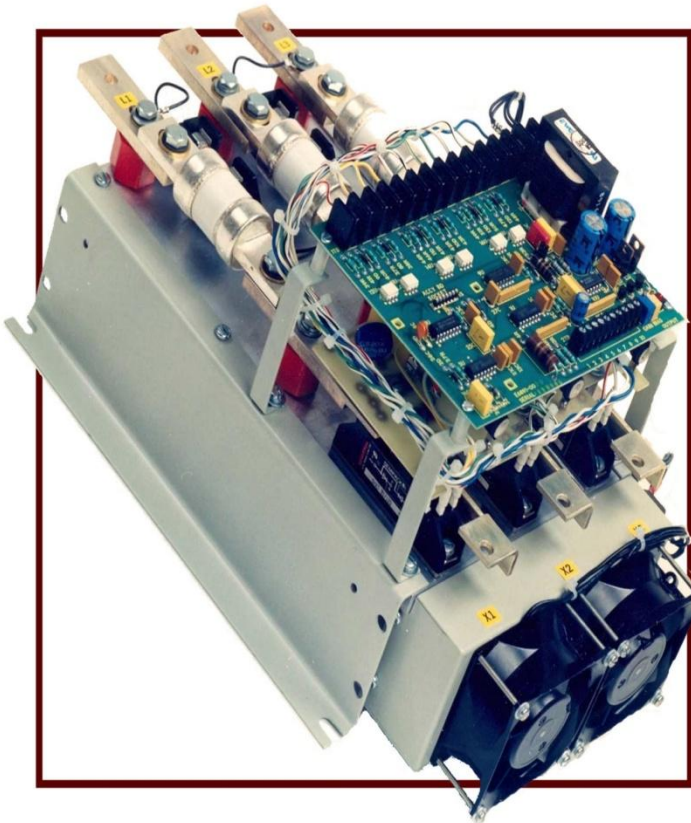


## **C-SERIES POWER CONTROLLERS** **Three Phase SCR Controllers** **Phase Angle and Zero Crossover**



### **STANDARD FEATURES**

- 40% smaller than conventional designs
- Electrically isolated heatsinks up to 350A
- Easy mounting – Easy service access
- Quick-change I<sup>2</sup>T fusing system
- Completely self-contained – No separate control voltage required for standard voltages
- Accepts all standard control signals
- Silver plated all copper bus bar
- Gate signal lockout
- Standard ratings designed for 50°C maximum ambient
- Immunity to line distortion
- Stepless control for proportional electric power

***The C-Series SCR Power Controllers are available either with phase angle or zero crossover firing control of the SCRs:***

- Phase angle controllers are normally applied to control dynamic resistive or transformer-coupled heating element loads.
- Zero crossover fired power controllers are primarily used to control static loads, such as resistive heating elements, which are not affected by age or drastic change in resistance versus temperature.

## Introduction

The C-Series – a new generation of Spang SCR Power Controllers answers the demand for a smaller, lighter, more cost-efficient unit capable of delivering peak performance under tough industrial conditions.

The C-Series combines large scale integration (LSI) and power semi-conductor technology with computer-optimized heat sink design and packaging techniques. This combination reduces size and weight without sacrificing the dependability that is traditional for Spang Power Electronics products.

SCR triggering is precise. The CMOS and digital logic circuits built into the firing control are unaffected by power line distortions such as harmonics, sags, and surges.

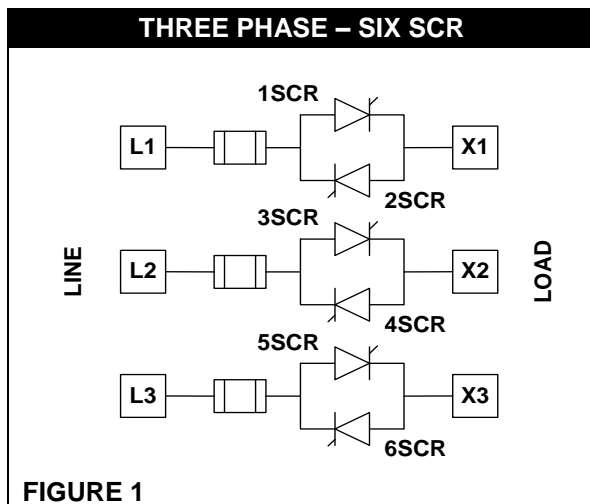
## Phase Angle Control

The C-Series Phase Angle Control uses a six (6) SCR configuration composed of two (2) SCRs, connected inverse parallel in each line to the load (Figure 1). Three phase loads may be either Delta or Wye connected.

In Phase Angle Control, the SCR is gated every cycle. Power control is accomplished by delaying SCR gating until some time after the voltage crosses zero. By varying this delay, the time the SCR is allowed to conduct is varied, as is the output.

## Advantages

- Conventional voltmeters and ammeters can be used for instrumentation over 0 to 100% voltage range
- Infinitely variable output.
- Operation into dynamic loads (i.e., transformers)



## Specifications - Phase Angle

### Input Voltage

Ratings are provided for 120, 240, and 480 volt three phase. Other input voltages are available with the addition of an optional transformer. Consult factory.

### Input Frequency

All units operate on 50 hertz or 60 hertz.

### Ambient

All ratings are designed for 50°C maximum operating temperature. For operation at higher temperature (to 65°C maximum) some derating is necessary. Please consult factory.

### Input Signals

Accepts all standard control signals and a manual potentiometer. See control connections chart.

Control Connections		
DC Control Signal	Input Control Terminal Points	Input Impedance
0-5 ma	1 (+) - 5 (-)	1000 ohms
2-12 ma	2 (+) - 5 (-)	400 ohms
4-20 ma	3 (+) - 5 (-)	250 ohms
10-50 ma	4 (+) - 5 (-)	100 ohms
0-10 V	7 (+) - 5 (-)	200K ohms
Contact Closure	8 and 7	Close Contact to turn PCU on
Manual Control: End of Pot Slider of Pot	6 and 8 7	Connect a 10kΩ 2Watt Potentiometer
Lockout (Shutdown Contact)	6 and 10	Close Contact to turn PCU off

### Adjustments

High resolution 20 turn potentiometers are provided for all adjustments.

- Gain adjustments provide full output for 50% to 200% standard control signal.
- Bias adjustments for manual control 100% output.

### Voltage Protection

Transient voltage suppression is provided by an R-C Snubber Network and Metal Oxide Varistors (MOVs), which clamp high voltage spikes to within the PRV rating of the semiconductors. NOTE: This product line standardizes on 1200V rated SCRs.

### Reference Supply

A 12 volt DC regulated reference supply is available from the firing circuit for connection to a remote potentiometer, from which the power controller can be operated manually. This supply is regulated to within  $\pm 1/2\%$  for line voltage variations. Maximum current rating from this reference source is 10 milliamperes.

## Cooling

The 40 amp current size is convection cooled. Larger sizes are forced-air cooled by integral cooling fans. Bimetallic temperature switches are supplied on all forced-air cooled units with one Normally Open (NO) contact wired to the terminal block. As an alternative, Normally Closed (NC) are available on request.

## Soft Start

An integral soft start ramp is provided on all C-Series Phase Angle fired units. Upon initial energization, gate firing is inhibited for a short time to all units for circuit stabilization. After this time, the SCR is ramped in response to the input control signal. The Transformer Inrush Protection (TIP) feature allows smooth, reliable control into the primary of a transformer, eliminating nuisance fuse blowing due to high inrush currents which can occur if power is applied too rapidly to a transformer.

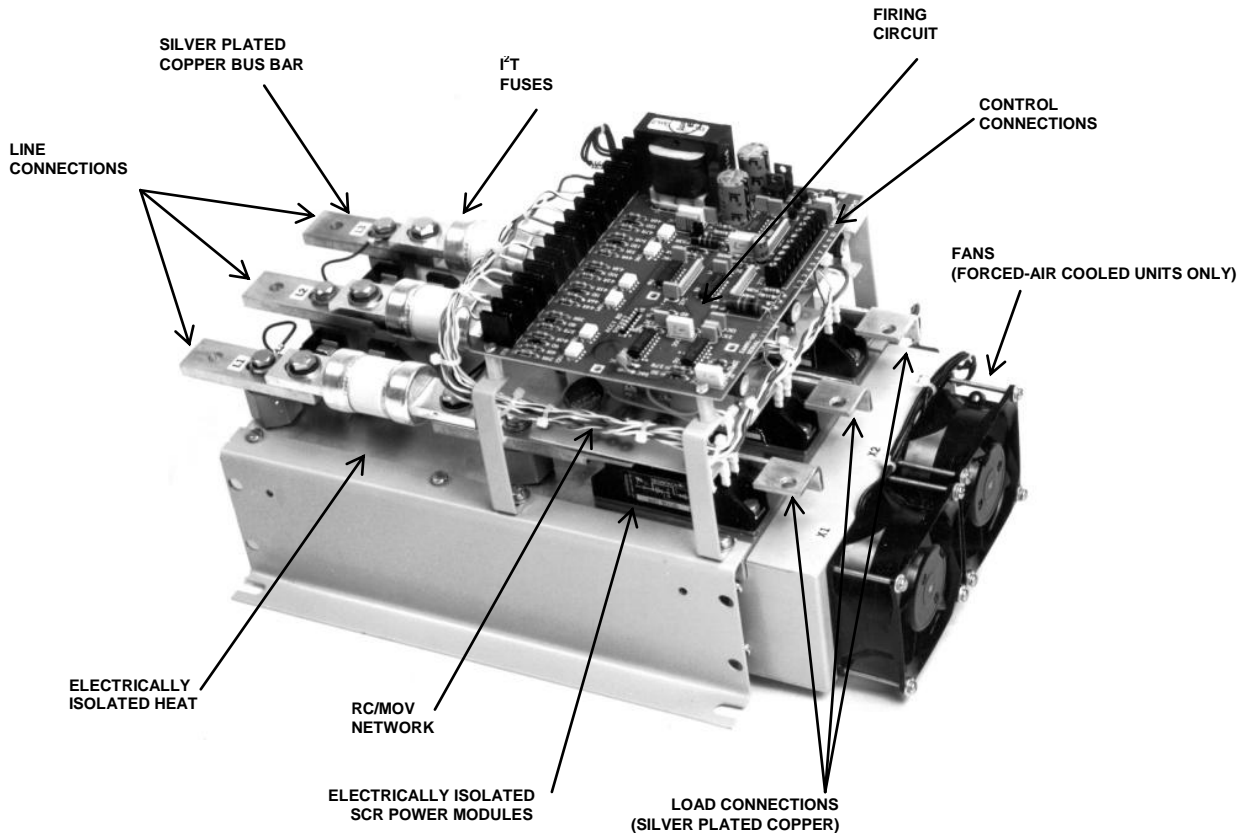
## Options Available

### Current Limit

Senses the RMS current and limits output. Current limit adjustment is from 5% to over 100% of rating by a potentiometer on the firing circuit.

### Voltage Regulation

Adds RMS voltage feedback to the standard model. Voltage regulation is  $\pm 1\%$  for line voltage excursions of  $+10\%$ ,  $-15\%$  of nominal. This option also improves control linearity to  $\pm 1\%$  from 0 to 100% output.



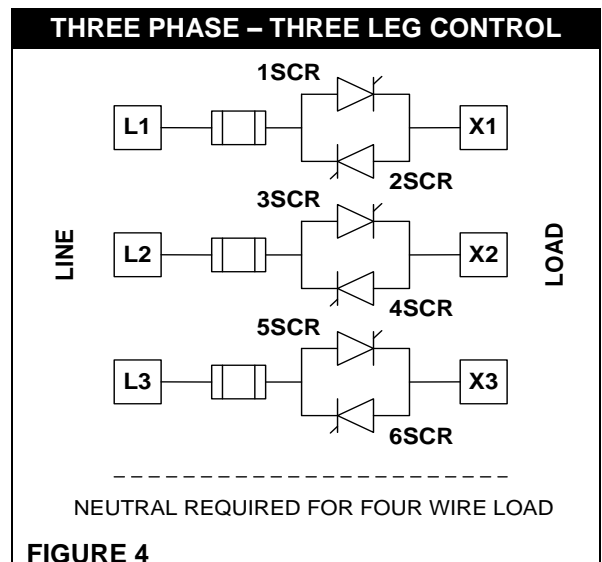
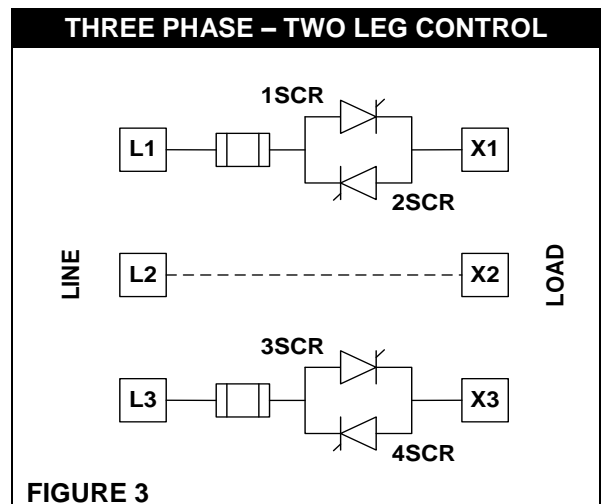
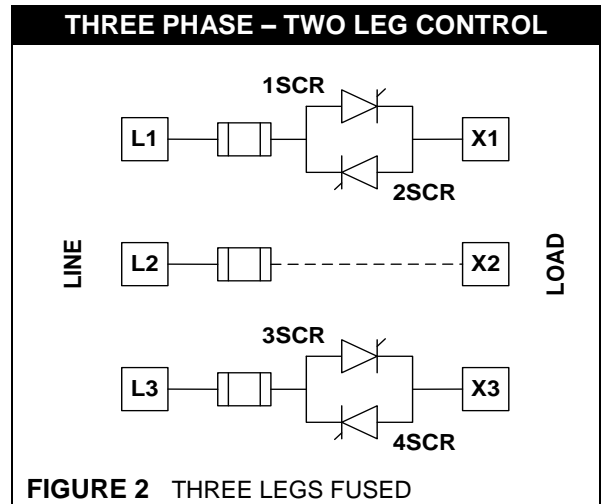
## Zero Crossover Control

The C-Series Zero Crossover Fired SCR Power Controller is available in two configurations: three-leg six (6) SCR and two-leg four (4) SCR. Two-leg control uses two SCRs connected inverse parallel in two of the three lines to the load (Figure 2 & 3). The six SCR three-leg uses two SCRs connected inverse parallel in each line of the load (Figure 4). Two-leg uses fewer power components and is more economical. Three phase loads may be either Delta or Wye connected. If control is required to a four wire grounded neutral Wye load, the six SCR configuration is required.

In zero crossover control, the SCRs are always gated a the moment the sine wave crosses zero and the anode is driven positive. Complete cycles of power are delivered at a time. Power control is achieved by having the SCRs ON for some cycles and OFF others. The ratio of the number of cycles ON to the number of cycles OFF is varied to proportion the power delivered to the load.

### Advantages

- Conventional voltmeters and ammeters can be used for instrumentation at 50% to 100% voltage range.
- Infinitely variable output.
- Elimination of RFI
- Power is evenly distributed over time
- Variable ratio cycling rate provides the smoothest power distribution over time.



## Specifications - Zero Crossover

### Input Voltage

Ratings are provided for 120, 240, and 480 volt three phase. Other input voltages are available with the addition of an optional transformer. Consult factory.

### Input Frequency

All units operate on 50 hertz or 60 hertz.

### Ambient

All ratings are designed for 50°C maximum operating temperature. For operation at higher temperatures (to 65°C maximum), some derating is necessary. Please consult factory.

### Input Signals

Accepts all standard control signals and a manual potentiometer. See control connections chart.

### Adjustments

High resolution, 20 turn potentiometers are provided for all adjustments.

- A. Gain adjustments provide full output for 50% to 200% standard control signal.
- B. Bias adjustment for manual control 100% output.

### Voltage Protection

Transient voltage suppression is provided by an R-C snubber network and metal oxide varistors (MOVs) which clamp high voltage spikes to within the PRV rating of the semiconductors  
NOTE: This product line standardizes on 1200V rated SCRs.

### Reference Supply

A 12 volt DC regulated reference supply is available from the firing circuit for connection to a remote potentiometer, from which the power controller can be operated manually. This supply is regulated to within  $\pm\frac{1}{2}\%$  for line voltage variations. Maximum current rating from this reference source is 10 milliamperes.

### Cooling

Current sizes 40 and 60 amperes two-leg and 40 amperes six SCR three-leg are convection cooled. Larger current sizes are forced-air cooled by integral cooling fans. Bimetallic temperature switches are supplied on all forced-air cooled units with one Normally Open (NO) contact wired to the terminal block. As an alternative, Normally Closed (NC) are available on request.

## Options Available

### Current Limit

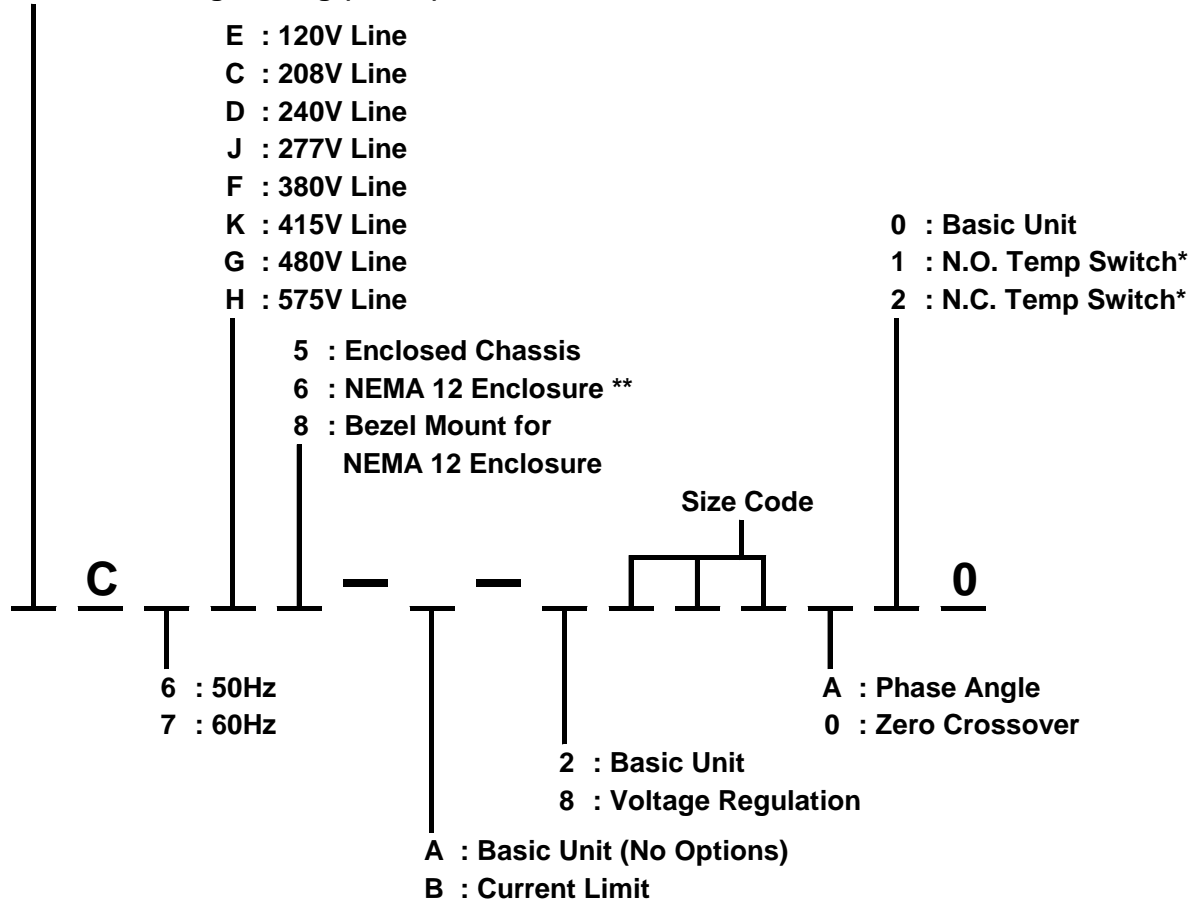
Senses the RMS current and limits output. Current limit adjustment is from 5% to over 100% of rating of a potentiometer on the firing circuit.

### Voltage Regulation

Adds RMS voltage feedback to the standard model. Voltage regulation is  $\pm 1\%$  for line voltage excursions of +10%, -15% of nominal. This option also improves control linearity to  $\pm 1\%$  from 0 to 100% output.

## Ordering Information

- M - Zero Crossover Firing (2-Leg Control, 3-Legs Fused)
- N - Zero Crossover Firing (6 SCR 3-Leg 3 Wire Wye or Delta Load)
- L - Zero Crossover Firing (2-Leg Control, 2-Legs Fused)
- J - Zero Crossover Firing (6 SCR 3-Leg 4 Wire Wye Load)
- F - Phase Angle Firing (6 SCR)



\* Forced-air cooled units only. Not applicable to convection cooled units.

\*\* NEMA 12 Enclosures available for select frame sizes.

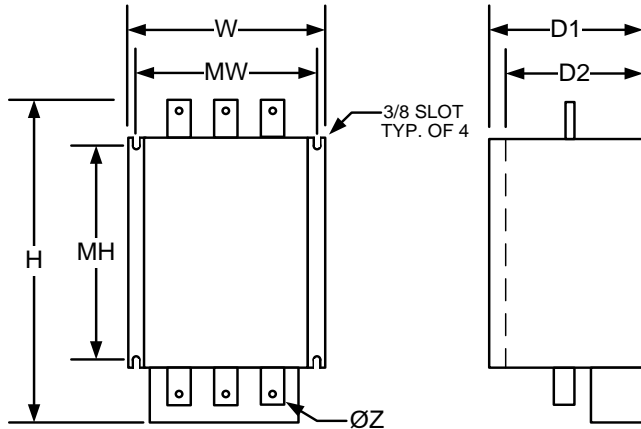
\*\*\* Line and Load guns not included. See Table below for ordering information.

Amps	Size Code	Terminal Kit		NEMA 12 Enclosure Dimensions (INCHES)		
		Catalog Number	Wire Size	H	W	D
40*	400	TERMKIT-3PH100A	#1/0 - 14 AWG	26	18	14
60	600	TERMKIT-3PH100A	#1/0 - 14 AWG	26	18	14
100	101	TERMKIT-3PH100A	#1/0 - 14 AWG	26	18	14
150	151	TERMKIT-3PH200A	250 MCM - 6 AWG	26	18	14
250	251	TERMKIT-3PH250A	350 MCM - 6 AWG	32	18	14
350	351	TERMKIT-3PH350A	350 MCM - 6 AWG	32	18	14
600	601	TERMKIT-3PH600A	(2) 600 MCM - 2 AWG	N/A	N/A	N/A
1000	102	TERMKIT-3PH1000A	(4) 600 MCM - 2 AWG	N/A	N/A	N/A
1300	132	Contact SPANG	Contact SPANG	N/A	N/A	N/A

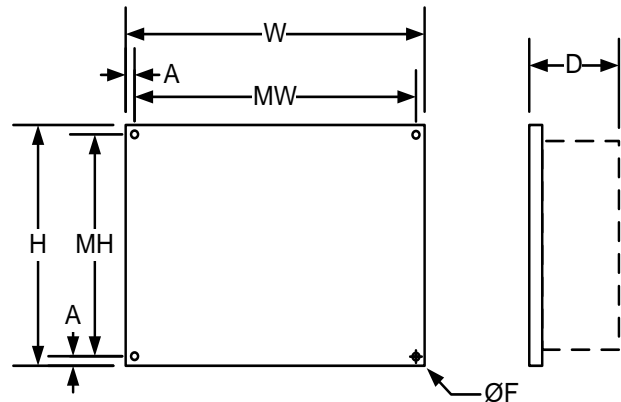
## Physical Dimensions

### PHYSICAL DIMENSIONS

#### 40 - 350 Amp



#### 600 - 1300 Amp



#### 40 – 350A CHASSIS DIMENSIONS (INCHES)

Frame Size	W	MW	H	MH	D1	D2	Z
40 Amp	9 7/8	9	14 3/8	11 1/8	9 1/8	8 7/8	5/16
60 Amp*	9 7/8	9	16 3/8	11 1/8	9 1/8	8 7/8	5/16
100 Amp	9 7/8	9	16 3/8	11 1/8	9 1/8	8 7/8	5/16
150 Amp	9 7/8	9	16 3/8	11 1/8	9 1/8	8 7/8	5/16
250 Amp	12 7/8	12	21	13 1/4	10 1/4	10	9/16
350 Amp	12 7/8	12	21	13 1/4	10 1/4	10	9/16

\* LC Series 60 Amp - 14 3/8\* H

#### 600 – 1000A CHASSIS DIMENSIONS (INCHES)

Frame Size	W	MW	H	MH	A	D	F
600 Amp	24	22 1/2	20	18 1/2	3/4	12	1/2
1000 Amp	36	34 1/2	26	24 1/2	3/4	14 3/4	1/2
1300 Amp	39	37 1/2	42	40 1/2	3/4	15	1/2