

## SECTION 26 60 00 - COMMON MOTOR REQUIREMENTS

### PART I - GENERAL

1.1 This section contains the requirements for single phase and three phase electric motors utilized at the University. It is the responsibility of the designer to apply the principles of this section such that the University may achieve a level of quality and consistency in the design and construction of their facilities. Any deviations from this section shall be pre-approved by the Variance Approval Committee.

### 1.2 APPLICATION

- A. Single phase motors for shaft mounted fans or blowers.
- B. Three phase motors for fans, pumps, blowers, or air compressors.

### 1.3 REFERENCE STANDARDS

- A. Motors and motor controls shall be designed, built, and tested in accordance with the latest revision of the following standards:
  - 1. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
  - 2. NEMA MG 1 - Motors and Generators
  - 3. NFPA 70 - National Electrical Code

### 1.4 SUBMITTALS

- A. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- B. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than three horsepower.
- C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, relubrication provisions, and wiring instructions.
- D. Construction documents shall include a schedule of all motors including the following information:
  - 1. Manufacturer
  - 2. Rated Horsepower
  - 3. Voltage(s)
  - 4. Number of Phases
  - 5. NEMA Frame
  - 6. Full Load Amps (FLA)
  - 7. Nominal Speed

8. Efficiencies ( Guaranteed, Nominal)

9. Label

#### 1.5 OPERATION AND MAINTENANCE DATA

- A. Operation Data: Include instructions for safe operating procedures.
- B. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture of electric motors for similar use, and their accessories. *[Note to AE: Acceptable manufacturers must have a minimum of 5 years documented product development, testing, and manufacturing experience.]*

#### 1.7 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Motors 3/4HP and smaller may be single phase, 60 Hz. Single phase 3/4HP motors shall be a minimum of 208V.
- B. Motors larger than 3/4HP shall be three phase, 60 Hz.
- C. Motors configured in duplex applications require 2 electrical circuits to each duplex control panel. Control circuits for each motor shall be capable of operating independently and shall be fed from their respective power circuits. Control transformers shall be provided as needed to limit control voltage to 120 volts. Single electrical feeds to dual motor systems are expressly prohibited.
- D. All motors shall be selected and applied such that they are capable of powering associated equipment at full design load/capacity without utilizing the service factor of the motor.
- E. The motor selected shall be an NEMA Premium Efficient motor.
- F. Motors located in wet locations shall be totally enclosed.

#### 2.2 CONSTRUCTION REQUIREMENTS

- A. Acceptable manufacturers
  - 1. Marathon XRI Premium Efficient series
  - 2. Siemens GP100 series
  - 3. Baldor Premium Efficient series
  - 4. Toshiba CT Premium Efficient Series

## B. Design

1. Open drip-proof (ODP) or totally enclosed fan cooled (TEFC), except where specifically noted otherwise.
2. Insulation System: NEMA Class B or better. Motors supplied by VFD's shall have NEMA Class F insulation as a minimum.
3. Design for continuous operation in 40 degree Centigrade environment.
4. Motor starting current shall be limited to no more than 7 times full load current.
5. Motors in Variable Frequency Drive (VFD) applications shall be "Inverter Approved" or "VFD Approved".
6. Explosion-proof motors shall be UL approved and labeled for hazard classification, with over temperature protection.
7. Bearings: Greased lubricated anti-friction ball bearings with housings equipped with plugged provision for re-lubrication.
8. Visible name plates shall be stainless steel, indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, and nominal and guarantee efficiencies.
9. Wiring Terminations
  - a. Motor leads shall be stranded copper and shall be permanently identified and brought out into the motor terminal box through a neoprene gasket. Conduit opening suitable for locknut type connector. Include UL listed ground lug in terminal enclosure.
  - b. For fractional horsepower motors where connection is made directly, provide conduit opening suitable for locknut type fitting in end frame.

### 2.3 SINGLE PHASE MOTORS

- A. Acceptable single phase motors are; Split Phase, Permanent Split Capacitor, and Capacitor Start.
- B. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
- C. Service Factor: Shall be a minimum of 1.0.
- D. Multiple Speed: Through tapped windings.

### 2.4 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Torque: NEMA Design B characteristics.
- B. Motor Frames: NEMA Standard T-Frames. Motor frame and end brackets shall be a minimum of grade 25 cast iron construction.
- C. Thermistor System shall be provided when specified in construction documents. Three (3) PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter. Refer to *Section 26 29 13 - Motor Control*.

- D. Bearings: Rated for minimum L-10 life of 40,000 hours, with an external load per NEMA 1-14, and an L-10 life of 100,000 hours in direct coupled applications. Stamp bearing sizes on nameplate.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Motors and associated devices shall be installed in accordance with the NEC requirements and in strict accordance with manufacturer's instructions.
- B. Install securely on a concrete housekeeping pad. Mount ball bearing motors with shaft in any position.
- C. Final wiring connections to all motors shall be made with stranded wire. All final wiring connections to any motor shall be in a Liquidtight Flexible Metal Conduit for the last six feet. Flexible Metal Conduit type is not acceptable, except in plenum spaces where a maximum of 4 feet of FMC shall be used. Per NEC, LFMC is not acceptable in plenum spaces.
- D. Testing: Record actual voltage and current readings at each motor in accordance with *Section 26 08 10 – Electrical System Start-Up*.

### 3.2 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. While being stored, motors shall have their shafts rotated periodically to protect bearings. For extended outdoor storage, remove motors from equipment and store separately. Prior to energizing the motor, a polarization index and MEG reading shall be performed and the results shall meet NEMA MG1 recommendations for new motors. Documentation shall be kept to verify rotation during storage and electrical test performed prior to startup.

### 3.3 Warranty

- A. Vendor shall provide the standard form of written guarantee and warranty covering defects in materials and workmanship for the equipment. The 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 the acceptance shall be defined as the date that the University assumes operation of the equipment.

END OF SECTION 26 60 00

This section of the *U of I Facilities Standards* establishes minimum requirements only.  
It should not be used as a complete specification.