Heathkit of the Month #40:
by Bob Eckweiler, AF6C

Heathkit HP-13/13A/13B and Related Mobile Power Supplies.

Introduction:

Hams like to operate their radios mobile. While today's solid state radios often run natively off of 12 volt power (actually nominally 13.8 volts), earlier tube radios require higher voltages to operate. To facilitate mobile operation with these earlier radios Heathkit manufactured a line of DC-DC power supplies that convert the battery voltage in a car to the higher B+ and bias voltages required by a tube-type radio.

In Heathkit of the Month #26 (February 2011 issue of RF) The AC line powered HP-23 series of power supplies, their predecessors and successor, were discussed. This article will look at the mobile versions of these power supplies in the same manner.

The most popular of the Heathkit DC power supplies is the HP-13 (Fig. 1) which went through two updates during its lifetime designated the HP-13A and HP-13B. This power supply was built specifically for the Heathkit SB and HW mobile lines such as the SB-100 and HW-100 series. For earlier mobile radios like the MT-1/MR-1 twins and the HX-20/HR-20 twins Heathkit manufactured the MP-1 and HP-10 mobile power supplies. Heathkit also manufactured the GP-11 mobile power supply for the Lunchbox series of transceivers popular in the 1960's and the HP-14 that powered the HA-14 "Kompact" Kilowatt.

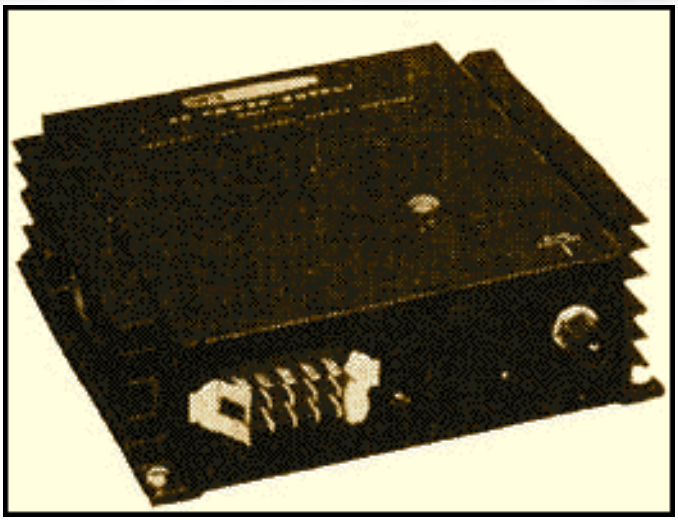

Figure 1: Heathkit HP-13 Mobile Power Supply

The Heathkit GP-11 Vibrator Power Supply:

Of all the power supplies covered in this article only the GP-11 uses a vibrator to convert DC into AC to be stepped up by a transformer and rectified into a higher voltage. The GP-11 output is 250 VDC at 100 ma ICAS (Intermittent Commercial and Amateur Service). It uses a Mallory 1610 vibrator which is long obsolete. Since vibrators contain dampening rubber that deteriorates with age, very few of these devices still have mechanical vibrators that work. Luckily there are solid-state vibrator replacements available, though they are rather expensive due to their small market base. The 1610 vibrates at a nominal 115 cps (cycles per second).

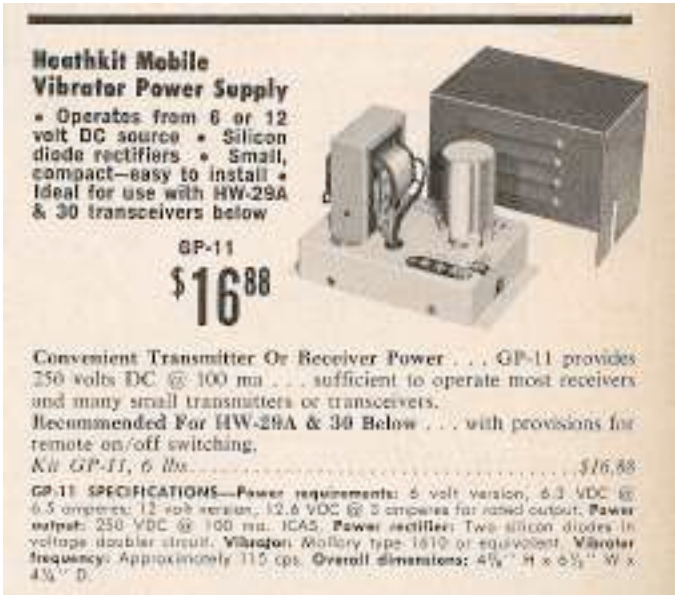

Figure 2: Heathkit GP-11 Vibrator Power Supply

The GP-11 (Fig. 2) weighs five pounds and can be wired to run on either 6 volts (@ 6.5A) or 12 volts (@ 3A) at full load. Maximum input voltage is 8 or 16 volts. The secondary of the trans-

former utilizes a full-wave voltage-doubling silicon diode rectifier circuit.

Measuring 4-5/8" H x 6-1/2" W x 4-1/8" D the GP-11 was small for its day and easily fit in cars and trucks. It is painted in a gray and green motif with a ventilated cover protecting the vibrator and transformer. Three terminals under the cover are for B+, Ground and Input Power.

The GP-11 sold for $16.88 in 1965. It was manufactured from 1963 through 1969.

The Heathkit MP-1 Mobile Power Supply:
The first transistorized power supply Heath manufactured to power a radio was the MP-1 (Fig 3). This was the DC equivalent of the AC line powered UT-1 that was manufactured to power the MT-1 Cheyenne and the MR-1 Comanche twins (See Heathkit of the Month #10 from the November 2008 issue of RF). The MP-1 measures 7" H x 9-1/16" W x 4-3/4" D. It was produced for one year - 1960.

The MP-1 uses a pair of 2N442 germanium power transistors switching at a nominal 400 Hz to provide the 600V DC and 300 VDC power needed to run the MT-1 / MR-1; the radio filaments run directly from the 12V supply. The MP-1 can supply 120 watts of DC power continuously and up to 150 watts intermittently. Input and output is via a six-pin Jones plug:

Pin #	Function:
1.	300 VDC @ 100 ma*
2.	600 VDC @ 200 ma*
3.	Ground
4.	On/Off Relay
5.	Filament 12 volts
6.	Filament Return (Ground)

* Maximum combined output power is 120 W CCS or 150 W ICAS

The Heathkit HP-10 Mobile Power Supply.
The MP-1 was replaced with the HP-10. The HP-10 supplies similar voltages to the MP-1, but also provides negative bias power. This was

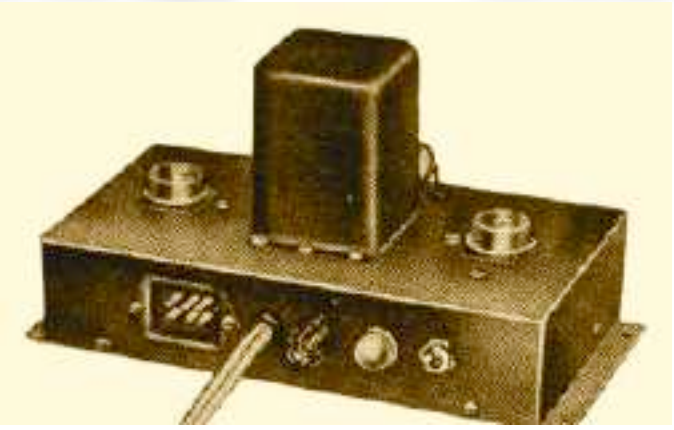

Figure 3: Heathkit MP-1 Transistorized Power Supply

needed to power the soon to be released HX-20 and HR-20 mobile twins. (See Heathkit of the Month #11 from the December 2008 issue of RF). The HP-10 also works well with the earlier MT-1 and MR-1. Besides providing the same high and medium voltages as the MP-1 it also provides a negative 130 volts at up to 30 ma for bias requirements. The relatively expensive Jones plug used in the MP-1 was replaced with an octal socket:

Pin #	Function:
1.	-130 VDC @ 30 ma
2.	Ground for bias and B+
3.	300 VDC @ 100 ma*
4.	600 VDC @ 200 ma*
5.	Spare
6.	Filament
7.	Filament Return (Ground)
8.	On/Off Relay

* Maximum combined output power is 120 W CCS or 150 W ICAS

The HP-10 uses two germanium 2N1147 switching transistors that are hard to find replacements for in today's market. It stayed on the market into 1963 when it was replaced by the HP-13 designed for the new SB-100 SSB Transceiver.

The Heathkit HP-13 Mobile Power Supply:
The HP-13 was released in 1963. It provides higher B+ voltage and current for the transmitting tubes, 750 VDC @ 150 ma CCS (continuous commercial service) and 300 ma ICAS. The

lower voltage can be selected internally at either 300 VDC or 250 VDC at up to 175 ma CCS. The bias supply can be adjusted internally from -40 to -130 VDC at up to 20 ma.

The transformer used in the HP-13 is toroid wound and switches at a frequency of ~1,500 cps. The switching transistors are germanium PNP and are identified only by their Heathkit 417-60 part number and a manufacturer's part number SP838. They are rated as 45V, 25A, 100W.

The HP-13 goes back to using a Jones plug, probably for its high current handling capability. This is a fifteen pin plug and handles both output to the radio and input from the automobile battery system. To handle the high current the 12 VDC and ground lines each use four paralleled terminals. An internal 12 VDC relay switches power to the filament pin as well as to the internal power. The relay coil terminals are available on pins 6 and 7 of the plug. Two circuit breakers provide input protection (30 amp) and filament protection (6 amp).

Pin #	Function:
1.	+12 VDC input*
2.	+12 VDC input*
3.	250/300 VDC @ 175 ma CCS**
4.	+12 VDC input*
5.	+12 VDC input*
6.	Relay coil (isolated from ground)
7.	Relay coil return (isolated from gnd.)
8.	+12 VDC output to filaments
9.	_40 to -130 VDC bias @ 20 ma***
10.	12 VDC return (Ground)****
11.	12 VDC return (Ground)****
12.	not used
13.	12 VDC return (Ground)****
14.	12 VDC return (Ground)****
15.	+750 VDC @ 150 ma CCS @ 300 ma ICAS

* Pins 1, 2, 4, 5 are internally connected
** Voltage selected internally by tap.
*** 20 ma @ -130V to 1 ma @ -40V CCS
**** Pins 10, 11, 13, 14 are internally connected

During the production run the HP-13 underwent a small parts change. The bias potentiometer was changed from part # 10-73 (20KΩ) to part number 11-81 (15KΩ), and the plastic guard control for the bias pot was changed from part # 252-20 to 440-11. These changes were introduced in a letter dated 11/18/1966.

The HP-13 is 2-3/8" H x 7-3/4" W x 7-5/16" D and weighs 5-1/4 pounds. Input power is 12 to 14.5 VDC at up to 25 amperes under full load. It's operating temperature range is from -10°F to 122° F. It sold mail order for $59.95 in 1965. Fiure. 5 shows the HP-13 schematic.

The Heathkit HP-13A

In mid 1969 the HP-13 was replaced by the HP-13A. This unit is physically similar to the original HP-13 with three significant changes. The power transistors were changed, the collector to base resistors were changed from 270Ω 2-watt carbon resistors to heavier 210Ω 5-watt resistors and the filament circuit breaker was changed from 6 amperes to 10 amperes. The new power transistors are Heathkit part #417-120, believed to have a manufacturer's part number of DTG110B. This transistor was capable of higher voltage and allowing the power supply input voltage rating to increase from 14.5 V to 16 V, a significant increase in safety margin.

The HP-13A sold from mid 1969 to 1973 when it was replaced by the HP-13B. In 1969 the HP-13A sold for $65.95.

The Heathkit HP-13B:

The HB-13B (Fig. 4) is a further refinement of the HP-13A. The circuit has been changed to improve starting and add protection to the power transistors. The bias voltage is now fixed and heavier wiring is used in the filament cable to reduce voltage drop. The fixed bias is set at -130 VDC @ 20 ma. The HP-13B stayed in production until Heathkit replaced its mobile transceivers with transistorized radios. The last units were produced in 1979. In 1973 the HP-13B sold for $69.95 and later in 1977 for $84.95.

Figure 4: Heathkit HP-13B from 1973 Catalog

Until next month...

73, from AF6C

Remember, if you are getting rid of any old Heathkit Manuals or Catalogs, please pass them along to me for my research.
Thanks - AF6C

This article originally appeared in the June 2012 issue of RF, the newsletter of the Orange County Amateur Radio Club - W6ZE.

Heathkit HP-14 Mobile Amplifier Power Supply:

Finally, there is another mobile power supply Heathkit manufactured. It supports their "Kompact Kilowatt" Model HA-14. Yes, it powers a 1 KW PEP mobile amplifier using a pair of 572B tubes, just like the SB-200. This power supply produces 2,000 VDC @ 170 ma and 500 ma peak. Input voltage is 12 to 14.5 VDC (and later 12 to 16 VDC); average current during transmitting is 25 amperes with a peak of 50 amperes, depending on the signal driving the amplifier. It also supplies -110 VDC at 60 ma bias and -6 VDC for ALC bias.

Heathkit came out with a service bulletin in May 1966 for the HP-14 recommending replacing both R1 and R3 with 125Ω 10 W resistors and the four transistors from Heathkit part# 417-60 to 417-120; both must be done.

The HP-14 has the same temperature rating as the HP-13; it measures 2-5/8" H x 8-3/8" W x 7-3/4" D and weighs 8 pounds

These power supplies have driven many radios over the years in a mobile environment. Still today, many are in use.

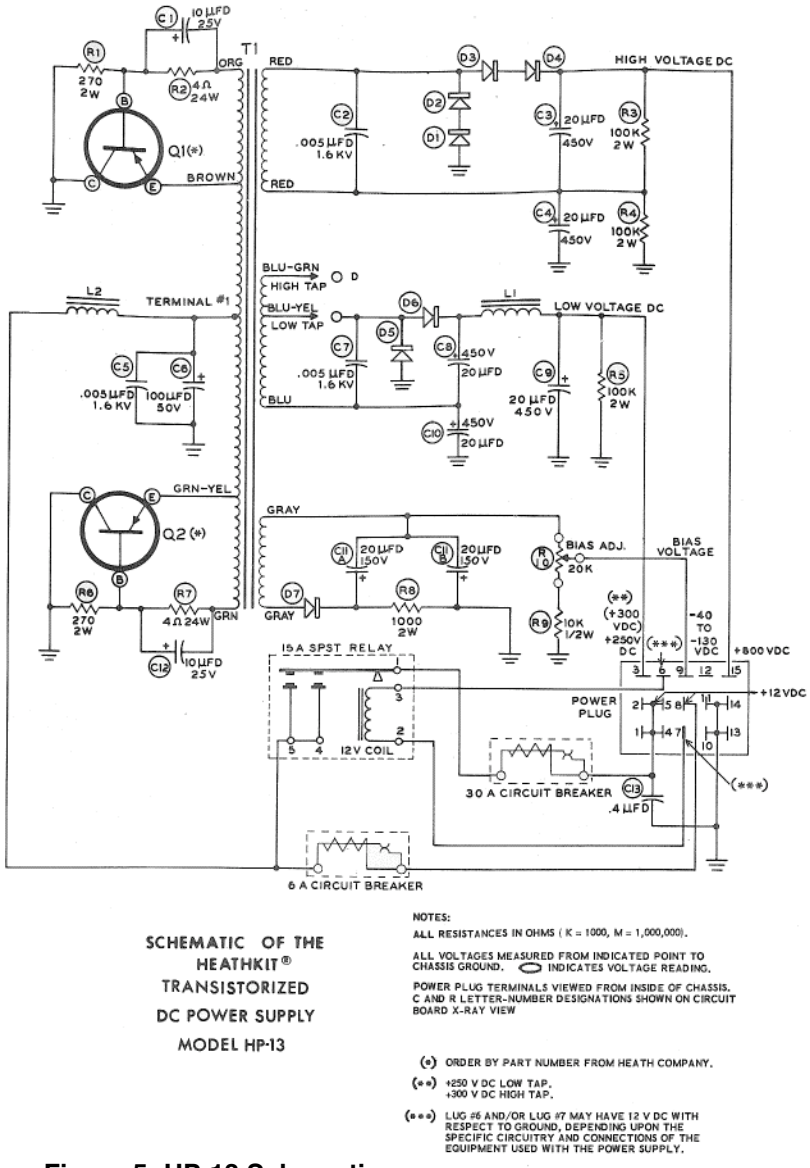

Figure 5: HP-13 Schematic