One Fuel Sender Failure and How to Repair It

By Bill Noble, Santa Monica, CA ©

I have a 59 Eldorado that I've been driving regularly for a few months because my regular car was imprisoned by a body shop and just couldn't make parole. While I was driving it, the fuel gauge became erratic, and then stopped working entirely, with the pointer out of view. Paying careful attention when I turned the ignition on, I could see the pointer go from empty to past full and disappear.

The fuel gauge system on these cars uses a variable resistance element in the tank, and a gauge with two electromagnets in the instrument cluster. The varying resistance changes the relative currents in the two electromagnets, moving the fuel pointer.

When the tank is empty, the resistance in the sender is a minimum, when it's full, it's at its maximum, so for the pointer to move off scale past the "F" means that there is an open circuit somewhere.

The sender is connected to the gauge by a brown colored wire (on 59) that runs from the sender, across the top of the gas tank, through the right rear trunk wall, where there is a connector, then it joins the harness containing the wiring for the electric trunk closer. Then it travels along the left side of the car, along the door sill, and up the front door pillar, where it is joined by the wires from the driver's side door switch, and then it eventually reaches the gauge.

To test if the wire was open somewhere, I located the connector in the trunk, disconnected the sender, and grounded it – the pointer moved nicely to "E", so the wires were OK. That means that the sender was bad.

The sender is mounted on top of the gas tank, and the tank is held in place by two straps. To remove the tank, first remove as much gas as you can (it's pretty heavy with even ¼ tank) – I used a drill powered pump and pumped the gas into some surplus jerry cans. Then, jack up the car (use jack stands) disconnect the fuel and fuel return lines (the clamps are the spring type hose clamp), and disconnect (or at least loosen) the clamp on the fuel filler pipe. Now, remove the two 9/16 nuts holding the rear of the two straps (a deep socket is very helpful) and lower the tank. Disconnect the electrical connections (a ground wire and the brown wire that goes to the sender).

With the tank free of the car, remove the Phillips head screws and remove the sender. Photo 1 shows what I found. The brass strap that connects the sender to the terminal had broken in half – I presume this is due to vibration induced stress fatigue, I can't imagine any other mechanism. Since this happened to me, there is a reasonable chance that other cars with a similar sender will encounter the same problem, so here's how to fix it.

First, clean the strap for about ¼ inch on either side if the break until it is shiny. Then tin both sides using electronics type (rosin core) solder (see photo 2). You want to tin first so you can be sure that the solder is adhering well and you will get a connection that is electrically good and has good mechanical strength.

Once the strap is tinned, clamp a short length of stranded wire to the strap, and solder it in place (photo 3). You need to clamp it with an alligator clip or something because otherwise it is likely to move and give you a "cold" solder joint. I used multi-strand wire because if the failure was in fact vibration induced, the multiple strands will not only help dampen vibrations but will also not support crack propagation like a single strand of wire. The current through the sender is very small, you could use thinner wire and less of it, but then you are subject to mechanical failure.

When you are through soldering the wire in place, trim the excess (photo 4) and you are ready to reinstall. This repair worked perfectly for me, saved the time and expense of locating a replacement part, and saved me having my car out of commission for weeks while I located a replacement and installed it. Maybe this can help you too.

If you have any questions, feel free to contact me via my web, www.wbnoble.com.

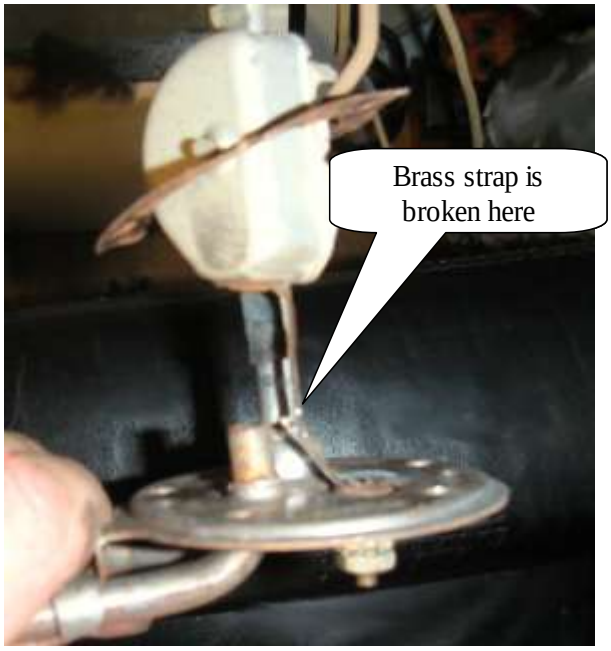

Photo 1 – broken strap on fuel sender

Photo 2 –

Tinning the strap on either side of the break – this is not good enough yet, after this photo, I cleaned it some more and tinned it again. Note that if you are soldering in your lap like I was in this photo, wear thick pants – the burns from solder dropping on your skin are 3rd degree burns, you don't want to experience that if you can avoid it.

Photo 3 – Soldering a length of stranded wire in place, using an alligator clip as a clamp

Photo 4 – the repair after trimming the excess wire, ready to re-install

Some Follow up

I originally wrote this article in 2005. In 2012, after letting the car sit (on jack stands) for about 5 years, I wanted (and actually needed) to drive it again, so I went through the usual steps, new battery, oil, etc. The fuel gauge was again reading well past "F" no matter how much fuel was in the tank. In fact, I actually ran out of gas due to this helpful feature.

Now, in 2012, there are reproduction fuel senders available, made out of stainless steel – I purchased one of them for approximately $60, and following the removal/installation procedure above, I installed it. Figure 5 shows the new sender, figure 6 shows the original sender. The new sender came with a neoprene gasket, and is made out of stainless steel (mostly). The float is a black plastic material. The original sensor was made from lead plated steel (mostly) with some brass, the float material is treated cork. The gasket was cork.

Figure 5 – new fuel sender

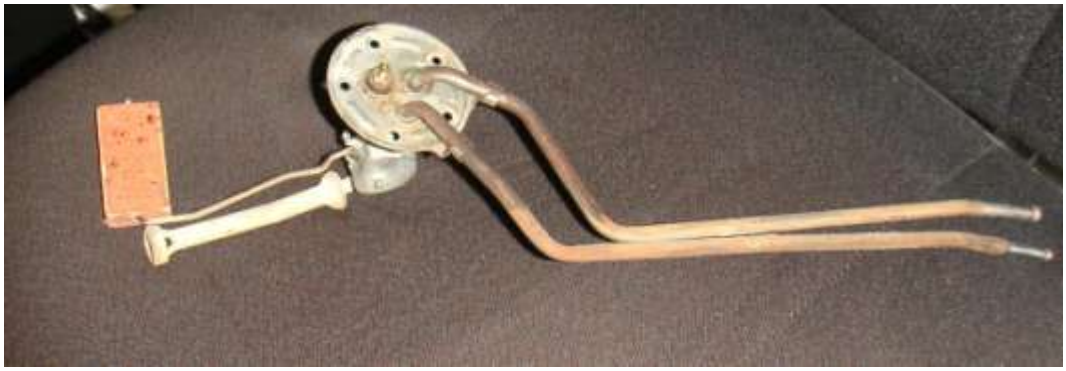

Figure 6 – original fuel sender

So, I wanted to figure out what went wrong with the old sender – the solder joint had not failed, so I got out my ohmmeter and connected one lead to the screw terminal and

one lead to the metal structure – I measured about 60 to 100 ohms no matter what position the float was in – that is not right, in the empty position the resistance should be an ohm or two. I didn't think of making a plot of resistance versus angle with the new unit until now, so sorry, you don't get that piece of information.

Clearly, something is wrong though if the resistance doesn't vary with the float angle, so I carefully pried back the tabs and looked inside the element that contains the resistance winding (that is the sort of rectangular thing next to the text callout in figure 1). Sadly, I didn't take a photo of what was inside, but what I found was some yellowish deposits (presumably from the old fuel vapors), a U shaped piece of brass spring material spot welded to the cross shaft to which the lever attaches, and on the end of the brass U a small contact (presumably phosphor bronze) that was swaged into place.

After quite a lot of messing around, I finally localized the problem to a lack of connection between the phosphor bronze contact and the brass U shaped object – the contact point would rub on the resistance element, but without connectivity to the brass wiper spring, there was no current flow. Once I figured this out, repair was simple – using a fine file, I cleaned up an area on the swaged part of the contact point (the part that doesn't contact the resistance wire) and I cleaned up some of the brass spring element near the contact point, and then using my soldering iron, I soldered the two areas together so that there was an electrical connection again. Now the original unit works fine. I believe what happened is that some kind of corrosion built up at the mechanical interface, and that the corrosion (or organic material deposits from the fuel) insulated the contact from the spring.

So, if you choose to repair your fuel sender, also remember to solder the contact to the spring so this doesn't happen to you.