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1.8T Timing Belt Replacement - Revised

******Feel free to reply or PM any comments to me. -Matt******

DaddyMatt's 1.8T Timing Belt Replacement Writeup

Scope: Replacement of timing belt and tensioner on a 1.8T (AEB) engined 1999 Passat GLS with Tiptronic. (Your engine may vary.) This post is a refinement of my previous **post** on the same subject. Volkswagen's original recommendation on the AEB engine was to replace the timing belt at 105,000 miles (5k after the drivetrain warranty expired...hmmm...). While there *have* been reports of the original belt lasting 105k or even longer, the likelihood of failure before then and high cost of the resulting repairs have lead many to change the belt (and tensioner) at a shorter interval (typically 60,000 miles).

Disclaimers: (Of course, all the pertinent "tear up your car at your own risk" disclaimers apply.) I assume no responsibility whatsoever for damages that an end user may inflict upon their vehicle, themselves or others using information contained herein. Proceed with caution and care when performing modifications to your vehicle. Be advised that making modifications to your vehicle may void your manufacturer's warranty. Follow general safety rules for automotive work. Read and understand the entire procedure before attempting this work. Bear in mind that this writeup was done 6 months after the fact, so not all was fresh in mind. Please bring any errors to my attention so I can correct them. Understand that I'm "not'cho Mama", so don't come cryin' to me if you mess up your car!

Most directions referred to in this write-up are those you would see if you were sitting in the driver's seat ("front" is toward the front of the car, etc.). Bear in mind that photos depicting some operations were taken after the fact. I did not include torque specifications, but any that you may need should be in Chilton/Haynes/Bentley (every Passat owner should own at least one of these, unless they keep their own mechanic on retainer). Please PM me if you find any errors or "opportunities for improvement" in this post! I tried to cover everything, but wouldn't be surprised if I missed something.
BTW, there is now additional AWM-specific info at the bottom of this post.

Props: Much thanks to **Msquared** for proofreading and technical assistance, Jay and Winston for hosting my pics on RMCB5, and **HermanH** for allowing me to crosslink photos from his most excellent "Snubmount" writeup. **Herman's site** has a lot of great info, plus photos from angles that I missed. If you're planning on doing your water pump at the same time, don't miss **Taligentx's** writeup; I'll be printing it next time I do ***MY*** timing belt! Also, there is an A4-specific writeup at **AudiWorld** that has good pictures of timing cover bolt locations, etc.

Tools:
Metric Sockets (3/8" and 1/2" Drive, various sizes)
Torx Bits (3/8" Drive, various sizes)
Allen (Hex) Bits (3/8" Drive, various sizes)
Torque Wrench
Volkswagen Special Tool 3369 or (2) 8mm X 1.25 threaded stock (optional)

Flashlight
Oil drain pan
Bottle of Wite-Out or piece of chalk (for making timing marks)
4"-5" blocks of 2x4 wood (qty 2) (EDIT: Or, if you want to go all-out, you can buy a couple of 1/2"O.D.x4" roll pins from the hardware store to use as sleeves around the bumper bolts, as suggested by Tom aka ms12339.)
"Auxiliary Voltage Input Device" (if you don't want to reprogram your radio stations)
Icy cold beverage of your choice (additional disclaimers may apply)

Parts: (These were the prices and part numbers when I bought them. Pricing for kits and individual parts have changed.)

- 058.198.479 Timing Belt Kit $109.00
  058.109.244 Timing Belt Roller $27.00 (not included in most timing belt kits, but replacing it is a good precaution)
  5PK-1300 Alt/PS Belt (5-rib) $10.79
  4PK-0855 A/C Belt (4-rib) $11.69

I bought my parts for this procedure from **ECS** because of their reputation and great prices. Tom was a big help, Brian was patient (in spite of my numerous questions), Coleen was prompt in getting me the tracking number…and most of their prices can't be beat. The timing belt in my kit was a Dayco, 153 tooth (original was a Gates, though made in Germany), accessory belts are Conti's, downright beautiful looking belts, almost too pretty to hide under the hood!

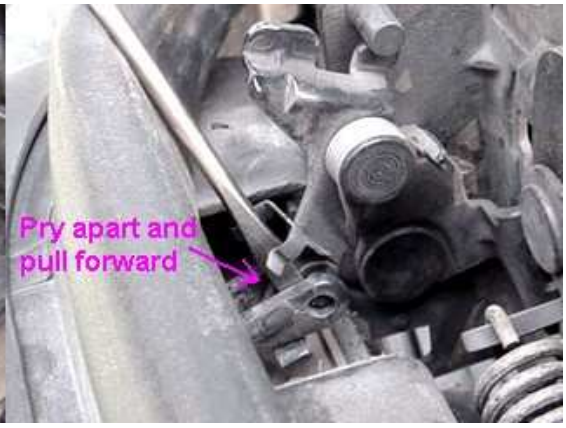
Helpful Hints:
*Consider buying the Haynes manual. It is cheap (~$15), well-written and well-illustrated; a handy reference for now AND later. I studied it in preparation for this procedure and referred to it repeatedly while writing this post (and tried my best to avoid plagiarizing it!).
*I used a clear plastic fishing lure box to keep track of nuts and bolts (Mr. Monk would be proud).

This was a big time saver. Since I was following the Haynes manual, I labeled each compartment with the paragraph number for that step.
If you're about due for new sparkplugs, now would be a good time to change them, since you have to remove them anyway.
*While performing this procedure, take time to check for things like leaky bearing seals, worn/damaged parts, etc.
*If your water pump is leaking (or has a lot of miles on it) you might want to replace it now. The Lock Carrier (LC) must be removed to replace the water pump, so some B5'ers choose to replace it and the timing belt together to save time later. Here's a helpful post on the subject: **Water Pump Writeup** ...though I haven't a clue where B5V6 got the first several pictures from! :wink:
*Now is also a good time to upgrade stuff like the DV (I did), the (dry-rot-prone) OEM vacuum hoses, crankshaft pulley, or N75 valve since they're all more accessible with the LC removed.
*Take care that you DO NOT (inadvertently or out of curiosity) pull the pin on the new tensioner before installing it and the new belt! The spring inside of it is under tension and you will have to compress it in a vise or such to get the pin back in.

Procedure:
1. Put car on ramps, put transmission in Park or Neutral, set emergency brake and block rear wheels. Remove the ignition key for safety.
2. (-optional-)Connect an "Auxiliary Voltage Input" device. This will keep power to your ECU and save you from having to reset the stations on your stereo. I chose to fabricate my own device, which was simply a fused jumper wire that I connected in parallel with the battery cable before disconnecting it. This kept voltage to the electronics, but since it was fused I was protected from the consequences of shorting-out anything with a wrench, etc.

3. Disconnect battery.
4. Remove belly pan. Take a deep breath...now you get to strip a few parts off the front of your B5 so you can put the "lock carrier" in the "service position".
5. Remove the air intake duct, and then remove the front turn-signal corner markers. Each is held in by a single catch and they come out easily, without tools. The catch is a white plastic ring attached to a small spring on the back side of the reflector. Grasp the ring with your finger and pull gently back and to the side (I say "gently" because I have broken the rings off both of mine - without even pulling very hard). Once the rings are unhooked, the reflector assembly slides right out the front. The turn signal bulb and socket will come out with just a push and a twist. Disconnect the headlight wires.
6. Hood latch: The plastic hood-release pull must be disconnected from the hood latch mechanism in order to remove the front bumper cover. Remove the three bumper cover retaining screws shown in the picture below. A plastic cover encloses the hood latch mechanism. Using a knife or a small flat-blade screwdriver, pry up the two small plastic pins that hold it in place, and then remove the cover.

Using a small flat-blade screwdriver (or two), disconnect the plastic hood-release pull from the latch mechanism. It's a bit of a pain to get off, so be patient.



7. Front Bumper Cover: Remove the screws shown in the following photos:

8. Carefully slide the front bumper cover forward and off the car. It's not heavy, but you may want a second set of eyes and hands to help you avoid scratching any of the bodywork. Set it aside in a safe place or let your kid(s) play with it.

9. Front Bumper: While you can leave the bumper on, I think the whole job goes smoother if you get it out of the way (besides, the bumper bolts might come in handy in Step 11!). Simply remove the two bumper bolts and pull the bumper off toward the front. The bumper is all-aluminum, so it's not as heavy as it may look. You may notice that each of the bolts is obstructed by the plastic carrier under the headlights. A bit of twisting and prying will pay off here, but be forewarned, getting them back in is actually a little bit harder.

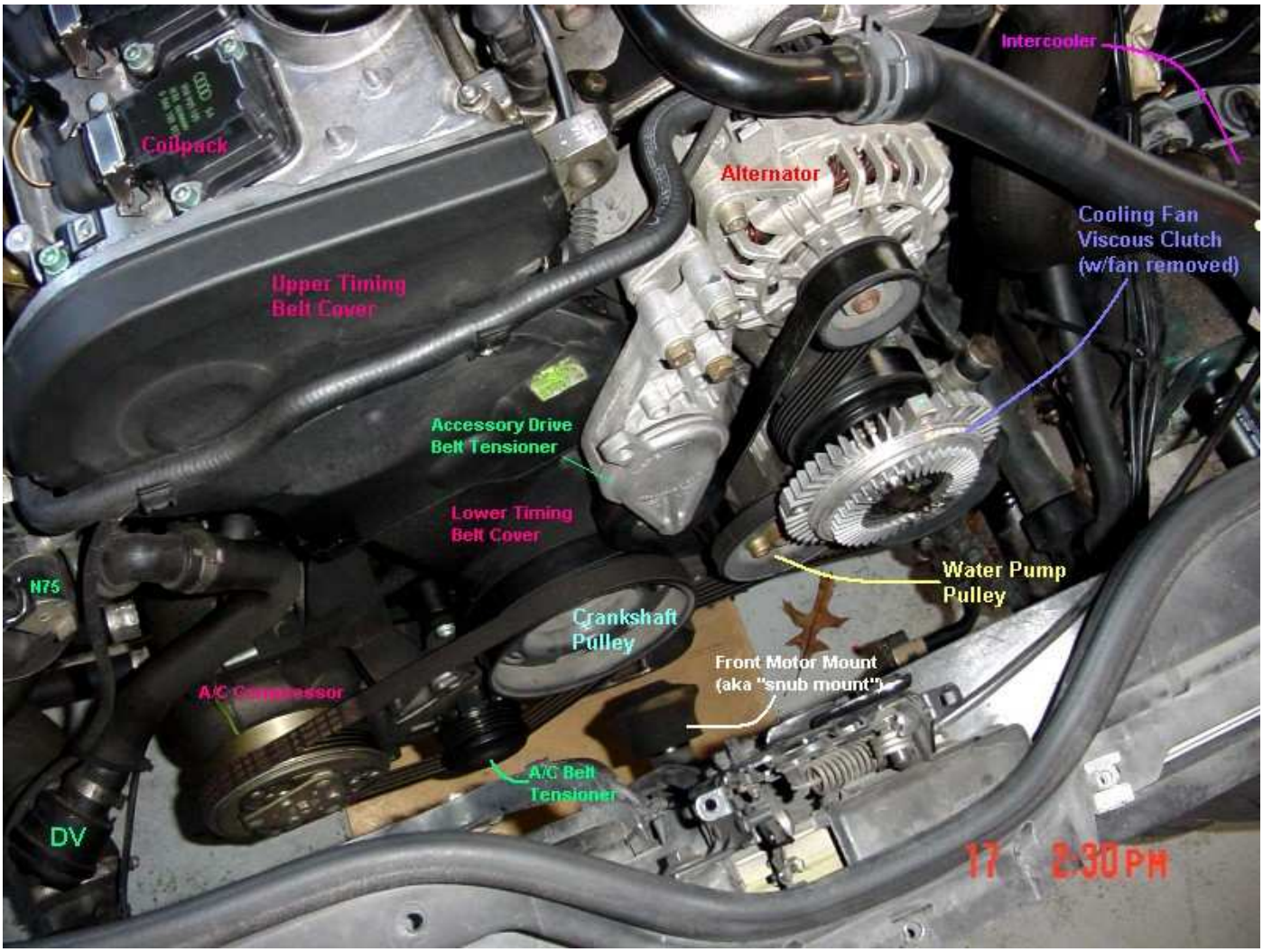
10. Lock Carrier (LC): This part of the body holds the radiator and oil cooler, headlights, horns and some other plumbing, as well as the hood latch. While the LC does not have to be completely removed, it does need to be moved forward several inches to provide the working space needed to change the timing belt. This can be done without draining the radiator, though care must be taken to avoid damaging the various lines that run to it, such as:

- A/C lines to condenser
- Oil lines to oil cooler
- Coolant lines to radiator
- Wires to horns
- Wire to outside temperature sensor

11. Remove one of the four lock carrier retaining bolts on either side of the radiator and replace it with the "Special Tool 3369", the 8mm X 1.25 threaded stock, or my favorite, the bumper bolt removed in step 9. (Note: When I did my car, I bought a couple pieces of 5/16" X 12" threaded stock from Lowes since nobody in my town seems to carry threaded stock in metric sizes. The 5/16" stock will thread (loosely) into the holes, but flexed a lot more than the hardened bumper bolts. I left both the threaded stock and the bumper bolts in place for strength, but I think the bumper bolts alone should be plenty strong. (EDIT: Other members have since confirmed this for me.)

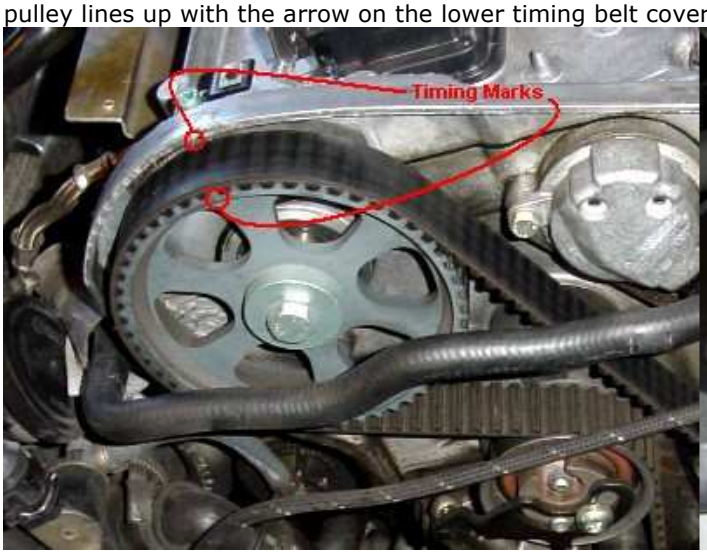
12. Unbolt the power steering oil cooler line and outside temperature sensor from the front of the LC. Also, remove the small retaining clip that secures the temp sensor's wire.

13. Disconnect the intercooler intake hose from the rigid pipe that forms the bottom of the LC. Place the oil drain pan under the end of the hose before disconnecting it; it is not uncommon for a few tablespoons of oil to pour out of the hose when disconnected. This is a "1.8T thing" and no cause for alarm. If you wish, you may use this opportunity to remove the hose entirely, wipe it out and spray some parts cleaner into the intercooler to dissolve any oil deposits that may have built up inside it.
14. Now that everything that needs to be disconnected is disconnected, start SLOWLY pulling the LC forward, into the service position. Do this carefully, making sure that no hoses or wires get pulled excessively or pinched. You will feel some resistance since you are pulling on the radiator hoses. Pulling the LC forward should give you plenty of working room without your having to disconnect the radiator hoses. Place the 4" 2x4 blocks between the LC and its two mounts to hold the LC in the service position.
15. Take a break to catch your breath and gaze upon the 1.8T in all its glory! Now you should have plenty of room to do the work you came here to do. Now would be a good time to take a break for lunch or the icy-cold beverage of your choice. This is also a good time to take a good look around the front of the engine for oil leaks, cracked hoses or anything else that will be easier to fix "while the patient is lying open on the table". The view from in front of your car should now be something like this:

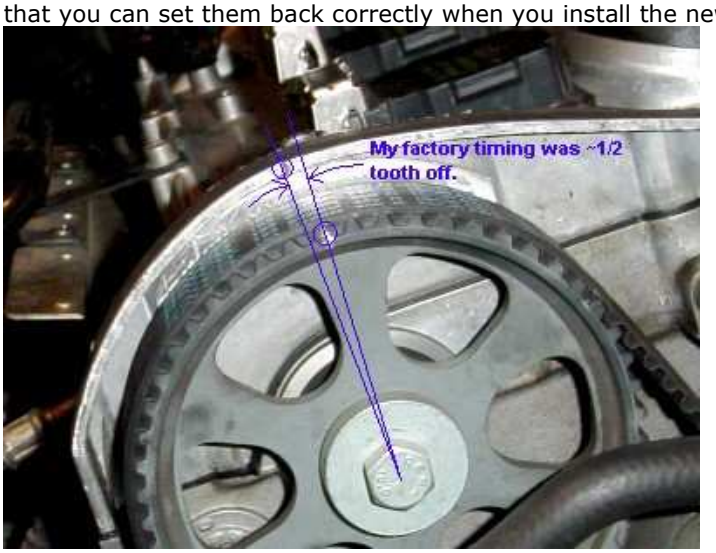


16. Timing Belt (finally): Start by removing the plastic engine cover, to expose the coilpacks. The three fasteners that hold it are loosened by turning them 90 degrees counterclockwise.
17. Remove the cooling fan. If you wish, you can also remove the fan's viscous clutch for more working space. At this point, you may want to break the crankshaft pulley bolts and water pump pulley bolts loose. If you don't, you'll need to secure each pulley with a drift or strap wrench to break the bolts loose after the belts are removed.
18. Using the Wite-Out or a piece of chalk, mark the A/C, alternator and water pump belts with arrows to show the direction of rotation. This may not be necessary if you are replacing all three, but a good precaution in case one of your new belts doesn't fit.
19. A/C Belt: Loosen the two Allen bolts holding the Tensioner and rotate it to remove the belt.
20. V-Belt (a.k.a. water pump belt): Remove the three Allen bolts from the two-piece water pump pulley. Remove the front half of the pulley and the V-belt. If you reside in the northern climes where they salt the roads, you'll probably want to hit the bolts with a couple shots of 3-in-1 Oil or PB Blaster to help loosen them up and coat them with anti-seize when you put them back in.
21. Accessory Drive Belt (a.k.a. alternator belt): Using an open-end wrench (EDIT: or a 3/4"x3' pipe...according to Carlos, aka passat_ts), rotate the tensioner, remove the belt and slowly release the tensioner. Remove the three bolts holding the drive belt tensioner and remove the tensioner.
22. Remove the upper timing belt cover. Pay attention to how it fits together with the lower cover; this will make reassembly easier.
23. TDC: To ensure your engine is timed correctly when the timing belt is replaced, you will need to set the engine's timing so that the No. 1 piston (closest to front of engine) is at Top Dead Center (TDC) on its compression stroke before you remove the old timing belt. The next two steps cover this procedure.
24. Sparkplugs: (You will need to remove the sparkplugs to relieve cylinder compression so you can hand-crank the engine to line up the timing marks.) Remove the coilpacks. Using a special "narrow access vacuum tool", clean out any dirt, etc. that may have fallen into the sparkplug wells. Remove the sparkplugs.

25. Using a large socket wrench or a breaker bar, slowly hand-turn the crankshaft pulley clockwise until the timing mark on the camshaft sprocket lines up with the mark on the front of the valve cover AND the timing mark on the crankshaft pulley lines up with the arrow on the lower timing belt cover. When they all line up, the engine is at TDC.



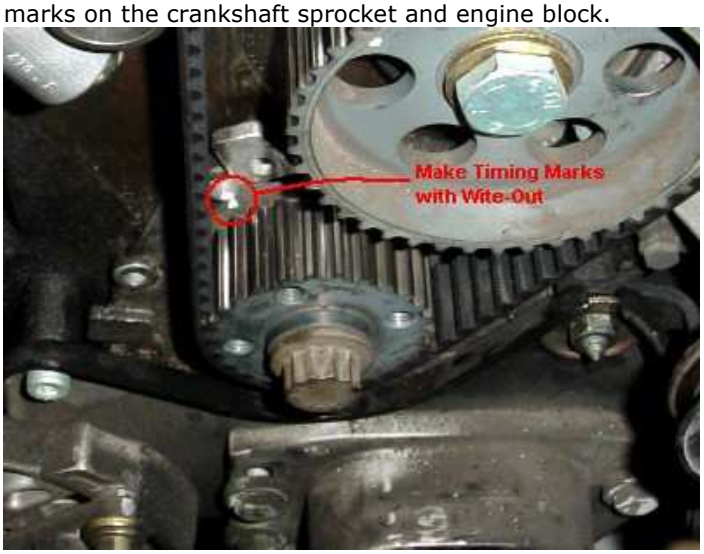
26. You may notice, as I did, that the timing marks do not line up exactly, but may be off by a half-tooth or so. This is no big deal, but be sure to note which direction they are off (or better yet, take a picture if you have a digital camera) so that you can set them back correctly when you install the new belt.



Update: A few other members have noted that on their engines the camshaft timing "leads" the crankshaft timing by about a half a tooth or so, especially after the new belt is installed. Apparently, this is part of the engine's design, so that if the belt stretches slightly over time, the timing will improve instead of getting worse.

27. Remove the four small bolts from the front of the crankshaft pulley (but NOT the big one in the center), verify that

the crankshaft is still at TDC, and then remove the pulley itself.
28. Remove the nuts/bolts for the lower timing belt cover; then remove the cover itself. After you have done this, you may realize that your timing marks for the crankshaft are now in the pile of parts on the garage floor. Before you do anything else, verify that the camshaft pulley timing mark is still at TDC and then use your Wite-Out to make new timing marks on the crankshaft sprocket and engine block.



29. Visually inspect the crankshaft sprocket, camshaft sprocket and intermediate sprocket for damage or wear. Replacement of any of them is outside the scope of these instructions; you will need to refer to Chilton/Haynes for further instructions, and your dealer for the parts.
30. Using chalk or Wite-Out, mark the old timing belt, indicating the direction of rotation (clockwise), just in case you have to reuse it.

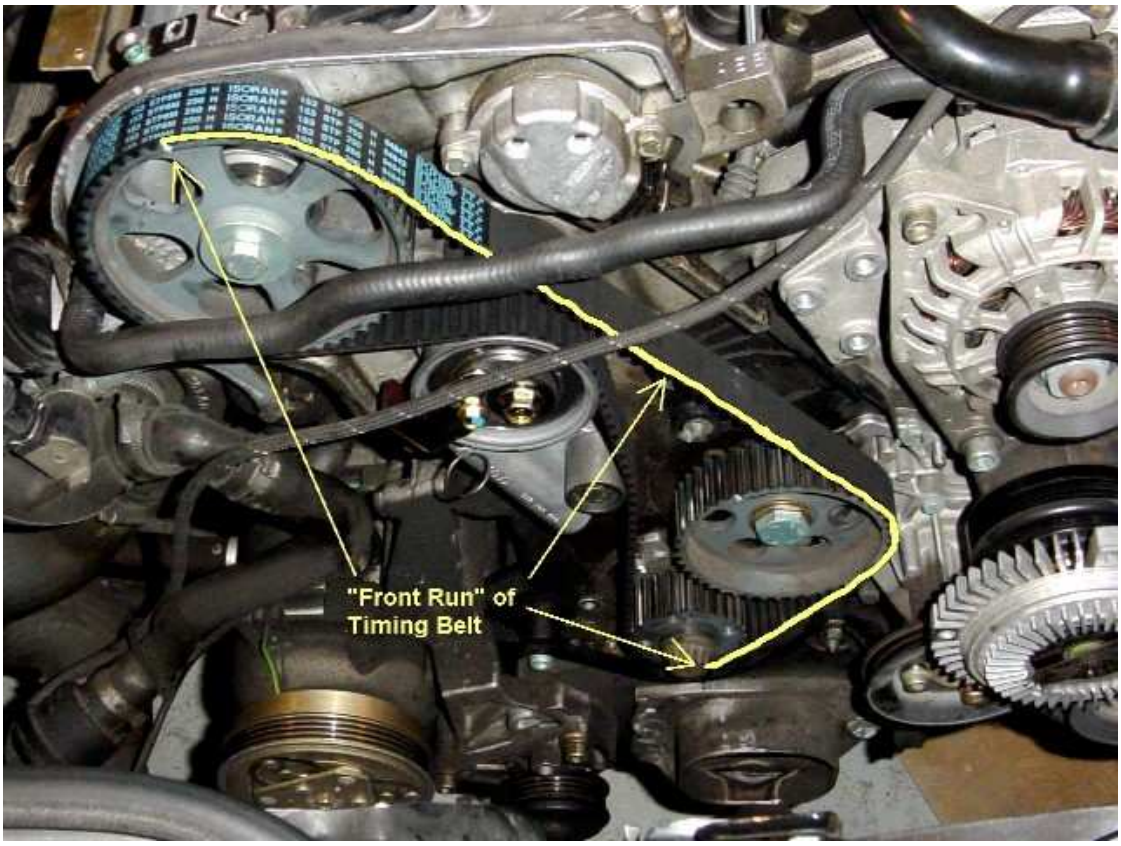
31. Now we reach the moment of no return...time to remove the factory timing belt and (evil) OEM tensioner. Release tension on the belt by loosening the adjustment bolt on the tensioner.

32. Remove the timing belt; try not to kink it or move either the camshaft sprocket or crankshaft sprocket. Visually inspect the belt for damage, uneven wear and contamination. Correct the causes of these conditions before proceeding.
33. Remove the timing belt tensioner. Hide it in the bottom of your toolbox and circle the next new moon on your calendar (so you can bury this accursed abomination in your back yard under cover of darkness)! Remove the stud that the old tensioner pulley rode on; the new pulley uses a bolt instead.

---Intermission!--- Visit the snack bar or just take a short break if you wish. If you're just reading this write-up for the first time, you're probably about due for a break as well. Visit the **"Fun Pictures"** link...maybe you'll want to add your own later.

34. Now it's time to start putting stuff back together!
35. Bolt the new timing belt roller onto the new tensioner (just hand-tighten for now). Don't bolt it to the engine yet; we'll do that later. Bolt the new tensioner pulley onto the front of the engine. The pieces go together like this:

36. Installing the new timing belt: *Banish any small children from the work area, especially if you are given to the utterance of expletives.* Loop the timing belt around the crankshaft sprocket, up over the intermediate sprocket and around the camshaft sprocket (take care to not twist, crimp or tightly bend the belt). It is a fairly tight fit, so it sounds easier than it really is...you may need to slide the belt onto the sprockets to get it on. You may even want to thread the belt on *before* installing the tensioner pulley. The most important thing (along with observing your timing marks) is to **make sure that the 'front run' of the belt (crank-intermediate-cam) is tight and any slack is on the part of the belt that runs past the tensioner pulley.** I found that hand-turning the crankshaft sprocket a tooth or so counterclockwise made it easier to engage the belt's teeth with the correct teeth on the sprocket; then, when the tensioner is engaged, everything lined up correctly.



37. Bolt the new tensioner onto the front of the engine. Start by hand-threading the lower-right (facing the engine) bolt into the engine with the tensioner rotated somewhat counterclockwise from its final position and then rotate the tensioner clockwise until you can hand-thread the other bolt. Torque these two bolts and the timing belt roller bolt to specifications (remember, the roller's bolt was only hand-tightened when we bolted it to the tensioner). Your engine should now look something like this gratuitous large photo of front of 1.8T:

38. Now that all the timing components are assembled, take a moment to verify that the timing marks on the crankshaft sprocket and the camshaft sprocket line up correctly. If they do, you can "pull the pin" to engage the tensioner. (This is one of life's watershed moments, like getting the training wheels off your bike or cutting your child's umbilical cord, so take a moment to enjoy it!)
39. Check timing again: Slowly hand-crank the crankshaft 720 degrees (two complete rotations). Watch for correct timing with the camshaft and listen/feel for any interference between the valves and the pistons. Reinstall the lower timing belt cover and crankshaft pulley (before installing it, take a moment to examine it and the upper cover to see how they fit together). Re-re-check the timing marks and the 'front run' tension of the belt. Torque the crankshaft pulley bolts to specifications (if you are using a drift to hold the pulley).
40. If all is well, you are now at the "installation is the reverse of removal" stage. Reinstall the upper timing belt cover. If you paid attention to how it came apart, it should go together easily.
41. Reinstall the sparkplugs, coilpacks and plastic engine cover.
42. Reinstall the accessory drive belt tensioner and reinstall/replace the accessory drive belt.
43. Reinstall/replace the V-Belt and two-piece water pump pulley. If an extra hand is available, this would be a good time to call it into service. The two-piece water pump pulley is a bit of a pain to put back together but at least you know it's correctly tensioned once it's done.
44. Reinstall/replace and re-tension the A/C Belt.
45. Torque the crankshaft pulley bolts to specifications (if you didn't use a drift).
46. Reinstall the cooling fan clutch (if you removed it).
47. Reinstall the cooling fan. Torque to specifications.
48. Remove the 4" 2x4 blocks. Slowly and gently slide the LC back into position, taking care to not pinch any wires or hoses.
49. Reconnect the intercooler intake hose and bolt the power steering oil cooler line and outside temperature sensor back in their respective positions. Reinstall the clip holding the sensor wire.
50. Reinstall the eight lock carrier retaining bolts and remove whatever you used for your "Special Tool 3369". Reinstall the front bumper and bumper bolts.
51. Carefully slide the front bumper cover back onto the front of the car. You might want to get your second set of eyes and hands if they did a good job back in Step 8. Install all the screws you took out when you removed the cover.
52. Reassemble the hood latch. The plastic hood-release pull snaps right in...much easier than disassembly! Carefully reinstall the plastic cover; the plastic pins bend easily if not reinserted properly.
53. Reconnect the headlight wires. Reinstall the front turn-signal corner markers. Reinstall the air intake duct.

54. Reinstall the belly pan.
55. Reconnect the battery.
56. Remove your "Auxiliary Voltage Input" device, if you used one.
57. Clean up your tools, etc., take the car off the ramps and road test it.
58. Buy yourself a $300 mod with the money you just saved!

Summary: All-in-all, this job took me 12 hrs from start to finish, including stopping to run to town for threaded stock, eat dinner on the workbench and take about 50 pictures. Next time it should be about a 4-hr job. So, was it worth doing myself? Let's see:

- Parts: $265 (though I'm saving the water pump for later)
  Tools: $45 (Hex bits, Torx bits and 5/16 threaded stock)
  Book: $15 (Haynes manual)
  Digital Camera: $325 (What can I say...I had to take pictures for the writeup!)
  Total: $650 (about the same as the dealer's price to replace belts and tensioner)

I got a real feeling of accomplishment out of doing this job myself, and know it will be a (relative) breeze next time. Also, I learned a lot about my car and how to fix it myself. For the price, I took care of the timing belt and my stock DV, before either went bad. I've got a water pump for later, some new tools, and a digital camera! Not a bad deal in my book.

Bonus: Here are some additional pointers specific to the AWM engine, courtesy of **pete1** (EDIT: I am adding pete1's pointers verbatim, so terminology may vary, additional disclaimers may apply, yada yada.)

- Timing belt on an AWM engine:

Starting from the camshaft gear (at the top) and going clockwise:
(1) camshaft
(2) water pump
(3) crankshaft
(4) idler pulley
(5) tensioner pulley

>>>Thanks Madman65 (Brian) for taking the pics!<<<

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Backing off the "new-style" tensioner on an AWM engine:

(1) Undo hex nut on the face of the tensioner pulley 1/2 turn, or as needed to release "tab plate" and let the cam relax -- you'll see it let go as soon as you turn enough.

(2) Insert allen wrench in hex hole on tensioner pulley. Slowly rotate COUNTERclockwise to depress oil-filled plunger on left side of tensioner assembly (This could take 5+ minutes -- go slowly). I used a screwdriver tip to press directly on the plunger, but it's not necessary. (see pic, above)

(3) Have a friend hold the tensioner in this position while you pull the old timing belt off the gears.

(4) If replacing tensioner (recommended) - Unbolt the tensioner from the front of the engine and set aside. Clean up the exposed part of the engine, and bolt the new tensioner in place. Do not pull the "pull tab" out from the plunger tip.

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Activating the new-style tensioner on an AWM engine:

(after new belt is in place, lined up, and timing is checked)

(1) You still have the pull tab in place at the tip of the plunger, right?

(2) Loosen the hex nut at the face of the tensioner just enough to turn the tab plate. Use a tool such as this... (Pin Wrench - p/n ZDM-ST12717 – www.zdmak.com) ...to turn the tab plate COUNTERclockwise, while holding the hex nut with a socket. This rotates a cam that pushes the tensioner pulley further into the belt, tightening it.

(3) While turning the tab plate, have a friend jiggle the pull tab and let you know when you have turned the tab plate just enough to loosen the pull tab. Tightening too much can cause problems.

(4) Tighten the hex nut to hold the tab plate in position.

(5) Double-check that the flange on the tensioner pully is not bearing on the plunger housing. There should be a gap so the plunger is doing all the work.

(6) Take out the pull tab -- Done.

The idea is that the tab/cam rotates the pulley to provide the initial tension in the timing belt. As the belt loosens, the plunger pushes up on the tensioner pulley to keep sufficient tension in the belt. The oil and valves in the plunger allow the plunger to move upward easily (tightening the belt), but don't allow the plunger to drop back down (loosening the belt).

Last edited by DaddyMatt : 09-18-2005 at 06:20 PM.

Quote

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