ARTICLE
455 Phase Converters

Part I. General

455.1 Scope. This article covers the installation and use of phase converters.

A phase converter is an electrical device that converts single-phase electrical power to 3-phase for the operation of equipment that normally operates from a 3-phase electrical supply. Phase converters are of two types: static, with no moving parts, and rotary, with an internal rotor that must be rotating before a load is applied.

See also

Article 100 for definitions of the terms *phase converter, rotary* and *phase converter, static*

Phase converters are frequently used to supply 3-phase motor loads in locations where only single-phase power is available from the local utility. Electrical installations on farms and in other remote or rural areas are examples of such locations. Although their most common loads are motors, phase converters are increasingly used to supply loads such as cellular telephone and other communication transmitter sites.

455.3 Other Articles. Phase converters shall comply with this article and with the applicable provisions of other articles of this *Code*.

455.4 Marking. Each phase converter shall be provided with a permanent nameplate indicating the following:

(1) Manufacturer's name
(2) Rated input and output voltages
(3) Frequency
(4) Rated single-phase input full-load amperes
(5) Rated minimum and maximum single load in kilovolt-amperes (kVA) or horsepower
(6) Maximum total load in kilovolt-amperes (kVA) or horsepower
(7) For a rotary-phase converter, 3-phase amperes at full load

455.5 Equipment Grounding Connection. A means for attachment of an equipment grounding conductor termination in accordance with 250.8 shall be provided.

455.6 Conductors.

(A) Ampacity. The ampacity of the single-phase supply conductors shall be determined by 455.6(A)(1) or (A)(2).

Informational Note: Single-phase conductors sized to prevent a voltage drop not exceeding 3 percent from the source of supply to the phase converter may help ensure proper starting and operation of motor loads.

(1) Variable Loads. Where the loads to be supplied are variable, the conductor ampacity shall not be less than 125 percent of the phase converter nameplate single-phase input full-load amperes.

(2) Fixed Loads. Where the phase converter supplies specific fixed loads, and the conductor ampacity is less than 125 percent of the phase converter nameplate single-phase input full-load amperes, the conductors shall have an ampacity not less than 250 percent of the sum of the full-load, 3-phase current rating of the motors and other loads served where the input and output voltages of the phase converter are identical. Where the input and output voltages of the phase converter are different, the current as determined by this section shall be multiplied by the ratio of output to input voltage.

Calculation Example

Determine the minimum ampacity for the single-phase input conductors supplying a phase converter used to supply 3-phase receptacles for electric welders. The number of welders connected at any one time is variable. The phase converter has a 230 V, single-phase input and a 230 V, 3-phase output. The phase converter input current is 105 A.

Solution

Because the loads are variable, 455.6(A)(1) applies.

$$1.25 \times 105\ \text{A} = 131.25\ \text{A}$$

If the same phase converter is used to supply only two 3-phase, 5 hp, 230 V motors, what is the minimum ampacity of the single-phase input conductors?

Solution

Because the loads are fixed, 455.6(A)(1) applies. According to Table 430.250, the full-load current (FLC) for a 10 hp, 230 V, 3-phase motor is 15.2 A. Thus,

$$2.5 \times (15.2 + 15.2) = 76\ \text{A}$$

(B) Manufactured Phase Marking. The manufactured phase conductors shall be identified in all accessible locations with a distinctive marking. The marking shall be consistent throughout the system and premises.

The *phase, manufactured (manufactured phase)* as defined in Article 100 is the phase that is created within the rotary or static equipment and is not solidly connected to the input conductors. Identification of the manufactured phase is necessary to help installers comply with 455.9, which does not permit single-phase loads to be supplied from the manufactured phase. The method of identification is not specified by the *NEC*®; therefore, it could be by any means acceptable to the AHJ. While many phase converters are installed to supply a specific item of equipment such