

Radiator Drain Valve Repair

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1976 Jaguar XJ-S

Background

The early XJ-S has a radiator drain valve that looks like one of the most solid components on the car. It is a solid brass “plug” style valve, about 5/8” diameter and 3” long. An extension rod connects to the stem and runs up the right side of the radiator so it can be operated from above. A 90-degree turn of the valve stem goes from fully open to fully closed. But despite its robust appearance, the valve has problems. For one thing, it sometimes leaks, and when you take it off to try to fix it you discover that the seal is no longer available. Also, when you open it to drain the radiator the water gushes out all over the front suspension, making it impossible to collect and reuse the coolant. I have recently addressed these issues on my car and provide solutions here. The matter is also discussed at length in Kirby Palm’s book.

The upshot is that I wound up replacing the Jaguar valve with a generic radiator drain cock and an adapter from McMaster-Carr Hardware.

Is it Leaking?

To see if your valve is leaking, put the car on jackstands or ramps after it’s been running, so the cooling system is pressurized. Then get under the car and look up under the radiator on the right side. It’s easier if the spoiler undertray is removed, but you will be able to see the valve. If it’s leaking there will be drips of coolant coming not necessarily from the outlet, but from the bottom of the valve plug.

Removal

Although you might be able to get at the valve with the spoiler undertray in place, removal will make working on the valve much easier.

To remove the valve, first detach the extension rod. It is fastened to the valve with a cotter pin. A long needle-nosed pliers makes this easy, working from below. The valve can then be unscrewed from the radiator. It is a 1/4” British Standard Parallel Pipe (BSPP) fitting requiring a strange wrench size. However, a 16-mm wrench will work nicely. Be sure to recover the seal. Although you will want to replace it, seeing the thing will help you improvise a replacement for this no longer available part (see below).

Valve Construction and Operation

A photo of the valve is shown assembled in Figure 1. The plastic fitting and hose is not part of the valve. I added it to allow easier recovery when draining, as discussed below.

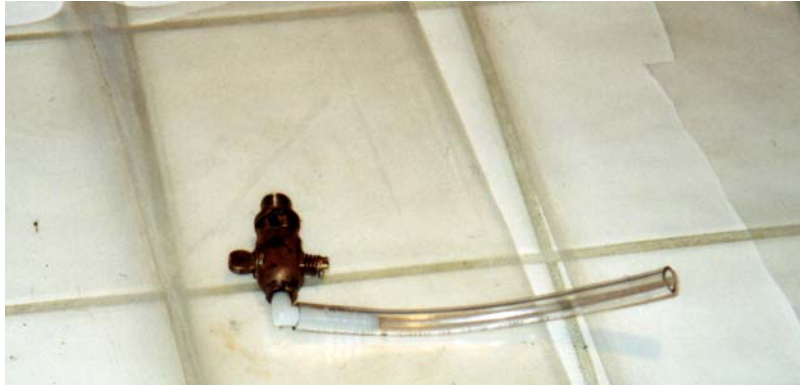


Figure 1. Drain Valve with outlet hose added.

Figure 2 shows it disassembled.

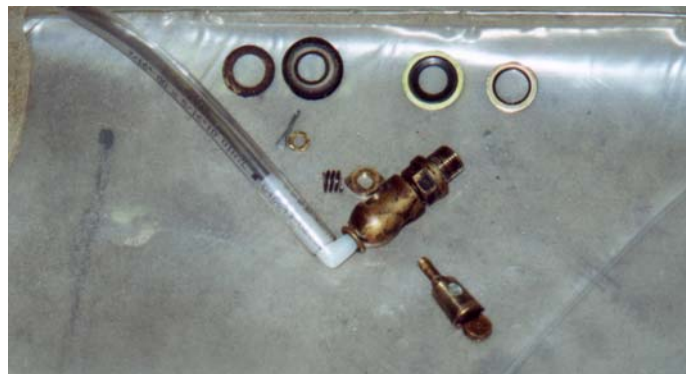


Figure 2. Drain valve disassembled.

As Kirby points out, the valve is solid brass, with no soft seals. There is a tapered plug, lower right, fitting into a hole through the midsection of the valve. This plug is held in place by a spring, washer, and cotter pin on the end of the plug that sticks out the opposite side. Under the spring there is a flat, diamond shaped, brass part that fits into a flat machined into the side of the valve body. This acts to limit the angular motion of the plug to 90 degrees. There is a hole through the center of the plug. The tapered plug is designed to mate perfectly with tapered hole in the valve body.

When the valve is in the open position, the hole in the plug is aligned with the main passageway through the valve body. When the plug is turned 90 degrees, the plug seals flow through the passageway.

The purpose of the spring is to keep the plug pulled tightly into its mating hole. It has to be strong enough to withstand the coolant pressure that tends to push the plug out.

What Goes Wrong

When the valve leaks it is probably because of one or two reasons. First, if the spring has weakened over time, the coolant pressure may lift the plug, allowing coolant to leak between the plug and valve body. Second, if particles of scale or dirt have gotten lodged between the plug and body, that too will keep the plug to not seat properly. Finally, it may be that either the plug or body has worn a bit.

Refurbishing the Valve

The unfortunate truth is that you probably won't be able to make it stop leaking because, most likely, it is due to wear between the plug and body. I worked diligently on the problem, first trying stronger springs, then lapping the seat and plug. In the end, it leaked more than before. So, my advice is to replace it.

If you want to give it a try, you can disassemble the valve. Clamp it gently in a vice with the spring upward. Study the valve a bit at this point, noting in particular the orientation of the plug (i.e., open or closed) and the diamond shaped motion limiter. Getting these back the same way will ensure that the valve operates the same way it did originally in terms of open and closed positions.

Using a pliers, push on the washer to take the spring pressure off of the cotter pin. Then remove the cotter pin. Be careful as you release the spring so it and the washer don't fly off somewhere. A gentle tap will then cause the plug to fall out. Recover the diamond shaped motion limiter that fits under the spring.

Seal

As noted earlier, the valve has a 1/4" BSPP fitting where it screws into the radiator. The problem with this design, as Kirby points out, is it not only has to seal water-tight, but also tighten so as to wind up with the tongue on the plug pointing straight up; otherwise, you could not attach the extension rod. The original seal (at least the one on my car when I took it out) is two parts. The first is a rubber washer with a fiber washer bonded to each side. The second is a separate fiber washer. These two parts are the left-most washers in Figure 2.

Interestingly, the bonded seal is not even listed in the Jaguar parts book. Greg Wells of Coventry West (CW) speculates that it may be part of the valve. I suspect he is right since I was unable to find anything close after extensive search. According to Greg, the fiber washers are listed, in two sizes:

C24288/1 1/32-inch thick

C24288/2 1/16-inch thick

with the notation to use these washers "As required." Apparently, as Greg (and Kirby) state, you are to stack the washers until you get the valve handle in the correct vertical position. The good news is that CW has stock in both numbers.

Since the bonded washer is not available, if you want to replace it you are going to have to improvise. As you do so, keep in mind that the purpose of the rubber in the bonded washer is there to give some compressibility, so you can continue to tighten the valve a bit for alignment after it first mates with the radiator boss. Another thing to keep in mind is the total thickness of fiber and rubber has to be at about the same as the original combination (0.0165" in by my measurement), and certainly not any less. The reason for this is that otherwise the valve bottoms out when threaded into the radiator and will not tighten on the seal.

Kirby suggest that oil pan drain plug seals may work (second from right in Figure 2). I tried this and must recommend against. First, they are too thin, so you will have to use some combination of these and fiber washers. But the real problem is that although the ID of the bonded rubber part fits snugly over the 1/4" BSPP (1/2"), the metal part has a

somewhat larger ID. This plus the thread undercut on the valve means the seal can, and does, slip off center as you tighten it in the radiator. I installed my valve with two of these plus the original fiber washer. I could see that each seal slipped off center in different directions, so I took it off. The rubber on the seals was pretty well mangled, so I abandoned the idea.

Another thought was to try a currently available BSPP seals. Parker-Hannifin recommended one, D9DT4, seen on the right in Figure 2. It is a metal (steel?) washer with thin rubber rings bonded to each side. Although the total thickness was about right, the rubber is too thin to give much compressibility. While it would work in combination with precisely the right thickness of fiber washers, I decided against it on cost grounds. Although I had already bought the seal (\$1.46 as I recall), the only source of fiber washers in a good range of thicknesses I could find was McMaster-Carr. Since they sell in quantity I would have wound up paying \$12 plus shipping, and would have had 196 or so extra washers.

But, after spending a week or so searching and worrying about the seal, the final answer turned out to be easy. I got a 1/16" thick, 7/16" ID, 1" OD rubber washer from the hardware store several of the Jaguar washers in each size from CW. I sandwiched the rubber between two of the 1/32" fiber washers and used an additional 1/16" one to bring the total thickness up to 0.187". This resulted having to turn the valve about 3/4 turn after snugging, perhaps squeezing the rubber a bit more than I would have liked. However, using 1/32" in place of the 1/16" one did not seem tight enough.

Coolant Recovery when Draining

As mentioned earlier, the drain valve normally directs the leaving coolant over the front suspension, making it not only hard to keep off the garage floor, but rendering dirty and useless any that you do manage to collect. Kirby makes several suggestions to improve this, including soldering a copper extension to the valve. This seemed like too much trouble to me. Instead, I used a 5/16" plastic hose barb elbow and a short length of vinyl hose, as seen in Figure 1 and 2. I cut off all but the last barb on one of the legs and pressed it into the valve outlet; it fits easily but tightly. It also is easily twisted, so you can leave it in place and rotate it up out of the way when not in use. Or, you can just keep it in the toolbox and insert it when you need to drain the radiator. Works perfectly. The only difficulty is in finding the fitting, since 5/16" sizes are not usually stocked by hardware stores. Try an industrial hardware store, or McMaster-Carr online.

Alternative Drain Valves

Here are some alternatives if you can't fix the old valve, or don't want to bother. Credits are given as appropriate.

Hose and Plug

This is (approximately) what Kirby did on his car. Get a 1/4" BSPP (male) to 1/4" NPT (female) adapter (McMaster-Carr 4092K42 looks good, \$7.92). Use a BSPP seal, perhaps Parker-Hannifin D9DT4, since we are no longer concerned with the angular position when tightened. To this, somehow attach a hose, and plug the free end of the hose. To attach the hose, consider an A4-4GFBN (glass filled black nylon) threaded adapter from

Eldon James. (They sent a couple to me as samples!). This will get you to 1/4" hose. A 1/4" brass bolt (threaded section cut off) jammed into the end and clamped will plug the free end. To drain the radiator, crimp the hose with vice grips, remove the plug, stick hose in a jug or tube and remove the vice grips.

My Solution--- Convert to Generic Radiator Drain Cock

As with the Hose and Plug solution, get a 1/4" BSPP (male) to 1/4" NPT (female) adapter (McMaster-Carr 4092K42 looks good, \$7.92). Use a BSPP seal, perhaps Parker-Hannifin D9DT4. Into this screw a generic radiator drain cock. Although McMaster-Carr has a drain cock (4921K2, \$2.78), it will not allow attachment of a hose for sanitary coolant collection. I got one made by Edelman from a Parts Plus Auto retail store (about \$7.00) that I like better because it has a 90-degree, 3/8" hose nipple.

Tee in Lower Radiator Hose

This was Ray Schmidt's solution when he installed a radiator with no drain port. "To replace it I perused the plumbing shelves at the hardware store and found a copper T with exactly the right diameter to match the lower hose (~1.75" OD I think). The T section is for 1/2" pipe. I soldered a short section of pipe to an internally threaded bit which accepts a standard plug. (1/4" NPT ?). Add a couple of hose clamps, cut the hose in the lowest, straightest section and install and you are in business."

Use the New Jaguar Part

If you order a new one from Jaguar you will probably get not the original valve but a replacement, for \$50-\$60 depending on where you buy it. Although the part number on the bag is the same as listed in the parts book, the valve was not suitable for my car. It is different in several ways. In fact, the only similarity is that it is a 1/4" BSNB thread, about the same length.

The important differences are:

1. The diameter of the bore is 3/16", whereas the original is 5/16". A longer drain time, but would work. Also, with the original you can jamb a 5/16" plastic hose barb fitting into outlet to allow coolant recovery (as opposed to washing down the front suspension and splashing on the floor). With the 3/16" bore, it appears impossible to attach a hose.
2. There is a handle instead of the tongue on the stem. Consequently, the extension for above-car operation of the valve can not be attached. This is very bad since you have to get under the car to operate it, and there appears to be no way to avoid being drenched when you open it! Could be used, but I wouldn't want to. Might as well just slash the lower hose!
3. Due to the height and length of the handle, it cannot be installed in the radiator while it is in the car. No matter which way I set the handle, it bumped into something, e.g., the front sub frame or the oil cooler line. This is the deal killer. It might work if it was screwed in before dropping the radiator into the car, but who wants to take the radiator out to install the valve?

I took this valve to a machine shop to see if it could be modified. The verdict is yes. It would take a good machinist about an hour or so to cut off the handle and mill a tongue

onto the stem. It can be done without taking the stem out of the valve body, which is probably a good idea. Since it too is a metal-to-metal seal, you might cause it to leak. Paranoia? Perhaps. You could also (carefully) drill the outlet to $\frac{1}{4}$ " or perhaps $\frac{5}{16}$ " to accept a hose barb as in the original valve. All of this might cost you \$60-\$70 plus the valve. Is it worth it? Probably not to most people. Operating the valve from below is not that bad if you can attach a hose so as not to get drenched.