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ADOPTION NOTICE 1
19 April 1993 for
NEMA TC 14-1984
(R 1986)
1984

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STANDARDS PUBLICATION/NO. TC 14-1984

nema

Filament-Wound Reinforced Thermosetting Resin Conduit And Fittings

NEMA

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TABLE OF CONTENTS

		Page
	FOREWORD	i
	SCOPE	ii
Section 1	REFERENCED STANDARDS & DEFINITIONS	1
Section 2	MATERIALS, APPLICATIONS AND DIMENSIONS	
	General	3
	Product Description	3
	Applications	3
	Adhesive Requirements	3
	Nominal Sizes	3
	Dimensions and Tolerances	3
	PART A—Standard IPS Outside Diameter	
	Conduit	6
	Fittings	7
	PART B—Inside Diameter	
	Conduit	17
	Fittings	18
Section 3	PERFORMANCE REQUIREMENTS	
	Workmanship	27
	Joining Methods	27
	Heat Distortion	27
	Tensile Strength	27
	Fire Resistance	27
	Stiffness	27
	Impact Resistance	27
	Joint Pullout	28
Section 4	TEST METHODS	
	Conditioning Test Specimens and Test Conditions	29
	Conduit Stiffness Test	29
	Impact Resistance Test	29
Section 5	MARKING	30
Section 6	REQUIREMENTS FOR REPORTING ENGINEERING DATA	
	Recommended Maximum Beam Deflection	31
	Beam Deflection/Support Spacing Calculation Method	31
	Bending Radius Calculation	31

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TABLES

Table 2-1A	Conduit Dimensions	6
Table 2-2A	Tapered Joint Dimensions—For Adhesive Jointing	7
Table 2-3A	Dimensions of Couplings and Adapters for Saw-Cut Conduit	8
Table 2-4A	Expansion Joints (Typical)	10
Table 2-5A	Plain End Elbows	11
Table 2-6A	End Bells (For Saw-Cut Joints Only)	12
Table 2-7A	Split Anchor Rings	13
Table 2-1B	Conduit Dimensions	17
Table 2-2B	Tapered Joint-Dimensions—For Adhesive Joining	18
Table 2-3B	Dimensions of Coupling and Adapters for Saw-Cut Conduit	20
Table 2-4B	Expansion Joints (Typical)	21
Table 2-5B	Sweep Elbows	23
Table 2-6B	End Bells	24
Table 2-7B	Split Anchor Rings	25
Table 3-1	Minimum Stiffness	27
Table 3-2	Minimum Impact Resistance	28
Table 3-3	Joint Pullout Resistance	28

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Foreword

The purpose of this standard for filament-wound reinforced thermosetting resin conduit (for both underground and above-ground installation) is:

1. To list dimensions and other significant requirements
2. To set forth the properties and performance requirements of this product and to assist the user in selecting 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, works closely with such organizations as the American Society for Testing and Materials, 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:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W., Suite 300
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Scope

This standard covers conduit employing filament wound reinforced thermosetting resins as defined in 1.2.2 and 1.2.3.

Two Series of Conduit and Fitting Dimensions are included as follows:

PART A— Dimensions Based on Outside Diameters of Iron Pipe Size (Corresponding to standard utility conduit i.e., 2.375″, 3.500″, 4.500″, 5.563″, and 6.625″)

PART B— Dimensions Based on Inside Diameters (even inch—i.e., 2″, 3″, 4″, 5″, and 6″)

Note: The values in U.S. customary units are to be regarded as the standard.

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FILAMENT-WOUND REINFORCED THERMOSETTING RESIN CONDUIT AND FITTINGS

Section 1
REFERENCED STANDARDS AND DEFINITIONS

1.1 GENERAL

The product is designed for installation below ground and above ground as a raceway for electrical and communications wire and cable.

NEMA Standard 7-12-1984.

1.2 REFERENCED STANDARDS

In this publication, reference is made to the standards listed below. Copies are available from the indicated source.

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 10103

F 412-82	*Standard Definition of Terms Relating to Plastic Piping Systems*
D 618-61 (R1981)	*Conditioning Plastics and Electrical Insulating Materials for Testing*
D 648-82	*Test Method for Deflection Temperature of Plastics Under Flexural Load*
D 883-83	*Definitions of Terms Relating to Plastics*
D 1600-83	*Abbreviations of Terms Relating to Plastics*
D 2105-67 (R1979)	*Test Method for Longitudinal Tensile Properties of Reinforced Thermosetting Plastic Pipe and Tube*
D 2122-81	*Determining Dimensions of Thermoplastic Pipe and Fittings*
D 2412-77	*Test for External Loading Properties of Plastic Pipe by Parallel-Plate Loading*
D 2444-80	*Test for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)*
D 2517-81	*Reinforced Epoxy Resin Gas Pressure Pipe and Fittings*
D 2749-68 (R1979)	*Standard Symbols for Dimensions of Plastic Pipe Fittings*
D 3567-77	*Determining Dimensions of Reinforced Thermosetting Resin Pipe (RTRP) and Fittings*

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062

UL 651-1981 (Section Flame)—*Rigid Nonmetallic Electrical Conduit*

National Electrical Manufacturers Association
2101 L Street, N.W., Suite 300
Washington, D.C. 20037

TCB 2-1976	*Users Manual for the Installation of Underground Plastic Duct*

1.3 DEFINITIONS

Definitions are in accordance with ASTM Definitions D 883 *Terms Related to Plastics;* and ASTM Abbreviations D 1600, *Terms Relating to Plastics,* and F 412 *Standard Definitions of Terms Relating to Plastic Piping Systems,* unless otherwise indicated.

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1.3.1 *Reinforced Thermosetting Resin Conduit* is a tubular product containing non-metallic reinforcement embedded in or surrounded by cured thermosetting resin. The composite structure may contain fillers, thixotropes, pigments, dyes, or other additives. Thermoplastic or thermosetting liners or coatings may be included.

1.3.2 *Filament Winding* is a process used to manufacture tubular conduit by winding continuous non-metallic strand roving or roving tape onto the outside of a mandrel in a predetermined pattern under controlled tension. The roving shall be saturated with liquid resin or pre-impregnated with partially cured resin. Subsequent polymerization of the resin system may require application of heat. The inside diameter (ID) of the finished conduit is fixed by the mandrel outside diameter (OD). The outside diameter (OD) of the finished conduit is determined by the amount of material that is wound on the mandrel.

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Section 2
MATERIALS, APPLICATIONS AND DIMENSIONS

2.1 GENERAL

The resins, reinforcements, colorants, fillers, and other materials when combined as a composite structure, shall produce a conduit that meets the dimensional and performance requirements of this standard.

NEMA Standard 7-12-1984.

2.2 PRODUCT DESCRIPTION

The product is a non-metallic reinforced thermosetting resin conduit.

2.2.1—Type SW—Standard wall
2.2.2—Type HW—Heavy wall

NEMA Standard 7-12-1984.

2.3 APPLICATIONS

2.3.1 Type SW

For exposed applications when supported as recommended by the manufacturer. For underground installation with or without concrete encasement shall be permitted in accordance with manufacturers instructions.

2.3.2 Type HW

For exposed applications with extended supports as recommended by the manufacturer. For direct burial in single or multiple configuration in accordance with NEMA TCB-2 1976 underground conduit practice.

NEMA Standard 7-12-1984.

2.4 ADHESIVE REQUIREMENTS

Adhesives used to join thermosetting resin conduit and fittings shall be suitable for use with the conduit and fittings and shall meet the requirements listed in 2.4.1 and 2.4.2.

2.4.1 Adhesive Test

All adhesives covered by this specification shall have a minimum ultimate shear strength of 500 psi when tested in accordance with ASTM D-2517.

2.4.2 Adhesive Kits

Each kit shall contain the necessary components and instruction sheets which shall include information regarding cure time, pot life, and other data deemed necessary by the manufacturer.

NEMA Standard 7-12-1984.

2.5 NOMINAL SIZES

The nominal sizes of the conduit shall be: 4, 5, and 6 inches for Type SW and 2, 3, 4, 5, and 6 inches for Type HW.

NEMA Standard 7-12-1984.

2.6 DIMENSIONS AND TOLERANCES

Dimensions of each size of conduit shall be in accordance with either Table 2-1A or Table 2-1B.

2.6.1 Diameter

The average diameter of any cross-section on the length of the conduit shall be the average of the maximum and minimum diameters of that cross-section, or as measured by the use of a vernier circumferential tape in accordance with Paragraph 7 of ASTM D-3567.

2.6.2 Wall Thickness

The actual wall thickness shall be that required to meet the performance requirements of this specification. Nominal wall thicknesses are shown in either Table 2-1A or 2-1B, measured in accordance with Paragraph 5 of ASTM D-3567.

2.6.3 Out-Of-Roundness

The maximum I.D. out-of-roundness shown in either Table 2-1A or 2-1B, measured in accordance with Paragraph 5 of ASTM D-3567.

2.6.4 Conduit Length

The specified length shall be the overall length including the belled end or attached coupling. Factory-joined lengths shall be permitted.

2.6.5 Integral Belled Ends and Tapered Couplings

The dimensions for machined-end conduit or couplings for joining machined-end conduit shall be as shown in Table 2-2A or 2-2B.

2.6.6 Couplings and Adapters for Joining Saw-Cut Conduit

Table 2-3A or Table 2-3B contains detailed dimensions which shall be used for couplings and adapters designed for adhesive-joining to saw-cut conduit.

2.6.7 Expansion Joints

Dimension for typical expansion joints shall be as shown in Table 2-4A or Table 2-4B.

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2.6.8 Plain End Elbows

Table 2-5A or Table 2-5B contains detailed dimensions which shall be used for plain end elbows.

2.6.9 End Bells

Table 2-6A or Table 2-6B contains detailed dimensions which shall be used for end bells.

2.6.10 Split Anchor Rings

Table 2-7A or Table 2-7B contains detailed dimensions which shall be used for split anchor rings.

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PART A

PART A
Dimensions Based on Outside Diameters of Iron Pipe Size

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PART A

Table 2-1A
CONDUIT DIMENSIONS

Type SW (Standard Wall) Inches

Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness
	Average	Tolerance			
2	...	...	...	...	...
3	...	...	...	...	...
4	4.500	+0.028 −0.018	4.320	0.100	.070
5	5.563	+0.028 −0.018	5.380	0.100	.070
6	6.545	+0.028 −0.018	6.380	0.100	.070

Type SW (Standard Wall) Millimeters

Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness
	Average	Tolerance			
2	...	...	...	...	...
3	...	...	...	...	...
4	114.30	+0.711 −0.457	109.73	2.54	1.78
5	141.30	+0.711 −0.457	136.65	2.54	1.78
6	166.24	+0.711 −0.457	162.05	2.54	1.78

Type HW (Heavy Wall) Inches

Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness
	Average	Tolerance			
2	2.375	+0.028 −0.018	2.200	0.060	.070
3	3.500	+0.028 −0.018	3.310	0.080	.070
4	4.540	+0.028 −0.022	4.320	0.100	.090
5	5.643	+0.034 −0.028	5.380	0.100	.110
6	6.625	+0.034 −0.028	6.380	0.100	.110

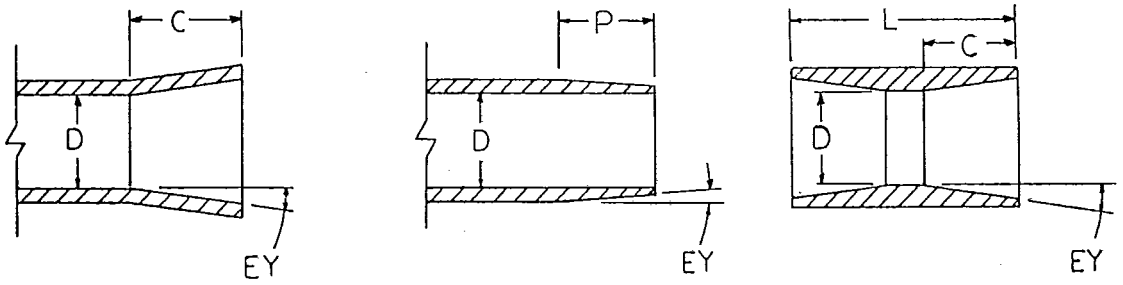
Type HW (Heavy Wall) Millimeters

Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness
	Average	Tolerance			
2	60.33	+0.711 −0.457	55.88	1.52	1.78
3	88.90	+0.711 −0.457	84.07	2.03	1.78
4	115.32	+0.711 −0.559	109.73	2.54	2.29
5	143.33	+0.864 −0.711	136.65	2.54	2.79
6	168.28	+0.864 −0.711	162.05	2.54	2.79

*Out-of-roundness is defined as maximum inside diameter minus minimum inside diameter.

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Table 2-2A
TAPERED* JOINT DIMENSIONS—FOR ADHESIVE JOINING



CONDUIT BELLED END **CONDUIT SPIGOT** **BELLED COUPLING**

Dimensions (inches)

Nominal Size	P		C		L	D	EY	
	Inches	Tolerance	Inches	Tolerance	Inches (Min.)	Inches (Min.)	Degrees	Tolerance
2	1.875	±.250	1.875	±.250	4.500	2.200	1.750	±.250
3	2.125	±.250	2.125	±.250	5.000	3.310	1.750	±.250
4	2.625	±.250	2.625	±.250	5.250	4.320	1.750	±.250
5	2.750	±.250	2.750	±.250	5.500	5.380	1.750	±.250
6	3.000	±.250	3.000	±.250	5.750	6.380	1.750	±.250

Dimensions (millimeters)

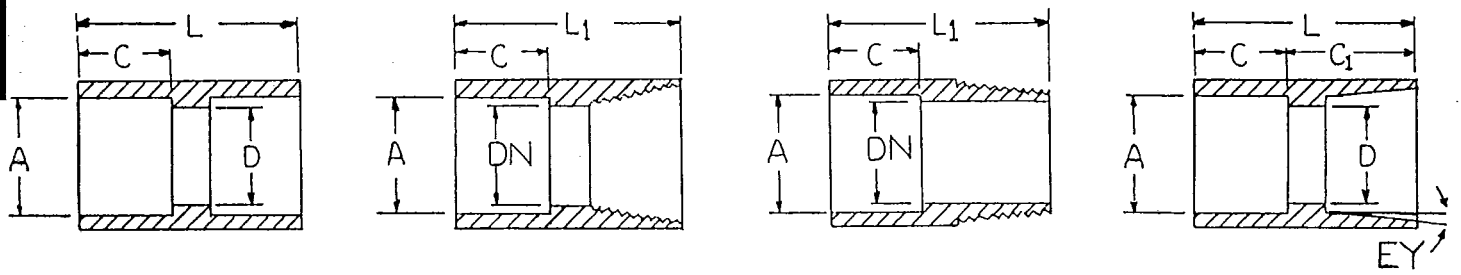
Nominal Size	P		C		L	D	EY	
	mm	Tolerance	mm	Tolerance	mm (Min.)	mm (Min.)	Degrees	Tolerance
2	47.63	±6.35	47.63	±6.35	114.30	55.88	1.750	±6.35
3	53.98	±6.35	53.98	±6.35	127.00	84.07	1.750	±6.35
4	66.68	±6.35	66.68	±6.35	133.35	109.73	1.750	±6.35
5	69.85	±6.35	69.85	±6.35	139.70	136.65	1.750	±6.35
6	76.20	±6.35	76.20	±6.35	146.05	162.05	1.750	±6.35

*The belled end and the spigot ends of the conduit and fittings may contain conduit type threads.

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Table 2-3A
DIMENSIONS OF COUPLINGS AND ADAPTERS FOR SAW-CUT CONDUIT



SOCKET X SOCKET | **SOCKET X FEMALE-NPT** | **SOCKET X MALE-NPT** | **SOCKET X FEMALE TAPER**

DIMENSIONS

Type SW (For Standard Wall Conduit) Inches

Nominal Size	A Inches	A Tolerance	C Inches (Min.)	C_1 Inches	C_1 Tolerance	L Inches (Min.)	L_1 Inches (Min.)	D Inches (Min.)	DN Inches (Min.)	EY Degree	EY Tolerance
2	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...
4	4.514	±0.014 −0	2.250	2.625	±.250	4.750	4.250	4.320	4.000	1.750	±.250
5	5.575	±0.016 −0	2.500	2.750	±.250	5.250	4.750	5.380	5.000	1.750	±.250
6	6.555	±0.018	2.500	3.000	±.250	5.250	4.750	6.380	6.000	1.750	±.250

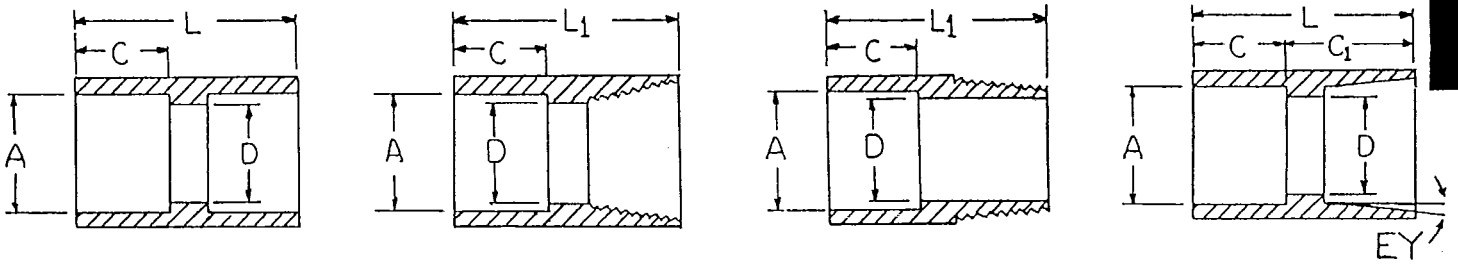
Type SW (For Standard Wall Conduit) Millimeters

Nominal Size	A mm	A Tolerance	C mm (Min.)	C_1 mm	C_1 Tolerance	L mm (Min.)	L_1 mm (Min.)	D mm (Min.)	DN mm (Min.)	EY Degree	EY Tolerance
2	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...
4	114.66	+0.36 −0	57.15	66.68	±6.35	120.65	107.95	109.73	101.60	1.750	±6.35
5	141.61	+0.41 −0	63.50	69.85	±6.35	133.35	120.65	136.65	127.00	1.750	±6.35
6	166.50	+0.46 −0	63.50	76.20	±6.35	133.35	120.65	162.05	152.40	1.750	±6.35

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PART A

Table 2-3A (Continued)
DIMENSIONS OF COUPLINGS AND ADAPTERS FOR SAW-CUT CONDUIT



SOCKET X SOCKET | **SOCKET X FEMALE-NPT** | **SOCKET X MALE-NPT** | **SOCKET X FEMALE TAPER**

DIMENSIONS

Type HW (For Heavy Wall Conduit) Inches

Nominal Size	A		C	C_1		L	L_1	D	DN	EY	
	Inches	Tolerance	Inches (Min.)	Inches	Tolerance	Inches (Min.)	Inches (Min.)	Inches (Min.)	Inches (Min.)	Degree	Tolerance
2	2.393	+0.010 −0	2.000	1.875	±.250	4.250	3.750	2.200	2.000	1.750	±.250
3	3.516	+0.012 −0	2.125	2.125	±.250	4.500	4.000	3.310	3.000	1.750	±.250
4	4.554	+0.014 −0	2.250	2.625	±.250	4.750	4.250	4.320	4.000	1.750	±.250
5	5.661	+0.016 −0	2.500	2.750	±.250	5.250	4.750	5.380	5.000	1.750	±.250
6	6.642	+0.018 −0	2.500	3.000	±.250	5.250	4.750	6.380	6.000	1.750	±.250

Type HW (For Heavy Wall Conduit) Millimeters

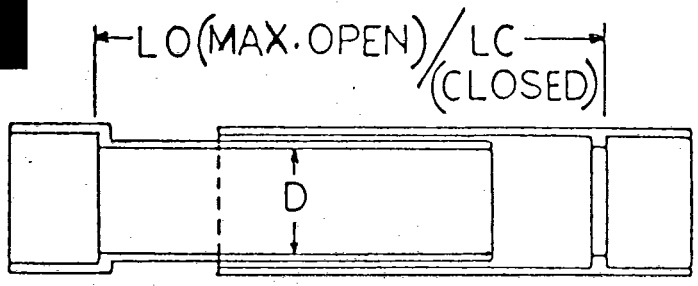
Nominal Size	A		C	C_1		L	L_1	D	DN	EY	
	mm	Tolerance	mm (Min.)	mm	Tolerance	mm (Min.)	mm (Min.)	mm (Min.)	mm (Min.)	Degree	Tolerance
2	60.78	+0.25 −0	50.80	47.63	±6.35	107.95	95.25	55.88	50.80	1.750	±6.35
3	89.31	+0.31 −0	53.98	53.98	±6.35	114.30	101.60	84.07	76.20	1.750	±6.35
4	115.67	+0.36 −0	57.15	66.68	±6.35	120.65	107.95	109.73	101.60	1.750	±6.35
5	143.79	+0.41 −0	63.50	69.85	±6.35	133.35	120.65	136.65	127.00	1.750	±6.35
6	168.71	+0.46 −0	63.50	76.20	±6.35	133.35	120.65	162.05	152.40	1.750	±6.35

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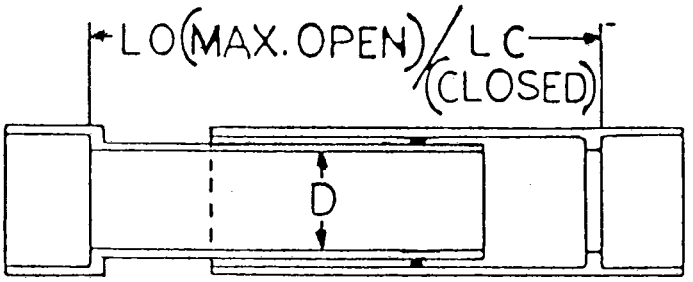
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Table 2-4A
EXPANSION JOINTS (TYPICAL)

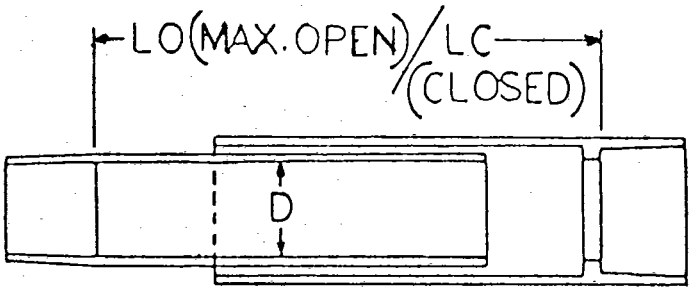
NON-GASKET-DOUBLE SOCKET



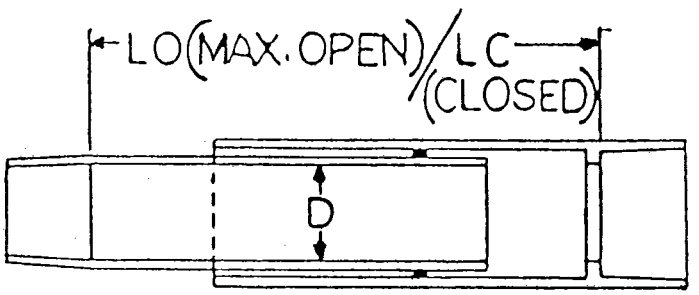
GASKET/O-RING-DOUBLE SOCKET



NON-GASKET-TAPERED JOINT



GASKET/O-RING-TAPERED JOINT



Note: All expansion joints shall include temperature setting marks or chart.

Dimensions, Inches

Nominal Conduit Size	D (Minimum)	LO Maximum Lay Length Open	LC Minimum Lay Length Closed	Available Length for Expansion/ Contraction
2	2.200	16.125	10.625	5.500
3	3.310	16.125	10.625	5.500
4	4.320	16.125	10.625	5.500
5	5.380	16.125	10.625	5.500
6	6.380	16.125	10.625	5.500

Dimensions, Millimeters

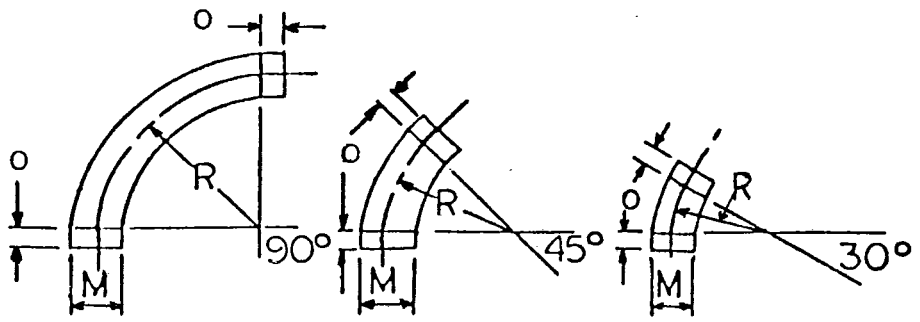
Nominal Conduit Size Inches	D (Minimum)	LO Maximum Lay Length Open	LC Minimum Lay Length Closed	Available Length for Expansion/ Contraction
2	58.88	409.58	269.88	139.7
3	84.07	409.58	269.88	139.7
4	109.73	409.58	269.88	139.7
5	136.65	409.58	269.88	139.7
6	162.05	409.58	269.88	139.7

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PART A

Table 2-5A
PLAIN END ELBOWS
Degrees Include: 11¼°, 22½°, 30°, 45°, and 90°



Inches

Nominal Size	M (NOM. O.D.) Type SW	M (NOM. O.D.) Type HW	O Tangent (Minimum)	R Standard Radius
2	...	2.375	2.000	24
3	...	3.500	2.000	30
4	4.500	4.540	2.000	42
5	5.563	5.643	2.000	60
6	6.545	6.625	2.000	60

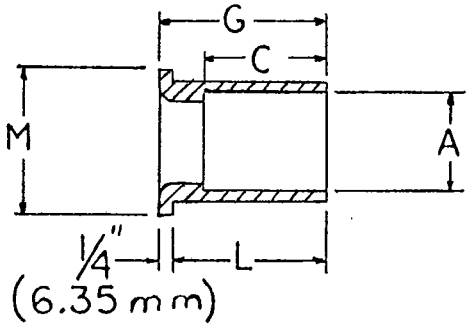
Millimeters

Nominal Size	M (NOM. O.D.) Type SW	M (NOM. O.D.) Type HW	O Tangent (Minimum)	R Standard Radius
2	...	60.33	50.80	609.60
3	...	88.90	50.80	762.00
4	114.30	115.32	50.80	1,066.80
5	141.30	143.33	50.80	1,524.00
6	166.24	168.28	50.80	1,524.00

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Table 2-6A
END BELLS (FOR SAW-CUT JOINTS ONLY)



Inches

Nominal Size	M (Minimum)	A		L (Minimum)	G Lay Length (Minimum)	C Inches (Minimum)
		Type SW	Type HW			
2	2.900	. . .	2.393±0.010 −0	2.250	2.500	2.000
3	4.000	. . .	3.516±0.012 −0	2.625	2.875	2.125
4	5.000	4.514±0.014	4.554±0.014 −0	2.750	3.000	2.250
5	6.125	5.575±0.016	5.661±0.016 −0	3.000	3.250	2.500
6	7.125	6.555±0.018	6.642±0.018 −0	3.125	3.375	2.500

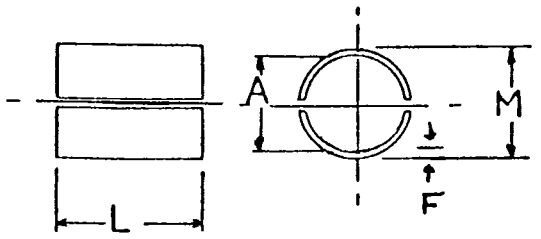
Millimeters

Nominal Size	M (Minimum)	A		L (Minimum)	G Lay Length (Minimum)	C mm (Minimum)
		Type SW	Type HW			
2	73.66	. . .	60.78 ±0.25 −0	57.15	63.50	50.80
3	101.60	. . .	89.31 ±0.31 −0	66.68	73.03	53.98
4	127.00	114.66 ±0.36	115.67 ±0.36 −0	69.85	76.20	57.15
5	155.58	141.61 ±0.41	143.79 ±0.41 −0	76.20	82.55	63.50
6	177.80	166.50 ±0.46	168.71 ±0.46 −0	79.38	85.73	63.50

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Table 2-7A
SPLIT ANCHOR RINGS



Inches

Nominal Size	A (Minimum)*	M (Minimum)*	L (Nominal)	F (Minimum)
2	2.200	2.600	2	.180
3	3.310	3.720	3	.180
4	4.320	4.720	3	.180
5	5.380	5.840	4	.200
6	6.380	6.910	4	.240

*Dimension Before Splitting

Millimeters

Nominal Size (Inch)	A (Minimum)*	M (Minimum)*	L (Nominal)	F (Minimum)
2	55.88	66.04	50.80	4.57
3	84.07	94.49	76.20	4.57
4	109.73	119.89	76.20	4.57
5	136.65	148.34	101.60	5.08
6	162.05	175.51	101.60	6.10

*Dimension Before Splitting

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PART B

PART B
Dimensions Based on Inside Diameters

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Table 2-1B
CONDUIT DIMENSIONS

Type SW (Standard Wall) Inches

Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness**
	Average	Tolerance			
2	...	...	...	...	...
3	...	...	...	...	...
4	4.140	+0.028 −0.018	4.000	0.100	.070
5	5.140	+0.028 −0.018	5.000	0.100	.070
6	6.140	+0.028 −0.018	6.000	0.100	.070

Type SW (Standard Wall) Millimeters

Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness**
	Average	Tolerance			
2	...	...	...	...	...
3	...	...	...	...	...
4	105.16	+0.710 −0.460	101.60	2.54	1.78
5	130.56	+0.710 −0.460	127.00	2.54	1.78
6	155.96	+0.710 −0.460	152.40	2.54	1.78

Type HW (Heavy Wall) Inches

Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness**
	Average	Tolerance			
2	2.140	+0.028 −0.018	2.000	0.060	.070
3	3.140	+0.028 −0.018	3.000	0.080	.070
4	4.180	+0.028 −0.022	4.000	0.100	.090
5	5.220	+0.034 −0.028	5.000	0.100	.110
6	6.220	+0.034 −0.028	6.000	0.100	.100

Type HW (Heavy Wall) Millimeters

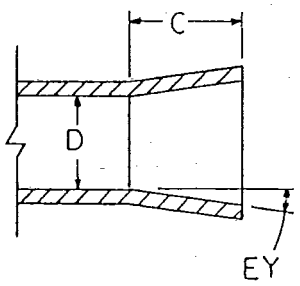
Nominal Size	Outside Diameter		Minimum Inside Diameter	Maximum Out-Of-Roundness (I.D.)*	Nominal Wall Thickness**
	Average	Tolerance			
2	54.36	+0.710 −0.460	50.80	1.52	1.78
3	79.76	+0.710 −0.460	76.20	2.03	1.78
4	106.17	+0.710 −0.560	101.60	2.54	2.29
5	132.59	+0.870 −0.710	127.00	2.54	2.79
6	157.99	+0.870 −0.710	152.40	2.54	2.79

*Out-of-roundness is defined as maximum inside diameter minus minimum inside diameter.
**The actual wall thickness is that required to meet the performance requirements of this specification.

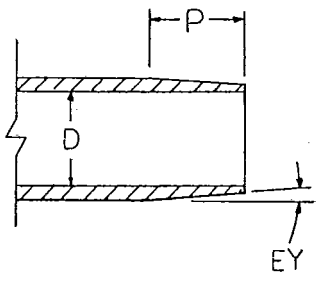
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PART B

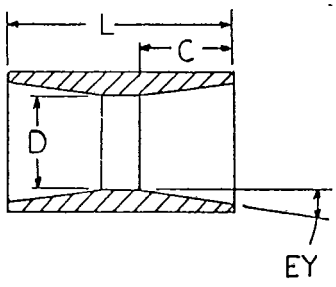
Table 2-2B
TAPERED JOINT DIMENSIONS—FOR ADHESIVE JOINING



TAPERED BELLED END



TAPERED CONDUIT



TAPERED COUPLING

Dimensions (inches)

Nominal Size	P		C		L		D	EY	
	Inches	Tolerance	Inches	Tolerance	Inches	Tolerance	Inches (Min.)	Degrees	Tolerance
2	2.250	±.250	2.250	±.250	5.000	±.500	2.000	1.750	±.250
3	2.500	±.250	2.500	±.250	6.000	±.500	3.000	1.750	±.250
4	2.500	±.250	2.500	±.250	6.000	±.500	4.000	1.750	±.250
5	3.250	±.250	3.250	±.250	7.000	±.500	5.000	1.750	±.250
6	3.250	±.250	3.250	±.250	7.000	±.500	6.000	1.750	±.250

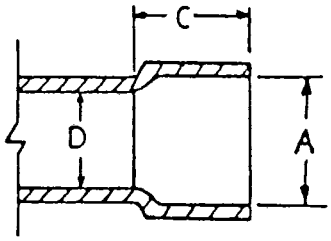
Dimensions (millimeters)

Nominal Size	P		C		L		D	EY	
	mm	Tolerance	mm	Tolerance	mm	Tolerance	mm (Min.)	Degrees	Tolerance
2	57.15	±6.35	57.15	±6.35	127.00	±12.70	50.80	1.750	±6.35
3	63.50	±6.35	63.50	±6.35	152.40	±12.70	76.20	1.750	±6.35
4	63.50	±6.35	63.50	±6.35	152.40	±12.70	101.60	1.750	±6.35
5	82.55	±6.35	82.55	±6.35	177.80	±12.70	127.00	1.750	±6.35
6	82.55	±6.35	82.55	±6.35	177.80	±12.70	152.40	1.750	±6.35

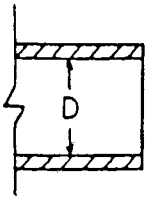
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2-2B (Continued)
UNTAPERED JOINT DIMENSIONS—FOR ADHESIVE JOINING



UNTAPERED BELLED END



UNTAPERED CONDUIT

Dimensions (inches)

Nominal Size	A Type SW		A Type HW		C Inches	C Tolerance	D Inches (Min.)
2	...	...	2.170	+.010 −0	5.000	±.125	2.000
3	...	...	3.170	+.0 −0	5.000	±.125	3.000
4	4.170	+.010 −0	4.230	+.015 −0	5.000	±.125	4.000
5	5.170	+.010 −0	5.230	+.015 −0	5.000	±.125	5.000
6	6.170	+.010 −0	6.230	+.015 −0	5.000	±.125	6.000

Dimensions (millimeters)

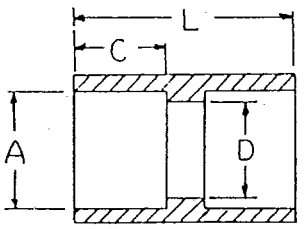
Nominal Size	A mm	A Type SW	A mm	A Type HW	C mm	C Tolerance	D mm (Min.)
2	...	...	55.12	+.25 −0	127.00	±3.18	50.80
3	...	...	80.52	+.25 −0	127.00	±3.18	76.20
4	105.92	+.25 −0	107.44	+.38 −0	127.00	±3.18	101.60
5	131.32	+.25 −0	132.84	+.38 −0	127.00	±3.18	127.00
6	156.72	+.25 −0	158.24	+.38 −0	127.00	±3.18	152.40

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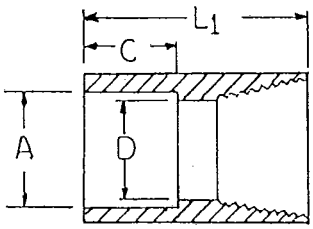
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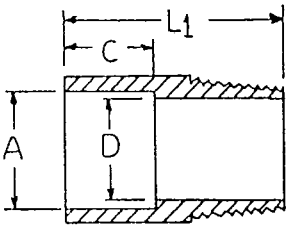
Table 2-3B
DIMENSIONS OF COUPLINGS AND ADAPTERS FOR SAW-CUT CONDUIT



BELL X BELL



BELL X FEMALE-NPT



BELL X MALE-NPT

DIMENSIONS

Type SW (For Standard Wall Conduit) Inches

Nominal Size	A		C		L		L_1		D
	Inches	Tolerance	Inches	Tolerance	Inches	Tolerance	Inches	Tolerance	(Min.) Inches
2	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...
4	4.170	+0.010 −0	5.000	±.125	10.250	±.250	8.000	±.250	4.000
5	5.170	+0.010 −0	5.000	±.125	10.250	±.250	8.000	±.250	5.000
6	6.170	+0.010 −0	5.000	±.125	10.250	±.250	8.000	±.250	6.000

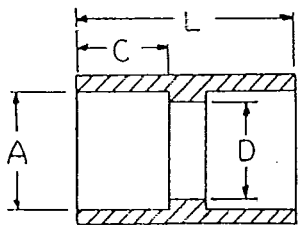
Type SW (For Standard Wall Conduit) Millimeters

Nominal Size	A		C		L		L_1		D
	mm	Tolerance	mm	Tolerance	mm	Tolerance	mm	Tolerance	(Min.) mm
2	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...
4	105.92	+.25 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	101.60
5	131.32	+.25 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	127.00
6	156.72	+.25 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	152.40

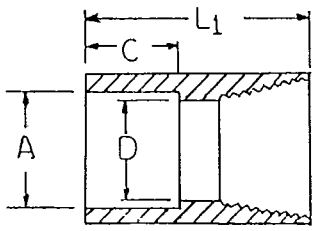
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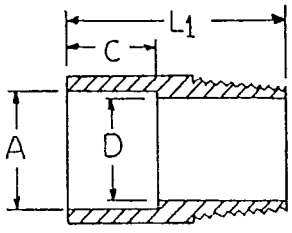
Table 2-3B (continued)
DIMENSIONS OF COUPLINGS AND ADAPTERS FOR SAW-CUT CONDUIT



BELL X BELL



BELL X FEMALE-NPT



BELL X MALE-NPT

DIMENSIONS

Type HW (For Heavy Wall Conduit) Inches

Nominal Size	A		C		L		L_1		D
	Inches	Tolerance	Inches	Tolerance	Inches	Tolerance	Inches	Tolerance	(Min.) Inches
2	2.170	+0.010 −0	5.000	±.125	10.250	±.250	8.000	±.125	2.000
3	3.170	+0.010 −0	5.000	±.125	10.250	±.250	8.000	±.125	3.000
4	4.230	+0.015 −0	5.000	±.125	10.250	±.250	8.000	±.125	4.000
5	5.230	+0.015 −0	5.000	±.125	10.250	±.250	8.000	±.125	5.000
6	6.230	+0.015 −0	5.000	±.125	10.250	±.250	8.000	±.125	6.000

Type HW (For Heavy Wall Conduit) Millimeters

Nominal Size	A		C		L		L_1		D
	mm	Tolerance	mm	Tolerance	mm	Tolerance	mm	Tolerance	(Min.) mm
2	55.12	+.25 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	50.80
3	80.52	+.25 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	76.20
4	107.44	+.38 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	101.60
5	132.84	+.38 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	127.00
6	158.24	+.38 −0	127.00	±3.18	260.35	±6.35	203.20	±6.35	152.40

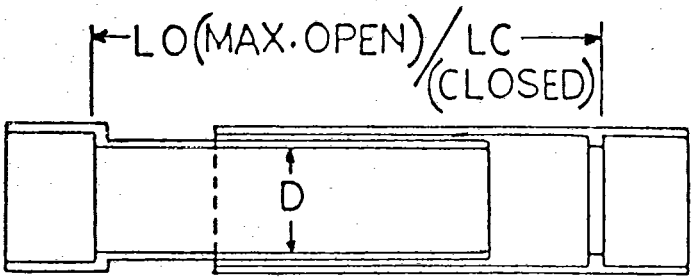
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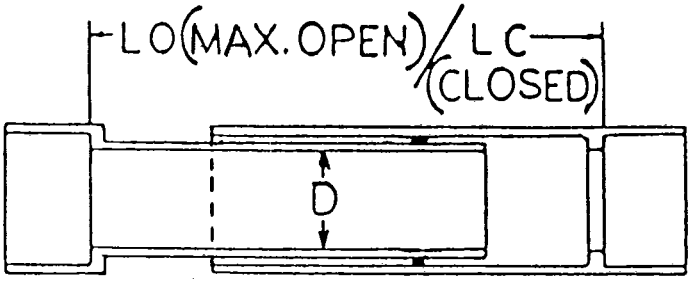
PART B

Table 2-4B
EXPANSION JOINTS (TYPICAL)

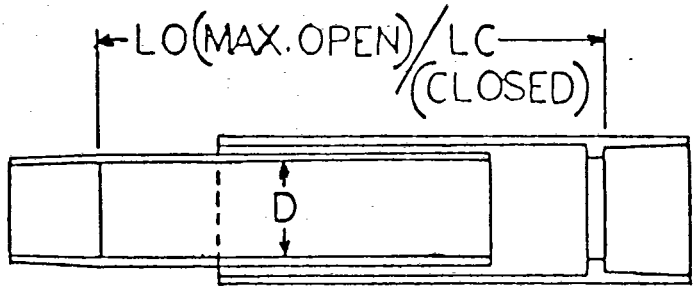
NON-GASKET-DOUBLE SOCKET for SAW-CUT CONDUIT



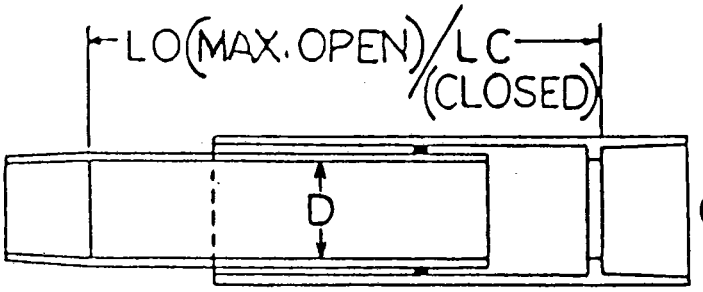
GASKET/O-RING-DOUBLE SOCKET for SAW-CUT CONDUIT



NON-GASKET-TAPERED JOINT



GASKET/O-RING-TAPERED JOINT



Dimensions, Inches

Nominal Conduit Size	D (Minimum)	LO Maximum Lay Length Open	LC Minimum Lay length Closed	Available Expansion –Contraction Length
2	2.000	24.000	14.000	10.000
3	3.000	24.000	14.000	10.000
4	4.000	24.000	14.000	10.000
5	5.000	24.000	14.000	10.000
6	6.000	24.000	14.000	10.000

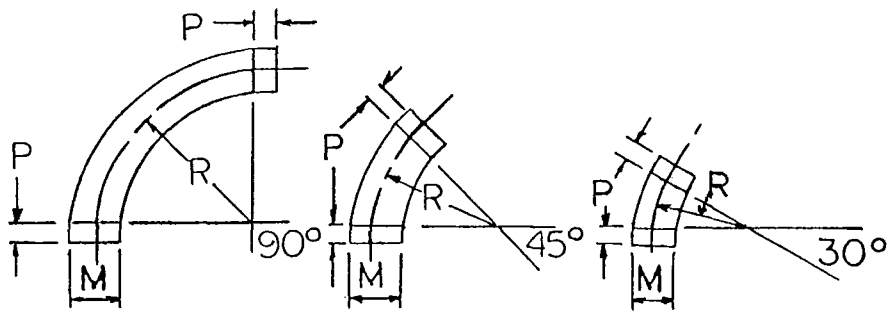
Dimensions, Millimeters

Nominal Conduit Size Inches	D (Minimum)	LO Maximum Lay Length Open	LC Minimum Lay length Closed	Available Expansion –Contraction Length
2	50.80	609.60	355.60	254.00
3	76.20	609.60	355.60	254.00
4	101.60	609.60	355.60	254.00
5	127.00	609.60	355.60	254.00
6	152.40	609.60	355.60	254.00

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Table 2-5B
SWEEP ELBOWS



Inches

Nominal Size	M		P		R
	Type SW (Nom. O.D.)	Type HW	Tangent	Tolerance	(Radius)
2	. . .	2.140	6.000	±1.000	36
3	. . .	3.140	6.000	±1.000	36
4	4.140	4.180	6.000	±1.000	36
5	5.140	5.220	6.000	±1.000	48
6	6.140	6.220	6.000	±1.000	60

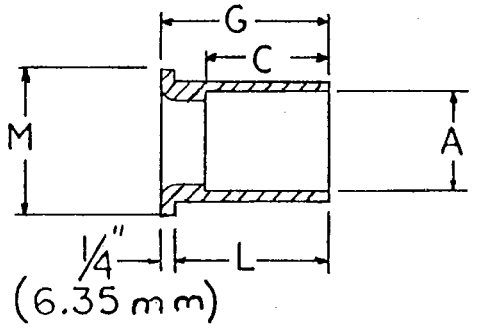
Millimeters

Nominal Size	M		P		R
	Type SW (Nom. O.D.)	Type HW	Tangent	Tolerance	(Radius)
2	. . .	54.36	152.40	±25.40	914.40
3	. . .	79.76	152.40	±25.40	914.40
4	105.16	106.17	152.40	±25.40	914.40
5	130.56	132.59	152.40	±25.40	1219.20
6	155.96	157.99	152.40	±25.40	1524.00

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Table 2-6B
END BELLS



Inches

Nominal Size	M (Minimum)	A Type SW	A Type HW	L (Minimum)	G Lay Length (Minimum)	C Inches	C Tolerance
2	3.000	...	2.180 + 0.010 −0	1.550	1.685	.740	±.010
3	4.000	...	3.180 + 0.010 −0	1.550	1.685	.740	±.010
4	5.000	4.190 + 0.010 −0	4.230 + 0.010 −0	2.000	2.150	1.200	±.010
5	6.000	5.190 + 0.010 −0	5.250 + 0.010 −0	2.000	2.150	1.200	±.010
6	7.000	6.190 + 0.010 −0	6.260 + 0.010 −0	2.250	2.400	1.450	±.010

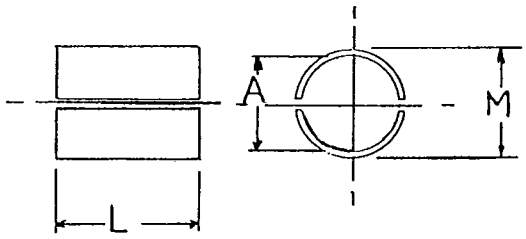
Millimeters

Nominal Size	M (Minimum)	A Type SW	A Type HW	L (Minimum)	G Lay Length (Minimum)	C Inches	C Tolerance
2	76.20	...	55.37 + .25 −0	39.37	42.80	18.80	±.25
3	101.60	...	80.77 + .25 −0	39.37	42.80	18.80	±.25
4	127.00	106.43 + .25 −0	107.44 + .25 −0	50.80	54.61	30.48	±.25
5	152.40	131.83 + .25 −0	133.35 + .25 −0	50.80	54.61	30.48	±.25
6	177.80	157.23 + .25 −0	159.00 + .25 −0	57.15	60.96	36.83	±.25

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Table 2-7B
SPLIT ANCHOR RINGS



Inches

Nominal Size	A (Min.)	M (Min.)	L (Nom.)
2	2.170	2.500	3
3	3.170	3.500	3
4	4.170	4.500	3
5	5.230	5.750	3
6	6.230	6.750	3

Millimeters

Nominal Size	A (Min.)	M (Min.)	L (Nom.)
2	55.12	63.50	76.20
3	80.52	88.90	76.20
4	105.92	114.30	76.20
5	132.84	146.05	76.20
6	158.24	171.45	76.20

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Section 3
PERFORMANCE REQUIREMENTS

3.1 WORKMANSHIP

The conduit shall be free from all defects including delaminations, bubbles, pinholes, foreign inclusions, and resin-starved areas, which due to their nature, degree, or extent, detrimentally affect the strength and serviceability of the conduit. The conduit shall be as uniform as commercially practicable in color, opacity, density, and other physical properties. The conduit shall be straight and the ends shall be cut at right angles to the axis and any burrs removed.

NEMA Standard 7-12-1984.

3.2 JOINING METHODS

3.2.1 Tapered—Bell and Spigot

Shall be for use with adhesives meeting the requirements of 2.4, shall be manufactured to the dimensions shown in Table 2-2A or Table 2-2B, and shall meet the requirements of 3.8.

3.2.2 Mechanical Joints

Threaded joints shall meet the dimensional requirements of Table 2-2A or Table 2-2B and the requirements of 3.8. Gasket-Type joints shall meet the requirements of 3.8.

3.2.3 Saw-Cut Joining Systems

Saw-cut systems are for use with adhesives (2.4) and manufactured to the dimensions in Table 2-3A or Table 2-3B and shall meet the requirements of 3.8.

NEMA Standard 7-12-1984.

3.3 HEAT DISTORTION (REFEREE TEST)

3.3.1 The minimum heat distortion temperature shall be 215°F (102°C) when tested at 264 psi (1,820 KPa) in accordance with ASTM D 648.

NEMA Standard 7-12-1984.

3.4 TENSILE STRENGTH

3.4.1 The minimum longitudinal tensile strength of the conduit shall not be less than 9,000 lbs. psi (62,052 KPa) when tested at 73°F (23°C) in accordance with ASTM D 2105.

NEMA Standard 7-12-1984.

3.5 FIRE RESISTANCE (FLAMMABILITY-REFEREE TEST)

3.5.1 Vertical specimens of the finished conduit shall not flame for longer than 5 seconds following any of three 60-second applications of flame, the period between applications being 30 seconds. The conduit shall not be capable of igniting combustible materials in its vicinity during, between, or after the three applications of the test flame, when tested in accordance with section 12 of UL 651.

NEMA Standard 7-12-1984.

3.6 STIFFNESS (F/ΔY)

3.6.1 The minimum conduit stiffness at five percent deflection for all sizes of conduit shall not be less than the values given in Table 3-1 when tested in accordance with 4.2.

NEMA Standard 7-12-1984.

Table 3-1
MINIMUM STIFFNESS (F/ΔY)

Nominal Sizes Inches	Type SW		Type HW	
	lbf/(in. · in.)	kPa	lbf/(in. · in.)	kPa
2	...	...	180	1241.1
3	...	...	60	413.7
4	40	275.8	90	620.5
5	22	151.7	80	551.6
6	13	89.6	50	344.7

3.7 IMPACT RESISTANCE

The minimum impact resistance values for the conduit shall be as shown in Table 3-2 when tested in accordance with 4.3.

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Table 3-2
MINIMUM IMPACT RESISTANCE

Foot Pounds

Nominal Size	at 73.4°F		at 32°F	
	Type SW	Type HW	Type SW	Type HW
2	. . .	30	. . .	30
3	. . .	50	. . .	50
4	50	80	50	80
5	70	105	70	105
6	100	140	100	140

Joules

Nominal Size	at 23°C		at 0°C	
	Type SW	Type HW	Type SW	Type HW
2	. . .	40.68	. . .	40.68
3	. . .	67.80	. . .	67.80
4	67.80	108.48	67.80	108.48
5	94.92	142.38	94.92	142.38
6	135.60	189.84	135.60	189.84

3.8 JOINT PULLOUT—REFEREE TEST ONLY

A 12-inch length shall be cut from both the belled end and spigot end of a length of conduit. The two parts shall be assembled in accordance with the manufacturer's instructions. The assembly shall be tested in accordance with ASTM D 2105 and shall meet the requirements of Table 3-3.

NEMA Standard 7-12-1984.

Table 3-3
JOINT PULLOUT RESISTANCE

Nominal Size	Minimum Force		
	Adhesive Joints	Mechanical Joints*	
All	Must equal or exceed the conduit tensile strength listed by the manufacturer	Pounds / 1000	Joules/cm / 44.48

*without adhesive

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Section 4
TEST METHODS

4.1 CONDITIONING TEST SPECIMENS AND TEST CONDITIONS

4.1.1 Referee Tests

When conditioning is required, the test specimen shall be conditioned in accordance with Procedure A in ASTM D 618 at 73.4° ± 3.6°F (23° ± 2°C) and 50 ± 5 percent relative humidity for not less than 40 hours prior to test. The 32°F (0°C) drop weight impact specimens shall be conditioned for at least 4 hours in liquid maintained at 32° to 35°F (0° to 1.6°C) unless otherwise specified.

Tests shall be conducted at 73.4° ± 3.6°F (23° ± 2°C) and 50 ± 5 percent relative humidity unless otherwise specified.

4.1.2 Quality Control

Specimens shall be conditioned for 3 hours in air, or 1 hour in liquid, at 73.4° ± 3.6°F (23° ± 2°C). The 32°F (0°C) drop impact samples shall be conditioned for not less than one hour in liquid maintained at 32° to 35°F (0° to 1.6°C).

Specimens shall be tested at 73.4 ± 3.6°F (23° ± 2°C) with no regard for relative humidity. The low temperature impact test equipment shall be at 73.4° ± 3.6°F (23° ± 2°C) with no requirement for relative humidity.

NEMA Standard 7-12-1984.

4.2 CONDUIT STIFFNESS TEST

The conduit stiffness (F/ΔY) shall be determined at 5 percent inside diameter deflection in accordance with ASTM D 2412. The vertical inside diameter shall be measured before compressing the specimens. Three specimens, each 6 ± ⅛ inches (152.4 ± 3.2 mm) long, shall be cut from the conduit. The specimens shall be compressed at the rate of ½ inch (12.7 mm) per minute and the load recorded at the vertical deflection equivalent to 5 percent of the original inside diameter of the specimen. The conduit stiffness at the 5 percent vertical deflection shall be determined as follows:

Conduit Stiffness (F/ΔY): Pounds · Force/(in. · in.) · (kPa)

Where:

F = load in pounds per inch of length recorded at 5 percent vertical deflection, of inside diameter of sample, in inches.

ΔY = vertical deflection of inside diameter in inches.

NEMA Standard 7-12-1984.

4.3 IMPACT RESISTANCE TEST

Five specimens, each 6 ± ⅛ (152.4 ± 1.6 mm) inches long, shall be tested using the apparatus described in ASTM D 2444, using a 12 pound (5.4 kg) Tup B and flat plate holder. If one specimen fails, another five specimens shall be tested. If nine out of ten specimens pass the requirements of 3.7, the conduit shall be considered to have met the requirements of this standard. No more than 15 seconds shall elapse from the time of removal of the specimen from the conditioning medium until completion of the 32°F (0°C) test.

Failure is defined as a sharp break that produces a sharp protrusion into the inside of the conduit.

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Section 5
MARKING

Each piece of conduit shall be clearly and durably marked every 10 feet with the following information in such a manner that it remains legible under normal shipping, handling, and installation procedures:

Nominal size (Specify A or B)
Type: SW or HW
Manufacturer's name or trademark
Material Designation: Resin designation (i.e., epoxy, polyester, and so forth)
The specification number (TC 14A or TC 14B).
Any additional information deemed necessary by the manufacturer.
All fittings shall be marked with the above information.
Bends shall, in addition, be marked to show the degree and radius of the curvature.

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Section 6
REQUIREMENTS FOR REPORTING ENGINEERING DATA

6.1 RECOMMENDED MAXIMUM BEAM DEFLECTION

Shall not exceed ⅝ inch (15.9 mm).

Authorized Engineering Information 9-12-1984.

6.2 BEAM DEFLECTION/SUPPORT SPACING CALCULATION METHOD

Method: Fixed and uniformly loaded beam; 5 or more interior continuous spans loaded and equal in length.

Calculations:

Maximum Support Spacing

$$L = \sqrt[4]{\frac{240\ EI}{W}}$$

Where:

L = Distance from support to adjacent support measured in inches

W = Unit load (pounds/linear inch of conduit and cable)

E = Flexural modulus in units of pounds force per square inch at 73.4°F (23°C), or the maximum ambient temperature anticipated.

I = Area moment of inertia about the centroidal axis of the conduit cross-section. Measured in units of inch to the fourth power.

Deflection = 0.625 inch (15.9 mm). Recommended maximum midspan conduit deflection.

240 = The deflection (0.625 in.) × the constant (384).

Note: Should conduit deflections, other than ⅝ inch (15.9 mm) be desired, the above expression may be used to calculate the distance between midspan support. Merely substitute the desired deflection in inches for 0.625 inch in the expression. To determine the spacing for the last two spans at the ends of the bridge, multiply the midspan spacing by 0.79.

Authorized Engineering Information 7-12-1984.

6.3 BENDING RADIUS CALCULATION

Bending radius may be calculated with a maximum design bending stress of 5000 psi using the following equations:

6.03.1 U. S. Units

$$R = \frac{(E)\ (OD)}{24\varphi}$$

Where:

R = minimum radius, ft.

E = bending modules, psi

OD = in inches

φ = design stress

6.03.2 Metric Units

$$R = \frac{(E)\ (OD)}{2000\varphi}$$

Where:

R = minimum radius, M

E = bending modules, kPa

OD = in millimeters

φ = design stress

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NEMA STANDARDIZATION

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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