

Water Pumps

You've probably noticed that an increasing number of repair parts are being covered by extended new car warranties. Some warranties are written, others are the "under the counter" variety. In spite of this disturbing trend for those of us in the independent aftermarket, water pump replacements are still a good source of customer pay work for independent repair shops. Water pumps come in a wide assortment of styles and shapes. On many cars, they are now driven by the timing belt instead of the more traditional v-belt setup we saw for years. Either way, water pumps are largely neglected until they fail completely.

This month, we'll take our first look at water pumps with an assortment of European models. We'll start

with photos showing several parts applications, help you locate hidden bolts and thermostats, and wind things up with a step-by-step look at a pump replacement on an Audi diesel.

How Important is a Water Pump?

Maybe your customers don't realize how important that plain old water pump can be. You might want to inform them of the following:

- **Good coolant circulation is critical to the operation of modern fuel systems.** The Coolant Temp Sensor needs to be immersed in a steady flow of coolant of the proper temperature before it can do its job. Air pockets

in the cooling system, sticking (or missing) thermostats, improper antifreeze concentrations, and loose belts can also contribute to faulty CTS signals.

- Improper coolant flow can also contribute to engine overheating, poor heater output, inoperative electric cooling fans, and transmission damage (on those cars equipped with transmission coolers).

- Since many water pumps are now driven by timing belts, pump replacement on these cars becomes a logical, and in some cases, mandatory part of a timing belt replacement. Replacing one but not the other when both pump and belt are worn out, is an open invitation to a costly and embarrassing comeback.

Severe engine damage can result when a timing belt-driven water pump seizes and stops dead in its tracks. There's something that finally gets a customer's attention!

In some cases, as with our BMW and Audi, a recent

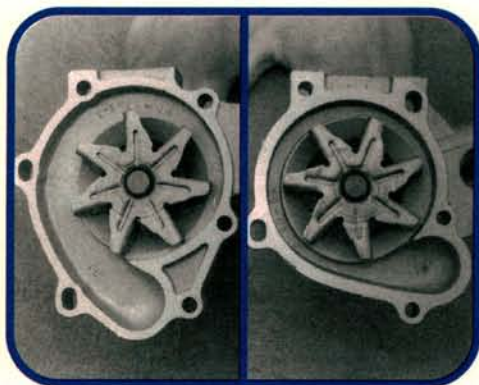
belt replacement which did not include a new pump, results in a pump-only replacement. Maybe the customer should have saved both of you a lot of added work by doing the entire job in the first place.

As usual, we're going to concentrate on procedural tips and highlights. For more detailed repair manuals which list all specifications and torque specs, we suggest you look into purchasing repair manuals from Robert Bentley, Inc. Circle No. 200.

And in the "last but not least" category, our segment on the Audi diesel shows several special tools available from Zelenda Machine and Tool Circle No.201, and also from Baum Tools Unlimited, Inc. Circle No. 202.

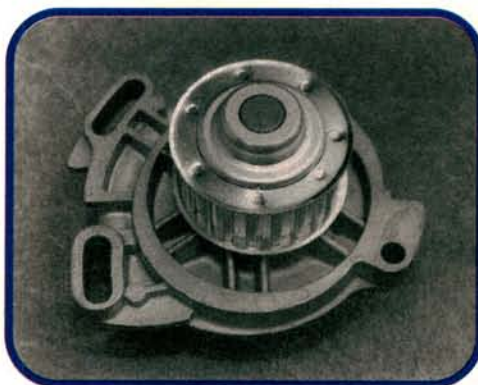
Both companies have catalogs available listing the special tools you'll need to do this repair properly.

—By Ralph Birnbaum



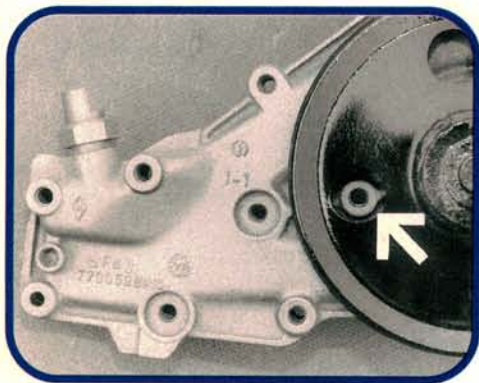
1

How about something as simple as installing the correct pump? Volvo B21 engines up to 1985 use the pump at the left. Later B230 engines, the one at the right. When installing either, be sure to pull the pump up tight against the bottom of the cylinder head overhang before tightening the pump bolts, or the o-ring will leak.



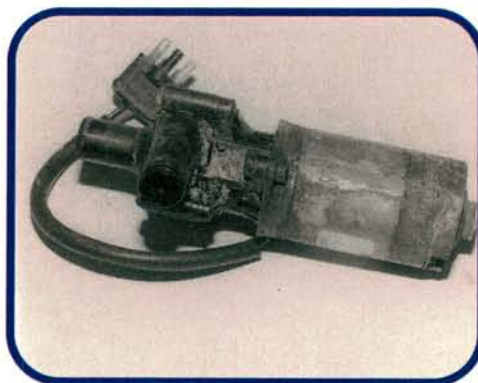
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Water pumps on Volvo diesels are driven by the timing belt. Slots in the pump bolt holes allow the pump to be rotated to adjust belt tension. Some shops said that while they don't always replace these pumps at the 75,000 mile belt change interval, they always replace the \$20 belt when they replace a pump. Economics.



3

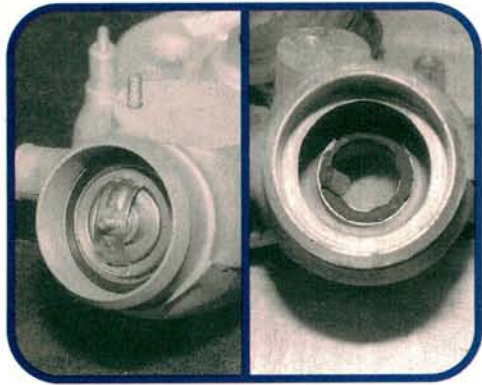
This pump is from a Renault 1.4 liter engine (Alliance/Encore models). The pump fastens to the side of the cylinder head with eight bolts, one of which is accessed through a hole in the pump pulley. Always pressure test and thoroughly bleed these systems.



4

This electric pump from a Mercedes may be the cause of a mysterious coolant loss. The pump is used to maintain a constant flow of coolant through the heater core. You can see the scaly debris from the coolant leak in the area between the motor and the impeller housing.

Water Pumps



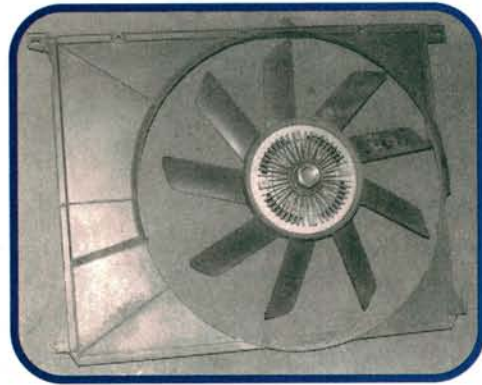
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The thermostat in the Porsche 944 engine is located in the water pump neck. It seals at top and bottom with rubber seals. If you've replaced a T-stat only, check the seal at the base of the stat. If the pump itself is good, a replacement seal is available. Our right photo shows a bad seal.



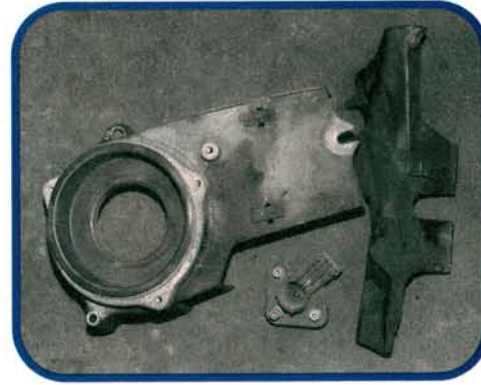
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The BMW "eta" engine is one example of a belt driven OHC which makes water pump removal a little trickier than normal. Hold the pump pulley while you loosen the left-hand thread on the fan clutch. Loosen the fan clutch on this engine with the same 32 mm wrench used on the BMW "big sixes."



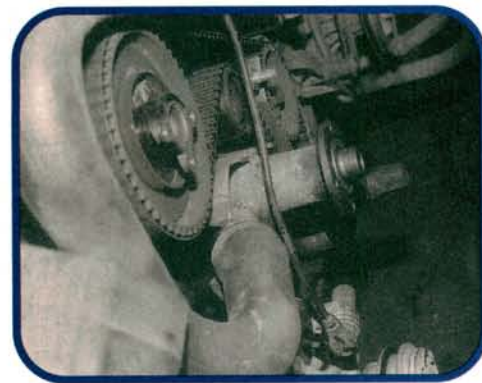
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The fan clutch on the big sixes can be pulled up and out of the way without removing the fan shroud. But the water pump on the eta motor sits lower, and access is a lot tighter. We found it easier to unfasten the fan shroud and lift fan and shroud out at the same time.



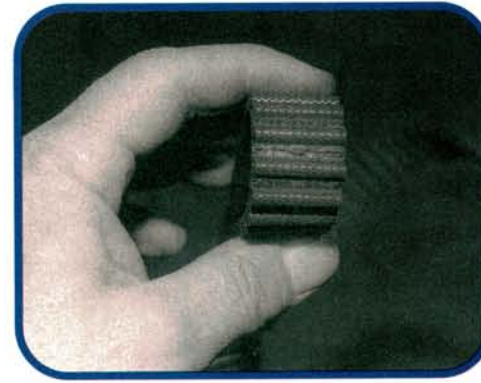
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Remove the distributor cap/wire set. Unbolt and remove the rotor and the dust shield behind it. Remove the top camshaft drive belt cover. On some 528e's, you may find that removing the crank pulley sensor helps, (but not everyone does). Remove the drive belt and pump pulley.



9

At this point you need to decide if we're replacing just the pump, or the timing belt too. We're replacing just the leaking pump, since the belt was replaced only 10,000 miles ago. We break the pump bolts loose, and remove the upper two. Don't loosen the tensioner bolt.



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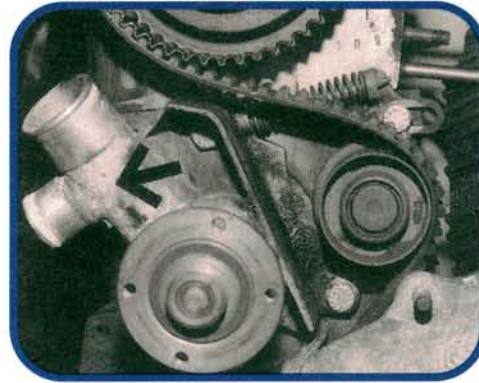
This is a great place to get into deep trouble if you assume a belt is good. We all know customers who "just" had their oil changed (two years ago). Same thing applies to timing belts. A second customer with a similar vintage car said this belt was new. It obviously wasn't.

Water Pumps



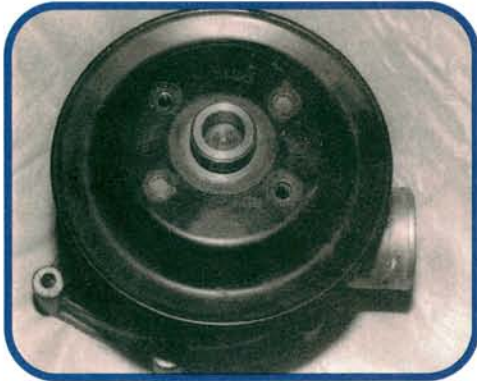
11

The timing belt tensioner spring and rod are located in a notch in the side of the water pump. The spring pushes against the pump body. After we replace the pump, we'll loosen and retighten the tensioner bolt to adjust the belt tension. During the pump replacement we'll leave it tight.



12

Pivot the pump away from the timing belt tensioner spring/pin far enough to remove them. Remember, the working space in the car is limited, and it's easy to launch the spring to parts unknown if you're not careful. Then take out the last bolt and replace the old pump.



13

The holes in the pump pulley on BMW's are not 90 degrees apart. It's possible to start two of the pulley bolts with the pulley 90 degrees from proper index. This blocks the remaining two holes. If this happens, turn the pulley 90 degrees so all the holes are aligned.



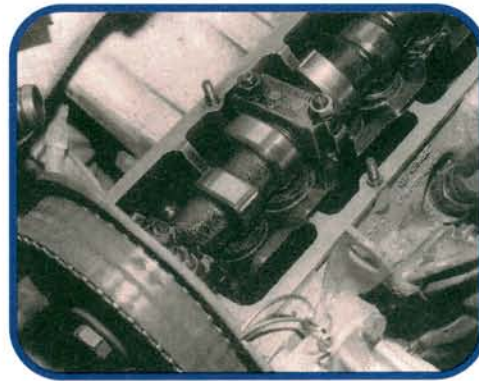
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This 1983 Audi diesel makes water pump replacement an adventure. The water pump is used to tension the camshaft drive belt. But the importance of maintaining cam and diesel injection pump timing adds a number of steps to the procedure.



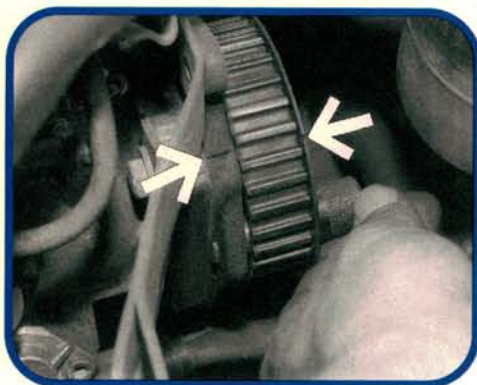
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Our first step will be to remove the power steering pump and lay it aside with the hoses still connected. Then we can remove the front timing cover which is held in place by three snap clips. We also remove the valve cover, and upper radiator hose.



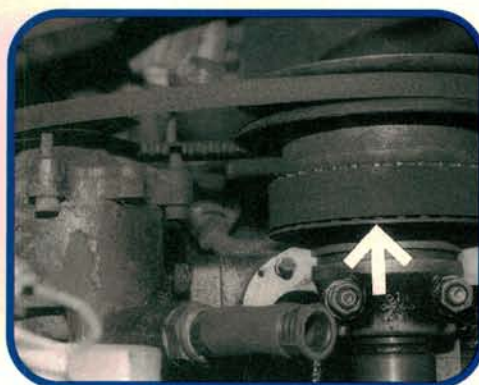
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Then we turn the engine to TDC on Number 1. Both cam lobes on Number 1 should be pointing up like rabbit ears as shown. Don't worry about setting the crankshaft right on the TDC timing mark just yet. First we need to lock the injection pump.



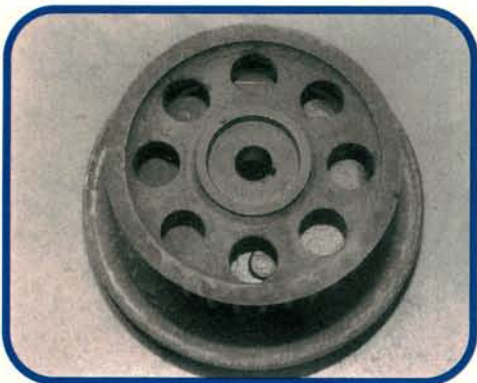
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This special tool is a pin which we insert through a hole in the injection pump sprocket. Then we rock the engine until the pin slips into a hole in the pump body. The marks on the pump body and sprocket (arrows) will align when the pin is fully inserted.



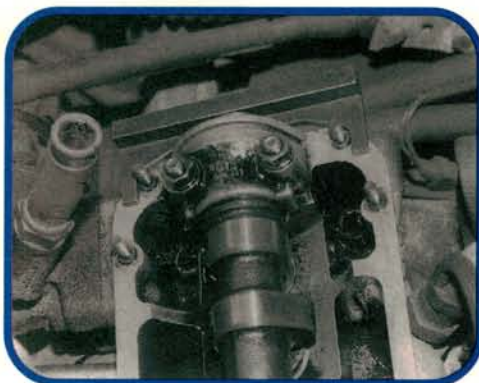
18

Hold the rear cam sprocket and loosen the large center nut holding it to the rear of the cam. Tap on the back of the sprocket (arrow) with a plastic mallet to loosen it. Remove the sprocket/drive pulley for the vacuum pump as an assembly.



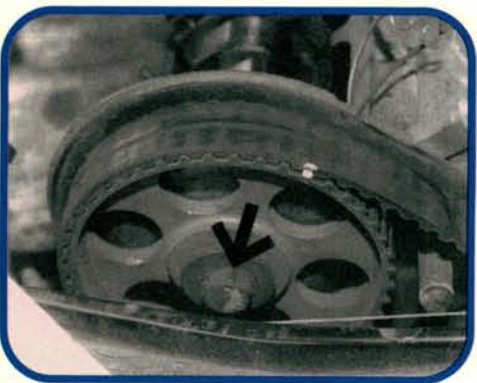
19

The rear sprocket and pulley deserve some special attention. The drive pulley for the vacuum pump belt is a split pulley. Belt tension can be adjusted by adding or removing shims between the pulley halves. The sprocket is not keyed to the cam.



20

That's right, the only thing driving the rear sprocket is friction provided by the bolt tension holding the sprocket to the cam. There is a slot in the rear of the cam, but that slot is for the cam locking tool which we slide into the notch as shown.



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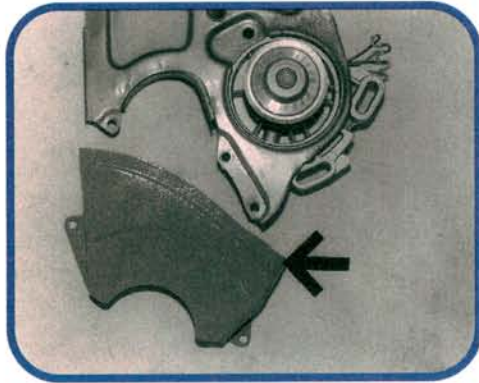
Now that the cam can't turn, we go back to the front of the engine and loosen the front sprocket bolt one turn. Hold the sprocket when you loosen the bolt. If you rely on the cam locking tool to hold the cam, you may damage the back of the cam.



22

Tap on the back of the front cam sprocket to loosen it. Like the rear sprocket, it isn't keyed to the cam. But the front sprocket is different, and uses a tapered friction fit. Remove the bolt and sprocket, and pull the timing belt off to the side.

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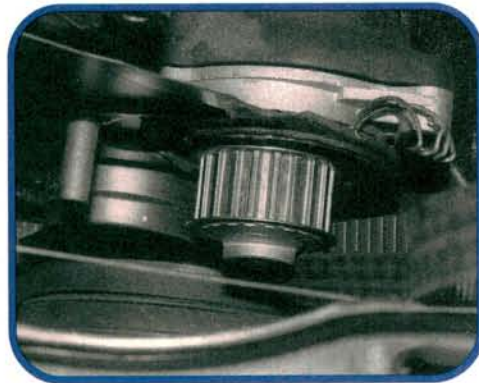
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The repair manual casually suggests removing the inner timing belt cover. Working space is very limited. We laid out the lower front cover (arrow) next to the inner cover. The lower cover must be removed to access the lower bolts on the inner cover.



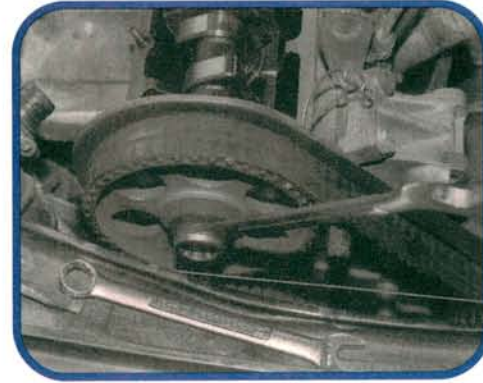
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We can finally remove the inner cover and pump. The engine block surface where the pump seal rides is thoroughly cleaned. The new pump will be pivoted to tension the timing belt. Any scale or debris may result in a damaged pump seal.



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The pump pivot bolt passes through the inner cover, so we install pump and cover at the same time. We snug the pump mounting bolts just enough that the pump can still be pivoted. Then we reinstall the timing belt and front cam sprocket.



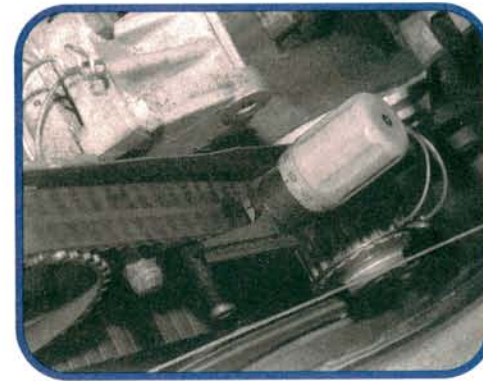
26

Now we snug the bolt on the front sprocket enough to seat the sprocket on the tapered nose of the cam. We want the sprocket to be just loose enough to rotate as we pivot the water pump to adjust the timing belt tension. Remember, the cam is still locked.



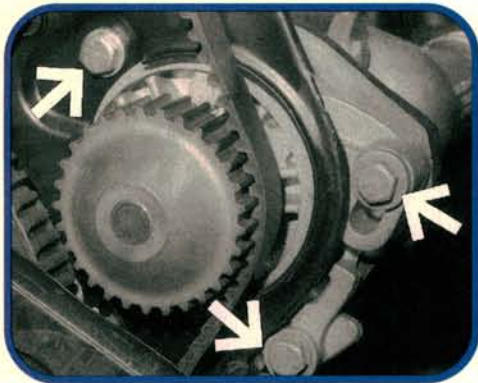
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Before we finish adjusting belt tension, we double check the crankshaft timing mark in the bell housing window to make sure the crank hasn't moved. Then we'll go back and check the crank timing one last time after completing the next step.



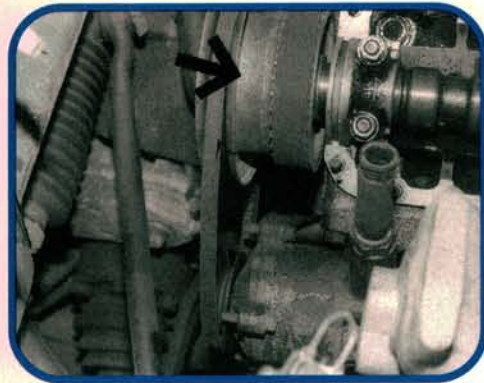
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We are using the approved belt tension gauge to check for proper belt tension as we pivot the water pump. Notice the position of the gauge on the belt. When the tension is correct (10-13 on the gauge), we tighten the three water pump mounting bolts.



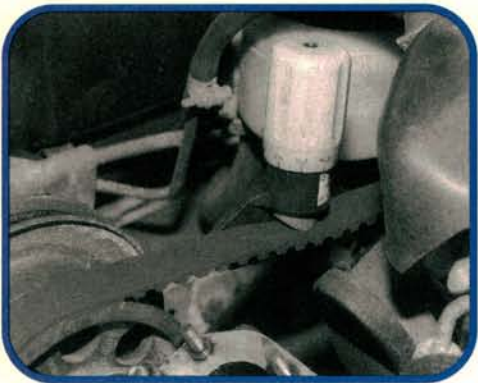
29

Here's a better view of the pump mounting bolt locations in another engine which is on a stand. The bolt at left is the pivot bolt which passes through the inner cover as well as the pump. After final tightening of the pump bolts, double check the crankshaft timing mark.



30

With cam and crank properly timed, and the timing belt tensioned, we can finish tightening the front cam sprocket retainer bolt to 45 Nm (33 ft-lb). Remove the locking tool from the back of the camshaft, and reinstall the rear sprocket/pulley and belts (arrow).



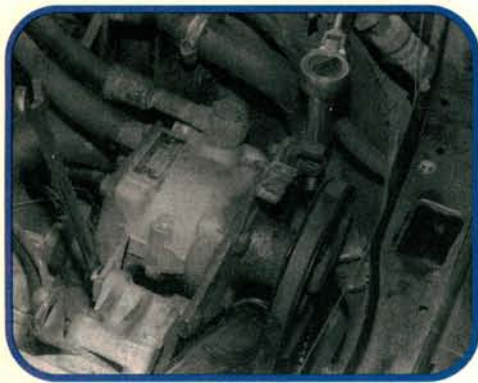
31

Don't tighten the rear sprocket bolt yet, just snug it enough that the sprocket can still rotate on the cam. And don't remove the injection pump locking pin yet. Check the tension on the injection pump drive belt first. If it's okay, hold the sprocket and tighten the rear sprocket bolt to 100 Nm (74 ft-lb).



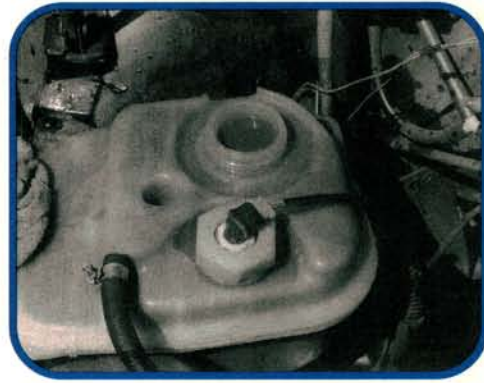
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If the belt tension needs to be adjusted, loosen the retaining bolts on the injection pump bracket, and rotate the pump body to adjust the belt tension. Then tighten the bolts on the pump mounting bracket, torque the cam sprocket bolt, and don't forget to remove the pump locking pin.



33

Now we can reinstall the radiator hose and valve cover. Use a new valve cover gasket. The power steering pump is also reinstalled, and properly tensioned using the screw-type adjuster. We also replace the plastic belt cover after the power steering pump is properly tensioned.



34

Now it's time to fill the system through the coolant overflow jug. We turn the heater control to HOT, and keep topping off the jug as air escapes. When the bubbles stop, we start the engine and keep topping off the jug until the engine is warm, and the system is fully bled.