



SECTION 23 05 13 – ELECTRIC MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary, and other Conditions) and Division 00 and 01 as appropriate, apply to the Work specified in this Section.
- B. Refer to all Sections, as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding all work.

1.2 SCOPE OF WORK

- A. This Section includes basic requirements for all motors connected to mechanical equipment. It includes motors that are factory-installed as part of equipment and appliances as well as field-installed motors.

1.3 QUALITY ASSURANCE

- A. As a minimum, comply with applicable local, state and federal codes.
- B. As a minimum, comply with applicable requirements of recognized industry associations which promulgate standards for the various trades. (See individual Sections of Division 23).
- C. Employ only qualified personnel for this work. Employ competent, qualified mechanics to supervise the work.
- D. As a minimum, comply with ASHRAE Standard 90.1 - 1999 (or latest edition) for motors.
- E. As a minimum, comply with NFPA 70, "National Electrical Code." (Latest Edition)
- F. NRTL Listing: Provide NRTL listed motors.
- G. Term "Listed": As defined in "National Electrical Code," Article 100.
- H. Listing Agency Qualifications: "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- I. As a minimum, comply with NEMA Standard MG 1, "Motors and Generators."
- J. As a minimum, comply with UL 1004, "Motors, Electric."

PART 2 - PRODUCTS

2.1 MOTORS, GENERAL

- A. General: Requirements below apply to motors covered by this Section except as otherwise indicated, for motors classified as simple or common motors (Section 230510).
 - 1. Motors 1.0 HP and Larger: Polyphase.
 - 2. Motors Smaller Than 1.0 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. Service factors indicated for motors are minimum values and 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 percent 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 percent of rated capacity.
7. Temperature Rise: Based on 40 deg. C ambient except 50 deg. C when otherwise indicated in equipment specifications or on equipment schedules on Plans.
8. Enclosure: Open drip proof except where exposed to elements, weather, or where specifically called for on Drawings and/or equipment specifications.

B. Manufacturers

1. Acceptable Manufacturers: Subject to the following requirements, provide motors from one of the following manufacturers:
 - a. Baldor
 - b. Marathon
 - c. U.S. Motors
 - d. General Electric
 - e. Reliance

2.2 POLYPHASE MOTORS

A. General: Squirrel-cage induction-type conforming to the following requirements except as otherwise indicated in equipment specifications.

1. NEMA Design Letter Designation: "B" with 1.15 Service Factor.
2. Multi-Speed Motors: Separate winding for each speed.
3. Energy Efficient Motors: Premium Efficiency.
4. Motors shall be complete with shaft grounding rings.

B. Variable Speed Motors for Use with Solid-State Drives:

1. NEMA Standard MG 1, Part 31, "Definite Purpose Inverter Fed Motors", continuous duty, Design B, squirrel-cage induction units with ratings, characteristics, and features coordinated with and approved by the drive manufacturer. The motor shall include 1600-volt slot and phase paper insulation for protection against damage due to reflected waves.
2. Internal Thermal Overload Protection for Motors: Protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to the temperature rating of the motor insulation.
3. Bearings: Double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading of the application.

2.3 SINGLE-PHASE MOTORS

A. General: Conform to the following requirements except as otherwise indicated.

B. Energy Efficient Motors: One of the following types as selected to suit the starting torque and other requirements of the specific motor application.

1. Permanent Split Capacitor.
2. Split-Phase Start, Capacitor-Run.
3. Capacitor-Start, Capacitor-Run.

C. Shaded-Pole Motors: Use only for motors smaller than 1/20 hp.

D. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.

E. Bearings, belt connected motors, and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, pre-lubricated sleeve bearings may be used for other single-phase motors.

2.4 MOTOR EFFICIENCIES

A. Premium Efficiency Motors:

1. All motors shall bear the NEMA "Premium" label and shall meet or exceed the following nominal energy efficiency levels prescribed below for Design A or B continuous rated:

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Table 1 Nominal Efficiencies For “NEMA Premium” Induction Motors
Rated 600 Volts or Less (Random Wound)

2.5	Open Drip Proof			Totally Enclosed Fan Cooled		
HP	6-Pole	4-Pole	2-Pole	6-Pole	4-Pole	2-Pole
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	95.0	95.8	96.2	95.4
250	95.4	95.8	95.0	95.8	96.2	95.8
300	95.4	95.8	95.4	95.8	96.2	95.8
350	95.4	95.8	95.4	95.8	96.2	95.8
400	95.8	95.8	95.8	95.8	96.2	95.8
450	96.2	96.2	95.8	95.8	96.2	95.8
500	96.2	96.2	95.8	95.8	96.2	95.8

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: The following requirements apply to field-installed motors.
- B. Install motors in accordance with manufacturer's published instructions and the following:
 - 1. Direct Connected Motors: Mount securely in accurate alignment.
 - 2. 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.

3.2 COMMISSIONING

- A. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.
- B. Report unusual conditions.
- C. Correct deficiencies of field-installed units.

3.3 TRAINING AND DEMONSTRATION

- A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:
 - 1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
 - 2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 01, for Closeout Submittals and Division 23, Section 230020 - "Basic Mechanical Requirements."
 - 3. Provide Service Manuals for each motor specified.
- B. Provide three (3) hours of factory authorized training to Owner's operating personnel.
 - 1. Schedule training with at least seven (7) days advanced notice to Owner's Representative.
 - 2. Refer to Section 230010 - "Mechanical General Provisions" for video taping requirements.

END OF SECTION 23 05 13