



# Standard Guide for Ordering Low Voltage (1000 VAC or Less) Alternating Current Electric Motors for Shipboard Service—Up to and Including Motors of 500 Horsepower<sup>1</sup>

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## 1. Scope

1.1 This guide covers the required basic ordering information for low voltage (1000 VAC or less) general-purpose, commercial, universal, small and medium sized alternating current electric motors for shipboard use, up to and including motors of 500 hp.

1.2 The electric motors covered by this guide are general-purpose (GP) motors intended to drive common shipboard mechanical machinery such as fans, blowers, centrifugal and screw pumps.

1.3 This guide is not intended to be used to order special-purpose (SP) motors or definite-purpose motors (for example, cryogenic service) or motors for use in hazardous (classified) locations as defined by the National Electrical Code (NFPA 70).

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

## 2. Referenced Documents

2.1 *Canadian Standards Association (CSA):*<sup>2</sup>

CSA Standard C390-93C Energy Efficiency Test Methods for Three-Phase Induction Motors General Instruction No.1

2.2 *Institute of Electrical and Electronic Engineers (IEEE):*<sup>3</sup>

IEEE Standard 45 Recommended Practice for Electrical Installations on Shipboard

IEEE Standard 112 Standard Test—Procedure for

Polyphase Induction Motors and Generators

2.3 *National Electrical Manufacturers Association (NEMA) Standard:*<sup>4</sup>

NEMA Standard MG-1 Motors and Generators

2.4 *National Fire Protection Association (NFPA):*<sup>5</sup>

NFPA 70 National Electrical Code

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *closed-coupled*—a special design where the motor features a face mounting flange that the pump casing mounts to, and a motor shaft extension on which the pump impeller is mounted.

3.1.2 *drip-proof*—a machine enclosure that allows the motor to be cooled by ambient air having ventilation openings that allow operation when drops of liquid or solid particles strike the enclosure at any angle from zero to 15°.

3.1.3 *drive method*—the method of driving the equipment, such as direct, belt, gearbox, or chain.

3.1.4 *efficiency classes*—standard efficiency classes established by NEMA based on motor performance.

3.1.5 *end shield*—a machined flange or base which have rabbets and bolt holes for mounting equipment to the motor or for overhanging the motor on a driven machine.

3.1.6 *frame size*—standard sizes established by NEMA based on motor power and speed.

3.1.7 *mounting arrangement*—the installed operating position of the motor, such as horizontal, vertical shaft up, or vertical shaft down.

3.1.8 *multi-speed*—a motor that can operate at more than one speed, typically at two or three speeds.

3.1.9 *NEMA design classes*—design classifications designated by NEMA (See NEMA Standard MG-1) for motors that provides information to the end user on characteristics such as motor starting, torque, voltage, and so forth.

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<sup>2</sup> Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON Canada M9W1R3.

<sup>3</sup> Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., P.O. Box 1331, Piscataway, NJ 08854-1331

<sup>4</sup> Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1847, Rosslyn, VA 22209.

<sup>5</sup> Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101.

3.1.10 *NEMA insulation classes*—NEMA system that classifies motor insulation systems by their ability to withstand a specified temperature for a specified length of time with minimum deterioration.

3.1.11 *polyphase medium motors*—motors which have windings so arranged to accept to polyphase voltage sources.

3.1.12 *service factor*—service factor for an ac motor is a multiplier, which when applied to the rated horsepower, indicates a permissible horsepower loading which may be carried under the conditions specified for the service factor.

3.1.13 *single-phase fractional horsepower motors*—motors with ratings up to 1 hp which use single-phase power.

3.1.14 *single-phase integral horsepower motors*—motors with ratings of 1 hp up to and including 10 hp, which normally use single-phase power but at the upper end of their specified range may also utilize polyphase power.

3.1.15 *slip*—the difference between synchronous speed and full load speed. Normal slip is less than 5 %.

3.1.16 *speed*—the number of revolutions per minute (r/min) at which an induction motor operates, which is dependent upon the input power, frequency, and the number of magnetic poles in the machine.

3.1.17 *temperature, ambient*—the temperature of the air surrounding the machine.

3.1.18 *temperature rise*—the difference between the hot spot temperature and the ambient temperature times a constant (see NEMA MG-1).

3.1.19 *totally-enclosed air over (TEAO)*—an enclosure similar to a TEFC except the cooling air is provided by a fan that is not part of the motor.

3.1.20 *totally-enclosed fan-cooled (TEFC)*—a totally-enclosed machine equipped for exterior cooling by means of a fan or fans integral with the machine but external to the enclosed parts.

3.1.21 *totally-enclosed non-ventilated (TENV)*—a machine enclosed to prevent the free exchange of air between the inside and outside of the case, but not sufficiently enclosed to be airtight.

3.1.22 *totally-enclosed water-air cooled (TEWAC)*—a totally-enclosed machine with integral water-to-air heat exchanger and internal fans to provide closed-loop cooling of the windings.

3.1.23 *universal motors*—typically small motors, which can operate on ac or dc current, or both.

3.1.24 *variable speed drive (VSD)*—a method used to permit an operator to vary the speed of a motor.

3.1.25 *weather protected*—a machine with ventilating passages so constructed as to minimize the entrance of rain, snow and airborne particles to the electrical components.

#### 4. General Requirements for Electric Motor Ordering

##### 4.1 Electric Motor Ordering Requirements:

4.1.1 With each electric motor ordered for marine service, provide the following, to the greatest extent practicable:

4.1.1.1 *Electrical Input*—Voltage, phases and frequency.

4.1.1.2 *Speed (Synchronous or Full Load)*—r/min.

**TABLE 1 Sample Electric Motor Ordering Checklist**

Design Parameter	Unit, Value, Other
Electrical Input	Voltage, Phase, Frequency
Speed	r/min (single speed, two speed, VSD)
Power	
Enclosure	Type per NEMA MG-1
Duty Cycles	Continuous or Other
Ambient Temperature	°C
Insulation Class	per NEMA MG-1
Design Class	per NEMA MG-1
Service Factor	1.0 or Other
Drive Method	Specify
Mounting Arrangement	Specify
Mounting Flange (end shield)	Yes or No
Rotation	CW, CCW, Reversible
Motor conduit box Location	F1, F2
Closed-Coupled	Yes or No
Efficiency	Standard, High, Premium
Special Requirements	Specify
Other Standards	Specify

4.1.1.3 *Power*—The horsepower of the motor must be stated as a standard NEMA rating. At a minimum, consideration should be given to the needed starting torque, capability to accelerate the load to full running speed and maximum overload.

4.1.1.4 *Enclosure*—Select in accordance with IEEE Standard 45. DP or TEFC are normally specified for below deck applications and WP for above deck applications.

4.1.1.5 *Duty Cycle*—Continuous duty is normally specified since it demands operation at an essentially constant load for an indefinitely long time. If intermittent or varying duty cycles are required, special motor selection criteria will apply.

4.1.1.6 *Ambient Temperature*—Standard motors are designed for 400°C ambient. If a higher ambient is required, this will reduce the service factor or reduce the motor rating thus requiring a larger size motor.

4.1.1.7 *Insulation Class*.

4.1.1.8 *Design Class*—NEMA designated design class.

4.1.1.9 *Service Factor (SF)*.

4.1.1.10 *Drive Method*.

4.1.1.11 *Mounting Arrangement*—If vertical, specify with or without feet.

4.1.1.12 *Mounting Flange (End Shield)*:

(1) C-face

(2) D-flange

(3) P-base

4.1.1.13 *Rotation*—The rotation of the motor must be specified as clockwise, counter-clockwise or reversible.

4.1.1.14 *Conduit Box Location*—View from the non-shaft end of the motor:

(1) Right (standard)—F1

(2) Left—F2

4.1.1.15 *Closed-coupled*—Specify when the motor will mount the pump on a flange and the motor shaft mounts the pump impeller.

4.1.1.16 *Efficiency*—If compliance with the Energy Policy Act of 1992 is necessary, it should be stated that motors shall be furnished with a nominal efficiency as defined in Table 12-10, NEMA MG-1.

4.1.1.17 *Special Requirements*—This shall include, but not be limited to, space heaters, temperature protection, additional

regulatory or classification society requirements. Specific specification sections and paragraphs must be cited.

**4.2 Other Requirements:**

4.2.1 *Marine Service*—Each motor specified for installation on board ship shall as a minimum comply with the requirements of IEEE Standard 45.

4.2.2 *General Testing*—Unless otherwise stated, all motors shall be tested in accordance with the requirements of IEEE Standard 112.

**4.3 Electric Motor Ordering Checklist:**

4.3.1 It is recommended that the minimum information shown in Table 1 be provided to the supplier when ordering an electric motor for marine service.

**5. Keywords**

5.1 general purpose motors; multi-speed motors; polyphase motors

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