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STANDARDS PUBLICATION NO. RN 1

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Polyvinyl-Chloride(PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W., WASHINGTON, D.C. 20037

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RN 1

POLYVINYL-CHLORIDE(PVC) EXTERNALLY COATED GALVANIZED RIGID STEEL CONDUIT AND INTERMEDIATE METAL CONDUIT

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FOREWORD

The purpose of this Standards Publication is to describe plastic coatings which are applied to galvanized rigid steel conduit and galvanized steel intermediate metal conduit. This Standard covers the properties and dimensions of these coatings and is intended as an aid for selecting and obtaining the proper coating for added corrosion protection in various applications of these electrical raceways.

Publication No. RN 1-1989 supersedes RN 1-1986. NEMA Standards and Authorized Engineering Information, which appears in this publication unchanged since its appearance in RN 1-1980, was reaffirmed. Information which has been revised is followed by the appropriate classification and the revision date.

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

This Standards Publication is reviewed periodically by the Steel Rigid Conduit and Electrical Metallic Tubing 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:

Vice President, Engineering
National Electrical Manufacturers Association
2101 L Street, N.W.
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SCOPE

These standards cover continuous polyvinyl chloride exterior coatings, corrosion resistant interior coatings, and the galvanized steel conduit, galvanized steel intermediate metal conduit, threaded couplings, and elbows to which they may be applied.

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Section 1
REFERENCED STANDARDS

1.1 The following publications are adopted in whole or in part, as indicated by reference in this Standards Publication.

American National Standards Institute (ANSI)
1430 Broadway
New York, NY 10018

C80.1-1983 — *American National Standard for Rigid Steel Conduit — Zinc Coated*

C80.6-1986 — *American National Standard for Intermediate Metal Conduit*

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

D149-87 — *Test Methods for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies*
This method describes a procedure for the determination of dielectric strength of solid, semi-solid and liquid electrical insulating materials.

D638-87 — *Test Method for Tensile Properties of Plastics*
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.

D1790-83 — *Test Method for Brittleness Temperature of Plastic Film by Impact*
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.

D2240-86 — *Test Method for Rubber Property Durometer Hardness*
This method is used to determine the Shore A and Shore D hardness of PVC coating compounds.

G6-83 — *Test Method for Abrasion Resistance of Pipeline Coatings*
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.

G10-83 — *Test Method for Specific Bendability of Pipeline Coatings*
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.

G23-81 — *Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Non-metallic Materials*
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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Underwriters Laboratories, Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062

UL 6-1983	*Safety Standard for Rigid Metal Conduit*
UL 1242-1983	*Safety Standard for Intermediate Metal Conduit*

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Section 2
RIGID CONDUIT AND IMC

2.1 GALVANIZED RIGID STEEL CONDUIT

Galvanized rigid steel conduit, threaded couplings, and elbows are defined in and shall conform to American National Standard C80.1, and Underwriters Laboratories Standard 6.

If the threads are cut after the zinc coating has been applied, the threads shall be treated with a protective coating to prevent corrosion before installing.

NEMA Standard 5-19-1986.

Where unusually corrosive environments require additional protection, it is recommended that threads be zinc coated with a hot-dip process or equivalent.

Authorized Engineering Information 5-19-1986.

2.2 INTERMEDIATE METAL CONDUIT

Galvanized steel intermediate metal conduit, threaded couplings and elbows are defined in and shall conform to American National Standard C 80.6 and Underwriters Laboratories Standard 1242.

NEMA Standard 5-19-1986.

2.3 INTERIOR COATINGS

Any supplemental interior coating shall be smooth and continuous and shall be unaffected by the heat of the exterior coating process.

NEMA Standard 5-19-1986.

2.4 THREAD PROTECTORS

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

NEMA Standard 5-19-1986.

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Section 3
EXTERNAL COATINGS

3.1 THICKNESS

The thickness of polyvinyl chloride (PVC) coatings shall be a nominal 40 mils (0.040 inches). The tolerance on the coating thickness shall be +10 mils (.010 inches) or -5mils (.005 inches).

NEMA Standard 5-19-1986.

3.2 COATING MATERIAL

The PVC coating shall have the properties specified in Table 3-1.

NEMA Standard 5-19-1986.

Table 3-1
PROPERTIES OF PVC COATINGS

Property	Minimum Requirement	ASTM Test Method
Hardness:		
Shore A	75	D 2240
Shore D	25	D 2240
Tensile strength, psi	2000	D 638
Elongation, percent	200	D 638
Dielectric strength, volts per mil	325	D 149
Brittleness temperature, degrees F	5	D 1790

3.3 APPLICATION OF COATING

3.3.1 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.

3.3.2 Priming

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

3.3.3 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 5-19-1986.

3.4 ELBOWS

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

NEMA Standard 5-19-1986.

3.5 COUPLINGS

Coated couplings shall be used with coated conduit.

Each coated coupling 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.

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 (id) of the overlapping sleeve shall be less than the outside diameter (od) of the PVC-coated conduit.

NEMA Standard 5-19-1986.

3.6 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. A suitable electrolyte is a solution containing tap water, 3.0 percent salt (sodium chloride), and 0.5 percent liquid detergent.

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

All sleeve extensions shall be square cut.

NEMA Standard 5-19-1986.

3.7 PERFORMANCE REQUIREMENTS

Typical physical requirements for PVC-coated conduit are given in Table 3-2.

Authorized Engineering Information 5-19-1986.

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Table 3-2
TYPICAL PHYSICAL PROPERTIES OF PVC-COATED RIGID CONDUIT AND IMC

Property	Requirement*	Test Method
Abrasion resistance, hours	200, no failure	ASTM G 6
Bendability, radius in inches at 73.4°±1.8°F	9	ASTM G 10
Artificial weathering, hours	Minimum 1000, no adverse effect	ASTM G 23

* The above requirements are based on testing a 40-mil PVC coating applied over a 3/4-inch galvanized rigid steel conduit. See Section 1 for information on the ASTM test methods.

3.8 ADHESION

The adhesion of the PVC coating to the conduit shall be greater than the strength of the coating itself. This 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. The plastic tab shall tear rather than any additional coating film separating from the substrate.

NEMA Standard 5-19-1986.

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Section 4
CORROSION RESISTANT INTERNAL COATINGS (OPTIONAL)

4.1 THICKNESS

An interior coating shall be no more than 7 mils (.007") thick.

NEMA Standard 9-6-1989.

4.2 COATING MATERIAL

An interior coating may be of any thermoplastic or thermosetting material that meets the other requirements of this standard.

Authorized Engineering Information 9-6-1989.

4.3 APPLICATION OF COATING

4.3.1 Cleaning

The interior surface to be coated shall be free of grease, oil, dirt or other extraneous matter. If galvanized, the surface shall be cleaned in such a manner that the galvanized surface is not harmed or eroded.

4.3.2 Priming

If a primer is required, it shall be suitable for the coating material to be applied.

4.3.3 Coating

The methods used to apply an interior coating shall produce a finished product conforming to this standard.

NEMA Standard 9-6-1989.

4.4 ELBOWS/BENDABILITY

Interior coated elbows shall be used with interior coated conduit. The interior coating on conduit shall be capable of being field bent without cracking or flaking. (Requirement based on bending each trade size to minimum radius per ANSI C80.1).

NEMA Standard 9-6-1989.

4.5 WORKMANSHIP AND APPEARANCE

An interior coating shall be free of blisters, bubbles, pinholes, etc., and shall be continuous over the entire length of the conduit.

NEMA Standard 9-6-1989.

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NEMA STANDARDIZATION

The purpose of NEMA Standards, their classification and status, are set forth in certain clauses of the NEMA *Standardization Policies and Procedures* manual and are referenced 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 purchasers in selecting and obtaining the proper product for their particular needs. 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. *(Standardization Policies and Procedures, p. 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.

(Standardization Policies and Procedures, p. 2)

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.

(Standardization Policies and Procedures, p.8)

Categories of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product, process, or procedure 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.

(Standardization Policies and Procedures, pp. 7 & 16)

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, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote on the standard.

(Standardization Policies and Procedures, pp. 7 & 16)

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, and which has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon.

(Standardization Policies and Procedures, pp. 7 & 16)

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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LTV Steel Tubular Products Company
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