

# Retrofit of an HE Fan to the pre HE XJ-S V-12

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*1976 Jaguar XJ-S*

## **Background**

When my temperature gauge was still reading a little high after recoring the radiator I began to get suspicious of my clutch, even though it was only 7 years old and had only about 15,000 miles of service. Rather than replacing it I decided to convert to the fan used in the later HE engines.

The preHE mechanical fan is quite different from the one fitted to later HE models. For one thing, the fan is steel rather than plastic, and the blades are narrower. Also, the preHE clutch has no thermostatic control such as used on the HE. All of this suggests that the later setup should offer better cooling. Also, the parts are readily available since many owners have converted to dual electric fans.

Figure 1 shows the HE and preHE fans with clutches, viewed from the front. Figure 2 shows the two clutches. Note that the HE clutch has a flange at the rear with four slots for studs that attach it to the fan pulley. The preHE clutch is sometimes called “the single bolt” clutch since it attaches to the fan shaft with a single central bolt. In Figure 3 you can see the thermostatic element that allows the clutch to run the fan at higher speeds when the air is hot.

## **Why Not Electric?**

Some will feel that I should have “gone electric” rather than bothering with this upgrade. After all, the reason I was able to find the parts so easily is that people are yanking these fans off the HEs all the time and installing dual electrics. An explanation is in order, although I have no illusions about convincing someone who has already made up their own mind on the issue.

Perhaps the main reason I’ve stayed with a mechanical fan is that I’ve owned this car a long time and know it cools just fine with the OE setup. Added to that is having read of several cases where XJ-S owners have removed their electric fans and gone back to the OE setup, saying that the latter seems to perform better. Finally, a really good electric fan setup can cost up to \$600. Moreover, people who go this route most often have to also install a new, higher amperage alternator. My judgment is the labor is about the same to do the retrofit I did as if I went electric, but the cost of parts for my project was about 1/3rd.



**Figure 1 HE (left) vs. preHE fans and clutches**



**Figure 2 HE vs. preHE clutches**



**Figure 3 Thermostatic element on HE clutch.**

### ***Parts You will Need***

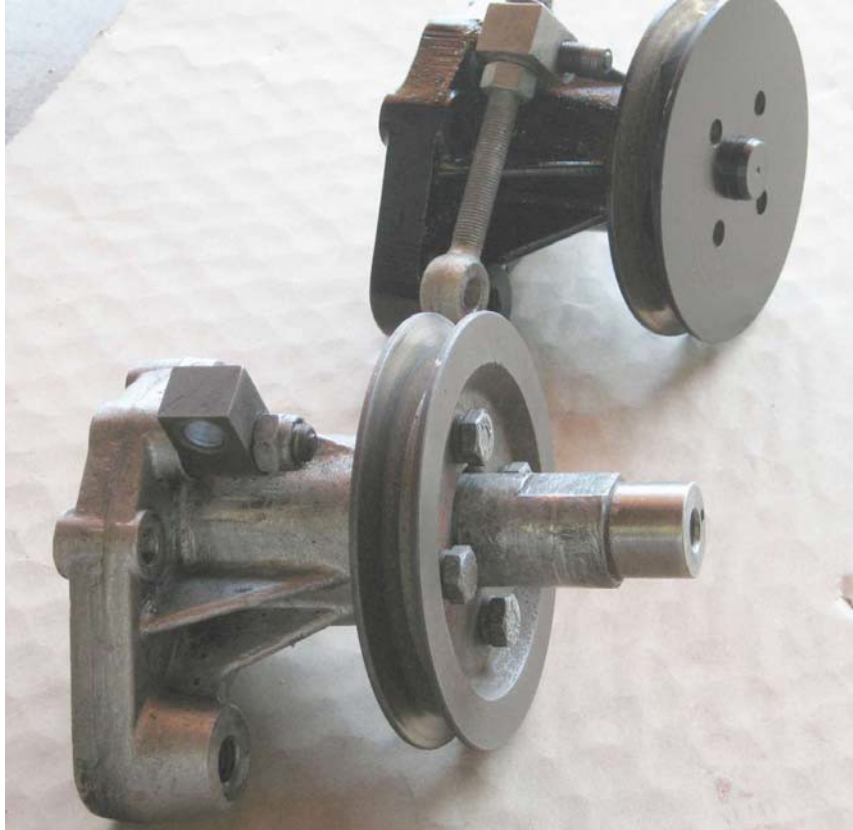
You will need to replace everything from the fan back to the engine. I placed an ad at [www.Jagads.com](http://www.Jagads.com) and got several responses from people offering the entire setup. The needed parts include:

- **Fan.** Be sure to get the newer black plastic fan, at the left in Figure 1, because the older yellow/white ones are known to have cracking problems. There have been several reports of these fans disintegrating, taking out the radiator and doing other damage. There are aftermarket black plastic fans as well as Jaguar parts but it is not clear that they are equivalent. Mine was the Jaguar part, imprinted on the fan, part number EBC4553. Although I bought a used one from a person who installed electrics, a Google search on this part number gets a lot of hits. I had little trouble finding ones claiming to be the Jaguar part for about \$90-100. See Figure 1, left.
- **Clutch.** As with the fan, clutches can be either Jaguar or aftermarket. If aftermarket, be sure to get one that fits the black fan. I got one from NAPA, part number TEM 274328, for \$58. This is not a stocked item at most NAPA stores so you will have to order and pay in advance, and I was told it is non-returnable. This clutch fits the Jaguar black fan perfectly. If you are not getting this exact combination I recommend getting the fan and the clutch from the same source and a guarantee that they fit together. See Figure 2, left.

- **Mount/Bearing housing Assembly.** Although the parts book shows the parts separately I highly recommend getting this as an assembly from someone who has gone electric. It will be cheaper, and you won't have to press the bearing and pulley into place. The assembly includes the bearing housing which bolts to the engine (over the water pump) (EAC3038), the bearing (EAC3437), and the pulley (EAC3438). See Figure 4, right.
- **Fan pulley studs.** The mount/bearing housing assembly has the pulley pressed onto the shaft. The pulley has four holds for studs that the clutch is attached to. The used assembly I got had no studs so I bought them from Jaguar, part number C36546. Although pricy (about \$5 each) I highly recommend getting the Jaguar parts since the ones sold in auto parts stores for (about \$5 for the set) are different in length, and space is precious when bolting the clutch on. The stud is shown in Figure 5.
- **Pulley stud nuts and washers.** The studs are 5/16-24 on both ends, so you will need 4 5/26-24 standard nuts. The spec sheet that comes with the NAPA clutch says these should be minimum grade 5, zinc or cad plated. I used the standard nuts from a trusted industrial hardware store that I believe are grade 5. I also used internally serrated lock washers since I'm told that's what was used at the factory. Also, these are thinner than split locks, and that is an advantage in this tight space. Get 6 or 8 of them just in case you drop some.

By the way, I tried the flanged lock nuts because they are a bit easier to get on than a standard nut plus lock washer. However, I did not like the way they interacted with the slotted clutch mounting flange. The ridged face of the flange sort of bumps over the slot edges and binds, giving an uneven tightening process, so to speak. In other words, I could not tell if they were really tight or just trying to get past a ridge on the flange. Then when I backed one off I found that after only a tiny turn the nut spun freely! I took them off and threw them in my collection.

- **Fan Bolts and washers.** The fan bolts to the aftermarket clutch with 5/16" NC by 1/2" bolts. You will need four. I used the washers that came with my used fan and clutch which happened to be the Jaguar washers with spiral serrations on the faces. Any kind of lock washer could be used here though, as space is not a problem.



**Figure 4 PreHE (left) and HE bearing housings.**



**Figure 5 Fan pulley stud (please excuse photo quality)**



## ***Parts Not Needed***

You will not need the fan shroud (cowl) from the HE. In fact, the HE one won't work on your preHE. See more on this below.

The jockey pulley assembly for the HE is functionally the same as the preHE one. At some point Jaguar switched to a steel arm, but otherwise the parts are the same.

## ***Disassembly***

**Jack stands:** You might as well begin by putting the car on jack stands at the front because you will have to get under the car to access the lower fan shroud bolts.

**Air filter cover:** the right air intake horn will be constantly in your way unless you remove the air filter cover.

**Belts:** You will have to remove the fan belt, of course. Also removing the AC compressor belt will give you more elbow room, saving time in the end.

**Radiator top rail:** It is difficult or impossible to get the shroud out of the way with the radiator top rail bolted firmly in place. At the very least, you will have to unbolt it so you can tilt it upwards enough for the shroud to clear the mounting studs that protrude from the rail. I detached it completely so I could lay it on top of the engine, making shroud removal easier. But, as usual, one thing leads to another and I had to undo the air bleed line from the upper right side of the radiator in order to get the rail off. I made the mistake of having the radiator cap off so I lost a lot of coolant, meaning I had to go through the bleeding process at the end of the project.

**Shroud:** The preHE fan can't be removed with the shroud bolted down. You might get away with only unbolting it so the fan can be lifted out when the shroud is tilted backwards a bit. However, once you've unbolted it you might as well remove it entirely along with the fan as described later.

You will need to unbolt both the mechanical and electrical fan shrouds. This requires unbolting three top mounting tabs, and unscrewing the mechanical fan shroud from the electric fan shroud at several places. Unfortunately, this requires removal, or at the very least unbolting, the radiator top rail. Also, get under the car and undo the electrical and mechanical fan shrouds mounting tabs down there. At this point the fan shrouds are loose and can be jockeyed around as needed to get the old fan out.

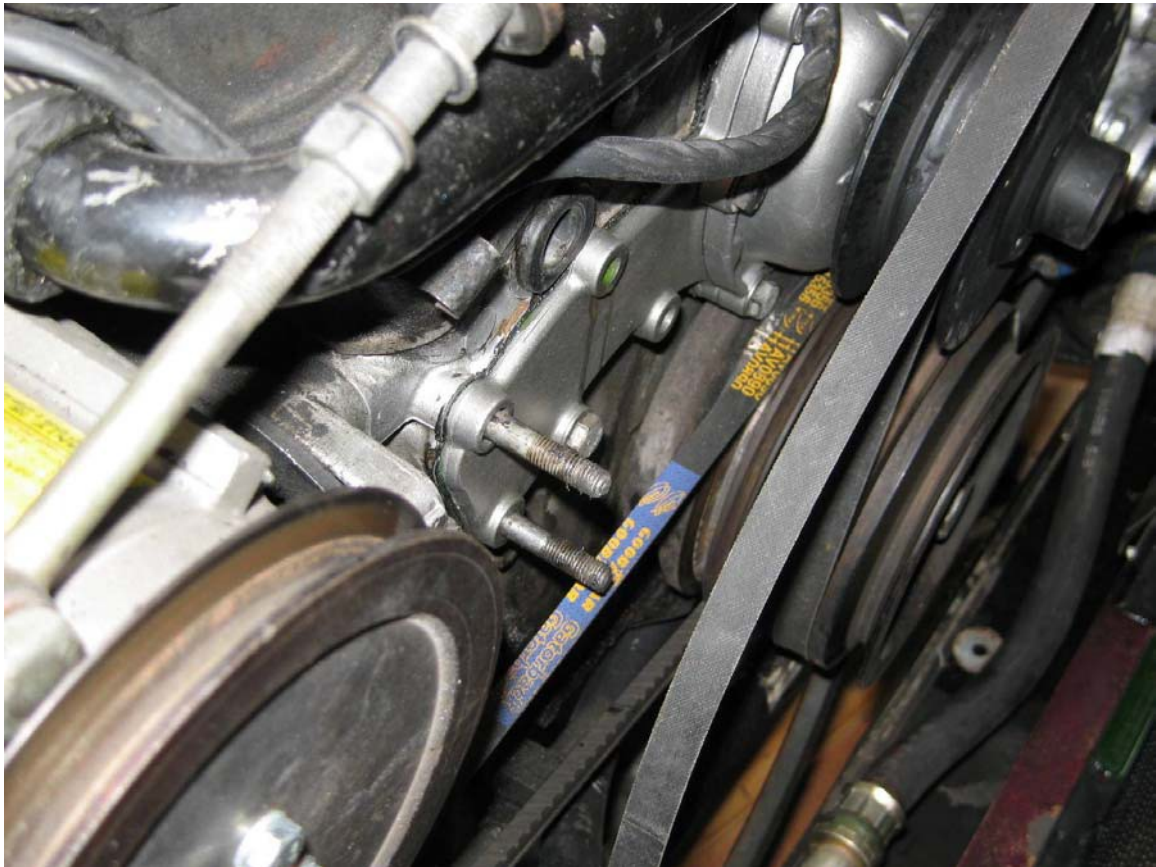
**Note:** At this point slip a piece of cardboard between the radiator and fan to protect the radiator during later operations.

**Fan & clutch:** Unbolt the fan from the clutch, held on by four nuts and bolts. Then, put a large adjustable wrench (spanner) on the flats of the fan shaft. You will have to reach through the blades with another wrench to undo the center bolt holding the clutch to the shaft. It's a normal right hand thread. The clutch will probably need to be coaxed off the shaft once the bolt has been removed. I used a ½" wooden dowel about 2 feet long and a mallet to knock it off. Once it's been knocked forward a bit you can wiggle it off the rest of the way.

Once the clutch is off the fan is left hanging on the shaft. At this point you can try to lift the fan out between the tilted-back shroud and the radiator. If that doesn't work, do as I did and lift the shroud and fan up and out at the same time.

**Jockey pulley assembly:** Remove the bolt holding the tension adjuster to the pulley arm, and then the one that holds the arm to the fan bearing housing. Remove the pulley and arm assembly.

**Fan bearing housing:** The fan bearing housing is bolted to the engine with two bolts and two studs. Since it sits atop the right end of the water pump, Figure 6, these bolts and studs also hold the water pump in place. At least one of the bolts penetrates into the coolant stream so you may note some coolant leaking when you remove it. Make note of this and remember to put sealant on the threads when you reassemble.



**Figure 6 Fan mounting pad**

### ***The Issue of the Shroud***

Someone had told me that the HE fan was different in diameter from the preHE metal one, so I assumed I should get an HE shroud (cowl) along with the new plastic fan. This was a mistake. First, the fans *are* the same diameter so there is no point in not keeping the preHE shroud. But as it actually turns out the HE shroud will not even fit on the preHE without modification. The difference is in the lower mounting tab, Figure 7.



**Figure 7 HE (left) and preHE (right) fan shroud difference.**

On the HE shroud this tab is offset about an inch further back, so when you have the shroud pressed against the radiator the stud that is supposed to engage the tab doesn't reach it. Apparently, the HE radiator is mounted an inch further forward. Ant any rate, do not bother to get the HE shroud.

### ***Replacement***

**Inspection.** Once all the old parts are out you should inspect things carefully so see what needs replacing while your there. The fan and AC belts are obvious candidates. If your new bearing housing assembly came with studs, inspect them carefully. It's somewhat easier to replace them while the unit is on the bench. Also, look for signs of water pump leakage, as now would be a good time to do that job if needed. Clean up all the nuts and bolts and any parts such as the jockey pulley that you are not replacing, and consider a little painting as well if you are the type. Finally, you might as well do some cleanup of the front of the engine since it's accessible.

**Studs.** Before installing the fan bearing housing on the engine it's a good idea to install the studs (if they are being replaced), and check the match up with the clutch. The issue here is the studs must not protrude from the pulley face too far, as they will run into the clutch. On the other hand, if they don't stand out far enough you won't get full engagement of the nut. You want to be able to see the end of the stud poking a bit out of the nut with washer in place. Figure 8 shows me checking this (unwisely, after the housing was installed on the engine!). In this photo I'm holding the nut beside the stud without a washer. It's clear that the stud exposure is it's not long enough. Figure 9 shows how it looked after adjusting the stud exposure. Those are standard thickness nuts (1/4") and internally serrated lock washers.

As can be seen in Figure 5 the Jaguar studs are not symmetrical. One end is a little longer and has a short unthreaded end. Although I installed mine with the long end screwed into



the pulley I now believe that end should be out. For one thing, the unthreaded end would allow easier starting of the nuts. But more importantly, when I put the long end into the pulley and fully tightened them the exposed length gave the situation shown in Figure 8. In order to get the wanted full engagement of the nut with a wash in place I had to back the studs out. This is fine since I used Loctite (blue) on the threads into the pulley, and securely tightened the nuts.

If you have never installed studs you may wonder how it's done. Do not use pliers or the like. Go to the hardware store and get a pair of jamb juts. Lock these one against the other on the exposed end of the stud and place your wrench on the outer nut to turn the stud.

**Fan bearing housing.** Install the bearing housing to the engine. Be sure to put some kind of sealant on the bolts that penetrate into the coolant. I used a Permatex water pump and thermostat housing gasket maker product, #22071.

**Jockey pulley.** Install the jockey pulley.

**Fan belt.** Install the fan belt, but leave very loose.

**Drop the Shroud into place.** If you have removed the shroud now is the time to drop it back into the car. Don't bolt it down yet, as you may want to be able to move it around a bit. On the other hand, the HE fan and clutch can be worked into place with the shroud bolted in place, so you can do that now if you wish.

**Install fan and Clutch.** Before beginning this step find a piece of cardboard about 6" wide and 2-3 feet long. Fold it so it can be placed between the clutch and the radiator, gently holding the clutch against the pulley as shown in Figure 8.

**Slip the fan into place.** You will note that the blades are not spaced uniformly. The wider spacing between some of the blades can be used to advantage while getting it past the AC compressor pulley and the shroud. If you work at it you will be able to get it in without bending the blades.

**Slip the clutch into place.** While holding the fan with one hand, use the other to gently work the clutch past the blades, so the clutch is between the fan and the radiator. The fan can now be hung on the clutch, freeing a hand. Manipulate the clutch to align the slots in the mounting flange with the pulley studs. Now, grab the folded cardboard and jamb it between the clutch and radiator.

**Bolt the clutch to the pulley.** This was the most difficult part for me, but my hope is you will have an easier time of it after reading these hints.

The first hint has already been given, i.e., check how it all fits together *before* putting the bearing housing on the engine. That gives you confidence that it will really work if you try hard enough.

The second hint is *to not bolt the fan to the clutch until the clutch is bolted to the pulley*. The reason for this is once the fan is bolted in place there is not enough room to get your hand in there to slip the washers on and start the nuts. The fan being loose allows it to be tilted forward, giving more hand space.

Now, get all the nuts and washers together, as well as a 9/16" wrench and a pry bar or a large flat blade screwdriver. The pry bar is needed because the folded cardboard is

probably holding the clutch snugly against the pulley, meaning there is not enough space between the ends of the studs and clutch to get the washers and nuts onto the studs. The pry bar lets you gently nudge the clutch forward so the nut and washer will clear.

While putting the washers and nuts on, following the procedure below, it is important to now tilt the fan forward such as to give maximum hand space near the stud closest to you.

Use the pry bar between the pulley face and the clutch flange to gently push the clutch forward far enough to get the washer and nut on the stud closest to you. *Screw the nut on no more than one turn.* (You will feel very good having done that!) Now, turn the pulley so another stud is close to you and repeat the above process. Continue until all the studs have washers and nuts.

Now comes the process of tightening the nuts. They have to be gradually tightened one after the other so that the flange is gradually pulled toward the pulley without cocking. If you are using fresh nuts and studs most of this is finger work, requiring the wrench only for the last turn or so. So, turn one nut about one turn and then turn the pulley to bring up the next stud and give its nut one turn. You will quickly get the feel of this and will soon be reaching for the wrench.

To tighten the nuts you will have to use the belt to grip the pulley. At first, it's more convenient to not involve the tensioner. Just wrap the belt around the pulley and grip it with one hand while applying the wrench to the closest nut with the other. Then turn the pulley to the next stud and repeat the process. Eventually you will get to the point where you have to put the belt around the crankshaft and jockey pulleys and tighten it with the tensioner. I don't see any way to get a torque wrench on those nuts, but the NAPA clutch spec sheet suggests 15-18 inch-pounds (20-24 N-m). I just tightened them as much as I could with an open end wrench.

**Bolt the fan to the clutch.** Relative to the clutch installation, this is an easy task. Just slip the fan onto the back of the clutch and insert the four 5/16-20 x 1/2" bolts, with lock washers. Like the clutch bolts, they should be tightened to 15-18 inch-pounds. The only difficulty is keeping the fan from turning while tightening the bolts. I simply held the fan blades, gripping as close to the base as I could to avoid overstressing them.

**Reinstall other items removed.** The rest of the job is straightforward.

Reinstall the radiator top rail. Don't forget to attach the ground straps.

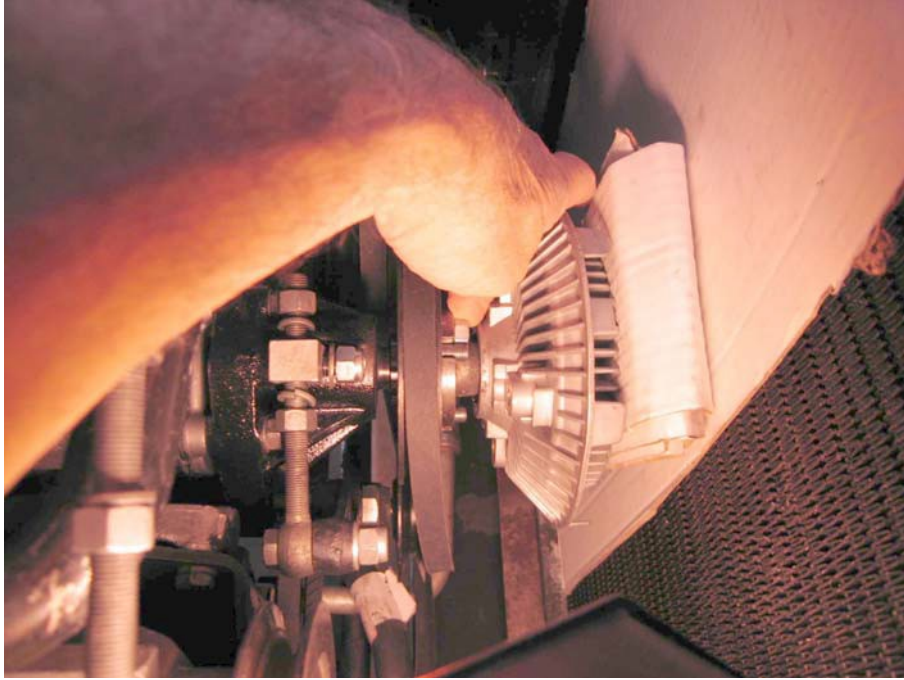
Bolt down the shroud.

Reinstall the AC compressor belt and adjust.

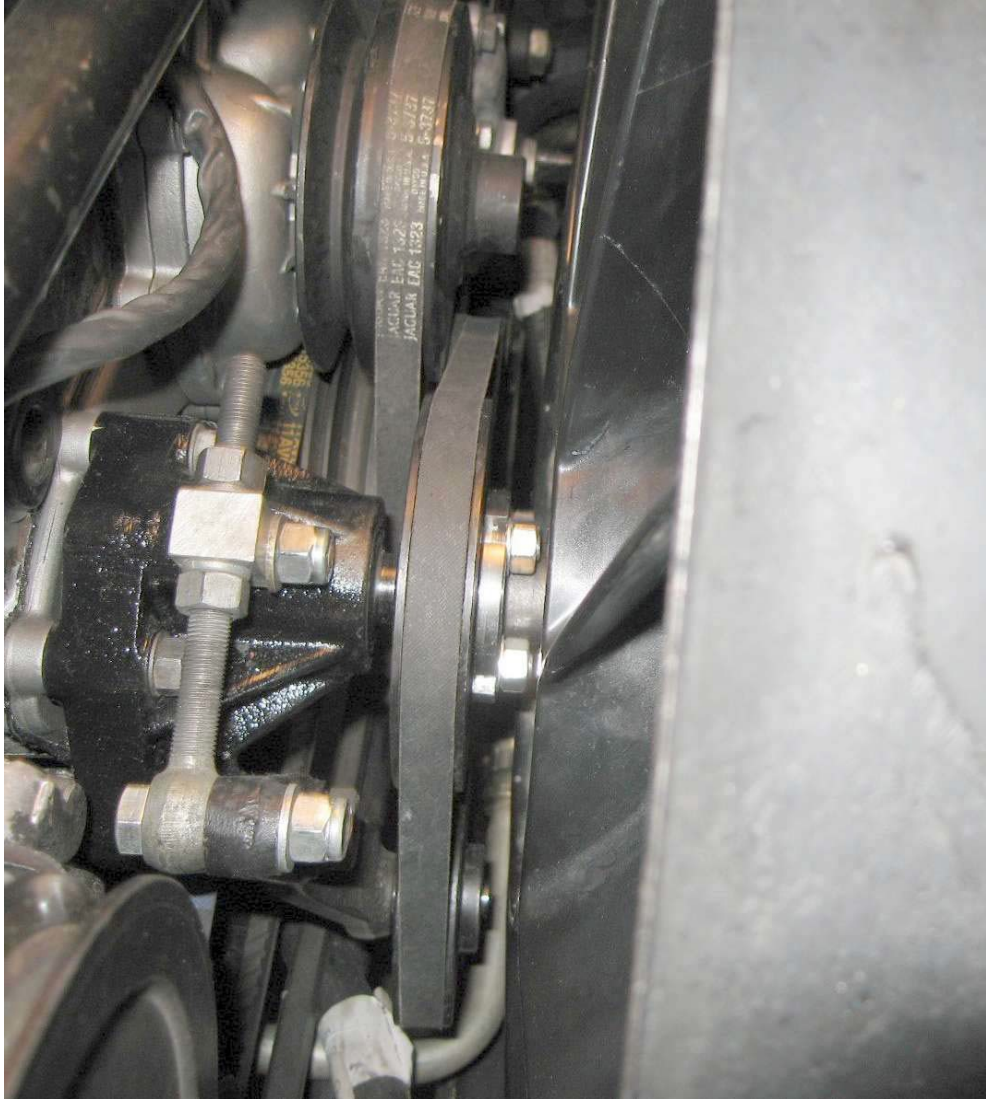
Reinstall the air filter cover.

If removed, reinstall the radiator bleed tube.

Afterwards, double check everything. Before starting the engine after this kind of work I sometimes disconnect the coil and crank it over to see if anything is hitting or dragging. Then start it up and let it run for a couple minutes. Recheck everything again, and if solid take it off the jack stands and go for a test drive!



**Figure 8 Checking stud exposure**



**Figure 9 Fan installed**

### ***Results***

It's still too soon to say what improvement the new fan may or may not have on the temperature gauge readings. For one thing, I did not have a terrible overheating problem to begin with, thus precluding any dramatic drops at the gauge. Moreover, before the project we were experiencing weather in the mid 80s while after completion it's been about 10 degrees hotter, so a modest improvement in cooling could be masked by higher cooling loads. That said here is my preliminary assessment based on driving the car only a couple times.

Driving on surface streets in light traffic (35-40 mph) at about 95-97F ambient, the needle was riding centered at the bottom of the N, about 205F for my gauge. After a 30 minute shopping stop it started up at the center of N, then dropped down to the bottom of N after a few blocks. In cooler weather (high 80s) several days later it settled at about 3 needle widths below the center of N, about 195F. As best as I can recall, a similar



situation before the fan retrofit it would have been centered on N (215F) on the 95-97F day, and about -2 needle widths (210F) on the cooler day. So, it looks like the fan has dropped the coolant temperature (entering the radiator) by 10-15 Fahrenheit degrees. I will add to this after I've driven the car more.

### ***Acknowledgements***

I received help and commentary from several XJ-S Lovers mail-list members during this project. In particular, I want to mention Rob Roe. Rob not only sold me the parts (yes, he had gone electric!), but he also came by one Saturday afternoon to help with the installation. He lives in the Seattle area, a long way from Placentia, California, but happened to be in the area. We had a great time trading stories, both in the garage and later at dinner. I also want to thank George Balthorpe who corresponded off-list several times on some of the issues. I especially appreciated the photos he took of his installation. There must have been several others on the mail list who helped along the way. Their help was appreciated even though I have forgotten their names.

### ***Request***

I would appreciate feedback on this write-up. If you have done this job or similar and happen to notice errors or omissions, please let me know.