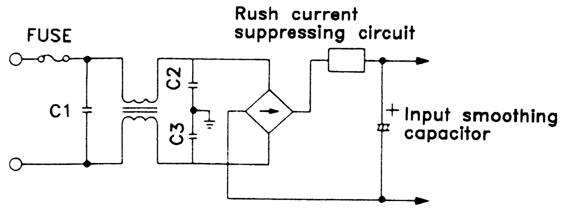
1. INPUT

1.1 Input Voltage

Switching power supplies are widely used all over the world. Many types of products are available for both alternating and direct currents. Before using the power supply, make sure that the output voltage is suitable for the intended load. Verify the correct input switching method and any other conditions that might affect the power supply's operation.
If an input voltage is applied which is different from the power supply's rating, the unit may be damaged.
Remember that if the input voltage wave is distorted, the power supply will not operate normally, even when the voltage is within the allowable range.

1.2 Input Current

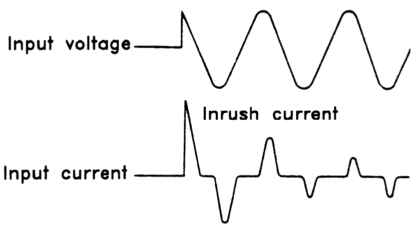
Standard power supplies directly rectify the input alternating current. Most standard units are capacitor-input-type, rectifying systems in which rectified current flows through the filtering capacitor. Therefore, the input current is determined by the output power, input voltage, power factor, and efficiency.



The power factor of a typical switching power supply is between 0.4 and 0.6.

1.3 Inrush Current

When power is applied to the power supply, a short duration current surge is drawn to charge the input filtering capacitor. This current is called the "inrush current". The value of the inrush current varies according to the power-on timing and the presence or absence of an inrush current protection circuit.
Inrush current is up to ten times larger than the normal input current. Fuses, switches and other parts on the input line must be selected to handle this current.



1.4 Input Fuse

If the switching power supply's built-in fuse is blown, something may be wrong in the internal circuits. In this case, the switching power supply will not recover even if the fuse is replaced. Contact Omnicorp.

2. OUTPUT

2.1 Maximum Output Power

Maximum output power (Pout) is defined as Pout = Vout X Aout where Vout is output voltage and Aout is output current. It is possible to adjust Vout. However, Pout must retain constant. Therefore, if Vout is increased, Aout must be decreased.
Example. A power supply has an output voltage of 5 volts and an output rated current of 10 amps. The maximum power output is 50 watts. Its adjustable voltage range is 4.7 volts to 5.5 volts. If the output voltage is adjusted to 5.5 volts, the maximum output current can be calculated by Aout = Pout/Vout i.e Aout = 50 watts/5.5 volts = 9.09 amps. The output voltage can also be adjusted lower than 5 volts. However due to the design of the output circuit, exceeding a 10-amp output is not recommended.

Some multiple output supplies have a Current Range that exceeds the Output Rated Current. The table below has some specifications for the D-60A (dual output) power supply. Ch.1 can output 6 amps, but the total power output cannot exceed 60 watts. **Example.** If Ch.1 was operated at a 5.5 amp output, the Ch.2 output current would have to be reduced to remain within the 60-watt limit. The total output power for Ch.1 would be: (5 volts) (5.5 amps) = 27.5 watts. This would leave 32.5 watts for Ch. 2. The total current available left for Ch.2 is: 32.5/12 = 2.7 amps.

Channel	Output Voltage	Output Rated Current	Output Current Range
1	5	4 amps	0.3-6amps
2	12	3 amps	0.2-4 amps

2.2 Overcurrent (Overload) Protection

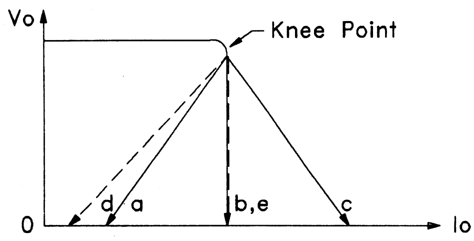
Omnicorp Power Supplies are equipped with a protection circuit that will automatically engage when the output current and/or output power exceeds maximum values.

2. 2.1 Types of Protection Circuits

a. Foldback Current Limiting:
Foldback Current Limiting is designed to linearly decrease both the voltage and current to a level that will prevent the power supply from being damaged during overcurrent / overload conditions.

b. Constant Current Limiting:
Constant Current Limiting allows the output current to remain stable, but reduces the output voltage to a level that permits the safe operation of the power supply.

c. Over Power Limiting:
Over Power Limiting reduces the output voltage and simultaneously allows the output current to increase.



2.2.2 Recovery Circuits

a. Automatic Recovery
Automatic Recovery senses the removal of an overcurrent 4 (overload) condition and returns the power supply to normal operation.

b. Manual Recovery
Manual Recovery requires cycling the input power between off and on to reset the protection circuitry. A several second wait is necessary prior to re-applying the input power. Before proceeding with Manual Recovery, make sure that the overcurrent / overload condition is removed.

2.2.3 Overcurrent / Overload Precautions

Protection and recovery circuits are designed to prevent damage to the power supply during an overcurrent / overload situation. However, leaving the power supply overload (or shorted) for extensive periods of time is NOT recommended and may result in component damage.

2.3 Over Temperature Protection

Some power supplies have an excessive temperature shut down circuit. When power supply operating temperatures become too high the protection circuit will turn off the output. Some common causes of excessive temperature are overcurrent / overload, high ambient temperature and a faulty cooling fan. To return the power supply to normal operation requires removing the cause of the over temperature condition and allowing the power supply to cool down.

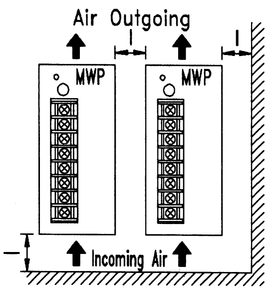
3. INSTALLATION, WIRING, CONNECTIONS

Even the most efficient switching power supply will not function properly if the installation, wiring or connection is not correct. Follow the installation, wiring, and connection instructions specified by the manufacturer before using switching power supplies.

3.1 Installation

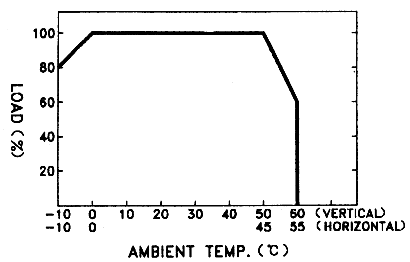
3.1.1 Heat Dissipation

a. Make sure the unit is properly ventilated.
b. Install the power supply in the correct position.
c. Make sure the unit has proper heat conduction.
d. When you install two or more power supplies, leave enough space for cooling.
e. Forcing air over the unit will improve heat dissipation.



3.1.2 Output Derating

Output power depends on operating temperature. Derate the output of the switching power supply according to the derating table shown on its specification.



3.1.3 Securing Screws

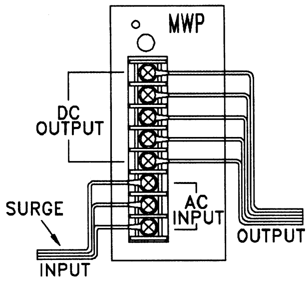
Check the specified screw length and tightening torque when you attach the power supply to the equipment enclosure. Use of excessively long screws can damage the power supply.

3.2 Wiring and Connections

3.2.1 Input and output wiring

a. Separate the input and output wires from each other so that any surge voltages on the input line do not cross over to the output side.

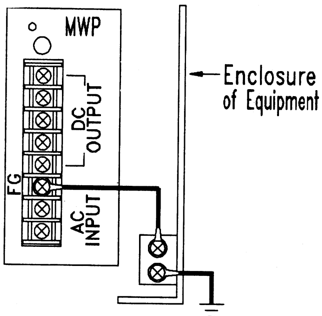
b. Use short, thick wires for the output. Wire thickness should be appropriate to carry the rated output current of the power supply.



c. When connecting wires to the switching power supply, use the appropriate terminal screws, solderless terminals and tools.

3.2.2 Grounding

Connect the grounding terminal of the switching power supply to the frame of the equipment with a short, thick wire to ensure safety and prevent noise.



3.3 Remote Control and Remote Sensor

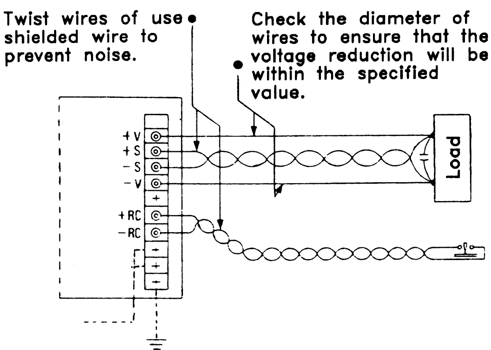
a. Remote Control and Remote Sensor

Supplying an appropriate TTL signal to the +RC & - RC terminals can control the output of some power supplies. A low TTL signal (0 volts) will turn the power supply output on. A high signal 1-volt) will turn the output off.

Remote control of the output can also be accomplished without the TTL signal. There is a 1-volt difference across the +RC & -RC terminals. If these terminals are shorted, the power supply output will be turned on. If the terminals are left open, the output will remain off. Power supplies are shipped with a jumper across the +RC & -RC terminals.

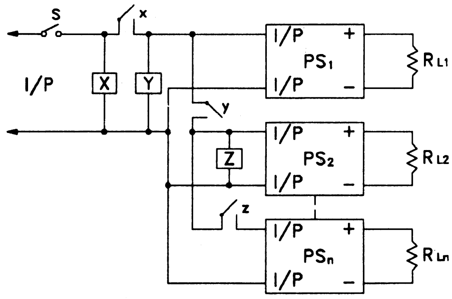
b. Remote Sensor

Power Supplies equipped with a Remote Sensor capability can detect voltage drop at the load. This feature is especially useful when the power supply and the load are separated by a long line. Power Supplies with the Remote Sensor have +S & -S terminals connected to the load side of the output, the power supply will be able to detect voltage drop at the load. The power supply will raise the output until the proper voltage is provided to the load.



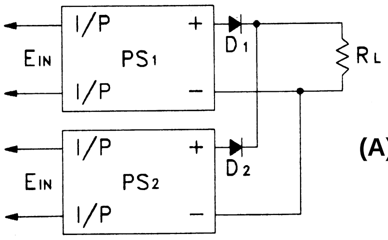
3.2.4 Inrush Current Control

Omnicorp Power Supplies have a large capacitor in the input circuit. Consequently, there is a high inrush current when input power is applied (eg. 20 amps @ 110 volts; 40 amps @ 220 volts.) When using several power supplies in a single system, do **NOT** apply power to all of them simultaneously. Note: ten power supplies would draw an inrush current of 200 amps @ 110 volts. A preferred power application would be a "delay power circuit." As shown below another method of controlling the inrush current is to individually apply power to each unit.



3.2.5 Parallel Use

Power supplies are commonly used in parallel to increase output current. Omnicorp PS Series has a "P" terminal circuit that is designed to sense other power supplies that are connected in parallel. This circuit controls output and allows more efficient operation of each parallel supply. Power supplies that are hooked up in parallel should have their "P" terminals connected together as described in fig.(A)



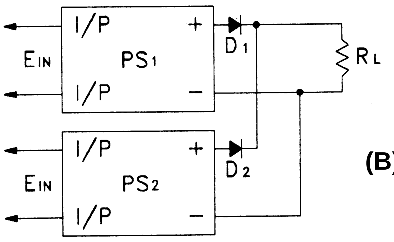
(A)

Power supplies should not be used at full output when they are connected in parallel. Small output voltage differences and power dissipation from added protection circuits can overload individual power supplies. The following information is a recommended percentage factor for the reduced output of each power supply when they are used in parallel.

Power Supplies Parallel	Maximum % of Total Output
4	90%
6	85%
8	80%

Example: Four 12 volt, 10 amp power supplies are connected in parallel. The total output current is 40 amps. The maximum current that should be used in this set up is (40 amps) (0.9) = 36 amps.

Fig. 13 describes a method for connecting power supplies in parallel that do not have the "P" terminal circuit. The series diode used in Fig. (B) must have a higher voltage and current rating than the combined parallel power supplies. Adequate cooling is recommended for large capacity diodes.



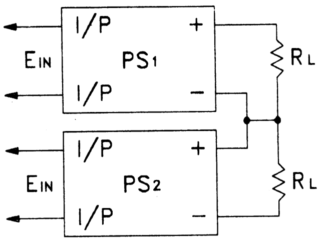
(B)

3.2.6 Series Use

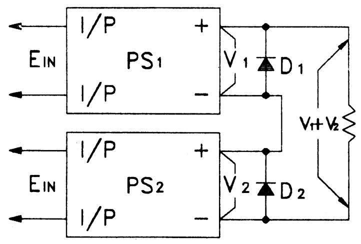
Power supplies are often connected in series to produce higher voltages. Two types of series connections are described below.

Some Omnicorp Power Supplies are designed for series use and have a built in reverse protection diode. Power supplies that have the function H (as listed in the catalog) are suitable for series use.

a. Fig.(C) describes a sample set up for separate distinctive loads.



(C)



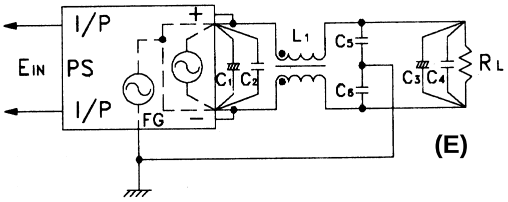
(D)

b. Fig.(D) illustrates a sample set up for power supplies not designed for series use and or power supplies that do not have a reverse protection diode.

3.2.7 Output Ripple and Noise Control

Fig.(E) is a diagram of a sample circuit that will control the output ripple and noise. Below is the suggested location for the components of the circuit.

a. Connect C3 & C4 on the load side of the circuit.
b. Connect C1 & C2 to the output side of the power supply.
c. Connect L1, C5, & C6.



(E)

Note: C1 & C3 control the output ripple. Their capacities should be between 47uf – 100uf. C2 and C4 control output differential noise. Their capacities range from 0.01µf to 0.1µf and they should be ceramic or film types.
C5, C6 and L1 are optimal and control output common mode noise. C5 and C6 should range from 0.01µF and 0.1µF and should be ceramic or film types. Their voltage rating should be selected to comply with output to earth insulation requirement. L1 should range between 0.5µH and 5µH. It should be wound on a high permeability ferrite core. Refer also to section 5. EMI.

3.2.8 Minimum Load Requirement

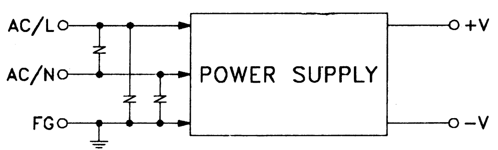
Multiple output power supplies are calibrated and fully regulated on Channel 1 (known as the master channel) of the unit. Channel 2 and higher are quasi regulated from Channel 1. If Channel 1 is not used, the output voltages of the other channels might be out of tolerance. Therefore, a minimum load on Ch.1 is required for correct operation. A minimum load can also be required on quasi-regulated outputs to prevent excessive voltage rise with a large load on the ch.1 output.
Example: A Omnicorp D-120B (dual output) power supply was connected in a circuit. The specifications for this unit are as follows.

Channel	Output Voltage	Tolerance	Output Rated Current	Output Current Range
1	5V	+2%	6A	2A-10A
2	24V	+7%	4A	0.4A-4A

A 4-amp load was connected to Ch.2 No load was connected to Ch.1. The Ch.2 output voltage was ~23 volts. A 2-amp load was then applied to the 5-volt output. The Ch.2 voltage rose to ~24 volts.
Another test was conducted with a 6-amp load on Ch.1 and no load on Ch.2. The Ch.2 output voltage was ~26 volts. A 0.4 amp load was then connected to Ch.2. The Ch.2 output voltage dropped back down to ~24 volts.

3.2.9 Input Surge Voltage Control

Fig.17 outlines a sample circuit used to control input voltage surges that may be caused by power fluctuations or stray fields due to lightning. Varistors are connected between AC/L – AC/N, AC/L – FG, and AC/N – FG.



3.2.10 Low Temperature Environments

Omnicorp Power Supplies use a thermistor that limits inrush current under cold start conditions. In a low temperature environment the thermistor resistance is high. The input current may become too low for the power supply to function. (This usually occurs under –10C). Use the procedures below can be used when operating power supplies in cold climates.

a. Apply the input power for 2 seconds. Then turn the power off for 2 seconds. Repeat this procedure several times until the inside of the unit reaches a temperature that allows the power supply to operate.
b. Decrease the load on the output until the power supply is fully operational.
c. If the power supply is in an environment that is frequently cold, install a heat producing device in the power supply case (such as a large resistor, a lamp or a heating unit).

3.2.11 Charger Use

When the switching power supply is used as a battery charger, a series diode and a fuse (or circuit breaker) should be installed in the output line. The diode prevents reverse flow of current from the battery into the power supply output when mains power is lost. This extends battery life. The fuse protects the power supply against reversed battery polarity.

4. SAFETY

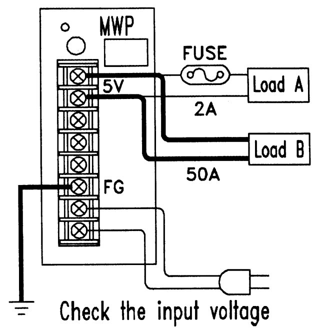
Generally speaking, switching power supplies are designed for integration into other equipment. All wiring to switching power supplies shall comply with AS/NZS 3000 " Australian / New Zealand Wiring Rules". When switching power supplies are integrated into other equipment, this installation shall comply with appropriate safety regulations as defined by AS/NZS 4417.2 "Marking of electrical products to indicate compliance with regulations". For example: information technology equipment shall comply with AS/NZS3260. " Approval and test specification – Safety of information technology equipment including electrical business equipment". (Except external types) Use a switching power supply only after it has been integrated into the other equipment.
Electric Shock:
High voltages are present inside the power supply (which can be 2 –4 times the input voltage). Do NOT attempt to repair the unit or remove the power supply's case cover. If the power supply needs service or repair return it to Omnicorp.
When the power supply is installed in a system, be sure that its case is properly grounded. Unless specified, all Omnicorp power supplies are to be used in a class I installation. This requires a connection between the frame of the power supply and the mains supply protective earth connector to ensure protection from electric shocks.
Some Omnicorp Power Supply's are shipped without a case. Use extreme caution when touching or removing the unit for repair.
High Operating Temperatures:
When the power supply is operating at full output, internal component temperatures may exceed 100c. Do NOT touch any components inside the power supply case.
Keep all flammable, explosive, and volatile materials away from the power supply.

4.1 Rated Input Voltage

Always use the power supply within its specified input voltage range. This can also cause damage to the power supply. It can be dangerous to apply voltage, which is outside of its specific range. In addition the inside of the power supply will be damaged.

4.2 Earth Leakage current

The internal noise filter generates an earth leakage current which complies with the safety standards specified on the data sheet. However, if two or more power supplies are used, this leakage current increases. Ensure that earthing connections comply with the requirements of the appropriate safety regulations based upon this total earth leakage current.



5. EMI

All Omnicorp power supplies comply with the Australian Communications Authority Electromagnetic Compatibility Framework and carry the C-Tick mark. Emissions standards and limits on which this compliance is based are identified in the product specification.

To comply with emissions standards, some models may require additional fitting components. These components are included with each unit and instructions for their installation are provided. Typically, these components can consist of input or output common mode ferrite chokes, chokes in the input earthing conductor, or additional "x2" capacitors across the AC mains lines.

Additional filtering components are specified based upon a const case configuration with the power supply and load free-standing on a bench with exposed output wiring. Consequently, if a power supply is incorporated within another piece of equipment, these components are often not necessary. Some of the principles which can reduce RF emissions are as follows.

5.1 Screening and Bonding

Often the power supply and load circuitry are contained within the same metal enclosure. In this case, radiated emissions from the output leads are well screened by this enclosure and specified output common mode ferrite chokes are not required.

5.2 Separation of Wires

Load circuitry itself can often be a source of RF interference; for example, microprocessor-based equipment will have emissions at harmonics of its clash frequency. This noise can be radiated onto any cabling going out of the enclosure and can cause excessive emissions. Ensure that noisy internal cabling is separated from any of this cabling, especially AC input cabling.

5.3 Twisting

Twisting +/- dc output leads together can also reduce radiated emissions from these lines.

6. RELIABILITY

6.1 Life Cycle and Breakdown

Switching power supplies have proven to be highly reliable when used in household appliances and industrial products.
The following figure shows the failure rate curve (bathtub curve) during a typical product life cycle.6 .

6.1.1 Early Failure Period

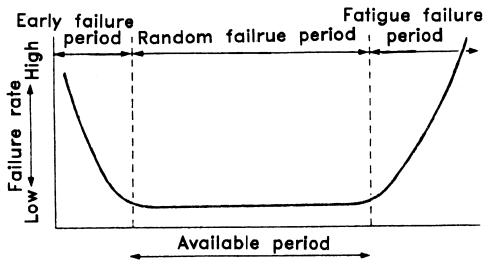
To prevent early failure, aging tests are performed on the finished product. When switching power supplies are delivered to users, the power supplies have already entered the random failure period.

6.1.2 Random Failure Period

The stability of each switching power supply depends on its own reliability (Mean Time between Failure: MTBF). Basically the failure rate is very low.
However the failure rate in the random failure period differs depending on installation and operating conditions (ambient temperature, installation method, derating, ventilation, vibration and shock) which are determined by the user.

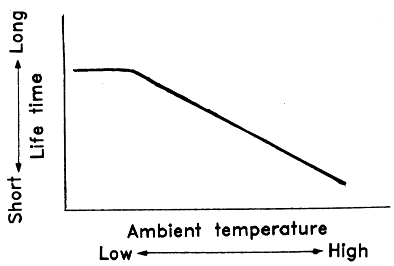
6.1.3 Fatigue Failure Period

Components with the power supply will eventually "wear out" leading to fatigue failure of the amt.



6.2 Ambient Temperature and Service Life

High efficiency switching at a high frequency, improvement in parts, and integration technology has greatly reduced the size of switching power supplies. Integration density has caused the internal parts to be packed more closely together.
Each part of a switching power supply distinctly differs in its service life depending on the ambient temperature.
Electrolytic capacitors used as a smoothing filter are generally most sensitive to the ambient temperature because of the chemical reactions, which occur inside them.
Typically, the service life of electrolytic capacitors drops by half if the ambient temperature increases by 10c . This characteristic determines the service life of the switching power supply.
The following figure shows the relationship between the service life of the switching power supply and ambient temperature. If the switching power supply is used at high temperatures, electrolytic capacitors may enter the fatigue failure period while the other parts are still in the random failure period.



6.3 Overhaul

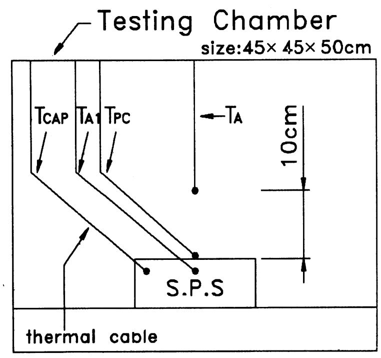
Though the service life of some switching power supplies is also increasing, as electric technology improves, they cannot be used forever.
Therefore, periodic overhauls are required to ensure the reliability of a power supply. How often an overhaul needs to be performed depends on operating conditions and temperature. Service life is most seriously affected when a power supply is operated continuously. As a reference, the frequency of overhauls to the power supply should be as follows:

- Ta is between 40c and 45c: once every three years
- Ta is between 35c and 40c: once every four years
- Ta is between 30c and 35c: once every five years

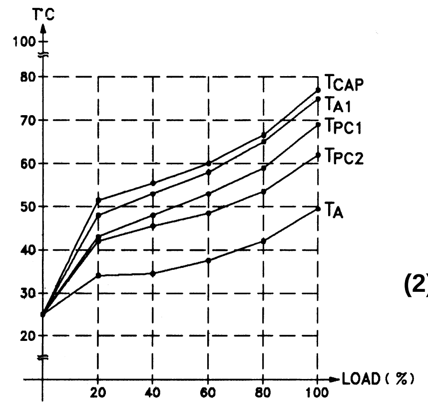
(Ta indicates the ambient temperature of the power supply.)
The above temperature values differ for each model. For details on overhauls and service life, contact Omnicorp.

6.4 Loading Capacity and Environmental Temperature

Power supply operating temperatures depend on output load, ambient temperature, and cooling. The most ideal way to increase the service life of a power supply is to NOT continuously operate it at full capacity. This becomes even more critical at high ambient temperatures.
Example: Two identical power supplies (subjected to the same environmental conditions) were operated using different loads. One had a 40% lead condition; the other had an 80% load condition. The power supply with 40% load lasted four times longer than the power supply with 80% load condition.
Every model of the Omnicorp Power Supply line is subjected to an environmental test during the prototype phase. Fig.1 – Fig. 3 lists the results of some of these tests.



(1)



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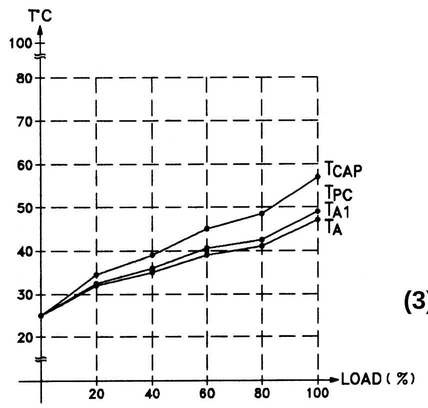

(3)

TA: Temperature of chamber inside. TA1: Temperature of power supply inside.
TPC: Temperature of power supply case. TCAP: Temperature of output capacitor.

7. REPAIR SERVICE

If a power supply fails to operate, perform the following steps prior to sending in for repair.

a. Check all connections. There may be a short circuit in the output side of the power supply.
b. Check the output voltage variable resistor (VR) adjustment screw. If the output voltage is set too high the power supply will sense an over voltage and shut down the output.
c. Check the AC input voltage. If it is out of the power supply's input voltage range, the power supply will not operate. Some power supplies are equipped with an input voltage selection switch (110-volt/220 volt). If the selection set is on 220 volt and the input voltage is 110 volt, the power supply will fail to operate. Applying an input voltage of 220 volts with the selection switch set on 110 volts will destroy the unit.
d. Remove the output load and cycle the input power (with a 10-second delay). Check the output terminals to see if the correct voltage is present. If the correct voltage is present, measure the current required by the load. If no output voltage is present, turn off the input voltage and allow the power supply to cool. Once the unit has cooled, apply input power. If the power supply operates, the shut down was a result of an over temperature condition. If the power supply still does not operate, perform the following steps.
e. Tighten all of the power supply terminal screws before shipping.
f. Ship only the power supply. Do NOT ship any accessories (such as the AC input cord or the manual).
g. Send a brief description of why the unit might have failed.
h. Pack the power in a sturdy carton with adequate padding around the unit. This will prevent damage during transportation.
i. Repairs will take up to 7 working days (not including the shipping time).