



**TSI**  
POWER™

**Operating Manual for:**

**VRP, Single Phase, 1.4 kVA – 49.9 kVA**

**MC60024**

**January, 2024**

**IMPORTANT SAFETY INSTRUCTIONS:** SAVE THESE INSTRUCTIONS – This manual contains important instructions for the single phase VRP Series that should be followed during installation and maintenance.

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To make a request or claim for service under this limited warranty, the original purchaser must return the product, in the original shipping container or equivalent, to TSI Power or its authorized agent, accompanied by a written receipt showing the date of purchase and both the model name and serial number of the product.

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## **REVISIONS**

<b><u>REV.</u></b>	<b><u>DATE</u></b>	<b><u>REASON FOR REVISION</u></b>
1	June, 2023	Initial release
2	January, 2024	Added lever (WAGO) terminal information, page 26. Included 17% and 15% units.

## 1 GENERAL

### 1.1 PRODUCT APPLICATION

The VRP is a highly sophisticated automatic precision AC voltage regulator that ensures maintenance free operation of electronic equipment over a very wide input voltage range. TSI Power's VRP series is designed to provide high precision power with industry leading response time of one-half line cycle (10 ms or less). Common applications include but are not limited to: graphics, broadcast, telecom, industrial, analytical equipment and digital copiers. The VRP series of products may provide enhanced operation, extended operating life, reduced downtime and lower service costs.



**Figure 1: The VRP Enclosures**

**IMPORTANT SAFETY INSTRUCTIONS:** SAVE THESE INSTRUCTIONS – This manual contains important instructions for the single phase VRP Series that should be followed during installation and maintenance.

## 1.2 SAFETY ALERTS

### SAFETY SIGNAL WORD DEFINITIONS

This document contains safety alert pictorial Symbols and Words that point out areas and procedures that require special attention with regards to safety. These Symbols and Words are defined in ANSI Z535.4-1998, Product Safety Signs and Labels.

#### **DANGER:**


**DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

#### **WARNING:**

**WARNING indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.**

#### **CAUTION:**

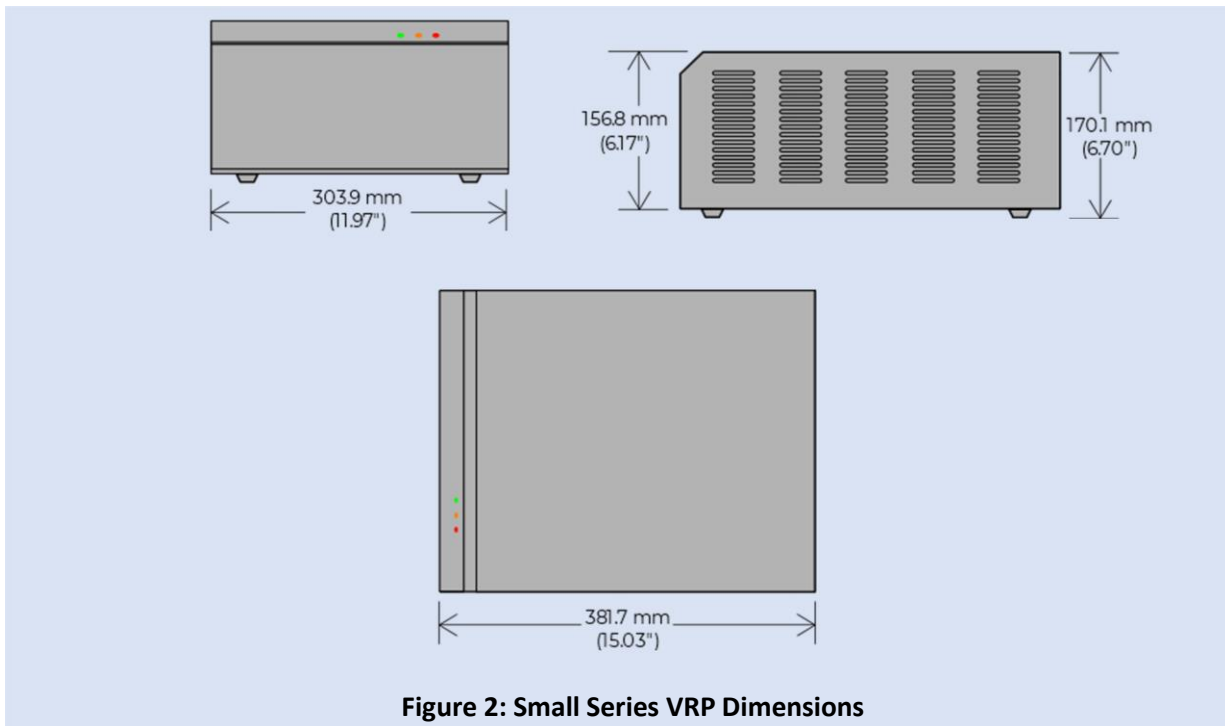
**CAUTION indicates an imminently hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.**

The safety alert pictorial symbol  appears in this document to make users aware of important operating and safety concerns.

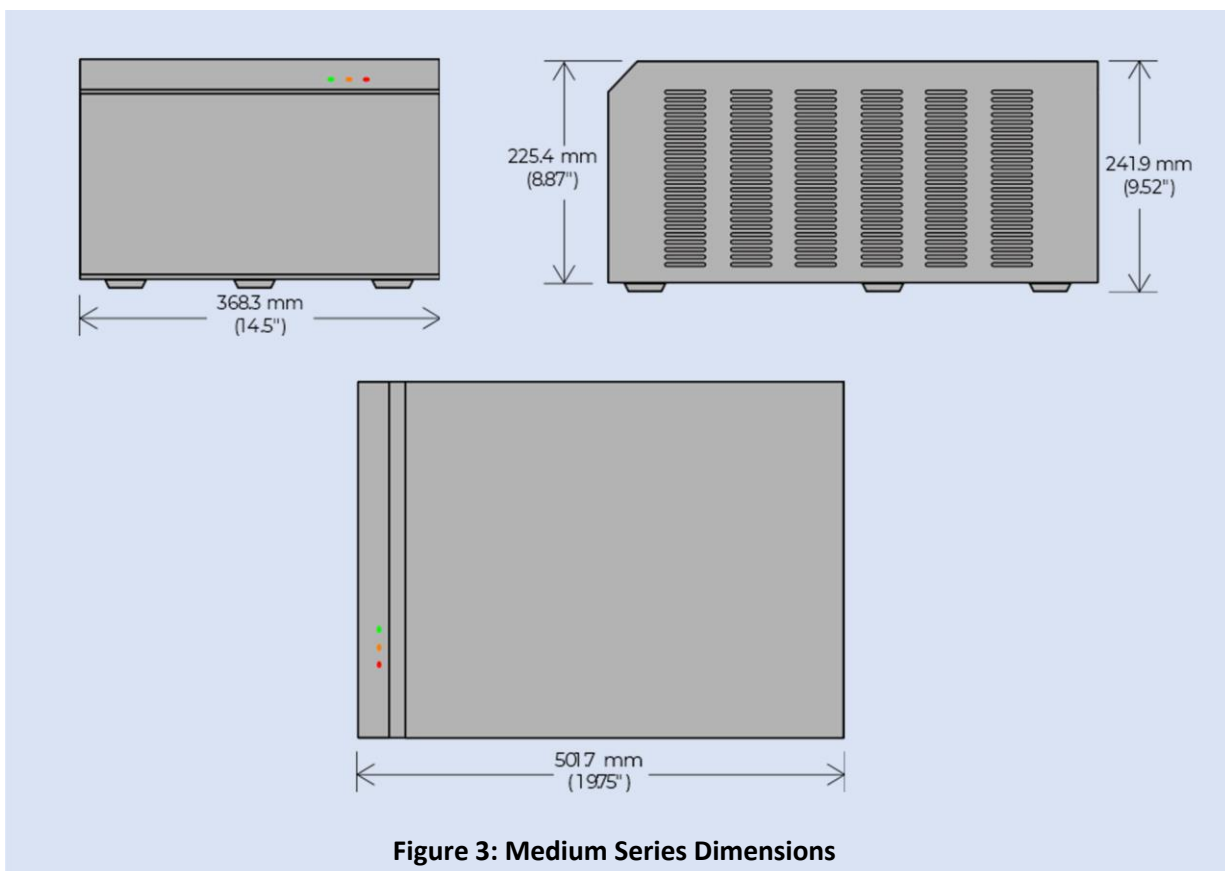
## 1.3 GENERAL VRP DESCRIPTION

- Enclosure with access panel for Hardwire terminations
- Vented cover or sides for cooling
- AC input over voltage protection circuit board
- DC fan for cooling, larger powered units have additional AC fans for cooling
- System status display LEDs
- AVR control circuit board
- AC input circuit breaker and system on/off switch, not present in large (24in. Cube) units

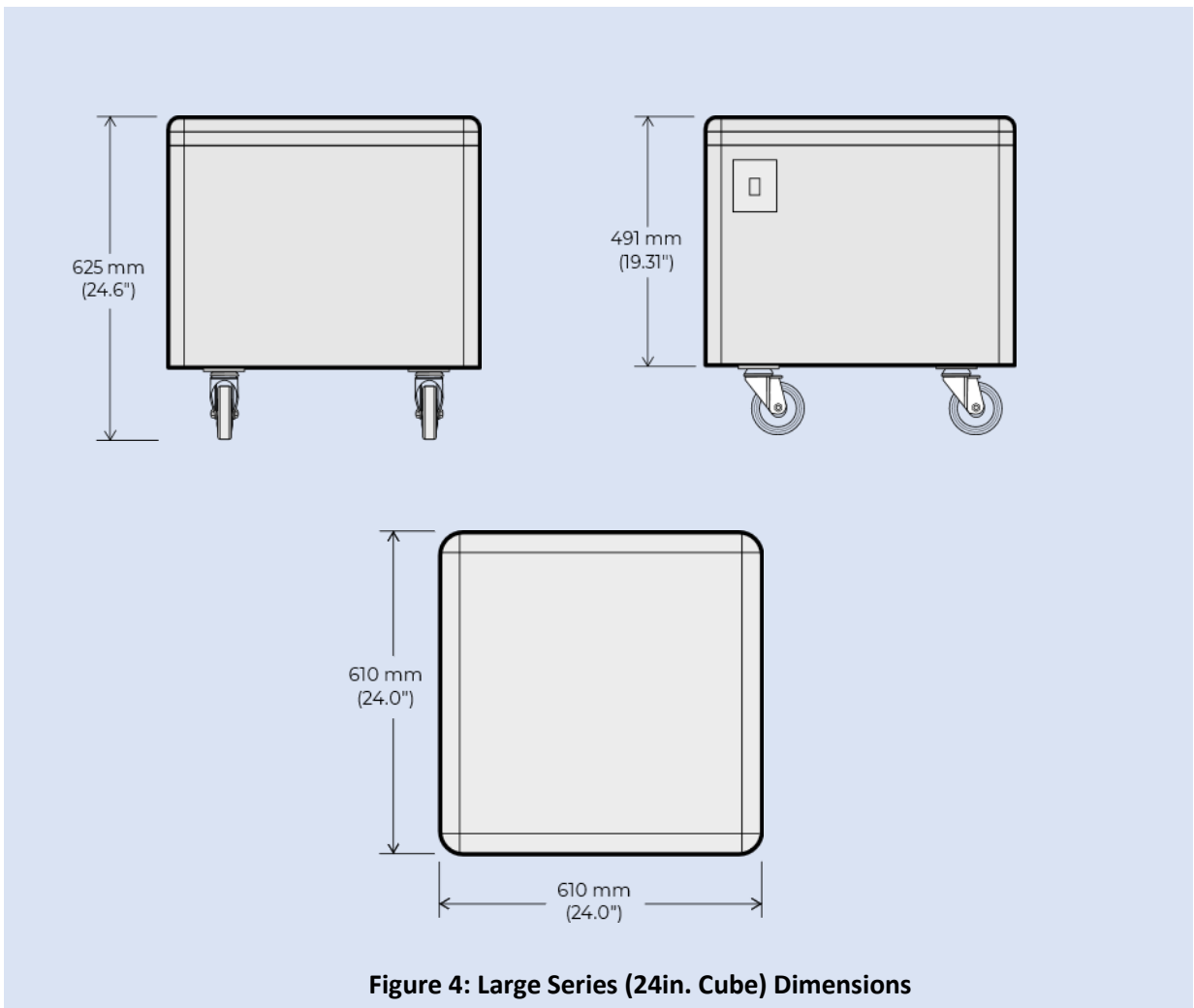
**1.4 OVERALL DIMENSIONS** -See Figures 2, 3 and 4



**Figure 2: Small Series VRP Dimensions**



**Figure 3: Medium Series Dimensions**



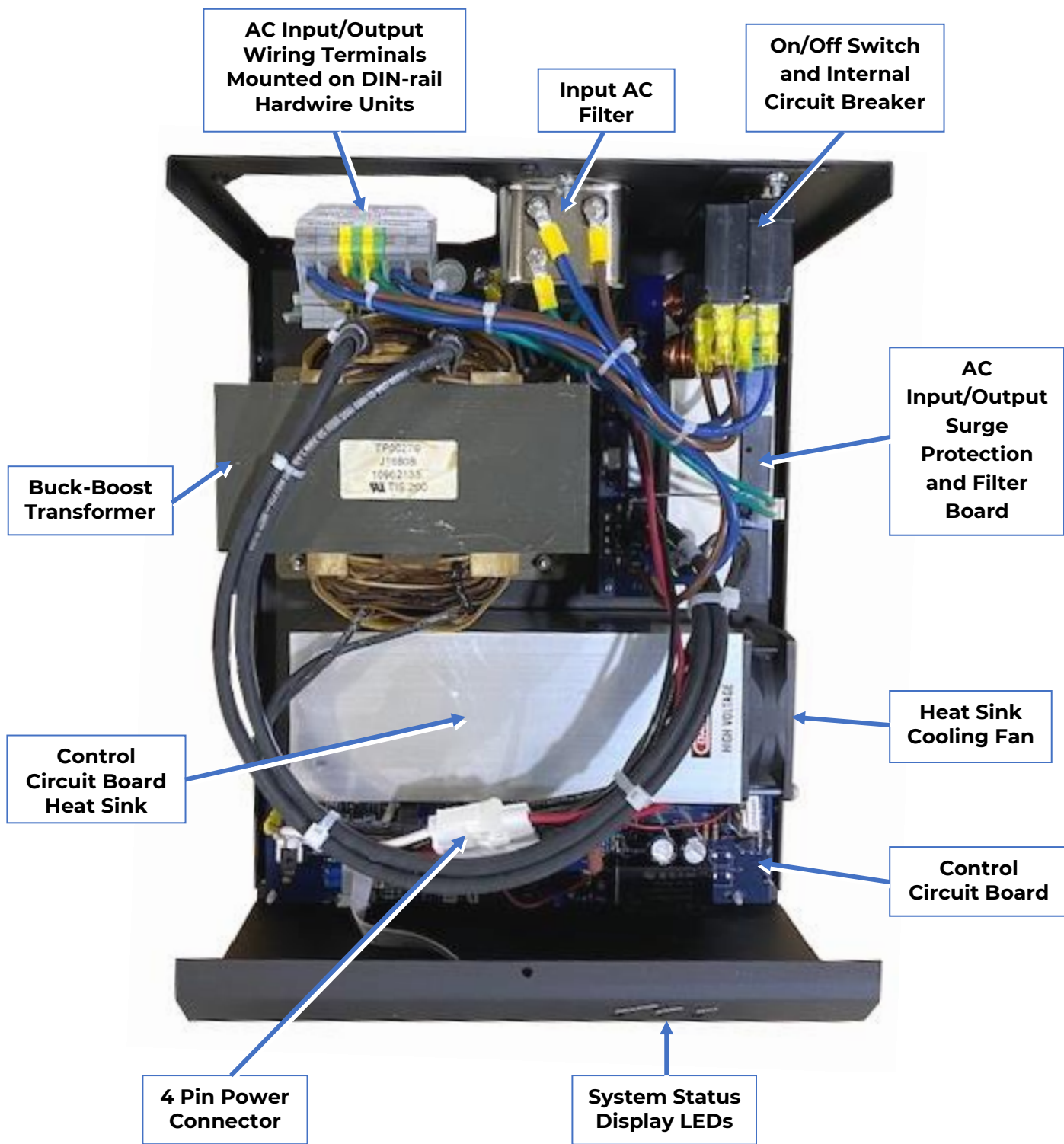
## Dimensions

### 1.5 CONSTRUCTION

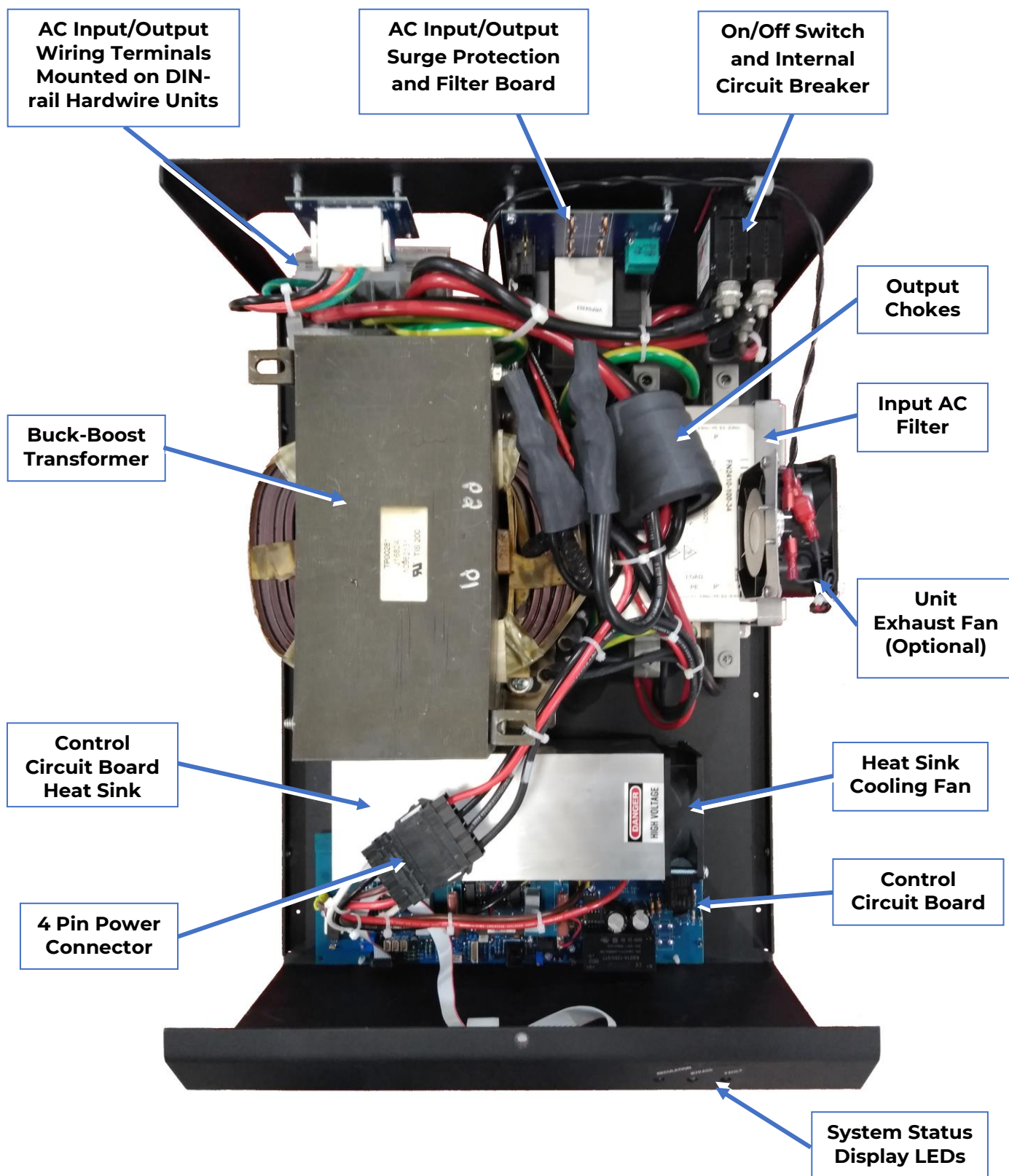
The VRP Series enclosures are constructed of Galvaneal Steel and finished with a black or light gray polyester powder coat and are intended for installation in a protected environment. The small and medium units are black while the large (24in. Cube) unit is light gray. Small unit Enclosure base is 2 mm (0.075") thick and Enclosure cover is 1.2 mm (0.048") thick. Medium unit Enclosure base is 2.7 mm (0.108") thick and Enclosure cover is 1.3 mm (0.052") thick. Large unit Enclosure base is 3.2 mm (0.125") thick and Enclosure sides and cover are 1.6 mm (0.063") thick.



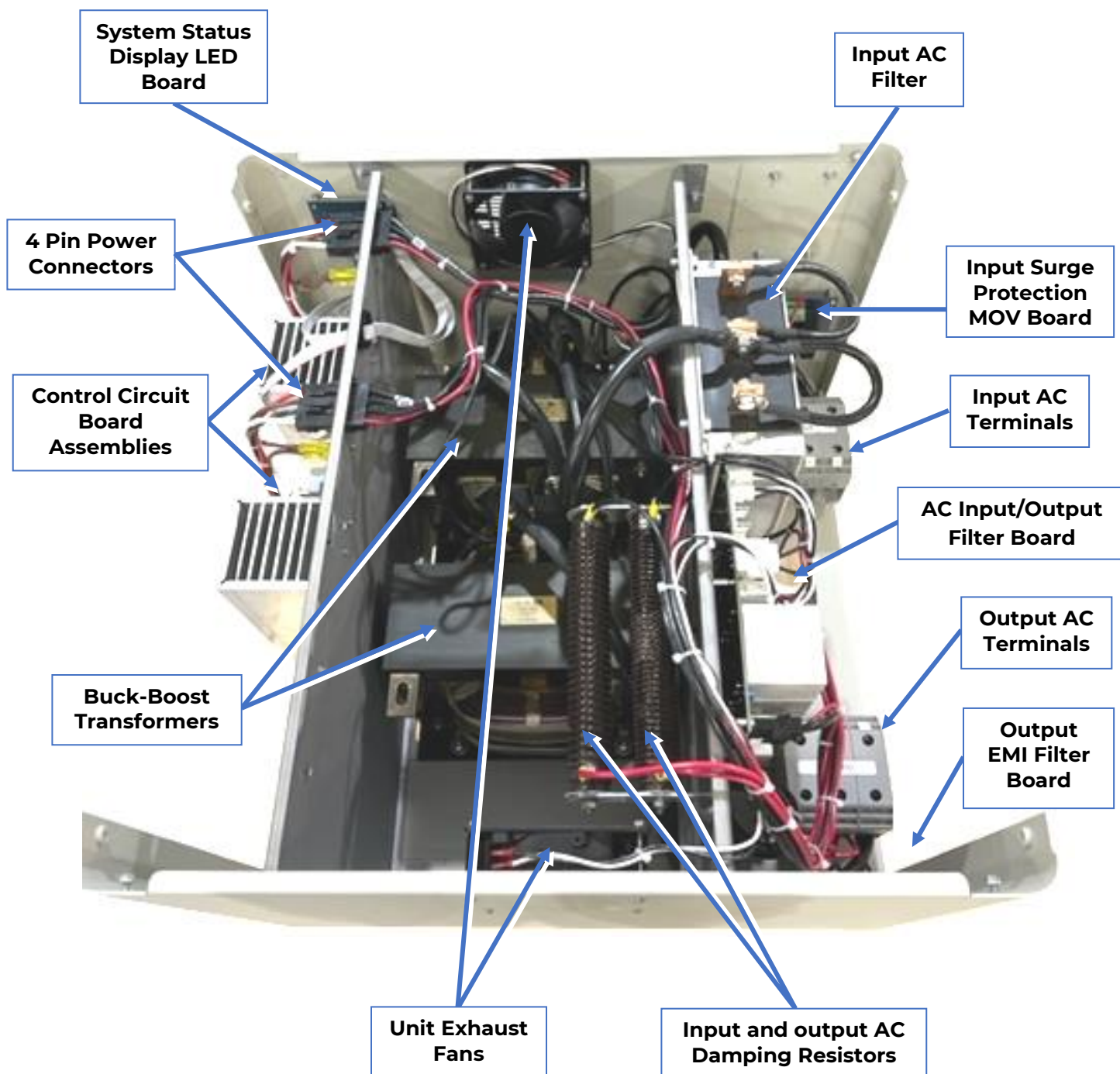
**1.6 VRP ENCLOSURE TOP VIEW WITH COVER REMOVED** -See Figures 5, 6 and 7



**Figure 5: Top View of Small Series VRP with Cover Removed**



**Figure 6: Top View of Medium Series VRP with Cover Removed**



**Figure 7: Top View of Large Series (24in. Cube) with Covers Removed**

### 1.7 SMALL/MEDIUM SERIES HARDWIRE ACCESS



Figure 8: Small Series VRP Shown With Rear Access Cover Removed

### 1.8 SMALL/MEDIUM SERIES HARDWIRE ACCESS COVER

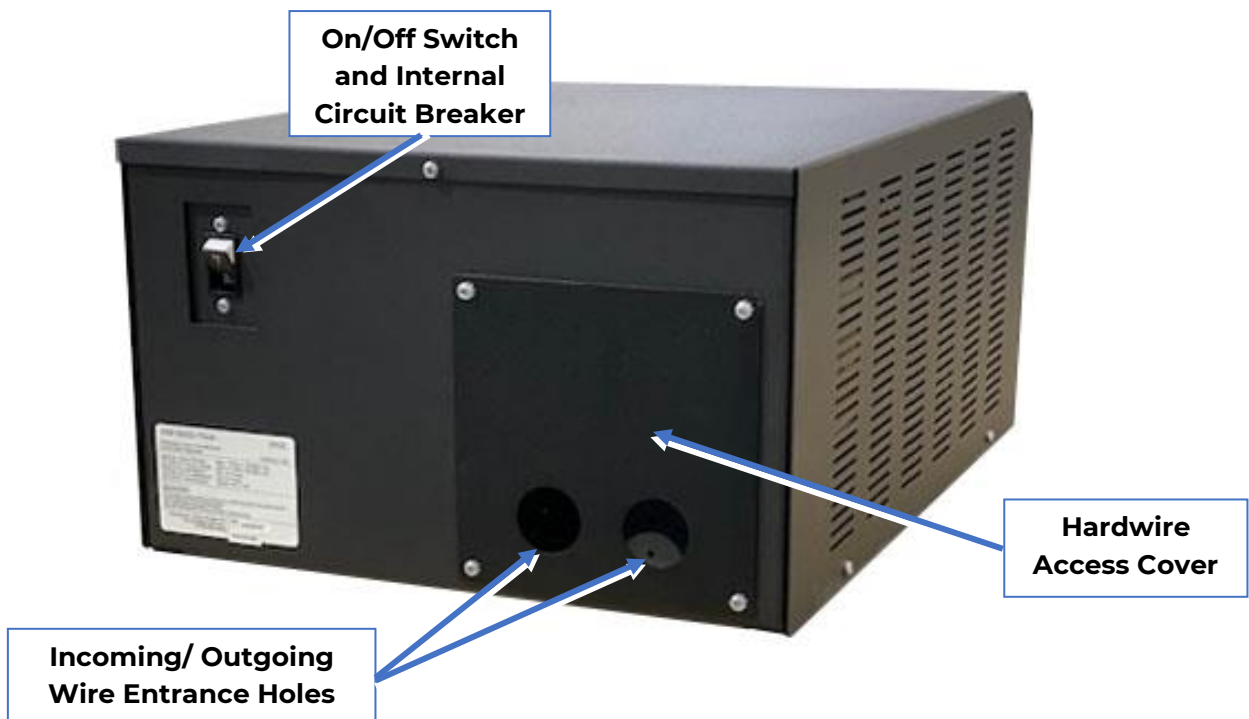


Figure 9: Rear View Medium Series VRP Shown With Rear Access Cover Attached

### 1.9 LARGE SERIES (24in. CUBE) HARDWIRE ACCESS

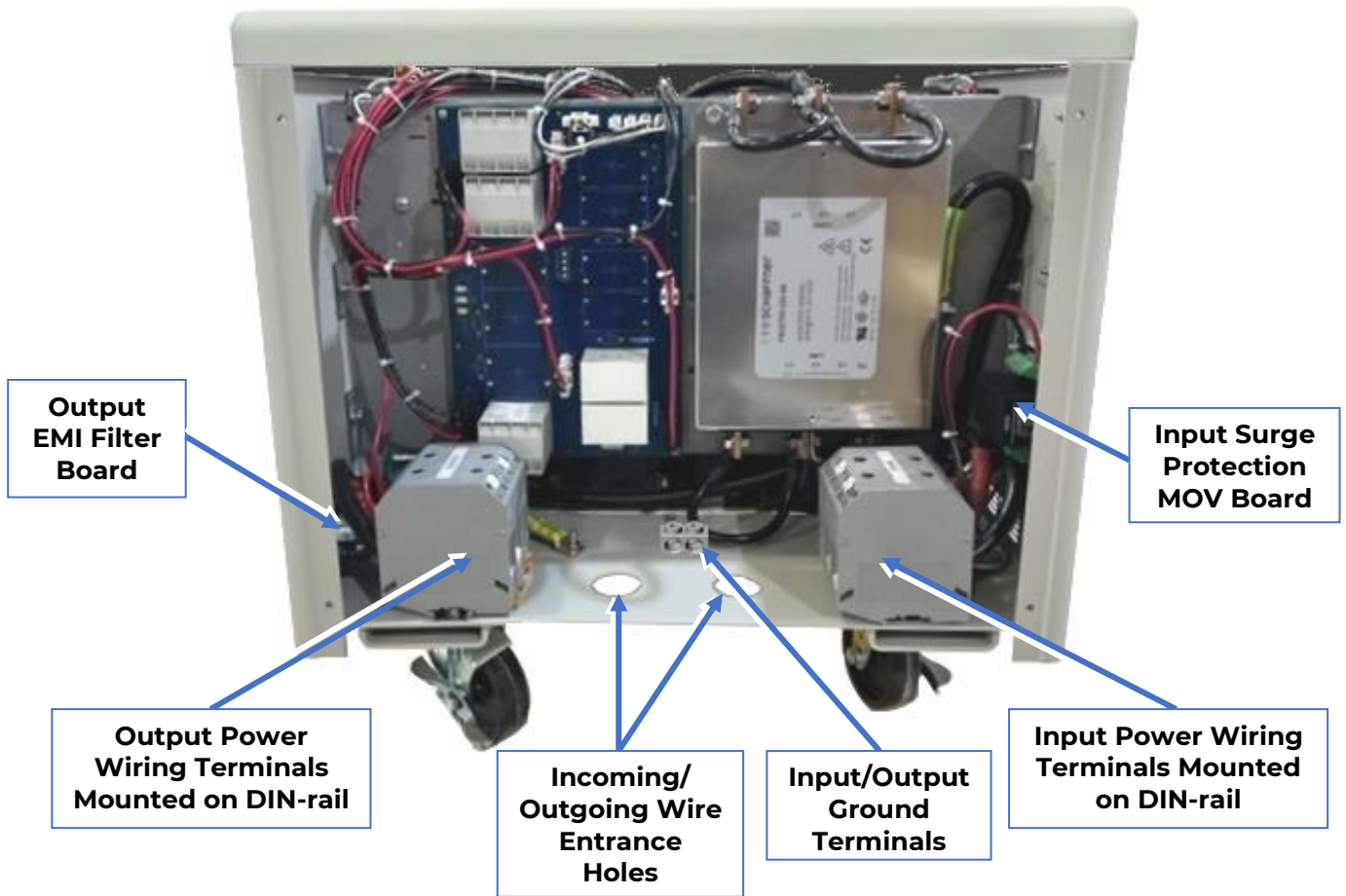


Figure 10: Large Series (24in. Cube) Shown With Wiring Access Cover Removed

### 1.10 SMALL/MEDIUM SERIES WITH PLUG AND RECEPTACLE



Figure 11: Small Series Shown With NEMA L6-20R Outlet and IEC-320 Inlet

## 2 MAJOR COMPONENT/CIRCUIT DESCRIPTIONS

### 2.1 SINGLE PHASE VRP WIRING DIAGRAMS -See Figures 12, 13 and 14

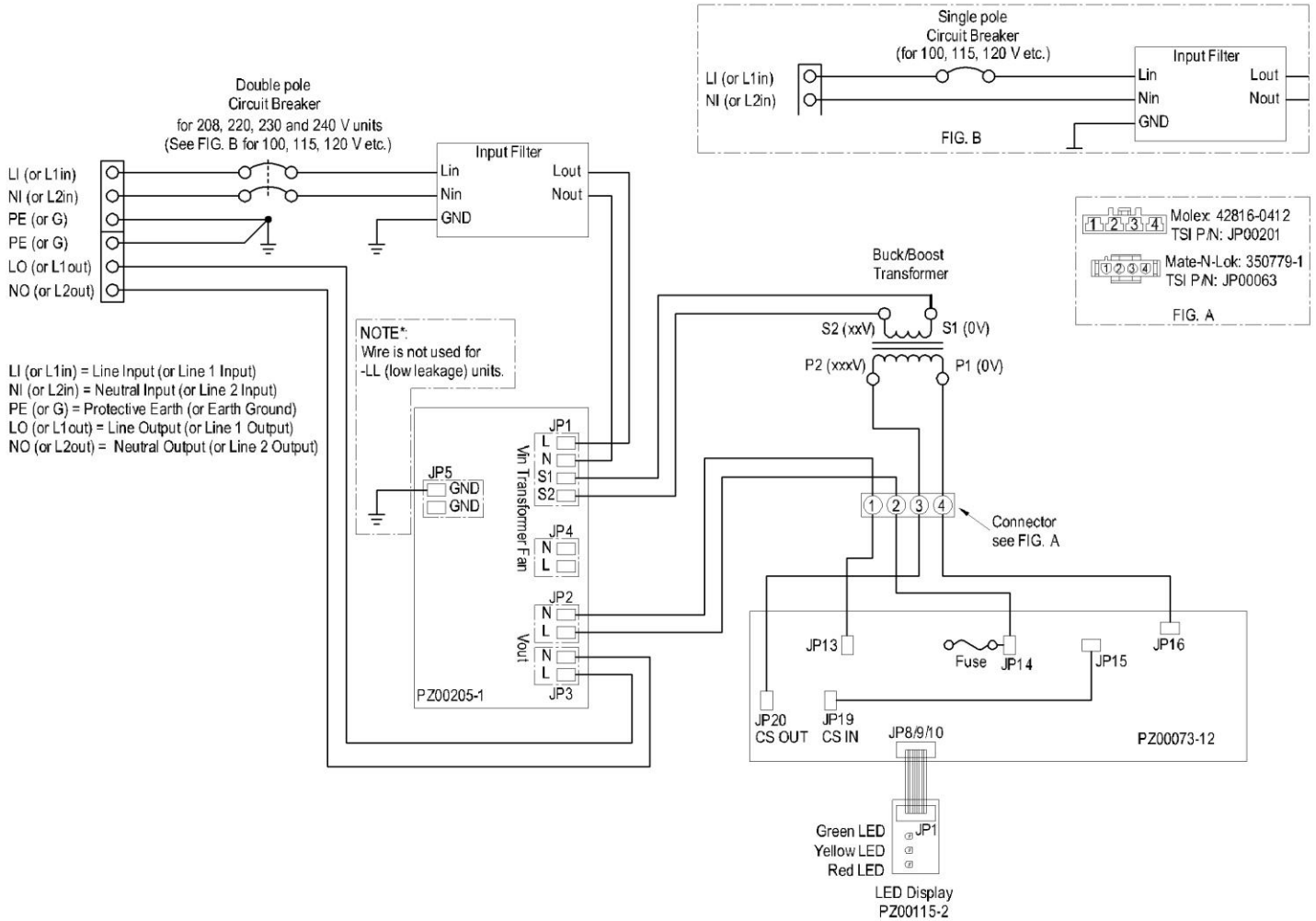
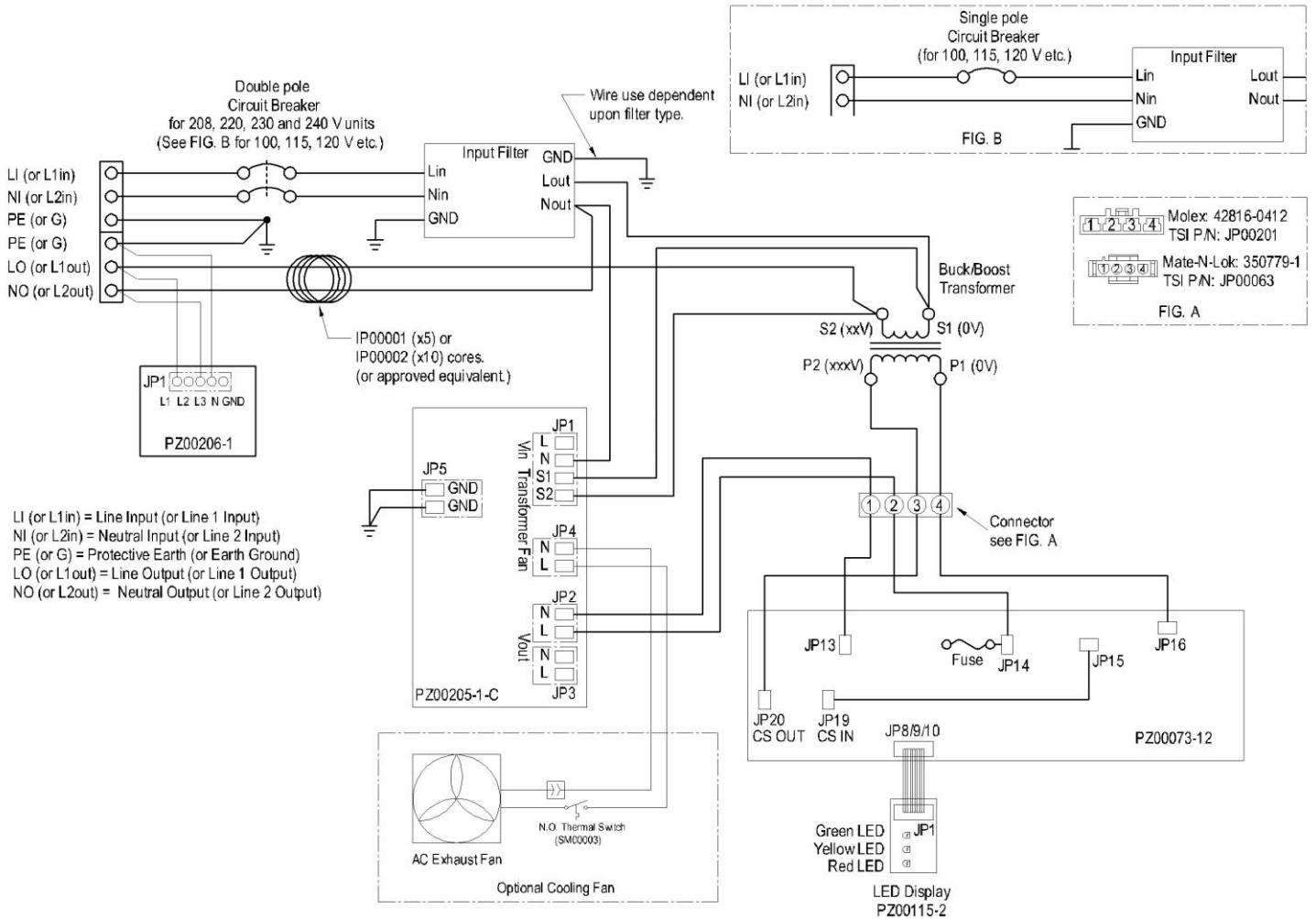
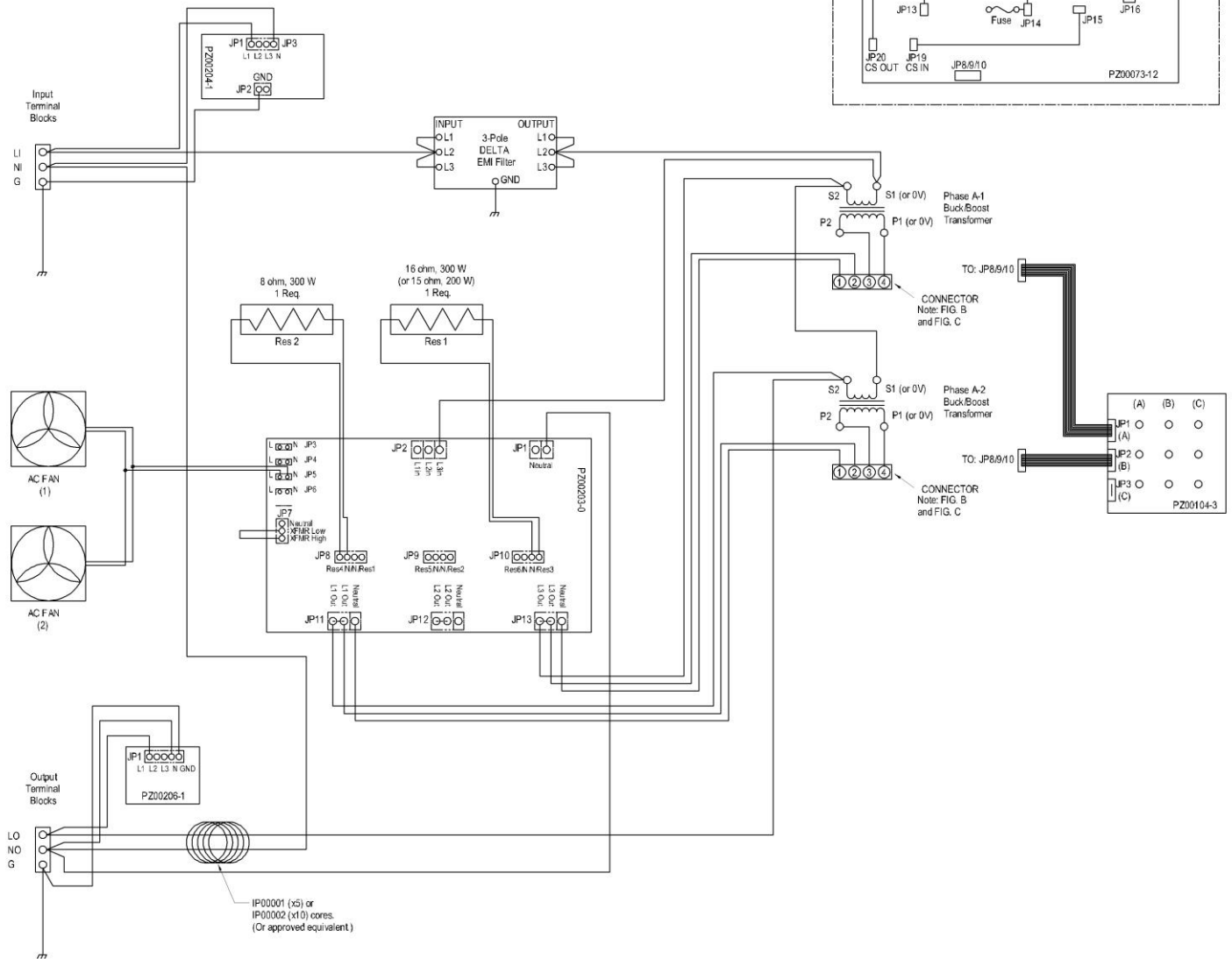
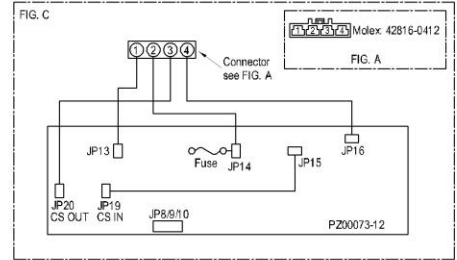
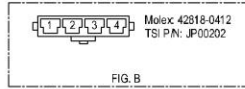


Figure 12: Single Phase Small Series VRP Wiring Diagram



**Figure 13: Single Phase Medium Series VRP Wiring Diagram**

LI (or L1in) = Line Input (or Line 1 Input)  
 NI (or L2in) = Neutral Input (or Line 2 Input)  
 G (or PE) = Earth Ground (Protective Earth)  
 LO (or L1out) = Line Output (or Line 1 Output)  
 NO (or Nout) = Neutral Output (or Line 2 Output)



**Figure 14: Single Phase Large Series (24in. Cube) VRP Wiring Diagram**



## 2.2 BUCK-BOOST VOLTAGE REGULATION TRANSFORMERS -See Figure 15

These transformers supply current to the load through the secondary winding. The primary winding is used to impose the correction voltage.

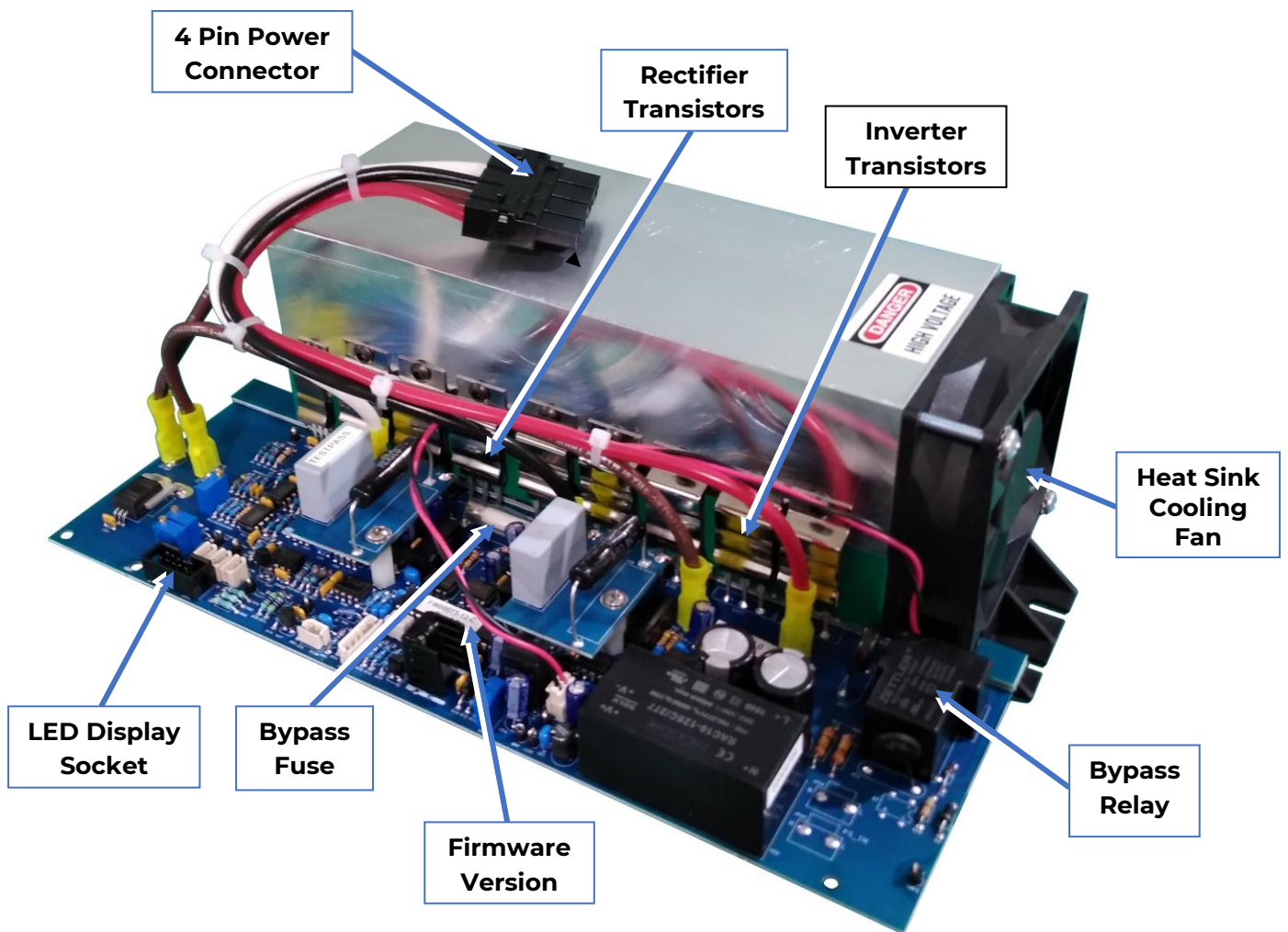


**Figure 15: Buck-Boost Transformer for VRP-2800-700A Shown**

NOTE: Figure for reference only, actual component may vary in appearance.

### 2.3 CONTROL CIRCUIT BOARD ASSEMBLY -See Figure 16

The proprietary voltage regulation control board is powered by a DSP microcontroller. The Control Board's Firmware Version is located on a label affixed to the microcontroller (see Figure 16). It senses the incoming mains voltage and corrects the output continuously. It incorporates advanced algorithms to ensure the fastest possible response time while maintaining control loop stability.

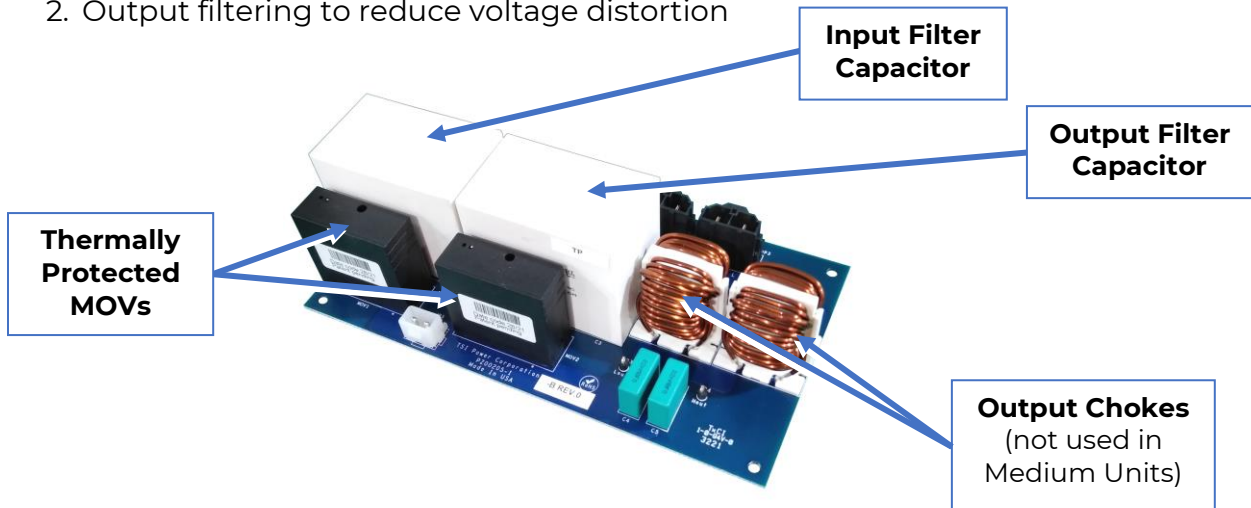


**Figure 16: PZ00073 Main Control Circuit Board Assembly Shown**

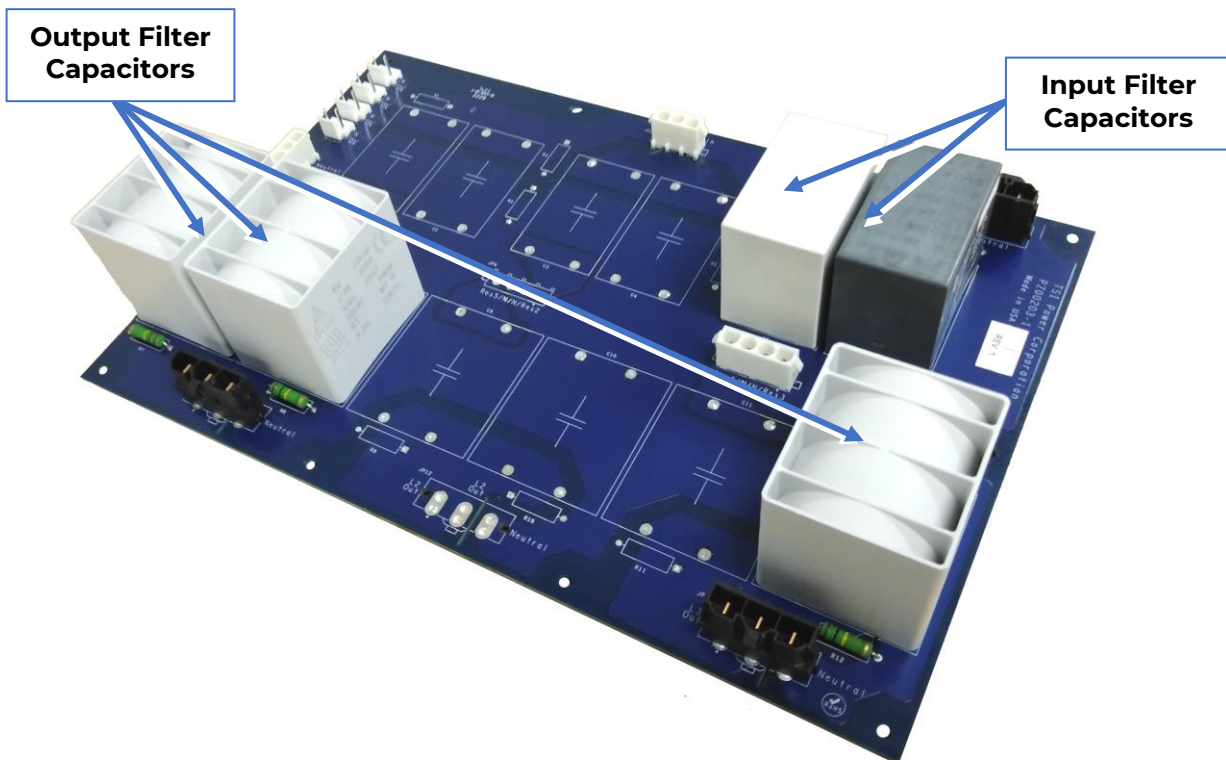
## 2.4 SURGE/FILTER CIRCUIT BOARD ASSEMBLY -See Figures 17, 18, 19 and 20

These circuit board assemblies provide two functions:

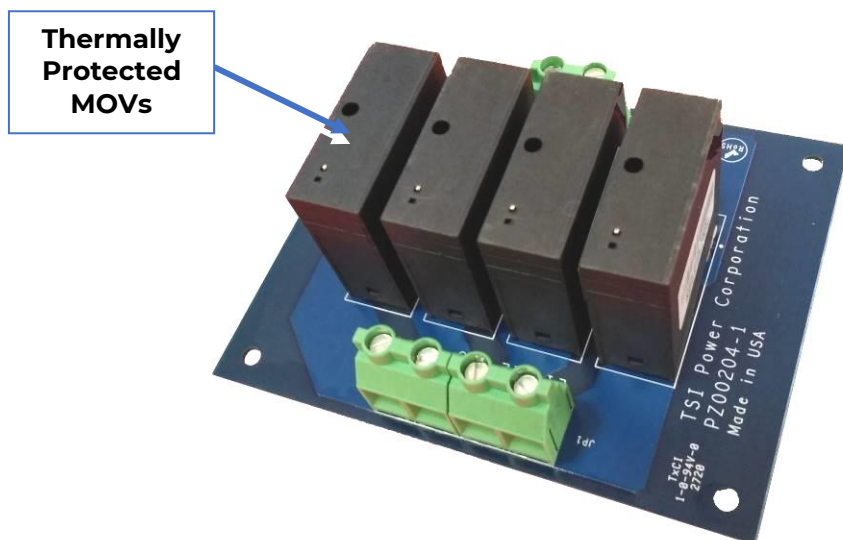
1. Surge voltage diversion
2. Output filtering to reduce voltage distortion



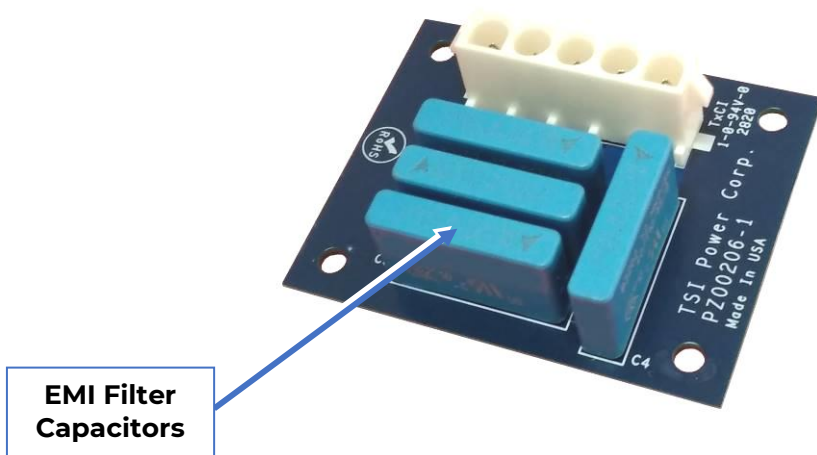
**Figure 17: PZ00205 Small/Medium Series VRP Surge/Filter Circuit Board Assembly**



**Figure 18: PZ00203 Large Series (24in. Cube) VRP Filter Circuit Board Assembly**



**Figure 19: PZ00204 Large Series (24in. Cube) Input Surge Circuit Board Assembly**

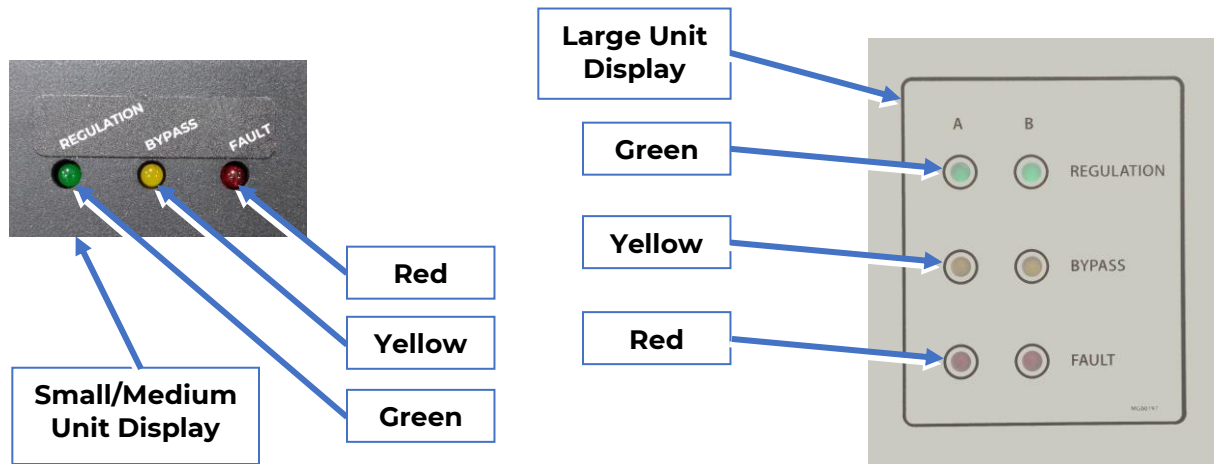


**Figure 20: PZ00206 Large Series (24in. Cube) Output EMI Filter Circuit Board Assembly**

**2.5 VRP STATUS INDICATORS** – See Figures 21 and 22

These LEDs monitor the various conditions and display the following outputs:

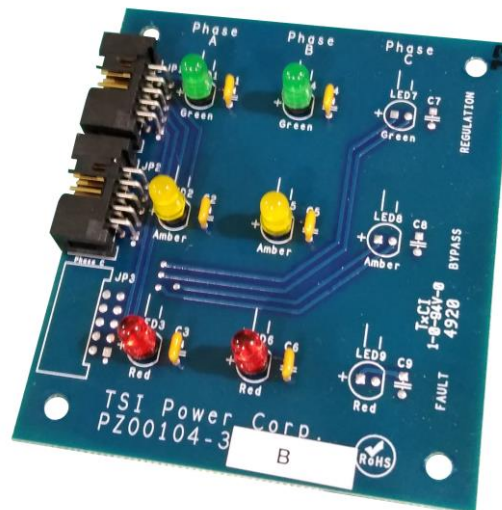
1. Green LED indicates REGULATION mode.
2. Yellow LED indicates that system is in BYPASS mode.
3. Red LED indicates that the VRP is in electronic FAULT mode.



**Figure 21: Status Display LEDs**



**Small/Medium Series LED Board -P/N PZ00115**



**Large Series (24in. Cube) LED Board -P/N PZ00104 (B)**

**Figure 22: Status Display LED Boards**

## 2.6 VRP INTERNAL CIRCUIT BREAKER -See Figure 23

The circuit breaker provides two functions; Note: Small and Medium Series only.

1. Over current protection
2. Unit on/off switch



**Figure 23: Double-Pole, 20 A Circuit Breaker -P/N FC00063 Shown**

NOTE: Figure for reference only, actual component may vary in appearance.

## 2.7 VRP INPUT EMI FILTER -See Figures 24 and 25



**Figure 24: 30 A, 1 ph EMI Filter -P/N EM00006 Shown**



**Figure 25: 320 A, 3 ph EMI Filter -P/N EM00008 Shown**

NOTE: Figures for reference only, actual components may vary in appearance

**2.8 VRP UNIT EXHAUST FAN** -See Figure 26 and 27



**Figure 26: 80 mm, AC, Unit Exhaust Fan  
-P/N VF00002 or VF00015**



**Figure 27: 120 mm, AC, Unit Exhaust Fan  
-P/N VF00009 or VF00013**

NOTE: Figures for reference only, actual components may vary in appearance.

**2.9 VRP HEAT SINK COOLING FAN** -See Figure 28



**Figure 28: 80 mm, DC, Heat Sink Cooling Fan -P/N VF00033**

NOTE: Figure for reference only, actual component may vary in appearance.

### 3 INSTALLATION

**IMPORTANT: ONLY QUALIFIED PERSONNEL SHOULD PERFORM THE INSTALLATION OF THIS PRODUCT.**

#### 3.1 SITE SELECTION & PREPARATION

- This product is intended for installation in “A PROTECTED ENVIRONMENT ONLY”.
- The Small and Medium VRPs are designed to be placed on a horizontal surface such as a floor or a desk. The Small and Medium VRPs can also be mounted to a wall using the optional MK-4000C (Small unit) or MK-8000C (Medium unit) brackets with hardware. The Large (24in. Cube) VRP is designed to be placed on a floor only.



**CAUTION: *The unit must be placed in a well - ventilated area to prevent risk of fire due to overheating. Ventilation slots must not be obstructed.***

- Select an area with enough space to provide sufficient clearance around the unit to provide unrestricted access.
- Make sure that nothing obstructs the cooling fan/fans.
- For the Large (24in. Cube) VRPs; once the unit is in place ensure that the casters are locked securely.
- Ensure that the closest distribution panel board has space and capacity for a circuit breaker rated for 1.25 x the maximum VRP input rating or 1 x the maximum VRP input rating for the Large (24in. Cube) VRPs.

#### 3.2 REQUIRED TOOLS

- Set of standard hand tools
- Wire stripper
- DMM (digital voltmeter)

#### 3.3 UNPACKING & INSPECTION

3.3.1 The Small and Medium units are shipped in individual boxes with shipping foam, with up to five (5) units shipped separately. Six (6) units or more are normally placed on a pallet (usually still in individual boxes). The Large (24in. Cube) units are shipped in crates, normally one (1) unit per crate.

3.3.2 Inspect the shipping container for obvious damage.



- 3.3.3 If no visible damage is found, carefully open the boxes (or crates) using a utility knife (or other required tools), making sure not to damage the units, and remove the shipping foam and packing material.
- 3.3.4 Before the units are removed from the boxes (or crates), inspect them for physical damage.
- 3.3.5 If no damage is found, remove the units and again inspect for damage. If damage is found in either steps 3.3.2, 3.3.3, 3.3.4 or 3.3.5, do not accept the shipment and file a claim with the carrier. Contact TSI Power if a replacement unit needs to be purchased.

### 3.4 INSTALLING THE VRP

- 3.4.1 After the unit has been unpacked and no damage has been found, proceed with the installation as outlined below.

### 3.5 AC CONNECTIONS (HARDWIRE VERSIONS) —If you have a corded version VRP proceed to section 4, POWERING UP THE VRP.

- 3.5.1 Make sure that the up-stream distribution panel circuit breaker is switched **OFF**.
- 3.5.2 Be sure to follow electric safety and installation codes in the country of use.
- 3.5.3 For Small and Medium VRPs the power entry is through two circular holes in the rear plate of the unit (see Figure 9). Remove this hardwire terminal access plate and save hardware before proceeding. In Large (24in. Cube) VRPs the power entry is through two circular holes in the bottom of the unit (see Figure 10). Remove the hardwire terminal access end panel located at the side near the TSI logo and ratings labels (see Figure 1, page 5), save the hardware before proceeding.



**To prevent damage do not reverse input and output**

LI, NI (or L1in, L2in) = INPUT

LO, NO (or L1out, L2out) = OUTPUT



**When terminating wires, carefully insert each wire into the appropriate slot, taking care to ensure that all strands are inserted properly. If screw type terminals, tighten the terminal screw using a slotted screwdriver for Small or Medium VRPs or an appropriately sized Allen/hex wrench for Large (24in. Cube) VRPs, refer to Figure 29 for recommended torque. Perform a pull test to make sure each connection is secure. Do not apply excessive torque to make sure that the terminal screws are not damaged. Note that failure to follow these instructions can lead to malfunction or short circuit.**

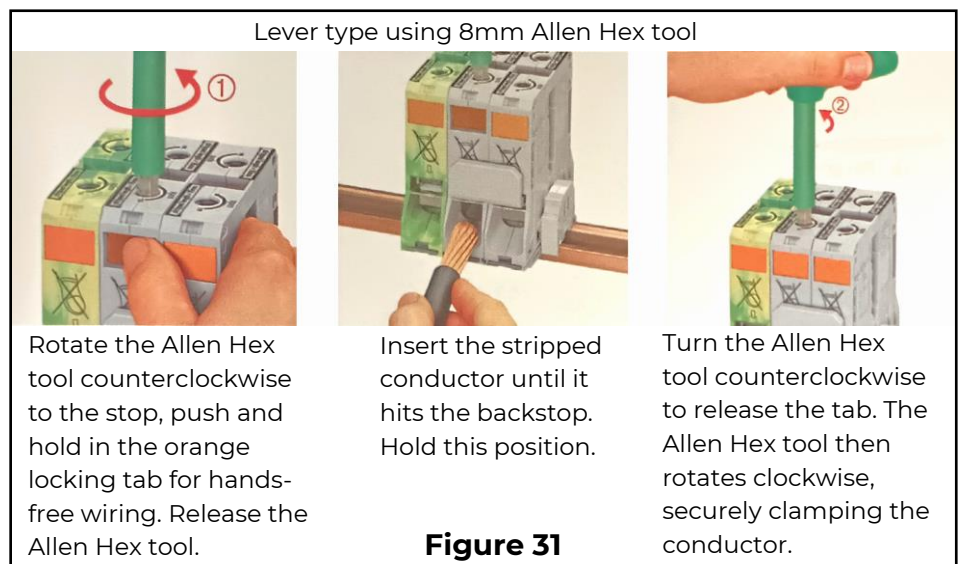
RECOMMENDATIONS FOR VRP INSTALLATION								
Units with rated maximum:		External Branch Circuit Protection Rating	Minimum Wire Size (use stranded copper wire with a 105°C insulation system)		Torque For Wire Terminations, Screw Type Terminals		Wire Strip Length, Screw Type Terminals	
Input Current	Output Current		Power Conductors	Ground Conductors				
10.4 A	8.00 A	15 A	14 AWG (2.5mm <sup>2</sup> )	14 AWG (2.5mm <sup>2</sup> )	13.3 to 15.9 in-lb (1.5 to 1.8 Nm)		0.39" (10mm)	
15.6 A	12.0 A	20 A	12 AWG (4mm <sup>2</sup> )	12 AWG (4mm <sup>2</sup> )				
20.8 A	16.0 A	25 A	10 AWG (6mm <sup>2</sup> )	10 AWG (6mm <sup>2</sup> )				
31.3 A	24.0 A	40 A	8 AWG (10mm <sup>2</sup> )	10 AWG (6mm <sup>2</sup> )				
41.7 A	32.0 A	50 A	8 AWG (10mm <sup>2</sup> )	10 AWG (6mm <sup>2</sup> )				
52.1 A	40.0 A	70 A	6 AWG (16mm <sup>2</sup> )	8 AWG (10mm <sup>2</sup> )				
72.9 A	56.0 A	90 A	4 AWG (25mm <sup>2</sup> )	8 AWG (10mm <sup>2</sup> )				
83.3 A	64.0 A	100 A	3 AWG (27mm <sup>2</sup> )	8 AWG (10mm <sup>2</sup> )	28.3 to 32.7 in-lb (3.2 to 3.7 Nm)		0.63" (16mm)	
93.8 A	72.0 A	125 A	2 AWG (35mm <sup>2</sup> )	6 AWG (16mm <sup>2</sup> )				
104 A	80.0 A	125 A	2 AWG (35mm <sup>2</sup> )	6 AWG (16mm <sup>2</sup> )				
196 A	150 A	200 A	3/0 AWG (85mm <sup>2</sup> )	6 AWG (16mm <sup>2</sup> )	Power Wires	Ground Wires	Power Wires	Ground Wires
227 A	181 A	225 A	4/0 AWG (120mm <sup>2</sup> )	4 AWG (25mm <sup>2</sup> )	18.4 to 22 ft.-lbs (25 to 30 Nm)	10 ft.-lbs (13.6 Nm)	1.3" (33mm)	0.63" (16mm)
255 A	208 A	250 A	300 kcmil	4 AWG (25mm <sup>2</sup> )	25 to 30 ft.-lbs (25 to 30 Nm)	10 ft.-lbs (13.6 Nm)	1.6" (40mm)	

**Figure 29: Branch Circuit Protection, Wire Size, Torque and Wire Strip Length Table**

3.5.4 Allow for sufficient wire length to reach the wiring terminals and leave enough slack to reduce the stress in the wires. Note: Two wires plus ground are required for both input and output.

3.5.5 Strip insulation from the end of each of the six (6) wires and terminate them in the wiring terminals as follows.

- If lever type terminal blocks see Figure 30 or 31.
  - VRP with up to 40 A max output, strip wires from 13mm to 15mm.
  - Larger VRP strip wire as per instructed on top of terminal block.
- If screw type terminal blocks; strip wires and torque terminations per Figure 29.

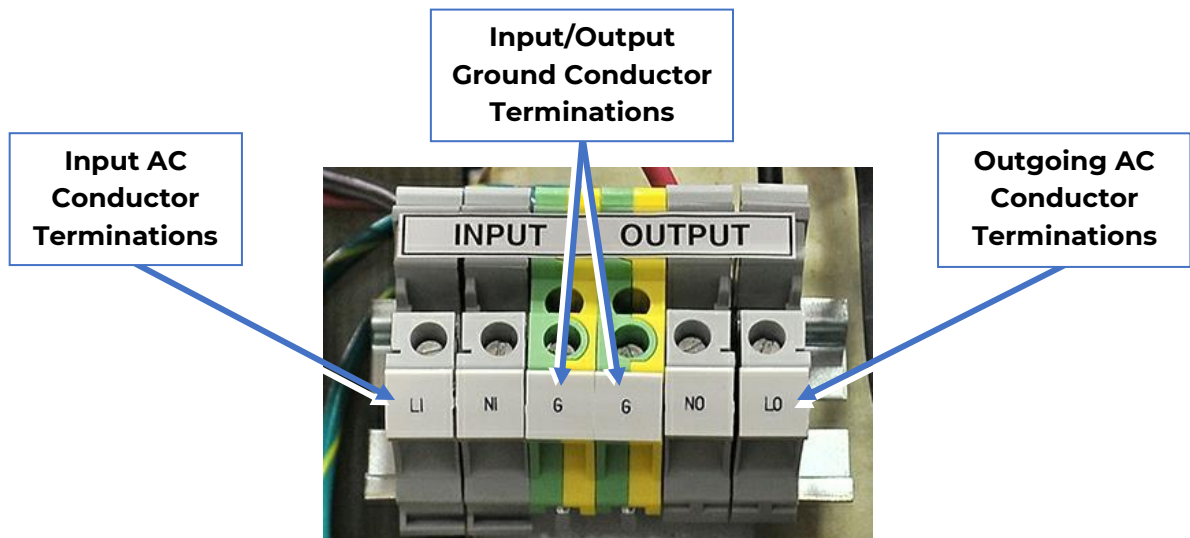


3.5.6 Terminate the incoming wires. The input terminals are on the left side of the terminal strip for Small and Medium VRPs (see Figure 32). For Large (24in. Cube) VRPs the input terminals are on the right side of the unit (see Figure 10). These terminals are marked as follows:

- **LI (or L1in)** for Line Input (or Line 1 Input)
- **NI (or L2in)** for Neutral Input (or Line 2 Input)
- **G or  $\perp$  (or PE)** for input Earth Ground (or Protective Earth)

3.5.7 Terminate the outgoing wires. The output terminals are on the right side of the terminal strip for Small and Medium VRPs (see Figure 32). For Large (24in. Cube) VRPs the output terminals are on the left side of the unit (see Figure 10). These terminals are marked as follows:

- **LO (or L1out)** for Line Output (or Line 1 Output)
- **NO (or L2out)** for Neutral Output (or Line 2 Output)
- **G or  $\perp$  (or PE)** for output Earth Ground (or Protective Earth)



**Figure 32: Small Series VRP Incoming & Outgoing Wire Terminations Shown**

NOTE: Figure for reference only, actual terminations may vary in appearance.

#### 4. POWERING UP THE VRP



**CAUTION: External branch circuit protection is to be provided by the customer at 125% (100% for the Large 24in. Cube units) of the VRP's maximum input current rating as shown in Figure 29 (page 26) per the national electric code or per local electrical codes if outside of the United States.**



**CAUTION:** *Before proceeding to the next step, make sure that the VRP's internal circuit breaker, if provided, is in the OFF position. For Hardwire units also make sure the AC input wires are de-energized before making connections.*



*Before powering up the unit, make sure that the air Ventilation slots are free of obstruction to prevent overheating.*



**CAUTION:** *Only people familiar with electricity should perform start-up of the VRP.*



**CAUTION:** *Remove metallic watches and rings. Always wear safety glasses, insulated gloves and insulated shoes.*

#### **4.1 CHECKING FOR PROPER INPUT VOLTAGE**

- 4.1.1 Switch on the up-stream distribution panel circuit breaker.
- 4.1.2 Check for proper input voltage across Line and Neutral (or Line 1 and Line 2), using an AC voltmeter.
- 4.1.3 The voltage must be within the input voltage range per the unit's ratings label.
- 4.1.4 If correct, switch off the up-stream distribution panel circuit breaker. For hardwire units, replace the terminal access plate/panel using previously saved hardware.

#### **4.2 ENERGIZING THE VRP**—The following steps outline the procedures for putting the VRP into operation:

- 4.2.1 If using a VRP model with a plug and receptacle; plug the VRP into the up-stream power receptacle. Plug the load equipment (that needs to be powered and protected) into the VRP (if using a hardwired VRP model the input and output connections were performed during step 3.5).
- 4.2.2 Switch-on the up-stream distribution panel circuit breaker.
- 4.2.3 Turn-on the VRP internal circuit breaker if provided.
- 4.2.4 After the VRP is powered, the Yellow Bypass LED should flash briefly.
- 4.2.5 The Green Regulation LED will then illuminate and should stay on. At this time, the heat sink cooling fan should be on, this is NORMAL. If energizing a Large (24in. Cube) unit, it's AC cooling fan should also be on. In Medium Unit's the optional cooling fan is controlled by a thermal switch so it may not be on depending on the unit's temperature. (The Bypass LED should be off.)

CONSULT VRP TROUBLE-SHOOTING PROCEDURE IF THE GREEN REGULATION LED IS NOT LIT AND/OR THE RED FAULT LED ILLUMINATES.

4.2.6 Check for proper output voltage across Line and Neutral (or Line 1 and Line 2), using an AC voltmeter. Output voltage should be  $\pm 3\%$  of the nominal voltage per the unit's ratings label.

4.2.7 Verify that the load equipment is operating properly.

4.2.8 THE SYSTEM IS NOW IN OPERATION.

## **5. MAINTAINING THE VRP**

To make sure that the unit is functioning properly and safely, check the following periodically or at least once a year:

### **5.1 VRP OPERATION**

5.1.1 Verify that the Green Regulation LED is illuminated.

5.1.2 Check if the unit appears hot to the touch as this indicates overload or fan failure.

5.1.3 Check and verify operation of the heat sink fan and optional unit exhaust fan/fans.

### **5.2 ENCLOSURE INTEGRITY**

5.2.1 Check the air intake and exhaust for dust and debris, remove as required.

5.2.2 Check for moisture and water accumulation and remove as necessary.

## **6. TROUBLESHOOTING & COMPONENT REPLACEMENT**

### **6.1 VISUAL STATUS INDICATORS**

6.1.1 The Regulation LED (green LED) on the enclosure chassis must be ON.

6.1.2 If the Regulation LED is not on, it could mean any of the following:

- There is no AC power present,
- Internal circuit breaker (if provided) is in the off position,
- Supply circuit breaker is in the off position,
- Bypass Fuse (see figure 16) on PCB assembly is blown thus indicating failure of power switching transistors.

6.1.3 If the Bypass LED (yellow LED) is ON (flashing), the internal bypass is activated. This state indicates that the VRP is either overloaded or is receiving an insufficient input voltage.

6.1.4 If the Fault LED (red LED) is ON (flashing), the VRP is in the electronic fault mode. The cause could be any of the following:

- Component overheating the heatsink,
- Out of range frequency,
- Failed component or circuit that prevents normal operation.

After orderly shutdown of the equipment that is connected, turn off the VRP's input circuit breaker (if provided) or the upstream circuit breaker. Restart the VRP by switching the circuit breaker back on. The Fault LED will turn OFF if the fault is temporary. If it does not, replace the Control Circuit Board Assembly.

## **6.2 DECOMMISSIONING THE VRP & INSPECTING FOR DAMAGE**

6.2.1 Follow the steps below to decommission the VRP:

- Switch off the internal circuit breaker, if provided.
- Switch off the up-stream distribution panel circuit breaker.
- Remove the case cover/covers.

6.2.2 Use a light to perform the inspection as follows:

- Check continuity of the Control Board Assembly Bypass Fuse/Fuses.
- Look for any obvious burn marks.
- Look for any damaged, cracked or discolored parts which might provide a clue as to what might have caused the unit failure.
- If no defect is found following inspection, you may decide to ship the entire unit back to TSI Power for factory repair or a replacement.

## **7. REPAIRS, SERVICE & SPARE PARTS**

### **7.1 REPAIRING VRP**

The VRP units should only be repaired by persons with a general knowledge of electronics and electrical safety procedures. Others should contact TSI Power Corp. for an RMA (Return Material Authorization). The TSI Power representative will ask a few simple questions and issue an RMA if factory repair is required.

### **7.2 REPAIRING VRP IN THE FIELD**

**7.2.1** The VRP is designed to facilitate quick replacement of modules in the field. Therefore, trouble-shooting procedures described in this manual are limited to identification of faulty modules that can be replaced by persons with a general knowledge of electronics.

**7.2.2** The main Control Circuit Board Assembly used in the VRP is not designed to be repaired in the field as it utilizes a microcontroller and programmable logic device.

**7.2.3** Spare parts can be ordered from TSI directly. However, contact TSI Power prior to ordering to ensure that the proper parts are specified for the specific VRP model.

**Note 1: For customers with a large number of VRP units –**

Since board exchange is the quickest way to repair a failed VRP unit, TSI Power recommends that customers keep at least 3% (one board set for every 30 VRP units) in spare main boards in order to minimize VRP downtimes while failed boards are being repaired at TSI Power.

**Note 2: For international customers with a large number of VRP units –**

Keeping about 5% (one board set for every 20 VRP units) in spare boards is highly recommended to minimize VRP repair time. Also, shipping costs (per each repaired board) can be reduced dramatically by always shipping a group of three or more boards in the same box, as the cost of international air shipment can be very high.

**7.2.4 Returning defective modules for repair or replacement**

- Contact TSI via telephone or e-mail to obtain a Return Material Authorization number (RMA).
- Make sure that returned parts are properly protected and packed in suitable shipping box, especially when sending parts via United Parcel Service.
- Mark shipping box with RMA number using indelible marker pen.
- TSI recommends that DHL be used for shipments originating outside the USA and FedEx for US domestic shipments. Do not use UPS if possible.
- Upon receiving the part, TSI will determine if it is covered by warranty, warranty repair or replacement is performed without charge. TSI will quote repair costs for out-of-warranty parts prior to starting any repair work. If repair is not cost effective, TSI will quote the cost of a replacement part.
- Shipping costs, duty and brokerage costs are the responsibility of the customer.

### 7.3 SPARE PARTS

The table below shows replaceable parts that can be ordered from TSI Power if necessary.

Voltage	Unit Part Number	Buck/Boost Transformer	Control Circuit Board Assembly	Surge/Filter Circuit Board Assembly	EMI Circuit Board Assembly	LED Circuit Board Assembly	Input Filter	Circuit Breaker	Unit Exhaust Fan	Heat Sink Cooling Fan
120 V units	VRP-1400-3XXX	TP00172	PZ00073-12-A	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00021	None	VF00033
	VRP-1900-3XXX	TP00172	PZ00073-12-A	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00017	None	VF00033
	VRP-2900-3XXX	TP00215	PZ00073-12-A	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00019	None	VF00033
	VRP-4800-3XXX	TP00156	PZ00073-12-A	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00025	None	VF00033
	VRP-7700-3XXX	TP00207	PZ00073-12-E	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00083	VF00015	VF00033
	VRP-9600-3XXX	TP00273	PZ00073-12-E	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00020	VF00015	VF00033
	VRP-18000-3XXX	TP00221 (2 per unit)	PZ00073-12-E (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00009	VF00033
	VRP-21700-3XXX	TP00301 (2 per unit)	PZ00073-12-E (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00009	VF00033
208 V units	VRP-25000-3XXX	TP00302 (2 per unit)	PZ00073-12-E (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00009	VF00033
	VRP-1700-5XXX	TP00173	PZ00073-12-B	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00088	None	VF00033
	VRP-2500-5XXX	TP00125	PZ00073-12-B	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00073	None	VF00033
	VRP-3300-5XXX	TP00169	PZ00073-12-B	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00063	None	VF00033
	VRP-5000-5XXX	TP00279	PZ00073-12-B	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00064	None	VF00033
	VRP-6700-5XXX	TP00153B	PZ00073-12-B	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00065	None	VF00033
	VRP-8300-5XXX	TP00192	PZ00073-12-B	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00066	None	VF00033
	VRP-13300-5XXX	TP00193	PZ00073-12-F	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00086	VF00002	VF00033
	VRP-15000-5XXX	TP00217	PZ00073-12-F	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00067	VF00002	VF00033
	VRP-16700-5XXX	TP00281	PZ00073-12-F	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00130	VF00002	VF00033
	VRP-31300-5XXX	TP00216 (2 per unit)	PZ00073-12-F (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
	VRP-37500-5XXX	TP00263 (2 per unit)	PZ00073-12-F (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
220 V units	VRP-43300-5XXX	TP00277 (2 per unit)	PZ00073-12-F (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
	VRP-1800-6XXX	TP00173	PZ00073-12-C	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00088	None	VF00033
	VRP-2600-6XXX	TP00125	PZ00073-12-C	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00073	None	VF00033
	VRP-3500-6XXX	TP00169	PZ00073-12-C	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00063	None	VF00033
	VRP-5300-6XXX	TP00279	PZ00073-12-C	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00064	None	VF00033
	VRP-7000-6XXX	TP00153B	PZ00073-12-C	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00065	None	VF00033
	VRP-8800-6XXX	TP00192	PZ00073-12-C	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00066	None	VF00033
	VRP-12300-6XXX	TP00193	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00070	None	VF00033
	VRP-14100-6XXX	TP00193	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00086	VF00002	VF00033
	VRP-15800-6XXX	TP00217	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00067	VF00002	VF00033
	VRP-17600-6XXX	TP00281	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00130	VF00002	VF00033
	VRP-33100-6XXX	TP00216 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
	VRP-39700-6XXX	TP00263 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
	VRP-45800-6XXX	TP00277 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
250 V units	VRP-1800-7XXX	TP00173	PZ00073-12-C	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00088	None	VF00033
	VRP-2800-7XXX	TP00125	PZ00073-12-C	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00073	None	VF00033
	VRP-3700-7XXX	TP00169	PZ00073-12-C	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00063	None	VF00033
	VRP-5500-7XXX	TP00279	PZ00073-12-C	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00064	None	VF00033
	VRP-7400-7XXX	TP00153B	PZ00073-12-C	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00065	None	VF00033
	VRP-9200-7XXX	TP00192	PZ00073-12-C	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00066	None	VF00033
	VRP-14700-7XXX	TP00193	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00086	VF00002	VF00033
	VRP-16600-7XXX	TP00217	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00067	VF00002	VF00033
	VRP-18400-7XXX	TP00281	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00130	VF00002	VF00033
	VRP-34600-7XXX	TP00216 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-I	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033



	VRP-41500-7XXX	TP00263 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-1	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
	VRP-47800-7XXX	TP00277 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-1	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
240 V units	VRP-1900-8XXX	TP00173	PZ00073-12-C	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00088	None	VF00033
	VRP-2900-8XXX	TP00125	PZ00073-12-C	PZ00205-1-A	N/A	PZ00115-2	EM00006	FC00073	None	VF00033
	VRP-3800-8XXX	TP00169	PZ00073-12-C	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00063	None	VF00033
	VRP-5800-8XXX	TP00279	PZ00073-12-C	PZ00205-1-B	N/A	PZ00115-2	EM00006	FC00064	None	VF00033
	VRP-7700-8XXX	TP00153B	PZ00073-12-C	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00065	None	VF00033
	VRP-9600-8XXX	TP00192	PZ00073-12-C	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00066	None	VF00033
	VRP-15400-8XXX	TP00193	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00004	FC00086	VF00002	VF00033
	VRP-17300-8XXX	TP00217	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00067	VF00002	VF00033
	VRP-19200-8XXX	TP00281	PZ00073-12-G	PZ00205-1-C	PZ00206-1	PZ00115-2	EM00009	FC00130	VF00002	VF00033
	VRP-36100-8XXX	TP00216 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-1	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
	VRP-43300-8XXX	TP00263 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-1	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033
	VRP-49900-8XXX	TP00277 (2 per unit)	PZ00073-12-G (2 per unit)	PZ00204-1-A / PZ00203-1-1	PZ00206-1	PZ00104-3-B	EM00008	None	VF00013	VF00033

## 7.4 REPLACEMENT OF HEAT SINK COOLING FAN

**7.4.1** Verify that the fan is operating properly, check for airflow through heat sink on main control board and replace the fan if there is any doubt that it is operating properly.



**Do not ignore a poorly operating fan as serious damage to power switching transistors can occur.**

**7.4.2** Contact TSI Power for a replacement heat sink fan (TSI part number: VF00033).

**7.4.3** Follow these steps to replace:



**WARNING: Make sure unit is de-energized before beginning fan replacement.**

- Using a Phillips screw driver, remove all the screws and washers that hold the fan to the heat sink and set aside.
- Disconnect fan connector from JP12 FAN header on board.
- Install new fan with the airflow towards the heat sink. Check that fan spins freely after installation.

## 7.5 REPLACEMENT OF MAIN CONTROL BOARD ASSEMBLY

**7.5.1** Contact TSI Power for a replacement main control board assembly (PZ00073-12).

**7.5.2** Follows these steps to replace:

- When a new spare PCB board assembly is received, examine it to make sure there is no damage resulting from mishandling during shipment,
- Take care to assure that the board is not damaged by static electricity by using a properly grounded wrist strap,



**WARNING: Make sure unit is de-energized before beginning main control board replacement.**

- Disconnect the LED Display Ribbon Connector and 4 Pin Power Connector of the failed Control Board Assembly.
- Remove the failed Control Board Assembly. Four (4) fasteners hold each assembly, two on either end of large heat sink.
- Install the new Control Board Assembly using the four (4) removed fasteners.
- Connect the LED Display Ribbon Connector and 4 Pin Power Connector to the new Control Board Assembly, (*Note: Make sure the connectors are secure*).
- Energize (power up) the VRP (refer to Section 4 **POWERING UP THE VRP**).

## 7.6 REPLACEMENT OF UNIT EXHAUST FAN

**7.6.1** Verify that the fan is operating properly, check for airflow through the fan and replace the fan if there is any doubt that it is operating properly.



**Do not ignore a poorly operating unit exhaust fan as serious damage to components can occur from overheating.**

**7.6.2** Contact TSI Power for a replacement unit exhaust fan.

**7.6.3** Follow these steps to replace:



**WARNING: Make sure unit is de-energized before beginning fan replacement.**

- Take note of the direction of the fan's airflow (note the arrow shown on the fan).
- Disconnect fan electrically from the unit by disconnecting the QDTs (Quick Disconnect Terminals) from either the fan wire or the thermal switch.
- Using a Phillips screw driver, remove all the screws and washers that hold the fan to the unit and set aside.
- Install new fan with the airflow the same direction as determined in the first step above. Check that fan spins freely after installation.

## 8. CONTACT INFORMATION

### 8.1 TSI POWER CONTACT INFORMATION

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