six-meter conversion of the Heathkit SB200 linear amplifier

The SB200 can be converted into a high-efficiency linear for 50-MHz in less than two hours

Louis E. Savioe, K1RAK, 29 Hillsdale Road, Holbrook, Massachusetts 02343

Most 50-MHz conversions of high-frequency rf power amplifiers involve modifications to the existing tank circuit. In most cases the number of turns on the 10-meter coil is reduced so the circuit will tune in the 50-MHz range. The 6-meter Heath SB200 conversion described here uses a tank circuit that is designed specifically for 6 meters. This provides maximum plate-tank circuit efficiency through the use of optimum L/C ratios, constant load to the exciter and maximum tuning ease.

design parameters

This six-meter conversion was based on two essential ground rules: nothing was to be done that would change the front panel, and the unit must be left in such a condition after the conversion that it could be easily restored to its original condition. Both of these aims have been realized.

Only three items must be purchased for this conversion: two pi-network tuning capacitors and 16-inches of copper tubing. The complete conversion can be completed in about two hours and requires no special tools.

step-by-step conversion

1. Remove the amplifier from the enclosure and remove the top shield cover.

2. Remove the two T160/572B power tubes and store in a safe place.

3. Unsolder both parasitic suppressors (PC1 and PC2) from the 1000 pF blocking capacitor (C24). Remove one turn from each suppressor and place aside. Unsolder the lead from plate choke RFC1 to C24.

4. Unsolder and carefully remove L7 (10-, 15- and 20-meter coil). Be careful not to break the switch connections on wafer B of the bandswitch.

5. Unsolder the connections from L6 (80- and 40-meter coil) to wafer A and B of the bandswitch. L6 may be left in the rf compartment if you wish. I chose to remove it.

6. Unsolder C26 (100 pF) from wafer A of the bandswitch and dismantle from C25.

7. Unsolder the heavy bus bar connections which connect both halves of C28 (loading capacitor). Remove the

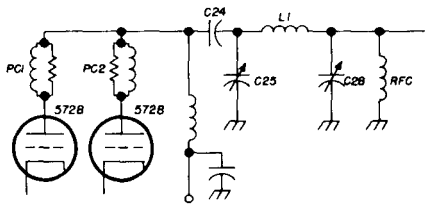
heavy bus wire connection which comes from wafer B on the top side of the chassis to C28 on the underside of the chassis (marked X in **fig. 2**).

8. Remove RFC3 (1.1 mH). Remove the RG-58/U cable between the relay and C28.

9. Unscrew all mounting hardware from C28 loading capacitor. To remove this capacitor from the chassis, it is necessary to loosen the hardware holding the front panel; following removal of C28 secure all panel hardware.

10. Remove the mounting hardware from C25 plate tuning capacitor and remove it from the chassis.

11. Install the new E. F. Johnson 154-1 air variable (C28). Use the front mounting hole of the original loading capacitor as a guide and drill and tap a 6-32 hole to match the mounting bracket of the new loading capacitor. Install the capacitor using star washers on all hardware.



C25	9-38 pF air variable (E. F. Johnson 154-11)
C28	12-244 pF air variable (E. F. Johnson 154-1)
L1	4 turns 3/16" copper tubing, 1¼" diameter, spaced 3/16" between turns (see fig. 3)
RFC	Ohmite Z-50
PC1,PC2	parasitic suppressors

fig. 1. Modified plate circuit for the 6-meter SB200.

12. Select the new E. F. Johnson 154-11 capacitor (C25), and using the front mounting hole of the original capacitor, drill a 6-32 hole to match the bracket of the 154-11. Install the capacitor.

13. Install the tuning knobs and tighten all front-panel hardware. Align the knob markings with the left edge of the tuning indices with both capacitors fully meshed.

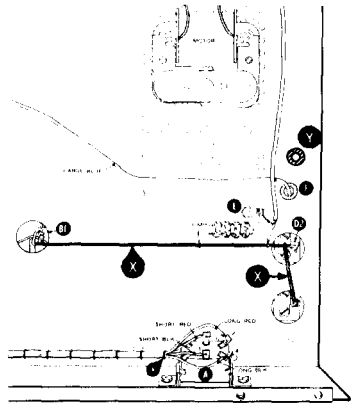


fig. 2. Under-chassis modifications to the SB200. Remove wires marked with X. Drill new 3/8" hole at position Y.

14. Install the plate coil and the 1000 pF coupling capacitor as shown in **fig. 4**. Use a 6-32 x ¾-inch threaded brass or aluminum standoff between the tuning capacitor and the 1000 pF coupling capacitor. Be sure to use star washers on all mechanical connections.

15. Install a 6-32 solder lug on the 1000-pF capacitor. Connect the 1000-pF capacitor to RFC1 with solid number-12 copper wire.

16. Install parasitic suppressors PC1 and PC2 and plate cap assemblies to RFC1.

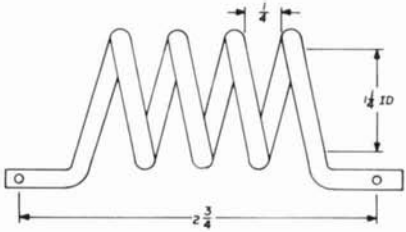


fig. 3. Construction of the plate-tank coil for the 6-meter SB200. Material is 3/16" copper tubing. Two small holes at ends are drilled for 6-32 screws.

20. Drill a 3/8-inch hole in the chassis (location Y in **fig. 2**) just above grommet F. Install a ½-inch rubber grommet.

21. Cut the RG-8/U exactly 9½-inches long. Strip 2½-inches of the unstripped end.

22. Unravel the braid and twist securely. Trim to a length of 1½ inches.

23. Using the 2½-inch stripped end of the RG-8/4 cable, attach and solder the braid to solder lug K (**fig. 2**).

17. Install a 6-32 solder lug on the rear stator plate of C28 — nearest the shield wall. Use a star washer.

24. Strip ½ inch of insulation from the inner conductor of the cable and solder it to lug 7 of the relay.

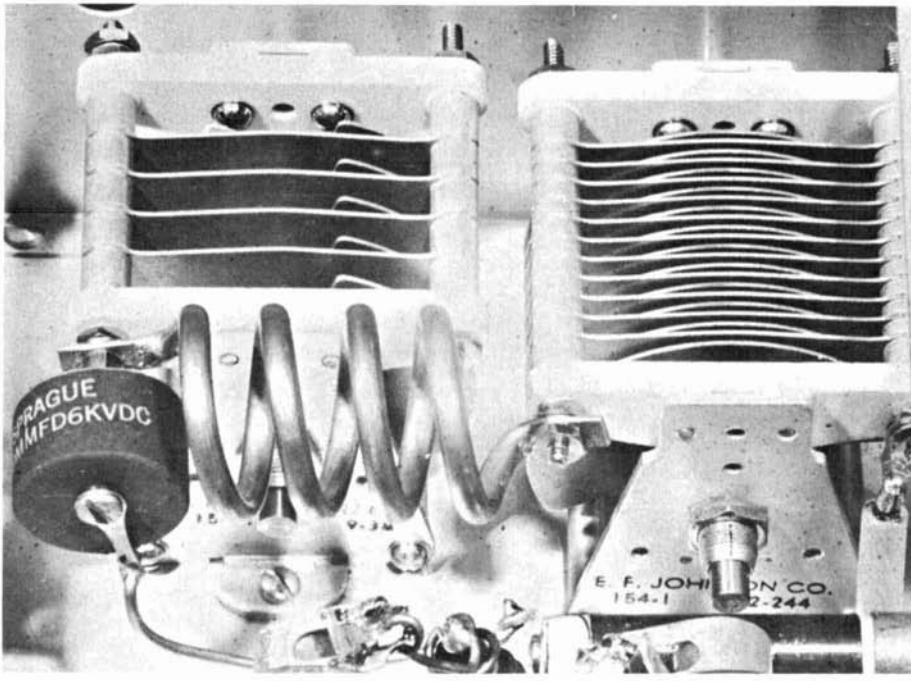


fig. 4. The plate-tank coil is mounted between solder lugs mounted on the pi-network capacitors. The 1000-pF coupling capacitor is mounted on a threaded metal standoff.

18. Strip 6 inches from one end of a 20-inch length of RG-8/U.

19. Unravel the shield braid and cut the braid 1½-inches long, measured from the end of the vinyl jacket. Twist and tin the braid.

25. Solder the shield braid at the other end of this piece of RG-8/U to solder lug E (**Fig. 2**).

26. Strip ½ inch of insulation from the inner conductor and push this end of the cable through the grommet at Y.

27. Solder the inner conductor to the empty solder lug on loading capacitor C28.

28. Install an Ohmite Z-50 RF choke between the solder lug in step 27 and the ground solder lug located on the rear mounting bolt of loading capacitor C28.

This completes the modifications in the rf compartment. Install the T160/572B power tubes and attach the plate caps. The only steps remaining are those necessary to modify the input circuit. Refer to **fig. 5.**

1. Disconnect and remove the 68 pF capacitor from coil CA to the ground lug at AE.

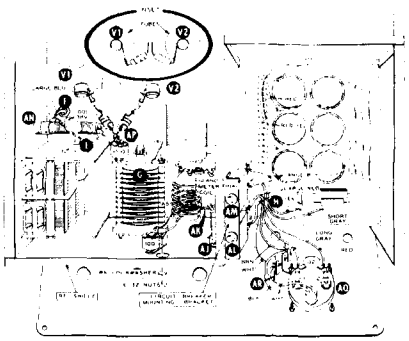


fig. 5. Above-chassis construction of the SB200 before modification.

2. Connect a 15 pF capacitor between lug 2 or CA to the ground lug at AE.

alignment and tune up

1. Connect the amplifier to the exciter; connect the keying line.

2. Set the bandswitch to the ten-meter position (this is now the permanent six meter position).

3. Set the load capacitor knob to 2 on the dial.

4. Set the plate tuning capacitor at half mesh.

5. Turn on the exciter and the linear amplifier. Allow three minutes for both to warm up.

6. Place the meter switch of the amplifier to the plate current position.

7. Key the exciter and apply enough drive to show 300 mA on the meter.

8. Adjust the tune (plate) control for a dip.

9. Increase exciter drive and adjust the amplifier for a dip at 500 mA plate current (use both plate tuning and loading controls). On this amplifier the dip occurs with the plate tune control at 40% mesh and the load control at 2½ on the dial.

10. Change the meter switch to the *rf out* position and adjust the *Sensitivity* control for half-scale indication.

11. Adjust the plate tuning control slightly for a maximum rf output indication.

Note: During all tuning and adjusting do not allow a key down condition for more than 30 seconds at a time.

12. Key the exciter and apply drive for a plate meter indication of 200 mA.

13. Adjust coil CA for maximum plate current indication.

This completes the 6-meter modifications to the SB200. This linear can be driven with any exciter which has an output of at least 35 watts. The unit in the photographs belongs to WA1LVF; Roy is driving it with a Heathkit SB110A. Tests conducted with Bird Thruline wattmeters on both exciter and linear, loaded into a Heath Cantenna, showed 60 watts output from the SB110A and linear amplifier output of 600 watts.

No instability has been experienced with this conversion. If you should exper-

ience instability, a stub neutralizing rod located between the power tubes, mounted on a ceramic feedthrough and connected to the bifilar choke with a 2-turn link should stabilize the amplifier.

optional modification

The small motor and fan used to circulate air around the power tubes leaves much to be desired for my tastes; I prefer lots of air around power tubes. The miniature Pamotor muffin fan can be purchased from most supply houses for about $10. In some areas it may be available as surplus.

Remove the original fan and fan motor. Use a nibbler tool or a fine coping saw to cut out a square hole to fit the outside dimensions of the Pamotor fan. Be sure to leave enough metal on the diagonal corners to accommodate the mounting ears. Mount the fan on the underside of the chassis; don't worry, there is just 3/16-inch of clearance between the fan and the bottom edge of the chassis.

Mount a 2-lug terminal as shown in **fig. 6.** Connect the black wires which went to the original fan motor to the tie points and the Pamotor fan leads to the same tie points. When the fan is installed in the SB200 cabinet there is more than enough room from the bottom of the fan to the cabinet. All SB-line enclosures are perforated, and this really helps air circulation. With the installation of the muffin fan air circulation has been improved by a factor of at least five. The fan motor is very quiet.

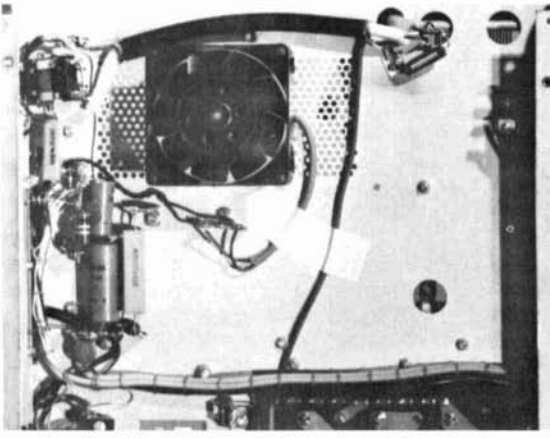
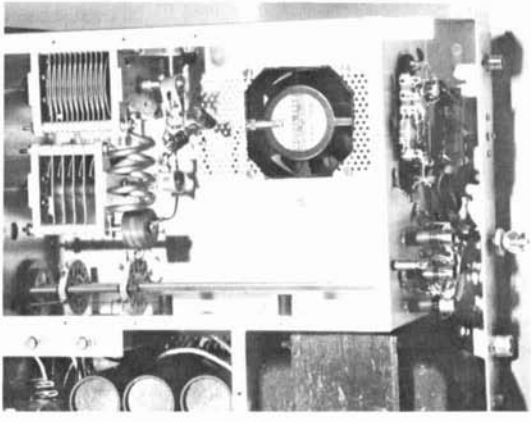


fig. 6. The Pamoter muffin fan is mounted directly below the plate area of the final tubes. The 2-lug tie point is mounted to the right of the fan motor.

Top view of the completed SB200 conversion including the new circulation system.



conclusion

The cost of the conversion is, to my mind, most reasonable. The two capacitors in the pi-network were ordered directly from E,F. Johnson for $15.63 including postage. The Pamotor fan was $9 locally and the copper tubing was 45c at the local hardware store. With the exception of the 15 pF capacitor, the new grommet and the length of RG-8/U cable, all other parts were salvaged from the original circuitry.

The SB200 has been a very popular linear amplifier and now, with the introduction of the SB220, they should be more plentiful on the used market. This conversion provides very respectable power output from a table-top linear which uses inexpensive tubes. I will be glad to answer inquiries if accompanied by a sase. My thanks to Roy Colella, WA1LVF, for furnishing the SB200 to experiment on and to Dick McGinn, WA1IMS, for the photographs.

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