

Drake R4B First Mixer V2 6HS6 Alternative

In looking for an alternative to the 6HS6 First Mixer tube used in the Drake R4B receiver, I considered several tubes which fall into the Sharp Cut-off Pentode family of tubes. There are numerous tubes in this family to choose from. The criteria was to examine tubes that retained the 7 pin base, had similar tube characteristics, needed minimum rewiring changes and were readily available.

One tube rose to the top of my list for consideration. This was the 6KD6. This tube was commonly used as RF Amplifier and IF amplifier applications in televisions. It seems to be readily available and at a much lower cost than the 6HS6.

Here are some of the electrical characteristics from the tube data sheets considered.

	6HS6	6KD6
Transconductance	9500 umhos	9800 umhos
Max. Plate voltage	300 VDC	300 VDC
Typical plate voltage	150 VDC	125 VDC
Max Screen voltage	300 VDC	150 VDC
Typical Screen voltage	150 VDC	125 VDC
Typical Plate current	8.8 ma.	12 ma.
Grid 1 to Plate capacitance	.006 pf	.02 pf
Grid 1 to Cathode	8.8 pf	6.3 pf

The Plate Characteristics for both tubes are nearly identical. Of all the tubes considered, the 6KD6 was the closest match for potential success as a replacement for the 6HS6. Both tubes are 7 pin bases but the Cathode and Suppressor pins (pins 2 and 7) are swapped. Therefore, this will not be a direct substitute tube. The wiring to pins 2 and 7 must be swapped. The location of V2, First Mixer, makes access to the tube pins easily accessible. The real test will be the performance of the receiver which can only be tested after making the changes.

The wiring changes are made as follows.

1. Remove the wire to ground on pin 2.
2. Remove R7 2.2 K from pin 7 to ground.
3. Reinstall R7 2.2 K between pin 2 and ground.
4. Disconnect C20 .005 uf from pin 7 and reconnect to pin 2. You will need to lengthen the lead and use some sleeving to prevent any short to other pins.
5. Ground pin 7.

This completes the wiring changes. These changes are easy to un-do should you want to restore the receiver to original condition. It is important to place a new label on top of the chassis to identify the new tube. Do not place a 6HS6 back into this socket!

Since my R4B receiver was new to me and was missing the First Mixer tube, I could not take any before modification data. The receiver was purchased as non-working and missing several tubes. My next step was to realign the entire receiver. I used the alignment procedure in the manual to accomplish this task.

Here are voltages measurements made on my receiver. They may vary a few percent on individual receivers.

Plate, pin 5: 140 VDC

Screen, Pin 6: 81 VDC

Cathode, Pin 2: 2.3 VDC

Cathode current runs about 1.05 ma. ($2.3 \text{ VDC} / 2.2 \text{ K Ohms}$)

Measured Receiver Sensitivity using an HP 8656B Signal generator, HP 334A AC Voltmeter and 4 ohm audio load.

1.9 MHz 0.36 μV for 10 dB S+N/N

3.8 MHz 0.28 μV for 10 dB S+N/N

7.3 MHz 0.28 μV for 10 dB S+N/N

14.3 MHz 0.22 μV for 10 dB S+N/N

21.3 MHz 0.28 μV for 10 dB S+N/N

28.8 MHz 0.20 μV for 10 dB S+N/N

The manual sensitivity specification is less than 0.5 μV on any band for 10 dB Signal plus Noise to Noise ratio. This clearly and easily meets that specification. Another commonly used check is to rotate the Preselector control through its range on each band and note an increase in noise at the appropriate setting for the band. This receiver exhibits that characteristic.

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