R390A/URR VACUUM-TUBE TO SOLID-STATE POWER SUPPLY CONVERSION

Charles A. Taylor

The purpose of this conversion is to replace the high-voltage 26Z5 rectifier tubes used in the power supply of the R-390A receiver with solid-state, silicon rectifier diodes.

First, the type 26Z5 dual-diode power rectifier tube is no longer being manufactured, and is available only infrequently. Second, a significant reduction in power draw and in heat dissipation from the R-390A will be effected by this conversion.

To determine if your R-390A has had this conversion performed upon it, and to perform the conversion if not installed, proceed as follows:

A. Disconnect the R-390A line cord and any other connector leads.

> WARNING: IF THE LINE CORD HAS NOT BEEN DISCONNECTED, DANGEROUS VOLTAGES WILL BE EXPOSED TO TOUCH ON THE BOTTOMSIDE OF THE R-390A!

B. Turn the R-390A receiver over onto its backside. When this is done, the VFO inductor can (the large cylinder of about 8 inches length and about 5 inches diameter), which is coupled to the KC CHANGE control, will be visible.

C. Look at the power supply subchassis, which is the removable chassis that is located in the compartment on the left side of the receiver. At the right rear of that subchassis will be seen a plug, beside which is the designation J811. This will positively identify the power supply subchassis.

At the left rear of this subchassis will be seen two tube sockets (possibly with tubes plugged into them), designated V801 and V802.

If your receiver operates, and the tubes are not installed in the sockets, the conversion has beenperformed, and no further action is required(other than turning your R-390A over and reconnecting it, of course!); Otherwise, if the tubes are present, the receiver lacks the conversion.

D. Unplug the two tubes whose sockets are designated V801 and V802. To aid in removing the tubes, pull upwards on each tube while simultaneously rocking the tube in the socket. Next, unplug the plug beside which the designation J811.

E. Using a suitable Phillips screwdriver, loosen the six green-head captive screws located three on the front bracket of the subchassis, and 3 under the rear of the subchassis. The latter 3 are accessible through the three holes in the subchassis rear located one in front of J811, one in front of V802, and one at the center rear of the subchassis. Loosen these six screws until the subchassis can be lifted upwards and out of the receiver. Turn the subchassis over on its backside and set it aside.

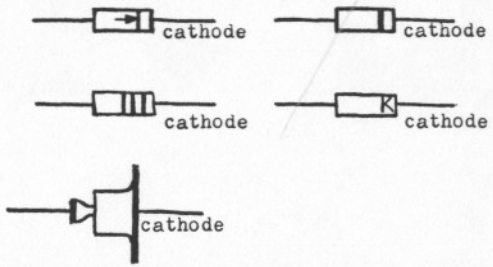

fig. 1. typical diode case outlines

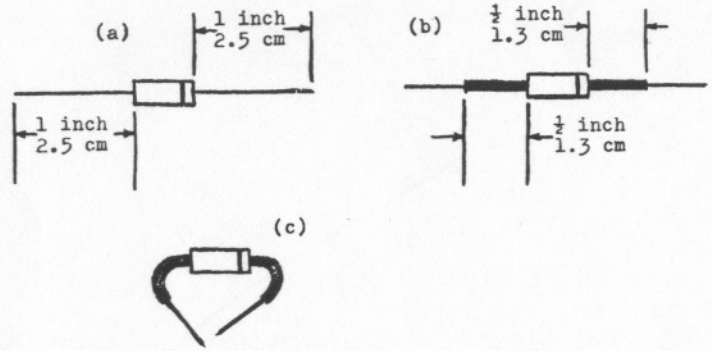

fig. 2. steps in preparing diode leads

F. Observe the diodes which will be installed. They will probably have a case outline and be marked in a manner illustrated in figure 1. The purpose of the marking is to indicate which end of the diode is the cathode. Usually the band or the letter is at the cathode end, the arrow head points toward the cathode end, or the bands are clustered toward the cathode end of the diode.

NOTE: The polarity of the diodes must be established positively to assure proper installation. Improper installation may damage components of the receiver. If you are unable to identify positively the cathode of the diode, seek competent assistance.

G. Prior to installation in the power supply subchassis, the diodes must be prepared as will be described:

1. Initially prepare each diode by trimming all but 1 inch (2.5 cm) of lead from each end. Refer to figure 2a.
2. Cut four lengths of ½-inch (1.3 cm) tubing from the stock.
3. Slide one ½-inch (1.3 cm) piece of plastic sleeving ("spaghetti") or heat-shrinkable tubing over each trimmed lead of the diodes. This will insulate the diode leads, reducing susceptibility to short-circuits with other circuitry. Refer to figure 2b.
4. Bend each insulated diode lead into a partial circle. Refer to figure 2c. An approach to this step is to place a round object (such as a pencil or pen) perpendicular (crosswise) to the diode leads, and bend them around the object. Avoid bending the leads at their point of entry into the diode case, as this may weaken the lead-to-case hermetic seal at the diode case and thereby possibly cause internal contamination and failure of the diode due to entry of moisture and/or impurit es into the case.

This completes preparation of the diodes.

H. Return to the power supply subchassis and continue as follows: With the power supply subchassis placed on its backside, with the tube sockets in the lower left of the field of view (as illustrated in figure 54 of page 78 of TM 11-5820-358-35), it will be observed that each tube socket has nine terminals (exclusive of the center shield post) that project from it. Further observe that there is a terminal omitted from the logical circular arrangement of these terminals. The missing terminal, and its corresponding omitted pin on the base of the 26Z5 tubes, forms a key which prevents incorrect insertion of the tubes into their sockets.

Each terminal (exclusive of the center shield post) is assigned a number for reference purposes. Numbering of the socket terminals begins at the left side of the blank (where a terminal is omitted), with terminal 1, and progresses clockwise (as viewed from the bottom of the tube socket!) up to terminal 9, which is the terminal at the right of the blank.

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I. In the following steps, the diodes will be attached and soldered to corresponding tube socket terminals:

1. Insert the cathode lead of one diode into terminal lug number 3 of V802 tube socket such that about ¼inch (6 mm) of lead protrudes from one side of the lug, as shown in figure 3a.
2. Using a pair of needle-nose pliers, bend the free end of the lead around the terminal and backupon itself, as shown in figure 3b (CRIMP).
3. Solder the diode lead to its associated terminal (SOLDER).
4. Insert the anode lead of the diode called forth in step I.(1) above into terminal lug number 1 of V802 tube socket, and repeat steps I.(2) and I.(3) above. This completes installation of one diode.

J. 5. Insert the cathode lead of the other diode into terminal lug number 3 of V801 tube socket. Hereafter proceed with the wiring of this diode as described in steps I.(1) through I.(3) (CRIMP and SOLDER).

6. Insert the anode lead of the diode called forth in step J.(5) immediately above into terminal lug number 1 of V801 tube socket, and proceed with the wiring of the diode as described in steps I.(1) through I.(3) above (CRIMP and SOLDER). This completes installation of the other diode.

K. 1. Inspect all four diode lead-to-terminal lug connections to assure that they conform to this pattern:

terminal lug number 1—lead—diode (anode)—(cathode) diode—lead—terminal lug number 3.

2. Inspect to see that no bare lead touches another lead, terminal lug, the subchassis, or any other conductive surface. It would be wise to bend all other insulated leads away from the uninsulated portions of the diode leads. Likewise, inspect to see that each diode stands free and does not touch any conductive surface such as the above.

L. Experimentally reposition the power supply subchassis at its normal location on the receiver chassis. Meanwhile, determine that no diode or bare lead touches the receiver chassis at any point.

M. Position the subchassis so that the six green-head captive screws mate with their respective holes on the receiver chassis. Tighten down the six screws firmly.

N. Reinsert plug J811 (called forth in step D) in its respective socket on the power supply subchassis.

This completes conversion of the R-390A. Return the receiver to its normal position and reconnect all cables.

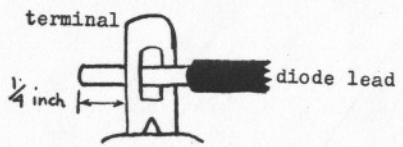

fig. 3a. Insert the diode lead into the terminal.

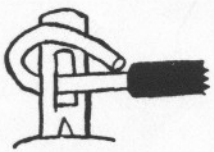

fig. 3b. Crimp the diode lead around the terminal.

R-390A/URR Vacuum-Tube to Solid-State, Power-Supply Conversion

PARTS AND TOOL LIST, AND REFERENCES

(Reference is made to Radio Shack catalog numbers to provide readers with a ready source of the tools and parts required for this conversion)

Tools:

		Radio Shack
1.	soldering iron, pencil-type, 40 watt	64-2072
2.	wicking braid, 5-inch roll	64-2090
3.	diagonal cutters, 6-inch ("dikes")	64-1845
4.	pliers, needle-nose, 6½-inch	64-1844
5.	screwdriver, #2 Phillips, 4-inch	64-1951
6.	solder, electronic, 12 inches	64-001

Parts:

1.	diodes, silicon 1000-volt, 1 ampere minimum, 2 each	276-1114
2.	tubing, insulating ("spaghetti"), or heat-shrinkable	278-1627

References:

1. TM 11-5820-358-35 Field and Depot Maintenance Manual Radio Receiver R-390A/URR (U.S. Army)

(or)

2. Radio Receiver R-390A/URR 0967-063-2010 (U.S. Navy)

These are some articles that I've written concerning the R-390A/URR and its various aspects. Except for the last article, all are available from IRCA Reprints:

3. R-390A/URR Optimization and Alignment Check (T34) (1 p.) October 1977
4. R-390A/URR: A Receiver Review (R18) (3 pp.) November 1977
5. R-390A Operating Procedure (2 pp.) November 1980

To order reference (3) and (4), send 9¢ per page (for IRCA members), or 11¢ per page (for non-members), and an SASE, to IRCA Reprints, P. O. Box 17088, Seattle, Washington 98107. Reference (5) is available from me for an SASE only, from Charles A. Taylor, Box 1226, FPO New York, New York 09560.

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ADDENDA

Some thoughts came to mind after completing this article. Not being your standard speed typist——in fact, not being a typist worth speaking (I type errors only; occasionally I accidentally type a whole sentence without error——but I try to avoid doing so as it astonishes me so that I fear for my heart), I decided against retyping this article to include them.

They are:

It is wise to tin the diode leads and the tube terminals before placing the spaghetti or heat shrink over the diode leads, and before crimping them onto the tube socket terminals. Tinning is the process of applying a thin coat of solder to the work before the regular solder operations. The diode leads are most likely already tinned, as are certainly the tube socket terminals of the R-390A power supply subchassis. However, and especially in the case of the R-390A which may have been exposed to corrosive atmosphere such as salty air, the solder itself may have surface corrosion. Tinning the terminals and leads will permit the soldering operation to proceed quickly.

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To tin the work, place the soldering iron (preheated by about five minutes) against the work, as shown in figure A. Then, touch the solder simultaneous to the work and the iron tip, as shown in figure B. This will allow a small amount of solder to melt and bridge the gaps between the iron tip and the work, hasten heat flow to the work, and thereby shorten the time that the iron is applied to the work (to prevent overheating the work). After several seconds, slide the solder along the work slowly. The solder should melt and flow out and over the surface of the work, forming a thin coat. If the solder congeals into lumps, reheat the work and remove them, and repeat the process. Continue this process until about one inch (2.5 cm) of the diode leads (as measured from the end) is tinned.

When tinning the tube socket terminals, more difficulty may be encountered due to corrosion extant upon the terminal surface. Also, the holes of the terminals may be filled with solder from a previous soldering operation. To clear the terminal holes, and to remove corrosion from the terminals, proceed as in figure C. Sandwich the wicking braid between the soldering iron tip and the work to be de-soldered. As the braid and the work heat up, flux from the braid will bubble out upon the work. Then solder from the work will flow, by capillary action, into the braid. As the braid becomes saturated with solder, trim off the saturated section with the "dikes", and discard the trimmings. Then repeat until blocking solder is wicked off of the terminal. This removes the old solder, and incidentally cleans the terminal of corrosion. If in doubt as to whether the terminal is now clean of corrosion, try to tin the terminal. If the solder flows out to a thin edge and "feathers" upon the terminal, it is clean and you can proceed to mount the diodes. If not, repeat the wicking operation until the terminal tins normally.

Both the diode lead and the terminal must be able to be soldered in a quick operation. This is true because otherwise the spaghetti or heat shrink tubing (whichever one is used to insulate the diode leads) will melt off the diode lead, and it will be necessary to detach the diode lead, slide on a new length of tubing, recrimp, and resolder. Your patience, and certainly the terminal, can only withstand so much of this abuse before it breaks.

If, after reading this, you decide just this once to take the subchassis and the diodes to your friendly, smiling corner radio-TV repairman (It will only take him/her/it five minutes to do the job), we will forgive you.

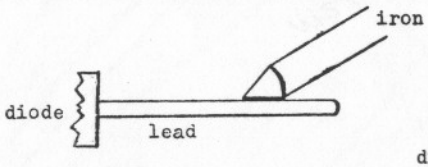

fig. A. Apply the soldering iron tip to the diode lead.

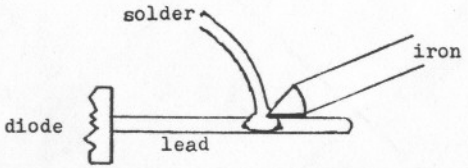

fig. B. Apply solder simultaneously to the diode lead and to the soldering iron tip.

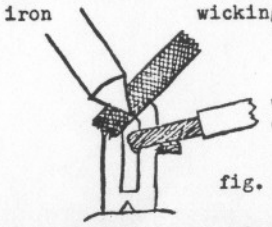

fig. C. Wick the terminal to clear the hole of solder, and to remove corrosion.