


Volvo TechTips

Information for the Independent Volvo Specialist

VolvoTechTips.com

Fall/Winter 2022

v7 | n3



Replacing
Pistons and
Rings on a
2016 Volvo
XC90 T6

Also Inside:

Replacing the Radiator and A/C Condenser
TF-80SC Automatic Transmission
Manifold Exhaust Leaks, Part 1

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V O L V O



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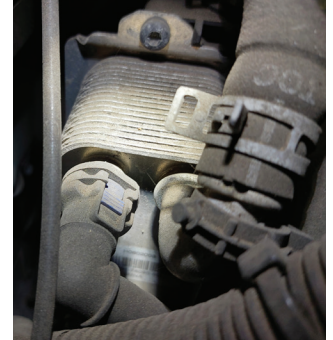
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Properly trained technicians have the equipment, tools, safety instructions and know-how to perform repairs correctly and safely. If a condition is described, DO NOT assume that a topic covered in these pages automatically applies to your vehicle or that your vehicle has that condition. Volvo Car USA LLC, the Volvo name and Volvo logo are registered trademarks of Volvo Corporation.

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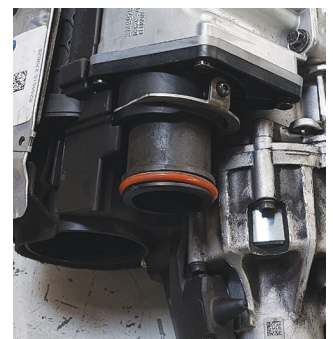
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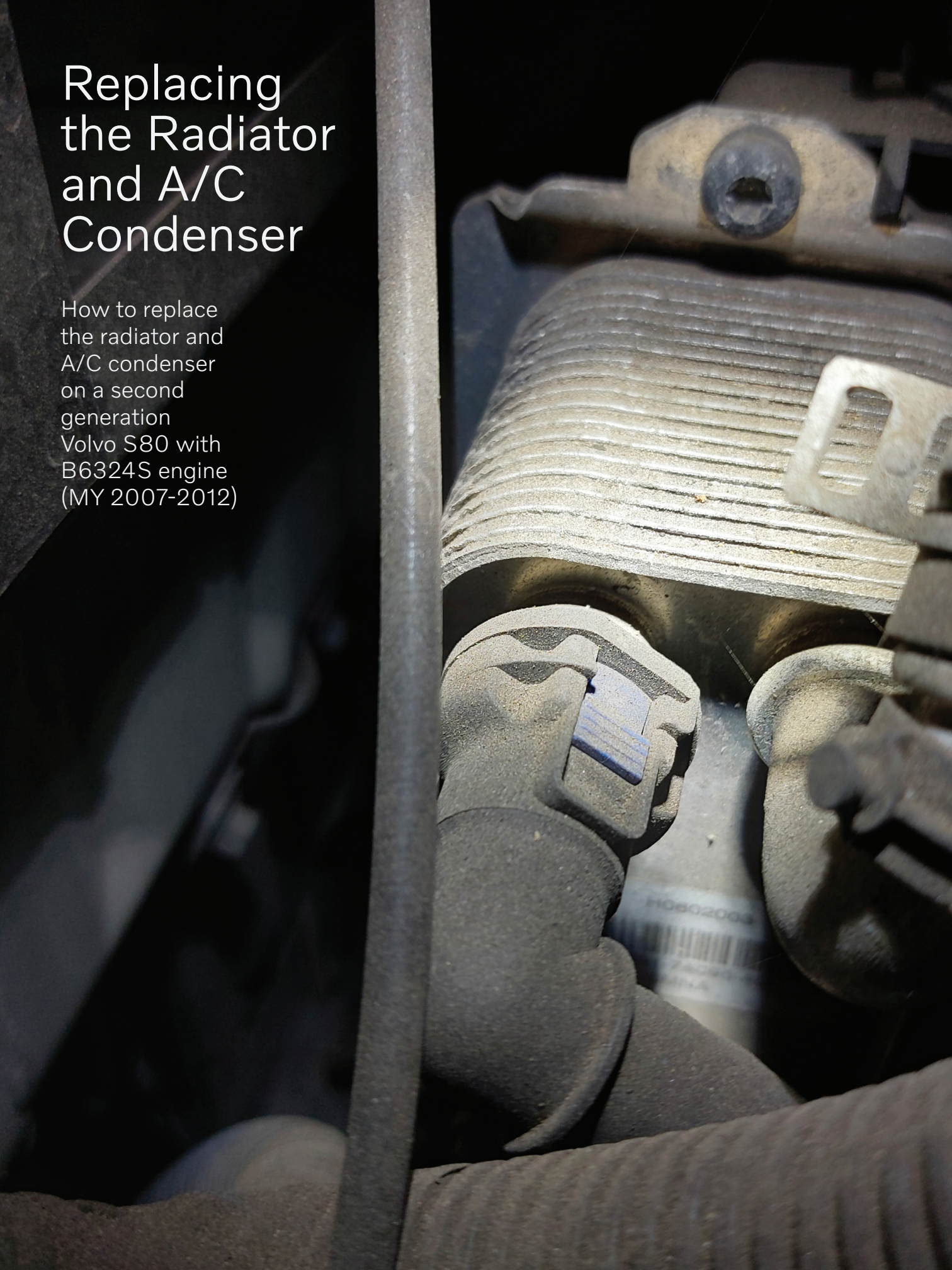
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Replacing the Radiator and A/C Condenser

How to replace
the radiator and
A/C condenser
on a second
generation
Volvo S80 with
B6324S engine
(MY 2007-2012)



Replacement of the radiator and/or air conditioning condenser on these cars can be challenging for some technicians because of the number of hidden bolts and screws that have to be removed when performing this job.

You will have to remove the front bumper cover and trim, so care needs to be taken so no damage to the paint finish is done while doing this job.

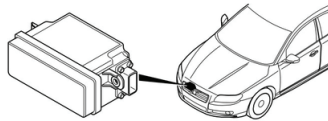
In most cases, you will be replacing only one of these components at a time. But in some cases, such as collision damage repairs, you may be replacing both the radiator and the A/C condenser at the same time.

In this article, we will cover the replacement of both at the same time.

To start, you will have to drain the engine coolant and remove the plastic cover under the bumper cover by removing the eight screws and three plastic clips.

On the left side of the radiator assembly, there is a drain plug at the bottom. You should loosen the filler cap on the coolant reservoir tank before you drain the engine coolant so that the coolant won't form a vacuum at the top of the cooling system, causing the coolant not to drain completely.

NOTE: If the radiator or condenser is being replaced because the car was involved in a front end collision, make sure that all the body repairs were done correctly. Note that the position and angle of the forward facing radar sensor is critical to the car's ADAS safety systems working properly. These sensors should be calibrated after replacement or if the mounting was bent in any way. Be sure to calibrate the new sensors using VIDA or a scan tool that has this calibration function.



Remove T25 screws under the bumper cover.

You won't be able to drain the cooling system completely this way, so use a drain pan to catch remaining coolant when you disconnect the radiator hoses.

Since you will be disconnecting and working around a lot of engine electrical systems, it's always a good idea to disconnect the negative battery terminal before you start disassembly.

Next, since you are going to remove the A/C condenser, you will have to recover the refrigerant from the system using an A/C service machine that is set up for R134A refrigerant.

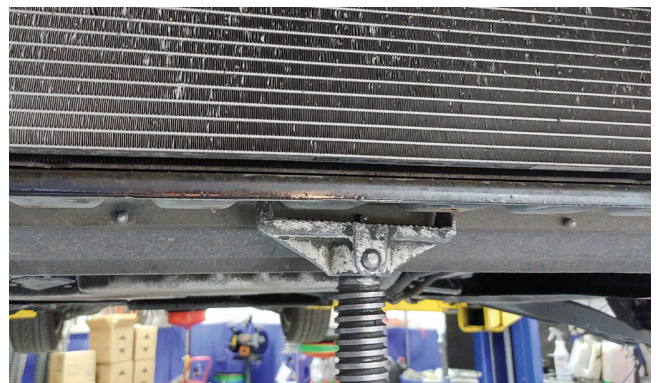
You will need someone to help you remove the front bumper cover and lower the radiator assembly. You could do it by yourself with a lifting stand, but it will be awkward when you remove and replace the bumper cover. It's much easier to line up when you have someone help you.

Volvo's instructions on radiator and condenser replacement start with removing the electric fan assembly first by removing the air box, intake pipe assembly, A/C compressor bolts, power steering pipe brackets, battery, and tray.

After all that, they want you to remove the auxiliary fan assembly by pulling it up and out.

Well, that's one way to do it, but as they say, there is more than one way to skin a cat!

If you have replaced a radiator on an earlier Volvo such as a 2001 XC70, you know that the radiator, A/C condenser, and the intercooler assembly are all sandwiched together. So even if you are just replacing the radiator, it's usually easier and safer to remove all three components at the same time and disassemble and reassemble them on the ground. Even though you will have to recover and recharge the refrigerant, it's still the best way to go with the earlier Volvos.



Support the radiator assembly with a jack stand.

Well, even though the late S80 is a different body type, you can take out the radiator, fan, and condenser through the bottom of the car and save yourself a lot of labor time.

You will have to be careful when lowering the radiator, condenser, and fan assembly because there is just barely enough room to drop all of it out the bottom of the engine bay. But, by doing the job this way, you will save yourself a lot of knuckle-busting work in tight spaces.

Remove both headlamp assemblies by pulling up on the retainer pins and disconnecting each of their main electrical connectors.

Be careful not to drop the headlamp assemblies because it can be easy to damage them internally, especially if the car you are working on has active adaptive beam headlights.

Disconnect the electrical connectors from the auxiliary fan assembly and release any clips that attach the fan's wire harness to the top of the fan shroud.

Next, you will have to remove the front bumper cover.

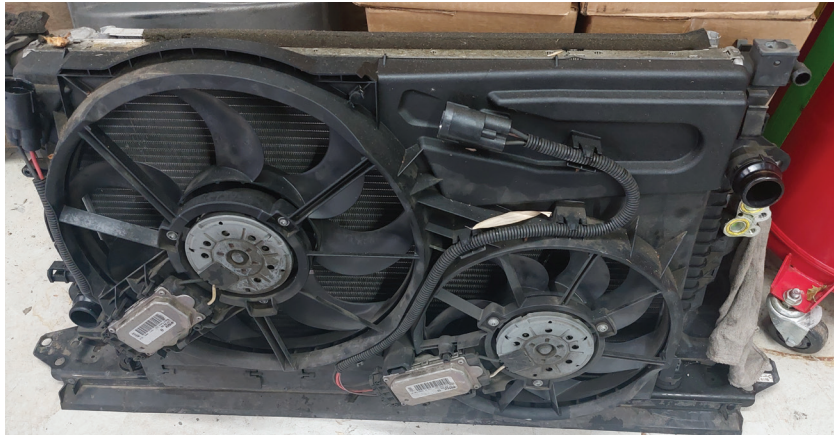
Remove the plastic clips at the upper lip of the bumper cover first; if you are careful, you can reuse these clips.

There are usually a few broken or missing clips, so make sure to order some new ones from your Volvo dealer parts department to have on hand.

Next, remove the screws from the bottom lip of the spoiler and the T25 Torx screws from the inner fender liners that attach to the bumper. (See "Inner fender screws" image on the next page.)

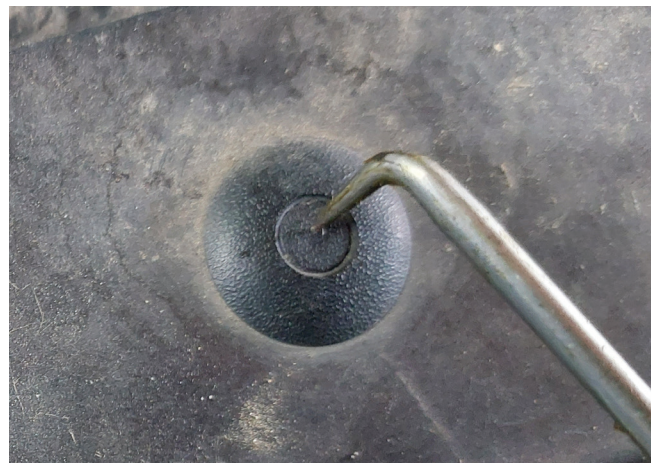
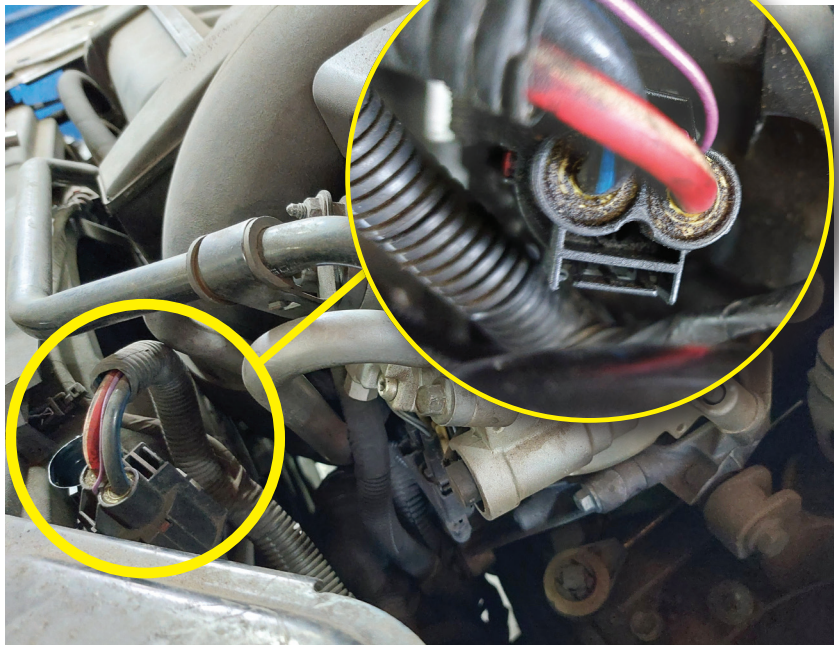
Now it's time to disconnect the fog light connectors from under the bumper cover.

If the car you are working on is equipped with high pressure headlamp washer jets, you will have to disconnect the hoses from the washer pump and use a pan to catch the washer fluid that will start pouring out of the washer reservoir. If the reservoir is full, it can



You can take out the fan assembly, A/C condenser, and radiator as one unit; this will save you a lot of time and a lot of extra work.

Remove the fan connectors.



Push in the center of the plastic bumper clips to release them.

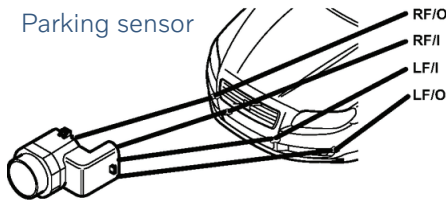


Inner fender screws



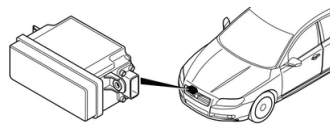
When you pull off the bumper cover, be sure to store it in a safe location with the painted side up to avoid scratching the paint.

hold over a gallon of fluid; so if you don't catch it, it can make a big mess.



Parking sensor

If the car you are working on is equipped with parking sensors in the front bumper, you will next have to disconnect the main harness connector for the sensors in the front bumper.



Parking sensor

Once all the connectors and hoses are disconnected from the front bumper cover, you can have someone help you remove it by pulling it forward and out.

Check to see if you forgot to disconnect anything before removing it completely.

Put the bumper cover in a safe place so the paint won't get damaged while it's off the car. Using a bumper stand if you have one is best.

Now with the bumper cover removed, you can get access to the A/C condenser pipes and fittings. (You should have already removed the refrigerant from the system prior to removing any of the A/C condenser fittings.)

On the right side of the radiator support you will see the screws for the A/C condenser high pressure fittings.

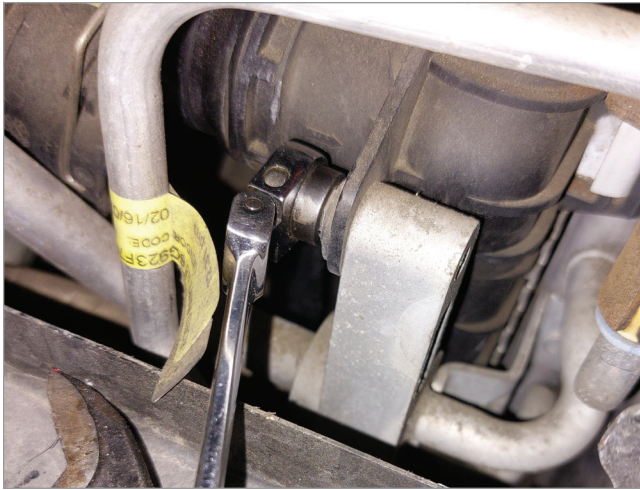


It's a tight fit behind the radiator, so quarter inch tools are the ticket.

There are two 10 mm bolts that hold the high and low side A/C pipes into the condenser on the right side; you can access them through the opening in the right side headlight bucket. (Make sure to use plugs in any open refrigerant fittings to keep contaminants out of the A/C system.)

The lower one is a little tight, but you should have no trouble removing it with a deep ¼ inch drive socket. (See image above.)

Remember, even if you have evacuated the refrigerant from the system, you may still have some residual pressure when the pipes are removed from the condenser.



You should always replace the A/C O-rings when you breach any A/C connection, and be sure to plug any open A/C pipes or fittings to keep out moisture and dirt while you are servicing the system.

When you are ordering new A/C O-rings, you can make sure you get the right size ones by using Volvo's Service, Parts and Diagnostic Application VIDA (Vehicle Information and Diagnostics for Aftersales) to look up parts diagrams. These are the same diagrams that your local Volvo dealerships parts department uses to look up parts for you when you call.

Radiator Hoses

The radiator hoses on this car are the bonded plastic and rubber type that use formed plastic connections that are secured in place by spring clips.

Now is a good time to replace these hoses with new ones, especially if the Volvo you are working on has over 75K miles on the odometer.

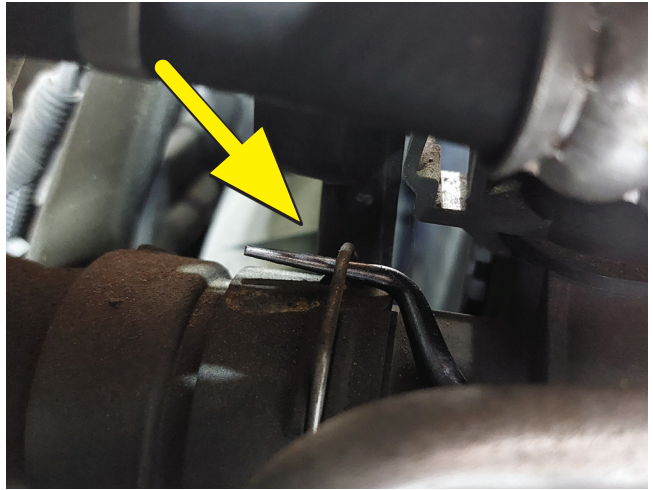
The hoses only go on one way due to a guide slot and ridge that are formed into the hose end connections.

When it comes time to disconnect the radiator hoses, you will need a pick to pull up and disengage the spring clip. (See image top, right column.)

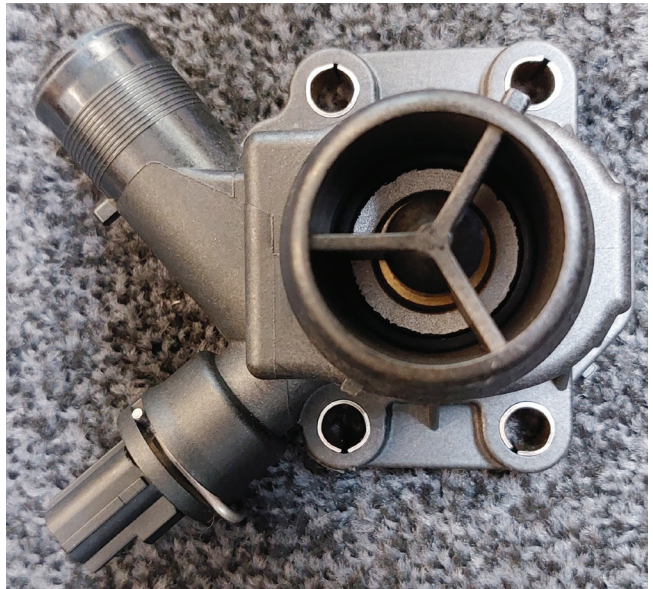
The hose ends can be stuck on and hard to remove, but with a little twist and pull action, you should be able to get them to release.

In some cases, you may have to use a small pry bar or flat tip screwdriver to get the hose end moving, so be careful. You will be applying force to old plastic engine parts that may crack or just break off. You don't want to cause more work for yourself if you can avoid it.

The upper radiator hose is connected to the thermostat assembly by a plastic fitting, so if the car has a lot



Remove the clip from the lower radiator hose connector.



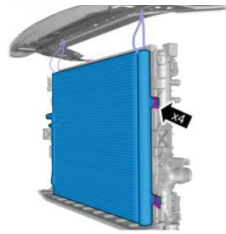
Top: B6324S thermostat assembly front;
Bottom: B6324S thermostat assembly

of miles on it, now may be the time to replace the thermostat assembly while you have the radiator out.

The thermostats on these cars come as a complete assembly with the thermostat, gasket, and coolant temp sensor included.

Pay attention to the direction and routing of the radiator hoses when they are being removed; you may want to use your phone to take a picture before you start disassembly. Doing this will save you time and aggravation.

There is a small coolant reservoir return hose at the right top of the radiator that will have to be disconnected. You can reach the clamp through the opening in the right headlight bucket.



Next, remove and hang the power steering cooler assembly out of the way; this will stay in the car when removing and replacing the radiator, condenser and fan assemblies.

Support power steering cooler

Use a couple of bungee cords or mechanic's wire to loosely hang the power steering cooler out in front of the condenser; it needs to be loose so you can move the attached hard lines out of the way while lowering out and raising the radiator, condenser, and fan assembly in and out of the engine bay.

Now that the radiator "sandwich" is disconnected from the hoses, pipes and electrical connectors, it's time to put the car about midway up on the lift and get someone to help you lower the radiator out.



Remove the four bolts from the lower radiator support last.

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You can use a transmission jack fitted with something like Volvo special tool 999 5463-8 lifting fixture or similar, or just get someone to help you when you lower the radiator sandwich down out of the engine bay. It is a tight fit and you will have to be careful not to cause damage when maneuvering the assembly in and out. This is much easier with two people.



Even if you are just replacing one of these three components, you should take this time to clean and inspect the other two.

Check the fan blades for cracks and check for play in the fan motor bearings.

Over the miles and years, a lot of bugs and dirt can build up and may cause reduced performance of the cooling system components. You can use low pressure shop air to blow out the cooling fins on the radiator and the A/C condenser. If the bugs and dirt are really stuck on, you can use some mild soap and water and a soft brush to get the parts clean.

After you assemble the radiator sandwich back together with the new parts, you can reassemble in reverse order.

Refill and bleed the cooling system with Volvo OE coolant and check for leaks.

Charge the A/C system to the proper level and check for function and leaks.

Be sure to check the rest of the fluids, like the transmission fluid level, because you will lose some during this job.

Test drive and check the headlight washer function if equipped, and check that the fog lights are working.

After the test drive, let the car sit for a while and recheck coolant level before delivery. ●

By this time, the only thing holding the radiator, condenser, and fan assembly in should be the four bolts at the bottom bracket of the radiator support.

Once you have removed the last four bolts that are holding the radiator "sandwich," carefully lower it out of the car. You may have to have someone hold some of the pipes out of the way. Make sure not to scrape the condenser fins on the way down.

Of course, this is less important if you are replacing the A/C condenser at this time.

Use a sheet of old cardboard or a radiator box to lay the radiator, A/C condenser, and fan unit on while you disassemble and transfer parts.

Be careful of the plastic clips on the new or old radiator; they can break very easily and are needed to hold the A/C condenser assembly securely to the radiator frame. This is also the case with the clips to which the power steering cooler is mounted.



Be careful with the plastic slots on the radiator. They are needed to mount the condenser and power steering cooler properly.



You should clean the parts you don't replace to allow proper air flow.

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The logo features the Castrol brand name in red and white, with a green and white checkered flag icon. Below it, the words 'EDGE' and 'PROFESSIONAL' are written in a bold, metallic, sans-serif font. The entire logo is set against a green background that tapers to the right.

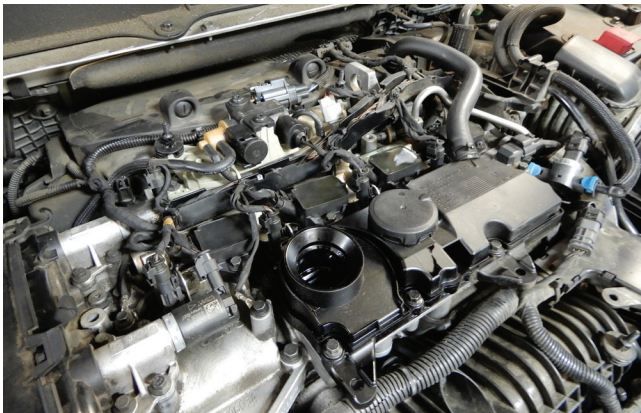
Replacing Pistons
and Rings on a 2016
Volvo XC90 T6



Have you ever had a customer come in and say, "I've been putting a lot of oil in my vehicle, but I don't see any leaking on the ground," only to find yes, the customer was right, there are no external leaks from the engine? The customer might also share that the Low Oil message keeps coming on. Technical Journal TJ 31216.5.0 can shed some light on this problem.

Well, the first thing to do is to find out whether the cylinder head valves have leakage past them or if the loss is farther down into the pistons and rings. This can be accomplished by doing a leakdown test.

To do a leakdown test, you will first need a leakdown tester tool setup. Remove the spark plug from the cylinder you are testing, and turn the engine over until it's at top dead center. Then insert the tester tool into the spark plug hole and add air pressure to around 100 psi.



Volvo 2016 XC90 top side of engine



Leakdown tester used to check cylinder leakdown

Five to ten percent loss indicates an engine in good running condition. An engine at ten to twenty percent loss can still be a good running engine. Anything above twenty percent indicates that the engine needs attention, possibly a rebuild. Anything above thirty percent indicates that there are definite problems. The percent of leakage should also be consistent across the cylinders. If there is a big difference, the low cylinder has a problem and will need attention.

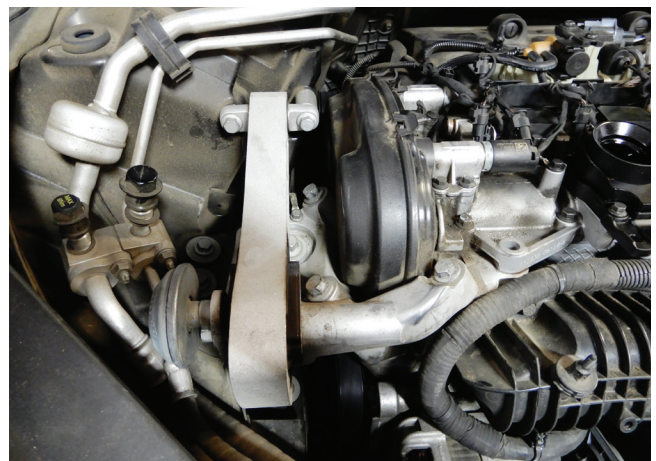
With the tester connected, listen for escaping air pressure. You may have one of the following scenarios:

- **Intake Valve:** Air whistling out of the intake or throttle body indicates a leak at the intake valve.
- **Exhaust Valve:** Air pressure heard at the tailpipe, exhaust manifold, or turbo indicates the exhaust valve is leaking.
- **Piston Rings:** Hissing out of the oil filler cap or dipstick tube means air is pushing past the piston rings.
- **Head Gasket or Cracked Head:** Air bubbles in the engine coolant could mean air is escaping past the head gasket, or coolant rising in the expansion tank could mean a cracked cylinder head.

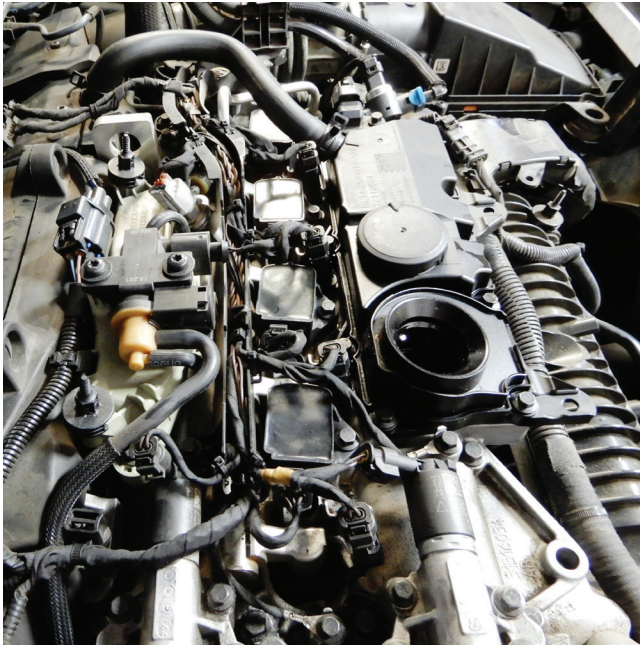
After checking each cylinder in the engine and finding air escaping from the oil dipstick and from the oil filler cap, we concluded that, on this Volvo, the piston rings were likely bad and overhaul would be necessary. If you find this condition on a similar Volvo, it's probably time for an overhaul. Here is a suggested procedure.

Position the vehicle on a hoist, drain the oil and coolant from the engine. Disconnect the battery. Remove the rear lower mount and install special tool 9997534 and tool 9997533 to hold the engine in place. Remove the top right-side torque mount.

Remove the oil trap from the top of the valve cover. Disconnect the coil pack electrical connectors and



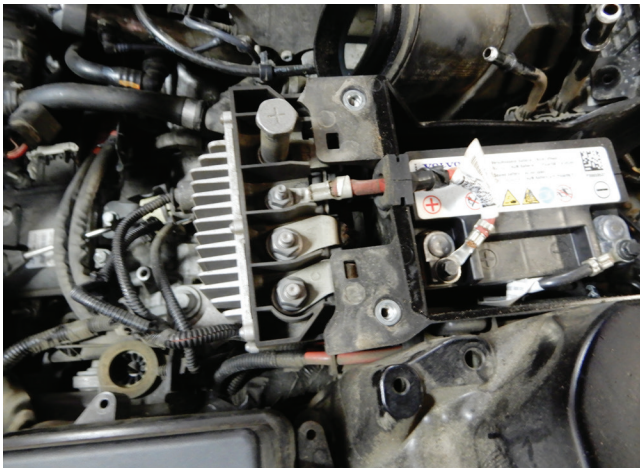
Right-side torque mount that needs to be removed



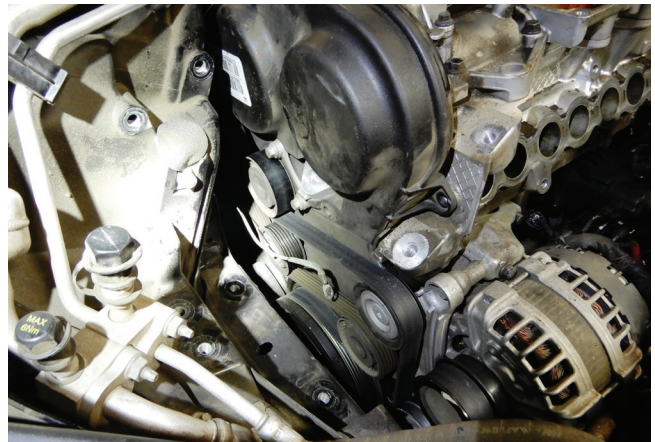
Vacuum decanter with vacuum regulator



Aluminum crossbar that needs to be removed



Battery and the connectors with BCSM (Battery Control Switch Module) that need to be removed



Right side mount removed and access to auxiliary belt

remove the coils. Disconnect and remove both intake and exhaust camshaft solenoids. Remove the ground leads on top of the valve cover. Disconnect the injector electrical connectors. Disconnect the vacuum hoses and electrical connectors at the decanter and vacuum regulator; remove the three bolts that hold to the valve cover and set aside.

Release the fuel pressure at the hard line to injector rail; catch any escaping fuel with a rag. Use Volvo tool 9814198 to remove the pipe. Remove the four bolts at the fuel rail and remove the fuel rail from the engine. If the injectors don't come out with the rail, use tool number 9997815 to extract the injectors from the cylinder head.

Remove the air filter box assembly and the hose to the supercharger. Remove the wiper arms and remove the cowl at the bottom of the windshield. Remove the top cover of the small battery. Disconnect the battery and remove. Disconnect the electrical connectors and remove the battery box from the vehicle with the battery control switch module.

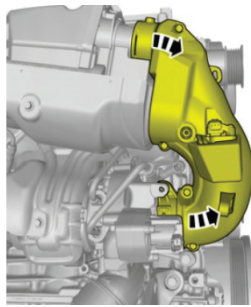
After the windshield cowl is removed, remove the three bolts that hold the windshield wiper assembly in place and remove from the vehicle. Remove the aluminum crossbar from strut tower to strut tower.

At the front of the engine on the right side of the vehicle, completely remove the engine mount and ground cable. Remove the auxiliary drive belt and pay attention to the routing of the auxiliary belt. Remove the idler pulley and bracket; two bolts hold it in place. Remove the covers around the timing belt.

After the auxiliary belt and idler pulley are out of the way, you can now remove the two bolts at

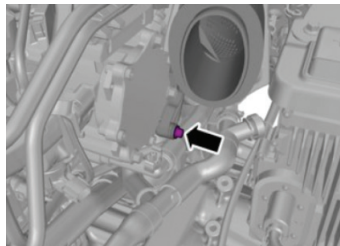
the supercharger just under the front pulley of the supercharger. After removing the top two bolts, bolt 1 has an adjuster in it that squeezes the supercharger against the head. Loosening this bolt will allow the supercharger to move. Disconnect the clips and the electrical connector that runs down to the turbo and pull up to remove it out of the way. Remove the cover around the supercharger. Remove the panel close to the firewall; two bolts secure it in place. Also, remove the plastic cover that surrounds the inlet for climate control, in the recirculation flap area.

The plastic pipe from the supercharger to the turbo will need to be removed. Remove the bolt at the top bracket at the supercharger and pull the bracket straight up and set aside. Remove the right front tire. Remove the inner fender well so to access the plastic pipe to the turbo. Remove the bolt and remove the clip that holds the pipe to the turbo. Carefully remove the pipe from the vehicle.

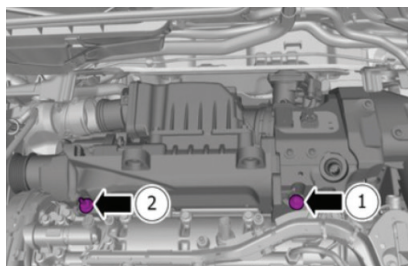


Plastic pipe from supercharger to turbo that needs to be removed

Remove all vacuum lines and disconnect the pipe that is connected to the supercharger near the air cleaner assembly on the bottom of the supercharger. Remove the bolt from the supercharger at the back of the cylinder head. Remove the two top bolts at the top of the supercharger.



Bolt at supercharger that needs to be removed



Two bolts at top of supercharger that need to come out

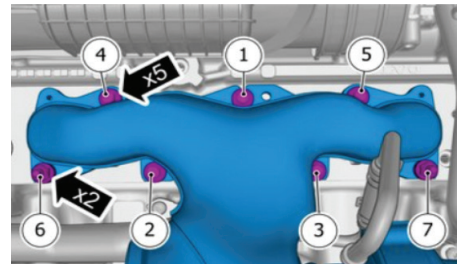
Disconnect both oxygen sensor connectors and set the wires out of the way. Pull up on the supercharger and carefully remove it from the vehicle.

Remove the heat shield at the top of the exhaust manifold. Lift the vehicle completely up and remove the pipe and hoses from the turbo to the intercooler. Lower the vehicle and remove the seven bolts that

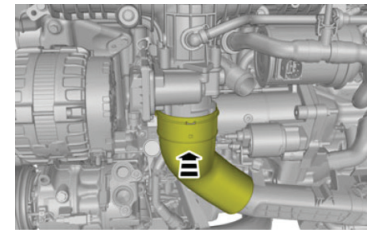
hold the exhaust manifold to the cylinder head.

The intake manifold will need to be removed next.

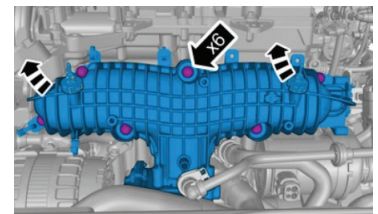
Disconnect the wire harness that runs across the top of the manifold, and disconnect the throttle housing connector. Remove the bolts that secure the harness to the engine. Disconnect the evap valve and hoses, and remove the bracket and valve. Disconnect the hose at the front of the intake manifold. Remove the hose at the bottom of the throttle housing.



Seven bolts that hold exhaust manifold to cylinder head



Hose at bottom of throttle housing



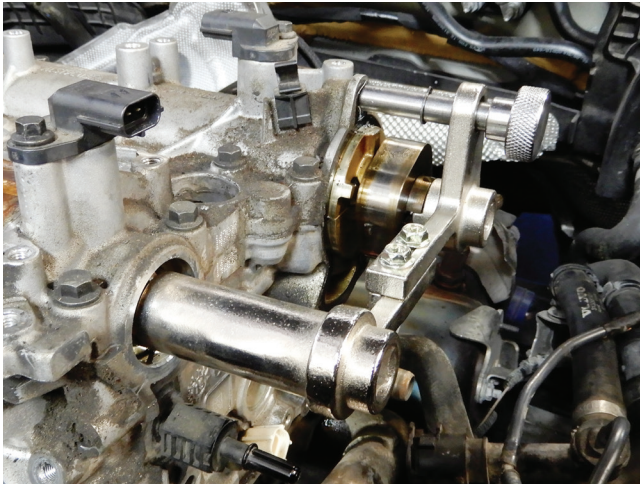
Six bolts that hold Intake manifold to engine

Remove the six bolts that hold the manifold to the cylinder head, and remove the manifold from the vehicle.

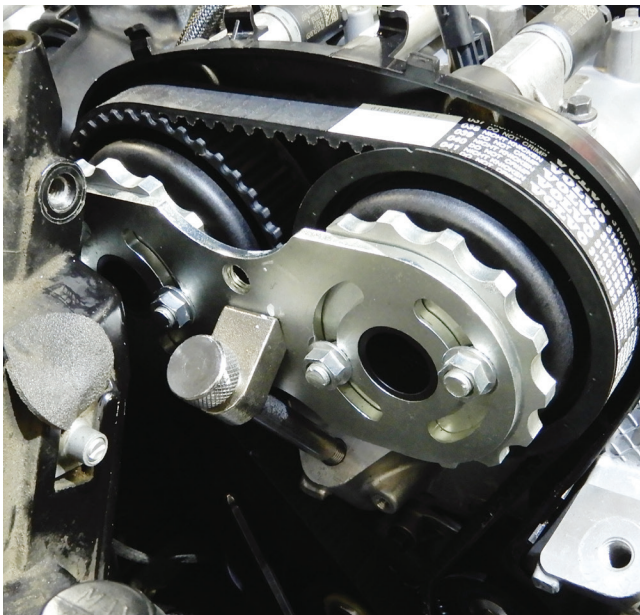
Now that the manifold is out of the way, let's remove the water pump. Disconnect the radiator hose from the water pump, then disconnect the electrical connector from the pump. Make sure there is no corrosion at the connector; if so, clean thoroughly before installing. Remove the three bolts that hold the pump to the block and remove the pump.

Disconnect the coolant hoses at the back of the cylinder head. Remove the two bolts at the injection pump and remove the pump. Remove the hose to the vacuum pump and the three bolts that hold it on to the head, and remove the vacuum pump.

Remove the plug at back of the head at the intake side, drill a hole in it and pop it out. Turn the engine until the camshafts are in alignment to install Volvo tool number 9997490. This will hold the camshafts in place when removing and installing the timing belt components.



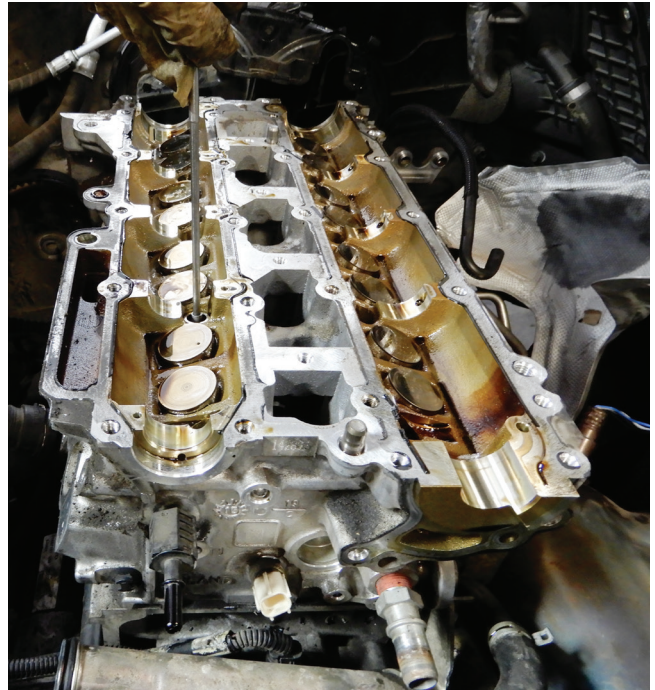
Volvo tool 9997490 installed at back of camshafts



Volvo tool in place at front of camshafts locked down

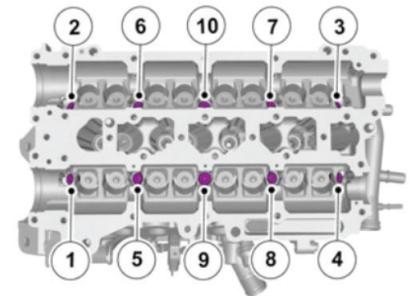
At the front of the engine, remove the idler pulleys and the tensioner for the auxiliary drive belt. Remove the two bolts that hold the plastic timing cover on and remove the cover. Now the timing belt is visible and can be removed. Remove the front vibration damper. Use tool number 9997495 to hold the damper in place so you can remove the center bolt. Remove the other four bolts and remove the vibration damper.

Check the alignment of the front crankshaft pulley; this should be in place after installing the tool at the camshafts. Install tool 9997497 and 9997497-1 to hold the camshaft sprockets in place. Turn the VVT units clockwise until they stop and tighten down the two nuts on both sides of the camshafts to lock them in place.



Removing valve tappets using a magnet

Remove the bolt from the tensioner and remove the tensioner and timing belt. Remove the tool at the front of the VVT pulleys. Now remove the center bolts at the VVT units and remove both VVT pulleys. Remove the 26 bolts that hold down the valve cover and remove the cover from the engine. Remove both camshafts from the engine. Make sure not to damage the camshafts. Remove the valve tappets, making sure to mark them and keep them in order, so to put them in the same place when reassembling.



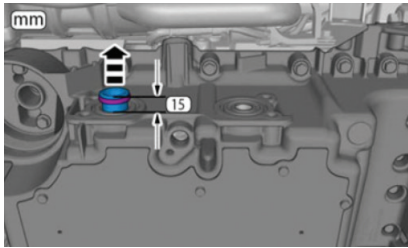
Removing cylinder head bolts in order

Remove the cylinder head from the engine block. Make sure to have the cylinder head checked out and seals replaced before reinstalling.

Remove the crankshaft front pulley using tool number 9997493 and 9997493-1. Remove the four screws that hold the plastic cover to the engine and set the cover aside. Remove two bolts that hold the front seal in place and remove the front seal assembly.

Now to remove the oil pan. Remove the turbo intercooler pipe at the bottom of the engine and hoses.

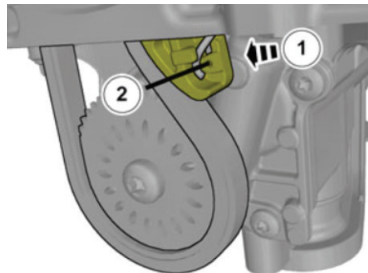
Remove the oil cooler on the side of the oil pan and the oil filter. Looking at the oil cooler, pull out the inside oil pipe on the left about 15 mm.



Pull out oil pipe at oil cooler 15 mm.

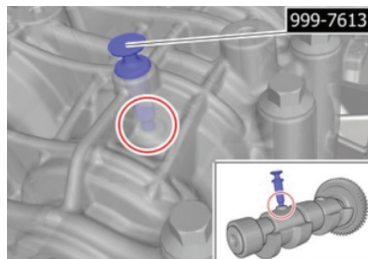
Remove the electrical connector for the oil sensor at the bottom of the oil pan. Remove the bolt that holds the sensor in and take out the oil sensor. Remove the 20 bolts from the oil pan and remove the pan from the engine.

Push the tensioner for the oil pump chain and remove the chain from the sprocket.



Pushing the oil pump tensioner to remove chain from oil pump

Remove the oil pickup assembly. Disconnect the electrical wire through the block and pull it out of the engine block. Remove the four bolts for the oil pump and lift out the oil pump from the engine.



Volvo tool 9997613 installed to keep balance shaft aligned

Remove the seven bolts that hold in the balance shaft

assembly and remove it from the block. Install Volvo tool 9997613 at the balance shaft to keep it in alignment.

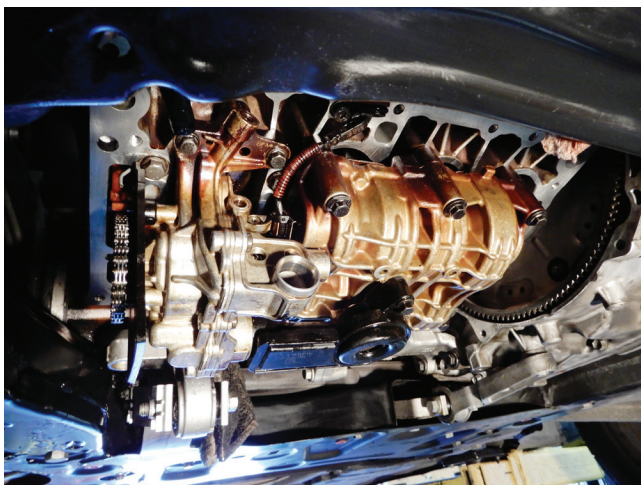
Remove the rod bearing caps and push out the pistons one at a time and mark the rod caps to their connecting rods, keeping them in order, so when installing new pistons and rings they will go into the same cylinder.

When all pistons are removed from the engine, make sure to measure inside the cylinder walls so they are in spec to put in new pistons and rings. Check the cylinder wall for scratches—use your fingernail and confirm by feeling the cylinder wall. If cylinder walls have bad scratches or do not measure within spec, the engine will need to be replaced.

Clean the connecting rods and remove the old rod bearings. Measure piston ring end gaps on the compression rings. Install new pistons on the rods by removing the wrist pin clips and push out of the old piston. Install each new piston onto its rod and install the wrist pin and clips. Install the piston rings onto each piston using piston ring pliers.

Make sure the rings are installed in the correct order: A is the top ring, B in the middle, and C, the oil ring, on bottom. Use TJ VCC 492577-1 to understand position of rings. Be sure to install rings with the proper side upward, and stagger openings of rings so they do not align. Rotate each ring in its gap to assure that there are no nicks and no pinching that would keep the rings from properly seating and rotating.

Install new rod bearings on the rods and install the rod caps, with the oil bearing side toward the crankshaft. Oil the cylinder walls and piston rings and, using a



Oil pump and balance shaft assembly



Pistons removed from engine

piston ring compressor, compress the rings and install each piston into its cylinder. Tap the pistons down into the cylinder. Install the rod cap and torque down. Using new bolts, torque stage one to 15 Nm, stage two 25 Nm, and stage three 90 degrees. Do the other three pistons one at a time the same way.

Spin the engine over each time you install a piston. Once all pistons are in place and rod caps are torqued on, spin the engine just to make sure it feels good and easy.

Reassembly of All Engine Components

Starting with the balance shaft assembly, make sure to use new bolts when assembling. Set the balance shaft assembly in place and install two bolts, finger tight. Remove the Volvo special tool that was installed at the balance shaft assembly.

Install the remaining bolts into the balance shaft assembly. Adjust the assembly as necessary, and torque down the bolts to 8 Nm and then 210 degrees.

Install the oil pump and finger tighten the bolts, then torque to 17 Nm. Push the tensioner back and install the chain to the pump. Install the pickup assembly. Feed the electrical wire through the block and tighten the bolt.

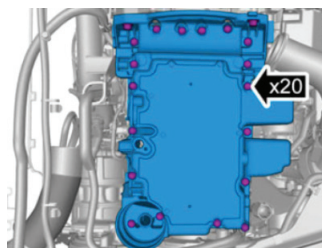
Clean the oil pan completely, clean the surface and add sealant part number 1161771. Install the oil pan onto the engine, finger tighten a few bolts to hold it in place. Add the remaining bolts and torque down to 17 Nm.

Install the oil pipe at the oil cooler into the pan and push into place. Install the oil cooler and tighten down. Install a new oil filter, and tighten the oil plug for draining oil.

Install a new front crankshaft seal. Clean the top of the engine block and lay down the new head gasket. Install the cylinder head with exhaust studs and exhaust gasket, and slide the head into place. Install the thread sleeve in each head bolt hole and torque to 10 Nm using special tool number 9997300.

Install the head bolts and torque in the correct sequence:

- Stage one: 40 Nm



Tightening sequence of bolts at oil pan

- Stage two: 120 degrees
- Stage three: 120 degrees

Oil the tappets and install them in their correct order, the same order they were taken out. Oil the camshaft journals and install the camshafts. Camshafts must be in a certain position.

With the camshafts in place, at the front of engine, make sure the oil holes for the sleeves are pointed upward. Make sure the clips at the front of the camshafts have their openings pointed upward also. Clean the valve cover completely and assure that the surface is free of any

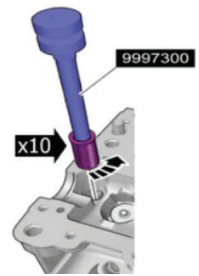
particles. Install chemical gasket 1161771 on to the cylinder head and install the valve cover. Torque down the 26 bolts at the valve cover in sequence to 17 Nm.

Now that the cylinder head and oil pan are complete, let's install the timing belt, idler pulley, and tensioner. Install tool 9997490 at the back of the camshafts. Install the plastic inside cover at the front of the engine. Install the camshaft seals using tool number 9997496.

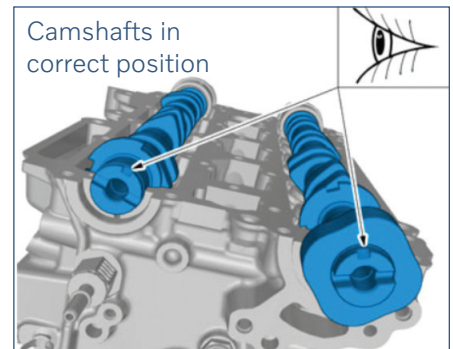
Install both front VVT pulleys at the camshafts, and install the center bolts and tighten finger tight for now. Install the special tool at the front of the camshaft pulleys and tighten the four nuts finger tight. Install the timing belt and adjust the tensioner to correct position and tighten to 24 Nm.

Tighten the four nuts at the tool for the VVT pulleys. Using special tools 9814244 and 9997673, tighten the center bolts to 90 Nm. Remove the special tool at the VVT pulleys and the tool at the back of the camshafts. Spin the engine over, turning clockwise a couple of times and make sure the alignment is good. Check the belt tensioner and make sure it's in the correct position.

Tighten the bolts at the exhaust manifold to 20 Nm and install the heat shield. Install the vacuum pump



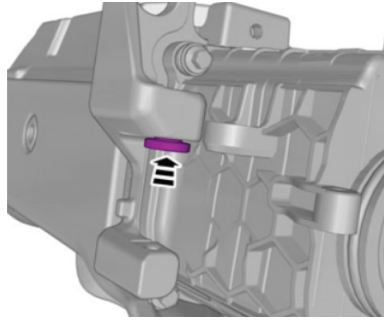
Threaded sleeve that needs to be installed in each head bolt hole



Camshafts in correct position

at the back of the engine. On the bottom of the supercharger, screw in the mount.

Install the shield under the supercharger and set the supercharger in place. Install the two top bolts and finger tighten them for now. Install the two front bolts at the front of the supercharger and tighten to 24 Nm.



Bottom of supercharger screw in mount

With the two top bolts holding the supercharger in place, tighten the front one closest to the front of the engine to 50 Nm. Remove the one at the rear and insert special tool 9997508 and screw it down until it bottoms out. Remove the tool and install the bolt and torque to 17 Nm.

Install the plastic pipe from the supercharger to the turbo and secure. On top of the engine, install the vacuum decanter and vacuum regulator. Install the injector pump at the vacuum pump. Install the injectors and hard lines. Install the oil trap and spark plugs along with the ignition coils.

Connect all electrical connectors at the injectors and vacuum decanter, and connect the vacuum hoses. Connect the electrical connector at the turbo. Install

the water pump using a new O-ring to fit into the water pipe.

Install the front cover over the timing belt area and front crankshaft pulley. Install the front auxiliary belt idler pulleys and tensioner and belt.

Install the intake manifold, and connect the hoses and electrical connectors. Connect the hose at the bottom of the throttle housing. Secure the fresh air pipe for the intercooler that runs at the bottom of the oil pan, and tighten the clamps for the rubber hoses.

Install the plastic cover at the firewall that protects the A/C system components. Set the wiper motor assembly in place and tighten the three bolts that hold it in place. Install the aluminum support bar from strut tower to strut tower.

Install the cowl over the top of the wiper assembly, and install the wiper arms. Install the engine mount at the front of the engine. Remove the special tool at the bottom of the engine at the torque mount, and install the mount.

Install the small battery box and battery control switch module. Connect all necessary electrical cables. Install the air filter housing.

Install the inner fender on the passenger side, and the front tire. Add oil and coolant to the engine. Start the vehicle and check completely, just to make sure everything is secure and working correctly. Test drive the vehicle and recheck fluids, topping off as necessary. ●

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Understanding and Diagnosing the Volvo TF-80SC Automatic Transmission in FWD and AWD Vehicles

The design and function of this transmission, what goes wrong, and how to diagnose problems

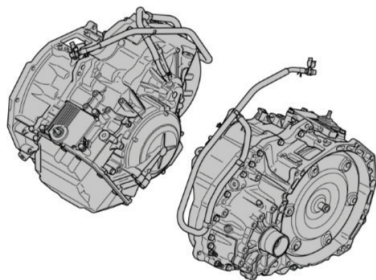


Shown here: Plastic air hose from air filter housing to throttle module

The Volvo TF-80SC transmission was used starting in 2005 in the V8 XC90 all the way through 2016 in most cars that had a 5-cylinder and all that had 6- and 8-cylinder engines.

The TF-80SC automatic transmission is a six-speed transmission made up of a five-pinion planetary gearset. The shifting of the gears is managed by a computer program that oversees a clutch-to-clutch actuation. These transmissions, both the TF-80SC and the TF-80SC AWD, function as two transmissions—one automatic and one manually shifting. This Geartronic transmission in automatic mode is more relaxing and the manual shifting is more for active driving.

To use the manually shifting experience, you have to push forward on the shifter to upshift to higher gears. All the forward gears in this transmission have a lockup function except first gear. The torque converter has both a locked and slipping lockup function.



The type of engine the vehicle has will determine which TF-80SC transmission model is used.

The shifts are controlled by a hydraulic operating system and are completely automatic in terms of load and speed. The TF-80SC has two planetary train units, a front and a rear, and shifts are controlled by a number of clutches and brakes.

The shape of the transmission casing is dependent on which engine the vehicle has.

The transmission has eight solenoids that control the hydraulic flow; six of the solenoids control the shift process. One solenoid controls the torque converter lockup and one solenoid controls the system pressure throughout the transmission.

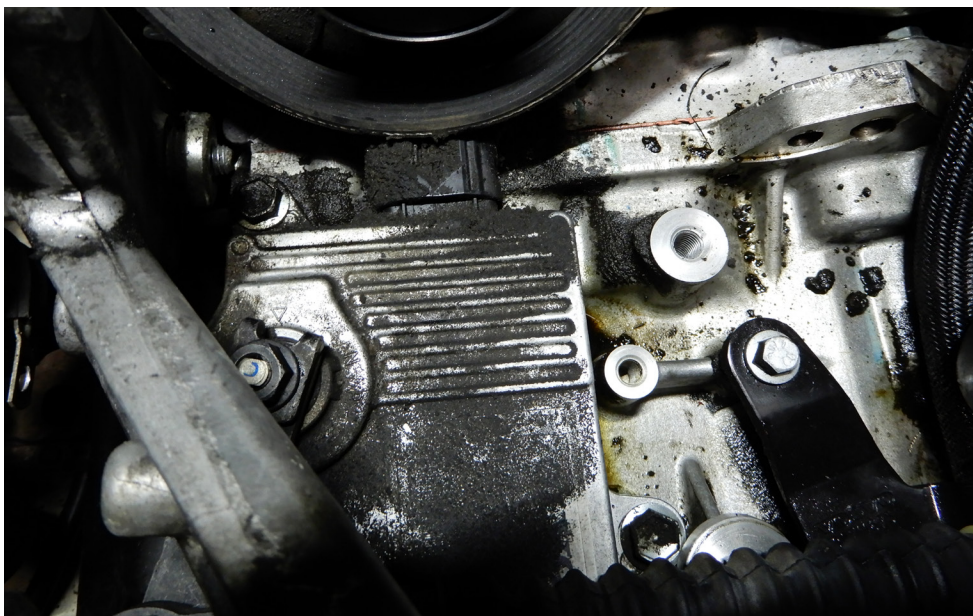
The Transmission Control Module (TCM) is located on the transmission itself. The advantage of this is the elimination of external wires. Gear changing happens when one clutch engages the instant the previous gear disengages.

Design and Function of the TF-80SC AWD Transmission

The torque converter consists of three impellers. The first impeller is connected to the crankshaft. The pump rotor is inside the metal housing and rotates with the crankshaft.

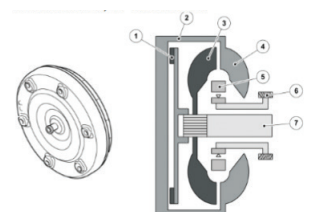
The second impeller, the turbine rotor, is connected to the transmission's input shaft and is driven by the oil that is circulated by the pump rotor. The stator, which is the third impeller, is between the pump rotor and the turbine rotor.

The torque converter is like a hydraulic automatic clutch. Remember your old go cart? It would sit still until you gave it gas, then it would take off. The torque converter works the same way. At idle, the pump action is too weak and then, as speed increases, the turbine rotor inside the torque converter starts to engage and drives smoothly.



Automatic transmission with control module on top

With slow speed driving, the impellers inside the torque converter slip a little bit. That affords a power loss, and this increases fuel consumption. When the vehicle is moving, the torque converter's reinforcement of the



Torque converter with inside components

engine's torque is not needed. This is when the lockup function is activated and the transmission input shaft is connected with the engine mechanically. Fuel consumption is reduced when the engine speed drops and the torque converter's slipping disappears.

The planetary gear system consists of a conventional planetary gear connected to a Ravigneaux planetary gear. The Ravigneaux planetary gear setup is unique to this TF-80SC transmission. There are three clutches and two brakes that control the gear ratios in this transmission.

No.	Designation	No.	Designation
1	Rear planetary train (Ravigneaux)	6	Input shaft
2	Front planetary train	7	Drive gear
3	Planetary gear	8	Oil pump
4	Sun gear	9	Differential
5	Ring gear	10	Driven counter-rotating gear

The planetary gear system breakdown

The oil pump for the transmission is located at front of transmission and is accessible when the torque converter is removed; it's driven from the crankshaft via the torque converter. The pump supplies the transmission with oil to lubricate and cool the transmission. There is an external oil cooler to help cool the transmission as well.

Inside the transmission pan is the valve body. The valve body contains solenoids and hydraulic valves. The solenoids are activated by the Transmission Control Module (TCM). Hydraulic pressure builds up inside the transmission, and the hydraulic valves, which are controlled by their solenoids, send hydraulic pressure to the relevant clutch.

As the clutch rotation speed increases, the centrifugal force affects the oil inside the clutch, and the pressure increases and the clutch engages.

In the all-wheel drive vehicles, the TF-80SC transmissions look a little different, but inside are primarily the same. All-wheel drive vehicles have a transfer case that is mounted on the transmission that connects the driveshaft to the rear differential; that transfers the power to the rear wheels.

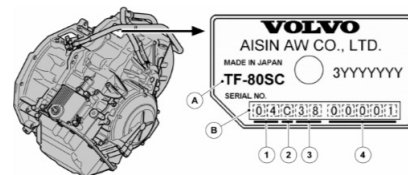
The product plate on top of the transmission serial number will identify the production year, month, and transmission model. The first two numbers in the



Valve body and solenoids inside transmission

Production plate on top of transmission:

A. Model number (Transverse FWD, Slipping lockup, integrated Computer)



B. Serial number:

1. Production year (04 indicates 2004)
2. Production month (C indicates March see table on VIDA)
3. Transmission model (38 indicates TF-80SC)
4. Sequence number

serial number are the year (07 indicates 2007). The third number indicates the production month (A would be January and so forth). The four and fifth numbers indicate the transmission, in this case, TF-80SC.

The gear selector assembly inside the vehicle has a cable that runs to the transmission to select which gear you want the transmission to be in. Park, Reverse, Neutral, Drive, and Manual shifting. The manual shifting position is controlled by pushing the shifter up or down to change gears manually.

Using the correct transmission fluid is important in these transmissions. The electronic controlled transmission system has a transmission control

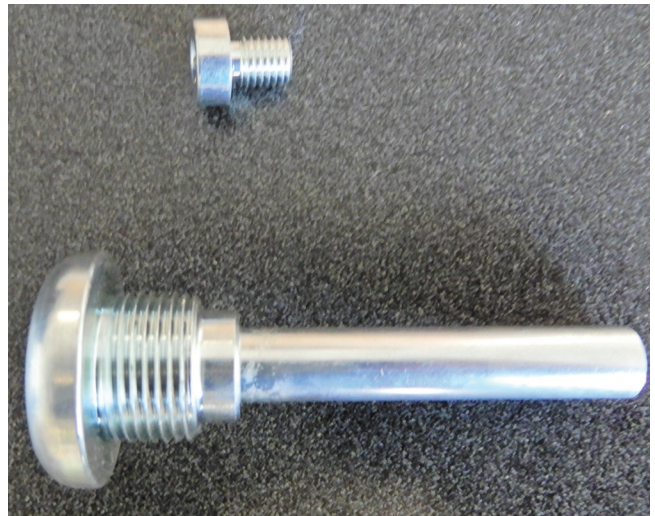
module with software that uses input information from the transmission sensors and other control systems to make decisions on gear selection, torque converter lockup, and gear shifting timing.

The transmission valve body gets commands from the transmission control module to activate solenoids in the valve body to control shifting, torque converter lockup, and line pressure in the transmission.

Volvo says the transmission fluid is a lifetime fill unless the car is used as a taxi or for towing, in which case it gets changed at 52,500 miles or 50,000 miles depending on the vehicle's service program. On high mileage cars, changing the fluid may provide improved shift feel.

After the transmission is drained, with a new washer, install the first plug with the long tube, the level indicating pipe. Adding fluid can be done at the bottom of this plug by injecting transmission fluid into the plug until fluid starts to escape. Insert the smaller plug and start the vehicle up and monitor it on VIDA; go to Vehicle Communication > TCM Transmission Control Module > Monitor Temperature Of Fluid. The fluid should be between 50 and 60 degrees C and just dripping out in small drops.

Fluid can also be added at the top of the transmission. Remove the air filter housing to expose the fill plug.



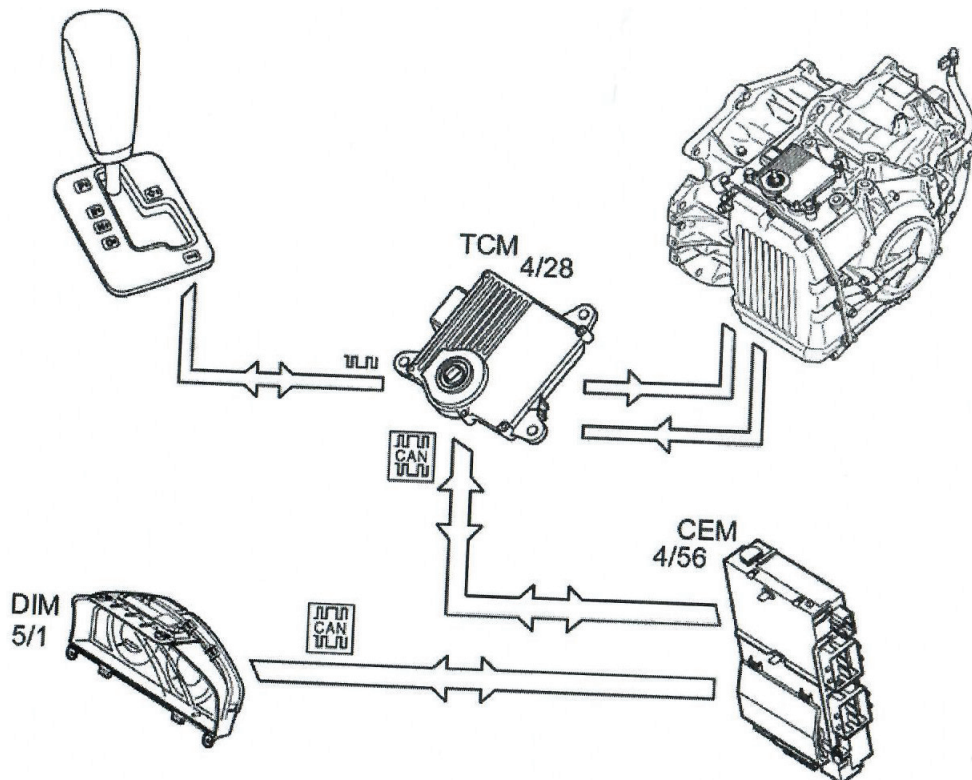
Level indicating pipe 30713218 and plug 30713219

Doing it this way, you will need to add three to four liters. Set the filter housing back in place, start the vehicle and check at the bottom plug. (See "transmission fill plug" image on next page.)

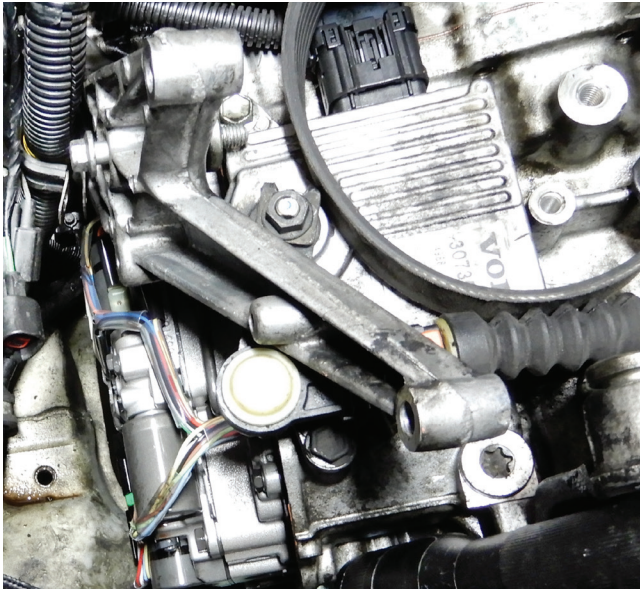
Transmission oil leaks can be spotted pretty easily most of the time. The most common are at the pan that covers the valve body controls, the B1 servo. The other common leak is actually motor oil from the rear main seal between the engine and transmission.

The complete transmission will have to come out to replace this seal. The B1 servo cover can be replaced and is now available separately from Volvo. There are two kits for repairing this job, for low torque and high torque engines. The low torque engine is XC70 (08-) engine B6324S, and the high torque version is found in other engines. The low torque part number is 31259740 and high torque 31259757; you will also need transmission oil. Use fluid part number 1161540 and 1161640 for the generation 1 TF80. Later transmissions take 31256775 or 31256774 depending on bottle size.

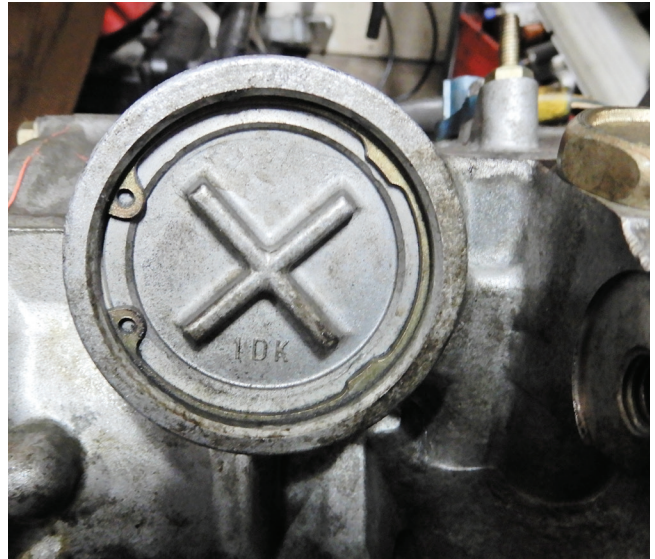
Replacing this B1 servo depends on the model



Electronic Controlled Transmission with component wire diagram numbers



Transmission fill plug at top of transmission



The B1 servo cover will need to be replaced due to transmission oil leak.

and year to access the servo. Volvo now has a replacement kit for sealing the servo.

Here are the affected vehicles:

- S80 2007- All chassis range
- V70 2008- All chassis range
- XC70 2008- All chassis range
- XC60 2010- All chassis range
- XC90 2005- All chassis range
- V70R 2006-2007 All chassis range
- S60R 2006-2007 All chassis range

Use VIDA to reset transmission adaptations.

Fill the transmission with new fluid per VIDA and check to make sure the transmission is filled correctly.

Connect VIDA to the vehicle; go to Vehicle Communications > TCM Transmission Control Module. Click on the Advanced tab > Control Module Adaption and reset the adaption.

Drain the transmission fluid. Clean the area around the servo so not to contaminate inside the transmission. Remove the lock ring and remove the servo piston. If the piston is damaged, the transmission will need to be replaced.

Clean the components and make sure there are no burrs on the piston ring groove. If there are burrs, use a fine emery cloth to remove them. Install the piston with new O-rings into the transmission and push down and install the lock ring.

You can find this information in the Technical Journal 21096 AW TF-80SC Servo Cover, automatic fluid leak.

Making sure the transmission and engine control modules have the latest software is very important. This doesn't mean that software will cure a customer's problem in their transmission simply by upgrading the software.

Technical Journal 16761 talks about rough shifting, harsh engagement or shift shock after standing still

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Code	Description	Code	Description
AE	Idling/Uneven idle	MH	Automatic transmission/Kickdown does not work
DL	Warning lights and chimes/Malfunction Indicator Light ("Check engine" light) indication/no indication	MO	Automatic transmission/Shifts occur too early, too late, too often/When downshifting
EX	Warning lights and chimes/Automatic transmission indication/no indication	MV	Automatic transmission/Gear changes take too long to complete/When downshifting
7Y	Automatic transmission/Gear changes take too long to complete/Unsure when/at all times	NB	Automatic transmission/Gear changes take too long to complete/When upshifting
7Z	Automatic transmission/Shifts occur too early, too late, too often/Unsure when/at all times	ND	Automatic transmission/Shifts rough or jerky/When downshifting
MA	Automatic transmission/Shifts rough or jerky/Unsure when/at all times	NF	Automatic transmission/Shifts rough or jerky/When engaging gear at standstill
MC	Automatic transmission/Winter mode does not work	NO	Automatic transmission/Shifts occur too early, too late, too often/From Park to Reverse or Drive
MD	Automatic transmission/No automatic gearshift	NS	Automatic transmission/Shifts rough or jerky/When upshifting
ME	Automatic transmission/Shifts occur too early, too late, too often/When upshifting	OC	Manual transmission/Gear pops out
		NY	Automatic transmission/Vibration

Customer Symptom Codes (CSC)

after brake pedal release. We will go over this Technical Journal and talk a little about it and the symptoms of the vehicle. (Log into volvotechinfo.com/account/library/library to look up TJ 16761 for more information.)

Removing Transmission Oil Pan to Reseal or Remove Valve Body and/or Replace Solenoids

First thing to do is to remove the air filter housing. Depending on the year and model, the ECM could sit on top of the air filter housing and will need to be removed. If the ECM needs to be removed, disconnect the negative battery terminal first.

Disconnect the air mass sensor and remove the air hose from the air filter housing and at the throttle module and set aside.

Pull up on the filter housing and remove it from the vehicle. Remove the battery from the vehicle and battery box; four bolts hold the box in place. The air conditioning compressor will need to be removed on XC90 S16 models; on other models, you can simply move the compressor to the side. On these XC90 models, you will have to remove the refrigerant from the A/C system using a machine suitable for R134.

Once the refrigerant is removed, disconnect both A/C lines from the compressor and tuck them out of the way. Remove the power steering hose bracket that sits on top of the A/C compressor if equipped. Using a 19 mm wrench, release the pressure at the drive belt

Control Module	Code	Fault Type
TCM	P089500	Intermittent
TCM	012B	Intermittent
TCM	012A	Intermittent
TCM	002F	Intermittent
TCM	0045	Intermittent
TCM	0053	Intermittent
TCM	008D	Intermittent
TCM	0028	Intermittent
TCM	0099	Intermittent
TCM	002E	Intermittent
ECM	530D	Intermittent
TCM	p074400	Intermittent
TCM	p073000	Intermittent
TCM	002A	Intermittent
TCM	002B	Intermittent
TCM	0029	Intermittent

Diagnostic Trouble Codes (DTC)

tensioner and insert a 3 mm pin to lock the tensioner in place so the belt is loose. (See image next page.)

Now remove the other bracket from engine to A/C compressor and set it aside. There is also a bracket at the A/C compressor to the top of the transmission that needs to come off.

Disconnect the two electrical connectors at the A/C compressor and remove the bolts that hold the compressor into place. Lift off the compressor and put

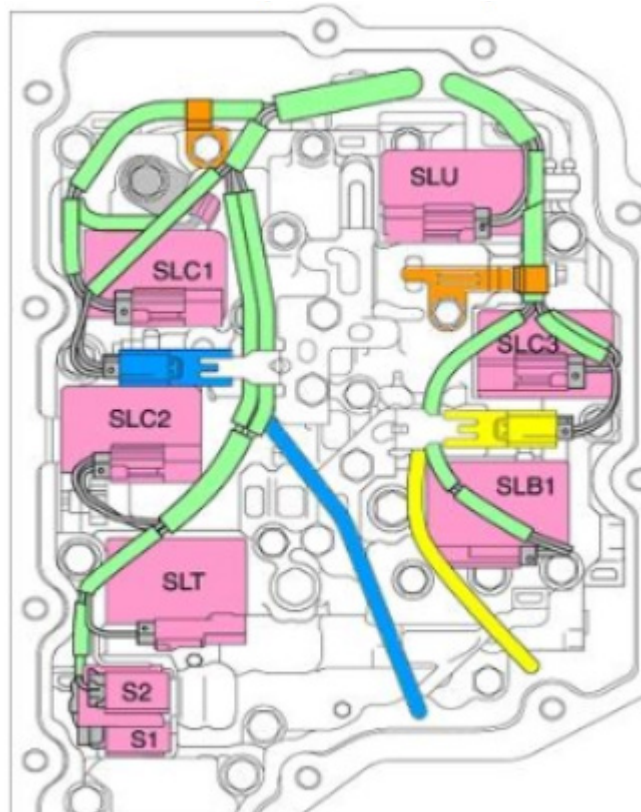
tape over the two hose lines so not to let debris and moisture into the compressor.

Remove the bolt that holds the belt tensioner to the bracket and remove the belt tensioner. Remove the bracket that holds the A/C compressor in place and set aside.

Drain coolant from vehicle and disconnect the bottom radiator hose that is in front of the transmission pan. Raise the vehicle in the air and drain the transmission



Belt tensioner with 3 mm pin in place



Valve body with solenoids

fluid. Remove the lines at the transmission that are in front of the pan and tuck them out of the way.

Now remove the 12 bolts that hold the pan in place and remove the pan from the transmission. Depending on what you're doing, resealing the pan or replacing solenoids or even replacing the valve body may be necessary. On certain vehicles it might be necessary to lower the subframe to remove the pan.

After repair and replacing parts, make sure to clean the surface and the oil pan. If you're replacing solenoids, make sure that any electrical connectors are secured and clipped into place so they don't disconnect.

Add a bead of chemical gasket, part number 31316436, 3 mm thick, around the pan and set it into place. Install the 12 bolts holding the pan in place and torque to 13 Nm.

Now you can start reinstalling all parts starting with the lines that go to the transmission. Install new O-rings so there are no leaks.

Install the bracket that holds the A/C compressor in place and secure. Connect the radiator hose. Install the drive belt tensioner and route the drive belt in the correct way. Set the A/C compressor in place and bolt down and connect the electrical connectors.

Once the A/C compressor is in place remove 3 mm pin using a 19 mm wrench to release the pressure. Install the A/C low and high pressure lines with new O-rings and tighten. Add the brackets at the compressor and the power steering hose and bracket if so equipped.

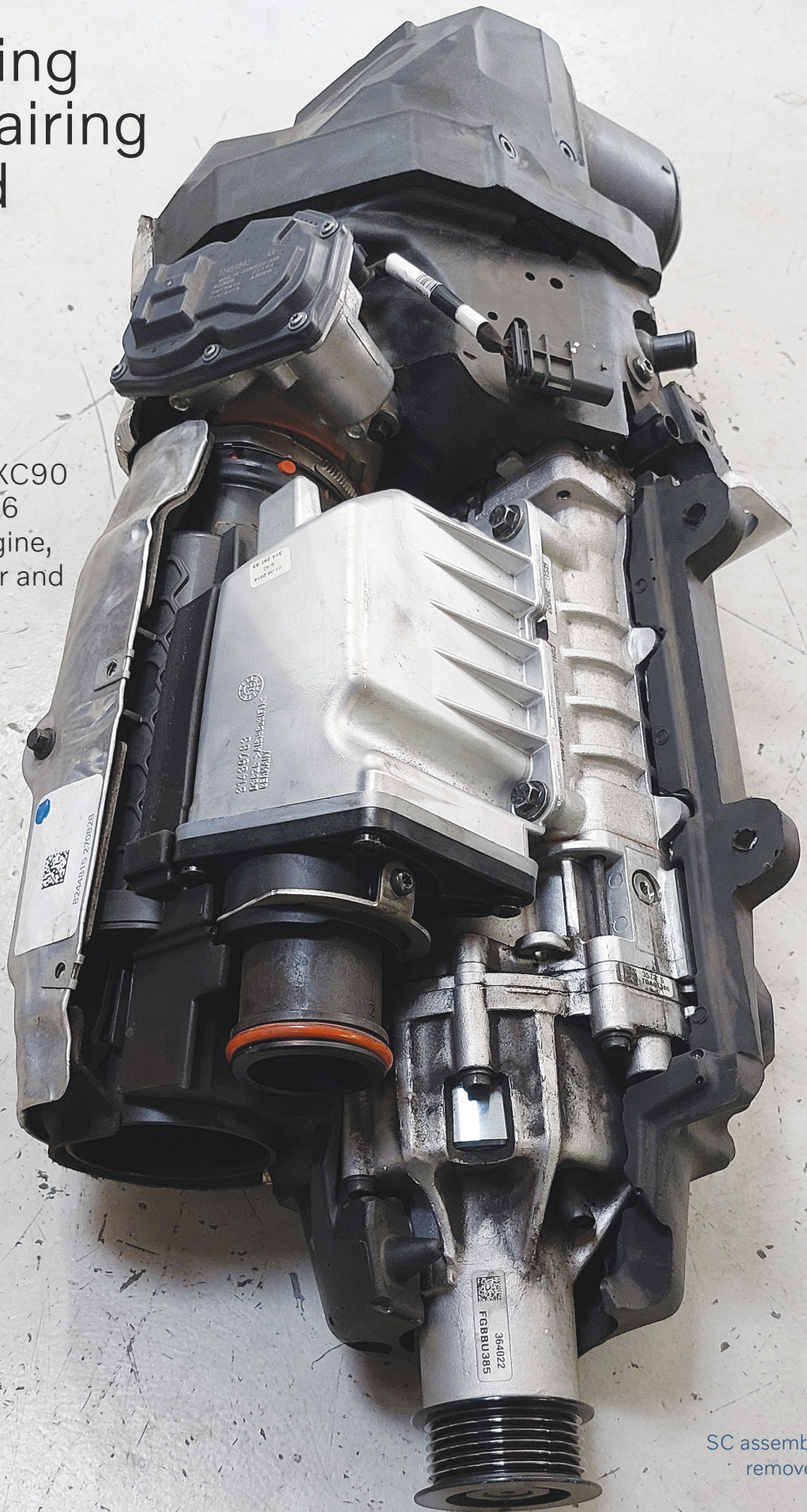
Install the battery box and battery but don't connect the terminals yet.

Install the plastic hose from the throttle housing, install the air filter housing in place and connect the hose from the throttle body and tighten. Connect the air mass meter. Set the power steering reservoir in place and connect the hoses. If needed, set the ECM in place on the air filter housing and connect.

Connect your A/C machine and install refrigerant to the proper value. Fill the transmission with fluid and add coolant to the engine. Connect the battery terminals and start the engine. Connect VIDA to the vehicle; go to Vehicle Communication > TCM > Check Temperature Of Transmission until the engine is warmed up and check fluid level until fluid just drips out. Secure the plug. If you replaced the valve body or solenoids, you will need to reset adaptations in VIDA. Test drive to make sure all is well. Recheck the fluid level and all repairs. ●

Diagnosing and Repairing Manifold Exhaust Leaks, Part 1

On a Second
Generation Volvo XC90
(2016—Present) T6
2.0L B6324S Engine,
With Supercharger and
Turbocharger

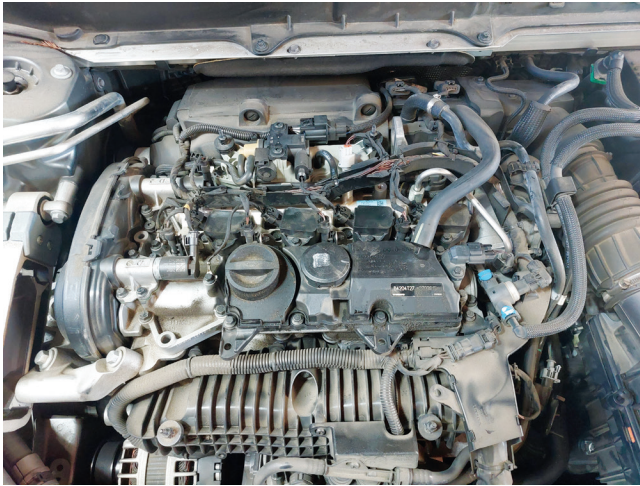


SC assembly
removed

More and more of these remarkable second generation Volvos are coming into independent shops every day, as these cars come off of warranty and dealer service contracts.

If you have worked on a few of these, you know that these late XC90s have very little in common with their ancestors from which their name comes.

In fact, you will need get to know Volvo's new 2.0L engine very well because, as of 2015, almost all new Volvo models come equipped with some version of this engine.



Volvo 2.0L T6 B6324S engine

That is because, like some other manufacturers, Volvo has adopted a new way of making their cars; it's called Scalable Product Architecture platform, or SPA. It basically means that Volvo can use the same platform for all their models. This cuts down on overall vehicle weight and allows them to standardize their systems across the entire Volvo line.

These modular engines are small but powerful—and they're also complex. Everything about these newer Volvos is advanced and state of the art. The electrical systems on these late Volvos would put anything that NASA has launched lately to shame.

These Volvos can have more communication going on between its modules in five minutes than all the kids in the average high school with their cell phones in an hour.

The average new Volvo can have over 35 modules and up to 5 networks to run all that data through.

When you use VIDA on these SPA Volvos, you will have to get a new dongle that attaches to your laptop with a cat 5 type of network cable.

Your old DICE dongle won't work on the newer SPA Volvos; they're not fast enough to handle all that data.

Volvo has this tool and all the other Volvo-specific special tools available from the Volvo Car Bookstore at volvotechinfo.com. You can also order any Volvo special tools from your local dealership parts department.

It's also better to use a hard line connection to the internet rather than Bluetooth, because these cars have a lot more data going back and forth than the earlier Volvos.

The second generation of Volvo's largest SUV are BIG! If you are working deep inside the engine bay, you may need a step stool unless you are a former pro basketball player.

When you need to remove the supercharger, turbo, or catalytic converter, you will have to get access deep into the firewall side of the engine.

If your shop is not equipped to work on large trucks or off-road vehicles, you may want to invest in a topline creeper. Tools like this will help save your back and avoid damage to the paint on the customer's fenders because you had to lie across them.



These newer XC90s are big, and when doing this and other jobs on this big SUV, one of these topline creepers will come in very handy—and they will help save your back.

Case Study: 2019 Volvo XC90 T6, With Exhaust Leak Above Turbo

This car came into the shop with a customer complaining of the car being louder than usual while driving and a Check Engine light on.

When the tech moved the car through the shop, an audible exhaust leak was heard at idle.

The tech put the car on a lift and started the engine; the source of the exhaust leak was not visible, but the sound seemed to be coming from the area where the exhaust manifold and turbocharger are attached to the cylinder head.

The technician's first thought was that one or more of the exhaust manifold nuts had loosened up and the



If your shop is seeing more of these next generation Volvos and you only have generic scan tools to diagnose them, it's time to step up to VIDA; it's cheaper to set up than most full function scan tools on the market today, and you can set it up on a regular laptop and get the needed communication dongles and purchase software subscriptions at volvotechinfo.com.

leak was coming from the exhaust manifold gasket at the head.

On older Volvos this can be very common, but it was not the case here.

The tech hooked the car up to a laptop with VIDA, using a cat 5 cable and Volvo's late-style network dongle.

Some advanced generic scan tools will communicate with the latest Volvos, but you may only get limited functions.

If your shop is going to work on late-style Volvos you need to get VIDA and the communication tools that are required to hook up your laptop to the cars' data link connector.

This XC90 had stored a few codes in the ECM that could be caused by a large exhaust leak.

The shop called the customer and got authorization for an inspection teardown to pinpoint the source of the exhaust leak.

To get to the place where it sounded like the leak was occurring, it would be necessary to remove the supercharger assembly to get access to all the bolts for the turbocharger, exhaust manifold, and catalytic converter assembly.

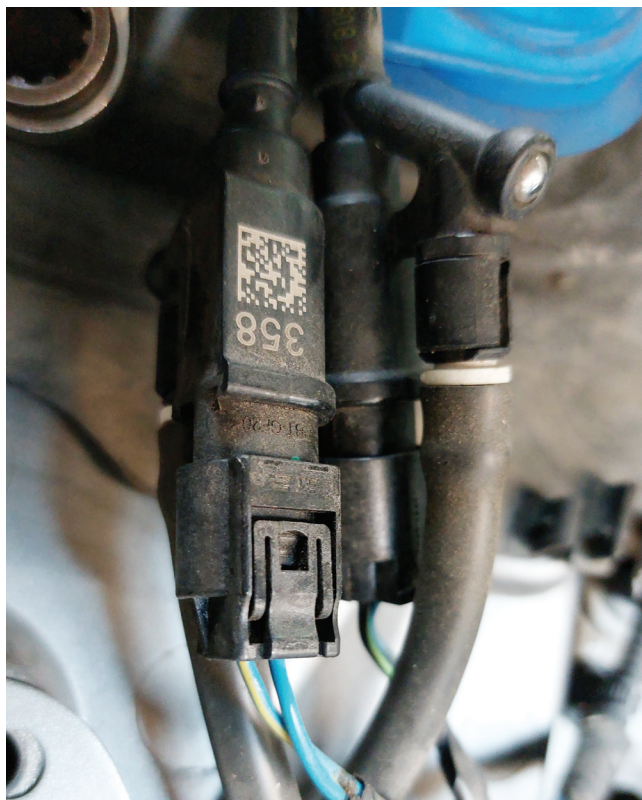
When performing this job, you will need a lift because, just like the stock market, there are going to be a lot of ups and downs.

If you have never done this job before, take some pictures with your phone before and during the procedure to help when it comes time to reassemble.

You will have to remove the windshield wiper arms, which are very different than those on other cars you have probably seen before; the washer jets are installed on the arm and the wiper heater wiring runs inside the washer tubing, so don't just pull them off.



If the exhaust leak is coming from an area near the engine block, you will probably have to remove the supercharger assembly to accurately determine the source of the leak and to repair it.



Wiper washer connectors



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The connectors for the washer/heaters are under the cover on the left side of the engine bay.

Tools Needed

You will be working in tight spaces in some cases, so a good selection of tools will help you out. ¼ inch drive tools are very useful.

Long extensions and swivel sockets will help too.

You will be draining the engine coolant during this job.

As far as special tools, Volvo has one that you may need, Volvo part #999 7508. It's a long Allen socket that is used to align the supercharger's height, by turning a threaded spacer the position of which you will mark when you remove the supercharger from the engine.



Volvo special tool 999 7508

You can also use a standard long Allen socket to turn this adjuster if you don't have the special tool.

A good torque wrench is a must when reassembling parts on this complex Volvo engine; taking the time to



Remove auxiliary belt idler bearing after right motor mount is removed.

accurately tighten the bolts to specs will save you and the customer a lot of possible headaches in the future.

Some of these bolts are hard to reach, so swivel sockets will come in handy.

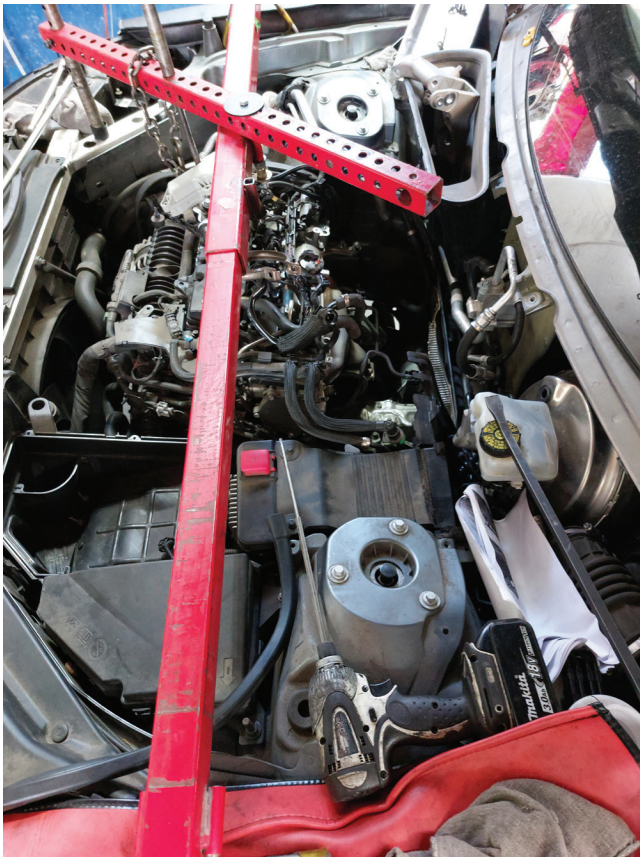
You will need an engine support rig to support the engine when you remove the right side engine mount to give you better access to the belt and the bolts under the supercharger's drive pulley.

Start this job like all major surgeries on a Volvo—by disconnecting the battery.

If you have to replace one or both of the batteries in this second generation XC90 with automatic start/stop, you will have to use VIDA to reset the battery monitoring system.

See VIDA for battery disconnect procedure.

After removing the splash shields under the bumper and engine, drain the engine coolant by loosening the radiator petcock at the bottom of the radiator.



Using an engine support will allow you to remove the right engine mount. This will give you a lot more access to the supercharger's belt and bolts.



With the right inner fender covers removed, you will gain more access to the area.



Radiator drain cock

Next, remove the right front wheel and the plastic covers in the inner fender well; this will give you a little more access to the area you will be working in.

Next, lower the car and remove all the cover panels on both sides of the engine bay by removing the plastic clips.

Try to save as many of the clips as you can because replacing them with all new ones can add up.

You will have to remove the wiper arms, cowl, and wiper motor assembly.



Remove cowl to expose the crossbar and wiper motor assembly.

There is a large section of the firewall that can be removed to allow just enough room to lift the supercharger up and out of the engine compartment.

Removing the wiper arms is a little more complex than on the average car because the washer jets are part of the arms; additionally, the washer nozzles

have electrical de-icers that are wired through the washer tubing.

The connectors for the whole mess are on the left side of the engine compartment under the left rear trim panel.

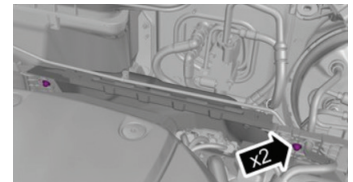
Be gentle when you disconnect the washer tubing and connectors since the clips are tiny and delicate.

Once you remove the wiper cowl and motor assembly, you can remove the screws that hold the removable part of the firewall. These screws are hard to get to, so be patient.



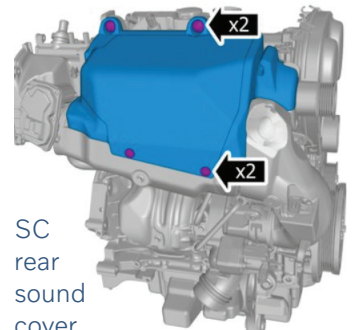
Lift out firewall plate.

A long ratcheting wrench will help here; these two screws have 6 mm heads.



Remove two screws holding the firewall cover in place.

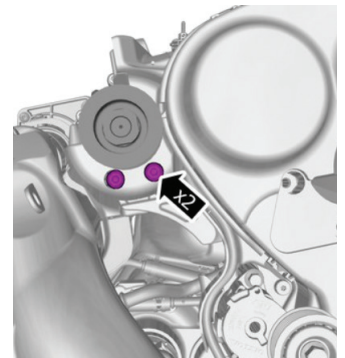
Remove the soft plastic sound deadening cover on the back of the supercharger by removing the four fasteners from the top and the bottom.



SC rear sound cover

When you get them out, you can lift the panel up and out.

Next, set up an engine support rig to hold up the engine when you remove the right motor mount.



SC pulley bolts

Remove the bolts that hold the right motor mount assembly. When this is out of the way, it will make removing the

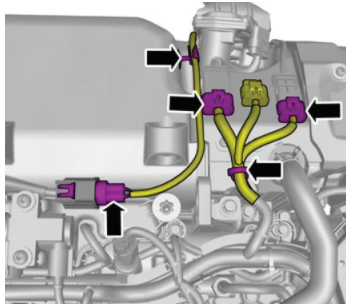
supercharger drive belt, idler, and the two Allen bolts under the S/C drive pulley a lot easier.

This can be a very difficult job if you try to do it with the mount in place; it's possible, but why work so hard?

Next, remove the drive belt and the drive belt idler pulley at the rear of the block.

Remove the two 6 mm Allen bolts under the supercharger pulley.

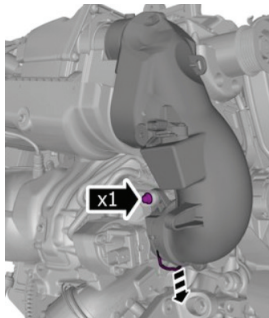
Disconnect the connectors for the oxygen sensors that are on top of the S/C assembly and pop off the wire harness hold down clips that are attached to the S/C housing.



Oxygen sensor connections on top of the SC

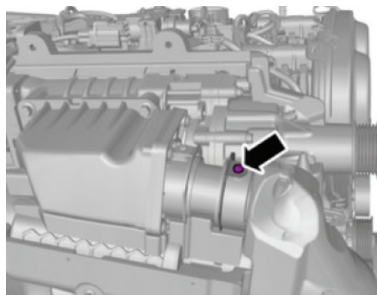
Next, remove the air filter box and intake hose and swing them out of the way.

Next, you will be removing the air pipe that comes out of the front of the supercharger; remove the screw that holds the clip in place and use a pick to lift the wire clip up.



SC air pipe attachment bolt

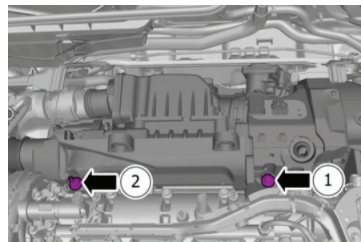
There is also one bolt near the bottom of this air pipe that you will have to remove before pulling the pipe off.



The lower connection of the pipe has a clip that can be a real challenge to keep in the open position while you try to pull the pipe off.

You will need to use three hands to get this pipe off quickly.

The air pipe that comes out of the supercharger is secured with wire clips that sit in a groove. The lower retainer clip can be a pain to keep in the open position while trying to pull the pipe free.



Remove the last two bolts mounting the SC assembly.

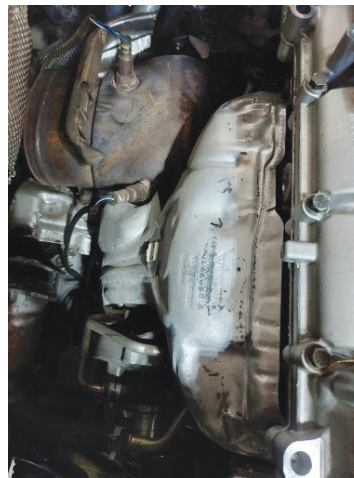
When you get this pipe free, just set it to the side because it is a tight fit and is hard to remove from the body at this time.

The supercharger is almost ready to lift off..

Just a few more bolts and you are home free.

The time has come to lift the supercharger assembly out of the engine bay. You should ask someone for help lifting because it's a tight fit and you're going to have to twist and angle the part to get it out.

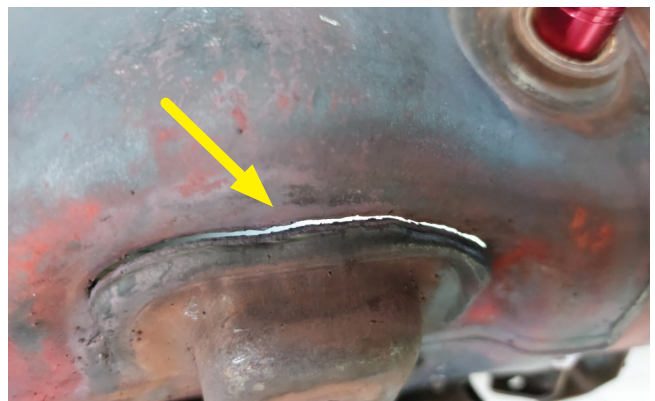
Now that the supercharger is removed, you will have full access to the turbocharger, exhaust manifold, and catalytic converter.



You will get full access to the turbo and exhaust manifold with the SC removed.

The cause of this customer's exhaust leak turned out to be a large crack in the side of the catalytic converter.

The shop decided to advise the customer to replace all the other exhaust manifold gaskets while the supercharger and catalytic converter were removed. ●



Using a flashlight, you can see evidence of this large crack that was causing the leak.

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