



## SDC SOLENOID DESIGN NOTE # 132

**TITLE:** Power Supply Investigation; 10,000 A, 30 Vdc and 5,000 A, 30 Vdc

**AUTHOR:** C. Drennan (Fermilab)

**DATE:** February 8, 1991

**ABSTRACT:** This design note reports four manufacturers quotations for 10,000 A, 30 Vdc and 5,000 A, 30 Vdc power supplies that could be used with the SDC solenoid.

### POWER SUPPLY SPECIFICATIONS

The following are the specifications for the power supplies considered in this investigation:

Current: 5,000 A 10,000 A  
Voltage: 30 V  
Regulation: 0.05% of set value in the range from 5% to 100% of the rated current.  
Filtering: Not specified.  
Supply Volts: 480 VAC

It was felt that, as far as investigating price and availability of power supplies, the voltage rating of 30 V should be sufficient. The magnet parameters are given as follows:

Stored Energy: 150 MJ  
Inductance: 3 H at 10,000 A

The maximum linear charge rate, assuming the magnet terminal voltage is equal to the power supply voltage of 30 V, would be,

$$dI_{\max}/dt = V / L = 10 \text{ A/s at } 10,000 \text{ A}$$

The minimum linear charge time would then be,

$$\text{Charge Time} = 1000 \text{ s at } 10,000 \text{ A}$$

If bus losses of 8 to 10 V at 10,000 A are considered the maximum linear charge rate becomes,

$$dI_{\max}/dt = 7.33 \text{ to } 6.67 \text{ A/s at } 10,000 \text{ A}$$

The magnet should be able to charge to 10,000 A in 25 minutes. Note that, in sizing the refrigeration, a charge rate of 8.3 A/s, giving an eddy current heat load of 270 W, was considered.

The 5,000 A power supplies are being considered for the 10,000 A application. Here, two of the 5,000 A supplies would be used in parallel. The possible advantage in this would be a reduction in the inventory and cost of repair parts. The cost of 5,000 A devices is generally less expensive than 10,000 A devices, but not necessarily half the price.

## THE QUOTATIONS

Dynapower

PO Box 3180-T

Farmington Hills, MI 48333-3180

(800)-521-6792

POC: Chris Manross

Quotation: 5,000 A, 30 Vdc — \$32,000.00 to \$35,000.00

10,000 A, 30 Vdc — \$53,000.00 to \$56,000.00

Other Information: Enclosure dimensions — 52"x52"x60" — 60"x60"x69"

Inverpower Controls Ltd.

835-T Harrington Court

Burlington, Ontario Canada, L7N 3P3

(416) 827-6673

Quotation: 5,000 A, 30 Vdc — \$40,000.00 to \$45,000.00

10,000 A, 30 Vdc — \$60,000.00 to \$70,000.00

Power Energy Industries

17025-T Kingsview Ave.

Carson, CA 90746

(213) 323-4552

POC: Richard Rall

Quotation: 5,000 A, 30 Vdc — \$58,000.00

Other Information: Currently used at Fermilab. Product information attached.

Rapid Power Technologies, Inc.

PO Box 291

Grays Bridge Road

Brookfield, CT (800) 332-1111

Quotation: 5,000 A, 30 Vdc — \$27,275.00

10,000 A, 30 Vdc — \$38,935.00

Other Information: See attached quotation.

**P=EI**

## Power Energy Industries

17025 Kingsview Avenue • Carson, California 90746-1279 • Phone: (213) 323-4552

January 28, 1991

Mr. Craig Drennan, Mail Stop 219  
Fermi National Accelerator Laboratory  
P.O. Box 500  
Batavia, Illinois 60510

PEI Ref: BQ91-030

Dear Craig:

Per our recent telephone conversation there are enclosed two copies of PEI Bulletin 7-84-0, describing PEI Model SR 1029 power supply, rated 30V @ 5000A.

The current nominal selling price for a quantity of two units is \$58,000.00 each. Depending on your actual requirements and the circumstances existing at the time of purchase, there may be room for some negotiation on this figure.

We appreciate your inquiry and we hope the SR 1029 will fit your equipment needs. We'll be pleased to supply any additional information you may require.

Very truly yours,

POWER ENERGY INDUSTRIES



Richard A. Rall, Jr.  
Manager Applications Engineering

Enclosure (2)

J0161.LTR

**P-EI**

**Power Energy  
Industries**

# 150 KW Power Supply

## Model SR 1029

This unit is a 150 KW precision, regulated, water-cooled, programmable D.C. power supply with a stability better than  $\pm 0.01\%$  for direct current, achieved with phase control of thyristors. Oven control of precision components is used in conjunction with water cooled power components.

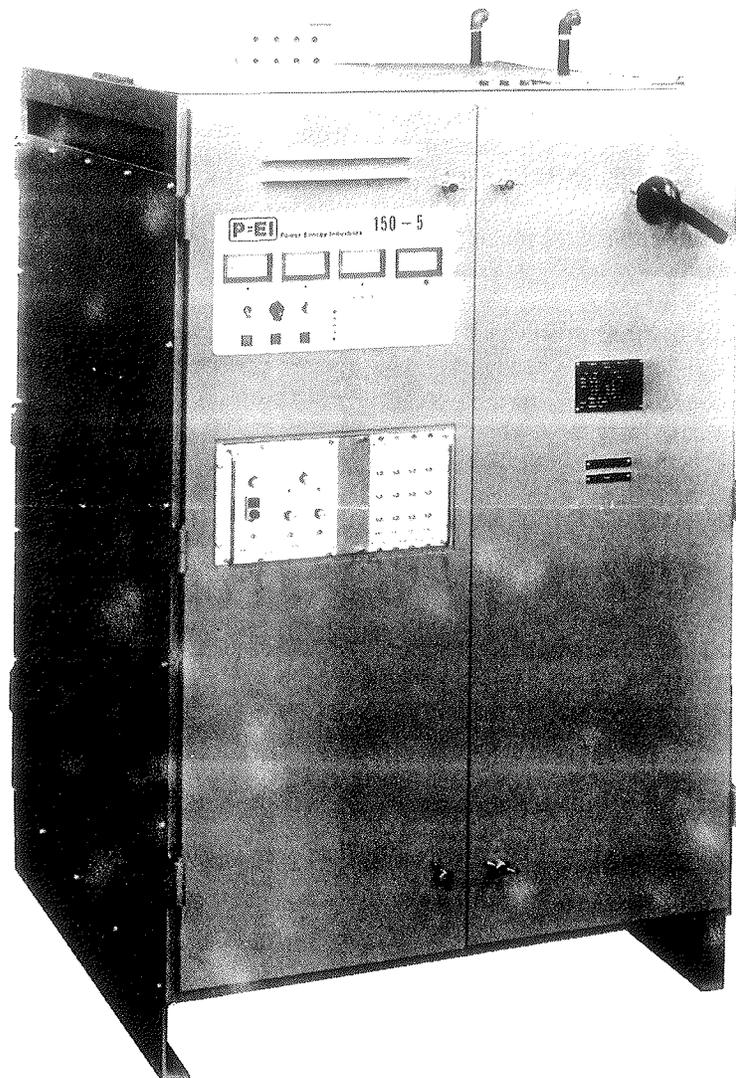
The power supply has two shielded input power transformers yielding a wye delta, twelve phase quadrupole wye system. Interphase transformers are provided for parallel operation of the secondary commutating groups. Bolted links, accessible from the front or rear of the power supply, are provided to connect for series or parallel operation of all commutating groups. The primary winding of the power transformers is quadrifilar wound and bolted links, accessible from the front of the power supply, is provided to connect the primary windings on each transformer leg in series, series-parallel or parallel, yielding 25%, 50% or 100% secondary voltage.

The unit can be operated in series since they have provisions for operation in either current or voltage control mode. Variable parameters for control of gain and time constant are incorporated into the current feedback loop to match various magnet loads.

The unit is housed in a portable drip proof enclosure. Doors and removable panels give immediate accessibility to all com-

ponents to facilitate servicing. The unit incorporates a complete system of control, metering, function indicators and protection devices. The overall regulation and stability can be improved to 0.001% with minor modifications.

Model SR 1029 provides a regulated output of 5000 amperes at 30 volts. A transductor is used for regulation and for the customer's precision readout.



## ELECTRICAL CHARACTERISTICS

The performance specifications are outlined below:

### Input Power:

480 Vac,  $\pm 10\%$ , 3 phase, 4-wire 60 Hz; 5% maximum unbalance;  $\pm 0.2$  Hz variation.

### Output:

With the basic output of 0 to 30 Vdc changing primary taps, the output can be selected to be 0 to 15 Vdc, 0 to 7.5 Vdc.  
0 to 5000 amps dc on any tap.

By changing the secondary link configuration output voltages can be changed to be:

- 0 to 15 Vdc @ 2500 Amps dc
- 0 to 30 Vdc @ 2500 Amps dc
- 0 to 60 Vdc @ 2500 Amps dc
- 0 to 30 Vdc @ 1250 Amps dc
- 0 to 60 Vdc @ 1250 Amps dc
- 0 to 120 Vdc @ 1250 Amps dc

### Regulation:

$\pm 0.05\%$  current regulation during flattop between 20% and 100% of rated output

$\pm 0.05\%$  voltage regulation during flattop

These values will occur with deviations containing the arithmetic sum of  $\pm 10\%$  static line, 25% static load, 30% thermal regulation PARD, only 60 Hz and 360 Hz components  $\pm 0.2$  Hz frequency variation 5% voltage unbalance.

### Overload Protection:

0 to 110% adjustable current meter relay, and a factory set overload firing latching at about 130% of maximum system current.

### Environment:

Water-cooled, with less than 4 gpm at 100 PSI; ambient air temperature range 15 to 45°C.

### Capabilities and Limitations

The supply does not employ a power filter in the dc output. Ripple voltage or current into a resistive load is approximately 20% peak-to-peak at 720 Hz.

Input power (KVA) can be minimized at reduced output voltages by reconnecting the primary tap-links.

The maximum KVA input for full load (5000 Amps) on each tap is 212 KVA (30V), 110 KVA (15V), 62 KVA (7.5V) @ 504 Vac input (high line).

### Mechanical Features or Characteristics

The power supply is in a standard 48½ inch cabinet with two 24 inch front doors.

AC Input cables connect directly into terminals on the main circuit breaker (CB1). The terminals can accept up to 350 MCM cable each.

DC Output cables connect to the (+) and (-) bus bars through the top with front access for bolting. Eight (8) holes (½-13) are provided. Polarity is marked for positive identification.

Remote Control monitoring and interlocking is handled by Interface connections on a connector panel at the front top of the supply.

**Safety Ground** terminal is provided on the upper right side of the supply next to the input circuit breaker. This terminal must be connected to facility safety ground for personnel safety and equipment protection.

### Cooling Water

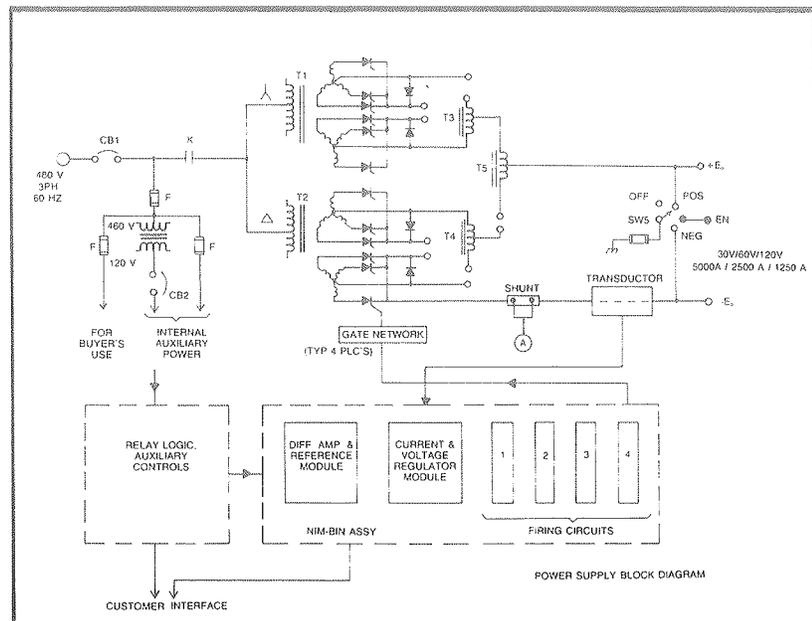
Connections are provided on the top of the supply with ¾ inch nipples of brass pipes.

Minimum water differential pressure of 60 psig is required to provide minimum flow of 4 gpm for full load cooling at ambient temperatures up to +45 C.

The power losses removed by cooling water are essentially independent of the primary tap configuration and are less than 15 KW.

A 40 mesh, Y-Strainer is recommended on the inlet.

Cooling water must be low conductivity (preferably deionized) to minimize galvanic corrosion of fittings.



Power Energy Industries

17115 Kingsview Ave., Carson, CA 90746 (213) 323-4552  
17025



Quotation

- DC and AC Power Supplies
- Dry and Liquid Filled Transformers
- Process Control Systems
- Line Drop Compensators
- Computer Protection Equipment
- Frequency Converters

GRAYSBRIDGE ROAD, P.O. BOX 291  
BROOKFIELD, CT 06804

TOLL FREE 1-800-332-1111 • In CT (203) 775-0411 • Telex: 643-012

Client: Fermi Labs  
 P.O. Box 500  
 Batavia, IL 60510  
 ATT: Craig Drennan  
 FAX: (708) 840-4343

Date: February 14, 1991

Quotation: No. LET41199

Your Inquiry No.

Prices Quoted BUDGET  
 Are Firm For \_\_\_\_\_ Days.

In response to your inquiry, we are pleased to submit the following quotation:

Qty.	Description	Price
1	RAPID PRECISION ENGINEERED SCR (THYRISTOR) DC POWER SUPPLY	\$38,935.00
	MODEL: SCRW410K030	
	COOLING: Water	
	RATED	
	DC OUTPUT: 10,000 Amperes 30 Volts 300 kW	
	AC INPUT: 460 Volts <u>+10%</u> 3 Phase 60 Hz	
	PLUS OR MINUS: 10% A.C. LINE VARIATION ALLOWABLE	
	CONTROL: SCR (Thyristor)	
	STARTING EQUIPMENT: AC Magnetic Contactor	
	REGULATION: <u>+0.05%</u> , Current and Voltage	
	RIPPLE: 5% rms ripple at rated output.	
	DIMENSIONS: 80" H X 72" W X 60" D (est.), with sealed side enclosure adding 7" to overall width.	
	REMOTE: 14" H X 12" W X 7" D	
	WARRANTY: Standard (See back of this quotation form)	

Price does not include any applicable state or local sales taxes.

Terms <b>1% 10D N30</b> SUBJECT TO CREDIT APPROVAL.	F.O.B. Brookfield, Ct.	Estimated Shipping Schedule <b>10 weeks ARO</b> <small>IF APPROVAL IS REQUIRED, DELIVERY SCHEDULE COMMENCES AFTER APPROVAL DRAWINGS ARE RECEIVED.</small>
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By:   
 Nels Andersson  
 Title: Vice President - Sales



POWER TECHNOLOGIES, INC.

Quotation

- DC and AC Power Supplies
- Dry and Liquid Filled Transformers
- Process Control Systems
- Line Drop Compensators
- Computer Protection Equipment
- Frequency Converters

GRAYSBRIDGE ROAD, P.O. BOX 291  
BROOKFIELD, CT 06804

TOLL FREE 1-800-332-1111 • In CT (203) 775-0411 • Telex: 643-012

Client: Fermi Labs  
 P.O. Box 500  
 Batavia, IL 60510  
 ATT: Craig Drennan  
 FAX: (708) 840-4343

Date: February 14, 1991

Quotation: No. LET41200

Your Inquiry No.

Prices Quoted BUDGET  
 Are Firm For \_\_\_\_\_ Days.

In response to your inquiry, we are pleased to submit the following quotation:

Qty.	Description	Price
1	RAPID PRECISION ENGINEERED SCR (THYRISTOR) DC POWER SUPPLY	\$27,275.00
	MODEL: SCRW450C030	
	COOLING: Water	
	RATED	
	DC OUTPUT: 5,000 Amperes 30 Volts 150 kW	
	AC INPUT: 480 Volts <u>+10%</u> 3 Phase 60 Hz	
	PLUS OR MINUS: 10% A.C. LINE VARIATION ALLOWABLE	
	CONTROL: SCR (Thyristor)	
	STARTING	
	EQUIPMENT: AC Magnetic Contactor	
	REGULATION: <u>+0.05%</u> , Current and Voltage	
	RIPPLE: 5% rms ripple at rated output.	
	DIMENSIONS: 72" H X 48" W X 48" D (est.), with sealed side enclosure adding 7" to overall width.	
	REMOTE: 14" H X 12" W X 7" D	
	WARRANTY: Standard (See back of this quotation form)	

Price does not include any applicable state or local sales taxes.

Terms 1% 10D N30 SUBJECT TO CREDIT APPROVAL.	F.O.B. Brookfield, Ct.	Estimated Shipping Schedule 10 weeks ARO IF APPROVAL IS REQUIRED, DELIVERY SCHEDULE COMMENCES AFTER APPROVAL DRAWINGS ARE RECEIVED.
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By:   
 Nels Andersson  
 Title: Vice President - Sales

**STANDARD TERMS INCLUDING LIMITED WARRANTY APPLYING TO TRANSACTIONS AND ORDERS**

1. Quoted price firm if item shipped by quoted delivery date. If shipment postponed by buyer, price shall be increased by same percentage as any price increase for similar equipment between quoted delivery date and date shipped. Quotation supersedes all previous quotations and is subject to change by Rapid Power Technologies, Inc. (Rapid) without notice, unless otherwise stated in writing. All orders are subject to Rapid's acceptance at its office. Acceptance of any purchase order is conditioned on assent by buyer to terms hereof. Buyer's terms shall not apply, regardless of any statement made on any document of buyer. Rapid objects to any additional or different terms proposed by buyer.

2. Sales are f.o.b. point of shipment; each shipment or delivery is separate and independent transaction, unless otherwise stated. Shipping dates given prior to shipment are estimated; delivery is subject to Rapid's prior orders. Rapid shall not be liable for delays unless otherwise agreed in writing.

3. Present or future sales, use or other taxes on sale, installation or use shall be paid by buyer.

4. Rapid warrants to first User of each new Rapid product or component that it is free from defect in material and workmanship. THE OBLIGATIONS OF RAPID UNDER THIS WARRANTY ARE EXPRESSLY LIMITED TO THE FOLLOWING:

**STANDARD  
WARRANTY**

A. Rapid will repair or replace, at its cost, any product, component of its products, and any component it sells separately which is installed in a Rapid product, if such product or component develops a defect in material or workmanship within one year of shipment. Rapid will repair or replace, at its cost, any other component it sells if such component develops a defect in material or workmanship within 30 days of shipment.

**EXTENDED  
WARRANTY**

A. Rapid will repair or replace, at its cost, any product, component of its products, and any component it sells separately which is installed in a Rapid product, if such product or component develops a defect in material or workmanship within the following periods after Rapid's shipment:

- (a) Silicon diodes and thyristors for longer of 5 years or warranty period original manufacturer extends to first User;
- (b) Diode and thyristor assembly for 7 years;
- (c) Transformers, saturable core reactors and chokes for 3 years;
- (d) Components not listed above, bought by Rapid (e.g., meters, starters, resistors) to longer of 1 year, or warranty period original manufacturer extends to first User;
- (e) Components not listed above, manufactured by Rapid (e.g., heat exchangers, shunts, ampere minute/hour meters and switches) 1 year, except electronic firing and regulating circuits 2 years.

5. This Warranty applies only if product or component is defective under normal use; it does not apply to breakage or defect from accident, alteration, misuse, abuse or improper installation of product or component. Defective item must be shipped to Rapid freight prepaid; replacement or repaired item shipped freight collect.

6. This Warranty effective only if product or component is installed in location and manner prescribed by Rapid's instructions and only if it is always so maintained. Warranty becomes ineffective if product or component altered by anyone other than Rapid.

7. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE. THE ABOVE WARRANTY IS MADE IN LIEU OF ALL OTHER GUARANTEES OR WARRANTIES, EXPRESS OR IMPLIED. No person is authorized to assume any other obligation or liability for Rapid.

8. RAPID WILL, IN NO CASE AND UNDER NO CIRCUMSTANCES, BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES, LOSS OF PROFIT OR COMMISSION, OR FOR LOSS OF DELAY IN PRODUCTION. Without limitation, Rapid will not be so liable with respect to: furnishing of any product or component; delay in such furnishing; use, resale or other disposition thereof; failure to furnish the same; or any other cause. Rapid's liability arising out of supply of any product or component, its use, resale or other disposition, or out of any guarantee or warranty, express or implied, or any other cause, shall in no case exceed cost to Rapid of product or component which Rapid agrees above to repair or replace. Rapid's liability for any product or component terminates upon expiration of applicable repair or replacement period above.

9. Rapid may change design or construction of any product or component in any way Rapid believes will improve it.

10. Any controversy or claim arising out of or relating to transactions or order, or breach thereof, including breach of warranty, shall be settled by arbitration in New York county, New York, under rules of American Arbitration Association. Any award made against Rapid shall be limited as above provided. Judgment upon award rendered by arbitrator(s) may be entered in any court having jurisdiction thereof. However, at Rapid's option, this paragraph shall not apply to collection of amount due from buyer.

RAPID POWER TECHNOLOGIES, INC.

### OPERATING CONDITIONS

AMBIENT: 40°C maximum, with an average 24 hour temperature of 30°C. Maximum altitude of 3,300 feet.

COOLING WATER: A minimum of approximately 1 to 2 gallons per minute per 1000 amperes of clean water is required. The maximum inlet temperature is not to exceed 30°C (84 F). Water flow is thermally controlled to minimize condensation.

Water quality recommendation. The cooling water shall have the following quality (distilled water is adequate):

- ° A neutral or slightly alkaline reaction, i.e. a pH between 7.0 and 9.0.
- ° A chloride content of not more than 20 parts per million; a nitrate content of not more than 10 parts per million; and a sulphate content of not more than 100 parts per million.
- ° A total solids content of not more than 250 parts per million.
- ° A total hardness, as calcium carbonate, of not more than 250 parts per million.
- ° No chemical additives to be used.

AC DISCONNECT EXTERNAL TO UNIT: Ac disconnect switch or circuit breaker is to be supplied by the purchaser in his distribution system to Rapid equipment; ac disconnect switch should be fused, with fuse rating of approximately 25% to 35% more than the nameplate ac current. Dual-element fuses are recommended. Ac circuit breaker should be rated a minimum of 35% more than nameplate ac current and instantaneous trips should be set at maximum.

AUXILIARY AND CONTROL POWER: Not required on rectifiers with ac input of 600 volts and below. An isolation transformer with 115-volt secondary (fuse protected on both primary and secondary) is supplied as part of the rectifier for control power.

CONSTANT CURRENT REGULATOR: Equipment will include a closed-loop constant current regulator to control the dc output called for by the reference signal from the current-control potentiometer.

The constant-current regulator will maintain a steady-state dc output current within plus or minus 1% of rated current for any reference signal from zero (0) to rated load, within the voltage capability of the equipment.

### PERFORMANCE

With the constant voltage regulator system, the dc output voltage can be set at the desired level; however, the dc current is dependent on the load resistance.

AUTOMATIC CROSSOVER: Equipment includes automatic crossover between voltage and current, i.e., operating in the constant-voltage mode transfer will occur to the constant-current mode when the load current reaches the preset current limit and conversely, operating in the constant-voltage mode will occur when the voltage reaches the preset limit.

RECTIFIER TRANSFORMER: Transformer will be open, dry-type, cooled by convection.

The transformer coils are copper wound with Class H (220° C) insulation. The conservative design of the unit will produce a temperature rise well within the insulation temperature limits. This type of design will avoid insulation dry-out and greatly extend the life of the transformer. The lower resulting heat generation will increase the efficiency and, therefore, consume less electrical energy. The transformer completed assembly is preheated to remove all moisture content. It is then vacuum impregnated with Class H varnish and baked dry during a 24-hour period. Coils are then pre-baked and epoxy treated for additional protection.

### THYRISTOR (SCR) RECTIFIER UNIT

Thyristor (SCR) portion of the unit is cooled by convection.

Thyristors are connected to the secondary of the power isolation transformer, thus affording maximum protection from voltage transients and electrical noise.

The Thyristors are mounted on extruded aluminum heat sinks. The peak reverse voltage rating of each Thyristor is a minimum of ten (10) times the maximum output voltage. The Thyristor is never operated at more than 80% of its maximum average current rating and if parallel devices are used, forced sharing of current is accomplished by the use of balancing reactors.

STARTING EQUIPMENT: The starting equipment consists of a full rated, 600-volt ac contactor controlled by a 115-volt coil.



## PERFORMANCE

### THYRISTOR (SCR) RECTIFIER UNIT

- ° Thyristor (SCR) portion of the unit is cooled by direct water flow.
- ° Thyristors are connected to the secondary of the power-isolation transformer, thus affording maximum protection from voltage transients and electrical noise.
- ° The Thyristors are mounted on plated-copper heat sinks. The peak reverse voltage rating of each Thyristor is a minimum of ten (10) times the maximum output voltage. The thyristor is never operated at more than 80% of its maximum average current rating and if parallel devices are used, forced sharing of current is accomplished by the use of balancing reactors.

STARTING EQUIPMENT: The starting equipment consists of a full rated, 600-volt ac contactor controlled by a 115-volt coil.

## OPERATION

POWER CIRCUIT: The power circuit consists of either a six (6) phase star (3000 amperes and below) or double wye with interphase transformer used with Thyristors as the controlling elements.

CONTROL CIRCUITS: The regulating system is shown in block form in Fig. #1.

A voltage and a current reference signal is set by the operator, or from an outside, isolated source. This signal is fed to the voltage and current regulators. The output of the regulator instructs the gate pulse generator to permit the Thyristors to conduct and for how long, thus affecting the output of the rectifier. A current signal (amplified by the shunt amplifier) and an output voltage signal are fed back to the regulator to correct its output if it is not in compliance with the reference signal.

The output of the regulator will adjust the position of the pulses of the gate pulse generator.

### PROTECTION EQUIPMENT:

1. Over-temperature sensors on Thyristor heat sink assemblies.
2. Over-temperature sensors in main transformer (one per coil).
3. Solid-state peak-overload detector.



SCR WATCHDOG: (Optional - Applies to units above 2000 amps)

The SCR Watchdog is an electronic circuit which is used in lieu of fuses to monitor each SCR (Thyristor) in the rectifier. In the event of an SCR failure, the Watchdog shuts down the remaining SCR's and removes the AC power. This method guards against multiple or cascade failures (domino effect) in your SCR's. An indicating light on the Watchdog pinpoints the faulty SCR, expediting troubleshooting and thereby reducing downtime.

Although the Watchdog is much faster than a fuse, there may be certain applications which mandate their use.

CAUTION

If the rectifier is to be used in parallel with, or with another rectifier feeding the same tank, Fuse Protection for the SCR's will be used in lieu of the Watchdog.

The Watchdog can be purchased as an option to prevent cascading of both the fuses and SCR's.

OPERATORS PANEL:

The remote operators panel contains the following:

1. Voltmeter
2. Ammeter
3. START-STOP pushbutton
4. POWER-ON light
5. Voltage control
6. Current control

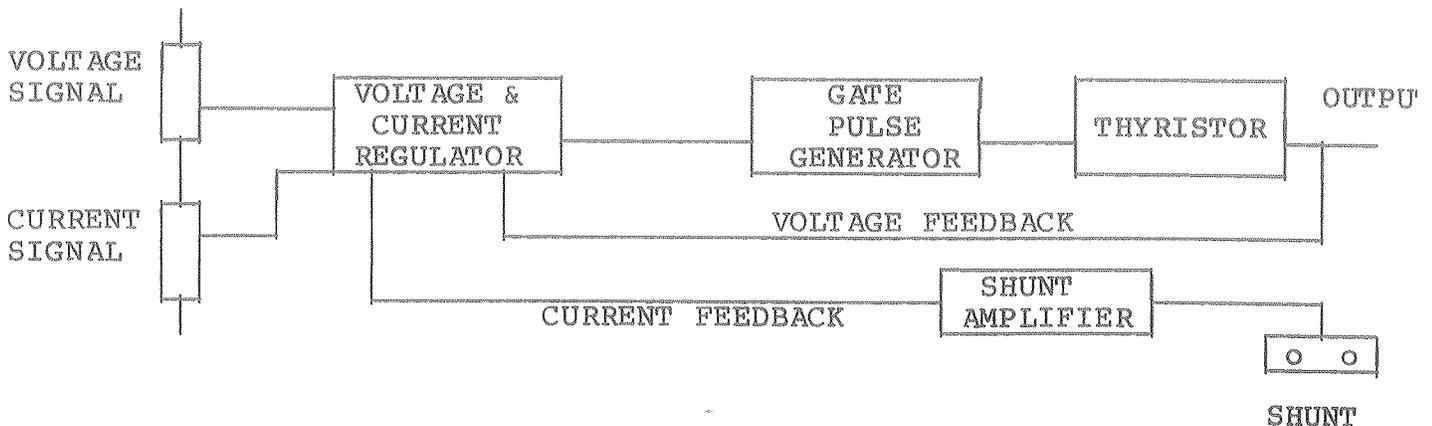
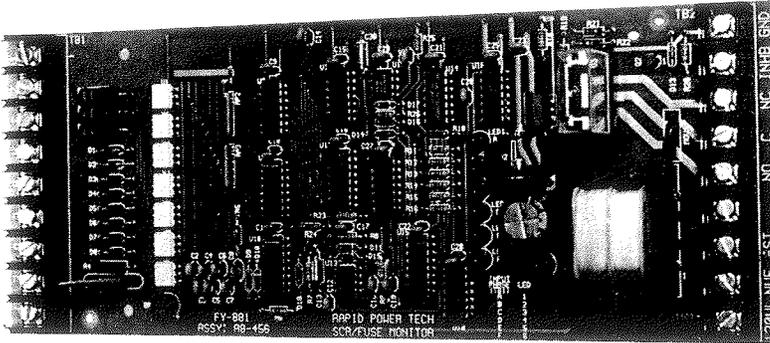


FIG. 1



# THE SCR WATCHDOG



Rapid Power Technologies, Inc. proudly announces our newest addition to our family of options, **The SCR Watchdog.**

## DOUBLE PROTECTION

Much faster than a fuse, *The SCR Watchdog* continuously monitors each SCR in your rectifier. In the event that an SCR fails, the remaining SCR's are shut down and AC power is cut off. This double protection method guards against multiple or cascade failures (domino effect) in your other SCR's.

## FEATURES

- Limits multiple failures and cuts repair costs.
- Pinpoints location of failure, reducing costly downtime.
- Lowers chance of work spoilage.

## RELIABILITY

- Shuts system down if wiring to Watchdog is broken.
- Shuts system down if on-board power supply fails.
- A built-in Watchdog timer monitors critical components on *The SCR Watchdog*.
- The Watchdog, on some products, may be used in place of fuses.

## FUNCTIONAL DESCRIPTION

- *The SCR Watchdog* produces a 7.5 volt gate inhibit signal in response to an SCR fault, to provide immediate shut down of the remaining SCR's.
- Within 23 ms of failure, the holding current through the interlock relay coil on the Watchdog will be interrupted, breaking the holding current to the main contactor.
- Location of the failure is pinpointed by an LED on the Watchdog which remains lit after rectifier shutdown.

## SPECIFICATIONS

**Capacity:** Can handle up to six SCR's per board.\*

### Reverse Blocking Voltage

#### Detection Threshold:

DC Bus connected to Terminal 1: 15 volts

DC Bus connected to Terminal 2: 10 volts

DC Bus connected to Terminal 3: 5 volts

### Max DC Bus Voltage:

Terminal 1: 30 volts

Terminal 2: 28 volts

Terminal 3: 25 volts

### Gate Inhibit Output:

7.25 volts minimum, 1000 ohm load.

### Power Required:

102 to 132 VAC, 50/60 Hz, 4 VA

**Board Size:** 4.20" x 10.50" x 1.80" High

\* For rectifiers operated in parallel, consult factory.

Solving Power Problems... Since 1944

# RAPID

POWER TECHNOLOGIES, INC.

GRAYSBRIDGE ROAD, P.O. BOX 291

BROOKFIELD, CT 06804

TELEX: 643-012 FAX: 203-775-0666

TOLL FREE 1-800-332-1111

in CT (203) 775-0411

# THYRISTOR (SCR) POWER SUPPLIES — for High Quality dc Power Supply Applications

## Rugged Reliability from Rapid

High efficiency and high-potential dc power supplies are yours from Rapid to meet the stringent industrial demands of this era. Our units feature solid-state controls—manufactured by Rapid from our exclusive design. These controls provide instantaneous adjustment of voltage or current, from zero to the full rating of the equipment.

Our thyristor power supplies are available with ratings from 6 to 100 volts dc as standard designs. Similarly, we provide as standard equipment our foregoing units with current ratings from 50 to 30,000 amperes. Rapid can manufacture thyristor units with higher voltage and current ratings on a custom basis: We can meet your specific dc power requirements.

Our basic power supply contains the main transformer, thyristors, thyristor fuses, power-on light and cooling fan.\* Solid-state modules, that provide AVS/ACC/CL/VL/AC, are located in a sealed enclosure that is mounted in side of the main enclosure. This technique offers protection of the modules against adverse, corrosive atmospheric conditions.

\*Not used in water-cooled units.

## Features

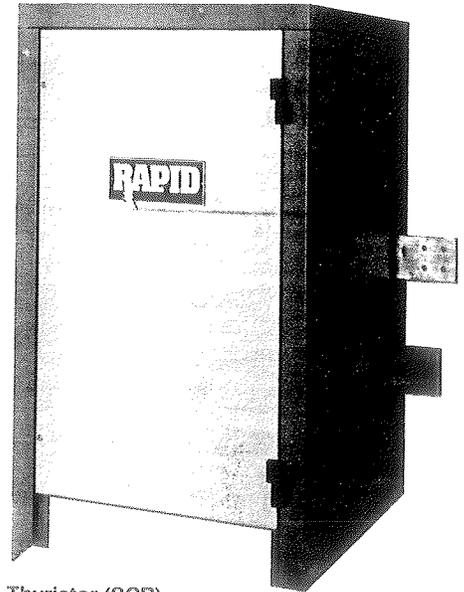
- Available from 50 to 30,000 amperes and 6 to 100 volts dc (higher current and voltage ratings available).
- Automatic voltage stabilization ( $\pm 1$  percent) with current limiting and automatic constant current ( $\pm 1$  percent) with voltage limiting.
- Automatic crossover from automatic voltage to automatic current and from current to voltage standard.
- Computer control.
- Computer interfacing.
- Copper bus bars (no aluminum used).

- Transformer coils copper-wound with Class-H, 220°C insulation.
- Corrosion-resistant cabinets made from electro-zinc plated steel.
- Forced air or direct water cooling.
- 5 percent rms ripple at full rated output.
- Built-in protection systems and devices.
- Full-load tested in addition to burn-in.

## Benefits

- Low operating cost.
- High technology at work for you.
- Maximum up time for nonstop performance.
- Low heat generation.
- High efficiency.

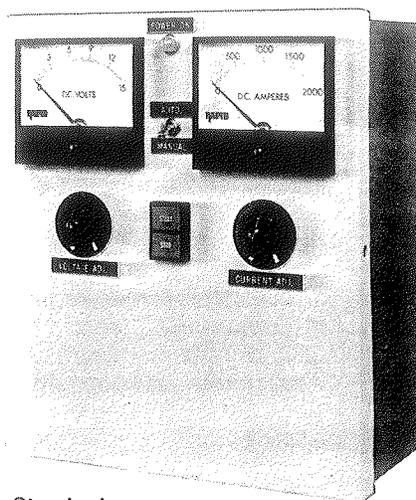
All components of our SCR rectifiers are of top quality. They are engineered and pretested by Rapid to ensure maximum performance, dependability and longevity. We manufacture our own corrosion-resistant cabinets from steel that has been zinc plated and painted. Each of our power supplies is thoroughly tested and approved (under full load) before being ship-



Thyristor (SCR)  
Power Supply

ped: A detailed test report is available for your unit.

We construct our transformers to meet all NEMA standards. The transformer windings are formed with copper conductors. Class H-220°C insulation is used. Our conservative design produces a temperature rise within Class-B limitations (80°C maximum temperature rise above ambient). This helps to prevent insulation dry-out and greatly extends the transformer life span. Furthermore, the reduced heat generation increases the unit efficiency and reduces overall power dissipation. After completion, our transformer assemblies are preheated to remove moisture. They are then vacuum-impregnated with Class-H varnish. A 24-hour curing period follows in our baking ovens.



Standard  
Remote Control Console

**RAPID**  
POWER TECHNOLOGIES.

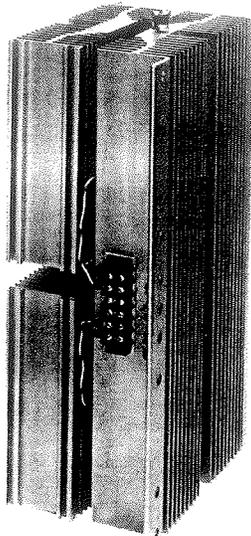
# Thyristor (SCR) Power Supplies

Rapid SCR power supplies contain multiple built-in protection systems. In the event of a momentary output short-circuit, the peak current overload detector senses the fault and reduces the output to a level within the safe limits of the power supply. This feature eliminates power-supply shutoff caused by momentary short-circuiting at the output. The detector monitors the dc output continuously for excessive current. It will force the thyristors to "phase back" automatically when excessive current flows. At such periods the voltage and current are reduced.

Our current-limiting fuses offer redundant protection of the power supply. Should a solid-state protective module fail (unlikely), the fuse will function as a go-no-go back-up device to protect the supply. Thermal detectors are included for the protection of the thyristors and transformer from excessive temperatures.

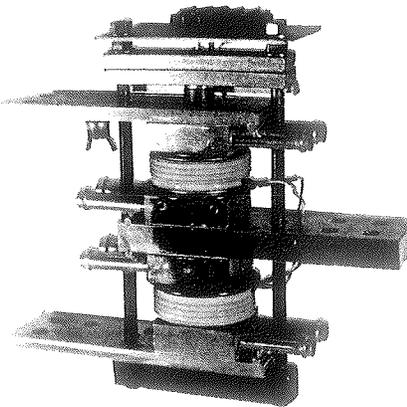
## Automatic Controls

Whatever your plating requirements may be, our Rapid power supplies utilize automatic controls as a standard feature. *Automatic voltage stabilization* (AVS) with *current limiting* (CL) eliminates the need for frequent adjustments. It also maintains a constant voltage within 1% for varying workloads.



Silicon Controlled Rectifier Assembly (air cooled)

Our *automatic constant current* (ACC) with *voltage limiting* (VL) maintains a preset current within 1%. This feature is used principally when the square-footage area is known. *Automatic crossover* (AC) from automatic voltage to automatic current are also standard features. This provision is very desirable in power supplies that are used for anodizing.



Silicon Controlled Rectifier (water cooled) Assembly

## Glossary of Terms

AC —Automatic crossover.

ACC—Automatic constant current ( $\pm 1$  percent) with rated load change and  $\pm 10$  percent change in ac input line voltage.

ACD—Automatic current density.

AVS—Automatic voltage stabilization ( $\pm 1$  percent) with rated load change and  $\pm 10$  percent change in ac input line voltage.

CL — Current limiting.

FR — Fixed ramp: i.e., one minute voltage or current ramp available.

VL — Voltage limiting.

VR — Variable ramp: range or ramp time adjustment from 1 to 100% of maximum setting. 15 maximum settings available from 12 seconds to 100 minutes.

## Summary of Standard Design Features

- Peak current overload detector that reduces the output to within design limits of the power supply in the event of a momentary output short-circuit.
- Current-limiting fuses that act as a back-up system for the protection of the thyristor power supply.
- Built-in thermal detectors to protect the thyristors and transformers from excessive temperature.
- All solid state firing circuits are designed, manufactured, burned-in and tested at Rapid.

## Quality Control for All Components

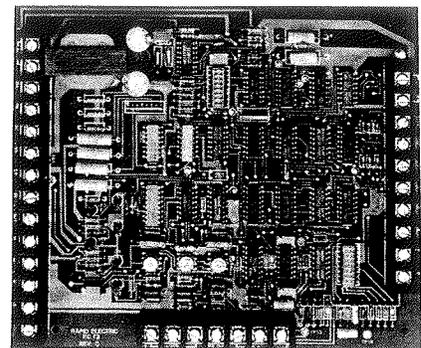
At Rapid, each component is carefully engineered and pretested before shipment. For example, we construct our own transformers to the highest quality standards.

The remote control, which is standard on all three-phase power supplies, houses the ammeter, voltmeter, power-on light, start/stop buttons and control potentiometers. Dimensions: 14" H X 12" W X 7" D.

If additional options such as automatic current density, fixed or variable voltage or current ramp, or step-programming are required, the controls will also be mounted on the remote-control console.

**Note:** With optional timer and digital ampere hour/minute meter, the remote enclosure will also measure 14" H X 12" W X 7" D.

## Solid-State Controls



# Convection, Air and Water Cooled Thyristor (SCR) Power Supplies

## Single Phase<sup>1</sup> 60 Hz

DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Convection Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>	DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Air Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>
			Cabinet Dimensions (Inches)										Cabinet Dimensions (Inches)						
			H	W	D	H	W	D					H	W	D	H	W	D	
50	0-6	120	15	22	18	28	22	18	120	*400	0-6	120	28	22	18	28	22	18	400
50	0-9	120	15	22	18	28	22	18	130	*400	0-9	120	28	22	18	28	22	18	425
50	0-12	120	15	22	18	28	22	18	165	*400	0-12	120	28	22	18	28	22	18	450
50	0-18	120	28	22	18	28	22	18	180										
50	0-24	120	28	22	18	28	22	18	210										
100	0-6	120	15	22	18	28	22	18	170	*500	0-6	120	28	22	18	28	22	18	475
100	0-9	120	28	22	18	28	22	18	185	*500	0-9	120	28	22	18	28	22	18	500
100	0-12	120	28	22	18	28	22	18	235	*500	0-12	120	28	22	18	28	22	18	565
100	0-18	120	28	22	18	28	22	18	260	*750	0-6	120	43	25	27	43	25	25	500
*100	0-24	120	28	22	18	28	22	18	300	*750	0-9	120	43	25	27	43	25	25	580
										*750	0-12	120	43	25	27	43	25	25	600
150	0-6	120	28	22	18	28	22	18	200	*1000	0-6	120	43	25	27	43	25	25	575
150	0-9	120	28	22	18	28	22	18	225	*1000	0-9	120	43	25	27	43	25	25	640
150	0-12	120	28	22	18	28	22	18	270										
*150	0-18	120	28	22	18	28	22	18	325	*1500	0-6	120	43	25	27	43	25	25	700
*150	0-24	120	28	22	18	28	22	18	350										
200	0-6	120	28	22	18	28	22	18	230										
200	0-9	120	28	22	18	28	22	18	250										
*200	0-12	120	28	22	18	28	22	18	310										
*200	0-18	120	28	22	18	28	22	18	350										
*200	0-24	120	28	22	18	28	22	18	390										
250	0-6	120	28	22	18	28	22	18	250										
250	0-9	120	28	22	18	28	22	18	350										
*250	0-12	120	28	22	18	28	22	18	375										
*250	0-18	120	28	22	18	28	22	18	400										
*250	0-24	120	28	22	18	28	22	18	425										
300	0-6	120	28	22	18	28	22	18	300										
*300	0-9	120	28	22	18	28	22	18	350										
*300	0-12	120	28	22	18	28	22	18	400										
*300	0-18	120	28	22	18	28	22	18	425										

\*Not available in 120 volts ac, single phase, 60 Hz.  
 Notes: 1. 120/208/380/460/550, single phase.  
 2. Add 7½% to weight for 50 Hz.  
 Option: 5% rms ripple throughout the entire range.

## Three Phase<sup>3</sup> 60 Hz

DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Convection Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>	DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Air Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>
			Cabinet Dimensions (Inches)										Cabinet Dimensions (Inches)						
			H	W	D	H	W	D					H	W	D	H	W	D	
150	0-6	220/460	28	22	18	28	22	18	200	500	0-6	220/460	43	25	27	43	25	25	475
150	0-9	220/460	28	22	18	28	22	18	220	500	0-9	220/460	43	25	27	43	25	25	500
150	0-12	220/460	28	22	18	28	22	18	280	500	0-12	220/460	43	25	27	43	25	25	550
150	0-18	220/460	28	22	18	28	22	18	310	500	0-18	220/460	43	25	27	43	25	25	600
150	0-24	220/460	28	22	18	28	22	18	400	500	0-24	220/460	43	25	27	43	25	25	625
										500	0-40	220/460	43	25	27	43	25	25	775
200	0-6	220/460	28	22	18	28	22	18	240	500	0-48	220/460	43	25	27	43	25	25	850
200	0-9	220/460	28	22	18	28	22	18	300	500	0-60	220/460	60	29	28	60	29	28	1000
200	0-12	220/460	28	22	18	28	22	18	330	500	0-75	220/460	60	29	28	60	29	28	1150
200	0-18	220/460	28	22	18	28	22	18	360	500	0-85	220/460	60	29	28	60	29	28	1300
200	0-24	220/460	28	22	18	28	22	18	410	500	0-100	220/460	60	29	28	60	29	28	1400
250	0-6	220/460	28	22	18	28	22	18	290	750	0-6	220/460	43	25	27	43	25	25	500
250	0-9	220/460	28	22	18	28	22	18	330	750	0-9	220/460	43	25	27	43	25	25	575
250	0-12	220/460	28	22	18	28	22	18	400	750	0-12	220/460	43	25	27	43	25	25	600
250	0-18	220/460	28	22	18	28	22	18	440	750	0-18	220/460	43	25	27	43	25	25	625
250	0-24	220/460	28	22	18	28	22	18	500	750	0-24	220/460	43	25	27	43	25	25	675
										750	0-40	220/460	60	29	28	60	29	28	800
300	0-6	220/460	28	22	18	28	22	18	340	750	0-48	220/460	60	29	28	60	29	28	900
300	0-9	220/460	28	22	18	28	22	18	390	750	0-60	220/460	60	29	28	60	29	28	1100
300	0-12	220/460	28	22	18	28	22	18	470	750	0-75	220/460	60	29	28	60	29	28	1200
300	0-18	220/460	28	22	18	28	22	18	520	750	0-85	220/460	60	29	28	60	29	28	1400
300	0-24	220/460	28	22	18	28	22	18	590	750	0-100	220/460	60	29	28	60	29	28	1500

## Three Phase<sup>3</sup> (cont.) 60 Hz

DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Air Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>	DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Air Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>				
			Cabinet Dimensions (Inches)										Cabinet Dimensions (Inches)										
			H	W	D	H	W	D										H	W	D	H	W	D
1000	0-6	220/460	43	25	27	43	25	25	600	4000	0-6	220/460	60	29	28	60	29	28	1200				
1000	0-9	220/460	43	25	27	43	25	25	620	4000	0-9	220/460	60	29	28	60	29	28	1350				
1000	0-12	220/460	43	25	27	43	25	25	650	4000	0-12	220/460	60	29	28	60	29	28	1400				
1000	0-18	220/460	43	25	27	43	25	25	780	4000	0-18	220/460	60	29	28	60	29	28	1800				
1000	0-24	220/460	43	25	27	60	29	28	825	4000	0-24	220/460	60	29	28	60	29	28	1950				
1000	0-40	220/460	60	29	28	60	29	28	1060	4000	0-40	220/460	72	48	48	72	48	48	2025				
1000	0-48	220/460	60	29	28	60	29	28	1100	4000	0-48	220/460	72	48	48	72	48	48	2500				
1000	0-60	220/460	60	29	28	60	29	28	1275	4000	0-60	220/460	72	48	48	72	48	48	2675				
1000	0-75	220/460	60	29	28	60	29	28	1500	4000	0-75	220/460	72	48	48	72	48	48	2900				
1000	0-85	220/460	60	29	28	60	29	28	1800	4000	0-85	220/460	72	48	48	72	48	48	3200				
1000	0-100	220/460	60	29	28	60	29	28	2100	4000	0-100	220/460	72	48	48	72	48	48	3400				
1500	0-6	220/460	43	25	27	43	25	25	700	5000	0-6	220/460	65	34	34	65	34	34	1250				
1500	0-9	220/460	43	25	27	43	25	25	780	5000	0-9	220/460	65	34	34	65	34	34	1600				
1500	0-12	220/460	43	25	27	43	25	25	1120	5000	0-12	220/460	65	34	34	65	34	34	1800				
1500	0-18	220/460	60	29	28	60	29	28	1150	5000	0-18	220/460	65	34	34	65	34	34	2150				
1500	0-24	220/460	60	29	28	60	29	28	1200	5000	0-24	220/460	65	34	34	65	34	34	2200				
1500	0-40	220/460	60	29	28	60	29	28	1400	5000	0-40	220/460	72	48	48	72	48	48	2600				
1500	0-48	220/460	60	29	28	65	34	34	1500	5000	0-48	220/460	72	48	48	72	48	48	2800				
1500	0-60	220/460	60	29	28	65	34	34	1650	5000	0-60	220/460	80	72	60	80	72	60	2975				
1500	0-75	220/460	60	29	28	65	34	34	2025	5000	0-75	220/460	80	72	60	80	72	60	3000				
1500	0-85	220/460	60	29	28	65	34	34	2250	5000	0-85	220/460	80	72	60	80	72	60	3300				
1500	0-100	220/460	60	29	28	72	48	48	2450	5000	0-100	220/460	80	72	60	80	72	60	3600				
2000	0-6	220/460	43	25	27	60	29	28	800	6000	0-6	220/460	65	34	34	65	34	34	1600				
2000	0-9	220/460	43	25	27	60	29	28	900	6000	0-9	220/460	65	34	34	65	34	34	1800				
2000	0-12	220/460	43	25	27	60	29	28	1000	6000	0-12	220/460	65	34	34	65	34	34	2500				
2000	0-18	220/460	60	29	28	60	29	28	1125	6000	0-18	220/460	65	34	34	72	48	48	2650				
2000	0-24	220/460	60	29	28	60	29	28	1200	6000	0-24	220/460	65	34	34	72	48	48	3000				
2000	0-40	220/460	60	29	28	60	29	28	1500	6000	0-40	220/460	72	48	48	72	48	48	3300				
2000	0-48	220/460	60	29	28	65	34	34	2150	6000	0-48	220/460	72	48	48	72	48	48	3600				
2000	0-60	220/460	60	29	28	65	34	34	2275	6000	0-60	220/460	80	72	60	80	72	60	4000				
2000	0-75	220/460	65	34	34	65	34	34	2450	6000	0-75	220/460	80	72	60	80	72	60	4400				
2000	0-85	220/460	65	34	34	72	48	48	2600	6000	0-85	220/460	80	72	60	80	72	60	4600				
2000	0-100	220/460	65	34	34	72	48	48	2800	6000	0-100	220/460	80	72	60	80	72	60	5200				
2500	0-6	220/460	60	29	28	60	29	28	900	7000	0-6	220/460	72	48	48	65	34	34	1800				
2500	0-9	220/460	60	29	28	60	29	28	1000	7000	0-9	220/460	72	48	48	65	34	34	2000				
2500	0-12	220/460	60	29	28	60	29	28	1050	7000	0-12	220/460	72	48	48	65	34	34	2750				
2500	0-18	220/460	60	29	28	60	29	28	1175	7000	0-18	220/460	72	48	48	72	48	48	3100				
2500	0-24	220/460	60	29	28	60	29	28	1300	7000	0-24	220/460	72	48	48	72	48	48	3500				
2500	0-40	220/460	60	29	28	65	34	34	1650														
2500	0-48	220/460	60	29	28	65	34	34	2250	7500	0-6	220/460	72	48	48	72	48	48	2100				
2500	0-60	220/460	60	29	28	72	48	48	2400	7500	0-9	220/460	72	48	48	72	48	48	2400				
2500	0-75	220/460	65	34	34	72	48	48	2675	7500	0-12	220/460	72	48	48	72	48	48	3000				
2500	0-85	220/460	65	34	34	72	48	48	2800	7500	0-18	220/460	72	48	48	72	48	48	3600				
2500	0-100	220/460	65	34	34	72	48	48	3100	7500	0-24	220/460	72	48	48	72	48	48	3800				
3000	0-6	220/460	60	29	28	60	29	28	1000	8000	0-6	220/460	72	48	48	72	48	48	2430				
3000	0-9	220/460	60	29	28	60	29	28	1150	8000	0-9	220/460	72	48	48	72	48	48	2860				
3000	0-12	220/460	60	29	28	60	29	28	1200	8000	0-12	220/460	72	48	48	72	48	48	3250				
3000	0-18	220/460	60	29	28	60	29	28	1350	8000	0-18	220/460	72	48	48	72	48	48	3630				
3000	0-24	220/460	60	29	28	60	29	28	1450	8000	0-24	220/460	72	48	48	72	48	48	4020				
3000	0-40	220/460	72	48	48	72	48	48	1750	8000	0-40	220/460	72	48	48	72	48	48	6010				
3000	0-48	220/460	72	48	48	72	48	48	2400	8000	0-48	220/460	80	72	60	80	72	60	7000				
3000	0-60	220/460	72	48	48	72	48	48	2650	8000	0-60	220/460	80	72	60	80	72	60	8230				
3000	0-75	220/460	72	48	48	72	48	48	2800	8000	0-75	220/460	80	72	60	80	72	60	9810				
3000	0-85	220/460	72	48	48	72	48	48	3100	8000	0-85	220/460	80	72	60	80	72	60	10840				
3000	0-100	220/460	72	48	48	72	48	48	3400	8000	0-100	220/460	80	72	60	80	72	60	12390				

- Notes:** 1. Use same dimensions and weights for (208-240)V, (440-480)V and (550-600)V, three phase, 60 Hz.  
2. Add 7½% to weight for 50 Hz.  
3. Pulse Power™ Thyristor (SCR) power supplies available — (150-30,000)A, (6-100)V see Rapid #122 brochure.
- Option:** 5% rms ripple throughout the entire range.

### Three Phase<sup>3</sup> (cont.) 60 Hz

DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Air Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>	DC Output Amps	DC Output Volts	AC Input Volts <sup>1</sup>	Air Cooled			Water Cooled			Approx. Weight (lb.) <sup>2</sup>	
			Cabinet Dimensions (Inches)										Cabinet Dimensions (Inches)							
			H	W	D	H	W	D				H	W	D	H	W	D			
10000	0-6	220/460	72	48	48	72	48	48	2800	20000	0-40	460	80	72	60	80	72	60	17100	
10000	0-9	220/460	72	48	48	72	48	48	3210	20000	0-48	460	80	72	60	80	72	60	20000	
10000	0-12	220/460	72	48	48	72	48	48	3650	20000	0-60	460	95	88	72	95	88	72	23600	
10000	0-18	220/460	72	48	48	72	48	48	4070	20000	0-75	460	95	88	72	95	88	72	28000	
10000	0-24	220/460	72	48	48	72	48	48	4650	20000	0-85	460	95	88	72	95	88	72	31000	
10000	0-40	220/460	80	72	60	80	72	60	6870	20000	0-100	460	95	88	72	95	88	72	35400	
10000	0-48	220/460	80	72	60	80	72	60	8010	21000	0-6	460	80	72	60	80	72	60	7370	
10000	0-60	220/460	80	72	60	80	72	60	9450	21000	0-9	460	80	72	60	80	72	60	8450	
10000	0-75	220/460	80	72	60	80	72	60	11210	21000	0-12	460	80	72	60	80	72	60	9600	
10000	0-85	220/460	80	72	60	80	72	60	12410	21000	0-18	460	80	72	60	80	72	60	10720	
10000	0-100	220/460	80	72	60	80	72	60	14180	21000	0-24	460	80	72	60	80	72	60	12110	
12000	0-6	460	72	48	48	72	48	48	3880	21000	0-40	460	80	72	60	80	72	60	18080	
12000	0-9	460	72	48	48	72	48	48	4450	21000	0-48	460	80	72	60	80	72	60	21050	
12000	0-12	460	72	48	48	72	48	48	5060	21000	0-60	460	95	88	72	95	88	72	24840	
12000	0-18	460	72	48	48	72	48	48	5640	21000	0-75	460	95	88	72	95	88	72	29470	
12000	0-24	460	72	48	48	72	48	48	6370	21000	0-85	460	95	88	72	95	88	72	32630	
12000	0-40	460	80	72	60	80	72	60	9520	21000	0-100	460	95	88	72	95	88	72	37250	
12000	0-48	460	80	72	60	80	72	60	11100	22500	0-6	460	80	72	60	80	72	60	7920	
12000	0-60	460	80	72	60	80	72	60	13050	22500	0-9	460	80	72	60	80	72	60	9080	
12000	0-75	460	80	72	60	80	72	60	15570	22500	0-12	460	80	72	60	80	72	60	10320	
12000	0-85	460	80	72	60	80	72	60	17200	22500	0-18	460	80	72	60	80	72	60	11510	
12000	0-100	460	80	72	60	80	72	60	19650	22500	0-24	460	80	72	60	80	72	60	13010	
14000	0-6	460	72	48	48	72	48	48	4960	22500	0-40	460	80	72	60	80	72	60	19430	
14000	0-9	460	72	48	48	72	48	48	5690	22500	0-48	460	80	72	60	80	72	60	22660	
14000	0-12	460	80	72	60	80	72	60	6470	22500	0-60	460	95	88	72	95	88	72	26740	
14000	0-18	460	80	72	60	80	72	60	7210	22500	0-75	460	95	88	72	95	88	72	31720	
14000	0-24	460	80	72	60	80	72	60	8140	22500	0-85	460	95	88	72	95	88	72	35120	
14000	0-40	460	80	72	60	80	72	60	12170	22500	0-100	460	95	88	72	95	88	72	40100	
14000	0-48	460	80	72	60	80	72	60	14190	24000	0-6	460	80	72	60	80	72	60	8480	
14000	0-60	460	80	72	60	80	72	60	16750	24000	0-9	460	80	72	60	80	72	60	9720	
14000	0-75	460	80	72	60	80	72	60	19870	24000	0-12	460	80	72	60	80	72	60	11050	
14000	0-85	460	80	72	60	80	72	60	22000	24000	0-18	460	80	72	60	80	72	60	12320	
14000	0-100	460	80	72	60	80	72	60	25120	24000	0-24	460	80	72	60	80	72	60	13930	
15000	0-6	460	80	72	60	72	48	48	5500	24000	0-40	460	80	72	60	80	72	60	20800	
15000	0-9	460	80	72	60	72	48	48	6300	24000	0-48	460	80	72	60	80	72	60	24260	
15000	0-12	460	80	72	60	80	72	60	7170	24000	0-60	460	95	88	72	95	88	72	28620	
15000	0-18	460	80	72	60	80	72	60	8000	24000	0-75	460	95	88	72	95	88	72	33960	
15000	0-24	460	80	72	60	80	72	60	9040	24000	0-85	460	95	88	72	95	88	72	37600	
15000	0-40	460	80	72	60	80	72	60	13490	24000	0-100	460	95	88	72	95	88	72	42950	
15000	0-48	460	80	72	60	80	72	60	15730	28000	0-6	460	80	72	60	80	72	60	9960	
15000	0-60	460	80	72	60	80	72	60	18560	28000	0-9	460	80	72	60	80	72	60	11420	
15000	0-75	460	80	72	60	80	72	60	22020	28000	0-12	460	80	72	60	80	72	60	12980	
15000	0-85	460	80	72	60	80	72	60	24380	28000	0-18	460	80	72	60	80	72	60	14470	
15000	0-100	460	80	72	60	80	72	60	27840	28000	0-24	460	80	72	60	80	72	60	16360	
18000	0-6	460	80	72	60	80	72	60	6400	28000	0-40	460	95	88	72	95	88	72	24430	
18000	0-9	460	80	72	60	80	72	60	7340	28000	0-48	460	95	88	72	95	88	72	28500	
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18000	0-18	460	80	72	60	80	72	60	9300	28000	0-75	460	95	120	80	95	120	80	39900	
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18000	0-60	460	80	72	60	80	72	60	21600	30000	0-9	460	80	72	60	80	72	60	12260	
18000	0-75	460	80	72	60	80	72	60	25630	30000	0-12	460	80	72	60	80	72	60	13940	
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18000	0-100	460	80	72	60	80	72	60	32410	30000	0-24	460	80	72	60	80	72	60	17000	
20000	0-6	460	80	72	60	80	72	60	7000	30000	0-40	460	95	88	72	95	88	72	26240	
20000	0-9	460	80	72	60	80	72	60	8020	30000	0-48	460	95	88	72	95	88	72	30570	
20000	0-12	460	80	72	60	80	72	60	9120	30000	0-60	460	95	120	80	95	120	80	36070	
20000	0-18	460	80	72	60	80	72	60	10180	30000	0-75	460	95	120	80	95	120	80	42800	
20000	0-24	460	80	72	60	80	72	60	11500	30000	0-85	460	95	120	80	95	120	80	47380	
										30000	0-100	460	95	120	80	95	120	80	54100	

## About Rapid

For over 40 years, Rapid has been a leader in the design and manufacture of electrical equipment for industrial, commercial, military and research applications. We specialize in power — power transformation, power rectification and power control. Rapid builds dry-type transformers, ac and dc power supplies, ac line voltage regulators and power conditioners.

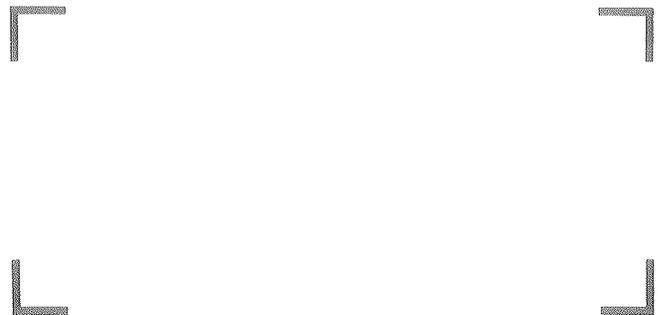
Our main plant in Brookfield, Connecticut contains over 250,000 square feet of modern, fully integrated engineering, R&D and manufacturing facilities. Here we employ more than 250 highly skilled and dedicated workers, each one committed to ensuring that every Rapid product incorporates the latest electronics and power technology and the highest quality materials and workmanship, and that each order meets the purchaser's exact specifications.

Rapid's production capability is so comprehensive because we have a uniquely high level of self-sufficiency. We wind our own transformer coils and make our own cores from grain-oriented silicon steel. We do all our own assembly work and even fabricate and finish our own enclosures. We design and build our own state-of-the-art electronic circuits. We do all this to make sure that every part in every unit meets our own high standards, and that the product is fully tested and ready for shipment or schedule. That's why Rapid can offer both standard and custom models fast at production line prices.

## Other Rapid Products

- Pulse Power™ Thyristor (SCR) power supplies (150-30,000) amperes; (6-100) volts (Rapid 118).
- Pulse Power™ for hard coat anodizing (Rapid 118).
- Transistor Pulse Power™ supplies-15 to 100 amperes with peak to 200 amperes, 20 volts dc (Rapid 110).
- Plating dc power supplies.
- Anodizing dc and ac power supplies (Rapid 102).
- Digital-ampere-hour/minute meters (Rapid 120).
- Solid-state polarity reversing power supplies (PRP).
- Polarity reversing switches manual or air operated (RP-1182) Electric.
- Dry-type transformers to 15kV and 10,000 kVA (Rapid 701).
- Computer power protection equipment.
- Regulated industrial dc power supplies Thyristor (SCR) - 125 and 250 volts dc (Rapid 203).
- Unregulated industrial dc power supplies - 125 and 250 volts dc (Rapid 202).
- Custom design dc power supplies ranging from 6 to 100 volts and 15 to 50,000 amperes.
- Mine power supplies.
- Shunts 10 to 50,000 amperes.
- Enclosures (custom and standard).
- Transistor
- Transformers-Liquid

## Your Rapid Representative:



# **RAPID**

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