

SECTION 9 **Motors and Controllers**

9 – 1 Motors and Controllers

9 – 1a Customer/Contractor

- Consult with the company concerning the characteristics of the service to which the motor will be connected to ensure correct application (phase and voltage) of the motor to be used. Direct inquiries to the company key account manager.
- Advise company key account manager before installing any single-phase motor rated 3 HP (equivalent 25,000 BTUH) or larger, or any three-phase motor rated 10 HP (equivalent 75,000 BTUH) or larger. Information required includes the rated voltage, full load and locked current, frequency of starting, the operating characteristics of the driven machine, and if the load fluctuates rapidly, such as in a stone crusher, sawmill, etc. The locked rotor current must be supplied by the manufacturer or computed from the appropriate table in the NEC.

9 – 2 Single-Phase Motors

Single-phase motors rated smaller than three-quarters HP may be connected for operation at 120 volts. Single-phase motors rated three-quarters HP and larger must be connected for operation at 208 volts or 240 volts. Single-phase air conditioning or heat pump compressors must be equipped with supplemental starting components.

9 – 3 Three-Phase Motors

Generally, motors rated larger than 5 HP are supplied from a three-phase service. The company does not, however, guarantee that three-phase service will be available whenever a customer installs a motor rated larger than 5 HP or an air conditioner or heat pump rated larger than 40,000 BTUH.

9 – 4 Motor Protection

9 – 4a Customer/Contractor

- Protect all motors against operation at any ampere/voltage level that exceeds their rating, including overloads caused by low-voltage conditions.
- Protect three-phase motors against the possibility of single-phase operation. Reverse-phase relays, together with circuit breakers or equivalent devices, should be used on all three-phase installations for elevators, cranes, and similar applications to protect the installation from phase reversal.

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9 – 5 Motor Controllers

9 – 5b Company

- Recommend that motor controllers be arranged so that in the event of sustained interruption the motor will be disconnected from the line, unless it is equipped for automatic starting after such an interruption. Where continuous operation of motorized equipment is essential, motor controllers should be arranged to allow motors to operate through a transient no-voltage condition lasting for one-half second (30 cycles).

9 – 6 Motor Starting Requirements

The current inrush to a motor during its start may cause fluctuations in the supply voltage. Where this effect is pronounced, the customer or other customers served from the same system may observe a visual disturbance or lighting flicker. To ensure high-quality service to all customers, the company has established certain rules pertaining to the limitation of motor starting current. The current limitations at a given location are determined by the service capacity contracted for, the type of motor, frequency of starting, and locked rotor current at the rated voltage.

The following specific motor starting current limitations are the maximum permissible limits to the current drawn from the service during each step of a motor starting operation, based upon frequency of starts. When a group of motors is started simultaneously, the allowable starting current applies to the total for the group and not to an individual motor of the group.

9 – 7 Single-Phase Motor Starting Current Limitations

The maximum starting currents permitted for single-phase motors rated in HP and for air conditioning or heat pump equipment rated in BTUH are:

Single-Phase Motors

Service Voltage	Maximum starting current/step Maximum four starts per hour	BTUH rating of air conditioner or heat pump
120v	50 Amp	10,000
208 or 240 v	60 Amp up to 2 HP	20,000
208 or 240v	80 Amp up to 3 HP	25,000
208 or 240v	120 Amp up to 5 HP	40,000

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Three-Phase Motor Starting Current Limitations

The maximum starting currents permitted for three-phase motors rated in HP and for air conditioning or heat pump equipment rated in BTUH are:

Three-Phase Motors

Service Voltage	Maximum starting current/step Maximum four starts per hour	BTUH rating of air conditioner or heat pump
208 or 240 v	100 Amp up to 5HP	40,000
208 or 240 v	130 Amp up to 7 1/2 HP	50,000
208 or 240v	160 Amp up to 10 HP	75,000
480v	50 Amp up to 5 HP	40,000
480v	65 Amp up to 7 1/2 HP	50,000
480v	80 Amp up to 10 HP	75,000

9 – 8 Favorable Locations

There are certain locations on the company's system where starting currents or frequency of starts greater than specified may be permitted. The customer must contact the company key account manager for motors that exceed the above limits.