

NEMA MG 1

American National Standard for Motors and Generators



NEMA MG 1

MOTORS

AND

GENERATORS

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Motors and Generators

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

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

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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 40° C, but Not Below 0° C
(Added section)
- 12.43.2 Temperature Rise for Air-Cooled Machines for Ambients Lower than 40° C, but Not Below 0° 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 40° C, but Not Below 0° C
Added section

Section II, Part 15

- 15.41.2 Temperature Rise for Ambients Higher than 40°C
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 40° C, but Not Below 0° 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 40° C, but Not Below 0° C
Added section

Section III, Part 24

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

Section IV, Part 31

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

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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
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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 40° C, but Not Below 0 °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

Index

- 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

Contents

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

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Section III LARGE MACHINES

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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:

Vice President, Technical Services
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209

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 Standards Publication No. MG 1-2009, Revision 1-2010 revises and supersedes the NEMA Standards Publication No. MG 1-2009. 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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