

SECTION 230513 – MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

Latest Update: 03-07-2022 See Underlined Text for Edits.

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all “Underlines”.)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 23.

1.2 SUMMARY

- A. This section includes the general requirements for single (1) phase and three (3) phase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70, “National Electrical Code.”
 - 1. National Recognized Testing Laboratory (NRTL) Listing: Provide NRTL listed motors.
 - a. Term “Listed”: As defined in “National Electrical Code,” Article 100.
 - b. Listing Agency Qualifications NRTL as defined in OSHA Regulation 1910.7.
 - 2. Comply with NEMA MG 1, “Motors and Generators.”
 - 3. Motors shall be UL listed.

1.4 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

1.5 WARRANTY/GUARANTEE

- A. See Division 23 Specification Section “Basic Mechanical Requirements – HVAC” for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

- A. Equipment Design and Selection: Motors shall be designed and selected, for the intended use, in accordance with the scheduled capacities on the drawings and the requirements of this specification.

2.2 MOTOR REQUIREMENTS

- A. Compliance: Comply with NEMA MG 1 unless otherwise indicated.
- B. Motor Requirements: Requirements below apply to motors covered by this Section except as otherwise indicated.
1. Motors 1 / 2 HP and Larger: Three phase.
 2. Motors smaller than 1/2 HP: Single phase.
 3. Frequency Rating: 60 Hz.
 4. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
 - a. 120 V Circuit: 115 V - motor rating.
 - b. 208 V Circuit: 200 V - motor rating.
 - c. 240 V Circuit: 230 V - motor rating.
 - d. 480 V Circuit: 460 V - motor rating.
 5. Minimum service factor shall be 15% and shall apply at frequency and utilization voltage at which motor is connected. Provide motors which will not operate in service factor range when supply voltage is within 10% of motor voltage rating.
 6. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100% of rated capacity.
 7. Temperature Rise: Based on 40°C ambient except as otherwise indicated.
 8. Enclosure: Open drip proof, unless otherwise specified. Provide screen over slots, where slots will permit passage of human extremities.
 9. Provide adjustable motor slide base for belt driven equipment. Include adjusting bolts and locknuts.
 10. Motors 5 HP and Smaller: Motors 5 HP and smaller shall be variable speed ECM motors with combination starter, disconnect and auxiliary contacts to interface with the BAS.
 11. Motors 7-1/2 HP and Larger: Motors 7-1/2 HP and larger shall be equipped with a VFD for each motor including required accessory to interface with the BAS. See

equipment specification for Division 23, Sections “Chillers” and “Cooling Towers” and Division 26, Section “Variable Frequency Drives” for requirements.

12. Shaft Grounding Rings: Provide shaft grounding rings on all motors with VFD’s.
13. Ceramic Bearings: Provide ceramic bearings on both ends of the shaft in motors 100 hp and larger.
14. Winding Heaters: Provide winding heaters as indicated below:
 - a. Required for emergency backup fans of all sizes and in all locations not operated by lead/lag control sequence.
 - b. Required for motors 100 hp and larger.
 - c. Not required for motors operated by a lead/lag control sequence.
 - d. Not required for motors located outdoors if they are smaller than 100 hp.

2.3 MOTOR CHARACTERISTICS

- A. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.4 THREE PHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Minimum motor efficiencies shall be as follows:

HP	Percent Efficiency, Minimum
1 and less	82.5
1½	84.0
2	84.0
3	87.5
5	87.5
7½	89.5
10	89.5
15	91.0
20	91.0
25	92.4
30	92.4
40	93.0
50	93.0
60	93.6
75 and larger	94.1

- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: [Class F] <Insert class>.
- I. Code Letter Designation:
1. Motors 15 HP and Larger: NEMA starting Code F or Code G. <Edit Code>
 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Motor Frames: Motor frames constructed of aluminum will not be permitted. Motor frame sizes 184T and larger shall be constructed of cast iron. Motor frames sizes smaller than 184T shall be constructed of rolled steel.

2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Motor ratings, characteristics, and features shall be coordinated with and approved by controller manufacturer.
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.6 SINGLE PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one (1) of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION

3.1 FIELD INSTALLED MOTORS

- A. General: The following requirements apply to field-installed motors.
 1. Install motors in accordance with manufacturer's published instructions and the following:
 - a. Direct Drive Motors: Mount securely in accurate alignment. Connect to driven equipment with coupler of appropriate type and material for the given duty. Coupler shall be selected for high and range of motor application.
 - b. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer recommendations.

END OF SECTION 230513