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NEMA STANDARDS PUBLICATION NO. TC 7

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Smooth-Wall Coilable Polyethylene Electrical Plastic Duct

NEMA

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

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NEMA TC 7–1990

TC 7

SMOOTH-WALL COILABLE POLYETHYLENE ELECTRICAL PLASTIC DUCT

Published by:

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Foreword

The purpose of these standards for smooth-wall coilable polyethylene plastic duct for underground use is:

1. To define dimensions and other significant requirements.
2. To inform producers, distributors, engineers, code officials, and users about some of the properties of these products and to assist in selecting and obtaining the proper product for a particular need.

User needs have been considered throughout the development of these standards. Test methods and performance values have been related as closely as possible to end-use applications.

The Plastic Conduit, Duct and Accessories Section of NEMA, through its members, has worked (and continues to work) closely with such organizations as the American Society for Testing and Materials, the Plastic Pipe Institute, Underwriters Laboratories, Inc., appropriate government agencies, and others in the periodic review and revision of these standards for any changes necessary to keep them 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., Suite 300
Washington, DC 20037

Publication No. TC 7–1990 revises and supersedes the NEMA Standards Publication for *Smooth-Wall Coilable Polyethylene Electrical Plastic Duct,* Publication No. TC 7–1983. Prior to publication, the NEMA Standards, Suggested Standards for Future Design, and Authorized Engineering Information which appear in this publication unchanged since their appearance in TC 7–1983 were reaffirmed.

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Scope

These standards cover requirements and methods of tests for materials, dimensions, workmanship, and so forth, of corrugated polyolefin coilable electrical plastic duct intended for the installation of cables or wires either in the factory or in the field.

NOTE—The values stated in U.S. customary units are to be regarded as the standard.

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SMOOTH-WALL COILABLE POLYETHYLENE ELECTRICAL PLASTIC DUCT

Section 1
REFERENCED STANDARDS

In this publication, reference is made to the following publications. Copies are available from the source indicated.

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

D 638–89	*Standard Test Method for Tensile Properties of Plastics*
D 746–79 (R1987)	*Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact*
D 883–88	*Definitions of Terms Relating to Plastics*
D 1238–88	*Standard Test Method for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer*
D 1248–84 (R1989)	*Specification for Polyethylene Plastics Molding and Extrusion Materials*
D 1600–REV. A 1986	*Abbreviations of Terms Relating to Plastics*
D 1693–80 (R1988)	*Standard Test Method for Environmental Stress-cracking of Ethylene Plastics*
F 412–89	*Standard Definitions of Terms Relating to Plastic Piping Systems*

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Section 2
GENERAL

2.1 DEFINITION

Coilable plastic duct is a plastic duct that is intended for underground use and that can be manufactured and coiled or reeled in continuous transportable lengths and uncoiled for further processing or installation, or both, without adversely affecting its properties of performance.

NEMA Standard 3-22-1972.

2.2 NOMINAL SIZES

The nominal sizes of smooth-wall coilable plastic duct shall be ½, ¾, 1, 1 ¼,1 ½, 2, 2 ½ and 3 inches.

NEMA Standard 3-22-1972.

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Section 3
MATERIALS, DIMENSIONS, AND WORKMANSHIP

3.1 MATERIALS

Medium-density polyethylene shall meet the requirements given in ASTM D 1248, Type II, Class C and, in addition, the requirements as shown in Table 3-1.

High-density polyethylene shall meet the requirements given in ASTM D 1248, Type III, Class C and, in addition, the requirements as shown in Table 3-1.

NEMA Standard 3-22-1972.

3.2 DIMENSIONS

Smooth-wall coilable plastic duct shall have the dimensions shown in Table 3-2.

NEMA Standard 3-22-1972.

3.3 WORKMANSHIP

Coilable plastic duct shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other defects that could cause damage. It shall be as uniform as practicable in colors, opacity, density, and other physical properties.

NEMA Standard 3-22-1972.

3.4 INSPECTION

Plastic ducts should be inspected at the point of manufacture for compliance with the dimensional and performance requirements of these standards and for freedom from defects as defined in 3.3.

Authorized Engineering Information 3-8-1978.

Table 3-1
MATERIAL REQUIREMENTS

Property	Requirements		Test Method
	Medium-density Polyethylene	High-density Polyethylene	
Tensile Strength, Minimum	2500 psi	3200 psi	ASTM D 638
Elongation, Minimum	400 percent	400 percent	ASTM D 638
Melt Index, Maximum	0.5	0.5	ASTM D 1238 Table 1 Condition E
Brittle Temperature, Maximum 80 Percent Nonfailure	–76°C (–105°F)	–76°C (–105°F)	ASTM D 746
Environmental Stress, Crack Resistance	No more than two out of 10 specimens shall fail in 48 hours.	No more than two out of 10 specimens shall fail in 48 hours.	ASTM D 1693

Table 3-2
DIMENSIONS OF SMOOTH-WALL MEDIUM- AND HIGH-DENSITY POLYETHYLENE

Nominal Size, Inches	Minimum Wall Thickness, Inch (mm)	Nominal Outside Diameter*, Inch (mm)	Minimum Bending Radius, Inch (mm)
½	0.60 + 0.020 (1.52 + 0.51)	0.840±0.008 (21.34±0.20)	13 (0.33)
¾	0.60 + 0.020 (1.52 + 0.51)	1.050±0.012 (26.67±0.30)	13 (0.33)
1	0.75 + 0.020 (1.90 + 0.51)	1.315±0.012 (33.40±0.30)	13 (0.33)
1 ¼	0.100 + 0.020 (2.54 + 0.51)	1.660±0.012 (42.16±0.30)	18 (0.46)
1 ½	0.115 + 0.020 (2.92 + 0.51)	1.900±0.012 (48.26±0.30)	21 (0.53)
2	0.145 + 0.020 (3.68 + 0.51)	2.375±0.012 (60.32±0.30)	26 (0.66)
2 ½	0.203 + 0.020 (5.16 + 0.51)	2.875±0.012 (73.02±0.30)	34 (0.86)
3	0.216 + 0.020 (5.49 + 0.51)	3.500±0.012 (88.90±0.30)	40 (1.02)

*Tolerances apply to duct as extruded.

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Section 4
PERFORMANCE TESTS

4.1 COMPRESSION AND RECOVERY

Three specimens of duct, each 6 in. (152 mm) long, that have been conditioned at 73.4°±3.6°F (23°±2°C) and 50±2 percent relative humidity for not less than 48 hours, shall be flattened between parallel plates at a rate of ½ in. (13 mm) per minute in a suitable press until the distance between the parallel plates has been decreased by 50 percent of the original inside diameter of the duct. The specimens, the test apparatus, and the surrounding air shall be in thermal equilibrium with one another at a temperature of 73.4±3.6°F (23±2°C) during the test. When the load is removed, the specimens shall recover to at least 85 percent of their original inside diameter within 10 minutes. There shall be no evidence of splitting or cracking of any of the specimens.

The load required to compress the samples to the 50 percent deflection shall be not less than that shown in Table 4-1.

NEMA Standard 3-8-1978.

Table 4-1
LOAD FOR COMPRESSION AND RECOVERY TEST

Nominal Size, Inches	Minimum Load	
	Medium-density Polyethylene, lb. (kg)	High-density Polyethylene, lb. (kg)
½	125 (57)	150 (68)
¾	125 (57)	150 (68)
1	138 (63)	175 (79)
1 ¼	150 (68)	188 (85)
1 ½	188 (85)	238 (108)
2	250 (113)	300 (136)
2 ½	350 (159)	350 (159)
3	350 (159)	350 (159)

4.2 IMPACT TEST

4.2.1 Room Temperature Test

Ten 6-in (152-mm) specimens on the surfaces of which there are no cracks, tears, or other imperfections shall be cut from finished lengths of each size of coilable plastic duct to be tested. The specimens, the test apparatus, and the surrounding air shall be in thermal equilibrium with one another at a temperature of 73.4±3.6°F (23±2°C) during the test. The test apparatus and method shall be as described in 4.2.3.

4.2.2 Low-Temperature Test

Ten 6-in (152-mm) specimens on the surface of which there are no cracks, tears, or other imperfections shall be cut from finished lengths of each size of coilable plastic duct to be tested. The specimens shall be conditioned at a temperature of –4±3.6°F(–20±2°C). The samples shall be removed from the cold chamber and immediately tested for impact in accordance with 4.2.3. The time between removal of the sample from the cold chamber and completion of impact shall not exceed 30 seconds.

4.2.3 Test Method

The specimens shall be tested separately while resting on a solid flat steel plate that is at least ½ in (13 mm) thick and that is firmly anchored with its upper surface horizontal. It is recommended that a protective cage surround the plates and specimens to prevent injury from pieces of broken duct in the event that the duct shatters. (Sentence approved as Authorized Engineering Information.) A 20-lb (9-kg) steel UL type tup [a 2-in (51-mm) right-circular cylinder with rounded edges] shall be allowed to fall freely through a vertical guide from the heights shown in Table 4-2. The flat face of the weight shall strike the center of the specimen once. (Provision shall be made to prevent the weight from striking the specimen more than once.) The duct does not meet the requirements of this standard if a crack or tear longer than 1/32 in (0.8 mm) appears on the surface of more than three of the ten specimens.

NEMA Standard 3-8-1978.

Table 4-2
IMPACT TEST

Nominal Size, Inches	Height of the Face of theWeight Above the Specimen Before the Weight is Released, ft. (m)	
	Room-temperature Test 73.4°F(23°C)	Low-temperature Test –4°F(–20°C)
½	4 (1.22)	2 ½ (0.76)
¾	4 (1.22)	4 (1.22)
1	5 (1.52)	5 (1.52)
1 ¼	6 (1.83)	6 (1.83)
1 ½	7 ½ (2.29)	7 ½ (2.29)
2	9 ½ (2.90)	9 ½ (2.90)
2 ½	10 ½ (3.20)	10 ½ (3.20)
3	11 (3.35)	11 (3.35)

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Section 5
INSTALLATION

5.1 INSTALLATION PROCEDURES

For proper installation, refer to procedures recommended by the manufacturer.

Authorized Engineering Information 3-22-1972.

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Section 6
MARKING

6.1 MARKING

Each length of coilable plastic duct shall be clearly and durably marked at least every 10 ft. (3 m) with the material designation (MDPE for medium-density polyethylene or HDPE for high-density polyethylene), nominal size of the duct, and with the name or trademark, or both, of the manufacturer.

NEMA Standard 3-8-1978.

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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 three 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.
3. Adoptive Standard, which is adopted in whole or in part from the standards of another organization, either domestic, regional, or international.

(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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PLASTIC CONDUIT, DUCT AND ACCESSORIES SECTION OF THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

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