UNIVERSITY OF MICHIGAN
ARCHITECTURE, ENGINEERING AND CONSTRUCTION

ARCHITECTURE & ENGINEERING
326 East Hoover, Mail Stop B
Ann Arbor, MI 48109-1002
Phone: 734-764-3414
Fax: 734-936-3334

BuildingName
The Description of the Project
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SPECIFICATION DIVISION 22

NUMBER SECTION DESCRIPTION

DIVISION 22
SECTION 220513 - MOTORS

END OF CONTENTS TABLE

DIVISION 22
SECTION 220513 - MOTORS

REVISIONS:

3-1-09: REVISED BEARING REQUIREMENTS AND MOTOR FRAME REQUIREMENTS BY D. KARLE PER MECH TECH TEAM.

10-21-10: REVISED TO ADD GROUNDING RINGS FOR HOSPITAL MOTORS OPERATED ON VFDS BY L. RICHARDSON FOR MECH TECH TEAM.

12-09-2010 - REVISED PERFORMANCE REQUIREMENTS AND REVISED FORMAT.

08-30-2012: REVISED TO DROP REQUIREMENT FOR MOTORS TO COMPLY WITH ALL PARTS MG-1 PART 31 AND TO DROP REQUIREMENT THAT MOTOR LABELS STATE "INVERTER DUTY". UPDATED MG-1 REFERENCES FROM MG-1 2009 TO MG-1 2011. D. KARLE FOR HVAC MTT.

07-29-13: REVISED TO DELETE "CLASS B TEMPERATURE RISE" REQUIREMENT FOR A MOTOR USED WITH A VFD PER K. BIRRINGER. D. KARLE.

OCT. 2016: REVISED 2.4.K. TO REQUIRE SHAFT GROUNDING RINGS FOR ALL MOTORS, AND CERAMIC BEARINGS ON THE NON-DRIVE END OF MOTORS 100 HP AND ABOVE, IN ALL CASES AS OPPOSED TO JUST FOR HOSPITAL FUNDED PROJECTS. CHANGE DUE TO NEW EVIDENCE OF BEARING FAILURES FROM ELECTRICAL DISCHARGE, PER DECISION OF AD-HOC COMMITTEE ON MOTOR FAILURES CONVENED 10-13-16. PER THAT COMMITTEE, USE OF CERAMIC BEARINGS MAY BE DROPPED AT LATER DATE AFTER ADDITIONAL RESEARCH, SINCE CERAMIC BEARINGS MAY NOT BE EFFECTIVE. ADDITIONALLY IMPROVED SPECIFICATION LANGUAGE FOR MOTORS ON VFDS, INCLUDING DROPPING REQUIREMENT FOR "RATED INVERTER DUTY" SINCE THAT TERM IS UNDEFINED BY NEMA. D. KARLE

PART 1 - GENERAL3

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

B. Related Sections:

1. Division 26: Electrical.

1.2 SUMMARY

A. Section includes:

1. Motors and requirements for factory or field installed motors, including but not limited to, air handling units, fans, pumps, and air compressors.

SPEC EDITOR: A/E MUST PROVIDE THE MOTOR SPECIFICATIONS FOR THE SPECIALIZED EQUIPMENT INDICATED BELOW. VERIFY IF THESE MOTORS ARE AVAILABLE IN EFFICIENCIES THAT COMPLY WITH NEMA MG-1 (2011) TABLE 12-12 AND SPECIFY AS SUCH, WHENEVER POSSIBLE.

B. This section does not include motors for fire pumps, elevators, centrifugal chillers, sealed refrigeration equipment and vertical hollow or vertical solid shaft motors used with vertical turbine pumps.

1.3 SUBMITTALS

A. Submit the following product data for approval:

1. Manufacturer information.
2. Dimensions and elevations.
3. Complete NEMA nameplate electrical data including design type, insulation, service factor, and efficiency.
4. Materials of construction.
5. Bearing type, L10 life, and seal construction (open, single, or double shielded).
6. Certification that VFD driven motors comply with NEMA MG-1 Part 31.

1.4 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

C. NFPA 70: National Electrical Code.

D. NEMA Standards Publication MG 1 (2011): Motors and Generators.

E. ABMA 9: American Bearings Manufacturers Association, Load Ratings and Fatigue Life for Ball Bearings.

F. UL 1004: Motors, Electric.

1.5 WARRANTY

A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers of motors 1/2 HP and larger.

1. Reliance Electric.
2. Baldor Electric Company.
3. Dayton.
4. General Electric.
5. Toshiba Corporation.
6. U. S. Electrical Motors.
7. Leeson Electric.
8. Marathon Electric.

2.2 MOTORS - GENERAL REQUIREMENTS

SPEC EDITOR: THE FOLLOWING IS GENERALLY APPLICABLE. REVIEW AND EDIT TO SUIT PROJECT.

A. Motors 1/2 HP and larger shall be three-phase, squirrel cage, induction type.

B. Motors smaller than 1/2 HP shall be single-phase, permanent split capacitor type, with built-in overload protection.

C. Frequency Rating: 60 Hz, alternating current.

D. Voltage rating of motor shall be determined by voltage of circuit to which motor is connected.

1. 120 V Circuit: 115 V motor rating.
2. 208 V Circuit: 200 V motor rating.
3. 240 V Circuit: 230 V motor rating.
4. 480 V Circuit: 460 V motor rating.

E. Motors shall be NEMA Design B.

F. Provide Class B insulation, unless noted otherwise.

G. Service Factor: 1.15, unless noted otherwise.

H. Motors shall be nominal 1,800 rpm, unless noted otherwise.

I. All disconnects and other electrical accessories shall comply with Division 26 requirements.

2.3 SINGLE PHASE MOTORS

A. Use shaded pole motors only for motors smaller than 1/20 HP.

B. Provide automatic reset type thermal over-load protection.

C. Bearings: Sealed or regreasable ball or sleeve bearings, suitable for the radial and thrust loading of the application.

D. Furnish with sliding base/slotted mounting holes adequate for proper belt tensioning and alignment of motor or motor/load.

E. Nameplates may be printed-type glued to the motor.

2.4 THREE PHASE MOTORS

A. Enclosure: Open Drip Proof (ODP) unless noted otherwise in equipment specifications or schedules, and as suitable for service and application.

SPEC EDITOR: ***ODP IS THE U-M STANDARD FOR MOST APPLICATIONS. TOTALLY ENCLOSED FAN COOLED (TEFC) MOTORS ARE SPECIFIED FOR COOLING TOWERS AND SOME OTHER APPLICATIONS. WHERE TEFC OR OTHER NON-ODP ENCLOSURES ARE REQUIRED, INCLUDE SPECIFIC REQUIREMENT IN EQUIPMENT SPECIFICATION SECTION AND/OR ON EQUIPMENT SCHEDULE.***

B. Motor Efficiency: Nominal (nameplate) full load efficiency and corresponding minimum efficiency shall be equal to or greater than that stated in NEMA MG-1 (2011) Table 12-12 – Full Load Efficiencies of 60hz NEMA Premium Efficient Electric Motors - 600 volts or Less

C. Motors less than 3 HP: Steel or cast iron motor frames, cast aluminum, cast iron, or steel end plates, steel or cast iron terminal box, copper windings. Motor nameplates shall be steel, engraved-type, riveted to motor.

1. Bearings: Regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings, selected for a minimum L-10 bearing life of 26,280 hours, for belted and direct drive.

D. Motors 3 HP and above: cast iron motor frame and mounting feet, cast iron end plates (bells), steel or cast iron terminal box, copper windings. Motor nameplates shall be stainless steel engraved type, riveted to the motor.

1. Bearings shall be regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings. Rated for an L-10 life of 40,000 hours (belted) or 130,000 hours (direct connected).

E. Bearing life calculations shall be per ABMA 9, and for belted applications shall be based on the maximum external side load limits for belted applications per NEMA MG-1 Table 14-1A. L-10 life calculations for vertical motors and horizontal motors mounted in the vertical position shall consider the application’s thrust loading.

F. TEFC motors shall also include an external shaft slinger on drive end.

G. Motors shall not exceed dBA levels listed in NEMA MG-1 54 PART 9 Tables 9-1 and 9-3, at all speeds.

H. Motors shall be suitable for continuous duty at rated horsepower, with a maximum hot spot temperature that does not exceed the temperature limit of the insulation, when operated in an ambient temperature of 40 degrees C, except as otherwise indicated.

I. Direct connected motors shall be furnished with adjustable base. Motors connected to driven equipment by belt or shaft shall be furnished with adjustable NEMA foundation sliding bases.

J. Multi-Speed Motors: Separate windings shall be provided for each speed.

K. For motors used with variable frequency drives, provide General Purpose NEMA Premium Efficiency Class motors compying with NEMA MG-1 Part 30 with windings that meet the requirements of NEMA MG-1 Part 31.4.4.2 and with minimum insulation of Class F.

1. For all PWM VFD driven motors up to 100 HP:

a. Provide a maintenance free, circumferential conductive micro fiber grounding ring installed on the AC motor to discharge shaft currents to ground. Grounding ring shall be AEGIS SGR (Shaft Grounding Ring).
b. Motors protected by the AEGIS SGR shall be warranted for the term of the manufacturer's motor warranty from induced bearing current damage.

2. For all PWM VFD driven motors 100 HP & greater:
a. Provide a maintenance free, circumferential conductive micro fiber grounding ring installed on the drive end of the AC motor to discharge shaft currents to ground. Grounding ring shall be AEGIS SGR (Shaft Grounding Ring). In addition, all VFD driven motors 100 HP and larger shall utilize an insulated ceramic bearing assembly on the non-drive end of the motor, in conformance with the Aegis installation requirements.

L. Explosion Proof motors:

1. UL listed for application or duty.
2. Motors shall conform to requirements defined in Article 500, 501, 502, and 503 of the National Electric Code.
3. Motor nameplate shall be specifically marked "explosion proof."
4. Sound power levels shall not exceed recommendations of NEMA MG-1 PART 9 Tables 9-1 and 9-3, at all speeds.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and align motors in accordance with equipment manufacturer's recommendations.

B. For VFD driven motors using a shaft grounding ring: Install grounding ring in accordance with the manufacturer’s recommendations, including the application of a colloidal silver shaft coating on the motor shaft.

3.2 COMMISSIONING

A. Perform the commissioning activities as outlined in the Division 01 Section Commissioning and other requirements of the Contract Documents.

3.3 ADJUSTING, CLEANING, PROTECTION

A. Assure motor nameplate is legible and properly affixed.

B. Verify that bearings are factory lubricated before starting motors. Lubricate per manufacturer’s instructions. Do not over-lubricate bearings.

C. Check motors for unusual heating, noise, or excess vibration during operation. Correct any such deficiencies.

1. Any motors with vibration exceeding specified limits, as noted in the Testing, Adjusting and Balancing Section, or manufacturer's recommendations, whichever is more stringent, shall be corrected, at no cost to Owner, until reduced below those limits.

D. Clean the motor prior to start-up and immediately prior to final turn over to the Owner.

END OF SECTION 220513