Installation Procedures

Audi A4 1.8T Ultimate Timing Belt Kit Installation ES#8146

Procedure: Install ECS Tuning Ultimate Timing Belt Kit - P/N ES#8146

Application Notes: This kit fits A4 1.8T up to model year 2004 - up to VIN# 8E 4 191 000

Kit Contents:

- Timing belt
- Accessory drive belt
- Tensioner roller
- Camshaft seal
- Crankshaft seal
- Hydraulic tensioner assembly
- Metal impeller water pump
- Replacement TTY crankshaft bolt
- Crank pulley bolts (4)
- 2- 1.5 liter G12 coolant

This kit installation has been performed in-house at **ECS Tuning**, using our **Ultimate Plus Timing Belt Kit**, **ES#8146.** Getting dirty gives us hands on experience and let's us verify installation procedures. We experience issues you may encounter.

This piece is not intended to replace every detail of the factory-defined procedure. It is a supplement. Should any question arise that is not covered here, we urge you to reference the OEM-approved repair procedure.

We use common generic shop tools when possible for widest application; OEM authorized special tools are expensive and less available outside dealerships and import repair specialists.

This tutorial is provided as a courtesy by ECS Tuning.

Proper service and repair procedures are vital to the safe, reliable operation of all motor vehicles as well as the personal safety of those performing the repairs. Standard safety procedures and precautions (including use of safety goggles and proper tools and equipment) should be followed at all times to eliminate the possibility of personal injury or improper service which could damage the vehicle or compromise its safety.

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Safety First
Conventional wisdom says: Disconnect the battery before doing this repair. Our attorney agrees.

However...
Disconnecting the battery has a dark side you ought to know about. Doing so erases all volatile memory in your vehicle computer. This commonly includes electronic throttle control learned positions. Some vehicles will not idle following a power down until throttle position data are restored with a scan tool and the correct vehicle software.

> Additionally, other driver preferences, antitheft radio code, radio presets and clock, and OBD II emissions data will be erased if battery power is removed. This is an important consideration if your vehicle is subject to a scan tool emissions test; erasing computer memory resets all OBD II monitors to incomplete, and your vehicle will not pass its emissions test until a global drive cycle completes all non-continuous monitors.

If you choose **NOT** to disconnect the battery, remove the ignition key and gather all copies of the ignition key and lock them away. Better still, mail them to yourself so nobody can crank over the engine or power up the ignition system until tomorrow's mail arrives. If you crank the engine over with the T-belt removed, ***you will bend valves.***

Other Cautions
Work carefully to avoid damaging wires and connectors. Avoid any test procedure that damages wire insulation or creates a short circuit—to voltage, ground, or another circuit. Failure to follow these and all other safety precautions and approved shop practices can result in costly vehicle damage and serious personal injury.

Read the instructions completely before starting! Obtain all required tools. Reference factory repair instructions, when in doubt. If the installation procedures are beyond your tools and skills, contact a qualified installer for professional assistance.

Audi A4 1.8T
Ultimate Timing Belt Kit Installation ES#8146

Preparations

Tools Required:
- Drain pans for coolant and power steering fluid
- Assorted Torx® drivers
- Assorted Allen sockets
- Assorted sockets, including 17 mm for camshaft nut and 19 mm 12-point for crankshaft nut.
- 17 mm open end (to rotate accessory belt tensioner)
- Torque wrench
- Snap ring pliers (or VW tool for tensioner pulley)

Tightening Torques
- Water pump bolts - 15 Nm
- Drive belt covers - 10 Nm
- Accessory belt tensioner to block - 23 Nm
- Drive belt tensioner pulley retaining nut - 27 Nm
- Camshaft sprocket bolt - 65 Nm (48 ft-lb)
- Crankshaft sprocket bolt - 90 Nm (66 ft-lb) plus ¼ turn (TTY bolt - always replace)
- Crankshaft pulley retainer bolts 10 Nm plus ¼ turn (TTY bolt - always replace)

Special Notes
No radiator drain plug - remove ECT sensor from bottom hose or pull bottom hose.
No radiator hose clamps - release clip attachments

Audi A4 1.8T
Ultimate Plus Timing Belt Kit Installation ES#8146

Vehicle Overview

This Audi A4 comes to us with 152,000 miles on the odometer. It's hemorrhaging coolant; the recovery jug is desert dry. There's a slow, steady trickle from the lower timing cover, directly below the water pump.

We pop the top timing cover, and sure enough, the water pump is the source of our leak. The timing belt is way loose, and fits the cam and crank sprockets like socks on a chicken. It's time to show the A4 some love.

At this mileage, we'll go all out and use the **ECS Ulimate Plus Kit (ES#8146)**, since it includes new timing and accessory belts, new cam and crank seals, a new crank sprocket bolt, four new crankshaft pulley bolts, timing belt tensioner assembly and roller, water pump with metal impeller, and two jugs of fresh Pentosin 12 coolant.

Access is the main challenge. If this engine is on a stand, belt and pump replacement is much easier. But the 1.8T is a shoehorn fit in the A4 engine bay. We're talkin' size 12 foot in a size 10 shoe. The front of the engine is *über* close to the electric cooling fans and to the radiator/header support member that spans the front of the vehicle. You can get your hand in there, but forget about actually working on the front of the engine.

Since this is a photo shoot (and we don't have a camera that shoots around corners!), we'll strip off everything in front of the engine: front bumper, radiator, condenser, headlight assemblies, and radiator fan support member.

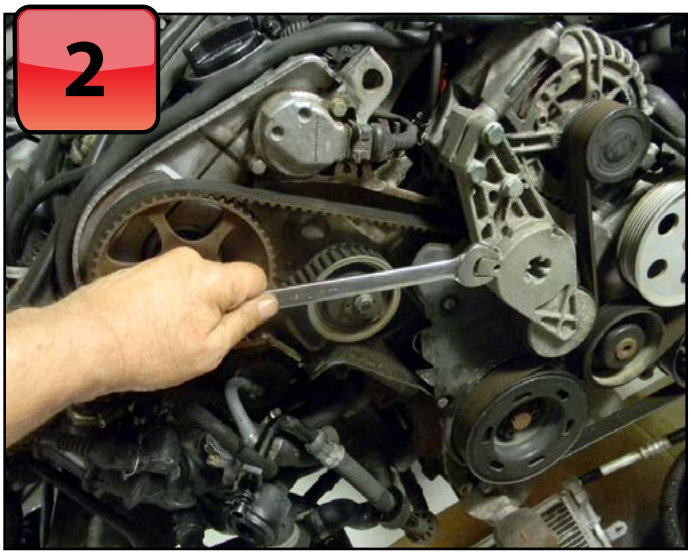
FYI, there is a service access compromise. Special tool hanger bolts are available for this job from the VW/Audi special tools people. They're nothing more than a couple of long, hardened bolts with metal tube collars that let you hang the front header away from the engine. Screw the bolt hangers into special threaded holes in the front bumper flanges, then loosen the front end and slide it forward several inches. This adds wiggle room and improves visibility; a tad. First-timers may still find working in close quarters challenging. Flat rate techs who do these in their sleep are already draining the coolant.

We'll admit that removing the whole front end must seem like a LOT of work. It is, sorta. But once everything is exposed, it was great seeing our work. If this is your first time through this procedure, you may want to take the long way home; it may be the shortest route.

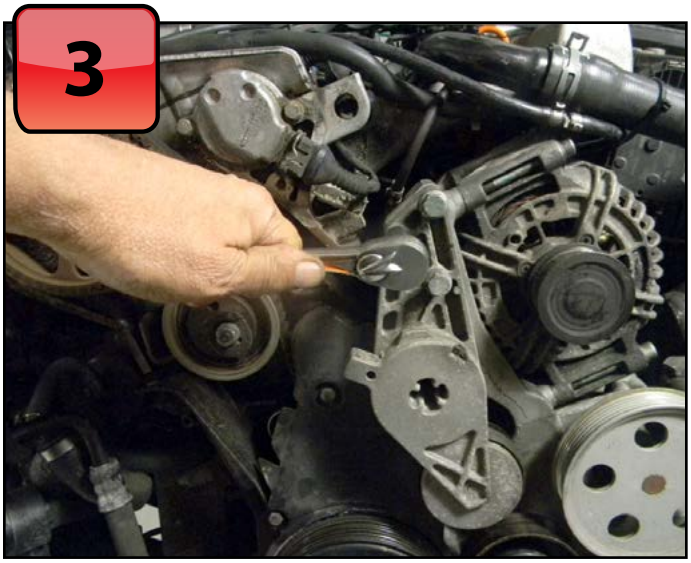
Section 2 - Belt Replacement

Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146

Our sequence starts with the front of the car removed, and the front of the engine exposed. Remove the timing covers. The top cover is held in place by two spring clips; no bolts.



Remove the accessory belt. Rotate the tensioner to leave enough slack in the accessory belt to remove it. Use a 17 mm open end to rotate the tensioner clockwise.

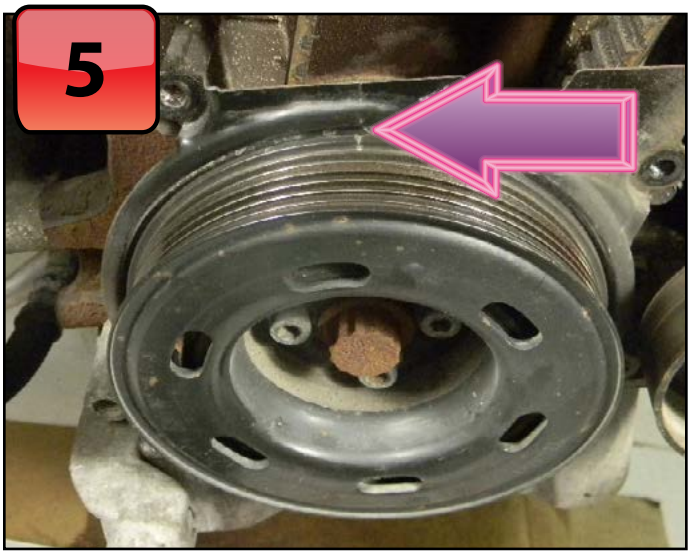


With the accessory belt removed, unbolt the tensioner assembly and remove it. Three bolts.

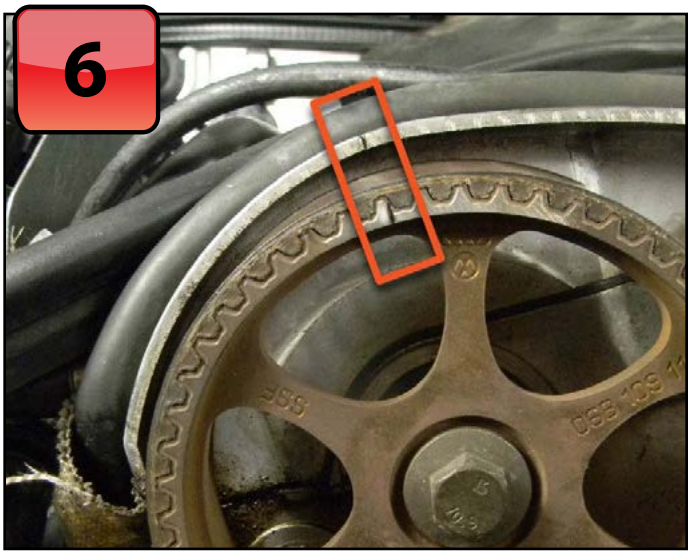
Remove the three middle cover bolts. Remove the middle cover. The bottom cover cannot be removed until we remove the crank pulley.

Section 2 - Belt Replacement

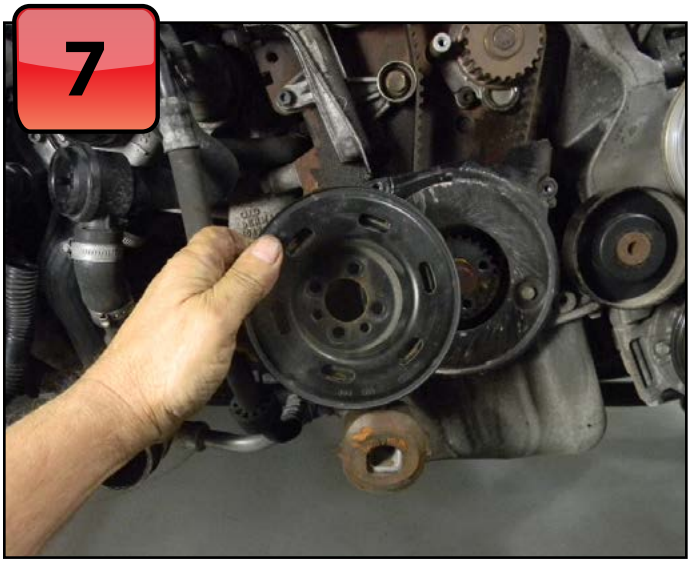
Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146



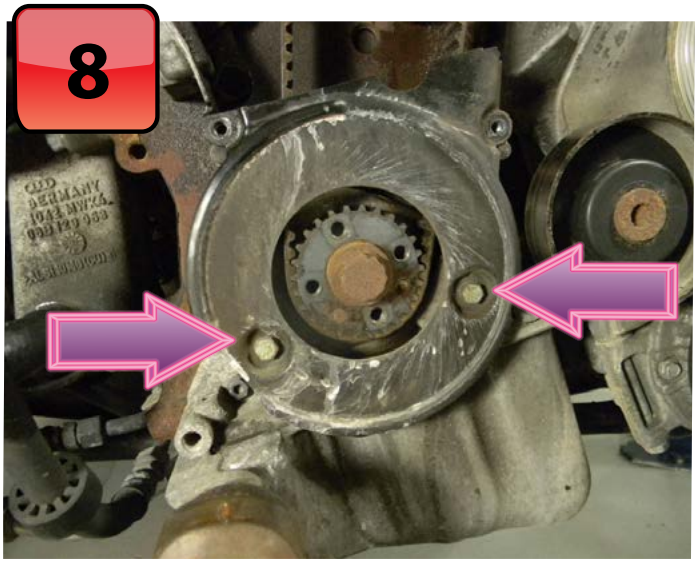
Bar the engine over by hand using a 19 mm 12-point wrench or socket. Align the timing mark on the crank pulley with the mark on the bottom cover. Check the cam sprocket timing mark at the same time (step 6). If it does not align with the match mark on the rear cam housing cover, rotate the crankshaft clockwise 180 degrees.



Make sure the timing marks on the cam sprocket and timing cover housing are aligned, as shown. Orange box added for emphasis.



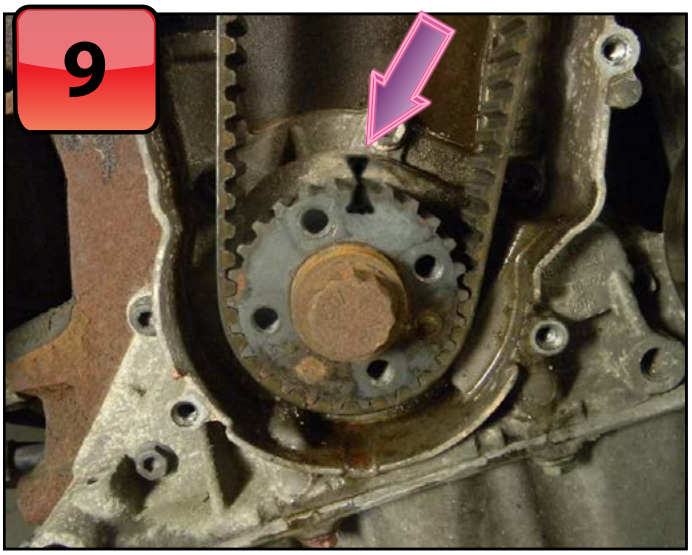
Being careful **not to turn the crankshaft**, unscrew the four Allen bolts holding the crankshaft pulley; remove it, without turning the crankshaft!



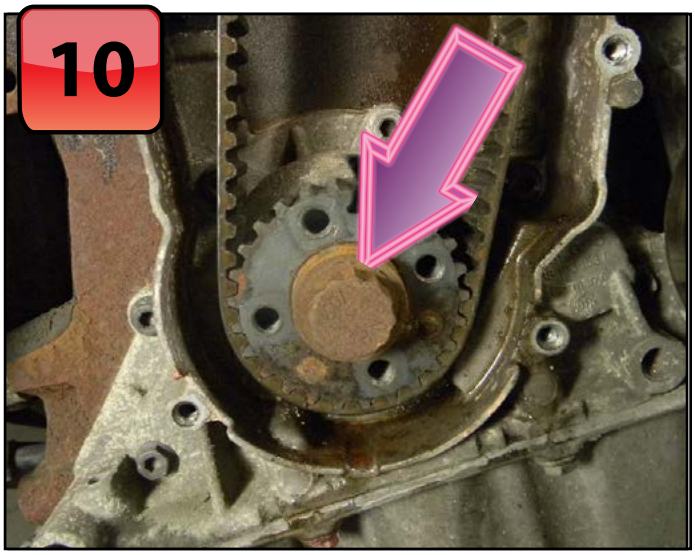
Remove the two lower cover retaining bolts. Remove the lower cover.

Section 2 - Belt Replacement

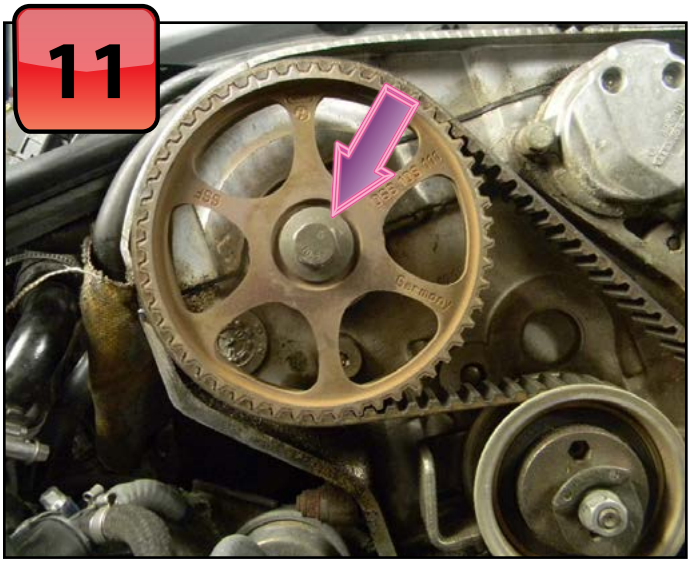
Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146



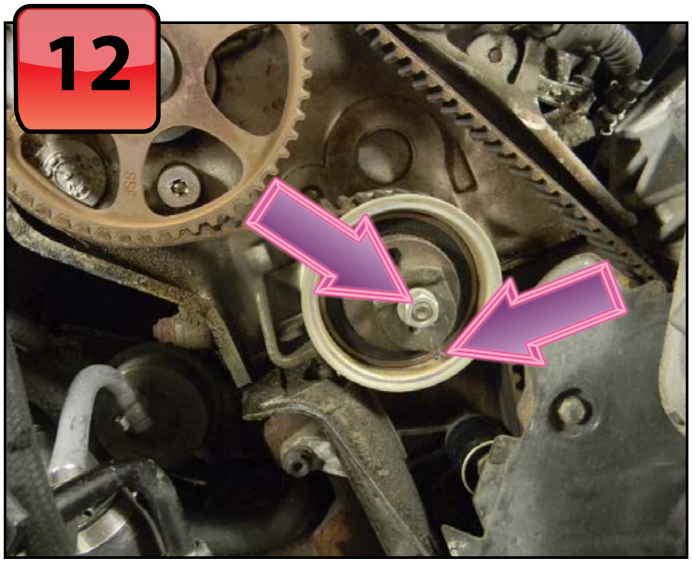
Do this immediately: Get a black felt tip pen. Make match marks: on one tooth of the crankshaft sprocket and another on the engine. Mark the top of the tooth, too. This step is very important. We will need these marks later to confirm crankshaft position as we install the new timing belt.



Remove the crankshaft sprocket retaining bolt. This may be a lot easier said than done. The bolt size is a 19 mm 12-point. This bolt laughed at our ½ inch impact, an Ingersoll with hair on its chest that commonly takes no prisoners. We fired up the torches and heated the bolt to soften up the thread locker, and it came out.



Before we remove the old timing belt, we loosen the cam sprocket retaining bolt. Loosen both crank and cam sprocket bolts before removing the timing belt. We don't want the pistons moving up and down out of synch with the cam. Bent valves suck.

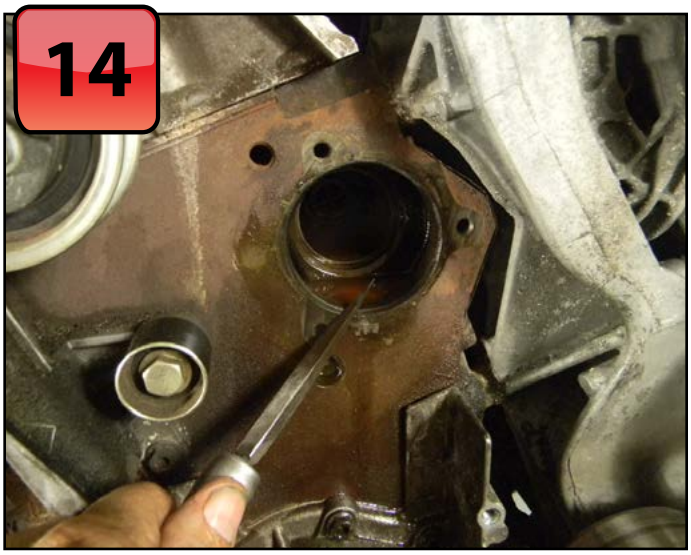


There's a small tab on the adjustment cap on the tensioner roller. Right now, it points to 4 o'clock (bottom arrow). Note this position for reference and comparison to the new tensioner after it is installed and adjusted. (A digital picture is a great way to keep track of your progress.) Loosen the roller nut (top arrow) and rotate the roller to create slack in the timing belt.

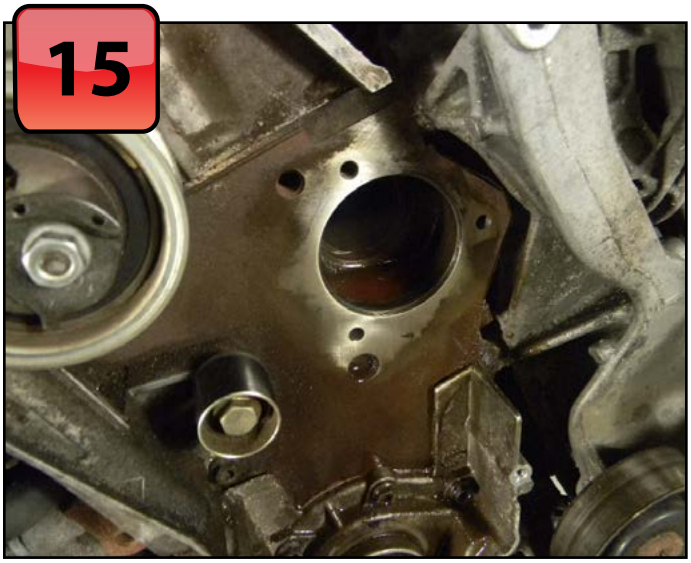
Section 2 - Belt Replacement

Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146

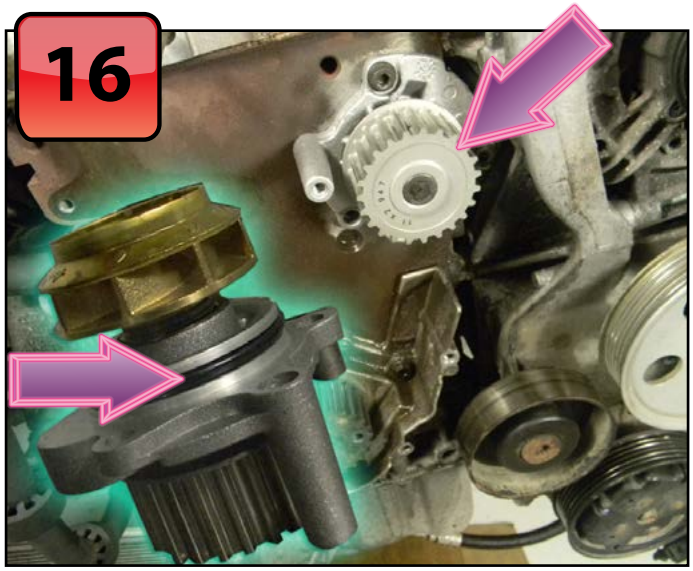
Remove the old timing belt. Unbolt and remove the water pump. The pump seals to the block with an o-ring, and the block mating surface here is covered with heavy rust scale. The old pump didn't want to leave, so we forcibly evicted it with an enthusiastic combination of twisting and prying.



Scrape away the scale at the hole chamfer and also inside the hole where the o-ring will seat. Hardened scale can damage the new water pump o-ring during pump installation, causing a leak. We clean carefully.



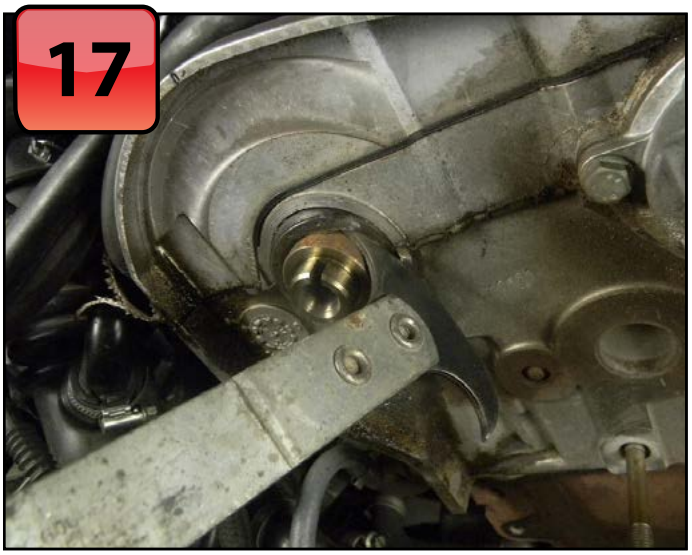
We spend more time cleaning the block than it takes to actually install the pump. Satisfied that we have everything shipshape, we lube the pump o-ring with fresh coolant, slide the new pump into the block, and bolt it up.



An o-ring is all that keeps the coolant inside the engine (lower arrow). It's the reason we were so careful preparing the water pump hole in the block. The new pump is installed and ready to go (upper arrow).

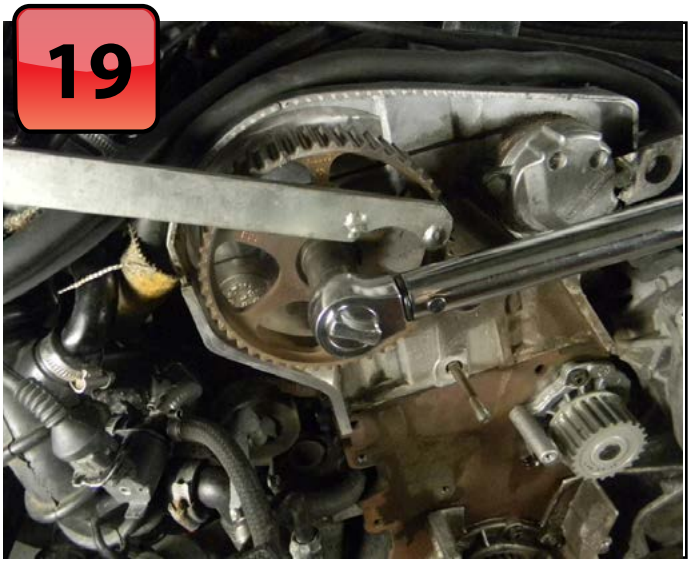
Section 2 - Belt Replacement

Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146

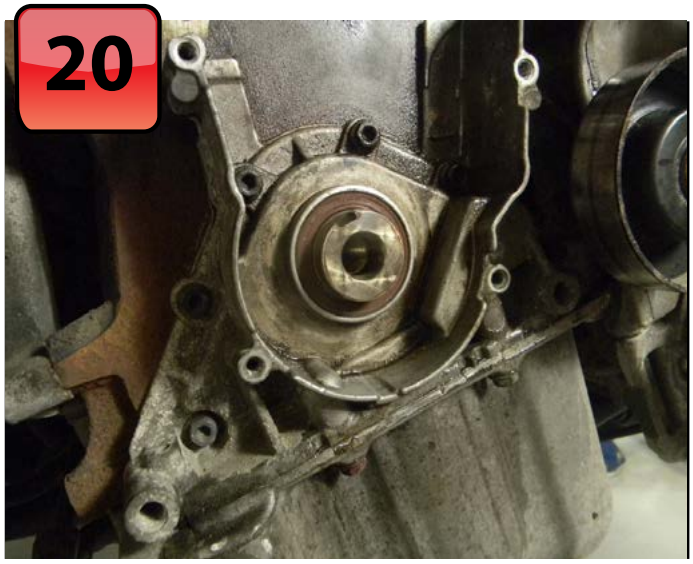


Time to install new cam and crankshaft seals. Remove the cam retainer bolt loosened earlier and pull the sprocket off the cam snout. We pry out the old seal using a generic seal puller that we have ground thin enough to slide between the seal and cam without scarring the camshaft sealing surface.

Apply a drop or two of clean motor oil to the cam sealing surface and slide the seal over the cam snout. Use a seal driver or other suitable tube (a deep socket also works), and tap the seal into place. We clean away old oil residue from the surrounding area so everything looks professional.



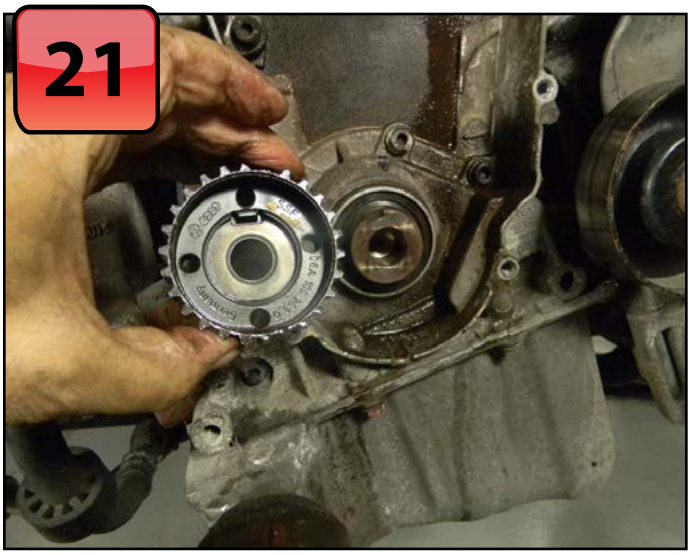
Hold the cam with a suitable holder, and torque it to 65 Nm (48 ft-lb). The cam sprocket should slide on easily. Align the sprocket tab with the notch in the cam snout before tightening the bolt.



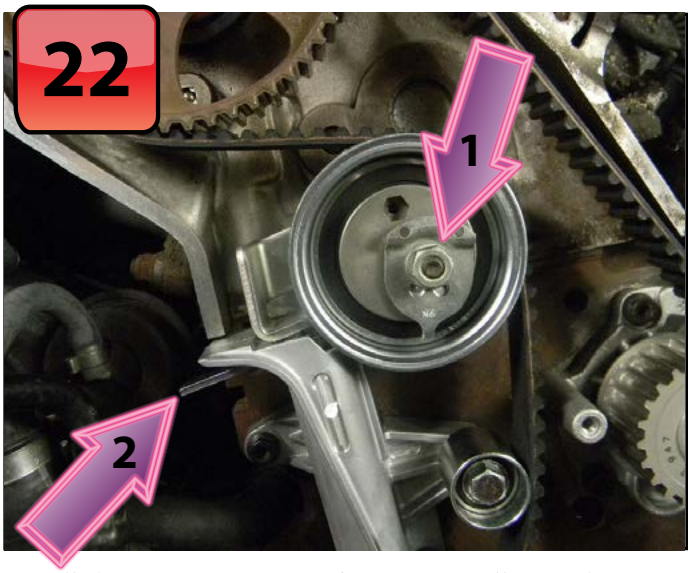
Second verse, same as the first. Repeat the seal replacement sequence, only this time at the crankshaft. The old crank seal was so heat-hardened that it came out in black chunks. We appreciate having a new seal in the kit. A 36mm socket made a great seal driver.

Section 2 - Belt Replacement

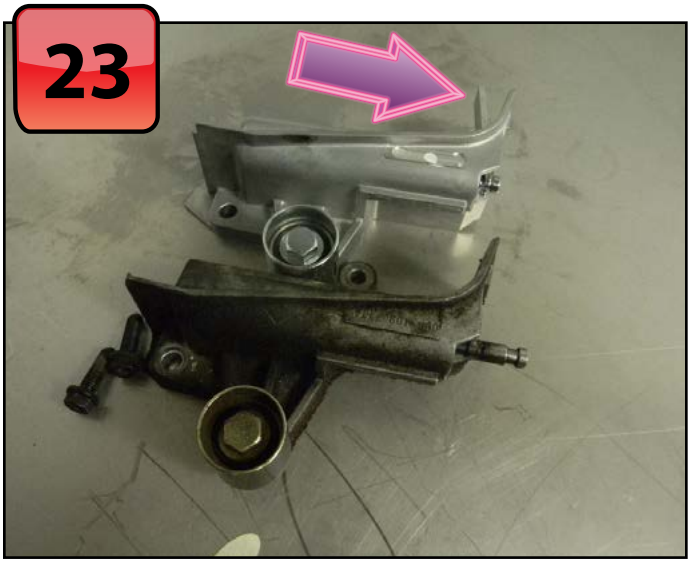
Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146



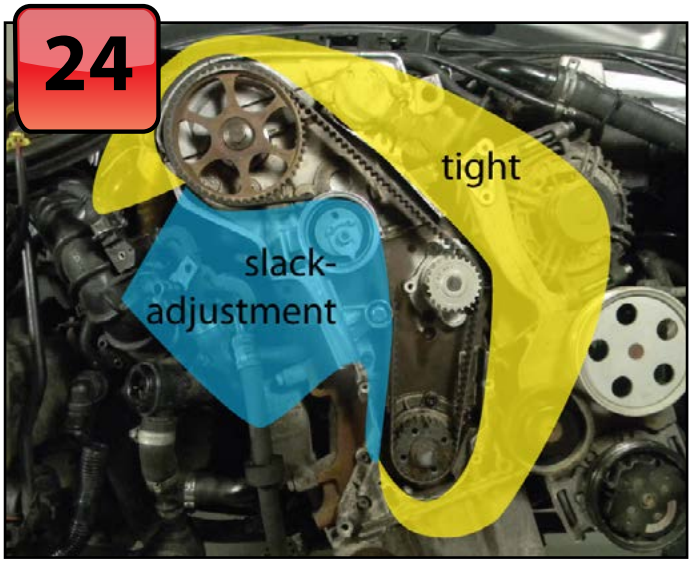
Reinstall the crank sprocket; replace the sprocket bolt with a new one, and tighten to 90 Nm (66 ft-lb), plus ¼ turn. **You must hold the crankshaft to keep it from turning as you tighten the bolt**. If this is your first T-belt replacement on this engine, see our special note at the end of this article before proceeding. This is critical!



Install the new tensioner and tensioner roller on the engine. Slide the roller over the stud and snug, but do not full tighten, the retainer nut (1). At this point, the lock plate is still installed in the tensioner (2).



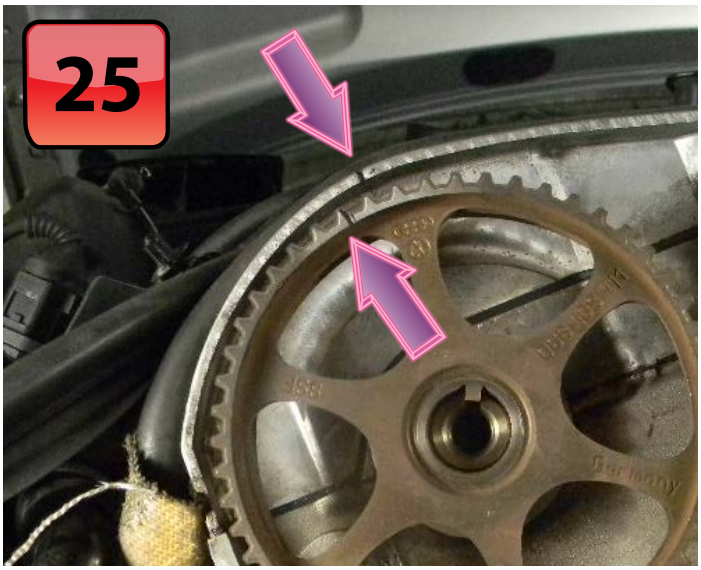
To better illustrate what's going on with the tensioner, let's compare the old and new parts. The piston in the old tensioner is fully extended. The piston in the new tensioner is fully retracted and held in place by a retainer plate (arrow). **Do not remove the plate yet!**



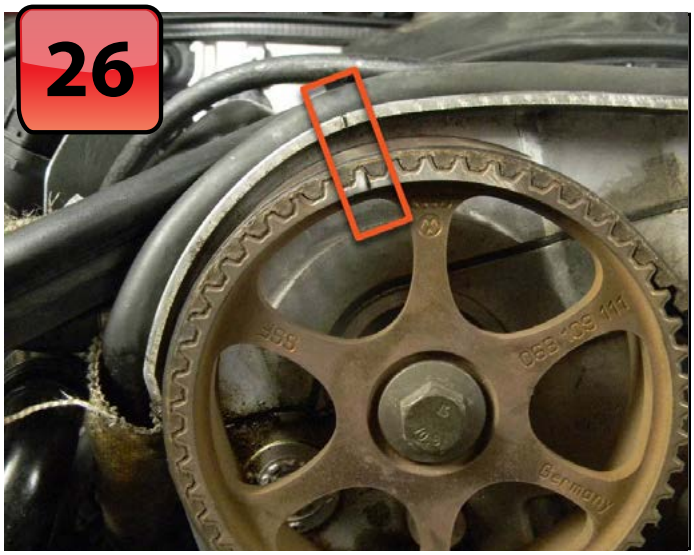
Install the timing belt. There should be no slack in the belt on the tight side (yellow). Belt teeth should be fully seated in the cam, crank, and water pump sprockets. All belt slack should be in the blue area, on the tensioner side. The cam timing mark (see step 6) and the timing felt marker match marks (see step 9), should be aligned. Now you know why we made those marks!

Section 2 - Belt Replacement

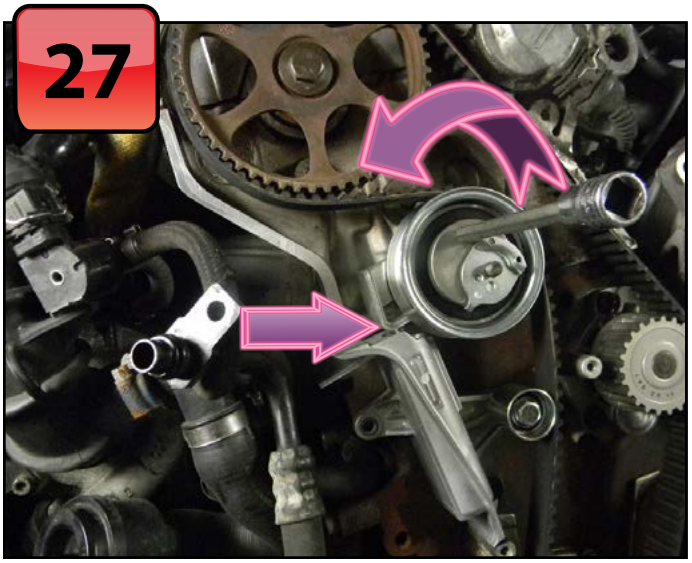
Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146



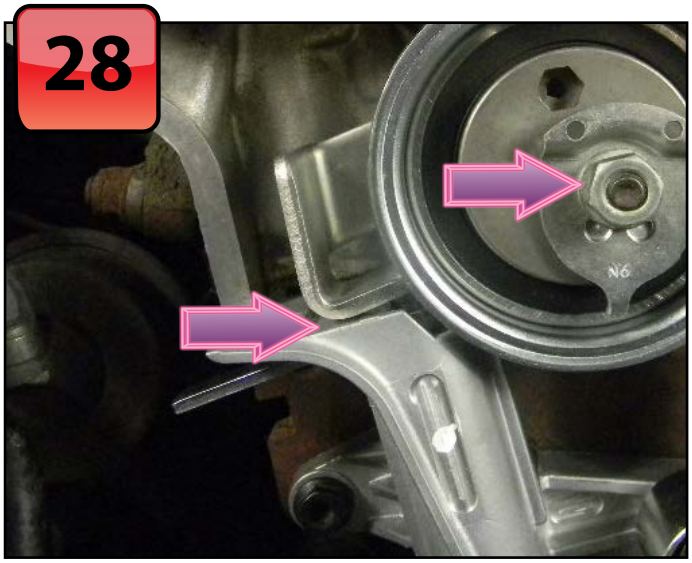
Here's where you can get into trouble. See the timing marks? Even though we aligned the cam sprocket timing marks before removing the timing belt, the cam has turned counterclockwise a tooth on its own. The cam lobes and valve springs are responsible. This is where the cam wants to center itself between the cam lobes.



Now what? We can turn the cam sprocket clockwise, align the marks, and clamp it in place (*somehow*) while we install the belt. Or we can rotate the **crank pulley *counterclockwise*** a couple of teeth and install the belt. Then, when we realign the crank marks after the belt is installed, the cam will be pulled back to its correct timing position.



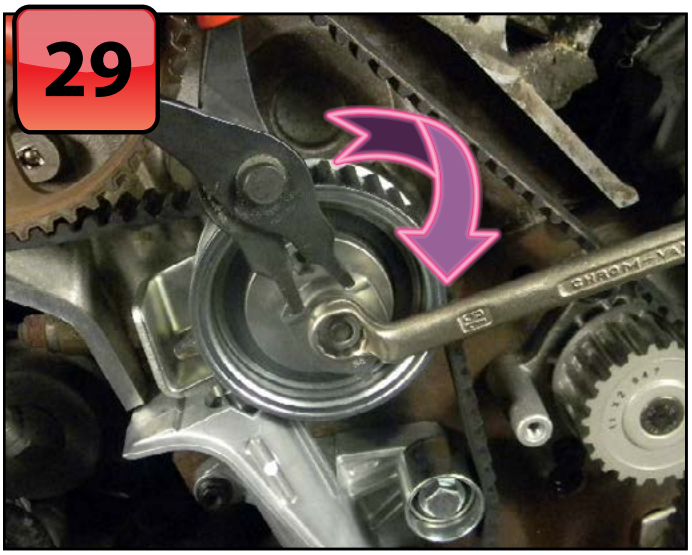
Timing marks both aligned? Sure? Then it's time to adjust belt tension. Insert an Allen tool into the hole in the tensioner roller. Rotate the roller center ***counterclockwise*** until the metal outrigger on the roller touches the head of the tensioner piston (arrow). If you look just below the bottom arrow, you can see that the tensioner lock plate is still installed.



Let's zoom in close. There's no gap between the roller outrigger bracket and the tensioner piston. The tensioner piston is still fully retracted and locked in place. Remember, the retainer nut on the tensioner roller stud should be snug (upper arrow), not totally tight.

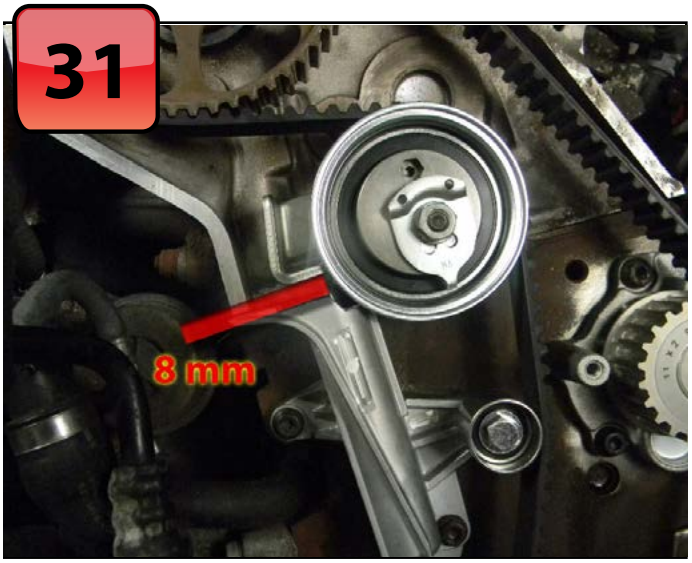
Section 2 - Belt Replacement

Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146



Knowing that some of you may not have the two-pin factory tool to make the final tensioner adjustment, we improvise, using angle head snap ring pliers in the adjustment collar. Remove the retainer plate from the tensioner to release the piston. Turn clockwise until there is an 8mm gap between the tensioner body and roller bracket.

Keep it simple. Grab something 8mm thick and use it as a fat feeler gauge to check your measurement. Here, we are using an 8mm thick Allen key.



From the side you can see the 8mm gap. The tensioner piston has expanded to make contact with the metal bracket on the tensioner roller.

Torque the tensioner nut to 27 Nm. The belt is now installed, timed, and tensioned. Using a 19 mm 12-point socket at the crank bolt, turn the engine over by hand, **two complete crankshaft revolutions**. (One complete camshaft rotation). Double check both timing marks. Everything should line up.

Section 2 - Belt Replacement

Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146

Reinstall the lower timing cover and crank pulley. Use the four new crank pulley bolts in the Ultra kit. Torque them to 10 Nm plus ¼ turn.

Now we can reinstall the accessory belt and tensioner (belt included in the Ultra Kit), and replace the other two timing covers. Reassemble the front header and bumper.

All buttoned up. We had no problem refilling the Audi cooling system. We kept the coolant jug full and ran the engine at 2500 rpm. With the heater on low, we could confirm that the heater core filed. Then we ran the engine again until the thermostat opened and the cooling fans ran.

If you end up disconnecting the lines to the power steering cooler in front of the radiator, don't forget to top off the P/S reservoir.

Thanks for joining us. Happy wrenching!

Section 2 - Belt Replacement

Audi A4 1.8T Ultimate Plus Timing Belt Kit Installation ES#8146

Special Notes on Crankshaft Bolt Tightening.
Read This Carefully to Avoid Engine Damage.

In **step 21** of your photo sequence, we install the crankshaft sprocket and retainer bolt. The T-belt is not yet installed, because it cannot be installed until the sprocket is in place.

That means that unless we lock the crankshaft in place as we tighten the crank bolt, **it may turn as we torque the bolt. Problem:** If you turn the crankshaft far enough with the belt off, a piston will hit an open valve. Totally undesirable.

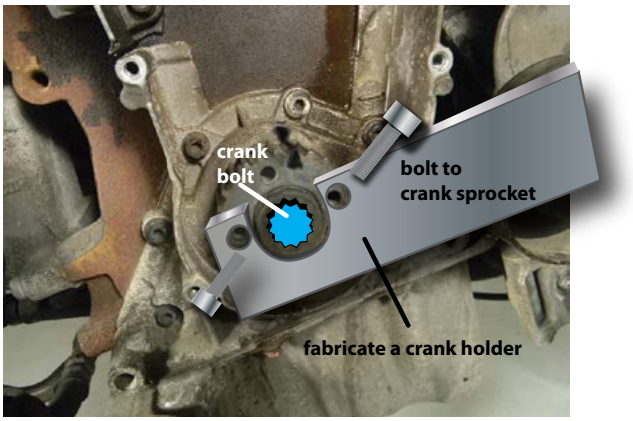
Also: This is a Torque-to-Yield Bolt, and should be replaced. There's a new one in your Ultra Kit. TTY bolts need to be replaced because they stretch when tightened: once. We are paranoid and apply thread locker as well. The torque spec is 90 Nm, plus a quarter turn.

Playing It Safe

You have a few choices here if you are performing this job and do not have access to all the special tools, including the crankshaft holder. There are many ways to do this job successfully. We want to offer one option.

1) Borrow or rent the special dealership crankshaft holder. (Potentially impractical, but worth mentioning if your brother or best buddy is a VW or Audi dealer tech.)

Can't borrow the crank holder? Fabricate one. Make one from a piece of flat iron (see image below). Drill holes to match the ones in the sprocket, and cut a relief exposing the crank sprocket center bolt. Bolt the holder to the sprocket and lock it in place so the crank cannot turn.



2) Hand snug the crankshaft bolt while holding the sprocket to prevent it from turning.

3) Install the timing belt **before** you final torque the crankshaft bolt. That way, the camshaft will turn with the crankshaft (and the valves will not be damaged) if you turn the crank while torquing the crank sprocket bolt. **Just don't forget to go back and torque it!**

4) When you are done installing the belt, turn the engine over clockwise two complete revolutions by hand.

Turn v-e-r-y slowly.

Two complete turns equals one complete combustion cycle. This brings us back to where we started, and we know the valves and pistons are not interfering. We can also double check our timing marks for alignment.

Double peace of mind.