

# NC State University Design and Construction Guidelines

## Division 23 HVAC Motors

### 1.1 Purpose

- A. The following guidelines shall apply to the selection of motors from one half (1/2) to 500 horsepower with nominal voltage rating 600 volts or less.

### 2.1 General Requirements

- A. Motors one half (1/2) horsepower or larger shall be three phase unless restricted by system voltage characteristics and shall be rated for continuous duty.
- B. Motors shall be built to minimum nominal full-load efficiency standards as defined in NEMA MG-1 (2006), Table 12-12, NEMA Premium Motors. Motors shall be NEMA Design B, normal torque, normal starting current unless specified otherwise or if higher starting or running torque is required by the application.
- C. Motors for equipment shall be sized so that the driving requirements shall operate between 75% and 95% of the rated horsepower of the motor.
- D. Motors for pumps shall be sized so that under any conditions of loading over the complete range of the head-capacity curve of the pump, the motor shall not be loaded to more than 95% its rated horsepower. Excessive over sizing shall be avoided.
- E. Single-phase motors shall be provided with built-in thermal protection.
- F. Three phase motors shall have 1.15 service factor. Single-phase motors shall have 1.35 service factor.
- G. Motor bases for belt driven equipment shall be adjustable slide base and base plate type with not less than two adjusting screws to maintain belt tension.
- H. Motors that are required to cycle on and off automatically under control of a device shall be capable of making starts as frequently as the device may demand. Other motors shall be capable of being started a minimum of four (4) times per hour with reliability. Motors shall be rated based on duty-cycles, S-1 thru S-8, in accordance with the International Electrotechnical Commission (IEC) standards.
- I. Each motor used with a variable frequency drive (VFD) shall be inverter — duty rated. The inverter-duty motor shall be designed and manufactured to meet the most current specifications defined by NEMA MG 1 Section IV, “Performance Standards Applying to All Machines,” Part 31, “Definite- Purpose Inverter-Fed Polyphase Motors.”
- J. Grounding Rings:
  - Motor shaft grounding rings shall be installed on all motors using a VFD.
  - All new motors that are not “Inverter” rated exceeding 15 hp must have a shaft grounding ring installed to prevent bearing and shaft wear. Smaller motors should have shaft grounding rings installed but may not have the grounding ring if approved in writing by N.C. State.

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- K. Designer shall specify the appropriate trade to verify proper overload protection is installed and that the motor is operating within nameplate voltage and current over the full range of operating conditions. Totally enclosed (TEFC) motors shall be specified for all exposed applications.

### 2.2 Variable Frequency Drive Requirements

#### A. Equipment Requirements

- Bypass: Mechanical Bypass or a Bypass Controller with a dedicated control board. This is to prevent any failure with the mainboard affecting the ability of the controller to be placed in Bypass.
- Line Choke/Reactors: Required on all drives for motors larger than 40Hp to prevent a build up of reactive power within the building. These reactive power loads can interfere with a building's power response if not kept under control.

#### B. Communications Standards

- Communication Architecture: NC State has selected BACNet as the communication standard for all installations of BAS controlled and monitored equipment. IF BACNet is not available and the equipment is deemed necessary, Modbus is the only other communication standard approved for new installations.
- BAS Data Points: The following Data Points are considered the minimum required for proper BAS monitoring and reporting:
  - Any input used in PID or Speed Control
  - Drive Status
  - Speed (RPM and Hz)
  - Amperage Draw