TRANSTECTOR
an INFINITE brand

Installation Manual

700 A/V-S Voltage Regulator and Power Conditioner

75K(i) Model Power Conditioner
for Accuray CyberKnife®



700 A/V-S

111819-100 A Rev E

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RECEIVING & INSPECTING THE UNIT

INSPECTING THE POWER CONDITIONER

Upon receipt of the unit, visually inspect for shipping damage. If any damage is found, the Purchaser must contact the Carrier immediately and file a shipping damage claim.

NOTE: Be sure to remove the front and side panels, and inspect the inside of the unit for shipping damage. If any internal damage has occurred or any external damage that could affect the operation of the unit, please contact Transtector.

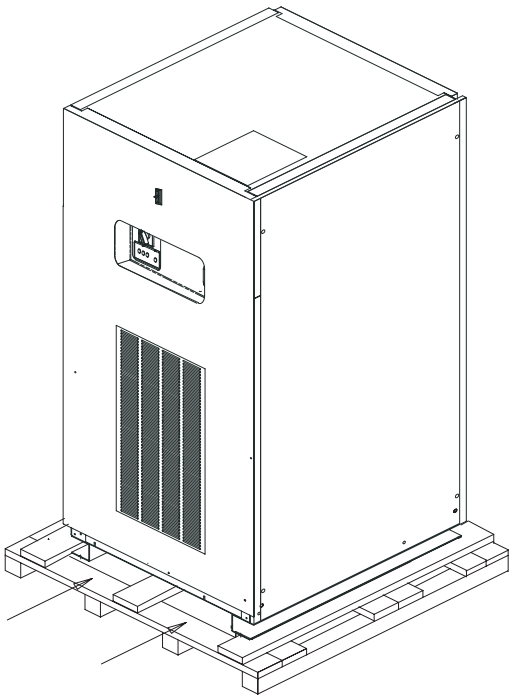
FOR ASSISTANCE CALL 1.800.882.9110 or +1.208.772.8515
AFTER HOURS CALL 1-800-521-4792

STORING

If it is necessary to store the unit for a period of time before it is installed, be sure to place the unit in a clean, dry area. To prevent excessive dust from accumulating on the unit, it is advisable to protect it by replacing it in the original container (if possible). If the original container is not available it is recommended that all openings that lead internally into the unit are covered so that dust, water or any other substance cannot enter the internal components of the system. The unit must be handled at all times with the same care you would give to any piece of precision industrial equipment.

REMOVING THE POWER CONDITIONER FROM PALLET

Please take special care when removing the unit from the pallet. Proper equipment must be used for lifting and moving, and all safety precautions should be taken. Each unit is bolted to a wooden pallet. In order to properly remove the cabinet from the pallet, all bolts connecting the unit to the pallet must be removed completely. The unit can then be lifted off the skid using a pallet jack or a fork lift, as shown below. When lifting the unit off of the pallet, be sure to take proper safety precautions. Serious injury and/or unit damage can result otherwise.



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GENERAL DESCRIPTION

The Series 700A/V-S Power Conditioner is designed to supply reliable, clean regulated power to critical loads. An efficient design with state of the art micro-processor controlled solid state devices provide immunity to all line disturbances.

The basic design consists of a three phase triple shielded isolation transformer with seven separate voltage taps per phase. Output regulation is achieved by monitoring the input and automatically switching taps anytime the input line sags or surges. The use of a triple shielded isolation transformer provides superior common mode and transverse mode noise attenuation. Automatic switching occurs during current zero allowing noise free switches for both leading and lagging power factor loads that are connected to the Series 700A/V-S.

MONITOR

Monitoring of the Series 700A/V-S is simple, clean and effective. Three green light indicators are utilized to display “POWER ON” (output line to neutral for each phase) and one red light indicator to display “ALERT”. The “POWER ON” display is connected directly to the output that indicates the Series 700A/V-S is operating properly with just a quick glance. The “ALERT” display represents an over-temp problem or output voltage loss (optional) when illuminated, and will shut down the output, but cooling fans remain on. Over-temp thermal sensors are strategically located at critical points on the regulator assemblies and transformer. The main AC input circuit breaker must be turned off in order to reset the “ALERT” light.

PROTECTION

Protection is accomplished very effectively to minimize failures and the cost of repairs. A total of five major devices protect the Series 700A/V-S.

1. The input is protected with a integrally mounted AC circuit breaker for abnormal current overloads and provides a convenient means of disconnecting utility power.

   As an option the input breaker may be equipped with a shunt trip device that is interfaced with a REMOTE EMERGENCY POWER OFF PUSH BUTTON. By pressing this button, the input breaker will trip and disable the Series 700A/V-S completely. The input breaker must be physically reset before unit will turn on again.

2. The main transformer is protected by fuse links connecting the SCR regulators together, and are designed to clear in the event that two or more SCR’s should fail. This will prevent a transformer tap short and the possibility of transformer failure.

3. (Optional) The output of the Series 700A/V-S is constantly monitored for extreme over and under voltage conditions. This device monitors each output phase and will electronically disable the Series 700A/V-S when any phase exceeds +10% or -10% of nominal output voltage.

4. Overtemp sensing devices are mounted at critical points on the SCR regulating assembly and the main transformer. When an overtemp condition exists the “ALERT” light will illuminate and hold until the overtemp is corrected. There are no automatic shut-off circuits for the “ALERT” condition. The main AC input breaker must be turned off in order to reset the “ALERT” light.

5. Each output of the Series 700A/V-S is protected with an integrally mounted AC breaker for abnormal current overloads and provides a convenient means of disconnecting power from the load.

GENERAL DESCRIPTION CONTINUED

OPERATION

The Series 700A/V-S Power Conditioner is operated by simply turning on the main AC input circuit breaker. Each unit is provided with a bypass switch. This is a no load switch and MUST only be operated when the unit is OFF. The bypass switch should be in the "NORMAL" position unless a problem occurs with the system. If a problem occurs, turn OFF the main AC circuit breaker and turn the bypass switch to the "BYPASS" position. Re-energize the system by turning on the AC circuit breaker and contact the Customer Support Department for repairs.

Any 'ALERT" condition requires the main AC input breaker to be turned off in order to reset the "ALERT" light.

THEORY OF OPERATION

The Series 700A/V-S Power Line Conditioner provides the triple function of isolation, noise attenuation and voltage regulation. The first two functions are provided by the power transformer, whereas the third function of voltage regulation is achieved through solid state thyristors (SCR's) connected to taps on the power transformer. A microprocessor monitors and controls the overall function of regulating the system.

The power transformer is manufactured with a unique method of shielding which produces very low capacitive coupling between the primary and secondary. This low coupling provides excellent attenuation of the common-mode noise. In addition, special care is taken in the design of the transformer to attenuate transverse-mode noise above 1000 Hz.

The power transformer has taps to which solid state switches (SCR's) are connected.

The voltage regulator incorporated in the Series 700A/V-S Power Line Conditioner is microprocessor controlled to achieve optimum correction time of input voltage sags and surges. The response time is typically one (1/2) cycle for 100% correction, therefore, a very smooth switch takes place undetected by computer equipment.

As the input voltage (building power) varies, the voltage available at each tap of the transformer will also change. The amount of variation is dependent upon the input sag or surge, turns ratio and transformer losses.

By selecting a particular tap voltage, the output can be kept within a tight range. The way in which this is accomplished is that an electronic control card using a micro-processor continually monitors the input voltage. When a voltage fluctuation occurs, which exceeds the limit of rated regulation (typically . 2%), the output is switched to another tap, that is within the required range. This "switch" will be made at the next current zero crossing to allow for both leading and lagging power loads to be connected to the conditioner.

SAFETY PRECAUTIONS

WARNING

- **THERE ARE DANGEROUSLY HIGH VOLTAGES PRESENT WITHIN THE ENCLOSURE OF THE POWER SUPPLY SYSTEM.**
- **CAUTION MUST BE TAKEN WHEN WORKING WITH THE SYSTEM.**
- **IT IS RECOMMENDED THAT ALL WORK BE PERFORMED BY QUALIFIED ELECTRICAL PERSONNEL ONLY.**

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PRELIMINARY INSTALLATION

INSTALLATION CONSIDERATIONS

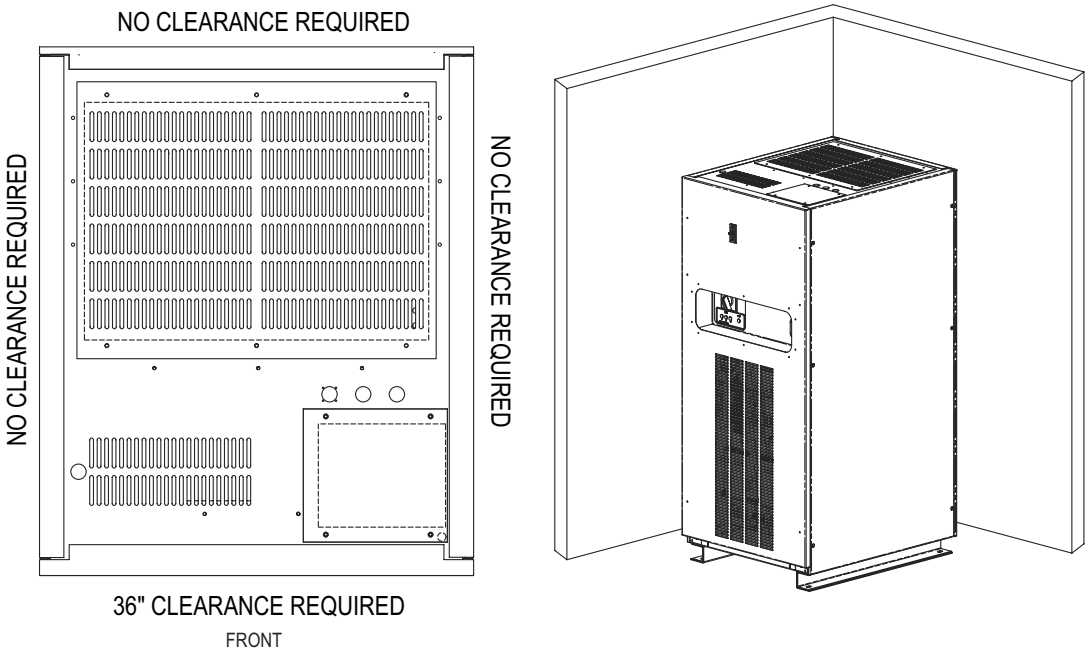
Prior to installing the Series 700A/V-S, be sure to take into consideration the site you have selected. Power Conditioners produce heat and therefore require ventilation as well as accessibility. Consider these factors.

- Ventilation - Input Source Voltage
- Size of the Power Conditioner - Receiving Facilities
- Weight Load - Distribution of Power
- Audible Noise Requirements - Room Temperature
- Remote Emergency Power Off (Repo) - Clearances
- Monitors - Accessibility
- Options - Excessively Long Power Runs
- Clean Environment
- Input Source Voltage
- Receiving Facilities
- Distribution of Power
- Room Temperature
- Clearances
- Accessibility
- Excessively Long Power Runs
- Proper Ground Techniques

CHOICE OF LOCATION

The unit has been completely inspected and extensively tested under various load conditions prior to shipment. Care to install it at a proper location will assure long trouble-free operation.

The unit is air cooled with the air intake at the front and exhausts at the top. Therefore, it should be installed in a clean, dry place with enough clearance to allow a free flow of air. Allow a minimum of 36” in front of the 700A/V-S for installation, operation, and maintenance. There is no clearance required on either the left or right hand side of this enclosure. Either or both sides, as well as the rear of the enclosure, can be set flush up against a wall. Input and output conductors should then enter/exit via the top and/or bottom of the enclosure as indicated.



Inspecting Components and Unpacking Equipment

Output KVA (I)	Output KVA Continuous	Input Breaker Size	Output Breaker Size	Max Output Current
75K (I)	50 KVA	200A at 208V 175A at 240V 100A at 480V 70A at 600V	150A, 3P at 208V 100A, 3P at 480V	138 amps continuous at 208V 208 amps intermittent at 208V 60 amps continuous at 480V 90 amps intermittent at 480V

WEIGHTS, BTU AND DIMENSIONS

Output KVA (I)	Weight	Operational BTU/HR Typical	Maximum BTU/HR	Dimensions
75 K (I)	1,142 lbs 518 kg	3,410	6,820	29”W x 35.875”D x 66”H 73.6cm x 91.12cm x 167.64cm

CAUTION

TO REDUCE THE RISK OF FIRE, USE ONLY ON CIRCUITS PROVIDED WITH AMPERE BRANCH CIRCUIT PROTECTION AS NOTED IN THE TABLE ABOVE, IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE, ANSI/NFPA 70.

* Stated BTU’s / Hr is at 100KVA rated load, 100% duty cycle. Operational BTU’s / Hr is typically at 50% of rated load. Input over current protection provided by others.

If unit is provide with no output circuit breaker option, output over-current protection and a disconnect device (circuit breaker) shall be provided by others.

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INPUT WIRE SIZE, GROUNDING AND OUTPUT WIRING

NOTE: Refer to the latest edition of The National Electric Code Requirements for over-current protection and wire sizing.

A Conduit should be used for both input and output wiring.

B Input wire size is based on the NEC table 310.16. Specifying not more than 3 connections in a raceway based on an ambient of 30°C and wire rated for 90°C (Note: amperages will need to be adjusted for 40° C ambient applications).

C. Input phase conductors are terminated directly to the input circuit breaker terminals. Wire range:1/0 – 4/0 AWG.

D. Input ground LUG 2/0 AWG.

E. Output is a 4 wire (5 including ground). If four (4) current carrying conductors are used in a raceway the neutral is assumed to be current carrying and the wire must be de-rated as indicated in table 310.6 on the NEC.

Example:
1. Assume #10 wire max current = 25 Amps.
2. Multiply 25 x .8 = 20
3. 20 Amps is max current for #10 wire in a raceway with 4 conductors.

NOTE: Installation is subject to local codes - verify with a local electrical inspector.

F. All output terminals are copper bus bars w/ two holes. Double bolted lug are recommended. Manufactured by Burndy

RECOMMENDED LUGS: Double bolted type as supplied by Burndy Copper Compression lug, 2 hole Type YA, ¼" stud, ¾" spacing.

YA6CL-2TC14E2 #6 wire	YA25L-2TC14E2 #1/0 wire
YA4CL-2TC14E2 #4 wire	YA26L-2TC14E2 #2/0 wire
YA2CL-2TC14E2 #2 wire	YA27L-2TC14E2 #3/0 wire
YA1CL-2TC14E2 #1 wire	YA28L-2TC14E2 #4/0 wire X 2

G. Output neutral to ground bonded during manufacturing of the power conditioner. Output Neutral is already grounded by the factory.

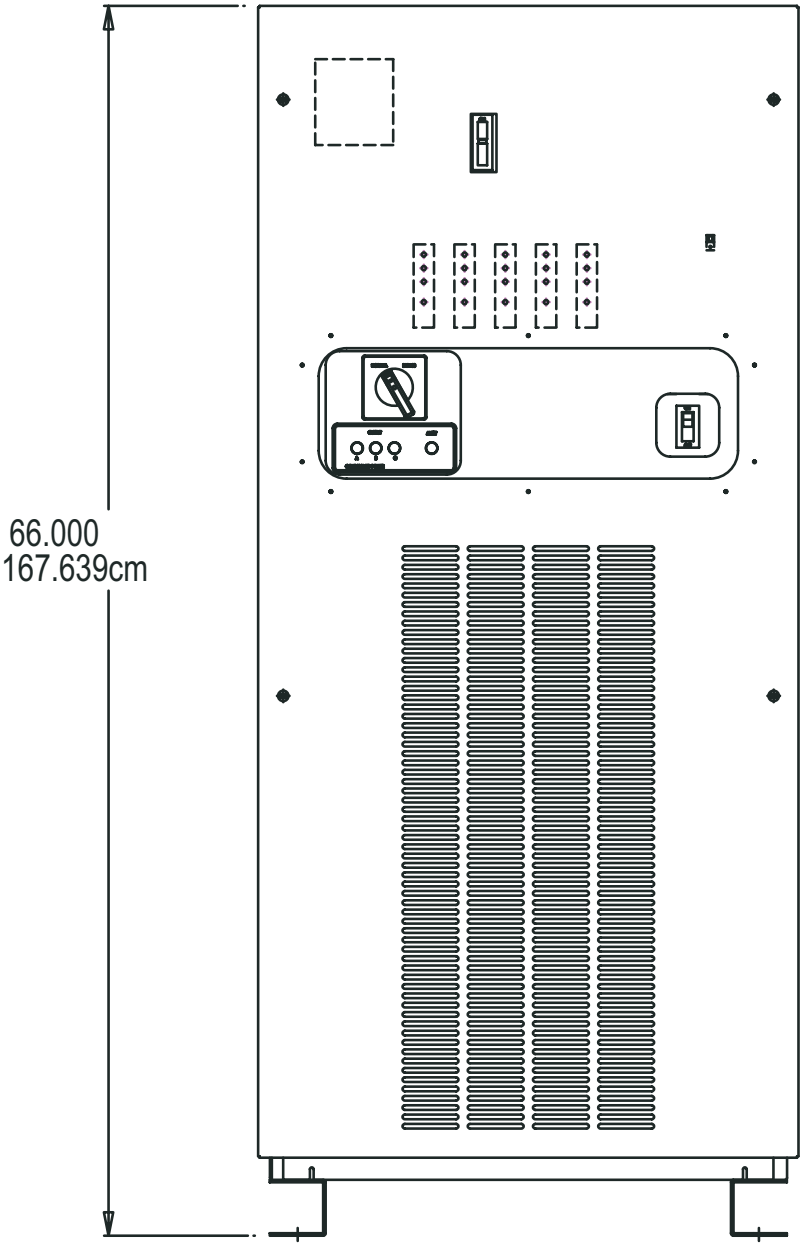
H. Installation is subject to local codes. Verify with a local electrician inspector.

The unit is constructed using an isolation transformer and is considered to be a "separately derived system". It should be grounded in accordance with the NFPA 70 article 250.20 "Alternating-Current Circuits and Systems to Be Grounded", article 250.20(D) "Separately Derived Systems" and article 250.30 "Grounding Separately Derived Alternating-Current Systems"

***The Output Neutral and Ground connection points are common to both wye outputs (208/120 VAC & 480/277 VAC). Therefore, it is considered a single, separately derived, power source and should be wired accordingly.**

INSTALLATION

CABINET OUTLINE FRONT VIEW

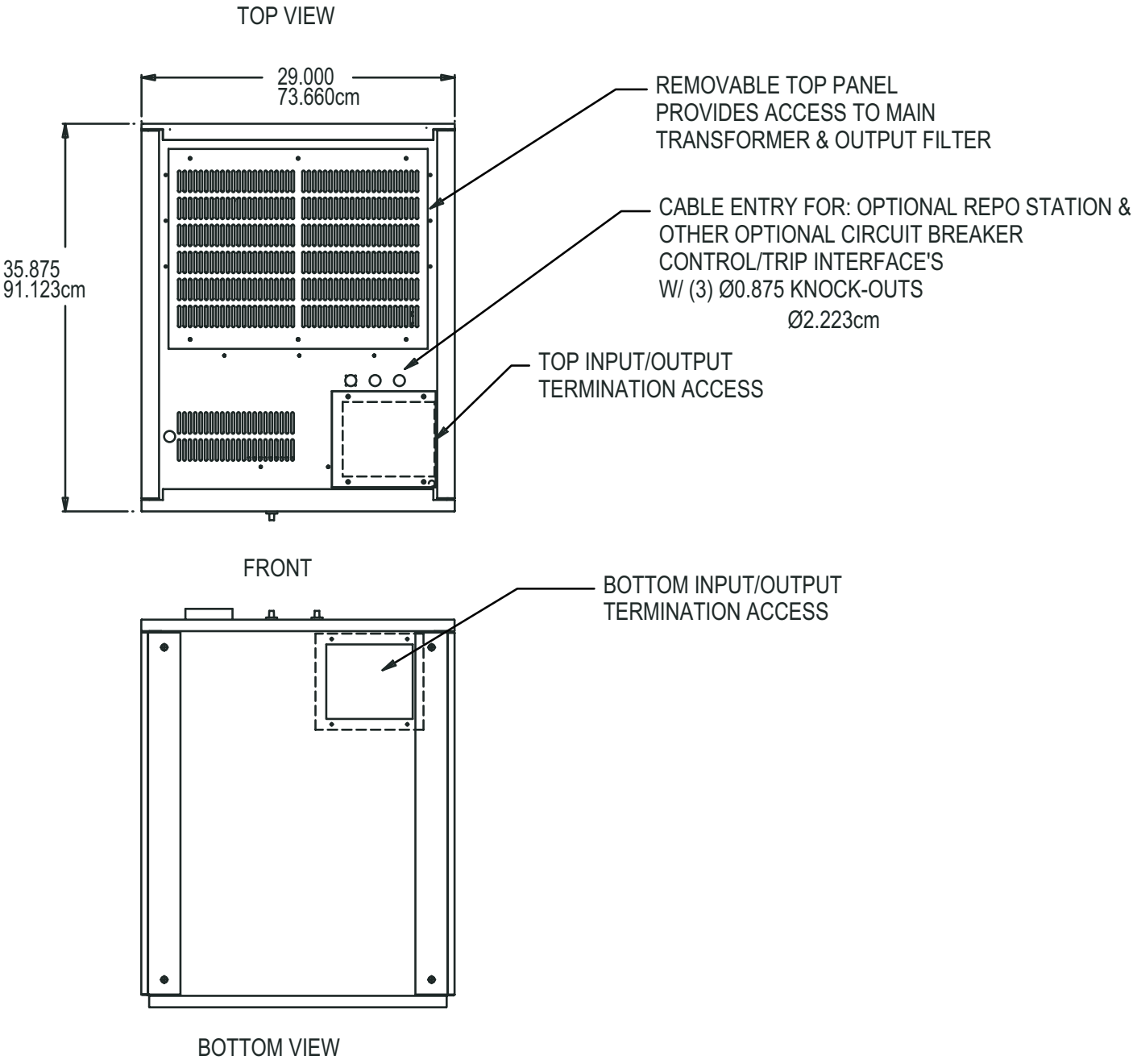


FRONT VIEW

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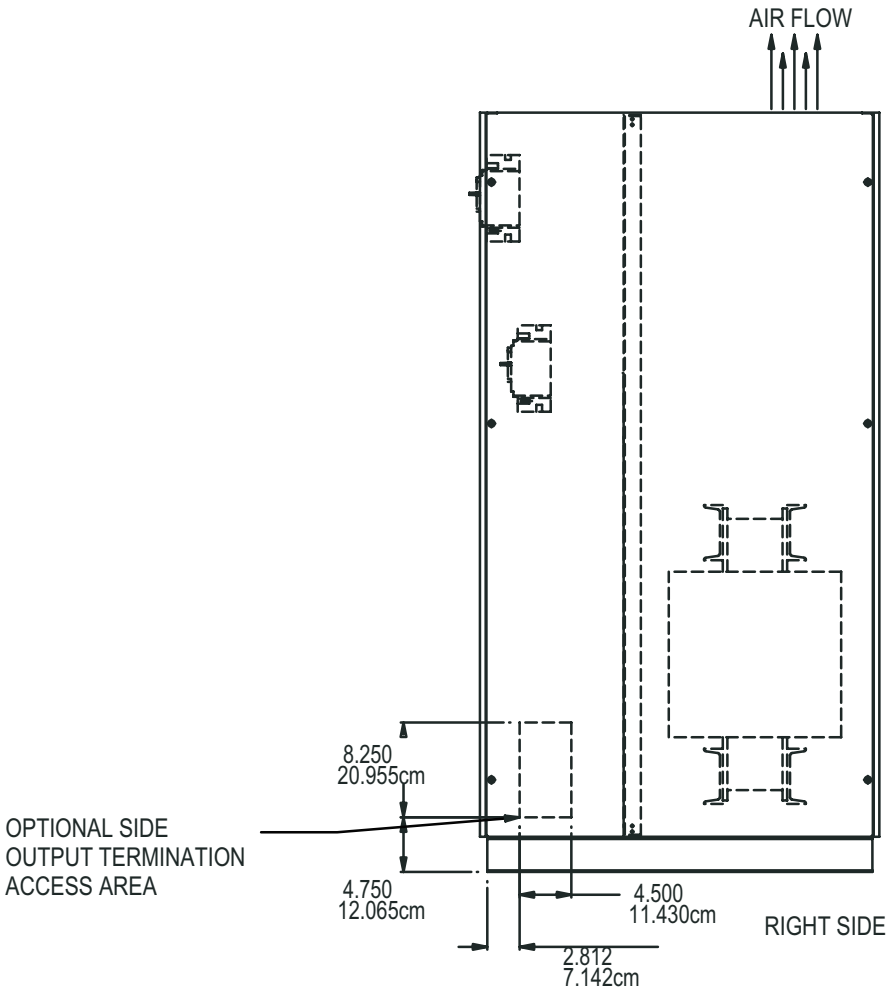
INSTALLATION CONTINUED

CABINET OUTLINE AND CLEARANCES - TOP AND BOTTOM VIEW



INSTALLATION CONTINUED

CABINET OUTLINE AND CLEARANCES -RIGHT SIDE VIEW



NO CLEARANCE REQUIRED ON RIGHT OR LEFT SIDES OF UNIT

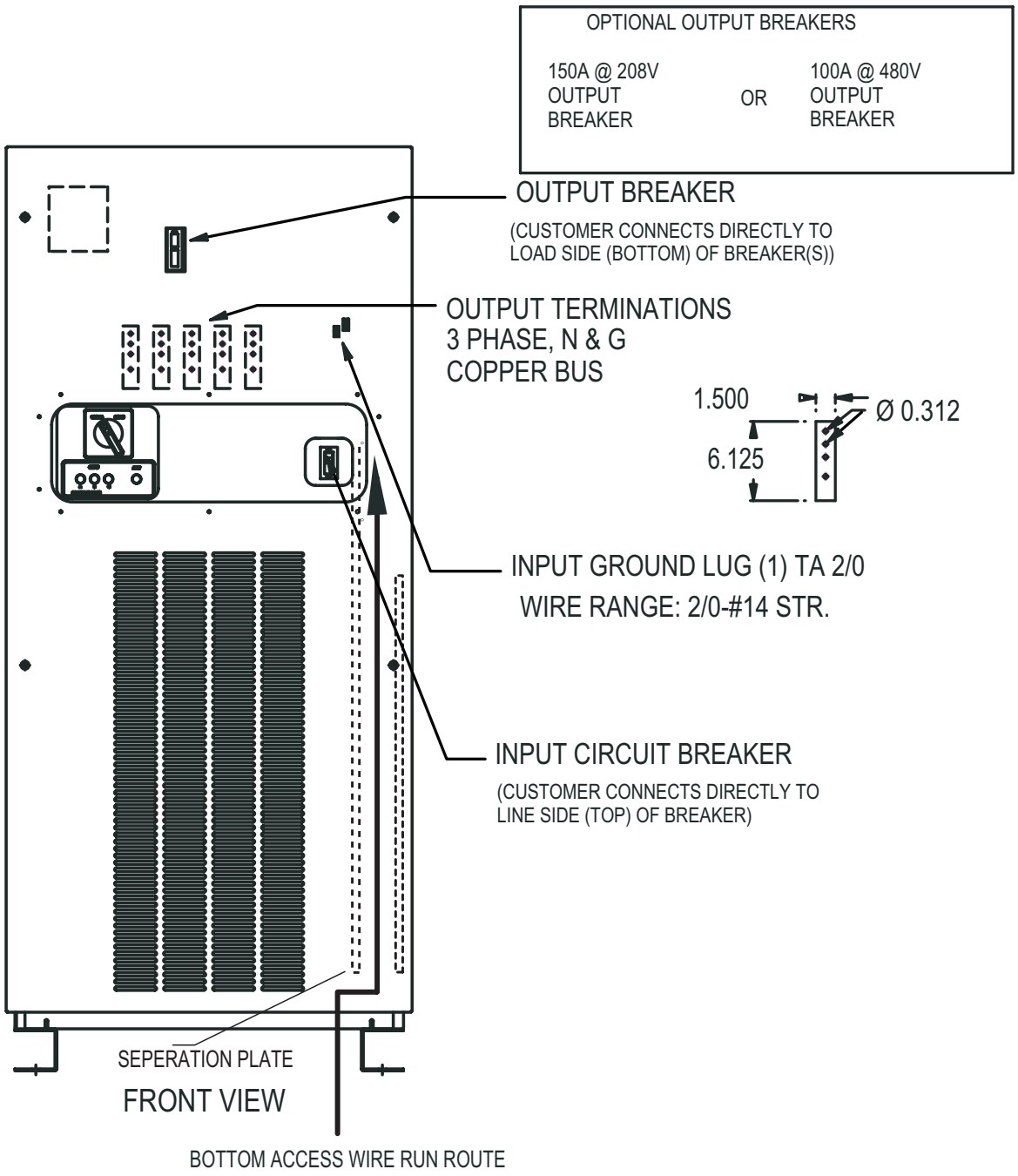
OPTIONAL 12" CLEARANCE ON RIGHT SIDE OF UNIT (IF USING OPTIONAL SIDE OUTPUT TERMINATION)

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INSTALLATION CONTINUED

INPUT & OUTPUT CONNECTIONS

1. Input connections are made directly to the unit's 3 pole main input circuit breaker and input lug provided. Note the bottom access wire run route illustrated below.
2. Output connections are made directly to these output breakers and output neutral and ground lugs provided. The load current is not to exceed 80% of the output breaker(s) rating, and not to exceed the rated total current.



BYPASS SWITCH

The manual bypass switch is a break before make switch located on the Series 700A/V-S. The manual bypass switch is used to bypass all power electronics in case of failure.

NORMAL MODE

With the switch in the normal position, the Series 700A/V-S will provide clean and regulated power to the critical loads. The Series 700A/V-S should have the switch in the normal position unless a failure has occurred.

BYPASS MODE

With the switch in the bypass position, the Series 700A/V-S will provide clean power to the critical loads. In the bypass position, the unit will not regulate the incoming voltage. The Series 700A/V-S should be placed in the bypass position when a failure of the system has occurred. This provides the user with some protection until a service technician arrives.

CAUTION

PRIOR TO SWITCHING FROM ONE POSITION TO ANOTHER- TURN OFF THE AC INPUT BREAKER.

REMOTE EMERGENCY POWER OFF (REPO) OPTION

The REPO is operated by a remote push button that when depressed will shunt trip the Series 700A/V-S input breaker and disable the unit. This option may be added to units in the field.

Contact our Customer Support Department if you wish to add this option. We can be reached at 1.800.882.9110, +1.208.772.8515 or www.transtector.com.

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START - UP

WARNING

THERE ARE DANGEROUSLY HIGH VOLTAGES PRESENT WITHIN THE ENCLOSURE OF THE POWERSUPPLY SYSTEM. CAUTION MUST BE TAKEN WHEN WORKING WITH THE ENCLOSURE. IT IS RECOMMENDED THAT ALL WORK BE PERFORMED BY QUALIFIEDELECTRICAL PERSONNEL ONLY.

NOTE: INITIAL START-UP SHOULD BE PERFORMED WITH NO LOAD ON SYSTEM.

1. Re-install all panels that may have been removed during installation.
2. Make sure the input circuit breaker is in the off position.
3. Energize the primary building power.
4. Turn on the main AC input breaker.
5. Verify that the output voltage is within the specified range.
6. Verify output phase rotation is correct.
7. Turn the system off.
8. Connect the loads one at a time and repeat Step 4.

PREVENTIVE MAINTENANCE

WARNING

DANGER OF ELECTRICAL SHOCK, TURN OFF ALL POWER SUPPLYING THIS EQUIPMENT PRIOR TO MAINTENANCE.

To ensure longer component life and trouble-free operation, minor preventive maintenance procedures should be performed at regular intervals, for example once every year. More frequent inspection intervals would be needed for more severe operating conditions and larger number of hours of continuous operation.

9. Remove front and side panels and at each service inspection any accumulated dust, dirt or foreign particles should be carefully removed. Special care should be exercised in cleaning the thyristors (SCR's), heat sinks and the control assembly.
10. Inverse Parallel Silicon Rectifiers (SCR's) or Thyristors. The silicon controlled rectifiers (SCR's or Power Mods) usually fail in the shorted mode. When this happens, normally the fusible link in series with the SCR will be blown open to clear the short and prevent damage to the transformers. If a blown SCR is suspected, contact Transtector for service.
11. A simple performance checklist has been developed for use in maintenance. See "Performance Checklist" and check off items 1-8.
12. After items 1-8 have been checked on the "Performance Checklist", the next step is to check the operation of the system.
13. Replace front and side panels. Turn unit on with no load. Check item 9 on the "Performance Checklist".
14. Turn on loads and check items 10-13 off the "Performance Checklist".

NOTE: Preventive Maintenance Plans are available. Please contact the Customer Support Group for information. Call 1-800-882-9110.

PERFORMANCE CHECKLIST

Company_____

Model #_____ Serial #_____

1. Customer Comments or Problems_____
2. Power Conditioner Environment Clean and Dust Free Yes_____ No _____
3. Phase Rotation Correct (ABC) Yes_____ No_____
4. Electrically wired properly ie...Conductor Sizing, Breakers, Grounding
5. Verify Input Voltage (See spec. tag)
6. Check Tightness of Electrical Connections:

   _____Input Connections

   _____Output Connections

   _____Heatsink Connections (SCR's)

   _____Circuit Board Connections

   _____By-Pass Switch

   _____Fuse Connections

   _____Fan Connections

   _____Transformer Connections
7. Exercise all circuit breakers

   _____Input Breaker

   _____Output Breakers
8. Resistance Check of all Semiconductors Power Mods (SCR's):

Phase A	Phase B	Phase C
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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9. Input/Output Voltage Checks (Adjust as Needed).

No Load Input		No Load Output			
A-B_____VAC_____		AN_____VAC		A-B_____VAC	
B-C_____VAC_____		BN_____VAC		B-C_____VAC	
A-C_____VAC_____		CN_____VAC		A-C_____VAC	

10. 1Available Load Input Available Load Output

A-B_____VAC_____	A-N_____VAC	A-B_____VAC	
B-C_____VAC_____	B-N_____VAC	B-C_____VAC	
A-C_____VAC_____	C-N_____VAC	A-C_____VAC	

11. Input/Output Current Checks (Balance as Needed).

Input	Output
A_____ Amps	A_____ Amps
B_____ Amps	B_____ Amps
C_____ Amps	C_____ Amps
	N_____ Amps
	G_____ Amps

12. Fans Operational_____

13. Testing Shutdown Circuitry ie...REPO, Over/Under Voltage_____

14. Comments: _____

_____

_____

_____

GENERAL TROUBLESHOOTING

WARNING

THERE ARE DANGEROUSLY HIGH VOLTAGES PRESENT WITHIN THE ENCLOSURE OF THE POWER SUPPLY SYSTEM. UNDER NO CIRCUMSTANCES SHOULD ANY PERSON REACH WITHIN THE ENCLOSURE OF THIS EQUIPMENT. ALL SERVICE TO THIS PIECE OF EQUIPMENT SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

SYMPTOM	PROBABLE CAUSE
No input on one or more phases	A) No input B) Blown fuse C) Defective SCR or power mod D) Defective Control Card E) Defective Sense Card
Output is too high or too low	A) Input out of range B) Control Card Adjustment C) Defective Control Card D) Defective sense card E) Defective SCR or power mod
Input breaker is tripping off	A) System Overload B) Defective Breaker C) Shorted Taps Reserved for future use

TROUBLESHOOTING

WARNING

THERE ARE DANGEROUSLY HIGH VOLTAGES PRESENT WITHIN THE ENCLOSURE OF THE POWER SUPPLY SYSTEM. UNDER NO CIRCUMSTANCES SHOULD ANY PERSON REACH WITHIN THE ENCLOSURE OF THIS EQUIPMENT. ALL SERVICE TO THIS PIECE OF EQUIPMENT SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

NOTICE: CIRCUIT DIAGRAMS IN THIS MANUAL ARE FOR REFERENCE ONLY. ALWAYS REFER TO THE ACTUAL CIRCUIT DIAGRAMS RECEIVED WITH THE SYSTEM.

INTRODUCTION

This procedure is written in a specific order and must be used from start to finish when troubleshooting. Any steps skipped over may cause serious damage to the system.

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EQUIPMENT REQUIRED

True RMS Digital multimeter, SCR tester, common hand tools, spare parts kit (contact service center at 1-800-882-9110 X 6112).

STEP 1. DISASSEMBLING THE POWER LINE CONDITIONER

A. Turn off the power to the Power Conditioner at its source.

B. Turn off the input circuit breaker on the unit and the output circuit breakers to all loads. (Remove all loads from unit).

C. Remove the front and side covers to the Power Conditioner. Refer to Diagrams in “Appendix A - Cabinet Layout”.

STEP 2. ELECTRICAL CONNECTIONS, FUSES

Refer to Diagrams in “Appendix A - Component Location Diagrams” for component locations.

A. Inspect the unit for proper tightness of all electrical connections, burnt, frayed, broken or loose connections and components in these areas. Input and output connections, SCR assembly, SCR snubber, output filter assembly, MOVs (metal oxide varistors), circuit boards, bypass switch and transformer connections.

B. Correct and tighten any loose connections, replace any physically burned or broken components.

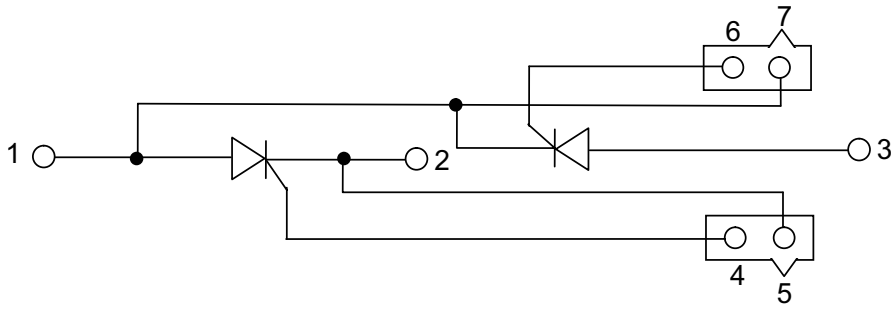
C. Check all fuses in system *. Time delay fuses, fan fuses, circuit board fuses, SCR fusible Link wire.

POWER MODULES (SCR’s)

Refer to the diagram below and the diagram in “Appendix A - Heatsink Layout”.

1. Unplug the connections to the control cards Part # 414921 labeled TB1, TB2 and TB3.
2. Disconnect any cooling fans in the unit so your SCR resistance checks are not interfered by fan motor coils. Each power mod contains 2 inverse parallel SCR’s.





3. Measure the following resistance on each power module. There are 7 per phase or 21 for all three phases. *Refer to the circuit diagrams received with your unit.

Note: When checking the power module assembly, if more than one defective power module is present it will appear as if all the power modules are defective. If this is the case, the individual power module must be isolated from the power transformer.

4. A. K1-1 to K2-1 thru K1-7 to K2-7=High resistance, 1 Meg Ohm.

   B. K1-1 to G1-1 thru K1-7 to G1-7=10 to 90 Ohms.
   K1-1 to G2-1 thru K1-7 to G2-7=1 Meg Ohm.

   C. K2-1 to G2-2 thru K2-7 to G2-7=10 to 90 Ohms.
   K2-1 to G1-1 thru K2-7 to G1-7=1 Meg Ohm.

   D. G1-1 to G2-1 thru G1-7 to G2-7=1 Meg Ohm.

5. Replace any defective power mods. This may require removing the shunt and loosening the K1 bus from all the power modules to get the defective power module out. Use only equivalent hardware and heat sink grease when replacing power modules.

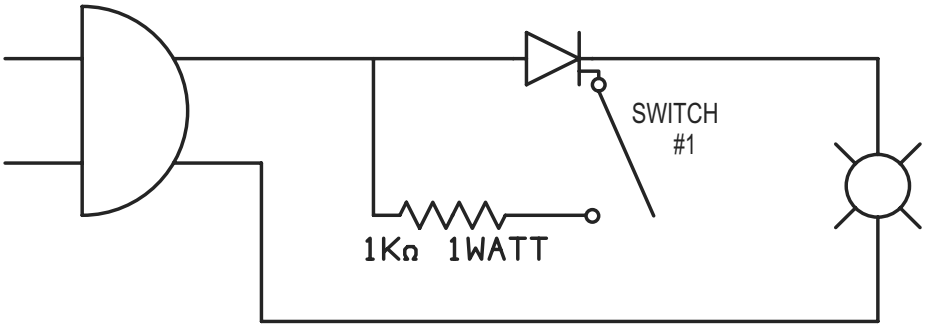
6. If a resistance measure is questionable, a more thorough test will assure an SCR is good or bad by using the following test procedure.

   A. Completely isolate SCR under test by removing all connections to the device.

   B. Hook up the following test circuit to each individual SCR.

   C. Plug in SCR tester. With Switch #1 open light bulb should be off. If not, replace SCR.

   D. Close Switch #1. Light bulb should illuminate to about 3/4 brilliance. If not, replace SCR.



7. Re-assemble the power module assembly, make sure all connections are tight.

CHECK THE SCR SNUBBER CARD

1. Three components make up the SCR snubber. (Resistors, MOVs and Capacitors). Check for open resistors. Check MOVs for shorts, they should read high resistance when ohm meter is placed across them. Resistance check each capacitor. The DC resistance across the snubber capacitor should look capacitive-that is high resistance after the meter charges the capacitor. If it measures open or shorted, replace the snubber card.

2. Re-connect all wires and fans. Double check that all connections are secure. Do not connect TB1, TB2 and TB3 connectors from the control cards #414921 yet!

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CHECK CONTROL CARD AND FILTER CARD

1. Verify input to the Power Conditioner matches the units specification. Also verify correct control board # 414921 jumper setup in "Appendix A - Control Board Layout".

2. Turn on AC input breaker to unit.

IMPORTANT: Extreme caution must be taken when measuring voltages on Molex connectors. Do not press meter leads into connectors or bend connectors back.

3. Measure the following voltages on wires feeding the TB1 Molex connector to the control card on all 3 phases.

   Pins 1 & 3 = 4-6 VAC.

   NOTE: When the connector is plugged in this voltage is around 3 VAC.

   Pins 7 & 8 = 120 VAC

If this voltage is incorrect or not present, then check the fuses associated with the filter card or replace filter card and re-check voltages.

4. Turn main AC circuit breaker off. Plug in connectors TB1 and TB3 ONLY!!! on the control card # 414921 on all 3 phases.

5. Turn main AC on.

   NOTE: Refer to "Appendix A - Control Board Layout" for test points and pot locations on control card.

6. Use the following formula to calculate the next adjustments. You must calculate each input phase for each control card or a total of 3 calculations.

   A. For phase 1 control card measure AC input at Line 1 to Line 2.

   B. For phase 2 control card measure AC input at Line 2 to Line 3.

   C. For phase 3 control card measure AC input at Line 1 to Line 3.

FORMULA X

$$\frac{\text{Actual AC Input} \times 2.59}{480\ (\text{Nominal})} = \text{Volts DC at TP2}$$

Example: $\frac{475\ \text{Volts AC Input} \times 2.59}{480\ (\text{Nominal})} = 2.56\ \text{Volts DC at TP2}$

7. After calculations are complete, place DC voltmeter on the 20 volt scale and check between TP2 and TP GND on control card. Adjust pot P1 so meter reads DC level calculated in Step 7 for all three phases.

   NOTE: If adjustments in Steps 5 and 6 are not possible, replace control card # 414921 and repeat Steps 5 and 7.

   NOTE: Be sure to turn power off when replacing circuit boards.

   NOTE: Be sure AC input is stable when making this adjustment. If the input changes, you must recalculate.

   NOTE: Output voltage correction is a "stepped correction", adjusting P1 will not cause a smooth change in output voltage as it is adjusted.

8. Turn the unit off. Plug in TB2 Molex connectors to all the control cards # 414921.

   NOTE: P1 pot turned clockwise = decrease in output voltage and counter-clockwise = increase in output voltage. By changing this adjustment on phase 1 you may see the output voltage change from line to neutral on two phases. It is best to use the procedures in Steps 1 – 8 for adjusting.

FINAL TESTING & ADJUSTMENT

1. Connect AC voltmeter to output of system with proper meter scale selected.

   NOTE: On 3 phase systems, connect your AC voltmeter across the output phase to neutral.

2. Disconnect customers loads.

3. Energize system.

4. Verify the output is within specifications. If not, adjust P1 on control board, for the appropriate phase. See “Control Board Adjustments”.

   NOTE: On 3 phase systems, be sure and check all 3 phases.

5. Turn the input circuit breaker off.

6. Connect customers equipment.

7. Energize system.

8. Repeat step #4 and adjust as needed.

CONTROL BOARD ADJUSTMENTS

CONTROL BOARD ADJUSTMENTS (#414921) FIELD ADJUSTMENT PROCEDURE



WARNING

THERE ARE DANGEROUSLY HIGH VOLTAGES PRESENT WITHIN THE ENCLOSURE OF THE POWER SUPPLY SYSTEM. UNDER NO CIRCUMSTANCES SHOULD ANY PERSON REACH WITHIN THE ENCLOSURE OF THIS EQUIPMENT. ALL SERVICE TO THIS PIECE OF EQUIPMENT SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

CAUTION

THE CONTROL BOARD (#414921) IS ELECTRICALLY REFERENCED TO HIGH VOLTAGE, NOT EARTH OR CHASSIS GROUND. EXTREME CARE MUST BE USED WHEN TAKING MEASUREMENTS ON THE CONTROL BOARD. ANY AC POWERED INSTRUMENTS MUST BE GROUND ISOLATED PRIOR TO TAKING MEASUREMENTS. A GROUND ISOLATED INSTRUMENTCASE WILL BE AT THE HIGH VOLTAGE LINE POTENTIAL.

ADJUSTMENT PROCEDURE

1. Prior to attempting any adjustment, measure the incoming voltage to the unit. Assure the voltage level is within the specified input range of the unit.

2. Turn off power to unit.

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3. Remove all loads from the output of unit under adjustment.
4. Remove both TB2 connectors on all control boards # 414921 (See “Appendix A - Control Board Layout”). Turn power on.
5. Use Formula X to calculate the next adjustments. You must calculate each input phase for each control card or a total of 3 calculations.

   A. For phase 1 control card, measure AC input at Line 1 to Line 2.

   B. For phase 2 control card, measure AC input at Line 2 to Line 3.

   C. For phase 3 control card, measure AC input at Line 1 to Line 3.

FORMULA X

$$\frac{\text{Actual AC Input} \times 2.59}{480 \text{ (Nominal)}} = \text{Volts DC at TP2}$$

Example: $\frac{475 \text{ Volts AC Input} \times 2.59}{480 \text{ (Nominal)}} = 2.56 \text{ Volts DC at TP2}$

NOTE: Be sure AC input is stable when making this adjustment. If the input changes, you must recalculate.

6. After calculations are complete, place DC voltmeter on 20 volt scale and check between TP2 and TP GND on control card. Adjust pot P1 so the meter reads DC level calculated in Step 5 for all 3 phases.

   NOTE: Output voltage correction is a “stepped correction”, adjusting P1 will not cause a smooth change in output voltage as it is adjusted.

7. Turn unit off and reconnect TB2 connectors on all control boards.
8. Turn unit on, verify output is correct by monitoring the output from each line to neutral. If not, make sure input power is stable and repeat adjustment procedure.

   NOTE: P1 Pot turned clockwise =decrease in output voltage and counter clockwise = increase in output voltage. By changing this adjustment on 1 phase you may see the output voltage change from line to neutral on 2 phases. It is best to use procedures in Steps 1-8 when adjusting.

9. Turn the unit off. Plug in TB2 and TB3 molex connectors to the control board.
10. Replace any fuses or wiring that may have been removed for the shutdown circuitry.

PARTS LIST

QTY	208 V Input Part #	240V Input Part #	480V Input Part #	600V Input Part #	Description
1	204587	204587	204587	204587	Main transformer
1	110877	110281	110217	111822	Main input breaker
6	17694	17694	17694	17694	Filter capacitor
3	17691	17691	17691	17691	Filter resistor
3	16638	16638	16638	16638	Sense fuse (.75 A)
3	109580	109580	109580	109580	Control fuse (SC-30)
1	13789	13789	13789	13789	Control Relay
1	13696	13696	13696	13696	Pilot light Red (Alert)
3	108876	108876	108876	108876	Pilot light Green (A,B,C)
3	23888	23888	23888	23888	Sense Board
3	35372	35372	35372	35372	Snubber Board
3	414921	414921	414921	414921	Main Control Board
1	100813	100813	100813	100813	Bypass switch

QTY	120/208V Output Part #	277/480V Output Part #	Description
1	110924	110213	Output circuit breaker
3	302284	301357	Heat sink assembly
3	407753	407753	Heat sink
21	109906	104583	Power module (SCR)
3	13319	13319	Thermal Sensor
6	104607	104607	Fusible link
3	110939	110939	Diode
1	16805	16805	Cooling fan
2	103759	103759	Blower motor

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SPECIFICATIONS

SCOPE

This specification covers the electrical characteristics of the Transtector Power Conditioner which provides clean regulated power for the entire Accuray CyberKnife.®

GENERAL

The Power Line Conditioner consists of a front access power cabinet incorporating an all copper, multiple tapped, triple shield isolation/ regulation transformer. The ultra low output impedance of the transformer in conjunction with the electrostatic shields assures precision hospital grade performance with excellent noise and transient attenuation. Independently controlled inverse parallel electronic switches for each of the 7 taps per phase provide

tight regulation over a wide input range. Linear devices are used for line synchronization to prevent phase shift errors normally associated with simple CT zero current crossing acquisition. The microprocessor control accurately selects the correct tap to provide line voltage regulation of + 2.0% typical, correcting for voltage disturbances within one cycle. Digital processing technique provides fast and accurate regulation without output voltage over or undershoots.

MODEL NUMBERS

MODEL	INPUT VOLTAGE	OUTPUT VOLTAGES
8BLX-75 K (I) -700A/V-S	208 VAC nominal input	208/120 VAC output
8BNX-75 K (I) -700A/V-S	208 VAC nominal input	480/277 VAC output
8CLX-75 K (I) -700A/V-S	240 VAC nominal input	208/120 VAC output
8CNX-75 K (I) -700A/V-S	240 VAC nominal input	480/277 VAC output
8DLX-75 K (I) -700A/V-S	480 VAC nominal input	208/120 VAC output
8DNX-75 K (I) -700A/V-S	480 VAC nominal input	480/277 VAC output
8ELX-75 K (I) -700A/V-S-C	600 VAC nominal input	208/120 VAC output
8ENX-75 K (I) -700A/V-S-C	600 VAC nominal input	480/277 VAC output

**Standard models shown above*

AGENCIES

STANDARDS

The systems shall be designed in accordance with:
American National Standards Institute
Institute of Electrical and Electronic Engineers
National Electric Code (NEC)
National Fire Protection Association (NFPA Article 70)
Underwriters Laboratories (UL) 1449, 1012
FCC Article 15, Section J, Class A
ISO 9001

LISTINGS
The system shall be listed to C-UL, UL standard UL1012
The system shall comply to: FCC Article 15, Section J, Class A and
ANSI C62.14 (electromagnetic compatibility)

DYNAMIC ELECTRICAL CHARACTERISTICS

OPERATING VOLTAGE AND OUTPUTS

The input voltage shall be 208VAC, 240VAC or 480VAC, Delta, three phases, 60Hz. The standard transformer design shall be capable of accepting three (3) input voltages, 208 VAC, 240 VAC or 480 VAC. Each unit will be pre-wired at the factory to accommodate the alternative nominal input voltage. The input voltage and input breaker can be changed in the field to accommodate an alternative input voltage. Units with other input voltages (i.e. 380, 400, 415, 600 VAC) and/or frequencies (50 Hz) are produced upon request.

LINE VOLTAGE REGULATION

- Nominal Input Line Voltage +10% to –15%
- 3.2.1 Output Line Voltage Regulation for the CyberKnife® System is typically +2.0%
- The design of the system shall indicate that with an input voltage of -10% of nominal, increasing the load to 1000% shall cause the output voltage to fall no lower than -6%.

OUTPUT VOLTAGE
The output voltage shall be 208/120 VAC or 480/277 VAC, 3 phase 4 wire, in a WYE configuration

OUTPUT CONNECTIONS
A 150 Amp three (3) pole circuit breaker is provided for the 208/120 VAC output, or a 100 Amp three (3) pole circuit breaker provided for the 480/277 VAC output.

INPUT/OUTPUT WIRING
The input/output wiring sizes are dependent upon the terminals provided by the circuit breakers.

Input Wiring Sizes

208 VAC	#3/0 AWG to 350 MCM
240 VAC	#4 AWG to 4/0 AWG
480 VAC	#14 AWG to #3/0 AWG
600 VAC	#14 AWG to #3/0 AWG

Output Wiring Sizes

208/120 VAC	150 Amp breaker	#14 AWG to #3/0 AWG
480/277 VAC	100 Amp breaker	#14 AWG to #3/0 AWG

The ILSCO TA-2/0 terminal allows wire sizes from #14 to 2/0 AWG to be connected to the ground.

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RESPONSE TIME
Response time is less than 1/2 cycle.

CORRECTION TIME
The output voltage is corrected within 1 cycle.

LOAD REGULATION
The output is maintained to within 2% of nominal or less, from no load to full load.

IMPEDANCE
Output impedance shall be less than 2.0%

OPERATING FREQUENCY
60 Hertz + 3 Hertz

HARMONIC DISTORTION
Less than 1% THD added to the output waveform under any dynamic linear loading conditions presented to the line regulator.

TURN-ON CHARACTERISTICS
When energized the voltage overshoot is 5% or less of the nominal voltage for less than 1 cycle.

OVERLOAD RATING
200% for ten seconds.
1000% for one cycle.

NOISE ATTENUATION
Common mode noise attenuation is typically 140 dB or greater.
Transverse mode noise attenuation is 3 dB down at 1000 Hertz, 40 dB down per decade to below 50 dB with a resistive load.

AUDIBLE NOISE
Not to exceed 55dB measured @1 meter

EFFICIENCY
Efficiency shall be > 96% typical at full load. Excitation losses shall be less than 1.5% of KVA rating

BTU
The Power Line Conditioner shall generate no more than 6,820 BTU/Hour in typical use.

POWER FACTOR
Input power factor shall be greater than .95 with a resistive load and reflect no triplen harmonics to the utility under non-linear loads.

LINE TO LINE BALANCE
The Power Line Conditioner shall not produce more than a 2% phase to phase unbalance

MTBF
The system shall exhibit a MTBF > 10,000Hr.

ENHANCED TRANSIENT OVERVOLTAGE SURGE SUPPRESSION
For 208/120 VAC outputs: A Transtector model MCP 120 W, silicon avalanche diode TVSS shall be installed parallel to the secondary output of the power line conditioner to provide bi-directional and bi-polar surge protection. The unit shall be non-degrading and provide <330 volt SVR rating. The suppression network systems shall conform to UL 1449 ratings when subjected to ANSI/IEEE 62.41-1991 category C1/B3 waveforms. The surge suppressor is installed on the load side of the transformer, connected in parallel.

For 480/277 VAC outputs: An enhanced surge protection device (SPD) shall be installed parallel to the secondary output of the power line conditioner to provide all mode, bi-directional and bi-polar surge protection. The SPD is rated for 100 Ka per phase, 50 Ka per mode capacity. (L-L, L-N, L-G, N-G) The suppression network systems shall conform to UL 1449 ratings when subjected to ANSI/IEEE 62.41-1991 category C1/B3 waveforms. The surge suppressor is installed on the load side of the transformer, connected in parallel.

MAIN TRANSFORMER

BASIC CONSTRUCTION
The transformer windings are of all copper conductor construction with separate primary and secondary isolated windings.

MAGNETIC
Grain oriented, stress relieved silicon transformer steel is utilized to minimize losses and provide maximum efficiency. Flux density will not exceed 14k gauss.

INSULATION
Class N (200° C) insulation is utilized throughout.

SHIELDING
The transformer has multiple (three) copper shields to minimize inner winding capacitance, transient and noise coupling between primary and secondary windings. Inner winding capacitance is limited to .001 pf or less.

COOLING
The transformer is designed for natural convection cooling. Fans are inside the unit.

OPERATING TEMPERATURE
The system operating range: 0 to 40 degrees C, 32 to 104 degrees Fahrenheit

OPERATING HUMIDITY
0-95% relative humidity, non-condensing.

MAIN INPUT BREAKER
A main input molded case, thermal magnetic circuit breaker, rated at 125 % of the full load input current, is furnished as an integral part of the unit. For example, a 200 Amp input breaker will be provided for 208 VAC input, a 175 Amp breaker will be provided for a 240 VAC input, or a 100 A input breaker will be provided for 480 VAC input. A 70 Amp input breaker will be provided for 600 VAC input.

BY-PASS SWITCH
A manually operated rotary bypass switch provides bypassing of the SCR controlled voltage regulator portion of the Power Line Conditioner. The Power Line Conditioner can be operated in either the on-line or bypassed mode with one turn of the switch. The transformer and surge suppression circuitry remains in the circuit when in the bypass mode. The output will remain at 208/120 VAC or 480/277 VAC, three (3) phase 4 wire WYE. The bypass switch is located on the front of the unit.

MONITORING

ALERT LIGHT
An indicator light shall annunciate that the output has been disabled by one of the following conditions.
(1) Transformer over-temperature
(2) SCR thermal over-temperature

INDICATING LAMPS
Output “ON” indicating lamps shall provide for each phase.

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CABINET

TERMINATION
Input and output terminations shall be front access. Input terminations shall be made directly to the main input circuit breaker and the input ground terminal provided. Output terminations shall be made directly to the output circuit breakers and neutral & ground copper bus provided.

The unit is constructed using an isolation transformer and is considered to be a “separately derived system”. It should be grounded in accordance with the NFPA 70 article 250.20 “Alternating-Current Circuits and Systems to be Grounded”, article 250.20 (D) “Separately Derived Systems” and article 250.30 “Grounding Separately Derived Alternating-Current Systems”

The Output Neutral and Ground is bonded at the output of the transformer and is considered a single, separately derived, power source and should be wired accordingly.

VENTILATION
Ventilation originates from the front of the cabinet, exiting through the top.

MOBILITY
The Power Line Conditioner cabinets are equipped with angle iron supports that allow for transport by pallet jack or fork lift. These can be used for mounting unit to the floor in seismic zones.

ACCESABILITY
The Power Line Conditioner will have front access. Access to all wiring inputs, outputs, bypass and breakers will be accessible through the front access panels. The back of the unit may be set next to a wall without impeding access. It will also incorporate with lift off side panels.

WEIGHT
Unit weight: Approximately 1142 lbs (518 kg)

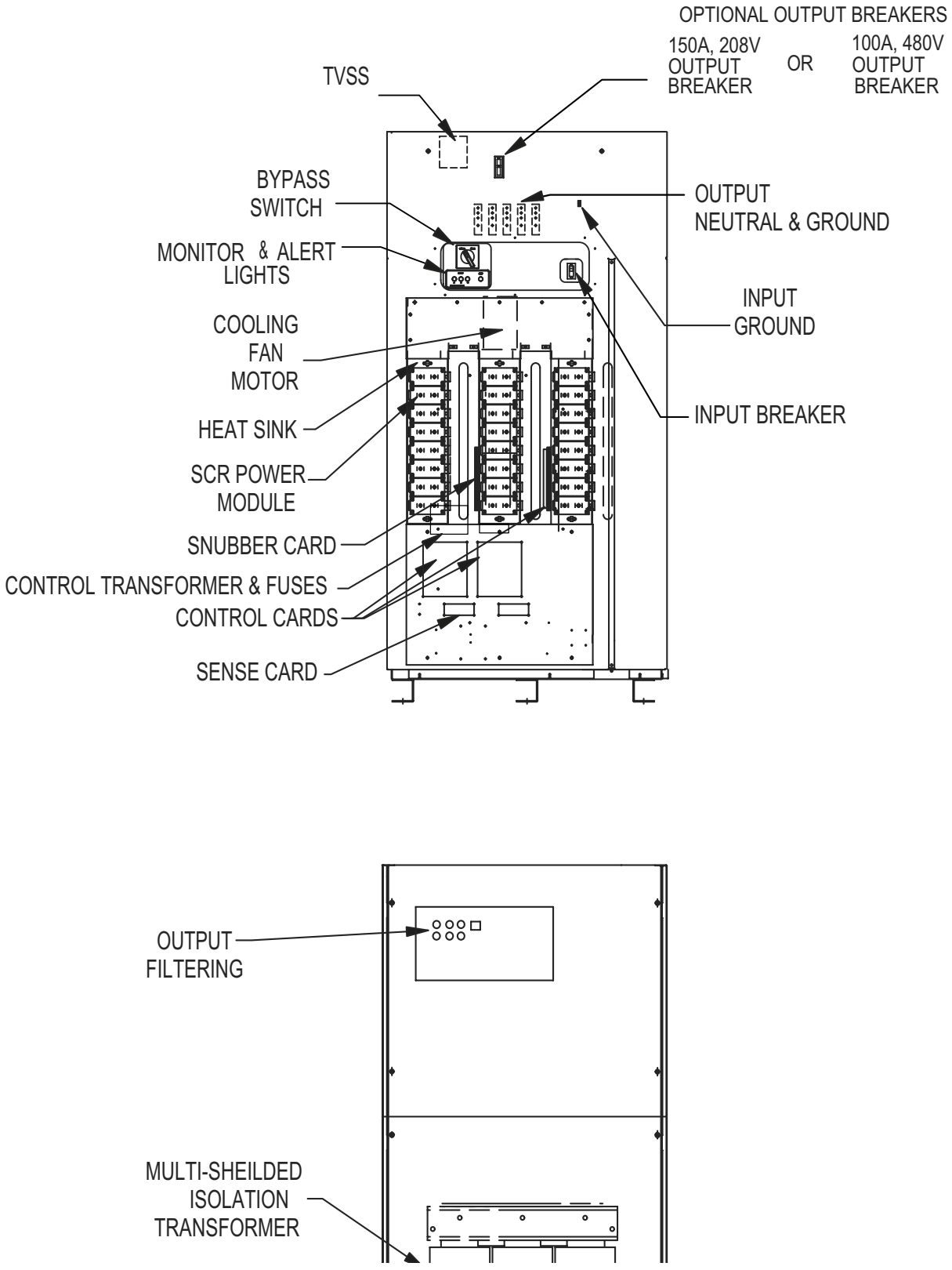
DIMENSIONS
29” Wide x 35.875” Deep x 66” Height (73.6 cm x 91.12 cm x 167.64 cm)

CONTROLS
The control portion of the cabinet containing the circuit boards and connection to the semi-conductor devices is separate from the transformer section and apart from the input and output power connections.

WARRANTY
Units within the contiguous United States (lower 48 states) shall include a comprehensive warranty for the first year, covering all parts and workmanship, inclusive of onsite labor and travel expenses. All units shall further be covered under a standard two year warranty covering parts and workmanship.

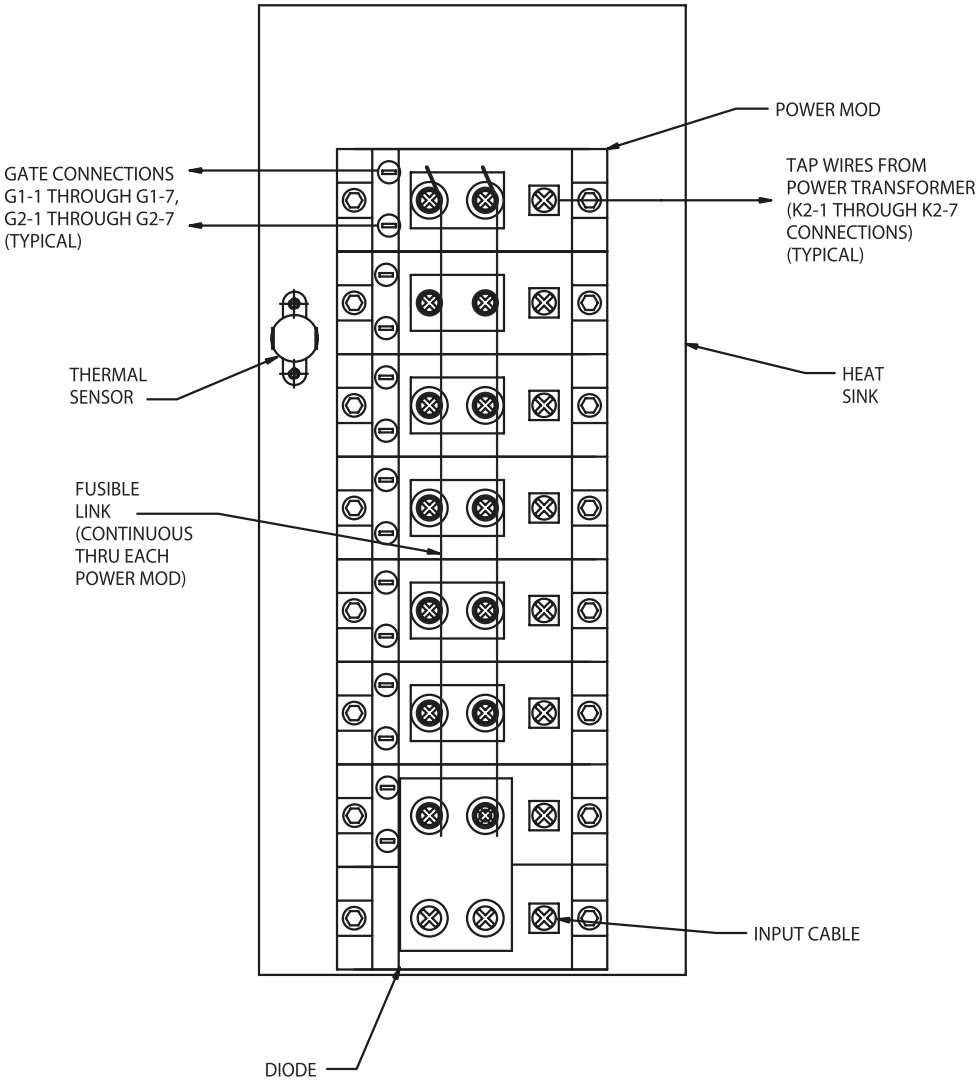
SERVICE
Transtector shall provide immediate phone support/consultation and if possible, same day parts shipment. (contact must be prior to 12:00 PM PST). If necessary, onsite service shall be scheduled the same day for service to be conducted within 24 to 48 hours, based on customer requirements. Typical service hours are 8 AM to 5 PM Monday through Friday.

APPENDIX A: COMPONENT LOCATION DIAGRAM



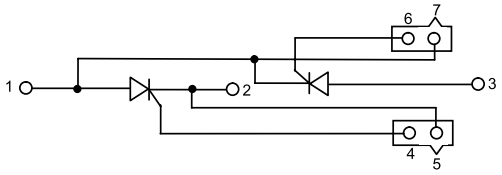
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APPENDIX A: HEAT SINK ASSEMBLY LAYOUT

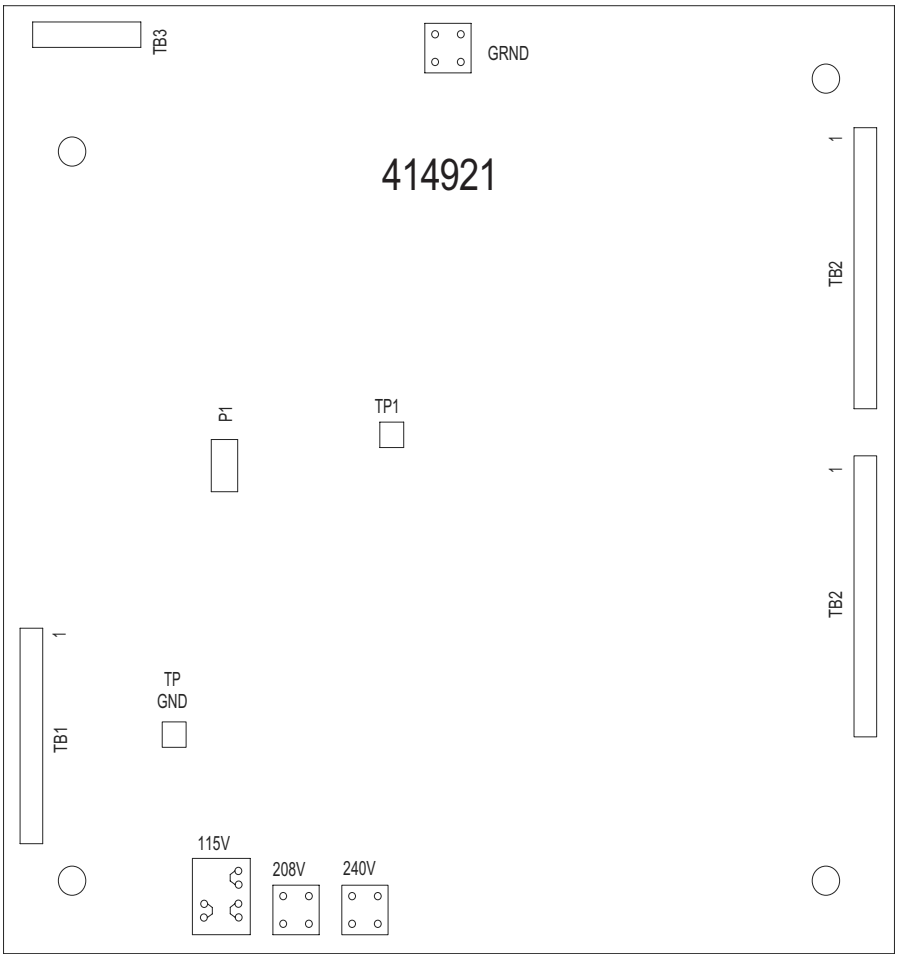




POWER MOD



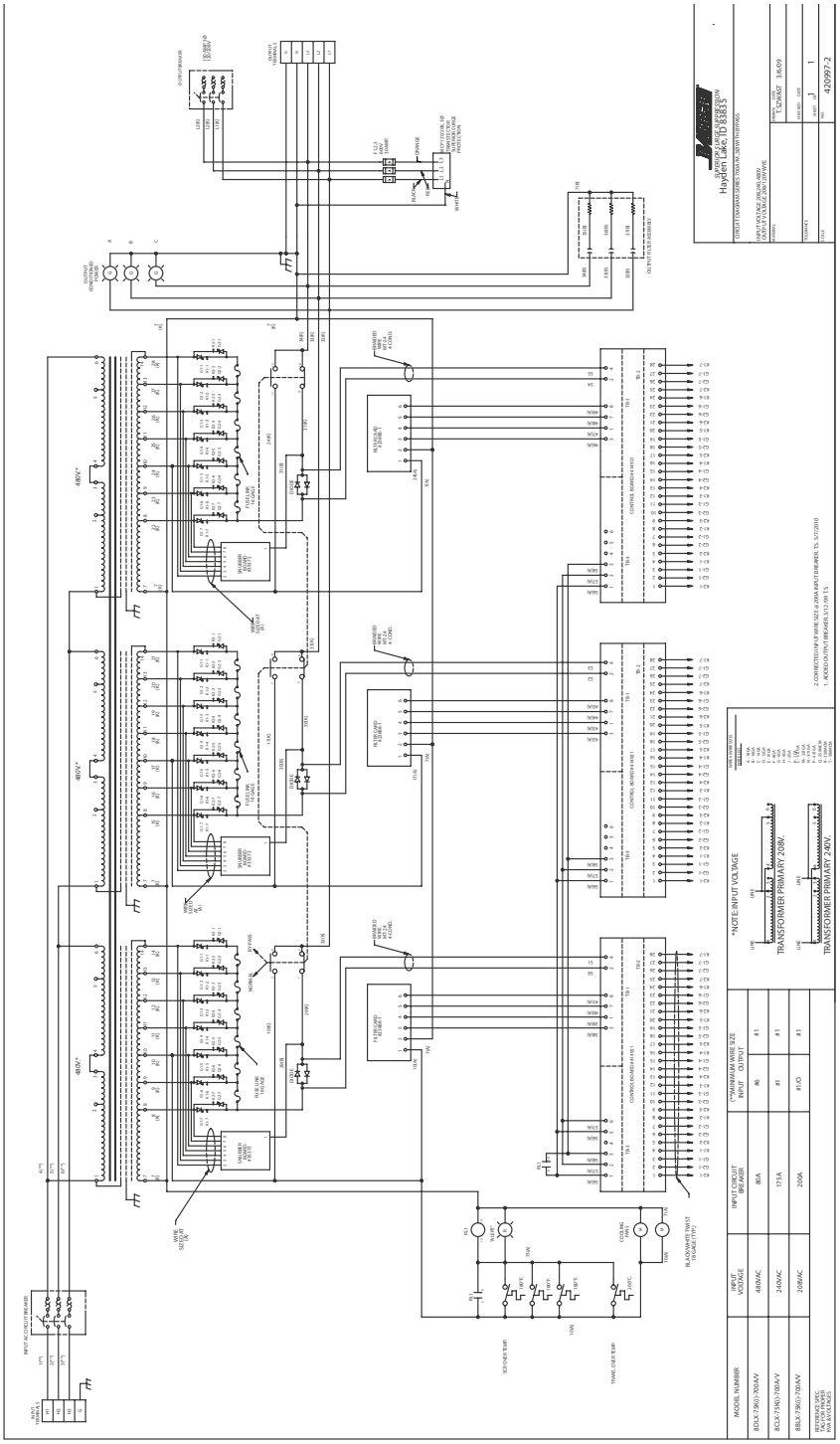
APPENDIX A: CONTROL BOARD LAYOUT



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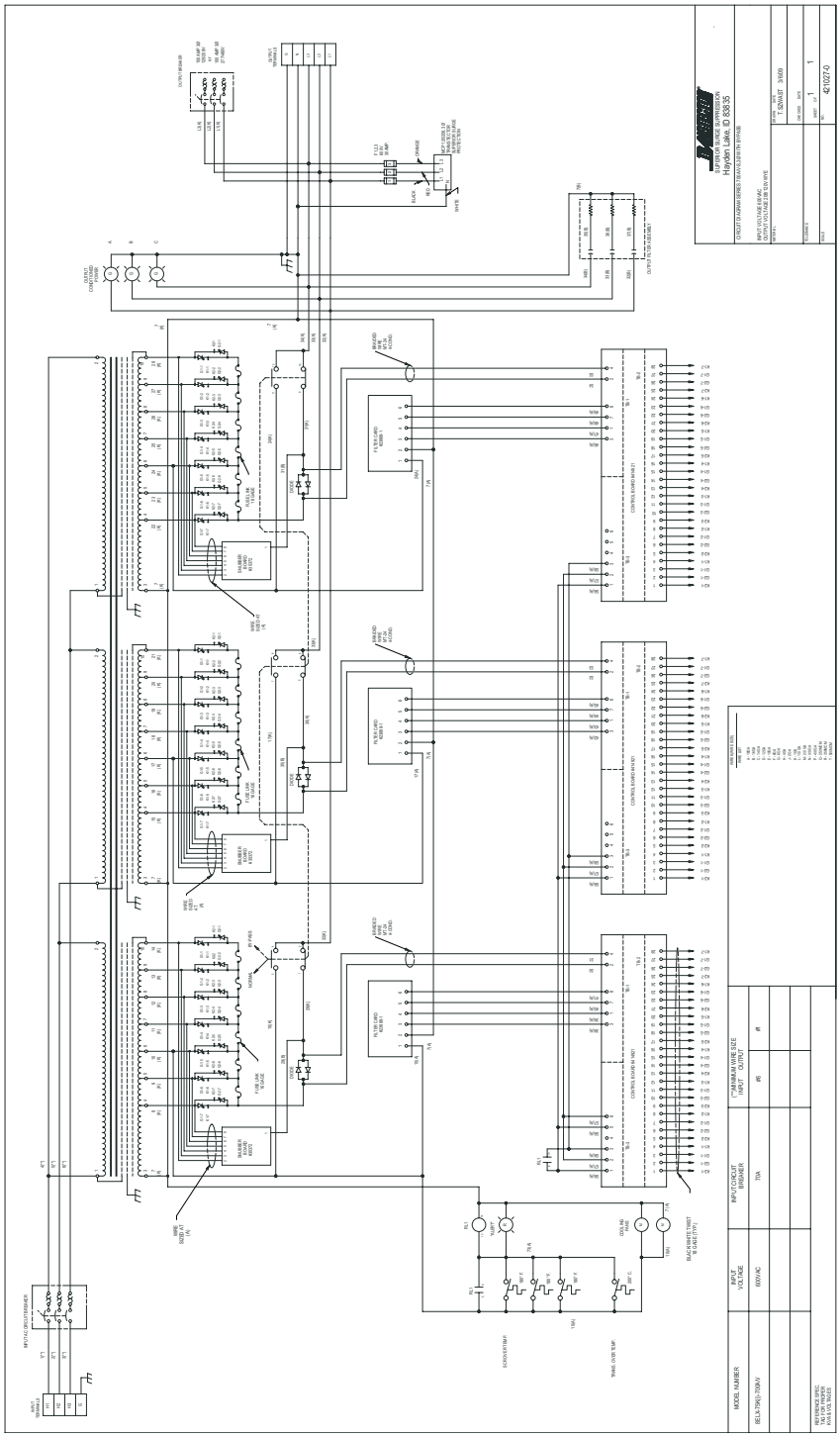
APPENDIX A: CIRCUIT DIAGRAM

CIRCUIT DIAGRAM - 208V, 240V or 480V INPUT - 208/120V OUTPUT



APPENDIX A: CIRCUIT DIAGRAM

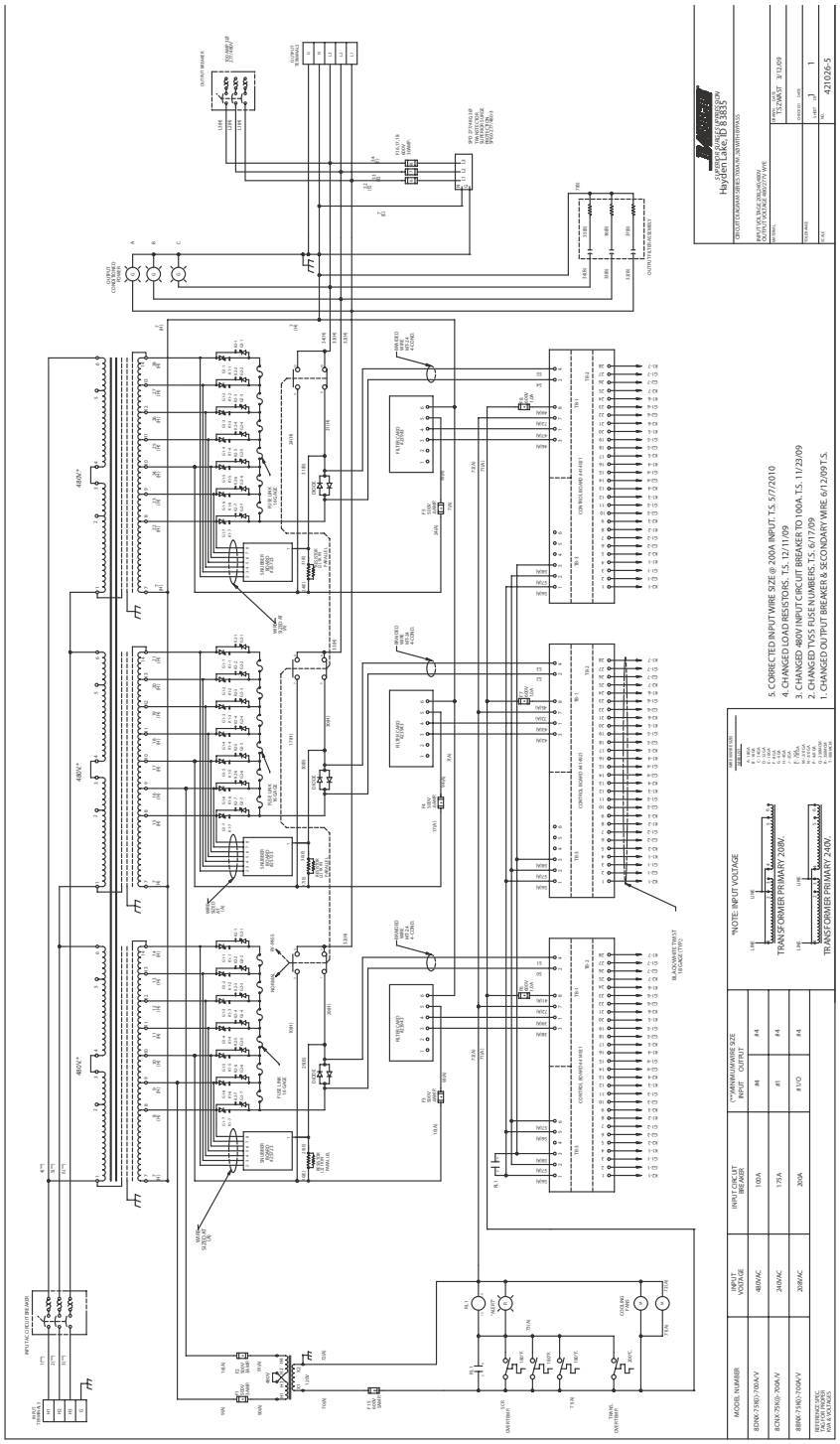
CIRCUIT DIAGRAM - 600V INPUT - 208/120V OUTPUT



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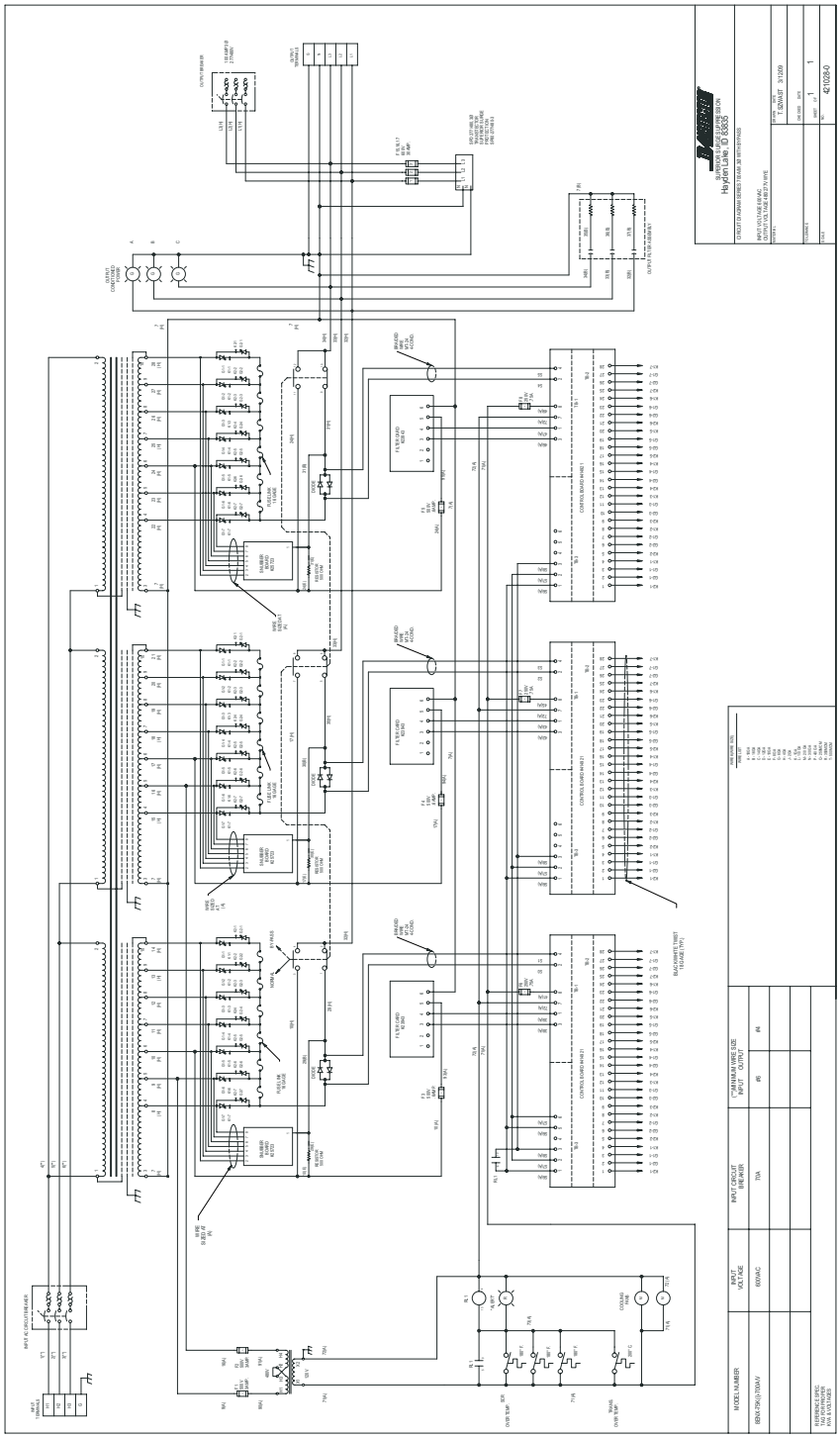
APPENDIX A: CIRCUIT DIAGRAM

CIRCUIT DIAGRAM - 208V, 240V or 480V INPUT - 480/277V OUTPUT



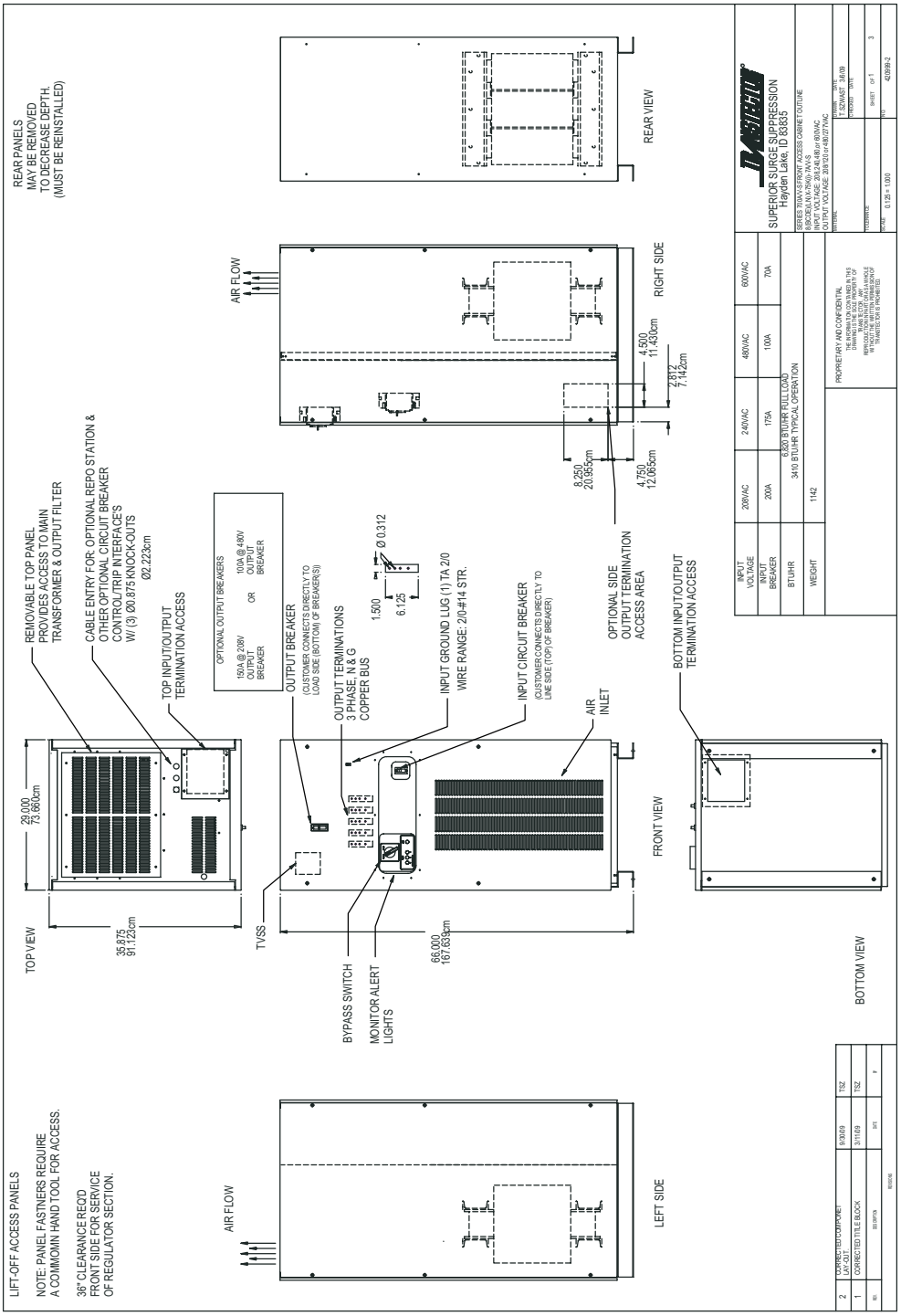
APPENDIX A: CIRCUIT DIAGRAM

CIRCUIT DIAGRAM - 600V INPUT - 480/277V OUTPUT

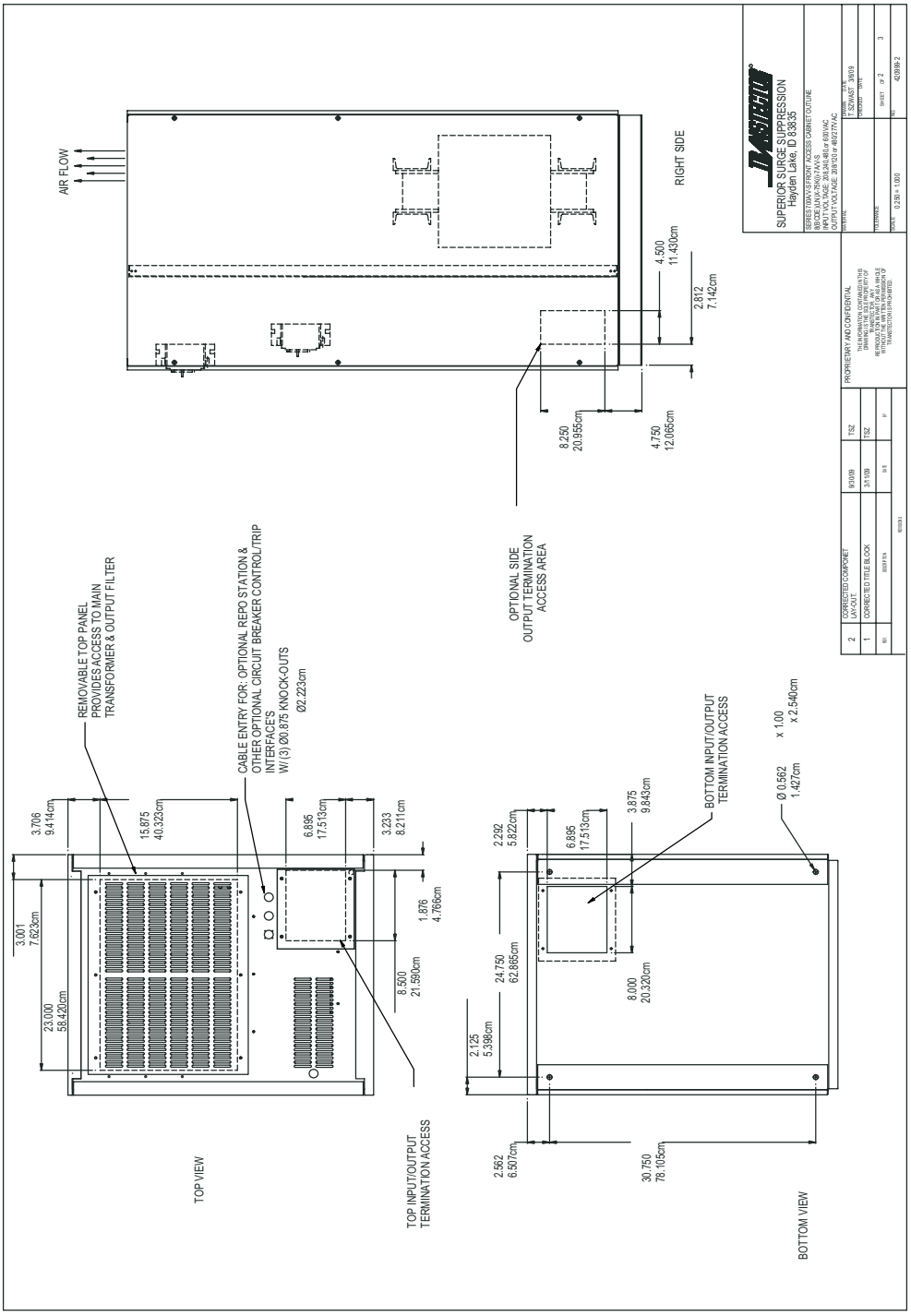


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APPENDIX A: CABINET LAYOUT

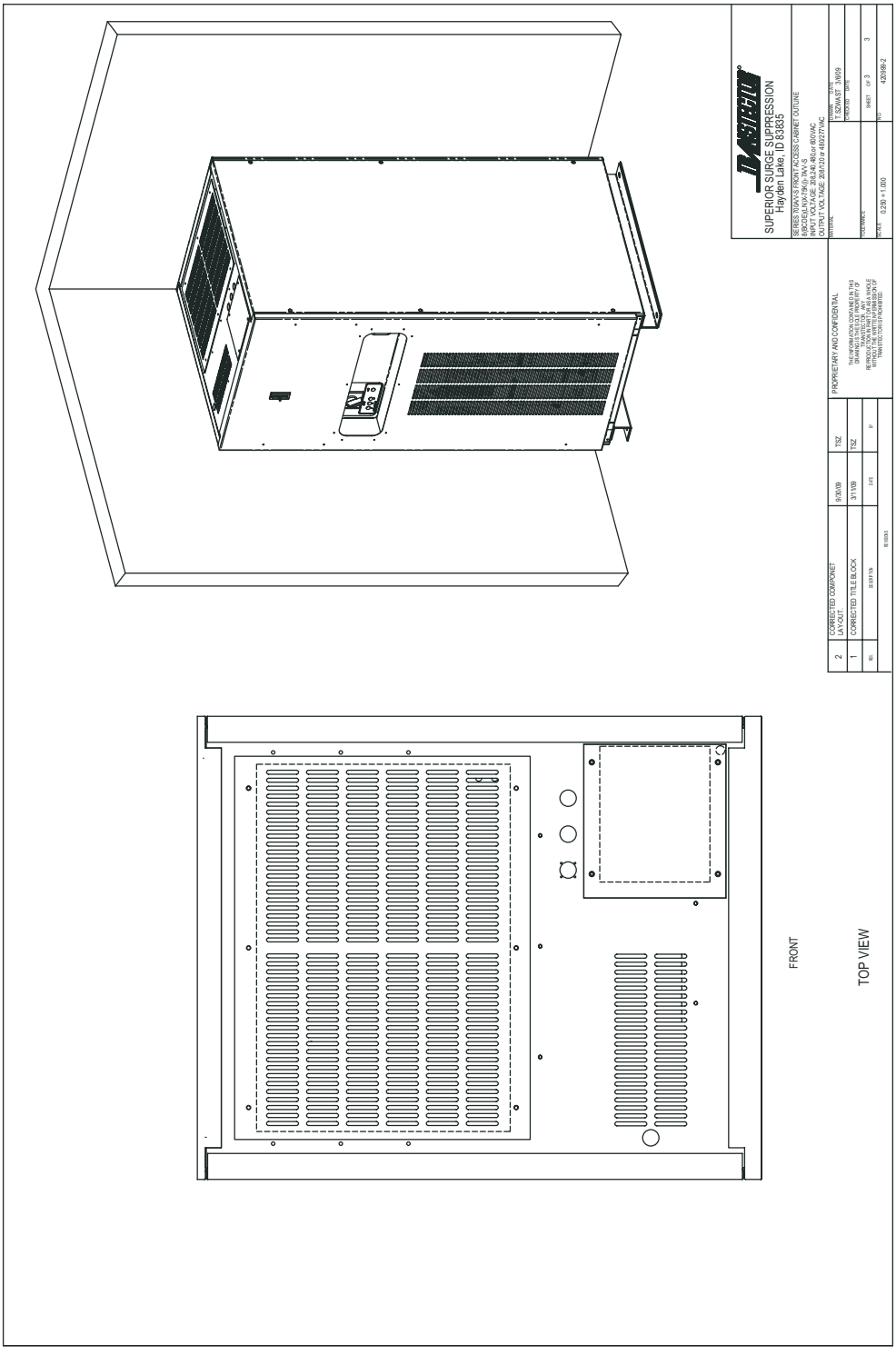


APPENDIX A: CABINET LAYOUT



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APPENDIX A: CABINET LAYOUT



SEISMIC CALCULATIONS 75KVA (I)

Coastal California, Zone 4
Equipment Anchorage
Uniform Building Code, Table 160

Z = 0.4
I = 1.5
Cp = 0.75

Fp = Z x I x (Cp) x Wp = 0.45 x Wp

Cabinet Weight
Center of Gravity Height

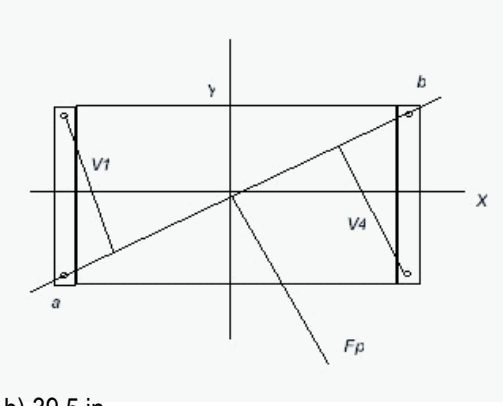
1142 lbs.
23.75 in.

Wp (max) = 1442.1 lbs x 1.15 = 1313.3 lbs.
Wp (min) = 1065.9 lbs. x 0.85 = 970.7 lbs.

Fp = 0.45 x 1313.3 = 591 lbs.

Vertical Force
Moment

(Fp) = 0.15 x 1313.3 = 197 lbs.
Mo = 23.75 x 591 = 14036.25 in. lbs.



Corners (a,b) 39.5 in
V1=V4 = 19.3 in.

Tension = Fp x Cg / V4 = 1406.7 lbs.
Shear = Wp(max)Fp/4 lbs., each anchor= 328.3 lbs.

EXAMPLE: <Rawl Power Bolt # 6913>
3/8” embedded 2.5” / min 2000 psi concrete
Tension rating of bolt: 5200 lbs.
Shear rating of bolt: 7270 lbs.

Interaction = (T/Tbolt) + (S/Sbolt)
Interaction = 0.32
Interaction = < 1.00 (OK)

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