Restoring Imported Mechanical Filters

Is Your Aging Receiver Suffering From A Common Malady?

by Peter J. Bertini, K1ZJH

No doubt about it, my JRC NRD-515 is a keeper! I've owned this classic receiver and the companion NSD-515 transmitter for over 20 years, and I don't plan to switch! Sure, there are newer receivers on the market sporting many more features, and even a select with better specs, but no one has offered companion receiver and transmitter packages since the JRC twins were taken off of the market!

Photo 1: My JRC twins, although vintage classics, still reliably provide the backbone for my HF ham and SWL needs.

After a long hiatus from ham and SWLing activities, I've recently had a renewed interest in pursuing my radio hobbies. But, after listening and operating for a few days, signals seemed to be a lot weaker than they used to be. Something wasn't right. I blamed it on poor propagation; until I made a startling discovery: Signals that were barely moving the S-meter using the 2.1 kHz and 600 Hz filter positions were S9 plus with either the 6-kHz AM ceramic filter or 300-Hz crystal filter selected. After some quick troubleshooting, my fears were confirmed: The two mechanical filters had become extremely lossy.

Nothing To Lose

Unfortunately, I couldn't find a source for replacement 600-ohm impedance filters the receiver was designed for; and as I will show, 20-year old *new-old-stock* filters from a dealer's back shelves may not be a bargain, even if they could be found. These were my alternatives: I could live with the degraded performance, or I could adapt the receiver to use more modern 2-kHz impedance Rockwell-Collins torsional-mode mechanical filters. Rob, from Sherwood Engineering, was willing to tackle the upgrades; or I could do them myself and just buy the filters. Either way it would be costly, but I'd do it if I had to if it meant saving my '515!

Mechanical filters use transducers to convert electrical energy into mechanical energy, and this energy is coupled through precisely made metal disks that resonant at the passband frequency. The action is not unlike a tuning fork, which responds to a single frequency. At the other end of the filter, another transducer converts the mechanical vibrations back into an electrical signal.

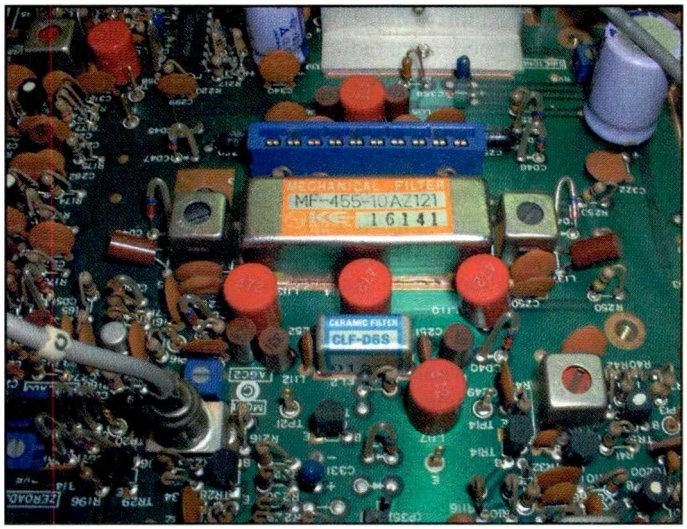

Photo 2: The JRC SSB filter (larger can) is seen in back of the smaller ceramic 6-kHz AM filter. The 600-Hz CW filter, with the companion 300-Hz CW crystal filter, is mounted on a plug-in "option board" — which was removed when the photo was taken.

Care Is Needed

The increased insertion loss for this style filter didn't make sense. Why? I decided to investigate to see if I could spot an obvious cause for the problem. Unless you have some experience removing components from circuit boards, and don't mind risking permanently damaging your mechanical filters, leave the repairs or upgrades to a professional! Unsoldering the filters is tricky! I was careful, yet I managed to pull the plated-through holes when removing the filters.

The filters can be opened for examination by lifting four metal tabs that hold the metal cover to the base assembly. ***Use great care here!*** The filter assembly is not fixed-mounted in the case — once the cover is removed, the filter component is free to

Photo 3: Opening the SSB filter reveals a gooey mass of decaying yellow foam adhering to the mechanical filter's transducers and resonator disks. The weight of the filter had compressed the gooey foam into an almost "superglue"-like substance where the filter components rested on the Bakelite base, destroying the filter's performance.

Photo 4: After using a solvent to melt away the old foam rubber, followed by several rinses in pure isopropyl alcohol, the old filter is free of contamination.

flop about, and is very easily destroyed if stressed or dropped! It's only supported by thin wire leads connecting the filter to the base terminals.

Photo 3 shows what was found when opening the 8-pole mechanical SSB filter. The filter was originally cradled in a wrapping of soft yellow-colored foam rubber. Over time the foam had gradually decomposed until it became a sticky mass adhering to the resonator disks. Even the foam that still looked like foam was extremely sticky and gooey, and was easily rolled into a mass of chewing gum-like consistency. The filter was "glued" to the base. At first I thought this was done intentionally, but upon closer examination I found the "glue" was fully decomposed foam. This was the primary cause for the severe attenuation, just as our tuning fork example would be muted when inserted into a vat of molasses.

I carefully picked away what foam I could by hand, and then used flux remover (Tech Spray 1621-10S defluxer) to dissolve the remaining foam, and to flush it away from the filter components. Acetone may also work as a solvent here. Work in a well-ventilated area when using these chemicals. The cleaning was assisted by using a small artist's brush to gently wipe the filter as it was soaking. For the final cleaning, the filter was thoroughly rinsed in pure isopropyl alcohol (Tech Spray 1610-P cleaner/degreaser) and allowed to air-dry. **Photo 4** shows the SSB filter after cleaning. Similar steps were taken to restore the 600-Hz mechanical filter. **Photo 5** shows the 7-pole CW filter after cleaning.

Rebuilding The Filter

The foam must be replaced. All I had on hand was a thick block of rubber foam salvaged from a shipping box; from this I cut-to-fit some narrow replacement strips. Thin sheets of foam are sold for replacement air conditioner filters. This material — cut to size — might also serve as good replacement cushions for the filters. **Photo 6** shows how a layer of new foam is placed between the filter and the Bakelite base. A second layer of foam was formed inside of the cover to provide protection for the sides, ends, and top of the filter. Once the cover is replaced, the filter is again gently cradled in a loose blanket of soft rubber-foam material.

Now the mechanical filters can be reinstalled in the receiver, and proper operation verified. Note that the filter terminals have E, G, E, P markings (Earth, Grid, Plate) that should line up with the silk-screened legends on the PCB when the filter is properly orientated.

A Common Problem?

I've heard this problem is common to other vintage receivers using Japanese mechanical filters; it is not unique to the JRC NRD-515. Opening and working on these delicate filters requires some skill, and a smattering of luck, but when faced with the

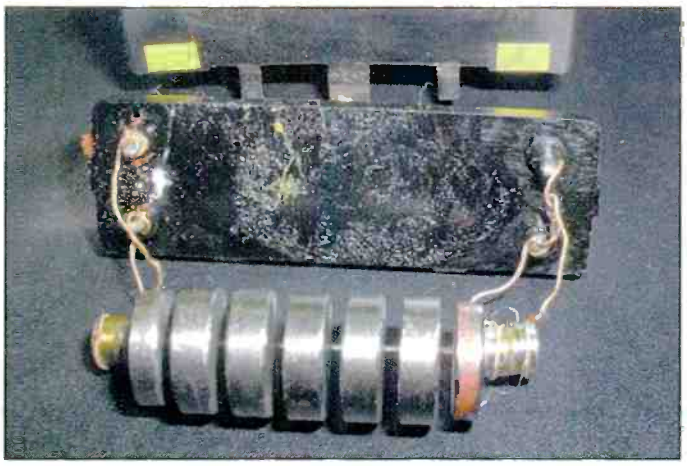

Photo 5: The 7-pole 800-Hz CW filter after cleaning.

Photo 6: Replacement foam is trimmed to fit and placed between the filter elements and the mounting base, and inside the cover. When assembled, the filter is again gently cradled in soft foam rubber.

chance of eking more life out an expensive component rather than trashing and replacing it, why not? Newer, torsional-mode 2k-ohm mechanical filters cost around $125 each, and would require some added impedance matching networks to work with the '515. 2k-ohm crystal filters are also available and will do the job for a similar cost. The '515 design inherently suffers from some IF signal *blow-by* issues caused by unwanted coupling between the SSB and AM filter inductors on the receiver board. Sherwood Engineering can correct these problems, if the set is sent to them for upgrades and modifications. There is quite a bit of work is involved in these mods, and it isn't cheap.

How long will the new foam last? I don't know; but I suspect at least several years if not much longer. But for now my problems are solved, and I am again actively SWLing and chasing DX on the ham bands! 73! ■

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