

Porsche 928 S4 Service

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Timing-Belt Procedure

(In only 175 easy steps!)

Subject: 1987 Porsche 928 S4 Automatic
Mileage: 119,177
VIN: WPOJBO928HS860179 (early build, August 1986)
Engine #: M28/42 - 81H05136
November 10-13, 2000

At 82½ inches long, the Porsche 928 timing-belt is one of the longest ever used in a production automobile. Its purpose is to turn the camshafts, thus driving the valve train in relation to the crankshaft. In all but the very early 928's a snap of the belt allows the valves and pistons to crash resulting in catastrophic engine (and financial) damage. Clearly the function of the timing-belt and its related components is absolutely critical.

While Porsche specifies a service interval of 60,000 miles, most 928 specialists recommend a conservative 40-45,000 mile service. Due to its location the water pump should be replaced. Additionally the belt tensioner should be rebuilt and Tony Harkin has some excellent information on his site at <http://members.rennlist.com/v1uhoh/>. Common shop quotes for these services range from \$700 to \$1200.

Due to the nature of the labor other items to consider servicing include: accessory belts, spark plug wires, distributors, rotors, coils, camshaft seals, crank seal, oil pump seals, flush and fill of fresh coolant, upper and lower radiator hoses, and the forward coolant reservoir hose.

This procedure is a compilation of the Workshop Manual, Wally Plumley's [928 Owners Club](#) article, the instructions accompanying Jay Kempf's "Aftermarket Belt Tension Tool", some emailed encouragement from [Greg Nichols](#) and Kevin Berez, Dave Roberts' recommendations ([928 Specialists](#)), emails from other [Rennlisters](#), and my own experience. As a rookie moving carefully I took about 22 hours to complete this job. Having the experience I now estimate it could be done in less than half that time.

The basic steps are:

1. [Get everything together](#)
2. [Remove the front of the engine](#)
3. [Remove the timing-belt](#)
4. [Remove the water pump](#)
5. [Remove, rebuild and install the tensioner](#)
6. [Install the water pump](#)
7. [Install and tighten the new timing-belt](#)
8. [Install the front of the engine](#)
9. [Break it in](#)

Get everything together

1 - I called Dave Roberts at [928 Specialists](#) and asked, "What do I need?" Here's what he sold me:

- Timing belt, genuine Porsche
- Water pump, Porsche rebuilt
- T-belt tensioner boot
- T-belt tensioner boot clamp
- T-belt tensioner gasket
- T-belt tensioner inner piston seal
- T-belt tensioner idler bushing (2)
- T-belt tensioner Large roller
- T-belt tensioner idler (DR said this was optional, but at my mileage...)
- Flywheel lock tool

2 - I called [928 International](#) and Jim Bailey sold me:

- the aftermarket belt tension tool
- a really sharp T-shirt

3 - I already had 2-3 gallons of Krogers distilled water, but I went to Walmart, Lowes, and Discount Auto Parts and bought:

- two gallons of Texaco/Havoline DexCool coolant
- some generic-looking "Lubriguard" HDX All Purpose 80W90 Gear oil
- house brand engine degreaser
- Locktite gasket sealant
- Locktite antiseize
- 3/16" clear tubing
- 1x30" black iron pipe
- 27mm 1/2" drive socket

4 - Other items I already had:

- WD-40
- 1/4" Sears Craftsman metric socket set - perfect for all the small bolts
- 3/8" metric deep socket set - particularly 8, 10, 13, 17, 19mm
- metric hex key socket set - particularly 4 and 6mm
- open and box-end wrenches - 8, 10, 13, 17, 19mm
- flat blade and Philips head screwdrivers
- 1-1/4" (32mm) open-end wrench
- 1-1/16" (27mm) open-end wrench
- two M8-1.25 nuts
- zip ties
- jack and jack stands
- other common tools

In keeping with Porsche convention, the LEFT is the driver's side. The RIGHT is the passenger's side.

Remove the front of the engine

1 - Start with a cold engine.

2 - Disconnect the battery ground strap behind the tool tray. I tend to blow



fuse #24 (interior lights) on the reconnect, so I pull that too.

3 - Raise front of car. I have yet to build some good ramps so I put it on jack stands. (Wally has a good idea about jacking the rear point and putting a jack stand under the front point. Then put the jack under the lower control arm rear support to raise the jack stand higher at the front point.)

4 - Open the hood and set out the service covers. What?? NO service covers? Are you just going to scratch your fenders up?? Put them on your shopping list! [928 Specialists](#) !!

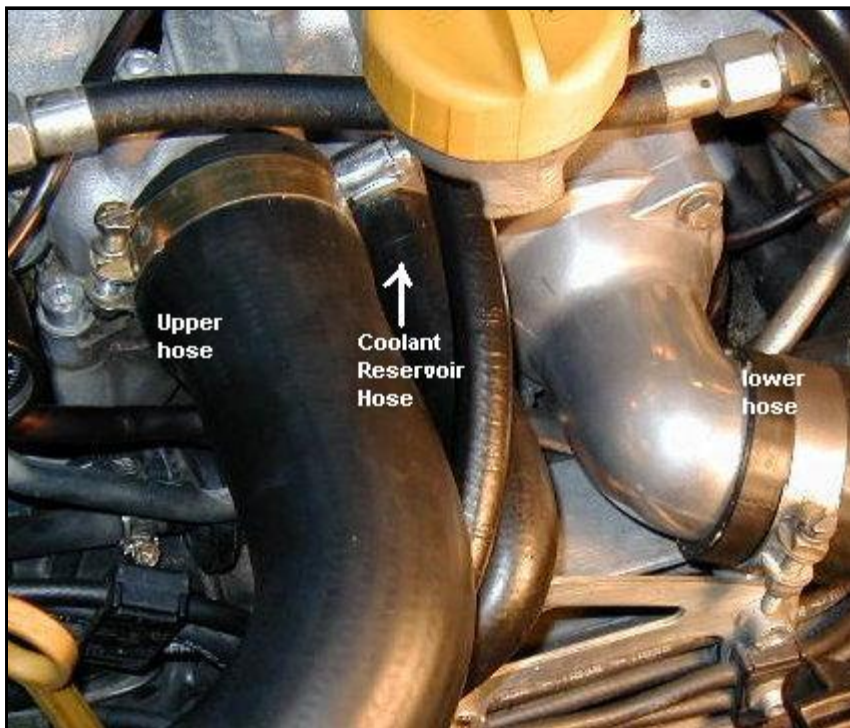
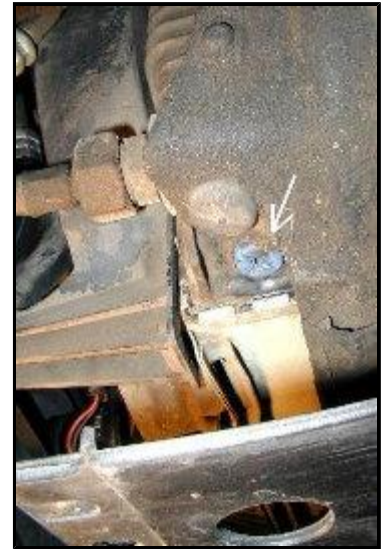
5 - Remove engine belly pans (if you have them!).

6 - Loosen coolant reservoir cap.

7 - Loosen the radiator drain cock (flathead screwdriver) and drain the radiator. You will catch about 2½ gallons.

8 - Remove left and right side engine block drain plugs (13mm) and drain the block. Be careful, these are usually very tight and could strip easily. You should catch about 1½ gallons.

9 - Remove the air cleaner intake hoses.



10 - Remove the upper and lower radiator hoses. My clamps were all 10mm, except the bottom lower hose was 8mm (must not be original Porsche).

11 - Replace and snug radiator drain cock.

12 - Replace the two engine block drain plugs. You might use some teflon tape to make insure the seal.

13 - Unplug the electrical connectors on each fan, and remove the wiring from the clips on the fan shroud. This is more easily done from underneath.

14 - Remove the jumper post cover (right sidewall).

15 - Loosen or remove the clamp on the power steering reservoir to allow clearance. Mine was 7mm.



16 - Loosen the air pump hose to the filter. Mine was 6.5mm. Tie back out of the way.

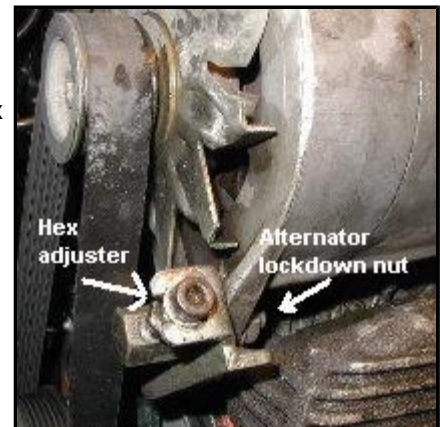
17 - Remove the two 10mm screwbolts on top of the fan shroud.

18 - Attempt with much conviction to remove the fan shroud. You may need to loosen the oil cooler line. This is on the top left of the radiator, next to the power steering reservoir. I used a 1-1/4" (32mm) wrench on the nut, and a 1-1/16" (27mm) wrench to counterhold the fitting. A little oil may drip. Be careful to counterhold because the radiator side tanks are plastic.

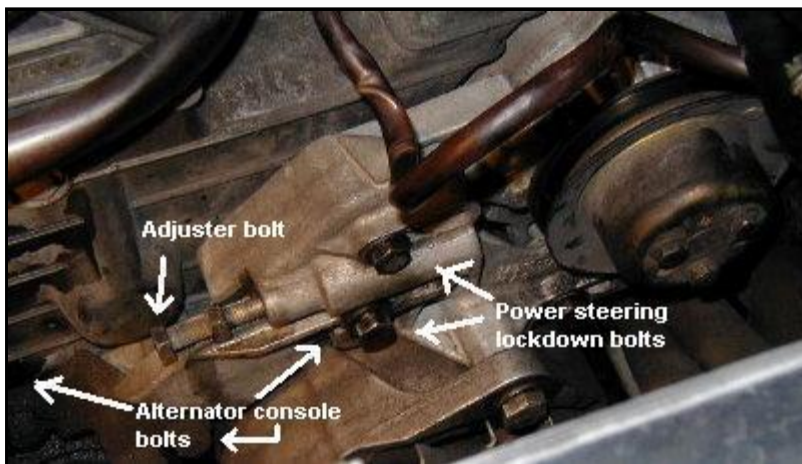


19 - If you loosened the oil cooling line, snug it back together. Later when you hand-crank the engine you could pump enough oil up to spill. (I know!).

20 - Loosen the alternator lockdown bolt with a 17mm open-end wrench. Use a 6mm hex key on the adjuster. You may also want to loosen the 17mm pivot bolt. Remove the belt.



21 - Loosen the three 13mm bolts for the power steering pump, and use a 13mm socket on the adjuster. Remove the belt and mark it "PS".



22 - Loosen the air pump 13mm lockdown bolt, and loosen the 13mm adjuster nut. I had trouble getting it to full loose, so I added another nut (M8-1.25) to the adjuster and tightened it to full loose. Remove the belt and mark it "AP".

23 - The A/C compressor belt was difficult to fully loosen as well, so I added another M8-1.25 nut to its adjuster. The lockdown bolt is 17mm, and the adjuster nut(s) are



13mm.

24 - Remove the oil dipstick.

25 - Mark the spark plug wires. I put tape across the distributor beneath the wires and wrote the plug cylinder numbers there. Later I saw that the cylinder numbers are already marked on the timing belt cover. Also my Beru wires have the cylinder number on them.



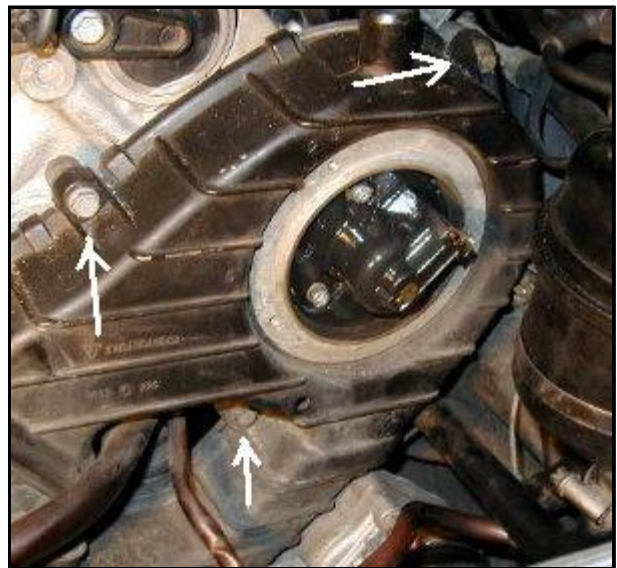
26 - Unplug all the wires (and the coil wire on the bottom) and lay back on the engine. Use a 4mm hex key on the plug wire loom at front/center of engine. Lay this section across the front of the intake manifold.

27 - Loosen the three screws (8mm socket or flathead) from each distributor and lay them aside. Note which is left vs. right.

28 - Disconnect the belt tension sensor from the front of the right timing belt cover.

29 - Detach the oil dipstick guide from the timing-belt cover.

30 - Remove both timing belt covers with a 10mm socket. The left side has three bolts. There are two bolts on the right cover and disconnect the tensioner sensor. Lay the covers aside, with their bolts in the proper holes.





31 - For 5-speed cars (from the Workshop Manual p.15-105): "Remove clutch slave cylinder. Take off clamp on clutch hose holder and remove push rod. Let cylinder with connected line hang down." The two bolts are 13mm.

"Note

Never operate clutch pedal after removing the slave cylinder."

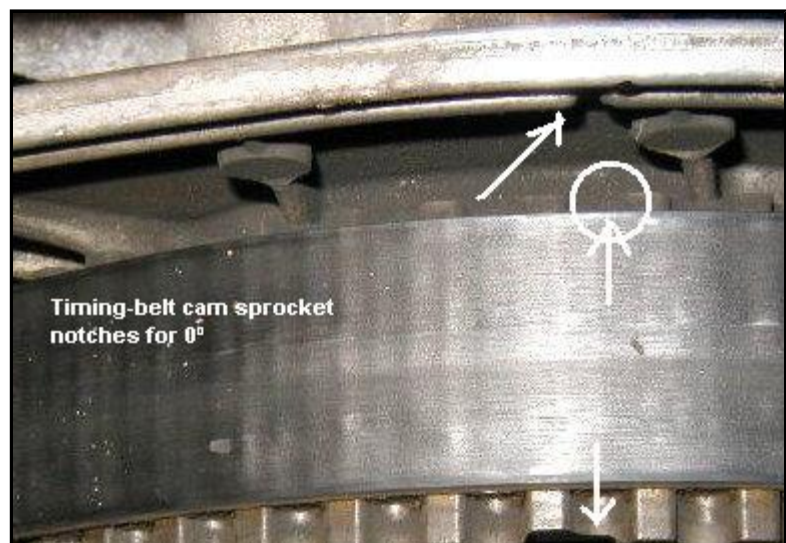
Remove the timing-belt

1 - Use a 27mm (or 1-1/16") socket on the crank bolt. (Wally recommends a 3/4" drive.) Turn crank clockwise to the top dead center 0° mark on the crank pulley. Never turn the engine counter-clockwise. (You *might* consider removing the sparkplugs to make the engine turn easier.)

2 - With the crank at 0° check that the notches on the back of the camshaft sprockets are aligned with the notches in the backing plates.

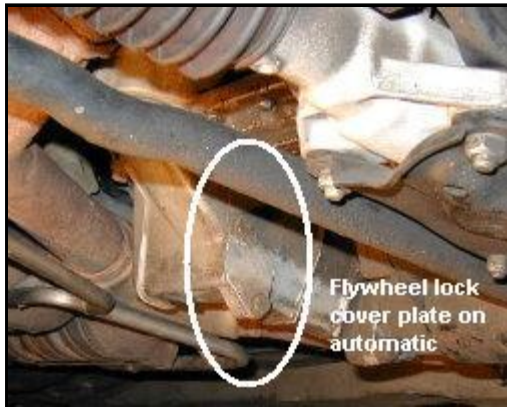
3 - Turn crank (always clockwise) to the 45° mark.

4 - Add marks to each camshaft pulley for the 45° alignment (I used some touch-up paint). According to the Workshop Manual p.15-106, "Camshafts may be turned without damaging the valves after aligning



the 45° mark."

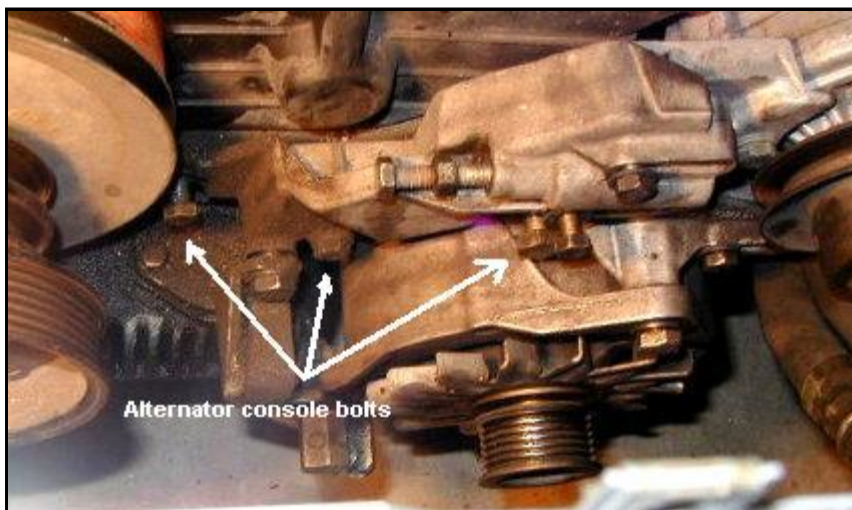
5 - Pull the engine two additional turns to ensure that the added 45° marks continue to align.



6 - Mount the Flywheel Lock (Special Tool 9161/1) with original 13mm bolts to hold the crankshaft. The tool mounts where the clutch slave cylinder was installed. On the automatic cars there is simply a cover plate. The two bolts are short so leave the washers off to snug up the flywheel lock.

7 - Remove the crankshaft bolt. It *should* be torqued to 218 ft/lbs. My bolt was tight but it came loose without too much effort - I did not need the pipe!

8 - Remove the pulleys, and wiggle the vibration damper. The damper will move in very small increments and may take several minutes of wiggling. Also remove the collar.



9 - Loosen console with alternator from engine - two 13mm and one 17mm bolt. This is to provide room to remove the center timing-belt cover. The "console" is a mount/spacer between the engine block and the alternator and power steering pump.

10 - Observe the wiring harness that runs across the front of the engine. This harness comes from the alternator and starter between the left timing-belt cover and the center timing-belt cover, has a smaller split to the connector by the left headlight, and runs back under the right timing-belt cover and up and forward to the jump point. Follow this harness and note the bracket behind the right timing-belt cover.

11 - There is also a wire running from the harness under the right fuel rail and connecting under the right timing-belt cover. Disconnect this.

12 - Disconnect the signal wire running to the A/C compressor.

13 - Disconnect the harness wire that splits to the left headlight connector. Replace that screw so it is not lost.

14 - Disconnect the end of the harness wire at the jump point. Replace the screw/jump contact so that it is not lost.



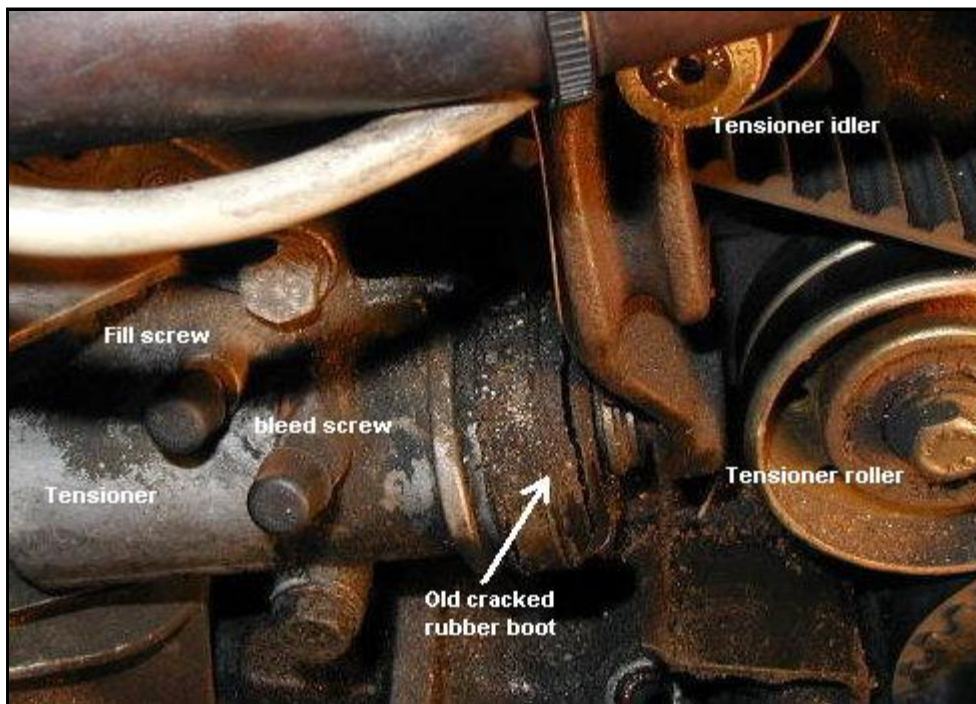
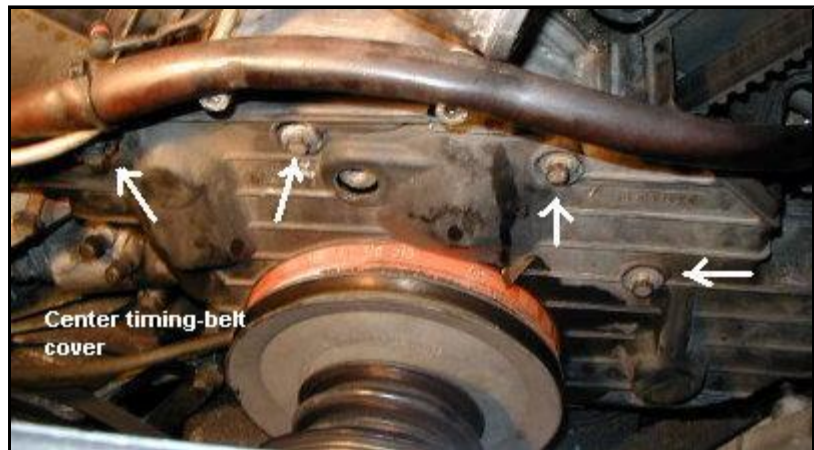
15 - The end of the harness also feeds into a small rectangle connector. Use a screwdriver to carefully pry it in half.

16 - Now comes the most difficult part of this entire project: removing the screwbolt that holds the harness bracket to the right-side engine lift point. A right-angled screwdriver might help - there are simply a lot of lines and hoses there. Put this screwbolt in a safe place.

17 - With the harness free, carefully thread it out to the front of the block.

18 - Clean around the guide tube for the oil dipstick, and then remove it. Some sort of a plug for the hole would be a good idea.

19 - Remove center timing-belt cover - one 13mm bolt that goes into the belt tensioner, and three 10mm bolts (one is long). Be careful to disconnect the timing-belt tension sensor on the inside. Set the cover aside with the bolts in their proper holes.



20 - Slacken the timing-belt by loosening the tensioner lock nut (13mm), and turning the adjusting screw (17mm) counter-clockwise.

21 - Unscrew (Philips head) the metal tensioner sensor strip that runs up the roller bracket. Snug the screw back into place.

22 - Unbolt (4mm hex key) and remove the tensioning roller bracket. This is the arm with two rollers at each end. Be careful not to lose or

mangle the sensor strip or spring, etc.

23 - Remove toothed-belt from right-hand side over cylinder 1-4 camshaft sprocket, water-pump sprocket, cylinder 5-8 camshaft sprocket, oil-pump sprocket and crankshaft sprocket. (p.15-107)

24 - Remove the timing-belt.

25 - With timing-belt in hand high above head, do the 928 Victory Dance. :)



Remove the water pump

- 1 - Temporarily replace the oil dipstick guide tube, but turn it so that it swings away from the water pump. This is to help prevent any spilling coolant from getting into the oil pan.
- 2 - Remove the tensioner idler spindle from the water pump. This is a 19mm nut that threads into the pump - it does not hold the pump onto the block but it does open into the water-jacket, so some coolant may drip.
- 3 - Place the *new* Porsche-rebuilt water pump next to you.
- 4 - Remove the timing pointer from the old pump (two flathead screws) and transfer to the new pump.
- 5 - Remove the fourteen 10mm water pump bolts. First loosen each of them - they are often over-torqued and could shear. Then go back and remove them. As you remove each bolt place it into the corresponding hole of the new pump.
- 6 - The old pump may be held fast to the block by the gasket - do NOT pry it loose. You don't want to gouge an aluminum block around the water pump! A good rap with the wood-handle end of a hammer should do it.
- 7 - Clean off any remaining gasket material from the block.
- 8 - Again remove the oil dipstick tube for room to work.



Remove, rebuild and install the tensioner

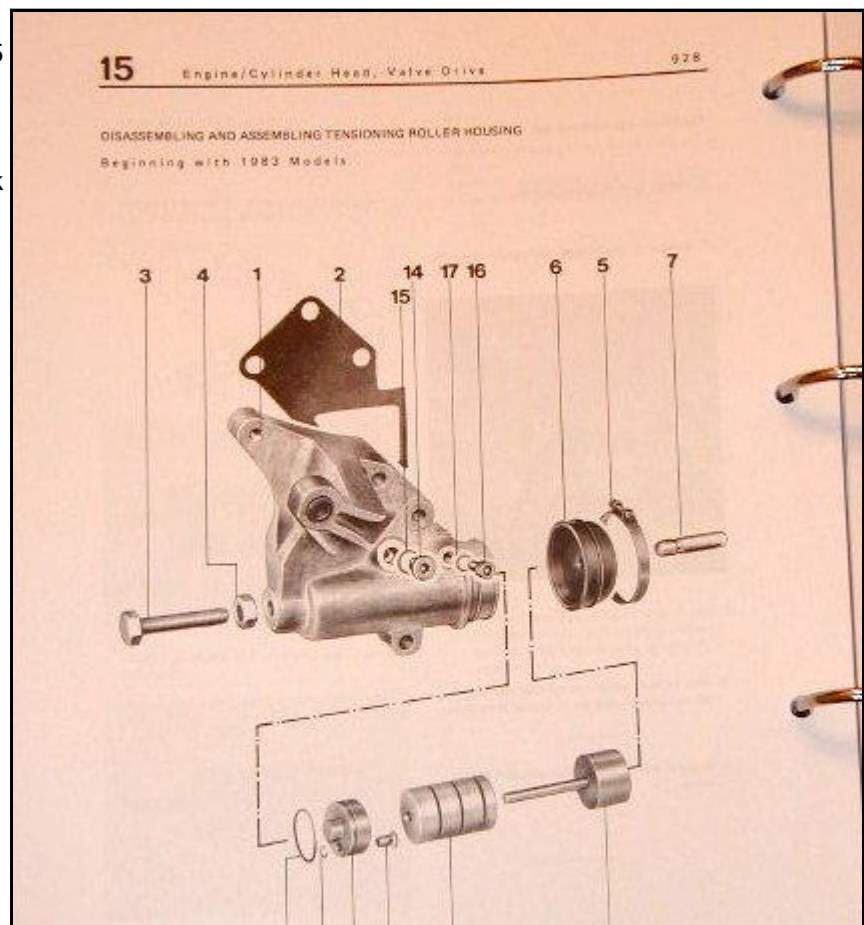
1 - See the manual pp.15-23 - 15-25 for a good picture.

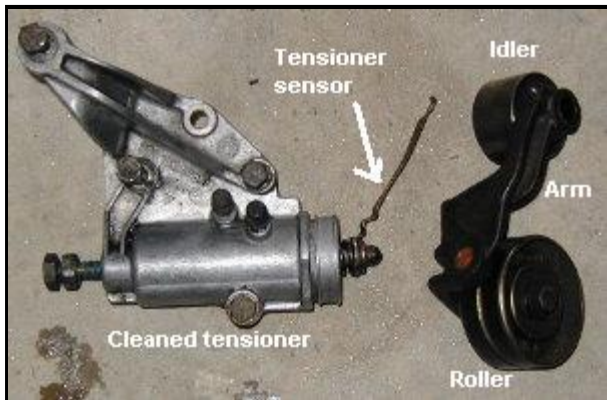
2 - The tensioner is held to the block by four bolts. One bolt has already been removed as part of the upper timing-belt cover. First remove the 13mm bolt that is the pivot for the air pump. I have a rigid A/C line running behind this bolt which was quite an obstacle.

3 - Next remove the remaining two 13mm bolts directly above and below the tensioner cylinder.

4 - Again, the tensioner may be stuck to the block - do NOT pry! Chances are it will fall off with that last bolt!

5 - Carefully note where the bolts came from and lay them aside.





6 - Remove the old rubber boot and clamp (or what's left of it - mine was hardened, brittle, and in pieces).

7 - I did not open the tensioner and clean the inside where the tensioning rod and washers are - I simply forgot all about it! Someone will have to clarify, but I believe you pull the plunger out. When reassembling, use the new rubber O-ring.

8 - Install the new boot and clamp. I used a flathead screwdriver to pry up on the ends of the clamp "pincher" to get a good grip with the pliers.

9 - I replaced both the tension roller and the smaller idler. Remove the roller with the bolt (10mm). Use a 10mm box-end wrench on the other end.



10 - The smaller idler is a press fit held on by a C-clip. A proper C-clip tool would be ideal, but some careful pointy needle-nosed pliers will work.

11 - I used a hammer and knocked the old idler off. :) Do not try the same method for pressing the new one on! It *might* work for you, but I whacked the bearing right out of the roller! I used a C-clamp and managed to press it back in - whew! (how embarrassing it would be: "Uh, Jeannie - don't tell Dave but I need another...") Use a clamp or vise or some sort of appropriate tool.

12 - With the idler in place, transfer the C-clip from the old roller to the new one, and bolt the new roller on.

13 - Turn the tensioner screwbolt counter-clockwise to full loose.

14 - Clean the block and the tensioner of any remaining gasket material from the tensioner.

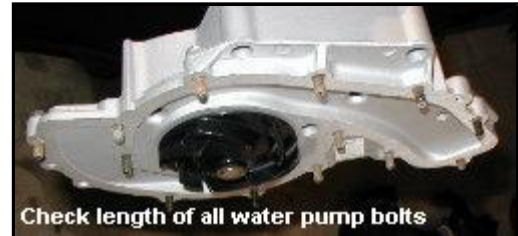
15 - Use a light coating of gasket sealant on the gasket and mate to the tensioner.

16 - Attach the tensioner to the block by first fitting the upper arms to the pivot of the air pump. Good luck with that A/C line if it is blocking your way. Do not tighten yet so that the air pump can still swing freely.

17 - Clean and mount the two 13mm bolts through the tensioner to the block. Check that they are snug.

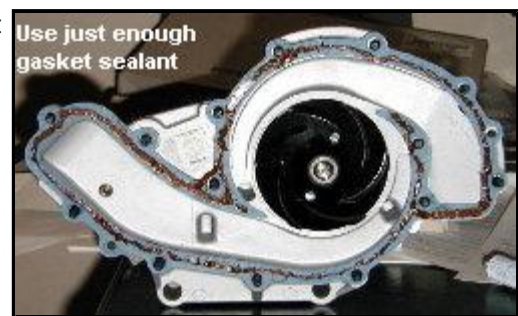
Install the water pump

1 - Hold the new water pump up with the screws in their holes. Inspect the rear making sure that all the screws extend the same distance from the pump.



2 - Lay the *old* water pump next to the *new* pump. Transfer the bolts back to the old pump, cleaning each bolt and spraying with WD-40 as you go.

3 - Use a light coating of gasket sealant on the gasket and mate it to the pump.



4 - Use a light coating of gasket sealant on the block side.

5 - Transfer the bolts from the far left and far right side of the old pump to the new water pump, and attach it to the block. Finger-tighten the two bolts.

6 - Transfer the other bolts to the new pump and finger-tighten.

7 - Snug each bolt. Count each bolt to be sure you snug all fourteen!

8 - Snug each bolt a little tighter and check, check, check.

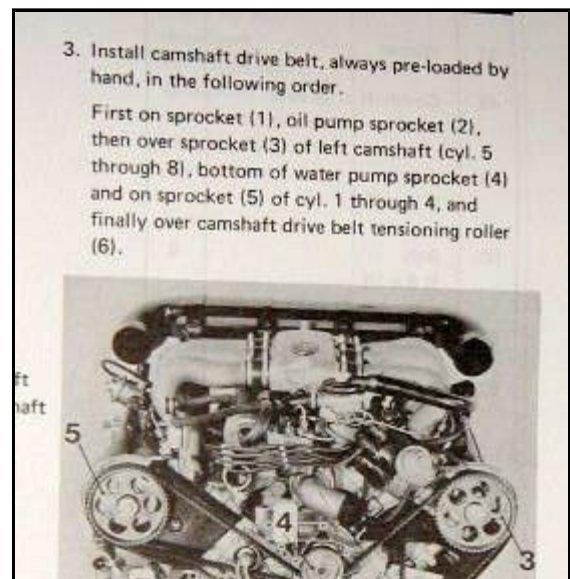
Install and tighten the new timing-belt

1 - According to the Workshop Manuals p.15-107, "Installation of toothed-belt is the reverse of the above sequence." (Ha Ha - I just had to throw that in....)

2 - Start the new timing belt at the crankshaft pulley. Pull it over the oil pump, the left cam sprocket, around the water pump, and over the right cam sprocket. (p.15-14 has a nice photo and instructions.) Turn/adjust the camshafts counter-clockwise as necessary for the 45° marks to line up when installing the belt (it is normal for the valve spring pressure to turn the cam sprockets).

3 - Check that ALL slack in the belt is at the tensioner.

4 - Install the tensioner arm (4mm hex key). Be careful with



the spring and sensor strip. This can be a little tricky getting the sensor into the tensioner arm dimple.

5 - Screw (Philips head) the tensioner sensor strip into the tensioner arm.

6 - Check that ALL slack in the belt is between the right cam sprocket and the tensioner.

7 - Use a 17mm open-end wrench and turn the tensioner clockwise to tighten the belt.

8 - Again check that ALL belt slack is at the tensioner.

9 - Install the center timing-belt cover. One 13mm bolt goes into the tensioner, plus three 10mm bolts (one is long). Be careful to not over tighten the bolts because the cover is plastic.

10 - Install the crank collar and damper. I used a large socket on the damper and *lightly* tapped it in.

11 - Finger tighten the crank bolt and washer.

12 - Temporarily remove the flywheel lock.

13 - Turn the engine to TDC 0° while watching the timing-belt and all movements.

14 - Check timing marks on camshaft sprockets.

15 - Turn the engine two turns and re-check all timing marks.

16 - Using the belt tension tool of your choice, check the belt tension with engine at 0° TDC. Place the tool midway between the right cam sprocket and the tensioner idler (smaller roller). Tighten the belt by turning adjusting the tensioner screw clockwise.

17 - Turn the engine two more turns and re-check the tension. Engine must always be at TDC 0° when checking. The correct value for factory tool 9201 is 5.0 + 0.3.

18 - Turn engine and re-check the belt tension several times.

19 - Refill the tensioner with 90-weight gear oil by loosening the fill (left) and bleed (right) screws (4mm). The gear oil I bought had a nozzle tip and I was able to feed it into a 3/16" clear tube. The clear tube fit snugly over the fill screw. By squeezing the oil container I was able to pressure the oil into the tensioner. It took about ten solid minutes to move 100mL (3+ ounces) into the tensioner before the bleed screw dripped. Tighten both bleed screws.



Install the front of the engine

- 1 - Insert the oil dipstick tube. I used some gasket sealer. Some diagrams in the Workshop Manual (p.17-6b) show the tube with a tightening nut. Mine was simply in a fitting.
- 2 - Plug in the connecting wire for the timing-belt tension sensor.
- 3 - Attach the upper part of the dipstick tube to the center timing-belt cover.
- 4 - Install the console mount for the alternator - two 13mm and one 17 mm bolt.
- 5 - Again install the flywheel lock.
- 6 - Remove the crank bolt and washer.
- 7 - Install the pulleys with the belts in place. From back to front the order is A/C belt (large single pulley), power steering belt, air pump belt, and alternator (thick, ribbed belt).
- 8 - Tighten the crank bolt (with thick washer) to 218 lbs. torque. Again, a 3/4" drive and socket are recommended - check with a local parts store for an available loan or rental.
- 9 - Remove the flywheel lock and replace access cover (on automatics) or clutch slave cylinder (on 5-speeds). Remember the washers with the two 10mm bolts.
- 10 - Replace the upper timing-belt covers. The right side has one short and one long 10mm bolt. The left cover has three short 10mm bolts.
- 11 - Thread the wiring harness across the front of the engine, under the right timing-belt cover and up and forward to the jump point and reconnect the cable and the rectangle connector (clean it first).
- 12 - Reconnect the harness split to the connector near the left headlight.
- 13 - Reattach the harness bracket to the right engine lift point.
- 14 - Reconnect the wire running from the right fuel rail harness to the connector underneath the right timing-belt cover.
- 15 - Tighten the A/C compressor belt and pivot bolt.
- 16 - Tighten the power steering belt with the 13mm adjuster nut. Tighten the two 13mm lockdown nuts and the 13mm pivot bolt.
- 17 - Tighten the air pump belt with the 13mm adjuster nut, 17mm lockdown bolt, and 13mm pivot bolt.
- 18 - Tighten the alternator using the 6mm hex key adjuster and the 17mm lockdown bolt. Do not forget to tighten the pivot bolt if you loosened it.
- 19 - Use a piece of sandpaper and clean the rotor and the contacts inside the distributor.
- 20 - Attach each distributor to its timing-belt cover with a flathead screwdriver or an 8mm socket.
- 21 - Connect the spark plug and coil wires.
- 22 - Attach the front spark plug wire loom to the water pump (4mm hex key).
- 23 - Tie the wiring harness to the spark plug wire loom.

- 24 - Start with cylinder #1 and check that its wire goes to the distributor terminal #1. Continue with #2 and so on until all eight are confirmed.
- 25 - Check the spark plug coil wires.
- 26 - Disconnect the oil cooling line and loosely replace the fan shroud.
- 27 - Reconnect and tighten the oil cooling lines (1-1/4" or 32mm and 1-1/16" or 27mm wrenches) remembering that the side tanks are plastic.
- 28 - From underneath, fit the three tabs at the bottom of the shroud into place, and connect the fan wiring and clips.
- 29 - Tighten the two 10mm screwbolts on top of the shroud.
- 30 - Reattach the air pump filter hose.
- 31 - Tighten the power steering reservoir clamp.
- 32 - Replace the jump point cover.
- 33 - Replace the oil dipstick.
- 34 - Reattach the coolant reservoir hose.
- 35 - Attach the lower radiator hose to the radiator.
- 36 - Attach the upper radiator hose to the water manifold.
- 37 - Fill the engine block with a coolant mix through the upper radiator hose and then connect the hose to the radiator. The mix should be approximately 50/50% aluminum-friendly coolant and distilled water (adjust the ratio to your climate).
- 38 - Fill the radiator through the lower radiator hose and then connect the hose to the water manifold.
- 39 - Fill the coolant reservoir.
- 40 - Check accessory belt tension.
- 41 - Check spark plug wire connections.
- 42 - Test upper, lower, and coolant reservoir hose clamps.
- 43 - Remove tools, lights, etc. from the engine bay.
- 44 - Reconnect the battery ground strap.
- 45 - Cross fingers, insert ignition key and turn. VROOooomm!
- 46 - Set heater to full HOT and fan on maximum.
- 47 - Check engine for leaks and bad noises.
- 48 - When coolant reaches operating temperature the thermostat will open and the lower radiator hose will begin to warm. At that point periodically squeeze the lower radiator hose to help move air out of the system.
- 49 - After the engine has fully warmed, shut it off.

- 50 - Check accessory belt tension.
- 51 - Check radiator hose clamps.
- 52 - Watch for leaks.
- 53 - Add coolant to the coolant reservoir and tighten the cap.
- 54 - Lower car off jack stands, etc.
- 55 - Go for a nervous drive! Listen for odd noises.
- 56 - Check for leaks.
- 57 - Check accessory belt tension.
- 58 - After engine cools, add coolant.
- 59 - Replace engine belly pans.
- 60 - Wash car.

Break it in

- 1 - Continually check for leaks and listen for odd noises.
- 2 - Periodically check accessory belt tension and reservoir coolant level.
- 3 - Check and re-tension the timing-belt after 1500-2000 miles, and then every 15,000 miles.

[928 S4 Page](#)

John Pirtle
October 16, 2006