Disconnection Means
(Individual hermetic motor compressor)
The amp rating of the disconnect shall be at least 115% of the compressors rated load current or branch-circuit selection current, whichever is greater [440.12(A)(1)]. 440.12(A)(1) Exception permits a nonfused disconnect rated less than 115% of the specified current if this disconnect has a horsepower rating not less than the equivalent horsepower rating per 440.12(A)(2).
The equivalent horsepower rating to comply with 430.109 can be obtained by taking the larger horsepower value from: (1) NEC® Tables 430.248, 430.249 or 430.250 using the greater of either the rated load current or the branch circuit selection current to select the corresponding horsepower rating, or (2) horsepower rating from Tables 430.251(A) and 430.251(B) corresponding to the locked-rotor current. For both preceding (1) and (2), if the value falls between two horsepower ratings in a table, the equivalent horsepower rating to use is the larger of the two; i.e. round up to the larger HP. [440.12(A)(2)].

Disconnection Means (Equipment that has hermetic motor-compressor and other loads)
The amp rating of the disconnecting means must be at least 115% of the sum of all of the individual loads within the equipment at rated load conditions [440.12(B)(2)]. 440.12(B)(2) Exception permits a nonfused disconnect rated less than 115% of the sum of the individual loads if the disconnect has a horsepower rating not less than the equivalent horsepower rating per 440.12(B)(1).
The horsepower rating of the disconnecting means must be at least equal to the equivalent horsepower determined per 440.12(B)(1) which accounts for all the individual loads with the equipment at rated load conditions.

Controller
The controller for a hermetic motor-compressor must have a continuous duty full-load current rating not less than the nameplate rated current or branch circuit selection current (whichever is larger) [440.41] and the controller must also have a locked rotor current rating equal to or greater than the locked rotor current of the compressor [440.41(A)]. Where the controller serves a hermetic motor-compressor(s) plus other loads, the controller rating is determined according to 440.12(B), in much the same manner as determining the disconnecting means rating. It may be necessary to refer to Tables 430.251(A) & (B) to convert locked rotor current values to horsepower.
The branch circuit protective device rating shall not exceed the maximum protective device rating shown on a manufacturer’s heater table for use with a given motor controller [440.22(C)]. Where the equipment is marked Maximum Size Fuse amp rating rather than stating Maximum Overcurrent Device amp rating, only fuses can be used for the branch circuit protection.

Marked Short-Circuit Current Rating - New Air Conditioning and Refrigeration Equipment with Multimotor and Combination-Loads
440.4(B) requires the nameplate of this equipment to be marked with its short-circuit current rating. There are exceptions for which this requirement does not apply to this equipment:
- One and two family dwellings
- Cord and attachment-plug connected equipment
- Or equipment on a 60A or less branch circuit
So for most commercial and industrial applications, air conditioning and refrigeration equipment with multimotor and combination loads must have the short-circuit current rating marked on the nameplate. This facilitates the inspection and approval process. Inspectors need this information to ensure that NEC® 110.10 is met. A potential hazard exists where the available short-circuit current exceeds the short-circuit current rating. For more information, see the Assembly Short-Circuit Current Rating section in this publication or Short-Circuit Current Rating web page on www.cooperbussmann.com.

Room Air Conditioners
Room air conditioners (hermetic refrigerant motor-compressor) installed in the conditioned room are considered as single-motor units when the conditions of 440.62 are met. This condition also applies to conditioners containing a heating unit. Branch circuit requirements are determined by nameplate rating (440.62).

Because of all the fires caused by mistreated cords, single phase cord-and-plug connected room air conditioners are now required to have either an AFCI (arc fault circuit interrupter) or a LCDI (leakage current detection and interruption) attached to the plug.

Electric Heat
Electric space heating equipment employing resistance type heating elements, rated more than 48A, must have heating elements subdivided. Each subdivided load must not exceed 48A, and the fuse for each load should not exceed 60A [424.22(B)]. If a subdivided load is less than 48A, the fuse rating should be 125% of that load.
Exception: Boilers employing resistance type immersion electric heating elements in an ASME rated and stamped vessel may be subdivided into circuits not exceeding 120A, and protected by a fuse at not more than 150A [424.22(B) and 424.72(A)]. If a subdivided load is less than 120A, the fuse rating should be 125% of that load.
Fusetron dual-element fuses in the sizes required above provide protection for electric heat applications (their lower internal resistance offers cooler operation than ordinary fuses).
T-Tron fast-acting fuses (JNJ and JJS) in the sizes required above provide protection for electric heat applications and offer small physical size to reduce space and material cost.

Capacitors
The purpose of fusing capacitors is for short circuit protection. When a capacitor fails, it shorts out. Proper fusing is intended to remove the shorted capacitor from the circuit, prevent the shorted capacitor from rupturing and protect the conductors from damage due to short-circuit current. However, proper fusing must also be sized such that the capacitor can operate normally; that is the fuse should not open due to the normal steady state current or the inrush current when voltage is applied. For example, when the circuit is switched on, a capacitor in the circuit can draw a very high inrush current for a very brief time. Therefore, a capacitor fuse must have the characteristics to not open due to the initial inrush current. Also, the steady state current of a capacitor is directly proportional to the applied voltage; when the voltage increases the capacitor current increases.
Equipment Protection

A fuse must be provided in each ungrounded conductor (no protection is required for a capacitor connected on the load-side of a motor running overcurrent device). The fuse rating must be as low as practical [460.8(B)]. Generally, size dual-element, current-limiting fuses at 150% to 175% of the capacitor rated current and size non-time-delay, fast-acting, current-limiting fuses at 250% to 300% of the capacitor rated current.

Conductor ampacity must be at least 135% of the capacitor rated current [460.8(A)]. The ampacity of conductors for a capacitor connected to a motor circuit must be \( \frac{1}{3} \) the ampacity of the motor circuit conductors [460.8(A)].

Welders

**Arc Welders** must be protected by a fuse rated at not more than 200% of the rated primary current. The fuse protecting the supply conductor can serve as the welder protection, if the fuse is rated at not more than 200% of \( I_{1\text{max}} \) or the welder rated primary current [630.12(A)]. Conductors supplying one or more welders must be protected by a fuse rated at not more than 200% of the conductor rating [630.12(B)].

**Resistance Welders** must be protected by a fuse rated at not more than 300% of the rated primary current of the welder. The fuse protecting the supply conductor can serve as the welder protection if the fuse is rated at not more than 200% of the welder rated primary current [630.32(A)]. Conductors supplying one or more welders must be protected by a fuse rated at not more than 300% of the conductor rating [630.32(B)].

For arc welder and resistance welder protection, Fusetron and Low-Peak dual-element fuses can be sized much closer than the above limits of 200% and 300%, respectively. Generally, the amp rating of these dual-element fuses can be sized at 71% of the welder rated primary current [630.32(A)]. For arc welder and resistance welder protection, Fusetron and Low-Peak dual-element fuses can be sized much closer than the above limits of 200% and 300%, respectively. Generally, the amp rating of these dual-element fuses can be sized at 71% of the welder rated primary current [630.32(A)].

Hazardous (Classified) Locations

The characteristics of various atmospheric mixtures of hazardous gases, vapors and dusts depend on the specific hazardous material involved. It is necessary therefore that equipment be approved not only for the class of location but also for the specific gas, vapor or dust that will be present (500.5).

**Class I Division 1**

Fuses located in Class I Division 1 locations are required to be provided with enclosures that are identified as a complete assembly for use in Class I locations [501.115(A)].

**Class I Division 2 Fuses In General Purpose Enclosures**

Certain fuses are permitted to be used in general purpose enclosures. 501.115(B)(3) addresses the use of current-limiting fuses in Class I Division 2 locations. Plug and cartridge fuses used for the protection of motors, appliances, and lamps are permitted provided they are placed in enclosures rated for the location. Fuses are permitted in general-purpose enclosures if they meet one of the following criteria:

a. They are the type which the element is immersed in oil or other approved liquid

b. The element is hermetically sealed against gases and vapors

c. They are non-indicating, filled, and current-limiting type

Cooper Bussmann offers many fuses that meet the criteria for non-indicating, filled, current-limiting type (check Data Sheet 8003 for any updates):

**Class CC:** LP-CC ½ - 30A, KTK-R ½ - 30 A, FNQ-R ½ - 30A

**Class T:** JN 1 - 1200A, JJS 1 - 800A

**Class J:** JKS 1 - 600A, LPJ.SP 1 - 600A

**Class G:** SC ¾ - 60A

**Class RK1:** KTN-R 1 - 600A, KTS-R 1 - 600A, LPN-RK.SP* 3½ -6½ and 65 - 600A, LPS-RK.SP* 65 - 600A

**Class RK5:** FRN-R 3½ -7½ and 450 - 600A, FRS-R** 65 - 600A

**Class L:** KRP-C.SP 601 - 6000A, KTU 601 - 6000A, KLU 601 - 4000A

*Fuses from July 1996 or date code C28 to present only.

**Fuses from October 1997 or date code D40 to present only.

**Class I, Division II — Listed cartridge fuses shall be permitted in luminaries (lighting fixtures) [501.115(B)(4)].

**Class II, Division I — Fuses must be provided with enclosures approved for Class II locations [502.115(A)(1)].

**Class II, Division 2 — Fuses must be provided with dust tight enclosures [502.115(B) and 502.135(B)(3)].

**Class III, Fuses must be provided with dust tight enclosures (503.115).

Mobile Homes

The branch circuit equipment may be combined with the disconnecting means as a single assembly. Such a combination may be designated as a distribution panel. Plug fuses must be Type S [650.11]. Branch circuit overcurrent devices must be rated [550.11(B)]:

1. Not more than the circuit conductors.

2. Not more than 150% of the rating of a single appliance rated 13.3A or more supplied by an individual branch circuit.

3. Not more than the fuse size marked on the air conditioner or other motor-operated appliance.

Ballasts

Each light fixture ballast should be individually protected by fuses. Fusing each fixture provides protection and isolation of a faulted ballast. When a ballast does fail, only the fuse for that fixture opens, and the remaining fixtures continue in normal operation. Without this individual ballast protection, a faulted ballast could cause the branch circuit protective device to open, thereby blacking out all fixtures. Additionally, special integrally protected ballasts, known as Class P Ballasts, are UL Listed under a 200A short circuit test condition. This test is conducted utilizing a fuse as the branch protection. The starting current and continuous current characteristics for lighting ballast can vary considerably for various manufacturers. For proper fuse amp rating, observe ballast manufacturer’s recommendation.

There is a wide variety of supplementary and branch circuit fuses available for protection of light fixture ballasts including fluorescent lighting, mercury vapor lighting, and sodium lighting, indoor and outdoor.

See additional information under Component Protection–Ballasts.
## Fuse Diagnostic Sizing Charts

### Ballasts

#### Indoor
- **Fluorescent**: Consult fixture manufacturer for size and type.
- **All Other (Mercury, Sodium, etc.)**: Consult fixture manufacturer for size and type.

#### Outdoor
- **Mercury, Sodium, etc.**: Consult fixture manufacturer for size and type.

### Capacitors (NEC® 460)

**Protected by Time-Delay Fuses.**
- 150% to 175% of Full Load Current

**Protected by Non-Time-Delay Fuses.**
- 250% to 300% of Full Load Current.
- Protection recommended as shown, but not required.

### Fuse Recommendations

#### Volts
- **0-250**: LPN-RK_SP, FRN-R
- **0-600**: LPS-RK_SP, FRS-R

#### Fuse(s)
- **Fuse Recommendations**
  - **0-250**: KTN-R, NON
  - **0-300**: JIN
  - **0-600**: KTS-R, NOS
  - **0-600**: JKS, KTK-R
  - **0-600**: JJS