

Engine: Seals, Belts, Crankcase Ventilation

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Abbreviations:

AMM Air Mass Meter

ECT Engine Coolant Temperature sensor

ECU Engine Control Unit computer (either fuel injection or ignition)

FI Fuel Injection

FPR Fuel Pressure Regulator

IAC Idle Air Control solenoid valve

TB Throttle Body

TPS Throttle Position Sensor

VSS Vehicle Speed Sensor

Accessory Belt Tightening and Maintenance.

Belt Diagnosis. [Problem: Squeeling belts; how to set tension?] You can easily isolate the problem. Take a spray bottle of water filled with water. With the engine on fast idle, spray a stream at each belt separately. The world will all of a sudden get real nice and quiet when you've hit the problem belt(s). If that doesn't alter the noise then you can look elsewhere (like bearings in the water pump, alternator, power steering, etc.). Tightening the belts will normally eliminate the squealing, but you don't want to overtighten lest you shorten the life of the water pump and/or alternator shaft bearings. (PS. While you're in there with the bottle, shoot the base of each injector with water. If the engine stumbles at all then that's a sign that the injector seals need replacing.

[Editor's Note: see <http://www.dayco.com> for a discussion on the various kinds of belt noise and causes.] The spec calls for a 1/4" max deflection (see [below](#) for tension specs) at the mid-point of the longest span, but a heavy thumb can often get 1/4" even with the belt overtightened. I prefer to run my belts not too taut because of this and consequently a tendency for belt squeal is the price I pay. You can eliminate this by keeping the belts in top shape:

- replace at the first sign of fatigue (fraying, hardening, cracking)
- de-glaze the belts and pulleys (with sandpaper and/or emery cloth)
- check that all pulleys are aligned. Any belt deflection will only hasten belt wear, glazing and squealing. If they are misaligned, suspect your rubber mounting [bushings](#).
- power steering pump pulley misalignment is usually due to a worn steering [pump bracket](#).

B23X Drive Belt Change. [Tips from Ed/Bruce/JTCharger/Jay Simkin and others] Drive belts are changed by loosening the fixing nuts and the 10mm adjuster bolt, pivoting the accessory toward the crankshaft, and changing the belt. Disconnect the battery ground cable first. Use a little PBlaster dripped (not sprayed) onto these bolts to ease in removal and avoid rounding them off. If they are corroded (and they frequently are), use six-point sockets. Reinstall using a little antiseize. In the case of the p/s and a/c belts, you will need to raise the car on jackstands at the jacking points and then remove the belly pan. It is easiest to replace all three belts as a group.

- Changing the outer, *air conditioning compressor belt* requires the loosening of a total of four bolts, two at the top of the compressor and two at the bottom of the compressor. The bolts at the bottom of the compressor must be accessed from underneath, after the black plastic belly pan has been removed. The top two bolts are on each of the two curved mounting arms at the top of the compressor (one in front and one in back). The front bolt is part of the tensioner assembly. The tensioner bolt has a 10mm hex head, and is perpendicular (90 degrees) to the compressor case. The nut on the rear bolt can be hard to reach. The wrench will be close to the point, where a wire goes into the compressor case. This nut is behind and in line with the front nut. Loosen both of these nuts. Then loosen the tensioner, by turning it counter-clockwise.

Once you have loosened the top two mounting bolt nuts and the tensioner, go underneath to loosen the compressor's two pivot bolts. These are closest to the base of the bracket, on which the compressor is mounted. Loosening these bolts lets the compressor be swung upwards and towards the engine. That lets the belt - already in place on the crank pulley - slip over the compressor pulley. You may need to use a round shank screwdriver to ease the belt over the compressor pulley.

Replace the belt and tighten the tensioner, until the belt can be pressed downwards with your index finger about 1/4" in the middle (between the crank and compressor pulleys). If you live in a high-moisture climate and/or one where salt is used on the roads, it might be well to remove the nuts on the lower pivot bolts, and to put anti-seize compound on the bolt threads. Tighten fully the nuts on the lower pivot bolts.

- The middle *alternator belt* requires two nuts to be loosened (not removed)

other than the adjusting tensioner bolt. One is at the back of the long top fixing bolt; the other is at the bottom in front. The tensioner bolt is beneath on the side. Turn the tensioner screw counter-clockwise to move the unit toward the engine and loosen the belt. You should check the three rubber alternator bushings when you replace this belt. They can be pressed out and replaced by hand.

- The inner *power steering pump belt* requires that you loosen the 13mm lock nut at the front of the power steering pump bracket (just above the pulley) and loosen the tensioner bolt (anti-clockwise to loosen). You may also need to loosen the nut and bolt through the bottom of the pump (best reached from below). To get enough slack to remove the belt, remove the bolt that tightens the pump against the adjustment bracket. With this bolt present, the pump will not move freely through the entire adjustment range. You will need to replace the bolt after you put the new belt on. If the pulley is misaligned, see the Steering section for information about the [pump bracket](#). When tightening the bottom bolt and nut, use Loctite to ensure it stays tight.
- In the case of the compressor and power steering pulleys, you may need to lever the belt over the edge of the pulley to install it.

Belt Tension. [Tips: Steve Ringlee/Jay Simkin] When you adjust the belt tension, take a look at how the adjuster mechanism works before you go at it. Loosen the 13mm or 12mm lock nuts on the belt side of the mechanism (two in the case of the compressor). This unlocks the alternator or compressor and allows you to adjust tension with the long 10mm bolt head parallel to the belt. This latter bolt is used ONLY to position the alternator. Once you have set belt tension (3/16 to 5/16 inch or 5-10mm deflection) with the long bolt, lock the position with the 12 or 13mm bolt and BACK OFF a few turns on the positioning bolt to unload it. Don't forget to lock the main nut/bolt or your belt tension will eventually fracture the adjusting bolt. If you fracture it, buy the assembly at the dealer (Volvo p/n 1378789; \$15) or the accessory adjusting bolt from [IPD](#). The alternator tensioning bolt is M6 x 1.0 x 90mm (long, measured from under head to tip). [Mikael Larsson] A threaded rod cut to the appropriate length and a nut held in place with Loctite would probably do the trick also. Or use two nuts that lock each other as a bolt head.

[Paul Spasske] The Krikit 1 belt tension tool (available at [NAPA online](#), part number NBHCR1, US\$10) is useful to test belt tension. Contitech recommends the following drive belt tension settings for Volvo B2XX engines:

- Narrow 11.9 mm belt used for alternator, power steering, and some air conditioning applications: **New:** 40kg; **Used:** 25-30 kg after 50,000km in service
- Wide 13 mm belt used for later (>1992) air conditioning applications: **New:** 55 kg; **Used:** 40-45 kg after 50,000km in service



960 Serpentine Belt.

Changing the Belt. [Jim Bowers] Use a 3/4" square adapter in the tensioner hole to remove tension on the belt. Take off the old belt noting the routing and install a new one. Let go of the tensioner and you are done. There is a revised belt that

is longer and uses a new routing. The new routing as the belt leaves the crank going CCW is: A/C to Alternator, back down and around the idler, up around the power steering pump, down past the tensioner to the crank.

Checking the Belt. [John Shatzer] Just a cautionary note to check your serpentine belt for inside edge fraying. Apparently when you begin to accrue higher mileage (in excess of 100K), the tensioner begins to sag, it will cause rubbing along the inside edge (toward the engine) of the belt surface. Replacement of the tensioner is called for. We've heard about at least one (rare) instance of a broken serpentine finding it's way into the timing belt housing, and the rest, as they say, is history.

Belt Noise.

[Dave Stevens] The usual source of screeching is the serpentine belt travelling through misaligned pulleys caused by worn (crushed) rubber accessory mounting bushings. Bushings are readily available and relatively cheap, even from Volvo. Poly bushings are also available.

Belt Brands.

Top quality belt brands are Continental, Gates, Goodyear, Bando, and NAPA Premium.

Alternator Belt Slips and Doesn't Charge. [Inquiry:] My alternator belt is squeaking and the alternator is not charging properly

[Response: Don Willson] Check the [harmonic balancer](#) for the cause of squeeking. Paint a stripe from the hub to the rim. Run the car until you hear the squeek. Look at the stripe, if it is displaced replace the harmonic balancer. The rubber insert loosens and slips after a time.

Timing Belt Replacement Chart. Timing belt change intervals, per Volvo service chart recommendations, are as shown below. Miles are shown; kilometers equal miles times 1.53. B234 engines require balance belt changes at the same intervals. B6300 engines for 1992 and 1993 require tensioner pulley lubrication at the same intervals. For interference engines (B200/B234/B6300) you are highly advised to replace tensioners and, if appropriate, idler pulleys regularly since a failure in any of these components will quickly lead to belt and valve failure. See detailed instructions in each engine section below. "[EGR](#)" refers to the presence of an exhaust gas recirculation valve.

Year	B230F	B230FT	B230FD	B234	B200F/T: B204: B230E	B6XXX
1987-1992	50,000	50,000	NA	50,000	50,000	30,000
	50,000 (no	50,000 (no				

1993	EGR) 100,000 w/ EGR	EGR) 100,000 w/ EGR	NA	NA	50,000	30,000
1994	50,000 (no EGR) 100,000 w/ EGR	50,000 (no EGR) 100,000 w/ EGR	50,000 (no EGR) 100,000 w/ EGR	NA	50,000	50,000
1995+	100,000	100,000	100,000	NA	50,000	70,000

B230 Series Engines:

Do I Have an Interference Engine? [Editor] An "interference" engine is one in which the tops of the pistons and the valves may collide if the timing belt breaks or is misaligned. If you have an interference engine, you **MUST** change your timing belt on schedule or else you risk very expensive damage. You must also pay closer attention to the condition of the tensioners, pulley bolts, and front seals: anything that can cause the belt to fail prematurely must be repaired quickly. Not all Volvo engines are non-interference. [Colin Shepherd/Peter Milnes]

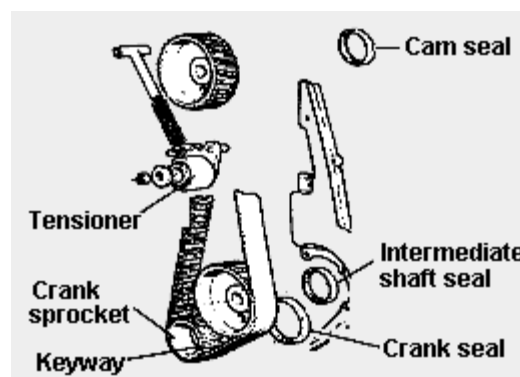
"Interference" Engines:

- B200 series (including E, F, G, FT, GT)
- B230E (high-compression B230 sold outside of North America)
- B204 series (including E, F, FT, GT)
- B234 series (including F, G)
- All B5XXX five-cylinder inline engines and 6XXX six-cylinder engines

The B230 series is non-interference with the exception of the B230E.

Timing Belt, Seals, Tensioner, Balancer Preventive Maintenance in B23/B230 Series. [From [RPR](#): illustration copyright and used by permission]

Four-cylinder engines 1976 and later all drive the camshaft(s) and intermediate shaft with a toothed timing belt. This part is replaced during normal maintenance every 50,000 or 100,000 miles, depending on your year and model. See the owner's manual. It is highly advisable to change the seals on cam, intermediate and crank shafts when changing the belt at 90,000 miles or more. Additionally, at 135,000 or more miles, consider replacing the timing belt tensioner since its bearing will not last much longer. Always carefully inspect the crankshaft sprocket for cracks along the



keyway that locks it to the crank. If your front seals (or any engine seals) are leaking, or you find your dipstick pushed up after running the engine, check your flame trap! For 960 B6300 series engines, see [960 Timing Belt Change](#) below. [Motor Magazine, Jul 2004] One belt manufacturer estimates that 50% of newly replaced timing belt failures are the result of nonreplacement of faulty tensioners and/or idler pulleys. So the best thing to do is to install all the components at the same time.

Belt Change: Mileage, Time or Condition Indictators? [Inquiry] Other than mileage is there a way to tell when it is time to change a timing belt? Does the belt show a particular wear pattern? Car in question is a 93 965 with 110k miles. Belt has 7K miles and there a very fine crack in the rubber on the inside of the belt next to one tooth. Crack goes across the whole belt width.

[Response: Chris Herbst] If there's a crack across the whole belt on **any** tooth, it's time for a replacement. Occasionally I've seen where the belt is joined, it will have a similar crack across the entire width (on the inside of the belt). You can sort of see the mark if you look at it carefully. But I'd be suspicious of the belt anyway with a crack in it. If it breaks that tooth, it will break more also. In the interest of potential expense vs. preventative expense, I'd get it replaced

Belt Tensioner/Idler Replacement. [Editor] Replace your B230 belt tensioner at 150k miles. See [below](#) for tips on replacement of B6304 tensioners and idler pulleys when changing the timing belt. These are critically important to your engine.

Harmonic Balancer Condition Indicator? These generally last 150k miles. This two-piece pulley has a rubber isolator between halves; it fails right there. To monitor its condition, paint a white stripe across the two pulley halves so you can detect any differential rotation.

Changing Timing Belt: Procedures for B23/B230 Series Engines.

For B23, B230F, B230FD and FT (incl EGR) Engines. See Michael Ponte's excellent website at <http://www.mikeponte.com/volvo/timing.htm>, a complete illustrated guide to changing the timing belt in B23/230 engines. Timing belt and shaft alignment marks are illustrated in this [FAQ file](#).

1. Remove engine cooling fan (fan and fan shroud, clips for preheater hose), lower splash pan, drive belts and upper timing belt cover. It helps to have the front of the car on ramps or jack stands. Label the drive belts so you can reinstall them correctly.
2. Cover the radiator fins with cardboard to keep from damaging them with tools.
3. Unbolt and remove the camshaft drivebelt cover. (On B230 engines, just remove the top half of the cover.) If this is stuck, remove the water pump pulley cover (four 10mm bolts) for better access.
4. Line up engine: Use crankshaft center bolt (24mm) to turn engine, bringing the engine to TDC, No 1 firing. This is indicated when the mark on the camshaft sprocket is in line with the mark on the camshaft cover or the drivebelt backplate. At the same time the marks on the crankshaft sprocket

guide plate and the oil seal housing will be in line. **IMPORTANT!** Do not turn crankshaft or camshaft with timing belt removed.

5. Secure Crank. Use [special tool 5284](#) to hold when removing crankshaft pulley with a 24mm socket. Remove tensioner 15mm nut and washer. Attach tool 5284 to tension stud. Use tensioner nut (no washer) to hold tool 5284. See the [notes](#) in Engine-Mechanical regarding inability to insert the 5284 tool tangs in certain aftermarket harmonic balancers. If you have no tool 5284, then you can see the notes in [Crankshaft Bolt](#) for tips on how to secure the crank.
6. Loosen the crankshaft bolt counterclockwise using a 24mm socket and the remove vibration damper assembly. Remove the lower timing belt cover.
7. Remove Timing Belt: Loosen tensioner nut approx. 1 turn. Pull belt to compress tensioner spring. Tighten tensioner nut. [Secure spring tensioner](#) by inserting a drill bit or nail through hole in tensioner bolt ([photos](#)).
8. Check Tensioner: Check tensioner roller bearing. Check tensioner roller. If roller surface is damaged, roller as well as timing belt must be replaced. Make sure the tensioner is seated correctly back in the block and not hanging at an angle.
9. Check Crankshaft Pulley/Harmonic Balancer. If your car has high miles, the rubber can [deteriorate](#). Now is the time to change this if it is needed. Install the drivebelt lower cover and the crankshaft pulley. Make sure that the dowel (guide pin) on the sprocket engages with the hole in the pulley. Tighten the pulley bolt to the specified torque which is 44 ft-lb (60 Nm) PLUS an additional 1/6 turn, or 60 degrees.
10. Check that engine is correctly lined up: **IMPORTANT!** Do not turn crankshaft or camshaft with timing belt removed. And when you do turn the crank, turn it only clockwise.
11. Do not contaminate the drivebelt with oil, nor kink or fold it sharply.
12. Install Timing Belt: First place timing belt on crankshaft sprocket and then on intermediate shaft sprocket. [Two lines](#) on timing belt should fit toward crankshaft marks. Make sure the [guide washers](#) are oriented correctly on the lower timing gear on the crankshaft.
13. Stretch timing belt on tension side and fit timing belt on camshaft sprocket and tensioner roller. Make sure timing belt is correctly installed and sprocket marks line up with marks on engine.
14. Tension timing belt: Keep the right side of the belt under tension and the tensioner side initially slack. Then release the belt tensioner by loosening the nut or pulling out the nail. (If the left side of the belt is tensioned and the right loose when you release the tensioner, the pulleys will move and ruin the alignment). Tap the tensioner flange with a hammer to ensure it is seated in its mounting holes. Loosely install the tensioner nut.
15. If this is your first belt change, use Whiteout or white paint to highlight the timing belt marks on the inner timing belt cover and make the next change easier. Make a Whiteout mark on the crankshaft pulley perpendicular to the rubber core so you can easily detect if it ever fails. Ditto the camshaft and intermediate pulley [markings](#).
16. Insert the lower belt washer with the concave side out onto the crankshaft pulley. Clean and install timing belt lower cover. Install crankshaft pulley vibration damper. Make sure that the dowel (guide pin) on the sprocket [engages](#) with the hole in the pulley. [Editor: See [Timing Belt Tips](#) to help ensure the damper pin is engaged.] Use special tool 5248 to hold. [Editor's

Note: See [Bolt](#), [Two Caveats](#) first.] Use [special tool 5284](#) or [secure the flywheel](#) and tighten the pulley bolt to the specified torque which is 44 ft-lb (60 Nm) PLUS an additional 1/6 turn, or 60 degrees. Highly recommended: 1/2 inch sockets and adapters since 3/8 are not strong enough.

17. Remove tool 5284, reinstall the tensioner nut then tighten it to 37 ft-lbs. Clean and install upper timing belt cover.
18. Install: clips for preheater hose, fan, fan shroud and [drive belts](#). Check that ignition timing is correct.
19. Run Engine: Run engine until it reaches normal operating temperature while checking operation. Then stop engine.
20. Readjust timing belt tension. Remove rubber plug from cover. Release belt tensioner nut approx. 1 turn to let tensioner spring stretch timing belt. Rotate engine clockwise at least one half turn to top dead center (TDC) using crankshaft bolt in order to properly position the tensioner. Tap the bolt head once or twice with a light hammer to ensure the tensioner can swivel on its pivot. Retighten nut to 37 ft-lb (50 Nm) and install rubber plug in cover. If a new belt has been installed, repeat this re-tensioning after approximately 600 miles (1000 km).

3. Plate and Pulley Tensioner Re-Assembly. [Inquiry:] I got the crank pulley on my 91 740 off finally, retimed the sprockets and the crank is on TDC. I now need to reassemble everything. The first question I have is which guide plate goes in first. There are two: one has a u- shape hole on the edge, and the other has two holes on the edge, a rectangular shape hole, and an additional small notch on the opposite side. Which plate goes in first?

[Response: Don Foster] You'll notice that the washers or guide plates, as you call them, are flared or beveled or dished or bell-shaped -- pick your descriptive term. They must be [oriented](#) so the flare is away from the belt like this ")B(". Otherwise the sharp edge will quickly abrade the belt.

First, slide one plate over the crank. I think the plate with a notch fits over the woodruff key. Be sure the dish is toward the engine. Then fit the crank sprocket, again over the key. Then install the timing belt, taking all the previously-mentioned precautions to align timing marks on belt, sprockets, and block. Release the tensioner to hold the belt against the sprockets

Install the outer guide plate, nearest you (this one does not need to fit over the key), assuring the dish is outward (toward you) so it won't cut the belt. It has no orientation, other than dished-out. (And the inner plate has a keyway simply so it'll fit over the key -- it doesn't otherwise need to be timed.) Install the lower cover. Install the front crank pulley ([vibration damper](#)). Because the top belt cover is still off, you can insert the crank tool over the tensioner stud to hold the pulley while you tighten and torque the center bolt. NOTE: It is this that holds the inner parts tightly in place. The front pulley bears against the timing sprocket and two plates, squeezing them against the crankshaft. It's a big sandwich.

4. Tensioner Reassembly. [Tip from Chris Herbst] If the tensioner is poorly seated, your belt can migrate off the tilted pulley. You might THINK it's seated properly, but the little peg that sets it into the head can bind and cause the tensioner to become crooked JUST enough to get the belt running off of the pulley. So... with the tensioner nut slightly loose, hammer lightly but firmly on the

flange on the tensioner, that holds the peg that seats into the head. Got it? Pound the tensioner's peg into the bore in the head where it lives. THERE. Now it's seated properly. Tighten the nut slowly, and pop the tensioner a few more times as you go. This is common. If you can't solve the problem this way, take off the tensioner, grease the hole in the head (after cleaning it out with a pick or some such thing) and slide everything back together.

[Tony Hoffman] Use a socket and ratchet to turn the engine crankshaft just slightly CLOCKWISE before tightening the tensioner bolt. Just a slight bit because the belt will start to walk off the tensioner. I've notice this helps a lot in 'setting' everything. Tighten tensioner and use the socket and ratchet to turn the crank CLOCKWISE at least one full revolution. Line the crank up to the zero timing mark, take the bolt out and take off the lower cover just to eyeball that the intermediate gear is lined up properly along with the cam gear. Now you can feel secure that all is well. Because of the way the tensioner works, I have had problems where it would pull in such a way that the cam gear would be off a tooth after releasing the tensioner. So it's worth the extra 2 minutes to feel good that all is OK. Drive the car for about ten miles then unplug the grommet on the upper timing cover and loosen the tensioner about 1 full turn. Then retighten. This will take out any additional stretching from the new belt. [See below about [adjusting](#) the belt after 500 miles].

4. **Tips and Ideas.** See the sections below on [Bolt Removal](#), establishing [Top Dead Center](#), [Pulley Removal](#), various [Timing Belt Installation Tips](#), and [Adjusting the Belt After Installation](#).

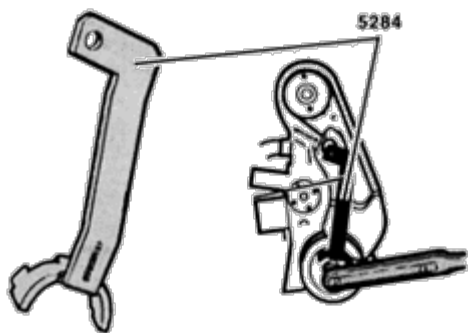
Changing Timing Belt: Bolt Removal in B23/B230

Bolt Size. [Don Foster] A 24 mm socket fits the crankshaft pulley bolt on my '86 245 and my '91 740 (both B230 engines). A 1/2" drive Craftsman socket would probably be perfect: don't use 3/8 inch here. On the B230, don't forget that an impact wrench is NOT a good idea because of the risk of snapping the crank. You'll need some way of holding the crank or pulley so you can use a breaker bar. The bolt loosens counterclockwise. See [Special Tools](#) for some homemade tool ideas useful for crankshaft immobilization.

Advice. [Editor] Of the techniques listed below, only one is guaranteed to remove and install the crankshaft pulley without potential damage to your engine: using tool 5284. Now that [IPD](#) sells this for a reasonable price, you might consider obtaining it and doing the job correctly. Other techniques work, but read the caveats and cautions very carefully so that you don't turn a simple job into an engine replacement.

Securing the Crankshaft While Removing the Center Bolt.

Method 1: Tool 5284 [Recommended] When the time came to replace my timing belt the first time, I tried every manner of removal for my crankshaft bolt. Nothing would budge that thing. Out of desperation, I sent off for the special tool 5284 which turned out to be a godsend. In order to break



the bolt free, I had to literally jump and down on my 15 inch long wrench (I weigh 180 lbs.) multiple times. I bought the car new, so it came from the factory way over torqued. Despite the upfront cost, the tool was a worthwhile purchase and I would recommend it for anyone contemplating keeping their brick for a long time. At the time, it cost me \$45 US from an out of state dealer who discounts 20% for out of state purchases. The tool for holding the B230 crankshaft pulley to loosen/tighten the center bolt is called Counterhold: for vibration damper Part # 999 5284-8. [Editor] You can buy this tool from online sources ([IPD](#) or [FCPGroton](#)). Note that it works reliably only on Volvo OEM harmonic balancers: various contributors have noted that the hole pattern for Scantech and MTC balancers may not match that of the tool and you may have to either grind the holes (equally to maintain balance) or ship them back.

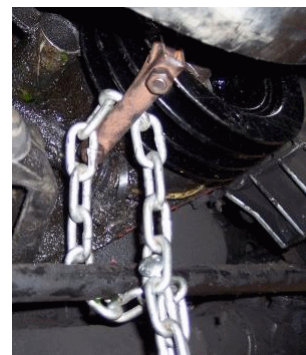
Method 2: Rope Trick in Cylinder. [Recommended] [Don Foster/Bruce Young]

Use the Rope Trick with a length of cotton or nylon clothesline rope to jam the piston near Top Dead Center while you turn the crank pulley bolt. Be careful how you do this: you can damage the valves.

- *To loosen the bolt*, first be absolutely certain you're at cylinder #1 TDC between the compression and power strokes. This way the valves will be closed in that cylinder. You can tell this by feeling compression pressure, using your finger, in the spark plug hole: air comes out the hole.
- Verify #1 and #2 valves closed - look thru oil fill hole: #1 cam should be pointed inboard and up about 45°, with #2 pointed horizontally outboard.
- Turn the crankshaft clockwise (facing the engine) about 1/4 to 1/3 turn after TDC. Stuff in about 2-3' of 1/4" soft rope into the spark plug hole. Leave 6 inches outside so you can pull it back out. Feeding the rope in thru a short length of heater hose makes the job even quicker.
- Turn the crankshaft back -counterclockwise- to compress the rope until it won't move further. This jams the piston in place.
- Using a socket, breaker bar, and -if needed- a pipe extension on the handle, loosen and remove the crankshaft bolt.
- *To tighten the bolt*, use the same approach except move the crankshaft about 1/4 to 1/3 turn counter clockwise before #1 TDC. Stuff in the rope. Turn the crank clockwise to compress the rope and jam the piston. Tighten and torque the center bolt following the torque and turn procedure.
- When tight to spec, back the crank up a little and remove the clothesline, then re-install the sparkplug.

Method 3: Jamming the Crank Pulley. [Alex] Buy a U-bolt (exhaust type) and insert it into one of the holes on the crank pulley. Attach a piece of chain on the u-bolt and then around engine crossmember, thence back to the u- bolt. Secure with two

nuts. This avoids stressing the outer part of the pulley with the rubber damper .



Method 4: Jamming the Ring Gear. [Not Recommended and NOT for LH2.4 cars, Rex/Regina cars, or any car with a crankshaft sensor] Some have suggested jamming the ring gear with a screwdriver or tire iron. **DON'T DO THIS:** several anecdotes of ruined torque converters, ring gears, and ring teeth have been reported. Any damage to the crank position sensor ring will cause your engine to misfire or stop. Repair is difficult.

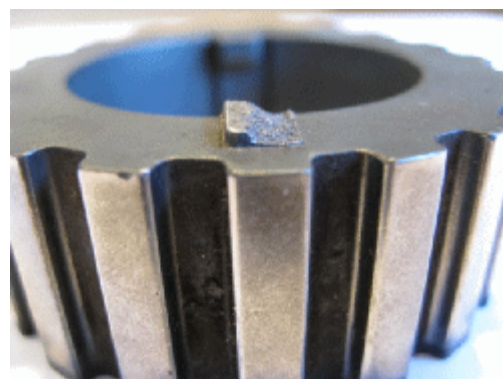
Caveat re: Sensor Ring Damage. Don't even *THINK* about attempting this ring gear technique above if you car has a Crankshaft Position sensor. This applies to all cars with LH 2.4 or greater or Rex/Regina. On these cars, what you have access to through the inspection plate on the bell housing is a thin sheetmetal metal ring with little square windows evenly spaced around the 360 dg with two windows missing at TDC and TDC + 180dg (or is it TDC - 90dg and TDC + 90dg? can't remember.) Either way, these little windows look like the perfect place to put a square shank screwdriver, but the sheetmetal ring is very weak and if you bend it even the slightest there's a good chance your fuel injection system will get highly confused. I believe that if the ring is even 1mm out of round, the pickup may miss one or more windows.

Method 5: Strap Wrench on the Pulley. [Not Recommended] Had same difficulty when changing belts on both 745 & 245, after much aggravation, bought a large (12", I believe, made by RIGID) plumbers' strap wrench at professional plumbers supply. This enabled me to hold pulley without damaging it so that I could remove it to change belt. [But: SEE BELOW for a [Warning](#).] For really tight ones, it helps to have a cooperative assistant to hold strap wrench. [Another technique for tightening:] For the camshaft and intermediate shaft pulleys, what I did was wrap the old timing belt around the pulley as padding, grip the padded wheel with my largest channel-lock pliers, (a big pipe wrench would also do) and torque the bolt to 37 ft/lbs.

Caveat re: Harmonic Balancer Failure While the strap around the crank pulley method will work just fine on the 84 B23, I'd be very careful doing this to the later B230. The 84 B23 has a solid metal crank pulley that should have no problems with this method but, all B230's (that's 85 and newer) use a two piece crank pulley. Not two piece like the B23's pulley, two piece like a common harmonic balancer. In fact that's what it is, a center pulley section with a rubber strip sandwiched between it and an outer pulley section. The early B230's had some problems with the outer pulley section moving because the rubber was not holding it tight enough. This causes no problems until you try to set the timing etc. Remember where the timing mark is? That's right, on the outer section of the crank pulley, (harmonic balancer). Holding the outer section of B230 crank pulley to loosen/tighten the center bolt would tend to promote movement of the outer pulley section. The early B230's moved on their own without help, think of the

movement possibilities with help! That being said, I wouldn't recommend holding the outer section of a B230 crank pulley to either loosen or tighten the center pulley bolt. If you plan on keeping your car and will be changing the timing belt yourself, buy a tool from Volvo they're not that much. As a heads up to everyone, if you find the timing mark way off when checking the ignition timing of a B230 (it usually way retarded). Make sure the pulley is OK first, before doing anything drastic. OK, OK you're right, buying a new B230 crank pulley is pretty drastic too, they don't come cheap. I've changed more than a couple pulleys, not only because you can't check the timing properly. It's because once the outer pulley section has moved you can be certain it's loose. Once it's loose, how long before it flies off completely! Will it happen at 70 MPH in traffic! Thankfully I've only seen this happen once or twice and no major damage was done but you do lose all the belts etc. and a tow truck is in your future.

[Caveat re: Timing Pulley Failure] [Tip from Tom Irwin:] Here one problem to watch out for... B230 lower timing pulleys have a little 'nib' extrusion that does the work of a keyway/shaft. It is a cast part and it is delicate. In the old days we used to fix a large socket and breaker bar over the pulley bolt, wedge it against something solid and whap the starter over to break loose the bolt... **DON'T DO IT!** That little key/nib will break off (see photo) or weaken so it breaks later and ALL your accessory drives (alt/ps/ac/etc) stops spinning. Any bolt removal technique that relies on "whapping the starter", jamming the ring gear, or using an air wrench on the center bolt, may cause this key to break off. Get the right tool (Volvo 5284) and restrain the pulley. Note: this part costs about \$35 from [FCPGroton](#).



Method 6: Large Breaker Bar on the Bolt. [Not Recommended] [Chris Mullet] Remove the splash shield. After all drive belts are removed, take the short wide one (from A/C) and hang it on the crank pulley only, so that it dangles down below the car. Slide about a 4 foot long board, under the air dam, through the hanging belt, and lodge the end under the cross member or oil pan. (I used a 2x6 with a belt I knew I was going to throw away. You could probably round the edges of the board, use a pipe, or just be a little careful if you are worried about hurting the belt.) With one foot, push down on the front end of the board in front of the bumper, until you just start to compress the motor mounts. I don't think it will take much weight as you have quite a mechanical advantage. While holding down on the board, take your breaker bar and solid hammer and knock the bolt loose. You can use the same method to retorque the bolt.

Now, some people will say you run the risk of spinning the center part of the pulley inside the damped outer section. I guess that's a possibility, but by pulling down firmly on the outer pulley, versus just holding it stationary with some other strap type holder, you increase the friction between the two....don't you?

Pulley Removal. [Tip from Pete Fluitman] Once you get the bolt off, the pulley

will just come off with a little persuasion. Don't get violent with it though. Usually as I'm facing it and it is stubborn put a pry bar on the left of the pulley between it and the engine block, and on the right gently tap, preferably with a hide hammer. Once it moves you can just wriggle it off. Or use a puller. Now is the time to inspect the condition of the [harmonic balancer](#) rubber and make sure it is intact.

[Chris Herbst] Take a rubber mallet or a light hammer and tap the perimeter of the pulley, going around the edge as you tap. Sometimes you can hit on it a few times in one spot, and a few times directly across from that spot. Repeat a few times but don't smash the thing unnecessarily. Eventually you should be able to just pull it off. You'll see it start to move around a little bit, and that's the high sign. Sometimes you have to wiggle it back and forth a little bit as it goes.

Pulley Installation: Tightening with a Belt. [Tip from Carl Buxbaum] After replacing my timing belt, in order to tighten the crankshaft pulley bolt to 60N/M, I wrapped one of the old drivebelts around the innermost groove of the pulley, and notched a couple of teeth of the belt over the top of the water pump, where there are a couple of ridges that helped hold it there. While grasping the belt with my left hand I was able to tighten the bolt to spec with my right without too much difficulty. [Editor] Note that Scantech and some Volvo harmonic balancers must have the holes filed out to fit the 5284 tool. The casting is ridged, causing the tool to shift under torque. File square.

B230F Crank Bolt Torque on Re-installation. [Abe Crombie] Torque this bolt to 60N-m (45 ft-lb) plus an additional 60 degrees (1/6 turn).

Timing Belt Tips in B23/B230.

Save Your Radiator. [Steve Cole] Cover the engine side of the radiator with cardboard to prevent damaging the fins. I thought of doing this at the beginning of the project, but decided to be careful instead. After I hit the radiator fins twice with a wrench I put some cardboard there.

Aftermarket Parts? I am going to be replacing the timing belt and front engine seals, on a 91, 740, non-turbo, sedan, B230F engine. I have a few questions: Does anyone besides Kent-Moore make any of the Volvo Special Service Tools? Are aftermarket timing belts and seals okay on quality from somewhere like PepBoys? Will I need a Vibration Damper (Harmonic Balancer) puller for the Crankshaft?

[Response Phil] You're better off getting a name brand belt. Both TRW and Goodyear brands both have the markings on them and I'm sure other name brands do also. [Response: Zee] Contitech is an aftermarket belt that my shop has used for decades. I liked the fact it had lines on it marking the positions of the timing gears. Great help on the install. (you will only see the lines for the two top gears, though, as the crankshaft marks are well out of sight at the 7 o'clock position. [Rob Bareiss] Don't buy the wrong timing belt. Cars to 1993 had a 50k belt with square teeth; 1994-95 cars with FD engines use a 100k belt with rounded teeth. [Jay Simkin] Volvo brand belt tensioners are made by INA in plants in Germany and Slovakia. Buy a branded tensioner. Unbranded Chinese parts are of unknown reliability.

Removing the A/C Compressor Belt. [Tips from Justin Seiferth] This can be tough. Loosen the 12mm holding bolt and the unscrew the 10mm tensioner bolt till there's a 1/4" of slack or so. If you still can't remove the belt, try unscrewing the 13mm mounting bolt just below the A/C compressor, this should give you enough slack. When putting the belt back on, make sure this mounting bolt is retightened. Put the A/C compressor belt onto the bottom of the crankshaft pulley and use the crankshaft bolt to turn the engine and inch the belt back on. It's a tight fit.

If you have a two piece **timing belt cover**, you can't remove the bottom half until you've taken off the crankshaft pulley. Be sure to put this cover back on after you've changed the belt and before you reinstall the pulley!

Lower Timing Gear Washer Installation [Gary DiFrancesco] This is one of those goofs that not everyone wants to fess up to, but sharing it could save someone a lot of grief. Several weeks ago, I replaced the timing belt in my '88 745T. The job seemed to go normally. A few weeks later I noticed what sounded like a worn bearing squawking away in the area of the tensioning pulley. I did not change the pulley when doing the belt since it seemed to be in good shape, and running smooth. When I removed the timing belt cover to replace the pulley, I found the compartment full of black fuzz. It was apparent the source of the fuzz was near the crank, and evidence of abrasion was visible on the outside edge of the timing belt.

To make a long story short, I reassembled the lower timing belt gear (on the crank) incorrectly. The outside washer for the timing belt gear was put on the shaft backwards. The subtle flare of this washer was pointing in and was rubbing the edge of the timing belt. I lost about 1/16" of the width of the timing belt in less than 400 miles. This error is an easy one to make: the washers can be installed both ways. The lesson here is obvious; double check your work before covering everything up. It might just save you some grief. [Genaro Lopez] Install the metal washers like this: **) belt (** The dished sides go away from the belt.

Locating Top Dead Center.

[Inquiry] How do I find TDC on my B230F when changing the timing belt?

[Response: Don Foster] Pull plug #1 and stick your finger in the hole. Turn the front pulley with a socket wrench until you see the timing mark (front of timing belt cover and on front pulley) coming up on 0 degrees. If you feel no pressure in cylinder #1, then it's TDC but on the exhaust/intake stroke.

Continue turning the front pulley until you feel pressure on your finger as you approach 0 degrees. At 0 degrees, you're at TDC for #1. Remember that as you replace the belt, you should fine tune setting the crank and cam at their alignment marks (the I-shaft isn't important on a 700, but it's good practice to do it).

Timing Belt Marks [Tips from Ross Gunn] The OEM belt has some printed lines that you position at the timing marks on the three pulleys, but other than that not much difference. You still have to find the timing marks and it can be a nuisance trying to position the belt on the marks on the pulleys. If you have factory belt

with alignment stripes on it, use a piece of chalk to extend the alignment marks onto the front of your new belt. This will make installation just a little easier. See the [FAQ File](#) for photos of alignment marks.

[Editor] Once you [find them](#), use "White Out" or white paint to mark them for future use.

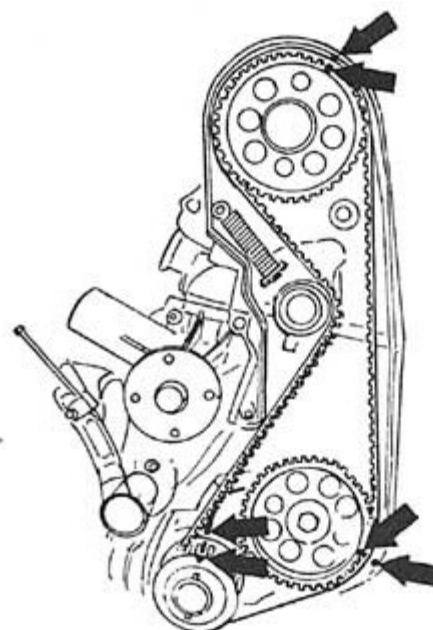
[Chris Herbst] The camshaft pulley dot lines up with the dimple on the inner timing cover. The intermediate shaft pulley lines up on the dimple on the inner cover. The crankshaft pulley's dot lines up with the extruded line in the block. It isn't exactly at 12:00. Once they all line up, if the white marks line up too, that's great. But as long as the PULLEYS line up, that is the important issue. I have a white paint pen that I dot the marks on the engine, and on the pulleys with. It makes alignment a 100% easy job. See the [FAQ File](#) for alignment photos.

The belt may be a bit small to get on easily- get an assistant to use a pipe wrench to compress the tensioner just a little.

[Timing Marks Tip from Mike] The crank [timing mark](#) is on the thin metal washer you removed after you removed the pulley. It is keyed. I determine which tooth on the crank gear it lines up with and then line that gear tooth or valley up with the casting mark on the motor behind the rear washer. Be sure to position the washer with the flanged side facing out or it will tear up your new timing belt.

[More from Ross Gunn] With the aftermarket belt, if there are no printed marks, just ensure the [timing marks on the pulleys](#) are lined up with the marks on the engine and you will be fine. The tricky one is the intermediate shaft. You will have to either look through the rad core with a light held between the rad and the block or hold a mirror directly in front of the timing mark and at 45 degrees so that you can look down from the top to see that the pulley mark and the mark on the plate behind are lined up. Or stick a small screwdriver into the slot and line up with the dot on the pulley to see if the pulley and alignment dot are aligned correctly. [Smitty] Count the number of belt teeth between timing marks on the cam-to-intermediate gear, and intermediate gear-to-crank gear... BEFORE you pull the old belt off. It's a reassuring check before firing up.

It helps if you line up the cam pulley mark before removing the old belt and then be careful not to let the intermediate shaft pulley move when installing the new one. The mark on the plate behind the int shaft can be hard to find - try to locate it after lining up the cam pulley marks and before removing the old belt. It would be wise to locate the crank pulley mark and corresponding mark on the block at the same time.



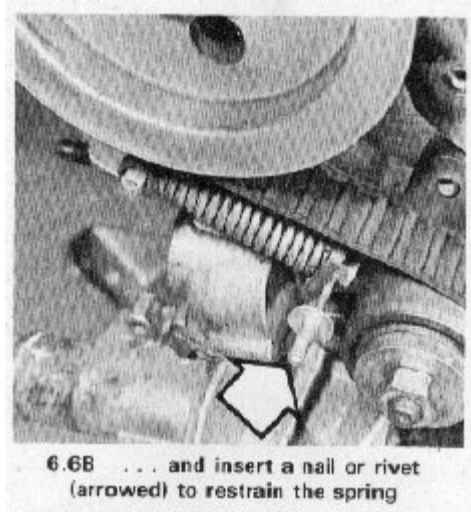
Timing marks for the camshaft, intermediate shaft and crankshaft sprockets

[Chris Herbst:] Are you absolutely positive that the intermediate shaft didn't slip when you were putting it back together? That [mark](#) is really hard to see. I usually have to line it up with a punch pin in the pulley groove before sliding the belt on. [John Wilt] You can miss the alignment by rotating the crankshaft counterclockwise; remember to rotate it only clockwise while installing the belt.

[R.Haire] On the timing belt, once it is installed, make sure the cam mark is dead on (easy to see), the intermediate shaft is set so the distributor rotor is pointing dead center at the tic mark on the distributor lip (subtle but very informative, no one ever mentions this trick for side-mount distributors) and the crank guide slot is exactly on the relief mark on the block at TDC on the crank. This last one can take time to find and appreciate.

I suggest removing the old belt with a sharp knife to avoid disturbing the position of any pulleys. Before removing the old belt, compress the spring on the tensioner and insert an appropriate pin in the hole in the rod inside the spring to retain it in the compressed position. Remove the pin after the new belt is installed.

[Don Foster] You know, of course, to first squeeze the tensioner back and lock the nut to hold it. Once the belt's in place release the lock nut so the tensioner presses against the belt. Tap it lightly -- this takes up the slack -- and lock the tensioner nut (37 lb.-ft).



[Tip from Steve Seekins] Rotate crank clockwise so that mark is about 9:00. Then put on belt - double marks straddle the crank mark (notch on outer plate). - be sure to get it right. Then put belt on intermediate shaft sprocket - line up mark and clip with a medium binder clip or one of those plastic woodworking spring clips. Do the same for the cam sprocket - you may need to use a wrench to turn the cam so the mark lines up with index mark on the belt - if the marks will not line up, you likely have the belt backwards - all three will only line up one way. Do not worry about rotating components individually - this is a non-interference engine. Before you remove the clips, double check to make sure that the crank mark is lined up with belt marks. Release the tension roller, rotate crank 2X CLOCKWISE with wrench and tighten tension roller. Replace covers, pulley, belts, fan and you are finished. After a couple of hundred miles, remove rubber plug in timing cover, loosen tension roller and rotate crank CW 2X again and tighten. Don't touch it again for 50k miles.

Indexing the Timing Belt Markings. [Tip from Randy] Lets assume the belt that is currently on there is correct. All you want to do is replace it with a new belt- you want all the orientations to remain the same. Mark the current belt in some permanent way in relation to the gear. If the timing marks on the gears match up with an individual cog on the belt that will be perfect- if they don't you might have to make your own marks on the gear (fingernail polish comes to mind). The point is once you have the belt indexed to the gear arrangement you can easily remove it and you could put it right back on and be confident of getting

it correct because you have the index marks on both the belt and the gears. So all you have to do is take the indexed belt off and carefully transfer your index marks on the old belt to the new one. Do this very carefully and be sure you match cog for cog as you move around the belt and mark the new belt exactly like the old one. BE CAREFUL to double-check the markings before going back to put it on. You might want to mark the front of the belt for reference in relation to the front of new belt. Some belts are already marked when new, but I always mark my own.

[Response 2: Paul Kane] The intermediate shaft is no longer important. I use white-out (correction fluid) to mark stuff. The Cam mark is at 12:00, the notch on the belt guide on the crank is at about 10:30 and IS the cast mark on the block. BTW the notch in the center pulley aligns with the pointer on the lower cover.

Do I Wrap the Belt First Over the Crank or Cam Pulley? [Don Foster] My preference is bottom-end up -- replacing a timing belt, I mean. The trick is, first, lining up the three pulleys to the timing marks (timing the I-shaft isn't that important on a 740 with rear distributor mount, but it's critical on a side-distributor mount engine). Then start at the bottom by fitting the marked tooth into the gear at the timing mark, and wrapping the belt upwards. (I confess that I use small Vise-grips to loosely clamp the belt to the crank pulley.) Wrap the belt around the intermediate-shaft pulley, around the cam pulley (observing alignment of the belt mark with the pulley timing mark) and slide it around the tensioner pulley.

Replacing the Harmonic Balancer. [Inquiry] How do I ensure that the keyway in the harmonic balancer engages the key on the crank sprocket? My crank:balancer fit is tight and the engagement is not obvious.[Responses: Tom F/Don Foster] I had always had to fight to get off the Harmonic Balancer due to a build up of rust and crud. After I remove the HB, usually after a hundred hits with a chunk of wood a little twisting, and lots of PB Blaster, I'd clean the shaft and the hole of the HB with emery paper or fine steel wool. The pulley normally fits snug but loose enough so that you can slide it and turn it on the crank by hand to engage the keyway. After you THOROUGHLY clean any residue from the crank, lubricate mating surfaces with engine oil and reassemble. Then when you put the pulley on the crank and rotate it as you push it in, it goes clunk and seats inward as the key engages the keyway. The looser fit allows you to get the confirmed "clunk" confirming that it has engaged correctly. The next time the HB has to be pulled, it should be easier which is the primary purpose of the oil lubricant along with corrosion control. If after doing this it is still too tight, It's possible that one of the surfaces or edges became dinged and a microscopic ridge is causing inteference, hence tightness. Inspect for this.

Poor Performance After a Belt Change: Did I Screw Up? [Comment] I replaced the timing belt on my 740 the other day. The car starts fine, and revs up fine in neutral. However, acceleration is sluggish. When I went to drive away initial acceleration was poor. Once I got the car up to about 2000 rpm acceleration seemed a bit better. Any thoughts? [Responses: Tom] Sounds like you are a tooth off. (I've done it many times!) First remove or pry back the upper T- belt cover to take a peek: the cam marks and the lower exterior timing marks should be enough to determine if you are off a tooth on the cam timing. If that's

OK, then pull the lower cover and make sure the pulley on the crank sprocket is mounted correctly. [John Wilt] If you rotate the belt counter-clockwise while installing it, you can cause misalignment. Rotate **CLOCKWISE** only to adjust the position.

Timing Belt Tensioner and Belt Adjustment After Installation.

Replace the Tensioner? [Don Foster] A new tensioner every 150k is the prevailing wisdom as I understand it. No need for a new spring -- reuse the existing spring. You'll note a small hole in the shaft inside the spring. Compress the spring with old tensioner and slide a nail through the hole. Remove the tensioner and install the new one. Then pinch up with a big pair of Channellocks and remove the nail. And at 225k miles, start thinking about the three front seals and water pump -- perfect time to do all that stuff.



[Inquiry:] Whilst removing the tensioner, it flew apart. How do I reassemble it?

[Nigel Sheerwater] Tensioner consists of.....a bar with a big hole one end..pin hole the other.a spring...a bearing with a plate on the back and a big hole in the middle and a smaller hole at right angles. Assemble as follows. Put spring on bar. Slide the small hole in the bearing plate on top of the bar to compress the spring....tricky so you will have to work out how to compress spring. Once compressed put a nail through small hole to hold it all together. Torque to 50 Nm (37 ft-lb). [John Wilt] After installing the tensioner, you can move the belt by rotating the crank but only in a clockwise direction.

Adjusting the Tensioner After Installing a New Belt. [Stoney] I just got email from 2 dealer techs I know, with 18 and 20 years experience between them both are top VISTA techs and they said that the belt should be adjusted after 5-600 miles due to the fact that a new belt will stretch some in the first 1000 miles and they have seen a few jump the cam gear..

[Response 2: Don Foster] The tensioner has a spring in it which forces the idler against the belt to a predefined tension. But then, when you tighten the nut on the tensioner, you lock its position. The instant the belt stretches one hair, the tension is relaxed (because the tensioner's position is fixed, it can't move inward to maintain the force). The tensioner, in this configuration, compensates for (adjusts for) the increased length from stretching -- to prevent it from jumping a tooth. It **DOES NOT** maintain a constant force on the belt. It's assumed a new belt will relax a bit during when first used, so you must loosen the nut, allowing the spring to again reposition the idler. This consumes the extra length from

stretching -- but then you tighten the nut again, locking the idler's position. Ideally, there will be virtually NO tension on the belt, but also virtually NO slop in the belt. Hence, after about 500 miles, more or less, remove the rubber plug from the timing belt cover, loosen the tensioner locknut, rock the crank slightly clockwise about 1/8 turn (this makes sure that belt has tension on the drive side between cam and crank gears), and tighten and retorquer the locknut. [Editor] Make sure you lock that tensioner nut to prevent the tensioner from loosening and destroying the new belt. Torque to 50 Nm (37 ft-lb).

B6300 Series Engines:

960 Flame Trap in B6300 Engines.

[Inquiry] Can anyone tell me where on the 6304 engine the flame trap is located, and how one goes about servicing it? Last year I replaced the rear engine seal, and I notice there is sometimes a faint smell of blow-by.

[Response: Tom Irwin] The flame trap is in the rear of the air intake runner, which is the big air hose between the Throttle Body and Air Mass Meter. The housing is made of 2 separate plastic pieces. One should be clamped in the air intake hose. The other is clamped in the flame trap hose. One plastic piece fits inside the other with a snap and a click. It is released with a firm twist, 1/8th of a turn CCW, and withdraw it from the air runner leaving the clamp on. Beware, this part is probably brittle and old. It may break. Personally, I have never seen a clogged one on a 960. If you have blowby, you need to check at various idle speeds, with the hose opened. If there is way excessive crank blow by... STOP. Get a leakdown test done and brace yourself for a big tearful goodbye to that car. If your oil consumption is increasing, then watch out. See the

[960-90 Series Information](#) section for more information.



Plugged Oil Breather Boxes. [Rob Bareiss] Anecdotal evidence from S80 6-cylinder engines indicates that the oil breather box on six-cylinder inlines plugs up solid rather easily and increases oil consumption. If your car is using oil and the flame trap is oil-soaked, consider replacing the plastic oil breather box. To remove this box, remove the two fixing bolts, then remove the alternator to access the box. On reinstallation, grease the two rubber ring couplers to push the breather box back in. The hoses are awkward but do-able.

960 Timing Belt Change in B6300 Series Engines.

960 Timing Belt Maintenance Intervals [Editor's Note] **This is an interference engine and you MUST rigorously maintain the timing belt and**

all associated parts!

[Inquiry:] I've heard that the timing belt for the 960 series has to be changed more frequently than stated in the owner's manual. I was wondering if anyone was advised to replace the tensioner as well and if there was a bulletin from Volvo recommending changing the tensioner at 100,000 miles.

[Response:] Follow closely the recommended intervals. The '92 timing belt should have been changed at 20k miles and again at 40k miles. At that time a modification should have been done under warranty. This extends belt life another 10k miles, so the next belt change should be done at 70k miles then every 30k after that. This is only for the 1992 cars!

[Details from Abe Crombie:] The 92's had an interval of 20K. Volvo developed a damper assembly that fits onto exhaust cam that was retrofitted to 92's (if it was being taken to a dealer AND the technical service bulletin was performed) and was factory-fitted to 93's that allowed the 21mm wide belt to last 30K due to less cyclic loading on belt. You can see the damper if is installed by looking through the holes in the cam gear on exhaust cam. The damper will make seeing the aluminum head through these holes difficult, especially if you compare to the intake cam pulley which is the same part but will have no damper fitted. The 94's have a revised damper and some belt driven pulleys revised and a 23mm wide belt is used (belt is different length than 21mm belt) to give a 50K interval. The 95-98 engines got a complete re-do of the belt drive and use a 28mm belt to give a 70K interval.

960 Timing Belt Tensioner/Idler Pulley Change Intervals. Caution! [Tips from Randy/Debbie/Lance] The timing belt replacement interval is a well-known critical maintenance item with the various interference motors. What is sometimes overlooked by the home mechanic is the equally important set of parts on which the belt rides: tensioner, tensioner pulley, idler pulley, and water pump. Our 960 threw a fairly new timing belt when the belt tensioner that holds the belt tipped (due to wear/age) allowing the belt to slip off...dead car. We have since learned that the manual calls only for inspecting the arms when the belt is changed. The bearing races can wear and fail suddenly.

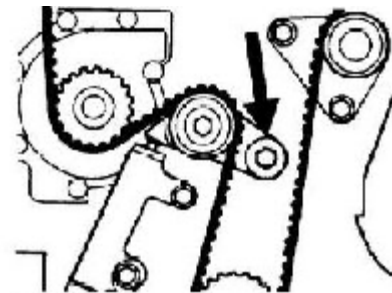
[Tale from Vic Lind] I heard a strange squeal coming from the engine in my '98 V90. I found the timing belt had worn through the front cover. Upon removing the cover I found the tensioner bearing had failed. **More and more reports are appearing at Brickboard about failure of tensioner/idler/pulleys in low mileage 960/90 cars. We recommend replacing the timing belt tensioner, its pulley, and idler pulleys as a standard maintenance item at each timing belt change. Check or replace your water pump at the same time.**

[Rafael Riverol] Change with new Volvo or OEM parts the tensioner bearing and everything else connected with the timing belt that could be even remotely suspect, either with every belt change if at 70K miles. I do not want to risk a broken timing belt!. This is much cheaper than an engine rebuild. [Randy] Another item to check is the water pump: in my case, the entire shaft assembly of my pump had shifted in the cast body and the vanes were rubbing on the casting, ready to fail. The obvious lesson is that the failure of any of the above-named parts (pulleys, idlers, water pump) is the same as a belt failure. Not changing

them on a regular basis is a bet against the top end of your engine.

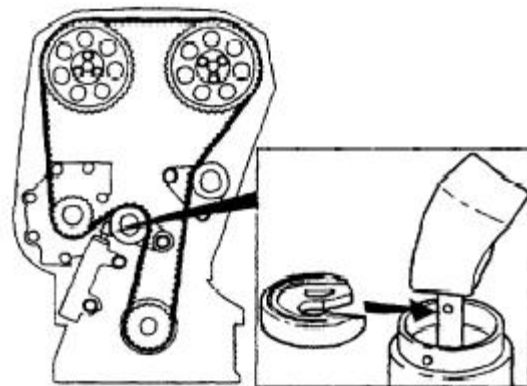
960 Timing Belt Tensioner Lubrication. [Volvo Cars NA] Lubrication and checking for free play of the tensioner pulley bushing is required on 92-93 960 cars with B6304 engines and recommended on 94-96 cars. **To Lubricate the Bushing:**

- Remove lever mounting screw, tensioner pulley, and sleeve behind screw. Lubricate surfaces of bushing, screw, and sleeve with grease. Reinstall sleeve, pulley and screw. Torque for screw: 29 +/- 5 ft-lbs (39 +/- 5 Nm) Torque for pulley lever: 30 ft-lb = 40 Nm Torque for idler pulley: 18 ft-lb = 25 Nm



To Reinstall the Washer on the Timing Belt Tensioner:

- Place NEW washer on piston stem of belt tensioner. Make sure that the correct **countersunk** side of the washer **faces up**
- Check that the washer centers on piston stem and tensioner case.

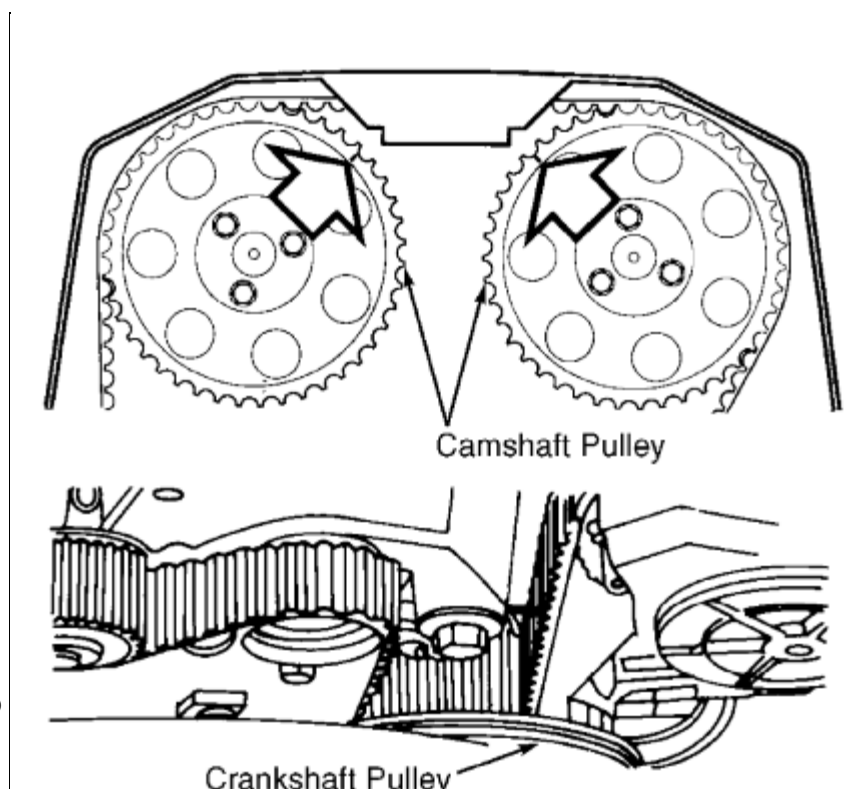


B6300 Engine Cam Pulley Alignment

Tool. [Editor] Anecdotes from Brickboard suggest you buy the alignment tool. It saves the frustration and futility of trying to align these pulleys correctly. Look on ebay for a used set, and then sell it when you are done.

960 B6304 Timing Belt Change. [Tip from Larry Borella] Recently there was an exchange posted concerning replacement of 960 timing belts. I did mine Saturday. All things considered, it was easier than replacing the belts on my 740. Here are a few hints if you are inclined to do this yourself. Start by removing the electric fan. Take out the two screws and then pull the wiring loom connectors from the shroud. Then you can just put the fan on top of the overflow reservoir/ac dryer and you don't have to take the battery out etc. Remove the accessory belt (I use a 3/4 in adapter on my 1/2 drive breaker bar). Take off front cover. I changed the plugs at the same time; leaving the plugs out makes it is easier to turn the crankshaft pulley to align the [timing marks](#) on the cam pulleys. I used a 1-1/4 socket to turn the crank. The notch on the crankshaft pulley is hard to find. You have to look straight down; its on the back side hub of the pulley. Shine a light on it at an angle. The matching mark is on the back of the plastic timing belt cover (which is not removed).

Using a paint marking pen, be sure to mark the slots for



the bolts and then mark the gear to the cam. If you don't you will have three choices for each gear as to the correct position. Get them all lined up, then remove the top bolt from the belt tensioner. Then back out the bottom bolt about 1/4 to 1/2 inch

(see below for tool tips). Then you can twist the tensioner which will pop the plunger from its position. Then you can take it off and remove the belt (there is a metal guard held on by two bolt behind the crankshaft pulley that must be removed from under the car).

[Tip from Robert Reagan] When I changed the belt, I ignored the reference marks and made my own marks with solvent-based Whiteout or white paint on the cam gears, the crank pulley and the existing belt. I made sure the replacement belt was positioned exactly like the one that came off, and everything went smoothly. Put the new belt on. The manual says start at the crankshaft pulley then work up and around in a counter clockwise direction. You have to compress the tensioner before installation. I put it in a vise (the vise has to open about 6 inches to hold the tensioner. If you were hard pressed, I think you could do this in a large c-clamp. The resistance on the tensioner is significant. I found that turning the vise about a 1/4 turn then waiting about 3 to 4 minutes before the next turn worked well. When you get it compressed, there is a keeper hole (make sure you line up the hole before you compress the tensioner) into which you must insert a pin to hold it in the compressed position. I used a 1/16 inch drill bit. Then you put the tensioner back on. I found that putting the top bolt in first worked best. You can push the bottom of the tensioner to get the bottom bolt lined up. If you do it the other way, you have try to pull the tensioner (working from the passenger side of the car).

Now you rotate the engine two revolutions and check the [alignment](#). Guess what. Mine didn't line up as well as I would have liked. The cam pulleys were fine but the crankshaft pulley was slightly advanced (maybe 5 degrees). I did it all again.

Same result. I took it off and did it a third time making doubly sure I had all the belt lugs where they should be. Same result. I spun the engine with the starter (with the plugs still out). All seemed well. I bolted her up, put in the Bosch +4's,

started the car and went for a test drive. Runs fine.

Two notes of caution. If you leave the plugs out for anything, put the ignition coil cover back on. Those openings look just like a funnel designed to put a dropped screw/nut into the cylinder. Second, don't leave plugs in too long between changes. If they seize up and break off when you try to remove them (as I have heard happens fairly regularly), you got real problems. I put penetrating oil around mine before I removed them and even so, they were uncomfortably tight with only 50 k on the car.

More 960 Timing Belt Instructions

[Procedure from Larry Jacobson] This has play by play instructions about the 960 timing belt. Today was the day to attack the timing belt on my 1996 965. I've changed lots of timing belts on lots of cars, but this was the first time I dug into the 2.9 ltr Volvo. Apparently there are no worthwhile aftermarket manuals for this car. I am grateful to a herein unnamed (for his own protection) list member for snailmailing me a copy of the appropriate section on a genuine honest-to-goodness, bona fide and sanctified Volvo shop manual. The bottom line was it took me 2.5 hours. It is not as difficult as the belt on the 2.3 ltr 4 cyl engine. No special tools are required. I'm sure I could do it again in 1.5 hours now that I know how. The following are my observations. If you are going to do this job plan to change the oil and filter at the same time, inspect the front brake pads, change the serpentine accessories belt, and if you suspect the integrity of your water pump ... do that too. You can't get back to the water pump without first taking out the timing belt. Before starting you will need common mechanics tools, ratchets, a variety of extensions, a big vice or a 6 inch C clamp, and probably a big pipe wrench. A dental mirror would be handy and some very good lighting. There are some things that are difficult to see.

Parts: Timing belt is Volvo part 271876. Serpentine belt is Volvo part 9146106. It is stamped Made in USA Dayco. You can probably find it cheaper in a parts store under the Dayco brand name. **Procedure:**

1. Jack up the front end of the car and suspend it on jack stands. Probably best to remove the front wheels. Check the brake pads while you are there. You are going to need enough room to get underneath to work.
2. Remove the belly pan that covers the oil filter. You might want to change the oil and filter now.
3. You're going to need two pins that will be used to hold things in place. Locate them now before you need them. a) Take a 16 penny common nail and cut it to 1 inch so that you have the head plus one inch. It will be used to hold the serpentine/accessory belt tensioner in place while you take off the belt. b) Locate a 3 penny common nail. It will be used to hold the timing belt tensioner in place while you reinstall it. Don't cut the 3 penny nail.
4. There is no need to remove the electric fan.
5. Draw a picture of how the serpentine belt is routed. If you don't know how it came off it is going to be real difficult to get it right when you try to put the new one back on. Now remove the serpentine belt tensioner. There is a tapered square hole that will fit 3/4 inch, 1/2 inch, and 3/8 in square drive. However you'll need a very short extension to fit deep enough into that hole. I couldn't find the right size so I just took a large pipe wrench and moved

the tensioner. Line up the holes and slip the cut off 16 penny nail to hold it in place. Remove the two 12 mm bolts that hold the tensioner in place and remove the tensioner. [Tip from D. Morgan] The lower 12mm bolt on the tensioner has been a PITA to break loose and tighten up, due to being recessed and behind the balancer. To remove this, try a Sears offset 12 point, combination 12&14mm wrench (part# 44361). Now remove the serpentine belt.

6. Remove the timing belt cover. It is held on by only one 12 mm bolt.
7. Crawl under the car and locate the shiny metal 'vibration damper guard'. It's held on by two 10 mm bolts. Unscrew those bolts and remove the shiny cover to expose the crankshaft gear and the lower end of the timing belt.
8. There is no need to remove the vibration damper. If you turn it slowly using the small bolts you can turn the engine to line up the timing marks. Turn it clockwise while looking at the front of the engine. The cam timing marks are obvious. The crank timing mark is not obvious. I used some of my daughter's silver nail polish to mark the crank's relationship to the block and the timing marks on the two cams. I also marked the existing timing belt so that if worst came to worst I could count the cogs between the various timing marks. [Tip from Bobby C] If you can't find the marks but the engine is already properly timed, line up TDC exactly on the crank, then (with the old belt still in place and tensioned) make your own marks (either punch marks or filed lines) on the sprockets themselves opposite something obvious (like the top edge of the head or cam carrier) for future use or if the timing slipped while installing the new belt. It's also not a bad idea to count the teeth between the crank sprocket mark to the marks on the other sprockets you made (with the old belt in place), then using White Out typing correction fluid, paint the ends of the new timing belt teeth at the corresponding tooth counts with a white dot. Then, it's a simple matter of making sure the painted teeth are installed opposite the marked sprocket marks. Remember that as soon as you rotate the engine once, those paint marks are no longer relevant.
9. Tensioner efficiency: Before you take off the tensioner and the timing belt, take a moment to notice the tension on the belt between the exhaust cam and the water pump. It seems to move about 1/4 inch with about 10 lbs lateral pressure. This is purely a guess based on what I thought it felt like.
10. Remove the tensioner by a) slacking the two 12 mm bolts, b) removing the upper bolt, c) rotating the tensioner clockwise a little, d) removing the bottom bolt and lifting out the tensioner. [Tip from Vic Lind] If you are trying to remove the tensioner pulley, it is held on with a Torx T-45 bolt but using a shallow hole. If you cannot get this off, try applying penetrating oil to the bolt then use a pipe wrench on the outer washer. This will move and in turn move the stuck bolt. DON'T allow the pulleys on top to move from their marks.
11. Remove the timing belt by first removing the two 10 mm bolts that hold the plastic housing on the top of the shroud at the top on the engine. No need to actually remove this top shroud. With the bolts out it can be moved enough to get the belt out. Remove the belt off the cams. Then get under the car and very carefully work the belt off the crankshaft gear. ...remembering how you got it off because it's like a Chinese puzzle to get the new belt back on.
12. Take a good look at the tensioner assembly. It is an hydraulic affair and it should not be leaking oil. If it is leaking you need to replace it. That

- tensioner fails the belt will jump cogs and the motor will be destroyed.
13. Compress the plunger back into the tensioner. First remove the white nylon positioning ring. Line up the three little holes so you can place the keeper through them to allow you to reinstall the tensioner. A vice would work well to compress the tensioner. My vice was not large enough so I used a 6 inch C clamp. Compress the plunger a quarter turn at a time allowing it to 'rest' between twists. When the plunger is all the way flush with the housing push a 3 penny common nail into the hole with the head of the nail facing out so you can pull the nail out when the tensioner has been reinstalled. Place the nylon guide washer back on the tensioner. A new one probably came with the new timing belt. See notes and diagram above about correct orientation.
14. Inspect all the idlers for smooth operation. Inspect the water pump for leaks. This is the time to change the water pump if it isn't in good shape.
15. Install the new belt. I found it was easiest to snake the belt down to the crankshaft gear before trying to place it on any of the other gears or idlers. Crawl under the car with a good light to work the belt on to the crankshaft gear without crimping it in any way. Once it's on the crankshaft gear, then put it on the intake cam and remove all the slack between crank and intake cam gear. Then do exhaust cam and then water pump and finally the idlers where the tensioner goes. You want all the slack at the tensioner idlers.
16. Install the tensioner. Tougher than it first looks. There's not much room between the tensioner and the fan for fat fingers. Locate the top bolt first and get it started. Then do the bottom one. Make sure the tensioner seats itself flush on the front on the engine and torque it down. Volvo says 18 ft pounds (25 Nm). I couldn't get a torque wrench in there. Regardless, that's not a lot of torque.
17. Critical point: carefully inspect all your [timing marks](#). Is there slack anywhere except around the tensioner? Is the belt fully seated on each gear? If everything's OK, take some pliers and pull out the 3 penny nail that has been holding in the plunger on the tensioner. It comes out fairly easy. The tensioner will ease itself back into position and will take up all the slack on the tensioner side of the engine. Inspect by feeling the tension between the exhaust cam and the water pump. Does it feel about as it did before you took the belt off. Are the timing marks still where they are supposed to be?
18. Crawl underneath to make sure the belt is seated on the crankshaft gear. If it is in place, reinstall the vibration damper guard. Reinstall the splashguard that covers the oil filter.
19. Reinstall the two 10 mm bolts that hold the top of the cam belt shroud on the top of the engine
20. Volvo recommends you make the crank turn two complete revolutions to make sure all the [timing marks](#) are still in place. That's more difficult than it sounds. I skipped that step and crossed my fingers.
21. Reinstall the timing belt cover.
22. Install the Serpentine/Accessories belt tensioner. While you are doing that snake the new belt around the accessories and locate the tensioner and bolt it down. Be very careful to be sure the serpentine belt is seated in the middle of all the pulleys on its route. When you are sure it is correctly positioned turn the tensioner just a little and remove the cut off 16 penny nail that you installed at the beginning of this operation, allowing the tensioner to take up all the slack in the belt.
23. Carefully inspect the engine bay for tools and stuff.

24. Voila! You have successfully changed the timing belt and the serpentine belt.

B6300 Timing Marks on Pulleys. [Jim Bowers] The marks on the pulleys, (2 cam & crank) look like lines made by a cold chisel being stamped against the face. They will identify a belt tooth and you follow it across the pulley to the rear where the corresponding reference mark is located. The corresponding mark for the cams is on the front of the top rear part of the plastic belt cover, that is left in place attached to the cam covers. They are approximately at the top and look like a molded in place arrow. Be aware that at least one member of the board found the cam marks not matching because someone in the past had reinstalled the pulleys wrong, (marks not matched), when they were using the cam alignment tool. (The cam pulleys can be installed in multiple positions and the clamp bolt holes are also slotted. Never remove a cam pulley with out careful marking/scribing their location on the cam unless you have access to the cam and crank alignment tools.) I can't remember exactly what the corresponding mark is on the engine casting for the crank but it is on the top adjacent to the pulley. You'll need good light but it will be obvious.

[Tip from Robert Reagan] When I changed the belt, I ignored the reference marks and made my own marks with solvent-based Whiteout or white paint on the cam gears, the crank pulley and the existing belt. I made sure the replacement belt was positioned exactly like the one that came off, and everything went smoothly.

[Mark Stites] Take some "white out" or any other kind of white touch up paint and put two stripes per cam gear. I stripe two different teeth at the top and then eyeball two stripes on the front timing cover, which has the timing scale and notches cut into it that bolts down to the cylinder head. When putting it back together I counted the teeth between the whiteout marks on the old belt and marked the new one so it went on in the same position.

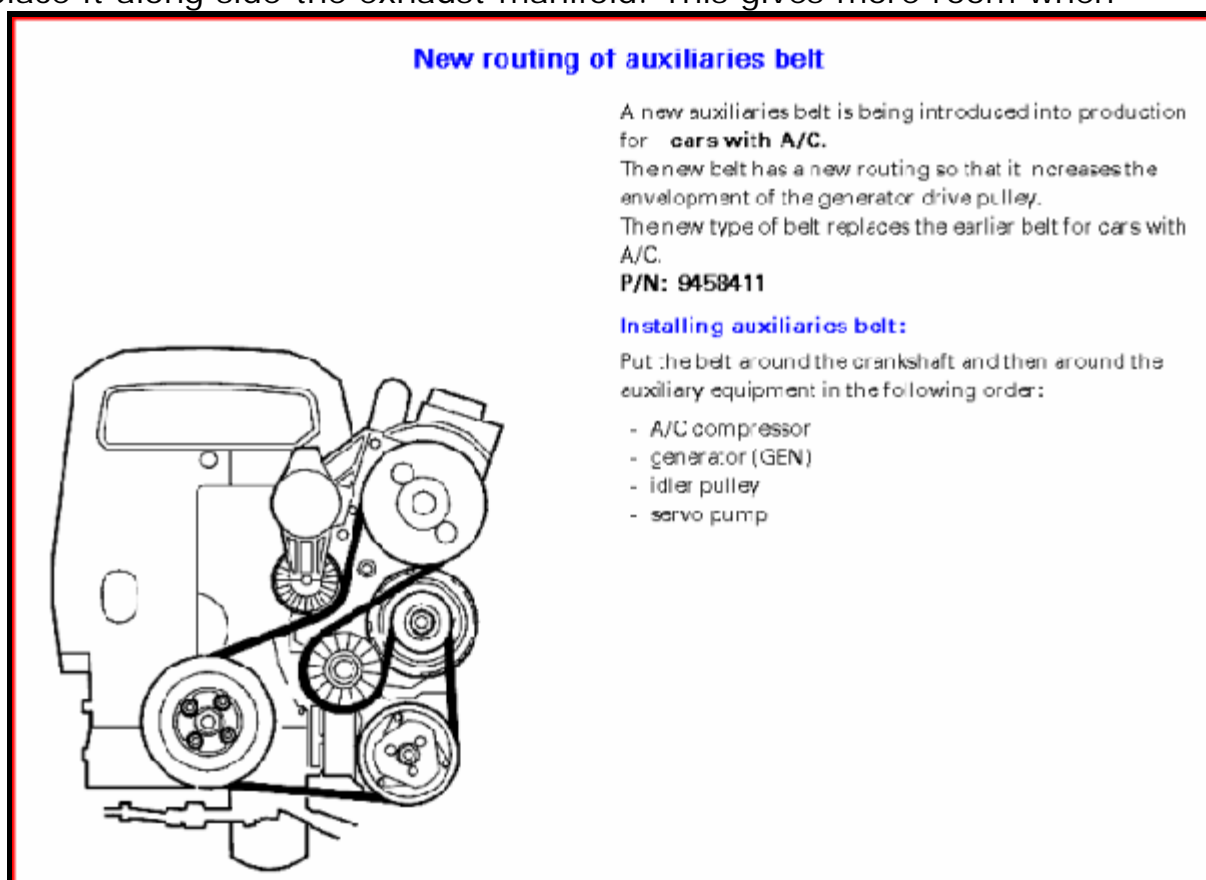
B6300 Engine Pulley Timing Marks Not Aligned Correctly. [Inquiry] I saw your posting on the internet about changing the timing belt, and wonder if you could help me with a question. I changed the belt on my '94 960 and put the new belt on just like the old one came off. The car ran just fine, so I should have left it alone. However, I noticed that the timing marks on the two camshafts did not align as the service manual showed that they should. The intake mark was four teeth off, and the exhaust was one tooth off. So I changed them to what the book showed, but the car ran ragged. I changed them back, but got confused somewhere along the line. Now I can't get them aligned at all, and the engine won't rotate all the way because of the valve/piston interference (I didn't crank it, just turned the motor gently with a socket wrench, so I haven't damaged the internals of the engine). The service manual says to align the marks on the camshafts with the indicators on the cover plate, and to align the mark on the crank pulley with the oil pump housing. I've studied the crank pulley and can't find a mark anywhere on it for reference. Do you know how to determine the correct position of the crank shaft when aligning the timing belt?

[Response: Jim Bowers] Sounds like someone has replaced seals, had the pulleys off and didn't take the trouble to put them back on with the marks lined up. Now the only way to get them set properly is to use the Volvo alignment tools. There is one that holds the cam shafts and one that holds the crank. The camshaft tool is about \$300 and the crankshaft is about \$60 from your friendly Volvo parts

dealer if he can get them in a reasonable time. I suggest you take the car to the dealer and ask him to set the timing and be sure to tell them to make sure they line up the marks so you won't have this problem next time.

960 Serpentine Belt Installation. [Inquiry:] My son's 960 needs a new serpentine belt and I planned to install it. Has anyone had this experience and how difficult is it?

[Response: Bruce] It is not difficult to install. You can remove the three top screws holding the electrical fan into the top of the radiator. Pick the fan assembly up and place it along side the exhaust manifold. This gives more room when



replacing the belt. Take a good look or write down how the belt travels around all of the pulleys first. You will need a 3/4" or a 3/8" wrench to move the belt tensioner. Depends on the year of the car. The tensioner has a 3/8" hole for a 3/8" ratchet to be inserted and move the tensioner assembly as to release the belt tension. There will be a small hole to insert a 1/8" or 3/16" cotter pin in to hold the tensioner in the released position. Remember how the old belt is routed. It can be installed in different configurations but only one will be correct and fit properly. Remove the old belt and install the new belt. Release the tensioner and you are all done.

[Response 2: J. Charger] a smart guy could unload the spring loaded tensioner with a very large set of channel lock pliers, then change the belt, with out special tools. on the other hand, the adapter tool needed is probably less than \$10, from Volvo, to adapt a 1/2" drive ratchet to the tensioner.

1998 S/V90 New Belt Routing: [Richard Rutledge] For later 90 series cars, be

aware of a Volvo update in which they changed the serpentine belt and the routing. The new routing adds about 6 inches so it uses a different and a longer belt. See the diagram to the right.

960 Rear Cam Seal Repair. See [960 Rear Cam Seal Repair](#).

B234 Series Engines:

B234 Timing Belt Replacement Procedures. See Dave Stevens' excellent [supplement](#) describing and illustrating the B234 belt and tensioner change procedures.

B234 Timing Belt Cautionary Tales. [Editor] **If you have a B234 16-valve interference engine, you MUST maintain the entire timing end of the engine rigorously. This means new timing and balance belts and a new oil pump bolt every 50k miles, and replacement timing belt covers, new tensioner, and shaft seals on a regular schedule.** See [Buying a Used GLE with B234F](#) for more details, along with the notes below. If you don't do this, you will join the ranks of ex-B234 owners whose valve trains self-destructed from belt failure.

Parts. Note that some engines have manual belt tensioners and some hydraulic tensioners. These cars use different length belts (the latter is longer), so don't buy the incorrect length.

B234 Timing Belt: New Oil Pump Bolt Needed.

[Tip from Abe Crombie] When replacing the timing or balance belts, [replace the bolt](#) on the oil pump pulley. These have been known to break and the belt comes off and you bend valves. It doesn't happen until you replace belt and the stress of new tight belt can pop the head off the bolt and then it's bad news.

[Confirmation from Paul Bente] When replacing the timing belt at the recommended 50,000 mile intervals on B234F motors (16-valve interference head), I highly recommend that the oil pump pulley (driven by the toothed timing belt) be removed, the pulley carefully checked for cracks and defects, the bolt replaced with a new one from Volvo, and torqued carefully to specifications. If you must use a non-Volvo bolt, be absolutely sure it is of the proper grade from a reliable source. If your motor has over 100,000 miles I urge you to check it now and not wait. If you wonder why, read the sad story below. Acquired my 91 940GLE from my brother-in-law at 137,000 miles. It had documented service by the Volvo dealer at all recommended intervals. After driving across country, the scheduled 150,000 timing belt replacement and other maintenance was done at 148,200 by a Volvo factory trained (presently independent) mechanic. Within 1,000 miles the engine failed. Symptoms were instant, complete loss of power, and check engine light on. Fortunately it happened at low speed on a two lane road next to a wide shoulder. If it had happened on the #1 lane of a crowded freeway at 70 mph, I hope I'd still be around to appreciate Volvo unibody

integrity. Teardown of the engine showed the bolt holding the oil pump pulley failed, pulley jumped off the shaft, engine lost timing, valves crashed into pistons -what a mess. Microscopic (40X) examination of the bolt showed classic tensile failure at the bolt head with no evidence of defects or inclusions in the bolt. Conclusion: bolt was probably overtorqued during assembly. I also observed that the cast iron oil pump pulley was also cracked starting at the stress concentration point on the inside diameter and progressing 2/3 of the way to one of the holes in the pulley. The crack was partially rusted, indicating slow propagation. This was not a cause of the bolt failure, but I estimate the pulley would have failed within another 50K miles. Since other B234F motors of similar vintage may also have been similarly overtorqued in assembly I strongly suggest you check yours out now. Don't wait for it to fail.

B234: Counterhold Tools for Seals and Harmonic Balancer.

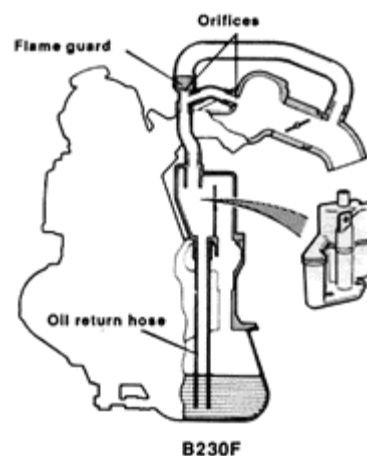
Seals: [Inquiry:] I am trying to find out where to obtain a balance shaft pulley counter hold tool (5362). I recently replaced the balance shaft seals but they are still leaking. I am afraid to try it again without the proper tool. [Response: Rob Abel] I got mine at the Volvo dealer, and wouldn't do the job without it. One DIY timing belt and it's paid for.

Harmonic Balancer: The Volvo -5284 tool for 8-valve engines won't work for the B234 because there is no tensioner stud on which to mount it. You can either use the 5284 tool while levering the horizontal end against a bottle jack from below or try the "[rope trick](#)" (method 2 above) to jam the pistons and lever the crankshaft bolt against the rope inside the cylinder.

Crankcase Ventilation and Flame Traps:

Crankcase Ventilation: A Treatise. [Don Foster]

Operation. A normal byproduct of a normal engine operation is blow-by, or a slight leakage of combustion gases by the piston rings and into the crankcase. It is very desirable to release this pressure. Years ago it was simply vented into the atmosphere. Later, it was vented into the intake system through the air filter. More recently, it is forcibly removed using engine vacuum and certain controls. This system burns the vapors, reducing the environmental problems. On the Volvo B21/23/230 engines, this is accomplished with the contraption we call the flame trap or guard, but the system also includes a flame arrestor, the oil separator, some hoses, and a fitting on the intake manifold. Excess pressure can force oil past seals. Excess pressure can damage seals and gaskets. Excess pressure gums up engines. Excess pressure vents into the atmosphere, which is not good for the environment. On the 240 with the B230, excess pressure can pop the plug outta the back of the cylinder head (happened to my daughter and she won't let me forget it). Crankcase vacuum is directed through the flame trap system. During normal driving, engine vacuum is from the intake manifold (upstream of the throttle), through the top of the flame trap, through the



flame arrestor, through the oil separator (a.k.a. breather box) and to the crankcase. During idle, when there's insufficient vacuum, additional vacuum comes through a small hose attached to the flame trap and to a small fitting in the center of the intake manifold.

Components. The flame trap consists of a lower hose (which sits directly on the oil separator), the upper hose (which has a large and a small fitting for vacuum hoses), and the flame arrestor. The gases in the crankcase are highly combustible, so it's very important to prevent igniting them with a backfire. (If you did, you'd be replacing all your engine seals and gaskets, or maybe your car.) The flame arrestor will absorb the thermal energy from a backfire and quench a flame front. (Note -- this is a very old technique, used during the last century in coalmines when the miners had acetylene lanterns.) So it blocks flames but passes gas.

Oil Separator. The oil separator is bolted to the block and is a single molded plastic unit. I don't know how to take one apart, although I've successfully cleaned out several of them. They're cheap enough that you might buy a new one without a second mortgage. The function of the separator is to allow the oil vapor and droplets some time and space to coalesce into larger drops and flow back to the sump. The separator has two openings into the block -- one for vapors to rise through, and one for the oil return. The oil return opening has a hose that **MUST** remain in place -- don't dislodge it, or you'll be pulling the pan.

Flame Trap. The flame trap is located (buried is more truthful) under the intake manifold between headers 3 and 4. It sits directly on the oil separator. Cleaning the system includes cleaning or replacing the top and bottom hoses, the brass or plastic arrestor, the y-shaped fitting in the plastic holder, the large hose to the intake manifold, the small hose, and the small fittings on the intake manifold. And the oil separator. Use carburetor cleaner as a cleaning solvent. The small hose and small fitting (in the manifold) are famous for plugging. Clean the fitting by running a paper clip or pipe cleaner through it, then replace the hose. Inspect the arrestor (old style=brass, new style=plastic) to confirm the passages are clean and free. If not, either wash or replace -- they're only a buck, or so. Buy a handful. Volvo sells a kit which includes the top 'n bottom molded hoses and the arrestor. It's worth the few dollars.

Diagnostics. A coupla quick checks..... With the engine idling, pull the small hose off the flame trap and feel for vacuum -- it should be there. Pull the trap off the oil separator and observe (or feel) the separator to confirm that crankcase vapors are streaming up.

[Randy Starkie] Remove the hose from the box and attach a length of 3/8 or 1/2" hose. Remove the oil filler cap and blow into the hose. Do you feel resistance? Could be a restricted oil breather box. Do the jiggle test -- with the engine idling, loosen the cap but leave it in place. If it sits there quietly then there's enough vacuum to hold the cap. But if it jiggles and bounces, you have insufficient vacuum (and maybe too much pressure). **[Editor's Note: This test is reliable only with the earlier metal cap, not the later plastic cap.]** It's conceivable that a partially blocked system might provide slight vacuum, requiring only a little finger pressure to hold the cap down. If so, I'd start thinking about some preventive maintenance.

For the technically-inclined..... I built an [adapter](#) and measured the crankcase vacuum at idle. All four of my registered Volvos ('82 245 with 335k; '82 245 turbo with 130k; '85 245 with 235k; and '91 740 with 180k) measured from 1.75 to 2.25" of water, vacuum. **Throttle Body**. While cleaning your flame trap, you might as well clean the throttle body and its vacuum nipples too. See the [Discussion](#) in Engine Performance.

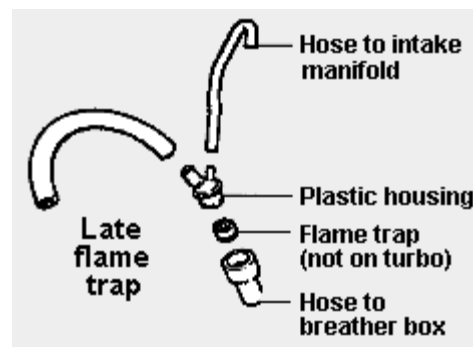
Vacuum Leaks. If you suspect vacuum leaks in the intake system, see the [FAQ section](#) for diagnostic notes.

Flame Trap & Crankcase Ventilation Questions.

Basic Crankcase Ventilation Maintenance:

[Response: Don Foster]

- Perform the jiggle test **if you have the earlier style metal oil fill cap** to see if you have enough crankcase vacuum. (See below.) If it fails this test, go on to step two. If you have a plastic oil cap, then the "jiggle test" is not relevant
- Remove the flame trap housing -- it's the rubber cup into which the hard plastic gizmo fits (containing the flame arrestor sits). Clean it, and inspect the three connections to be sure they're clean and unplugged. The three openings are the bottom one, the large top one, and the small top one.
- Inspect the large top hose to be sure it's clear. Inspect the small top hose -- it plugs into a fitting in the center top inner part of the intake manifold. Often this hose is plugged solid. It's easier to simply replace the line.
- Inspect the small Y-fitting in the manifold where this line connects -- sometimes it's plugged, and must be reamed out. A little carb cleaner helps dissolve the varnish. You can replace this for about \$4, not a bad idea since it can become brittle.
- The lower part of the flame trap -- the cup, as I called it -- sits on the breather box (again, I don't know the official Volvo name), This box is bolted to the side of the block, and is easier to unbolt and remove than it appears.
- Remove the box, being careful to NOT pull on the hose inside the block -- the box connects to this hose. The hose is clipped into position in the sump, and you should avoid disturbing this.
- The box can be replaced, or it can be washed out. The function of the box is to provide a space for oil mist and droplets to coalesce into large drops and return to the sump. When reinstalling, check the gasket (O-ring?) -- it may need to be replaced.



Does my Turbo have a "flame trap"? [John Sargent/Editor] While the turbo engine does not have the plastic flame arrestor insert, it has all the other hoses, fittings, and breather box that can clog up. You still have to inspect and clean as necessary.

[Inquiry:] How much suction should I expect with the vent system working properly? Should the oil cap suck down hard, or is a slight jiggle with what appears as an overall suction enough? [Response 1:] In order for the 'jiggle' test to work, the filler cap needs to have a good gasket. These gaskets only last a year or so on the turbos, then they get hard and brittle. Even with some crankcase vacuum, the engine vibration will make them jiggle. Replace the rubber gasket and try the test again - let us know the results.

[Response 2:] Even without the 'flame trap', the positive crankcase ventilation system can become clogged with hard deposits. The hoses themselves can become restricted, or various ports and orifices can become clogged or the oil vapor separator on the side of the block can become clogged. Often, the hoses, when clogged and old just need to be replaced. (BTW - running the engine with synthetic oil will help prevent clogging of the PCV system because the synthetic oil has a much higher vapor point so that you do not get as much oil vapor condensing and hardening in the system. And what vapor does exist does not coke as easily to form the hard deposits.) The 'jiggle test' is to loosen but do not remove the oil filler cap while the engine is running. If there is negative pressure in the crankcase, it will be sucked down to the valve cover and will sit still. If there is positive pressure in the crankcase, the cap will dance or 'jiggle' on top of the valve cover as the pressure escapes. **[Editor: But NOT for the later style plastic filler caps]**

[Response 3:] I just purchased a 87 745 turbo that was blowing oil from the oil fill cap on the valve cover. I took a rather heavy handed approach. I bought a can of Gunk motor flush. I warmed the motor, turned the motor off and then poured the motor flush down the large hose leading to the flame trap. Initially, the motor flush would not move through the flame trap. Within a few min. it was running through the hose and into the flame trap as fast as I could pour it. I then blew through the hose with compressed air, started the motor and let it idle a few min. Then drained the oil and changed the oil filter. Just to make sure all of the motor flush was out, I again blew through the flame trap with compressed air. I plan to drive the car about 1,000 miles and replace the oil and filter again. I know this is probably sacrilege to some but I think this is the fix. The motor is no longer blowing oil out the breather.

[Response 4: Don Foster] I had luck with carb cleaner, a coat hanger, and compressed air. I sprayed the cleaner in and let it soak 45 minutes before blasting the crud through with compressed air. I followed with a quart of Gunk Motor Flush (I think it's only kerosene or diesel fuel). Then I drove the car 25 miles and changed the oil. In my opinion, if you tried to pour anything down there while the engine's idling, you'd end up wearing most of it. The only reason I didn't remove the oil separator is because on an '82, with K-jet, the separator's buried. It would have been a two-day job to remove and clean it. On the B230 engine, it's a half-hour job to do it correctly.

[Tip from Ralph Haber] This may seem obvious, but can be easily overlooked. During a recent oil change and flame trap replacement, I decided to check for vacuum at the FT fitting. There wasn't any. Closer inspection revealed that the hose and intake manifold nipple were completely sealed off by a 10 year accumulation of dried oil/carbon and other yuk. No vacuum was present at the

flame trap fitting. Replacing the hose and drilling out the nipple gunk corrected the problem. This was on a B230F engine in a 89 744GL with 189K on it. This is real easy to check and can be rectified with a minimum of effort. Untreated, it may allow unwanted pressure to accumulate in the crankcase leading to oil leaks and blown seals.

[Related Tip from Steve Roop] The intake manifold vacuum fitting (small) going to the flame trap was hopelessly clogged. After struggling with trying to clear the blockage and wanting to get to bed in this century, I found that a 3/32 drill bit, turned slowly, would clean out the nipple perfectly (of course I removed the fitting from the intake manifold first!). Anyway, it really speeds up the cleaning process and I now pass the jiggle test again.

[Tip from Mike W.] If the manifold fitting is plugged, the hose between it and the flame trap surely is also, and should be replaced.

[Inquiry:] Why not just leave out the flame trap?

[Response: Editor] The flame trap prevents any engine backfires from reaching blowby gases in the crankcase, which would otherwise cause catastrophic results. It is an important part of the engine and must be left in place. Since cleaning it is not hard, there is no reason to remove it.

[Inquiry: Stuck Flame Trap] In the Volvo dealership where I worked as a tech for quit a long time, what we did to get the flame trap out was take your screw gun and shoot a small screw partially into the center hole in the lil bugger. This gives you a handle to pull it out with and makes it very easy to change. Otherwise you'll screw around all day trying to get it out.

Crankcase Pressure Gauge and Tester. [Tips from Don Foster] To measure crankcase conditions, I built a vacuum gauge to quantitatively measure the actual vacuum. I started with a modified oil cap, shown below. It's an older style metal cap into which I soldered a brass barb fitting, available at any hardware store. One could use a plastic cap with the same fitting, glued with Goop or a similar adhesive.



The gauge is a Magnehelic gauge, by Dwyer, which measures very low pressures. It can be hooked to measure either a pressure or a vacuum -- it's a differential gauge. These gauges are often on eBay for a few bucks. All my cars tend to run around 1"-2" of water vacuum, so a gauge that measures 5" of H2O max works fine. Below you can see the gauge (mounted in a metal box) measuring crankcase vacuum on my '86.



Excess Crankcase Pressure. [Inquiry:] My Volvo has recently developed a case of extreme crankcase pressure. I noted on more than one occasion that the oil dip-stick had been blown up from the tube, spraying oil throughout the engine compartment. I replaced the original flame-trap element with the newer factory plastic resin type, cleaned the manifold orifices, changed the oil and filter and checked the results. Once again, the oil dip-stick was blown up, and another oil-bath was applied to the engine compartment. The only way I can make the dipstick remain in place is to use an elastic cord holding the stick to the manifold. I am obviously missing something here... How else can I relieve this pressure?

[Response 1:Don Foster] On your engine, the major components of the crankcase ventilation system needing attention are:

- The large hose from intake manifold to top of flame trap assembly.
- The flame trap housing.
- The flame arrestor, now white plastic (formerly brass).
- The large lower hose from flame trap to top of breather box.
- Breather box
- Small hose from flame trap assembly to fitting in intake manifold.
- Fitting mentioned above.

Each of these items should be inspected, cleaned, or replaced. Volvo sells a replacement flame trap kit that may be more useful than trying to recover a badly varnished (and hardened) housing. The small vacuum hose, and the manifold fitting, are notorious for becoming plugged. The hose you replace for \$0.25. The fitting can be reamed out with a piece of wire and carb cleaner.

The breather box has been mentioned several times -- it can be removed carefully, washed out, and reinstalled. (Be careful to NOT tug on the hose inside the block that meets this hose.) If these are all fine and you have vacuum at the two vacuum lines, then you might have a serious engine problem, such as a bad ring. This is very rare with that engine.

[Randy Starkie] Remove the hose from the oil breather box and attach a length of 3/8 or 1/2" hose. Remove the oil filler cap and blow into the hose. Do you feel resistance? Could be a restricted box.

[Simple Fix to Another Problem from Randy] I had the same problem with a 1990 740 GL. All of the plumbing was open and clean and yet at high RPM'S the

dipstick would blow out and the engine bay would be bathed in oil. I even went so far as to rig a pressure gauge to try to measure excessive pressure that didn't seem to exist. After talking to a Volvo mechanic and explaining all the things I had done he suggested I replace the rubber O-ring on the dipstick. That was the fix for me and 40,000 miles later it hasn't done it again.

Turbo Oil Breather Box Notes: [Editor's Note: See Michael Ponte's excellent tips and illustrations on oil breather box maintenance at <http://www.mikeponte.com/volvo/oiltrap.htm>

Turbo PTC Nipple Clogging. If your 90+ turbo [PTC nipple](#) clogs, it can lead to crankcase overpressure and cap/seal leaks.

Excess Crankcase Pressure? Dipstick O-Ring Fails. [Comment from Randy:] I had what I thought was an excessive pressure problem in my 90 740 with the b230f. Had the same problem with the dipstick blowing out and bathing the engine compartment in oil. The flametrap and all the plumbing was not restricted. I even went to far as to hook up a pressure gauge to the crankcase! Findings?? There wasn't the tremendous pressure I expected to find. Solution?? Replaced the O-ring on the dipstick- problem solved. It is worth the investment in a new O-ring to check it out.

Oil Breather Box Beneath Flame Trap. [Inquiry:] My crankcase pressure is still high, even after cleaning the flame trap. How do I clean the [breather box](#)?

Function of Oil Separator or Breather Box:

[Motor Magazine, Bob Savasta, July 2001] One of the often overlooked components of the PCV system on the B230 engine is a little black plastic box called an oil separator, which is hung on the left side just below the intake manifold. See photos [below](#). As the name implies, this three-port gizmo grabs oil and blowby gases from the crankcase, internally separates the liquid oil from the gases, then routes the oil back to the crankcase while the purified gases get routed upstream to the intake to be burned. A clogged separator can exhibit the exact symptoms of a sludged-up flame trap.

Diagnostic Notes:

[Motor Magazine, Bob Savasta, July 2001] The oil breather box (the black box under the flame trap) function is to provide a low-velocity space for fine oil mist and droplets to collect (or coalesce) into larger drops that can flow back into the crankcase. Yes, it can get clogged, and can be removed and replaced. It can also be removed, cleaned, and reinstalled.

Diagnosing a plugged separator is a piece of cake. See John Dymond's photo of a cut-in-half clogged breather box to the right. These can coke up from oil fumes: removing the coke can be impossible and only replacement solves the problem.



[Randy Starkie] Remove the top hose from the box and attach a length of 3/8 or 1/2" hose. Remove the oil filler cap and blow into the hose. Do you feel resistance? Could be a restricted box. A few observations: 1. Most people haven't had luck cleaning the separator; if it's loaded with sludge, simply replace it. 2. Volvo doesn't include the oil separator in its maintenance program because it's usually not a problem, unless oil change intervals are extended way beyond the norm. 3. Replace the oil separator before going after the rear main seal leak. In many cases, the immediate drop in crankcase pressure will be sufficient to seal up the leak on its own.

Parts Sources. [Dan] I read mixed reviews of aftermarket oil traps (aka breather box) and thought it would be best to go OEM when seeking a breather box for my 1986 740. My search for a low price turned up this ebay item "1306398 OIL TRAP AQ131A VOLVO PENTA". The same part interchanges with Volvo boat engines? Sure enough, a search found Volvo Penta store has it for \$25!

(http://www.volvopentastore.com/Cylinder-Block/dm/store_id.366--view_id.320836) [Editor: this part fits the earlier engines; see the upgrade below.]

That's less than half of the dealer price of \$57. Item was genuine with Volvo labels on plastic bag and parts (ordered O-ring also). The install went smooth with a 13mm universal socket and a 10" extension (both worth the cost). The only drawback was slow delivery, well over 12 days. Took about 6 days to fill order. Volvo Penta store uses iboat.com to fill orders. [Editor] Brickboard reports anecdotes of aftermarket oil breather boxes splitting after a short time. Buy OEM.

Replacing Breather Box with Improved Version. [Tip from John Sargent] Volvo re-designed the oil trap sometime between the 1987 and 1990 model years of the B230 series engines. The improved oil trap is about twice as tall as the earlier model, and I think it must do a much better job. At least you have twice as much volume to plug up! It is more difficult to remove and replace with the intake manifold in place, but I just did one in a half hour. The new oil trap is Volvo part number 1389430. It can be identified by the flange on the upper end to slide a tinnerman nut onto for securing the engine wiring harness. If I had to buy one, I would buy the improved version in spite of the greater difficulty in removing and replacing. Don't forget to get the new (shorter) S tube with it, and a new o-ring for sealing between the oil trap and the block.

Removal Tips. [Kevin] Access is a little tight, so a set of 1/4 inch drive metric sockets/handles and a selection of extensions is going to be a big help. If you have a portable shop light, hang it in the back of the engine compartment behind the inlet manifold. A little illumination makes this a lot easier. The removal and re-installation should take about 2 hours or so in total, plus whatever time you may take cleaning the breather box, EGR, etc. Overall this is not a very difficult procedure, and with a little patience most weekend mechanics should be able to get through it without too much cursing. Buy a replacement o-ring (it is listed as 34mm IDx3mm) for the box, since the existing ring is sure to be hardened.

B230 Series Engines and General Notes: Cleaning Oil Breather Box by Removal:

[Editor's Note: See <http://www.mikeponte.com/volvo/oiltrap.htm> and the photos below. [Alternate Procedure from Chris Herbst] When I want to remove the breather box, I take the intake manifold off the head and pull it back to the strut

tower. That makes EVERYTHING accessible. It's also a good time to replace the heater hoses as long as you're down there. The oil trap is easily accessible from that position, and if you pop out the airbox (non turbo left side, a few grommets) it makes a great platform to stand and work. Sounds bizarre, but it's really simple when you do it a few times.

[Procedure from Kevin & Jay Simkin]

Disconnect Idle Air Control Solenoid (IAC) hose and PCV breather hose from main air intake hose immediately upstream of throttle body. IAC hose is the one on the left and breather hose on the right relative to the throttle body. Loosen the hose clamps that hold the air intake hose at the Air Mass Meter (next to air cleaner box) and at the throttle body. Clamps have a 7mm hex head screw that also has a screwdriver slot. Pull the hose off the AMM and the throttle body and put to one side.

Remove the flame trap/nipple and the short hose below the flametrap that connects to the top of the breather box. This is located between the 3rd and 4th legs of the inlet manifold. If there is not enough room for finger access, the end of the hose may be gripped gently with needle-nosed pliers. Be careful not to press so hard on the plier handles, that you cut into the hose! Pull gently, and the hose will come free. Disconnect the IAC electrical connector (push on the spring clip on the back side of the connector and pull the connectors apart).

Remove two 10mm hex bolts attaching the IAC to its bracket underneath the inlet manifold. Disconnect the IAC outlet hose where it connects to the manifold header. The IAC hose is the one located directly below the flame trap vacuum hose. Another 7mm hex-head screw on the clamp. Pull the hose off the nipple. To speed hose removal, slide a short length of 1/4" rope(not twine or wire) around the hose. Gripping the rope on both sides of the hose - do not make a slip knot - pull gently on the hose to remove it from the manifold nipple. Remove the IAC, with the hoses still attached, threading the discharge hose down the back of the manifold. Now is a good time to clean the IAC. When you re-install the discharge hose, route it to the right side (passenger cabin side) of the fuel injection harness.

If your car is so equipped, the EGR valve is now exposed, behind and to the right of where the IAC was. It is connected to the inlet manifold via a steel tube that connects to the side of the valve. There is another steel tube connected to the end of the valve, that runs around the back of the block, to the exhaust manifold. [Remove it](#) and the EGR valve bracket on top of the base of the breather box. Remove the two 12mm hex bolts that attach the breather box to the block. These can be removed with a box wrench or a socket and there is now plenty of space under the manifold to get at them directly. There is a bracket supporting a wiring harness clip in front of the block at this location. Remove two 10mm hex bolts attaching the bracket to the wiring clip. One is front and center relative to the breather box, the other is to the right of the breather box.

Pry the bracket away from the wiring clip and it will pop off. Now is the time to wipe dirt away from the area surrounding the box. Use brake cleaner spray and a rag or brush and remove as much as you can so that when the box is removed, you don't push dirt down into the crankcase through the opening. Lift the breather box up away from the block. Rotate it forward slightly when it raised 1/2 inch or

so, so that it clears the heater hose (this is connected to the block slightly above the breather box) and it will come free and can be maneuvered out easily.

Caution: there is a curved hose inside the block into which is fitted a 3/4 inch long lip on the bottom of the box. This hose goes back down to the sump, and is held in place with clips. When removing the box, be careful to NOT disturb or yank this hose: gently pull the lip out of the hose. [Mike] If the trap nipple breaks off in the hose, use a spring puller from Harbor Freight (\$2) or the equivalent (photo right). Use it to hook the bottom of the broken piece and pull it out. [Editor] If the hose or a portion breaks off and drops into the crankcase oil pan, you will have to [drop](#) the oil pan and replace it.



There's an O-ring where the box fits against the block -remove this carefully as it may be brittle. Cleaning the box. Use a solvent or degreaser that won't attack plastic, such as Gunk Motor Flush, citrus-based solvent, non-chlorinated brake cleaner.

[Paul Seminara:] Soak it in Naptha thinner for a day. Follow with a soak and scrub with Simple Green (straight), hot water rinse and dry.

[John Sargent/Randy Starkie] Air will flow quite freely through a clean oil trap. If you want to clean it up instead of buying a new one, try probing inside with a piece of wire to break up the deposits. I have found that a lot of deposit build up occurs around the top opening. An initial reaming out by hand with a 5/16 or 1/8" drill bit will remove a lot of the crud. There are no check valves inside the oil trap, just a baffle or two. Carefully clean the bottom surface and o-ring groove with rag and cleaner. Install new O-ring (which will be green and fit nicely). Smear some general purpose grease on the o-ring to hold it in place while re-installing the box. Before beginning to re-install parts, clean up the exposed surface on the block where the breather box sits. This area is usually something of a dirt trap. Be careful not to knock any crud into the openings into the crankcase. Also, while you are doing this, take care not to disturb the oil return hose (front opening). Carefully wipe around the larger opening, and then (even more carefully) around the smaller opening that has the oil return hose inside it. Then spray a little throttle-body cleaner onto a clean rag and wipe the surfaces again. This is the sealing surface for the breather box o-ring, so it is important not to leave any dirt.

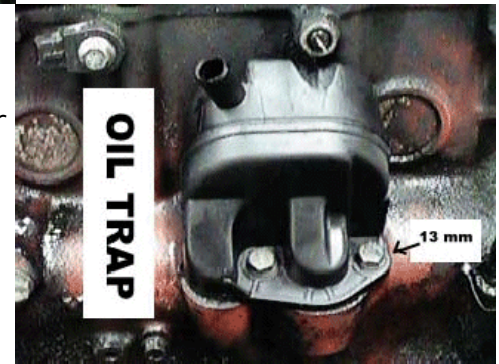
The rest of the re-installation process is (as they say) a reverse of the removal process. Apply a little dielectric grease to the contacts of the IAC solenoid and EGR before re-connecting them.





If Your B230 Car Has an EGR (Exhaust Gas Recirculation) Valve. [Kevin] You will have to remove the [EGR valve](#) to gain access to the breather box.

Cleaning Oil Breather Box In Situ: Try running some Gunk Motor Flush (a kerosene solvent/detergent used just before an oil change) down into the breather box through the flame trap tube. It may dislodge any crud inside the box and free up the drain into the crankcase. Just make sure you change the oil immediately after you do this. [Response: Mark] If you want to unclog the oil trap without removing it, try this. During the oil change, with the plug out and the pan drained, place a funnel in the hose nipple coming out of the oil trap and dump a quart of cheap motor flush down the funnel. It should go right through and drain right out into the pan. If it drains sloooooowly, pour some carb cleaner to break up the globs and follow with the rest of the motor flush. The nipple diameter is small. I place a length of hose over the nipple and place the funnel in the hose. Make sure the hose fits the nipple snugly. Use a zip tie to reduce the diameter by tightening it until the hose snugs. [Response: Ivan] On my '86 B230FT, changing all the clogged PCV hoses did not affect the vacuum at the fill cap, but changing the oil trap sure did. The old oil trap weighed about twice as much as the new, and was visibly full of crud. Changing it was pretty easy, even without removing the intake manifold, but do be sure to buy the O-ring that goes with it, and some liquid gasket. The results are well worth the \$37: the turbo is no longer blowing oil past its seals (I think), the car idles a little more smoothly, and the oil fill cap stays happily in place at idle.



B234 Engines: The B234 breather box is different than that for an 8 valve. While it uses one o-ring, like the 8v, you must pull the intake manifold off to clear the long pan drain pipe when removing the box. This is not very hard: you only have to loosen the lower manifold nuts a few turns, not remove them. The intake stud holes are open on the bottom so you can then lift it off. Makes it easy to put back also. Have new gasket ready.

B6304 Engines: [John Roberson]

Disconnect your battery negative. You will need to get a 3/4 adaptor for your socket wrench to take the pressure off your serpentine belt tensioner. With the tension off the belt tensioner, take a small nail and insert it in the hole to fix the tensioner. Now remove the two bolts holding the tensioner from its holding

brackets. With the belt and tensioner out of the way, remove the bolts holding your power steering pump and move the pump out of your way your right out of the way, fixing it with a cord to hold it. Next remove your alternator bolts from their brackets and disconnect the two wires from the alternator well. Remove two plates affixed to the block. Remove two 10mm bolts on each side of the oil breather box. Pry off hoses using a blunt screwdriver and inspect them for plugging or deposits. Remove the box. Clean the box and make sure the drain into the sump is clear. Replace everything, using Vaseline as a lubricant to help things go back together.

B6304 Seal Replacement Notes. [Inquiry] The new seals I bought for my breather box look nothing like the old ones. [Response: Walt Poluszny] The new green doughnut goes on the side against the block with the flat side of the doughnut facing the PCV box. The old bottom/right seal against the block was indeed a tube with two hose clamps. The new upgraded part (P/N 8653339) is rubber with a metal fill sleeve. The 'flanged' end of the tube goes toward the PCV box. I used RTV as a lubricant and a sealer on the 'O' ring and tube on the advice of a Volvo mechanic.

Vacuum Leaks. See diagnostic tips in the [Fuel Injection](#) FAQ file. For vacuum hose replacement, see the section [Vacuum Hose Replacement](#)

Oil Seals and Leaks:

Finding Engine Oil Leaks

. See also the section at [Oil Leak Diagnostics](#). Auto supply stores (larger ones such as NAPA) sell an ~\$5 1-2 oz. bottle of oil leak dye. Clean/wipe existing oil from engine etc., add to engine oil, run for 50-100 miles and inspect for leaks with a black light while wearing UV-enhancing glasses from JCWhitney or your local supplier. The dye fluoresces brightly when exposed to black light. Buy a fluorescent black light from Tracerline at Autozone.

[Look for leaks at:] Regarding oil leaks on 89 744T: Prime places to look are cam cover, distributor O-rings, turbocharger return line (at turbo and the O ring into the engine) and, like Letterman's top 10, Number 1: Oil Filter mounting O ring(s). [Editor's Note:] It helps to have a clean engine when you are looking for leaks. See below for tips on cleaning your engine.

Potential Water Pump Failure from Cam Oil Seal Leaks. [Paul Ramdial] Cam oil seal leaks will degrade your water pump top seal; you can [protect](#) it with silicone dabbed around the seal.

Cleaning Your Engine. [Editor's Note:] It helps to have a clean engine when you are looking for leaks. Cover the distributor with plastic wrap. Put a piece of well-chewed chewing gum on top of the little vent hole on your brake fluid reservoir. Use Simple Green or a water-based degreaser on stubborn spots, then use the tire cleaner/degreaser setting at your local self-carwash to cover the engine with cleaner. Try not to spray into the alternator, ABS unit or distributor. Let it soak

for a while, scrubbing with a brush where necessary. Use the low-pressure wash to remove the deposits. Do this at least once per year and you will find it much easier to both work on the engine and diagnose problems.

Replacing Oil Seals.

Tools. Seal Removal Tools: [What have you used to pull the old seals out and press the new ones in?] It's pretty straightforward as long as you have all the timing marks lined up. Just keep that little detail in mind for re-installing the belt. As far as removing the seals go, I have a little tool in my tool cab that I don't know the origin of that slightly resembles a dental probe. It's a straight, ice pick looking thing with a 90 deg bend at the working end. I simply reach back behind the edge of the seals, work my way around and pry 'em out...being careful not to nick any of the sealing surfaces. [Other Techniques to Remove Seals] Use a small screwdriver to pry out the seal.



[Bruce Feinberg] Try a seal puller. The one I used is made by KD Tools. (The rack at the front of many parts stores full of strange and seldom used tools is probably KD.) The tool I'm referring to looks like a hammer that got flattened, but with a hook on each side of the head. Slip the hook under the lip of the seal and roll the tool. Its out...with no damage. [Editor] Use a drywall screw, carefully inserted in the rubber portion of the seal to pull it out. Be VERY CAREFUL you do not touch the softer crank with the hardened screw. [Larry Williams] Use a packing puller, sold at plumbing stores for removing valve stem packing in water or steam valves.



Front Seal Installation Tools: OEM Tools.

[Technical Tip from Volvo TSB 21121 Oct 93] New Volvo OEM seal designs are now used for camshaft, intermediate shafts and cranks starting in Oct 93. The seals (p/n 6842273-2 for cam/int and 1276425 for crank) are more compact and use a special version of the seal installation tool p/n 9995283 (crankshaft-\$24) and 9995025 (camshaft), respectively (see photos right and note the lips on the tools). These tools are available inexpensively from SPX Corp. in Owatonna, MN (866-640-7305). Lubricate the seal and press it onto the shaft using the tool. To ensure that it sits correctly, it must be pressed in



for at least 30 seconds. If pressed for a shorter period, it may creep back out. Remove the tool carefully to avoid damage to the seal lip or spring. See the Procedural Tips below; if you do not have the special tools, the homemade solutions noted will work with these OEM cam and crank seals to keep their lips from rolling over. Aftermarket seals are different.

Homemade Installation Tools. [Response: Rob Abel] The special tool is just a socket-like contraption that fits over the crank, then has a bolt which threads to the crank - purpose to evenly, slowly and gently press in crank seal. You can do the same thing with homemade tubing, pvc, pipe, or whatever has the proper diameter and two square ends. On the crankshaft, the tube should fit over the crank, but not be so large as to be larger than the crank seal. Ideally, the outside diameter should be just smaller than outer diameter of crank seal, and inside diameter just larger than O.D. of crankshaft.

Load the spring into the lips of the seal with some grease so it won't fall out, lube the lips of the seal, start it in by hand evenly, then gently tap it into place using the seal installer you've found/made/stolen/borrowed or whatever, and a wooden block. The cam and auxiliary shaft are the same diameter, same seal, so you only need 2 installers, one for cam and aux., and one for crank seal. Just be patient and go slowly, and you'll get them in right.

[Another tip:] I bought a PVC coupling that was close to the same size. I used the crankshaft bolt and a piece of flat iron to press it in. Went in squarely. [Another: John B.] Use a seal pusher you can make out of copper tubing or pvc tubing...use a rubber mallet on the pusher tap the new seals in.

[Editor] The newer OEM grey Viton seals are tougher to install without rolling the lip. Modelling it after the [end of the Volvo tool](#), I made a semi-circular piece of thin plastic sheet, heat-formed in the same diameter as the shaft, to carefully insert between the new seal lip and the shaft after installation. This gently pushes any rolled seal lips back and ensures a correct installation.

Parts.

Seals: [Editor] Volvo OEM seals are black or grey in color and use Viton, an advanced long-lasting elastomer. They fit perfectly but tend to require the proper seal tool to ensure correct installation on the shaft. Aftermarket red seals are made of EPDM, are easier to install, tend to fit more loosely, don't last as long, and often require gasket cement on the outer edge to keep them in place.

Mounting Plate Gasket: If you're doing the crank-seal and balance shaft seal, get the gasket for the front bearing mounting plate in which these are both mounted, as it makes things much easier if you have this on hand if/when those seals fail to come out in one piece. Much easier to just remove the plate, and push them out from the backside. Then install the seals in the seal cover and remount it with a fresh paper gasket. You get to set them where you want and observe the spring is in place.

Removal Tips:

[Inquiry] How does the lower front crank gear come off?

[Randy Starkie] Once you remove the harmonic balancer you just pull the gear

off. Remember to replace the pieces on each side of the gear when you reassemble and be sure that the cog on the back of the gear is engaged properly with the slot in the crankshaft. [A cautionary tale] I just did a 120K mile service on our '90 745 (B230F). I did the oil seals (and water pump--how's that for anal!) as long as I was doing the timing belt. Two things about that. First, a good impact wrench makes the crankshaft pulley nut a breeze, even with an automatic trans. The crankshaft barely moves, even with nothing holding it in place. Now the bad news. I think I may have slightly scratched the camshaft in pulling the seal. There is oil on the water pump coming from the vicinity of the top, front of the head, on the order of a drop or two per minute. To be sure I didn't screw it up, I redid both valve cover gasket and camshaft seal the next day (cursing all the way). I felt a slight scratch on the shaft with a q-tip the second time, and buffed the cam with fine emery paper and 1200 grit finishing paper. Anyway, it still seems to leak. [Barry Wilson] I did this with the cover installed. To remove the seals, I used a drift to force one side of the seal inward. This cocked the seal and I was able to grab it with needle nose pliers to remove it. Be SURE not to scratch the crank or intermediate shafts.

[R. Haire] Be careful not to rip the oil pan gasket where the lower bearing housing bottom rests or sticks, or the job will become much larger.

Lubricating the Seal Prior to Installation:

[Fix:] did you lube the sealing lips of the oil seal with engine oil prior to installation? I've learned the hard way; it doesn't take long to maim a dry seal.

[Fix:] [See also [Cam Seal Replacement](#)] Make sure you put sealant on the sides of the front bearing cap, and on top of the gasket in the same places, also put sealant under the cap on the head mating surface between the bearing and the seal. If the leak is indeed through the seal, you could try moving it in or out a little or get a new seal with two lips (no idea what it's called...). I always do exactly as all the books say not to, I remove the front bearing cap and take the old seal out, then I apply oil to the outside of the new one to avoid squeezing it and put it in. Then I apply sealant on the bearing cap, just in front of the bearing surface, and put it back. Torque the bearing cap to 14 ft-lb.



[Another response:] Two common problems installing seals are rolling over the seal lip, and failing to pre-lube the lip and crank surface. I hope you considered both of these.

Location of New Seal: [Inquiry:] I'm still at a loss as to how deep to press in the main seal - should it be flush with the housing or jammed all the way in?

[Response : Rob Abel] See if you can get a good look at the surface of the crankshaft which was in contact with the lips of the old seal. Sometimes, grit gets in there and causes ridges to wear in the crankshaft. Because of this, many will seat their seals a bit deeper, to offset the lips of the seal from the more abrasive surface of the scratched crankshaft. The idea is to seat the seal so it contacts the crankshaft at a smooth point. Doesn't really matter whether it's flush or all the way in. I would put it just inside of flush if you can, but it depends on the cranks surface.

[Another:] If you install the seal about 1/16"-1/8" further in than the old seal, the lip will have a fresh surface on the crank.

[Tip from Washington Volvo Club] Care is required when installing front oil seals- DON'T push in too far. DON'T get it more than 1/16 to 1/8 in. past flush.

Pressing in the New Seal: Installation is NOT the reverse of removal. I used my hands to gently but forcefully press the seals in place. Worked for me... at least they're still holding after 10k miles



[Response: Paul Grimshaw] There is a special Volvo Tool (PN 9995025-5) that is used to press the oil seal into place. Is the tool necessary? Well, the seal is fairly fragile, with an inner spiral spring that can be easily bent. The seal costs almost as much as the press tool, so I'll let you decide the cost/benefit. As for tool necessity to install the seal, if you are careful it can be done without the press. Some prefer to use RTV sealer, grease, or other sealing compound on the outside diameter of the seal, others don't. If you do use a sealer, use brake cleaner to clean up all surfaces first.

Procedural Tips: More on Engine Seal Installation. [Inquiry:] I'm doing my timing belt and want to replace the seals. I can't bend, push, force or cajole the new cam and idler seals in place. I've tried everything I can think of. Are there any tricks? The old ones were orange reddish, the new are black and seem slightly larger.

[Response: Alan C.] Just my 2 cents worth having just gone through this, twice for the intermediate shaft seal. It leaked after installation. When I checked it with a mirror before the second replacement I saw that the lip had rolled out on the bottom causing the leak. Use a mirror and flashlight to be sure the lip is not rolled out. Volvo told me to put white grease in the area that contacts the shaft but nothing on the outside of the seal. They also told me that they redesigned the seals, that is why the new ones are black. Make sure there are no pieces of the old seal in the recess as it would make it hard to press in the new one. I found it helpful to gently slide the seal over the shaft while rotating it to be sure the lip does not roll over. Find/make a press tool from pvc pipe/coupling and use the pulley bolt to press in the seal. Take your time and check the progress to make

sure it is going in straight and do not seat it too far in. I do not think it is a good idea to pound in the seal as this might cause the spring on the inside to pop out. Hope this helps. As long as you grease the seals and the shafts (I use white lithium) and pay attention to getting both seals started on without rolling the lip you should be fine.

Remove the Bearing Cap or Not? Is it better to remove the bearing cover plate and put the seals in that way, then replace the plate, or just do it by pressing in the new seals with the plate still in (and thus not disturbing the plate)? [Randy Starkie] I prefer to do them with the cover in place, but as mentioned it is a lot easier to clean up the contact surfaces with the cover off. Putting the cover back on with the new seals in it has one drawback. It increases the risk of pushing the lip of one or both of the seals outward and allowing the spring to become unseated. This can go unnoticed during installation and will only become evident shortly after completing the job when the seal leaks. [Bill Bithell] Don't take off the cover, the pan gasket makes up to the bottom of it! I learned this the hard way. (Then I had "fun" with silicone stuff). [Editor] Use a razor to separate the cover from the pan gasket prior to removing the cover. [James Glowonia] I prefer to install the seals without removing the cover. The main fear I have is bugging the oil pan gasket and having to replace that as well which is a major endeavor compared to the front seals. I would just rather not risk an accident and so replace the seals the same way as the Volvo green manual which is with the cover in place. [Response: Don Foster] Last time I did a cam seal I pulled the valve cover and removed the front bearing cap, which also retains the seal. Be careful of the valve cover gasket. The I-shaft seal, as I recall, pried out easily, and the new one pressed in -- a tad firmly (which is comforting). Don't forget to clean everything thoroughly, and lube the seal lip and shaft surfaces before you install the seal. Also, examine carefully to be certain you haven't rolled the seal lip during installation -- easy to do, easy to miss. [Matthew Mallett] I have done it both ways and prefer to remove cover. It allows you to get a better look at the crankshaft end and A) see where wear marks are from old seal and B) Get the end all nice and clean so you have a good mating surface for the new seal. Plus the crankshaft seal is pretty damn tight in the carrier/cover. Cover off lets you play with it on a bench until you get it perfectly in there and even all around. PB Blaster all around the cover then tap it with a rubber mallet then gently pry all around till it pops off. [Editor] Note: it is not necessary to remove the bearing cover to replace the seal. Removing it requires a replacement gasket.

[Editor] The newer OEM grey Viton seals are tougher to install without rolling the lip. Modelling it after the [end of the Volvo tool](#), I made a semi-circular piece of thin plastic sheet, heat-formed in the same diameter as the shaft, to carefully insert between the new seal lip and the shaft after installation. This gently pushes any rolled seal lips back and ensures a correct installation.

[Response: Henry Cordova] When my seals leaked after installation, I traced the problem to forgetting to clean the sealing surface on the camshaft before replacing the seal. I was used to Japanese engines which have a positive stop on the seal to ensure it always goes in the same depth. The Volvo seals don't have this stop, so I put it in just a little off from where the old one was. The old location was smooth due to the presence of the old seal. The new location had some build up which ruined the seal in no time. I pulled it apart, cleaned the

camshaft with fine emory cloth and replaced the seal. No more leak.

[Response: Kerry Schutt] Be sure to clean the seating surfaces on the engine real well where the seals go. Most of my time doing the job was spent cleaning those areas. I used small cotton rags and lacquer thinner and kept rubbing until it was all shiney metal. I didn't want any leaks after I was done. [Barry Wilson] I used a little Permatex gasket remover on a shop rag to get the worst of the grime off. If you use this stuff, be careful with it. It likes to remove skin too. I went through a few pairs of Nitrile gloves (eats them instead of your fingers). Next I cleaned the sealing surface on the crank and intermediate shaft with scotchbrite until they were clean. This is time consuming because it is so hard to get to everything.

[Response: Alan Carlo] So now I gently turn the seal onto the shaft when assembling to prevent this. Then check the installation with a mirror and flashlight, all around. Be sure to pre-lube the seal surface where it contacts the shaft before assembly. A Volvo tech told me to use white lithium grease to fill the small recess of the shaft contact area. Also do not hammer the seal in as the jolts can dislodge the spring causing a leak.

[Response: Dick Riess] Volvo even went so far as to advise a wait of 20 minutes to make certain they were in ok as they can flip the seal lip. I use some Vaseline on my seal lips and use an old seal backwards to tap on to insert new seal. Don't drive new seal all the way in either. Would clean the crank surface with some of that 3M Scotchbrite or a strip of fine emory papers like they use to polish cranks. [Editor's note: use the less abrasive Scotchbrite blue].

[Response: Ivan K] To prevent the seal spring from getting out of position during installation, pack the area around it with grease.

[Response:] When punting the cam oil seal, I always put a bit of red RTV/Permatex on these seals between the cylinder head and bearing cap for insurance... [Editor's Note: See [Cam Seal Replacement](#)] Also use sealant on the valve cover gasket, where it has a sharp bend around the front bearing cap. **If You Are a 240 Owner Reading This:** The only thing you have to worry about that most 700/900 owners don't is maintaining the correct intermediate shaft timing, because the distributor is driven off the intermediate shaft on the 240 versus the back end of the camshaft for most 700/900s.

Crank Seal Leaks After Installation.

[Problem:] I could kick myself! I just checked my front main crank seal I replaced a week ago! After running the car for a short bit, I noticed leakage at the bottom of the crank housing! Ahhhhhgg! I know when I put the seal in it was flush to the housing and felt even all the way around! I have heard you should seat them deeper when replacing one - but it looked good and I did not have the proper seal tool to do the job, plus I afraid to seat it to deep and get a leak that way. I used a giant 3/4 socket to seat it in the past. But this time I didn't have it around! I bet I didn't seat it far enough or messed up the spring!

[Suggestions:] If it leaks after installation, you probably flipped your seal lip; I have done it more than once.

[More:] Something I did on mine when I replaced it was coat it thoroughly with petroleum jelly. I had been warned that the seal can be messed up by installing it dry. Also, are you sure it's straight? If it is cocked at an angle, it will leak. Also, You may have popped out the spring! If you pounded the seal the spring can pop out. Check it! If you didn't buy an original seal, check the rotation mark. They make seals for both rotation directions.

[Eventual solution:] Spring had popped out. [Jon Scheetz] : If you are looking for an oil leak that appears to be a shaft seal on the front of the engine, be sure to check the security of the bolts holding the metal crank seal carrier cover on the lower front of the engine block. On my 1995 940, I had replaced all the shaft seals when I renewed the timing belt only to have the leak return almost immediately. When I went back in and checked the front cover bolts, a couple were barely finger tight. I did not trust a gasket that had leaked to seal again by simply tightening the bolts. So I carefully removed the front cover, cleaned the block and renewed the gasket. The routing of the engine wiring complicates removing the front cover but it can be done: loosen/remove all the wiring attachments and wiggle. The bottom of the front cover also mates with the oil pan. I cleaned the pan gasket surface with solvent and applied a sealant before replacing the front cover. This fixed my leaks. I now recheck these bolts when ever I'm in to do the timing belt but have not had a recurrence.

Front Cam and Intermediate Seal Replacement. Tools: [Genaro Lopez] Sears sells a GREAT seal puller. It has a red thick handle and a thin curved and notched end that slips right in between the cam and the seal, and allows you to just pull out the seal with no fuss. [Tip from Zippy] The latest seal installer for the cam and intermediate shaft seals is nylon and steel (Volvo special tool [9995025](#)) and I don't see how anyone can successfully install the Volvo Viton seals without it. Some replace the seals at every 50,000 service, we do it every 100,000 or sooner if required. (which it rarely is). [Editor] This device is a thin sleeve just large than the diameter of the shaft that pushes out the lips of the seal and seats them against the shaft. You can simulate its results by following the "procedural tips" above.

Seals Selection. [Editor] Volvo OEM seals are black or grey in color and use Viton, an advanced long-lasting elastomer. They fit perfectly but tend to require the proper seal tool to ensure correct installation on the shaft. Aftermarket red seals are made of EPDM, are easier to install, tend to fit more loosely, and often require gasket cement on the outer edge to keep them in place.

1. **Cam Seal Procedures:**[Inquiry:] I have identified an oil leak on my 740 as a blown front cam seal and I'm preparing to replace it. Any tips I might benefit from?

[Don Foster] Very often, the cam seal is the first to leak when you have excessive crankcase pressure -- so it's good you're going after that, too. It's good you're replacing the seal -- excess oil can leak onto the water pump and cause the top mushroom seal to leak -- then you'll have more headaches. For crankcase pressure, remember to check and clean the small vacuum line from the flame trap to the intake manifold. Replacing the cam seal is straightforward. You will need a new seal and a timing

cover gasket. I first highlighted all the timing marks with white crayon. I then set the engine to TDC. I stuffed a rag into the opening of the bottom cover to prevent losing nuts, sockets, etc. down there. Then the tensioner was pulled back, and I used a small clamp to lock the belt to the intermediate shaft pulley (on a 240, that's important -- on a 740, not important -- but still, you want the belt to stay in position). See photo below. I also stuffed something down the passenger's side of the belt to prevent it from disengaging from the crank pulley. Remove the bolt holding the sprocket on, using a rubber strap wrench to hold the sprocket while loosening and tightening this bolt. Or use Volvo tool 5034, cam sprocket counterhold. The seal is held in by the first bearing cap and I prefer to replace it by removing cam bearing cap #1. Of course, this means pulling the valve cover -- so be prepared with a new gasket. No need to remove the camshaft. The cam seal then lifts out with two fingers. The cam surface and replacement seal MUST be prelubed with motor oil on the shaft sealing surfaces. The bolts on the cam gear are torqued to [Bill Gantt: I found that if you set the belt in place on crank & auxiliary shaft & use a small spring type clamp to hold them in place it helps until you release the tension pulley.] Once the seal was replaced and the cam pulley reinstalled (see torque values below), I looped the timing belt back over the pulley, carefully observing the timing marks. I reset the belt tensioner. Worked great.

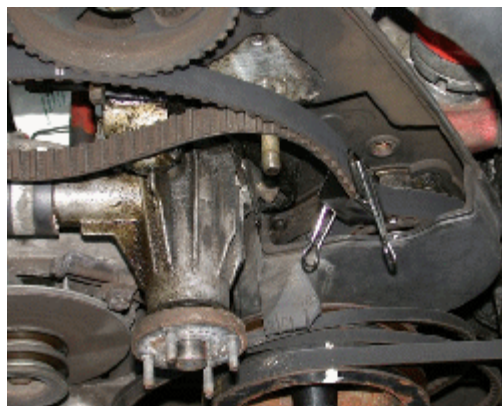
[Ozzie] You should probably just spend the extra money and replace all three front seals while you have the timing belt off. The only trick I found to replacing the seals was to use a can opener, the triangle tipped kind, to get the seal out...When you put the new ones in cover them in oil and make sure you buy them from a Volvo dealer...I got the wrong crankshaft seal, and lost oil. I had to take everything back off and put the right one in...it took me 2.5 hours to replace all the seals, timing belt, and belts.

Removing the Seals. A number of techniques can be used to remove the seals, the only common thread being NOT to scratch the shafts. [Paul Ramdial] To remove the cam seal I used two DRY WALL screws. I tapped them in with a hammer just enough so I could use a screw driver to get them in further. Don't drive them in a lot; just enough to hold them and pull the seal out. To give you an idea the tip of the screws were not protruding out of the other side. Do NOT scratch the shaft surface: be careful!



[Chris Mullet] I've replaced the cam seal before by only removing the upper belt cover and cam sprocket - the crank pulley and lower belt cover stayed in place. But before loosening the belt you MUST bring the crank to TDC and verify the cam sprocket is also aligned to the index mark. (This assures you that the crank pulley hasn't spun on the inner hub.) Once you have the cam and crank on TDC, you can loosen the

belt tensioner and slip the belt off of the cam sprocket. The I-shaft sprocket index mark is also out of sight during this procedure, but you don't care if it gets out of time when you have a cam-driven distributor. As I recall, you also have to bend the rear belt cover forward to get the seal in and out, but that's no biggie. It sure beats having to go through removing all the other stuff. [Randy Starkie] I agree. After releasing the tension on the belt I slipped it off of the cam sprocket. I carefully pinched the belt together to maintain tension and placement on the crank and intermediate pulley. I used a small C clamp to keep the tension on the belt and then went back the cam sprocket removal and seal replacement.



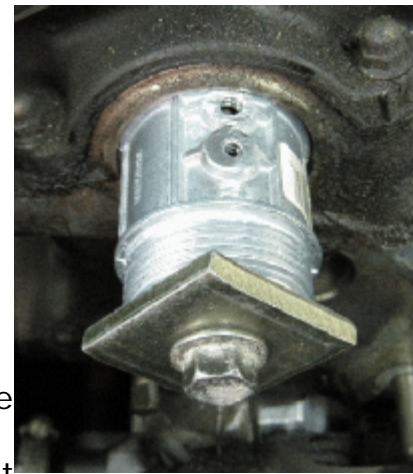
Cam Pulley Removal: [Don Foster] Grabbing onto or jamming the pulley should allow you to loosen the bolt. An impact wrench works wonders. [Editor's Note: Better to use a Volvo tool 5034 called a cam sprocket counterhold to secure this sprocket.] If you have the special tool for holding the crank pulley, it will also fit the configuration of the cam and I-shaft pulleys so you can hold them. I've also used an old timing belt around the sprocket and then grabbed it with a big mutha pair of water pump pliers. The old belt cushions the sprocket teeth, preventing damage. Tighten the cam 'n intermediate shaft pulley bolts to 37 lb-ft of torque. Same for the tensioner nut.

[R. Haire] A good rubber strap wrench opposed by a breaker bar should do it. You might see some mention of pliers locking the cam, in a green manual as I recall. *Lock on a non-contact part.* These tend to be over-tightened, according to the recommended torque for the pulley bolt. Don't use a chain vice grip or anything that can nick the teeth.

[John Sargent] If you insert a screwdriver through one of the sprocket holes in the cam or intermediate gears you can keep the sprocket from turning by pushing the screwdriver tip hard against one of the protrusions under the sprocket. Then use a socket to remove the bolt.
Don't Damage the Cam Gear While Changing Seal.

I always use a 17mm box wrench, tap the end with a hammer, and depend on the timing belt to hold the gear still. This slowly turns the motor over, but no problem, just move the wrench again.

Cam Seal Installation Tool. [John Sargent] I just replaced the camshaft seal on one of our cars. I used an 1-1/4" die cast EMT (Electrical Metallic Tubing) connector to press the seal in place. The fitting goes over the camshaft, and fits inside the recess for the seal. I removed the two set screws and cut the set screw bosses off



the connector. Using a longer bolt of and a large washer allowed me to nicely press the seal to the bottom of it recess. The electrical fitting cost \$2.50 at a local hardware store.

Reinstalling the Front Bearing Cap. Reinstall this and torque to 14 ft-lb (20 Nm).

Reinstalling the Cam Gear. [Paul Grimshaw] The timing belt tensioner makes refitting difficult [while the timing belt is in place.] The last thing that you would want to do is wedge the cam gear back onto the cam as you run the risk of damaging the flange, so slack off the tensioner.

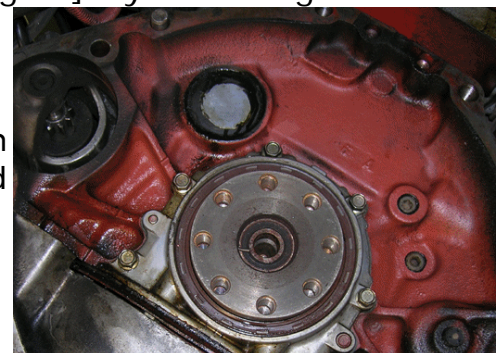
Re-Torquing the Cam Gear After Changing the Seal:[Tom Francis]

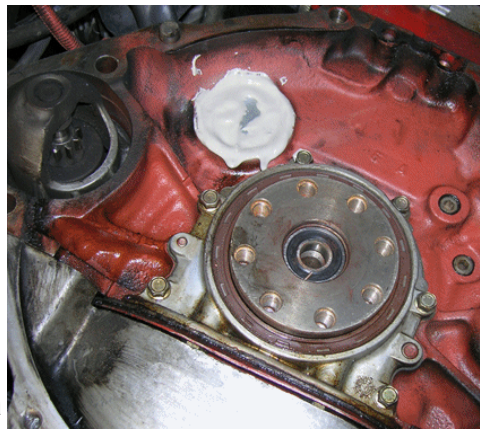
It is very important to correctly re-torque the cam and intermediate pulleys on reinstallation (see this [report](#) of a broken index pin to understand why). Torque these bolts to 50 Nm (36 ft-lbs). Use some thread lock to ensure they do not vibrate loose.

2. **Intermediate Shaft Seal Procedures.** The intermediate seal replacement requires removing the timing belt (See [above](#)) and the rear timing belt cover. Procedures for insertion, etc. are similar to those for the cam seal.

Leaking Intermediate Shaft Rear Plug. [John Sargent] My 745's engine has had a persistent oil drip at the rear of the engine.

The Volvo rear main seal was fine, The soft plug, at the end of the intermediate shaft at the back of the engine, was not. I repaired the leaking soft plug with JB Weld. I cleaned all of the old liquid gasket off and sanded everything clean with emery cloth before cleaning with lacquer thinner, followed by the JB Weld. In the event you want to replace the plug, the part number is 463905. Remove the old one by carefully drilling a hole in the soft plug and pulling it out. Limited clearance between the soft plug and the intermediate





shaft could make that a tough job. It's probably safer just to epoxy it in place.

Leaking Rear Seal and Replacement Tips. [Inquiry:] I had my Volvo to the dealer today. They told me that there is a slight leak in the rear main oil seal and that it would cost between \$700 and \$1000 to fix. I only plan on having the car another year or so. Is it really necessary to have this fixed? I never noticed any oil leak and I'm not losing more than .2 qt oil between oil changes (3000 miles.) Is it okay just to keep an eye on the oil level and then fix if absolutely needed?

Diagnostics: Check Flame Trap Function. Note: for information on B6304 engine rear main seal replacement, see the [FAQ file](#).

[Response: Gene Stevens] Before replacing the rear seal, have you made absolutely sure that the crankcase vent system isn't plugged? The N/A engine uses a flame trap (which doesn't belong on the Turbo, but that doesn't stop some guys from installing one anyway) and when it gets blocked causes excessive crankcase pressure, pushing oil out wherever it wants to go. I've heard of new replacements seals being pushed out of the bore from the same pressure that caused the old one to leak. Curing the pressure may slow or stop the leak.

[Response: Ted] If the seal is seeping keep close tabs on it. Make sure that the flame trap is clear and working properly. If the seal is leaking because of wear this will not be a factor, but if it is leaking because of crankcase pressure the excess pressure can actually push the seal right out of the back of the engine, creating a large leak.

Seal Choices: [Matt L./Rolyak] There are two rear seals available: one is 10mm thick (red: silicone) and the other (grey or brown: Viton) is 7mm. The more expensive Viton will last much longer than the silicone rubber material. The 10mm is stock and the 7mm is replacement. Why? Because the original 10mm seal wore a tiny groove in the crankshaft after thousands of miles of driving. For best results, the new seal should rub against the crankshaft in a new place (after you have cleaned the crankshaft with crocus cloth or fine steel wool). You could also accomplish the same thing by driving the 10mm seal into the seal housing slightly more than the old one was.

[Editor] Volvo grey Viton seal p/n 6842160 is well worth the slight extra cost. When you get the seal, it comes on a round plastic carrier. Cut off the inner protrusion (the lip pointing toward the center of the circle) with a coping saw and an X-Acto knife, then use the carrier as the seal lip seating tool. It will fit perfectly over the 92mm crankshaft. Insert this after the seal is installed to make sure the lips are not curled under, since the Viton seal is much tighter than the silicone seal. Works like a champ.

[John Sargent] If you purchase a universal aftermarket kit, it may come with both the later lipped rubber seal and a replacement for the earlier felt seal (soft white sponge like ring about 3/16" thick) on B23 engines. DON'T install both as some have mistakenly done.

Tools. [Bruce Young] You can purchase the rear seal OEM tools from SPX in Owatonna, MN (866-640-7305). Buy V9991801-3 "Standard Handle" and V9995276-4 "Press Tool". It works like the front seal tools described above in that the seal is mounted onto the press, which is driven in until it contacts some part of the crankshaft. I assume the handle is used to remove the tool once the seal is in place. The tool comes with shims that are used to adjust the seal depth in the carrier.

Engine Rear Main Oil Seal Replacement Tips [Tips: John Sargent] The reason it is so expensive to replace the rear main seal is that the transmission must be removed to access the rear of the crankshaft. See the [FAQ section](#) on transmission replacement for more tips. To fix it yourself, you pull the transmission and clutch/pressure plate assembly or the respective auto transmission parts. The rear main seal is pressed into a seal housing. You remove this and press in a new seal. Then you reinstall the seal housing with a new gasket. The seal and gasket are less than \$20. When you reinstall the seal over the crankshaft flange, you have to be sure that you don't push one edge of the seal lip over.

[Response: Randy] I'm assuming you have a transmission jack. I purchased an inexpensive one from Harbor Freight because several people here at the BrickBoard advised me NOT to try to use a floor jack. It was good advice. It really takes some shaking and push/pulling to remove and install the transmission. My experience is with the 240 but you'll have the same type of situation with the 740. On the 240's it is a very tight fit between the transmission and the sheetmetal in the area of the starter. While you have it out it is a good time to replace the front seal on the transmission (readily accessible once removed) as well as the rear seal and output shaft bushing if the bushing hasn't been replaced yet (you'll need the gasket between the transmission and the rear housing if you replace the bushing). There are various other seals on the transmission that can be replaced at this time- look for fluid leaks.

The transmission cooling lines may not come off as you plan (rust and corrosion) and you may need to cut those lines to remove the transmission. You can use a high quality hose and clamps to save the cost of purchasing new lines. Clean up the crankshaft with carb cleaner or something similar to remove any build up before installing the new mainseal. I packed the back of mine with grease and liberally greased the crankshaft. Don't try to start it straight on when installing on

the crank or you might cause the lip of the seal to push out and the spring might come out of place. It would be a bummer to have a brand new rear seal not do its job because the spring was dislodged.

[Tips from Chris] Last weekend I replaced (at home with no help) the rear main engine oil seal in my wife's B230F auto. This board has been a great help to me over the time we've been Volvo owners. Here's some of the things I learned during the job. (These are random notes, not a step by step.....)

1. It's a common problem (leaking rear main). any local independent volvo shop will be well-versed in doing the job. In NE florida the price for the job is about \$350 (it's a big job, really, so think long and hard about tackling this one yourself. About halfway through my project I was wishing that I had had the shop do it. 4-6 hours of labor time in a shop).
2. **Tools.** You need the tools and a good space to work.
 - 4 jackstands, a good floor jack, and a transmission jack. Don't neglect to make the work area safe because you will be under the car for a while horsing on the tranny to get it in and out. The regular full assortment of hand tools, including a ratchet set with 12mm and up and an 18 mm socket. Prybar & hammer Brake cleaner (for the plate and clutch faces) Long extensions for the bell housing Air wrench Volvo clutch alignment tool(for manual transmissions) Torque wrench
 - Volvo flywheel lock. You can also hold the crankshaft with a breaker bar and socket on the bolt that holds the harmonic balancer on the front of the crank, or use the 5284 crankhold tool. This will let you loosen the flex plate bolts without the crank turning.

The parts you need are not too expensive. The new oil seal at NAPA was about \$20 (I found them cheaper at our local discount chain but they would have to be ordered) and so I paid the \$20. If you need to remove the seal carrier housing, purchase a housing paper gasket as well. While you're under there with the tranny fluid drained, replace the fluid and the the filter and the pan gasket (another \$15 kit). I also replaced the front seal of the tranny (pump seal) while I had it out. It was not leaking, that I could tell, but it, like the engine oil seal is a bear to get to and so I did the tranny seal too while I was in there. All together, I think I spent \$50 on parts and fluid. Not sure if the \$350 at the shop included the parts or not. Also, make sure you know what model tranny you have before you go to the parts store. Ours has a plate riveted on the side of the tranny on the drivers side I bought tranny pump seals for both types and used the one that fit. It can be (was in my case) a messy job. Even after draining the pan and the cooling lines, etc etc the tranny dripped oil all over me and the floor the whole time I was under there. next time I'll be prepared with a short length of fuel hose to cap the two nipples after I remove the lines that run up to the radiator.

My book talks about the option of removing the exhaust. I took it off and had lots more room to work. I also completely removed the lines at the tranny and at the radiator: not hard to do these 2 things and gives you lots more room. The two top bolts that secure the tranny to the back of the engine block and the top starter bolt are bears to get to. 18 mm. I had to drop the tranny crossmember at the rear of the tranny/engine assembly down so that the angle would allow me access to those bolts. Really tough: required a couple of long extensions to get

the ratchet back far enough to have room to use it. Support the engine with a jack stand or transmission jack. After you get the tranny out, [MARK THE FLEXPLATE ORIENTATION](#) so you can reinstall it correctly. When you finally get access to the back of the crank where the seal (and the leak is), you will need a small hook tool (or similar) to get the old seal out of its housing.

The seal sits in a housing that you can take off if you need to (make sure your engine oil seal comes with the gasket for this housing). I was able to get the old seal out without taking off the housing but you will probably find it easier by removing the seal housing, replacing the rear main seal, and then reinstalling the assembly. If you remove the housing, make sure you use a razor to separate the oil pan gasket from the seal housing. [Randy Starkie] The large rear main seals are easy to remove with a screwdriver, as long as you don't scratch the surface of the crank that comes in contact with the rear main seal. Insert the screwdriver so that the exposed back surface of the crankshaft (the part that comes in contact with the flexplate) is the prying point. Get the end of the screw driver up into the old seal and pry it out. Double check the surface of the crank before inserting the new seal. I usually go over mine with light abrasive cloth and check visually and with your finger for sharp edges. Lacquer thinner is helpful in removing buildup and stray abrasive material before installation of the seal. If you remove the seal and find a lot of build up on the crank that you can not get off with thinner then it would be best to remove the housing so that you can get at the crank to clean it properly with very light abrasive cloth. Grease the inside of the seal (but not the metal outside ring) and the crank with white lithium grease. Put it in place starting on one side and pressing against that first lip to ease the other side over the end of the crankshaft without forcing the lip towards the outside. If the lip is forced back the fine spring on the backside can become dislodged and you can not see it. If it comes out of place the seal will leak. Be careful not to get the edge of the lip hung up on the crankend when getting the new seal started. It can be difficult to get the seal started evenly all the way around. Light tapping on the surface of the seal face around the radius of the seal will eventually get it started. Get it started and then push the seal against the started edge to get the room you need to get it started all the way around. Once the seal is on the surface of the crank **ALL THE WAY AROUND** you tap it into place evenly by working your way around the seal with your striking tool. A 3/8 or 1/2 socket extension allows you to direct the contact on the seal once it is started into place.

[Randy Starkie] A piece of the white 4" plastic [pipe](#) has just about (but not quite) the right diameter to match the seal size. You can cut a section out and pull it together with zip ties to reduce the diameter. It makes a good installer tool to put on the seal surface and strike with a hammer to get the correct placement. The image below shows it sitting on a 230 rear main seal. the other end in contact with the seal has a better cut on it and contacts the seal all the way around.

[Chris] Don't push it in too far so that it slips out the back side of the housing. If that happens, remove the housing and do it right again, using a new housing gasket on reinstallation. Most oil seals that I've dealt with had lips in the housings that stop you from pushing it too far and make it square to the centerline of the crank. Not on Volvos. (I did the same dumb thing on the front crank seal of a friend's 240). Also, the end of the crank will have some baked on oil and crud on it except for the thin shiny ring where the old seal was riding on it. I recommend

that you clean that stuff off (carefully, so as not to nick the crank) maybe with some super fine sandpaper or fine Scotchbrite or similar (?). Make sure that the seal is facing the right way when you put it in. Call me paranoid, but when I replace a seal I always wipe the outside of it with a thin coat of indian head gasket shellac to keep it from weeping around the housing. the book recommends grease for the same purpose. Regardless, ALWAYS coat the lip of the seal (the part that rides on the crank) with some grease to keep it from burning on the crank right after you start it up.

[Don Foster] Install your new seal flush or about 1/16"-1/8" deeper. If you see very little wear on the crank, then you can install it at normal depth, i.e., flush. [Tip] To keep the seal carrier bolts from backing out and ruining your starter, use Loctite threadlock when reinstalling these bolts. That's not a bad idea for the flywheel bolts as well. If you are installing the Viton gray seal, see the [notes above](#) regarding using the seal shipping carrier to make sure the lips are correctly placed. Getting the tranny mated back to the engine was hard for me. I could get it up to about an inch and no further: much pain here. Finally figured out that the torque converter was not fully seated back into the transmission. The shaft has two slots into which the torque converter must engage in order to engage the cogs driving the oil pump inside the transmission. If the face of the torque converter (the face that bolts to the flywheel/flex plate) is flush with the edge of the bell housing, it's not in far enough. you have to slide it out then turn it a bit and then try to shove it back into the tranny shaft. Took me a while to do this. Place direct, even pressure on the torque converter until you feel it drop.

When it's right, the face of the converter should be set back inside the bell housing about an inch or so from the edge of the bellhousing that mates to the block. You may have to turn the tranny face up and rotate the torque converter until it engages and drops an inch. **This is important**, since if you manage to install it with the converter out of place, your transmission pump will not engage. I recommend that you get the tranny completely flush with the engine before attempting to put the flywheel bolts in. I make those the last thing I do when replacing a tranny as they're one of the first things I take out when removing it.

[Jerry Andersch] When the torque converter is properly seated it should sit 1/2" below the bell housing flange. If it's flush with it, it's not seated all the way. With the tranny slightly angled up (bell housing higher than the tail) work the TC back and forth until it seats, sliding down 1/2" or so below the bell housing flange. When installing the tranny make sure the BH is slightly higher as you move the box into place, so the TC does not slide forward and out of place. Bolting the autobox into place with the TC not properly seated can damage the transmission. Putting everything else back on and back together is pretty straightforward (heard that before, huh?). During the pull-down I put all the bolts into a single can. Mistake! Many of the fasteners used are the same diameter but slightly different lengths: keep them separate as you take it apart and you won't have to switch bolts around when they bottom out in the wrong holes during the reassembly.

After all this work and my reassembly, mine seemed to continue to leak for a day or so after I put in the new seal. I was sick about it during the time it was leaking. It stopped, though after a bit of driving and has been tight ever since. Looking back, I'm not sure if the oil that I saw on the driveway was really leaking

past the new seal while it was getting introduced to the crank OR if it was just some residue oil from before the replacement. It's a big job, not for the faint of heart. I do almost all my own work but I'm not sure I'd do this one again. Might pony up the \$350 next time and let somebody else do it. I'm slow, and I had problems along the way so it took me probably 12 hours total. Having done it once, I think I could do it in 6-8 hours now. I hope this helps, or at least entertains, someone.

[Notes from Paul DePres] Nice write-up Chris. Allow me an addendum.

Stubby box wrenches come in handy for getting the top tranny to engine bolts. The 30" socket extension is necessary for torqueing the bolts, but the stubbies work well for getting them loose and started back in. I removed the ATF lines at the tranny only, and did not have the problems with leaking fluid everywhere. If you plan on removing the seal carrier from the outset, and are not planning on replacing the tranny input seal, then you can leave the exhaust alone; you don't need as much room.

My new Volvo seal still leaks a little bit after several months. I don't know what I did wrong. I used emery cloth to clean the periphery of the crank prior to replacing the seal housing with the new seal. I was very careful, but will probably get a second chance this fall.

[Volvo Maintenance FAQ for 7xx/9xx/90 Cars](#)
