SECTION 26 60 00– ELECTRIC MOTORS

PART 1: GENERAL

1.1 This standard is intended to provide useful information to the A/E to establish a basis of design. The responsibility of the engineer is to apply the principles of this section such that the University of Texas at Dallas may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.

1.2 Standards

1.2.1 Motors shall be designed, built, and tested in accordance with the latest revision of the following standard documents.

1.2.1.1 NEMA MG 1 - Motors and Generators.
1.2.1.2 ANSI/IEEE 112 - Test Procedures for Motors/Generators.
1.2.1.3 UL 1004 - Motors, Electric.
1.2.1.4 UL 674 - Motors, Generators, Electric, for use in hazardous locations: Class I, Groups C and D; Class II, Groups E, F, and G.
1.2.1.5 Provide minimum nominal motor efficiency per the latest version of ASHRAE 90.1.

1.4 Warranties

1.4.1 Vendor shall provide the standard form of written guarantee and warranty covering defects in materials and workmanship for the equipment. Said guarantee and warranty shall be for a period of one year from the date of final acceptance of the equipment by the University. Date of acceptance shall be defined as the date that the University assumes operation of the unit.

PART 2: PRODUCTS

2.1 Motors Less Than ½ HP

2.1.1 Unless otherwise specified, motors less than ½ HP shall be squirrel-cage, induction type, capacitor start with copper stator windings as the standard low-horsepower motor.

2.1.2 Motors shall be continuously rated with 1.15-service factor for operation at 115 volts, single-phase, 60 Hz.

2.1.3 The driven load for constant speed applications shall not exceed the motor's continuous nameplate rating, exclusive of any service factor, under any normal operating condition.

2.2 Motors Larger Than ½ HP Through 250 HP

2.2.1 Motors shall be 3-phase, continuously rated, squirrel-cage, random-wound copper, induction motors designed for 460 volt, 60 Hz operation. Provide motors rated for continuous operation with 1.15-service factor. Motors 7½ HP and larger shall be 3- phase 480 volt only.

2.2.2 Provide motors with Class F insulation and a Class B temperature rise based on 40° C ambient. When ambient temperatures exceed 40° C, temperature rise shall be adjusted according to MG 1-12. Locked Rotor Current: Provide motors with locked rotor starting currents not exceeding Code L under 3 HP, Code K for 3 and 5 HP, Code H for 7½ and 10 HP, and Code G for 15 HP and above.

2.2.3 Provide motors meeting the energy efficiency and power factor requirements of ASHRAE 90.1 Table 6.8 Minimum Equipment Efficiency Tables for minimum nominal efficiency, when tested in accordance with NEMA MG 1-12.53a and IEEE Standard 112, Test Method B.

2.2.4 Provide motors rated for continuous operation with 1.15-service factor. For constant speed motors, the driven load shall not exceed the motor's brake horsepower nameplate rating, exclusive of any service factor, under any normal operating condition.

2.2.5 Provide all TEFC motors with anti-friction grease lubricated ball bearings, with a bearing AFBMA B-10 life of 100,000 hours, and sealed from the environment. Provide factory lubrication of all motors prior to shipment. Provide all grease-lubricated bearings with relief fittings.

2.2.6 Provide all ODP motors with sealed anti-friction grease lubricated ball bearings, with a bearing AFBMA B-10 life of 100,000 hours. Provide factory lubrication of all motors prior to shipment. Provide all grease-lubricated bearings with relief fittings.

2.2.7 Motors which are located outside or wherever specified shall be provided with space heaters sized to prevent moisture condensation, rated 120 volts, with a separate conduit box for heater leads only.

2.2.8 For motors 5 HP and larger, provide a snap action normally closed Klixon embedded in the stator winding at the 12:00 position with tee leads wired out to the wiring compartment. The temperature of the Klixon shall be set for 25% of the insulation temperature rating.

2.2.9 Provide motors with conduit boxes that are fully rotatable, diagonally split, including gasket between cover and box, and box and frame, with threaded hubs and a grounding lug located within the box for ground conductor connection.

2.2.10 Provide nameplates of stainless steel or other approved corrosion resistant material to provide a permanent legible marking, containing NEMA data plus guaranteed minimum efficiency. Attach nameplates and connection plates to the motor frame by rivets or screws.

2.2.11 Variable torque, inverter duty rated motors **shall be provided for variable speed applications**. Insulated bearings shall be used for motors driven by variable frequency drives.

2.3 Motor Types

2.3.1 The following Standard motor types shall conform to the following requirements:

2.3.1.1 Horizontal Drip proof: Provide horizontal motors with an enclosure that meets NEMA Standard MG 1 for open, drip proof construction. Provide screen over all air openings.

2.3.1.2 Horizontal Totally Enclosed Fan-Cooled: Provide totally enclosed fan-cooled (TEFC) motors with frame sizes 182 and larger with cast iron frames and end shields. Smaller frame sizes may be constructed of rolled steel with cast metal end shields. Provide motors with condensate drain holes. For frame size 286 and larger, provide automatic breather/drain device in drain hole.

2.3.1.3 Vertical Weather Protected Type I: Provide vertical motors with an enclosure that meets NEMA Standard MG 1 for weather protected Type I (WP-I) enclosure. Provide screens over all air openings.

2.3.1.4 Vertical Totally Enclosed Fan-Cooled: Provide vertical motor with an enclosure identical to the requirements for the horizontal TEFC motors.

2.3.1.5 Explosion proof: Provide all horizontal and vertical motors with TEFC explosion proof enclosures, UL listed for Class 1, Division 1, and Group D hazardous atmosphere. Provide motors manufactured by Reliance Electric, or equal.

2.3.1.6 Submersible: Submersible motors UL listed for explosion proof atmospheres in accordance with subsequent sections of this specification. In addition, provide submersible motors with two mechanical seals; the lower one outside the motor and protecting the upper one, which is in an oil filled chamber. Provide moisture detector probes in the oil filled seal chamber to indicate the presence of moisture in the seal chamber. Provide a temperature detector and switch rated 3 amperes, 120 volts minimum, set to operate when the internal motor temperature exceeds a preset limit. Provide any relays or solid-state controls for separate mounting.

2.3.1.7 Horizontal, Totally Enclosed, Fan-Cooled, Severe Duty: Provide horizontal (TEFC), severe duty motors suitable for contaminated environments, including gasketed conduit box, stainless steel drains, double-shielded bearings, and corrosion resistant paint. Provide motors manufactured by Reliance Electric SXT-XT-XE, Century Type SCE E-Plus, or equal.

2.3.1.8 Vertical, Totally Enclosed, Fan-Cooled, Severe Duty: Provide vertical (TEFC), severe duty motors with the requirements identical to horizontal (TEFC), severe duty motors, above.

2.4 Motors for use with Variable Frequency Drives

2.4.1 Motor Application Considerations:

2.4.1.1 NEMA Standard MG1 definite purpose inverter duty rated motors shall be used for all variable frequency drive installations. The inverter duty motors shall be able to withstand voltages greater than 1600 volts peak and rise times of 0.1 micro second.

2.4.1.2 Applications where the motor specification does not meet NEMA MG1 Part 31 (1600V peak and 0.1 micro second rise time), and the cable length between the inverter and motor exceeds the drive manufacturer recommended maximum cable length; load sideline reactors shall be used. The load sideline reactor shall be design and constructed to operate with variable frequency inverter drives with switching frequencies up to 20 KHz. Line reactor insulation dielectric strength shall be greater than or equal to 4000 volts and shall carry a UL506 & UL508 approval.

2.4.1.3 Insulated or isolated bearings shall be used for the inverter duty rated motors.

2.4.1.4 The inverter duty motor shall be constructed with triple film wire, increased winding slot insulation, increased insulation between phases, and increased first turn insulation. The inverter duty motor shall use slot fillers as required to avoid loose windings.

2.4.1.5 The inverter duty motor insulation class shall be class F insulation and a class B temperature rise based on 40° C.

2.4.1.6 The inverter duty motor nameplate shall indicate that the motor is an inverter duty motor.

2.5 Motors and Motor Starters

2.5.1 Specific motors are not generally specified within this section. Refer to appropriate mechanical design requirements for specifics on motors.

2.5.2 Coordinate with mechanical designer to require only NEMA premium efficiency motors with guaranteed efficiency at least equal to NEMA standards.

2.5.3 Motors 5 HP or smaller shall have sealed, lubricated-for-life bearings. Motors 7½ HP or larger shall have antifriction ball or roller bearings, oil or grease lubricated.

2.5.4 Motors 10 HP and larger shall be 480V, 3 phase; Motors 7½ HP to 1 HP can be 208V, 3 phase motors less than 1 HP can be 120V, single phase.

2.5.5 Motor Starters: Motor starters shall contain a NEMA integer sized contactor; one overload relay per phase; 120 volt coil for external control power; interlock on disconnect switch to de-energize external voltage control. Where external control power is not provided, include a fused control power transformer, 120 volt secondary mounted in the starter cabinet only. Starter shall provide for the field installation of up to 3 N.O. and 4 N.C. interlocks in addition to the hold-in interlock. Fan starters are to have safety switches on the line side of the motor or Variable Frequency Drive. The safety switch is to be located inside large air handler units and close to the air handler unit on small units. Where start/stop functions are controlled through control system, provide a relay in the automatic circuit of the control coil such that a 24V signal will actuate the starter.

PART 3: EXECUTION

3.1 Pump Motor Requirements:

3.1.1 Wiring Requirements:

3.1.1.1 Connect all pump motors rated at 25 amps or below with a flexible power cord no longer than 3'. The cord shall be hard service SO cord, rubber insulated with a neoprene jacket, rated at 90° C, 600V, oil resistant. It should be sized for the motor nameplate amperage.

3.1.1.2 Duplex sump pumps and condensate return pumps should be wired so that each pump is on a separate dedicated circuit. A mechanical alternator is to be provided to alternate operation of the pumps. There should be three floats in the sump; the lowest to energize the first pump, the next highest to energize both pumps and the highest to operate a N.O. set of contacts for alarm purposes. (Rhombus Controllers)

3.1.1.3 Some pumps may require emergency power. [Coordinate with Owner for special requirements.]

3.1.2 Electrical engineer to coordinate cord and NEMA plug/receptacle requirements with mechanical engineer and pump manufacturer.

3.2 Motors and Motor Starters

3.2.1 Variable speed drives shall be installed on the load side of the motor starter with an internal bypass.

3.2.2 Single-line diagram shall indicate motor and motor starter size information. If motor starter information is shown on mechanical coordinate such that no discrepancies will exist.

3.2.3 Circuit information for motors may be shown either on panel schedules or the floor plan, but not both to eliminate potential for discrepancies.

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