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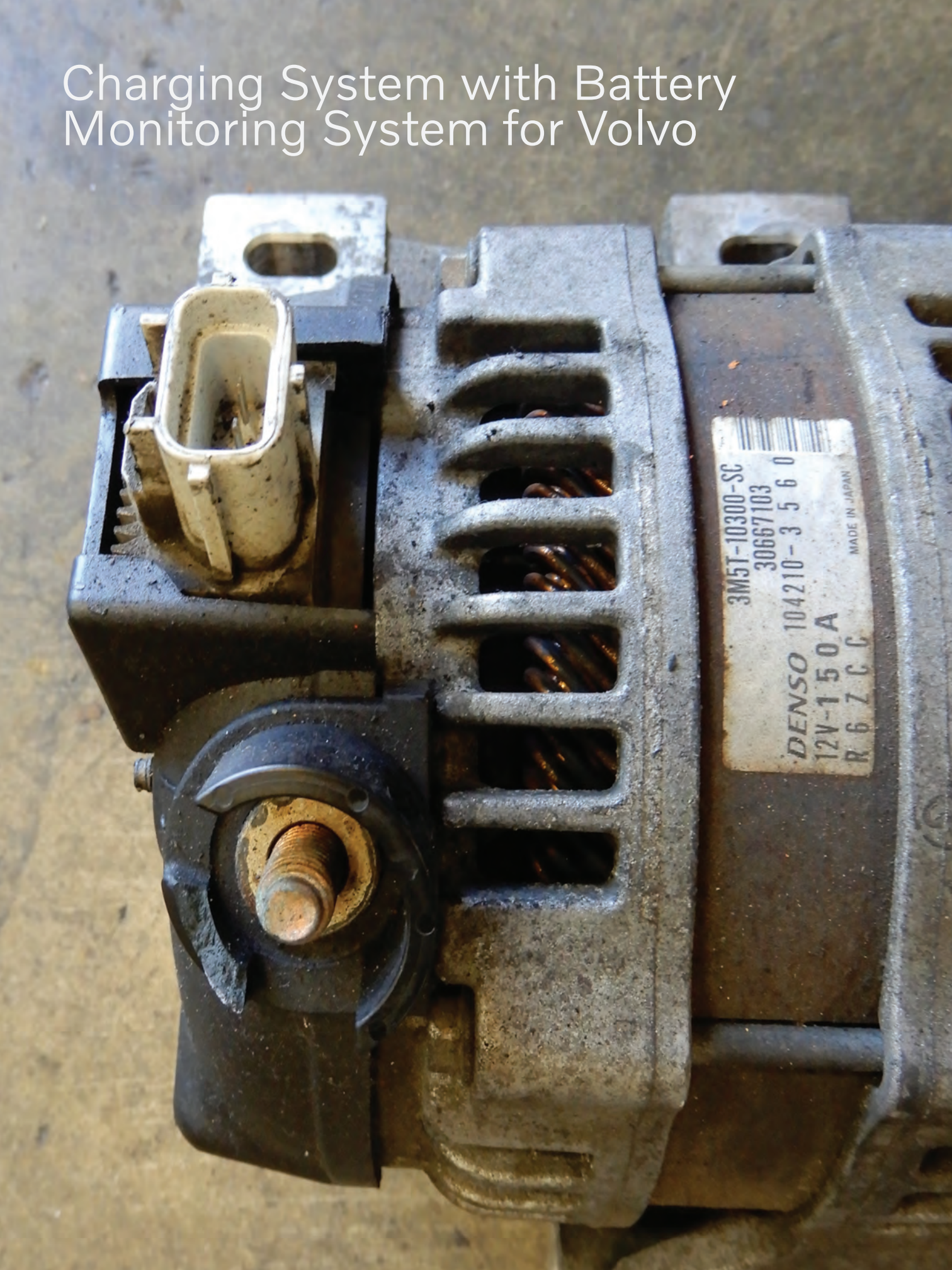
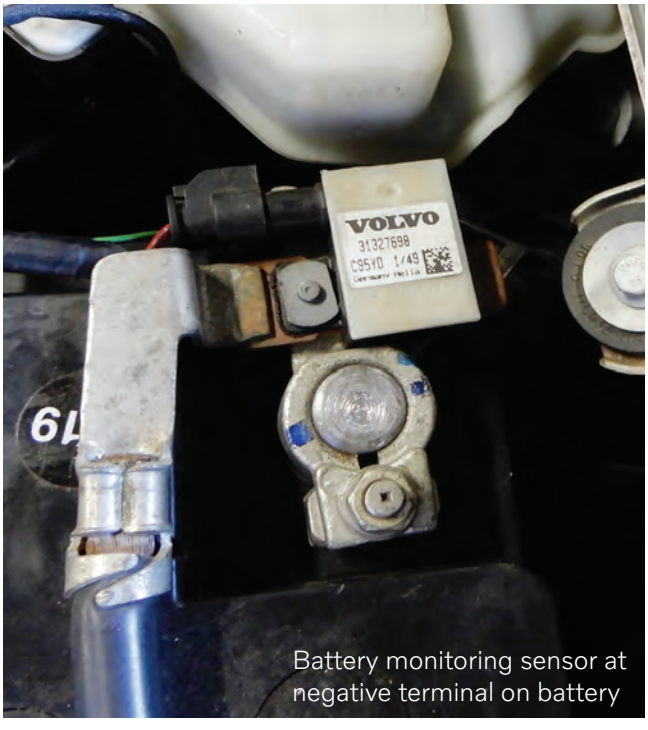
FEATURES

Charging System with Battery Monitoring System for Volvo



Although charging systems seem pretty straightforward these days, these systems can become very technical and sometimes hard to diagnose. Volvo vehicles equipped with the Battery Monitoring Sensor (BMS) can sometimes be tricky also, but with the help of VIDA we can limit the time spent on a vehicle and be sure that it's repaired correctly.

Checking battery operation can be done with VIDA if the vehicle is equipped with the battery monitoring sensor. Visual inspection is very important as is making sure all connections are clean of any corrosion. If there are any signs of new leakage or battery leakage that has already dried into powder, you will need to clean completely and the battery should be replaced.



Battery monitoring sensor at negative terminal on battery

To check the battery system in the vehicle with VIDA, connect VIDA and run Profile, go to Communication and click on Central Electronic Module (CEM). Scroll down to the Battery Monitoring Sensor. Here you will be able to monitor and check different readings of the system.

When replacing the battery, you will need to go into VIDA and then go to Advanced Settings, then scroll down to Battery Monitoring Sensor. Select resetting the information to zero on the power supply when replacing the battery or Battery Monitoring Sensor. There is also an automatic battery test that can be used to check your customer's battery.

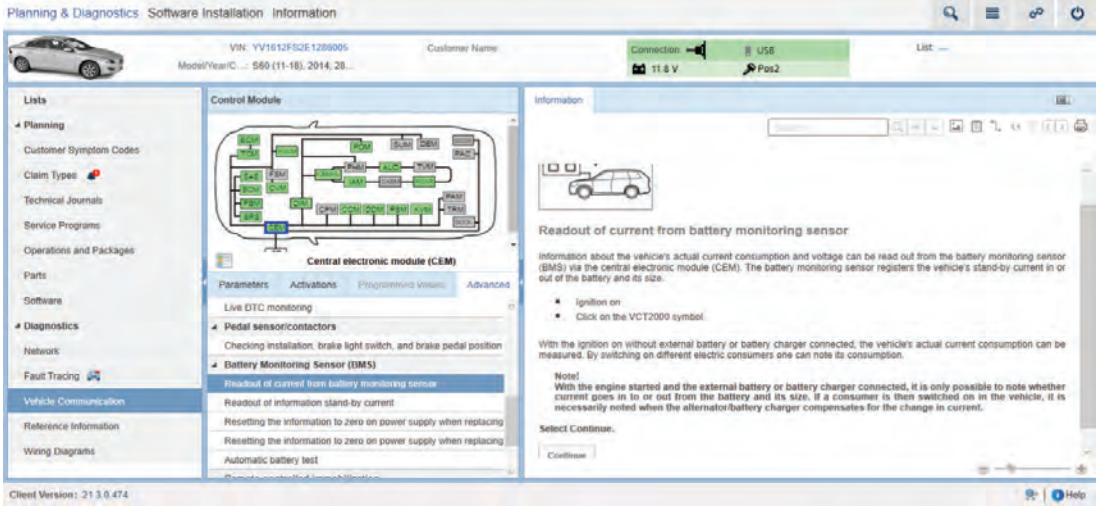
As an example, here we'll check the battery charging during operation on a 2012 Volvo S60 five-cylinder engine equipped with BMS. We need to make sure that there has been no electrical equipment connected directly to the battery negative terminal. If there is, it is necessary to remove it and connect it to the correct place on the vehicle.

If there is electrical equipment connected in line at the negative terminal, the BMS will not have the correct state of charge.

Check the state of charge in the battery using VIDA. If the battery monitoring sensor has been disconnected and then connected again, the state of charge defaults to 80%.

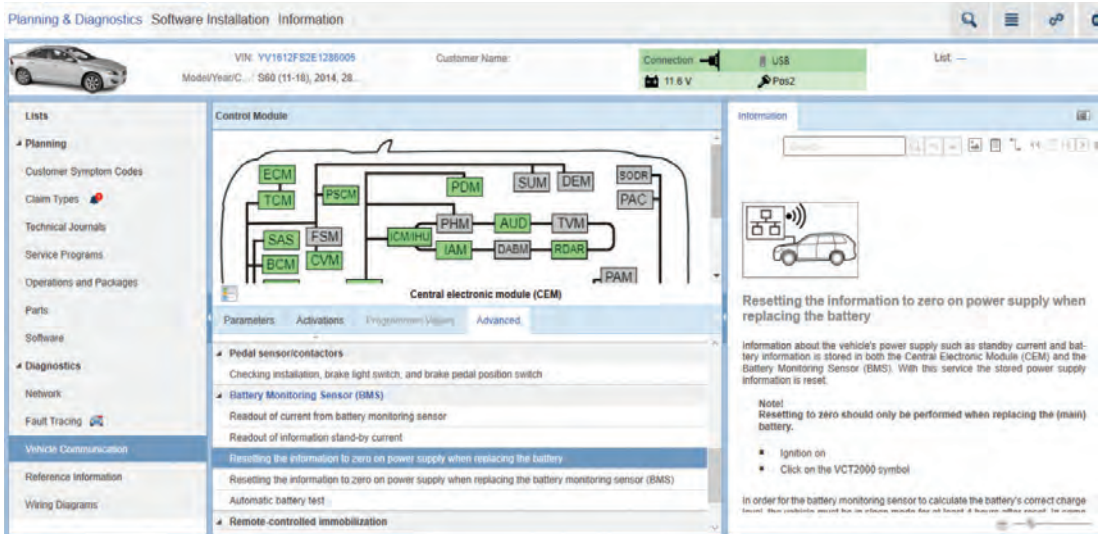
Warm the vehicle up and check the battery current using VIDA. Make sure that the battery current is positive; if the current is low the battery might need recharging or possibly, replacement.

If the battery monitoring sensor is replaced, you can reset it also by disconnecting the sensor and reconnecting.

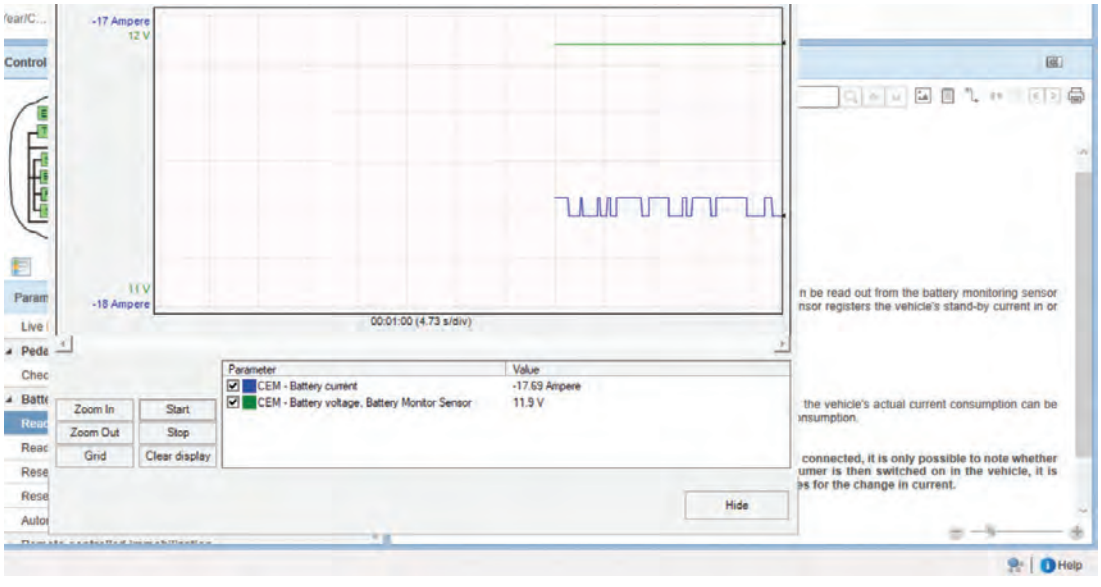


Vehicle connected to VIDA reading the battery system

Battery discharging while the vehicle is parked could be caused by a software issue and could be cured by adding new software to the CEM. In some instances, the battery draining could be caused by a component elsewhere in the system.



This image shows connection to VIDA and resetting the system to zero after replacing the battery or the Battery Monitoring Sensor.



VIDA connected to vehicle checking battery current

To check the individual components in the system, you will need to use the 10 volt scale on a multimeter, and check the CAN network. To do this, the vehicle must be powered down and locked. With the front driver's door open, use a screwdriver to lock the latch. Let the vehicle sit for a few minutes, maybe five or so. This will let everything go into sleep mode, and then voltage in the CAN system should be zero. Communication on the CAN network will be 0.5 to 4 volts.

Measure voltage at the diagnostic socket to which DICE connects. The low speed CAN network can be checked by connecting your meter to terminals 3 and 11. The high side can be checked at terminals 6 and 14.

Checking accessory installation, low battery voltage

This symptom fault tracing only applies to the S40 2004-Present/V50/C30/C70 2006-Present with structure week 200923 and onward, as well as the S60 2011-Present/V60/XC60/S80 2007-Present/S80L/V70 2008-Present/XC70 2008-Present with structure week 201005 and onwards that display the following symptoms:

- LM, 12 V main battery/dead battery
- LN, 12 V main battery/weak or low electrical power
- LO, alternator and charge regulator/power supply problems

If electrical accessories are installed, it is very important to ensure that these accessories are

grounded after the BMS and not before the battery's negative terminal. If the battery's negative terminal is used as a ground point, there is a risk of the BMS giving incorrect data to the alternator. This can lead to reduced charging voltage at the alternator.

Suggestions for alternative ground points for accessories are:

- For S40 2004-Present/V50/C30/C70 2006-Present ground points 31/110, 31/112, 31/114 are recommended.
- For S60 2011-Present/V60/XC60/S80 2007-Present/S80L/V70 2008-Present/ XC70 2008-Present ground point 31/AL is recommended.

Remedy as necessary.

Let's go in another direction. Let's say you have a code in the CEM because the battery is over charging. This will happen if the CEM detects that the battery voltage is over 16 volts.

This could be a battery problem or the alternator, and possibly both. Make sure the drive belt and tensioner are not damaged and look to be OK.

Checking voltage drop between the battery and the alternator using a multimeter

Check the battery to see if it has the proper charge. If not, charge the battery. Disconnect the battery from the vehicle before charging and always disconnect the negative terminal first. If needed, replace the battery. Once the battery has been charged correctly or replaced, connect it to the vehicle. Start the vehicle and check the voltage. If the voltage is still too high, there could be an alternator problem or a fault in the Alternator Control Module (ACM). Replace as necessary.

Checking voltage drop between the battery and the alternator

When you have a vehicle that is not charging correctly, and the resistance in the circuit is too high, in certain circumstances you will get a code to check the resistance in the wiring harness.

Expose the battery and check for any corrosion at the cables. If you can see corrosion inside the cable, you will need to replace this cable.

To check the voltage drop on the cable between the battery and alternator, you will need your multimeter for this task.

Now connect your meter between the battery positive terminal and the alternator. Start the vehicle and maintain a constant speed around 2,300 rpm. Make sure to turn off the radio, climate control, and any other power consuming components. Check the voltage drop and record.

Then do the same on the negative side of battery, and add up your values. The total value should not be over 0.72 volts.

Battery warning messages in DIM

There are two different battery warning messages that can appear in the Drivers Information Module (DIM).

- Low battery
- Low battery power save mode

For vehicles equipped with BMS, when a low battery message appears at the DIM, one of the following has happened:

- Key out of ignition and the infotainment system is on, battery State Of Charge (SOC)

is less than 60% for more than 30 seconds.
- Key in ignition and turned to position I or II the battery SOC is less than 60% for more than 30 seconds.

The message "Low Battery Power Save Mode" appears at the DIM when the following conditions occur:

- Key out of ignition and infotainment system on, the SOC is less than 55% for more than 120 seconds after low battery light is on.
- Key in ignition and turned to position I or II and the battery state of charge is less than 55% for more than 120 seconds.

Now connect one lead to the negative side of battery and the other lead to the engine block for ground. Take two measurements. The total value should not exceed 0.72 volts.

For vehicles with BMS, if the battery monitoring sensor is disconnected and then connected, the battery's state of charge is set to 80% until the next calibration when the vehicle has been switched off for at least four hours.

The overall purpose of the alternator is to ensure the charging system has current while the vehicle is running and the battery maintains charge.

The alternator creates alternating current which is converted into direct current. There is a built-in regulator inside the alternator, the Alternator Control Module (ACM). The regulator communicates with the ECM via the LIN system.

The charge indicator light coming on means there is a problem in the system. The system is diagnosed through the CEM and the ECM.

Check the battery and all cables and terminal connections for corrosion or looseness. With the vehicle running, the correct voltage should be 12.8 volts to 14.2 volts, depending on the speed of the engine and the components in the system that might be on.

To understand the alternator, the components that make it up are:

1. Stator
2. Rotor with slip rings
3. Integrated cooling fans
4. DC bridge
5. Charge regulator
6. Front pulley

Depending on the make and model, some of these alternators are freewheeling.

The terminal connections at the alternator on a 2012 Volvo S60 are:

- A 1 B+ Main power to alternator
- B 1 Engine control module (ECM)
- B 2 Not used

The alternator has a regulator that is fitted into the rear of the alternator (also known as the alternator control module, or ACM). The ACM can be replaced without replacing the complete alternator.

Once the vehicle is started, the ACM communicates with the ECM via LIN communication. The ECM then communicates with the CEM via the CAN to regulate the alternator output.

Certain alternators have a freewheel feature between the rotor shaft and the pulley. These alternators can be identified by a cover over the center pulley nut. The freewheel rotor shaft can only rotate freely in one direction; this minimizes any jerking in the belt setup.

Checking the function of the alternator freewheel while running the engine

Start up the engine, making sure to shut off all power consuming components. Run the engine to 3,000 rpm. Check to hear just a faint clicking noise at the alternator freewheel; this is the engaging and disengaging of the

freewheel. Shut the engine off and immediately check to see that the alternator is still rotating. If the alternator is still rotating, then the freewheel is fine.

To check with the alternator off the vehicle, rotate the pulley counterclockwise, then brake the pulley. The freewheel will grip the alternator shaft turning counterclockwise.

Stopping the rotation, the freewheel pulley should release so that the alternator shaft continues to spin.

Using VIDA to check the alternator function

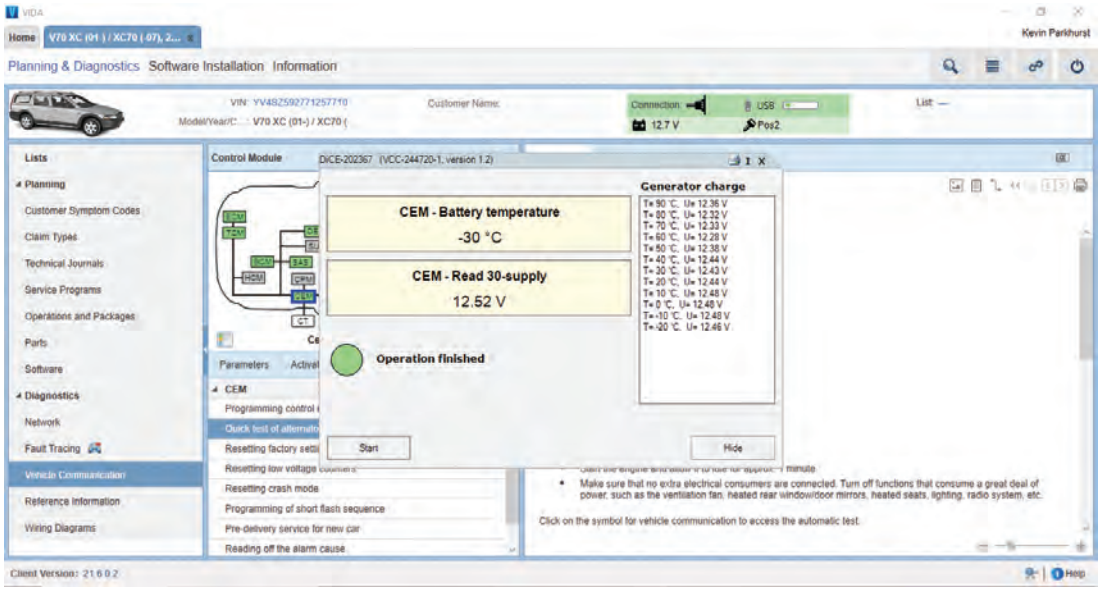
Checking the alternator function on VIDA will differ depending on whether the vehicle is equipped with BMS or not.

VIDA will give you the option to test the alternator either with BMS or without. The CEM works with the ACM to regulate the alternator's output.

The temperature of the battery helps determine the output of the alternator which is controlled through the BMS.

To test the alternator function when the vehicle is not equipped with BMS, use the manual test of the alternator in VIDA. Go to CEM, Advanced tab B. Scroll down to Quick Test of Alternator, then go to Manual Test.

Turn off all electronics in the vehicle. Start the vehicle and click on Test. Compare the values from the



Automatic test of alternator using VIDA connected to vehicle

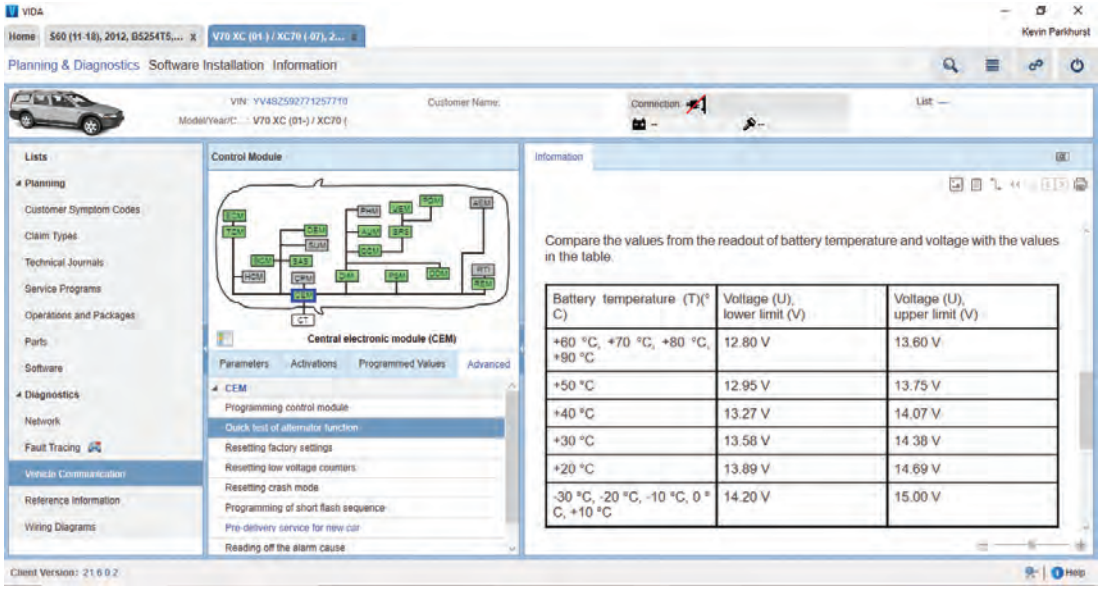
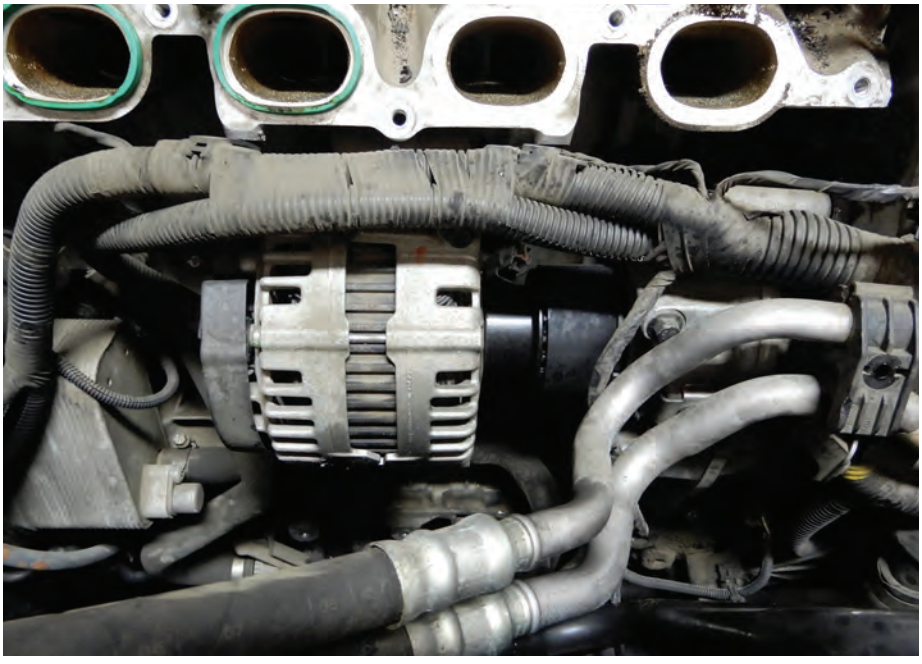


Table for manual battery test

readout of the battery temperature and voltage in the "table for manual battery test" image.

If the voltage is low, redo the test at an engine speed of 2,500 rpm. If the voltage is within tolerance, the alternator is good at this time.

In the table there are values for temperature and voltage; select a temperature value and give the alternator a few seconds to read voltage properly. You can check each value to test the alternator at different temperatures.



Alternator on a six-cylinder Volvo engine

The CEM checks the battery voltage, and if the voltage stays at 11.6 volts or less for longer than two minutes, an error code will set the Check Engine light.

If the CEM detects voltage is 16 volts or higher, this too will set a Check Engine light, and you will have to diagnose the problem with the charging system.

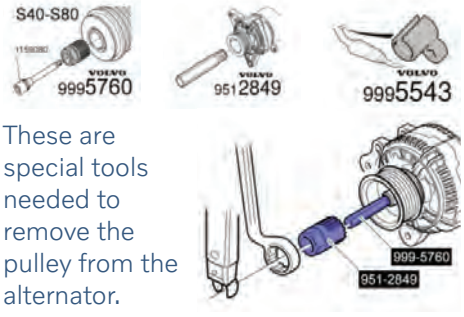
On Volvo's six-cylinder engines, the alternator is connected to the engine block underneath the intake manifold and is driven by a gear transmission connected to the timing chain assembly.

The alternator on these six-cylinder engines operates the same way; the mounting is the only difference.

When replacing an alternator on a six-cylinder engine, the first thing to always do is disconnect the negative side of the battery. Disconnect the hose from the air filter housing to throttle housing and set it out of the way.

Disconnect all electrical connectors to the intake manifold and throttle housing. Be sure to remove the two bolts at the bottom of the intake that secure the unit to the block.

You will need to drain the coolant from the vehicle. Remove the coolant hose that is connected to the block at the middle of the intake manifold. Remove the seven bolts that hold the intake onto engine. Here it might be a good idea to remove the fuel pressure sensor so not to damage it. Remove the intake.



These are special tools needed to remove the pulley from the alternator.

Remove the two electrical connectors at the alternator. Four bolts hold the alternator to the block; remove these four bolts and remove the alternator from the vehicle.

When installing a new Volvo alternator, be sure to replace the small belt and any pulleys that might show signs of wear.

Also, when installing a new Volvo alternator, be sure to install the two dowels between the alternator and the engine block. Properly install both dowels into the engine block and tap into place. Make sure both dowels are correctly installed; otherwise premature coupler wear can occur. Also replace the small belt and any pulleys that might show signs of wear.

In some instances, the alternator might not be bad, but the freewheel pulley may be damaged and needs to be replaced. You will need to remove the alternator from the vehicle to do this.

To remove the pulley, first remove the front cover and use special tools to hold the shaft and remove the pulley. Install the new pulley and torque to 80 Nm. ●

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First Gen Volvo C70 Window and Door Service

This article is going to cover what Volvo would call a classic car, as the first C70 that came out in the U.S. market was introduced in 1998. It came in two configurations—hardtop coupe and what many people think was Volvo's first convertible model. Well folks, Volvo did make a very small production run of convertibles in the early days.

Volvo's first foray into the top-down sports car market was the P1900. It was made with a custom fiberglass body from 1956-1957.

You probably will never see one in your shop because only 68 were produced.

The purpose of this article is to educate you about problems and repair procedures on early Volvo C70 (1998-2004) windows and doors, which can be more challenging and complex than most other Volvo models.

These cars are older but there are still a lot of them rolling around out there, especially the convertibles.

When working on these cars, you should use extra care because the plastic parts can be brittle and break easily.

You may have to move or disassemble other parts during the repair. Be sure to confirm availability of replacement parts with your local Volvo retailer. Such parts might include door weatherstrips and seals, which might be difficult to remove during disassembly.

History

Volvo unveiled the first generation C70 at the 1996 Paris motor show.

They followed by introducing it into the European market as a 1997 model, and a year later as a 1998 model in North America with a low-pressure turbo (2.4 L) and a high-pressure turbo (2.0 L and 2.3 L) turbocharged engine.

The C70 broke Volvo's decades-long styling tradition of boxy, rectilinear designs and was Volvo's first luxury coupe since the 780.

According to Peter Horbury, Volvo's design chief from 1991 to 2002, “With the C70, Volvo threw away the box, but 'kept the toy inside!'"

Volvo's vision was to design a convertible that would meet the needs of a family of four looking for comfortable blue-sky motoring in a vehicle also providing stylish looks, performance and faultless driving, and road-holding.

The C70's development program was only 30 months long, and designers and engineers started working with a Volvo 850 platform.

Volvo C70 Convertible/C70 (early years)

According to Volvo, the first Volvo C70 launched in 1997. It was a true two-door, luxury sports car convertible that combined high performance, high-level equipment and the highest safety standards. Designed for four adults, it included two pronounced, deeply contoured seats in the rear.

The engine alternatives were five-cylinder gasoline engines with output ranging from 163 to 240 bhp. This model was also produced as a coupe up until August 2002. The Volvo C70 convertible was manufactured at the Volvo plant in Uddevalla, Sweden.

Door panels coming apart

As these cars age, the glue and vinyl in the door panels can crack and shrink.

The door panel is made up of sections that are glued together at the factory. Over time, the glue can fail and the door panel parts can separate.

This does not mean you have to get a new panel or take it to an upholstery shop; in most cases, you can fix it yourself. A hot glue gun can come in handy here.

Previous Page: When you get a door panel that is coming unglued, you can often just repair it yourself with a hot glue gun. Make sure to use a heavy duty industrial glue stick; the ones that your kids use for arts and crafts won't cut it.

Door panel

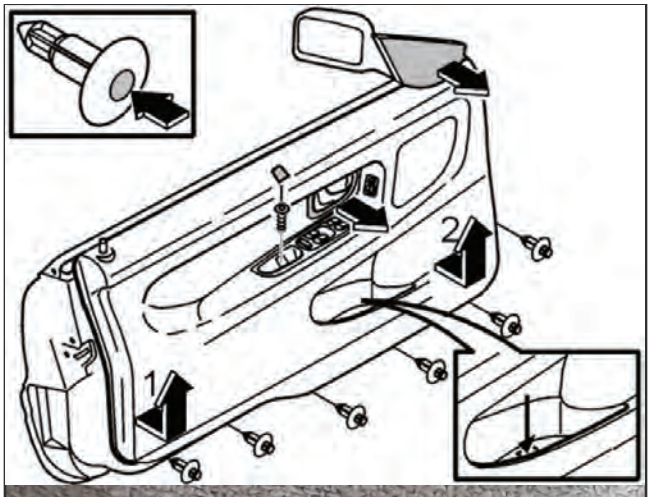
Removing the door panel

Remove one screw from the handle.

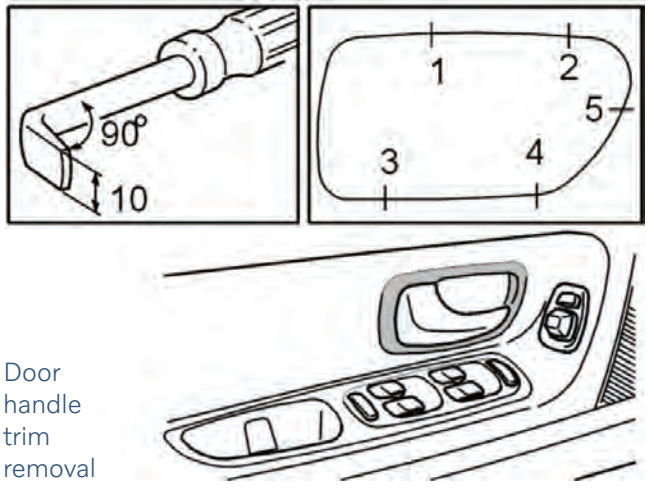
Use a screwdriver with a 10 mm wide tip. Bend the tip to an angle of 90 degrees.

Detach the surround in the order illustrated (next page).

Door panel removed



Remove the six press clips at the bottom edge of the door.



Door handle trim removal

Pry off surround carefully by pressing clips in towards the center of the surround and carefully pulling it outwards using the bent screwdriver.

NOTE

Protect the door panel.

Remove the:

- door mirror panel.
- six press clips at the bottom edge of the door.
- two press clips in the side of the door.

Pull out the bottom edge of the panel.

Lift out the panel. Start at the rear edge of the panel.

The panel is secured using two internal clips at the rear and front edges.

Lift up on the door panel.

The weatherstrip may come off with the panel on removal. Remove the smaller molding in the weatherstrip.

Press the control panel for the power window mechanism upwards by hand from the inside. Disconnect the connectors.

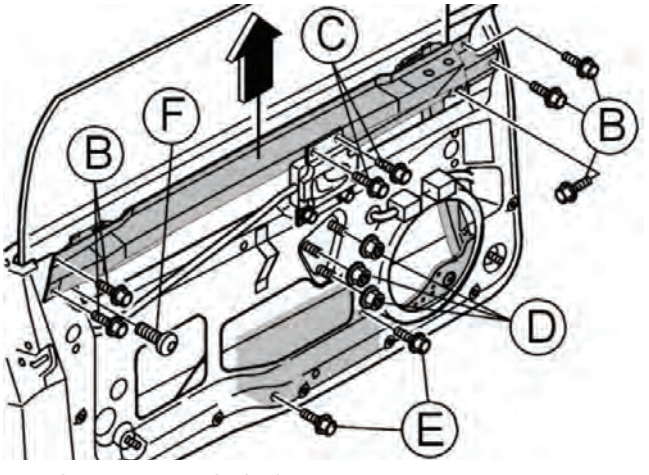
Removing the front power window lift mechanism cassette

NOTE

Check if the mounting screws have washers between the inner panel and the power window lift mechanism cassette. If this is the case, count the washers. Install the same number of washers for each mounting screw as were removed from between the inner panel and the power window lift mechanism cassette.

The window must be up to lift out the cassette. If the window is in the down position, because of a faulty motor or mechanical cable, the mechanical cable directly connected to the motor must be cut off.

C70 window motor and cable assembly



Window cassette bolt diagram

Replacing the lift mechanism motor and mechanical cable for side window

NOTE

The front adjustment screw must not press into the guide rail.

Remove:

- The connector
- Five screws for the loudspeaker
- Four screws (C) for the inner door opener
- The soundproofing mats (Hint: Scrape off the soundproofing mats using a plastic filler spatula.)
- One nut (D) and one screw (E) from the lock bracket
- The connector and the remaining nuts (D) for the lift mechanism motor
- The remaining screw (E) for the SIPS block in the bottom edge of the door
- Lift out the SIPS block

NOTE

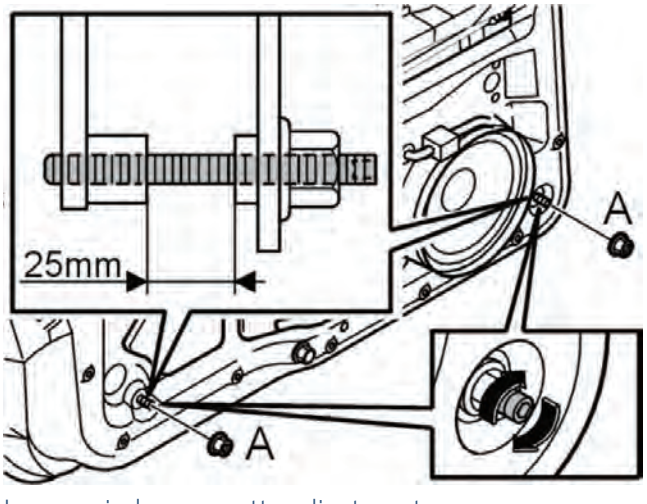
Certain cars between chassis numbers 329 and 604 have standard bolts and washers instead of adjustment screws. Replace with adjustment screws.

- The lock nuts (A) on both adjustment screws. Counter hold using a Torx screwdriver. Screw in both adjustment screws as far as they will go.

NOTE

The front adjustment screw must not press into the guide rail. Screw in lightly by hand until it engages.

- Six screws (B) and (F) in the upper edge of the door securing the cassette in the door.
- Lift out the power window mechanism cassette.



Lower window cassette adjustment

CAUTION

Take care not to damage the door panels when lifting the cassette out of the door. It is easier if two people lift the cassette.

Installing the front power window lift mechanism cassette

Lift the power window lift mechanism cassette into place.

CAUTION

Take care not to damage the door panels when lifting the cassette in. It is easier if two people lift the cassette.

NOTE

Turn the motor so that it is in the correct position before lifting in the power window lift mechanism cassette.

Screw out the adjustment screws so that there is a gap of 25 mm between the power window lift mechanism cassette and the adjustment screw. See the illustration.

Hint: Make a 25 mm spacer, using sheet metal for example, to facilitate measuring between the power window lift mechanism cassette and the adjustment screw.

Install the six screws (B) and (F) for the power window lift mechanism cassette in the upper edge of the door. The door must be closed before the five screws (B) and screw (F) are tightened so that good alignment is retained. Tighten the screws (B). Tighten to 25 Nm. Tighten the screw (F). Tighten to 6 Nm.

NOTE

The power window lift mechanism cassette is part of the collision protection system.

Hint: Use a thread sealant to secure the screws.

Install the lock nuts (A) on both adjustment screws. Counter hold using a Torx screwdriver.

Hint: Use a bent wrench.

Soundproofing panel

In order for the audio system to retain high sound quality and minimize road noise, it is important that the soundproofing mats in the doors are complete and properly bonded to the doors.

Adjusting the front side window vertically

When the door is shut, two things happen to the window:

1. The window is pressed against the weatherstrip.
2. Because of its design, the window is pressed upwards.

CAUTION

The window must be correctly adjusted so that it is not outside the trim strip when the door is closed.

The door mirror is adjusted last, after adjusting the window to the weatherstrips.

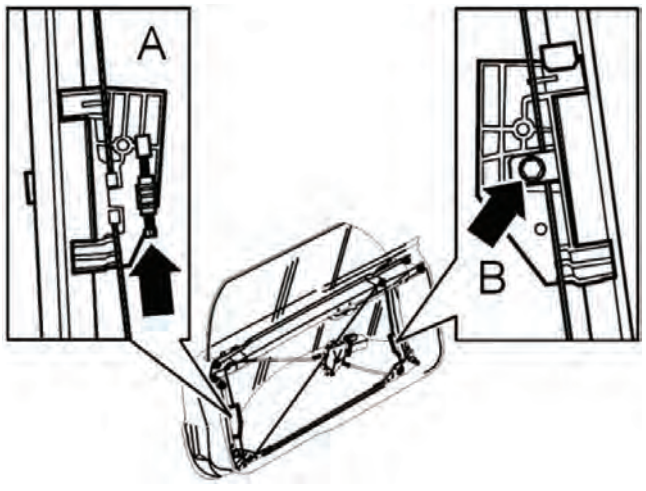
Adjust the upper window position when the cassette is in position in the door. The height can only be adjusted using an adjustment screw on the carriage.

The door panel must be removed before any adjustment can take place.

Original position:

- The height adjustment screw must be in the same position as it was when the cables were removed.
- The carriage (B), without an adjustment screw, must not be tightened next to the cable. (Refer to the "C70 window diagram" image.)

Front window cassette adjustment bolt



C70 window diagram

Reconnect the motor connector and switch on the ignition.

Run the window up so that the adjustment screw on the carriage (A) is just in contact with the stop at the top of the door.

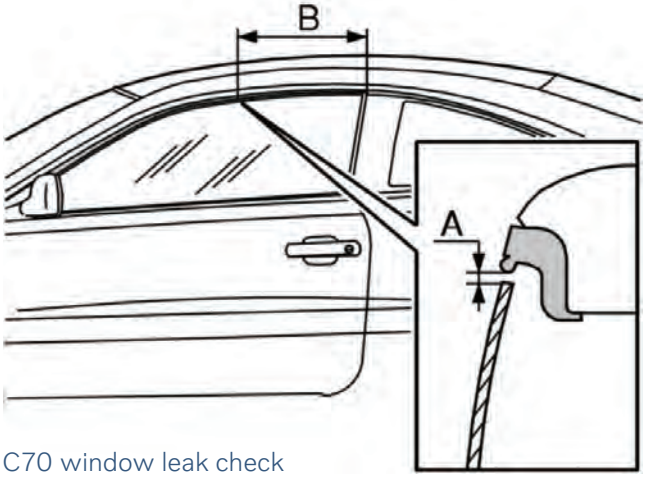
The front stop must stop 2 mm before the rear stop. If the front stop stops first, the motor continues so that the rear stop reaches the top.

The distance between the rail lower edge and the lower edge of the carriage should be 25 mm greater than the corresponding distance at the other carriage. Replace the lift mechanism motor and mechanical cable for side window.

Mark the cable at the bottom of carriage (B) with a marker pen.

Run the window down a little.

Tighten the screw that locks the carriage (B) to the wire by the mark.



C70 window leak check

If necessary, adjust the adjustment screw on the carriage (A).

Align the door mirror so that there is a straight line between the door and the door mirror. Check the seal between the door mirror and the weatherstrip. Check for leaks between the window and weatherstrip (see "Checking the seal, front side window").

During the closing movement of the door, when the window passes the outer edge of the rubber strip, the distance (A) should be 2-4 mm vertically between the window and molding. Measure 350 mm from the rear edge of the side window (B). These measurements can be seen in the image, "C70 window leak check."

Adjusting the front side window laterally

The window can be adjusted laterally using two screws in the lower edge of the cassette.

The door panel must be removed before any adjustment can take place (see Components front side door, replacing).

Adjusting the rear side window vertically

The rear side panel must be removed before any adjustment can take place.

Window stop adjuster

The rear side window can be adjusted by moving the stop lug up or down as illustrated.

Check for leaks between the rear side window and weatherstrip.

Adjusting the rear side window laterally

Begin adjusting the window so that it contacts lightly on the corner of the C-post trim and on the weatherstrip on the rear side window. Then adjust the window so that it lies against all the C-post trim, down to the B-post in the same way.

Check for leaks between the rear side window and weatherstrip.

Adjusting the rear side window longitudinally

The rear side panel must be removed before any adjustment can take place.

There is a certain amount of leeway in the mounting of the window in the power window lift mechanism cassette.

A good way to check if you have the window glass adjusted correctly is to close the window on a dollar bill. If the window is correctly adjusted you should be able to feel drag when you pull it out.

There should be 4-6 mm of clearance between the front and rear side windows (B-post) when the door is closed and the windows are completely raised.

Checking the seal, front side window

Check that the window makes a seal with the weatherstrip around the door opening. Fold a piece of paper in two and pull it out. It should be hard to pull the paper out but not so hard that the paper rips.

The force required should be between 8-22 Nm. Check that the window is in contact with the weatherstrip all the way around the window with the paper.

Spray water over the upper section of the B-post weatherstrip.

Close the door to the first catch point. The door must not be shut completely.

The corner of the window should lie against the B-post trim.

A water bead should form if the window is sealed to the weatherstrip. The water bead should be 20-50 mm long. The width and shape of the water bead can vary by between 3-6 mm.

If the door is not sufficiently tight, adjust the window.

Spray water over the whole B-post weatherstrip.

Close the door completely.

The rear of the window should lie against the whole of the B-post weatherstrip.

A water bead should form if the window is sealed to the weatherstrip. See the illustration. The water bead should start a maximum 10 mm under the upper edge of the window and all the way down the B-post. The width and shape of the water bead can vary by between 3-10 mm.

If the door is not sufficiently tight, adjust the window. Repeat the vertical and side to side adjustment until the window is correctly positioned against the weatherstrip.

When the window is in the correct position, lock the adjustment screws with the lock nuts at the lower edge of the power window lift mechanism cassette.

Adjusting doors

The doors must be easy to open and close.

The edges of the door must be flush with the car exterior.

The front edge of the door must be 0-1.5 mm inside the front fender, and the rear edge of the door should 0-1.5 mm outside the bodywork.

The door length can be adjusted by installing or removing shims on the upper and lower hinges.

0.3 and 0.5 mm shims are available as replacement parts.

Adjusting the striker plate

Check to see if the striker plate and latch pin have excessive wear before you attempt to adjust the striker plate. If the parts are too worn, it may be time to replace them.

A striker plate or latch pin that is too worn may not be able to be adjusted enough to ensure reliable door latch operation.

The door must not rest on the striker plate. The striker plate must not press the door upwards.

There are rectangular holes in the striker plate. Slacken off the striker plate screws just enough to allow the striker plate to be moved stiffly.

Hold the handle out while closing and opening the door. Repeat until the striker plate is correctly adjusted.

Then tighten the striker plate screws.

Check the function of the lock by opening and closing the door.

Adjusting the travel of the external door handle

Insert the key into the lock and turn it so that the lock rod is out of the way of the screwdriver.

Adjust using a Phillips screwdriver.

Hint: If it is incorrectly adjusted, it may not be possible to open the door from outside.

Yes, these cars are becoming rarer every year. But, if you have the opportunity to work on one of these unique Volvos, you should read up on them before performing any repairs on the doors or windows. ●

Volvo Electronic Parking Brake (EPB) Systems, Repairs and Service

Volvo adopted the use of an electronic parking brake system on the 2007 S80 V8 and subsequently on the V70, XC70, and S80 T6 models. All Volvos 2015 and newer in the North American market are equipped with electronic parking brakes.

Volvo is, of course, not the only auto maker using these parking brake systems; a lot of other manufacturers have this option installed in their higher-end models as well.

A lot of technicians wonder, why the change from the old reliable parking brake systems that used a lever, cables and shoes?

Is it safer? In some cases, yes.

Is it a cheaper system? No.

Is it more reliable in some cases? Yes.

But the most likely answer is the same reason for a lot of the electronic CAN networked systems that have replaced older technology.

It's all about weight savings, which affects efficiency, and the big one—emissions.

You may get some customers coming into your shop with complaints about the electronic parking brake system not working right. When you check it, there will be no stored codes and the system will work flawlessly for you.

So customer education will be a big part of your job in the future.

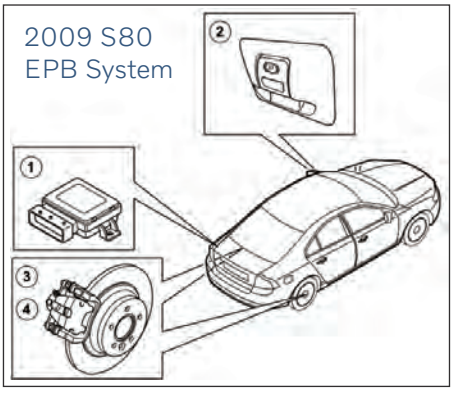
EPB Caliper Switch

Previous page: Electronic parking brakes are not new, but they may be new to your customer. With customer complaints about these systems, a lot of issues can be traced back to customers that don't really know how to use these systems.

The Volvo EPB system uses a networked control module that is mounted near the Rear Electronic Module (REM) in the back of the car.

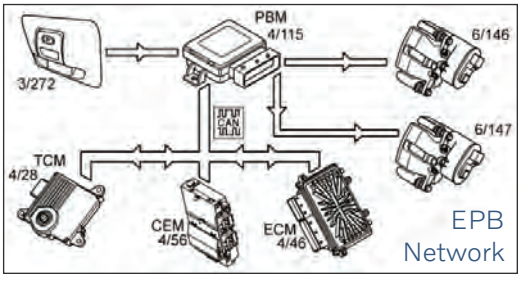
The system can be activated by the driver with a switch or, in some cases, the parking brake can be activated automatically by the control unit when the car is turned off and parked.

In most of the later models that are equipped with the electronic parking brake system, the parking brake can be set up to use the "hill holder" function that will apply the parking brakes temporarily when the car is stopped on a hill. This prevents the car from rolling backwards, and the parking brake will automatically disengage when the driver takes their foot off the brake and steps on the accelerator pedal.



How it works: Activating/deactivating the parking brake in stationary vehicles

Vehicles are defined as stationary up to a speed of about 2 miles per hour. It is always possible to manually activate the parking brake. When the driver presses the parking brake switch (3/272), an analog signal is transmitted to the PBM (4/115), which activates the electric motor in the brake caliper (6/146-147). This, in turn, presses on the brake pads to deactivate (release) the parking brake. The parking brake module requires information about the following:



EPB Network

- Signal from the parking brake switch
- Start switch (start button) must have been activated or the engine must be running. Information about this is retrieved from the Central Electronic Module (CEM) (4/56) via the CAN network.
- Signal from the clutch pedal sensor or, alternatively, the brake pedal sensor.

The ECM (4/46) supplies information about the clutch pedal position. The ECM supplies information about the position of the brake pedal (applies to vehicles with manual transmission).

- Signal from the brake pedal sensor. The BCM (4/16) supplies information about the position of the brake pedal (applies to vehicles with automatic transmission).

The PBM retrieves information from the above control modules by reading messages on the CAN network. If all conditions are met, the PBM activates the electric motor in the brake caliper and releases the brake pads.

Automatic deactivation of the parking brakes

This means that the parking brake is automatically released when the driver drives off. A condition for this is that the parking brake was activated when the car was stationary. The following information about the vehicle is required for the PBM (4/115) to release the parking brake at the right moment:

- Current gear (only automatic transmission), from TCM (4/28) via the CAN network.
- The engine torque, from the ECM (4/46) via the CAN.
- The vehicle angle, from the vehicle angle sensor in the PBM.
- The clutch pedal position (only manual transmission), from the ECM and CEM (4/56) via the CAN network.
- The gas pedal position from the ECM via the CAN.

The PBM uses the information above to calculate when the engine torque is sufficient for the vehicle to be stationary when the parking brake is released.

Activating/Deactivating the parking brake when moving

It is possible to activate the parking brake while moving, that is to say at speeds exceeding about two miles per hour. But this is an emergency function which must only be used when the normal brakes are not functioning.

The condition is when the parking brake switch (3/272) is activated for the duration.

The ABS function is used to prevent overloading the parking brake and to quickly reduce the speed.

In order for activation of the parking brake while moving to be possible, the function of automatic deactivation when stationary must have been used.

When activating the parking brake when moving, the PBM (4/115) will transmit a request to the BCM (4/16) via the CAN network to brake the vehicle using the ABS function. When the speed is less than about two miles per hour, the PBM will take over the braking by activating the electric motor in the brake calipers (6/146-147).

There is a little known feature of the Volvo electronic parking brake system that the customer can use in the case of an emergency (it should only be employed if the regular brakes have failed). If the hydraulic brakes fail and the car is moving at speed over about 2 miles per hour, the parking brake can be activated if the customer is pressing down on the regular brake pedal when they press the EPB switch.

Rolling brake test

The PBM has a function for a rolling brake test. The rolling brake test is used to check the function of the electrically operated parking brake, such as during the annual vehicle inspection.

The following conditions must be fulfilled for three seconds before the test and remain during the test for PBM to allow a rolling brake test:

- Speed front wheel: 0 miles per hour.
- Speed rear wheel: a little over 1 mile per hour to about 8 miles per hour.
- Ignition on/engine running.
- No trouble codes related to parking brake switch, electric motor in brake calipers, or speed signal from the BCM.

Remarks

If conditions for the rolling brake test are not met when the parking brake switch is activated, then the PBM will perform normal application of the parking brake.

There are two different ways to activate a rolling brake test:

- **Activate (hold in) parking brake switch.** When parking brake switch is activated, then the PBM will activate the electric motor in the brake calipers (6/146-147). This presses on the brake pads until minimum required brake force is reached. Then the brake force increases automatically every third second until the system's maximum limit is reached. Increase of the brake force occurs in steps for a total of approximately ten seconds.
- **Activate (press in) parking brake switch repeatedly.** Activate (press in) parking brake switch once. When the parking brake switch is activated, the PBM will activate the electric motor in the brake calipers (6/146-147), which presses on the brake pads until minimum

Retailer Technical Journal 18923
Electrically Operated Parking Brake Module (PBM) - Not possible to release or apply

Issue Date 07-27-2009 Reference: VIDA, VSTG

NOTE

If using a printed copy of this Retailer Technical Journal, first check for the latest online version.

Affected Vehicles

Model	Type	MY	Chassis Range
S80	125	2007-2009	000850 – 097649
V70	135	2008-2009	000395 – 085643
XC70	136	2008-2009	000400 – 057782

Description

When diagnosing an electrically operated parking brake that will not apply or release or a Parking Brake Module (PBM) that is not responding, attention should be paid to which Diagnostic Trouble Codes (DTCs) are set.

SERVICE

If this symptom exists and any of the following DTCs are set (Brake Control module (BCM)-U012800, Central Electronic Module (CEM)-U012800, Driver Information Module (DIM)-U014000, Park Assist Module (PAM)-U042200), replace the PBM and download the PBM Reload according to VIDA:

- INFORMATION
- Removal, Replacement, and Installation
- Parking Brake Module
- REPAIR
- Brakes
- Parking brake
- Brake control

See the latest version, online, for warranty claim information.

required brake force is reached. With repeated activation of the parking brake switch, the brake force increases in steps until the system's maximum limit is reached.

Most technicians will only deal with these systems when they have to retract the calipers to replace the rear brake pads and/or rotors because the majority of these electronic parking brake systems are very reliable.

But as these cars get older and the miles get higher, these cars can begin to exhibit problems with these systems.

A lot of problems most shops see in the Volvo EPB systems will manifest in the calipers not being able to retract or the actuator motors sticking; in some rare cases, an EPB module can go bad.

Volvo has issued multiple Technical Journals that are related to possible problems with EPB systems.

So, as always, it's a great idea to check for these when you are working a Volvo that has an issue in the EPB system.

Here is one that has to do with an issue that may be caused after you use VIDA to download a software package to the EPB module.

This will need to be done when you replace the EPB control module.

The switch can fail but, if this happens, in most cases, a bad switch will leave the calipers in the disengaged position.

When the EPB switch fails, it may generate fault codes in the EPB control module and the CEM. A failed EPB switch will usually display a fault warning in the LCD screen on the DIM or instrument cluster.

Service: Check the parking brake

Check to see if it is possible to release the parking brake with the parking brake switch or by using the fault tracing function.

Is the parking brake released?

- Yes - Troubleshooting complete
- No - Release the parking brake with the special tool

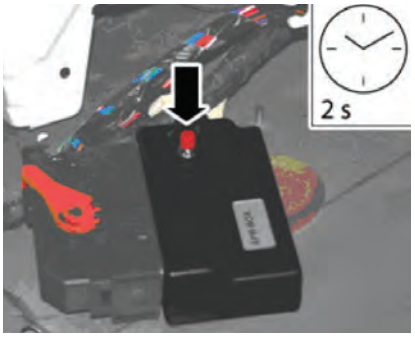
Release the parking brake with the special tool

NOTE

Some variation may occur in the images; however, the essential information in the illustrations is always correct.

Remedy in the following order:

1. Ignition off.
2. Expose Parking Brake Module (PBM).
3. Unplug the connector for the Park Brake Module (PBM).
4. Connect the special tool to Parking Brake Module (Use Volvo special tool marked EPB-BOX part number 9513014).
5. Hold the button on the special tool pressed in for two seconds.
6. Disconnect the special tool from the connector.



EPB Tool

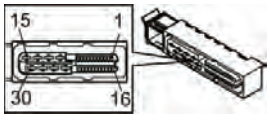
NOTE

Do not plug in the connector for the Park Brake Module (PBM).

EPB Diagnostics

U =	DC voltage in volts (V)
U_{bat} =	Battery voltage (V)
U_{low} =	Voltage approximately 0V
PWM =	Pulse width modulated signal in %
U_{AC} =	AC voltage in volts (V)
f =	Frequency in Hertz (Hz)
t =	Time in seconds
% duty =	Duty cycle (pulse ratio in percent (%))

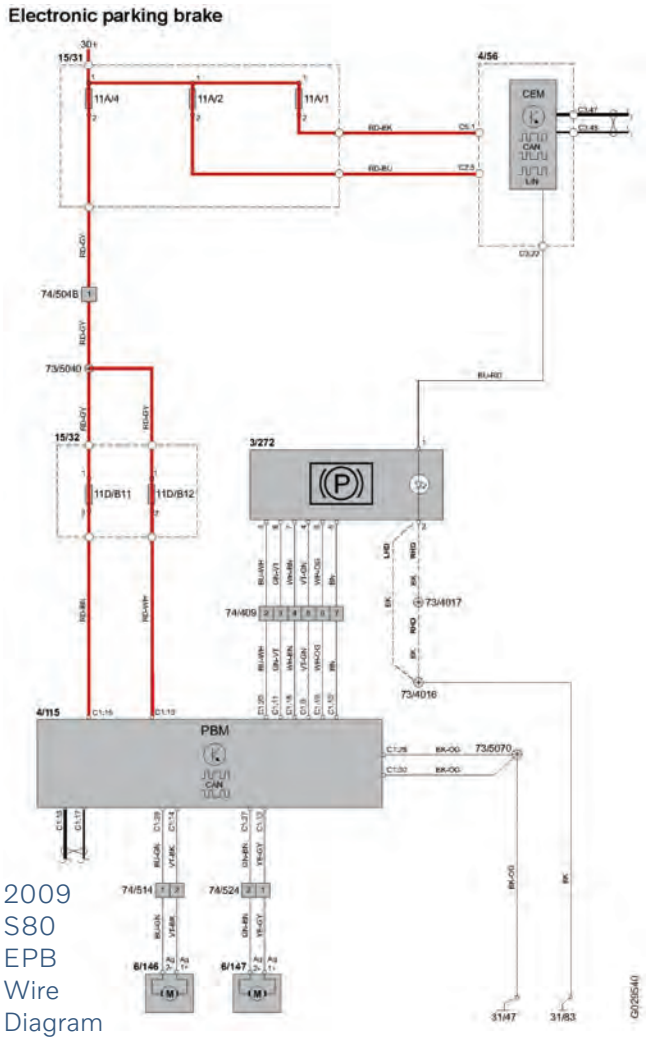
Checking the supply voltage/ground terminal voltage feed parking brake module



EPB Connector View

The PBM is supplied with voltage via two voltage inputs on the control module.

1. Power input 1 terminal #C1:13 (#13) is supplied with +30 via a fuse in the rear relay/fuse box (RJB) from the battery. The input also supplies voltage



2009 S80 EPB Wire Diagram

Caliper Piston

to the right brake caliper. In the case of an open circuit, the right brake caliper will not be activated.

2. Power input 2 terminal #C1:15 (#15) is supplied with +30 via a fuse in the rear relay/fuse box (RJB) from the battery. The input also supplies voltage to the left brake caliper.

In case of open circuit, the left brake caliper will not be activated.

Checking the power supply

Check the voltage feed cable from the battery to the PBM #C1:13 (#13) and #C1:15 (#15) for open circuit, loose connection, or contact resistance and oxidation. Check the fuse. The voltage must be approximately battery voltage.

Ground connection for the Parking Brake Module (PBM)

The PBM has two ground inputs. Both ground inputs from the control module are connected via two separate ground leads to the same ground connection in the body. See the relevant wiring diagram for further information about the ground terminal.

- Ground input 1, #C1:28 (#28) is power ground and is connected to the ground connection in the body.
- Ground input 2, #C1:30 (#30) is power ground and is connected to the ground connection in the body.

Checking the ground terminal

Check the ground cables between the PBM #C1:28 (#28), #C1:30 (#30) and ground connection for open circuit, loose connection, contact resistance and oxidation. At ignition on, the voltage drop between the PBM ground connection and chassis connection may not be greater than 0.5 volts. Remedy as necessary.

Brake pad replacement

Replacing the rear brake pads on a Volvo that is equipped with electronic parking brakes is not that different from any car that has caliper pistons that have to be screwed in with a tool to open them.

The difference is that you will have to use a scan tool with bi-directional control, like Volvo's VIDA.

You can also use Volvo's EBD BOX (part number 9513014) to retract the caliper motors.

Once the calipers are in service position, you can use Volvo special tool 9995782 or the equivalent to push back the caliper pistons and replace the pads as usual. ●

Volvo brake caliper tool 9995782

Parking brake (EPB), Not possible to get brake caliper in service position

No: TJ 27500.6.0
Func Group: 5127
Func Description: Brake caliper
Partner: 3 US 7510 Volvo Cars North America
Issue Date: July 08, 2016

Vehicle Type

Type	Model Year	Plant	Chasis range	Struc Week Range
124	2008-2016		0000001-0200260	200720-201614
134	2011-9999		0000001-9999999	201020-999952
135	2008-9999		0000001-0377263	200720-999952
136	2008-2016		0000001-0274097	200720-201619
137	2016-9999		0000019-9999999	201524-999952
138	2016-9999	36	0000122-9999999	201345-999952
155	2015-9999		0000001-9999999	201348-999952
156	2010-9999		0000001-9999999	200835-999952
157	2015-9999		0000022-9999999	201450-999952

Customer Symptom Codes (CSC)

Code	Description
PK	Parking brake/No/reduced/ incorrect function
WS	Parking brake/Difficult to operate

Diagnostic Trouble Codes (DTC)

Code	Description	Fault Type
PBM	C200577	Intermittent
PBM	C200677	Intermittent
PBM	C200671	Intermittent
PBM	C200571	Intermittent

Description:

If the vehicle is equipped with Electrical Parking Brake (EPB), it is required to retract the rear caliper brake pistons by a special service command in VIDA when replacing the rear brake pads.

It may happen that the brake piston does not retract at all or does not retract completely, which makes it impossible to remove the rear brake pads from the caliper due to one of the following reasons:

- An electrical failure or a communication error between VIDA and PBM and caliper actuator.
- A seized piston, probably due to excess wear on the brake pads causing the piston to have an unsuitable angle to fit the caliper housing, which causes a wedging/racking condition.

NOTE

The PBM unit shuts off the electrical current to the caliper actuators if the electrical draw is above 1A for more than 5 seconds.

NOTE

Vehicles with EPB can be identified with VDN code NE02.

PBM= Parking Brake Module

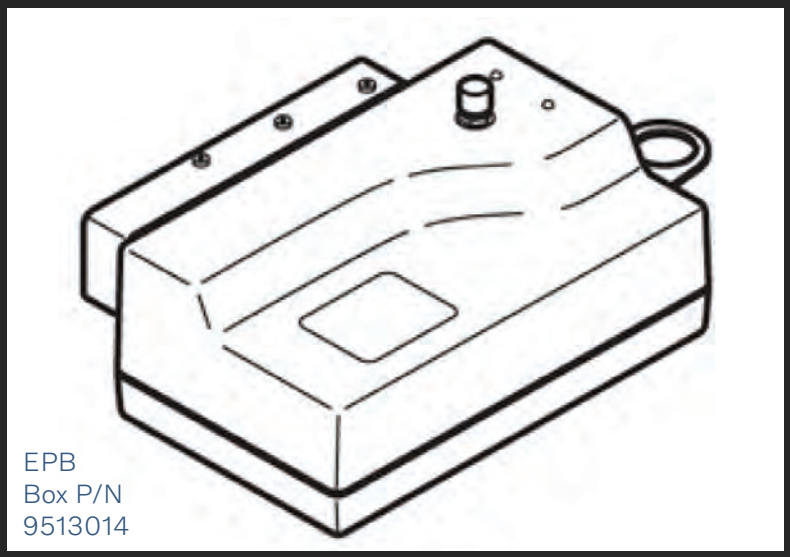
EPB= Electronic Parking Brake

DTC=Diagnostic Trouble Code

Service:

If the actuator does not respond from VIDA command (there is no sound from actuator), then try this:

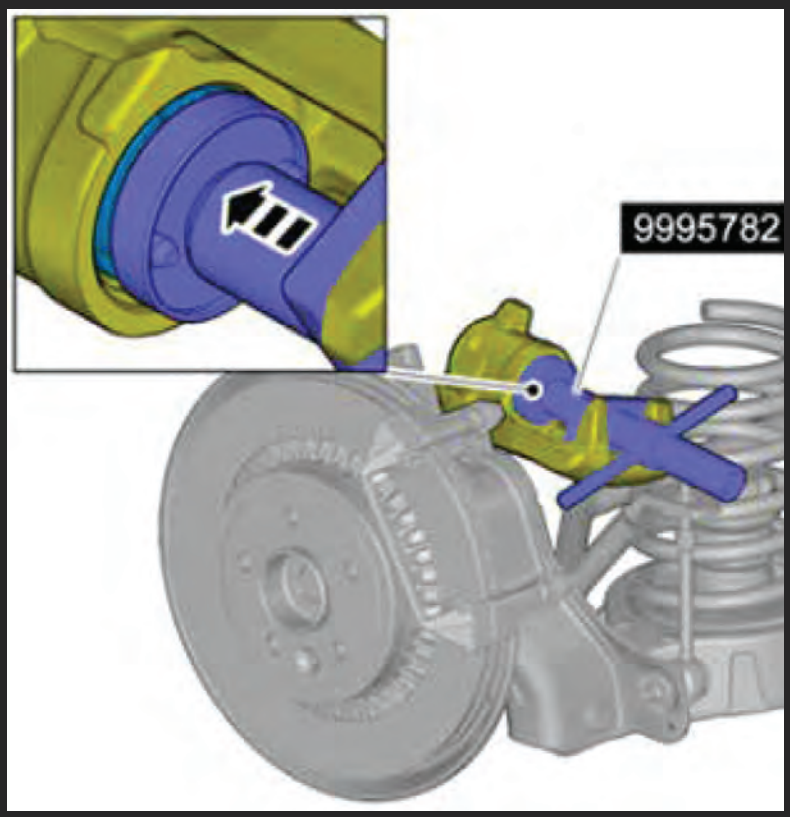
- Release the EPB by using the tool PN 9513014 , which overrides PBM control unit.
- If the tool is not available, try to close all doors, lock the car, wait at least one minute, unlock the car and open one door and try again with VIDA activation; repeat if necessary.
- Fault trace any DTCs according to VIDA (including wires/terminals etc.).



EPB
Box P/N
9513014

If the actuator starts to retract the caliper pistons, but stops before the pistons are fully retracted, then try this:

- Blow clean the caliper/ actuator with high pressure air.
- Remove the actuator from caliper housing by loosening the two screws.
- Check the caliper to see if the activation shaft has been rewound, if neccessary manually screw back the activation shaft clockwise by using a suitable torx screw drive (refer to the TJ for video).
- Reinstall the actuator to the caliper.
- Push the piston into caliper housing all the way once the activation shaft is fully returned.



NOTE

If needed, use special tool 9995782 (refer to image on right).

NOTE

Replacing the rear brake pads before they are totally worn down will reduce the risk for having a seized caliper piston.

Volvo Suspension and Comfort Ride

Control arm with bushing

Like all vehicles nowadays, the suspension has changed through the years and Volvo is no different.

In this article, we will go over the Volvo suspension systems through the years, how they have changed, what problems occur and how to remedy those problems.

Some common signs of suspension problems include:

- Pulling to one side when driving.
- Feeling every bump in the road.
- One side or corner sits low.
- Diving, rolling, and/or squatting, especially when sharp turning.
- Difficulty when steering. Steering becomes difficult, especially when driving at low speeds; this means that there might be a problem with the suspension or steering systems.
- Leaky or oily shock absorbers.

Ball joint connected to control arm

So now to diagnose these problems; this can sometimes be tricky, especially if more than one part is worn.

Pulling to one side could be a tire problem, or a worn out tie rod or ball joint. To check these problems, the best way is to raise the vehicle up on a hoist and move each front wheel back and forth to see if there is any play.

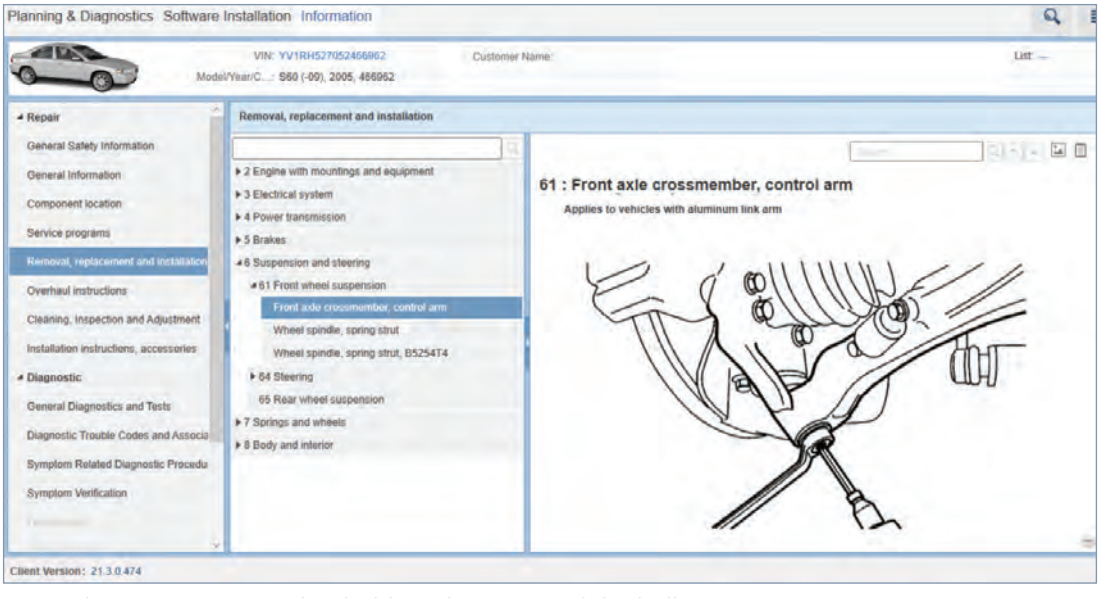
Volvo has some ball joints that are part of the control arm and others that are separate and are bolted into place.

To replace a ball joint on a S60 2001-2009, first remove the front tire. You will need to remove the bottom nut at the ball joint. If equipped with aluminum control arms, use a Torx bit to hold the center of the ball joint while removing the nut.

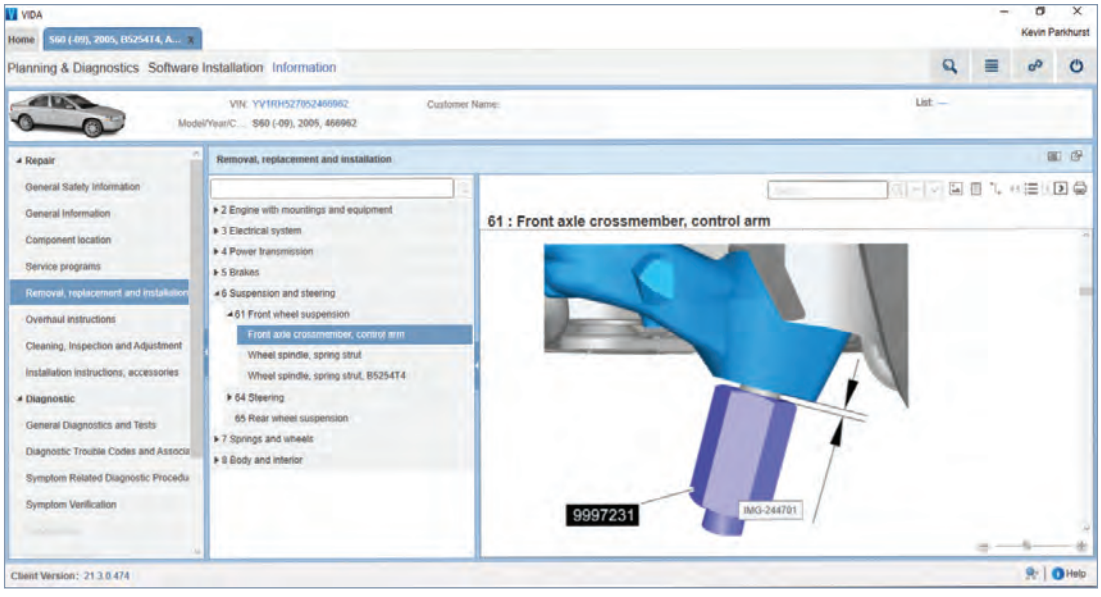
If the control arm is steel, remove the nut and use Volvo special tool 9997231 and screw it onto the ball joint, leaving 1.5 mm between the control arm and the tool. Now use tool 9997062 and fit it around the control arm and use special tool 9997231 to release the ball joint from the control arm.

Now use Volvo special tool number 9997076 to pull down on the control arm to release the control arm from the ball joint.

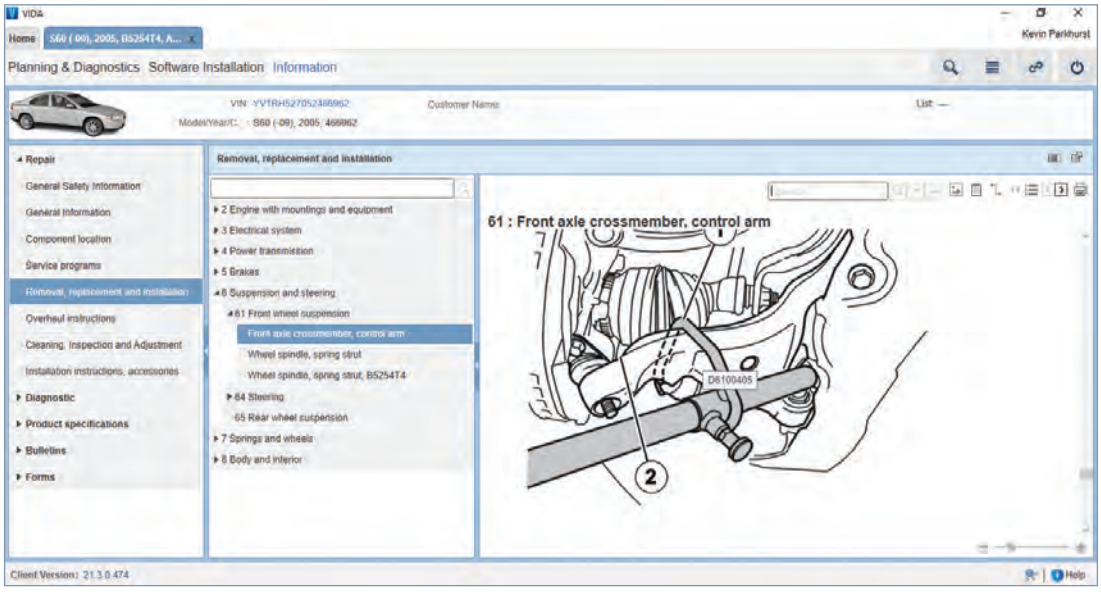
Remove two bolts at the ball joint, and depending on which type of control arm you're dealing with, use adapter special tool number 9997148 if aluminum, and if steel, use special tool adapter 9997230. Both will connect to slide hammer tool number 9992709 and will pop out the ball joint.



Control arm Torx T25 socket holding the center of the ball joint



Volvo special tools 9997231 and 9997062



Use special Volvo tool number 9997076 to pull down on the control arm

Clean the surface of the ball joint with a wire brush and install a new ball joint into place using guide pin tool number 9995781. If the control arm is aluminum, the guide tool will install with a wrench gripping at the bottom; if steel, turn the guide tool around with the wrench gripping at the top of the tool.

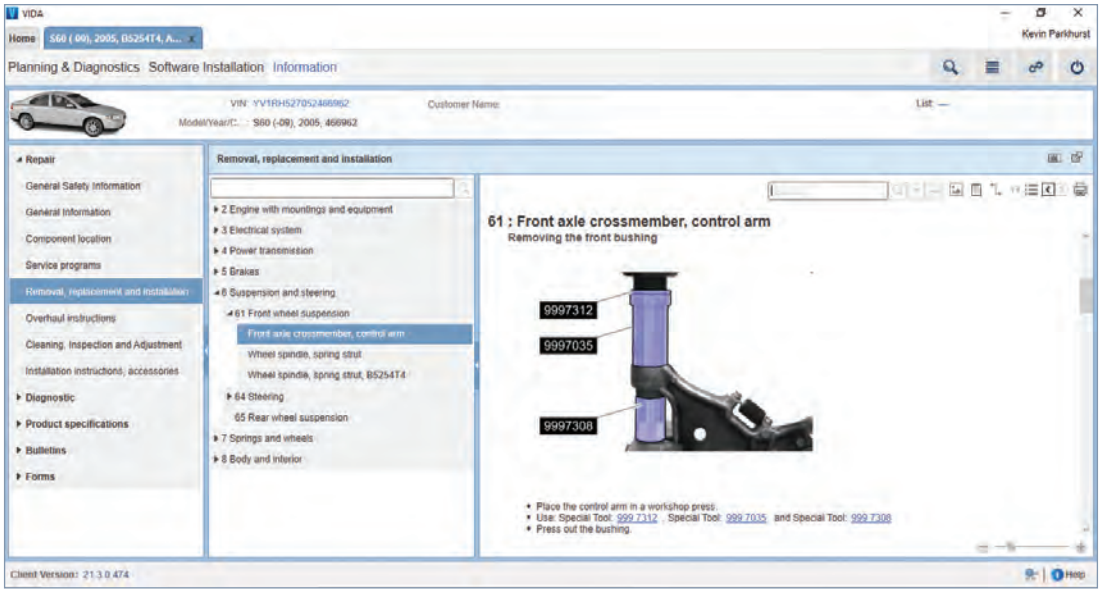
Tighten the guide tool securely and use tool number 9995796 to fit around the ball joint. Knock in the ball joint with a brass hammer, being careful not to damage anything. Install the two bolts and tighten down.

Use the special tool number 9997076 to pull down on the control arm to fit the ball joint into place. With an aluminum control arm, use tool number 9512927 to hold the ball joint into place so as not to damage the rubber boot and torque down to 50 Nm. For steel control arms, use tool number 9995467 to torque down the ball joint nut.

Install the tire and test drive. It's always a good idea to do a wheel alignment after doing any suspension repairs.

Control arm bushings that are worn out can cause the front end to float around and when turning tight, feels like it's over turning.

To replace control arm bushings, you will need to remove the control arms from the vehicle. To do this, you will need to remove the ball joint nut and remove the bolts through the sub frame to the control arms. To make this a little easier, use a scissors jack and lift the



Control arm set up with both removal of bushing and installation of bushing

Special tools number 9995460 and 9995716 holding up the engine and transmission

engine up a bit to expose the bolts at the sub frame and remove.

Once the control arms are removed from the vehicle, the old bushings will need to be pressed out and new ones pressed in. The tools to press out are Volvo tool number 9997312, 9997035 and 9997308. To press bushings in, use Volvo special tool number 9992852 and 9997308.

When installing front bushings in the control arms, make sure each bushing is in the correct position.

Correct position of bushing in control arm. Use tool 9995624 and 9997209 to press out the old rear bushing. For pressing the new bushing in, use the same tools as pressing out.

Make sure to do both sides when replacing bushings. Install control arms and, once again, its always a good idea to align the vehicle after any suspension repair.

Sub frame on Volvo

The sub frame on these vehicles consists of four mounting areas that have sub frame bushings. The four bushings through the years start to wear from all the weight and movement of the vehicle. To replace all four of these bushings, it might be a good idea to remove the sub frame from the vehicle.

To do this, you will need a Volvo special tool to hold up the engine and transmission. This will be the first thing you will need to do.

Raise the vehicle in the air and remove the front wheels. Remove the bolts from all three engine mounts; also remove the bolts that hold the steering rack into place. Remove the nuts that hold the ball joint to the spindle. Disconnect the sway bar links. Remove the mount from the sub frame to the transmission. Remove the bracket at the exhaust at the rear of the sub frame.

Position a transmission jack under the sub frame so that it won't fall out. Remove the four sub frame bolts and the four bolts at the bracket at the rear of the sub frame. Start to lower the sub frame. Now you can disconnect the bracket at the oxygen sensors and set aside. On the front side of the sub frame, remove the screw that holds the electrical harness and the power steering hose bracket.

Use tie straps and hold the steering rack up so when the sub frame is lowered, the steering rack won't be hanging.

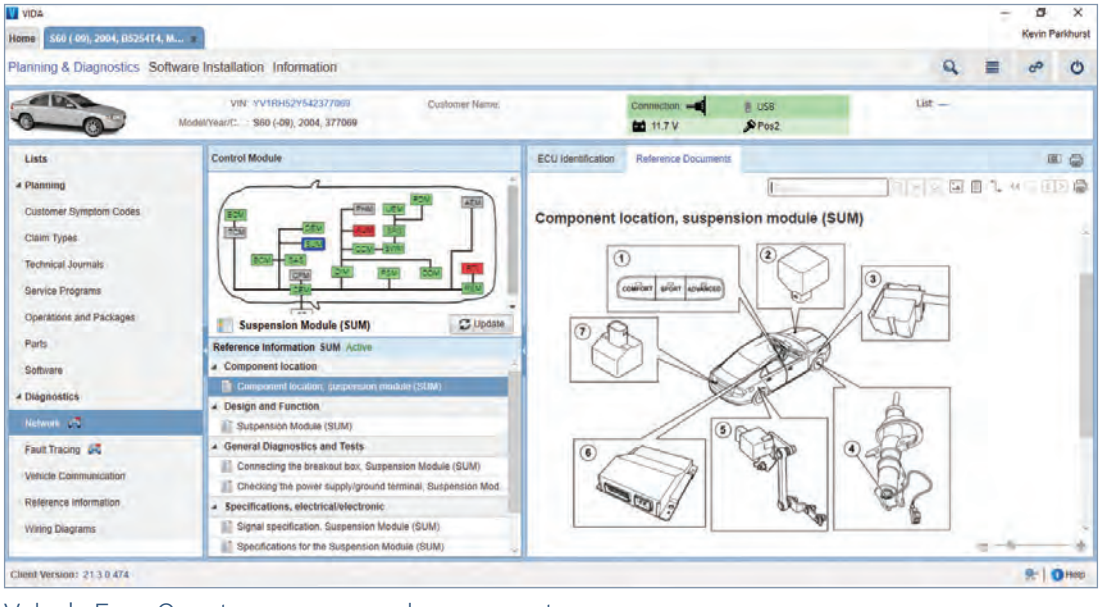
Reinstallation

Lower the sub frame enough to be able to remove and replace the sub frame mounts. Once the sub frame mounts are replaced, you will need to lift the sub frame up and connect the bracket at the electrical wire harness and the bracket for oxygen sensors, making sure the oxygen sensor wires are not hitting against the exhaust.

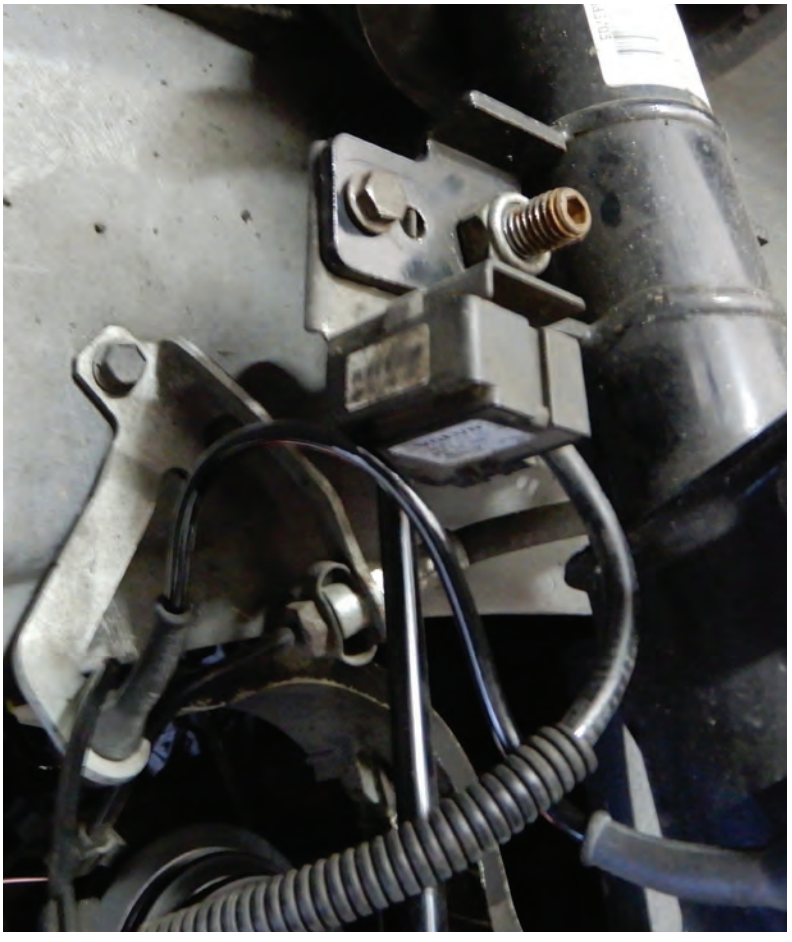
Lift the sub frame up and set the steering rack into place. Insert the four sub frame bolts, making sure to align the ball joints, just to make the job a little easier and install the ball joint nuts and tighten.

Tighten the sub frame bolts and the four bolts at the bracket at the rear of the sub frame. These bolts are stretch bolts and need to be replaced and

Control buttons for the system are located on the dash inside the vehicle



Volvo's Four-C system sensors and components



Acceleration sensor at front strut

2006 Volvo S60R front and rear struts with electrical connections

tightened correctly. Attach and tighten the exhaust bracket.

Install the nuts for the steering rack and tighten. Secure the sway bar links. Install the bolts for the engine mounts and tighten. Install and torque the mount from the sub frame to the transmission. Install the tires and lower the vehicle.

Remove the tool from the top of the engine. Test drive to make sure the vehicle sounds and feels good on the road.

After any suspension work, it's always a good idea to align the vehicle.

The Volvo Four-C Suspension

The Four-C Suspension Volvo introduced in their S60R was the most active suspension of any vehicle in the world. The Four-C (Continuously Controlled Chassis Concept) system has sensors on the chassis to measure the rotation speed and vertical movement of each wheel, steering wheel deflection and velocity, cornering, engine torque, and braking interventions by ABS and DSTC.

The controls for Volvo 4-C suspension are located on the dash of the vehicle.

This computerized system has a sophisticated microprocessor that computes the motion of the vehicle and adjusts the struts and shocks to ride smoothly. The Four-C system not only adjusts the struts and shocks, but also communicates with the ABS system. The sensors in the vehicle can receive braking information a few milliseconds before the brake pads touch the disc.

The Four-C system works with the ABS and the DSTC in a unique way, making the driver in full control of the ride they want.

The system consists of:

1. Switch
2. Acceleration sensors on the body, with two in the front
3. Acceleration sensors in the suspension, one at each front wheel

4. Damper solenoid one at each strut/shock, four total
5. Position sensors, one at each rear wheel
6. Suspension Module (SUM)
7. Acceleration sensor, one in the rear of vehicle.

The Volvo Four-C system is a highly advanced suspension system that makes driving safer and more pleasurable.

When the car is accelerating, Four-C receives the upcoming information from the longitudinal acceleration sensor. Similarly, the system passes on information about a sharp deflection of the steering wheel a few milliseconds before the car actually changes direction.

Replacing rear struts and springs on a 2007 Volvo S60

Lay down the back seats and open the trunk; remove the carpet to expose the top of the shock mount. Remove the bolt with washer on each side and raise the vehicle.

Remove the mud guard at the bottom of the control arms and the lateral link on both sides. Remove the two bolts on each side that secure the strut to the vehicle. Using a come-along or a retaining strap, connect to each control arm, and compress with slight pressure.

If vehicle is equipped with Four-C, be sure to disconnect the electrical connector and feed it out of the way.

Remove the bolts at the bottom of the struts that connect the shock to the control arm. Now you can wiggle the complete strut/spring assembly out of the vehicle. Before disassembling the spring strut, be sure to mark the rubber shim and spring seat.

Secure complete strut assembly in a vise or use a wall mounted spring compressor, and compress the spring. Use Volvo tool 9995500 to remove the nut at the top of the strut.

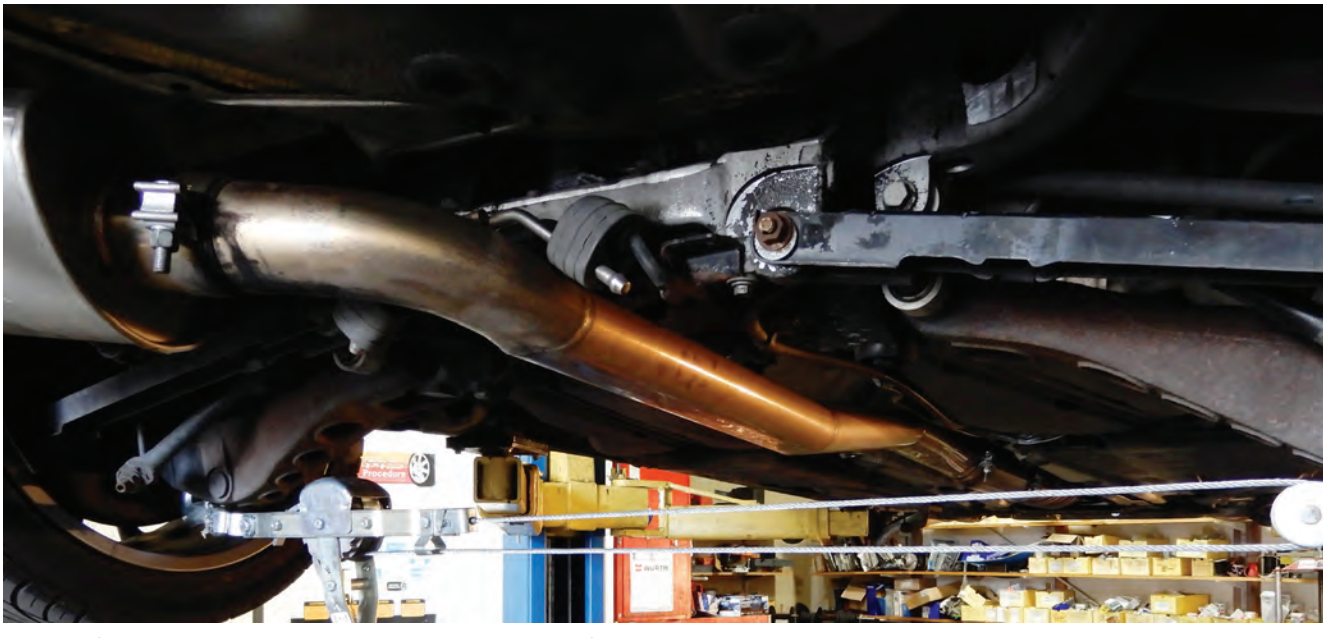
Remove the top mount and replace the rubber shim, if needed, when reassembling. Remove the strut from the spring and install the new strut through the spring, making sure to align the spring at the bottom of the spring seat. Install the top mount and align the marks that were made earlier. Install the top nut and tighten with tool 9995500.

Decompress the spring and install the strut/spring unit into the vehicle. The assembly will only go in one way. Install the two bolts that hold the assembly to the vehicle chassis and tighten. Install the bottom bolt at the control arm through the strut and secure.

Remove the tension strap from the control arms, and install the mud guard at the bottom of the control arm and lateral arm.

Lower the vehicle and install the bolt at the top of the strut assembly and tighten. Reinstall the carpet and set the seats back into place.

Test drive the vehicle to make sure all is well. ●



Come-along or retaining strap to compress control arms

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

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

Contact your local Volvo retailer for a complete selection of Volvo Genuine Parts.

2-YEAR WARRANTY

VOLVO | WHOLESALE PARTS

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

VOLVO | WHOLESALE PARTS

A Partnership for Satisfied Volvo Owners

What do independent repair facilities and authorized Volvo retailers have in common? Our shared commitment to make Volvo drivers happy through safe maintenance solutions. One way to achieve this is to only install Genuine Parts.

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

But there's more. Volvo can support your business on many levels. We cater to your needs with easy ordering, unrivaled availability, and you get access to technical information. Satisfied Volvo customers are the basis of a rewarding relationship.

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