



AC POWER SUPPLY

MODEL HP-23B





INTRODUCTION

The Heathkit Model HP-23B AC Power Supply is designed to provide all the necessary operating voltages for fixed station operation of Heathkit amateur radio transceivers. The versatility and many features of this Power Supply also make it ideal for use with many other types of amateur radio equipment.

The Power Supply features a high voltage source, a choice of two low voltage sources, a fixed bias source, and a 12.6 volt filament source. Extensive filtering and good regulation is provided for the dc sources. The power transformer has a dual primary winding which can be connected for operation from either 120 or 240 Vac power lines.

A series connection is provided at the power output socket to permit turning the Power Supply on or off remotely from

the equipment with which it is used. A toggle switch on the Power Supply is used to select the value of low B+ voltage available at the output socket. The switch also will turn off the Power Supply. A circuit breaker in the primary circuit provides overload and short circuit protection.

All output voltage connections from the Power Supply are made through the power output socket on the chassis. This provides an easy means of rapidly changing the equipment from mobile to fixed station operation.

Read the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

CIRCUIT DESCRIPTION

To better understand the circuit operation, refer to the Schematic Diagram while you read the following description. Each section of the Power Supply will be discussed individually.

PRIMARY CIRCUIT

The AC OFF switch, circuit breaker, transformer primary, and two terminals of the power output socket are wired in series across the ac line. The Power Supply may be controlled by its AC OFF switch, or by the off-on switch in the equipment being used with it. The dual primary winding may be connected in series for 240 Vac line operation, or in parallel for use on a 120 Vac line.

HIGH VOLTAGE SECONDARY CIRCUIT

The high voltage winding applies approximately 282 volts ac (rms) to a full-wave voltage doubler rectifying circuit consisting of silicon diodes D1, D2, D3, and D4, and capacitors C1 and C2. These diodes are connected so that during one-half cycle, capacitor C2 becomes charged; during the next half cycle capacitor C1 is charged. Resistors R1, R2, R3, and R4 are connected in the circuit to provide a discharge path for capacitors C1 and C2. The capacitors are charged individually, but discharge in series to produce a dc voltage equal to approximately twice the applied peak ac voltage. Excellent dynamic regulation is provided by the

large capacitance values of C1 and C2. The output of the voltage doubler circuit has a low ripple content and no further filtering is required.

LOW VOLTAGE CIRCUIT

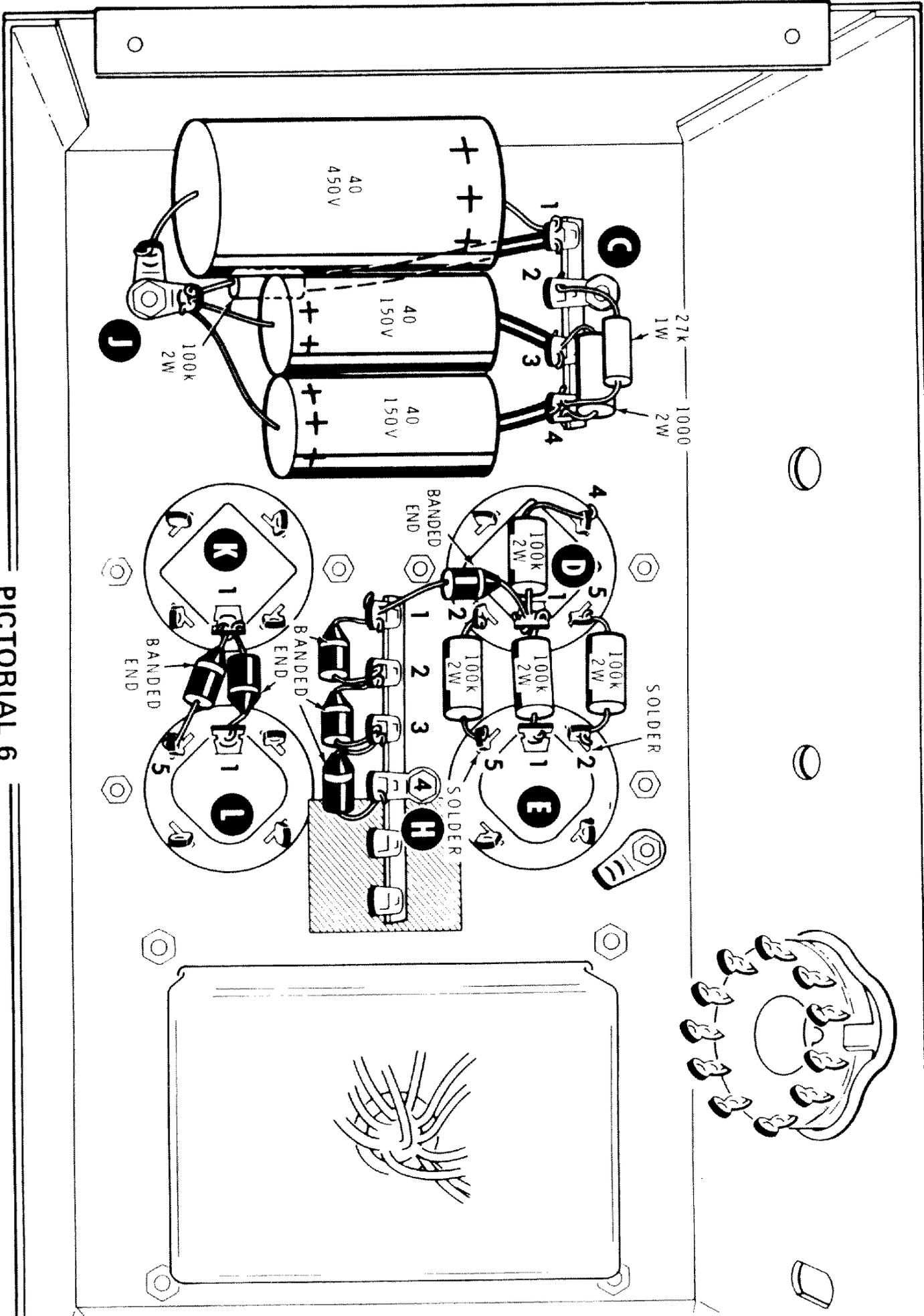
The low voltage winding is tapped so that either 95 or 125 volts ac (rms) may be applied to a half-wave voltage-doubler rectifying circuit consisting of diodes D5 and D6, and capacitors C3 and C4. Capacitor C4 is also used with choke L1 and capacitor C5 in a pi filter; C4 is the input capacitor in the filter network. The use of a high-capacitance input pi filter network provides a well filtered dc output that has a very low percentage of ripple.

BIAS VOLTAGE CIRCUIT

The bias voltage is obtained from the low tap on the low voltage winding. About 95 volts ac (rms) is applied to half-wave rectifier diode D7. Capacitors C6 and C7, with resistor R7, provide a filter network to remove the ripple from the bias voltage. -130 volts of fixed bias is coupled to the power output socket.

FILAMENT VOLTAGE CIRCUIT

The 12.6 volt filament winding provides 12.6 Vac to the power output socket.



PICTORIAL 6



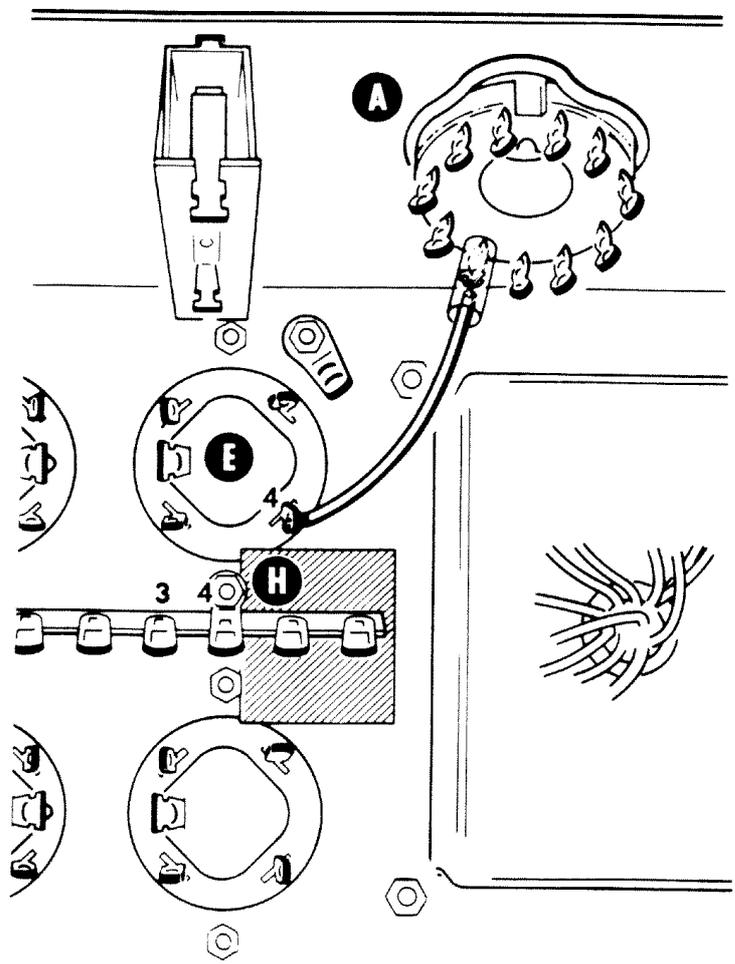
INITIAL TESTS

To avoid possible damage, it is important that you use an ohmmeter to make the following resistance checks before you connect or turn on the Power Supply. If you cannot obtain the proper ohmmeter indication in the following steps, refer to the "In Case of Difficulty" section. DO NOT turn on the Power Supply until the difficulty has been corrected.

NOTE: Use a vacuum tube voltmeter (VTVM) or a volt-ohmmeter (VOM) to make the resistance checks in the following steps (solid-state ohmmeters do not furnish a voltage high enough to make the diodes conduct in the circuit being tested). Make sure you have the ohmmeter set correctly, since the range setting influences the meter reading when a diode is in the circuit.

- () Set the ohmmeter to the RX1 range.

Because some of the circuits to be measured contain diodes, you will obtain different resistance readings if the polarity of the meter leads is reversed in the following measurements. Therefore, in the next two steps you will determine the polarity of the ohmmeter test leads and connect the proper lead to chassis ground.



PICTORIAL 8

Refer to Pictorial 8 for the following steps.

- () Connect the negative meter lead to lug 3 and the positive meter lead to lug 4 of terminal strip H. If the resistance is approximately 10 ohms, connect the negative meter lead to lug 4 (ground) of capacitor E for the following resistance checks and disregard the next step.
- () If the meter needle remains on or near the infinity mark (full scale), reverse the meter leads. If you now obtain a reading of approximately 10 ohms, connect the positive meter lead to lug 4 (ground) of capacitor E for the following resistance checks.
- () Set your ohmmeter to the RX10k range.

Now use the remaining meter lead to verify the resistance measurements in following steps. Some of the readings will take a few seconds to reach the indicated resistance because of the slow charging rate of the capacitors in the Power Supply.

SOCKET LUG	READING
(N) 1	22 kΩ or higher
(M) 2	Infinity
() 3	75 kΩ or higher
(V) 4	75 kΩ or higher
(W) 5	Infinity
(Y) 6	Infinity
(U) 7	0 Ω
(V) 8	Infinity
(Z) 9	Infinity
(S) 10	Infinity
(T) 11	Infinity

- () Disconnect the ohmmeter leads.

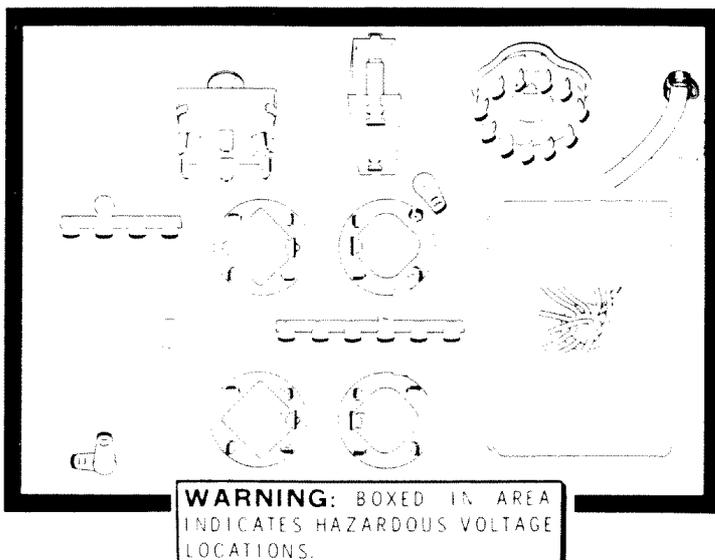
This completes the "Initial Tests." Proceed to "Final Assembly."

NOTE: DO NOT turn on the Power Supply until the proper connector for your equipment has been installed, as outlined in the "Operation" sections of this Manual.



OPERATION

CAUTION: The output voltage of this Power Supply can be lethal. Also, the potential stored in the large capacitors is dangerous. Allow time for these capacitors to discharge through the bleeder resistors before working on the Power Supply. The capacitors can be discharged more quickly by shorting the capacitor lugs to the chassis with a screwdriver blade. In a situation where electrical shock is a possibility, stand on some dry insulating material and work with one hand behind your back. Never attempt to do any work on the Power Supply with the line cord connected to an ac outlet. Figure 1 shows the location of this high voltage area.



WARNING: BOXED IN AREA INDICATES HAZARDOUS VOLTAGE LOCATIONS.

Figure 1

Connections at the free end of the 8-conductor power supply cable will depend on the requirements of the equipment to be powered. With the cable wired as directed in this Manual, the no load voltage shown in Table 1 will be available at the free end of the cable. It is recommended that a connector which attaches to the power input socket on your equipment, be permanently installed on the free end of this cable. Connectors and connection instructions are supplied with Heath products designed for use with this Power Supply.

Cable Wire Color	Voltage
Green	-130 VDC.
Black	Filament common.
Orange	+275 VDC or +350 VDC.
Yellow	+820 VDC.
Red	12 VAC.
White	Ground wire.
*Brown	AC switch in equipment .
*Blue	AC switch in equipment .

*The voltage or function available at these cable wires depends upon how the plug at the other end of the cable was wired in the steps on Page 13.

TABLE 1

- () Connect the power cable from the Power Supply to your equipment.
- () Connect the line cord plug to an electrical outlet supplying the voltage for which the Power Supply was wired (120 Vac or 240 Vac).
- () Select the desired low B+ voltage by moving the AC OFF switch to the right for 350 Vdc, or to the left for 275 Vdc. If your equipment does not have provisions for remote control of the Power Supply, this will turn the Power Supply ON. (Plate and filament voltages are always turned on and off simultaneously.)
- () If your equipment has provisions for remote control of the Power Supply, turn the equipment off-on switch to ON.
- () The Power Supply may be turned off by the AC OFF switch on the chassis, or by the off-on switch on your equipment, provided that it was wired for remote control.



IN CASE OF DIFFICULTY

This section of the Manual is divided into two parts. The first part, titled "General Troubleshooting Information" describes what to do about any difficulties that may occur right after the Power Supply is assembled.

The second part, a "Troubleshooting Chart," is provided to assist in servicing if the "General Information" does not clear up the problem, or if difficulties occur after the Power Supply has been in operation for some time. This Chart lists some difficulties which could arise, and several possible causes.

GENERAL TROUBLESHOOTING INFORMATION

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the builder.
2. About 90% of the kits that are returned to Heath Company for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the soldering section of the "Kit Builders Guide."

3. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as called out in the wiring instructions.

4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.

5. If, after careful checks the trouble is still not located, check voltage readings against those on the Schematic.
NOTE: All voltage readings were taken with an 11 megohm input voltmeter. Voltages shown are with no load on the output.

6. A review of the "Circuit Description," and a study of the Schematic Diagram will help you locate a difficulty in the Power Supply.

7. Check for loose hardware. Be especially careful that metal capacitor mounting wafers and terminal strip mounting feet are well grounded.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.



Troubleshooting Chart

DIFFICULTY	POSSIBLE CAUSE
Completely inoperative.	<ol style="list-style-type: none"> 1. Circuit breaker open. 2. Switch S1. 3. Pin 9 or 10 on power output socket or cable plug open or incorrectly wired. 4. Remote switching circuit in associated equipment faulty. 5. Power transformer T1.
Circuit breaker opens when reset.	<ol style="list-style-type: none"> 1. Short in power transformer windings. 2. Short in rectifier or filter circuits. 3. Short in associated equipment. 4. Overload in associated equipment.
No high B+ voltage.	<ol style="list-style-type: none"> 1. Diodes D1, D2, D3 or D4 faulty. 2. Pin 4 on power output socket or power cable plug open or incorrectly wired. 3. Power transformer T1.
No low B+ voltage.	<ol style="list-style-type: none"> 1. Diode D5 and/or D6. 2. Filter choke L1. 3. Pin 3 of power output socket or cable plug open or incorrectly wired. 4. Switch incorrectly wired or faulty. 5. Polarity of diodes or filter capacitors is incorrect.
No bias voltage.	<ol style="list-style-type: none"> 1. Diode D7. 2. Resistor R7 or R8. 3. Pin 1 of power output socket or cable plug open or incorrectly wired.
High B+ voltage only half of indicated value with no load, less under load.	<ol style="list-style-type: none"> 1. Diode D1, D2, D3 or D4. 2. Capacitor C1 or C2.
Low B+ voltage only half of indicated value.	<ol style="list-style-type: none"> 1. Diode D5 or D6.
All voltages only half of indicated values.	<ol style="list-style-type: none"> 1. Power transformer primary wired for 240 Vac when Power Supply is used on 120 Vac.

SPECIFICATIONS

HIGH VOLTAGE SUPPLY

Output Voltage	820 volts dc, no load. 700 volts dc at 250 mA.
Effective Output Capacitance	62.5 μ F.
Ripple	Less than 1% at 250 mA.
Duty Cycle	Continuous up to 150 mA. 50% at 300 mA.

LOW VOLTAGE SUPPLY (high tap)

Output Voltage	350 volts dc no load. 300 volts dc at 150 mA (with 100 mA load on High Voltage).
Ripple	Less than .05% at 150 mA.
Duty Cycle	Continuous up to 175 mA.

LOW VOLTAGE SUPPLY (low tap)

Output Voltage	275 volts dc, no load. 250 volts dc, at 100 mA (with 100 mA load on High Voltage).
Ripple	Less than .05% at 150 mA.
Duty Cycle	Continuous up to 175 mA.

OTHER OUTPUT VOLTAGES

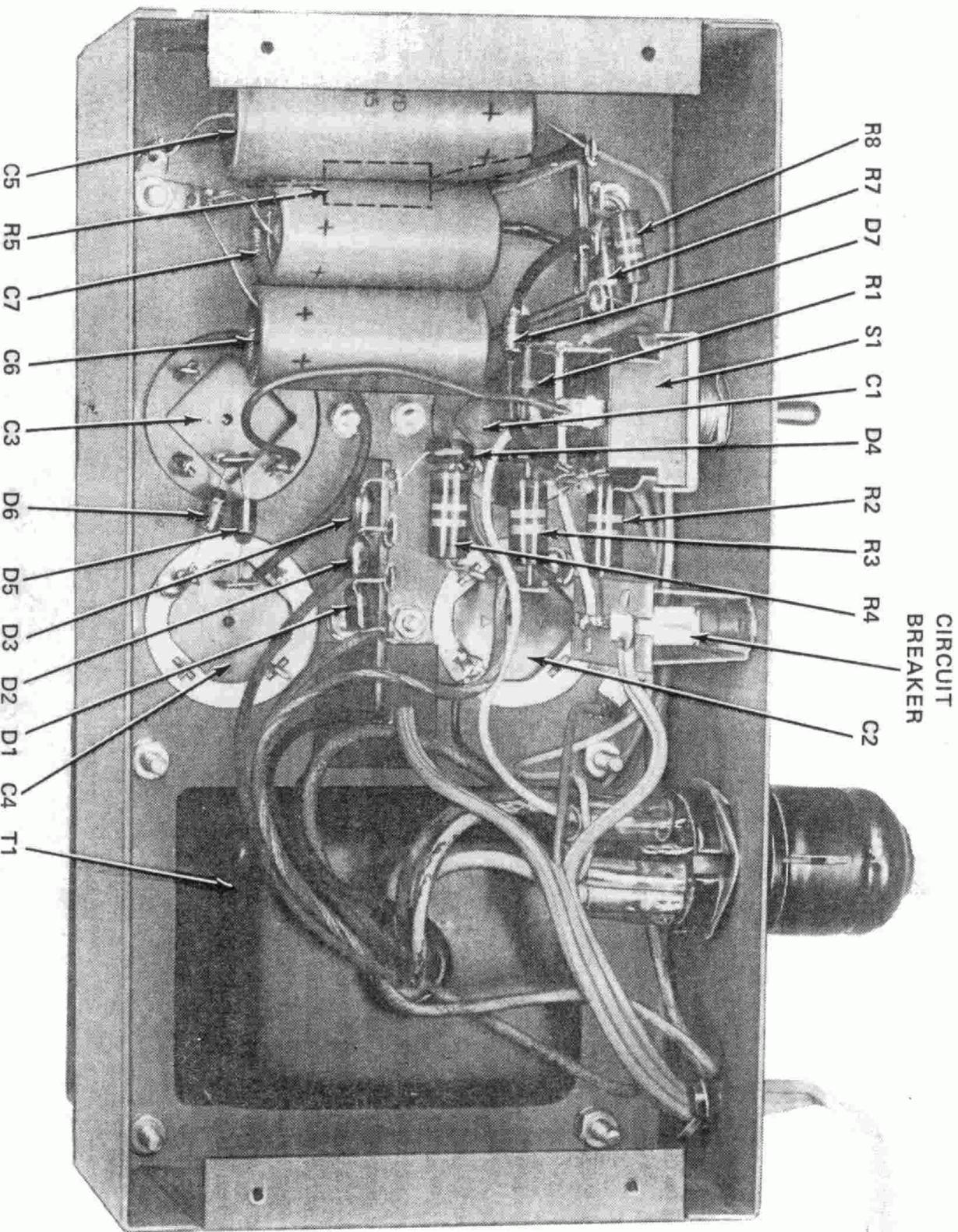
Fixed Bias	-130 volts dc, no load. -100 volts dc, at 20 mA.
Filaments	12.6 volts ac at 5.5 amperes.

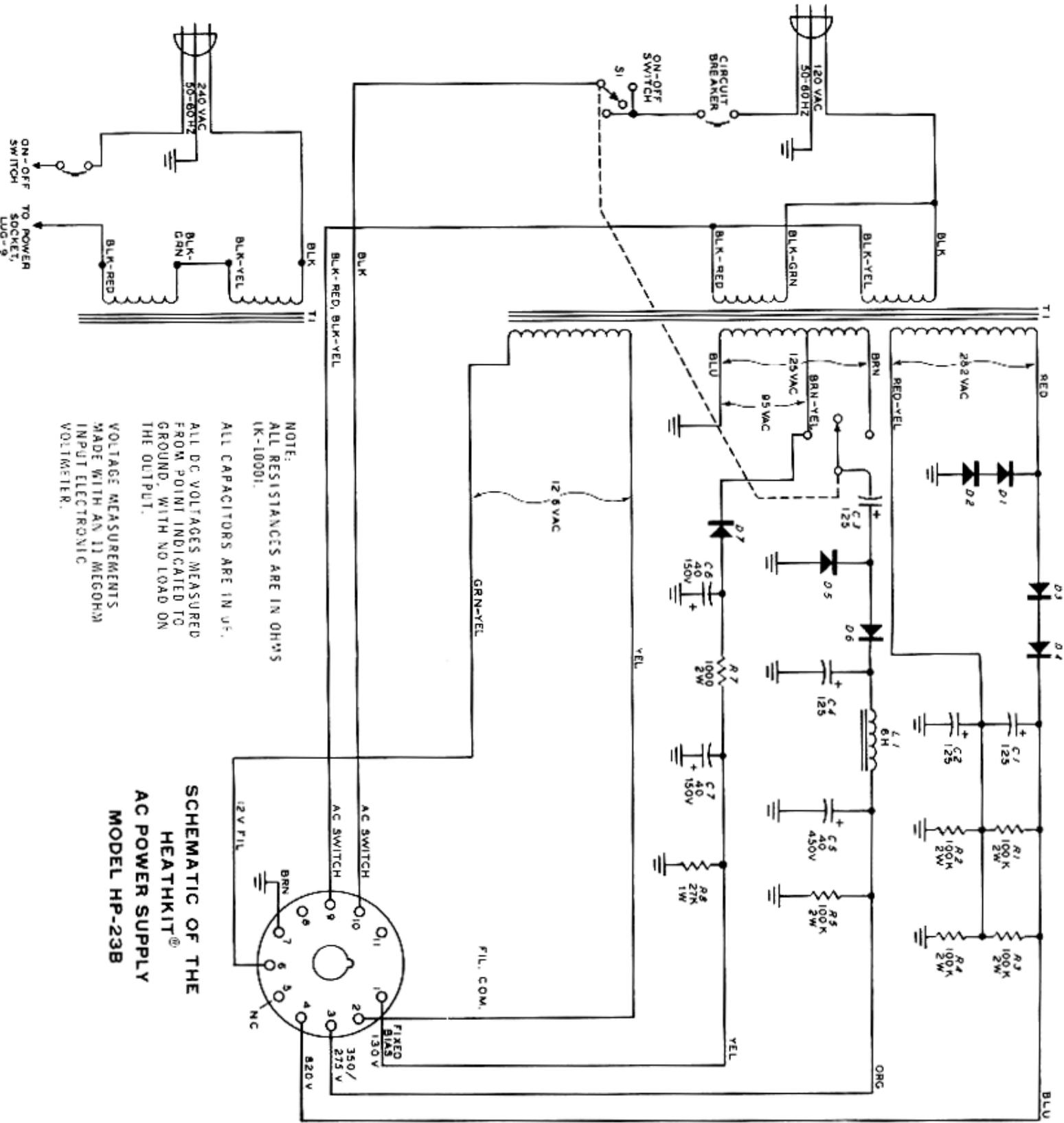
GENERAL

Power Requirements	120/240 volts ac, 50/60 Hz, 350 watts.
Dimensions	9" long x 4-3/4" wide x 6-3/4" high.
Net Weight	16 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CHASSIS PHOTOGRAPHS





NOTE:
ALL RESISTANCES ARE IN OHMS
1K-1000.

ALL CAPACITORS ARE IN UF.

ALL DC VOLTAGES MEASURED
FROM POINT INDICATED TO
GROUND, WITH NO LOAD ON
THE OUTPUT.

VOLTAGE MEASUREMENTS
MADE WITH AN 11 MEGOHM
INPUT ELECTRONIC
VOLTMETER.

**SCHEMATIC OF THE
HEATHKIT®
AC POWER SUPPLY
MODEL HP-23B**