

## **5. CUSTOMER'S USE OF SERVICE**

### **5.1 GENERAL**

The customary use of most electric equipment does not affect the operation of other equipment connected to the same electric service and is not objectionable to other Customers served from the same facilities of the Company. However, it is characteristic of most electric motors to draw heavy currents on starting, and other equipment, such as welders intermittently draw heavy currents during operation. This type of use may cause unbalance and fluctuation of the service supply voltages. When sufficient capacity is not present in the circuits and equipment of either the Customer or Company, the equipment may not operate properly, resulting in overheating, blown fuses, or damage to the equipment. The requirements of the edition of the National Electrical Code currently in effect in the Company's service area shall be met in all respects regarding conductor sizes, controlling and protecting equipment.

### **5.2 FLUCTUATIONS**

Where electric service is used in such manner as to cause objectionable voltage fluctuations or disturbances in the Company's supply system, the Company may discontinue service or require the Customer to modify the installation and/or equip it with approved controlling devices.

#### **5.2.1 Motors**

These Electric Service Requirements are designed to limit the application of motors only insofar as they affect voltage fluctuation and disturbances to the Company's supply system.

#### **5.2.2 Welders and Furnaces**

Welders for residential application with a transformer type "limited input", not to exceed 37-1/2 amperes at 240 volts, are acceptable. Other electric welding equipment, electric furnaces, and other special forms of electric equipment will be accepted for connection to the Company's lines only under conditions and arrangements specified by the Company for each particular case.

The Customer shall provide a copy of the manufacturer's data concerning the electrical input characteristics of all welders proposed for use on the Company system.

#### **5.2.3 Waveform and Harmonic Distortion**

See IEEE Standard 519 for recommended maximum harmonic current and voltage distortion limits as measured at the service point.

### **5.3 TYPE OF INSTALLATIONS**

Motor and other installations shall be designed to draw minimum starting current and shall conform to the requirements of the Company with respect to wiring, characteristics of equipment, and control devices.

#### **5.4 UNBALANCED LOAD**

The Customer shall at all times take, and use, energy in such manner that the load will be balanced between phases to within nominally 10%. In the event of unbalanced polyphase loads, the Company reserves the right to require the Customer to make the necessary changes at their expense to correct the unsatisfactory condition, or to compute the demand used for billing purposes on the assumption that the load on each phase is equal to that on the greatest phase.

#### **5.5 CHANGE OF INSTALLATION**

The Customer shall give immediate written notice to the Company of any substantial increase or decrease in, or change of purpose or location of this installation.

#### **5.6 MOTOR INSTALLATIONS**

##### **5.6.1 General**

Before purchasing and installing any motor equipment, the Customer should consult the Company in order to verify the voltage, frequency and phase characteristics of the service to be supplied, the capacity available, and the suitability of the proposed equipment for operation at the intended location. The Company has established limits for motor starting inputs for each type of service to minimize voltage fluctuations and disturbances to the Company's supply system.

Motor voltage ratings for standard polyphase secondary systems should be in accordance with ANSI Standard C84, Voltage Ratings for Electric Power Systems and Equipment as follows:

<b>Nominal System Voltage</b>	<b>Motor Voltage Rating</b>
<b>208</b>	<b>200</b>
<b>240</b>	<b>230</b>
<b>480</b>	<b>460</b>

### **5.6.2 Motor Code Letters**

Motors are furnished with a code letter on the nameplate that designates the locked rotor rating of the motor in kilovolt-amperes per nameplate horsepower. The letters range in alphabetical order from A to V in increasing values of locked rotor current.

#### **MOTOR CODE LETTER TABLE**

<u>Code Letter</u>	<u>Locked Rotor kVA per HP</u>
A	0.00-3.14
B	3.15-3.54
C	3.55-3.99
D	4.00-4.49
E	4.50-4.99
F	5.00-5.59
G	5.60-6.29
H	6.30-7.09
J	7.10-7.99
K	8.00-8.99
L	9.00-9.99
M	10.00-11.19
N	11.20-12.49
P	12.50-13.99
R	14.00-15.99
S	16.00-17.99
T	18.00-19.99
U	20.00-22.39
V	22.40 and up

### **5.6.3 Acceptable Motor Code Letters**

The maximum current of motors started at full line voltage will be at the locked rotor rating, and maximum kilovolt-ampere input allowed for starting motors depends upon the motor size and the type of service used. Motors acceptable for connection to secondary voltage services of the Company are determined from the information found on motor nameplates. The maximum code letter and locked rotor current ratings for motors acceptable on the Company's secondary service voltages are as follows:

MAXIMUM LOCKED ROTOR CODE LETTER AND CURRENTS

<u>Motor Horsepower</u>	<u>115 Volt Single Phase Max. Amperes</u>	<u>Max. Code Letter</u>	<u>230 Volt Single Phase Max. Amperes</u>	<u>Max. Code Letter</u>
Under 3/4 (Note 1)				
3/4	60	L	35	M
1	70	J	35	J
1-1/2			50	J
2			65	J
3			90	H
5			150	H
7-1/2			175	F
10			175	D

MAXIMUM LOCKED ROTOR CODE LETTER AND CURRENTS

<u>Motor Horsepower</u>	<b>220 Volt (Note 3) Three Phase</b>		<b>220 Volt (Note 3) Two Phase</b>	
	<u>Max. Amperes</u>	<u>Max. Code Letter</u>	<u>Max. Amperes</u>	<u>Max. Code Letter</u>
3/4	30	R	26	R
1	30	N	26	N
1-1/2	40	M	35	M
2	50	L	43	L
3	64	K	55	K
5	92	H	80	H
7-1/2	127	H	110	H
10	162	H	140	H
15	232	G	200	G
20	290	F	250	F
25 (Note 2)	365	F	315	F
30 (Note 2)	435	F	375	F
40 (Note 2)	580	F	500	F
50 (Note 2)	725	F	625	F

**Note 1: Any motor under 3/4 horsepower and manufactured to NEMA standards is acceptable.**

**Note 2: Outside the City of Philadelphia, Company approval must be obtained for installation of any motor rated in excess of 20 HP.**

**Note 3: Locked rotor currents of motors designed for voltages other than 220 volts shall be inversely proportional to the voltage.**

**5.6.4 Alternate Code Letters**

The letters and current ratings shown in above table represent the maximum rating acceptable. Any code letter is acceptable from "A" through the maximum letter shown in the above table for the particular horsepower and voltage application.

**5.6.5 Single Phase Motors**

Single-phase motors may be used at secondary service voltages up to and including 1 horsepower on 120-volt services and 10 horsepower on 240-volt services, provided that they meet the locked rotor current ratings listed above.

#### **5.6.6 Motors on Services Below 13kV**

Polyphase motors larger than 50 horsepower in the Philadelphia Region and larger than 20 horsepower in other regions of the Company may be used on Company services under certain conditions, provided that the Company is notified and gives its approval beforehand.

#### **5.6.7 Motors on Services 13kV and Above**

For 13 kV services, motors are usually acceptable for across the line starting up to 400 HP in the Philadelphia Region and up to 200 HP in the suburban regions.

For services above 13 kV, motors up to 400 HP are usually acceptable for across the line starting.

#### **5.6.8 Other Motor Sizes**

For motors exceeding the limits stated above, the customer must provide data prior to purchase or installation so that the company may calculate voltage fluctuations. The calculations are used to determine acceptability of the installation.

#### **5.6.9 Motor Soft Start Controllers**

Motors having locked rotor currents or code letters in excess of those allowed will be considered as meeting these requirements provided they are equipped with a starting controller (i.e., Variable Frequency Drive, Reduced Voltage Start, etc.) that will ensure that the input to the motor during the starting cycle does not at any time exceed the values allowed in these requirements-

#### **5.6.10 Multiple Starting**

Where equipment is proposed with more than one motor that may be arranged to start simultaneously, the sum of the locked rotor inputs of all power consuming components shall be used to calculate the resulting voltage fluctuation.

#### **5.6.11 Sequential Starting**

Sequential starting of motors may be utilized to mitigate voltage fluctuations on the Company's supply system.

#### **5.6.12 Under voltage Protection**

All motors connected to the Company's lines, unless inherently protected, should be equipped with low voltage or no voltage protection to ensure that such motors will be automatically disconnected from the line in case of failure of the normal voltage supply on all phases simultaneously or to any one phase, or in case of sustained low voltage approximating 75% or less of the normal supply voltage. Where practical, motor under voltage protection should include time delay features, which will prevent interruption of operation under conditions of momentary voltage disturbance.

#### **5.6.13 Single-Phase Protection**

Polyphase motors must be protected against damage caused by single-phase conditions in starting and running modes.

#### **5.6.14 Relay Protection**

The Customer shall install at his own expense a reverse phase relay of approved type on all alternating current motors for passenger or freight elevators, hoist, and cranes.

#### **5.7 Emergency Generators**

Wiring for generators installed on customer premises should be connected in a manner to prohibit paralleling of the generator with the Company's energy supply. Interlocked switches or an automatic transfer switch which provides an "open transition" transfer (break before make) of load from the Company supply to the generator and in the opposite direction are acceptable.

Momentary paralleling of emergency generators, **regardless of size**, is permitted where the system meets the requirements of the Gray Book ("**Requirements for Parallel Operation of Generation Greater Than 50 kW**").

#### **5.8 Distributed Energy Resources (DER)**

Customers installing distributed energy resources (i.e., Solar, Wind, Combined Heat and Power, Hydro, etc.) shall comply with the requirements of the Gray Book ("**Requirements for Parallel Operation of Generation Greater Than 50 kW**") or Yellow Book ("**Requirements for Parallel Operation for Customers With Generation Not Exceeding 50 kW**"), based on the rating of the system.