

## **9.0 MOTORS AND CONTROLLERS**

### **9.1 GENERAL**

Before any large motors or special apparatus are installed, it is necessary to consult LIPA regarding the character and adequacy of the available service and the manner in which the equipment may be connected.

### **9.2 MOTOR PROTECTION**

9.2.1 For the customer's protection, all motors and special apparatus should be equipped with suitable under voltage tripping devices to prevent sustained under voltage operation and equipment damage.

9.2.2 All poly-phase motors shall be equipped with suitable protection to prevent single phase operation, improper rotation and excessive heating due to phase current unbalance.

9.2.3 LIPA will not be responsible in any way for damage to customer's equipment due to the failure of the customer to provide adequate protection.

### **9.3 MOTOR STARTING LIMITATIONS**

9.3.1 The starting of a motor on an electric circuit causes a momentary fluctuation of the circuit voltage each time the motor starts. Where this effect is pronounced, a visual disturbance or lighting flicker may be observed by the customer or other customers served from the same system. In extreme cases, the motor itself may have difficulty in starting. To minimize this problem, it is necessary to set limits upon the starting current permitted in any motor installation. These limits are designed to cover typical cases, and LIPA gives no warranty that particular conditions may not later require changes.

9.3.2 Typical motor starting limitations based on motor start cycles not exceeding four starts per hour, are listed on the tables on pages 36 thru 38. Separate limitations are prescribed for conventional motorized equipment rated in BTU's per hour. Cases not covered therein should be referred to LIPA.

9.3.3 All motors connected for operation at 120 or 240 volts which do not exceed the locked rotor starting current limitations as stated in tables 1 and 2, and are normally started four times per hour or less, may be connected directly to LIPA's supply lines.

9.3.4 Motors that do not comply with the locked rotor starting current limitations, or not covered therein, shall be discussed with LIPA. Specific inrush limitations will be supplied and will vary with the size, type, demand and location of service.

9.3.5 When starting devices are used, the total current taken by the motor is not restricted by the rules but may have to be built up in steps, each of which does not exceed the maximum allowable motor starting current as stated by the company. When a step type starter is used, an appreciable time must be allowed on each step.

9.3.6 When motors are started in a group instead of individually, the starting current limitations apply to the group and not to the individual motors.

#### 9.4 STARTING CURRENT LIMITS FOR SINGLE PHASE MOTORS

- 9.4.1 LIPA must be notified of any single phase motor installation totaling 3 HP or more, as it may be necessary, in such cases, to effect changes in the supply system to serve the additional load.
- 9.4.2 All single phase motor driven equipment rated larger than 1 HP must be connected for operation at 240 volts unless arranged as part of an approved three phase installation.
- 9.4.3 Tables I and II list the maximum starting currents permitted at 120 or 240 volts single phase for conventional motorized equipment rated in horsepower and for air conditioning or heat pump equipment rated in BTU's per hour. These limits are permitted only for motors normally expected to start not more than four times per hour. For convenience, the tables include the NEMA Code designation of motors which will start without exceeding the prescribed starting current limits and without requiring auxiliary starting devices.

<b>Table I            Motor Starting Limitations            Single Phase Equipment With Motors Rated            In Horsepower</b>			
Operating Voltage	Motor Size (HP)	Maximum Starting Current Amp.	NEMA Code Letter
120	½	50	A to M
120	¾	50	A to J
120	1	50	A to G
240	½	60	A to S
240	¾	60	A to P
240	1	60	A to H
240	2	60	A to G
240	3	80	A to B
240	5	120	A
	In excess of 5 HP		(see note)

Table II Single Phase Air Conditioning Or Heat Pump Equipment		
Operating Voltage	Capacity BTU/Hr.	Maximum Starting Current Amp.
120		50
240	20,000 or less	60
240	25,000	75
240	30,000	90
240	35,000	105
240	40,000	120
240	In excess of 40,000	120 (see note below)

**Note:**

***Motors in these sizes generally require an auxiliary starting device to meet the starting current limits. The Company should be consulted to obtain allowable inrush limitations which will vary with service size and location.***

#### 9.5 STARTING CURRENT LIMITS FOR THREE PHASE MOTORS

- 9.5.1 Tables III and IV list the maximum starting current permitted at 240 volts, three phase for conventional motorized equipment rated in horsepower and for air conditioning or heat pumping equipment rated in BTU's per hour, on the basis of not more than four starts per hour.
- 9.5.2 A customer, upon proper notification to the Company, may connect to the Company's supply lines, any motor which conforms to the starting current limits specified in these tables, with or without the use of reduced voltage starting equipment; provided that the estimated or recorded electrical demand at the point of service, exclusive of the motor being added, meet the Minimum Demand Required, shown in the left hand column.
- 9.5.3 In the case of motor-driven equipment rated greater than 20 HP or 225,000 BTU's per hour, the Company should be consulted. In cases of motor driven equipment rated less than 20 HP or 225,000 BTU's per hour, if the equipment in question cannot meet the starting current limits indicated in the Tables or if the customer's existing load does not satisfy the minimum demand requirements. The Company will then determine whether specific conditions at the point of service will permit a greater starting current to be drawn without adverse effect on the electric service to other customers.
- 9.5.4 The starting currents permitted in the Tables are based on motors carrying a nameplate voltage rating of 220 volts. Motors rated at 200 volts, or at 208 volts, will actually draw a higher starting current than indicated on their name plates when they are supplied at a higher voltage, for example, 230 volts. However, for the purpose of these Rules and Regulations, it may be assumed that the actual starting currents of motors rated at 200 or 208 volts will be the same as the starting current (*locked rotor current*) indicated on the nameplate.

<b>Table III Motor Starting Limitations Three-Phase Equipment With Motors Rated In Horsepower</b>		
<b>Minimum Demand Required – KW</b>	<b>Motor Size (HP)</b>	<b>Maximum Starting Current Amp.</b>
No Minimum Demand Required	2 or less	50
10	3	64
10	5	92
10	7	127
20	10	162
20	15	232
30	20	300

<b>Table IV Three-Phase Air Conditioning Or Heat Pump Equipment</b>		
<b>Minimum Demand Required – KW</b>	<b>Capacity BTU/Hr.</b>	<b>Maximum Starting Current Amp.</b>
No minimum demand required	20,000 or less	50
10	30,000	75
10	40,000	100
10	50,000	125
10	60,000	135
10	75,000	150
20	100,000	175
20	150,000	225
30	200,000	275
30	225,000	300