July 2008

NEMA Contactors & Starters

Contents

A

NEMA, Size 0
Full Voltage Non-reversing Starter

Product Description

Eaton's Cutler-Hammer® Intelligent Technologies (***IT.***) Electro-Mechanical line of Contactors and Starters is the result of a substantial engineering, manufacturing and marketing effort involving extensive customer input, combined with new advances in solid-state technology. ***IT.*** Electro-Mechanical products have greatly increased functionality, significantly reduced size and utilize the benefits of 24V DC control. The exclusive Pulse Width Modulation (PWM) control and digital microprocessor generate a minimized DC value which reduces energy to the contact block and provides the most compact system available.

Standards and Certifications

- Standard: Designed to meet or exceed UL, NEMA and CSA
- UL Listed: UL File #E1491, Guide #NLDX — Open, UL 508
- CSA Certified: CSA File #156828, Class #3211 04 Open, C22.2 No. 14-95
- CE
- NEMA ICS1, ICS2, ICS5
- NEMA, Certificate No. 2074289

ISO 9002 Certification

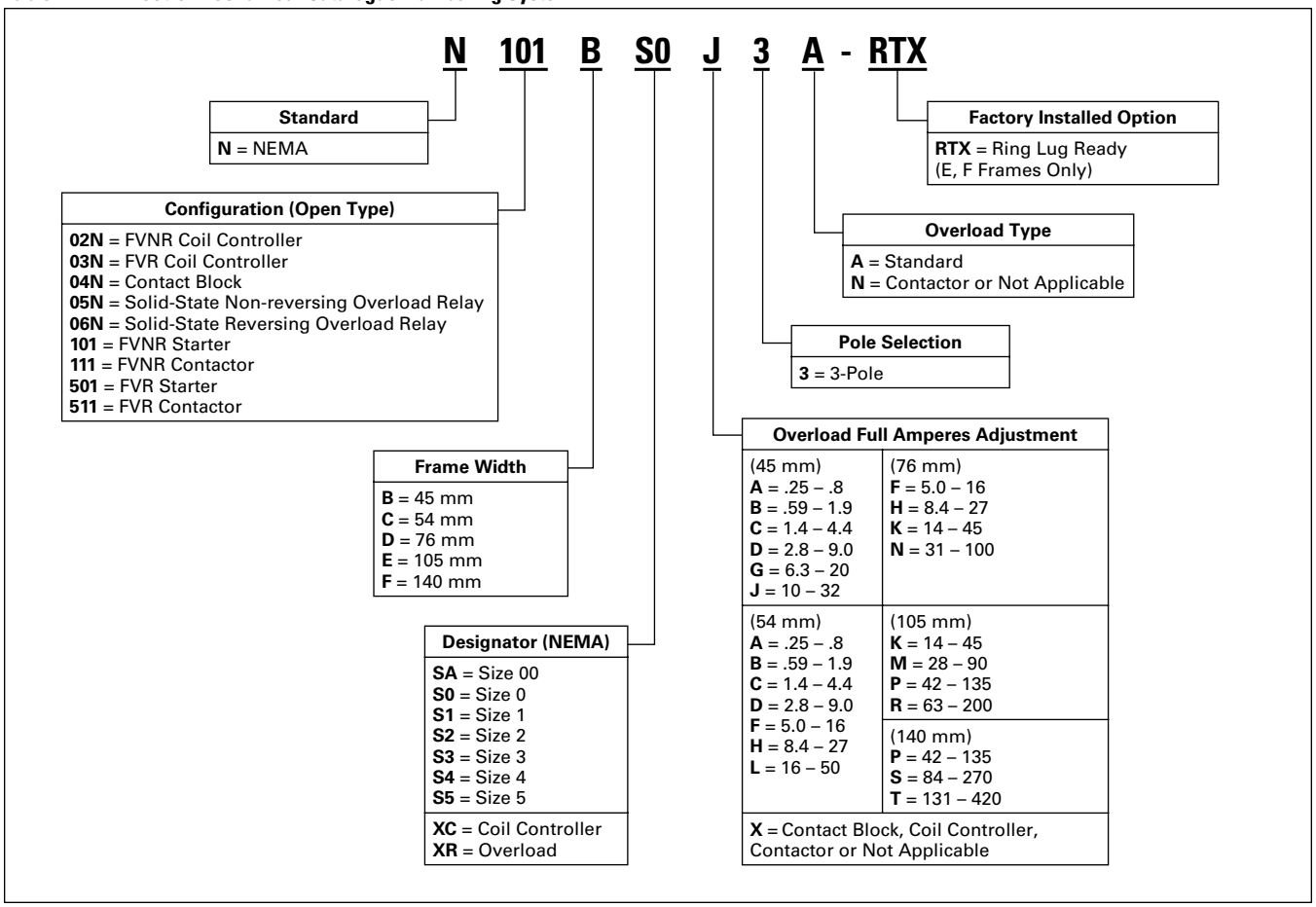
When you turn to Eaton's Cutler-Hammer Products, you turn to quality. The International Standards Organization (ISO) has established a series of standards acknowledged by 91 industrialized nations to bring harmony to the international quest for quality. The ISO Certification process covers 20 quality 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.

Publications

Pub. MN03305002E ***IT.*** NEMA Overload Relay Setup and Troubleshooting Manual
Pub. MN03305001E ***IT.*** NEMA Contactor and Starter User Manual
Pub. 50102 ***IT.*** NEMA Overload Relay Quick Setup Guide
Pub. 49416 ***IT.*** NEMA Contact Blocks (Size 00 – 4)
Pub. 50140 ***IT.*** NEMA Non-reversing Contactor Size 00 and 0 Installation Guide
Pub. 50150 ***IT.*** NEMA Non-reversing Contactor Size 1 Installation Guide
Pub. 50160 ***IT.*** NEMA Non-reversing Contactor Size 2 Installation Guide
Pub. 50170 ***IT.*** NEMA Non-reversing Contactor Size 3 and 4 Installation Guide
Pub. 50180 ***IT.*** NEMA Non-reversing Contactor Size 5 Installation Guide
Pub. 50141 ***IT.*** NEMA Reversing Contactor Size 00 and 0 Installation Guide
Pub. 50151 ***IT.*** NEMA Reversing Contactor Size 1 Installation Guide
Pub. 50161 ***IT.*** NEMA Reversing Contactor Size 2 Installation Guide
Pub. 50171 ***IT.*** NEMA Reversing Contactor Size 3 and 4 Installation Guide
Pub. 50181 ***IT.*** NEMA Reversing Contactor Size 5 Installation Guide
Pub. 50142 ***IT.*** NEMA Non-reversing Starter Size 00 and 0 Installation Guide
Pub. 50152 ***IT.*** NEMA Non-reversing Starter Size 1 Installation Guide
Pub. 50162 ***IT.*** NEMA Non-reversing Starter Size 2 Installation Guide
Pub. 50172 ***IT.*** NEMA Non-reversing Starter Size 3 and 4 Installation Guide
Pub. 50182 ***IT.*** NEMA Non-reversing Starter Size 5 Installation Guide
Pub. 50143 ***IT.*** NEMA Reversing Starter Size 00 and 0 Installation Guide
Pub. 50153 ***IT.*** NEMA Reversing Starter Size 1 Installation Guide
Pub. 50163 ***IT.*** NEMA Reversing Starter Size 2 Installation Guide
Pub. 50173 ***IT.*** NEMA Reversing Starter Size 3 and 4 Installation Guide
Pub. 50183 ***IT.*** NEMA Reversing Starter Size 5 Installation Guide

Catalogue Number Selection (Open Components)

Table A-1. *IT.* Electro-Mechanical Catalogue Numbering System



Note: When using the Catalogue Numbering System for Eaton's Cutler-Hammer ***IT.*** Electro-Mechanical products, care should be exercised to assure that the Catalogue Number for the Overload Relay aligns with the ***IT.*** Contact Block selected for type, frame size and ampacity, if purchased as separate components.

Examples:
N101BS0J3A — Full Voltage Non-reversing, Size 0 Starter with a 10 – 32 amp overload range
N111FS5X3N — Full Voltage Non-reversing, Size 5 Contactor
N501DS2K3A — Full Voltage Reversing Starter with a 14 – 45 amp overload range
N02NCXCXNN — Coil Controller 54 mm
N04NBSAX3N — Contact Block Size 00

A

Contents

NEMA Full Voltage Non-reversing Contactor, Size 0, Cat. No. N111BS0X3N

NEMA Full Voltage Reversing Contactor, Size 0, Cat. No. N511BS0X3N

Product Description

The Cutler-Hammer® Intelligent Technologies (***IT.***) Electro-Mechanical Contactor from Eaton's electrical business consists of an ***IT.*** Electro-Mechanical Contact Block and ***IT.*** Electro-Mechanical Coil Controller as a Full Voltage Non-reversing (FVNR) or Full Voltage Reversing (FVR) device. Size 00 to Size 4 Contact Blocks combined with Coil Controllers (factory or field assembled) are stand-alone Contactors. Only the Size 5 Contactors have internal factory assembled coil controllers.

Features

- Size 00 – 5, 9 – 270A, 2 – 200 hp, 600V
- 24V DC Coil Control — safe, reliable global standard
- Frame width (mm): 45, 54, 76, 105, 140
- No laminations, shading coils or magnet noise
- -40 to 149°F (-40 to 65°C) operating temperature
- No seal in auxiliary contacts required — control wiring is not needed between the contactor and overload relay
- Conformal coated printed circuit boards for resistance to harsh environments
- Unique Pulse Width Modulated coil controller minimizes coil power consumption
- Microprocessor-based control
- Easily accessible mounting feet for panel mounting
- Meets or exceeds global standards for EMC (Electromagnetic compatibility) immunity and emissions
- Front and side mounted Auxiliary Contacts: 1NO, 1 NC, 2NO, 2NC, 1NO/1NC and logic level
- 2- or 3-wire control
- Built-in logic to provide either 2- or 3-wire control, eliminating the need to provide and wire auxiliary contacts to seal in and interlock the contactor coils
- Easy field assembly of control wiring — plug and unplug lockable control connector
- DIN rail mounting for Sizes 00 – 2
- Optional mounting plates for Size 00 – 4
- Common accessories
- Long-life silver nickel and silver tin oxide contacts provide excellent conductivity and superior resistance to welding and arc erosion
- Environmentally friendly materials
- Low wattage coils and minimal heat dissipation

Reversing Contactors

- Includes Reversing Power Wiring and bus bars
- Mounting plates for Size 00 – 4
- Exclusive internal electronic interlock for reversing
- Field installed Reversing Kits
- Unique coil controller energizes both forward and reverse contactors — one control point for wiring

Product Selection

Non-reversing Contactors

When Ordering Specify

NEMA Size, Continuous Ampere Rating, Voltage, kW/hp and Non-reversing or Reversing

Note:

- An **N111** (Size 00 – 4) consists of an **N04N** (Contact Block) and an **N02N** (Coil Controller), factory assembled.
- An **N111F** (Size 5) has an internal coil controller, factory assembled.

Cat. No. N111BS0X3N

Table A-2. Full Voltage 3-Pole DC-Operated Non-reversing Contactors ①

NEMA Size	Continuous Ampere Rating	Max. UL Horsepower (hp) 60 Hz						Max. UL Horsepower (hp) 50 Hz	3-Pole Non-reversing	
		1-Phase		3-Phase				3-Phase	Catalogue Number	Price
		115V	230V	200V/ 208V	230V/ 240V	460V/ 480V	575V/ 600V	380V		
00	9	1/3	1	1-1/2	1-1/2	2	2	1-1/2	**N111BSAX3N**	
0	18	1	2	3	3	5	5	5	**N111BS0X3N**	
1	27	2	3	7-1/2	7-1/2	10	10	10	**N111CS1X3N**	
2	45	3	7-1/2	10	15	25	25	25	**N111DS2X3N**	
3	90	7-1/2	15	25	30	50	50	50	**N111ES3X3N**	
4	135	—	—	40	50	100	100	75	**N111ES4X3N**	
5	270	—	—	75	100	200	200	150	**N111FS5X3N**	

① 24V DC coil voltage.

Note:

- If required, accessories are available on **Page A-13**.
- Integral solid-state auxiliary hold-in circuit.
- See **Table A-7** for 24V DC power supply requirements.
- Control inputs are rated 24V DC (3 – 5 mA).

Accessories ..... **Pages A-13 – A-16**
Technical Data ..... **Pages A-10 – A-12**
Dimensions ..... **Pages A-18 – A-21**
Discount Symbol **MC7**

Reversing Contactors

When Ordering Specify

NEMA Size, Continuous Ampere Rating, Voltage, kW/hp, and Non-reversing or Reversing

Note:

- An **N511** (Size 00 – 4) consists of two **N04N** (Contact Blocks), an **N03N** (FVR Coil Controller), Mechanical Interlock, Fanning Strips and Mounting Plate, factory assembled.
- An **N511F** (Size 5) consists of two **N111F** (Contactors), an Internal Reversing Coil Controller, Mechanical Interlock, Crossover Bus Bars and Wiring Harness, factory assembled.

Cat. No. N511BS0X3N

Table A-3. Full Voltage 3-Pole DC-Operated Reversing Contactors ①

NEMA Size	Continuous Ampere Rating	Max. UL Horsepower (hp) 60 Hz						Max. UL Horsepower (hp) 50 Hz	3-Pole Reversing	
		1-Phase		3-Phase				3-Phase	Catalogue Number	Price
		115V	230V	200V/ 208V	230V/ 240V	460V/ 480V	575V/ 600V	380V		
00	9	1/3	1	1-1/2	1-1/2	2	2	1-1/2	**N511BSAX3N**	
0	18	1	2	3	3	5	5	5	**N511BS0X3N**	
1	27	2	3	7-1/2	7-1/2	10	10	10	**N511CS1X3N**	
2	45	3	7-1/2	10	15	25	25	25	**N511DS2X3N**	
3	90	7-1/2	15	25	30	50	50	50	**N511ES3X3N**	
4	135	—	—	40	50	100	100	75	**N511ES4X3N**	
5	270	—	—	75	100	200	200	150	**N511FS5X3N**	

① 24V DC coil voltage.

Note:

- If required, accessories are available on **Page A-13**.
- Integral solid-state auxiliary hold-in circuit.
- See **Table A-7** for 24V DC power supply requirements.
- Control inputs are rated 24V DC (3 – 5 mA).

Accessories . . . . . **Pages A-13 – A-16**
Technical Data . . . . . **Pages A-10 – A-12**
Dimensions . . . . . **Pages A-18 – A-21**
Discount Symbol **MC7**

Contents

NEMA Full Voltage Non-reversing Starter, Size 0

NEMA Full Voltage Reversing Starter, Size 0

Product Description

The Cutler-Hammer® Intelligent Technologies (***IT.***) Electro-Mechanical Starter from Eaton's electrical business consists of an ***IT.*** Electro-Mechanical Contact Block or Contactor and ***IT.*** Electro-Mechanical Solid-State Overload Relay as a Full Voltage Non-reversing (FVNR) or Full Voltage Reversing (FVR) device. Size 00 to Size 5 Starters are factory or field assembled.

Features

- 24V DC control power — safe, reliable global standard
- Unique Pulse Width Modulated (PWM) coil controller minimizes coil power consumption
- Microprocessor based control
- Phase loss and current unbalance protection, user selectable
- Standard selectable Trip Class 10, 20 (factory default) or 30 — no individual part numbers — no programming software
- Ambient compensated overload
- Motor temperature and power-up protection with thermal memory
- Front and side mounted Auxiliary Contacts: 1NO, 1NC, 2NO, 2NC, 1NO/1NC and logic level (1NO/1NC)
- Easily accessible mounting feet for panel mounting
- LED status indication — trip, trip class, motor thermal state, reset, overload state
- Unique "Alarm without Trip" option for critical must run applications
- Lockable overload cover protects against unauthorized adjustment and reset functions
- No control wiring needed between contactor and overload relay — eliminates seal in auxiliary contacts
- Minimal heat — no full voltage coils
- -40° to 149°F (-40° – 65°C) operating temperature
- Wide 3.2:1 current adjustment range
- Exclusive internal 24-bit floating point math calculations with RMS calibrated current measurement
- Meets or exceeds global standards for EMC (Electromagnetic compatibility) immunity and emissions
- IP20 Finger Protection
- Motor running thermal utilization indication
- Manual, Automatic or Remote Reset
- Easy field assembly of control wiring — plug and unplug lockable control connector
- DIN rail mountable, Size 00 – 2
- Communication Interface with Starter Network Adapter Product (SNAP)
- 2- or 3-wire control
- Solid-state alarm output indication
- Optional mounting plates with "Ease of Installation" slotted hole design
- Type 2 Coordination
- Conformal coated printed circuit boards for resistance to harsh environments

Reversing Starters

- Includes Reversing Power Wiring and bus bars
- Mounting plates for Size 00 – 4
- Built-in electronic interlock for FVR units
- Unique overload board energizes both forward and reverse starters — one control point for wiring

Product Selection

Non-reversing Starters

A

When Ordering Specify

NEMA Size, Continuous Ampere Rating, Voltage, kW/hp, Non-reversing or Reversing and Overload Adjustment Range (Amperes)

Note:

- An **N101** (00 – 4) consists of an **N04N** (Contact Block) and an **N05N** (Non-reversing Overload Relay), factory assembled.
- An **N101** (Size 5) consists of an **N111F** (Contactor) and an **N05N** (Non-reversing Overload Relay), factory assembled.

Cat. No. N101BS0G3A

Table A-4. Full Voltage Non-reversing DC-Operated, Open Type Starters (Size 00 – 5),① with 3-Pole Solid-State Overload Protection

NEMA Size	Continuous Ampere Rating	Overload Adjustment Range (Amperes)	Max. UL Horsepower (hp) 60 Hz						Max. UL Horsepower (hp) 50 Hz	3-Pole Non-reversing	
			1-Phase		3-Phase				3-Phase	Catalogue Number	Price
			115V	230V	200V/ 208V	230V/ 240V	460V/ 480V	575V/ 600V	380V		
00	9	.25 – .8 .59 – 1.9 1.4 – 4.4 2.8 – 9.0 6.3 – 20	—	—	1-1/2	1-1/2	2	2	1-1/2	**N101BSAA3A** **N101BSAB3A** **N101BSAC3A** **N101BSAD3A** **N101BSAG3A**	
0	18	.25 – .8 .59 – 1.9 1.4 – 4.4 2.8 – 9.0 6.3 – 20 10 – 32	—	—	3	3	5	5	5	**N101BS0A3A** **N101BS0B3A** **N101BS0C3A** **N101BS0D3A** **N101BS0G3A** **N101BS0J3A**	
1	27	.25 – .8 .59 – 1.9 1.4 – 4.4 2.8 – 9.0 5.0 – 16 8.4 – 27 16 – 50	—	—	7-1/2	7-1/2	10	10	10	**N101CS1A3A** **N101CS1B3A** **N101CS1C3A** **N101CS1D3A** **N101CS1F3A** **N101CS1H3A** **N101CS1L3A**	
2	45	5.0 – 16 8.4 – 27 14 – 45 31 – 100	—	—	10	15	25	25	25	**N101DS2F3A** **N101DS2H3A** **N101DS2K3A** **N101DS2N3A**	
3	90	14 – 45 28 – 90 42 – 135	—	—	25	30	50	50	50	**N101ES3K3A** **N101ES3M3A** **N101ES3P3A**	
4	135	14 – 45 28 – 90 42 – 135 63 – 200	—	—	40	50	100	100	75	**N101ES4K3A** **N101ES4M3A** **N101ES4P3A** **N101ES4R3A**	
5	270	42 – 135 84 – 270 131 – 420	—	—	75	100	200	200	150	**N101FS5P3A** **N101FS5S3A** **N101FS5T3A**	

① 24V DC coil voltage.

Note:

- If required, accessories are available on **Page A-13**.
- The standard ***IT.*** starter is for 3-phase applications only.
- See **Table A-7** for 24V DC power supply requirements.
- Control inputs are rated 24V DC (3 – 5 mA).

Accessories ..... **Pages A-13 – A-16**
Technical Data ..... **Pages A-10 – A-12**
Dimensions ..... **Pages A-22 – A-24**
Discount Symbol **MC7**

Reversing Starters

When Ordering Specify

NEMA Size, Continuous Ampere Rating, Voltage, kW/hp, Non-reversing or Reversing and Overload Adjustment Range (Amperes)

Note:

- An **N501** (Size 00 – 4) consists of two **N04N** (Contact Blocks), **N06N** (Reversing Overload Relay), Fanning Strips, Mechanical Interlock and Mounting Plate, factory assembled.
- An **N501F** (Size 5) consists of two **N111F** (Contactors), **N06N** (Reversing Overload Relay), Fanning Strips, Mechanical Interlock, Crossover Bus Bars and Reversing Wiring Harness, factory assembled.

Cat. No. N501BS0G3A

Table A-5. Full Voltage Reversing DC-Operated, Open Type Starters (Size 00 – 5), ① with 3-Pole Solid-State Overload Protection

NEMA Size	Continuous Ampere Rating	Overload Adjustment Range (Amperes)	Max. UL Horsepower (hp) 60 Hz						Max. UL Horsepower (hp) 50 Hz	3-Pole Reversing	
			1-Phase		3-Phase				3-Phase	Catalogue Number	Price
			115V	230V	200V/ 208V	230V/ 240V	460V/ 480V	575V/ 600V	380V		
00	9	.25 – .8 .59 – 1.9 1.4 – 4.4 2.8 – 9.0 6.3 – 20	—	—	1-1/2	1-1/2	2	2	1-1/2	**N501BSAA3A** **N501BSAB3A** **N501BSAC3A** **N501BSAD3A** **N501BSAG3A**	
0	18	.25 – .8 .59 – 1.9 1.4 – 4.4 2.8 – 9.0 6.3 – 20 10 – 32	—	—	3	3	5	5	5	**N501BS0A3A** **N501BS0B3A** **N501BS0C3A** **N501BS0D3A** **N501BS0G3A** **N501BS0J3A**	
1	27	.25 – .8 .59 – 1.9 1.4 – 4.4 2.8 – 9.0 5.0 – 16 8.4 – 27 16 – 50	—	—	7-1/2	7-1/2	10	10	10	**N501CS1A3A** **N501CS1B3A** **N501CS1C3A** **N501CS1D3A** **N501CS1F3A** **N501CS1H3A** **N501CS1L3A**	
2	45	5.0 – 16 8.4 – 27 14 – 45 31 – 100	—	—	10	15	25	25	25	**N501DS2F3A** **N501DS2H3A** **N501DS2K3A** **N501DS2N3A**	
3	90	14 – 45 28 – 90 42 – 135	—	—	25	30	50	50	50	**N501ES3K3A** **N501ES3M3A** **N501ES3P3A**	
4	135	14 – 45 28 – 90 42 – 135 63 – 200	—	—	40	50	100	100	75	**N501ES4K3A** **N501ES4M3A** **N501ES4P3A** **N501ES4R3A**	
5	270	42 – 135 84 – 270 131 – 420	—	—	75	100	200	200	150	**N501FS5P3A** **N501FS5S3A** **N501FS5T3A**	

① 24V DC coil voltage.

Note:

- If required, accessories are available on **Page A-13**.
- The standard ***IT.*** starter is for 3-phase applications only.
- See **Table A-7** for 24V DC power supply requirements.
- Control inputs are rated 24V DC (3 – 5 mA).

Accessories ..... **Pages A-13 – A-16**
Technical Data ..... **Pages A-10 – A-12**
Dimensions ..... **Pages A-22 – A-24**
Discount Symbol **MC7**

Table A-6. Specifications

Description	Size 00, 0	Size 1	Size 2	Size 3, 4	Size 5
Overall Dimensions in Inches (mm) ① — *w* x *h* x *d*					
Non-reversing Contactor	1.8 x 4.4 x 2.4 (45 x 111 x 60)	2.1 x 4.4 x 2.4 (54 x 113 x 60)	3.0 x 5.9 x 3.1 (76 x 150 x 79)	4.1 x 8.0 x 3.5 (105 x 203 x 90)	5.6 x 14.0 x 7.0 (142 x 355 x 178)
Reversing Contactor	3.8 x 5.9 x 2.7 (96 x 149 x 69)	4.5 x 5.9 x 2.6 (114 x 149 x 67)	6.2 x 7.4 x 3.3 (158 x 188 x 84)	8.5 x 9.5 x 3.8 (216 x 242 x 97)	11.7 x 17.2 x 7.0 (296 x 436 x 178)
Non-reversing Starter	1.8 x 5.0 x 2.5 (45 x 127 x 63)	2.1 x 5.4 x 2.5 (54 x 138 x 63)	3.0 x 5.9 x 3.1 (76 x 150 x 79)	4.1 x 8.0 x 3.5 (105 x 203 x 90)	5.7 x 19.4 x 7.0 (145 x 492 x 178)
Reversing Starter	3.8 x 5.9 x 2.7 (96 x 149 x 69)	4.5 x 5.9 x 2.6 (114 x 149 x 67)	6.2 x 7.4 x 3.3 (158 x 188 x 84)	8.5 x 9.5 x 3.8 (216 x 242 x 97)	11.8 x 21.0 x 7.0 (300 x 533 x 178)
Mounting Hole Spacing in Inches (mm) — *w* x *h*					
Non-reversing Contactor	1.33 x 4.0 (33.8 x 101)	1.46 x 4.10 (37 x 104)	.94 x 2.87 (24 x 73)	1.33 x 4.13 (33.8 x 105)	1.75 x 13.0 (44.5 x 330)
Reversing Contactor	3.15 x 5.35 (80 x 136)	3.15 x 5.35 (80 x 136)	5.51 x 6.89 (140 x 175)	7.87 x 9.06 (200 x 230)	7.82 x 13.0 (198.5 x 330)
Non-reversing Starter	1.33 x 4.62 (33.8 x 117.3)	1.46 x 5.04 (37 x 128)	.94 x 2.87 (24 x 73)	1.33 x 4.13 (33.8 x 105)	1.75 x 18.3 (44.5 x 465)
Reversing Starter	3.15 x 5.35 (80 x 136)	3.15 x 5.35 (80 x 136)	5.51 x 6.89 (140 x 175)	7.87 x 9.06 (200 x 230)	7.82 x 18.3 (198.5 x 465)
Mounting Positions					
Panel-Vertical	Yes	Yes	Yes	Yes	Yes
Panel-Horizontal	Yes	Yes	Yes	Yes	Yes
DIN Rail Mountable	Yes ②	Yes ②	Yes ②	No	No
Weights in Lb. (kg)					
Non-reversing Contactor	.7 (.31)	.9 (.42)	2.8 (1.27)	6.7 (3.05)	20.0 (9.1)
Reversing Contactor	1.9 (.86)	2.6 (1.17)	6.9 (3.13)	16.9 (7.67)	48.0 (21.8)
Non-reversing Starter	.9 (.40)	1.2 (.53)	2.9 (1.32)	7.1 (3.20)	27.0 (12.3)
Reversing Starter	2.0 (.90)	2.6 (1.20)	7.1 (3.20)	16.8 (7.60)	55.0 (25.0)
Mechanical Operating Rate ③					
Maximum	3/sec	3/sec	2/sec	2/sec	1/sec
Mechanical Life					
	10,000,000	10,000,000	8,000,000	8,000,000	5,000,000
Humidity ④					
	95% Non-condensing	95% Non-condensing	95% Non-condensing	95% Non-condensing	95% Non-condensing
Insulation Voltage (Ui)					
	690V	690V	690V	690V	690V
Impulse Withstand Voltage (Uimp)					
	6 kV	6 kV	6 kV	6 kV	6 kV

① Auxiliaries add approximately 1.0" (25 mm) to depth for single, 1.2" (30 mm) for dual.
② Non-reversing contactors and starters only.
③ No load condition.
④ Up to 99% humidity depending on application. Consult Eaton.

Table A-6. Specifications (Continued)

Description	Size 00, 0	Size 1	Size 2	Size 3, 4	Size 5
Finger Protection					
Front	IP20	IP20	IP20	IP20	IP20
At Terminals	IP10	IP10	IP00	IP00	IP00
At Terminals with max. size wire installed	IP20	IP10	IP10	IP00	IP00
Terminals L1, L2, L3/T1, T2, T3 ①					
1 Wire per Terminal (stranded or solid)	14 – 8 AWG (1.5 – 10 mm^2)	14 – 4 AWG (1.5 – 16 mm^2)	14 – 1 AWG (1.5 – 35 mm^2)	6 – 250 MCM (16 – 120 mm^2)	4 – 750 MCM (25 – 420 mm^2)
2 Wires per Terminal (stranded or solid)	14 – 10 AWG (1.5 – 4 mm^2)	14 – 6 AWG (1.5 – 16 mm^2)	14 – 2 AWG (1.5 – 25 mm^2)	6 – 3/0 AWG (16 – 70 mm^2)	1/0 — 300 MCM (50 — 150 mm^2)
Strip Length	.45" (11 mm)	.5" (12 mm)	.7" (18 mm)	.8" (21 mm)	1.5" (40 mm)
Torque (max.)	20 lb-in (2.2 Nm) for 14 – 10 AWG (1.5 – 6 mm^2); 25 lb-in (2.8 Nm) for 8 AWG (10 mm^2)	35 lb-in (4.0 Nm) for 14 – 10 AWG (1.5 – 6 mm^2); 40 lb-in (4.5 Nm) for 8 AWG (10 mm^2); 45 lb-in (5.0 Nm) for 6 – 4 AWG (16 mm^2)	45 lb-in (5.0 Nm) for Single 14 – 8 AWG (1.5 – 10 mm^2); 100 lb-in (11 Nm) for Single 6 – 1 AWG (16 – 35 mm^2) and Dual Wire Combinations	250 lb-in (28 Nm)	550 lb-in (62 Nm)
Driver	2.5 mm Hex Key	3 mm Hex Key	5/32" (4 mm) Hex Key	5/16" (8 mm) Hex Key	5/16" (8 mm) Hex Key
Operation Performance					
Coil Voltage (nominal)	24V DC	24V DC	24V DC	24V DC	24V DC
Coil Operating Voltage Range (V DC)	20 – 28	20 – 28	20 – 28	20 – 28	20 – 28
Control Terminals					
(- and +) 1 Wire per Terminal	14 – 12 AWG (1.5 – 2.5 mm^2)	14 – 12 AWG (1.5 – 2.5 mm^2)	14 – 12 AWG (1.5 – 2.5 mm^2)	14 – 12 AWG (1.5 – 2.5 mm^2)	14 – 12 AWG (1.5 – 2.5 mm^2)
(- and +) 2 Wires per Terminal	14 AWG (1.5 mm^2)	14 AWG (1.5 mm^2)	14 AWG (1.5 mm^2)	14 AWG (1.5 mm^2)	14 AWG (1.5 mm^2)
(P, F, R, 1, 2, 3) 1 Wire per Terminal	22 – 12 AWG (0.5 – 2.5 mm^2)	22 – 12 AWG (0.5 – 2.5 mm^2)	22 – 12 AWG (0.5 – 2.5 mm^2)	22 – 12 AWG (0.5 – 2.5 mm^2)	22 – 12 AWG (0.5 – 2.5 mm^2)
(P, F, R, 1, 2, 3) 2 Wires per Terminal	18 – 14 AWG (0.75 – 1.5 mm^2)	18 – 14 AWG (0.75 – 1.5 mm^2)	18 – 14 AWG (0.75 – 1.5 mm^2)	18 – 14 AWG (0.75 – 1.5 mm^2)	18 – 14 AWG (0.75 – 1.5 mm^2)
Torque (max.)	4.5 lb-in (.5 Nm)	4.5 lb-in (.5 Nm)	4.5 lb-in (.5 Nm)	4.5 lb-in (.5 Nm)	4.5 lb-in (.5 Nm)
Strip Length	.25 (7 mm)	.25 (7 mm)	.25 (7 mm)	.25 (7 mm)	.25 (7 mm)
Driver	.13 (3.5 mm) Flat	.13 (3.5 mm) Flat	.13 (3.5 mm) Flat	.13 (3.5 mm) Flat	.13 (3.5 mm) Flat
Temperature ②					
Operating	-40° to +149°F (-40° to +65°C)	-40° to +149°F (-40° to +65°C)	-40° to +149°F (-40° to +65°C)	-40° to +149°F (-40° to +65°C)	-40° to +149°F (-40° to +65°C)
Storage	-58° to +176°F (-50° to +80°C)	-58° to +176°F (-50° to +80°C)	-58° to +176°F (-50° to +80°C)	-58° to +176°F (-50° to +80°C)	-58° to +176°F (-50° to +80°C)
Environmental					
Shock/Vibration	15G/5G	15G/5G	15G/5G	15G/5G	15G/5G ③
Altitude ②	6600 FT (2000M)	6600 FT (2000M)	6600 FT (2000M)	6600 FT (2000M)	6600 FT (2000M)
Pull-In Time (mS) @ 24V					
Excl. Debounce Time	15	15	25	30	70 – 200
Incl. Debounce Time	75	80	88	95	120 – 300
Dropout Time (mS) @ 24V					
Excl. Debounce Time	5	5	12	15	50 – 150
Incl. Debounce Time	65	70	75	80	70 – 250

① Use Class B 75°C copper wire only (or 90°C copper wire sized for 75°C operation per NEC).

② Consult Eaton for higher ratings.

③ The Non-reversing Starter requires the use of all six mounting screws for the maximum rating.

Note: At other temperatures expressed in °C, for either inrush or sealed, use the 20°C value from the table in the following

$$Watts = W_{20} [1.1 - .005(T)]$$
$$Amps = A_{20} [1.1 - .005(T)]$$

For example, inrush requirements for a NEMA Size 2 Starter at -25°C would be:
Watts = 130 [1.1 – .005 (-25)] = 160
Amps = 5.4 [1.1 – .005 (-25)] = 6.6

Notes:

- Response time for Control Inputs = Debounce Time
- The time between operating forward and reverse must be greater than the Debounce Time.

Table A-7. 24V DC Power Supply Requirements @ 68°F (20°C) (see Note at left)

Contactor/Starter Size		Sealed In		Inrush		
Catalogue Number ④	NEMA Size	Wattage	Amps	Wattage	Amps	Duration (mS)
N_11B_ _X3N	00, 0	3.7	.15	80	3.3	50
N_01B_ _ _3A	00, 0	3.2	.13	80	3.3	50
N_11C_ _X3N	1	4.2	.18	90	3.8	50
N_01C_ _ _3A	1	3.6	.15	90	3.8	50
N_ _1D_ _ _3_	2	5.0	.21	130	5.4	65
N_ _1E_ _ _3_	3, 4	5.6	.23	140	5.8	85
N_ _1F_ _ _3_	5	12.0	.50	200	8.3	250
N_01F_ _ _3_	5	13.0	.54	200	8.3	250

④ _ indicates missing digit/character of the Catalogue Number; may have multiple values.

A

Electrical Life — AC-1, AC-2, AC-3 and AC-4 Utilization Categories

Table A-8. Utilization Categories

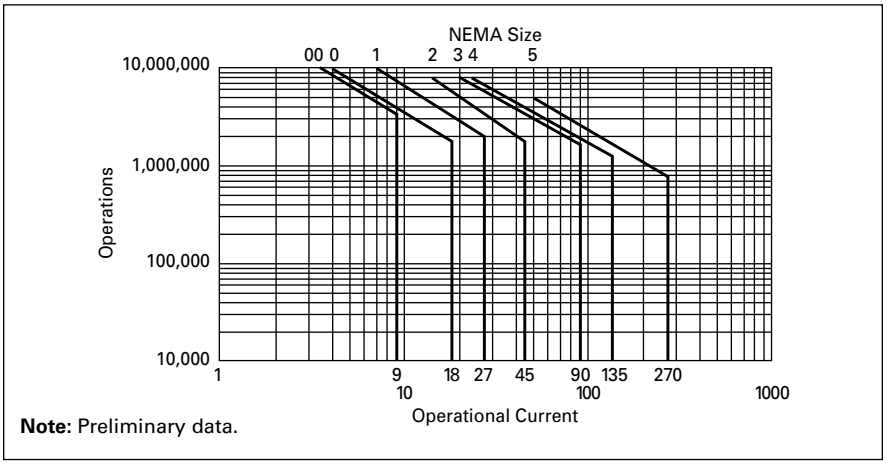
The International Electrotechnical Commission (IEC) has developed utilization categories for contactors and auxiliary contacts. The IEC utilization categories are used to define the type of electrical load for estimating electrical life, and do not imply the devices are IEC rated.	
Category	**Typical Application**
AC-1	Non-inductive or slightly inductive loads: Resistance furnaces, heating.
AC-2	Slip-ring motors: Starting and stopping of running motors
AC-3	Squirrel cage motors: Starting, switching off motors during running (motors in most industrial applications typically fall into this category).
AC-4	Squirrel cage motors: Starting, plugging ①, inching ② (very few applications in industry are totally AC-4).

① Plugging is stopping or reversing the motor rapidly by reversing the connections while the motor is running.
② Inching or jogging is energizing the motor once or repeatedly for short durations to obtain small movements of the motor driven load.

Life Load Curves — Eaton's Cutler-Hammer *IT.* Electro-Mechanical Series NEMA contactors have been designed and manufactured for superior life performance. All testing has been based on requirements as found in IEC 60947-4-1 and conducted by us. When selecting a contactor, the specifier must give attention to the specific load, utilization category and the required electrical life. For a definition of Utilization Categories, see **Table A-8** above.

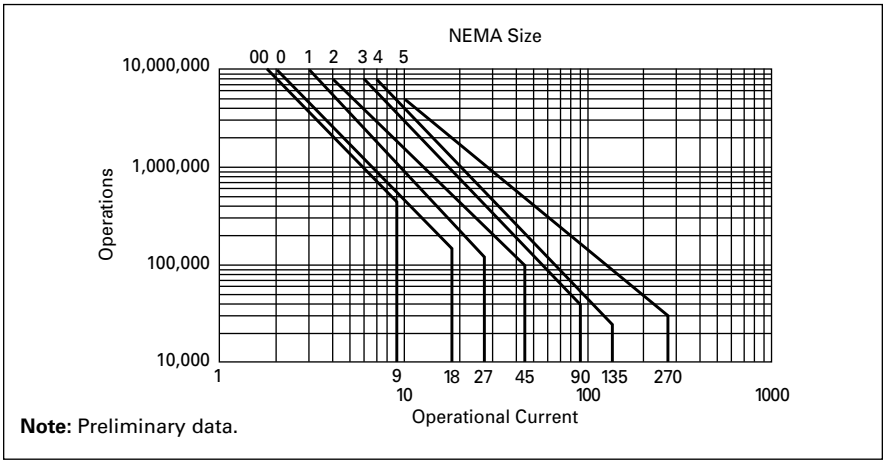
Note: AC-3 tests are conducted at rated device currents and AC-4 tests are conducted at six-times rated device currents. All tests have been run at 460V, 60 Hz.

Actual application life July vary, depending on environmental conditions and application duty cycle.



Note: Preliminary data.

Figure A-1. Electrical Life — AC-3 Utilization Category



Note: Preliminary data.

Figure A-2. Electrical Life — AC-4 Utilization Category

Contactor Choice

- Decide what utilization category the application is and choose the appropriate curve from **Figure A-1** or **Figure A-2**.
- Locate the intersection of the life-load curve with the operational current (Ie) of the application, as found on the horizontal axis.
- Read the estimated contact life along the vertical axis in number of operations.

Trip Times

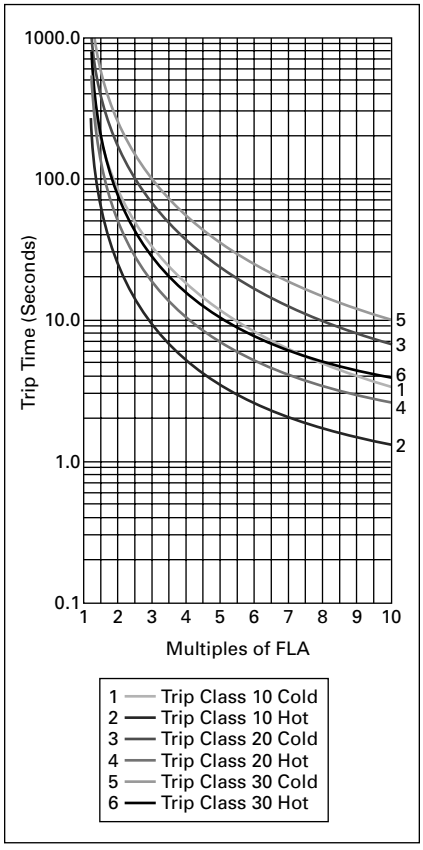


Figure A-3. Class 10, 20 and 30 Trip Curves

Modular Components — Contactor Field Assembly

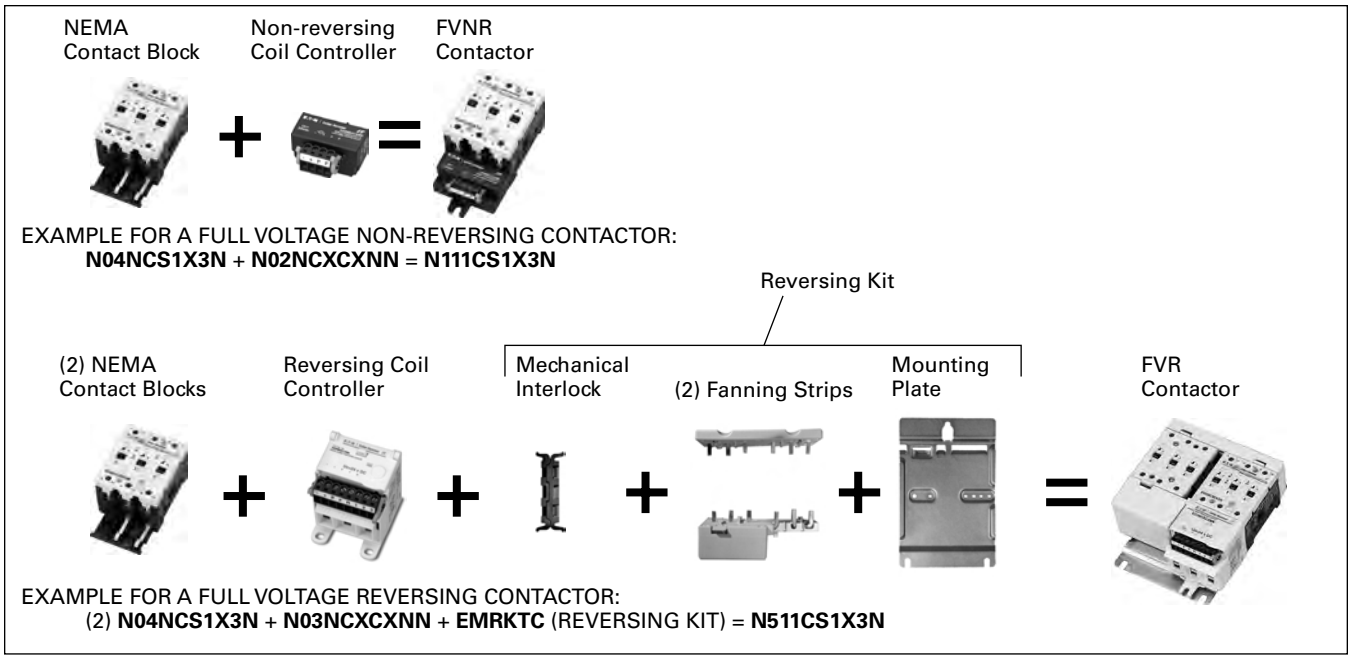


Figure A-4. Modular Contactor Assembly

Modular Components — Starter Field Assembly

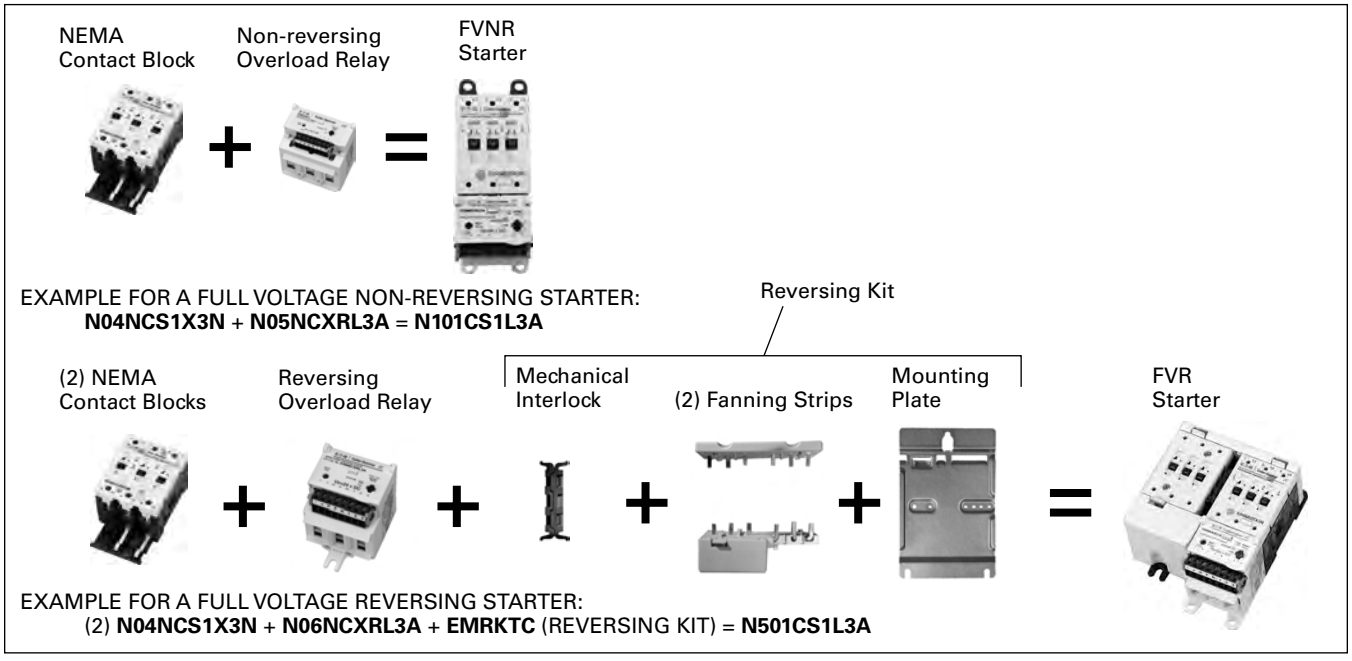


Figure A-5. Modular Starter Assembly

A

NEMA Contact Block

Table A-9. NEMA Contact Block

Size	Amperes	Catalogue Number	Price
00	9	**N04NBSAX3N**	
0	18	**N04NBS0X3N**	
1	27	**N04NCS1X3N**	
2	45	**N04NDS2X3N**	
3	90	**N04NES3X3N**	
4	135	**N04NES4X3N**	

Note:

- N04N + N05N = N101; N04N + N02N = N111 (45 – 140 mm)
- N04N + N06N = N501; N04N + N03N = N511 (45 – 140 mm)

NEMA Coil Controller

Size 00-1 Non-reversing (pictured)

Table A-10. NEMA Coil Controller

Size	Catalogue Number	Price
Non-reversing		
00, 0	**N02NBXCXNN**	
1	**N02NCXCXNN**	
2	**N02NDXCXNN**	
3, 4	**N02NEXCXNN**	
5	**EMUCCF**	

NEMA Solid-State Overload Relay

Table A-11. NEMA Solid-State Overload Relay

Size	Overload Adjustment Range (Amperes)	Catalogue Number	Price
Non-reversing			
00, 0	.25 – .8	**N05NBXRA3A**	
	.59 – 1.9	**N05NBXRB3A**	
	1.4 – 4.4	**N05NBXRC3A**	
	2.8 – 9.0	**N05NBXRD3A**	
	6.3 – 20	**N05NBXRG3A**	
0	10 – 32	**N05NBXRJ3A**	
1	.25 – .8	**N05NCXRA3A**	
	.59 – 1.9	**N05NCXRB3A**	
	1.4 – 4.4	**N05NCXRC3A**	
	2.8 – 9.0	**N05NCXRD3A**	
	5.0 – 16	**N05NCXRF3A**	
	8.4 – 27	**N05NCXRH3A**	
	16 – 50	**N05NCXRL3A**	
2	5.0 – 16	**N05NDXRF3A**	
	8.4 – 27	**N05NDXRH3A**	
	14 – 45	**N05NDXRK3A**	
	31 – 100	**N05NDXRN3A**	
3, 4	14 – 45	**N05NEXRK3A**	
	28 – 90	**N05NEXRM3A**	
	42 – 135	**N05NEXRP3A**	
4	63 – 200	**N05NEXRR3A**	
5	42 – 135	**N05NFXRP3A**	
	84 – 270	**N05NFXRS3A**	
	131 – 420	**N05NFXRT3A**	
Reversing			
00, 0	.25 – .8	**N06NBXRA3A**	
	.59 – 1.9	**N06NBXRB3A**	
	1.4 – 4.4	**N06NBXRC3A**	
	2.8 – 9.0	**N06NBXRD3A**	
	6.3 – 20	**N06NBXRG3A**	
0	10 – 32	**N06NBXRJ3A**	
1	.25 – .8	**N06NCXRA3A**	
	.59 – 1.9	**N06NCXRB3A**	
	1.4 – 4.4	**N06NCXRC3A**	
	2.8 – 9.0	**N06NCXRD3A**	
	5.0 – 16	**N06NCXRF3A**	
	8.4 – 27	**N06NCXRH3A**	
	16 – 50	**N06NCXRL3A**	
2	5.0 – 16	**N06NDXRF3A**	
	8.4 – 27	**N06NDXRH3A**	
	14 – 45	**N06NDXRK3A**	
	31 – 100	**N06NDXRN3A**	
3, 4	14 – 45	**N06NEXRK3A**	
	28 – 90	**N06NEXRM3A**	
	42 – 135	**N06NEXRP3A**	
4	63 – 200	**N06NEXRR3A**	
5	42 – 135	**N06NFXRP3A**	
	84 – 270	**N06NFXRS3A**	
	125 – 400	**N06NFXRT3A**	

Discount Symbol **MC7**

Auxiliary Contacts



Auxiliary Contacts are available for mounting on Eaton's Cutler-Hammer Intelligent Technologies (***IT.***) Electro-Mechanical Contactors and Starters. The various choices available for non-reversing models are shown in **Tables A-12** and **A-13,** and their ratings in **Tables A-14** – **A-16**. For reversing models, the number of auxiliaries indicated is for each of the contactors/starters in the assembly.

Table A-12. Auxiliary Contact Availability — Sizes 00 – 5

Top Mounted (Maximum Auxiliaries per Contactor/Starter) ②							
Contactor/Starter Size					Contact Type	Catalogue Number	Price
Size 00, 0	Size 1	Size 2	Size 3, 4	Size 5			
3	3	3	3	—	1NO	**EMA13**	
3	3	3	3	—	1NC	**EMA14**	
2	2 ①	3	3	—	1NO-1NC	**EMA15**	
2	2 ①	3	3	—	2NO	**EMA16**	
2	2 ①	3	3	—	2NC	**EMA17**	
2	3	3	3	3	Logic Level 1NO-1NC	**EMA70**	

① Other combinations: Single, Dual, Single; Dual, Single, Dual; and Dual, Logic Level, Dual.
② For reversers, multiply quantities by two.

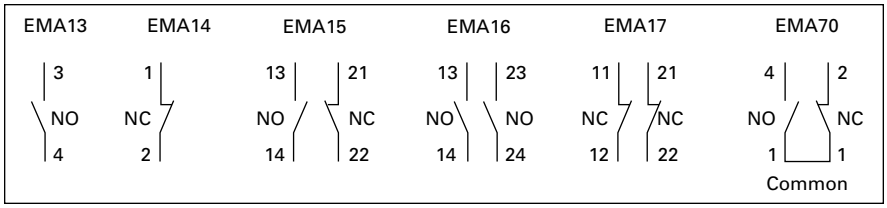


Figure A-6. Connecting Diagram — Sizes 00 – 5

Table A-13. Auxiliary Contact — Size 5

Auxiliary Contacts per Non-reversing and Reversing Contactor or Starter				
Max	Contact Type	Description	Catalogue Number	Price
2	1NO	Base auxiliary (max. 1 per side)	**C320KGS41**	
2	1NO-1NC	Base auxiliary (max. 1 per side)	**C320KGS42**	
6	1NO	C320KGS41 or C320KGS42 required (max. 3 Add-on auxiliaries per side)	**C320KGS20**	
2	1NO Logic Level	C320KGS41 or C320KGS42 required (max. 1 Add-on auxiliary per side)	**C320KGS20L**	
6	1NC	C320KGS41 or C320KGS42 required (max. 2 Add-on auxiliaries per side)	**C320KGS21**	
2	1NC Logic Level	C320KGS41 or C320KGS42 required (max. 1 Add-on auxiliary per side)	**C320KGS21L**	
2	1NO-1NC	C320KGS41 or C320KGS42 required (max. 1 Add-on auxiliary per side)	**C320KGS22**	
2	1NO-1NC Logic Level	C320KGS41 or C320KGS42 required (max. 1 Add-on auxiliary per side)	**C320KGS22L** ③	
3	1NO-1NC Logic Level	Front mounted only	**EMA70** ④	

③ Form C contacts.
④ For reversers, multiply quantities by two.

Notes:

- Side Mounted — Maximum (10) Total Circuits
- Front Mounted — Maximum (6) Total Circuits ④
- Maximum 4 auxiliaries per side (base + 3 side mounted)
- EMASA/B _ _ have been superseded by the above Catalogue Numbers.

Table A-14. IEC Ratings

DC-13		AC-15	
U_e Voltage	I_e Amps.	U_e Voltage	I_e Amps.
24	5	48	8
48	2.5	120	6
125	1.1	240	4
250	.55	440	2

Table A-15. NEMA A600 Ratings

Current	AC Voltage			
	120	240	480	600
Make and Interrupting	60	30	15	12
Break	6	3	1.5	1.2
Continuous	10	10	10	10
Thermal	10	10	10	10

Table A-16. NEMA P300 Ratings

Current	DC Voltage	
	125	250
Make and Interrupting	1.1	.55
Break	1.1	.55
Continuous	5	5
Thermal	5	5

Table A-17. EMA70 Auxiliary Contact

DC-12		AC-12	
Ue	Ie	Ue	Ie
30	.1	250	.1

Table A-18. C320KGS20L, C320KGS21L, C320KGS22L, Auxiliary Contact Ratings

DC-12		AC-12	
Ue	Ie	Ue	Ie
80	0.1	250	0.1

Discount Symbol **MC7**

A

Mounting Plates

Table A-19. Mounting Plates

NEMA Size	Metal Reversing Contactor/Starter Plates	
	Catalogue Number	Price
00, 0, 1	**EMA9B**	
2	**EMA9D**	
3, 4	**EMA9E**	
5	**EMA9F**	

Reversing Fanning Strips

Table A-20. Reversing Fanning Strips

NEMA Size	Line Side		Load Side	
	Catalogue Number	Price	Catalogue Number	Price
00, 0	**EMFRLB**		**EMFRTB**	
1	**EMFRLC**		**EMFRTC**	
2	**EMFRLD**		**EMFRTD**	
3, 4	**EMFRLE**		**EMFRTE**	
5	**EMFRLF**		**EMFRTF**	

Reversing Kits

Includes Fanning Strips, Mechanical Interlock, Mounting Plate and hardware.

Table A-21. Reversing Kits ①

NEMA Size	Catalogue Number	Price
00, 0	**EMRKTB**	
1	**EMRKTC**	
2	**EMRKTD**	
3, 4	**EMRKTE**	
5	**EMRKTF**	

① For Contactor and Starter.

Note: Also order separately the appropriate contact blocks and overload relay.

Lug Kits

Table A-22. Lug Kits

NEMA Size	Description	Catalogue Number	Price
1	Contactor or Starter Line or Load (3 Lugs)	**EMLUGKTC**	
2	Contactor or Starter Line or Load	**EMLUGKTD**	
3, 4	Contactor Line or Load, Starter Line Starter Load	**EMLUGKTLE** **EMLUGKTTE**	
5	Contactor or Starter Line or Load, Horizontal Contactor or Starter Line or Load, Vertical	**EMLUGKTFA** **EMLUGKTFB**	

Table A-23. Ring Lug Retrofit Kits

Product	NEMA Sizes 3, 4			NEMA Size 5		
	Catalogue Number			Catalogue Number		
	Factory Installed	Retrofit Kits ②	Lug Kits ③	Factory Installed	Retrofit Kits ②	Lug Kits ③
N111 **N511**	Add "**-RTX**" Add "**-RTX**"	**EMRTXKTEN** **EMRTXKTER**	**EMLUGREN** **EMLUGRER**	Add "**-RTX**" Add "**-RTX**"	**EMRTXKTF** **EMRTXKTF**	**EMLUGRFC** **EMLUGRFC**
N101 **N501**	Add "**-RTX**" Add "**-RTX**"	**EMRTXKTEN** **EMRTXKTER**	**EMLUGREN** **EMLUGRER**	Add "**-RTX**" Add "**-RTX**"	**EMRTXKTF** **EMRTXKTF**	**EMLUGRFS** **EMLUGRFS**
N05N **N06N**	Add "**-RTX**" Add "**-RTX**"			Add "**-RTX**" Add "**-RTX**"		
N02N **N03N**	Add "**-RTX**" Add "**-RTX**"					
N04N	Add "**-RTX**"					

② Retrofit Kits used to field install ring lugs on standard lug units.

③ Lug Kits used to field install standard lugs into factory assembled ring lug units.

Discount Symbol **MC7**

Coils

Table A-24. Coils

Description ①	Catalogue Number	Price
Size 1 Coil	**EMCC**	
Size 2 Coil	**EMCD**	
Size 3, 4 Coil	**EMCE**	
Size 5 Coil	**EMCF**	

① For reversing contactors and starters, order two.

DIN Rail Catch

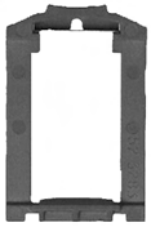


Table A-25. DIN Rail Catch

NEMA Size	Description	Catalogue Number	Price
00 – 1	Catch with Leaf Spring and Pad	**EMDRCB**	
2	Catch with Leaf Spring and Pad	**EMDRCD**	

Contact Kits

Table A-26. Contact Kits

NEMA Size	Description	Catalogue Number	Price
1	Hold Open	**EMCKTS1**	
	Non-hold Open	**EMCKTS1NH**	
2	Hold Open	**EMCKTS2**	
	Non-hold Open	**EMCKTS2NH**	
3	Hold Open	**EMCKTS3**	
4	Hold Open	**EMCKTS4**	
5	Hold Open	**EMCKTS5**	

Control Terminal Blocks

Table A-27. Control Terminal Blocks

No. of Pins	Terminal Markings	NEMA Size	Coil Controller		Contactor		Overload		Starter		Catalogue Number	Price
			Non-reversing	Reversing	Non-reversing	Reversing	Non-reversing	Reversing	Non-reversing	Reversing		
8	-+PFR123	00, 0		X		X	X	X	X	X	**EMA76L**	
		1		X		X	X	X	X	X		
		2	X	X	X	X	X	X	X	X		
		3,4	X	X	X	X	X	X	X	X		
		5					X	X	X	X		
5	-+PFR	5	X	X	X	X					**EMA77L**	
5	RFP+-	5		X		X		X		X	**EMA77LR**	
4	-+PF	00,0	X		X						**EMA78L**	
		1	X		X							
5 x 2	-+PFR and RFP+-	5				X				X	**EMA80L** ②	

② Consists of (1) EMA77L and (1) EMA77LR inter-wired.

Discount Symbol **MC17**

A

Non-reversing Contactors (Sizes 00 – 1)

Table A-28. Approximate Dimensions in Inches (mm)

NEMA Size	Overall					Mounting Holes				Req. Mtg. Screws	Terminals		
	Width	Height	Depth	Depth w/ Auxiliary	Depth added w/ DIN Rail	Width	Height	Mtg. Hole to Top	DIN Rail to Top		Control	Line	Load
	A	B	C	D	E	F	G	H	J	K	P	Q	R
00, 0	1.8 (45)	4.4 (111)	2.4 (60)	3.6 (91)	.1 (3)	1.33 (33.8)	4.0 (101)	.2 (5)	.9 (23)	(3) #8 M4	.7 (19)	1.2 (30)	1.2 (30)
1	2.1 (54)	4.45 (113)	2.4 (60)	3.6 (91)	.1 (3)	1.46 (37)	4.1 (104)	.2 (5)	.8 (20)	(3) #8 M4	.7 (19)	1.2 (30)	1.2 (30)

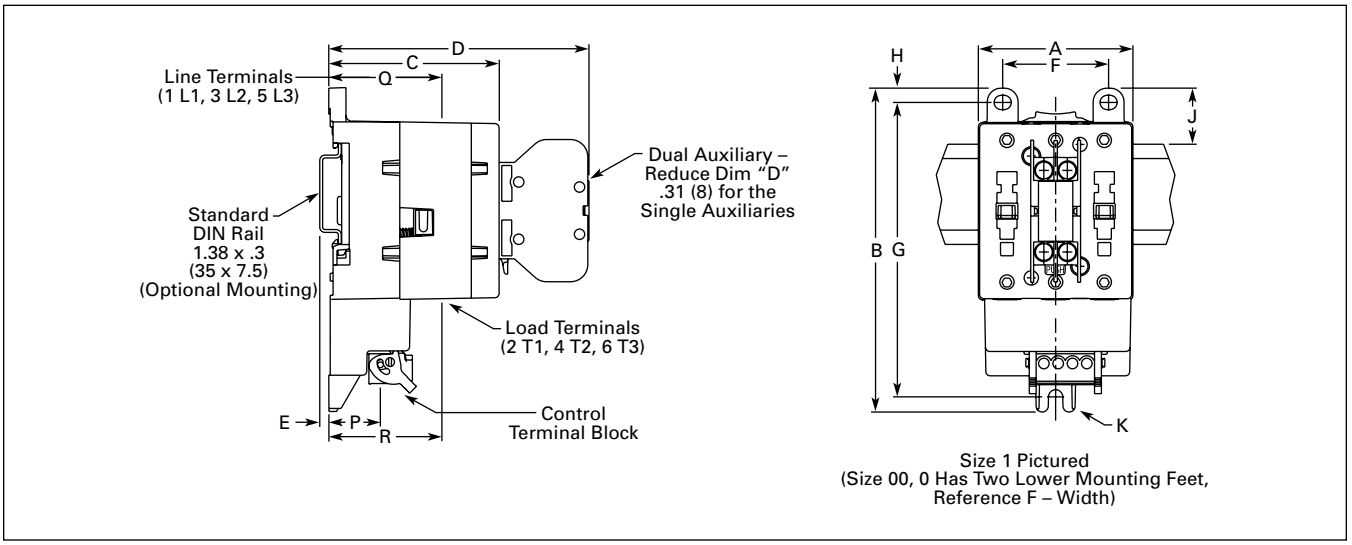


Figure A-7. Approximate Dimensions — Inches (mm)

Non-reversing Contactors (Sizes 2 – 4)

Table A-29. Approximate Dimensions in Inches (mm)

NEMA Size	Overall					Mounting Holes				Req. Mtg. Screws	Terminals		
	Width	Height	Depth	Depth w/ Auxiliary	Depth added w/ DIN Rail	Width	Height	Mtg. Hole to Top	DIN Rail to Top		Control	Line	Load
	A	B	C	D	E	F	G	H	J	K	P	Q	R
2	3.0 (76)	5.9 (150)	3.1 (79)	4.2 (107)	.2 (4)	.94 (24)	2.87 (73)	.5 (13)	.9 (23)	(4) #6 x 2 M3.5 x 50	2.4 (60)	1.5 (37)	.6 (14)
3, 4	4.1 (105)	8.0 (203)	3.5 (90)	4.7 (119)	—	1.33 (33.8)	4.13 (105)	.6 (15)	—	(4) #8 x 1.5 M4 x 40	2.8 (72)	1.7 (42)	.3 (8)

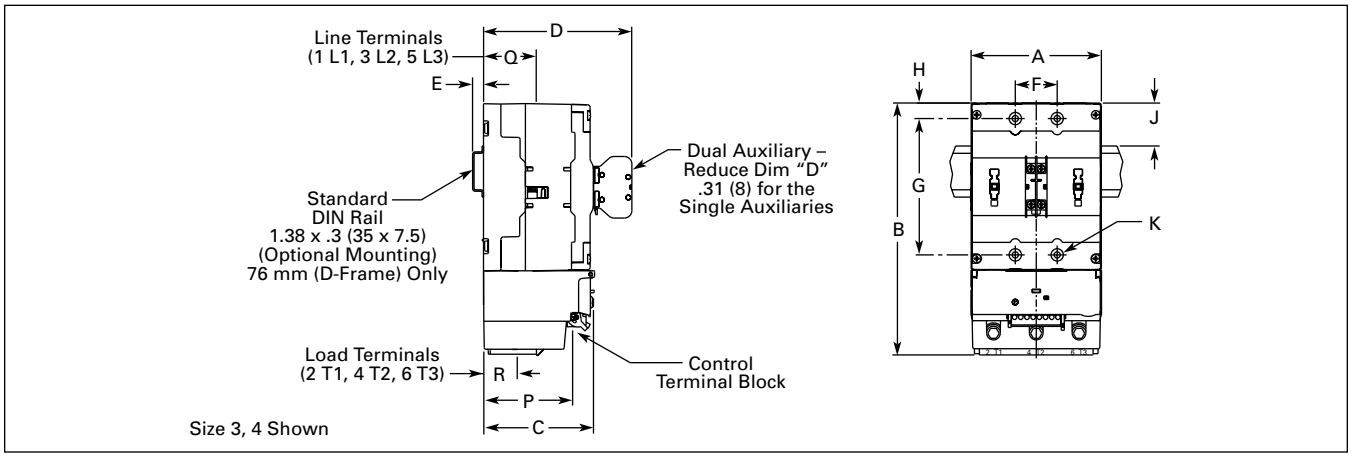


Figure A-8. Approximate Dimensions — Inches (mm)

Non-reversing Contactors (Size 5)

Table A-30. Approximate Dimensions in Inches (mm)

NEMA Size	Overall					Mounting Holes			Req. Mtg. Screws	Terminals		
	Width	Height	Depth	Depth w/Logic Level Auxiliary	Width w/Side Auxiliaries	Width	Height	Mounting Hole to Top		Control	Line	Load
	A	B	C	D	E	F	G	H	K	P	Q	R
5	5.6 (142)	14.0 (355)	7.0 (178)	8.2 (208)	6.70 (170)	1.75 (44.5)	13.0 (330)	.58 (14.7)	(4) 5/16 M8	.8 (20)	4.4 (112)	4.4 (112)

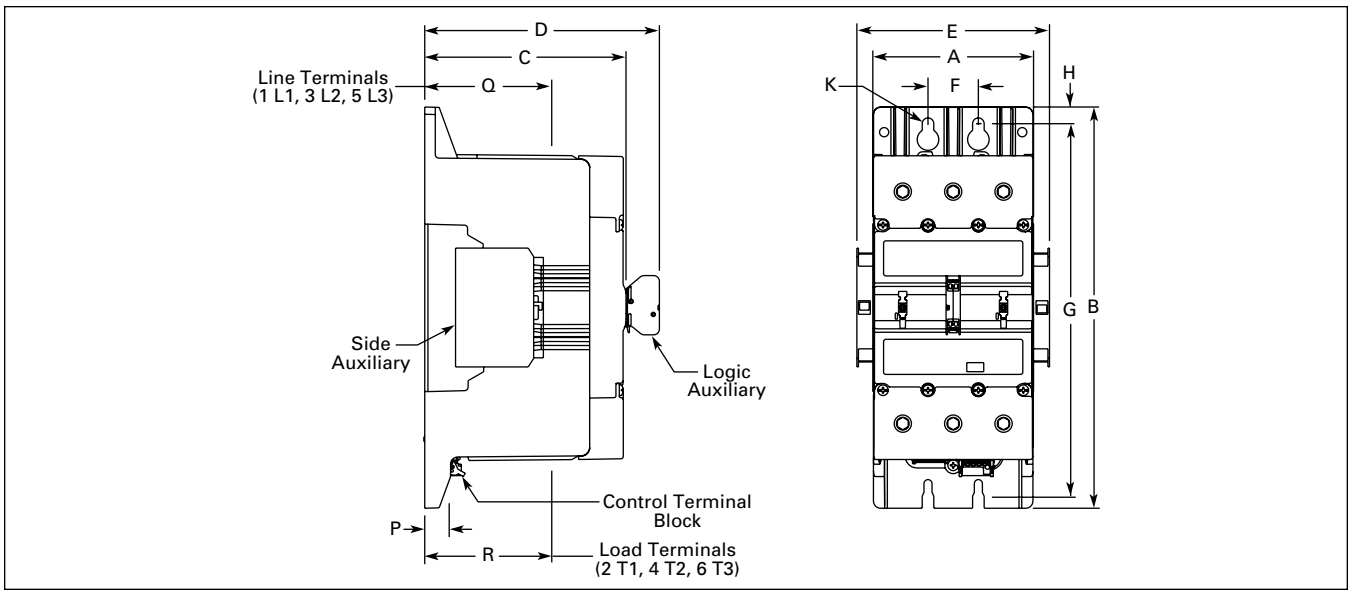


Figure A-9. Approximate Dimensions in Inches (mm)

A

Reversing Contactors (Sizes 00 – 4)

Table A-31. Approximate Dimensions in Inches (mm)

NEMA Size	Overall				Mounting Holes			Req. Mtg. Screws	Terminals		
	Width	Height	Depth	Depth w/ Auxiliary	Width	Height	Mtg. Hole to Top		Control	Line	Load
	A	B	C	D	F	G	H	K	P	Q	R
00, 0	3.8 (96)	5.9 (149)	2.7 (69)	3.8 (96)	3.15 (80)	5.35 (136)	.3 (7)	(3) #10 M5	2.0 (50)	1.5 (38)	.9 (22)
1	4.5 (114)	5.9 (149)	2.6 (67)	3.8 (96)	3.15 (80)	5.35 (136)	.3 (7)	(3) #10 M5	2.0 (50)	1.5 (38)	.6 (16)
2	6.2 (158)	7.4 (188)	3.3 (84)	4.4 (112)	5.51 (140)	6.89 (175)	.2 (6)	(3) #10 M5	2.6 (67)	1.9 (48)	.9 (22)
3, 4	8.5 (216)	9.5 (242)	3.8 (97)	4.9 (125)	7.87 (200)	9.06 (230)	.2 (6)	(3) #10 M5	3.1 (80)	2.1 (54)	.7 (17)

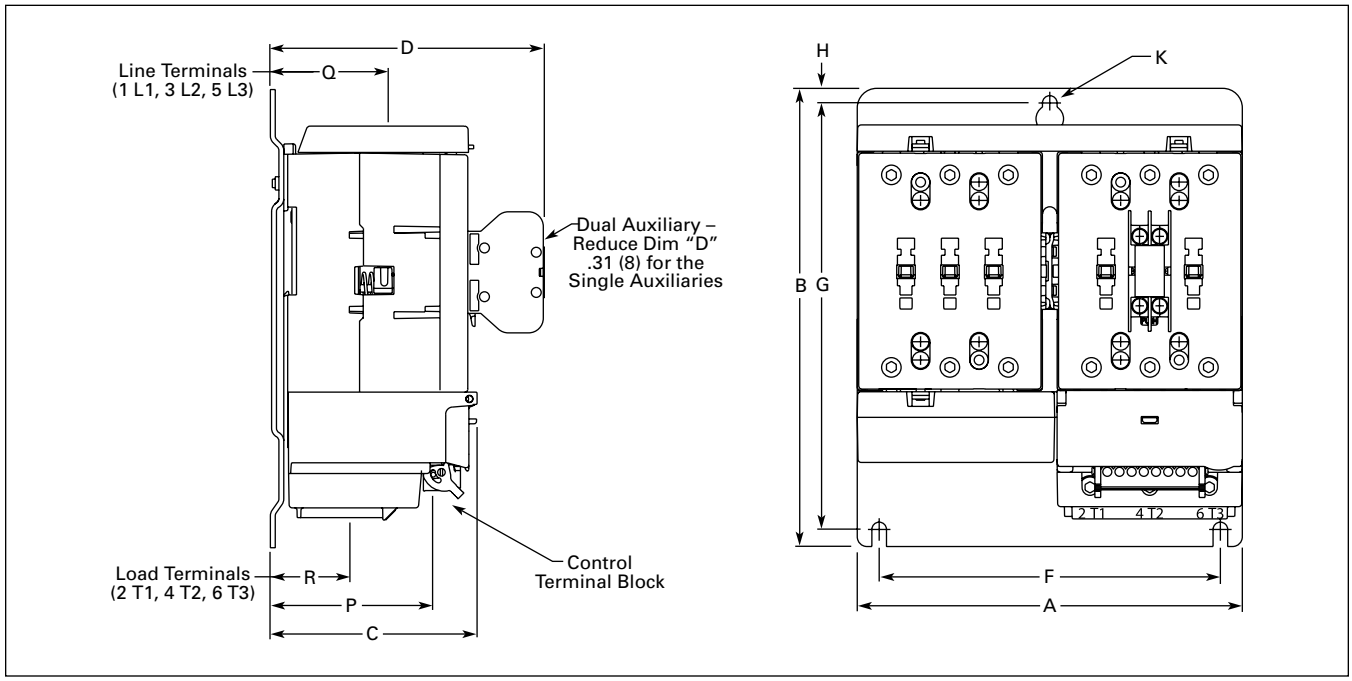


Figure A-10. Approximate Dimensions — Inches (mm)

Reversing Contactors (Size 5)

Table A-32. Approximate Dimensions in Inches (mm)

NEMA Size	Overall					Mounting Holes			Req. Mtg. Screws	Terminals		
	Width	Height	Depth	Depth w/Logic Level Auxiliary	Width w/Side Auxiliaries	Width	Height	Mounting Hole to Top		Control	Line	Load
	A	B	C	D	E	F	G	H	K	P	Q	R
5	11.7 (297)	17.2 (436)	7.0 (178)	8.2 (208)	12.8 (325)	7.8 (198.5)	13.0 (330)	2.19 (55.5)	(4) 5/16 M8	.8 (20)	4.4 (112)	4.4 (112)

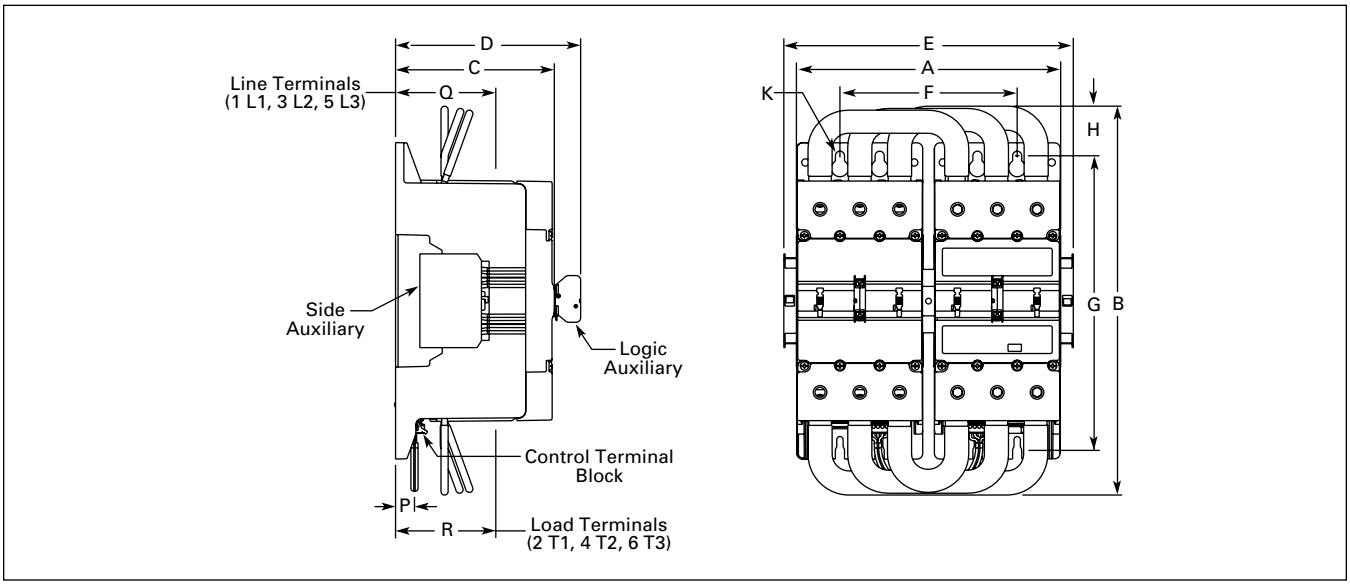


Figure A-11. Approximate Dimensions in Inches (mm)

A

Non-reversing Starters (Sizes 00 – 4)

Table A-33. Approximate Dimensions in Inches (mm)

NEMA Size	Overall					Mounting Holes				Req. Mtg. Screws	Reset Button			Terminals		
	Width	Height	Depth	Depth w/ Auxiliary	Depth added w/ DIN Rail	Width	Height	Mtg. Hole to Top	DIN Rail to Top		Width	Height	Depth	Control	Line	Load
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R
00, 0	1.8 (45)	5.0 (127)	2.5 (63)	3.6 (91)	.1 (3)	1.33 (33.8)	4.62 (117.3)	.2 (5)	.9 (23)	(3) #8 M4	.6 (14)	3.6 (91)	2.5 (63)	1.7 (44)	1.2 (30)	.6 (16)
1	2.1 (54)	5.4 (138)	2.5 (63)	3.6 (91)	.1 (3)	1.46 (37)	5.04 (128)	.2 (5)	.8 (20)	(3) #8 M4	.7 (17)	3.7 (93)	2.4 (62)	1.8 (45)	1.2 (30)	.3 (8)
2	3.0 (76)	5.9 (150)	3.1 (79)	4.2 (107)	.2 (4)	.94 (24)	2.87 (73)	.5 (13)	.9 (23)	(4) #6 x 2 M3.5 x 50	.7 (17)	4.2 (106)	3.1 (78)	2.4 (60)	1.5 (37)	.6 (14)
3, 4	4.1 (105)	8.0 (203)	3.5 (90)	4.7 (119)	—	1.33 (33.8)	4.13 (105)	.6 (15)	—	(4) #8 x 1.5 M4 x 40	.7 (17)	5.7 (146)	3.5 (88)	2.8 (72)	1.7 (42)	.3 (8)

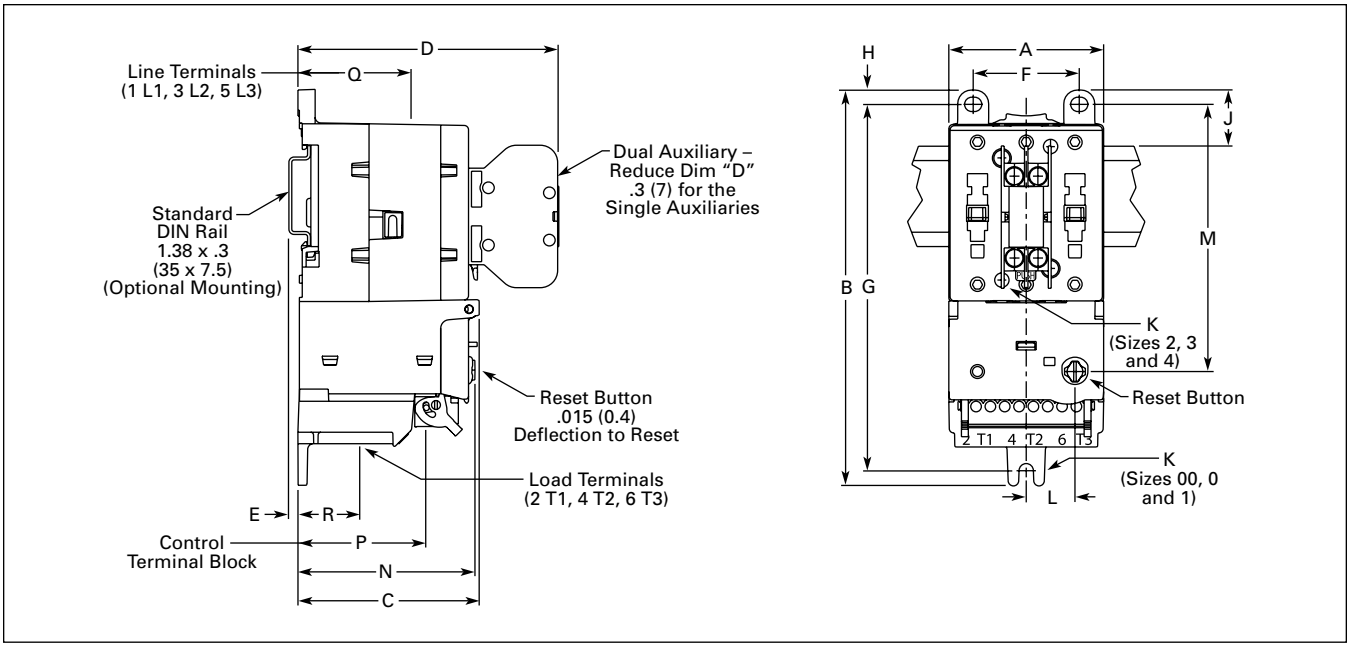


Figure A-12. Approximate Dimensions — Inches (mm)

Non-reversing Starter (Size 5)

Table A-34. Approximate Dimensions in Inches (mm)

NEMA Size	Overall					Mounting Holes			Req. Mtg. Screws	Reset Button			Terminals			
	Width	Length	Depth	Depth w/Logic Level Auxiliary	Width w/Side Auxiliaries	Width	Height	Mntg. Hole to Top		Width	Height	Depth	Control	Line	Load	Load
	A	B	C	D	E	F	G	I	K	L	M	N	P	Q	R	S
5	5.7 (145)	19.4 (492)	7.0 (178)	8.2 (208)	6.7 (170)	1.75 (44.5)	18.3 (465)	.58 (14.7)	(4) 5/16 M8	2.4 (61)	12.4 (315)	5.3 (135)	5.0 (126)	4.4 (112)	3.0 (75)	4.0 (101)

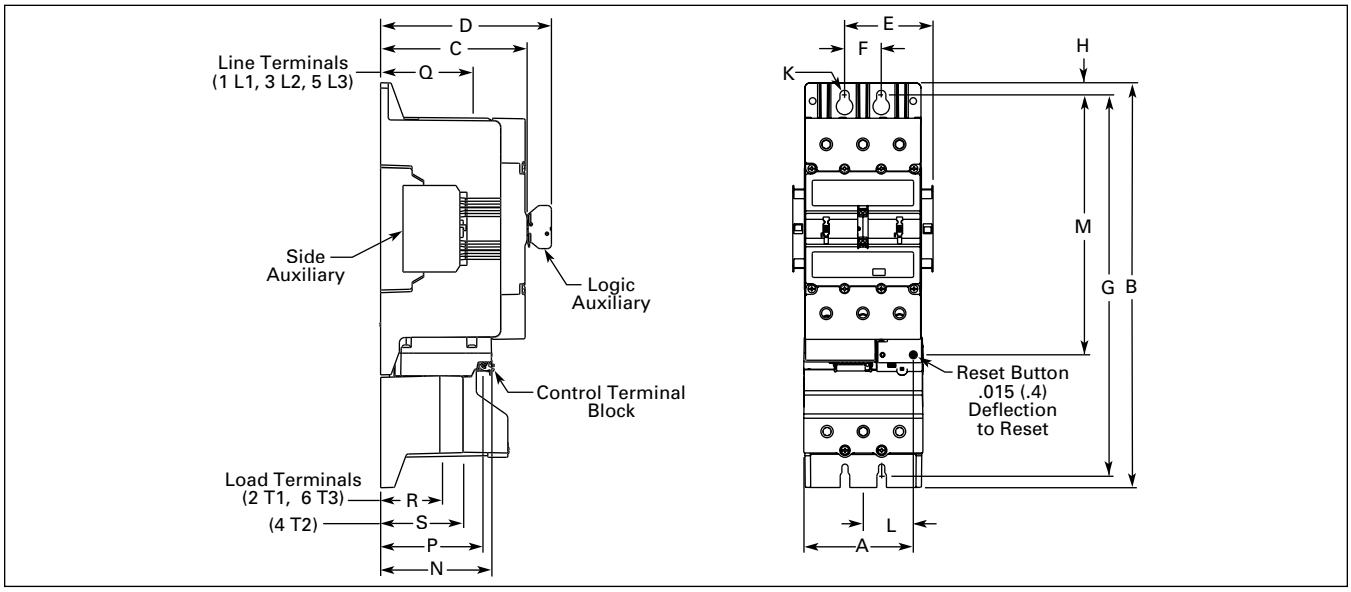


Figure A-13. Approximate Dimensions in Inches (mm)

Reversing Starters (Sizes 00 – 4)

Table A-35. Approximate Dimensions in Inches (mm)

NEMA Size	Overall				Mounting Holes			Req. Mtg. Screws	Reset Button			Terminals		
	Width	Length	Depth	Depth w/ Auxiliary	Width	Height	Mtg. Hole to Top		Width	Height	Depth	Control	Line	Load
	A	B	C	D	F	G	H	K	L	M	N	P	Q	R
00, 0	3.8 (96)	5.9 (149)	2.7 (69)	3.8 (96)	3.15 (80)	5.35 (136)	.28 (7)	(3) #10 M5	1.6 (40)	3.8 (97)	2.7 (68)	2.0 (50)	1.5 (38)	.9 (22)
1	4.5 (114)	5.9 (149)	2.6 (67)	3.8 (96)	3.15 (80)	5.35 (136)	.28 (7)	(3) #10 M5	1.7 (43)	4.1 (104)	2.6 (65)	2.0 (50)	1.5 (38)	.6 (16)
2	6.2 (158)	7.4 (188)	3.3 (84)	4.4 (112)	5.51 (140)	6.89 (175)	.24 (6)	(3) #10 M5	2.3 (58)	5.5 (139)	3.3 (83)	2.6 (67)	1.9 (48)	.9 (22)
3, 4	8.5 (216)	9.5 (242)	3.8 (97)	4.9 (125)	7.87 (200)	9.06 (230)	.24 (6)	(3) #10 M5	2.9 (73)	7.2 (182)	3.7 (94)	3.1 (80)	2.1 (54)	.7 (17)

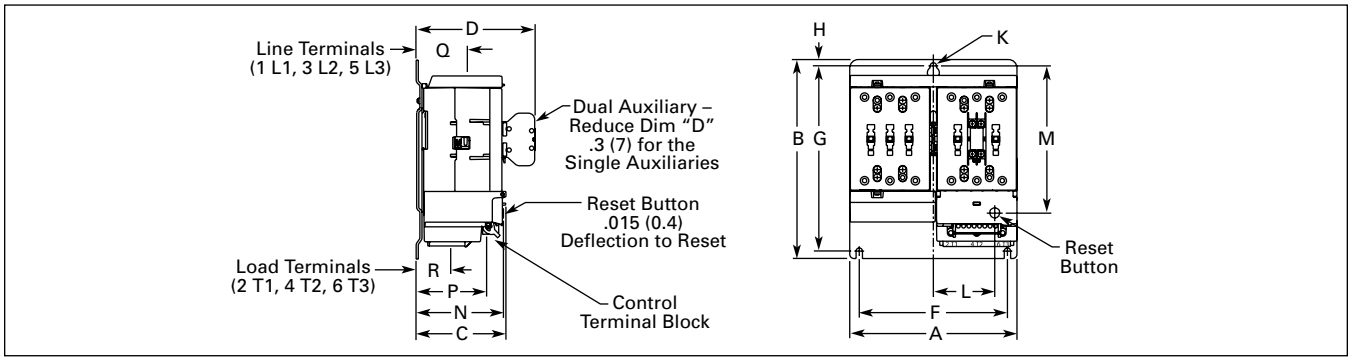


Figure A-14. Approximate Dimensions — Inches (mm)

A

Reversing Starter (Size 5)

Table A-36. Approximate Dimensions in Inches (mm)

NEMA Size	Overall					Mounting Holes				Req. Mtg. Screws	Reset Button			Terminals			
	Width	Length	Depth	Depth w/Logic Level Auxiliary	Width w/Side Auxiliaries	Width	H1	Mntg. Hole to Top	H2		Width	Height	Depth	Control	Line	Load	Load
	A	B	C	D	E	F	G	H	I	K	L	M	N	P	Q	R	S
5	11.8 (300)	21.0 (533)	7.0 (178)	8.2 (208)	12.8 (325)	7.82 (199)	18.3 (465)	2.19 (55.5)	13 (330)	(5) 5/16 M8	5.4 (138)	12.4 (315)	5.3 (135)	5.0 (126)	4.4 (112)	3.0 (75)	4.0 (101)

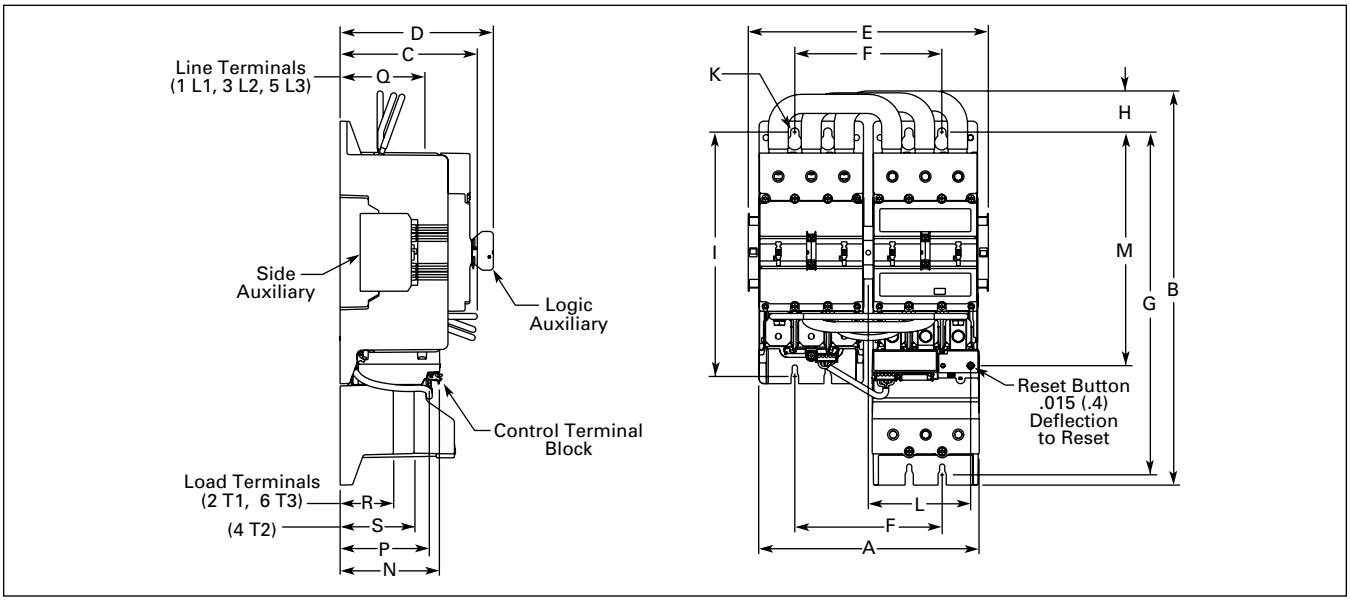
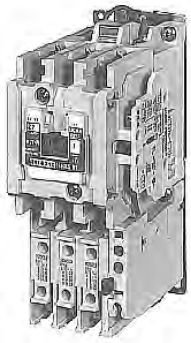
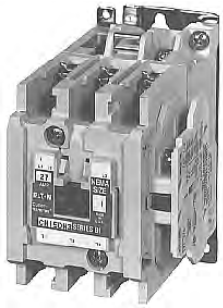


Figure A-15. Approximate Dimensions in Inches (mm)



NEMA AN16DN0AB
NEMA Size 1 Starter



NEMA Size 1 Contactor

Product Description

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

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 Solid-State Overload Relay (C396) available as a stand-alone unit and assembled with Freedom Contactor.
- A full line of snap-on accessories common to both IEC and NEMA devices — top and side mounted auxiliary contacts, solid-state and pneumatic timers, etc.
- 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.
- Encapsulated dual voltage/frequency magnet coils — permanently marked with voltage, frequency and part number. NEMA Sizes 00 – 0 have non-encapsulated coils as standard.
- 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.

Series B1 32A Overload

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

ISO 9000 Certification

When you turn to Eaton's Cutler-Hammer 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.

C396 Electronic Overload

A

Catalogue Number Selection

Table A-37. Freedom Catalogue Numbering System

A N 1 4 A N 0 A 1E 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
4 = Starter w/C396 Electronic Overload
5 = Contactor only — no overload relay
6 = Starter w/C306 Bi-Metal OLR
7 = Starter w/C316 Bi-Metal OLR
8 = Starter w/***IT.*** SSOLR

Contactor Frame Size ①

NEMA Size	Continuous Amp Rating
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 = 2-pole
3 = 3-pole
4 = 4-pole
5 = 5-pole

C396 Electronic Overload FLA Range (FNVR & FVR Only)

Frame A — NEMA Size 00 **P05** = 0.1 – 0.5A **002** = 0.4 – 2.0A **005** = 1.0 – 5.0A **008** = 1.6 – 8.0A	*Frame G — NEMA Size 2* **008** = 1.6 – 8.0A **032** = 6.4 – 32A **045** = 9.0 – 45A
Frame B — NEMA Size 0 **P05** = 0.1 – 0.5A **002** = 0.4 – 2.0A **005** = 1.0 – 5.0A **008** = 1.6 – 8.0A **032** = 6.4 – 32A	*Frame K — NEMA Size 3* **110** = 22 – 110A
	Frame N — NEMA Size 4 ② **150** = 30 – 150A
	Frame S — NEMA Size 5 ③ **300** = 60 – 300A
Frame D — NEMA Size 1 **P05** = 0.1 – 0.5A **002** = 0.4 – 2.0A **005** = 1.0 – 5.0A **008** = 1.6 – 8.0A **032** = 6.4 – 32A	*Frame T — NEMA Size 6* ③ **600** = 120 – 600A
	Frame U — NEMA Size 7 ③ **10C** = 200 – 1000A
	Frame V — NEMA Size 8 ③ **15C** = 300 – 1500A

C396 Electronic OLR Designation (FVNR & FVR Only)
1E = Economy C396 OLR, Manual Reset, Class 10
2E = Economy C396 OLR, Manual Reset, Class 20
3E = Standard C396 OLR, SEL Reset, SEL Class
4E = Advanced C396 OLR, SEL Reset, SEL Class, GF Sensing, Jam

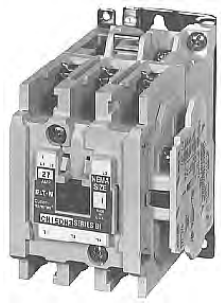
C306 Bi-Metallic OLR Designation
C = NEMA Size 00, 0
B = NEMA Size 1, 2
N/R = NEMA Size 3, 4 ④
B = NEMA Size 5
C = NEMA Size 6
B = NEMA Size 7, 8

AC Coil Suffix

Suffix	Coil Volts and Hertz
A = **B** = **C** = **D** =	120/60 or 110/50 240/60 or 220/50 480/60 or 440/50 600/60 or 550/50
E = **H** = **J** = **K** =	208/60 277/60 208 – 240/60 ⑤ 240/50
L = **N** = **T** = **U** =	380 – 415/50 550/50 24/60, 24/50 ⑥ 24/50
V = **W** = **Y** =	32/50 48/60 48/50

① For Contactor Only orders, add **B** to end of Catalogue Number if NEMA Size 00 – 2, 6.
② 3E, 4E feature set only.
③ Uses CT with C396 45 mm OLR, 3E, 4E feature set only.
④ Not required.
⑤ NEMA Sizes 00 and 0 only.
⑥ NEMA Sizes 00 and 0 only. Sizes 1 – 8 are 24/60 only.

Contents

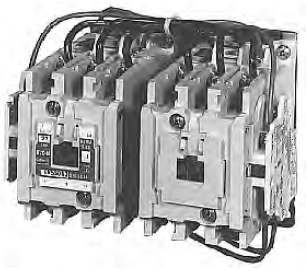


NEMA Size 1 — Cat. No. CN15DN3AB

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 push-button station or pilot device such as a proximity switch, limit switch, float switch, auxiliary contacts, etc.



NEMA Size 1
Cat. No. CN55DN3AB

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

- 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.

Technical Data

Table A-38. 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 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	

① Two compartment box lug.

Table A-39. 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

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.

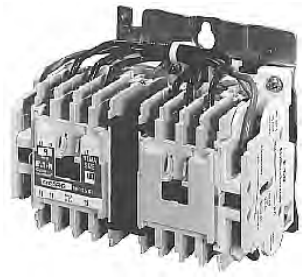
Kits and Accessories

- Auxiliary Contacts, contactor mounted — **Pages A-43** and **A-44**.
- Transient Suppressor, for magnet coil — **Pages A-41**.
- Timers — Solid-State and Pneumatic, mount on contactor — **Page A-40**.

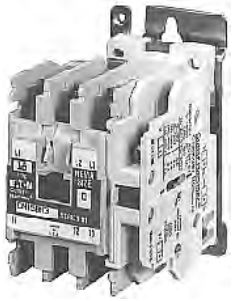
Renewal Parts Publication Numbers

- See **Page A-48.**

A



NEMA Size 00
3-Pole Contactor
Cat. No. CN55AN3AB



NEMA Size 0
3-Pole Contactor
Cat. No. CN15BN3AB

NEMA Size 3
3-Pole Contactor
Cat. No. CN15KN3A

Product Selection — 3-Pole Contactors

Table A-40. Type CN15/CN55 NEMA Contactors — 3-Pole Non-reversing and Reversing

NEMA Size	Continuous Ampere Rating	Maximum UL Horsepower ①						3-Pole Non-reversing		3-Pole Reversing	
		1-Phase		3-Phase							
		115V	230V	208V	240V	480V	600V	Catalogue Number	Price	Catalogue Number	Price
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_**	

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 Catalogue Number. EXAMPLE: CN15VN**D**3C.

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 Catalogue Number and replace the magnet coil alpha designation in the Catalogue Number (_) with the proper Code Suffix from the adjacent table.

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

For **DC Magnet Coils**, see Accessories, **Pages A-45** – **A-46**.

Table A-41. AC Suffix Code

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**
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**

③ NEMA Sizes 00 and 0 only.

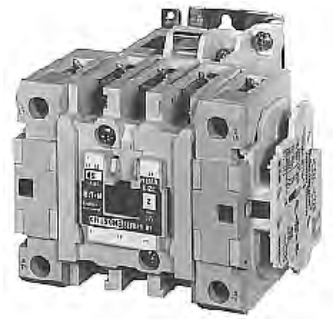
④ NEMA Sizes 00 and 0 only. Sizes 1 – 8 are 24/60 only.

Technical Data ..... **Pages A-36** – **A-38**
Dimensions ..... **Pages A-51** – **A-52**
Special Modifications... **Page A-47**
Accessories ..... **Pages A-39** – **A-47**
Discount Symbol **MC7**

Product Selection — 2-, 4- and 5-Pole Contactors

Table A-42. Type CN15 NEMA Contactors — 2-, 4- and 5-Pole Non-reversing

NEMA Size	Continuous Ampere Rating	Maximum UL Horsepower						2-Pole Non-reversing		4-Pole Non-reversing		5-Pole Non-reversing	
		1-Phase (2-Pole)		3-Phase				Catalogue Number	Price	Catalogue Number	Price	Catalogue Number	Price
		115V	230V	208V	240V	480V	600V						
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**		—		—	



NEMA Size 2
5-Pole Contactor
Cat. No. CN15GN5AB

Magnet Coils — AC or DC

Select required starter by Catalogue Number and replace the magnet coil alpha designation in the Catalogue Number (_) with the proper Code Suffix from the adjacent table.

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

For **DC Magnet Coils**, see Accessories, **Pages A-45** – **A-46**.

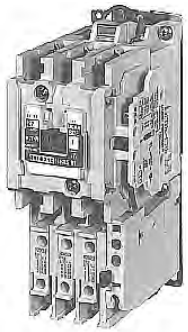
Table A-43. AC Suffix Code

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**
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**

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

Technical Data. . . . . **Pages A-36** – **A-38**
Dimensions . . . . . **Pages A-51** – **A-52**
Special Modifications . . . **Page A-47**
Accessories . . . . . **Pages A-39** – **A-47**
Discount Symbol **MC7**

Contents

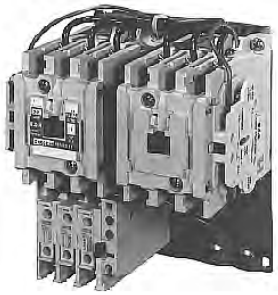


NEMA Size 1 — Cat. No. AN16DN0AB

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.



NEMA Size 1 — Cat. No. AN56DN0AB

Reversing

Three-phase, full voltage magnetic starters are used primarily for reversing of 3-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

- 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 C396 is a self-powered, robust electronic overload designed for integrate 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 – 1500 Amps 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.

Technical Data

Table A-44. Wire (75°C) Sizes — AWG or kcmil — NEMA Sizes 00 – 2 — Open and Enclosed

NEMA Size	Wire Size ② 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 ①
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	

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

Table A-45. Wire (75°C) Sizes — AWG or kcmil — NEMA Sizes 3 – 8 — Open and Enclosed

NEMA Size	Wire Size ③
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	

③ Minimum per NEC. Maximum wire size: Sizes 00 and 0 to 8 AWG and Sizes 1 – 2 to 2 AWG.

Wiring Diagrams

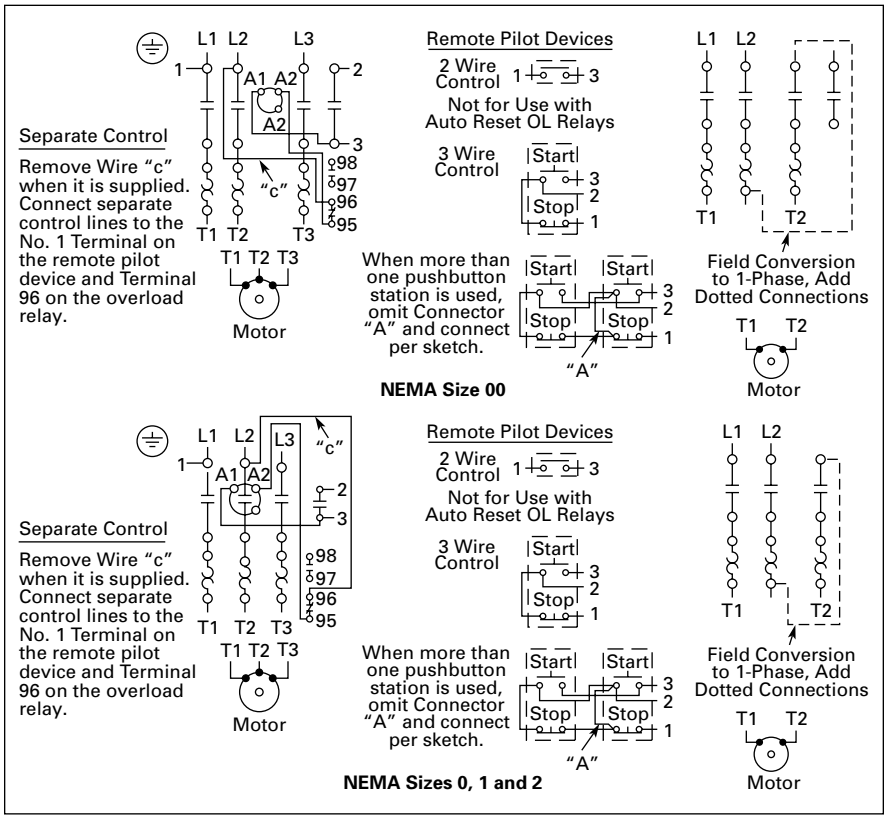


Figure A-15. Typical Wiring Diagrams — Three-Phase and Single-Phase Applications

Table A-46. Plugging and Jogging Service Horsepower Ratings ④

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

④ 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.

Kits and Accessories

- Auxiliary Contacts, contactor mounted — **Pages A-43** – **A-44**.
- Transient Suppressor, for magnet coil — **Pages A-41**.
- Timers — Solid-State and Pneumatic, mount on contactor — **Page A-40**.

Renewal Parts Publication Numbers

- See **Page A-48.**

A

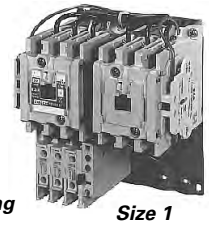
Product Selection

When Ordering Supply

- Catalogue Number
- Heater pack number (see selection table, **Pages A-64 – A-64**) or full load current.

A

Size 0 Non-reversing Starter



Size 1 Reversing Starter

Size 3 Vertical Reversing Starter

Table A-47. Type AN16/AN56 NEMA — Manual or Automatic Reset Overload Relay — Non-reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service-Limit Current Rating ③ (Amperes)	Maximum UL Horsepower ②						3-Pole Non-reversing ①		3-Pole Reversing ①	Vertical Reversing ①	Price
			1-Phase		3-Phase								
			115V	230V	208V	240V	480V	600V	Catalogue Number	Price	Catalogue Number	Catalogue 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 ④	1215	1400	—	—	400	450	900	900	**AN16VN0_B**		**AN56VN0_B**	—	

Note: Starter Catalogue Numbers do not include heater packs. Select one carton of three heater packs. Heater pack selection, **Pages A-64 – A-64**.

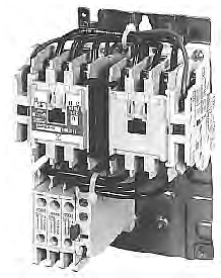
① Underscore (_) indicates coil suffix required, see **Table A-48**.

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 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.

④ Common control. For separate 120V control, insert letter **D** in 7th position of listed Catalogue Number. EXAMPLE: AN56VN**D**0CB.



NEMA Size 0
Cat. No. AN56BN0AC

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 Catalogue Number and replace the magnet coil alpha designation in the Catalogue Number (_) with the proper Code Suffix from the adjacent table.

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

For **DC Magnet Coils**, see Accessories, **Pages A-45 – A-46**.

Table A-48. AC Suffix Code

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 ⑤	**J**
240/50	**K**
380 – 415/50	**L**
550/50	**N**
24/60, 24/50 ⑥	**T**
24/50	**U**
32/50	**V**
48/60	**W**
48/50	**Y**

⑤ NEMA Sizes 00 and 0 only.

⑥ NEMA Sizes 00 and 0 only. Sizes 1 – 8 are 24/60 only.

Technical Data ..... **Pages A-36 – A-38**
Overload Relay..... **Page A-60**
Dimensions ..... **Pages A-53 – A-55**
Special Modifications.... **Page A-47**
Accessories ..... **Pages A-39 – A-47**
Heater Packs ..... **Pages A-64 – A-64**
Discount Symbol **MC7**

Catalogue Number AN700BN0218
NEMA Size 0, Open Type
Two-Speed, Reconnectable

Catalogue Number AN700DN0218
NEMA Size 1, Open Type
Two-Speed, Reconnectable Winding (One-Winding)

Catalogue Number AN700DN022
NEMA Size 1, Open Type
Two-Speed, Two-Winding Separate Winding) Wye-Wye Motor

Product Selection

When Ordering Specify

For 2-Speed Selective Control:

- Catalogue Number plus magnet coil Code Suffix. Example: Size 0 — AN700BN022**B.**
- Heater pack number or full load current for each speed.

For 2-Speed other than Selective Control:

- Catalogue Number plus magnet coil Code Suffix and option required. Example: AN700BN022B except Compelling.
- Heater pack number or full load current for each speed.

Note: 2-speed starters are designed for starting and controlling both separate (2-winding) and reconnectable (1-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.

Table A-49. Product Selection — 2-Speed — Selective Control — Separate Winding ①

Maximum Horsepower — 60/50 Hertz								NEMA Size	Open Type	
Constant or Variable Torque				Constant Horsepower					Catalogue Number	Price
115V	200V	230V	460V/575V	115V	200V	230V	460/575V			
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 2 packs (2 overload relays, one for each speed). Heater pack selection, **Pages A-64 – A-64.**

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

Table A-50. Product Selection — 2-Speed — Selective Control — Reconnectable Winding ②

Maximum Horsepower — 60/50 Hertz								NEMA Size	Open Type		
Constant or Variable Torque				Constant Horsepower					Constant or Variable Torque	Constant Horsepower	Price
115V	200V	230V	460V/575V	115V	200V	230V	460/575V		Catalogue Number	Catalogue 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 2 packs (2 overload relays, one for each speed). Heater pack selection, **Pages A-64 – A-64.**

② If branch circuit protective device is 45A or greater, C320FBR1 fuse kit(s) may be required for circuit protection per NEC 530-072.

Table A-51. 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 ③	**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**

③ NEMA Sizes 00 and 0 only. Sizes 1 – 5 are 24/60 only.

Dimensions..... **Page A-56**
Discount Symbol..... **MC7**

A

NEMA Size 1 — Cat. No. BN16DN0AB

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 horsepower at 230V. They consist of a 2-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 2 and 3 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.

Wiring Diagrams

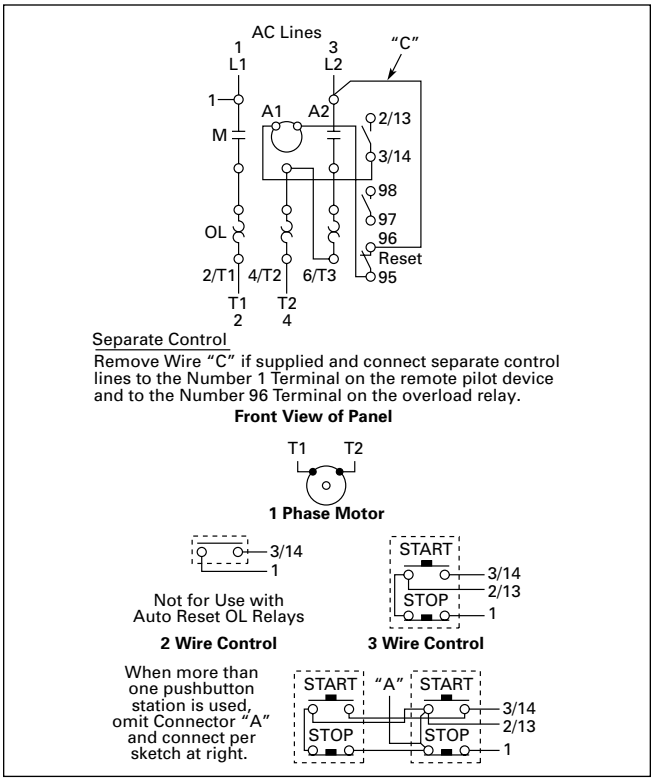


Figure A-16. Typical Wiring Diagrams — Single-Phase Applications (Factory Wired)

Product Selection

When Ordering Specify

- Catalogue Number
- Heater Pack Number (see selection table, **Pages A-64 – A-64**) or full load current.

Table A-52. Type BN16 NEMA — Manual or Automatic Reset Overload Relay

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

Note: Starter Catalogue Numbers do not include heater packs. Select 1 carton of 3 heater packs. Heater pack selection, **Pages A-64 – A-64**.

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

Accessories ..... **Pages A-39 – A-47**
Discount Symbol **MC7**

Product Selection

*Catalogue Number AN14GN0_*

Table A-53. Type AN14/AN54 NEMA — C396 Manual or Selectable Reset Electronic Overload Relay — Non-reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service-Limit Current Rating ⑥ (Amperes)	Maximum UL Horsepower ⑤						3-Pole Non-reversing ①②③		3-Pole Reversing ①②③	Vertical Reversing ①②③	Price
			1-Phase		3-Phase								
			115V	230V	208V	240V	480V	600V	Catalogue Number	Price	Catalogue Number	Catalogue Number	
00	9	11	1/3	1	1-1/2	1-1/2	2	2	**AN14AN0_ _ _**		**AN54AN0_ _ _**	—	
0	18	21	1	2	3	3	5	5	**AN14BN0_ _ _**		**AN54BN0_ _ _**	**AN54BNV_ _ _**	
1	27	32	2	3	7-1/2	7-1/2	10	10	**AN14DN0_ _ _**		**AN54DN0_ _ _**	**AN54DNV_ _ _**	
2	45	52	3	7-1/2	10	15	25	25	**AN14GN0_ _ _**		**AN54GN0_ _ _**	**AN54GNV_ _ _**	
3	90	104	—	—	25	30	50	50	**AN14KN0_ _ _**		**AN54KN0_ _ _**	**AN54KNV_ _ _**	
4 ④	135	156	—	—	40	50	100	100	**AN14NN0_ _ _**		**AN54NN0_ _ _**	**AN54NNV_ _ _**	
5	270	311	—	—	75	100	200	200	**AN14SN0_ _ _**		**AN54SN0_ _ _**	—	
6	540	621	—	—	150	200	400	400	**AN14TN0_ _ _**		**AN54TN0_ _ _**	—	
7	810	932	—	—	200	300	600	600	**AN14UN0_ _ _**		**AN54UN0_ _ _**	—	
8 ⑦	1215	1400	—	—	400	450	900	900	**AN14VN0_ _ _**		**AN54VN0_ _ _**	—	

① Underscore (_) indicates coil suffix required, see **Table A-54**.

② Underscore (_) indicates OLR designation required, see **Table A-55**.

③ Underscore (_) indicates FLA range, see **Table A-56**.

④ Starter is shipped unassembled. Catalogue Number includes overload relay and contactor. Not a direct dimensional replacement for Size 4 Starter with C306 bi-metallic overload.

⑤ 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

⑥ 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.

⑦ Common control. For separate 120V control, insert letter **D** in 7th position of listed Catalogue Number. EXAMPLE: AN54VN**D**_ _ _.

Table A-54. AC Suffix Code

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 ⑧	**J**
240/50	**K**
380 – 415/50	**L**
550/50	**N**
24/60, 24/50 ⑨	**T**
24/50	**U**
32/50	**V**
48/60	**W**
48/50	**Y**

⑧ NEMA Sizes 00 and 0 only.

⑨ NEMA Sizes 00 and 0 only. Sizes 1 – 8 are 24/60 only.

Table A-55. OLR Designation

OLR
3E = Standard C396 OLR, SEL Reset, SEL Class

Table A-56. C396 FLA Range (FNVR & FVR Only)

NEMA Size	FLA Range
00	**P05** = 0.1 – 0.5A **005** = 1.0 – 5.0A **002** = 0.4 – 2.0A **008** = 1.6 – 8.0A
0	**P05** = 0.1 – 0.5A **008** = 1.6 – 8.0A **002** = 0.4 – 2.0A **032** = 6.4 – 32A **005** = 1.0 – 5.0A
1	**P05** = 0.1 – 0.5A **008** = 1.6 – 8.0A **002** = 0.4 – 2.0A **032** = 6.4 – 32A **005** = 1.0 – 5.0A
2	**008** = 1.6 – 8.0A **045** = 9.0 – 45A
3	**110** = 22 – 110A
4	**150** = 30 – 150A
5 ⑩	**300** = 60 – 300A
6 ⑩	**600** = 120 – 600A
7 ⑩	**10C** = 200 – 1000A
8 ⑩	**15C** = 300 – 1500A

⑩ Uses CT with C396 45 mm OLR, see **Table A-125**

Technical Data – Contactors ..... **Pages A-36 – A-38**
Technical Data – Overload ..... **Page A-70**
Overload Relay ..... **Page A-66**
Dimensions ..... **Pages A-57 – A-59**
Special Modifications ... **Page A-47**
Accessories ..... **Pages A-39 – A-47**
Discount Symbol **MC7**

Table A-57. 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.

A

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

Table A-58. Specifications — Sizes 00 – 3

Description	Contactor Catalogue Number/Size				
	CN15A NEMA Size 00	**CN15B NEMA Size 0**	**CN15D NEMA Size 1**	**CN15G NEMA Size 2**	**CN15K 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	600V AC	600V AC	600V AC	600V AC	600V AC
Continuous Ampere Ratings (I)	9A	18A	27A	45A	90A
Maximum Horsepower (hp)					
1-Phase 115V	1/3	1	2	3	7-1/2
230V	1	2	3	7-1/2	15
3-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	74%	74%	74%	74%	72%
Pick-Up Volts — Hot	78%	78%	78%	78%	76%
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	45%	45%	49%	49%	50%
Drop-Out Volts — Hot	46%	46%	50%	50%	52%
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 A-45 – A-46.**				
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.)	6,000	6,000	6,000	6,000	6,000
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, 12 – 14 solid Cu	8 – 16 stranded, 10 – 14 solid Cu	8 – 14 stranded or solid Cu	2 – 14 (upper) and/or 6 – 14 (lower) stranded or solid Cu	1/0 – 14 Cu
Control Terminals	12 – 16 stranded, 12 – 14 solid Cu	12 – 16 stranded, 12 – 14 solid Cu	12 – 16 stranded, 12 – 14 solid Cu	12 – 16 stranded, 12 – 14 solid Cu	12 – 16 stranded 12 – 14 solid Cu
Power Terminal Torque Line and Load — lb-in	7	15	20	40 (14 – 8 AWG) 45 (6 – 4 AWG) 50 (3 AWG)	35 (14 – 10 AWG) 40 (8 AWG) 45 (6 – 4 AWG) 50 (3 – 1/0 AWG)
Auxiliary Contact Rating	A600, P300				

Table A-59. Specifications — Sizes 4 – 8

Description	Contactor Catalogue Number/Size				
	CN15N NEMA Size 4	**CN15S NEMA Size 5**	**CN15T NEMA Size 6**	**CN15U NEMA Size 7**	**CN15V 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	600V AC	600V AC	600V AC	600V AC	600V AC
Continuous Ampere Ratings (I)	135A	270A	540A	810A	1215A
Maximum Horsepower (hp)					
1-Phase 115V	—	—	—	—	—
230V	—	—	—	—	—
3-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	72.5%	75%	75%	75%	75%
Pick-Up Volts — Hot	76%	77%	75%	75%	75%
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	54%	63%	①	①	①
Drop-Out Volts — Hot	56%	64%	①	①	①
Maximum Operation Rate — Ops/Hour	2,400	2,400	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 A-45** – **A-46**.				
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.)	6,000	6,000	6,000	6,000	6,000
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	7,400	5,000	4,200
Wire Range					
Power Terminals	Open — 3/0 – 8 Cu; Enclosed — 250 kcmil – 6 Cu/Al	750 kcmil — 2 or (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, 12 – 14 solid Cu	12 – 16 stranded, 12 – 14 solid Cu	12 – 16 stranded, 12 – 14 solid Cu	12 – 16 stranded, 12 – 14 solid Cu	12 – 16 stranded, 12 – 14 solid Cu
Power Terminal Torque Line and Load — lb-in	200	550	550	550	500
Auxiliary Contact Rating	A600, P300				

① 20 – 30% of rated coil voltage.

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

Life Load Curves

A

Eaton's Cutler-Hammer 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 (Ie), as found on the horizontal axis.
- Read the estimated contact life along the vertical axis in number of operational cycles.

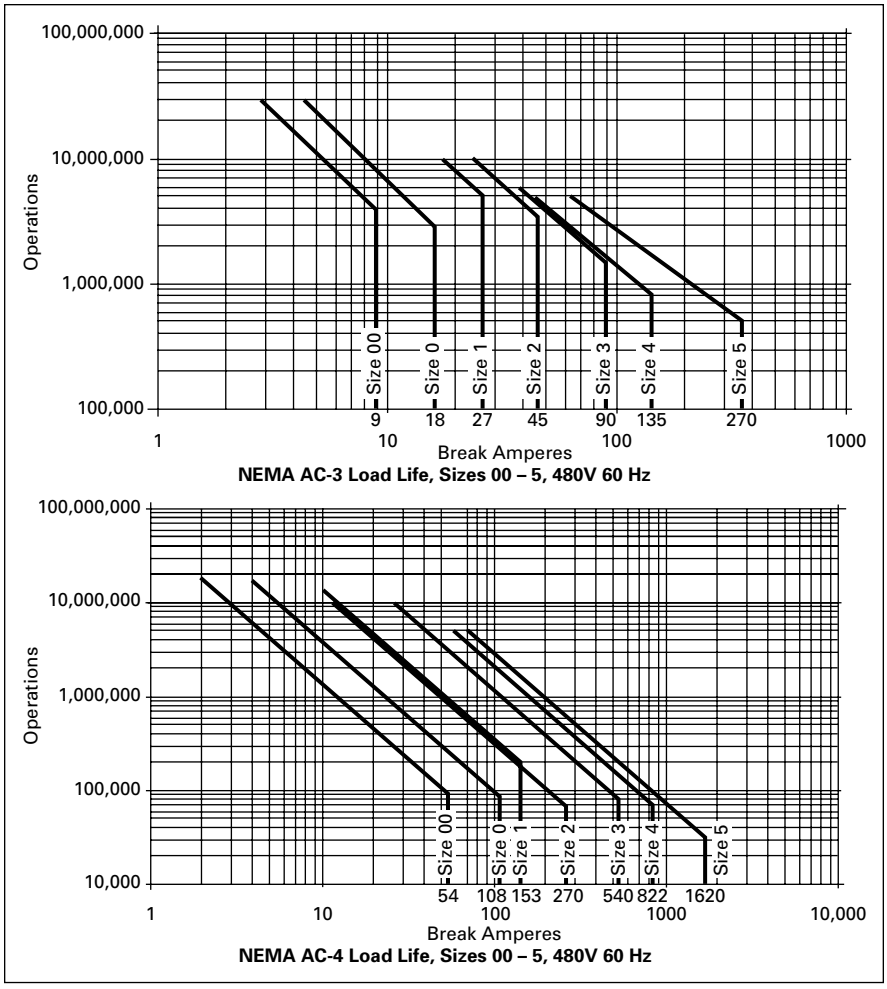


Figure A-17. AC-3 and AC-4 Utilization Categories

3-Pole Top Mounted Fuse Block Kit

IEC Sizes A – K, NEMA Sizes 00 – 2

Mounted Fuse Block Kit

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

Table A-60. Fuse Block Kits

Fuse Type		Catalogue Number	Price
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**	

① Type M fuse block not approved for branch circuit protection.

Table A-61. Approximate Dimensions

Fuse Block			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)	—

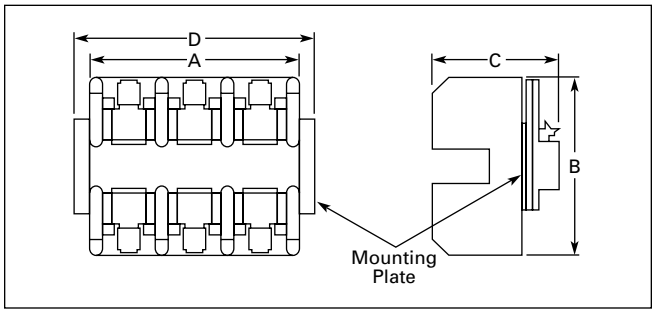


Figure A-18. Approximate Dimensions in Inches (mm)

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 **Page A-43**.

Cat. No. C321KM60B

Part No. 23-7165

Wire Set

Table A-62. Mechanical Interlock Only ②③

Application			Catalogue Number	Price
NEMA Size	IEC Size	Contactor Mounting		
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	—	Horizontal	**C321KM80**	
5	—	Horizontal	**C321KM50**	
5 to 6	—	Horizontal	**C321KM56**	
6	—	Horizontal	**C321KM70**	
6 to 7	—	Horizontal	**C321KM90**	
7	—	Horizontal	**C321KM34**	
4 or 5 to 5	P – S to 5	Vertical	**C321KM55**	
5 to 6	—	Vertical	**C321KM65**	
6	—	Vertical	**C321KM66**	
6 to 7	—	Vertical	**C321KM67**	

② Without cross-wiring.
③ For use with latest series product.

Table A-63. Reversing Kits (Horizontal Contactor Mounting Only)

Application		Catalogue Number	Price
NEMA Size	IEC Size		
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	

④ Kit includes (2) NC auxiliary contacts.

Discount Symbol **MC7**

A

Solid-State Timers

Solid-State Timer

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.

Table A-64. Mounted Timer Product Selection

Timing Range	Catalogue Number ①②③	Price
.1 – 1.0 Seconds 1 – 30 Seconds 30 – 300 Seconds 5 – 30 Minutes	**C320TDN1_** **C320TDN30_** **C320TDN300_** **C320TDN3000_**	

① Add operating voltage Suffix to Catalogue Number. **A** = 120V, **B** = 240V, **E** = 208V

② Rated .5 ampere pilot duty — not to be used on larger contactors.

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

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.

Table A-65. Product Selection

Description	Catalogue Number	Price
NEMA Size 3, IEC Sizes L – N NEMA Size 4, IEC Sizes A – S NEMA Size 6	**C321SB18** **C321SB19** **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 can not 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.

Table A-66. Product Selection

Timing Range	Catalogue Number	Price
.1 to 30 Seconds 10 to 180 Seconds	**C320TP1** **C320TP2**	

Table A-67. Maximum Ampere Ratings

Description	Volts AC			
	120	240	480	600
Make Break	30 3	15 1.5	7.5 .75	6 .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.

Table A-68. Product Selection

Description	Min. Ordering Quantity (Std. Pkg.)	Catalogue Number	Price
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**	

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.

Table A-69. Product Selection

Description	Catalogue Number	Price
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.

Table A-70. Product Selection

Type	Max. Amperes	Catalogue Number	Price
Fuse Holder Only	15 30	**C320FB** ④ **C320FBR** ⑤	

④ A fuse is not supplied, but holder will accept a Bussman Type KTK or KTK-R (13/32" x 1-1/2") fuse, 600V maximum.

⑤ Includes a 5A, 600V KTK-R fuse.

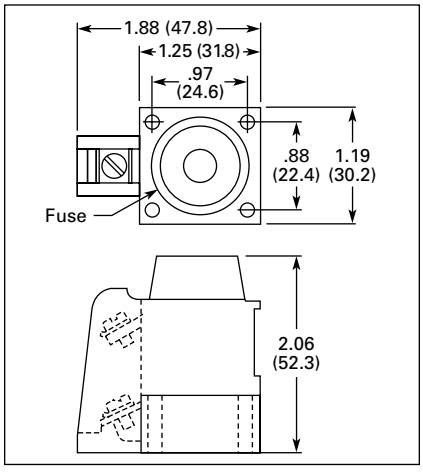


Figure A-19. Approximate Dimensions in Inches (mm)

Discount Symbol **MC7**

DIN Rail Mounting Channel — 35 mm

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

DIN Rail

Table A-71. Product Selection

Description	Catalogue Number	Price
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.

Table A-72. Product Selection

Application	Catalogue Number	Price
NEMA Size 00, IEC Sizes A – C NEMA Size 0, IEC Sizes D – F	**C320LS1** **C320LS2**	
NEMA Sizes 1 – 2, IEC Sizes G – K Contactors Reversing Contactors	 **C320LS3** **C320LS4**	
NEMA Size 1 Starters Reversing Starters	 **C320LS5** **C320LS6**	
NEMA Size 2, IEC Sizes G – K Starters Reversing Starters	 **C320LS7** **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.

Table A-73. Product Selection

Catalogue Number	Price
C320DN65	

Transient Suppressor Kits

NEMA Sizes 00 – 2, IEC Sizes A – K

Cat. No. C320TS2

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.

Table A-74. Product Selection

Description	Coil ① Voltage	Catalogue Number	Price
Transient Suppressor	24/120V 208/240V 277/480V	**C320TS1** **C320TS2** **C320TS3**	

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

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.

Table A-75. Product Selection

Description	Coil Voltage	Catalogue Number	Price
Transient Suppressor	120V	**C320AS1**	

Discount Symbol **MC7**

A

DC/AC Interface Module

Cat. No. C320DC

The Catalogue Number C320DC Interface Module is an optically isolated solid-state switch which provides a means of operating AC coils with 5 – 48V DC control signal. It acts as a space saving interposing relay which can switch a specified 50/60 Hz AC source to the contactor or starter coil.

The module may be directly attached to the coil terminals of any Freedom Series contactor or starter — NEMA Sizes 00 – 3, IEC Sizes A – N and lighting contactors 10 – 100A. It also has provisions for DIN rail mounting.

The module will operate coils within the voltage ranges shown in **Table A-76**.

Design Characteristics

- DC Input: 5 – 48V DC at mA nominal
- AC Operating Voltage: 240V AC (360 VA) ±10% 50/60 Hz;
- DC Operating Voltage: 30V DC max. (.5A)
- AC Current Rating
  - 10A make (inrush)
  - 1A break (sealed)

Table A-76. Controller Coil Voltage Ranges

Controller Catalogue Number Prefix	Controller Size or Rating	Coil Range Volts AC
AE16, AE17, AE56, AE57, CE15, CE55	A – F G – K L – N	24 – 240 48 – 240 110 – 240
AN16, AN56, CN15, CN55	00 – 0 1 – 2 3	24 _ 240 48 – 240 110 – 240
CN35	10 – 30A 60A 100A	24 – 240 48 – 240 110 – 240

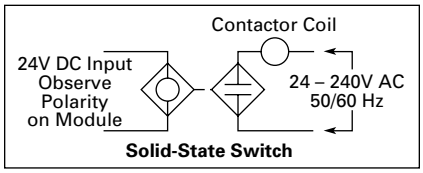


Figure A-20. Typical Application

Table A-77. Product Selection

Coil Voltage	Catalogue Number	Price
5V DC 6V DC 9V DC	**C320DC2V5** **C320DC2V6** **C320DC2V9**	
12V DC 48V DC	**C320DC2V12** **C320DC2V48**	

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.

Table A-78. Product Selection

Catalogue Number	Price
C320DSTCVR (25 to a package)	

Add-On Power Pole Kit

NEMA Sizes 00 – 2, IEC A – K

This device mounts on the side of Freedom NEMA Size 00 – 2 and IEC Size A – K 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.

Table A-79. Product Selection

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

Discount Symbol **MC7**

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 below 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.

Side Mounted

Top Mounted

Table A-80. Product Selection

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

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

① For reference only — not part of Catalogue Number. See above.

NEMA Sizes 3 – 8 — IEC Sizes L – S

Base Auxiliary Contact Cat. No. C320KGS42

Auxiliary Contac Cat. No. C320KGS22

Table A-81. Product Selection

Circuit	Contact Configuration Code ②	Catalogue Number		Price
Base Auxiliary Contacts — NEMA Sizes 3 – 5, IEC Sizes L – S				
		NEMA Size 3 IEC Sizes L – N	**NEMA Sizes 4 – 5 IEC Sizes P – S**	
NO NO-NC	10 11	**C320KGS31** **C320KGS32**	**C320KGS41** **C320KGS42**	
Auxiliary Contacts — NEMA Sizes 3 – 5, IEC Sizes L – S				
		Catalogue Number		
NO NC NO-NC ③	10 01 11	**C320KGS20** **C320KGS21** **C320KGS22**		
Auxiliary Contacts, Sealed Logic Level – NEMA Sizes 3 – 5, IEC Sizes L – S				
		Catalogue Number		
NO NC NO-NC ④	10 01 11	**C320KGS20L** **C320KGS21L** **C320KGS22L**		
Auxiliary Contacts — NEMA Sizes 6 – 8				
		Size	**Catalogue Number**	
NO-NC 2NO-2NC 2NO-2NC	11 22 22	NEMA 8 NEMA 6 – 7	**C320KA5** **C320KA6** **C320KA8**	

② For reference only — not part of Catalogue Number. See above left.

③ NO-NC occupies two positions — L2 and L3, or R2 and R3. See **Figure A-21** on **Page A-44**.

④ Form C contacts.

Auxiliary Contact Ratings (Amperes)

Table A-82. Ratings — NEMA A600

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

Table A-83. Ratings — NEMA P300

Continuous Thermal Rating: 5A	
DC Volts	Make/Break Amperes
125 250	1.10 .55

Table A-84. Ratings — Logic Level

Minimum Ratings for Logic Level and Hostile Atmosphere Application	
Minimum Amperes Minimum Volts	20 mA 24V AC/DC

Table A-85. Ratings C320KGS20L, C320KGS21L, C320KGS22L

DC-12		AC-12	
Ue	Ie	Ue	Ie
80	0.1	250	0.1

Discount Symbol **MC7**

A

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.

Table A-86. Auxiliary Contacts

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

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.

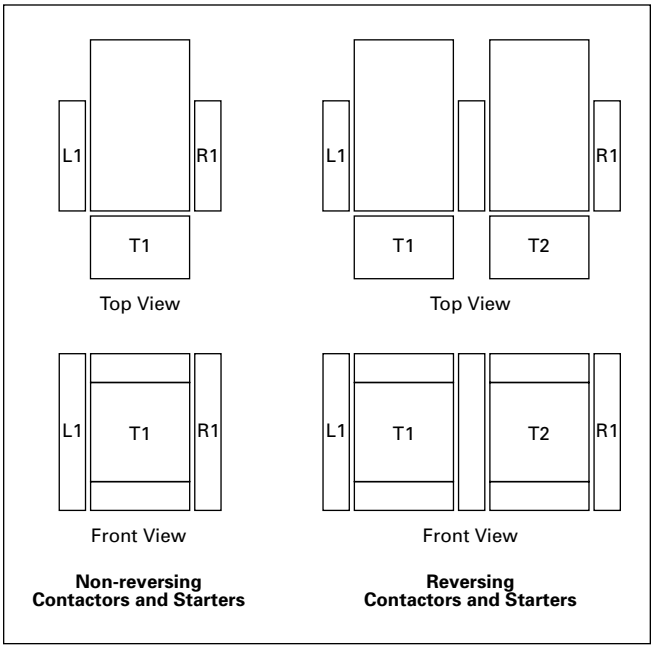


Figure A-21. Auxiliary Contact Location

NEMA Sizes 3 – 8, IEC Sizes L – S

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.

Table A-87. Mounting Positions

Size	Available Mounting Positions ③
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	R1
NEMA Size 8	L2, R2

③ Available positions on contactors or starters other than what is factory installed.

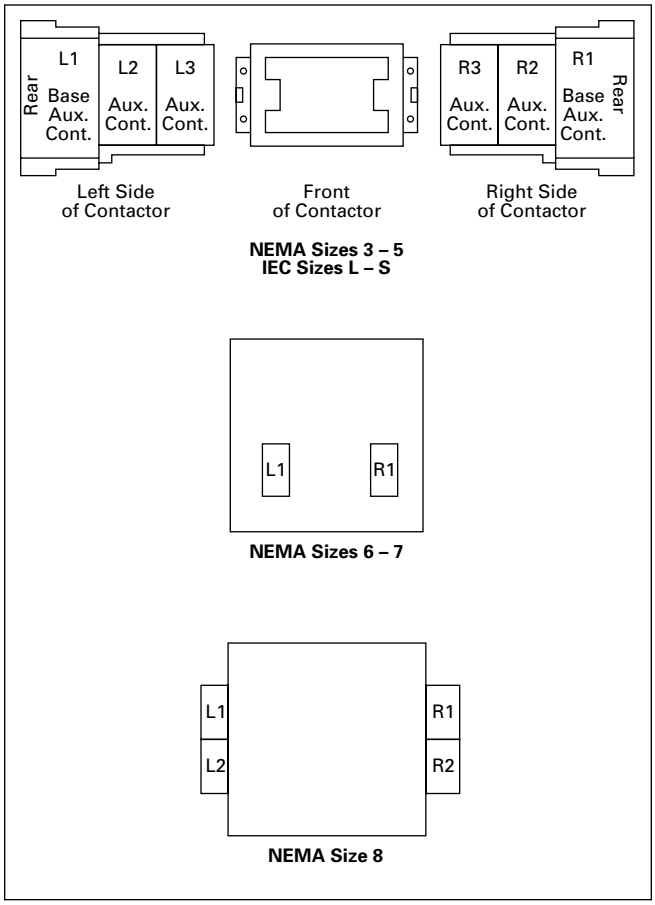


Figure A-22. Auxiliary Contact Location

DC Magnet Coils

When Ordering Specify

Conversion Kit for Field Assembly

- Catalogue 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 table below for the magnet coil identifier in the device Catalogue Number.

EXAMPLE: For Size 0 AC contactor with a 24V DC 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:

- 1 Encapsulated DC magnet coil
- 1 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.
- 2 Blue colored connection wires
- 1 Instruction publication

Operation

See next page for operation details.

A

Table A-88. Product Selection

Contactor or Starter Size		Conversion Data					Complete Conversion Kit			Factory Installed	
		Volts	Magnet Coil			NCI Interlock					
NEMA	IEC		Coil Number	Amps P.U./Seal	Watts P.U./Seal		Catalogue Number	Price	Ship Wt. Lbs. (kg)	Code Suffix	Adder
Non-reversing — Kit includes NCI Side Mounted Auxiliary contact											
00 and 0 CN35 – A, B, D D15 Relays	A – F	12 24 48 120	**9-2988-11** **9-2988-12** **9-2988-13** **9-2988-14**	6.4/.28 3.2/.14 1.6/.07 .64/.028	76.8/3.36 76.8/3.36 76.8/3.36 76.8/3.36	**C320KGD1** **C320KGD1** **C320KGD1** **C320KGD1**	**C335KD3R1** **C335KD3T1** **C335KD3W1** **C335KD3A1**		1.0 (.5)	**R1** **T1** **W1** **A1**	
① 00 and 0 CN35 – A, B, D D15 Relays	A – F	12 24 48 120	**9-2988-11** **9-2988-12** **9-2988-13** **9-2988-14**	6.4/.28 3.2/.14 1.6/.07 .64/.028	76.8/3.36 76.8/3.36 76.8/3.36 76.8/3.36	**C320KGD2** ① **C320KGD2** ① **C320KGD2** ① **C320KGD2** ①	**C335KD3R4** **C335KD3T4** **C335KD3W4** **C335KD3A4**		1.0 (.5)	**R4** **T4** **W4** **A4**	
1 and 2 CN35 – G	G – K	12 24 48 120	**9-2990-1** **9-2990-2** **9-2990-3** **9-2990-4**	15.4/.42 7.7/.21 3.9/.11 1.5/.041	185/4.98 185/4.96 185/5.04 185/4.87	**C320KGD5** **C320KGD5** **C320KGD5** **C320KGD5**	**C335KD4R4** **C335KD4T4** **C335KD4W4** **C335KD4A4**		1.0 (.5)	**R4** **T4** **W4** **A4**	
3 CN35 – K	L – N	12 24 48 120	**9-3002-1** **9-3002-2** **9-3002-3** **9-3002-4**	24/.40 12/.20 6.1/.097 2.5/.038	293/4.84 288/4.75 295/4.67 298/4.57	**C320KGD3** **C320KGD3** **C320KGD3** **C320KGD3**	**C335KD5R1** **C335KD5T1** **C335KD5W1** **C335KD5A1**		2.0 (.9)	**R1** **T1** **W1** **A1**	
4 and 5 CN35 – N, S	P – S	24 48 120 240	**9-2026-4** **9-2026-3** **9-2026-2** **9-2026-1**	18/.22 9/.11 3.3/.05 1.7/.02	400/5.3 400/5.2 450/5.4 440/4.9	**C320KGD3** **C320KGD3** **C320KGD3** **C320KGD3**	**C335KA3T1** **C335KA3W1** **C335KA3A1** **C335KA3B1**		2.5 (1.1)	**T1B** **W1B** **A1B** **B1B**	
Reversing											
00 and 0 CN35 – A, B, D D15 Relays	A – F	12 24 48 120	**(2) 9-2988-1** **(2) 9-2988-2** **(2) 9-2988-3** **(2) 9-2988-4**	6.4/.28 3.2/.14 1.6/.07 .64/.028	76.8/3.36 76.8/3.36 76.8/3.36 76.8/3.36	**(2) C320KGD1** **(2) C320KGD1** **(2) C320KGD1** **(2) C320KGD1**	**C335RD3R1** ② **C335RD3T1** ② **C335RD3W1** ② **C335RD3A1** ②		1.0 (.5)	**R1** ③ **T1** ③ **W1** ③ **A1** ③	
1 and 2 CN35 – G	G – K	12 24 48 120	**(2) 9-2990-1** **(2) 9-2990-2** **(2) 9-2990-3** **(2) 9-2990-4**	15.4/.42 7.7/.21 3.9/.11 1.5/.041	185/4.98 185/4.96 185/5.04 185/4.87	**(2) C320KGD3** **(2) C320KGD3** **(2) C320KGD3** **(2) C320KGD3**	④			**R1** ③ **T1** ③ **W1** ③ **A1** ③	

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.

Discount Symbol **MC7**

A

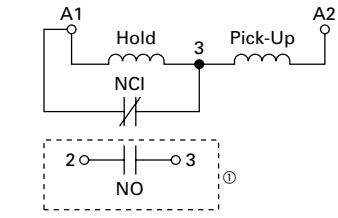
Operation

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**. The 1 suffix contains only the **special** (side mounted) early break NCI auxiliary contact. The 4 suffix contains a NO contact in the same package as the **special** (side mounted) early-break NCI auxiliary contact.

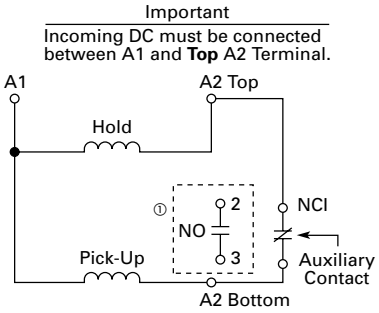
Note: For NEMA Sizes 00 and 0 and IEC Sizes A – F, contactors may utilize either suffix 1 or 4 DC coil kits; starters may utilize suffix 4 DC coil kits only. For NEMA Sizes 1 and 2 and IEC Sizes G – K, both contactors and starters may utilize a suffix 4 DC coil kit only.

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.



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

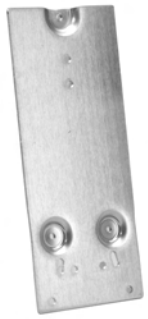


DC Coil Elementary Diagram for NEMA Sizes 00, 0, 4 & 5 and IEC Sizes A – F & P – S Contactors and Starters

Figure A-23. Elementary Diagrams

① 1NO available in Suffix 4 kits only.

Competitive Mounting Plates



C321CMP1

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 Cutler-Hammer 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.

Table A-89. Product Selection

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

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

Discount Symbol **MC7**

Table A-90. Competitive Mounting Plates — Approximate Dimensions and Shipping Weights

NEMA Size	Catalogue Number	Dimensions in Inches (mm)		Ship Wt. Lbs. (kg)
		Wide A	Deep B	
0 – 00	**C321CMP0**	3.25 (82.6)	8.50 (215.9)	.63 (.29)
1	**C321CMP1**	3.75 (95.3)	9.50 (241.3)	.90 (.41)
2	**C321CMP2**	3.75 (95.3)	10.25 (260.4)	1.20 (.54)
3	**C321CMP3**	6.00 (152.4)	12.75 (323.9)	2.40 (1.09)
4	**C321CMP4**	7.50 (190.5)	13.50 (342.9)	3.00 (1.36)
5	**C321CMP5**	11.00 (279.4)	19.00 (482.6)	6.63 (3.01)

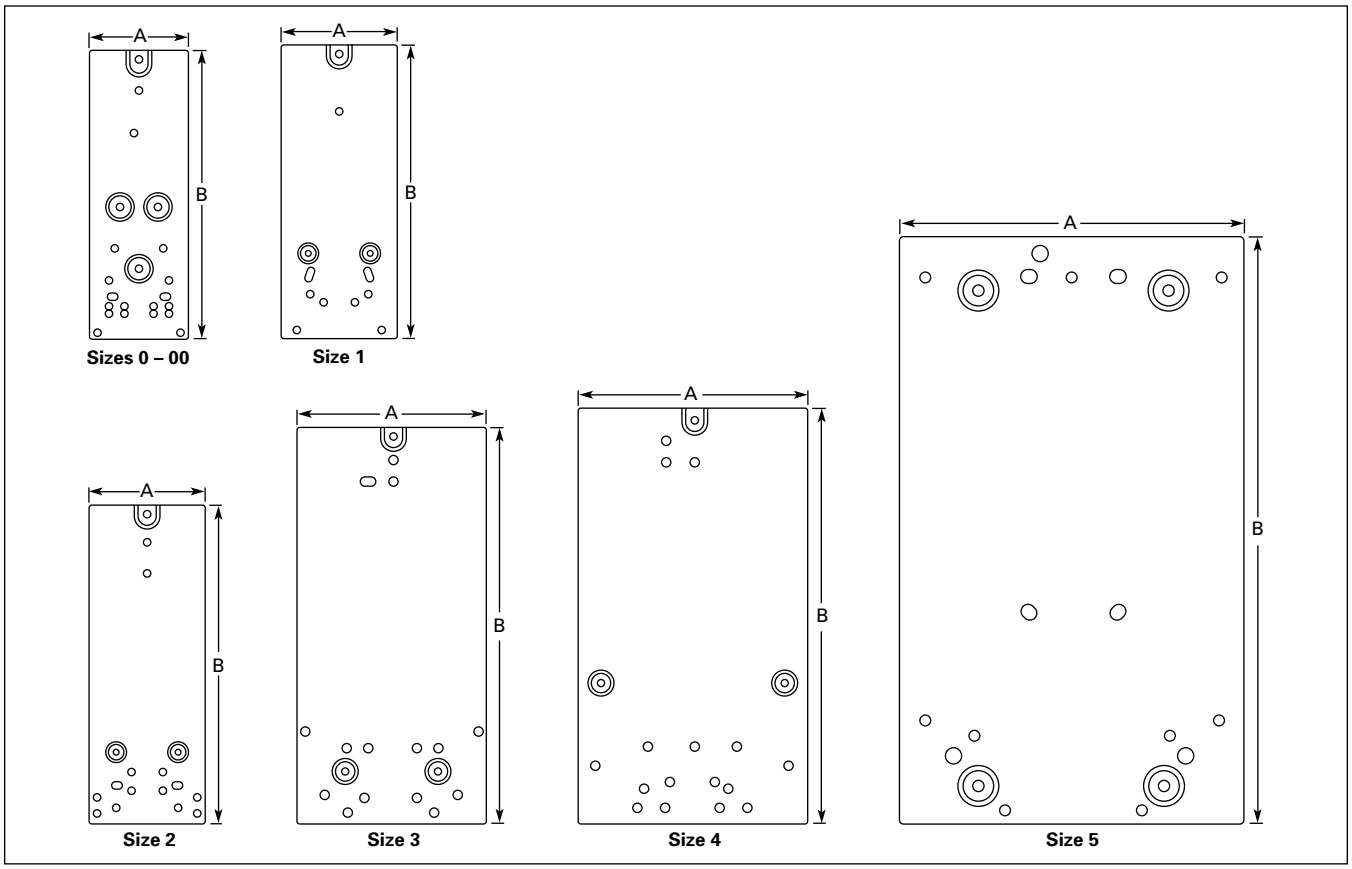


Figure A-24. Approximate Dimensions

Special Modifications

Table A-91. For Catalogue Numbers AE16, AE17, AN16, AE56, AE57, AN56, CE15, CN15, CN35, CE55, CN55

Addition or Special Feature	Starter Size and Price Adder — NEMA/IEC									
	00/ A – C	0/ D – F	1 —	2/ G – K	3/ L – N	4/ P – S	5	6	7	8
Control Circuit										
Extra Auxiliary Circuit, Factory Installed NO or NC — each contact ①										
Transient Suppressor ①										
Power Circuit										
Contactor/Starter for Ring Lug Capability — Add Mod Code **T16** to Catalogue Number (Power Terminals Only, Control Terminals as Standard) Standalone Overload Relays Can Not Accept Ring Lugs on Line Side										
Factory Installed Dust Covers										
Factory Installed C320DSTCVR — Add Mod Code **-53** to Catalogue Number ①			NA	NA	NA	NA	NA	NA		

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

A

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

Table A-92. For Catalogue Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 ② and CN55 Contactors and Starters

Description		NEMA Size 00-0	Price	NEMA Size 00		Price	NEMA Size 0		Price
		Series A1		Series B1	Series C1		Series B1	Series C1	
		Part No.		Part No.	Part No.		Part No.	Part No.	
Renewal Parts Publication Number		None		None	None		None	None	
Contact Kits									
2-Pole		①		①	①		①	①	
3-Pole		①		①	①		①	①	
4-Pole		①		①	①		①	①	
5-Pole		①		①	①		①	①	
Magnet Coils	**Coil Suffix**								
120V 60 Hz or 110V 50 Hz	A	①		9-2875-1	9-2875-1		9-2876-1	9-2876-1	
240V 60 Hz or 220V 50 Hz	B	①		9-2875-2	9-2875-2		9-2876-2	9-2876-2	
480V 60 Hz or 440V 50 Hz	C	①		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	①		9-2875-5	9-2875-5		9-2826-5	9-2876-5	
277V 60 Hz	H	①		9-2875-12	9-2875-12		9-2826-12	9-2876-12	
208/240V 60Hz	J	—		9-2875-37	9-2875-37		9-2826-17	9-2876-17	
240V 50Hz	K	—		9-2875-11	9-2875-11		9-2826-11	9-2876-11	
380 – 415V 50 Hz	L	①		9-2875-6	9-2875-6		9-2826-6	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	①		—	—		—	—	
24V 50 Hz	U	①		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		①		①	①		①	①	
Upper Magnet Frame		①		①	①		①	①	

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

① Replace with complete contactor.

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

Discount Symbol **MC17**

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

Table A-92. For Catalogue Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 ① and CN55 Contactors and Starters (Continued)

Description		NEMA Size 4			NEMA Size 5			NEMA Size 6			
		Series A1	Series B1	Price	Series A1	Series B1	Price	Contactor & Starter Series A1, Starter Series B1	Price	Contactor Series B1, Starter Series C1	Price
		Part No.	Part No.		Part No.	Part No.		Part No.		Part No.	
Renewal Parts Publication Number		20428	20428		20429	20429		20146		23349	
Contact Kits											
2-Pole		6-44	6-26		6-45	6-45		6-601-2		—	
3-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	9-1891-1		9-1891-1	9-1891-1		9-2698		9-3006	
240V 60 Hz or 220V 50 Hz	B	9-1891-2	9-1891-2		9-1891-2	9-1891-2		9-2698-2		9-3006-2	
480V 60 Hz or 440V 50 Hz	C	9-1891-3	9-1891-3		9-1891-3	9-1891-3		9-2698-3		9-3006-3	
600V 60 Hz or 550V 50 Hz	D	9-1891-4	9-1891-4		9-1891-4	9-1891-4		9-2698-4		9-3006-4	
208V 60 Hz	E	9-1891-13	9-1891-13		9-1891-13	9-1891-13		9-2698-5		—	
277V 60 Hz	H	9-1891-26	9-1891-26		9-1891-26	9-1891-26		—		—	
208/240V 60Hz	J	—	—		—	—		—		—	
240V 50Hz	K	9-1891-20	9-1891-20		9-1891-20	9-1891-20		—		—	
380 – 415V 50 Hz	L	—	—		—	—		9-2698-6		9-3006-7	
380V 50 Hz	L	9-1891-14	9-1891-14		9-1891-14	9-1891-14		—		—	
415V 50 Hz	M	9-1891-21	9-1891-21		9-1891-21	9-1891-21		—		—	
550V 50 Hz	N	9-1891-8	9-1891-8		9-1891-8	9-1891-8		—		—	
24V 60 Hz – 24V 50 Hz	T	—	—		—	—		—		9-3006-8	
24V 60 Hz	T	9-1891-15	9-1891-15		9-1891-15	9-1891-15		—		—	
24V 50 Hz	U	9-1891-16	9-1891-16		9-1891-16	9-1891-16		—		—	
48V 60 Hz	W	—	—		—	—		9-2698-8		9-3006-9	
48V 50 Hz	Y	9-1891-18	9-1891-18		9-1891-18	9-1891-18		—		—	
Overload Relays											
For replacement on existing starters 3-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			NEMA Size 5			NEMA Size 6			
		Series A1	Series B1	Price	Series A1	Series B1	Price	Contactor & Starter Series A1, Starter Series B1	Price	Contactor Series B1, Starter Series C1	Price
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	

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

② Consult Eaton.

③ Voltage ratings of the main coils must match those of the feeder group for proper operation of the starter/contactor.

Discount Symbol **MC17**

A

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

Table A-92. For Catalogue Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 ① and CN55 Contactors and Starters (Continued)

Description		NEMA Size 7		Price	NEMA Size 8		Price
		Series A1	Series B1		Series A1	Series B1	
		Part No.	Part No.		Part No.	Part No.	
Renewal Parts Publication Number		**20848**	**20848**		**20849**	**20849**	
Contact Kits							
2-Pole		—	—		—	—	
3-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 60Hz	**J**	—	—		—	—	
240V 50Hz	**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 3-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		—	—		—	—	

Feeder Group Renewal ③

Volts	Hertz	NEMA Size 7			NEMA Size 8		
		Series A1	Series B1	Price	Series A1	Series B1	Price
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**	

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

② Consult Eaton.

③ Voltage ratings of the main coils must match those of the feeder group for proper operation of the starter/contactor.

Discount Symbol **MC17**

Non-reversing Contactors

Table A-93. Approximate Dimensions and Shipping Weights — Open Type

NEMA Size	Number of Poles	Dimensions in Inches (mm)							Ship Wt. Lbs. (kg)
		Wide A	High B	Deep C	Mounting D	Mounting E	F	G	
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)	.54 (13.7)	1.7 (.8)
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)	.54 (13.7)	1.8 (.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)	.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)	.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)	.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)

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

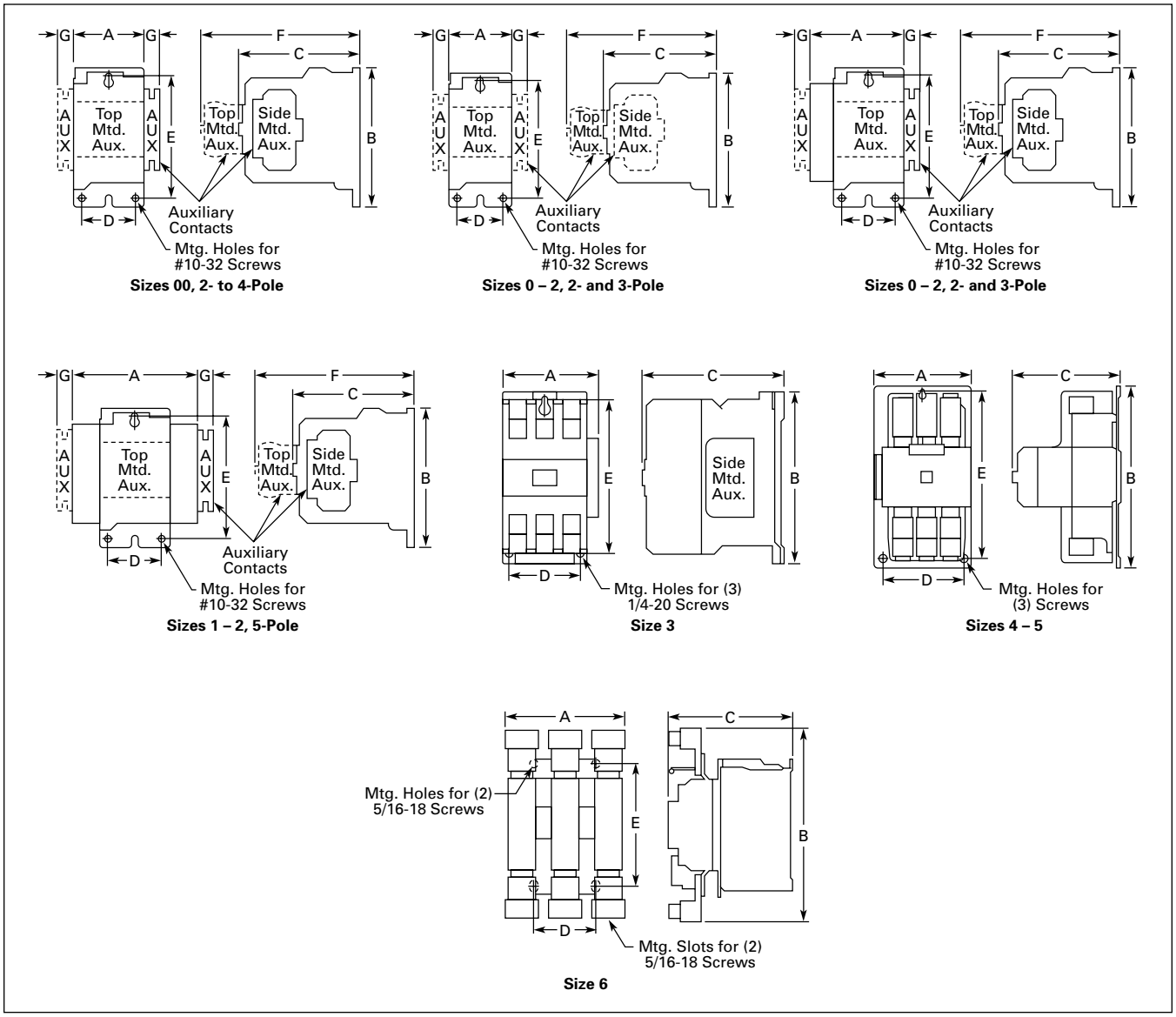


Figure A-25. Approximate Dimensions

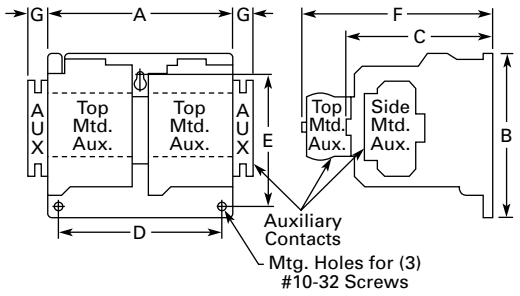
A

Reversing Contactors

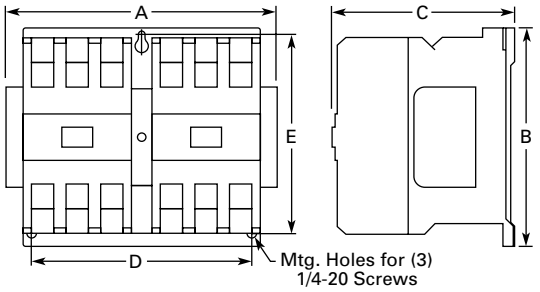
Table A-94. Approximate Dimensions and Shipping Weights — Open Type

NEMA Size	Dimensions in Inches (mm)							Ship Wt. Lbs. (kg)
	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	
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)	.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)	.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)

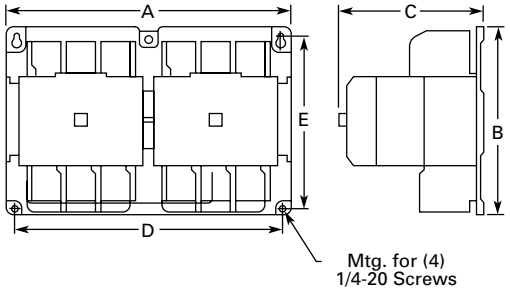
① Includes cross wiring.



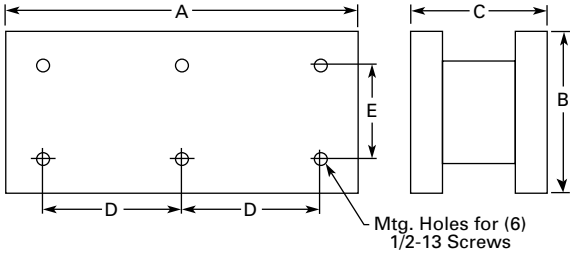
Sizes 00 – 2



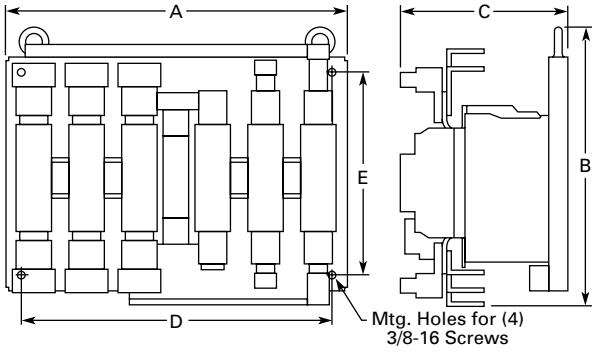
Size 3



Sizes 4 – 5



Open Type — Sizes 7 – 8 Horizontal



Size 6

Figure A-26. Approximate Dimensions

Non-reversing Starters, Bi-Metallic Overload

Table A-95. Approximate Dimensions and Shipping Weights — Open Type

NEMA Size	Dimensions in Inches (mm)							Ship. Wt. Lbs. (kg)
	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	
00 – 0	1.80 (45.7)	6.60 (167.6)	3.52 (89.4)	—	6.07 (154.2)	4.90 (124.5)	.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)	.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)	.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)

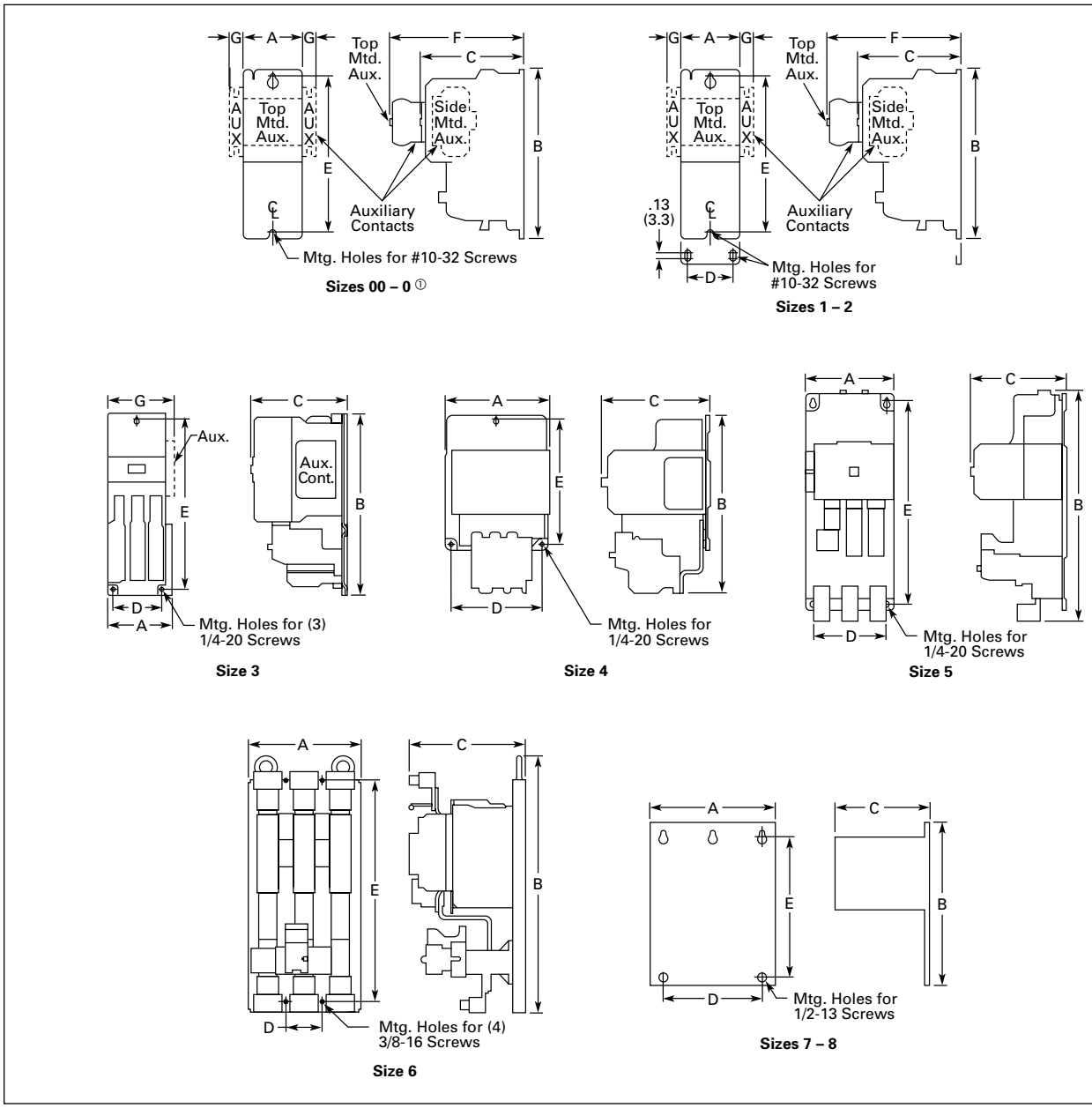


Figure A-27. Approximate Dimensions

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

A

Reversing Starters, Bi-Metallic Overload

Table A-96. Approximate Dimensions and Shipping Weights — Open Type

NEMA Size	Dimensions in Inches (mm)									Ship.Wt. Lbs. (kg)
	Wide A	High B	Deep C	Mounting D	Mounting E	D1	E1	F	G	
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)	.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)	.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)	.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)

① Includes cross wiring overhang.

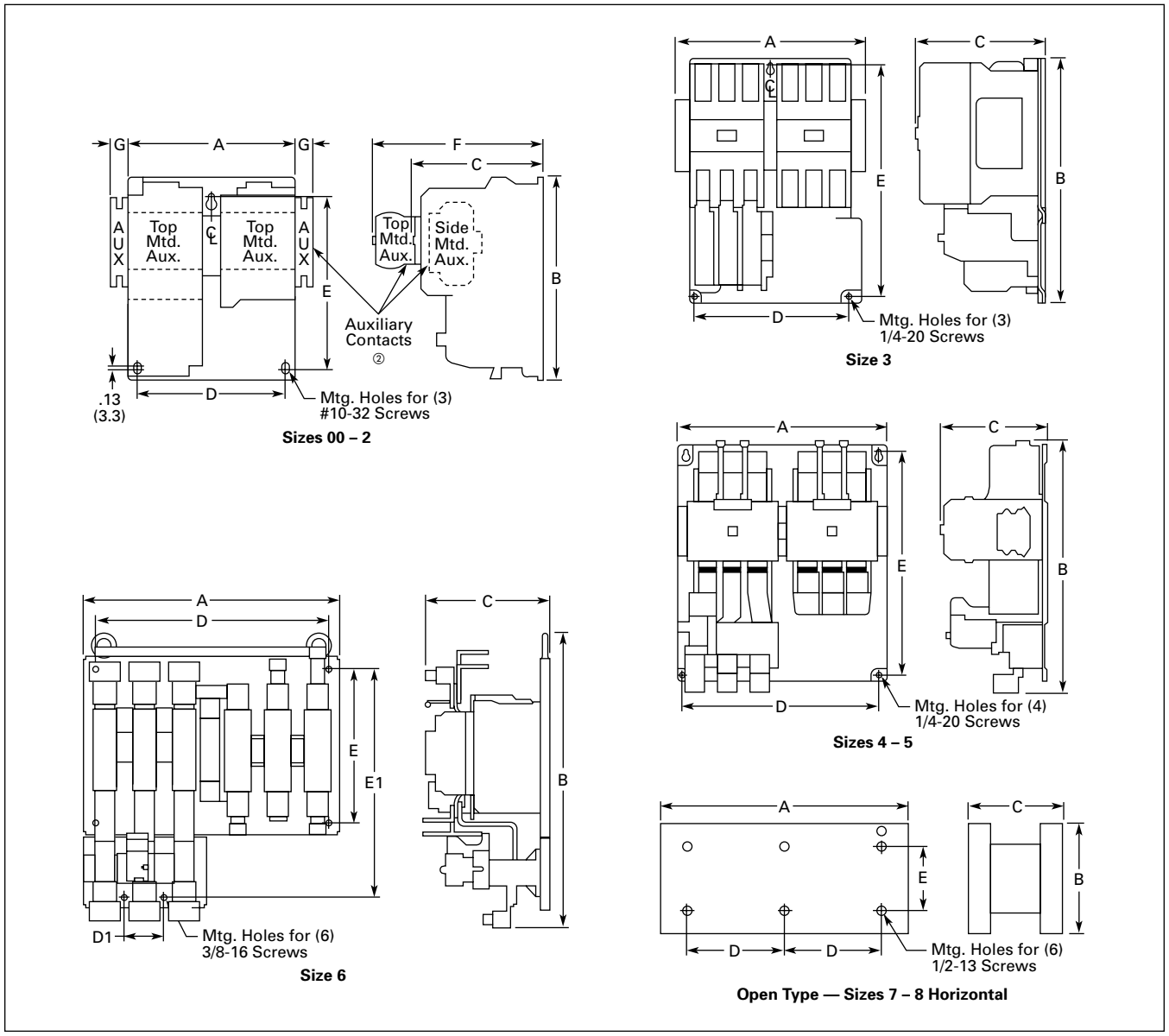


Figure A-28. Approximate Dimensions

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

Reversing Starters — Vertical Construction, Bi-Metallic Overload

Table A-97. Approximate Dimensions and Shipping Weights — AN56V Open Vertical Starter

NEMA Size	Dimensions in Inches (mm)						Ship. Wt. Lbs. (kg)
	Wide A	High B	Deep C	Mounting		Wire Zone	
				Wide D	High E		
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)

① Wire overhang 1.00 mm left, 50 mm right.

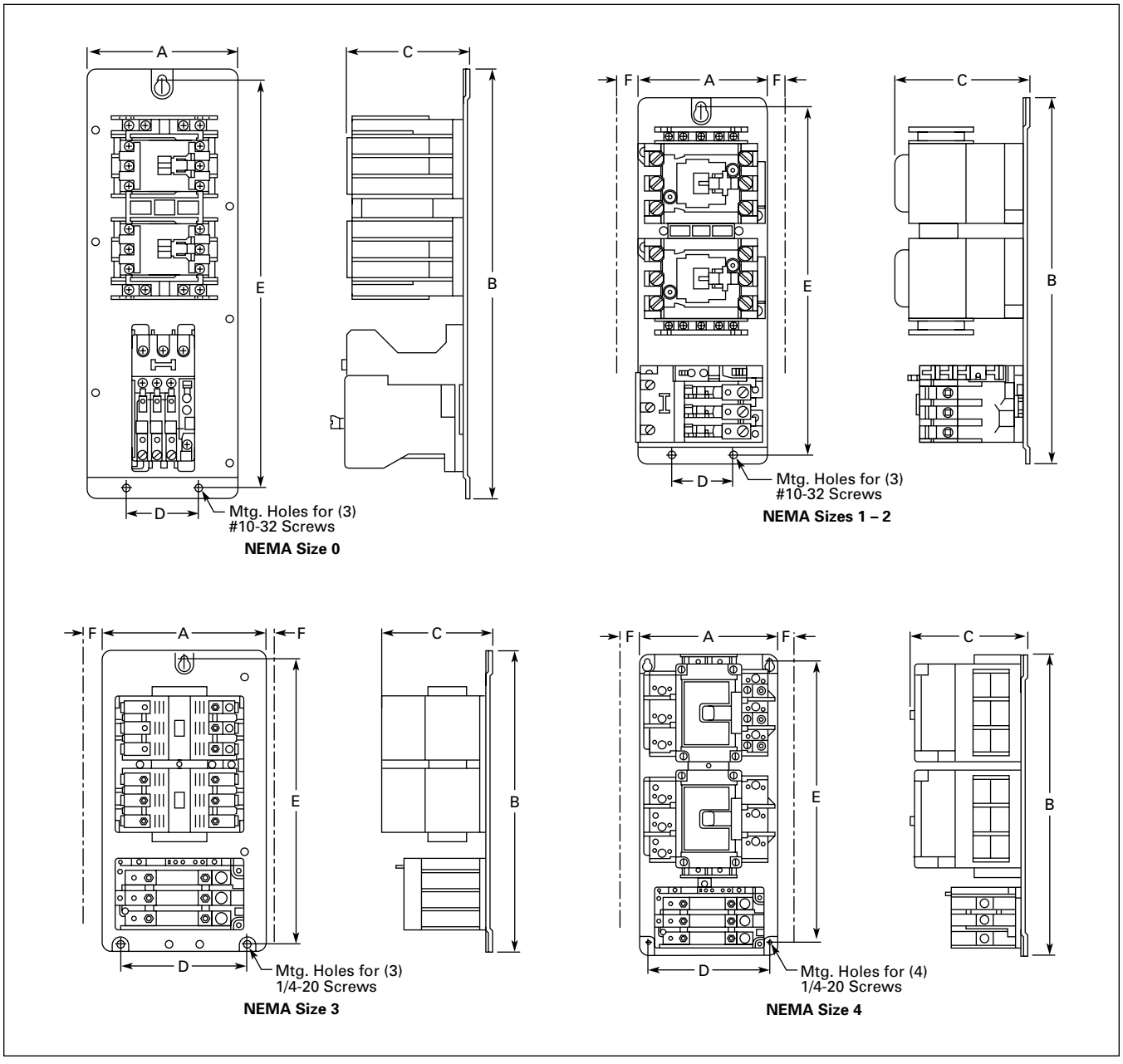


Figure A-29. Approximate Dimensions

A

Multispeed Starters, Bi-Metallic Overload

Table A-98. Approximate Dimensions and Shipping Weights — AN700 Open Vertical Starter

NEMA Size	Dimensions in Inches (mm)						Ship Wt. Lbs. (kg)
	Wide A	High B	Deep C	Mounting Wide D	Mounting High E	Wire Zone F	
2-Speed — Selective Control — Separate Winding							
0	5.19 (132)	7.38 (188)	3.52 (89)	3.50 (89)	6.87 (175)	.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)
2-Speed — Selective Control — Reconnectable Winding							
0	8.62 (219)	7.06 (179)	3.82 (81)	6.62 (168)	6.50 (165)	.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)

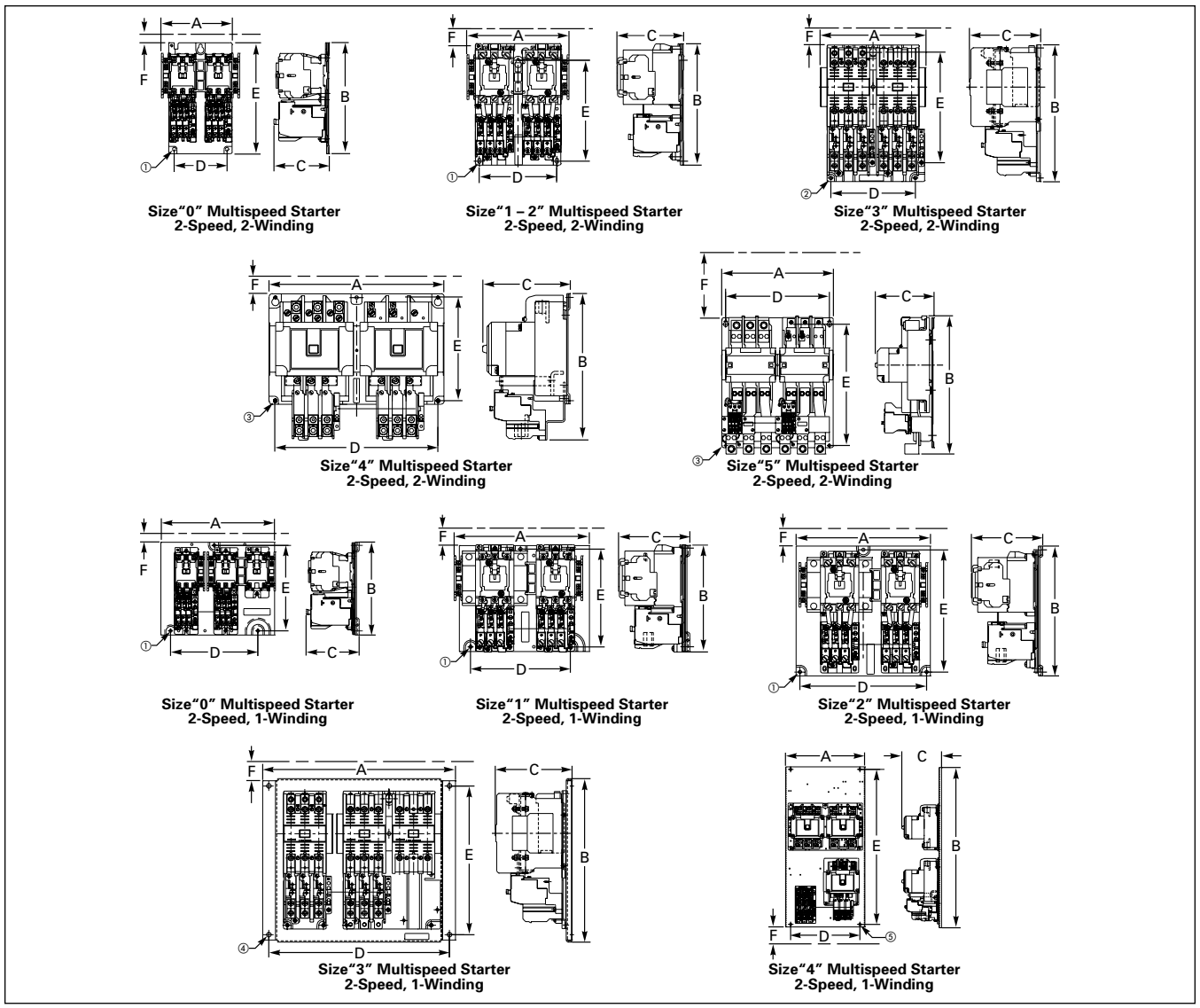


Figure A-30. Approximate Dimensions

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.

Non-reversing Starters, C396 Electronic Overload

Table A-99. Approximate Dimensions and Shipping Weights — C396 Electronic Overload

NEMA Size	Dimensions in Inches (mm)						
	Wide A	High B	Deep C	Mounting			
				Wide D	High E	Wide D1	High E1
00 – 0	2.13 (54.0)	6.60 (167.6)	3.65 (92.8)	1.01 (25.7)	6.18 (157.0)	—	—
1	2.59 (65.9)	7.08 (179.7)	4.49 (114.0)	2.00 (50.8)	6.50 (165.1)	1.29 (32.8)	—
2	2.59 (65.9)	8.08 (205.1)	4.49 (114.0)	2.00 (50.8)	7.50 (190.5)	1.29 (32.8)	6.50 (165.1)
3	4.09 (103.9)	11.40 (289.6)	5.82 (147.9)	3.00 (76.2)	10.81 (274.6)	1.50 (38.1)	6.63 (168.3)

① Consult Eaton.

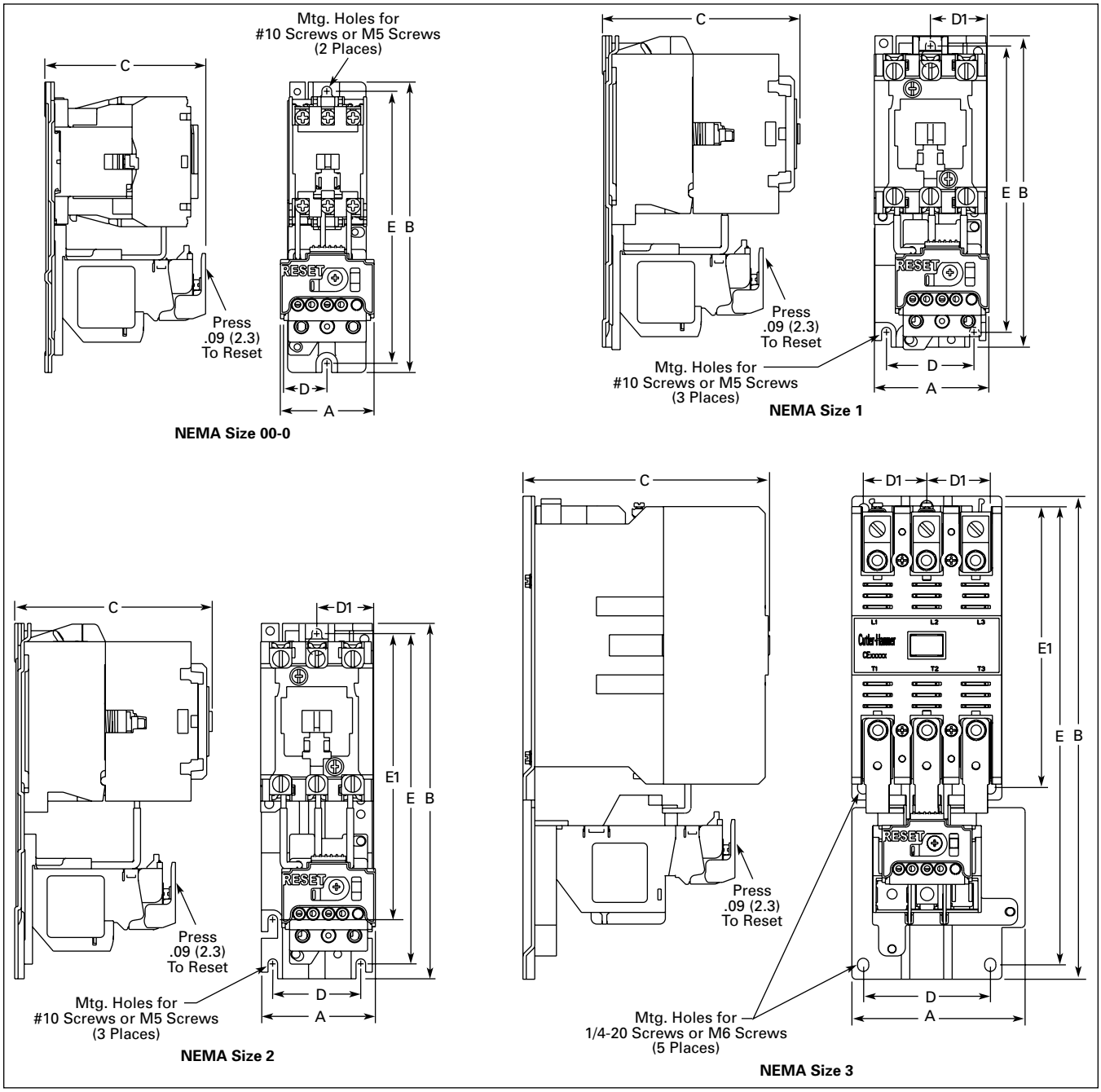
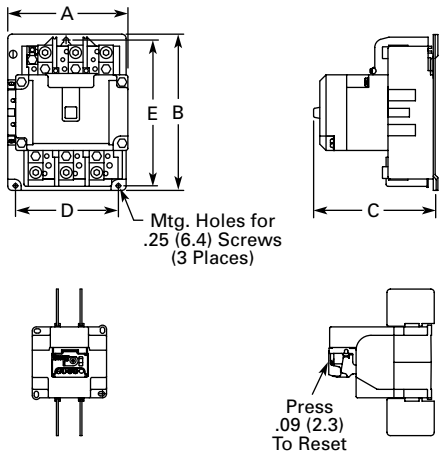


Figure A-31. Approximate Dimensions

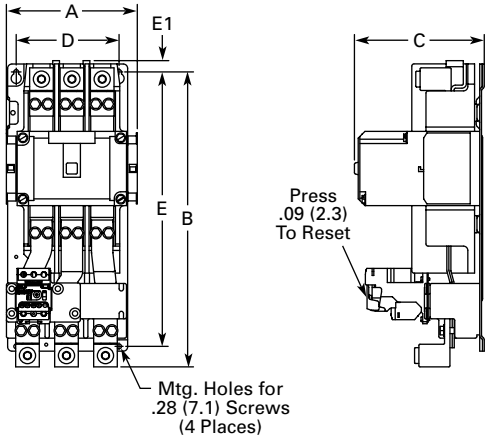
Table A-100. Approximate Dimensions and Shipping Weights — C396 Electronic Overload

NEMA Size	Dimensions in Inches (mm)						
	Wide A	High B	Deep C	Mounting			
				Wide D	High E	Wide D1	High E1
4	7.00 (177.8)	9.11 (231.4)	7.17 (182.2)	6.00 (152.4)	8.50 (215.8)	—	—
5	7.64 (194.0)	17.86 (453.7)	7.57 (192.4)	6.00 (152.4)	16.01 (406.6)	—	.66 (16.7)
6	9.47 (240.5)	21.69 (551.0)	9.89 (251.2)	3.10 (79.7)	18.00 (457.2)	3.18 (80.9)	.89 (22.5)

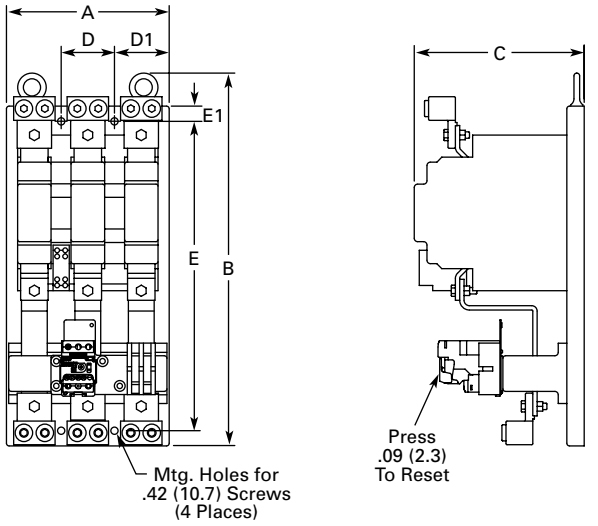


Note: Size 4 Starter comes unassembled. The starter is comprised of the Size 4 Freedom Series NEMA Contactor and the C396 Overload Relay.

Size 4



Size 5



Size 6

Figure A-32. Approximate Dimensions

Table A-101. Approximate Dimensions and Shipping Weights — C396 Electronic Overload

NEMA Size	Dimensions in Inches (mm)						
	Wide A	High B	Deep C	Mounting			
				Wide D	High E	Wide D1	High E1
7	15.11 (383.8)	29.04 (737.7)	12.63 (320.9)	13.25 (336.6)	21.25 (539.8)	.93 (23.7)	1.27 (32.4)
8	15.11 (383.8)	35.28 (895.1)	14.69 (373.0)	13.25 (336.6)	16.75 (425.5)	.93 (23.7)	—

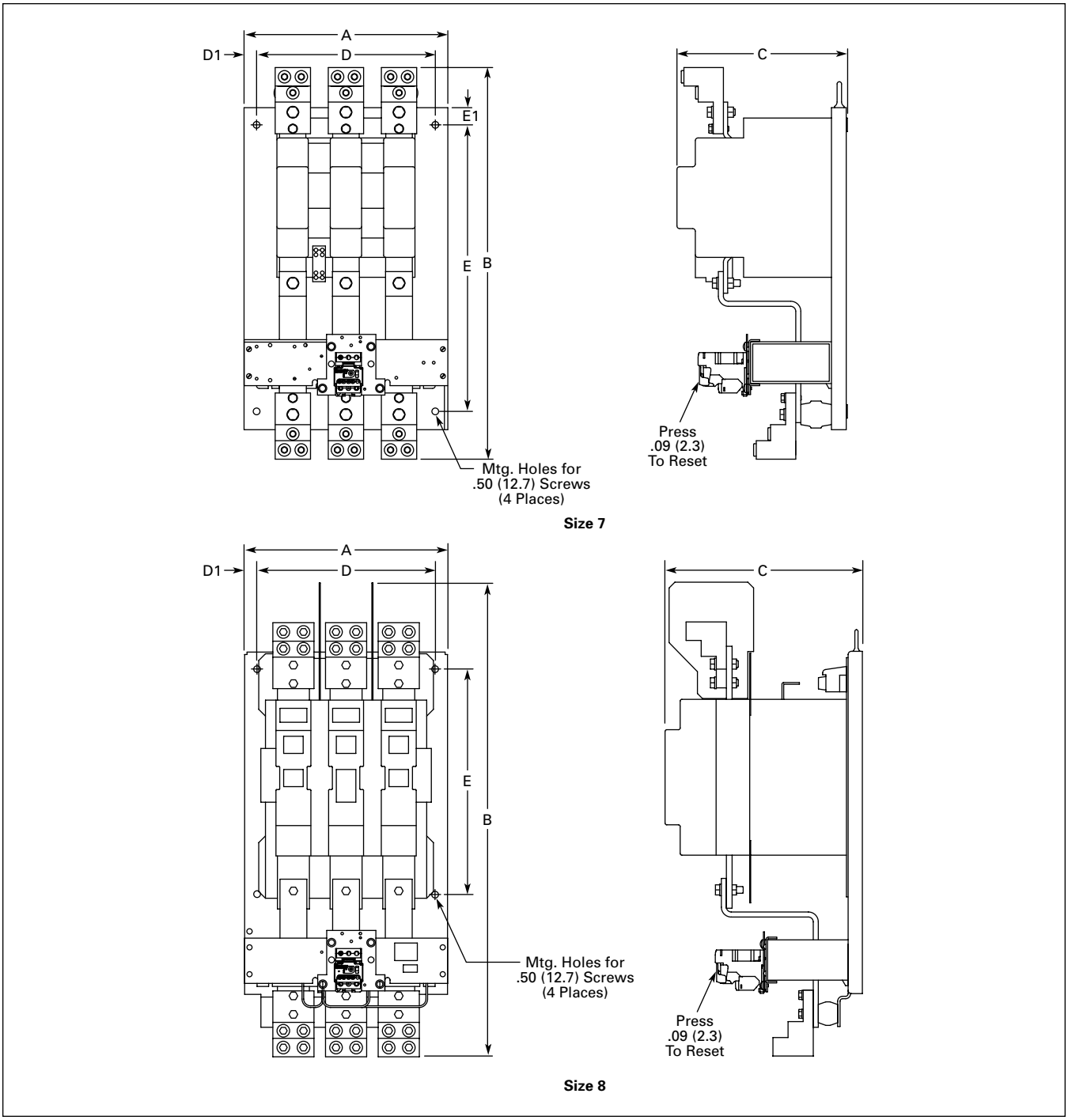


Figure A-33. Approximate Dimensions

Contents

A

32A Overload
Cat. No. C306DN3B

Product Description

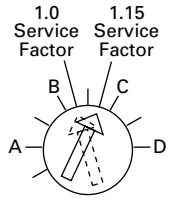
C306 Overload Relays are designed for use with CE or CN non-reversing and reversing contactors. Four sizes are available for overload protection up to 144A.

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 A-106** on **Page A-61**).
- Overload trip indication.
- Shrouded or fingerproof terminals to reduce possibility of electrical shock.
- Meets UL 508 single-phasing requirements.
- UL listed, CSA certified, NEMA compliance and CE mark.

Operation

C306 Overload Relay Setting



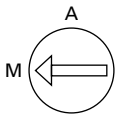
Example of 12.0 FLA setting for heater pack number H2011B showing position for 1.0 or 1.15 service factor motors.

Figure A-34. FLA Dial Adjustment

For motors having a 1.15 service factor, rotate the FLA 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).



Example of setting for manual reset.

Figure A-35. Manual/Automatic Reset

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.

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.

Technical Information

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 (Full Load Amperes) 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.

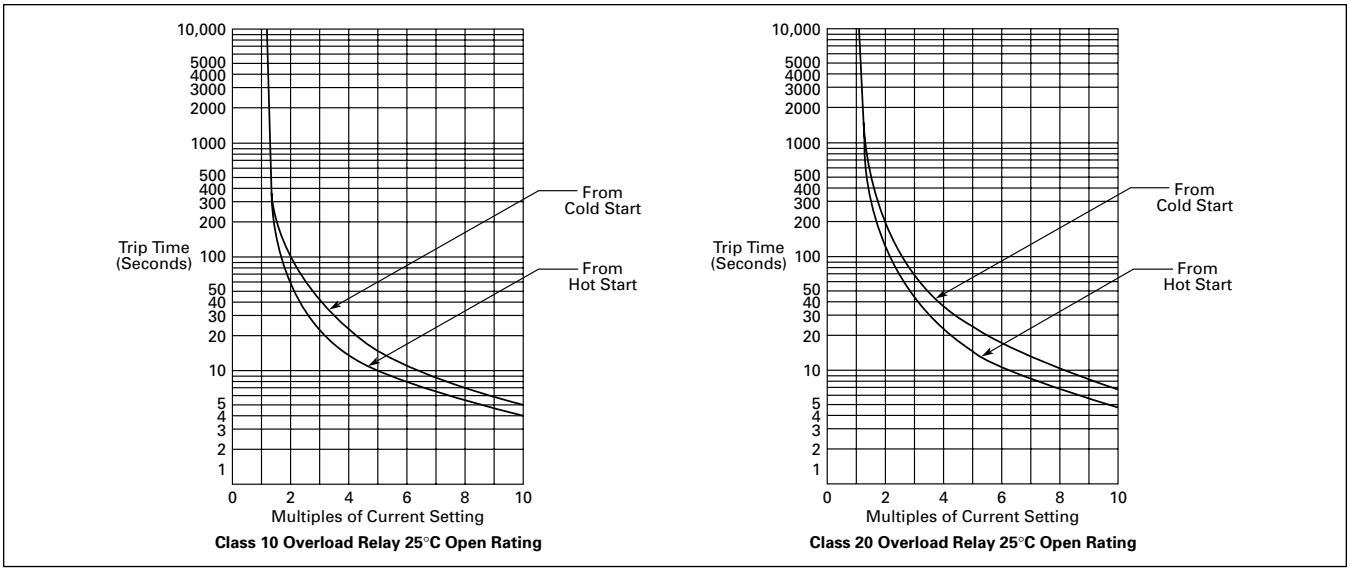


Figure A-36. Class 10 and Class 20 Trip Curves

Technical Data

Table A-102. Wire (75°C) Sizes — AWG or kcmil — NEMA Sizes 00 – 2, IEC A – K — Open

IEC Size	NEMA Size	Cu Only
Power Terminals — Line		
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)		
Catalogue 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		

① Two compartment box lug.

Table A-103. Wire (75°C) Sizes — AWG or kcmil — NEMA Sizes 3 – 8, IEC L – N — Open

IEC Size	NEMA Size	Wire Size
Power Terminals — Line and Load		
L	3	1/0 – 14 Cu/Al
M	—	1/0 – 8 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		

Table A-104. Power Terminal Torque Line and Load Terminals

Terminal	Catalogue Number	Torque in lb-in
32A	**C306DT3B**	20
75A	**C306GT3B**	35 (14 – 10 AWG) 40 (8 AWG) 45 (6 – 4 AWG) 50 (3 – 2 AWG)
105A	**C306KN3** (Socket Head Screw)	120 (3/16) 200 (1/4) 250 (5/16)
144A	**C306NN3** (Socket Head Screw)	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)

Table A-105. 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

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.

Table A-106. Overload Relay UL/CSA Contact Ratings Control Circuit ③

AC Volts	120V	240V	480V	600V
NC Contact B600				
Make and Break Amps	30	15	7.5	6
Break Amps	3	1.5	.75	.6
Continuous Amps	5	5	5	5
NO Contact C600				
Make and Break Amps	15	7.5	3.375	3
Break Amps	1.5	.75	.375	.3
Continuous Amps	2.5	2.5	2.5	2.5

③ DC ratings cover Freedom Series coils only.

A

Factory 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.

Table A-107. Product Selection

Description	Catalogue Number	Price
C306DN3B + C306TB1 C306GN3B + C306TB2B	**C306DT3B** **C306GT3B**	

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 A-64**.

Cat. No. C306TB1

Table A-108. Product Selection

Description	Catalogue Number	Price
For 32A Overload Relay For 75A Overload Relay	**C306TB1** **C306TB2B** ①	

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

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

Table A-109. Product Selection

Description	Min. Order Qty. (Std. Pkg.)	Catalogue Number	Price
Clear cover, no accessibility	50	**C320PC3**	
Gray cover, no accessibility w/Auto only nib	50	**C320PC4**	
Gray cover, no accessibility, w/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**	

Replacement Parts

Heater Pack Replacement

The heater pack series is determined by the 6th character of the Catalogue 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 C3606KAL1-3B to the Series A1 overload relay.

Superseded Series A Heater Pack

Series B Heater Pack

Table A-110. Heater Pack Replacement Requirements

Existing Heater Pack Catalogue Numbers	Replacement Product Required
H2001-3 – H2013-3 **H2001A-3 – H2013A-3**	Lug Adapter Kit C3606KAL1-3B and Series B Heater Pack
H2001B-3 – H2013B-3	Series B Heater Pack
H2014-3 **H2014A-3**	When inventory is exhausted, replace with Lug Adapter Kit C3606KAL1-3B and Series B Heater Pack
H2014B-3	Series B Heater Pack
H2015-3 – H2017-3	When inventory is exhausted, replace with heater pack chosen from **Table A-111**
H2015A-3 – H2017A-3	When inventory is exhausted, replace with Lug Adapter Kit C3606KAL1-3B and Series B Heater Pack
H2015B-3 – H2017B-3	Series B Heater Pack

Table A-111. Heater Pack Ratings

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

Discount Symbol **MC7**

Overload Relay Lug Adapter Kit

Cat. No. C306KAL1-3
Overload Relay
Lug Adapter Kit

These kits are used in conjunction with Catalogue Numbers H2001B – H2014B or H2101B – H2114B heater packs as a means of utilizing these Series B heater packs in Catalogue Numbers C306DN3 and C306GN3 Series AI overload relays. The kit consists of 3 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).

Table A-112. Product Selection — Overload Relay Lug

Description	Catalogue Number	Price
Series AI Overload Relay Lug Adapter Kit	**C306KAL1-3B**	

Superseded 32A Series A
Overload Relay
Cat. No. C306DN3

Superseded 75A Series A
Overload Relay
Cat. No. C306GN3

Overload Relay Replacement — Series A Only

When replacing a Catalogue 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.

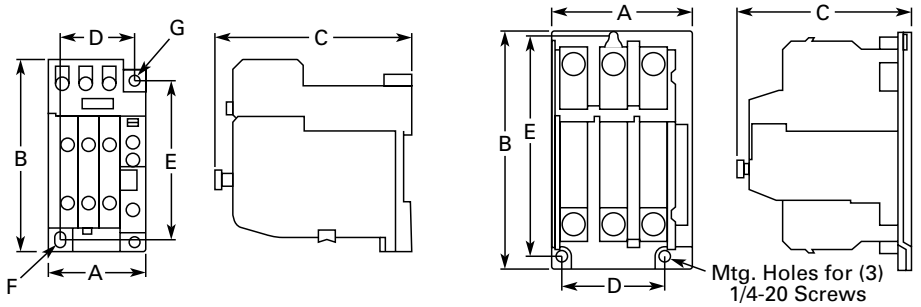
A

Dimensions

Table A-113. Stand-Alone Overload Relays — Approximate Dimensions and Shipping Weight

Ampere Size	Dimensions in Inches (mm)							Ship. Wt. Lbs. (kg)
	Wide A	High B	Deep C	Mounting D	E	F (Slot)	G (Hole)	
32A	1.77 (45.0)	4.13 (104.9)	3.69 (93.7)	1.36 (34.5)	3.74 (95.0)	.18 x .30 (4.6 x 7.6)	.18 (4.6) Dia.	.8 (.4)
75A	2.54 (64.5)	4.69 (119.1)	3.74 (95.0)	2.00 (50.8)	3.45 (87.6)	.22 x .26 (5.6 x 6.6)	.21 (5.3) Dia.	1.4 (.6)
105 & 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)

Stand-Alone Overload Relays



32A and 75A Sizes
C306DT3B and C306GT3B

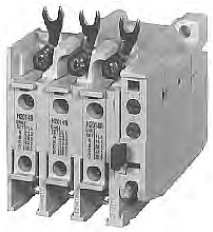
105A and 144A Sizes
C306KN3 and C306NN3

Figure A-37. Approximate Dimensions — Stand-Alone Overload Relays

Discount Symbol **MC7**

A

Product Selection



75A Overload
Cat. No. C306GN3B

75A Overload
Cat. No. C306GT3B

32A Overload
Cat. No. C306DT3B

32A Overload
Cat. No. C306DN3B

Table A-114. C306 Thermal Overload Relays

For Use with Freedom Series Contactors	Maximum Ampere Rating	Number of Poles	Open Type		NEMA 1 Enclosed	
NEMA Size			Catalogue Number	Price	Catalogue Number	Price
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	—	—	—			

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 A-62**.
③ These relays can be panel mounted only.

Table A-115. C306 Thermal Overload Relays

For Stand-Alone Applications	Maximum Ampere Rating	Number of Poles	Open Type	
NEMA Size			Catalogue Number	Price
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	—	—	—	

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.

Heater Pack
H2001B – H2017B

Heater Pack
H2101B – H2117B

Heater Pack
H2018 – H2024

Heater Pack Selection

Heater packs H2001B to H2017B and H2101B to H2117B are to be used only with Series B overload relays Catalogue 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.

Table A-116. Starters with Series B Overload Relays

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

Note: The series of a starter is the last digit of the listed Catalogue Number. EXAMPLE: AN16DN0A**B**.FreedomRelays — Thermal Overload

Technical Data ..... **Page A-61**
Dimensions ..... **Page A-63**
Replacement Parts..... **Pages A-62 – A-63**
Discount Symbol..... **MC7**

Table A-117. Standard Trip — Class 20 Heater Selection

Overload Relay Size	Motor Full Load Ampere Rating — Dial Position A	B	C	D	Catalogue Number (Includes 3 Heater Packs) ①	Price
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	.254	.306	.359	.411	**H2001B-3**	
	.375	.452	.530	.607	**H2002B-3**	
	.560	.676	.791	.907	**H2003B-3**	
	.814	.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**	
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 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 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 with Size 8 Starters Only — Series B 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**	

① Heater packs are shipped 3 to a carton. Catalogue Numbers are for 3 heater packs.

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

Table A-118. Fast Trip — Class 10 Heater Selection

Overload Relay Size	Motor Full Load Ampere Rating — Dial Position A	B	C	D	Catalogue ue Number (Includes 3 Heater Packs) ③	Price
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	.260	.313	.367	.420	**H2101B-3**	
	.384	.464	.543	.623	**H2102B-3**	
	.570	.688	.806	.924	**H2103B-3**	
	.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 NEMA 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 ④	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 with 600/5 CT						
32A ④	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 with 1000/5 CT						
32A ④	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 with 1500/5 CT						
32A ④	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**	

③ Heater packs are shipped 3 to a carton. Catalogue Numbers are for 3 heater packs.

④ Sizes 5 – 8 and IEC P – S use the 32A overload relay with current transformers.

Discount Symbol **MC7**

A

Contents

C396 Electronic Overload Relay

Product Description

The C396 is a self-powered, robust electronic overload designed for integrated use with Freedom NEMA, ***XT*** IEC, and DP contactors. The overload can also be ordered as a stand-alone device that is designed for Panel-Mounting and for use on 35 mm DIN rail. The C396 has an FLA range of 0.1 – 150 Amps with internal CTs, and up to 1500 Amps using external CTs.

Features

- Standard Version: Selectable trip class (5, 10, 20, 30) with Selectable Manual or Auto Reset
- Broad 5:1 FLA range
- Self-Powered Design, will accept AC voltages from 12 – 690V 50/60 Hz
- Ambient Temperature Compensation
- Low Heat Generation
- Phase Loss Protection
- Phase Unbalance Protection
- Electrically isolated 1NO-1NC Contacts (Push-to-Test)
- Trip Status Indicator
- FLA range of 0.1 – 1500 Amps

Standards and Certifications

- UL Listed Components: Stand-alone, starter-mounted devices and remote reset kit.
- CSA Certified Components: Stand-alone, starter-mounted devices and remote reset kit.
- IEC EN 60947-4-1, EN 60947-5-1
- CE
- RoHS

Catalogue Number Selection

Table A-119. C396 Electronic Overload Catalogue Numbering System

C396 A 2 A P05 SEL AX

Device Type
C396 = C396 Electronic Overload Relay

Frame Size
A = 45 mm **B** = 65 mm **C** = 110 mm

Feature Set	Reset Type
2 = Standard	**A** = Auto

Max. Amperes Current Rating
Frame A (45 mm) **P05** = 0.1 – 0.5 **002** = 0.4 – 2.0 **005** = 1 – 5 **008** = 1.6 – 8 **032** = 6.4 – 32 **045** = 9 – 45
Frame B (65 mm) **075** = 15 – 75 **110** = 22 – 110
Frame C (110 mm) **150** = 30 – 150

Class
SEL = Selectable

Adapter Suffix Code ①
See **Tables A-120** to **A-123**.

① Choose appropriate adapter based on application FLA range and contactor's frame size.

Table A-120. Stand-Alone Overload Relay Suffix Code

FLA Range	Frame Size	Suffix
All	N/A	**AX**

Table A-121. *XT* IEC Adapter Suffix Code

Contactor Frame Size	FLA Range (Amps)	Suffix
IEC Frame B	0.1 – 0.5 0.4 – 2.0 1 – 5 1.6 – 8 6.4 – 32	**XB**
IEC Frame C	0.1 – 0.5 0.4 – 2.0 1 – 5 1.6 – 8 6.4 – 32	**XC**
IEC Frame D	6.4 – 32 9 – 45 15 – 75	**XD**
IEC Frame F – G	22 – 110	**XF**

Table A-122. Freedom NEMA Adapter Suffix Code

FLA Range (Amps)	Contactor Frame Size	Suffix
0.1 – 0.5	NEMA Size 00 NEMA Size 0 NEMA Size 1	**FD**
0.4 – 2.0	NEMA Size 00 NEMA Size 0 NEMA Size 1	**FD**
1 – 5	NEMA Size 00 NEMA Size 0 NEMA Size 1	**F00** **F0** **F1**
1.6 – 8	NEMA Size 00 NEMA Size 0 NEMA Size 1 NEMA Size 2	**F00** **F0** **F1** **F2**
6.4 – 32	NEMA Size 0 NEMA Size 1	**FB** **FD**
9 – 45	NEMA Size 2	**FG**
22 – 110	NEMA Size 3	**FK**

Table A-123. DP Contactor Adapter Suffix Code

FLA Range (Amps)	Contactor Frame Size	Suffix
0.1 – 0.5 0.4 – 2.0 1 – 5	15, 25, 30A	**DC**
1.6 – 8	15, 25, 30, 40A	**DE**
6.4 – 32	15, 25, 30, 40, 50A	**DF**
9 – 45	40, 50A	**DF**
15 – 75	60, 75A	**DG**

A

Product Selection

Cat. No.
C396A2A045SELAX

Cat. No.
C396B2A110SELFK

Cat. No.
C396C2A150SELAX

Cat. No.
C396C2A150SELAX +
C396CBAR

Cat. No.
C396C2A150SELAX +
C396CBAR + C396CLUG

Table A-124. C396 Stand-Alone Overload Relay

FLA Range (Amps)	Description	Catalogue Number	Price
45 mm Overload Frame Size ①			
0.1 – 0.5	—	**C396A2AP05SELAX**	
0.4 – 2.0		**C396A2A002SELAX**	
1 – 5		**C396A2A005SELAX**	
1.6 – 8		**C396A2A008SELAX**	
6.4 – 32		**C396A2A032SELAX**	
9 – 45		**C396A2A045SELAX**	
65 mm Overload Frame Size ①			
15 – 75	—	**C396B2A075SELAX**	
22 – 110		**C396B2A110SELAX**	
110 mm Overload Frame Size ②			
30 – 150	—	**C396C2A150SELAX**	

① Overload comes with a panel/DIN rail mounting adapter assembled. No separate mounting adapter accessory offered.

② Panel mount only! Overload comes with integrated pass-through holes for power wires. Bus Bar Kit (C396CBAR or C396CBARXT, see **Table A-129**) and Lug Kit (C396CLUG) must be purchased separately if customer prefers not to use pass-through capability.

Table A-125. Current Transformer Kits for Use with Stand-Alone Overload Relay C396A2A005SELAX ③

FLA Range (Amps)	Description	Catalogue Number	Price
60 – 300	300: 5 Panel-mount CT Kit with integrated, pass-through holes. Kit includes CT, bus bars, lugs and hardware to mount C396A2A005SELAX (*not* included).	**C396CTK300**	
120 – 600	600: 5 Panel-mount CT Kit with integrated, pass-through holes. Kit includes CT, bus bars, lugs and hardware to mount C396A2A005SELAX (*not* included).	**C396CTK600**	
200 – 1000	1000: 5 Panel-mount CT Kit with integrated, pass-through holes. Kit includes CT, bus bars, lugs and hardware to mount C396A2A005SELAX (*not* included).	**C396CTK1000**	
300 – 1500	1500: 5 Panel-mount CT Kit with integrated, pass-through holes. Kit includes CT, bus bars, lugs and hardware to mount C396A2A005SELAX (*not* included).	**C396CTK1500**	

③ C396A2A005SELAX is *not* included in the current transformer kits. This item must be ordered separately.

Table A-126. C396 Overload for Integrated Use with *XT* IEC Contactors

FLA Range (Amps)	*XT* IEC Contactor Frame Size / Width	Catalogue Number	Price
45 mm Overload Frame Size			
0.1 – 0.5	B / 45 mm	**C396A2AP05SELXB**	
0.4 – 2.0	B / 45 mm	**C396A2A002SELXB**	
1 – 5	B / 45 mm	**C396A2A005SELXB**	
1.6 – 8	B / 45 mm	**C396A2A008SELXB**	
6.4 – 32	B / 45 mm	**C396A2A032SELXB**	
0.1 – 0.5	C / 45 mm	**C396A2AP05SELXC**	
0.4 – 2.0	C / 45 mm	**C396A2A002SELXC**	
1 – 5	C / 45 mm	**C396A2A005SELXC**	
1.6 – 8	C / 45 mm	**C396A2A008SELXC**	
6.4 – 32	C / 45 mm	**C396A2A032SELXC**	
6.4 – 32	D / 55 mm	**C396A2A032SELXD**	
9 – 45	D / 55 mm	**C396A2A045SELXD**	
65 mm Overload Frame Size			
15 – 75	D / 55 mm	**C396B2A075SELXD**	
22 – 110	F – G / 90 mm	**C396B2A110SELXF**	
110 mm Overload Frame Size — Stand-Alone or Direct to *XT* Contactor with Indicated Kit			
30 – 150	G / 90 mm	**C396C2A150SELAX** ④	
110 mm ***XT*** Bus Bar Kit		**C396CBARXT**	

④ Catalogue Number shown is for Stand-Alone C396 Overload Relay. For direct connection to ***XT*** Frame G contactor, order additional ***XT*** Bus Bar Kit, C396CBARXT, shown in **Tables A-126** and **A-129**. If load side lugs are required, order C396CLUG (set of 3).

Technical Data . . . . . **Pages A-70**
Dimensions . . . . . **Page A-71**
Accessories . . . . . **Page A-69**
Discount Symbol **MC7**

Table A-127. C396 Overload for Integrated Use with Freedom NEMA Contactors

FLA Range (Amps)	NEMA Contactor Frame Size	Description	Catalogue Number	Price
45 mm Overload Frame Size				
0.1 – 0.5 0.4 – 2.0	00, 0, 1 00, 0, 1	—	**C396A2AP05SELFD** **C396A2A002SELFD**	
1 – 5	00 0 1	—	**C396A2A005SELF00** **C396A2A005SELF0** **C396A2A005SELF1**	
1.6 – 8	00 0 1 2	—	**C396A2A008SELF00** **C396A2A008SELF0** **C396A2A008SELF1** **C396A2A008SELF2**	
6.4 – 32	0 1	—	**C396A2A032SELFB** **C396A2A032SELFD**	
9 – 45	2	—	**C396A2A045SELFG**	
65 mm Overload Frame Size				
22 – 110	3	—	**C396B2A110SELFK**	
110 mm Overload Frame Size — Stand-Alone ①				
30 – 150	4	—	**C396C2A150SELAX**	

Note: For NEMA Sizes 5 – 8, refer to **Table A-125**, Current Transformer Kits.

① Panel mount only! Overload comes with integrated pass-through holes for power wires. Bus Bar Kit (C396CBAR or C396CBARXT, see **Table A-129**) and Lug Kit (C396CLUG) must be purchased separately if customer prefers not to use pass-through capability.

Cat. No.
C396A2A008SELDC

Table A-128. C396 Overload for Integrated Use with DP Contactors by Feature Set

FLA Range (Amps)	DP Contactor Rating	Catalogue Number	Price
45 mm Overload Frame Size			
0.1 – 0.5 0.4 – 2.0 1 – 5 1.6 – 8 6.4 – 32 9 – 45	15, 25, 30 15, 25, 30 15, 25, 30 15, 25, 30, 40 15, 25, 30, 40, 50 40, 50	**C396A2AP05SELDC** **C396A2A002SELDC** **C396A2A005SELDC** **C396A2A008SELDE** **C396A2A032SELDF** **C396A2A045SELDF**	
65 mm Overload Frame Size			
15 – 75	60, 75	**C396B2A075SELDG**	

Accessories

Table A-129. C396 Electronic Overload Accessories

	Description	Catalogue Number	Price
	Reset Bar Kit assembles to the top of the overload to increase reset area.	**C396ARST**	
	110 mm Lug Kit ②	**C396CLUG**	
	110 mm Bus Bar Kit ③	**C396CBAR**	
	110 mm ***XT*** Bus Bar Kit ③	**C396CBARXT**	
 ***C396ARST + C396RR _ _ _ _ _ Assembled to a C396 Overload Relay***	Remote Reset 24V DC ⑤	**C396RR024DC**	
	Remote Reset 24V AC ⑤	**C396RR024AC**	
	Remote Reset 120V AC ⑤	**C396RR120AC**	
	Remote Reset 240V AC ⑤	**C396RR240AC**	
	Mechanical Reset with E22 Flush Pushbutton and Mechanical Push Rod ④ Plastic Black Bezel Chrome Bezel	 **E22PB6N29L** **E22P6N29L**	
	Mechanical Push Rod — for external mechanical reset ⑥	**E22MRL**	
	Mounting Hole Adapter Kit ⑦	**E22ARK**	

② Set of 3 lugs and hardware, 2 sets are required to wire line and load sides. Bus Bar Kit (C396CBAR or C396CBARXT) is needed to use the Lug Kit.

③ Bus bar kits do not include lugs. Order C396CLUG if lugs are needed (3 lugs per kit).

④ The operator button is blue with the letters "RESET" printed in white. The push rod is 4.72" long and can be cut to the desired length. This kit can be used alone or in conjunction with the C396 Reset Bar Kit, C396ARST, to increase the size of the reset area on the overload.

⑤ Reset Bar Kit (C396ARST) required to use the Remote Reset modules. Note that all Freedom Starters come with Reset Bars.

⑥ Must be cut to proper length — uncut 4.72 inches (119.9 mm) long.

⑦ Enables a 22.5 mm operator to be mounted in a 30.5 mm holes — 1/16 to 7/32 inch (1.6 to 5.6 mm) panel thickness.

Dimensions ..... **Page A-71**

A

Technical Data and Specifications

Table A-130. Overload Relay Specifications

General Description	C396_2_
	Standard
Protection	
Thermal	1.05 x FLA: Does not trip 1.25 x FLA: Overload trip
Phase Loss	1 Phase = 0, Trip time = 3s (Hot Status)
Phase Imbalance	Max - Min / Max > 40%, Trip time = 3s (Hot Status)
Inrush Current	> 8 x Max FLA, Trip time is 0.3s (Cold Status)
Trip Class	
Class 5, 10, 20, 30	Selectable
Reset	
M / M-O A / A-O	Manual / Manual + Stop Auto / Auto + Stop Auto Reset Time = 165s
Indications	
Test Indicator	Yellow
Trip Indicator	Yellow
PCBA	
Power Sensing	3 phase
Instant Reset by Power ON	CPU reset by Power ON after 2 – 3s
Thermal memory	< 3 min.
Cold and Hot Trip Curves	Power ON > 20 min. is Hot Status
Power Consumption	< 300 mW
Options	
Safety Cover	Covers FLA dial, DIP switches
Remote Reset	24V DC, 24V AC, 120V AC, 240V AC

Table A-130. Overload Relay Specifications (Continued)

General Description	C396_2_
	Standard
Climate Considerations	
Ambient Temperature (Operating)	-25° to 65°C (-13° to 149°F) inside enclosure
Ambient Temperature (Storage / Transportation)	-40° to 80°C (-40° to 176°F)
Humidity	UL991 (H3): 20 – 95% non-condensing
Altitude (Operating)	NEMA ICS1: 2000 meters max above sea level
Pollution (Operating — External)	Pollution degree 3
Mechanical Shock Resistance (IEC/EN 68-2-17)	15g
Vibration (Lloyd's Register of Shipping, Vibration Test 2)	6g
Temperature Compensation	Continuous
Voltages	
Control Voltage	12 – 690V AC, 50/60 Hz
Insulation Voltage (Ui) — Main Circuit	1000V AC
Insulation Voltage (Ui) — Control Circuit	690V AC
Impulse Withstand Voltage (Uimp) VAC	6000
FLA Range	
45 mm Frame: C396A_	0.1 – 45A
65 mm Frame: C396B_	15 – 110A
110 mm Frame: C396C_	30 – 150A
Safety	
Degree of Protection	IP20 (Stand-Alone Version Only)
Capacity	
Control Terminal Capacity	18 – 14 AWG
Control Terminal Tightening Torque in Nm (lb-in)	0.79 (7)
Load Terminal Capacity	
45 mm Frame: C396A_	14 – 6 AWG
65 mm Frame: C396B_	10 – 1 AWG
110 mm Frame: C396C_	6 AWG – 250 mcm
Load Terminal Tightening Torque in Nm (lb-in)	
45 mm Frame: C396A_	3.2 (28)
65 mm Frame: C396B_	9.0 (80)
110 mm Frame: C396C_	22.6 (200)

Dimensions . . . . . **Page A-71**

A

Dimensions

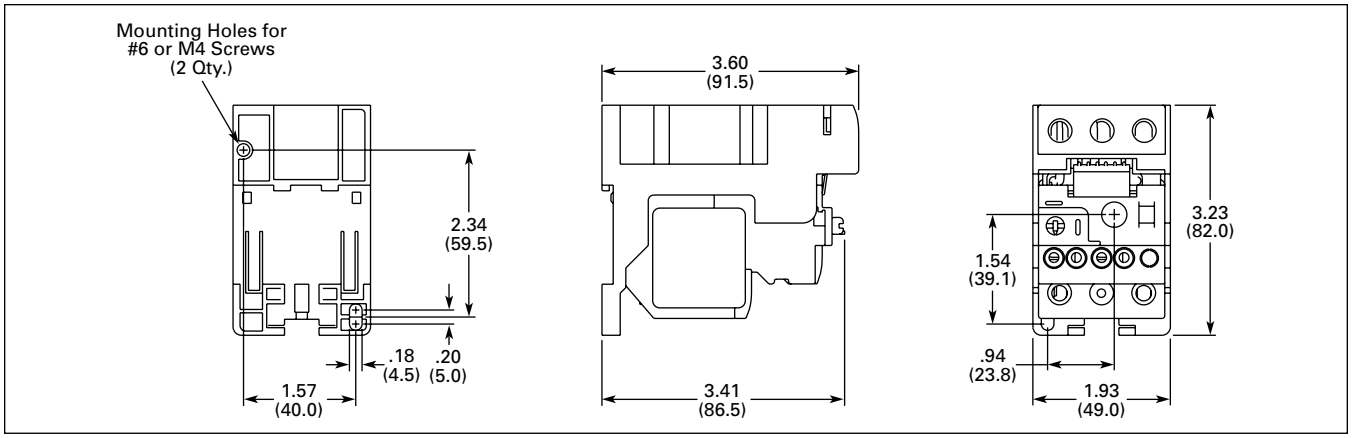


Figure A-38. 45 mm Stand-Alone C396 Electronic Overload Relay

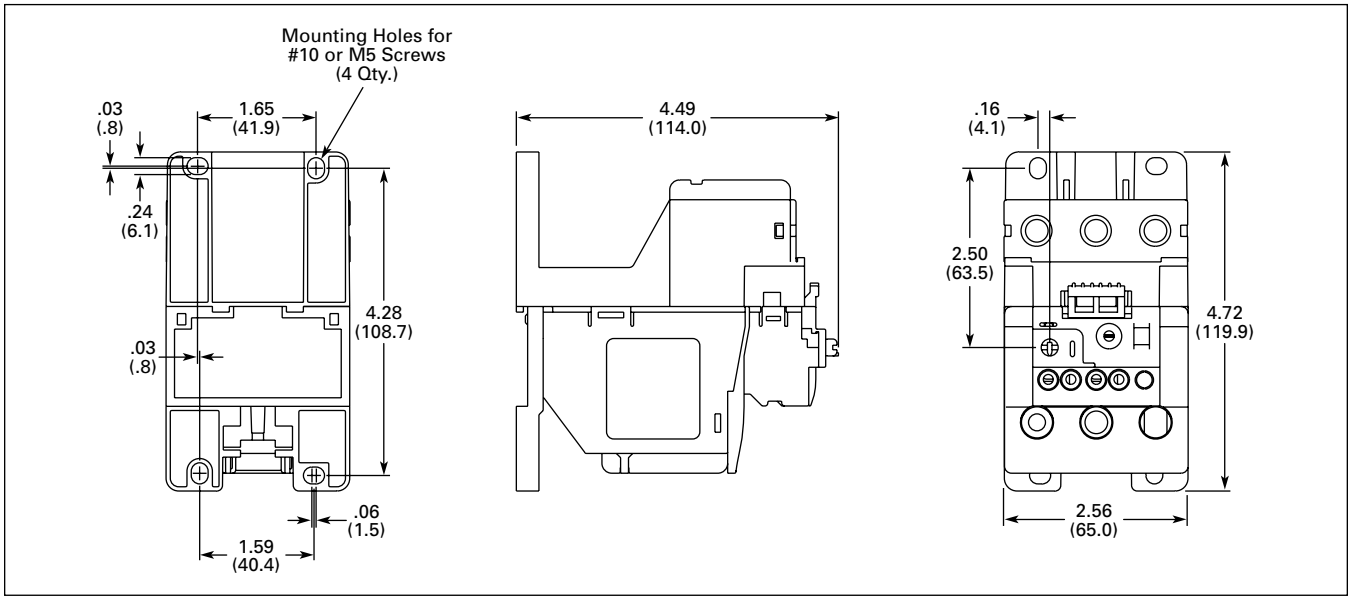


Figure A-39. 65 mm Stand-Alone C396 Electronic Overload Relay

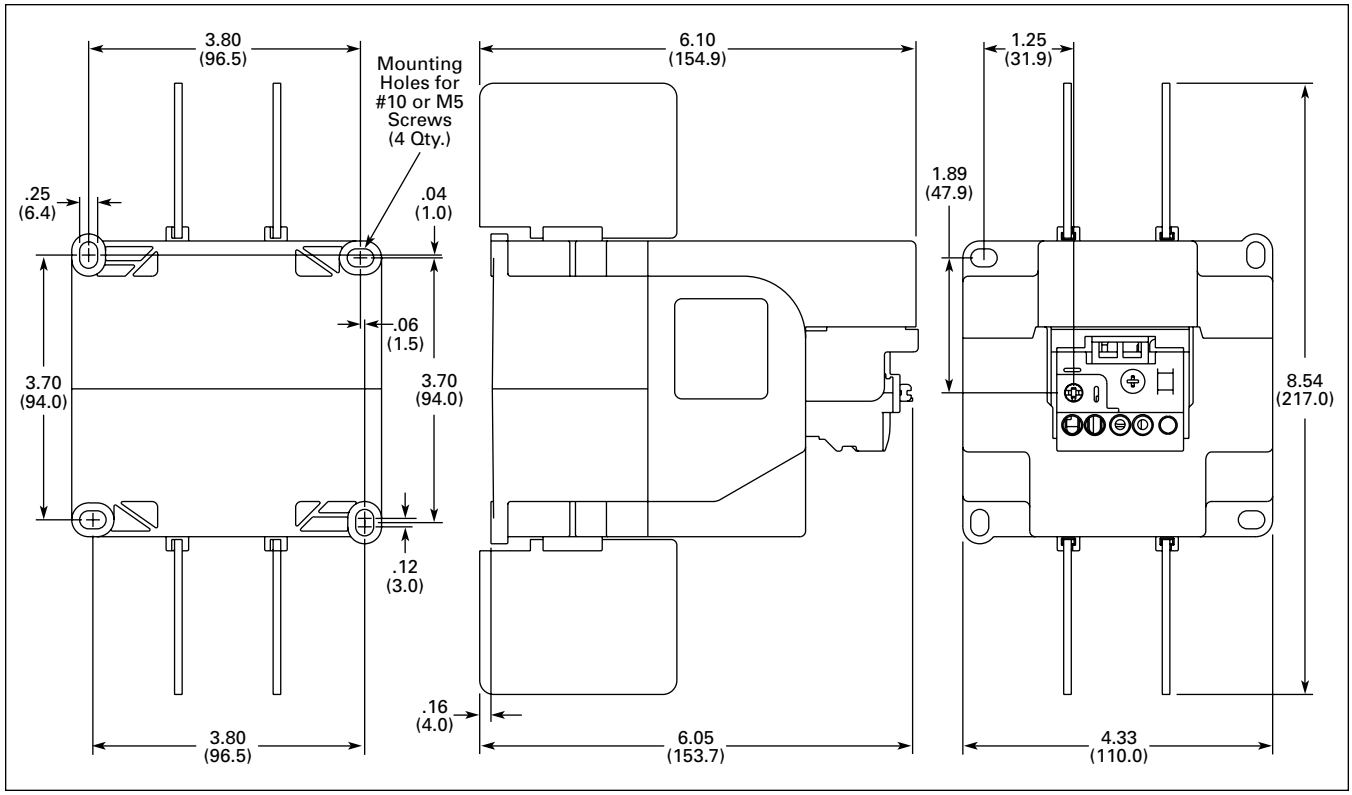


Figure A-40. 110 mm Stand-Alone C396 Electronic Overload Relay

Contents

Size 1 Contactor

Product Description Sizes 00 – 4

Application

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.

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

A201 Magnetic Contactors from Eaton's electrical business 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 A-91**.

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.

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

Technical Data . . . . . **Pages A-87 – A-90**

A

Size 5 Contactor

Product Description — Sizes 5 – 9

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

These Cutler-Hammer® 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

Cutler-Hammer 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 drop-out 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

Cutler-Hammer 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.

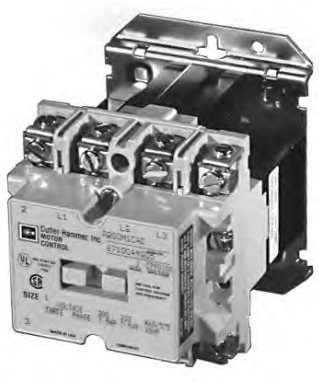
Sizes 7 and 8 accommodate three Type L-63 auxiliary contacts which are easily converted from normally-open to normally-closed, providing auxiliary circuit flexibility. Size 9 uses L-64 auxiliary contacts with a total of four circuits.

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.

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

Technical Data . . . . . **Pages A-87 – A-90**



A201 Size 1 Contactor

Product Selection — Non-reversing, Sizes 00 – 9

When Ordering Specify

Order by Catalogue Number from **Table A-131**, plus Suffix for coil voltages, verifying usage of appropriate sizes.

Table A-131. Front Connected Contactors Selection

Size	Amps	Max. UL Horsepower						2 Poles — Open		3 Poles — Open		4 Poles — Open		5 Poles — Open	
		1-Phase		3-Phase				Catalogue Number	Price	Catalogue Number	Price	Catalogue Number	Price	Catalogue Number	Price
		115V	230V	208V	240V	480V	600V								
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		—		—	

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

Table A-132. Rear Connected Contactors Selection

120 Volt Rectified Coil/Open Only		
Size	**Catalogue Number**	**Price**
7 8 9	**A201K7CJZ1Z4** **A201K8CJZ1Z4** **A201K9CJZ1Z4**	

Table A-133. Coils for Sizes 00 – 6

Coil Volts and Hz	Code Suffix
120/60 or 110/50	**A**
200 – 208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**

Table A-134. Coils for Sizes 7, 8 and 9 ④

Coil Volts and Hz	Code Suffix
110 – 120/50 or 60	**J**
220 – 240/50 or 60	**K**
440 – 480/50 or 60	**U**
600/60	**E**

④ For Size 9, only available coil voltage is 120V.

Modification Kits, Accessories . . . . . **Pages A-91 – A-93**
Factory Modifications . . . . **Page A-91**
Other Coil Voltages . . . . . **Page A-90**
Technical Data . . . . . **Pages A-87 – A-90**
Dimensions . . . . . **Page A-77**
Discount Symbol **MC29**

Size 1 Horizontal Reversing Contactor

Product Selection — Reversing, Sizes 00 – 9

When Ordering Specify

Order by Catalogue Number from **Table A-135**, plus Suffix for coil voltages, verifying usage of appropriate sizes.

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

Table A-135. Reversing Contactors Selection

Size	Amps	Max. UL Horsepower						Horizontal Design		Vertical Design	
		1-Phase		3-Phase				Catalogue Number	Price	Catalogue Number	Price
		115V	230V	208V	240V	480V	600 V				
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	

① Sizes 7 – 9 use rectifier with DC coil.
② For Size 9, only available coil voltage is 120V.

Table A-136. Coils for Sizes 00 – 6

Coil Volts and Hz	Code Suffix
120/60 or 110/50	**A**
200 – 208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**

Table A-137. Coils for Sizes 7, 8 and 9 ③

Coil Volts and Hz	Code Suffix
110 – 120/50 or 60	**J**
220 – 240/50 or 60	**K**
440 – 480/50 or 60	**U**
600/60	**E**

③ For Size 9, only available coil voltage is 120V.

Modification Kits, Accessories . . . . . **Pages A-91 – A-93**
Factory Modifications . . . . . **Page A-91**
Oth er Coil Voltages . . . . . **Page A-90**
Technical Data . . . . . **Pages A-87 – A-90**
Dimensions . . . . . **Page A-78**
Discount Symbol **MC29**

Dimensions and Shipping Weights

Not to be used for construction purposes unless approved.

Table A-138. Non-reversing Open Contactors Dimensions

NEMA Size	No. of Poles	Fig.	Mounting Screws		Approximate Dimensions in Inches (mm)								Weight, Lbs. (kg)
			No.	Size	A	B	C	D	E	F	G	H	
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)	.23 (5.8)	—	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)	.23 (5.8)	—	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)	.23 (5.8)	—	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)	.23 (5.8)	—	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)	.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)	.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)	—	.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)	—	.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)	.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)	.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)

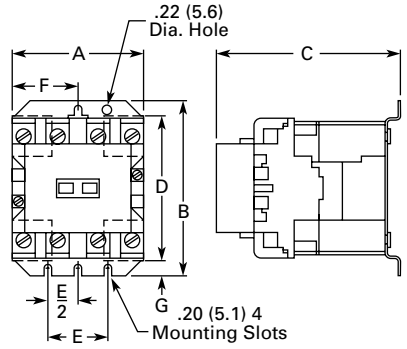


Figure A
Sizes 00 – 4 A201 Contactors

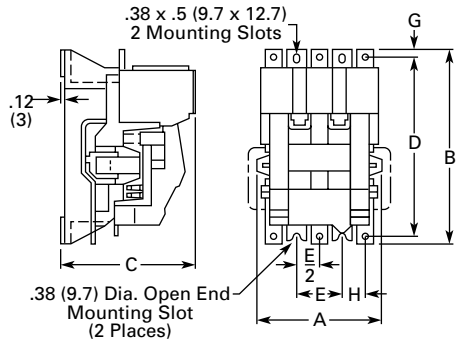


Figure B
Size 5

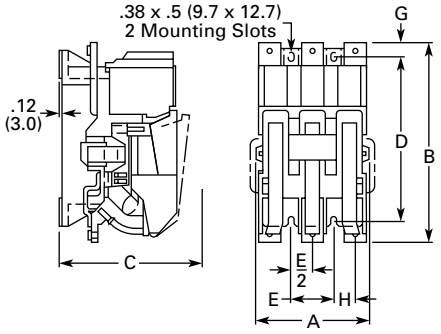


Figure C
Size 6

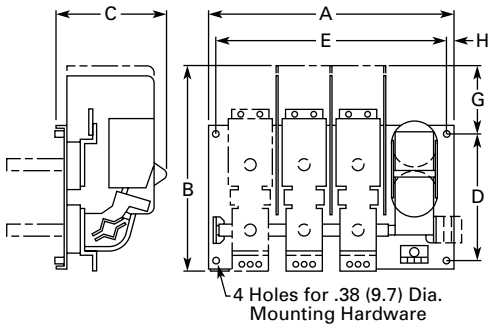


Figure D
Sizes 7 – 9

Figure A-41. Non-reversing Open Contactors Dimensions

A

Not to be used for construction purposes unless approved.

Table A-139. Reversing Open Contactors Dimensions

NEMA Size	No. of Poles	Fig.	Mounting Screws		Approximate Dimensions in Inches (mm)								Weight, Lbs. (kg)
			No.	Size	A	B	C	D	E	F	G	H	
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)	.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)	.75 (19.1)	.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)	.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)	.75 (19.1)	.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)	.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)	.94 (23.9)	.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)	.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 (26.0)
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)	.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)	.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)	.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)

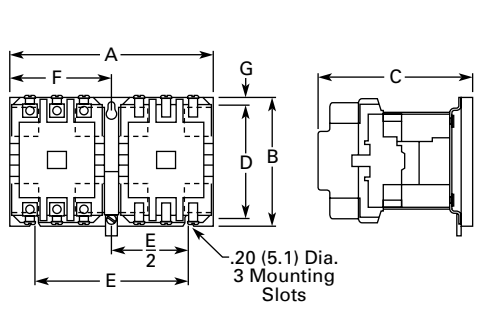


Figure A
Sizes 00 – 4 Horizontal

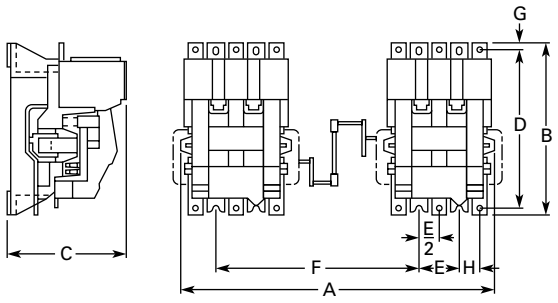


Figure C
Sizes 5, 6 Horizontal

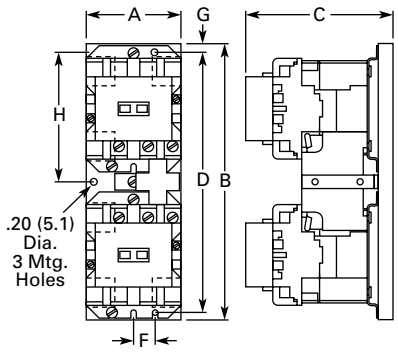


Figure B
Sizes 00 – 4 Vertical

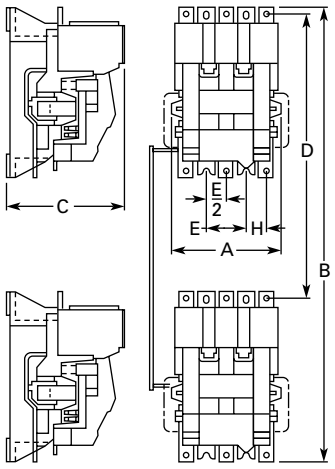


Figure D
Sizes 5, 6 Vertical

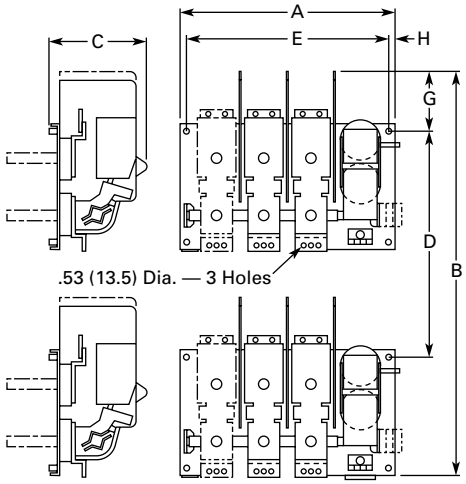


Figure E
Sizes 7 – 9 Vertical

Figure A-42. Reversing Open Contactors Dimensions

Contents

Size 1 Starter

Product Description — Sizes 00 – 4

Application

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.

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

These Cutler-Hammer® Starters from Eaton's electrical business use Class A201 contactors as described on **Page A-73**. Contactor features are enhanced through the ability to provide positive motor protection in the form of several types of overload relays.

See **Pages A-99** – **A-107**.

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.

Class A200 starters are available as UL listed or recognized components, as well as with CSA certification.

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 Cutler-Hammer 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 July 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.

Size 5 Starter

Product Description — Sizes 5 – 9

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 Cutler-Hammer starters use Class A201 contactors as described on **Page A-74**. 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.

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

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.

Technical Data ..... **Pages A-87** – **A-90**

A

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 A-83**.

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.

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

Technical Data . . . . . **Pages A-87 – A-90**

Size 3 Starter

Product Selection — Non-reversing, Sizes 00 – 9

When Ordering Specify

Order by Catalogue Number from **Table A-140** or **Table A-141**, plus Suffix for coil voltages, verifying usage of appropriate sizes.

Heaters

Enter heaters as separate item by listing Catalogue Number from tables, **Pages A-106 – A-107**, as required per starter.

Table A-140. Non-reversing Starters Selection — 2 Poles ②

Size	Amps	Max. UL Horsepower						Open	
		1-Phase		3-Phase				Catalogue Number ①	Price
		115V	230V	208V	240V	480V	600V		
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**	

① For ambient compensated overload relay with auto-reset, add Suffix **D.**
② Single-phase with one single-pole overload relay.

Table A-141. Non-reversing Starters Selection — 3 Poles

Size	Amps	Max. UL Horsepower						Open	
		1-Phase		3-Phase				Catalogue Number ③	Price
		115V	230V	208V	240V	480V	600V		
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_**	
Sizes 7 – 9									
7 ④	810	—	—	200	300	600	600	**A200M7C_**	
8 ④	1215	—	—	400	450	900	900	**A200M8C_**	
9 ④	2250	—	—	—	800	1600	—	**A200M9C_** ⑤	

③ For ambient compensated overload relay with auto-reset, add Suffix **D.**
④ Sizes 7 – 9 use rectifier with DC coil.
⑤ For Size 9, only available coil voltage is 120V.

Table A-142. Coils for Sizes 00 – 6

Coil Volts and Hz	Code Suffix
120/60 or 110/50	**AC**
200 – 208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**

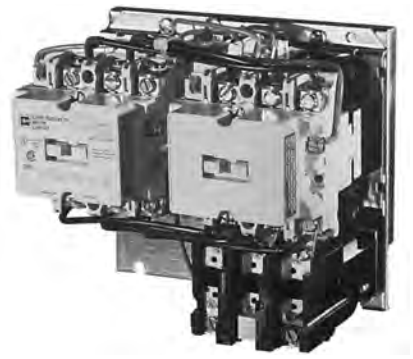
Table A-143. Coils for Sizes 7, 8 and 9 ⑥

Coil Volts and Hz	Code Suffix
110 – 120/50 or 60	**J**
220 – 240/50 or 60	**W**
440 – 480/50 or 60	**X**
600/60	**E**

⑥ For Size 9, only available coil voltage is 120V.

Technical Data . . . . . **Pages A-87 – A-90**
Heaters . . . . . **Pages A-106 – A-107**
Other Coil Voltages . . . . . **Page A-90**
Factory Modifications . . . . . **Page A-91**
Modification Kits, Accessories . . . . . **Pages A-91 – A-93**
Dimensions . . . . . **Page A-84**
Discount Symbol **MC29**

A



Size 1 Horizontal Reversing Starter

Product Selection — Reversing, Sizes 00 – 9

When Ordering Specify

Order by Catalogue Number from **Table A-144**, plus Suffix for coil voltages, verifying usage of appropriate sizes.

Heaters

Enter heaters as separate item by listing Catalogue Number from tables, **Pages A-106 – A-107**, as required per starter.

Table A-144. Reversing Starters Selection

Size	Amps	Max. UL Horsepower						Horizontal Design		Vertical Design	
		1-Phase		3-Phase				Catalogue Number ①	Price	Catalogue Number ①	Price
		115V	230V	208V	240V	480V	600V				
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	

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.

Table A-145. Coils for Sizes 00 – 6

Coil Volts and Hz	Code Suffix
120/60 or 110/50	**AC**
200 – 208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**

Table A-146. Coils for Sizes 7, 8 and 9 ④

Coil Volts and Hz	Code Suffix
110 – 120/50 or 60	**J**
220 – 240/50 or 60	**W**
440 – 480/50 or 60	**X**
600/60	**E**

④ For Size 9, only available coil voltage is 120V.

Technical Data . . . . . **Pages A-87 – A-90**
Heaters . . . . . **Pages A-106 – A-107**
Other Coil Voltages . . . . . **Page A-90**
Factory Modifications. . . . . **Page A-91**
Modification Kits, Accessories . . . . . **Pages A-91 – A-93**
Dimensions . . . . . **Page A-85**
Discount Symbol **MC29**

Product Selection

For Separate Two-Winding Motors

Heaters

Enter heaters as separate item by listing Catalogue Number from table, **Pages A-106 – A-107**, as required per starter.

Table A-147. Three-Phase, Non-reversing, Reversing 60 Hz Starters — Heater Selection

NEMA	Amps	Constant Horsepower				Constant or Variable Torque				3 Poles — Open	
		208V	240V	480V	600V	208V	240V	480V	600V	Catalogue Number ①	Price
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_**	

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

Table A-149. Coils for Sizes 0 – 6

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

For Single-Winding Motors

Table A-148. Product Selection — Sizes 0 – 6

NEMA	Amps	208V	240V	480V	600V	3 Poles — Open	
						Catalogue Number ②	Price
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_**	

② For ambient compensated overload relay with auto-reset, add Suffix **D.**

Table A-150. Coils for Sizes 0 – 6

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

Technical Data..... **Pages A-87 – A-90**
Heaters ..... **Pages A-106 – A-107**
Other Coil Voltages..... **Page A-90**
Factory Modifications .... **Page A-91**
Modification Kits,
Accessories..... **Pages A-91 – A-93**
Dimensions..... **Page A-86**
Discount Symbol..... **MC29**

Dimensions and Shipping Weights

Not to be used for construction purposes unless approved.

Table A-151. Open Non-reversing Starters Dimensions

A

NEMA Size	No. of Poles	Fig.	Mounting Screws		Dimensions in Inches (mm)												Weight, Lbs. (kg)
			No.	Size	A	B	C	D	E	F	G	H	J	K	L	M	
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)	.23 (5.8)	—	.39 (9.9)	.59 (15.0)	4.48 (113.8)	.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)	.23 (5.8)	—	.41 (10.4)	.77 (19.6)	4.53 (115.1)	.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)	.38 (9.7)	—	.55 (14.0)	.80 (20.3)	6.36 (161.5)	.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)	.33 (8.4)	.33 (8.4)	7.00 (177.8)	.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)	.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 Refer to factory.

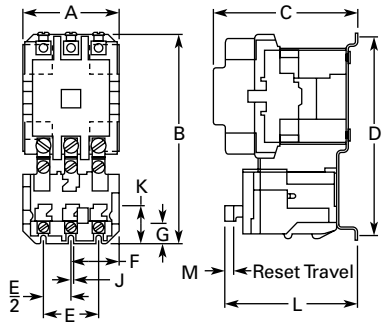


Figure A, Sizes 00 – 4

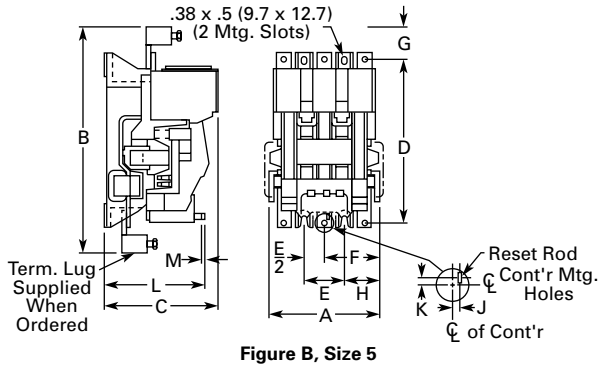


Figure B, Size 5

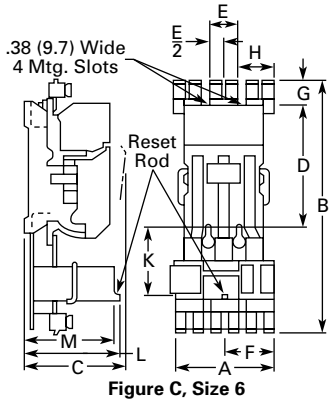


Figure C, Size 6

Figure A-43. Open Non-reversing Starters Dimensions

Not to be used for construction purposes unless approved.

Table A-152. Open Reversing Starters Dimensions

NEMA Size	Number of Poles	Fig.	Mounting Screws		Dimensions in Inches (mm)												Weight, Lbs. (kg)
			No.	Size	A	B	C	D	E	F	G	J	K	L	M	N	
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)	.25 (6.4)	2.3 (58.4)	.59 (15.0)	4.92 (125.0)	.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)	.25 (6.4)	.39 (9.9)	.59 (15.0)	4.92 (125.0)	.27 (6.9)	4.52 (114.8)	9.8 (4.4)
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)	.25 (6.4)	2.31 (58.7)	.77 (19.6)	4.97 (126.2)	.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)	.25 (6.4)	.39 (9.9)	.77 (19.6)	4.97 (126.2)	.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)	.44 (11.2)	3.11 (79.0)	.80 (20.3)	6.86 (174.2)	.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)	.44 (11.2)	.55 (14.0)	.80 (20.3)	6.86 (174.2)	.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																
8	①																
9	①																

① Refer to factory.

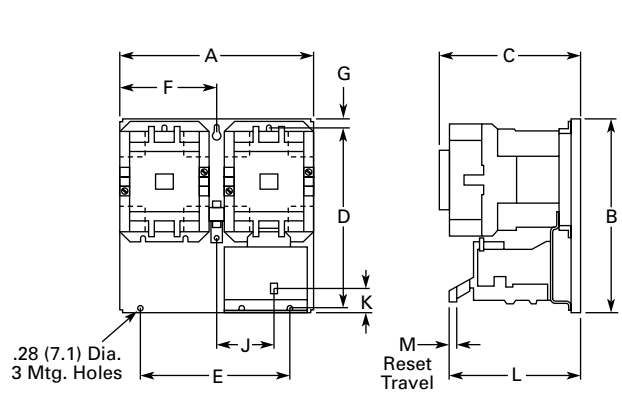


Figure A
Sizes 00 – 4 Horizontal

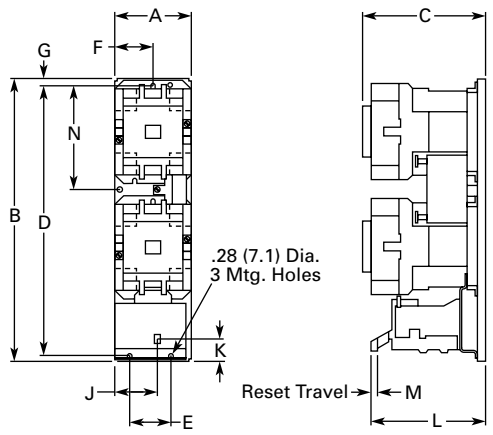


Figure B
Sizes 00 – 4 Vertical

Figure A-44. Open Reversing Starters Dimensions

A

Not to be used for construction purposes unless approved.

Table A-153. Open Multi-Speed Starters Dimensions

NEMA Size	Number of Poles	Fig.	Mounting Screws		Dimensions in Inches (mm)														Weight, Lbs. (kg)
			No.	Size	A	B	C	D	E	F	G	J	K	L	M	N	P	R	
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)	.25 (6.4)	2.30 (58.4)	.33 (8.4)	4.92 (125.0)	.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)	.25 (6.4)	2.30 (58.4)	.48 (12.2)	4.92 (125.0)	.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)	.25 (6.4)	2.69 (68.3)	.69 (17.5)	4.97 (126.2)	.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)	.25 (6.4)	2.69 (68.3)	.69 (17.5)	4.97 (126.2)	.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)	.44 (11.2)	3.11 (79.0)	.80 (20.3)	6.86 (174.2)	.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)	.44 (11.2)	3.11 (79.0)	.80 (20.3)	6.86 (174.2)	.27 (6.9)	6.44 (163.6)	—	4.00 (101.6)	33.5 (15.2)
5										①									
6										①									

① Refer to factory.

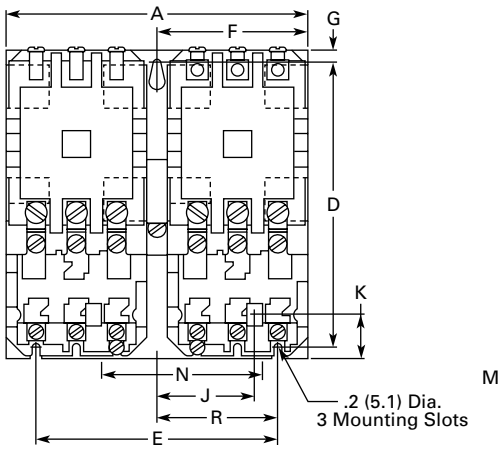


Figure A, Sizes 00 – 4

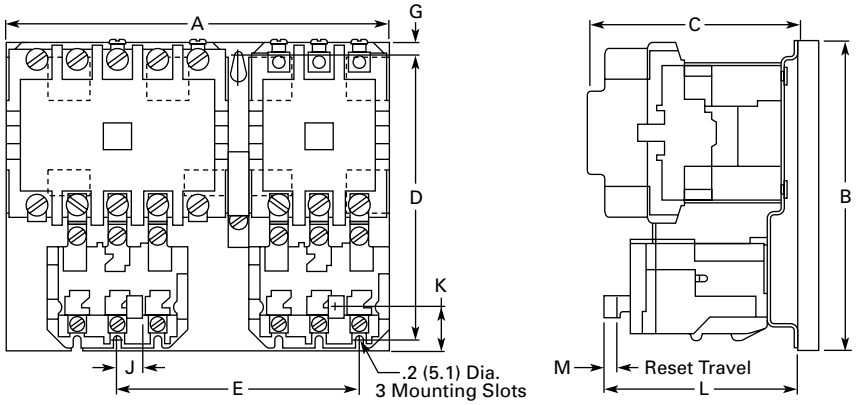


Figure B, Size 2

Note: 3-Pole x 3-Pole Devices Are for Wye-Wye Two-Winding Motors Only

Figure A-45. Open Multi-Speed Starters Dimensions

Electrical Characteristics

Table A-154. 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, 2-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, 3-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, 2-Pole						
120V	—	.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, 3-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

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 Eaton.

Table A-155. Electrical Characteristics — 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 ④					
Single-Phase, 2-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, 3-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 ⑤					
Single-Phase, 2-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, 3-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

③ For ratings refer to Eaton.

④ Resistive loads having inrush currents not exceeding 1.5 times continuous rating.

⑤ 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 Eaton.

DC Power Pole Ratings

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

A

Table A-156. DC Operated 120 and 240V Coils

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

① Non-inductive load.

380V, 50 Hz Starter Maximum Horsepower Ratings

Table A-157. 380V, 50 Hz Starters — Maximum 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.

Table A-158. 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 ⑦⑧	1 – 1-1/2	1-1/2 – 2	2 – 2-1/2	1 – 1-1/2	1.5	4.0	—	—	—
Drop-Out Time Hz ⑦	3/4 – 1	3/4 – 1	3/4 – 1	3/4 – 1	.75	.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% ⑤	45% – 65% ⑤	50% – 65% ⑤
Drop-Out Volts ④	5 – 10%	5 – 10%	5 – 10%	5 – 10%	18%	13%	30% – 45% ⑤	30% – 45% ⑤	40% – 50% ⑤
Pick-Up Time Hz ⑧	—	25 – 75 mS	25 – 75 mS	25 – 75 mS	2.7 Hz ⑦	3 Hz ⑦	21 – 41 Hz ⑤⑦	17 – 29 Hz ⑤⑦	16 – 18 ⑤⑦
Drop-Out Time Hz ⑦	—	16 – 25 mS	16 – 25 mS	16 – 25 mS	9.3 Hz ⑦	17.5 Hz ⑦	7 – 12 Hz ⑥⑦	7 – 12 Hz ⑥⑦	18 – 20 Hz ⑤⑦

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 Lower figure when coil is cold. Higher figure when coil is hot.
⑥ Drop-out time to clear arc. Time varies with type of load and contact wear.
⑦ At 60 Hz base.
⑧ To contact touch.

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.

Table A-159. 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 Lbs.	3.5 Lbs.	11.5 Lbs.	11.5 Lbs.	25 Lbs.	42 Lbs.	215 Lbs.	265 Lbs.	315 Lbs.
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	Verti., 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

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

Table A-160. Data from Tables 430 — 147 Through 150 of 1996 NEC: Motor Amperes at Full Load ②, Three-Phase AC

hp	Single-Phase AC		Induction Type Squirrel-Cage and Wound-Rotor Amperes				DC	
	115V	230V	200V	230V	460V	575V	120V	240V
1/6	4.4	2.2	—	—	—	—	—	—
1/4	5.8	2.9	—	—	—	—	3.1	1.6
1/3	7.2	3.6	—	—	—	—	4.1	2.0
1/2	9.8	4.9	2.5	2.2	1.1	.9	5.4	2.7
3/4	13.8	6.9	3.7	3.2	1.6	1.3	7.6	3.8
1	16	8	4.8	4.2	2.1	1.7	9.5	4.7
1-1/2	20	10	6.9	6.0	3.0	2.4	13.2	6.6
2	24	12	7.8	6.8	3.4	2.7	17	8.5
3	34	17	11.0	9.6	4.8	3.9	25	12.2
5	56	28	17.5	15.2	7.6	6.1	40	20
7-1/2	80	40	25.3	22	11	9	58	29
10	100	50	32.2	28	14	11	76	38
15	—	—	48.3	42	21	17	—	55
20	—	—	62.1	54	27	22	—	72
25	—	—	78.2	68	34	27	—	89

hp	Single-Phase AC		Induction Type Squirrel-Cage and Wound-Rotor Amperes				DC	
	115V	230V	200V	230V	460V	575V	120V	240V
30	—	—	92	80	40	32	—	106
40	—	—	120	104	52	41	—	140
50	—	—	150	130	65	52	—	173
60	—	—	177	154	77	62	—	206
75	—	—	221	192	96	77	—	255
100	—	—	285	248	124	99	—	341
125	—	—	359	312	156	125	—	425
150	—	—	414	360	180	144	—	506
200	—	—	552	480	240	192	—	675
250	—	—	—	—	302	242	—	—
300	—	—	—	—	361	289	—	—
350	—	—	—	—	414	336	—	—
400	—	—	—	—	477	382	—	—
450	—	—	—	—	515	412	—	—
500	—	—	—	—	590	472	—	—

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

A

Combination Ratings

Table A-161. 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	—	5,000A	600V
Class J Fuse	60A	—	100,000A	600V
Class R Fuse	60A	—	100,000A	600V
ClassT Fuse	60A	—	100,000A	600V
Magnetic Only ① Type CB ②	30A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/Mag. 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/Mag. Type CLB ⑤	50A	150,000A	100,000A	480V
Size 2				
Class H Fuse	100A	—	5,000A	600V
Class J Fuse	100A	—	100,000A	600V
Class R Fuse	100A	—	100,000A	600V
ClassT Fuse	100A	—	100,000A	600V
Magnetic Only ① Type CB ②	50A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/Mag. 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/Mag. Type CLB ⑤	50A	150,000A	100,000A	480V

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.

Table A-162. Combination Ratings — 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	—	5,000A	600V
Class J Fuse	60A	—	100,000A	600V
Class R Fuse	60A	—	100,000A	600V
ClassT Fuse	60A	—	100,000A	600V
Magnetic Only ⑥ Type CB ⑦	100A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/Mag. Type CB ⑧	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 ⑨	100A	HMCP + Current Limiter	100,000A	600V
Thermal/Mag. Type CLB ⑩	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
ClassT Fuse	400A	—	100,000A	600V
Magnetic Only ⑥ Type CB ⑦	150A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/Mag. Type CB ⑧	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 ⑨	150A	HMCP + Current Limiter	100,000A	600V
Thermal/Mag. Type CB + CL ⑩	250A	200,000A	100,000A	600V
Thermal/Mag. Type CLB ⑪	250A	150,000A	100,000A	480V

⑥ Instantaneous Adjustable Trip.
⑦ Circuit Breaker.
⑧ Inverse Time Circuit Breaker.
⑨ Instantaneous Adjustable Trip with Current Limiting Attachment.
⑩ Inverse Time with Built-In Current Limiting Attachment.
⑪ Inverse Time Current Limiting Breaker.

Coil Suffix

Table A-163. Other Available Coil Voltages — AC and DC Coils ⑰

Coils	Catalogue Number Suffix	Coil Rating (Volts/Hertz)	Catalogue Number Suffix	Coil Rating (Volts/Hertz)
AC	**A**	120/60, 110/50	**N**	110/50
	B	200-208/60	**P**	48/60
	C ⑫	240/60 and 480/60	**Q** ⑯	AC/DC Volts Specified
	D	440/50	**R** ⑫	120/60 and 240/60
	E	600/60 Hz	**U**	440-480/50 or 60 Rect. to DC
	G	220/50		
	H	380/50	**V**	110/60
	I	24/60	**W**	240/60
	J	110-120/50 or 60 Rect. to DC	**X**	480/60
			Y	415/50
	K	220-240/50 or 60 Rect. to DC	**Z**	277/60
DC ⑬⑭⑮	**L**	24V DC	**S**	125V DC
	M	48V DC	**T**	250V DC

⑫ List Price Addition for dual voltage coils.
⑬ List Price Addition for DC coils.
⑭ DC coils for Size 5 and 6 contactors and starters are intermittent duty rated only. A mechanical latch is required.
⑮ DC coils. Use only on contactors originally supplied with a DC coil.
⑯ For Q suffixes "order by description" consult Customer Support Centre, 1-800-268-3578.
⑰ Availability may be limited.

Table A-164. Other DC Coils Available (For Q Suffix) ⑱

Voltages	Sizes 0 & 1	Size 2	Voltages	Sizes 0 & 1	Size 2
	1- to 4-Pole	1- to 3-Pole		1- to 4-Pole	1- to 3-Pole
	Style Number			Style Number	
12	1268C86G07		79	1268C86G08	
28	1268C86G06		96	1268C86G15	
32	1268C86G09		200	1268C86G11	
34	1268C86G16		300	1268C86G14	
37.5	1268C86G17		315	1268C86G12	
40	1268C86G13		125/250	1268C86G03	
50	1268C86G10		—		

⑱ For Q suffixes "order by description" consult Customer Support Centre, 1-800-268-3578. Availability may be limited.

Discount Symbol **MC17**

Factory Modifications

Table A-165. A200 Factory Modifications

Modifications	Description	Catalogue Number Suffix	NEMA Size								
			00 – 1	2	3	4	5	6	7	8	9
			Adder								
Control Circuit	1 Extra Auxiliary Contact (1NO-1NC) Non-reversing, Reversing, 2-Speed Unwired	**J1**									
	2 Extra Auxiliary Contact Non-reversing, Reversing, 2-Speed Unwired	**J2**									
	3 Extra Auxiliary Contact Non-reversing, Unwired	**J3**									
	4 Extra Auxiliary Contact Non-reversing, Unwired	**J4**									
	Wired for Separate Control (NC)	**C**									
	Omit Control Wiring (NC)	**X**									
Overload Relays (Substitutions)	Ambient Compensated with Auto Reset (NC)	**D**									
	FastTrip — Ambient Compensated (Specify Motor FLA)	**D7**									
	Overload Relay Alarm Contact (NO) per overload	**E**									

Accessories and Field Modification Kits

Type J Auxiliary Contact

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.

Table A-166. Auxiliary Contact Ratings

Voltage	Make	Break
NEMA A600		
120 – 600V AC	7200 VA	720 VA
72 – 120V AC	60A	720 VA
28 – 72V AC	60 VA	10A
NEMA R300		
28 – 300V DC	28 VA	28 VA

Table A-167. Auxiliary Contact Types

Contact Type	Max.	Catalogue Number	Price
1NO and 1NC	4	**J11**	
2NC	4	**J02**	
2NO	4	**J20**	
1 Coil Clearing NC and 1NO	4	**J1C**	

Discount Symbol **MC7**

A

SS-56 Surge Suppressor

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: .5 per mS

Table A-168. Surge Suppressor ①

Type Mounting	Kit Catalogue Number	Price
Starter	**SS-56**	

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

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.

Table A-169. Fuse Block

Mounting	Kit Catalogue Number	Price
Starter Panel	**F56** **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 120V AC control relay, and will operate on as little as 40V AC 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.

Table A-170. Interposing Relay

Type Mounting	Kit Catalogue Number	Price
Starter or Panel	**R56-AA**	

B3NO Bell Alarm Contact

- Isolated Normally Open Bell Alarm Contact.
- Mounts in Type B block-type overload relay.

Table A-172. Bell Alarm Contact

Kit Catalogue Number	Price
B3NO-2 **B3NO-4** ②	

② For Size 3 and 4.

Table A-173. Control Contact Ratings (B600)

AC Volts	Maximum Amperes	
	Make	Break
24 – 120 121 – 600	30 3600 VA	3.00 360 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**, i.e., 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.

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.

Table A-171. Mechanical Interlock

Contactor Arrangement (Number of Poles, Horizontal or Vertical)	Continuous Size	Interlock Catalogue Number	Price
3 x 3 Horizontal 4 x 4 Horizontal 5 x 3 Horizontal	0, 1 0, 1 0, 1	**M-33-1B** **M-33-1B** **M-33-1B**	
All Pole Combination, Vertical 3 x 3 Horizontal Reversing 3 x 3 Vertical Reversing	0, 1 2 2	**M-34-1A** **M-33-2B** **M-34-2A**	
5 x 3 Horizontal 4 x 4 Horizontal	2 2	**M-35-2A** **M-36-2A**	
All Pole Combination Horizontal All Pole Combination Vertical	3, 4 3, 4	**M-33-3B** **M-34-3**	

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.
- 600V AC.
- Continuous current rating of 18A for Size 0, 27A for Size 1.

Table A-174. Power Pole Kit ③

Continuous Current Rating	Kit Size	Kit Catalogue Number	Price
Normally Open			
18 27	0 1	**PN0-0** **PN0-1**	
Normally Closed			
18 27	0 1	**PNC-0** **PNC-1**	

③ Do not use with DC operated contactors.

Discount Symbol **MC29**

Replacement Auxiliary Contacts

Table A-175. Replacement Auxiliary Contacts

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

Table A-176. Extra Auxiliary Contact Kits

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

① Size 7 and larger use DC coils as standard.

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.

Table A-177. DC Coil Conversion Kits

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

Mechanical Interlocks

Table A-178. Mechanical Interlocks

Contactor Sizes	Style Numbers		Price
	Horizontal	Vertical	
3, 4 and 5 5 and 5 5 and 6 6 and 6 6 and 7, 8	**2050A11G75** **2050A11G25** **2050A11G27** **2050A11G26** —	**2050A11G65** **2050A11G15** **2050A11G17** **2050A11G16** **2050A11G55**	
7, 8 and 7, 8 7, 8 and 9 9 and 9	No (Rear Conn.) No (Rear Conn.) No (Rear Conn.)	**567D624G01** **9944D56G06** **9944D56G01**	

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.

Table A-179. Overload Relay Kits

Kit Size	Kit Part Number	Price
5 6	**2057A34G01** **6379D80G10**	

Table A-180. Replacement Terminal Lugs ②

Contactor Size	Cable Size	Terminals		Kit Style Number	Price
		Qty. in Kit	Qty. Req'd. per Pole		
5 6 7 8	1-500 MCM 2-500 MCM 4-500 MCM 4-500 MCM	6 6 12 12	2 2 4 4	**2119A76G01** **7858A96G01** **7858A96G02** **7858A96G03**	

② All mounting hardware is included in kit.

Discount Symbol **MC29**

A

When Ordering Specify

Use this renewal parts data to identify device by style number, catalogue 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 Centre.

General Information

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

It is the intent of this catalogue 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 Cutler-Hammer replacement parts should be used.

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

JF Autostarters

Table A-181. JF Autostarter Kits

Frame Size	Start Contacts			Run Contacts			Grid Stack Kit		
	Required	Style Number	Price	Required	Style Number	Price	Required	Style Number	Price
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**	

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

Table A-182. Solenoid Assembly with Coil (All Sizes) ①

Volt	Hz	Style Number ②	Price
115	60	**5264C05H01**	
230	60	**5264C05H02**	
460	60	**5264C05H03**	
575	60	**5264C05H04**	

① When replacing solenoid assembly series 416C160 use adapter plate style 9917D02H01 — 1 required.

② These styles replace coil style 296B892G__. When ordering new style as replacement, customer must order adapter plate 9917D02H01, Quantity 1 required.

Discount Symbol **MC17**

AC Starters, Contactors A200, A201

Table A-183. AC Contactors Model J Sizes 00, 0, 1, 2 Kits ①

Part	Poles	Size 00		Size 0		Size 1		Size 2	
		Style Number	Price	Style Number	Price	Style Number	Price	Style Number	Price
Contact Kit	2 3 4 5	**373B331G17** **373B331G18** **373B331G18** **373B331G19**		**373B331G02** **373B331G04** **373B331G04** **373B331G05**		**373B331G07** **373B331G09** **373B331G09** **373B331G10**		**373B331G11** **373B331G12** **373B331G13** ③	
Arc Box ②	2, 3, 4 5	**6714C74G01** **6714C74G04**		**6714C74G02** **6714C74G05**		**6714C74G03** **6714C74G06**		**6714C74G07** **(2-, 3-pole)** **6714C74G08** **(4-, 5-pole)**	
Cross Bar	2, 3 4, 5	**N/A** **N/A**		**N/A** **N/A**		**N/A** **N/A**		**672B788G32** **672B788G34**	
Upper Base (for single rated coils only)	2, 3 4, 5	**N/A** **N/A**		**N/A** **N/A**		**N/A** **N/A**		**672B788G33** **672B788G35**	
Lower Base	2, 3 4, 5	**N/A** **N/A**		**N/A** **N/A**		**N/A** **N/A**		**1250C33G09** **1250C33G05**	
KO Spring (Pk of 10)	All	**N/A**		**N/A**		**N/A**		**503C796G01**	
Terminal Line/Load (Pk of 3)	All	**N/A**		**N/A**		**N/A**		**371B870G03**	

① Model C contact tips and coils 00-4, 2-, 3-, 4- and 5-pole contactors are same as Model J. All other parts are unavailable.
② Mounting hardware included.
③ Use one each of 373B331G11 and 373B331G12.

Table A-184. AC Coils

Voltage	Hz	Size 00, 0, 1				Size 2			
		2-, 3-, 4-Pole		5-Pole		2-, 3-Pole		4-, 5-Pole	
		Style Number	Price	Style Number	Price	Style Number	Price	Style Number	Price
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 ④	60/60	**505C806G03**		**505C808G03**		**505C806G03**		**505C818G03**	
120/240 ④	60/60	**505C806G10**		**505C808G10**		**505C806G10**		**505C818G10**	

④ Dual Voltage Coils. Use only on contactors or starters originally supplied with a dual voltage coil.

Table A-185. DC Coil ⑥

Voltage	Size 0, 1	Size 2	Price
	1, 2, 3, 4 Pole	1, 2, 3 Pole	
	Style Number		
12	**1268C86G07**		
24	**1268C86G04**		
48	**1268C86G05**		
125	**1268C86G02**		
250	**1268C86G01**		
125/250 ⑤	**1268C86G03**		

⑤ Dual Voltage Coils. Use only on contactors or starters originally supplied with a dual voltage coil.
⑥ Use only on contactors originally supplied with a DC coil.

Accessories for Size 5 – 9 AC Contactors

Note: 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.

Table A-186. AC-DC Coil Conversion Kits

Voltage	Size 5		Size 6	
	Style Number	Price	Style Number	Price
120V AC	**7864A28G01**		**7864A29G01**	
240V AC	**7864A28G02**		**7864A29G02**	
480V AC	**7864A28G03**		**7864A29G03**	

Table A-187. Replacement Coils for Above

Voltage	Size 5		Size 6	
	Style Number	Price	Style Number	Price
120V AC	**7856A15G05**		**7856A16G05**	
240V AC	**7856A15G10**		**7856A16G10**	
480V AC	**7856A15G15**		**7856A16G15**	

Discount Symbol **MC17**

AC Starters, Contactors A200, A201 (Continued)

Accessories for Size 5 – 9 AC Contactors

Table A-188. Auxiliary Electrical Interlocks Size 7 – 9 AC and All DC Units

A

Type	Circuits	Application	Style Number	Price
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

Table A-189. Auxiliary Electrical Interlocks

Catalogue Number (Obsolete)	Style Number (Obsolete)	Circuits	Catalogue Number Current	Style Number Current	Price
(L-56)	(2609D01G01)	1NO & 1NC	**J11**	**9084A17G01**	
(L-56D)	(2609D01G02)	2NO	**J20**	**9084A17G02**	
(L-56E)	(2609D01G03)	1NO & 1NC	**J11**	**9084A17G01**	
(L-56B)	(2609D01G04)	2NO	**J20**	**9084A17G02**	
(L-56H)	(2609D01G05)	2NO	**J20**	**9084A17G02**	
(L-56J)	(2609D01G06)	1NO & 1NC 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 & 1NC DB	**J1C**	**9084A17G04**	
(L-56C)	(2609D01G11)	2NC	**J02**	**9084A17G03**	
(L-56M)	(2609D01G12)	N/A	**N/A**	**N/A**	
(L-56P)	(2609D01G17)	1NO & 1NC	**J11**	**9084A17G01**	
(L-56R)	(2609D01G18)	2NC	**J02**	**9084A17G03**	
(L-56S)	(2609D01G19)	1NO & 1NC	**J11**	**9084A17G01**	

Model J – K, Sizes 3 and 4

Table A-190. Model J – K Series 3, 4 Kits ①

Part	Poles	Size 3 – Model J		Size 4 – Model J ③		Size 4 – Model K ②	
		Style Number	Price	Style Number	Price	Style Number	Price
Contact Kit	2 3 4 5	**626B187G12** **626B187G13** ④ ⑤		**626B187G16** **626B187G17** ⑥ ⑦		**5250C81G16** **5250C81G17** **5250C81G18** **5250C81G19**	
Arc Box	2, 3 4, 5	**6714C74G09** **6714C74G10**		**6714C74G11** **6714C74G12**		**6714C74G11** **6714C74G12**	
Cross Bar	2, 3 4, 5	**672B788G36** **672B788G38**		**672B788G36** **672B788G38**		**672B788G40**	
Upper Base	2, 3 4, 5	**672B788G37** **672B788G39**		**672B788G37** **672B788G39**		**672B788G52**	
Lower Base	2, 3 4, 5	**1250C33G03** **1250C33G06**		**1250C33G03** **1250C33G06**		**1250C33G10**	
KO Spring (Pk of 10)	All	**503C796G02**		**503C796G02**		**672B788G50**	
Terminal Line/Load (Pk of 3)	All	**372B357G12**		**372B357G18**		**372B357G18**	

① Model C contact tips and coils 00-4, 2-, 3-, 4- and 5-pole contactors are same as model J. All other parts are unavailable.
② Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.
③ For 200 Amp A202 Magnetically Latched Lighting Contactors order 3-pole contact kit style 672B788G07.
④ Use Qty. 2 of 626B187G12.
⑤ Use Qty. 1 each of 626B187G12 and 626B187G13.
⑥ Use Qty. 2 of 626B187G16.
⑦ Use Qty. 1 each of 626B187G16 and 626B187G17.

Discount Symbol **MC17**

AC Starters, Contactors A200, A201 (Continued)

Accessories for Model J – K, Series 3, 4

Table A-191. DC Coils ①

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

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.

Table A-192. AC Coils

Voltage	Hz	Model J Size 3, 4				Model K Size 4 ③			
		2-, 3-Pole		4-, 5-Pole		2-, 3-Pole		4-, 5-Pole	
		Style Number	Price	Style Number	Price	Style Number	Price	Style Number	Price
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 ④	60/60	**505C633G03**		**505C635G03**		**5250C79G03**		**5250C80G03**	
120/244 ④	60/60	**505C633G10**		**505C635G10**		**5250C79G10**		**5250C80G10**	

③ Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.

④ Dual Voltage Coils. Use only on contactors or starters originally supplied with dual voltage coil.

A201 Contactors — Size 5 – 9

Table A-193. GCA 530/630 — GPD 7, 8, 9 Kits ⑤

Part	Size 5		Size 6		Size 7		Size 8		Size 9	
	Style Number	Price	Style Number	Price	Style Number	Price	Style Number	Price	Style Number	Price
Contact Kit (1 per pole)	**477B477G05** ⑥		**2066A10G11**		**461A757G17**		**646C829G05**		**5264C42G01** (R.C.) **5264C42G02** (F.C.)	
Arc Box	**2050A15G45**		**2066A10G45**		**831D580G01**		**831D580G01**		**9917D69G02**	
Magnet Assy.	**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 Conn. Kit	**2050A15G49**		**2066A10G49**		**N/A**		**N/A**		**N/A**	
Line Conn. 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**									
C.T. 600/5 ⑦	**N/A**		**2066A10G18**		**N/A**		**N/A**		**N/A**	
C.T. 800/5 ⑦	**N/A**		**2066A10G19**		**N/A**		**N/A**		**N/A**	
Phase Barrier	**N/A**		**N/A**		**640C441G01**		**640C441G01**		**5264C35G03** (R.C.)	
Cross Bar	**2050A15G12**		**2066A10G15**		**N/A**		**N/A**		**N/A**	
Shunt	**N/A**		**2066A10G48**		**650C129G01**		**646C831G02** (Set of 3)		**5264C39G02** (Set of 4)	

⑤ Catalogue Number A201/A200 Series replaces GCA/GPD series. Renewal parts are the same.

⑥ Use 477B477G06 for Silver Tungsten applications.

⑦ C.T. kit which replaces the single moulded 1 CT assembly used on the old size 6 airbreak. The kit includes a single moulded 3 C.T. assembly, 2 bus bar and hardware. This C.T. kit also replaces the single moulded 3 C.T. assembly used on the present size 6 airbreak and size vacuum.

Discount Symbol **MC17**

Accessories for A201 Contactors — Size 5 – 9

Table A-194. Coils

Voltage	Hz	Size 5		Size 6	
		Style Number	Price	Style Number	Price
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**	

Line Voltage	Size 7, 8		Required
	Style Number	Price	
Sizes 7 and 8			
125V DC	**438C805G04**		2
230V DC	**438C805G02**		2
250V DC	**438C805G03**		2
110/120V AC ① ④	**438C805G12**		2
220/240V AC ② ④	**438C805G11**		2
380V AC ③ ④	**438C805G15**		2
440/480V AC ③ ④	**438C805G10**		2
550/575V AC ③ ④	**438C805G13**		2

Line Voltage	Size 9	
	Style Number	Price
Size 9		
110V DC	**5264C34G01** ⑤	

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

Discount Symbol **MC17**

Contents

Type A Overload Relay
3-Pole Panel Mount

Product Family Overview

Type B and Type A, Class 20 Cutler-Hammer® Thermal Overload Relays from Eaton's electrical business 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. The 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 .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.

Design Features

Manual or Automatic Reset

The Type B is furnished with a manual reset. The Type A is normally furnished set for manual reset operation and July be quickly adjusted for automatic reset when required. Automatic reset should not be used with 2-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. The Type B has a mechanical trip bar to manually check the NC contact operation on the overload relay.

Adjustable Trip

On the 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 the Type A and light gray reset rods on the 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 the Type A. An isolated NO contact can be supplied on the Type B as either a factory modification or as a field kit.

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

Type B Overload Relay Panel Mounting

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 3-phase applications.

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

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 centres where internal temperature rise is significant compared to motor ambient temperature. The compensating characteristic is maintained in ambient temperatures from 40° to 77°C.

Standards and Certifications

- UL508
- CSA
- ANSI/NEMA ICS 2-222

Technical Data

Table A-195. Control Contact Ratings — NEMA B600 NO and NC Control Contact Rating

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

Accessories

Table A-196. Alarm Contact Kit Selection ①

Type B Overload Relay Size	Catalogue Number	Price
1, 2 3, 4	**B3NO-2** **B3NO-4**	

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

Product Selection

Heaters

Enter heaters as separate item by listing Catalogue Number from tables, **Pages A-106 – A-107**, as required per starter.

Relays

Table A-197. Product Selection — Thermal Type B Overload Relay Selection

Motor Full Load Amps	Panel Mounted Catalogue Numbers		Starter Mounted Catalogue Numbers				Price
			Replacement for Type B Overload Relays		Replacement for Type A Overload Relays in Manual Reset Mode (3-Pole Only) ②		
	Ambient Comp.	Non comp.	Ambient Comp.	Non-comp.	Ambient Comp.	Non-comp.	
Single-Pole (One NC Contact)							
.25 – 26.2 26.3 – 45	**BA11JP** **BA21JP**	**BN11JP** **BN21JP**	**BA11A** **BA21A**	**BN11A** **BN21A**	— —	— —	
19 – 90 19 – 135	Use 3-Pole Design, Wire 3 Poles in Series						
Three-Pole (One NC Contact)							
.25 – 26.2 26.3 – 45 19 – 90 19 – 135	**BA13JP** **BA23JP** **BA33P** **BA43P**	**BN13JP** **BN23JP** **BN33P** **BN43P**	**BA13A** ③ **BA23A** **BA33A** **BA43A**	**BN13A** ③ **BN23A** **BN33A** **BN43A**	**BA13J** **BA23J** **BA33A** **BA43A**	**BN13J** **BN23J** **BN33A** **BN43A**	

② Includes contactor mounting bracket, overload relay and connection straps to contactor.

③ For replacement on B200 size 00, 0, 1 use BA23A instead of BA13A and use BN23A instead of BN13A.

Discount Symbol **MC29**

Dimensions

Not to be used for construction purposes unless approved.

Table A-198. Thermal Type B Overload Relays Dimensions

Relay Size	Approximate Dimensions in Inches (mm)			
	A	B	C	D
3	3.13 (79.5)	4.06 (103.1)	.44 (11.2)	.31 (7.9)
4	3.38 (85.9)	4.38 (111.3)	.31 (7.9)	.19 (4.8)

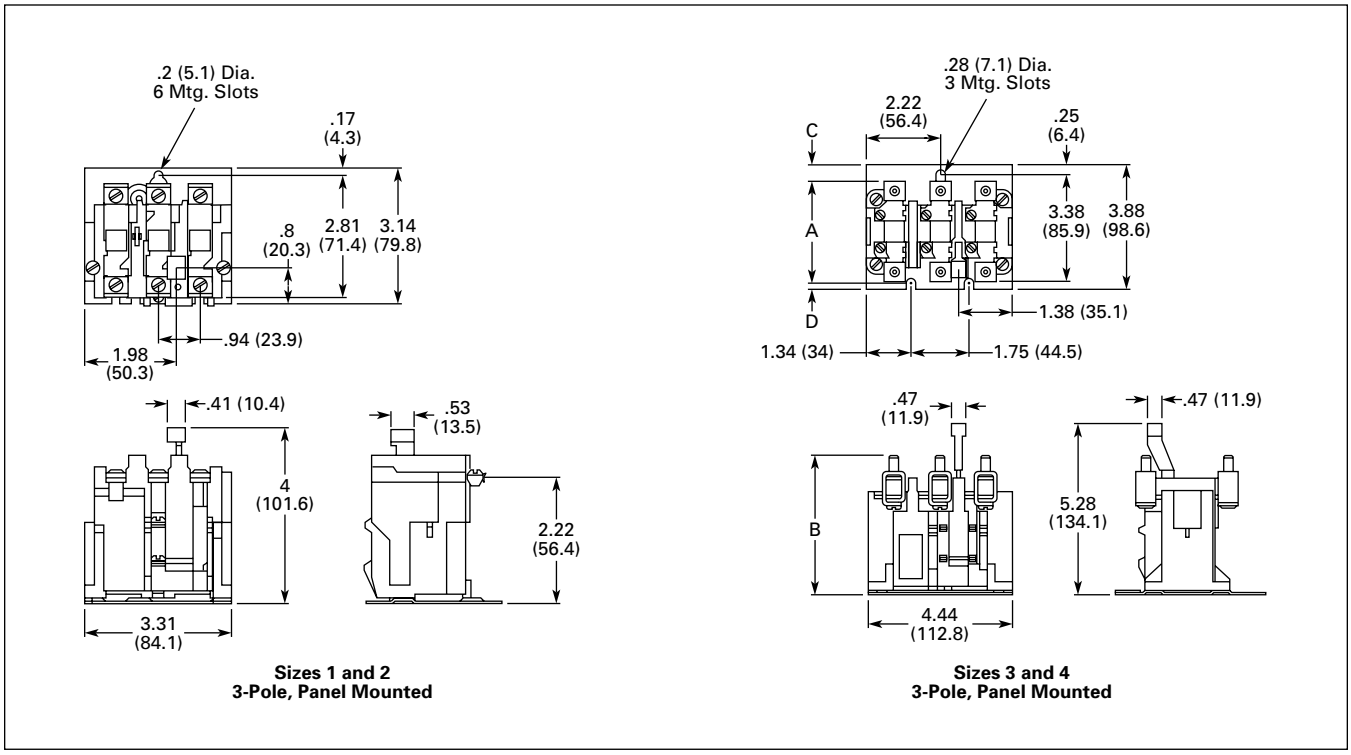


Figure A-46. Thermal Type B Overload Relays Dimensions in Inches (mm)

Thermal Type A, Class 20, Auto/Manual Reset

Type A Overload Relay
1-Pole Panel Mounting

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 3-phase applications.

Features

- Field selectable manual/auto reset
- Alarm contract 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.

Standards and Certifications

- UL508
- CSA
- ANSI/NEMA ICS 2-222

Technical Data

Table A-199. Control Contact Ratings

AC Volts	Normally Closed		Normally Open	
	Make	Break	Make	Break
Three-Pole Control Contact Ratings				
24 – 120 120 – 600	20A 2400 VA	2A 240 VA	.5A 600 VA	.5A 60 VA
One-Pole Control Contact Ratings				
24 – 120 120 – 600	30A 3600 VA	3A 360 VA	10A 1200 VA	1A 120 VA

Product Selection

Heaters

Enter heaters as separate item by listing Catalogue Number from tables, **Pages A-106 – A-107**, as required per starter.

Relays

Table A-200. Product Selection — Thermal Type A Overload Relay Selection

Motor Full Load Amps	Panel Mounted		Starter Replacement		Price
	Ambient Comp.	Non-comp.	Ambient Comp.	Non-comp.	
	Catalogue Number	Catalogue Number	Catalogue Number	Catalogue Number	
Single-Pole (One NC Contact)					
.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)					
.25 – 26.2	**AA13P** ①	**AN13P** ①	**AA13A** ①	**AN13A** ①	
26.3 – 45	**AA23P** ①	**AN23P** ①	**AA23A** ①	**AN23A** ①	
19 – 90	**AA33P** ①	**AN33P** ①	**AA33A** ①	**AN33A** ①	
19 – 135	**AA43P** ①	**AN43P** ①	**AA43A** ①	**AN43A** ①	

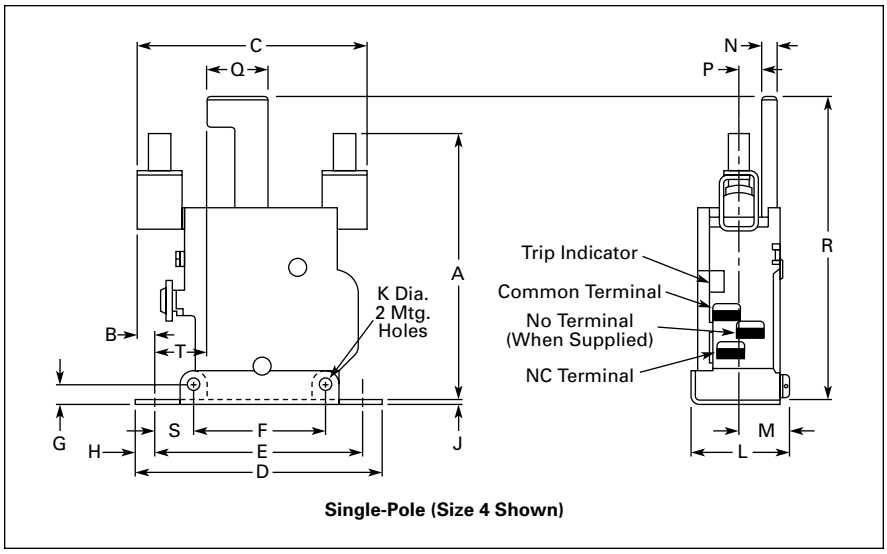
Note: For Alarm Contact (Form C), add Suffix **B**. Available only as factory modification on Type A relay.

① 3-Pole Type B Overload Relay is a suitable alternative to a 3-Pole Type A Overload Relay in Manual Reset Mode. For example, BA13JP for AA13P, BN23J for AN23A, etc. (See **Page A-100**.)

Discount Symbol **MC29**

Dimensions

Not to be used for construction purposes unless approved.



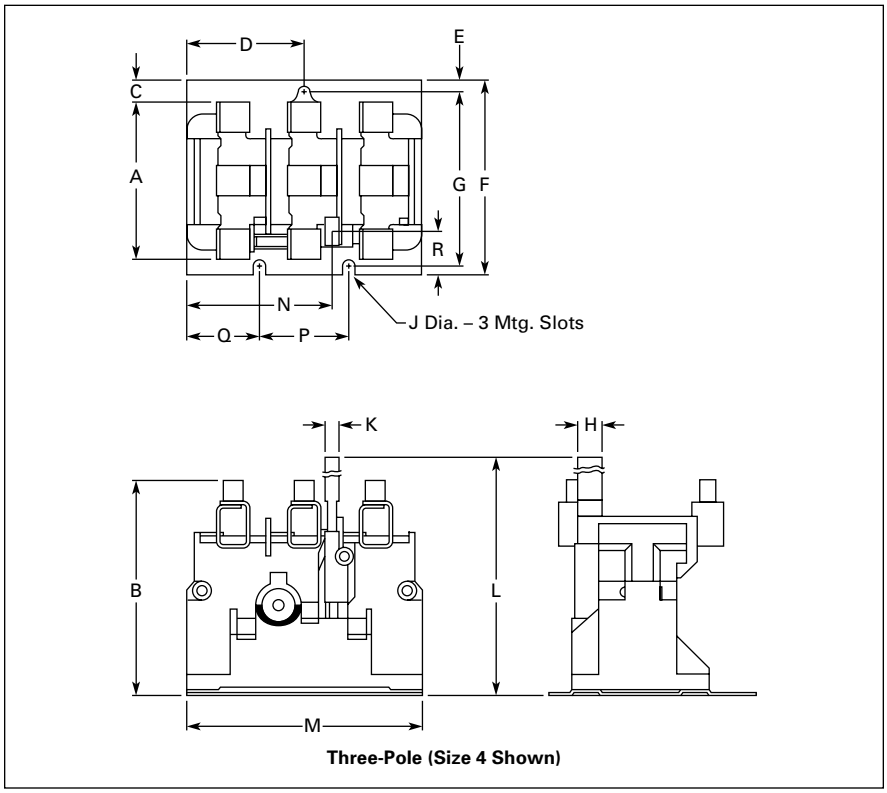
Single-Pole (Size 4 Shown)

Figure A-47. Type A Single-Pole Approximate Dimensions

Table A-201. Type A Single-Pole — Approximate Dimensions in Inches (mm)

Dim.	Relay Size			
	1	2	3	4
A	2.72 (69.1)	3.48 (88.4)	4.19 (106.4)	4.5 (114.3)
B	.94 (23.9)	.67 (17.0)	.25 (6.4)	.38 (9.7)
C	2.75 (69.9)	3.5 (88.9)	3.53 (89.7)	3.78 (96.0)

Dim.	1, 2	3, 4
D	3.25 (82.6)	4.13 (104.9)
E	2.63 (66.8)	3.38 (85.9)
F	1.34 (34.0)	2.19 (55.6)
G	.25 (6.4)	.28 (7.1)
H	.31 (7.9)	.38 (9.7)
J	.06 (1.5)	.06 (1.5)
K	.22 (5.6)	.27 (6.8)
L	1.34 (34.0)	1.69 (42.9)
M	.66 (16.8)	.88 (22.4)
N	.16 (4.1)	.27 (6.8)
P	.22 (5.6)	.34 (8.6)
Q	.06 (1.5)	.69 (17.5)
R	4.00 (101.6)	5.19 (131.8)
S	.47 (11.9)	.59 (15.0)
T	1.11 (28.2)	.69 (17.5)



Three-Pole (Size 4 Shown)

Figure A-48. Type A Three-Pole Approximate Dimensions

Table A-202. Type A Three-Pole — Approximate Dimensions in Inches (mm)

Dim.	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	.36 (9.1)	.33 (8.4)	.44 (11.2)	.31 (7.9)

Dim.	1, 2	3, 4
D	1.66 (42.2)	2.22 (56.4)
E	.17 (4.3)	.25 (6.4)
F	2.81 (71.4)	3.38 (85.9)
G	3.08 (78.2)	3.88 (98.6)
H	.47 (11.9)	.47 (11.9)
J	.20 (5.1)	.28 (7.1)
K	.28 (7.1)	.47 (11.9)
L	4.00 (101.6)	5.28 (134.1)
M	3.31 (84.1)	4.44 (112.8)
N	1.80 (45.7)	2.77 (70.4)
P	1.89 (48.0)	1.75 (44.5)
Q	1.00 (25.4)	1.34 (34.0)
R		1.03 (26.2)

Type FT Fast Trip, Class 10

Application Description

A

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
- Colour coded reset rod — green
- Alarm contact factory available
- Field selectable manual/auto reset
- Adjustable trip rating ±20%
- Ambient compensation included

Technical Data

Table A-204. Control Contact Ratings

AC Volts	Normally Closed		Normally Open	
	Make	Break	Make	Break
24 – 120	30A	3A	10A	1A
120 – 600	3600 VA	360 VA	1200 VA	120 VA

Product Selection

Table A-203. Type FT Single-Pole (One NC Contact); Three-Phase (Three NC Contacts in Series)

Motor Full Load Amperes	Panel Mounted				Starter Replacement		
	Single-Pole		Three-Pole		NEMA Size	Single-Pole	
	Catalogue Number	Price	Catalogue Number	Price		Catalogue Number	Price
.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**		2	**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**	

Note: Single-Pole (1NO-NC Contact): Add Suffix **B**.
Three-Pole (3NO-NC Contacts): Add Suffix **B**. Example: FT13P**B**-12.

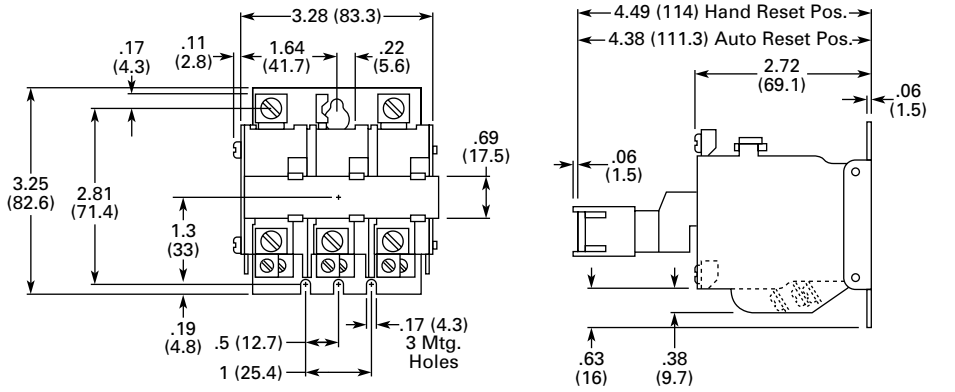
Discount Symbol **MC29**

Dimensions

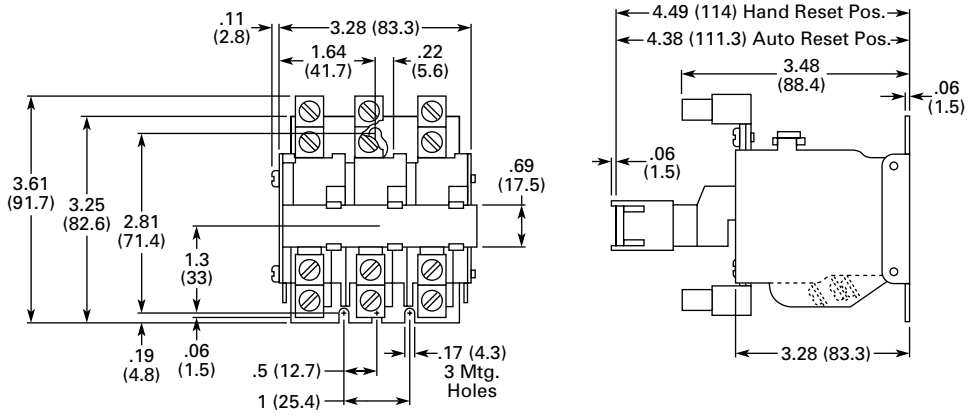
Not to be used for construction purposes unless approved.

Table A-205. Type FT Overload Relays Dimensions

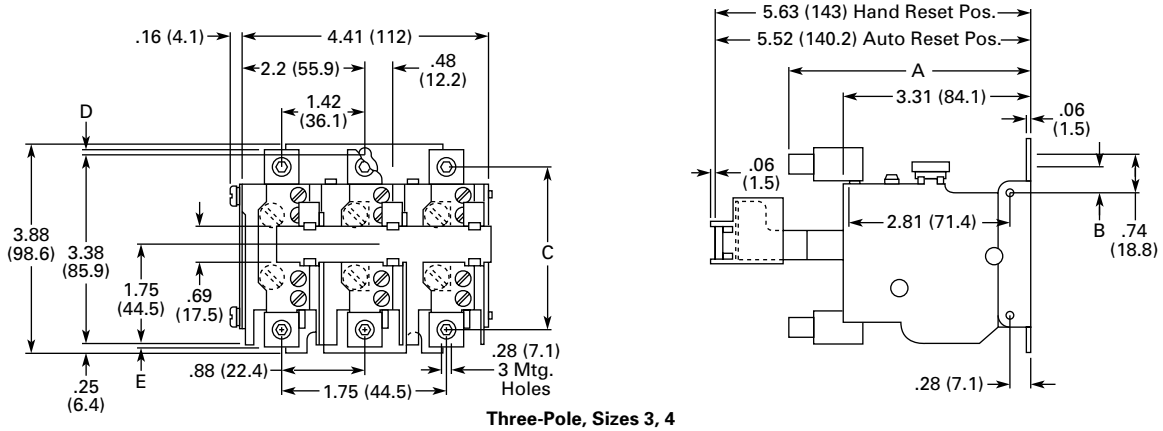
Relay Size	Approximate Dimensions in Inches (mm)				
	A	B	C	D	E
3	4.25 (108.0)	.53 (13.5)	2.91 (73.9)	.09 (2.3)	.06 (1.5)
4	4.50 (114.3)	.59 (15.0)	3.03 (77.0)	.22 (5.6)	.19 (4.8)



Three-Pole, Size 1



Three-Pole, Size 2



Three-Pole, Sizes 3, 4

Figure A-49. Type FT Overload Relays Dimensions in Inches (mm)

Heater Selection

General Information on Heater Coil Selection

A

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 July be made on the basis of average full load currents as shown on **Pages A-147** and **A-148**.

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.

Table A-206. Heater Selection — Type A and B Overload Relays, Sizes 3 and 4

Size Starter		Ambient Compensated Enclosed Starters	Non-compensating Enclosed Starters	Heater (One Heater per Catalogue Number)	
		All Applications		Catalogue Number	Price
		Full Load Current of Motor Amps			
For Size 4 Starters	For Size 3 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**	
		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**	

Table A-207. Heater Selection — Type A and B Overload Relays, Sizes 5 and 6

Compensated Overload Relay		Heater (One Heater per Catalogue Number)	
Open Starter	Enclosed Starter	Catalogue Number	Price
Full Load Current of Motor (Amps)			
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: Size 7 and Larger — Advise Full Load Current.

Discount Symbol **MC7**

Table A-208. Heater Selection — Type A and B Overload Relays, Sizes 0, 1 and 2

Size Starter	Non-compensated Open Starters and Ambient Comp. Open and Enclosed Starters		Heater (One Heater per Catalogue Number)		Non-compensating Enclosed Starters		Heater	
	Block Type Overload Using 3 Heaters	Single-Pole Type Overload	Catalogue Number	Price	Block Type Overload Using 3 Heaters	Single-Pole Type Overload	Catalogue Number	Price
	Full Load Current of Motor (Amps)							
For Size 2 Starters / For Size 1 Starters / For Size 0 Starters	.25 – .27	.29 – .31	**FH03**		.24 – .25	.28 – .30	**FH03**	
	.28 – .31	.32 – .35	**FH04**		.26 – .28	.31 – .34	**FH04**	
	.32 – .34	.36 – .39	**FH05**		.29 – .31	.35 – .37	**FH05**	
	.35 – .38	.40 – .43	**FH06**		.32 – .35	.38 – .42	**FH06**	
	.39 – .42	.44 – .48	**FH07**		.36 – .39	.43 – .47	**FH07**	
	.43 – .46	.49 – .53	**FH08**		.40 – .43	.48 – .52	**FH08**	
	.47 – .50	.54 – .58	**FH09**		.44 – .47	.53 – .56	**FH09**	
	.51 – .55	.59 – .64	**FH10**		.48 – .51	.57 – .63	**FH10**	
	.56 – .62	.65 – .71	**FH11**		.52 – .57	.64 – .70	**FH11**	
	.63 – .68	.72 – .79	**FH12**		.58 – .63	.71 – .77	**FH12**	
	.69 – .75	.80 – .87	**FH13**		.64 – .70	.78 – .85	**FH13**	
	.76 – .83	.88 – .96	**FH14**		.71 – .77	.86 – .94	**FH14**	
	.84 – .91	.97 – 1.06	**FH15**		.78 – 85	.95 – 1.03	**FH15**	
	.92 – 1.00	1.07 – 1.16	**FH16**		.86 – .93	1.04 – 1.13	**FH16**	
	1.01 – 1.11	1.17 – 1.28	**FH17**		.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**	
	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**	
	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**	

Discount Symbol **MC7**

A

Size 1 and 2 Starter

Product Description

Setting the Standard in Motor Control

Cutler-Hammer® Advantage motor starters from Eaton's electrical business have extended operating life in a physical space requirement one half the size of conventional motor starters.

Offering motor overcurrent protection accurate to 2% at maximum FLC, Advantage also maintains constant coil power regardless of varying control circuit conditions, eliminating coil burnout, contact chatter and welding due to low voltage of fluttering control signals.

Advantage is designed with a full complement of features that make it the most versatile motor starter in the industry. Multifunction overload protection options provide application flexibility while reducing inventory. Communication capability extends benefits, allowing Advantage to be interactively linked to higher order control systems for monitoring, troubleshooting and control.

Technological advances incorporated in the Advantage design, such as prestart diagnostics, increased accuracy and the ability to communicate with other systems, are benefits not realized in traditional motor starters.

Benefits

Advantage Breakthroughs

To achieve the level of benefits envisioned for Advantage controls at a competitive price, it was discovered early in the development process that simply improving existing design concepts would fall short of the mark. A new approach involving a higher level of technology was required. The result was the incorporation of three technical breakthroughs — new current sensing monitoring, an energy-balanced contact closure system that increased life by decreasing electrical and mechanical wear and an intelligent coil controller optimizing the contact closing process based on varying control circuit conditions. Coordinating these breakthroughs to provide enhanced motor control performance is concentrated in the SURE chip.

Advantage uses the right combination of brains and brawn in effecting a motor start. The power circuit of the contactor employs heavy-duty silver alloy contacts scientifically designed for long life. The addition of a uniquely developed application-specific microprocessor chip regulates power supplied to the operating coil. The regulated closing profile is tailored to existing control circuit conditions. This results in an energy balanced system which reduces armature/magnet crash and contact bounce, extending mechanical and electrical life.

Improved Protection and Motor Utilization

The motor circuit monitoring and overload protection functions of Advantage starters are provided by three current sensors closely monitored by the microprocessor. This sensor/microprocessor combination yields a protection scheme closely paralleling that of the motor heating damage boundary expressed in terms of current and time. Accurate to 2% of full scale, Advantage allows full utilization of motor capability without motor damage or nuisance tripping.

No Heaters, Small Size

Advantage starters eliminate the need for costly heater elements and their associated installation expense. Standard overload protection functions include phase loss and unbalance protection, selectable trip class, automatic/manual reset and ground current protection.

Built-In Communications Capabilities Provide Two-Way Control

Advantage also offers low cost communication capability. ON/OFF commands, status and motor data can be linked to automated control systems without the addition of costly sensors, I/O modules and transducers, in a language compatible with many computer-based software systems in use today.

Protected by 22 patents and proven in many years of operating experience in harsh industrial applications, Advantage motor starters and contactors offer the user unprecedented value at a price competitive with traditional devices.

Instructional Leaflets

17401	Sizes 1, 2 Non-reversing Contactors and Starters
17403	Sizes 3, 4 Non-reversing Contactors and Starters
17405	Sizes 5, 6 Non-reversing Contactors and Starters
17482	Sizes 1, 2 Reversing Contactors and Starters
17484B	Sizes 3, 4 Reversing Contactors and Starters
17486	Sizes 5, 6 Reversing Contactors and Starters
17456	Sizes 1, 2 Contactor Overload Combo
17457	Sizes 3, 4 Contactor Overload Combo
17604	Sizes 5, 6 Contactor Overload Combo
17595	Sizes 1, 2 Reversing Contactors and Starters with status-only ACM
17596	Sizes 3, 4 Reversing Contactors and Starters with status-only ACM
17597	Sizes 5, 6 Reversing Contactors and Starters with status-only ACM
17598	Sizes 1, 2 Two-Speed Two-Winding Starters with status-only ACM
17599	Sizes 3, 4 Two-Speed Two-Winding Starters with status-only ACM
17600	Sizes 5, 6 Two-Speed Two-Winding Starters with status-only ACM
17601	Sizes 1, 2 Two-Speed One-Winding Starters with status-only ACM
17602	Sizes 3, 4 Two-Speed One-Winding Starters with status-only ACM
17603	Sizes 5, 6 Two-Speed One-Winding Starters with status-only ACM

Contents

Size 3 and 4 Starter

Product Description

Catalogue Number W201 — Non-reversing Contactors

Catalogue Number W211 — Horizontal Reversing Contactors (shown above) — long axis horizontal

Catalogue Number W251 — Vertical Reversing Contactors (not illustrated) — long axis vertical

Features

- Small physical size
- Brownout protection
- Communications capability
- Long electrical life
- Higher contact force

Product Selection

When Ordering Specify

- Non-reversing Catalogue Number as specified in table below.
- Reversing Catalogue Number as specified in table below.

Table A-209. Advantage Contactors — 3-Pole Non-reversing and Reversing — NEMA Sizes 1 – 6

NEMA Size	Motor Voltage	Max. hp	Continuous Amperes (Enclosed)	Coil Voltage/Hz	Non-reversing		Reversing (Horizontal)		Reversing (Vertical)	
					Catalogue Number	Price	Catalogue Number	Price	Catalogue Number	Price
1	200 230 460 575	7-1/2 7-1/2 10 10	27	120/60 110/50	**W201K1CF** **W201K1CN**		**W211K1CF** **W211K1CN**		**W251K1CF** **W251K1CN**	
2	200 230 460 575	10 15 25 25	45	120/60 110/50	**W201K2CF** **W201K2CN**		**W211K2CF** **W211K2CN**		**W251K2CF** **W251K2CN**	
3	200 230 460 575	25 30 50 50	90	120/60 110/50	**W201K3CF** **W201K3CN**		**W211K3CF** **W211K3CN**		**W251K3CF** **W251K3CN**	
4	200 230 460 575	40 50 100 100	135	120/60 110/50	**W201K4CF** **W201K4CN**		**W211K4CF** **W211K4CN**		**W251K4CF** **W251K4CN**	
5	200 230 460 575	75 100 200 200	270	120/60 110/50	**W201K5CF** **W201K5CN**		**W211K5CF** **W211K5CN**		**W251K5CF** **W251K5CN**	
6	200 230 460 575	150 200 400 400	540	120/60 110/50	**W201K6CF** **W201K6CN**		**W211K6CF** **W211K6CN**		**W251K6CF** **W251K6CN**	

Discount Symbol **MC7**

A

Contents

Size 5 and 6 Starter

Product Description

Catalogue Number W200 — Non-reversing Starters (shown above)

Catalogue Number W210 — Horizontal Reversing Starters — long axis horizontal.

Catalogue Number W250 — Vertical Reversing Starters (not illustrated) — long axis vertical.

Features

Starter

- Small physical size
- Brownout protection
- Communications capability
- Minimized bounce times
- Higher contact force
- Common auxiliary contacts

Motor Protection

- Heaters not required — selectable settings
- Overload protection — accuracy 2%
- Phase loss and phase unbalance protection
- Ground current protection

OL Protection Settings

- Selectable automatic/manual reset
- Selectable trip class — 10, 20, 30 or no protection (disables overload)
- Selectable trip current

Technical Data

Table A-210. Motor FLA Ranges

NEMA Size	1.15 to 1.25 Service Factor	1.0 Service Factor
1 ①	.47 – 3.81	.51 – 4.14
1	3.15 – 27.0	3.43 – 27.0
2	3.15 – 45.0	3.43 – 45.0
3	9.90 – 90.0	10.8 – 90.0
4	9.90 – 135	10.8 – 135
5	38.3 – 270	41.7 – 270
6	38.3 – 540	41.7 – 540

① For motor full load current (FLA) range of .47A – 3.81A with a 1.15 to 1.25 service factor and for motor hp range of 1/4 hp to 2 hp at 460V.

Options

Table A-211. Optional Features

Description	Catalogue Number Suffix
Omit Class II Ground-Current Protection	**Y7**
Omit Phase-Loss Protection	**Y4**
Omit both Class II Ground-Current Protection and Phase-Loss Protection	**Y4Y7**

Product Selection

When Ordering Specify

- Non-reversing Catalogue Number as specified in table below.
- Reversing Catalogue Number as specified in table below.

A

Table A-212. Advantage Starters — 3-Pole Non-reversing and Reversing — Wired for Separate Control — Heaters Not Required — NEMA Sizes 1 – 6

NEMA Size	Motor Voltage	Max. hp	Continuous Amperes (Enclosed)	Coil Voltage/Hz	Non-reversing		Reversing (Horizontal)		Reversing (Vertical)	
					Catalogue Number	Price	Catalogue Number	Price	Catalogue Number	Price
1 ①	200 230 460 575	1 1 2 2	27	120/60 110/50	**W200MLCFC** **W200MLCNC**		**W210MLCFC** **W210MLCNC**		**W250MLCFC** **W250MLCNC**	
1	200 230 460 575	7-1/2 7-1/2 10 10	27	120/60 110/50	**W200M1CFC** **W200M1CNC**		**W210M1CFC** **W210M1CNC**		**W250M1CFC** **W250M1CNC**	
2	200 230 460 575	10 15 25 25	45	120/60 110/50	**W200M2CFC** **W200M2CNC**		**W210M2CFC** **W210M2CNC**		**W250M2CFC** **W250M2CNC**	
3	200 230 460 575	25 30 50 50	90	120/60 110/50	**W200M3CFC** **W200M3CNC**		**W210M3CFC** **W210M3CNC**		**W250M3CFC** **W250M3CNC**	
4	200 230 460 575	40 50 100 100	135	120/60 110/50	**W200M4CFC** **W200M4CNC**		**W210M4CFC** **W210M4CNC**		**W250M4CFC** **W250M4CNC**	
5	200 230 460 575	75 100 200 200	270	120/60 110/50	**W200M5CFC** **W200M5CNC**		**W210M5CFC** **W210M5CNC**		**W250M5CFC** **W250M5CNC**	
6	200 230 460 575	150 200 400 400	540	120/60 110/50	**W200M6CFC** **W200M6CNC**		**W210M6CFC** **W210M6CNC**		**W250M6CFC** **W250M6CNC**	

① For motor full load current (FLA) range of .47A – 3.81A with a 1.15 to 1.25 service factor and for motor hp range of 1/4 hp to 2 hp at 460V.

Discount Symbol **MC7**

Contents

A

Product Selection

When Ordering Specify

- Catalogue Number as shown in table below.

Table A-213. Two-Speed Advantage Starters — Wired for Separate Control — Heaters Not Required — NEMA Sizes 1 – 6

NEMA Size	Motor Voltage	Max. Horsepower		Continuous Amperes (Enclosed)	Coil Voltage/ Hz	Open Type (Horizontal)	
		Constant or Variable Torque	Constant hp			Catalogue Number	Price
For Separate (2) Winding Type Motors — Wye Wye							
1 ①	200 230 460 575	1 1 2 2	1 1 2 2	27	120/60 110/50	**W960MLCFCM3** **W960MLCNCM3**	
1	200 230 460 575	7-1/2 7-1/2 10 10	5 5 7-1/2 7-1/2	27	120/60 110/50	**W960M1CFCM3** **W960M1CNCM3**	
2	200 230 460 575	10 15 25 25	7-1/2 10 20 20	45	120/60 110/50	**W960M2CFCM3** **W960M2CNCM3**	
3	200 230 460 575	25 30 50 50	20 25 40 40	90	120/60 110/50	**W960M3CFCM3** **W960M3CNCM3**	
4	200 230 460 575	40 50 100 100	30 40 75 75	135	120/60 110/50	**W960M4CFCM3** **W960M4CNCM3**	
5	200 230 460 575	75 100 200 200	60 75 150 150	270	120/60 110/50	**W960M5CFCM3** **W960M5CNCM3**	
6	200 230 460 575	150 200 400 400	100 150 300 300	540	120/60 110/50	**W960M6CFCM3** **W960M6CNCM3**	

① For motor full load current (FLA) range of .47A – 3.81A with a 1.15 to 1.25 service factor and for motor hp range of 1/4 hp to 2 hp at 460V.

Discount Symbol **MC7**

Table A-213. Two-Speed Advantage Starters — Wired for Separate Control — Heaters Not Required — NEMA Sizes 1– 6 (Continued)

NEMA Size	Motor Voltage	Max. Horsepower		Continuous Amperes (Enclosed)	Coil Voltage/ Hz	Open Type (Horizontal)	
		Constant or Variable Torque	Constant hp			Catalogue Number	Price
For Single Winding Type Motors Constant Horsepower							
1 ①	200 230 460 575	—	1 1 2 2	27	120/60 110/50	**W970MLCFCM3** **W970MLCNCM3**	
1	200 230 460 575	—	5 5 7-1/2 7-1/2	27	120/60 110/50	**W970M1CFCM3** **W970M1CNCM3**	
2	200 230 460 575	—	7-1/2 10 20 20	45	120/60 110/50	**W970M2CFCM3** **W970M2CNCM3**	
3	200 230 460 575	—	20 25 40 40	90	120/60 110/50	**W970M3CFCM3** **W970M3CNCM3**	
4	200 230 460 575	—	30 40 75 75	135	120/60 110/50	**W970M4CFCM3** **W970M4CNCM3**	
5	200 230 460 575	—	60 75 150 150	270	120/60 110/50	**W970M5CFCM3** **W970M5CNCM3**	
6	200 230 460 575	—	100 150 300 300	540	120/60 110/50	**W970M6CFCM3** **W970M6CNCM3**	
For Single Winding Type Motors (Constant or Variable Torque)							
1 ①	200 230 460 575	1 1 2 2	—	27	120/60 110/50	**W980MLCFCM3** **W980MLCNCM3**	
1	200 230 460 575	7-1/2 7-1/2 10 10	—	27	120/60 110/50	**W980M1CFCM3** **W980M1CNCM3**	
2	200 230 460 575	10 15 25 25	—	45	120/60 110/50	**W980M2CFCM3** **W980M2CNCM3**	
3	200 230 460 575	25 30 50 50	—	90	120/60 110/50	**W980M3CFCM3** **W980M3CNCM3**	
4	200 230 460 575	40 50 100 100	—	135	120/60 110/50	**W980M4CFCM3** **W980M4CNCM3**	
5	200 230 460 575	75 100 200 200	—	270	120/60 110/50	**W980M5CFCM3** **W980M5CNCM3**	
6	200 230 460 575	150 150 400 400	—	540	120/60 110/50	**W980M6CFCM3** **W980M6CNCM3**	

① For motor full load current (FLA) range of .47A – 3.81A with a 1.15 to 1.25 service factor and for motor hp range of 1/4 hp to 2 hp at 460V.

Discount Symbol **MC7**

Table A-214. Electrical Characteristics, Sizes 1 – 6

Description	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6
Maximum Voltage Rating	600V	600V	600V	600V	600V	600V
Ampere Rating — Open	30A	50A	100A	150A	300A	600A
— Enclosed	27A	45A	90A	135A	270A	540A
Maximum Horsepower — Squirrel Cage Motor						
200V, 60 Hz	7-1/2 hp	10 hp	25 hp	40 hp	75 hp	150 hp
230V, 60 Hz	7-1/2 hp	15 hp	30 hp	50 hp	100 hp	200 hp
380V, 50 Hz	10 hp	25 hp	50 hp	75 hp	150 hp	300 hp
460 – 575V, 60 Hz	10 hp	25 hp	50 hp	100 hp	200 hp	400 hp
Resistive Heating, kW ① — Three-Phase, 3-Pole						
120V	5 kW	8.5 kW	17 kW	26 kW	52 kW	105 kW
240V	10 kW	17 kW	34 kW	68 kW	105 kW	210 kW
480V	20 kW	34 kW	68 kW	105 kW	210 kW	415 kW
600V	25 kW	43 kW	86 kW	130 kW	260 kW	515 kW
Capacitor Switching kVAR — Three-Phase						
240V	—	12 kVAR	27 kVAR	40 kVAR	80 kVAR	160 kVAR
480V	—	25 kVAR	53 kVAR	80 kVAR	160 kVAR	320 kVAR
600V	—	32 kVAR	67 kVAR	100 kVAR	200 kVAR	400 kVAR
Transformer Switching, kVA ② — Three-Phase, 3-Pole						
208V	3.6 kVA	6.3 kVA	12 kVA	20 kVA	41 kVA	81 kVA
240V	4.3 kVA	7.2 kVA	14 kVA	23 kVA	47 kVA	94 kVA
480V	8.5 kVA	14 kVA	28 kVA	47 kVA	94 kVA	188 kVA
600V	11 kVA	18 kVA	35 kVA	59 kVA	117 kVA	234 kVA

① Resistive loads having inrush currents not exceeding 1.5 times continuous rating.
② Transformers having inrush currents not more than 20 times peak of continuous current ratings.

Table A-215. 380V, 50 Hz Starters — Maximum Horsepower Ratings

NEMA Size	1	2	3	4	5	6
Maximum hp	10	25	50	75	150	300

Ground Current Sensing Protection

Eaton's Cutler-Hammer Advantage starters with ground current sensing protection feature provide equipment protection against ground currents between a factory-set low level and a lockout current. It is designed to open the circuit when it senses the low-level and arcing ground currents often occurring in motor branch circuits. This feature is standard with Cutler-Hammer Advantage starters. The ground current sensing protection feature can either be omitted from devices supplied by the factory, or omitted in the field by modifying the device with an Advantage Programming Module (WAPM).

Note: These devices are NOT Ground Fault Interrupters (GFIs) designed to protect people. Additionally, branch circuit short-circuit protective devices are to be used to clear faults that exceed the interrupting rating of the starter.

Table A-216. Ground Current Sensing

Size	Trip Current	Lockout Current	Trip Time
IL	10	24	.4 sec.
1	10	48	.4 sec.
2	20	86	.4 sec.
3	40	171	.4 sec.
4	60	256	.4 sec.
5	240	1045	.4 sec.
6	240	1045	.4 sec.

The table above gives trip amperes and lockout amperes for each size of the starter. Lockout current is the sum of the phase current and ground current.

Phase Unbalance

If the unbalance of any two phases is greater than 30% of the DIP switch selected trip rating of the starter, a phase unbalance is declared and a trip occurs. No time delay is required for reset. This feature is standard in the Cutler-Hammer Advantage starter. To customize your protection, phase unbalance can be omitted by disabling the protection using an Advantage Programming Module (WAPM).

Phase Loss

The Advantage starter will trip on phase loss, after two seconds, if the current in any one phase is lower than the currents listed in the table below. No time delay is required for reset. Phase loss protection is standard on the Cutler-Hammer Advantage starter. The phase loss protection feature can either be omitted from devices supplied by the factory, or omitted in the field by modifying the device with an Advantage Programming Module (WAPM).

Table A-217. Phase Trip Time

	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6
Phase Unbalance Level	30% Unbalance					
Phase Unbalance Trip Delay	6 sec.		9 sec.		12 sec.	
Phase Loss Trip after 2 sec. if Phase Current is below:	.15A ③ 1.15A	1.15A	2.5A	2.5A	11A	11A

③ Size 1 Lower Current Range for motor hp range of 1/4 hp to 2 hp at 460V.

Table A-218. Operating Coil Characteristics at Rated Coil Volts, Sizes 1 – 6

Description	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6
AC Coil						
Burden — Inrush VA	250 VA	250 VA	500 VA	500 VA	2600 VA	2600 VA
Closed VA	25 VA	25 VA	50 VA	50 VA	50 VA	50 VA
Closed Watts	5W	5W	10W	10W	10W	10W
Pick-Up Volts ①	78V	78V	78V	78V	78V	78V
Drop-Out Volts ①	60V	60V	60V	60V	60V	60V
Recommended VA rating for machine tool control power transformers	100 VA	100 VA	150 VA	150 VA	300 VA	300 VA

Note: The above represent typical production test values and should not be interpreted as a guarantee of actual performance.
① Values July vary based upon control power transformer capacities.

Advantage contactors will withstand 110% of their rated voltage continuously without injury to the operating coils and will close successfully at 65% of their rated voltage.

Table A-219. Mechanical Characteristics — Sizes 1 – 6

Description	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6
Dimensions in Inches (mm)						
Height	6.50 (165.1)	6.50 (165.1)	8.00 (203.2)	8.00 (203.2)	10.08 (256.0)	10.08 (256.0)
Width	2.50 (63.5)	2.50 (63.5)	3.68 (93.5)	3.68 (93.5)	7.07 (179.6)	7.07 (179.6)
Depth	4.96 (126.0)	4.96 (126.0)	6.54 (166.1)	6.54 (166.1)	7.64 (194.1)	7.64 (194.1)
Panel area, square inches	16.25	16.25	29.44	29.44	71.27	71.27
Shipping weight, lbs.	2.00	2.00	6.00	6.00	30.00	30.00
Maximum cable size/phase copper — AWG/MCM ②	8 AWG	4 AWG	250 MCM ②	250 MCM ②	(1) 500 MCM ②	(2) 500 MCM ②
Auxiliary Electrical Circuits Available	8	8	8	8	8	8
Maximum wire size for auxiliary electrical circuit — AWG	12	12	12	12	12	12
Maximum wire size for control circuit — AWG	(2) 14	(2) 14	(2) 14	(2) 14	(2) 14	(2) 14
Mechanical interlock combinations available	Vert. Horiz.	Vert. Horiz.	Vert. Horiz.	Vert. Horiz.	Vert. Horiz.	Vert. Horiz.

② Also referenced as "kcmil" (1990 NEC).

Motor FLA, Three-Phase AC

Table A-220. Data from Table 430-150 of 1990 NEC

Horsepower	Squirrel Cage AC			
	200V	230V	460V	575V
1/4	1.15	1	.6	.5
1/2	2.3	2.0	1.0	.8
3/4	3.2	2.8	1.4	1.1
1	4.1	3.6	1.8	1.4
1-1/2	6.0	5.2	2.6	2.1
2	7.8	6.8	3.4	2.7
3	11.0	9.6	4.8	3.9
5	17.5	15.2	7.6	6.1
7-1/2	25.3	22	11	9
10	32.2	28	14	11
15	48.3	42	21	17
20	62.1	54	27	22
25	78.2	68	34	27
30	92	80	40	32
40	120	104	52	41
50	150	130	65	52
60	177	154	77	62
75	221	192	96	77
100	286	248	124	99
125	359	312	156	125
150	414	360	180	144
200	552	480	240	192

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

Table A-221. Temperature Specifications, Sizes 1 – 6

Ambient Temperature	
Storage	-40° to 100°C (-40° to 212°F)
Operating	-40° to 40°C (-40° to 104°F)
External (NEMA Enclosed)	-40° to 40°C (-40° to 104°F)

Table A-222. DIP Switch Overload Protection Settings

Reset Method	Position 8
MANUAL (Non-automatic — wait 5 minutes)	0
AUTOMATIC (Reset time is based on protection Class)	1

Overload Class	Position 7	Position 6
10	0	0
20	0	1
30	1	0
None	1	1

Overload Trip Current Settings

Full Voltage Starters

To select the overload current trip setting, find the starter size table. Locate the full load current from motor nameplate in column A or B. Change DIP switch positions 5 – 1 to correspond to the table.

A

Reduced Voltage Starters

Multiply the full load current from motor nameplate by factor below for your type of reduced voltage starter. Find this adjusted full load current in starter Size table in Column A or B. Change DIP switch positions 5 – 1 to correspond to the table.

Table A-223. Factor

Catalogue Number	Multiplier Factor
W600 Autotransformer	1.0
W700 Part Winding	.5
W800, W890 Wye-Delta	.575

Table A-224. Size 1 — Lower Current Range

Column A Service Factor 1.15 to 1.25 Min.	Column A Service Factor 1.15 to 1.25 Max.	Column B Service Factor 1.0 Min.	Column B Service Factor 1.0 Max.	Trip Rating Amperes	DIP Switch Setting ① (Positions) (54321)
.47	.51	.51	.56	.59	00000
.52	.56	.57	.61	.65	00001
.57	.61	.62	.67	.71	00010
.62	.68	.68	.74	.78	00011
.69	.75	.75	.82	.86	00100
.76	.82	.83	.89	.95	00101
.83	.90	.90	.98	1.04	00110
.91	1.00	.99	1.09	1.14	00111
1.01	1.09	1.10	1.19	1.26	01000
1.10	1.21	1.20	1.31	1.38	01001
1.22	1.33	1.32	1.44	1.52	01010
1.34	1.46	1.45	1.59	1.67	01011
1.47	1.61	1.60	1.75	1.84	01100
1.62	1.77	1.76	1.93	2.02	01101
1.78	1.95	1.94	2.12	2.23	01110
1.96	2.14	2.13	2.33	2.45	01111
2.15	2.36	2.34	2.56	2.69	10000
2.37	2.60	2.57	2.82	2.96	10001
2.61	2.85	2.83	3.10	3.26	10010
2.86	3.14	3.11	3.42	3.58	10011
3.15	3.46	3.43	3.76	3.94	10100
3.47	3.81	3.77	4.14	4.34	10101

① All settings not shown are equivalent to 00000.

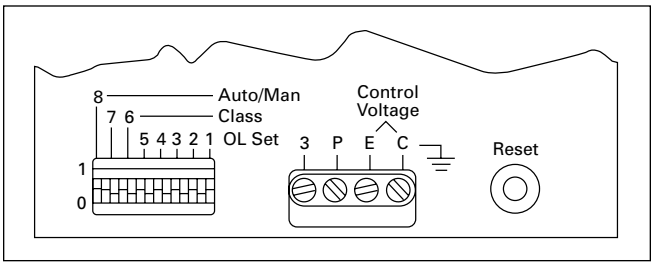


Figure A-50. DIP Switch, Terminals and Reset

Table A-225. Size 1 — Upper Current Range

Column A Service Factor 1.15 to 1.25 Min.	Column A Service Factor 1.15 to 1.25 Max.	Column B Service Factor 1.0 Min.	Column B Service Factor 1.0 Max.	Trip Rating Amperes	DIP Switch Setting ② (Positions) (54321)
3.15	3.46	3.43	3.75	3.93	00000
3.47	3.81	3.76	4.13	4.33	00001
3.82	4.19	4.14	4.55	4.77	00010
4.20	4.61	4.56	4.99	5.25	00011
4.62	5.0	5.00	5.4	5.77	00100
5.2	5.5	5.5	6.0	6.35	00101
5.6	6.0	6.1	6.5	6.9	00110
6.1	6.6	6.6	7.2	7.7	00111
6.7	7.3	7.3	8.0	8.5	01000
7.4	8.1	8.1	8.8	9.3	01001
8.2	8.9	8.9	9.6	10.2	01010
9.0	9.8	9.7	10.6	11.2	01011
9.9	0.8	10.7	11.7	12.4	01100
10.9	11.9	11.8	12.9	13.6	01101
12.0	13.1	13.0	14.2	15.0	01110
13.2	14.4	14.3	15.7	16.5	01111
14.5	15.8	15.8	17.2	18.1	10000
15.9	17.4	17.3	18.9	19.9	10001
17.5	19.2	19.0	20.9	21.9	10010
19.3	21.1	21.0	22.9	24.1	10011
21.2	23.3	23.0	25.2	26.5	10100
23.4	25.6	25.3	27.0	29.1	10101
25.7	27.0	—	—	32.1	10110

② All settings not shown are equivalent to 00000.

Table A-226. Size 2 — Current Range

Column A Service Factor 1.15 to 1.25 Min.	Column A Service Factor 1.15 to 1.25 Max.	Column B Service Factor 1.0 Min.	Column B Service Factor 1.0 Max.	Trip Rating Amperes	DIP Switch Setting ③ (Positions) (54321)
3.15	3.46	3.43	3.75	3.93	00000
3.47	3.81	3.76	4.13	4.33	00001
3.82	4.19	4.14	4.55	4.77	00010
4.20	4.61	4.56	4.99	5.25	00011
4.62	5.0	5.00	5.4	5.77	00100
5.1	5.5	5.5	6.0	6.35	00101
5.6	6.0	6.1	6.5	6.9	00110
6.1	6.6	6.6	7.2	7.7	00111
6.7	7.3	7.3	8.0	8.5	01000
7.4	8.1	8.1	8.8	9.3	01001
8.2	8.9	8.9	9.6	10.2	01010
9.0	9.8	9.7	10.6	11.2	01011
9.9	10.8	10.7	11.7	12.4	01100
10.9	11.9	11.8	12.9	13.6	01101
12.0	13.1	13.0	14.2	15.0	01110
13.2	14.4	14.3	15.7	16.5	01111
14.5	15.8	15.8	17.2	18.1	10000
15.9	17.4	17.3	18.9	19.9	10001
17.5	19.2	19.0	20.9	21.9	10010
19.3	21.1	21.0	22.9	24.1	10011
21.2	23.2	23.0	25.2	26.5	10100
23.3	25.6	25.3	27.8	29.1	10101
25.7	28.1	27.9	30.5	32.1	10110
28.2	31.0	30.6	33.7	35.3	10111
31.1	34.1	33.8	37.0	38.9	11000
34.2	37.5	37.1	40.7	42.8	11001
37.6	41.2	40.8	44.8	47.0	11010
41.3	45.0	44.9	45.0	51.6	11011

③ All settings not shown are equivalent to 00000.

Overload Trip Current Settings (Continued)

Table A-227. Size 3 Current Range

Column A Service Factor 1.15 to 1.25		Column B Service Factor 1.0		Trip Rating Amperes	DIP Switch Setting ① (Positions) (54321)
Min.	Max.	Min.	Max.		
9.9 –	10.8	10.8 –	11.7	12.4	00000
10.9 –	11.9	11.8 –	12.9	13.6	00001
12.0 –	13.1	13.0 –	14.2	15.0	00010
13.2 –	14.4	14.3 –	15.6	16.5	00011
14.5 –	15.8	15.7 –	17.2	18.1	00100
15.9 –	17.3	17.3 –	18.9	19.9	00101
17.5 –	19.2	19.0 –	20.9	21.9	00110
19.3 –	21.1	21.0 –	22.9	24.1	00111
21.2 –	23.2	23.0 –	25.2	26.5	01000
23.3 –	25.6	25.3 –	27.8	29.1	01001
25.7 –	28.1	27.9 –	30.6	32.1	01010
28.2 –	30.9	30.7 –	33.6	35.3	01011
31.0 –	34.1	33.7 –	37.0	38.8	01100
34.2 –	37.5	37.1 –	40.8	42.7	01101
37.6 –	41.3	40.9 –	44.9	47.0	01110
41.4 –	45.4	45.0 –	49.4	51.7	01111
45.5 –	50.0	49.5 –	54.3	56.9	10000
50.1 –	54.9	54.4 –	59.7	62.6	10001
55.0 –	60.5	59.8 –	65.7	68.8	10010
60.6 –	66.5	65.8 –	72.3	75.7	10011
66.6 –	73.2	72.4 –	79.6	83.3	10100
73.3 –	80.7	79.7 –	87.7	91.6	10101
80.8 –	88.7	87.8 –	90.0	101.0	10110
88.8 –	90.0	—	—	111.0	10111

① All settings not shown are equivalent to 00000.

Table A-228. Size 4 Current Range

Column A Service Factor 1.15 to 1.25		Column B Service Factor 1.0		Trip Rating Amperes	DIP Switch Setting ② (Positions) (54321)
Min.	Max.	Min.	Max.		
9.9 –	10.8	10.8 –	11.7	12.4	00000
10.9 –	11.9	11.8 –	12.9	13.6	00001
12.0 –	13.1	13.0 –	14.2	15.0	00010
13.2 –	14.4	14.3 –	15.6	16.5	00011
14.5 –	15.8	15.7 –	17.2	18.1	00100
15.9 –	17.4	17.3 –	18.9	19.9	00101
17.5 –	19.2	19.0 –	20.9	21.9	00110
19.3 –	21.1	21.0 –	22.9	24.1	00111
21.2 –	23.2	23.0 –	25.2	26.5	01000
23.3 –	25.6	25.3 –	27.8	29.1	01001
25.7 –	28.1	27.9 –	30.6	32.1	01010
28.2 –	30.9	30.7 –	33.6	35.3	01011
31.0 –	34.1	33.7 –	37.0	38.8	01100
34.2 –	37.5	37.1 –	40.8	42.7	01101
37.6 –	41.3	40.9 –	44.9	47.0	01110
41.4 –	45.4	45.0 –	49.4	51.7	01111
45.5 –	50.0	49.5 –	54.3	56.9	10000
50.1 –	54.9	54.4 –	59.7	62.6	10001
55.0 –	60.5	59.8 –	65.7	68.8	10010
60.6 –	66.5	65.8 –	72.3	75.7	10011
66.6 –	73.2	72.4 –	79.6	83.3	10100
73.3 –	80.7	79.7 –	87.7	91.6	10101
80.8 –	88.7	87.8 –	96.4	101	10110
88.8 –	97.5	96.5 –	105	111	10111
97.6 –	106	106 –	116	122	11000
107 –	117	117 –	127	134	11001
118 –	129	128 –	133	147	11010
130 –	133	—	—	162	11011

② All settings not shown are equivalent to 00000.

Table A-229. Size 5 Current Range

Column A Service Factor 1.15 to 1.25		Column B Service Factor 1.0		Trip Rating Amperes	DIP Switch Setting ③ (Positions) (54321)
Min.	Max.	Min.	Max.		
38.3 –	41.9	41.7 –	45.6	47.9	00000
42.0 –	46.1	45.7 –	50.1	52.5	00001
46.2 –	51.0	50.2 –	55.5	57.7	00010
51.1 –	55.9	55.6 –	60.8	63.9	00011
56.0 –	61.7	60.9 –	67.1	70.0	00100
61.8 –	67.5	67.2 –	73.4	77.3	00101
67.6 –	74.9	73.5 –	81.4	84.5	00110
75.0 –	82.3	81.5 –	89.5	93.7	00111
82.4 –	90.3	89.6 –	98.2	103	01000
90.4 –	99.9	98.3 –	108	113	01001
100 –	109	109 –	118	125	01010
110 –	120	119 –	130	137	01011
121 –	132	131 –	143	151	01100
133 –	145	144 –	157	166	01101
146 –	159	158 –	173	182	01110
160 –	175	174 –	190	200	01111
176 –	193	191 –	209	220	10000
194 –	213	210 –	231	242	10001
214 –	233	232 –	254	267	10010
234 –	257	255 –	270	293	10011
258 –	270	—	—	322	10100

③ All settings not shown are equivalent to 00000.

Table A-230. Size 6 Current Range

Column A Service Factor 1.15 to 1.25		Column B Service Factor 1.0		Trip Rating Amperes	DIP Switch Setting ④ (Positions) (54321)
Min.	Max.	Min.	Max.		
38.3 –	41.9	41.7 –	45.6	47.9	00000
42.0 –	46.1	45.7 –	50.1	52.5	00001
46.2 –	51.0	50.2 –	55.5	57.7	00010
51.1 –	55.9	55.6 –	60.8	63.9	00011
56.0 –	61.7	60.9 –	67.1	70.0	00100
61.8 –	67.5	67.2 –	73.4	77.3	00101
67.6 –	74.9	73.5 –	81.4	84.5	00110
75.0 –	82.3	81.5 –	89.5	93.7	00111
82.4 –	90.3	89.6 –	98.2	103	01000
90.4 –	99.9	98.3 –	108	113	01001
100 –	109	109 –	118	125	01010
110 –	120	119 –	130	137	01011
121 –	132	131 –	143	151	01100
133 –	145	144 –	157	166	01101
146 –	159	158 –	173	182	01110
160 –	175	174 –	190	200	01111
176 –	193	191 –	209	220	10000
194 –	213	210 –	231	242	10001
214 –	233	232 –	254	267	10010
234 –	257	255 –	279	293	10011
258 –	282	280 –	307	322	10100
283 –	311	308 –	338	354	10101
312 –	342	339 –	372	390	10110
343 –	376	373 –	409	429	10111
377 –	414	410 –	450	471	11000
415 –	456	451 –	496	519	11001
457 –	501	497 –	540	571	11010
502 –	540	—	—	628	11011

④ All settings not shown are equivalent to 00000.

A

Short Circuit Ratings

Table A-231. Short-Circuit Ratings

Short-Circuit Protective Device (SCPD)	Max. Rating (SCPD)	Circuit Breaker Interrupting Rating	Short-Circuit Withstand Rating		Typical Disconnect Device
			Current	Voltage	
Size 1					
Class H Fuse	60A	—	5,000A	600V	30A DS Sw.
Class J, R orT Fuse	60A	—	100,000A 50,000A	480V 600V	30A DS Sw.
			65,000A	600V	100A FD-K Molded Case Sw.
Magnetic Only ① Type CB ②	3A	—	100,000A 25,000A	480V 600V	HMCP HMCPS
	7A	—	100,000A 25,000A	480V 600V	HMCPS
	15A	—	100,000A 25,000A	480V 600V	HMCP
	30A	—	100,000A 25,000A	480V 600V	HMCP
Thermal Magnetic Type CB ③	50A	65,000A 25,000A	65,000A 25,000A	480V 600V	HFD
		100,000A 35,000A	100,000A 35,000A	480V 600V	FDC
Magnetic Only Type CB plus CL ④	30A	—	100,000A	600V	HMCP plus CL
Thermal/Mag. Type CB plus CL ⑤	50A	150,000A	100,000A	600V	HFD plus CL
Size 2					
Class H Fuse	100A	—	5,000A	600V	60A DS Sw.
Class J, R orT Fuse	100A	—	100,000A 50,000A	480V 600V	60A DS Sw.
			65,000A	600V	100A FD-K Molded Case Sw.
Magnetic Only ① Type CB ②	50A	—	100,000A 25,000A	480V 600V	HMCP
Thermal Magnetic Type CB ③	90A	65,000A 25,000A	65,000A 25,000A	480V 600V	HFD
		100,000A 35,000A	100,000A 35,000A	480V 600V	FDC
Magnetic Only Type CB plus CL ④	50A	—	100,000A	600V	HMCP plus CL
Thermal/Mag. Type CB plus CL ⑤	90A	150,000A	100,000A	600V	HFD plus CL
Size 3					
Class H Fuse	350A	—	5,000A	600V	100A DS Sw.
Class R Fuse	200A	—	100,000A 65,000A	480V 600V	100A FD-K Molded Case Sw.
Class J orT Fuse	200A	—	100,000A 65,000A	480V 600V	100A FD-K Molded Case Sw.
Magnetic Only ① Type CB ②	200A	—	100,000A 25,000A	480V 600V	HMCP
Thermal Magnetic	150A	65,000A 25,000A	65,000A 25,000A	480V 600V	HFD
		100,000A 35,000A	100,000A 35,000A	480V 600V	FDC
Magnetic Only Type CB plus CL ④	100A	—	100,000A	600V	HMCP plus CL
Thermal/Mag. Type CB plus CL ⑤	150A	150,000A	100,000A	600V	HFD plus CL

Short-Circuit Protective Device (SCPD)	Max. Rating (SCPD)	Circuit Breaker Interrupting Rating	Short-Circuit Withstand Rating		Typical Disconnect Device
			Current	Voltage	
Size 4					
Class H Fuse	500A	—	10,000A	600V	200A DS Sw.
Class J Fuse	400A	—	100,000A 65,000A	480V 600V	250A JD-K Molded Case Sw.
Class R or ClassT Fuse	400A	—	100,000A 65,000A	480V 600V	250A JD-K Molded Case Sw.
Magnetic Only ① Type CB ②	150A	—	100,000A 50,000A	480V 600V	HMCP
Thermal Magnetic Type CB ③	250A	100,000A 35,000A	100,000A 50,000A	480V 600V	JDC
		65,000A 25,000A	65,000A 25,000A	480V 600V	HJD
Magnetic Only Type CB plus CL ④	150A	—	100,000A	600V	HMCP plus CL
Size 5					
Class H Fuse	600A	—	10,000A	600V	400A KD-K Molded Case Sw.
Class J, R orT Fuse	600A	—	100,000A	600V	
Magnetic Only ① Type CB ②	250A	—	100,000A 25,000A	480V 600V	HMCP
	400A	—	100,000A 25,000A	480V 600V	
Thermal Magnetic Type CB ③	400A	65,000A 50,000A 35,000A	65,000A 100,000A 25,000A	480V 600V 600V	HFD KDC HKD
Size 6					
Class J, R orT Fuse	600A	—	100,000A 65,000A	480V 600V	600A LD-K Molded Case Sw.
Class L Fuse	800A	—	100,000A 65,000A	480V 600V	600A LD-K Molded Case Sw.
Magnetic Only ① Type CB ②	600A	—	100,000A 25,000A	480V 600V	HMCP
	800A	—	65,000A 25,000A	480V 600V	Magnetic Only HMCP
Thermal Magnetic Type CB ③	600A	65,000A 25,000A	65,000A 35,000A	480V 600V	HLD
	800A	50,000A 25,000A	65,000A 25,000A	480V 600V	Thermal Mag-netic HMC
Thermal/Mag. with CL ⑤	800A	200,000A	100,000A	600V	NBTri-Pac

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.

DeviceNet™ Communications Module

DeviceNet Module

The DeviceNet Communications module (Catalogue Number WPONIDNA) is designed to plug into the Advantage with the attached cable and plug. The module can be snapped onto the top or bottom of the Advantage unit. It can also be mounted separately using the mounting plate assembly (Catalogue Number WPONIBASE). The module provides DeviceNet users with the ability to control and monitor the functions of the Advantage system at 125, 250 or 500 kbaud. A connector is provided so that a HAND/OFF/AUTO hard contact July be used to selectively enable or disable the output of the control functions from the module without affecting its ability to monitor. A "Feedback" input is provided so that the state of an auxiliary contact July be read over the DeviceNet network.

Three bicolor LEDs indicate:

- DeviceNet address
- Network status (including connected, not connected, not powered)
- Module status (including normal operation, minor fault, needs commissioning)

Table A-232. DeviceNet Interface

Description	Catalogue Number	Price
DeviceNet Interface Module	**WPONIDNA**	
Mounting Plate Assembly	**WPONIBASE**	

Note: See **Page A-134** for WPONI Network Interface.

Type W Auxiliary Contact Modules

- Provides four separate contact sets which wire vertically and are color coded; black designates NC and silver designated NO.
- Up to two auxiliary contact modules can be mounted for a total of up to eight contact sets.
- Provides circuit isolation (no polarity restrictions) and single break bifurcated contacts.
- Common design fits all Sizes 1 – 6.

Table A-233. Ratings

Voltage	Make	Break
NEMA A600 — 120 – 600V AC	7200 VA	720 VA
NEMA Q300 — 125 – 300V DC	69 VA	69 VA

Table A-234. Auxiliary Contact Modules

Description	Catalogue Number	Price
2NO, 2NC	**W22**	
3NO, 1NC	**W31**	
4NO	**W40**	
4NC	**W04**	
1NO, 3NC	**W13**	
1NO, 1NC and 2Tie Points	**W11T**	

Bell Alarm Module

Bell Alarm Module

- Simple snap-on mounting — see mounting examples in **Figure A-51**.
- Isolated NO and NC contacts (1 each)
- Plugs into Reset port
- Remote electrical Reset wired to Catalogue Number WBELL module

Table A-235. Ratings

Form C Contact Ratings Maximum Amperes — 120V AC		Catalogue Number	Price
Make	Break		
2880 VA	480 VA	**WBELL**	
Continuous Current Rating: 5A			

Transformer Pilot Light Kits

Table A-236. Transformer Pilot Light Kits

Voltage	Colour	Legend Plate	Catalogue Number	Price	Replacement Part	Price
120	Red	RUN	**PLK1R**		**99-3590-1**	
240	Red	RUN	**PLK2R**		**99-3590-3**	
480	Red	RUN	**PLK4R**		**99-3590-6**	
600	Green	OFF	**PLK1G**		**99-3590-8**	

Discount Symbol **MC7**

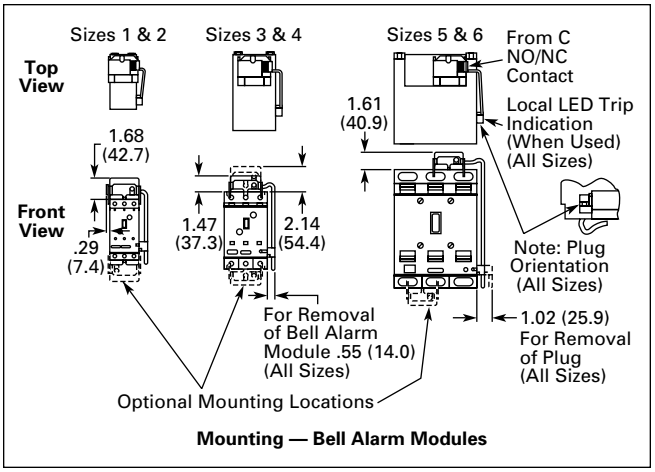
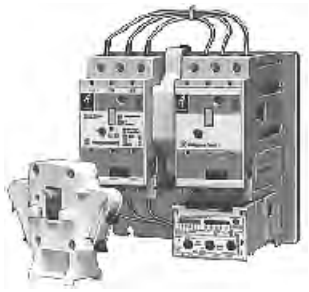


Figure A-51. Approximate Dimensions in Inches (mm)

Mechanical Interlock Kits



Installed Mechanical Interlock Kit

- Prevents closing of one contactor of a reversing or multi-speed controller until the opposite contactor is completely open.
- Lever type mechanism assures positive action.
- Electrical interlocking contacts included — two NC contacts.

Note: These kits cannot be field installed on reversing starters.

Table A-237. Mechanical Interlock Kits

Orientation	NEMA Size	Catalogue Number	Price
Horizontal	1 – 6	**WM16H**	
Vertical	1, 2 3, 4 5 6	**WM12V** **WM34V** **WM55V** **WM66V**	
Vertical	1 or 2 to 3 or 4 3 or 4 to 5 or 6 5, 6	**WM23VR** ① **WM45VR** ② **WMBBV** ③	

① Used to interlock a Size 1 or 2 to a Size 3 or 4 — mounts on right only.
② Used to interlock a Size 3 or 4 to a Size 5 or 6 — mounts on right only.
③ Interconnecting bus bars are furnished with the interlock.

Control Wire Ring/Spade Terminal Block

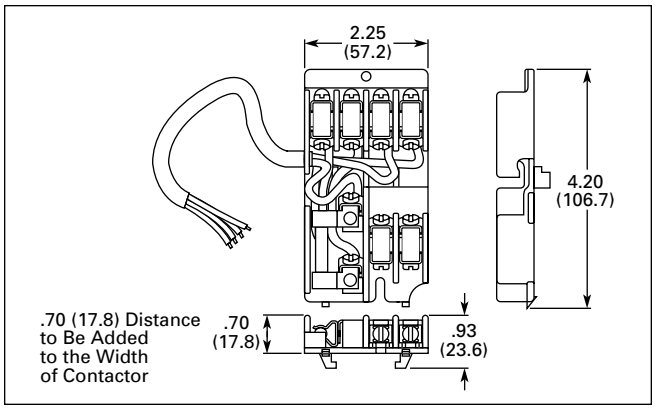


Figure A-52. Approximate Dimensions in Inches (mm)

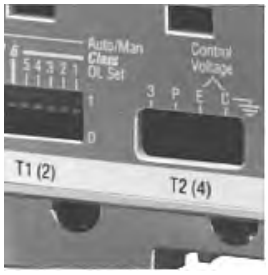
- For use with all Sizes 1 – 6.
- Provisions for ring or spade type lugs or stripped conductors.
- Bottom side pre-wired with color coded conductors.
- Side mounting on contactor identical to Type W auxiliary contact module mounting or can be mounted on Type W auxiliary contacts.
- Kit contains fuses for use with all size starters.

Table A-238. Control Wire Terminal Block

Description	Catalogue Number	Price
Control Wire Terminal Block	**WTBF16**	

Discount Symbol **MC7**

OL Selection DIP Switch Window



DIP Switch Window

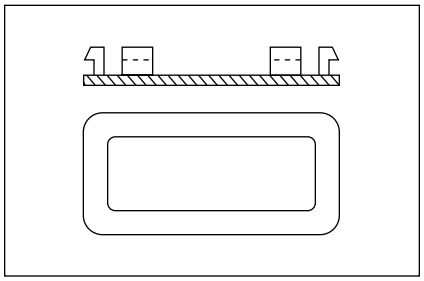


Figure A-53. DIP Switch Window

- Simple snap-in installation
- Allows clear visibility of DIP switches
- Prevents unwanted tampering of DIP switch settings
- Once in must be pried out from rear
- One window supplied with each starter

Table A-239. DIP Switch Window

Description	Catalogue Number	Price Each
DIP Switch Window, (Must order in packages of 10)	**WDIPSW10**	

DIN Rail Adapter Kit

- Provides snap-on mounting on 35 mm DIN rail
- For use with Sizes 1 and 2 non-reversing contactors and starters

Table A-240. DIN Rail Adapter Kit

Description	Catalogue Number	Price
DIN Rail Adapter Kit	**WDIN**	

Internal Trip Indicator

Internal Trip Indicator

- Overload condition indication — indicated by blinking light
- Trip condition — indicated by solid light

Table A-241. Trip Indicator

Description	Catalogue Number	Price
Internal Trip Indicator	**WLED**	

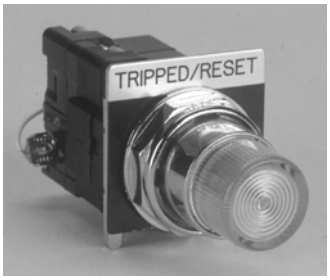
Competitive Baseplate Kit

- Allows for direct retrofit of competitive non-reversing starters
- Eliminates the need for re-drilling and tapping of mounting holes
- Simple selection of competitive footprints

Table A-242. Baseplate Kit

Description	Catalogue Number	Price
Sizes 1 and 2 Sizes 3 and 4	**WBASE12** **WBASE34**	

Remote Reset and Trip Indicator Pushbutton



FWD/REV/OFF/AUTO Control

- OL condition indication
- Trip indication — OL phase-loss/unbalance and ground fault
- OL reset capability
- 10250T — for 30 mm mounting
- NEMA 4 oiltight rated
- Mount remotely up to 6 ft. away
- Unit completely assembled including legend plate
- Available also in reset-only form — no trip indication provided

Table A-243. Remote Pushbuttons

Description	Catalogue Number	Price
Reset with Trip Indication 2 ft. Cable 6 ft. Cable 15 ft. Cable	 **WRSTL24** **WRSTL72** **WRSTL180**	
Reset Only 2 ft. Cable 6 ft. Cable 15 ft. Cable	 **WRST24** **WRST72** **WRST180**	
Conversion Kit Reset Only to Reset with Trip Indication	**WRLTT**	
6 ft. Cable Only 15 ft. Cable Only LED Replacement Bulb	**WRC72** **WRC180** **WRLT**	

Renewal Parts

Table A-244. Replacement Contact Kits

NEMA Size	Number of Poles	Catalogue Number	Price
1	3	**WCK13**	
2	3	**WCK23**	
3	3	**WCK33**	
4	3	**WCK43**	
5	3	**WCK53**	
6	3	**WCK63**	

Table A-245. Replacement Coils

Coil Size	Voltage and Hz	Catalogue Number	Price
1 & 2	110/120V 60 Hz	**WCOIL12F**	
3 & 4	110/120V 60 Hz	**WCOIL34F**	
5 & 6	110/120V 60 Hz	**WCOIL56F**	

Discount Symbol **MC7**

Full Voltage Pushbutton Control Module

Metering Module

Cutler-Hammer® Advantage Control Modules (ACMs) from Eaton's electrical business provide a cost-effective alternative to pushbuttons, selector switches, indicating lights, reset mechanisms, bell alarms and panel meters when used with the Advantage product line. Typical input/output control functions provided by panel mounted devices are conveniently packaged in a series of modules depending on application and complexity.

Sixteen styles cover applications ranging from:

- Full voltage non-reversing
- Full voltage reversing
- Full voltage multispeed
- Reduced voltage
- DeviceNet compatible

Modules exist for each application to provide the functions of:

- Status only
  - ❑ Indicating lights
  - ❑ Reset
- Status, START/STOP and RESET
- Status, HOA and RESET
- Status, START/STOP/HOA and RESET

An additional Metering Module replaces conventional ammeters (three-phase), replaces reset mechanisms and displays trip cause and data, control voltage and status.

This Metering Module can be used independently or in conjunction with any of the ACMs. An extra plug connection is available on the rear of each ACM to accept the Metering Module input.

The ACM family has been designed to save:

- Panel space (versus conventional pushbuttons, selector switches and indicating lights)
- Mounting and assembly labor
- Wiring and installation time

Regardless of the configuration, installation requires mounting only one 2.25 x 3.5 inch module, substantially reducing space requirements. Fitting a standard Greenlee punch and die set, Greenlee #60071, installation is accomplished with only two screws.

ACMs provide savings in wiring costs as well. Regardless of the complexity of the application, wiring is reduced to a single plug-in cable, see photo at left.

Communication is not restricted by use of the Advantage Control Modules. An extra plug connection is available on the rear of the ACM or Metering Module to allow a WPONIDNA or WPONI Communications module to be plugged in.

Full Voltage and Reduced Voltage Control Modules

Status Only

- 4 LEDs indicate that the motor is OFF, Running, Tripped or in Alarm mode (motor current is above the trip current setting)
- Includes RESET button

START/STOP

- Motor START/STOP controlled by START and STOP buttons
- Includes all features of Status Only module

HOA Selector Switch with START/STOP

- In HAND mode, motor will start and stop in response to START/STOP pushbuttons
- In AUTO mode, motor will run in response to remote signal
- Includes all features of Status Only module

ON/OFF/AUTO Selector Switch

- Motor will run in ON mode and not in the OFF mode
- In AUTO mode the motor will run in response to a remote signal
- Includes all features of Status Only module

Reduced Voltage Control Modules

The four reduced voltage pushbutton control modules provide control using two to four starters and/or contactors. The faceplates are identical to the full voltage modules, and the pushbuttons all perform the same functions. The module is programmed for the type of reduced voltage starter which sets the sequence of contact open and closing.

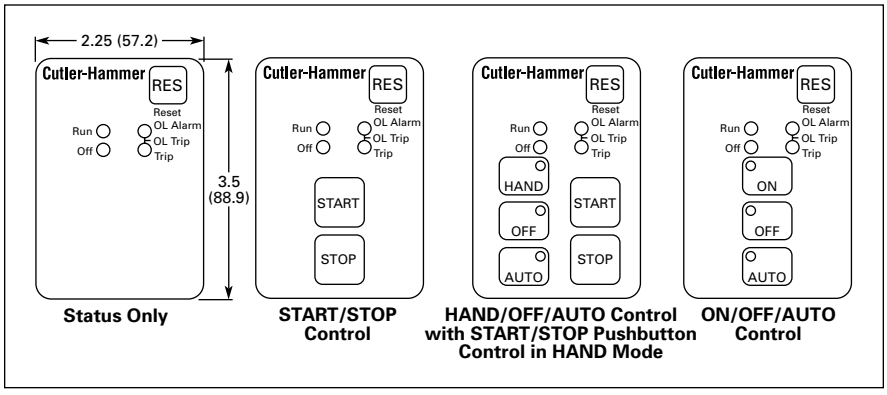


Figure A-54. Full Voltage and Reduced Voltage Control Modules

Reversing and 2-Speed Pushbutton Modules

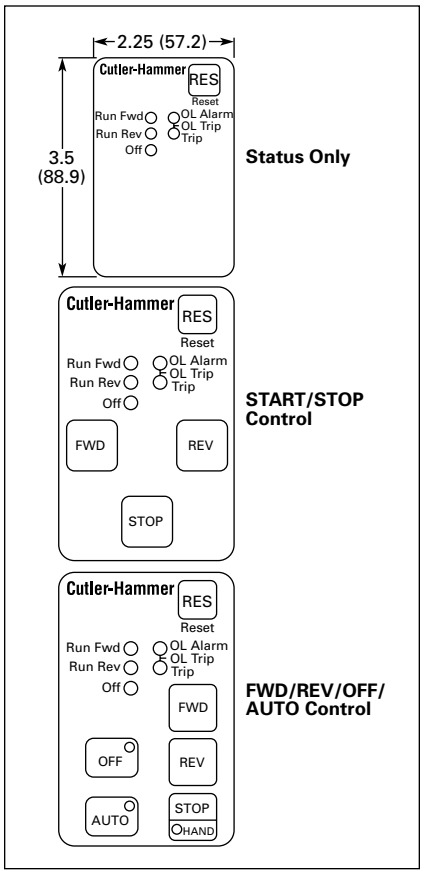


Figure A-55. Reversing and 2-Speed Pushbutton Module

ACM Specifications

- Input supply requirements: 120V AC (supplied by the Advantage motor controller)
- Max. distance from Advantage motor controller: 6 ft. (1.83m)
- Operating frequency: 50 or 60 Hz
- Operating temperature: -20° to 70°C
- Storage temperature: -20° to 85°C
- Humidity: 0 to 95%, non-condensing
- Remote input wire size: 18 – 14 AWG
- Maximum distance between remote pushbuttons and ACM: 200 ft. (60.9m)
- Cutout dimensions: 2.25 x 3.5 inches (57.2 x 88.9 mm) (see above). The cutout can be made using a Greenlee rectangular punch #600710
- Enclosure type: NEMA 1 or 12, when properly installed

Status Only

- 5 LEDs which indicate that the motor is OFF, running forward (FAST), running reverse (SLOW), tripped or in alarm mode
- Includes RESET button

FORWARD (FAST)/REVERSE (SLOW)/STOP

- Pushbuttons control whether motor is running forward (FAST), running reverse (SLOW) or stopped
- Includes all features of Status Only module

FWD/REV/OFF/AUTO

- In AUTO mode, motor is running forward (FAST), running reverse (SLOW) or OFF in response to a remote signal
- All features of FORWARD/REVERSE/ STOP module

Note: For 2-speed modules, FAST replaces FWD and SLOW replaces REV.

Metering Module

The Advantage Metering Module monitors status of a motor along with any of the pushbutton modules. It July be plugged into the pushbutton control module, and communicates to the starter through it, or plugged directly into the starter when a pushbutton control module is not used.

The four digit display will show the current in each phase, control voltage or cause of trip. The STEP button July be pressed to step through these values, and the five LEDs will indicate which value is being displayed. It is also equipped with a reset button and Trip Lockout LED.

A

Table A-246. Control Modules/Accessories

Description	Catalogue Number	Price
Full Voltage		
Status Only with Reset	**WPBFV1**	
START/STOP	**WPBFV2**	
START/STOP/HOA	**WPBFV3**	
ON/OFF/AUTO	**WPBFV4**	
LOCAL/OFF/REMOTE with Lockable ACM ①	**WPBFV5** ①	
LOCAL/OFF/REMOTE with Network Health ①	**WPBFV7** ①	
Reversing		
Status Only with Reset	**WPBR1**	
FWD/REV/STOP	**WPBR2**	
FWD/REV/STOP/HOA	**WPBR3**	
2-Speed		
Status Only with Reset	**WPB2S1**	
FAST/SLOW/STOP	**WPB2S2**	
FAST/SLOW/STOP/HOA	**WPB2S3**	
Reduced Voltage		
Status Only with Reset	**WPBRV1**	
START/STOP	**WPBRV2**	
START/STOP/HOA	**WPBRV3**	
ON/OFF/AUTO	**WPBRV4**	
Metering Module	**WMETER** ②	
10 ft. Interconnect Cable (3m)	**WACM10**	
6 ft. Interconnect Cable (1.8m)	**WACM6**	
3 ft. Interconnect Cable (.9m)	**WACM3**	
1 ft. Interconnect Jumper (.3m)	**WACM1**	

① The WPBFV5 and WPBFV7 are DeviceNet® only. They can only be used when an active network is connected.
② Harmonic distortion may cause the WMETER to display inaccurate current measurements.

Discount Symbol **MC7**

A

Non-reversing Contactors, NEMA Sizes 1 – 6

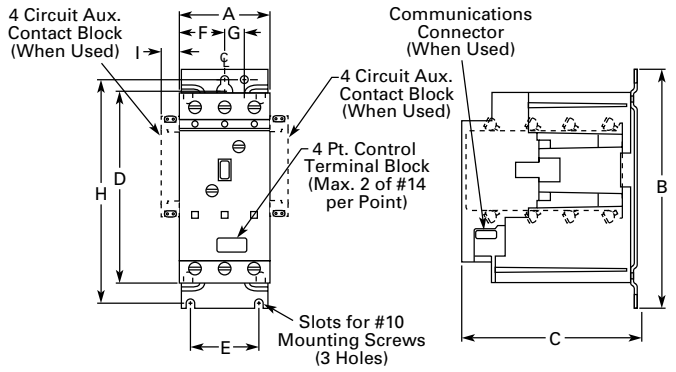


Figure 1
Sizes 1 and 2 Contactor

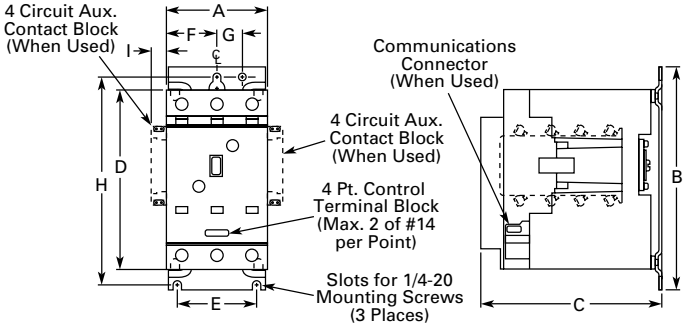


Figure 2
Sizes 3 and 4 Contactor

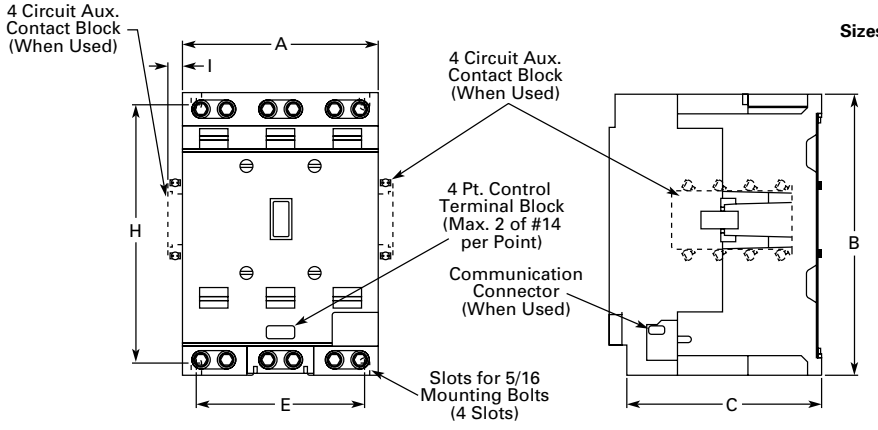


Figure 3
Sizes 5 and 6 Contactor

Figure A-56. Approximate Dimensions in Inches and Shipping Weights

Table A-247. Catalogue Number W201 Non-reversing Contactors

NEMA Size	Number of Poles	Figure Number	Mounting Screws		Dimensions in Inches (mm)									Ship. Wt. Lbs. (kg)
			Number	Size	Wide A	High B	Deep C	D	E	F	G	H	I	
1, 2	3	1	3	#10	2.50 (63.5)	6.50 (165.1)	4.84 (122.9)	5.12 (130.0)	1.88 (47.8)	1.25 (31.8)	.75 (19.1)	6.00 (152.4)	.52 (13.2)	2 (.9)
3, 4	3	2	3	1/4-20	3.68 (93.5)	8.00 (203.2)	6.49 (164.8)	6.45 (163.8)	2.80 (71.1)	1.84 (46.7)	.93 (23.6)	7.50 (190.5)	.52 (13.2)	6 (2.7)
5, 6	3	3	4	5/16	7.07 (179.6)	10.08 (256.0)	7.64 (194.1)	—	6.00 (152.4)	—	—	9.20 (233.7)	.50 (12.7)	30 (13.6)

Horizontal Reversing, Open Contactors, NEMA Sizes 1 – 6

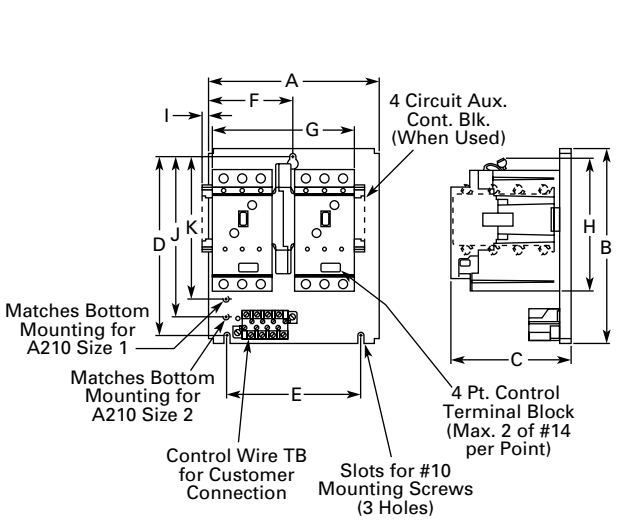


Figure 1
Sizes 1 and 2 Horizontal Reversing Contactor

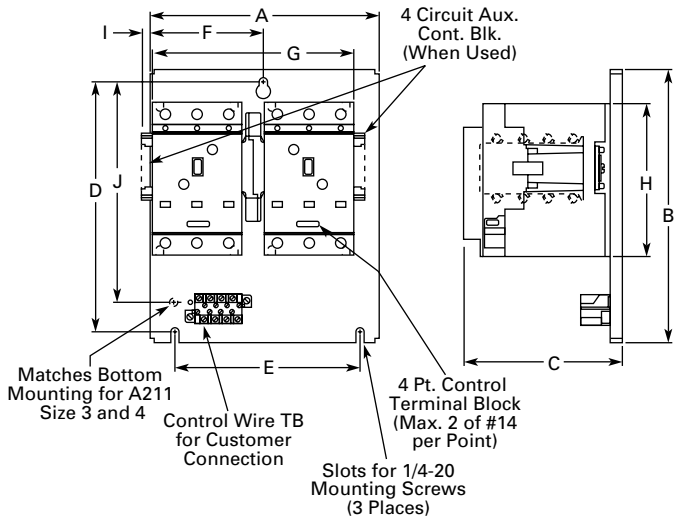


Figure 2
Sizes 3 and 4 Horizontal Reversing Contactor

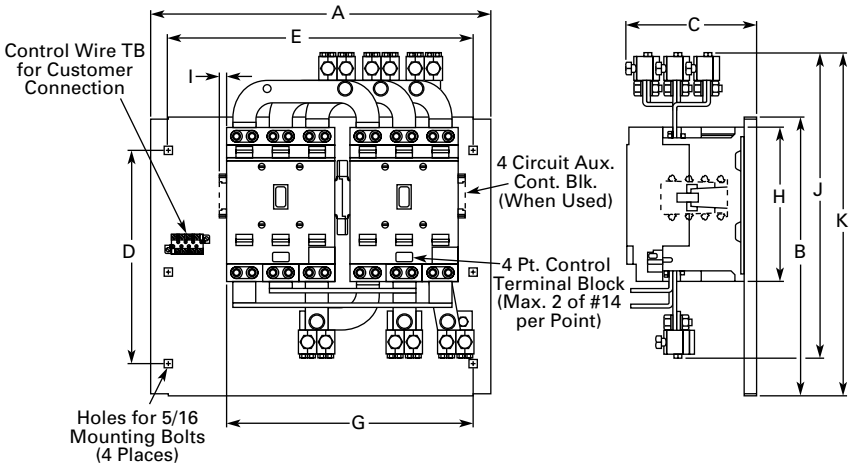


Figure 3
Sizes 5 and 6 Horizontal Reversing Contactor

Figure A-57. Approximate Dimensions in Inches and Shipping Weights

Note: For all Sizes 1 – 6, factory furnishes the control wiring between the forward and reverse contactors, and the control wire terminal block for customer connection.

Table A-248. Catalogue Number W211 Horizontal Reversing Contactors

NEMA Size	Number of Poles	Figure Number	Mounting Screws		Dimensions in Inches (mm)											Ship. Wt. Lbs. (kg)
			Number	Size	Wide A	High B	Deep C	D	E	F	G	H	I	J	K	
1, 2	3 x 3	1	3	#10	7.13 (181.1)	8.05 (204.5)	5.09 (129.3)	7.50 (190.5)	5.69 (144.5)	3.56 (90.4)	6.00 (152.4)	5.53 (140.5)	.33 (8.4)	6.75 (171.5)	6.00 (152.4)	6 (2.7)
3, 4	3 x 3	2	3	1/4-20	9.76 (247.9)	11.37 (288.8)	6.76 (171.7)	10.50 (266.7)	8.00 (203.2)	4.88 (124.0)	8.36 (212.3)	6.45 (163.8)	.45 (11.4)	9.25 (235.0)	—	16 (7.3)
5	3 x 3	3	4	5/16	22.24 (564.9)	18.24 (463.3)	8.91 (226.3)	14.00 (355.6)	20.00 (508.0)	—	15.15 (384.8)	10.08 (256.0)	.50 (12.7)	19.95 (506.7)	22.47 (570.7)	80 (36.3)
6	3 x 3	3	4	5/16	22.24 (564.9)	18.24 (463.3)	8.65 (219.7)	14.00 (355.6)	20.00 (508.0)	—	16.18 (411.0)	10.08 (256.0)	.50 (12.7)	19.76 (501.9)	22.28 (565.9)	80 (36.3)

Vertical Reversing, Open Contactors, NEMA Sizes 1 – 6

A

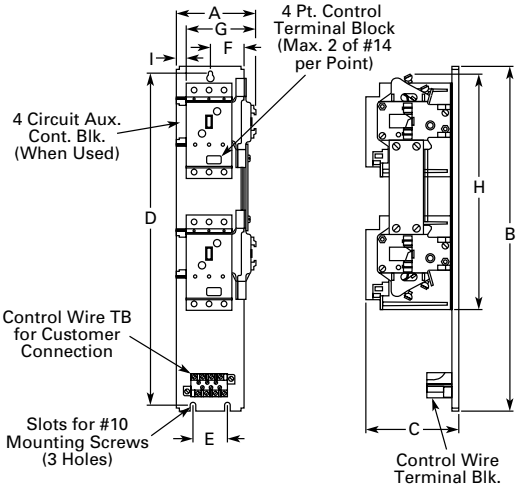


Figure 1
Sizes 1 and 2 Vertical Reversing Contactor

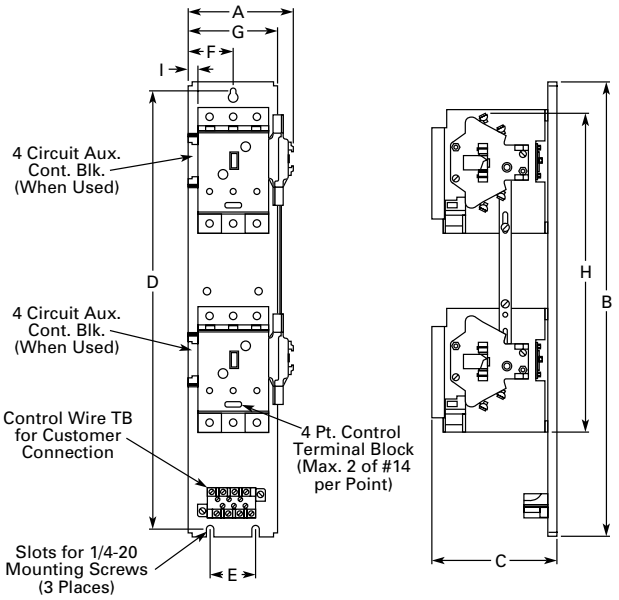


Figure 2
Sizes 3 and 4 Vertical Reversing Contactor

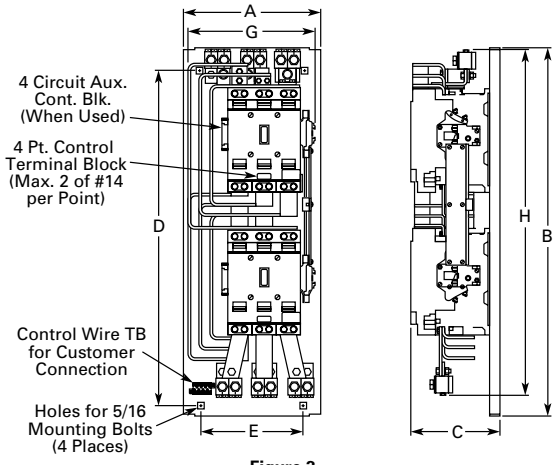


Figure 3
Sizes 5 and 6 Vertical Reversing Contactor

Figure A-58. Approximate Dimensions in Inches and Shipping Weights

Note: For all Sizes 1 – 6, factory furnishes the control wiring between the forward and reverse contactors, and the control wire terminal block for customer connection.

Table A-249. Catalogue Number W251 Vertical Reversing Contactors

NEMA Size	Number of Poles	Figure Number	Mounting Screws		Dimensions in Inches (mm)									Ship. Wt. Lbs. (kg)
			Number	Size	Wide A	High B	Deep C	D	E	F	G	H	I	
1, 2	3 x 3	1	3	#10	4.27 (108.5)	18.50 (469.9)	5.09 (129.3)	18.00 (457.2)	1.88 (47.8)	1.80 (45.7)	3.73 (94.7)	12.65 (321.3)	.52 (13.2)	7 (3.2)
3, 4	3 x 3	2	3	1/4-20	5.42 (137.7)	25.13 (638.3)	6.76 (171.7)	24.25 (616.0)	2.88 (73.2)	2.31 (58.7)	4.62 (117.3)	16.94 (430.3)	.52 (13.2)	17 (7.7)
5	3 x 3	3	4	5/16	13.24 (336.3)	34.94 (887.5)	8.64 (219.5)	32.00 (812.8)	10.00 (254.0)	—	12.04 (305.8)	33.29 (845.6)	—	80 (36.3)
6	3 x 3	3	4	5/16	13.24 (336.3)	34.94 (887.5)	8.64 (219.5)	32.00 (812.8)	10.00 (254.0)	—	12.04 (305.8)	33.16 (842.3)	—	80 (36.3)

Non-reversing Starters, NEMA Sizes 1 – 6

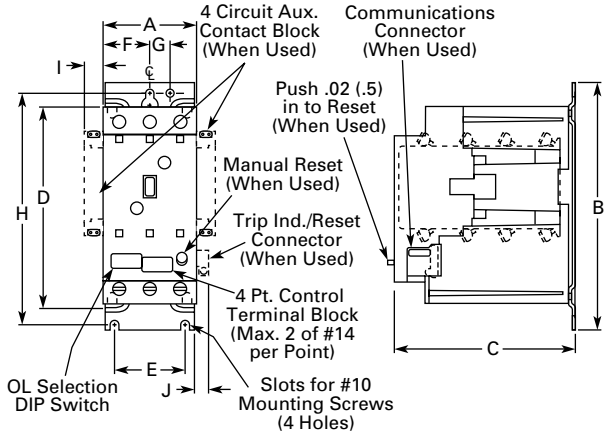


Figure 1
Sizes 1 and 2 Starter

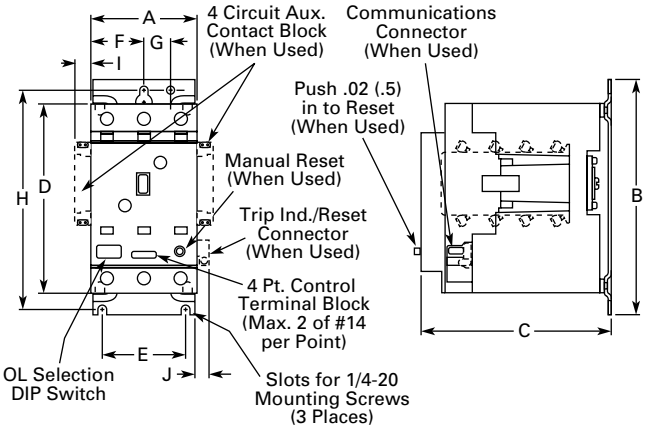


Figure 2
Sizes 3 and 4 Starter

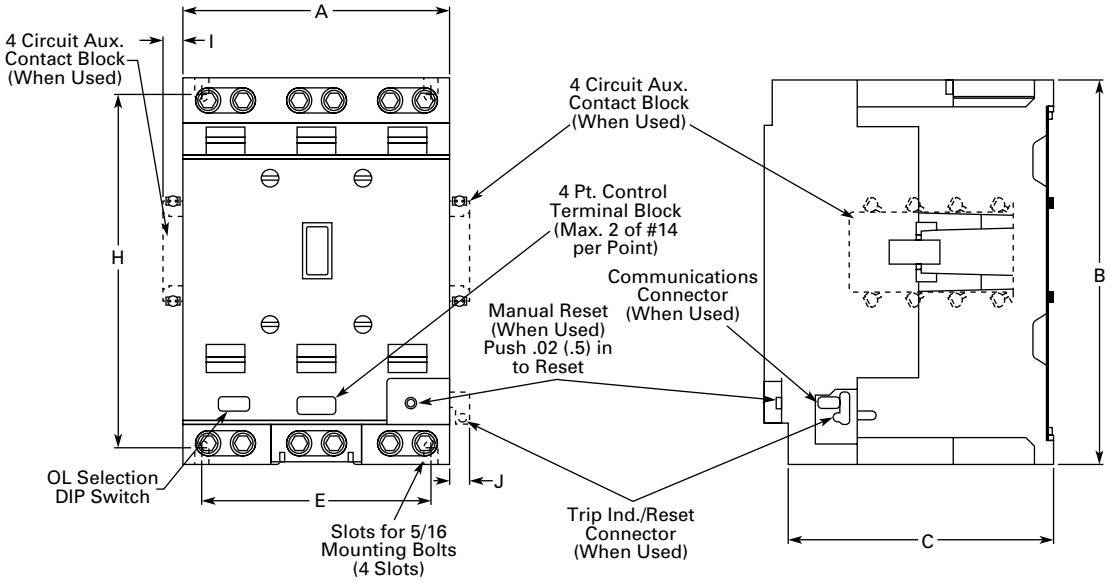


Figure 3
Sizes 5 and 6 Starter

Figure A-59. Approximate Dimensions in Inches and Shipping Weights

Table A-250. Catalogue Number W200 Non-reversing Starters

NEMA Size	Number of Poles	Figure Number	Mounting Screws		Dimensions in Inches (mm)										Ship. Wt. Lbs. (kg)
			Number	Size	Wide A	High B	Deep C	D	E	F	G	H	I	J	
1, 2	3	1	3	#10	2.50 (63.5)	6.50 (165.1)	4.96 (126.0)	5.12 (130.0)	1.88 (47.8)	1.25 (31.8)	.75 (19.1)	6.00 (152.4)	.52 (13.2)	.29 (7.4)	2 (.9)
3, 4	3	2	3	1/4-20	3.68 (93.5)	8.00 (203.2)	6.54 (166.1)	6.45 (163.8)	2.80 (71.1)	1.84 (46.7)	.93 (23.6)	7.50 (190.5)	.52 (13.2)	.32 (8.1)	6 (2.7)
5, 6	3	3	4	5/16	7.07 (179.6)	10.08 (256.0)	7.64 (194.1)	—	6.00 (152.4)	—	—	9.20 (233.7)	.50 (12.7)	.46 (11.7)	30 (13.6)

Horizontal Reversing, Open Starters, NEMA Sizes 1 – 6

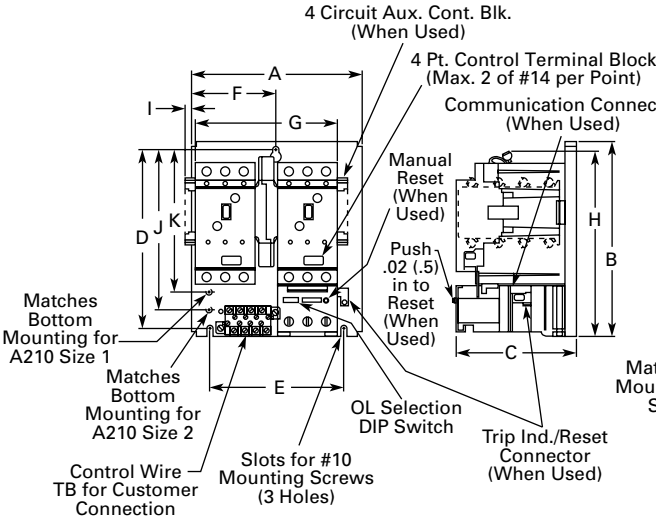


Figure 1
Sizes 1 and 2 Horizontal Reversing Contactor

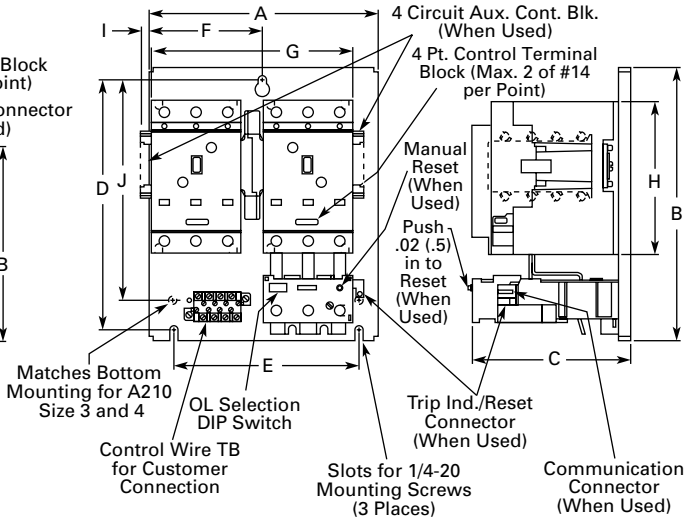


Figure 2
Sizes 3 and 4 Horizontal Reversing Contactor

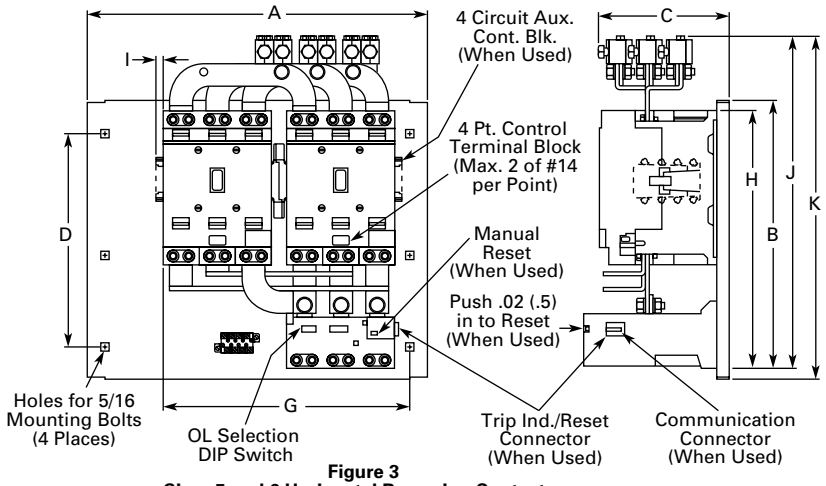


Figure 3
Sizes 5 and 6 Horizontal Reversing Contactor

Figure A-60. Approximate Dimensions in Inches and Shipping Weights

Note: For all Sizes 1 – 6, factory furnishes the control wiring between the forward and reverse contactors, and the control wire terminal block for customer connection.

Table A-251. Catalogue Number W210 Horizontal Reversing Starters

NEMA Size	Number of Poles	Figure Number	Mounting Screws		Dimensions in Inches (mm)											Ship. Wt. Lbs. (kg)
			Number	Size	Wide A	High B	Deep C	D	E	F	G	H	I	J	K	
1, 2	3 x 3	1	3	#10	7.13 (181.1)	8.05 (204.5)	5.25 (133.4)	7.50 (190.5)	5.69 (144.5)	3.56 (90.4)	6.00 (152.4)	7.62 (192.5)	.33 (8.4)	6.75 (171.5)	6.00 (152.4)	7 (3.2)
3, 4	3 x 3	2	3	1/4-20	9.76 (247.9)	11.37 (288.8)	6.81 (173.0)	10.50 (266.7)	8.00 (203.2)	4.88 (124.0)	8.47 (215.1)	9.79 (248.7)	.45 (11.4)	9.25 (235.0)	—	18 (8.2)
5	3 x 3	3	4	5/16	22.24 (564.9)	18.24 (463.3)	8.91 (226.3)	14.00 (355.6)	20.00 (508.0)	—	15.28 (388.1)	16.82 (427.2)	.50 (12.7)	21.76 (552.7)	22.47 (570.7)	85 (38.6)
6	3 x 3	3	4	516	22.24 (564.9)	18.24 (463.3)	8.65 (219.7)	14.00 (355.6)	20.00 (508.0)	—	15.28 (388.1)	16.82 (427.2)	.50 (12.7)	21.57 (547.9)	22.28 (565.9)	85 (38.6)

Vertical Reversing, Open Starters, NEMA Sizes 1 – 6

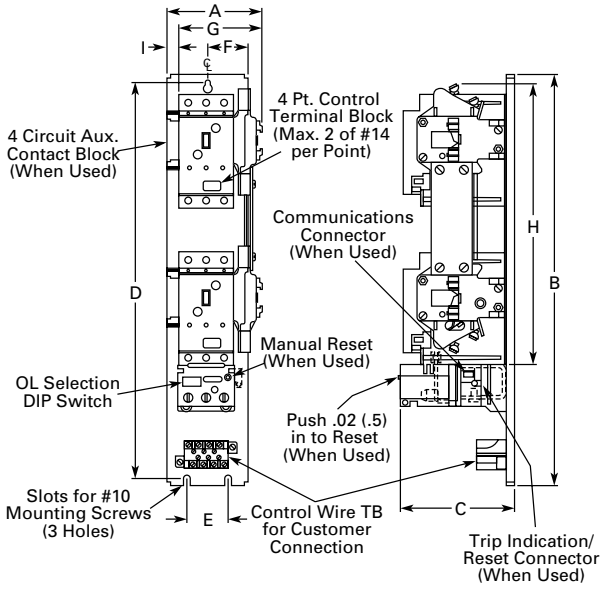


Figure 1
Sizes 1 and 2 Vertical Reversing Starter

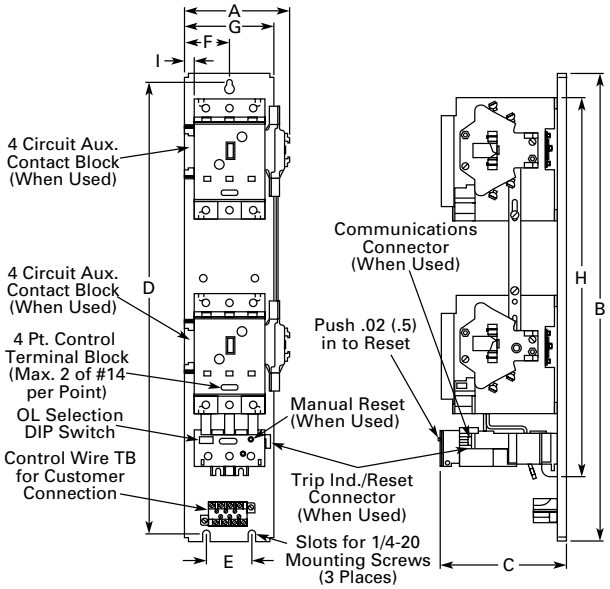


Figure 2
Sizes 3 and 4 Vertical Reversing Starter

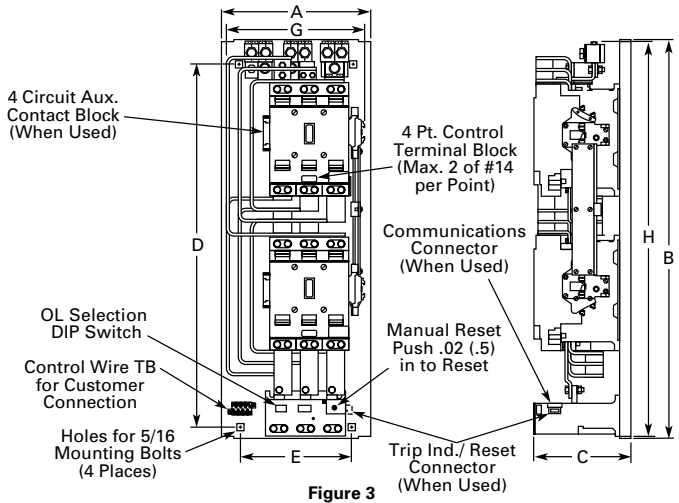


Figure 3
Sizes 5 and 6 Vertical Reversing Starter

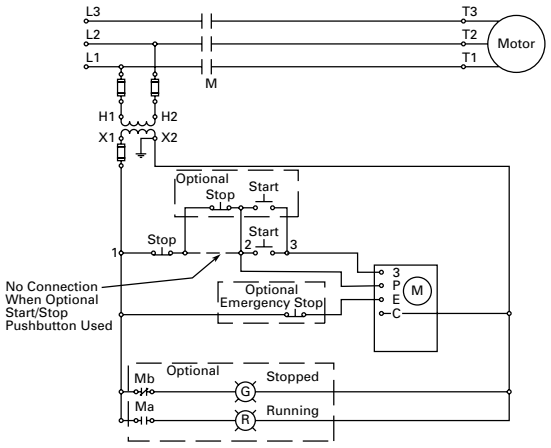
Figure A-61. Approximate Dimensions in Inches and Shipping Weights

Note: For all Sizes 1 – 6, factory furnishes the control wiring between the forward and reverse contactors, and the control wire terminal block for customer connection.

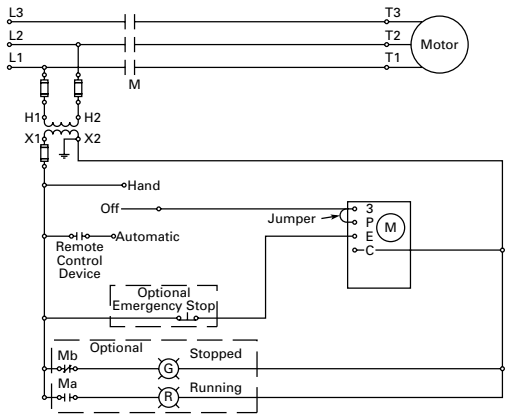
Table A-252. Catalogue Number W250 Vertical Reversing Starters

NEMA Size	Number of Poles	Figure Number	Mounting Screws		Dimensions in Inches (mm)									Ship. Wt. Lbs. (kg)
			Number	Size	Wide A	High B	Deep C	D	E	F	G	H	I	
1, 2	3 x 3	1	3	#10	4.27 (108.5)	18.50 (469.9)	5.25 (133.4)	18.00 (457.2)	1.88 (47.8)	1.80 (45.7)	3.73 (94.7)	14.72 (373.9)	.52 (13.2)	7.5 (3.4)
3, 4	3 x 3	2	3	1/4-20	5.42 (137.7)	25.13 (638.3)	6.81 (173.0)	24.25 (616.0)	2.88 (73.2)	2.31 (58.7)	4.62 (117.3)	20.28 (515.1)	.52 (13.2)	19.0 (8.6)
5	3 x 3	3	4	5/16	13.24 (336.3)	34.94 (887.5)	8.64 (219.5)	32.00 (812.8)	10.00 (254.0)	—	12.04 (305.8)	34.78 (883.4)	—	85.0 (38.6)
6	3 x 3	3	4	516	13.24 (336.3)	34.94 (887.5)	8.64 (219.5)	32.00 (812.8)	10.00 (254.0)	—	12.04 (305.8)	34.59 (878.6)	—	85.0 (38.6)

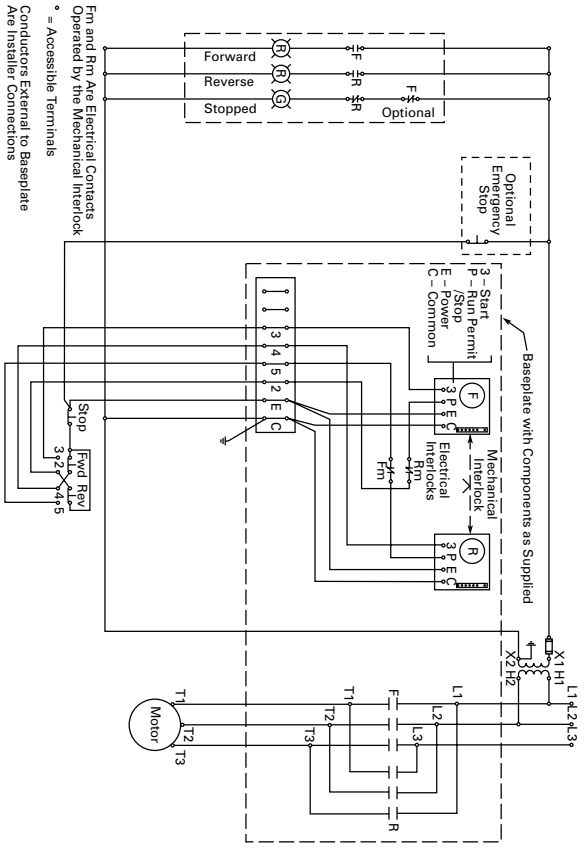
Non-reversing and Reversing Contactors, NEMA Sizes 1 – 6



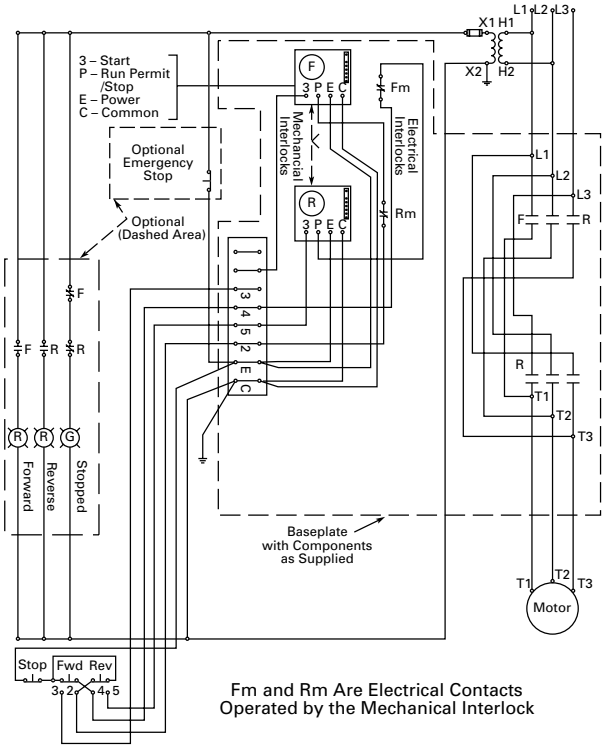
Cat. No. W201 Non-reversing Contactor
3-Wire Control with Internal Holding Circuit



Cat. No. W201 Non-reversing Contactor
2-Wire Control with Maintained HOA Switch



Cat. No. W211 Horizontal Reversing Contactor ①
3-Wire Control with Internal Holding Circuit

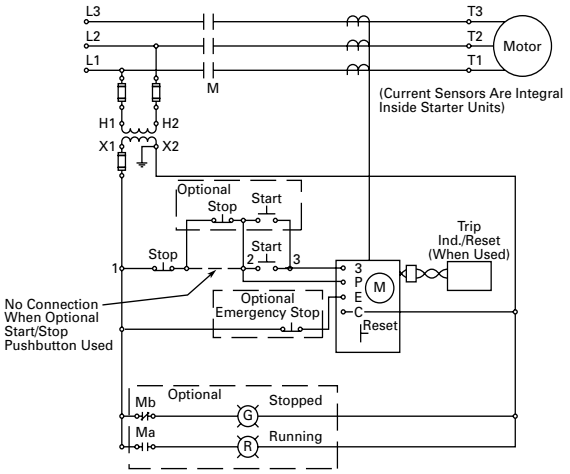


Cat. No. W251 Vertical Reversing Contactor
3-Wire Control with Internal Holding Circuit

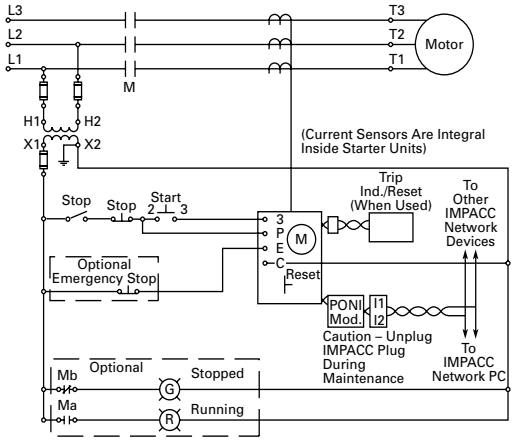
Figure A-62. Typical Wiring Diagrams

① Sizes 5 and 6 horizontal reversing contactors have their Forward and Reverse contactor arrangement reversed. Reverse contactor is on left and Forward contactor is on right.

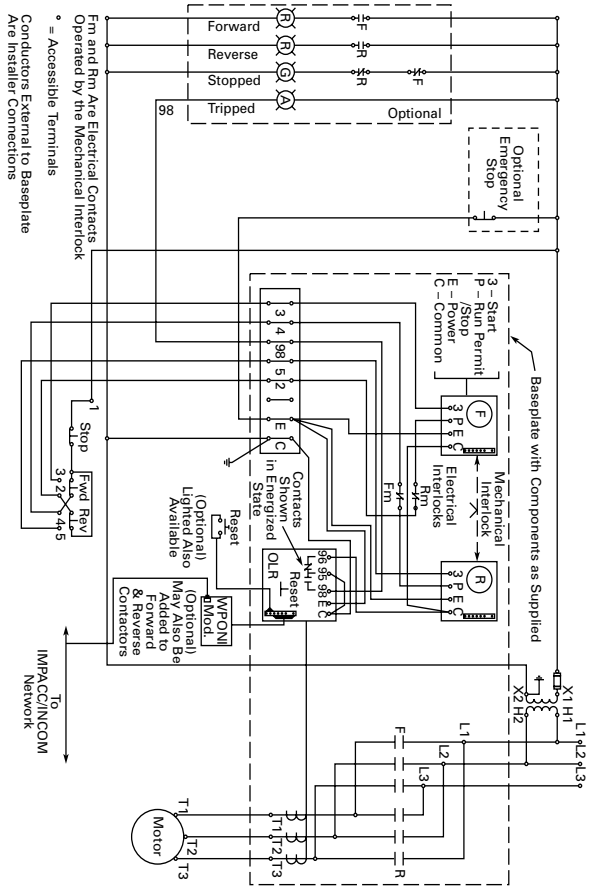
Non-reversing and Reversing Starters, NEMA Sizes 1 – 6



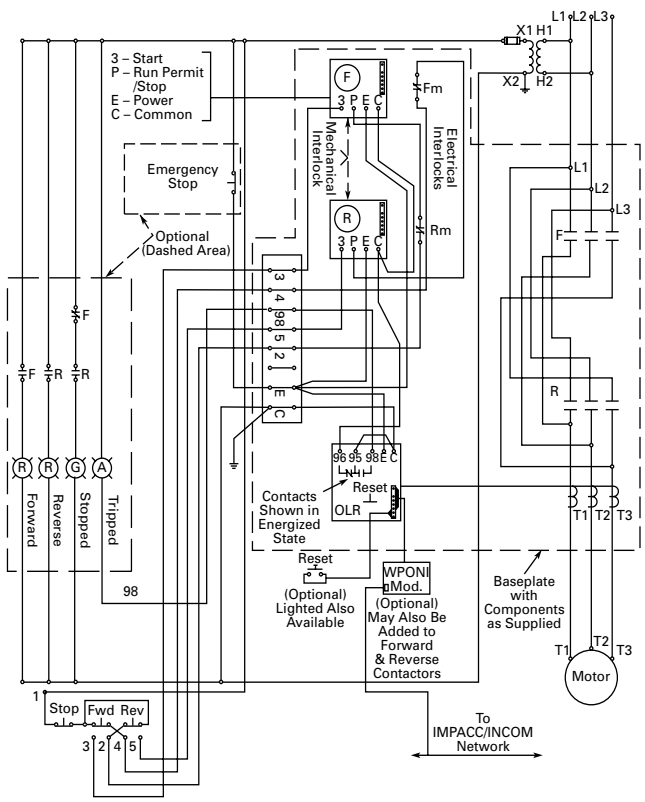
Cat. No. W200 Non-reversing Starter
3-Wire Control with Internal Holding Circuit



Cat. No. W200 Non-reversing Starter
Internal Holding Circuit, 3-Wire with IMPACC



Cat. No. W210 Horizontal Reversing Starter ①
3-Wire Control with Internal Holding Circuit



Cat. No. W250 Vertical Reversing Starter
3-Wire Control with Internal Holding Circuit

Figure A-63. Typical Wiring Diagrams

① Sizes 5 and 6 horizontal reversing contactors have their Forward and Reverse contactor arrangement reversed. Reverse contactor is on left and Forward contactor is on right.

Contents

Central Monitoring Unit

Central Monitoring Unit

Product Description

The Cutler-Hammer® Advantage Central Monitoring Unit from Eaton's electrical business is a communications centre which transmits to and receives data from up to 99 Advantage starters or contactors or IQ500s equipped with PONI cards. The CMU can be mounted on the door of a motor control center or custom panel using the existing IQ cut-out dimensions.

The eight-digit alphanumeric display monitors active data, trip data or set points. The group of data being displayed is indicated by one of three LEDs and is selected by the user. The two-digit alphanumeric display indicates the address of the device about which the data is being displayed. This address is also selected by the user.

Five LEDs are provided which indicate the present status of the selected starter. Two additional LEDs are also provided at the top of the panel, one which indicates that the CMU is OPERATIONAL, and another which indicates ALARM status. An ACKNOWLEDGE/RESET button permits the user to reset the CMU following a device trip.

The CMU can be interfaced into a larger PowerNet network with the addition of a PowerNet PONI Communications Module.

Parameters Displayed

- Monitored values:
  - Device description
  - 1_A, 1_B, 1_C currents
  - Control voltage (excluding IQ500)
  - Present time, date
  - Resettable operation count
  - Run time, hours
- Trip data — same as current values with cause of trip
- Set points:
  - Device size
  - OL trip current setting (FLA setting)
  - OL trip class
  - Ground fault protection — ON/OFF
  - Phase loss/unbalance protection — ON/OFF
  - Reset mode — AUTO/MANUAL
  - Frequency
  - Ground fault trip level (IQ500 only)
  - Ground fault trip delay time (IQ500 only)
  - Phase unbalance % (IQ500 only)
- IQ500M — Special Functions Module set points — if LOAD CONTROL selected:
  - Load shed level
  - Load shed delay time
  - Load resume level
  - Load resume delay time
  - Long acceleration time

  If UNDERLOAD/JAM selected:
  - Jam trip level
  - Jam trip delay time
  - Jam start delay time
  - Underload trip level
  - Underload trip delay time
  - Underload start delay time
  - Long acceleration time
  - Relay control

Technical Data

- Device power requirement: 10 VA maximum
- Frequency: 50/60 Hz
- Line characteristics: 120 or 240V AC +20%, -20% (auto selected)
- Operating temperature: 0° to 70°C (32° to 158°F)
- Storage temperature: -20° to 85°C (-4° to 185°F)
- Humidity: 0 to 95%, R.H. non-condensing
- Alarm contact ratings —
  - 240V AC: 10A, resistive
  - 30V DC: 10A, resistive

Dimensions

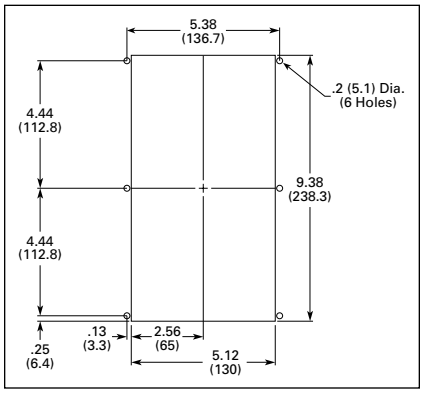


Figure A-64. Chassis Cutout Dimensions in Inches (mm)

Wiring Diagram

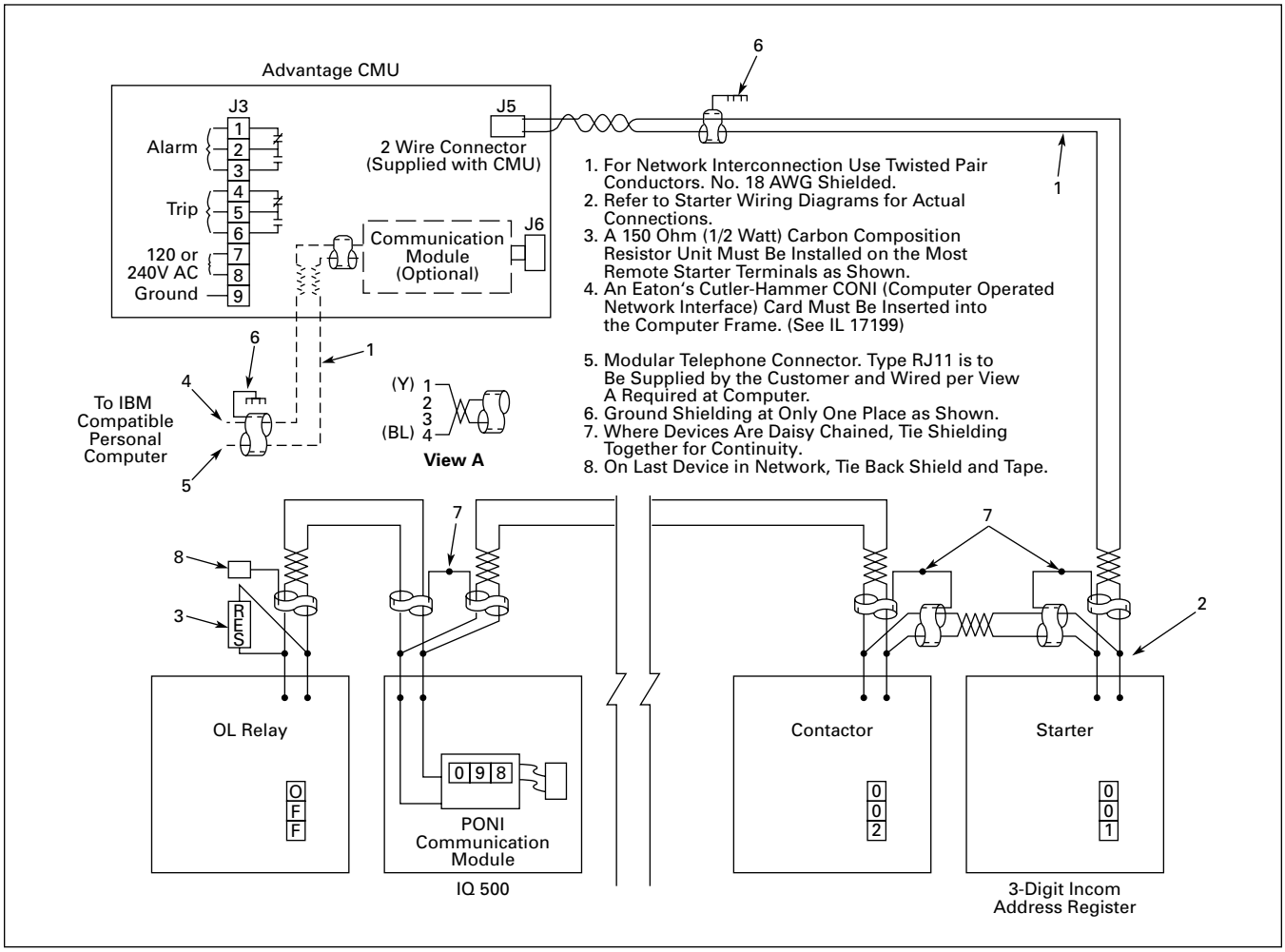


Figure A-65. Typical Wiring Diagram

Product Selection

Table A-253. Central Monitoring Unit

Description	Catalogue Number	Price
Advantage Central Monitoring Unit	**WCMU**	

Discount Symbol **C40**

A

Product Operated Network Interface (PONI)

Product Description

To use the PowerNet Communications network with Advantage motor control, a PONI is required for each device. The WPONI operates at 9600 baud.

Communications Data

- ON/OFF reset
- Status (ON, OFF, TRIPPED, NO RESPONSE)
- 3-phase unbalance
- % phase unbalance
- Control voltage
- Overload protection settings
- Cause of trip
- Trip data

Product Selection

Table A-254. WPONI Network Interface

Description	Catalogue Number	Price
Advantage WPONI To panel mount a WPONI	**WPONI WPONIBASE**	

Note: See **Page A-119** for WPONIDNA DeviceNet Interface Module.

Mounting Dimensions

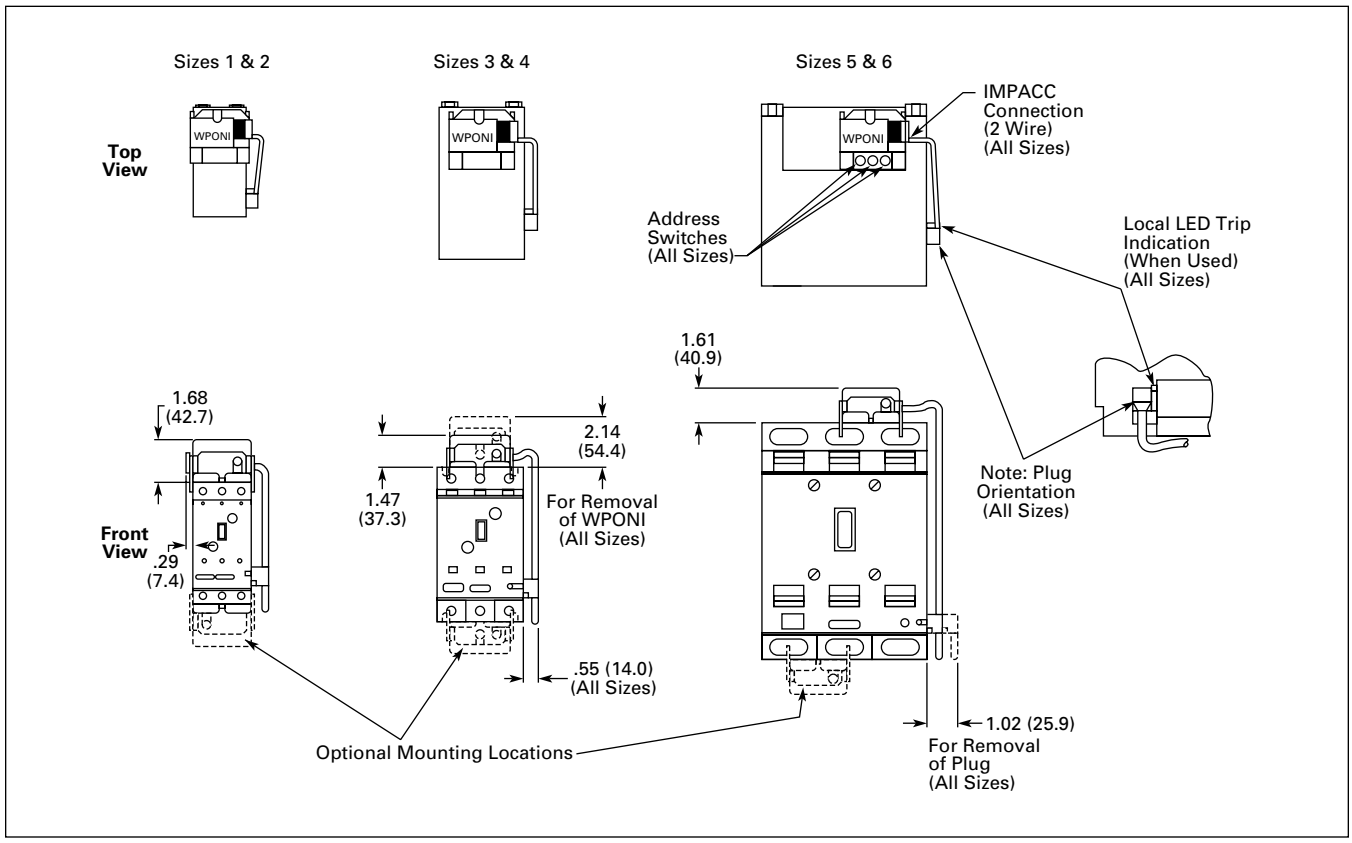


Figure A-66. Mounting Procedures — WPONI — Approximate Dimensions in Inches (mm)

Discount Symbol **MC7**

For Catalogue Numbers A10, A11, A13, A30, A31, A40, A41, A50, A51, A70, A71, A80, A81, B10, B11, B50, B51, B52, C10, C30 and C50 Contactors and Starters

Note: For a complete listing of parts refer to the Renewal Parts Publication Number referenced on the device nameplate.

Table A-255. Citation Renewal Parts

Description		Size 00					Size 0	
		Series A1 ①	Series B1	Series C1	Series D1/C2	Price		
		Part Number	Part Number	Part Number	Part Number		Part Number	Price
Set of Contacts								
Part Number on Contactor or Starter Nameplate								
2-Pole without Interlock		**6-21**	②	②	②		**6-22**	
3-Pole without Interlock		**6-21-2**	②	②	②		**6-22-2**	
3-Pole with Interlock		**6-21-3**	②	②	②		**—**	
4-Pole without Interlock		**—**	**—**	**—**	**—**		**6-22-3**	
5-Pole without Interlock		**—**	**—**	**—**	**—**		**6-22-4**	
Magnet Coils	**Coil Suffix**							
120V 60 Hz or 110V 50 Hz	**A**	**9-1945-1**	④	④	**9-2823-1**		**9-1887-1**	
240V 60 Hz or 220V 50 Hz	**B**	**9-1945-2**	④	④	**9-2823-2**		**9-1887-2**	
480V 60 Hz or 440V 50 Hz	**C**	**9-1945-3**	④	④	**9-2823-3**		**9-1887-3**	
600V 60 Hz or 550V 50 Hz	**D**	**9-1945-4**	④	④	**9-2823-4**		**9-1887-4**	
208V 60 Hz	**E**	**9-1945-5**	④	④	**9-2823-5**		**9-1887-5**	
24V 60 Hz	**T**	**9-1945-8**	④	④	**9-2823-7**		**9-1887-7**	
380V 50 Hz	**L**	**9-1945-6**	④	④	**9-2421-18** ③		**9-1887-8**	
120/240V 60 Hz or 110/220V 50 Hz	**F**	**—**	**—**	**—**	**—**		**9-1888-1**	
240/480V 60 Hz or 220/440V 50 Hz	**G**	**—**	**—**	**—**	**—**		**9-1888-2**	
277V 60 Hz	**H**	**9-1945-16**	④	④	**9-2823-12**		**9-1887-16**	
208/240V 60 Hz	**J**	**—**	**—**	**—**	**9-2823-17**		**—**	
120V DC	**A1**	**—**	**—**	**—**	**—**		**9-2024-2**	
240V DC	**B1**	**—**	**—**	**—**	**—**		**9-2024-1**	
24V DC	**T1**	**—**	**—**	**—**	**—**		**9-2024-4**	
48V DC	**W1**	**—**	**—**	**—**	**—**		**9-2024-3**	
Replacement Thermal Elements								
Standard Trip Eutectic (12 teeth)		**10-4767**	**10-4767**	**10-4767**	**10-4767**		**10-4767**	
Slow Trip Eutectic (24 teeth)		**10-5018**	**10-5018**	**10-5018**	**10-5018**		**10-5018**	
Current Transformer		**—**	**—**	**—**	**—**		**—**	

① For non-reversing contactors and starters only. For Size 00 reversing, select parts from adjoining size 0 column.
② Replace complete contactor.
③ Non-encapsulated coil.
④ Obsolete.

Discount Symbol **MC17**

Table A-255. Citation Renewal Parts (Continued)

Description		Size 1		Size 2				Size 3			
				Series A1		Series B1		Series A1		Series B1	
		Part Number	Price	Part Number	Price	Part Number	Price	Part Number	Price	Part Number	Price
Set of Contacts											
Part Number on Contactor or Starter Nameplate											
2-Pole without Interlock		6-23		6-24		6-34		6-25		6-35	
3-Pole without Interlock		6-23-2		6-24-2		6-34-2		6-25-2		6-35-2	
3-Pole with Interlock		—		—		—		—		—	
4-Pole without Interlock		6-23-3		—		6-34-3		—		—	
5-Pole without Interlock		6-23-4		—		6-34-4		—		—	
Magnet Coils	**Coil Suffix**										
120V 60 Hz or 110V 50 Hz	A	9-1887-1		9-1889-1		9-2526-1		9-1891-1		9-1889-1	
240V 60 Hz or 220V 50 Hz	B	9-1887-2		9-1889-2		9-2526-2		9-1891-2		9-1889-2	
480V 60 Hz or 440V 50 Hz	C	9-1887-3		9-1889-3		9-2526-3		9-1891-3		9-1889-3	
600V 60 Hz or 550V 50 Hz	D	9-1887-4		9-1889-4		9-2526-4		9-1891-4		9-1889-4	
208V 60 Hz	E	9-1887-5		9-1889-13		9-2526-5		9-1891-13		9-1889-13	
24V 60 Hz	T	9-1887-7		9-1889-20		9-2526-6		9-1891-15		9-1889-20	
380V 50 Hz	L	9-1887-8		9-1889-14		9-2526-7		9-1891-14		9-1889-14	
120/240V 60 Hz or 110/220V 50 Hz	F	—		9-1890-1		—		—		—	
277V 60 Hz	H	9-1887-16		9-1889-31		9-2526-15		9-1891-26		9-1889-31	
120V DC	A1	9-2024-2		9-2025-2		9-2626-2		9-2026-2		9-2025-2	
240V DC	B1	9-2024-1		9-2025-1		9-2626-1		9-2026-1		9-2025-1	
24V DC	T1	9-2024-4		9-2025-4		9-2626-4		9-2026-4		9-2025-4	
48V DC	W1	9-2024-3		9-2025-3		9-2626-3		9-2026-3		9-2025-3	
Replacement Thermal Elements											
Standard Trip Eutectic (12 teeth)		10-4767		10-4767		10-4767		10-4767		10-4767	
Slow Trip Eutectic (24 teeth)		10-5018		10-5018		10-5018		10-5018		10-5018	
Current Transformer		—		—		—		—		—	

Description		Size 4		Size 5		Size 6					
						Series A1		Series B1		Series C1	
		Part Number	Price	Part Number	Price	Part Number	Price	Part Number	Price	Part Number	Price
Set of Contacts											
Part Number on Contactor or Starter Nameplate											
2-Pole without Interlock		6-36-3 ①		6-27		—				6-601-2	
3-Pole without Interlock		6-36-4 ①		6-27-2		—		6-570		6-601	
3-Pole with Interlock		—		—		—		—		—	
4-Pole without Interlock		—		—		—		—		—	
5-Pole without Interlock		—		—		—		—		—	
Magnet Coils	**Coil Suffix**										
120V 60 Hz or 110V 50 Hz	A	9-1891-1		9-1891-1		9-1875-1		9-2651		9-2698	
240V 60 Hz or 220V 50 Hz	B	9-1891-2		9-1891-2		9-1875-2		9-2651-2		9-2698-2	
480V 60 Hz or 440V 50 Hz	C	9-1891-3		9-1891-3		9-1875-3		9-2651-3		9-2698-3	
600V 60 Hz or 550V 50 Hz	D	9-1891-4		9-1891-4		9-1875-4		9-2651-4		9-2698-4	
208V 60 Hz	E	9-1891-13		9-1891-13		9-1875-14		9-2651-6		9-2698-5	
24V 60 Hz	T	9-1891-15		9-1891-15		—		—		—	
380V 50 Hz	L	9-1891-14		9-1891-14		—		9-2651-5		9-2698-6	
120/240V 60 Hz or 110/220V 50 Hz	F	—		—		—		—		—	
240/480V 60 Hz or 220/440V 50 Hz	G	—		—		—		—		—	
277V 60Hz	H	9-1891-26		9-1891-26		—		—		—	
120V DC	A1	9-2026-2		9-2026-2		—		—		—	
240V DC	B1	9-2026-1		9-2026-1		—		—		—	
24V DC	T1	9-2026-4		9-2026-4		—		—		—	
48V DC	W1	9-2026-3		9-2026-3		—		—		—	
Replacement Thermal Elements											
Standard Trip Eutectic (12 teeth)		10-4767		10-4767		10-4767		10-4767		10-4767	
Slow Trip Eutectic (24 teeth)		10-5018		10-5018		—		—		—	
Current Transformer		—		—		—		—		—	

① #Series B1. For Series A1, order 6-26 or 6-26-2.

Discount Symbol **MC17**

Table A-255. Citation Renewal Parts (Continued)

Description		Size 7				Size 8	
		Series A1	Price	Series B1	Price		
		Part Number		Part Number		Part Number	Price
Set of Contacts							
Part Number on Contactor or Starter Nameplate							
2-Pole without Interlock		—		—		—	
3-Pole without Interlock		—		**6-570**		**6-571**	
3-Pole with Interlock		—		—		—	
4-Pole without Interlock		—		—		—	
5-Pole without Interlock		—		—		—	
Magnet Coils	**Coil Suffix**						
120V 60 Hz or 110V 50 Hz	**A**	**9-1875-1**		**9-2651**		**9-2654**	
240V 60 Hz or 220V 50 Hz	**B**	**9-1875-2**		**9-2651-2**		**9-2654-2**	
480V 60 Hz or 440V 50 Hz	**C**	**9-1875-3**		**9-2651-3**		**9-2654-3**	
600V 60 Hz or 550V 50 Hz	**D**	**9-1875-4**		**9-2651-4**		**9-2654-4**	
208V 60 Hz	**E**	**9-1875-14**		**9-2651-6**		**9-2654-6**	
24V 60 Hz	**T**	—		—		—	
380V 50 Hz	**L**	—		**9-2651-5**		**9-2654-5**	
120/240V 60 Hz or 110/220V 50 Hz	**F**	—		—		—	
240/480V 60 Hz or 220/440V 50 Hz	**G**	—		—		—	
277V 60 Hz	**H**	—		—		—	
120V DC	**A1**	—		—		—	
240V DC	**B1**	—		—		—	
24V DC	**T1**	—		—		—	
48V DC	**W1**	—		—		—	
Replacement Thermal Elements							
Standard Trip Eutectic (12 teeth)		**10-4767**		**10-4767**		**10-4767**	
Slow Trip Eutectic (24 teeth)		—		—		—	
Current Transformer		—		—		—	

Discount Symbol **MC17**

A

For Type N Control

Table A-256. Contact Kits

Poles	NEMA Size	Part Number	Price
3	0	**1605226**	
	1	**1605212**	
	2	**1605202**	
	3	**1625563**	
	4	**1625564**	

Table A-257. AC Coils

Voltage	Hz	2-, 3-Pole			4-, 5-Pole		
		Obsolete Part Number	Current Part Number	Price	Obsolete Part Number	Current Part Number	Price
Size 0, 1 ①							
110	60	1470241	**9969D90G01**		1470261	**9969D90G16**	
110/208/220	25/60/60	1470242	**9969D90G02**		1470262	**9969D90G17**	
220/380/440	25/50/60	1470243	**9969D90G03**		1470263	**9969D90G18**	
550	60	1470244	**9969D90G04**		N/A	**N/A**	
220	50	1470247	**9969D90G06**		N/A	**N/A**	
440	50	1470248	**9969D90G07**		1470268	**9969D90G19**	
440	25	1470250	**9969D90G08**		1470270	**9969D90G21**	
120	60	1605268	**9969D90G09**		N/A	**N/A**	
115/208/230	60/60/60	1605513	**9969D90G15**		N/A	**N/A**	
600	60	1470245	**9969D90G20**		N/A	**N/A**	
550	25	1470251	**9969D90G22**		N/A	**N/A**	
Size 2 ①							
110	60	1470201	**9969D92G01**		1470221	**9969D93G01**	
110/208/220	25/60/60	1470202	**9969D92G02**		1470222	**9969D93G02**	
220/380/440/480	25/50/60/60	1470203	**9969D92G03**		N/A	**N/A**	
550	60	1470204	**9969D92G04**		1470224	**9969D93G10**	
110	50	1470206	**9969D92G05**		1470226	**9969D93G05**	
220	50	1470207	**9969D92G06**		1470227	**9969D93G06**	
440	50	1470208	**9969D92G07**		N/A	**N/A**	
600	60	1470205	**9969D92G08**		1470225	**9969D93G08**	
440	25	1470210	**9969D92G09**		N/A	**N/A**	
120/110	60/50	1605478	**9969D92G10**		N/A	**N/A**	
550	50	1470209	**9969D92G11**		N/A	**N/A**	
415	50	N/A	**N/A**		L1557647	**9969D93G09**	
220/380/440	25/60/60	N/A	**N/A**		1470223	**9969D93G03**	
Size 3 ①							
110	60	1490645	**9969D96G04**		1490645	**9969D96G04**	
110/208/220	25/60/60	1490646	**9969D96G05**		1490646	**9969D96G05**	
220/380/400/440	25/50/50/60	1490647	**9969D96G06**		1490647	**9969D96G06**	
110	50	1490652	**9969D96G08**		1490652	**9969D96G08**	
120/110	60/50	1600770	**9969D96G09**		1600770	**9969D96G09**	
600/500	60/50	1490649	**9969D96G21**		1490649	**9969D96G21**	
600/500/400	60/50/40	1659421	**9969D96G23**		1659421	**9969D96G23**	
220	50	1490653	**9969D93G24**		1490653	**9969D93G24**	
240	60	1490648	**9969D96G29**		1490648	**9969D96G29**	
Size 4							
110	60	1596633	**9969D96G10**		1597723	**9969D96G01**	
110/208/220	25/60/60	1490658	**9969D96G11**		1597724	**9969D96G02**	
110	50	1596636	**9969D96G13**		N/A	**N/A**	
220	50	1596637	**9969D96G14**		N/A	**N/A**	
240	50	1596639	**9969D96G15**		N/A	**N/A**	
600/500	60/50	1596635	**9969D96G16**		1490649	**9969D96G21**	
440	25	1596641	**9969D96G17**		N/A	**N/A**	
600	60	1596634	**9969D96G19**		N/A	**N/A**	
440	60	1490659	**9969D96G12**		N/A	**N/A**	
120/110	60/50	1600771	**9969D96G20**		N/A	**N/A**	
220/380/400/440	25/50/50/60	N/A	**N/A**		1597725	**9969D96G31**	

① Minimum order quantity of 3 required.

Discount Symbol **MC17**

Contents

Cat. No. 10370

Product Description

Cutler-Hammer® Solenoids from Eaton's electrical business are used for a wide variety of applications where straight line motion is to be obtained automatically or at a remote point.

A

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

- Catalogue Number

Table A-258. AC Solenoids — 60 Hz, Continuous Duty

Size	Volt.	Operating Data ②												
		Magnetic Force in Lbs.						Max. Stroke in Inches (mm)	Current		Without Conduit Box			With Conduit Box	
		Horizontal Position		With Gravity		Against Gravity			Inrush	Sealed	Floor Mtg.	Wall Mtg.	Price	Mtg. ①	Price
		At 100% Voltage	At 85% Voltage	At 100% Voltage	At 85% Voltage	At 100% Voltage	At 85% Voltage				Catalogue Number	Catalogue Number		Catalogue Number	
60 Hertz Pull Type															
A	110	.72	.50	.90	.68	.55	.33	1 (25.4)	1.83	.34	—	**10370H1**		**10370H610**	
	220	.72	.50	.90	.68	.55	.33	1 (25.4)	.92	.17	—	**10370H2**		**10370H611**	
	440	.72	.50	.90	.68	.55	.33	1 (25.4)	.45	.08	—	**10370H3**		**10370H612**	
B	110	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	5.4	.87	**10370H57**	**10370H694**		**10370H69**	
	220	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	2.6	.42	**10370H58**	**10370H696**		**10370H70**	
	440	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	1.29	.20	**10370H59**	**10370H697**		**10370H71**	
C	110	7	5.25	8	6.25	6	4.25	1.25 (31.8)	10.4	1.07	**10370H244**	—		**10370H256**	
	220	7	5.25	8	6.25	6	4.25	1.25 (31.8)	5.2	.52	**10370H245**	—		**10370H257**	
	440	7	5.25	8	6.25	6	4.25	1.25 (31.8)	2.5	.26	**10370H246**	—		**10370H258**	
D	110	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	18	1.58	**10370H356**	**10370H814**		**10370H368**	
	220	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	9.3	.81	**10370H357**	**10370H816**		**10370H369**	
	440	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	4.4	.40	**10370H358**	**10370H817**		**10370H370**	
60 Hertz Push Type															
A	110	.72	.50	.90	.68	.55	.33	1 (25.4)	1.83	.34	—	**10370H13**		**10370H25**	
	220	.72	.50	.90	.68	.55	.33	1 (25.4)	.92	.17	—	**10370H14** ③		**10370H26**	
	440	.72	.50	.90	.68	.55	.33	1 (25.4)	.45	.08	—	**10370H15**		**10370H27**	
B	110	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	5.4	.87	**10370H81**	**10370H708**		**10370H93**	
	220	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	2.6	.42	**10370H82**	**10370H710**		**10370H94**	
	440	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	1.29	.20	**10370H83**	**10370H711**		**10370H95**	
C	110	7	5.25	8	6.25	6	4.25	1.25 (31.8)	10.4	1.07	**10370H268**	—		**10370H280**	
	220	7	5.25	8	6.25	6	4.25	1.25 (31.8)	5.2	.52	—	**10370H774**		**10370H281**	
	440	7	5.25	8	6.25	6	4.25	1.25 (31.8)	2.5	.26	—	**10370H775**		**10370H282**	
D	110	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	18	1.58	**10370H380**	**10370H828** ③		**10370H392**	
	220	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	9.3	.81	**10370H381**	**10370H830** ③		**10370H393**	
	440	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	4.4	.40	**10370H382**	**10370H831** ③		**10370H394**	

① Recommended selection of solenoids on basis of 85% voltage values.
② Mounting of solenoids "with conduit box" — Size A are for wall mounting — Size B, C and D are for floor mounting.
③ Part numbers are now obsolete.

Discount Symbol **MC7**

A

Dimensions

Table A-259. Approximate Dimensions in Inches (mm) and Shipping Weights

Size	Push Type						Pull Type					
	Dimensions in Inches (mm)					Ship. Wt. Lbs. (kg)	Dimensions in Inches (mm)					Ship. Wt. Lbs. (kg)
	Wide A	High B ①	Deep C	Mounting D	Mounting E		Wide A	High B ①	Deep C	Mounting D	Mounting E	
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 (.9)	2.38 (60.5)	2.63 (66.8)	2.25 (57.2)	1.13 (28.7)	1.63 (41.4)	2.0 (.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)

① In sealed state.

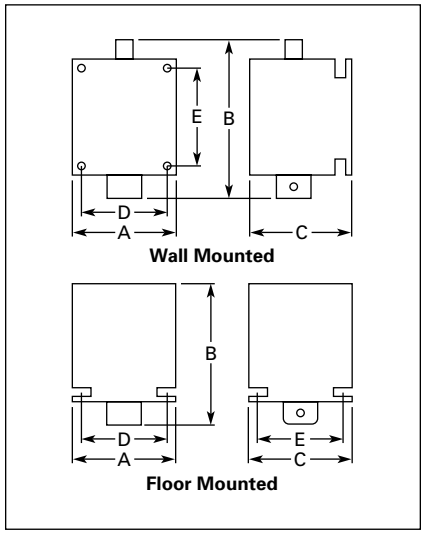


Figure A-67. Approximate Dimensions

Contents

Size S-7 Brake and Wheel

Product Description

Cutler-Hammer® Type S Brakes from Eaton's electrical business 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 moulding 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.

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.

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.

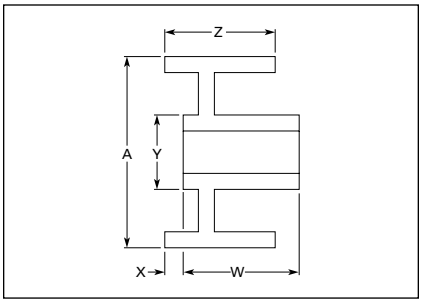


Figure A-68. Standard Brake Wheels — Approximate Dimensions

Table A-260. Standard Brake Wheel Dimensions

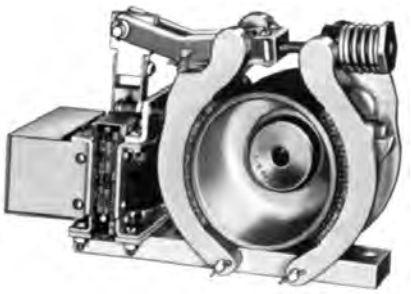
Approximate Dimensions in Inches (mm)					Bore	
A	Z	W ①	X	Y	Max.	Min.
4.00 (101.6)	2.75 (69.9)	1.63 (41.4)	1.38 (35.1)	2.50 (63.5)	1.38 (35.1)	.50 (12.7)
5.50 (139.7)	3.25 (82.6)	2.00 (50.8)	1.63 (41.4)	3.25 (82.6)	2.00 (50.8)	.75 (19.1)
7.00 (177.8)	4.25 (108.0)	3.00 (76.2)	1.25 (31.8)	4.00 (101.6)	2.25 (57.2)	1.00 (25.4)
10.00 (254.0)	4.25 (108.0)	3.25 (82.6)	1.25 (31.8)	4.88 (124.0)	2.88 (73.2)	1.38 (35.1)

① Hub lengths other than standard are not available.

Shipping Weights

Table A-261. 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)
S-10	125, 160	200.0 (90.8)	38.5 (17.3)	225.0 (102.2)
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)



Size S-4 Brake and Wheel

Product Selection

When Ordering Specify

- Brake
  - Catalogue Number plus Suffix Number for coil
  - Example: 511H1193-**41**
- Wheel
  - Catalogue Number plus Suffix Number for bore size
  - Example: 511H1150-**3**

Table A-262. Type S Brakes — Floor Mounting

Torque — lb-ft		Brake Size	AC				DC			
Continuous	Intermittent ①		Base Catalogue Number ②③	Price	For Type S4, S5-1/2, S7, S10		Base Catalogue Number ②③	Price	Coil Voltage	Coil Suffix ②
					Coil Volts and Hertz	Coil Suffix ②				
3	3	S-4	**511H1194**		120V 60 Hz	**-39**	**511H955**		120V DC	**-97**
10	10	S-4	**511H1193**		208V 60 Hz	**-45**	**511H956**		240V DC	**-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**			
125	125	S-10	**511H996**		550V 50 Hz	**-9**	—			
—	160	S-10	**511H997**				—			

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 Catalogue Number.

③ Does not include Wheel.

Discount Symbol **MC7**

Table A-263. 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 ③			Tapered Bore ①		
					Base ② Catalogue Number	Finished Bore Price	Pilot Bore Only Price	Base ② Catalogue Number	Finished Bore Price	Pilot Bore Only Price
4.0	.50 (12.7)	1.38 (35.1)	.50 (12.7)	.06	**511H1150**			**511H1151**		
5.5	.75 (19.1)	2.00 (50.8)	.75 (19.1)	.26	**511H1160**			**511H1161**		
7.0	1.00 (25.4)	2.25 (57.2)	.75 (19.1)	.77	**511H1170**			**511H1171**		
10.0	1.38 (35.1)	2.88 (73.2)	1.13 (28.7)	3.10	**511H1190**			**511H1191**		

① Taper is at rate of 1.25 inches per foot on diameter. In bore size selection, use diameter of tapered shaft. Bore tolerance: +.000 -.005 inches.
② Add Suffix Number for bore size to Base catalogue Number.
③ Bore tolerance: +.000 -.001 inches.

Table A-264. Brake Wheel Suffix Numbers

Bore Size Suffix Number — Add to Base Catalogue 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 — No Price Addition					
Pilot Bore	None	**-1**	1.625 (41.28)	3/38 x 3/16	**-9**
.625 (15.88)	3/16 x 3/32	**-2**	1.875 (47.63)	1/2 x 1/4	**-10**
.750 (19.05)	3/16 x 3/32	**-3**	2.125 (53.98)	1/2 x 1/4	**-11**
.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 — Make Necessary Price Addition ⑤					
.500 (12.70)	1/8 x 1/16	**-50**	1.687 (42.85)	3/8 x 3/16	**-58**
.750 (19.05)	1/4 x 1/8	**-51**	1.750 (44.45)	3/8 x 3/16	**-59**
.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**	—	—	**—**

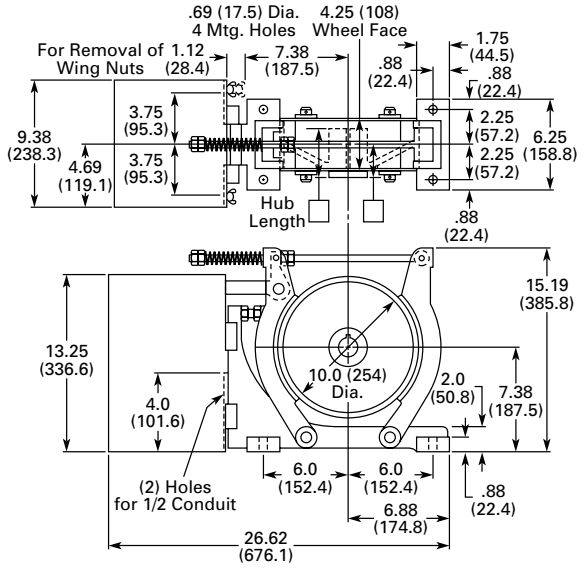
④ Bore size selected must be between minimum and maximum dimensions listed in brake wheel selection table.
⑤ Price Additions

Description	Adder
4.0 Inch (101.6 mm) 5.5 Inch (139.7 mm) 7.0 Inch (177.8 mm) 10.0 Inch (254.0 mm)	

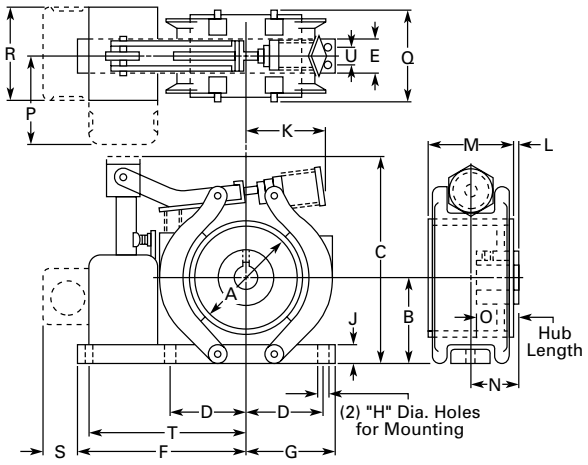
Discount Symbol **MC7**

A

Dimensions



Type S10
Clapper Type Magnet Operated



Types S4, S5-1/2, and S7
Solenoid Operated

Figure A-69. Approximate Dimensions in Inches (mm)

Table A-265. Approximate Dimensions

Brake Size	Torque Rating ft-lb	Dimensions in Inches (mm)																
		A	B ①	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
Type "S" AC Shoe Brakes																		
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)	.38 (9.7)	.63 (16.0)	2.88 (73.2)	.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)	.38 (9.7)	.63 (16.0)	2.88 (73.2)	.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)	.38 (9.7)	.63 (16.0)	2.88 (73.2)	.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)	.44 (11.2)	1.00 (25.4)	4.88 (124.0)	.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)	.44 (11.2)	1.00 (25.4)	7.88 (200.2)	.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)	.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)	.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-10	125, 160	Refer to above drawing.																
Type "S" DC Shoe Brakes																		
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)	.38 (9.7)	.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-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)	.38 (9.7)	.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-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)	.38 (9.7)	.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)	.44 (11.2)	.75 (19.1)	4.88 (124.0)	.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)	.44 (11.2)	.75 (19.1)	4.88 (124.0)	.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)	.56 (14.2)	.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)	.56 (14.2)	.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)	.56 (14.2)	.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)	.56 (14.2)	.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)

① Open type brake only.

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.

Table A-266. Used in Technical Data & Formulas

Code	Descriptions
DF	Duty factory
$I_{\Delta n}$	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
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)

Table A-267. 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

① 60947-1 © IEC: 2004.
② By plugging is understood stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.
③ By inching (jogging) is understood energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

Annex A (informative)

Table A-267. Examples of Utilization Categories for Low-Voltage Switchgear and Controlgear ① (Continued)

Category	Typical Applications	Relevant IEC Product Standard
Nature of Current — AC (Continued)		
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
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, e.g. 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 (e.g. shunt motors)	60947-3
DC-23	Switching of motor loads or other highly inductive loads (e.g. 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

① 60947-1 © IEC: 2004.

② By plugging is understood stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.

③ By inching (jogging) is understood 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 below.

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.

A

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	.55	.48	.38	—
	1200	1.61	1.40	.81	.70	.56	—
	900	1.84	1.60	.93	.80	.64	—
1/3	1800	1.37	1.19	.69	.60	.48	—
	1200	1.83	1.59	.92	.80	.64	—
	900	2.07	1.80	1.04	.90	.72	—
1/2	1800	1.98	1.72	.99	.86	.69	—
	1200	2.47	2.15	1.24	1.08	.86	—
	900	2.74	2.38	1.38	1.19	.95	—
3/4	1800	2.83	2.46	1.42	1.23	.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	—
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

① 380V 50 Hz.

A

Single-Phase AC Motors

Table 430.248. **Full-Load Currents in Amperes, Single-Phase Alternating-Current 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.

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

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.

DC Motors

Table 430.247. **Full-Load Current in Amperes, Direct-Current Motors**

The following values of full-load currents are for motors running at base speed.

Note: These are average direct-current quantities.

hp	Armature Voltage Rating ②		Ampere Capacity of Fuses for Motors	
			Recommended Values	
	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	—	—

② These are average direct-current quantities.

Table 430.250. **Full-Load Current Three-Phase Alternating-Current Motors**

hp	Induction Type Squirrel-Cage and Wound-Rotor Amperes							Synchronous Type Unity Power Factor ① Amperes			
	115V	200V	208V	230V	460V	575V	2300V	230V	460V	575V	2300V
1/2	4.4	2.5	2.4	2.2	1.1	.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	—	—	—	—

① For 90 and 80 percent power factor, the above figures shall be multiplied by 1.1 and 1.25 respectively.