

**SECTION 23 05 12-HV  
GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies the furnishing, installation and connection of motors for HVAC equipment.

**1.2 RELATED WORK:**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- G. Section 26 29 11, MOTOR CONTROLLERS.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Provide documentation to demonstrate compliance with drawings and specifications.
  - 2. Include electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
- C. Manuals:

Submit simultaneously with the shop drawings, companion copies of complete installation, maintenance and operating manuals, including technical data sheets and application data.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit 1 copy of the certification to the COR that the motors have been applied, installed, adjusted, lubricated, and tested according to manufacturer published recommendations.

**1.4 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):

MG 1-2006 Rev. 1 2009 ..Motors and Generators

MG 2-2001 Rev. 1 2007...Safety Standard for Construction and Guide for  
Selection, Installation and Use of Electric  
Motors and Generators

- C. National Fire Protection Association (NFPA):  
70-2008.....National Electrical Code (NEC)
- D. Institute of Electrical and Electronics Engineers (IEEE):  
112-04.....Standard Test Procedure for Polyphase Induction  
Motors and Generators
- E. American Society of Heating, Refrigerating and Air-Conditioning  
Engineers (ASHRAE):  
90.1-2007.....Energy Standard for Buildings Except Low-Rise  
Residential Buildings

## **PART 2 - PRODUCTS**

### **2.1 MOTORS:**

- A. For alternating current, fractional and integral horsepower motors,  
NEMA Publications MG 1 and MG 2 shall apply.
- B. All material and equipment furnished and installation methods shall  
conform to the requirements of Section 26 29 11, LOW-VOLTAGE MOTOR  
STARTERS; and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS  
AND CABLES. Provide all electrical wiring, conduit, and devices  
necessary for the proper connection, protection and operation of the  
systems. Provide premium efficiency type motors as scheduled. Unless  
otherwise specified for a particular application, use electric motors  
with the following requirements.
- C. Single-phase Motors: Motors for centrifugal fans and pumps may be split  
phase or permanent split capacitor (PSC) type. Provide capacitor-start  
type for hard starting applications. At Contractor's Option  
Electrically Commutated motor (EC Type): Motor shall be brushless DC  
type specifically designed for applications with heavy duty ball  
bearings and electronic commutation. The motor shall be speed  
controllable down to 20% of full speed and 85% efficient at all speeds.
- D. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
- E. Voltage ratings shall be as follows:
  - 1. Single phase:
    - a. Motors connected to 208-volt systems: 200 volts.
    - b. Motors connected to 240 volt or 480 volt systems: 230/460 volts,  
dual connection.

2. Three phase:
  - a. Motors connected to 208-volt systems: 200 volts.
  - b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 208-230/460 volts, dual connection.
  - c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
  - d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
  - e. Motors connected to high voltage systems (Over 600V): Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.
- F. Number of phases shall be as follows:
  1. Motors, less than 373 W (1/2 HP): Single phase.
  2. Motors, 373 W (1/2 HP) and larger: 3 phase.
  3. Exceptions:
    - a. Hermetically sealed motors.
    - b. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
- G. Motors shall be designed for operating the connected loads continuously in a 40°C (104°F) environment without exceeding the NEMA standard temperature rise for the motor insulation.
- H. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.
- I. Motor Enclosures:
  1. The motors for this project will be located on the roof and therefore must be NEMA Type Totally Enclosed suitable for use in high humidity outdoor locations with corrosion resistant finish.
  2. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and corrosion resistant finish for coastal environments.
- J. Special Requirements:
  1. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
  2. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:

- a. Wiring material shall be stranded copper with Teflon FEP insulation with jacket.
- b. Provide shielded conductors or wiring in separate conduits for all instrumentation and control.
- 4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment.
- 5. Motors utilized with variable frequency drives shall be rated "inverter-duty" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.
- K. Additional requirements for specific motors, as indicated in the other sections listed in Article 1.2, shall also apply.
- L. Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section. Motors not specified as "premium efficiency" shall comply with the Energy Policy Act of 2005 (EPACT).

<b>Minimum Premium Efficiencies</b>			
<b>Totally Enclosed Fan-Cooled</b>			
<b>Rating kW (HP)</b>	<b>1200 RPM</b>	<b>1800 RPM</b>	<b>3600 RPM</b>
0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.0%	93.6%	91.7%

29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.8%	96.2%	95.4%

M. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION:**

Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

#### **3.2 FIELD TESTS**

- A. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before start-up. All shall test free from grounds.
- B. Perform Load test in accordance with ANSI/IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.
- C. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.
- D. All test data shall be compiled into a report form for each motor and provided to the contracting officer or their representative.

#### **3.3 STARTUP AND TESTING**

**SEE SECTION 23 08 00-IRV - COMMISSIONING OF ISO ROOM VENT SYSTEM.**

- - - E N D - - -