

23 05 13 – Common Motor Requirements for HVAC Equipment

1. Introduction

- A. This section contains guidelines and requirements for all HVAC system pump and fan motors.
- B. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
- C. Designers should coordinate with Duke Office of Project Management and Duke Utilities & Engineering Services (DUES Engineering) on all phases of projects and equipment requiring electrical motors. These projects may include but are not limited to:
 - 1. New buildings
 - 2. Renovations to the existing building
 - 3. Replacement of existing equipment
 - 4. For utility projects installations coordinate exact motor manufacturers and requirements with DUES.
- D. Designers are expected to share and review any project data, load calculations and site condition evaluations with DUES Engineering.

2. References

- A. NEMA MG Guidelines
- B. IEEE
- C. ANSI
- D. NEC
- E. North Carolina Building Code
- F. UL Guidelines

3. Design Standards

- A. GENERAL REQUIREMENTS FOR MOTORS
 - 1. Preferred Manufacturers

- a. Baldor, US Motors, Marathon, General Electric, Toshiba or approved equal.
 - b. Any deviation from preferred manufacturers shall be discussed with Duke FMD.
2. Single Phase Motors
 - a. Single-phase motors shall be furnished with built-in thermal overload protection.
 - b. Use NEMA Design B motors, normal starting torque with re-greasable ball bearings
 - c. L-10 life 200,000 hours at full-load, and Class B insulation unless specified otherwise or unless manufacturer of equipment on which motor is being used has more stringent requirements.
3. Polyphase Motors
 - a. Motors shall be rated continuous duty and have 1.15 service factor unless otherwise noted.
4. Motors Driven by Variable Frequency Drives (VFD)
 - a. Motors shall comply with the latest edition of NEMA MG-1, Section IV, and Part 31. Starter winding insulation shall be designed to operate under maximum voltage peak of not less than 1600 volts with time rise not greater than 0.1 micro-seconds. Motors shall have corona gas resistant stator insulation.
 - b. Motors shall be rated for 90°C temperature rise with 40° C ambient.
 - c. Class F Temperature Rise with Class H Insulation
 - d. Motors shall be listed as “Inverter Duty” and indicated as such on motor nameplate. Motors listed only as “suitable for use with inverter” is not acceptable.
 - e. Motors shall have service factor not less than 1.0 when rated for inverter duty.
 - f. Furnish each motor with grounding brush similar to AEGIS Shaft Grounding Ring to prevent bearing from shaft current. Provide/confirm grounded connection between shaft grounding ring to motor casing with braided copper conductor.
 - g. Vibration shall not exceed 0.15 inch per second, unfiltered peak unless otherwise noted.
5. Fan Walls
 - a. Motors shall be designed and sized to operate at maximum 60 Hz.
 - b. Label each motor with applicable nomenclature to match VFD drive/service.

- c. Provide a minimum of two separate VFD drives for fan walls.
 6. All integral horse power motors shall have totally enclosed fan cooled (TEFC) enclosures.
 7. All motors to be provided with grease fittings.
 8. Provide NEMA Premium Efficiency Motors values based on latest NEMA Motor Guidelines.
 9. Motors (180 frames and larger) shall have provisions for lifting eyes or lugs capable of safety factor of 5.
 10. Except for special purpose motors (e.g. two-speed, explosion proof, etc.), full load nominal efficiency of motors 1 HP and larger shall meet or exceed listed values when tested in accordance with IEEE Standard 112 Method B as defined by NEMA Standard MG 1-12.6C.
4. Documentation and Review Requirements
- A. Documentation of factors used in equipment selection (heating and cooling load, diversity allowed for in air distribution, etc.) must be submitted for review at DD submittal and each subsequent submittal if conditions have changed. Summary of factors shall identify which factors are known and which are assumptions.
 - B. Detailed equipment selection (including expected sound levels for unit discharge, unit return, radiated sound and sound level in space served). Where multiple spaces are served, expected sound levels are required only for those spaces nearest the unit.
 - C. Cost of operations and maintenance shall be included in system Life Cycle Cost Analysis. This information shall be reviewed at DD submittal.
5. Installation and Performance Requirements
- A. Install materials in accordance with drawings, approved shop drawings and manufacturer's recommendations.
 - B. Contractor shall make provisions to protect motors from all construction debris and dust.
 - C. Unit installation shall include services of a factory authorized service representative for motor start up.
 - D. Coordinate all commissioning efforts with Duke Utilities and Engineering Services (DUES).