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Safety and fire protection in the workshop

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Introduction

Introduction

Changes since the previous issue

The most important changes are described below.

Oils and lubricating greases

Information on the handling of oils and lubricating greases has been added.

Feedback

In the section about feedback, the reference has been changed to FRAS.

Precautionary measures

Information on the handling of LNG gas has been added.

Actions before transporting gas tanks

The section *Actions before transporting gas tanks* has been added.

Vehicles with electric drive

The wording in the section about vehicles with electric drive has been adapted. Hybrid battery has been changed to propulsion battery. Hybrid system has been changed to electric drive system. The table for voltage class A and voltage class B has been adjusted.

Prerequisites for safety

The purpose of this section is to inform you of the risks involved in service workshops.

Since it is not possible to give a comprehensive account in this format, the information is based on the following:

- maintenance instructions are adhered to,
- local laws and regulations are complied with,
- work is carried out according to instructions in the Workshop Manual.

Use the workshop information

The workshop information provides instructions for working methods to reduce the risk of damage and injury. Scania assumes that the workshop information is available to the mechanics and that the instructions are adhered to.

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Observe warning signals

The workshop information contains symbols to indicate dangerous or essential tasks. Always read and follow these warnings and instructions. Do not make the mistake of thinking you are aware of all the risks. The properties of a part or the chemical composition of a product may have changed since you last used it.

WARNING!

Used when an incorrect action could result in personal injury.

IMPORTANT!

Used when an incorrect action could result in damage to the vehicle or other property.

Please note:

Used when an incorrect action could result in a poor result or unnecessary work.

ENVIRONMENT

The environmental advisory is used when a material being used could be hazardous to the environment. Find out how the material being used in the workshop must be disposed of according to national and international laws.

Warnings in the workshop information do not cover risks that can arise when driving the vehicle. Such information is available in the Operator's Manual of the vehicle.

The operations supervisor is also responsible for fire safety. Scania has therefore released the manual Scania Fire Prevention, which is available on Scania's website.

Near-accidents

An incident may be a chance accident that does not cause any injuries or damage. On the other hand, it does demonstrate the risks involved. Each incident must be taken as a warning, just as important accidents or cases of illness. The next time the incident occurs, the consequences may be much more severe unless your awareness has improved.

Feedback

Report any incidents, injuries and damage that may have been caused by insufficient workshop information etc., to Scania. Make a report using FRAS.

Safety requirements

Local laws and regulations

Most countries have local laws and regulations that are intended to prevent damage, injuries and accidents at work. These laws and regulations must be followed.

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Safety instructions

Take note of any existing safety instructions before beginning work involving a risk of damage or injury.

Knowledge

Scania assumes that the mechanic has the necessary professional training as an automotive mechanic and has taken part in Scania courses for mechanics. It is impossible to foresee all the occupational safety risks involved if the mechanic does not possess these qualifications.

Alert

The mechanic must be aware of the risks involved with the task. New risks may arise and previous experience, both your own and your colleagues', may not be enough. It is therefore important that instructions are always available and are read.

Handling of ADR vehicles

A document containing instructions on handling ADR vehicles, called *Handling ADR Vehicles*, can be downloaded from *Reflex > Service Operations > Workshop operations*.

Caution

There must be no carelessness or nonchalance. Hazardous work must always be carried out with a safety margin.

Protective equipment and protection devices must be used whenever specified in the instructions. Common sense should always prevail when working in a workshop.

Personal safety

Jewellery

Remove necklaces, rings and bracelets. Jewellery can conduct current, cause electric arcs, get caught in machines, etc., and consequently cause serious injury.

Hair

Long hair must be tied back or gathered in a hairnet or similar hair restraints. Hair can easily get caught in machinery or in moving parts.

Hair is extremely flammable. Observe caution when welding or using naked flames.

Upholstery

Make sure all clothing is intact. Remove loose clothing such as ties and scarves. Do not wear clothing with wide sleeves or legs etc.

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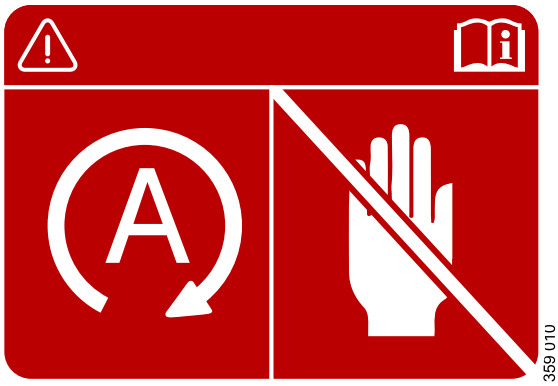
Safety around the vehicle

Safety around the vehicle

General safety precaution

Disconnect the power to damaged vehicles standing in the workshop before repairs are commenced. This is to avoid a fire hazard in the event of a short circuit in cable harnesses.

Vehicles fitted with idle stop and start



WARNING!

The idle stop and start function means that the engine can restart automatically. For all workshop operations the vehicle should be switched off with the starter key or battery master switch.

Working under vehicles

Risks

Mechanical or hydraulic tools and lifting devices may tip over or their level may drop due to malfunctions or incorrect operation.

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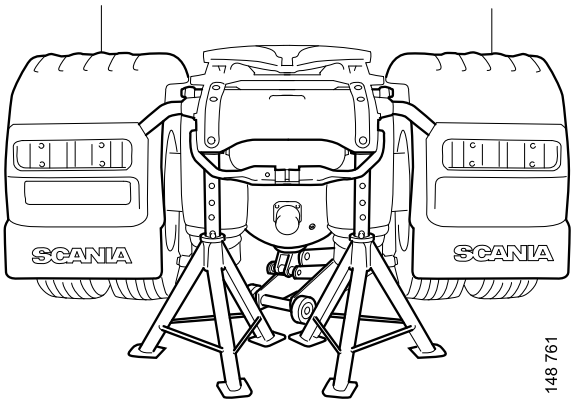
Precautionary measures

- Use reliable and correctly dimensioned axle stands, struts and locks with standard locking devices.
- Stands and struts must be sturdy.
- Lifting accessories must have been inspected and approved for use.



Working under the chassis

- A raised vehicle must never be supported on or lifted by parts that belong to the wheel suspension or steering.
- Support the vehicle under the frame or one axle only.
- Do not walk under a vehicle that is raised on a jack only.
- Follow the maintenance instructions.

Working underneath bodywork

- Always support a raised bodywork.

Working under vehicles with air suspension

- Always support vehicles with air suspension under the frame. Otherwise the vehicle may drop when the air pressure in one or more air bellows is reduced.
- Never work under vehicles with air suspension so that there is no risk of personal injuries.
- If the frame drops on to the axle there is a risk of crush or impact injuries.

WARNING!

Always use axle stands to support the vehicle when working under vehicles with air suspension.

The frame may drop on to the axle if:

- an air bellows is punctured,
- a compressed air line is disconnected,
- voltage is applied to a valve for the purpose of emptying the air bellows,
- a levelling valve is operated when the 15 voltage is activated.

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Working under the cab

WARNING!

Working on the cab tilting mechanism may disable the integral safety functions.

Always follow the instructions in the Workshop Manual and use the special tools specified. Otherwise there is a risk of injury.

WARNING!

There is a danger of crushing when working on cab suspension. Secure the cab with a cab lifting accessory to avoid injury.

WARNING!

Do not work under a cab that is tilted to the intermediate position.

Remember to always tilt and tilt back the cab completely.

Working under a partially tilted cab can result in personal injury.

Scania recommends avoiding being in front of a tilted cab if it is not absolutely necessary - in the same way as we avoid being under a hanging load, e.g. from an overhead hoist.

Never loosen the tipping cylinder screw in the tilted position. Tipping cylinders are always renewed with the cab in the drive position, as indicated in the method description.

This entails a risk of serious near misses and accidents if personnel carry out work on the cab tilt system without sufficient training, method descriptions and parts.

Cab strut *99 431* only secures the cab from falling back in an uncontrolled manner to the drive position. It does not secure against an uncontrolled fall forwards.

Scania encourages workshops to always follow the Workshop Manual and Driver's Manual, and to use the correct tools, methods and parts.

Scania wants the workshop manager to ensure and follow up that all personnel have an appropriate understanding of how the tipping system is structured, and what a faulty repair may lead to.

Working at altitude.

Work on vehicles may be carried out high up and in such cases, local laws and regulations regarding working at height must be followed.

For example, use a work platform, scaffolding or a safety harness to minimise the risk of falling when working on the bus roof, bodywork or cab.

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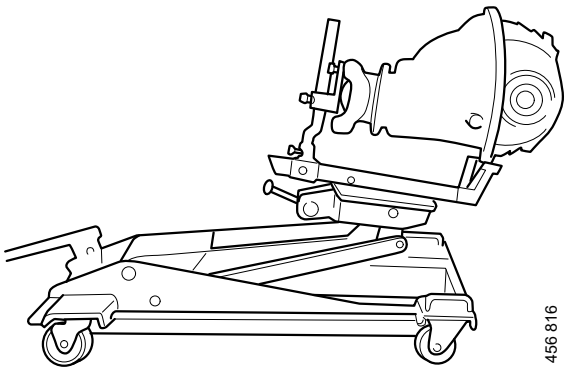
Heavy equipment



WARNING!

If heavy equipment is not handled with care, this may lead to serious personal injury and material damage. Use approved lifting accessories or other aids to move heavy equipment. Make sure the device is sturdy and intact.

Risks

- Unsuitable lifting straps could break or slip.
- The equilibrium of the equipment or device may change while work is being carried out, which can cause unexpected movements. This may cause severe personal injury and damage to property.
- Equipment being lifted in a stand may start to revolve if its equilibrium changes.
- Equipment being lifted with an overhead hoist may start to swing and cause severe crush injuries or damage to property.

Precautionary measures

- Use approved lifting accessories or other aids, especially when there are such aids suitably adapted to a specific task.
- If it is still necessary to lift equipment without aids:
  - Lift with the equipment close to your body.
  - Keep your back vertical.
  - Use your arms and legs to lift and lower the equipment, do not bend your back.
  - Do not turn your body while lifting.
  - Ask for help beforehand if you think it will be necessary.
- Stands must lock automatically (braking device or irreversible screw).
- Use gloves. They usually offer good protection against crush injuries to your fingers.
- Use protective shoes with steel caps.
- Use a jack with fixture as instructed in the workshop information for lifting gearboxes, rear axle gears, clutches, leaf spring assemblies, rear wheel hubs, torque converters, etc.

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Several mechanics working on the same vehicle

Inadvertent movements may cause another person injury if there are several mechanics working on the same vehicle.

Risks

- A wheel being rotated on a driving axle may cause the driving wheel in another location to rotate resulting in injury or damage.
- Working on suspension attachments (springs and shock absorbers) can initiate movement in components on the opposite side.
- Operations controlled from the driver area, such as tilting, tag axle lift or bodywork, could initiate movement in other parts and cause serious personal injury.

Precautionary measures

- Be aware of the risks involved when more than one person is working on the vehicle.
- Make colleagues aware of the work being carried out.
- Wait until the half shafts have been removed before commencing any work on more than one driving wheel at the same time.
- When working on buses: Place a sign on the steering wheel and the rear central electric unit. Also move the start selector on the rear central electric unit to position 0 to prevent attempts to start the vehicle. If signs have been posted or if the start selector is in position 0, check before starting the engine that it is safe to do so.

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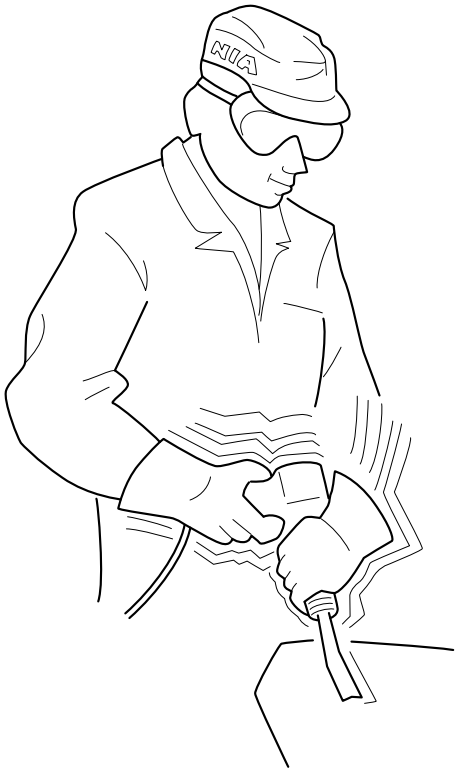
Mechanical work

Mechanical work

Noise



Being exposed to noise louder than 85 dBA for longer than 8 hours is considered harmful to your hearing. (Limit values for noise levels may differ between different countries.) High-frequency noise is more harmful than low-frequency noise at the same sound level.

Noise can be just as harmful intermittently as it is continuously. The noise of a striking blow can be harmful just because it occurs for a very short time.

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Risks

- Noise levels higher than recommended limits will impair your hearing. In severe cases, this damage may be permanent.
- You cannot get used to noise. If you begin to perceive noise as being less severe, it may mean your hearing has been impaired.
- Seek medical advice if you notice signs of hearing impairment.

Precautionary measures

- Wear ear protectors. Make sure the ear protectors have been tried and tested for protection at the relevant noise level.
- Limit exposure to noise with noise absorbent shields and also use noise absorbent materials in ceilings and walls.

Vibrations

The use of vibrating tools such as jackhammers, hammer drills, impact nut runners and grinding machines can cause injury when the vibration in the tool is conveyed to your hands. Injuries are more likely to occur if your fingers are cold.

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Vibration can cause vascular spasms (tingling and pain) in blood vessels near the surface of the skin. Fingers may become pale, cold and numb. Damage may also be caused to the nervous system, muscles, bones, ligaments and joints. Seek medical advice if you notice any signs of injuries caused by vibration. The damage can be cured if treated at an early stage.

Risks

- Cold increases the risk of injury, if the tool is cold to the hand or if cold air is blowing on your hands for example.
- The use of tobacco impedes blood circulation and increases the risk of injury.

Precautionary measures

- Use thick gloves. They protect against vibration and cold.
- Alternate between working with and without vibrating tools so that your body is given the chance to rest.
- Change working position and grip often so that you do not expose only one side of your body to vibration stress.
- If possible, use tools that protect against vibrations.
- Avoid smoking before and after the work in order to maintain good blood circulation.

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Dust

Brake and clutch linings

Brake and clutch linings emit a very fine-grained dust. Brake and clutch linings may also contain asbestos. Use of components containing asbestos is prohibited by law in certain countries. Therefore, observe your local laws and regulations on the use of asbestos.

Risks

- Inhaling dust can cause pulmonary disease.
- Dust containing asbestos can cause cancer. Smokers run a much greater risk of developing lung cancer.

Precautionary measures

- Bind the dust with water before working on brakes and clutches.
- Use respiratory protective equipment with suitable dust filters. A simple paper mask is not sufficient.
- Never blow off such dust with compressed air.
- Clean brake components and clutch components with water or a special vacuum cleaner.

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Silencer, general

When working on the silencer there is a risk of exposure to dust from the catalytic converters and particulate filter. The risk of exposure differs between different emission classes.

This sectioion contains safety instructions that apply for all emisson classes. Specific instructions for the different emission classes can be found in *Euro 5 silencer and corresponding emission classes* and *Euro 6 silencers and the corresponding emission classes*.

Risks

- There is a risk of permanent personal injury from exposure to dust. There is also a risk of foetal damage.
- Inhalation of dust can cause irritation of the airways.
- Contact with the eyes or skin can cause irritation.
- Ingestion can cause irritation in the mouth and throat and produce discomfort. The ingestion of large quantities may cause disorders in the gastric and intestinal canals.

Precautionary measures

- P3 type respiratory protective equipment/mask with filter, eye protection and gloves should be used for any work where there is a risk of exposure to dust.
- To remove the dust use a vacuum cleaner with a HEPA filter that can filter out particles down to a particle size of 0.3 µm.
- Eating, drinking or smoking while working is not permitted.
- Make sure you clean your hands after the work.
- If you are exposed to dust or suspect that you have been exposed to dust, throw away waste products such as rags, vacuum cleaner bags and filters in sealable bags.
- Handle waste products in accordance with local laws and regulations.

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Silencer Euro 5 and corresponding emission classes

When working on the silencer there is a risk of exposure to dust from the SCR catalytic converter.

The SCR catalytic converter has a core of silicon dioxide and titanium dioxide. The catalysts are vanadium and tungsten. These substances, especially vanadium, can be detrimental to health.

Substances, SCR catalytic converter

- Silicon dioxide
- Titanium dioxide
- Vanadium
- Tungsten

Safety precautions must be taken when working where there is a risk of exposure to dust from the SCR catalytic converter and silencer. Such work includes opening the silencer, machining and scrapping the SCR catalytic converter.

Euro 6 silencer and corresponding emission classes

When working on the silencer, the risk of exposure to dust is minimal if the work is carried out in accordance with the work descriptions in the Workshop Manual.

The components of the silencer and the substances they contain are listed below. The substances listed can be detrimental to health.

Oxidation catalytic converter

Applies to compact silencers [623 mm and 900 mm] and distributed systems

The oxidation catalytic converter has a core of cordierite. The catalytic substance is platinum and, in some cases, palladium. Oxidation catalytic converters which are adapted for fuel with high sulphur content also have vanadium pentoxide as a catalytic substance. The oxidation catalytic converter may also contain remnants of burnt engine oil, such as calcium, phosphorous, zinc and carbon.

Substances, oxidation catalytic converter

- Cordierite
- Platinum
- Palladium
- Applies to oxidation catalytic converters that are modified for fuel with a high sulphur content.
- Calcium
- Phosphorus
- Zinc
- Carbon

Particulate filter

Applies to compact silencer [623 mm, 900 mm and 685mm] and distributed system.

The particulate filter has a core of cordierite. The catalytic substance is platinum and, in some cases, palladium.

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Soot and ash are stored in the particulate filter. Next to the particulate filter, there is a graphite seal which is made up of graphite and quartz. In addition, calcium, phosphorus, zinc and carbon are present in the exhaust gases.

Substances, particulate filter

- Cordierite
- Platinum
- Palladium (applies to some compact silencers [623 mm and 900 mm])
- Graphite
- Quartz
- Calcium
- Phosphorus
- Zinc
- Carbon

Ammonia slip catalytic converter assembled with a particle filter

Compact silencer (900 mm) and 2 reductant dosers

The particle filter is assembled with an ammonia slip catalytic converter. The exhaust gases pass the ammonia slip catalytic converter first and then the particulate filter.

The ammonia slip catalytic converter has a core of cordierite, and the active substance is platinum. The ammonia slip catalytic converter also contains copper.

Substances, ammonia slip catalytic converter

- Cordierite
- Platinum
- Copper

SCR catalytic converter at the silencer intake

Compact silencer [685 mm and 900 mm] and 2 reductant dosers

The SCR catalytic converter has a frame of titanium dioxide and glass fibre or cordierite and the catalyst is vanadium and copper. Vanadium can be harmful to health, although during normal use and handling, the vanadium in the catalytic converters does not constitute a health hazard. The catalytic converter also contains tungsten and antimony.

Furthermore, the SCR catalytic converter contains residue of a reductant as well as residuals of combusted engine oil such as calcium, phosphor, zinc and carbon.

Substances, SCR catalytic converter

- Titanium dioxide
- Glass fibre
- Cordierite
- Vanadium
- Copper
- Tungsten
- Antimony
- Reductant

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- Calcium
- Phosphorus
- Zinc
- Carbon
- Residue of a reductant

Ammonia slip catalytic converter assembled with am SCR catalytic converter

Compact silencer (685 mm) and 2 reductant dosers

The SCR catalytic converter is asembled with an ammonia slip catalytic converter. The exhaust gases initially pass the SCR catalytic converter and then the ammonia slip catalytic converter.

The ammonia slip catalytic converter has a core of cordierite, and the active substance is platinum. The ammonia slip catalytic converter also contains copper.

Substances, ammonia slip catalytic converter

- Cordierite
- Platinum
- Copper

SCR catalytic converter at the silencer outlet

No repairs or maintenance should be carried out on the SCR catalytic converter and the ammonia slip catalytic converter at the silencer outlet. If there is a defect in the SCR catalytic converter in a compact silencer, the entire silencer must be replaced. If there is a defect in the SCR catalytic converter in the distributed system, the SCR catalytic converter will be replaced.

Applies to compact silencers [623 mm and 900 mm] and distributed systems

The SCR catalytic converter has a frame of titanium oxide and titanium. The catalytic substance is vanadium. Vanadium can be harmful to health, although during normal use and handling, the vanadium in the catalytic converters does not constitute a health hazard. The catalytic converter also contains tungsten and sometimes iron.

The ammonia slip catalytic converter has a core of cordierite, and the active substance is platinum. The ammonia slip catalytic converter also contains copper.

Substances, SCR catalytic converter and ammonia slip catalytic converter:

- Titanium dioxide
- Titanium
- Vanadium
- Tungsten
- Iron (applies to compact silencer [900 mm])
- Cordierite
- Platinum
- Copper

Compact silencer (685 mm) and 2 reductant dosers

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The SCR catalytic converter has a frame of titanium oxide and glass fibre. The catalytic substance is vanadium. Vanadium can be harmful to health, although during normal use and handling, the vanadium in the catalytic converters does not constitute a health hazard. The catalytic converters also contain tungsten and antimony.

The ammonia slip catalytic converter has a core of cordierite, and the active substance is platinum. The ammonia slip catalytic converter also contains copper.

Substances, SCR catalytic converter and ammonia slip catalytic converter:

- Titanium dioxide
- Glass fibre
- Vanadium
- Tungsten
- Antimony
- Cordierite
- Platinum
- Copper

Compact silencer (900 mm) and 2 reductant dosers

The SCR catalytic converter has a frame of titanium dioxide or cordierite The catalytic substance is vanadium. Vanadium can be harmful to health, although during normal use and handling, the vanadium in the catalytic converters does not constitute a health hazard. The catalytic converter also contains tungsten and iron.

The ammonia slip catalytic converters have a core of cordierite and the active substance is platinum. The ammonia slip catalytic converter also contains copper.

Substances, SCR catalytic converter and ammonia slip catalytic converter:

- Titanium dioxide
- Cordierite
- Vanadium
- Tungsten
- Iron
- Platinum
- Copper

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Exhaust gas aftertreatment, industrial and marine engines

When working on the catalytic converters, there is a risk of exposure to dust, which can be detrimental to health. Such work includes, for example, machining and scrapping. Take the safety precautions below when carrying out work where there is a risk of dust exposure.

Risks

- With exposure to dust there is risk of permanent personal injury. There is also a risk of foetal damage.
- Inhalation of dust can cause irritation of the airways.
- Contact with the eyes or skin can cause irritation.
- Ingestion can cause irritation in the mouth and throat and produce discomfort. The ingestion of large quantities may cause disorders in the gastric and intestinal canals.

Precautionary measures

- P3 type respiratory protective equipment/mask with filter, eye protection and gloves should be used for any work where there is a risk of exposure to dust.
- To remove the dust use a vacuum cleaner with a HEPA filter that can filter out particles down to a particle size of 0.3 µm.
- Eating, drinking or smoking while working is not permitted.
- Make sure you clean your hands after the work.
- If you are exposed to dust or suspect that you have been exposed to dust, throw away waste products such as rags, vacuum cleaner bags and filters in sealable bags.
- Handle waste products in accordance with local laws and regulations.

Substances, SCR catalytic converter

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The SCR catalytic converter has a core of silicon dioxide and titanium dioxide. The catalysts are vanadium and tungsten. These substances, especially vanadium, can be detrimental to health.

List of substances, SCR catalytic converter

- Silicon dioxide
- Titanium dioxide
- Vanadium
- Tungsten

Substances, oxidation catalytic converter

The oxidation catalytic converter has a core of metal. The catalytic substance is platinum. The oxidation catalytic converter may also contain remnants of burnt engine oil, such as calcium, phosphorous, zinc and carbon.

List of substances, oxidation catalytic converter

- Metal (stainless steel)
- Platinum
- Phosphorus
- Zinc
- Carbon
- Calcium

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Compact silencer [900 mm] and distributed system

When working on the silencer, the risk of exposure to dust is minimal if the work is carried out in accordance with the work descriptions in the Workshop Manual. The components of the silencer and the substances they contain are listed below. The substances listed can be detrimental to health.

Oxidation catalytic converter

The oxidation catalytic converter has a core of cordierite. The catalytic substance is platinum and, in some cases, palladium. The oxidation catalytic converter may also contain remnants of burnt engine oil, such as calcium, phosphorous, zinc and carbon.

Substances, oxidation catalytic converter

- Cordierite
- Platinum
- Palladium
- Calcium
- Phosphorus
- Zinc
- Carbon

Particulate filter

The particulate filter has a core of cordierite. The catalytic substance is platinum and, in some cases, palladium.

Soot and ash are stored in the particulate filter. Next to the particulate filter, there is a graphite seal which is made up of graphite and quartz. In addition, calcium, phosphorus, zinc and carbon are present in the exhaust gases.

Substances, particulate filter

- Cordierite
- Platinum
- Palladium (applies to certain compact silencers [900 mm])
- Graphite
- Quartz
- Calcium
- Phosphorus
- Zinc
- Carbon

SCR catalytic converter at the silencer outlet

No repairs or maintenance should be carried out on the SCR catalytic converter and the ammonia slip catalytic converter at the silencer outlet. If there is a defect in the SCR catalytic converter in a compact silencer, the entire silencer must be replaced. If there is a defect in the SCR catalytic converter in the distributed system, the SCR catalytic converter will be replaced.

The SCR catalytic converter has a frame of titanium oxide and titanium. The catalytic substance is vanadium. Vanadium can be harmful to health, although during normal use and handling, the vanadium in the

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catalytic converters does not constitute a health hazard. The catalytic converter also contains tungsten and sometimes iron.

The ammonia slip catalytic converter has a core of cordierite, and the active substance is platinum. The ammonia slip catalytic converter also contains copper.

Substances, SCR catalytic converter

- Titanium dioxide
- Titanium
- Vanadium
- Tungsten
- Iron (applies to compact silencer [900 mm])
- Cordierite
- Platinum
- Copper

Grinding

Lead can enter the bloodstream through skin contact and cause lead poisoning.

Risks

Dust formed when grinding bodywork, solder and certain paints contains lead.

Precautionary measures

- Avoid skin contact and inhalation.
- Use protective gloves, respiratory protective equipment and a face mask.

Rotating components and tools

Examples of rotating components and tools:

- Cooling fan
- Drive belts

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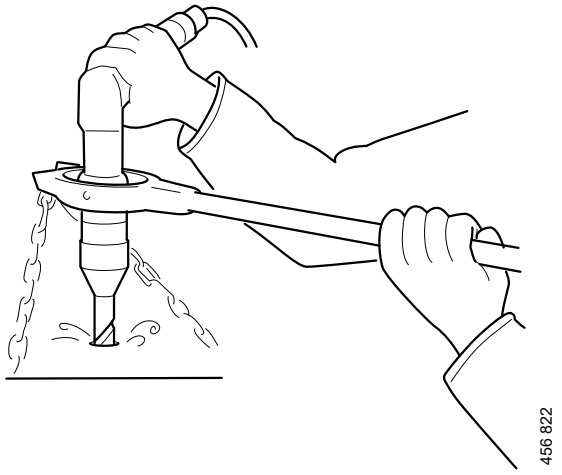
- Injection pump clutch
- Propeller shafts:
- Drills
- Lathes, grinding machines

Risks



- Rotating components such as fans and shafts can cause injury if touched. It is also possible to get entangled in a completely smooth rotating shaft.
- Drilling machines, lathes, grinders or other machinery with rotating parts can cause severe injury if hair or clothes get tangled up in it.
- A hand-held drill with rotating bit can be forced out of your grip. The tool will be thrown aside or continue to rotate until the electrical cable has torn off.

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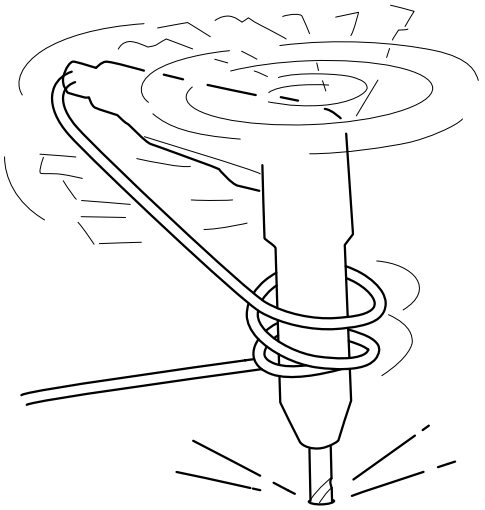
Precautionary measures



- Do not use gloves when working with a drill.
- Use a lever on the hand-held drill whenever suitable.
- Remove loose scarves and ties.
- Never wear clothing with wide sleeves or legs.
- Make sure all clothing is intact.
- Long hair must be gathered in a hairnet or similar hair restraints.
- Remove large or loose hanging jewellery from hands, arms and neck.
- Always use a protective guard on grinding machines.

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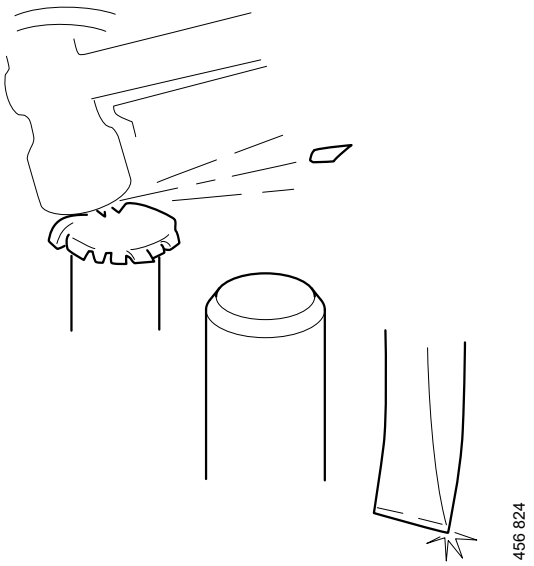
Fragments from tools

Risks



- Burrs can be knocked loose from drifts and chisels.
- The hammer head can fly off the shaft.
- Circular saws can grab or wobble.
- Propelled particles from machining (e.g. when grinding, cutting or turning).

Precautionary measures

- Check the tool. Sharpen the tool if necessary.
- Check hammers and shafts in advance. Repair or replace hammers and shafts if necessary.
- Keep the supporting hand away from the underside of the saw.
- Use protective screens or eye protection.

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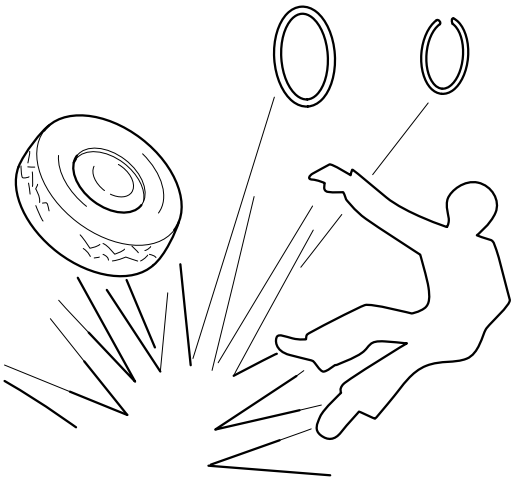
Flying parts

Rubber repairs

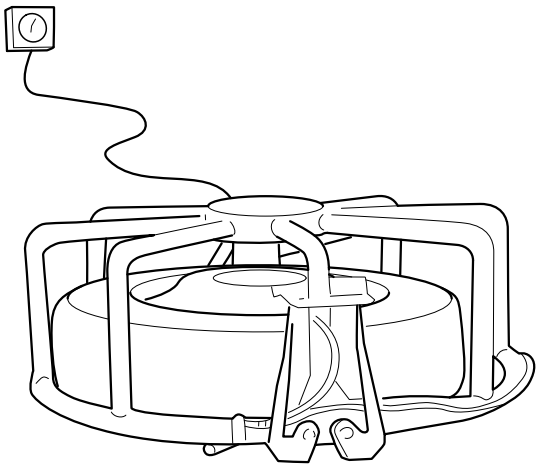
Risks



- Dismantling wheels: Tyres, rims and retaining rings can fly off.
- Assembling wheels.
- Pumping up tyres: Tyres, rims and retaining rings can fly off.
- Wheel balancing: Stones stuck in the tyre can fly off when the wheel is rotated.
- Mechanical brushing and turning: Flying fragments

Precautionary measures

- Let the air out before starting work.
- Dismantle the wheel.
- Check that tyres, rims and retaining rings are not damaged. Never repair damaged rims or retaining rings.



- Place the wheel in a cage to pump up the tyre. Fasten the pump hose to the air valve with a clamp. Stand away from the pressure gauge at the side of the tyre when pumping it up. At no more than 3 bar, check that the retaining ring is positioned correctly.

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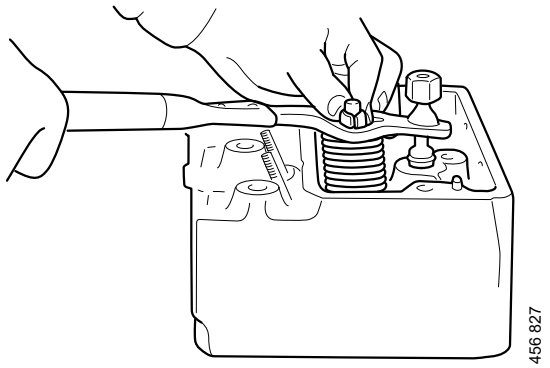
- Clean the tyre thoroughly, removing grit and sand before balancing. Use a protective casing over the wheel.
- Use protective screens or eye protection.

Tensioned springs



Examples of tensioned springs:

- Equaliser springs for bonnet and front grille panel (3-series vehicles only)
- Parking brake cylinders
- Return springs for brake shoes
- Retaining rings
- Valve springs
- Gas springs or gas dampers

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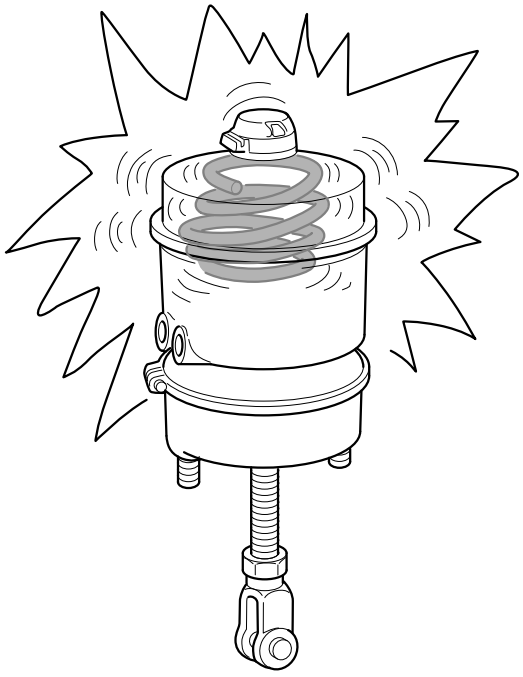
Risks



- If a tensioned spring comes loose, it will be propelled by the spring force and may take some surrounding parts with it.
- Small springs can cause e.g. eye injuries if they come loose.
- Parking brake cylinder springs are tensioned with great force and can cause very severe injuries if they come loose unexpectedly.
- Gas springs and gas dampers are tensioned with great force and can cause very severe injuries if they come loose unexpectedly. Even scrapped gas springs and gas dampers can be dangerous to handle.
- Gas dampers and gas springs can explode if heated, e.g. in a fire.

Precautionary measures

- Use eye protection.
- Retaining ring pliers must be of suitable type and size for the purpose and in good condition.
- Follow the maintenance instructions or any special instructions for the component concerned, with regard to service and scrapping.
- Always use recommended tools.

Airbag, belt pretensioner and other pyrotechnic equipment

Airbags, belt pretensioners and fail safe switches all contain a pyrotechnic propellant and can cause damage or injury if they are triggered in uncontrolled forms. They must therefore be handled by personnel with the correct training. Refer to the complete workshop information on belt pretensioners, airbags and automatic fail safe switches for more information concerning handling these units.

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Cut the power to the vehicle before starting repairs in order to avoid the uncontrolled discharge of airbags, belt pretensioners and fail safe switches.

Airbags and belt pretensioners are triggered by applying electronic pulses to the connector pin or by extreme heat.

Precautionary measures

- Cut the power to the vehicle before starting the repair.
- If a module is triggered:
  - Move away from the vehicle for about 10 minutes to allow the dust to settle. Do not spray water onto the module.
  - Vacuum clean the vehicle. Cleaning personnel must use gloves.
  - Do not allow the gas to come into contact with the respiratory system or eyes.
  - Do not inhale smoke or dust.
  - Wash your hands after touching a triggered module.
  - A triggered module must be placed in a plastic bag and transported to a facility that handles safe and environmentally responsible disposal of hazardous waste.
- Mark scrapped modules with a label for non-mountable materials, Bn 1947, and return to the supplier.
- In the event of fire, units in storage can be cooled down with water to prevent accidental triggering. If the module has already been triggered, it must not be cooled down with water.
- Individual modules kept in the workshop must be stored in a locked cupboard marked Airbag, Explosive.

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Fluids and gases

Fluids and gases

Risk of fire and explosion

Examples of flammable substances:

- Oils
- Petrol
- Diesel
- Ethanol
- Vehicle gas
- Oxyhydrogen gas when batteries are being charged
- Organic solvents (paint, plastic, detergent)
- Anti-corrosive agents
- Glycol
- Washer fluid
- Welding gas such as acetylene and heating gas such as liquefied petroleum gas

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Examples of ignition causes

- Welding, cutting and sparks from sanding discs.
- Smoking.
- Heat release from rags or other materials that have been soaked in oil or paint (linseed oil).
- Short circuits in electrical installations.
- Hot surfaces on electrical or mechanical equipment.
- Oxygen increases the risk of ignition. Containers, pipes or valves used for oxygen must be kept free from oil and grease.

Special cases

Diesel

The flashpoint, the temperature at which a liquid evaporates and can be ignited in air, will drop if petrol or other fluids with a low flashpoint are used as additives. This may also mean there is a risk of it igniting at room temperature. Diesel has a lower ignition temperature than petrol.

Welding close to the gearbox

The noise shield under the gearbox may become a fire hazard if the insulation material has absorbed oil. Red-hot weld spatter can cause ignition and the rapid spread of fire.

Battery charging

When a battery is being charged, its electrolyte will be divided into oxygen and hydrogen gas. This is an extremely explosive combination. The risk of an explosion is especially high when using an auxiliary battery or boost charger due to the increased risk of gases forming.

Precautionary measures

- Keep hazardous substances in approved and airtight containers.
- Make sure there are no sources of ignition in the vicinity of flammable or explosive substances. Keep them completely shielded if possible.
- Remove the noise shield from under the gearbox whenever welding is carried out close to the gearbox. Protect the noise shield from weld spatter.
- Ensure there is good ventilation or use an extractor system.
- If not working specifically on the battery, always ensure that the power to the vehicle is disconnected when working on e.g. the starter motor. This is to avoid subsequent short-circuiting and damage to the cable harness.

Hot work

Hot work requires training and certification as well as written permission from the fire safety officer on site. If a fire should break out and these regulations have not been followed there is risk that the insurance will be invalid.

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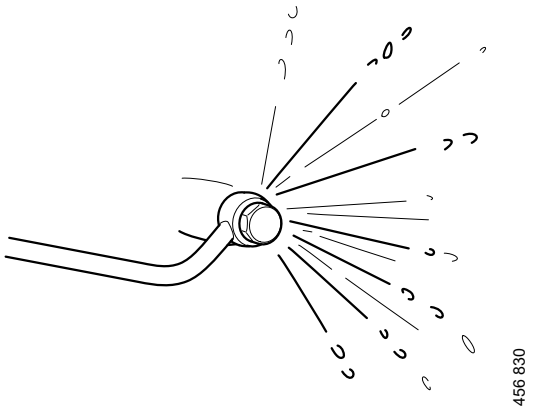
Pressurised liquids or gases



Pipes under high pressure can be damaged while work is being carried out and liquid or gas may escape. Pipes may be under high pressure even if the pump has stopped so that liquid or gas can leak out after loosening a pipe connection.

Rapid and powerful heating can cause gas bottles to burst and cause an explosion. Most gas bottles have safety valves which release the gas before they burst, which leads to a rapidly-spreading fire. An acetylene bottle that has been exposed to external damage can explode, for example if it falls against a hard surface. Gas can escape from damaged valves. Pressurised gas bottles can be expelled with a power equivalent to up to 60 tonnes if the valve is damaged and there is an uncontrolled release from the gas bottle.

Risks

Working on the following components may involve a risk of injury:

- power steering
- tag axle lift
- loading crane
- tipping device
- brake system
- compressed air from workshop pneumatic systems
- rubber repairs (tyre repairs)

A jet of liquid or gas under pressure will entail the following risks:

- gas could penetrate the skin and cause severe tissue damage.
- gas that penetrates body tissue could disrupt blood circulation.
- eyes could be seriously injured.
- many substances in gases cause poisoning.

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Precautionary measures

- Wear eye protection and protective gloves.
- Never work on a pressurised system unless absolutely necessary.
- Use liquids for leak testing.
- Never clean clothing by blowing with gas or compressed air.
- Protective casing for the valve must always be fitted when transporting pressurised vessels.

Solvents

Fluids that dissolve grease, paint, varnish, wax, oil, adhesive, rubber, etc. (unlike water, for example), are called organic solvents.

Examples of organic solvents:

- White spirit
- Toluene
- Trichloroethylene
- Thinner
- Petrol
- Alcohols
- Xylene

Risks

- Solvents and products containing solvents give off fumes that can cause dizziness, headache and nausea. They can also cause bronchial irritation. Prolonged exposure to a solvent and its fumes could cause damage to the central nervous system. This will become evident through difficulty sleeping, depression, nervousness, poor memory and general tiredness.
- Solvent in direct contact with the skin will make it dry and crack. The risk of skin allergies will also increase. Solvents can also penetrate the skin and be taken up by the bloodstream. Many solvents are flammable.
- Most solvents give off extremely flammable fumes at normal room temperature. These fumes can easily ignite, e.g. from a spark. Smoke from a fire where solvent or some other flammable product is burning will contain large amounts of black, corrosive smoke.

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Precautionary measures

- Avoid inhaling fumes by providing good ventilation, fresh-air masks or other respiratory protective equipment with suitable filter for hazardous gases.
- Ventilation must be adequate for the relevant amount of solvent being used and the associated risk of fire.
- Never leave a container of solvent without an airtight lid.
- Use solvents with low levels of aromaticity. This will reduce the risks.
- Avoid contact with the skin.
- Wear protective gloves.
- Make sure that protective clothing is resistant to solvents.
- Electrical equipment must be approved and suited for use in environments where the air may have some solvent content.

Oils and lubricating greases

Risks

- Oils and lubricants may be **allergenic**.
- Used oils and lubricating greases are classified as **carcinogenic** and may contain substances that are otherwise **allergenic**.
- Oils and lubricating greases may cause **dry skin or cracks in the skin** in the event of repeated contact with the skin.

Avoid injury by always following the specified safety measures.

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Precautionary measures

Overall requirements

- Make sure that the process ventilation is active* when working with oils and lubricating greases.
- Do not handle oil above 50°C, as hot oil emits more steam/smoke/mist compared to oils at a lower temperature.
- Avoid open handling of oil.
- Wipe up spillage immediately.

*If there is forced ventilation or a spot extractor, it is important that these are maintained and checked regularly.

General requirements for personal protective equipment

- Use nitrile gloves, change gloves often.
- Use thicker nitrile gloves (TEGERA 7 361) in situations where a lot of oil is handled, e.g. when cleaning up spillages or leaks.
- Use respiratory protective equipment (Brown A filter + P3) where there is a risk of oil mist, e.g. when cleaning up spillages or leaks
- Wear eye protection if there is a risk of splashing in your eyes.
- Wear a long sleeved sweater and long trousers to protect your skin from contact with harmful substances.
- Change clothes if they have been splashed with oil.
- If the skin has come into contact with oil or lubricating grease, wash the skin with soap and water.

In addition to these requirements, there may also be special safety information for different work operations. **To avoid personal injury, always make sure to read the instructions for the work to be carried out**.

If a personal injury occurs, immediately stop work and contact medical care services.

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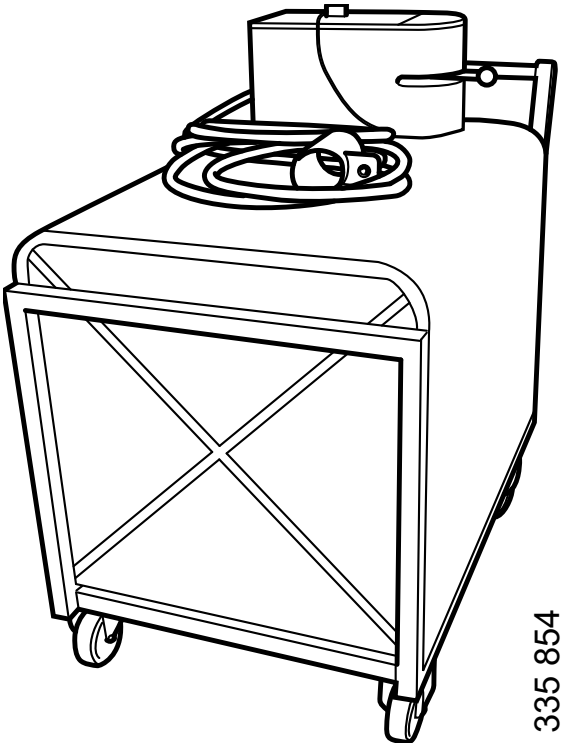
Ethanol



Use tool 588 794 to drain ethanol tanks safely.

Keep the tank well sealed and away from sources of ignition. Smoking is prohibited.

WARNING!

Comply with local laws and regulations when handling ethanol fuel. Consult and obtain permits from the relevant authority for fire protection, environment and health.

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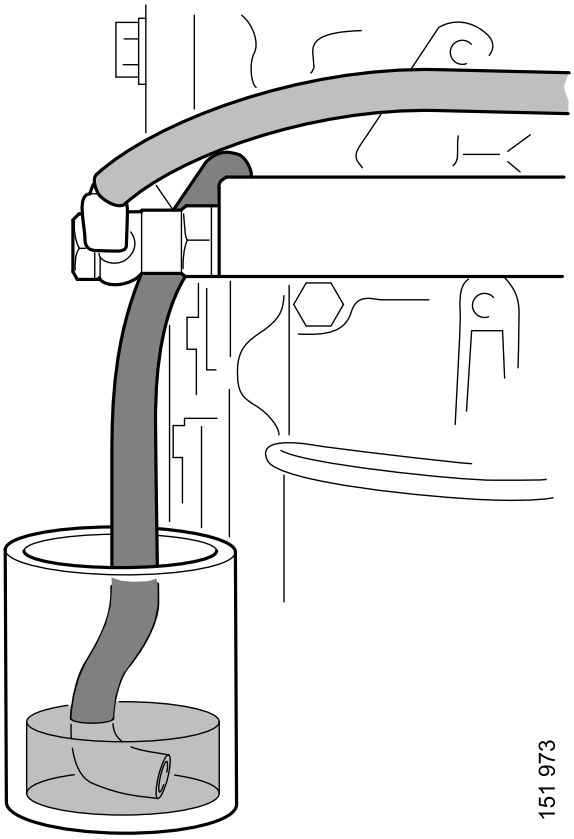
Risks

- Ethanol fuel is highly flammable and should be handled with great care.
- Ethanol fuel is harmful to health. Rinse with water if ethanol has come into contact with your eyes or skin.
- At room temperature, ethanol vapour can form an inflammable mixture with air, both in closed and open vessels.
- The vapour is heavier than air, spreads along the ground and can ignite far from the source.
- Ethanol burns with a faintly visible flame and without smoke. Burning ethanol is therefore difficult to detect in daylight.



Avoid free-falling jets. Instead, use a hose.

- Avoid a free-falling jet as there is a risk of static electricity with spark formation as a result. Instead, use a hose.
- Prevent sparking through equipotential bonding (connection of the relevant parts with conducting electrical cable).

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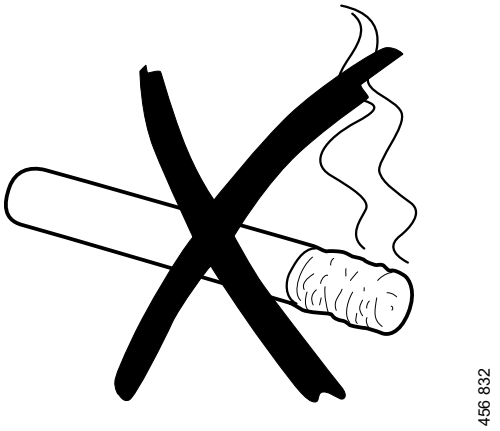
Precautionary measures

Display signs as in this example during work requiring ethanol handling in the workshop.

- Follow applicable local laws and regulations when handling ethanol fuel.
- Use a warning sign that says Work with flammable fuel is in progress during work requiring ethanol handling in the workshop. See the example in the illustration. The workshop is responsible for obtaining a sign in the relevant language.
- In the event of an ethanol fire, powder is the most suitable extinguishing agent.



- Smoking and performing hot work is forbidden while handling ethanol in the open.
- Ventilate the room thoroughly when handling ethanol.
- Establish procedures for ethanol decontamination during workshop work. Sand or other absorbent for decontamination should be present.
- Store waste ethanol in a labelled closed receptacle specially intended for ethanol so that there can be no confusion with diesel.

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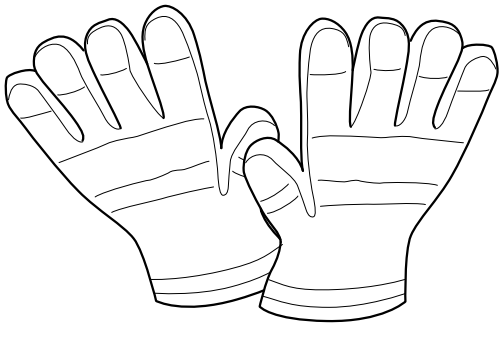

- Wear protective gloves and eye protection that can withstand ethanol when handling the fuel. Cotton clothing is recommended.
- Store replaced parts, such as fuel filters, in a closed container specifically intended for this.

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Procedures for all work in the workshop

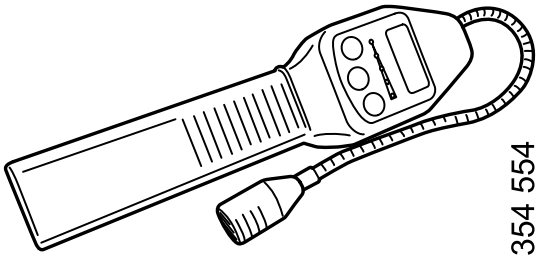
WARNING!

Read the regulations for ethanol before commencing any work. In addition, adhere to any local rules and regulations for working with ethanol applicable to the workshop.

WARNING!

Think about the environment, avoid spills and use receptacles!

Before work in the workshop



Gas detector 2 380 848.

- Check whether the fuel system leaks ethanol before the vehicle is brought into the workshop. The recommended method is to carry out leak tracing using gas detector 2 380 848.
- Cut the power to the vehicle via the battery master switch before starting work. This is to minimise spark formation that can ignite ethanol vapour.

WARNING!

If work is to be carried out in engine compartments on vehicles equipped with fire extinguishing equipment in the engine compartment, cut the power to the vehicle by loosening the batteries' connections.

During work in the workshop

- If work is to be carried out on fuel tanks, the tanks must be emptied according to the job description for emptying the fuel tank in the Workshop Manual.
- If hot work affecting fuel tanks, fuel pipes or other components that may contain ethanol is to be carried out, the fuel tanks must be emptied according to the job description for emptying the fuel tank in the Workshop Manual.

After workshop work

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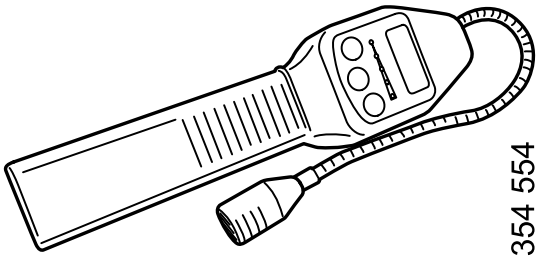

Gas detector 2 380 848.

- Start the vehicle and check whether ethanol is leaking. The recommended method is to carry out leak tracing on the fuel system using gas detector 2 380 848.

Vehicle gas

WARNING!

Scania recommends that the vehicle is declared to be free of gas leakages immediately after it has been driven into the workshop. Follow the guidelines in *03:00-05, Declaration of a leak-free gas vehicle in the workshop*. See *03-00 Fuel and exhaust system assembly* in the Workshop Manual.

If the vehicle has a gas leakage or is suspected of having a gas leakage, see *03-00 Fuel and exhaust system assembly* in the Workshop Manual.

WARNING!

Vehicle gas refers to natural gas and biogas, both of which are primarily made up of methane. Vehicle gas is flammable and must be handled very carefully.

WARNING!

Do not loosen union assemblies when the system is pressurised.

IMPORTANT!

Work on the fuel system may only be carried out by staff who are aware of the risks of gas and have sufficient knowledge of it.

IMPORTANT!

Comply with the applicable local laws and regulations when handling vehicle gas and removed gas tanks.

The vehicle gas used in Scania gas vehicles is biogas or natural gas, but it is also possible for a mixture of these gases to be used. The vehicle gas in the gas tanks can be in 2 different states of matter: fluid or in the form of gas. If the vehicle gas is stored in gas form, the vehicle is designated as a CNG vehicle (Compressed Natural Gas). If the vehicle

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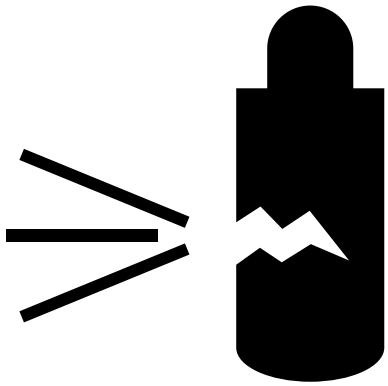
gas is stored in liquid form, the vehicle is designated as an LNG vehicle (Liquefied Natural Gas).

In order for the vehicle to be able to take on as much fuel as possible, i. e. to achieve as high an energy density as possible, the vehicle gas for a CNG vehicle is pressurised. With a full tank, the tank pressure is over 200 bar.

The high energy density is achieved in an LNG vehicle by making the gas fluid, which means that it must be cooled intensely. Its temperature can be as low as -130°C, which means that LNG can cause frostbite if it comes into contact with the skin. Fluids with such a low temperature are often designated as cryogenic fluids.

When heated, LNG expands to up to 600 times its original volume. Therefore, even a small leakage can cause a fire hazard.

Vehicle gas is basically colourless and odourless, but CNG often has a mixture of odorants. Odorants allows small leaks to be detected before there is a risk of the vehicle gas becoming flammable. LNG is odourless.



Gas leakage warning in the instrument panel.

The engine management system can diagnose gas leakages from a drop in pressure. If the engine management system has discovered a gas leakage, a warning is displayed in the instrument panel.

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Risks

Vehicle gas mainly consists of methane and can have a methane content of more than 90%.

- Methane is a highly flammable gas which is flammable when present in a 5-16% mixture in the air.
- Methane is extremely flammable and can even be ignited by static electricity from a person.
- Methane ignites when in contact with hot surfaces at approx. 600°C
- Methane burns with an almost invisible flame. Therefore, take extra care.
- Methane is not toxic but in a mixture of 50% or more with air, the oxygen content will be so low that the risk of suffocation increases.
- Methane is lighter than air and therefore rises in the event of leakage. Bear this in mind if leaks do occur in enclosed spaces such as indoors or in a tunnel. In those cases the gas can cause suffocation and an explosive atmosphere.
- Bear in mind that the CNG flowing out of gas tanks can cause frostbite, since the reduction in pressure in the gas tank causes the gas temperature to fall.
- The risk of explosion in the event of a gas leakage in CNG vehicles is relatively small, but if e.g. a fusible link is opened and the gas ignites, flames tens of metres high can occur. If several fusible links are opened, extremely intense fires can occur.
- Liquid vehicle gas, LNG (Liquefied Natural Gas), is very cold – approx. -130°C – and can cause frostbite.

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Precautionary measures

- Use warning plates to indicate that work with flammable fuel is in progress. Warning signs should be written in the local language. Comply with local regulations on the design of warning signs. An example of the design of a warning sign is shown in the illustration.
- Inform all personnel in the workshop of the essential risks of vehicle gas.
- Smoking is prohibited in the vicinity of gas vehicles.
- Do not loosen union assemblies when the system is pressurised.
- Earth the frame of the vehicle where open handling of gas takes place, i.e. handling which may give rise to an explosive atmosphere.
- Keep removed gas tanks in a well-ventilated place and separated from sources of ignition.
- Never refuel the vehicle immediately before it is brought into the workshop. This is particularly important if it is cold outdoors since the gas pressure will increase as the temperature rises.
- Remove the gas tanks from the vehicle before draining, if the state of the gas tanks is not considered to put people at risk.
- Never use compressed air to drain the gas tanks, since an explosive mixture of oxygen and methane may then arise.
- If the work involves a risk of contact with cold liquid, cold equipment or cold gas, bear the following in mind:
  - Handle LNG such that the liquid does not splash, flow or leak.
  - Protect eyes and skin.
  - Wear a long-sleeved sweater or shirt.
  - Wear trousers that are not folded up at the bottom and which reach your shoes. This prevents spilled liquid from collecting in the trousers or shoes.

  The following equipment is recommended, depending on the work:
  - Eye protection
  - Clean gloves, for cold work
  - Face mask
  - Apron
  - Safety shoes

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Put up signs as indicated in the example when working on gas vehicles in the workshop.

Hot work

- Remove gas-filled high pressure tanks if there is a risk of the vehicle being subjected to temperatures of more than 60°C.
- Follow the guidelines in *03:00-05, Declaration of leak-free gas vehicle in the workshop* if welding, grinding and other metalworking which can produce heat and sparks is to be performed in the vicinity of the vehicle. See *03-00 Fuel and exhaust system assembly* in the Workshop Manual.
- Gas tanks and gas systems must be protected from sparks and weld spatter when welding is being carried out on the vehicle.

Safety precautions in the event of fire

- Take the vehicle out of the workshop. Move the gas tanks to safety.
- Never attempt to put out a burning gas flame. Try to stop the flow of gas instead. Move material that could be ignited by the flame.
- Do not cool the fusible links on a CNG vehicle in the event of fire.
- If LNG catches fire, do not use water or carbon dioxide to extinguish the fire, as these cause LNG to evaporate more quickly, thereby intensifying the fire. Use a powder fire extinguisher instead. A burning gas flame should not be extinguished, in accordance with the instructions in the second point in this section.

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Actions before transporting gas tanks

Carry out the following actions before transporting gas tanks, for inspection, scrapping or similar.

- Make the gas tanks gas-free by draining them and then rinsing them with nitrogen.
- Select the draining method that is technically most effective and has the smallest environmental impact possible.
- Label the fuel tank clearly with the text Gas free or N2 cleaned.
- Gas may not be released in the workshop, and preferably not into the atmosphere, to prevent environmental impact.
- After rinsing CNG tanks: Remove the entire tank valve to clearly show the gas tank is not pressurised.
- After rinsing LNG tanks: Allow the manual shut-off valves for fuel and gas recovery to remain open.

WARNING!

Methane is a greenhouse gas with a greenhouse effect that is approx. 20 times greater than carbon dioxide. The gas should therefore not be released into the open air.

- First run the gas until it runs out and the engine stops. Then there is a smaller amount of gas in the gas lines and in the gas tanks.
- Secondly contact an external company which can handle gas.
- Thirdly, store the gas in a safe and environmentally-friendly way by collecting the gas in an external tank.
- Fourthly, light the gas in a safe way.
- In absolute emergencies, you can empty the gas system in the open air. The gas system may only be emptied outside in a place where there is no risk of sparks.

Coolant

Coolant used in vehicle cooling systems consists of water and corrosion protection and perhaps antifreeze, ethylene glycol for example.

Coolant must not be disposed of in drains or directly on the ground. Drain the coolant using a coolant tank.

Concentrated glycol is a combustible fluid and must be stored as such.

Risks

- Direct contact with coolant, e.g. in the eyes or on the skin, will cause injury.
- The cooling system runs at overpressure. Hot coolant can escape if there is leakage or when the filler cap is opened, causing burns.
- Ethylene glycol and corrosion protection is dangerous if swallowed.

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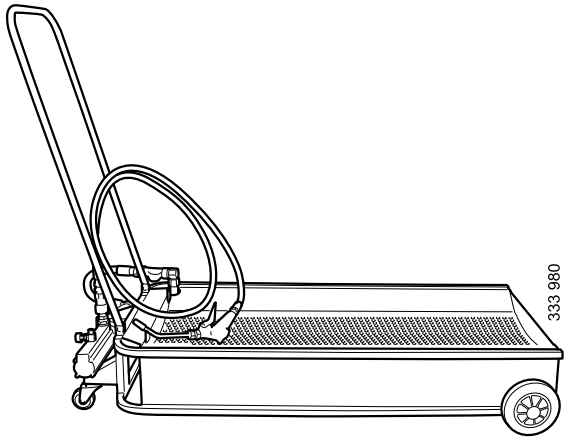
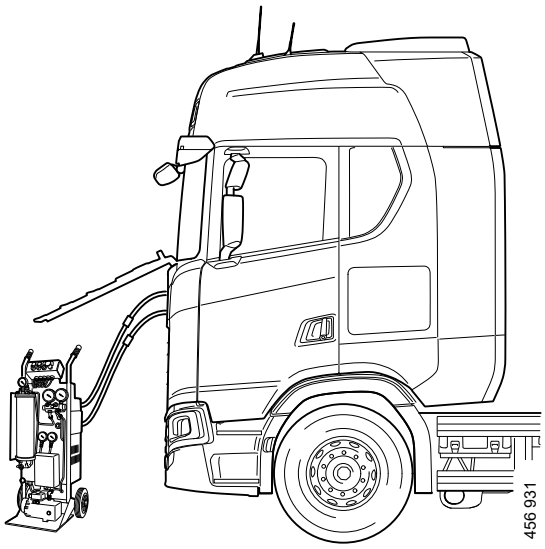
Precautionary measures



- Wear protective gloves and eye protection if there is any risk of splashing or spraying.
- Open the filler cap first to relieve any overpressure. Do this carefully. Hot steam and coolant could spray out.
- If possible, avoid working on the cooling system until the coolant has cooled down.
- Use equipment as instructed in the workshop information and follow any other instructions concerning work carried out on the cooling system.

Refrigerant



Refrigerant is used in the vehicle’s climate system.

Work on the climate system must be carried out in compliance with the legislation for the market in question.

Only use tools that are especially designed for this purpose.

Observe local laws and regulations for handling and recycling refrigerant.

Contact your importer for further directions.

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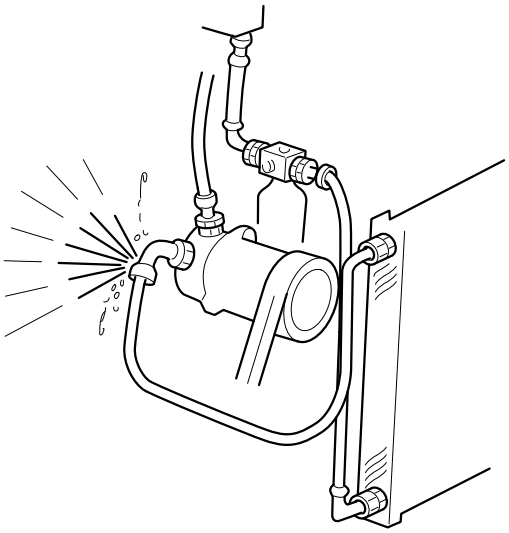
Risks

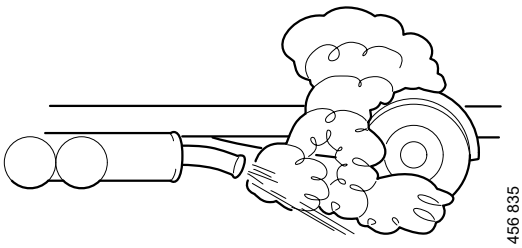


- Air conditioning operates under pressure. Escaping refrigerant can cause frostbite or personal injury.
- Refrigerant that is heated by smoking or welding, for example, will form gases that are extremely dangerous to inhale.
- Remember that refrigerant will contribute to the greenhouse effect if released into the atmosphere.

Precautionary measures

- Wear protective gloves and eye protection where there is risk of leakage.
- Ensure there are no sources of heat in the vicinity, welding and cigarettes for example.
- Read the instructions and use the equipment for the refrigerant according to the workshop information when working on the climate system.
- Use local extractors at floor level. Any gas that is formed will be heavier than air and will sink to the floor. The gas is also invisible and almost odourless, which makes it difficult to detect.

Air pollutants



Air pollutants are the pollutants found in the air and considered as being hazardous to health. Certain pollutants occur in a more concentrated form in certain environments.

The following pollutants can be found especially in workshops:

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- Carbon monoxide, from vehicle exhaust gases. Carbon monoxide is odourless and therefore especially dangerous.
- Nitrogen oxides or nitrous gases, from vehicle exhaust gases.
- Welding fumes, especially from galvanised or painted materials.
- Oil mist, e.g. from anti-corrosion treatment.
- Fuming sulphuric acid, e.g. from battery charging.
- Grinding dust and gases formed when grinding and heating plastic, paint, anti-corrosive agent, lubricant, paint, etc.
- When heated, PVC will emit toxic smoke that when combined with moisture forms hydrochloric acid, which can cause corrosion damage to metal after about 2 hours.

Risks

- Carbon monoxide impairs the ability of the blood to take up oxygen, reducing the supply of oxygen to the brain and other parts of the body. Carbon monoxide poisoning is therefore regarded as internal suffocation. This toxic process can take place rapidly without prior warning.
- Remember also that cab heaters emit exhaust gases.
- Nitrogen oxides, gases and grinding dust can damage the lungs.
- Oil mist from certain oils can cause skin problems such as pimples, boils and eczema.
- Fuming sulphuric acid is corrosive and can damage the respiratory system.

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Precautionary measures

- Ensure there is good ventilation with fresh air during welding, battery charging or other work where hazardous gases can be emitted.
- Use protective gloves and respiratory protective equipment whenever there is risk of oil mist occurring. Make sure all protective equipment is oil resistant.
- Cover unprotected skin with oil-resistant barrier cream.
- Ensure there is an eye washing facility in the immediate vicinity when carrying out work with corrosive substances.
- Avoid operating the vehicle unnecessarily in the workshop. Connect an extractor to the exhaust pipe to lead exhaust fumes out of the workshop in a closed system.
- Use local extractors if the vehicle’s short-stop heater is used.

Isocyanates

Isocyanates occur in some paints, putty, adhesives, plastics, etc. used in motor vehicles.

It is Scania's goal to avoid the use of paints, putty and adhesives containing isocyanates but Scania cannot guarantee that this is the case for paintwork, etc. carried out on the vehicle once it has left the factory.

Risks

- Inhaling isocyanates in the form of vapour, dust or aerosol may cause mucous membrane irritation with asthmatic symptoms from the respiratory passages and impair the function of the lungs. Even short-term exposure to high levels can cause problems with a lasting hypersensitivity.
- When products containing isocyanates in combined form are heated, they may be set free and give high levels of exposure. This applies e. g. to grinding, welding and cutting products covered in paint containing isocyanates.

Precautionary measures

When grinding, welding and cutting products covered in paint containing isocyanates:

- Make sure that the ventilation in the premises is very good.
- Use respiratory protective equipment with a supply of fresh air.

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Electricity

Electricity

Workshop

Before starting work, carry out *Procedures for electrical work on electric vehicles*.

Cleanliness

Dirt can cause fire, short circuits, electrical arcs and insulation faults.

WARNING!

Danger to life and property.

Clean the components and areas around the components to be opened. To clean certain components, blocking components may need to be removed. Remember that this may affect the IP classification of the product.

Be careful when cleaning when components are fully or partially opened. Modules and cells in the modules are sensitive to dirt, even very small particles can cause serious damage resulting in fire or arcing. Therefore, great care must be placed on cleanliness when the battery is opened.

Be aware of dirt that is pulled up from the floor from other workshop locations, through open workshop ports, falling down from overheads and other cranes. Clean the floor and taps if necessary, avoid opening ports when the battery is exposed. Pause the work and cover the battery if ports need to be opened.

Immediately discard clipped cable ties and other waste to prevent them from being left inside the battery. Make sure that all components are refitted and that all screws are tightened to the correct torque. If necessary, mark the screws after they have been tightened so as not to forget anything.

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Workshop environment

During electrical work in the vehicle or battery, the area must be cordoned off so that no unauthorised persons may enter. Place signs and cordon tape to provide information about the work that is in progress. Examples of content include:

- That there are electric vehicles in the workshop
- Who is responsible for the work with contact details

Inform others in the workshop about what work is going on and whether special measures are needed to maintain cleanliness during the work. Make sure that the others in the workshop announce whether they will do something that could potentially create contamination so that the right measures can be taken, such as covering batteries or other sensitive components such as electric machines.

IMPORTANT!

Use desks and unloading surfaces to ensure a safe work environment.

Risk of short circuit

Dismantling a live electrical connection can cause sparks, resulting in a fire hazard. Never cut a wire with several internal electrical cables when it is live. This would mean a high risk of a short circuit and consequently a fire hazard.

Battery charging

Explosive gas is formed when batteries are being charged. Smoking is prohibited and there must not be any apparatus that can cause sparks in the vicinity.

Voltage class A (VCA) Electric motors

Precautionary measures

- Disconnect the batteries. This is a sound safety precaution to prevent inadvertent operation of the electric motor.

Windscreen wipers

Even after turning off the windscreen wipers with the relevant switch, there will still be power remaining in the wiper motor for its return stroke to its starting position. It only requires an insignificant movement of the engine to make the wiper motor operate.

Precautionary measures

- Detach the wiper motor only if you are sure that the power has been disconnected.

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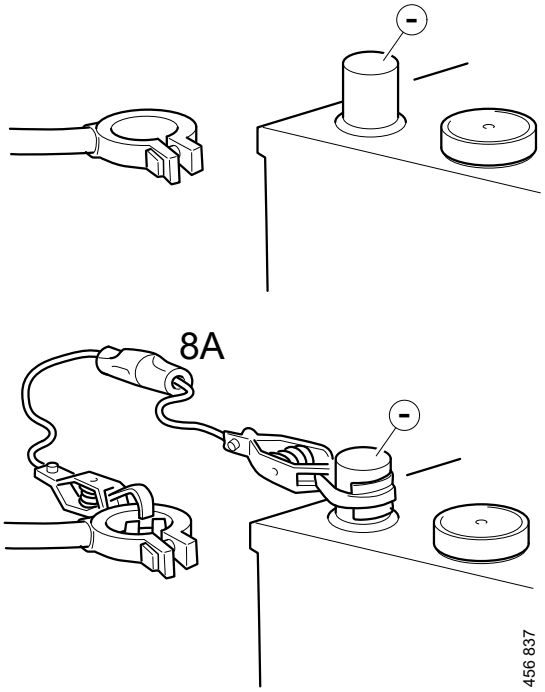
Starter motor

The vehicle will be set in motion if the starter motor is connected while a gear is engaged. In turn, the engine may start if the starter key is in Drive mode and the vehicle will move off with a gear engaged. Remember that a moving truck is very difficult to stop if the cab is tilted.

Precautionary measures

- Cut all power to the vehicle. This applies to all vehicles no matter what the condition.



- Connect a hanging fuse (8 A) between the negative battery terminal and the cable terminal if power is required in the electrical system. This action will also reduce the risk of burns and fire caused by power from the battery.

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Voltage class B (VCB)

Risks

Risks must be identified before they can be managed. We must therefore understand the systems, vehicles, tools, methods, etc. in order to be able to carry out a risk analysis. In addition, it is made more difficult when vehicles in the workshop may be defective and needing to be repaired. This can have a direct impact on the safety of the vehicle, e.g. exposed electrified parts. This may affect, for example, our ability to read fault codes.

WARNING!

Damaged vehicles or vehicles with an unknown status may need to be quarantined before work is started.

Remember that everyone who is in the workshop needs to be informed about risks related to the electrified vehicles and what the various signs and barriers mean. Visitors and hired staff such as cleaners also need to be informed

Remember to follow all methods regarding tightening torques, if damaged components need to be renewed, etc.

Risk management

Be sure to follow all the steps in the risk analysis before starting electrical work:

1. There must be an electrical organisation. Follow both Scania's rules and local laws and regulations. The electrical organisation ensures that everyone involved has the right training, competence and permission to carry out specific work
2. Emergency exits must be operational and accessible. If possible, also prepare for vehicle evacuation. Fire extinguishing equipment must be available to prevent small fires from becoming large.
3. Carry out risk analyses for all work. If a risk has been identified, it must be rectified before starting work. Never start work if there are unaddressed risks. Remember that the vehicle may be damaged or have been converted in an unexpected way. This may mean that the vehicle's integrated safety systems may not work correctly or would produce incorrect fault codes. This may also mean that ingrained safety measures are inadequate in the present case.
4. The correct protective equipment for the work in question must be available and used.
5. Do not carry out any work or tasks unless they can be handled safely. Any risks must have a measure to minimise the likelihood of something happening and consequences if something should happen.
6. Do not carry out any work or tasks unless they can be handled safely. Any risks must have a measure to minimise the likelihood of something happening and consequences if something should happen. Stop work if an unexpected event occurs. Only start work once you have understood how the deviation can be handled safely

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Clothes

Electrical work must be carried out without rings, bracelets, watches, neck chains or similar items regardless of the risk of arcing, as metal jewellery and the like can cause serious personal injury in the event of a short circuit or arc.

The clothes must protect against current flow when in contact with electrified components. They must also protect against heat, molten metal and flying particles in the event of an electric arc.

Work near the voltage source requires additional protection. Clothes therefore need to be adapted to the current work. Remember that batteries with a higher state of charge (SOC) have the potential to cause worse accidents.

If possible, try to bring the vehicle into the workshop when the charge level in the battery is low. Depending on the fault in the battery, however, it may be impossible to discharge the battery before it has been repaired. It is extremely important that the correct protective equipment and correct working methods are used.

IMPORTANT!

Only use clothes of the same make.

Protective equipment against electric arcs can be measured in accordance with ELIM. If 2 layers of clothing are used, the common level of protection expressed in cal/cm^2 may be greater than the sum of the two levels of protection in the two garments. The total protection must be at least 26 cal/cm^2 according to the ELIM value. There are other types of test scales, but Scania requires the ELIM scale to be used.

This summary can only be obtained from the manufacturer of the garment. In order to ensure the correct level of protection, the clothes must come from the same manufacturer and the manufacturer must also state the overall test values for the garments in question.

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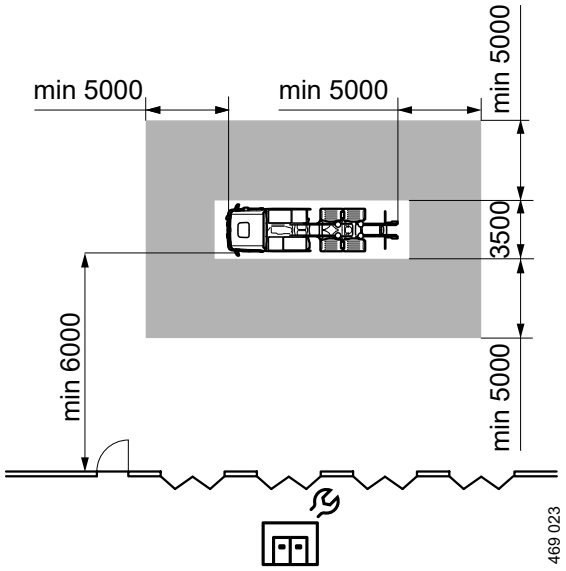
Quarantine

Quarantine is a secluded area where vehicles or batteries with suspected or confirmed damage are to be stored until they are confirmed safe to be stored. An example may be when a tow truck comes with a damaged truck where the status is unknown. If the tower cannot determine this themselves, then the truck is quarantined until the workshop has had time to check the status of the vehicle.

The quarantine zone must be at a sufficient distance away from buildings and vehicles. Check with insurance companies and local laws etc. that the quarantine zone meets all requirements and conditions.

Scania says that the zone in all directions should be 5 metres larger than the vehicle, and at least 6 metres from buildings.

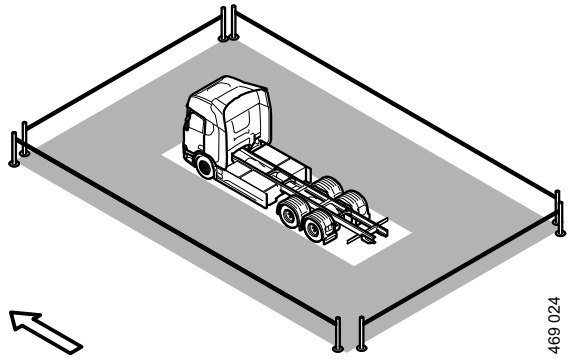


No electrical work other than to check the status of the vehicle may occur in the quarantine zone. Bear in mind the weather before starting work in the zone.

If there is a risk of reaction or fire in the batteries after analysis, the battery/vehicle must be in the zone for at least 48 hours. A new analysis may then be carried out and if it is considered safe, the battery/vehicle may be taken into the workshop.

See the classification guide in 16-27 to determine the battery status.

Batteries/vehicles that have been involved in an incident, such as a collision, need to be quarantined for at least 48 hours. After this they may be classified.



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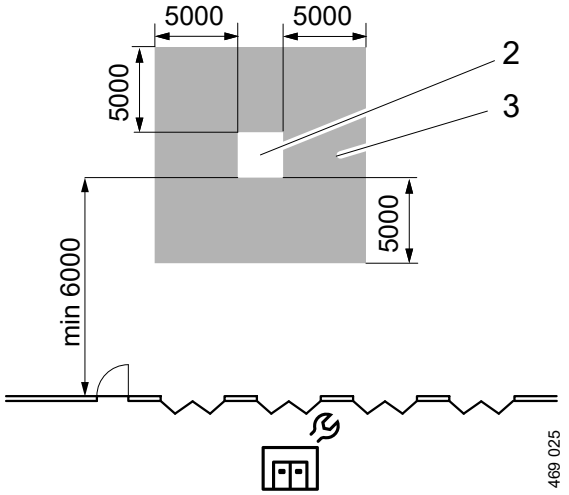
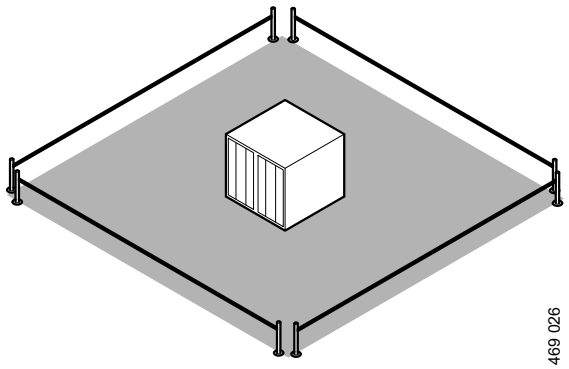
Safety container

The safety container must be positioned in a safety zone with a safety distance of at least 5 m in each direction due to the risk of fire, etc. The minimum distance to another building must be at least 6 m. The ground surface in the safety zone must be: asphalt, concrete or ground stone.





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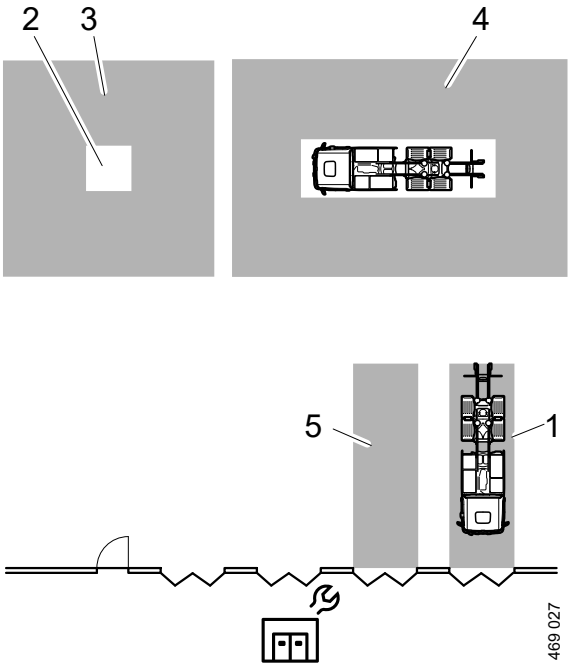

Tool

Use the correct tool when working on the VCB system, when working with voltage or where there may be voltage. Use tools classified for 1,000 V, approved in accordance with IEC 60 900 (see local standards and laws).

The tools must not be modified, e.g. by stripping away insulation. Tools and measuring cables often have double insulation with different colours to make it easier to determine whether the insulation is damaged. Never use damaged tools.

Measuring instruments must be approved in accordance with EN 61010-1 1,000 V CAT III (see local standards and laws).

Note that Scania supplies several different measuring instruments and spare parts to measure voltage. Among these, only insulation multimeters 1,000 V 2 779 227 may be used to verify that the vehicle has no power.

To eliminate the risk of a mix up, do not use lower classed instruments to measure VCA voltage in the battery.

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Battery storage and transport

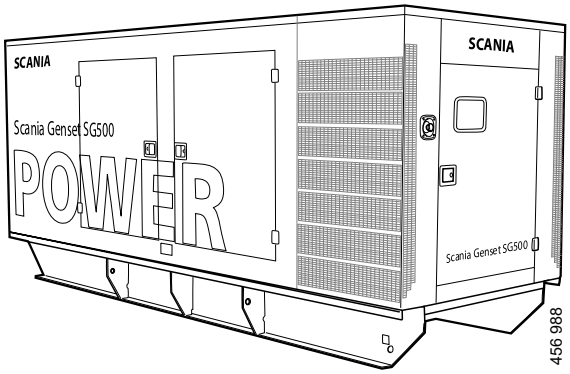
Batteries stored for a prolonged period of time will have their health deteriorated. This process will be sped up at high ambient temperatures. This occurs even if the battery is not used.

Modules and batteries constitute danger in the event of a fire. Therefore, store the batteries in a safe way so that they are not contaminated, become damp, risk short circuiting or being damaged by collision. Remember to clearly mark storage locations for batteries and see to it that everyone who uses the premises knows where they are and be able to convey to the emergency services where that is and that there are batteries on the premises. Follow the laws, rules and insurance directives for storage.

For stored batteries, it may be useful to regularly review the battery and read the state of charge and other important parameters from the battery to ensure that it does not reach a critically low charge level, for example. If the charge level is too low, the battery may reach a limit where it may no longer be used but must be recycled.

Transport must take place in accordance with ADR 1.3 (see local regulations). For transport, the battery must be classified according to the applicable methods in WSM. The type of transport and the packaging to be used depends on the class of the battery in the classification. The scheduling and management of the transport must be carried out by personnel with the correct training.

Generator set



A generator set may be the primary power source, but can also work as a standby in an electrical consumer network and be connected in case of a fault on the regular network.

The generator set can operate separately or be connected together with other generator sets for joint operation.

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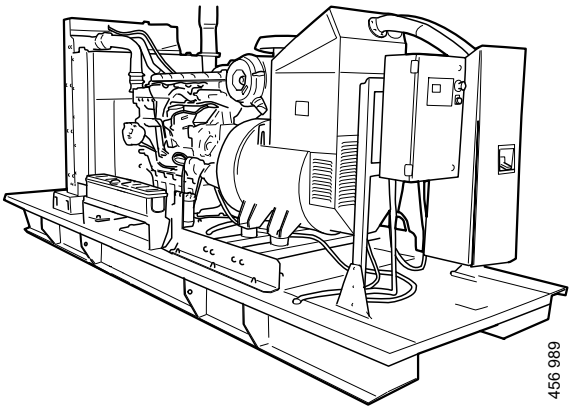
Safety regulations



- Read and understand all safety precautions and warnings before installation, commissioning, operation and maintenance of the generator set.
- Bear in mind that the generator set may be remote-controlled and could start without warning.
- The generator set must only be started and switched off if this can be done safely in relation to connected electrical consumers.
- Never run a generator set with known function faults.
- Only trained and qualified personnel authorised to carry out this work can install, commission and perform maintenance on the generator set.

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Electrical system

WARNING!

The generator set must be installed and commissioned in full agreement with current national, local or regional regulations, standards or other requirements.

WARNING!

Only trained and qualified personnel authorised to carry out this work can install, commission and perform maintenance on the generator set.

WARNING!

When a generator set with a canopy is in operation, all hatches must be closed. The hatches may only be opened once the generator set has been switched off and when required by the work.

WARNING!

The generator set can be remote controlled and start without prior warning. Therefore, set the battery master switch (option) to the OFF position or disconnect the battery negative cable before any work is carried out on the generator set.

WARNING!

Electrical cables and components in the generator set may be live with lethal voltage.

When any hatch is opened while working on the generator set, its electrical cables and components are unprotected.

Work may only be performed by trained and qualified personnel.

Connecting current consumers

WARNING!

Electrical consumers may only be connected by trained and qualified personnel authorised to carry out this work.

WARNING!

Electrical consumers may only be connected in full compliance with national or local regulations.

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Electric shock

WARNING!

Always cut off the power and take a reading between a conductor and earth before starting work on the generator set. This is to ensure no voltage remains in the system. High voltage could lead to damage, injury or even death.

24 V and 230 V central electric unit

WARNING!

Cut the 230 V power before opening the central electric unit front grille panel to reset tripped miniature circuit breakers. Otherwise there is a risk of serious personal injury.

Automatic switch

WARNING!

Cut off the power by either disconnecting the electrical cable to the negative battery terminal or cutting off the power via the battery master switch, if fitted.

WARNING!

Always cut the power using the 400 V circuit breaker and measure between earth and conductor. The reason for this is to ensure that there is no current remaining. If an electric current passes through the body, it can cause cardiac arrest, burns and shock.

Hot surfaces

WARNING!

Exhaust manifolds, turbochargers, cooling packages and generators can become extremely hot when in operation. Do not touch these components when the generator set is in operation, and make sure that it has cooled down sufficiently before any maintenance is carried out.

Moving parts

WARNING!

A generator set contains many mechanical moving parts. Remove protective devices and belt guards with care and only if it is absolutely essential to do so. Do not run a generator set without all protection devices in place.

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Noise

WARNING!

Ear protectors must be worn at all times when in the vicinity of a generator set in operation. Long-term exposure to noise levels above 85 dBA is harmful to hearing.

A generator set without a superstructure can create noise levels of more than 105 dBA.

Earthing a generator set

WARNING!

The generator set must be earthed in accordance with national or local regulations. The provisions for earthing may vary from country to country.

WARNING!

If necessary, protect exposed power cables from the mechanical impact of being run over.

WARNING!

If necessary, warn others of the risk of tripping if cables are exposed.

Batteries

WARNING!

Batteries contain and emit oxyhydrogen gas, particularly during charging, and this gas is flammable and highly explosive. There must be no smoking, naked flames or sparks near batteries or in the battery compartment.

Lifting the generator set

A generator set can be lifted in various ways depending on its equipment.

- Lift using straps connected to the 4 load securing eyes in the beam frame.
- Lift using straps connected to lifting eyes on the roof of a built-in lifting device. Only applies to generator sets with canopy. The lifting device is an option.
- Lift using a lift fork in the specific recesses (optional).

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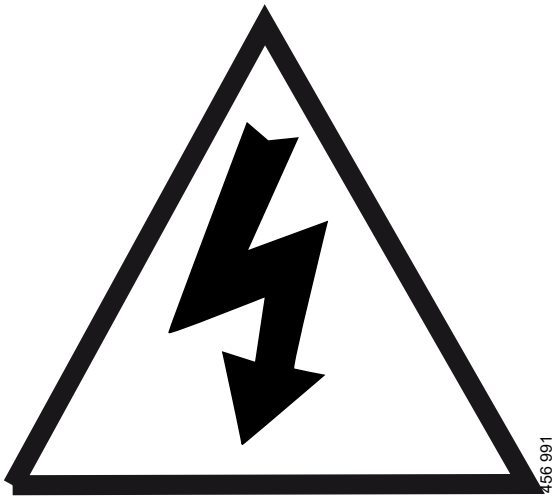
Warning stickers

The generator set is supplied with general warning stickers; see the examples in the illustrations. Replace the warning stickers if they disappear or can no longer be read.

Warning! The generator set can be remotely controlled and may start without warning.



A warning sticker with a lightning symbol indicates that there is a voltage within the casing that is dangerous to a person.

Electric drive

The electric drive system is driven by voltage class B, 650 V.

Voltage class A	0-60 V DC
	0-30 V AC
Voltage class B	60-1,500 V DC
	30V-1,000 V AC

WARNING!

If the control switch for the VCB system is not switched off, the vehicle can activate the high voltage system at any time to charge the 24 V battery.

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WARNING!

Danger of personal injury. The high voltage system can continue to be active even if the vehicle is switched off. Make sure that the control switch for the VCB system is switched off.

WARNING!

Work that is classified as **VCB electrical work** may only be carried out by trained and qualified personnel who are authorised to perform the work.

The vehicle must be secured as specified in *Procedures for all VCB electrical work on electric vehicles*. See *the Workshop Manual > 00-00 Vehicle, assembly*.

WARNING!

The vehicle must always be secured as specified in *Procedures for all workshop operations* before carrying out work. See *Workshop Manual > 00-00 Vehicle assembly*.

WARNING!

The electric machine always produces power if the combustion engine is in operation, or if it for some other reason starts rotating, even if the electric drive system is otherwise disconnected.

If the vehicle must be towed, detach the propeller shaft to ensure that the electric motor is disconnected.

IMPORTANT!

The propulsion battery must not be exposed to direct sunlight. Therefore, do not position the vehicle outdoors without protective casing. Direct sunlight could cause the battery to reach a high temperature that would permanently damage the cells.

The electric drive system has the following safety devices:

- The electric drive system cable harness for voltage class B (650 V) is orange. The cable harness for voltage class B (650 V) does not share earth with the chassis. This means that there has to be contact with both conductors before there is a risk of personal injury.
- All components in the electric drive system are provided with warning signs for voltage class B (650 V).
- The electric drive system monitors the battery temperature, voltage, current intensity and electrical insulation level. The electric drive system disconnects the battery and isolates the power to the cable harness if the results deviate.
- The electric drive system voltage is normally cut off when the 24 V system is cut off.

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Procedure for extinguishing a fire

Battery fire

If there is a visible fire in the battery, use large amounts of water to cool the battery.

Extinguishing a fire in a battery is a time-consuming and difficult process as the fire inside the battery core continues until the components in each affected cell are consumed by the fire. Extinguishing by cooling the fire can stop the spread of fire between the different battery units in the vehicle.

This increases the risk of exposure to hazardous substances, which are released from both the batteries and the rest of the vehicle. This means that it is important that fire fighting personnel are properly trained and equipped for the task, as normally only professional firefighters are.

Always consider the possibility of abandoning the vehicle or battery in the event of a fire. Have a plan for how to handle fires before starting work

Other vehicle fires, not battery fire

- In the event of a vehicle fire where the battery box is intact and not on fire, we recommend using normal procedures for extinguishing a fire.
- The battery must be protected and cooled with large amounts of water.
- If the battery box is significantly damaged, large amounts of water must be used to cool the battery. It is important for the temperature of the battery to be reduced by only using water, to prevent risk of fire and to fight any fire.

Chemical information on propulsion batteries

The chemicals in the propulsion battery are under normal circumstances not dangerous for the environment because the cells are contained in a closed and sealed space with controlled ventilation.

The contents of the cells is normally solid. The risk of contact only occurs in the event of external damage to one or more cells, too high a temperature or overload combined with damage to the seal of the battery. The contents is flammable and can be corrosive if it comes into contact with moisture.

Damage and steam or mist from the battery may cause irritation of mucous membranes, air ways, eyes and skin. Exposure can also cause dizziness, nausea and headache.

The cells in the battery can handle up to 80°C. If the temperature in the cells is higher than 80 °C, the catalytic converter will start to change into a gaseous form. This may cause the pressure relief value in the cells to break, and flammable and corrosive gas is released via the battery pack ventilation duct.

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