

## **Tube Rolling with the HA-2**

### *Wheatfield Audio*

Part of the joy of owning tube audio equipment is the ability to change the way it sounds by changing the tubes - or, as tubeheads call it, "tube rolling". You can tailor the sound to your liking, and to the music that you listen to.

We've put together this paper to help the HA-2 owner who is unfamiliar with this audiophile ritual to experiment with confidence. We will recommend a few tube types, but don't be afraid to try others. You can also get suggestions from the tube magazines, tube dealers, and internet groups that we will list at the end of the paper.

### ***A tube primer***

As most folks know, before about the mid-1960's all audio equipment used tubes instead of modern-day IC's and transistors. But the use of tubes in audio equipment never quite disappeared, especially in high-end hi-fi equipment and guitar amplifiers. It is now enjoying a bit of a renaissance, gaining popularity in high end hi-fi equipment.

Tube equipment sounds different than solid-state equipment. The reason it sounds different (and by many accounts better) is complex, having to do with the way the devices operate. To most, the reasons are unimportant - it's the *sound* that matters.

There were thousands of different types of tubes manufactured from the 1930's through the 1980's, by dozens of manufacturers like GE, RCA, Sylvania and Philips, in the US and Europe. Today, there are only perhaps 100 types of tubes appropriate for audio use still in production, mostly in the former Soviet Union and in China. Most tube audio equipment available now, including the HA-2, uses current-production tubes, because the price is low and availability is good.

Unfortunately, the quality of many of the current-production tubes is not equal to that of the older US and European tubes. Luckily, there are still large quantities of these older tubes available in the marketplace. These tubes are referred to as "New Old Stock", or NOS, tubes.

Some NOS tube types, which were used extensively in military equipment up until recent times, are available in large quantities at good prices as the governments sell of excess stock that is no longer needed. These tube types often have the prefix "JAN" - for "Joint Army-Navy" - in front of the tube type. The 6080 tube used in the HA-2 falls into this category - the JAN 6080 is readily available, so we use them now as original equipment in the HA-2.

Most common tube types were manufactured by several different companies over the years, and many different varieties are available from companies that specialize in selling tubes. Other NOS types, especially those treasured by audio nuts, are scarce and expensive - but almost always can still be found in small quantities, if you're willing to pay the price.

### ***Some notes about tube type numbers***

The variations and combination of tube type numbers can be confusing to the uninitiated.

Standard commercial American types are the most common, with designations like 6SN7GT and 6AS7G. The thing to remember with these type numbers is that, in general, tubes with the same basic part number (e.g., 6SN7) are interchangeable, with the last set of letters indicating either the mechanical shape of the tube (G, GT, etc.) or minor specification differences (GA, WA, etc.), or both. So, for this example, 6SN7, 6SN7GT, 6SN7WGT, 6SN7GTA, etc. are all interchangeable.

Military American types used a totally different numbering system, using four numeric digits. The military types were usually either ruggedized versions of commercial tubes, or simply tubes that were tested more rigorously than the commercial type. Many common commercial types have military-numbered counterparts, like the 5692 (military 6SN7) and the 6080 (military 6AS7). Like the commercial numbers, letters after the type indicate minor variations, so a 5692A is interchangeable with a 5692 (or 6SN7 type).

European types are a little more complex, with different standards for different countries. Either stick with the numbers we have given or consult someone who is knowledgeable in European types.

## ***The HA-2 tubes***

### ***The 6SN7 input/driver tube***

In the HA-2, by far the greatest benefit (and variation) will be obtained from changing the 6SN7 input tube. There is quite a bit of difference in the tonal qualities of 6SN7's, and there are as many different opinions about them as there are 6SN7 types.

Most (though not all) agree that just about any NOS American or European 6SN7 type will be an improvement over the Russian tubes, so don't worry about your choices *too* much. Any 6SN7 type will work in the HA-2, including all 6SN7 variants, 5692, CV181, CV1988, ECC32, and probably a dozen others we haven't even heard of.

It's very difficult to create a short list of tubes we recommend, but here are our choices:

For the 6SN7:

- Affordable upgrade: JAN-Philips 6SN7WGTA, GE 6SN7GTA or GTB (side getter)
- Good compromise: Sylvania 6SN7GTA or 6SN7WGT (older, top getter)
- High-end upgrade: CBS/Hytron 5692 Brown Base

➤ *Almost all 6SN7 tubes tend to be microphonic in the HA-2 - that is, they make audible noise in your headphones when tapped or subjected to vibration. The 5692 types are usually quieter than 6SN7 types, because they have a more rugged internal construction. Luckily, in a headphone amplifier, the tubes aren't subject to the sound from the loudspeakers, so microphony is less of a problem. You can also try "tube dampers" if the noise bothers you.*

### ***The 6080/6AS7G output tube***

We now supply an NOS JAN 6080WC tube manufactured by GE as standard equipment in the HA-2. This tube is quite good, and, depending on your musical tastes, you may not be able to improve on it much.

Changing the 6080 output tube has less of an affect on the sound of the HA-2, probably because in a cathode-follower circuit, the characteristics of the tube make less difference in the operation of the circuit. But because of that, there is a much wider choice of tubes that can be plugged into that socket.

We have tried 6AS7, 6080, 5998, 7236, and 6528 tubes in the HA-2. They each sound a little different. The 7236 is our overall favorite, but it is difficult to find. The 6336 should work as well, as should CV2523, ECC230, and lots of other European types.

The 5998, 7236, and 6528 have different characteristics than the 6AS7 and 6080 tubes, which lower the output impedance of the HA-2. The resulting sound tends to be brighter and faster than the stock 6080. Conversely, a good old-stock 6AS7G tube can fatten the bass and give an even more "tubey" sound.

Our recommendations:

For the 6080/6AS7G:

- For fatter bass: RCA 6AS7G
- For faster sound, brighter: 7236
- For low-impedance headphones: 6528A, graphite plate

➤ *Be warned: Many of these power tubes, used in this circuit, can be noisy. The Russian 6AS7G tubes (Svetlana or Sovtek, they're the same tube) are particularly bad in this regard, which is why we've changed to NOS 6080 tubes. You may get a tube that is noisy. You might want to discuss this with whoever you buy a tube from, to see if they'll take it back if it isn't up to your standards.*

### The 5U4 rectifier tube

We believe that it's not worth your effort to mess with the rectifier tube.

Some people claim that they can change the sound of an amplifier substantially by using a different rectifier. This might be the case in a high-power class AB amp, but not in the HA-2.

If you do want to try a different tube, stick with a 5U4 type. Don't use something else, like a 5AR4, because it may raise the supply voltage.

Our recommendation:

For the 5U4G:

- Leave the Sovtek tube in there!

### *Some rules and cautions*

Swapping tubes is something that just about anybody can do. But there are some rules and cautions that you need to follow:

➤ Turn the power off and WAIT FOR THE TUBES COOL before pulling them out!

The tubes, especially the 6080, get very hot! You will get burned if you grab them. Also, it takes a little time for all the high voltages to decay after the power is turned off, and you don't want to pull any tube with live voltage on it.

➤ Make sure the right tube is in the right socket

Check, and double-check, that the right tube is installed in the right socket. Putting the wrong type in can cause a variety of problems, from no operation to a brief flash of light while your expensive new tube goes up in smoke!

➤ Don't power up the amp with a tube missing

The HA-2 is designed to have all tubes installed... duh! If you power it up without one of the tubes installed, you may create an overload condition that won't be good for the other tubes and components in the amp.

➤ Don't power up the amp with one cold tube

This is important, and not obvious: You can cause a temporary overload condition if you put in one cold tube along with others that are still warm, and turn the power back on. In particular, with the HA-2, if you power up with a cold 6080 with the other tubes warm, you will get arcing between the grid and cathode of the 6080 until the heater warms up. You really don't want your expensive headphones plugged in if this happens! The resulting "pop" sound could damage them (or your hearing).

➤ Unplug your headphones

Just in case you get a bad tube, or don't observe the rules above, it's a good idea to unplug your headphones when changing tubes. Wait until all the tubes are warm (maybe a minute) and then plug them in.

➤ Be patient

Tubes take some time to "burn in". You can expect the sound of the tube to change, especially in the first 10-20 hours of operation, and then at a slower rate for up to 100 hours or so. Most tubes tend to improve with time, so if they sound a little rough at first (especially on the highs), be patient and wait a little to let the tube burn in.

➤ Have fun

Don't take it all too seriously. Don't believe everything you hear - trust *your* ears! Don't be afraid to experiment... and don't spend *all* your money on tubes!

## ***Tube dealers***

Here is a list of our favorite dealers that specialize in selling tubes for audio equipment. Many stock a wide assortment of 6SN7 types, and many can give you their opinion about which one sounds best. Also, many high end hi-fi shops carry tubes (especially the 6SN7 types), though they tend to be expensive.

➤ *A word of warning: Be careful buying tubes from unknown sources, like on e-Bay. There have been a lot of counterfeit and misrepresented tubes being sold. We advise you stick to reputable dealers experienced in audio tubes.*

Angela Instruments  
10830 Guilford Road, Suite 309  
Annapolis Junction, MD 20701  
(301) 725-0451  
FAX (310) 725-8823  
[www.angela.com](http://www.angela.com)

Antique Electronic Supply  
6221 S Maple Avenue  
Tempe, AZ 85283  
(480) 820-5411  
FAX (800) 706-6789  
[www.tubesandmore.com](http://www.tubesandmore.com)

SND Tube Sales  
908 Caulks Hill Road  
St. Charles, MO 63304  
(636) 939-9109  
FAX (636) 922-0601  
[www.vacuumtubes.com](http://www.vacuumtubes.com)

Tube World  
2712 Superior Avenue  
Sheboygan, WI 53081  
(920) 208-0353 Phone/FAX  
[www.tubeworld.com](http://www.tubeworld.com)

The TubeStore  
(877)-570-0979  
[www.thetubestore.com](http://www.thetubestore.com)

### ***Tube audio magazines***

There are a couple of specialty magazines that cater to the tubeophile that are useful sources of information, tube vendors, and opinions:

Glass Audio  
Audio Amateur, Inc.  
P.O. Box 876 / 305 Union Street  
Peterborough, NH 03458-0876  
(888)924-9465  
(603)924-9464  
FAX (603) 924-9467  
[www.audioexpress.com](http://www.audioexpress.com)

Vacuum Tube Valley  
P.O. Box 1499,  
Lakeport, CA 95453  
(707) 263-5881  
FAX: (707) 263-7648  
[www.vacuumtube.com](http://www.vacuumtube.com)

### ***Internet resources***

There are discussion groups on the internet that cater to tube audio as well:

Tube Asylum  
<http://www.audioasylum.com/audio/tubes/bbs.html>

Newsgroup [rec.audio.tubes](mailto:rec.audio.tubes)