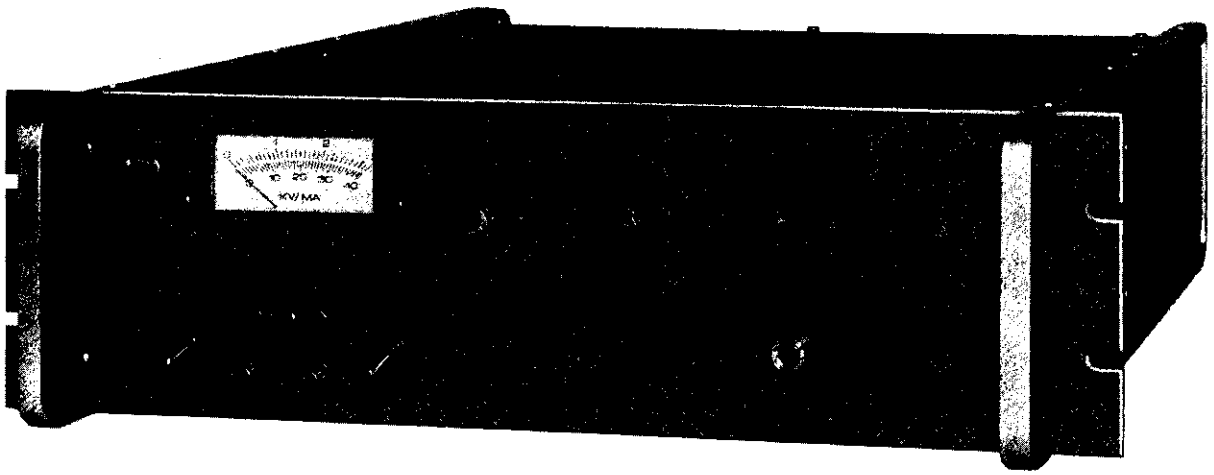
1-3012 VOLTS DC, 0-40 MA



APPLICATIONS

PHOTO MULTIPLIERS
SOLID STATE DETECTORS
PROPORTIONAL COUNTERS
ELECTRON OPTICS
IMAGE INTENSIFIERS
CRT DISPLAYS

GENERAL DESCRIPTION

The Model 1570 is a calibrated, high voltage power source designed to supply closely regulated DC to critical circuits where stability, low noise and reliability are prime considerations. This instrument replaces Models 1544 and 1547 and offers new technology reflecting field experience with more than 7,000 units in service over ten years. The Model 1570 offers twice the current output of the Model 1544 at a modest increase in cost and the equivalent current output of the Model 1547 at a lower price.

High voltage components including plate, heater transformers, voltage multiplier assemblies, etc. are environmentally isolated in vacuum-encapsulated epoxy modules.

FEATURES

- Calibrated control of the output voltage in 500 V, 100 V, 10 V steps and a continuously adjustable vernier potentiometer. This potentiometer has a range of 11 V and a resolution of 10 mV. Calibrated accuracy is better than 0.25% of the dial settings above 250 V, 1% or 100 mV below 250 V.
- Continuously adjustable front panel current limiter permits adjustment of the maximum output current from 5 to 40 mA. Screw slot access avoids accidental misadjustment. Electronic current limiting system permits continuous operation into an overload or short circuit with automatic restoration upon fault clearance. Output condition is periodically sensed and normal function restored automatically upon fault clearance. Pulsating meter signals malfunction.*
- Solid state control amplifier employing a new low noise zener voltage reference with a temperature coefficient of better than 10 ppm. Parallel high voltage vacuum tubes are used for the regulator series control element.
- Rear panel polarity reversing switch provides operation with either positive or negative terminal at ground potential. An option is available for operation of the normally grounded terminal at potentials up to 500 VDC from chassis.

*Patent No. 3,083,330

POWER DESIGNS

POWER DESIGNS INC.
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

POWER DESIGNS PACIFIC INC.
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

CAUTION

DANGEROUS VOLTAGES EXIST WITHIN THIS POWER SUPPLY. USE EXTREME CAUTION WHEN SERVICING OR MAKING ADJUSTMENTS. DO NOT SERVICE THE POWER SUPPLY WHEN POWER IS OFF UNTIL ALL HIGH VOLTAGE CAPACITORS HAVE BEEN SHORTED. USE AN INSULATED SCREW DRIVER WHEN MAKING ADJUSTMENTS. WHEN SERVICING WITH THE AC POWER ON, THE POLARITY SWITCH SHOULD ALWAYS BE IN THE NEGATIVE OUTPUT POSITION TO AVOID HIGH VOLTAGES FROM THE SEMICONDUCTOR CIRCUITS TO CHASSIS.

BEFORE OPERATING THE SUPPLY:

1. DISASSEMBLE TOP AND BOTTOM DUST COVERS AND CAREFULLY REMOVE SPONGE RUBBER PACKING MATERIAL.

2. BE SURE TUBES ARE FIRMLY SEATED IN THE SOCKETS.

3. REMOVE ALL TRACES OF DUST ACCUMULATION ON HIGH VOLTAGE INSULATION SURFACES.

4. REASSEMBLE BOTH DUST COVERS BEFORE CONNECTING THE SUPPLY TO AN AC SOURCE.

ADDENDA

POWER SUPPLY

MODEL 1570

The following components are omitted from the printed circuit board on a standard Model 1570. These components do not appear on the schematic diagram. They are utilized only for special modifications.

C22
CR26
CR27
CR28
R75
R76
R77

SECTION 1
GENERAL DESCRIPTION

1.1 DESCRIPTION

The Model 1570 is a well regulated, high voltage power source designed to operate devices requiring stable DC voltages with unusually low noise and ripple content.

The regulator circuits use series regulator tubes driven by a semiconductor control amplifier. The regulator provides a power source with excellent operating characteristics, stability and response time. Also included are electronic overload circuits to protect semiconductor circuits from damage caused by voltage transients, arcing in the series regulator tube, or external short circuits.

The high stability of the output voltage is due to the use of a temperature compensated zener diode as a reference element, to the use of precision, wirewound, low temperature coefficient resistors in all voltage dividers, and to the use of a solid state control amplifier, fully compensated for temperature effects.

1.2 ELECTRICAL SPECIFICATIONS

INPUT: 105 to 125 V, 50 to 440 Hz, single phase, 230 watts at nominal line voltage.

OPERATING TEMPERATURE: 0° to 50°C.

OUTPUT: 1 to 3012 VDC, continuously adjustable, 0-40 millamperes maximum. A panel adjustment control permits adjustment of the output current from 5-40 milliamperes.

REGULATION: Better than 0.001% + 2 millivolts for line variations of ±10% or 100% changes in rated load.

RIPPLE AND NOISE: 1 millivolt peak-to-peak maximum, 300 microvolts rms.

TEMPERATURE COEFFICIENT: Output voltage change less than 25 ppm per °C change in ambient after warm-up.

STABILITY: Better than 0.005% per hour or 0.01% per 24 hours (after warm-up) at constant ambient temperature, line voltage and load.

OUTPUT VOLTAGE CONTROLS: The output voltage equals the sum of the settings of three rotary switches and an interpolation potentiometer.

CALIBRATION ACCURACY: 0.25% of the voltage control dial readings from 250 to 3012 volts; 1% or 100 millivolts (whichever is greater) from 1 to 250 volts, with the interpolation potentionmeter set to its extreme counterclockwise position.

POLARITY: Either positive or negative output terminal may be operated at ground potential, selected by the POLARITY SWITCH mounted on the front panel.

METERING: Measurement output voltage or current is provided by a toggle switch (spring return to KV position) and a single front panel meter.

RESOLUTION: 10 millivolts on the interpolation potentiometer.

RESETABILITY: 0.1% or 100 millivolts.

RECOVERY TIME: Better than 50 microseconds to return to within regulation limits for 100% step change (1 microsecond rise time) in rated load.

1-3. MECHANICAL SPECIFICATIONS

Dimensions: 19 inches x 5 1/4 inches x 16 inches behind front panel. The supply may be mounted in a standard 19-inch rack.

Weight: 33 lbs.

OUTPUT TERMINALS: The high voltage output is available from two paralleled SHV (BNC) high voltage connectors at the rear of the chassis. These "Safety High Voltage Connectors" are designed for personnel protection and to prevent accidental insertion of standard BNC signal connectors.

SECTION 2
PREPARATION FOR USE, STORAGE AND RESHIPMENT

2-1 PREPARATION FOR USE

Before operating the power source:

a. Disassemble top and bottom dust covers and carefully remove the packing material protecting the series regulator vacuum tubes.

b. Be sure tubes are firmly seated in their sockets.

c. Remove all traces of dust accumulation on high voltage insulation surfaces.

d. Reassemble both dust covers.

e. Keep the original carton, protective wrapping and cushioning for possible future use.

The power supply has been adjusted at the factory and is ready for operation. The three-conductor, molded line cord provided with the power supply, grounds the chassis and front panel when plugged into a DC outlet. If a two-conductor outlet must be used, connect through a 3 pin NEMA adapter. Wire the ground lead of the adapter to ground on the outlet.

NOTE: The maximum operating temperature of the power source is 50°C (122°F). In rack installations be sure that the circulation of air within the cabinet or the total heat dissipation of other equipment does not result in too high an ambient temperature. If the unit is operated on a bench, provide space for free circulation of air

2-2 PREPARATION FOR STORAGE AND RESHIPMENT

For storing or reshipping the power source:

a . Protect the series regulator tube with foam cushioning materi al.

b. Wrap the power supply in heavy paper or in a plastic bag. Protect the meter face from scratches if paper is used. Do not put tape directly over the meter face.

c. Pack the power supply in a heavy corrugated cardboard carton and use heavy tape or metal bands to seal the carton.

NOTE: If the power supply is to be returned to the factory for service, attach a tag identifying the owner and indicating the reason for return. In any correspondence, identify the power supply by Model and Serial Number.

SECTION 3
OPERATION

3.1 OPERATION

3.1.1 Connect the separately furnished AC line cord to the NEMA receptacle at the rear of the power supply and to a source of AC power.

3.1.2 Set the POLARITY switch to the desired output polarity. Note that the opposite polarity DC output terminal is automatically connected to chassis.

3.1.3 Set the AC ON switch to the AC ON position. This energizes the auxiliary internal power sources and the heaters of the series regulator tubes. The AC ON lamp will light.

3.1.4 Set the panel switches to the desired output level. The output voltage is the sum of the settings of these switches and the continuously adjustable potentiometer.

3.1.5 Set the HV ON switch to the ON position. This energizes the high voltage plate transformer and the high voltage circuits. The HV ON lamp on the front panel will light as well as a HV ON indicator at the rear of the supply.

CAUTION: DO NOT MAKE OR REMOVE CONNECTIONS TO THE HIGH VOLTAGE OUTPUT CONNECTORS WITH THE HV ON SWITCH IN THE ON POSITION. (REAR HV ON LAMP ILLUMINATED) ARCING WILL OCCUR WHICH MAY DAMAGE THE CONNECTORS OR INTERNAL CIRCUITRY AS WELL AS PRESENT A POSSIBLE SHOCK HAZARD.

3.2 OPERATIONAL NOTES

3.2.1 Tube Heater Time Delay: No vacuum tube heater time delay is incorporated in the supply. The HV ON switch may be operated simultaneously with the AC ON switch. The power supply may also be turned on and off by means of the AC ON switch with the HV ON switch in the ON position. No damage to the supply or any output voltage overshoot will occur. The output voltage will rise slower than normal under these circumstances since the series regulator tubes will not deliver current until their heaters have warmed up. However, it is preferable to turn on the HV ON switch approximately 20-30 seconds after the AC ON switch is operated. This procedure tends to minimize "cathode shedding" phenomena (see paragraph 3.2.5).

3.2.2 Polarity Switching: DO NOT REVERSE POLARITY WITH THE HIGH VOLTAGE ON. Set the HV ON switch to off. Operate the Polarity switch only when the output voltage has fallen to zero. Failure to observe this precaution will cause arcing in the switch and possible internal damage.

3.2.3 Panel Meter: The panel meter normally reads the output voltage. A KV/MA spring-return toggle switch, when held in the MA position, will indicate the output current of the supply. This meter is connected outside the regulating loop and thus, introduces an impedance in series with the output terminals when in the MA position. To minimize the effect on the load regulation, the meter switch is spring-loaded to read output voltage in its normal position.

3.2.4 Current Limiting: The Model 1570 is factory adjusted to limit the maximum output current to approximately 45 milliamperes. A screw-slot front panel adjustment permits variation of the maximum output current from 8-45 milliamperes. If a current overload is applied to the output terminals (depending upon the setting of the CURRENT LIMIT CONTROL) the output voltage will pulsate from zero to a value determined by the current limit level setting and the load resistance. This condition may be observed on the output meter. The pulsing rate is set by an internal time constant to approximately 0.5 seconds. The duty cycle of the high voltage 'on' period is automatically determined by the internal circuitry such that the load and the power supply are protected from damage by limiting the average power delivered to that level under normal operating conditions. This patented circuit also functions to quench temporary arcing at the load caused by dust accumulation, high humidity, etc. and avoid burning of the insulating materials, contacts, etc.

3.2.5 Cathode Shedding: A common phenomenon occurring with vacuum tube cathodes, particularly with tubes operated at high voltage, is the loosening of bits of the oxide coating on cathode sleeves or on coated heaters due to mechanical stresses resulting from cooling and heating of the cathode/heater structure. There is a greater tendency for this condition to occur with new vacuum tubes and diminish as they age. However, cathode shedding is observable during the entire life of the tube. When bits of cathode material leave the cathode, they are attracted to positively biased electrodes of the vacuum tube and fly through the grid structures of the tube toward the plate. In their passage, they may strike interelectrode arcs often of only microseconds duration. Since some of the potentials applied to the vacuum tube electrodes are derived from semiconductor circuitry, this arcing may produce high voltage transients which can damage the semiconductor devices. In the Model 1570, neon glow discharge tubes are incorporated to harmlessly bypass these transients to preclude semiconductor damage. These discharge tubes are mounted in clamps on the printed circuit board. Occasional flashing indicates normal operation as protective devices. These transients do not appear across the output of a properly protected power supply and do not effect operation.

3.2.6 Precision Resistor Protection: The output voltage of the Model 1570 is determined by the value of a precision resistance divider whose value is adjusted by the panel switches. If the power supply is operated at a high output voltage and then suddenly reduced to a lower value, the output capacitors

in the power supply as well as any external capacitance across the output terminals of the supply charged to a previous voltage level will discharge through the remaining resistors in the divider with resulting large voltage transients across them. These resistors are wound with low temperature coefficient wire on multi-pi bobbins. However, the instantaneous voltage may be large enough to result in breakdown of the insulated coating between turns of wire. In time, this may produce shorted turns resulting in resistance change and loss of calibration. Intermittent shorts may also occur which will make the divider and the output extremely noisy. The Model 1570 incorporates a proprietary technique utilizing glow discharge tubes across the precision resistors subject to these transients. These tubes will automatically flash to clamp the voltage across the resistors affected, to a safe voltage level. In operation, if the step switches are turned down from a high to a low voltage setting, these neon tubes may be observed to flash. This is normal. However, if any of the tubes glow continuously, this is an indication of a divider resistor malfunction or of the supply regulator system and should be investigated.

SECTION 4
THEORY OF OPERATION

4-1. GENERAL

The Model 1570 consists of the following basic sub-assemblies; an unregulated DC source, a series pass element, a control amplifier and auxiliary power sources.

4-2. UNREGULATED DC SOURCE

This is a voltage doubler circuit using silicon rectifiers. Taps on the primary of the high voltage transformer, T2, are changed by the 0 - 2500 volt switch. [redacted] the unregulated to the regulated voltage output in this manner minimizes power dissipation in the series regulator tubes.

4-3. SERIES PASS ELEMENT

Power tetrodes are used as series regulator tubes in the positive leg of the unregulated supply. The tubes act as an electronically variable series resistance connected between the unregulated source and the load.

4-4. CONTROL AMPLIFIER

This transistor amplifier senses a fraction of the output voltage obtained from a switched resistance divider and compares it with a fixed zener diode voltage reference. The error signal is then amplified and applied to the control grids of the regulator tubes to control their effective series resistance.

4-5. AUXILIARY POWER SOURCES

The control amplifier, regulator tubes and zener diode reference circuit derive their operating potentials from the following auxiliary power sources;

(1) An unregulated DC source (+80V, -84V) provides screen voltage for the series regulator tubes and operating voltage for control amplifier.

(2) A constant current source Q1 derived from the +80V source provides operating potential for the reference voltage zener diode.

SECTION 5

MAINTENANCE

5.1 GENERAL

Under normal conditions no special periodic maintenance is required except for dust removal or series tube replacement. Calibration may be checked and re-calibration performed at predetermined intervals, as desired. The long-term stability of critical components utilized in this instrument is such that recalibration should be necessary only after 5,000 to 10,000 hours of normal operation or when a component has been replaced.

5.2 DUST AND GRIME

In dusty or oily environments, exposed high voltage circuits tend to function as dust precipitators and build-up of dust and grime on insulating surfaces adjacent to high potential points is common. This accumulation may be electrically conductive, resulting in corona, noisy output or arcing. Visual examination of the supply should be made at periodic intervals and the dust accumulation, if any, removed with a soft brush. If this accumulation is oily and sticks to insulating surfaces, it should be removed with a solvent such as alcohol, trichlorethane, TMC (Freon), etc. The use of acetone or acetone bearing solvents should be avoided.

5.3 TUBE REPLACEMENT

The 8068 series pass tube is a "10,000 hour" industrial type, operated at reduced heater voltage to enhance filament life. Field history indicates that the average life expectancy is 4-5 years. Failure of the power supply to meet performance specifications at full load and minimum AC line voltages may be an indication of the need for replacement.

CAUTION

LETHAL VOLTAGES ARE PRESENT WHEN THE POWER SUPPLY IS ON AND MAY BE PRESENT FOR A MINUTE OR MORE AFTER THE POWER SUPPLY IS TURNED OFF UNTIL BLEEDER RESISTORS HAVE FULLY DISCHARGED THE HIGH VOLTAGE CAPACITORS. DISCHARGE ALL HIGH VOLTAGE CAPACITORS WITH A SUITABLE JUMPER LEAD BEFORE SERVICING. WHENEVER POSSIBLE, SERVICE THE SUPPLY WITH THE OUTPUT POLARITY SWITCH SET TO NEGATIVE. THIS POSITION PUTS THE SOLID STATE CONTROL CIRCUITRY NEAR CHASSIS POTENTIAL. IN THE POSITIVE POLARITY CONDITION THESE CIRCUITS OPERATE WITH THE HIGH VOLTAGE OUTPUT POTENTIAL BETWEEN THEM AND CHASSIS MAKING SEMICONDUCTOR VOLTAGE MEASUREMENTS

EXTREMELY HAZARDOUS. ALWAYS USE AN INSULATED SCREWDRIVER WHEN MAKING INTERNAL ADJUSTMENTS.

5.4 SERVICE NOTES

(a) Maintenance and repair should not be attempted by technicians without experience with high voltage regulated power supplies of the series regulator type. Adequate instrumentation of sufficient accuracy, voltage rating, etc. must be available to avoid loss of performance and calibration accuracy.

(b) Output ripple and noise observation should be made with an oscilloscope connected to the supply through a "viewing" capacitor of at least 1-2 MFD and a voltage rating of 3,500 VDC minimum. An NE-2 neon bulb in parallel with a 470K, 1/2 watt composition resistor should be connected across the input terminals of the oscilloscope to avoid damage to the oscilloscope when the viewing capacitor charges or discharges.

(c) A schematic diagram and component location diagram is part of this manual. P. C. board components are labeled with circuit designations corresponding to the schematic diagram. Significant voltages are also shown on the schematic diagram at appropriate points.

(d) Conventional methods of isolating defective components may be employed utilizing the voltages listed on the schematic, point-to-point resistance measurements and in-circuit checking of semiconductors. The power supply should never be operated with an external load and one or more components or semiconductors removed from the circuit. Circuit runaway may occur resulting in chain-reaction burnout of a substantial portion of the semiconductor devices.

(e) Use extreme caution when servicing the supply in the positive output polarity condition. A slip of a test prod or screwdriver resulting in a circuit short to chassis may destroy every semiconductor in the supply.

5.5 RECALIBRATION

Periodic calibration check of the supply may be made at regular intervals as required and after components have been replaced.

5.5.1 OUTPUT VOLTAGE CALIBRATION

(a) Set panel switches and potentiometer to 3006 volts and observe the output voltage with a suitable digital voltmeter and divider combination. Readjust trimmer potentiometer R16 if necessary.

(b) Set panel switches to zero and potentiometer to 6 volts on the digital voltmeter, loosen knob set screws if necessary and reset so that knob points to 6 volt panel mark.

(c) Run each panel switch through its range separately with the other switches set to zero observing the output voltage for accuracy and linearity. If improved linearity or accuracy is desired over specific ranges, a slight readjustment of R16 may be desirable. An abnormal reading at a specific switch setting may be due to a defective precision resistor. Note that as these switches are rotated, the neon bulbs on each switch deck may flash. Use of these neon bulbs are a proprietary technique to limit the transient voltage across the precision wirewound resistors to a safe level if the voltage of the supply is suddenly reduced and the output capacitors of the supply discharge through this divider network. Failure to protect these resistors will reduce their life expectancy as a result of inter-turn breakdown and resulting circuit noise.

5.5.2 METER CALIBRATION

(a) Set the panel controls to 3001 volts output.

(b) Adjust trimmer potentiometer R50 so that meter reads 3000 volts.

(c) Check meter with panel controls at 1501 volts. A slight readjustment may be desired for improved linearity and accuracy at mid-scale.

(d) Make sure that the meter is set to zero when calibrating. With no load on the supply, depressing the spring-return KV/MA toggle switch will provide a quick check. Readjust zero if necessary by means of black screw accessible from the front of the panel.

(e) Set OUTPUT CURRENT LIMIT panel screw-slot control maximum clockwise. Connect a suitable 40 milliampere load to the output of the supply. An accurate external milliameter should be connected in series with the low voltage side of the load. Note that this adjustment may be made at any output voltage. The panel voltage controls may be used to set this current accurately.

(f) Depress KV/MA toggle switch and adjust trimmer R48 until panel meter reads 40 milliamperes.

5.5.3 MAXIMUM OUTPUT CURRENT

The maximum output current of the supply is limited to 45 milliamperes in the event of a short circuit or overload (with the OUTPUT CURRENT LIMIT control in its maximum clockwise position).

(a) Connect a load of approximately 45 milliamperes to the supply in series with a suitable milliameter. Choose a value of resistance such that the output current can be increased to 50 milliamperes by increasing the supply output voltage.

(b) Slowly increase the load current by increasing the output voltage while observing the panel voltmeter.

(c) If the supply is properly adjusted, at an output current level of approximately 45 MA the output voltage will suddenly collapse and the meter will pulsate. Pulsations will occur at about a one second rate as the overload monitoring circuit attempts to restore operation, senses the overload and cuts off the supply again. Lowering the output current by lowering the output voltage will return the supply to normal operation.

(d) Adjust R6 if necessary so that the overload circuit is triggered at approximately 45MA.

5.5.4 ZENER REFERENCE DIODE REPLACEMENT

If zener reference diode CR11 is replaced and R16 adjustment does not permit recalibration of the supply per paragraph 5.5.1, use the following procedure:

(a) Remove jumpers (if any) across R17 and R18.

(b) Clip a jumper across R17. Readjust R16 to determine if it is now in range. Repeat with jumper across R18 or with jumper across both resistors. Solder correct jumper in place.

5.5.5 LOAD REGULATION ADJUSTMENT

A regulation adjustment is provided which permits setting of the change in output voltage to zero (any output voltage) for a load change of 40MA. Do not attempt this adjustment without instrumentation capable of observing a 2.0 millivolt or less change in output voltage at an output level of 3000 volts. If such instrumentation is available R27 trimmer may be adjusted for perfect load regulation when alternately connecting or disconnecting a 40MA load to the supply.

5.5.6 LINE REGULATION

Similarly to the load regulation adjustment of paragraph 5.5.5 the power supply output voltage may be perfectly compensated for line voltage variations. With a variable autotransformer in series with the AC input to the supply and a 40MA load on the output at 3000 volts, adjust R38 so that no discernible change in output voltage can be observed when varying the input AC voltage from 105 to 125 volts.

APPENDIX

1. INTRODUCTION

This Appendix contains an Electrical Parts List, Schematic Diagram, Parts Location Diagram and equipment Warranty.

2. ELECTRICAL PARTS LIST

All electrical and electronic parts are listed in the sequence of their circuit numbers as shown on the Schematic Diagram. A brief description of each part is given, followed by the code number of the manufacturer and his part number. All manufacturers' code numbers are taken from Cataloging Handbooks H4-1 and H4-2, Federal Supply Code for Manufacturers. These handbooks can be obtained from Federal Agencies or ordered directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

We recommend that all parts with the code number 98095 be ordered directly from Power Designs, Inc. The commercial equivalents of these parts may have wide parameter tolerances or require special factory inspection or modification before they can be used in the power supply.

All components used in the power supply or supplied as replacements are carefully inspected at the factory. Inspections are performed on a 100% basis or at AQL levels to Military Specification MIL-Q-9858 under which Power Designs, Inc. has been qualified.

All semiconductors are inspected on a 100% basis, not only for operating parameters, but also for critical characteristics related to reliability and predictable life expectancy. Some of these characteristics are observed when the device is taken beyond its normal operating regions. These test techniques have been developed under a "predictable reliability" program in operation at Power Designs, Inc. for the past twelve years. Under this program, quality control procedures are constantly revaluated and updated as advances are made in solid state technology and experience is gained from field history.

Semiconductor manufacturers are continually modifying their products. Complete lines are discontinued to be replaced by devices having improved gain, operating voltage levels and frequency responses. The high gain, closed loop DC amplifiers used in regulator circuits are particularly sensitive to slight changes in these parameters. Commercial or military "equivalent" transistors may affect the performance of the power supply. We can assure compliance with the original specifications if replacement semiconductors are ordered from the Factory.

All replacement semiconductors are processed and stocked at the factory to insure complete interchangeability with the devices in the original equipment. These devices are coded with a Power Designs Inc. part number. For example:

	Prefix	Type No.	Suffix
	Semiconductor Manufacturers' Code	Power Designs Inc. Type	Suffix Identifying Special Parameters
i.e.	MS	1028	A

When ordering replacements, please identify the device as thoroughly as possible, giving the model and serial number if available.

The replacement part you receive may not have the same part number as that shown on the Electrical Parts List. This may be due to one of the following factors:

a. A different prefix indicating that Power Designs Inc. is using another vendor source, although the operating characteristics of the devices are interchangeable.

b. A completely different part number indicating:

1. The original vendor has discontinued manufacture of the device or can no longer manufacture it to the original specifications.

2. A better or more reliable device has been substituted.

3. Tighter controls for interchangeability have provided greater assurance of equivalent performance with the replacement.

CODE LIST OF MANUFACTURERS

01121	Allen-Bradley	Milwaukee, Wisconsin
09408	Star-Tronics, Inc.	Georgetown, Massachusetts
33173	General Electric Co.	Owensboro, Kentucky
71400	Bussman Manufacturing Division	St. Louis, Missouri
98095	Power Designs, Inc.	Westbury, New York

ELECTRICAL PARTS LIST

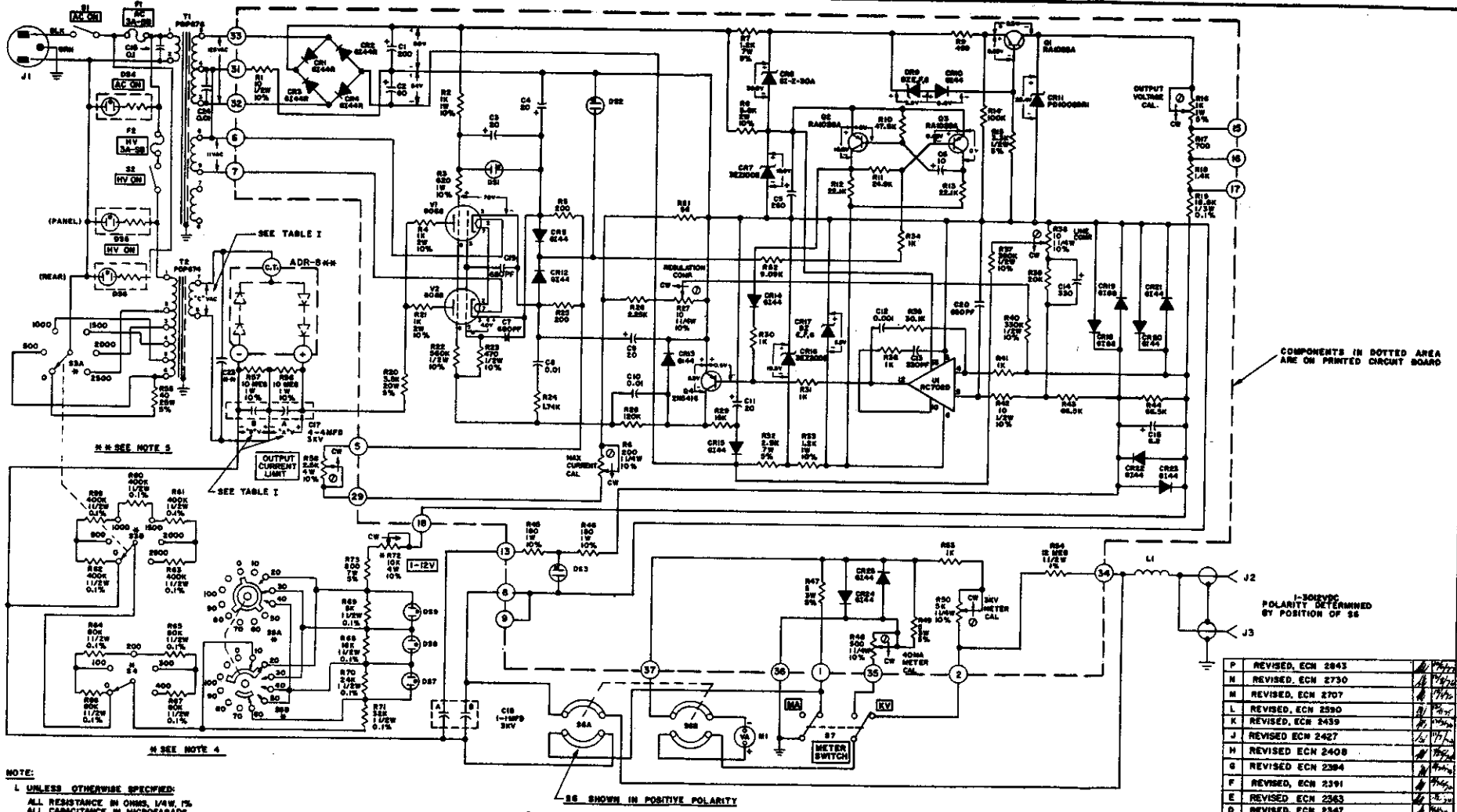
NOTE: Before replacing semiconductors, see paragraph 2 of this Appendix.

Circuit Number	Description	Mfr Code Number	Part Number
ADR-8A	H.V. Rectifier Assembly	98095	PS-1570-5(B)
C1	Capacitor, electrolytic, 200 μf, 100 vdc	98095	CE-200-100
C2	Capacitor, electrolytic, 60 μf, 100 vdc	98095	CE-117-101
C3, C4	Capacitor, electrolytic, 20 μf, 100 vdc	98095	CE-103-1
C5	Capacitor, electrolytic, 260 μf, 15 vdc	98095	CEX-260-15
C6	Capacitor, tantalum, 10 μf, 35 vdc	98095	CE-106-.35
C7	Capacitor, ceramic disc, 680 pf, 3 kvdc	98095	CC-680P-302
C8	Capacitor, plastic film, .01 μf, 200 vdc	98095	CP-16-2
C9	Capacitor, electrolytic, 20 μf, 100 vdc	98095	CE-103-1
C10	Capacitor, plastic film, .01 μf, 200 vdc	98095	CP-16-2
C11	Capacitor, electrolytic, 20 μf, 100 vdc	98095	CE-103-1
C12	Capacitor, plastic film, .001 μf, 200 vdc	98095	CP-24-2
C13	Capacitor, tubular, 330 pf, 500 vdc	98095	CC-26-5
C14	Capacitor, electrolytic, 330 μf, 1.5 vdc	98095	CE-77-.015
C15	Capacitor, tantalum, 6.8 μf, 35 vdc	98095	CE-6A8-.35
C16	Capacitor, ceramic disc, 0.1 μf, 600 vdc	98095	CC-37-6
C17	Capacitor, oil filled, dual, 4 μf, 3 kvdc	98095	CO-2X4-302
C18	Capacitor, oil filled, dual, 1 μf, 3 kvdc	98095	CO-23-30
C19, C20	Capacitor, ceramic disc, 680 pf, 3 kvdc	98095	CC-680P-302
C23	Capacitor, ceramic disc, .0022 μf, 6 kvdc	98095	CC-A0022-602
C24	Capacitor, ceramic disc, .01 μf, 1 kv	98095	CC-A01-102
CR1 thru CR4	Diode, silicon	98095	GI44R (red dot)
CR5	Diode, silicon	98095	GI44
CR6	Diode, silicon, zener	98095	SI-Z-30A
CR7	Diode, silicon, zener	98095	1N5067
CR9	Diode, silicon, zener	98095	SV359E, F, G
CR10	Diode, silicon	98095	GI44
CR11	Diode, silicon, zener	98095	PD-1006-BR1
CR12 thru CR15	Diode, silicon	98095	GI44
CR16	Diode, silicon, zener	98095	1N4881
CR17	Diode, silicon, zener	98095	SV359E, F, G
CR18, CR19	Diode, silicon	98095	GI88
CR20 thru CR25	Diode, silicon	98095	GI44
DS1	Lamp, neon	98095	GD-11
DS2, DS3	Lamp, neon	98095	GD-13
DS4, DS5	Lamp, neon and resistor assembly	98095	PLA-19-1
DS6	Pilot lamp assembly	98095	PLA-16
DS7 thru DS9	Lamp, neon	98095	GD-10

ELECTRICAL PARTS LIST

Circuit Number	Description	Mfr Code Number	Part Number
F1, F2	Fuse, Slo-Blo, 3 ampere	71400	Type MDX
J1	AC Receptacle connector	96791	160-5N
J2, J3	Connector receptacle	09408	7758
L1	Surge current limiter	98095	PS-1543A-195(A)
M1	Meter, dual, 0-3 KV, 0-40 MA	98095	MVA-148
P1	Connector	09408	5135A
Q1 thru Q3	Transistor, silicon, PNP	98095	TI1028A
Q4	Transistor, silicon, PNP	98095	2N5416
R1	Resistor, composition, 10 Ω, ± 10%, 1/2 w	01121	EB1001
R2	Resistor, composition, 1 kΩ, ± 10%, 1 w	01121	GB1021
R3	Resistor, composition, 820 Ω, ± 10%, 1 w	01121	GB8211
R4	Resistor, composition, 1 kΩ, ± 10%, 2 w	01121	HB1021
R5	Resistor, precision, metal film, 200 Ω, ± 1%, 1/4 w	98095	RD-201-1QA
R6	Resistor, variable, wirewound, 200 Ω, ± 10%, 1-1/4 w	98095	RWTP-201-C4
R7	Resistor, wirewound, 1.2 kΩ, ± 5%, 7 w	98095	RW-122-3RA
R8	Resistor, composition, 5.6 kΩ, ± 10%, 2 w	01121	HB5621
R9	Resistor, precision, metal film, 499 Ω, ± 1%, 1/4 w	98095	RD-4990-1QA
R10	Resistor, precision, metal film, 47.5 kΩ, ± 1%, 1/4 w	98095	RD-4752-1QA
R11	Resistor, precision, metal film, 24.9 kΩ, ± 1%, 1/4 w	98095	RD-2492-1QA
R12, R13	Resistor, precision, metal film, 22.1 kΩ, ± 1%, 1/4 w	98095	RD-2212-1QA
R14	Resistor, precision, metal film, 100 kΩ, ± 1%, 1/4 w	98095	RD-104-1QA
R15	Resistor, composition, 3.3 kΩ, ± 5%, 1/2 w	01121	EB3325
R16	Resistor, variable, wirewound, 1 kΩ, ± 5%, 1 w	98095	RWT-102-3BHS
R17	Resistor, precision, metal film, 700 Ω, ± 1%, 1/4 w	98095	RD-701-1QA
R18	Resistor, precision, metal film, 1.4 kΩ, ± 1%, 1/4 w	98095	RD-142-1QA
R19	Resistor, precision, wirewound, 18.8 kΩ, ± 0.1%, 1/3 w	98095	RW-1882-8SA
R20	Resistor, wirewound, 3.5 kΩ, ± 5%, 20 w	98095	RW-352-3F
R21	Resistor, composition, 1 kΩ, ± 10%, 2 w	01121	HB1021
R22	Resistor, composition, 560 kΩ, ± 10%, 1/2 w	01121	EB5641
R23	Resistor, composition, 470 Ω, ± 10%, 1/2 w	01121	EB4711
R24	Resistor, precision, metal film, 1.74 kΩ, ± 1%, 1/4 w	98095	RD-1741-1QA
R25	Resistor, precision, metal film, 200 Ω, ± 1%, 1/4 w	98095	RD-201-1QA
R26	Resistor, precision, metal film, 2.25 kΩ, ± 1%, 1/4 w	98095	RD-2251-1QA
R27	Resistor, variable, wirewound, 10 Ω, ± 10%, 1-1/4 w	98095	RWTP-100-C4
R28	Resistor, precision, metal film, 120 kΩ, ± 1%, 1/4 w	98095	RD-124-1QA
R29	Resistor, precision, metal film, 15 kΩ, ± 1%, 1/4 w	98095	RD-153-1QA
R30, R31	Resistor, precision, metal film, 1 kΩ, ± 1%, 1/4 w	98095	RD-102-1QA
R32	Resistor, wirewound, 2.5 kΩ, ± 5%, 7 w	98095	RW-252-3 RA
R33	Resistor, composition, 1.2 kΩ, ± 10%, 1 w	01121	GB1221

Circuit Number	Description	Mfr Code Number	Part Number
R34	Resistor, precision, metal film, 1 kΩ, ± 1%, 1/4 w	98095	RD-102-1QA
R35	Resistor, precision, metal film, 30 kΩ, ± 1%, 1/4 w	98095	RD-303-1QA
R36	Resistor, precision, metal film, 1 kΩ, ± 1%, 1/4 w	98095	RD-102-1QA
R37	Resistor, composition, 390 kΩ, ± 10%, 1/2 w	01121	EB3941
R38	Resistor, variable, wirewound, 10 Ω, ± 10%, 1-1/4 w	98095	RWTP-100-C4
R39	Resistor, precision, metal film, 20 kΩ, ± 1%, 1/4 w	98095	RD-203-1QA
R40	Resistor, composition, 330 kΩ, ± 10%, 1/2 w	01121	EB3341
R41	Resistor, precision, metal film, 1 kΩ, ± 1%, 1/4 w	98095	RD-102-1QA
R42	Resistor, composition, 10 Ω, ± 10%, 1/2 w	01121	EB1001
R43, R44	Resistor, precision, metal film, 66.5 kΩ, ± 1%, 1/4 w	98095	RD-6652-1QA
R45, R46	Resistor, composition, 180 Ω, ± 10%, 1 w	01121	GB1811
R47	Resistor, wirewound, 5 Ω, ± 5%, 3 w	98095	RW-050-3KA
R48	Resistor, variable, wirewound, 500 Ω, ± 10%, 1-1/4 w	98095	RWTP-501-C4
R49	Resistor, wirewound, 5 Ω, ± 5%, 3 w	98095	RW-050-3KA
R50	Resistor, variable, wirewound, 5 kΩ, ± 10%, 1-1/4 w	98095	RWTP-502-C4
R51	Resistor, precision, metal film, 56 Ω, ± 1%, 1/4 w	98095	RD-560-1QA
R52	Resistor, precision, metal film, 9.09 kΩ, ± 1%, 1/4 w	98095	RD-9091-1QA
R53	Resistor, precision, metal film, 1 kΩ, ± 1%, 1/4 w	98095	RD-102-1QA
R54	Resistor, precision, metal film, 12 mΩ, ± 10%, 1-1/2 w	98095	RD-126-4TA
R55	Resistor, wirewound, 40 Ω, ± 5%, 25 w	98095	RW-400-3G
R56, R57	Resistor, precision, metal film, 10 mΩ, ± 10%, 1 w	98095	RD-106-4B
R58	Resistor, variable, wirewound, 2.5 kΩ, ± 10%, 4 w	98095	RWV-252M4-1.37
R59 thru R63	Resistor, precision, wirewound, 400 kΩ, ± 0.1±, 1-1/2w	98095	RW-404-8TA
R64 thru R67	Resistor, precision, wirewound, 80 kΩ, ± 0.1%, 1-1/2 w	98095	RW-803-8TA
R68	Resistor, precision, wirewound, 16 kΩ, ± 0.1%, 1-1/2 w	98095	RW-163-6BA
R69	Resistor, precision, wirewound, 8 kΩ, ± 0.1%, 1-1/2 w	98095	RW-802-6BA
R70	Resistor, precision, wirewound, 24 kΩ, ± 0.1%, 1-1/2 w	98095	RW-243-6BA
R71	Resistor, precision, wirewound, 32 kΩ, ± 0.1%, 1-1/2 w	98095	RW-323-6BA
R72	Potentiometer, wirewound, 10 kΩ, ± 10%, 4 w	98095	RWV-103M4-1.7
R73	Resistor, wirewound, 800 Ω, ± 5%, 7 w	98095	RW-801SP-3RA
S1, S2	Switch, toggle, SPST	98095	ST-5
S3	Switch, rotary assembly (0-2500v)	98095	PS-1544-22(A)
S4	Switch, rotary assembly (0-400v)	98095	PS-1565-26
S5	Switch, rotary assembly (0-100v)	98095	PS-1565-28
S6	Switch, rotary assembly (polarity reversal)	98095	PS-1565-30
S7	Switch, toggle, DPDT, momentary	98095	ST-34
T1	Transformer	98095	676
T2	Transformer	98095	674
U1	Integrated circuit	98095	RC702D
V1, V2	Tube, electron, power tetrode	33173	8068
W1	Line cord	98095	A63052
XV1, XV2	Tube socket	98095	TS101P01



NOTE:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE IN OHMS, 1/4W, 1%
   ALL CAPACITANCE IN MICROFARADS.
2. VOLTAGES INDICATED ARE MEASURED WITH 115VAC, 60HZ INPUT & 3000VDC OUTPUT WITH A 40MA LOAD. MEASUREMENTS MADE WITH A 20,000Ω/VOLT METER FOR DC & 1000Ω/VOLT METER FOR AC. VOLTAGES ARE DC EXCEPT WHERE OTHERWISE INDICATED.
3. CAUTION: ALL MEASUREMENTS SHOULD BE MADE WITH S6 IN THE NEGATIVE OUTPUT POLARITY POSITION.

* 4. ASTERISK MARKED SWITCHES AND POTENTIOMETER ARE OUTPUT VOLTAGE CONTROLS. (OUTPUT VOLTAGE EQUALS THE SUM OF CONTROL SETTINGS).

** 5. WHEN USING MODULE ADR-8, C23 IS (2) IN PARALLEL, 0.0022 MFD EA. WHEN USING MODULE ADR-8A, C23 IS (1) 0.0022 MFD.

TABLE I
(VOLTAGE AT INDICATED POINTS)

OUTPUT	A	B	C
0-500V, 40MA	640	640	960
500-1KV, 40MA	950	950	720
1KV-1500V, 40MA	1100	1100	850
1.5-2KV, 40MA	1400	1400	1050
2-2.5KV, 40MA	1600	1600	1290
2.5-3KV, 40MA	1900	1900	1450

REVISIONS			
LTR	DESCRIPTION	APVD	DATE
P	REVISED, ECN 2843		
N	REVISED, ECN 2730		
M	REVISED, ECN 2707		
L	REVISED, ECN 2590		
K	REVISED, ECN 2439		
J	REVISED ECN 2427		
H	REVISED ECN 2408		
G	REVISED ECN 2394		
F	REVISED, ECN 2391		
E	REVISED ECN 2363		
D	REVISED, ECN 2347		
C	REVISED, ECN 2321		
B	REVISED, ECN 2120		
A	RELEASED		

DRAWING NO. PS-1570-1 REV. P

TITLE SCHEMATIC, MODEL 1570

DRAWN RZ & HC	CHECKED	APPROVED
DATE 1/10/73	DATE	DATE

Power Designs Inc. NEW YORK

SHEET 1 OF 2

CABLE ASSEMBLY INSTRUCTIONS FOR *SHV CONNECTOR

FIG. 1

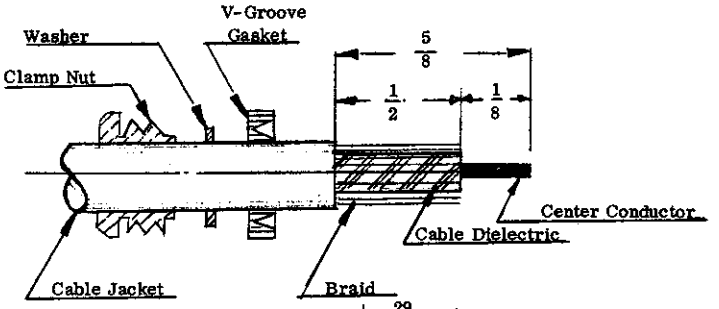


FIG. 2

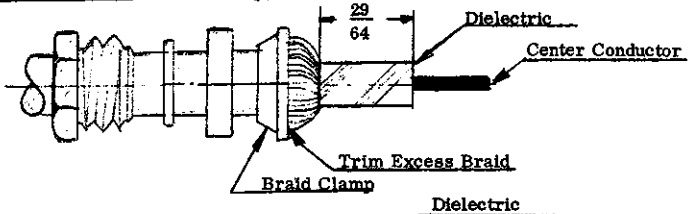


FIG. 3
Assembly for RG-62/U and RG-71B/U Cables

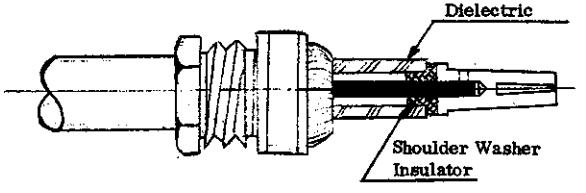
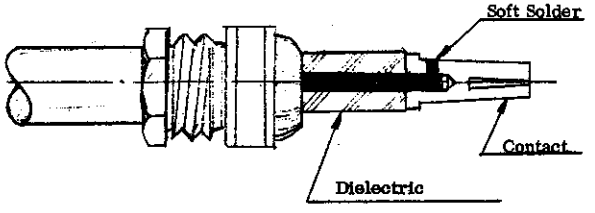


FIG. 4
Assembly for RG-59/U Cable



*Per National Bureau of Standards Dwg. ND-545A "Safety High Voltage Connector"

CABLE TRIM RECOMMENDATIONS

1. Use only proper razor-edged tools or special automatic trimming tools.
2. Keep all trims square, maintain 90° relationship between cable jacket O.D. on all cuts.

CABLE ASSEMBLY INSTRUCTIONS FOR *SHV CONNECTOR

PROCEDURE:

(IMPORTANT: READ CABLE TRIM RECOMMENDATIONS BEFORE BEGINNING ASSEMBLY.)

1. Slide clamp nut, washer and V-groove gasket over cable as shown in Fig. 1.
2. Remove cable jacket to dimension shown; do not damage braid. Comb out braid wires, then fold back and make dielectric cut. Do not nick center conductor (Fig. 1).
3. Fold braid wires forward and taper toward center conductor. Place braid clamp over braid and set firmly against cable jacket. Fold braid wires back in even distribution and trim excess braid where indicated. Check for exposed dielectric dimension shown and retrim if necessary (Fig. 2).
4. For applications requiring use of RG-62 and 71/U cables, add the insulator bushing as shown in Fig. 3.
5. Place contact onto center conductor and bottom on insulator bushing. Soft solder as shown using 60/40 alloy multicore solder with rosin or ersin flux. Remove any surplus solder from outside of contact and thoroughly clean insulator bushing of chips, flux, etc. (Fig. 4).
6. Insert prepared cable into connector shell and tighten clamp nut securely using 20-40 inch-lbs. torque.

*Per National Bureau of Standards Dwg. ND-545A.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED
TOLERANCES FRACTIONAL ± 1/64 DECIMAL ± .005 ANGLES ± 0° 30'
DIMENSIONS AND TOLERANCES TO BE HELD
REMOVE ALL BURRS AND SHARP EDGES

SYM.	DESCRIPTION	APPD	DATE
A	RELEASED	AM	7/16/79

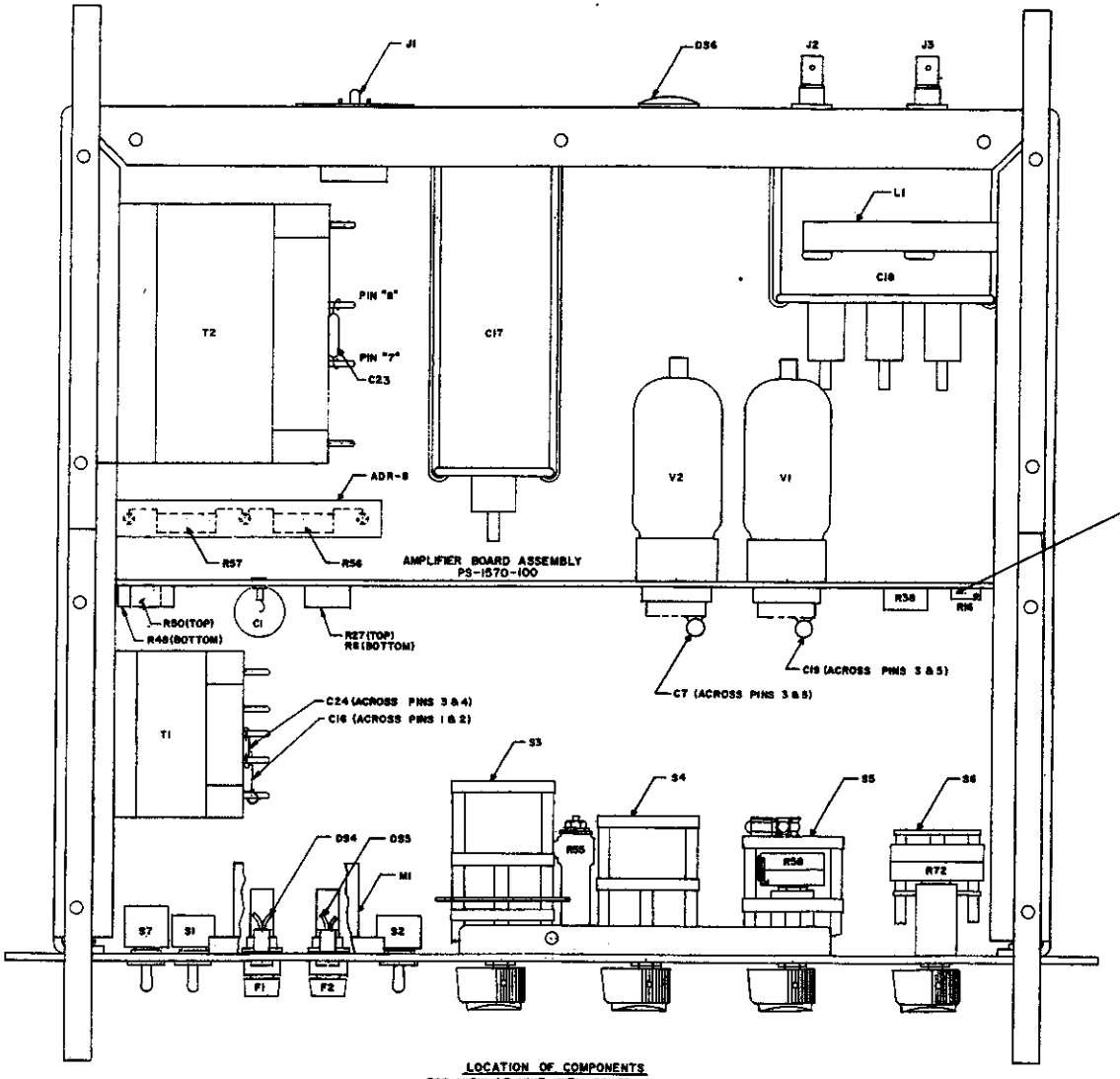
REVISIONS

DRAWING NO. B76006 REV. A

TITLE CABLE ASS'Y. INSTRUCTIONS FOR SHV MATING CONNECTOR

DRAWN	CHECKED	APPROVED
AM		
DATE 8/16/79	DATE	DATE

Power Designs inc.
NEW YORK



NOTE:
R16, R27, R38, R6, R50 & R48 ARE INTERNAL CALIBRATION TRIMMER POTENTIOMETERS.

LOCATION OF COMPONENTS
TOP VIEW OF UNIT WITH COVER REMOVED

SHEET 2 OF 2

REVISIONS			
SYM.	DESCRIPTION	APPD.	DATE
P	REVISED, ECN 2845		
N	REVISED, ECN 2730		
M	REVISED, ECN 2707		
L	REVISED, ECN 2590		
K	REVISED, ECN 2439		
J	REVISED ECN 2427		
H	REVISED ECN 2408		
G	REVISED, ECN 2394		
F	REVISED, ECN 2391		
E	REVISED ECN 2363		
D	REVISED, ECN 2347		
C	REVISED, ECN 2321		
B	REVISED, ECN 2120		
A	RELEASED		

DRAWING NO. PS-1570-1 REV. P

TITLE LOCATION OF COMPONENTS MODEL 1570

DRAWN	CHECKED	APPROVED
HS		
DATE 1/13/75	DATE	DATE 1/22/75

Power Designs Inc.
NEW YORK