SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

Revise this Section by deleting and inserting text to meet Project-specific requirements.

See "Legislation and Energy Efficiency" Article in the Evaluations for information about the 2016 DOE ruling for motors.

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
       3. COORDINATION
          1. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

Motor controllers.

Torque, speed, and horsepower requirements of the load.

Ratings and characteristics of supply circuit and required control sequence.

Ambient and environmental conditions of installation location.

1. PRODUCTS
   * + 1. GENERAL MOTOR REQUIREMENTS
          1. Comply with NEMA MG 1 unless otherwise indicated.

Retain paragraph below if severe-duty motors are required.

* + - * 1. Comply with IEEE 841 for severe-duty motors.
      1. MOTOR CHARACTERISTICS
         1. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.
         2. 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. POLYPHASE MOTORS

This Section is written around Design B motors. For Design A or Design C, edit below and revise other characteristics accordingly (note that Design A and Design C motors still must meet NEMA Premium efficiency levels). According to the DOE, NEMA MG 1, Design B motors are the most common motors used in equipment in the United States, accounting for 96.13 percent of all motor shipments in 2011.

* + - * 1. Description: NEMA MG 1, Design B, medium induction motor.

See "Energy Considerations" Article in the Evaluations for discussion of motor efficiency.

* + - * 1. Efficiency: Premium efficient, as defined in NEMA MG 1.

Retain "Service Factor" pParagraph below for service factors exceeding NEMA standard for other than open-dripproof motors. If retaining, coordinate with Drawings or other Sections specifying motorized equipment. See "Product Characteristics" Article in the Evaluations for discussion of service factor. A service factor of at least 1.15 is available for most motors, including explosion proof; however, there are exceptions.

* + - * 1. Service Factor: 1.15.

Retain one of two "Multispeed Motors" paragraphs below. Retain first paragraph for lower first cost. Retain second to require all multispeed motors to be two-winding type. See "Multispeed and Variable-Speed Considerations" Article in the Evaluations.

* + - * 1. Multispeed Motors: Variable torque.

For motors with 2:1 speed ratio, consequent pole, single winding.

For motors with other than 2:1 speed ratio, separate winding for each speed.

* + - * 1. Multispeed Motors: Separate winding for each speed.
        2. Rotor: Random-wound, squirrel cage.

NEMA MG 1 recommends ball bearings for polyphase motors 500 hp and smaller due to their ability to sustain coupling end-play and rotor float. Some smaller integral and fractional polyphase motors might have sleeve bearings for lower cost and quieter operation, especially if direct coupled and not subjected to belted loads. For motor-bearing requirements for specific equipment, specify those requirements in motorized equipment Sections. Coordinate with equipment suppliers for bearing types in smaller motors. Specify bearing-life requirements, according to ABMA 9, in motor-driven equipment Sections.

* + - * 1. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

For longer motor insulation life, consider specifying a temperature rise one class below the insulation rating class; for example, Class F insulation with Class B temperature rise. Many energy-efficient and most premium-efficient motors come standard with Class F insulation and Class B temperature rise to obtain higher service factors and meet energy-efficiency levels.

* + - * 1. Temperature Rise: Match insulation rating.

Standard insulation class for general-purpose, open-dripproof motors, of nominal efficiency rating, is Class B; however, many premium-efficient motors, and those with service factors 1.15 or higher, are built with insulation meeting Class F requirements, especially if designed as "inverter ready" for use with variable-frequency controllers. Retain option in "Insulation" paragraph below unless a higher or lower insulation class is required as a default.

* + - * 1. Insulation: [**Class F**] <**Insert class**>.
        2. Code Letter Designation:

Starting codes in first subparagraph below are adequate for most variable-torque loads encountered in HVAC applications; 15 hp is a common breakpoint in rating among manufacturers when Code F and Code G apply. Retain both subparagraphs and options unless Project conditions or equipment characteristics otherwise dictate.

Motors [**15**] <**Insert number**> HP and Larger: NEMA starting Code F or Code G.

Motors Smaller Than [**15**] <**Insert number**> HP: Manufacturer's standard starting characteristic.

See "Product Characteristics" Article in the Evaluations for enclosure frame material discussion. Retain "Enclosure Material" paragraph below to require other than manufacturer's standard enclosure materials. Specify other types of enclosures in motorized-equipment Sections.

* + - * 1. Enclosure Material: Cast iron for motor frame sizes [**324T**] <**Insert number**> and larger; rolled steel for motor frame sizes smaller than [**324T**] <**Insert number**>.
      1. ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

See "Multispeed and Variable-Speed Considerations" Article in the Evaluations for discussion of motor controllers. Retain "Motors Used with Reduced-Voltage and Multispeed Controllers" paragraph below only if Project includes separately connected motors and where controllers are not furnished as a component of the motorized equipment.

* + - * 1. 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.

See "Multispeed and Variable-Speed Considerations" Article in the Evaluations for discussion of motor types used with variable-frequency controllers. Retain option in "Motors Used with Variable-Frequency Controllers" paragraph below if Project includes separately connected motors.

* + - * 1. Motors Used with Variable-Frequency Controllers:[**Ratings, characteristics, and features coordinated with and approved by controller manufacturer.**]

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.

Premium-Efficient Motors: Class B temperature rise; Class F insulation.

Inverter-Duty Motors: Class F temperature rise; Class H insulation.

See "Multispeed and Variable-Speed Considerations" Article in the Evaluations for discussion of thermally protected motors. Thermal protection is not usually required for HVAC equipment and energy- or premium-efficient motors specified in this Section. Retain "Thermal Protection" Subparagraph below to require added protection from overheating or if inverter-duty motors are required.

Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

Retain paragraph below only if Project requires severe-duty motors, based on environmental conditions.

* + - * 1. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
      1. SINGLE-PHASE MOTORS
         1. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

See the Evaluations for a comparison of single-phase motor types.

Permanent-split capacitor.

Split phase.

Capacitor start, inductor run.

Capacitor start, capacitor run.

* + - * 1. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
        2. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
        3. Motors 1/20 HP and Smaller: Shaded-pole type.
        4. 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.

1. EXECUTION (Not Applicable)

END OF SECTION 230513