

Summer 2016 v1 | n1

# VOLVO TECHTIPS

Information for the Independent Volvo Specialist



## 「CRANKCASE VENTILATION」

CVVT TIMING BELT SERVICE  
VIDA FOR INDEPENDENT SHOPS  
AGING PROBLEMS

BROUGHT TO YOU BY YOUR LOCAL WHOLESALE DEALER

## WELCOME TO VOLVO TECHTIPS!

We are pleased to share with you this inaugural issue of Volvo TechTips. This new quarterly publication is written specifically for technicians and shop owners who are servicing Volvo vehicles at independent repair shops. It is sponsored and brought to you by the parts department at your local Volvo dealership.

Every issue of Volvo TechTips will include technical articles crafted to help you diagnose and repair Volvo vehicles correctly and efficiently. When Volvo vehicles find their way to your service bays for maintenance and repair, it's in our collective best interests that you're able to quickly and efficiently correct issues. Maintaining Volvo's hard-earned reputation for reliability and durability is important for the brand.

We also want you to know that only Volvo Genuine Parts fit and perform like the original parts, and hope that you'll choose to purchase replacement parts from your nearby Volvo dealership parts department. Volvo has just launched a new and ambitious wholesale parts program directed to independent repair shops. The program is designed to supply you with OE Volvo parts – quickly, accurately and at pricing levels competitive with what you previously paid to other sources. Remember, only Volvo dealerships can supply you with Volvo Genuine Parts.

We know you need to stand behind your work, and we are here to stand behind you. Effective immediately, we have introduced an extraordinary 2-year unlimited mileage warranty on nearly all of our genuine Volvo replacement parts. A warranty of this scope is not normally offered through other parts suppliers, and is further evidence of our commitment to supporting our wholesale parts customers.

You will be receiving Volvo TechTips on a quarterly basis. Each issue will include four or more feature articles of highly technical and specific diagnostic/repair information. We will cover all types of vehicle systems – engine management systems including fuel, ignition, and emission control; electrical systems including starting, charging, and lighting; braking systems; collision repair including both structural and cosmetic repair and refinishing; and accessories such as heating and A/C systems, power window and locking mechanisms, heated seats, etc.

We welcome your comments on the publication and any suggestions you may have for future topics. Please direct all comments and suggestions to our publisher Chris Ayers, Jr. at [cayers@automotivedatamedia.com](mailto:cayers@automotivedatamedia.com).

Please enjoy this edition of Volvo TechTips and we hope you find it a useful and valuable resource provided by your local dealership's parts department.



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# VOLVO TECHTIPS



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## FEATURES

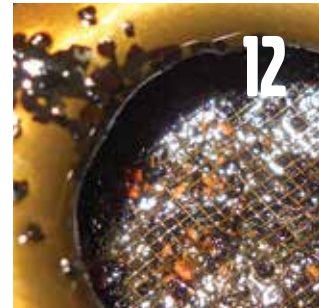
### AGING VEHICLES

This series will cover aging issues on all the later Volvos that are commonly being serviced in independent Volvo shops.



### CRANKCASE BREATHERS ARE CRITICAL

PCV was mandated in the U.S. 53 years ago(!), and the systems have naturally evolved. On Volvos, ALWAYS check them during any engine service or the consequences may be far-reaching.



### VIDA FOR THE INDEPENDENT SHOP

Vehicle Information and Data for Aftersales — If you work on Volvos you are either using it or you need to use it. Yes, your scan tool can speak Swedish, but only VIDA can truly speak Volvo.



### CVVT TIMING BELT SERVICE

Continuously Variable Valve Timing makes a big difference in the efficiency of Volvo engines, but it also complicates service procedures.



## DEPARTMENTS

TSB 32  
THE SIDEBAR 34



## AGING VEHICLES

THERE ARE PLENTY OF "FIRST GEN" S/V40S OUT THERE THAT HAVE PILED ON THE MILES. HERE ARE THE MOST COMMON AGING ISSUES THEY'RE APT TO DEVELOP, AND HOW TO FIX THEM.



Technicians who've worked on Volvos over the last couple of decades have seen huge changes from a growing assortment of engines and transmissions to the adoption of CAN and fiber optics. Volvo continues to advance automotive technology at a rapid pace, so it is a challenge for technicians in the trenches to keep up with these vehicles. The following discussion of vehicle aging issues experienced in a typical shop should help you meet that challenge.

We'll limit our attention to the first-generation (1999 through 2004) S40 sedan and V40 wagon, popular models that have probably been



Pull the hose off the fuel pressure regulator.

finding their way into your shop for years. Assembled in the Netherlands, they can be powered by a small turbocharged four, and early versions were engineered with a mix of old-school 12V electrical systems and a partial CAN.

## FUEL PRESSURE LEAK-DOWN

One issue seen on this series is a failing fuel pressure regulator. Your customer will complain of hard starting when the car is cold, or after it sits for a while.

You can confirm that the symptoms are indeed caused by this issue by removing the cover over the throttle body and looking at the fuel pressure regulator. It's best to leave the car sit overnight so you can examine it cold, or at least give it a few hours to cool down. Pull the regulator's vacuum hose. If you find evidence of fuel, replace the regulator — don't forget to relieve the residual fuel pressure before removing the screws.



If you find gasoline, replace the regulator.

You can also test the regulator by attaching a pressure gauge to the fitting at the end of the fuel rail. Start the engine, allow it to warm up, then shut it off and let it sit for at least 20 minutes. A good regulator should be able to maintain 29 psi (200 kPa) for at least 20 minutes after the ignition switch is turned off. Although that's the factory recommended test, we have had mixed results — we've found that it won't always identify a failing regulator.

By the way, a bad fuel pressure regulator usually won't set a DTC (Diagnostic Trouble Code) because the excess fuel that enters the engine is usually burned off before closed loop is achieved.

## FALSE AIR

A lack of fuel control, hard starting, and DTCs, usually P0171, may be caused by a leaky AAC (Assisted Air Control) valve hose. Cracking hoses are normal signs of aging and we suggest that you check this hose

on every '99 through '04 S/V40 that comes in. If you look closely at the bottom of this hose on the intake manifold side, you will likely see cracks, which could eventually lead to causing an unmeasured air leak. Even a small crack admits "false" air and can set codes, so the rule of thumb is, if it's brittle, replace it. Use a Volvo OE hose and new clamps if you want the repair to last as long as the first one did.

## ABOUT TO BURST

Checking brake hose condition should be a regular part of your safety inspection on all vehicles, not just Volvos. We have seen many high-mileage Volvos with cracks in these hoses, and also with bubbles or bulges in the outer skin, which is due to ruptures in the inner hose. Needless to say, whether the hose is cracked or bubbled it should be replaced as this is a dangerous condition.

You may see this more often in older models, particularly with the front hoses. You may have seen several of these cars come in on a tow truck with a seeping front hose and a panicked customer. Luckily, Volvo has built-in backup systems so if a brake hose fails you won't lose all ability to stop, but the driver will still be alarmed by the low pedal. The only service problem here is that these issues are hard to spot on an S/V40 unless you know where and how to look for them.

To properly inspect these hoses, remove the wheels and pull back the spring that shields the top part of the hose. Look carefully at the hose right above the strut bracket and there's a good chance you'll see cracks and/or bulges. You should recommend that all four hoses be replaced, and doing a full brake system fluid flush and refill with an approved DOT 4 fluid makes sense. Use only the high-quality Volvo OE replacement parts here because your customers' safety is in your hands.

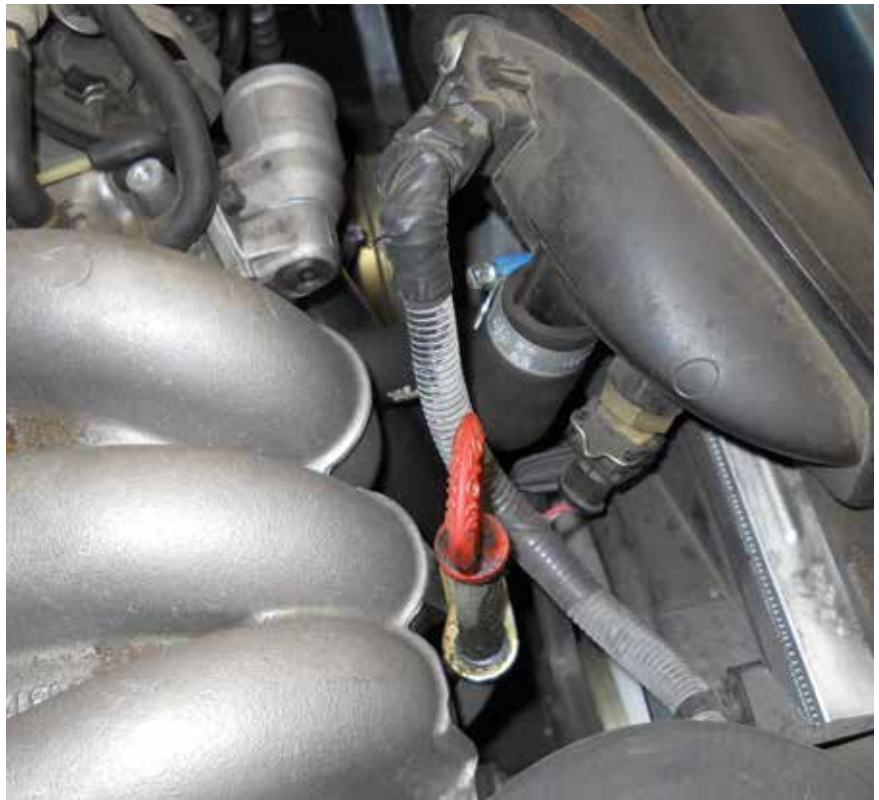
## DEAD TEMP SENSOR, NO CODE

An out-of-range or totally failed CTS (Coolant Temperature Sensor, also known as the ECT for Engine Coolant Temperature sensor) can be an issue on S/V40s, and it doesn't always set a code. When the sensor acts up, it can cause poor running, hard starting, and poor fuel economy. The best way to check for this is to watch the live data and make sure the

temperature numbers make sense. With the engine cold, plug in your scan tool, turn the ignition switch to position "2," and see if you read something near the ambient temperature. Check other available temperature sensor readings, such as that from the IAT (Intake Air Temperature) sensor, while you're at it. If the IAT number suggests that you're in the Temperate Zone, yet the CTS/ECT matches a temperature you might encounter in Antarctica, you can bet that the latter has failed. Now, start the engine and watch the data from the CTS/ECT, which has two PIDs, one for the PCM/ECU, and one for the dash gauge. If these readings start going in different directions, the sensor is bad.



Cracks? Get a new brake hose pronto!



Make sure you check this hose during your regular inspections. When it breaks, the car will stall at idle.



# THERE'S NO SECOND CHANCE

## VOLVO GENUINE BRAKES

Volvo Genuine Brakes are more than simply replacement discs and pads. They are essential components that interact with sophisticated systems and software to help ensure the safety and performance of Volvo cars.

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They are critical in Volvo Active Safety Systems including:

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- Automatic Braking
- City Safety
- Collision Warning with Auto Brake
- Pedestrian Detection

Get the replacement brake parts designed and engineered by Volvo. Contact your local Volvo dealer for a complete selection of Volvo Genuine Parts.



Unfortunately, a code is not set in many cases. The sensor glitch may be intermittent, and only go out of whack for a few seconds at a time. Regardless, you will have recognized the problem with the above procedure. You should replace the thermostat along with the sensor because it has to be removed anyway, and it amounts to extra insurance that the thermostat is not contributing to the problem. Make sure you use a Volvo OE replacement as we have seen too many aftermarket sensors fail prematurely.

## LACK OF LOW BEAMS

On the '99 through '04 S/V40 series, Volvo used the CEM (Central Electronic Module) to power the low-beam headlights. The headlight relays are built into the module, and over time the circuit board tends to overheat and compromise the soldered connections (also, the relays themselves tend to get weak and fail — sometimes you can give the CEM a tap and it will bring the low beams back on line). Technicians have been known to open up the CEM and poke around with a soldering gun, and try to replace the relays. Some are successful, but most of the time the problem comes back in a few months. So if you find a CEM that has worn out, make sure you replace it with a new one from Volvo, but make sure you check the basics first. Some technicians prefer to diagnose electrical problems “backwards,” from the load to the main power and grounds, which is often faster. Start with the low-beam bulb — is the bulb itself good? If the answer is yes, move on to the connector for power and ground. If you have ground and no power, the problem is most likely the CEM, but make sure you check the fuses and the inputs and outputs at the module's connector before replacing it. The good news is that unlike all other Volvos that use a CEM, this one does not require a



The Central Electronic Module completes the circuit to the low beams.



Hydraulic motor mounts make for smoothness — until they lose their fluid.



software download. The bad news is you have to tell the customer it's going to cost over \$600 to fix what they thought was just a burned-out bulb.

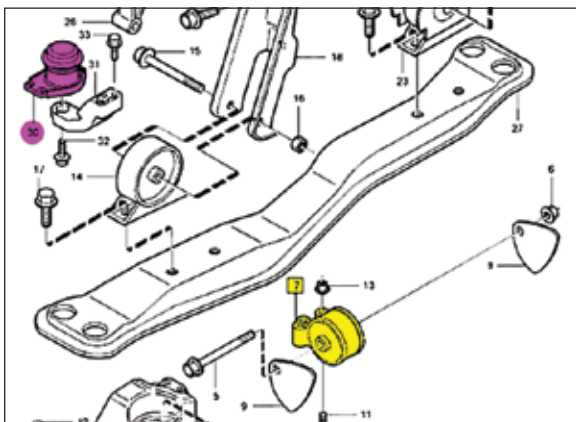
## ESCAPING EXHAUST

Did you ever notice when you start one of the 40-series cars that it sounds louder, then gets quieter as it warms up? On the early S/V40s with the B4204T 1.8L turbo engine, the exhaust manifold nuts on the head studs start to loosen up over time with the result that the gaskets fall apart. As the manifold gets hot, it expands and seals up the exhaust leak, so if the car comes in with a hot engine you may not even hear it. Sometimes you'll get a fuel trim code PO171 (too lean). Whenever you see this code, make sure to check the exhaust manifold gaskets as a part of your testing. A smoke machine can help here.

If these gaskets are not replaced and are allowed to leak for a long time, the exhaust manifold may permanently warp and there might even be valve damage. Also, the fuel control system's continuous compensation can cause catalyst failure. When performing this repair, you should check the manifold with a straight edge and recommend replacement if it's out of tolerance. Replace all the manifold studs and nuts with new ones — you don't want a brittle stud breaking off in the head while you're putting it back together. Also, replace the turbo oil return line seal and gasket.

## HEAVY VIBRATION

If a customer complains of heavy vibration when the car is in gear at a stop, the cause may be a collapsed motor mount. Volvo used hydraulic liquid-filled motor mounts on the right and left sides (#30 and #7 in the diagram below) on the early 40-series cars, and over time they may develop small cracks that allow the fluid to seep out. The hydraulic mounts are the main culprits in the vibration the driver feels, but if they have failed you should inspect the other mounts also.



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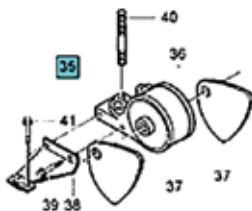
[www.OEConnection.com](http://www.OEConnection.com)

The passenger's side hydraulic mount is relatively easy to change. Start by supporting the engine with either the Volvo tool #999 506, or by carefully using a block of wood and a floor jack under the oil pan. You will need to raise the engine only a few millimeters. Remove the bracket for the power steering hose, the three bolts that attach the mount to the right inner fender, and the three bolts that attach the mount assembly to the engine block bracket. Volvo has an updated mount for this position, so be sure to use an OE Volvo mount. Some aftermarket motor mounts are solid rubber, which defeats the whole purpose of hydraulic motor mounts.

Before installing the new mount, check the threads in the block mounting holes. These can become stripped if a previous tech was careless when he changed the motor mount or timing belt. If they are stripped, replace the engine block bracket along with its three bolts. If everything looks good, carefully start the three bolts that hold the mount assembly to the block and also start the three bolts that hold the assembly to the body. Tighten the block bolts to 49 ft. lbs. (67 Nm) and the body bolts to 37 ft. lbs. (50 Nm), and reattach the power steering hose bracket.

For the driver's side mount, start by removing the battery and air filter box. Support the transmission by using a floor jack and a block of wood, then remove the bolts and nuts (diagram box 35).

Replace the mount with the Volvo updated Part #30620778. Tighten the bracket nuts to 33 ft. lbs. (45 Nm) and main bolt and nut to 72 ft. lbs. (98 Nm). Make sure you test drive the car before and after the repair to confirm the fix.



## LOUD NOISE UNDERFOOT!

Many instances of broken sway bar brackets have occurred over the years. You will hear and feel a large clacking noise under your feet going over bumps on your test drive. This job is not for the faint-hearted — it can take the whole 3.3 hours that it bills if you're not lucky. The aluminum brackets with built-in bushings come in two-piece kits with new bolts (Part #30620989).

After this repair, the car should get a four-wheel alignment. Volvo says that if you mark the location of the front axle cross member, you don't have to do an alignment, but that's in a perfect world. If your customer has managed to break a sway bar bracket, the car is probably out of alignment anyway.

After your initial test drive to confirm the noise, put the car on the rack and raise it to eye level. Remove the front tires and grab the sway bar at the part closest to the body. If the bracket is broken, the bar will move freely and hit the body. Usually only one side is broken, but you should replace them both, and it's also a good time for new sway bar links.

Start the job by removing the splash guards under the engine, and the lateral strut bar between the control arms. Remove all the bolts from the front and rear motor mount brackets and the bolts for the rear member. Now, lower the rear member, remove the header pipe from the catalytic converter, and support the exhaust. Be careful not to put a strain on the oxygen sensor wires.

Next, remove the rear engine mounting from the transmission and push the engine forward so you can take the heat shield off the steering rack. Remove the bracket that holds the power steering pipes and let it hang. Take out the four bolts that hold the steering rack to the sub-frame and support the rack.

Mark the position of the sub-frame with a crayon or permanent marker to keep it as close to alignment specs as possible. Now support the sub-frame with a transmission jack and remove the six bolts. Lower the sub-frame to gain access to the sway bar brackets, remove the nuts at both sway bar link ends, and the bolts on the sway bar brackets. Now the fun part: Remove the sway bar from the car and mark the position of the bushings. Using a pair of Channellock® pliers, pull the aluminum brackets apart (a pry bar can be used if you prefer).

Guess what — you're now halfway there! Assemble the sway bar brackets and bushings (do not use any grease or oil on these bushings as it will damage the rubber). Using your Channellock® pliers again, snap the upper and lower parts of the bracket assembly together on the sway bar — make sure they're facing the right way. After you have both sides assembled, you're home-free. Just put everything back together in the reverse order. ●



As with all other cars, Volvo ECT sensors can fail. Replace the thermostat and gasket along with it.



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In support of the collision repair market, Volvo Car USA has introduced Volvo Collision Advantage, powered by CollisionLink®. Volvo Collision Advantage supports body shops with faster estimates and cycle times, and also offers price matching on a select group of parts. Volvo wants to help repair shops get the Volvo Genuine Parts they need to help ensure the vehicle will be repaired properly.

Contact your local Volvo dealer to learn more.

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## CRANKCASE BREATHERS ARE CRITICAL!

PCV WAS MANDATED IN THE U.S. 53 YEARS AGO(!), AND THE SYSTEMS HAVE NATURALLY EVOLVED. ON VOLVOS, ALWAYS CHECK THEM DURING ANY ENGINE SERVICE OR THE CONSEQUENCES MAY BE FAR-REACHING.



A long time ago in a galaxy not so far away (Sweden), Volvo engineers used a standard PCV system — a one-way vacuum valve and a hose or two to recycle engine blow-by (through 1975). It was a simpler time when men were men, cars were heavy, and gas cost less than a dollar a gallon. But in 1976, Volvo introduced the B21 engine, the 2.1L naturally-aspirated follow-up to the legendary B20 and B18. At that time, Volvo, like all auto makers, was trying to keep up with the latest U.S. and California emissions regulations. The year before, Volvo engineers in conjunction with Robert Bosch, came up with the first oxygen sensor-regulated fuel injection system (electronic K-Jetronic). Volvo called it Lambda Sond.

## SCREEN SCENE

Along with this groundbreaking feedback fuel injection, Volvo did a redesign of the positive crankcase ventilation system. Instead of a standard PCV valve, the Swedish engineers came up with a free-flowing blow-by recirculation system with no check valve. Instead, an oil separator box on the side of the block with an in-line brass screen was used to prevent ignition of

the vapors returning to the intake manifold. These systems worked well — as long as the cars were serviced regularly and properly. The weak point was the brass-screen flame trap. The screen would get clogged with carbon and restrict or completely stop crankcase ventilation.

On '76 through '79 models, the flame trap was right on top connected to the valve cover, which made it easy to check and change. In 1980, the flame trap holder was relocated under the intake manifold on top of the oil separator box, which made it much more difficult to check or service. If the shop did not specialize in Volvos, the technicians most likely did not even know it existed.

When the Volvo engineers created the B23 and B230, they moved the flame trap fitting to a more serviceable location. That was a good thing because when these systems clogged up, they would naturally cause high crankcase pressure. That would slightly affect emissions, but the real problem was seal failure. More than one rear main seal has popped out because of this. So, if you happen to see one of these early Volvos in your shop for service, make sure you don't forget to check that flame trap.

In 1994, Volvo introduced the 850 series to the U.S. market. The new five-cylinder all-aluminum engine, which came in either N/A (Naturally Aspirated) or turbo versions, used a new type of PCV system. Non-turbo models still had a plastic flame-trap screen, but turbos added a heater element to the vacuum fitting in the air intake tube from the MAF (Mass Air Flow) sensor to the turbo inlet. This system worked well, but as the cars got older they were likely to develop some of the same clogging problems.

## BAD ELBOW

On the 850 and early S70 and V70 series (1994 through 2000), another possible PCV failure was deterioration of the vacuum elbow on the right side of the intake manifold.

When this hose failed, it would cause a number of troubles, such as oil burning, seal failure, and an unmetered air leak that would adversely affect fuel trim and mileage.

It is wise to visually check the PCV vacuum hoses, and also perform a crankcase pressure test during an inspection. There are several ways to do this. The old-school guys will tell you to take off the oil filler cap while the car is idling and



Ancient history: The Lambda Sond warning light on a 1981 Volvo 242 Turbo.



PCV/flame trap kit for a 240 Volvo.

hold a piece of toilet paper over the opening to see if there is pressure or vacuum. Another method is to fasten a rubber glove over the oil filler neck with a rubber band and see if it is sucked against the opening, or inflates. Or, you can remove the dipstick and look for escaping smoke. If you happen to have your smoke machine out, see if smoke is drawn into the oil filler at idle (cooling fan off). None of these is very high tech, but they give a fast indication. For more accuracy, you can use the Volvo PCV tester, which you can order from your Volvo dealer's parts department.

So to test the PCV system have the car at operating temperature and idling, then remove the oil dipstick and insert the nipple of the test gauge into the tube. You should see negative pressure (vacuum), the amount of which depends on the model. After you've done this frequently, you'll know what normal looks like on different engines.

If you see positive pressure, it's time to do some further investigation. On later Volvos, looking at the inside of

the oil filler cap is a good indicator of how much carbon is probably clogging the breather system. If the oil cap looks like a barbecue grill at the local public park, you can bet this car has not been serviced regularly. Other factors that can contribute to breather system carbon build-up are poor fuel quality, lack of service, and a cooling system thermostat that's stuck open. Of course higher-mileage cars will eventually clog up even if they are well serviced.

These days, we see clogged breather systems causing more far-reaching damage on the networked fly-by-wire cars, such as the PCV heater on the intake hose leaking oil into the connector and causing a short. This won't turn on the MIL (Malfunction Indicator Lamp) for the heater, but it will sometimes set a code for an oxygen sensor because they share a ground.

## PLUGGED ORIFICE

One thing we can see on 1999 and up cars is carbon clogging of the orifice under the intake manifold

that supplies vacuum to the breather system. If you catch this in the early stages of the blockage, you can sometimes get away with just cleaning the orifice, but most of the cars we see have been clogged for so long that you will need to replace the whole breather system.

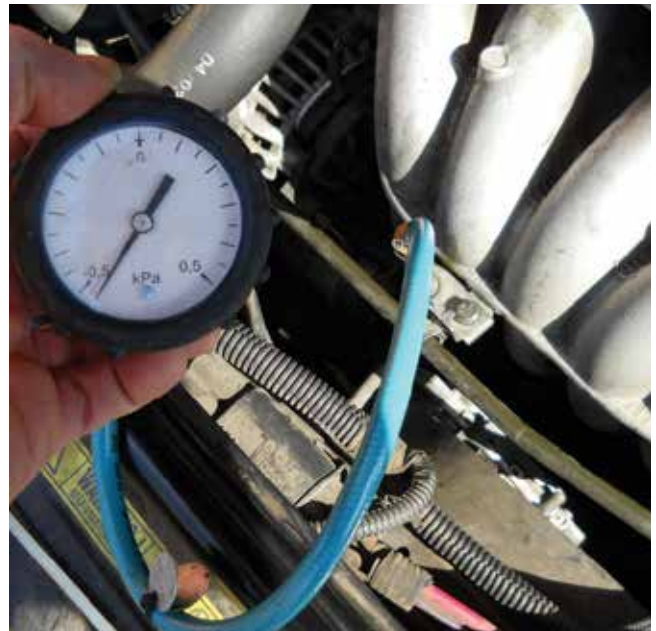
On P1 cars (2005 and up S40, V50, and C30), we've mostly seen two issues in the PCV system. One issue may be that the hose from the oil separator assembly to the top of the camshaft case is cracking and breaking open.

These broken hoses are easy to spot, not because they're easy to see, but because the customer will complain about a high-pitched ("flying saucer") type of noise. You can confirm that this hose is at fault by removing the oil filler cap while the car is idling. If the noise goes away, the hose is leaking. Most cars have received a replacement part by now, but they still show up in service bays.

Also, if the car has low mileage make sure that the PCV repair is not covered under the factory



Here's the heater element for the PCV system on a 1997 850 Turbo. The electrical connector can fill with oil and cause a short.



Here's the reading at idle on a 2003 Volvo V70 after the breather system was replaced. Before the repair, the car had a fuel trim code and showed positive pressure on the gauge.



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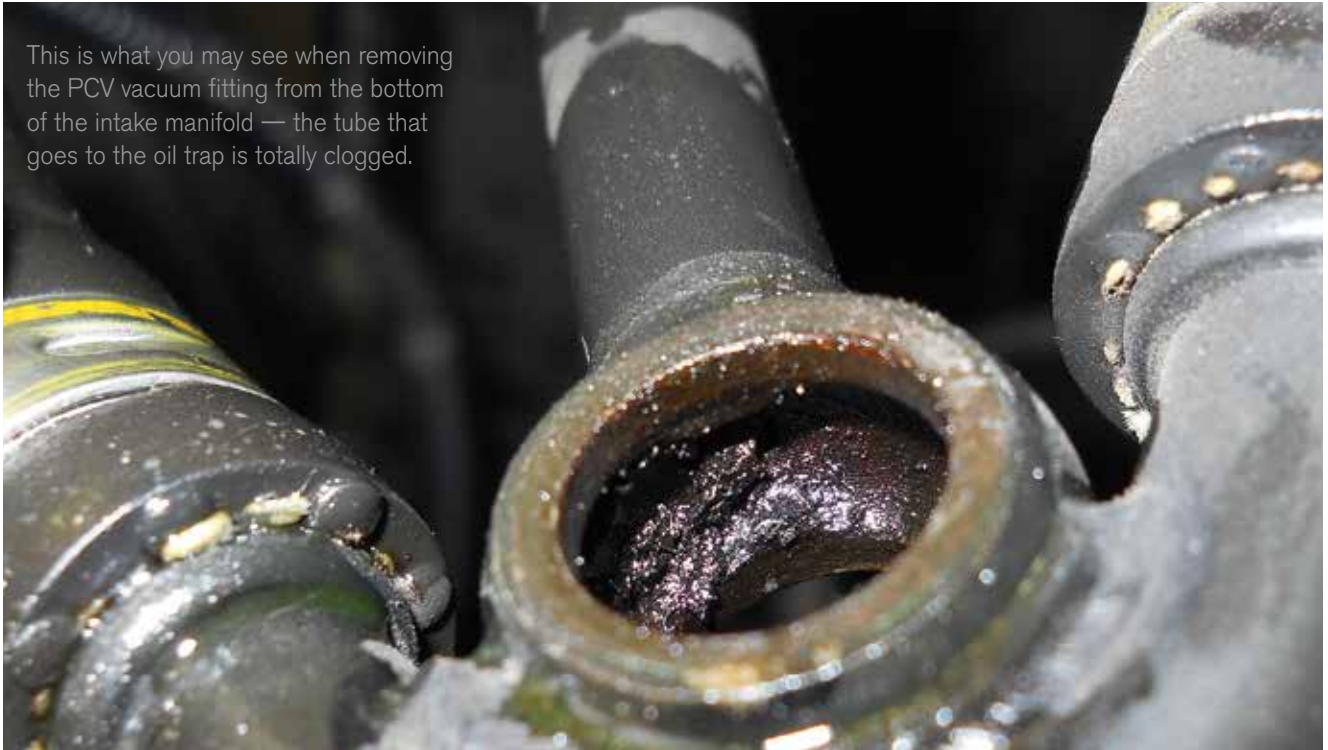
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This is what you may see when removing the PCV vacuum fitting from the bottom of the intake manifold — the tube that goes to the oil trap is totally clogged.



emissions warranty before you do any work. In some states such as California, the emissions warranties are much longer than the factory warranty. It's just good business (and good "Karma") to make sure your customer doesn't have to pay for a covered repair.

Lately on the higher-mileage P1 cars, oil leaks have been seen coming from the bottom of the crankcase oil separator assembly. This is an all-in-one type of part — it has the oil trap, breather box, and oil filter stack in one unit. There are two ways you can repair this oil leak. You could just replace the seals at the bottom of the unit, or replace the whole unit, which comes with new seals (Part #31228685). Both repairs involve the same amount of labor, but if the car has over 90K on it, it's best to sell the customer the whole assembly because of the sludge and carbon build-up inside the oil trap, and because you're going to do an oil change anyway and the new assembly comes with a new oil filter and housing.



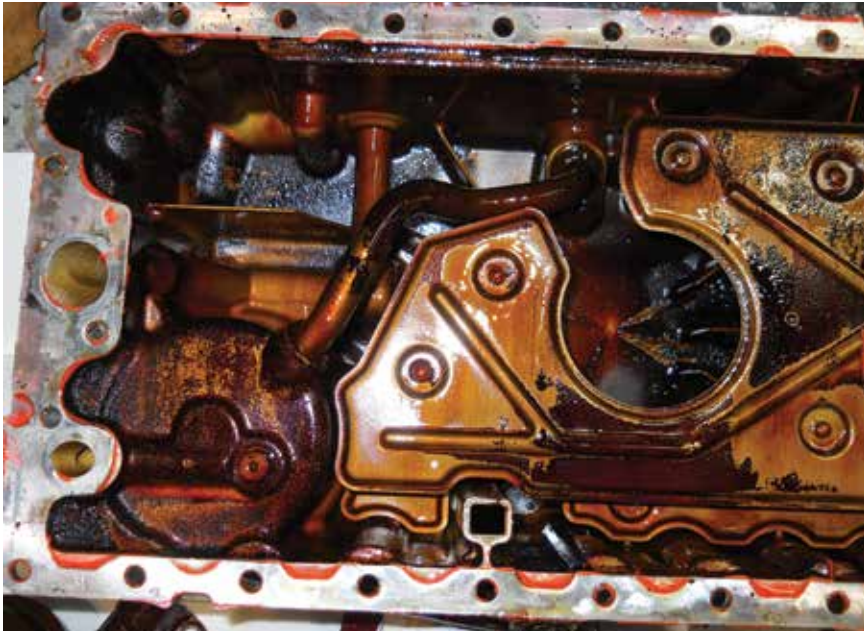
The breather on this Volvo was clogged, which caused a front camshaft seal to pop out. A massive oil leak was the result.

Once the PCV system stops working and the engine starts building up carbon, oil leaks are likely. Sometimes front camshaft seals are actually pushed out of place so that the timing belt becomes wet with oil. You know what happens if the belt jumps off or breaks — the valves would say "nice to meet ya" to the pistons.

## SERIOUS NEGLECT

A car in for service recently demonstrated the damage a clogged breather system can cause. The oil pressure light came on at idle when the car was hot. After confirming that the breather was clogged, the oil pressure sending unit was removed and a mechanical gauge connected to confirm the low oil pressure.

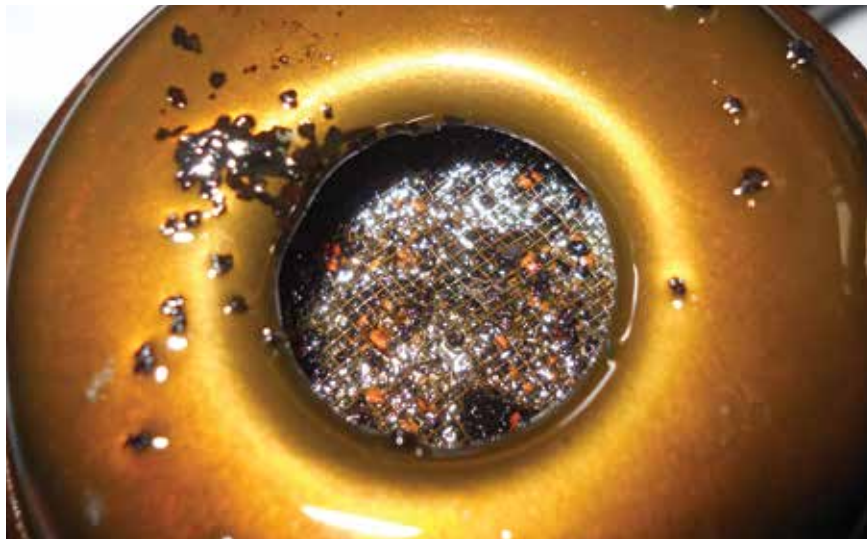




Always change all of the oil seals when you remove the pan.

Once the PCV system fails, the sludge and carbon can grow like a cancer. This car only had 120K on it, but there was a 1/4 inch of sludge in the oil pan that was clogging the oil pump pickup.

To think all that could have been avoided by regular attention to the PCV and more frequent oil changes. You should make crankcase pressure testing part of your routine service and diagnostic procedures. It's good for your customer and your shop. Catching a clogged breather in the early stages can save your customer a lot of money.



A clogged oil pickup screen caused low oil pressure at hot idle.

## HANDS - ON

The PCV system most frequently serviced these days is on 1999-2007 Volvo five-cylinder turbo engines, the standard system for Volvo models during those years. This is the year range that's typically found in aftermarket service shops since the cars have outlived their factory warranty. So, we'll take you through the step-by-step repair and replacement procedures for this system.

When doing this job, it's a good idea to read and take note of some of the live-data PIDs before and after the job. It's interesting to see the difference in the fuel trim data. It will make you a believer.

As always with a job like this, start by removing the negative battery terminal. Now raise the car so you can remove the splash pan and air guide. Loosen the coolant drain at

As suspected, the reading dropped to 10 psi at hot idle and rose to normal above 1,200 rpm. Cracked seals for the oil pickup tube can cause this condition, so the oil pan was removed. The amount of carbon and sludge was incredible. The passageway that connects to the oil separator was totally clogged and there was a quarter-inch of sludge and carbon in the bottom of the pan.

Removal of the pickup tube revealed the cause of the low oil pressure. The

pickup seals were bad, plus the pickup tube's screen was completely plugged.

A rod and main bearing cap were pulled to inspect for damage. The bearings looked good, and so were re-installed and torqued to spec. The recommended repair is the installation of a new breather system, an oil system cleanout, and new pickup seals, along with a new updated oil pickup (Part #9186116) that has a much larger screen so it won't clog as easily in the future.

the back of the engine above the right axle — you only need to drain a little coolant so the level drops below the thermostat. Lower the car and remove the charge air pipe, fuel rail cover, and the cover over the coils. Remove the two bolts at the top of the electric fan and the bolt for the dipstick tube. Take out the dipstick tube and pull the electric fan assembly up and out of the way (you can disconnect it or just set it off to the side) to give yourself more room to work.

Loosen the large clamp at the intake tube going into the throttle body and pop it off, then reach down and unhook the big connector for the throttle body harness. Remove the bolts that hold the fuel rail in place and release the quick-disconnect fitting for the fuel feed line — be careful about residual fuel pressure! Carefully wiggle the fuel rail out of the intake manifold and lay to the side. Raise the car again and unscrew the bolt from the intake manifold support bracket. You can now take out the bolts for the intake manifold itself. Once it's loose, lift it up slightly and use a 17 mm wrench or a stubby socket to remove the

banjo bolt for the breather system at the right bottom of the intake manifold. This banjo bolt is the hardest part of the job because it's at a weird angle and it's in a tight spot. Reassembly can be challenging.

If the car has low miles, you may be able to get away with cleaning out the hole in the banjo fitting. You can do this by just removing the power steering pump to access the bolt and fitting. But many of the cars you'll see in your shop will have well past 100K and will need to have the whole PCV system replaced.

With the banjo bolt out, remove the clamp on the soft breather hose at the top of the engine, and you should be able to lift the intake out of the car.

Remove the oil separator box and breather hose assemblies and inspect the hole in the side of the engine, where the box connects. It will be partially or fully clogged if it's been building up for a while. If this passageway is completely blocked, you may want to get the customer

to authorize removing the oil pan so you can clean out the breather passage from the bottom. In most cases, this will not be necessary. If you do end up taking the oil pan off, make sure you replace the oil pickup seals and the old pickup tube with the updated part.

Clean the passageway with a pick and some aerosol parts cleaner. Once that's done, you can reassemble the breather system with new parts. The aftermarket parts for this job don't quite fit right, so it's best to only use Volvo Genuine Parts for this job. A full service kit for this job isn't available, so make sure when you place the order with your local Volvo dealer's parts department, you ask for all the hoses, clamps, and other related parts for this job. Don't skimp on the clamps, either. They're expensive, but they will guarantee that you achieve a properly-sealed PCV system, and that the job will have been done right the first time. ●



Typical carbon build-up from poor maintenance.



This is where the PCV gets its vacuum, and it's where the trouble starts. If caught early enough, you can get away with just cleaning out the hole.



# VOLVO GENUINE PARTS

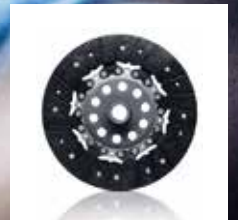
## NOTHING CAN REPLACE THEM

When a part needs replacement, a Volvo Genuine Part is the right choice. Manufactured to Volvo's exact specifications, they deliver the safety, quality and reliability your customers expect from the Volvo brand.

Volvo Genuine Parts fit perfectly and come with a 2-year limited warranty.\*

Don't let your Volvo customers leave your shop with less Volvo than they came in with. Contact your local Volvo dealer for a complete selection of Volvo Genuine Parts.

**2-YEAR  
WARRANTY**



\*Warranty excludes consumable "wear item" parts, labor and Volvo accessories.



# VOLVO VIDA FOR THE INDEPENDENT SHOP

IF YOU WORK  
ON VOLVOS, YOU  
REALLY, REALLY  
NEED THIS.

VIDA is not just another four-letter word. VIDA stands for Vehicle Information and Diagnostics for Aftersales. If you work on Volvos, you're already using it, or you are going to need to use it. Yes, your scan tool can speak Swedish, but only VIDA can truly speak Volvo. Some independent shops have been hesitant to invest in this Volvo factory information system for several reasons. They think it costs too much, it's too hard to use, or maybe they believe they don't need it to fix Volvos.

Well, it's time to wake up and smell the meatballs. To effectively diagnose and service Volvos built from 1999 to the present, you're going to have to get to know VIDA. As for cost, VIDA can be purchased in three-day subscriptions as needed. With the introduction of the web-based VIDA 2015, the subscription costs have gone down. The previous cost was

about \$130 for three days, but now that's about \$70, which can more easily be expensed to the customer. Also, it is more efficient to do multiple software downloads and diagnostics while the subscription is live to get the most value out of it.

Volvo has been improving VIDA every year since its creation. If you have been around Volvos for a while, you may remember VIDA's predecessor VADIS. It worked fairly well for its time, but it was a CD ROM-based system with limited capabilities.

When VIDA came out in 2007, it used the same communication tool that VADIS did, the VCT 2000. It was a box hooked up to your PC or laptop with a six-foot cable, so your computer had to be pretty close to the car to plug the cable into the DLC. This was an awkward setup, and more than one tech has driven out of the shop

dragging a computer. Volvo recognized the problem and came out with a new Bluetooth-based communication tool, the VIDA DiCE unit.

The DiCE works well and you can communicate with a car all the way across the shop. Volvo says that the Bluetooth has a maximum range of 100 meters if unobstructed.

VIDA 2015 is the first version to be online only, so there's no more waiting to get a new disc in the mail!

It has some new features, such as fault tracing in ranked order, integrated wiring diagrams, and the Volvo Standard Time Guide (VSTG) built in. As with older versions of VIDA, you have tons of information available to you: parts images and numbers, two-way communication and component activation with all modules, and live data that can be recorded and graphed for precise diagnostics. It's also the only safe way to download needed software updates and new software to CAN modules and replacement parts that require software to begin to work.

Some of you are probably saying, "I just send the customer to the dealer." We're sure your local dealer loves the referrals, but what if you don't have a local dealer? The closest one might be 100 miles away. What if the car is towed in with a no-start or poor running condition, say from a malfunctioning throttle module? You replace that part and it's going to need software before you can drive out of the shop. This is where VIDA goes beyond handy to indispensable. You might be asking, "How do I get my hands on this awesome tool?" The short answer is [volvotechinfo.com](http://volvotechinfo.com), which has all the information and



VST 2000

links you'll need to get started. Take some time to explore this site as it will be your main link to up-to-date Volvo information and support.

## INITIAL SETUP

VIDA is a relatively easy tool to learn and use. The only hard part is the initial setup, so here we will try to make it a bit easier to understand. To get started, you will need a laptop or PC with at least the following:

- Core i3 or better processor
- 4 Gigs of RAM
- 10 Gigs of local free disc space
- 2 x USB 2.0 or higher
- A good internet connection
- Microsoft Internet Explorer 10 or higher
- Adobe Acrobat 8 or higher
- Windows 7 Professional/ Enterprise (64 bit) or Windows 8.1 Professional (64 bit) operating system
- NTFS file system
- Display resolution:

Aspect Ratio	Minimum Resolution
16:95	1280 x 720
16:10	1280 x 800

It can be installed on a PC workstation, but most techs prefer to use a laptop because you can test drive with it connected to the car.\* If you use a laptop or mobile device, make sure you plug it into a power source while you're downloading software. You don't want to lose battery power during the process as it can possibly corrupt the software package or damage the new part you just installed.

Whatever you use should have room to expand because Volvo often adds new features to the system. You should get a machine that you can add more RAM or hard drives to if

\*Cellular Wi-Fi is needed for VIDA to work outside the workshop.

needed (more memory will give you better performance).

You will also need to purchase the Volvo DiCE communication tool and Volvo Bluetooth adapter to connect to the vehicle.

We mentioned software downloads above, and we should make an important point about that operation: You should have the car hooked up to a stable power source to maintain

the proper voltage in the car's network. Volvo recommends using the Midtronics battery charger/maintainer. This unit keeps the voltage at a steady 13.5. Do not use your shop's old-school battery charger because of the risk of voltage and amperage spikes that could cause damage to the vehicle's network.

You can purchase the DiCE tool and other Volvo special tools at [volvodealersolutions.com](http://volvodealersolutions.com).



The VIDA DiCE tool can communicate via Bluetooth from across the shop.



VIDA 2015 is online only, so there's no more waiting for discs in the mail!

## PIRATES!

Some of you are probably saying, "Why should I buy it from Volvo? I've seen a bunch of pirate VIDA and DiCE units on eBay® and Amazon® for a lot less." Well, you get what you pay for. Suppose you get one of those knockoff discs that actually work and you plug the dollar store tool into

your customer's car. It's possible that it'll give you the info you're looking for. Or, maybe it was a long day at the knockoff factory and the guy didn't have enough solder to cobble those recycled TV parts into a working unit, and you just plugged a short or 12V DC into the CAN bus! Oops! Also, do you think that disc of unknown origin

that has a sticker on it that looks like a nice photo copy of a VIDA disc is okay? That's a big risk. The moral of this story is if you want it to work right the first time, to have the most accurate up-to-date information, and not risk your customer's safety or your sanity, only buy VIDA and DiCE from Volvo at [volvotechinfo.com](http://volvotechinfo.com), or [volvodealersolutions.com](http://volvodealersolutions.com).

Part Number	Description	Comments	Size (KB)	Download Time (min)
30656215	Circum 2005 application		1	1
30656219	Circum 2005 application		1	1
30682142	Configuration test		1	1
9438402	Cruise control remove		1	1
9403140	Danish application		67	-
9438272	DDM reload		60	4
30677018	DDM upgrade		60	4
9438293	DIM reload		67	-
30677020	DIM upgrade		67	-
9463159	Dutch application		67	-
9438288	ECM gasoline reload		741	1
30677021	ECM gasoline upgrade		741	1
8633764	Ei retr mirr w mem app		1	1
8633763	Ei retr mirr w mem rem.		1	1
9463151	English application		67	-
9438290	ETM reload		741	1
30785453	ETM/ECM p upgrade		741	1

Here's just a small sample of the software packages available to you on VIDA 2015.

## VIDA 2015

If you're a regular VIDA user, but have not installed or used VIDA 2015 yet, here are some things you should know.

- Your old machine may not work for the online version. So make sure that your "old faithful" is up to the challenge.
- Even if you're a VIDA vet, but have not used the new version, you should start by going to [volvotechinfo.com](http://volvotechinfo.com) and reviewing the installation instructions under the VIDA tab.
- If you already have a user name and password, it will still work with VIDA 2015.
- You will need to have administrative rights on your PC to install VIDA 2015.
- Purchasing the VIDA subscription is the same as before, but when you get to the part where you used to select VIDA AIO (all in one) or VIDA, make sure you select VIDA, the online version.

**STORE** **VIDA** **SUPPORT** **RESOURCES** **ACCOUNT**

### TECHNICAL & OWNER BOOKSTORE

**Welcome**

Volvotechinfo.com is Volvo's online bookstore – one-stop-shopping for Volvo service, owner information, Aftersales Marketing Material and Sales Materials.

**Technical and Owner Bookstore Overview Video:**  
This video a guide to the redesigned [volvotechinfo.com](http://volvotechinfo.com) website to help you navigate and find information on the new website.

[NEW USERS](#) [CREDIT INFO](#)

The [volvotechinfo.com](http://volvotechinfo.com) home page.

The DiCE tool and Volvo Bluetooth adapter.



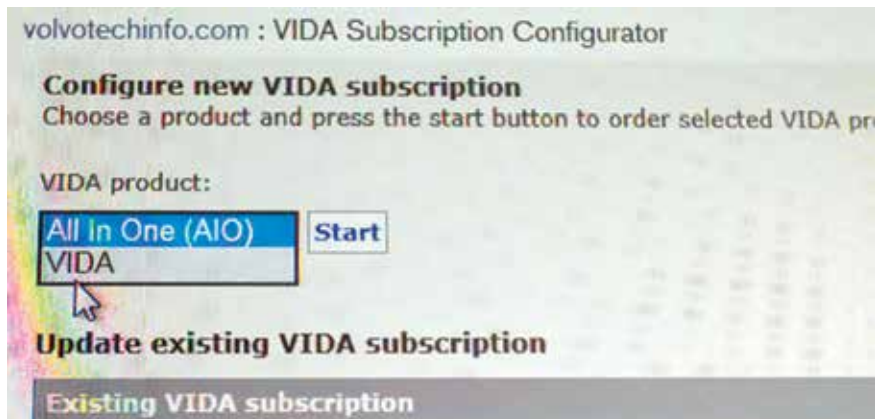
- When you activate VIDA 2015 for the first time in VIDA admin, there is one additional step: Your computer (or “device,” as they call it) needs to be approved. So, after you save all the usual tabs (Computer, Subscription, and User), click on the Device tab and follow the device-approval instructions. You only have to do this the first time you use VIDA 2015.

## FOR NEW USERS

If this is going to be your first time installing and using VIDA 2015, congratulations! You came in at the right time. VIDA is better and less expensive than it has ever been before.

Here are 12 tips on getting started:

1. After you've purchased the required equipment as listed earlier, start by registering for a user name and password for the volvotechinfo.com website. Under the Support tab, there's a link for New Users. Click here to create a user name and password.
2. Next, log onto volvotechinfo.com and under the VIDA tab click on installation instructions. Make sure you take the time to read and understand all the steps. You may want to print out the .pdf so you can highlight each step before doing the install.
3. There's a short video that covers some of the new features of the volvotechinfo.com website on the first page.
4. The first time you install VIDA it can seem complicated, so if you're not a computer person, you may want to get some help from someone who is.
5. You should set up and install VIDA when you can focus on it and have no distractions — after hours, at home, or on a weekend.
6. Make sure you are logged on to your PC with administration rights, and that you are using Internet Explorer, not Firefox or another browser.
7. After you're sure your computer meets all the requirements, you should download the pre-installation package. There's a link in Section 2.1, line 4 of the installation instructions labeled (vidainstaller.volvocars.biz/client-installer/VIDASetup.exe.). When you click the link, the installation wizard window will pop up, so follow the screen prompts.
8. After you install the prerequisite package, a desktop shortcut to VIDA 2015 should be created. Double click the desktop shortcut (V) to install the VIDA 2015 client. After it verifies the application requirements, a window will pop up asking if you want to install the application. Click “install,” which will download and install VIDA. Now check to see if the installation was successful. There should be three new VIDA icons on your desktop: VIDA, VIDA Admin, and VIDA Support.
9. Also make sure that the Volvo Car Corp. program group has been set up under the Windows start menu. At this point, if the installation went



Make sure you select VIDA, not VIDA AOI.

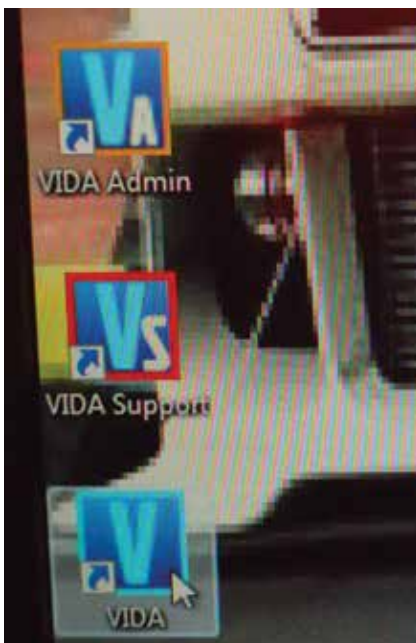


While using VIDA to communicate or download software to a Volvo, you need to provide stable voltage to the car's network. The Midtronics battery charger/maintainer is what Volvo recommends.



well you will need to log onto [volvotechinfo.com](http://volvotechinfo.com) and purchase at least one three-day subscription. Click on the Store tab, then Subscriptions. Follow the instructions on how to buy, if it's your first time. You can chose from three-day, 30-day, or 365-day subscriptions. You should probably buy a three-day to start with, even if you don't have a download to do right then. It will give you time to learn and play with VIDA 2015. Think of it as a really affordable three-day automotive training class.

10. After purchasing a VIDA subscription for the first time, a new user will be set up with a dealer code (Partner ID), a VIDA user name (different than the one for the website) and a temporary password.
11. The user will be sent an email from Volvo with instructions on resetting the temporary password and adding a security question. It is highly recommended the user sets the security question and answer at this time. Also, your VIDA password will have to be changed every 90 days.



VIDA 2015 desktop icons.

12. Now select a subscription by clicking one of the radio buttons, Continue, and Confirm. This should complete registration.
13. But wait, there's more. After initial registration, you will have to go to the VIDA Admin page from the link on your desktop and approve your device. You only have to do this the first time you register. Every time you purchase a new subscription, however, you will have to log into admin to activate it.

Confused yet? We know this sounds like the instructions for starting the space shuttle, but a lot of it is only for the first time you install VIDA. Once you use it a few times, it becomes second nature and if you get stuck or have a problem, Volvo has great technical information, which you can access on the [volvotechinfo.com](http://volvotechinfo.com) site. You can get assistance by opening a Help Request under Support.

## COOL CAPABILITIES

VIDA can do some pretty cool things. Here are just a few examples:

### •DIAGNOSTICS

On one screen you can view the high- and low-speed networks and immediately see all the car's modules and the network map. You will see all the nodes and their status, and be able to quickly diagnose whether you have a problem with the node or the network. If you have a ECM code stored, you can not only read

the code, but you can get specific information such as if the fault is intermittent or permanent, and if the fault data is high, low, faulty, or a missing signal. You can go right to fault tracing and live data on the same tool. This extra data will save you lots of time, money, and sanity.

### •CALIBRATION

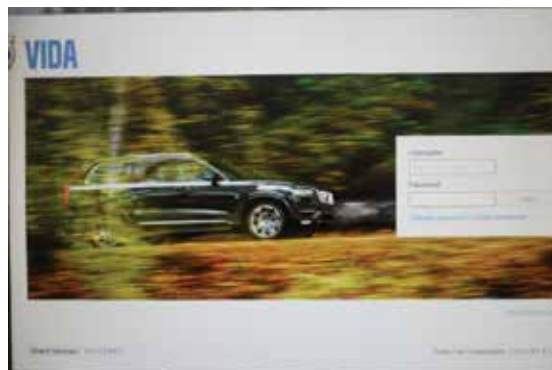
There are multiple calibrations you can do without software. The most common one is window calibration. If you have a late-model Volvo with windows that go to the fully closed position, then go back down or up a little on their own, this can be fixed with calibration. In Communication, select the DDM (Driver's Door Module) or PDM (Passenger's Door Module) and click on "Advanced." Follow the screen instructions and — BAM! — you've just fixed the customer's window problem in under five minutes. This is just one example of the usefulness of Calibration.

### •PARTS CATALOG

Do you ever find yourself doing a repair and you're looking at a part that you have never changed before, such as a cracked bracket on the back of the engine or a coolant hose that you can't quiet describe to the parts person? VIDA has the answer. When you click on Parts Catalog, it opens the factory catalog that you can search by system, and get a parts image so you can quickly identify that mystery bracket or hose by part number. You'll get the right part the first time.

### •SOFTWARE FIXES

There are many repairs on Volvos that can be done just by updating the software in a specific module. We'll cover some of the most common ones in future Volvo TechTips articles. ●



VIDA 2015 login screen.



## NOT SO SIMPLE ANYMORE: TIMING BELT SERVICE WITH CVVT

CONTINUOUSLY VARIABLE VALVE TIMING MAKES A BIG DIFFERENCE IN THE EFFICIENCY OF VOLVO ENGINES, BUT IT ALSO COMPLICATES SERVICE PROCEDURES.



Wet, wet, wet! This timing belt is saturated with oil from a big leak at a front cam seal. At least it's getting replaced before breaking or coming off and causing bent valves.

Volvo adopted variable valve timing in 1999. The first versions had CVVT (Continuously Variable Valve Timing) only on the exhaust camshaft, but with the advent of stricter emissions regulations and the ongoing quest for better performance, Volvo added this efficiency-enhancing feature to the intake cam. In the ISP (Independent Service Provider) world, most of the Volvos we see have camshaft control, and often require service on that system and the timing belt that powers it.

Early on, technicians were only replacing the belt, the tensioner, and the idler bearing as cars reached the recommended mileage intervals. But more and more Volvos are suffering from a lack of regular maintenance. So problems are developing, such as camshaft seals leaking or popping out, and CVVT valve and unit failure. If a car is on its second timing belt, it's best to not only replace the timing belt and bearings, but also the CVVT hub or hubs, the camshaft seals, and the water pump. By the way, whenever you find a camshaft seal problem, make sure you check for pressure in the crankcase caused by a clogged PCV system (see

Crankcase Breathers are Critical elsewhere in this issue).

Sometimes a car comes in that's had no maintenance beyond the occasional oil change at the local "lffy" lube. You know, "when the oil light comes on." You're probably familiar with the condition of the cars they own: lots of dents and scratches, an "interesting" smell inside, as well as most of the newspapers from the last 15 years in the back seat. The customer comes in and tells the service writer that he or she has an oil leak, followed by the statement, "I've never had to do anything to this car." As you drive it onto the rack, you notice that you can't see out of the back window because it's covered with oil residue. You look at the oil change sticker on the windshield, but it's so faded you'd have to use a black light to make out the mileage. And you have at least three warning lights glowing — "Check Engine," "Service Required," and "Bulb Out," with the odd SRS or ABS lights mixed in. You open the hood, pull the dipstick, and — surprise, surprise! — no oil present, yet the engine is dripping with that liquid lubricant. You pull off the timing belt cover, which is distorted, to confirm

that, yes, the oil has been pouring out of the front camshaft seals. The timing belt is soaked with oil, and when you test the breather system it shows positive pressure, instead of vacuum.

This is a worst-case scenario, of course. But more high-mileage Volvos are turning up with these issues. As for a car that needs all the work done to correct the conditions listed above, there is only one way to do it: the right way. This customer is going to have to decide to "fish or cut bait" because to do what's necessary to get this Volvo back from the grave will be expensive. Customers who love their Volvos will have them fixed, whatever it takes. On the other hand, if they ask you to put a band-aid on it, do yourself a favor and don't. You will thank yourself later when the timing belt jumps off or the engine locks up.

## PRELIMS

Here, we will walk you through one of the most common Volvo CVVT timing belt and seal jobs using a 2003 Volvo XC70 with a 2.5L turbo engine (B5254T2) as our example. As always with a big job like this, test drive the car first and make note of any irregularities. Since the camshaft seals are leaking, test the breather system for pressure first — there should be a vacuum at idle if the PCV system is working correctly. Let's assume that this car passes the test.

It's a good idea to read and note the live data from your scan tool, especially those for the cam angle. Of course, you don't have to do this every time, but it will help you get a sense of what normal readings are and you'll see what numbers change after the repairs are done.



No, this is not an oil-cooled timing belt.

You're going to need some special tools for this job, which you can purchase at the parts counter of your local Volvo dealer, or online from [volvodealersolutions.com](http://volvodealersolutions.com). Of course, you can substitute generics for some of them, such as the seal drivers, but the 999 5452 and the 999 5451 are "must-haves." Here's a list:

- 999 5452 Camshaft Adjustment Tool
- 999 5451 Adjustment Tool
- 999 5651 Extractor
- 999 5719 Drift
- 999 5718 Drift
- 999 5919 Puller
- 999 5450 Punch
- 999 5433 Crank Holder

## STEPS

Start the job by removing the negative battery clamp in the trunk. If you're new to Volvo, you should be aware that you need to wait at least five minutes after the car is turned off to disconnect the battery to let the modules store information. Also, if you disconnect the battery while the climate control is doing its "after-blow," you can damage the CCM. (This recently happened to a tech — he had to eat a \$700 CCM and software, and he was just changing the battery!) In addition, the SRS system is active for three minutes after the key is turned off. All in all, it's good to be patient.

Open the hood and remove the brace from the strut towers and the upper engine torque member. Take off the intake tube between the air mass sensor and the turbo inlet. Some techs just disconnect the hose from the air mass sensor and pull it to the side to install the cam holder assembly (999 5452 Camshaft Adjustment Tool), but it only takes a few more minutes to remove the tube altogether and it gives you tons more room. The next step is optional — you can remove just the T25 screws for the intercooler pipe that runs over the top of the engine, or remove the whole pipe to

gain access to the Torx bolts for the ignition coil cover. Be careful not to pull on the plastic pipe if you're not going to remove the clamp at the top of the turbo because the short intercooler hose may tear if abused. This can cause a nice unmetered air leak that you may not notice till the customer brings the car back a few days later with a MIL (Malfunction Indicator Lamp) on and a DTC (Diagnostic Trouble Code) for fuel trim.

Unscrew the eight T40 bolts that hold down the upper timing belt cover and coil cover. Next, use soft-jawed hose pliers to pinch off the small coolant return hose going to the coolant reservoir, remove the

clamp, and disconnect the hose. If you're going to replace the water pump as part of the job, drain the coolant before you start. If you're not, you can leave the coolant in the reservoir — we use a small plug to block the nipple on the reservoir.

Disconnect the coolant level sensor wire at the base of the reservoir and lift the power steering and coolant reservoirs up and out of the way. You may spill some P/S fluid but probably not much. Pull the reservoirs and hoses away from the cam sprockets.

Raise the car, remove the right front tire and the two plastic 10 mm nuts that hold the bottom of the fender



This is a well-used set of camshaft tools.



These are the two most important special tools you need for this job.

liner in place, and hold the bottom edge of the liner out of the way so you can see the crank pulley. Lower the car and remove the serpentine accessory belt. It's a good idea to draw a map or take a photograph of the belt routing before you remove it, unless you know it by heart. Unscrew the main timing cover bolt and lift the cover up and away. Now you can see all the timing marks.

Install the upper timing belt cover so you can see the timing notches. With a 32 mm socket, turn the crankshaft clockwise until all three marks align, rotate the crankshaft clockwise 1/4 turn past the marks, then back counter-clockwise to the marks. At this point, we use a permanent marker to make our own marks on the camshaft gears and the head (this is the TDC position). After you remove the timing belt, the camshaft or camshafts (with dual CVVT) will be able to move independently.

To take off the timing belt, remove the crank pulley (four 10 mm bolts first, then one 32 mm nut — Volvo recommends the use of holder tool 999 5433).



This short intercooler hose on top of the turbo will crack if the hard plastic pipe that connects to it is moved too far without loosening the clamps.

Loosen the 12 mm bolt on the tensioner and you can turn the eccentric clockwise to let the belt loose. With the belt off, we then turn the CVVT hub by hand to its rest position and make another mark. Marking the camshaft in the TDC and rest positions is a good habit even if you're just replacing the timing belt by itself because it's extra insurance that you get the cam timing correct the first time.

Since here we are replacing the CVVT hub and camshaft seals, we need to lock the cams and crank in the TDC position with the special tools (999 5452 and 999 5451). The reason for this is once you remove the CVVT hub there is no accurate way to tell if the camshafts are in the correct positions even if you mark the gears and manage not to move the cams during the job.

At the back of the head, remove the bolts for the wiring harness bracket and move it away from the head, remove the two 10 mm bolts that hold the cam position sensor on and lay the sensor to the side. Mark the head and trigger wheel with your

permanent marker, then unscrew the 10 mm bolt that holds the trigger wheel. It is hard to put the CPK wheel on the wrong way, but we have seen it done. Just get in the habit of marking things and it will save you a lot of headaches. On the intake side there's a rubber-covered plug. Insert a flat screwdriver into the slot in the center of the plug and pop it out.

Time to lock the cams. Take the cam tool (999 5452) apart and install one side in the slot on the end of the exhaust cam, then install the other side of the tool on the intake side — carefully turn the exhaust cam clockwise with the tool until the two parts line up in the middle. Install and tighten the bolt that holds the tool together. If you did it right, both cams will be locked at TDC. The crankshaft should be lined up with the notch on the block, and you can insure this position by removing the starter and installing the crank holding tool (999 5451). It is best to line up the crankshaft with the timing mark and don't use the crank lock since it's easy to see if the crank is in the right position and it usually doesn't move.

Now take a short T55 bit and remove the threaded plug in the front of the CVVT hub on the exhaust cam. You will need a pretty stubby bit (about 20 mm long) because there's not much room between the cam and the strut tower.

Next, remove the CVVT hub assembly. With the cam-holding tools tight, you're supposed to be able to loosen the T55 inside the CVVT hub with just the cam tool (999 5452) holding it, but that bolt gets very tightly stuck in high-mileage cars, and techs have been known to break the tool, or, worse yet, chip the cam at the back. Since you're replacing the exhaust hub anyway, hold the sprocket with a chain wrench to protect the tool and the camshaft while breaking the CVVT bolt loose.

Once you've removed the cam sprockets, the tensioner, and the timing belt idler, use some parts cleaner to

get the oil and sludge off the front of the engine. If you're going to replace the water pump, now is the time. Next, remove the front cam seals and press the new seals into place (the exhaust seal is thinner than the one for the intake). You can replace the front crank seal too, but it's rare that one would fail on a late-model Volvo.

## BY THE BOOK

Now comes the fun part: Reassembly. You need to take extra time to make sure you do the installation by the book because if you are off just a little, you will have a comeback and have to do the job over. Install the timing belt idler pulley bearing and torque the bolts to 15 ft. lbs. Put the tensioner assembly on, but leave the bolt loose for now.

Examine the new CVVT hub for defects, make sure the seal on the inside lip is okay, slide it on the end of the exhaust cam, thread the bolt in, and tighten it lightly. You will notice there is no timing mark on the new gear, but don't worry about the position right now. Make sure the mark on the crank sprocket is still lined up with the notch on the oil pump. Loosen the three screws that hold the sprocket to the CVVT unit, turn the sprocket so that the bolts are centered in the slots, and tighten the three screws slightly.

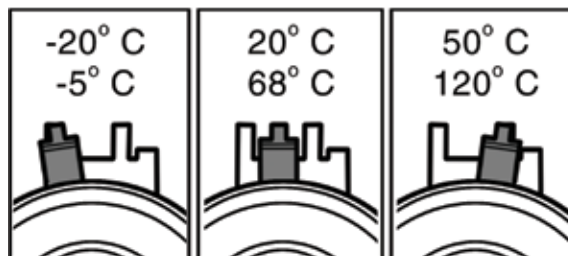


Here's the mechanical tensioner from a Volvo B5254T engine.

This next step is critical: Turn the sprocket clockwise to its stop position — you'll feel it. With the upper timing cover on and holding the gear in its stop position, make a mark on the sprocket that lines up with the notch on the timing cover. If you are reusing the CVVT unit, you can use the old mark — just make sure it lines up with the marks at the full-stop position. At this point, if the mark on the CVVT lines up with the mark on the timing cover when you turn it clockwise with your hand, you can torque the center bolt to 95 ft. lbs.

To install the timing belt, start at the crank sprocket and go up to the idler pulley, then to the intake cam, then the exhaust cam, next the water pump, and finally the tensioner. For the fine tuning, hold the center 12 mm bolt on the tensioner and with a 6 mm Allen wrench turn the eccentric clockwise until the indicator passes the marked position and reaches the end position, then turn the eccentric back until it reaches the position in the accompanying diagram. Hold the wrench in place and torque the tensioner bolt to 15 ft. lbs.

Last but not least, to make sure the CVVT hub is at the right position install



Fine tuning the eccentric indicator.

You'll need a short T55 bit to get in between the cam hub and the strut tower.



the center plug on the end of the CVVT hub and torque it to 26 ft. lbs. Loosen the three screws on the CVVT sprocket or sprockets and with a torque wrench and a T55 bit in the cam plug, hold the gear at 19 ft. lbs. and at the same time with a second torque wrench tighten the three outer gear screws to 7.5 ft. lbs. This is to make sure that the CVVT hub is at its end position.

As with all timing belt jobs, turn the crankshaft at least two full rotations and make sure all the marks line up and the tensioner is in the right place. Put everything else back together, fill the cooling system, test drive, and you're done.

A word about parts: We know it's tempting to use aftermarket parts because of the savings, but there's a big difference in quality. With this labor-intensive job, IT'S NOT WORTH THE RISK! So, for the sake of both your customer and your shop's reputation, use only Volvo OE parts. ●



The new CVVT hub has no timing marks, but with the cam lock installed you don't have to worry about that.



# GENUINE ORIGINAL EQUIPMENT VOLVO BATTERIES

YOUR LOCAL VOLVO RETAILER  
HAS A FULL LINE OF MODEL  
SPECIFIC REPLACEMENT  
BATTERIES WITH A FULL  
RANGE OF POWER RATINGS.



- Built to Volvo OEM specifications to help optimize vehicle performance, battery life and vehicle fit.
- Backed by a Volvo Car USA LLC limited warranty. See retailer for details.
- Very price competitive.

# TRANSMISSION CONTROL SOFTWARE UPDATE



Technical Service Bulletins (TSBs) should be among your very first resources when servicing a vehicle. TSBs can be just as important and helpful as scan tools and test drives. And in some cases they can give you solutions to problems you didn't even know were there. Of course some TSBs point to issues that are covered under factory warranty or recall campaigns. And in these cases it's honorable and good business to direct the owner of the vehicle back to his dealership for the specified repair, typically at no cost.

But in most instances TSBs will help you in your daily diagnostic and repair work, and they represent a resource you should rely on. The best place to find the most up-to-date TSBs for Volvos is on their website [volvotechinfo.com](http://volvotechinfo.com) or on Volvo VIDA.

Customers may complain of a variety of shift quality issues, including soft shifts, slipping, or harsh shifts. These may be caused by problems with hardware or software, but mechanical issues are rare. Most often problems are related to electronic shift control.

## BEGIN WITH THE BASICS

Certainly the place to start, with transmission issues, as well as with virtually any customer complaint, is to discuss with the motorist, in detail, exactly what their concerns are, and what symptoms they are experiencing. And you'll want to explore all the angles that may prove helpful in your diagnosis. Does the problem occur when the ambient temperature is hot or cold? Does it occur when the engine is hot or cold? Is it present only after hot

soak? Does it happen more when going uphill or when the engine is under load?

There are other questions you might ask. Does the problem occur when the transmission is shifted manually? Do any other symptoms manifest themselves at the same time, like a change in engine sound, or perhaps a "hiccup" in any instrument readings? Are symptoms more common on the highway or in stop-and-go driving? Are symptoms intermittent or repeatable? Is there a MIL illuminated, indicating the likely presence of what are likely to be helpful DTCs? These questions and more will become important pieces of evidence.

Similarly, a road test may well prove valuable in pinpointing specific trouble areas. You and your technicians are more likely than the owner to glean helpful information from a road test, since you will have driven far more vehicles similar to this one, so you'll know what's normal and what's not. If customer input and your test drive point to a specific issue, certainly you should look for TSBs that address that specific problem. Further, a test drive using a scan tool or Volvo DiCE will reveal if there are DTCs stored in the TCM and/or ECM. If codes are present, you can follow the appropriate diagnostic procedure for those codes.

## BE SURE SOFTWARE IS CURRENT

In any event, you'll want to check to see if the vehicle has the latest software updates installed. You can do so using the Volvo VIDA system. Before VIDA 2015 became available,

it was necessary to purchase and try to install the TCM software to see if it would load. If the latest updates were already present, loading would stop and you'd get a message saying that the latest TCM software was already installed. This was an inefficient and time-consuming process.

Now, of course, you can use the online version of VIDA to detect the software status and diagnose likely transmission problems. You can also find additional information by accessing the .pdf viewing library. If there are no indications of catastrophic transmission problems and no DTCs pointing to a specific fault, you may well find success in performing a software update and fluid change.

When draining the fluid in high mileage vehicles, you may observe that the fluid is very black. This is not necessarily an indication of an internal transmission failure, but may only signify that the fluid has not been changed regularly.

While the capacity of transmissions in 5-cylinder Volvos is typically more than four quarts, you may only get four quarts when draining. If the oil is particularly dark or if you find significant amounts of water or debris, you may want to replace the oil, drive the vehicle for an extended test drive shifting up and down through the gears, and then drain that oil and replenish it with new. It is critical to use only the oil specified for these vehicles, and you can be sure of getting the proper oil from the parts department of your local Volvo dealership. ●



## DTC DIAGNOSTIC TROUBLE CODES

CONTROL MODULE	CODE	FAULT TYPE
TCM	P089500	Intermittent
	012B	
	012A	
	002F	
	0045	
	0053	
	008D	
	0028	
	0099	
	002E	
ECM	530D	Intermittent
TCM	p074400	Intermittent
	p073000	
	002A	
	002B	
	0029	

NOTE! New AW TF80SC (Gen II) TCM upgrade is available to remedy a rough shift from 5th to 4th gear, and/or shift shock after standing still at brake pedal release, and/or harsh engagement during the neutral to drive (N-D) shift, and/or set Transmission Control Module (TCM) DTC P089500. This applies to all vehicles with the Gen II AW TF80 SC.

### IT IS IMPORTANT TO NOTE:

1. The ECM and TCM should always have the latest SW before returning the car to the customer.
2. Just because there is a TCM or ECM upgrade available, it doesn't necessarily mean the customer's symptom will be remedied by the upgrade. If the transmission-related complaint is not listed in the attached chart, further fault tracing is required for a proper repair!

### SERVICE:

If the vehicle fits in the model year or chassis range for the symptom in the attachment, download a TCM upgrade unless otherwise stated in the attached document.

Vehicle	Complaint/Symptom	Reset Adaptation to Zero	Adaptive Test Drive
<b>AW 6 Speed (TF80SC)</b>			
2012-2013 S60 T5 (Structure week 201046-201247) 2011-2013 S60 T6 (Structure week 201020-201244) 2011-2013 XC60/XC70/S80 (Structure week 201020-201246) 2013 XC90 (Structure week 201220-201246)	A TCM upgrade is available to remedy a rough shift from 5th to 4th gear, and/or shift shock after standing still at brake pedal release, and/or harsh engagement during the neutral to drive (N-D) shift, and/or set Transmission Control Module (TCM) DTC P089500.  The customer may notice a difference in shift feeling after the download that will improve as the car is driven for a few days.	Yes	Yes
2011 S60 T6 (Structure week 201120-201146)	If a 2011 S60 T6 (structure week 201020-201046) does not have SPORT mode already, performing a TCM Upgrade will give this car SPORT mode.	No	No
2011- S80/XC60/ XC70 Eng 94 (PZEV) only	The customer may notice a difference in shift feeling after the download. SW is available 2011W49 for vehicles built between 2011W33 and 2011w40. SW is available 2011W31 for all other structure week.	No	No
2011- S80/XC60/XC70 Eng 94 (PZEV) only	The customer may notice a difference in shift feeling after the download. SW is available 2011W49 for vehicles built between 2011W33 and 2011w40. SW is available 2011W31 for all other structure week.	No	No
2011 S60 T6/S80/XC70/XC60	Lock-up release and 4-3 downshift programming have been altered and the temporary protection mode has been removed.	No	No
2010 XC90 Chassis 532101-568100	While the engine is warming up (cold start), the winter mode function on the gearbox will not be activated if selected by the driver. There will be no "W" in the Driver Information Module (DIM) or any indication on the winter mode button on the shifter panel.  The Transmission Control Module (TCM) Software (SW) has been changed during structure week 2010w20 (See chassis ranges to the left).	No	No
2005-2007 XC90 V8	General shift quality Soft, harsh or long 1-2 Upshift Delayed engagement when moving shifter to 'R' or 'D' Power-On Downshift Response, especially after coast-down (ECM should also be upgraded for maximum response improvement) TCM DTC P074400  (This DTC indicates that the engine has stalled on one or more occasions. Fault trace the vehicle accordingly.) TCM DTC P073000	No	No
2007 XC90 3.2	Delayed upshifts after releasing the accelerator pedal. Excessive engine braking during coasting.	No	No



# GHOST IN THE WHEEL

## DIAGNOSING ABS WHEEL SPEED SENSOR PROBLEMS AFTER A COLLISION

LEARN HOW COLLISION IMPACT TO THE WHEEL SPEED SENSOR, THE TONE RING, OR THE WIRING THAT TRANSMITS ROTATIONAL SPEED DATA FROM THE WHEEL TO THE ABS CONTROL MODULE CAN “CONFUSE” THE COMPUTER, AND WHAT COLLISION REPAIR TECHNICIANS SHOULD DO ABOUT IT.

After post-collision checks confirm that there are no leaking brake lines, you may be tempted to attribute any ongoing anti-lock brake system (ABS) performance problems to computer or other underhood components. Before you recommend swapping out the control module, brake fluid pump, or master cylinder, remember that key inputs to the ABS decision process originate at the wheels. The entire ABS operation is vulnerable to impact damage to the wheel speed sensor, tone ring, wiring, and brake lines, all of which are located on or near the wheels.

Erratic signals to the ABS control module, problems that do not set a code, or worse, brake pulsations that occur even though there has been no emergency braking situation or driver input all can result from failure to properly check and repair ABS wheel speed sensor issues after a collision.

Accurate real-time information about the rotational speed of each wheel is critical to the operation of anti-lock brake, traction

control, stability control, and some suspension and steering systems. The ABS control module receives wheel speed information from a combination of a stationary speed sensor and a toothed wheel (reluctor/tone ring) that rotates with the axle at each wheel. As the tone ring rotates, it generates a magnetic field that is strongest near a tooth, and weakest in the gap between teeth.

The wheel speed sensor (WSS) converts the magnetic field into a voltage signal that appears on your scan tool or scope as either an alternating current sine wave, or a Hall Effect style digital square wave pattern, depending on the sensor technology on the vehicle. The frequency of the voltage signal varies with the speed of the wheel. The voltage data goes to the ABS control module, which uses it to actuate solenoids that increase, maintain, or decrease brake fluid pressure to each individual wheel. If the anti-lock brake system is performing erratically or not at all, one of the most likely causes is a control module that no

longer sees a voltage signal for a given wheel, or sees a signal that is out of range.

The control module sets a fault code, and the ABS light comes on. Volvo diagnostic information suggests three possible causes to investigate first when you see a wheel speed sensor trouble code: a loose wheel speed sensor, damaged toothed wheel, or damaged cables.

### INTO THE GAP

A major cause of ABS failure is a gap between the wheel speed sensor and the tone ring that has changed from the Volvo factory specification. When that happens, the voltage signal going to the ABS control module changes in frequency, or may cease being transmitted.

Collision impact can alter the gap in a variety of ways. Look for cracks in the tone ring, in the wheel speed sensor housing, or in the mounting that holds the WSS in position. Collision debris or rust lodged between the sensor and

tone ring also can throw the gap out of spec. Missing or chipped teeth on the tone ring will alter the voltage signal.

## SURF THE WAVE (FORMS)

If you find no problems in a visual inspection, there may still be damage that is too small to easily see, or is hidden behind nearby components. Use your scan tool to check for fault codes. Each wheel speed sensor-related DTC you find will point to the individual wheel where a sensor is receiving or transmitting out-of-spec or no voltage data.

Some damage may create an intermittent glitch that causes ABS activation at inappropriate times, but does not set a fault code. You may need a scan tool with a high sampling rate in order to see the glitch.

Using a digital scope, connect its leads at the Brake Control Module (BCM) and watch for distorted waveform patterns as you rotate the wheel. A cracked toothed wheel/tone ring will appear as a much narrower riser than normal square wave blocks. If a gap in the toothed wheel has been filled in with rust or debris (from a collision impact

or from magnetized metallic brake dust), the waveform may appear as if two or more riser blocks have merged into one very wide block. If a tooth has been chipped, damaged, or just shrunken from normal wear, the waveform will show a much narrower riser block when that worn tooth passes the wheel speed sensor.

A weak sensor signal may not show up on a test of a sensor that has been disconnected. Back-probing at the Brake Control Module (BCM) allows you to test the circuit with the sensor connected, making it easier to catch a weak signal that does not show up on a disconnected sensor test.

The tone wheel is mounted on the end of the axle, and spins with axle rotation. If wheel bearings are damaged, worn, or loose, the tone wheel will wobble as the axle rotates. The wheel speed sensor is mounted on a stationary bracket, so a wobbling tone wheel changes the gap with the speed sensor. Even if the sensor and tone ring are in good condition, voltage signals from that wheel will be off due to the bearing damage and resultant wobble. Similarly, bent wheels or mismatched tire sizes may alter the air gap at a given axle.

Replace a damaged tone ring, WSS, or its housing or mounting bracket. If there are no fault codes set, wipe the wheel speed sensor off with a soft bristle brush, and reinstall.

Wheel speed sensors are delicate devices. It doesn't take a big hit to cause a break in the wire windings inside the sensor. A road test may help identify internal damage to a wheel speed sensor or its feed wire. If the ABS light comes on when the vehicle is driven over bumps, there may be a problem with internal sensor wiring.

Visual inspection of ABS sensor wiring before and after a road test may reveal a changed wire position. Even a small amount of vibration can cause a wire to shift position enough to alter the voltage signal.

## THE BRAKE CONTROL MODULE DOESN'T LIKE DIFFERENT

Assuming the vehicle is driving straight on a level road, the computer ideally wants all four wheels turning at the same rate. Differences between wheel speed sensor readings on the left and right sides of a given axle are usually more important than the absolute value of the voltage measurement. Regardless of what tool or measurement method you use, if the wheel speed value for any one wheel is significantly different from the others, focus your diagnostic efforts on that wheel.

Look for a loose wheel sensor, too little or too large a gap between the wheel speed sensor and the toothed wheel/tone ring, wheel bearing play or axle vibrations, dirt between the sensor and toothed wheel, or a damaged toothed wheel or speed sensor. Also make sure that tire sizes and diameters match, as well as inflation pressures.

Volvo diagnostic trouble codes (DTCs) will point you to the likely problem wheel. It should be noted, however, that too low a voltage signal on one wheel may indicate a problem with the opposite wheel on that axle. For example, if you see the voltages as a percentage of each side of the axle, but the low side speed sensor and toothed wheel appear to be in good shape, check the high side. The opposite side may be generating a very high voltage signal due to a fault such as a crack in the toothed wheel on that side. ●



2012 XC90  
Front wheel  
speed sensor



# A PARTNERSHIP FOR SATISFIED VOLVO OWNERS

What's the most important thing that independent repair facilities and Volvo dealers have in common? We think it's our shared commitment to make Volvo drivers happy. One way to do that is to be sure everyone driving a Volvo car is always able to get Volvo Genuine Parts installed.

The advantages are clear. Today's sophisticated safety and performance features demand replacement parts that precisely replicate the originals. Volvo Genuine Parts also fit perfectly on the first try, which saves you time and money. Add to that a 2-year limited warranty\* and you have a formula for satisfaction that's unmatched.

But there's more. Volvo can support your business on many levels. We cater to your needs with easy ordering, unrivaled availability, and you get access to technical information.

Satisfied Volvo customers –  
the basis of a rewarding relationship.

\*Warranty excludes consumable "wear item" parts, labor and Volvo accessories.