

Restoring the KLH Model Eight Table Radio

the best radio ever built

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For those not familiar with this excellent radio, Andrew Hayden's article "KLH Raises the Bar" is recommended reading:

http://www.antiqueradio.com/Jun05_Hayden_KLH.html

This Henry Kloss marvel is unique in many ways: It was probably the first high fidelity table radio and it is the ONLY tube table radio with an acoustic suspension speaker. Music lovers and collectors prize these radios, but being nearly a half-century old, they inevitably require some refurb and restoration work.

This guide is based on my experience restoring dozens of these and is intended for the advanced hobbyist. You don't have to be a technician or have the ability to read a schematic. If you are comfortable building a *dynakit* you should be able to follow these instructions.

The outside: Common problems

An inspection of the KLH Model Eight should cover the following points:

- What is the condition of the cabinets? Are there any scratches, gouges, corner dings, water stains, etc? Early cabinets were solid walnut while later ones were high quality walnut veneered plywood. A look at the back edges on both the receiver and speaker will reveal what you have(*fig. 1*).
- How does the faceplate look? The faceplate is painted Masonite.
- Are all of the knobs there and are they original? The smaller tuning knobs were easily lost. Sometimes an on/off switch has been replaced and a different knob installed. The tuning is a "vernier dial" in which the outer ring turns more slowly than the inner knob, to allow for fine tuning. Are the knob and dial there and intact? Does the tuning work properly?
- How does the speaker cloth look? Water stains seem to be common. Is the KLH logo badge on the cloth?
- Is the 30' white twisted pair speaker wire intact? The proprietary double banana plug is often missing due to a design flaw, and typically will have been replaced with two standard banana plugs.
- Are the plastic cleats on the back of the speaker intact? These are often broken.
- Other things to look for are the metal labels (2) on the back of the receiver and (1) on the back of the speaker. Serial numbers rarely match (I have an original factory carton, with serial numbers of the receiver and speaker on the outside. They don't match). Check the AC power cord for cracks and stiffness. There should be 3 knurled nuts and a small strap on the back of the receiver for the antenna connections (*fig 2*).

Problems in any of these areas are not necessarily sufficient reasons to pass on a Model Eight you may be considering, but some (such as a missing volume knob or a scratched cabinet) are fairly easy to remedy while others may be difficult (a scratched faceplate) to

impossible (a broken tuning mechanism) to fix. To find out how to address some of the more common and repairable problems, read on.



fig 1 --Veneer (top) and solid (bottom) cabinets



fig 2 – Radio back

Disassembly and cabinet restoration

The receiver chassis can be removed by *gently* removing the knobs, then unscrewing the four Phillips-head screws holding the feet to the bottom of the cabinet. To remove the knobs use your fingers and fingernails only. Rock and pull straight out. Do not use a screwdriver or any other tool to pry the knobs—you run the risk of breaking the brittle plastic or damaging the painted faceplate. As a last resort, you can make a knob-puller from the cardboard center of a roll of packing tape (*fig 3*). Cut a notch in the cardboard and slip it under the knob, so the shaft slips into the notch (thanks to Tim Schwartz of Bristol Electronics for this tip).

Once the knobs and feet have been removed, slide out the chassis and set it aside. The painted faceplate can be cleaned with soap and water, *Fantastik*, 409 or similar cleaner. Do NOT use any kind of abrasive! If the faceplate is scratched or the lettering is rubbed off there is little you can do. I have touched up small scratches and chips by spraying almond spray paint into a cup, then brushing it on with a very fine paintbrush (*fig 4*).



fig 3—knob-removal “tool”

fig 4 – repaired paint chip



After the face is clean and thoroughly dry, mask it with painter's tape. Now turn to the speaker and decide whether the cloth should stay. In my experience, there is no suitable way to clean this cloth if it is stained. If the cloth looks good enough to keep, cover it with cardboard and painter's tape. If it is stained, torn or frayed; remove it. The cloth is quite stiff and is only about 1/8" larger than the front frame. The edges are tucked into a groove that runs around the perimeter and the cloth is glued to the baffle. Pull off the KLH logo (it is glued on) and try to lift the cloth. At this point don't worry about damaging it but be very careful not to poke anything into the speaker drivers! Early speakers had two 3" drivers; later ones had one 4" driver. Use a knife to work around the edge of the cloth—it should come off easily. Once it is off, cover the front baffle with cardboard to protect the driver(s).

If a cleat is broken, you can remove it by drilling out the metal rivets. This is best accomplished from inside the speaker cabinet. Assuming the grille cloth has been removed, unscrew the #4 flat head Phillips screws holding the speaker baffle in place, and pull the baffle off. It is caulked with some putty that is probably dried out and may require some gentle prying (be careful of the walnut frame), but it will come loose. Inside is some pink fiberglass insulation. Remove it (gloves and a mask are a good idea) and save it in a plastic bag. Now drill out the rivets from the inside. Later the cleats can be reattached with #4 machine screws, lock washers (or *Loctite*) and nuts.

To restore a cleat, I made a cast of an intact cleat using Plaster of Paris. A better choice would be a product for making molds, sold in art stores. After you have your mold, set the broken cleat in it, then pour in a mixture of *Plas-T-Pair*. This product may also be used for patching broken knobs.

Plas-T-Pair is available online at <http://www.radiodaze.com/spec-plas-t-pair.htm> It consists of powdered plastic and a liquid solvent. Follow the directions and work in a ventilated area. The product will dry cream-color, so to repair black plastic add a few drops of *Evercoat* black coloring agent to the mix. It is sold in auto body or marine supply stores. Pour the black *Plas-T-Pair* mix into the mold, let it cure 24 hours and remove your restored cleat (figs 5 & 6). A similar method can be used to make repairs to the plastic knobs (more on that later).



fig 5 – broken cleat & plaster mold



fig 6 – repaired cleat

If the *Plas-T-Pair* requires cutting or sanding it is best to let it cure at least a week—two weeks is better.

At this point you'll have to decide whether the cabinets need to be refinished. The solid ones can be sanded aggressively with an orbital sander. I would NOT sand veneer unless absolutely necessary—and then only by hand. For veneer cabinets I recommend *Howard's Restor-a-Finish*, available at hardware stores, online and Home Depot.

<http://www.howardproducts.com/restora.htm>

You cannot put polyurethane or any hard finish over *Restor-a-Finish*, but *Minwax Antique Oil Finish* works well and will result in a hard, low luster finish. The Model Eight's original finish was apparently lacquer, NOT oil. If you have a solid cabinet and sand it down you could use varnish or lacquer if you choose. I will not go into the steps of successively finer sanding and applying the finishes. There are many books and online articles to cover furniture refinishing, but one useful trick I learned from John O'Hanlon is worth mentioning: For big gouges, corner bashes or open seams a filler can be made from 2-part epoxy and a pigment called *Mixol*.

<http://www.woodcraft.com/family.aspx?FamilyID=5522>

Mixol is sold in art supply and woodworking stores. It comes in a small (20 ml) bottle, costs about \$5 and you need only a drop added to your epoxy. "Tobacco" #22 is a good match for the dark walnut wood. On corners build a dam out of masking tape and pour the epoxy mixture in (*fig 7*). Open seams can be re-glued by forcing the tinted glue into the joint with a razor blade or X-acto knife, then clamping (*fig 8*). After 24 hours it can be filed and sanded down. It is MUCH more durable than "plastic wood".



fig 7—corner bash, tape dam and epoxy filler



fig 8—clamping

After the cabinets have both been refinished and the cleats reinstalled, replace the fiberglass stuffing and reattach the speaker baffle. Use the screws you removed and some window putty or caulk to get an airtight seal.

There is a schematic diagram pasted to the bottom of the receiver. If this is missing or damaged, you can download it and print it, then glue the new one to the cabinet bottom:

<http://www.freeinfosociety.com/media.php?id=5045>

There are also downloads here: http://www.somerset.net/arm/fm_only_klh_8.html

Replacing the grille:

Oddly, speaker grilles on the Model Eight are often water-stained. And like many parts of the Eight, the speaker grille fabric (shown in *fig 10*) is 100% “unobtainium”. It is very stiff and was cut just about $\frac{1}{4}$ ” bigger than the opening so it could be slipped into a groove around the perimeter. If you try to wash it, it will shrink and/or unravel. After much experimenting my favorite replacement is this: Cut a piece of $\frac{1}{8}$ ” Masonite $9\frac{13}{16}$ ” x $4\frac{13}{16}$ ”. Use a hole saw to make two $3\frac{1}{4}$ ” cutouts (for a 2-driver speaker) or one 4” cutout (for a 1-driver speaker). Sand the edges of the cutout, then paint the board black. This board will be covered with Irish Linen. Linen or a similar fabric was used on many early New England speakers, and although it is not a match for the original KLH cloth, it has an appropriate “vintage” look. The linen can be purchased at reasonable cost at Michael’s craft stores. Look for *CharlesCraft Irish Linen* cross stitch fabric 28 count in “Tea.”

<http://www.charlscraft.com/shoppingcart/customer/viewproductdetails.jsp?pname=Irish+Lin en+Evenweave&catid=30>

There are other linens that look good. 18-count Linen in “lambwool” color from this site is especially nice for classic speakers:

<http://www.123stitch.com/cgi-bin/itemdetail.pl?item=59-135X>

Irish Linen makes an excellent, acoustically transparent grille. I’ve used other cloth also—white burlap that I dyed with coffee (less transparent) or salvaged cloth from other speakers like the KLH Model Five. You only need a small piece but be sure to use a natural fiber like linen, wool or cotton—not synthetic.

Cut a piece of the speaker cloth about $5\frac{3}{4}$ ” x $10\frac{3}{4}$ ”. Run a bead of *Aleene’s Tacky Glue* (available in craft or fabric stores) around the back edge of the Masonite and smooth it out with your finger. Now place the cloth on the front and fold over each of the 4 corners, keeping the cloth straight and square, and pulling it snugly (you don’t have to get it *too* tight). Next, glue down one entire edge at a time. The *Aleene’s* is water-soluble and dries quickly. You can use your fingers to work the cloth into the glue, and you may want to use small clamps or clothespins to hold it in place while it dries. This site shows the general procedure, although it shows the stretchy synthetic cloth:

<http://www.humanspeakers.com/howto/grill-cloth.htm>

Be very careful not to get glue on the face of the speaker grille cloth. After the glue is totally dry (overnight) use a spray bottle to spritz water on the face of your grille. Blot with a towel then dry with a hair dryer. The fabric will shrink to be as tight as a drum (*fig 9*). You can spray it with *ScotchGuard* if you want, then glue the KLH logo on with *Aleene’s*. If the logo was missing, there is no suitable replacement (more unobtainium!). Your best bet is to watch eBay, but be sure to get the one pictured. It was only used on the Model Eight (*fig 10*) and the Model Eleven “suitcase stereo”.



fig 9—Irish Linen grille cloth

Your completed grille can be glued to the front baffle with *Aleene's*, *Elmer's* or hot melt glue.

This should complete the cosmetic work, except for the knobs, if needed. Next—on to the electronic restoration!

What if a speaker driver is damaged?

The 3" drivers were used only in the Model Eights, and if one is damaged it cannot be replaced. Options in this case would be:

1. Replace the two drivers with modern replacements. *Tang Band* 3" drivers are well regarded, but they are not authentic. If you go this route, wire the new drivers in series. It may be necessary to make a new Masonite baffle, depending on the diameter of the replacement speakers.
2. Later Eights used a single 4" driver and this driver is VERY common. It was used in the Model 21 radio as well as the 5, 11, 12, 14, 19 and several other KLH speakers. They are often found on eBay. Just remove the double 3" speaker baffle and make a new baffle out of 1/8" Masonite with a 4" hole in the center. Note: If you have the original plug, the positive terminal on the speaker is connected to the plug at the tip of the arrow (*fig 11*). Polarity is only an issue when connecting the speaker to the rare KLH Model Thirteen Stereo Adaptor.

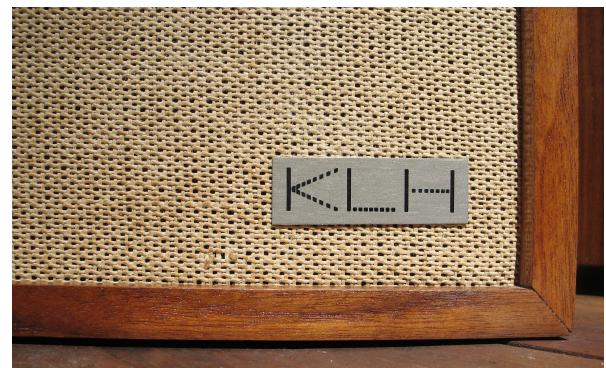


fig 10—Original grille cloth and logo



fig 11—speaker plug (against original speaker cloth)

Working on the chassis

The KLH chassis is pictured here, with the main components labeled (fig 12). The vacuum tubes are readily available but usually do NOT need to be replaced. Things like Power Transformers and Tuning Capacitors are unobtainium—if you need one your best bet is to find a “parts” Eight to cannibalize.

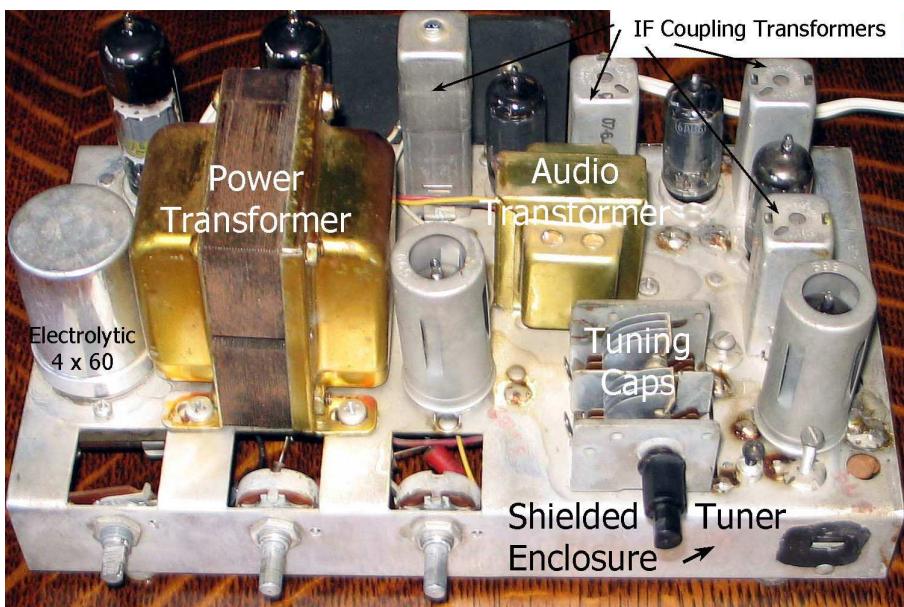


fig 12—chassis

So what should you replace? If the power cord is cracked or damaged (look very carefully at where it meets the strain relief), replace it. Some online suppliers sell non-polarized power cords, or you can just buy a 10-foot extension cord and use that. The wider prong can be cut down if you wish to make it more authentic. If you decide to use a new cord/plug and leave the wider prong as-is, be SURE that wire is connected to the neutral on the chassis (you can trace the “hot” side from the on/off switch).

REPLACE ALL ELECTROLYTIC AND PAPER CAPACITORS. For an excellent overview on replacing caps, see this article:

<http://antiqueradio.org/recap.htm>

Helpful tips (and new caps) are found here:

<http://www.justradios.com/captips.html>

The Model Eight has five electrolytic capacitors. It “may” have up to seven paper caps. In the photos (figs 17 & 18) the red tubes that look like firecrackers are paper caps. Some Eights used film caps in some of those spots, so you may not need to replace all seven. For example, the green Cornell-Dubilier cap in figure 16 has a part number on it that showed it to be a plastic film cap. On the other hand, many Eights have brown Dart or Good-All caps that may be plastic film but they also may be plastic-coated paper. They have a band around one end, which suggests they may be paper. The safest option: When in doubt, replace.

The biggest recapping hassle is the 4-part “can” power supply filter cap. It is a nuisance to remove and replace, and a new one costs about \$35 + S/H from Antique Electronic Supply <http://www.tubesandmore.com>. The original 4-section cap is 60- μ F, 150-Vdc per section. The replacement is 50- μ F, 350-Vdc per section (part number C-EC50X4-350).

I usually build my own, using these high-temp miniature 47 μ F caps (the actual value is not that critical for filter caps):

<http://www.parts-express.com/pe/pshowdetl.cfm?Partnumber=020-1692>

Total cost: \$5 + S/H. Here's how:

1. Unsolder all the connections to the old can and remove it, being careful not to break any of the tabs. A Dremel tool may help in grinding off the solder that holds the ground tab to the chassis.
2. Using a cutting wheel in a Dremel tool, cut along the bottom seam (*fig 13*).
3. Remove the top of the can and remove/discard all of the stuffing (*fig 14*).
4. Clean the parts in water and baking soda to neutralize the acid.
5. Drill 1/16" holes in the lugs and through the phenolic bottom plate for the cap leads.
6. Insert the leads through the holes. Positive leads go to the 4 lugs, negative go to the outer grounded mounting tabs.
7. Solder the leads.
8. Epoxy the can top back on (*fig 15*).
9. Reinstall the rebuilt 4-section cap (*fig 16*). Although it is not critical, try to keep the orientation right (the lug marked with a triangle goes toward the front of the chassis and has the two 220 Ω resistors soldered to it).



fig 13—cutting can



fig 14—removing insides



Fig 15—completed stuffed can

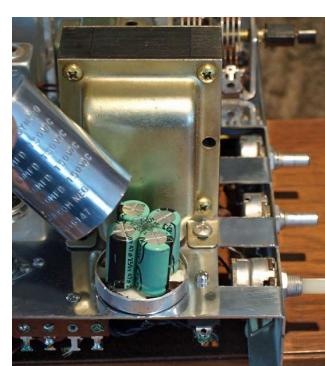


fig 16—installed on chassis

Reconnect all of the wires and components. Because of the higher voltage rating of the new cap, I replace the two 2-W, 220Ω resistors with 5-W resistors and replace the 200-mA diode with a 1N5408 3-A 1000-V rectifier diode (because the old diode might not be able to take the new capacitor set's faster charging speed) (*fig 17*).



fig 17—new components

The only other electrolytic is a $5\text{-}\mu\text{F}$ in the middle of the chassis (*the black cap under the $0.03\text{-}\mu\text{F}$ red paper cap in fig 18*). I replace this with a $4.7\text{-}\mu\text{F}$ 50-V electrolytic (*the light blue cap in fig 16*). BE SURE TO OBSERVE CORRECT POLARITY!

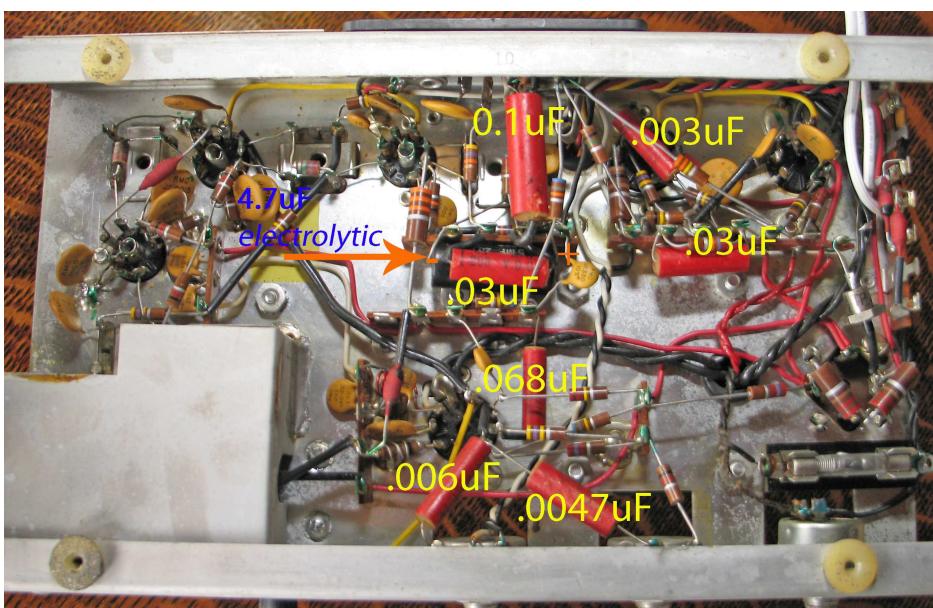


fig 18—capacitor values

The values of the paper caps are marked on the photo (*fig 18*) but sometimes the original caps are different. In one radio for example, the $.068\mu\text{F}$ cap was $.008\mu\text{F}$ and the $.006\mu\text{F}$ cap was

.03 μ F. In those cases I replace with the same values as printed on the originals. Be aware that +/-10% is considered to be within spec (it's OK to replace a .03 with a .033).

A good source for replacements is www.justradios.com although for one radio it may be more practical to buy the parts locally, IF you can find them. Use good quality film caps of at least 200 volt rating (I use 600 to 630-V whenever possible).

Resistors are pretty durable, but it may be a good idea to check them with an ohmmeter. Disconnect one end of the resistor to avoid false readings. If a resistor goes to a tube socket, pulling the tube will effectively disconnect one end.

Resistors are coded with stripes to indicate their value. A convenient way to read them is to plug the colors into a resistor color code calculator like this one:

http://samengstrom.com/nxl/3660/4_band_resistor_color_code_page.en.html

The first three bands tell the value, the 4th band tells the tolerance. Thus a resistor with red-violet-orange-silver bands is 27000 ohms (2.7K ohms) with 10% tolerance. The resistors in the Model Eight are either 1/2 watt, 1 watt or 2 watt. When replacing, you should use the same value and wattage. I would opt for 5% tolerance when available, and be sure to use "flame proof" resistors of at least 350 volts rating. The JustRadios.com site says that you may want to replace 1/2 watt resistors with 1 watt resistors. That should be fine as long as they are not too big physically, and they are flame proof, 350 volt. A new 1 watt film resistor is smaller than an old 1/2 watt carbon resistor. Like capacitors, a +/- 10% range is close enough (you can replace a 2.7K resistor with a 3K).

The volume and tone pots can be cleaned with a spray control cleaner. The on/off switches are sometimes broken, and oddly enough it is very difficult to find a simple on/off rotary switch. It should have a solid 1/4" shaft and about a 30 degree on/off range, but these are nearly impossible to find. Some restorers have resorted to using just the on/off section of an on/off/volume switch, but even these are generally salvaged used parts (and may have a splined shaft).

The tubes usually do not require replacement but if they do they are readily available. The Model Eight uses two ECL82/6BM8, three 6AU6A, one 6U8A and one 6BS8 vacuum tube.

Make sure all the tubes are seated and that they all light up. The 6BS8 and 6U8A tubes must have tube shields. If these have been lost you can get acceptable (not exact) replacements from Antique Radio, ApexJr.com, and eBay sellers to name a few. You need a 2" tall shield that is designed for a 9-pin socket.

I have never had to replace a neon bulb, but if needed, it is under the metal shield. The shield is soldered on and can be removed by desoldering. Be sure to resolder when you are finished.

I have not addressed alignment because if a radio needs to be aligned I take it to a tech. If you replace tubes, the radio should be realigned (maybe I'll learn how to align these radios sooner or later!)

If you are compulsive (like me), you can polish the chassis and shields with *MAAS Metal Creme*. This is a tedious task but the result looks nice! (fig 19).

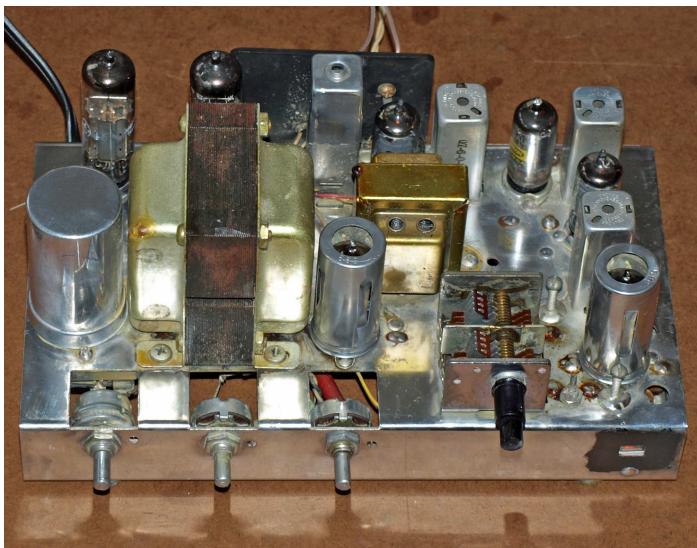


fig 19—polished chassis

Reinstall the chassis and attach the knobs

Now that the electronics are complete, you can put the chassis back in the cabinet and reinstall the knobs. If the small knobs are missing, or if a control pot has been replaced with one that has a splined shaft that will not accept the original knob, some acceptable replacements are available: The *Kilo International*, part number DDS-90-4-5 in matte black is a solid aluminum knob with 2 set screws that is very close in appearance to the original plastic knobs (*fig 20*). They are available from a number of online sellers. My local parts shop stocks them, but they cost about \$10 apiece!



fig 20—Kilo aluminum knob left, original plastic knob right

If the on/off switch has been replaced with one with a solid shaft, the needed “flat” can be made with a file so the original knob will fit.

There is no perfect replacement for the center tuning knob. I found a 1.9" diameter knob that is close (*fig 21*), but it had an aluminum insert and a 1/4" mounting hole. Remove the aluminum disc (place it in the freezer overnight and the disk will pop off) and sand the center to look like the original. I used an adaptor bushing to make it fit on the 1/8" shaft (*fig 22*).

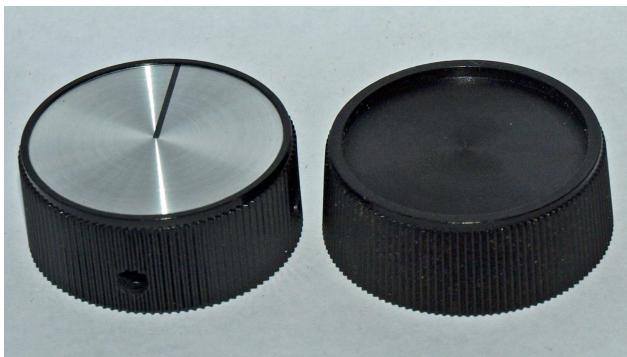


fig 21—new & old tuning knob



fig 22—installing shaft bushing

The outer tuning dial may present a problem. If it is cracked, it can be repaired with *Plas-T-Pair*. But if it is missing, there is no replacement. I had one hand made by a woodturner who happens to be a close friend, but if I had to pay for it. . . .

Here's how to repair a chip: Put tape over the void on the front of the knob and on the edge to make your "dam." Mix some *Plas-T-Pair* and Evercoat as previously described and slowly (to avoid air bubbles) pour it in from the back (*figs 23 & 24*). After 24 hours, remove the tape. Wait a week before sanding any irregularities. A final buff with steel wool should make the patch all but invisible. In *fig 25*, the patch is at the top of the dial. I had to enhance the photo in PhotoShop to make it visible at all!



fig 23—broken tuning dial

fig 24—*Plas-T-Pair* poured in tape mold

fig 25—patched dial

The knurled nuts for the antenna, if missing, may be replaced with solid brass knurled nuts available in hardware stores. If the antenna strap is missing, a piece of bare wire or even a paper clip can be used as a jumper.

After following these guidelines, you will have transformed your Model Eight from this:



to this:



Now that the radio has been repaired and refurbished, place it in a prominent spot, turn it on (and wait while it warms up!) and enjoy the rich, full sound. One last note: Be sure to allow plenty of air circulation around the receiver, and do NOT place anything (like the speaker for example) on top of the receiver. Many old Eights have split or blistered top panels on the receiver cabinet from excessive heat.

Acknowledgements

Special thanks to John O'Hanlon, without whose tutelage I would not know an electrolytic cap from a baseball cap. John has provided long-distance instruction on everything from identifying capacitors to mixing up epoxy wood filler.

Thanks to other *CSP* contributors, for freely sharing tips, advice and support. The excellent booklet *Restoring the AR-3a*, found on *The Classic Speaker Pages* inspired me to share some of what I've learned in via this paper.

And to Mark Spencer, for providing and maintaining this forum—a big thanks from us all!