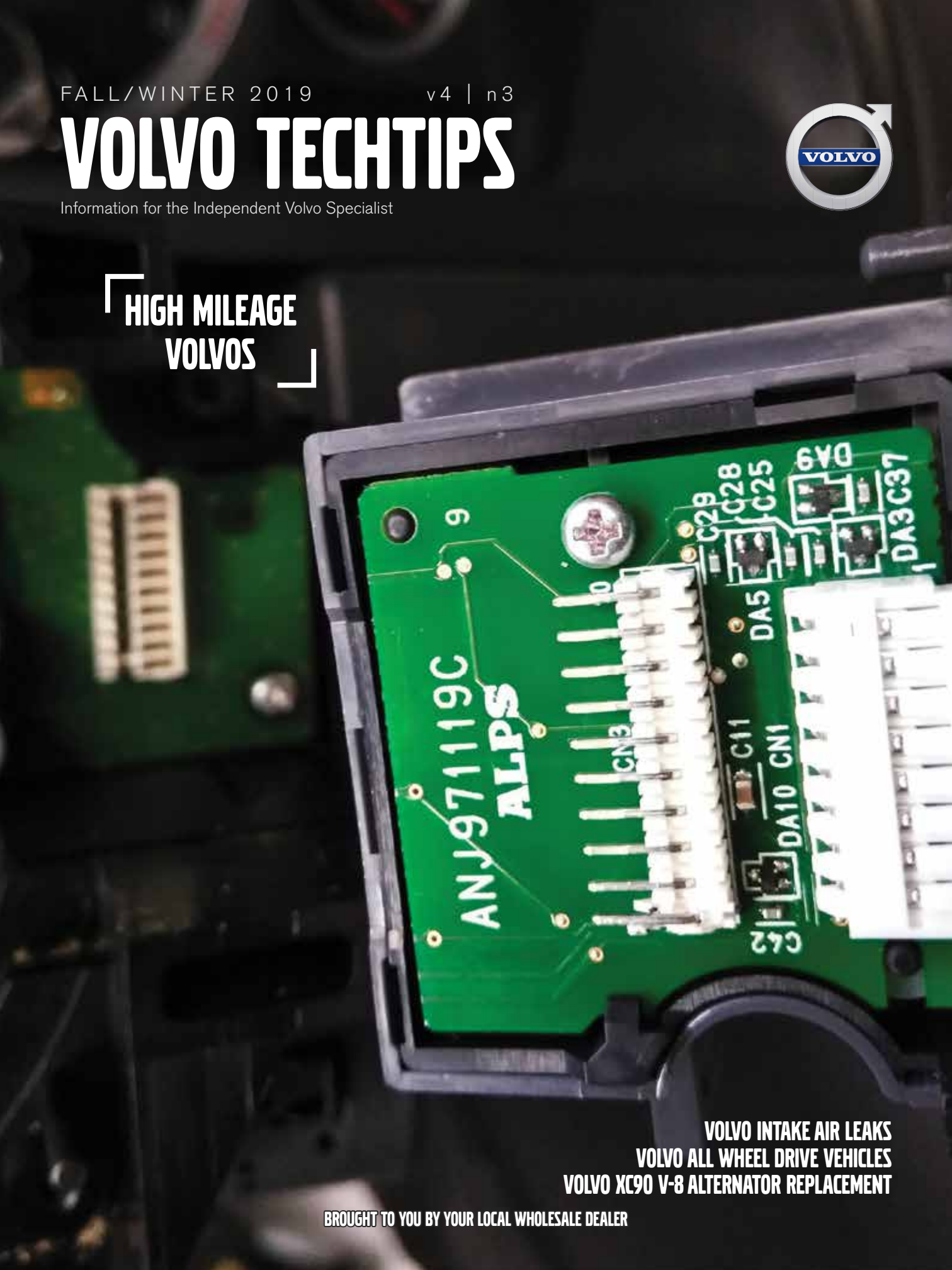
FALL/WINTER 2019 v4 | n3

VOLVO TECHTIPS

Information for the Independent Volvo Specialist

HIGH MILEAGE VOLVOS



VOLVO INTAKE AIR LEAKS
VOLVO ALL WHEEL DRIVE VEHICLES
VOLVO XC90 V-8 ALTERNATOR REPLACEMENT

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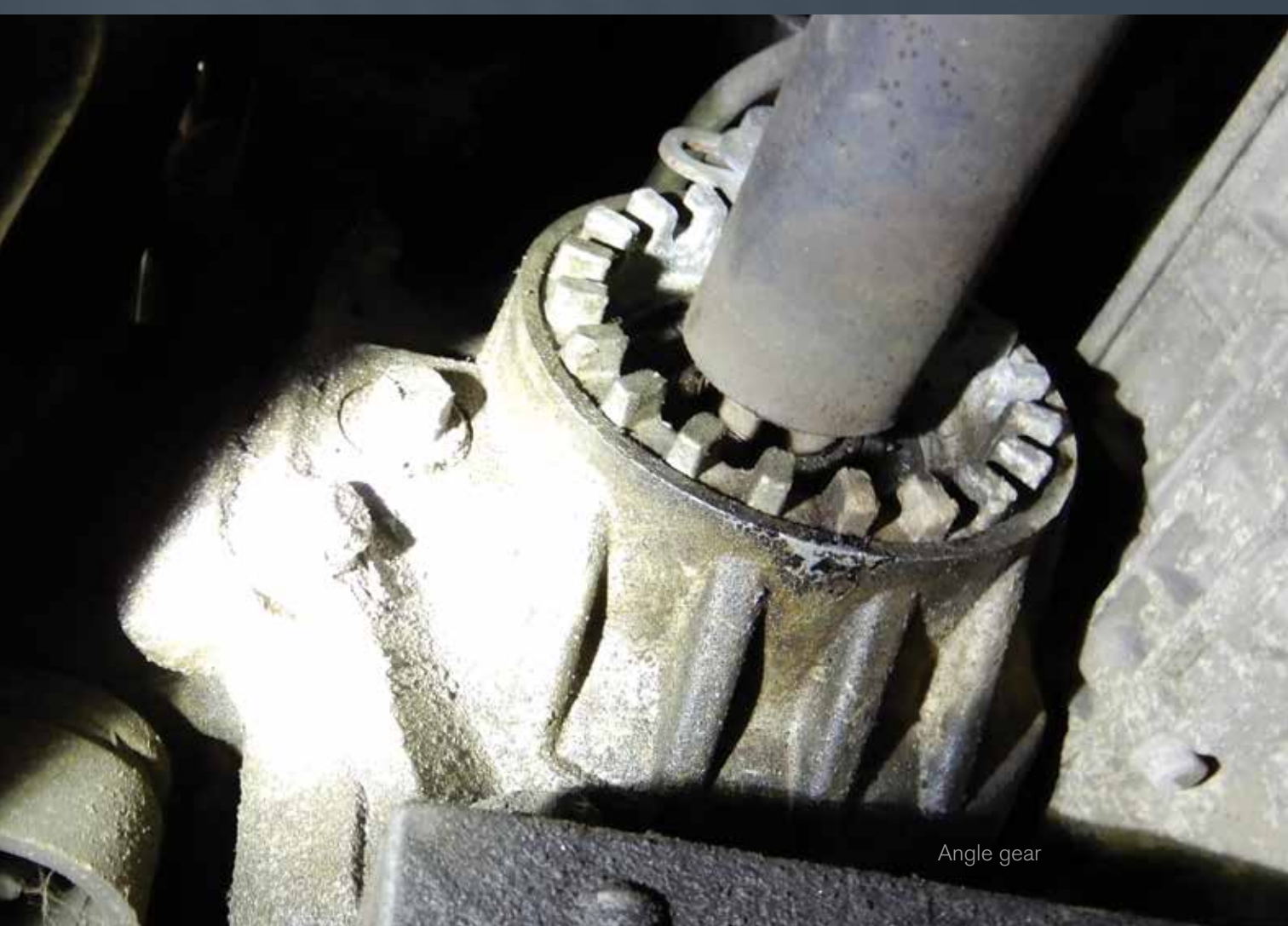
FEATURES

Cover Photo Credit: Sean Stephens

VOLVO ALL WHEEL DRIVE VEHICLES

VOLVO HAS BEEN MAKING ALL WHEEL DRIVE VEHICLES FOR OVER 20 YEARS NOW. WOW! HAS IT BEEN THAT LONG?

AMAZING.



Angle gear

What exactly does all wheel drive mean? The Purpose All Wheel Drive is a type of four-wheel drive system, and is used to give a car more traction for cornering and all-weather safety. A 4WD system uses a transfer case to engage the front and rear axles, locking them together.

Alright, let's get to it. In this article, we'll be talking about maintaining all wheel drive vehicles, diagnosing some familiar and unfamiliar problems.

Your basic Volvo all wheel drive system consists of two axles in front and two axles in the rear, and a transfer case or, as Volvo calls it, an angle gear, that connects the front wheels to the rear using a driveshaft.

Volvo has used Haldex Traction's AWD system for nearly all of their models since the introduction of their FWD/AWD platform. However, before the switchover to the Haldex system in 2003, Volvo used a viscous coupling to transfer torque to the rear axles. A viscous coupling is an assembly of closely spaced plates soaking in a dilatant fluid (a thickening fluid). This viscous coupling links the front and rear drive axles.

When the vehicle is traveling with relatively equal traction on the front and rear axles, the two halves of the coupler rotate at nearly the same speed. When the car loses traction and the front wheels begin to spin, the side of the coupler attached to the front axles will begin to spin faster than the side attached to the rear axles.

This difference in speed causes a shearing effect on the dilatant fluid that the coupling is immersed in. When the fluid heats up, it quickly transforms from a liquid into a state resembling a solid, locking the plates together and forcing the two sides of the coupler to be locked together. This type of AWD system required almost no maintenance and was fairly reliable.

REPLACING VISCOUS COUPLING 1998-2000

The viscous coupling can be replaced, first making sure to leave the vehicle in Neutral so you will be able to turn the driveshaft. Raise the vehicle in the air. Remove exhaust components that might be in the way of removing the driveshaft.

Layout on all wheel drive with Active on Demand (AOD)

Mark the driveshaft at both ends so you can reinstall it in the same orientation. Remove the bolts from both ends of the driveshaft. Remove the center support from the vehicle and remove the driveshaft.

Now that the driveshaft is out, unbolting the viscous coupling unit consists of removing four bolts at the differential and the mounting bolt at the front of the viscous coupling. Remove the six bolts at the differential pinion gear. Remove the complete unit.

Install the new viscous coupling, secure the bolts and tighten. Install the driveshaft and tighten down. Secure the center support bracket and tighten. Install the exhaust system and secure all mounting rubbers. Test drive the vehicle to make sure there is no vibration or unfamiliar noise.

Viscous coupling

Volvo introduced the first generation Haldex system for the All Wheel Drive systems used on 1998-2000 Volvo V70XC and 1998-2000 S70 AWD models.

The first-generation Haldex AWD system is the first reactive hydraulic AWD system produced by Haldex Traction. This means the AWD system relies on wheel spin to activate the torque transfer from front to rear wheels. It uses a mechanical pump connected to the input and output shafts of the Haldex clutch assembly.

Normal driving with ample traction means the car is nearly entirely front wheel drive. When wheel slip occurs, the difference in rotation speed between the input and output shafts drives the hydraulic pump. Operation of the clutch pack is almost entirely mechanical.

A mechanically driven pump and a mechanical linear throttle valve were used to determine wheel slip and lock-up of the clutch pack, converting the system from 90/10 front/rear torque distribution to 50/50 torque distribution within 90 degrees of wheel slip.

SECOND GENERATION HALDEX 2001-2003 VOLVO V70XC AND 2002-2003 S60 AWD MODELS

Haldex's second generation is also a reactive AWD system, just with the addition of computer-controlled solenoids to control the clutch plates. This system reacts within 90 degrees of wheel slip.

When wheel slip occurs, the difference in rotation speed from front to rear axles activates a mechanically driven hydraulic pump. The pump forces hydraulic fluid through a computer-controlled solenoid, which then engages a set of clutch plates to transfer torque to the rear axles.

THIRD GENERATION HALDEX 2004-2009 S60, 2003-2008 XC70 MODELS

The Haldex third generation system is the first proactive AWD system deployed on Volvos. As soon as the engine is started, an electric pump pre-pressurizes the AWD transfer clutch. When the traction control computer senses wheel spin, the pre-pressurized clutch pack is engaged instantaneously and torque is transferred to the rear axles. Once engine torque is transmitted through the Haldex unit, the mechanical oil pump takes over from the electric pump and continues to supply pressure to the hydraulic clutch pack.

FOURTH GENERATION HALDEX 2009-2014 VOLVO XC90, 2010-2012

This is virtually identical to the third generation system, but does away with the mechanical hydraulic pump.

Mounting bolts at differential for viscous coupling

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HALDEX FIFTH GENERATION, 2013-2016 VOLVO S60, 2013-2016 VOLVO XC60

The fifth generation of Haldex's AWD system focused on tighter integration of components and a simplified construction. The fifth generation system simplified the design and uses only a computer controlled high pressure hydraulic pump to replace the accumulators and solenoids used in previous versions.

ANGLE GEAR FIVE CYLINDER VOLVO RESEALING

Oil leakage from the angle gear halves can be resolved by resealing and/or replacing the seals. The angle gear itself does not normally need to be replaced. However, if you hear any noise or binding while driving, or if there is any angle gear backlash, bearing damage, or excessive pinion shaft play found during disassembly, you should replace the entire unit.

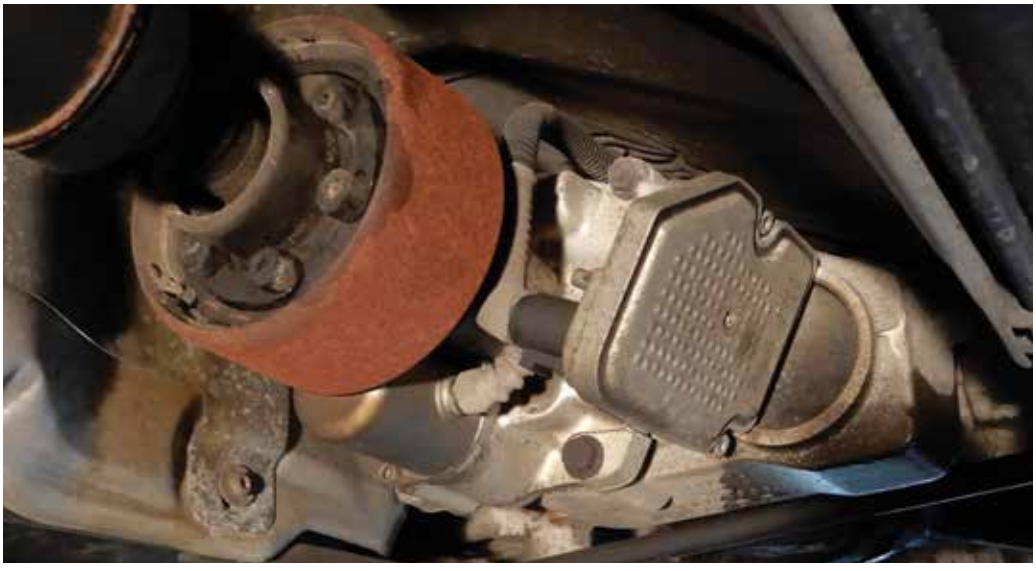
Volvo Technical Journal 18513 will also help in resealing these units.

1. Remove the 13 mm fill plug and drain the fluid. This plug can be found on the side of the angle gear closest to the passenger side and has a copper crush washer.
2. Remove the axle seal, right side crown wheel ring gear shaft seal, and pre-load adjustment nut o-ring. You can remove the seal with a screwdriver or pry bar. Before removing the crown wheel, make sure to mark its position in relation to the housing. You can use an impact punch.

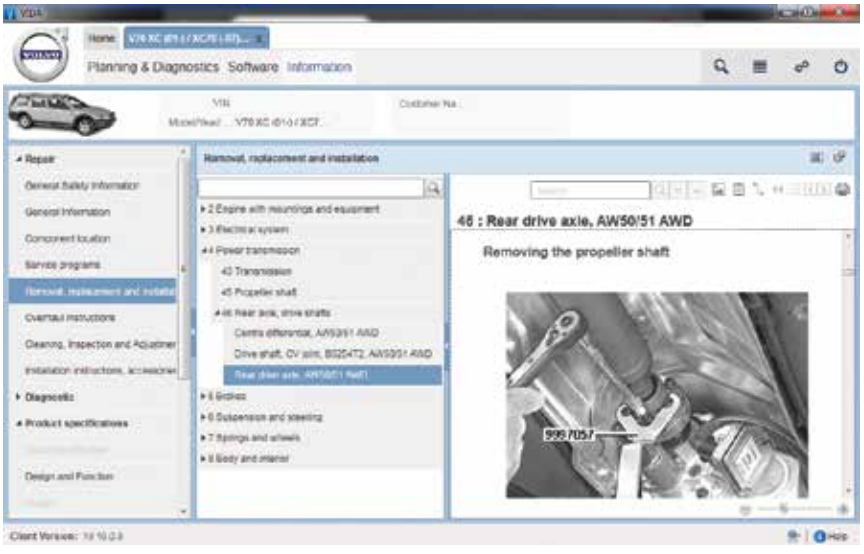
   You should also measure the height of the crown wheel to ensure it's reinstalled back to the same position. Remove the locking bolt and anchor and remove the nut. Volvo has a special socket for this but you can use a long screwdriver or pry bar to back it out. It just threads in, so spin it counterclockwise to remove. Once the nut is removed, tap out the seal.
3. Remove the pinion shaft seal from the angle gear. First mark the driveshaft flange in relation to the angle gear flange and remove the flange. Mark the position of the driveshaft flange center nut in relation to the housing and remove the nut. Remove the seal, inspect the carrier plate, clean the mating surfaces and reinstall the seal.
4. Clean the angle gear using alcohol around the sealing surfaces and blow the area clean with air when finished.
5. Next remove the ten screws and the cover separating the two halves. To make it easier you can tap them using a plastic hammer to release them.
6. Check the pinion gear and crown wheel for any type of abnormal wear or damage.
7. Check the pinion shaft for axial play or any kind of binding, and also check the bearing races in both halves of the angle gear.
8. If you find a bearing race is damaged, if the pinion shaft has play, if there is abnormal gear wear, or if there is any kind of binding, replace the angle gear.
9. If you find these parts to be serviceable, remove the left side crown wheel shaft seal and replace.
10. This is the tedious part. Measure 3 mm from the inside of the flange and draw a line along the inside circumference.
11. You'll need to file this so make sure you protect the bearing race from debris.
12. File off the inner edge of the cover, essentially making a tapered 30 degree angle up to the line that you drew.
13. After filing, you can now polish the chamfered edge with some emery cloth. Polish in a radial motion and clean when done.
14. Remove and clean any remaining liquid gasket from both flanges. You can use a Scotch-Brite™ type pad and finish cleaning with alcohol when done.
15. Apply a 5 mm bead of chemical gasket approx. 1 mm from the chamfered edge you just filed.
16. Complete the following within 4-5 minutes to ensure that the two halves are torqued together while the sealant is still wet.
17. Pay close attention to the routing of the sealant as shown. This is for the opening from the opposite side half which should be about 43 mm wide.
18. NOTE: Don't apply sealant to both halves.
19. Install the ten bolts and tighten them crosswise to 18 Nm. Then angle tighten them crosswise 85 degrees.
20. Install the axle seal.
21. Install the pre-load adjustment nut o-ring from the angle gear. Lube the new seal, install, and reinstall the nut back to its original location. Tighten the locking nut to 50 Nm.
22. Install the pinion shaft seal.
23. Install new left side and right side crown wheel shaft seals.
24. Install new bleeder pipe and filter.
25. Fill the angle gear with Genuine Volvo fluid part number 31259380 and install a new drain plug gasket.
26. Install the angle gear in reverse order, test drive the vehicle making sure of no vibrations and noises.

VOLVO SIX CYLINDER ANGLE GEAR RESEAL

1. Remove seal 8636015 with a seal removal tool (a screwdriver may also work, but be careful not to mark up the sealing surface). Be careful not



Rear differential 2003 Volvo XC70



Holding driveshaft with Volvo tool and removing bolts

to damage the bearing seated below the seal. Lubricate the new seal with oil.

2. Make sure the angle gear is supported so that no pressure is on the input shaft. Once supported, you can remove the eight bolts to lift the cover off.
3. Pay attention. Find seal part number 8636016. Record the depth at which it is installed and then remove it. Again lubricate the new seal and install it to the same depth as the original.
4. Now let's work on the opposite side. Hold the gears and chain in place and flip the assembly on its side so that the gears and chain lay flat on your bench. Lift the cover off of the gears and leave them as they are. Remove seal part numbers 8636014 and 9480961. Flip the cover over to install the new seals.
5. Lubricate both of the seals and place the cover back over the gears and chain. The cover should go on relatively easily.
6. Hold the cover, chain, and gears in place, while flipping it over to install the new gasket 8636802. No additional gasket sealer is needed.
7. Clean the mating surface of the outer cover and place it back on top over the bearings. Make sure there isn't any gap between the two halves and torque the bolts to 22 ft-lbs. in a criss-cross pattern.
8. When installing the angle gear, positioning the chain gear onto the transmission, and fitting the axles into the angle gear/chain gear, be sure to install them straight to avoid damage to any of the seals.
9. Refill with oil part number 1161745 to the level of the fill plug.
10. Go over your work, make sure you didn't miss a step and take it for a test drive making sure all is good.

Now that we've gone over resealing the angle gear, let's talk about the rear differential and its components.

The rear differential sits behind the Haldex. The two axles for each side run the power to the wheels making this system an AWD vehicle.

Changing the fluid on these units can sometimes be a challenge. Sucking the fluid out through the fill plug can be done and then you can fill it through the same plug using Volvo part number 31259380.

Replacing the differential fluid is just a good idea, like changing the engine oil. This can make the unit last longer.

In case you might have to replace the differential, here are the steps in doing that replacement.

Make sure the vehicle is in Neutral and disconnect the battery negative terminal. Raise the vehicle in the air.

Remove the exhaust system from the catalytic converter back. Disconnect all rubber mounts. You will need to have help removing the exhaust system and setting it aside. Use Volvo tool number 9997057 to hold the driveshaft while removing bolts at both ends. Make sure to mark the driveshaft so that it can be reassembled in the same orientation.

If the vehicle is equipped with a vibration damper on the Active on Demand coupling flange, use tool 9512940 to hold the driveshaft and remove the bolts. The flange can be removed by using two 8 mm bolts that thread into the flange and can be pressed off. Disconnect the center support bracket and remove the driveshaft.

Remove the rear wheels and remove the center bolt for axles on both sides. Remove the shock absorber bottom bolt from both sides. Remove the bolt for the lateral links, and remove the links for the anti-roll bar on both sides. Remove the bolts for the track rod (stay) on both sides and set aside. Remove the brackets for the e-brake and let the cables hang. The bottom control arms on both sides need to be removed from the vehicle.

Disconnect the electrical connector at the Active on Demand unit. Remove the anti-roll bar (sway bar). Set a transmission jack under the differential unit and strap to the jack, using caution so the unit is stable and will not move around.

Remove the eight bolts that hold the rear subframe to the chassis and lower the unit slightly. Disconnect the breather hose at top of the final drive unit. Now lower the unit with axles until the axles are slightly below the wheel bearing housing. Remove the axles from the wheel bearing hub and lower the unit away from the vehicle.

Now that unit is out, remove the axles and Active on Demand unit and transfer them to the new final drive (differential), making sure to clean all parts and being careful when installing the axles not to damage the seals.

Secure the new unit with axles installed onto the transmission jack. Raise the jack up and insert the axles into the wheel hubs, making sure that the splines line up and slide in easily. Jack the unit up, connect the breather hose and jack the rest of the way up into place. Insert and tighten the eight bolts that hold the final drive in. Remove the jack and install the anti-roll bar (sway bar).

Install the lower control arms and the track rods and tighten down. You will need to jack up at the wheel hub assembly to line up the control arms.

Once both control arms and track rods are on, insert the bolts for the shock absorbers and the lateral link, leaving them loose at this time. Install the links on both sides for the anti-roll bar and tighten.

Jack under wheel hub assembly to install lower control arm.

Connect the electrical connection at the Active on Demand unit. Install the driveshaft and tighten, making sure to line up the marks that were made during disassembly. Install the center support.

Fill the final drive unit with Volvo fluid part number 1161620-8 until it drips out, insert the plug and tighten. Check and fill the Active on Demand unit. Note that if this unit is replaced, it is necessary to test drive the vehicle and check again.

The suspension needs to be in its normal driving condition, meaning that you should lower the vehicle onto the ground or use a track hoist. Now tighten the shock absorbers and lateral link. Raise the vehicle back up and install the exhaust system using new gaskets and secure at hangers. Tighten the axle bolts and install the tires. Look over all work done to make sure everything is tightened and in place. Of course the vehicle should have the alignment checked after this procedure. ●

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VOLVO INTAKE AIR LEAKS

COMMON CAUSES, SYMPTOMS AND FIXES

INTAKE AIR LEAKS, UNMETERED AIR LEAKS, FALSE AIR, VACUUM LEAKS OR WHATEVER NAME YOU USE FOR THIS PROBLEM, IT ALL MEANS THE SAME THING — AIR IS LEAKING INTO THE INTAKE SYSTEM BEHIND THE AIR MASS SENSOR, AIR THAT IS NOT BEING PROPERLY MEASURED AND CALCULATED FOR.

To check to see if the oil trap's check valve diaphragm is ruptured, just try to remove the oil filler cap while the engine is at idle. If it is working normally, the cap should be easy to remove. If the check valve is torn, the cap will be held down by excessive vacuum.

All makes and models of cars on the road today that use an internal combustion engine can suffer from this very common problem, and the factors that cause this problem are as many as the problems that unmetered intake air leaks can cause.

Volvos are not immune to this problem either. Different years and models of Volvos can have common issues with intake system leaks.

Even a tiny amount of unmetered air can have long-term consequences for the powertrain of an engine.

We all know that larger vacuum leaks can cause problems like poor running, stalling and poor fuel economy. These types of leaks are usually easy to spot and are usually accompanied by a Check Engine light. But the most common types of intake leaks on Volvos are small ones, the type that won't always be easy to spot. Most customers won't even notice the subtle differences in their cars' everyday performance.

This is, of course, by design. All cars sold in the United States, starting around 1994, were required to be OBD II compliant.

All manufacturers were required to design fuel and ignition systems that would self check and have the capability to "adapt" to small issues in the powertrain systems. The main reason for this was to keep the emissions of the vehicle below a specified level.

The earliest versions of OBD II were pretty basic and, compared with modern emission systems, they were Stone Age.

The powertrain system "adapts" to problems like a small vacuum leak by changing things like fuel trim, valve timing, and much more in some cases.

This is all done by the car's powertrain systems to keep the engine performing as efficiently as possible and to protect the car's catalytic converter from being damaged.

A lot of systems are able to adapt the engine's management systems enough to account for smaller vacuum leaks without setting a lean code in the ECM. But the adaption was only designed to be a temporary fix for problems like small intake air leaks.

WHAT ARE SOME POSSIBLE LONG-TERM EFFECTS OF SMALL, UNMETERED INTAKE AIR LEAKS?

We all know that when a car rolls into the shop with a large intake air leak, in a lot of cases with Volvos you can hear a larger vacuum leak when the engine is at idle. These larger leaks are usually accompanied by symptoms like stalling, uneven idle, loss of power and a Check Engine light on or flashing. But there are a lot of cars that will come into your shop with small vacuum leaks and no apparent symptoms or warnings.

Think about unmetered intake vacuum leaks as a high-fat diet for a car's engine. In most cases, a normal engine management system will interpret a small vacuum leak as a lean condition and add extra fuel to compensate.

Over time and miles, this condition could begin to prematurely wear some of the engine's internal and external parts and sensors.

Probably the most common part to be affected by this long-term abuse is the catalytic converter.

Ever wonder why some catalytic converters are still going strong at over 200,000 miles and some fail at 50,000 or 60,000 miles? Of course there are a lot of factors that can contribute to a catalyst's early demise. Lack of proper maintenance by the car's owner is probably the leading cause.

How many times has a customer come into your shop with a Check Engine light, and when the service writer asks them how long has it been on, they either look at them with a blank stare or say, "I don't know" or "a few months" or similar response.

In most cases, early catalyst failure could have been avoided by proper care and regular maintenance.

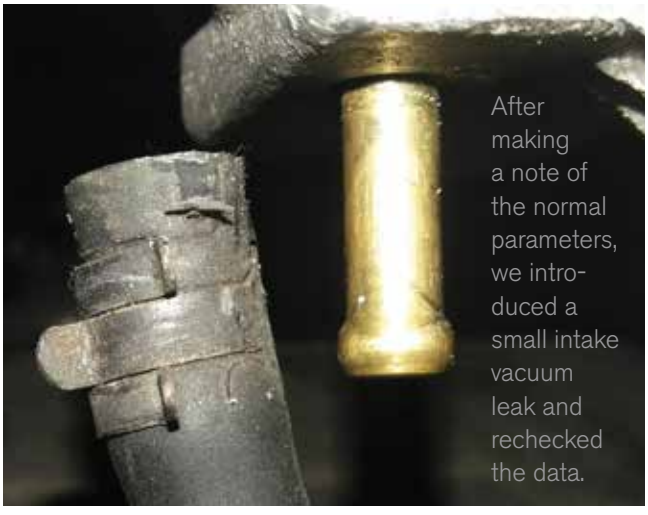
Unmetered intake air leaks can contribute to early cat failure, but are usually not the sole cause. Oxygen sensors and air/fuel ratio sensors can suffer from unmetered air leaks too. Extra fuel and oxygen in the exhaust can cause things to heat up and damage the delicate parts of these sensors.

CASE STUDY 2005 VOLVO XC90 2.5T

With the engine fully warmed up and pretested to confirm that there were no existing unmetered intake leaks, we hooked up this Volvo to VIDA and went into ECM Communication. We selected five different parameters: air mass sensor, short-term fuel trim bank 1, long-term fuel trim idle bank 1, boost pressure, and Oxygen sensor bank 1.

After making a note of the normal parameters, we introduced a small intake vacuum leak and rechecked the data.

The boost pressure and long-term fuel trim don't immediately change, but look at the difference in the air mass, short-term fuel trim, and O_2 sensor numbers.



After making a note of the normal parameters, we introduced a small intake vacuum leak and rechecked the data.

PARAMETERS	VALUE
ECM-Boost pressure	1000 hPa
ECM-Mass air flow	11.7 kg/h
ECM-Short-term fuel trim, bank 1	1.02
ECM-Long-term fuel trim idle, bank 1	-1.45%
ECM-Oxygen front sensor, bank 1	1.00

Before vacuum leak introduced

PARAMETERS	VALUE
ECM-Boost pressure	1000 hPa
ECM-Mass air flow	9.3 kg/h
ECM-Short-term fuel trim, bank 1	1.24
ECM-Long-term fuel trim idle, bank 1	-1.45%
ECM-Oxygen front sensor, bank 1	1.20

After vacuum leak introduced

Even a small vacuum leak can cause big problems.

Of course, the most common problem caused by intake air leaks is reduced fuel economy because the oxygen sensors will interpret the extra oxygen as a lean condition and richen up the fuel mixture.

The moral of this story is that you should always make checking for intake air leaks part of your diagnostic strategy on Volvos and all other makes.

WHAT ARE THE BEST WAYS TO PINPOINT INTAKE AIR LEAKS?

In the old days, you could walk into almost any shop and see someone testing for an unmetered intake air leak by spraying some sort of flammable aerosol on and around a running engine's intake manifold to see if the engine's idle speed would be affected by a vacuum leak allowing this extra fuel source to be burned in the combustion chamber.

This method was effective in finding vacuum leaks, but spraying highly flammable aerosols onto a hot running engine has its obvious problems.

When your customer calls you to ask, "Is my car done?" Your response should not be, "No, it's well done!"

These days the most popular way to find intake and other leaks is to use a smoke machine. Most shops have them. If your shop does not, it's time to get one.

The best ones are set up for EVAP testing because the pressure is regulated to a safe pressure. Most of these smoke testing machines have a way to measure the size of the leak as well as generating a non-toxic smoke that make spotting leaks very easy.

COMMON VOLVO INTAKE AIR LEAKS IN PLASTIC AIR INTAKE PIPE FROM AIR MASS SENSOR TO TURBO INLET

1999-2007 5 CYLINDER TURBO ENGINES (B5244T THROUGH B5244T7)

This one is a very commonly overlooked intake air leak, because in most cases the amount of unmetered air that enters the turbo inlet is a small amount. But over time, these plastic pipes can begin to show signs of wear, and with everyday driving, the expansion and contraction of these pipes can cause a vacuum leak. Most times these pipes start to leak around the fitting that holds the PVC heater (also known as the PTC valve). They can also crack at the lower flange that attaches to the turbo's inlet.

NOTE: When replacing these hard plastic turbo pipes, you should always order and replace the hose clamps with Volvo Genuine clamps from your local Volvo dealer's parts department.

DON'T TRUST THAT OLD HOSE CLAMP!

Always replace those clamps. They were only designed to be used one time.

In many cases, you can get a comeback from a turbo hose or pipe popping off if you reinstall the old clamp. It may

The most popular way to find vacuum leaks these days is to use a smoke machine. The best ones out there are set up with a pressure regulator to ensure that you do not cause any damage by applying too much pressure to a sealed system when testing.

One of the more common unmetered intake vacuum leaks you will see in older Volvo turbos will come from the hard plastic intake pipe that runs from the back of the air mass sensor to the turbo inlet. The plastic can distort and shrink over time, causing cracks and leakage from the fittings that are built into this pipe.

Have you ever heard that it is bad to reuse radiator hose clamps? Well, the same holds true with those large intake hose clamps, especially the ones that are exposed to high heat on a regular basis. The constant heating and cooling of the metal in the clamp can cause distortion over time and an old clamp may feel tight when it's really not.

have felt like it was tight but the screw and grooves of the clamp may be stripped. It's not worth the risk. Just make it part of the job.

EARLY T-6 2.9L TWIN TURBO INTAKE PIPE LEAKS (B 6294T)

If you work on Volvos on a regular basis, you are bound to see a few of these cars roll into the shop.

This engine only came in the XC90 (2003-2005) and a few S80s (2001-2006).

When you open the hood on one of these Volvos, you will know it by the design of the air intake plumbing and pipes that cover most of the top of the engine.

This 2.9L twin turbo engine turned out to be pretty reliable for Volvo even though some of the transmissions that came in these cars turned out to be less than stellar. The air intake plumbing is where you will experience problems with vacuum leaks.

This one can drive you crazy. The intake system on this car is a work of art and resembles a set of bagpipes more than an intake manifold. As the plastic pipes age, they can shrink, crack, and distort, causing small leaks.

But the real problems can be caused by you. This is because every time you touch one of these intake pipes, you can create problems that may have not been there before.

Every time you remove this intake plumbing to perform services like replacing the spark plugs, checking or

replacing ignition coils, or even replacing the upper engine torque mount, it can be difficult to reassemble with no leaks.

So what's the answer? You could replace the intake pipes and clamps every time you service one of these engines, but in most cases that's not needed. The best practice to ensure a sealed intake system on one of these is to use your smoke machine to check for leaks after reassembly.

In most cases, adjusting the position and tightness of the hose clamps will stop the leakage and, in some cases, you will have to replace the clamps.

OLDER VOLVO VACUUM LEAKS (1993-1999 850, S/V/70, 960, S/V 90)

Small, unmetered air leaks don't affect these older Volvos as much, but any unmetered vacuum leak will not allow your customer's Volvo to operate at its peak efficiency, regardless of its age.

The main problem you will experience on these older Volvos is the deterioration of the silicon and rubber vacuum hoses and elbows that are hooked up to different parts of the intake manifold.

A quick visual inspection of these hoses can usually turn up a few cracked or collapsed hoses.

The main thing to remember is if one hose is leaking, there will be more. So you should recommend that your customer replace all of the older vacuum hoses because a lot of these Volvos will still have the original hoses on them.

Use Volvo Genuine hoses and elbows to replace these hoses. You can purchase different size vacuum hose in bulk from your Volvo dealer, and it can be ordered in lengths.

OIL TRAP AND CRANKCASE BREATHER LEAKS

Starting in 2005, Volvo started using a diaphragm-based crankcase breather system. These systems were more efficient and less prone to clog than older PCV systems.

Some vacuum leaks on Volvos can be checked with a smoke machine; that's because they are leaking intake air directly into the crankcase.

Theses oil traps are designed to recirculate unburnt crankcase gases back into the intake for combustion.

These systems work well, but with any plastic and rubber engine parts that are constantly exposed to heat and pressure, they will fail over time and need replacement.

When these oil trap breather systems start to fail, the customer may hear a whining or whistling noise when the engine is at idle. Some technicians refer to this noise as the "flying saucer noise."

If you get one of these early T-6 twin turbo Volvos in your shop, make sure you check for air leaks after any service or repairs that involve removing the intake plumbing that runs across the top of the engine. They are prone to leak after the pipes are reassembled.

Pre-1998 Volvos are less affected by smaller vacuum leaks, but any unmetered air leaks can affect the overall performance of these vintage cars. Make sure to inspect the small vacuum elbows since these will tend to deteriorate over time.

On the P2 Volvos (2005-2010 V50, S40, and C30) the oil trap and oil trap diaphragm are part of the oil filter stand assembly bolted to the front side of the engine block.

Some intake vacuum leaks can come from internal sources like a damaged or leaking oil trap diaphragm. A whining noise, and in some cases, a Check Engine light can be symptoms of a larger leak in this diaphragm.

This assembly comes from Volvo in one piece that includes the oil filter cup, oil filter, oil trap, oil trap diaphragm, and PTC heater.

If you have a failed oil trap check valve, you can check it by carefully removing the oil filler cap while the engine is at idle. If the oil trap needs to be replaced, you will have a hard time removing the cap because, if the check valve is ruptured, the crankcase will be generating a lot of vacuum, holding the oil cap in place. ●

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REPLACING ALTERNATOR ON A VOLVO XC90 V-8

ALTERNATORS HAVE BEEN CHARGING VEHICLE BATTERIES FOR MANY YEARS, AND CHARGING SYSTEMS HAVE CHANGED THROUGH THE YEARS AS WELL. WE WILL TALK ABOUT ONE SPECIFIC MODEL, THE VOLVO XC90 V-8 ENGINE TYPE.

It's important to note that 2003-2004 V-8 models use a self-regulating alternator in which the current and voltage regulation systems are built into the alternator unit. Starting in 2005, the regulation is controlled by the ECU. The regulators are still inside of the alternator, but the current and voltage output are now controlled by the ECU instead of internally in the alternator.

Starting in 2011, Volvo P3 vehicles have a Battery Monitoring Sensor (BMS). This sensor is located on the battery negative terminal and monitors the current flow in and out of the battery. The information is sent from the BMS to the CEM.

All the information regarding battery charge level is stored in the CEM. The BMS is always monitoring battery status. This is the reason, when connecting a battery charger, the ground cable should be connected to an engine ground point.

Be careful not to mix up years and alternators. A different alternator will fit and charge, but you might get an error message: a red triangle warning "POWER SYSTEM SERVICE URGENT," and a battery light because the ECU cannot communicate with the alternator. The alternator will continue to function normally and will charge the battery, but you will still get the warning messages. It's just a good idea to put the correct alternator in the vehicle so that it works properly.

Top side of V-8 Volvo engine

BMS sensor at negative battery cable

Once you have determined the alternator is not charging enough, or maybe it's over charging, here is the procedure to remove the unit and replace.

Start by letting the car sit for at least five minutes after you take the key out. This allows the ECM to store any running parameters and go into a safe state so you can disconnect the power. The battery is in the back. You will need to uncover and disconnect it, starting with the negative cable. While the battery is disconnected, hook up a battery charger and make sure the battery is fully charged.

On Volvo 2007 XC90 V-8 models, the new alternator for this vehicle is Volvo part number 36000791. Make sure to have the correct part for the vehicle you're working on.

STEP 1: REMOVE FRONT PASSENGER SIDE WHEEL

Since the V-8 engine is so crammed into the engine compartment, the alternator is somewhat difficult to reach. It is installed at the bottom behind the passenger side front wheel close to the firewall.

The first step is to remove the wheel so you can access the panel and components behind it. Raise the vehicle on a hoist or make sure the vehicle is jacked up and on a secure jack stand. After the wheel is off, the plastic inner

Plastic panel in wheel area

fender well will need to be taken off. Remove a series of plastic flange nuts so the lower component cover can be removed. Remove the nuts and then remove the panel.

STEP 2: DISCONNECT SUSPENSION COMPONENTS

Now take a look at the hub assembly. There is an axle nut on the front that needs to be taken off. Remove this, the outer tie rod, and the sway bar link. Spray them down thoroughly with a penetrating lubricant first to make the job easier. The joints may rotate in the socket, so you might need to improvise something to take the nut off. It will also help to jack up the entire hub assembly with a floor jack to make it much easier to remove the sway bar link connection to the strut body.

STEP 3: REMOVE AXLE

With the linkages removed, it's now time to remove the axle from the hub assembly. Make sure the ABS sensor and the brake lines are out of the way. Unbolt the brackets and tuck them away. Remove the ball joint nut and use tool number 9997076 to pull down on the control arm and remove the ball joint. Another way to remove the axle is to remove the two bolts that hold the strut assembly to the hub assembly. This will also give you room to remove the axle.

Turn the hub assembly hard to the left all the way as if you were making a hard left turn, and then get a punch with a flat point. Put the punch where you removed the axle nut and lightly tap with the hammer to remove the axle from the hub assembly. You may need to play with the hub angle and vary the pressure on the axle to get it to pop out.

Before the axle will come out from the transaxle willingly, the axle bearing cradle has to be removed. It's a lot easier than it sounds. Follow the axle into the car until you come across a U-shaped piece bolted in at two opposite points. Remove the bolts and give it a firm whack with a drift and rubber mallet and it will come off.

Now, jack up the hub assembly again as if you were removing the sway bar link bolt, firmly grab the axle with both hands, and give it a firm tug. The axle will pop out of the transaxle. You will need to maneuver around with the hub and the axle to get it out. You will be able to remove it without removing the lower ball joint, it will just take some time and some effort to get it out. Remove the jack that's holding up the hub assembly.

STEP 4: REMOVE DRIVE BELT AND ALTERNATOR

This is the most difficult part of the job. See the alternator hidden up there? Disconnect the fuel lines at the valve cover firewall side. The lines use quick connectors. Be sure to clean up any kind of fuel spill.

Fuel lines quick disconnect at top of valve cover

Alternator mounted on engine near firewall

With the vehicle on the hoist, raise it and remove the two screws that hold the fuel lines in place. Now disconnect the two lines at the bottom of the vehicle and remove the lines and set aside. Before you remove the three bolts, you will need to disconnect the wiring harnesses to the alternator.

The alternator output positive cable is pretty easy to get to with a small 1/4 inch socket wrench from under the car. Reach up from the wheel well, up behind the engine, and

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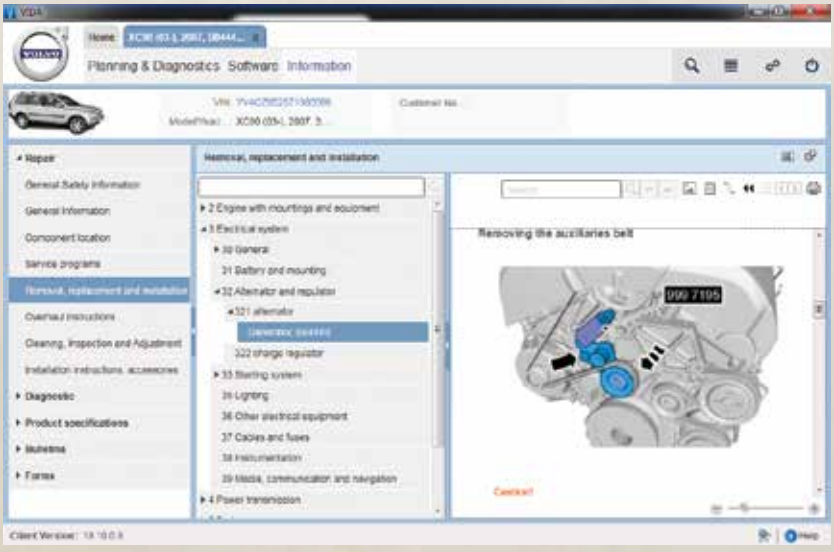
up over the alternator and remove the nut that holds the positive cable in and remove it.

The alternator field wiring is easier to remove from the top of the car. You will need to remove the upper engine mount assembly that goes between the strut towers, the rear plastic engine cover, and the plastic accessory belt cover. Beware of the accessory belt cover. There are two Torx T30 screws holding it in. With the plastic covers off, you can reach behind the engine from the top of the engine bay, reach the alternator, and disconnect the field wiring.

Now we will need to remove the accessory belt around the alternator. You can do this by first removing the servo oil line bracket, then disconnect the hoses and cap them so fluid doesn't spill everywhere. To relieve pressure on the tensioner, use a 19 mm socket with ratchet. You might want to use a 1/2 inch drive socket and ratchet. These tensioners have a heavy load so you will need to use some muscles.

Tool installed to remove pressure on belt tensioner



Auxiliary belt tensioner tool installed and belt path

Once the tensioner is loose and the belt is free, insert tool number 9997195 at the tensioner. This will hold it in place until you reassemble it. You will need to pull on this toward the front of the car, firmly, for about 40 seconds. Slowly, the belt tensioner will release and you can slip the belt off the top idler pulley. Take your time on this! If you exceed 230 Nm on the tensioner, you can damage it, so do it slowly! Remember the correct belt path so you will know the proper routing when assembling the auxiliary belt.

It's just a matter of unbolting the three bolts — two lower, one upper — that hold the alternator to the engine block, and dropping it out. This is what takes the longest time. It's a tight squeeze to get the alternator out of this little hole you made. Get the alternator out, and turn it around. You need to remove the heat shield on the back of the old alternator and install it on the back of the new alternator, reusing the Torx mounting screws.

STEP 5: INSTALL NEW ALTERNATOR AND DRIVE BELT

Now you'll need to negotiate the new alternator back into the engine bay and bolt it up. The alternator alone is nearly 20 lbs. It will be extremely beneficial to have someone hold it while you navigate the mounting bolts in, being very careful not to strip these threads. Note that the engine block that you are bolting the alternator onto is made of aluminum.

Once the alternator is bolted up, install the output positive cable and the field cable. It is easier to do the output positive cable from the bottom, and the field cable from the top.

Now install the fuel lines that you removed earlier, making sure not to bend them. Connect the fuel lines at the bottom of the vehicle and insert the screws to hold the fuel lines down. Lower the vehicle and connect the fuel lines at the valve cover. Make sure there are no fuel leaks once you start the vehicle again.

Get your 19 mm socket and long socket wrench again. Install the alternator belt around all the accessories, making sure the belt is correctly routed around the pulleys. From the top of the engine bay, put the socket wrench on the tensioner, and give it a firm and steady pull and release the tensioner, then remove the tool holding the tensioner in place. The tensioner will release and the belt should be tensioned correctly.

STEP 6: INSTALL AXLE

Now, jack up the hub assembly again and install the axle back into the transaxle. Putting it back in requires some maneuvering of the axle, the hub assembly, and adjusting the height with the jack. Make sure the bearing surface is clean and then bolt the bearing cradle back up.

Now comes the tricky part. Turn the hub assembly and pull it away from the ball joint to insert the axle into the hub assembly, making sure the splines are clean and that the ABS contact wheel is not damaged. Pull down on the control arm using Volvo tool 9997076 and insert the ball joint. Tighten down the ball joint.

STEP 7: CONNECTING SUSPENSION COMPONENTS

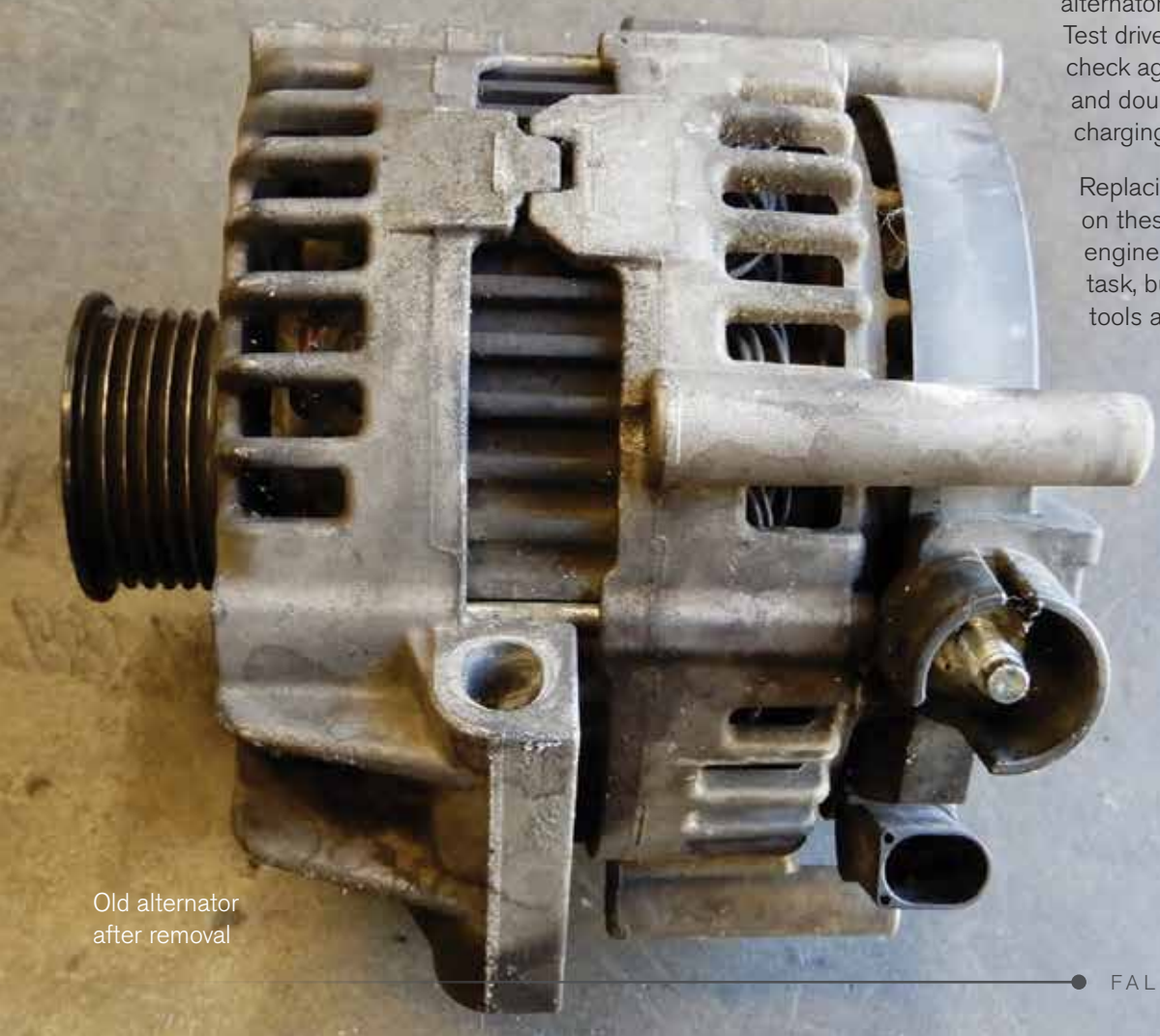
With the axle back in place and the hub assembly still jacked up, connect the sway bar end link back to the strut housing and lower the hub assembly. Reinstall the axle bolt and the tie rod. Reinstall the ABS sensor line and brake line brackets and secure. Install the inner fender well liner, both sections, and tighten down the plastic nuts until secure.

Install the wheel and tighten down. Lower the vehicle and install both plastic covers over the valve covers. Install the plastic cover around the power steering pump. Connect the servo lines and tighten to the bracket. Set your coolant reservoir and power steering reservoir back into place, making sure both are full of fluid.

Check that everything is working correctly and there are no leaks.

Now, reconnect the battery. Double check that the belt is installed correctly and the alternator is wired correctly, and the engine bay is free and clear of tools, rags, and foreign objects. Start the car and check the voltage across the positive junction and a ground. You should get around 13.8 to 14.2 volts. This confirms that the alternator works correctly. Test drive the vehicle and check again for any noises, and double check the charging system.

Replacing the alternator on these Volvo V-8 engines can be quite the task, but with the right tools and some Volvo repair under your belt it should be no problem. Always be sure to check and double check all your work. ●



Old alternator after removal

NOISY ALTERNATOR

VADIS/VIDA REPAIR INSTRUCTIONS

MODEL/YEAR: S40, V50; MAY 2004 -OCT. 2010

NO: 32 - 03
FUNC GROUP: 3203
PARTNER: 3 US 7510 VOLVO CARS NORTH AMERICA
ISSUE DATE: JUNE 15, 2007

VEHICLE TYPE

Type	Eng	Eng Desc	Sales	Body	Gear	Steer	Model Year	Plant	Chassis range	Struc Week Range
544	38	B5244S4					2004-2005		0000295 -9999999	200339 -200510
545	66	B5244S5					2004 -2005		0000133 -9999999	200347 -200510

CSC

Code	Description
B5	Alternator and charge regulator/Unusual noise

DESCRIPTION:

If there are reported cases of alternator noise and/or auxiliary belt damage, it may be possible that the belt is not tracking properly.

SERVICE:

On customer complaints of "noisy alternator", the alignment of the auxiliary belt must be checked and corrected as described in the instructions below.

Only in cases where the auxiliary belt alignment is correct and the noise is still present with a new auxiliary belt can the replacement of the alternator to solve the noise concern be justified.

CHECKING METHOD:

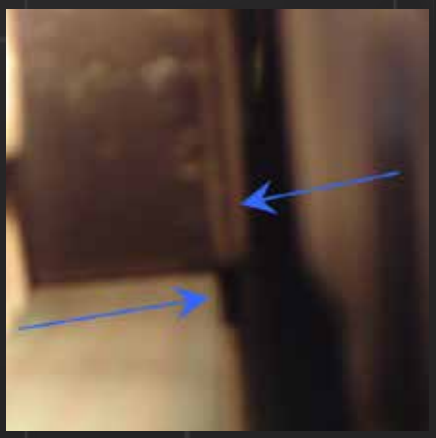
- Place vehicle on a lift
- Remove protection plate under the engine
- With the engine running, check the alignment of the inner auxiliary belt to the idler pulley. This is best viewed with a flashlight while standing just behind the RF wheel (see illustration)
- The belt should be centered on the pulley

ADJUSTMENT METHOD:

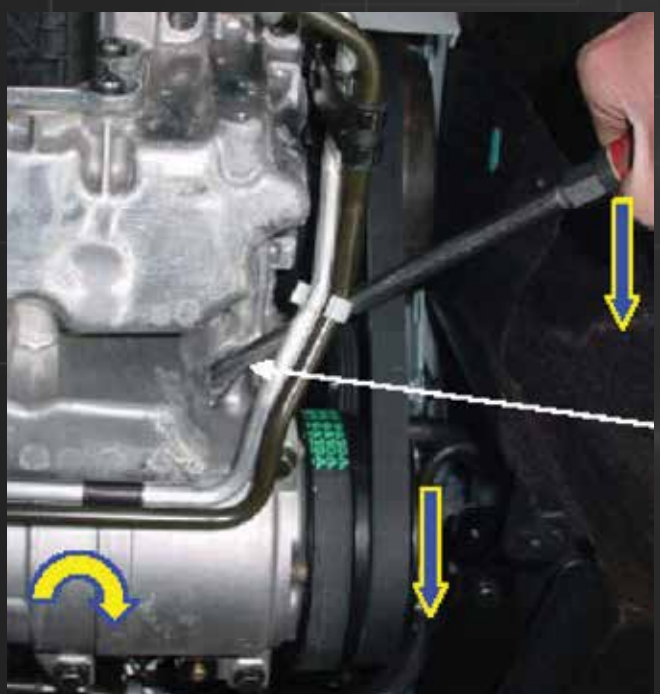
- Place vehicle on a lift
- Remove protection plate under the engine
- With the engine running, check the alignment of the inner auxiliary belt to the idler pulley. This is best viewed with a flashlight while standing just behind the RF wheel (see illustration)
- The belt should be centered on the pulley

Inspect that the inner auxiliary belt is in center of the tensioner pulley. Illustration shows an incorrectly tracking belt.

Start the engine, let it run on idle and inspect that the inner auxiliary belt is in center of the tensioner pulley when viewed from under the engine



Loosen the 3 bolts on the A/C compressor, 12 mm socket.



Place tool in between A/C compressor and oil sump.
Push firmly towards the front of the vehicle.
Protect the tool with plastic, rubber, or nylon to prevent damage to the oil sump and the A/C compressor.

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HIGH MILEAGE VOLVOS

THE BULK OF THE VOLVOS YOU ARE WORKING ON TODAY ARE PRE-2014 AND THE TIMES, THEY ARE A-CHANGING.

If you are working on Volvos today in an independent shop, you are at the beginning of a whole new world for Volvo cars, since most independent shops don't usually see new Volvos until they are out of warranty. Most shops won't start servicing and repairing these new Volvos until they are at least four years old, and many shops won't see them until long after that.

What this means is that the bulk of the Volvos you are working on today are pre-2014 models, and times are a-changing.

There are a lot of new Volvos out there, actually more than there have ever been before.

So stay tuned because Volvo is just getting started.

Luckily for us there are still millions of old Volvos on the road today, but a lot of the fleet is getting older and it's up to us to keep these old Swedish beasts from going to Valhalla prematurely.

FUEL LEVEL SENSORS
WORN OR SHORTED FUEL LEVEL SENSORS CAUSING ERRATIC OR INCORRECT FUEL GAUGE READINGS

Volvo fuel level sensors have been very reliable over the years.

Most modern Volvos use two fuel level sensors and a saddle type tank because of the all wheel drive option for a center driveshaft that the fuel tank must straddle. So two sensors are needed to get an accurate measurement of the total fuel level in the tank.

When theses sensors start to wear, they won't always set a code in the CEM, because the fault can be very intermittent.

These sensors use a relatively old technology to measure the fuel level. The reason is that it works and is very reliable. Most of them still use a contact arm that sweeps along a series of graduated resistors that are used to tell the gauge what the current fuel level is. The fuel gauge then determines the fuel level by the difference in the reference voltage.

Most Volvos these days use two level sensors, one on the left side of the tank and one on the right. In U.S. market Volvos, the right side sensor is integrated into the fuel pump assembly; the driver's side sensor is just a stand-alone sensor.

The main reason for this is to get the most accurate readings under all driving and fuel level conditions, as most fuel tanks today are made in odd shapes and sizes to accommodate different body and drivetrain setups. But over time, these sensors can wear down from constant movement and from corrosive elements in the fuel.

Most customers have a routine on how and when they fill up their fuel tanks. This can result in the fuel level sensors' sweep arms being in the same areas and wearing in the same places.

Selected Parameters | **Information**

	Parameters	Value
	CEM-Fuel level left side	5.5 Litre
	CEM-Fuel level right side	37 Litre
	DIM-Total fuel level	42.5 L

In most cases, on Volvos, the customer may complain of intermittent accuracy issues with the fuel level gauge, and in 9 out of 10 cases the problem will be caused by a worn or shorted tank sensor.

Of course there is the rare case of a problem with the fuel gauge or Driver Information Module (DIM), but this is very rare in the case of fuel level.

When testing for problems in the fuel level system, you can save yourself a lot of time if you have Volvo's VIDA software.

You can not only check the codes and freeze frame data (if there is any), but you can use the communication feature to see the live data from both the left and right sensors.

The individual sensor readings will be found in the Central Electronic Module (CEM), and the total fuel level can be found in the Driver's Information Module (DIM). The readings on the left and right sensors will be different but should add up to the total fuel level.

On a Volvo that has a problem with one of the sensors, there may not be a code stored since the glitch can be very intermittent.

But if you use VIDA, you can watch the live data on the two sensors as compared to the total fuel level and you should be able to see the glitch when it occurs.

Of course it's best to always follow the electrical testing procedures to verify that the problem is caused by a worn fuel level sensor before you replace parts.

In some cases, removing the fuel level sensors can be a very large job that involves removing the fuel tank.

If the Volvo you are working on is an all wheel drive model, the job will take you some time. So if you have one side sensor that's malfunctioning, you should recommend that the customer replace both sensors. This is good advice because the sensors are the same age and you will have to remove all those parts again if the other side fails shortly after the sensor you just replaced.

ALTERNATOR NOISE 2005-2007 S40/V50

This subject is covered in Volvo's TJ 16341.

A common complaint seen on the 2005-2007 S40 and V50 is a bearing noise that can come and go with varying engine temperatures and different climate conditions. This can be a high pitched whine or bearing noise that seems to come from the alternator area.

When diagnosing this problem make sure to check not only the belt condition but also the alignment of the pulleys that the belts ride on.

Misalignment of these pulleys can cause a noise that is similar to a worn alternator bearing. Even if you use a stethoscope to pinpoint the noise, it can sound like it's coming from the internals of the alternator.

Belt alignment is crucial on these cars to ensure noise-free operation and help prevent premature belt wear.

A lot of technicians have replaced alternators for bearing noise on 2005–2007 S40 and V50 that were not needed. In a lot of these cases the problem turned out to be a loose or misaligned alternator or A/C compressor causing the belts to run out of line. This can cause a squealing noise that could easily be mistaken for alternator bearings going out.

HEADLAMP MOISTURE DUE TO BROKEN GUIDE PIN

NO: TJ 27303
FUNC GROUP: 3521
FUNC DESC.: HEADLAMP, COMPLETE
PARTNER: 3 US 7510 VOLVO CARS NORTH AMERICA
ISSUE DATE: MARCH 15, 2013

VEHICLE TYPE

Type	Eng	Eng Desc	Sales	Body	Gear	Steer	Model Year	Plant	Chassis range	Struc Week Range
275							2003-2013		0000690-0668008	200232-201309

CSC

Code	Description
W4	Headlights/Moisture/mist on inside of lens
LC	Headlights/Bulbs blow frequently
3Q	Headlights/Vibration/shake

CSC

Materials	Quantity	Part No.
Sealing	1.0	30779754

DESCRIPTION:

The headlamp may have a broken guide pin on the headlamp housing. This can lead to moisture. The guide pin is only used in the factory assembly process. Any residual moisture should dissipate shortly with normal headlight use.

SERVICE:

In case of customer complaints, check the headlamp for damages. Repair the headlamp according to attached instruction.

VOLVO STANDARD TIMES GUIDE (VSTG) INFO:

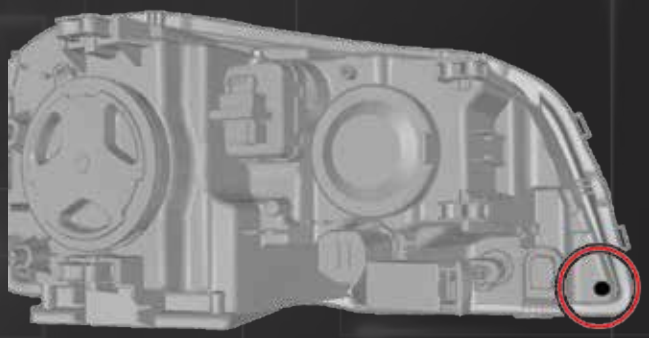
Operation number *98465-2* - **Head lamp 1 side adjust ** - "0.1 hrs."

- Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01
- Labor times are valid at the time of release and are subject to change.

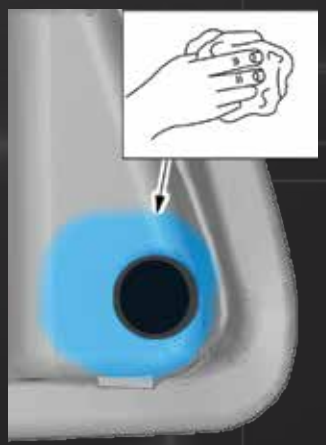
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

REMOVAL

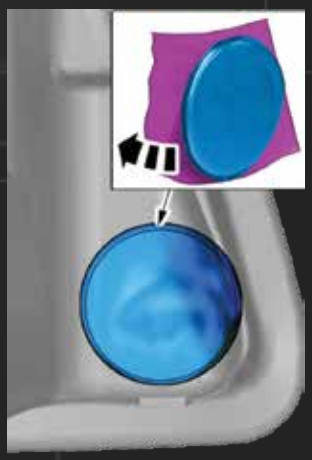
REPAIR



NOTE: Orientation view



NOTE: Make sure that the component is clean and free of foreign material.



NOTE: Ensure that the tape is fixed to the surface.

HEADLAMP INTERNAL MOISTURE DUE TO BROKEN GUIDE PIN XC90 2003-2013

This Issue is covered in Volvos TJ 27303

Moisture inside a sealed headlamp light assembly is something that is rarely seen on Volvos unless there is a crack in the lens. But on some Volvo XC90 headlamps there is a guide pin that can break off the back of the assembly and allow water and dust to get into the assembly.

These headlight assemblies can be costly to replace, so if you can save your customer some money by repairing them, it can be a good thing.

Of course, the most common problem that these light assemblies have is that the clear coating on the lens has yellowed and fogged up. Most body shops can make these look new by resurfacing and recoating them.

If you get one of these in your shop, the assembly can be saved with a little cleaning and repair.

Volvos TJ 27303 uses a sticker to seal up the hole in the back of the assembly, where the guide pin used to be. The part number is 30779754.

STEERING ANGLE SENSOR MOST VOLVO MODELS 2001-2007

The Steering Angle Sensor, or SAS on a Volvo is a very important part of the vehicle's stability and traction control systems.

Volvo has been using them on all their cars since 2001. The design of the sensor has evolved over the years, but the basic purpose has not changed.

The SAS is integrated into the steering wheel's contact reel. Its only job is to accurately report the angle of the steering wheel in real time.

Here is how it works….

STEERING WHEEL ANGLE SENSOR MODULE (SAS)

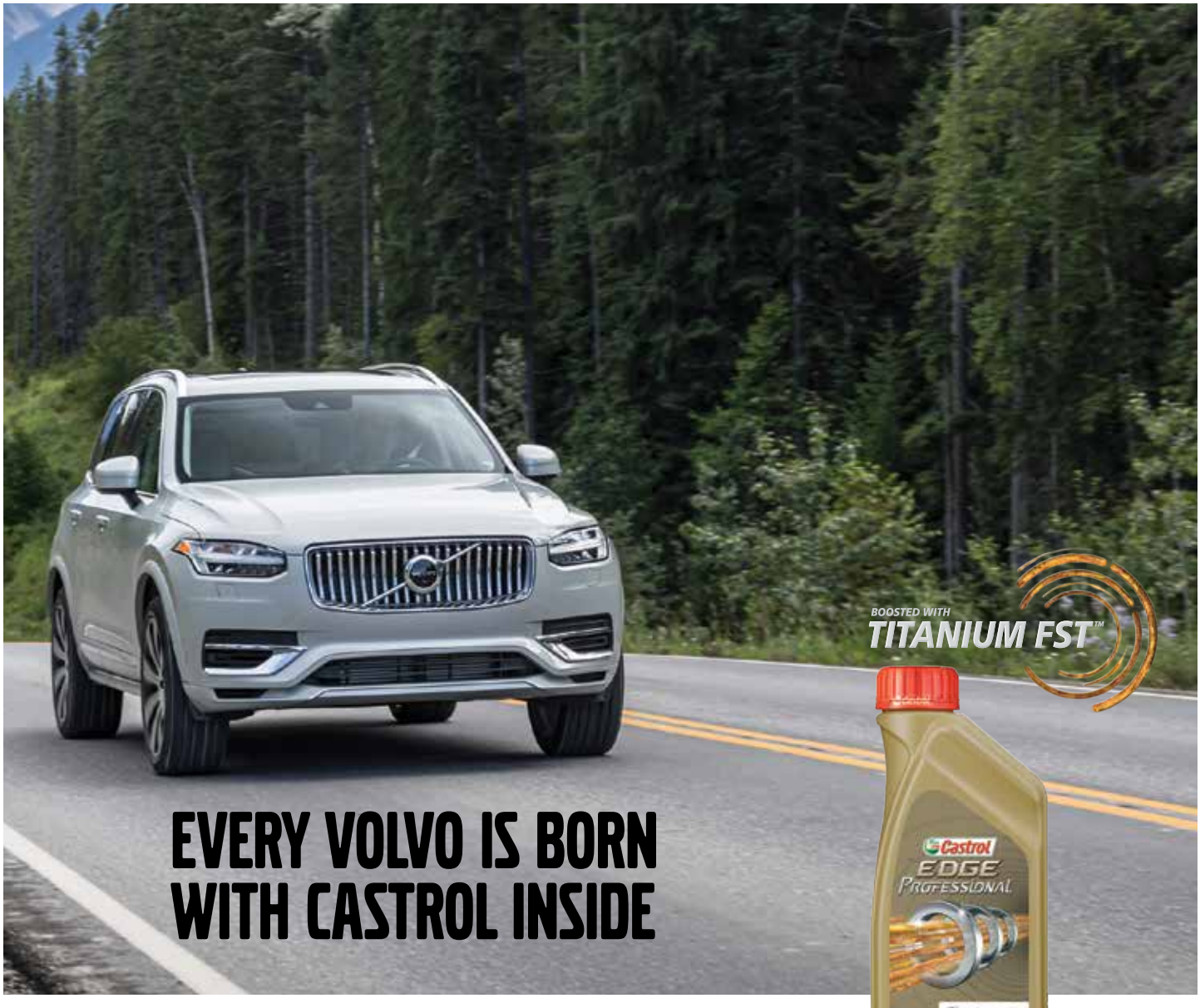
After initiation, with the ignition key in position II and when the steering wheel is turned 4.5 degrees in any direction, the steering wheel angle sensor module continuously transmits information about the steering wheel angle position to the Brake Control Module (BCM) to calculate the intended direction of travel. The steering wheel angle sensor module also transmits information to the Suspension Module (SUM).

Communication between the SAS and the BCM occurs on the high speed side of the Controller Area Network (CAN). The SAS is integrated in the Steering Wheel Module (SWM).

The SAS is powered via the steering wheel module (SWM).

The steering wheel angle sensor module (SAS) is powered via the steering wheel module (SWM).

Volvo Cars recommends Castrol EDGE Professional



EVERY VOLVO IS BORN WITH CASTROL INSIDE

Castrol EDGE Professional V 0W-20 is exclusively engineered in collaboration with Volvo cars for use in Volvo Drive-E engines. This low viscosity engine oil becomes incredibly strong when put under pressure, maintaining ultimate engine protection whilst delivering high performance and fuel economy.

Castrol EDGE Professional, is our strongest range of engine oils. It is boosted with **TITANIUM FST™** to help maximize engine performance and every litre is certified CO_2 neutral according to the highest global standard.

Every Volvo engine starts its life with Castrol EDGE Professional oil inside.

Castrol EDGE Professional V 0W-20 is specially developed for Volvo Cars authorized dealerships.

IT'S MORE THAN JUST OIL.

Castrol EDGE PROFESSIONAL

STEERING WHEEL ANGLE SENSOR

The steering wheel angle sensor is incorporated with the SRS contact reel, which in turn is installed on the steering wheel module. A code wheel is mounted inside the steering wheel angle sensor which follows the movement of the steering wheel. Nine optical digital sensors and two analog photo diodes read off the code wheel. The signal must create a specific pattern.

This information is transmitted to the steering wheel angle sensor module which uses these signals to calculate the steering wheel angle, speed, and number of turns. In total, the steering wheel angle sensor can measure a range of +/- 720 degrees, although the steering wheel can only be turned a maximum of +/- 540 degrees.

Due to the reliance of the DSTC (Dynamic Stability and Traction Control) system on information from the steering angle sensor, it is extremely important that the contact reel has been centered correctly and that only an original Volvo steering wheel is used.

A worn steering angle sensor (SAS) will almost always set a code, but not always just in the SAS module. It's common to see codes stored in the brake control module and central electronic module also.

The steering angle sensor is a CAN module, so that means that when you replace it you will need to use VIDA to order and download a software package for it to work properly.

It's also a great idea to sell your customer a four wheel alignment as part of the job, as most newer alignment machines have a steering angle sensor calibration capability.

If the alignment is off and you replace the SAS module and download software only, the accuracy of the steering angle may be off a few degrees left or right when the steering wheel is straight.

Instructions for changing the SAS contact reel on a 2012 Volvo XC90 is similar to that on most Volvos from 2001-2007.

As always, with any electrical repair on a Volvo, start this job by disconnecting the battery. It's always best to wait at least five minutes after the ignition key is turned off before disconnecting the negative battery terminal at the battery.

Make sure to isolate the negative battery terminal away from the post to make sure that the post and clamp don't come back together while you are handling and removing the largest air bag on the car.

It is extremely unlikely that the air bag would deploy accidentally, but as wise man once said, "Better safe than sorry."

The next step is to remove the driver's air bag assembly.

Insert the ignition key, and from center, turn the steering wheel 90 degrees to the right.

Insert a screwdriver in the holes on the reverse side of the steering wheel. The screwdriver must be at a right angle to the rear surface of the steering wheel.

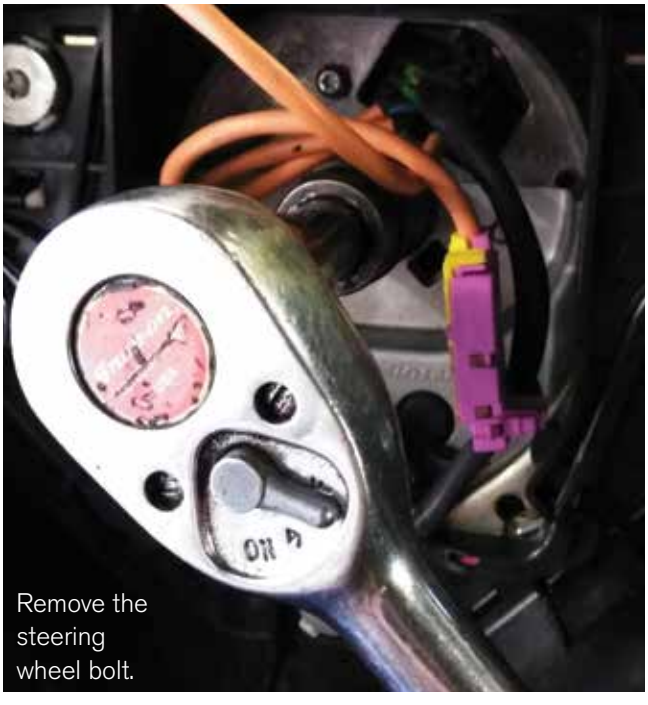
Place the screwdriver point against the top of the spring clip as illustrated.

Warning! Under no circumstances should you use an ohmmeter or other live measuring instrument to take readings on a disconnected, non-deployed pyrotechnical SRS component.

Warning! Pyrotechnical SRS components must never be taken apart, repaired, or transferred to another vehicle.

Volvo suggests that you use a small screwdriver to pop the spring clips that hold the air bag in place. A long Torx T30 socket works best because of the tight space. Just insert into the hole at the back of the steering wheel and lift up while pulling on the front edge of the air bag. Then turn the steering wheel in the opposite direction and repeat to release the air bag from the steering wheel.

Release the three air bag connectors.



Remove the steering wheel bolt.

Mark the position of the spline shaft and the wheel center so you can put the wheel back on in the exact same position.

Pry the screwdriver up against the upper edge of the hole so that the point of the screwdriver presses down the catch until the catch releases.

Turn the steering wheel one turn in the opposite direction. Repeat the process on the other side.

Turn the steering wheel to the neutral position.

Fold out the air bag.

Next, carefully release the three air bag connectors by depressing the small clips on the sides of the connector and pulling them straight out.

Be gentle with these tiny locking tabs because they can break easily. Of course, if you are replacing the steering angle sensor/contact reel, the new part comes with new connectors.

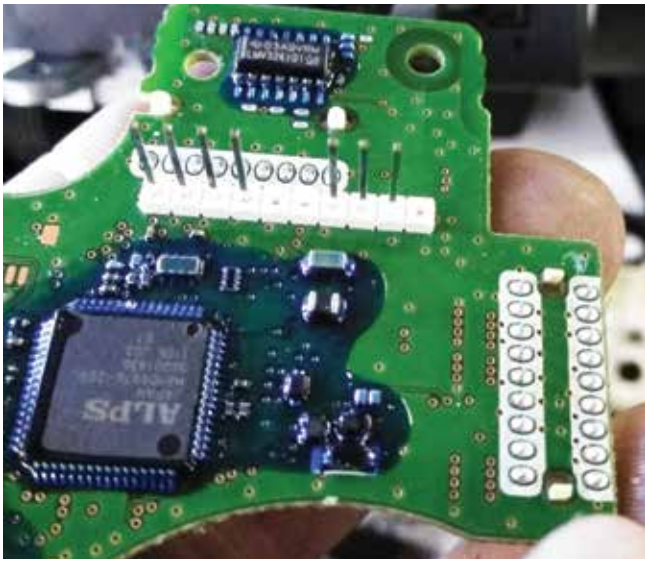
Place the air bag unit in a safe place so that in the extremely unlikely event that static or some other mysterious source was to deploy the bag accidentally, it will not hurt anyone or damage the car.

The next step will be to remove the steering wheel.

Center the wheel and remove the ignition key. This will engage the steering lock, and will hold the wheel in place while you remove the steering wheel bolt.

Once the center bolt is removed, take a marker and mark the position of the spline shaft and the wheel center so you can put the wheel back on in the exact same position.

Pull the steering wheel off while feeding the air bag wires through the hole in the bottom of the steering wheel.



The pins on the steering angle sensor are very fine and easily damaged, so be careful not to bend or force the new part on.

The next step will be to remove the three Phillips screws that hold the SAS sensor assembly onto the steering wheel module assembly.

Be careful to pull the sensor assembly straight out since the pins are very fine and delicate.

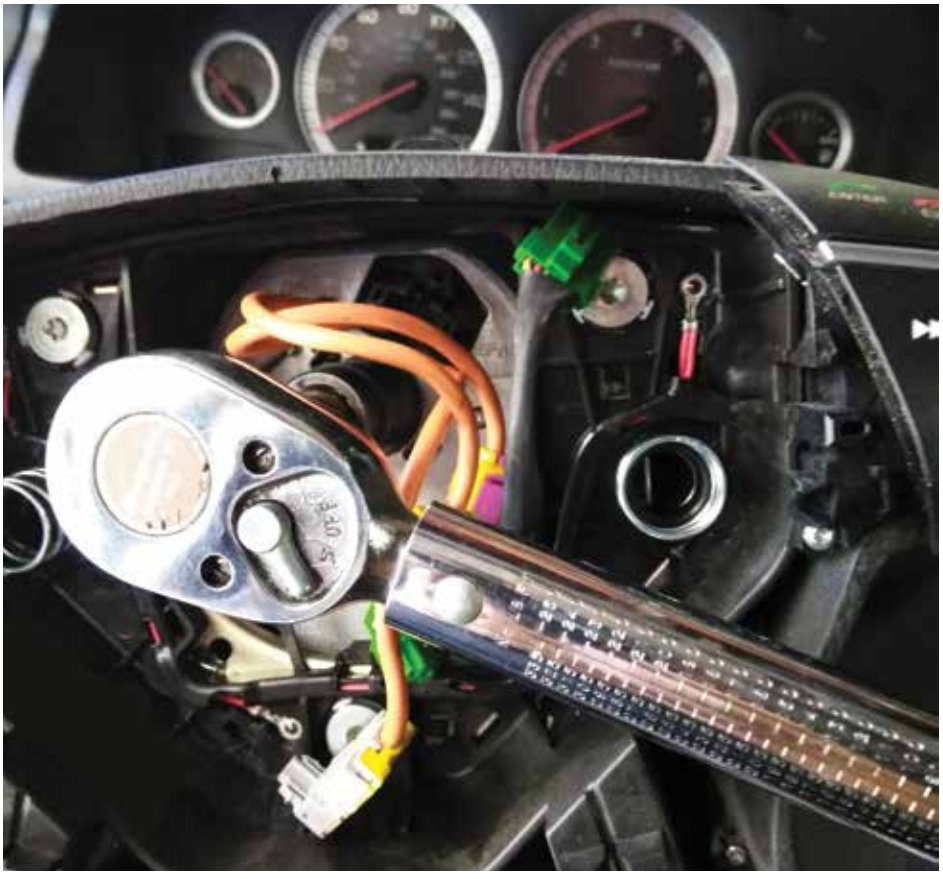
Now you can install the new SAS sensor and reassemble. The screw in the new part is to hold the contact reel in place while you reassemble the steering wheel. You will be able to remove it after the steering wheel is back on and bolted down.

After installing the screws for the SAS sensor and the steering wheel, torque the steering wheel center bolt in two stages: first stage 30 Nm and second stage 30 degree angle torque.

You can now remove the new SAS sensor's holding screw and install the air bag connectors and press on the air bag.

Now it's time to reconnect the battery and use VIDA to download the software package called SAS RELOAD.

If your shop does not have VIDA, you will need to have someone that does have it install the software, and it's always a good idea to perform a four wheel alignment with an SAS calibration after this repair is done. ●



Torque the steering wheel center bolt in two stages: first stage 30 Nm and second stage 30 degree angle torque.

Remove the new SAS sensor's holding screw and install the air bag connectors and press on the air bag.

☐	9488735	Residual header appl
☐	31285540	RTI appl middle east
☐	30737868	RTI application (au)
☐	8666626	RTI application (eu)
☐	9155232	RTI application (excl.eu)
☐	31285539	RTI application (ru)
☐	31327009	Russian application
☐	9438417	SAS reload
☐	8651385	Seatheater 28-35c appl
☐	8651382	Seatheater 32-38c appl

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