Type 40

Each coated coupling used with Type 40 conduit shall have a flexible PVC sleeve which extends from each end of the coupling and which will overlap the PVC coating on the conduit when the coupling has been installed on the conduit. However, when the conduit is coated with a coupling attached, a PVC sleeve conforming to this standard shall be provided on the open end of the coupling.

The length of the sleeve extension(s) shall be at least equivalent to the nominal conduit size for sizes up through 2 inches. For sizes of 2½ through 6 inches, the length of the sleeve extension(s) shall be at least 2 inches.

The PVC sleeve shall have a nominal thickness of 40 mils. The inside diameter (I.D.) of the overlapping sleeve shall be less than the outside diameter (O.D.) of the PVC-coated conduit.

B. Type 20

The thickness of the PVC coating on the coupling shall be at least equal to the thickness of the coating on the conduit.

NEMA Standard 3-19-1980.

Coated couplings for Type 20 conduit may have overlapping sleeves. When the conduit is coated with a coupling attached, a PVC sleeve is not required.

Authorized Engineering Information 3-19-1980.

RN 1-2.6 WORKMANSHIP AND APPEARANCE

The PVC coating shall be free of blisters, bubbles, and pinholes. The PVC coating shall be continuous over the entire length of the conduit except at the threads and shall be holiday-free at the time of manufacture.

A holiday is herein defined as an electrical discontinuity of less than 80,000 ohms equivalent resistance sensed with a cellulose sponge wet with a suitable electrolyte and measured with an appropriate low-voltage direct-current instrument (such as Tinker & Rasor Model M-1, or the equivalent) at the time of manufacture. A suitable electrolyte is a solution containing tap water, 3.0 percent salt (sodium chloride), and 0.5 percent detergent (such as Ivory liquid soap).

The inside of the PVC-coated conduit, couplings, and elbows and EMT shall be free of the PVC coating material.

All sleeve extensions shall be square cut.

NEMA Standard 11-8-1973.

RN 1-2.7 PERFORMANCE REQUIREMENTS

Typical physical requirements for PVC-coated conduit and EMT are given in Table 2-2.

Authorized Engineering Information 3-19-1980.

RN 1-2.8 ADHESION TEST

The adhesion of the PVC coating shall be determined by making two circumferential cuts, about ½ inch apart, through the plastic to the substrate. A third cut shall be made perpendicular to and crossing the circumferential cuts. The edge of the plastic shall be carefully lifted with a knife to form a plastic tab. This tab shall be pulled perpendicular to the conduit with a pair of pliers.

NEMA Standard 3-19-1980.

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Table 2-2
TYPICAL PHYSICAL PROPERTIES OF PVC-COATED CONDUIT AND EMT

Property	Requirement *	Test Method
Abrasion resistance, hours	200, no failure	ASTM G 6-77
Bendability, radius in inches at 73.4° ± 1.8°F	9, shall comply with par. 2.6	ASTM G 10-77
Adhesion	Greater than cohesive strength of the coating	See RN 1-2.8
Artificial weathering, hours	Minimum 1000, no adverse effect	ASTM G 23-69 (1975)

* The above requirements are based on testing a nominal 40-mil PVC coating applied over a 3/4-inch galvanized rigid steel conduit. See Appendix A for description of test methods.

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Appendix A
REFERENCED STANDARDS

American National Standards Institute, 1430 Broadway, New York, NY 10018

C 80.1-1977 *Specification for Rigid Steel Conduit, Zinc Coated*
C 80.3-1977 *Specification for Electrical Metallic Tubing, Zinc Coated*

American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103

D 149-75 *Dielectric Breakdown Voltage and Dielectric Strength of Electric Insulating Materials at Commercial Power Frequencies, Test for*

This method describes a procedure for the determination of dielectric strength of solid, semi-solid and liquid electrical insulating materials.

D 638-77a *Tensile Properties of Plastics, Test for*

This test method is used to determine the tensile strength and the percent elongation of plastic coating compounds. A Type IV specimen is tested at a crosshead speed of 2 inches per minute.

D 1790-62 (1976) *Brittleness Temperature of Plastic Film by Impact, Test for*

This method covers the determination of that temperature at which plastic film 0.25 mm (10 mils) or less in thickness exhibits a brittle failure.

D 2240-75 *Rubber Property—Durometer Hardness, Test for*

This method is used to determine the Shore A and Shore D hardness of PVC coating compounds.

G 6-77 *Abrasion Resistance of Pipeline Coatings, Test for*

This method is used to determine the abrasion resistance of the applied coating material. It measures the time to loss of infinite resistance when the coating is subjected to an abrasive slurry.

G 10-77 *Bendability of Pipeline Coatings, Test for*

This test method is used to determine the bendability of coated conduit. It consists of bending a small-diameter specimen of coated pipe around a mandrel to produce a range of short-radius bends.

G 23-69 (1975) *Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials, Practice for Operating*

This recommended practice covers the basic principles and standard operating procedure for light-and-water exposure apparatus employing a carbon-arc light source.

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The purpose of NEMA Standards, their classification and status are set forth in certain clauses of the NEMA Bylaws, which are quoted below:

Purpose of Standards

National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard.

(Bylaw—Art. V, Sec. 1)

Definition of a Standard

A standard of the National Electrical Manufacturers Association defines a product, process or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Bylaw—Art. V, Sec. 2, Subsection A)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(NEMA Policy Memorandum 84-2, dated June 7, 1984)

Classes of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product commercially standardized and subject to repetitive manufacture, which standard has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon;
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote thereon.

(Bylaw—Art. V, Sec. 2, Subsection B)

Authorized Engineering Information

Authorized Engineering Information consists of explanatory data and other engineering information of an informative character not falling within the classification of NEMA Standard or Suggested Standard for Future Design.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment and/or approval.

(Bylaw—Art. V, Sec. 4, Subsection A)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

The material identified as "Authorized Engineering Information" and "Official Standards Proposal" is designated similarly.

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STEEL RIGID CONDUIT AND ELECTRICAL METALLIC TUBING SECTION OF THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

MEMBER COMPANIES

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Harvey, IL 60426

Cerro Wire & Cable Company
Division of The Marmon Group, Inc.
Maspeth, NY 11378

Georgia Tubing Corporation
Cedar Springs, GA 31732

Occidential Coating Company
Van Nuys, CA 91405

Picoma Industries, Inc.
Martins Ferry, OH 43935

Pittsburgh Nipple Works, Inc.
Pittsburgh, PA 15212

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Cleveland, OH 44108

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Verona, PA 15147

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Carrollton, GA 30117

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