

**Heathkit of the Month:**  
by Bob Eckweiler, AF6C



### The Heath HN31 "Cantenna" Dummy RF Load.

#### Introduction:

Mid-1959 found this author completing his first ham transmitter kit, a Heathkit DX-40. To check out the finished kit required a dummy load which was quickly built. It was a standard 50's era bakelite lamp socket connected to a short length of standard zip cord\*. The zip cord was separated into two leads that had an alligator clip on one lead and a banana plug on the other. Screwed into the lamp socket was a 60 watt 120VAC light-bulb, just like the one you'd use in your living-room lamp. When the transmitter was keyed the lamp lit brightly. The bulb was a crude dummy load: the SWR was not close to 1:1; the device radiated more RF than a true load; and the load varied as the bulb warmed up. Still the 6146 tube class C output stage, with its pi-network, easily loaded up fully and lit the lamp brightly.

Soon after that though, SSB transmitters with a linear Class AB output amplifier became the norm, and today solid-state transmitters with broadband output stages are typical. Both of these require an accurate 50 ohm dummy load for good results. Thus the light bulb dummy load has long been relegated to the junk box.

All you need for a good dummy load is a 50Ω resistor that can handle the required power. This sounds simple but it isn't; the resistor has to have a very low reactive component, especially at higher frequencies. This eliminates a majority of high power resistors that are wire-wound and have a highly inductive component. Low power dummy loads may be built using

standard carbon or film resistors. Beyond that an expensive, hard-to-find, high-power non-inductive resistor is required.

#### The Heathkit HN-31 Cantenna:

In 1961 Heathkit, using its quantity buying power, introduced the HN-31 Cantenna dummy load. The Cantenna was well received by the ham community because of its low price and high performance. It can handle a full kilowatt for up to 9-10 minutes, depending upon the cooling oil used. The SWR remains under 1.5: 1 at frequencies up to 450 MHz. When originally introduced the Cantenna was priced at \$9.95.

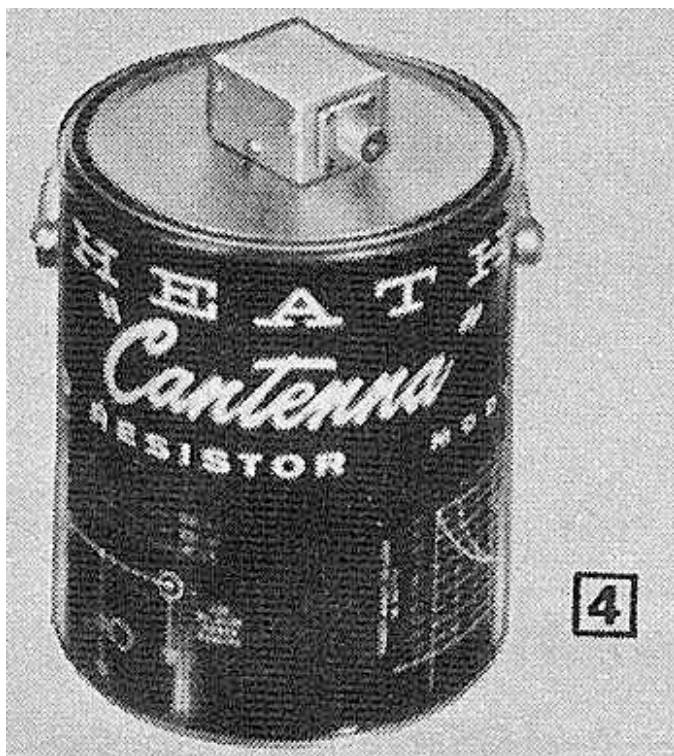


Older Heathkit HN-31 'Cantenna' from the March 1965 Heathkit Factory Catalog. Note the lack of graphics on the can.

The name *Cantenna* is very apropos as the dummy load is built into a one-gallon paint can. All components mount on the lid of the can. Visible is a small metal mini-box that holds an SO-239 UHF connector and an RCA phono connector. The UHF connector is the input and the RCA jack provides a DC voltage output relative to the input power/frequency for indication purposes. A simple circuit inside the little box taps a small part of the input power and rectifies it to provide this DC voltage. Also on the lid of the paint can is a small relief valve that opens should the oil get too hot

and release vapor. Early Antenna cans came painted a solid black, according to pictures in the early catalogs. Later, white lettering was added to the can, including a graph of allowed power input vs. time and a schematic.

The high power non-inductive resistor that is the actual dummy load is mounted underneath the lid and projects down into the can. An open aluminum tube surrounds the resistor and acts in a coaxial configuration that reduces stray reactance and helps maintain a 50Ω impedance at frequencies well into the UHF range.



4 "Antenna" dummy load  
1 kW max. input; 1.5-300 MHz w/SWR 1.5:1 or less. Oil not incl.  
Kit HN-31, Shpg. wt. 3 lbs. ....14.95

Later Heathkit HN-31  
Note the graphics on the can.

**Cooling Oil:**

To provide cooling for the resistor, the can is filled with oil that can freely circulate through the open aluminum tube and remove heat from the resistor. The oil was not provided by Heath as part of the kit. Either transformer oil or mineral oil may be used. Motor oil is verboten since its vaporizing temperature is low, and ex-

cess vapors would be emitted. Heath sold transformer oil in gallon plastic bottles at its retail stores for use in the Antenna. It is important that the oil be filled to the right level so oil can circulate up the tube surrounding the resistor as the oil near the resistor heats the oil in its proximity.

In the late '60s many transformer oils were found to contain PCBs which was identified to be a significant carcinogen. It created a panic on the order of the 1950's cranberry scare. Heathkit announced that the oil they sold in their stores was PCB free. If you buy a used Antenna, you might want to get assurance that the transformer oil is not PCB based.

The oil also creates another problem. A paint can full of oil is not something one finds agreeable in the house. If tipped, oil can leak from the relief valve. My observation is that a little oil somehow always manages to escape no matter what. Thus Antenna Dummy loads are often placed away from the living areas of the house.

With transformer oil the Antenna is rated at 1KW for just under ten minutes and 200 watts continuous. If mineral oil is used instead the 1KW rating is just a minute or two but the continuous rating remains at 200 watts. A de-rating curve is provided showing power vs. time. It is also printed on the can of the later HN-31 and its successor - the HN-31A

I purchased a Antenna HN-31 over the week between Christmas and New Years in 1968 at the local Heathkit store on Ball Rd. in Anaheim. The price at the retail store was usually higher than from the factory, so it cost me a whopping \$12.50 plus 63¢ tax.

Heathkit produced the HN-31 from 1961 to 1983. In their March 1965 mail order catalog it cost \$9.95. In the winter 1983 mail order catalog it cost \$24.95.



**The HN-31A Updated Cantenna:**

In late 1983 Heathkit discontinued the HN-31 and introduced the HN-31A. This dummy load is a step backwards from the original. The can sports a new red, black and white paint scheme spelling out specifications. The graph of power vs. time is still on the can, but is physically smaller (the dissipation remains the same). Gone is the mini-box on top of the can lid with the monitor jack and its associated circuitry. Instead of the box, the coaxial connector mounts directly on the lid of the can and the only other electronic component is the resistor. The coaxial shielding around the resistor is still present so the device still boasts an SWR < 1.5:1 up to 450 MHz and the power capability is still the same. Heath probably made this change due to the increased cost of parts. The aluminum box and the porcelain feed-through between the box and resistor in the can are gone, removing two of the more expensive parts. The RF monitoring option is not something many people use.

**Heath cantenna dummy load**

SKILL LEVEL Eliminate unnecessary QRM during tune-up and minimize mistakes while performing hot gear maintenance or alignment. Handles 1 kW of RF with VSWRs less than 1.5:1 up to 450 MHz. Requires 1 gallon mineral or transformer oil.

Kit HN-31-A (3 lbs.) ... \$24.95

The Later Heathkit Cantenna HN-31A

The HN-31-A stopped production in 1991 as the Heathkit period was drawing to a close. In late 1983 it cost \$24.95. Near the end of production the price increased to \$26.95. But, in the fall of 1984 and again in the Winter of 1991 its price was reduced to \$19.95.

**The Heathkit HM-2103 Dummy Load and Wattmeter:**

Heathkit produced another dummy load, the HM-2103. This unit was manufactured between 1973 and 1975. It is a "dry" unit that can handle a kilowatt and includes a wattmeter. It

is rated at 1 KW for a couple of minutes or 175 watts continuous. The SWR is specified at 1.2: 1 over the HF bands (1.8 - 30 MHz). The built-in wattmeter has two ranges: 0 - 200 watts and 0 - 1,000 watts; wattmeter accuracy is  $\pm 10\%$  of full scale. A battery powered "Over Temp" lamp warns the user if overheating occurs.

The HM2103 sold for \$59.95 during its two year production run.

**Author's Comments:**

Heathkit Cantenna Dummy loads can still be found on eBay and at swap-meets. the RF monitoring available on the original Cantenna is not a reason to favor it over the later 'A' version unless you foresee a need for it. If you are looking for one at a swap-meet., take along a trusted VOM and check the resistance between the Center of the UHF connector and ground. It should be within 20%, and preferably within 10% of  $50\Omega$ . If not, the resistor in the dummy load may have been over-heated. As stated above, you should be assured the oil in the Cantenna is not PCB based. If the dummy load is empty of oil, be sure to carefully clean it before refilling it with a good mineral or transformer oil.

*\* For those unfamiliar with the term zip cord, it is the standard two wire power cord that has been used on lamps and small electrical devices for years.*

73, from AF6C



*Remember if you come across any old Heathkit Manuals or Catalogs that you do not need, please pass them along to me.*

*Thanks - AF6C*

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