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ANSI/NEMA MW 1000-2020

American National Standard for Magnet Wire

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FOREWORD

ANSI/NEMA MW 1000-2020 supersedes ANSI/NEMA MW 1000-2018. It has been approved as an American National Standard.

This Standard is periodically reviewed by the NEMA Magnet Wire Section for revisions considered to be necessary to keep it up to date with changes in technology and regulations. See http://www.MW1000.com for additional information.

Proposed or recommended revisions should be submitted to:

Technical Director, Operations
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MW 1000 was developed by the Magnet Wire Section of NEMA, working closely with representatives of various industries that use magnet wire. At the time this edition was approved, the Magnet Wire Section had the following members:

CONDUMEX	México, D.F., México
Elektrisola, Inc.	Boscawen, NH
Essex Furukawa	Fort Wayne, IN
Magnekón	San Nicolas, NL, México
MWS Wire Industries	Westlake Village, CA
New England Wire Technologies	Lisbon, NH
Rea Magnet Wire Company, Inc.	Fort Wayne, IN
Rubadue Wire Company, Inc.	Loveland, CO
Virginia Insulated Products, Inc.	Saltville, VA
Zeus Industrial products, Inc.	Orangeburg, SC

How to Use This Publication

First, review Part 1 for general information. Then in Part 2, locate the specification for the type of insulation and conductor of interest. Part 2 is arranged in numerical order as shown beginning on page 14. The dimensions for each Part 2 MW type are provided in Part 1, beginning with Table 1. The specification in Part 2 will indicate the requirements to be met and will refer to the test procedures and corresponding test values to be attained in Part 3.

Part 1 of this publication deals with information common to all types of magnet wire: ordering information, general material requirements, general test conditions, definitions, and manufacturing data in support of thermal rating. This part also includes dimensions with metric equivalents for all bare, minimum insulation increase, and overall dimensions for all Part 2 MW specification requirements.

Part 2 consists of product specifications requirements (other than dimensions) for magnet wire with different types of coatings and/or coverings. Insofar as possible, the product specifications are complete on one sheet, since they are arranged to include only one insulation or covering per sheet. The title on each sheet identifies the product. Example: MW 15-C, Polyvinyl Acetal Round Copper Magnet Wire. MW 15-A covers the aluminum version of the same generic product.

Part 3 contains the test procedures to be followed and corresponding tables of specific test values to be attained in determining compliance with the requirements given in Part 2. The requirements are consolidated with the test procedures and testing parameters for a given property. An index of the main test paragraphs is provided, beginning on page 14, Part 3 Test Procedures, in the Table of Contents.

Annex A provides a cross reference between test procedures in this Standards publication and those published by the American Society for Testing and Materials (ASTM).

Annex B consists of definitions, requirements, and recommended test procedures for reusable magnet wire packaging, standardized dimensions for spools and reels, and formatting for the labeling of magnet wire products.

Annex C provides a cross reference between NEMA and IEC magnet wire specifications.

Annex D provides the formulas for determining dimensional requirements of round film-insulated magnet wire and dielectric breakdown, as well as cross-sectional area and resistance calculations.

Annex E provides the dimensional criteria for ranges of sizes of rectangular bare, film, and fabric magnet wire products, setting the general rules and guidelines for various traditional yet non-Standard rectangular magnet wire products.

Annex F provides properties of selected refrigerants determined as suitable alternatives to refrigerant R22 in the Refrigerant Extraction Test, clause 3.55.

Annex G provides recommended winding tensions for round copper and aluminum magnet wire to ensure that wire, as it is de-reeled, is not stretched beyond end user requirements.

Annex H provides the test methods and requirements for fully insulated winding wire (FIW) referenced in specification MW 85-C in Part 2.

Annex I provides a standardized repeated (bi-directional) scrape resistance procedure for film insulated magnet wire.

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Updated Tables of Contents iv

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1.2.1, revised to add two ASTM standards associated with new Note 3, clause 1.8 1

1.3, revised with new definition for “fully insulated wire” and revised definitions for “number of tapes” and “varnish” 4-5

1.4.1.2, revised for clarification and deletion of reference to NIST Handbook 100 6

1.4.1.3, deleted characteristics of aluminum requirements 6

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1.5.2.3, revised for clarification 8

1.5.3, revised to align with conductor surface requirements and to define insulation requirements at joints 8

1.5.4, revised to improve wording 8

1.6.2, revised to indicate that results from any test can be affected by contaminants 9

1.6.3, revised to align with the IEC 60317-0 series of general requirements standards 9

1.6.7.2, revised to remove an incorrect table title reference 11

1.8.1, revised with note recognizing ASTM E1877 as a screening method to obtain preliminary thermal class data 12

1.9.1, revised to add “FIW 3” in the Insulation Build column of the PIN table 13

Table 1, revised to delete the † footnote, given the addition of columns for dimensions for MW 16-C Quad 15-24

Table 3, revised to expand the wire size range to include 8-13.5 AWG 26-29

Table 8 (mm), revised to correct tolerance on bare wire thickness for wire with a full rounded edge or 0.51-mm radii 39

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Part 2
Specifications Listing by Thermal Class, Film Insulation, Coating, Covering and Form

Thermal Class	Film Insulation, Coating, Covering, and Form	See Part 2, Specification No.		
		Aluminum	Copper	Page No.
FILM-INSULATED ROUND MAGNET WIRE				
105	Polyvinyl Acetal	MW 15-A	MW 15-C	3, 4
105	Polyvinyl Acetal and Self-bonding Overcoat	-	MW 19-C	9
120	Polyvinyl Acetal	MW 86-A	MW 86-C	67, 68
120	Polyvinyl Acetal	MW 87-A	MW 87-C	69, 70
180	Polyvinyl Acetal Polyvinyl Acetal with self-bonding overcoat	-	MW 88-C	71
130 Solderable	Polyurethane Overcoated with Polyamide	MW 28-A	MW 28-C	14, 15
130 Solderable	Polyurethane	-	MW 75-C	54
130 Solderable	Polyurethane with Self-bonding Overcoat	-	MW 130-C	76
130 Solderable	Polyurethane Overcoated with Polyamide and Self-bonding Overcoat	-	MW 135-C	79
155	Polyester	-	MW 5-C	2
155	Polyester (amide)(imide) Overcoated with Polyamide	MW 24-A	MW 24-C	12, 13
155 Solderable	Polyurethane	-	MW 79-C	59
155 Solderable	Polyurethane Overcoated with Polyamide	MW 80-A	MW 80-C	60, 61
155 Solderable	Polyurethane with Self-bonding Overcoat	-	MW 131-C	77
155 Solderable	Polyurethane Overcoated with Polyamide and Self-bonding Overcoat	-	MW 136-C	80
180	Polyester (amide)(imide)	-	MW 30-C	16
180	Polyester (amide)(imide) Overcoated with Polyamide	MW 76-A	MW 76-C	55, 56
180	Polyester (amide)(imide) Overcoated with Polyamideimide and Self-bonding Overcoat	MW 102-A	MW 102-C	72, 73
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180	Polyamideimide with self-bonding overcoat	-	MW 122-C	75
180 Solderable	Polyester (imide)	-	MW 77-C	57
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180 Hermetic	Polyester (amide) (imide)	-	MW 72-C	49
180 Solderable	Polyurethane	-	MW 82-C	63
180 Solderable	Polyurethane Overcoated with Polyamide	-	MW 83-C	64
180 Solderable	Polyurethane Fully Insulated	-	MW 85-C	66
180 Solderable	Solderable Polyurethane with Self-bonding Overcoat	-	MW 132-C	78
180 Solderable	Solderable Polyurethane Overcoated with Polyamide and Self-bonding Overcoat	-	MW 137-C	81
200	Polyester (amide) (imide) Overcoated with Polyamideimide	-	MW 35-C	21
200	Polyester (amide)(imide)	-	MW 74-C	53
220 Hermetic	Polyester (amide)(imide) Overcoated with Polyamideimide	MW 73-A	-	51
220	Polyester (amide)(imide) Overcoated with Polyamideimide	-	MW 37-C	25
220	Polyester (amide)(imide)	MW 74-A	-	52

Thermal Class	Film Insulation, Coating, Covering, and Form	See Part 2, Specification No.		
		Aluminum	Copper	Page No.
220	Polyamideimide	-	MW 81-C	62
240 Hermetic	Polyimide	-	MW 16-C	6
260	Polyimide	MW 16-A	-	5
260	Polyimide	MW 20-A	-	10
FILM-INSULATED RECTANGULAR AND SQUARE WIRE				
105	Polyvinyl Acetal	MW 18-A	MW 18-C	7, 8
120	Polyvinyl Acetal	-	MW 88-C	71
200	Polyester (amide)(imide) Overcoated with Polyamideimide	-	MW 36-C	24
220	Polyester (amide)(imide) Overcoated with Polyamideimide	MW 36-A	-	23
220	Polyester (amide)(imide) Overcoated with Polyamideimide	-	MW 38-C	26
220	Polyamideimide	-	MW 84-C	65
240	Polyimide	-	MW 20-C	11
260	Polyimide	MW 20-A	-	10
FIBROUS COVERED ROUND MAGNET WIRE				
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155	Polyester Glass Fiber Covered	-	MW 45-C	31
180	Glass Fiber Covered, High-Temperature Organic Varnish Treated	-	MW 50-C	35
180	Polyester Glass Fiber Covered, High-Temperature Organic Varnish Treated	-	MW 51-C	36
200	Glass Fiber Covered, Silicone Treated	-	MW 44-C	30
200	Polyester Glass Fiber Covered, Silicone Treated	-	MW 47-C	33
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FIBROUS COVERED RECTANGULAR & SQUARE MAGNET WIRE				
90 or 105	Paper Covered	MW 33-A	MW 33-C	19, 20
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Part 1

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Part 1
General

1.1. Scope

This publication is designed to present in concise and convenient form all existing NEMA Standards for magnet wire. It contains Standards for round, rectangular, and square film-insulated and/or fibrous-covered copper and aluminum magnet wire for use in electrical apparatus. Included are the definitions, type designations, dimensions, constructions, performance, and test methods for magnet wire generally used in the winding of coils for electrical apparatus. Unless otherwise stated, a revision to a product specification in this Standards publication does not affect compliance of product manufactured during the time a previous version of that specification was in effect.