

669.9 Overcurrent Protection. Direct-current conductors shall be protected from overcurrent by one or more of the following:

- (1) Fuses or circuit breakers
- (2) A current-sensing device that operates a disconnecting means
- (3) Other approved means

ARTICLE 670 Industrial Machinery

670.1 Scope. This article covers the definition of, the nameplate data for, and the size and overcurrent protection of supply conductors to industrial machinery.

Informational Note No. 1: For further information, see NFPA 79-2007, *Electrical Standard for Industrial Machinery*.

Informational Note No. 2: For information on the workspace requirements for equipment containing supply conductor terminals, see 110.26. For information on the workspace requirements for machine power and control equipment, see NFPA 79-2007, *Electrical Standard for Industrial Machinery*.

670.2 Definition.

Industrial Machinery (Machine). A power-driven machine (or a group of machines working together in a coordinated manner), not portable by hand while working, that is used to process material by cutting; forming; pressure; electrical, thermal, or optical techniques; lamination; or a combination of these processes. It can include associated equipment used to transfer material or tooling, including fixtures, to assemble/disassemble, to inspect or test, or to package. [The associated electrical equipment, including the logic controller(s) and associated software or logic together with the machine actuators and sensors, are considered as part of the industrial machine.]

670.3 Machine Nameplate Data.

(A) Permanent Nameplate. A permanent nameplate shall be attached to the control equipment enclosure or machine and shall be plainly visible after installation. The nameplate shall include the following information:

- (1) Supply voltage, number of phases, frequency, and full-load current
- (2) Maximum ampere rating of the short-circuit and ground-fault protective device
- (3) Ampere rating of largest motor, from the motor nameplate, or load
- (4) Short-circuit current rating of the machine industrial control panel based on one of the following:

- a. Short-circuit current rating of a listed and labeled machine control enclosure or assembly
- b. Short-circuit current rating established utilizing an approved method

Informational Note: UL 508A-2001, Supplement SB, is an example of an approved method.

- (5) Electrical diagram number(s) or the number of the index to the electrical drawings

The full-load current shown on the nameplate shall not be less than the sum of the full-load currents required for all motors and other equipment that may be in operation at the same time under normal conditions of use. Where unusual type loads, duty cycles, and so forth require oversized conductors or permit reduced-size conductors, the required capacity shall be included in the marked “full-load current.” Where more than one incoming supply circuit is to be provided, the nameplate shall state the preceding information for each circuit.

Informational Note: See 430.22(E) and 430.26 for duty cycle requirements.

(B) Overcurrent Protection. Where overcurrent protection is provided in accordance with 670.4(B), the machine shall be marked “overcurrent protection provided at machine supply terminals.”

670.4 Supply Conductors and Overcurrent Protection.

(A) Size. The size of the supply conductor shall be such as to have an ampacity not less than 125 percent of the full-load current rating of all resistance heating loads plus 125 percent of the full-load current rating of the highest rated motor plus the sum of the full-load current ratings of all other connected motors and apparatus, based on their duty cycle, that may be in operation at the same time.

Informational Note No. 1: See the 0–2000-volt ampacity tables of Article 310 for ampacity of conductors rated 600 volts and below.

Informational Note No. 2: See 430.22(E) and 430.26 for duty cycle requirements.

(B) Disconnecting Means. A machine shall be considered as an individual unit and therefore shall be provided with disconnecting means. The disconnecting means shall be permitted to be supplied by branch circuits protected by either fuses or circuit breakers. The disconnecting means shall not be required to incorporate overcurrent protection.

(C) Overcurrent Protection. Where furnished as part of the machine, overcurrent protection for each supply circuit shall consist of a single circuit breaker or set of fuses, the machine shall bear the marking required in 670.3, and the supply conductors shall be considered either as feeders or as taps as covered by 240.21.

The rating or setting of the overcurrent protective device for the circuit supplying the machine shall not be greater than the sum of the largest rating or setting of the branch-circuit short-circuit and ground-fault protective device provided with the machine, plus 125 percent of the full-load current rating of all resistance heating loads, plus the sum of the full-load currents of all other motors and apparatus that could be in operation at the same time.

Exception: Where one or more instantaneous trip circuit breakers or motor short-circuit protectors are used for motor branch-circuit short-circuit and ground-fault protection as permitted by 430.52(C), the procedure specified in 670.4(C) for determining the maximum rating of the protective device for the circuit supplying the machine shall apply with the following provision: For the purpose of the calculation, each instantaneous trip circuit breaker or motor short-circuit protector shall be assumed to have a rating not exceeding the maximum percentage of motor full-load current permitted by Table 430.52 for the type of machine supply circuit protective device employed.

Where no branch-circuit short-circuit and ground-fault protective device is provided with the machine, the rating or setting of the overcurrent protective device shall be based on 430.52 and 430.53, as applicable.

670.5 Short-Circuit Current Rating. Industrial machinery shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 670.3(A)(4).

ARTICLE 675 Electrically Driven or Controlled Irrigation Machines

I. General

675.1 Scope. The provisions of this article apply to electrically driven or controlled irrigation machines, and to the branch circuits and controllers for such equipment.

675.2 Definitions.

Center Pivot Irrigation Machine. A multimotored irrigation machine that revolves around a central pivot and employs alignment switches or similar devices to control individual motors.

Collector Rings. An assembly of slip rings for transferring electric energy from a stationary to a rotating member.

Irrigation Machine. An electrically driven or controlled machine, with one or more motors, not hand-portable,

and used primarily to transport and distribute water for agricultural purposes.

675.4 Irrigation Cable.

(A) Construction. The cable used to interconnect enclosures on the structure of an irrigation machine shall be an assembly of stranded, insulated conductors with nonhygroscopic and nonwicking filler in a core of moisture- and flame-resistant nonmetallic material overlaid with a metallic covering and jacketed with a moisture-, corrosion-, and sunlight-resistant nonmetallic material.

The conductor insulation shall be of a type listed in Table 310.104(A) for an operating temperature of 75°C (167°F) and for use in wet locations. The core insulating material thickness shall not be less than 0.76 mm (30 mils), and the metallic overlay thickness shall be not less than 0.20 mm (8 mils). The jacketing material thickness shall be not less than 1.27 mm (50 mils).

A composite of power, control, and grounding conductors in the cable shall be permitted.

(B) Alternate Wiring Methods. Installation of other listed cables complying with the construction requirements of 675.4(A) shall be permitted.

(C) Supports. Irrigation cable shall be secured by straps, hangers, or similar fittings identified for the purpose and so installed as not to damage the cable. Cable shall be supported at intervals not exceeding 1.2 m (4 ft).

(D) Fittings. Fittings shall be used at all points where irrigation cable terminates. The fittings shall be designed for use with the cable and shall be suitable for the conditions of service.

675.5 More Than Three Conductors in a Raceway or Cable. The signal and control conductors of a raceway or cable shall not be counted for the purpose of ampacity adjustment as required in 310.15(B)(3)(a).

675.6 Marking on Main Control Panel. The main control panel shall be provided with a nameplate that shall give the following information:

- (1) The manufacturer's name, the rated voltage, the phase, and the frequency
- (2) The current rating of the machine
- (3) The rating of the main disconnecting means and size of overcurrent protection required

675.7 Equivalent Current Ratings. Where intermittent duty is not involved, the provisions of Article 430 shall be used for determining ratings for controllers, disconnecting means, conductors, and the like. Where irrigation machines have inherent intermittent duty, the determinations of equivalent current ratings in 675.7(A) and (B) shall be used.