



Volvo Trucks. Driving Progress

# SERVICE INFORMATION

Product information on Volvo Trucks for emergency services personnel, Alternative fuels

FM FH FE



# Foreword

The descriptions and service procedures contained in this manual are based on designs and methods studies carried out up to February 2018.

The products are under continuous development. Vehicles and components produced after the above date may therefore have different specifications and repair methods. When this is judged to have a significant bearing on this manual, an updated version of this manual will be issued to cover the changes.

The new edition of this manual will update the changes.

In service procedures where the title incorporates an operation number, this is a reference to V. S.T. (Volvo Standard Times).

Service procedures which do not include an operation number in the title are for general information and no reference is made to V.S.T.

The following levels of observations, cautions and warnings are used in this Service Documentation:

**Note:** Indicates a procedure, practice, or condition that must be followed in order to have the vehicle or component function in the manner intended.

**Caution:** Indicates an unsafe practice where damage to the product could occur.

**Warning:** Indicates an unsafe practice where personal injury or severe damage to the product could occur.

**Danger:** Indicates an unsafe practice where serious personal injury or death could occur.

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Göteborg, Sweden

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# Product information on Volvo Trucks for emergency services personnel

## Alternative fuels

### Introduction

This document aims to provide technical product information that can be used to establish procedures and methods for rescue operations following traffic accidents involving Volvo trucks that run on alternative fuels.

The document covers only alternative fuels. Please refer to the Emergency Manual for the truck in question regarding other issues.

The document is directed to Emergency Services carrying out rescue operations at the scene of an accident and contains the following information:

- Electric hybrid
- Gas driven truck

# Electric hybrid

## DANGER

### HAZARDOUS VOLTAGE!

#### Traction voltage system/600V (orange cables)

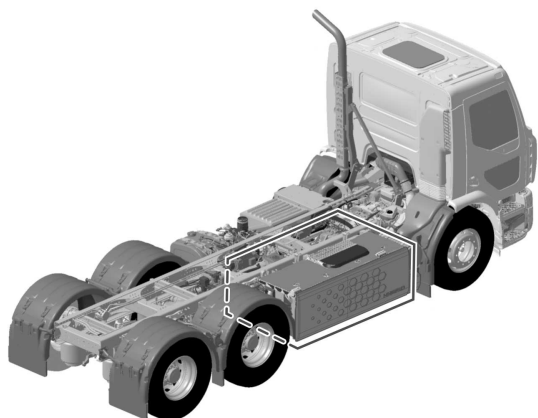
Can cause severe electrical shock, arc-flash, and burn resulting in serious personal injury or death.

Volvo hybrid trucks are equipped with both diesel engine and electric motor that can be used independently.

- These trucks can be identified from a hybrid decal on the front and adjacent to the door handles on the cab.
- The hybrid system comprises a diesel engine, clutch, gearbox and an electric driveline containing an electric motor/generator, battery and power electronics with a working voltage of 600V (DC).
- The ESS (Energy Storage System) stores energy and drives the electric motor.
- A voltage converter changes 600VDC to 400VAC. 400VAC is used to drive the hydraulic pumps for the power steering.
- ESS and other hybrid components are located under a cover between the front and rear axles on the right hand side of the truck.
- ESS contains lithium-ion cells that supply a power of 120 kW.
- ESS is a separate circuit with its own ground.
- ESS has internal circuit breakers that isolate it from the voltage system when turned off or if a serious fault should arise in the components.
- ESS is disengaged when the ignition is turned off.
- The cables in the electrical system that conduct high tension are marked in orange.
- Volvo hybrid trucks have three different system voltages:
  - 600VDC traction voltage (orange cables)
  - 400VAC (orange cables)
  - 24V low voltage (red and black cables)

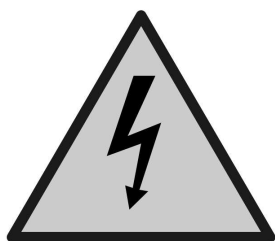
## Hybrid system

ESS, high-voltage cables and other hybrid components are located in the marked area



T1078649

Live components are marked with warning symbols



T9009354

## Hybrid decals, front and cab

**FEHYBRID**

T1078854



T1078853

## Various rescue scenarios

### In the event of a collision:

- Apply the parking brake.
- Turn off the ignition and remove the key.
- Cut the power to the vehicle, see “Break the high-voltage circuits”, page 4 and “Electrical system, 24V (low voltage)”, page 12
- ESS (600V system) is located on the right-hand side of the vehicle, which is why a collision on this side may have a large impact on rescue operations.
- There is risk of serious electric shock if the ESS cover has been opened or deformed and the inside is exposed.
- ESS can emit hazardous fluids and gases.

### In case of fire:

- Apply the parking brake.
- Turn off the ignition and remove the key.
- Cut the power to the vehicle, see “Break the high-voltage circuits”, page 4 and “Electrical system, 24V (low voltage)”, page 12
- In case of fire in the ESS, an ABC class fire extinguisher (powder extinguisher) should be used.
- Do not use water when extinguishing a fire in the ESS as it may aggravate the fire and cause electric shock.
- Hazardous gases such as HF and CO can be emitted in case of fire in the ESS. At temperatures above 100°C, the electrolyte in the lithium-ion cells can evaporate quickly. This means the battery cells may crack or emit gases, which will lead to the emission of flammable and corrosive substances.

### In case of contact with water (immersed):

- Turn off the ignition and remove the key.
- Cut the power to the vehicle, see “Break the high-voltage circuits”, page 4 and “Electrical system, 24V (low voltage)”, page 12
- Contact with water will cause a short circuit in the ESS, which can lead to electric shocks.
- There are no immediate safety risks as long as the ESS cover is intact.
- Transport the truck away from the water and if possible drain it completely.

## Break the high-voltage circuits

### DANGER

**Avoid touching, cutting or opening an orange high-voltage cable or high-voltage component.**

Can cause severe electrical shock, arc-flash, and burn resulting in serious personal injury or death.

The system should be powered down in a controlled manner so that normal rescue operations can then be carried out.

### High voltage, orange (600V)

**Note:** Never assume that a drive system is disengaged just because it is silent, turn off the system to make sure. The diesel engine can start without previous warning if the pneumatic system or ESS requires charging.

- **Turn off the engine and remove the ignition key.** The first task in a rescue operation is, if possible, to disengaging the electrical drive system by cutting the dangerous voltage. All the components are designed to discharge their own capacitance within 5 seconds.



- **Turn off the hybrid's main switch.** As an extra safety measure, also turn off the main switch in the cab.
- **Both the high and low voltage circuits must be cut to ensure the entire vehicle is without current.** To cut the low voltage circuit, see "Electrical system, 24V (low voltage)", page 12

## Gas driven truck

The Volvo natural gas truck is equipped with a system that enables the engine to run on a mixture of natural gas and diesel fuel. The methane gas may be either natural gas or

biogas. CNG and LNG are described below. They can be found under various names such as biogas, biomethane, LMG, LCMG, LBG.

### CNG (Compressed Natural Gas)

#### DANGER

High pressure up to 200 bar! Gas tanks, pipes, valves and filters located before the pressure regulator are under high pressure.

#### DANGER

Flammable gas! Natural gas has a high ignition point but a flame or spark can ignite the gas resulting in personal injury or death.

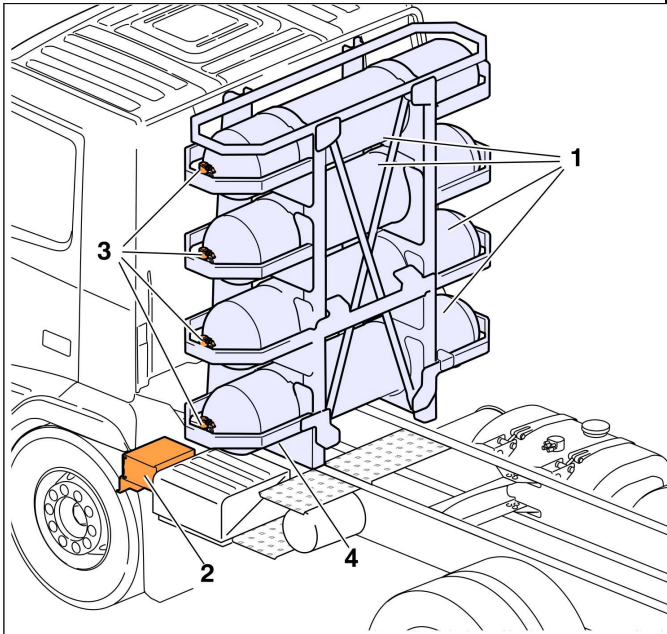
#### CNG properties:

- Natural gas is flammable in a 5% to 15% fuel/air ratio (biogas 7% to 20%).
- Natural gas is lighter than air and will disperse upwards.

#### Overview of component parts:

- Stored at high pressure (250 bar) in specially constructed tanks located behind the driver's cab.
- The system is equipped with electronic valves that cut the flow of gas to the engine when the ignition or main switch is turned off.
- Each tank has a shut-off valve.
- The main shut-off valve cuts the flow of gas to the engine from all the tanks simultaneously.
- The flow of gas from each tank is monitored by an excess flow valve that prevents gas escaping if one of the gas lines breaks.
- Relief valves release gas if the pressure in the tanks gets too high.
- In the case of a collision, a safety switch will activate and stop the gas drive.
- The system's electrical distribution unit on the right hand side of the luggage compartment. The system safety switch is also located there.

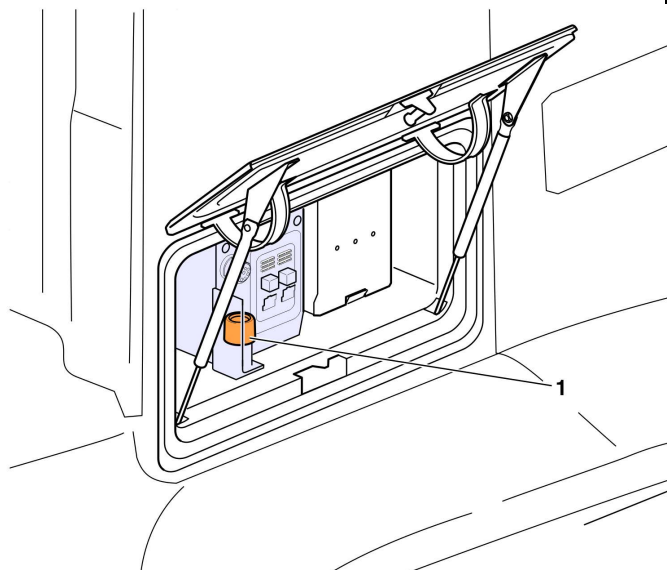
## Location of CNG tanks



T2078685

- 1 CNG tanks
- 2 Tank flap
- 3 Shut-off valves
- 4 Main shut-off valve

## System safety switch



T2078828

- 1 Safety switch

## **Various rescue scenarios**

### **In the event of a collision:**

- Turn off the ignition.
- Close the main shut-off valve.
- Cut the power to the vehicle, see “Electrical system, 24V (low voltage)”, page 12

### **In case of fire:**

- Turn off the ignition.
- Close the main shut-off valve.
- Cut the power to the vehicle, see “Electrical system, 24V (low voltage)”, page 12
- Cool down the LNG tank with water to reduce the risk of an increase in tank pressure.

### **In case of a leak:**

- Turn off the ignition.
- Close the main shut-off valve.
- Close the shut-off valve on each tank.
- Cut the power to the vehicle, see “Electrical system, 24V (low voltage)”, page 12

## LNG (Liquefied Natural Gas)

### DANGER

The tank is ventilated if the pressure rises above 16 bar (230 psi). Natural gas displaces oxygen and can cause asphyxiation. In the event of a natural gas leak resulting in a vapour cloud, evacuate the area of the vapour cloud immediately.

### DANGER

Natural gas is flammable when mixed with air and can be ignited by static discharge. Ensure the system is properly grounded during fueling or venting.

### DANGER

Liquefied natural gas (LNG) is a cryogenic fluid. Spill or spray of LNG may result in cryogenic burns. Always wear appropriate personal protective equipment (PPE) when working around the LNG tank or associated plumbing.

#### LNG properties:

- Natural gas is flammable in a 5% to 15% fuel/air ratio (biogas 7% to 20%).
- Stored in liquid form at very low temperature in a special low-temperature tank located on the left-hand side of the truck.
- Natural gas is lighter than air at standard conditions and will disperse upwards.
- Natural gas vapor from a LNG source is heavier than air at temperatures below -110°C and will result in a vapor cloud until warmed.
- At atmospheric conditions LNG will boil off completely and form natural gas.
- Natural gas is colourless and non-toxic.
- In high concentration, natural gas can cause suffocation.
- LNG is clear, odourless, and non-toxic as a liquid or a gas.
- LNG can also pool and flow under certain conditions.
- LNG expands 600:1 when vaporized.
- LNG is very cold. It is kept at a temperature of -160°C in the tank.

#### Overview of component parts Euro 5:

- The gas tank has two control valves, one grey for manual ventilation of the tank and one red for manual tank shut-off.
- The gas tank has three safety valves that monitor the pressure in the tank.
- If the tank pressure gets too high, >16 bar (230 psi), the first safety valve opens to ventilate the pressure automatically through the breather pipe behind the driver's cab.

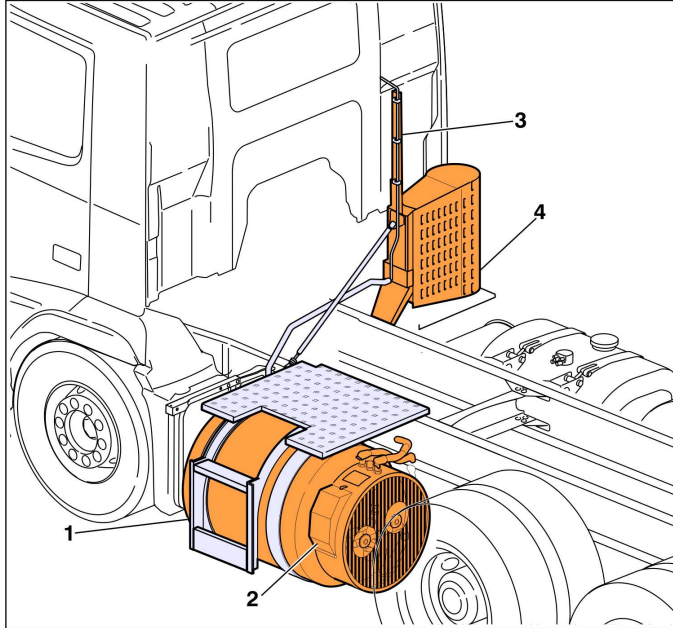
- The other safety valve, which protects the tank if the first safety valve (16 bar) stops working, opens when the pressure exceeds 24 bar (350 psi).
- The flow of gas from the tank is monitored by an excess flow valve that prevents gas escaping if one of the gas lines breaks.
- The system is equipped with electronic valves that close when the ignition or main switch is turned off.
- Fuel is transported in stainless steel pipes.
- In the case of a collision, a safety switch will activate and stop the gas drive.
- The system's electrical distribution unit on the right hand side of the luggage compartment. The system safety switch is also located there.
- Gas is supplied to the engine from the LNG tank at 10 bar.

#### Overview of component parts Euro 6:

- The gas tank has two control valves, one for manual draining of the tank and one for manual ventilation of the tank.
- The gas tank has two safety valves that manage the pressure in the tank.
- If the tank pressure gets too high, >16 bar (230 psi), the first safety valve opens to ventilate the pressure automatically through the breather pipe behind the driver's cab.
- The other safety valve, which protects the tank if the first safety valve (16 bar) stops working, opens when the pressure exceeds 22 bar (315 psi).
- If the pressure in the IGM (Integrated Gas Module) exceeds 440 bar (6400 psi ± 5%), a safety valve will open to protect the system.
- In the case of a downstream leak, an automatic shut-off valve isolates the tank from the rest of the system.
- Fuel is transported in stainless steel pipes and flexible hoses.
- The Euro 6 setup has both LNG and CNG on board.
- Gas is supplied to the engine from the LNG tank at high pressure (>300 bar).
- The system is equipped with electronic valve that close and shutoff supply at the engine when the ignition or main switch is turned off.

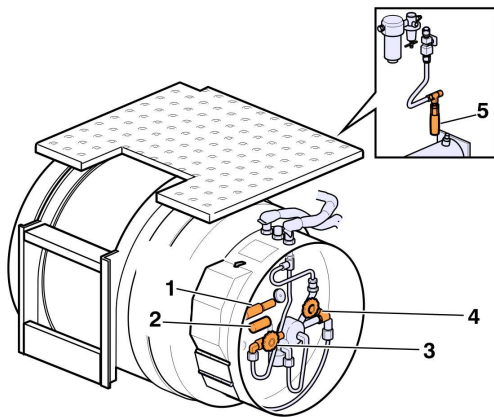
## Location of LNG tank and valves

### Euro 5



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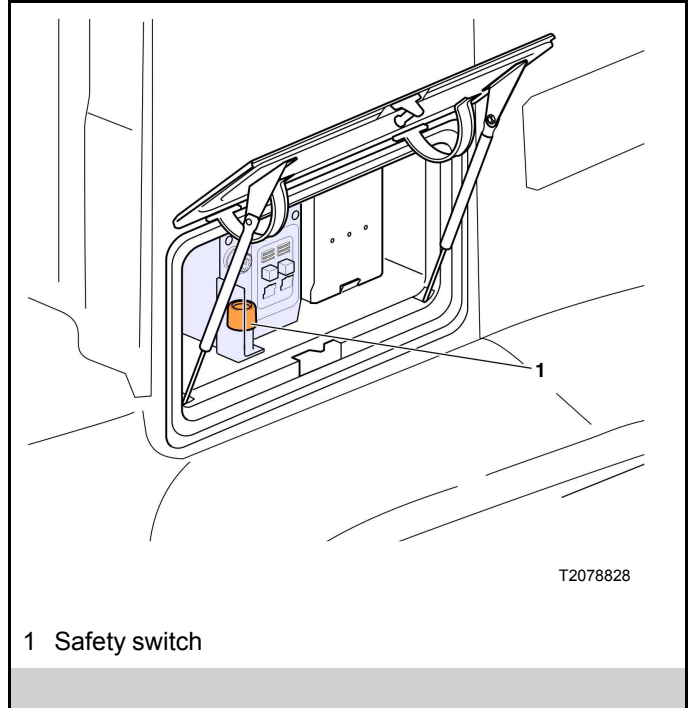
- 1 LNG tank
- 2 Tank flap
- 3 Breather pipe
- 4 Methane catalyst



T2078686

- 1 Safety valve (16 bar)
- 2 Safety valve (24 bar)
- 3 Shut-off valve (grey), ventilation
- 4 Shut-off valve (red), gas/LNG
- 5 Safety valve chassis (24 bar)

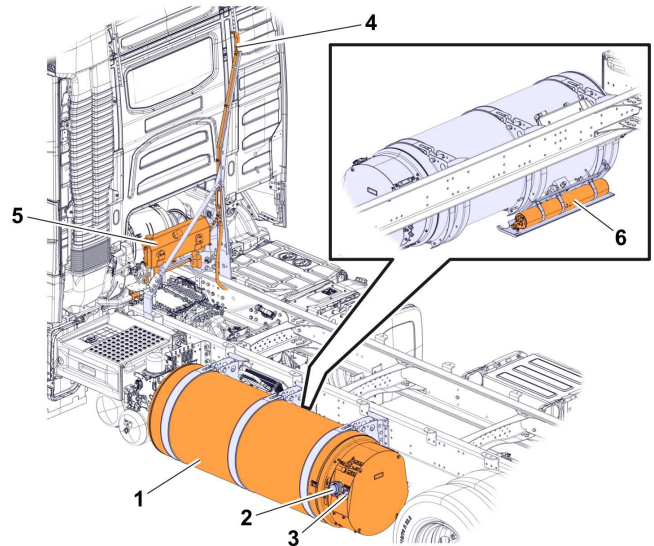
### System safety switch



T2078828

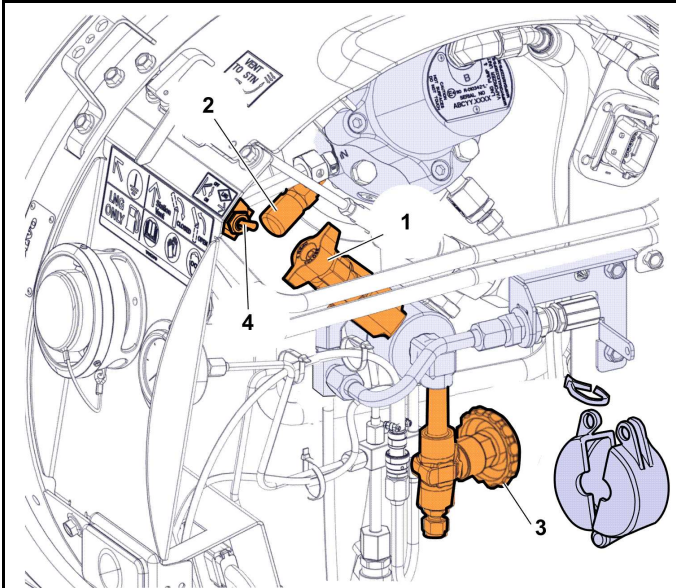
- 1 Safety switch

### Euro 6



T2092216

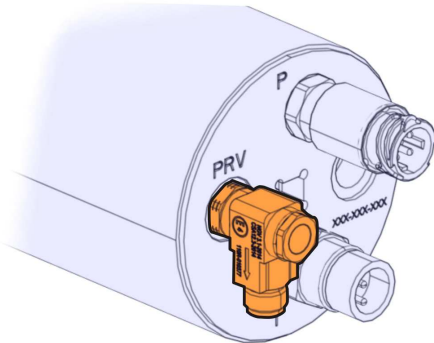
- 1 LNG tank
- 2 Tank connection
- 3 Pressure gauge
- 4 Breather pipe
- 5 Hydraulic tank
- 6 IGM



T1133431

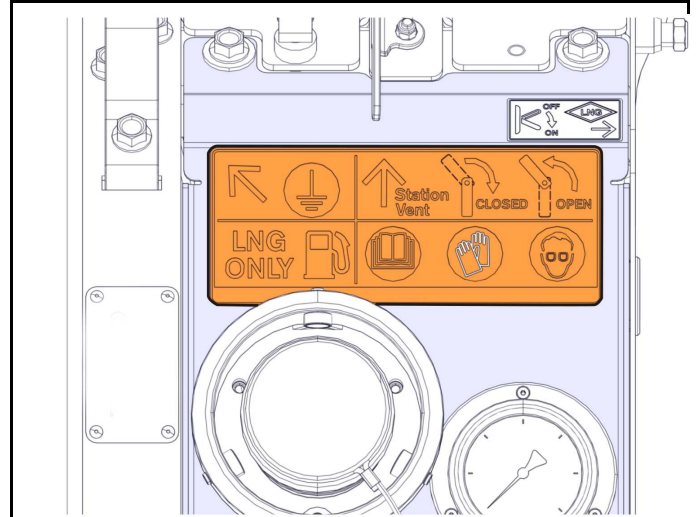
- 1 Safety valve with manual ventilation (15 bar)
- 2 Safety valve (22 bar)
- 3 LNG fluid drain (may be used only by qualified personnel for service)
- 4 LNG switch (operates the gas valve from the outside to shut off the gas)

#### IGM



T1125906

Safety valve (440 bar)



T1125905

LNG decals on the LNG tank

## Various rescue scenarios

### In the event of a collision:

- Turn off the ignition.
- Close the shut-off valve (red). (Euro 5 only)
- Cut the power to the vehicle, see "Electrical system, 24V (low voltage)", page 12

### In case of fire:

- Turn off the ignition.
- Close the shut-off valve (red). (Euro 5 only)

- Cut the power to the vehicle, see "Electrical system, 24V (low voltage)", page 12

### In case of a leak:

- Turn off the ignition.
- Close the shut-off valve (red). (Euro 5 only)
- Cut the power to the vehicle, see "Electrical system, 24V (low voltage)", page 12

# Electrical system, 24V (low voltage)

## How is the electrical supply cut off?

### Cut the power to the vehicle:

- **Break the battery circuit by disconnecting/cutting the cables from the battery terminals.** This is the safest way to cut the power. All power is cut, also to the tachograph and electrically adjustable driver seat, see "General recommendations:", page 13

### Cut the power to most of the units:

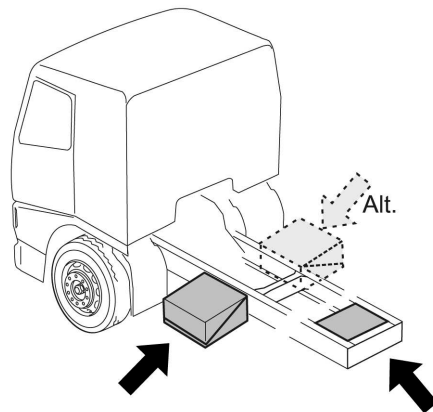
- **Turn off the main switch (not found on all trucks).** All the power to the vehicle is not cut, certain circuits are still energised.

**Note that the truck is still energised if only the key is removed.**

The SRS control unit will retain energy for about three seconds after the battery power has been disconnected. This means the airbag and belt tensioner can be activated up to three seconds after the power has been cut.

### The figure shows the normal location of the battery.

- 1 The battery box is fitted on the left-hand longitudinal side member
- 2 Battery box fitted inside the rear cross member



T3072656



## Different methods of cutting power:

### C. ADR circuit breaker.

Only on trucks for transporting hazardous goods.

Cuts ALL power except to the tachograph.

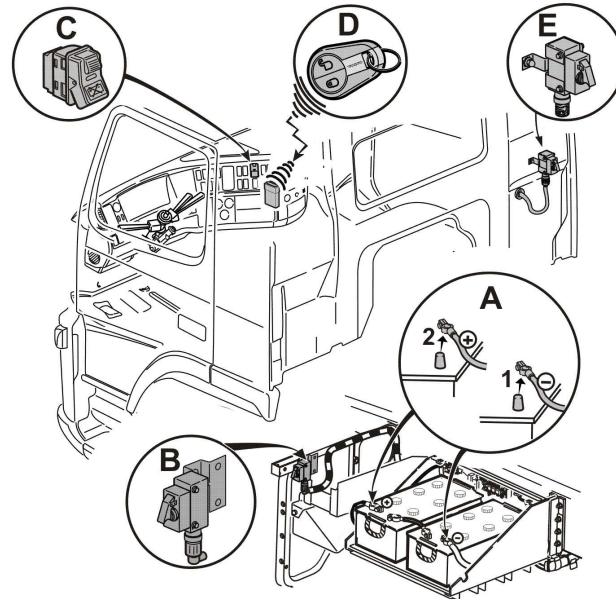
### B. Main switch/ battery switch.

Not found on all trucks.

Some circuits are still energised.

### A. Battery.

When disconnecting the battery, start with the negative terminal. If you need to cut the cable, cut as close to the terminal as possible to include any secondary connections beside the main connection.



### D. Remote switch.

Not found on all trucks. Pressing the left-hand button twice within five seconds will turn off the main switch. Some circuits are still live.

### E. Outer switch, ADR option.

This main switch is available as an option on trucks used for transporting hazardous goods. Cuts ALL power except to the tachograph.

T3132975

**Note:** Not all components in the above figure are found on all trucks!

## Central locking

The central locking system is designed so that the door lock function is turned off in the following circumstances:

- When the truck's power circuit is cut at the battery.
- When one of the truck's ADR switches is turned off.
- In the event of a collision, the SRS system will send a signal to the central locking system. The central locking system will not function for around two minutes after unlocking in this way.
- Locked doors can be opened from inside with the door handles and from the outside with a key.

## General recommendations:

- A main switch can cut power only when the engine has been turned off. The power supply to tachograph, central locking system, alarm and parking heater is NOT cut. The exception is ADR trucks for transporting hazardous goods, where the main switch cuts all the power irrespective of whether the engine is running.  
**Only disconnecting the battery or the ADR main switch will cut ALL the power.**
- Appearance and function vary between different main switches; some models are not equipped with main switch at all.
- Energy is stored in the SRS system a few seconds after cutting the battery power, which is sufficient to activate the airbag and belt pretensioner. To be sure the system has been deactivated; wait for about three seconds after cutting the battery power.
- **Before cutting power: Consider the need of opening doors and adjusting the driver's seat!** Driver seats that are electrically adjustable cannot be adjusted once the power has been cut since the seat does not have manual adjustment.



### CAUTION

In cases where the ADR main switch is used to cut the power while the ignition is on, the SCR system will remain pressurised and still contain AdBlue!  
Wait two minutes after turning off the engine before using the main switch to ensure the system is completely drained of AdBlue.



# Feedback

One of our objectives is that workshop personnel should have access to correct and appropriate service manuals where it concerns fault tracing, repairs and maintenance of Volvo vehicles.

In order to maintain the high standards of our service information, your opinions and experiences when using this information would be greatly appreciated.

If you have any comments or suggestions, use "Argus dealer" or send them to us using the email address below.

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