

Y-Connector Replacement

By Bob Fuelleman

Here's a step-by-step history of how I found and fixed the broken part. The subject vehicle is a 1989 928S4. The repair was performed in July 1998, with this document following. The pictures were taken with an inexpensive Epson digital camera, with some supplemental lighting to improve the images.

Description

This is a diagnosis and repair description that focuses on replacement of a broken hose connector in the emissions control system of later Porsche 928 models. Neither the Owner's Manual nor the factory service manuals available from the Porsche factory and its licensees cover the procedures described here.

Disclaimers and Warnings

All risks of damage to the health and safety of the reader resulting from the use of this instruction are the sole responsibility of the reader. No representation of fitness or suitability of this instruction for any purpose other than reading enjoyment should be assumed by the reader. It is an account of a diagnostic process and repair procedure performed by the author on the author's personal vehicle. This document serves solely as a historical record documenting that process and procedure.

System Overview

The evaporative control system on the later 928 models includes a closed (non-vented) fuel tank, a sealed tank cap, a carbon canister, and a system of valves and hoses that attach the tank to the canister, and the canister to the intake system on the engine. In normal operation, fumes from the tank are captured in the activated charcoal in the carbon canister. When the engine is running, the hoses and valves carry the captured fumes to the engine's intake system, where they are mixed with incoming air and burned as part of the engine's normal fuel and air charge.

Diagnosis

The first sign of trouble was a faint odor of gasoline in the garage after the car was parked for an hour or two. After a while, the smell was more and more noticeable, so the search was on for the leak. Postings to the Porschelists, Porschefans, and Rennlist internet list servers suggested that the hoses and plumbing around the carbon canister might be the problem, so the search was directed there first. Inspection showed a broken "Y" fitting in the vapor line. The replacement was obtained from the local dealer. The following section details the replacement procedure I followed.

Tools required

1. 19mm (or 3/4") socket and bar for the wheel nuts. Your tire-changing wrench from the boot will suffice for this.
2. 10mm Deep socket and a suitable ratchet.
3. 8mm Socket and a suitable ratchet, with a 4" or so extension available.
4. Flat blade screwdriver for the hose clamps.
5. Large diagonal cutter for cutting hoses, or a razor knife.
6. Jack
7. Safety stand

Materials required

1. The "Y" fitting
2. Wire ties 12" long
3. Wire ties 6" long
4. 18" of 12.5mm braided vent hose (optional)

The braid-covered vent hose was used to replace a hardened section. This is the same hose used in Volkswagen and other cars for various vent duties, so it's off the shelf at my local imported car parts place. It's easily possible to reuse the original hose, by the way.

Procedure Overview

The carbon canister and its associated plumbing are located in the right front wheelhouse, above and behind the wheel. For access, the wheel and tire are removed, and the plastic wheelhouse liner is also removed. The canister and plumbing are easily accessible once the liner is removed.

Procedure

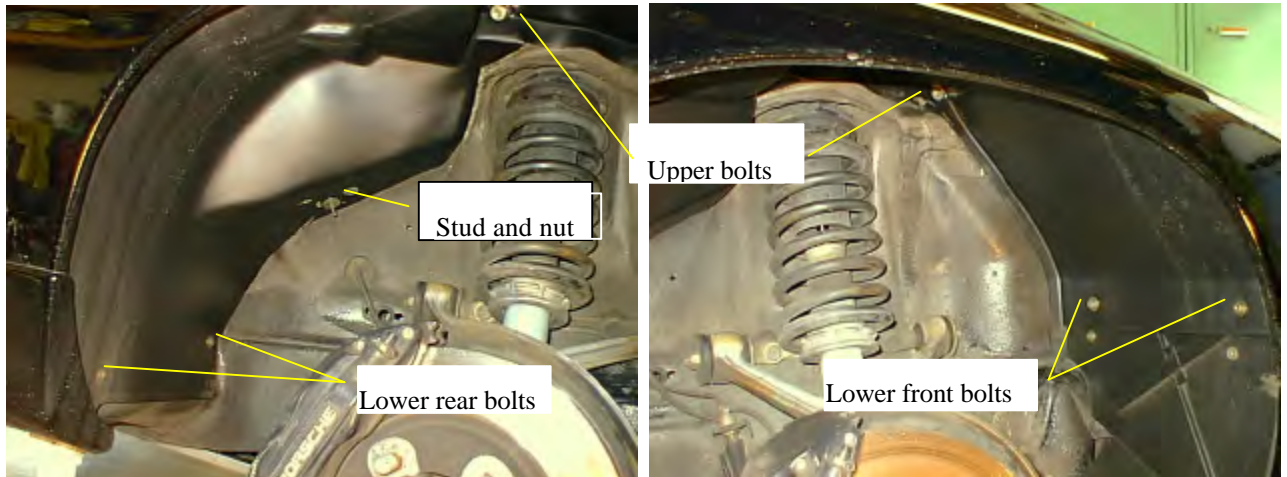
a) Remove the Wheel and Tire:

Safety dictates that the work is done with the car on safety stands rather than supported solely by the jack. The first step is to loosen the wheel nuts while the car is still on the ground. Just break them loose slightly. Lift the car with a jack under the right rear jack point, and lift until you can place a safety stand under the right front jack point. Lower the jack slightly so that the car is resting on the stand. Complete the removal of the wheel and tire.

Note the position of the lock and the valve in relation to the brake rotor. My car still has the original red mark on the end of the wheel stud, where the lock and valve should be lined up. If you don't have that mark, make one now so that the wheel and lock can be returned to the current position on the rotor.

b) Remove the Plastic Wheelhouse Liner:

A pair of self-tapping bolts at the rear bottom, another pair just above the spring seat at the top, and a pair of larger bolts at the front hold the black plastic liner in where the liner overlaps the front plastic panel in the wheelhouse. There is also a nut that threads onto a stud to the rear of the spring assembly. Remove all six screws and that nut, and carefully remove the liner.

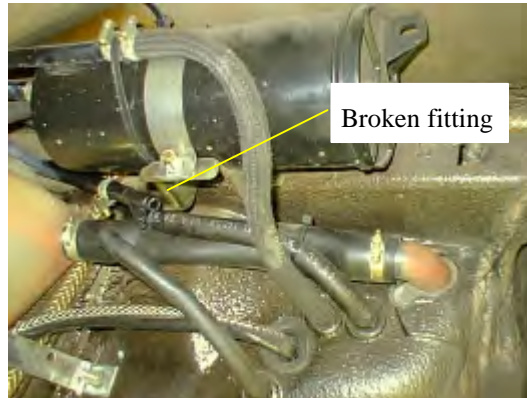


The easiest method for liner removal involves lifting the outside lip of the liner clear of the rolled fender lip, starting at the front corner. Reach in to the inner edge of the liner at the front bottom, and pull it slightly towards the rear of the car. At the same time, pull the lower outer front edge toward the rear slightly, and wedge a finger in between the edge of the liner and the fender lip. You'll then be able to work the edge of the liner free almost all the way to the rear lower corner. Once the edge is free as far back as you can get it with your finger, reach in and pull the liner down over the stud, and then slightly towards you so that it stays clear of the stud. Then roll the whole liner forward in the wheelhouse so the rear corners come clear of that large lower lip. Store the liner in a safe place while you proceed with the repair.

c) Remove the old fitting:

In the next picture, you can clearly see the broken “Y” fitting. The plastic hose from the carbon canister holds the remains of the old fitting, while the two forward hoses have the broken plastic stubs inside.

In this picture, you can see that the hose clamps have been removed from the front hoses, and the clamp on the rear hose has been loosened. The bolt that holds the carbon canister in the bracket has also been loosened, so that the canister can be moved forward to access the hose clamp on the other end of that rear hose. The plastic wire ties were later cut, freeing the hoses when the canister was moved.

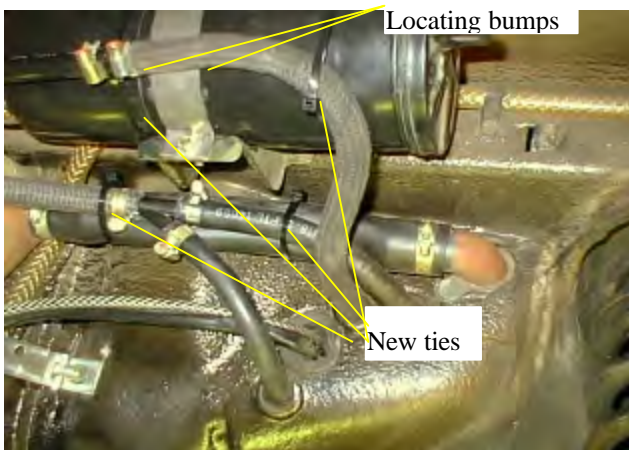


Slide the canister forward in the bracket far enough to loosen the clamp on the canister end of that rear plastic hose. As you can see in the picture, the fitting on the canister is not barbed, so the hose slides off easily with the clamp loose. Once the hose is clear of the canister, you can remove the plastic “Y” fitting from the front end. I grabbed it with a pair of pliers and pulled hard to get it out.

The broken stubs in the rubber hoses were a little tougher. I ended up cutting the hoses just behind the broken stubs, and making up the lost length with the replacement vent hose back to the canister. If you are going to use the old plastic canister hose, you'll need to extract the broken stubs from the hoses.



d) Install the New Fitting:



Assemble the hoses to the replacement “Y” fitting, using the original hose clamps. The routing for the replacement hose takes the strain off the new “Y” fitting. The hoses are tied to the plastic washer bottle hose.



e) Install the Carbon Canister:

Once the hose routing is finalized and tied, rotate the carbon canister in its mount so that it’s back in the original position. The unused plastic mounting tab at the front is vertical from the factory, at the top.

There are a couple plastic bumps molded into the canister to help locate it in the clamp. With those bumps in their correct positions, tighten that clamp bolt. Be aware also that the tension on the ties should only be enough to hold them. Don’t collapse either the vent hoses or the washer hose when you tighten those ties.

Note that the small vent hose from the windshield washer reservoir routes over the top of the canister. This hose is free at the forward end; so don’t bother looking for something to connect it to up there. I put a short tie on it where it passes the canister bracket to make sure it didn’t fall down in the way.

f) Replace the Wheelhouse Liner

Do one final visual check, and then replace the wheelhouse liner. The replacement technique is similar to removal, with some considerations. Those two upper bolts are slightly smaller in diameter and longer than the lower rear bolts. The upper bolts should go in first, but don’t tighten any bolts until all are started. Make sure the stud is sticking through the liner correctly before you start tightening, and save the nut on the stud for last. The edge of the liner can be rolled back into the edge of the fender with your fingers once the rear edge is set in the lower trim and the two top bolts are started. That leaves you maximum flexibility around the edges.

The torque required for the bolts is very small-- just enough to hold them in snugly. The speed nuts used in the mating panels are thin sheet metal, and can be damaged if you get aggressive with the wrench. The nut that threads on to that stud gets the same caution.

g) Replace the Wheel and Tire

Replace the wheel and tire to its original position. Your owner's manual suggests that the wheel should be installed with the tire valve adjacent to the painted stud, and the wheel lock should also go on that stud. Lightly lubricate the tapered face of each nut with moly paste or anti-seize before installing. With the nuts snugged up, lower the car so that the wheel is just in contact with the floor. Progressively torque the lug nuts to specification (94 ft/lbs), and install the lock and cover.

You are done.

Cost

As this is written, the total cost of the project is less than \$10. The "Y" fitting is about \$2 at the dealer, while that section of hose I added was \$4 at the local import parts store. I had the wire ties in stock at home, and they can be found at home centers or Radio Shack stores I'm sure. My total time was less than two hours, including the setups for the pictures and the unplanned trip to the parts store for the hose. If you have the pieces in front of you, the whole job should take less than an hour.

Safety

Shop safety is important when you work on your car. For this project, there are the safety stands and the jack to think about. The fuel liquid and vapor are highly flammable. Although there is minimal exposure to either, you need to be aware of the risk of fire. That means there is plenty of ventilation, and no nearby ignition sources. A fire extinguisher is nearby in case something happens.

I strongly recommend that you wear gloves for at least the plumbing work. I use vinyl plastic painters gloves from Home Depot to keep any stray fuel off my hands and skin. MTBE, toluene, and a host of other things go into modern fuel, and many of them have longer-term health effects if inhaled or absorbed through the skin. Gloves are cheap, and they keep your hands clean too.

Tools

Don't be afraid to invest in the tools you need. The most exotic tool used today was the torque wrench needed to properly install the wheel nuts. I have a good collection of tools acquired over the years, but I'm always on the lookout for more. I found the 1/2" click torque wrench at a discount tool store on sale for \$12 (www.harborfreight.com). If you ever plan on having the wheels off the car for anything, including flat repairs and stuff like that, the torque wrench is almost mandatory. Incorrectly torqued nuts risk the wheel coming off if they are too loose, or rotor warpage and/or stud weakening if they are too tight. There are horror stories of owners who have used hole saws to remove frozen lug nuts from damaged wheels, all because the tire store or previous owner didn't take the time to do it right.

I hope you enjoyed this trip through a common procedure. Many of the 928 tasks that demand our attention turn out to be relatively simple and inexpensive. This is certainly one of those.

Comments and suggestions on this document are welcome and appreciated. E-mail them to me at dr.bobf@worldnet.att.net.

I've tried to keep careful photo documentation of all the repairs and modifications done to my car. Many of us end up being victims of previous owners' or mechanics' negligence. I promise myself that I will never be that negligent "previous owner" to anyone who buys a car from me. To that end, this kind of photo documentation will perhaps be more valuable than a stack of repair receipts. Time and future owners will tell.

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