NEMA MG 1-2014

Motors and Generators

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Changes made for MG 1-2014 will be unmarked in this version. Changes made for the MG 1-2014 revision are identified here.

Section I, Part 1

1.1 Revised text, updated, and occasionally added references
1.19.1.2 Updated references to subsections
1.19.1.3 Updated references to subsections
1.27.2 Added footnote
1.41.2 Reference to added clause
1.41.3 Reference to added clause
1.54 Revised and redefined

Section I, Part 4

4.4.8 Added subtitle

Section II, Part 10

10.39.1 Addition of letter m to Nameplate Marking Requirement

Section II, Part 12

12.31 Revised and added characteristics
12.58.1 Added references, revised determination of Motor Efficiency and Losses, deleted outdated information, added footnotes
12.58.2 Added and revised to include Design N, Design L and Design M single-speed single-phase squirrel-cage small motors, added efficiency levels to Table 12-10
12.59 Revised title to Efficiency Levels of Energy Efficient Polyphase Squirrel-Cage Random Wound Induction Motors Rated 600 Volts or Less at 60 Hz and added new paragraph
12.60 Revised title to Efficiency Levels of Premium Efficientcy Random Wound Electric Motors Rated 600 Volts or Less at 60 Hz
12.60.1 Revised title to Random Wound Electric Motor, added paragraph
12.60.1.1 Added new subsection title Single-Phase Capacitor-Start Induction-Run or Capacitor-Start Capacitor-Run Small Motors and paragraph
12.60.1.2 Added new subsection title Single-Phase Capacitor-Start Capacitor-Run Small Motors and paragraph
12.60.1.3 Added new subsection title Polyphase Small Motors and paragraph
12.60.1.4 Added new subsection title Polyphase Medium Motors and paragraph
12.60.2 Revised 60 Hz Motors Rated Medium Voltage, 5000 Volts or Less (Form Wound) and paragraph
12.60.3 Revised 50 Hz Motors Rated 600 Volts or Less (Random Wound), paragraph, revised formulas, added 8 Pole category to table, revised values
12.61 Revised Table 12-11 title, revised Table 12-12, revised Table 12-13, deleted data in Table 12-14, added Table 12-15, added Table 12-16, added Table 12-17, added Table 12-18, added Table 12-19, added Table 12-20, added Table 12-21

Section III, Part 20

20.21 Addition of KW Values
20.21.1 Addition of subtitle, addition of KW Values
20.21.A Revision of referenced paragraphs
20.21.B Revised paragraph, added Table 20-A
20.21.C Revised paragraph, added Table 20-B
20.21.C.2 Revised paragraphs, added Table 20-C
20.21.C.3 Revised paragraphs, added Table 20-D
20.21.C.4 Added paragraph, added Table 20-E, Table 20-F, Table 20-G
20.25.1 Revised Nameplate Marking requirement by the addition of l (NEMA nominal efficiency)

Section IV, Part 31

31.3.5 Simplified text

31.4.4.3 Revised paragraph for clarification purposes

Changes made for MG 1-2009, Revision 1-2010 are marked by an orange line to the left of the changed material

Note: Where text has been revised in more than one version, only the most recent is color-coded

Example of change made for MG 1-2009, Revision 1-2010

Section I, Part 7

7.4.2	Replaced “inches” with “mils”
7.6.1	Revised text
Figure 7-1	Renamed figure
7.8.1	Revised text
Figure 7-6	Replaced figure
Table 7-1	Revised table
7.8.2	Deleted section
7.8.3	Deleted section
7.8.4	Deleted section
7.8.5	Revised reference to table
7.8.6	Revised reference to table
7.9.1	Revised reference to table
7.9.2	Revised text and reference to table
7.9.3	Deleted section
Table 7-2	Deleted table
Table 7-3	Deleted table
Table 7-4	Added table to replace Tables 7-2 and 7-3

Section II, Part 14

14.48	Added section

Changes made for MG 1-2009 are marked by a red line to the left of the changed material

Note: Where text has been revised in more than one version, only the most recent is color-coded

Example of change made for MG 1-2009

Section I, Part 1

1.1	Added: Reference to IEC 60034-30-2008
1.16	Deleted section
1.41.3	Added: Premium Efficiency Motor

Section I, Part 2

2.2	Added: “To prevent confusion with the numerals 1 and 0, the letters “I” and “O” shall not be used.”
	Updated footnote references
	Added and revised markings
	Added: Reference to 2.67 for auxiliary devices
2.60.1.2	Revised Figure 2-48B for clarity
2.67	Added: Auxiliary Devices (entire section)

Section I, Part 4

Table 4-2	Dimension revised in column 6

Section II, Part 10

Table 10-5	Adjusted table

Section II, Part 12

12.41	In table, corrected synchronous speed of the 50 Hz machine
12.60.3	Added: Additional paragraphs, equation, and table
Table 12-14	Replaced Table 12-14
12.62	Revised 12.62a
	For 12.62b and 12.62d, revised minimum insulation resistance
	Added: Note
12.63	Note 2: Updated reference to 20.8

Section II, Part 13

13.2	Revised frame size

Section II, Part 18:

18.131	Figure 18-16: Dimension revised to 5.875

Section III, Part 20:

20.18.1	Revised 20.18.1a
	For 20.18.1b and 20.18.1d, revised minimum insulation resistance
20.18.2	Revised 20.18.2a
	For 20.18.2b and 20.18.2d, revised minimum insulation resistance
	Added: Note

Section IV, Part 30:

Table 30-1	Revised footnote G.1 reference to 12.53

Changes made for MG 1-2006 Revision 1, published Nov. 20, 2007 (includes MG 1-2006 Errata) are marked by a blue line to the left of the changed material

Note: Where text has been revised in more than one version, only the most recent is color-coded

Example of change made for MG 1-2006 Revision 1

Contents

Entire Table of Contents was revised due to added sections and repagination

Section I, Part 1

1.16	NEMA PREMIUM® EFFICIENCY ELECTRIC MOTOR
	Changed ™ to ®
	Deleted general paragraph, added:
1.16.1	60 Hz
1.16.2	50 Hz

Section I, Part 2

2.2	TERMINAL MARKINGS Footnotes
2.20.2	Induction Machines
2.24	DIRECTION OF ROTATION
2.60.1.1	Terminal Markings Using “T”
2.60.1.2	Terminal Markings in Accordance with IEC 60034-8 Using U, V, W
FIGURE 2-48B	Added figure
2.61.6	Sixth
	Revised text

Section I, Part 3

3.1.8	Accessories and Components
	Inserted sentence

Section I, Part 4

4.9.4	Parallelism of Keyseats to Shaft Centerline
4.9.5	Lateral Displacement of Keyseats
Figure 4-7	Corrected specifications
4.9.8	Shaft Extension Key(s)
Table 4-7	Corrected specifications

Section II, Part 10 Ratings—AC Motors

10.38	NAMEPLATE TEMPERATURE RATINGS FOR ALTERNATING-CURRENT SMALL AND UNIVERSAL MOTORS
	Corrected reference 12.42.3
10.40.1	Medium Single-Phase and Polyphase Squirrel-Cage Motors
	Corrected references in text and footnote 2
10.42.2	Polyphase Wound-Rotor Motors
	Corrected references in text

Section II, Part 10 Ratings—DC Motors

10.66.2	Small Motors Except Those Rated 1/20 Horsepower and Less
	Corrected footnote references

Section II, Part 12 Ratings Tests and Performance —AC Motors

12.42.4	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C (Added section)
12.43.2	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C (Added section)
12.60	EFFICIENCY LEVEL OF PREMIUM EFFICIENCY ELECTRIC MOTORS (Added ® throughout) Tables 12-12 through 12-14 (Added ®)
12-13	FULL-LOAD EFFICIENCIES FOR 60 HZ NEMA PREMIUM® EFFICIENCY ELECTRIC MOTORS (Added ®), edited table title
12.62	MACHINE WITH ENCAPSULATED OR SEALED WINDINGS—CONFORMANCE TESTS (Clarified text in b and d)

Section II, Part 12 Ratings Tests and Performance —DC Motors

12.67.5	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C Added section

Section II, Part 15

15.41.2	Temperature Rise for Ambients Higher than 40ºC Added section

Section III, Part 20

20.8.1	Machines with a 1.0 Service Factor at Rated Load Corrected reference in footnote
20.8.2	Machines with a 1.15 Service Factor at Service Factor Load Corrected reference in footnote
20.18.1	Test for Stator Which Can Be Submerged Clarified text in b and d
20.18.2	Test for Stator Which Can Be Submerged Clarified text in b and d

Section III, Part 20

21.10.5	Temperature Rise for Air-Cooled Motors for Ambients Lower than 40º C, but Not Below 0º C Deleted lower ambients in a and b
21.28.3	Unusual Service Conditions Corrected references in subclause b.
21.37	COMPRESSOR FACTORS Corrected reference
21.38	SURGE CAPABILITIES OF AC WINDINGS WITH FORM-WOUND COILS Corrected reference

Section III, Part 23

23.9.3	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C Added section

Section III, Part 24

24.40.3	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C Added section

Section IV, Part 31

31.4.1.6	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C Added section

Section IV, Part 32

Table 32-3	corrected reference
32.6.2	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C Added section
32.26	GENERATOR TERMINAL HOUSING Added “housing”

Section IV, Part 33

33.3.2.5	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0º C Added section

Changes made for MG 1-2003 Revision 2, published as MG 1-2006, are marked by a purple line to the left of the changed material

Note: Where text has been revised in more than one version, only the most recent is color-coded

Example of change made for MG 1-2003 Revision 2, published as MG 1-2006

Section I, Part 1

1.1	Referenced Standards updated to reflect current editions
1.70	NAMEPLATE MARKING Entire section added

Section I, Part 3

3.1.8	Accessories and Components Correction
3.1.11	Tests of an Assembled Group of Machines and Apparatus Correction

Section I, Part 4

4.4.1	Dimensions for Alternating-Current Foot-Mounted Machines with Single Straight-Shaft Extension Notes correction
4.4.2	Notes correction
4.4.3	Notes correction
4.5.1	Notes correction
4.5.2	Notes correction
4.5.3	Notes
4.9.3	Bottom of Keyseat to Shaft Surface
Figure 4-7	Corrected dimension
4.9.8	Shaft Extension Key(s) correction

Section I, Part 9

9.1	SCOPE changed “electrical motors” to “machines”
9.4	METHODS OF MEASUREMENT updated references to ANSI standards
9.4.2	“The” (added; “Either” deleted) method specified in ANSI S12.56 may be used.
9.6.2	Corrected reference to 9.6.2b
Table 9-4	Updated ANSI standard references; added third column

Section II, Part 10

10.39	corrected section reference
10.39.6	deleted
10.40.1	Medium Single-Phase and Polyphase Squirrel-Cage Motors corrected section reference
10.66	NAMEPLATE MARKING correction
10.66.3	Medium Motors correction

Section II, Part 12

12.3	HIGH-POTENTIAL TEST VOLTAGES FOR UNIVERSAL, INDUCTION, AND DIRECT-CURRENT MOTORS

Corrections to Effective Test Voltage
Corrections to Note 3— 80 percent

12.35 LOCKED-ROTOR CURRENT OF 3-PHASE SMALL AND MEDIUM SQUIRREL-CAGE INDUCTION MOTORS
deleted reference “60-hertz” and “rated at 230 volts”

12.40.1 Design A and B Motors
The pull-up torque of Design A and B
Added: 60- and 50-hertz

12.40.2 Design C Motors
The pull-up torque of Design C
Added: 60- and 50-hertz, single speed, polyphase squirrel-cage medium motors

12.54.1 Normal Starting Conditions

12.54.3 Considerations for Additional Starts

Table 12-7 SQUIRREL-CAGE INDUCTION MOTORS
Revised specifications

Section II, Part 14

14.43 ASEISMATIC CAPABILITY

Table 14-1 MEDIUM MOTORS—POLYPHASE INDUCTION
Correction to conventional specifications

Section II, Part 15

15.12 NAMEPLATE MARKING

Section II Part 18

Added and corrected headers throughout (editorial)

- DEFINITE PURPOSE MACHINES
- MOTORS FOR HERMETIC REFRIGERATION COMPRESSORS
- SMALL MOTORS FOR AIR CONDITIONING CONDENSERS AND EVAPORATOR FANS
- SMALL MOTORS FOR GASOLINE DISPENSING PUMPS
- SMALL MOTORS FOR HOME LAUNDRY EQUIPMENT
- MEDIUM AC POLYPHASE ELEVATOR MOTORS
- MEDIUM AC CRANE MOTORS
- MEDIUM SHELL-TYPE MOTORS FOR WOODWORKING AND MACHINE-TOOL APPLICATIONS

18.9 VARIATIONS
updated reference to 12.44

18.27 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.41 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.52 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.74 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.101 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.111 NAMEPLATE MARKING

18.116 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.128 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.142 VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY
updated reference to 12.44

18.152	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.153	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.165	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.166	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.177	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.178	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.210	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.211	NAMEPLATE MARKING
18.216	NAMEPLATE MARKING (Revised reference)
18.225	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.230	DIMENSIONS AND TOLERANCES FOR ALTERNATING-CURRENT OPEN AND TOTALLY ENCLOSED WOUND-ROTOR CRANE MOTORS HAVING ANTIFRICTION BEARINGS Deleted note
18.247	VARIATIONS FROM RATED VOLTAGE AND RATED FREQUENCY updated reference to 12.44
18.264	NAMEPLATE MARKING
18.269.1	AC Torque Motors
18.269.2	DC Torque Motors

Section III Part 20

20.5	VOLTAGE RATINGS (complete replacement of existing text)
20.7.3.1	General
20.8.5	Temperature Rise for Air-Cooled Machines for Ambients Lower than 40º C, but Not Below 0 º C Added section
20.10.3	Motor Torques When Customer Specifies A Custom Load Curve Added
20.10.4	Motor with 4.5 pu and Lower Locked-Rotor Current Added
20.11	LOAD WK2 FOR POLYPHASE SQUIRREL-CAGE INDUCTION MOTORS
20.24.2	Voltage Unbalance Defined Corrected specification in example
20.25	For some examples of additional information that may be included on the nameplate see 1.70.2.
20.25.5	Deleted
20.27	EMBEDDED TEMPERATURE DETECTORS Revised text and dimensions in table
20.31.3	Units for Capability Requirements
20.35.8	Test Voltage Values

Section III Part 21

21.5	VOLTAGE RATINGS Revised specification
21.5.1	Voltage Ratings Added
21.5.2	Preferred motor output/voltage rating Added

21.8.3.1	General
21.10.5	Temperature Rise for Air-Cooled Motors for Ambients Lower than 40° C, but not Below 0° C Added section
21.11	deleted text
21.11.1	General Added
21.11.2	Motor Torques When Customer Supplies Load Curve
21.25	For some examples of additional information that may be included on the nameplate see 1.70.2. Added

Section III Part 23

23.13	EFFICIENCY
23.24	For some examples of additional information that may be included on the nameplate see 1.70.2. Added

Section III Part 24

24.61	NAMEPLATE MARKING

Section IV Part 30

30.1.3	Power Factor Correction
Figure 30-2	THE EFFECT OF REDUCED COOLING ON THE TORQUE CAPABILITY AT REDUCED SPEEDS OF 60 HZ NEMA DESIGN A AND B MOTORS
30.2.2.2.4	Motor Torque During Operation Above Base Speed
30.2.2.8	Voltage Stress

Section IV Part 31

31.5.1	Variable Torque Applications

Section IV Part 30

32.24	NAMEPLATE MARKING Revised additional information

Section IV Part 30

33.3.2.2	Embedded Temperature Detectors

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Revised references throughout

Changes made for MG 1-2003, Revision 1-2004 are marked by a green line to the left of the changed material

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Example of change made for MG 1-2003 Revision 1-2004

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pages vii, viii, xii, xv, xxvii

Section I, Part 5

5.1	Scope
5.3.4	Table 5-1
5.4.1	Indication of Degree of Protection
5.6	GENERAL REQUIREMENTS FOR TESTS
5.7	TESTS FOR FIRST CHARACTERISTIC NUMERAL
Table 5-3:	TEST AND ACCEPTANCE CONDITIONS FOR FIRST CHARACTERISTIC NUMERAL
5.8.1	Test Conditions
5.8.2.1	Allowable Water Leakage
5.8.2.2	Post Water Electrical Test
Figure 5-1:	STANDARD TEST FINGER NOTES—
Figure 5-2	Added: (Reproduced with permission of the IEC, which retains the copyright.)
Figure 5-3	Added: (Reproduced with permission of the IEC, which retains the copyright.)
Figure 5-4	Added: (Reproduced with permission of the IEC, which retains the copyright.)
Figure 5-5	Added: (Reproduced with permission of the IEC, which retains the copyright.)
Figure 5-6	Added: (Reproduced with permission of the IEC, which retains the copyright.)

Section II, Part 12

12.51.1	General-Purpose Alternating-Current Motors of the Open Type
Table 12-4	Note: *In the case of polyphase squirrel-cage motors, these service factors apply only to Design A, B, and C motors.
12.51.2	Other Motors
12.58.2	Efficiency of Polyphase Squirrel-Cage Medium Motors with Continuous Ratings

Section II DC SMALL AND MEDIUM MOTORS

Added Header (editorial) to odd pages

Section II, Part 14

14.3	UNUSUAL SERVICE CONDITIONS b. Operation where: (revised text) 1. There is excessive departure from rated voltage or frequency, or both (see 12.44 for alternating current motors and 12.68 for direct-current motors) 3. The alternating-current supply voltage is unbalanced by more than 1 percent (see 12.45 and 14.36)
14.42	APPLICATION OF V-BELT SHEAVES TO ALTERNATING CURRENT MOTORS HAVING ANTIFRICTION BEARINGS
14.42.1	Dimensions
14.42.1.1	Selected Motor Ratings
14.42.1.2	Other Motor Ratings
14.42.2	Radial Overhung Load Limitations
Table 14-1	Note: The width of the sheave shall be not greater than that required to transmit the indicated horsepower but in no case shall it be wider than 2(N-W) - 0.25.
Table 14-1A	Added 2004

Section III, Part 20

20.17.2	Test Voltage—Primary Windings Footnote

Section III, Part 21

21.35.1	Undamped Natural Frequency

Section IV, Part 30

30.0	SCOPE
30.2.2.2.2	Torque Derating Based on Reduction in Cooling
30.2.2.2.4	Motor Torque During Operation Above Base Speed
Figure 30-4	Notes
Figure 30-4	Note: a. Standard NEMA Design A and B motors in frames per Part 13.

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Revised references on pages 3, 4, 5

Changes made for MG 1-2011 are marked by a teal line to the left of the changed material

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Example of change made for MG 1-2011

Part I, Section I

1.41.2 Addition of or 20.21 B
1.41.3 Addition of or 20.21 C

Part 12, Section II

12.59 Addition of RANDOM WOUND
Table 12-11 Addition of (RANDOM WOUND) to open and enclosed motor table title
Table 12-12 Removed open and enclosed motor table efficiency values for 6 pole 300-500HP motors and added 8 pole efficiency values
Table 12-13 Removed table efficiency values for 6 pole 400, 450 and 500 HP motors and added 8 pole efficiency values
Table 12-14 Removed efficiency values for 6 pole 400, 450 and 500 HP motors

Part 20, Section III

20.21 Revised
20.21A Added efficiency of polyphase squirrel cage large motors with continuous ratings
20.21B Added efficiency levels of energy efficient polyphase squirrel-cage random wound large induction Motors
Table 20-A Addition of full load efficiency table
20.21C Addition of efficiency level of premium efficiency large electric motors
20.21.C.1 Addition of 60Hz motors rated 600 volts or less
Table 20-B Addition of full load premium efficiency table
20.21.C.2 Addition of 60Hz motors rated 5000 volts or less
Table 20-C Addition of full load efficiency values for 60Hz premium efficiency of motors rated 5000Volts or less
20.21.C.3 Addition of 50Hz motors rated 600volts or less
Table 20-D Addition of full load efficiency values for 50Hz premium efficiency motors 600 volts or less
20.25.1 Addition of item l,

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GENERATING SET APPLICATIONS

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Foreword

The standards appearing in this publication have been developed by the Motor and Generator Section and approved for publication as standards of the National Electrical Manufacturers Association. They are intended to assist users in the proper selection and application of motors and generators. These standards are revised periodically to provide for changes in user needs, advances in technology, and changing economic trends. All persons having experience in the selection, use, or manufacture of electric motors and generators are encouraged to submit recommendations that will improve the usefulness of these standards. Inquiries, comments, and proposed or recommended revisions should be submitted to the Motor and Generator Section by contacting:

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National Electrical Manufacturers Association
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The best judgment of the Motor and Generator Section on the performance and construction of motors and generators is represented in these standards. They are based upon sound engineering principles, research, and records of test and field experience. Also involved is an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. For machines intended for general applications, information as to user needs was determined by the individual companies through normal commercial contact with users. For some motors intended for definite applications, the organizations that participated in the development of the standards are listed at the beginning of those definite-purpose motor standards.

Practical information concerning performance, safety, test, construction, and manufacture of alternating-current and direct-current motors and generators within the product scopes defined in the applicable section or sections of this publication is provided in these standards. Although some definite-purpose motors and generators are included, the standards do not apply to machines such as generators and traction motors for railroads, motors for mining locomotives, arc-welding generators, automotive accessory and toy motors and generators, machines mounted on airborne craft, etc.

In the preparation and revision of these standards, consideration has been given to the work of other organizations whose standards are in any way related to motors and generators. Credit is hereby given to all those whose standards may have been helpful in the preparation of this volume.

NEMA MG 1-2014 is a revision of MG 1-2011. Prior to publication, the NEMA Standards and Authorized Engineering Information that appear in this publication unchanged since the preceding edition were reaffirmed by the Motor and Generator Section.

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This standards publication was developed by the Motors and Generator Section. Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Motors and Generator Section was composed of the following members:

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