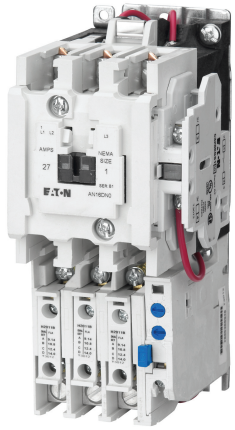
# NEMA Contactors and Starters



**NEMA AN16DN0AB**
**NEMA Size 1 Starter**



**NEMA Size 1 Contactor**

**NEMA Space-Savings Size 1C Contactor**

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Freedom Series

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## Product Overview

Freedom Series starters and contactors feature a compact, space-saving design, using state-of-the-art technology and the latest in high strength, impact and temperature resistant insulating materials.

## Features, Benefits and Functions

### Freedom NEMA

- Adjustable bimetallic ambient compensated overload relays with interchangeable heater packs—available in three basic sizes, covering applications up to 900 hp—reducing the number of different contactor/overload relay combinations that have to be stocked. Fixed heater overloads are optional
- Electronic overload relay (C440) available as a stand-alone unit and assembled with Freedom Contactor
- A full line of snap-on accessories— top and side mounted auxiliary contacts, solid-state and pneumatic timers, and so on
- Straight-through wiring—line lugs at top, load lugs at bottom
- Horizontal or vertical mounting on upright panel for application freedom
- Screw type power terminals have captive, backed-out self-lifting pressure plates with ± screws—reduced wiring time
- Accessible terminals for easy wiring. Optional fingerproof shields available to prevent electrical shock
- Top located coil terminals convenient and readily accessible. 45 mm contactor magnet coils have three terminals, permitting either top or diagonal wiring—easy to replace European or U.S. style starters or contactors without changing wiring layout
- Designed to meet or exceed NEMA, UL, CSA, VDE, BS and other international standards and listings
- American engineering—built by Eaton, using the latest in statistical process control methods to produce high quality, reliable products
- Sized based on standard NEMA classifications
- Easy coil change and inspectable/replaceable contacts
- Available in open and NEMA Type 1, 3R, 4/4X and 12 enclosures

## Standards and Certifications

- Standard: designed to meet or exceed UL, NEMA, IEC, CSA, VDE and BS
- UL listed: UL File #E1491, Guide #NLDX—Open and NEMA 1, 4, 12 Enclosed
- CSA Certified: CSA File #LR353, Class #321104 Open and NEMA 1 Enclosed

Listed

### ISO 9000 Certification

When you turn to Eaton's products, you turn to quality. The International Standards Organization (ISO) has established a series of standards acknowledged by 91 industrialized nations to bring harmony to the international quest for quality. The ISO certification process covers 20 quality system elements in design, production and installation that must conform to achieve registration. This commitment to quality will result in increased product reliability and total customer satisfaction.

### Short Circuit Protection

**Fuses** and **Inverse-Time Circuit Breakers** may be selected per Article 430, Part D of the National Electrical Code to protect motor branch circuits from fault conditions. If higher ratings or settings are required to start the motor, do **not** exceed the maximum as listed in Exception No. 2, Article 430-52.

## Catalog Number Selection

### Freedom Series

**A N 1 9 A N 0 A 5E 005**

**Device Type**
**A** = Starter
**C** = Contactor

**Standard**
**E** = IEC
**N** = NEMA

**Device Assembly Configuration**
**70** = Multi-speed
**1** = Non-reversing
**5** = Reversing

**OLR Type**
**5** = Contactor only—no overload relay
**6** = Starter w/C306 bi-metal OLR
**9** = Starter w/C440 electronic overload

**Contactor Frame Size** ①

| | NEMA Size | Continuous Amperes |
|---|---|---|
| **A**= | 00 | 9 |
| **B**= | 0 | 18 |
| **D**= | 1 | 27 |
| **G**= | 2 | 45 |
| **K**= | 3 | 90 |
| **N**= | 4 | 135 |
| **S**= | 5 | 270 |
| **T**= | 6 | 540 |
| **U**= | 7 | 810 |
| **V**= | 8 | 1215 |

**NEMA Enclosure**
**N** = Open

*For Starters*

**Starter Mounting Option**
**0** = Horizontal
**V** = Vertical

For Contactors Only
**2** = Two-pole
**3** = Three-pole
**4** = Four-pole
**5** = Five-pole

**AC Coil Suffix**

| Suffix | Coil Volts and Hertz |
|---|---|
| **A** | = 120/60 or 110/50 |
| **B** | = 240/60 or 220/50 |
| **C** | = 480/60 or 440/50 |
| **D** | = 600/60 or 550/50 |
| **E** | = 208/60 |
| **H** | = 277/60 |
| **J** | = 208 – 240/60 ② |
| **K** | = 240/50 |
| **L** | = 380 – 415/50 |
| **N** | = 550/50 |
| **T** | = 24/60, 24/50 ③ |
| **U** | = 24/50 |
| **V** | = 32/50 |
| **W** | = 48/60 |
| **Y** | = 48/50 |

**C440 OLR Designation (FVNR and FVR only)**
**5E** = Standard feature set SEL Reset, SEL Class (10A, 10, 20, 30)
**5G** = Ground fault feature set SEL Reset, SEL Class (10, 20)

**C440 FLA Range (FVNR and FVR only)**

**NEMA Size 00**
**1P6** = 0.33–1.65A
**005** = 1–5A
**020** = 4–20A

**NEMA Size 0**
**1P6** = 0.33–1.65A
**005** = 1–5A
**020** = 4–20A

**NEMA Size 1**
**1P6** = 0.33–1.65A
**005** = 1–5A
**020** = 4–20A
**045** = 9–45A

**NEMA Size 2**
**005** = 1–5A
**020** = 4–20A
**045** = 9–45A

**NEMA Size 3**
**100** = 20–100A

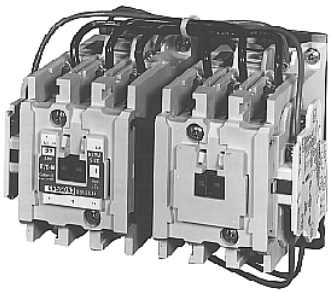
**NEMA Size 4**
**140** = 28–140A

**NEMA Size 5** ④
**300** = 60–300A

***Notes***

① For contactor only orders, add **B** to end of catalog number if NEMA Size 00–2, 6.
② NEMA Sizes 00 and 0 only.
③ NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.
④ NEMA Size 5 requires the use of CTs with 1-5A OL relay.

**Non-Reversing and Reversing Contactors**



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## Contactors—Non-Reversing and Reversing

### Product Description

***Non-Reversing***

Contactors are most commonly used to switch motor loads in applications where running overcurrent protection is either not required or is provided separately. Contactors consist of a magnetically actuated switch which can be remotely operated by a pushbutton station or pilot device such as a proximity switch, limit switch, float switch, auxiliary contacts, and so on.

***Reversing***

Reversing contactors are used primarily for reversing single- or three-phase motors in applications where running overcurrent protection is either not required or is provided separately. They consist of two contactors mechanically and electrically interlocked to prevent line shorts and energization of both contactors simultaneously.

### Features, Benefits and Functions

- Designed specifically for use in applications requiring NEMA ratings. Contactors meet or exceed NEMA standards ICS 2-1993
- Long life twin break, silver cadmium oxide contacts—provide excellent conductivity and superior resistance to welding and arc erosion
- Designed to 3,000,000 electrical operations at maximum hp ratings up through 25 hp at 600V
- Steel mounting plate standard on all open type contactors

***Non-Reversing***

- Holding circuit contact(s) supplied as standard:
  - Sizes 00–3 have NO auxiliary contact block mounted on right hand side (on Size 00, contact occupies 4th power pole position—no increase in width)
  - Sizes 4–5 have a NO contact block mounted on left side
  - Sizes 6–7 have a 2NO/2NC contact block on top left
  - Size 8 has a NO/NC contact block on top left back and a NO contact block on top right back

***Reversing***

- One NO-NC side mounted interlock supplied as standard on each contactor for Sizes 00–8

## Product Selection

### *Three-Pole Contactors*

**NEMA Size 00**
**CN55AN3AB**

**NEMA Size 0**
**CN15BN3AB**

**NEMA Size 3**
**CN15KN3A**

### Type CN15/CN55 NEMA Contactors—Non-Reversing and Reversing

| NEMA Size | Continuous Ampere Rating | Maximum UL Horsepower ① Single-Phase 115V | Single-Phase 230V | Three-Phase 208V | Three-Phase 240V | Three-Phase 480V | Three-Phase 600V | Non-Reversing Catalog Number | Reversing Catalog Number |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 9 | 1/3 | 1 | 1-1/2 | 1-1/2 | 2 | 2 | **CN15AN3_B** | **CN55AN3_B** |
| 0 | 18 | 1 | 2 | 3 | 3 | 5 | 5 | **CN15BN3_B** | **CN55BN3_B** |
| 1 | 27 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **CN15DN3_B** | **CN55DN3_B** |
| 2 | 45 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **CN15GN3_B** | **CN55GN3_B** |
| 3 | 90 | | | 25 | 30 | 50 | 50 | **CN15KN3_** | **CN55KN3_** |
| 4 | 135 | | | 40 | 50 | 100 | 100 | **CN15NN3_** | **CN55NN3_** |
| 5 | 270 | | | 75 | 100 | 200 | 200 | **CN15SN3_** | **CN55SN3_** |
| 6 | 540 | | | 150 | 200 | 400 | 400 | **CN15TN3_B** | **CN55TN3_B** |
| 7 | 810 | | | 200 | 300 | 600 | 600 | **CN15UN3_** | **CN55UN3_** |
| 8 ② | 1215 | | | 400 | 450 | 900 | 900 | **CN15VN3_** | **CN55VN3_** |

### *Magnet Coils—AC and DC*

Contactor coils listed in this section also have a 50 Hz rating as shown in the adjacent table. Select required contactor by catalog number and replace the magnet coil alpha designation in the catalog number (_) with the proper code suffix from the table.

For Sizes 00–2, the magnet coil alpha designation will be the next to the last digit of the listed catalog number.

EXAMPLE: For a 380V, 50 Hz coil, change CN15AN3_B to CN15AN3**L**B. For all other sizes, the magnet coil alpha designation will be the last digit of the listed catalog number.

For **DC Magnet Coils**, see Accessories, **Pages V5-T2-28** and **V5-T2-29**.

### AC Suffix

| Coil Volts and Hertz | Code Suffix |
|---|---|
| 120/60 or 110/50 | **A** |
| 240/60 or 220/50 | **B** |
| 480/60 or 440/50 | **C** |
| 600/60 or 550/50 | **D** |
| 208/60 | **E** |
| 277/60 | **H** |
| 208–240/60 ③ | **J** |
| 240/50 | **K** |

| Coil Volts and Hertz | Code Suffix |
|---|---|
| 380–415/50 | **L** |
| 550/50 | **N** |
| 24/60, 24/50 ④ | **T** |
| 24/50 | **U** |
| 32/50 | **V** |
| 48/60 | **W** |
| 48/50 | **Y** |

***Notes***

① Maximum horsepower rating of starters for 380V 50 Hz applications:

| NEMA Size | 00 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| Horsepower | 1-1/2 | 5 | 10 | 25 | 50 | 75 | 150 | 300 | 600 | 900 |

② Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example:CN15VN**D**3C.

③ NEMA Sizes 00 and 0 only.

④ NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

***Two-, Four- and Five-Pole Contactors***



**NEMA Size 2 Five-Pole Contactor CN15GN5AB**

## Type CN15 NEMA Contactors—Non-Reversing

| NEMA Size | Continuous Ampere Rating | Maximum UL Horsepower Single-Phase (Two-Pole) 115V | 230V | Three-Phase 208V | 240V | 480V | 600V | Two-Pole Non-Reversing Catalog Number | Four-Pole Non-Reversing Catalog Number | Five-Pole Non-Reversing Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 9 | 1/3 | 1 | 1-1/2 | 1-1/2 | 2 | 2 | **CN15AN2_B** | **CN15AN4_B** | — |
| 0 | 18 | 1 | 2 | 2 | 3 | 5 | 5 | **CN15BN2_B** | — | — |
| 1 | 27 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **CN15DN2_B** | **CN15DN4_B** | **CN15DN5_B** |
| 2 | 45 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **CN15GN2_B** | **CN15GN4_B** | **CN15GN5_B** |
| 3 | 90 | | | 25 | 30 | 50 | 50 | **CN15KN2_** | — | — |
| 4 | 135 | | | 40 | 50 | 100 | 100 | **CN15NN2_** | — | — |
| 5 | 270 | | | 75 | 100 | 200 | 200 | **CN15SN2_** | — | — |
| 6 | 540 | | | 150 | 200 | 400 | 400 | **CN15TN2_B** | — | — |

### *Magnet Coils—AC and DC*

Select required starter by catalog number and replace the magnet coil alpha designation in the catalog number (_) with the proper code suffix from the table.

For Sizes 00–2, the magnet coil alpha designation will be the next to the last digit of the listed catalog number. EXAMPLE: For a 380V, 50 Hz coil, change CN15BN3_B to CN15BN3**L**B. For all other sizes, the magnet coil alpha designation will be the last digit of the listed catalog number.

For **DC Magnet Coils**, see Accessories, **Pages V5-T2-28** and **V5-T2-29**.

## AC Suffix

| Coil Volts and Hertz | Code Suffix |
|---|---|
| 120/60 or 110/50 | **A** |
| 240/60 or 220/50 | **B** |
| 480/60 or 440/50 | **C** |
| 600/60 or 550/50 | **D** |
| 208/60 | **E** |
| 277/60 | **H** |
| 208–240/60 ① | **J** |
| 240/50 | **K** |

| Coil Volts and Hertz | Code Suffix |
|---|---|
| 380–415/50 | **L** |
| 550/50 | **N** |
| 24/60, 24/50 ② | **T** |
| 24/50 | **U** |
| 32/50 | **V** |
| 48/60 | **W** |
| 48/50 | **Y** |

### Kits and Accessories

- Auxiliary contacts, contactor mounted—**Pages V5-T2-25** to **V5-T2-27**
- Transient suppressor, for magnet coil—**Page V5-T2-24**
- Timers—solid-state and pneumatic, mount on contactor—**Page V5-T2-22**

### *Publication Numbers*

- See **Page V5-T2-30**

### *Renewal Parts*

***Notes***

① NEMA Sizes 00 and 0 only.
② NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

## Technical Data and Specifications

### Wire (75°C) Sizes—AWG or kcmil—Open and Enclosed

| NEMA Size | Power Terminals Line or Load | Control Terminals Cu Only |
|---|---|---|
| 00 | 12–16 stranded; 12–14 solid Cu | 12–16 stranded<br>12–14 solid |
| 0 | 8–16 stranded; 10–14 solid Cu | |
| 1 | 8–14 stranded or solid Cu | |
| 2 | 3–14 (upper) and/or 6–14 (lower) stranded or solid ① Cu | |
| 3 | 1/0–14 Cu/Al | |
| 4 | 250 mcm–6 | |
| 5 | 750 kcmil–2, or (2) 250 kcmil–3/0 Cu/Al | |
| 6 | (2) 750 kcmil–3/0 Cu/Al | |
| 7 | (3) 750 kcmil–3/0 Cu/Al | |
| 8 | (4) 750 kcmil–4/0 Cu/Al | |

### Plugging and Jogging Service Horsepower Ratings ②

| NEMA Size | 200V | 230V | 460V | 575V |
|---|---|---|---|---|
| 00 | — | 1/2 | 1/2 | 1/2 |
| 0 | 1-1/2 | 1-1/2 | 2 | 2 |
| 1 | 3 | 3 | 5 | 5 |
| 2 | 7-1/2 | 10 | 15 | 15 |
| 3 | 15 | 20 | 30 | 30 |
| 4 | 25 | 30 | 60 | 60 |
| 5 | 60 | 75 | 150 | 150 |
| 6 | 125 | 150 | 300 | 300 |

***Notes***

① Two compartment box lug.

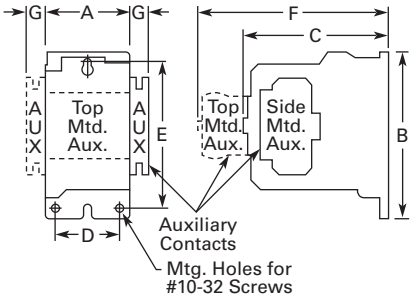
② Maximum horsepower where operation is interrupted more than 5 times per minute or more than 10 times in a 10 minute period. NEMA standard ICS 2-1993 table 2-4-3.

## Dimensions

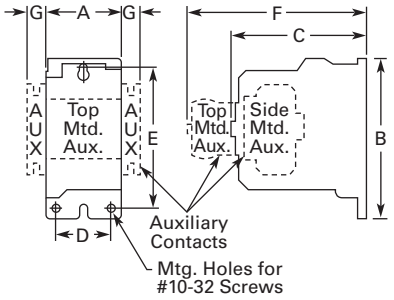
Approximate Dimensions in Inches (mm)

2

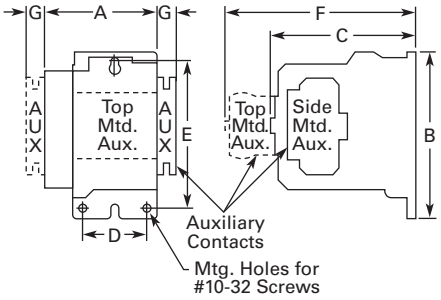
### Non-Reversing Contactors—Open Type



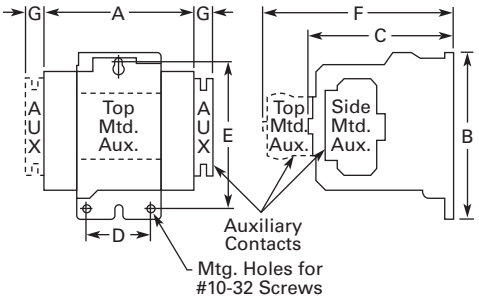

**Sizes 00, Two- to Four-Pole**



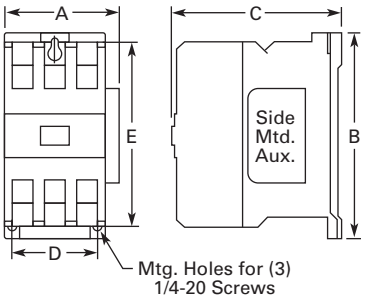

**Sizes 0–2, Two- and Three-Pole**



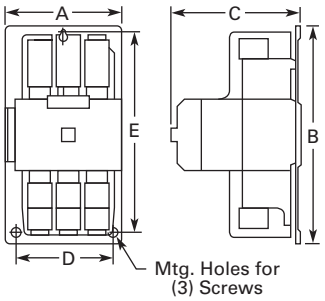

**Sizes 0–2, Two- and Three-Pole**



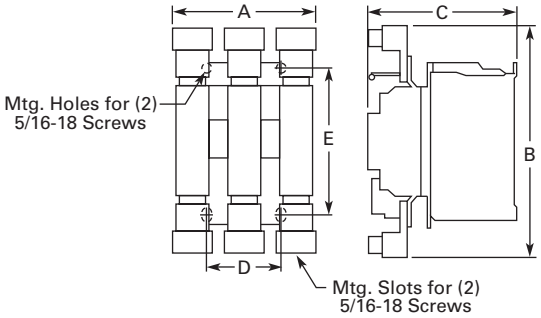

**Sizes 1–2, Five-Pole**




**Size 3**




**Sizes 4–5**




**Size 6**

### Dimensions and Shipping Weights

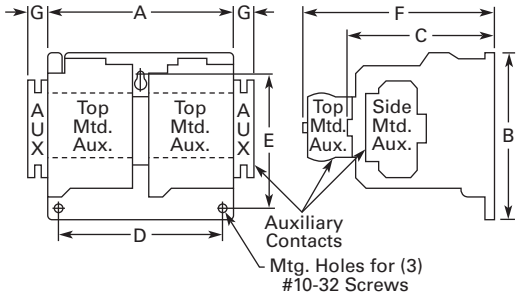
| NEMA Size | Number of Poles | Wide A | High B | Deep C | Mounting D | Mounting E | F | G | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 2–4 | 1.75 (44.5) | 3.88 (98.6) | 3.49 (88.6) | 1.50 (38.1) ① | 3.38 (85.9) | 4.62 (117.3) | 0.54 (13.7) | 1.7 (0.7) |
| 0 | 2–3 | 1.75 (44.5) | 3.88 (98.6) | 3.49 (88.6) | 1.50 (38.1) ① | 3.38 (85.9) | 4.62 (117.3) | 0.54 (13.7) | 1.8 (0.8) |
| 1–2 | 2–3 | 2.56 (65.0) | 5.05 (128.3) | 4.44 (112.8) | 2.00 (50.8) ① | 4.50 (114.3) | 5.80 (147.3) | 0.54 (13.7) | 3.1 (1.4) |
| 1–2 | 4 | 3.44 (87.4) | 5.05 (128.3) | 4.44 (112.8) | 2.00 (50.8) ① | 4.50 (114.3) | 5.80 (147.3) | 0.54 (13.7) | 3.6 (1.6) |
| 1–2 | 5 | 4.32 (109.7) | 5.05 (128.3) | 4.44 (112.8) | 2.00 (50.8) ① | 4.50 (114.3) | 5.80 (147.3) | 0.54 (13.7) | 4.0 (1.8) |
| 3 | 2–3 | 4.08 (103.6) | 7.17 (182.1) | 5.94 (150.9) | 3.00 (76.2) | 6.63 (168.4) | — | — | 8.5 (3.9) |
| 4 | 2–3 | 7.05 (179.1) | 9.11 (231.4) | 7.25 (184.2) | 6.00 (152.4) | 8.50 (215.9) | — | — | 20.0 (9.1) |
| 5 | 2–3 | 7.05 (179.1) | 13.12 (333.2) | 7.78 (197.6) | 6.00 (152.4) | 12.50 (317.5) | — | — | 23.0 (10.4) |
| 6 | 3 | 8.63 (219.2) | 13.54 (343.9) | 8.88 (225.6) | 4.33 (110.0) | 8.63 (219.2) | — | — | 35.0 (15.9) |
| 7 | 3 | 11.02 (279.9) | 19.30 (490.2) | 11.46 (291.1) | 6.89 (175.0) | 11.02 (279.9) | — | — | 100.0 (45.4) |
| 8 | 3 | 13.00 (330.2) | 24.50 (622.3) | 13.63 (346.2) | 4.22 (107.2) | 14.86 (377.4) | — | — | 160.0 (72.6) |

***Note***

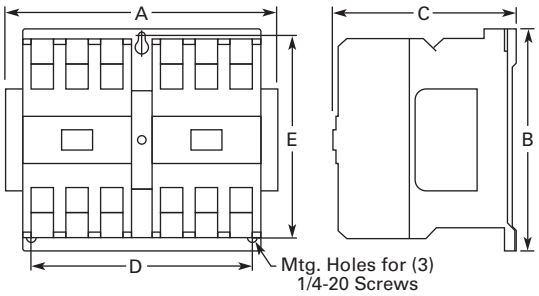
① Center mounting slot at bottom supplied only on Size 00 and 0 contactors.

Approximate Dimensions in Inches (mm)

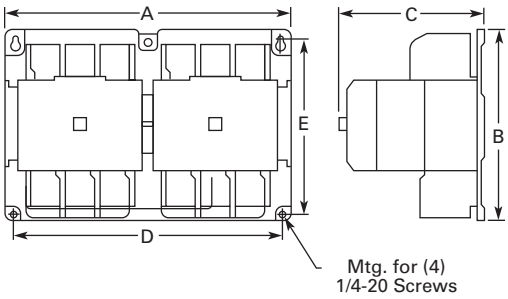
## Reversing Contactors—Open Type



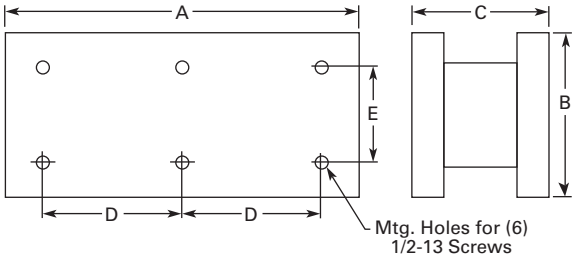

**Sizes 00–2**



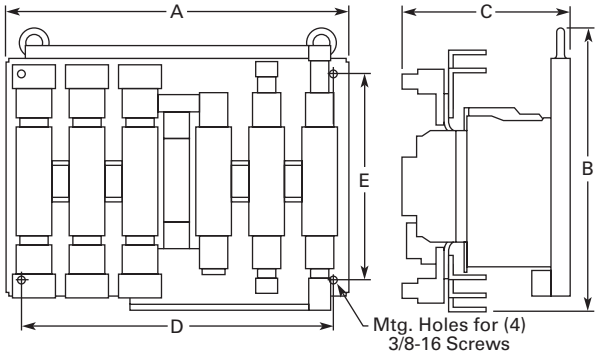

**Size 3**




**Sizes 4–5**




**Open Type—Sizes 7–8 Horizontal**




**Size 6**

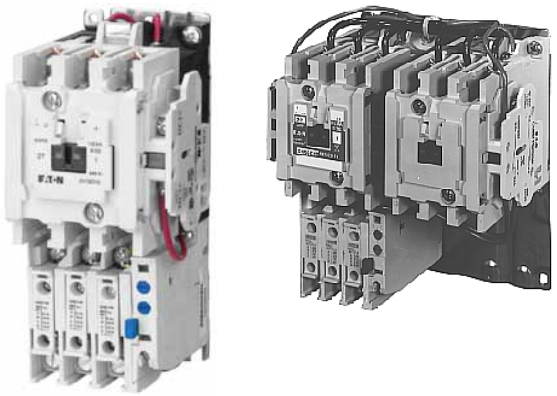
## Dimensions and Shipping Weights

| NEMA Size | Wide A | High B | Deep C | Mounting D | Mounting E | F | G | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|---|
| 00–0 | 4.20 (106.7) | 4.35 (110.5) | 3.52 (89.4) | 3.50 (88.9) | 3.86 (98.0) | 4.90 (124.5) | 0.54 (13.7) | 3.3 (1.5) |
| 1–2 | 5.71 (145.0) | 5.05 (128.3) | 4.44 (112.8) | 5.25 (133.4) | 3.63 (92.2) | 5.80 (147.3) | 0.54 (13.7) | 7.8 (3.5) |
| 3 | 8.70 (221.0) | 7.17 (182.1) | 5.94 (150.9) | 7.00 (177.8) | 6.63 (168.4) | — | — | 17.0 (7.7) |
| 4 | 14.68 (372.9) | 9.11 (231.4) | 7.25 (184.2) | 13.50 (342.9) | 8.50 (215.9) | — | — | 47.0 (21.3) |
| 5 | 14.50 (368.3) | 12.25 (311.2) | 7.78 (197.6) | 13.50 (342.9) | 11.50 (292.1) | — | — | 63.0 (28.6) |
| 6 | 19.77 (502.2) | 16.61 (421.9) | 9.90 (251.5) | 18.00 (457.2) | 12.00 (304.8) | — | — | 80.0 (36.3) |
| 7 | 28.00 (711.2) | 26.75 (679.5) ① | 12.75 (323.9) | 12.75 (323.9) | 11.00 (279.4) | — | — | 260.0 (118.0) |
| 8 | 30.13 (765.3) | 39.00 (990.6) ① | 14.69 (373.1) | 14.13 (358.9) | 15.00 (381.0) | — | — | 350.0 (158.9) |

***Note***

① Includes cross wiring.

**Three-Phase Non-Reversing and Reversing, Full Voltage Starters**



## Contents


| *Description* | *Page* |
|---|---|
| Contactors—Non-Reversing and Reversing | **V5-T2-4** |
| Starters—Three-Phase Non-Reversing and Reversing, Full Voltage | |
| Product Selection | **V5-T2-11** |
| Kits and Accessories | **V5-T2-13** |
| Renewal Parts Publication Numbers | **V5-T2-13** |
| Technical Data and Specifications | **V5-T2-13** |
| Wiring Diagrams | **V5-T2-14** |
| Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload | **V5-T2-15** |
| Accessories | **V5-T2-21** |
| Renewal Parts | **V5-T2-30** |
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## Starters—Three-Phase Non-Reversing and Reversing, Full Voltage

### Product Description

***Non-Reversing***

Three-phase, full voltage magnetic starters are most commonly used to switch AC motor loads. Starters consist of a magnetically actuated switch (contactor) and an overload relay assembled together.

***Reversing***

Three-phase, full voltage magnetic starters are used primarily for reversing of three-phase squirrel cage motors. They consist of two contactors and a single overload relay assembled together. The contactors are mechanically and electrically interlocked to prevent line shorts and energization of both contactors simultaneously.

### Features, Benefits and Functions

- Bimetallic ambient compensated overload relays—available in three basic sizes covering applications up to 900 hp—reducing number of different contactor/overload relay combinations that have to be stocked

  These overload relays feature:
  - Selectable manual or automatic reset operation
  - Interchangeable heater packs adjustable ±24% to match motor FLA and calibrated for 1.0 and 1.15 service factors. Heater packs for smaller overload relay will mount in larger overload relay—useful in derating applications such as jogging
  - Load lugs built into relay base
  - Single-phase protection, Class 20 or Class 10 trip time
  - Overload trip indication
  - Electrically isolated NO-NC contacts (pull RESET button to test)
- The C440 is a self-powered, robust electronic overload designed for integrated use with Freedom NEMA contactors
  - Tiered feature set to provide coverage specific to your application
  - Broad 5: 1 FLA range for maximum flexibility
  - Coverage from 0.05–1500A to meet all your needs
- Long life twin break, silver cadmium oxide contacts—provide excellent conductivity and superior resistance to welding and arc erosion. Generously sized for low resistance and cool operation
- Designed to 3,000,000 electrical operations at maximum hp ratings up through 25 hp at 600V
- Steel mounting plate standard on all open type starters
- Wired for separate or common control

***Non-Reversing***

- Holding circuit contact(s) supplied as standard:
  - Sizes 00–3 have a NO auxiliary contact block mounted on right-hand side (on Size 00, contact occupies 4th power pole position—no increase in width)
  - Sizes 4–5 have a NO contact block mounted on left side
  - Sizes 6–7 have a 2NO/2NC contact block on top left
  - Size 8 has a NO/NC contact block on top left back and a NO on top right back

***Reversing***

- Each contactor (Size 00–8) supplied with one NO-NC side mounted contact block as standard. NC contacts are wired as electrical interlocks

## Product Selection

### *When Ordering Supply*

- Catalog number
- Heater pack number (see selection table, **Pages V5-T2-40** to **V5-T2-42**) or full load current

**Size 0**
**Non-Reversing Starter**

**Size 1**
**Reversing Starter**

### Type AN16/AN56 NEMA—Manual or Automatic Reset Overload Relay—Non-Reversing and Reversing ①

| NEMA Size | Continuous Ampere Rating | Service-Limit Current Rating (Amperes) ④ | Maximum UL Horsepower ② Single-Phase 115V | Single-Phase 230V | Three-Phase 208V | Three-Phase 240V | Three-Phase 480V | Three-Phase 600V | Three-Pole Non-Reversing ③ Catalog Number | Three-Pole Reversing ③ Catalog Number | Vertical Reversing ③ Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 9 | 11 | 1/3 | 1 | 1-1/2 | 1-1/2 | 2 | 2 | **AN16AN0_C** | **AN56AN0_C** | — |
| 0 | 18 | 21 | 1 | 2 | 3 | 3 | 5 | 5 | **AN16BN0_C** | **AN56BN0_C** | **AN56BNV0_** |
| 1 | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **AN16DN0_B** | **AN56DN0_B** | **AN56DNV0_** |
| 2 | 45 | 52 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **AN16GN0_B** | **AN56GN0_B** | **AN56GNV0_** |
| 3 | 90 | 104 | — | — | 25 | 30 | 50 | 50 | **AN16KN0_** | **AN56KN0_** | **AN56KNV0_** |
| 4 | 135 | 156 | — | — | 40 | 50 | 100 | 100 | **AN16NN0_** | **AN56NN0_** | **AN56NNV0_** |
| 5 | 270 | 311 | — | — | 75 | 100 | 200 | 200 | **AN16SN0_B** | **AN56SN0_B** | — |
| 6 | 540 | 621 | — | — | 150 | 200 | 400 | 400 | **AN16TN0_C** | **AN56TN0_C** | — |
| 7 | 810 | 932 | — | — | 200 | 300 | 600 | 600 | **AN16UN0_B** | **AN56UN0_B** | — |
| 8 ⑤ | 1215 | 1400 | — | — | 400 | 450 | 900 | 900 | **AN16VN0_B** | **AN56VN0_B** | — |

### *Magnet Coils—AC or DC*

Starter coils listed in this section also have a 50 Hz rating as shown in the adjacent table. Select required starter by catalog number and replace the magnet coil alpha designation in the catalog number (_) with the proper code suffix from the table.

For Sizes 00–2 and 5–8, the magnet coil alpha designation will be the next to last digit of the listed catalog number.

EXAMPLE: For a 380V, 50 Hz coil, change AN16BN0_C to AN16BN0**L**C. For all other sizes, the magnet coil alpha designation will be the last digit of the listed catalog number.

For **DC Magnet Coils**, see Accessories, **Pages V5-T2-28** and **V5-T2-29**.

### AC Suffix

| Coil Volts and Hertz | Code Suffix |
|---|---|
| 120/60 or 110/50 | **A** |
| 240/60 or 220/50 | **B** |
| 480/60 or 440/50 | **C** |
| 600/60 or 550/50 | **D** |
| 208/60 | **E** |
| 277/60 | **H** |
| 208–240/60 ⑥ | **J** |
| 240/50 | **K** |

| Coil Volts and Hertz | Code Suffix |
|---|---|
| 380–415/50 | **L** |
| 550/50 | **N** |
| 24/60, 24/50 ⑦ | **T** |
| 24/50 | **U** |
| 32/50 | **V** |
| 48/60 | **W** |
| 48/50 | **Y** |
| 48/50 | **Y** |

***Notes***

① Starter catalog numbers do not include heater packs. Select one carton of three heater packs. Heater pack selection, **Pages V5-T2-40** to **V5-T2-42**.

② Maximum horsepower rating of starters for 380V 50 Hz applications:

| NEMA Size | 00 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| Horsepower | 1-1/2 | 5 | 10 | 25 | 50 | 75 | 150 | 300 | 600 | 900 |

③ Underscore (_) indicates coil suffix required, see AC Suffix table.

④ The service-limit current ratings represent the maximum rms current, in amperes, which the controller shall be permitted to carry for protracted periods in normal service. At service-limit current ratings, temperature rises shall be permitted to exceed those obtained by testing the controller at its continuous current rating. The current rating of overload relays or trip current of other motor protective devices used shall not exceed the service-limit current rating of the controller.

⑤ Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example: AN56VN**D**0CB.

⑥ NEMA Sizes 00 and 0 only.

⑦ NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

***Two-Speed Selective Control***

2

***When Ordering Supply***

- Catalog number plus magnet coil code suffix. Example: Size 0—AN700BN022**B**
- Heater pack number or full load current for each speed

For two-speed other than selective control:

- Catalog number plus magnet coil code suffix and option required. Example: AN700BN022B except compelling
- Heater pack number or full load current for each speed

**Note:** Two-speed starters are designed for starting and controlling both separate (two-winding) and reconnectable (one-winding) motors. Separate winding, WYE-WYE motors have a separate winding for each speed. Reconnectable, consequent pole motors use the same winding for both speeds. All standard starters are wired for selective control.

**Two-Winding AN700DN022**

## Separate Winding ①

**Maximum Horsepower—60/50 Hertz**

| Constant or Variable Torque | | | | Constant Horsepower | | | | NEMA | Open Type |
|---|---|---|---|---|---|---|---|---|---|
| 115V | 200V | 230V | 460V/575V | 115V | 200V | 230V | 460/575V | Size | Catalog Number |
| 1-1/2 | 3 | 3 | 5 | 1 | 2 | 2 | 3 | 0 | **AN700BN022_** |
| 3 | 7-1/2 | 7-1/2 | 10 | 2 | 5 | 5 | 7-1/2 | 1 | **AN700DN022_** |
| — | 10 | 15 | 25 | — | 7-1/2 | 10 | 20 | 2 | **AN700GN022_** |
| — | 25 | 30 | 50 | — | 20 | 25 | 40 | 3 | **AN700KN022_** |
| — | 40 | 50 | 100 | — | 30 | 40 | 75 | 4 | **AN700NN022_** |
| — | 75 | 100 | 200 | — | 60 | 75 | 150 | 5 | **AN700SN022_** |

**Prices of starters do not include heater packs.** Select two packs (two overload relays, one for each speed). Heater pack selection, **Pages V5-T2-40** to **V5-T2-42**.

**One-Winding AN700BN0218**

**One-Winding AN700DN0218**

## Reconnectable Winding ①

**Maximum Horsepower—60/50 Hertz**

| Constant or Variable Torque | | | | Constant Horsepower | | | | NEMA | Open Type Constant or Variable Torque | Constant Horsepower |
|---|---|---|---|---|---|---|---|---|---|---|
| 115V | 200V | 230V | 460V/575V | 115V | 200V | 230V | 460/575V | Size | Catalog Number | Catalog Number |
| 1-1/2 | 3 | 3 | 5 | 1 | 2 | 2 | 3 | 0 | **AN700BN0218_** | **AN700BN0219_** |
| 3 | 7-1/2 | 7-1/2 | 10 | 2 | 5 | 5 | 7-1/2 | 1 | **AN700DN0218_** | **AN700DN0219_** |
| — | 10 | 15 | 25 | — | 7-1/2 | 10 | 20 | 2 | **AN700GN0218_** | **AN700GN0219_** |
| — | 25 | 30 | 50 | — | 20 | 25 | 40 | 3 | **AN700KN0218_** | **AN700KN0219_** |
| — | 40 | 50 | 100 | — | 30 | 40 | 75 | 4 | **AN700NN0218_** | **AN700NN0219_** |

**Prices of starters do not include heater packs.** Select two packs (two overload relays, one for each speed). Heater pack selection, **Pages V5-T2-40** to **V5-T2-42**.

## Magnetic Coils—AC or DC

| Coil Voltage and Hz | Code Suffix | Coil Voltage and Hz | Code Suffix | Coil Voltage and Hz | Code Suffix |
|---|---|---|---|---|---|
| 120/60 or 110/50 | **A** | 277/60 | **H** | 24/60, 24/50 ② | **T** |
| 240/60 or 220/50 | **B** | 208–240/60 | **J** | 24/50 | **U** |
| 480/60 or 440/50 | **C** | 240/50 | **K** | 32/50 | **V** |
| 600/60 or 550/50 | **D** | 380–415/50 | **L** | 48/60 | **W** |
| 208/60 | **E** | 550/50 | **N** | 48/50 | **Y** |

***Notes***

① If branch circuit protective device is 45A or greater, C320FBR1 fuse kit(s) may be required for circuit protection per NEC 530-072.

② NEMA Sizes 00 and 0 only. Sizes 1–5 are 24/60 only.

### Kits and Accessories

- Auxiliary contacts, contactor mounted—**Pages V5-T2-25** to **V5-T2-27**
- Transient suppressor, for magnet coil—**Page V5-T2-24**
- Timers—solid-state and pneumatic, mount on contactor—**Page V5-T2-22**

### Renewal Parts Publication Numbers

- See **Page V5-T2-30**

## Technical Data and Specifications

### Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 00–2—Open and Enclosed

| NEMA Size | Wire Size ① Cu Only |
|---|---|
| **Power Terminals—Line** | |
| 00 | 12–16 AWG stranded, 12–14 AWG solid |
| 0 | 8–16 AWG stranded, 10–14 AWG solid |
| 1 | 8–14 AWG stranded or solid |
| 2 | 3–14 AWG (upper) and/or 6–14 AWG (lower) stranded or solid ② |
| **Power Terminals—Load—Cu Only (stranded or solid)** | |
| 00–0 | 14–6 AWG stranded or solid |
| 1–2 | 14–2 AWG stranded or solid |
| **Control Terminals—Cu Only** | |
| 12–16 AWG stranded, 12–14 AWG solid | |

### Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 3–8—Open and Enclosed

| NEMA Size | Wire Size ② |
|---|---|
| **Power Terminals—Line and Load** | |
| 3 | 1/0–14 AWG Cu/Al |
| 4 | Open—3/0–8 AWG Cu; Enclosed—250 kcmil—6 AWG Cu/Al |
| 5 | 750 kcmil—2 AWG; or (2) 250 kcmil—3/0 AWG Cu/Al |
| 6 | (2) 750 kcmil—3/0 AWG Cu/Al |
| 7 | (3) 750 kcmil—3/0 AWG Cu/Al |
| 8 | (4) 750 kcmil—1/0 AWG Cu/Al |
| **Control Terminals—Cu Only** | |
| 12–16 AWG stranded, 12–14 AWG solid | |

### Plugging and Jogging Service Horsepower Ratings ③

| NEMA Size | 200V | 230V | 460V | 575V |
|---|---|---|---|---|
| 00 | — | 1/2 | 1/2 | 1/2 |
| 0 | 1-1/2 | 1-1/2 | 2 | 2 |
| 1 | 3 | 3 | 5 | 5 |
| 2 | 7-1/2 | 10 | 15 | 15 |
| 3 | 15 | 20 | 30 | 30 |
| 4 | 25 | 30 | 60 | 60 |
| 5 | 60 | 75 | 150 | 150 |
| 6 | 125 | 150 | 300 | 300 |

***Notes***

① Minimum per NEC. Maximum wire size: Sizes 00 and 0 to 8 AWG and Sizes 1–2 to 2 AWG.

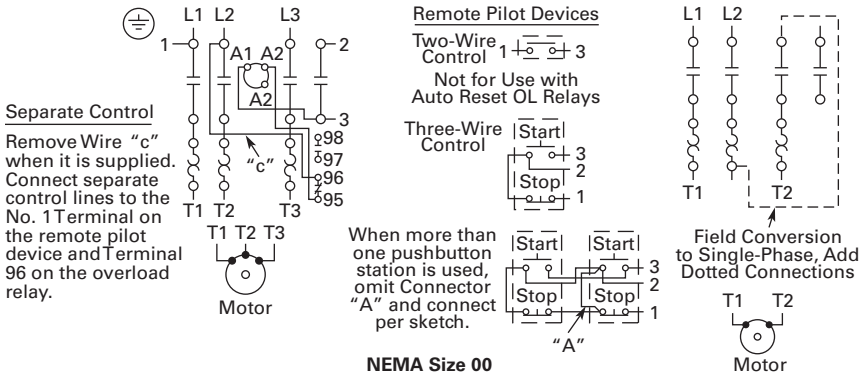
② Two compartment box lug.

③ Maximum horsepower where operation is interrupted more than 5 times per minute, or more than 10 times in a 10 minute period. NEMA Standard ICS2-1993 table 2-4-3.

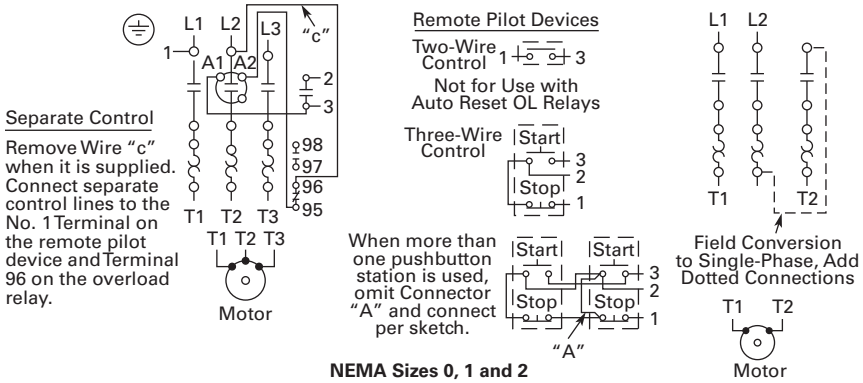
## Wiring Diagrams

2

### Three-Phase and Single-Phase Applications




**NEMA Size 00**




**NEMA Sizes 0, 1 and 2**

NEMA Size 1—BN15DN0AB

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| Contactors—Non-Reversing and Reversing | **V5-T2-4** |
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| Renewal Parts | **V5-T2-30** |
| Technical Data and Specifications | **V5-T2-34** |
| Relays—Thermal Overload | **V5-T2-38** |
| C440/***XT*** Electronic Overload Relay | **V5-T2-48** |


## Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload

### Product Description

Single-phase, full voltage magnetic starters connect the motor directly across the line, allowing it to draw full inrush current during start-up. These starters are most commonly used for control of self-starting single-phase motors up to 15 hp at 230V. They consist of a two-pole electromagnetic contactor to make and break the motor power circuit and an overload relay to provide running overload protection. Starters listed in the table include:

- Two-pole Freedom Series contactor with long life twin break, silver cadmium oxide contacts. Generously sized for low resistance and cool operation. Designed to 3 million electrical operations at maximum hp and 30 million mechanical operations to Size 0, 10 million operations to Size 2 and 6 million operations to Size 3
- Three-pole Freedom Series overload with poles two and three wired in series for motor overload protection. This overload is ambient compensated, selectable manual or automatic reset, interchangeable Class 10 or 20 heater packs, 1.0 or 1.15 service factor selectability, overload trip indication and electrically isolated NO-NC contacts (pull RESET button to test)
- Holding circuit NO auxiliary contact supplied as standard. On Size 00, the contact occupies the 4th power pole position. Sizes 0–3 have the NO auxiliary mounted on the right side of the contactor
- Steel mounting plate as standard on all open type starters. Wired for separate or common control

## Product Selection



***When Ordering Specify***

- Catalog number
- Heater pack number (see selection table, **Pages V5-T2-40** to **V5-T2-42**) or full load current

**BN16DM0AB**

### Type BN16 NEMA—Manual or Automatic Reset Overload Relay

| NEMA Size | Maximum Horsepower Motor Voltage | Single-Phase | Magnet Coil Voltage (60 Hz) | Open Type Two-Pole Catalog Number |
|---|---|---|---|---|
| 00 | 115 | 1/3 | 120 ① | **BN16AN0AC** |
| | 230 | 1 | 240 | **BN16AN0BC** |
| 0 | 115 | 1 | 120 ① | **BN16BN0AC** |
| | 230 | 2 | 240 | **BN16BN0BC** |
| 1 | 115 | 2 | 120 ① | **BN16DN0AB** |
| | 230 | 3 | 240 | **BN16DN0BB** |
| 1P | 115 | 3 | 120 ① | **BN16PN0AB** |
| | 230 | 5 | 240 | **BN16PN0BB** |
| 2 | 115 | 3 | 120 ① | **BN16GN0AB** |
| | 230 | 7-1/2 | 240 | **BN16GN0BB** |
| 3 | 115 | 7-1/2 | 120 ① | **BN16KN0A** |
| | 230 | 15 | 240 | **BN16KN0B** |

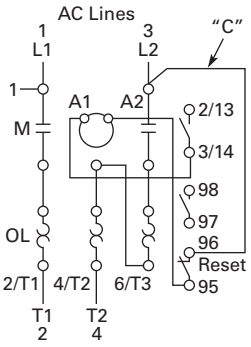
Starter catalog numbers do not include heater packs. Select one carton of three heater packs. Heater pack selection, **Pages V5-T2-40** to **V5-T2-42**.

***Note***

① For separate 120V control circuit. For maximum hp at listed motor voltages, use the rating of other starters of same size.

## Wiring Diagrams

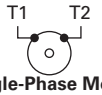
### Single-Phase Applications (Factory Wired)



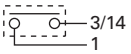

Separate Control

Remove Wire "C" if supplied and connect separate control lines to the Number 1 Terminal on the remote pilot device and to the Number 96 Terminal on the overload relay.

**Front View of Panel**

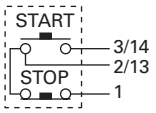



**Single-Phase Motor**



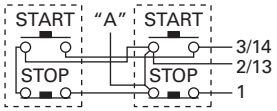

Not for Use with Auto Reset OL Relays

**Two-Wire Control**




**Three-Wire Control**

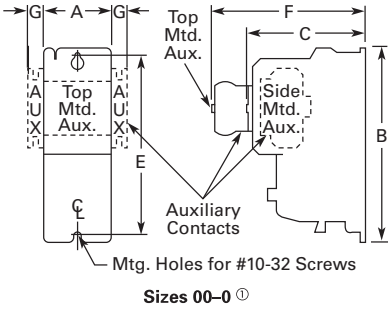
When more than one pushbutton station is used, omit Connector "A" and connect per sketch at right.



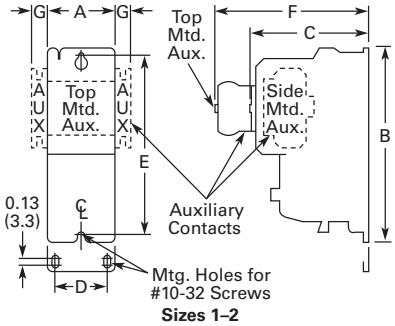
## Dimensions

Approximate Dimensions in Inches (mm)

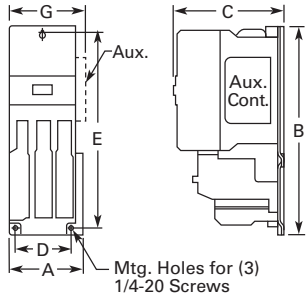
### Non-Reversing Starters, Bi-Metallic Overload—Open Type



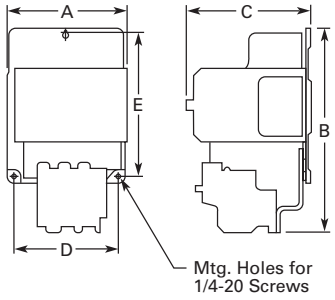

Sizes 00–0 ①



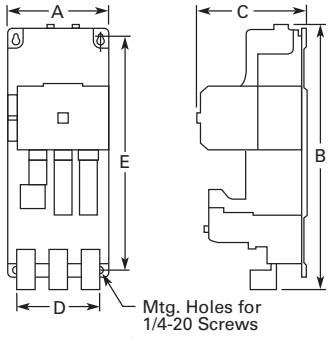

Sizes 1–2



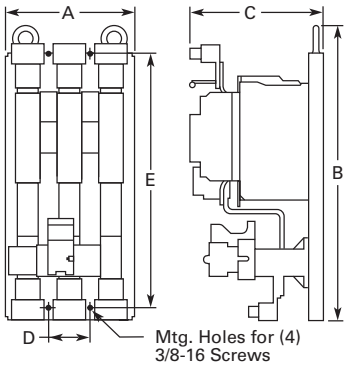

Size 3



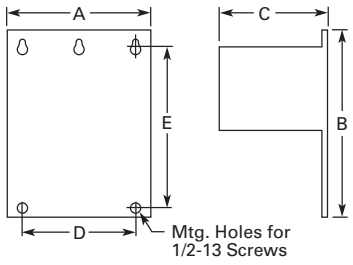

Size 4




Size 5




Size 6




Sizes 7–8

### Dimensions and Shipping Weights

| NEMA Size | Wide A | High B | Deep C | Mounting D | Mounting E | F | G | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|---|
| 00–0 | 1.80 (45.7) | 6.60 (167.6) | 3.52 (89.4) | — | 6.07 (154.2) | 4.90 (124.5) | 0.54 (13.7) | 2.2 (1.0) |
| 1–1P | 2.56 (65.0) | 7.08 (179.8) | 4.44 (112.8) | 2.00 (50.8) | 6.63 (168.4) | 5.80 (147.3) | 0.54 (13.7) | 4.5 (2.0) |
| 2 | 2.56 (65.0) | 8.08 (205.2) | 4.44 (112.8) | 2.00 (50.8) | 7.63 (193.8) | 5.80 (147.3) | 0.54 (13.7) | 4.7 (2.1) |
| 3 | 4.08 (103.6) | 11.35 (288.3) | 5.94 (150.9) | 3.00 (76.2) | 10.81 (274.6) | — | — | 11.0 (5.0) |
| 4 | 7.05 (179.1) | 12.06 (306.3) | 7.25 (184.2) | 6.00 (152.4) | 8.50 (215.9) | — | — | 23.0 (10.4) |
| 5 | 7.00 (177.8) | 17.77 (451.4) | 7.76 (197.1) | 6.00 (152.4) | 16.00 (406.4) | — | — | 36.0 (16.3) |
| 6 | 9.47 (240.5) | 21.69 (550.9) | 9.90 (251.5) | 3.10 (78.7) | 18.00 (457.2) | — | — | 75.0 (34.1) |
| 7 | 15.13 (384.3) | 29.13 (739.9) | 12.64 (321.1) | 13.25 (336.6) | 21.25 (539.8) | — | — | 120.0 (54.5) |
| 8 | 15.13 (384.3) | 34.50 (876.3) | 15.00 (381.0) | 13.25 (336.6) | 16.75 (425.5) | — | — | 210.0 (95.3) |

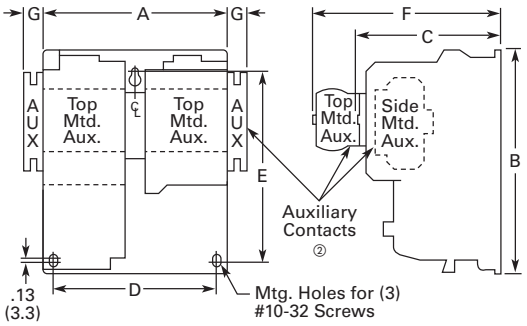
***Note***

① Holding circuit contact for Size 00 occupies 4th power pole position—no increase in width.

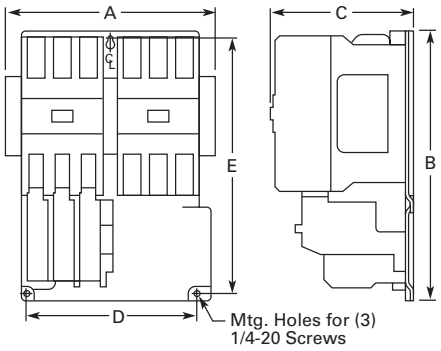
Approximate Dimensions in Inches (mm)



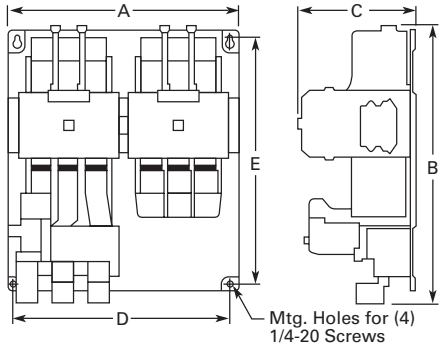
## Reversing Starters, Bi-Metallic Overload—Open Type



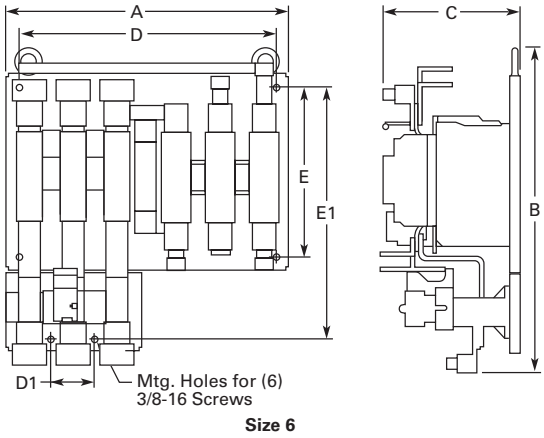

**Sizes 00 – 2**



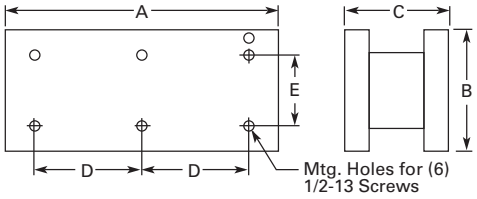

**Size 3**




**Sizes 4 – 5**




**Size 6**




**Open Type — Sizes 7 – 8 Horizontal**

## Dimensions and Shipping Weights

| NEMA Size | Wide A | High B | Deep C | Mounting D | Mounting E | D1 | E1 | F | G | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 00–0 | 4.20 (106.7) | 7.38 (187.5) | 3.52 (89.4) | 3.50 (88.9) | 6.87 (174.5) | — | — | 4.90 (124.5) | 0.54 (13.7 | 3.6 (1.6) |
| 1 | 5.71 (145.0) | 7.08 (179.8) | 4.44 (112.8) | 5.25 (133.4) | 5.75 (146.1) | — | — | 5.80 (147.3) | 0.54 (13.7) | 8.3 (3.8) |
| 2 | 5.71 (145.0) | 8.08 (205.2) | 4.44 (112.8) | 5.25 (133.4 | 6.75 (171.5) | — | — | 5.80 (147.3) | 0.54 (13.7) | 8.5 (3.9) |
| 3 | 8.70 (221.0) | 11.35 (288.3) | 5.94 (150.9) | 7.00 (177.8) | 10.81 (274.6) | — | — | — | — | 20.0 (9.1) |
| 4 | 14.68 (372.9) | 12.06 (306.3) | 7.25 (184.2) | 13.50 (342.9) | 8.50 (215.9) | — | — | — | — | 49.0 (22.2) |
| 5 | 14.50 (368.3) | 17.77 (451.4) | 7.76 (197.1) | 13.50 (342.9) | 16.00 (406.4) | — | — | — | — | 68.0 (30.9) |
| 6 | 19.77 (502.2) | 22.63 (574.8) | 9.90 (251.5) | 18.00 (457.2) | 12.00 (304.8) | 3.10 (78.7) | 18.00 (457.2) | — | — | 90.0 (40.9) |
| 7 | 28.06 (712.7) | 32.13 (816.1) ① | 12.70 (322.6) | 12.75 (323.9) | 21.25 (539.8) | — | — | — | — | 175.0 (79.5) |
| 8 | 30.38 (771.7) | 41.50 (1054.1) ① | 14.70 (373.4) | 14.13 (358.9) | 16.75 (425.5) | — | — | — | — | 430.0 (195.2) |

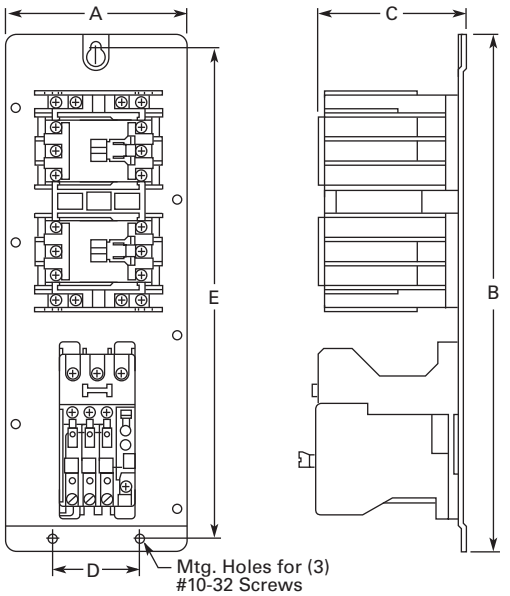
***Notes***

① Includes cross wiring overhang.

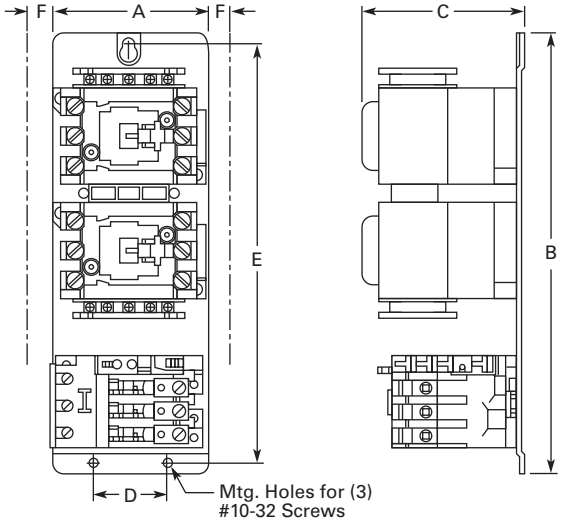
② See catalog listings for type and location of auxiliary contacts supplied with a particular starter.

Approximate Dimensions in Inches (mm)

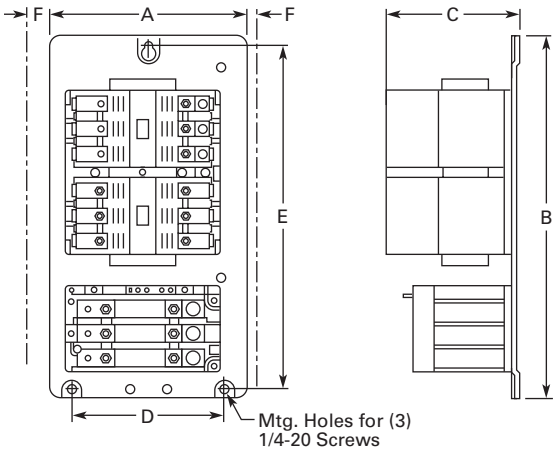
## Reversing Starters—Vertical Construction, Bi-Metallic Overload—AN56V Open Vertical Starter



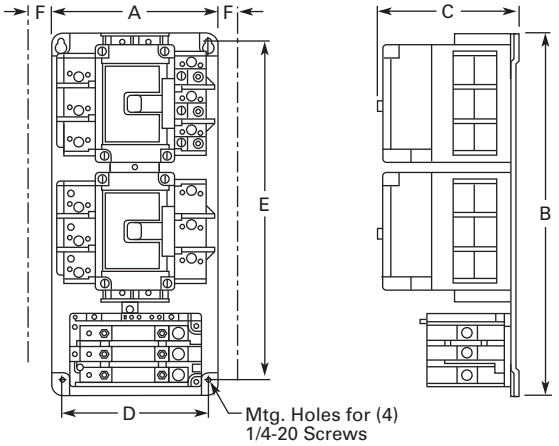

**NEMA Size 0**




**NEMA Sizes 1 – 2**




**NEMA Size 3**




**NEMA Size 4**

## Dimensions and Shipping Weights

| NEMA Size | Wide A | High B | Deep C | Mounting Wide D | Mounting HIgh E | Wire Zone | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|
| 0 | 4.25 (108.0) | 12.05 (306.1) | 3.84 (97.5) | 2.00 (50.8) | 11.50 (292.1) | — | 4.0 (1.8) |
| 1 | 4.25 (108.0) | 12.05 (306.1) | 3.86 (98.0) | 2.00 (50.8) | 11.50 (292.1) | 1.00 (25.4) | 9.0 (4.1) |
| 2 | 4.25 (108.0) | 12.05 (306.1) | 3.86 (98.0) | 2.00 (50.8) | 11.50 (292.1) | 1.00 (25.4) | 9.5 (4.3) |
| 3 | 9.25 (235.0) | 16.75 (425.5) | 5.18 (131.6) | 7.15 (181.6) | 16.07 (408.2) | ① | 21.0 (9.5) |
| 4 | 9.08 (230.6) | 19.84 (503.9) | 5.18 (131.6) | 8.00 (203.2) | 18.51 (470.2) | 1.50 (38.1) | 50.0 (22.7) |

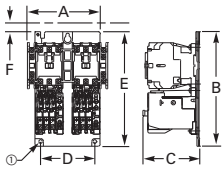
***Note***

① Wire overhang 1.00 mm left, 50 mm right.

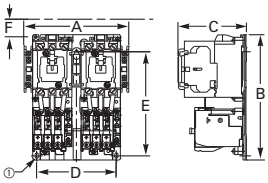
Approximate Dimensions in Inches (mm)



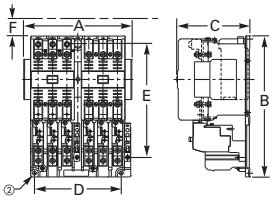
## Multispeed Starters, Bi-Metallic Overload—AN700 Open Vertical Starter



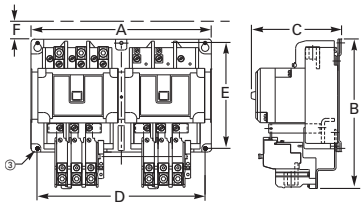

Size "0" Multispeed Starter
2-Speed, 2-Winding



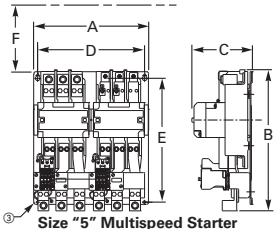

Size "1 – 2" Multispeed Starter
2-Speed, 2-Winding



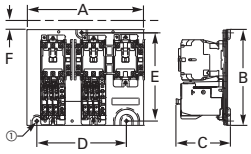

Size "3" Multispeed Starter
2-Speed, 2-Winding



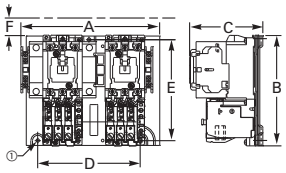

Size "4" Multispeed Starter
2-Speed, 2-Winding



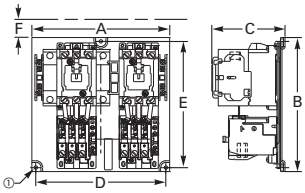

Size "5" Multispeed Starter
2-Speed, 2-Winding



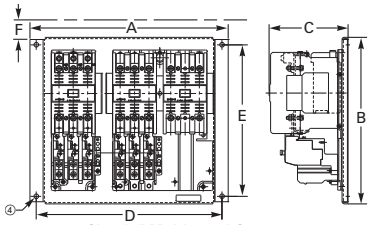

Size "0" Multispeed Starter
2-Speed, 1-Winding



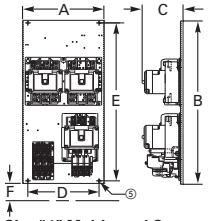

Size "1" Multispeed Starter
2-Speed, 1-Winding




Size "2" Multispeed Starter
2-Speed, 1-Winding




Size "3" Multispeed Starter
2-Speed, 1-Winding




Size "4" Multispeed Starter
2-Speed, 1-Winding

## Dimensions and Shipping Weights

| NEMA Size | Wide A | High B | Deep C | Mounting Wide D | Mounting High E | Wire Zone F | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|
| **Two-Speed—Selective Control—Separate Winding** | | | | | | | |
| 0 | 5.19 (132) | 7.38 (188) | 3.52 (89) | 3.50 (89) | 6.87 (175) | 0.89 (23) | 4.5 (2.0) |
| 1 | 5.66 (144) | 7.08 (180) | 4.42 (112) | 5.25 (133) | 5.75 (146) | 1.23 (31) | 9.0 (4.1) |
| 2 | 5.66 (144) | 8.08 (205) | 4.42 (112) | 5.25 (133) | 6.75 (165) | 1.63 (41) | 10.0 (4.5) |
| 3 | 8.72 (221) | 11.35 (288) | 5.89 (150) | 7.00 (178) | 10.81 (275) | 1.77 (45) | 24.0 (10.9) |
| 4 | 14.68 (373) | 12.06 (306) | 7.25 (184) | 13.50 (343) | 8.50 (216) | 1.95 (50) | 53.0 (24.1) |
| 5 | 14.50 (368) | 17.82 (453) | 7.76 (197) | 13.50 (343) | 16.00 (406) | 4.56 (116) | 73.0 (33.1) |
| **Two-Speed—Selective Control—Reconnectable Winding** | | | | | | | |
| 0 | 8.62 (219) | 7.06 (179) | 3.82 (81) | 6.62 (168) | 6.50 (165) | 0.50 (13) | 6.0 (2.7) |
| 1 | 8.97 (228) | 7.12 (181) | 4.72 (120) | 6.62 (168) | 6.50 (165) | 1.04 (26) | 10.0 (4.5) |
| 2 | 8.90 (226) | 8.62 (219) | 4.75 (121) | 8.40 (213) | 8.12 (206) | 1.03 (26) | 11.0 (5.0) |
| 3 | 16.00 (406) | 13.46 (342) | 6.38 (162) | 15.00 (381) | 12.25 (311) | 1.24 (31) | 31.0 (14.1) |
| 4 | 15.46 (393) | 31.00 (787) | 7.74 (197) | 13.50 (343) | 30.00 (762) | 1.84 (47) | 72.0 (32.7) |

***Notes***

① Mounting holes for (3) #10 screws.
② Mounting holes for (3) 1/4-20 screws.
③ Mounting holes for (4) 1/4-20 screws.
④ Mounting holes for (4) 5/16 screws.
⑤ Mounting holes for (4) 3/8 screws.

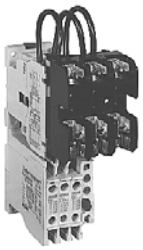
# Accessories

## Three-Pole Top Mounted Fuse Block Kit

***IEC Sizes A–K, NEMA Sizes 00–2***

Field mount to Freedom Series starters and contactors. Designed to save space and reduce installation costs. They provide short circuit protection for branch circuits.

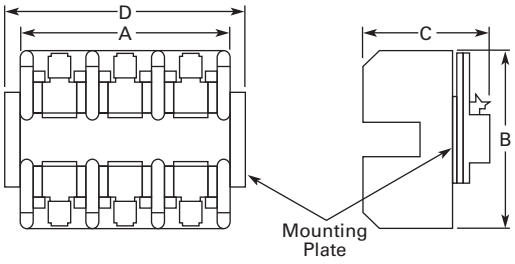
**Mounted Fuse Block Kit**



### Fuse Block Kits

| Fuse Type | Catalog Number |
|---|---|
| Class H—30A 250V | **C350KH21** |
| Class R—30A 250V | **C350KR21** |
| Class G—15A 300V | **C350KG37** |
| Class G—20A 300V | **C350KG38** |
| Class G—30A 300V | **C350KG31** |
| Class G— 60A 300V | **C350KG32** |
| Class T— 30A 300V | **C350KT31** |
| Class T— 60A 300V | **C350KT32** |
| Class J—30A 600V | **C350KJ61** |
| Class J—60A 600V | **C350KJ62** |
| Type M—30A 600V ① | **C350KM61** |
| Class CC—30A 600V | **C350KC63** |
| Class T—30A 600V | **C350KT61** |
| Class T—60A 600V | **C350KT62** |

### Three-Pole Top Mounted Fuse Block Kit




| Fuse Block | | | Approximate Dimensions in Inches (mm) | | | |
|---|---|---|---|---|---|---|
| Class | Amperes | Volts | Wide A | High B | Deep C | D |
| G | 15, 20, 30 | 300 | 2.40 (61.0) | 3.00 (76.2) | 2.04 (51.8) | — |
| | 60 | 300 | 2.62 (66.5) | 4.25 (108.0) | 2.08 (52.8) | — |
| H | 30 | 250 | 3.00 (76.2) | 3.10 (78.7) | 2.23 (56.6) | 3.62 (91.9) |
| J | 30, 60 | 600 | 4.81 (122.2) | 4.12 (104.6) | 2.82 (71.6) | — |
| M, CC | 30 | 600 | 2.40 (61.0) | 3.00 (76.2) | 2.04 (51.8) | — |
| R | 30 | 250 | 3.00 (76.2) | 3.10 (78.7) | 2.23 (56.6) | 3.62 (91.9) |
| T | 30, 60 | 300 | 3.44 (87.4) | 3.00 (76.2) | 2.33 (59.2) | — |
| | 30 | 600 | 3.75 (95.3) | 3.31 (84.1) | 2.26 (57.4) | — |
| | 60 | 600 | 4.87 (123.7) | 3.00 (76.2) | 2.58 (65.5) | — |

## Mechanical Interlock and Reversing Kits

Mechanical interlocks and reversing kits are designed for field assembly of reversing contactors or starters from Freedom Series components. The reversing kits include a mechanical interlock, stabilizer bar and a pre-cut, trimmed and formed wire set. Auxiliary contacts, if required, must be ordered separately. See **Pages V5-T2-25** and **V5-T2-26**.

**C321KM60B**

**Part No. 23-7165**

**Wire Set**

### Mechanical Interlock Only ②③

| Application | | | |
|---|---|---|---|
| NEMA Size | IEC Size | Contactor Mounting | Catalog Number |
| 00–2 | A–K | Horizontal | **C321KM60B** |
| 3 | L–N | Horizontal | **C321KM30** |
| 3 to 4 | N to P | Horizontal | **C321KM43** |
| 4 | P–S | Horizontal | **C321KM40** |
| 4 to 5 | — | Horizontal | **C321KM45** |
| 4 to 6 | S to T/U | Horizontal | **C321KM80** |
| 5 | — | Horizontal | **C321KM50** |
| 5 to 6 | — | Horizontal | **C321KM56** |
| 6 | T and U | Horizontal | **C321KM70** |
| 6 to 7 | T/U to V–X | Horizontal | **C321KM90** |
| 7 | V, W and X | Horizontal | **C321KM34** |
| 4 or 5 to 5 | P–S to 5 | Vertical | **C321KM55** |
| 5 to 6 | — | Vertical | **C321KM65** |
| 6 | T and U | Vertical | **C321KM66** |
| 6 to 7 | T/U to V–X | Vertical | **C321KM67** |

### Reversing Kits (Horizontal Contactor Mounting Only)

| Application | | |
|---|---|---|
| NEMA Size | IEC Size | Catalog Number |
| 00 | A–C | **C321KM60K14B** |
| 0 | D–F | **C321KM60K13B** |
| 1 | — | **C321KM60K15B** |
| 2 | G–K | **C321KM60K16B** |
| 3 | — | **C321KM60K17** ④ |
| — | L and M | **C321KM60K21** ④ |
| — | N | **C321KM60K18** ④ |
| 4 | — | **C321KM60K19** ④ |
| 5 | — | **C321KM60K20** ④ |
| — | P–S | **C321KM60K44** ④ |

***Notes***

① Type M fuse block not approved for branch circuit protection.
② Without cross-wiring.
③ For use with latest series product.
④ Kit includes (2) NC auxiliary contacts.

2

## Solid-State Timers

***Solid-State ON DELAY Timer—Side Mounted on Freedom Series NEMA 00–2, IEC A–K and C25D, C25E and C25F Frame***

This timer is designed to be **wired in series with the load** (typically a coil). When the START button is pushed (power applied to timer), the ON DELAY timing function starts. At the completion of the set timing period, timer and series wired load will both be energized.

**Solid-State Timer**

### Mounted Timer Product Selection

| Timing Range | Catalog Number ①②③ |
|---|---|
| 0.1–1.0 seconds | **C320TDN1_** |
| 1–30 seconds | **C320TDN30_** |
| 30–300 seconds | **C320TDN300_** |
| 5–30 minutes | **C320TDN3000_** ④ |

## Shorting Bar Kits

These kits provide phase-to-phase power connections of contactors for field assembly. The kits include bus connections and mounting hardware. The shorting bars connect all three phases of a single contactor.

### Shorting Bar Kits

| Description | Catalog Number |
|---|---|
| NEMA Size 3, IEC Sizes L–N | **C321SB18** |
| NEMA Size 4, IEC Sizes A–S | **C321SB19** |
| NEMA Size 6, IEC Sizes T and U | **C321SB22** |

## Pneumatic Timers—Top Mounted

Attachment mounts on top of any NEMA Size 00–2 or IEC Size A–K Freedom Series starter or contactor (top mounted auxiliary contacts cannot be installed on device when timer is used). Timer unit has 1NO-1NC isolated timed contacts—circuits in each pole must be the same polarity. Units are convertible from OFF to ON DELAY or vice-versa.

**Pneumatic Timers**

### Pneumatic Timers

| Timing Range | Catalog Number |
|---|---|
| 0.1 to 30 seconds | **C320TP1** |
| 10 to 180 seconds | **C320TP2** |

### Maximum Ampere Ratings

| | Vac | | | |
|---|---|---|---|---|
| Description | 120 | 240 | 480 | 600 |
| Make | 30 | 15 | 7.5 | 6 |
| Break | 3 | 1.5 | 0.75 | 0.6 |

## Locking Cover for Overload Relay—C306 Only

Snap-on transparent or opaque plastic panel for covering access port to the overload relay trip setting dial—helps prevent accidental or unauthorized changes to trip and reset setting.

**Locking Cover for Overlay Relay**

### Locking Cover for Overlay Relay

| Description | Min. Ordering Quantity (Std. Pkg.) | Catalog Number |
|---|---|---|
| Clear cover, no accessibility | 50 | **C320PC3** |
| Gray cover, no accessibility, with Auto only nib | 50 | **C320PC4** |
| Gray cover, no accessibility, with Manual only nib | 50 | **C320PC5** |
| Gray cover with FLA dial accessibility, A, B, C, D positions and Auto only nib | 50 | **C320PC6** |
| Gray cover with FLA dial accessibility, A, B, C, D positions and Manual only nib | 50 | **C320PC7** |

***Notes***

① Add operating voltage suffix to catalog number.
**A** = 120V, **B** = 240V, **E** = 208V

② Rated 0.5 ampere pilot duty—not to be used on larger contactors.

③ Terminal connections are quick connects only. Two per side.

④ 240V operating voltage not available for C320TDN3000_.

## Identification Markers

***IEC Sizes A–K, NEMA Sizes 00–2***

Designed to snap on the face of contactor for easy, personalized identification of individual devices. Includes holder and labels.

### Identification Markers

| Description | Catalog Number |
|---|---|
| Identification marker | **C320DL2** |

## Control Circuit Fuse Block

These panel mounted fuse holders, designed for control circuit protection or other similar low current requirements, have extractor type fuse caps. The Class CC rejection type fuses (KTK-R) used in these holders are intended for use with equipment designated as being suitable for use on systems having high available fault currents. If branch circuit protective device is 45A or greater, C320FBR fuse kit may be required for control circuit protection per NEC 430-72.

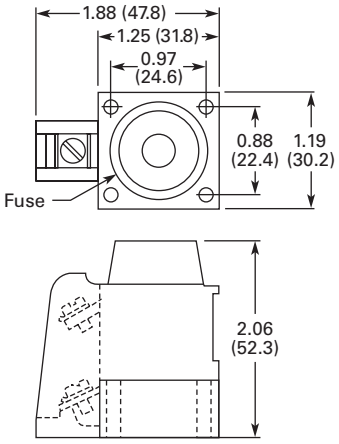
**Control Circuit Fuse Block**

### Control Circuit Fuse Block

| Type | Max. Amperes | Catalog Number |
|---|---|---|
| Fuse holder only | 15 | **C320FB** ① |
| | 30 | **C320FBR** ② |

### Dimensions

Approximate Dimensions in Inches (mm)




## DIN Rail Mounting Channel—35 mm

Designed for DIN rail mounting of IEC style contactors and starters.

**DIN Rail**

### DIN Rail

| Description | Catalog Number |
|---|---|
| 1 meter length | **MC382MA1** |

## Finger Protection Shields

Snap-on shields for both contactors and starters provide IEC Type IP20 finger protection. Prevents accidental contact with line/load terminals.

### Finger Protection Shields

| Application | Catalog Number |
|---|---|
| NEMA Size 00, IEC Sizes A–C | **C320LS1** |
| NEMA Size 0, IEC Sizes D–F | **C320LS2** |
| **NEMA Sizes 1–2, IEC Sizes G–K** | |
| Contactors | **C320LS3** |
| Reversing contactors | **C320LS4** |
| **NEMA Size 1** | |
| Starters | **C320LS5** |
| Reversing starters | **C320LS6** |
| **NEMA Size 2, IEC Sizes G–K** | |
| Starters | **C320LS7** |
| Reversing starters | **C320LS8** |

## Adapter to DIN Rail Mount

***NEMA 1–2 and IEC G–K Contactors***

Designed to allow DIN rail mounting of NEMA 1–2 and IEC G–K contactors. Includes all hardware required to convert contactors from panel mounting to 35 mm DIN rail mounting.

### Adapter to DIN Rail Mount

| Catalog Number |
|---|
| **C320DN65** |

***Notes***

① A fuse is not supplied, but holder will accept a Bussman Type KTK or KTK-R (13/32 in x 1-1/2 in) fuse, 600V maximum.

② Includes a 5A, 600V KTK-R fuse.

## Transient Suppressor Kits

### *NEMA Sizes 00–2, IEC Sizes A–K*

These kits limit high voltage transients produced in the control circuit when power is removed from the contactor or starter coil. There are three separate suppressors for use on 24–120V, 208–240V or 277–480V coils respectively.

These devices mount directly to the coil terminals of Freedom Series contactors or starters NEMA Sizes 00–2, IEC Sizes A–K and lighting contactors 10–60A. Reversing devices will require two.

**C320TS2**

#### NEMA Sizes 00–2, IEC Sizes A–K

| Description | Coil Voltage ① | Catalog Number |
|---|---|---|
| Transient suppressor | 24/120V | **C320TS1** |
| | 208/240V | **C320TS2** |
| | 277/480V | **C320TS3** |

### *NEMA Sizes 3–5, IEC Sizes L–S*

This device mounts on top of any side mounted auxiliary contact on Freedom Series NEMA Sizes 3–5, IEC Sizes L–S and lighting contactors 100–300A. It connects across coil terminals on any 120V contactor or starter magnet coil (reversing starters or contactors require 2).

Limits high voltage transients produced in the circuit when power is removed from the coil.

**C320AS1**

#### NEMA Sizes 3–5, IEC Sizes L–S

| Description | Coil Voltage | Catalog Number |
|---|---|---|
| Transient suppressor | 120V | **C320AS1** |

## Add-On Power Pole Kit ②

### *NEMA Sizes 00–0, IEC Sizes A–F*

This device mounts on the side of Freedom NEMA Size 00–0 and IEC Sizes A–F contactors. One unit can be mounted on each side and carries UL, cUL and IEC ratings. The device is rated for resistive, inductive and lighting applications.

#### NEMA Sizes 00–0, IEC Sizes A–F

| UL Ampere Rating | | | | | | IEC 947 Ampere Rating | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Horsepower Single-Phase | | | | | | | |
| Inductive 600V | Resistive 600V | 115V | 230V | Locked Rotor 240V | Lighting Ballast Tungsten 480V | AC-1 600V | AC-3 600V | AC-5a AC-5b 480V | 1NO Power Pole Catalog Number |
| 15 | 20 | 1/2 | 2 | 96 | 20 | 20 | 12 | 18 | **C320PPD10** |

## Adhesive Dust Cover

### *NEMA Sizes 00–2, IEC Sizes A–K*

These adhesive stickers come 25 to a package and provide extra protection from contaminants when applied to the sides of Freedom NEMA Sizes 00–2 and IEC Sizes A–K. Adhesive covers are easily applied to side opening where auxiliaries are not installed and provide extra protection from metal filings and other debris.

#### NEMA Sizes 00–2, IEC Sizes A–K

| Description | Catalog Number |
|---|---|
| 25 to a package | **C320DSTCVR** |

***Notes***

① Suppressor is compatible with coil voltages/ranges as shown, both 50 and 60 Hz.

② Power pole kits sold for replacement purposes only. For new applications, order the correct four-pole and five-pole contactor catalog numbers.

## Auxiliary Contacts

***Contact Configuration Code***

This two-digit code is found on the auxiliary contact to assist in identifying the specific contact configuration. The first digit indicates the quantity of NO contacts and the second indicates the quantity of NC contacts.

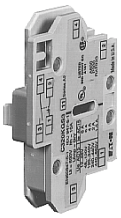
***NEMA Sizes 00–2—IEC Sizes A–K***

The auxiliary contacts listed on this page are designed for installation on Freedom Series starters and contactors. Snap-on design facilitates quick, easy installation.

These bifurcated design contact blocks, featuring silver cadmium alloy contacts, are well suited for use in very low energy (logic level) circuits.

### NEMA Sizes 00–2—IEC Sizes A–K ①

**Side Mounted**



**Top Mounted**

| Description | Contact Configuration Code ② | Catalog Number |
|---|---|---|
| **Side Mounted** | | |
| 1NO | 10 | **C320KGS1** |
| 1NC | 01 | **C320KGS2** |
| 1NO-1NC | 11 | **C320KGS3** |
| 2NO | 20 | **C320KGS4** |
| 2NC | 02 | **C320KGS5** |
| 1NO-1NCI | N/A | **C320KGS6** |
| 1NO (EC)-1NC (LO) | N/A | **C320KGS7** |
| 1NCI | N/A | **C320KGS8** |
| **Top Mounted** | | |
| 1NO | 10 | **C320KGT1** |
| 1NC | 01 | **C320KGT2** |
| 1NO-1NC | 11 | **C320KGT3** |
| 2NO | 20 | **C320KGT4** |
| 2NC | 02 | **C320KGT5** |
| 1NO-1NCI | N/A | **C320KGT6** |
| 1NO (EC)-1NC (LO) | N/A | **C320KGT7** |
| 1NCI | N/A | **C320KGT8** |
| 3NO | 30 | **C320KGT9** |
| 2NO-1NC | 21 | **C320KGT10** |
| 1NO-2NC | 12 | **C320KGT11** |
| 3NC | 03 | **C320KGT12** |
| 4NO | 40 | **C320KGT13** |
| 3NO-1NC | 31 | **C320KGT14** |
| 2NO-2NC | 22 | **C320KGT15** |
| 1NO-3NC | 13 | **C320KGT16** |
| 4NC | 04 | **C320KGT17** |
| 3NO-1NCI | N/A | **C320KGT18** |
| 2NO-1NCI-1NC | N/A | **C320KGT19** |
| 2NO-1NO (EC)-1NC (LO) | N/A | **C320KGT20** |
| 1NO-1NC-1NO (EC)-1NC (LO) | N/A | **C320KGT21** |

***Notes***

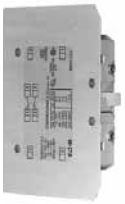
① NCI = Normally Closed early opening designed for use in reversing applications. EC = Early Closing. LO = Late Opening.

② For reference only—not part of catalog number.

***NEMA Sizes 3–8—IEC Sizes L–Z***



C320KGS42



## Base Auxiliary Contacts—NEMA Sizes 3–5, IEC Sizes L–S

| Circuit | Contact Configuration Code ① | NEMA Size 3 IEC Sizes L –N Catalog Number | NEMA Sizes 4–5 IEC Sizes P–S Catalog Number |
|---|---|---|---|
| NO | 10 | **C320KGS31** | **C320KGS41** |
| NO-NC | 11 | **C320KGS32** | **C320KGS42** |

C320KGS22

## Auxiliary Contacts—NEMA Sizes 3–5, IEC Sizes L–S

| Circuit | Contact Configuration Code ① | Catalog Number |
|---|---|---|
| NO | 10 | **C320KGS20** |
| NC | 01 | **C320KGS21** |
| NO-NC ② | 11 | **C320KGS22** |
| **Sealed Logic Level** | | |
| NO | 10 | **C320KGS20L** |
| NC | 01 | **C320KGS21L** |
| NO-NC ③ | 11 | **C320KGS22L** |

## Auxiliary Contacts—NEMA Sizes 6–8, IEC Sizes T–Z

| Circuit | Contact Configuration Code ① | Size | Catalog Number |
|---|---|---|---|
| NO-NC | 11 | NEMA 8, IEC Z | **C320KA5** |
| 2NO-2NC | 22 | NEMA 6–7 | **C320KA6** |
| 2NO-2NC | 22 | IEC T–X | **C320KA8** |

***Auxiliary Contact Ratings (Amperes)***

## Ratings—NEMA A600

| Current | AC Volts 120V | 240V | 480V | 600V |
|---|---|---|---|---|
| Make | 60 | 30 | 15 | 12 |
| Break | 6 | 3 | 1.5 | 1 |
| Continuous | 10 | 10 | 10 | 10 |

## Ratings—NEMA P300

**Continuous Thermal Rating: 5A**

| DC Volts | Make/Break Amperes |
|---|---|
| 125 | 1.10 |
| 250 | 0.55 |

## Ratings—Logic Level

**Minimum Ratings for Logic Level and Hostile Atmosphere Application**

| | |
|---|---|
| Minimum Amperes | 20 mA |
| Minimum Volts | 24 Vac/Vdc |

## Ratings C320KGS20L, C320KGS21L, C320KGS22L

| DC-12 | | AC-12 | |
|---|---|---|---|
| $U_e$ | $I_e$ | $U_e$ | $I_e$ |
| 80 | 0.1 | 250 | 0.1 |

***Notes***

① For reference only—not part of catalog number.
② NO-NC occupies two position—L2 and L3, or R2 and R3. See figure on **Page V5-T2-27**.
③ Form C contacts.

## Auxiliary Contact Location

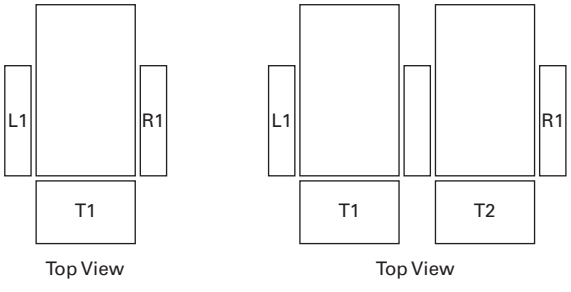
### *NEMA Sizes 00–2, IEC Sizes A–K*

The sketches below illustrate the maximum number of auxiliary contacts that can be assembled to a contactor or starter and their locations.

### Auxiliary Contacts

| Size | Poles | Available Mounting Positions ①② Open Type | Enclosed | Catalog Number |
|---|---|---|---|---|
| A–K | 3 | T1, L1 | L1 | **AE16** |
| 00 | 3 | T1, L1, R1 | L1 | **AN16** |
| 0–2 | 3 | T1, L1 | L1 | |
| A–K | 3 | L1, R1 | L1, R1 | **AE56** |
| 00–2 | 3 | T1, T2 | — | **AN56** |
| A–C | 2–4 | T1, L1, R1 | L1, R1 | **CE15** |
| D–K | 3 | T1, L1 | L1 | |
| G–J | 4 | T1, R1 | — | |
| G–J | 5 | T1 | — | |
| 00 | 2–4 | T1, L1, R1 | L1 | **CN15** |
| 0–2 | 2–3 | T1, L1 | L1 | |
| 1, 2 | 4 | T1, L1 | — | |
| 1, 2 | 5 | T1, L1 | — | |
| 10A | 2–4 | T1, L1, R1 | L1 | **CN35** |
| 20–60A | 2–3 | T1, L1 | L1 | |
| 60A | 4 | T1, L1 | — | |
| 60A | 5 | T1, L1 | — | |
| A–K | 3 | L1, R1 | L1, R1 | **CE55** |
| 00–2 | 3 | T1, T2 | — | **CN55** |

### Auxiliary Contact Location




**Non-Reversing Contactors and Starters**

**Reversing Contactors and Starters**

### *NEMA Sizes 3–8, IEC Sizes L–Z*

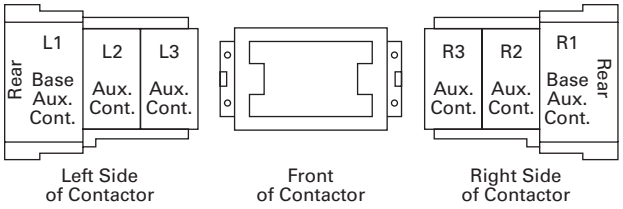
The sketches below illustrate the maximum number of auxiliary contacts that can be assembled to a contactor and their locations.

**Note:** A base auxiliary contact must be added in position R1 before additional auxiliary contacts can be mounted on NEMA Size 3 and IEC Sizes L–N, or in L1 on NEMA Sizes 4–5 and IEC Sizes P–S.

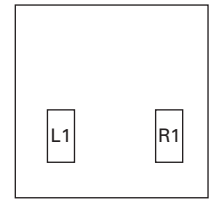
### Mounting Positions

| Size | Available Mounting Positions ① |
|---|---|
| NEMA Size 3, IEC Sizes L–N | R2, R3, L1, L2, L3 |
| NEMA Sizes 4–5, IEC Sizes P–S | L2, L3, R1, R2, R3 |
| NEMA Sizes 6–7, IEC Sizes T–X | R1 |
| NEMA Size 8, IEC Size Z | L2, R2 |

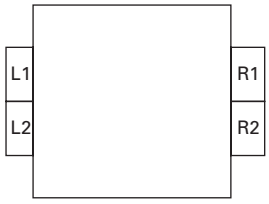
### Auxiliary Contact Location




**NEMA Sizes 3–5**
**IEC Sizes L–S**




**NEMA Sizes 6–7**
**IEC Sizes T, U, V, W and X**




**NEMA Size 8**
**IEC Size Z**

***Notes***

① Available positions on contactors or starters other than what is factory installed.

② When a pneumatic timer is mounted on contactor, only side mounted auxiliary contact positions are available. The solid-state timer, when added, takes up side mounted auxiliary contact position.

## DC Magnet Coils

2

### *When Ordering Specify*

**Conversion Kit for Field Assembly**

- Catalog number

**Factory Installed DC Coil**

- For factory installed DC magnet coil on AC contactors or non-combination starters (open type only), substitute the code suffix from the table on this page for the magnet coil identifier in the device catalog number. EXAMPLE: For Size 0 AC contactor with a 24 Vdc coil, change AN16BN0**A**C to AN16BN0**T1**C

### *Application*

- Connect for separate control
- Not for use with cover control switch operators
- Use twin break, heavy-duty pilot devices
- Designed for +10%, –20% rated voltage, continuous duty operation

### *Non-Reversing Kit Consists of:*

- One encapsulated DC magnet coil
- One NCI or NO/NCI side mounted auxiliary contact

**Note:** These kits are supplied with a NO/NCI side mounted auxiliary contact in place of the NCI contact.

- Two blue colored connection wires
- One instruction publication

### *Operation*

See next page for operation details.

### DC Magnet Coils

| Contactor or Starter Size | | Conversion Data | | | | | Complete Conversion Kit | | Factory Installed |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnet Coil | | | | | | |
| NEMA | IEC | Volts | Coil Number | Amps P.U./Seal | Watts P.U./Seal | NCI Interlock | Catalog Number | Ship Wt. Lbs (kg) | Code Suffix |
| **Non-Reversing—Kit Includes NCI Side Mounted Auxiliary Contact** | | | | | | | | | |
| 00 and 0 CN35–A, B, D D15 Relays | A–F | 12 | **9-2988-11** | 6.4/0.28 | 76.8/3.36 | **C320KGD1** | **C335KD3R1** | 1.0 (0.5) | **R1** |
| | | 24 | **9-2988-12** | 3.2/0.14 | 76.8/3.36 | **C320KGD1** | **C335KD3T1** | | **T1** |
| | | 48 | **9-2988-13** | 1.6/0.07 | 76.8/3.36 | **C320KGD1** | **C335KD3W1** | | **W1** |
| | | 120 | **9-2988-14** | 0.64/0.028 | 76.8/3.36 | **C320KGD1** | **C335KD3A1** | | **A1** |
| ① 00 and 0 CN35–A, B, D D15 Relays | A–F | 12 | **9-2988-11** | 6.4/0.28 | 76.8/3.36 | **C320KGD2** ① | **C335KD3R4** | 1.0 (0.5) | **R4** |
| | | 24 | **9-2988-12** | 3.2/0.14 | 76.8/3.36 | **C320KGD2** ① | **C335KD3T4** | | **T4** |
| | | 48 | **9-2988-13** | 1.6/0.07 | 76.8/3.36 | **C320KGD2** ① | **C335KD3W4** | | **W4** |
| | | 120 | **9-2988-14** | 0.64/0.028 | 76.8/3.36 | **C320KGD2** ① | **C335KD3A4** | | **A4** |
| 1 and 2 CN35–G | G–K | 12 | **9-2990-1** | 15.4/0.42 | 185/4.98 | **C320KGD5** | **C335KD4R4** | 1.0 (0.5) | **R4** |
| | | 24 | **9-2990-2** | 7.7/0.021 | 185/4.96 | **C320KGD5** | **C335KD4T4** | | **T4** |
| | | 48 | **9-2990-3** | 3.9/0.11 | 185/5.04 | **C320KGD5** | **C335KD4W4** | | **W4** |
| | | 120 | **9-2990-4** | 1.5/0.041 | 185/4.87 | **C320KGD5** | **C335KD4A4** | | **A4** |
| 3 CN35–K | L–N | 12 | **9-3002-1** | 24/0.40 | 293/4.84 | **C320KGD3** | **C335KD5R1** | 2.0 (0.9) | **R1** |
| | | 24 | **9-3002-2** | 12/0.20 | 288/4.75 | **C320KGD3** | **C335KD5T1** | | **T1** |
| | | 48 | **9-3002-3** | 6.1/0.097 | 295/4.67 | **C320KGD3** | **C335KD5W1** | | **W1** |
| | | 120 | **9-3002-4** | 2.5/0.038 | 298/4.57 | **C320KGD3** | **C335KD5A1** | | **A1** |
| 4 and 5 CN35–N, S | P–S | 24 | **9-2026-4** | 18/0.22 | 400/5.3 | **C320KGD3** | **C335KA3T1** | 2.5 (1.1) | **T1B** |
| | | 48 | **9-2026-3** | 9/0.11 | 400/5.2 | **C320KGD3** | **C335KA3W1** | | **W1B** |
| | | 120 | **9-2026-2** | 3.3/0.05 | 450/5.4 | **C320KGD3** | **C335KA3A1** | | **A1B** |
| | | 240 | **9-2026-1** | 1.7/0.02 | 440/4.9 | **C320KGD3** | **C335KA3B1** | | **B1B** |
| **Reversing** | | | | | | | | | |
| 00 and 0 CN35–A, B, D D15 relays | A–F | 12 | **(2) 9-2988-1** | 6.4/0.28 | 76.8/3.36 | **(2) C320KGD1** | **C335RD3R1** ② | 1.0 (0.5) | **R1** ③ |
| | | 24 | **(2) 9-2988-2** | 3.2/0.14 | 76.8/3.36 | **(2) C320KGD1** | **C335RD3T1** ② | | **T1** ③ |
| | | 48 | **(2) 9-2988-3** | 1.6/0.07 | 76.8/3.36 | **(2) C320KGD1** | **C335RD3W1** ② | | **W1** ③ |
| | | 120 | **(2) 9-2988-4** | 0.64/0.028 | 76.8/3.36 | **(2) C320KGD1** | **C335RD3A1** ② | | **A1** ③ |
| 1 and 2 CN35–G | G–K | 12 | **(2) 9-2990-1** | 15.4/0.42 | 185/4.98 | **(2) C320KGD3** | ④ | — | **R1** ③ |
| | | 24 | **(2) 9-2990-2** | 7.7/0.21 | 185/4.96 | **(2) C320KGD3** | ④ | | **T1** ③ |
| | | 48 | **(2) 9-2990-3** | 3.9/0.11 | 185/5.04 | **(2) C320KGD3** | ④ | | **W1** ③ |
| | | 120 | **(2) 9-2990-4** | 1.5/0.041 | 185/4.87 | **(2) C320KGD3** | ④ | | **A1** ③ |

***Notes***

① These kits are supplied with a NO/NCI side mounted auxiliary contact in place of the NCI contact.

② Kit does not include mechanical interlock or crossover wiring. Two NO/NCI top mounted auxiliary contacts are supplied for electrical interlocking.

③ Factory installed DC coils on NEMA contactors and starters include a NO/NC top mounted auxiliary contact on each contactor for electrical interlocking. On IEC contactors and starters, a NC top mounted auxiliary contact is supplied on each contactor for electrical interlocking.

④ Available factory assembled only.

### *Operation*

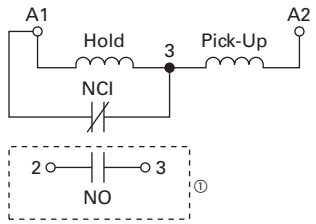
These DC coil kits have separate pick-up and seal windings. A **special** (side mounted) early-break NCI auxiliary contact is used to either disconnect the pick-up winding or insert the seal winding in series with the pick-up winding, depending on the frame size of the contactor. DC coil kits come in two styles, a suffix **1** and a suffix **4**. Suffix 1 contains only the **special** (side mounted) early break NCI auxiliary contact. Suffix 4 contains a NO contact in the same package as the **special** (side mounted) early-break NCI auxiliary contact.

**Note:** For NEMA Sizes 00 and 0 and IEC Sizes A–F, contactors may utilize either suffix 1 or 4 DC coil kits; starters may utilize suffix 4 DC coil kits only. For NEMA Sizes 1 and 2 and IEC Sizes G–K, both contactors and starters may utilize a suffix 4 DC coil kit only.

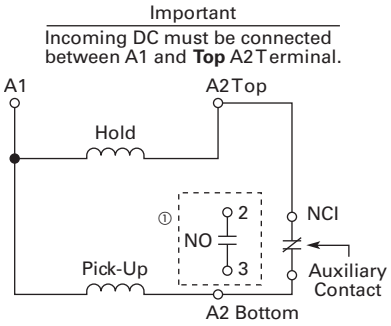
On the above sizes only, when the **special** auxiliary package is mounted on the side of a contactor or starter, **no** standard auxiliary contact may be mounted on the same side.

**Note:** For NEMA Sizes 3–5 and IEC Sizes L–S, special coil NCI clearing contact is an add-on auxiliary (**must** mount on a base mount auxiliary contact; normally a 1NO). This arrangement will normally account for two of the three contact positions on the side of each contactor or starter.

## Elementary Diagrams




**DC Coil Elementary Diagram for NEMA Sizes 1–3 and IEC Sizes G–N Contactors and Starters**




**DC Coil Elementary Diagram for NEMA Sizes 00, 0, 4 and 5 and IEC Sizes A–F and P–S Contactors and Starters**

## Competitive Mounting Plates

The C321 adapter plates permit direct replacement of competitive starters with Freedom Series starters without drilling and tapping new mounting holes. Allen-Bradley 509, Eaton's A10 (adapter plate not required for replacing A10 Starter Sizes 1, 4 and 5), Furnas 14, ESP100, General Electric CR206, CR306, Siemens SXL, Square D 8536, Westinghouse A200, B200.

**C321CMP1**

### Competitive Mounting Plates

| Freedom NEMA Size | Index Number ② Catalog Number |
|---|---|
| 00, 0 | **C321CMP0** |
| 1 | **C321CMP1** |
| 2 | **C321CMP2** |
| 3 | **C321CMP3** |
| 4 | **C321CMP4** |
| 5 | **C321CMP5** |

***Note***

① 1NO available in Suffix 4 kits only.

② Handling number only—does not appear on product. The handling number is stamped on the carton label only.

## Special Modifications

### For Catalog Numbers AN16, AN56, CE15, CN15, CN35, CN55

2

| Addition or Special Feature | Starter Size —NEMA 00 | 0 | 1/— | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Control Circuit** | | | | | | | | | | |
| Extra auxiliary circuit, factory installed NO or NC—each contact ① | Consult sales office for pricing adders. | | | | | | | | | |
| Transient suppressor ① | Consult sales office for pricing adders. | | | | | | | | | |
| **Power Circuit** | | | | | | | | | | |
| Contactor/starter for ring lug capability—add Mod Code **T16** to catalog number ② (Power terminals only, control terminals as standard) Standalone overload relays can not accept ring lugs on line side | Consult sales office for pricing adders. | | | | | | | | | |
| **Factory Installed Dust Covers** | | | | | | | | | | |
| Factory installed C320DSTCVR—add Mod Code **-53** to catalog number ① | | | | | NA | NA | NA | NA | NA | NA |

## Renewal Parts

For a complete listing of parts, refer to the Renewal Parts Publication Number referenced below.

### For Catalog Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 ③ and CN55 Contactors and Starters (Size 00, 0)

| Description | | NEMA Size 00 Series B1 Part No. | NEMA Size 00 Series C1 Part No. | NEMA Size 0 Series B1 Part No. | NEMA Size 0 Series C1 Part No. |
|---|---|---|---|---|---|
| **Renewal Parts Publication Number** | | **22177** | **22177** | **22177** | **22177** |
| **Contact Kits** | | | | | |
| Two-pole | | ④ | ④ | ④ | ④ |
| Three-pole | | ④ | ④ | ④ | ④ |
| Four-pole | | ④ | ④ | ④ | ④ |
| Five-pole | | ④ | ④ | ④ | ④ |
| **Magnet Coils** | **Coil Suffix** | | | | |
| 120V 60 Hz or 110V 50 Hz | **A** | **9-2875-1** | **9-2875-1** | **9-2876-1** | **9-2876-1** |
| 240V 60 Hz or 220V 50 Hz | **B** | **9-2875-2** | **9-2875-2** | **9-2876-2** | **9-2876-2** |
| 480V 60 Hz or 440V 50 Hz | **C** | **9-2875-3** | **9-2875-3** | **9-2876-3** | **9-2876-3** |
| 600V 60 Hz or 550V 50 Hz | **D** | **9-2875-4** | **9-2875-4** | **9-2876-4** | **9-2876-4** |
| 208V 60 Hz | **E** | **9-2875-5** | **9-2875-5** | **9-2876-5** | **9-2876-5** |
| 277V 60 Hz | **H** | **9-2875-12** | **9-2875-12** | **9-2876-12** | **9-2876-12** |
| 208/240V 60 Hz | **J** | **9-2875-37** | **9-2875-37** | **9-2876-17** | **9-2876-17** |
| 240V 50 Hz | **K** | **9-2875-11** | **9-2875-11** | **9-2876-11** | **9-2876-11** |
| 380–415V 50 Hz | **L** | **9-2875-6** | **9-2875-6** | **9-2876-6** | **9-2876-6** |
| 380V 50 Hz | **L** | — | — | — | — |
| 415V 50 Hz | **M** | — | — | — | — |
| 550V 50 Hz | **N** | — | — | — | — |
| 24V 60 Hz–24V 50 Hz | **T** | **9-2875-36** | **9-2875-36** | **9-2876-36** | **9-2876-36** |
| 24V 60 Hz | **T** | — | — | — | — |
| 24V 50 Hz | **U** | **9-2875-36** | **9-2875-36** | **9-2876-36** | **9-2876-36** |
| 32V 50 Hz | **V** | **9-2875-16** | **9-2875-16** | **9-2876-16** | **9-2876-16** |
| 48V 60 Hz | **W** | **9-2875-8** | **9-2875-8** | **9-2876-8** | **9-2876-8** |
| 48V 50 Hz | **Y** | **9-2875-9** | **9-2875-9** | **9-2876-9** | **9-2876-9** |
| **Magnet Frame Armature** | | | | | |
| Lower magnet frame | | ④ | ④ | ④ | ④ |
| Upper magnet frame | | ④ | ④ | ④ | ④ |

***Notes***

① These modifications are generally available in kit form at lower cost. See specific product sections for kit listings.

② The T16 modifications are only available on C306 overloads and the following three-pole devices: CN15, CN55, AN16, AN56 and AN700 (separate winding only). The 45 mm and 65 mm frames (NEMA Size 0–2) reversing devices (CN55B, CN55D, CN55G, AN56B, AN56D, AN56G, AN700 and AN700G) with the T16 modification are supplied without crossover wires.

③ CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.

④ Replace with complete contactor.

## For Catalog Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 ① and CN55 Contactors and Starters (Size 1, 2)

| Description | | NEMA Size 1 Series A1 Part No. | NEMA Size 1 Series B1 Part No. | NEMA Size 2 Series A1 Part No. | NEMA Size 2 Series B1 Part No. | NEMA Size 3 Part No. |
|---|---|---|---|---|---|---|
| **Renewal Parts Publication Number** | | **20861** | **22177** | **20861** | **22177** | **20426** |
| **Contact Kits** | | | | | | |
| Two-pole | | **6-65** | **6-65** | **6-65-7** | **6-65-7** | **6-43-5** |
| Three-pole | | **6-65-2** | **6-65-2** | **6-65-8** | **6-65-8** | **6-43-6** |
| Four-pole | | **6-65-9** | **6-65-9** | **6-65-15** | **6-65-15** | — |
| Five-pole | | **6-65-10** | **6-65-10** | **6-65-16** | **6-65-16** | — |
| **Magnet Coils** | **Coil Suffix** | | | | | |
| 120V 60 Hz or 110V 50 Hz | **A** | **9-3285-1** | **9-3285-1** | **9-3285-1** | **9-3285-1** | **9-2756-1 KIT** |
| 240V 60 Hz or 220V 50 Hz | **B** | **9-2703-2 KIT** | **9-2703-2 KIT** | **9-2703-2 KIT** | **9-2703-2 KIT** | **9-2756-2 KIT** |
| 480V 60 Hz or 440V 50 Hz | **C** | **9-2703-3 KIT** | **9-2703-3 KIT** | **9-2703-3 KIT** | **9-2703-3 KIT** | **9-2756-3 KIT** |
| 600V 60 Hz or 550V 50 Hz | **D** | **9-2703-4 KIT** | **9-2703-4 KIT** | **9-2703-4 KIT** | **9-2703-4 KIT** | **9-2756-4 KIT** |
| 208V 60 Hz | **E** | **9-2703-9 KIT** | **9-2703-9 KIT** | **9-2703-9 KIT** | **9-2703-9 KIT** | **9-2756-5 KIT** |
| 277V 60 Hz | **H** | **9-2703-7 KIT** | **9-2703-7 KIT** | **9-2703-7 KIT** | **9-2703-7 KIT** | **9-2756-9 KIT** |
| 208/240V 60 Hz | **J** | — | — | — | — | — |
| 240V 50 Hz | **K** | **9-2703-14 KIT** | **9-2703-14 KIT** | **9-2703-14 KIT** | **9-2703-14 KIT** | **9-2756-13 KIT** |
| 380–415V 50 Hz | **L** | **9-2703-8 KIT** | **9-2703-8 KIT** | **9-2703-8 KIT** | **9-2703-8 KIT** | — |
| 380V 50 Hz | **L** | — | — | — | — | **9-2756-12 KIT** |
| 415V 50 Hz | **M** | — | — | — | — | **9-2756-8 KIT** |
| 550V 50 Hz | **N** | — | — | — | — | **9-2756-14 KIT** |
| 24V 60 Hz–24V 50 Hz | **T** | — | — | — | — | — |
| 24V 60 Hz | **T** | **9-2703-6 KIT** | **9-2703-6 KIT** | **9-2703-6 KIT** | **9-2703-6 KIT** | **9-2756-6 KIT** |
| 24V 50 Hz | **U** | **9-2703-12 KIT** | **9-2703-12 KIT** | **9-2703-12 KIT** | **9-2703-12 KIT** | **9-2756-11 KIT** |
| 32V 50 Hz | **V** | **9-2703-10 KIT** | **9-2703-10 KIT** | **9-2703-10 KIT** | **9-2703-10 KIT** | **9-2756-10 KIT** |
| 48V 60 Hz | **W** | **9-2703-11 KIT** | **9-2703-11 KIT** | **9-2703-11 KIT** | **9-2703-11 KIT** | **9-2756-15 KIT** |
| 48V 50 Hz | **Y** | **9-2703-13 KIT** | **9-2703-13 KIT** | **9-2703-13 KIT** | **9-2703-13 KIT** | **9-2756-7 KIT** |
| **Magnet Frame Armature** | | | | | | |
| Lower magnet frame | | **17-18200** | **17-18200** | **17-18200** | **17-18200 KIT** | **17-8955-2 KIT** |
| Upper magnet frame | | **48-1936** | **48-1936** | **48-1936** | **48-1936 KIT** | **48-1902 KIT** |

***Note***

① CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.

For a complete listing of parts, refer to the Renewal Parts Publication Number referenced below.



## For Catalog Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 ① and CN55 Contactors and Starters (Size 4, 5, 6)

| Description | | NEMA Size 4 Series A1 Part No. | NEMA Size 4 Series B1 Part No. | NEMA Size 5 Series A1 Part No. | NEMA Size 5 Series B1 Part No. | NEMA Size 6 Contactor and Starter Series A1, Starter Series B1 Part No. | NEMA Size 6 Contactor and Starter Series B1, Starter Series C1 Part No. |
|---|---|---|---|---|---|---|---|
| **Renewal Parts Publication Number** | | **20428** | **20428** | **20429** | **20429** | **20146** | **23349** |
| **Contact Kits** | | | | | | | |
| Two-pole | | **6-44** | **6-26** | **6-45** | **6-45** | **6-601-2** | — |
| Three-pole | | **6-44-2** | **6-26-2** | **6-45-2** | **6-45-2** | **6-601** | **6-648** |
| **Magnet Coils** | **Coil Suffix** | | | | | | |
| 120V 60 Hz or 110V 50 Hz | **A** | **9-1891-1 KIT** | **9-1891-1 KIT** | **9-1891-1 KIT** | **9-1891-1 KIT** | **9-2698** | **9-3006** |
| 240V 60 Hz or 220V 50 Hz | **B** | **9-1891-2 KIT** | **9-1891-2 KIT** | **9-1891-2 KIT** | **9-1891-2 KIT** | **9-2698-2** | **9-3006-2** |
| 480V 60 Hz or 440V 50 Hz | **C** | **9-1891-3 KIT** | **9-1891-3 KIT** | **9-1891-3 KIT** | **9-1891-3 KIT** | **9-2698-3** | **9-3006-3** |
| 600V 60 Hz or 550V 50 Hz | **D** | **9-1891-4 KIT** | **9-1891-4 KIT** | **9-1891-4 KIT** | **9-1891-4 KIT** | **9-2698-4** | **9-3006-4** |
| 208V 60 Hz | **E** | **9-1891-13 KIT** | **9-1891-13 KIT** | **9-1891-13 KIT** | **9-1891-13 KIT** | **9-2698-5** | — |
| 277V 60 Hz | **H** | **9-1891-26 KIT** | **9-1891-26 KIT** | **9-1891-26 KIT** | **9-1891-26 KIT** | — | — |
| 208/240V 60 Hz | **J** | — | — | — | — | — | — |
| 240V 50 Hz | **K** | **9-1891-20 KIT** | **9-1891-20 KIT** | **9-1891-20 KIT** | **9-1891-20 KIT** | — | — |
| 380–415V 50 Hz | **L** | — | — | — | — | **9-2698-6** | **9-3006-7** |
| 380V 50 Hz | **L** | **9-1891-14 KIT** | **9-1891-14 KIT** | **9-1891-14 KIT** | **9-1891-14 KIT** | — | — |
| 415V 50 Hz | **M** | **9-1891-21 KIT** | **9-1891-21 KIT** | **9-1891-21 KIT** | **9-1891-21 KIT** | — | — |
| 550V 50 Hz | **N** | **9-1891-8 KIT** | **9-1891-8 KIT** | **9-1891-8 KIT** | **9-1891-8 KIT** | — | — |
| 24V 60 Hz–24V 50 Hz | **T** | — | — | — | — | — | **9-3006-8** |
| 24V 60 Hz | **T** | **9-1891-15 KIT** | **9-1891-15 KIT** | **9-1891-15 KIT** | **9-1891-15 KIT** | — | — |
| 24V 50 Hz | **U** | **9-1891-16 KIT** | **9-1891-16 KIT** | **9-1891-16 KIT** | **9-1891-16 KIT** | — | — |
| 48V 60 Hz | **W** | — | — | — | — | **9-2698-8** | **9-3006-9** |
| 48V 50 Hz | **Y** | **9-1891-18 KIT** | **9-1891-18 KIT** | **9-1891-18 KIT** | **9-1891-18 KIT** | — | — |
| **Overload Relays** | | | | | | | |
| For replacement on existing starters three-pole—ambient compensated bimetallic | | **10-6530-4** | **10-6530-4** | **C306DN3B** | **C306DN3B** | **C306DN3B** | **C306DN3B** |
| **Current Transformer** | | — | — | **42-3564** | **42-3564** | **42-3598** | **42-3598** |
| **Magnet Frame Armature** ② | | | | | | | |
| Lower Magnet Frame | | **48-1030-2** | **48-1030-2** | **48-1030-2** | **48-1030-2** | — | — |
| Upper Magnet Frame | | **48-1029-4** | **48-1029-4** | **48-1029-4** | **48-1029-4** | — | — |

## Feeder Group Renewal ③

| Volts | Hertz | NEMA Size 4 Series A1 | NEMA Size 4 Series B1 | NEMA Size 5 Series A1 | NEMA Size 5 Series B1 | NEMA Size 6 Contactor and Starter Series A1, Starter Series B1 | NEMA Size 6 Contactor and Starter Series B1, Starter Series C1 |
|---|---|---|---|---|---|---|---|
| 110–120 | 50/60 | — | — | — | — | **9-2705** | **9-3007** |
| 220–240 | 50/60 | — | — | — | — | **9-2705-2** | **9-3007-2** |
| 440–480 | 50/60 | — | — | — | — | **9-2705-3** | **9-3007-3** |
| 550–600 | 50/60 | — | — | — | — | **9-2705-4** | **9-3007-4** |
| 208 | 50/60 | — | — | — | — | **9-2705-5** | **9-3007-5** |
| 380–415 | 50/60 | — | — | — | — | **9-2705-6** | **9-3007-8** |
| 48–52 | 50/60 | — | — | — | — | **9-2705-8** | **9-3007-6** |

***Notes***

① CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.
② Consult factory.
③ Voltage ratings of the main coils must match those of the feeder group for proper operation of the starter/contactor.

For a complete listing of parts, refer to the Renewal Parts Publication Number referenced below.

## For Catalog Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 ① and CN55 Contactors and Starters (Size 7, 8)

| Description | | NEMA Size 7 Series A1 Part No. | NEMA Size 7 Series B1 Part No. | NEMA Size 8 Series A1 Part No. | NEMA Size 8 Series B1 Part No. |
|---|---|---|---|---|---|
| **Renewal Parts Publication Number** | | **20848** | **20848** | **20849** | **20849** |
| **Contact Kits** | | | | | |
| Two-pole | | — | — | — | — |
| Three-pole | | **6-613** | **6-613** | **6-571** | **6-571** |
| **Magnet Coils** | **Coil Suffix** | | | | |
| 120V 60 Hz or 110V 50 Hz | **A** | **9-2698** | **9-2698** | **9-2654** | **9-2654** |
| 240V 60 Hz or 220V 50 Hz | **B** | **9-2698-2** | **9-2698-2** | **9-2654-2** | **9-2654-2** |
| 480V 60 Hz or 440V 50 Hz | **C** | **9-2698-3** | **9-2698-3** | **9-2654-3** | **9-2654-3** |
| 600V 60 Hz or 550V 50 Hz | **D** | **9-2698-4** | **9-2698-4** | **9-2654-4** | **9-2654-4** |
| 208V 60 Hz | **E** | **9-2698-5** | **9-2698-5** | **9-2654-6** | **9-2654-6** |
| 277V 60 Hz | **H** | — | — | — | — |
| 208/240V 60 Hz | **J** | — | — | — | — |
| 240V 50 Hz | **K** | — | — | — | — |
| 380–415V 50 Hz | **L** | — | — | — | — |
| 380V 50 Hz | **L** | **9-2698-6** | **9-2698-6** | **9-2654-5** | **9-2654-5** |
| 415V 50 Hz | **M** | — | — | — | — |
| 550V 50 Hz | **N** | — | — | — | — |
| 24V 60 Hz–24V 50 Hz | **T** | — | — | — | — |
| 24V 60 Hz | **T** | — | — | — | — |
| 24V 50 Hz | **U** | — | — | — | — |
| 32V 50 Hz | **V** | — | — | — | — |
| 48V 60 Hz | **W** | — | — | — | — |
| 48V 50 Hz | **Y** | — | — | — | — |
| **Overload Relays** | | | | | |
| For replacement on existing starters three-pole—ambient compensated bimetallic | | **C306DN3B** | **C306DN3B** | **C306DN3B** | **C306DN3B** |
| **Current Transformer** | | **42-3598-2** | **42-3598-2** | **42-3598-3** | **42-3598-3** |
| **Magnet Frame Armature** ② | | | | | |
| Lower magnet frame | | — | — | — | — |
| Upper magnet frame | | — | — | — | — |

***Notes***

① CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.

② Consult factory.

## Feeder Group Renewal ①

| Volts | Hertz | NEMA Size 7 Series A1 | NEMA Size 7 Series B1 | NEMA Size 8 Series A1 | NEMA Size 8 Series B1 |
|---|---|---|---|---|---|
| 110–120 | 50/60 | **9-2705** | **9-2705** | — | — |
| 220–240 | 50/60 | **9-2705-2** | **9-2705-2** | — | — |
| 440–480 | 50/60 | **9-2705-3** | **9-2705-3** | — | — |
| 550–600 | 50/60 | **9-2705-4** | **9-2705-4** | — | — |
| 208 | 50/60 | **9-2705-5** | **9-2705-5** | — | — |
| 380–415 | 50/60 | **9-2705-6** | **9-2705-6** | — | — |
| 48–52 | 50/60 | **9-2705-8** | **9-2705-8** | — | — |
| 120 | 50/60 | — | — | **9-2664** | **9-2664** |
| 240 | 50/60 | — | — | **9-2664-2** | **9-2664-2** |
| 480 | 50/60 | — | — | **9-2664-3** | **9-2664-3** |
| 600 | 50/60 | — | — | **9-2664-4** | **9-2664-4** |
| 380 | 50/60 | — | — | **9-2664-5** | **9-2664-5** |
| 208 | 50/60 | — | — | **9-2664-6** | **9-2664-6** |
| 415 | 50/60 | — | — | **9-2664-7** | **9-2664-7** |
| 110 | 50/60 | — | — | **9-2664-8** | **9-2664-8** |
| 220 | 50/60 | — | — | **9-2664-9** | **9-2664-9** |
| 550 | 50/60 | — | — | **9-2664-10** | **9-2664-10** |
| 440 | 50/60 | — | — | **9-2664-11** | **9-2664-11** |

## Technical Data and Specifications

All data is based on a standard contactor with no auxiliary devices and a 120 Vac or 24 Vdc magnet coil. Coil data has a ±5% range depending on the application, therefore specific data may vary.

### Coil Data Notes

| | |
|---|---|
| P.U. | Pick-up time is the average time taken from closing of the coil circuit to main contact touch |
| D.O. | Drop-out time is the average time taken from opening of the coil circuit to main contact separation |
| Cold | Coil data with a cold coil |
| Hot | Coil data with a hot coil |

***Note***

① Voltage ratings of the main coils must match those of the feeder group for proper operation of the starter/contactor.

## Specifications—Sizes 00–3

| Description | Contactor Catalog Number/Size<br>CN15A<br>NEMA Size 00 | CN15B<br>NEMA Size 0 | CN15D<br>NEMA Size 1 | CN15G<br>NEMA Size 2 | CN15K<br>NEMA Size 3 |
|---|---|---|---|---|---|
| **Configuration** | | | | | |
| Number of poles | 2, 3, 4 | 2, 3 | 2, 3, 4, 5 | 2, 3, 4, 5 | 2, 3 |
| Auxiliary contacts, standard | 4th pole NO (1) | Side NO (1) | Side NO (1) | Side NO (1) | Side NO (1) |
| Add-on auxiliary contacts | Top (4) or side (4) | Top (4) or side (3) | Top (4) or side (3) | Top (4) or side (3) | Left side (4) or right side (3) |
| Frame size | 45 mm | 45 mm | 65 mm | 65 mm | 90 mm |
| Maximum voltage rating | 600 Vac | 600 Vac | 600 Vac | 600 Vac | 600 Vac |
| Continuous ampere ratings (I) | 9A | 18A | 27A | 45A | 90A |
| **Maximum Horsepower (hp)** | | | | | |
| Single-phase | | | | | |
| 115V | 1/3 | 1 | 2 | 3 | 7-1/2 |
| 230V | 1 | 2 | 3 | 7-1/2 | 15 |
| Three-phase | | | | | |
| 200V | 1-1/2 | 3 | 7-1/2 | 10 | 25 |
| 230V | 1-1/2 | 3 | 7-1/2 | 15 | 30 |
| 460V | 2 | 5 | 10 | 25 | 50 |
| 575V | 2 | 5 | 10 | 25 | 50 |
| **AC Magnet Coil Data** | | | | | |
| Pick-up volts—cold | 85% | 85% | 85% | 85% | 85% |
| Pick-up volts—hot | 85% | 85% | 85% | 85% | 85% |
| Pick-up voltamperes | 80 | 100 | 230 | 230 | 390 |
| Pick-up watts | 49 | 65 | 95 | 95 | 112 |
| Sealed voltamperes | 7.5 | 10 | 28 | 28 | 49.8 |
| Sealed watts | 2.4 | 3.1 | 7.8 | 7.8 | 13 |
| Drop-out volts—cold | 75% | 75% | 75% | 75% | 75% |
| Drop-out volts—hot | 75% | 75% | 75% | 75% | 75% |
| Maximum operation rate—ops/hour | 12,000 | 12,000 | 12,000 | 12,000 | 7,200 |
| Pick-up time (ms) | 12 | 12 | 20 | 20 | 14 |
| Drop-out time (ms) | 12 | 12 | 14 | 14 | 11 |
| Coil operating range % of rated voltage | –15% to +10% | –15% to +10% | –15% to +10% | –15% to +10% | –15% to +10% |
| DC magnet coil data | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. |
| Operating temperature | –20° to 65°C | –20° to 65°C | –20° to 65°C | –20° to 65°C | –20° to 65°C |
| Maximum operating altitude (ft) | 6000 | 6000 | 6000 | 6000 | 6000 |
| Mechanical life | 20,000,000 | 20,000,000 | 10,000,000 | 10,000,000 | 6,000,000 |
| **Electrical Life (480V/60 Hz)** | | | | | |
| AC-3 | 4,000,000 | 3,000,000 | 5,000,000 | 3,500,000 | 1,700,000 |
| AC-4 | 90,000 | 85,000 | 200,000 | 62,000 | 80,000 |
| **Wire Range** | | | | | |
| Power terminals | 12–16 stranded,<br>12–14 solid Cu | 8–16 stranded,<br>10–14 solid Cu | 8–14 stranded or solid Cu | 2–14 (upper) and/or<br>6–14 (lower) stranded or solid Cu | 1/0–14 Cu |
| Control terminals | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu |
| Power terminal torque<br>Line and load—lb-in | 7 | 15 | 20 | 40 (14–8 AWG) | 35 (14–10 AWG) |
| | | | | 45 (6–4 AWG) | 40 (8 AWG) |
| | | | | 50 (3 AWG) | 45 (6–4 AWG) |
| | | | | | 50 (3–1/0 AWG) |
| Auxiliary contact rating | A600, P300 | A600, P300 | A600, P300 | A600, P300 | A600, P300 |

## Specifications—Sizes 4–8



| Description | Contactor Catalog Number/Size<br>CN15N<br>NEMA Size 4 | CN15S<br>NEMA Size 5 | CN15T<br>NEMA Size 6 | CN15U<br>NEMA Size 7 | CN15V<br>NEMA Size 8 |
|---|---|---|---|---|---|
| **Configuration** | | | | | |
| Number of poles | 2, 3 | 2, 3 | 3 | 3 | 3 |
| Auxiliary contacts, standard | Side NO (1) | Side NO (1) | Top left 2NO/2NC (1) | Top left 2NO/2NC (1) | Side 2NO/NC (1) |
| Add-on auxiliary contacts | Left side (3) or right side (4) | Left side (3) or right side (4) | Top right 2NO/2NC (1) | Top right 2NO/2NC (1) | NO/NC (2) |
| Frame size | 180 mm | 180 mm | 280 mm | 280 mm | 334 mm |
| Maximum voltage rating | 600 Vac | 600 Vac | 600 Vac | 600 Vac | 600 Vac |
| Continuous ampere ratings (I) | 135A | 270A | 540A | 810A | 1215A |
| **Maximum Horsepower (hp)** | | | | | |
| Single-phase | | | | | |
| 115V | — | — | — | — | — |
| 230V | — | — | — | — | — |
| Three-phase | | | | | |
| 200V | 40 | 75 | 150 | 200 | 400 |
| 230V | 50 | 100 | 200 | 300 | 450 |
| 460V | 100 | 200 | 400 | 600 | 900 |
| 575V | 100 | 200 | 400 | 600 | 900 |
| **AC Magnet Coil Data** | | | | | |
| Pick-up volts—cold | 85% | 85% | 85% | 85% | 85% |
| Pick-up volts—hot | 85% | 85% | 85% | 85% | 85% |
| Pick-up voltamperes | 1158 | 1158 | 1600 | 1600 | 2450 |
| Pick-up watts | 240 | 240 | 1345 | 1345 | 2060 |
| Sealed voltamperes | 100 | 100 | 25 | 25 | 75 |
| Sealed watts | 27.2 | 27.2 | 22 | 22 | 60 |
| Drop-out volts—cold | 75% | 75% | ① | ① | ① |
| Drop-out volts—hot | 75% | 75% | ① | ① | ① |
| Maximum operation rate—ops/hour | 2400 | 2400 | N/A | N/A | N/A |
| Pick-up time (ms) | 28 | 25 | 105 | 105 | 70 |
| Drop-out time (ms) | 14 | 13 | 200 | 200 | 50 |
| Coil operating range % of rated voltage | –15% to +10% | –15% to +10% | –15% to +10% | –15% to +10% | –15% to +10% |
| DC magnet coil data | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. | For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**. |
| Operating temperature | –20° to 65°C | –20° to 65°C | –20° to 65°C | –20° to 65°C | –20° to 65°C |
| Maximum operating altitude (ft) | 6000 | 6000 | 6000 | 6,00 | 6000 |
| Mechanical life | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| **Electrical Life (480V/60 Hz)** | | | | | |
| AC-3 | 800,000 | 500,000 | 590,000 | 450,000 | 420,000 |
| AC-4 | 70,000 | 34,000 | 7400 | 5000 | 4200 |
| **Wire Range** | | | | | |
| Power terminals | Open—3/0–8 Cu;<br>Enclosed—250 kcmil–6 Cu/Al | 750 kcmil—2 or<br>(2) 250 kcmil–3/0 Cu/Al | (2) 750 kcmil–3/0 Cu/Al | (3) 750 kcmil–3/0 Cu/Al | (4) 750 kcmil–1/0 Cu/Al |
| Control Terminals | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu | 12–16 stranded,<br>12–14 solid Cu |
| Power terminal torque line and load—lb-in | 200 | 550 | 550 | 550 | 500 |
| Auxiliary contact rating | A600, P300 | A600, P300 | A600, P300 | A600, P300 | A600, P300 |

***Note***

① 20–30% of rated coil voltage.

## Electrical Life—AC-3 and AC-4 Utilization Categories

### *Life Load Curves*

Eaton's Freedom Series NEMA contactors have been designed and manufactured for superior life performance in any worldwide application. All testing has been based on requirements as found in NEMA and UL standards and conducted by Eaton. Actual application life may vary depending on environmental conditions and application duty cycle.

### *Utilization Categories*

The International Electrotechnical Commission (IEC) has developed utilization categories for contactors and auxiliary contacts. The IEC utilization categories are used to define the type of electrical load for estimating electrical life, and do not imply the devices are IEC rated.

AC-1—Non-inductive or slightly inductive loads, such as resistance furnaces and heating.

AC-2—Starting of slip-ring motors.

AC-3—Squirrel cage motors; starting, switching off motors during running.

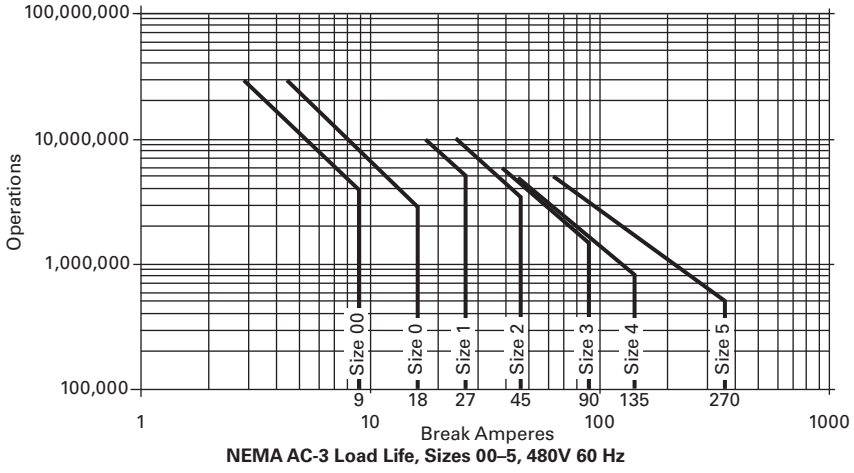
AC-4—Squirrel cage motors; starting, plugging, inching or jogging.

**Note:** AC-3 tests are conducted at rated device currents and AC-4 tests are conducted at six times rated device currents. All tests have been run at 460V, 60 Hz.

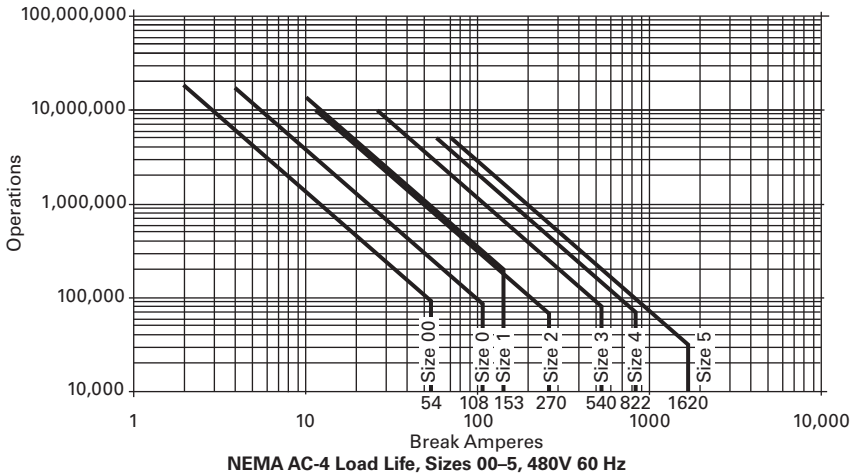
### *Contactor Choice*

- Decide what utilization category your application is and choose the appropriate curve
- Locate the intersection of the life-load curve of the appropriate contactor with the applications operational current ($I_e$), as found on the horizontal axis
- Read the estimated contact life along the vertical axis in number of operational cycles

### AC-3 and AC-4 Utilization Categories




**NEMA AC-3 Load Life, Sizes 00–5, 480V 60 Hz**




**NEMA AC-4 Load Life, Sizes 00–5, 480V 60 Hz**

32A Overload—C306DN3B

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| Starters—Three-Phase Non-Reversing and Reversing, Full Voltage | **V5-T2-10** |
| Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload | **V5-T2-15** |
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| C440/***XT*** Electronic Overload Relay | **V5-T2-48** |


## Relays—Thermal Overload

### Product Description

C306 Overload Relays are designed for use with CE or CN non-reversing and reversing contactors. Four sizes are available for overload protection up to 144A.

### Features

- Selectable manual or automatic reset operation
- Interchangeable heater packs adjustable ±24% to match motor FLA and calibrated for use with 1.0 and 1.15 service factor motors. Heater packs for 32A overload relay will mount in 75A overload relay—useful in derating applications such as jogging
- Class 10 or 20 heater packs
- Load lugs built into relay base
- Bimetallic, ambient compensated operated. Trip free mechanism
- Electrically isolated NO-NC contacts (pull RESET button to test). (Electrical ratings see table on **Page V5-T2-46**)
- Overload trip indication
- Shrouded or fingerproof terminals to reduce possibility of electrical shock

### Standards and Certifications

- Meets UL 508 single-phasing requirements
- UL listed, CSA certified, NEMA compliance and CE mark

Listed

## Product Selection

### *C306 Thermal Overload Relays*

**C306DN3B**

**C306GN3B**

### Contactors

| NEMA Size | Maximum Ampere Rating | Number of Poles | Open Type Catalog Number | NEMA 1 Enclosed Catalog Number |
|---|---|---|---|---|
| 00, 0 | 32 ② | 3 | **C306DN3B** | **C306DG3B** |
| 1, 2 | 75 ② | 3 | **C306GN3B** | **C306GG3B** |
| 3 | 105 ③ | 3 | **C306KN3** | — |
| 4 | 144 ③ | 3 | **C306NN3** | — |
| 5–8 ① | — | — | — | — |

**C306DT3B**

**C306GT3B**

### Standalone Applications

| NEMA Size | Maximum Ampere Rating | Number of Poles | Open Type Catalog Number |
|---|---|---|---|
| 00, 0, 1 ④ | 32 | 3 | **C306DT3B** |
| 1 ④ | 75 | 3 | **C306GT3B** |
| 3 ⑤ | 105 | 3 | **C306KN3** |
| 4 ⑤ | 144 | 3 | **C306NN3** |
| 5–8 ⑥ | — | — | — |

***Notes***

① NEMA Sizes 5–8 use the 32A overload in conjunction with CTs.

② Series B overload relays have load lugs built into relay base and will only accept Series B heater packs. These relays can be directly attached to contactor or they can be DIN rail or panel mounted using adapter on **Page V5-T2-44**.

③ These relays can be panel mounted only.

④ Overload relay assembled with mounting adapter for DIN rail or panel mount.

⑤ Panel mount only.

⑥ NEMA Sizes 5–8 use the 32A overload in conjunction with CTs.

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### *Heater Pack Selection*

Heater packs H2001B to H2017B and H2101B to H2117B are to be used only with Series B overload relays Catalog Numbers C306DN3B (Part No. 10-7016) and C306GN3B (Part No. 10-7020). The load lugs are built into the overload relay base to allow load wiring prior to heater pack installation. The previous heater design had integral load lugs. The Series B heater packs are electrically equivalent to the previous heater design. Heaters H2018-3 to H2024-3 have not changed.

## Starters with Series B Overload Relays ①

| NEMA—AN Type | | IEC—AE Type | |
|---|---|---|---|
| **Size** | **Series** | **Size** | **Series** |
| 00–0 | **C** | A–F | **C** |
| 1–2 | **B** | G–K | **B** |
| 5 | **B** | G–K | **B** |
| 6 | **C** | G–K | **B** |
| 7–8 | **B** | G–K | **B** |

**Heater Pack H2001B–H2017B**

## Standard Trip—Class 20 Heater

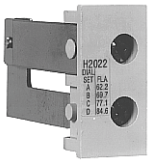
| | Motor Full Load Ampere Rating Dial Position | | | | |
|---|---|---|---|---|---|
| **Overload Relay Size** | **A** | **B** | **C** | **D** | **Catalog Number ②** |
| **For Use with NEMA Sizes 00–0 Series C, NEMA Sizes 1–2 Series B; IEC Sizes A–F Series C, IEC Sizes G–K Series B** | | | | | |
| 32A or 75A | 0.254 | 0.306 | 0.359 | 0.411 | **H2001B-3** |
| | 0.375 | 0.452 | 0.530 | 0.607 | **H2002B-3** |
| | 0.560 | 0.676 | 0.791 | 0.907 | **H2003B-3** |
| | 0.814 | 0.983 | 1.15 | 1.32 | **H2004B-3** |
| | 1.20 | 1.45 | 1.71 | 1.96 | **H2005B-3** |
| | 1.79 | 2.16 | 2.53 | 2.90 | **H2006B-3** |
| | 2.15 | 2.60 | 3.04 | 3.49 | **H2007B-3** |
| | 3.23 | 3.90 | 4.56 | 5.23 | **H2008B-3** |
| | 4.55 | 5.50 | 6.45 | 7.40 | **H2009B-3** |
| | 6.75 | 8.17 | 9.58 | 11.0 | **H2010B-3** |
| | 9.14 | 10.8 | 12.4 | 14.0 | **H2011B-3** |
| | 14.0 | 16.9 | 19.9 | 22.8 | **H2012B-3** |
| | 18.7 | 22.7 | 26.7 | 30.7 | **H2013B-3** |
| | 23.5 | 28.5 | 33.5 | 38.5 | **H2014B-3** |
| **For Use with NEMA Size 2, IEC Sizes G–K Only, Series B** | | | | | |
| 75A | 29.0 | 34.0 | 39.1 | 44.1 | **H2015B-3** |
| | 39.6 | 45.5 | 51.5 | 57.4 | **H2016B-3** |
| | 53.9 | 60.9 | 67.9 | 74.9 | **H2017B-3** |

***Notes***

① The series of a starter is the last digit of the listed catalog number. Example: AN16DN0AB.

② Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

**Heater Pack H2018–H2024**



## Standard Trip—Class 20 Heater, continued

| Overload Relay Size | Motor Full Load Ampere Rating Dial Position A | B | C | D | Catalog Number ① |
|---|---|---|---|---|---|
| **For Use with NEMA Sizes 3–4, IEC Sizes L–N Only—Series A** | | | | | |
| 105A or 144A | 8.0 | 9.2 | 10.3 | 11.5 | **H2025-3** |
| | 11.4 | 12.8 | 14.3 | 15.7 | **H2026-3** |
| | 14.3 | 15.7 | 17.4 | 19.0 | **H2027-3** |
| | 18.0 | 20.2 | 22.3 | 24.5 | **H2018-3** |
| | 24.6 | 27.6 | 30.5 | 33.4 | **H2019-3** |
| | 33.5 | 37.5 | 41.5 | 45.6 | **H2020-3** |
| | 45.7 | 51.2 | 56.7 | 62.1 | **H2021-3** |
| | 62.2 | 69.7 | 77.1 | 84.6 | **H2022-3** |
| | 84.7 | 95.0 | 105.0 | 115.0 | **H2023-3** |
| | 106.0 | 118.0 | 131.0 | 144.0 | **H2024-3** |
| **For Use with Size 5 Starters—Series B and IEC P, R and S with 300/5 CT** | | | | | |
| 32A ② | 49 | 59 | 69 | 79 | **H2004B-3** |
| | 72 | 87 | 103 | 118 | **H2005B-3** |
| | 107 | 130 | 152 | 174 | **H2006B-3** |
| | 129 | 156 | 182 | 209 | **H2007B-3** |
| | 194 | 234 | 274 | — | **H2008B-3** |
| **For Use with Size 6 Starters Only—Series B and IEC T–V with 600/5 CT** | | | | | |
| 32A ② | 144 | 174 | 205 | 235 | **H2005B-3** |
| | 215 | 259 | 304 | 348 | **H2006B-3** |
| | 258 | 312 | 365 | 419 | **H2007B-3** |
| | 388 | 468 | 547 | 627 | **H2008B-3** |
| **For Use with Size 7 Starters Only—Series B and IEC W–X with 1000/5 CT** | | | | | |
| 32A ② | 163 | 197 | 230 | 264 | **H2004B-3** |
| | 240 | 290 | 342 | 392 | **H2005B-3** |
| | 358 | 432 | 506 | 580 | **H2006B-3** |
| | 430 | 520 | 608 | 698 | **H2007B-3** |
| | 646 | 780 | 912 | — | **H2008B-3** |
| **For Use Size 8 Starters Only—Series B and IEC Z with 1500/5 CT** | | | | | |
| 32A ② | 244 | 295 | 345 | 396 | **H2004B-3** |
| | 360 | 435 | 513 | 588 | **H2005B-3** |
| | 537 | 648 | 759 | 870 | **H2006B-3** |
| | 645 | 780 | 912 | 1047 | **H2007B-3** |
| | 969 | 1170 | 1368 | — | **H2008B-3** |

***Notes***

① Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

② Sizes 5–8 and IEC P–Z use the 32A overload relay with current transformers.

**Heater Pack**
**H2101B–H2117B**

2

## Fast Trip—Class 10 Heater

| Overload Relay Size | Motor Full Load Ampere Rating Dial Position A | B | C | D | Catalog Number ① |
|---|---|---|---|---|---|
| **For Use with NEMA Sizes 00–0 Series C, NEMA Sizes 1–2 Series B; IEC Sizes A–F Series C, IEC Sizes G–K Series B** | | | | | |
| 32A or 75A | 0.260 | 0.313 | 0.367 | 0.420 | **H2101B-3** |
| | 0.384 | 0.464 | 0.543 | 0.623 | **H2102B-3** |
| | 0.570 | 0.688 | 0.806 | 0.924 | **H2103B-3** |
| | 0.846 | 1.02 | 1.20 | 1.37 | **H2104B-3** |
| | 1.28 | 1.55 | 1.83 | 2.10 | **H2105B-3** |
| | 1.92 | 2.33 | 2.74 | 3.15 | **H2106B-3** |
| | 2.30 | 2.79 | 3.28 | 3.77 | **H2107B-3** |
| | 3.38 | 4.10 | 4.82 | 5.54 | **H2108B-3** |
| | 4.96 | 6.03 | 7.09 | 8.16 | **H2109B-3** |
| | 7.07 | 8.58 | 10.1 | 11.6 | **H2110B-3** |
| | 9.60 | 11.2 | 12.8 | 14.4 | **H2111B-3** |
| | 14.4 | 17.5 | 20.7 | 23.8 | **H2112B-3** |
| | 18.7 | 21.8 | 25.0 | 28.1 | **H2113B-3** |
| | 23.5 | 27.3 | 31.0 | 34.8 | **H2114B-3** |
| **For Use with Size 2, IEC Sizes G–K Only—Series B** | | | | | |
| 75A | 28.3 | 32.6 | 37.0 | 41.3 | **H2115B-3** |
| | 36.6 | 42.3 | 48.1 | 53.8 | **H2116B-3** |
| | 53.8 | 60.8 | 67.9 | 74.9 | **H2117B-3** |
| **For Use with Size 5 Starters Only—Series B and IEC P, R and S with 300/5 CT** | | | | | |
| 32A ② | 51 | 61 | 72 | 82 | **H2104B-3** |
| | 77 | 93 | 110 | 126 | **H2105B-3** |
| | 115 | 140 | 164 | 189 | **H2106B-3** |
| | 138 | 167 | 197 | 226 | **H2107B-3** |
| | 203 | 246 | 289 | — | **H2108B-3** |
| **For Use with Size 6 Starters Only—Series B and IEC T–V with 600/5 CT** | | | | | |
| 32A ② | 154 | 186 | 220 | 252 | **H2105B-3** |
| | 230 | 280 | 329 | 378 | **H2106B-3** |
| | 276 | 335 | 394 | 452 | **H2107B-3** |
| | 406 | 492 | 578 | — | **H2108B-3** |
| **For Use with Size 7 Starters Only—Series B and IEC W–X with 1000/5 CT** | | | | | |
| 32A ② | 169 | 204 | 240 | 274 | **H2104B-3** |
| | 256 | 310 | 366 | 420 | **H2105B-3** |
| | 384 | 466 | 543 | 630 | **H2106B-3** |
| | 460 | 558 | 656 | 754 | **H2107B-3** |
| | 676 | 820 | — | — | **H2108B-3** |
| **For Use with Size 8 Starters Only—Series B and IEC Z with 1500/5 CT** | | | | | |
| 32A ② | 254 | 306 | 360 | 411 | **H2104B-3** |
| | 384 | 465 | 549 | 630 | **H2105B-3** |
| | 576 | 699 | 822 | 945 | **H2106B-3** |
| | 690 | 837 | 984 | 1131 | **H2107B-3** |
| | 1014 | 1230 | — | — | **H2108B-3** |

***Notes***

① Heater packs are shipped three to a carton. catalog numbers are for three heater packs.
② Sizes 5–8 and IEC P–Z use the 32A overload relay with current transformers.

## Accessories

### *DIN Rail and Panel Mounting Adapter*

These adapters are required when component overload relays are to be separately mounted. The terminal base adapter includes line terminals and connects with the overload relays on **Page V5-T2-39**.

**C306TB1**

### DIN Rail and Panel Mounting Adapter

| Description | Catalog Number |
|---|---|
| For 32A overload relay | **C306TB1** |
| For 75A overload relay | **C306TB2B** ① |

### *Locking Cover for Overload Relay—C306 Only*

Snap-on transparent or opaque plastic panel for covering access port to the overload relay trip setting dial—helps prevent accidental or unauthorized changes to trip and reset setting.

**Overload Relay Cover**

### Locking Cover for Overload Relay—C306 Only

| Description | Min. Order Qty. (Std. Pkg.) | Catalog Number |
|---|---|---|
| Clear cover, no accessibility | 50 | **C320PC3** |
| Gray cover, no accessibility with auto only nib | 50 | **C320PC4** |
| Gray cover, no accessibility with manual only nib | 50 | **C320PC5** |
| Gray cover with FLA dial accessibility, A, B, C, D positions and auto only nib | 50 | **C320PC6** |
| Gray cover with FLA dial accessibility, A, B, C, D positions and manual only nib | 50 | **C320PC7** |

***Note***

① This Series B adapter will accept Series A or B overload relays (C306GN3 or C306GN3B), C306TB2 can only be used with C306GN3.

## Modifications

### *C306 Thermal Overload Relays with Mounting Adapter*

Consists of a thermal overload relay mounted to a terminal base adapter—permits fast and easy installation.

### C306 Thermal Overload Relays with Mounting Adapter

| Description | Catalog Number |
|---|---|
| C306DN3B + C306TB1 | **C306DT3B** |
| C306GN3B + C306TB2B | **C306GT3B** |

## Replacement Parts



### *Heater Pack Replacement*

The heater pack series is determined by the 6th character of the catalog number. Series A or prior heater packs (identified by either "A" or "-" as the 6th character) have built-in load lugs. Series B or later heater packs do not (load lugs are on overload relay). Replacement of Series A or earlier heater packs with Series B or later heater packs, requires the one time addition of Lug Adapter Kit C306KAL1-3B to the Series A1 overload relay.

**Superseded Series A Heater Pack**

**Series B Heater Pack**

### Heater Pack Replacement Requirements

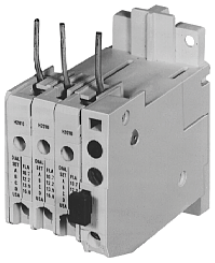
| Existing Heater Pack Catalog Numbers | Replacement Product Required |
|---|---|
| **H2001-3–H2013-3**<br>**H2001A-3–H2013A-3** | Lug adapter kit C306KAL1-3B and Series B heater pack |
| **H2001B-3–H2013B-3** | Series B heater pack |
| **H2014-3**<br>**H2014A-3** | Replace with lug adapter kit C306KAL1-3B and Series B heater pack |
| **H2014B-3** | Series B heater pack |
| **H2015-3–H2017-3** | Replace with heater pack chosen from table below |
| **H2015A-3–H2017A-3** | Replace with lug adapter kit C306KAL1-3B and Series B heater pack |
| **H2015B-3–H2017B-3** | Series B heater pack |

### Heater Pack Ratings

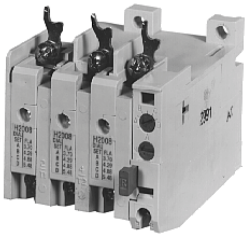
| Motor Full Load Ampere Rating Dial Position | | | | |
|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **Order Heater Pack Catalog Number** |
| 29.0 | 32.5 | 36.0 | 39.5 | **H2015B-3** |
| 39.6 | 44.3 | 49.1 | 53.8 | **H2016B-3** |
| 53.9 | 60.4 | 66.8 | 74.9 | **H2017B-3** |

### *Overload Relay Lug Adapter Kit*

#### Superseded 32A Series A Overload Relay—C306DN3



#### Superseded 75A Series A Overload Relay—C306GN3



These kits are used in conjunction with Catalog Numbers H2001B–H2014B or H2101B–H2114B heater packs as a means of utilizing these Series B heater packs in Catalog Numbers C306DN3 and C306GN3 Series AI overload relays. The kit consists of three lug adapters and installation instructions. When installing Series B heater packs plus lug adapters in Series A overload relays, refer to heater pack FLA adjustment tables originally supplied with equipment (also supplied with kit).

**C306KAL1**

#### Overload Relay Lug

| Description | Catalog Number |
|---|---|
| Series AI overload relay lug adapter kit | **C306KAL1-3B** |

### *Overload Relay Replacement—Series A Only*

When replacing a Catalog Number C306DN3 (Part No. 10-6044) or C306GN3 (10-6319) Series A overload relay on a starter, order a Series B overload relay and Series B heater packs.

## Technical Data and Specifications

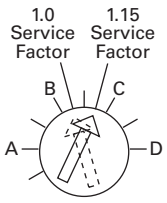
### *Operation*

**C306 Overload Relay Setting**
For motors having a 1.15 service factor, rotate the FLA (Full Load Amperes) adjustment dial to correspond to the motor's FLA rating.

Estimate the dial position when the motor FLA falls between two letter values as shown in the example.

For motors having a 1.0 service factor, rotate the FLA dial one-half position counterclockwise (CCW).

### FLA Dial Adjustment

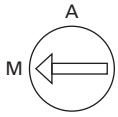



Example of 12.0 FLA setting for heater pack number H2011B showing position for 1.0 or 1.15 service factor motors.

The overload relay is factory set at M for manual reset operation. For automatic reset operation, turn the reset adjustment dial to the A position as shown in the illustration.

Automatic reset is not intended for two-wire control devices.

### Manual/Automatic Reset




Example of setting for manual reset.

### *Test for Trip Indication*

To test overload relay for trip indication when in manual reset, pull out the blue reset button. An orange flag will appear indicating that the device has tripped. Push reset button in to reset.

**Warning**—To provide continued protection against fire or shock hazard, the complete overload relay must be replaced if burnout of the heater element occurs.

### *General*

"Overload relays are provided to protect motors, motor control apparatus and motor-branch circuit conductors against excessive heating due to motor overloads and failure to start. This definition does not include: 1) motor circuits over 600V, 2) short circuits, 3) ground faults and 4) fire pump control." (NEC Art. 430-31)

### *Time Current Characteristics*

The time-current characteristics of an overload relay is an expression of performance which defines its operating time at various multiples of its current setting. Tests are run at Underwriters Laboratories (UL) in accordance with NEMA Standards and the NEC. UL requires:

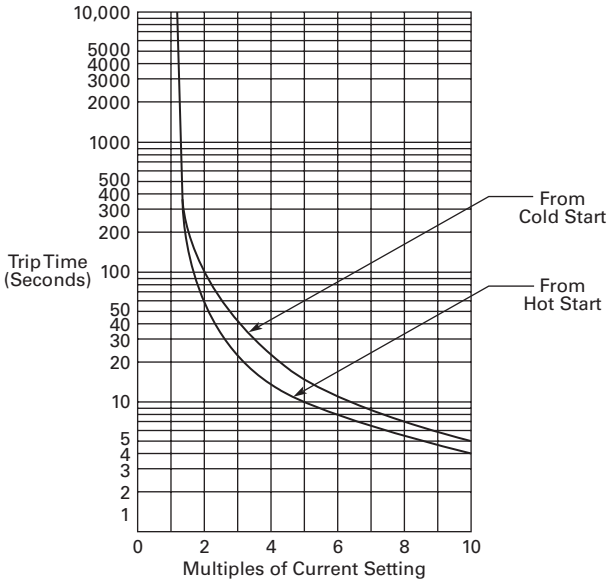
- When tested at 100 percent of its current rating, the overload relay shall trip ultimately
- When tested at 200 percent of its current rating, the overload relay shall trip in not more than 8 minutes
- When tested at 600 percent of the current rating, the overload relay shall trip in not more than 10 or 20 seconds, depending on the Class of the relay

"Current Rating" is defined as the minimum current at which the relay will trip. Per NEC, an overload must ultimately trip at 125% of FLA current (heater) setting for a 1.15 service factor motor and 115% FLA for a 1.0 service factor motor.

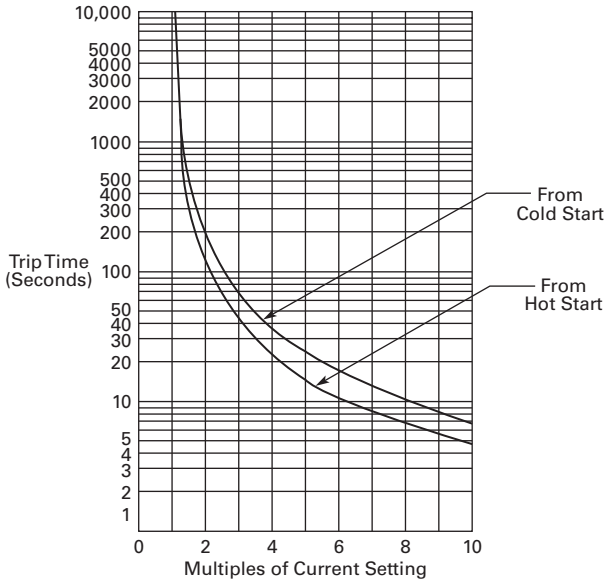
"Current Setting" is defined as the FLA of the motor and thus the overload heater pack setting.

Example: 600% of current rating is defined as 750% (600 x 1.25) of FLA current (heater) setting for a 1.15 service factor motor. A 10A heater setting must trip in 20 seconds or less at 75A motor current for a Class 20 relay.

### Class 10 and Class 20 Trip Curves




**Class 10 Overload Relay 25C Open Rating**




**Class 20 Overload Relay 25C Open Rating**

***Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 00–2, IEC A–K—Open***

## Power Terminals—Line

| IEC Size | NEMA Size | Cu Only |
|---|---|---|
| A, B, C | 00 | 12–16 stranded, 12–14 solid |
| D, E, F | 0 | 8 –16 stranded, 10–14 solid |
| | 1 | 8–14 stranded or solid |
| G, H, J, K | 2 | 3–14 (upper) and/or 6–14 (lower) stranded or solid ① |

## Power Terminals—Load—Cu Only (Stranded or Solid)

| Catalog Number | Terminal | Wire Size |
|---|---|---|
| **C306DN3B** | 32A | 14–6 AWG |
| **C306GN3B** | 75A | 14–2 AWG |
| **Control Terminals—Cu Only** | | |
| 12–16 AWG stranded, 12–14 AWG solid | | |

***Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 3–8, IEC L–N—Open***

## Power Terminals—Line and Load

| IEC Size | NEMA Size | Wire Size |
|---|---|---|
| L | 3 | 1/0–14 Cu/Al |
| M | — | 14–2/0 Cu/Al |
| N | — | 3/0–8 Cu/Al |
| — | 4 | Open—3/0–8 Cu |
| | | Enclosed—250 kcmil—6 Cu/Al |
| — | 5 | 750 kcmil—2 or (2) 250 kcmil—3/0 Cu/Al |
| | 6–7 | (2) 750 kcmil—3/0 Cu/Al |
| | 8 | (2) 750 kcmil—1/0 Cu/Al |
| **Control Terminals—Cu Only** | | |
| 12–16 AWG stranded, 12–14 AWG solid | | |

## Power Terminal Torque Line and Load Terminals

| Catalog Number | Terminal | Torque in lb-in |
|---|---|---|
| **C306DT3B** | 32A | 20 |
| **C306GT3B** | 75A | 35 (14–10 AWG) |
| | | 40 (8 AWG) |
| | | 45 (6–4 AWG) |
| | | 50 (3–2 AWG) |
| **C306KN3** (socket head screw) | 105A | 120 (3/16) |
| | | 200 (1/4) |
| | | 250 (5/16) |
| **C306NN3** (socket head screw) | 144A | 120 (3/16) |
| | | 200 (1/4) |
| | | 250 (5/16) |
| **C306NN3** (slotted head screw) | | 35 (14–10 AWG) |
| | | 40 (8 AWG) |
| | | 45 (6–4 AWG) |
| | | 50 (3–1/0 AWG) |

## Plugging and Jogging Service Horsepower Ratings ②

| NEMA Size | 200V | 230V | 460V | 575V |
|---|---|---|---|---|
| 00 | — | 1/2 | 1/2 | 1/2 |
| 0 | 1-1/2 | 1-1/2 | 2 | 2 |
| 1 | 3 | 3 | 5 | 5 |
| 2 | 7-1/2 | 10 | 15 | 15 |
| 3 | 15 | 20 | 30 | 30 |
| 4 | 25 | 30 | 60 | 60 |
| 5 | 60 | 75 | 150 | 150 |
| 6 | 125 | 150 | 300 | 300 |

## Overload Relay UL/CSA Contact Ratings Control Circuit ③

| AC Volts | 120V | 240V | 480V | 600V |
|---|---|---|---|---|
| **NC Contact B600** | | | | |
| Make and break amperes | 30 | 15 | 7.5 | 6 |
| Break amperes | 3 | 1.5 | 0.75 | 0.6 |
| Continuous amperes | 5 | 5 | 5 | 5 |
| **NO Contact C600** | | | | |
| Make and break amperes | 15 | 7.5 | 3.375 | 3 |
| Break amperes | 1.5 | 0.75 | 0.375 | 0.3 |
| Continuous amperes | 2.5 | 2.5 | 2.5 | 2.5 |

***Notes***

① Two compartment box lug.

② Maximum horsepower where operation is interrupted more than 5 times per minute or more than 10 times in a 10 minute period. NEMA standard ICS 2-1993 table 2-4-3.

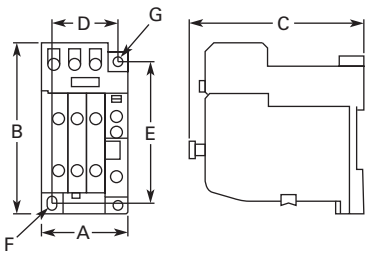
③ DC ratings cover Freedom Series coils only.

## Dimensions

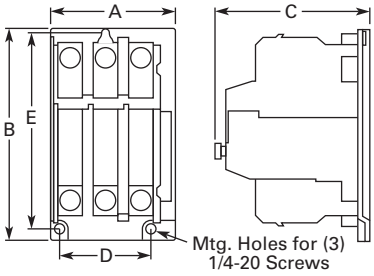
Approximate Dimensions in Inches (mm)

***Stand-Alone Overload Relays***

### 32A and 75A Sizes—C306DT38 and C306GT3B




### 105A and 144A Sizes—C306KN38 and C306NN3B




### Dimensions and Shipping Weights

| Ampere Size | Wide A | High B | Deep C | Mounting D | E | F (Slot) | G (Hole) | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|---|
| 32A | 1.77 (45.0) | 4.13 (104.9) | 3.69 (93.7) | 1.36 (34.5) | 3.74 (95.0) | 0.18 x 0.30 (4.6 x 7.6) | 0.18 (4.6) dia. | 0.8 (0.4) |
| 75A | 2.54 (64.5) | 4.69 (119.1) | 3.74 (95.0) | 2.00 (50.8) | 3.45 (87.6) | 0.22 x 0.26 (5.6 x 6.6) | 0.21 (5.3) dia. | 1.4 (0.6) |
| 105 and 144A | 4.00 (101.6) | 7.17 (182.1) | 4.91 (124.7) | 3.00 (76.2) | 6.62 (168.1) | — | — | 4.0 (1.8) |

C440/*XT* Electronic Overload Relay

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| Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload | **V5-T2-15** |
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# C440/*XT* Electronic Overload Relay

## Product Description

Eaton's new electronic overload relay (EOL) is the most compact, high-featured, economical product in its class. Designed on a global platform, the new EOL covers the entire power control spectrum including NEMA, IEC and DP contactors. The NEMA and DP versions are offered with the *C440* designation while the IEC offering has the ***XT*** designation. The electronic design provides reliable, accurate and value driven protection and communications capabilities in a single compact device. It is the flexible choice for any application requiring easy-to-use, reliable protection.

Eaton has a long history of innovations and product development in motor control and protection, including both traditional NEMA, as well as IEC control. It was from this experience that the C440 was developed, delivering new solutions to meet today's demands.

C440 is a self-powered electronic overload relay available up to 175A as a self contained unit. With external CTs, C440 can protect motor up to 1500 FLA. Available add-on accessories include remote reset capability and communication modules with I/O for DeviceNet, PROFIBUS, and Modbus.

## Features and Benefits

### *Features*

- Reliable, accurate, electronic motor protection
- Easy to select, install and maintain
- Compact size
- Flexible, intelligent design
- Global product offering—available with NEMA, IEC and DP power control

### Size/Range

- Broad FLA range (0.33–1500A)
- Selectable trip class (10A, 10, 20, 30)
- Direct mounting to NEMA, IEC and DP contactors
- Most compact electronic overload in its class

### Motor Control

- Two B600 alarm (NO) and fault (NC) contacts
- Test/Trip button

### Motor Protection

- Thermal overload
- Phase loss
- Selectable (ON/OFF) phase unbalance
- Selectable (ON/OFF) ground fault

### User Interface

- Large FLA selection dial
- Trip status indicator
- Operating mode LED
- DIP switch selectable trip class, phase unbalance and ground fault
- Selectable Auto/Manual reset

### Feature Options

- Remote reset
  - 120 Vac
  - 24 Vac
  - 24 Vdc
- Tamper-proof cover
- Communications modules
  - Modbus RTU RS-485
  - DeviceNet with I/O
  - PROFIBUS with I/O
  - Modbus RTU with I/O
  - Ethernet IP with I/O
  - Modbus TCP with I/O

***Benefits***

### Reliability and Improved Uptime

- C440 provides the users with peace of mind knowing that their assets are protected with the highest level of motor protection and communication capability in its class
- Extends the life of plant assets with selectable motor protection features such as trip class, phase unbalance and ground fault
- Protects against unnecessary downtime by discovering changes in your system (line/load) with remote monitoring capabilities
- Status LED provides added assurance that valuable assets are protected by indicating the overload operational status

### Flexibility

- Available with NEMA, IEC and DP contactors
- Improves return on investment by reducing inventory carrying costs with wide FLA adjustment (5:1) and selectable trip class
- Design incorporates built-in ground fault protection thus eliminating the need for separate CTs and modules
- Flexible communication with optional I/O enables easy integration into plant management systems for remote monitoring and control
- Available as an open component and in enclosed control and motor control center assemblies

### Monitoring Capabilities

- Individual phase currents RMS
- Average three-phase current RMS
- Thermal memory
- Fault indication (overload, phase loss, phase unbalance, ground fault)

### Safety

- IP 20 rated terminal blocks
- Available in Eaton's industry leading FlashGard MCCs
- Tested to the highest industry standards such as UL, CSA, CE and IEC
- RoHS compliant

### Standards and Certifications

- UL
- CSA
- CE
- NEMA
- IEC/EN 60947 VDE 0660
- ISO 13849-1 (EN954-1)
- RoHS
- ATEX directive 94/9/EC
- Equipment Group 2, Category 2

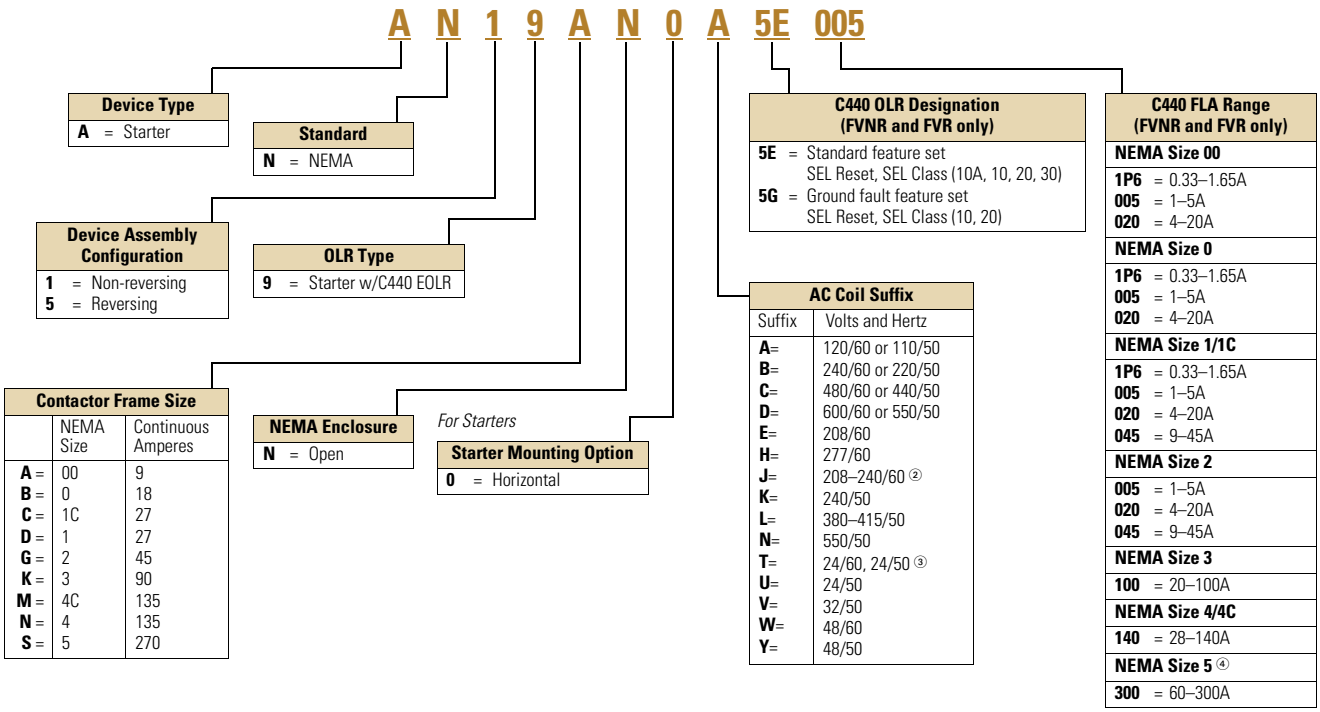
## Electronic Overload Education

| Description | Definition | Cause | Effect if not Protected | C440/*XT* Protection |
|---|---|---|---|---|
| **Motor Protection** | | | | |
| Thermal overload | Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor. | • An increase in the load or torque that is being driven by the motor.<br>• A low voltage supply to the motor causes the current to go high to maintain the power needed.<br>• A poor power factor causing above normal current draw. | • Increase in current draw leads to heat and insulation breakdown, which can cause system failure.<br>• Increase in current can increase power consumption and waste valuable energy. | • Thermal trip behavior is defined by UL, CSA and IEC standards.<br>• Trip class is settable from 10A, 10, 20, 30 |
| Ground fault | A line to ground fault. | A current leakage path to ground. | An undetected ground fault can burn through multiple insulation windings, ultimately leading to motor failure, not to mention risk to equipment or personnel | Fixed protective setting that takes the starter offline if ground fault current exceeds 50% of the FLA dial setting, that is, if the FLA dial is set to 12A, the overload relay will trip if the ground current exceeds 6A. |
| Unbalanced phases (voltage and current) | Uneven voltage or current between phases in a three-phase system. | When a three-phase load is powered with a poor quality line, the voltage per phase may be unbalanced. | Unbalanced voltage causes large unbalanced currents and as a result this can lead to motor stator windings being overloaded, causing excessive heating, reduced motor efficiency and reduced insulation life. | Fixed protective setting that takes the starter offline if a phase drops below 50% of the other two phases. |
| Phase loss—current (single-phasing) | One of the three-phase voltages is not present. | Multiple causes, loose wire, improper wiring, grounded phase, open fuse, and so on. | Single-phasing can lead to unwanted motor vibrations in addition to the results of unbalanced phases as listed above. | Fixed protective setting that takes the starter offline if a phase drops below 50% of the other two phases. |

## Catalog Number Selection

2

### Freedom Series NEMA Starters with C440 Electronic Overload Relays ①




***Notes***

① See **Page V5-T2-51** for Product Selection.

② NEMA Sizes 00 and 0 only.

③ NEMA Sizes 00 and 0 only. Sizes 1–3 are 24/60 only.

④ NEMA Size 5 starter available with 60-300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

## Product Selection

***Type AN19/59 Freedom Series Starters***

### Type AN19/59 Freedom Series Starters with C440 Electronic Overload Relays

**NEMA Starter**

#### Non-Reversing and Reversing

| NEMA Size | Continuous Ampere Rating | Service Limit Current Rating (Amps) | Maximum UL Horsepower Single-Phase 115V | Single-Phase 230V | Three-Phase 208V | Three-Phase 240V | Three-Phase 480V | Three-Phase 600V | Three-Pole Non-Reversing ①② Catalog Number | Three-Pole Reversing ①② Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 9 | 11 | 1/3 | 1 | 1-1/2 | 1-1/2 | 2 | 2 | **AN19AN0_5E _** | **AN59AN0_5E _** |
| 0 | 18 | 21 | 1 | 2 | 3 | 3 | 5 | 5 | **AN19BN0_5E _** | **AN59BN0_5E _** |
| 1 | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **AN19DN0_5E _** | **AN59DN0_5E _** |
| 2 | 45 | 52 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **AN19GN0_5E _** | **AN59GN0_5E _** |
| 3 | 90 | 104 | — | — | 25 | 30 | 50 | 50 | **AN19KN0_5E _** | **AN59KN0_5E _** |
| 4 | 135 | 156 | — | — | 40 | 50 | 100 | 100 | **AN19NN0_5E _** | **AN59NN0_5E _** |
| 5③ | 270 | 311 | — | — | 75 | 100 | 200 | 200 | **AN19SN0_5E _** | **AN59SN0_5E _** |

### Type AN19/59 Freedom Series Starters with C440 with Ground Fault Electronic Overload Relays

**NEMA Starter with Ground Fault**

#### Non-Reversing and Reversing

| NEMA Size | Continuous Ampere Rating | Service Limit Current Rating (Amps) | Maximum UL Horsepower Single-Phase 115V | Single-Phase 230V | Three-Phase 208V | Three-Phase 240V | Three-Phase 480V | Three-Phase 600V | Three-Pole Non-Reversing ①② Catalog Number | Three-Pole Reversing ①② Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 9 | 11 | 1/3 | 1 | 1-1/2 | 1-1/2 | 2 | 2 | **AN19AN0_5G _** | **AN59AN0_5G _** |
| 0 | 18 | 21 | 1 | 2 | 3 | 3 | 5 | 5 | **AN19BN0_5G _** | **AN59BN0_5G _** |
| 1 | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **AN19DN0_5G _** | **AN59DN0_5G _** |
| 2 | 45 | 52 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **AN19GN0_5G _** | **AN59GN0_5G _** |
| 3 | 90 | 104 | — | — | 25 | 30 | 50 | 50 | **AN19KN0_5G _** | **AN59KN0_5G _** |
| 4 | 135 | 156 | — | — | 40 | 50 | 100 | 100 | **AN19NN0_5G _** | **AN59NN0_5G _** |
| 5③ | 270 | 311 | — | — | 75 | 100 | 200 | 200 | **AN19SN0_5G _** | **AN59SN0_5G _** |

### Coil Suffix Codes

| Suffix | Coil Volts and Hertz | Suffix | Coil Volts and Hertz |
|---|---|---|---|
| **A** | 120/60 or 110/50 | **L** | 380–415/50 |
| **B** | 240/60 or 220/50 | **N** | 550/50 |
| **C** | 480/60 or 440/50 | **T** | 24/60, 24/50 |
| **D** | 600/60 or 550/50 | **U** | 24/50 |
| **E** | 208/60 | **V** | 32/50 |
| **H** | 277/60 | **W** | 48/60 |
| **J** | 208–240/60 | **Y** | 48/50 |
| **K** | 240/50 | | |

### C440 FLA Range (FVNR and FVR Starters Only)

| NEMA Size | OLR Code | FLA Range | OLR Code | FLA Rating |
|---|---|---|---|---|
| 00 | **1P6** | 0.33–1.65A | **020** | 4.0–20A |
| | **005** | 1.0–5.0A | **—** | — |
| 0 | **1P6** | 0.33–1.65A | **020** | 4.0–20A |
| | **005** | 1.0–5.0A | **—** | — |
| 1 | **1P6** | 0.33–1.65A | **020** | 4.0–20A |
| | **005** | 1.0–5.0A | **045** | 9.0–45A |
| 2 | **005** | 1.0–5.0A | **045** | 9.0–45A |
| | **020** | 4.0–20A | **—** | — |
| 3 | **100** | 20–100A | **—** | — |
| 4 | **140** | 28–140A | **—** | — |
| 5③ | **300** | 60–300A | **—** | — |

***Notes***

① Underscore (_) indicates coils suffix required, see Coil Suffix table above.
② Underscore (_) indicates OLR designation required, see C440 FLA Range table above.
③ NEMA Size 5 starter available with 60-300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

## Compact NEMA Size 1 and 4 Starters

**New** Compact NEMA Size 1 and 4 starters—available with electronic overload relay **only**.

### Non-Reversing

| NEMA Size | Continuous Ampere Rating | Service Limit Current Rating (Amps) | Maximum UL Horsepower Single-Phase 115V | 230V | Three-Phase 208V | 240V | 480V | 600V | Three-Pole Non-Reversing Catalog Number |
|---|---|---|---|---|---|---|---|---|---|
| **Standard Fault Overload** | | | | | | | | | |
| 1C | 27 | 32 | 2 | 3 | 7.5 | 7.5 | 10 | 10 | **AN19CN0_5E_** |
| 4C | 135 | 156 | — | — | 40 | 50 | 100 | 100 | **AN19MN0_5E_** |
| **Ground Fault Overload** | | | | | | | | | |
| 1C | 27 | 32 | 2 | 3 | 7.5 | 7.5 | 10 | 10 | **AN19CN0_5G_** |
| 4C | 135 | 156 | — | — | 40 | 50 | 100 | 100 | **AN19MN0_5G_** |

### Electrical Life at Rated Continuous Current

| NEMA Size | Rated Current (Amperage) AC3/AC4 | Operations |
|---|---|---|
| 1C | 27/150 | 2,500,000/40,000 |
| 1 | 27/153 | 5,000,000/110,000 |
| 4C | 135/516 | 500,000/40,000 |
| 4 | 135/822 | 800,000/70,000 |

## Accessories

### *CT Kits*

### Accessories

| | Description | Catalog Number |
|---|---|---|
| **Safety Cover** | **Safety Cover** | |
| | Clear Lexan cover that mounts on top of the FLA dial and DIP switches when closed. | **ZEB-XSC** |
| **Reset Bar** | **Reset Bar** | |
| | Assembles to the top of the overload to provide a larger target area for door mounted reset operators. | **ZEB-XRB** |
| **Remote Reset** | **Remote Reset** | |
| | Remote reset module (24 Vdc) ① | **C440-XCOM** |
| | Remote reset module (120 Vac) ① | **ZEB-XRR-120** |
| | Remote reset module (24 Vac) ① | **ZEB-XRR-24** |

### *Communication*

The C440/XTOE is provided with two levels of communication capability.

**Basic Communication via Expansion Module—Monitoring Only**

Basic communication on the C440 is accomplished using an expansion module (C440-XCOM). The expansion module plugs into the expansion bay on the C440 overload relay, enabling communications with the overload via their Modbus RTU (RS-485) network. No additional cards or modules are required. See figure below.

**Basic Communication—Modbus**

**Advanced Communication—Monitoring and Control**

C440 also has the ability to communicate on industrial protocols such as Modbus RTU, DeviceNet, PROFIBUS, Modbus TCP, and EtherNet/IP while providing control capability using I/O.

An expansion module (C440-XCOM) combined with a communication adapter (C440-COM-ADP) and a communication module allows easy integration onto the customer's network. See figure below. ②

**Advanced Communication—Communication Adapter with Communication Module**

**Advanced Communication—Communication Adapter** ②

The communication adapter (C440-COM-ADP) is required for obtaining control capability via communications within the C440 family. Combined with a communication module, the customer is provided with flexible mounting options (DIN rail or panel) along with four inputs and two outputs (24 Vdc or 120 Vac) as standard.

***Notes***

① Customer can wire remote mounted button to reset module (that is, 22 mm pushbutton, catalog number M22-D-B-GB14-K10).

② Modbus TCP and EtherNet/IP communication modules do not require the C440-COM-ADP communication adapter.

The following information can be viewed using the communication option:

- Motor status—running, stopped, tripped or resetting
- Individual rms phase currents (A, B, C)
- Average of three-phase rms current
- Percent thermal capacity
- Fault codes (only available prior to reset)
- Percent phase unbalance
- Ground fault current and percent
- Overload relay settings—trip class, DIP switch selections, reset selections
- Modbus address (can be set over the network)

## Communication Accessories

| | Description | Catalog Number |
|---|---|---|
| **Expansion Module** | Expansion module (Remote Reset/Modbus RTU, RS-485 Communication) | **C440-XCOM** |
| **Communication Adapter** | Communication adapter kit (DIN C Panel mounted adapter, required for advance communication option) | **C440-COM-ADP** |
| | DeviceNet communication module kit—120V I/O (consists of C440-XCOM + C441K + C440-COM-ADP) | **C440-DN-120** |
| | DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441L + C440-COM-ADP) | **C440-DN-24** |
| | PROFIBUS communication module kit—120V I/O (consists of C440-XCOM + C441S + C440-COM-ADP) | **C440-DP-120** |
| | PROFIBUS communication module kit—24V I/O (consists of C440-XCOM + C441Q + C440-COM-ADP) | **C440-DP-24** |
| | Modbus communication module kit—120V I/O (consists of C440-XCOM + C441N + C440-COM-ADP) | **C440-MOD-120** |
| | Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441P + C440-COM-ADP) | **C440-MOD-24** |
| | Modbus TCP/Ethernet IP communication module kit—120V I/O (consists of C440-XCOM + C441U) | **C440-ET-120** |
| | Modbus TCP/Ethernet IP communication module kit—24V I/O (consists of C440-XCOM + C441V) | **C440-ET-24** |

### *Modbus Communication Module*

The Modbus communication module combined with an expansion module and a communication adapter provides monitoring and control capability to the C440/XTOE electronic overload relay via Modbus RTU communications. These modules also provide convenient I/O with 24 Vdc or 120 Vac options.

**Modbus Communication Module**

**Features and Benefits**

- The Modbus communication module is capable of baud rates up to 115K
- The Modbus address and baud rate configuration can be easily changed using the HMi user interface
- Modbus address and baud rate are set via convenient DIP switches; LEDs are provided to display Modbus traffic
- Configuration with common Modbus configuration tools
- Terminals
  - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
  - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
  - 4IN/2OUT
  - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF

### *DeviceNet Communication Modules*

The DeviceNet communication module combined with an expansion module and a communication adapter provides monitoring and control capability to the C440/XTOE electronic overload relay via DeviceNet communications. These modules also provide convenient I/O with 24 Vdc or 120 Vac options.

**DeviceNet Communication Module**

**Features and Benefits**

- Communication to DeviceNet uses only one DeviceNet MAC ID
- Configuration
  - DeviceNet MAC ID and Baud rate are set via convenient DIP switches with an option to set from the network
  - Advanced configuration available using common DeviceNet tools
- Terminals
  - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
  - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
  - 4IN/2OUT
  - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF
- Combined status LED

### *PROFIBUS Communication Modules*

The PROFIBUS communication module combined with an expansion module and a communication adapter provides monitoring and control capability to the C440 / XTOE electronic overload relay via PROFIBUS communications. These modules also provide convenient I/O with 24 Vdc or 120 Vac options.

**PROFIBUS Communication Module**

**Features and Benefits**

- The PROFIBUS communication module is capable of baud rates up to 12 Mb
- PROFIBUS address is set via convenient DIP switches; LEDs are provided to display PROFIBUS status
- Intuitive configuration with common PROFIBUS configuration tools
- Terminals
  - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
  - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
  - 4IN/2OUT
  - Signal types include 24 Vdc I/O and 120 Vac I/O

### *Ethernet Communication Modules*

The Ethernet communication module combined with an expansion module provides both Modbus TCP and EtherNet/IP communication capabilities with built-in HTTP web services to the C440/ XTOE overload relay. Unlike the other communications modules, a communication adapter (C440-COM-ADP) is not required when using the Ethernet communication module in C440/XTOE applications.

The Ethernet communication module has built-in I/O providing communication, monitoring and control for the C440/XTOE overload relay.

**Features and Benefits**

- Supports Modbus TCP or EtherNet/IP in a single device
- Contains an internal embedded switch which provides two Ethernet ports allowing linear or ring network configurations
- Embedded web services allow for simple configuration and monitoring through Internet Explorer
- IP Address is set via convenient DIP Switches located on the device
- Terminals
  - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
  - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
  - 4IN/2OUT
  - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF

**Ethernet with I/O Module**

### Ethernet Communication Module

| Description | I/O | Catalog Number |
|---|---|---|
| Modbus TCP / EtherNet/IP Communication Module, 4IN/2OUT (DIN/Panel) | 120 Vac | **C441U** |
| Modbus TCP / EtherNet/IP Communication Module, 4IN/2OUT (DIN/Panel) | 24 Vdc | **C441V** |

## Technical Data and Specifications

### Electronic Overload Relays up to 1500A

| Description | Specification<br>45 mm | 55 mm | 110 mm |
|---|---|---|---|
| **Electrical Ratings** | **Range** | **Range** | **Range** |
| Operating voltage (three-phase) and frequency | 690 Vac (60/50 Hz) | 690 Vac (60/50 Hz) | 690 Vac (60/50 Hz) |
| **FLA Range** | | | |
| | 0.33–1.65A<br>1–5A<br>4–20A<br>9–45A | 20–100A | 28–140A (NEMA)<br>35–175A (IEC) |
| **Use with Contactors** | | | |
| ***XT*** IEC frames | B, C, D | F, G | G, H |
| Freedom NEMA sizes | 00, 0, 1, 2 | 3 | 4 |
| **Trip Class** | | | |
| | 10A, 10, 20, 30<br>Selectable | 10A, 10, 20, 30<br>Selectable | 10A, 10, 20, 30<br>Selectable |
| **Motor Protection** | | | |
| Thermal overload setting | 1.05 x FLA: does not trip<br>1.15 x FLA: overload trip | 1.05 x FLA: does not trip<br>1.15 x FLA: overload trip | 1.05 x FLA: does not trip<br>1.15 x FLA: overload trip |
| **Feature** | **Range** | **Range** | **Range** |
| Phase loss | Fixed threshold 50% | Fixed threshold 50% | Fixed threshold 50% |
| Phase unbalance (selectable: enable/disable) | Fixed threshold 50% | Fixed threshold 50% | Fixed threshold 50% |
| Ground fault (selectable: enable/disable) | 50% of FLA dial setting<br>>150% = 2 sec<br>>250% = 1 sec | 50% of FLA dial setting<br>>150% = 2 sec<br>>250% = 1 sec | 50% of FLA dial setting<br>>150% = 2 sec<br>>250% = 1 sec |
| Reset | Manual/automatic | Manual/automatic | Manual/automatic |
| **Indicators** | | | |
| Trip status | Orange flag | Orange flag | Orange flag |
| Mode LED | One flash: Overload operating properly<br>Two flashes: Current is above FLA dial setting—pending trip | One flash: Overload operating properly<br>Two flashes: Current is above FLA dial setting—pending trip | One flash: Overload operating properly<br>Two flashes: Current is above FLA dial setting—pending trip |
| **Options** | | | |
| Remote reset | Yes | Yes | Yes |
| Reset bar | Yes | Yes | Yes |
| Communication expansion module | Yes | Yes | Yes |
| Communication adapter | Yes | Yes | Yes |
| **Capacity** | | | |
| Load terminals | | | |
| Terminal capacity | 12–10 AWG (4–6 $mm^2$)<br>8–6 AWG (6–16 $mm^2$) | 6–1 AWG (16–50 $mm^2$) | 8–4/0 AWG (10–95 $mm^2$) |
| Tightening torque | 20–25 lb-in (2.3–2.8 Nm)<br>25–30 lb-in (2.8–3.4 Nm) | 25–30 lb-in (2.8–3.4 Nm) | 124 lb-in (14 Nm) |
| Input, auxiliary contact and remote reset terminals | | | |
| Terminal capacity | 2 x (18–12) AWG | 2 x (18–12) AWG | 2 x (18–12) AWG |
| Tightening torque | 7–11 lb-in (0.8–1.2 Nm) | 7–11 lb-in (0.8–1.2 Nm) | 7–11 lb-in (0.8–1.2 Nm) |
| **Voltages** | | | |
| Insulation voltage $U_i$ (three-phase) | 690 Vac | 690 Vac | 690 Vac |
| Insulation voltage $U_i$ (control) | 500 Vac | 500 Vac | 500 Vac |
| Rated impulse withstand voltage | 6000 Vac | 6000 Vac | 6000 Vac |
| Overvoltage category/pollution degree | III/3 | III/3 | III/3 |

## Electronic Overload Relays up to 1500A, continued



| Description | Specification 45 mm | 55 mm | 110 mm |
|---|---|---|---|
| **Auxiliary and Control Circuit Ratings** | | | |
| Conventional thermal continuous current | 5A | 5A | 5A |
| Rated operational current—IEC AC-15 | | | |
| Make contact (1800 VA) | | | |
| 120V | 15A | 15A | 15A |
| 240V | 15A | 15A | 15A |
| 415V | 0.5A | 0.5A | 0.5A |
| 500V | 0.5A | 0.5A | 0.5A |
| Break contact (180 VA) | | | |
| 120V | 1.5A | 1.5A | 1.5A |
| 240V | 1.5A | 1.5A | 1.5A |
| 415V | 0.9A | 0.9A | 0.9A |
| 500V | 0.8A | 0.8A | 0.8A |
| IEC DC-13 (L/R F 15 ms1) | | | |
| 0–250V | 1.0A | 1.0A | 1.0A |
| Rated operational current—UL B600 | | | |
| Make contact (3600 VA) | | | |
| 120V | 30A | 30A | 30A |
| 240V | 15A | 15A | 15A |
| 480V | 7.5A | 7.5A | 7.5A |
| 600V | 6A | 6A | 6A |
| Break contact (360 VA) | | | |
| 120V | 3A | 3A | 3A |
| 240V | 1.5A | 1.5A | 1.5A |
| 480V | 0.75A | 0.75A | 0.75A |
| 600V | 0.6A | 0.6A | 0.6A |
| R300—Vdc ratings (28 VA) | | | |
| 0–120V | 0.22A | 0.22A | 0.22A |
| 250V | 0.11A | 0.11A | 0.11A |
| **Short-Circuit Rating without Welding** | | | |
| Maximum fuse | 6A gG/gL | 6A gG/gL | 6A gG/gL |
| **Environmental Ratings** | | | |
| Ambient temperature (operating) | –13° to 149°F (–25° to 65°C) | –13° to 149°F (–25° to 65°C) | –13° to 149°F (–25° to 65°C) |
| Ambient temperature (storage) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) |
| Operating humidity UL 991 (H3) | 5% to 95% non-condensing | 5% to 95% non-condensing | 5% to 95% non-condensing |
| Altitude (no derating) NEMA ICS1 | 2000m | 2000m | 2000m |
| Shock (IEC 600068-2-27) | 15g any direction | 15g any direction | 15g any direction |
| Vibration (IEC 60068-2-6) | 3g any direction | 3g any direction | 3g any direction |
| Pollution degree per IEC 60947-4-1 | 3 for product (2 for pcb) | 3 for product (2 for pcb) | 3 for product (2 for pcb) |
| Ingress protection | IP20 | IP20 | IP20 |
| Protection against direct contact when actuated from front (IEC 536) | Finger- and back-of-hand proof | Finger- and back-of-hand proof | Finger- and back-of-hand proof |
| Mounting position | Any | Any | Any |
| Climatic proofing | Damp heat, constant to IEC 60068-2-30 | Damp heat, constant to IEC 60068-2-30 | Damp heat, constant to IEC 60068-2-30 |

## Electronic Overload Relays up to 1500A, continued

| Description | Specification 45 mm | 55 mm | 110 mm |
|---|---|---|---|
| **Electrical/EMC** | | | |
| Radiated emissions<br>IEC 60947-4-1-Table 15<br>EN 55011 (CISPIR 11) Group 1, Class A, ISM | 30 mHz to 1000 mHz | 30 mHz to 1000 mHz | 30 mHz to 1000 mHz |
| Conducted emissions<br>IEC 60947-4-1-Table 14<br>EN 55011 (CISPIR 11) Group 1; Class ISM | 0.15 mHz to 30 mHz | 0.15 mHz to 30 mHz | 0.15 mHz to 30 mHz |
| ESD immunity<br>IEC 60947-4-1 (Table 13) | ±8 kV air, ±6 kV contact | ±8 kV air, ±6 kV contact | ±8 kV air, ±6 kV contact |
| Radiated immunity<br>IEC 60947-4-1<br>IEC 61000-4-3 | 10 V/m 80 mHz–1000 mHz<br>3 V/m from 1.4 to 2.7 gHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80 mHz–1000 mHz<br>3 V/m from 1.4 to 2.7 gHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80 mHz–1000 mHz<br>3 V/m from 1.4 to 2.7 gHz<br>80% amplitude modulated<br>1 kHz sine wave |
| Conducted immunity<br>IEC 60947-4-1, IEC 61000-4-6 | 140 dub (10V rms)<br>150 kHz–100 mHz | 140 dub (10V rms)<br>150 kHz–100 mHz | 140 dub (10V rms)<br>150 kHz–100 mHz |
| Fast transient immunity<br>IEC 60947-4-1 (Table 13)<br>IEC 61000-4-4 | ±4 kV using direct method<br>with accessory installed in expansion bay<br>±2 kV using direct method | ±4 kV using direct method<br>with accessory installed in expansion bay<br>±2 kV using direct method | ±4 kV using direct method<br>with accessory installed in expansion bay<br>±2 kV using direct method |
| Surge immunity<br>IEC 60947-4-1 (Table 13)<br>IEC 61000-4-5 a Class 4 | Three-phase power inputs:<br>±4 kV line-to-line (DM)<br>±4 kV line-to-ground (CM) | Three-phase power inputs:<br>±4 kV line-to-line (DM)<br>±4 kV line-to-ground (CM) | Three-phase power inputs:<br>±4 kV line-to-line (DM)<br>±4 kV line-to-ground (CM) |
| | With accessory installed in expansion bay:<br>±2 kV line-to-line (DM) –>1.2/50 us;<br>2 kV line-to-earth, 1 kV line-to-line<br>±4 kV line-to-ground (CM) | With accessory installed in expansion bay:<br>±2 kV line-to-line (DM) –>1.2/50 us;<br>2 kV line-to-earth, 1 kV line-to-line<br>±4 kV line-to-ground (CM) | With accessory installed in expansion bay:<br>±2 kV line-to-line (DM) –>1.2/50 us;<br>2 kV line-to-earth, 1 kV line-to-line<br>±4 kV line-to-ground (CM) |
| Power freq. magnetic field immunity<br>IEC 60947-4-1, IEC 61000-4-8 | 30 A/m, 50 Hz | 30 A/m, 50 Hz | 30 A/m, 50 Hz |
| Electromagnetic field<br>IEC 60947-4-1 Table 13, IEC 61000-4-3 | 10 V/m | 10 V/m | 10 V/m |
| Distortion IEEE 519 | 5% THD max., 5th harmonic 3% max. | 5% THD max., 5th harmonic 3% max. | 5% THD max., 5th harmonic 3% max. |
| Electrostatic discharge (ESD)<br>IEC 61000-4-2, EN 61131-2 | 4 kV contact<br>8 kV air discharge | 4 kV contact<br>8 kV air discharge | 4 kV contact<br>8 kV air discharge |
| Electrical fast transient (EFT)<br>IEC 61000-4-4, EN 61131-2 | ±2 kV using direct method | ±2 kV using direct method | ±2 kV using direct method |
| Surge immunity<br>IEC 61000-4-5, EN 61131-2 | ±2 kV line-to-ground (CM) | ±2 kV line-to-ground (CM) | ±2 kV line-to-ground (CM) |

## Communication Modules



| Description | Modbus | DeviceNet | PROFIBUS | Ethernet |
|---|---|---|---|---|
| **Electrical/EMC** | | | | |
| Radiated emissions<br>IEC 60947-4-1—Table 15, EN 55011<br>(CISPIR 11) Group 1, Class A | 30–1000 mHz | 30–1000 mHz | 30–1000 mHz | 30–1000 mHz |
| Conducted emissions<br>IEC 60947-4-1—Table 14, EN 55011<br>(CISPIR 11) Group 1, Class A | 0.15–30 mHz | 0.15–30 mHz | 0.15–30 mHz | 0.15–30 mHz |
| ESD immunity<br>IEC 60947-4-1 (Table 13) | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact |
| Radiated immunity<br>IEC 60947-4-1 | 10 V/m 80–1000 mHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80–1000 mHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80–1000 mHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80–1000 mHz<br>80% amplitude modulated<br>1 kHz sine wave |
| Conducted immunity<br>IEC 60947-4-1 | 140 dBuV (10V rms)<br>150 kHz–80 mHz | 140 dBuV (10V rms)<br>150 kHz–80 mHz | 140 dBuV (10V rms)<br>150 kHz–80 mHz | 140 dBuV (10V rms)<br>150 kHz–80 mHz |
| Fast transient immunity<br>IEC 60947-4-1 (Table 13) IEC 6100-4-4 | ±2 kV using direct method | ±2 kV supply and control,<br>±1 kV communication | ±2 kV supply and control,<br>±1 kV communication | ±2 kV supply and control,<br>±1 kV communication |
| Surge immunity<br>IEC 60947-4-1 (Table 13)<br>IEC 61000-4-5 Class 3 | User IO and communication lines ①:<br>±1 kV line-to-line (DM)<br>±2 kV line-to-ground (CM) | User IO and communication lines:<br>±0.5 kV line-to-line (DM)<br>±1 kV line-to-ground (CM) | User IO and communication lines:<br>±0.5 kV line-to-line (DM)<br>±1 kV line-to-ground (CM) | User IO and communication lines:<br>±0.5 kV line-to-line (DM)<br>±1 kV line-to-ground (CM) |
| Electromagnetic field ①<br>IEC 60947-4-1 (Table 13) IEC 61000-4-3 | 10 V/m | 10 V/m | 10 V/m | 10 V/m |
| **Environmental Ratings** | | | | |
| Ambient temperature (operating) | –4° to 122°F (–20° to 50°C) | –13° to 122°F (–25° to 50°C) | –13° to 122°F (–25° to 50°C) | –13° to 122°F (–25° to 50°C) |
| Ambient temperature (storage) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) |
| Operating humidity | 5–95% noncondensing | 5–95% noncondensing | 5–95% noncondensing | 5–95% noncondensing |
| Altitude (no derating) | 2000m | 2000m | 2000m | 2000m |
| Shock (IEC 600068-2-27) | 15G any direction | 15G any direction | 15G any direction | 15G any direction |
| Vibration (IEC 60068-2-6) | 3G any direction | 3G any direction | 3G any direction | 3G any direction |
| Pollution degree per IEC 60947-1 | 3 | 3 | 3 | 3 |
| Degree of protection | IP20 | IP20 | IP20 | IP20 |
| Overvoltage category per UL 508 | III | III | III | III |
| **DeviceNet** | | | | |
| DeviceNet connections | — | Group 2, polling, bit strobe,<br>explicit, no UCMM | — | — |
| DeviceNet baud rate | — | 125K, 250K, 500K | — | — |
| **Ethernet** | | | | |
| Ethernet connections | — | — | — | Integrated two-port switch with dual<br>RJ45 Ethernet connections |
| Ethernet type | — | — | — | Ethernet 10/100 Mbs, AutoMDX,<br>Auto Negotiation |
| **PROFIBUS** | | | | |
| PROFIBUS connections | — | — | Group 2, polling, bit strobe,<br>explicit, no UCMM | — |
| PROFIBUS baud rate | — | — | 9.6K, 19.2K, 45.45K, 93.75K, 187.5K,<br>500K, 1.5M, 3M, 6M, 12M | — |

***Note***

① Relates to C441M only.

## Communication Modules, continued

| Description | Modbus | DeviceNet | PROFIBUS | Ethernet |
|---|---|---|---|---|
| **C441_ 24 Vdc Input** | | | | |
| Nominal input voltage | 24 Vdc | 24 Vdc | 24 Vdc | 24 Vdc |
| Operating voltage | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc |
| Number of inputs | 4 | 4 | 4 | 4 |
| Signal delay | 5 ms (programmable to 65 sec) | 5 ms (programmable to 65 sec) | 5 ms (programmable to 65 sec) | 5 ms (programmable to 65 sec) |
| OFF-state voltage | <6 Vdc | <6 Vdc | <6 Vdc | <6 Vdc |
| ON-state voltage | >18 Vdc | >18 Vdc | >10 Vdc | >18 Vdc |
| Nominal input current | 5 mA | 5 mA | 5 mA | 5 mA |
| Isolation | 1500V | 1500V | 1500V | 1500V |
| Terminal screw torque | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb |
| 24V source current | 50 mA | 50 mA | 50 mA | 50 mA |
| **Operating Voltage Range—DC Input Modules** | | | | |
| OFF state | 0–6 Vdc | 0–6 Vdc | 0–6 Vdc | 0–6 Vdc |
| Transition region | 6–18 Vdc | 6–18 Vdc | 6–18 Vdc | 6–18 Vdc |
| ON state | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc |
| **C441_ 120 Vac Input** | | | | |
| Nominal input voltage | 120 Vac | 120 Vac | 120 Vac | 120 Vac |
| Operating voltage | 80–140 Vac | 80–140 Vac | 80–140 Vac | 80–140 Vac |
| Number of inputs | 4 | 4 | 4 | 4 |
| OFF-state voltage | <30 Vac | <30 Vac | <20 Vac | <30 Vac |
| ON-state voltage | >80 Vac | >80 Vac | >70 Vac | >80 Vac |
| Nominal input current | 15 mA | 15 mA | 15 mA | 15 mA |
| Signal delay | 1/2 cycle | 1/2 cycle | 1/2 cycle | 1/2 cycle |
| Isolation | 1500V | 1500V | 1500V | 1500V |
| Terminal screw torque | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb |
| **Operating Voltage Range—AC Input Modules** | | | | |
| OFF state | 0–30 Vac | 0–30 Vac | 0–30 Vac | 0–30 Vac |
| Transition region | 30–80 Vac | 30–80 Vac | 30–80 Vac | 30–80 Vac |
| ON state | 80–140 Vac | 80–140 Vac | 80–140 Vac | 80–140 Vac |
| **Output Modules** | | | | |
| Nominal voltage | 120 Vac<br>24 Vdc | 120 Vac<br>24 Vdc | 120 Vac<br>24 Vdc | 120 Vac<br>24 Vdc |
| Number of outputs | (2) 1NO Form A<br>1NO/NC Form C | (2) 1NO Form A<br>1NO/NC Form C | (2) 1NO Form A<br>1NO/NC Form C | (2) 1NO Form A<br>1NO/NC Form C |
| Relay OFF time | 3 ms | 3 ms | 3 ms | 3 ms |
| Relay ON time | 7 ms | 7 ms | 7 ms | 7 ms |
| Max. current per point ① | 5A (B300 rated) | 5A (B300 rated) | 5A (B300 rated) | 5A (B300 rated) |
| Electrical life | 100,000 cycles | 100,000 cycles | 100,000 cycles | 100,000 cycles |
| Mechanical life | 1,000,000 cycles | 1,000,000 cycles | 1,000,000 cycles | 1,000,000 cycles |

***Note***

① Relates to C441M only.

***Short Circuit Ratings (North America CSA, cUL)***

Changes to UL 508A and NEC in recent years have brought a focus to control panel safety with regard to short-circuit current ratings (SCCR). Eaton's C440 electronic overload relays combined with ***XT*** series IEC and Freedom Series NEMA contactors provide a wide variety of SCCR solutions needed for a variety of applications. The SCCR data in this document reflects the latest information as of April 2010.

## C440/*XT* Standalone Overload Relays (*XT*, C440)

| | | Standard-Fault Short Circuit Data | | | High-Fault Short Circuit Data | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fuses (RK5, J, CC) | | | Thermal-Magnetic Circuit Breakers | | |
| Overload FLA Range | Maximum Operating Voltage | 600V (kA) | Maximum Fuse Size (A) (RK5) | Maximum Breaker Size (A) | 480V (kA) | 600V (kA) | Maximum Fuse Size | 480V (kA) | 600V (kA) | Maximum Breaker Size |
| 0.33–1.65A | 600 Vac | 1 | 6 | 15 | — | — | — | — | — | — |
| 1–5A | 600 Vac | 5 | 20 | 20 | 100 | 100 | 30 | 100 | 35 | 20 |
| 4–20A | 600 Vac | 5 | 80 | 80 | 100 | 100 | 100 | 100 | 35 | 80 |
| 9–45A | 600 Vac | 5 | 175 | 175 | 100 | 100 | 100 | 100 | 35 | 100/175 (480/600) |
| 20–100A | 600 Vac | 10 | 400 | 400 | 100 | 100 | 200 | 150 | 35 | 250/400 (480/600) |
| 28–140A | 600 Vac | 10 | 450 | 500 | 100 | 100 | 400 | 100 | 65 | 400 |
| 35–175A | 690 Vac | 10 | 500 (gG) | 350 (690 Vac)<br>320 (415 Vac) | 100 | 100 | 500 (gG) | 100 (415 Vac) | — | 350 (LGC3350)<br>320 (NZMH3) |

## NEMA Freedom Series Starters with C440 Electronic Overload Relays

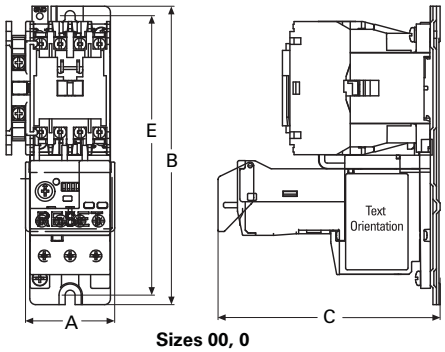
| | | High-Fault Short Circuit Data | | | Thermal-Magnetic Circuit Breakers | | |
|---|---|---|---|---|---|---|---|
| | Maximum | Fuses (RK5, J, CC) | | | | | |
| NEMA Size | Operating Voltage | 480V | 600V | Maximum Fuse Size | 480V | 600V | Maximum Breaker Size |
| 00 | 0.33–1.65A | 100 | 100 | 30 | — | — | — |
| | 1–5A | 100 | 100 | 30 | 100 | 35 | 35 |
| | 4–20A | 100 | 100 | 30 | 100 | 35 | 35 |
| 0 | 0.33–1.65A | 100 | 100 | 60 | — | — | — |
| | 1–5A | 100 | 100 | 60 | 100 | 35 | 70 |
| | 4–20A | 100 | 100 | 60 | 100 | 35 | 70 |
| 1 | 0.33–1.65A | 100 | 100 | 100 | — | — | — |
| | 1–5A | 100 | 100 | 100 | 100 | 35 | 100 |
| | 4–20A | 100 | 100 | 100 | 100 | 35 | 100 |
| | 9–45A | 100 | 100 | 100 | 100 | 35 | 100 |
| 2 | 1–5A | 100 | 100 | 100 | 100 | 35 | 175 |
| | 4–20A | 100 | 100 | 100 | 100 | 35 | 175 |
| | 9–45A | 100 | 100 | 100 | 100 | 35 | 175 |
| 3 | 20–100A | 100 | 100 | 200 | 50 | 50 | 250 |
| 4 | 28–140A | 100 | 100 | 400 | 100 | 65 | 300 |

## Dimensions

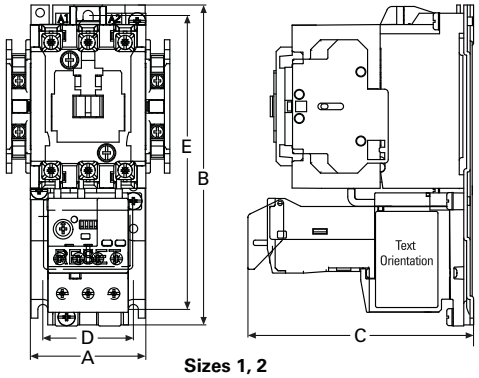
Approximate Dimensions in Inches (mm)

### *NEMA Starters*

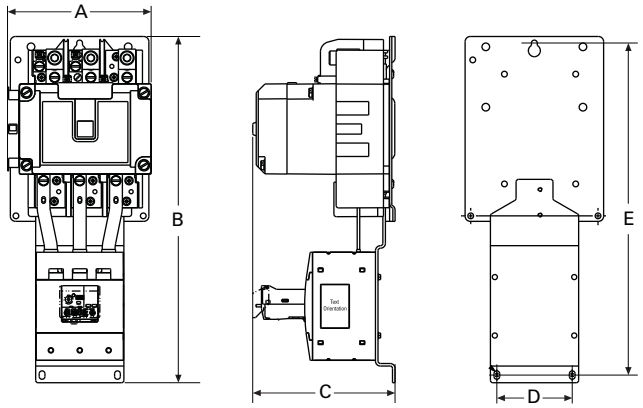
#### Full Voltage Non-Reversing Starters



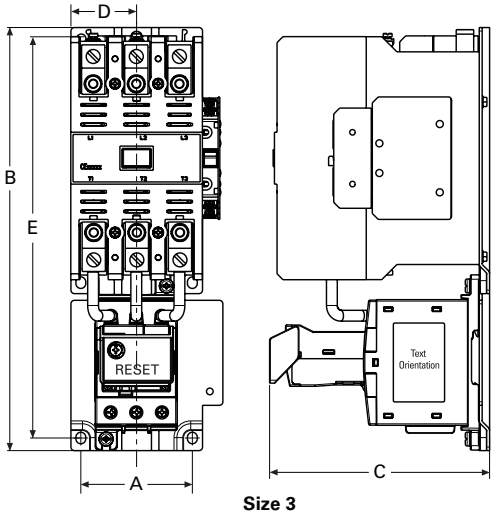

**Sizes 00, 0**



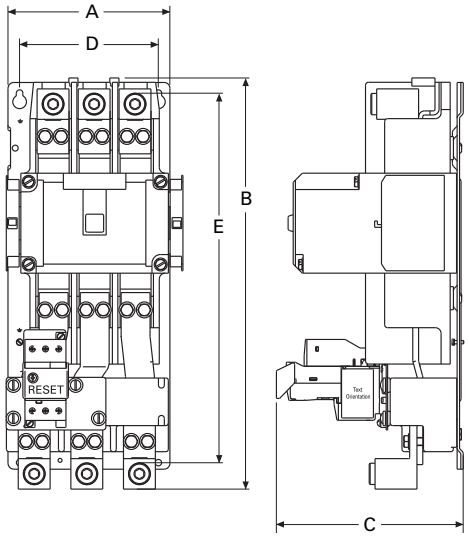

**Sizes 1, 2**




**Size 4**




**Size 3**



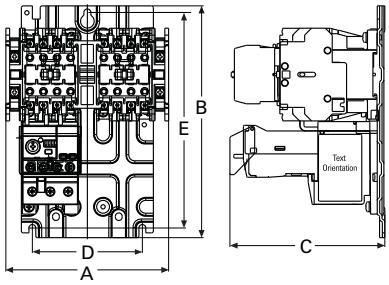

**Size 5**

| NEMA Size | A | B | C | D | E |
|---|---|---|---|---|---|
| 00, 0 | 1.97 (50.0) | 6.60 (167.6) | 4.90 (124.5) | — | 6.18 (157.0) |
| 1, 2 | 2.60 (65.0) | 7.10 (180.0) | 4.98 (126.5) | 2.00 (50.8) | 6.50 (165.0) |
| 3 | 4.09 (103.8) | 11.40 (289.6) | 5.92 (150.3) | 1.77 (44.9) | 10.81 (274.6) |
| 4 | 7.10 (179.0) | 17.00 (432.0) | 7.00 (177.0) | 3.70 (94.0) | 16.30 (415.0) |
| 5 | 7.00 (177.8) | 17.81 (452.3) | 8.08 (205.2) | 6.00 (152.4) | 16.01 (406.6) |

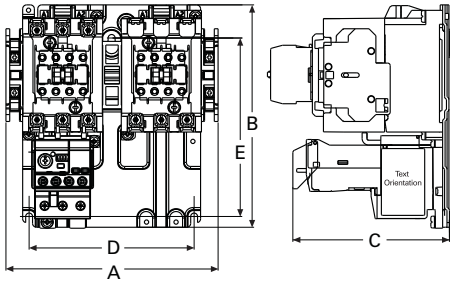
Approximate Dimensions in Inches (mm)



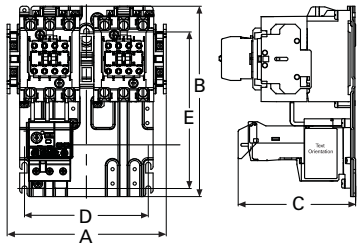
## Full Voltage Reversing Starters



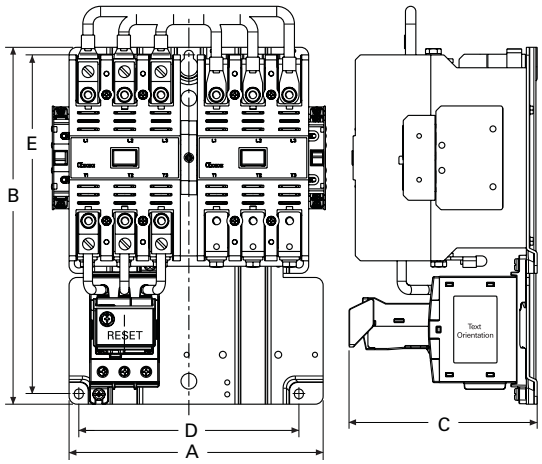

Sizes 00, 0



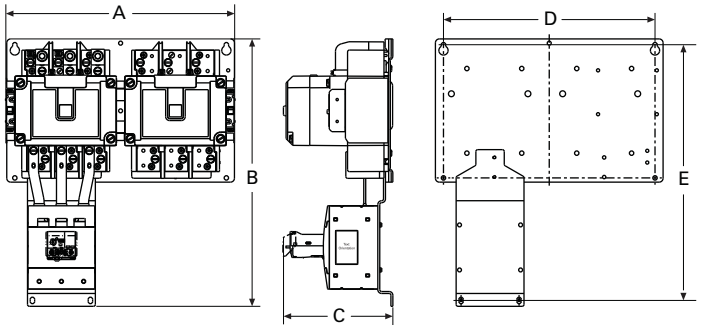

Size 1



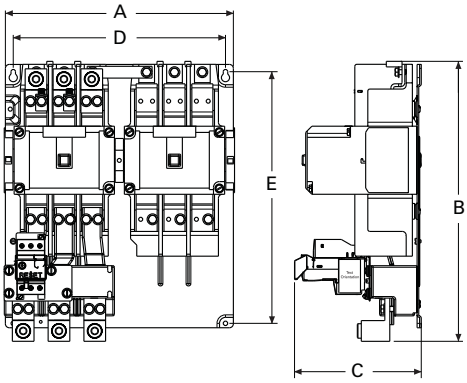

Size 2




Size 3




Size 4




Size 5

| NEMA Size | A | B | C | D | E |
|---|---|---|---|---|---|
| 00, 0 | 5.20 (132.0) | 7.40 (187.0) | 4.90 (125.0) | 3.50 (89.0) | 6.90 (174.0) |
| 1 | 6.70 (171.0) | 7.10 (180.0) | 4.98 (126.5) | 5.25 (133.0) | 5.70 (144.0) |
| 2 | 6.70 (171.0) | 8.10 (205.0) | 4.98 (126.5) | 5.25 (133.0) | 6.70 (170.0) |
| 3 | 8.08 (205.2) | 11.35 (288.3) | 6.00 (152.0) | 7.00 (177.8) | 10.77 (273.6) |
| 4 | 14.60 (371.0) | 17.10 (433.0) | 7.00 (177.0) | 13.50 (343.0) | 16.30 (145.0) |
| 5 | 14.50 (368.3) | 17.81 (452.3) | 8.06 (204.8) | 13.50 (342.9) | 16.00 (406.6) |

NEMA Space-Savings Family of Contactors and Starters

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| Product Selection | **V5-T2-66** |
| Accessories | **V5-T2-68** |
| Renewal Parts | **V5-T2-72** |
| Technical Data and Specifications | **V5-T2-73** |
| Dimensions | **V5-T2-97** |


An Eaton Green Solution

## Contactors and Starters

### Product Description

The Eaton NEMA® Space-Savings line of contactors and starters includes non-reversing and reversing contactors, electronic overload relays and a variety of related accessories. Because the Space-Savings family meets IEC, UL®, CSA® and CE standards, it is the perfect product solution for applications all over the world. The compact and easy to install Space-Savings line of NEMA contactors and starters is the efficient and effective solution for customer applications from Size 0 through Size 5.

### Application Description

The Space-Savings line of NEMA power control was engineered to provide highly effective control and protection for a variety of loads, including motors, compressors, pumps, resistive, capacitor banks, isolation and others.

The Space-Savings contactors are perfectly suited for use in Motor Control Center applications where bucket space sizing is critical. With both AC and DC control and flexible communication options, the Space-Savings family can be easily integrated into various customer applications.

### Features and Benefits

- AC control from 120V to 600V 50/60 Hz
- 24 Vdc control
- Reversing or non-reversing contactors and starters
- XTOE self-powered electronic overload relay
- Non-reversing starters to NEMA Size 5
- Panel or DIN rail mounting to NEMA Size 2
- IP20 finger and back-of-hand proof
- Large ambient temperature range, –25 to 50°C [–13 to 122°F]
- AC and DC controlled contactors in the same compact frame
- Low power consumption AC and DC coils
- Built-in NO or NC auxiliary contacts to 32A
- Plug-in accessories for reduced installation time
- Coil replacement on NEMA Size 0–5
- Contact replacement on NEMA Size 1–5
- Integrated suppressor NEMA Size 0–4 DC operated contactors and NEMA Size 5 AC and DC operated contactors

### Standards and Certifications

- IEC EN 60947
- CE approved
- UL
- CSA
- ATEX
- RoHS

CE UL CSA RoHS COMPLIANT

## Catalog Number Selection

2

### Space-Savings NEMA Starters with XTOE Electronic Overload Relays

A N 1 3 C N 0 1 A 5E 005

**Device Type**
**A** = Starter
**C** = Contactor

**Standard**
**N** = NEMA

**Device Assembly Configuration**
**1** = Non-reversing
**5** = Reversing

**OLR Type**
**3** = Starter w/XTOE EOLR

**Contactor Frame Size**

| | NEMA Size | Continuous Amperes |
|---|---|---|
| **B** = | 0 | 18 |
| **C** = | 1C | 27 |
| **D** = | 1 | 27 |
| **G** = | 2 | 45 |
| **K** = | 3 | 90 |
| **M** = | 4 | 135 |
| **S** = | 5 | 270 |

**NEMA Enclosure**
**N** = Open

*For Starters*
**Starter Mounting Option**
**0** = Horizontal

*For Contactors Only*
**Starter Mounting Option**
**10** = 1 normally open
**01** = 1 normally closed
**11** = 1 normally open, 1 normally closed
**00** = No auxiliary contacts
**22** = 2 normally open, 2 normally closed

**Coil Suffix**

| Suffix | Volts and Hertz |
|---|---|
| **A** = | 120/60 or 110/50 |
| **B** = | 240/60 or 220/50 |
| **TD** = | 24 Vdc |

**XTOE OLR Designation (FVNR and FVR only)**
**5E** = Standard feature set SEL Reset, SEL Class (10A, 10, 20, 30)
**5G** = Ground fault feature set SEL Reset, SEL Class (10, 20)

**XTOE FLA Range (FVNR and FVR only)**
**NEMA Size 0**
**1P6** = 0.33–1.65A
**005** = 1–5A
**020** = 4–20A
**NEMA Size 1C/1**
**1P6** = 0.33–1.65A ①
**005** = 1–5A
**020** = 4–20A
**045** = 9–45A
**NEMA Size 2**
**045** = 9–45A
**NEMA Size 3**
**100** = 20–100A
**NEMA Size 4/4C**
**175** = 35–175A
**NEMA Size 5**
**300** = 60–300A

## Product Selection

### Type CN13/53 Space-Savings NEMA Contactors

**NEMA Contactor**

#### Non-Reversing and Reversing

| NEMA Size | Continuous Ampere Rating | Service Limit Current Rating (Amps) | Maximum UL Horsepower Single-Phase 115V | Single-Phase 230V | Three-Phase 208V | Three-Phase 240V | Three-Phase 480V | Three-Phase 600V | Three-Pole Non-Reversing ② Catalog Number | Three-Pole Reversing ② Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 18 | 21 | 1 | 2 | 3 | 3 | 5 | 5 | **CN13BN010_** | — |
| 1C | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **CN13CN010_** | **CN53CN011_** |
| 1 | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **CN13DN000_** | **CN53DN011_** |
| 2 | 45 | 52 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **CN13GN000_** | **CN53GN011_** |
| 3 | 90 | 104 | 7.5 | 15 | 25 | 30 | 50 | 50 | **CN13KN000_** | **CN53KN011_** |
| 4 | 135 | 156 | — | — | 40 | 50 | 100 | 100 | **CN13MN000_** | — |
| 5 ③ | 270 | 311 | — | — | 75 | 100 | 200 | 200 | **CN13SN022_** | — |

***Notes***
① Available on Compact Size 1 starter only.
② Underscore (_) indicates coils suffix required, see Coil Suffix table above.
③ NEMA Size 5 starter available with 60-300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

## Type AN13/53 Space-Savings Starters with XTOE Electronic Overload Relays

**NEMA Starter**

### Non-Reversing and Reversing

| NEMA Size | Continuous Ampere Rating | Service Limit Current Rating (Amps) | Maximum UL Horsepower Single-Phase 115V | 230V | Three-Phase 208V | 240V | 480V | 600V | Standard MCC Bucket Size | Three-Pole Non-Reversing ①② Catalog Number | Three-Pole Reversing ①② Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 18 | 21 | 1 | 2 | 3 | 3 | 5 | 5 | Not offered | **AN13BN0_5E_** | **AN53BN0_5E_** |
| 1C | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | Not offered | **AN13CN0_5E_** | **AN53CN0_5E_** |
| 1 | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | 1X | **AN13DN0_5E_** | **AN53DN0_5E_** |
| 2 | 45 | 52 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | 1X | **AN13GN0_5E_** | **AN53GN0_5E_** |
| 3 | 90 | 104 | — | — | 25 | 30 | 50 | 50 | 2X | **AN13KN0_5E_** | **AN53KN0_5E_** |
| 4 | 135 | 156 | — | — | 40 | 50 | 100 | 100 | 2X | **AN13NN0_5E_** | **AN53NN0_5E_** |
| 5 ③ | 270 | 311 | — | — | 75 | 100 | 200 | 200 | 6X | **AN13SN0_5E_** | **AN53SN0_5E_** |

## Type AN13/53 Space-Savings Starters with XTOE Ground Fault Electronic Overload Relays

**NEMA Starter with Ground Fault**

### Non-Reversing and Reversing

| NEMA Size | Continuous Ampere Rating | Service Limit Current Rating (Amps) | Maximum UL Horsepower Single-Phase 115V | 230V | Three-Phase 208V | 240V | 480V | 600V | Standard MCC Bucket Size | Three-Pole Non-Reversing ①② Catalog Number | Three-Pole Reversing ①② Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 18 | 21 | 1 | 2 | 3 | 3 | 5 | 5 | Not offered | **AN13BN0_5G_** | **AN53BN0_5G_** |
| 1C | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | Not offered | **AN13CN0_5G_** | **AN53CN0_5G_** |
| 1 | 27 | 32 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | 2X | **AN13DN0_5G_** | **AN53DN0_5G_** |
| 2 | 45 | 52 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | 2X | **AN13GN0_5G_** | **AN53GN0_5G_** |
| 3 | 90 | 104 | — | — | 25 | 30 | 50 | 50 | 4X | **AN13KN0_5G_** | **AN53KN0_5G_** |
| 4 | 135 | 156 | — | — | 40 | 50 | 100 | 100 | 4X | **AN13NN0_5G_** | **AN53NN0_5G_** |
| 5 ③ | 270 | 311 | — | — | 75 | 100 | 200 | 200 | 8X | **AN13SN0_5G_** | **AN53SN0_5G_** |

### XTOE Overload FLA Range (FVNR and FVR Starters Only) Magnet Coil Suffix

| NEMA Size | OLR Code | FLA Range | OLR Code | FLA Rating |
|---|---|---|---|---|
| 0 | **1P6** | 0.33–1.65A | **020** | 4.0–20A. |
| | **005** | 1.0–5.0A | — | — |
| 1C/1 | **1P6** ④ | 0.33–1.65A | **020** | 4.0–20A |
| | **005** | 1.0–5.0A | **045** | 9.0–45A |
| 2 | — | — | **045** | 9.0–45A |
| | — | — | — | — |
| 3 | **100** | 20–100A | — | — |
| 4 | **175** | 35–175A | — | — |
| 5 ③ | **300** | 60–300A | — | — |

| Coil Voltage | Suffix Code |
|---|---|
| **Sizes 0–2** | |
| 110V 50 Hz, 120V 60 Hz | **A** |
| 220V 50 Hz, 240V 60 Hz | **B** |
| 24–27 Vdc | **TD** |
| **Sizes 3, 4** | |
| 100–120V 50/60 Hz | **A** |
| 190–240V 50/60 Hz | **B** |
| 24–27 Vdc | **TD** |
| **Sizes 5** | |
| 100–120V 50/60 Hz | **A** |
| 24–48 Vdc | **TD** |

***Notes***

① Underscore (_) indicates coils suffix required, see Coil Suffix table above.

② Underscore (_) indicates OLR designation required, see XTOE FLA Range table above.

③ NEMA Size 5 starter available with 60-300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

④ Not available on AN13**D**N or AN53**D**N starters.

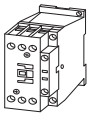
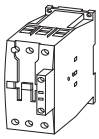
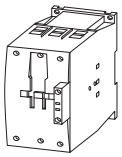
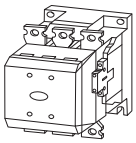
## Accessories



### *Auxiliary Contacts—Overview*

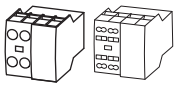
Front-mounted snap-on auxiliary contacts for Space-Savings contactors are available with screw terminals in a variety of contact configurations.

### Auxiliary Contacts Possible Combinations

| Frame Size | Catalog Number | Contactor | Built-In Auxiliary | Front (Top) Mount Two-Pole | Front (Top) Mount Four-Pole | Side-Mount Single-Pole | Side-Mount Two-Pole | Total Auxiliary Contacts Available |
|---|---|---|---|---|---|---|---|---|
| 0, 1C | **CN13BN0_ – CN13CN0_** |  | 1NO or 1NC | 1 | — | — | — | 3 |
| | | | | — | 1 | — | — | 5 |
| | | | | — | — | — | 1 | 3 |
| | | | | | | — | | — |
| 1, 2 | **CN13DN0_ – CN13GN0_** |  | — | 1 | — | — | 2 | 6 |
| | | | | — | 1 | — | 1 | 6 |
| | | | | | | — | | — |
| 3, 4 | **CN13KN0_ – CN13MN0_** |  | — | 1 | — | — | 2 | 6 |
| | | | | — | 1 | — | 2 | 8 |
| | | | | — | — | — | 4 | 8 |
| | | | | | | — | | — |
| 5 | **CN13SN0** |  | 2NO–2NC | — | — | | 2 | 8 |
| | | | | — | — | | | — |

## *Auxiliary Contacts*

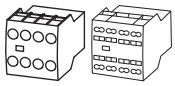
**XTCEXF_**



### NEMA Size 0, 1C— Front (Top) Mount—Two-Pole

| Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps | Contact Configuration | Circuit Symbol | Pkg. Qty. ① | Screw Terminal Catalog Number |
|---|---|---|---|---|
| 16 | 2NO | 53 63 / 54 64 | 5 | **XTCEXFAC20** |
| 16 | 1NO-1NC | 53 61 / 54 62 | 5 | **XTCEXFAC11** ② |
| 16 | 2NC | 51 61 / 52 62 | 5 | **XTCEXFAC02** |

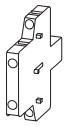
**XTCEXF_**



### NEMA Size 0, 1C— Front (Top) Mount—Four-Pole

| Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps | Contact Configuration | Circuit Symbol | Pkg. Qty. ① | Screw Terminal Catalog Number |
|---|---|---|---|---|
| 16 | 4NO | 53 63 73 83 / 54 64 74 84 | 5 | **XTCEXFAC40** ② |
| 16 | 3NO-1NC | 53 61 73 83 / 54 62 74 84 | 5 | **XTCEXFAC31** ② |
| 16 | 2NO-2NC | 53 61 71 83 / 54 62 72 84 | 5 | **XTCEXFAC22** ② |
| 16 | 1NO-3NC | 53 61 71 81 / 54 62 72 82 | 5 | **XTCEXFAC13** |
| 16 | 4NC | 51 61 71 81 / 52 62 72 82 | 5 | **XTCEXFAC04** |

**XTCEXSCC11**



### NEMA Size 0, 1C—Side-Mount—Two-Pole

| Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps | Contact Configuration | Circuit Symbol | Pkg. Qty. ① | Screw Terminal Catalog Number |
|---|---|---|---|---|
| 10 | 1NO-1NC | 53 61 / 54 62 | 1 | **XTCEXSCC11** ③ |

***Notes***

No auxiliary contacts can be fitted between two contactors.

① Orders must be placed in multiples of package quantity listed.

② To avoid duplicate terminal numbers in contact sequence, these auxiliary contacts should only be used with contactors having a built-in 1NO contact (XTCE…B10_, XTCE…C10_).

③ Can be mounted to the left side of contactor only. Cannot be used in combination with front (top) mount auxiliary contacts or mechanical interlocks.

2

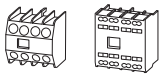
## NEMA Sizes 1–4—Two-Pole

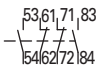
**XTCEXF_**

| Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps | Contact Configuration | Circuit Symbol | Pkg. Qty. ① | Screw Terminal Catalog Number |
|---|---|---|---|---|
| 16 | 2NO | | 5 | **XTCEXFBG20** |
| 16 | 1NO-1NC | | 5 | **XTCEXFBG11** |
| 16 | 2NC | | 5 | **XTCEXFBG02** |

## NEMA Sizes 1–4—Four-Pole

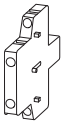
**XTCEXF_**



| Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps | Contact Configuration | Circuit Symbol | Pkg. Qty. ① | Screw Terminal Catalog Number |
|---|---|---|---|---|
| 16 | 4NO-0NC | | 5 | **XTCEXFBG40** |
| 16 | 3NO-1NC | | 5 | **XTCEXFBG31** |
| 16 | 2NO-2NC | | 5 | **XTCEXFBG22** |
| 16 | 2NO-2NC |  | 5 | **XTCEXFAG22** |
| 16 | 1NO-3NC | | 5 | **XTCEXFBG13** |

## NEMA Sizes 1–4, Side Mount (Snap-On)—Two-Pole

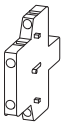
**XTCEXS_**



| Conventional Free Air Thermal Current, $I_{th} = I_e$, AC-1 in Amps | Contact Configuration | Circuit Symbol | Pkg. Qty. ① | Screw Terminal Catalog Number |
|---|---|---|---|---|
| 10 | 1NO–1NC | | 1 | **XTCEXSBN11** |

## NEMA Size 5, Side Mount (Screw Mount)—Two-Pole

**XTCEXS_**



| Conventional Free Air Thermal Current, $I_{th} = I_e$, AC-1 in Amps | Contact Configuration | Circuit Symbol | Pkg. Qty. ① | Screw Terminal Catalog Number |
|---|---|---|---|---|
| 10 | 1NO–1NC | | 1 | **XTCEXSBR11** ② |

***Notes***

No auxiliary contacts can be fitted between two contactors.

① Orders must be placed in multiples of package quantity listed.

② For replacement only. XTCEXSBR11 and XTCEXSBLR11 cannot be added onto side mount auxiliaries that come with the Size 5 contactors as standard. To add auxiliaries onto the included side auxiliaries on Size 5 contactors, use XTCEXSCR11.

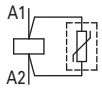
### *Suppressors*

The switching of contactor coils can generate voltage transients that may cause arching on switch contacts and/or damage electronics on the control line. Either an RC or varistor suppressor is recommended in these types of applications. All Space-Savings DC contactor coils have built-in suppression.

Varistor suppressors clamp the voltage transient above the maximum coil voltage and are recommended when the level of the transient is known to not exceed the coil voltage. RC suppressors slow and reduce the level of the voltage transient but do not clamp them at a specific level. The slowing of the transient can reduce electrical interference. These are recommended in applications where operating rates are high.

**XTCEXVS_**

**Contact Sequence**

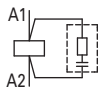



## Varistor Suppressor ①②

| Voltage | For Use with… | Pkg. Qty. ③ | Catalog Number |
|---|---|---|---|
| 48–130 | CN13BN0_ CN13CN0_ | 10 | **XTCEXVSCA** |
| 48–130 | CN13DN0_ CN13GN0_ | 10 | **XTCEXVSFA** |

**XTCEXRS_**

**Contact Sequence**




## RC Suppressor ①②

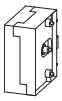
| Voltage | For Use with… | Pkg. Qty. ③ | Catalog Number |
|---|---|---|---|
| 24–48 | CN13DN0_ CN13GN0_ | — | **XTCEXRSFW** |
| 110–130 | | — | **XTCEXRSFA** |

### *Additional Accessories*

## Mechanical Interlock ⑤

**XTCEXML_**

**XTCEXMLM**



| For Use with… | Pkg. Qty. ③ | Catalog Number |
|---|---|---|
| CN13BN0_, CN13CN0_ | 1 | **XTCEXMLC** |
| CN13DN0_, CN13GN0_ | 1 | **XTCEXMLD** |
| CN13KN0_, CN13MN0_ | 1 | **XTCEXMLG** ⑥ |
| CN13SN0_ | 1 | **XTCEXMLM** |

**XTCEXRL_**

## Reversing Link Kits

| For Use with… | Pkg. Qty. ③ | Catalog Number |
|---|---|---|
| CN13BN0_, CN13CN0_ | 1 | **XTCEXRLC** |
| CN13DN0_, CN13GN0_ | 1 | **XTCEXRLD** |
| CN13KN0_, CN13MN0_ | 1 | **XTCEXRLG** |

Main current wiring for reversing combinations. Includes paralleling bridge and reversing bridge. Does not include mechanical interlock, see table on this page.

**XTCEXTLA400**

## Terminal Lug Assembly

| For Use with… | Pkg. Qty. ③ | Catalog Number |
|---|---|---|
| CN13SN0_ | 1 | **XTCEXTLA400** |

For connection of: round conductor, flexible and stranded, flat strip conductor, with control circuit terminal. See **Page V5-T2-74** for terminal capacities.

**XTCEXTS_**

## Terminal Shroud

| For Use with… | Pkg. Qty. ③ | Catalog Number |
|---|---|---|
| CN13SN0_ | 1 | **XTCEXTS400** |

Protection against direct contact with connection lugs when touched vertically from the front.

### *Notes*

① Note dropout delay.
② For AC operated contactors, 50–60 Hz. Sizes 0–5 DC operated contactors and Size 5 AC operated contactors have a built-in suppressor circuit.
③ Orders must be placed in multiples of package quantity listed.
④ In addition to the built-in suppressor circuit for DC actuated contactors. Prevents negative breaking voltage when contactors are used in combination with a safety PLC.
⑤ For two contactors with AC or DC operated magnet system which are horizontally or vertically mounted. For Sizes 0–4, mechanical lifespan is 2.5 x $10^6$ operations and the distance between contactors is 0 mm. For Size 5, mechanical lifespan is 5 x $10^6$ operations and no auxiliary contact can be mounted between the mechanical interlock and the contactor—the distance between contactors is 15 mm.
⑥ XTCEXMLG and XTCEXMLN consist of an interlock element and mounting plate.

## Renewal Parts

2

XTCERENC_

### Replacement Coils

| Voltage | Coil Suffix | Catalog Number |
|---|---|---|
| **Size 0, 1C** | | |
| 110/50 120/60 | **A** | **XTCERENCOILCA** |
| 220/50 240/60 | **B** | **XTCERENCOILCB** |
| 24–27 Vdc | **TD** | **XTCERENCOILCTD** |
| **Size 1, 2** | | |
| 110/50 120/60 | **A** | **XTCERENCOILDA** |
| 220/50 240/60 | **B** | **XTCERENCOILDB** |
| 24–27 Vdc | **TD** | **XTCERENCOILDTD** |
| **Size 3, 4** | | |
| 100–120V 50/60 | **A** | **XTCERENCOILGA** |
| 190–240V 50/60 | **B** | **XTCERENCOILGB** |
| 24–27 Vdc | **TD** | **XTCERENCOILGTD** |
| **Size 5** | | |
| 110–250 Vac/Vdc | **A** | **XTCERENCOILLA** |
| 24–48 Vdc | **TD** | **XTCERENCOILLTD** |

### Replacement Contact Kit

| For Use with… | Catalog Number |
|---|---|
| CN13DN0_, CN13GN0_ | **XTCERENCONTACTD** |
| CN13SN0_ | **XTCERENCONTACTL** |

### Replacement Arc Chamber

| For Use with… | Catalog Number |
|---|---|
| CN13SN0_ | **XTCERENARC250** |

## Technical Data and Specifications

### Auxiliary Contacts

| Description | CN13BN0_, CN13CN0_ | XTCEXFAC_ XTCEXFATC_ | XTCEXFCC_ XTCEXSCC_ | XTCEXFAG_ | XTCEXSBLN_ XTCEXSBN_ XTCEXSBNC_ XTCEXSCN_ XTCEXSCNC_ |
|---|---|---|---|---|---|
| Interlocked opposing contacts with an auxiliary contact module (to IEC 60947-5 -1 Annex L) | — | Yes | Yes | Yes | Yes |
| Break contact (not late-break contact) suitable as a mirror contact (to IEC/EN 60947-4 -1 Annex F) | CN13BN0_, CN13CN0_ | CN13BN0_, CN13CN0_ | CN13BN0_, CN13CN0_ | CN13DN0_, CN13GN0_ | CN13DN0_, CN13GN0_, CN13SN0_ |
| Rated impulse withstand voltage, ($U_{imp}$) Vac | 6000 | 6000 | 6000 | 6000 | 6000 |
| Overvoltage category/pollution degree | III/3 | III/3 | III/3 | III/3 | III/3 |
| Rated insulation voltage, ($U_i$) Vac | 690 | 690 | 690 | 690 | 690 |
| Rated operational voltage, ($U_e$) Vac | 500 | 500 | 500 | 500 | 500 |
| Safe isolation to VDE 0106 Part 101 and Part 101(A) in Vac | | | | | |
| Between coil and auxiliary contacts | 400 | 400 | 400 | 440 | 440 |
| Between the auxiliary contacts | 400 | 400 | 400 | 440 | 440 |
| Rated operational current, $I_e$ | | | | | |
| AC-15 | | | | | |
| 230V | 6A | 6A | 6A | 6A | 6A |
| 380/415V | 4A | 3A | 4A | 4A | 4A |
| 500V | 1.5A | — | 1.5A | 1.5A | 1.5A |
| DC-3 L/R ≤5 ms ① | | | | | |
| 24V | 10A | 10A | 10A | 10A | 10A |
| 60V | 6A | 6A | 6A | 6A | 6A |
| 110V | 3A | 3A | 3A | 3A | 3A |
| 220V | 1A | 1A | 1A | 1A | 1A |
| Conventional thermal current, $I_{th}$ | 16A | 16A | 16A ③ | 10A | 10A |
| Control circuit reliability (at $U_e$ = 24 Vdc, $U_{min}$ = 17 V, $I_{min}$ = 5.4 mA) | $<10^{-8}$, <1 failure at 100 million operations | $<10^{-8}$, <1 failure at 100 million operations | $<10^{-8}$, <1 failure at 100 million operations | $<10^{-8}$, <1 failure at 100 million operations | $<10^{-8}$, <1 failure at 100 million operations |
| Component lifespan, operations x $10^6$ at $U_e$ = 230V, AC-15, 3A | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Short-circuit rating without welding ② | | | | | |
| Maximum fuse, gG/gL | 10A | 10A | 10A | 16A | 16A |

***Notes***

① Making and breaking conditions to DC-13, time L/R contact as stated.
② See fuses overlay for time/current characteristic (on request).
③ Conventional thermal current ($I_{th}$) of XTCEXSCC_ is 10A.

## Parallel Link

| Description | XTCEXPLKB | XTECXPLKC | XTCEXPLKD | XTCEXPLKG | XTCEXPLK185 |
|---|---|---|---|---|---|
| Terminal capacity | | | | | |
| Solid ($mm^2$) | 1–16 | 16 | 16 | — | — |
| Flexible with ferrule ($mm^2$) | 1 x (0.5–25)<br>2 x (0.5–16) | 1 x (16–35) | 1 x (16–120) | — | — |
| Stranded ($mm^2$) | 1 x (0.5–25)<br>2 x (0.5–16) | 1 x (16–50) | 1 x (16–120) | 1 x (35–300)<br>2 x (35–120) | — |
| Flat conductor—number of segments x width x thickness (mm) | 6 x 9 x 0.8 | — | — | 2 x (11 x 21 x 1) | 1 x (6 x 16 x 0.8)<br>2 x (20 x 32 x 0.5)<br>2 x (11 x 21 x 1) |
| Tightening torque (Nm) | 4 | 4 | 14 | — | — |
| Tools | | | | | |
| Pozidriv screwdriver | Size 2 | Size 2 | — | — | — |
| Hexagon socket head spanner—SW (mm) | — | — | 5 | 6 | — |
| Conventional thermal current | | | | | |
| Three-pole ($I_{th}$) A | 50 | 100 | 180 | 400 | — |
| Four-pole ($I_{th}$) A | 60 | — | — | — | — |

## Cable Terminal Block, Flat Cable Terminal

| Description | XTCEXTLA400 | XTCEXPLK185 | XTCEXTFB650 | XTCEXTFB820 |
|---|---|---|---|---|
| Terminal capacity | | | | |
| Stranded ($mm^2$) | 1 x (120–300)<br>2 x (70–240) | — | — | — |
| Stranded (AWG) | 1 x (250–600 kcmil)<br>2 x (2/0–500 kcmil) | — | — | — |
| Flat conductor—number of segments x width x thickness (mm) | — | 1 x (6 x 16 x 0.8)<br>2 x (20 x 32 x 0.5)<br>2 x (11 x 21 x 1) | 1 x (6 x 16 x 0.8)<br>2 x (20 x 32 x 0.5)<br>2 x (11 x 21 x 1) | 1 x (6 x 16 x 0.8)<br>2 x (10 x 40 x 1)<br>2 x (20 x 40 x 0.5) |

## AC Ratings—AC-1 Operation

| Description | CN13B | CN13C | CN13D | CN13G | CN13K | CN13M | CN13S |
|---|---|---|---|---|---|---|---|
| Conventional free air thermal current, three-pole, 50–60 Hz | | | | | | | |
| Open | | | | | | | |
| at 40°C ($I_{th}$) | 40A | 45A | 60A | 80A | 130A | 190A | 490 |
| at 50°C ($I_{th}$) | 38A | 43A | 57A | 71A | 125A | 180A | 438 |
| at 55°C ($I_{th}$) | 37A | 42A | 55A | 68A | 115A | 170A | 418 |
| at 60°C ($I_{th}$) | 35A | 40A | 50A | 65A | 110A | 160A | 400 |
| Enclosed | 32A | 36A | 45A | 58A | 100A | 144A | 315 |
| Conventional free air thermal current, single-pole ($I_{th}$) | | | | | | | |
| Open | 88A | 100A | 125A | 162A | 275A | 400A | — |
| Enclosed | 80A | 90A | 112A | 145A | 250A | 360A | — |

## Space-Savings Contactors—NEMA Sizes 0–2

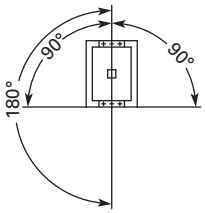
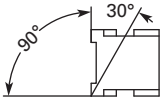
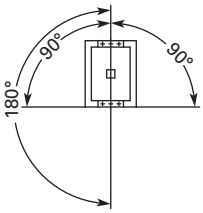
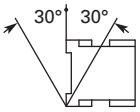
| Description | Size 0<br>CN13BN010_ | Size 1C<br>CN13CN010_ | Size 1<br>CN13DN000_ | Size 2<br>CN13GN000_ |
|---|---|---|---|---|
| **General** | | | | |
| Standards | IEC/EN 60947,<br>VDE 0660, UL, CSA,<br>CCC, RoHS | IEC/EN 60947,<br>VDE 0660, UL, CSA,<br>CCC, RoHS | IEC/EN 60947,<br>VDE 0660, UL, CSA,<br>CCC, RoHS | IEC/EN 60947,<br>VDE 0660, UL, CSA,<br>CCC, RoHS |
| Weights in kg [lb] | | | | |
| AC operated | 0.42 [0.93] | 0.42 [0.93] | 0.9 [2.0] | 0.9 [2.0] |
| DC operated | 0.48 [1.06] | 0.48 [1.06] | 1.1 [2.4] | 1.1 [2.4] |
| Mechanical life—operations | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 |
| Climatic proofing | ① | ① | ① | ① |
| Insulation voltage ($U_i$) Vac | 690 | 690 | 690 | 690 |
| Impulse withstand voltage ($U_{imp}$) Vac | 8000 | 8000 | 8000 | 8000 |
| Operating voltage ($U_e$) Vac | 690 | 690 | 690 | 690 |
| Safe isolation to VDE 0106 Part 101 and Part 101/A1 | | | | |
| Between coil and contacts (Vac) | 440 | 440 | 440 | 440 |
| Between contacts (Vac) | 238 | 440 | 440 | 440 |
| Making capacity (amps) | 238 | 384 | 560 | 910 |
| Breaking capacity (amps) | | | | |
| 220/230V | 170 | 320 | 400 | 650 |
| 380/400V | 170 | 320 | 400 | 650 |
| 500V | 170 | 320 | 400 | 650 |
| 660/690V | 120 | 180 | 250 | 370 |
| Short-circuit protection rating maximum fuse (amps) | | | | |
| Type 2 coordination ② | | | | |
| 400V; gG/gL 500V | 25 | 63 | 63 | 125 |
| 690V; gG/gL 690V | 25 | 35 | 50 | 80 |
| Type 1 coordination ② | | | | |
| 400V; gG/gL 500V | 63 | 125 | 125 | 250 |
| 690V; gG/gL 690V | 50 | 63 | 80 | 100 |
| Degree of protection | IP00 | IP00 | IP00 | IP00 |
| Protection against direct contact when actuated from front (IEC 536) | Finger and back-of-hand proof | Finger and back-of-hand proof | Finger and back-of-hand proof | Finger and back-of-hand proof |
| Terminal capacity main cable—screw terminals | | | | |
| Solid ($mm^2$) | 1 x (0.75–16)<br>2 x (0.75–10) | 1 x (0.75–16)<br>2 x (0.75–10) | 1 x (0.75–16)<br>2 x (0.75–10) | 1 x (0.75–16)<br>2 x (0.75–10) |
| Flexible with ferrule ($mm^2$) | 1 x (0.75–16)<br>2 x (0.75–10) | 1 x (0.75–16)<br>2 x (0.75–10) | 1 x (2.5–35)<br>2 x (2.5–25) | 1 x (2.5–35)<br>2 x (2.5–25) |
| Stranded ($mm^2$) | 1 x 16 | 1 x 16 | 1 x (16–50)<br>2 x (16–35) | 1 x (16–50)<br>2 x (16–35) |
| Solid or stranded (AWG) | 18–6 | 18–6 | 12–2 | 12–2 |
| Flat conductor<br>(number of segments x width x thickness) (mm) | — | — | 2 x (6 x 9 x 0.8) | 2 x (6 x 9 x 0.8) |

***Notes***

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.

## Space-Savings Contactors—NEMA Sizes 0–2, continued



| Description | Size 0<br>CN13BN010_ | Size 1C<br>CN13CN010_ | Size 1<br>CN13DN000_ | Size 2<br>CN13GN000_ |
|---|---|---|---|---|
| **General, continued** | | | | |
| Main cable connection screw/bolt | M5 | M5 | M6 | M6 |
| Tightening torque | | | | |
| Nm | 3 | 3 | 3.3 | 3.3 |
| Lb-in | 26.6 | 26.6 | 29.2 | 29.2 |
| Terminal capacity control circuit cable—screw terminals | | | | |
| Solid ($mm^2$) | 1 x (0.75–4)<br>2 x (0.75–4) | 1 x (0.75–4)<br>2 x (0.75–4) | 1 x (0.75–4)<br>2 x (0.75–4) | 1 x (0.75–4)<br>2 x (0.75–4) |
| Flexible with ferrule ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Solid or stranded (AWG) | 18–14 | 18–14 | 18–14 | 18–14 |
| Control circuit cable connection screw/bolt | M3.5 | M3.5 | M3.5 | M3.5 |
| Tightening torque | | | | |
| Nm | 1.2 | 1.2 | 1.2 | 1.2 |
| Lb-in | 10.6 | 10.6 | 10.6 | 10.6 |
| Tools | | | | |
| Main and control circuit cable—screw terminals | Size 2 | Size 2 | Size 2 | Size 2 |
| Pozidriv screwdriver | 0.8 x 5.5 | 0.8 x 5.5 | 0.8 x 5.5 | 0.8 x 5.5 |
| Standard screwdriver | 1 x 6 | 1 x 6 | 1 x 6 | 1 x 6 |
| Terminal capacity control circuit cable—spring cage terminals | | | | |
| Solid ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Flexible ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Flexible with ferrule ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Solid or stranded (AWG) | 18–14 | 18–14 | 18–14 | 18–14 |
| Tools | | | | |
| Main and control circuit cable—spring cage terminals | | | | |
| Stripping length (mm) | 10 | 10 | 10 | 10 |
| Screwdriver blade width (mm) | 3.5 | 3.5 | 3.5 | 3.5 |
| Mounting position, AC and DC operated |  |  |  |  |
| Ambient temperature | | | | |
| Open | –25 to 60°C<br>[–13 to 140°F] | –25 to 60°C<br>[–13 to 140°F] | –25 to 60°C<br>[–13 to 140°F] | –25 to 60°C<br>[–13 to 140°F] |
| Enclosed | –25 to 40°C<br>[–13 to 104°F] | –25 to 40°C<br>[–13 to 104°F] | –25 to 40°C<br>[–13 to 104°F] | –25 to 40°C<br>[–13 to 104°F] |
| Ambient storage temperature | –40 to 80°C<br>[–40 to 176°F] | –40 to 80°C<br>[–40 to 176°F] | –40 to 80°C<br>[–40 to 176°F] | –40 to 80°C<br>[–40 to 176°F] |
| **Environmental** | | | | |
| Mechanical shock resistance (IEC/EN 60068-2-27) | | | | |
| Main contact—NO Contact | 10 | 10 | 10 | 1 |
| Auxiliary contact—NO Contact | 7 | 7 | 7 | 7 |
| Auxiliary contact—NC Contact | 5 | 5 | 5 | 5 |
| Overvoltage category/pollution degree | III/3 | III/3 | III/3 | III/3 |

## Space-Savings Contactors—NEMA Sizes 3, 4

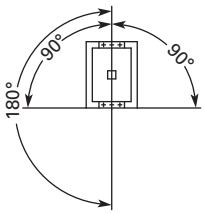
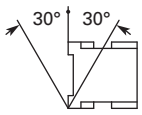
| Description | Size 3<br>CN13KN000_ | Size 4<br>CN13MN000_ |
|---|---|---|
| **General** | | |
| Standards | IEC/EN 60947,<br>VDE 0660, UL, CSA,<br>CCC, RoHS | IEC/EN 60947,<br>VDE 0660, UL, CSA,<br>CCC, RoHS |
| Weights in kg [lb] | | |
| AC operated | 2 [4.41] | 2 [4.41] |
| DC operated | 2.1 [4.63] | 2.1 [4.63] |
| Mechanical life—operations | 10,000,000 | 10,000,000 |
| Climatic proofing | ① | ① |
| Insulation voltage ($U_i$) Vac | 690 | 690 |
| Impulse withstand voltage ($U_{imp}$) Vac | 8000 | 8000 |
| Operational voltage ($U_e$) Vac | 690 | 690 |
| Safe isolation to VDE 0106 Part 101 and Part 101/A1 | | |
| Between coil and contacts (Vac) | 690 | 690 |
| Between contacts (Vac) | 690 | 690 |
| Making capacity (amps) | 1610 | 2100 |
| Breaking capacity (amps) | | |
| 220/230V | 1150 | 1500 |
| 380/400V | 1150 | 1500 |
| 500V | 1150 | 1500 |
| 660/690V | 1100 | 1200 |
| 1000V | — | — |
| Short-circuit protection rating maximum fuse | | |
| Type 2 coordination ② | | |
| 400V; gG/gL 500V | 250 | 25 |
| 690V; gG/gL 690V | 25 | 250 |
| Type 1 coordination ② | | |
| 400V; gG/gL 500V | 250 | 250 |
| 690V; gG/gL 690V | 250 | 250 |
| Degree of protection | IP00 | IP00 |
| Protection against direct contact when actuated from front (IEC 536) | Finger and<br>back-of-hand proof | Finger and<br>back-of-hand proof |
| Terminal capacity main cable—screw terminals | | |
| Solid ($mm^2$) | — | — |
| Flexible with ferrule ($mm^2$) | 1 x (10–95)<br>2 x (10–70) | 1 x (10–95)<br>2 x (10–70) |
| Stranded ($mm^2$) | 1 x (10–95)<br>2 x (10–20) | 1 x (10–95)<br>2 x (10–20) |
| Flat conductor<br>(number of segments x width x thickness) (mm) | 2 x (6 x 16 x 0.8) | 2 x (6 x 16 x 0.8) |
| Solid or stranded (AWG) | 8–3/0 | 8–3/0 |
| Main cable connection screw/bolt | M10 | M10 |
| Tightening torque | | |
| Nm | 14 | 14 |
| Lb-in | 123.9 | 123.9 |

***Notes***

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.

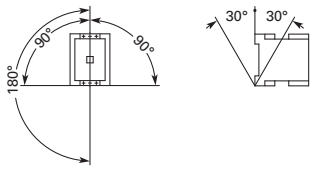
## Space-Savings Contactors—NEMA Sizes 3, 4, continued



| Description | Size 3<br>CN13KN000_ | Size 4<br>CN13MN000_ |
|---|---|---|
| **General, continued** | | |
| Terminal capacity control circuit cable—screw terminals | | |
| Solid ($mm^2$) | 1 x (0.75–4)<br>1 x (0.75–4) | 1 x (0.75–4)<br>1 x (0.75–4) |
| Flexible with ferrule ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Solid or stranded (AWG) | 18–14 | 18–14 |
| Control circuit cable connection screw/bolt | M3.5 | M3.5 |
| Tightening torque | | |
| Nm | 1.2 | 1.2 |
| Lb-in | 10.6 | 10.6 |
| Tools | | |
| Main circuit cable—screw terminals | | |
| Hexagon socket-head spanner (mm) | 5 | 5 |
| Control circuit cable—screw terminals | Size 2 | Size 2 |
| Pozidriv screwdriver | 0.8 x 5.5 | 0.8 x 5.5 |
| Standard screwdriver | 1 x 6 | 1 x 6 |
| Terminal capacity control circuit cable—spring cage terminals | | |
| Solid ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Flexible ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Flexible with ferrule ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Solid or stranded (AWG) | 18–14 | 18–14 |
| Tools | | |
| Control circuit cable—spring cage terminals | | |
| Stripping length (mm) | 10 | 10 |
| Screwdriver blade width (mm) | 3.5 | 3.5 |
| Mounting position, AC and DC operated |  |  |
| Ambient temperature | | |
| Open | –25 to 60°C<br>[–13 to 140°F] | –25 to 60°C<br>[–13 to 140°F] |
| Enclosed | –25 to 40°C<br>[–13 to 104°F] | –25 to 40°C<br>[–13 to 104°F] |
| Ambient storage temperature | –40 to 80°C<br>[–40 to 176°F] | –40 to 80°C<br>[–40 to 176°F] |
| **Environmental** | | |
| Mechanical shock resistance<br>(IEC/EN 60068-2-27) | | |
| Half-sinusoidal shock 10 ms | | |
| Main contact—NO contact | 10g | 10g |
| Auxiliary contact—NO contact | 7g | 7g |
| Auxiliary contact—NC contact | 5g | 5g |
| Overvoltage category/pollution degree | III/3 | III/3 |

## Space-Savings Contactors—NEMA Size 5

| Description | Size 5 CN13SN022_ |
|---|---|
| **General** | |
| Standards | IEC/EN 60947, VDE 0660, UL, CSA |
| Weights in kg [lb] | 6.5 [14.3] |
| Mechanical life—operations | 10,000,000 |
| Mechanical operating frequency (ops/hr) | |
| AC operated | 3000 |
| DC operated | 3000 |
| Climatic proofing | ① |
| Insulation voltage ($U_i$) Vac | 1000 |
| Impulse withstand voltage ($U_{imp}$) Vac | 8000 |
| Operating voltage ($U_e$) Vac | 1000 |
| Safe isolation to VDE 0106 Part 101 and Part 101/A1 | |
| Between coil and contacts (Vac) | 500 |
| Between contacts (Vac) | 500 |
| Making capacity (amps) | 3000 |
| Breaking capacity (amps) | |
| 220/230V | 2500 |
| 380/400V | 2500 |
| 500V | 2500 |
| 660/690V | 2500 |
| 1000V | 760 |
| Short-circuit protection rating maximum fuse | |
| Type 2 coordination ② | |
| 400V; gG/gL 500V | 315 |
| 690V; gG/gL 690V | 315 |
| 1000V; gG/gL 1000V | 160 |
| Type 1 coordination ② | |
| 400V; gG/gL 500V | 400 |
| 690V; gG/gL 690V | 400 |
| 1000V; gG/gL 1000V | 200 |
| Degree of protection | IP00 |
| Protection against direct contact when actuated from front (IEC 536) | Finger and back-of-hand proof with terminal shroud or terminal block |
| Main cable cross-section | |
| Flexible with cable lug ($mm^2$) | 50–240 |
| Stranded with cable lug ($mm^2$) | 70–240 |
| Solid or stranded (AWG) | 1/0–250 kcmil |
| Flat conductor (mm) | ③ |
| Bus bar—width in mm | 25 |
| Main cable connection screw/bolt | M10 |
| Tightening torque | |
| Nm | 24 |
| Lb-in | 213 |

| Description | Size 5 CN13SN022_ |
|---|---|
| **General, continued** | |
| Control circuit cable cross-sections | |
| Solid ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Flexible with ferrule ($mm^2$) | 1 x (0.75–2.5)<br>2 x (0.75–2.5) |
| Solid or stranded (AWG) | 2 x (18–12) |
| Control circuit cable connection screw/bolt | M3.5 |
| Tightening torque | |
| Nm | 1.2 |
| Lb-in | 10.6 |
| Tools | |
| Main cable wrench | 16 mm |
| Control circuit cable pozidriv screwdriver | Size 2 |
| Mounting position, AC and DC operated | |
| Ambient temperature | –25 to 60°C [–13 to 140°F] |
| Ambient storage temperature | –40 to 80°C [–40 to 176°F] |
| **Environmental** | |
| Mechanical shock Resistance (IEC/EN 60068-2-27) |  |
| Half-sinusoidal shock 10 ms | |
| Main contact—NO contact | 10g |
| Auxiliary contact—NO contact | 10g |
| Auxiliary contact—NC contact | 8g |
| Overvoltage category/pollution degree | III/3 |
| Switching capacity, kVAR ④ | |
| Individual compensation | |
| 230V | — |
| 400/420/440V | — |
| 525V | — |
| 690V | — |
| Group compensation, with choke | |
| 230V | 100 |
| 400/420/440V | 190 |
| 525V | 260 |
| 690V | 340 |
| Group compensation, without choke | |
| 230V | — |
| 400/420/440V | — |
| 525V | — |
| 690V | — |

***Notes***

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.
③ Screw tightening with flat cable terminal or cable terminal blocks. See terminal capacity for cable terminal blocks.
④ When using contactors for group compensation, a minimum inductance of approx. 6 uh per capacitor must be available to limit the high inrush current peaks. This corresponds to an air-cored coil with five windings and a coil diameter of approximately 140 mm. The conductor cross-section must be selected according to the rated current per phase.

**XTOE/*XT* Electronic Overload Relay**

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An Eaton Green Solution

# XTOE/*XT* Electronic Overload Relay

## Product Description

Eaton's new electronic overload relay (EOL) is the most compact, high-featured, economical product in its class. Designed on a global platform, the new EOL covers the entire power control spectrum including NEMA, IEC and DP Contactors. The standard NEMA and DP versions are offered with the C440 designation while the Space-Savings NEMA and IEC versions have the XTOE designation. The electronic design provides reliable, accurate and value driven protection and communications capabilities in a single compact device. It is the flexible choice for any application requiring easy-to-use, reliable protection.

Eaton has a long history of innovations and product development in motor control and protection, including both traditional NEMA, as well as IEC control. It was from this experience that the XTOE was developed, delivering new solutions to meet today's demands.

XTOE is a self-powered electronic overload relay available up to 175A as a self contained unit. With external CTs, XTOE can protect motor up to 1500 FLA. Available add-on accessories include remote reset capability and communication modules with I/O for DeviceNet, PROFIBUS, Modbus, EtherNet/IP, and Modbus TCP.

## Features and Benefits

***Features***

- Reliable, accurate, electronic motor protection
- Easy to select, install and maintain
- Compact size
- Flexible, intelligent design
- Global product offering—available with NEMA, IEC and DP power control

### Size/Range

- Broad FLA range (0.33–1500A)
- Selectable trip class (10A, 10, 20, 30)
- Direct mounting to NEMA, IEC and DP contactors
- Most compact electronic overload in its class

### Motor Control

- Two B600 alarm (NO) and fault (NC) contacts
- Test/Trip button

### Motor Protection

- Thermal overload
- Phase loss
- Selectable (ON/OFF) phase unbalance
- Selectable (ON/OFF) ground fault

### User Interface

- Large FLA selection dial
- Trip status indicator
- Operating mode LED
- DIP switch selectable trip class, phase unbalance and ground fault
- Selectable Auto/Manual reset

### Feature Options

- Remote reset
  - 120 Vac
  - 24 Vac
  - 24 Vdc
- Tamper-proof cover
- Communications modules
  - Modbus RTU RS-485
  - DeviceNet with I/O
  - PROFIBUS with I/O
  - Modbus RTU with I/O
  - Ethernet IP with I/O
  - Modbus TCP with I/O

***Benefits***

### Reliability and Improved Uptime

- XTOE provides the users with peace of mind knowing that their assets are protected with the highest level of motor protection and communication capability in its class
- Extends the life of plant assets with selectable motor protection features such as trip class, phase unbalance and ground fault
- Protects against unnecessary downtime by discovering changes in your system (line/load) with remote monitoring capabilities
- Status LED provides added assurance that valuable assets are protected by indicating the overload operational status

### Flexibility

- Available with NEMA, IEC and DP contactors
- Improves return on investment by reducing inventory carrying costs with wide FLA adjustment (5:1) and selectable trip class
- Design incorporates built-in ground fault protection thus eliminating the need for separate CTs and modules
- Flexible communication with optional I/O enables easy integration into plant management systems for remote monitoring and control
- Available as an open component and in enclosed control and motor control center assemblies

### Monitoring Capabilities

- Individual phase currents RMS
- Average three-phase current RMS
- Thermal memory
- Fault indication (overload, phase loss, phase unbalance, ground fault)

### Safety

- IP 20 rated terminal blocks
- Available in Eaton's industry leading FlashGard MCCs
- Tested to the highest industry standards such as UL, CSA, CE and IEC
- RoHS compliant

### Standards and Certifications

- UL
- CSA
- CE
- NEMA
- IEC/EN 60947 VDE 0660
- ISO 13849-1 (EN954-1)
- RoHS
- ATEX directive 94/9/EC
- Equipment Group 2, Category 2

## Electronic Overload Education

| Description | Definition | Cause | Effect if not Protected | XTOE/*XT* Protection |
|---|---|---|---|---|
| **Motor Protection** | | | | |
| Thermal overload | Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor. | • An increase in the load or torque that is being driven by the motor.<br>• A low voltage supply to the motor causes the current to go high to maintain the power needed.<br>• A poor power factor causing above normal current draw. | • Increase in current draw leads to heat and insulation breakdown, which can cause system failure.<br>• Increase in current can increase power consumption and waste valuable energy. | • Thermal trip behavior is defined by UL, CSA and IEC standards.<br>• Trip class is settable from 10A, 10, 20, 30 |
| Ground fault | A line to ground fault. | A current leakage path to ground. | An undetected ground fault can burn through multiple insulation windings, ultimately leading to motor failure, not to mention risk to equipment or personnel | Fixed protective setting that takes the starter offline if ground fault current exceeds 50% of the FLA dial setting, i.e., if the FLA dial is set to 12A, the overload relay will trip if the ground current exceeds 6A. |
| Unbalanced phases (voltage and current) | Uneven voltage or current between phases in a three-phase system. | When a three-phase load is powered with a poor quality line, the voltage per phase may be unbalanced. | Unbalanced voltage causes large unbalanced currents and as a result this can lead to motor stator windings being overloaded, causing excessive heating, reduced motor efficiency and reduced insulation life. | Fixed protective setting that takes the starter offline if a phase drops below 50% of the other two phases. |
| Phase loss—current (single-phasing) | One of the three-phase voltages is not present. | Multiple causes, loose wire, improper wiring, grounded phase, open fuse, etc. | Single-phasing can lead to unwanted motor vibrations in addition to the results of unbalanced phases as listed above. | Fixed protective setting that takes the starter offline if a phase is lost. |

## Catalog Number Selection



### XT Electronic Overload Relay—NEMA Space-Savings

**XT OE 1P6 C CS S**

| Designation |
|---|
| ***XT*** = NEMA Space-Savings control |

| Type |
|---|
| **OE** = Electronic overload relay |

| Mounting |
|---|
| **Blank** = Direct to contactor<br>**P** = Pass-through<br>**S** = Separate mount (Frames C and G only) |

| Trip Type |
|---|
| **CS** = Selectable Class 10A, 10, 20, 30<br>**GS** = Ground fault with selectable Class 10, 20 |

| Overload Range | Contactor Frame |
|---|---|
| **1P6** = 0.33–1.65A<br>**005** = 1–5A<br>**020** = 4–20A | **C** = Space-Savings Size 0 |
| **1P6** = 0.33–1.65A<br>**005** = 1–5A<br>**020** = 4–20A<br>**045** = 9–45A | **C** = Space-Savings Size 1C |
| **1P6** = 0.33–1.65A<br>**005** = 1–5A<br>**020** = 4–20A | **D** = Space-Savings Size 1 |
| **045** = 9–45A | **D** = Space-Savings Size 2 |
| **100** = 20–100A | **G** = Space-Savings Size 3 |
| **175** = 35–175A | **G** = Space-Savings Size 4 |

## Product Selection

### *XT Electronic Overload Relays*

**XTOE for Direct Mount to NEMA Size 1**

#### *XT* Electronic Overload Relays for Direct Mount to NEMA Space-Savings Contactors

| NEMA Space-Savings Size | For Use with Contactor | Overload Range (Amps) | Contact Sequence | Frame Size | Auxiliary Contact Configuration | Catalog Number |
|---|---|---|---|---|---|---|
| 0 | CN13BN010_ | 0.35–1.65 | 97 95<br>2 4 6 98 96 | 45 mm | NO-NC | **XTOE1P6CCS** |
| | | 1–5 | | | | **XTOE005CCS** |
| | | 4–20 | | | | **XTOE020CCS** |
| 1C | CN13CN010_ | 0.35–1.65 | 97 95<br>2 4 6 98 96 | 45 mm | NO-NC | **XTOE1P6CCS** |
| | | 1–5 | | | | **XTOE005CCS** |
| | | 4–20 | | | | **XTOE020CCS** |
| | | 9–45 | | | | **XTOE045CCS** |
| 1 | CN13DN000_ | 1–5 | 97 95<br>2 4 6 98 96 | 55 mm | NO-NC | **XTOE005DCS** |
| | | 4–20 | | | | **XTOE020DCS** |
| | | 9–45 | | | | **XTOE045DCS** |
| 2 | CN13GN000_ | 9–45 | 97 95<br>2 4 6 98 96 | 55 mm | NO-NC | **XTOE045DCS** |
| | | 20–100 | | | | **XTOE100DCS** |
| 3 | CN13KN000_ | 20–100 | 97 95<br>2 4 6 98 96 | 55 mm | NO-NC | **XTOE100GCS** |
| 4 | CN13MN000_ | 35–175 | 97 95<br>2 4 6 98 96 | 110 mm | NO-NC | **XTOE175GCS** |

**XTOE for Direct Mount to NEMA Size 4**

#### *XT* Electronic Overload Relays with Ground Fault for Direct Mount to NEMA Space-Savings Contactors

| NEMA Space-Savings Size | For Use with Contactor | Overload Range (Amps) | Contact Sequence | Frame Size | Auxiliary Contact Configuration | Catalog Number |
|---|---|---|---|---|---|---|
| 0 | CN13BN010_ | 0.33–1.65 | 97 95<br>2 4 6 98 96 | 45 mm | NO-NC | **XTOE1P6CGS** |
| | | 1–5 | | | | **XTOE005CGS** |
| | | 4–20 | | | | **XTOE020CGS** |
| 1C | CN13CN010_ | 0.33–1.65 | 97 95<br>2 4 6 98 96 | 45 mm | NO-NC | **XTOE1P6CGS** |
| | | 1–5 | | | | **XTOE005CGS** |
| | | 4–20 | | | | **XTOE020CGS** |
| | | 9–45 | | | | **XTOE045CGS** |
| 1 | CN13DN000_ | 0.33–1.65 | 97 95<br>2 4 6 98 96 | 55 mm | NO-NC | **XTOE1P6DGS** |
| | | 1–5 | | | | **XTOE005DGS** |
| | | 4–20 | | | | **XTOE020DGS** |
| | | 9–45 | | | | **XTOE045DGS** |
| 2 | CN13GN000_ | 9–45 | 97 95<br>2 4 6 98 96 | 55 mm | NO-NC | **XTOE045DGS** |
| | | 20–100 | | | | **XTOE100DGS** |
| 3 | CN13KN000_ | 20–100 | 97 95<br>2 4 6 98 96 | 55 mm | NO-NC | **XTOE100GGS** |
| 4 | CN13MN000_ | 35–175 | 97 95<br>2 4 6 98 96 | 110 mm | NO-NC | **XTOE175GGS** |

1–5A OL with CTs

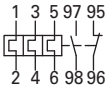
## *XT* Electronic Overload Relays for use with Size 5 NEMA Space-Savings Contactors

Use CTs and 1-5A ***XT*** overload relay. CT kit does not include overload relay (order separately).

| Space-Savings Contactor Size | For Use with Contactor | CT Range (Amps) | Description | CT Kit Catalog Number | Terminal Size | Overload Relay Catalog Number | Overload Relay with Ground Fault Catalog Number |
|---|---|---|---|---|---|---|---|
| 1 | CN13SN022_ | 60-300 | 300: 5 panel-mount CT kit with integrated lugs | **ZEB-XCT300** | 750 kcmil (2) 250 kcmil 3/0 Cu/Al | **XTOE005CCSS** | **XTOE005CGSS** |

45 mm *XT* for Separate Mount

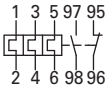
## *XT* Electronic Overload Relays for Separate Mount

| Overload Range (Amps) | Frame Size | Contact Sequence | Type | Overload Relay Catalog Number | Overload Relay with Ground Fault Catalog Number |
|---|---|---|---|---|---|
| **Overload Relay** | | | | | |
| 0.33–1.65 | 45 mm |  | ZEB32-1,65/KK | **XTOE1P6CCSS** | **XTOE1P6CGSS** |
| 1–5 | | | ZEB32-5/KK | **XTOE005CCSS** | **XTOE005CGSS** |
| 4–20 | | | ZEB32-20/KK | **XTOE020CCSS** | **XTOE020CGSS** |
| 9–45 | | | ZEB32-45/KK | **XTOE045CCSS** | **XTOE045CGSS** |
| 20–100 | 55 mm | | ZEB150-100/KK | **XTOE100GCSS** | **XTOE100GGSS** |
| 35–175 | 110 mm | | ZEB150-175/KK | **XTOE175GCSS** | **XTOE175GGSS** |



## *XT* Electronic Overload Relay for Pass-Through Design

Pass-through design does not include any lugs to land wires.
Terminate motor leads directly on contactor.

| Overload Range (Amps) | Frame Size | Contact Sequence | Type | Overload Relay Catalog Number | Overload Relay with Ground Fault Catalog Number |
|---|---|---|---|---|---|
| 35–175 | 110 mm |  | ZEB150-175/PT | **XTOE175GCSP** | **XTOE175GGSP** |

## Accessories

### *CT Kits*

**Accessories**

| | Description | Catalog Number |
|---|---|---|
| **Safety Cover** | **Safety Cover** | |
| | Clear Lexan cover that mounts on top of the FLA dial and DIP switches when closed. | **ZEB-XSC** |
| **Reset Bar** | **Reset Bar** | |
| | Assembles to the top of the overload to provide a larger target area for door mounted reset operators. | **ZEB-XRB** |
| **Remote Reset** | **Remote Reset** | |
| | Remote reset module (24 Vdc) ① | **C440-XCOM** |
| | Remote reset module (120 Vac) ① | **ZEB-XRR-120** |
| | Remote reset module (24 Vac) ① | **ZEB-XRR-24** |

### *Communication*

The XTOE is provided with two levels of communication capability.

**Basic Communication via Expansion Module—Monitoring Only**

Basic communication on the XTOE is accomplished using an expansion module. The expansion module plugs into the expansion bay on the XTOE overload relay, enabling communications with the overload via their Modbus RTU (RS-485) network. No additional parts are required. See figure below.

**Basic Communication—Modbus**

**Advanced Communication—Monitoring and Control**

XTOE also has the ability to communicate on industrial protocols such as DeviceNet, PROFIBUS, Modbus RTU and Modbus TCP, and EtherNet/IP while providing control capability using I/O.

An expansion module (mentioned earlier) combined with a communication adapter and a communication module allows easy integration onto the customer's network. See figure below.

**Advanced Communication—Communication Adapter with Communication Module**

**Advanced Communication—Communication Module**

The communication adapter comes standard with four inputs and two outputs (24 Vdc or 120 Vac) while providing the customer with flexible mounting options (DIN rail or panel). See figure below,

***Note***

① Customer can wire remote mounted button to reset module (i.e., 22 mm pushbutton, catalog number M22-D-B-GB14-K10).

The following information can be viewed using the communication option:

- Motor status—running, stopped, tripped or resetting
- Individual rms phase currents (A, B, C)
- Average of three-phase rms current
- Percent thermal capacity
- Fault codes (only available prior to reset)
- Percent phase unbalance
- Ground fault current and percent
- Overload relay settings—trip class, DIP switch selections, reset selections
- Modbus address (can be set over the network)

## Communication Accessories

| | Description | Catalog Number |
|---|---|---|
| **Expansion Module** | Expansion module (Remote Reset/Modbus RTU, RS-485 Communication) | **C440-XCOM** |
| **Communication Adapter** | Communication adapter kit (DIN C Panel mounted adapter, required for advance communication option) | **C440-COM-ADP** ① |
| | DeviceNet communication module kit—120V I/O (consists of C440-XCOM + C441K + C440-COM-ADP) | **C440-DN-120** |
| | DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441L + C440-COM-ADP) | **C440-DN-24** |
| | PROFIBUS communication module kit—120V I/O (consists of C440-XCOM + C441S + C440-COM-ADP) | **C440-DP-120** |
| | PROFIBUS communication module kit—24V I/O (consists of C440-XCOM + C441Q + C440-COM-ADP) | **C440-DP-24** |
| | Modbus communication module kit—120V I/O (consists of C440-XCOM + C441N + C440-COM-ADP) | **C440-MOD-120** |
| | Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441P + C440-COM-ADP) | **C440-MOD-24** |
| | Modbus TCP/Ethernet IP communication module kit—120V I/O (consists of C440-XCOM + C441U) | **C440-ET-120** |
| | Modbus TCP/Ethernet IP communication module kit—24V I/O (consists of C440-XCOM + C441V) | **C440-ET-24** |

***Note***

① C440-COM-ADP Din C Panel adapter not required for ModbusTCP / EtherNet/IP communication module.

### *Modbus Communication Module*

The Modbus module combined with an expansion module and a communication adapter provide Modbus communication capability to the XTOE electronic overload relay.

**Modbus Communication Module**

**Features and Benefits**

- The Modbus communication module is capable of baud rates up to 115K
- The Modbus address and baud rate configuration can be easily changed using the HMi user interface
- Modbus address and baud rate are set via convenient DIP switches; LEDs are provided to display Modbus traffic
- Configuration with common Modbus configuration tools
- Terminals
  - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
  - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
  - 4IN/2OUT
  - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF

### *DeviceNet Communication Modules*

The DeviceNet Communication Module provides monitoring and control for the XTOE overload relay from a single DeviceNet node. These modules also offer convenient I/O in two voltage options, 24 Vdc and 120 Vac.

**DeviceNet Communication Module**

**Features and Benefits**

- Communication to DeviceNet uses only one DeviceNet MAC ID
- Configuration
  - DeviceNet MAC ID and Baud rate are set via convenient DIP switches with an option to set from the network
  - Advanced configuration available using common DeviceNet tools
- Terminals
  - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
  - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
  - 4IN/2OUT
  - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF
- Combined status LED

### *PROFIBUS Communication Modules*

The PROFIBUS module combined with an expansion module and a communication adapter provide Modbus communication capability to the XTOE electronic overload relay.

**PROFIBUS Communication Module**

**Features and Benefits**

- The PROFIBUS communication module is capable of baud rates up to 12 Mb
- PROFIBUS address is set via convenient DIP switches; LEDs are provided to display PROFIBUS status
- Intuitive configuration with common PROFIBUS configuration tools
- Terminals
  - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
  - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
  - 4IN/2OUT
  - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF

### *Modbus TCP / EtherNet/IP Communication Modules*

The Ethernet module combines user selectable Modbus TCP and EtherNet/IP protocols in a single device. A communication adapter is not required for this module as it is designed for DIN/Panel-Mounting. Combined with an expansion module, Modbus TCP and EtherNet/IP capability are added to the XTOE overload relay.

**Modbus TCP / EtherNet/IP Communication Module**

**Features and Benefits**

- Supports EtherNet/IP Protocol
- Supports Modbus TCP Protocol
- Integrated web page for device monitoring and configuration
- Dual Ethernet ports with integrated switch
- Can simultaneously support data access from EtherNet/IP originators and Modbus TCP clients

## Technical Data and Specifications

### Electronic Overload Relays up to 1500A

| Description | Specification<br>45 mm | 55 mm | 110 mm |
|---|---|---|---|
| **Electrical Ratings** | **Range** | **Range** | **Range** |
| Operating voltage (three-phase) and frequency | 690 Vac (60/50 Hz) | 690 Vac (60/50 Hz) | 690 Vac (60/50 Hz) |
| **FLA Range** | | | |
| | 0.33–1.65A<br>1–5A<br>4–20A<br>9–45A | 20–100A | 28–140A (NEMA)<br>35–175A (IEC) |
| **Use with Contactors** | | | |
| Space-Savings NEMA Size | 0, 1C | 1, 2, 3 | 4 |
| **Trip Class** | | | |
| | 10A, 10, 20, 30<br>Selectable | 10A, 10, 20, 30<br>Selectable | 10A, 10, 20, 30<br>Selectable |
| **Motor Protection** | | | |
| Thermal overload setting | 1.05 x FLA: does not trip<br>1.15 x FLA: overload trip | 1.05 x FLA: does not trip<br>1.15 x FLA: overload trip | 1.05 x FLA: does not trip<br>1.15 x FLA: overload trip |
| **Feature** | **Range** | **Range** | **Range** |
| Phase loss | Fixed threshold 50% | Fixed threshold 50% | Fixed threshold 50% |
| Phase unbalance (selectable: enable/disable) | Fixed threshold 50% | Fixed threshold 50% | Fixed threshold 50% |
| Ground fault (selectable: enable/disable) | 50% of FLA dial setting<br>>150% = 2 sec<br>>250% = 1 sec | 50% of FLA dial setting<br>>150% = 2 sec<br>>250% = 1 sec | 50% of FLA dial setting<br>>150% = 2 sec<br>>250% = 1 sec |
| Reset | Manual/automatic | Manual/automatic | Manual/automatic |
| **Indicators** | | | |
| Trip status | Orange flag | Orange flag | Orange flag |
| Mode LED | One flash: Overload operating properly<br>Two flashes: Current is above FLA dial setting—pending trip | One flash: Overload operating properly<br>Two flashes: Current is above FLA dial setting—pending trip | One flash: Overload operating properly<br>Two flashes: Current is above FLA dial setting—pending trip |
| **Options** | | | |
| Remote reset | Yes | Yes | Yes |
| Reset bar | Yes | Yes | Yes |
| Communication expansion module | Yes | Yes | Yes |
| Communication adapter | Yes | Yes | Yes |
| **Capacity** | | | |
| Load terminals | | | |
| Terminal capacity | 12–10 AWG (4–6 $mm^2$)<br>8–6 AWG (6–16 $mm^2$) | 6–1 AWG (16–50 $mm^2$) | 8–4/0 AWG (10–95 $mm^2$) |
| Tightening torque | 20–25 lb-in (2.3–2.8 Nm)<br>25–30 lb-in (2.8–3.4 Nm) | 25–30 lb-in (2.8–3.4 Nm) | 124 lb-in (14 Nm) |
| Input, auxiliary contact and remote reset terminals | | | |
| Terminal capacity | 2 x (18–12) AWG | 2 x (18–12) AWG | 2 x (18–12) AWG |
| Tightening torque | 7–11 lb-in (0.8–1.2 Nm) | 7–11 lb-in (0.8–1.2 Nm) | 7–11 lb-in (0.8–1.2 Nm) |
| **Voltages** | | | |
| Insulation voltage $U_i$ (three-phase) | 690 Vac | 690 Vac | 690 Vac |
| Insulation voltage $U_i$ (control) | 500 Vac | 500 Vac | 500 Vac |
| Rated impulse withstand voltage | 6000 Vac | 6000 Vac | 6000 Vac |
| Overvoltage category/pollution degree | III/3 | III/3 | III/3 |

## Electronic Overload Relays up to 1500A, continued



| Description | Specification 45 mm | 55 mm | 110 mm |
|---|---|---|---|
| **Auxiliary and Control Circuit Ratings** | | | |
| Conventional thermal continuous current | 5A | 5A | 5A |
| Rated operational current—IEC AC-15 | | | |
| Make contact (1800 VA) | | | |
| 120V | 15A | 15A | 15A |
| 240V | 15A | 15A | 15A |
| 415V | 0.5A | 0.5A | 0.5A |
| 500V | 0.5A | 0.5A | 0.5A |
| Break contact (180 VA) | | | |
| 120V | 1.5A | 1.5A | 1.5A |
| 240V | 1.5A | 1.5A | 1.5A |
| 415V | 0.9A | 0.9A | 0.9A |
| 500V | 0.8A | 0.8A | 0.8A |
| IEC DC-13 (L/R F 15 ms1) | | | |
| 0–250V | 1.0A | 1.0A | 1.0A |
| Rated operational current—UL B600 | | | |
| Make contact (3600 VA) | | | |
| 120V | 30A | 30A | 30A |
| 240V | 15A | 15A | 15A |
| 480V | 7.5A | 7.5A | 7.5A |
| 600V | 6A | 6A | 6A |
| Break contact (360 VA) | | | |
| 120V | 3A | 3A | 3A |
| 240V | 1.5A | 1.5A | 1.5A |
| 480V | 0.75A | 0.75A | 0.75A |
| 600V | 0.6A | 0.6A | 0.6A |
| R300—Vdc ratings (28 VA) | | | |
| 0–120V | 0.22A | 0.22A | 0.22A |
| 250V | 0.11A | 0.11A | 0.11A |
| **Short-Circuit Rating without Welding** | | | |
| Maximum fuse | 6A gG/gL | 6A gG/gL | 6A gG/gL |
| **Environmental Ratings** | | | |
| Ambient temperature (operating) | –13° to 149°F (–25° to 65°C) | –13° to 149°F (–25° to 65°C) | –13° to 149°F (–25° to 65°C) |
| Ambient temperature (storage) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) |
| Operating humidity UL 991 (H3) | 5% to 95% noncondensing | 5% to 95% noncondensing | 5% to 95% noncondensing |
| Altitude (no derating) NEMA ICS1 | 2000m | 2000m | 2000m |
| Shock (IEC 600068-2-27) | 15g any direction | 15g any direction | 15g any direction |
| Vibration (IEC 60068-2-6) | 3g any direction | 3g any direction | 3g any direction |
| Pollution degree per IEC 60947-4-1 | 3 for product (2 for pcb) | 3 for product (2 for pcb) | 3 for product (2 for pcb) |
| Ingress protection | IP20 | IP20 | IP20 |
| Protection against direct contact when actuated from front (IEC 536) | Finger- and back-of-hand proof | Finger- and back-of-hand proof | Finger- and back-of-hand proof |
| Mounting position | Any | Any | Any |
| Climatic proofing | Damp heat, constant to IEC 60068-2-30 | Damp heat, constant to IEC 60068-2-30 | Damp heat, constant to IEC 60068-2-30 |

## Electronic Overload Relays up to 1500A, continued

| Description | Specification<br>45 mm | 55 mm | 110 mm |
|---|---|---|---|
| **Electrical/EMC** | | | |
| Radiated emissions<br>IEC 60947-4-1-Table 15<br>EN 55011 (CISPIR 11) Group 1, Class A, ISM | 30 MHz to 1000 MHz | 30 MHz to 1000 MHz | 30 MHz to 1000 MHz |
| Conducted emissions<br>IEC 60947-4-1-Table 14<br>EN 55011 (CISPIR 11) Group 1; Class ISM | 0.15 MHz to 30 MHz | 0.15 MHz to 30 MHz | 0.15 MHz to 30 MHz |
| ESD immunity<br>IEC 60947-4-1 (Table 13) | ±8 kV air, ±6 kV contact | ±8 kV air, ±6 kV contact | ±8 kV air, ±6 kV contact |
| Radiated immunity<br>IEC 60947-4-1<br>IEC 61000-4-3 | 10 V/m 80 MHz–1000 MHz<br>3 V/m from 1.4 to 2.7 GHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80 MHz–1000 MHz<br>3 V/m from 1.4 to 2.7 GHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80 MHz–1000 MHz<br>3 V/m from 1.4 to 2.7 GHz<br>80% amplitude modulated<br>1 kHz sine wave |
| Conducted immunity<br>IEC 60947-4-1, IEC 61000-4-6 | 140 dub (10V rms)<br>150 kHz–100 MHz | 140 dub (10V rms)<br>150 kHz–100 MHz | 140 dub (10V rms)<br>150 kHz–100 MHz |
| Fast transient immunity<br>IEC 60947-4-1 (Table 13)<br>IEC 61000-4-4 | ±4 kV using direct method<br>with accessory installed in expansion bay<br>±2 kV using direct method | ±4 kV using direct method<br>with accessory installed in expansion bay<br>±2 kV using direct method | ±4 kV using direct method<br>with accessory installed in expansion bay<br>±2 kV using direct method |
| Surge immunity<br>IEC 60947-4-1 (Table 13)<br>IEC 61000-4-5 a Class 4 | Three-phase power inputs:<br>±4 kV line-to-line (DM)<br>±4 kV line-to-ground (CM) | Three-phase power inputs:<br>±4 kV line-to-line (DM)<br>±4 kV line-to-ground (CM) | Three-phase power inputs:<br>±4 kV line-to-line (DM)<br>±4 kV line-to-ground (CM) |
| | With accessory installed in expansion bay:<br>±2 kV line-to-line (DM) –>1.2/50 us;<br>2 kV line-to-earth, 1 kV line-to-line<br>±4 kV line-to-ground (CM) | With accessory installed in expansion bay:<br>±2 kV line-to-line (DM) –>1.2/50 us;<br>2 kV line-to-earth, 1 kV line-to-line<br>±4 kV line-to-ground (CM) | With accessory installed in expansion bay:<br>±2 kV line-to-line (DM) –>1.2/50 us;<br>2 kV line-to-earth, 1 kV line-to-line<br>±4 kV line-to-ground (CM) |
| Power freq. magnetic field immunity<br>IEC 60947-4-1, IEC 61000-4-8 | 30 A/m, 50 Hz | 30 A/m, 50 Hz | 30 A/m, 50 Hz |
| Electromagnetic field<br>IEC 60947-4-1 Table 13, IEC 61000-4-3 | 10 V/m | 10 V/m | 10 V/m |
| Distortion IEEE 519 | 5% THD max., 5th harmonic 3% max. | 5% THD max., 5th harmonic 3% max. | 5% THD max., 5th harmonic 3% max. |
| Electrostatic discharge (ESD)<br>IEC 61000-4-2, EN 61131-2 | 4 kV contact<br>8 kV air discharge | 4 kV contact<br>8 kV air discharge | 4 kV contact<br>8 kV air discharge |
| Electrical fast transient (EFT)<br>IEC 61000-4-4, EN 61131-2 | ±2 kV using direct method | ±2 kV using direct method | ±2 kV using direct method |
| Surge immunity<br>IEC 61000-4-5, EN 61131-2 | ±2 kV line-to-ground (CM) | ±2 kV line-to-ground (CM) | ±2 kV line-to-ground (CM) |

## Communication Modules

| Description | Modbus | DeviceNet | PROFIBUS | Ethernet |
|---|---|---|---|---|
| **Electrical/EMC** | | | | |
| Radiated emissions<br>IEC 60947-4-1—Table 15, EN 55011<br>(CISPIR 11) Group 1, Class A | 30–1000 MHz | 30–1000 MHz | 30–1000 MHz | 30–1000 MHz |
| Conducted emissions<br>IEC 60947-4-1—Table 14, EN 55011<br>(CISPIR 11) Group 1, Class A | 0.15–30 MHz | 0.15–30 MHz | 0.15–30 MHz | 0.15–30 MHz |
| ESD immunity<br>IEC 60947-4-1 (Table 13) | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact |
| Radiated immunity<br>IEC 60947-4-1 | 10 V/m 80–1000 MHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80–1000 MHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80–1000 MHz<br>80% amplitude modulated<br>1 kHz sine wave | 10 V/m 80–1000 MHz<br>80% amplitude modulated<br>1 kHz sine wave |
| Conducted immunity<br>IEC 60947-4-1 | 140 dBuV (10V rms)<br>150 kHz–80 MHz | 140 dBuV (10V rms)<br>150 kHz–80 MHz | 140 dBuV (10V rms)<br>150 kHz–80 MHz | 140 dBuV (10V rms)<br>150 kHz–80 MHz |
| Fast transient immunity<br>IEC 60947-4-1 (Table 13) IEC 6100-4-4 | ±2 kV using direct method | ±2 kV supply and control,<br>±1 kV communication | ±2 kV supply and control,<br>±1 kV communication | ±2 kV supply and control,<br>±1 kV communication |
| Surge immunity<br>IEC 60947-4-1 (Table 13)<br>IEC 61000-4-5 Class 3 | User IO and communication lines ①:<br>±1 kV line-to-line (DM)<br>±2 kV line-to-ground (CM) | User IO and communication lines:<br>±0.5 kV line-to-line (DM)<br>±1 kV line-to-ground (CM) | User IO and communication lines:<br>±0.5 kV line-to-line (DM)<br>±1 kV line-to-ground (CM) | User IO and communication lines:<br>±0.5 kV line-to-line (DM)<br>±1 kV line-to-ground (CM) |
| Electromagnetic field ①<br>IEC 60947-4-1 (Table 13) IEC 61000-4-3 | 10 V/m | 10 V/m | 10 V/m | 10 V/m |
| **Environmental Ratings** | | | | |
| Ambient temperature (operating) | –4° to 122°F (–20° to 50°C) | –13° to 122°F (–25° to 50°C) | –13° to 122°F (–25° to 50°C) | –13° to 122°F (–25° to 50°C) |
| Ambient temperature (storage) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) | –40° to 185°F (–40° to 85°C) |
| Operating humidity | 5–95% noncondensing | 5–95% noncondensing | 5–95% noncondensing | 5–95% noncondensing |
| Altitude (no derating) | 2000m | 2000m | 2000m | 2000m |
| Shock (IEC 600068-2-27) | 15G any direction | 15G any direction | 15G any direction | 15G any direction |
| Vibration (IEC 60068-2-6) | 3G any direction | 3G any direction | 3G any direction | 3G any direction |
| Pollution degree per IEC 60947-1 | 3 | 3 | 3 | 3 |
| Degree of protection | IP20 | IP20 | IP20 | IP20 |
| Overvoltage category per UL 508 | III | III | III | III |
| **DeviceNet** | | | | |
| DeviceNet connections | — | Group 2, polling, bit strobe,<br>explicit, no UCMM | — | Group 2, polling, bit strobe,<br>explicit, no UCMM |
| DeviceNet baud rate | — | 125K, 250K, 500K | — | 125K, 250K, 500K |
| **Ethernet** | | | | |
| Ethernet connections | — | — | — | Integrated two-port switch with dual<br>RJ45 Ethernet connections |
| Ethernet type | — | — | — | Ethernet 10/100 Mbs, AutoMDX,<br>Auto Negotiation |
| **PROFIBUS** | | | | |
| PROFIBUS connections | — | — | Group 2, polling, bit strobe,<br>explicit, no UCMM | — |
| PROFIBUS baud rate | — | — | 9.6K, 19.2K, 45.45K, 93.75K, 187.5K,<br>500K, 1.5M, 3M, 6M, 12M | — |

***Note***

① Relates to C441M only.

## Communication Modules, continued

| Description | Modbus | DeviceNet | PROFIBUS | Ethernet |
|---|---|---|---|---|
| **C441_ 24 Vdc Input** | | | | |
| Nominal input voltage | 24 Vdc | 24 Vdc | 24 Vdc | 24 Vdc |
| Operating voltage | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc |
| Number of inputs | 4 | 4 | 4 | 4 |
| Signal delay | 5 ms (programmable to 65 sec) | 5 ms (programmable to 65 sec) | 5 ms (programmable to 65 sec) | 5 ms (programmable to 65 sec) |
| OFF-state voltage | <6 Vdc | <6 Vdc | <6 Vdc | <6 Vdc |
| ON-state voltage | >18 Vdc | >18 Vdc | >10 Vdc | >18 Vdc |
| Nominal input current | 5 mA | 5 mA | 5 mA | 5 mA |
| Isolation | 1500V | 1500V | 1500V | 1500V |
| Terminal screw torque | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb |
| 24V source current | 50 mA | 50 mA | 50 mA | 50 mA |
| **Operating Voltage Range—DC Input Modules** | | | | |
| OFF state | 0–6 Vdc | 0–6 Vdc | 0–6 Vdc | 0–6 Vdc |
| Transition region | 6–18 Vdc | 6–18 Vdc | 6–18 Vdc | 6–18 Vdc |
| ON state | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc | 18–30 Vdc |
| **C441_ 120 Vac Input** | | | | |
| Nominal input voltage | 120 Vac | 120 Vac | 120 Vac | 120 Vac |
| Operating voltage | 80–140 Vac | 80–140 Vac | 80–140 Vac | 80–140 Vac |
| Number of inputs | 4 | 4 | 4 | 4 |
| OFF-state voltage | <30 Vac | <30 Vac | <20 Vac | <30 Vac |
| ON-state voltage | >80 Vac | >80 Vac | >70 Vac | >80 Vac |
| Nominal input current | 15 mA | 15 mA | 15 mA | 15 mA |
| Signal delay | 1/2 cycle | 1/2 cycle | 1/2 cycle | 1/2 cycle |
| Isolation | 1500V | 1500V | 1500V | 1500V |
| Terminal screw torque | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb | 7–9 in-lb |
| **Operating Voltage Range—AC Input Modules** | | | | |
| OFF state | 0–30 Vac | 0–30 Vac | 0–30 Vac | 0–30 Vac |
| Transition region | 30–80 Vac | 30–80 Vac | 30–80 Vac | 30–80 Vac |
| ON state | 80–140 Vac | 80–140 Vac | 80–140 Vac | 80–140 Vac |
| **Output Modules** | | | | |
| Nominal voltage | 120 Vac<br>24 Vdc | 120 Vac<br>24 Vdc | 120 Vac<br>24 Vdc | 120 Vac<br>24 Vdc |
| Number of outputs | (2) 1NO Form A<br>1NO/NC Form C | (2) 1NO Form A<br>1NO/NC Form C | (2) 1NO Form A<br>1NO/NC Form C | (2) 1NO Form A<br>1NO/NC Form C |
| Relay OFF time | 3 ms | 3 ms | 3 ms | 3 ms |
| Relay ON time | 7 ms | 7 ms | 7 ms | 7 ms |
| Max. current per point ① | 5A (B300 rated) | 5A (B300 rated) | 5A (B300 rated) | 5A (B300 rated) |
| Electrical life | 100,000 cycles | 100,000 cycles | 100,000 cycles | 100,000 cycles |
| Mechanical life | 1,000,000 cycles | 1,000,000 cycles | 1,000,000 cycles | 1,000,000 cycles |

***Note***

① Relates to C441M only.

***Short Circuit Ratings (North America CSA, cUL)***

Changes to UL 508A and NEC in recent years have brought a focus to control panel safety with regard to short-circuit current ratings (SCCR). Eaton's XTOE electronic overload relays combined with ***XT*** Series IEC, Freedom Series NEMA and ***XT*** NEMA contactors provide a wide variety of SCCR solutions needed for a variety of applications. The SCCR data in this document reflects the latest information as of April 2010.

## XTOE Standalone Overload Relays (XTOE)

| | | Standard-Fault Short Circuit Data | | | High-Fault Short Circuit Data | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fuses (RK5, J, CC) | | | Thermal-Magnetic Circuit Breakers | | |
| Overload FLA Range | Maximum Operating Voltage | 600V (kA) | Maximum Fuse Size (A) (RK5) | Maximum Breaker Size (A) | 480V (kA) | 600V (kA) | Maximum Fuse Size | 480V (kA) | 600V (kA) | Maximum Breaker Size |
| 0.33–1.65A | 600 Vac | 1 | 6 | 15 | — | — | — | — | — | — |
| 1–5A | 600 Vac | 5 | 20 | 20 | 100 | 100 | 30 | 100 | 35 | 20 |
| 4–20A | 600 Vac | 5 | 80 | 80 | 100 | 100 | 100 | 100 | 35 | 80 |
| 9–45A | 600 Vac | 5 | 175 | 175 | 100 | 100 | 100 | 100 | 35 | 100/175 (480/600) |
| 20–100A | 600 Vac | 10 | 400 | 400 | 100 | 100 | 200 | 150 | 35 | 250/400 (480/600) |
| 28–140A | 600 Vac | 10 | 450 | 500 | 100 | 100 | 400 | 100 | 65 | 400 |
| 35–175A | 690 Vac | 10 | 500 (gG) | 350 (690 Vac)<br>320 (415 Vac) | 100 | 100 | 500 (gG) | 100 (415 Vac) | — | 350 (LGC3350)<br>320 (NZMH3) |

## NEMA Space-Savings Starters with XTOE Electronic Overload Relays

| | | High-Fault Short Circuit Data | | | | | |
|---|---|---|---|---|---|---|---|
| | | Fuses (RK5, J, CC) | | | Thermal-Magnetic Circuit Breakers | | |
| Contactor Frame Size | Overload FLA Range | 480V | 600V | Maximum Fuse Size | 480V | 600V | Maximum Breaker Size |
| B | 1–5A | 100 | 100 | 30 | — | — | — |
| | 4–20A | 100 | 100 | 30 | — | — | — |
| C | 1–5A | 100 | 100 | 60 | — | — | — |
| | 4–20A | 100 | 100 | 60 | — | — | — |
| | 9–45A | 100 | 100 | 60 | — | — | — |
| D | 9–45A | 100 | 100 | 200 | 65 | 35 | 175 |
| | 20–100A | 100 | 100 | 200 | 65 | 35 | 175 |
| F | 20–100A | 100 | 100 | 200 | 65 | 65 | 350 |
| G | 20–100A | 100 | 100 | 200 | 65 | 65 | 350 |
| | 35–175A | 100 | 100 | 400 | 65 | 30 | 250 (480 Vac)<br>350 (600 Vac) |
| H | 35–175A | 100 | 100 | 400 | 65 | 30 | 400 |

## Coil Data—Frames B–D

| Description | CN13B_ NEMA Size 0 | CN13C_ NEMA Size 1C | CN13D_ NEMA Size 1 | CN13G_ NEMA Size 2 |
|---|---|---|---|---|
| **Voltage Tolerance** | | | | |
| Pickup (x $U_c$) | | | | |
| AC operated | 0.8–1.1 | 0.8–1.1 | 0.8–1.1 | 0.8–1.1 |
| DC operated | 0.7–1.2 ① | 0.7–1.2 ① | 0.7–1.2 ① | 0.7–1.2 ① |
| Dropout (x $U_c$) | | | | |
| AC operated | 0.3–0.6 | 0.3–0.6 | 0.3–0.6 | 0.3–0.6 |
| DC operated | 0.15–0.6 | 0.15–0.6 | 0.15–0.6 | 0.15–0.6 |
| **Power Consumption of the Coil at Cold State and 1.0 x $U_c$** | | | | |
| AC operated<br>Single-voltage coil 50 Hz | | | | |
| Pickup VA | 52 | 52 | 149 | 149 |
| Pickup W | 40 | 40 | 80 | 80 |
| Sealing VA | 7.1 | 7.1 | 16 | 16 |
| Sealing W | 2.1 | 2.1 | 4.3 | 4.3 |
| Single-voltage coil 60 Hz | | | | |
| Pickup VA | 67 | 67 | 178 | 178 |
| Pickup W | 50 | 50 | 117 | 117 |
| Sealing VA | 8.7 | 8.7 | 19 | 19 |
| Sealing W | 2.6 | 2.6 | 5.3 | 5.3 |
| 50/60 Hz | | | | |
| Pickup VA | 62<br>58 | 62<br>58 | 168<br>154 | 168<br>154 |
| Pickup W | 48<br>43 | 48<br>43 | 120<br>43 | 120<br>43 |
| Sealing VA | 9.1<br>6.5 | 9.1<br>6.5 | 22<br>14 | 22<br>14 |
| Sealing W | 2.5<br>2 | 2.5<br>2 | 5.3<br>4.3 | 5.3<br>4.3 |
| DC operated | | | | |
| Pickup W | 12 at 24V | 12 at 24V | 24 at 24V | 24 at 24V |
| Sealing W | 0.5 at 24V | 0.5 at 24V | 0.5 at 24V | 0.5 at 24V |
| Duty factor (%DF) | 100 | 100 | 100 | 100 |
| **Switching Time at 100% $U_c$ (Approximate Values)** | | | | |
| Main contact | | | | |
| AC operated | | | | |
| Closing delay (ms) | <22 | <22 | <18 | <18 |
| Opening delay (ms) | <14 | <14 | <13 | <13 |
| DC operated | | | | |
| Closing delay (ms) | <47 | <47 | <54 | <54 |
| Opening delay (ms) | <30 | <30 | <24 | <24 |
| Arcing time (ms) | 10 | 10 | 10 | 10 |
| **Electromagnetic Compatibility (EMC)** | | | | |
| Emitted interference | To EN-60947-1 | To EN-60947-1 | To EN-60947-1 | To EN-60947-1 |
| Noise immunity | To EN-60947-1 | To EN-60947-1 | To EN-60947-1 | To EN-60947-1 |

***Note***

① Coil Suffix TD: $U_{min}$ 24 Vdc/$U_{max}$ 27 Vdc.
Coil Suffix WD: $U_{min}$ 48 Vdc/$U_{max}$ 60 Vdc.
Coil Suffix AD: $U_{min}$ 110 Vdc/$U_{max}$ 130 Vdc.
Coil Suffix BD: $U_{min}$ 200 Vdc/$U_{max}$ 240 Vdc.
Example:
$U_c$ = 0.7 x $U_{min}$—1.2 x $U_{max}$
$U_c$ = 0.7 x 24V—1.2 x 27 Vdc

## Coil Data—Frames F–G

| Description | CN13K_ NEMA Size 3 | CN13M_ NEMA Size 4 |
|---|---|---|
| **Voltage Tolerance** | | |
| Pickup (x $U_c$) | | |
| AC operated | 0.8–1.1 | 0.8–1.1 |
| DC operated | 0.7–1.2 ① | 0.7–1.2 ① |
| Dropout (x $U_c$) | | |
| AC operated | 0.25–0.6 | 0.25–0.6 |
| DC operated | 0.15–0.6 | 0.15–0.6 |
| **Power Consumption of the Coil at Cold State and 1.0 x $U_c$** | | |
| AC operated<br>Single-voltage coil 50 Hz | | |
| Pickup VA | 180 | 180 |
| Pickup W | 130 | 130 |
| Sealing VA | 3.1 | 3.1 |
| Sealing W | 2.1 | 2.1 |
| Single-voltage coil 60 Hz | | |
| Pickup VA | 170 | 170 |
| Pickup W | 130 | 130 |
| Sealing VA | 3.1 | 3.1 |
| Sealing W | 2.1 | 2.1 |
| 50/60 Hz | | |
| Pickup VA | 170 | 170 |
| Pickup W | 130 | 130 |
| Sealing VA | 3.1 | 3.1 |
| Sealing W | 2.1 | 2.1 |
| DC operated | | |
| Pickup W | 149 at 24V | 149 at 24V |
| Sealing W | 2.1 at 24V | 2.1 at 24V |
| Duty factor (%DF) | 100 | 100 |
| **Switching Time at 100% $U_c$ (Approximate Values)** | | |
| Main contact | | |
| AC operated | | |
| Closing delay (ms) | <33 | <33 |
| Opening delay (ms) | <41 | <41 |
| DC operated | | |
| Closing delay (ms) | <35 | <35 |
| Opening delay (ms) | <30 | <30 |
| Arcing time (ms) | 15 | 15 |
| Permissible residual current with actuation of A1–A2 by the electronics (with 0 signal) (mA) | ≤1 | ≤1 |
| **Electromagnetic Compatibility (EMC)** | | |
| Emitted interference | To EN60947-1 | To EN60947-1 |
| Noise immunity | To EN60947-1 | To EN60947-1 |

## Coil Data—Frames L–R

| Description | CN13S_ NEMA Size 5 |
|---|---|
| **Voltage Tolerance** | |
| Pickup (x $U_c$) | |
| XTCE185L–XTCEC20R | 0.7 x $U_{cmin}$–1.15 x $U_{cmax}$ |
| XTCS185L–XTCS500M | 0.85 x $U_{cmin}$–1.1 x $U_{cmax}$ |
| Dropout (x $U_c$) | |
| XTCE185L–XTCEC20R | 0.2 x $U_{cmin}$–0.6 x $U_{cmax}$ |
| XTCS185L–XTCS500M | 0.2 x $U_{cmin}$–0.4 x $U_{cmax}$ |
| **Power Consumption of the Coil at Cold State and 1.0 x $U_c$** | |
| XTCE185L–XTCEC20R | |
| Pickup VA | 250 ② |
| Pickup W | 200 |
| Sealing VA | 4.3 |
| Sealing W | 3.3 |
| XTCS185L–XTCS500M | |
| Pickup VA | 360 |
| Pickup W | 325 |
| Sealing VA | 4.3 |
| Sealing W | 3.3 |
| Duty factor (%DF) | 100 |
| **Switching Time at 100% Main Contact $U_c$ (Approximate Values)** | |
| XTCE185L–XTCEC20R | |
| Closing delay (ms) | <100 |
| Opening delay (ms) | <80 |
| XTCS185L–XTCS500M | |
| Closing delay (ms) | <50 |
| Opening delay (ms) | <40 |
| **Reaction in Threshold and Sealing State Transition Range (XTCE185L–XTCEC20R)** | |
| Voltage interruptions | |
| (0–0.2 x $U_{cmin}$) ≤10 ms | Time is bridged successfully |
| (0–0.2 x $U_{cmin}$) >10 ms | Dropout of the contactor |
| Voltage dips | |
| (0.2–0.6 x $U_{cmin}$) ≤12 ms | Time is bridged successfully |
| (0.2–0.6 x $U_{cmin}$) >12 ms | Dropout of the contactor |
| (0.6–0.7 x $U_{cmin}$) | Contactor remains switched on |
| Excess voltage | |
| (1.15–1.3 x $U_{cmax}$) | Contactor remains switched on |
| (>1.3 x $U_{cmax}$) ≤3s | Contactor remains switched on |
| (>1.3 x $U_{cmax}$) >3s | Dropout of the contactor |
| Pickup phase | |
| (0–0.7 x $U_{cmin}$) | Contactor does not switch on |
| (0.7 x $U_{cmin}$ –1.15 x $U_{cmax}$) | Contactor switches on with certainty |
| (>1.15 x $U_{cmax}$) | Contactor switches on with certainty |

***Notes***

① At 24V: 0.7–1.3 without additional auxiliary contact modules and ambient temperature +40°C [104°F].

② Control transformer with $U_k$ ≤6%.

### Current Heat Loss (Three-Pole) in Watts

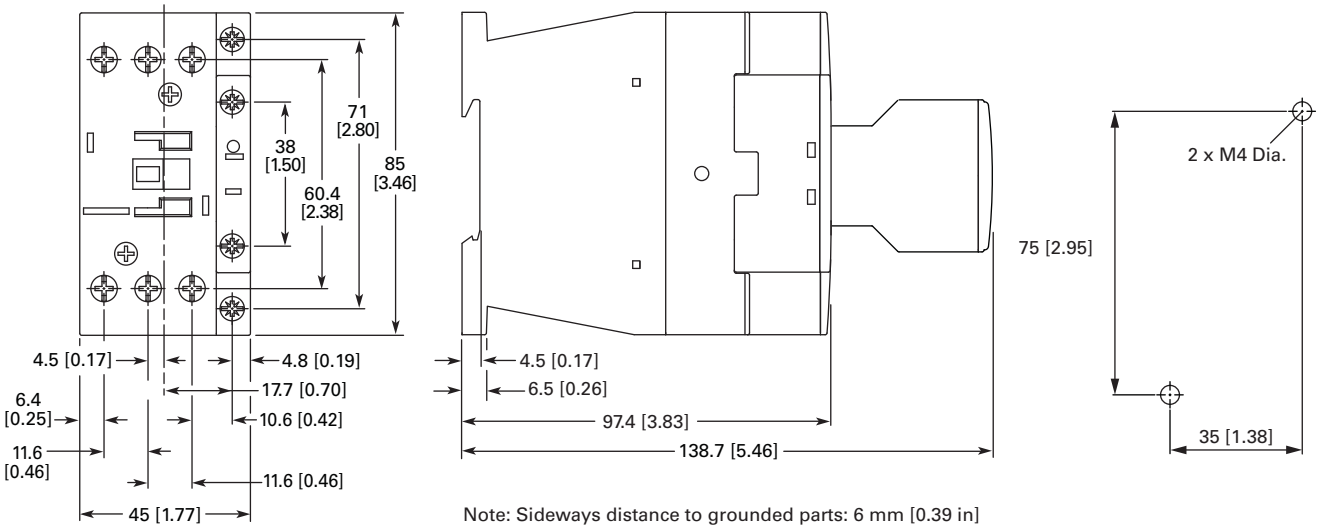
| Description | CN13BN0_ | CN13CN0_ | CN13DN0_ | CN13GN0_ | CN13KN0_ | CN13MN0_ |
|---|---|---|---|---|---|---|
| Current heat loss (three-pole) in watts | | | | | | |
| at $I_{th}$ | 7.3 | 12.1 | 11.3 | 28.8 | 20.3 | 30.7 |
| at $I_e$ to AC-3/400V | 1.9 | 6.1 | 7.2 | 19 | 15.9 | 27.0 |
| Impedance per pole, megohms | 2 | 2 | 1.5 | 1.5 | 0.4 | 0.4 |

## Dimensions

Approximate Dimensions in mm [in]

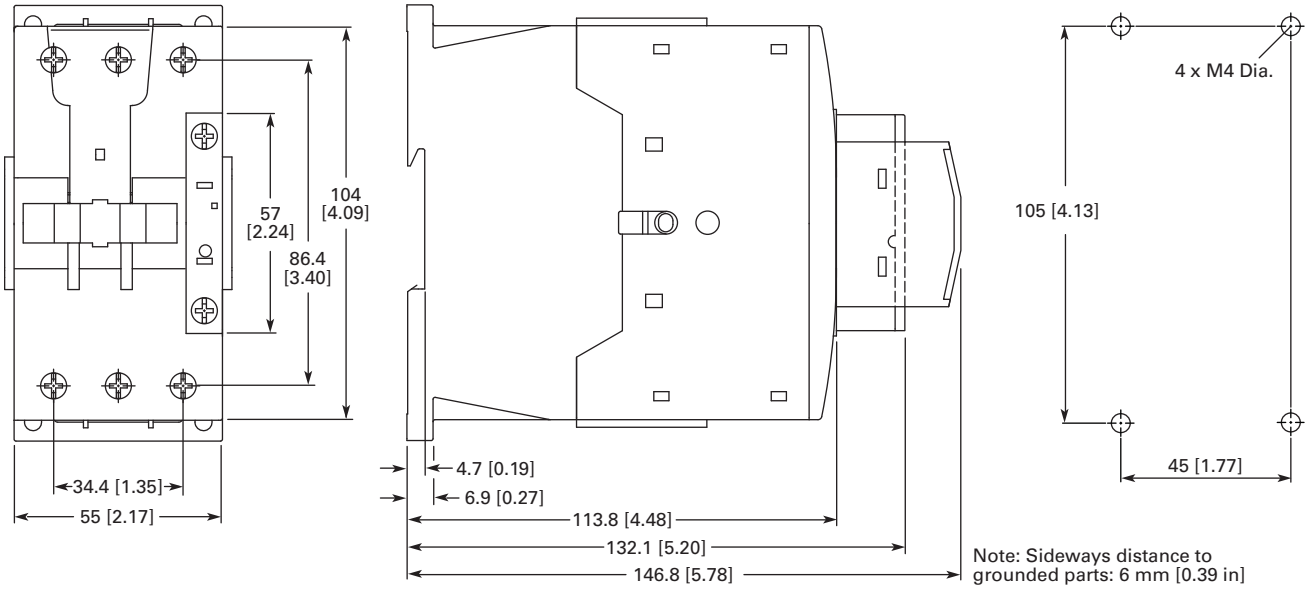
***Contactors***

### Type CN13 NEMA Size 0 and 1C




Note: Sideways distance to grounded parts: 6 mm [0.39 in]

### Type CN13 NEMA Size 1 and 2

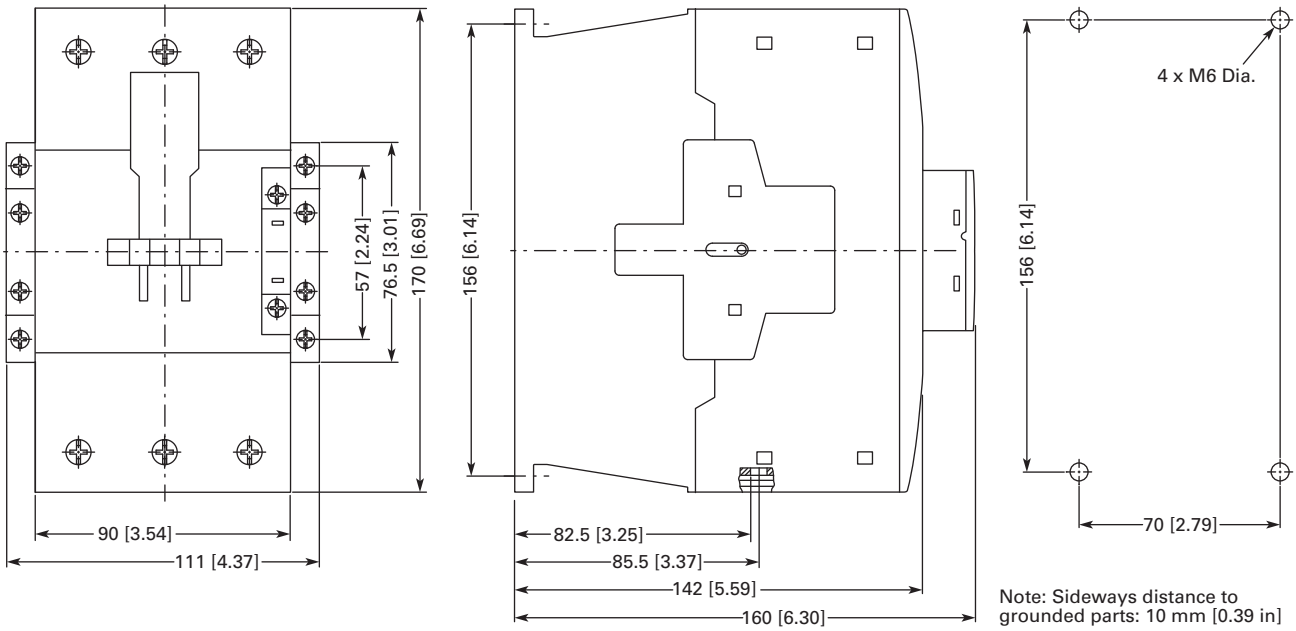



Note: Sideways distance to grounded parts: 6 mm [0.39 in]

Approximate Dimensions in mm [in]

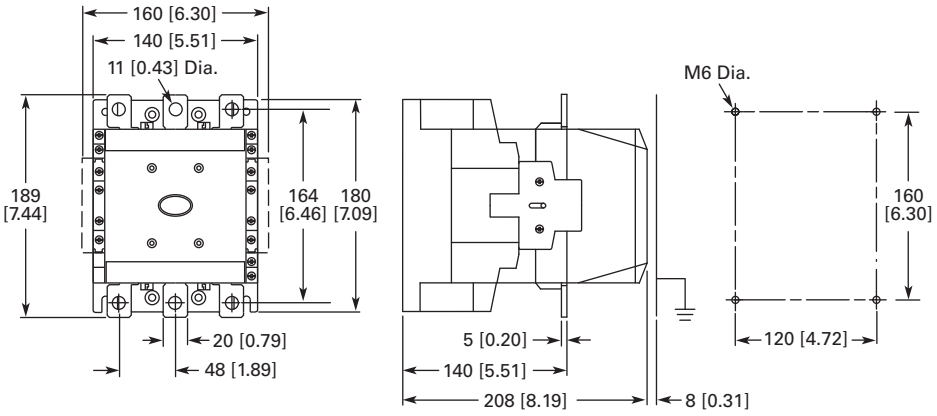


## Type CN13 NEMA Size 3 and 4




Note: Sideways distance to grounded parts: 10 mm [0.39 in]

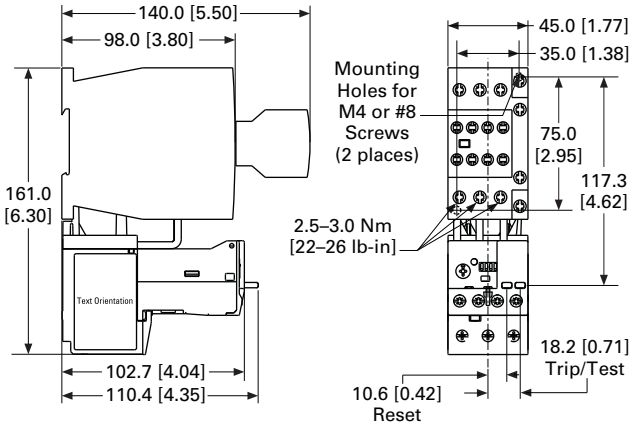
## Type CN13 NEMA Size 5



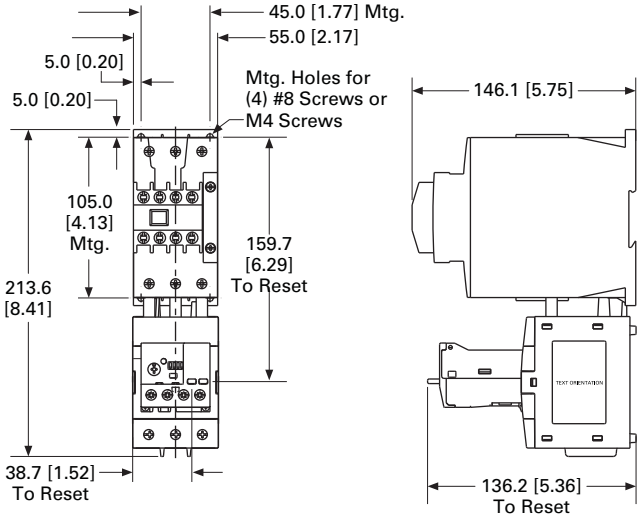
Approximate Dimensions in mm [in]

***XTAE Starters with XTOE Overload Relay***

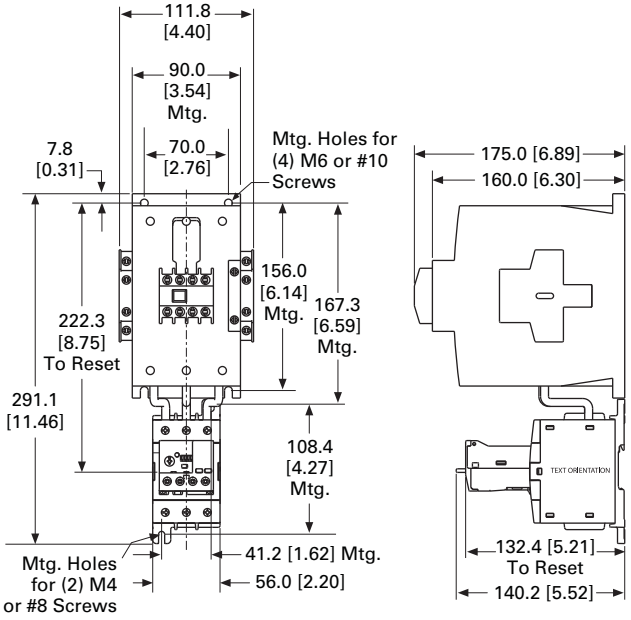
### Type AN13 NEMA Size 0 and 1C



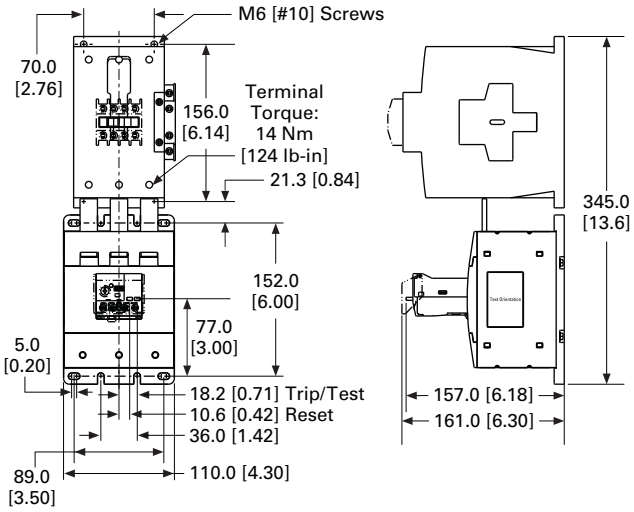

### Type AN13 NEMA Size 1 and 2




### Type AN13 NEMA Size 3




### Type AN13 NEMA Size 4

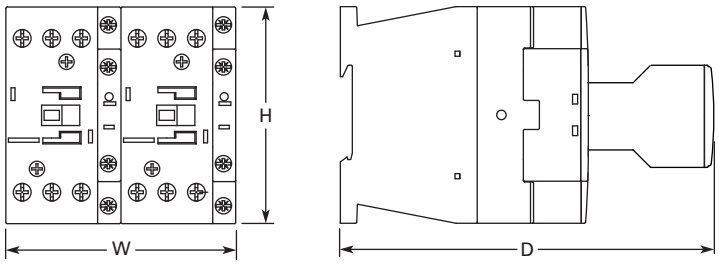


Approximate Dimensions in mm [in]

2

***Reversing Contactors***

## Type CN53 Size 0, 1C, 1 and 2



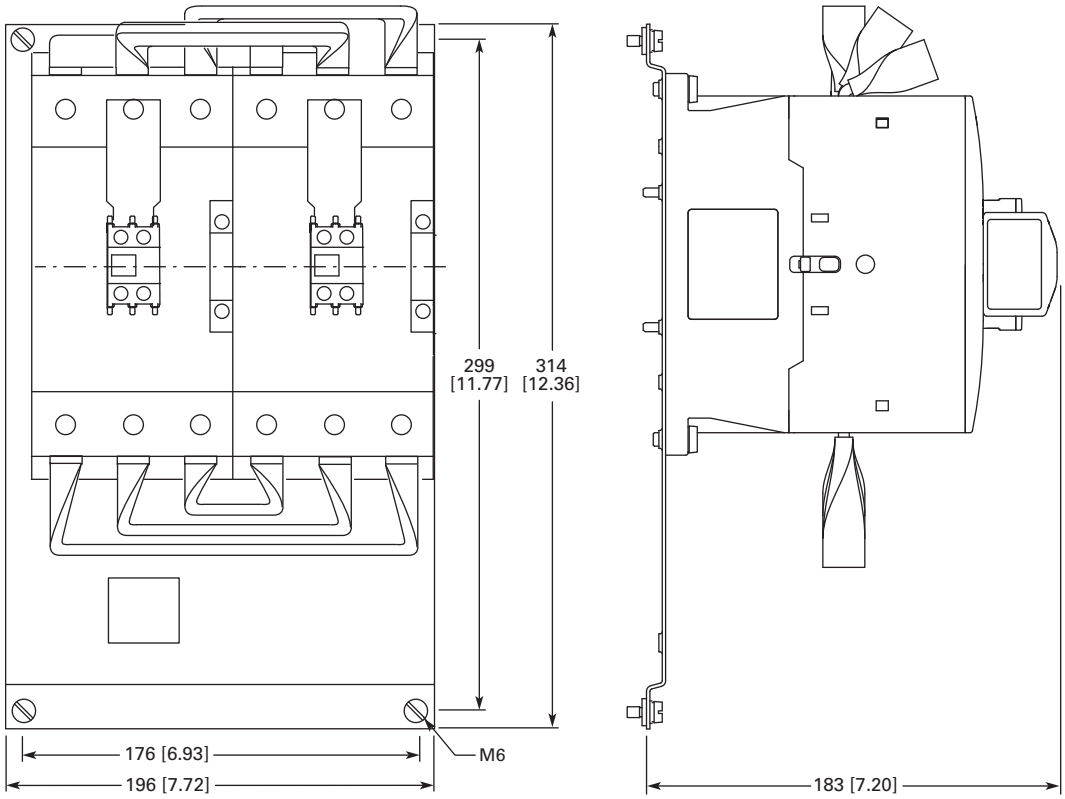

**Size 0 and 1C**

| W | H | D |
|---|---|---|
| 90 [3.54] | 85 [3.34] | 138 [5.43] |

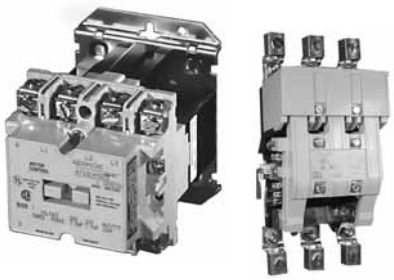
**Size 1 and 2**

| W | H | D |
|---|---|---|
| 110 [4.33] | 115 [4.53] | 146.8 [5.78] |

## Type CN53 Size 3 and 4



**Contactors—Non-Reversing and Reversing**



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## Contactors—Non-Reversing and Reversing

### Product Description

***Class A201 Contactors, Sizes 00–4; Three-Phase, 1-1/2–100 hp***

A201 Magnetic Contactors from Eaton's Electrical Sector are 600V rated devices available in NEMA Sizes 00–4, 10A through 150A (open rating). Product features include:

- Straight-through wiring to line and load terminals located up front for ease of installation
- Moving and stationary contacts are front accessible, simplifying inspection and maintenance
- Reliable U-shaped magnet for reduced power consumption
- Coil design reduces inventory/maintenance expenses. For a given voltage, one size coil fits all contactors Sizes 00–2, and a second coil fits three-pole Model J Sizes 3 and 4. Model K coils are different design

A201 contactors have normally open holding circuit interlocks which are supplied as standard.

Panel layout and drilling are simplified through the use of common backplates, one for Sizes 00–2 and one for Sizes 3–4. In addition, panel space is reduced dramatically through the use of unique corner cavities for mounting the wide variety of modifications shown on **Page V5-T2-120.**

For reversing applications, two contactors are supplied on a common base with electrical and mechanical interlocks which prevent both contactors from being closed at the same time.

***Class A201 Contactors, Sizes 5–9; Three-Phase, Over 100 hp***

These AC magnetic contactors utilize clapper design and feature straight-through wiring.

Contacts are silver alloy for longer life. The contacts close with optimum wiping action which serves to keep the contacting surfaces clean. De-ion® arc quenchers draw the arc away from the contacts at opening, which reduces burning and pitting and increases contact life.

All of the contactors are complete with one unwired, normally-open (NO) auxiliary contact mounted and have accommodations for additional auxiliary contacts. No control circuit wiring or terminal markings are included.

***Size 5, 300A, 600V, Open***
***Size 6, 600A, 600V, Open***

Class A201 Size 5 and 6 contactors are front clapper design, AC operated with the armature pivoting on dual needle bearings which assure accurate contact alignment.

The contactor base is molded of a high impact, non-tracking, non-hygroscopic glass polyester material permitting front mounting and wiring on a steel panel.

Floating magnet assures quiet operation.

Size 5 and 6 contactors must be mounted with the line terminals directly above the load terminals.

Multi-voltage coil ratings allow selection of the voltage which closely matches the actual system voltage to assure optimum contactor operation.

Each contactor accommodates two Type J11 auxiliary contacts, providing up to four auxiliary circuits, normally-open or normally-closed (NO and NC).

A201 Size 5 and 6 contactors and starters are UL recognized when supplied without terminals. When supplied with terminals, the devices are UL listed.

Two special configurations of the Class A201 Size 5 and 6 contactors are available:

- **Latched Design**—This is a mechanically held, electrically released device. It is applied where the contactor must remain closed during extreme voltage fluctuations or power failure. It is also suitable for applications requiring quiet operation since the operating coil is de-energized when the contactor is closed. The latch assembly consists of a mechanical latch mechanism, electrically operated AC trip solenoid and a clearing contact
- **DC Operated**—This device is DC operated. It is used where low dropout voltage or exceptionally quiet operation is desired. The DC assembly consists of a DC operating coil, integrally mounted rectifier and shorting contact

***Size 7, 900A, 600V, Open***
***Size 8, 1350A, 600V, Open***
***Size 9, 2500A, 600V, Open***

Class A201 Size 7 and 8 contactors are DC operated side clapper design with the shaft mounted on dual needle bearings to ensure positive contact alignment and long contact life.

A steel panel base permits mounting on angle or channel without additional support, for versatile low cost installation.

Each stationary contact assembly is mounted on an individual molded insulator. Each pair of contacts is surrounded by a De-ion grid type arc quencher for rapid and confined arc interruption and long contact life.

The shunt for each pole is made of flexible, braided copper cable for freedom of movement and long life.

The rugged DC operating coils are designed to operate at high temperature and insulated to meet Class H service.

An integrally mounted avalanche type silicon rectifier supplies DC coil voltage from the AC control circuit.

Sizes 7 and 8 accommodate three Type L-63 auxiliary contacts which are easily converted from normally-open to normally-closed, providing auxiliary circuit flexibility. Size 9 uses L-64 auxiliary contacts with a total of four circuits.

A201 Size 7, 8 and 9 contactors and starters are UL recognized when supplied without terminals. When supplied with terminals, the devices are UL listed.

## Application Description

Magnetic contactors are used to switch transformers and capacitors and to control electrical power circuits such as heating, lighting and motors that require no overload protection, or where overload protection is separately provided. They can be operated remotely by manual or automatic pilot devices.

## Standards and Certifications

A201 contactors are UL listed components and also have CSA certification.

Listed

## Instructional Leaflets

16960B Sizes 00–1 Magnetic Contactor, Non-reversing or Reversing

16961E Size 2 Magnetic Contactor, Non-reversing or Reversing

13238G Size 3 Magnetic Contactor, Non-reversing or Reversing

17001C Size 4 Magnetic Contactor, Non-reversing or Reversing

17049D Size 5 Magnetic Contactor, Non-reversing or Reversing

17053B Size 6 Magnetic Contactor, Non-reversing or Reversing

17048 Sizes 7–8 Magnetic Contactor, Non-reversing or Reversing

16978 Size 9 Magnetic Contactor, Non-reversing or Reversing

## Product Selection

***Non-Reversing, Sizes 00–9***

### When Ordering Specify

Order by catalog number from the table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

**A201 Size 1 Contactor**

## Front Connected Contactors

| Size | Amps | Max. UL Horsepower Single-Phase 115V | 230V | Three-Phase 208V | 240V | 480V | 600V | Two Poles Open Catalog Number | Three Poles Open Catalog Number | Four Poles Open Catalog Number | Five Poles Open Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sizes 00–6** | | | | | | | | | | | |
| 00 | 9 | 1/3 | 1 | 1-1/2 | 1-1/2 | 2 | 2 | **A201KAB_** | **A201KAC_** | **A201KAD_** | **A201KAE_** |
| 0 | 18 | 1 | 2 | 3 | 3 | 5 | 5 | **A201K0B_** | **A201K0C_** | **A201K0D_** | **A201K0E_** |
| 1 | 27 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **A201K1B_** | **A201K1C_** | **A201K1D_** | **A201K1E_** |
| 2 | 45 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **A201K2B_** | **A201K2C_** | **A201K2D_** | **A201K2E_** |
| 3 | 90 | — | — | 25 | 30 | 50 | 50 | **A201K3B_** | **A201K3C_** | **A201K3D_** | **A201K3E_** |
| 4 | 135 | — | — | 40 | 50 | 100 | 100 | **A201K4B_** | **A201K4C_** | **A201K4D_** | **A201K4E_** |
| 5 | 270 | — | — | 75 | 100 | 200 | 200 | **A201K5B_** | **A201K5C_** | — | — |
| 6 | 540 | — | — | 150 | 200 | 400 | 400 | **A201K6B_** | **A201K6C_** | — | — |
| **Sizes 7–9** | | | | | | | | | | | |
| 7 ① | 810 | — | — | 200 | 300 | 600 | 600 | **A201K7B_** | **A201K7C_** | — | — |
| 8 ① | 1215 | — | — | 400 | 450 | 900 | 900 | **A201K8B_** | **A201K8C_** | — | — |
| 9 ① | 2250 | — | — | — | 800 | 1600 | — | **A201K9B_** | **A201K9C_Z1** ②③ | — | — |

## Rear Connected Contactors

**120V Rectified Coil/Open Only**

| Size | Catalog Number |
|---|---|
| 7 | **A201K7CJZ1Z4** |
| 8 | **A201K8CJZ1Z4** |
| 9 | **A201K9CJZ1Z4** |

## Coil Suffix

| Coil Volts and Hz | Code Suffix |
|---|---|
| **Sizes 00–6** | |
| 120/60 or 110/50 | **A** |
| 200–208/60 | **B** |
| 240/60 | **W** |
| **Sizes 7, 8 and 9** ② | |
| 480/60 | **X** |
| 600/60 | **E** |
| 110–120/50 or 60 | **J** |
| 220–240/50 or 60 | **K** |
| 440–480/50 or 60 | **U** |
| 600/60 | **E** |

***Notes***

① Sizes 7–9 use rectifier with DC coil.
② For Size 9, only available coil voltage is 120V.
③ Supplied without terminal lugs.

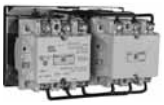
***Reversing, Sizes 00–9***

2

## When Ordering Specify

Order by catalog number from the table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

**Size 1 Horizontal Reversing Contactor**



### Class A211—Horizontally Mounted and Class A251—Vertically Mounted Reversing Contactors

| Size | Amps | Max. UL Horsepower Single-Phase 115V | 230V | Three-Phase 208V | 240V | 480V | 600V | Horizontal Design Catalog Number | Vertical Design Catalog Number |
|---|---|---|---|---|---|---|---|---|---|
| **Sizes 0–6** | | | | | | | | | |
| 0 | 18 | 1 | 2 | 3 | 3 | 5 | 5 | **A211K0C_** | **A251K0C_** |
| 1 | 27 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **A211K1C_** | **A251K1C_** |
| 2 | 45 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **A211K2C_** | **A251K2C_** |
| 3 | 90 | — | — | 25 | 30 | 50 | 50 | **A211K3C_** | **A251K3C_** |
| 4 | 135 | — | — | 40 | 50 | 100 | 100 | **A211K4C_** | **A251K4C_** |
| 5 | 270 | — | — | 75 | 100 | 200 | 200 | **A211K5C_** | **A251K5C_** |
| 6 | 540 | — | — | 150 | 200 | 400 | 400 | **A211K6C_** | **A251K6C_** |
| **Sizes 7–9** | | | | | | | | | |
| 7 ① | 810 | — | — | 200 | 300 | 600 | 600 | — | **A251K7C_** |
| 8 ① | 1215 | — | — | 400 | 450 | 900 | 900 | — | **A251K8C_** |
| 9 ① | 2250 | — | — | — | 800 | 1600 | — | — | **A251K9C_** ② |

### Coil Suffix

| Coil Volts and Hz | Code Suffix |
|---|---|
| **Sizes 00–6** | |
| 120/60 or 110/50 | **A** |
| 200–208/60 | **B** |
| 240/60 | **W** |
| 480/60 | **X** |
| 600/60 | **E** |
| **Sizes 7, 8 and 9** ② | |
| 110–120/50 or 60 | **J** |
| 220 –240/50 or 60 | **K** |
| 440–480/50 or 60 | **U** |
| 600/60 | **E** |

***Notes***

① Sizes 7–9 use rectifier with DC coil.

② For Size 9, only available coil voltage is 120V.

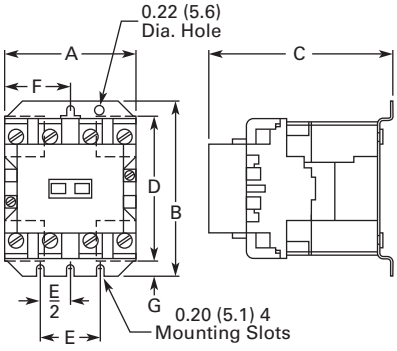
## Dimensions

Approximate Dimensions in Inches (mm)

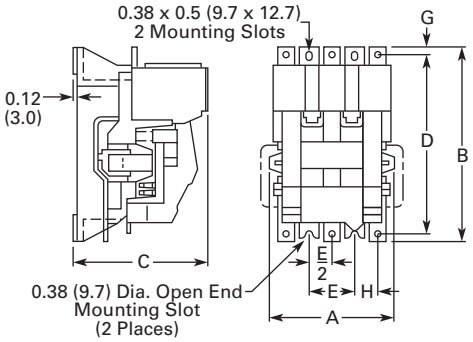
***Not to be used for construction purposes unless approved.***

***Non-Reversing Open Contactors***

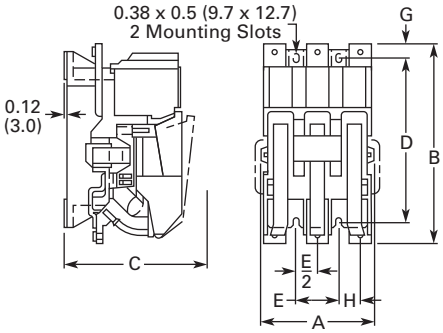
### Figure A—Sizes 00–4 A210



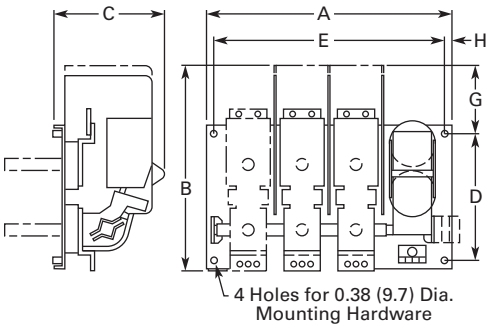

### Figure B—Size 5




### Figure C—Size 6




### Figure D—Sizes 7–9




### Dimensions and Shipping Weights

| NEMA Size | No. of Poles | Fig. | Mounting Screws No. | Size | A | B | C | D | E | F | G | H | Weight, Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00, 0, 1 | 2–4 | A | 3 | #10 | 3.31 (84.1) | 4.38 (111.3) | 4.61 (117.1) | 3.95 (100.3) | 1.50 (38.1) | 1.66 (42.2) | 0.45 (11.5) | — | 2.6 (1.2) |
| | 5 | A | 3 | #10 | 4.19 (106.4) | 4.38 (111.3) | 4.61 (117.1) | 3.95 (100.3) | 1.50 (38.1) | 2.09 (53.1) | 0.45 (11.5) | — | 3.2 (1.5) |
| 2 | 2, 3 | A | 3 | #10 | 3.31 (84.1) | 4.38 (111.3) | 4.94 (125.5) | 3.95 (100.3) | 1.50 (38.1) | 1.66 (42.2) | 0.45 (11.5) | — | 3.3 (1.5) |
| | 4, 5 | A | 3 | #10 | 5.06 (128.5) | 4.38 (111.3) | 4.94 (125.5) | 3.95 (100.3) | 1.50 (38.1) | 2.53 (64.3) | 0.45 (11.5) | — | 4.5 (2.0) |
| 3, 4 | 2, 3 | A | 3 | 1/4 in. | 4.63 (117.6) | 6.63 (168.4) | 6.75 (171.5) | 6.00 (152.4) | 1.88 (47.8) | 2.31 (58.7) | 0.38 (9.7) | — | 9.3 (4.2) |
| | 4, 5 | A | 3 | 1/4 in. | 7.25 (184.2) | 6.63 (168.4) | 6.75 (171.5) | 6.00 (152.4) | 1.88 (47.8) | 3.63 (92.2) | 0.38 (9.7) | — | 13.0 (5.9) |
| 5 | 2, 3 | B | 4 | 3/8 in. | 7.22 (183.4) | 12.00 (304.8) | 7.75 (196.9) | 11.00 (279.4) | 2.75 (69.9) | — | 0.59 (15.0) | 2.22 (56.4) | 25.0 (11.4) |
| 6 | 2, 3 | C | 4 | 3/8 in. | 7.22 (183.4) | 13.50 (342.9) | 9.50 (251.3) | 11.00 (279.4) | 2.75 (69.9) | — | 0.59 (15.0) | 2.22 (56.4) | 42.0 (19.1) |
| 7 | 3 | D | 4 | 3/8 in. | 23.50 (596.9) | 18.63 (473.2) | 11.00 (279.4) | 12.00 (304.8) | 22.00 (558.8) | — | 5.63 (143.0) | 0.75 (19.1) | 215.0 (97.6) |
| 8 | 3 | D | 4 | 3/8 in. | 23.50 (596.9) | 19.25 (489.0) | 11.00 (279.4) | 12.00 (304.8) | 22.00 (558.8) | — | 5.63 (143.0) | 0.75 (19.1) | 265.0 (120.3) |
| 9 | 3 | D | 4 | 1/2 in. | 33.00 (838.2) | 29.75 (755.7) | 12.94 (328.7) | 8.00 (203.2) | 30.75 (781.1) | — | 14.50 (368.3) | 1.63 (41.4) | 315.0 (143.0) |

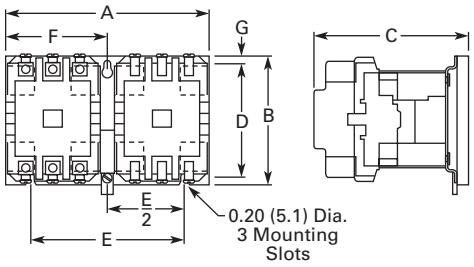
Approximate Dimensions in Inches (mm)

***Not to be used for construction purposes unless approved.***

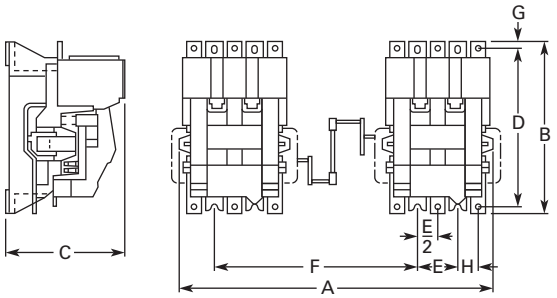
2

***Reversing Open Contactors***

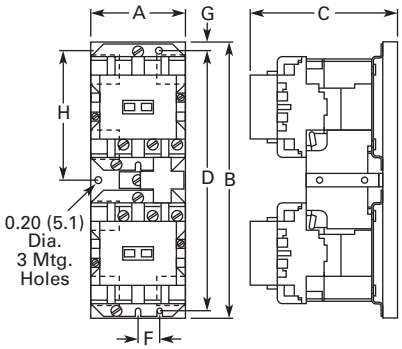
### Figure A—Sizes 00–4 Horizontal



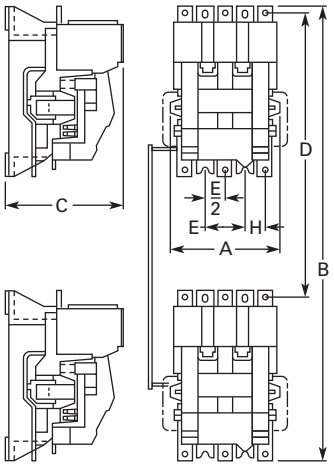

### Figure C—Sizes 5, 6 Horizontal



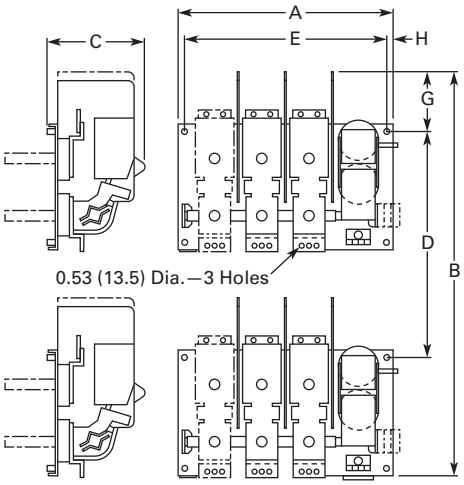

### Figure B—Sizes 00–4 Vertical




### Figure D—Sizes 5, 6 Vertical

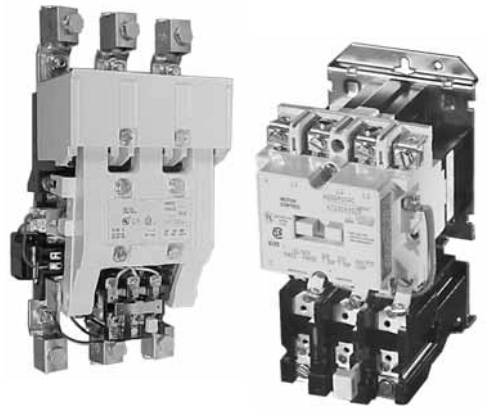



### Figure E—Sizes 7–9 Vertical




## Dimensions and Shipping Weights

| NEMA Size | No. of Poles | Fig. | Mounting Screws No. | Mounting Screws Size | A | B | C | D | E | F | G | H | Weight, Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00, 0, 1 | 3 x 3 H. | A | 3 | #10 | 7.13 (181.1) | 4.45 (113.0) | 5.05 (128.3) | 3.95 (100.3) | 5.31 (134.9) | 3.56 (90.4) | 0.25 (6.4) | — | 7.8 (3.5) |
| | 3 x 3 V. | B | 3 | #10 | 3.33 (84.6) | 9.61 (244.1) | 5.05 (128.3) | 9.08 (230.6) | 2.16 (54.9) | 0.75 (19.1) | 0.25 (6.4) | 4.52 (114.8) | 8.9 (4.0) |
| 2 | 3 x 3 H. | A | 3 | #10 | 7.13 (181.1) | 4.45 (113.0) | 5.38 (136.7) | 3.95 (100.3) | 5.31 (134.9) | 3.56 (90.4) | 0.25 (6.4) | — | 9.1 (4.1) |
| | 3 x 3 V. | B | 3 | #10 | 3.33 (84.6) | 9.61 (244.1) | 5.38 (136.7) | 9.08 (230.6) | 2.16 (54.9) | 0.75 (19.1) | 0.25 (6.4) | 4.52 (114.8) | 10.0 (4.5) |
| 3, 4 | 3 x 3 H. | A | 3 | 1/4 in. | 9.75 (247.7) | 6.88 (174.8) | 7.25 (184.2) | 6.00 (152.4) | 7.00 (177.8) | 4.88 (124.0) | 0.44 (11.2) | — | 24.0 (10.9) |
| | 3 x 3 V. | B | 3 | 1/4 in. | 4.63 (117.6) | 16.56 (420.6) | 7.25 (184.2) | 15.69 (398.5) | 2.75 (69.9) | 0.94 (23.9) | 0.44 (11.2) | 7.78 (197.6) | 25.0 (11.4) |
| 5 | 3 x 3 H. | C | 8 | 3/8 in. | 17.22 (437.4) | 12.00 (304.8) | 7.75 (196.9) | 11.00 (279.4) | 2.75 (69.9) | 10.00 (254.0 | 0.59 (15.0) | 1.38 (35.1) | 55.0 (25.0) |
| | 3 x 3 V. | D | 8 | 3/8 in. | 8.25 (209.6) | 30.00 (762.0) | 7.75 (196.9) | 18.00 (457.8) | 2.75 (69.9) | — | — | 1.38 (35.1) | 55.0 (25.0) |
| 6 | 3 x 3 H. | C | 8 | 3/8 in. | 17.22 (437.4) | 13.50 (342.9) | 8.75 (222.3) | 11.00 (279.4) | 2.75 (69.9) | 10.00 (254.0) | 0.59 (15.0) | 1.38 (35.1) | 90.0 (40.9) |
| | 3 x 3 V. | D | 8 | 3/8 in. | 8.25 (209.6) | 41.50 (1054.1) | 8.75 (222.3) | 28.00 (711.2) | 2.75 (69.9) | — | — | 1.38 (35.1) | 90.0 (40.9) |
| 7 | 3 x 3 V. | E | 8 | 3/8 in. | 23.50 (596.9) | 38.63 (981.2) | 11.00 (279.4) | 20.00 (508.0) | 22.00 (558.8) | — | 5.63 (143.0) | 0.75 (19.1) | 450.0 (204.3) |
| 8 | 3 x 3 V. | E | 8 | 3/8 in. | 23.50 (596.9) | 39.25 (997.0) | 11.00 (279.4) | 20.00 (508.0) | 22.00 (558.8) | — | 5.63 (143.0) | 0.75 (19.1) | 550.0 (249.7) |
| 9 | 3 x 3 V. | E | 8 | 1/2 in. | 33.00 (838.2) | 62.75 (1593.9) | 12.94 (328.7) | 33.00 (838.2) | 30.75 (781.1) | — | 14.50 (368.3) | 1.63 (41.4) | 650.0 (295.1) |



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| Instructional Leaflets | **V5-T2-108** |
| Product Selection | **V5-T2-109** |
| Accessories | **V5-T2-112** |
| Renewal Parts | **V5-T2-115** |
| Modifications | **V5-T2-120** |
| Technical Data and Specifications | **V5-T2-121** |
| Mechanical Characteristics | **V5-T2-123** |
| Dimensions | **V5-T2-125** |
| Relays—Thermal and Fast Trip | **V5-T2-128** |
| Thermal Type B, Class 20, Manual Reset | **V5-T2-130** |
| Thermal Type A, Class 20, Auto/Manual Reset | **V5-T2-133** |
| Type FT Fast Trip, Class 10 | **V5-T2-136** |
| Heater Selection | **V5-T2-139** |
| Relays—Current Sensing Protective | **V5-T2-141** |




# Starters—Non-Reversing and Reversing

## Product Description

***NEMA Sizes 00–4; Three-Phase, 1-1/2–100 hp***

These Starters from Eaton's Electrical Sector use Class A201 contactors as described on **Page V5-T2-101**. Contactor features are enhanced through the ability to provide positive motor protection in the form of several types of overload relays. See **Pages V5-T2-128** to **V5-T2-140**.

**Type B Overload Relay, Manual Reset Only**

Supplied as standard on Class A200 and A900 starters (two-speed). The bi-metallic overload relay offers ambient compensation and trip-to-test feature (relay contact status check) as standard. In addition, an isolated normally-open contact is available in kit form for customer mounting. Type B overload relays are manual reset only.

**Type A Overload Relay, Manual or Automatic Reset**

This is an optional overload relay, offering the capability of field conversion to automatic reset. It is available as an ambient compensated or non-compensated type.

**Non-Reversing Starters**

Non-reversing starters are supplied as open devices. All starters are supplied with a normally-open holding circuit interlock.

**Reversing Starters**

For reversing applications (Class A210), a starter and a contactor electrically and mechanically interlocked are supplied on a common baseplate. Reversing starters are used to start, stop and reverse AC squirrel cage motors and for primary control of reversing wound-rotor motors.

For plugging or inching, when operations exceed five times per minute, decreased horsepower ratings in accordance with NEMA Standard ICS 2-321 are recommended.

***Two-Speed Starters, A900s***

For across-the-line starting of two-speed constant hp, constant torque and variable torque squirrel cage motors, two-speed starters (Class A900) are available. These starters consist of two starters, one for each motor speed, mechanically and electrically interlocked and wired for manual speed selection by means of pushbuttons. Auxiliary relays may be added to provide automatic acceleration or deceleration.

Starters for two-speed, two independent winding motors consist of two-, three- or four-pole starters electrically and mechanically interlocked.

Starters for two-speed, single reconnectable winding motors consist of one three-pole and one five-pole starter mechanically and electrically interlocked.

***NEMA Sizes 5–9; Three-Phase 75 to 1600 hp***

Non-reversing (Class A200), and reversing (Classes A210, A250) full voltage starters are used for across-the-line starting of squirrel cage induction motors. They are used with motors rated above 50 hp at 230V, and above 100 hp at 460 through 600V.

Sizes 5 and 6 starters use Class A201 contactors as described on **Page V5-T2-101**. In addition to standard motor starters, special application devices are available: Sizes 5 and 6 starters with integrally rectified AC to DC coils for applications where low voltage problems are prevalent are available.

**Front Removable Parts**—All operating parts can be removed quickly and easily from the front. Straight-through wiring and conveniently located connection points for external wires and cables minimize installation time.

**Type B Block Type Thermal Overload Relay**—Dependable overload protection is assured by these snap-action, manual reset relays. Automatic reset Type A relays are available as an option.

***Types of Starters***

**Class A200, Sizes 5 and 6**—Non-reversing starters contain an AC magnetically-operated Size 5 or Size 6 line contactor and block Type B three-pole overload relay, along with three current transformers. A control relay whose contacts handle the coil current of the starter is provided with Size 6 starters.

**Class A200, Sizes 7, 8 and 9**—Non-reversing starters contain a DC operated line contactor, DC power supply, block Type B three-pole overload relay with three current transformers and a control relay.

**Class A960/A970/A980 Multi-Speed Starters:** Refer to **Page V5-T2-111**.

## Application Description

Magnetic starters are used for full-voltage, across-the-line starting and stopping of squirrel cage motors. They can be operated locally or remotely by manual or automatic pilot devices.

## Features and Benefits

***Sizes 00–4***

- **Straight-Through Wiring, Up-Front, Out-Front Terminals** for ease in installation
- **Unique Accessory Mounting Cavities** reduce panel space requirements
- **Snap-in Accessories** for application flexibility
- **Vertical and Horizontal Interlocking** capability increases application flexibility
- **Ambient Compensated Overload Relays** available as standard, offering superior motor protection in variable motor/controller environments
- **Isolated Normally Open Relay Contact** available in kit mounting form on Type B Overload Relay

***Sizes 5–9***

- **Rectified AC/DC Coils** available to reduce premature drop-out or "kiss" problems due to inherent low voltage conditions
- **Clapper Design** armature assembly pivots on needle bearings resulting in quick, smooth opening and closing of the magnet
- **Stainless Steel Kick-Out Spring** assures quick, positive drop-out time
- **Front Removable Parts** all current carrying parts front removable for easy inspection and maintenance

## Standards and Certifications

Class A200 starters are UL listed and recognized and also carry CSA certification.

Listed

## Instructional Leaflets

| | |
|---|---|
| 16958 | Sizes 00–1, 3-Pole Motor Controller |
| 16956 | Sizes 00–1, 2-Pole, Single-Phase Motor Controller |
| 16959 | Size 2, 3-Pole Motor Controller |
| 16957 | Size 2, 2-Pole, Single-Phase Motor Controller |
| 15465C | Sizes 3 and 4J Motor Controller |
| 17000C | Size 4, Model K Motor Controller |
| 17054C | Size 5 Motor Controller |
| 17055C | Size 6 Motor Controller |

## Product Selection

***Non-Reversing, Sizes 00–9***

### When Ordering Specify

Order by catalog number from the tables to the right, plus suffix for coil voltages, verifying usage of appropriate sizes.

### Heaters

Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-139** and **V5-T2-140**, as required per starter.

**Size 3 Starter**

### Non-Reversing Starters

| Size | Amperes | Max. UL Horsepower Single-Phase 115V | 230V | Three-Phase 208V | 240V | 480V | 600V | Open Catalog Number ① |
|---|---|---|---|---|---|---|---|---|
| **Two-Poles ② —Sizes 00–2** | | | | | | | | |
| 00 | 9 | 1/3 | — | 1-1/2 | 1-1/2 | 2 | 2 | **A200MABR** |
| 0 | 18 | 1 | — | 3 | 3 | 5 | 5 | **A200M0BR** |
| 1 | 27 | 2 | — | 7-1/2 | 7-1/2 | 10 | 10 | **A200M1BR** |
| 1-1/2 | 36 | 3 | — | — | — | — | — | **A200MDBR** |
| 2 | 45 | 7-12 | — | 10 | 15 | 25 | 25 | **A200M2BR** |
| **Three Poles—Sizes 00–6** | | | | | | | | |
| 00 | 9 | 1/3 | — | 1-1/2 | 1-1/2 | 2 | 2 | **A200MAC_** |
| 0 | 18 | 1 | — | 3 | 3 | 5 | 5 | **A200M0C_** |
| 1 | 27 | 2 | — | 7-1/2 | 7-1/2 | 10 | 10 | **A200M1C_** |
| 2 | 45 | 7-12 | — | 10 | 15 | 25 | 25 | **A200M2C_** |
| 3 | 90 | — | — | 25 | 30 | 50 | 50 | **A200M3C_** |
| 4 | 135 | — | — | 40 | 50 | 100 | 100 | **A200M4C_** |
| 5 | 270 | — | — | 75 | 100 | 200 | 200 | **A200M5C_** |
| 6 | 540 | — | — | 150 | 200 | 400 | 400 | **A200M6C_** |
| **Three Poles—Sizes 7–9** | | | | | | | | |
| 7 ③ | 810 | — | — | 200 | 300 | 600 | 600 | **A200M7C_** |
| 8 ③ | 1215 | — | — | 400 | 450 | 900 | 900 | **A200M8C_** |
| 9 ③ | 2250 | — | — | — | 800 | 1600 | — | **A200M9C_** ④ |

### Coil Suffix

| Coil Volts and Hz | Code Suffix |
|---|---|
| **Sizes 00–6** | |
| 120/60 or 110/50 | **AC** |
| 200–208/60 | **B** |
| 240/60 | **W** |
| 480/60 | **X** |
| 600/60 | **E** |
| **Sizes 7, 8 and 9** ④ | |
| 110–120/50 or 60 | **J** |
| 220–240/50 or 60 | **W** |
| 440–480/50 or 60 | **X** |
| 600/60 | **E** |

***Notes***

① For ambient compensated overload relay with auto-reset, add Suffix **D.**
② Single-phase with one single-pole overload relay.
③ Sizes 7–9 use rectifier with DC coil.
④ For Size 9, only available coil voltage is 120V.

***Reversing, Sizes 00–9***



### When Ordering Specify

Order by catalog number from table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

**Heaters**
Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-139** and **V5-T2-140**, as required per starter.

**Size 1 Horizontal Reversing Starter**

## Reversing Starters

| Size | Amps | Max. UL Horsepower Single-Phase 115V | Single-Phase 230V | Three-Phase 208V | Three-Phase 240V | Three-Phase 480V | Three-Phase 600V | Horizontal Design Catalog Number ① | Vertical Design Catalog Number ① |
|---|---|---|---|---|---|---|---|---|---|
| **Sizes 00–6** | | | | | | | | | |
| 00 | 9 | 1/3 | 1 | 1-1/2 | 1-1/2 | 2 | 2 | **A210MAC_** | **A250MAC_** |
| 0 | 18 | 1 | 2 | 3 | 3 | 5 | 5 | **A210M0C_** | **A250M0C_** |
| 1 | 27 | 2 | 3 | 7-1/2 | 7-1/2 | 10 | 10 | **A210M1C_** | **A250M1C_** |
| 2 | 45 | 3 | 7-1/2 | 10 | 15 | 25 | 25 | **A210M2C_** | **A250M2C_** |
| 3 | 90 | — | — | 25 | 30 | 50 | 50 | **A210M3C_** | **A250M3C_** |
| 4 | 135 | — | — | 40 | 50 | 100 | 100 | **A210M4C_** | **A250M4C_** |
| 5 | 270 | — | — | 75 | 100 | 200 | 200 | **A210M5C_** | **A250M5C_** |
| 6 | 540 | — | — | 150 | 200 | 400 | 400 | **A210M6C_** | **A250M6C_** |
| **Sizes 7–9** | | | | | | | | | |
| 7 ② | 810 | — | — | 200 | 300 | 600 | 600 | — | **A250M7C_** |
| 8 ② | 1215 | — | — | 400 | 450 | 900 | 900 | — | **A250M8C_** |
| 9 ② | 2250 | — | — | — | 800 | 1600 | — | — | **A250M9C_** ③ |

## Coil Suffix

| Coil Volts and Hz | Code Suffix |
|---|---|
| **Sizes 00–6** | |
| 120/60 or 110/50 | **AC** |
| 200–208/60 | **B** |
| 240/60 | **W** |
| 480/60 | **X** |
| 600/60 | **E** |
| **Sizes 7, 8 and 9** ③ | |
| 110–120/50 or 60 | **J** |
| 220–240/50 or 60 | **W** |
| 440–480/50 or 60 | **X** |
| 600/60 | **E** |

***Notes***

① For ambient compensated overload relay with auto-reset, add Suffix **D.**
② Sizes 7–9 use rectifier with DC coil.
③ For Size 9, only available coil voltage is 120V.

***For Separate Two-Winding Motors***

**Heaters**
Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-139** and **V5-T2-140**, as required per starter.

### Three-Phase, Non-Reversing, Reversing 60 Hz Starters—Heater Selection

| | | Constant or Variable Torque | | | | Constant Horsepower | | | | Three Poles Open |
|---|---|---|---|---|---|---|---|---|---|---|
| NEMA | Amperes | 208V | 240V | 480V | 600V | 208V | 240V | 480V | 600V | Catalog Number ① |
| **Sizes 0–6** | | | | | | | | | | |
| 0 | 18 | 3 | 3 | 5 | 5 | 2 | 2 | 3 | 3 | **A960M0C_** |
| 1 | 27 | 7-1/2 | 7-1/2 | 10 | 10 | 5 | 5 | 7-1/2 | 7-1/2 | **A960M1C_** |
| 2 | 45 | 10 | 15 | 25 | 25 | 7-1/2 | 10 | 20 | 20 | **A960M2C_** |
| 3 | 90 | 25 | 30 | 50 | 50 | 20 | 25 | 40 | 40 | **A960M3C_** |
| 4 | 135 | 40 | 50 | 100 | 100 | 30 | 40 | 75 | 75 | **A960M4C_** |
| 5 | 270 | 75 | 100 | 200 | 200 | 60 | 75 | 150 | 150 | **A960M5C_** |
| 6 | 540 | 150 | 200 | 400 | 400 | 100 | 150 | 300 | 300 | **A960M6C_** |

***For Single-Winding Motors***

### Sizes 0–6

| NEMA | Amperes | 208V | 240V | 480V | 600V | Three Poles Open Catalog Number ① |
|---|---|---|---|---|---|---|
| **Constant Horsepower** | | | | | | |
| 0 | 18 | 3 | 3 | 5 | 5 | **A970M0C_** |
| 1 | 27 | 7-1/2 | 7-1/2 | 10 | 10 | **A970M1C_** |
| 2 | 45 | 10 | 15 | 25 | 25 | **A970M2C_** |
| 3 | 90 | 25 | 30 | 50 | 50 | **A970M3C_** |
| 4 | 135 | 40 | 50 | 100 | 100 | **A970M4C_** |
| 5 | 270 | 75 | 100 | 200 | 200 | **A970M5C_** |
| 6 | 540 | 150 | 200 | 400 | 400 | **A970M6C_** |
| **Constant or Variable Torque** | | | | | | |
| 0 | 18 | 2 | 2 | 3 | 3 | **A980M0C_** |
| 1 | 27 | 5 | 5 | 7-1/2 | 7-1/2 | **A980M1C_** |
| 2 | 45 | 7-1/2 | 10 | 20 | 20 | **A980M2C_** |
| 3 | 90 | 20 | 25 | 40 | 40 | **A980M3C_** |
| 4 | 135 | 30 | 40 | 75 | 75 | **A980M4C_** |
| 5 | 270 | 60 | 75 | 150 | 150 | **A980M5C_** |
| 6 | 540 | 100 | 150 | 300 | 300 | **A980M6C_** |

### Coil Suffix

| Coil Volts and Hz | Coil Suffix |
|---|---|
| **Sizes 0–6** | |
| 120/60 or 110/50 | **AC** |
| 200–208/60 | **B** |
| 240/60 | **W** |
| 480/60 | **X** |
| 600/60 | **E** |

***Note***

① For ambient compensated overload relay with auto-reset, add Suffix **D**.

## Accessories



### *SS-56 Surge Suppressor*

- Designed to be used with magnetic motor controllers through Size 4 in 120V, 60 Hz control circuit applications where electronic equipment is used
- Steady state coil volts: 120, 60 Hz, rms
- Peak input volts: 169.6, 60 Hz, max. amplitude
- Max. ambient temperature: 65°C
- Nominal limiting volts: 270 peak
- Nominal rate of volt rise: 0.5 per ms

**SS-56 Surge Suppressor**

### Surge Suppressor ①

| Type Mounting | Kit Catalog Number |
|---|---|
| Starter | **SS-56** |

### *Mechanical Interlock*

- Prevents closing of one member of a reversing or multi-speed contactor until the opposite member is completely open
- Lever type mechanism assures positive action
- Can be factory assembled or field mounted on A200 and A900 starters and contactors

### Mechanical Interlock

| Contactor Arrangement (Number of Poles, Horizontal or Vertical) | Continuous Size | Interlock Catalog Number |
|---|---|---|
| 3 x 3 horizontal | 0, 1 | **M-33-1B** |
| 4 x 4 horizontal | 0, 1 | **M-33-1B** |
| 5 x 3 horizontal | 0, 1 | **M-33-1B** |
| All pole combination, vertical | 0, 1 | **M-34-1A** |
| 3 x 3 horizontal reversing | 2 | **M-33-2B** |
| 3 x 3 vertical reversing | 2 | **M-34-2A** |
| 5 x 3 horizontal | 2 | **M-35-2A** |
| 4 x 4 horizontal | 2 | **M-36-2A** |
| All pole combination horizontal | 3, 4 | **M-33-3B** |
| All pole combination vertical | 3, 4 | **M-34-3** |

### *F-56 Fuse Block*

- Facilitates installation of fuses (15A, 600V max.) in control circuits
- Utilizes Bussman type KTK fuses, or equivalent
- Mounts in same cavity as Type J auxiliary contact
- No tools or mounting hardware needed
- Fuse not included

### Fuse Block

| Mounting | Kit Catalog Number |
|---|---|
| Starter | **F56** |
| Panel | **F56-P** |

### *R-56 Interposing Relay*

The R-56AA interposing relay is a low energy solid-state device with a single NO solid-state contact. It can be used as a 120 Vac control relay, and will operate on as little as 40 Vac input. Is useful in applications requiring long control wiring runs where excessive voltage drop would prevent the contactor or relay from energizing. Will operate a Size 4 contactor from 10,000 feet using 18 AWG wire.

### Interposing Relay

| Type Mounting | Kit Catalog Number |
|---|---|
| Starter or panel | **R56-AA** |

### *B3NO Bell Alarm Contact*

- Isolated normally open bell alarm contact
- Mounts in Type B block-type overload relay

### Bell Alarm Contact

| Kit Catalog Number |
|---|
| **B3NO-2** |
| **B3NO-4** ② |

### Control Contact Ratings (B600)

| | Maximum Amperes | |
|---|---|---|
| AC Volts | Make | Break |
| 24–120 | 30 | 3.00 |
| 121–600 | 3600 VA | 360 VA |
| Continuous current rating: 5A | | |

### *Overload Relay Reset Extension*

- Used to adjust overload reset rod depth of Class A200 Model J starters and current design overload relays to same dimensions as obsolete B200 starters and overloads identified by suffix **B**, for example, BA13**B**

When replacing obsolete B200 device with Class A200 starter and Type B overload, order Style 6710C11H03. No charge.

When replacing obsolete B200 device with Class A200 starter and Type A overload, order Style 1490C15H10. No charge.

***Notes***

① Can be used on Sizes 5 and 6 with 120V coil. Mounting bracket required—order separately. Mounting bracket 177C043G04.

② For Size 3 and 4.

### *Power Pole Kit*

- Adds 1NO or 1NC power pole to Size 00–1 A201 Class contactors
- Factory installed or field mountable in load side auxiliary cavities
- 600 Vac
- Continuous current rating of 18A for Size 0, 27A for Size 1

## Power Pole Kit ①

| Continuous Current Rating | Kit Size | Kit Catalog Number |
|---|---|---|
| **Normally Open** | | |
| 18 | 0 | **PNO-0** |
| 27 | 1 | **PNO-1** |
| **Normally Closed** | | |
| 18 | 0 | **PNC-0** |
| 27 | 1 | **PNC-1** |

## Replacement Auxiliary Contacts

| Contactor Size | Contact Arrangement | Auxiliary Elect. Contact Catalog Number | Auxiliary Elect. Contact Style Number |
|---|---|---|---|
| 5, 6 | 1NO + 1NC | **J11** | **9084A17G01** |
| | 2NO | **J20** | **9084A17G02** |
| | 2NC | **J02** | **9084A17G03** |
| 7, 8 | 1NO | — | **578D461G01** |
| | 1NC | — | **578D461G03** |
| 9 | 1NO + 1NC | — | **843D943G04** |
| | 2NO | — | **843D943G05** |
| | 2NC | — | **843D943G06** |

### *Extra Auxiliary Contact Kits*

All starters include an auxiliary contact with 1NO and 1NC contact. These kits include an auxiliary contact with contacts as shown, plus operating arm and mounting bracket when required.

## Extra Auxiliary Contact Kits

| Contactor Size | Contact Arrangement | Style Number |
|---|---|---|
| 5, 6 | 1NO + 1NC | **3463D94G18** |
| | 2NO | **3463D94G04** |
| | 2NC | **3463D94G19** |
| 7, 8 ② | 2NO | **818D498G06** |
| | 1NO | **818D498G04** |

### *DC Coil Conversion Kits*

Kits listed below include all necessary parts to convert from AC to DC control including the DC coil with built-in diode, rectifier, auxiliary interlock and all mounting hardware.

## DC Coil Conversion Kits

| Size | Voltage | Kit Style Number |
|---|---|---|
| 5 | 110-120 | **7864A28G01** |
| | 220-240 | **7864A28G02** |
| | 440-480 | **7864A28G03** |
| 6 | 110-120 | **7864A29G01** |
| | 220-240 | **7864A29G02** |
| | 440-480 | **7864A29G03** |

## Mechanical Interlocks

| Contactor Sizes | Style Numbers Horizontal | Style Numbers Vertical |
|---|---|---|
| 3, 4 and 5 | **2050A11G75** | **2050A11G65** |
| 5 and 5 | **2050A11G27** | **2050A11G17** |
| 5 and 6 | **2050A11G26** | **2050A11G16** |
| 6 and 7, 8 | — | **2050A11G55** |
| 7, 8 and 7, 8 | No (rear conn.) | **567D624G01** |
| 7, 8 and 9 | No (rear conn.) | **9944D56G06** |
| 9 and 9 | No (rear conn.) | **9944D56G01** |

***Notes***

① Do not use with DC operated contactors.
② Size 7 and larger use DC coils as standard.

### *Overload Protection*

**Overload Protection Size 5 Starters**

Type B overload relay is a three-pole, block type, thermal ambient compensated device with manual reset mounted integrally. Current transformers are enclosed in a protective case and integrally mounted to save panel space. Standard ratio is 300:5.

**Overload Protection Size 6 Starters**

Overload protection assembly consists of three current transformers, Type B three-pole block overload relay and an optional interposing relay. These parts are mounted on a panel which connects directly to the load terminal of the contactor. Current transformers are 600:5 ratio as standard.

If automatic reset is required, the Type A, three-pole block, ambient compensated relay is available upon request.

### *Overload Relay Kits*

Each kit includes three current transformers (standard ratio) and one Type B, three-pole block overload relay, ambient compensated with manual reset.

## Overload Relay Kits

| Kit Size | Kit Part Number |
|---|---|
| 5 | **2057A34G01** |
| 6 | **6379D80G10** |

## Replacement Terminal Lugs ①

| | | Terminals | | |
|---|---|---|---|---|
| **Contactor Size** | **Cable Size** | **Quantity in Kit** | **Quantity Required per Pole** | **Kit Style Number** |
| 5 | 1-500 MCM | 6 | 2 | **2119A76G01** |
| 6 | 2-500 MCM | 6 | 2 | **7858A96G01** |
| 7 | 4-500 MCM | 12 | 4 | **7858A96G02** |
| 8 | 4-500 MCM | 12 | 4 | **7858A96G03** |

***Note***

① All mounting hardware is included in kit.

## Renewal Parts

***When Ordering Specify***

Use this renewal parts data to identify device by style number, catalog number and/or description.

Select style number of replacement part from the following pages.

For clarification of ordering procedure, pricing and discounts, contact the Customer Support Center.

***General Information***

This renewal parts data will provide the proper identification of standard parts which may be required for maintenance of Eaton's components.

It is the intent of this catalog section to make it possible to quickly select the parts needed.

An investment in renewal parts and regular maintenance program will protect against downtime and ensure a proper duty cycle for your equipment.

To maintain maximum operating efficiency and dependability of your equipment, only genuine Eaton replacement parts should be used.

This section identifies the replacements parts which are available. Order by style number.

***JF Autostarters***

### JF Autostarter Kits ①

| Frame Size | Start Contacts Required | Start Contacts Style Number | Run Contacts Required | Run Contacts Style Number | Grid Stack Kit Required | Grid Stack Kit Style Number |
|---|---|---|---|---|---|---|
| 2–3 | 1 | **38A7018G12** | 1 | **38A7018G13** | 1 | **3354D90G10** |
| 4–5 5L | 1 | **550D409G18** | 1 | **550D409G19** | 1 | **3354D90G10** |
| 5M–5MM | 1 | **3354D90G08** | 1 | **3354D90G09** | 2 | **3354D90G10** |

### Solenoid Assembly with Coil (All Sizes) ②

| Volt | Hz | Style Number ③ |
|---|---|---|
| 115 | 60 | **5264C05H01** |
| 230 | 60 | **5264C05H02** |
| 460 | 60 | **5264C05H03** |
| 575 | 60 | **5264C05H04** |

***Notes***

① Kits contain a complete set of moving contacts, stationary contacts and springs.

② When replacing solenoid assembly series 416C160 use adapter plate style 9917D02H01—one required.

③ These styles replace coil style 296B892G___. When ordering new style as replacement, customer must order adapter plate 9917D02H01, one required.

***AC Starters, Contactors A200, A201***



## AC Contactors Model J Sizes 00, 0, 1, 2 Kits ①

| Part | Poles | Size 00 Style Number | Size 0 Style Number | Size 1 Style Number | Size 2 Style Number |
|---|---|---|---|---|---|
| Contact kit | 2 | **373B331G17** | **373B331G02** | **373B331G07** | **373B331G11** |
| | 3 | **373B331G18** | **373B331G04** | **373B331G09** | **373B331G12** |
| | 4 | **373B331G18** | **373B331G04** | **373B331G09** | **373B331G13** ③ |
| | 5 | **373B331G19** | **373B331G05** | **373B331G10** | — |
| Arc box ② | 2, 3, 4 | **6714C74G01** | **6714C74G02** | **6714C74G03** | **6714C74G07** ④ |
| | 5 | **6714C74G04** | **6714C74G05** | **6714C74G06** | **6714C74G08** ⑤ |
| Cross bar | 2, 3 | **N/A** | **N/A** | **N/A** | **672B788G32** |
| | 4, 5 | **N/A** | **N/A** | **N/A** | **672B788G34** |
| Upper base (for single rated coils only) | 2, 3 | **N/A** | **N/A** | **N/A** | **672B788G33** |
| | 4, 5 | **N/A** | **N/A** | **N/A** | **672B788G35** |
| Lower base | 2, 3 | **N/A** | **N/A** | **N/A** | **1250C33G09** |
| | 4, 5 | **N/A** | **N/A** | **N/A** | **1250C33G05** |
| KO spring (package of 10) | All | **N/A** | **N/A** | **N/A** | **503C796G01** |
| Terminal line/load (package of 3) | All | **N/A** | **N/A** | **N/A** | **371B870G03** |

## AC Coils

| Voltage | Hz | Size 00, 0, 1 Two-, Three-, Four-Pole Style Number | Five-Pole Style Number | Size 2 Two-, Three-Pole Style Number | Four-, Five-Pole Style Number |
|---|---|---|---|---|---|
| 120/110 | 60/50 | **505C806G01** | **505C808G01** | **505C806G01** | **505C818G01** |
| 208 | 60 | **505C806G02** | **505C808G02** | **505C806G02** | **505C818G02** |
| 600/550 | 60/50 | **505C806G05** | **505C808G05** | **505C806G05** | **505C818G05** |
| 380 | 50 | **505C806G07** | **505C808G07** | **505C806G07** | **505C818G07** |
| 240/220 | 60/50 | **505C806G12** | **505C808G12** | **505C806G12** | **505C818G12** |
| 480/440 | 60/50 | **505C806G13** | **505C808G13** | **505C806G13** | **505C818G13** |
| 24 | 60 | **505C806G16** | **N/A** | **505C806G16** | **505C818G15** |
| 277 | 60 | **505C806G18** | **505C808G16** | **505C806G18** | **505C818G16** |
| 240/480 ⑥ | 60/60 | **505C806G03** | **505C808G03** | **505C806G03** | **505C818G03** |
| 120/240 ⑦ | 60/60 | **505C806G10** | **505C808G10** | **505C806G10** | **505C818G10** |

## DC Coil ⑦

| Voltage | Size 0, 1 Single-, Two-, Three-, Four-Pole Style Number | Size 2 Single-, Two-, Three-Pole Style Number |
|---|---|---|
| 12 | **1268C86G07** | **1268C86G07** |
| 24 | **1268C86G04** | **1268C86G04** |
| 48 | **1268C86G05** | **1268C86G05** |
| 125 | **1268C86G02** | **1268C86G02** |
| 250 | **1268C86G01** | **1268C86G01** |
| 125/250 ⑥ | **1268C86G03** | **1268C86G03** |

***Notes***

① Model C contact tips and coils 00-4, two-, three-, four- and five-pole contactors are same as Model J. All other parts are unavailable.
② Mounting hardware included.
③ Use one each of 373B331G11 and 373B331G12.
④ Two-, three-pole.
⑤ Four-, five-pole.
⑥ Dual voltage coils. Use only on contactors or starters originally supplied with a dual voltage coil.
⑦ Use only on contactors originally supplied with a DC coil.

### *Accessories for Size 5–9 AC Contactors*

A rectifier circuit converts the AC supply to DC supply. This conversion provides pick up and drop out characteristics. All necessary parts are included in the kit.

#### AC-DC Coil Conversion Kits

| Voltage | Size 5 Style Number | Size 6 Style Number |
|---|---|---|
| 120 Vac | **7864A28G01** | **7864A29G01** |
| 240 Vac | **7864A28G02** | **7864A29G02** |
| 480 Vac | **7864A28G03** | **7864A29G03** |

#### Replacement Coils for AC-DC Coil Conversion Kit

| Voltage | Size 5 Style Number | Size 6 Style Number |
|---|---|---|
| 120 Vac | **7856A15G05** | **7856A16G05** |
| 240 Vac | **7856A15G10** | **7856A16G10** |
| 480 Vac | **7856A15G15** | **7856A16G15** |

#### Auxiliary Electrical Interlocks Size 7–9 AC and All DC Units

| Type | Circuits | Application | Style Number |
|---|---|---|---|
| L63 | NO | Size 7–8 | **578D461G01** |
| L63 | NC | Size 7–8 | **578D461G03** |
| L64 | NO-NC | Size 9 | **843D943G04** |
| L64 | 2NO | Size 9 | **843D943G05** |
| L64 | 2NC | Size 9 | **843D943G06** |

### *Accessories for Size 00–6 AC Contactors*

#### Auxiliary Electrical Interlocks

| Catalog Number (Obsolete) | Style Number (Obsolete) | Circuits | Catalog Number Current | Style Number Current |
|---|---|---|---|---|
| (L-56) | (2609D01G01) | 1NO and 1NC | **J11** | **9084A17G01** |
| (L-56D) | (2609D01G02) | 2NO | **J20** | **9084A17G02** |
| (L-56E) | (2609D01G03) | 1NO and 1NC | **J11** | **9084A17G01** |
| (L-56B) | (2609D01G04) | 2NO | **J20** | **9084A17G02** |
| (L-56H) | (2609D01G05) | 2NO | **J20** | **9084A17G02** |
| (L-56J) | (2609D01G06) | 1NO and1NC DB | **J1C** | **9084A17G04** |
| (L-56A) | (2609D01G07) | N/A | **N/A** | **N/A** |
| (L-56B) | (2609D01G08) | N/A | **N/A** | **N/A** |
| (L-56F) | (2609D01G09) | N/A | **N/A** | **N/A** |
| (L-56G) | (2609D01G10) | 1NO and 1NC DB | **J1C** | **9084A17G04** |
| (L-56C) | (2609D01G11) | 2NC | **J02** | **9084A17G03** |
| (L-56M) | (2609D01G12) | N/A | **N/A** | **N/A** |
| (L-56P) | (2609D01G17) | 1NO and 1NC | **J11** | **9084A17G01** |
| (L-56R) | (2609D01G18) | 2NC | **J02** | **9084A17G03** |
| (L-56S) | (2609D01G19) | 1NO and 1NC | **J11** | **9084A17G01** |

### *Model J–K, Sizes 3 and 4*

#### Sizes 3 and 4 Kits ①

| Part | Poles | Size 3–Model J Style Number | Size 4–Model J ② Style Number | Size 4–Model K ③ Style Number |
|---|---|---|---|---|
| Contact kit | 2 | **626B187G12** | **626B187G16** | **5250C81G16** |
| | 3 | **626B187G13** | **626B187G17** | **5250C81G17** |
| | 4 | ④ | ⑥ | **5250C81G18** |
| | 5 | ⑤ | ⑦ | **5250C81G19** |
| Arc box | 2, 3 | **6714C74G09** | **6714C74G11** | **6714C74G11** |
| | 4, 5 | **6714C74G10** | **6714C74G12** | **6714C74G12** |
| Cross bar | 2, 3 | **672B788G36** | **672B788G36** | **672B788G40** |
| | 4, 5 | **672B788G38** | **672B788G38** | — |
| Upper base | 2, 3 | **672B788G37** | **672B788G37** | **672B788G52** |
| | 4, 5 | **672B788G39** | **672B788G39** | — |
| Lower base | 2, 3 | **1250C33G03** | **1250C33G03** | **1250C33G10** |
| | 4, 5 | **1250C33G06** | **1250C33G06** | — |
| KO spring (package of 10) | All | **503C796G02** | **503C796G02** | **672B788G50** |
| Terminal line/load (package of 3) | All | **372B357G12** | **372B357G18** | **372B357G18** |

***Notes***

① Model C contact tips and coils 00-4, two-, three-, four- and five-pole contactors are same as Model J. All other parts are unavailable.
② For 200A A202 magnetically latched lighting contactors order three-pole contact kit style 672B788G07.
③ Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.
④ Use quantity two of 626B187G12.
⑤ Use quantity one each of 626B187G12 and 626B187G13.
⑥ Use quantity two of 626B187G16.
⑦ Use quantity one each of 626B187G16 and 626B187G17.

### *Accessories for Model J–K, Series 3, 4*



## DC Coils ①

| Voltage | Model J Size 3, 4 Two-, Three-Pole Style Number |
|---|---|
| 24 | **1255C68G04** |
| 48 | **1255C68G05** |
| 125 | **1255C68G01** |
| 250 | **1255C68G02** |
| 125/250 ② | **1255C68G03** |

## AC Coils

| Voltage | Hz | Model J Size 3, 4 Two-, Three-Pole Style Number | Four-, Five-Pole Style Number | Model K Size 4 ③ Two-, Three-Pole Style Number | Four-, Five-Pole Style Number |
|---|---|---|---|---|---|
| 120/110 | 60/50 | **505C633G01** | **505C635G01** | **5250C79G01** | **5250C80G01** |
| 208 | 60 | **505C633G02** | **505C635G02** | **5250C79G02** | **5250C80G02** |
| 600/550 | 60/50 | **505C633G05** | **505C635G05** | **5250C79G05** | **5250C80G05** |
| 380 | 50 | **505C633G07** | **505C635G07** | **5250C79G07** | **5250C80G07** |
| 240/220 | 60/50 | **505C633G12** | **505C635G12** | **5250C79G12** | **5250C80G12** |
| 480/440 | 60/50 | **505C633G13** | **505C635G13** | **5250C79G13** | **5250C80G13** |
| 24 | 60 | **505C633G34** | **N/A** | **5250C79G34** | **N/A** |
| 277 | 60 | **505C633G14** | **N/A** | **5250C79G14** | **N/A** |
| 240/480 ② | 60/60 | **505C633G03** | **505C635G03** | **5250C79G03** | **5250C80G03** |
| 120/244 ② | 60/60 | **505C633G10** | **505C635G10** | **5250C79G10** | **5250C80G10** |

### *A201 Contactors—Size 5–9*

## GCA 530/630—GPD 7, 8, 9 Kits ④

| Part | Size 5 Style Number | Size 6 Style Number | Size 7 Style Number | Size 8 Style Number | Size 9 Style Number |
|---|---|---|---|---|---|
| Contact kit (one per pole) | **477B477G05** ⑤ | **2066A10G11** | **461A757G17** | **646C829G05** | **5264C42G01** ⑥ |
| | | | | | **5264C42G02** ⑦ |
| Arc box | **2050A15G45** | **2066A10G45** | **831D580G01** | **831D580G01** | **9917D69G02** |
| Magnet assembly | **2050A15G46** | **2050A15G46** | **N/A** | **N/A** | **N/A** |
| Mag. spg. kit | **2050A15G47** | **2050A15G47** | **N/A** | **N/A** | **N/A** |
| Acr cup kit | **2050A15G48** | **N/A** | **N/A** | **N/A** | **N/A** |
| Load conversion kit | **2050A15G49** | **2066A10G49** | **N/A** | **N/A** | **N/A** |
| Line conversion kit | **2050A15G50** | **2066A10G50** | **N/A** | **N/A** | **N/A** |
| K.O. spring–6 | **2050A15G51** | **2066A10G46** | **N/A** | **N/A** | **N/A** |
| C.T. 300/5 | **655C285H03** | **N/A** | **N/A** | **N/A** | **N/A** |
| C.T. 400/5 | **655C285H04** | **N/A** | **N/A** | **N/A** | **N/A** |
| C.T. 600/5 ⑧ | **N/A** | **2066A10G18** | **N/A** | **N/A** | **N/A** |
| C.T. 800/5 ⑧ | **N/A** | **2066A10G19** | **N/A** | **N/A** | **N/A** |
| Phase barrier | **N/A** | **N/A** | **640C441G01** | **640C441G01** | **5264C35G03** ⑥ |
| Cross bar | **2050A15G12** | **2066A10G15** | **N/A** | **N/A** | **N/A** |
| Shunt | **N/A** | **2066A10G48** | **650C129G01** | **646C831G02** ⑨ | **5264C39G02** ⑩ |

***Notes***

① Use only on units originally supplied with DC coil.
② Dual voltage coils. Use only on contactors or starters originally supplied with dual voltage coil.
③ Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.
④ Catalog Number A201/A200 Series replaces GCA/GPD series. Renewal parts are the same.
⑤ Use 477B477G06 for silver tungsten applications.
⑥ R.C.
⑦ F.C.
⑧ C.T. kit which replaces the single molded 1 C.T. assembly used on the old size 6 airbreak. The kit includes a single molded 3 C.T. assembly, 2 bus bar and hardware. This C.T. kit also replaces the single molded 3 C.T. assembly used on the present size 6 airbreak and size vacuum.
⑨ Set of three.
⑩ Set of four.

***Accessories for A201 Contactors—Size 5–9***

## Coils (Sizes 5 and 6)

| Voltage | Hz | Size 5 Style Number | Size 6 Style Number |
|---|---|---|---|
| **Sizes 5 and 6** | | | |
| 110/120 | 60 | **2050A14G05** | **2050A12G05** |
| 110/120 | 50 | **2050A14G06** | **2050A12G06** |
| 200/208 | 50 | **2050A14G07** | **2050A12G07** |
| 220/240 | 50 | **2050A14G08** | **2050A12G08** |
| 200/208 | 60 | **2050A14G09** | **2050A12G09** |
| 220/240 | 60 | **2050A14G10** | **2050A12G10** |
| 277/303 | 60 | **2050A14G12** | **2050A12G12** |
| 380/415 | 50 | **2050A14G14** | **2050A12G14** |
| 440/480 | 60 | **2050A14G15** | **2050A12G15** |
| 440/480 | 50 | **2050A14G16** | **2050A12G16** |
| 550/600 | 60 | **2050A14G17** | **2050A12G17** |
| 550/600 | 50 | **2050A14G18** | **2050A12G18** |
| 380/415 | 60 | **2050A14G19** | **2050A12G19** |
| 120/240 | 60 | **2050A14G20** | **2050A12G20** |
| 24 DC | — | **2050A14G21** | **2050A12G21** |
| 48 DC | — | **2050A14G22** | **2050A12G22** |
| 125 DC | — | **2050A14G25** | **2050A12G25** |
| 250 DC | — | **2050A14G27** | **2050A12G27** |

## Coils (Sizes 7–9)

| Line Voltage | Style Number | Required |
|---|---|---|
| **Sizes 7 and 8** | | |
| 125 Vdc | **438C805G04** | 2 |
| 230 Vdc | **438C805G02** | 2 |
| 250 Vdc | **438C805G03** | 2 |
| 110/120 Vac ①④ | **438C805G12** | 2 |
| 220/240 Vac ②④ | **438C805G11** | 2 |
| 380 Vac ③④ | **438C805G15** | 2 |
| 440/480 Vac ③④ | **438C805G10** | 2 |
| 550/575 Vac ③④ | **438C805G13** | 2 |
| **Size 9** | | |
| 110 Vdc | **5264C34G01** ⑤ | — |

***Notes***

① Rectifier 125V 2018A40G01 (one required).
② Rectifier 250V 2018A40G02 (one required).
③ Rectifier 600V 2018A40G03 (one required).
④ These coils require an external rectifier. If the rectifier needs replacement, order by the appropriate style number.
⑤ Contains coil and resistor.

## Modifications



### Factory Modifications

| Modification | Description | Catalog Number Suffix | NEMA Size 00–1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Control circuit | 1 Extra auxiliary contact (1NO-1NC) non-reversing, reversing, 2-speed unwired | **J1** | Consult sales office for pricing adders. | | | | | | | | |
| | 2 Extra auxiliary contact non-reversing, reversing, 2-speed unwired | **J2** | Consult sales office for pricing adders. | | | | | | | | |
| | 3 Extra auxiliary contact non-reversing, unwired | **J3** | Consult sales office for pricing adders. | | | | | | | | |
| | 4 Extra auxiliary contact non-reversing, unwired | **J4** | Consult sales office for pricing adders. | | | | | | | | |
| | Wired for separate control (NC) | **C** | Consult sales office for pricing adders. | | | | | | | | |
| | Omit control wiring (NC) | **X** | Consult sales office for pricing adders. | | | | | | | | |
| Overload relays (substitutions) | Ambient compensated with auto reset (NC) | **D** | Consult sales office for pricing adders. | | | | | | | | |
| | Fast trip—ambient compensated (specify motor FLA) | **D7** | Consult sales office for pricing adders. | | | | | | | | |
| | Overload relay alarm contact (NO) per overload | **E** | Consult sales office for pricing adders. | | | | | | | | |

### *Accessories and Field Modification Kits*

#### Type J Auxiliary Contact

- Capable of being field mounted in a contactor or starter (Classes A200, A900 Sizes 00–6, V200, V201 vacuum and definite purpose controllers)
- Provides two separate electrical contact sets which wire vertically and are color coded; black designates NC and silver designates NO. Please note that the vertical wiring is contrary to the horizontal wiring of the L-56 auxiliary contacts
- Designed to fit within dimensions of starter; no additional panel space is required
- Provides circuit isolation (no polarity restrictions) and single break bifurcated contacts

#### Auxiliary Contact Ratings

| Voltage | Make | Break |
|---|---|---|
| **NEMA A600** | | |
| 120–600 Vac | 7200 VA | 720 VA |
| 72–120 Vac | 60A | 720 VA |
| 28–72 Vac | 60 VA | 10A |
| **NEMA R300** | | |
| 28–300 Vdc | 28 VA | 28 VA |

#### Auxiliary Contact Types

| Contact Type | Max. | Catalog Number |
|---|---|---|
| 1NO and 1NC | 4 | **J11** |
| 2NC | 4 | **J02** |
| 2NO | 4 | **J20** |
| 1 coil clearing NC and 1NO | 4 | **J1C** |

## Technical Data and Specifications

### *Electrical Characteristics*

### Sizes 00–4

| | Size 00 | Size 0 | Size 1 | Size 2 | Size 3 | Size 4 |
|---|---|---|---|---|---|---|
| Max. voltage rating | 600V | 600V | 600V | 600V | 600V | 600V |
| Ampere rating | | | | | | |
| (Open) | 10A | 20A | 30A | 50A | 100A | 150A |
| (Enclosed) | 9A | 18A | 27A | 45A | 90A | 135A |
| **Squirrel Cage Motor** | | | | | | |
| Maximum horsepower at: | | | | | | |
| 200V/60 Hz | 1-1/2 hp | 3 hp | 7-1/2 hp | 10 hp | 25 hp | 40 hp |
| 230V/ 60 Hz | 1-1/2 hp | 3 hp | 7-1/2 hp | 15 hp | 30 hp | 50 hp |
| 380V/50 Hz | 1-1/2 hp | 5 hp | 10 hp | 25 hp | 50 hp | 75 hp |
| 460V–575V/60 Hz | 2 hp | 5 hp | 10 hp | 25 hp | 50 hp | 100 hp |
| **Resistive Heating kW** ① | | | | | | |
| Single-phase, two-pole | | | | | | |
| 120V | — | — | 3 kW | 5 kW | 10 kW | 15 kW |
| 240V | — | — | 6 kW | 10 kW | 20 kW | 30 kW |
| 480V | — | — | 12 kW | 20 kW | 40 kW | 60 kW |
| 600V | — | — | 15 kW | 25 kW | 50 kW | 75 kW |
| Three-phase, three-pole | | | | | | |
| 120V | — | — | 5 kW | 8.5 kW | 17 kW | 26 kW |
| 240V | — | — | 10 kW | 17 kW | 34 kW | 68 kW |
| 480V | — | — | 20 kW | 34 kW | 68 kW | 105 kW |
| 600V | — | — | 25 kW | 43 kW | 86 kW | 130 kW |
| **Capacitor Switching kVAR, Three-Phase** | | | | | | |
| 240V | — | — | — | 12 kVAR | 27 kVAR | 40 kVAR |
| 480V | — | — | — | 25 kVAR | 53 kVAR | 80 kVAR |
| 600V | — | — | — | 31 kVAR | 67 kVAR | 100 kVAR |
| **Transformer Switching kVA** ② | | | | | | |
| Single-phase, two-pole | | | | | | |
| 120V | — | 0.6 kVA | 1.2 kVA | 2.1 kVA | 4.1 kVA | 6.8 kVA |
| 240V | — | 1.2 kVA | 2.4 kVA | 4.1 kVA | 8.1 kVA | 14 kVA |
| 480V | — | 2.4 kVA | 4.9 kVA | 8.3 kVA | 16 kVA | 27 kVA |
| 600V | — | 3 kVA | 6.2 kVA | 10 kVA | 20 kVA | 34 kVA |
| Three-phase, three-pole | | | | | | |
| 120V | — | 1.8 kVA | 3.6 kVA | 6.3 kVA | 12 kVA | 20 kVA |
| 240V | — | 2.1 kVA | 4.3 kVA | 7.2 kVA | 14 kVA | 23 kVA |
| 480V | — | 4.2 kVA | 8.5 kVA | 14 kVA | 28 kVA | 47 kVA |
| 600V | — | 5.2 kVA | 11 kVA | 18 kVA | 35 kVA | 59 kVA |

### Sizes 5–9

| | Size 5 | Size 6 | Size 7 | Size 8 | Size 9 |
|---|---|---|---|---|---|
| Max. voltage rating | 600V | 600V | 600V | 600V | 600V |
| Ampere rating | | | | | |
| (Open) | 300A | 600A | 900A | 1350A | 2500A |
| (Enclosed) | 270A | 540A | 810A | 1215A | 2250A |
| **Squirrel Cage Motor** | | | | | |
| Maximum horsepower at: | | | | | |
| 200V/60 Hz | 75 hp | 150 hp | — | — | — |
| 230V/60 Hz | 100 hp | 200 hp | 300 hp | 450 hp | 800 hp |
| 380V/50 Hz | 150 hp | 300 hp | — | — | — |
| 460V–575V/60 Hz | 200 hp | 400 hp | 600 hp | 900 hp | 1600 hp |
| **Resistive Heating kW** ① | | | | | |
| Single-phase, two-pole | | | | | |
| 120V | 30 kW | 60 kW | 90 kW | ③ | ③ |
| 240V | 60 kW | 120 kW | 180 kW | ③ | ③ |
| 480V | 120 kW | 240 kW | 360 kW | ③ | ③ |
| 600V | 150 kW | 300 kW | 450 kW | ③ | ③ |
| Three-phase, three-pole | | | | | |
| 120V | 52 kW | 105 kW | 155 kW | ③ | ③ |
| 240V | 105 kW | 210 kW | 315 kW | ③ | ③ |
| 480V | 210 kW | 415 kW | 625 kW | ③ | ③ |
| 600V | 260 kW | 515 kW | 775 kW | ③ | ③ |
| **Capacitor Switching kVAR, Three-Phase** | | | | | |
| 240V | 80 kVAR | 160 kVAR | 240 kVAR | 360 kVAR | 665 kVAR |
| 480V | 160 kVAR | 320 kVAR | 480 kVAR | 720 kVAR | 1325 kVAR |
| 600V | 200 kVAR | 400 kVAR | 600 kVAR | 900 kVAR | 1670 kVAR |
| **Transformer Switching kVA** ② | | | | | |
| Single-phase, two-pole | | | | | |
| 120V | 14 kVA | 27 kVA | 41 kVA | 61 kVA | 112 kVA |
| 240V | 27 kVA | 54 kVA | 81 kVA | 122 kVA | 225 kVA |
| 480V | 54 kVA | 108 kVA | 162 kVA | 244 kVA | 450 kVA |
| 600V | 68 kVA | 135 kVA | 203 kVA | 304 kVA | 562 kVA |
| Three-phase, three-pole | | | | | |
| 120V | 41 kVA | 81 kVA | 122 kVA | 182 kVA | 337 kVA |
| 240V | 47 kVA | 94 kVA | 140 kVA | 210 kVA | 342 kVA |
| 480V | 94 kVA | 188 kVA | 280 kVA | 420 kVA | 783 kVA |
| 600V | 117 kVA | 234 kVA | 351 kVA | 526 kVA | 975 kVA |

***Notes***

① Resistive loads having inrush currents not exceeding 1.5 times continuous rating.

② These ratings are for transformers having inrush currents not more than 20 times peak of continuous current ratings. For inrush currents greater than 20 times, refer to factory.

③ For ratings refer to factory.

### *DC Power Pole Ratings*

The following represent typical production test values and should not be interpreted as a guarantee of actual performance.

## DC Operated 120 and 240V Coils

| Contactor Size | DC Contact Ampere Rating Two Poles in Series ① 120V | 240V |
|---|---|---|
| 0 | — | — |
| 1 | 20 | 10 |
| 2 | 45 | 30 |
| 3 | 75 | 40 |
| 4 | 90 | 70 |

### *380V, 50 Hz Starter Maximum Horsepower Ratings*

## Horsepower Ratings

| NEMA Size | 00 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum horsepower | 1-1/2 | 5 | 10 | 25 | 50 | 75 | 150 | 300 | 450 | 700 |

### *Operating Coil Characteristics at Rated Coil Volts, Sizes 00–9*

The following represent typical production test values and should not be interpreted as a guarantee of actual performance.

## Operating Coil Characteristics

| | Sizes 00, 0, 1 | Size 2 | Size 3 | Size 4 ② | Size 5 | Size 6 | Size 7 | Size 8 | Size 9 |
|---|---|---|---|---|---|---|---|---|---|
| **AC Coil** | | | | | | | | | |
| Burden | | | | | | | | | |
| (Open VA) | 160 VA | 160 VA | 625 VA | 700 VA | 1700 VA | 2900 VA | ③ | ③ | ③ |
| (Closed VA) | 25 VA | 25 VA | 50 VA | 64 VA | 180 VA | 220 VA | ③ | ③ | ③ |
| (Closed Watts) | 7.8 W | 7.8 W | 18 W | 21 W | 32 W | 42 W | — | — | — |
| Pick-up volts ④ | 85% | 85% | 85% | 85% | 78% | 70% | — | — | — |
| Drop-out volts ④ | 40–60% | 40–60% | 40–60% | 40–60% | 65 to 75% | 60 to 70% | — | — | — |
| Pick-up time Hz ⑤⑥ | 1–1-1/2 | 1-1/2–2 | 2–2-1/2 | 1–1-1/2 | 1.5 | 4.0 | — | — | — |
| Drop-out time Hz ⑤ | 3/4–1 | 3/4–1 | 3/4–1 | 3/4–1 | 0.75 | 0.75 | — | — | — |
| **DC Coil** | | | | | | | | | |
| Burden | | | | | | | | | |
| (Open VA) | 17 VA | 17 VA | 35 VA | 35 VA | 600 VA | 2120 VA | 400 VA | 400 VA | 2100 VA |
| (Closed VA) | 17 VA | 17 VA | 35 VA | 35 VA | 22 VA | 21 VA | 400 VA | 400 VA | 350 VA |
| (Closed Watts) | 18 W | 18 W | 35 W | 35 W | 20 W | 20 W | 400 W | 400 W | 350 W |
| Pick-Up Volts ④ | 80% | 80% | 80% | 80% | 64% | 73% | 45%–65% ⑦ | 45%–65% ⑦ | 50%–65% ⑦ |
| Drop-Out Volts ④ | 5–10% | 5–10% | 5–10% | 5–10% | 18% | 13% | 30%–45% ⑦ | 30%–45% ⑦ | 40%–50% ⑦ |
| Pick-Up Time Hz ⑥ | — | 25–75 ms | 25–75 ms | 25–75 ms | 2.7 Hz ⑤ | 3 Hz ⑤ | 21–41 Hz ⑦⑤ | 17–29 Hz ⑦⑤ | 16–18 ⑦⑤ |
| Drop-Out Time Hz ⑤ | — | 16–25 ms | 16–25 ms | 16–25 ms | 9.3 Hz ⑤ | 17.5 Hz ⑤ | 7–12 Hz ⑧⑤ | 7–12 Hz ⑧⑤ | 18–20 Hz ⑦⑤ |

***Notes***

① Non-inductive load.
② AC coil data pertains to Model K, DC coil data pertains to Model J.
③ DC operated only.
④ Percent of rated coil voltage.
⑤ At 60 Hz base.
⑥ To contact touch.
⑦ Lower figure when coil is cold. Higher figure when coil is hot.
⑧ Drop-out time to clear arc. Time varies with type of load and contact wear.

## Mechanical Characteristics

***NEMA Standard ICS 2-110***

Direct-current operated contactors shall withstand 110% of their rated voltage continuously without injury to the operating coils and shall close successfully at 80% of their rated voltage.

Alternating-current operated contactors shall withstand 110% of their rated voltage continuously without injury to the operating coils and shall close successfully at 85% of their rated voltage.

### Mechanical Characteristics, Sizes 00–9

| | Sizes 00, 0, 1 | Size 2 | Size 3 | Size 4 | Size 5 | Size 6 | Size 7 | Size 8 | Size 9 |
|---|---|---|---|---|---|---|---|---|---|
| Dimensions in inches (mm) | | | | | | | | | |
| Height | 6.45 (163.8) | 7.16 (181.9) | 9.93 (252.2) | 9.93 (252.2) | 12.00 (304.8) ① | 13.50 (342.9) ① | 18.62 (472.9) ① | 19.25 (489) ① | 25.00 (635) ① |
| Width | 3.31 (84.1) | 3.31 (84.1) | 4.62 (117.3) | 4.62 (117.3) | 7.00 (177.8) ① | 7.00 (177.8) ① | 23.50 (596.9) ① | 23.50 (596.9) ① | 32.00 (812.8) ① |
| Depth | 4.61 (117.1) | 4.96 (126) | 6.75 (171.5) | 6.75 (171.5) | 7.75 (196.9) ① | 8.75 (222.3) ① | 11.00 (279.4) ① | 11.00 (279.4) ① | 13.00 (330.2) ① |
| Panel area—square inches | 21.35 | 23.7 | 46.0 | 46.0 | 84.0 | 94.5 | 437.5 | 452.4 | 800 |
| Weight—pounds | 3.5 | 3.5 | 11.5 | 11.5 | 25 | 42 | 215 | 265 | 315 |
| Cable connection | — | — | — | — | Front | Front | Front/rear | Front/rear | Front/rear |
| Maximum cable size/phase copper (AWG/MCM) | 6 AWG | 3 AWG | 1/0 | 4/0 | 1–500 MCM | 2–500 MCM | 3–500 MCM | 4–500 MCM | 8–500 MCM |
| Auxiliary electrical circuits available | 8 | 6 | 6 | 6 | 4 | 4 | 3 | 3 | 4 |
| Latched version available | Yes | Yes | Yes | Yes | Yes | Yes | No | No | No |
| **Mechanical interlock combinations available** | | | | | | | | | |
| Sizes | | | | | | | | | |
| 00, 0, 1, 2, 3, 4 | Vert., Horiz. | Vert., Horiz. | Vert., Horiz. | Vert., Horiz. | Vert., Horiz. | — | — | — | — |
| 5 | — | — | — | — | Vert., Horiz. | Vert., Horiz. | — | — | — |
| 6 | — | — | — | — | Vert., Horiz. | Vert., Horiz. | Vertical | Vertical | — |
| 7, 8 | — | — | — | — | — | Vertical | Vertical | Vertical | Vertical |
| 9 | — | — | — | — | — | — | Vertical | Vertical | Vertical |

### Data from Tables 430—147 Through 150 of 1996 NEC: Motor Amperes at Full Load ②, Three-Phase AC

| | Single-Phase AC | | Induction Type Squirrel Cage and Wound-Rotor Amperes | | | | DC | | | Single-Phase AC | | Induction Type Squirrel Cage and Wound-Rotor Amperes | | | | DC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| hp | 115V | 230V | 200V | 230V | 460V | 575V | 120V | 240V | hp | 115V | 230V | 200V | 230V | 460V | 575V | 120V | 240V |
| 1/6 | 4.4 | 2.2 | — | — | — | — | — | — | 30 | — | — | 92 | 80 | 40 | 32 | — | 106 |
| 1/4 | 5.8 | 2.9 | — | — | — | — | 3.1 | 1.6 | 40 | — | — | 120 | 104 | 52 | 41 | — | 140 |
| 1/3 | 7.2 | 3.6 | — | — | — | — | 4.1 | 2.0 | 50 | — | — | 150 | 130 | 65 | 52 | — | 173 |
| 1/2 | 9.8 | 4.9 | 2.5 | 2.2 | 1.1 | 0.9 | 5.4 | 2.7 | 60 | — | — | 177 | 154 | 77 | 62 | — | 206 |
| 3/4 | 13.8 | 6.9 | 3.7 | 3.2 | 1.6 | 1.3 | 7.6 | 3.8 | 75 | — | — | 221 | 192 | 96 | 77 | — | 255 |
| 1 | 16 | 8 | 4.8 | 4.2 | 2.1 | 1.7 | 9.5 | 4.7 | 100 | — | — | 285 | 248 | 124 | 99 | — | 341 |
| 1-1/2 | 20 | 10 | 6.9 | 6.0 | 3.0 | 2.4 | 13.2 | 6.6 | 125 | — | — | 359 | 312 | 156 | 125 | — | 425 |
| 2 | 24 | 12 | 7.8 | 6.8 | 3.4 | 2.7 | 17 | 8.5 | 150 | — | — | 414 | 360 | 180 | 144 | — | 506 |
| 3 | 34 | 17 | 11.0 | 9.6 | 4.8 | 3.9 | 25 | 12.2 | 200 | — | — | 552 | 480 | 240 | 192 | — | 675 |
| 5 | 56 | 28 | 17.5 | 15.2 | 7.6 | 6.1 | 40 | 20 | 250 | — | — | — | — | 302 | 242 | — | — |
| 7-1/2 | 80 | 40 | 25.3 | 22 | 11 | 9 | 58 | 29 | 300 | — | — | — | — | 361 | 289 | — | — |
| 10 | 100 | 50 | 32.2 | 28 | 14 | 11 | 76 | 38 | 350 | — | — | — | — | 414 | 336 | — | — |
| 15 | — | — | 48.3 | 42 | 21 | 17 | — | 55 | 400 | — | — | — | — | 477 | 382 | — | — |
| 20 | — | — | 62.1 | 54 | 27 | 22 | — | 72 | 450 | — | — | — | — | 515 | 412 | — | — |
| 25 | — | — | 78.2 | 68 | 34 | 27 | — | 89 | 500 | — | — | — | — | 590 | 472 | — | — |

***Notes***

① For Sizes 5–9 contactors only; for starter Sizes 5–9, refer to factory.

② These current values are for motors running at usual speeds and with normal torque characteristics. Motors for special low speed or high torque may require higher current. In all cases, heaters should be selected on basis of information on motor nameplate or motor card data.

### *Combination Ratings*



#### Sizes 00–2

| Short-Circuit Protective Device (SCPD) | Max. Rating SCPD | Circuit Breaker Interrupting Rating | Short-Circuit Withstand Capability Current | Voltage |
|---|---|---|---|---|
| **Sizes 00, 0, 1** | | | | |
| Class H fuse | 60A | — | 5000A | 600V |
| Class J fuse | 60A | — | 100,000A | 600V |
| Class R fuse | 60A | — | 100,000A | 600V |
| Class T fuse | 60A | — | 100,000A | 600V |
| Magnetic only ① Type CB ② | 30A | Marked HMCP | 100,000A | 480V |
| | | | 50,000A | 600V |
| Thermal/magnetic Type CB ③ | 50A | 65,000A | 65,000A | 480V |
| | | 25,000A | 25,000A | 600V |
| | | 100,000A | 100,000A | 480V |
| | | 35,000A | 35,000A | 600V |
| Magnetic only Type CB + CL ④ | 30A | HMCP + current limiter | 100,000A | 600V |
| Thermal/magnetic Type CLB ⑤ | 50A | 150,000A | 100,000A | 480V |
| **Size 2** | | | | |
| Class H fuse | 100A | — | 5000A | 600V |
| Class J fuse | 100A | — | 100,000A | 600V |
| Class R fuse | 100A | — | 100,000A | 600V |
| Class T fuse | 100A | — | 100,000A | 600V |
| Magnetic only ① Type CB ② | 50A | Marked HMCP | 100,000A | 480V |
| | | | 50,000A | 600V |
| Thermal/magnetic Type CB ③ | 90A | 65,000A | 65,000A | 480V |
| | | 25,000A | 25,000A | 600V |
| | | 100,000A | 100,000A | 480V |
| | | 35,000A | 35,000A | 600V |
| Magnetic only Type CB + CL ④ | 50A | HMCP + current limiter | 100,000A | 600V |
| Thermal/magnetic Type CLB ⑤ | 50A | 150,000A | 100,000A | 480V |

#### Sizes 3 and 4

| Short-Circuit Protective Device (SCPD) | Max. Rating SCPD | Circuit Breaker Interrupting Rating | Short-Circuit Withstand Capability Current | Voltage |
|---|---|---|---|---|
| **Size 3** | | | | |
| Class H fuse | 60A | — | 5000A | 600V |
| Class J fuse | 60A | — | 100,000A | 600V |
| Class R fuse | 60A | — | 100,000A | 600V |
| Class T fuse | 60A | — | 100,000A | 600V |
| Magnetic only ① Type CB ② | 100A | Marked HMCP | 100,000A | 480V |
| | | | 50,000A | 600V |
| Thermal/magnetic Type CB ③ | 150A | 65,000A | 65,000A | 480V |
| | | 25,000A | 25,000A | 600V |
| | | 100,000A | 100,000A | 480V |
| | | 35,000A | 35,000A | 600V |
| Magnetic only Type CB + CL ④ | 100A | HMCP + current limiter | 100,000A | 600V |
| Thermal/magnetic Type CLB ⑤ | 150A | 50,000A | 100,000A | 480V |
| **Size 4** | | | | |
| Class H fuse | 400A | — | 10,000A | 600V |
| Class J fuse | 400A | — | 100,000A | 600V |
| Class R fuse | 400A | — | 100,000A | 600V |
| Class T fuse | 400A | — | 100,000A | 600V |
| Magnetic only ① Type CB ② | 150A | Marked HMCP | 100,000A | 480V |
| | | | 50,000A | 600V |
| Thermal/magnetic Type CB ③ | 250A | 65,000A | 65,000A | 480V |
| | | 25,000A | 25,000A | 600V |
| | | 100,000A | 100,000A | 480V |
| | | 35,000A | 35,000A | 600V |
| Magnetic only Type CB + CL ④ | 150A | HMCP + current limiter | 100,000A | 600V |
| Thermal/magnetic Type CB + CL ⑤ | 250A | 200,000A | 100,000A | 600V |
| Thermal/magnetic Type CLB ⑥ | 250A | 150,000A | 100,000A | 480V |

### *Coil Suffix*

#### Other Available Coil Voltages—AC and DC Coils ⑦

| Coils | Catalog Number Suffix | Coil Rating (Volts/Hertz) | Catalog Number Suffix | Coil Rating (Volts/Hertz) |
|---|---|---|---|---|
| **AC** | **A** | 120/60, 110/50 | **N** | 110/50 |
| | **B** | 200-208/60 | **P** | 48/60 |
| | **C** | 240/60 and 480/60 | **R** | 120/60 and 240/60 |
| | **D** | 440/50 | **U** | 440-480/50 or 60 Rect. to DC |
| | **E** | 600/60 Hz | **V** | 110/60 |
| | **G** | 220/50 | **W** | 240/60 |
| | **H** | 380/50 | **X** | 480/60 |
| | **I** | 24/60 | **Y** | 415/50 |
| | **J** | 110-120/50 or 60 Rect. to DC | **Z** | 277/60 |
| | **K** | 220-240/50 or 60 Rect. to DC | — | — |
| **DC** ⑧⑨ | **L** | 24 Vdc | **S** | 125 Vdc |
| | **M** | 48 Vdc | **T** | 250 Vdc |

***Notes***

① Instantaneous adjustable trip.
② Circuit breaker.
③ Inverse time circuit breaker.
④ Instantaneous adjustable trip with current limiting attachment.
⑤ Inverse time with built-in current limiting attachment.
⑥ Inverse time current limiting breaker.
⑦ Availability may be limited.
⑧ DC coils for Size 5 and 6 contactors and starters are intermittent duty rated only. A mechanical latch is required.
⑨ DC coils. Use only on contactors originally supplied with a DC coil.

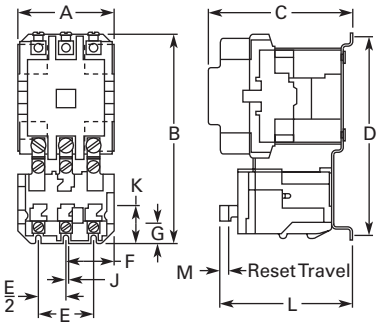
## Dimensions

Approximate Dimensions in Inches (mm)

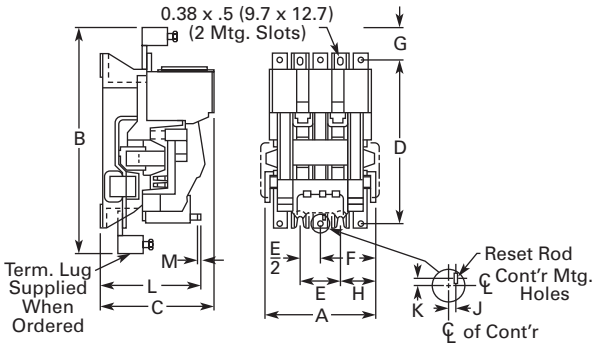
***Not to be used for construction purposes unless approved.***

***Open Non-Reversing Starters***

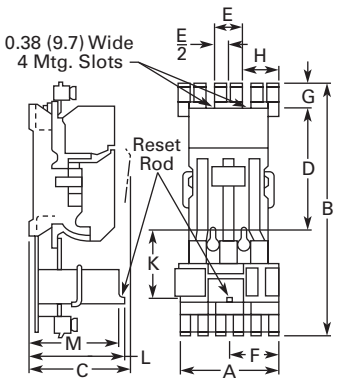
### Figure A—Sizes 00–4




### Figure B—Size 5




### Figure C—Size 6




### Dimensions and Shipping Weights

| NEMA Size | No. of Poles | Fig. | Mounting Screws No. | Mounting Screws Size | A | B | C | D | E | F | G | H | J | K | L | M | Weight, Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00, 0, 1 | 2, 3 | A | 3 | #10 | 3.31 (84.1) | 6.42 (163.1) | 4.61 (117.1) | 6.00 (152.4) | 1.88 (47.8) | 1.66 (42.2) | 0.23 (5.8) | — | 0.39 (9.9) | 0.59 (15.0) | 4.48 (113.8) | 0.27 (6.9) | 35.0 (15.9) |
| 2 | 2, 3 | A | 3 | #10 | 3.31 (84.1) | 7.17 (182.1) | 4.94 (125.5) | 6.75 (171.5) | 1.88 (47.8) | 1.66 (42.2) | 0.23 (5.8) | — | 0.41 (10.4) | 0.77 (19.6) | 4.53 (115.1) | 0.27 (6.9) | 43.0 (19.5) |
| 3, 4 | 2, 3 | A | 3 | 1/4 in. | 4.63 (117.6) | 9.94 (252.5) | 6.75 (171.5) | 9.25 (235.0) | 2.88 (73.2) | .94 (23.9) | 0.38 (9.7) | — | 0.55 (14.0) | 0.80 (20.3) | 6.36 (161.5) | 0.27 (6.9) | 115.0 (52.2) |
| 5 | 3 | B | 4 | 3/8 in. | 7.59 (192.8) | 16.22 (412.0) | 7.75 (196.9) | 11.00 (279.4) | 2.75 (69.9) | 3.81 (96.8) | 2.69 (68.3) | 2.42 (61.5) | 0.33 (8.4) | 0.33 (8.4) | 7.00 (177.8) | 0.27 (6.9) | 29.0 (13.2) |
| 6 | 3 | C | 4 | 3/8 in. | 9.25 (235.0) | 23.50 (596.9) | 9.50 (241.3) | 11.00 (279.4) | 2.75 (69.9) | 4.81 (122.2) | 2.75 (69.9) | 3.06 (77.7) | — | 6.50 (165.1) | 8.44 (214.4) | 0.27 (6.9) | 55.0 (25.0) |
| 7 | 3 | ① | ① | ① | 37.88 (962.2) | 21.50 (546.1) | 11.75 (298.5) | — | — | — | — | — | — | — | — | — | — |
| 8 | 3 | ① | ① | ① | 37.88 (962.2) | 21.50 (546.1) | 11.75 (298.5) | — | — | — | — | — | — | — | — | — | — |
| 9 | 3 | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① |

***Note***

① Refer to factory.

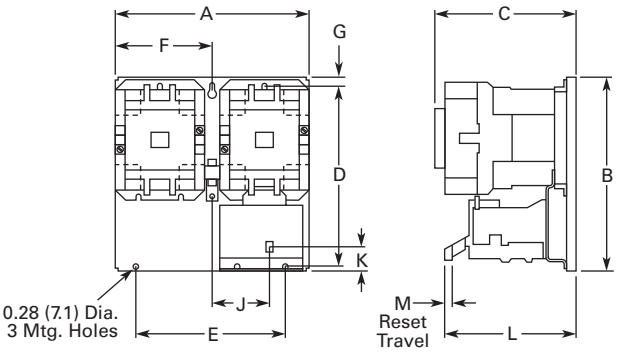
Approximate Dimensions in Inches (mm)

***Not to be used for construction purposes unless approved.***

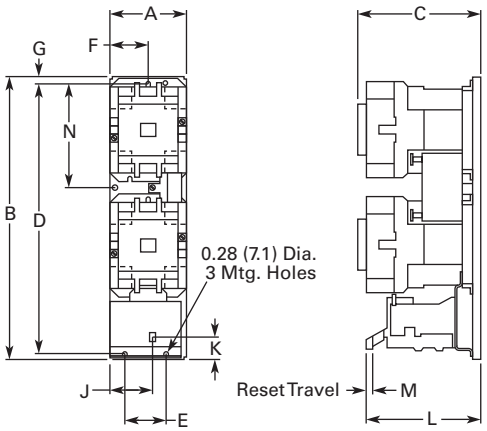
2

***Open Reversing Starters***

### Figure A—Sizes 00–4 Horizontal




### Figure B—Sizes 00–4 Vertical




### Dimensions and Shipping Weights

| NEMA Size | Number of Poles | Fig. | Mounting Screws No. | Mounting Screws Size | A | B | C | D | E | F | G | J | K | L | M | N | Weight, Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00, 0, 1 | 3 x 3 Horiz. | A | 3 | #10 | 7.13 (181.1) | 6.50 (165.1) | 5.05 (128.3) | 6.00 (152.4) | 5.69 (144.5) | 3.56 (90.4) | 0.25 (6.4) | 2.3 (58.4) | 0.59 (15.0) | 4.92 (125.0 | 0.27 (6.9) | — | 9.0 (4.0) |
| | 3 x 3 Vert. | B | 3 | #10 | 3.33 (84.6) | 11.63 (295.4) | 5.05 (128.3) | 11.13 (282.7) | 1.88 (47.8) | 1.66 (42.2) | 0.25 (6.4) | 0.39 (9.9) | 0.59 (15.0) | 4.92 (125.0) | 0.27 (6.9) | 4.52 (114.8) | 9.8 (4.4) |
| 2 | 3 x 3 Horiz. | A | 3 | #10 | 7.13 (181.1) | þ7.25 (184.2) | 5.38 (136.7) | 6.75 (171.5) | 5.69 (144.5) | 3.56 (90.4) | 0.25 (6.4) | 2.31 (58.7) | 0.77 (19.6) | 4.97 (126.2) | 0.27 (6.9) | — | 10.8 4.9) |
| | 3 x 3 Vert. | B | 3 | #10 | 3.33 (84.6) | 12.38 (314.5) | 5.38 (136.7) | 11.88 (301.8) | 1.88 (47.8) | 1.66 (42.2) | 0.25 (6.4) | 0.39 (9.9) | 0.77 (19.6) | 4.97 (126.2) | 0.27 (6.9) | 4.52 (114.8) | 12.2 (5.5) |
| 3, 4 | 3 x 3 Horiz. | A | 3 | 1/4 in. | 9.75 (247.7) | 10.13 (257.3) | 7.25 (184.2) | 9.25 (235.0) | 8.00 (203.2) | 4.88 (124.0) | 0.44 (11.2) | 3.11 (79.0) | 0.80 (20.3) | 6.86 (174.2) | 0.27 (6.9) | — | 26.0 (11.8) |
| | 3 x 3 Vert. | B | 3 | 1/4 in. | 4.63 (117.6) | 19.81 (503.2) | 7.25 (184.2) | 18.94 (481.1) | 2.88 (73.2) | 2.94 (74.7) | 0.44 (11.2) | 0.55 (14.0) | 0.80 (20.3) | 6.86 (174.2) | 0.27 (6.9) | 7.91 (200.9) | 28.0 (12.7) |
| 5 | 3 x 3 Horiz. | — | 4 | 3/8 in. | 35.25 (895.4) | 25.50 (647.7) | 8.75 (222.3) | — | — | — | — | — | — | — | — | — | 73.0 (33.1) |
| 6 | 3 x 3 Horiz. | — | 4 | 3/8 in. | 35.25 (895.4) | 25.50 (647.7) | 10.50 (266.7) | — | — | — | — | — | — | — | — | — | 127.0 (57.7) |
| 7 | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① |
| 8 | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① |
| 9 | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① |

***Note***

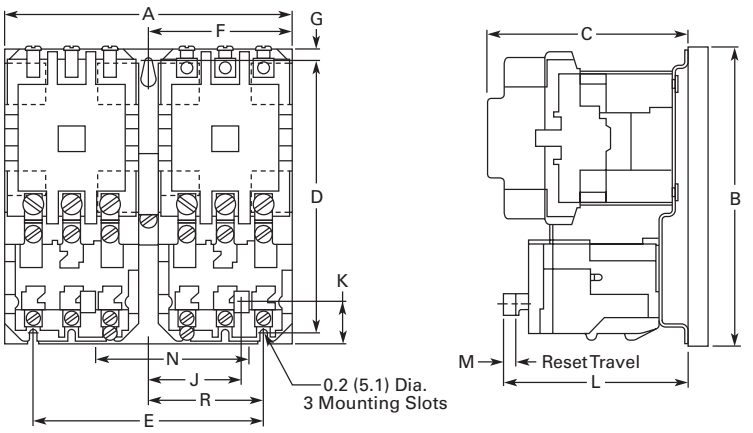
① Refer to factory.

Approximate Dimensions in Inches (mm)

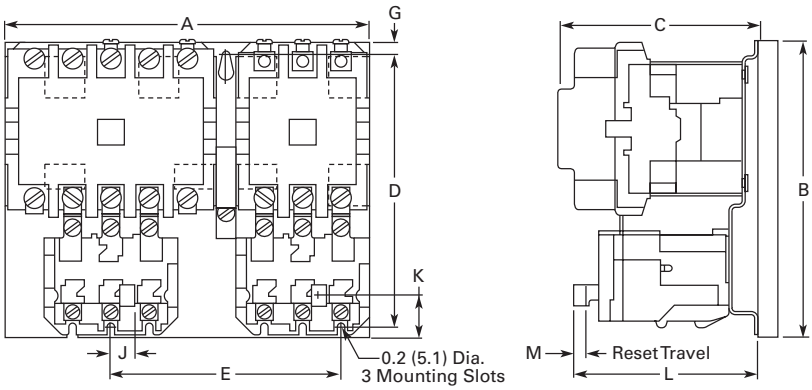
***Not to be used for construction purposes unless approved.***

***Open Multi-Speed Starters***

## Figure A—Sizes 00–4




## Figure B—Sizes 2



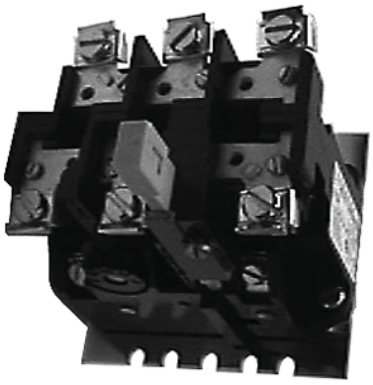

## Dimensions and Shipping Weights

| NEMA Size | Number of Poles | Fig. | Mounting Screws No. | Mounting Screws Size | A | B | C | D | E | F | G | J | K | L | M | N | P | R | Weight, Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00, 0, 1 | 3 x 3 Horiz. | A | 3 | #10 | 7.13 (181.1) | 6.50 (165.1) | 5.05 (128.3) | 6.00 (152.4) | 5.69 (144.5) | 3.56 (90.4) | 0.25 (6.4) | 2.30 (58.4) | 0.33 (8.4) | 4.92 (125.0) | 0.27 (6.9) | 3.81 (96.8) | — | 2.91 (73.9) | 10.0 (4.5) |
| | 5 x 3 Horiz. | B | 3 | #10 | 8.00 (203.2) | 6.50 (165.1) | 5.05 (128.3) | 6.00 (152.4) | 6.53 (165.9) | 3.56 (90.4) | 0.25 (6.4) | 2.30 (58.4) | 0.48 (12.2) | 4.92 (125.0) | 0.27 (6.9) | 4.66 (118.4) | — | 2.91 (73.9) | 11.0 (5.0) |
| 2 | 3 x 3 Horiz. | A | 3 | #10 | 7.13 (181.1) | 7.25 (184.2) | 5.38 (136.7) | 6.75 (171.5) | 5.69 (144.5) | 3.56 (90.4) | 0.25 (6.4) | 2.69 (68.3) | 0.69 (17.5) | 4.97 (126.2) | 0.27 (6.9) | 3.81 (96.8) | — | 2.91 (73.9) | 11.0 (5.0) |
| | 5 x 3 Horiz. | B | 3 | #10 | 8.88 (225.6) | 7.25 (184.2) | 5.38 (136.7) | 6.75 (171.5) | 6.56 (166.6) | 3.56 (90.4) | 0.25 (6.4) | 2.69 (68.3) | 0.69 (17.5) | 4.97 (126.2) | 0.27 (6.9) | 4.66 (118.4) | — | 2.84 (72.1) | 13.0 (5.9) |
| 3, 4 | 3 x 3 Horiz. | A | 3 | 1/4 in. | 9.75 (247.7) | 10.13 (257.3) | 7.25 (184.2) | 9.25 (235.0) | 8.00 (203.2) | 4.88 (124.0) | 0.44 (11.2) | 3.11 (79.0) | 0.80 (20.3) | 6.86 (174.2) | 0.27 (6.9) | 5.13 (130.3) | — | 4.00 (101.6) | 28.0 (12.7) |
| | 5 x 3 Horiz. | B | 3 | 1/4 in. | 12.38 (314.5) | 10.13 (257.3) | 7.25 (184.2) | 9.25 (235.0) | 9.31 (236.5) | 4.88 (124.0) | 0.44 (11.2) | 3.11 (79.0) | 0.80 (20.3) | 6.86 (174.2) | 0.27 (6.9) | 6.44 (163.6) | — | 4.00 (101.6) | 33.5 (15.2) |
| 5 | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① |
| 6 | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① | ① |

***Notes***

Three-pole x three-pole devices are for Wye-Wye two-winding motors only.

① Refer to factory.



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# Relays—Thermal and Fast Trip

## Product Overview

Type B and Type A, Class 20 Thermal Overload Relays from Eaton's Electrical Sector will protect the motor against abnormal overload conditions. Bimetallic actuated, they are available as either ambient compensated or non-compensated in either single-pole or block type three-pole design. Type B use one pole of the three-pole block for single-phase.

Single-pole relays are also available as Fast Trip Class 10 ambient compensated type, which provides approximately 125% motor protection with a tripping time of less than 10 seconds, at 600% of heater current rating.

Fast trip relays can be identified by the green reset rods. They are available for panel or starter mounting. The three-pole fast trip design is composed of three single-pole relays on a common baseplate, with a common reset bar.

The bimetal element is actuated by precisely calibrated heater elements which are connected directly in the circuit to be protected. Thermal actuation of this device opens the contacts in the coil circuit of a contactor or relay which results in the disconnection of power to the overloaded circuit.

Interchangeable thermal heater elements for single-pole standard trip and block type overload relays are available to cover motor full load currents from 0.29 to 133A in approximately 10% steps (see Heater Application Table). Fast trip overload relays do not have interchangeable heater elements but are available in a series of ratings to cover motor full load currents from 1.6 to 150A in approximately 50% steps.

## Features

### *Manual or Automatic Reset*

Type B is furnished with a manual reset. Type A is normally furnished set for manual reset operation and may be quickly adjusted for automatic reset when required. Automatic reset should not be used with two-wire control or where automatic restarting would endanger either personnel or equipment.

### *Trip Indication*

An immediate visible indication of trip is provided on the overload relay. When an overload occurs, which causes the relay to operate, a trip indicator projects out and thus shows positive visual indication of trip. Type B has a mechanical trip bar to manually check the NC contact operation on the overload relay.

### *Adjustable Trip*

On Type A, the trip rating of a specific heater element can be adjusted over a range of approximately 85% to 115% of its respective rating to permit the desired close protection.

This is accomplished by turning the adjusting knob on the relay to the respective stop position.

### *Positive Contact Break*

A follow-through contact, provided on the stationary terminal of the snap action control switch, provides reliable electrical continuity during toggling, thus eliminating false trip sometimes prevalent with thermally operated switches. This contact also allows contact wipe for further reliability.

***Ambient Compensation***

Motor overload protection can be provided with the same trip characteristics in ambient temperature from –40° to 77°C (–40° to 167°F). A compensating bimetal maintains a constant "travel to trip" distance independent of ambient conditions. The compensating feature is fully automatic and no adjustments are required over wide fluctuations in ambient temperatures. Compensated relays are identified by black reset rods on Type A and light gray reset rods on Type B, while non-compensated relays use red reset rods. AA three-pole units have gray reset rods. AA one-pole units have black reset rods.

***Control Contact***

Single-pole and block type relays are supplied as standard with a SPST NC control contact. A SPDT NO-NC with common is available as a factory modification on Type A. An isolated NO contact can be supplied on Type B as either a factory modification or as a field kit.

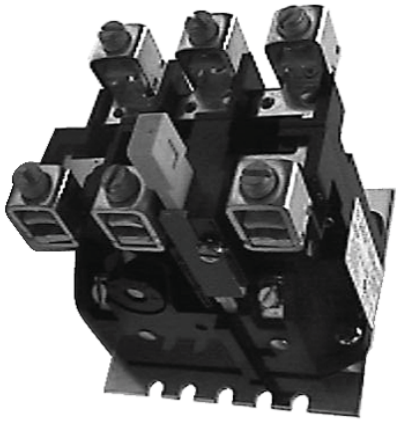
**Standards and Certifications**

- UL 508
- CSA
- ANSI/NEMA ICS 2-222

**Instruction Leaflets**

| | |
|---|---|
| 14885B | Fast Trip A Sizes 0–4, 3-Pole OL Relay |
| 14567E | Type A Sizes 1–2, 1-Pole OL Relay Mod A |
| 14568 | Type A Sizes 1–2, 3-Pole OL Relay Mod J |
| 14570D | Type A Sizes 3–4, 3-Pole OL Relay Mod J |
| 14569C | Type A Sizes 3–4, 1-Pole OL Relay Mod A |
| 17093A | Type B OLR for Sizes 7, 8 and 9 Contactors |
| 16955A | Type B Sizes 1–2, 1-Pole OL Relay |
| 16954A | Type B Sizes 1–2, 3-Pole OL Relay |
| 15392B | Type B Sizes 3–4, 3-Pole OL Relay |
| 13676F | Fast Trip Sizes 0–4, 1-Pole OL Relay |

Thermal Type B, Class 20, Manual Reset



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## Thermal Type B, Class 20, Manual Reset

### Application Description

The Type B overload relay is designed to protect industrial motors against overload conditions. Using modern block type, bimetallic design, this relay will provide Class 20 operation in either single-phase or three-phase applications.

### Operation

The Type B overload relay is a bimetallic actuated device. The bimetal elements are operated by precisely calibrated heaters. The heater elements are connected either directly in the circuit to be measured, or through current transformers on applications NEMA Size 5 and larger.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap-action output contact.

#### *Ambient Compensation*

The Type B ambient compensated design is supplied as standard on all A200 starters. This design uses a second compensating bimetal responsive to ambient air temperature in the surrounding enclosure. This feature reduces nuisance tripping in applications using compact control panels and motor control centers where internal temperature rise is significant compared to motor ambient temperature. The compensating characteristic is maintained in ambient temperatures from 40° to 77°C.

### Features

- Ambient compensation standard
- Alarm contact field mountable
- Class 20—600V design
- Inverse time delay trip
- Test trip device for weld check
- Hi-visibility up-front trip indication
- Trip-free reset mechanism

## Product Selection

### *Heaters*

Enter heaters as separate item by listing catalog number from tables, **Pages V5-T2-139** and **V5-T2-140**, as required per starter.

### *Relays*

**Type B Overload Relay Panel Mounting**

### Thermal Type B Overload Relay

| Motor Full Load Amps | Panel Mounted Ambient Comp. Catalog Number | Panel Mounted Non-Comp. Catalog Number | Starter Mounted Replacement for Type B Overload Relays Ambient Comp. Catalog Number | Starter Mounted Replacement for Type B Overload Relays Non-Comp. Catalog Number | Replacement for Type A Overload Relays in Manual Reset Mode (Three-Pole Only) ① Ambient Comp. Catalog Number | Replacement for Type A Overload Relays in Manual Reset Mode (Three-Pole Only) ① Non-Comp. Catalog Number |
|---|---|---|---|---|---|---|
| **Single-Pole (One NC Contact)** | | | | | | |
| 0.25–26.2 | **BA11JP** | **BN11JP** | **BA11A** | **BN11A** | — | — |
| 26.3–45 | **BA21JP** | **BN21JP** | **BA21A** | **BN21A** | — | — |
| 19–90 | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series |
| 19–135 | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series | Use three-pole design, wire three poles in series |
| **Three-Pole (One NC Contact)** | | | | | | |
| 0.25–26.2 | **BA13JP** | **BN13JP** | **BA13A** ② | **BN13A** ② | **BA13J** | **BN13J** |
| 26.3–45 | **BA23JP** | **BN23JP** | **BA23A** | **BN23A** | **BA23J** | **BN23J** |
| 19–90 | **BA33P** | **BN33P** | **BA33A** | **BN33A** | **BA33A** | **BN33A** |
| 19–135 | **BA43P** | **BN43P** | **BA43A** | **BN43A** | **BA43A** | **BN43A** |

## Accessories

### Alarm Contact Kit Selection ①

| Type B Overload Relay Size | Catalog Number |
|---|---|
| 1, 2 | **B3NO-2** |
| 3, 4 | **B3NO-4** |

***Notes***

① Includes contactor mounting bracket, overload relay and connection straps to contactor.

② For replacement on B200 size 00, 0, 1 use BA23A instead of BA13A and use BN23A instead of BN13A.

## Technical Data

2

### Control Contact Ratings—NEMA B600 NO and NC Control Contact Rating

| AC Volts | Make | Break |
|---|---|---|
| 24–120 | 30A | 3A |
| 120–600 | 3600 VA | 360 VA |

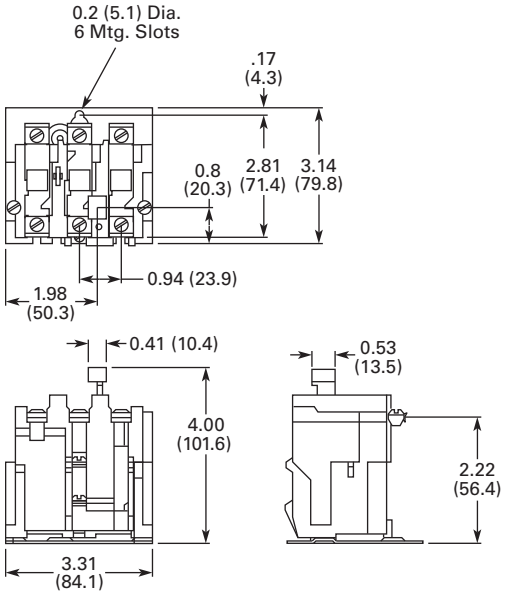
## Dimensions

Approximate Dimensions in Inches (mm)

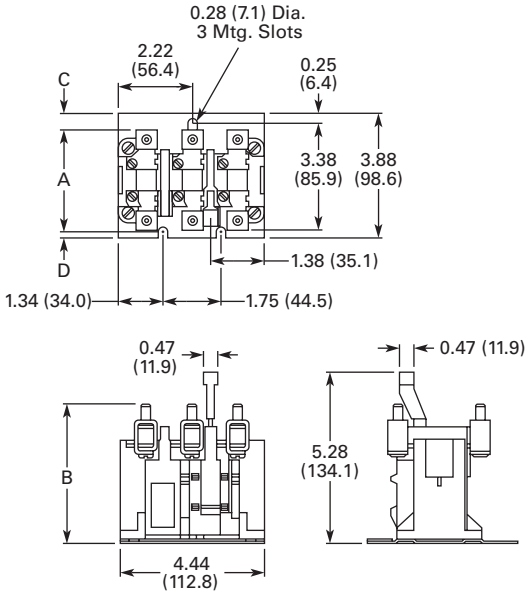
***Not to be used for construction purposes unless approved.***

***Thermal Type B Overload Relays***

### Sizes 1 and 2—Three-Pole, Panel Mounted




### Sizes 3 and 4—Three-Pole, Panel Mounted




### Dimensions

| Relay Size | A | B | C | D |
|---|---|---|---|---|
| 3 | 3.13 (79.5) | 4.06 (103.1) | 044 (11.2) | 0.31 (7.9) |
| 4 | 3.38 (85.9) | 4.38 (111.3) | 0.31 (7.9) | 0.19 (4.8) |

***Note***

① Alarm contact available as factory modification of field mountable. For factory modification, add suffix B.

Thermal Type A, Class 20, Auto/Manual Reset

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| Technical Data and Specifications | **V5-T2-134** |
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| Type FT Fast Trip, Class 10 | **V5-T2-136** |
| Heater Selection | **V5-T2-139** |
| Relays—Current Sensing Protective | **V5-T2-141** |


## Thermal Type A, Class 20, Auto/Manual Reset

### Application Description

The Type A overload relay is designed to protect industrial motors against overload conditions. Using modern block type, bimetallic design, this relay will provide Class 20 operation in either single- or three-phase applications.

### Features

- Field selectable manual/auto reset
- Alarm contact factory available
- Class 20—600V design
- Inverse time delay trip
- Adjustable trip rating ±15%
- Color coded reset rod:
  - Compensated (gray)
  - Non-compensated (red)

#### *Operation*

The Type A overload relay is a bimetallic actuated device. The bimetal elements are operated by precisely calibrated heaters. The heater elements are connected either directly in the circuit to be measured, or through current transformers on applications NEMA Size 5 and larger.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap-action output contact.

#### *Automatic Reset*

The Type A overload relay can be supplied as an option on all A200 starters to provide automatic reset operation. The overload relay is always shipped in the non-automatic mode. To set up auto operation, reposition the reset rod by loosening and re-tightening a hold-down clamp at the base of overload relay.

## Product Selection



### *Heaters*

Enter heaters as separate item by listing catalog number from tables, **Pages V5-T2-139** and **V5-T2-140**, as required per starter.

### *Relays*

**Type A Overload Relay Single-Pole Panel Mounting**

### Thermal Type A Overload Relay ①

| Motor Full Load Amps | Panel Mounted Ambient Comp. Catalog Number | Panel Mounted Non-Comp. Catalog Number | Starter Replacement Ambient Comp. Catalog Number | Starter Replacement Non-Comp. Catalog Number |
|---|---|---|---|---|
| **Single-Pole (One NC Contact)** | | | | |
| 0.25–26.2 | **AA11P** | **AN11P** | **AA11A** | **AN11A** |
| 26.3–45 | **AA21P** | **AN21P** | **AA21A** | **AN21A** |
| 19–90 | **AA31P** | **AN31P** | **AA31A** | **AN31A** |
| 19–135 | **AA41P** | **AN41P** | **AA41A** | **AN41A** |
| **Three-Pole (One NC Contact)** | | | | |
| 0.25–26.2 | **AA13P** ② | **AN13P** ② | **AA13A** ② | **AN13A** ② |
| 26.3–45 | **AA23P** ② | **AN23P** ② | **AA23A** ② | **AN23A** ② |
| 19–90 | **AA33P** ② | **AN33P** ② | **AA33A** ② | **AN33A** ② |
| 19–135 | **AA43P** ② | **AN43P** ② | **AA43A** ② | **AN43A** ② |

## Technical Data and Specifications

### Control Contact Ratings

| AC Volts | Normally Closed Make | Normally Closed Break | Normally Open Make | Normally Open Break |
|---|---|---|---|---|
| **Three-Pole Control Contact Ratings** | | | | |
| 24–120 | 20A | 2A | 0.5A | 0.5A |
| 120–600 | 2400 VA | 240 VA | 600 VA | 60 VA |
| **Single-Pole Control Contact Ratings** | | | | |
| 24–120 | 30A | 3A | 10A | 1A |
| 120–600 | 3600 VA | 360 VA | 1200 VA | 120 VA |

***Notes***

① For alarm contact (Form C), add Suffix **B**. Available only as factory modification on Type A relay.

② Three-pole Type B overload relay is a suitable alternative to a three-pole Type A overload relay in manual reset mode. For example, BA13JP for AA13P, BN23J for AN23A, and so on. (See **Page V5-T2-131**.)

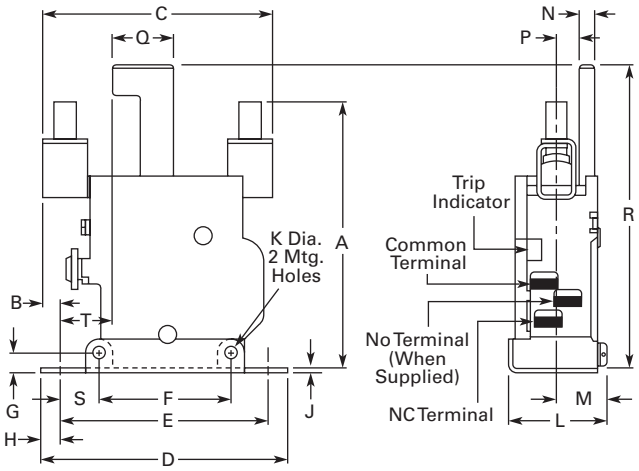
## Dimensions

Approximate Dimensions in Inches (mm)

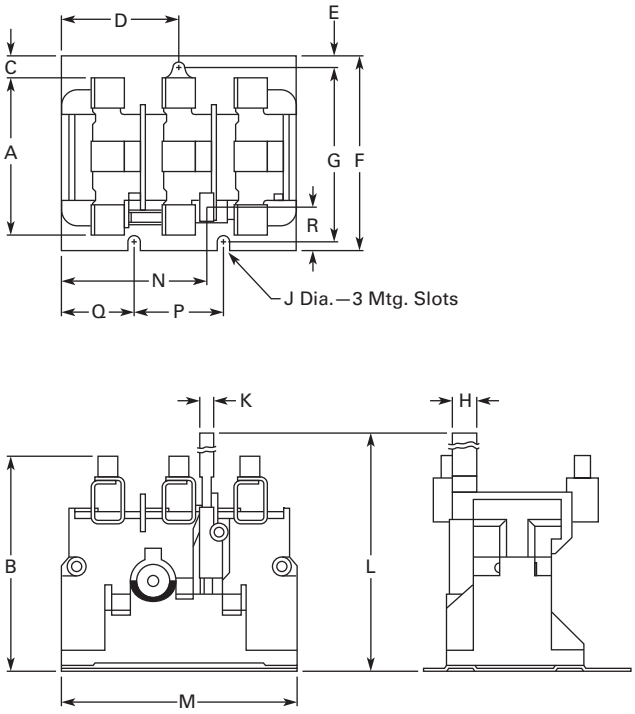
***Not to be used for construction purposes unless approved.***

***Type A***

### Single-Pole (Sizes 4 Shown)




### Three-Pole (Size 4 Shown)



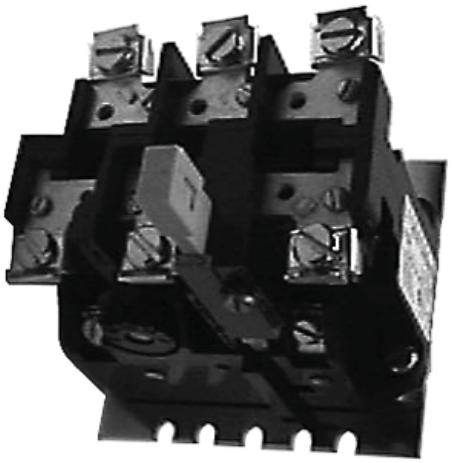

### Dimensions

| Dimension | Relay Size 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| A | 2.72 (69.1) | 3.48 (88.4) | 4.19 (106.4) | 4.5 (114.3) |
| B | 0.94 (23.9) | 0.67 (17.0) | 0.25 (6.4) | 0.38 (9.7) |
| C | 2.75 (69.9) | 3.5 (88.9) | 3.53 (89.7) | 3.78 (96.0) |
| D | 3.25 (82.6) | 3.25 (82.6) | 4.13 (104.9) | 4.13 (104.9) |
| E | 2.63 (66.8) | 2.63 (66.8) | 3.38 (85.9) | 3.38 (85.9) |
| F | 1.34 (34.0) | 1.34 (34.0) | 2.19 (55.6) | 2.19 (55.6) |
| G | 0.25 (6.4) | 0.25 (6.4) | 0.28 (7.1) | 0.28 (7.1) |
| H | 0.31 (7.9) | 0.31 (7.9) | 0.38 (9.7) | 0.38 (9.7) |
| J | 0.06 (1.5) | 0.06 (1.5) | 0.06 (1.5) | 0.06 (1.5) |
| K | 0.22 (5.6) | 0.22 (5.6) | 0.27 (6.8) | 0.27 (6.8) |
| L | 1.34 (34.0) | 1.34 (34.0) | 1.69 (42.9) | 1.69 (42.9) |
| M | 0.66 (16.8) | 0.66 (16.8) | 0.88 (22.4) | 0.88 (22.4) |
| N | 0.16 (4.1) | 0.16 (4.1) | 0.27 (6.8) | 0.27 (6.8) |
| P | 0.22 (5.6) | 0.22 (5.6) | 0.34 (8.6) | 0.34 (8.6) |
| Q | 0.06 (1.5) | 0.06 (1.5) | 0.69 (17.5) | 0.69 (17.5) |
| R | 4.00 (101.6) | 4.00 (101.6) | 5.19 (131.8) | 5.19 (131.8) |
| S | 0.47 (11.9) | 0.47 (11.9) | 0.59 (15.0) | 0.59 (15.0) |
| T | 1.11 (28.2) | 1.11 (28.2) | 0.69 (17.5) | 0.69 (17.5) |

### Dimensions

| Dimension | Relay Size 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| A | 2.38 (60.5) | 2.44 (62.0) | 3.13 (79.5) | 3.38 (85.9) |
| B | 3.13 (79.5) | 3.17 (80.5) | 4.06 (103.1) | 4.38 (111.3) |
| C | 0.36 (9.1) | 0.33 (8.4) | 0.44 (11.2) | 0.31 (7.9) |
| D | 1.66 (42.2) | 1.66 (42.2) | 2.22 (56.4) | 2.22 (56.4) |
| E | 0.17 (4.3) | 0.17 (4.3) | 0.25 (6.4) | 0.25 (6.4) |
| F | 2.81 (71.4) | 2.81 (71.4) | 3.38 (85.9) | 3.38 (85.9) |
| G | 3.08 (78.2) | 3.08 (78.2) | 3.88 (98.6) | 3.88 (98.6) |
| H | 0.47 (11.9) | 0.47 (11.9) | 0.47 (11.9) | 0.47 (11.9) |
| J | 0.20 (5.1) | 0.20 (5.1) | 0.28 (7.1) | 0.28 (7.1) |
| K | 0.28 (7.1) | 0.28 (7.1) | 0.47 (11.9) | 0.47 (11.9) |
| L | 4.00 (101.6) | 4.00 (101.6) | 5.28 (134.1) | 5.28 (134.1) |
| M | 3.31 (84.1) | 3.31 (84.1) | 4.44 (112.8) | 4.44 (112.8) |
| N | 1.80 (45.7) | 1.80 (45.7) | 2.77 (70.4) | 2.77 (70.4) |
| P | 1.89 (48.0) | 1.89 (48.0) | 1.75 (44.5) | 1.75 (44.5) |
| Q | 1.00 (25.4) | 1.00 (25.4) | 1.34 (34.0) | 1.34 (34.0) |
| R | — | — | 1.03 (26.2) | 1.03 (26.2) |

Type FT Fast Trip, Class 10



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| Thermal Type A, Class 20, Auto/Manual Reset | **V5-T2-133** |
| Type FT Fast Trip, Class 10 | |
| Product Selection | **V5-T2-137** |
| Technical Data and Specifications | **V5-T2-137** |
| Dimensions | **V5-T2-138** |
| Heater Selection | **V5-T2-139** |
| Relays—Current Sensing Protective | **V5-T2-141** |


## Type FT Fast Trip, Class 10

### Application Description

The Type FT overload relay is designed to protect special purpose motors having restricted thermal and locked rotor capabilities. Using modern block type, bimetallic design, this relay will provide Class 10 operation in single- or three-phase applications.

### Operation

The Type FT overload relay is a bimetallic actuated device. The bimetal elements are operated directly from line current, thus separate calibrating heater elements are not utilized. The overload relay may be wired directly in the motor circuit, or through-current transformers on applications larger than 150A.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap action output contact.

### Features

- Class 10—600V design
- Inverse time delay trip
- Color coded reset rod—green
- Alarm contact factory available
- Field selectable manual/auto reset
- Adjustable trip rating ±20%
- Ambient compensation included

## Product Selection

Type FT Single-Pole

### Type FT Single-Pole (One NC Contact); Three-Phase (Three NC Contacts in Series) ①

| Motor Full Load Amperes | Panel Mounted Single-Pole Catalog Number | Three-Pole Catalog Number | Starter Replacement NEMA Size | Single-Pole Catalog Number |
|---|---|---|---|---|
| 0.76–1.1 | **FT11P-1.1** | **FT13P-1.1** | — | **FT11A-1.1** |
| 1.1–1.6 | **FT11P-1.6** | **FT13P-1.6** | — | **FT11A-1.6** |
| 1.6–2.4 | **FT11P-2.4** | **FT13P-2.4** | 0, 1 | **FT11A-2.4** |
| 2.4–3.6 | **FT11P-3.6** | **FT13P-3.6** | 0, 1 | **FT11A-3.6** |
| 3.6–5.4 | **FT11P-5.4** | **FT13P-5.4** | 0, 1 | **FT11A-5.4** |
| 5.4–8.0 | **FT11P-8.0** | **FT13P-8** | 0, 1 | **FT11A-8** |
| 8.0–12 | **FT11P-12** | **FT13P-12** | 0, 1 | **FT11A-12** |
| 12–18 | **FT11P-18** | **FT13P-18** | 1 | **FT11A-18** |
| 16–24 | — | **FT13P-24** | | — |
| 22–32 | **FT11P-32** | **FT13P-32** | 0, 1 | **FT11A-32** |
| 24–36 | **FT21P-36** | **FT23P-36** | 2 | **FT21A-36** |
| 36–54 | **FT21P-54** | **FT23P-54** | 12 | **FT21A-54** |
| 22–32 | **FT31P-32** | **FT33P-32** | 3 | **FT31A-32** |
| 32–48 | **FT31P-48** | **FT33P-48** | 3 | **FT31A-48** |
| 48–72 | **FT31P-72** | **FT33P-72** | 3 | **FT31A-72** |
| 72–110 | **FT41P-110** | **FT43P-110** | 4 | **FT41A-110** |
| 100–150 | **FT41P-150** | **FT43P-150** | 4 | **FT41A-150** |

## Technical Data and Specifications

### Control Contact Ratings

| AC Volts | Normally Closed Make | Normally Closed Break | Normally Open Make | Normally Open Break |
|---|---|---|---|---|
| 24–120 | 30A | 3A | 10A | 1A |
| 120–600 | 3600 VA | 360 VA | 1200 VA | 120 VA |

***Note***

① Single-pole (1NO-NC contact): add suffix **B**. Three-pole (3NO-NC contacts): add suffix **B**. Example: FT13P**B**-12.

## Dimensions

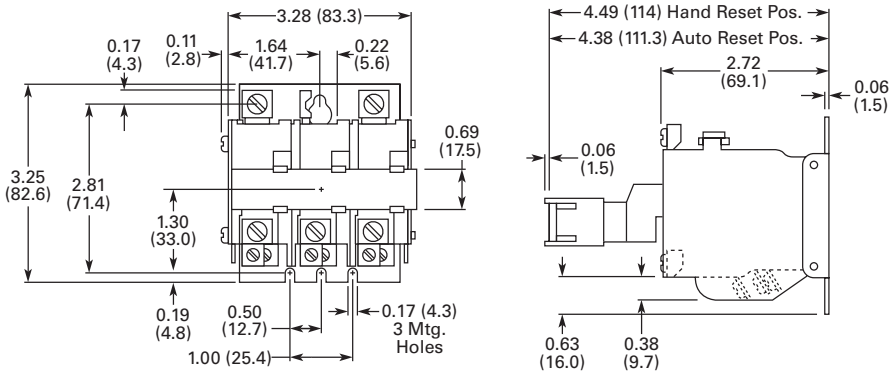
Approximate Dimensions in Inches (mm)

2

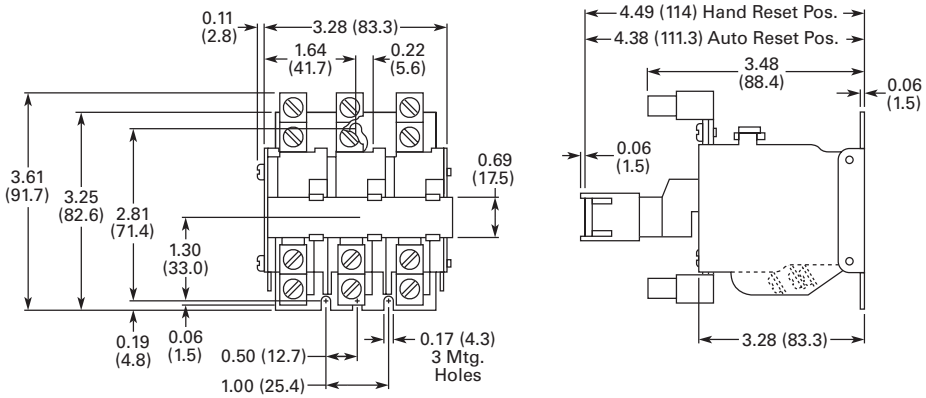
***Not to be used for construction purposes unless approved.***

***Type FT Overload Relays***

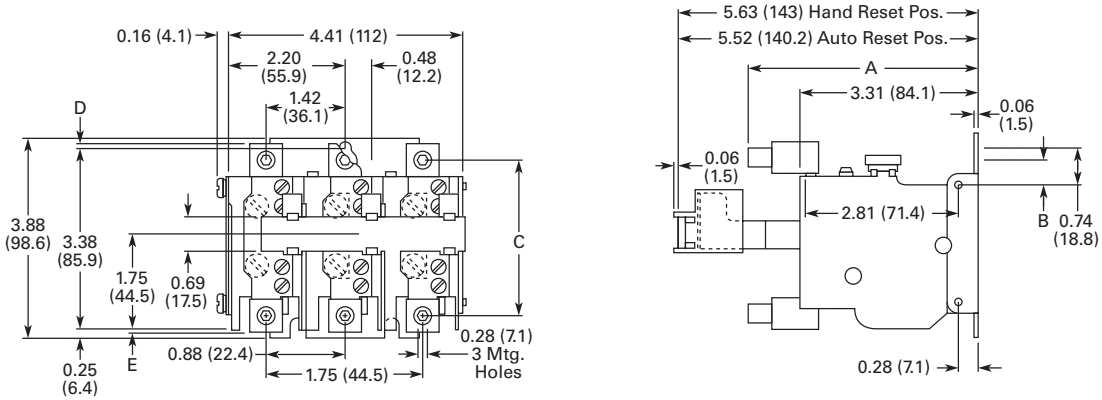
### Three-Pole, Size 1




### Three-Pole, Size 2




### Three-Pole, Sizes 3, 4




### Dimensions

| Relay Size | A | B | C | D | E |
|---|---|---|---|---|---|
| 3 | 4.25 (108.0) | 0.53 (13.5) | 2.91 (73.9) | 0.09 (2.3) | 0.06 (1.5) |
| 4 | 4.50 (114.3) | 0.59 (15.0) | 3.03 (77.0) | 0.22 (5.6) | 0.19 (4.8) |

## Heater Selection

### General Information on Heater Coil Selection

For maximum motor protection and compliance with Article 430-32 of the National Electrical Code, select heater coils from the tables in this section on the basis of motor nameplate full load current.

When the full load current is unknown, selection may be made on the basis of average full load currents as shown on **Pages V5-T2-155** and **V5-T2-156**. **Caution—The average ratings could be high or low for a specific motor and therefore selection on this basis always involves risk. For fully reliable motor protection, select heater coils on the basis of full load current rating as shown on the motor nameplate.**

Heater coils are rated to protect 40°C rise motors, and open and drip-proof motors having a **service factor of 1.15** where the motor and the controller are at the same ambient temperature.

For other conditions:

1. For 50°C, 55°C, 75°C rise motors and **enclosed motors having a service factor of 1.0, select one size smaller coil.**
2. Ambient temperature of controller lower than motor by 26°C (47°F), use one size smaller coil.
3. Ambient temperature of controller higher than motor by 26°C (47°F), use one size larger coil.

Ultimate tripping current of heater coils is approximately 1.25 times the minimum current rating listed in the tables.

### Type A and B Overload Relays, Sizes 3 and 4

| Size Starter | Ambient Compensated Enclosed Starters All Applications Full Load Current of Motor Amps | Non-Compensating Enclosed Starters | Heater (One Heater per Catalog Number) Catalog Number |
|---|---|---|---|
| For Size 4 Starters | 12.8–14.1 | 11.9–13.0 | **FH68** |
| | 14.2–15.5 | 13.1–14.3 | **FH69** |
| | 15.6–17.1 | 14.4–15.9 | **FH70** |
| | 17.2–18.9 | 16.0–17.4 | **FH71** |
| | 19.0–20.8 | 17.5–19.1 | **FH72** |
| For Size 3 Starters | 20.9–22.9 | 19.2–21.1 | **FH73** |
| | 23.0–25.2 | 21.2–23.2 | **FH74** |
| | 25.3–27.8 | 23.3–25.6 | **FH75** |
| | 27.9–30.6 | 25.7–28.1 | **FH76** |
| | 30.7–33.5 | 28.2–30.8 | **FH77** |
| | 33.6–37.5 | 30.9–34.5 | **FH78** |
| | 37.6–41.5 | 34.6–38.2 | **FH79** |
| | 41.6–56.3 | 38.3–42.6 | **FH80** |
| | 46.4–50 | 42.7–46 | **FH81** |
| | 51–55 | 47–51 | **FH82** |
| | 56–61 | 52–56 | **FH83** |
| | 62–66 | 57–61 | **FH84** |
| | 67–73 | 62–67 | **FH85** |
| | 74–78 | 68–72 | **FH86** |
| | 79–84 | 73–77 | **FH87** |
| | 85–92 | 78–84 | **FH88** |
| | 93–101 | 85–91 | **FH89** |
| | 102–110 | 92–99 | **FH90** |
| | 111–122 | 100–110 | **FH91** |
| | 123–129 | 111–122 | **FH92** |
| | 130–133 | 123–128 | **FH93** |
| | — | 129–133 | **FH94** |

### Type A and B Overload Relays, Sizes 5 and 6 ①

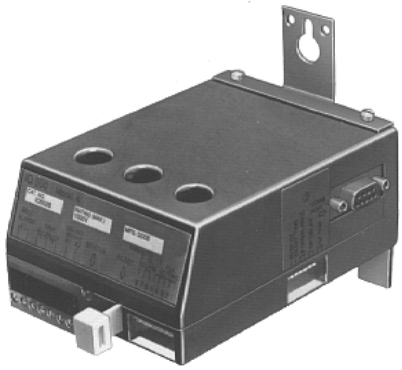
| Compensated Overload Relay Open Starter Full Load Current of Motor (Amps) | Enclosed Starter | Heater (One Heater per Catalog Number) Catalog Number |
|---|---|---|
| **Size 5 (with 300/5 Current Transformers)** | | |
| — | — | **FH23** |
| 118–129 | 118–129 | **FH24** |
| 130–141 | 130–141 | **FH25** |
| 142–155 | 142–155 | **FH26** |
| 156–170 | 156–170 | **FH27** |
| 171–187 | 171–187 | **FH28** |
| 188–205 | 188–205 | **FH29** |
| 206–224 | 206–224 | **FH30** |
| 225–244 | 225–244 | **FH31** |
| 245–263 | 245–263 | **FH32** |
| 264–292 | 264–292 | **FH33** |
| 293–300 | — | **FH34** |
| **Size 6 (with 600/5 Current Transformers)** | | |
| — | — | **FH23** |
| 236–259 | 236–259 | **FH24** |
| 260–283 | 260–283 | **FH25** |
| 284–310 | 284–310 | **FH26** |
| 311–340 | 311–340 | **FH27** |
| 341–374 | 341–374 | **FH28** |
| 375–411 | 375–411 | **FH29** |
| 412–448 | 412–448 | **FH30** |
| 449–489 | 449–489 | **FH31** |
| 490–527 | 490–527 | **FH32** |
| 528–585 | 528–540 | **FH33** |
| 586–600 | — | **FH34** |

***Note***

① Size 7 and larger—advise full load current.

## Type A and B Overload Relays, Sizes 0, 1 and 2

| Size Starter | Non-Compensated Open Starters and Ambient Comp. Open and Enclosed Starters: Block Type Overload sing Three Heaters | Non-Compensated Open Starters and Ambient Comp. Open and Enclosed Starters: Single-Pole Type Overload | Heater (One Heater per Catalog Number) Catalog Number | Non-Compensating Enclosed Starters: Block Type Overload Using Three Heaters | Non-Compensating Enclosed Starters: Single-Pole Type Overload | Heater Catalog Number |
|---|---|---|---|---|---|---|
| **Full Load Current of Motor (Amps)** | | | | | | |
| For Size 0 Starters | 0.25–0.27 | 0.29–0.31 | **FH03** | 0.24–0.25 | 0.28–0.30 | **FH03** |
| | 0.28–0.31 | 0.32–0.35 | **FH04** | 0.26–0.28 | 0.31–0.34 | **FH04** |
| | 0.32–0.34 | 0.36–0.39 | **FH05** | 0.29–0.31 | 0.35–0.37 | **FH05** |
| | 0.35–0.38 | 0.40–0.43 | **FH06** | 0.32–0.35 | 0.38–0.42 | **FH06** |
| | 0.39–0.42 | 0.44–0.48 | **FH07** | 0.36–0.39 | 0.43–0.47 | **FH07** |
| | 0.43–0.46 | 0.49–.053 | **FH08** | 0.40–0.43 | 0.48–0.52 | **FH08** |
| | 0.47–0.50 | 0.54–0.58 | **FH09** | 0.44–0.47 | 0.53–0.56 | **FH09** |
| | 0.51–0.55 | 0.59–0.64 | **FH10** | 0.48–0.51 | 0.57–0.63 | **FH10** |
| | 0.56–0.62 | 0.65–0.71 | **FH11** | 0.52–0.57 | 0.64–0.70 | **FH11** |
| | 0.63–0.68 | 0.72–0.79 | **FH12** | 0.58–0.63 | 0.71–0.77 | **FH12** |
| | 0.69–0.75 | 0.80–0.87 | **FH13** | 0.64–0.70 | 0.78–0.85 | **FH13** |
| | 0.76–0.83 | 0.88–0.96 | **FH14** | 0.71–0.77 | 0.86–0.94 | **FH14** |
| | 0.84–0.91 | 0.97–1.06 | **FH15** | 0.78–0.85 | 0.95–1.03 | **FH15** |
| | 0.92–1.00 | 1.07–1.16 | **FH16** | 0.86–0.93 | 1.04–1.13 | **FH16** |
| | 1.01–1.11 | 1.17–1.28 | **FH17** | 0.94–1.03 | 1.14–1.25 | **FH17** |
| | 1.12–1.22 | 1.29–1.41 | **FH18** | 1.04–1.13 | 1.26–1.38 | **FH18** |
| | 1.23–1.34 | 1.42–1.55 | **FH19** | 1.14–1.25 | 1.39–1.52 | **FH19** |
| | 1.35–1.47 | 1.56–1.71 | **FH20** | 1.26–1.37 | 1.53–1.67 | **FH20** |
| | 1.48–1.62 | 1.72–1.87 | **FH21** | 1.38–1.51 | 1.68–1.83 | **FH21** |
| | 1.63–1.78 | 1.88–2.06 | **FH22** | 1.52–1.65 | 1.84–2.01 | **FH22** |
| | 1.79–1.95 | 2.07–2.26 | **FH23** | 1.66–1.81 | 2.02–2.21 | **FH23** |
| | 1.96–2.15 | 2.27–2.48 | **FH24** | 1.82–1.99 | 2.22–2.43 | **FH24** |
| | 2.16–2.35 | 2.49–2.72 | **FH25** | 2.00–2.19 | 2.44–2.66 | **FH25** |
| | 2.36–2.58 | 2.73–2.99 | **FH26** | 2.20–2.39 | 2.67–2.92 | **FH26** |
| | 2.59–2.83 | 3.00–3.28 | **FH27** | 2.40–2.63 | 2.93–3.21 | **FH27** |
| | 2.84–3.11 | 3.29–3.60 | **FH28** | 2.64–2.89 | 3.22–3.53 | **FH28** |
| | 3.12–3.42 | 3.61–3.95 | **FH29** | 2.90–3.17 | 3.54–3.87 | **FH29** |
| | 3.43–3.73 | 3.96–4.31 | **FH30** | 3.18–3.47 | 3.88–4.22 | **FH30** |
| | 3.74–4.07 | 4.32–4.71 | **FH31** | 3.48–3.79 | 4.23–4.61 | **FH31** |
| | 4.08–4.39 | 4.72–5.14 | **FH32** | 3.80–4.11 | 4.62–4.9 | **FH32** |
| | 4.40–4.87 | 5.15–5.6 | **FH33** | 4.12–4.55 | 5.0–5.5 | **FH33** |
| | 4.88–5.3 | 5.7–6.2 | **FH34** | 4.56–5.0 | 5.6–6.0 | **FH34** |
| | 5.4–5.9 | 6.3–6.8 | **FH35** | 5.1–5.5 | 6.1–6.6 | **FH35** |
| | 6.0–6.4 | 6.9–7.5 | **FH36** | 5.6–5.9 | 6.7–7.3 | **FH36** |
| | 6.5–7.1 | 7.6–8.2 | **FH37** | 6.0–6.6 | 7.4–8.0 | **FH37** |
| | 7.2–.78 | 8.3–9.0 | **FH38** | 6.7–7.2 | 8.1–8.7 | **FH38** |
| | 7.9–8.5 | 9.1–9.9 | **FH39** | 7.3–7.9 | 8.8–9.7 | **FH39** |
| | 8.6–9.4 | 10.0–10.8 | **FH40** | 8.0–8.7 | 9.8–10.5 | **FH40** |
| | 9.5–10.3 | 10.9–11.9 | **FH41** | 8.8–9.5 | 10.6–11.7 | **FH41** |
| | 10.4–11.3 | 12.0–13.1 | **FH42** | 9.6–10.5 | 11.8–12.7 | **FH42** |
| | 11.4–12.4 | 13.2–14.3 | **FH43** | 10.6–11.5 | 12.8–14.0 | **FH43** |
| | 12.5–13.5 | 14.4–15.7 | **FH44** | 11.6–12.6 | 14.1–15.3 | **FH44** |
| | 13.6–14.9 | 15.8–17.2 | **FH45** | 12.7–13.8 | 15.4–16.6 | **FH45** |
| | 15.0–16.3 | 17.3–18.9 | **FH46** | 13.9–15.1 | 16.7–18.3 | **FH46** |
| | 16.4–18.0 | 19.0–20.8 | **FH47** | 15.2–16.7 | 18.4–20.0 | **FH47** |
| For Size 1 Starters | 18.1–19.8 | 20.9–22.9 | **FH48** | 16.8–18.3 | 20.1–21.9 | **FH48** |
| | 19.9–21.7 | 23.0–25.2 | **FH49** | 18.4–20.2 | 22.0–23.9 | **FH49** |
| | 21.8–23.9 | 25.3–27.6 | **FH50** | 20.3–22.2 | 24.0–26.2 | **FH50** |
| | 24.0–26.2 | 27.7–30.3 | **FH51** | 22.3–24.3 | 26.3–28.8 | **FH51** |
| | 26.3–28.7 | 30.4–33.3 | **FH52** | 24.4–26.6 | 28.9–31.4 | **FH52** |
| For Size 2 Starters | 28.8–31.4 | 33.4–36.4 | **FH53** | 26.7–29.1 | 31.5–34.5 | **FH53** |
| | 31.5–34.5 | 36.5–39.9 | **FH54** | 29.2–32.0 | 34.6–37.9 | **FH54** |
| | 34.6–37.9 | 40.0–43.9 | **FH55** | 32.1–35.2 | 3.80–41.9 | **FH55** |
| | 38.0–41.5 | | **FH56** | 35.3–38.5 | 42.0–45.0 | **FH56** |
| | 41.6–45.0 | | **FH57** | 38.6–42.3 | | **FH57** |



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## Relays—Current Sensing Protective

### Product Description

The IQ500 is a heaterless, current-sensing, solid-state motor protective relay with optional communications capabilities. Several functions are incorporated into the base relay (IQ502/IQ504) as standard:

- Overload (overcurrent) protection
- Phase unbalance and phase loss protection
- Ground current protection (Class II)

The base relay can serve as the initial building block for a motor protection system by adding the IQ500M Special Function Module. The module can address application related motor load functions with the additional features:

- Underload protection
- Long acceleration
- Jam protection
- Load control

The IQ500 can provide a cost-effective alternative to conventional protective relays such as current relays, ground fault relays and phase loss or phase unbalance relays. Used with the PowerNet system, a low-cost, local area communication network, information such as current values, status, setpoint values and cause of trip can be displayed remotely. The IQ500 relay is ideal for a variety of industrial applications such as mining, timber, material handling, air conditioning compressors, wastewater treatment plants and petrochemical industries.

## Features

- Overload class is adjustable using DIP switches for 5, 10, 20 or 30 seconds, maximum trip times at six times rated current
- Designed for 1000V and less distribution systems
- Form C (NO/NC) contact on output relay
- Isolated alarm relay output contact
- Communications capability using IMPACC network
- Manual or automatic reset (either a true manual or remote electrical reset)—selectable
- Overload, Class II ground current, phase unbalance and single-phase protection are standard
- LED indication (bi-colored—red/green) for device status, including overload, phase unbalance or ground current trip
- Special Function Module adds protection for underload and jam conditions, also provides for long acceleration
- Optional load control feature available with special function module
- Feed-through current transformer windows for contactors, NEMA Sizes 1–4 (for Size 5 and larger, external current transformers can be used)
- Fits mounting footprint of Eaton's MORA relay
- Panel or starter mountable
- Cause of trip is held in memory through a power loss
- Bell alarm contact available for remote status indication
- DIP switch provided for setting operating frequency—50 or 60 Hz
- Plug-in terminal block for control power, trip relay and bell alarm relay connections
- Operating temperature: –20° to 60°C (–4° to 140°F)

### *Benefits*

- No external current transformers are required since they are internal to the IQ500
- DIP switches used to select functions and settings on base relay are clearly marked and covered with screw-on plastic covers
- On the automatic reset, the reset times can be selected for long (90 second) or short (10 second) delay
- Device can be set for different motor full load currents without additional parts or modules

### *Optional Benefits*

- With the addition of the IQ500M Special Function Module, the enhanced protection includes jam (overtorque) and underload and provides long acceleration time (high inertia load)
- The underload and jam protection functions each have independent Form C output relays as part of the module. In addition, the underload and jam functions each have their own LEDs for status indication
- The underload and jam functions also have separate selectable trip levels and adjustable trip-delay and start-delay settings
- The IQ500M can be used as a load control module that allows "shedding and restoring" a particular load that contributes to the load being monitored
- The PONI (Product Operated Network Interface) card attaches directly to the base relay or special function module for interfacing with the Eaton's PowerNet communications system
- Localized display can be achieved with the Central Monitoring Unit

## Standards and Certifications

- UL File No. E19223

## Product Selection

**IQ502A**

### Current Sensing Protective Relay

| Maximum Horsepower | | | | Control Voltage | |
|---|---|---|---|---|---|
| 200V | 230V | 460–475V | Ampere Rating | 110/120V 50/60 Hz Catalog Number | 220/240V 50/60 Hz Catalog Number |
| 20 | 25 | 50 | 3.4–66A | **IQ502A** | **IQ502B** |
| 60 | 75 | 150 | 10.8–207A | **IQ504A** | **IQ504B** |
| — | — | — | 0.32–5.4A | **IQ500LA** ① | **IQ500LB** ① |
| Special function module | | | | **IQ500M** | **IQ500M** |

***Note***

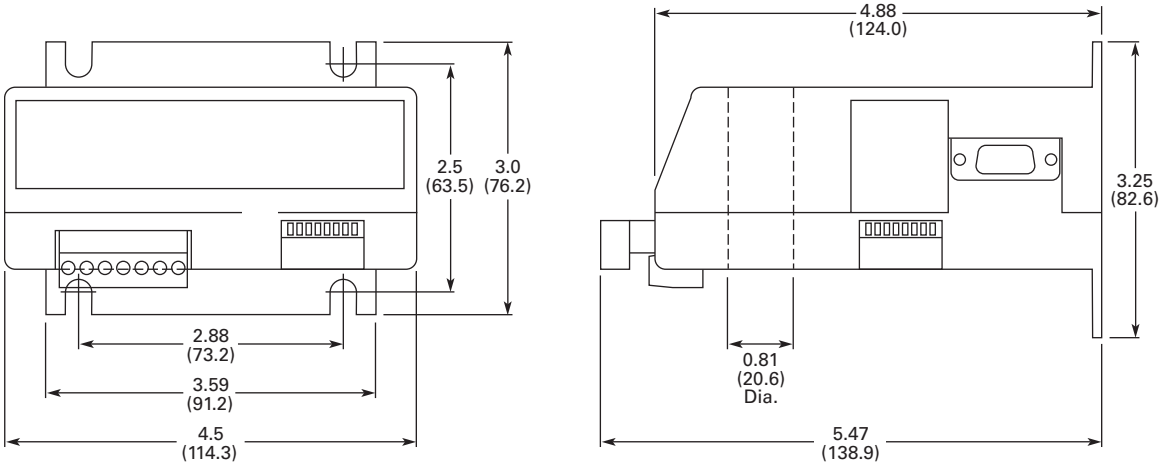
① Can be used with external CTs having 5A secondary.

## Dimensions

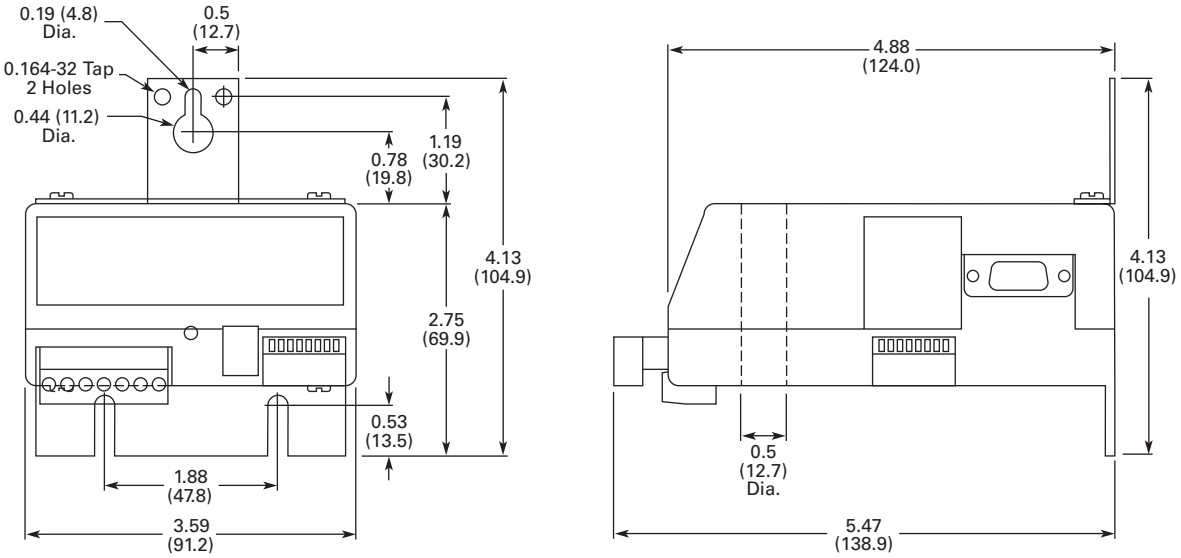
Approximate Dimensions in Inches (mm)

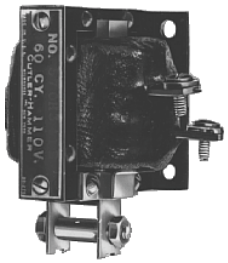
***Current Sensing Protective Relays***

### IQ504




### IQ500L and IQ502





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| Solenoids—Alternating Current | |
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## Product Description

Solenoids from Eaton's Electrical Sector are used for a wide variety of applications where straight line motion is to be obtained automatically or at a remote point.

## Features

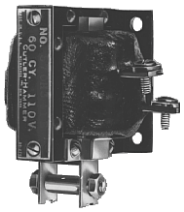
- Plunger and frame are machined to ensure quiet operation
- Push- and pull-type operation
- With and without terminal box
- Plunger provided with connecting pin
- Size C and D solenoids are provided with special bearing to minimize wear in clevis under severe service

## Product Selection

***When Ordering Specify***

- Catalog number

**10370**



### AC Solenoids—60 Hz, Continuous Duty

| Size | Volt. | Operating Data ① Magnetic Force in Lbs Horizontal Position With Gravity At 100% Voltage | With Gravity At 85% Voltage | Against Gravity At 100% Voltage | Against Gravity At 85% Voltage | Max. Stroke in Inches (mm) | Current Inrush | Current Sealed | Without Conduit Box Floor Mtg. Catalog Number | Wall Mtg. Catalog Number | With Conduit Box Mtg. ② Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **60 Hertz Pull Type** | | | | | | | | | | | |
| A | 110 | 0.72 | 0.50 | 0.55 | 0.33 | 1 (25.4) | 1.83 | 0.34 | — | **10370H1** | **10370H610** |
| | 220 | 0.72 | 0.50 | 0.55 | 0.33 | 1 (25.4) | 0.92 | 0.17 | — | **10370H2** | **10370H611** |
| | 440 | 0.72 | 0.50 | 0.55 | 0.33 | 1 (25.4) | 0.45 | 0.08 | — | **10370H3** | **10370H612** |
| B | 110 | 4.2 | 3 | 3.9 | 2.7 | 1 (25.4) | 5.4 | 0.87 | **10370H57** | **10370H694** | **10370H69** |
| | 220 | 4.2 | 3 | 3.9 | 2.7 | 1 (25.4) | 2.6 | 0.42 | **10370H58** | **10370H696** | **10370H70** |
| | 440 | 4.2 | 3 | 3.9 | 2.7 | 1 (25.4) | 1.29 | 0.20 | **10370H59** | **10370H697** | **10370H71** |
| C | 110 | 7 | 5.25 | 6.25 | 4.25 | 1.25 (31.8) | 10.4 | 1.07 | **10370H244** | — | **10370H256** |
| | 220 | 7 | 5.25 | 6.25 | 4.25 | 1.25 (31.8) | 5.2 | 0.52 | **10370H245** | — | **10370H257** |
| | 440 | 7 | 5.25 | 6.25 | 4.25 | 1.25 (31.8) | 2.5 | 0.26 | **10370H246** | — | **10370H258** |
| D | 110 | 12.4 | 10 | 11.25 | 8.75 | 1.25 (31.8) | 18 | 1.58 | **10370H356** | **10370H814** | **10370H368** |
| | 220 | 12.4 | 10 | 11.25 | 8.75 | 1.25 (31.8) | 9.3 | 0.81 | **10370H357** | **10370H816** | **10370H369** |
| | 440 | 12.4 | 10 | 11.25 | 8.75 | 1.25 (31.8) | 4.4 | 0.40 | **10370H358** | **10370H817** | **10370H370** |
| **60 Hertz Push Type** | | | | | | | | | | | |
| A | 110 | 0.72 | 0.50 | 0.55 | 0.33 | 1 (25.4) | 1.83 | 0.34 | — | **10370H13** | **10370H25** |
| | 220 | 0.72 | 0.50 | 0.55 | 0.33 | 1 (25.4) | 0.92 | 0.17 | — | **10370H14** ③ | **10370H26** |
| | 440 | 0.72 | 0.50 | 0.55 | 0.33 | 1 (25.4) | 0.45 | 0.08 | — | **10370H15** | **10370H27** |
| B | 110 | 4.2 | 3 | 3.9 | 2.7 | 1 (25.4) | 5.4 | 0.87 | **10370H81** | **10370H708** | **10370H93** |
| | 220 | 4.2 | 3 | 3.9 | 2.7 | 1 (25.4) | 2.6 | 0.42 | **10370H82** | **10370H710** | **10370H94** |
| | 440 | 4.2 | 3 | 3.9 | 2.7 | 1 (25.4) | 1.29 | 0.20 | **10370H83** | **10370H711** | **10370H95** |
| C | 110 | 7 | 5.25 | 6.25 | 4.25 | 1.25 (31.8) | 10.4 | 1.07 | **10370H268** | — | **10370H280** |
| | 220 | 7 | 5.25 | 6.25 | 4.25 | 1.25 (31.8) | 5.2 | 0.52 | — | **10370H774** | **10370H281** |
| | 440 | 7 | 5.25 | 6.25 | 4.25 | 1.25 (31.8) | 2.5 | 0.26 | — | **10370H775** | **10370H282** |
| D | 110 | 12.4 | 10 | 11.25 | 8.75 | 1.25 (31.8) | 18 | 1.58 | **10370H380** | **10370H828** ③ | **10370H392** |
| | 220 | 12.4 | 10 | 11.25 | 8.75 | 1.25 (31.8) | 9.3 | 0.81 | **10370H381** | **10370H830** ③ | **10370H393** |
| | 440 | 12.4 | 10 | 11.25 | 8.75 | 1.25 (31.8) | 4.4 | 0.40 | **10370H382** | **10370H831** ③ | **10370H394** |

***Notes***

① Mounting of solenoids "with conduit box"—Size A are for wall mounting—Size B, C and D are for floor mounting.

② Recommended selection of solenoids on basis of 85% voltage values.

③ Part numbers are now obsolete.

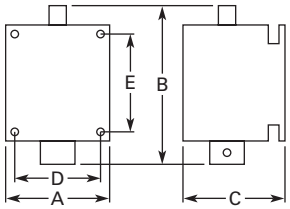
## Dimensions

Approximate Dimensions in Inches (mm)

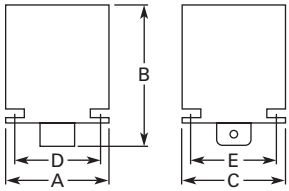
2

### *AC Solenoids*

#### Wall Mounted




#### Floor Mounted



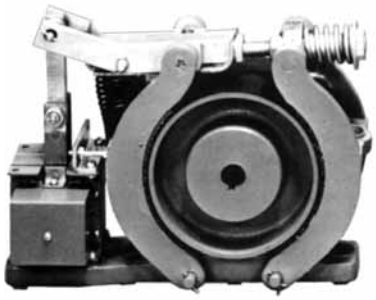

### Dimensions and Shipping Weights

| Size | Push Type Wide A | High B ① | Deep C | Mounting D | Mounting E | Shipping Weight Lbs (kg) | Pull Type Wide A | High B ① | Deep C | Mounting D | Mounting E | Shipping Weight Lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wall Mounted** | | | | | | | | | | | | |
| A | 2.38 (60.5) | 3.63 (92.2) | 2.25 (57.2) | 1.13 (28.7) | 1.63 (41.4) | 2.0 (0.9) | 2.38 (60.5) | 2.63 (66.8) | 2.25 (57.2) | 1.13 (28.7) | 1.63 (41.4) | 2.0 (0.9) |
| B | 2.63 (66.8) | 4.88 (124.0) | 3.00 (76.2) | 2.00 (50.8) | 2.13 (54.1) | 2.5 (1.1) | 2.63 (66.8) | 3.63 (92.2) | 3.00 (76.2) | 2.00 (50.8) | 2.13 (54.1) | 2.5 (1.1) |
| C | 3.00 (76.2) | 6.13 (155.7) | 4.13 (104.9) | 2.38 (60.5) | 3.13 (79.5) | 5.0 (2.3) | 3.00 (76.2) | 4.88 (124.0) | 4.13 (104.9) | 2.38 (60.5) | 3.13 (79.5) | 5.0 (2.3) |
| D | 4.00 (101.6) | 6.13 (155.7) | 4.13 (104.9) | 2.75 (69.9) | 3.13 (79.5) | 7.0 (3.2) | 4.00 (101.6) | 4.88 (124.0) | 4.13 (104.9) | 2.75 (69.9) | 3.13 (79.5) | 7.0 (3.2) |
| **Floor Mounted** | | | | | | | | | | | | |
| B | 3.13 (79.5) | 4.88 (124.0) | 3.00 (76.2) | 1.50 (38.1) | 2.25 (57.2) | 2.5 (1.1) | 3.13 (79.5) | 3.88 (98.6) | 3.00 (76.2) | 1.50 (38.1) | 2.25 (57.2) | 2.5 (1.1) |
| C | 3.50 (88.9) | 6.13 (155.7) | 3.75 (95.3) | 1.75 (44.5) | 3.13 (79.5) | 5.0 (2.3) | 3.50 (88.9) | 4.88 (124.0) | 3.75 (95.3) | 1.75 (44.5) | 3.13 (79.5) | 5.0 (2.3) |
| D | 3.88 (98.6) | 6.13 (155.7) | 3.75 (95.3) | 2.25 (57.2) | 3.13 (79.5) | 7.0 (3.2) | 3.88 (98.6) | 4.88 (124.0) | 3.75 (95.3) | 2.25 (57.2) | 3.13 (79.5) | 7.0 (3.2) |

***Note***

① In sealed state.

**Shoe Brakes—AC and DC, 511 Series**



## Contents


| *Description* | *Page* |
|---|---|
| **Shoe Brakes—AC and DC Magnetic** | |
| Product Selection | **V5-T2-148** |
| Dimensions | **V5-T2-150** |


## Product Description

Type S Brakes from Eaton's Electrical Sector are electrically released and spring applied providing "fail-safe" operation. The retarding torque developed is directly proportional to the spring pressure.

## Application Description

- Conveyors
- Machine tools
- Printing presses
- Small cranes
- Overhead doors
- Dumb waiters
- Vacuum molding machines
- Carnival rides

## Features

The brake wheel is of relatively large size in relation to the torque developed by the brake. This permits use of a larger brake shoe lining and lower shoe pressures. Low shoe pressure, equally distributed over a large lining area, results in even wear of the friction surfaces and even braking torque. The oversize wheel type construction also permits use of a smaller operating solenoid that requires less current for a given torque rating.

### DC Brakes

Standard DC brakes are equipped with shunt coils. The magnet coil circuit on DC brakes consists of two separate windings and a protective switch.

### Mounting

Type S brakes are designed and recommended for use and mounting only in the horizontal position. Side or vertical mountings are not recommended because the solenoid loading is altered, resulting in accelerated wear and premature coil failure.

## Product Selection



***When Ordering Specify***

- Brake
  - Catalog number plus suffix number for coil
  - Example: 511H1193-**41**
  - Wheel
  - Catalog number plus suffix number for bore size
  - Example: 511H1150-**3**

**Size S-4 Brake and Wheel**

### Type S Brakes—Floor Mounting

| Torque—lb-ft | | | AC | For Type S4, S5-1/2, S7, S10 | | DC | | |
|---|---|---|---|---|---|---|---|---|
| Continuous | Intermittent ① | Brake Size | Base Catalog Number ②③ | Coil Volts and Hertz | Coil Suffix ② | Base Catalog Number ②③ | Coil Voltage | Coil Suffix ② |
| 3 | 3 | S-4 | **511H1194** | 120V 60 Hz | **-39** | **511H955** | 120 Vdc | **-97** |
| 10 | 10 | S-4 | **511H1193** | 208V 60 Hz | **-45** | **511H956** | 240 Vdc | **-98** |
| — | 15 | S-4 | **511H1192** | 240V 60 Hz | **-40** | **511H957** | | |
| 25 | 25 | S-5-1/2 | **511H992** | 480V 60 Hz | **-41** | **511H994** | | |
| — | 35 | S-5-1/2 | **511H993** | 600V 60 Hz | **-58** | **511H995** | | |
| 50 | 50 | S-7 | **511H970** | 110V 50 Hz | **-5** | **511H975** | | |
| — | 75 | S-7 | **511H971** | 220V 50 Hz | **-6** | **511H976** | | |
| 85 | 85 | S-7 | **511H1195** | 380V 50 Hz | **-7** | **511H1197** | | |
| — | 110 | S-7 | **511H1196** | 440V 50 Hz | **-8** | **511H1198** | | |
| | | | | 550V 50 Hz | **-9** | | | |

***Notes***

① Intermittent duty indicates that the coil can be placed across the line continuously for one hour maximum without excessive heating. It is equivalent to 1/2 time ON and 1/2 time OFF.

② Add suffix number for coil voltage to base catalog number.

③ Does not include wheel.

## Brake Selection

The method most generally used to determine required braking torque is to calculate the full load motor torque by the following formula:

$$T = \frac{5252 \times hp}{rpm}$$

T = Full load motor torque in lb-ft

hp = Motor horsepower

rpm = Speed of shaft on which brake wheel is mounted

The torque rating of the brake selected should be at least equal to the full load motor torque for the duty considered.

## Brake Wheels

| Wheel Size in Inches | Min. Bore in Inches (mm) | Max. Bore in Inches (mm) | Pilot Bore in Inches (mm) | $WK^2$ | Straight Bore ① Base ③ Catalog Number | Tapered Bore ② Base ③ Catalog Number |
|---|---|---|---|---|---|---|
| 4.0 | 0.50 (12.7) | 1.38 (35.1) | 0.50 (12.7) | 0.06 | **511H1150** | **511H1151** |
| 5.5 | 0.75 (19.1) | 2.00 (50.8) | 0.75 (19.1) | 0.26 | **511H1160** | **511H1161** |
| 7.0 | 1.00 (25.4) | 2.25 (57.2) | 0.75 (19.1) | 0.77 | **511H1170** | **511H1171** |

## Brake Wheel Suffix Numbers

**Bore Size Suffix Number—Add to Base Catalog Number**

| Bore ④ in Inches (mm) | Keyway in Inches | Suffix Number | Bore ④ in Inches (mm) | Keyway in Inches (mm) | Suffix Number |
|---|---|---|---|---|---|
| **Standard Bore Sizes** | | | | | |
| Pilot bore | None | **-1** | 1.625 (41.28) | 3/38 x 3/16 | **-9** |
| 0.625 (15.88) | 3/16 x 3/32 | **-2** | 1.875 (47.63) | 1/2 x 1/4 | **-10** |
| 0.750 (19.05) | 3/16 x 3/32 | **-3** | 2.125 (53.98) | 1/2 x 1/4 | **-11** |
| 0.875 (22.23) | 3/16 x 3/32 | **-4** | 2.375 (60.33) | 5/8 x 5/16 | **-12** |
| 1.000 (25.40) | 1/4 x 1/8 | **-5** | 2.500 (63.50) | 5/8 x 5/16 | **-63** |
| 1.125 (28.58) | 1/4 x 1/8 | **-6** | 2.625 (66.68) | 5/8 x 5/16 | **-13** |
| 1.250 (31.75) | 1/4 x 1/8 | **-7** | 2.750 (69.85) | 5/8 x 5/16 | **-18** |
| 1.375 (34.93) | 5/16 x 5/32 | **-8** | 2.875 (73.03) | 3/4 x 3/8 | **-14** |
| **Non-Standard Bore Sizes** | | | | | |
| 0.500 (12.70) | 1/8 x 1/16 | **-50** | 1.687 (42.85) | 3/8 x 3/16 | **-58** |
| 0.750 (19.05) | 1/4 x 1/8 | **-51** | 1.750 (44.45) | 3/8 x 3/16 | **-59** |
| 0.875 (22.23) | 1/4 x 1/8 | **-52** | 1.937 (49.20) | 1/2 x 1/4 | **-60** |
| 1.000 (25.40) | 5/16 x 5/32 | **-53** | 2.000 (50.80) | 1/2 x 1/4 | **-61** |
| 1.187 (30.15) | 1/4 x 1/8 | **-54** | 2.250 (57.15) | 1/2 x 1/4 | **-62** |
| 1.375 (34.93) | 3/8 x 3/16 | **-55** | — | — | **—** |
| 1.437 (36.50) | 3/8 x 3/16 | **-56** | — | — | **—** |
| 1.500 (38.10) | 3/8 x 3/16 | **-57** | — | — | **—** |

***Notes***

① Bore tolerance: +0.000–0.001 in.

② Taper is at rate of 1.25 in per ft on diameter. In bore size selection, use diameter of tapered shaft. Bore tolerance: +0.000–0.005 in.

③ Add suffix number for bore size to base catalog number.

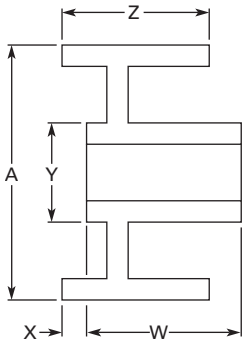
④ Bore size selected must be between minimum and maximum dimensions listed in brake wheel selection table.

## Dimensions

Approximate Dimensions in Inches (mm)



### Standard Brake Wheels




### Standard Brake Wheel Dimensions

| A | Z | W ① | X | Y | Bore Max. | Bore Min. |
|---|---|---|---|---|---|---|
| 4.00 (101.6) | 2.75 (69.9) | 1.63 (41.4) | 1.38 (35.1) | 2.50 (63.5) | 1.38 (35.1) | 0.50 (12.7) |
| 5.50 (139.7) | 3.25 (82.6) | 2.00 (50.8) | 1.63 (41.4) | 3.25 (82.6) | 2.00 (50.8) | 0.75 (19.1) |
| 7.00 (177.8) | 4.25 (108.0) | 3.00 (76.2) | 1.25 (31.8) | 4.00 (101.6) | 2.25 (57.2) | 1.00 (25.4) |

### Approximate Shipping Weights

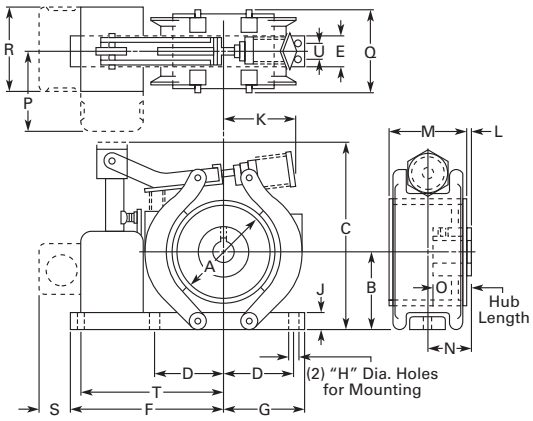
| Brake Size | Torque Rating ft-lb | Weight in Lbs (kg) Net — Brake with Wheel | Net — Wheel Only | Boxed — Brake with Wheel |
|---|---|---|---|---|
| **Type "S" AC Shoe Brakes** | | | | |
| S-4 | 3 | 15.8 (7.2) | 3.4 (1.5) | 17.0 (7.7) |
| S-4 | 10 | 15.8 (7.2) | 3.4 (1.5) | 17.0 (7.7) |
| S-4 | 15 | 15.8 (7.2) | 3.4 (1.5) | 17.0 (7.7) |
| S-5-1/2 | 25 | 33.2 (15.1) | 7.5 (3.4) | 36.0 (16.3) |
| S-5-1/2 | 35 | 33.2 (15.1) | 7.5 (3.4) | 36.0 (16.3) |
| S-7 | 50 | 52.1 (23.7) | 18.8 (8.5) | 55.0 (25.0) |
| S-7 | 75 | 52.1 (23.7) | 18.8 (8.5) | 55.0 (25.0) |
| **Type "S" DC Shoe Brakes** | | | | |
| S-4 | 3 | 18.0 (8.2) | 3.4 (1.5) | 20.0 (9.1) |
| S-4 | 10 | 18.0 (8.2) | 3.4 (1.5) | 20.0 (9.1) |
| S-4 | 15 | 18.0 (8.2) | 3.4 (1.5) | 20.0 (9.1) |
| S-5-1/2 | 25 | 35.0 (15.9) | 7.5 (3.4) | 38.0 (17.3) |
| S-5-1/2 | 35 | 35.0 (15.9) | 7.5 (3.4) | 38.0 (17.3) |
| S-7 | 50 | 54.0 (24.5) | 18.8 (8.5) | 58.0 (26.3) |
| S-7 | 75 | 54.0 (24.5) | 18.8 (8.5) | 58.0 (26.3) |
| S-7 | 85 | 54.0 (24.5) | 18.8 (8.5) | 58.0 (26.3) |
| S-7 | 110 | 54.0 (24.5) | 18.8 (8.5) | 58.0 (26.3) |

***Note***

① Hub lengths other than standard are not available.

Approximate Dimensions in Inches (mm)

## Type S4, S5-1/2 and S7 Solenoid Operated




## Type "S" AC Shoe Brakes

| Brake Size | Torque Rating ft-lb | A | B ① | C | D | E | F | G | H | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-4 | 3 | 4.00 (101.6) | 2.88 (73.2) | 7.50 (190.5) | 2.63 (66.8) | 1.25 (31.8) | 7.50 (190.5) | 3.13 (79.5) | 0.38 (9.7) | 0.63 (16.0) | 2.88 (73.2) | 0.25 (6.4) | 2.75 (69.9) | 1.63 (41.4) | 1.63 (41.4) | 2.88 (73.2) | 3.00 (76.2) | 3.13 (79.5) |
| S-4 | 10 | 4.00 (101.6) | 2.88 (73.2) | 7.50 (190.5) | 2.63 (66.8) | 1.25 (31.8) | 7.50 (190.5) | 3.13 (79.5) | 0.38 (9.7) | 0.63 (16.0) | 2.88 (73.2) | 0.25 (6.4) | 2.75 (69.9) | 1.63 (41.4) | 1.63 (41.4) | 2.88 (73.2) | 3.00 (76.2) | 3.13 (79.5) |
| S-4 | 15 | 4.00 (101.6) | 2.88 (73.2) | 7.50 (190.5) | 2.63 (66.8)) | 1.25 (31.8) | 7.50 (190.5) | 3.13 (79.5) | 0.38 (9.7) | 0.63 (16.0) | 2.88 (73.2) | 0.25 (6.4) | 2.75 (69.9) | 1.63 (41.4) | 1.63 (41.4) | 2.88 (73.2) | 3.00 (76.2) | 3.13 (79.5)) |
| S-5-1/2 | 25 | 5.50 (139.7) | 4.00 (101.6) | 9.50 (241.3) | 3.50 (88.9) | 2.00 (50.8) | 8.38 (212.9) | 4.13 (104.9) | 0.44 (11.2) | 1.00 (25.4) | 4.88 (124.0) | 0.38 (9.7) | 3.25 (82.6) | 2.00 (50.8) | 2.00 (50.8) | 3.13 (79.5) | 3.75 (95.3) | 3.13 (79.5) |
| S-5-1/2 | 35 | 5.50 (139.7) | 4.00 (101.6) | 9.50 (241.3) | 3.50 (88.9) | 2.00 (50.8) | 8.38 (212.9) | 4.13 (104.9) | 0.44 (11.2) | 1.00 (25.4) | 7.88 (200.2) | 0.38 (9.7) | 3.25 (82.6) | 2.00 (50.8) | 2.00 (50.8) | 3.13 (79.5) | 3.75 (95.3) | 3.13 (79.5) |
| S-7 | 50 | 7.00 (177.8) | 5.00 (127.0) | 11.50 (292.1) | 4.38 (111.3) | 2.50 (63.5) | 9.50 (241.3) | 5.00 (127.0) | 0.56 (14.2) | 1.00 (25.4) | 6.00 (152.4) | — | 4.25 (108.0) | 2.13 (54.1) | 3.00 (76.2) | 3.13 (79.5) | 4.75 (120.7) | 3.13 (79.5) |
| S-7 | 75 | 7.00 (177.8) | 5.00 (127.0) | 11.50 (292.1) | 4.38 (111.3) | 2.50 (63.5) | 9.50 (241.3) | 5.00 (127.0) | 0.56 (14.2) | 1.00 (25.4) | 6.00 (152.4) | — | 4.25 (108.0) | 2.13 (54.1) | 3.00 (76.2) | 3.13 (79.5) | 4.75 (120.7) | 3.13 (79.5) |

## Type "S" DC Shoe Brakes

| Brake Size | Torque Rating ft-lb | A | B ① | C | D | E | F | G | H | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-4 | 3 | 4.00 (101.6) | 3.50 (88.9) | 8.00 (203.2) | 2.63 (66.8) | 1.25 (31.8) | 7.56 (192.0) | 3.25 (82.6) | 0.38 (9.7) | 0.75 (19.1) | 2.88 (73.2) | 0.25 (6.4) | 2.75 (69.9) | 1.63 (41.4) | 1.63 (41.4) | 2.63 (66.8) | 3.00 (76.2)) | 4.06 (103.1) |
| S-4 | 10 | 4.00 (101.6) | 3.50 (88.9) | 8.00 (203.2) | 2.63 (66.8) | 1.25 (31.8) | 7.56 (192.0) | 3.25 (82.6) | 0.38 (9.7) | 0.75 (19.1) | 2.88 (73.2) | 0.25 (6.4) | 2.75 (69.9) | 1.63 (41.4) | 1.63 (41.4) | 2.63 (66.8) | 3.00 (76.2) | 4.06 (103.1)) |
| S-4 | 15 | 4.00 (101.6) | 3.50 (88.9) | 8.00 (203.2) | 2.63 (66.8) | 1.25 (31.8) | 7.56 (192.0) | 3.25 (82.6)) | 0.38 (9.7) | 0.75 (19.1) | 2.88 (73.2) | .25 (6.4) | 2.75 (69.9) | 1.63 (41.4) | 1.63 (41.4) | 2.63 (66.8) | 3.00 (76.2) | 4.06 (103.1) |
| S-5-1/2 | 25 | 5.50 (139.7) | 4.00 (101.6) | 9.50 (241.3) | 3.50 (88.9) | 2.00 (50.8) | 8.38 (212.9) | 4.13 (104.9) | 0.44 (11.2) | 0.75 (19.1) | 4.88 (124.0) | 0.38 (9.7) | 3.25 (82.6) | 2.00 (50.8) | 2.00 (50.8) | 2.88 (73.2) | 3.75 (95.3) | 4.06 (103.1) |
| S-5-1/2 | 35 | 5.50 (139.7) | 4.00 (101.6) | 9.50 (241.3) | 3.50 (88.9) | 2.00 (50.8) | 8.38 (212.9) | 4.13 (104.9) | 0.44 (11.2) | 0.75 (19.1) | 4.88 (124.0) | 0.38 (9.7) | 3.25 (82.6) | 2.00 (50.8) | 2.00 (50.8) | 2.88 (73.2) | 3.75 (95.3) | 4.06 (103.1) |
| S-7 | 50 | 7.00 (177.8) | 5.00 (127.0) | 11.50 (292.1) | 4.38 (111.3) | 2.50 (63.5) | 9.50 (241.3) | 5.00 (127.0) | 0.56 (14.2) | 0.75 (19.1) | 6.00 (152.4) | — | 4.25 (108.0) | 2.13 (54.1) | 3.00 (76.2) | 2.88 (73.2) | 4.88 (124.0) | 4.06 (103.1) |
| S-7 | 75 | 7.00 (177.8) | 5.00 (127.0) | 11.50 (292.1) | 4.38 (111.3) | 2.50 (63.5) | 9.50 (241.3) | 5.00 (127.0) | 0.56 (14.2) | 0.75 (19.1) | 6.00 (152.4) | — | 4.25 (108.0) | 2.13 (54.1) | 3.00 (76.2) | 2.88 (73.2) | 4.88 (124.0) | 4.06 (103.1) |
| S-7 | 85 | 7.00 (177.8) | 5.00 (127.0) | 11.50 (292.1) | 4.38 (111.3) | 2.50 (63.5) | 9.50 (241.3) | 5.00 (127.0) | 0.56 (14.2) | 0.75 (19.1) | 6.00 (152.4) | — | 4.25 (108.0) | 2.13 (54.1) | 3.00 (76.2) | 2.88 (73.2) | 4.88 (124.0) | 4.06 (103.1) |
| S-7 | 110 | 7.00 (177.8) | 5.00 (127.0) | 11.50 (292.1) | 4.38 (111.3) | 2.50 (63.5) | 9.50 (241.3) | 5.00 (127.0) | 0.56 (14.2) | 0.75 (19.1) | 6.00 (152.4) | — | 4.25 (108.0) | 2.13 (54.1) | 3.00 (76.2) | 2.88 (73.2) | 4.88 (124.0) | 4.06 (103.1) |

***Note***

① Open type brake only.

## Reference Data

### IEC Utilization Categories

(See also IEC/EN 60947-1; 2.1.18/IEV 441-17-19)

A combination of specified requirements relating to the condition in which the switching device or fuse fulfills its purpose and selected to represent a characteristic group of real-life applications. The specified requirements may, for example, relate to the values of making and breaking capacity and other characteristic values, data concerning associated circuits and the applicable conditions of use and operational behavior.

### Used in Technical Data and Formulas

| Code | Descriptions |
|---|---|
| DF | Duty factory |
| $I_{Dn}$ | Response value of earth-fault release |
| $I_{cm}$ | Rated short-circuit making capacity |
| $I_{cn}$ | Rated short-circuit breaking capacity |
| $I_{cs}$ | Rated service short-circuit breaking capacity |
| $I_{cu}$ | Rated ultimate short-circuit breaking capacity |
| $I_{cw}$ | Rated short-time withstand current |
| $I_e$ | Rated operational current |
| $I_k$ | Transformer initial short-circuit AC current |
| $I_L$ | Load monitoring response value |
| $I_n$ | Rated current |
| $I_{NT}$ | Transformer rated current |
| $I_{PK}$ | Rated peak withstand current |
| $I_q$ | Rated conditional short-circuit current |
| $I_r$ | Overcurrent release set value |
| $I_{rm}$ | Response value of non-delayed short-circuit release |
| $I_i$ | Response value of non-delayed short-circuit release |
| $I_{rmf}$ | Response value of fixed, non-delayed short-circuit release |

| Code | Descriptions |
|---|---|
| $I_{rmv}$ | Response value of short-time delayed short-circuit release |
| $I_{sd}$ | Response value of short-time delayed short-circuit release |
| $I_T$ | Response value of earth-fault release |
| $I_g$ | Response value of earth-fault release |
| $I_{th}$ | Conventional free air thermal current |
| $I_{the}$ | Conventional thermal current of enclosed devices |
| $I_u$ | Rated uninterrupted current |
| $S_{NT}$ | Transformer rating |
| $t_r$ | Time delay of overload release response |
| $t_T$ | Time delay of earth-fault release response |
| $t_g$ | Time delay of earth-fault release response |
| $t_v$ | Time delay of short-circuit release response |
| $U_c$ | Rated actuating voltage |
| $U_e$ | Rated operational voltage |
| $U_i$ | Rated insulation voltage |
| $U_{imp}$ | Rated impulse withstand voltage |
| $U_k$ | Transformer short-circuit voltage |
| $U_s$ | Rated control voltage |

## Annex A (informative)

### Examples of Utilization Categories for Low-Voltage Switchgear and Controlgear ①

| Category | Typical Applications | Relevant IEC Product Standard |
|---|---|---|
| **Nature of Current—AC** | | |
| AC-1 | Non-inductive or slightly inductive loads, resistance furnaces | 60947-4-1 |
| AC-2 | Slip-ring motors: starting, switching off | 60947-4-1 |
| AC-3 | Squirrel-cage motors: starting, switching off motors during running | 60947-4-1 |
| AC-4 | Squirrel-cage motors: starting, plugging ②, inching ③ | 60947-4-1 |
| AC-5a | Switching of electric discharge lamp controls | 60947-4-1 |
| AC-5b | Switching of incandescent lamps | 60947-4-1 |
| AC-6a | Switching of transformers | 60947-4-1 |
| AC-6b | Switching of capacitor banks | 60947-4-1 |
| AC-7a | Slightly inductive loads for household appliances and similar applications | 61095 |
| AC-7b | Motor-loads for household applications | 61095 |
| AC-8a | Hermetic refrigerant compressor motor control with manual resetting of overload releases | 60947-4-1 |
| AC-8b | Hermetic refrigerant compressor motor control with automatic resetting of overload releases | 60947-4-1 |
| AC-12 | Control of resistive loads and solid-state loads with isolation by optocouplers | 60947-5-1 |
| AC-12 | Control of resistive loads and solid-state loads with optical isolation | 60947-5-2 |
| AC-13 | Control of solid-state loads with transformer isolation | 60947-5-1 |
| AC-14 | Control of small electromagnetic loads | 60947-5-1 |
| AC-15 | Control of AC electromagnetic loads | 60947-5-1 |
| AC-20 | Connecting and disconnecting under no-load conditions | 60947-3 |
| AC-21 | Switching of resistive loads, including moderate overloads | 60947-3 |
| AC-22 | Switching of mixed resistive and inductive loads, including moderate overloads | 60947-3 |
| AC-23 | Switching of motor loads or other highly inductive loads | 60947-3 |
| AC-31 | Non inductive or slightly inductive loads | 60947-6-1 |
| AC-33 | Motor loads or mixed loads including motors, resistive loads and up to 30% incandescent lamp loads | 60947-6-1 |
| AC-35 | Electric discharge lamp loads | 60947-6-1 |
| AC-36 | Incandescent lamp loads | 60947-6-1 |
| AC-40 | Distribution circuits comprising mixed resistive and reactive loads having a resultant inductive reactance | 60947-6-2 |
| AC-41 | Non-inductive or slightly inductive loads, resistance furnaces | 60947-6-2 |
| AC-42 | Slip-ring motors: starting, switching off | 60947-6-2 |
| AC-43 | Squirrel cage motors: starting, switching off motors during running | 60947-6-2 |
| AC-44 | Squirrel cage motors: starting, plugging ②, inching ③ | 60947-6-2 |
| AC-45a | Switching of electric discharge lamp controls | 60947-6-2 |
| AC-45b | Switching of incandescent lamps | 60947-6-2 |
| AC-51 | Non-inductive or slightly inductive loads, resistance furnaces | 60947-4-3 |
| AC-52a | Control of slip ring motor stators: 8 h duty with on-load currents for start, acceleration, run | 60947-4-2 |
| AC-52b | Control of slip ring motor stators: intermittent duty | 60947-4-2 |
| AC-53a | Control of squirrel cage motors: 8 h duty with on-load currents for start, acceleration, run | 60947-4-2 |
| AC-53b | Control of squirrel cage motors: intermittent duty | 60947-4-2 |

***Notes***

① 60947-1 © IEC: 2004.

② Plugging is understood to be stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.

③ Inching is understood to be energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

## Examples of Utilization Categories for Low-Voltage Switchgear and Controlgear, continued ①



| Category | Typical Applications | Relevant IEC Product Standard |
|---|---|---|
| **Nature of Current—AC, continued** | | |
| AC-55a | Switching of electric discharge lamp controls | 60947-4-3 |
| AC-55b | Switching of incandescent lamps | 60947-4-3 |
| AC-56a | Switching of transformers | 60947-4-3 |
| AC-56b | Switching of capacitor banks | 60947-4-3 |
| AC-58a | Control of hermetic refrigerant compressor motors with automatic resetting of overload releases: 8 h duty with on-load currents for start, acceleration, run | 60947-4-2 |
| AC-58b | Control of hermetic refrigerant compressor motors with automatic resetting of overload releases: intermittent duty | 60947-4-2 |
| AC-140 | Control of small electromagnetic loads with holding (closed) current ≤0,2 A, for example contactor relays | 60947-5-2 |
| **Nature of Current—AC and DC** | | |
| A | Protection of circuits, with no rated short-time withstand current | 60947-2 |
| B | Protection of circuits, with a rated short-time withstand current | 60947-2 |
| **Nature of Current—DC** | | |
| DC-1 | Non-inductive or slightly inductive loads, resistance furnaces | 60947-4-1 |
| DC-3 | Shunt-motors: starting, plugging ②, inching ③, dynamic breaking of motors | 60947-4-1 |
| DC-5 | Series-motors: starting, plugging ②, inching ③, dynamic breaking of motors | 60947-4-1 |
| DC-6 | Switching of incandescent lamps | 60947-4-1 |
| DC-12 | Control of resistive loads and solid-state loads with isolation by optocouplers | 60947-5-1 |
| DC-12 | Control of resistive loads and solid-state loads with optical isolation | 60947-5-2 |
| DC-13 | Control of electromagnets | 60947-5-1 |
| DC-13 | Control of electromagnets | 60947-5-2 |
| DC-14 | Control of electromagnetic loads having economy resistors in circuit | 60947-5-1 |
| DC-20 | Connecting and disconnecting under no-load conditions | 60947-3 |
| DC-21 | Switching of resistive loads, including moderate overloads | 60947-3 |
| DC-22 | Switching of mixed resistive and inductive loads, including moderate overloads (for example shunt motors) | 60947-3 |
| DC-23 | Switching of motor loads or other highly inductive loads (for example series motors) | 60947-3 |
| DC-31 | Resistive loads | 60947-6-1 |
| DC-33 | Motor loads or mixed loads including motors | 60947-6-1 |
| DC-36 | Incandescent lamp loads | 60947-6-1 |
| DC-40 | Distribution circuits comprising mixed resistive and reactive loads having a resultant inductive reactance | 60947-6-2 |
| DC-41 | Non-inductive or slightly inductive loads, resistance furnaces | 60947-6-2 |
| DC-43 | Shunt-motors: starting, plugging ②, inching ③, dynamic breaking of DC | 60947-6-2 |
| DC-45 | Series-motors: starting, plugging ②, inching ③, dynamic breaking of DC | 60947-6-2 |
| DC-46 | Switching of incandescent lamps | 60947-6-2 |

***Notes***

① 60947-1 © IEC: 2004.
② Plugging is understood to be stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.
③ Inching is understood to be energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

## Motor Ratings Data

### *Ampere Rating of AC and DC Motors*

Ampere ratings of motors vary somewhat, depending upon the type of motor. The values given below are for drip-proof, Class B insulated (T Frame) where available, 1.15 service factor, NEMA Design B motors. These values represent an average full load motor current which was calculated from the motor performance data published by several motor manufacturers. In the case of high torque squirrel cage motors, the ampere ratings will be at least 10% greater than the values given in the following table.

**Caution—These average ratings could be high or low for a specific motor and therefore heater coil selection on this basis always involves risk. For fully reliable motor protection, select heater coils on the basis of full load current rating as shown on the motor nameplate.**

### Ampere Ratings of Three-Phase, 60 Hz, AC Induction Motor

| hp | Syn. Speed RPM | Current in Amperes 200V | 230V | 380V ① | 460V | 575V | 2200V |
|---|---|---|---|---|---|---|---|
| 1/4 | 1800 | 1.09 | .95 | 0.55 | 0.48 | 0.38 | — |
| | 1200 | 1.61 | 1.40 | 0.81 | 0.70 | 0.56 | — |
| | 900 | 1.84 | 1.60 | 0.93 | 0.80 | 0.64 | — |
| 1/3 | 1800 | 1.37 | 1.19 | 0.69 | 0.60 | 0.48 | — |
| | 1200 | 1.83 | 1.59 | 0.92 | 0.80 | 0.64 | — |
| | 900 | 2.07 | 1.80 | 1.04 | 0.90 | 0.72 | — |
| 1/2 | 1800 | 1.98 | 1.72 | 0.99 | 0.86 | 0.69 | — |
| | 1200 | 2.47 | 2.15 | 1.24 | 1.08 | 0.86 | — |
| | 900 | 2.74 | 2.38 | 1.38 | 1.19 | 0.95 | — |
| 3/4 | 1800 | 2.83 | 2.46 | 1.42 | 1.23 | 0.98 | — |
| | 1200 | 3.36 | 2.92 | 1.69 | 1.46 | 1.17 | — |
| | 900 | 3.75 | 3.26 | 1.88 | 1.63 | 1.30 | — |
| 1 | 3600 | 3.22 | 2.80 | 1.70 | 1.40 | 1.12 | — |
| | 1800 | 4.09 | 3.56 | 2.06 | 1.78 | 1.42 | — |
| | 1200 | 4.32 | 3.76 | 2.28 | 1.88 | 1.50 | — |
| | 900 | 4.95 | 4.30 | 2.60 | 2.15 | 1.72 | — |
| 1-1/2 | 3600 | 5.01 | 4.36 | 2.64 | 2.18 | 1.74 | — |
| | 1800 | 5.59 | 4.86 | 2.94 | 2.43 | 1.94 | — |
| | 1200 | 6.07 | 5.28 | 3.20 | 2.64 | 2.11 | — |
| | 900 | 6.44 | 5.60 | 3.39 | 2.80 | 2.24 | — |
| 2 | 3600 | 6.44 | 5.60 | 3.39 | 2.80 | 2.24 | — |
| | 1800 | 7.36 | 6.40 | 3.87 | 3.20 | 2.56 | — |
| | 1200 | 7.87 | 6.84 | 4.14 | 3.42 | 2.74 | — |
| | 900 | 9.09 | 7.90 | 4.77 | 3.95 | 3.16 | — |
| 3 | 3600 | 9.59 | 8.34 | 5.02 | 4.17 | 3.34 | — |
| | 1800 | 10.8 | 9.40 | 5.70 | 4.70 | 3.76 | — |
| | 1200 | 11.7 | 10.2 | 6.20 | 5.12 | 4.10 | — |
| | 900 | 13.1 | 11.4 | 6.90 | 5.70 | 4.55 | — |
| 5 | 3600 | 15.5 | 13.5 | 8.20 | 6.76 | 5.41 | — |
| | 1800 | 16.6 | 14.4 | 8.74 | 7.21 | 5.78 | — |
| | 1200 | 18.2 | 15.8 | 9.59 | 7.91 | 6.32 | — |
| | 900 | 18.3 | 15.9 | 9.60 | 7.92 | 6.33 | — |
| 7-1/2 | 3600 | 22.4 | 19.5 | 11.8 | 9.79 | 7.81 | — |
| | 1800 | 24.7 | 21.5 | 13.0 | 10.7 | 8.55 | — |
| | 1200 | 25.1 | 21.8 | 13.2 | 10.9 | 8.70 | — |
| | 900 | 26.5 | 23.0 | 13.9 | 11.5 | 9.19 | — |
| 10 | 3600 | 29.2 | 25.4 | 15.4 | 12.7 | 10.1 | — |
| | 1800 | 30.8 | 26.8 | 16.3 | 13.4 | 10.7 | — |
| | 1200 | 32.2 | 28.0 | 16.9 | 14.0 | 11.2 | — |
| | 900 | 35.1 | 30.5 | 18.5 | 15.2 | 12.2 | — |
| 15 | 3600 | 41.9 | 36.4 | 22.0 | 18.2 | 14.5 | — |
| | 1800 | 45.1 | 39.2 | 23.7 | 19.6 | 15.7 | — |
| | 1200 | 47.6 | 41.4 | 25.0 | 20.7 | 16.5 | — |
| | 900 | 51.2 | 44.5 | 26.9 | 22.2 | 17.8 | — |
| 20 | 3600 | 58.0 | 50.4 | 30.5 | 25.2 | 20.1 | — |
| | 1800 | 58.9 | 51.2 | 31.0 | 25.6 | 20.5 | — |
| | 1200 | 60.7 | 52.8 | 31.9 | 26.4 | 21.1 | — |
| | 900 | 63.1 | 54.9 | 33.2 | 27.4 | 21.9 | — |

***Note***

① 380V 50 Hz.

## Ampere Ratings of Three-Phase, 60 Hz, AC Induction Motor, continued

| hp | Syn. Speed RPM | Current in Amperes 200V | 230V | 380V ① | 460V | 575V | 2200V |
|---|---|---|---|---|---|---|---|
| 25 | 3600 | 69.9 | 60.8 | 36.8 | 30.4 | 24.3 | — |
| | 1800 | 74.5 | 64.8 | 39.2 | 32.4 | 25.9 | — |
| | 1200 | 75.4 | 65.6 | 39.6 | 32.8 | 26.2 | — |
| | 900 | 77.4 | 67.3 | 40.7 | 33.7 | 27.0 | — |
| 30 | 3600 | 84.8 | 73.7 | 44.4 | 36.8 | 29.4 | — |
| | 1800 | 86.9 | 75.6 | 45.7 | 37.8 | 30.2 | — |
| | 1200 | 90.6 | 78.8 | 47.6 | 39.4 | 31.5 | — |
| | 900 | 94.1 | 81.8 | 49.5 | 40.9 | 32.7 | — |
| 40 | 3600 | 111 | 96.4 | 58.2 | 48.2 | 38.5 | — |
| | 1800 | 116 | 101 | 61.0 | 50.4 | 40.3 | — |
| | 1200 | 117 | 102 | 61.2 | 50.6 | 40.4 | — |
| | 900 | 121 | 105 | 63.2 | 52.2 | 41.7 | — |
| 50 | 3600 | 138 | 120 | 72.9 | 60.1 | 48.2 | — |
| | 1800 | 143 | 124 | 75.2 | 62.2 | 49.7 | — |
| | 1200 | 145 | 126 | 76.2 | 63.0 | 50.4 | — |
| | 900 | 150 | 130 | 78.5 | 65.0 | 52.0 | — |
| 60 | 3600 | 164 | 143 | 86.8 | 71.7 | 57.3 | — |
| | 1800 | 171 | 140 | 90.0 | 74.5 | 59.4 | — |
| | 1200 | 173 | 150 | 91.0 | 75.0 | 60.0 | — |
| | 900 | 177 | 154 | 93.1 | 77.0 | 61.5 | — |
| 75 | 3600 | 206 | 179 | 108 | 89.6 | 71.7 | — |
| | 1800 | 210 | 183 | 111 | 91.6 | 73.2 | — |
| | 1200 | 212 | 184 | 112 | 92.0 | 73.5 | — |
| | 900 | 222 | 193 | 117 | 96.5 | 77.5 | — |
| 100 | 3600 | 266 | 231 | 140 | 115 | 92.2 | — |
| | 1800 | 271 | 236 | 144 | 118 | 94.8 | 23.6 |
| | 1200 | 275 | 239 | 145 | 120 | 95.6 | 24.2 |
| | 900 | 290 | 252 | 153 | 126 | 101 | 24.8 |
| 125 | 3600 | — | 292 | 176 | 146 | 116 | — |
| | 1800 | — | 293 | 177 | 147 | 117 | 29.2 |
| | 1200 | — | 298 | 180 | 149 | 119 | 29.9 |
| | 900 | — | 305 | 186 | 153 | 122 | 30.9 |
| 150 | 3600 | — | 343 | 208 | 171 | 137 | — |
| | 1800 | — | 348 | 210 | 174 | 139 | 34.8 |
| | 1200 | — | 350 | 210 | 174 | 139 | 35.5 |
| | 900 | — | 365 | 211 | 183 | 146 | 37.0 |
| 200 | 3600 | — | 452 | 257 | 226 | 181 | — |
| | 1800 | — | 458 | 265 | 229 | 184 | 46.7 |
| | 1200 | — | 460 | 266 | 230 | 184 | 47.0 |
| | 900 | — | 482 | 279 | 241 | 193 | 49.4 |
| 250 | 3600 | — | 559 | 338 | 279 | 223 | — |
| | 1800 | — | 568 | 343 | 284 | 227 | 57.5 |
| | 1200 | — | 573 | 345 | 287 | 229 | 58.5 |
| | 900 | — | 600 | 347 | 300 | 240 | 60.5 |
| 300 | 1800 | — | 678 | 392 | 339 | 271 | 69.0 |
| | 1200 | — | 684 | 395 | 342 | 274 | 70.0 |
| 400 | 1800 | — | 896 | 518 | 448 | 358 | 91.8 |
| 500 | 1800 | — | 1110 | 642 | 555 | 444 | 116 |

### *Single-Phase AC Motors*

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents and multispeed motors will have full-load current varying with speed, in which case the nameplate current ratings shall be used.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240V.

## *Table 430.248.* Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

| hp | 115V | 200V | 208V | 230V |
|---|---|---|---|---|
| 1/6 | 4.4 | 2.5 | 2.4 | 2.2 |
| 1/4 | 5.8 | 3.3 | 3.2 | 2.9 |
| 1/3 | 7.2 | 4.1 | 4.0 | 3.6 |
| 1/2 | 9.8 | 5.6 | 5.4 | 4.9 |
| 3/4 | 13.8 | 7.9 | 7.6 | 6.9 |
| 1 | 16 | 9.2 | 8.8 | 8 |
| 1-1/2 | 20 | 11.5 | 11 | 10 |
| 2 | 24 | 13.8 | 13.2 | 12 |
| 3 | 34 | 19.6 | 18.7 | 17 |
| 5 | 56 | 32.2 | 30.8 | 28 |
| 7-1/2 | 80 | 46 | 44 | 40 |
| 10 | 100 | 57.5 | 55 | 50 |

***Note***

① 380V 50 Hz.

### *DC Motors*

The following values of full-load currents are for motors running at base speed.

These are average direct-current quantities.

### *Three-Phase AC Motors*

The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics.

Motors built for low speeds (1,200 RPM or less) or high torques may require more running current and multispeed motors will have full-load current varying with speed. In these cases the nameplate current rating shall be used.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480 and 550 to 600V.

## *Table 430.247* Full-Load Current in Amperes, Direct-Current Motors

| | Armature Voltage Rating ① | | Ampere Capacity of Fuses for Motors Recommended Values | |
|---|---|---|---|---|
| hp | 120V | 240V | 120V | 240V |
| 1/4 | 3.1 | 1.6 | 5 | 3 |
| 1/3 | 4.1 | 2.0 | 5 | 3 |
| 1/2 | 5.4 | 2.7 | 7 | 3 |
| 3/4 | 7.6 | 3.8 | 10 | 5 |
| 1 | 9.5 | 4.7 | 15 | 7 |
| 1-1/2 | 13.2 | 6.6 | 20 | 10 |
| 2 | 17 | 8.5 | 25 | 12 |
| 3 | 25 | 12.2 | 30 | 15 |
| 5 | 40 | 20 | 50 | 25 |
| 7-1/2 | 58 | 29 | 80 | 40 |
| 10 | 76 | 38 | 100 | 50 |
| 15 | — | 55 | — | 75 |
| 20 | — | 72 | — | 100 |
| 25 | — | 89 | — | 125 |
| 30 | — | 106 | — | 150 |
| 40 | — | 140 | — | 200 |
| 50 | — | 173 | — | 250 |
| 60 | — | 206 | — | 275 |
| 75 | — | 255 | — | 350 |
| 100 | — | 341 | — | 500 |
| 125 | — | 425 | — | 600 |
| 150 | — | 506 | — | — |
| 200 | — | 675 | — | — |

## *Table 430.250.* Full-Load Current Three-Phase Alternating-Current Motors

| | Induction Type Squirrel Cage and Wound-Rotor Amperes | | | | | | | Synchronous Type Unity Power Factor ② Amperes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| hp | 115V | 200V | 208V | 230V | 460V | 575V | 2300V | 230V | 460V | 575V | 2300V |
| 1/2 | 4.4 | 2.5 | 2.4 | 2.2 | 1.1 | 0.9 | — | — | — | — | — |
| 3/4 | 6.4 | 3.7 | 3.5 | 3.2 | 1.6 | 1.3 | — | — | — | — | — |
| 1 | 8.4 | 4.8 | 4.6 | 4.2 | 2.1 | 1.7 | — | — | — | — | — |
| 1-1/2 | 12.0 | 6.9 | 6.6 | 6.0 | 3.0 | 2.4 | — | — | — | — | — |
| 2 | 13.6 | 7.8 | 7.5 | 6.8 | 3.4 | 2.7 | — | — | — | — | — |
| 3 | — | 11.0 | 10.6 | 9.6 | 4.8 | 3.9 | — | — | — | — | — |
| 5 | — | 17.5 | 16.7 | 15.2 | 7.6 | 6.1 | — | — | — | — | — |
| 7-1/2 | — | 25.3 | 24.2 | 22 | 11 | 9 | — | — | — | — | — |
| 10 | — | 32.2 | 30.8 | 28 | 14 | 11 | — | — | — | — | — |
| 15 | — | 48.3 | 46.2 | 42 | 21 | 17 | — | — | — | — | — |
| 20 | — | 62.1 | 59.4 | 54 | 27 | 22 | — | — | — | — | — |
| 25 | — | 78.2 | 74.8 | 68 | 34 | 27 | — | 53 | 26 | 21 | — |
| 30 | — | 92 | 88 | 80 | 40 | 32 | — | 63 | 32 | 26 | — |
| 40 | — | 120 | 114 | 104 | 52 | 41 | — | 83 | 41 | 33 | — |
| 50 | — | 150 | 143 | 130 | 65 | 52 | — | 104 | 52 | 42 | — |
| 60 | — | 177 | 169 | 154 | 77 | 62 | 16 | 123 | 61 | 49 | 12 |
| 75 | — | 221 | 211 | 192 | 96 | 77 | 20 | 155 | 78 | 62 | 15 |
| 100 | — | 285 | 273 | 248 | 124 | 99 | 26 | 202 | 101 | 81 | 20 |
| 125 | — | 359 | 343 | 312 | 156 | 125 | 31 | 253 | 126 | 101 | 25 |
| 150 | — | 414 | 396 | 360 | 180 | 144 | 37 | 302 | 151 | 121 | 30 |
| 200 | — | 552 | 528 | 480 | 240 | 192 | 49 | 400 | 201 | 161 | 40 |
| 250 | — | — | — | — | 302 | 242 | 60 | — | — | — | — |
| 300 | — | — | — | — | 361 | 289 | 72 | — | — | — | — |
| 350 | — | — | — | — | 414 | 336 | 83 | — | — | — | — |
| 400 | — | — | — | — | 477 | 382 | 95 | — | — | — | — |
| 450 | — | — | — | — | 515 | 412 | 103 | — | — | — | — |
| 500 | — | — | — | — | 590 | 472 | 118 | — | — | — | — |

***Notes***

① These are average direct-current quantities.

② For 90 and 80 percent power factor, the above figures shall be multiplied by 1.1 and 1.25 respectively.