REVISIONS

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TITLE
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350 SERIES POWER SUPPLY

SIZE	CODE IDENT	NUMBER	REV
A	50163	80002150	G

SCALE — DO NOT SCALE PRINT SHEET 1 OF 24

REP 8/18

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1.0 SCOPE

This specification defines the functional characteristics and requirements applicable to the design and construction of a power supply for use in the 350 Series products.

2.0 RELATED DOCUMENTS

A. VDE 0806 - VDE Safety Standard
B. VDE 0875 & VDE 0871 - VDE EMI Standard
C. IEC 380 - IEC Safety Standard
D. UL 478 - UL Safety Standard
E. FCC 20780, Part 15, Subpart J - FCC EMI Standard
F. CSA 154 - Canadian Safety Standard
G. IEEE Std. 587-1980 - Surge Power in AC Power Circuits

3.0 GENERAL

The 350 Power Supply is an "off-line" switching power supply that is used as the primary power source for all 350 Series products. The supply provides regulated DC voltage from the 110 VAC/220 VAC, 50/60 Hz mains and sources line voltage to the printer cooling fan. A line filter in conjunction with an EMI screen limits EMI levels below regulatory agency requirements when installed in the printer. The printer cooling fan, which is physically attached to the supply EMI shield, also provides cooling for the power supply.

4.0 PERFORMANCE REQUIREMENTS

This section describes the electrical characteristics of the power supply input and outputs.

4.1 INPUT SPECIFICATIONS

4.1.1 Input Voltage

4.1.1.1 Nominal Voltage

The input voltage range is reconfigurable with a jumper (Ref. Fig. 1) for the following voltage ranges:

A. 90 VAC RMS to 132 VAC RMS
B. 180 VAC RMS to 264 VAC RMS

4.1.1.2 Voltage Variation

The power supply shall be designed to operate without interruption for a step change of + or - 10% of nominal voltage for 0.1 sec maximum duration with a maximum rate of change of voltage not to exceed 1 volt per microsecond and occurring not more frequently than once every 10 seconds.

4.1.1.3 Reconfiguration for Input Voltage Range

The supply shall be reconfigured for the 90 VAC to 132 VAC input with a jumper connection. The jumper shall connect the AC neutral line to the the tie point of the input capacitors, which forms a voltage doubler out of the rectifier bridge and input capacitors.

The jumper connection is made via a five position locking header (Molex Type 2630 or equivalent). This header is also used to reconfigure the printer cooling fan windings (see Figure 1). The pin assignment for J104 is:

J104 Pin	Connection
1	Input Capacitor Tie Point
2	Fan Lead 1A, AC Hot
3	Fan Lead 1B
4	Fan Lead 2A
5	Fan Lead 2B, AC Neut.

4.1.1.4 Line Voltage Disturbance

4.1.1.4.1 Undervoltage and Outage

The power supply and all components shall be capable of withstanding undervoltage disturbances of any level and duration without physical damage. The power supply must shutdown in accordance with Section 5.1 for any input voltage or load combination for which the regulated outputs would exceed the requirements of Sections 4.3.1 and 4.3.2 prior to exceeding those requirements.

4.1.1.4.2 Reduced Load Brownout

The power supply shall maintain the regulation requirements of Sections 4.3.1 and 4.3.2 for undervoltages to 70 VAC RMS when strapped for 110 VAC operation (or 140 VAC RMS when strapped for 220 VAC operation) providing the DC output loading is 40 Watts or less. The requirement for 70 VAC (140 VAC) operation is valid providing the DC output load is reduced to 40 Watts or less within one millisecond of the occurrence of an active (Logic 1) power fail imminent signal. In the event that the DC output loading remains greater than 40 Watts, the power down sequence of Sections 5.1 and 4.3.11.2 shall apply. When the input line voltage returns within the limits of Section 4.1.1, the power fail imminent signal shall return to an inactive (Logic 0) state and the supply shall be capable of normal full operation.

NOTE: The power fail imminent signal is used to force the output loading to remain less than 40 Watts. The power fail imminent signal must be conditioned to prevent toggling between active and inactive states due to output loading or input voltage ripple variations.

If the input voltage falls below 70 VAC (140 VAC for 220 VAC operation) while operating under reduced load brownout conditions, the supply shall shutdown per Sections 5.1 and 4.3.11.2 with the exception that additional hold time is not required. The power up sequence of Sections 5.1 and 4.3.11.1 shall apply when input line voltage returns within the limits of Section 4.1.1 for brownout conditions which result in a full supply shutdown.

4.1.1.4.3 Overvoltages

The power supply shall be designed to accept a voltage of 150 VRMS for one second when operating from the 110 VAC nominal input voltage range without causing system degration or component damage. When operating from the 220 VAC nominal input voltage range, the supply shall accept a voltage of 300 VRMS for one second without causing system degradation or component damage.

4.1.1.4.4 High Voltage Transients

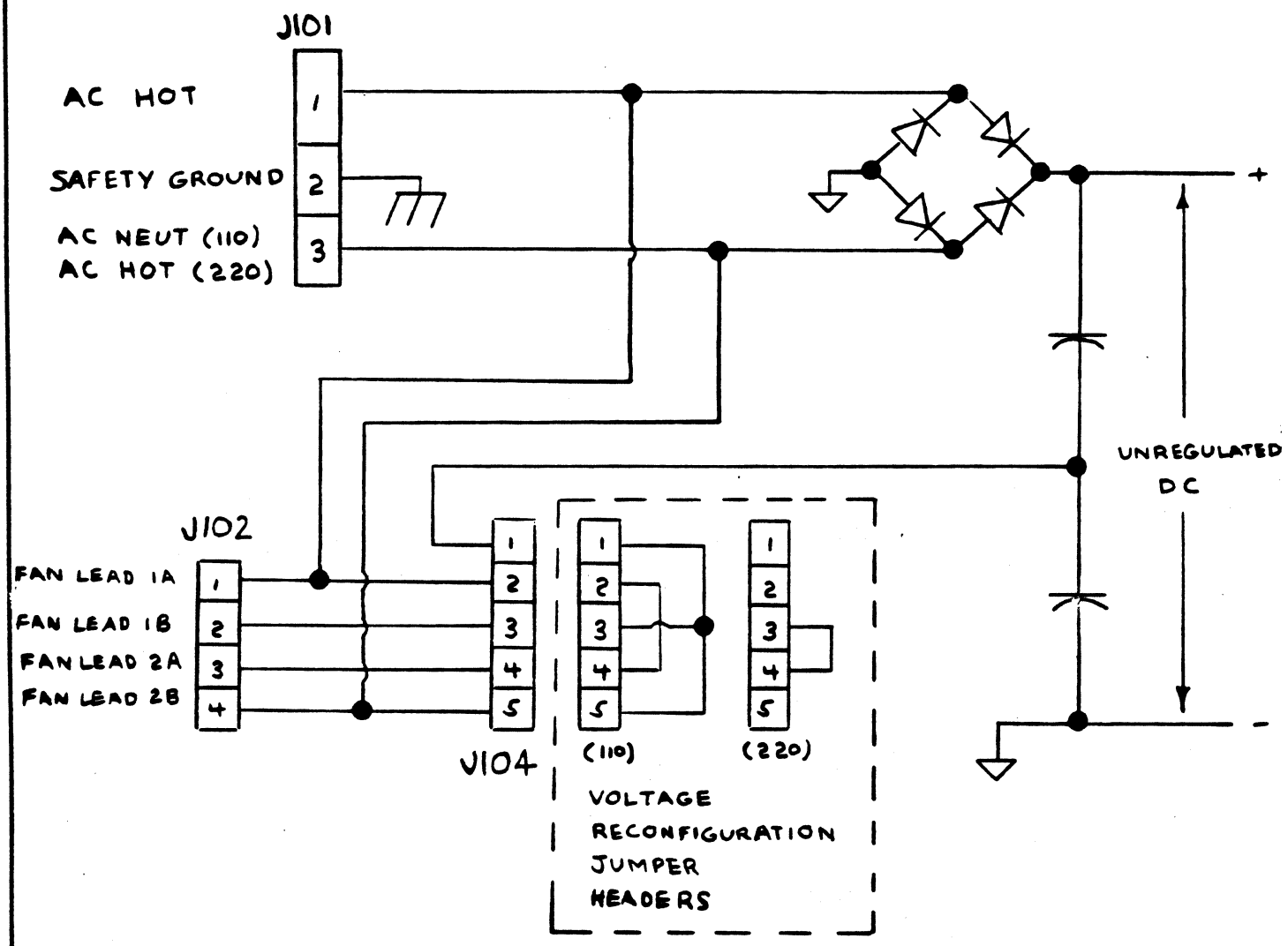
The power supply, including line filter, shall operate without degradation with up to a 3 KV peak voltage surge randomly superimposed on the line voltage. The supply shall survive without physical damage with up to a 6 KV peak voltage surge randomly superimposed on the line voltage. The waveshape of the surge voltages shall comply with the IEEE Std 587-1980. This waveshape, as delineated in the standard, rises from 10% to 90% in 0.5 microsecond, then decays while oscillating at 100 KHz, each peak being 60% of the preceding peak. The rate of occurrence in burst mode shall not exceed one burst in five minutes with a maximum of ten surges with a rate of occurrence not more than once per second. The rate of occurrence in non-burst mode shall not be more than once every ten seconds.

4.1.2 Input Current

4.1.2.1 Rated Current

A. 4A RMS Max for 110 VAC nominal input voltage range and full rated load.
B. 2A RMS Max for 220 VAC nominal input voltage range and full rated load.

NOTE: The maximum currents listed include the effects of the minimum efficiency of 65% and minimum power factor of .65.



J101 - Input AC, Molex Type 1991 or Equivalent

J102 - Fan, Molex Type 2630 or Equivalent

J104 - Jumper, Molex Type 2630 or Equivalent

Figure 1. INPUT CIRCUIT CONFIGURATION

4.1.2.2 Inrush Current

The power supply must limit the inrush current under worst case conditions of input line voltage, temperature and output loading to a level which will not damage the supply or blow the input fuse. The worst case conditions are typically 50 Hz high line at low temperature with full output loading.

Maximum Inrush: 40A peak (110 VAC) and 80A peak (220 VAC) for first 1/2 cycle and less than 6A RMS after the first 500 msec. The I^2T value of the first 1/2 cycle shall be less than 8 A^2S (ampere-squared seconds).

NOTE: The printer mains fuse is a 4A slo blo (110 VAC) or a 2A slo blo (220 VAC) fuse. The fusing integral of the printer mains fuse is 10 A^2S (ampere-squared seconds).

4.1.2.3 Leakage Current

The power supply (including external line filter) leakage current for 132 VAC (264 VAC) line voltage, shall be less than 3.5 MA RMS from the input AC lines to safety ground. The Power Supply (excluding external line filter) leakage current for 132 VAC (264 VAC) line voltage shall be less than 1.5 MA RMS from the input AC lines to safety ground.

4.1.3 Input Voltage Frequency

The power supply shall operate with an input voltage frequency between 47 Hz and 63 Hz.

4.1.4 Power Factor

The power factor for the supply at nominal input voltage and full output load shall be greater than .65.

4.1.5 Connections

A three pin polarized locking connector (Molex International type 1991 or equivalent - Molex Plug No. 19-09-2032 and Molex male .093 PC tail pins No. 02-09-8133)1 shall be used to make connection to the printer main socket. The pin assignment for J101 is:

J101 Pin	Connection
1	AC Hot (110/220)
2	Safety Ground
3	AC Neut (110), AC Hot (220)

4.2 AC Output Specifications

The AC output power is provided for the printer cooling fan only.

4.2.1 Voltage

The output voltage and frequency is the same as the input mains voltage as defined in Section 4.1.1 and 4.1.3.

4.2.2 Current

The maximum current is 1/2 A RMS.

4.2.3 Connections

The fan output connections are made via a four pin locking connector (Molex Type 2630 or equivalent). The fan has a dual winding which is configured in parallel (110 VAC) or in series (220 VAC) by the same jumper header used to reconfigure the supply for input voltage range (see Figure 1).

The pin assignment for J102 is:

J102 Pin	Output
1	Winding #1 Lead A
2	Winding #1 Lead B
3	Winding #2 Lead A
4	Winding #2 Lead B

4.3 DC OUTPUT SPECIFICATIONS

4.3.1 Voltage Regulation

The DC output voltages shall remain within the limits specified below for any combination of specified operating line/load variations. The limits include effects due to drift (typically 0.1% over 24 hours) and temperature stability (typically 0.05% per degree C). The +5 volt output is initially adjusted to +5.00 volts within the resolution of Section 4.3.7 with an input line voltage of 110 VAC RMS, 60 Hz. All outputs shall remain within the limit as the input voltage is varied per Section 4.1.1 (Voltage) and 4.1.3 (Frequency) and/or the output loads are varied per Section 4.3.3.

Output	Min.(v)	Nominal(v)	Max(v)
+5	+4.90	+5.00	+5.10
+12	+11.40	+12.0	+12.60
-12	-11.40	-12.0	-12.60
+35	+35	+37.2	+42

The voltage regulation under no load (all outputs) may exceed the regulation limits of Section 4.3.1 and the ripple limits of Section 4.3.2 by 20 percent. The supply shall not be physically damaged by operation under no load conditions. The voltage regulation and ripple limits shall be met when the outputs are loaded within the range of Section 4.3.3.

4.3.2 Ripple and Noise

Ripple and noise measurements are made with the supply at full rated load (per Section 4.3.3) and low line voltage. The loads are DC loads only.

4.3.2.1 Differential Mode

A filter with a 300 Khz or higher 3db frequency may be inserted between the power supply and the measurement equipment to isolate the equipment from the common mode noise. The filter typically consists of 40 to 50 cm of 22 AWG wire terminated with 1 uf of high frequency capacitance. The differential ripple and noise limits are:

Output	Max Ripple and Noise (MV P-P)
+5	100
+12	100
-12	100
+35	700

4.3.2.2 Common Mode

The common mode noise current is the current flowing through a 20 cm length of 22AWG wire connected between the output +5V RTN and the chassis (earth) ground.

The common mode noise limit is 400 MA peak to peak measured at the output connector from the +5V RTN to chassis ground.

4.3.3 Current

Output	Min.(A)	Nominal(A)	Max(A)
+5	1.25	3	7
+12	0	.4	.75
-12	0	.4	.75
+35	0	1.8 (1)	3.2 (1)

[1]These figures are average. The actual instantaneous currents are a function of the character string printed. Refer to Section 4.3.9 (Dynamic Loading) for instantaneous current levels.

4.3.4 Power

Min. (Watt)	Nominal (Watt)	Max. (Watt)
6.2	92 (2)	172 (2)

[2]These figures are average. The actual instantaneous power is a function of the character string printed. Refer to Section 4.3.10 (Dynamic Loading) for instantaneous power levels.

4.3.5 Efficiency

The supply DC outputs have a combined maximum power output of 186 watts. The efficiency from input line to DC outputs, excluding fan load, shall be 70% or better without linear regulators and 65% or better with linear regulators on the ± 12V outputs.

4.3.6 Turn on Overshoot

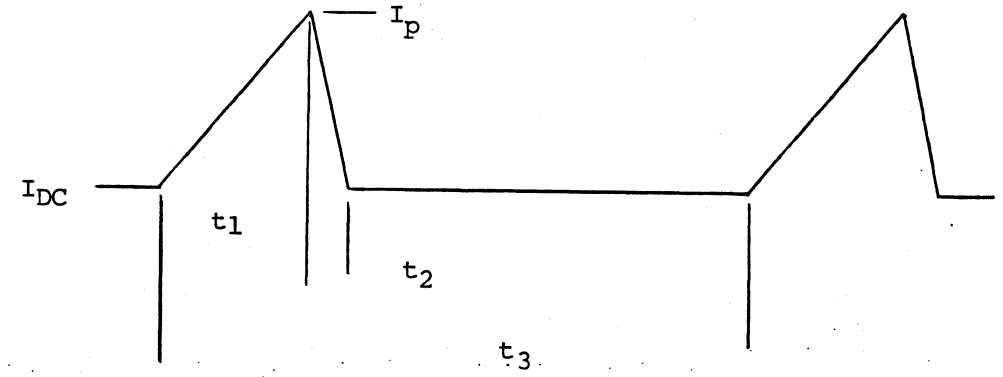
The overshoot of any DC output at turn on shall be less than 5%.

4.3.7 Resolution

The +5V output shall be adjustable with a potentiometer to within .01 volts.

4.3.8 Dynamic Loading

With the +5V, -12V, and -12V outputs loaded within the range defined in Section 4.3.3, the +35V output will experience a dynamic load as defined in Figure 2. Under these conditions, the average voltage of the +35V output and the voltage of the remaining outputs shall not exceed the limits defined in Section 4.3.1 and 4.3.2. The transient voltage superimposed on the average voltage of the +35V output shall not exceed 3V peak-to-peak.



I_{DC} = 1.5A t_1 = 175u SEC

I_p = 37.5A t_2 = 5u SEC

t_3 = 2M SEC

Figure 2. DYNAMIC LOADING FOR +35V OUTPUT

4.3.9 Power Fail Imminent

A power fail imminent indicator shall provide a signal to indicate the failure of input line voltage. The signal shall be sourced from an open collector transistor with a resistor pull up to +5V which is saturated (VSAT less than 0.5V) to sink 10MA while the input line voltage is present.

The power fail signal must be conditioned to prevent a power fail indication during supply power up and while operating for missing half cycle (at 50 Hz) and zero crossing of the input line voltage. The power fail signal must also be conditioned to prevent toggling between active and inactive states for output loading and input ripple voltage variations, particularly while under reduced load brownout conditions. The power fail signal must provide indication of line loss 4 milliseconds (minimum) prior to DC power invalid for any combination of input voltage and output loading.

NOTE: The hold up time from the power fail signal indication to DC power invalid is 4 msec minimum. DC power is invalid when not within the limits of Section 4.3.1.

4.3.10 Hold Up Time

The supply shall maintain all outputs for 15 MSEC minimum after loss of input line voltage at an output power level of 172 watts and 50 Hz low line input voltage. The hold up time is measured from the loss of AC power to DC power invalid.

NOTE: The hold up time from the power fail signal indication to DC power invalid is 4 MSEC minimum. DC power is invalid when not within the limits of Section 4.3.1.

4.3.11 Power Sequencing

4.3.11.1 Power Up

The power up sequencing is defined by Figure 3A. The minimum power up sequence requirement allows all DC voltages to rise simultaneously. Outputs utilizing three terminal linear regulators may become stable prior to other outputs, providing the input to the linear regulators complies to the minimum power up sequence of Figure 3A.

Recovery from reduced load brownout operation shall occur when the input line voltage returns within the limits of Section 4.1.1.1. recovery and resumption of normal supply operation shall be indicated by the power fail signal returning to the inactive (Logic 0) state.

4.3.11.2 Power Down

The power down sequencing is defined by Figure 3B. The power fail indicator signal becomes active, indicateing line loss after 10 Msec. minimum to allow for missing half-cycle. All DC outputs must remain stable for a minimum of 4 Msec. after the power fail signal becomes active. The minimum power down sequence requirement allows all DC voltages to decay simultaneously providing the +35 volt output is less than +8V when the +5 volt output is less than +3V. The ±12 volt outputs may decay naturally to zero due to loading, providing the outputs decay to zero in less than five seconds.

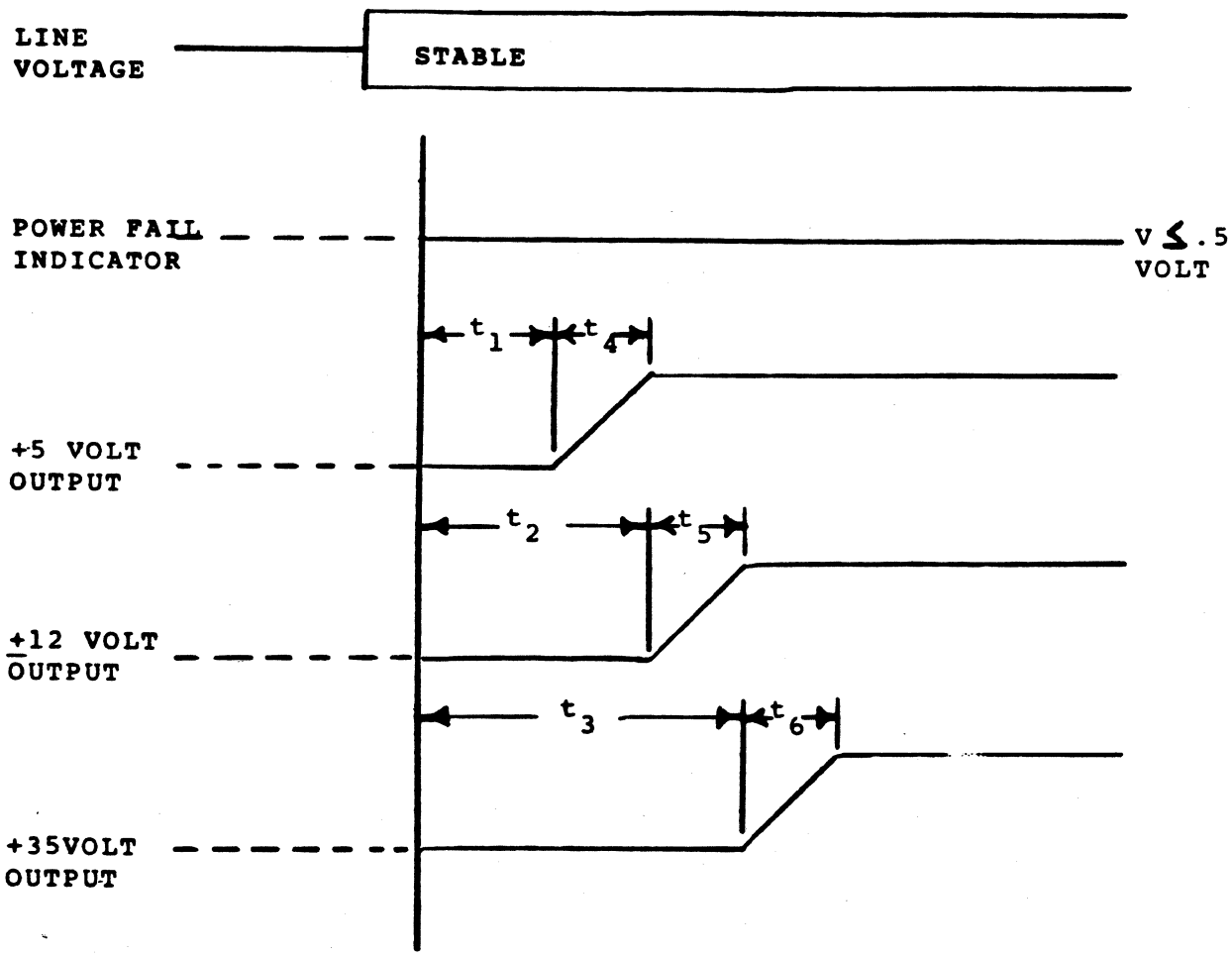
A power down initiated by the functioning of a protect circuit due to a secondary fault per Section 5 is not required to comply with the power down sequence of Figure 3B. However, the +35 volt output must be less than +8V when the +5 volt output is less than +3V.

The power down sequence of figure 3B may dwell or be interrupted in the region shown by Figure 3B between the onset of the power fail signal (Logic 1 level) and any change in the DC outputs for reduced load brownout operation. The reduced load brownout condition is valid only for input voltages above 70 VAC (140 VAC for 220 VAC operation) providing the total DC output power is reduced to less than 40 Watts within 1 millisecond of the onset of an active power fail signal. If the loading remains greater than 40 watts, the power down sequence of figure 3B shall apply. If the input voltage should fall below 70 VAC (140 VAC for 220 VAC operation) while operating under reduced load brownout, the power down sequence of figure 3B shall apply with the exception that additional hold time is not required. If the input voltage returns within the limits of 4.1.1.1 while operating under reduced load brownout, the supply shall resume normal operation without shutdown per Section 4.3.11.1.

4.3.12 Connections

The DC output connections are made via two locking connectors (Molex type 2630 or equivalent). To avoid ground noise under dynamic loading, the supply shall maintain separate isolated grounds for logic power (+5V, +12V, -12V) and driver power (+35V). The pin assignments for these connectors is defined as follows:

POWER UP SEQUENCE

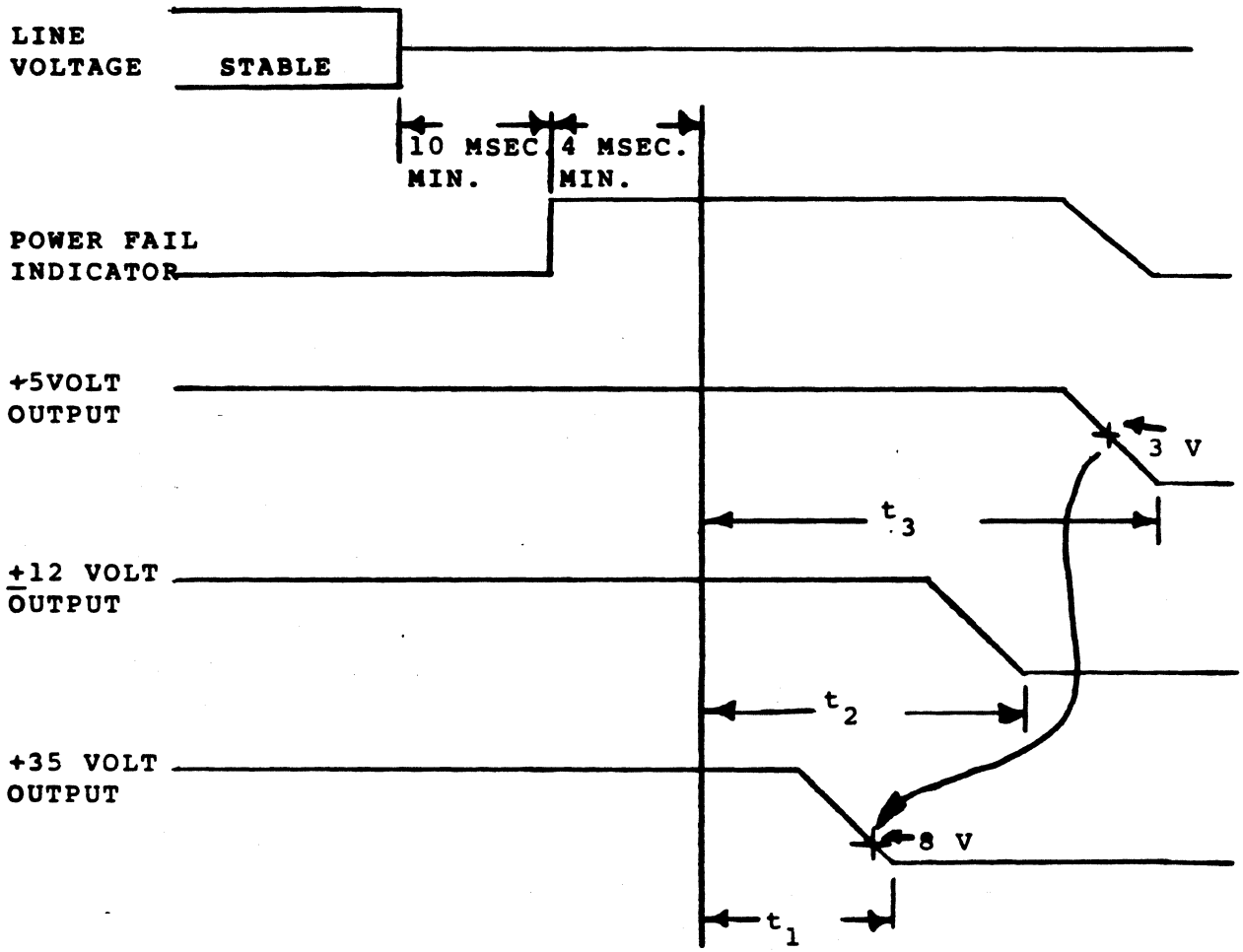


$0 \leq t_1 \leq t_2 \leq t_3$

$10 \text{ MSEC} \leq t_4 \leq t_5 \leq t_6 \leq 200 \text{ MSEC}$

Figure 3A.

POWER DOWN SEQUENCE



$0 \leq t_1 \leq t_3$ $\quad 0 \leq t_2 \leq t_3 + 5$ SEC

THE +35 VOLT OUTPUT MUST BE LESS THAN 8V WHEN THE +5VOLT OUTPUT IS LESS THAN 3 V.

Figure 3B.

J107 Pin	Output
1	+12V
2	+12V RTN
3	−12V
4	+5V RTN
5	Chassis Ground
6	+5V
7	+35V
8	+35V RTN
9	Power Fail Indicator

J103 Pin	Output
1	+12V
2	+12V RTN
3	−12V
4	+5V RTN
5	Chassis Ground
6	+5V

NOTE: The +5V RTN and +12V RTN are common within the supply. The +5V RTN and the +35V RTN must be connected externally while the supply is in use or under test.

5.0 PROTECTION CIRCUITS

5.1 INPUT VOLTAGE

The power supply shall be capable of withstanding undervoltage disturbances and power interruptions, both of any duration, without physical damage. The power supply shall initiate an orderly shutdown in accordance with Section 4.3.11.2 for any undervoltage level or power interruption duration which will result in loss of DC output validity prior to loss of DC output validity. Power supply shutdowns due to loss of input line voltage integrity are not to be latched in the OFF state. Upon restoration of input line voltage integrity per Section 4.1, the supply shall initiate a full turn ON per Section 4.3.11.1.

NOTE: The supply may be latched OFF for the duration of the line voltage integrity loss plus sufficient time to allow secondary crowbar functions to be cleared. The supply must be latched OFF for sufficient time to allow secondary crowbar functions to be cleared for shutdowns due to momentary loss of line voltage integrity. A momentary line loss is an undervoltage or power interruption with a duration greater than one half cycle and less than the duration of the power down sequence plus crowbar function clearing time.

5.2 PRIMARY POWER

The power supply shall shut down without physical damage for any primary power demands that exceed normal operation. The shutdown condition may be cleared only by removing the cause of the overpower, removing the input power for approximately 30 seconds, and then restoring the input power.

Any catastrophic failure of the power supply shall be protected by a mains fuse. The printer has a mains fuse (4A Slo Blo for 110V, 2A Slo Blo for 220V). Any additional primary or secondary fuse located within the supply must be replaceable without disassembly of the supply.

5.3 THERMAL

The temperature of power switching device(s) shall be monitored. The power supply shall shut down without physical damage if the maximum safe operating temperature is reached. The shut down may be cleared only by cooling the device, removing the input power for approximately 30 seconds, and then restoring the input power.

5.4 SECONDARY SHORT CIRCUIT

A short circuit from any DC output to any other DC output shall force a full supply shut down without physical damage. A short circuit is defined as any output power level which could damage the supply. The power sequencing during shutdown is per Section 4.3.11.2. The shutdown condition may be cleared only by removing the short, removing the input power for approximately 30 seconds, and then restoring the input power.

NOTE: Outputs using three terminal linear regulators may rely on internal short circuits protection, if reverse polarity protection is provided.

5.5 OVERCURRENT (+5 VOLT OUTPUT)

An overcurrent on the +5 Volt output shall force a full supply shutdown for a load current between 110% (7.7 Amps) and 150% (10.5 Amps) of full rated load. The power sequencing during shutdown is per Section 4.3.11.2. The shutdown condition may be cleared only by removing the overcurrent, removing the input power for approximately 30 seconds, and then restoring the input power.

5.6 OVER/UNDER VOLTAGE (+5 VOLT OUTPUT)

An overvoltage or an undervoltage on the +5V output shall force a full supply shutdown. The overvoltage shutdown shall occur between 5.5V and 6V and the undervoltage shutdown shall occur between 4.5V and 4V. The power sequencing during shutdown is per Section 4.3.11.2.

The shutdown condition may be cleared only by removing the cause of the over/under voltage, removing the input power for approximately 30 seconds, and then restoring the input power.

6.0 ENVIRONMENTAL REQUIREMENTS

6.1 TEMPERATURE AND HUMIDITY

Operating: 5°C to 50°C up to 95% Relative Humidity, Non-condensing

Non-Operating: -40°C to 66°C up to 95% Relative Humidity, Non-Condensing

6.2 ALTITUDE

Operating: -1,000 Ft. (-303 M) to 8,000 Ft. (2.4 KM)

Non-Operating: -1,000 Ft. (-303 M) to 30,000 Ft. (9.1 KM)

6.3 SHOCK

Operating: The supply installed in the printer must operate within specification while the printer experiences a 1/2 Sine shock pulse up to 10 Gpk, 10 MS ± 3 MS in duration. The shock pulse is applied once in either direction of three orthogonal axes (3 pulses total).

Non-Operating: The supply installed in the printer which is packaged in its shipping container must survive without physical damage when the printer experiences a 1/2 Sine shock pulse up to 40 Gpk, 30 MS ± 10 MS in duration. One shock pulse will be applied perpendicular to each of the six surfaces. The printer surface judged most vulnerable to shock input will receive a total of three pulses.

6.4 VIBRATION

6.4.1 Vibration - Operating

The supply installed in the printer must operate within specifications while the printer experiences the sine vibration test listed below. The test will be applied once in each of three orthogonal axes.

The printer will be tested hard mounted to the vibration table. Cushioning or isolation methods utilized for transportation will be disabled during these tests.

Frequency	Vibration
5-22 Hz	0.010" DA
22-500 Hz	0.25 Gpk
500-22 Hz	0.25 Gpk
22-5 Hz	0.010" DA

Sweep rate of 1 octave/min.

6.4.2 Vibration Non-Operating

The supply as installed in the printer which is packaged in its shipping container must withstand random vibration during transportation as follows:

Vertical Axis Excitation - 1.40 Grms overall from 10-300 Hz. Power Spectral Density .029 g2/Hz from 10-50 Hz with 8dB/octave rolloff from 50-300 Hz.

Longitudinal and Lateral Axis Excitation - 0.68 Grms Overall from 10-200 Hz. Power Spectral Density 0.007 g2/Hz from 10-50 Hz with 8dB/octave rolloff from 50-200 Hz.

Test duration shall be one hour in each axis (3 hours total).

7.0 MECHANICAL REQUIREMENTS

The power supply electronics shall be contained within a volume as specified by the envelope drawing in Figure 5.

The power supply enclosure layout (Figure 4.) is provided as reference to aid visualization of the power supply envelope.

The input/output connector locations and mounting hole pattern are as defined in the envelope drawing.

8.0 REGULATORY AGENCY REQUIREMENTS

The Regulatory Agency Safety Requirements are as defined in VDE Standard #0730 and UL Standard #478. The power supply as installed in the printer must comply with these standards.

9.0 EMI COMPATABILITY

The power supply assembly, when installed in the 350 Series printer, must comply with EMI standards. Since the integrity of the EMI shield is not complete until installed in the printer, the supply as a stand-alone entity, may not fully comply with the standards. The supply, however, must be designed with these standards in mind.

9.1 EMI SUSCEPTABILITY

The EMI susceptability requirements are defined in terms of observable malfunctions to the operating printer. The power supply (and associated input line filter) must attenuate power line transients such that the DC output voltages remain within specification per Section 4.3. The operating printer will be subjected to the following test conditions and associated allowable malfunction levels.

The malfunctions levels are:

Level 1 - No observable susceptability.

Level 2 - Minor susceptability (i.e., minimal operator intervention - no data loss).

Level 3 - No component damage. Operator intervention permitted to restart - data loss allowed.

The waveshape of the power line transient shall comply with the IEE Std 587-1980. This waveshape, as delineated in the standard, rises from 10% to 90% in 0.5 microsecond, then decays while oscillating at 100 KHz, each peak being 60% of the preceding peak. The power line transient is injected into the power line using a KEYTEK Model 424 surge generator with a Model PN 281 plug-in programmer network. The transients are injected with the peak open circuit voltage increasing in 500 V steps until the maximum voltage for that level is reached. A total of ten transients is injected at each voltage level in alternating polarities.

The peak open circuit transient voltage for each malfunction level is:

Level 1 - 3 KV
Level 2 - 4 KV
Level 3 - 6 KV

9.1.1 Common Mode, AC High

The power line transient is injected between the AC high lead and the earth or "green" lead.

9.1.2 Common Mode, AC Low

The power line transient is injected between the AC low lead and the earth or "green" lead.

9.1.3 Common Mode, AC High and Low

The power line transient is injected between the AC high and low leads and the earth or "green" lead.

9.1.4 Differential Mode

The power line transient is injected between the AC high lead and the AC low lead.

9.2 EMI EMISSION

The EMI emission standards, both conducted and radiated, are as defined in VDE 871 Level B (N-12) minimum.

10.0 RELIABILITY PROVISIONS

10.1 RELIABILITY DEFINITIONS

10.1.1 Failure

A failure is any stoppage or malfunction of the Power Supply specified herein which prohibits product conformance as defined by the specifications herein. This excludes stoppages or sub-standard performance caused by operator error, power failure, environmental conditions exceeding specified limits, or failures induced in the product (secondary failures) due to malfunctions in other portions of the printer.

10.1.2 Power-On Time

The period of time during which A.C.Power is applied to the product is defined as Power-On Time. Unless stated otherwise, all hours are expressed in terms of Power-On Time.

10.1.3 Duty Cycle

The percentage of Power-On Time for which certain operational modes must be limited. There shall be no Duty Cycle constraints on the power supply.

10.1.4 Power Supply Failure Rate ( )

The Failure Rate ( ) shall be defined only during the product Useful Life and is calculated as follows:

$$\lambda = \frac{\text{Number of Failures}}{\text{Power On Time}}$$

10.1.5 Useful Life

The period of operating time after delivery to B10 Life. During the Useful Life, failures which occur must be repairable, such that the parts replacement cost does not exceed 20% of the Power Supply cost.

10.1.6 Mean-Time to Repair (MTTR):

The MTTR is the average value of time required to perform repair of the product by a properly trained and equipped service representative after it has failed. MTTR is calculated as follows:

$$MTTR = \frac{\text{Total Product Repair Time}}{\text{Number of Repair Actions}}$$

10.1.7 Infant Mortality Period

Infant Mortality Period is defined as that time period of early product life when an initially high failure rate decreases to a specified Useful Life failure rate level.

10.1.8 B10 Life

The time duration of Power Supply operating time until 10% of the supplies have failed due to an end of life, or wear out pattern; which is defined either as a pattern of failures which render the supply non-repairable within the time and cost constraints referenced herein, or a failure pattern distinguished by an increasing Power Supply failure rate relative to time.

10.2 RELIABILITY PARAMETERS

The Power Supply shall be capable of demonstrating, in a randomly selected sample, with a ninety percent (90%) level of Statistical Confidence, the following parameters:

A. All Reliability Parameters are based on the Operating Environment specified in Section 6.

B. The Population Failure Rate shall not exceed 50X10-6 failures per hour, during the useful life.

C. Power supplies delivered to Centronics Data Computer Corporation shall be free of Infant Mortality.

D. The B10 Life shall exceed 15,000 hours.

E. The Mean Time To Repair (MTTR) shall be equal to or less than 0.5 hours per repair action.

F. Ninety percnt (90%) of all repair actions shall require less than one hour to complete.

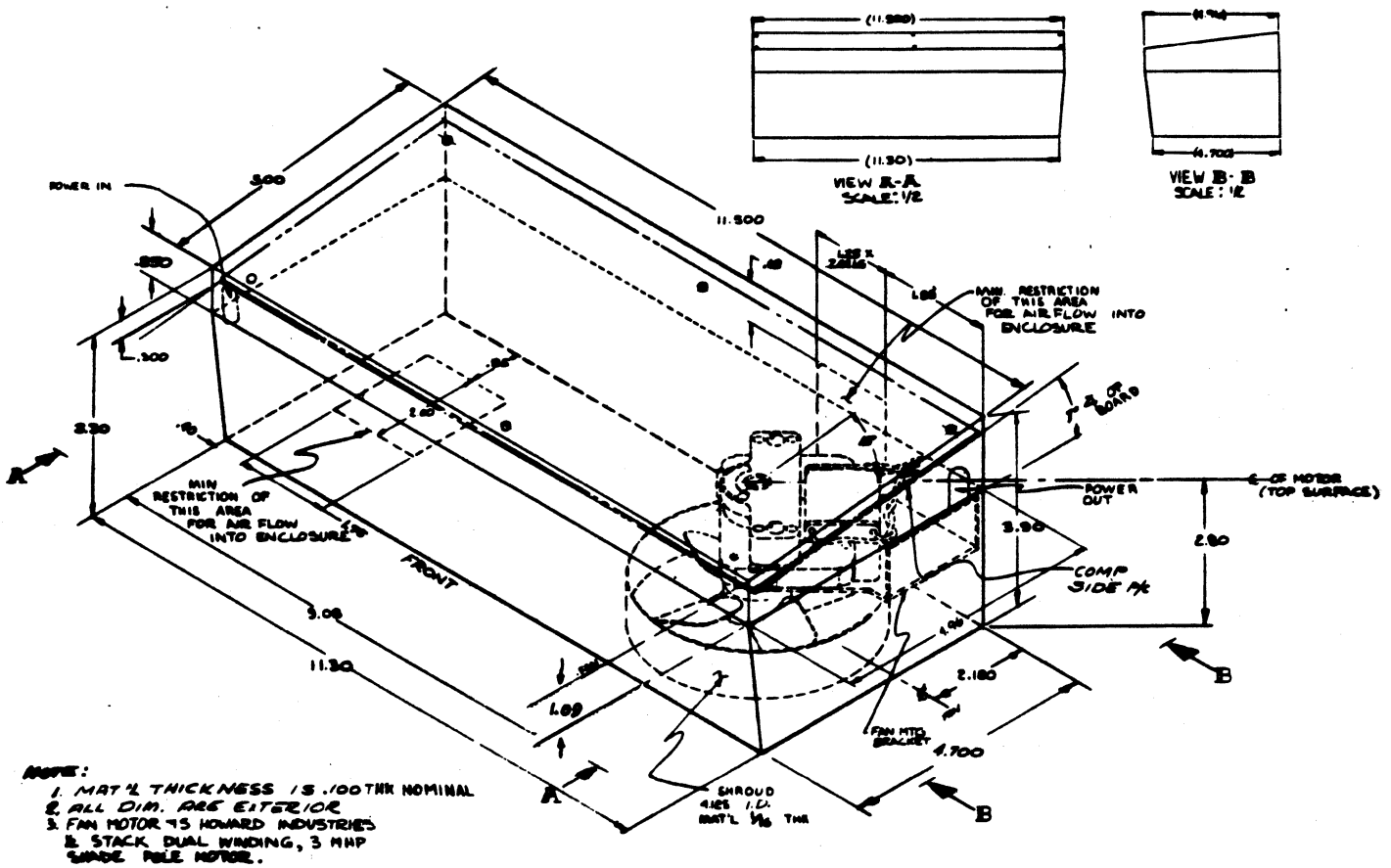
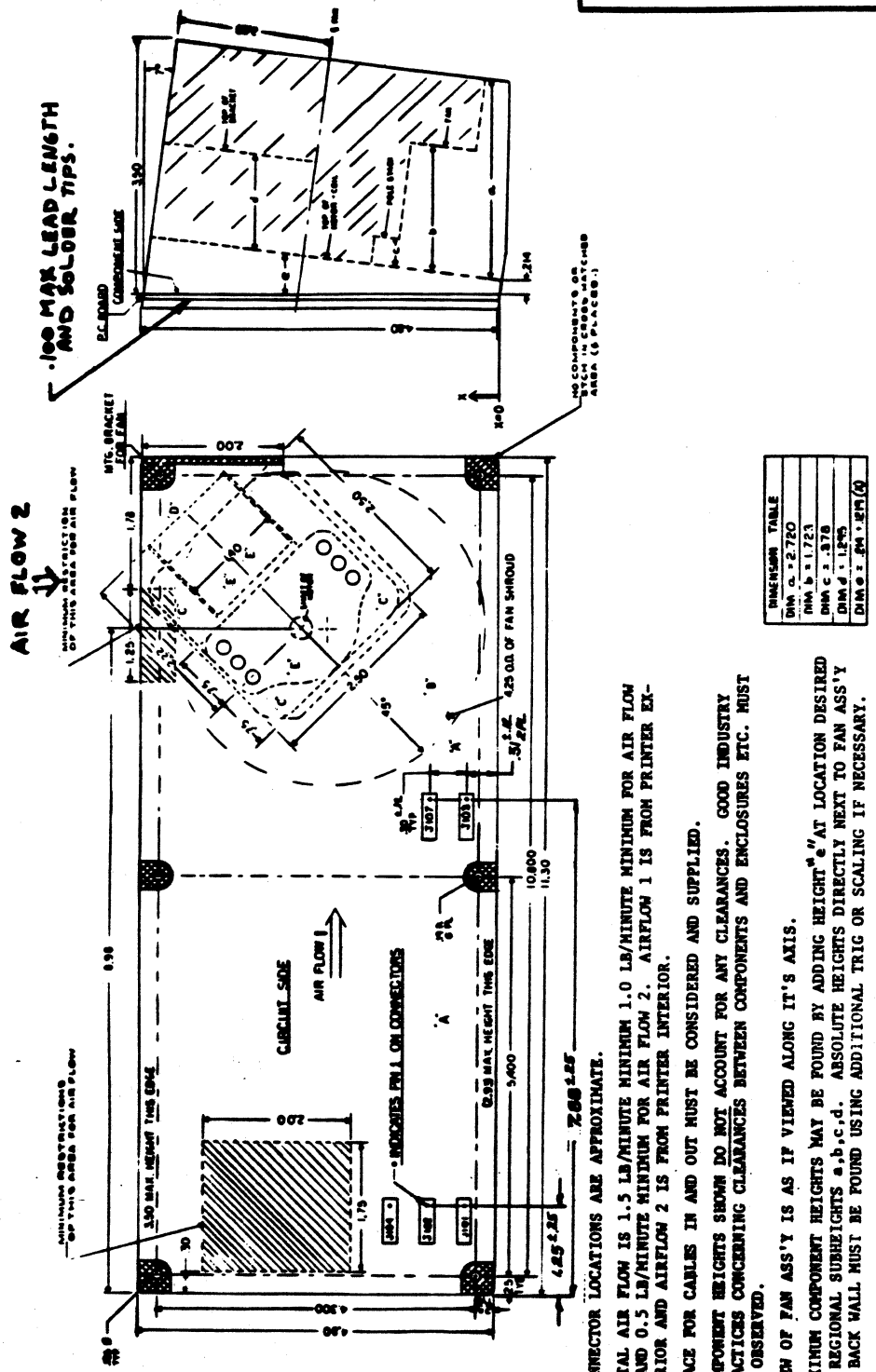


Figure 4. POWER SUPPLY ENCLOSURE LAYOUT



NOTES:

1. CIRCUITRY MUST BE A MINIMUM OF .025 FROM EDGE OF P.C.BOARD.
2. COMPONENTS MUST BE A MINIMUM OF .10 FROM EDGE OF P.C. BOARD.
3. MAXIMUM COMPONENT HEIGHTS MAY BE FOUND BY ADDING HEIGHT "e" AT LOCATION DESIRED TO REGIONAL SUBHEIGHTS a,b,c,d. ABSOLUTE HEIGHTS DIRECTLY NEXT TO FAN ASS'Y OR BACK WALL MUST BE FOUND USING ADDITIONAL TRIG OR SCALING IF NECESSARY.
4. VIEW OF FAN ASS'Y IS AS IF VIEWED ALONG IT'S AXIS.
5. COMPONENT HEIGHTS SHOWN DO NOT ACCOUNT FOR ANY CLEARANCES. GOOD INDUSTRY PRACTICES CONCERNING CLEARANCES BETWEEN COMPONENTS AND ENCLOSURES ETC. MUST BE OBSERVED.
6. SPACE FOR CABLES IN AND OUT MUST BE CONSIDERED AND SUPPLIED.
7. TOTAL AIR FLOW IS 1.5 LB/MINUTE MINIMUM 1.0 LB/MINUTE MINIMUM FOR AIR FLOW 1 AND 0.5 LB/MINUTE MINIMUM FOR AIR FLOW 2. AIRFLOW 1 IS FROM PRINTER EXTERIOR AND AIRFLOW 2 IS FROM PRINTER INTERIOR.
8. CONNECTOR LOCATIONS ARE APPROXIMATE.

Figure 5. POWER SUPPLY ENVELOPE