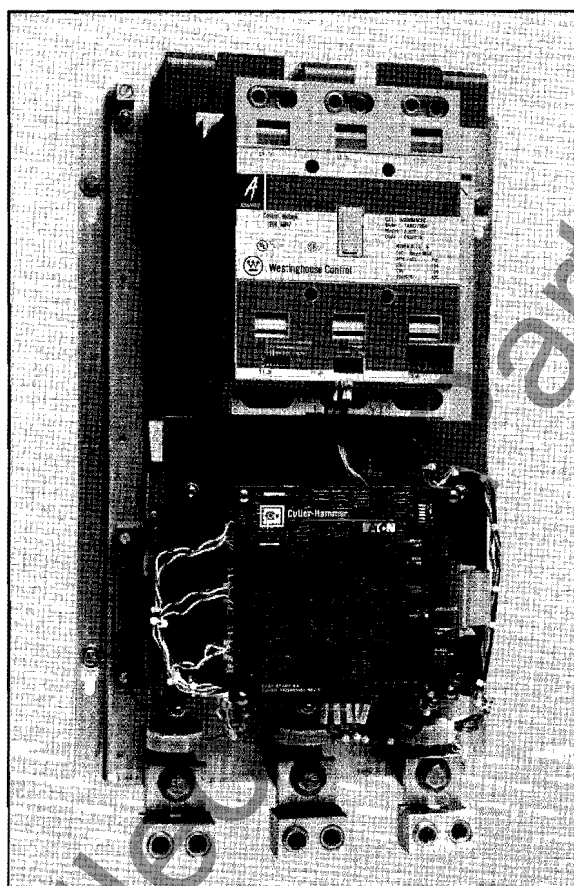




## Cutler-Hammer Easy-Start EA Reduced Voltage Starter



### CHARACTERISTICS

The **Easy-Start EA** is a unique approach to solid state motor starting, combining the performance benefits expected from a solid state starter with the electrical efficiencies and small physical size that are typically associated with electro-mechanical devices.

The Easy-Start EA uses six back-to-back silicon controlled rectifiers (SCRs) to provide smooth, stepless, acceleration to an ac induction motor. Once the motor reaches full speed, an Advantage bypass contactor is energized in parallel to the SCRs to handle the motor's continuous duty requirements.

Since the SCRs are only conducting current for a short period of time, electrical losses are greatly reduced. The elimination of bulky heat sinks allows the Easy-Start EA to be mechanically designed with size reduction in mind. Due to the fact that heat dissipation is no longer an issue, the Easy-Start EA can be packaged in a wide variety of space saving enclosures, including those without ventilation.

Available in current ranges from 45-760 amps, the Easy-Start EA is ideal for the space conscious OEM or for the industrial user who requires specialty enclosures due to environmental or maintenance concerns. The Easy-Start EA can also be mounted in the Cutler-Hammer motor control centers (MCCs) requiring less mounting space than typical reduced voltage starters.



## Cutler-Hammer *Easy-Start EA* Reduced Voltage Starter

### APPLICATIONS AND FEATURES

#### Applications

The Easy-Start EA can be applied in a wide variety of industrial and commercial applications requiring reduced voltage starting of an AC induction motor. Solid state benefits include:

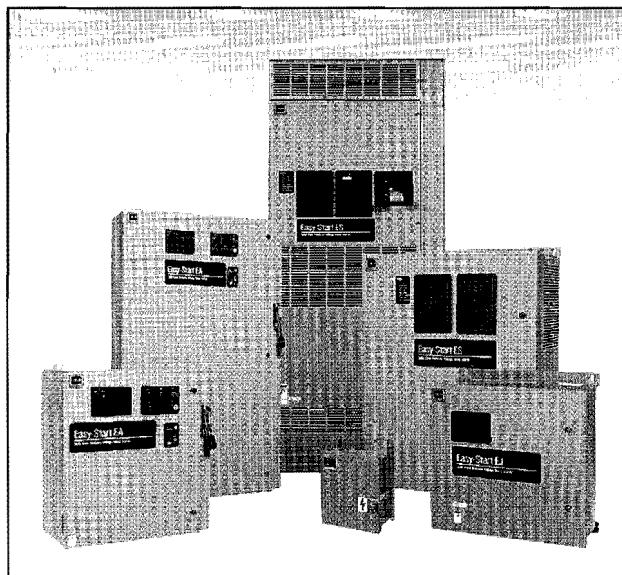
- Reduced torque on mechanical equipment providing longer life of belts, gears, pulleys and motor shafts commonly weakened by across-the-line starting.
- Elimination of voltage drop on weak utility systems where the performance of nearby equipment can be adversely affected.
- Reduced inrush currents during starting allowing better management of utility peak demand charges.
- Smooth, stepless acceleration with an abundance of torque and ramp time settings allowing superior flexibility over typical electromechanical starting methods.
- Solid state motor overload characteristics providing more accurate motor protection and flexibility of use with various motor sizes.

Typical customer applications include:

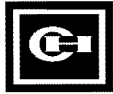
- Centrifugal compressors
- Screw compressors
- Conveyors
- Pumps
- Material handling equipment
- Textile machinery
- Fans and blowers
- Woodworking equipment
- Machine tools

#### Features and Benefits

- |                                  |   |
|----------------------------------|---|
| • Small physical size            | • Reduced panel space, smaller enclosures   |
| • Reduced heat losses            | • Better efficiencies/no heat dissipation concerns  |
| • Smooth start/stop              | • Stepless motor acceleration/deceleration, reduced initial torque and inrush currents  |
| • Adjustable torque              | • Wide range of initial step settings for various load starting requirements  |
| • Adjustable ramp time           | • Ability to control rate of current ramp   |
| • 600V rating                    | • Both 50 Hz and 60 Hz models available. Models are rated for 208V through 575V operation.  |
| • Emergency backup               | • Advantage starter is rated to handle full across-the-line starting current, in a customer initiated backup mode, if a problem is encountered. |
| • Current limit                  | • Limits current inrush and current draw during ramp.   |
| • Electronic overload            | • Flexibility of use with various motor sizes, more accurate than bi-metallic methods   |
| • Selectable overload protection | • Overload curve can be tailored to Class 10 or 20 application requirements   |
| • Advantage starter bypass       | • Reduced contact bounce and contact wear, lifetime coil warranty; contactor closes and opens at 1 times current                                |
| • Communications                 | • Advantage starter can be modified to communicate on the IMPACC network  |



Easy-Start Family of Enclosed Starters through 760A Base Rating



## Cutler-Hammer *Easy-Start EA* Reduced Voltage Starter

### RATINGS AND CATALOG NUMBERING

#### Ratings

Catalog Number	Amperes			Horsepower				Kilowatts	
	Base Rating	Maximum Continuous	Range	208V	230V	460V	575V	380V	415V
EA045	45	52	12-52	15	15	30	40	22	22
EA090	90	104	23-104	30	30	60	75	45	45
EA135	135	155	34-155	50	50	100	125	55	75
EA270	270	311	69-311	100	100	200	250	110	110
EA360	360	414	92-414	125	125	250	350	160	160
EA540	540	621	137-621	200	200	450	500	250	300
EA760	760	874	193-874	250	300	600	750	400	450

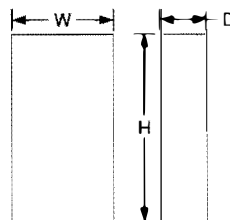
#### Starts Per Hour

Catalog Number	Starting Current		Start Time — Seconds		
	Percent	Amps	20	10	5
EA045	300	135	8	24	30
	400	180	4	16	24
	500	225	2	8	20
EA090	300	270	8	20	30
	400	360	4	12	20
	500	450	—	4	8
EA135	300	405	4	20	24
	400	540	1	8	16
	500	675	—	2	8
EA270	300	810	8	24	30
	400	1080	4	16	24
	500	1350	1	8	20
EA360	300	1080	4	16	30
	350	1260	1	12	20
	417	1500	—	4	12
EA540	300	1800	6	16	20
	400	2400	1	8	16
	500	2700	—	6	12
EA760	300	2400	4	12	16
	400	3000	2	6	12
	500	3800	—	4	8

#### Approximate Dimensions and Shipping Weights

Model	Open Starter Panel				Enclosed Starter			
	W	H	D	Lbs.	W	H	D	Lbs.
EA045	10.5	14.0	6.66	12	25.6	30.4	11.2	80
EA090	10.5	16.0	7.50	18	25.6	30.4	11.2	135
EA135	10.5	16.0	7.50	18	25.6	30.4	11.2	160
EA270	15.0	24.0	9.70	70	37.6	48.4	13.2	570
EA360	15.0	24.0	9.70	81	37.6	48.4	13.2	570
EA540	16.0	30.0	11.50	210	37.6	60.4	13.2	590
EA760	18.0	32.0	12.50	260	39.8	72.0	18.1	750

① Except EA360 which is Definite Purpose Rated at 417% (1500 Amps Max Starting).



#### Technical Data

- Current ratings (amps rms) . . . . . 45 90 135 270 360 540 760
- AC line voltage . . . . . 200-600V AC, 3 phase, 60 Hz or 50 Hz options
- Output stage . . . . . 6 SCRs full wave during start; bypass contactor during run
- Control voltage . . . . . 120V AC, +10%/-15%
- Ramp time . . . . . 1-45 seconds; 16 position hexadecimal switch
- Initial torque . . . . . 100 to 200% current; 16 position hexadecimal switch
- Current limit . . . . . 100 to 500% of base rating ①; 16 position hexadecimal switch
- Overload capacity . . . . . 115% continuous (of base rating); 5 position DIP switch
- Overload protection . . . . . Inverse time-trip (DIP switch adjustable); Class 10/20 selectable (DIP switch DS1-6)
- Phase Rotation . . . . . ABC only — start prohibit
- Phase loss/unbalance . . . . . 35% or greater difference between any two phases
- RC snubber . . . . . SCR protection for dv/dt characteristics
- LED indications: . . . . . Phase Unbalance  
Current Trip  
Phase Rotation
- Trip relay . . . . . N.O. contact; Resistive load 60VA; Inductive load 20VA; Maximum switching voltage: 125V AC; Maximum switching current: 1 amp; Closes on phase unbalance or overload trip
- Ambient temperature: . . . . . Open: -20 to +50° C  
Enclosed: -20 to +40° C  
Storage: -50 to +65° C



## Cutler-Hammer *Easy-Start EA* Reduced Voltage Starter

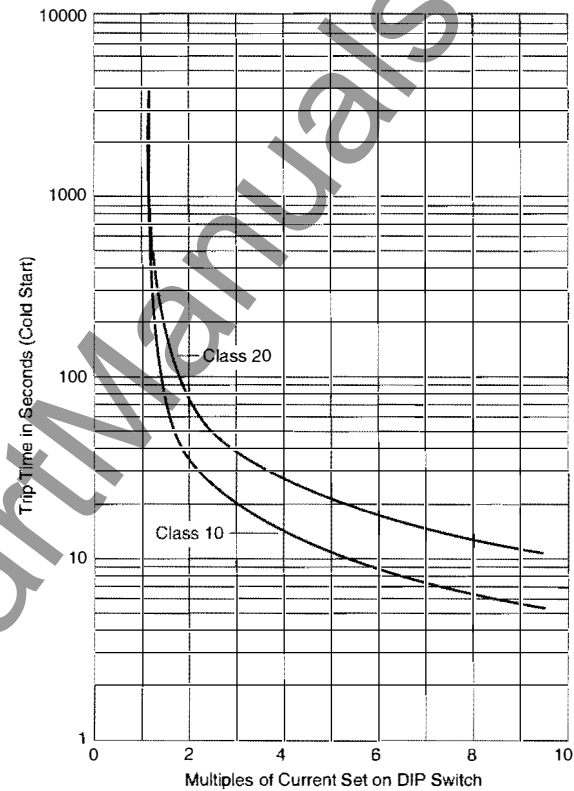
### Overload Protection

The Easy-Start EA includes electronic motor overload protection in both start and run modes as a standard feature.

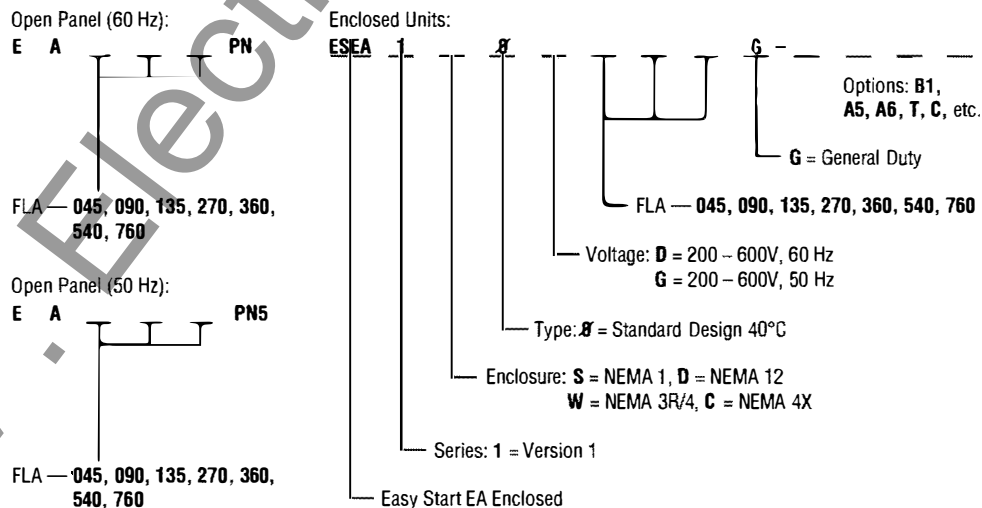
The protection curve is based upon an inverse time/current algorithm which is part of the main printed circuit board logic. Current Transformers (CTs) are used for current sensing and feedback resulting in greater accuracy than that of bi-metal approaches.

The motor's FLA is "programmed" into the starter's logic via a five position DIP (dual inline package) switch. Starters can be set up to protect motors down to 25% of the starter's base rating, allowing greater flexibility. A class 10/20 adjustment is also standard.

### Overload Curve



### Catalog Numbering System





## Cutler-Hammer *Easy-Start EA* Reduced Voltage Starter

### OPTIONS DESCRIPTIONS

#### OPTIONS DESCRIPTIONS

Cat. No. Suffix	Description
-----------------	-------------

#### Door Mounted Operator Devices

**NOTE:** Only one of the selections below may be chosen.

**B1** Hand-Off-Auto Selector Switch, Reset PB (Gray), with 3 Indicating Lights and Control Power Transformer (T), Run Relay (Y), and Trip Relay (Y1). Indicating Lights are 30mm. Lights are "Power-On" (Red), "Run" (Green), and "Tripped" (Amber).

Hand-Off-Auto and Reset Operation:

**Hand** – This selection starts the starter.

**Off** – This selection provides an unconditional stop regardless of the switch's prior position. In the event of a "tripped" condition the selector switch must first be placed in the **Off** position prior to resetting. Momentarily pressing the **Reset Pushbutton** will reset the starter.

**Auto** – In this position the starter is controlled by a remote maintained contact (rated 120V AC).

**A5** Start PB (Green), Stop PB (Red), Reset PB (Gray), with 3 Indicating Lights and Control Power Transformer (T), Run Relay (Y), and Trip Relay (Y1). Indicating Lights are 30mm. Lights are "Power-On" (Red), "Run" (Green), and "Tripped" (Amber).

Start/Stop/Reset Operation:

**Start** – Momentarily pressing the **Start Pushbutton** will start the starter.

**Stop** – Momentarily pressing the **Stop Pushbutton** will stop the starter

**Reset** – In the event of a "tripped" condition momentarily pressing the **Reset Pushbutton** will reset the starter.

**A6** Hand, Off, Auto Selector Switch, Start PB (Green), Stop PB (Red), Reset PB (Gray), with 3 Indicating Lights and Control Power Transformer (T), Run Relay (Y), and Trip Relay (Y1).

Indicating Lights are 30mm. Lights are "Power-On" (Red), "Run" (Green), and "Tripped" (Amber).

Hand-Off-Auto and Start/Stop/Reset Operation:

**Hand** – This selection enables the use of the **Start/Stop Pushbuttons**.

Momentarily pressing the **Start Pushbutton** will start the starter.

Momentarily pressing the **Stop Pushbutton** will stop the starter

**Off** – This selection provides an unconditional stop regardless of the switch's prior position. In the event of a "tripped" condition, the selector switch must first be placed in the **Off** position prior to resetting. Momentarily pressing the **Reset Pushbutton** will reset the starter.

**Auto** – In this position the starter is controlled by a remote maintained contact (rated 120V AC).

#### OPTIONS DESCRIPTIONS

Cat. No. Suffix	Description
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#### Control Devices

**T** Control Power Transformer  
**MODELS 45 AMPS THROUGH 135 AMPS – 300VA IS PROVIDED.**  
**(150VA IS AVAILABLE FOR CUSTOMER USE)**  
**MODELS 270 AMPS THROUGH 760 AMPS – 500VA IS PROVIDED.**  
**(200VA IS AVAILABLE FOR CUSTOMER USE)**

The Control Power Transformer is a multi-voltage transformer. **It must be field wired for correct operation prior to Start-Up.**

The Control Power Transformer is fused on the primary and one leg of the secondary.

**NOTE: The (T) Option is included with the B1, A5, A6, Y, Y1 and H options.**

**Y** Auxiliary Run Relay with 2 N.O./1 N.C. contacts available for customer use. The Control Power Transformer (T) is included.

The auxiliary relay's coil is rated 110V – 120V AC. It is factory wired to the (T) option.

The contacts are mounted on the DIN-mounted relay.

**The contacts are rated for 10 amps continuous.**

AC Volts	Make	Break
120–600VAC	7200VA	720VA

**NOTE: The (Y) option is included with options B1, A5 and A6.**

**Y1** Auxiliary Trip Relay with 2 N.O./1 N.C. contacts available for customer use. The Control Power Transformer (T) is included.

The auxiliary relay's coil is rated 110V – 120V AC. It is factory wired to the (T) Option.

The contacts are located on the din-mounted relay.

**The contacts are rated for 10 amps continuous.**

AC Volts	Make	Break
120–600VAC	7200VA	720VA

**NOTE: The (Y1) option is included with options B1, A5 and A6.**



## Cutler-Hammer *Easy-Start EA* Reduced Voltage Starter

### OPTIONS DESCRIPTIONS

#### OPTIONS DESCRIPTIONS

Cat. No. Suffix	Description
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#### Control Devices (Continued)

**Y3** End of Ramp Auxiliary Contacts – 2 N.O., 2 N.C.  
The contacts are mounted on the Advantage contactor.  
**The contacts are rated for 10 amps continuous.**

AC Volts	Make	Break
120-600V AC	7200VA	720VA

#### Door Mounted Metering

**G2** Voltmeter – 30mm analog (device type) – single phase, scale is 0 to 600 volts. PTs are not furnished or required.

**H** Elapsed Time Meter – 30mm – measures running time in tenths of an hour (Non-Resettable). The Control Power Transformer (T) is included.

**F1** Advantage Metering Module (W-Meter) measures 3-phase amps and 120V AC control voltage. The W-Meter is cabled directly to the Advantage Contactor. The four digit display shows current in each phase and the control voltage. The “STEP” button may be depressed to step through these values.

#### Plug-in Printed Circuit Boards

**S** Smooth Stop – Adjustable from 1 to 75 seconds. It extends the stop time beyond the coasting stop time. This is useful in preventing sudden stopping. The Smooth Stop is a plug-in type daughterboard. No wiring is necessary. This option is also available on the open panel models.

**P** Pulse Start – The current is adjustable from 100 to 500% with an adjustable time period of 0.2 to 3 seconds. This option provides an initial breakaway current to assist in starting high torque or heavily loaded applications. The Pulse Start option is a plug-in type daughterboard. No wiring is required. This option is also available on the open panel models.

#### OPTIONS DESCRIPTIONS

Cat. No. Suffix	Description
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#### Communications

**F4** **W-PONI** monitors the “On, Off” status of the Advantage Contactor, and displays 3-phase current and 120V AC control voltage through the customer’s IMPACC System.

#### Circuit Breakers (Shunt Trip Included – Rated 120V AC)

C	Model	Breaker	Shunt Trip VA
	EA045	HMCP070M2	570VA
	EA090	HMCP150T4	570VA
	EA135	HMCP250K5	84VA
	EA270	HMCP400R5	120VA
	EA360	HMCP600L6W	120VA
	EA540	HND3800T33W	120VA
	EA760	HND312T33W	120VA

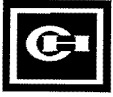
The breakers are rated at 65,000 AIC at 480V.

**If the customer desires to activate the shunt trip upon a tripped condition the customer must have the Trip Relay (Y1) option which includes the Control Power Transformer (T) Option.**

#### Nameplates

**N1** Laminated Plastic door mounted Nameplate with black lettering on white background.  
2 lines – 18 characters each line maximum.  
Dimensions of nameplate are 3 inches H x 5 inches W.

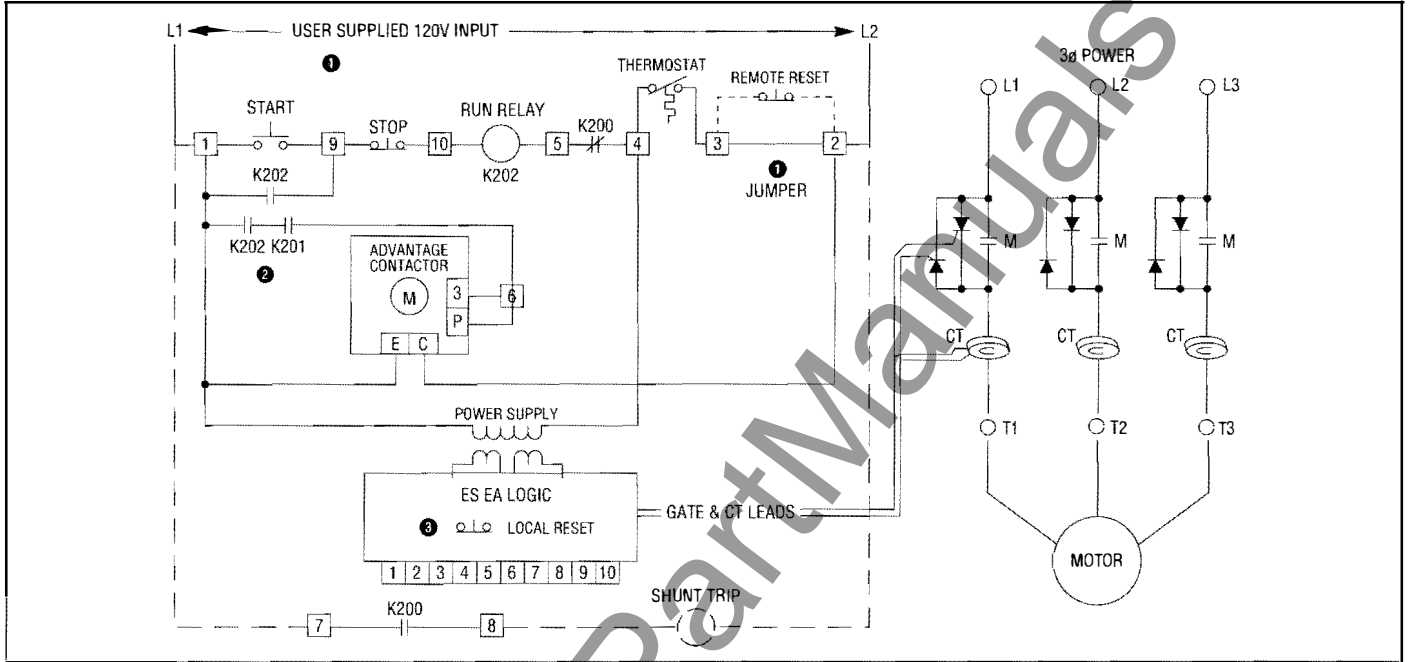
**N2** Stainless Steel door mounted Nameplate with black lettering on silver background.  
2 lines – 18 characters each line maximum.  
Dimensions of nameplate are 3 inches H x 5 inches W.



## Cutler-Hammer *Easy-Start EA* Reduced Voltage Starter

DIAGRAMS AND DIMENSIONS

### Schematic



- ① User supplied Remote Reset can be installed by removing jumper between terminals 2 and 3.
- ② End-of-ramp Relay (K201) and Trip Relay (K200) are part of Logic Board; a remote fault device, such as Shunt Trip, may be connected in series with the N.O., K200 contact at point 8.
- ③ Starter is reset by interrupting 120 volt supply at remote reset, or by using the "RESET" pushbutton on the main logic board, which is at low level voltage.
- ④ CPT and operator devices to be supplied by users unless ordered with enclosed units. Models EA045 through EA135 require 150VA minimum CPT. Models EA270 through EA760 require 300VA minimum CPT.

### Line and Load Lug Wire Size Ranges

Model	Open Starter Panel		Enclosed Starter Configuration			
	Line	Load	Non-Combination Type		Combination Type	
			Line	Load	Line	Load
EA045	#14-4 AWG	#14-6 AWG	#14-4 AWG	#14-6 AWG	#4-4/0 AWG	#14-6 AWG
EA090	#14-250 MCM	#6-250 MCM	#14-250 MCM	#6-250 MCM	#4-4/0	#6-250 MCM
EA135	#14-250 MCM	#6-250 MCM	#14-250 MCM	#6-250 MCM	#4-350 MCM	#6-250 MCM
EA270	(2) 2/0-500 MCM	#4-500 MCM	(2) 2/0-500 MCM	4-500 MCM	(2) 3/0-250 MCM	4-500 MCM
EA360	(2) 2/0-500 MCM	(2) 4-500 MCM	(2) 2/0-500 MCM	(2) 4-500 MCM	(2) 400-500 MCM	(2) 4-500 MCM
EA540	(2) 500-750 MCM	(2) 4-500 MCM	(2) 2/0-500 MCM	(2) 4-500 MCM	(4) 4/0-500 MCM	(2) 4-500 MCM
EA760	(2) 500-750 MCM	(3) 4-500 MCM	(2) 500-750 MCM	(3) 4-500 MCM	(4) 4/0-500 MCM	(3) 4-500 MCM



## Cutler-Hammer *Easy-Start EA* Reduced Voltage Starter

### GUIDE SPECIFICATIONS

#### Guide Specifications

The solid state reduced voltage starter shall be UL and cUL listed and consist of an SCR based power section, logic board and paralleling bypass contactor.

The SCR based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1500 PIV. Units using triacs or SCR/diode combinations shall not be acceptable. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dv/dt characteristics of the electric system.

The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits. The logic board shall be identical through all ampere ratings and voltage classes and shall be conformally coated to protect from environmental conditions.

The paralleling bypass contactor shall energize when the motor reaches full speed and close/open under 1X motor current. The contactor shall be fully rated for across-the-line starting duty should this be desired. The contactor shall utilize an *energy balanced contact closure* to limit contact bounce and an *intelligent coil controller* which optimizes coil voltage during varying system conditions. The coil shall have a lifetime warranty.

The overload protection shall be electronic and be based on an inverse

time/current algorithm. Overload protection shall be adjusted via DIP (Dual Inline Package) switch on the logic board. Class 10/20 shall be selectable. Units using bimetal overload relays are not acceptable. Overtemperature protection (on heat sink) shall be standard.

The solid state logic shall be phase sensitive, and shall inhibit starting on incorrect rotation. Improper phase rotation shall be indicated on the logic board of the starter.

Starters shall protect against a phase loss/unbalance condition shutting down if a 35% current differential between any two phases is encountered.

A normally open (NO) contact shall announce fault conditions, with contact ratings of 60VA (resistive load) and 20VA (inductive load). In addition, an LED display on the logic board shall indicate type of fault (current trip, phase loss, phase rotation).

The following logic board adjustments are required:

- Ramp Time; 1-45 seconds, on hexadecimal switch
- Initial Torque; 100-200% current, on hexadecimal switch
- Current limit; 100-500% current, on hexadecimal switch <sup>①</sup>
- FLA of motor; 4-1 range of starter, on DIP switch

Smooth stopping (optional) shall be available to provide a linear voltage deceleration should the load require it. It is to be adjustable from 1-45 seconds.

Pulse Start (optional) shall be available to provide an initial breakaway current to assist in high torque or heavily loaded applications. The current is adjustable from 100 to 500% with an adjustable time period of 0.2 to 3 seconds.

Enclosed units <sup>②</sup> shall include a flange mounted circuit breaker for short circuit protection and quick disconnect means. Starters and breakers are to be tested in series and be rated for UL508 withstand rating of 65KAIC RMS.

Other options shall include Control Power Transformer (300VA minimum) and a door mounted Advantage Metering Module. Operator devices shall include Hand-Off- Auto switch, Start, Stop, and Reset Pushbuttons along with "Power-On," "Run" and "Trip" indicating lights. Operator devices shall be 30mm.

Units enclosed in motor control centers shall be of the same manufacturer as that of the circuit breaker and motor control center manufacturer due to coordination and design issues.

The manufacturer of the solid state starter shall employ a factory trained field service organization for the purpose of start up and repair of units. (Third party service contractors are not acceptable.)

<sup>①</sup> Except EA360 which is Definite Purpose Rated at 417% (1500 Amps Max Starting).

<sup>②</sup> User to select between NEMA 1, NEMA 12, NEMA 3R/4 or NEMA 4X for enclosed units.

## Cutler-Hammer

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**EAT•N**