

Revamping the XJS V12 cooling system

In the XJS HE, the cooling system of Jaguar's V12 has a number of problems to overcome, partly because Jaguar styling gurus insisted the elegant bonnet must be extremely low. By contrast, modern Jaguar sports cars tower over the XJS. The Lyons era Jaguar's styling, while aerodynamically led, was a sacrosanct area. It was the Jaguar engineer's job to make the car work given the styling, rather than the reverse. This illustrates a Great Truth that for some unknown reason car manufacturers periodically forget: *Nobody will buy a car that looks dreadful, no matter how well it performs.*

The low bonnet line of the XJS certainly gave the engineers something to chew on to make the cooling system work. Also it must be said, to get the V12 and all the hardware involved with it under the bonnet at all! The heart of the problem, besides the sheer lack of room, is that the radiator top is only fractionally higher than the engine hot coolant exit, while the coolant pressurised expansion tank is considerably lower than both. Therefore the natural "syphonage" of hot coolant as it circulates through the engine to the radiator is reduced and air bubbles cannot find their way naturally to the expansion tank. Fig 1 shows the basic levels concerned. Another problem was how to fill the cooling system in the first place, the solution requiring a special extra feature - the crosspipe fill spout.

FIG 1: XJS V12 HE cooling system component levels

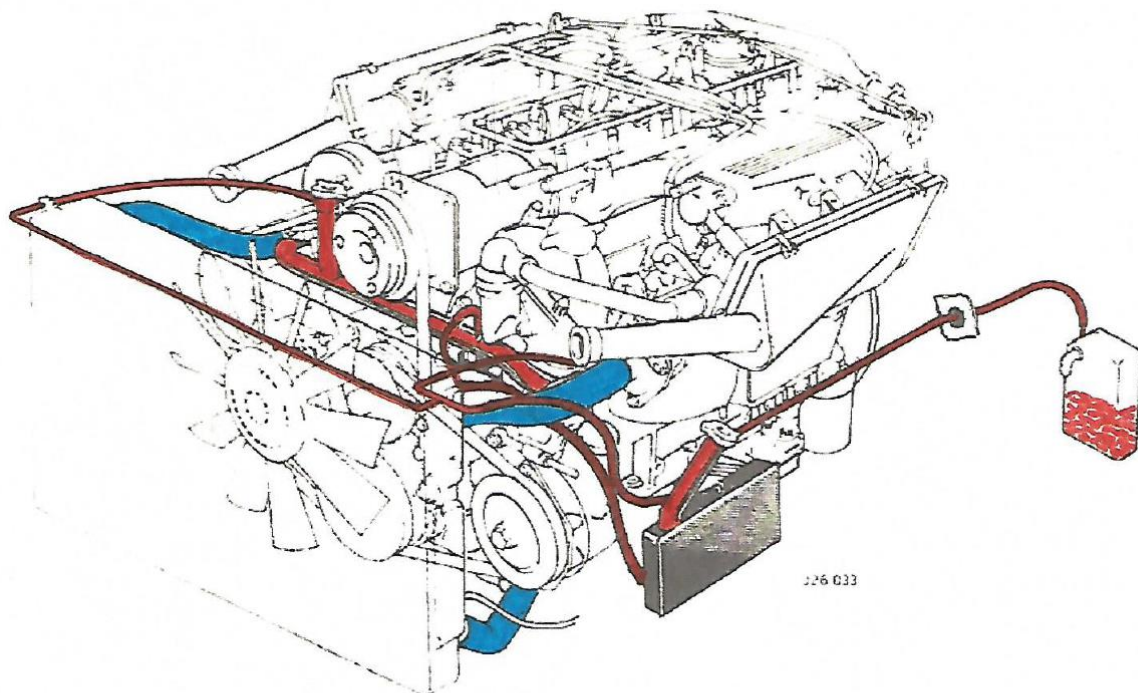


Fig. 1

To overcome these difficulties (and the system certainly works, even if almost all XJS V12 owners have no idea of how!) Jaguar's engineers installed the following extra bits in the XJS HE:

1. An external radiator top air bleed system, which

2. Is powered by a special water-jet venturi system to evacuate trapped air bubbles, plumbed directly off the B bank thermostat casting, and
3. A high level fill spout that had to be connected to the bleed system and to the two banks of the V via a coolant crosspipe connected to the water pump, all of which together with the venturi system return
4. Had to be connected to the pressurised expansion tank which itself
5. Had to have a large bore engine coolant return pipe connected to the water pump via a spigot on the crosspipe to ensure the pressurised header tank did not fill up and block the venturi system
6. The pressurised tank also has a standard cap with an overflow/return valve that
7. Overflowed into a hidden atmospheric catch tank in the cavity behind the front offside wheelarch stone baffle, to ensure the pressurised expansion tank, the engine cooling passages, and radiator were always full of coolant,
8. All of which necessitated two pressure caps, a large number of small bore flexible pipes, banjo bleed fittings and jubilee clips, to connect the components together in a leak-proof manner.

In practice ends up looking like this under the bonnet, Fig 2 is a shot from a friend's wonderfully kept original car – not something I can aspire to!

Fig 2 The OEM system

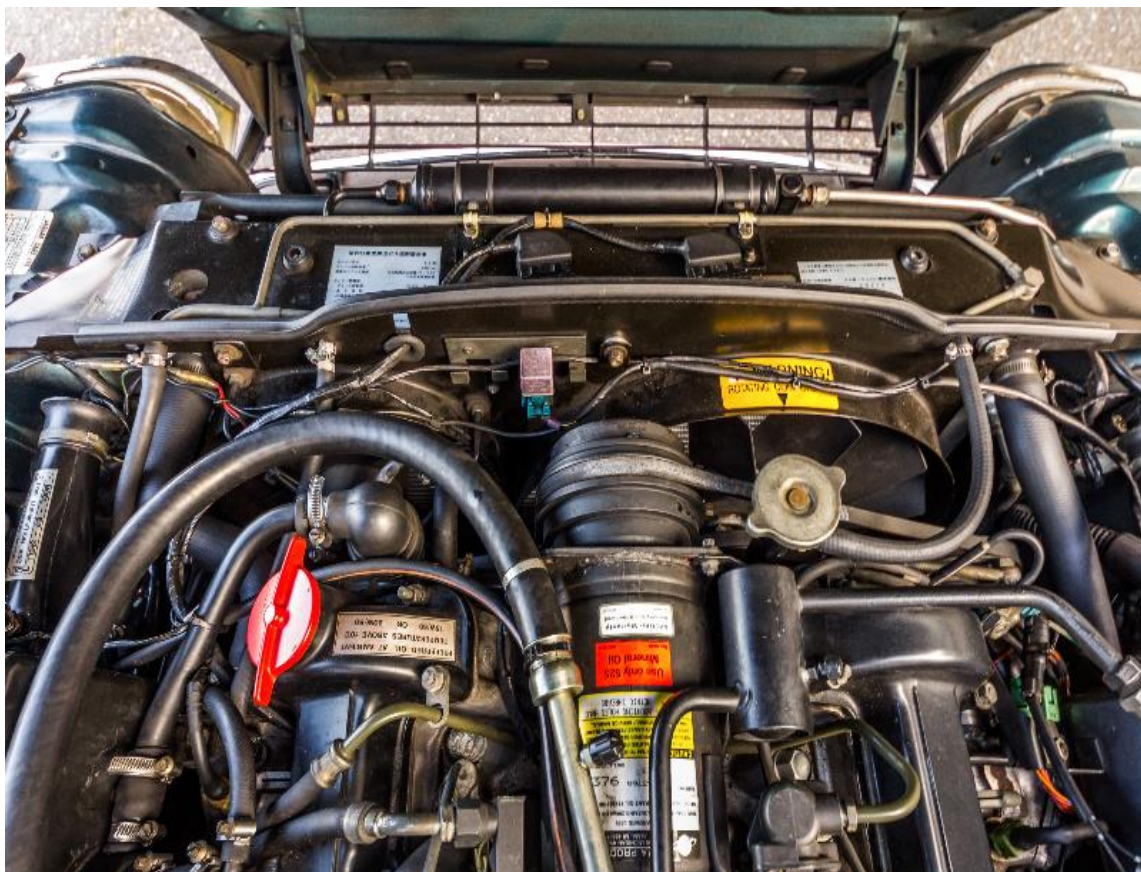


Fig 3: XJS V12 HE Jaguar's own cooling system diagram from the workshop manual

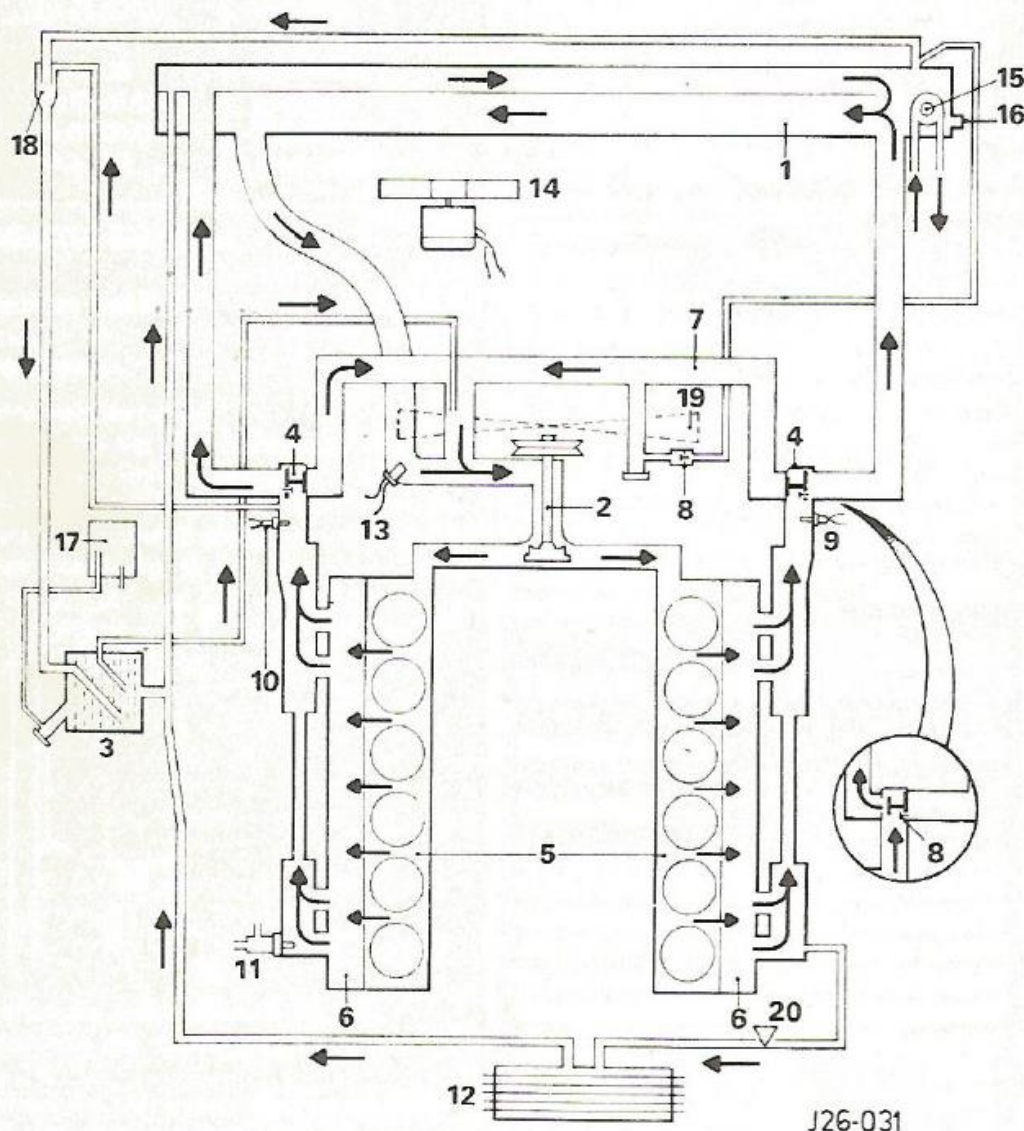


Fig. 2

Key to 12 Cylinder HE cooling system

- | | |
|-------------------------------|---|
| 1 Radiator matrix | 11 Auxiliary air valve |
| 2 Water pump | 12 Heater matrix |
| 3 Remote header tank | 13 Thermostatic fan switch |
| 4 Thermostat | 14 Radiator electric cooling fan |
| 5 Cylinder block | 15 Automatic transmission fluid cooling tube coil |
| 6 Cylinder head | 16 Radiator drain tap |
| 7 Engine crosspipe | 17 Atmospheric catch tank |
| 8 Jiggle pins | 18 Venting jet |
| 9 Thermostime switch | 19 Engine driven fan |
| 10 Coolant temperature sensor | 20 Heater water control valve |

As anyone over 50 who did 'O' Level physics should remember, if a pressurised fluid (whether gas or liquid) suddenly decompresses, a low pressure area is created at the point of decompression. This is the basic reason why the "ground effect" GP cars of the late 1970s, as pioneered by Lotus, hugged the ground and why aircraft fly. The air bleed system on the XJS makes use of this phenomenon. Fig 4 is a photo of the radiator top bleed pipe. As is obvious, the long section feeds into a fatter two pronged section, and within this is the venturi, which is shown in diagrammatic form in Fig 5.

FIG 4: XJS V12 HE radiator top bleed pipe

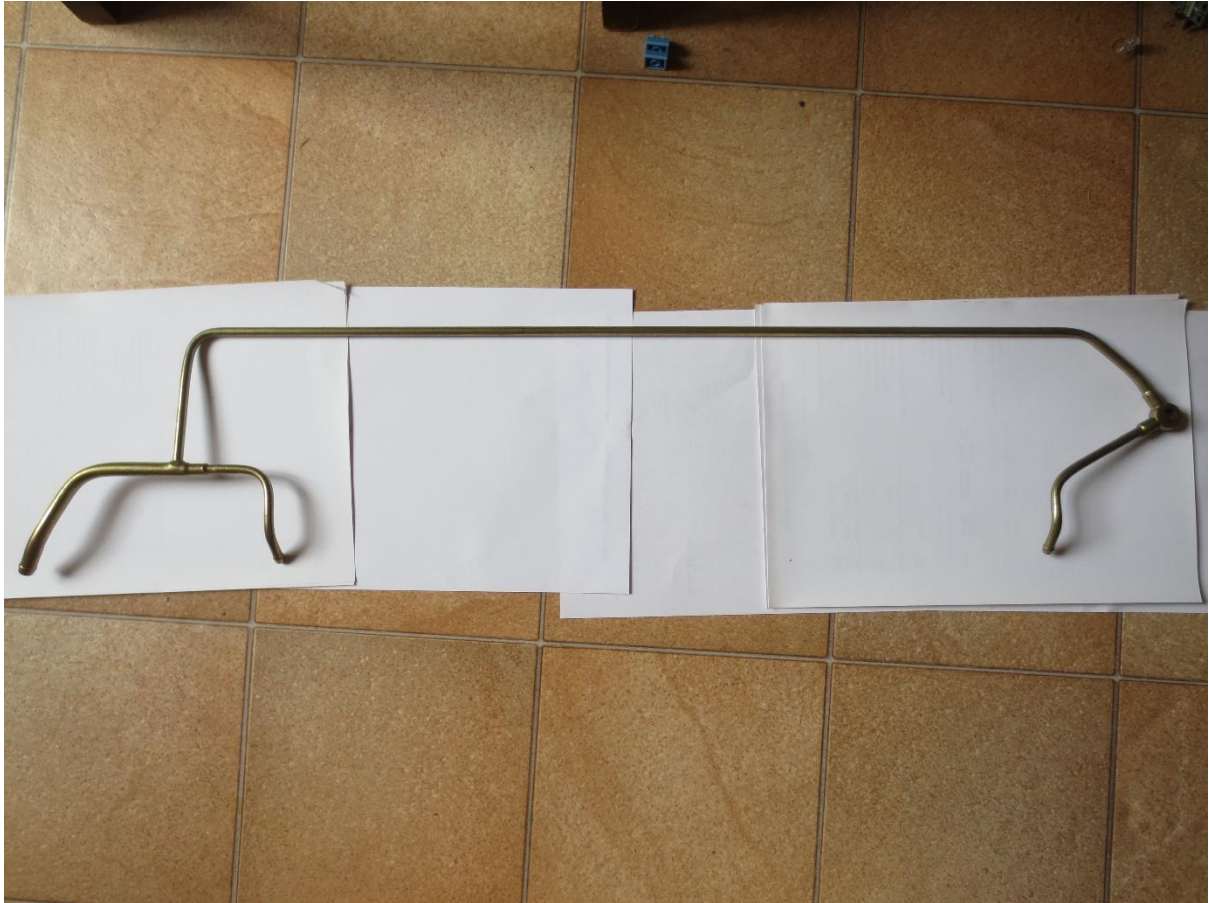
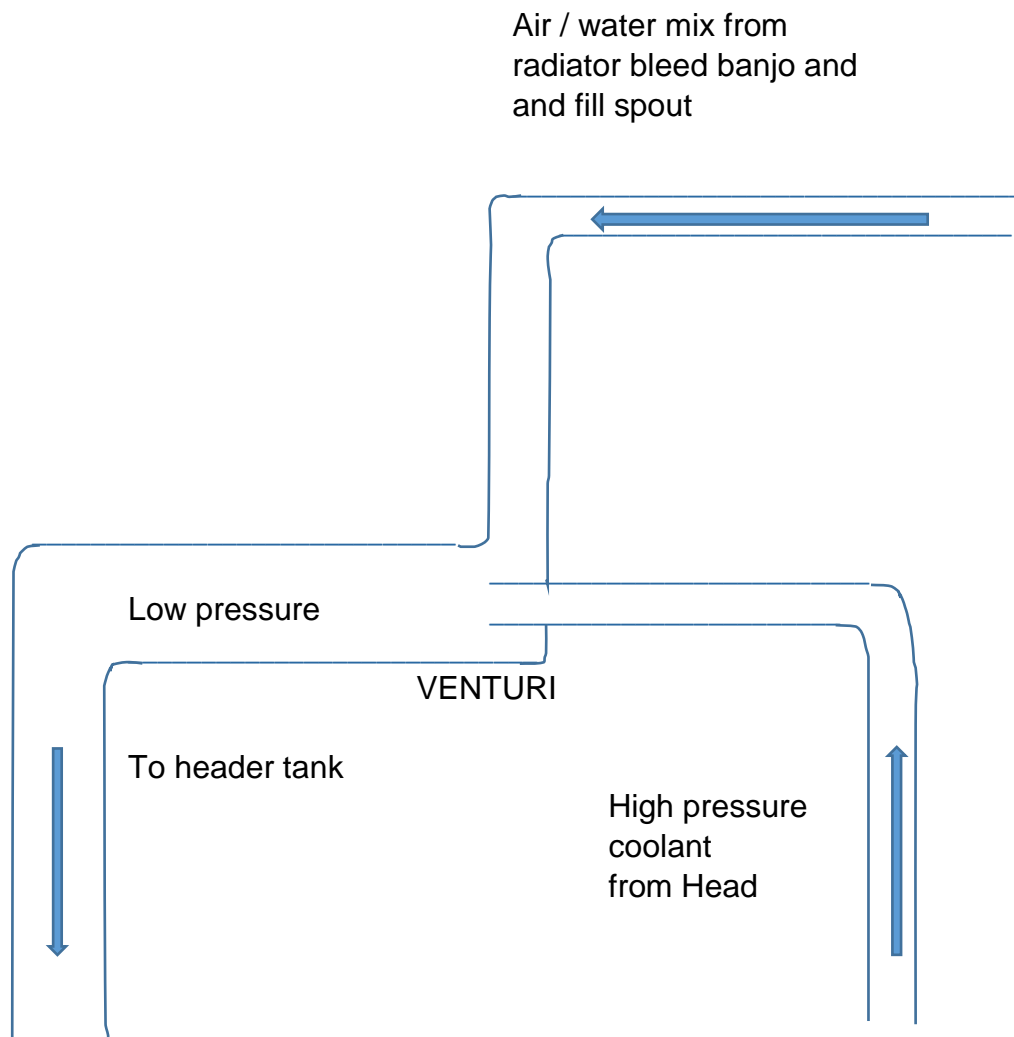


FIG 5: XJS V12 HE bleed pipe venturi diagram

Fig. 5



My car is 33 years old, and cooling system spare parts with the exception of the radiator and water pump, are NLA. So a rusty expansion tank, a rusty crosspipe, and a rusty or a perforated bleed pipe all present a repair problem, and I had two of these three. Necessity being the mother of..., I got thinking how the underlying cause of all this complexity might be addressed. First was the difficulty of finding a place for an expansion tank in the engine bay at a point *higher* than the radiator. Luckily my car, being a pre ABS model, does not have a bulky ABS pump and associated bits by the passenger side bulkhead. Instead, it has is a HUGE windscreen/headlight washer bottle that must hold more than a gallon, as shown in Fig 6.

FIG 6: XJS HE huge Border Collie-sized OEM washer bottle



On later XJS cars with ABS, Jaguar relocated the washer bottle into a wing cavity behind a wheelarch baffle, so I did the same. In fact fitting this component with a decent bracket and associated fill and breather tubes was the most difficult part of the job. Moving the washer bottle made room for an expansion tank by the bulkhead sited a few inches *higher* than the radiator. An aluminium expansion tank with a spigot for the engine feed, one for the bleed feed and one for an atmospheric overflow was easily sourced. England is just wonderful for obtaining specialised bits and I cannot recommend too highly Unit 7 Creations of March, Cambs, see FIG 7.

FIG 7 New expansion tank by the bulkhead



New crosspipes *with* a spout are also NLA; however new *spoutless* ones (as used on V12 versions of the XJ40 and X300 XJ saloons) appear on Ebay now and then, so I bought one. At this point I had in stock, waiting for that karmic moment my subconscious would say "begin": an aftermarket expansion tank that would be mounted in a position higher than both the engine and radiator, and a new Jaguar spoutless crosspipe. The last piece of the puzzle was to find a rightangle BSPP threaded fitting that would screw into the OEM radiator top bleed hole, with a barbed hosetail on the other end, *with a very low overall profile* because the clearance available between the radiator top and the bonnet is less than half an inch. Many hours of googling and several abortive purchases later, I lucked into one. All that remained was to see if it worked. The entire new system was lashed up with flexible tubes from Viper Performance Hoses to see what happened on test. At this test stage I kept the spouted crosspipe as replacing it is a royal pain which could wait until the system was proved or otherwise. Once the expansion tank is higher than the radiator, a separate fill point and the need to bleed it is redundant. If all were to go well, the full stainless steel small-bore-piped extravaganza would be productionised to give that sought after "enthusiastic-amateur-doing-his-absolute-best" under-bonnet look. Fig 8 shows the test rig.

FIG 8: Coolant bleed test rig



An extensive test run proved the modified system worked perfectly, for some reason the engine was quieter too, and because so many jubilee clipped joints, flexibles and banjo fittings had disappeared, any slight coolant-loss went with them. In the jury-rigged test shown in Fig 8 the original spouted crosspipe is still in place and the spout can be seen just north of the compressor pulley. For the test, the bleed from the spout was connected to the radiator bleed. Once the spoutless crosspipe was fitted, the need for this goes. The radiator-top bleed pipe has already gone and the pressure cap of the disconnected OEM expansion tank can just be seen by the Y join in the red flexibles. If the system was proved this tank would be removed and replaced with a fabricated atmospheric catch tank. On an extended road test air bled perfectly out of the system up the slight incline from the radiator top to the expansion tank. Result!

Now to make it all look halfway decent. The spouted crosspipe was removed greatly cleaning up the engine bay, a couple of metres of 6mm malleable stainless small-bore pipe to connect the radiator top to the header tank was purchased and painstakingly fitted along the inner wing with stainless P clips. The main feed to the engine from the header tank by the bulkhead to the engine coolant system was tee'd into the heater return pipe which runs handily by the new expansion tank. This is the dark blue pipe that can just be seen in Fig 7 between the two red ones. In fact, this type of heater return/header tank connection was how Jaguar originally plumbed the system on early versions of the XJS V12.

Finally Unit 7 creations made a superb ally atmospheric catch tank, all powder coated in red with a satisfyingly solid knurled screw cap, to capture coolant expansion from the header tank. This fitted in the space previously occupied by the OEM header tank. The entire modification gives a cooling system that is simpler, better, cleaner, far more understandable and serviceable; which is in

principle identical to Jaguar's own installation in their 1990 era XJ V12 saloons, where height and space are less restricted. The final job is shown in Fig 9.

FIG 9: finally done:



I calculate that four hoses, one pressure cap, four pieces of hardware and countless copper washers and Jubilee clipped hose joins have been eliminated. Within the limits of V12 plumbing complexity, it is apparent that there are significantly fewer bits in this area of the engine bay. In fact, almost everything coloured red in Fig 1 has gone, and is replaced by one pipe and one header tank sited above the level of the engine. The system is more easily understood, far more easily filled, more accessible, bleeds the coolant better, and is more reliable as a result. It also has a significant Jaguar XJS V12 HE nerd discussion benefit. The burning topic is: "Which way round should the one-way valve between the fill spout bleed spigot and the radiator top banjo bleed pipe be: (a) Preventing air escaping from the spout or (b) Allowing air to escape"? This most vexing conundrum has been abolished along with the fill spout!

My thanks to: Unit 7 Creations, Viper Performance Hoses, Orangeblossom, The WoOz, Lortec Precision Engineering, and many others on the XJS section of www.jaguarforums.com for their encouragement and help.