KALMAR

Forklift Trucks 18-33 tonnes

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Maintenance Manual in original

MAINTENANCE MANUAL

DCG 180-330

KALMAR

Maintenance Manual

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Contents A Foreword

A Foreword

About the maintenance manual

General

Thank you for selecting Cargotec as your machine supplier. We hope that we will meet your expectations.

The maintenance manual contains information about how the machine should be maintained for maximal operating reliability and service life as well as troubleshooting information for fast correction of any malfunctions.

Conditions

The instructions are based on use of general tools available in stores. All lifting devices, e.g., straps, slings, ratchet blocks, etc., must meet governing national regulations for lifting devices.

Cargotec will not accept any responsibility for modifications performed without permission from Cargotec or in the event of the use of lifting devices, tools or work methods other than those described in this manual.

Storage

NOTE

The maintenance manual shall be accessible to service personnel.

About the machine version

The information in this publication corresponds to the machine's design and appearance when delivered from Cargotec. There may be differences due to customisation of the machine.

Cargotec reserves the right to change specifications and equipment without prior notification. The information in the manual is valid at the time of publication.

DANGER

External equipment may only be used if it is approved by Cargotec.

Risk of fatal accidents and property damage!

Use only equipment approved by Cargotec.

Copyright

Reading instructions

Warning information

Warnings inform of potential hazards that, if warnings are not heeded, may result in personal injury or product damage.

DANGER

Situation that may lead to severe personal injury or fatality if the rule is not followed.

WARNING

Situation that may lead to personal injury if the rule is not followed.

CAUTION

Situation that may lead to product damage if the rule is not followed.

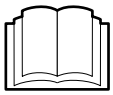
Important information

Important information is indicated by NOTE, and is provided to facilitate the work process, handling or increase understanding of the information.

NOTE

Information that is important without being related to safety.

Read operator's manual



000262

Read the operator's manual

The symbol to the left is used in certain cases on the machine and refers to important information in the operator's manual.

Read maintenance manual

001128

Read the maintenance manual

The symbol to the left is used in certain cases on the machine and refers to important information in the maintenance manual.

Maintenance manual's content

The information in the maintenance manual is divided into function groups (0-12) to facilitate searching for information. The manual is divided in 20 sections A-C, 0-12, D-G. The sections with letters contain specific information that applies to several function groups and is not bound to a function, e.g., section "F Technical data". This is described in greater detail in the table below.

For more information about function groups, see *Function group structure*, page A:6.

A	Foreword	General information about the maintenance manual's purpose, content and reading instructions as well as survey for feedback of views and eventual inaccuracies.
B	Safety	Keep in mind for your safety.
C	Preventive maintenance	General information about preventive maintenance of the machine. Instructions for lubricating and checking for cracks over the entire machine.
0	Complete machine	Work instructions for preventive maintenance.
1	Engine	
2	Transmission	
3	Driveline/Axle	
4	Brakes	
5	Steering	
6	Suspension	
7	Load handling	
8	Control system	
9	Frame, body, cab and accessories	
10	Common hydraulics	
11	Common electrics	
12	Common pneumatics	
D	Error codes	Error code information is found in the Workshop manual and Operator's manual.
E	Diagrams	Wiring diagrams and hydraulic diagrams are found in the Workshop manual.
F	Technical data	Technical data, conversion tables, information for conversion of units.
G	Terminology and index	General terminology and abbreviations, explanations of terms and abbreviations that may appear in the manual, index for headings in the manual.

Function group structure

The information in the manual is divided in a structure of functions at different levels, based on the machine's design and use, called function groups.

The upper level (called main group) determines group, e.g., group 7 Load handling. The second level (called two-digit) determines function, e.g., 7.2 Lifting/lowering. The third and fourth levels are used to break down functions into smaller parts (components).

The function groups' structure for main group and two-digit group level are common for all machines from Cargotec, e.g., 4.3 Power-assisted brake system. Machine-unique adaptations of function groups are done at the third and fourth group level, e.g., 4.3.9 Wheel brake and 4.3.9.1 Disc pack. This means that some function groups (headings) will be left out of the documentation for certain machines since the machine does not have that particular function or component. In turn, this means that the function groups' numbering may 'skip', e.g., the three-digit heading level 4.8.7 Oil cooler may be included for some machines but not for others.

The idea is that the function groups are intended to work as a search term to find different types of information between different sections and manuals. The information under a function group is divided into smaller sections according to the type of content, e.g., description or change.

The maintenance manual and workshop manual contain different information. The maintenance manual only includes information needed for preventive maintenance. The workshop manual includes more in-depth information and repair instructions.

References are indicated by either section and group numbers, e.g. "see section *4 Brakes*, group *4.3.9 Wheel brakes*" or with the section and page number, e.g. "see *Fuel level sensor, description page 4:24*" where 4:24 denotes section 4 Brakes, page 24.

References are not given between Maintenance manual and Workshop manual. If more information is desired for a function group, the primary recommendation is to search under the same function group in the other manual.

Product alternatives and optional equipment

Symbol indicating optional equipment

000264

The information in the manual is divided in modules. For product alternatives and optional equipment, handling of the modules differs depending on if it is the one or the other that is described, see below.

Special equipment is not described in the manual. If you're uncertain about what equipment the machine should have, use the machine card to decide which information applies, see *Machine card*, page A:8.

Product alternatives

Product alternatives are such options that exclude certain standard equipment (e.g., engine alternative).

Equivalent information for different product alternatives is described in separate sections following each other under the same function group. To indicate that there are different alternatives, the supplement "Product alternative" is used in the heading together with a simple description of which alternative is described, e.g., "(Product alternative Climate control unit ECC)". In addition, alternatives that are optional are marked with the symbol for optional equipment.

Optional equipment

Optional equipment are options that can be added to the standard equipment to obtain additional or improved functions.

Information for optional equipment is described in separate sections with the standard equipment as starting point. Description of the optional equipment describes how the standard function is affected by the option as well as which additional components are added.

Machine card

NOTE

If the machine has been modified after delivery the information on the machine card may be lacking or incorrect.

IMPORTANT

Changes done on the machine shall be reported to Cargotec so that the machine card can be updated. A new updated machine card is sent on the request of the customer.

The machine card indicates of which drawings the machine consists, in many cases these can be associated to options and product alternatives. For more information on handling product alternatives and optional equipment, see *Product alternatives and optional equipment*, page A:7. The machine card is supplied together with the spare parts catalogue and should be stored in the cab as an aid to service personnel.

The machine card is divided in the same function groups as the spare parts catalogue, maintenance manual, and workshop manual. For practical reasons, the machine card only uses the first and second level of the function group index. The function groups are written in groups of four characters, e.g., group 0107 corresponds to group 1.7 Cooling system in the manual.

For more information about how the machine card is used for ordering spare parts, see the parts catalogue's foreword.

If the information on the machine card does not help, contact Cargotec.

NOTE

All documents that accompany the machine are non-registered documents and there will be no notification of changes.

About the documentation

The documentation's parts

The documentation for the machine consists of the following parts:

Operator's manual

The operator's manual is delivered with the machine in the cab.

Documentation kit

Maintenance manual, spare parts catalogue and machine card are supplied for the machine as a separate documentation kit.

Supplementary documentation

Supplementary documentation can be ordered for the machine.

- Workshop manual
- Supplier documentation for engine, transmission and drive axle.

Ordering of documentation

The documentation is ordered from the dealer for Cargotec.

Always specify publication number when ordering.

For publication number, see the machine card.

Feedback

Cargotec's ambition is that you who work with maintenance of Kalmar machines shall have access to correct information.

Your feedback is important to be able to improve the information.

If you have any comments then please send them to the address below. Thanks for your help!

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Contents B Safety

B Safety

General safety information

Safety concerns everyone!

The safety information concerns everyone who works with the machine! Persons who do not follow the safety instructions in this manual must make absolutely sure that the work is performed without risks of personal injury, without risks of machine damage, or property damage!

Remember to:

- follow the instructions in this manual
- be trained for the work in question
- follow local laws, safety rules and regulations
- use the correct equipment and tools for the job
- wear the correct clothes
- use common sense and be careful. Do not take any risks!

Cargotec has in this publication documented and warned for situations and risks that may occur in connection with using as well as service or repairs of the machine during normal circumstances.

Therefore, it is very important that all who work with the machine, or carry out repairs or service work, acquaint themselves with and act according to the information in the Operator's Manual, Maintenance Manual and Workshop Manual.

A near accident is a warning!

An incident is an unforeseen event where neither a person, the machine, nor property is damaged. However, incidents indicate that there is a risk of injury and actions must be taken to avoid injury risks.

Safety instructions

General

Read, consider and follow the safety instructions below before starting to work in the machine:

Service position

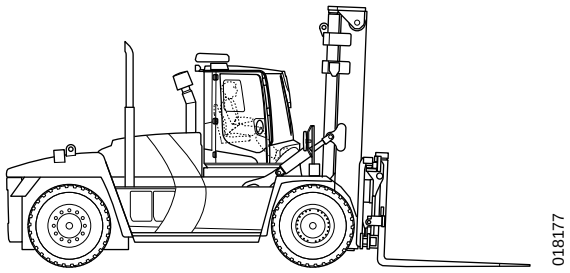
General

Service position is used for service, maintenance and other situations when the machine needs to be secured.

Service position is the starting point in most instructions. Certain work requires that service position is not used.

Service position means:

- Machine parked, that is, applied parking brake.
- Forks and trolley in completely lowered position.
- Engine off.
- System voltage off (with battery disconnector).
- If the engine is being started, connect exhaust-venting equipment to the exhaust pipe when working indoors.



Machine with forks and trolley in completely lowered position

Hydraulic system, depressurising

1 Machine in service position, see *Service position*, page B:5.

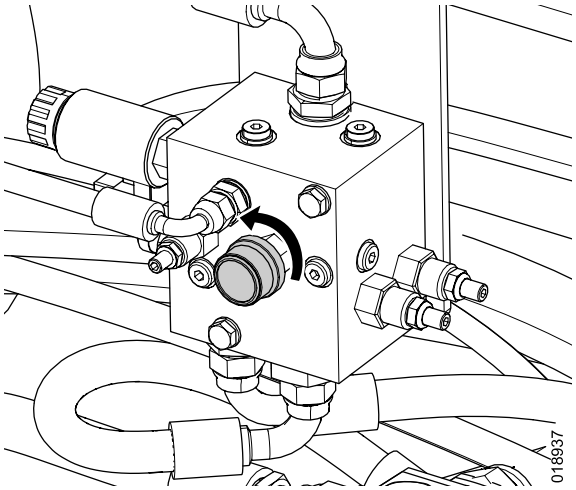
2 Depressurise the hydraulic system by opening the drain valve on the accumulator charging valve.

NOTE

Keep the accumulator drain valve open as long as work is in progress.

NOTE

After the work has been finished, close the drain valve and tighten the lock ring.



Oils

The following safety instructions shall be followed for work when handling oils.

WARNING

Warm and pressurised oil.

Always depressurise the hydraulic system before starting work in the system. The hydraulic system is pressurised and its oil can cause personal injury.

Avoid skin contact with the oil, use protective gloves. Hot oil may cause burns, rashes and irritation! The oil can be corrosive to the eyes and skin, as well as mucous membranes in the throat.

CAUTION

Always clean the area around components and connections before loosening them, and plug the connections. Dirt in oil systems causes increased wear, which results in material damage.

Always take actions to avoid spills. Where a container cannot be used for draining, use a pump or hose for safe handling.

Always check that plugs seal tight before collection containers are moved.

Handle all oil as environmentally hazardous waste. Oils freely released cause damage to the environment and may also start fires. Waste oils/fluids shall always be handled and taken care of by companies that are authorised for this work.

Fuel system

The following safety instructions shall be followed for work when handling fuel.

DANGER

Pay attention to the risk of fire when working on the fuel system.

Work on the fuel system shall be avoided when the engine is warm since fuel can spill on hot surfaces and may ignite.

Ensure that naked flames, sparks or red-hot/glowing objects have been extinguished before starting work on or in the vicinity of the fuel system.

Do not smoke in the vicinity of the machine when work on the fuel system is in progress.

WARNING

The engine's fuel system operates at very high pressure. The pressure is so high that the jet can damage the skin, which results in serious injuries.

Risk of personal injury.

Use protective gloves and protective safety goggles, avoid skin contact with fuel. If a component is to be loosened, hold a rag over the coupling as protection and collect the fuel. Fuel can be corrosive to the eyes and skin, as well as mucous membranes in the throat.

CAUTION

Always clean the area around components and connections before loosening them, and plug the connections. Dirt in the fuel system causes malfunctions and engine stops in unwanted situations, as well as increasing wear and material damage as a consequence.

Always take actions to avoid spills. Where a container cannot be used for draining, use a pump or hose for safe handling.

Always check that plugs seal tight before collection containers are moved.

Handle the fuel as environmentally hazardous waste. Fuel freely released causes damage to the environment and may also start fires. Fuel shall always be handled and taken care of by companies that are authorised for this work.

AdBlue

The following safety instructions shall be followed for work when handling AdBlue.

WARNING

AdBlue spilled onto hot components evaporates quickly. AdBlue can irritate the skin and eyes and when inhaled.

Health hazard!

Turn your face away. Vaporised AdBlue can be corrosive to the eyes, as well as mucous membranes in the throat. In the event of inhalation, breathe fresh air and seek medical advice if necessary.

Handle with care and avoid contact with skin, use gloves. In the event of contact with skin and spillages on clothing, rinse the skin with large amounts of water and replace contaminated clothing and gloves. In the event of contact with eyes, rinse thoroughly with water for several minutes and seek medical advice if necessary.

CAUTION

Switch off the engine and wait at least two minutes before working on the AdBlue system.

Risk of unnecessarily large spill.

When the engine is switched off the AdBlue system pumps back the AdBlue in the lines to the AdBlue tank. Allow this process to run to completion before starting work in order to reduce spill quantity.

CAUTION

AdBlue is very corrosive and penetrating.

AdBlue is extremely aggressive to wiring.

Wiring that has come into contact with AdBlue must be replaced.

IMPORTANT

Avoid spilling AdBlue on the ground and in watercourses.

Spillages on the ground must be absorbed with sand or other absorbent, non-combustible material.

Risks

AdBlue is very corrosive and penetrating, spills not cleaned cause damage to wiring, machine and tools. In the event of a spill there is a risk that AdBlue causes oxidisation that is impossible to remove. Cleaning with compressed air and water is not enough since AdBlue oxidises the metal itself.

Safety actions

- Before working on the AdBlue system, switch off the engine and **wait for two minutes** so that the AdBlue system can pump back the solution to the tank. Do not switch off the system voltage with the battery disconnector before two minutes have elapsed.
- **If a connector has been exposed to AdBlue solution then it must be replaced immediately in order that the AdBlue solution penetrates no further into the wiring. AdBlue penetrates at a speed of 0.6 m/h into wiring.**
- Clean the machine immediately in the event of a spill in order to prevent damage.
- Clean tools after the service work has been completed in order to prevent damage.
- Fully protect all electrical connectors before the work, such as with the AdBlue system's tank and lines.
- Always plug the AdBlue system's hoses, pump unit, metering valve and tank when they are disconnected in order to prevent spills and to protect the system against contaminants that cause the AdBlue solution to crystallise.

Clothing, etc.

Clothes should be in good repair. Remove loose, hanging items (e.g., tie, scarf). Do not wear clothes with wide sleeves, pant legs, etc.

Remove jewellery as it may conduct electricity and get caught in moving parts.

Long hair should be put up securely since it may otherwise get caught in moving parts. Be careful when working with a welder or open flame since hair is flammable.

Several mechanics on the same machine

WARNING

If several mechanics are working on the same vehicle, be extra careful so that accidental movements do not injure another person. Communicate so that everyone knows where everyone is and what they are doing.

Risks

Movements performed from the operator's station, e.g., all movement of lifting equipment, may cause severe personal injuries.

Safety actions

- Make sure that the machine's lifting equipment is completely lowered or secured in another way.
- Move the battery disconnector to position zero and remove the key.
- Be aware of the risks when several persons work around the vehicle.
- Make your co-workers aware of what you're working with.
- Do not work with the drive wheels on both sides of the truck at the same time if the drive wheels on both sides are raised.

Working under the machine

Working under the cab

Loose objects must not be present in cabs that are to be tilted.

The cab must always be tilted over the equilibrium position. If the space is insufficient laterally, or when working on the cab suspension, then the cab must always be secured against accidental lowering by means of a brace.

On machines with vertically adjustable cab the cab must be secured in the raised position with the intended lock.

Working under the frame

A raised vehicle may not, for any reason, be supported or lifted in parts that belong to the wheel suspension or steering. Do not support under mudguards or tanks either. Always support under the frame or drive axle.

Risks

Mechanical or hydraulic tools and lifting devices can fall over or accidentally be lowered due to malfunctions or incorrect use.

Safety actions

- Use axle stands that withstand the load and stand securely.
- Lifting tools should be inspected and type approved for use.

Lifting heavy components

WARNING

Careless handling of heavy components may lead to serious personal injury and material damage.

Use type approved lifting tools or other devices to move heavy components. Make sure that the device is sturdy and intact.

Risks

Unsuitable lift slings, straps, etc. may break or glide.

The centre of gravity of the component can change during the course of the work, and the component may then make unexpected movements which may cause severe personal injuries and material damage.

A component lifted with lifting equipment can start to turn if the centre of gravity changes.

A component lifted using an overhead crane may start to swing back and forth, which can cause severe crushing injuries or material damage.

Safety actions

Lift with lifting device. Use lifting tools or other devices, especially when such items are available for certain jobs.

If lifting must be performed without lifting device:

- Lift near the body.
- Keep your back vertical. Raise and lower with your legs and arms, do not bend your back. Do not twist your body while lifting. Ask for assistance - before lifting.
- Wear gloves. They're often good protection to reduce crushing and cutting injuries to fingers.
- Always use protective shoes.

Vibrations

Use of vibrating tools, e.g. impact nut runner or grinder, for an extended period of time may cause injuries as vibration is transmitted from tool to hands. Most of all when fingers are cold.

Safety actions

- Use heavy gloves to protect against the cold and transfer of vibrations.
- Switch between work duties to give the body time to rest.
- Vary work position and grip so that the body is not stressed in only one position by the vibrations.

Noise

Noise louder than 85 dB (A) lasting for longer than 8 hours is deemed to damage hearing. (Limit values may differ between different countries.) High tones (high frequency) is more damaging than low tones at the same sound level. Noise in the form of impulse sounds may also be damaging, e.g., hammer blows.

Risks

Hearing damage may occur at noise levels higher than the limit value. In severe cases, damage may be permanent.

Safety actions

- Use hearing protection. Make sure that it's tested and protects against the right noise level.
- Limit noise with noise-absorbing dividers, for example, noise-absorbing materials in roof and on walls.

Solvents

Fluids that (unlike water) dissolve grease, paint, lacquer, wax, oil, glue, rubber, etc., are called organic solvents. Examples: Naphtha, gasoline, thinner, alcohols, diesel, xylene, toluene, etc. Many solvents are flammable.

Risks

Products with solvents give off vapours that may cause dizziness, headache, and nausea. They may also cause irritation of mucous membranes in the throat and respiratory tracts.

If dissolvent comes into direct contact with the skin it can dry and crack. Higher risk of skin allergies. Solvents may also cause injuries if they penetrate the skin and are absorbed by the blood.

If the body is continuously exposed to solvents, the central nervous system may be injured. This manifests itself as trouble sleeping, depressions, nervousness, poor memory, and general tiredness. Continuous inhalation of gasoline and diesel vapours is suspected of causing cancer.

Safety actions

- Avoid inhaling solvent fumes by providing good ventilation, or wearing a fresh-air mask or respiratory device with a suitable filter for the toxic gases.
- Never leave a solvent container without tight-sealing lid.
- Use solvents with a low content of aromatic compounds. This reduces the risk of injuries.
- Avoid skin contact.
- Use protective gloves that are resistant to dissolvent (e.g. nitrile rubber gloves)
- Make sure that the protective clothing is resistant to the dissolvents that shall be used.

Fire and explosion risks

DANGER

The operator's safety may not be jeopardised in case of fire.

If possible, take the following actions at the slightest sign of fire:

1. **Stop the machine and turn the start key to stop position.**
2. **Leave the cab.**
3. **Turn off the system voltage with the battery disconnector.**
4. **Call the fire department.**
5. **Try to put out the fire.**

   If this is not possible, leave the machine and the danger area.

DANGER

Smoke from a fire may be very toxic.

Smoke anesthetises, suffocates, and kills! Smoke from fires, even small amounts, can damage lungs and respiratory organs.

Avoid inhaling smoke gases, do not stand in the smoke. Use breathing protection when putting out a fire and working with burnt materials.

DANGER

Tyres that have caught fire are difficult to extinguish and can cause fires with explosive development.

Fatal danger!

Always take cover if tyres catch fire.

Examples of flammable and explosive substances are oils, gasoline, diesel fuel oil, organic solvents (lacquer, plastics, cleaning agents), rustproofing agents, welding gas, gas for heating (acetylene), high concentration of dust particles consisting of combustible materials. Rubber tyres that have caught fire are difficult to extinguish and can cause fires with explosive development.

Risks

Examples of causes of ignition are welding, cutting with a welding torch, smoking, sparks from grinding machines, contact between hot machine parts and flammable materials, heat generation in rag drenched with oil or paint (linseed oil), and oxygen. Oxygen cylinders, lines, and valves shall be kept free from oil and grease.

Fumes from, e.g., fuel are heavier than air and may "run" down into a sloping plane, or down in a grease pit, where welding flames, grinding sparks or cigarette glow may cause an explosion. Evaporated gasoline explodes very forcefully.

Special cases

Gas oil with added gasoline has a reduced flash point. Risk of explosion already at room temperature. Explosion risk for heated gas oil is higher than for gasoline.

When changing oil in the engine, hydraulic system and transmission, keep in mind that the oil may be hot and can cause burn injuries.

Welding on or near machine. If diesel and or other oils have leaked out and been absorbed by rags, absorbent agents, paper or other porous material, glowing welding sparks can cause ignition and explosive fires.

When a battery is being charged, the battery electrolyte's water is divided into oxygen and hydrogen gas. This mixture is very explosive. The risk of explosion is especially high when a booster battery or a rapid-charge device is used since this increases the risk of sparks.

In today's machines there are a lot of electronics. When welding, all control units must be unplugged and the electric power must be turned off with the battery disconnector. Powerful welding currents may otherwise short-circuit the electronics, destroy expensive equipment, and may cause an explosion or fire.

Never weld on painted surfaces (remove paint, preferably by blasting at least 10 cm around the welding or cutting point). Use gloves, breathing protection, and protective safety glasses. Also, never weld near plastic or rubber materials without first protecting them from the heat. Paint, plastic, and rubber generate many substances when heated, and these may be hazardous to health. Be careful with machines that have been exposed to intense heat or fire.

Safety actions

DANGER

Remains of fuel, oils, grease, and other flammable materials on the engine or in the engine compartment are fire hazards.

Risk of fire!

Remove remains of flammable materials from the engine compartment as soon as they are discovered, be extra thorough with hot surfaces such as the exhaust system, manifold, or turbo. If leaks of oil, fuel, or coolant are detected, find the cause and solve the problem before starting the engine.

- Make a habit of performing a visual check of the engine and engine compartment before starting the engine and after operation, when the engine has been stopped. This ensures fast detection if anything abnormal has happened or is about to occur. Pay special attention to oil, fuel, or coolant leaks, loose bolts, worn or poorly tensioned drive belts, loose connections, damaged hoses, and electrical cables. The inspection only takes a few minutes and may prevent serious problems and expensive repairs.
- Store hazardous substance in approved and sealed container.
- Make sure that there is no ignition source near flammable or explosive substances.
- Make sure that ventilation is adequate or there is an air extraction unit when handling flammable substances.
- Always have a fire extinguisher close at hand.

Fluid or gas under pressure

Lines with high pressure may be damaged during work and fluid or gas may jet out.

There may be high pressure in a line even if the pump has stopped, therefore gas or fluid may leak out when the connection for the hose is loosened.

A gas cylinder exposed to outside forces may explode, e.g., if it falls on a hard surface. Gas may flow out from damaged valves.

Risks

Risk of damage/injuries in connection with work on:

- Hydraulic systems (e.g., working hydraulics and brake system).
- Fuel system.
- Changing tyres.
- Climate control unit (air conditioning).
- Cooling system.

Safety actions

- Use protective goggles and protective gloves.
- Never work in a pressurised system.
- Never adjust a pressure limiting valve to a higher pressure than the manufacturer's recommendations.
- A hydraulic hose that swells, e.g., at a connection, shows that it is about to rupture. Replace it as soon as possible! Check the connections thoroughly.
- Use fluid when checking for leaks.
- Never blow clothes clean with compressed air.
- Failed pressure accumulators shall first be drained of pressure and then punctured before being discarded (to avoid risk of explosion). Carefully drill a hole with 3 mm diameter after draining the pressure.
- Never feel with your hands to check for any leaks. A fine jet from a hydraulic hose may have such high pressure that it easily cuts through, e.g., a hand, causing very severe injuries.
- First open the cooling system's cap for the filling point, to release the high pressure. Be careful. Hot steam and coolant may jet out.

Coolant

The coolant in the machine's cooling system consists of water, anti-corrosion compound and anti-freeze fluid, for example, ethylene glycol.

Coolant must not be drained into the sewer system or directly onto the ground.

Risks

The cooling system is at high pressure when the engine is warm. Hot coolant may jet out and cause scalding in case of leaks or when the cap on the expansion tank (filling point) is opened.

Ingesting glycol and anti-corrosion compound is dangerous and hazardous to health.

Safety actions

- Use protective gloves and safety glasses if there is a risk of splashing or spraying.
- First open the cap for the filling point, to release the high pressure. Be careful. Hot steam and coolant may jet out.
- If possible, avoid working on the cooling system when the coolant is hot.

Refrigerant

Refrigerant is used in the machine's air conditioning system.

Work on the air conditioning system must be performed by accredited/authorised and trained personnel according to national legislation and local regulations.

Risks

The air conditioning operates at high pressure. Escaping refrigerant can cause frostbite injuries.

Refrigerant that is heated (e.g., when repairing leaking climate/AC system), generates gases that are very dangerous to inhale.

Safety actions

- Follow special instructions and equipment for refrigerant according to the manual when working on the air conditioning unit. Any person doing the work must have special accreditation. (Note national legislation and local regulations!)
- Use protective gloves and safety glasses if there's a risk of leaks.
- For example, make sure that heat-producing sources or objects are not close by (cigarette glow, welding flame).

Air pollution

Air pollution is the pollution in the air around us and that are regarded as hazardous to health. Certain pollutants are more prevalent in some environments.

The following health-hazardous air pollution is especially prominent in workshops:

- **Carbon monoxide (fumes)** is found in exhaust gases. Odourless and therefore extremely dangerous.
- **Nitrogen oxides (nitrous gases)** are present in exhaust fumes.
- **Welding smoke** especially hazardous to health when welding on oily surfaces, galvanised or lacquered materials.
- **Oil mist** for example, when applying anti-corrosion agent.
- **Grinding dust and gases** generated when grinding and heating plastics, lacquer, anti-corrosion agents, lubricants, paint, etc.
- **Isocyanates** can be found in some paints, fillers, adhesives and foam plastics.

Risks

Sulphuric acid mist is corrosive and injures the respiratory tracts. (Generated when heating certain plastics and paints.)

Isocyanates may be released in the form of vapour, dust (or may be found in aerosol) when cutting, grinding, or welding. May cause irritation of mucous membranes with asthma-like symptoms as well as impaired lung function. Even brief exposure to high levels may give problems with permanent oversensitivity.

Safety actions

- Make sure of adequate ventilation with fresh air when welding, battery charging and other work when hazardous gases are generated.
- Use suitable protective gloves and breathing protection when there is risk of oil mist. Make sure that the protection is oil-resistant.
- Apply oil-resistant protective lotion to unprotected skin.
- Make sure that an eyewash station is in the immediate vicinity when working with corrosive substances.
- Avoid unnecessary operation of the machine inside the workshop. Connect air extraction to the exhaust pipe so that exhausts are led out from the workshop.

Tensioned springs

Examples of tensioned springs:

1. Torque springs in, e.g., pedals.
2. Return spring (cup springs) in parking brake cylinder.
3. Lock rings
4. Gas springs

Risks

If a tensioned spring releases, it is shot out by the spring force and can also take adjoining parts with it.

Small springs can cause eye injuries.

Parking brake springs are tensioned with high force and can cause very severe accidents if they are accidentally released in an uncontrolled manner.

Gas springs and gas-charged shock absorbers are tensioned with high force and can cause very severe accidents if they are accidentally released in an uncontrolled manner.

Safety actions

- Use safety glasses.
- Lock rings should be of a suitable type and in good condition.
- Follow the instructions in this and other manual when performing maintenance and changing parts and components.
- Always use recommended tools.

Electrical system and electric motors

Safety actions

Always turn off the battery disconnector when working on the electrical system and electric motors.

Rotating components and tools

Examples of rotating components and tools:

- Cooling fan
- Drive belts
- Propeller shafts
- Drills
- Grinding machines

Risks

Rotating components, e.g., fans or shafts, can cause severe injuries if touched.

Drills, lathes, grinders or other machines with rotating parts can cause severe accidents if clothes or hair get caught and are wound up in the machine.

Safety actions

- Do not use gloves when working with a drill.
- Remove loose, hanging clothing, scarf or tie.
- Never use clothing with wide sleeves or pant legs.
- Make sure that clothing is intact and in good condition.
- Long hair should be gathered up in a hair-net or similar.
- Remove large or loose hanging jewellery from hands, arms and neck.

Tyres and rims

DANGER

Tyres are to be considered as pressurised containers. Handling incorrectly, they are a fatal hazard.

Parts can be thrown with explosive force and may cause severe injuries.

Never repair damaged tyres, rims, or lock rings. Tyre changes shall be performed by authorised personnel.

Risks

Dismantling wheels: Tyres, rims, and lock rings may be ejected.

Inflating the tyres: Tyres, rims, or lock rings may be ejected.

Safety actions

- Always deflate the tyre before starting to work on the wheel.
- Check that tyres, rims, and lock rings are free from damage. Never repair damaged rims or lock rings.
- Tyres must be inflated on the machine or in a protective device, designed and dimensioned so that it can handle or dissipate a shock wave from a tyre explosion as well as catch the ejected parts.
- Use protective screen and safety glasses.

Lifting equipment

When working on the machine in general, and with the machine's lifting equipment in particular, the greatest care must be taken with regard to securing the mast and carriage.

Get into the habit of always keeping the carriage lowered to the lowest position when working on the machine.

Risks

If the machine's lifting equipment is not lowered or secured, there is a risk of crushing.

Risk of crushing is extra high when depressurising the hydraulic system, see *Hydraulic system, depressurising*, page B:5.

Safety actions

Do not start work until the carriage is fully lowered. If the nature of the work requires the carriage to be raised, it must be secured in some way.

Welding

DANGER

Contact Cargotec Support before welding on the machine.

CAUTION

In today's machines there are a lot of electronics. All control units must be unplugged and the electric power must be turned off with the battery disconnector prior to all welding on the machine.

Powerful welding currents may otherwise short-circuit the electronics, destroy expensive equipment, and may cause an explosion or fire.

Spare parts

WARNING

For safety reasons, the following spare parts may only be replaced by genuine spare parts:

- **Brake valve**
- **Drive axle**
- **Valve for mini-wheel/joystick control**
- **Steering valve (Orbitrol)**
- **Control valve steering incl. priority valve**
- **Steering axle**
- **Steering cylinder**
- **Steering spindle**
- **Hub**
- **Rim**
- **Mast, carriage**
- **Lift cylinder incl. load control valve**
- **Separate load control valve**
- **Lifting chains**
- **Chain tightener and shaft**
- **Forks, fork carrier**
- **Tilt cylinder**
- **Twistlock**
- **Attachment complete**
- **Lifting ears**
- **Control breaker (for hydraulic function)**
- **Cab**
- **Hydraulic cylinder, cab tilt**
- **Frame**
- **Accumulator**
- **Tilt valve**
- **Main valve load handling**
- **Accumulator charging valve**
- **All control units**

Non-ionised radiation

WARNING

Extra equipment such as two-way radio, remote controlled door opener, etc. may emit non-ionising radiation. This type of equipment transmits on the frequency band 100 - 500 MHz.

Danger of disturbances on active medical products (e.g. a pacemaker).

Do not use a two-way radio, remote controlled door opener, etc. when persons with active implanted medical products are in the cab.

NOTE

Cargotec does not assume any responsibility for extra equipment not installed by Cargotec or according to installation instructions approved by Cargotec.

Environment

General

Our global environment is significantly affected by the world's ever-increasing industrialisation. Nature, animals, and humans are exposed daily to great risks in connection with handling of chemicals in various forms.

Still there are no environmentally safe chemicals, e.g., oils and coolants, on the market. Therefore, all who handle, perform service, or repair machines must use the tools and methods that are necessary to protect the environment in an environmentally correct way.

By following the simple rules below, you will contribute to protecting our environment.

Recycling

Well-planned recycling of the machine is the starting point for finishing the life cycle and making use of materials for re-use in new products. According to calculations by Cargotec, the machine can be recycled to more than 90% by weight.

Environmentally hazardous waste

Components such as batteries, oils and other chemicals, and other materials that may constitute environmentally hazardous waste, must be handled and taken care of in an environmentally safe and sound manner.

Discarded batteries contain substances hazardous to personal health and the environment. Therefore, handle batteries in an environmentally safe manner and according to national regulations.

Oils and fluids

Oils freely released cause damage to the environment and may also start fires. When emptying and draining oils or fuel, take actions to prevent unnecessary spills.

Waste oils and fluids must always be taken care of by an authorised disposal company.

Pay close attention to oil leaks and other fluid leaks! Take immediate action to seal any leaks.

Air conditioning system

The refrigerant in the air conditioning unit for the cab contributes to the greenhouse effect if it escapes into the open air. Special training is required for all service work on the air conditioning unit. Many countries also require certification by an authority for such work. When scrapping an air conditioning unit, the refrigerant shall be taken care of by a certified company.

Working in a contaminated area

The machine shall be equipped for work within a contaminated area (polluted environment or health-hazardous area) before starting the work. Also, special local instructions apply for handling and service work on such a machine.

Declarations

The machine does not contain asbestos.

The machine contains lead in batteries and electrical wiring. Some models have cast lead counterweights.

Refrigerant type R134a is used if the machine is equipped with air conditioning.

Contents C Preventive maintenance

C Preventive maintenance

Preventive maintenance, general

It's very important that preventive maintenance is performed according to recommended intervals.

Preventive maintenance should be performed by Cargotec, or by a service organisation authorised by Cargotec.

CAUTION

Service intervals shall be followed.

This is to maintain the machine's safety and to fulfil warranty and service agreements!

Use spare parts and fluids approved by Cargotec to fulfil the warranty.

Preventive maintenance, work instructions

1 For a new machine it is very important to check-tighten the wheel nuts during the first work week until they are seated properly. This should be done at an interval of 4–5h (up to approx. 40–50h).

2 Regular service shall be performed according to service schedule, see *Service schedule*, page C:5. The service schedule shall be followed to ensure high machine reliability and safety.

Note completed service in the service log, see *Check and service log*, page C:4.

Check and service log

Model:	
Serial number:	

		Completed maintenance		
Operating time	**Actions**	**Operating time**	**Date**	**Signature**
500h	500h service			
1000h	1000 service			
1500h	500h service			
2000h	2000h service			
2500h	500h service			
3000h	1000 service			
3500h	500h service			
4000h	2000h service			
4500h	500h service			
5000h	1000 service			
5500h	500h service			
6000h	2000h service			
6500h	500h service			
7000h	1000 service			
7500h	500h service			
8000h	2000h service			
8500h	500h service			
9000h	1000 service			
9500h	500h service			
10000h	2000h service			

Service schedule

Service shall be performed every 500h. Actions are divided into 500h, 1000h and 2000h service.

Actions for 500h service are performed between 1000h and 2000h service, which means at 500h, 1500h, 2500h, etc.

Actions for 1000h service are performed at **odd** thousands of operating hours: 1000h, 3000h, 5000h, etc.

Actions for 2000h service are performed at **even** thousands of operating hours: 2000h, 4000h, 6000h, etc.

After service is performed, make a note in the check and service log, see *Check and service log*, page C:4.

In the column for service below, the following abbreviations are used:

R = replace

C = check or inspection

L = lubrication

h= operating hour

CAUTION

Lubrication intervals are based on normal handling and environment and are subject to the use of the recommended grades and quantities.

The lubrication interval must never exceed 12 months.

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	**1000h, 3000h, 5000h etc.**	**2000h, 4000h, 6000h etc.**		
0 complete machine					
Checking cleanliness and leakage**	C	C	C	Check and remove remains of flammable materials in the engine compartment, pay extra attention to hot surfaces such as exhaust system, manifold, or turbo. If leaks of oil, fuel, AdBlue or coolant are detected, find the cause and solve the problem. Also check radiator hoses**, air intake lines* and the exhaust system's flex hoses.	Section *B Safety*
Attachments (stub axles)		C	C	Visual check in connection with greasing.	
Lubricating 500h	L	L	L		*Lubricating 500h*, page C:17
Lubricating 1000h		L	L		*Lubricating 1000h*, page C:30
Checking for cracks			C*	* Check every 4000h or every year.	*Checking for cracks*, page C:36

Object, action	Service 500h, 1500h, 2500h, etc.	Service 1000h, 3000h, 5000h etc.	Service 2000h, 4000h, 6000h etc.	Comment	Reference
1 Engine (engine alternative Volvo TAD871VE Stage 4/Tier 4f)					
Bolted joints, attachments, mountings, etc.	C*		C	* Check once at 500 h, then every 2000 h	
Fuel tank		C	C	Clean if necessary.	*Fuel tank, cleaning*, page 1:5
Fuel prefilter	C*	R**	R**	*Drain water/impurities. Change filter earlier if error code is displayed. ** Change every 1000 h or every 12 months.	*Fuel prefilter, draining condensation water (engine alternative Volvo TAD871VE)*, page 1:6 *Fuel prefilter, changing (engine alternative Volvo TAD871VE)*, page 1:8
Fuel filter		R*	R*	Change filter earlier if error code is displayed. * Change every 1000 h or every 12 months.	*Fuel filter, changing (engine alternative Volvo TAD871VE)*, page 1:10
AdBlue tank			C	Cleaning	*AdBlue tank, cleaning (engine alternative Volvo TAD871VE and Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:12
Filter AdBlue pump unit		C	R*	Check at 1000h * Change every 2000 h or every 24 months.	*Filter AdBlue pump unit, replacement (engine alternative Volvo TAD871VE and Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:17
Filter on tank unit in AdBlue tank			R*	* Change every 2000 h or every 24 months.	*Filter in AdBlue tank, replacement (engine alternative Volvo TAD871VE and Cummins QSB6.7 and Stage 4/Tier 4f)*, page 1:19
Valve clearance		C*	C	* First time at 1000 h, then every 2000 h or every 24 months. After engine replacement or engine overhaul check/adjust at 250 h.	Must be carried out by a service technician authorised by Volvo.
Air filter main cartridge	C / R	C / R	C / R	Checking indicators, change when indicated. Reset when changing the filter.	*Air filter, changing*, page 1:36
Air filter safety cartridge	C	C / R*	C / R*	* Changed every other time main cartridge is changed.	
Prefilter air intake	C	R	R	Washed every 500 operating hours. Filter change every 1000 operating hours.	*Prefilter air intake, replacement*, page 1:36
Turbo			C*	* Check every 2000 h or every 24 months.	Must be carried out by a service technician authorised by Volvo.

Object, action	Service 500h, 1500h, 2500h, etc.	Service 1000h, 3000h, 5000h etc.	Service 2000h, 4000h, 6000h etc.	Comment	Reference
Intercooler and hoses		C	C	Sealing integrity check and loosen the drain plug for draining the condensation water.	*Intercooler, checking/cleaning*, page 1:39 *Air intake and exhaust outlet, check*, page 1:35
Radiator	C	C	C	External check and cleaning.	*Radiator, checking/cleaning*, page 1:46
Drive belt AC compressor	C / R*	C / R*	C / R*	* If necessary, alternate every 2000 h or every 48 months.	*Drive belt, check (engine alternative Volvo)*, page 1:47 *Drive belt, changing (engine alternative Volvo TAD871VE)*, page 1:47
Belt tensioner	C	C	C	Check every 500 h or every 12 months	*Drive belt tensioner, check (engine alternative Volvo)*, page 1:49
Coolant, level check	C	C	C	For volume and quality, see section *F Technical data*. * Change every 8000 h or every 48 months.	*Coolant level, check*, page 1:53
Coolant, freezing point	C	C	C		-
Coolant, changing			R*		*Coolant, changing (engine alternative Volvo TAD871VE)*, page 1:54
Engine oil and oil filter	R*	R*	R*	For volume and quality, see section *F Technical data*.	*Oil and oil filters, changing (engine alternative Volvo TAD871VE)*, page 1:63
				The oil must always be changed for the first time at 500h. * The oil change interval can be extended from 500h to 1000h with approved documented oil samples at 500h, 750h and 1000h.	*Oil testing (engine alternative Volvo)*, page 1:62
Filter, crankcase ventilation	R*	R*	R*	* Change every 1500 h or every 12 months.	*Crankcase filter, changing (engine alternative Volvo TAD871VE)*, page 1:41
Connector			C	Visual check for damage or corrosion. ***NOTE*** *Never detach connectors unnecessarily, risk of introducing contaminants into the connector.*	-
1 Engine (engine alternative Cummins QSB6.7 Stage 3A/Tier 3)					
Bolted joints, attachments, mountings, etc.	C	C	C		
Fuel tank		C	C	Clean if necessary.	*Fuel tank, cleaning*, page 1:5

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	**1000h, 3000h, 5000h etc.**	**2000h, 4000h, 6000h etc.**		
Fuel filter	R	R	R		*Fuel filter, changing (engine alternative Cummins QSB6.7)*, page 1:11 *Fuel system, bleeding air (engine option Cummins QSB6.7)*, page 1:4
Fuel prefilter	R	R	R	Drain water/impurities.	*Fuel prefilter, changing (engine alternative Cummins QSB6.7)*, page 1:9 *Fuel prefilter, draining the condensation water (engine alternative Cummins QSB6.7)*, page 1:7
Valve clearance		C		Valve clearance checked/adjusted after 5000h / every 4th year.	*Valves, checking/adjustment (engine alternative Cummins QSB6.7 Stage 3A/Tier 3)*, page 1:29
Air filter main cartridge	C / R	C / R	C / R	Checking indicators, filter change when indicated.	*Air filter, changing*, page 1:36
Air filter safety cartridge	C	C / R	C / R	Changed every other time main cartridge is changed.	
Prefilter air intake	C	R	R	Washed every 500 operating hours. Filter change every 1000 operating hours.	*Prefilter air intake, replacement*, page 1:36
Exhaust system	C	C	C	Sealing check.	*Air intake and exhaust outlet, check*, page 1:35
Charge air hoses	C	C	C	Sealing check.	*Charge air hoses, checking*, page 1:40
Drive belts	C / R	C / R	C / R	Change when needed.	*Drive belt, changing (engine alternative Cummins QSB6.7)*, page 1:52 *Vibration damper, rubber, checking (engine alternative Cummins QSB6.7 Stage 3A/Tier 3)*, page 1:33
Drive belt tensioner		C / R	C / R	* Check every 1000h or every year. Change when needed.	
Hub		C	C	* Check every 1000h or every year.	
Vibration damper, rubber			C	* Check every 2000h or every 2 years.	
Radiator	C	C	C	External check and cleaning. ***NOTE*** *Do not use high pressure wash.*	*Radiator, checking/cleaning*, page 1:46
Coolant	C	C	C	Level check. Coolant should be replaced after 2000h. When changing, check/clean the cooling system. For volume, see section *F Technical data*.	*Coolant level, check*, page 1:53
Coolant freezing point	C	C	C		

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	1000h, 3000h, 5000h etc.	2000h, 4000h, 6000h etc.		
Engine oil and oil filter	R*	R*	R*	* Change intervals depend on sulphur content in the fuel. Sulphur content <0.3%: Change every 500 h or at least every 12 months. Sulphur content 0.3–0.5%: Change every 250 h or at least every 12 months. Sulphur content >0.5%: Change every 125 h or at least every 12 months. For volume and quality, see section *F Technical data*.	*Oil and oil filter, changing (engine alternative Cummins QSB6.7)*, page 1:64
Connector			C	Visual check for damage or corrosion.	-
1 Engine (engine alternative Cummins QSB6.7 Stage 4/Tier 4f)					
Bolted joints, attachments, mountings, etc.	C	C	C		
Fuel tank			C	Clean if necessary.	*Fuel tank, cleaning*, page 1:5
Fuel filter	R	R	R		*Fuel filter, changing (engine alternative Cummins QSB6.7)*, page 1:11 *Fuel system, bleeding air (engine option Cummins QSB6.7)*, page 1:4
Fuel prefilter	R	R	R	Drain water/impurities.	*Fuel prefilter, changing (engine alternative Cummins QSB6.7)*, page 1:9 *Fuel prefilter, draining the condensation water (engine alternative Cummins QSB6.7)*, page 1:7
AdBlue tank			C	Cleaning.	*AdBlue tank, cleaning (engine alternative Volvo TAD871VE and Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:12
AdBlue filter in the pump unit		C	R*	Check at 1000h * Change every 2000 h or every 24 months.	*Filter AdBlue pump unit, replacement (engine alternative Volvo TAD871VE and Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:17
Filter on tank unit in AdBlue tank			R		*Filter in AdBlue tank, replacement (engine alternative Volvo TAD871VE and Cummins QSB6.7 and Stage 4/Tier 4f)*, page 1:19

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	**1000h, 3000h, 5000h etc.**	**2000h, 4000h, 6000h etc.**		
Valve clearance		C		Valve clearance checked/adjusted after 5000h / every 4th year.	*Valves, checking/adjustment (engine alternative Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:23
Air filter main cartridge	C / R	C / R	C / R	Checking indicators, change when indicated. Reset when changing the filter.	*Air filter, changing*, page 1:36
Air filter safety cartridge	C	C / R	C / R	Changed every other time main cartridge is changed.	
Prefilter air intake	C	R	R	Washed every 500 operating hours. Filter change every 1000 operating hours.	*Prefilter air intake, replacement*, page 1:36
Crankcase ventilation filter			C / R	Changed if necessary	*Crankcase ventilation filter, changing (engine alternative Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:42
Intercooler and hoses	C	C	C	Sealing check	*Intercooler, checking/cleaning*, page 1:39 *Air intake and exhaust outlet, check*, page 1:35
Drive belt alternator, water pump and cooling fan, check		C / R	C / R	Check every 1000 h or every 12 months	*Drive belt/alternator belt, check (engine alternative Cummins QSB6.7)*, page 1:50
Drive belt tensioner, check		C / R	C / R	Check every 1000 h or every 12 months	*Drive belt tensioner, check (engine option Cummins QSB6.7)*, page 1:50
Drive belt alternator, water pump and cooling fan, replace		C / R	C / R	Change when needed	*Drive belt, changing (engine alternative Cummins QSB6.7)*, page 1:52
Radiator	C	C	C	External check and cleaning.	*Radiator, checking/cleaning*, page 1:46
Vibration damper, viscous.			C	* Check every 2000h or every 2 years.	*Vibration damper, viscous, checking (engine alternative Cummins QSB6.7 Stage 4f/Tier 4)*, page 1:34
Coolant			C	Level check, daily Coolant must be replaced after 2000h; when changing, the cooling system must also be checked and cleaned/flushed. For volume, see section *F Technical data*.	*Coolant level, check*, page 1:53 *Changing of coolant and cleaning of cooling system (engine alternative Cummins QSB6.7)*, page 1:58
Coolant freezing point	C	C	C		
Engine oil and oil filter	R	R	R	For volume and quality, see section *F Technical data*.	*Oil and oil filter, changing (engine alternative Cummins QSB6.7)*, page 1:64

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	1000h, 3000h, 5000h etc.	2000h, 4000h, 6000h etc.		
Connector			C	Visual check for damage or corrosion.	-
2 Transmission (Dana Spicer Off-Highway TE17)					
Breather filter		C	C	Clean if necessary	*Breather filter, cleaning*, page 2:4
Transmission oil and oil filter	R*	R	R	* First time at 500 h, then every 1000 h. For volume and quality, see section *F Technical data*.	*Oil and oil filter transmission, changing*, page 2:5
Transmission, calibration	C*	C	C	* Calibration of transmission recommended at oil change or every 1000 h.	*Transmission, calibration*, page 2:7
3 Driveline/Axle					
Propeller shaft	C	C	C		*Propeller shaft, checking*, page 3:3
Drive axle		C	C		*Drive axle, check (DCG 180-250)*, page 3:4 *Drive axle, check (DCG 280-330)*, page 3:5
Drive axle oil	R*		R*	* First time at 500 h, then every 2000 h or every 12 months. For volume and quality, see section *F Technical data*.	*Drive axle oil, change (DCG 180–250)*, page 3:5 *Drive axle oil, change (DCG 280–330)*, page 3:7
4 Brake system					
Power-assisted brake	C	C	C	Function check.	*Power-assisted brake system, check*, page 4:4
Brake pressure, checking	C	C	C		
Brake pedal and pedal assembly	C	C	C		*Brake pedal, checking*, page 4:3
Parking brake	C / R	C / R	C / R	Check pad thickness, change when needed.	*Parking brake unit, checking and adjusting*, page 4:7 *Brake pads, replacement*, page 4:8
Oil cooler brake system ⊕	C	C	C	Clean when needed. ***NOTE*** *Do not use high pressure wash.*	*Oil cooler, cleaning*, page 4:9
Oil filter, brake system ⊕		R	R		*Hydraulic oil filter (high-pressure filter), changing*, page 10:10
Breather filter, brake system ⊕			R		*Breather filter, changing*, page 4:10

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	1000h, 3000h, 5000h etc.	2000h, 4000h, 6000h etc.		
Oil brake system ⊕			R	For volume and quality, see section *F Technical data*.	*Brake system oil, changing*, page 4:11
5 Steering					
Link arms	C	C	C	Checking the bearings and lock iron for the shafts.	*Bearing in link arm, checking (DCG 180–250)*, page 5:3 *Bearing in link arm, checking (DCG 280–330)*, page 5:4
Sensor steering wheel angle mini-wheel/joystick control ⊕	C	C	C		*Sensor steering wheel angle, checking*, page 5:5
Sensor wheel angle, feedback joystick control ⊕	C	C	C	Check sensor wheel angle with regard to play. Check the wiring.	-
6 Suspension					
Steering axle suspension		C	C	Suspension in the frame.	*Steering axle cradle, checking*, page 6:3
Steering spindle, check		C	C	Clearance in wheel suspension shall be checked. Max. 0.25 mm.	*Wheel spindle bearing, checking (DCG 180–250)*, page 6:4 *Wheel spindle bearing, checking (DCG 280–330)*, page 6:4
Wheel hub, checking		*)	C	Check bearing pre-load. *) Check the first time after 1000 h, then every 2000 h.	*Wheel hub, checking*, page 6:4
Tyres and rims	C	C	C	Damage, wear and pressure, change as needed.	*Tyres and rims, check*, page 6:8
Wheel nuts	C	C	C	Check-tighten.	*Tyres and rims, check*, page 6:8
Rim			C*	* Checking for cracks, every 2,000 hours and in connection with tyre changes.	*Rim, check*, page 6:18
7 Load handling					
Mast suspension		C	C	Check that the welds are intact and check the bearings.	*Mast suspension, checking*, page 7:4
Slide plates.	C	C	C		*Slide plates mast, checking*, page 7:6
Support rollers	C	C	C		*Support rollers mast, checking*, page 7:6
Lifting chains	C	C	C	Check for damage. Tension chain when needed.	*Lifting chains, checking and adjusting*, page 7:7
Side shift cylinder	C	C	C		*Side shift cylinder, checking*, page 7:10

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	1000h, 3000h, 5000h etc.	2000h, 4000h, 6000h etc.		
Tilt cylinder	C	C	C	Check that the welds are intact and check the bearings.	*Tilt cylinder, checking*, page 7:11
Lifting forks	C	C	C		*Lifting forks, checking*, page 7:12
Side lift attachment ⊕		C	C	Damage.	Side lift attachment *Twistlocks, checking*, page 7:13
Twistlocks, (side lift attachment) ⊕		C	C / R	Check for cracks every other year or 4000 operating hours. Replace every 10,000 operating hours. Reset time counter for twistlocks after replacement.	*Twistlocks, checking for cracks*, page 7:14
Sensor, (side lift attachment) ⊕	C	C	C	Check attachment and wiring.	*Sensor contact, checking and adjusting* , page 7:15 *Sensor twistlocks, checking and adjusting* , page 7:16
Top lift attachment ⊕		C	C	Damage.	-
Spreading chains (top lift attachment) ⊕		C	C	Tension chain when needed.	*Spreading chains, checking*, page 7:17
Slide plates, spreader beam (top lift attachment) ⊕		C	C	Check wear, change as needed.	*Glide plates extension beam, checking and adjusting*, page 7:20 *Slide plates main beam attachment, checking*, page 7:21
Oil, spreader motor unit (top lift attachment) ⊕		R	R	For volume and quality, see section *F Technical data*.	*Oil spreading motor unit, changing*, page 7:17
Twistlocks, (top lift attachment)	C	C	C		*Twistlocks, checking*, page 7:22
	C	C	C	Check float position.	*Twistlocks, checking float position*, page 7:24
			C	Check vertical movement.	*Twistlocks, checking vertical movement*, page 7:24
			C*	* Check for cracks every 4000 h or every 24 months.	*Twistlocks, checking for cracks*, page 7:14
			R*	* Replace every 10 000 h.	*Twistlocks, replacement*, page 7:25
8 Control system					
Service indicator, reset	C	C	C	A special code is required in addition to the service code.	*Service indicator, resetting*, page 8:11
Load sensor ⊕		C	C	Load sensor calibration.	*Load sensor, calibration*, page 8:13
9 Frame, body, cab and accessories					
Instruments and controls	C	C	C	Function check	-

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	1000h, 3000h, 5000h etc.	2000h, 4000h, 6000h etc.		
Air conditioning unit ⊕	C	C	C	Checking function. Function check of drive belt.	*Air conditioning, checking/performance test*, page 9:6
Fresh air filter	C* / R*	R	R	* Depending on the external environment.	*Fresh air filter air conditioning, checking and replacement*, page 9:7
Drive belt AC compressor, check ⊕ Applies to machines with Cummins QSB6.7		C / R	C / R	Check every 500 h or every 12 months	*Drive belt AC compressor, check (engine alternative Cummins QSB6.7)*, page 9:9
Drive belt AC compressor, replace ⊕ Applies to machines with Cummins QSB6.7		C / R	C / R	Change when needed.	*Drive belt AC compressor, replacement (engine alternative Cummins QSB6.7)*, page 9:9
Recirculation filter	C	C	R*	Clean when needed. * Replacement every two years or if the filter is damaged.	*Recirculation filter, checking*, page 9:12
Windscreen wipers	C	C	C	Replacement of wiper blades if necessary. Filling washer fluid if necessary.	*Wipers, checking*, page 9:13 *Windscreen wipers, replacement (combined windscreen wiper windscreen/roof window)*, page 9:14 For filling of washer fluid, see *Operator's manual*, section *6 Inspection and maintenance*, group *6.2 Maintenance*
Lighting and audible signals	C	C	C		*Lighting, check*, page 9:16
Communication equipment ⊕	C	C	C		See *separate subcontractor information*
Roof window		C	C	Check damage, change when needed.	*Roof window, checking*, page 9:17
Cab frame		C	C	Check rust damage, deformation or cracks.	*Cab frame, checking*, page 9:18
Doors and cover lids	C	C	C	Checking the doors' attachment points, door stops and locking mechanism.	*Doors, checking*, page 9:18
Cab undercarriage		C	C	Check mountings, isolators and bolted joints.	*Cab undercarriage, checking*, page 9:19
Hydraulic tilting of the cab	C	C	C	Check the pin for the cab and the lift cylinder's mounting.	9.10.4 *Cab tilting*, page 9:20
Frame		C	C	Check for any deformation and rust damage as well as cracks in welded joints.	*Frame, checking*, page 9:22
Non-slip plate for cab steps and on cab floor		C	C	Check and replace non-slip plate in poor condition.	-

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	**1000h, 3000h, 5000h etc.**	**2000h, 4000h, 6000h etc.**		
Counterweight fastening		C	C		*Counterweights, checking*, page 9:23
Central lubrication	C	C	C	Top up the grease container if necessary.	*Central lubrication, checking*, page 9:24
Paint/coatings			C	Check the machine's painted surfaces for stone chips and scratches Repair damage immediately to avoid corrosion.	*Paint/coatings, check*, page 9:25
Safety decals	C	C	C	Check that safety decals are legible, securely fastened, and not damaged. Clean dirty decals and replace decals as needed.	See *Operator's manual*, section *3 Overview*, group *3.2 Signs*
10 Common hydraulics					
Hydraulic pressure, checking	C	C	C		*Hydraulic pressure, checking*, page 10:3
Accumulator	C	C	C	Check the precharge pressure.	*Accumulator, checking*, page 10:7
Cooler for hydraulic oil		C	C	External check and cleaning. ***NOTE*** *Do not use high pressure wash.*	*Hydraulic oil cooler, cleaning*, page 10:8
Breather filter hydraulic oil tank	C / R	C / R	C / R	Checking indicators, change when indicated.	*Breather filter hydraulic oil tank, changing*, page 10:9
Hydraulic oil filter (high-pressure filter) The machine is equipped with one or two high pressure filters.		R	R		*Hydraulic oil filter (high-pressure filter), changing*, page 10:10
Hydraulic oil filter (return filter)		R	R		*Hydraulic oil filter (return filter), changing*, page 10:12
Hydraulic oil			C / R	Checked with oil sample. • If oil sample OK after 2000h, drive further 1000h and take new oil sample. • If oil sample OK after 3000h, drive further 1000h and change oil. Note! Max. 4000h change interval. Additive: Lubrizol should be added when changing hydraulic oil. Concentration 3%. For volume, see section *F Technical data*.	*Hydraulic oil, level check*, page 10:13

Object, action	Service			Comment	Reference
	500h, 1500h, 2500h, etc.	1000h, 3000h, 5000h etc.	2000h, 4000h, 6000h etc.		
11 Common electrics					
Position sensors	C	C	C	Should be free from grease and dirt, clean as needed.	Mast *Position sensor, checking*, page 7:9
Fuses	C	C	C	Check that fuses are intact, change if needed.	*Fuse, replacement*, page 11:3
Batteries	C	C	C	Clean and wipe the battery, and in particular the top at the terminal connections, in order to avoid self-discharge. Check the state of charge and electrolyte level and add battery water as required. Charge the batteries fully if the machine shall be stored for a longer time in order to avoid sulphation.	*Start battery, checking*, page 11:6
Battery cables and connections	C	C	C	Replace damaged cables.	*Battery cables, checking*, page 11:7
Test-run	C	C	C	Test-run the machine and check the following: • Instruments • Brakes • Gearshifting • All load handling functions • Communication equipment • Steering • Any noise	
After test-run	C	C	C	Check the following after test-run: • Sealing (no leakage) • Fluid levels	

Washing

CAUTION

High-pressure washing of sensitive components can lead to short-circuiting and may cause malfunctions.

Product damage!

Do not use high-pressure washing on cab, radiator, battery compartment, electric components, control units, connectors, cable splices, cylinder seals, stub axles, axle/shaft seals, and chains.

Lubricating 500h

1 Turn off the engine and turn off the system voltage.

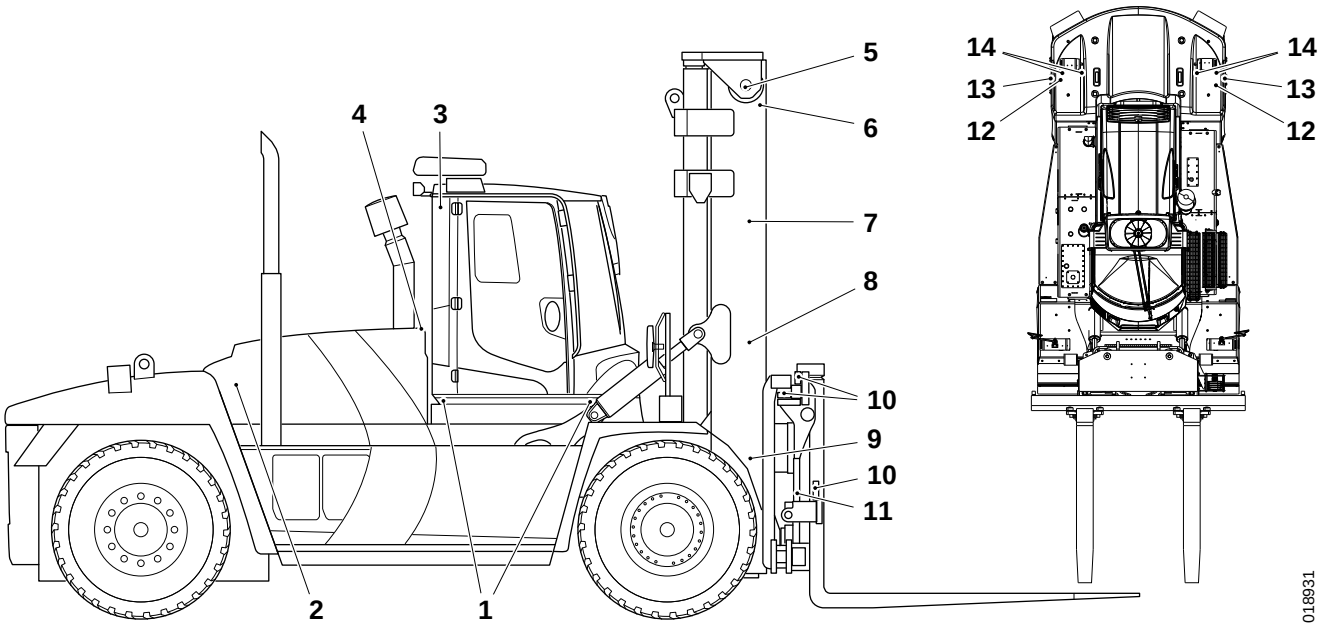
2 Clean the area around each grease cup before greasing.

3 Lubricate the machine's lubrication points with **lubricant** in accordance with the recommendation, see section *F Technical data*. Also do a visual check of all lubricated mounts.

IMPORTANT

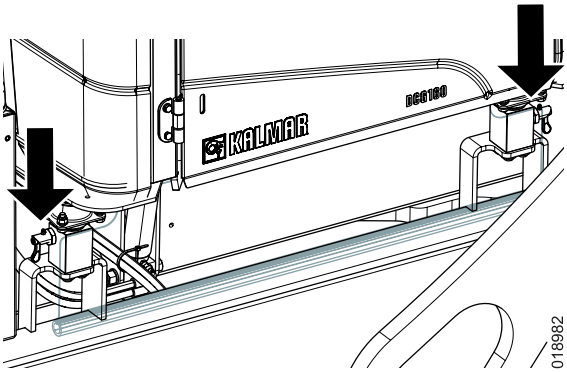
On machines with central lubrication, check that the central lubrication's lubrication points are lubricated, see section *9 Frame, body, cab and accessories,* group *9.14 Central lubrication*.

DCG 180-250



Lubrication points, lubricating grease

Pos.	Lubrication points	Reference
1	Cab locks (2 pcs)	*Cab lock*, page C:19
2	Hinge and mechanism, hood (1 pc)	*Hinge and mechanism, hood*, page C:19
3	Gas springs, doors (2 pcs)	*Gas spring, door*, page C:19
4	Key lock door/engine cover (3 pcs)	*Key lock door/engine cover*, page C:19
5	Chain wheels (2 pcs)	*Chain wheel* , page C:19
6	Lifting chains (2 pcs)	*Lifting chains*, page C:19
7	Mast beams (2 pcs)	*Mast beam*, page C:20
8	Support rollers (4–6 pcs) and mast wheels (4–6 pcs), mast Mast top support rollers (2 pcs), if applicable.	*Support rollers and mast wheels, mast*, page C:20
9	Support rollers (4 pcs) and mast wheels (4 pcs), trolley	*Support rollers and mast wheels, trolley*, page C:21
10	Support rollers (4 pcs) and fork wheels (8 pcs), forks	*Support rollers and fork wheels, forks*, page C:21
11	Side shift cylinders (4 pcs)	*Side shift cylinder*, page C:21
12	Spindle bolt bearing	*Spindle bolt bearing*, page C:22
13	Wheel bearings, steering axle	*Wheel bearings, steering axle*, page C:22
14	Link arms (4 pcs)	*Link arms*, page C:22
15	Side lift attachment ⊕ (not shown on diagram)	*Side lift attachment*, page C:23
16	Top lift attachment ⊕ (not shown on diagram)	*Top lift attachment*, page C:24



Cab lock

1 Tilt the cab.

2 Lubricate the cab locks with lubricating grease.

Hinge and mechanism, hood

3 Lubricate the mechanism in the hood.

Gas spring, door

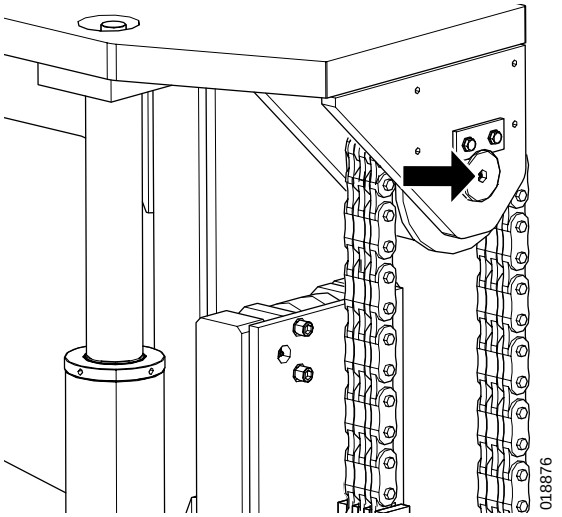
4 Lubricate the ball brackets with lubricating grease.

Key lock door/engine cover

5 Lubricate the key locks on doors and hood with lock oil.

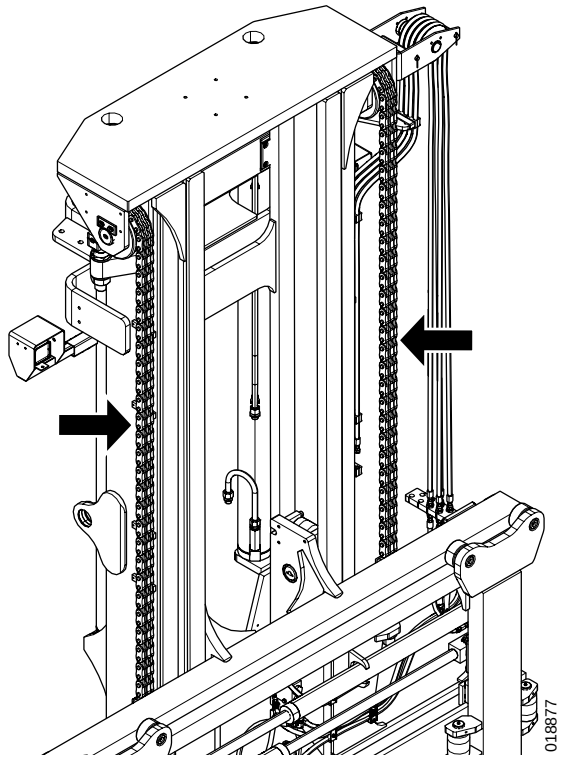
Chain wheel

6 Lubricate the chain wheels' shafts with lubricating grease.

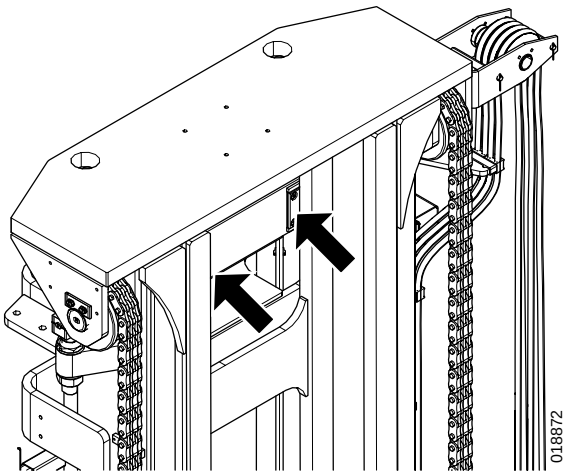


Lifting chains

7 Brush or spray the chains with chain oil. Make sure that the chains are well lubricated.

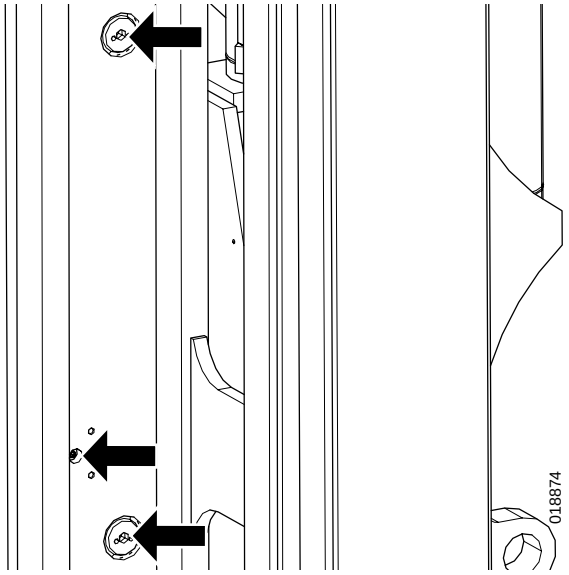


Mast beam

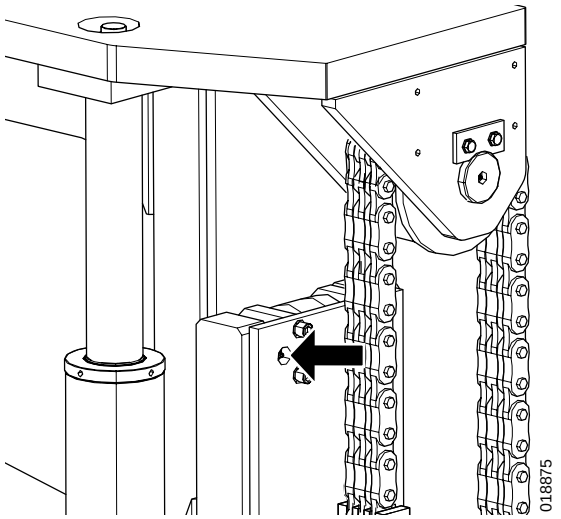


8 Lubricate the slide plates.

Support rollers and mast wheels, mast

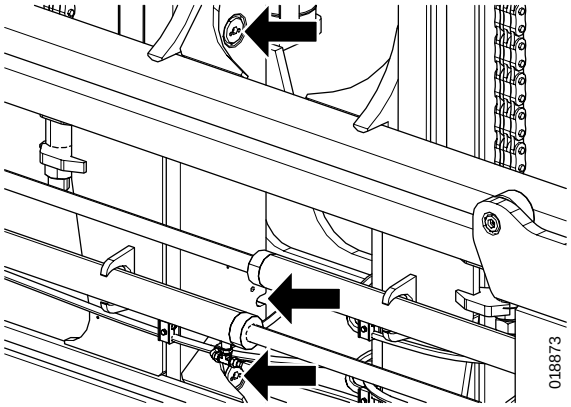


9 Lubricate the support rollers and mast wheels in the mast.



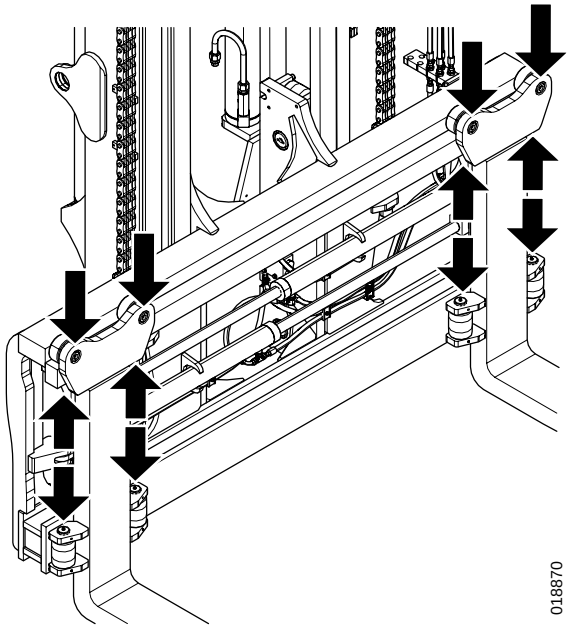
10 Lubricate the top support roller in the mast, if applicable.

Support rollers and mast wheels, trolley



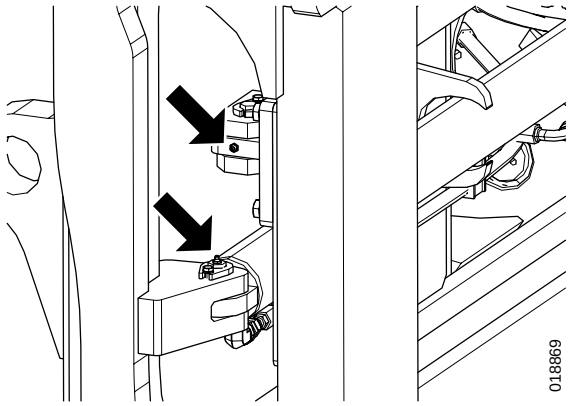
11 Lubricate the support rollers and mast wheels in the trolley.

Support rollers and fork wheels, forks



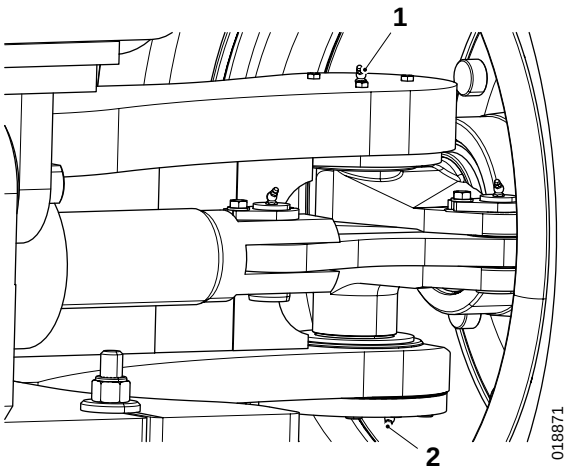
12 Lubricate the support rollers and fork wheels with lubricating grease.

Side shift cylinder



13 Lubricate the side shift cylinder with lubricating grease.

Spindle bolt bearing

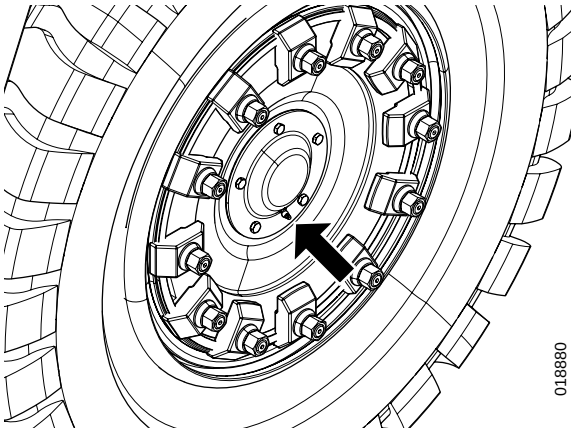


1. Lubrication point, upper king pin bearing
2. Lubrication point, lower king pin bearing

14 Lubricate the wheel spindle's bearings (upper and lower) with lubricating grease on both sides.

If necessary, turn the wheels for better access.

Wheel bearings, steering axle



15 Lube the wheel hub until grease is forced out by the seal on the hub's inside.

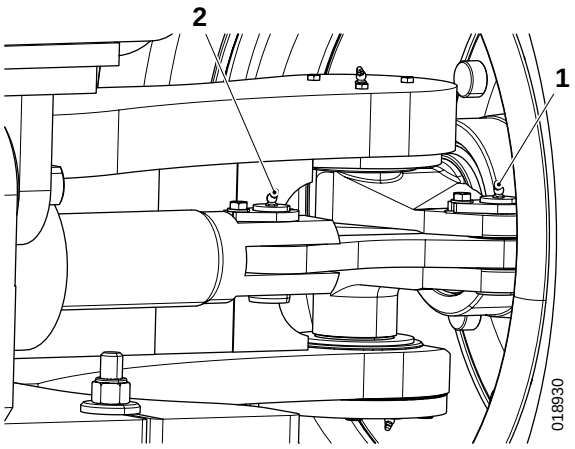
Lift the seal ring's lip with a small screwdriver to facilitate pressing out of air. Grease until grease comes out by the seal.

NOTE

Work carefully to avoid damaging the seal.

Link arms

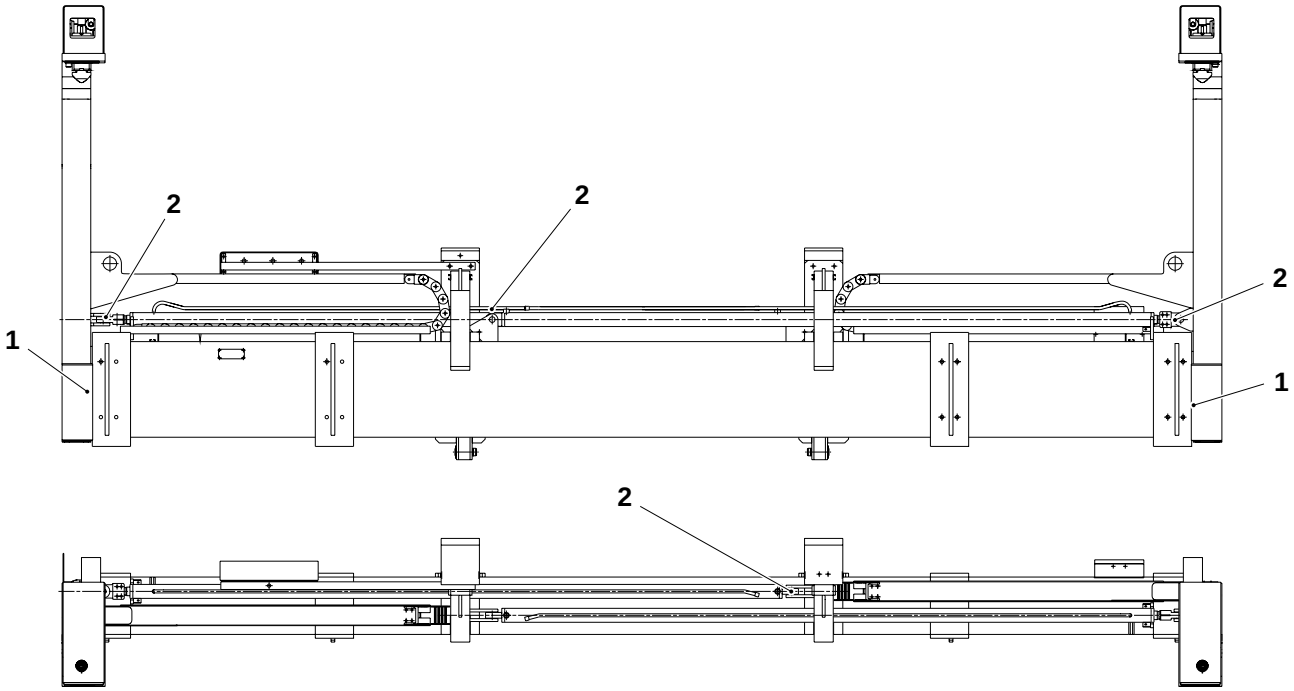
16 Lubricate the link arms' bearings with lubricating grease.

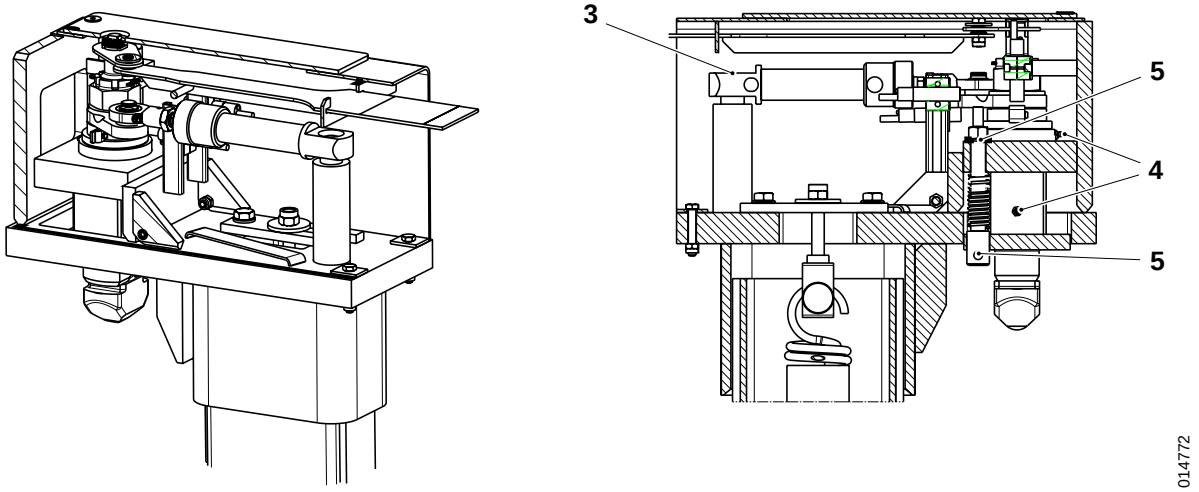


1. Lubrication point, outer link bearing
2. Lubrication point, inner link bearing

Side lift attachment

1 Lubricate all slide surfaces with slide grease (pos. 1) with attachment in max. extended position.



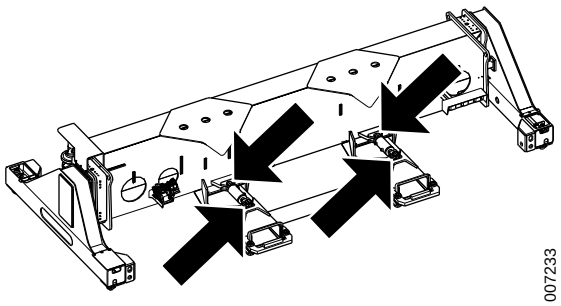


2 Lubricate the shafts of the hydraulic cylinders with lubricating grease (pos. 2).

3 Lubricate the twistlock cylinder's shaft with lubricating grease (pos. 3).

4 Lubricate the twistlocks with lubricating grease (pos. 4).

5 Lubricate the contact pins with lubricating grease (pos. 5).

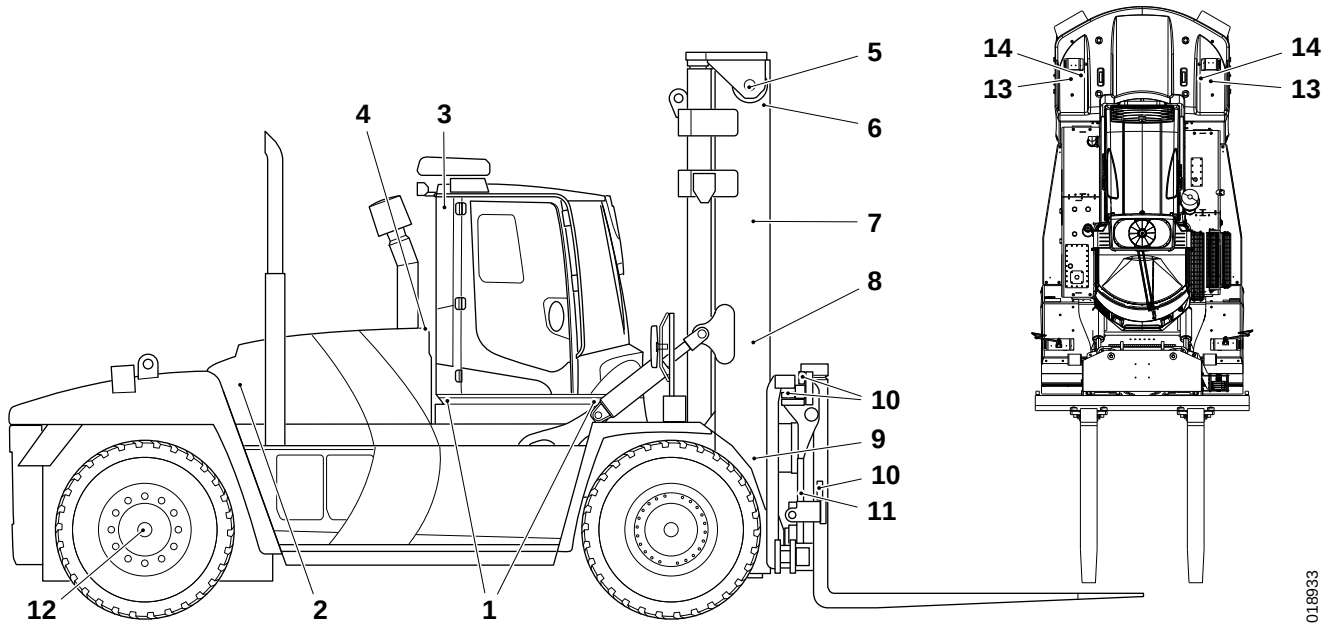


Grease points on the rotation cylinders.

Top lift attachment

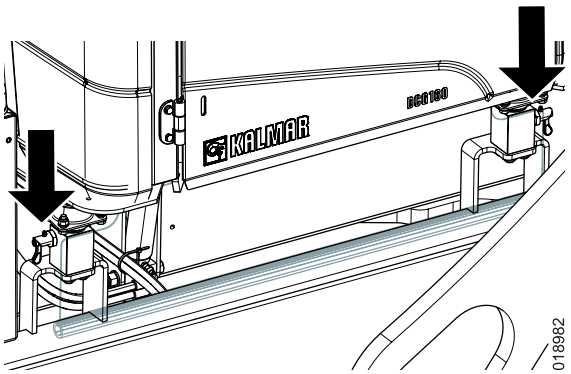
1 Lubricate the mounts for the rotation cylinders with lubricating grease.

DCG 280–330



Lubrication points, lubricating grease

Pos.	Lubrication points	Reference
1	Cab locks (2 pcs)	*Cab lock* , page C:26
2	Hinge and mechanism, hood (1 pc)	*Hinge and mechanism, hood*, page C:26
3	Gas springs, doors (2 pcs)	*Gas spring, door*, page C:26
4	Key lock door/engine cover (3 pcs)	*Key lock door/engine cover*, page C:26
5	Chain wheels (2 pcs)	*Chain wheel* , page C:26
6	Lifting chains (2 pcs)	*Lifting chains*, page C:26
7	Mast beams (2 pcs)	*Mast beam*, page C:27
8	Support rollers (4-6 pcs) and mast wheels (4-6 pcs), mast Mast top support rollers (2 pcs), if applicable.	*Support rollers and mast wheels, mast*, page C:27
9	Support rollers (4 pcs) and mast wheels (4 pcs), trolley	*Support rollers and mast wheels, trolley*, page C:28
10	Support rollers (4 pcs) and fork wheels (8 pcs), forks	*Support rollers and fork wheels, forks*, page C:28
11	Side shift cylinders (4 pcs)	*Side shift cylinder*, page C:28
12	Wheel hubs (2 pcs)	*Wheel hub and wheel spindle*, page C:29
13	Wheel spindles (4 pcs)	
14	Link arms (4 pcs)	*Link arms*, page C:29
15	Side lift attachment ⊕ (not shown on diagram)	*Side lift attachment*, page C:23
16	Top lift attachment ⊕ (not shown on diagram)	*Top lift attachment*, page C:24



Grease points on the cab locks.

Cab lock

1 Tilt the cab.

2 Lubricate the cab locks with lubricating grease.

Hinge and mechanism, hood

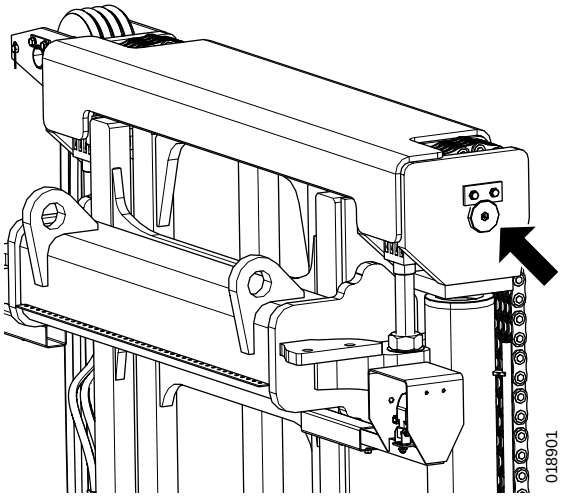
3 Lubricate the mechanism in the hood.

Gas spring, door

4 Lubricate the ball brackets with lubricating grease.

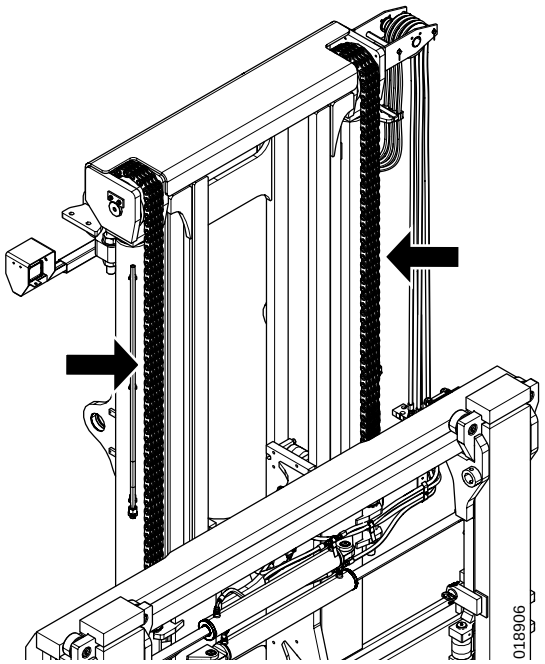
Key lock door/engine cover

5 Lubricate the key locks on doors and hood with lock oil.



Chain wheel

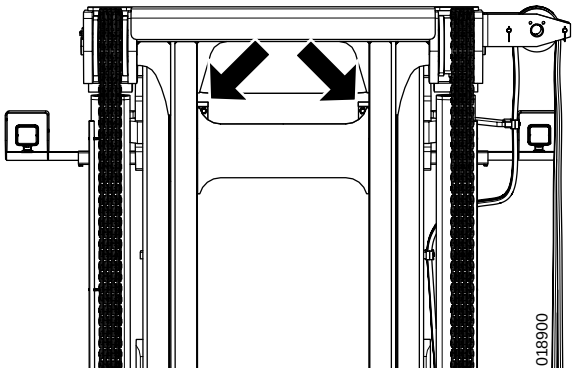
6 Lubricate the chain wheels' shafts with lubricating grease.



Lifting chains

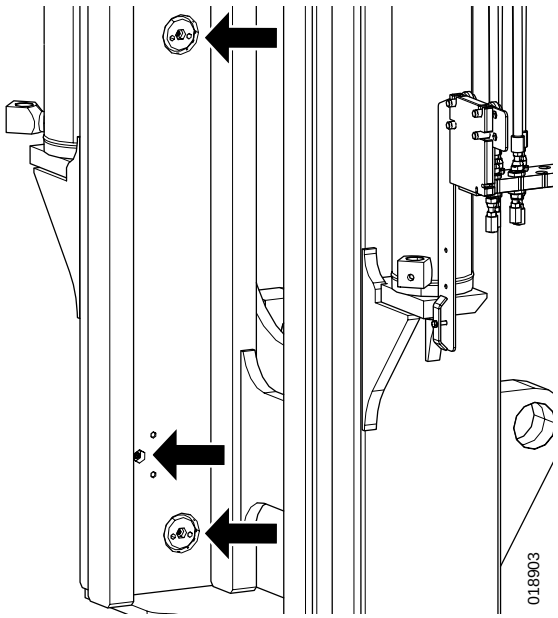
7 Brush or spray the chains with chain oil. Make sure that the chains are well lubricated.

Mast beam

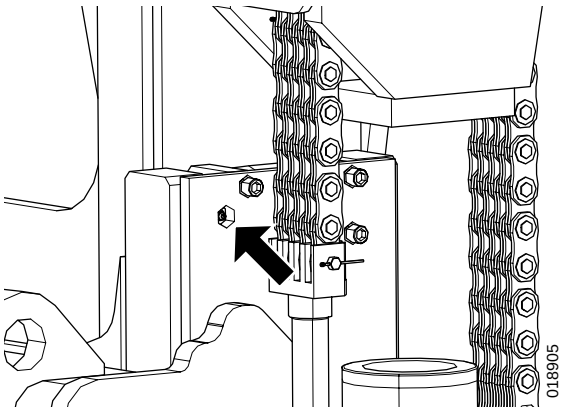


8 Lubricate the slide plates.

Support rollers and mast wheels, mast

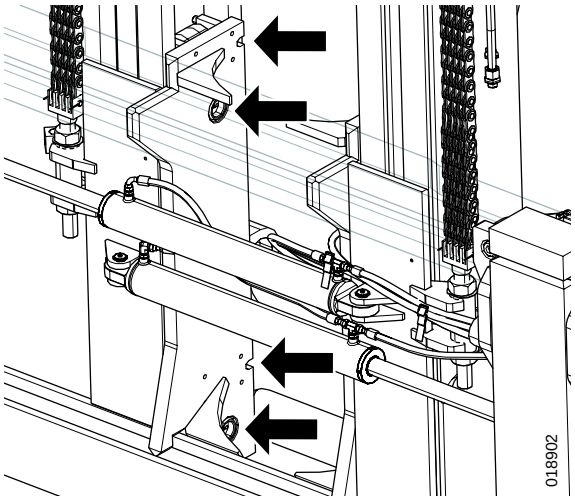


9 Lubricate the support rollers and mast wheels in the mast.



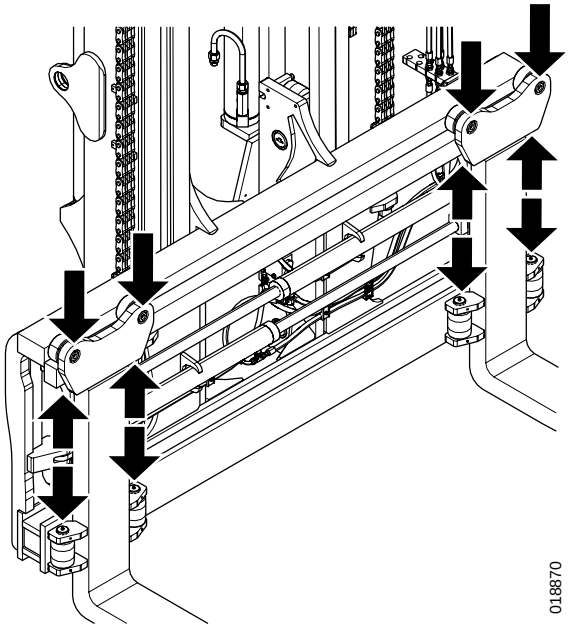
10 Lubricate the top support roller in the mast, if applicable.

Support rollers and mast wheels, trolley



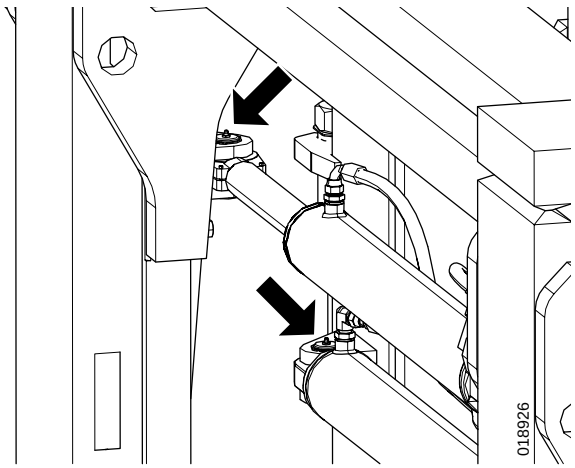
11 Lubricate the support rollers and mast wheels in the trolley.

Support rollers and fork wheels, forks



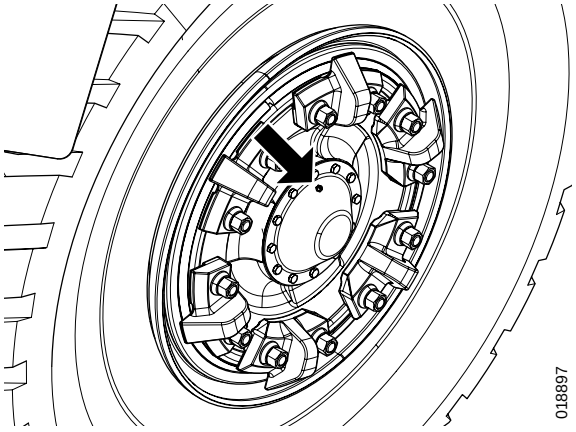
12 Lubricate the support rollers and fork wheels with lubricating grease.

Side shift cylinder

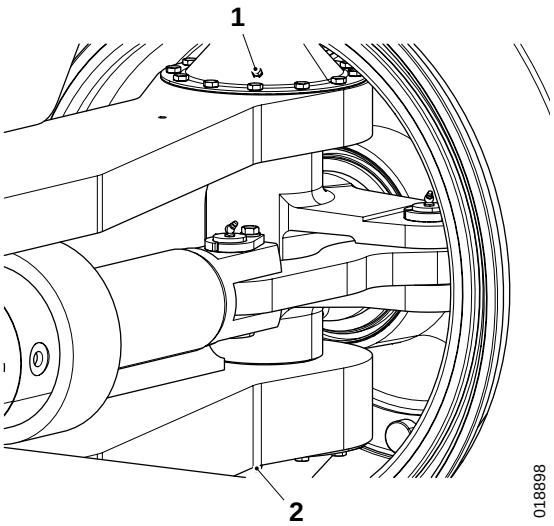


Grease points on the side shift cylinder.

13 Lubricate the mounts for the side shift cylinder with lubricating grease.

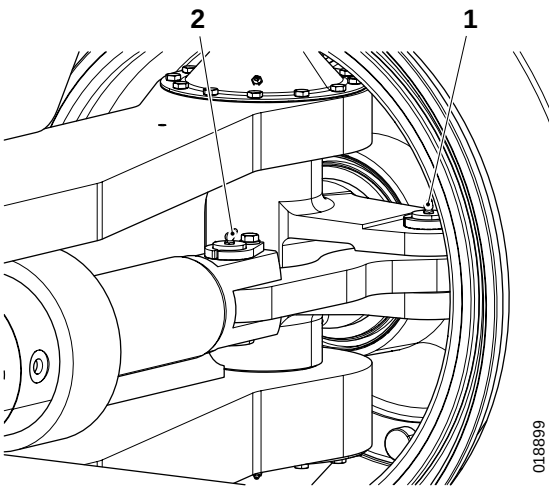


Lubrication point wheel hub



Lubrication points wheel spindle

1. Lubrication point, upper king pin bearing
2. Lubrication point, lower king pin bearing



1. Lubrication point, outer link bearing
2. Lubrication point, inner link bearing

Wheel hub and wheel spindle

14 Raise the right-hand steering wheel with a jack so that wheel bearing and wheel spindle are unloaded, do not lift so high that the wheel hangs freely.

15 Lube the wheel hub until grease is forced out by the seal on the hub's inside.

Lift the seal ring's lip with a small screwdriver to facilitate pressing out of air. Grease until grease comes out by the seal.

NOTE

Work carefully to avoid damaging the seal.

16 Grease the wheel spindle's upper and lower bearings.

NOTE

It is important that both upper and lower bearings are greased separately since grease is not pressed between the bearings.

17 Lower the wheel.

18 Repeat the procedure on the left-hand steering wheel.

Link arms

19 Lubricate the link arm bearings (position 1 and 2) with lubricating grease.

Side lift attachment

See *Side lift attachment*, page C:23.

Top lift attachment

See *Top lift attachment*, page C:24.

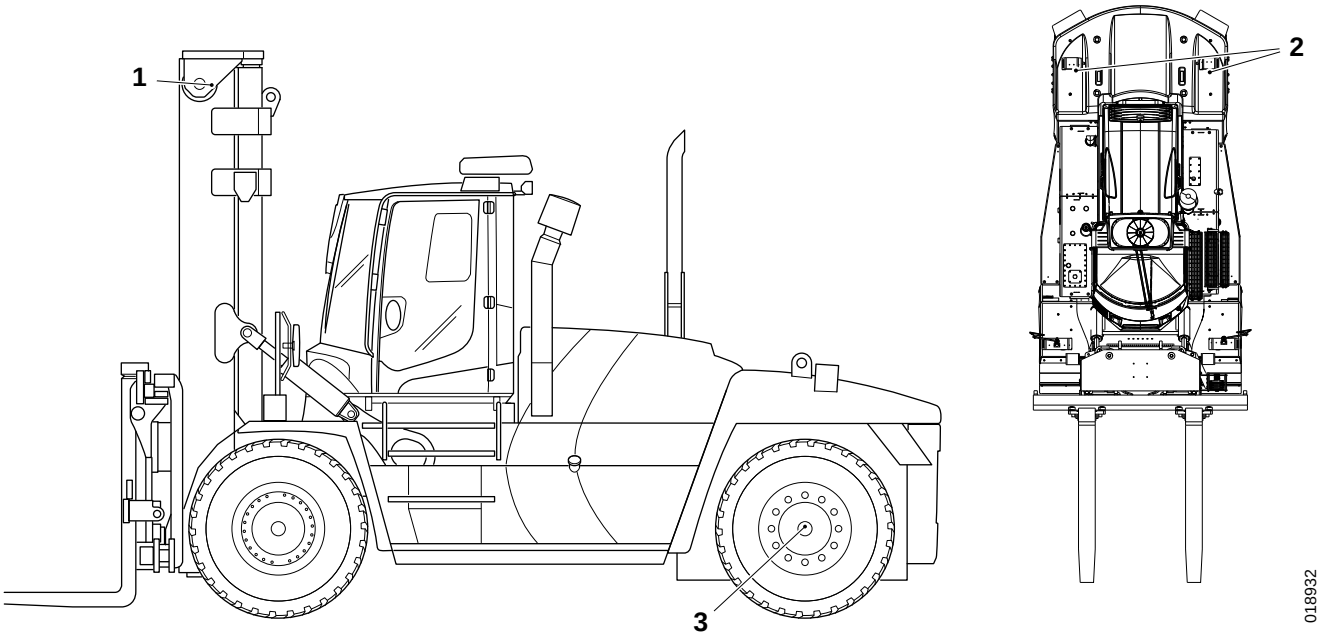
Lubricating 1000h

1 Turn off the engine and turn off the system voltage.

2 Clean the area around each grease cup before greasing.

3 Lubricate the machine's lubrication points with **lubricant** in accordance with the recommendation, see section *F Technical data*. Also do a visual check of all lubricated mounts.

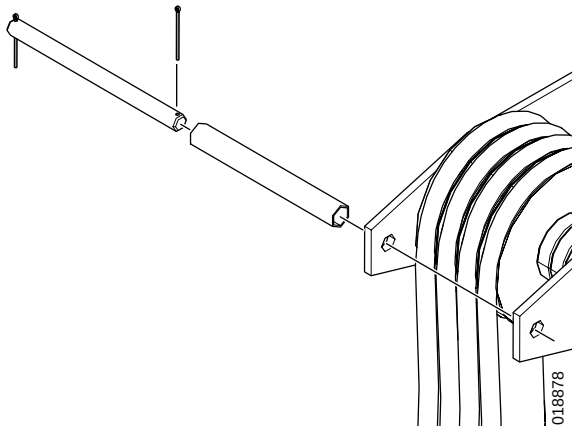
DCG 180-250



Lubrication points, lubricating grease

Pos.	Lubrication points	Reference
	Lubricating 500h	*Lubricating 500h*, page C:17
1	Hose wheels	*Hose wheels*, page C:31
2	Electric connectors (not shown on diagram)	*Electric connectors*, page C:31
3	Top lift attachment ⊕ (not shown on diagram)	*Top lift attachment*, page C:32
	Chain and chain wheel spreading ⊕	*Chain wheel* , page C:19 and *Lifting chains*, page C:19
	Twistlocks (4 pcs) ⊕	*Twistlocks*, page C:33
4	Side lift attachment ⊕ (not shown on diagram)	*Side lift attachment*, page C:32

Hose wheels

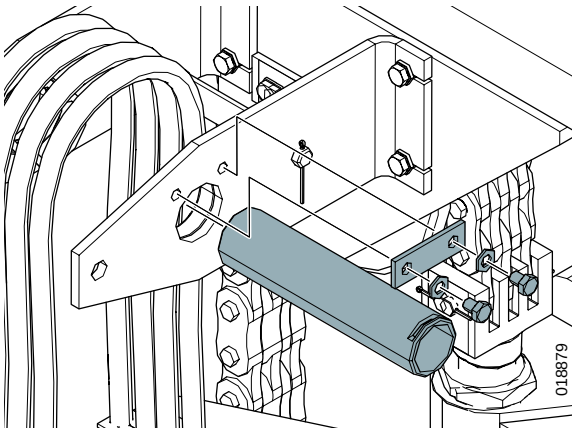


1 Lift the mast.

2 Position a support under the trolley and lower the mast again. The chains and hoses are now slack.

3 Machine in service position, see section *B Safety*.

4 Remove the hose guide that prevents the hoses from becoming unrouted.



5 Remove the lock plate to release the hose wheel.

6 Remove the hose wheels.

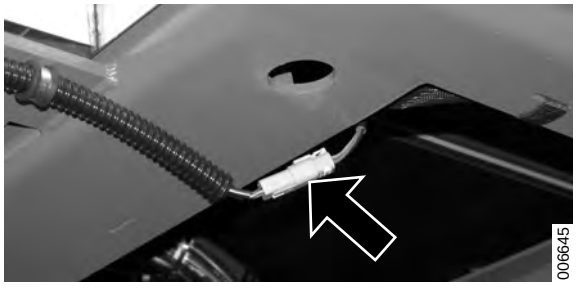
7 Apply slide grease to the shaft.

8 Fit the hose wheels.

9 Fit the shaft and lock with the lock plate and the screws.

10 Refit the hoses and fit the hose guide. Secure the hose guide with split pins.

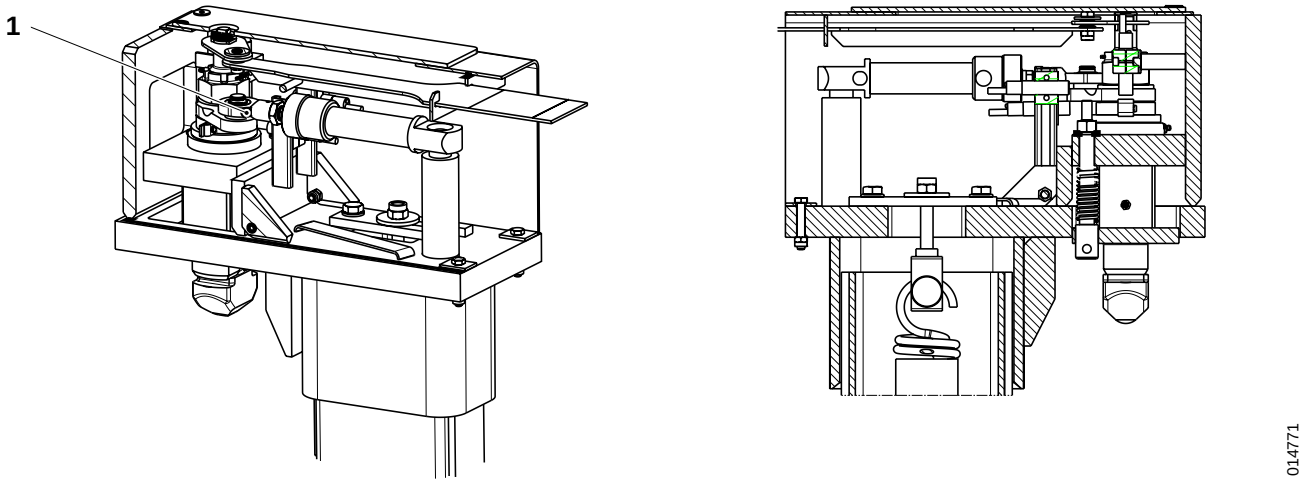
Electric connectors



Electric connector, example

11 Grease electric connectors with electric connector grease.

Side lift attachment



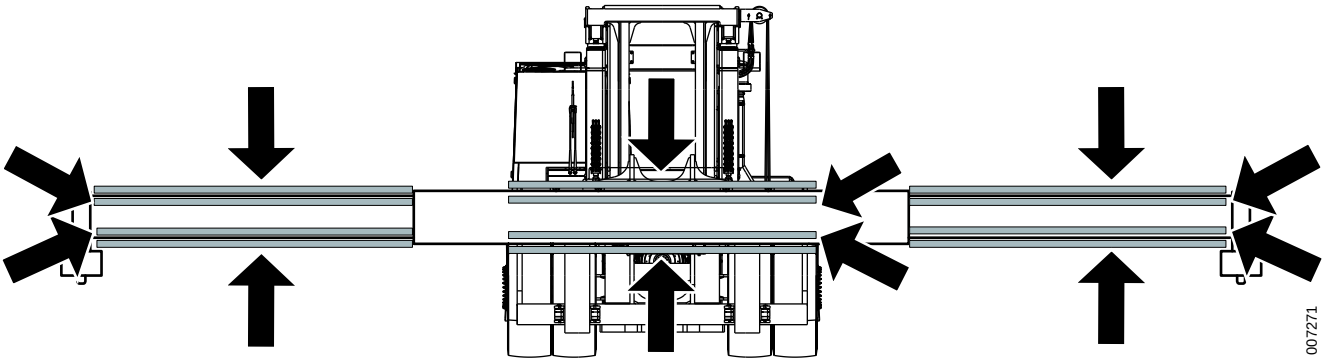
1 Machine in service position, see section *B Safety*.

2 Lubricate the rotary coupling (pos. 1) with lubricating grease.

3 Clean and lubricate the twistlocks with lubricating grease.

Top lift attachment

1 Brush the slide surfaces on the attachment with **white lubrication paste** as shown in the figure below, see section *F Technical data*.



NOTE

The upper slide surfaces in the outer boom should be lubricated at the same time as the other slide surfaces.

Run spreading in and out several times without load.

IMPORTANT

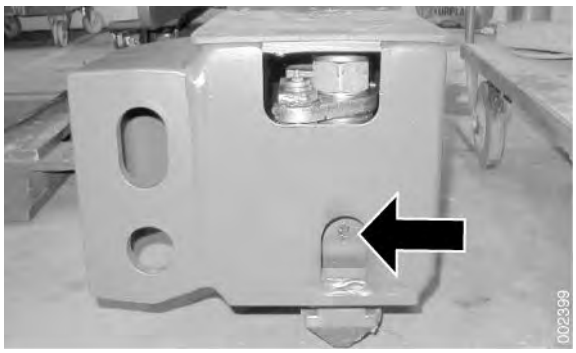
Wipe off excess lubrication paste.

Chain wheel spreading

2 Lubricate the chain wheel's bearing with lubricating grease.

Chain spreading

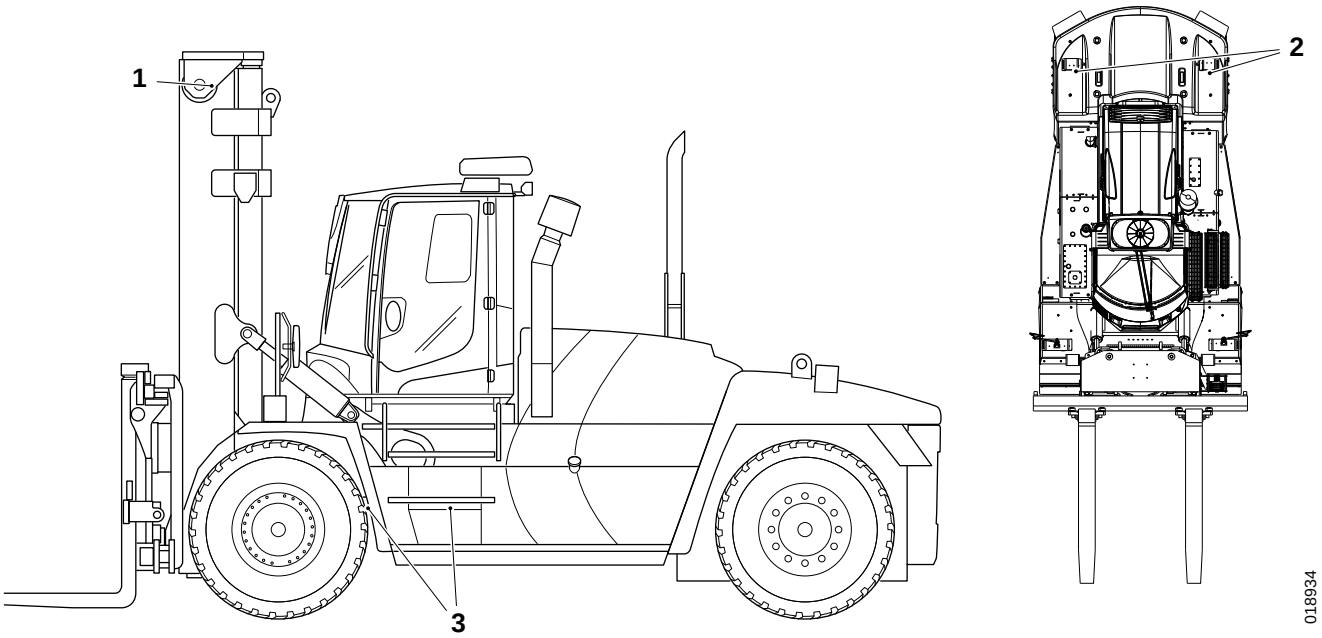
3 Brush the chain with lubricating grease.



Twistlocks

4 Lubricate the bearing for the lift pins with lubricating grease.

DCG 280-330



Lubrication points, lubricating grease

Pos.	Lubrication points	Reference
1	Lubricating 500h	
2	Hose wheels	*Hose wheels*, page C:35
3	Universal joints (2 pcs)	*Universal joint*, page C:35
4	Electric connectors (not shown on diagram)	Lubricate with contact grease
5	Top lift attachment ⊕	*Top lift attachment*, page C:32
	Chain and chain wheel spreading ⊕	*Chain wheel* , page C:19 and *Lifting chains*, page C:19
	Twistlocks (4 pcs) ⊕	*Twistlocks*, page C:33
6	Side lift attachment ⊕ (not shown on diagram)	*Side lift attachment*, page C:32

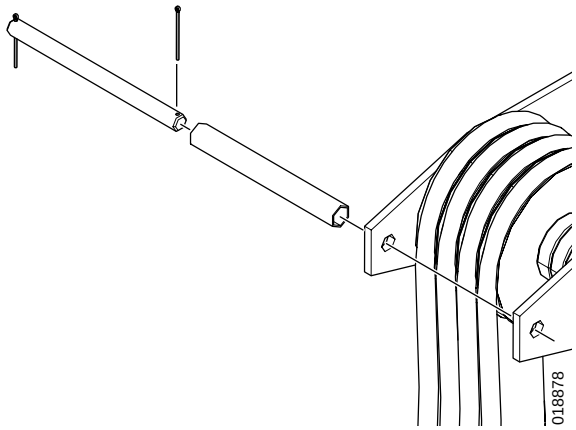
Hose wheels

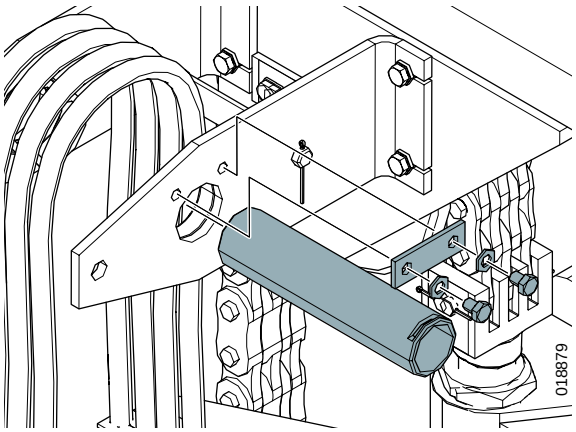
1 Lift the mast.

2 Position a support under the trolley and lower the mast again. The chains and hoses are now slack.

3 Machine in service position, see section *B Safety*.

4 Remove the hose guide that prevents the hoses from becoming unrouted.





5 Remove the lock plate to release the hose wheel.

6 Remove the hose wheels.

7 Apply slide grease to the shaft.

8 Fit the hose wheels.

9 Fit the shaft and lock with the lock plate and the screws.

10 Refit the hoses and fit the hose guide. Secure the hose guide with split pins.

Universal joint

11 Grease universal joints with lubricating grease.

Grease nipple for universal joint, example

Side lift attachment

See *Side lift attachment*, page C:32.

Top lift attachment

See *Top lift attachment*, page C:32.

Checking for cracks

DANGER

If the welds show signs of cracking, take the machine out of operation as soon as possible and contact Cargotec Support.

1 Turn off the engine and turn off the system voltage.

2 Clean every weld carefully before inspection.

3 Visually inspect for damage and cracks in the areas with high stress concentration, see *Check points*, page C:38. Check the whole length of every weld.

Welds where cracks are suspected following visual inspection are tested with magnetic particle inspection and liquid penetrant if appropriate in accordance with the following:

a. The magnetic particle method is used to determine if there's a crack or not, and where it is. See *Magnetic particle method*, page C:36.

b. Confirmed cracks are investigated further with penetrating fluid. See *Checking cracks with penetrating fluid*, page C:37.

Magnetic particle method

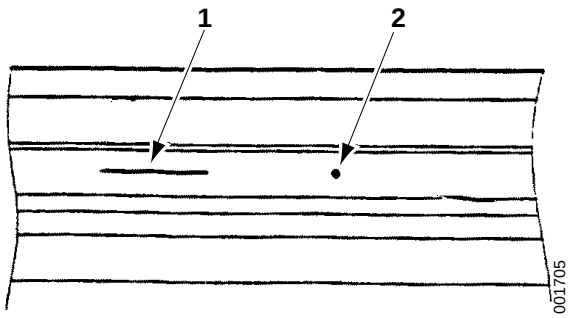
1 Blast the applicable area clean so that it is completely free of paint residue.

2 Test using magnetic particle and the following equipment:

- Equipment: Yoke Tiede
- Method:
  - a Alternating current AC
  - b Contrast colour
- Checking medium:
  - a Wet
  - b Colour (for example, Tiede Ferrolux)

If no cracks are detected with the magnetic particle method, checking is finished and the applicable area is approved.

If cracks are indicated, the crack should be investigated further with penetrating fluid.



Examples of cracks

1. Linear crack
2. Pointed crack

Checking cracks with penetrating fluid

1 Clean the area with cleaning fluid part no. 923626.0668.

2 Spray penetrating fluid part no. 923626.0669 on the cleaned area and let dry 10 min.

3 Wash off penetrating fluid with cleaning fluid part no. 923626.0668.

Thoroughly wipe off the cleaning fluid with a drying cloth and let any remaining cleaning fluid evaporate.

4 Spray detection fluid part no. 923626.0670 on the area.

5 Let the sprayed area dry 1-2 hours.

6 Visually inspect the area.

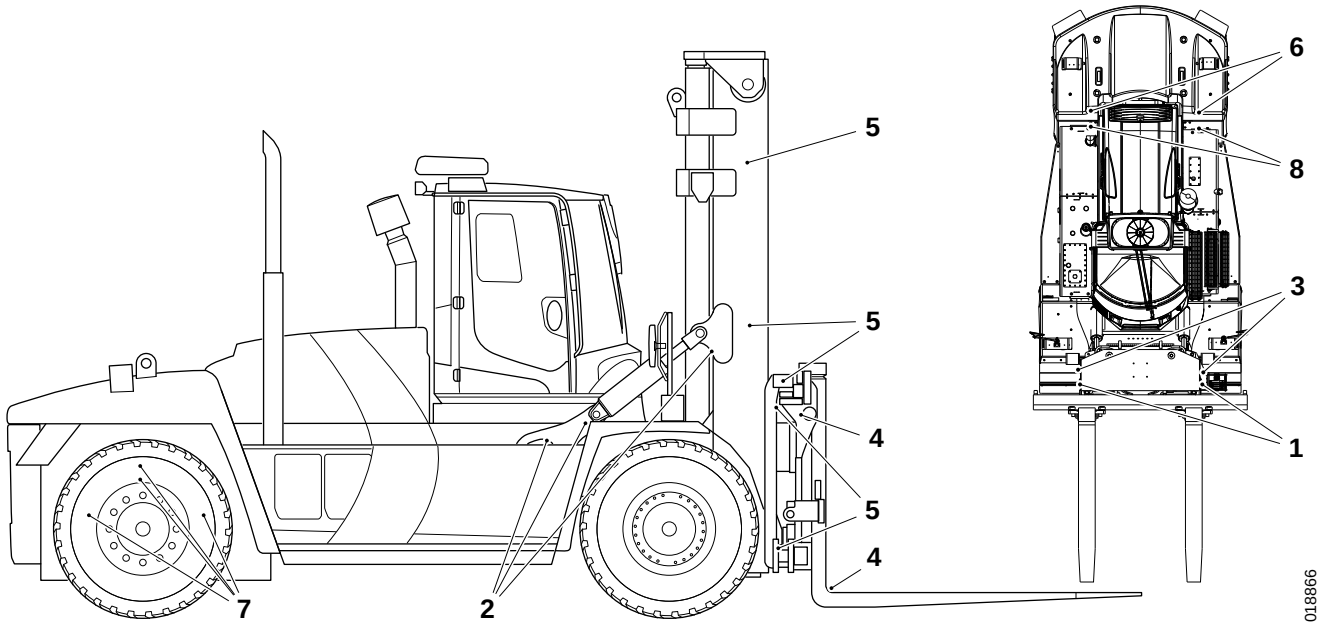
If the tested area does not show signs of linear or point-shaped cracks, it is approved.

If the crack check indicates linear or point-shaped cracks, contact Cargotec Support.

Check points

Check the following welds carefully:

DCG 180-250

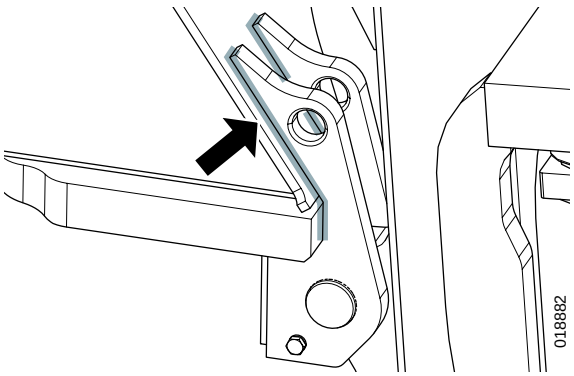


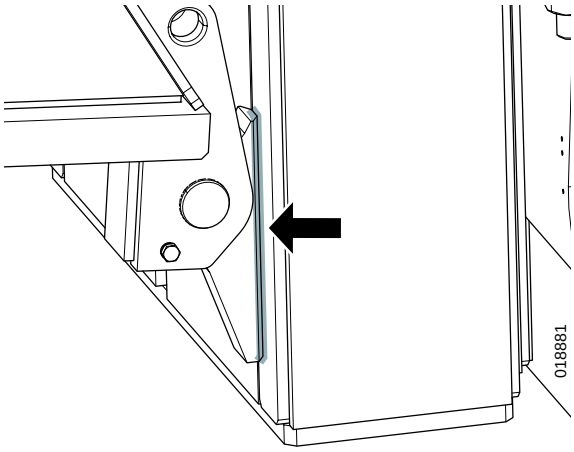
Checking for cracks

Pos.	Check point	Reference
1	Mast mount	*Mast mount*, page C:38
2	Tilt mount	*Tilt mount*, page C:40
3	Drive axle mount	*Drive axle mount*, page C:40
4	Lifting forks	*Lifting forks*, page C:41
5	Lifting equipment	*Lifting equipment*, page C:41
6	Counterweight box	*Counterweight box*, page C:43
7	Steering axle mounts	*Steering axle mounts*, page C:44
8	Mounting of frame beam to back piece	*Mounting of frame beam to back piece*, page C:44
9	Top lift attachment ⊕ (not shown on diagram)	*Top lift attachment*, page C:45

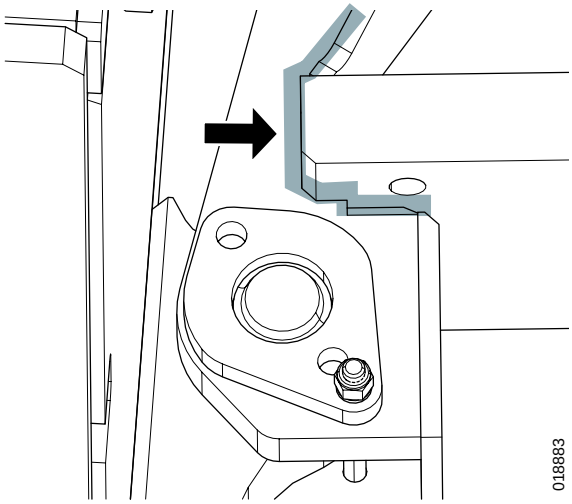
Mast mount

a) Mast mount in frame

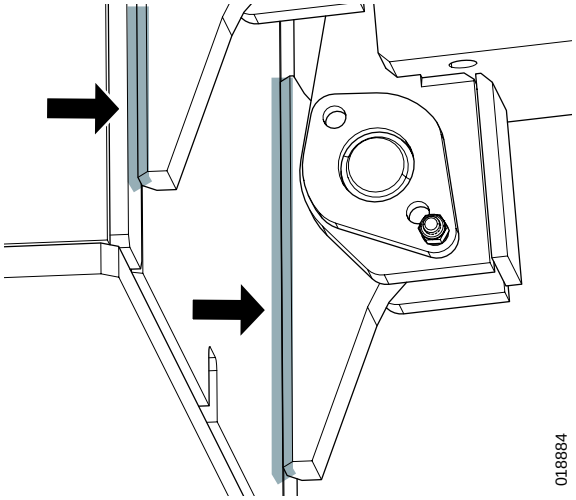




b) Welds between mast beam and mount tab.



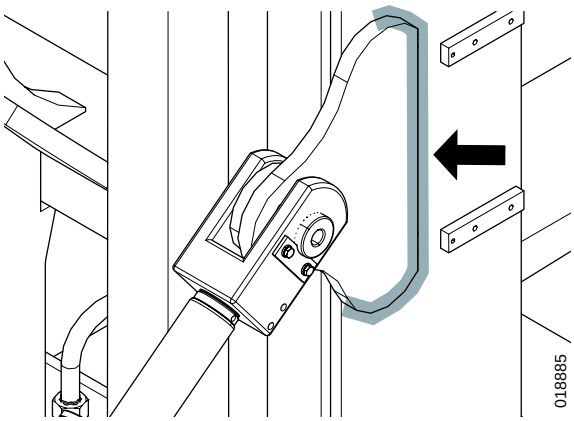
c) Mast mount in frame, bottom view



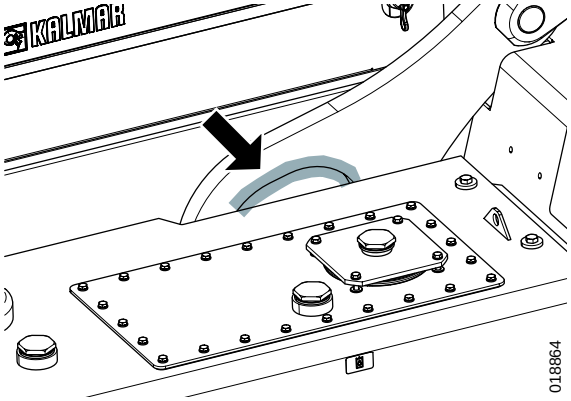
d) Weld between mast beam and mount tab, bottom view.

Tilt mount

a) Tilt mount in mast.

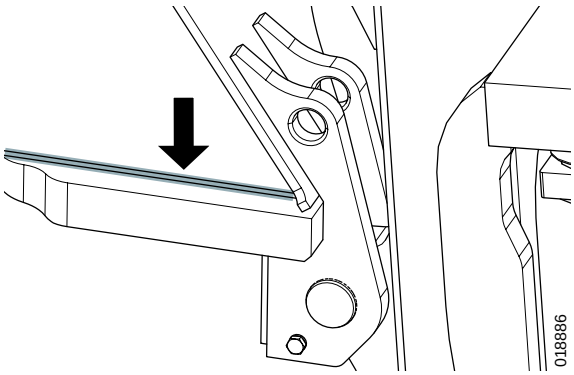


b) Tilt mount in frame.

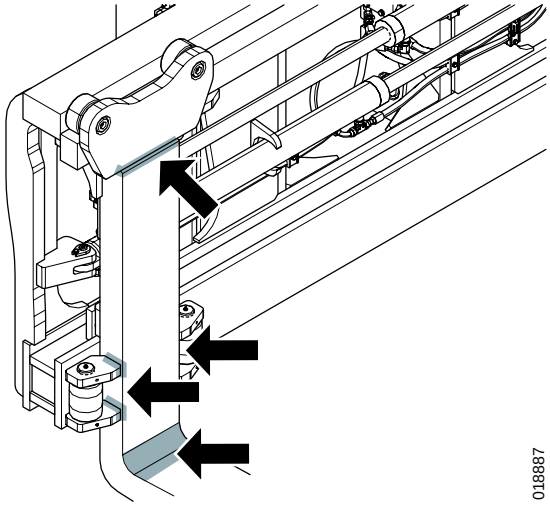


Drive axle mount

a) Drive axle mount in the frame.



Lifting forks



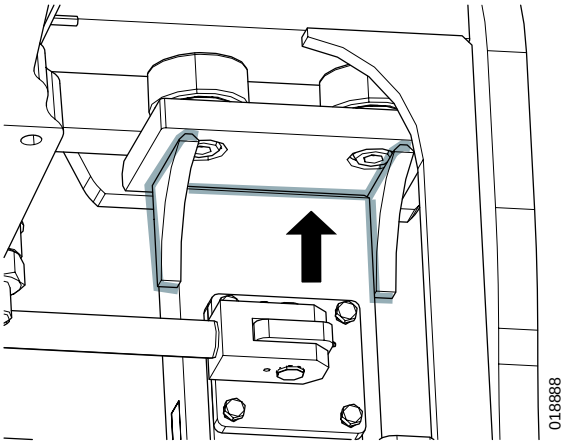
NOTE

There may be other variants of forks than those shown here.

a) The fork's suspension bracket against the carriage beams.

Mounting of support rollers.

When checking fork material, see section *7 Load handling*, group *7.9.1 Lifting forks*.



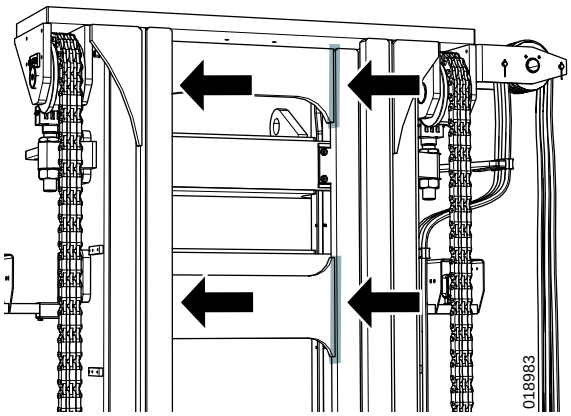
b) Fork upper mounting bracket, bottom view.

Lifting equipment

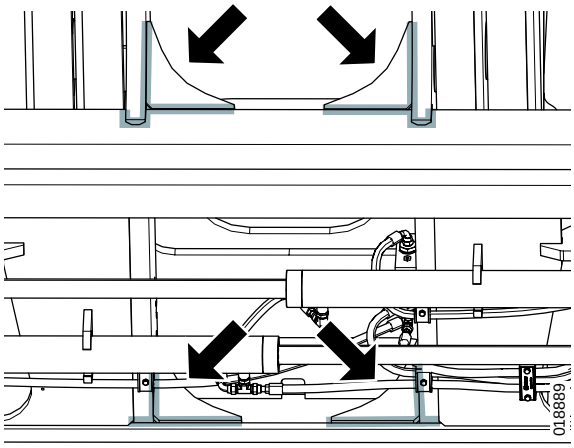
1

NOTE

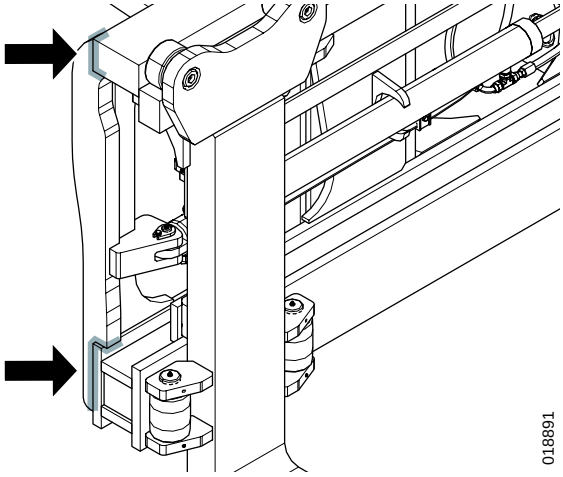
There may be other variants of trolleys than the variants shown here.



a) The welding of the cross plates against the mast beams.



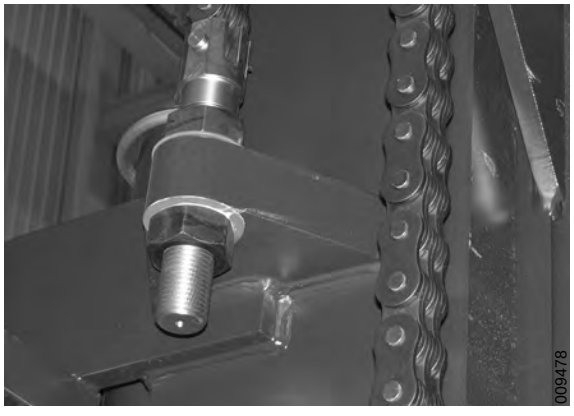
b) Trolley side's welds against the trolley beams.



c) Outer struts' welds against the trolley beams.

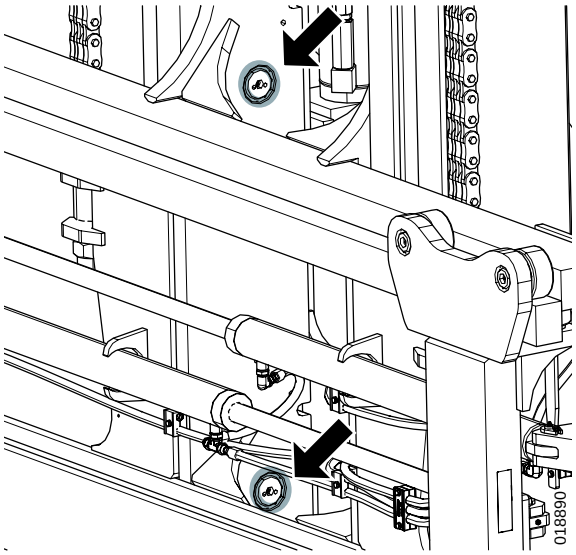
d) Chain mounting in the trolley.

Also check the mounting pin to the chain and its split pin.

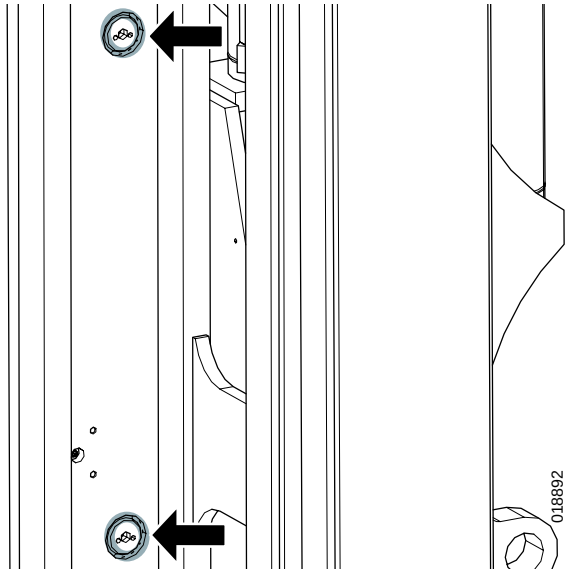


e) Chain mounting in the mast.

Also check the chain tightener, mounting pin to the chain and its split pin.

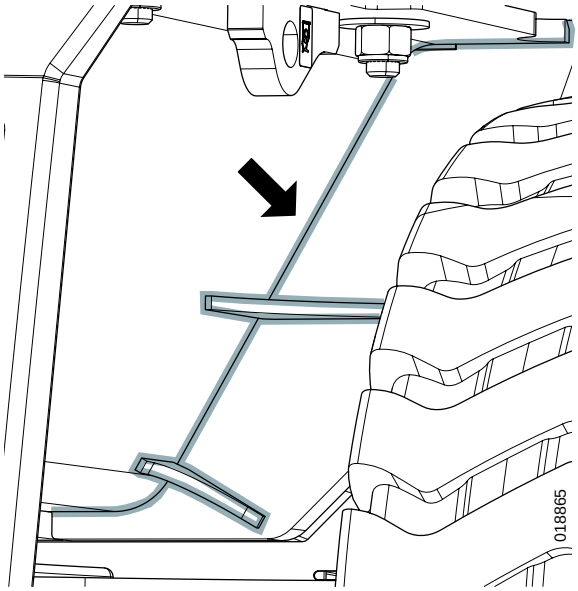


f) The wheel pin welds in the trolley.



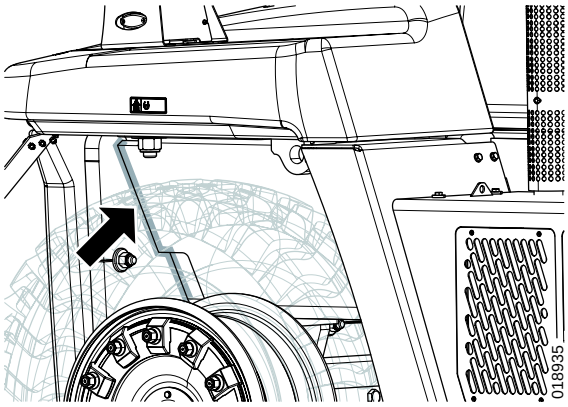
g) The welding of the wheel pins in the inner mast.

Counterweight box



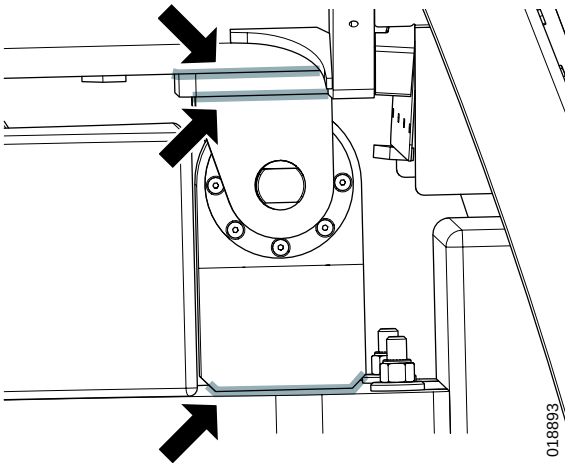
a) Counterweight box mounting against the frame, under rear mudguard.

Angle the steering wheels on the ground for easier access.



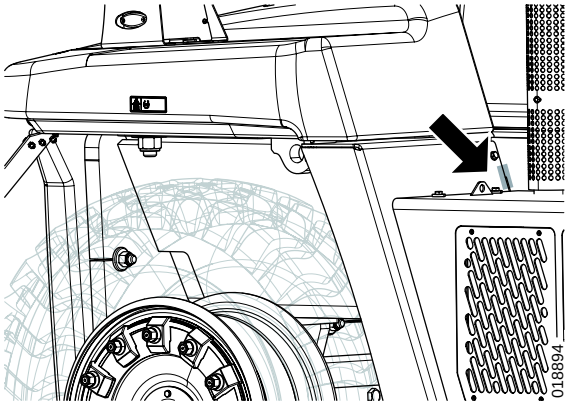
b) Counterweight box mounting to back piece.

Steering axle mounts

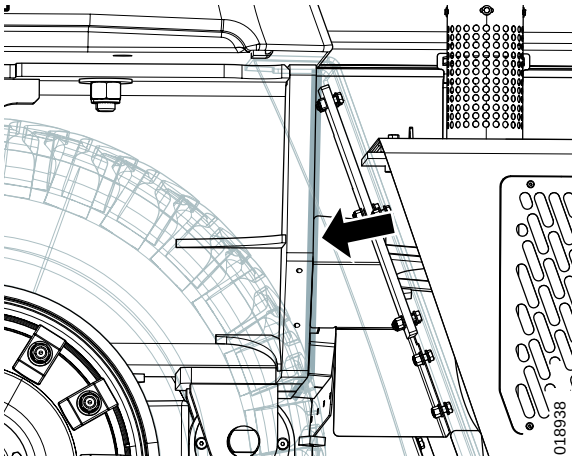


a) Steering axle mounts in the frame.
b) Steering axle mounts in the steering axle cradle.

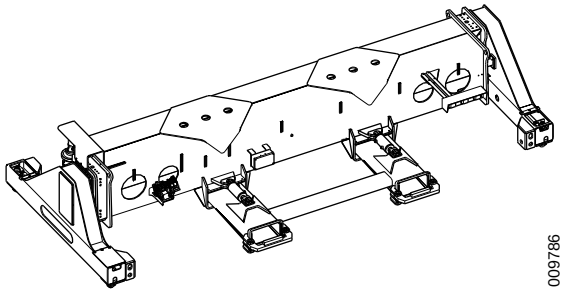
Mounting of frame beam to back piece



a) Mounting of frame beam to back piece.



b) Mounting of frame beam to back piece.



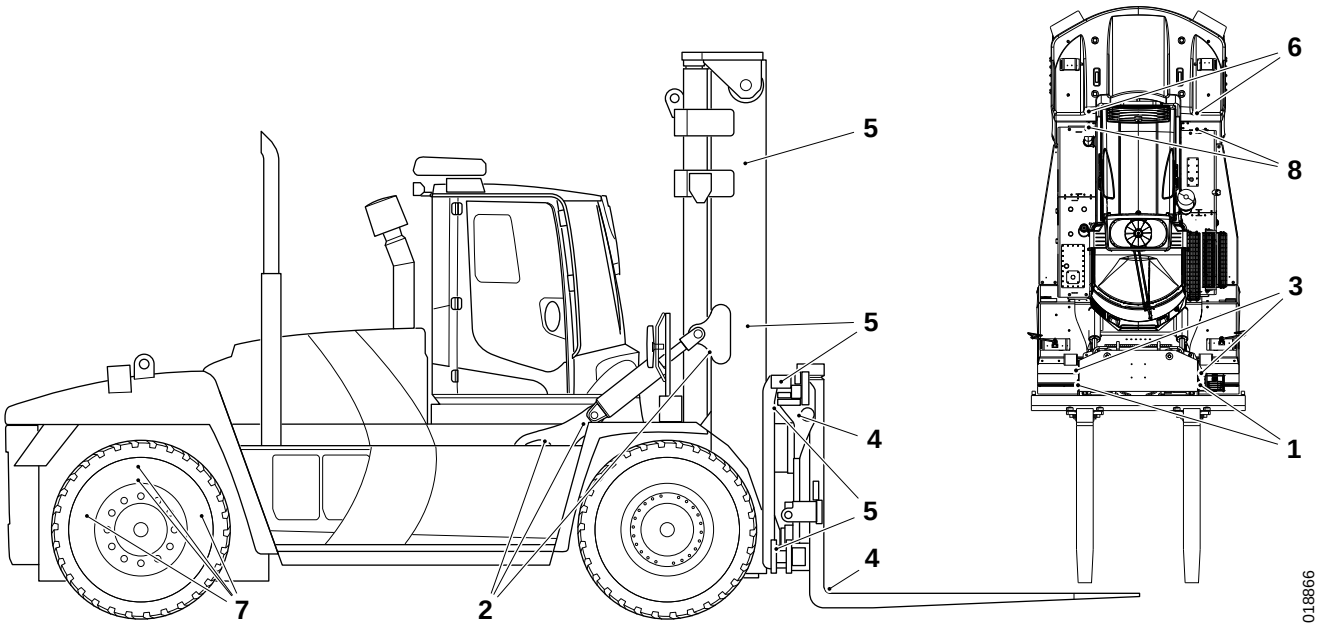
Top lift attachment

1 Check the top lift attachment's welding seams.

NOTE

There may be other variants of top lift attachment than the variants shown here.

DCG 280-330



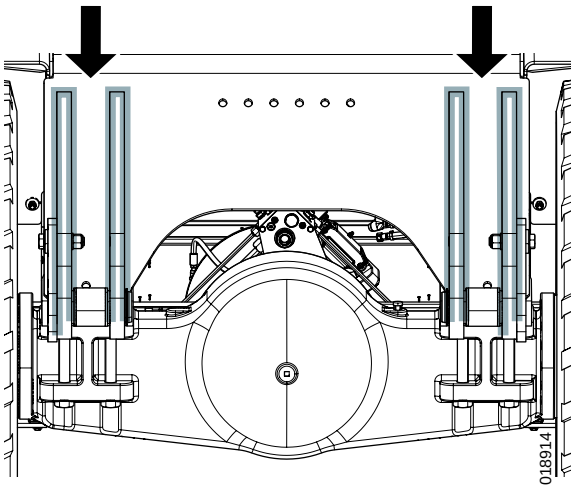
Checking for cracks

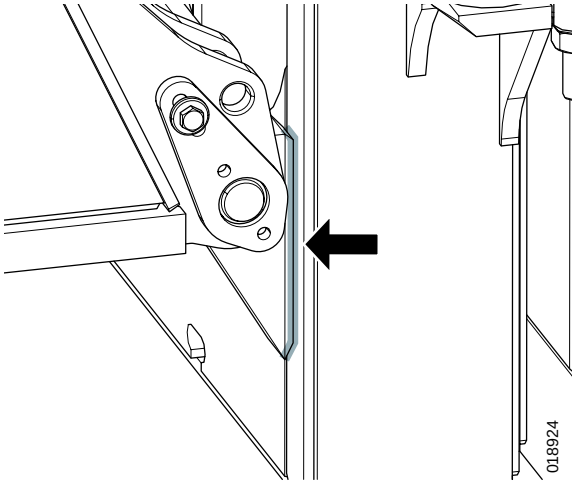
Pos.	Check point	Reference
1	Mast mount	*Mast mount*, page C:46
2	Tilt mount	*Tilt cylinder and tilt cylinder mount.*, page C:47
3	Drive axle mount	*Drive axle mount*, page C:48
4	Lifting forks	*Lifting forks*, page C:49
5	Lifting equipment	*Lifting equipment*, page C:49
6	Counterweight box	*Counterweight box*, page C:43
7	Steering axle mounts	*Steering axle mounts*, page C:53
8	Mounting of frame beam to back piece	*Mounting of frame beam to back piece*, page C:53
9	Top lift attachment ⊕ (not shown on diagram)	*Top lift attachment*, page C:45

Mast mount

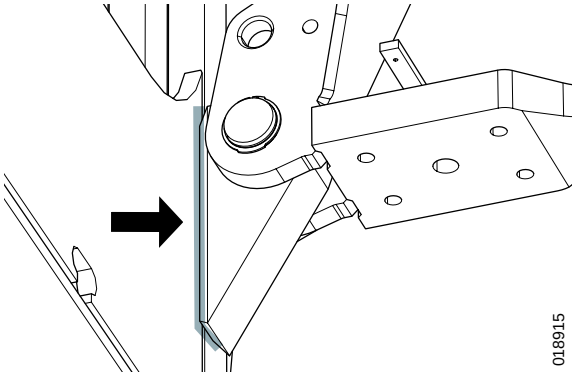
1

a) Mast mount in frame.





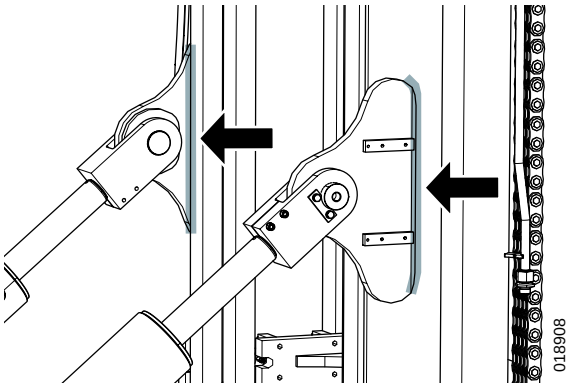
b) Welds between mast beam and mount tab.



c) Weld between mast beam and mount tab, bottom view.

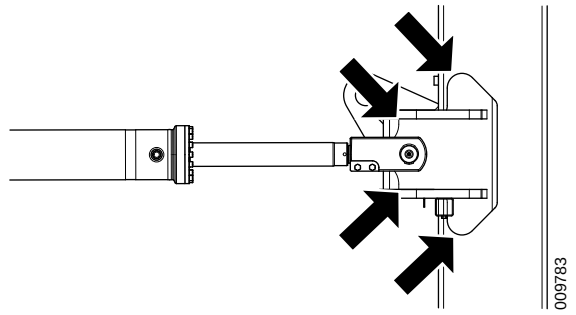
Tilt cylinder and tilt cylinder mount.

2



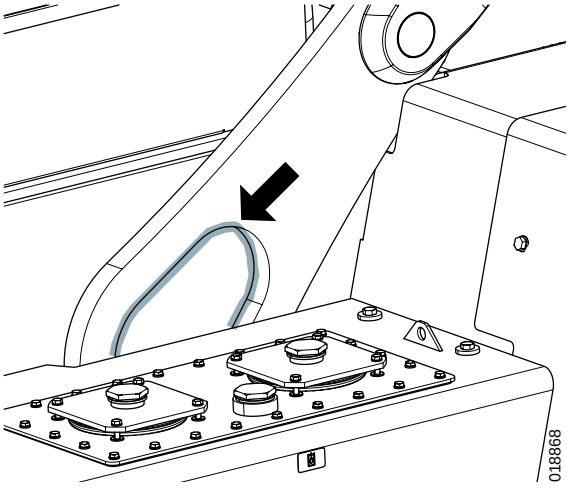
Machine without tilt frame

a) Check the tilt cylinder.

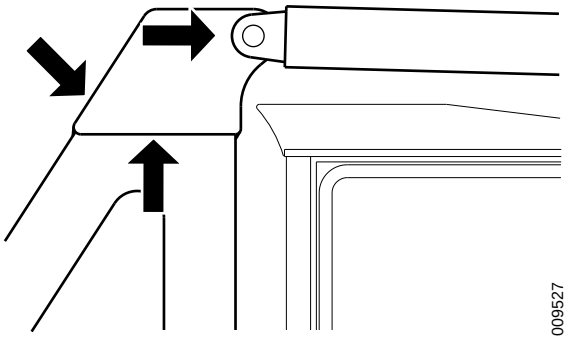


Machine with tilt frame

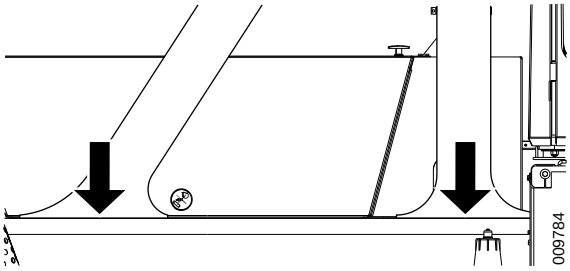
b) Tilt mount in mast.



c) Tilt mount in frame.

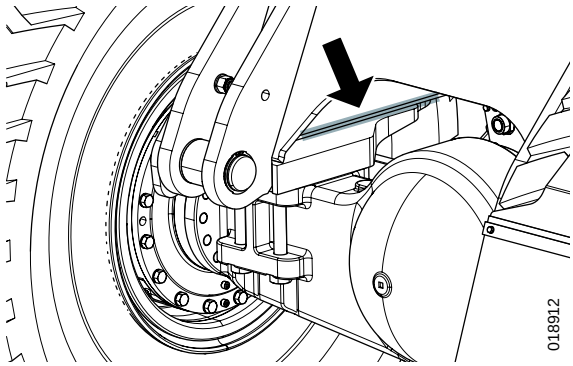


d) Tilt mount in tilt frame.

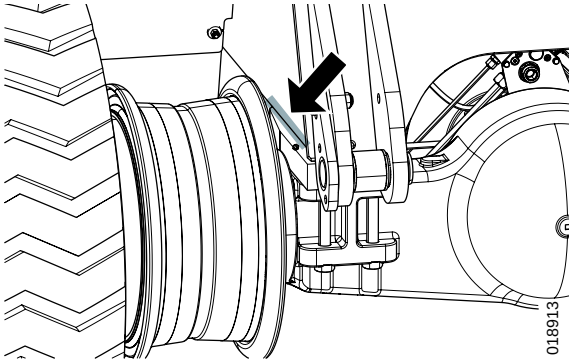


e) Tilt frame mount in chassis.

Drive axle mount



a) Drive axle mount in the frame.

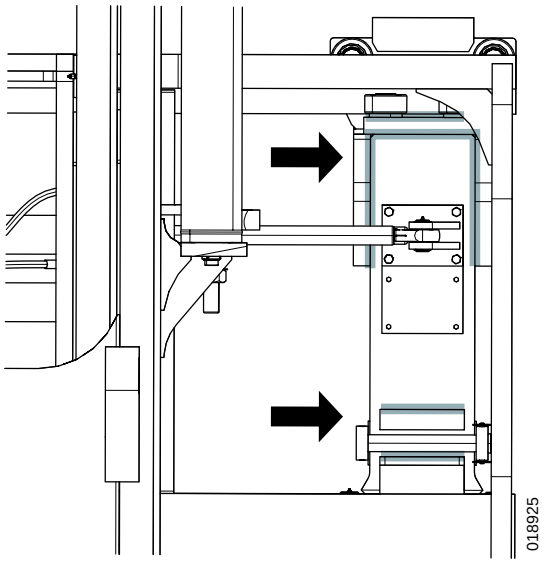


b) Drive axle mount in the frame.

Lifting forks

NOTE

There may be other variants of forks than those shown here.



a) The fork's suspension bracket against the carriage beams.

Mounting of support rollers.

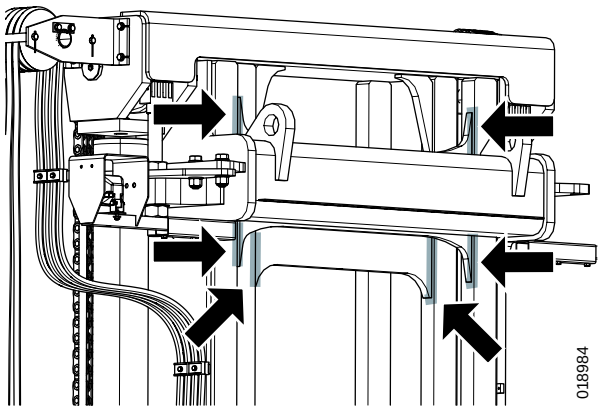
When checking fork material, see section *7 Load handling*, group *7.9.1 Lifting forks*.

Lifting equipment

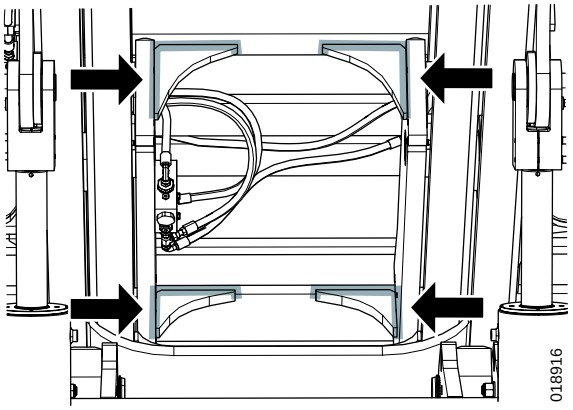
3

NOTE

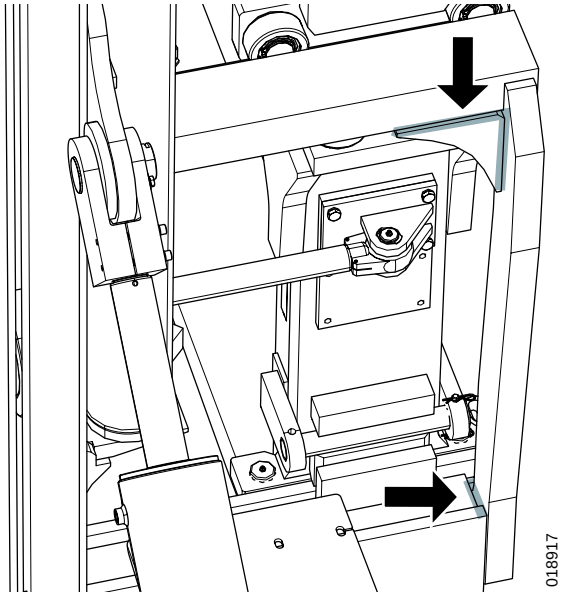
There may be other variants of trolleys than the variants shown here.



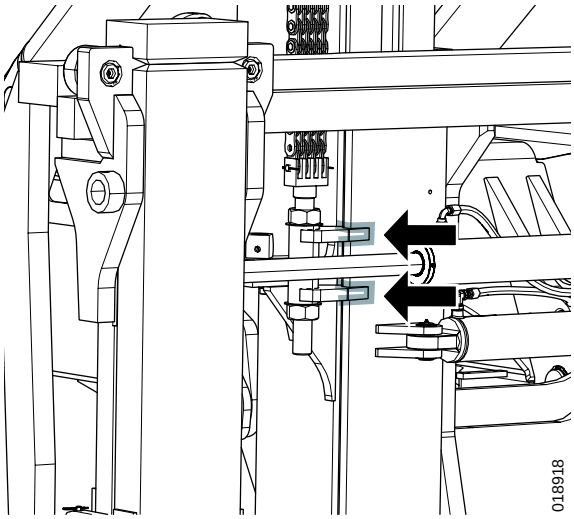
a) The welding of the cross plates against the mast beams.



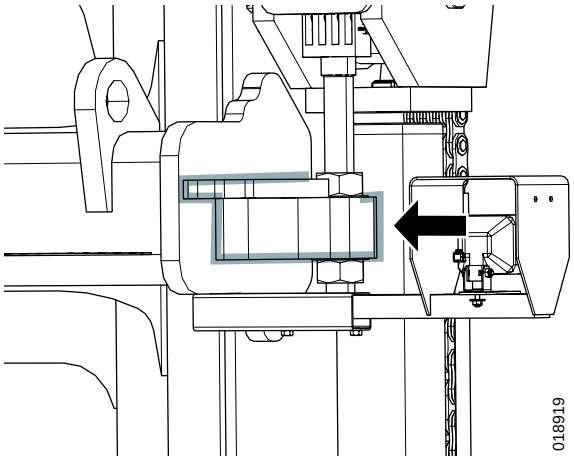
b) Trolley side's welds against the trolley beams.



c) Outer struts' welds against the trolley beams.

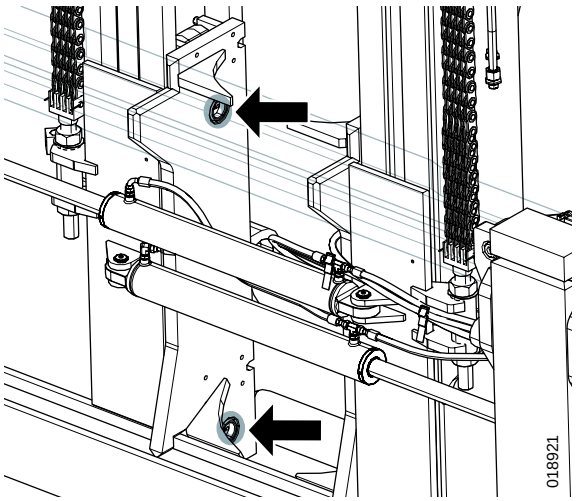


d) Chain mounting in the trolley.
Also check the mounting pin to the chain and its split pin.

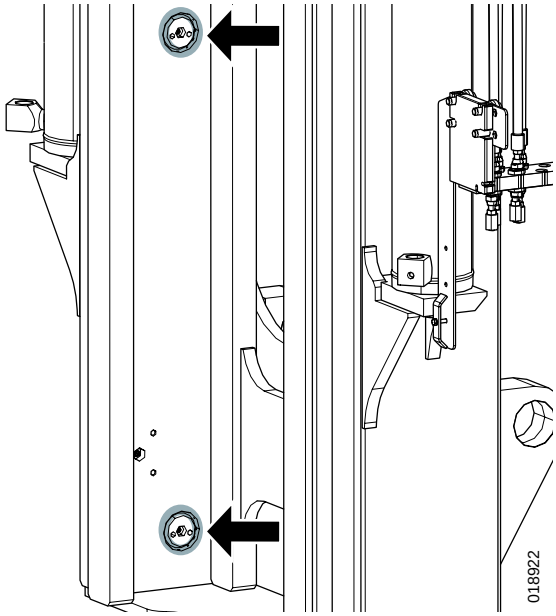


e) Chain mounting in the mast.

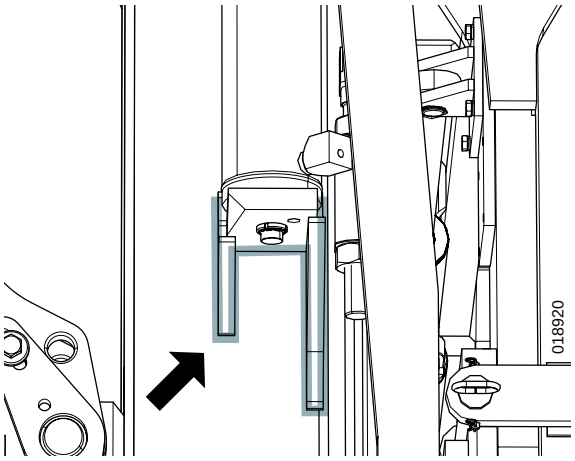
Also check the chain tightener, mounting pin to the chain and its split pin.



f) The wheel pin welds in the trolley.

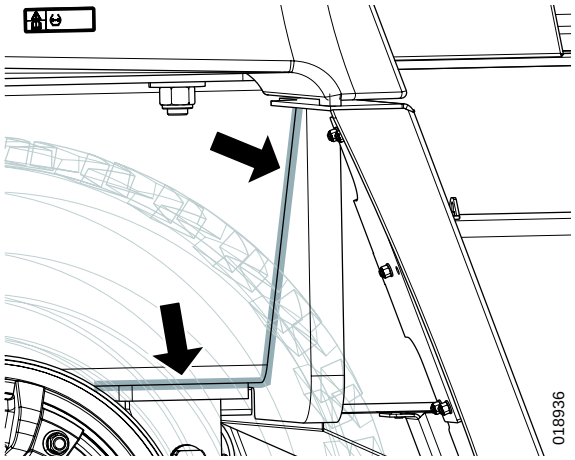


g) The welding of the wheel pins in the inner mast.



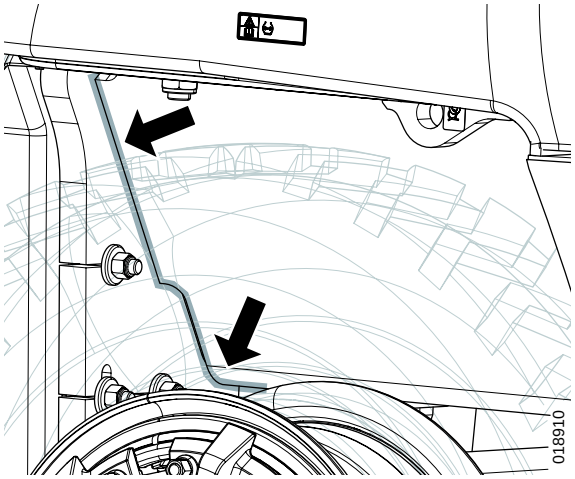
h) Mounting of lower support for the lift cylinders against the mast beam.

Counterweight box



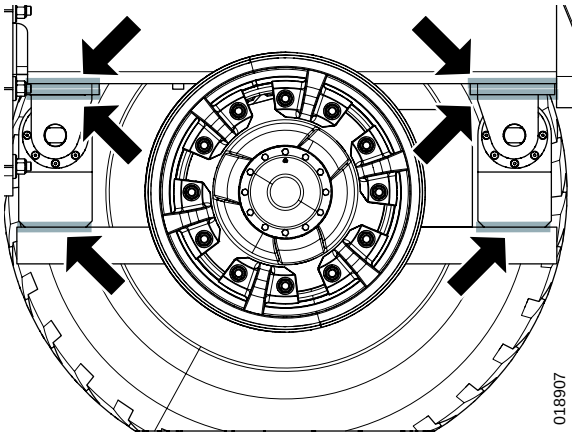
a) Counterweight box mounting against the frame, under rear mudguard.

Angle the steering wheels on the ground for easier access.



b) Counterweight box mounting to back piece.

Steering axle mounts

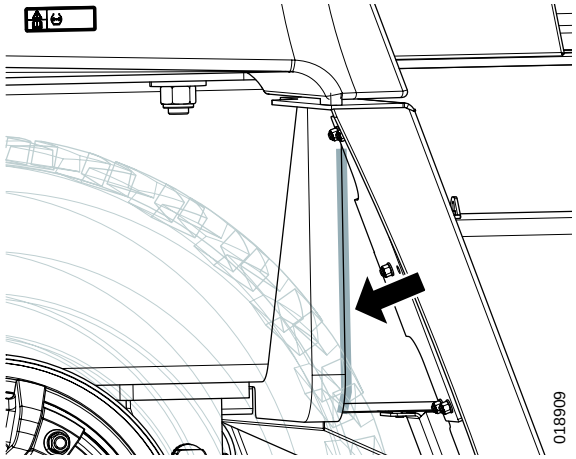


4

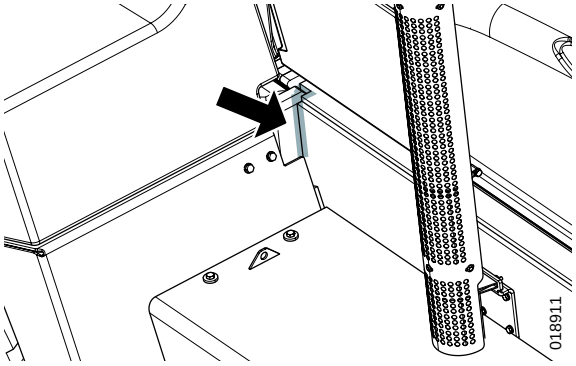
a) Steering axle mounts in the frame

b) Steering axle mounts in the steering axle cradle

Mounting of frame beam to back piece



a) Mounting of frame beam to back piece.



b) Mounting of frame beam to back piece.

Top lift attachment

See *Top lift attachment*, page C:45.

Contents 0 Complete machine

0 Complete machine

Complete machine, general

For a general description of the machine and its components, see *Operator's manual DCG 180–330*, chapter *3 Overview*.

Contents 1 Engine

1 Engine

1.2 Fuel system

Fuel system, bleeding (engine alternative Volvo TAD871VE)

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.

The fuel system must be bled after fuel filter replacement, if the fuel tank has been run dry or after long periods of operation for example.

1 Machine in service position, see section *B Safety*.

2 Remove the protective plug from the bleed nipple (position 1).

3 Open the bleed nipple two turns and connect a transparent fuel-resistant hose to the bleed nipple. Route the open end of the hose into a receptacle.

4 Bleed the fuel system by pumping with the hand pump (position 2) until fuel free of air emerges from the bleed hose.

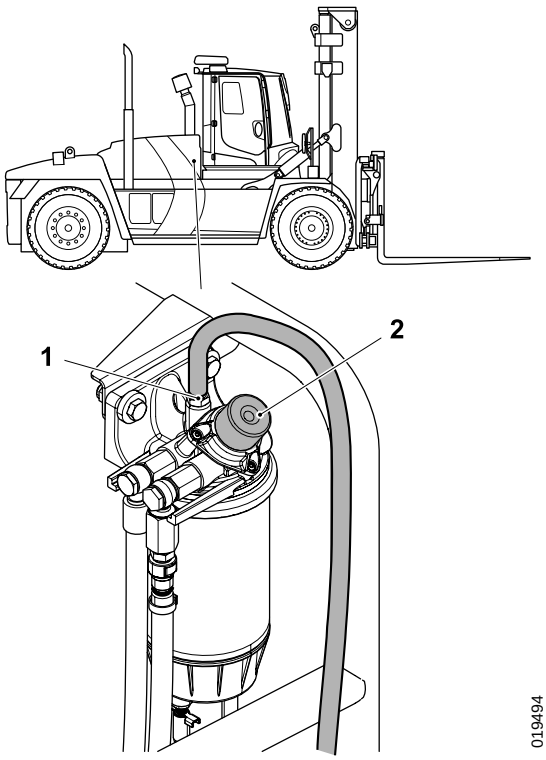
5 Close the bleed nipple while fuel is flowing out of the hose.

6 Wait for 15 seconds, then repeat Steps 4 – 5.

7 Remove the hose and tighten the bleed nipple by **3.5 Nm**.

8 Refit the protective plug on the bleed nipple.

9 Start the engine and allow it to idle for about five minutes before increasing speed.



1. Bleed nipple
2. Hand pump

Fuel system, bleeding air (engine option Cummins QSB6.7)

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.

The fuel system must be bled e.g. after fuel filter change, if the fuel tank has been run dry or after long periods of non-operation, etc.

1 Machine in service position, see section *B Safety*.

2 Turn (as illustrated) the hand pump (position 1) to open the pump.

3 Pump with the handle until resistance is felt and it is not possible to pump more (approx. 140 to 150 strokes for empty filter, or 20 to 60 strokes for pre-filled filter).

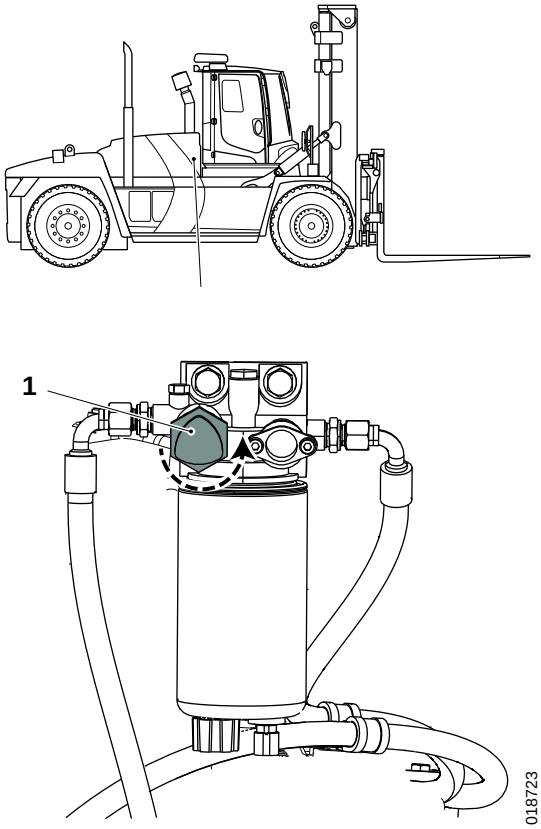
4 Tighten and lock the hand pump's handle.

5 Crank the engine with the starter motor. If the engine does not start after 30 seconds, wait, the starter motor may have become too hot.

6 Pump again with the hand pump, repeat the above steps until the engine starts.

7 When the engine starts, it may run irregularly and with increased noise levels for a few minutes. This is a normal condition which stops as soon as the fuel system is free from air.

8 Start the engine and check sealing.



1. Hand pump

1.2.1 Fuel tank

Fuel tank, cleaning

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.

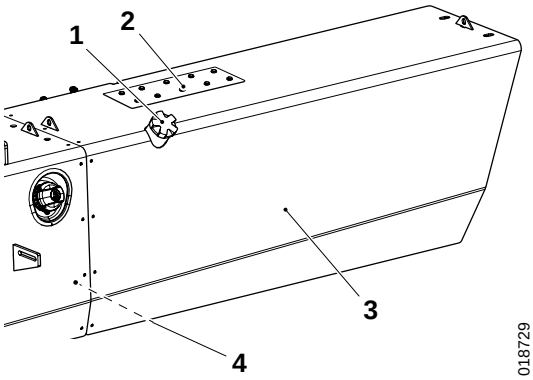
1 Machine in service position, see section *B Safety*.

2 Empty the fuel tank of fuel. Use a pumping device if necessary.

3 Remove the drain plug from the fuel tank.

4 Remove the cover lid and flush clean the fuel tank through the cover lid on the tank.

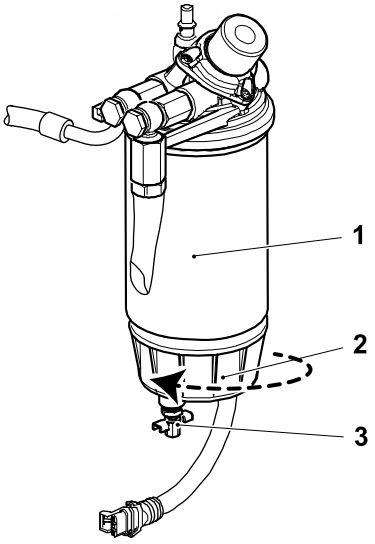
5 Refit the drain plug with a new seal ring.



1. Fuel filler
2. Cover lid for cleaning
3. Fuel tank
4. Drain plug, under tank

1.2.3 Fuel prefilter

Fuel prefilter, draining condensation water (engine alternative Volvo TAD871VE)



1. Fuel prefilter
2. Water separator
3. Drain cock

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.

NOTE

The water trap must be drained of water as necessary or at least every 50 operating hours.

1 Machine in service position, see section *B Safety*.

2 Place a container under the fuel prefilter.

3 Open the drain cock (position 3) on the underneath and allow the condensation water to run out. Close the cock when clean fuel without water runs out.

4 Remove the water separator (position 2) from the fuel prefilter (position 1) by turning it in accordance with the figure.

5 Clean the water separator and refit it on the filter.

6 Close the drain cock.

7 Bleed the fuel system, see *Fuel system, bleeding (engine alternative Volvo TAD871VE)*, page 1:3.

8 Turn on the system voltage and start the engine. Check that the filter seals tight.

Fuel prefilter, draining the condensation water (engine alternative Cummins QSB6.7)

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.

NOTE

The water trap must be drained of water as necessary or at least every 50 operating hours.

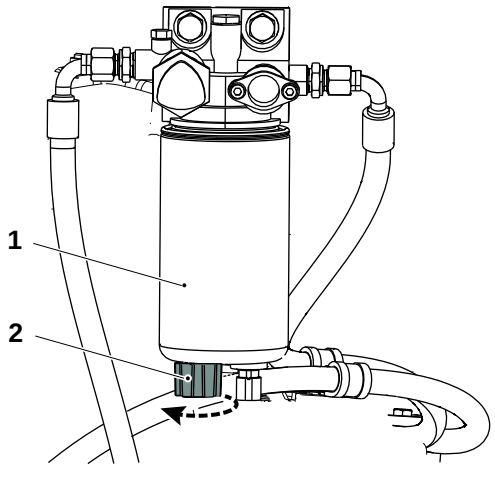
1 Machine in service position, see section *B Safety*.

2 Turn (as illustrated) the drain cock (position 2) on the underside, about 3 1/2 turns, until the valve drops and bleeding takes place, close the cock when only clean fuel runs out.

To close the cock, slide the valve up and tighten.

NOTE

Do not over-tighten the drain cock, as the threads may be damaged.

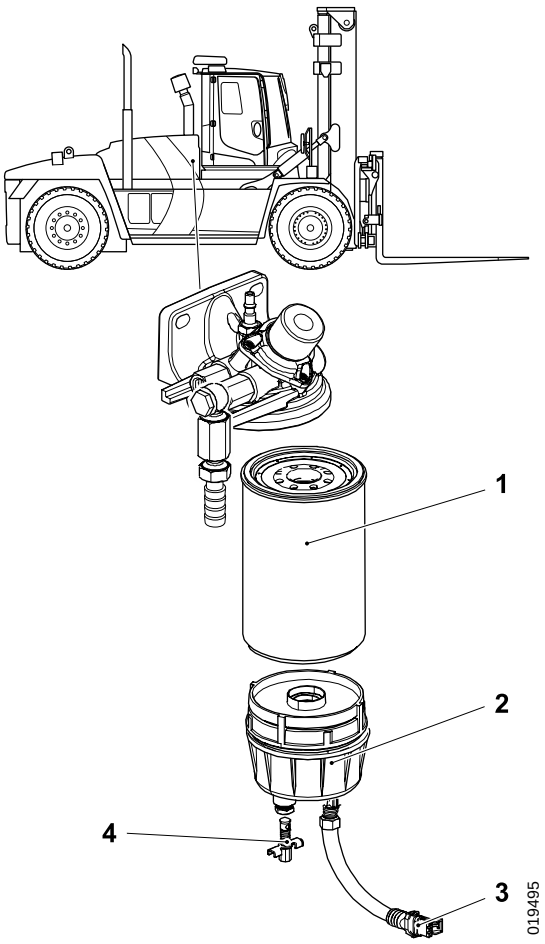


1. Fuel prefilter
2. Drain cock

Fuel prefilter, changing (engine alternative Volvo TAD871VE)

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.



1. Fuel prefilter
2. Water separator
3. Connector
4. Draining

1 Machine in service position, see section *B Safety*.

2 Clean the fuel prefilter and water separator externally.

3 Empty the fuel prefilter (position 1) of fuel and water by means of opening the drain cock (position 4). Collect any fuel in a container.

4 Detach the connector (position 3) for the water separator.

5 Remove the water separator (position 2) from the old filter.

6 Remove the fuel filter (position 1) from the filter holder, use a filter tool. Collect any fuel in a container.

7 Clean the water separator internally.

8 Lubricate the gasket on the new fuel prefilter with diesel oil.

9 Fit a new O-ring on the water separator and lubricate with diesel oil.

Install the water separator on the new fuel prefilter.

NOTE

Do not fill the fuel filter with fuel prior to installation. There is a risk of contaminants entering the fuel system and causing malfunctions or damage.

10 Fit the new fuel prefilter on the filter holder.

Tighten in accordance with the instructions on the filter.

11 Connect the connector to the water separator.

12 Bleed the fuel system, see *Fuel prefilter, draining condensation water (engine alternative Volvo TAD871VE)*, page 1:6.

13 Turn on the system voltage and start the engine. Check sealing integrity.

Fuel prefilter, changing (engine alternative Cummins QSB6.7)

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.

1 Machine in service position, see section *B Safety*.

2 Open the drain cock and drain any water.

3 Remove the filter cartridge.

4 Check that the new filter cartridge is absolutely clean and that the gasket is intact. Brush a small amount of oil onto the gasket.

NOTE

Do not fill the fuel filter with fuel prior to installation. There is a risk of contaminants entering the fuel system and causing malfunctions or damage.

5 Screw the filter cartridge onto the filter bracket.

Screw on the fuel filter until it makes contact with the contact surface, then tighten a further 3/4 turn.

6 Bleed the fuel system, see *Fuel system, bleeding air (engine option Cummins QSB6.7)*, page 1:4.

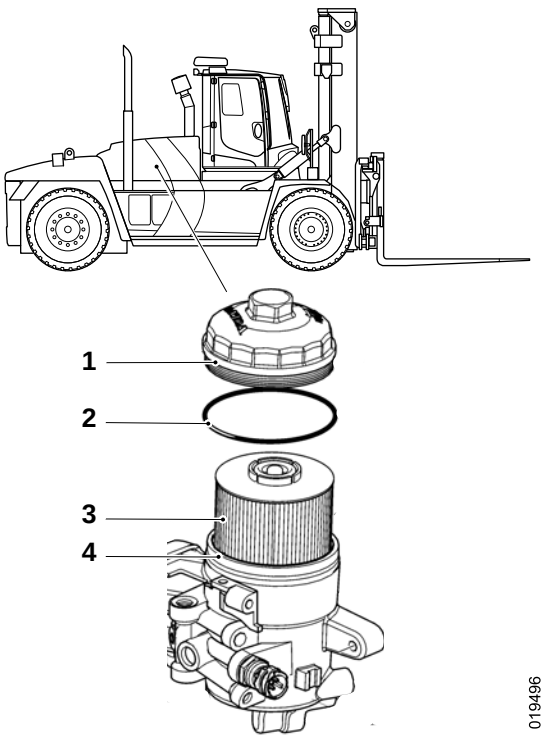
7 Start the engine and check sealing.

1.2.4 Fuel filter

Fuel filter, changing (engine alternative Volvo TAD871VE)

NOTE

Read safety recommendations for fuel system before starting work, see section B Safety.



1. Filter cover
2. O-ring
3. Filter insert
4. Filter housing

1 Machine in service position, see section *B Safety*.

2 Clean the fuel filter externally. Clean around the filter as well.

NOTE

Be prepared to collect up some diesel. The filter housing is full of diesel and there is a risk of spillage when the cover is removed.

3 Remove the filter cover (position 1) from the filter housing (position 4).

4 Remove the filter insert (position 3) and O-ring (position 2) from the filter cover.

5 Replace the O-ring, moisten the new O-ring in order to prevent it from turning.

6 Fit the new filter insert in the cover. Make sure that the filter insert is fitted correctly in the cover.

7 Lower the filter insert with cover fitted into the filter housing. Carefully tighten the cover and check that the O-ring does not turn. If necessary, lubricate the O-ring again.

Tighten to a tightening torque of **25 Nm**.

8 Bleed the fuel system, see *Fuel prefilter, draining condensation water (engine alternative Volvo TAD871VE)*, page 1:6.

9 Start the engine and check sealing.

Fuel filter, changing (engine alternative Cummins QSB6.7)

NOTE

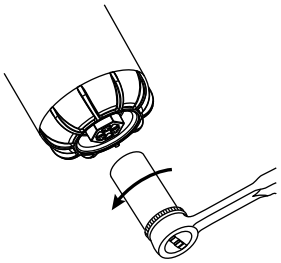
Read safety recommendations for fuel system before starting work, see section B Safety.

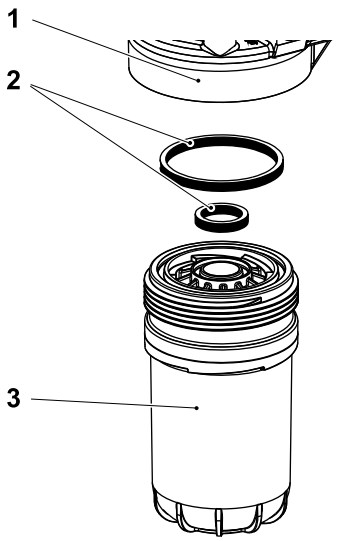
1 Machine in service position, see section *B Safety*.

2 Use a 25 mm socket on the filter capsule in order to loosen it. Loosen and remove the filter and capsule.

Make sure that the inner and outer gasket follow out with the used filter.

3 Remove the fuel filter carefully.





Cummins QSB6.7 Stage 4/Tier 4f

1. Filter housing
2. Inner and outer gasket
3. Fuel filter (incl. capsule)

4 Clean the filter's contact surface on the filter housing (position 1).

5 Moisten the gasket on the new filter with oil.

NOTE

Use the correct fuel filter

NOTE

Do not fill the fuel filter with fuel prior to installation. There is a risk of contaminants entering the fuel system and causing malfunctions or damage.

6 Fit the new filter with the gasket on the filter head.

Screw on the fuel filter until it makes contact with the contact surface, then tighten it further, tightening toque **38 Nm**.

7 Bleed the fuel system, see *Fuel system, bleeding air (engine option Cummins QSB6.7)*, page 1:4.

8 Start the engine and check sealing.

1.2.12 AdBlue tank

AdBlue tank, general

The AdBlue tank is fitted on the left-hand side of the machine and is equipped with a tank unit to indicate level and temperature, as well as quality for certain engine alternatives. The amount of AdBlue in the tank is shown on an operating menu on the display in the cab.

AdBlue tank, cleaning (engine alternative Volvo TAD871VE and Cummins QSB6.7 Stage 4/Tier 4f)

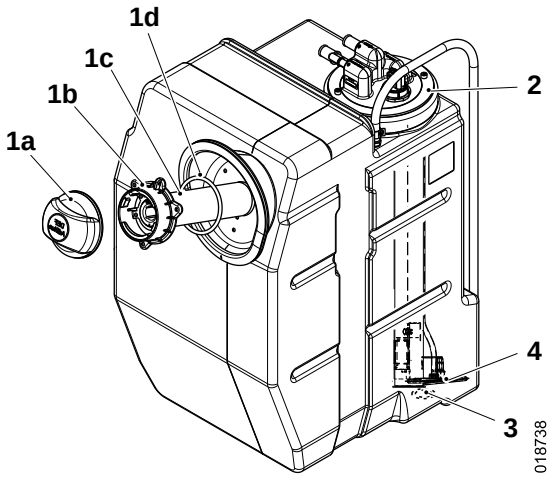
NOTE

Read safety recommendations for AdBlue before starting work, see section B Safety.

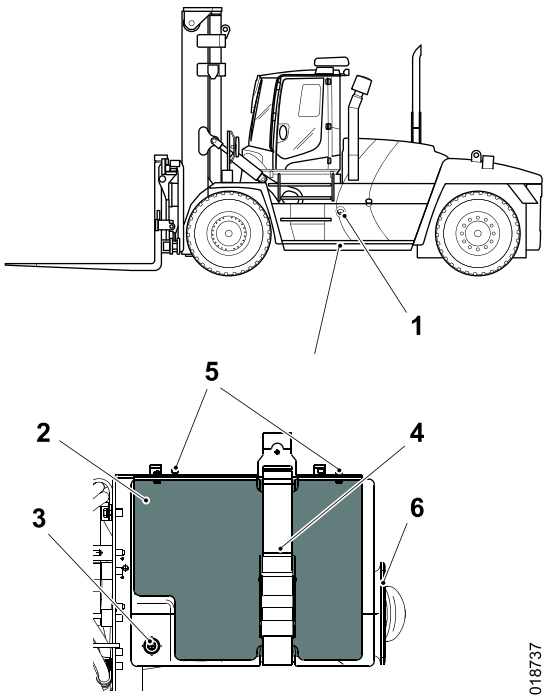
1 Machine in service position, see section *B Safety*.

2 Drain the AdBlue tank into a receptacle.

The drain plug for the AdBlue tank can be accessed from the underside of the machine.



1a Filler cap
1b Filler pipe with strainer
1c Filler spigot
1d O-ring
2 Tank unit
3 Drain plug and seal ring
4 Filter on tank unit



1. AdBlue filling
2. Console AdBlue tank
3. Drain point AdBlue tank
4. Tensioning strap
5. Screws for the console
6. Rubber gasket AdBlue filling point

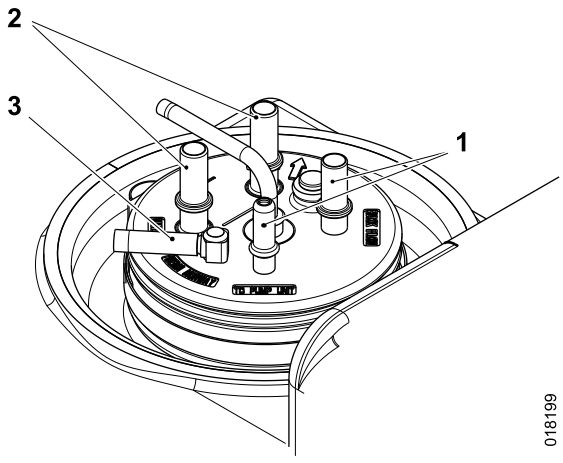
3 Position a jack or similar as support under the console for the AdBlue tank.

4 Release the rubber gasket (position 6) that seals the AdBlue filling point against the cover plate by pressing it in behind the cover plate.

5 Loosen the tensioning strap (position 4) that secures the console with the tank.

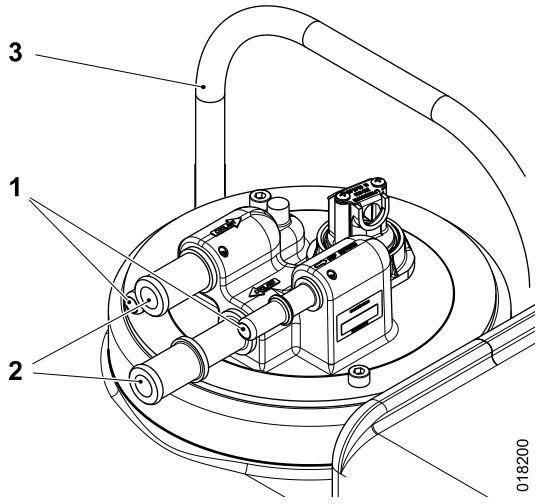
6 Release the console by loosening the 2 screws (position 5) that attach the lower console to the side console.

7 Lower the AdBlue tank so that you can access the connector for the tank armature through the hole in the cover plate for the AdBlue filling point.



Engine alternative Volvo TAD871VE

1. Connection AdBlue
2. Connection coolant for tank heating
3. Connection ventilation hose



Engine alternative Cummins QSB6.7 Stage 4/Tier 4f

1. Connection AdBlue
2. Connection coolant for tank heating
3. Ventilation hose

8 Mark and undo the hose connections for AdBlue from the tank unit, protect the machine from leakage by isolating the AdBlue hoses with a plastic bag.

Note the locations so that the hoses are connected correctly.

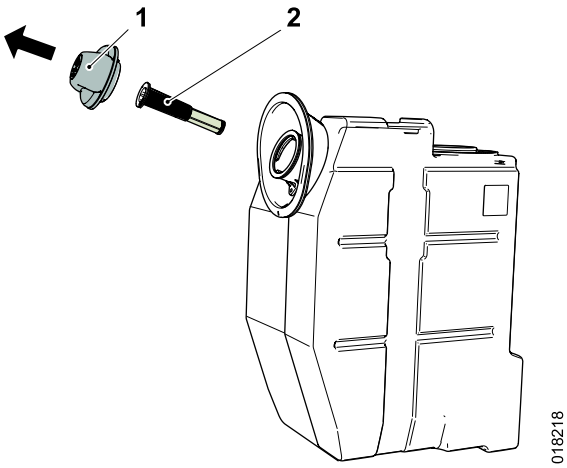
9 Clamp the hoses for tank heating together using hose clamp pliers or similar in order to avoid coolant leakage when the hoses are undone.

10 Mark and undo the hoses for the tank heating from the tank unit.

Note the locations so that the hoses are connected correctly.

11 Release the AdBlue tank by fully loosening the tensioning strap and removing the jack and console.

12 Remove the filler cap and filler pipe with strainer.



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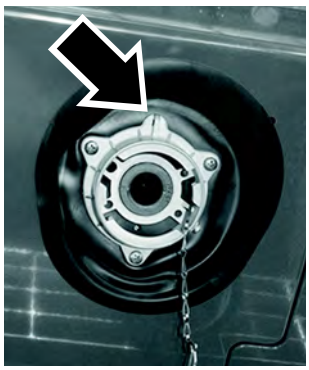
1. Filler cap
2. Filler pipe with strainer



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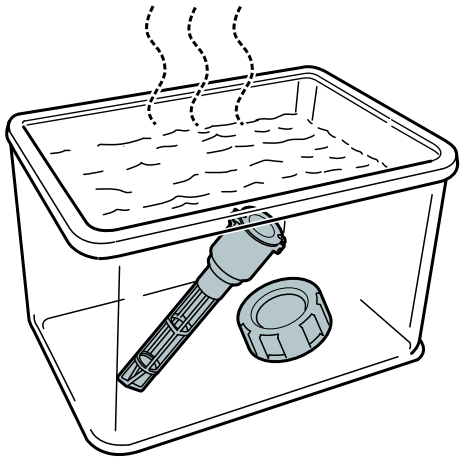
NOTE

In the event of difficulty in removing the filler pipe, then remove the filler spigot (3 screws) and press forward the pipe from the inside. When refitting the spigot, it is important that it is correctly rotated. See figure.

13 Rinse the strainer for the filler pipe.



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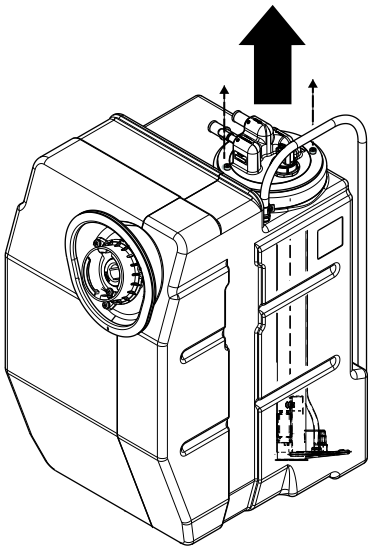
Example figure

14 Lower the filler cap and filler pipe in a water bath. Let them remain for at least two minutes.


018739

15 Engine alternative Cummins QSB6.7;
Undo the screws that attach the tank unit and lift it straight out of the tank. Check the O-ring that is fitted between the tank unit and the tank.

16 Protect the electrical connections by packing them into a bag. Check the filter, clean if necessary. To change, see *Filter in AdBlue tank, replacement (engine alternative Volvo TAD871VE and Cummins QSB6.7 and Stage 4/Tier 4f)*, page 1:19.

NOTE

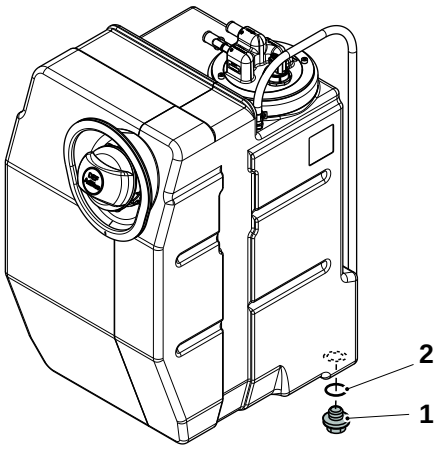
Always replace a damaged filter.

17 Flush the tank with hot water for at least ten minutes.

Then check that the tank is completely drained of water.

18 Refit and attach the tank unit in the tank. For Cummins QSB6.7, check that the O-ring is fitted in place between tank unit and tank

19 Refit the filler pipe and filler cap.



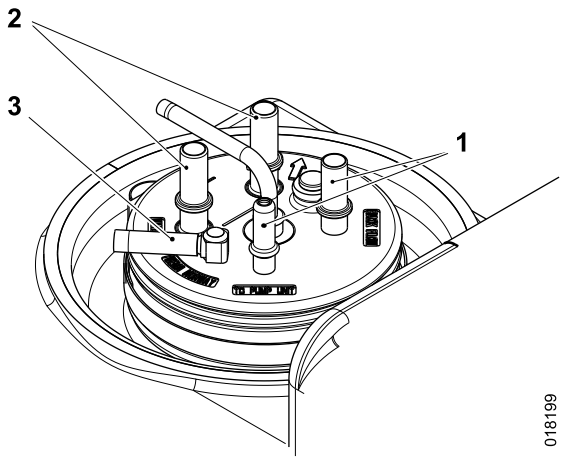
018740

20 Fit the drain plug, use a new gasket. Tighten to a tightening torque of **30 Nm**.

NOTE

Only use gaskets that can withstand AdBlue.

1. Drain plug
2. Gasket



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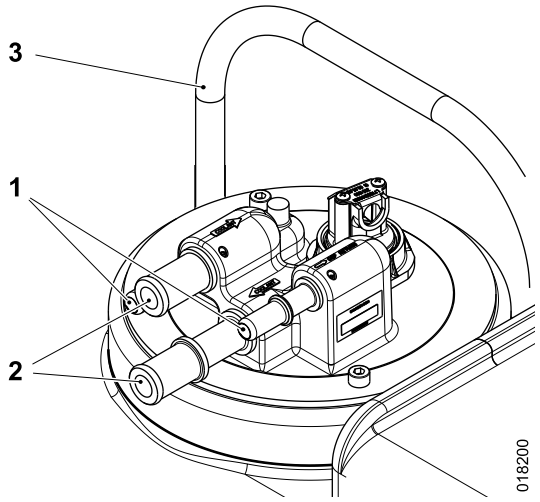
Engine alternative Volvo TAD871VE

1. Connection AdBlue
2. Connection coolant for tank heating
3. Connection ventilation hose



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Engine alternative Cummins QSB6.7 Stage 4/Tier 4f

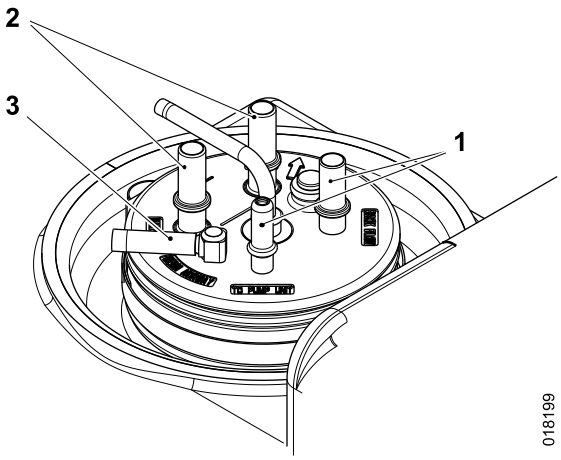
1. Connection AdBlue
2. Connection coolant for tank heating
3. Ventilation hose

21 Check that the ventilation hose is not clogged. Blow it clean using compressed air if necessary.
Pay attention that AdBlue does not come into contact with the

electrical connection. Make sure that the ventilation hose emerges under the tank.

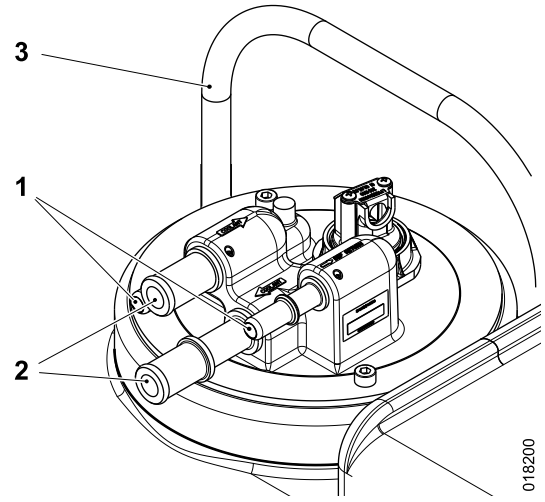
22 Lift the AdBlue tank back into its place. Lift it up far enough so that you can access the connector for the tank armature through the hole in the cover plate for the AdBlue filling point. Use a jack if necessary.

23 Plug in the electrical connector for the tank unit



Engine alternative Volvo TAD871VE

1. Connection AdBlue
2. Connection coolant for tank heating
3. Connection ventilation hose



Engine alternative Cummins QSB6.7 Stage 4/Tier 4f

1. Connection AdBlue
2. Connection coolant for tank heating
3. Ventilation hose

24 Connect the hose connections for AdBlue to the tank unit in accordance with the marking.

25 Remove the blocking from the hoses for tank heating.

26 Fit the console with its 2 attaching bolts. Secure the AdBlue tank by tightening the tensioning strap around the tank and the console.

27 Fit the tensioning strap back in the buckle in accordance with the series of figures.

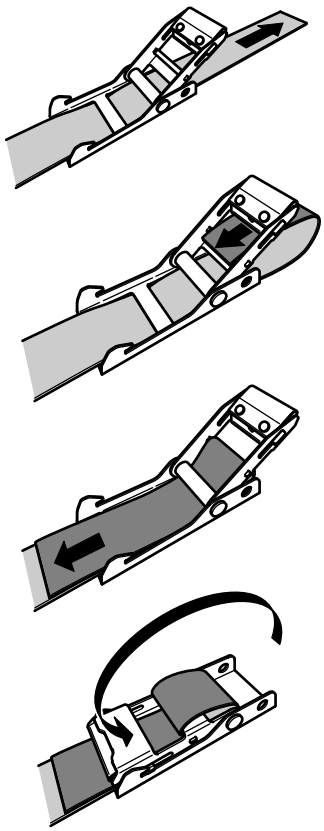
28 Pull the rubber gasket in front of the cover plate so that it seals between the cover plate and the AdBlue filling point.

29 Check that the drain plug is tightened correctly.

30 Fill the tank with AdBlue. Refit the filler cap.

31 Start the engine and check sealing.

32 Check the coolant level.



1.2.13 Filter in the AdBlue pump unit

Filter AdBlue pump unit, replacement (engine alternative Volvo TAD871VE and Cummins QSB6.7 Stage 4/Tier 4f)

NOTE

Read safety recommendations for AdBlue before starting work, see section B Safety.

⚠ CAUTION

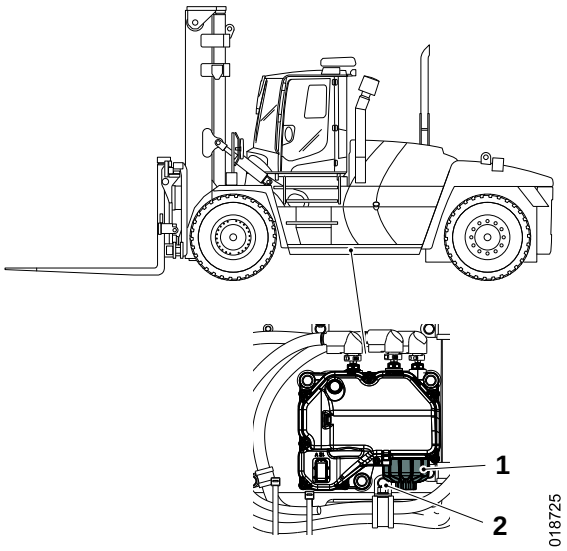
Wait at least two minutes after switching the engine off before removing the hoses for AdBlue so that the after-treatment system has time to drain and depressurise.

1 Machine in service position, see section *B Safety*.

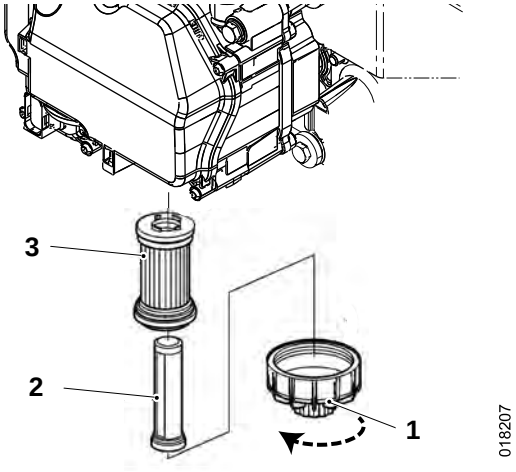
2 The AdBlue pump unit is located on the left-hand side of the machine on the inside of the AdBlue tank. The filter cover on the pump (position 1) can be accessed from the underside of the machine.

3 To access the filter unit, unscrew the console (position 2) together with the hoses.

4 Inspect the area around the filter cover for leakage. AdBlue leakage gives off a white precipitate. If there are signs of leakage, clean with hot water and check what could be causing the leakage.



1. Filter cover AdBlue pump unit
2. Screw for hose console



1. Filter cover
2. Equalisation unit
3. Filter insert

5 There may be AdBlue residue in the filter housing. Position a receptacle under the filter cover.

6 Screw off the filter cover from the pump (position 1). A 27 mm spanner can be used to facilitate the process.

7 Remove the equalisation unit (position 2).

8 Remove the old filter insert (position 3). To pull out the filter, use the puller included with the filter kit by first pressing it into the filter hole until it clicks.

9 Install the new filter insert and then the equalisation unit.

10 Fully screw in the filter cover, tighten to **tightening torque 20 (+5) Nm**

11 Start the engine and check sealing.

1.2.14 Filter in AdBlue tank

Filter in AdBlue tank, replacement (engine alternative Volvo TAD871VE and Cummins QSB6.7 and Stage 4/Tier 4f)

NOTE

Read safety recommendations for AdBlue before starting work, see section B Safety.

CAUTION

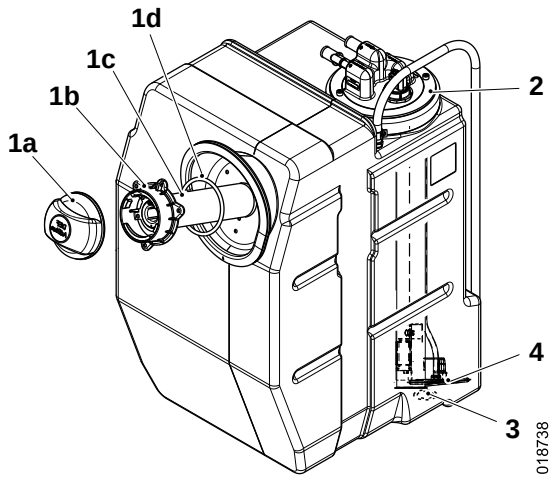
Switch off the engine and wait at least two minutes before working on the AdBlue system.

Risk of unnecessarily large spill.

When the engine is switched off the AdBlue system pumps back the AdBlue in the lines to the AdBlue tank. Allow this process to run to completion before starting work in order to reduce spill quantity.

1 Machine in service position, see section *B Safety*.

2 Drain the AdBlue tank into a receptacle.



1a Filler cap

1b Filler pipe with strainer

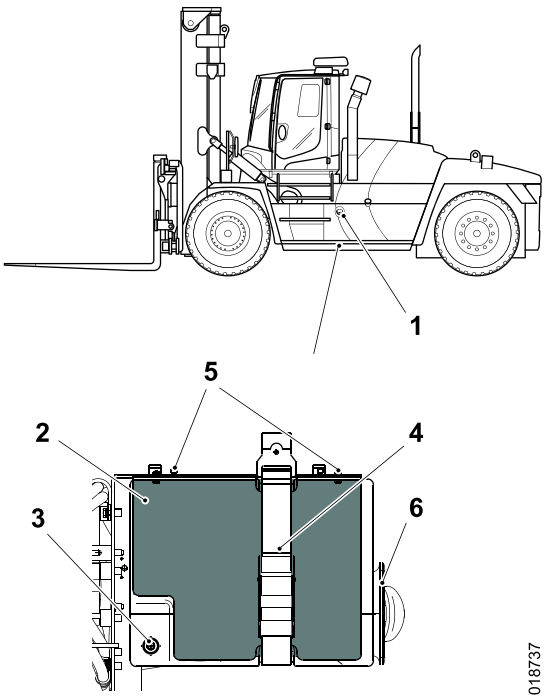
1c Filler spigot

1d O-ring

2 Tank unit

3 Drain plug and seal ring

4 Filter on tank unit



1. AdBlue filling
2. Console AdBlue tank
3. Drain point AdBlue tank
4. Tensioning strap
5. Screws for the console
6. Rubber gasket AdBlue filling point

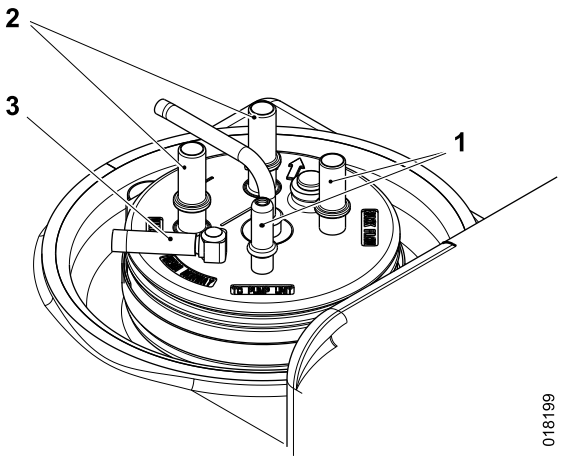
3 Position a jack or similar as support under the console for the AdBlue tank.

4 Release the rubber gasket (position 6) that seals the AdBlue filling point against the cover plate by pressing it in behind the cover plate.

5 Loosen the tensioning strap (position 4) that secures the console with the tank.

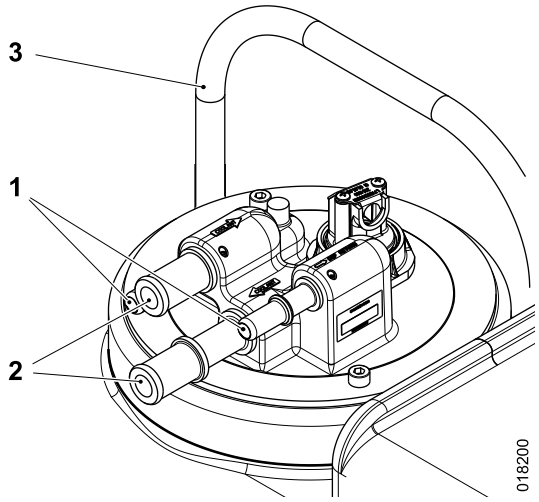
6 Release the console by loosening the 2 screws (position 5) that attach the lower console to the side console.

7 Lower the AdBlue tank so that you can access the connector for the tank armature through the hole in the cover plate for the AdBlue filling point.



Engine alternative Volvo TAD871VE

1. Connection AdBlue
2. Connection coolant for tank heating
3. Connection ventilation hose



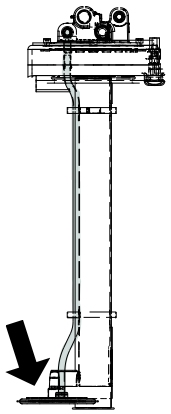
Engine option Cummins QSB6.7

1. Connection AdBlue
2. Connection coolant for tank heating
3. Ventilation hose

8 Mark and undo the hose connections for AdBlue (position 1) from the tank unit, protect the machine from leakage by isolating the AdBlue hoses with a plastic bag.

Note the locations so that the hoses are connected correctly.

9 Clamp the hoses for tank heating together (position 2) using hose clamp pliers or similar in order to avoid coolant leakage when the hoses are undone.



The tank unit's filter on engine alternative Cummins QSB6.7

10 Mark and undo the hoses for the tank heating (position 2) from the tank unit.

Note the locations so that the hoses are connected correctly.

11 Release the AdBlue tank by fully loosening the tensioning strap and removing the jack and console.

12 Protect the electrical connection on the tank unit by packing it into a bag.

13 Remove the filter from the tank unit.

14 Flush clean the AdBlue pipes on the tank unit using hot water.

15 Fit the new filter on the tank unit.

16 Refit the tank unit in the tank.

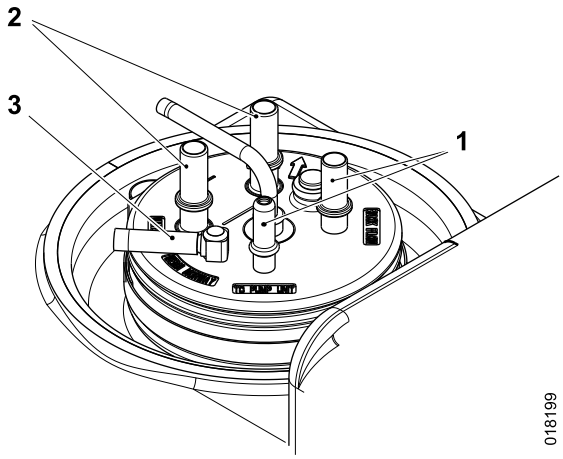
17 Fit the drain plug, use a new gasket. Tighten to a tightening torque of **30 Nm**.

NOTE

Only use gaskets that can withstand AdBlue.

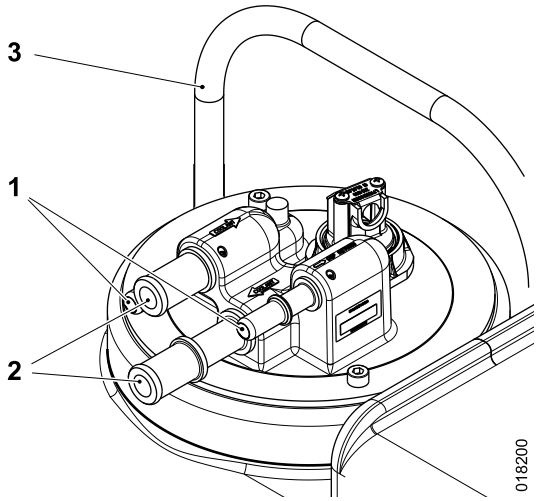
18 Lift the AdBlue tank back into its place. Lift it up far enough so that you can access the connector for the tank armature through the hole in the cover plate for the AdBlue filling point. Use a jack if necessary.

19 Plug in the electrical connector for the tank unit.



Engine alternative Volvo TAD871VE

1. Connection AdBlue
2. Connection coolant for tank heating
3. Connection ventilation hose



Engine option Cummins QSB6.7

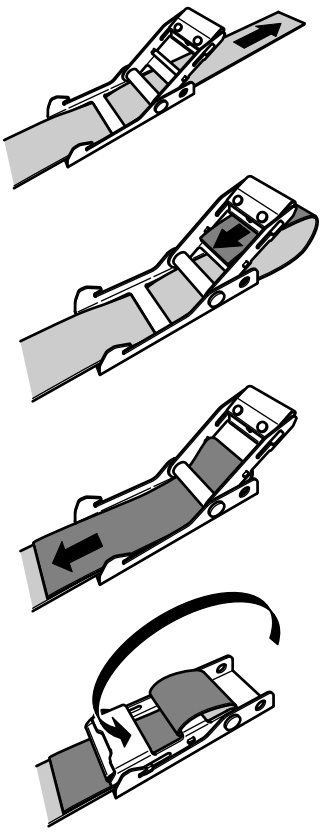
1. Connection AdBlue
2. Connection coolant for tank heating
3. Ventilation hose

20 Connect the hoses for the tank heating (position 2) to the tank unit in accordance with the marking.

21 Remove the blocking from the hoses for tank heating (position 2).

22 Connect the hose connections for AdBlue (position 1) to the tank unit in accordance with the marking.

23 Fit the console with its 2 attaching bolts. Secure the AdBlue tank by tightening the tensioning strap around the tank and the console.



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24 Fit the tensioning strap back in the buckle in accordance with the series of figures.

25 Pull the rubber gasket in front of the cover plate so that it seals between the cover plate and the AdBlue filling point.

26 Check that the drain plug is tightened correctly.

27 Fill the AdBlue tank with AdBlue.

28 Start the engine and check sealing.

29 Check the coolant level.

1.5 Engine's mechanical parts

1.5.4 Valve mechanism

Valves, checking/adjustment (engine alternative Cummins QSB6.7 Stage 4/Tier 4f)

1 Machine in service position, see section *B Safety*.

Preparation

2 Before beginning work, carefully clean all attachments, mountings and joints with compressed air to remove all loose particles.

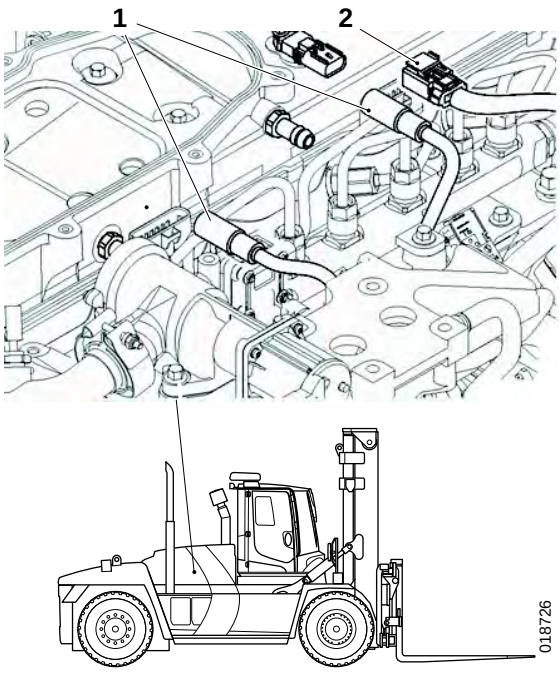
3 Remove the cover and filter for the crankcase ventilation, see *Crankcase ventilation filter, changing (engine alternative Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:42.

Removing

4 Remove the crankcase ventilation's oil drain hoses from the valve cover.

Remove the wiring for the crankcase's pressure sensor by sliding the lock tab sideways. Press the button on the rear of the connector and loosen the connector from the sensor.

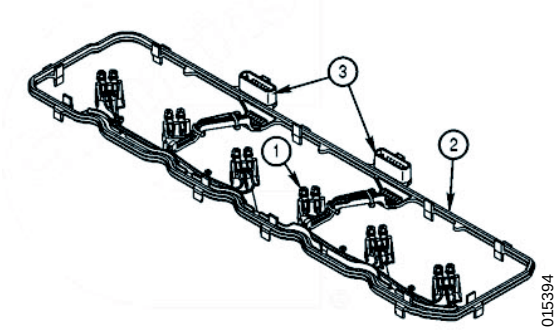
Remove the mounting bracket that secures the exhaust pressure sensor line to the valve cover.



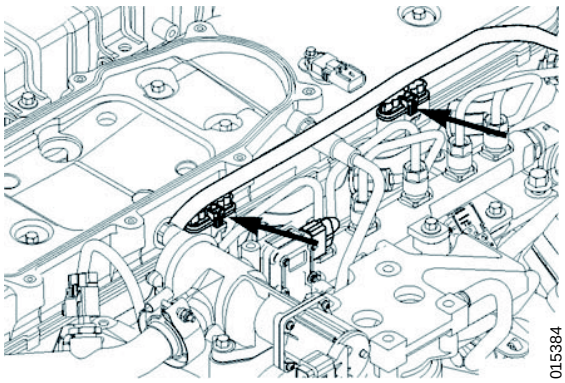
1. Oil drainage hoses
2. Wiring

5 The engine has a valve cover gasket with integrated wiring for the injectors, where wiring and connectors are moulded into the gasket.

The gasket can be re-used, and is only replaced if it is damaged or if it does not seal.



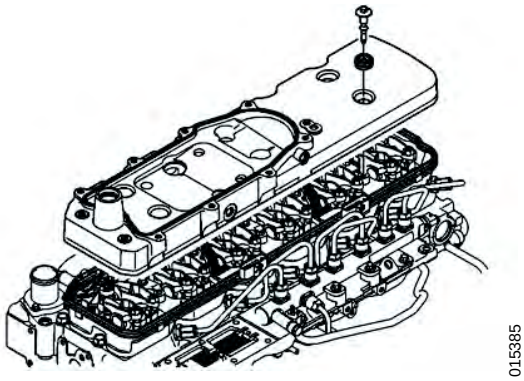
1. Brackets for the injectors' connection terminals
2. Valve cover gasket
3. Two connections for the engine wiring



Engine wiring connections

6 Remove the engine wiring's connection from the valve cover gasket.

Detach the connector using a small screwdriver to push in the connector's retaining bracket while pulling the connector upward.

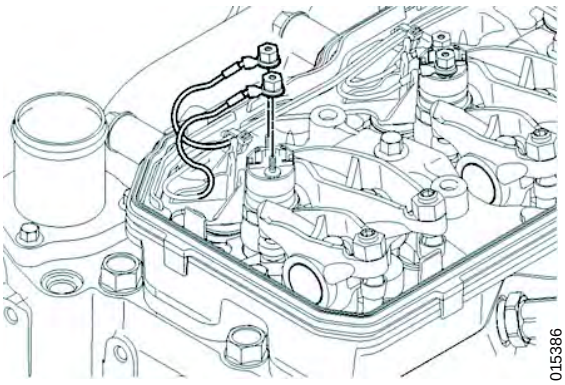


7 Remove mounting screws and insulators from the valve cover.

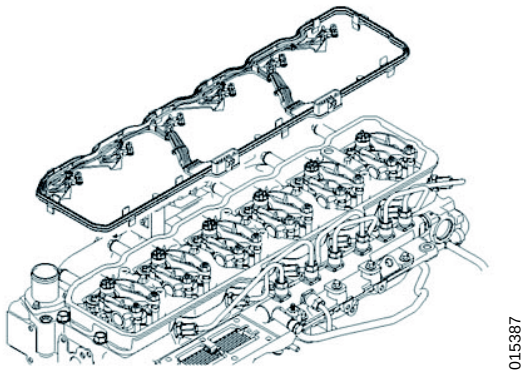
Remove the valve cover.

NOTE

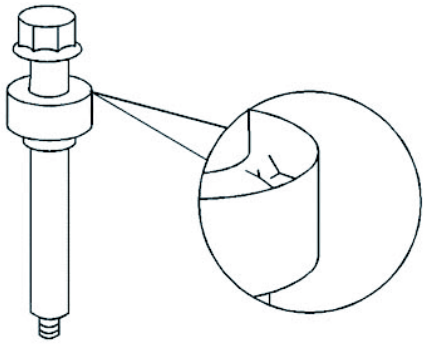
Do not remove the gasket for the crankcase ventilation filter from the valve cover; if the gasket is exposed to oil, it may swell, which can make it difficult to fit it into the slot. If the gasket is detached from the slot on the valve cover, do not try to re-use the old gasket, but replace the gasket instead.



8 Detach the cables from all injectors.

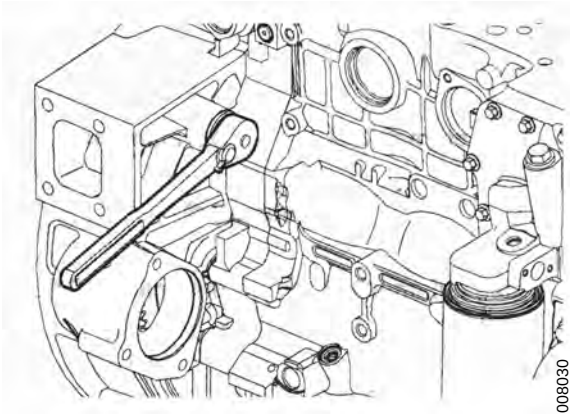


9 Remove the valve cover's gasket.



10 Check to see if the rubber insulators are cracked, replace the insulators if they are cracked or damaged.

Adjusting

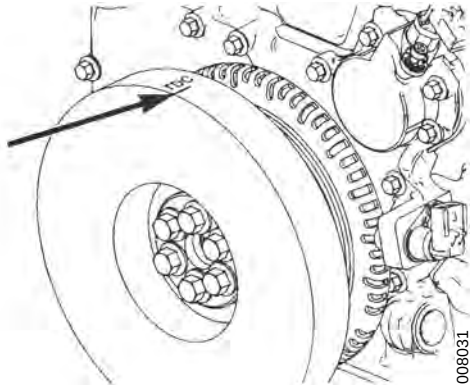


NOTE

Coolant temperature must be below 60 °C.

11 Use special tool, part number 3824591 to rotate the crankshaft until cylinder no. 1 is located in the top dead centre (T.D.C.).

The top dead centre (T.D.C.) can be determined by the following method:



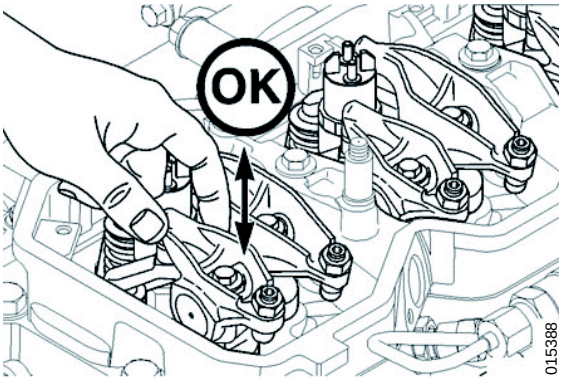
NOTE

The indicator for the top dead centre (T.D.C.) is on the vibration damper/crankshaft speed indicator.

NOTE

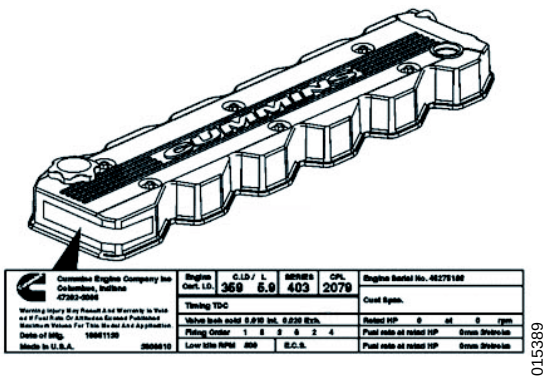
If there is no TDC stamp, align the large spring in the crankshaft's speed indicator ring to 5 o'clock. The pin will be visible at 9 o'clock. Check that the valve lifters for cylinder 1 are loose. If they are not loose, rotate the crankshaft 360 degrees and check again.

Rotate the vibration damper/crankshaft speed indicator ring until the indicator for the top dead centre (T.D.C.) is pointing straight up (12 o'clock). If the valve lifters for cylinder 1 are loose, continue with the next step. If the valve lifters for cylinder 1 are not loose, rotate the crankshaft 360 degrees before continuing.



NOTE

Cylinder number 1 is the cylinder nearest the cooling fan.



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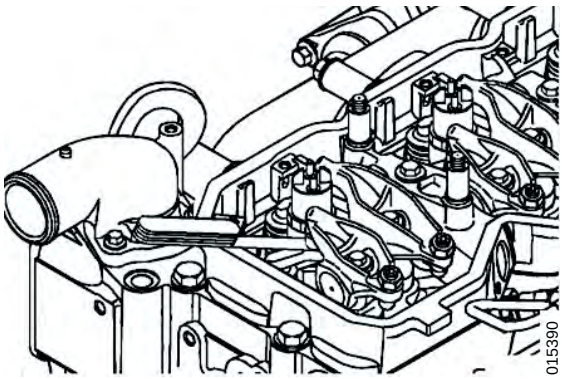
12 Check on the engine's data plate for correct valve clearance specification (overhead set).

The engine's data plate is usually located on the valve cover, but can also be located on the gear housing.

NOTE

Cylinder number 1 is the cylinder nearest the cooling fan.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13 With the engine in this position, the valve clearance is checked for the following valves (A = Exhaust valve, I = Intake valve):

Cylinder	1	2	3	4	5	6
Valve	I, A	I	A	I	A	-

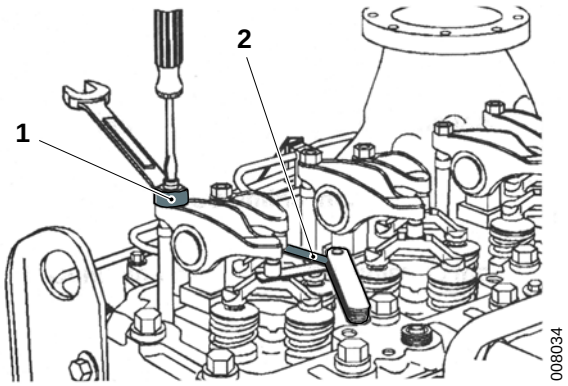
	Valve clearance mm	
Intake valves	0.152	MIN
	0.254	NOMINAL
	0.381	MAX
Exhaust valves	0.508	MIN
	0.533	NOMINAL
	0.863	MAX

NOTE

Valve clearance checks are usually performed as a part of troubleshooting, and adjustments are not normally necessary during inspection as long as the valve clearance lies between the values listed above.

NOTE

*The valve clearance is correct when the feeler gauge can be moved forward and back with only a **slight** resistance.*



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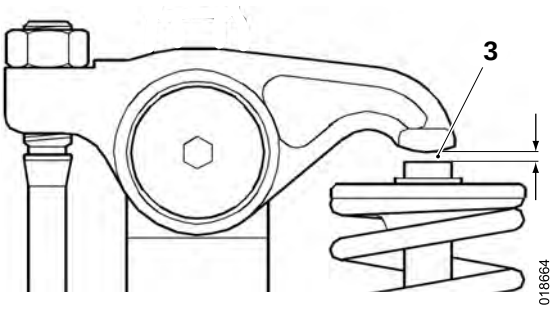
1. Lock nut
2. Feeler gauge



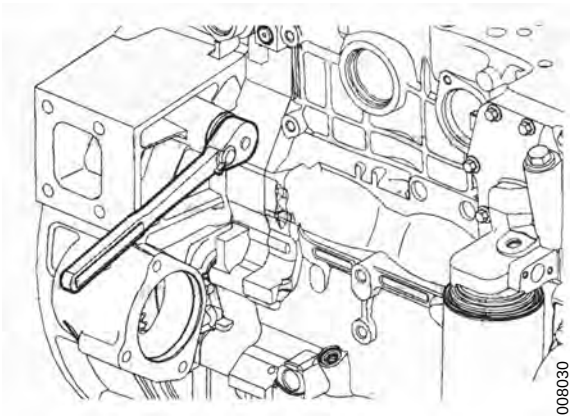
3. Valve clearance

14 Measure the valve clearance (position 3) by positioning a feeler gauge (position 2), with a thickness that corresponds to the valve clearance to be adjusted. If the valve clearance does not correspond, loosen the lock nut (position 1) and adjust the valve clearance to the correct value.

Tighten the lock nut and check the measurement of the valve clearance again. Tighten to a tightening torque of **24 Nm**.

NOTE

Cylinder number 1 is the cylinder nearest the cooling fan.



15 Use special tool, part number 3824591, and rotate the crankshaft 360 degrees.

Use the previous steps and specifications in order to set the valve clearance for the following valves (A = Exhaust valve, I = Intake valve):

Cylinder	1	2	3	4	5	6
Valve	-	A	I	A	I	I, A

If the measurements are outside the specification, set the valve clearance.

Installing

NOTE

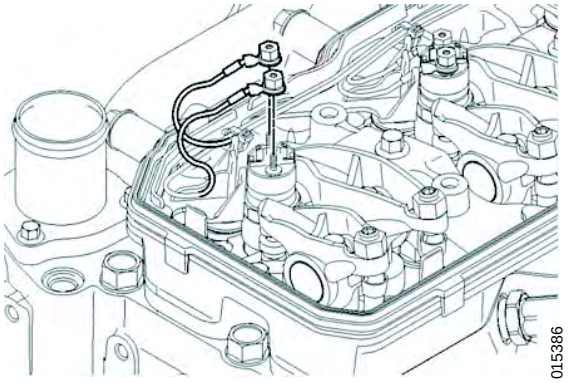
The valve cover gasket is re-usable, only replace the gasket if it is damaged or does not seal.

Check the gasket's cables, if the insulation is cracked or damaged on any cable, replace the gasket.

Check that the threads on the injectors' connecting screws or nuts are not damaged, replace the injector in the event of any damage.

Wipe the valve cover's sealing surfaces with a clean cloth.

Check that there are no tears or cracks in the valve cover gasket, replace the gasket in the event of any damage.



16 Connect all cables to injectors.

Use the special tool, spare part number 3823208, or a torque wrench to tighten the cable connections. Tighten to a tightening torque of **1.5 Nm**.

NOTE

Hold the cables for the injectors when the nuts are tightened so that they do not rotate and sustain damage.

NOTE

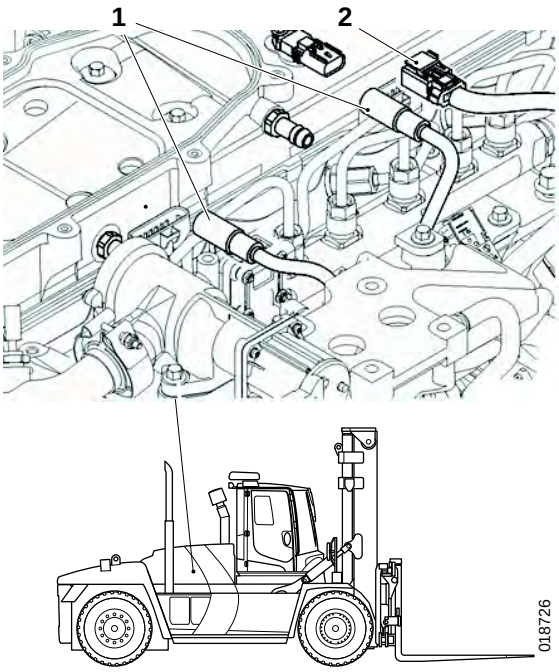
Do not tighten the connections for the injectors too hard, they may flex and break.

17 Reinstall the valve cover.

Reinstall the insulators and mounting screws.

Tighten the screws (starting from the centre of the cover) to a tightening torque of **24 Nm**.

18 Fit the mounting bracket that secures the exhaust pressure sensor line to the valve cover and tighten to a tightening torque of **24 Nm**



1. Oil drainage hoses
2. Wiring

Completion

19 Fit the crankcase ventilation's oil drain hoses (position 1) on the valve cover.

Connect the wiring (position 2) for the crankcase's pressure sensor, secure the connector by sliding the lock tab sideways.

20 Fit the cover and filter for the crankcase ventilation, see *Crankcase ventilation filter, changing (engine alternative Cummins QSB6.7 Stage 4/Tier 4f)*, page 1:42.

21 Start the engine and check sealing.

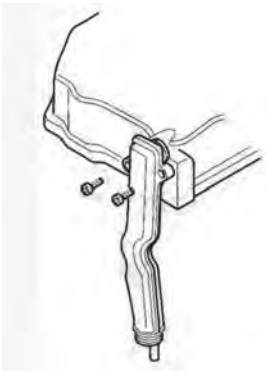
Valves, checking/adjustment (engine alternative Cummins QSB6.7 Stage 3A/Tier 3)

1 Machine in service position, see section *B Safety*.

Preparation

2 Before beginning work, carefully clean all attachments, mountings and joints with compressed air to remove all loose particles.

Removing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3 Detach the ventilation pipe from the rear section of the valve cover. Remove the screws that attach the ventilation pipe to the valve cover.


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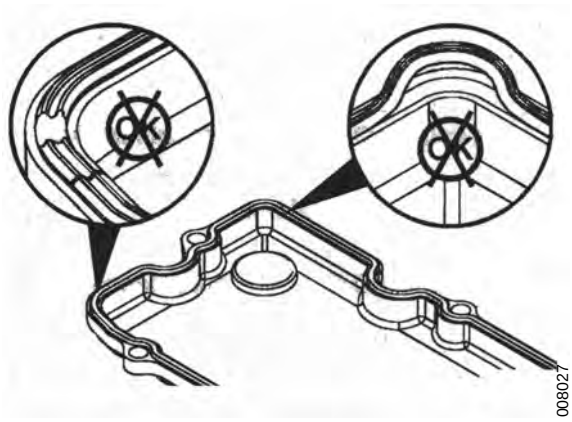
4 Remove the mounting screws and the rubber insulators for the screws from the valve cover.

5 Remove the valve cover.

NOTE

***Do not** remove the valve cover gasket on engines where the gasket is fitted in a groove on the valve cover; these gaskets can be re-used. If the gasket is removed from the valve cover, it **must** be replaced.*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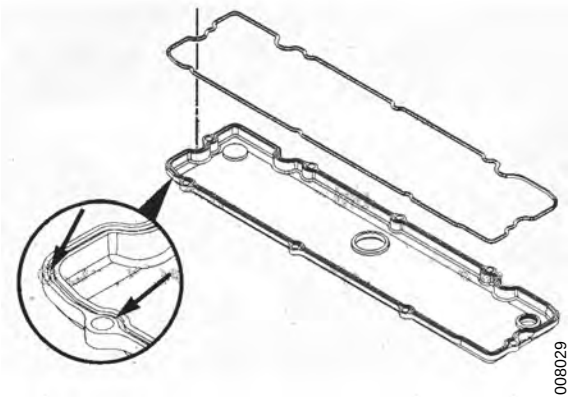
6 Check that the gasket does not show signs of damage against the sealing surface.

Replace the gasket if it is damaged or if it has been removed from its groove in the valve cover.

NOTE

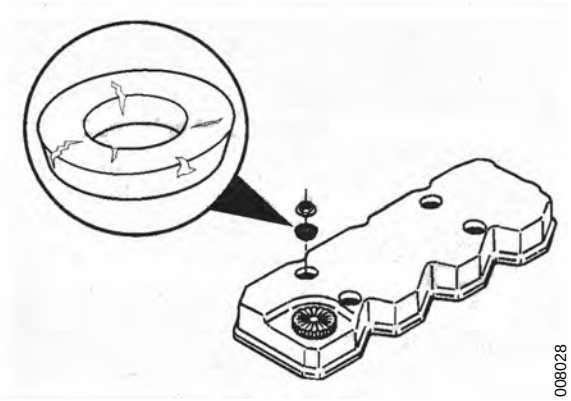
*Check the valve cover gasket when it is still sitting in the valve cover. When the gasket has been removed from the valve cover, it **must** be replaced.*



7 If the valve cover gasket must be replaced, follow these instructions for installing a new gasket:

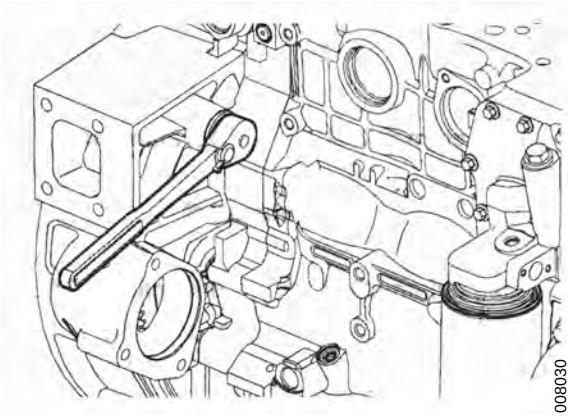
a) Begin by pushing down the corner of the gasket in the groove on the valve cover.

b) Then push the rest of the gasket down into the valve cover.



8 Check the rubber insulators, replace the insulators if they are cracked or damaged.

Adjusting

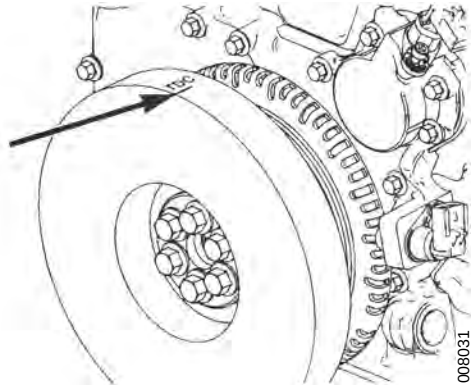


NOTE

Coolant temperature must be below 60 °C.

9 Use special tool, part number 3824591 to rotate the crankshaft until cylinder no. 1 is located in the top dead centre (T.D.C.).

The top dead centre (T.D.C.) can be determined by the following method:



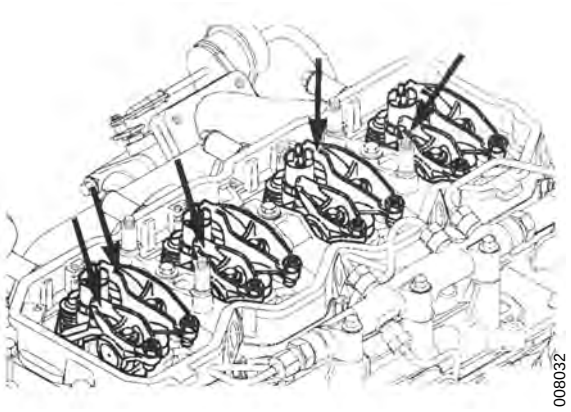
NOTE

The indicator for the top dead centre (T.D.C.) is on the vibration damper/crankshaft speed indicator.

Rotate the vibration damper/crankshaft speed indicator ring until the indicator for the top dead centre (T.D.C.) is pointing straight up (12 o'clock). If the valve lifters for cylinder 1 are loose, continue with the next step. If the valve lifters for cylinder 1 are not loose, rotate the crankshaft 360 degrees.

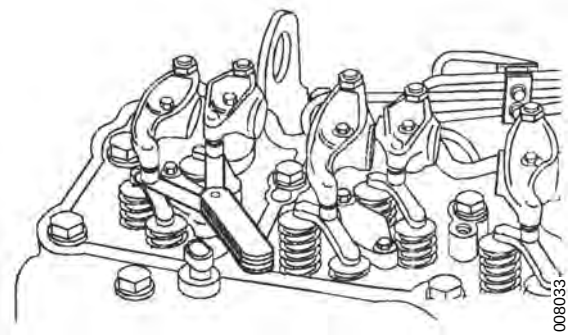
NOTE

Cylinder number 1 is the cylinder nearest the cooling fan.



10 With the engine in this position, the valve clearance is checked for the following valves (A = Exhaust valve, I = Intake valve):

Cylinder	1	2	3	4	5	6
Valve	I, A	I	A	I	A	-



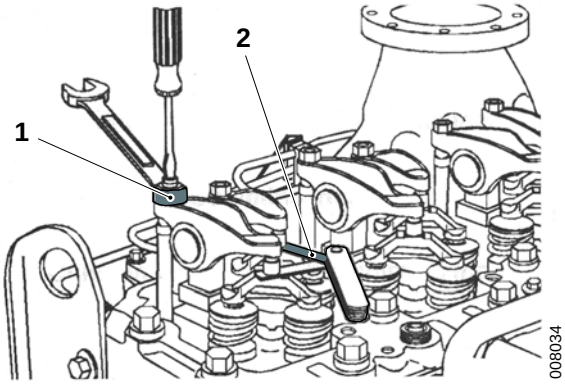
	Valve clearance **mm**	
Intake valve	0.152	MIN
	0.254	NOMINAL
	0.381	MAX
Exhaust valve	0.381	MIN
	0.508	NOMINAL
	0.762	MAX

NOTE

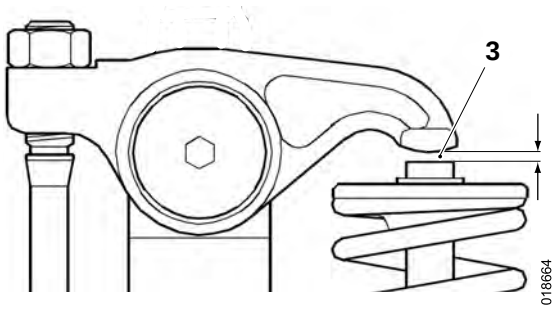
Valve clearance checks are usually performed as a part of troubleshooting, and adjustments are not normally necessary during inspection as long as the valve clearance lies between the values listed above.

NOTE

*The valve clearance is correct when the feeler gauge can be moved forward and back with only a **slight** resistance.*



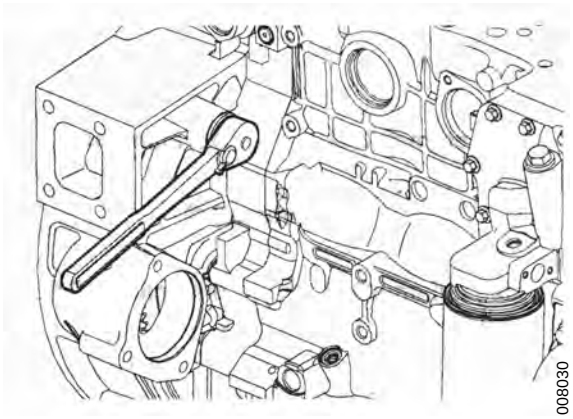
1. Lock nut
2. Feeler gauge



3. Valve clearance

11 Measure the valve clearance by positioning a feeler gauge (position 2), with a thickness that corresponds to the valve clearance (position 3) to be adjusted. If the valve clearance does not correspond, loosen the lock nut (position 1) and adjust the valve clearance to the correct value.

Tighten the lock nut and check the measurement of the valve clearance again. Tighten to a tightening torque of **24 Nm**.



12 Use special tool, part number 3824591, and rotate the crankshaft 360 degrees.

Follow the same steps and specifications as above and measure the clearance for the following valves (A = Exhaust valve, I = Intake valve):

Cylinder	1	2	3	4	5	6
Valve	-	A	I	A	I	I, A

Installing

13 Reinstall the valve cover.

a) Reinstall the insulators and mounting screws.

b) Tighten the screws to a tightening torque of **24 Nm**.

14 Before the ventilation pipe is fitted on the valve cover, lubricate the O-ring on the ventilation pipe connection with clean engine oil.

15 Fit the ventilation pipe on the valve cover. Tighten the screws to a tightening torque of **10 Nm**.

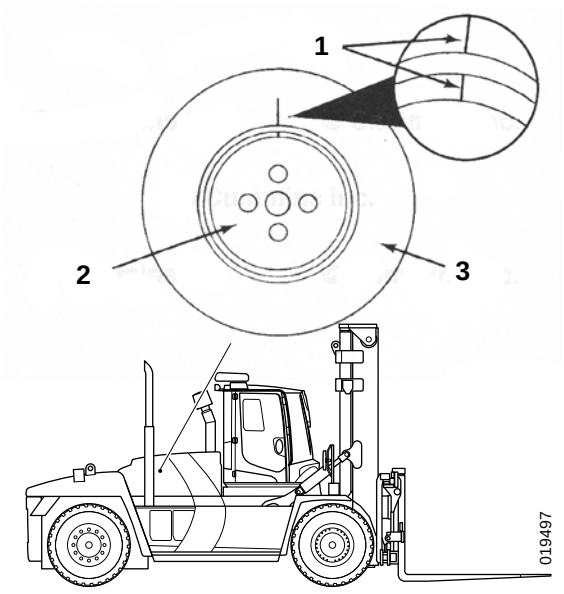
Completion

16 Turn on the system voltage.

17 Start the engine and check sealing.

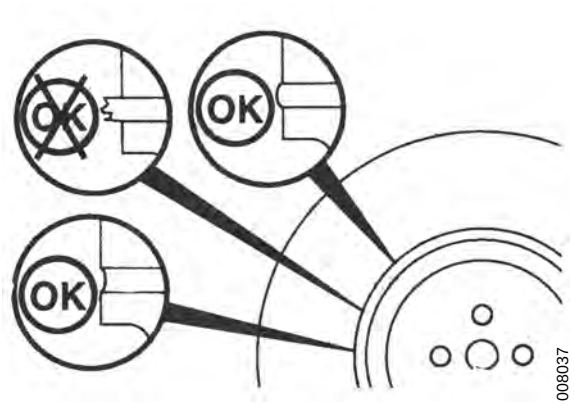
1.5.6 Crank mechanism

Vibration damper, rubber, checking (engine alternative Cummins QSB6.7 Stage 3A/Tier 3)



1. Indexing lines
2. Vibration damper hub
3. Vibration damper

1 Check that the indexing lines (position 1) on the vibration damper hub (position 2) and the vibration damper (position 3) align with each other. If the position between the lines deviates more than 1.59 mm, replace the vibration damper.



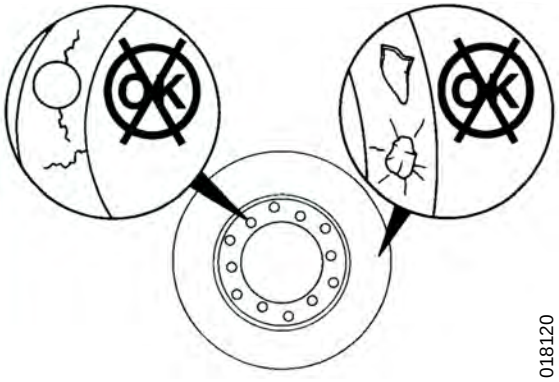
2 Check the rubber part for signs of wear. If any rubber pieces are missing or if the surface of the rubber is more than 3.18 mm below the metal surface, replace the vibration damper.

Check that the damper ring cannot move longitudinally in relation to the hub. Replace the vibration damper if it can move longitudinally.

Vibration damper, viscous, checking (engine alternative Cummins QSB6.7 Stage 4f/Tier 4)

NOTE

The silicone fluid in the vibration damper becomes solidified after a time and loses function, which may lead to engine damage



018120

Check/inspect the damper with indication of:

- fluid loss
- dents and buckles
- deformation (thickness)
- raised damper cover plate

Replace the damper in the event of any of the indications above.

1.6 Air intake and exhaust outlet

Air intake and exhaust outlet, check

WARNING

Hot exhaust system!

Risk of burn injuries.

Never touch hot components, e.g. turbo, exhaust pipe, silencer or catalysts when the machine is in operation or has recently been switched off!

1 Machine in service position, see section *B Safety*.

2 Check the exhaust system visually for signs of leakage (soot deposits) and other external damage. Check the flex hoses extra closely.

3 Check that the exhaust system suspension is intact.

4 Check the charge air hoses/pipes, connections and clamps for visible cracks and external damage.

If the hoses are damaged or if connections leak, the boost pressure will be too low and engine power is reduced. Damaged charge air hoses/pipes may also result in engine damage.

5 Check the intercooler for damage and signs of leakage.

6 Clean the intercooler externally with compressed air. Blow carefully in the opposite direction.

NOTE

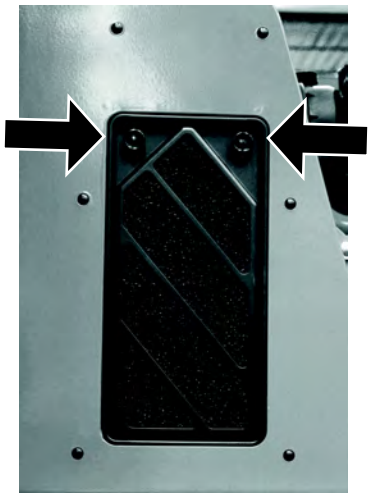
Do not use high pressure wash.

7 Check air intakes, hose connections, clamps and air cleaners for visible cracks and other external damage.

If the hoses are damaged or are leaking then polluted air is sucked into the engine, which can lead to engine damage.

1.6.1 Air cleaning system

Prefilter air intake, replacement



018718

1 Machine in service position, see section *B Safety*.

2 Unscrew the two screws that hold the air filter holder.

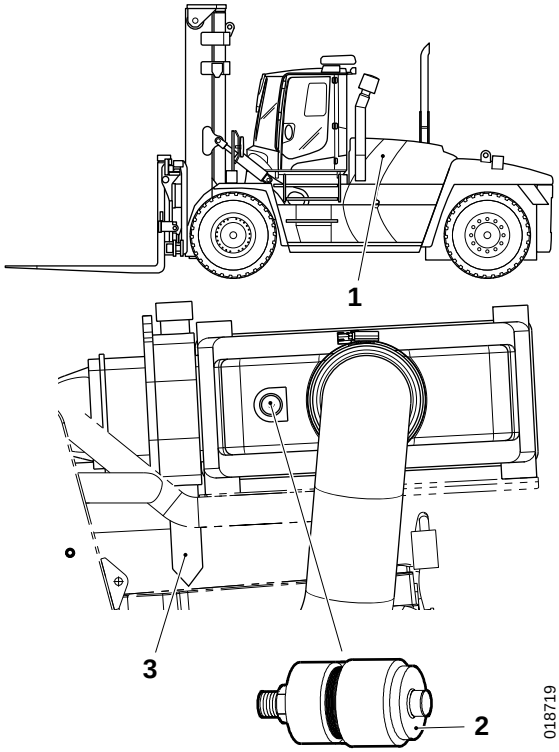
3 Remove the air filter holder.

4 Replace the filter and refit the filter holder.

Air filter, changing

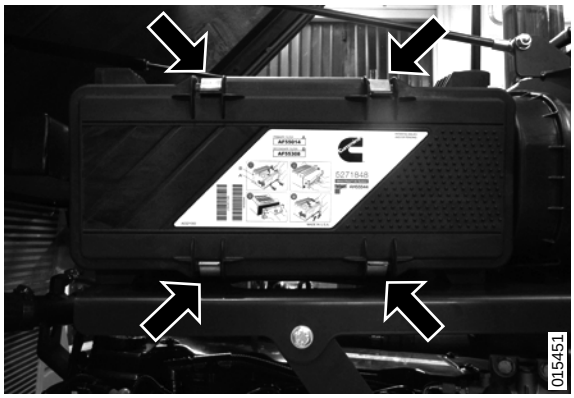
1 Machine in service position, see section *B Safety*.

2 Clean the outside of the air filter housing.

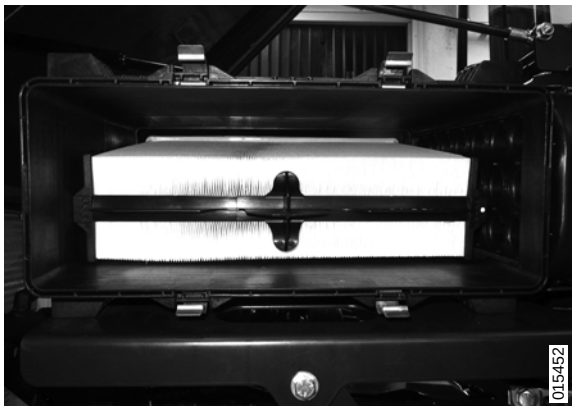


018719

1. Position for air filter holder
2. Replacement indicator
3. Dust reservoir

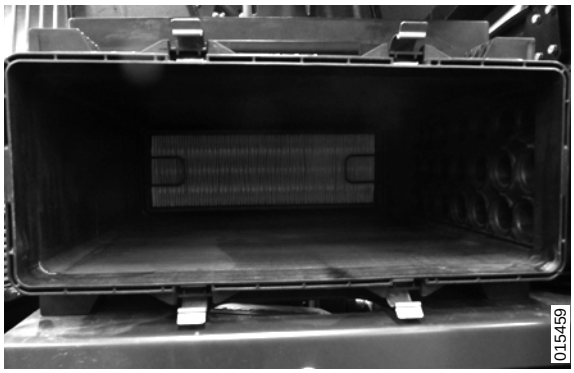


3 Remove the cap from the air filter housing.



4 Remove the filter cartridge.

5 Clean the precleaner's dust reservoir.



6 Check the safety insert, change as needed. (The safety insert should be changed every other time the filter insert is changed).

7 Fit a new filter insert.

NOTE

The filter cartridge should be changed, not cleaned.

8 Fit the cover to the air cleaner casing.

9 Check that the hoses from the air filter housing (and other parts) are intact and sealed.

10 Check that the hose clamps for the intake hose are firmly attached.

11 Reset the indicator by pressing the reset button.

1.6.3 Exhaust system

Exhaust system, checking

WARNING

Hot exhaust system!

Risk of burn injuries.

Never touch hot components, e.g. turbo, exhaust pipe, silencer or catalysts when the machine is in operation or has recently been switched off!

1 Machine in service position, see section *B Safety*.

2 Check the exhaust system's sealing and other wear. Check the flex hoses extra closely.

3 Check that the exhaust system suspension is intact.

1.6.4 Intercooler

Intercooler, checking/cleaning

1 Machine in service position, see section *B Safety*.

2 If the intercooler is clogged, clean it in accordance with the following:

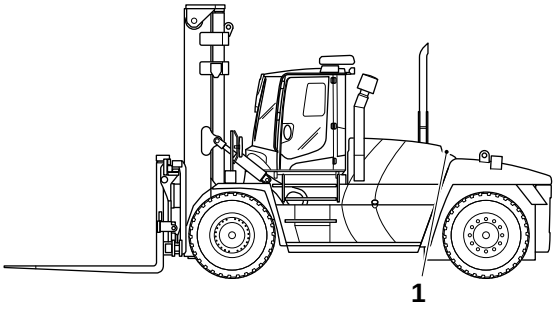
a) If necessary, remove the outer grating.

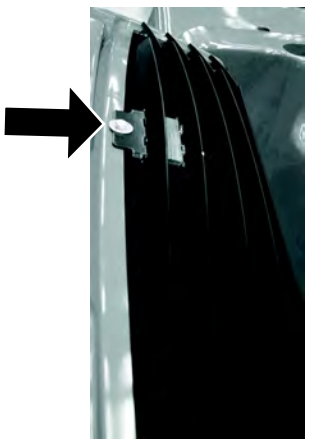
b) Clean the intercooler with compressed air.

NOTE

Do not use high pressure wash.

3 Check that the intercooler's hoses and clamps are in good condition.





018721

1. Position of grating

Charge air hoses, checking

1 Machine in service position, see section *B Safety*.

2 Check charge air pipes/hoses with regard to leaks, holes, cracks or loose connections and other external damage. Tighten hose clamps if necessary.
If the pipes/hoses are damaged or if connections leak, the boost pressure will be too low and engine power is reduced. Damaged charge air pipes/hoses can also result in engine damage.

NOTE

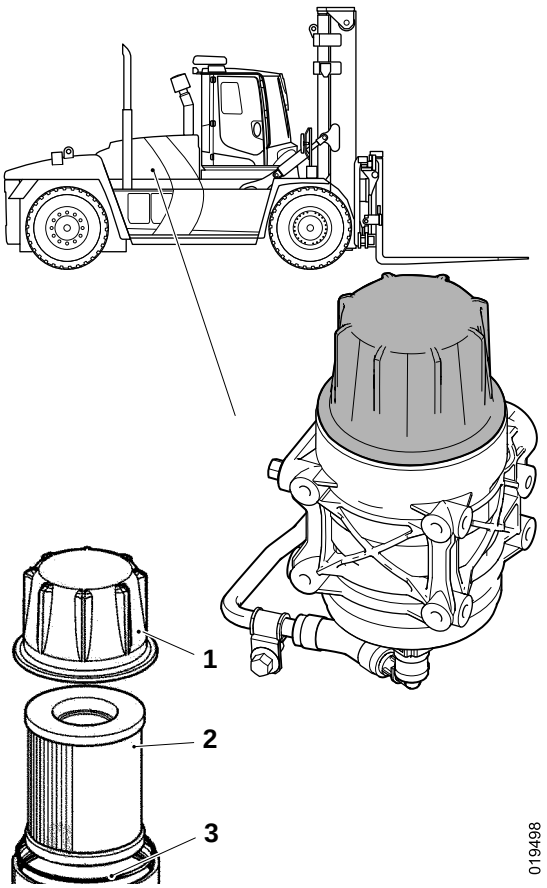
If there is oil in the intercooler hoses, very carefully clean the intercooler and all pipes and hoses in the intercooler system on the inside before the engine is started.

3 Check that there is no oil in the charge air hoses/pipes. If they are contaminated by oil on the inside, this indicates leakage at the turbo's shaft seal. In which case, replace the turbocharger assembly.

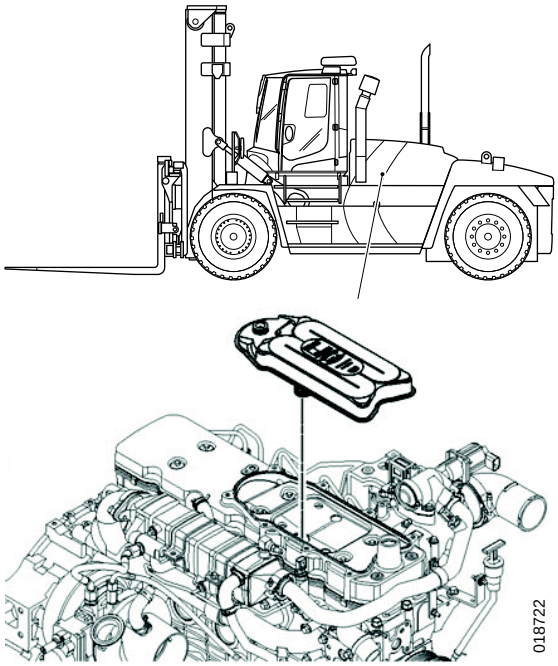
1.6.7 Crankcase ventilation

Crankcase filter, changing (engine alternative Volvo TAD871VE)

1 Machine in service position, see section *B Safety*.
2 Clean around the filter.
3 Remove the filter cover manually.
4 Remove the filter cartridge.
5 Replace the O-ring.
6 Fit the new filter insert.
7 Turn and tighten the filter cover.
8 Start the engine and check sealing.



1. Filter cover
2. Filter insert
3. O-ring



Crankcase ventilation filter, changing (engine alternative Cummins QSB6.7 Stage 4/Tier 4f)

Crankcase ventilation filter, location

The crankcase ventilation filter is located on top of the engine's valve cover. The crankcase ventilation is an open system, which means that the gases from the crankcase are vented out into the atmosphere.

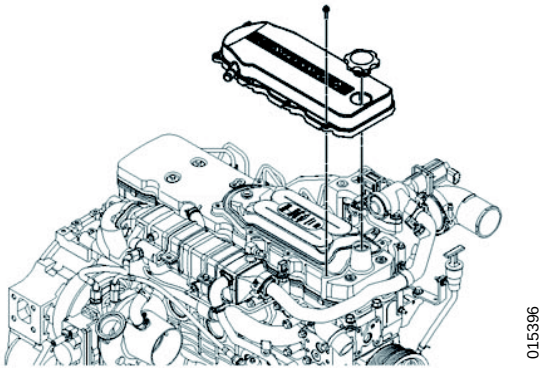
Preparation

1 Machine in service position, see section *B Safety*.

2 Remove any fastening devices that attach the crankcase ventilation hose/pipes to the engine.

3 Detach the clamps for the crankcase ventilation hose/pipes and remove the hose/pipes.
Check the hose/pipes for damage and clean from dirt or ice using hot water and cleaning agent. Dry with compressed air

Removing



NOTE

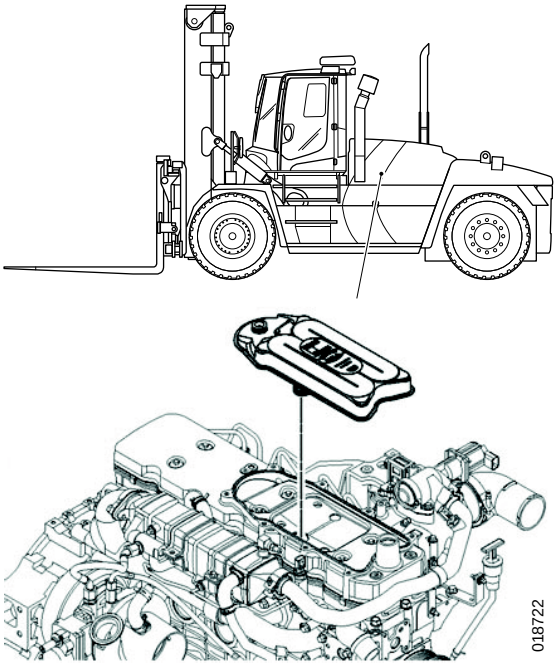
Do not use pneumatic tools to remove the filter cover's screws, the valve cover could be damaged.

4 Remove the oil filler cap.

Remove the screws that attach the filter cover for the crankcase ventilation and then lift away the filter cover.

NOTE

Note the location of the filter cover's screws during removal.

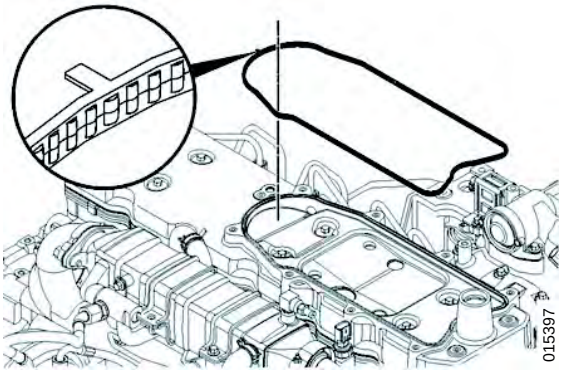


5 Remove the crankcase ventilation filter from the valve cover.

Do **not** touch the crankcase ventilation filter's gasket on the valve cover.

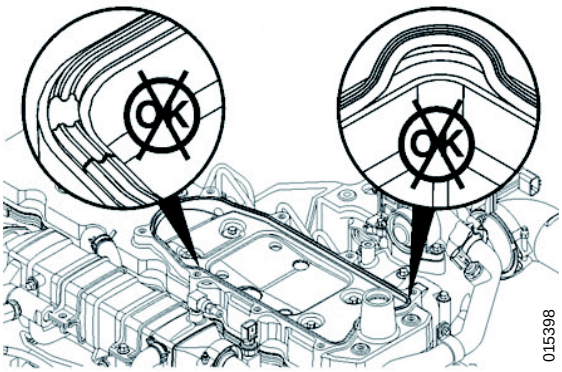
NOTE

Do not remove the gasket for the crankcase ventilation filter from the valve cover; if the gasket is exposed to oil, it may swell, which can make it difficult to fit it into the slot. If the gasket is detached from the slot on the valve cover, do not try to re-use the old gasket, but replace the gasket instead.



6 If the gasket is damaged, remove it by gripping the tab and pulling upward.

Clean and check

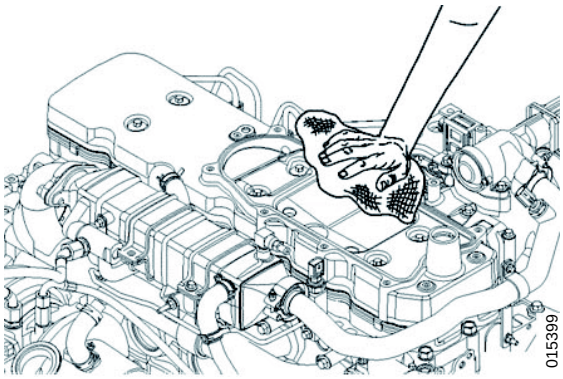


NOTE

Do not remove the gasket for the crankcase ventilation filter from the valve cover; if the gasket is exposed to oil, it may swell, which can make it difficult to fit it into the slot. If the gasket is detached from the slot on the valve cover, do not try to re-use the old gasket, but replace the gasket instead.

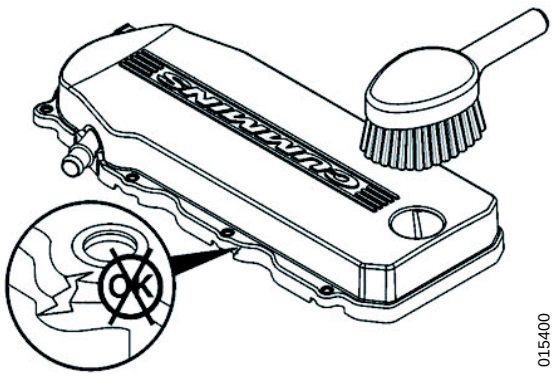
7 Check the cover and gasket for the crankcase ventilation filter to ensure that it is not brittle or damaged.

If the gasket is damaged it must be replaced. Do **not** stretch the new gasket during fitting.



8 Clean the contact surfaces for the crankcase ventilation filter and the gasket; use a clean cloth and a dissolvent recommended by the manufacturer.

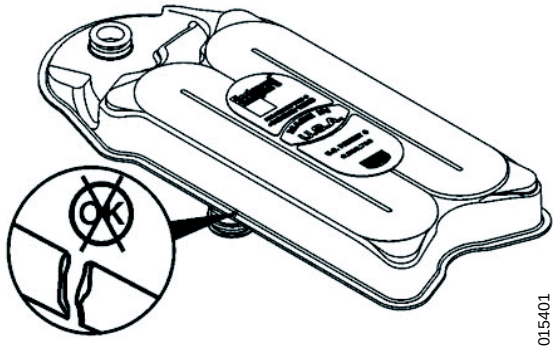
Then wipe off the surfaces with a dry and clean cloth.



9 Clean the filter cover for the crankcase ventilation.

Dry with compressed air.

Check that the cover is not damaged or cracked, replace the cover in the event of damage.

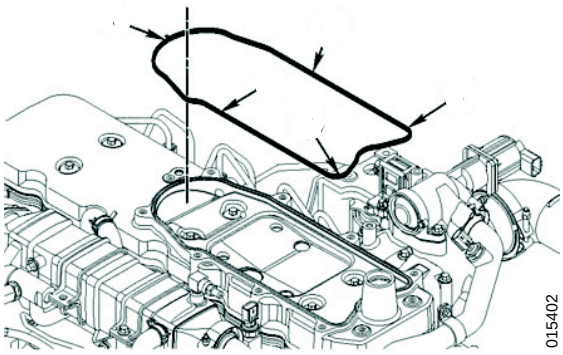


10 If the crankcase ventilation filter has been removed and shall be re-used, check the filter's edges with regard to tearing, cutting damage or brittleness.

Check the O-ring with regard to tearing, cutting damage or brittleness.

If damage is found, replace the filter and/or the O-ring.

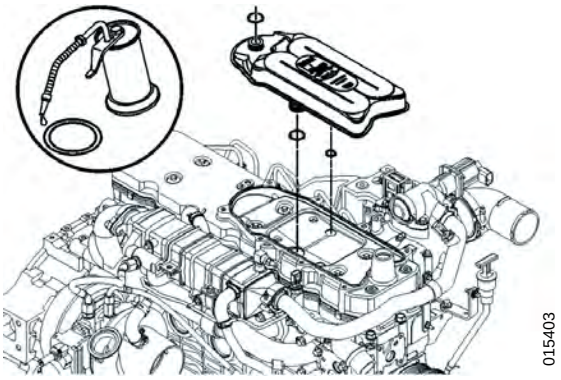
Installing



11 If the filter cover's gasket has been removed, fit a new gasket in the groove on the valve cover. Start with the tab end, continue with the corners and finish with the long sides (see the figure).

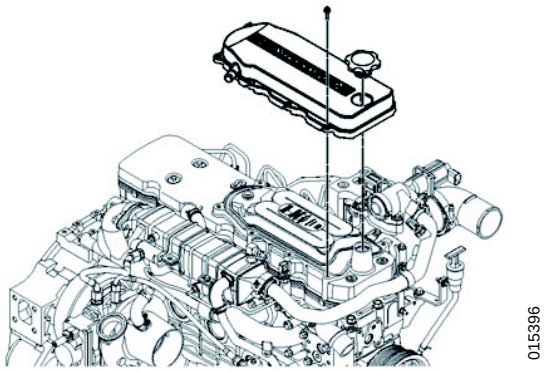
Gently press the gasket down into the groove. Do **not** use your finger to pull around the gasket in order to get it down into the groove, as this stretches out the gasket and makes it difficult to get it into the correct position.

The gasket **must** have full contact around the whole groove.



12 Apply clean engine oil onto the crankcase ventilation filter's O-rings.

Refit the filter on the valve cover.



13 Refit the filter cover for the crankcase ventilation.

Fit the screws that attach the cover.

NOTE

Refit the screws in the same location as noted during removal.

Tighten the screws, start with the innermost and work outward in a circle. Tightening torque **7 Nm**.

Refit the oil filler cap.

14 Fit and secure all hose clamps. Install and secure the brackets that attach the hose to the engine.

15 Start the engine and check sealing.

1.7 Cooling system

1.7.4 Radiator and expansion tank

Radiator, checking/cleaning

1 Machine in service position, see section *B Safety*.

2 Open the hood and check that the outside of the radiator is not clogged.

3 Clean the radiator with compressed air.

NOTE

Blow perpendicular to the radiator so that the cooling fins are not destroyed.

NOTE

Do not use high pressure wash.

4 Check that the radiator's cooling fins are not damaged.

5 Check the sealing integrity and check that the radiator's hoses and clamps are in good condition.

1.7.5 Cooling fan

Drive belt, check (engine alternative Volvo)

Check after operating when the belt is warm.

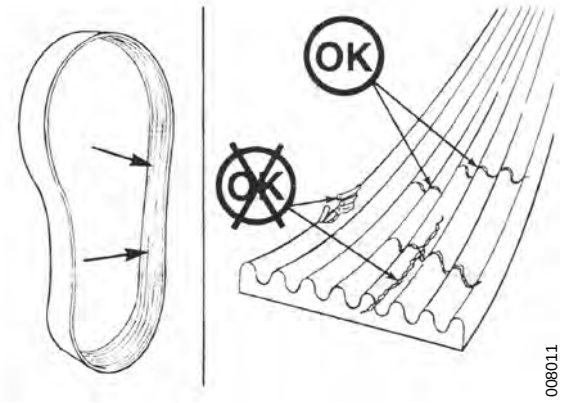
1 Machine in service position, see section *B Safety*.

2 Raise the hood.

3 It should be possible to press down the drive belt approx. 3-4 mm between the belt pulleys.

The drive belt has an automatic belt tensioner and does not need to be adjusted. Replace the drive belt if it is damaged or worn, see .

Check that the belt does not have any intersecting cracks. Transverse cracks are acceptable, longitudinal cracks that are intersected by transverse cracks are **not** acceptable.



NOTE

The belt tensioner is automatic.

IMPORTANT

Always change a drive belt that looks to be worn or has cracks.

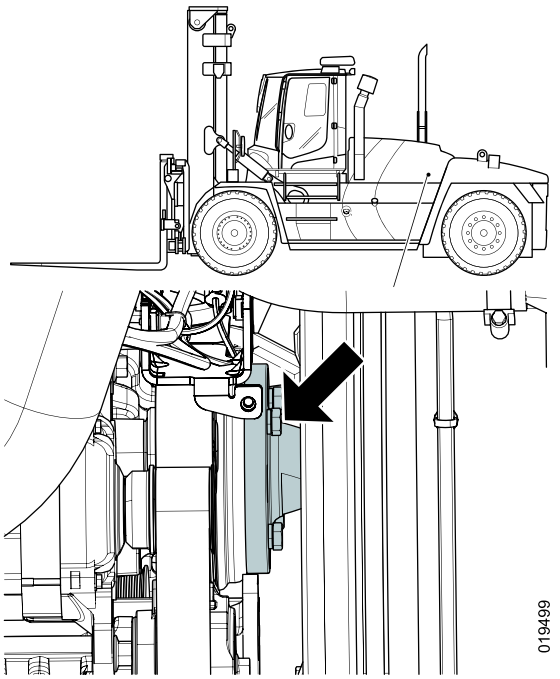
4 Close the hood.

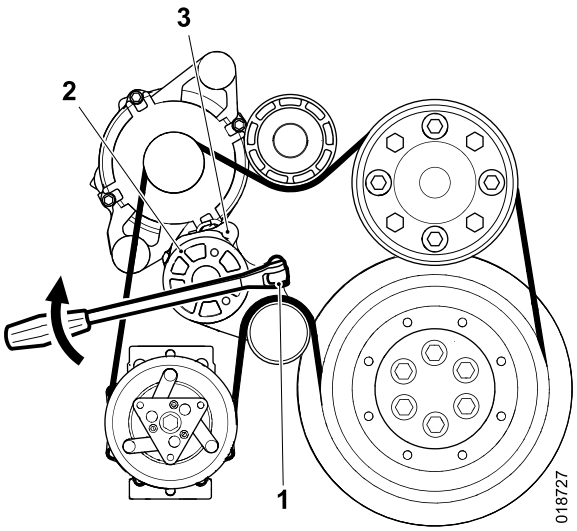
Drive belt, changing (engine alternative Volvo TAD871VE)

1 Machine in service position, see section *B Safety*.

2 Detach the hub between engine and cooling fan. Fold down the cooling fan so that you have access to replace the belt.

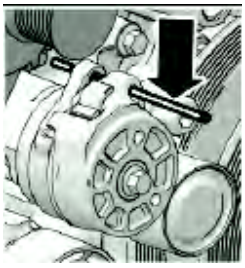
3 Loosen the belt tensioner by fitting a 1/2-inch square key in the belt tensioner (position 1). Lift the wrench up and remove the drive belt.





1. Socket wrench with 1/2" sleeve socket.
2. Belt tensioner
3. Positioning of drift or similar

4 A 21 mm socket grip is moulded into the tensioner, use a socket wrench with a 21 mm socket pressed onto the socket wrench's barrel plug (position 1). Unload the belt tensioner by turning the belt tensioner (position 2) with the socket wrench.



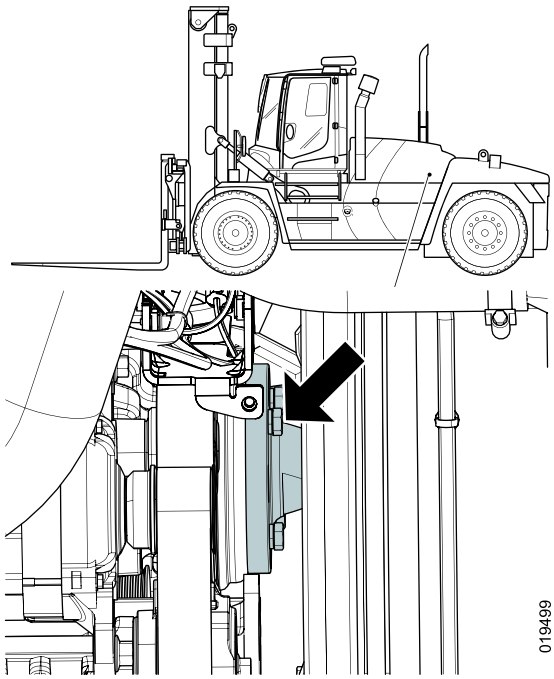
5 When the tension lever is unloaded with the socket and the socket wrench, 2 holes align (position 3). Block the tension lever by inserting a drift (see figure) or similar in both holes. The socket wrench and socket can now be removed.

6 Check that the belt pulleys are clean and undamaged.

7 Fit the new drive belt.

8 Fit the socket and socket wrench again and remove the drift. Carefully release the belt tensioner so that the belt is tensioned once again.

9 Check that the drive belts are correctly aligned and that they can be pressed down 3–4 mm.



10 Fit the hub between engine and cooling fan.

11 Start the engine and perform a function check.

Drive belt tensioner, check (engine alternative Volvo)

Check below for any replacement of the belt tensioner (see *workshop manual*)

1 Check that there are no cracks on the drive belt tensioner's wheels or levers.

2 Check that the tension lever stop is not touching the moulded stop lugs on the belt tensioner housing.

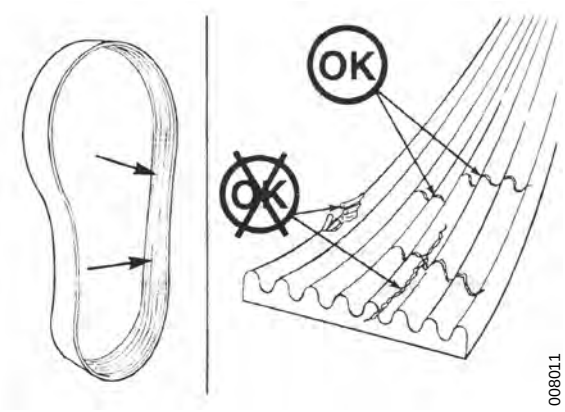
3 Check that the lower tension lever stop is in contact with the lower stop lug on the belt tensioner housing.

With drive belt removed

4 Check the belt tensioner for signs of wear and damage at the tension wheel and the tension lever, if there are signs of damage then the centre bearing may be worn out.

5 Measure the distance between the belt tensioner's spring housing and the tension lever, the clearance must not exceed 3 mm.

Drive belt/alternator belt, check (engine alternative Cummins QSB6.7)



008011

Check after operating when the belts are warm.

Check that the drive belt does not have any intersecting cracks. Transverse cracks are acceptable, longitudinal cracks that are intersected by transverse cracks are **not** acceptable. Replace the drive belt if it is damaged or worn. See *Drive belt, changing (engine alternative Cummins QSB6.7)*, page 1:52 for drive belt changing and adjusting.

Drive belt damage can be caused by:

- Incorrect drive belt tension
- Incorrect length or dimensions
- Belt pulleys that are not in alignment
- Incorrect installation
- Stresses in the operating environment
- Grease or oil on the sides of the drive belt

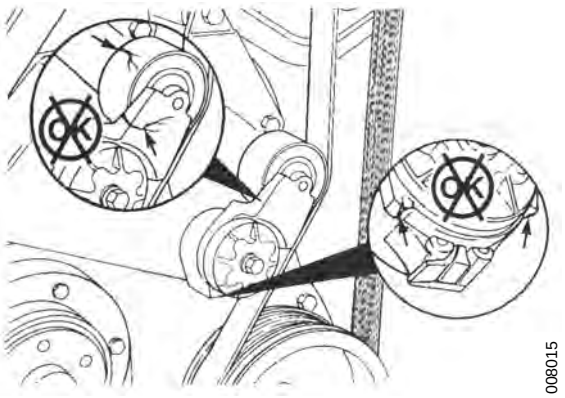

008012

It should be possible to press down the alternator belt and drive belt approx. 3-4 mm between the belt pulleys.

The alternator belt and drive belt have an automatic belt tensioner and do not need to be adjusted.

IMPORTANT
Always change a drive belt that looks to be worn or has cracks.

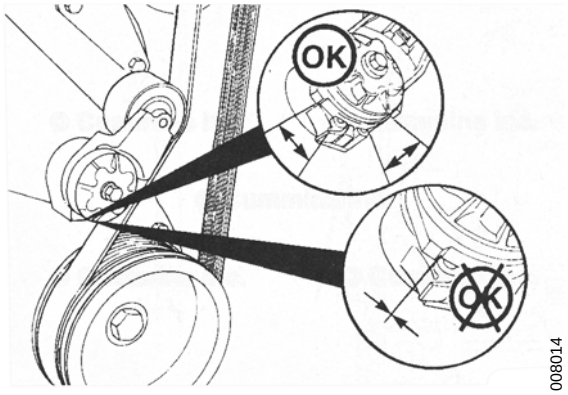
Drive belt tensioner, check (engine option Cummins QSB6.7)



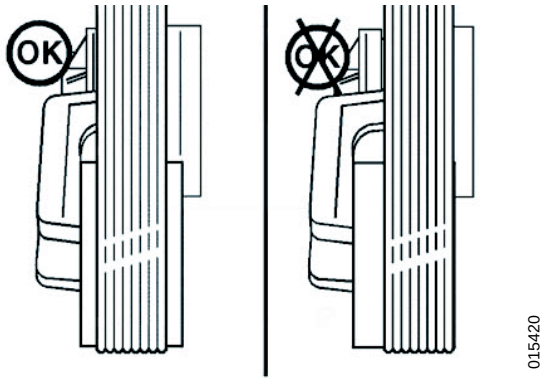
008015

To replace the belt tensioner (see *workshop manual*)

1 Check that there are no cracks on the drive belt tensioner's wheels or levers. If there are cracks then the belt tensioner **must** be replaced.

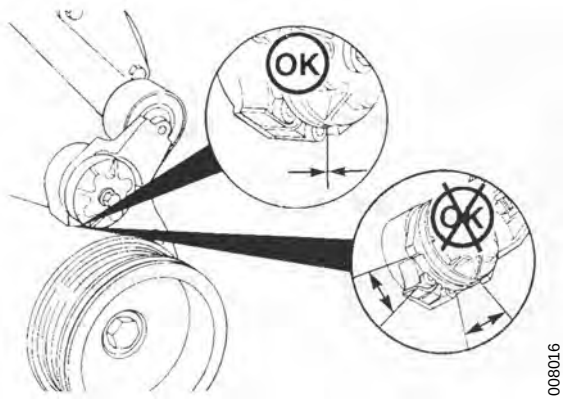


2 With the drive belt in place, check that neither the lower nor the upper tension lever stop is touching the cast stop lugs on the belt tensioner's housing. If any tension lever stop is touching a stop lug then the drive belt **must** be replaced. Check to ensure that the correct drive belt is used. If any tension lever stop is still touching a stop lug after drive belt replacement then the belt tensioner **must** be replaced.

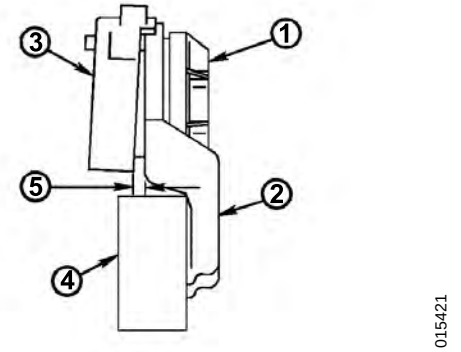


3 Check the drive belt's location on the belt tensioner. The drive belt must be centred on or near the centre of the wheel. A misaligned drive belt (either too far forward or back on the belt tensioner) may result in increased belt wear, that the drive belt "wanders" off the pulleys, or result in increased/uneven wear on the belt tensioner's bushing.

4 Check the belt tensioner for signs of wear and damage at the tension wheel and the tension lever, if there are signs of damage then the centre bearing may be worn out and the drive belt tensioner **must** be replaced.



5 With the drive belt removed, check that the lower tension lever stop is in contact with the lower stop lug for the tension lever on the belt tensioner housing. If these two are not in contact with each other, the drive belt tensioner **must** be replaced.



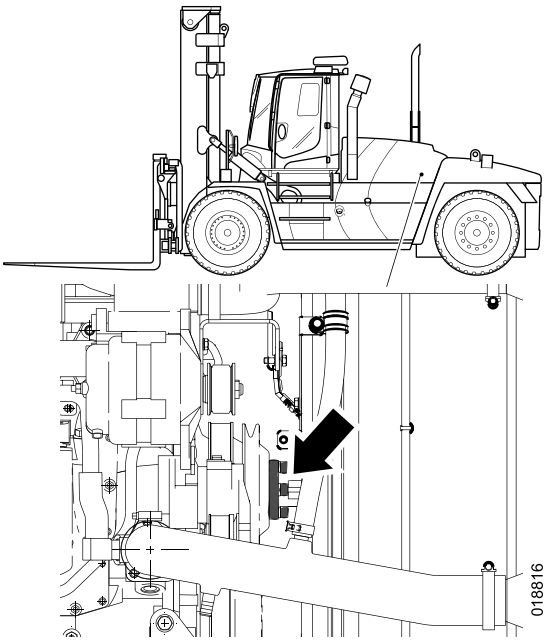
6 With the drive belt removed, measure the distance between the belt tensioner's spring housing and the tensioner arm in order to check the wear of the belt tensioner or uneven bearing wear. If the clearance at measurement point 5 exceeds 3 mm at any point, the belt tensioner is damaged and must be replaced as a complete unit.

Belt tensioners generally have a larger clearance close to the lower part of the spring housing, which results in that the upper part rubs against the tensioner arm.

7 Install the drive belt.

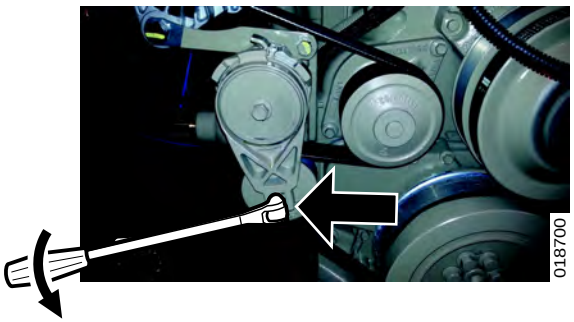
1. Belt tensioner cover
2. Tensioner arm
3. Spring housing
4. Tension wheel
5. Clearance

Drive belt, changing (engine alternative Cummins QSB6.7)



1 Machine in service position, see section *B Safety*.

2 Detach the hub between engine and cooling fan. Fold down the cooling fan so that you have access to replace the belt.



3 Position a socket wrench with a 1/2" socket fitting (square barrel) on the belt tensioner arm. Unload the belt tensioner using the socket wrench and remove the belt.

CAUTION

Do not use too much force when unloading the belt tensioner. Continued winding can cause the tensioner arm to break.

4 Unload the belt tensioner and fit the drive belt. If it is difficult to fit the drive belt (the belt seems too short), first place the belt in the grooved belt pulley. Then continue to hold up the belt tensioner and pry the belt over the coolant pump's belt pulley.

Ease down the belt tensioner and check that the belt is fitted correctly in the grooves and is correctly tensioned.

1.7.7 Coolant

Coolant level, check

WARNING

The cooling system is pressurised. Steam or hot coolant may jet out.

Risk of scalding and burn injuries!

Open the filler cap very carefully when the engine is warm. Wait until the coolant has cooled before topping up.

NOTE

Open very carefully as hot coolant may jet up.

Low coolant level is indicated with the event menu, see *Operator's manual*, section *4 Instruments and controls,*, group *4.11 Control system*

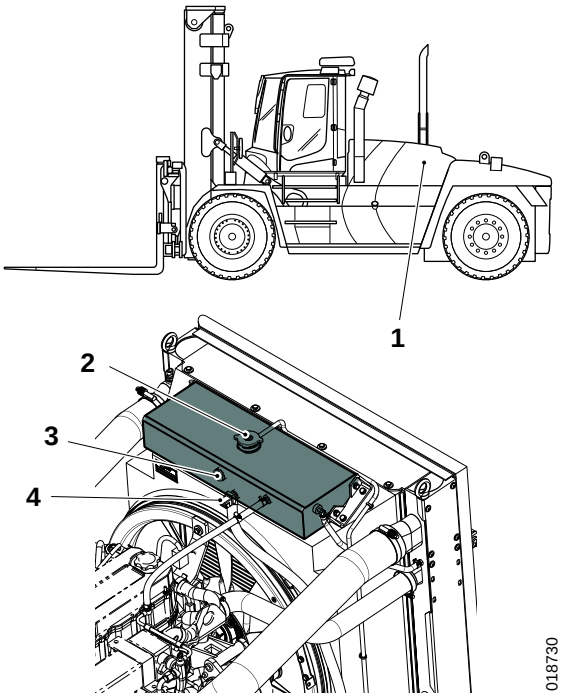
NOTE

A low coolant level may cause engine damage or may cause the engine to stop.

1 Machine in service position, see section *B Safety*.

2 Coolant should be filled in the system's expansion tank (position 2). With the engine cold, the coolant should be visible in the sight glass (position 3) on the expansion tank.

3 If needed, top up with ready-mixed recommended coolant. For volume and quality, see section *F Technical data*. Top up slowly so that there are no spills and no air pockets in the cooling system.



1. Position for coolant reservoir (expansion tank)
2. Filling point
3. Sight glass
4. Sensor coolant level

CAUTION

Use approved coolant.

Risk of engine damage and invalidated warranty if unapproved coolant is used.

When changing and filling coolant, only coolant approved by the engine manufacturer may be used.

CAUTION

Coolant is toxic on ingestion and environmentally hazardous. Remember to handle it with caution and take care of waste.

Coolant, changing (engine alternative Volvo TAD871VE)

Radiator performance is reduced due to deposits in the radiator and in the engine's radiator ducts. Clean the system in conjunction with changing the coolant.

⚠ WARNING

The cooling system is pressurised. Steam or hot coolant may jet out.

Risk of scalding and burn injuries!

Open the filler cap very carefully when the engine is warm. Wait until the coolant has cooled before topping up.

⚠ WARNING

Glycol and anti-corrosion agents are hazardous to health.

Health hazard!

Handle with care. Avoid contact with skin, use protective goggles and protective gloves. In the event of contact with skin, wash the skin.

IMPORTANT

Machines with ECC or AC are equipped with a combined heating and cooling unit, which can lead to frost erosion if the machine runs without coolant.

Risk of freezing and damage to the heating and cooling unit!

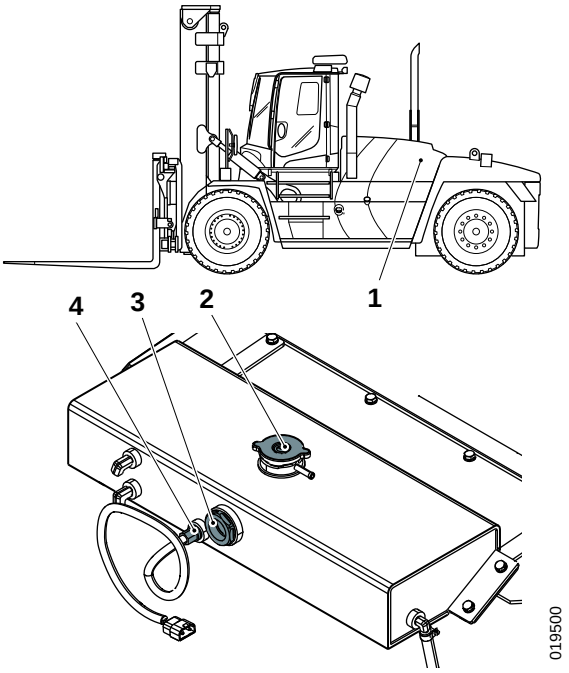
The electrical connection to the AC compressor must be disconnected, when cleaning the radiator with water or agent without antifreeze properties.

NOTE

Read safety instructions for coolant before starting work, see section B Safety.

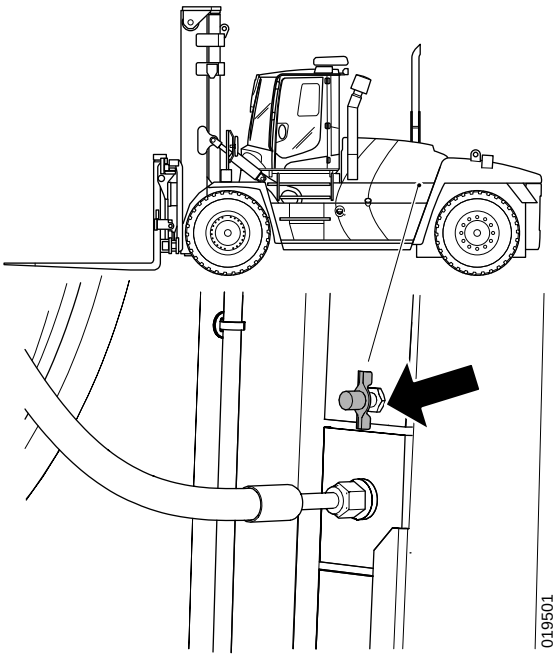
NOTE

The filler cap must be screwed off before draining.



Engine alternative Volvo TAD871

1. Position for coolant reservoir (expansion tank)
2. Filling point
3. Sight glass
4. Sensor coolant level



Drain point radiator

Draining

1 Machine in service position, see section *B Safety*.

2 Open the filler cap on the expansion tank carefully until a slight resistance is felt and allow any overpressure to be vented away.

The filler cap has a position for venting out overpressure without the risk of the cap loosening. The position feels like a small notch when turning the cap.

WARNING

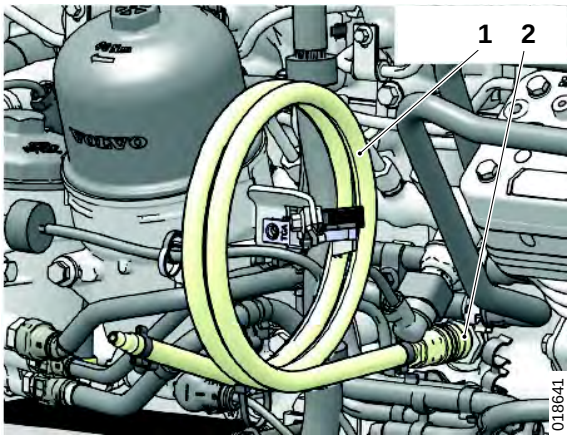
The cooling system is pressurised. Steam or hot coolant may jet out.

Risk of scalding and burn injuries!

Open the filler cap very carefully when the engine is warm. Wait until the coolant has cooled before topping up.

3 When the overpressure has been vented away, remove the filler cap from the cooling system's expansion tank.

4 Position a receptacle under the drain points on the radiator and engine. For cooling system volume, see section *F Technical data*.



1. Drain hose
2. Drain point, engine

5 Open all drain points. Drain the coolant from the radiator and engine block with drain hose.

The cock for draining the radiator is located in the lower part of the right-hand coolant tank. Thread a hose onto the cock in order to route the coolant away during draining.

The cock for draining the radiator is located in the lower part of the left-hand coolant tank. The drain point for the engine is located on the right-hand side of the engine block. Thread a drain hose onto the drain point.

6 Check that all coolant drains.

NOTE

The deposits that may be inside the cock/plug must be cleaned out; otherwise there is a risk that coolant may remain and cause freezing damage.

Allow all drain points to be open and make sure that the heating knob is set to full heat during cleaning.

7 Insert a hose in the filler hole in the expansion tank and flush with **clean** water, until the water flowing out is clear.

8 Remove the thermostat and flush out the thermostat housing.

9 It is recommended to flush the cab heating circuit. Flush in the opposite direction to normal through the cab's heating coil. As well as to detach the radiator hoses and flush the radiator in the opposite direction to the flow.

Cleaning with coolant

1 Fill the cooling system, see *Filling point*, page 1:57. Only use the recommended coolant, see section *F Technical data*.

2 Drain the cooling system after 1-2 days of operation.

NOTE

In order to avoid dissolved materials getting into the cooling system, drain quickly, within 10 minutes, without the engine having been stationary for a long time.

Remove the filler cap from the expansion tank and any lower radiator hose to increase the drain speed.

3 Immediately flush the system thoroughly with **clean** hot water to prevent dirt getting on the internal surfaces. Flush until clean water runs out. Check that the water valve in the cab is fully open during cleaning.

4 If there still are impurities after flushing for some time, cleaning with a radiator cleaner can be performed, contact Cargotec Service.

NOTE

Use only cleaning agent approved by the engine manufacturer. Follow the instructions on the packaging carefully.

Filling point

1 When the cooling system is completely free from impurities, close the drain points.

CAUTION

Use approved coolant.

Risk of engine damage and invalidated warranty if unapproved coolant is used.

When changing and filling coolant, only coolant approved by the engine manufacturer may be used.

2 Fill with recommended coolant so that the level is visible in the sight glass.

Fill new ready-mixed coolant of the correct type in the expansion tank until the level is in the centre of the sight glass. For volume and quality, see section *F Technical data*.

3 Turn on the system voltage and start the engine.

4 Turn on max. heat in the cab.

5 Run the engine to 85 °C and operate the machine at least a further 25 minutes at full heat in the cab so that the coolant is pumped round the whole system in order to bleed the system.

Use the operating menus to check the coolant temperature.

6 Allow the coolant to cool down to the same temperature as the surroundings.

IMPORTANT

Do not open the filler cap when the coolant is hot, the coolant may jet out and air bubbles may form.

7 Check the level in the expansion tank, fill if necessary.

8 Recheck the coolant level after 10 operating hours, see *Coolant level, check*, page 1:53.

Changing of coolant and cleaning of cooling system (engine alternative Cummins QSB6.7)

Radiator performance is reduced due to deposits in the radiator and radiator ducts. For this reason, clean the system in conjunction with changing the coolant.

IMPORTANT

Cleaning may not be performed if there can be a risk of freezing in the cooling system since the cleaning solution does not have anti-freeze properties.

NOTE

Read safety instructions for coolant before starting work, see section B Safety.

NOTE

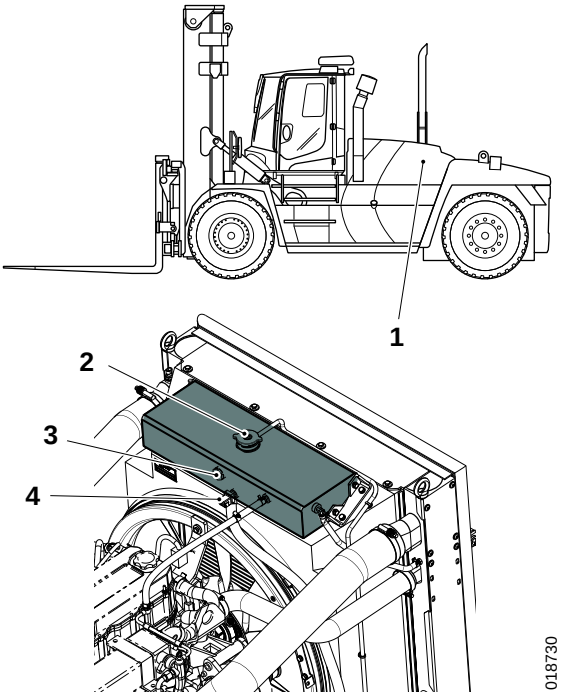
The filler cap must be screwed off before draining.

1 Machine in service position, see section *B Safety*.

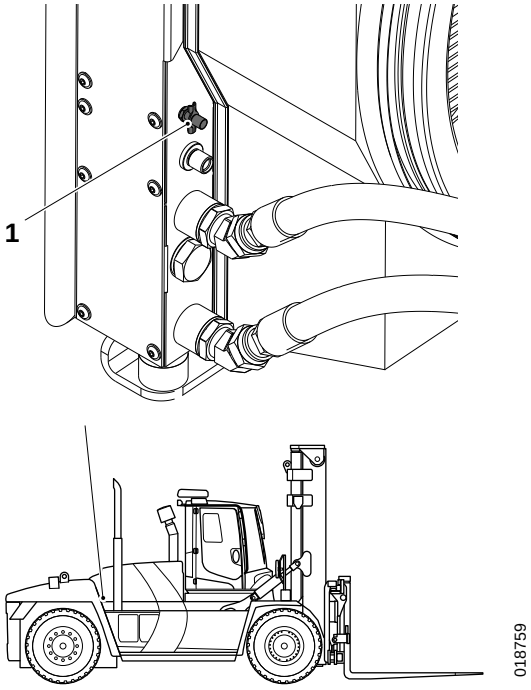
Draining

2 Remove the filler cap from the cooling system's expansion tank.

3 Position a receptacle under the drain points on the radiator and engine. For cooling system volume, see section *F Technical data*.



1. Position for coolant reservoir (expansion tank)
2. Filling point
3. Sight glass
4. Sensor coolant level



1. Drain point, radiator

4 Open all drain points on the radiator and engine block. The cock for draining the radiator is located in the lower part of the right-hand coolant tank. Thread a hose onto the cock in order to route the coolant away during draining.

5 Check that all coolant drains.

NOTE

The deposits that may be inside the cock/plug must be cleaned out; otherwise there is a risk that coolant may remain and cause freezing damage.

Check whether the installation has additional drain points on the coolant line's lowest points. Allow the drain points to remain open and make sure that the heating knob is set to full heat during cleaning.

6 Check the condition of the hoses, clamps and radiator sealing. Replace and clean if needed.

⚠ CAUTION

The cooling system must be fully filled in order to prevent air pockets.

During filling the air must be vented from the radiator ducts. Wait 2 to 3 minutes to allow the system to be bled, then fill up the system.

Cleaning

NOTE

Do not fit the filler cap. The engine must be run without filler cap during this process.

7 Fill the system with one of the radiator cleaning agents approved by the engine manufacturer.

NOTE

Use only cleaning agent approved by the engine manufacturer. Follow the instructions on the packaging carefully.

8 Open all heat controls on the heater unit so that it is bled.

Wait for a few minutes without starting the engine in order to allow the air to escape naturally from the system and for the fluid level to stabilise. Refill water so that the level is visible in the sight glass.

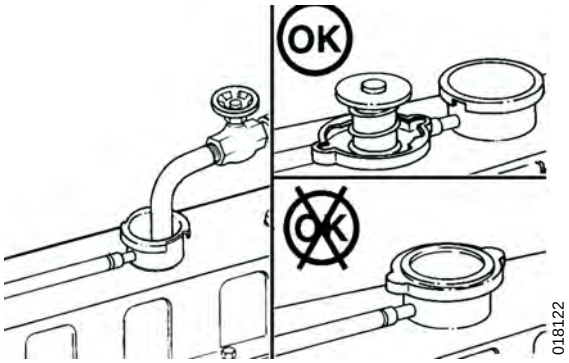
NOTE

Do not fit the filler cap. The engine must be run without filler cap during this process.

9 Start the engine without the filler cap fitted, and allow it to run at idling speed for two minutes. Switch off the engine and refill water so that the level is visible in the sight glass.

10 Start the engine without the filler cap fitted, and allow it to run at working speed until the thermostat opens.

Allow the engine to run at idling speed for two minutes before stopping the engine. This is in order to ensure that the pistons, cylinders, bearings and turbocharger cool down.



11 Refit the filler cap.

Run the engine for 1–1.5 h with the coolant temperature above 80 °C.

Stop the engine and allow the coolant temperature to fall below 50 °C.

Drain the coolant system.

12 Fill the cooling system with clean water.

13 Open all heat controls on the heater unit so that it is bled.

Wait for a few minutes without starting the engine in order to allow the air to escape naturally from the system and for the fluid level to stabilise. Refill water so that the level is visible in the sight glass.

NOTE

Do not fit the filler cap. The engine must be run without filler cap during this process.

14 Start the engine without the filler cap fitted, and allow it to run at idling speed for two minutes. Switch off the engine and refill water so that the level is visible in the sight glass.

15 Start the engine without the filler cap fitted, and allow it to run at working speed until the thermostat opens.

Allow the engine to run at idling speed for two minutes before stopping the engine. This is in order to ensure that the pistons, cylinders, bearings and turbocharger cool down.

16 Turn off the engine and empty the cooling system.

NOTE

*If the water drained out is still dirty, the cooling system **must** be flushed until the water is clean.*

17 When the cooling system is completely free from impurities, close the drain points.

Filling

18 Fill with recommended coolant so that the level is visible in the expansion tank's sight glass.

NOTE

Only use recommended coolant.

⚠ CAUTION

Use approved coolant.

Risk of engine damage and invalidated warranty if unapproved coolant is used.

When changing and filling coolant, only coolant approved by the engine manufacturer may be used.

19 Open all heat controls on the heater unit so that it is bled.

Wait for a few minutes without starting the engine in order to allow the air to escape naturally from the system and for the coolant level to stabilise. Refill coolant so that the level is visible in the sight glass.

NOTE

Switch off the air conditioning unit before starting the engine.

20 Start the engine without the filler cap fitted, and allow it to run at idling speed for two minutes. Switch off the engine and refill coolant so that the level is visible in the sight glass.

21 Start the engine without the filler cap fitted, and allow it to run at working speed until the thermostat opens.

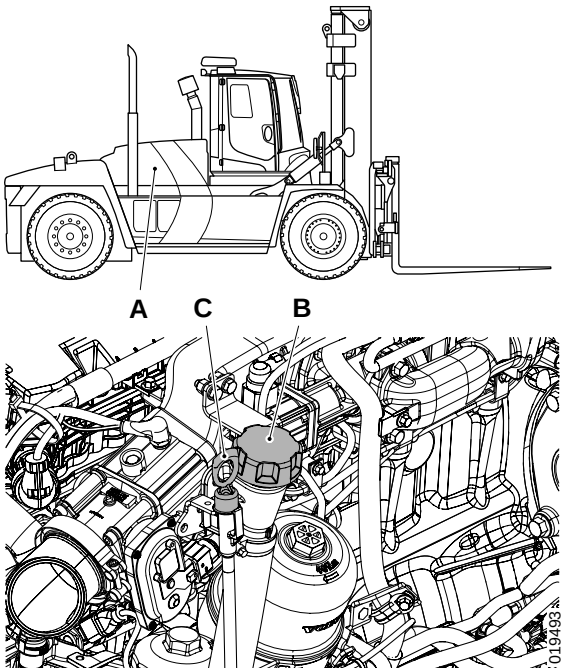
Allow the engine to run at idling speed for two minutes before stopping the engine. This is in order to ensure that the pistons, cylinders, bearings and turbocharger cool down.

22 Wait until the engine and coolant have cooled down and then check and top up the coolant, if necessary, so that the level is visible in the sight glass.

23 Fit the filler cap, start the engine and allow it to run until the engine temperature increases to 80 °C, check the cooling system's sealing integrity.

1.8 Lubrication system

Oil testing (engine alternative Volvo)



Volvo TAD871VE Stage 4/Tier 4f

A. Location for filling and dipstick for engine oil

B. Oil filling

C. Dipstick

By taking an oil sample at 500 h, 750 h and 1500 h, it is possible to extend the change interval for engine oil to 1000 h.

The new change intervals only apply for the tested combination of engine type, engine oil, fuel quality and operating mode. If any of these parameters are changed then the interval must be identified through testing by means of a new series of oil samples.

In order for the 1000 h change interval to apply, all of the conditions below must be met:

- Carry out and document service in accordance with Volvo Penta's service protocol for the engine.
- Oil samples approved and carried out using the Volvo Penta Kit for oil analysis (can be ordered using part number 923944.2781).
- Only Volvo Penta oil filters.
- Only oil grade in accordance with section *F Technical data*.
- Only ULSD fuel may be used.

Taking samples

1 Follow the instructions in the kit.

The oil sample can be taken via oil filling (position B).

Oil and oil filters, changing (engine alternative Volvo TAD871VE)

NOTE

Read safety instructions for oil before starting work, see section B Safety.

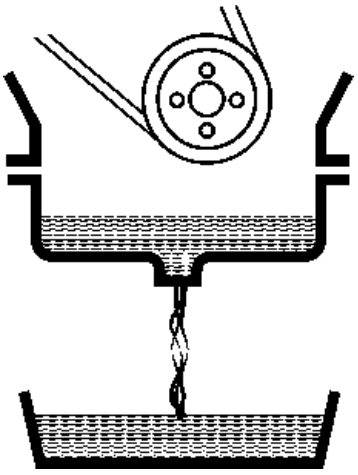
1 Run the engine until warm.

2 Machine in service position, see section *B Safety*.

3 Position a receptacle under the engine's drain point for engine oil. For volume see section *F Technical data*.

4 Remove the drain plug from the engine and drain the engine of oil.

5 Clean around the oil filter.



6 Carefully remove the filter cover (position 1).

7 Remove the O-ring (position 2) and filter insert (position 3).

Allow the oil to drain from the filter into the container.

8 Fit a new O-ring on the cover.

9 Secure the new filter insert in the cover.

10 Then fit the filter cover with new filter insert and O-ring in the filter housing and tighten to a torque of **40 Nm**. Do not tighten the cover too hard, the threads may crack, which can lead to leakage.

11 When the oil has run out fit the oil plug with a new gasket. Tighten to a maximum tightening torque of **55 Nm**.

NOTE

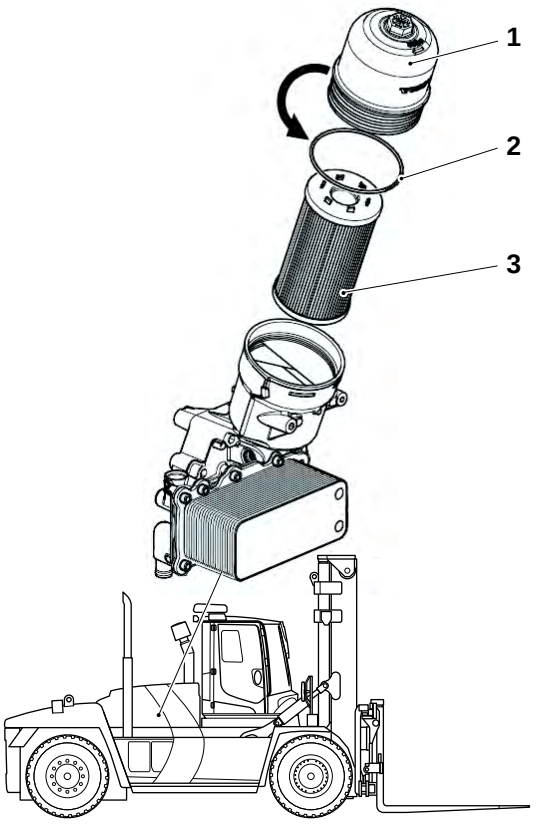
Do not tighten the oil plug with higher tightening torque, the threads will be damaged.

12 Fill with engine oil to the correct level. Do not fill over MAX-level.

For volume and quality, see section *F Technical data*.

13 Start the engine, let it idle. Check that the oil pressure is normal and that there is no leakage.

14 Switch off the engine, wait 5 minutes and check the oil level, see *Oil and oil filters, changing (engine alternative Volvo TAD871VE)*, page 1:63. Top up as needed.



1. Filter cover
2. O-ring
3. Filter insert

Oil and oil filter, changing (engine alternative Cummins QSB6.7)

NOTE

Read safety instructions for oil before starting work, see section B Safety.

NOTE

Always follow the recommended intervals for changing.

NOTE

Oil filters should be changed in connection with oil change.

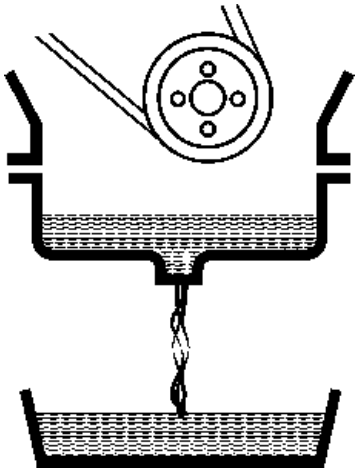
NOTE

Use a vessel for draining that has sufficient capacity for the amount of oil.

1 Run the engine until warm.

2 Machine in service position, see section *B Safety*.

3 Park the vehicle on a level surface.
Position a receptacle under the engine with sufficient capacity for all the oil



4 Remove the oil plug from the engine and drain the engine of oil.

5 When the oil has run out, fit the plug. Tighten to a torque in accordance with the table below:

Engine	Screw	Torque
Cummins QSB6.7 Stage 3A/Tier 3		max. 80 Nm
Cummins QSB6.7 Stage 4/Tier 4f	M18	max. 60 Nm
Cummins QSB6.7 Stage 4/Tier 4f	M22	max. 80 Nm

NOTE

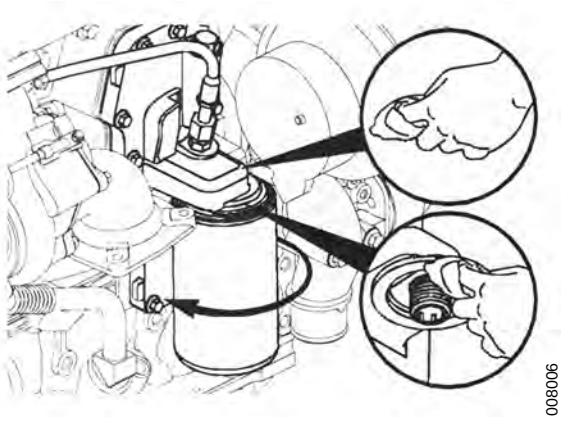
Do not tighten the oil plug with higher tightening torque, the threads will be damaged.

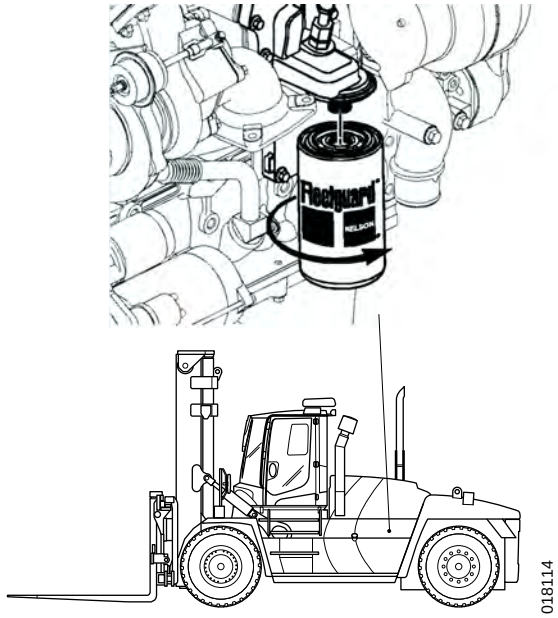
6 Clean the area around the oil filter.

7 Remove the oil filter with the filter tool.

8 Check that the contact surface on the filter bracket is clean.

9 Brush a little oil on the new filter's rubber gasket.





10 Spin on the filter by hand until the rubber gasket just touches the contact surface on the filter bracket.

Then turn a further 1/2 — 3/4 turns by hand.

11 Fill with engine oil to the correct level. For volume and quality, see section *F Technical data*.

NOTE

Do not fill over MAX-level.

12 Start the engine and let it idle. Check that the oil pressure is normal

13 Switch off the engine, wait 5 minutes and check the oil level, see *Oil level, check*, page 1:65, as well as the sealing integrity. Top up the oil as required.

Oil level, check

NOTE

Read safety instructions for oil before starting work, see section B Safety.

The engine's oil filling pipe and oil dipstick are located under the hood.

1 Machine in service position, see section *B Safety*.

2 Check the oil level when the engine has been warmed up. Wipe off the dipstick before checking.

The oil dipstick has two markings, MAX and MIN, between which the oil level should be.

NOTE

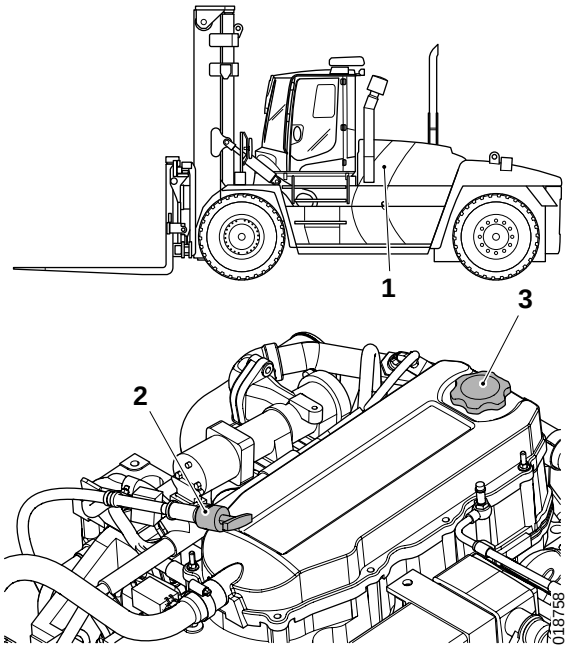
On certain machines the dipstick is long. Wear gloves.

3 Top up with new engine oil as required. For volume and quality, see section *F Technical data*.

4 Fill – wait 5 minutes – check on the dipstick.

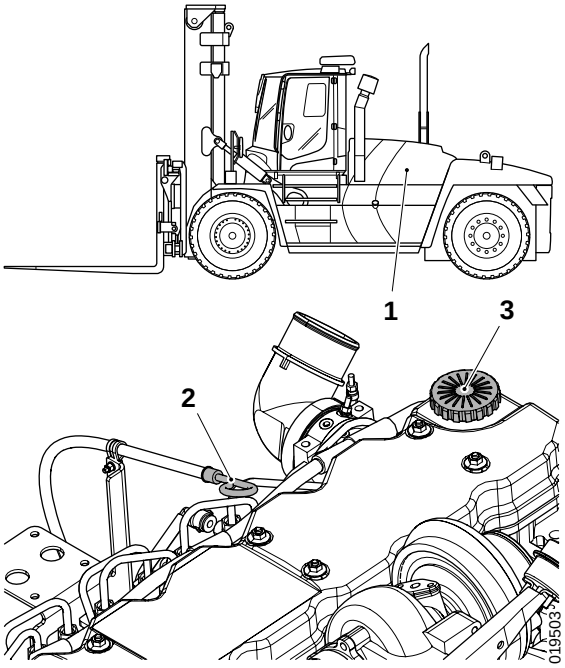
NOTE

Work carefully when filling to prevent other fluids or particles from contaminating the oil, which means risk of engine damage.



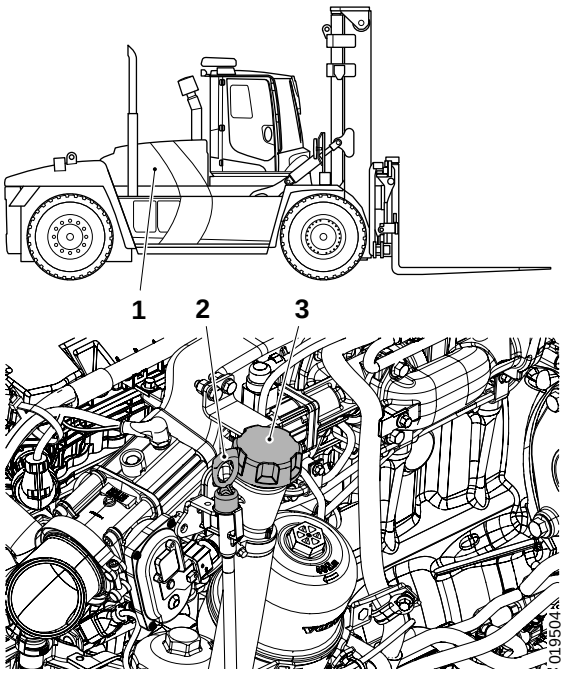
Cummins QSB6.7 Stage 4/Tier 4f

1. Location for filling and dipstick for engine oil
2. Dipstick
3. Oil filling



Cummins QSB6.7 Stage 3A/Tier 3

1. Location for filling and dipstick for engine oil
2. Dipstick
3. Oil filling



Volvo TAD871VE Stage 4/Tier 4f

1. Location for filling and dipstick for engine oil
2. Dipstick
3. Oil filling

Contents 2 Transmission

2 Transmission

Transmission locked in neutral position

The machine is equipped with a safety function that results in the transmission shifting to neutral position if the operator leaves the operator's station. The system uses the same switch in the driver's seat as the warning for released parking brake in order to sense when the operator leaves the operator's station.

If the buzzer sounds when the operator sits down in the seat and releases the parking brake, the switch in the seat may not be working. In which case, it is not possible to select any travel direction.

In an emergency situation, the machine can be operated by bypassing the safety system, see *Operator's manual*.

WARNING

Safety interlocks blocked.

No safety system is engaged! Risk of tipping and rolling over!

Only use bypassing in emergency situations!

1 Release the load.
2 Activate switch for bypassing.
3 Select travel direction.
4 Drive the machine to service. Speed is limited to 10 km/h.

2.2 Torque converter/Clutch system

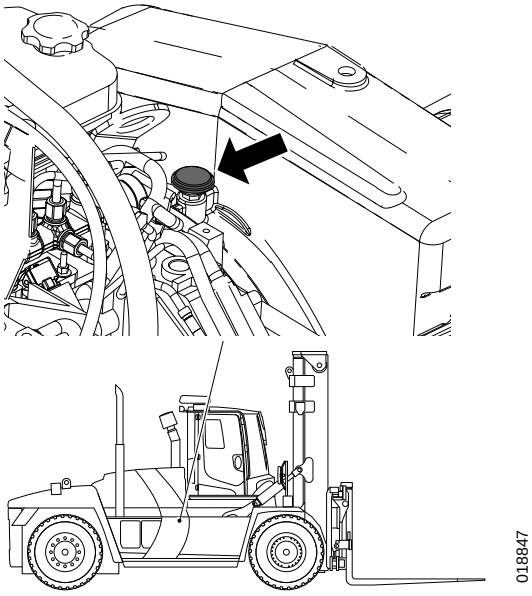
Breather filter, cleaning

1 Machine in service position, see section *B Safety*.

2 Disconnect the breather filter from the transmission.

3 Clean the breather filter from dirt.

4 Refit the breather filter.



Breather filter, on top of torque converter.

2.6 Lubrication system

Oil and oil filter transmission, changing

NOTE

Read safety instructions for oil before starting work, see section B Safety.

NOTE

Do not over-fill the transmission!

1 Operate and warm up the transmission oil.

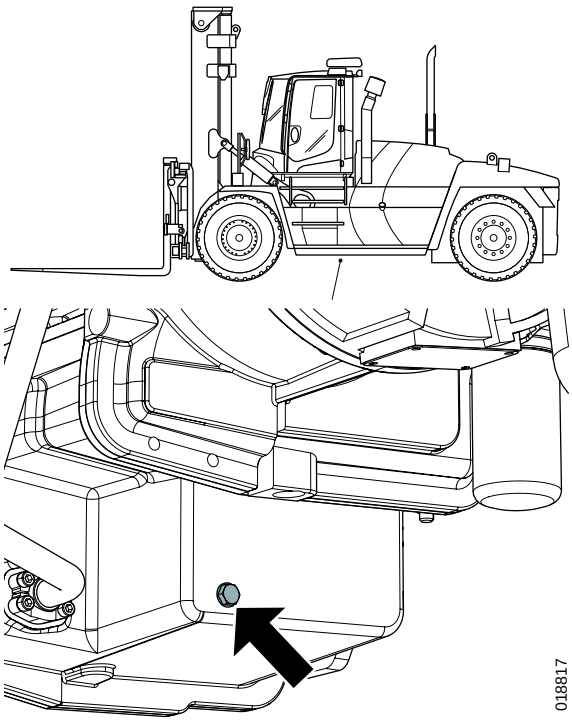
2 Machine in service position, see section *B Safety*.

3 Place a container under the transmission.

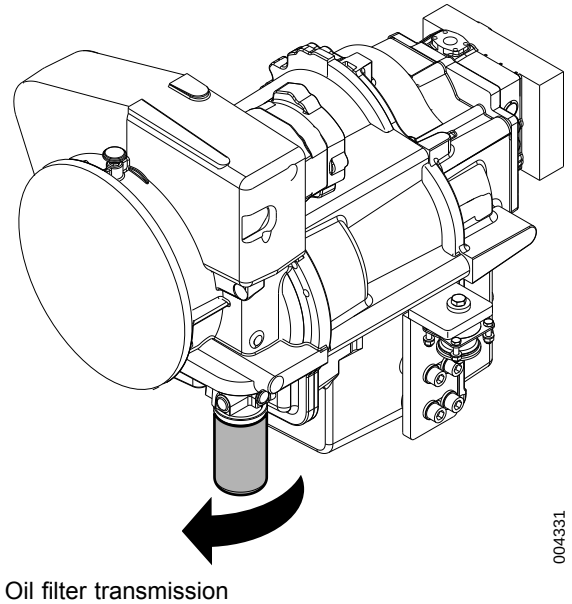
4 Remove the drain plug for transmission oil and let the oil drain into the receptacle.

NOTE

Make sure that the drain plug's washer seal is also removed.



Draining transmission oil



Oil filter transmission

5 Clean the area around the oil filter.

6 Change oil filter.

Lubricate the O-ring on the new oil filter with transmission oil. Tighten to contact and then another two-thirds of a turn.

7 When the transmission oil has drained, fit the drain plug.

NOTE

Make sure that the drain plug's washer seal is also removed.

8 Fill new transmission oil through the oil filling hole to the marking for low level on the oil dipstick.

For volume and quality, see section *F Technical data*.

9 Switch on the main current and start the engine and allow the engine to idle for at least two minutes.

10 Check that the drain plug for transmission oil seals tightly.

11 Check the transmission oil level with the engine running at idle and top up to the marking for low level.

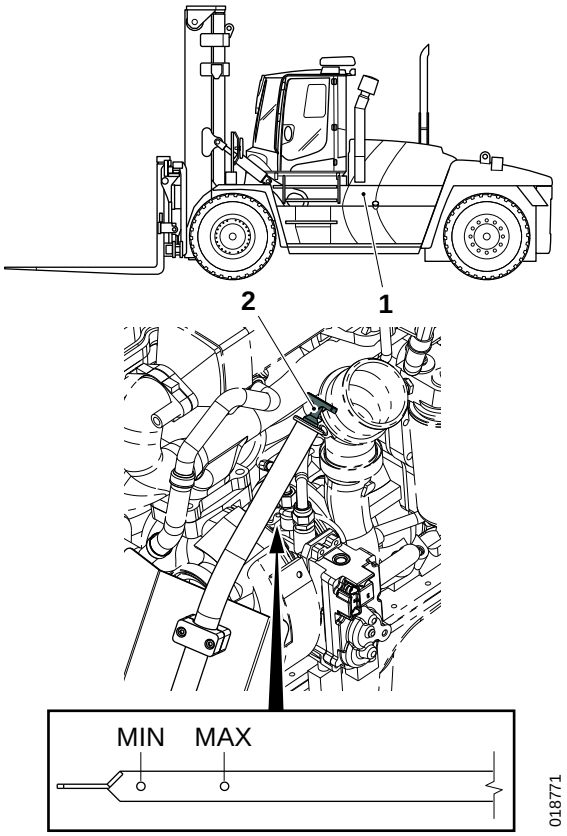
12 Check the oil level, see *Oil level, check*, page 2:6.

13 Calibrate the transmission, see *Transmission, calibration*, page 2:7.

Oil level, check

NOTE

Read safety instructions for oil before starting work, see section B Safety.



1. Position for filling and level checking
2. Transmission oil dipstick and filling

1 Check the oil level with the engine at idle and transmission in neutral position. The oil dipstick has two markings, MAX and MIN, the oil level should be at MAX.

Wipe off the dipstick before checking.

NOTE

The oil dipstick is long. Wear gloves.

2 Fill - wait awhile - check on the oil dipstick.

NOTE

Work carefully when filling transmission oil to prevent other fluids or particles from contaminating the oil, which means risk of transmission damage.

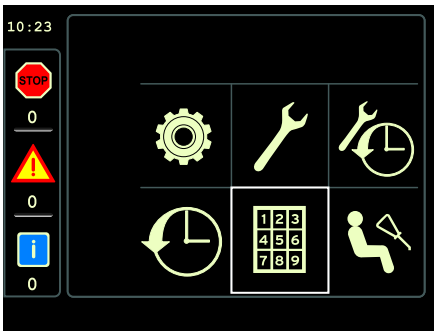
2.8 Control system transmission

Transmission, calibration

DANGER

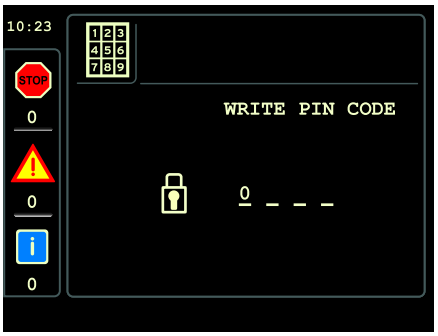
Do not leave the machine during calibration. The machine may start to move.

1 Check the transmission oil level, see .



014981

2 In order to select the function to calibrate, navigate first to the menu for service and settings with ◀ or ▶ and confirm with ○.

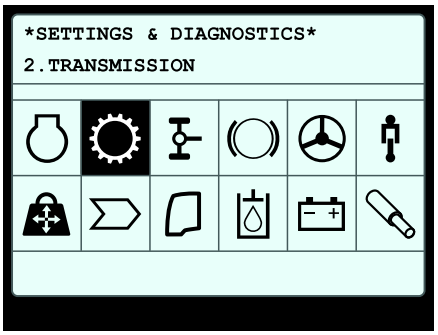


015625

3 Enter diagnostic code 1111, with ▲ or ▼. Confirm each digit with ○.

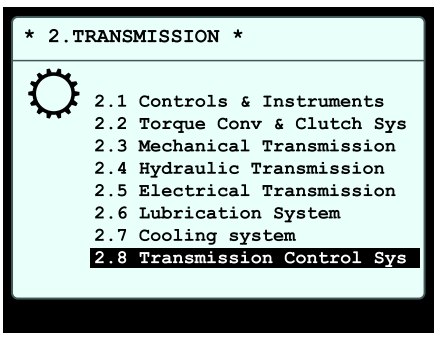
NOTE

The code determines which service menus are activated.



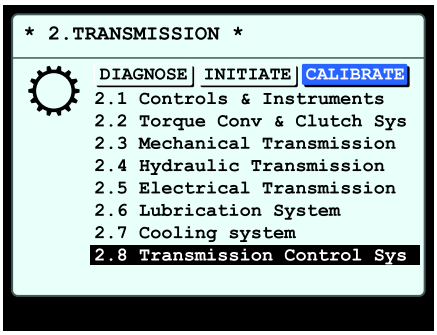
015623

4 Select 2. TRANSMISSION by scrolling with ◀ or ▶ and confirm with ○.



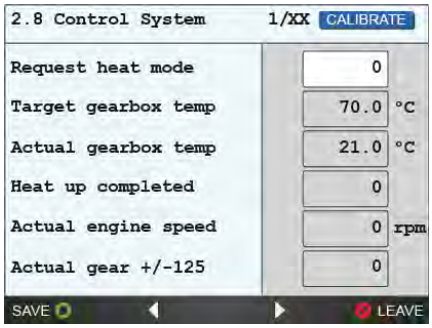
015627

5 Select 2.8 Transmission Control Sys by scrolling with ▲ or ▼ and confirm with ○.



015626

6 Select CALIBRATE by scrolling with ◀ or ▶ and confirm with ○.



7 2.8 Request Heat mode is a function for heating the transmission when the machine is stationary by braking the machine and allowing the converter to heat the transmission oil.

Request heat mode

Status for heating.

0. Heating not in progress.

1. Heating in progress.

Target gearbox temperature

Indicates the lowest temperature the transmission should maintain during calibration.

Actual gearbox temperature

Indicates the current temperature.

Heat up completed

Specifies whether the heating is completed.

0. Heating required.

1. Heating completed.

Actual engine speed

Current engine speed.

Actual gear

Specifies the gear that is activated -3 – +3. 0 indicates transmission in neutral while + before gear value indicates forward and - indicates backward.

8 If necessary, increase the oil temperature in the transmission as follows:

A. Start Gearbox heat mode by pressing ○.

B. Move the gear selector to neutral without depressing the brake pedal. The parking brake is then still active.

C. Select direction of travel forward or backward and apply half to full throttle for 30 seconds.

D. Engage neutral position and apply half throttle for 15 seconds, run the engine at idle.

E. Repeat steps C and D until the oil is warm.

When the temperature is correct Heat up completed changes from 0 to 1.

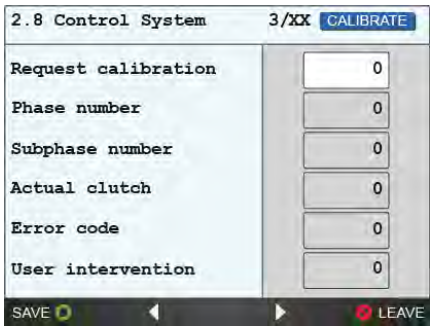
NOTE

During this warming-up procedure, it is possible that the temperature out from the converter exceeds the limit value. This is a result of heating the transmission using this rapid procedure.

Set the transmission in neutral and rev the engine to approx. 1300 rpm for about one minute in order to cool the transmission. This means that the heat in the converter can be evacuated.

After one or two minutes the warming-up procedure can be resumed, if the transmission temperature has not yet reached 70 °C.

9 Select Gearbox Calibration 3/XX by pressing ▶.



10 2.8 Request Calibration is a function to calibrate the transmission.

Request calibration

Status for calibration.

0. Calibration not in progress.

1. Calibration in progress.

Phase number

Indicates current phase in the calibration, see Table Table *Phase number (Phase number)*, page 2:10.

Subphase number

Cycle counter for current phase. When the counter counts up, this indicates that the calibration is in progress.

Actual clutch

Indicates which clutch is being calibrated, see Table Table *Clutch (Actual clutch)*, page 2:10.

Error code

Indicates active error codes for the transmission, see *Workshop manual* for an explanation of the error codes.

If there is more than one error code then they are shown in a rotating list, scroll through the list using ◀ or ▶.

Actual engine speed

Current engine speed.

11 Activate the parking brake. Start calibration by pressing ○. Request operation changes the digit 0 to 1 and calibration starts.

The transmission will activate all gears during calibration.

NOTE

If the machine starts to move during calibration then use the footbrake to keep the machine stationary.

⚠ DANGER

It is forbidden to leave the operator's station until calibration is complete.

Fatal danger!

The machine may start to move and you must be prepared to immediately stop calibration or brake the machine.

IMPORTANT

Calibration can be cancelled at any time by moving the gear selector to the opposite travel direction, exiting the menu, releasing the parking brake or switching off the machine. The transmission control unit will then be reset and ignore the calibration results obtained thus far.

- If calibration is performed without problems then the display shows Phase number (Phase number) = 4, which means that the calibration is finished, see Table Table *Phase number (Phase number)*, page 2:10.
- If an error is identified during calibration then the display shows a Phase number (Phase number) with a single number, see Table Table *Phase number (Phase number)*, page 2:10.

Table Phase number (Phase number)

0	Pre-filling of clutches.
1	Calibration of clutches.
2	Calibration of pressure against torque.
3	Calibration of pressure against current.
4	Calibration complete.
5	Calibration incorrect.
6	Calibration paused.

Table Clutch (Actual clutch)

1	Clutch forwards.
2	Clutch backwards.
3	Clutch gear 1.
4	Clutch gear 2.
5	Clutch gear 3.
6	Clutch gear 4.

12 When the engine speed decreases to idling and Phase number (Phase number) = 4 then calibration is complete.

13 Switch off the ignition with the ignition key lock and leave the ignition switched off for at least 30 seconds in order to store the values.

Contents 3 Driveline/Axle

3 Driveline/Axle

3.2 Propeller shaft

Propeller shaft, checking


Grease nipple for universal joint, example

1 Clean the area around the universal joints.
2 Check clearance in universal joints.
3 Grease universal joints with universal grease EP2.
4 Check-tighten the retaining bolts at the mountings for the drive axle and transmission to **115 Nm** (oiled screw).

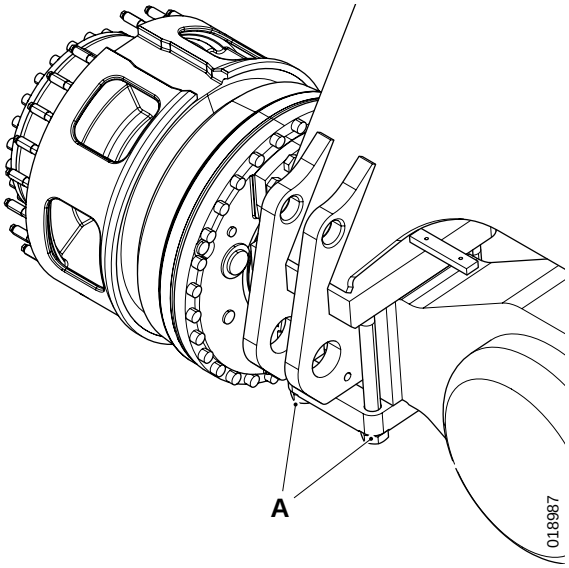
3.3 Drive axle

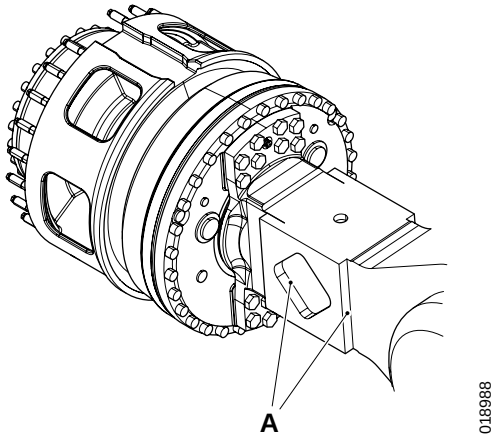
Drive axle, check (DCG 180-250)

1 Machine in service position, see section *B Safety*.

2 Check the drive axle's attachment to the frame so that there is no corrosion on structural elements (e.g., attaching bolts).

3 Check-tighten the drive axle's attaching bolts (position A) to **1380 Nm**.





4 Visually inspect the drive axle's welding seams (position A) at the mountings.

5 Check that the drive axles and hub reductions are sealed. Listen for noise.

6 Check the bolted joint to the parking brake caliper's attaching plate and brake disc.

7 Check whether the drive axle's wheel bearings have play by means of the following:

- Lift the machine under the mast beam. Support under the drive axle in a secure way.
- Check whether the drive axle's wheel bearings have play. Loose bearings should be adjusted, see the *Workshop Manual*.

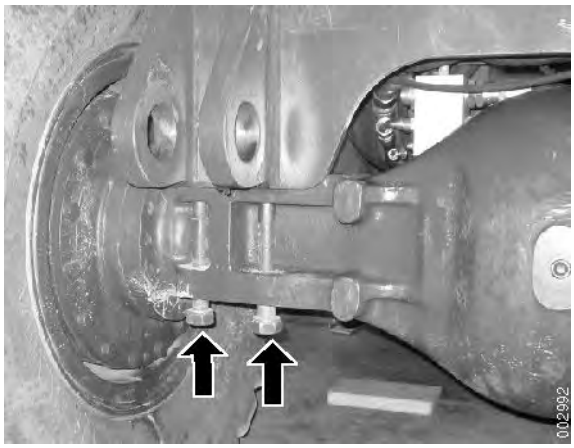
Drive axle, check (DCG 280-330)

1 Check the drive axle's attachment to the frame so that there is no corrosion on structural elements (e.g., attaching bolts).

2 Check-tighten the drive axle's attaching bolts to **1380 Nm** (oiled screw).

3 Check the bolted joint to the parking brake caliper's attaching plate and brake disc.

4 Check that drive axle seals tight.



Attaching bolts drive axle

Drive axle oil, change (DCG 180–250)

NOTE

Read safety instructions for oil before starting work, see section B Safety.

Equipment: Receptacle (30 l).

1 Position the machine so that the hub reductions' drain plugs at the wheels are in the lowest position.

Wheel 1: move forwards or backwards to obtain the correct position.

Wheel 2: lift the wheel from the ground (raise the machine under the drive axle) and rotate the wheel into the correct position. Lower the wheel.

2 Turn off the engine and apply the parking brake.

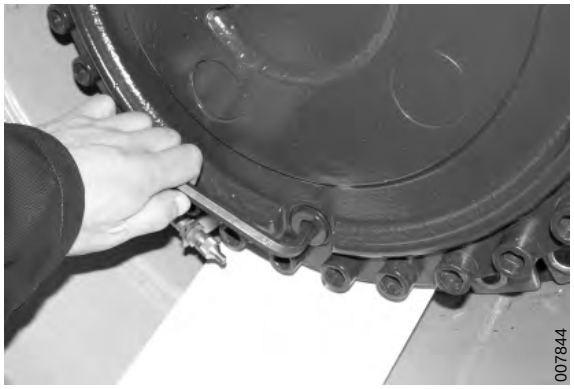
3 Place a receptacle under the differential carrier's drain plug.

NOTE

The drive axle has a capacity of approx. 44 l oil.

4 Remove the differential carrier's drain plug.

5 Position a receptacle by each hub. Position a piece of sheet metal or similar in the wheel rim to lead oil into the receptacle.



6 Remove the drain plug and the level plug.

7 Repeat steps 5 and 6 on the other hub.

8 When the oil has drained, fit the drain plugs.

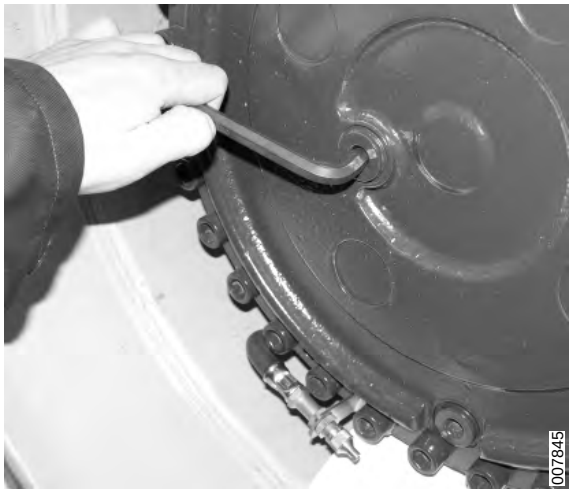
NOTE

Make sure that the sealing washers are fitted in place.

9 Fill one hub with oil until the oil level is at the lower edge of the filler hole.

NOTE

The oil is very viscous, fill the oil slowly. Check the level in stages so that the oil has time to settle.

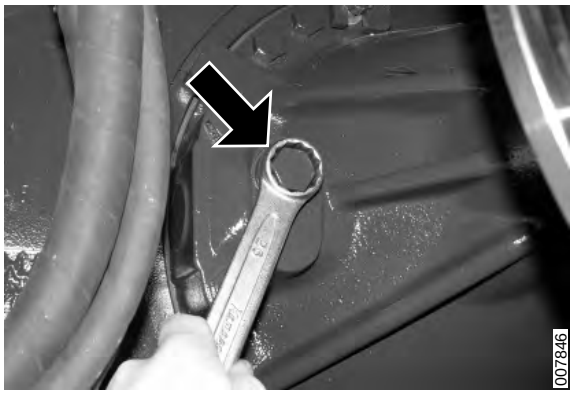


10 Fit the hub reduction's filler plug.

NOTE

Make sure that the sealing washer is fitted in place.

11 Repeat steps 9 and 10 on the other hub.



12 Remove the filler plug for the differential carrier.

13 Fill the differential with new oil until the oil is level with the filler hole.

14 Fit the differential carrier's filler plug.

NOTE

Make sure that the sealing washer is fitted in place.

15 Remove and clean the drive axle's ventilation.

16 Clean the axle from oil spillage.

17 Remove the receptacles and pieces of sheet metal. Handle the oil as environmentally hazardous waste.

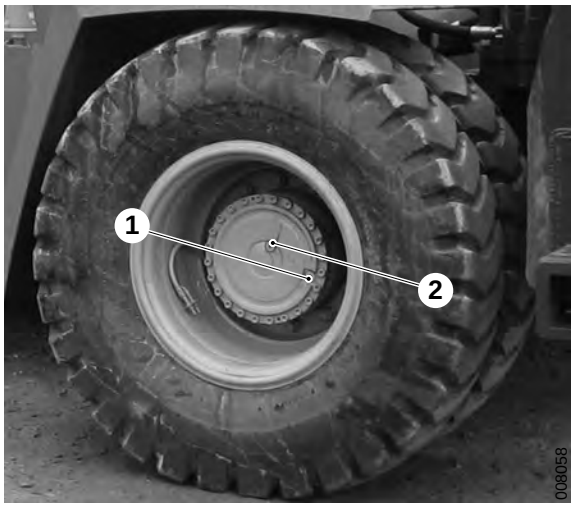
18 Test drive the machine for a short distance without load.

19 Check the oil level in hubs and differential carrier assembly.

Drive axle oil, change (DCG 280–330)

NOTE

Read safety instructions for oil before starting work, see section B Safety.



Wheel hub, drive axle

1. Drain plug hub
2. Level and filling plug hub

1 Position the machine so that the hub reductions' drain plugs at the wheels are in the lowest position.

This applies to both drive wheels.

Wheel 1: move forwards or backwards to obtain the correct position.

Wheel 2: lift the wheel from the ground (raise the machine under the mast) and rotate the wheel into the correct position. Lower the machine.

2 Machine in service position, see section *B Safety*.

3 Position a receptacle by each hub. Position a piece of sheet metal or similar in the wheel rim to lead oil into the receptacle.

4 Remove the drain plugs for the hubs (position 1) on both sides. Also remove the level and filling plugs for the hubs (position 2) to facilitate draining.

Both sides shall be drained separately.

Differential drive axle

5 Position a receptacle under the differential carrier and remove the drain plug.

6 Install the drain plugs on the hubs and the differential.

NOTE

Check that the seals are intact, clean and in the correct position.

7 Fill oil in the hubs until the oil level is flush with the filling and level holes. For volume and quality, see section *F Technical data*.

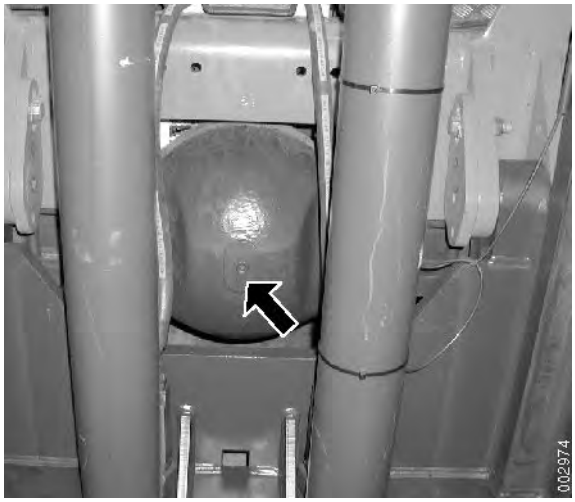
NOTE

The oil is very viscous, fill the oil slowly. Check the level in stages so that the oil has time to settle.

8 Install the hubs' level and filler plugs.

NOTE

Check that the seals are intact, clean and in the correct position.



9 Fill oil in the differential until the oil level is flush with the filler and level hole.

10 Install the level and filler plug on the differential.

NOTE

Check that the seal is intact, clean and in the correct position.

11 Turn on the system voltage.

12 Check the oil level in the drive axle after a short test-run.

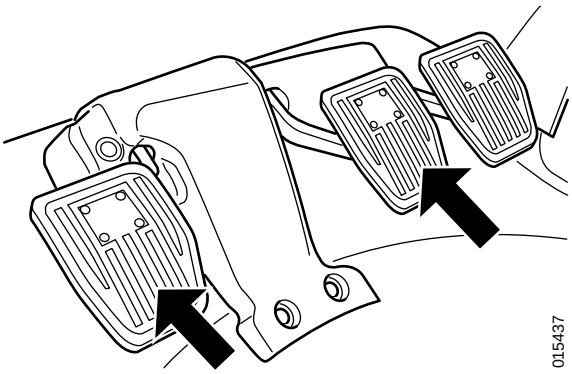
Contents 4 Brakes

4 Brakes

4.1 Controls and instruments

4.1.1 Brake pedal

Brake pedal, checking



1 Clean the floor around the brake pedal and check that nothing blocks movement of the brake pedal.

2 Check that the pedal travels smoothly and springs back properly.

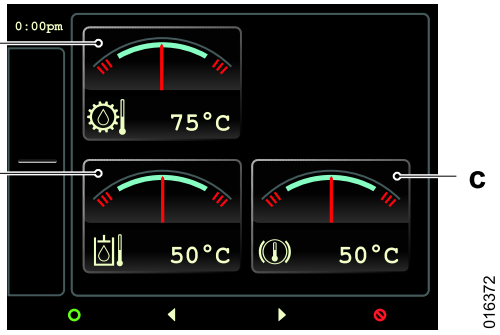
3 Check that the rubber on the pedal is intact and that the tread pattern isn't worn out. Change when needed.

NOTE

Check both the pedals.

4.3 Power-assisted brake system

Power-assisted brake system, check



Operating menu transmission and hydraulic system

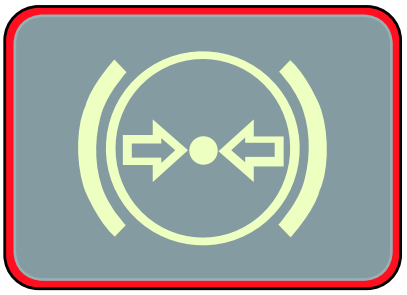
a. Oil temperature transmission
b. Oil temperature hydraulic system
c. Oil temperature brake system ⊕

1 Operate and warm up the machine so that the oil in the brake system reaches operating temperature, at least 50 °C.

Use the operating menus transmission and hydraulics to check the oil temperature.

Accumulator

2 Park the machine and allow the engine to run at idling speed for approx. 1 minute (until the accumulator charging valve switches to cooling).



Event menu, low accumulator pressure

3 Turn off the engine and turn the start key to position I.

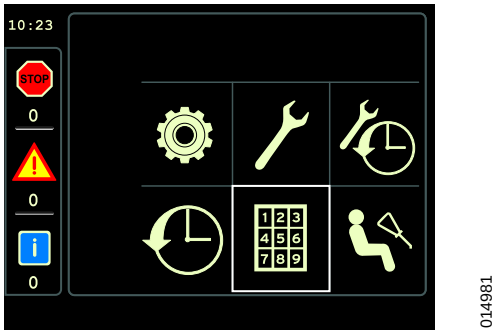
4 Apply and release the brake several times, and count the number of times that the brake can be applied before the event menu for low accumulator pressure is shown.

It should be possible to apply the brake at least 8 times before the event menu is shown.

If the event menu is illuminated earlier then check accumulators, accumulator charging valve and the oil pump brake system, see *Workshop manual*.

Brake pressure

5 Start the engine.

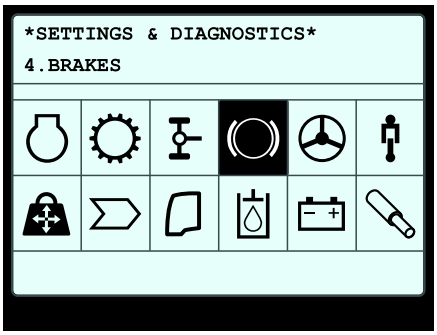


6 Navigate to the menu for service and settings with ◀ or ▶ and confirm with ○.

7 Enter diagnostic code 1111 ▲ or ▼. Confirm each digit with ○.

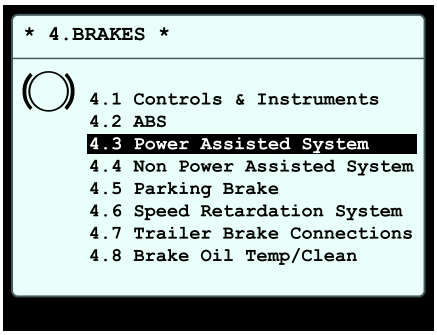
NOTE

The code determines which service menus are activated.



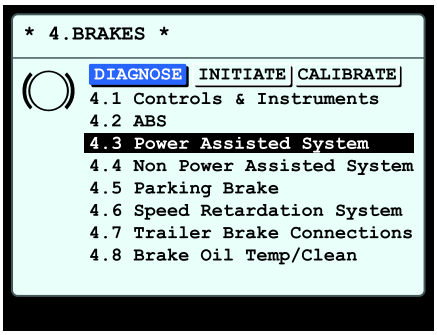
016946

8 Select 4. Brakes by scrolling with ◀ or ▶ and confirm with ○.



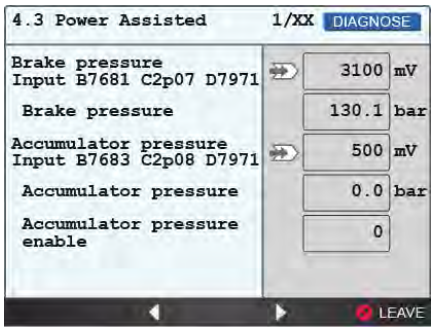
016947

9 Select 4.3 Power Assisted System by scrolling with ▲ or ▼ and confirm with ○.

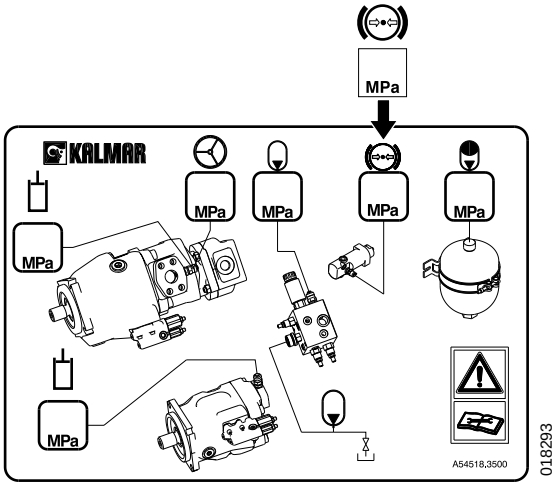


016948

10 Select DIAGNOSE by scrolling with ◀ or ▶ and confirm with ○.



11 Select 4.3 Power Assisted 1 by scrolling with ◀ or ▶.



Pressure plate, brake pressure

12 Fully depress the brake pedal and read the pressure, Brake Pressure. Compare with the permissible pressure on the pressure plate.

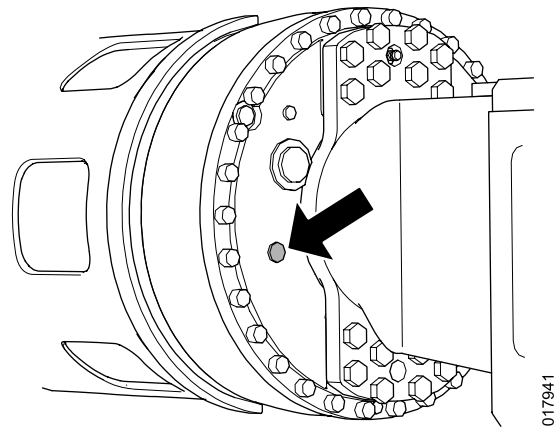
If the pressure is not correct, check the hydraulic oil pump brake system and accumulator charging valve, see *Workshop manual*.

13 Release the pedal. The brake pressure should go down to 0 MPa directly.

If the pressure does not go down to 0 MPa directly, check the brake pedal, see *Brake pedal, checking*, page 4:3. If the fault persists, check the brake valve, see *Workshop manual*.

4.3.9 Wheel brake

Wheel brake, wear checking (DCG 180–250)



Check hole for wear measurement, Kessler D102

1 Machine in service position, see section *B Safety*.

2 Clean the area around the plug for the check hole for wear measurement on the drive axle.

3 Remove the plug for the check hole.

4 Measure the distance from the edge of the brake housing to the end surface of the plunger through the hole. Note the measurement with released brake.

5 Apply the brake and measure the distance from the edge of the brake housing to the end surface of the plunger. Note the measurement with applied brake.

6 Compare the measurements between released and applied brake, the difference must be **max. 2 mm**.

If the difference is greater, then the brake discs must be replaced. *See supplier information for the drive axle.*

WARNING

If the wear limit has been passed then the brakes stop working.

Risk of personal injury or product damage.

If the wear limit has been passed then the brake discs must be replaced before the machine is put into service.

7 Refit the plug.

8 Repeat steps 2 - 8 for the other brake.

4.5 Parking brake system

4.5.4 Parking brake unit

Parking brake unit, checking and adjusting

DANGER

The machine may start to roll.

Risk of crushing.

Block the wheels so that the machine cannot start to roll when the parking brake is released.

1 Start the engine and run up hydraulic pressure until the accumulators are fully charged and the accumulator charging valve switches to cooling.

2 Turn off the engine and turn the start key to position I.

3 Release the parking brake.

The parking brake is applied by spring force and is released with accumulator pressure that is controlled electrically by a solenoid valve.

4 Check that the parking brake caliper can move on the bracket.

5 Check that the brake disc is free from oil and dirt.

6 Remove the cover from the brake caliper.

Check that there is no oil inside the cover.

7 Loosen the lock nut.

8 Adjust the adjustment screw so that the brakes are applied.

9 Turn back the adjusting screw so that the clearance between pad and disc becomes 0.5±0.1 mm.

10 Tighten the lock nut.

NOTE

To avoid turning the adjustment screw as well, it must be held still when tightening the lock nut.

11 Refit the cover on the caliper.

12 Check the function of the parking brake.

4.5.4.2 Parking brake pads

Brake pads, replacement

DANGER

The machine may start to roll.

Risk of crushing.

Block the wheels so that the machine cannot start to roll when the parking brake is released.

1 Machine in service position and wheels blocked, see section *B Safety*.

2 Remove the cover from the brake caliper.

3 Loosen the lock nut.

4 Loosen the adjusting screw so that the brake pads become loose.

5 Remove the split pin and loosen the nut on the attaching bolt holding the parking brake caliper.

6 Pull out the attaching bolt so that the brake pads can be twisted out and removed.

NOTE

The bolt does not have to be removed.

7 Remove the parking brake pads.

8 Clean the brake disc with methylated spirit.

9 Fit the new parking brake pads.

10 Press back the attaching bolt.

11 Fit the nut and fit a new split pin.

12 Adjust the parking brake, see *Parking brake unit, checking and adjusting*, page 4:7.

4.8 Temperature control, cleaning and oil brake system

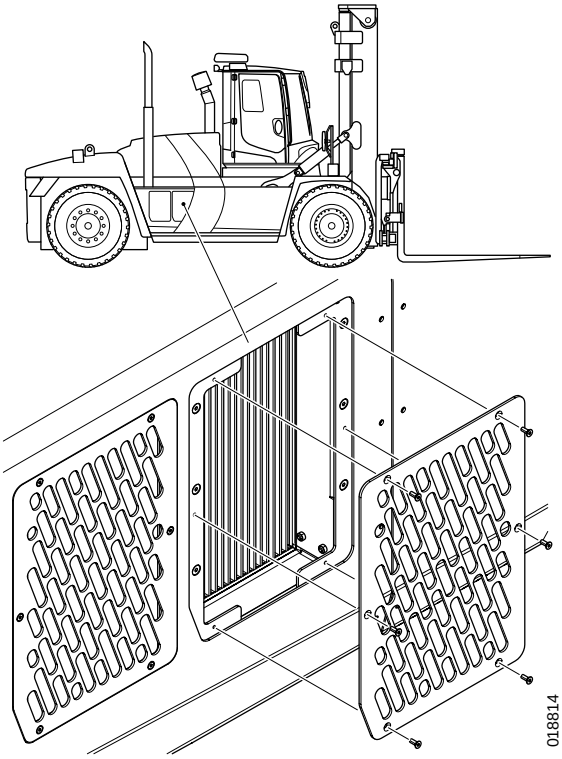
4.8.7 Oil cooler

Oil cooler, cleaning

⊕

1 Machine in service position, see section *B Safety*.

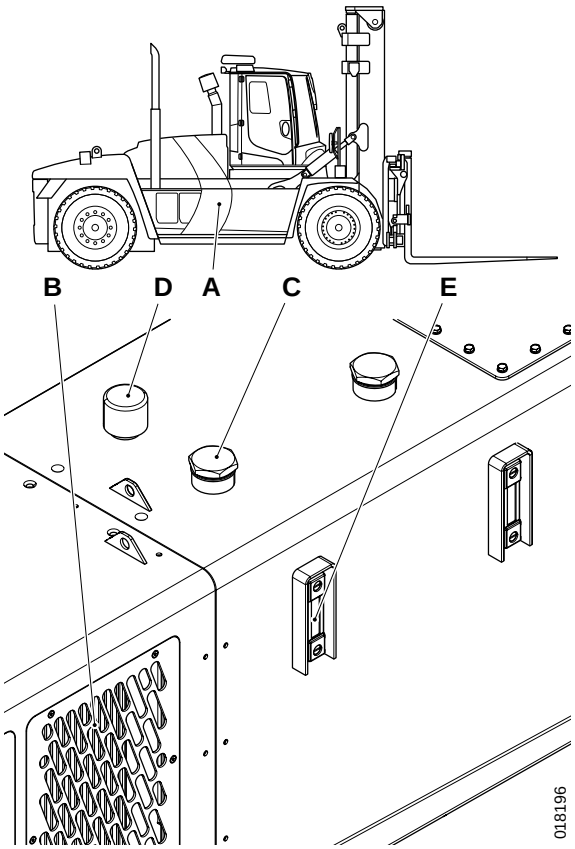
2 Clean the hydraulic oil cooler with compressed air.
Blow away dust and other loose dirt.



Machine with common hydraulic oil tank

4.8.11 Breather filter

Breather filter, changing



A. Oil tank for brake system
B. Oil cooler
C. Filling point
D. Breather filter
E. Sight glass, oil tank

⊞

1 Clean the area around the brake tank's breather filter.
2 Remove the cover from the filter holder.
Remove the bolt in the middle and lift away the cover.
3 Remove the old filter insert.
4 Clean the filter holder.

NOTE

Work carefully so that contaminants do not enter the tank.

5 Fit a new filter insert.
6 Reinstall the cover on the filter holder.

4.8.12 Oil filter, brake system

Oil filter brake system, changing

⊞

See *Hydraulic oil filter (high-pressure filter), changing*, page 10:10.

4.8.14 Oil for brake system

Brake system oil, changing

⊞

NOTE

Read safety instructions for oil before starting work, see section B Safety.

1 Machine in service position, see section *B Safety*.

2 Depressurise the hydraulic and brake systems, see section *B Safety*.

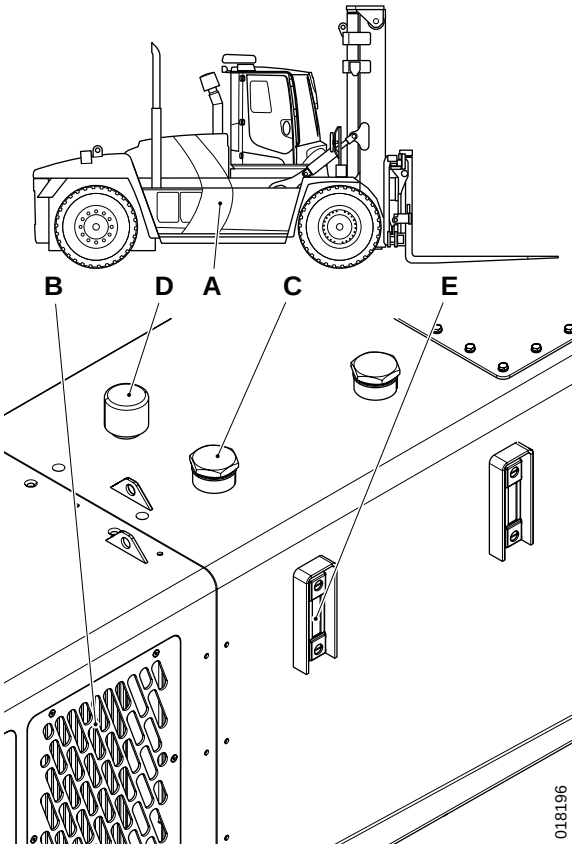
3 Remove the filler cap and drain the brake system's oil tank.

4 Remove the drain plug and let the last of the oil drain into a receptacle.

5 Fit the drain plug, use a new sealing washer.

6 Fill with oil until the oil level is in the centre of the sight glass. For volume and quality, see section *F Technical data*.

7 Fit the filler cap.



A. Oil tank for brake system

B. Oil cooler

C. Filling point

D. Breather filter

E. Sight glass, oil tank

Contents 5 Steering

5 Steering

5.2 Power assisted system

5.2.6 Link arm

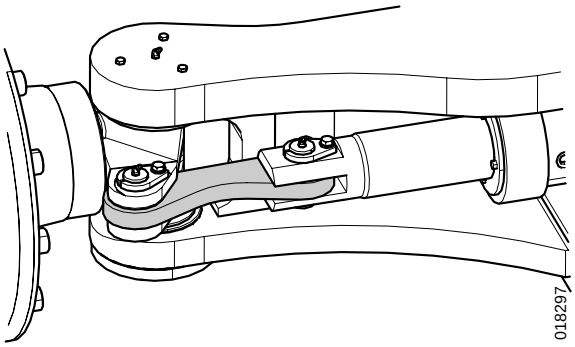
Bearing in link arm, checking (DCG 180–250)

1 Machine in service position, see section *B Safety*, with wheels.

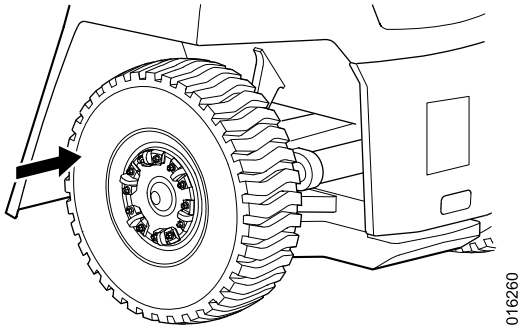
2 Lift the machine under the steering axle.

3 Check clearance in wheel hub, see *Wheel hub, checking*, page 6:4.

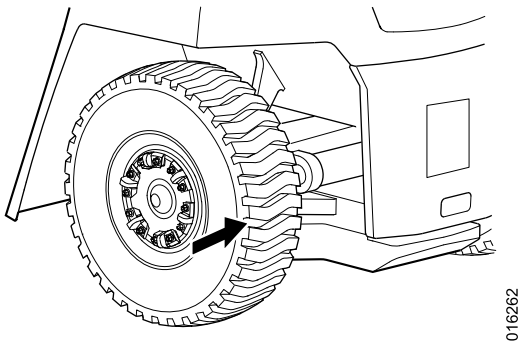
4 Check for play in the link arm's bearings between link arm and steering cylinder, and between link arm and wheel spindle while the wheel is being moved by hand, see steps 5 and 6.



Link arm

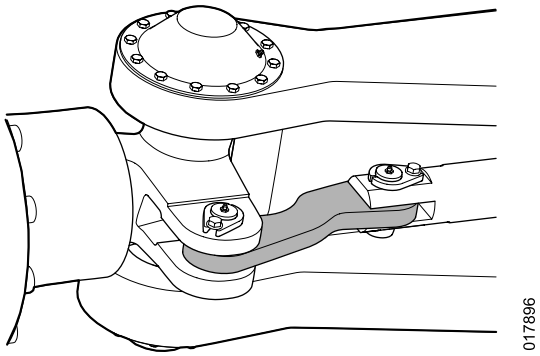


5 Press inward on the wheel's front section.



6 Press inward on the wheel's rear section.

7 If play can be felt then the link arm's bearing must be replaced, see *Workshop manual*.



Link arm

Bearing in link arm, checking (DCG 280–330)

DANGER

It is forbidden for any part of the body to remain within the movement range of the steering wheels while the machine is operating.

Fatal danger!

It is not possible to observe the movement of the steering wheels or personnel standing next to them from the operator's station. During steering wheel movement with the engine running, the wheels are turned with great force and the deflection can be large and rapid.

1 Machine parked on a level surface with the engine idling, gear in neutral position and parking brake applied.

2 Two people are required, one to turn the steering wheel and one to check the link arms during steering deflection.

3 Stand a safe distance from the movement range of the steering wheel in question. Look and listen for signs of play in the link arm's bearings while the wheels are being turned.

It is easiest to detect any play during changes in deflection. Turn the wheel to an end position where the link arm is most visible from the outside and make small deflections forward and back.

4 Repeat step 3 on the other steering wheel.

5 If signs of play are visible or audible then the link arm's bearings must be replaced, see *Workshop manual*.

5.2.11 Sensor steering wheel angle

Sensor steering wheel angle, checking

⊞ (product option mini-wheel or joystick control)

1 Check that the joystick control and mini-wheel disconnect when the steering wheel is turned.

Contents 6 Suspension

6 Suspension

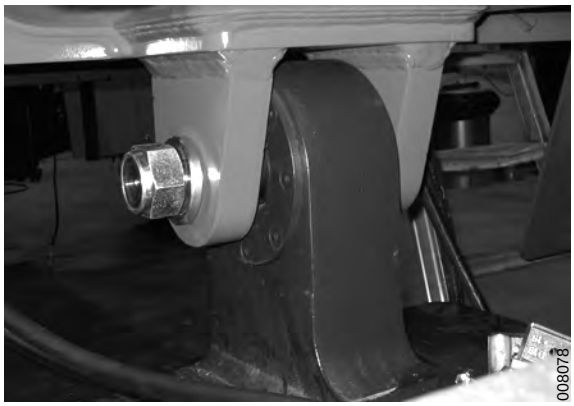
6.2 Suspension

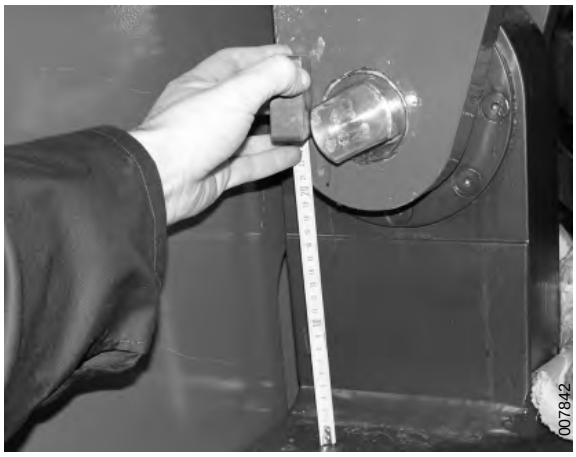
6.2.1 Steering axle cradle

Steering axle cradle, checking

1 Machine in service position, see section *B Safety*, with transverse wheels.

2 Check that the bushings in the suspension are intact.





The figure shows front mounting

3 Measure the distance between the frame and the steering axle cradle. Note the measurement.

4 Lift the machine under the rear counterweight.

NOTE

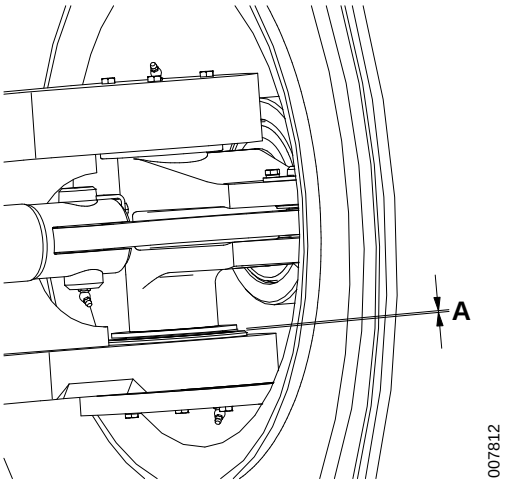
Do not lift under the steering axle.

5 Again, measure the distance between the frame and the steering axle cradle. Note the measurement.

6 Calculate the difference between the two measurements. The difference may be max. 3 mm. If the difference is greater, the bushing must be replaced.

6.2.2 Wheel spindle

Wheel spindle bearing, checking (DCG 180–250)



1 Machine in service position, see section *B Safety*, with transverse wheels.

2 Measure dimension **A** with a feeler gauge. Note the measurement.

3 Lift the machine under the rear counterweight.

4 Re-measure measurement **A**.

5 Calculate the difference between the two measurements. The difference must be max. 0.25 mm.

If the difference is greater, shimming must be repeated, see *Workshop manual*.

Wheel spindle bearing, checking (DCG 280–330)

1 Machine in service position, see section *B Safety*.

2 Lift and lower the machine under the steering axle with a jack at the wheel in question and check that there is no clearance in the spindle joint.

6.2.3 Wheel hub

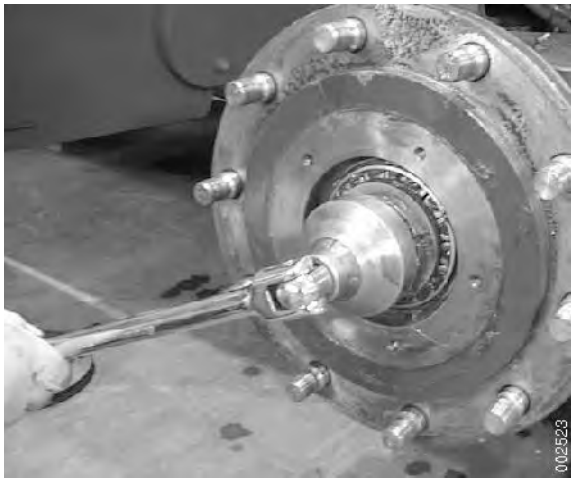
Wheel hub, checking

1 Clean the hub covers on the control wheels.

2 Remove the hub cover.

3 Wipe away grease from hub cover and outer KM nut. Handle as environmentally hazardous waste.

4 Bend up the locking washer's tabs.



5 Remove the outer KM nut and locking washer.

6 Check that the inner KM nut is tightened to a torque of at least **200 Nm** (DCG 180–250)/**500 Nm** (DCG 280–330).

- If the torque is correct, continue in accordance with point 8.
- If the torque is not correct, continue in accordance with point 7.

7 Tighten the inner KM nut in the following steps:

a) Tighten the inner KM nut at the same time as turning the hub.

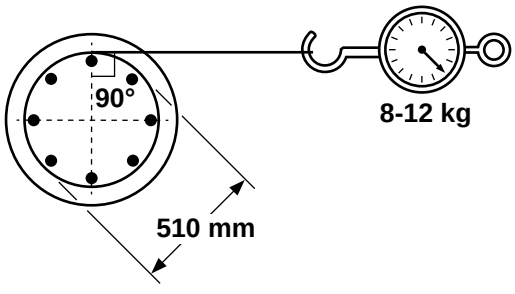
Tighten to a torque of **200 Nm** (DCG 180–250)/**500 Nm** (DCG 280–330).

b) Rotate the hub at least 10 revolutions.

c) Retighten the inner KM nut to a torque of **200 Nm** (DCG 180–250)/**500 Nm** (DCG 280–330) and rotate the hub a number of turns.

d) Retighten the inner KM nut one last time to a torque of **200 Nm** (DCG 180–250)/**500 Nm** (DCG 280–330).

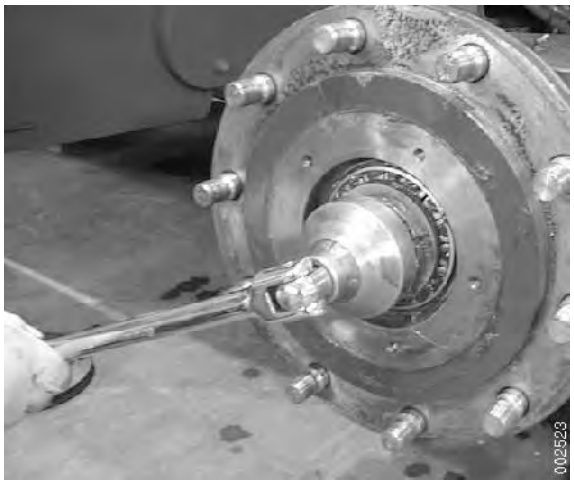
The hub should now be sluggish to rotate.



e) Check the friction torque in accordance with the following:

- Wind a wire around the wheel nuts a couple of times before the wheel is fitted and pull with a spring balance.
- Read from the spring balance when the hub begins to rotate.

The friction torque should be between **20-30 Nm**, which is obtained when the spring balance shows between **8-12 kg**.



8 Fit the outer KM nut and locking washer in the following steps:

a) Fit the locking washer. Check whether a tab fits into one of the grooves on the inner KM nut. If not, adjust the position of the inner KM nut so that the locking washer's tab fits into a groove.

b) Lubricate the thread of the outer KM nut with oil (SAE 80W/140), as well as its smooth surface, which shall be fitted against the locking washer.

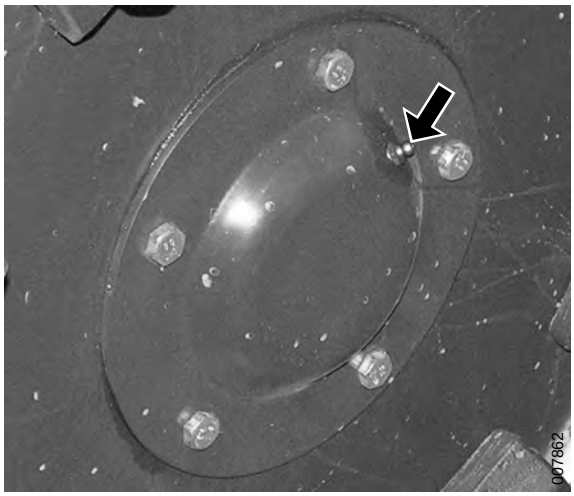
c) Tighten the outer KM nut closely but loose so that the locking washer is clamped between the nuts.

d) Bend the locking washer's tab in the groove on the inner KM nut.

e) Tighten the outer KM nut to at least **200 Nm** (DCG 180–250)/**250 Nm** (DCG 280–330) or as hard as required to engage the locking washer in the closest groove.

f) Bend the locking washer's tab in the groove on the outer KM nut.

9 Fit the gasket and hub cover.



10 Fill the hub cover with grease and fit it.

11 Grease the wheel bearing with grease through the grease nipple.

Rotate the hub to distribute the grease. Lift the seal ring's lip with a small screwdriver to facilitate pressing out of air. Grease until grease comes out by the seal.

NOTE

Work carefully to avoid damaging the seal.

6.3 Tyres and rims

Tyres and rims, safety

DANGER

Always block wheels on the side of the axle that is not going to be worked on before placing the jack. Always secure the jack to prevent it from slipping out of position.

Wheels (tyre + rim) must only be handled pressurised after inspection and approval, as well as inflated to full pressure, by certified personnel.

Deflate the tyres before removing. Otherwise the lock ring and lock lugs can release and shoot off when the pressure changes. For twin tyres, both tyres must be deflated!

The air must always be released through the valve. If this is not possible - loosen the valve in the rim are release the air. If this does not work, break off, cut or saw off the valve pipe. If it is not possible to release the air via the valve connection, the tyre must be emptied by drilling a hole in the tyre's tread. Use a drill bit of a max. Ø 5 mm. Damaged tyres may explode.

Never stand in front of the tyre when deflating or inflating. Lock ring and lock lugs may release and shoot off when the pressure changes.

Never install damaged tyres or rims.

It is not permitted to mix rim components between rims. The parts are adapted during manufacture.

It's prohibited to repair rims with welding.

It's prohibited to operate the machine if one of the tyres is flat.

Wheels, tyres, and rims are dimensioned and selected for each machine type so that max. wheel loads and operating speeds are not exceeded. Therefore, changing of tyre dimension, tyre brand, tyre type, rim type, or rim brand is not permitted without approval from Cargotec.

CAUTION

When removing wheels, leave the wheel nuts in place after they have been loosened. If the wheel nuts are removed immediately the wheel may release from the hub.

Wheel nuts should be check-tightened after 4-5 operating hours.

Always follow the tyre manufacturer's or other approved instructions when changing tyres.

Never use a steel hammer to install or remove rim components. Instead, use a lead, brass, or plastic mallet.

Keep tyre pressures at the prescribed level. Loosely inflated tyres impair stability and reduce the machine's capacity.

Remove penetrating objects such as crushed glass, pieces of wood, metal filings, etc.

Check if the tyre wear is abnormal, this may be indicative of mechanical problems. Take action immediately to repair any defects and change damaged tyres.

Tyres and rims, check

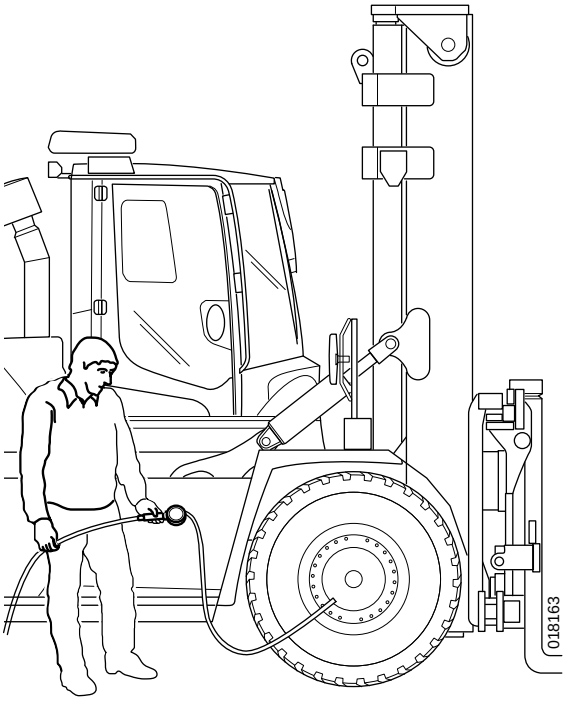
Read the safety instructions before working with tyres and rim, see *Tyres and rims, safety*, page 6:7.

DANGER

Never stand in front of the tyre when deflating or inflating! Lock ring and lock lugs may release and shoot off when the pressure changes.

The air must always be released through the valve. If this is not possible - loosen the valve in the rim are release the air. If this does not work, break off, cut or saw off the valve pipe. If it is not possible to release the air via the valve connection, the tyre must be emptied by drilling a hole in the tyre's tread. Use a drill bit of a max. Ø 5 mm. Damaged tyres may explode.

Do not exceed prescribed air pressure! When changing tyre or rim version, another air pressure may apply, contact Cargotec.



Examples: The figure shows inflation of drive wheel.

1 Check the rims.

- Check that there are no cracks in the rims' parts.

In case of damage, the tyre and rim must be removed and checked.

2 Check the air pressure in the tyres, see section *Tyres, inflating*, page 6:17.

The pressure must be **1.0 MPa**, inflate if necessary.

3 Check the tyres.

- Check for uneven and fast wear, this is caused by mechanical defects such as, e.g., uneven brake action. Make sure that such defects are repaired immediately.
- Remove penetrating objects such as crushed glass, pieces of wood, metal filings, etc.

If the tyre is damaged, the wheel shall be dismantled and the tyre shall be changed, see *Tyre, change*, page 6:18.

4 If the tyres and rims have no defects, check-tighten the wheel nuts.

Tighten crosswise to a torque of:

- **350 Nm** (DCG 180-250).
- **400 Nm** (DCG 280-330).

Tyre and rim system, removing and fitting (drive axle)

Read the safety instructions before working with tyres and rim, see *Tyres and rims, safety*, page 6:7.

NOTE

Pay attention to the placement of the spacer rings during dismantling so that they reassembled in their correct locations. With single mounting of the drive wheel, there can also be two spacer rings that can be positioned in different ways.

Removing

1 Machine in service position, see section *B Safety*.

2 Raise the machine under the mast or under the drive axle with a jack at the wheel in question. Support under the drive axle in a secure way.

DANGER

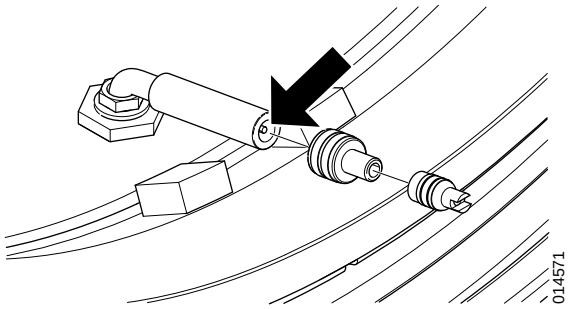
With double wheel fitting both tyres must be deflated otherwise the inner may explode when the outer is removed.

Risk of tyre explosion! Fatal danger!

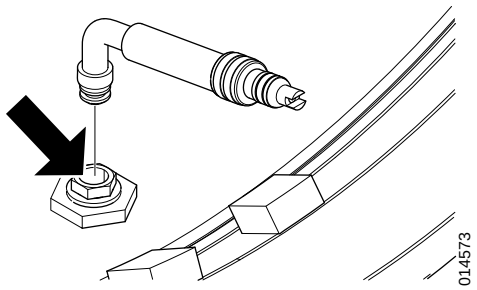
Empty both tyres of air.

3 Release the air from the tyres by:

a) Unscrewing the valve and releasing the air.

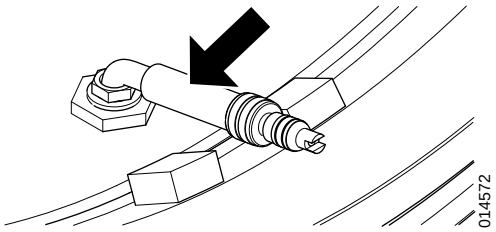


b) If this does not work, undo the valve in the rim and release the air.

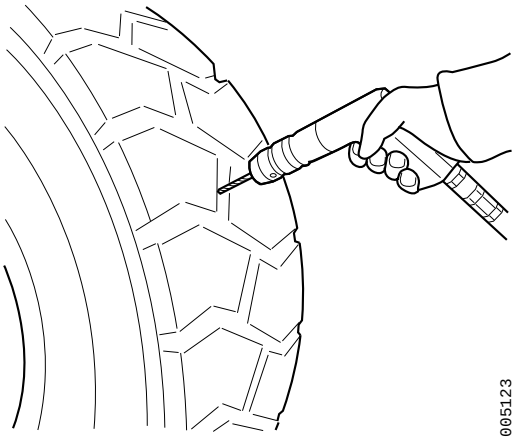


NOTE

Only applies to tubeless tyres.

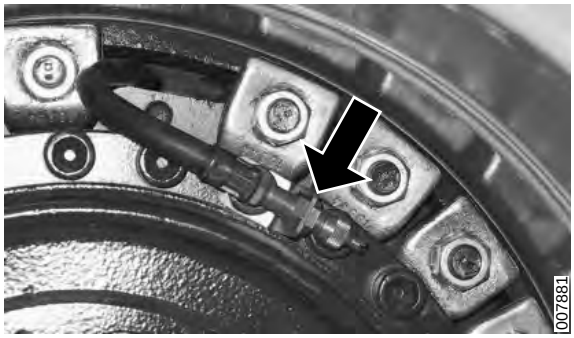


c) If this does not work, break off, cut or saw off the valve pipe.

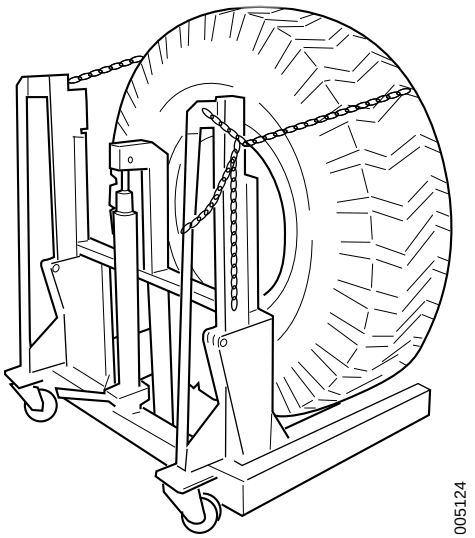


d) If it is not possible to release the air via the valve connection, the tyre must be emptied by drilling a hole in the tyre's tread. Use a drill bit of a max. Ø 5 mm.

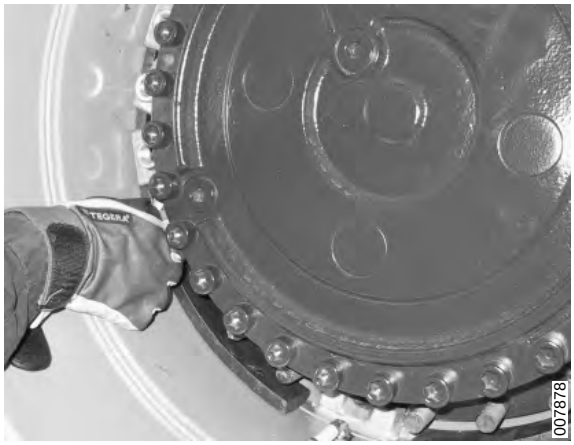
4 Loosen the wheel nuts.



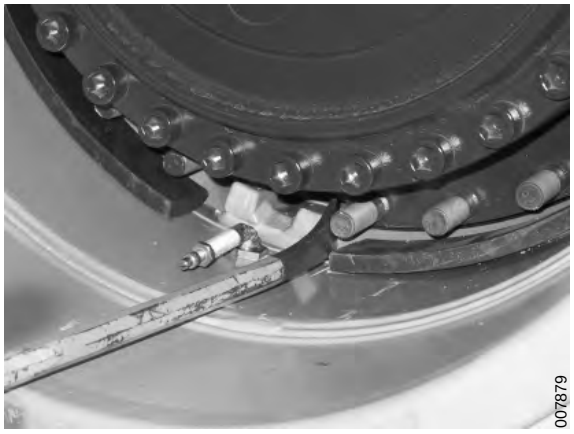
5 Loosen the inner drive wheel's valve from the bracket.



6 Secure the wheel with the lifting equipment, i.e. make sure that the wheel is positioned safely for lifting in the lifting equipment.



7 Remove all wheel nuts and clamps.



8 Remove the spacer ring.

Pull the wheel out a bit so that the spacer ring comes loose.

NOTE

The spacer ring weighs approx. 20 kg.

9 Lift the outer wheel away and position it safely so that it does not fall or move.

10 Secure the inner drive wheel with lifting equipment.

11 Remove the spacer ring between the outer and inner drive wheel.

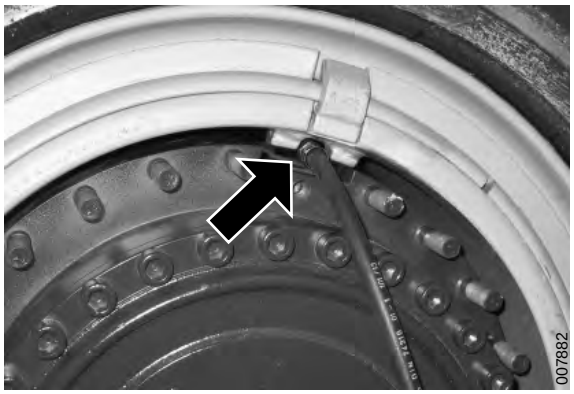
NOTE

The spacer ring weighs approx. 20 kg.

12 Remove the inner drive wheel and position it safely so that it does not fall or move.

Installing

1 Make sure the mounting surfaces (location A) on the hub and wheel are clean and free from paint and grease.



2 Lift the inner wheel into place with lifting equipment. Turn the wheel so that the guide lug runs into the groove on the hub. This work is facilitated if the hub's groove is aligned towards the top and bottom.

3 Fit the inner spacer ring.

NOTE

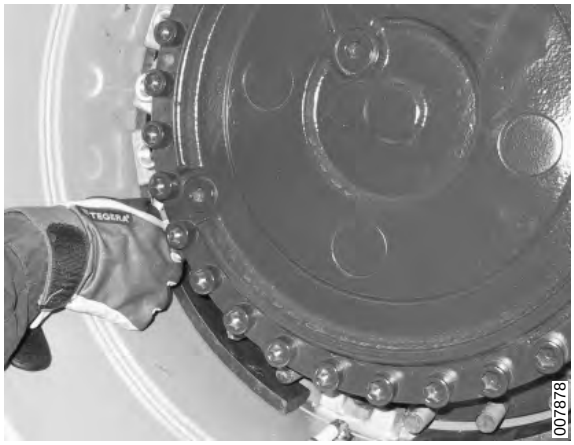
The inner ring is not split.

4 Lift the outer wheel into place using lifting equipment. Turn the wheel so that the guide lug enters the groove on the hub.

5 Fit the outer spacer ring.

NOTE

The outer spacer ring is split. Turn the ring so that the opening ends up directly opposite the groove on the hub.

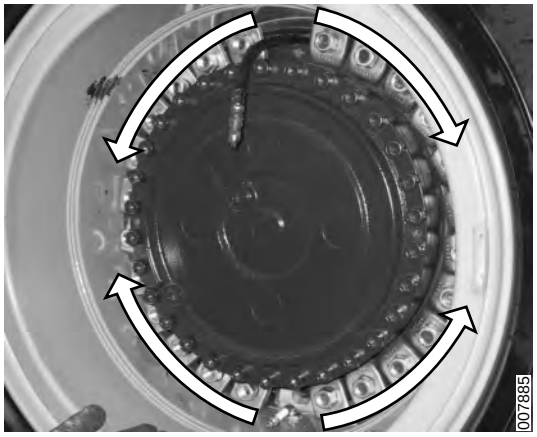


6 Fit clamps and nuts on the wheel studs. Fit washers as well where applicable.

NOTE

Don not forget the bracket for the inner tyre's valve extender.

7 Remove the lifting equipment.



8 Tighten the wheel nuts crosswise, start at the guide lugs and move outwards to prevent the spacer rings from aligning incorrectly.

9 Tighten the wheel nuts crosswise in turn with increasing torque to **350 Nm**.

10 Fill wheel with air, see *Tyres, inflating*, page 6:17.

11 Lower the axle and remove the jack.

12 Test-run the machine and check that the wheels are secure.

13 Check-tighten the wheel nuts crosswise to a torque of **350 Nm**.

Tyre and rim system, removing and fitting (steering axle)

Read the safety instructions before working with tyres and rim, see *Tyres and rims, safety*, page 6:7.

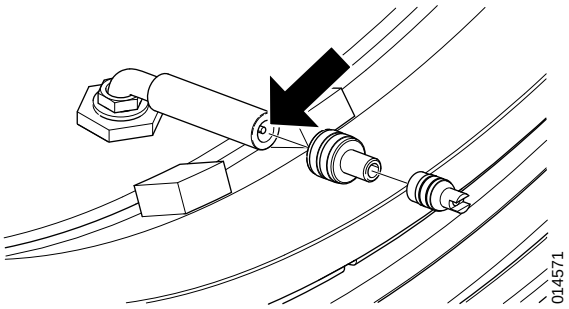
Removing

1 Machine in service position, see section *B Safety*.

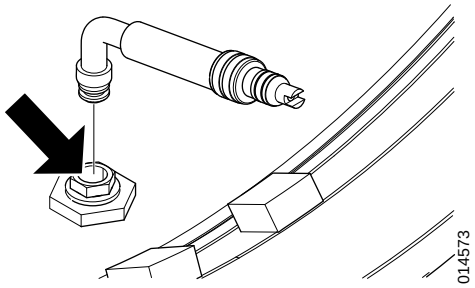
2 Raise the machine under the steering axle at the wheel in question with a jack. Support under the steering axle in a secure way.

3 Release the air from the tyres by:

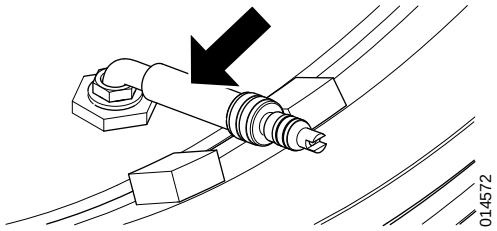
a) Unscrewing the valve and releasing the air.



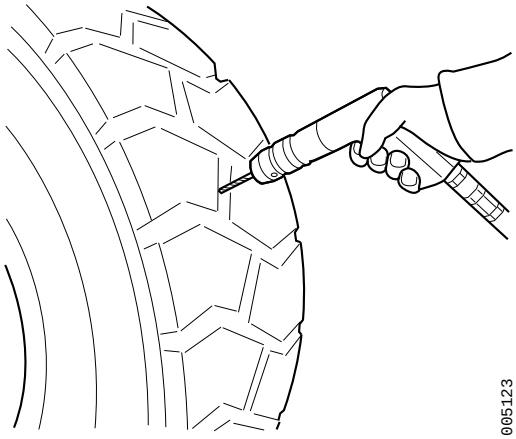
b) If this does not work, undo the valve in the rim and release the air.

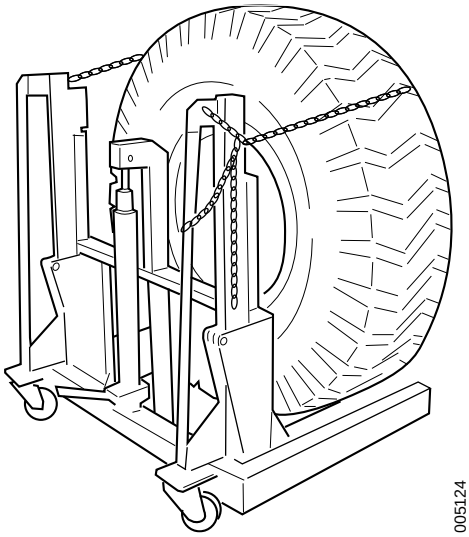


c) If this does not work, break off, cut or saw off the valve pipe.



d) If it is not possible to release the air via the valve connection, the tyre must be emptied by drilling a hole in the tyre's tread. Use a drill bit of a max. Ø 5 mm.





4 Secure the wheel with the lifting equipment, i.e. make sure that the wheel is positioned safely for lifting in the lifting equipment.

5 Remove all wheel nuts and clamps.

6 Remove the wheel and position it safely so that it does not fall or move.

Installing

7 Make sure the mounting surfaces on the hub and wheel are clean and free from paint and grease.

8 Lift the wheel into place using lifting equipment.

Adjust the position of the wheel so that the guide pin passes over the notch in the hub and so that the wheel rim is in contact against the hub.

9 Fit clamps and nuts on the wheel studs. Fit washers as well where applicable.

10 Remove the lifting equipment.

11 Secure the wheel. Tighten the wheel nuts crosswise in turn with increasing torque to **350 Nm**.

12 Fill wheel with air, see *Tyres, inflating*, page 6:17.

13 Lower the axle and remove the jack.

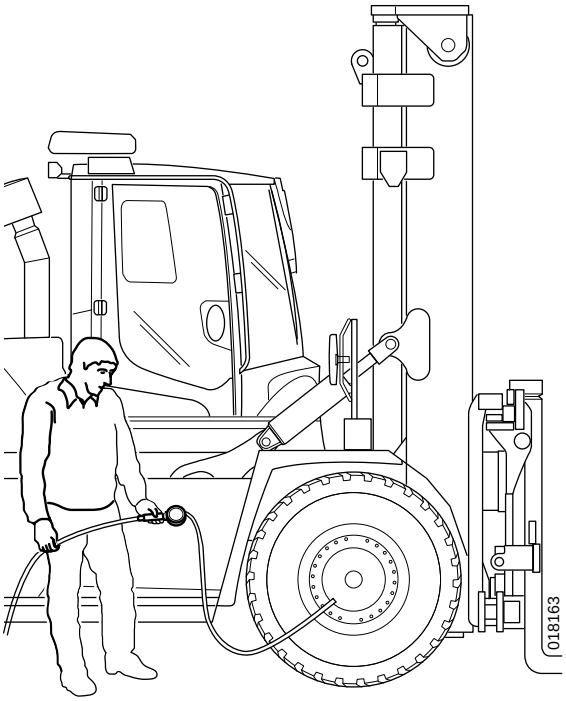
14 Test-run the machine and check that the wheels are secure.

15 Check-tighten the wheel nuts crosswise to a torque of **350 Nm**.

6.3.1 Tyres

Tyres, inflating

Read the safety instructions before working with tyres and rim, see *Tyres and rims, safety*, page 6:7.



Examples: The figure shows inflation of drive wheel.

DANGER

Always follow the instructions for inflating tyres to avoid risk of accidents.

Only use approved rim components. It is not permitted to mix rim components between rims. The parts are adapted during manufacture.

If the tyre pressure has been below 300 kPa then the tyre must be removed and both tyre and rim examined with regard to damage.

Never install rim components by striking with a hammer while inflating. Never strike fully or partly inflated tyres or rim sets.

Never inflate tyres before all parts are in place.

Wheels shall be inflated on the machine or in a protective device, designed and dimensioned so that it can handle or dissipate a shock wave from a tyre explosion as well as catch the ejected parts.

Do not exceed the prescribed tyre pressure. The tyre pressure must be checked when the tyre is at ambient temperature. The pressure increases due to heat while driving. When changing tyre or rim version, another air pressure may apply, contact Cargotec. Plate for air pressure in tyres must be replaced with a plate that shows applicable pressure.

Never stand in front of the tyre when deflating or inflating. Lock ring and lock lugs may release and shoot off when the pressure changes.

Check that all wheel rim parts are fitted in place when the tyre pressure is 30 kPa.

NOTE

An air filter and water trap should be installed on the line from the compressor that is used to inflate tyres to avoid rim corrosion.

1 Make sure that the lock ring and lock lugs are in the correct position before inflating.

2 Connect the compressor with a locking air-chuck to the nipple on the tyre.

3 Stand at an angle behind the tyre and remain there until inflating has been completed in order to prevent being hit by rim parts in the event of an explosion.

4 Check that all wheel rim parts are in the correct position when the tyre pressure is 30 kPa.

5 Inflate the tyre to prescribed pressure, see section *F Specifications*.

When changing tyre or rim version, another air pressure may apply, contact Cargotec.

Tyre, change

DANGER

Changing tyres is complicated and dangerous work.

FATAL DANGER!

Leave tyre work to authorised personnel/tyre company.

Check the rim in connection with tyre change, see *Rim, check*, page 6:18.

6.3.2 Rim

Rim, check

DANGER

Perform the following checks to minimise risks of accidents for all split rims.

Always use the right tyre size and a design corresponding to the manufacturer's rim type and size. Over-dimensioned tyres may not be used.

It is not permitted to mix rim components between rims. The parts are adapted during manufacture. If a part is damaged then all rim parts must be replaced.

1 Dismantle the rim, see *Tyre, change*, page 6:18.

2 Carefully clean the outside of the rim edge with a steel brush.

3 Check that the lock ring (position 1) and rim flange (position 2) are intact and in the correct position. Replace damaged parts.

4 Check for damage in the areas with high stress concentration.

Checking is done in two steps:

1. The magnetic particle method is used to determine if there's a crack or not, and where it is.
2. Confirmed cracks are investigated further with penetrating fluid.

Typical rim damages are circumference cracks, corrosive damage, rust, warping and wear.

Magnetic particle method

1 Blast the applicable area clean so that it is completely free of paint residue.

2 Test using magnetic particle and the following equipment:

- Equipment: Yoke Tiede
- Method:
  - a Alternating current AC
  - b Contrast colour
- Checking medium:
  - a Wet
  - b Colour (for example, Tiede Ferrolux)

If no cracks are detected with the magnetic particle method, checking is finished and the applicable area is approved.

If cracks are indicated, the crack should be investigated further with penetrating fluid.

Checking cracks with penetrating fluid

1 Clean the area with cleaning fluid part no. 923626.0668.

2 Spray penetrating fluid part no. 923626.0669 on the cleaned area and let dry 10 min.

3 Wash off penetrating fluid with cleaning fluid part no. 923626.0668.

Thoroughly wipe off the cleaning fluid with a drying cloth and let any remaining cleaning fluid evaporate.

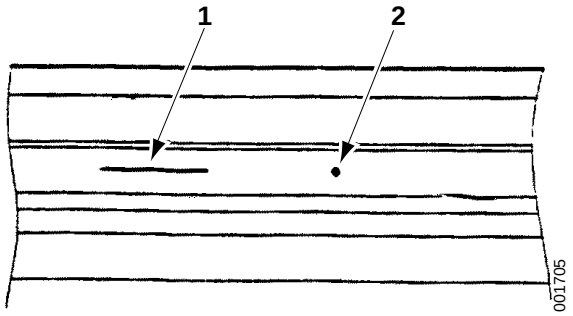
4 Spray detection fluid part no. 923626.0670 on the area.

5 Let the sprayed area dry 1-2 hours.

6 Visually inspect the area.

If the tested area does not show signs of linear or point-shaped cracks, it is approved.

If the crack check indicates linear or point-shaped cracks, contact Cargotec Support.



Examples of cracks

1. Linear crack
2. Pointed crack

6.3.4 Sensor tyre pressure monitoring

Sensor tyre pressure monitoring, replacement

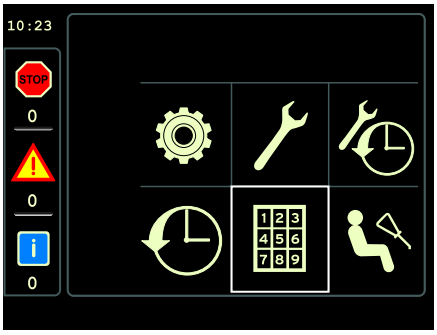
Read the safety instructions before working with tyres and rim, see *Tyres and rims, safety*, page 6:7.

1 Machine parked with engine idling.

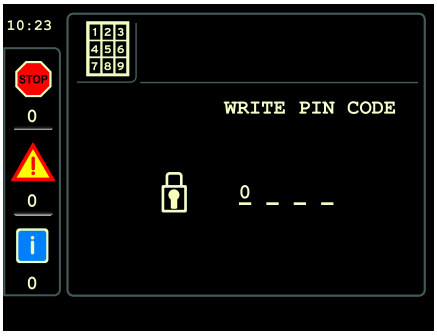
Identifying a defective sensor

2 Check which have low battery level and need replacement.

3 In order to select the function to calibrate, navigate first to the menu for service and settings with ◀ or ▶ and confirm with ○.



014981

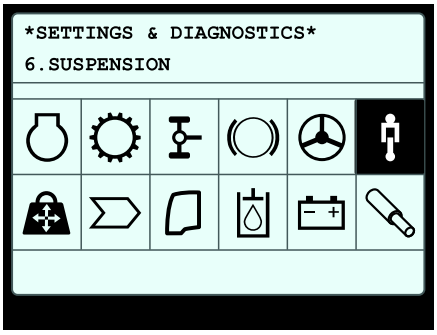


015625

4 Enter diagnostic code 1111, with ▲ or ▼. Confirm each digit with ○.

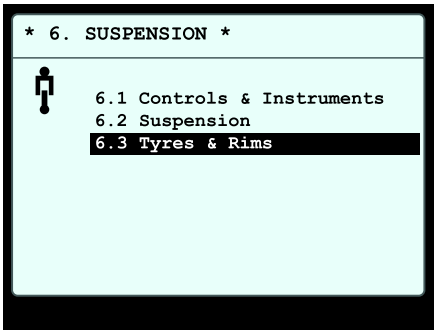
NOTE

The code determines which service menus are activated.



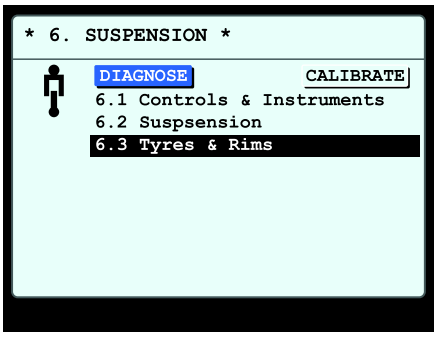
017988

5 Select 6. SUSPENSION by scrolling with ◀ or ▶ and confirm with ○.



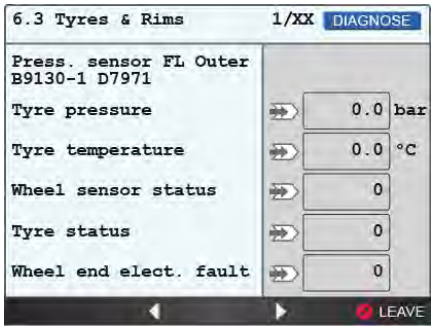
017989

6 Select 6.3 Tyres & Rims by scrolling with ▲ or ▼ and confirm with ○.



017991

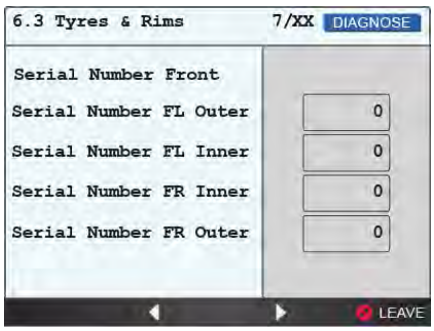
7 Select DIAGNOSE by scrolling with ◀ or ▶ and confirm with ○.



Example diagnostic menu 6.3 Tyres & Rim 1/XX Diagnose

8 Check which sensors need replacement by scrolling through menu 1 – 6 with ◀ or ▶ and check which sensors have Wheel end elect. fault = 1.

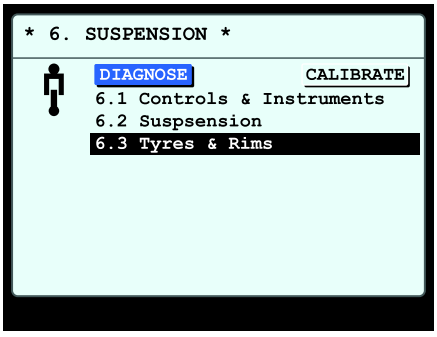
For more details, see *Workshop manual*, section *8 Control system*.



Example diagnostic menu 6.3 Tyres & Rim 7/XX Diagnose

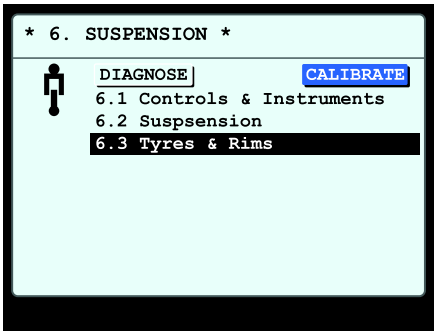
9 Scroll to menu 7 Serial Number Front and menu 8 Serial Number Rear with ◀ or ▶.

10 Note the serial number on the sensors to be replaced. This makes it more certain to identify which sensors should be replaced.



017991

11 Go back out to DIAGNOSE with ⊘.

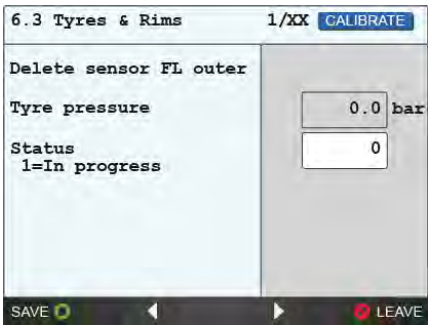


017990

Sensor replacement

12 Select CALIBRATE by scrolling with ◀ or ▶ and confirm with ●.

13 If several sensors shall be replaced then the sensors must be replaced one at a time, in accordance with steps 14 – 19, since the pairing can only handle one new sensor at a time.



Example menu 6.3 Tyres & Rims 1/XX Calibrate

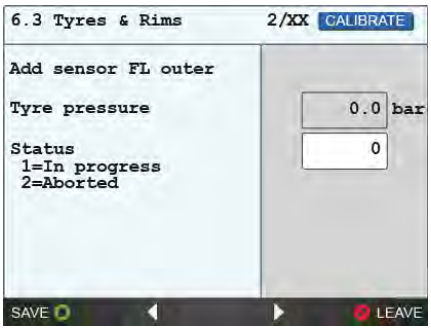
14 Scroll to the menu Delete sensor... for the current sensor with ◀ or ▶.

Location	Menu
Left front, outer wheel	6.3 Tyres & Rims 1/XX Calibrate
Left front, inner wheel	6.3 Tyres & Rims 3/XX Calibrate
Right front, inner wheel	6.3 Tyres & Rims 5/XX Calibrate
Right front, outer wheel	6.3 Tyres & Rims 7/XX Calibrate
Left rear	6.3 Tyres & Rims 9/XX Calibrate
Right rear	6.3 Tyres & Rims 11/XX Calibrate

15 Cancel the pairing to the old sensor by pressing ●.

The Status row shows value 1 when the connection is being broken, wait until the connection is broken Status = 0.

16 Remove the old sensor, check that the serial number on the old sensor corresponds with the serial number noted down earlier.



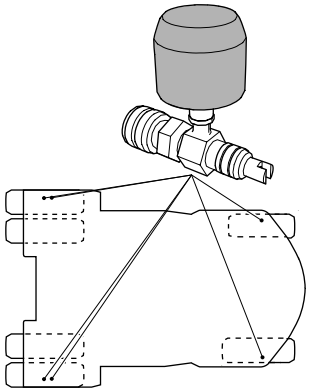
Example menu 6.3 Tyres & Rims 2/XX Calibrate

17 Scroll to the menu Add sensor... for the current sensor with ◀ or ▶.

Location	Menu
Left front, outer wheel	6.3 Tyres & Rims 2/XX Calibrate
Left front, inner wheel	6.3 Tyres & Rims 4/XX Calibrate
Right front, inner wheel	6.3 Tyres & Rims 6/XX Calibrate
Right front, outer wheel	6.3 Tyres & Rims 8/XX Calibrate
Left rear	6.3 Tyres & Rims 10/XX Calibrate
Right rear	6.3 Tyres & Rims 12/XX Calibrate

18 Search for and pair the new sensor by pressing ●. The progress of the pairing is shown in the Status row.

Status	Explanation
0	Pairing completed.
1	Pairing in progress.
2	Pairing cancelled. Check that the sensor is firmly attached on the valve and start a new pairing.



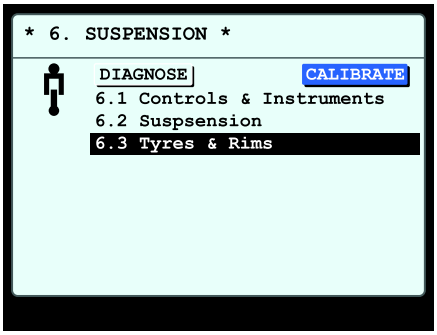
019515

19 Fit the new sensor.

20 Check that the row for Tyre pressure shows the tyre pressure.

It can take up to a minute before the pressure is shown in the display.

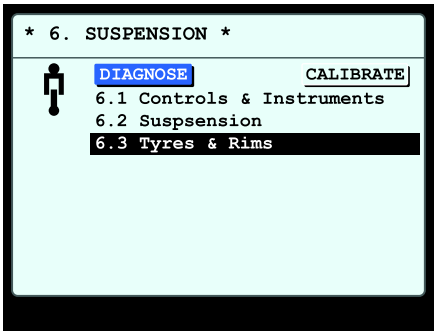
21 If more sensors shall be replaced, repeat steps 14 – 19 for one sensor at a time.



017990

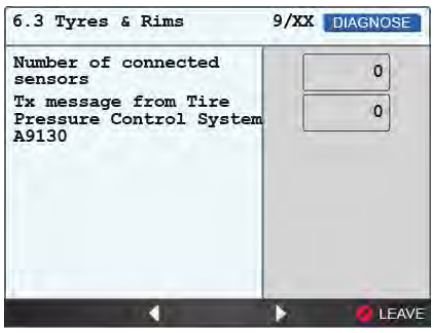
22 Go back out to CALIBRATE with .

Checking the sensors



017991

23 Select DIAGNOSE by scrolling with or and confirm with .



24 Scroll to menu 9 with or .

25 Check that the value for the row for Number of connected sensors = 6.

If the value does not correspond, use the menus for 6.3 Tyres & rims 7/xx Diagnose and 6.3 Tyres & rims 8/xx Diagnose in order to identify which wheels do not have a sensor connected.

The row Tx message from Tire Pressure Control System = 1, indicates that the tyre pressure monitoring has contact with the control system in the machine.

Contents 7 Load handling

7 Load handling

7.2 Lifting/lowering

7.2.5 Accumulator damping

Setting of gas precharge pressure in the accumulator for lift cylinder damping

1 Machine in service position, see section *B Safety*.

2 Fit a measuring outlet in the lift cylinder or in the lifting circuit.

3 Connect a pressure gauge in the measuring outlet.

4 Start the engine.

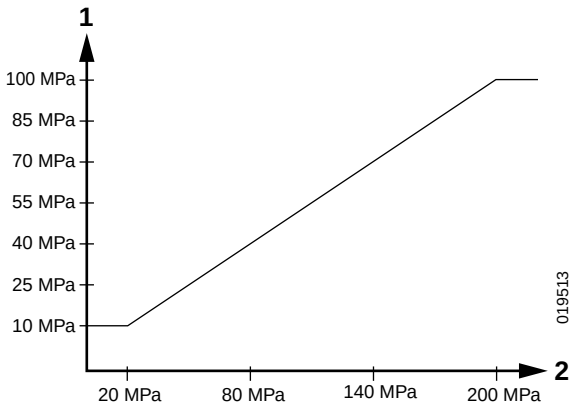
5 Lift the load for which the damping shall be optimised.

6 Read the pressure in the lift cylinder with the pressure gauge.

7 Read the recommended gas precharge pressure in the graph.

8 Lower the load so that the pressure in the lift cylinder is unloaded.

9 Machine in service position, see section *B Safety*.

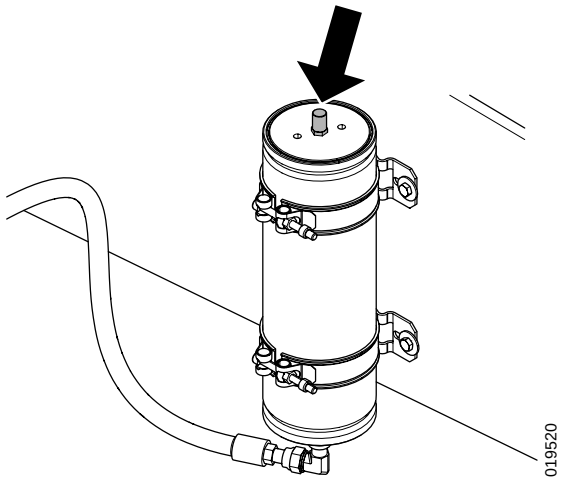


1. Gas precharge pressure
2. Pressure in lift cylinder

10 Connect the gas filling equipment to the connection on the accumulator. Adjust the gas precharge pressure in the accumulator to the recommended pressure.

NOTE

Use only pure nitrogen when filling.



Connection gas precharge pressure accumulator

7.2.6 Mast

Mast suspension, checking

1 Machine in service position, see section *B Safety*.

2 Visually check that the frame's mounting points and welding seams are intact.

3 Also check that the mast's mounting points and welding seams are intact. Check both inside and outside.

Mast suspension, checking bearings

1 Raise and secure the trolley.

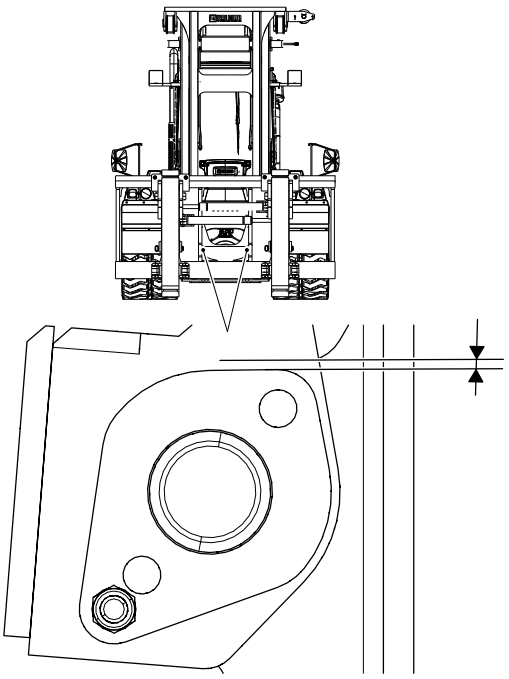
WARNING

Never work under a trolley that is not secured.
Risk of crushing!
Secure the trolley properly before beginning work.

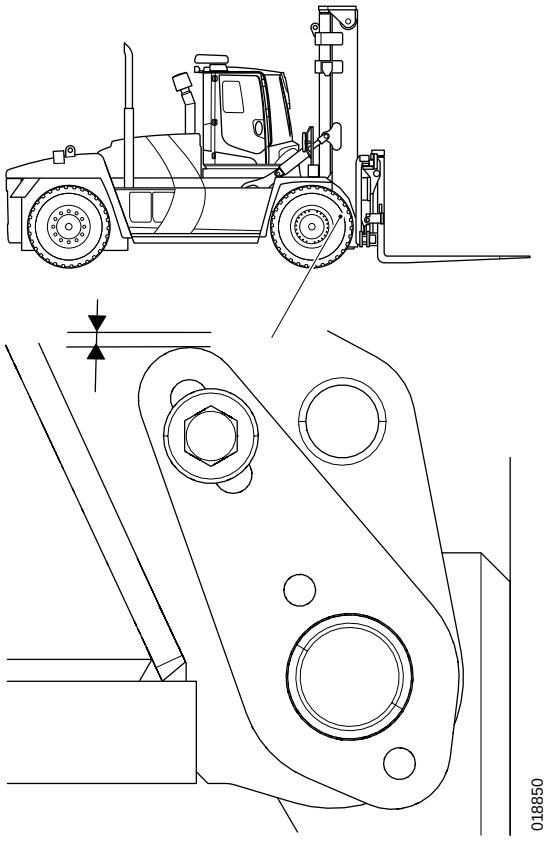
2 Machine in service position, see section *B Safety*.

3 Visually check that the frame's mounting points and welding seams are intact.

4 Also check that the mast's mounting points and welding seams are intact. Check both inside and outside.



DCG 180-250



DCG 280-330

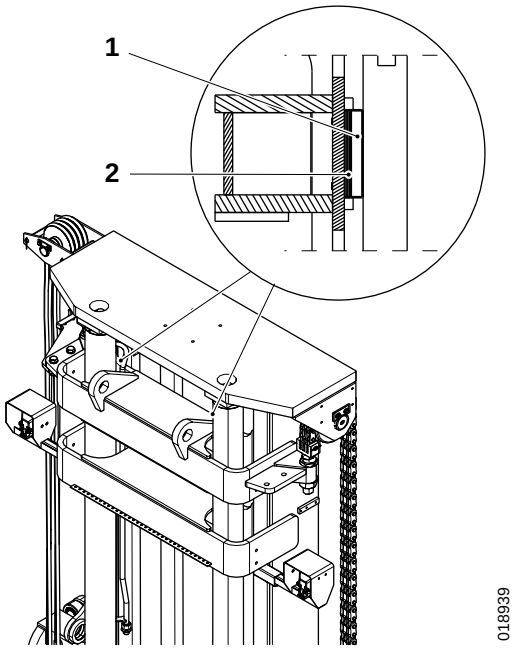
5 Make a marking on the mast.

6 Remove the load from the mast mountings in an appropriate manner.

7 Make a new marking on the mast. Measure the distance between the markings. The measurement should be max. 1 mm.

8 If the difference is greater, the bearings in the mast mountings must be replaced, see *Workshop manual*.

Slide plates mast, checking



1. Slide plate
2. Shim

1 Machine in service position, see section *B Safety*.

2 Check that the slide surfaces in the inner mast have a normal appearance and do not show signs of damage or unevenness.

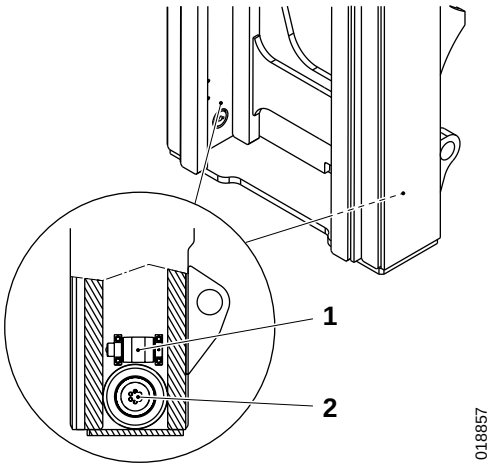
3 Check the clearance between the outer and inner mast with the mast in the fully lowered position. The clearance should be between 0-5 mm.

4 If the clearance between the outer and inner masts exceeds 5 mm, reduce the clearance by shimming.

NOTE

Do not use adjustment shims that are too thick. Inadequate clearance increases wear on the slide plates.

Support rollers mast, checking



1. Support roller
2. Mast wheel

1 Machine in service position, see section *B Safety*.

2 Check that the support rollers are running correctly and that all surfaces of the support rollers and contact surfaces against the mast have normal appearances.

NOTE

Support rollers and mast wheels are also located in the upper section of the mast.

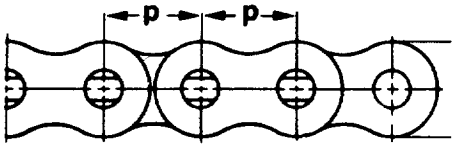
7.2.8 Chains

Lifting chains, checking and adjusting

With the aim of increasing safety, the lifting chains should be checked regularly according to the following:

Wear checking

1 The chain must not have extended more than 3%. Measure over the 25 links that are first (and most frequent) to pass over the chain wheel during lifting. This is where the extension is greatest. Compare with the value in the table. If the 3% limit is exceeded the chains must be replaced.



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2 P-measurement = the distance between 2 pins

P-measurement [in]	P-measurement [mm]	Measurement over 25 links [mm]	
		New chain	Max. measurement
3/4	19.05	476.25	490
1	25.4	635	654
1.1/4	31.75	793.75	817
1.1/2	38.1	952.5	981
2	50.8	1270	1308

On chains with up to 1 inch pitch, it is possible to use a special measuring tape intended to measure the wear.

The measuring tape is marked with:

- Zulässige Verlängerung = permitted lengthening.
- Kette austauschen = chain must be replaced.

The measuring tape can be ordered from Cargotec.

Adjusting

3 Check that the pins for the outer washers are securely fastened.

4 Check that the washers are free of visible cracks.

5 Check that the chain is free from mechanical damage.

6 Check that the chain is free of rust.

7 Check that the chain bends easily over the pulley (does not jam when bending).

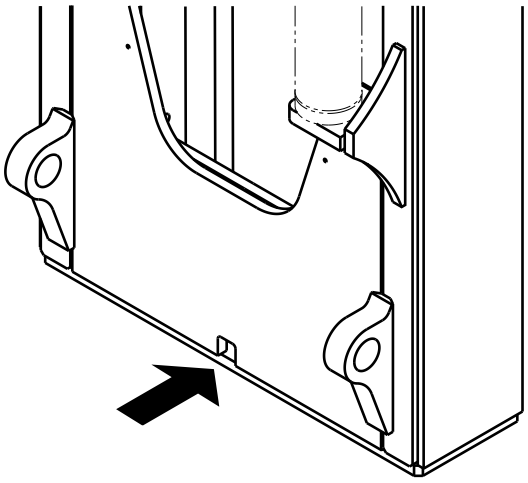
8 Place the machine on level surface with the mast vertical (0° tilt).

9 Lower the carriage to the bottom position.

10 Check that there is **10-20 mm** of space between carriage and the mast. Adjust the position by tensioning or loosening the chains equally on the adjustment nut in the carriage.

NOTE

If the chain is slack when the carriage is in its lowest position, the chain must be tightened.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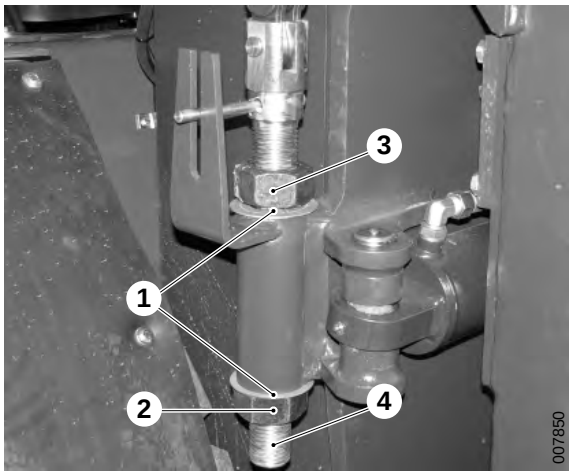
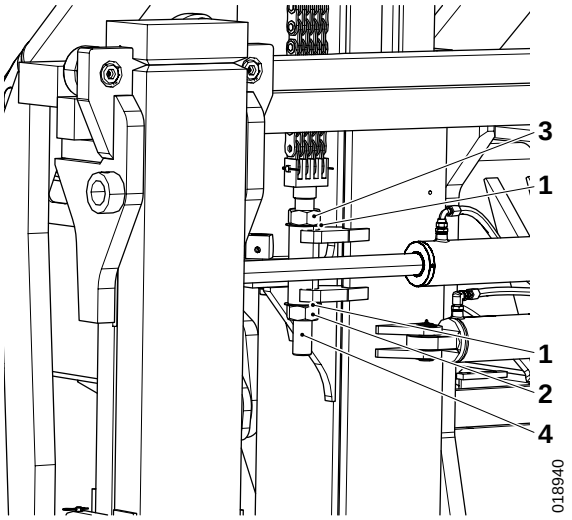
Inspection hole, distance between carriage and mast.



DCG 180-250

1. Locking washer
2. Lower nut
3. Upper nut
4. Chain tensioner



DCG 280-330

1. Locking washer
2. Lower nut
3. Upper nut
4. Chain tensioner

11 Adjust the chains so that the carriage is lifted evenly in the mast.

- Loosen the locking washers (position 1) and remove the lower nut (position 2).
- Lift the chain tightener (position 4) out of the carriage and remove the old locking washer.
- Reinstall with new locking washer, chain tightener, locking washer and lower nut. Repeat on the other side.

NOTE

Reinstall only new locking washers.

- Adjust the nuts on each side to balance the carriage so that the distance between carriage and mast is **10-20 mm**.
- Tighten the nuts.
- Test lift and check that the lifting chain stretches equally on each side so that the carriage is balanced.

  Repeat adjustments as needed.
- When the chains are aligned, lock the nuts with locking washers.

12 Lubricate the chains after completed inspection.

7.2.10 Mast position sensor

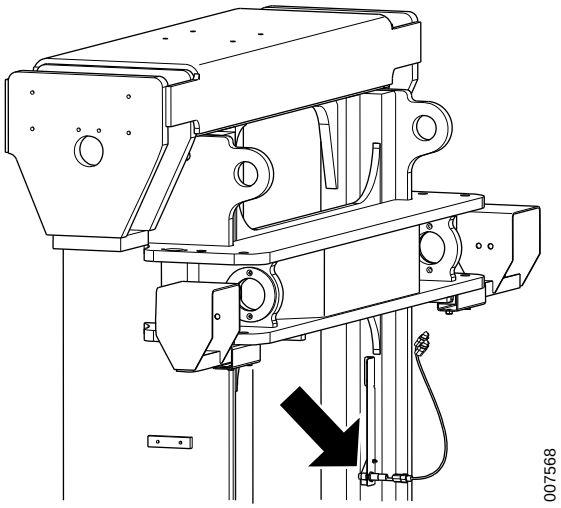
Position sensor, checking

1 Machine in service position, see section *B Safety*.

2 Wipe the sensors clean with a rag or similar item.

3 Check that they are secured properly.

4 Check that the distance between the sensor and the indicator pin is **5±1 mm**.

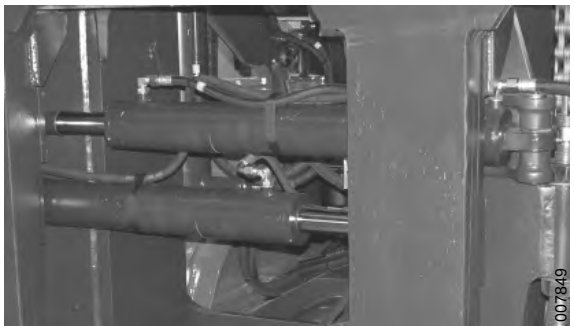


The diagram shows an example of a position sensor on a mast.

7.4 Side shift

7.4.4 Side shift cylinder

Side shift cylinder, checking



Visually check that the cylinders are straight and that the mounting points and welding seams are intact.

7.7 Tilt

7.7.5 Tilt cylinder

Tilt cylinder, checking

Check:

- visually that the frame's mounting points and welding seams are intact.
- that the piston rod head is securely fastened to the tilt cylinder (tightening torque **136 Nm**).
- that the tilt cylinders are correctly adjusted.

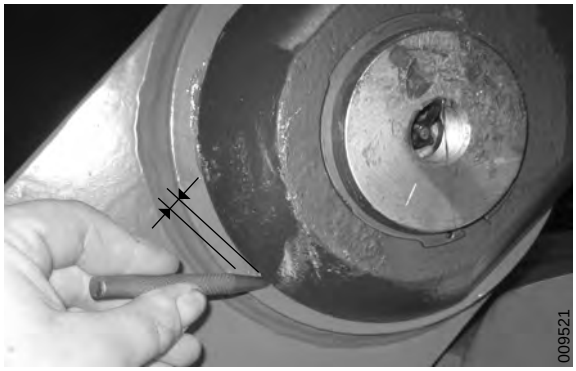
Tilt mount, checking bearings

NOTE

There may be other variants of tilt cylinder mounts than the variants shown here.

1 Machine in service position, see section *B Safety*.

DCG 180–250



DCG 280–330

2 Make marks on the mast and frame when the mast is vertical.

3 Add blocks under the outer mast in order to unload the tilt mounts and tilt out to the maximum. Measure the distance to the mark. The measurement should be max. 2 mm.

4 If the difference is greater, the bearings in the tilt mounting must be replaced, see *Workshop manual*.

7.9 Load carrier

Load carrier, general

Load carrier refers to lifting a load. There are several ways to lift a load, such as:

- Lifting forks.
- ⊕

  Fork shank system, which allows use of:

  – Lifting forks
  – Inverted lifting forks
  – Coil ram
- Side lift attachment ⊕
- ⊕

  The machine is additionally prepared for attaching separate top lift attachments that are connected to lifting forks or inverted lifting forks, see .

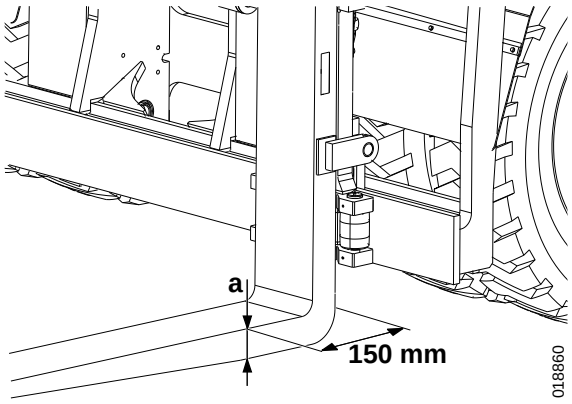
7.9.1 Lifting forks

Lifting forks, checking

DANGER

Damaged lifting forks must be changed.

Repairs to lifting forks change their strength, which may lead to dropped loads and fatalities.



1 Machine in service position, see section *B Safety*.

2 Check the fork arms with regard to blade thickness, cracks and deformation.

- Blade wear (at position a) must not exceed 10% (calculated from initial dimensions and measured 150 mm from the heel of the fork).
- Visible cracks may not be present.

  Pay special attention to the fork heel. Surface cracks are generally no longer than 5 mm.

  If surface cracks are discovered, grind down approx. 0.5 mm and test with magnetic particle inspection to see if the crack is still visible. Testing must be performed by an approved company.

3 Check the forks' suspension mountings, e.g. clearance.

4 If the forks need repair - contact Cargotec or one of Cargotec's approved service personnel, who will determine whether the forks can be repaired.

NOTE

Surface cracks and wear must not be dealt with using welding.

5 Forks which have been hot-straightened must be heat treated again (carried out by an approved firm).

7.10 Other functions

7.10.5 Side lift attachment

Twistlocks, checking

WARNING

Dropped load.

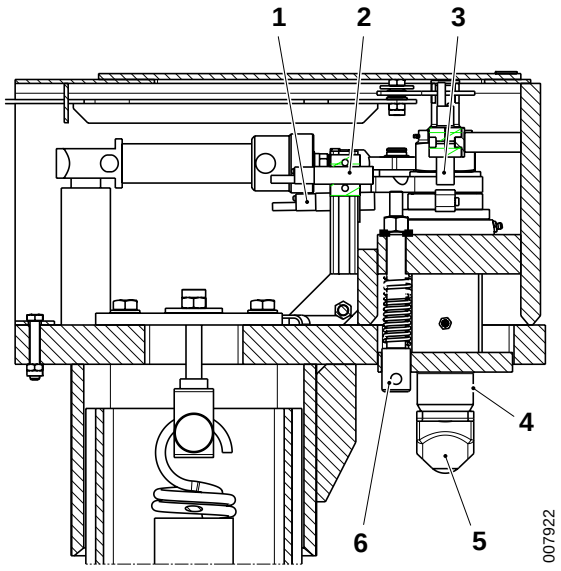
Fatal danger!

Twistlocks hold the load during load handling and therefore it is crucial that twistlocks are checked according to instructions and replaced at the slightest sign of damage or wear.

WARNING

Make sure that the engine is off when working on the twistlocks.

Twistlocks can be locked automatically if all sensors for contact are activated manually.



1. Sensor unlocked twistlock
2. Sensor contact
3. Sensor locked twistlock
4. Lock guide
5. Lift pin
6. Contact pin

1 Check that the twistlocks function correctly.

Lock and open the twistlocks, check that the indicator lights work, both in cab and on attachment.

2 Clean the twistlocks from any dirt.

3 Under the rubber cover for twistlocks: check pin, link arm and lock nut.

4 Clean the area around sensor contact.

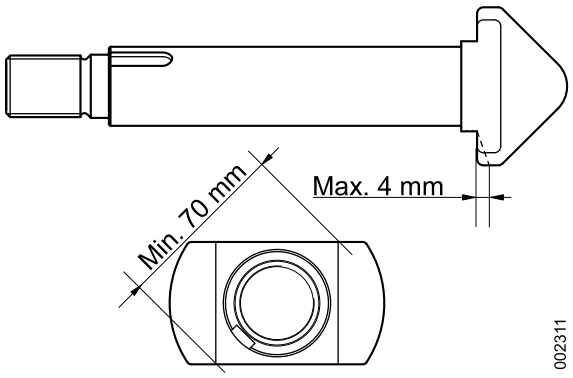
5 Press in the contact pin so that the head is flush with the spreader beam's underside. Check the distance to sensor contact, the distance should be **5±1 mm**. Adjust when needed

NOTE

The contact pin should move easily and spring back completely.

6 Check that the lock guide and lift pin can move freely.

7 Fit a pry bar between the lift pin (position 5) and the lock guide (position 4) and check the clearance, **max. clearance:** 1-1.5 mm.



Wear limits lift pin.

8 Turn twistlocks to locked position and check wear of the lift pin. Replace the lift pin as required.

9 Repeat steps 1–8 on the other side.

Twistlocks, checking for cracks

DANGER

Material fatigue, reduced strength.

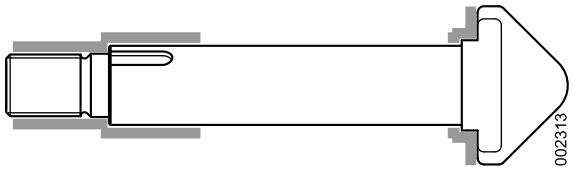
Fatal danger!

Change twistlocks that shows signs of cracks or other external damage, or twistlocks with more than 10 000 operating hours.

1 Remove the lift pins from the attachment.

NOTE

Twistlocks are heavy, be careful when removing.



Area for checking for cracks on lift pin.

2 Check for cracks within the marked area on the lift pins without causing damage.

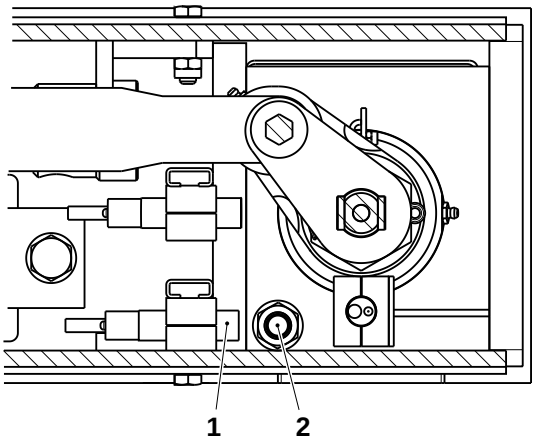
3 If the lift pins show signs of cracking, they must be replaced with new ones.

4 Install approved twistlocks.

NOTE

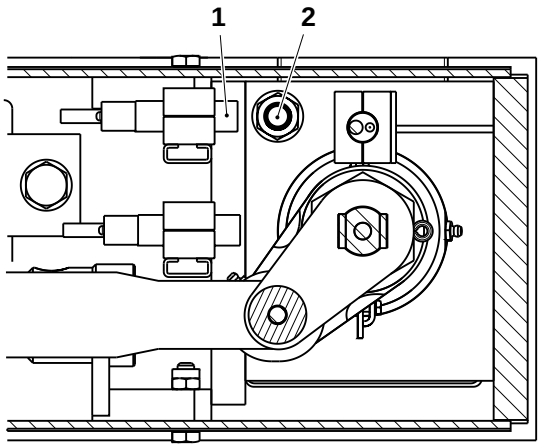
Use the new attaching nut and spherical bearing.

Sensor contact, checking and adjusting



Right side

1. Sensor contact
2. Contact pin



Left side

1. Sensor contact
2. Contact pin

1 Check that the contact pins in the corner boxes can move freely up and down. The contact pins shall spring down when not loaded.

2 Check that the sensor is free of damage and dirt.

3 Turn the start key to position I and check that the LED on the sensor is switched off.

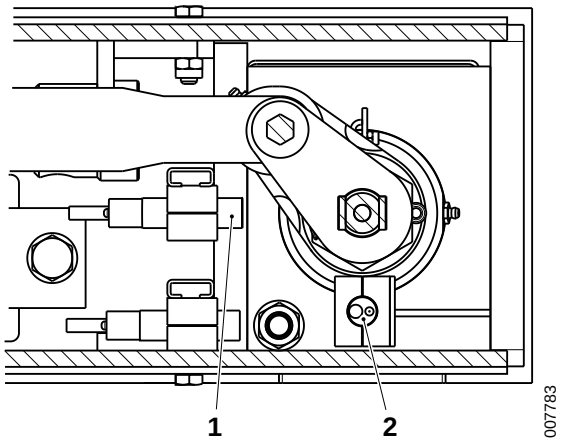
4 Lower the attachment onto a container and check that Indicator light contact is illuminated.

5 Lift the container a little bit so that the Indicator light contact is switched off.

6 With the container raised, check how much movement on the contact pins is needed to detect contact (LED on the sensor illuminates). The movement should be 3–4 mm.

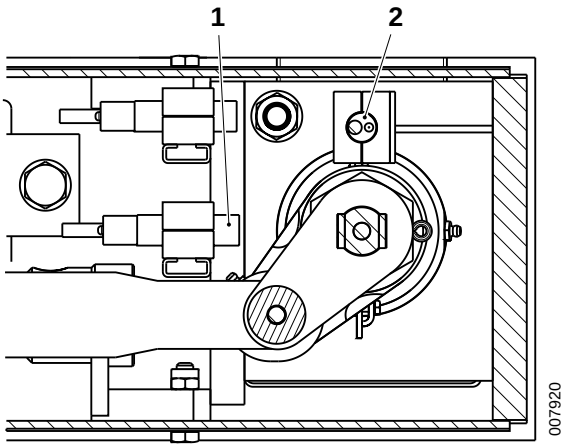
7 If necessary, loosen the lock nut and screw the sensor in/out until the distance between the sensor and the contact pin is 5±1 mm.

Sensor twistlocks, checking and adjusting



Right side

1. Sensor unlocked twistlock
2. Sensor locked twistlock



Left side

1. Sensor unlocked twistlock
2. Sensor locked twistlock

1 Check that the sensors are free of damage and dirt.

2 Turn the start key to position I and check that the LED on the sensor for unlocked twistlock is illuminated.

If necessary, loosen the lock nut and screw the sensor in/out until the distance between the sensor and the indicator plate is 5±1 mm.

3 Check that indicator light twistlocks open is illuminated.

4 Lower the attachment over a container and lock twistlocks.

5 Check that the LED on the sensor for locked twistlock is illuminated.

If necessary, loosen the lock nut and screw the sensor in/out until the distance between the sensor and the indicator plate is 5±1 mm.

6 Check that indicator light twistlocks locked is illuminated.

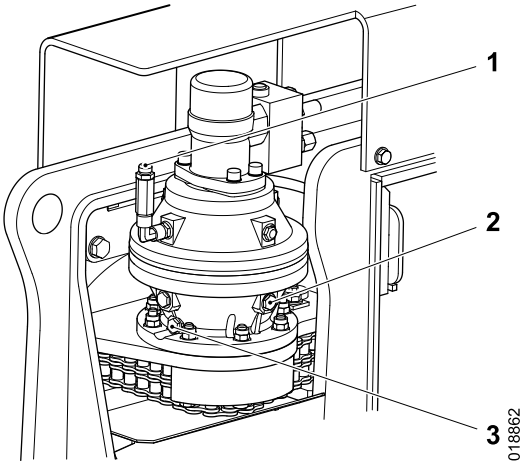
7.10.6 Separate top lift attachment

7.10.6.1 Spreading

Oil spreading motor unit, changing

NOTE

Read safety instructions for oil before starting work, see section B Safety.



1. Filling point
2. Sight glass
3. Drain plug

1 Remove the drain plug.

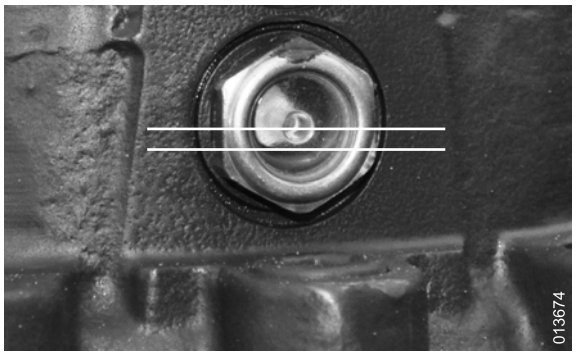
2 Remove and clean the sight glass.

3 Fit the drain plug when all the oil has drained.

NOTE

Make sure that the drain plug's washer seal is also removed.

4 Top up the oil through the filling point (position 1) until the level is in the middle of the sight glass, as illustrated. For volume and quality, see section *F Technical data*.



Spreading chains, checking

1 Before adjusting, the clearance between the slide plates and extension beams must be checked, as otherwise the chain's mounts may be damaged, see *Glide plates extension beam, checking and adjusting*, page 7:20.

20-foot position

2 Start the engine, move in the spreading to the 20-foot position and turn off the engine.

3 Check that both spreading beams move toward the 20-foot stop and that the distance between the spreading beam and the spreading motor's mount is at least 3 mm.

4 Check the C-C measurement between the twistlocks.

C-C 20 foot: 5853±3 mm.

If the 20-foot setting is correct, go to step 8.

20-foot stop

5 If needed, adjust the distance by moving the washers between right and left 20-foot stop. The number of washers may not be changed.

NOTE

Note the distance that the stop is adjusted to.

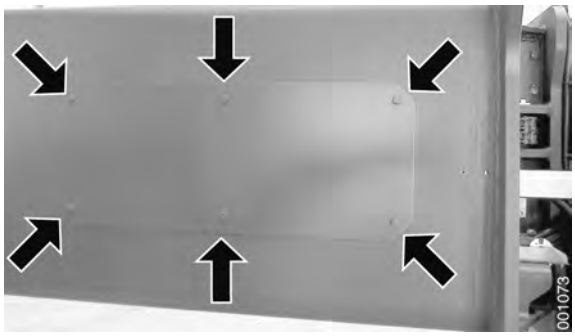
Move out the spreading a bit in order to move the washers.

⚠ CAUTION

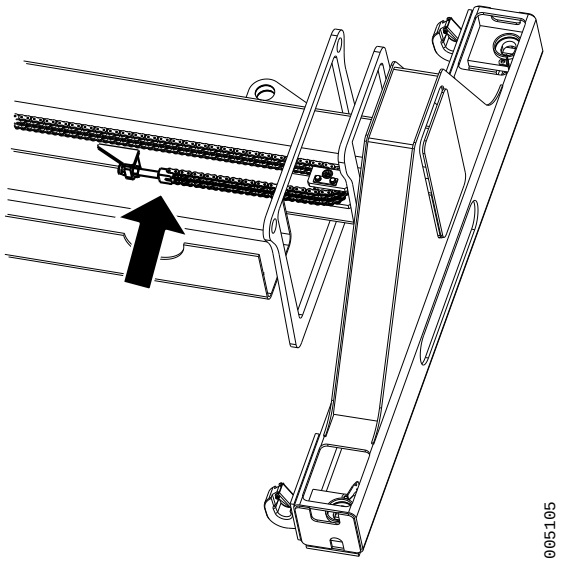
Incorrect chain tension.

Risk of damage to the attachment.

If the 20-foot stop is adjusted, the spreader chains must be adjusted equally.



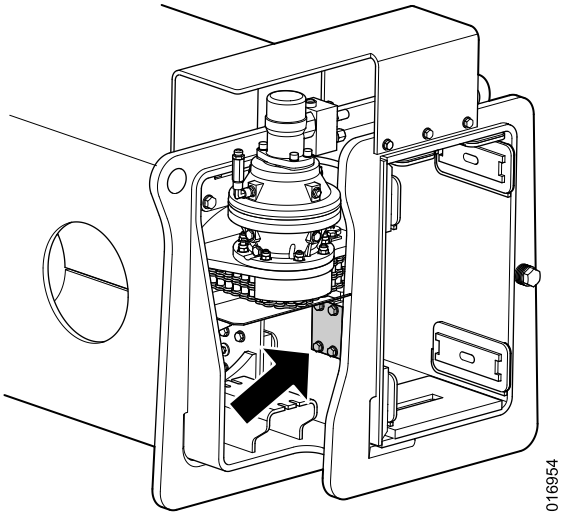
6 Remove the cover plates on the attachment's main beam.



7 If the 20-foot stop is adjusted, the spreader chains must be adjusted equally, see step 14.

NOTE

Check the vertical position of the chain tensioner to ensure that the chain runs straight against the chain wheel.



40-foot stop

40-foot position

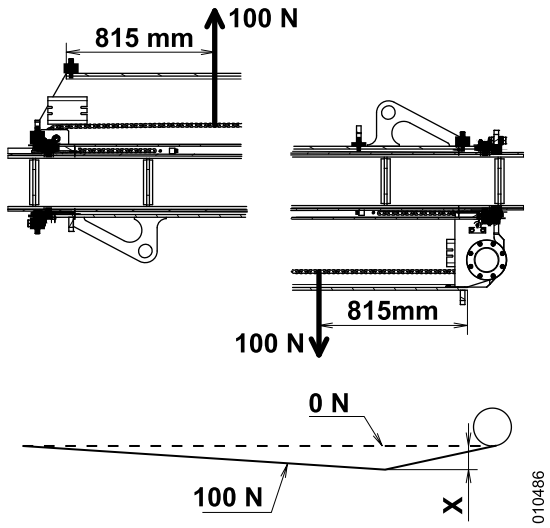
8 Start the engine and move out the spreading to the 40-foot position and turn off the engine.

9 Check the C-C measurement between the twistlocks.

C-C 40 foot: 11985±3 mm.

If the 40-foot setting is correct, go to step 11.

10 If needed, adjust the 40-foot stop.



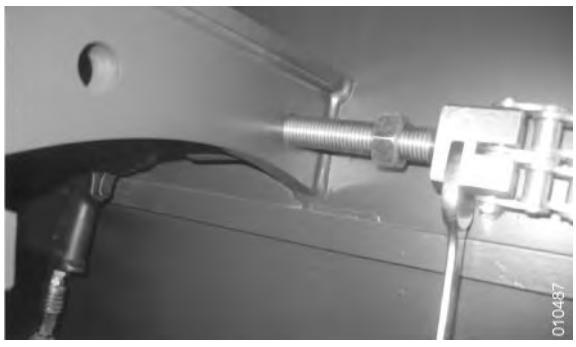
Chain tension

11 Start the engine and move the spreading out to the 40-foot position.

12 Wait 2 minutes and then check the tension of the chains.

13 Use a pull scale and measure how far the chain moves when pulled out with a force of **100 N** at **815 mm** in from the main beam's inner reinforcement collar, as illustrated.

Standard attachment: **X = 8-13 mm**.



14 If needed, adjust the tension of the chains.

Start the engine and run spreading out until the chain tensioners are visible in the inspection holes (approx. 250 mm). Adjust the chains, hold the chain tensioner with a box-end wrench so that the chain is not twisted while adjusting.

NOTE

Adjust the chain on the chain tightener max. 2 mm at a time.

15 Repeat steps 11-14 until the tension of the chains is correct.

16 ⊕

If the machine is equipped with 30 or 35-foot stop.

Start the engine and run out spreading to the 30 or 35-foot position. Switch off the engine and check the C-C measurement between the twistlocks.

C-C 30 foot: 8918±3 mm

C-C 35 foot: 10488±3 mm

IMPORTANT

Check the distance at stop from both 20' and 40'.

17 Apply lubricating grease to the spreading chains.

18 Fit the cover plates onto the attachment's main beam.

Glide plates extension beam, checking and adjusting

1 Park the machine with attachment lowered as far down as possible and spreaders in their narrowest position.

2 Turn off the engine and turn off the system voltage.

3 Unload applicable slide plate.

The glide plates can be unloaded by lifting the extension beam in the outer edge or by using wedges to change the extension beam's position in the attachment's main beam.

The diagram shows inner slide plates in the attachment's main beam.

The diagram shows inner slide plates in the attachment's main beam.

4 Remove the attaching bolts from the slide plate console.

5 Remove the slide plate's guide bolts.

6 Pull out the slide plate together with spacer plates and console.

7 Measure the thickness of the slide plate, replace if needed.

NOTE

*Slide plate thickness should be at least **10 mm**.*

8 Place the slide plate in the correct position.

Check the clearance between extension beam and slide plate. Clearance should be less than **1 mm** with all slide plates fitted.

Use a spacer plate to adjust the clearance.

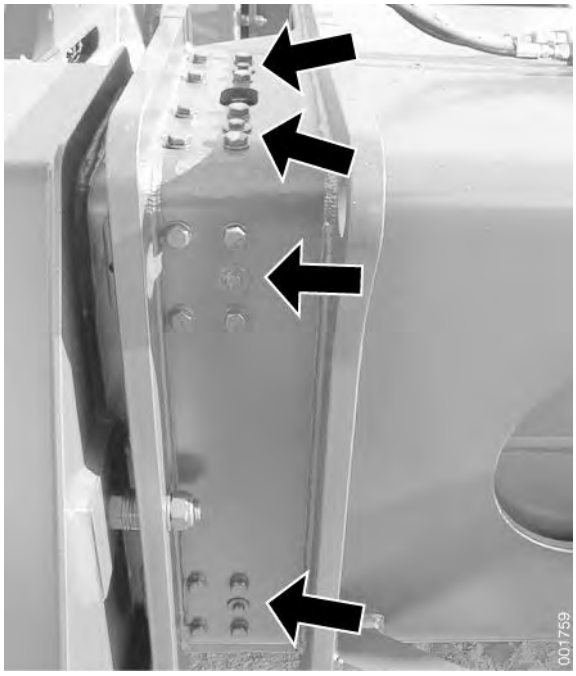
9 Install the slide plate console.

10 Install the slide plate guide bolt.

11 Lubricate the slide surface on the extension beam.

12 Start the machine and check the spreading function. Try to lift a container and recheck the clearance of the extension beams in the attachment's main beam.

Slide plates main beam attachment, checking



1 Park the machine with the attachment as far down as possible and spreading run inward so that 40 cm remain to the 20-foot position.

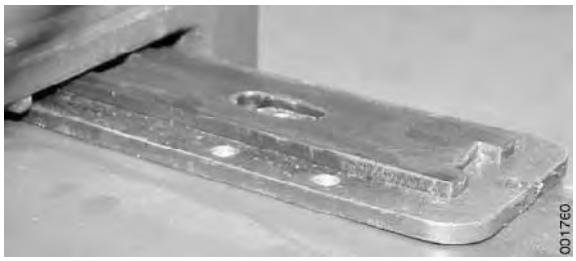
2 Turn off the engine and turn off the main electric power.

3 Unload applicable slide plate.

Take the strain off the lower glide plates by lifting the spreader beam at the outside edge or by using wedges to change the spreader beam's position on the attachment's main beam.

4 Remove the attaching bolts from the slide plate console.

5 Remove the slide plate's guide bolts.



6 Pull out the slide plate together with spacer plates and console.

7 Measure the thickness of the slide plate, replace if needed.

NOTE

*Slide plate thickness should be at least **10 mm**.*

8 Place the slide plate in the correct position.

Check the clearance between spreader beam and slide plate. The clearance should be max. **1 mm** with all slide plates fitted.

Fit or remove spacer plates until the distance is correct.

NOTE

Excessive clearance may result in damage to the spreader beam during load handling.

9 Install the slide plate console.

10 Install the slide plate guide bolt.

11 Repeat steps 3-10 on the other slide plates.

12 Start the machine and check the spreading function. Try to lift a container and check that there is no clearance in the spreader beams.

7.10.6.3 Twistlocks

Twistlocks, checking

WARNING

Dropped load.

Fatal danger!

Twistlocks hold the load during load handling and therefore it is crucial that twistlocks are checked according to instructions and replaced at the slightest sign of damage or wear.

WARNING

In case of incorrect horizontal movement the twistlocks are subjected to material fatigue.

Shortened life of twistlocks.

Check the float position every 500 hours of operation.

WARNING

Make sure that the engine is off when working on the twistlocks.

Twistlocks can be locked automatically if all sensors for contact are activated manually.

1 Check that the twistlocks function correctly.

Lock and open the twistlocks, check that the indicator lights are working, both in the cab and on the attachment.

2 Machine in service position, see section *B Safety*.

3 Clean the twistlocks from any dirt.

4 Under the rubber cover for twistlocks: check pin, link arm and lock nut.

5 Clean the area around sensor contact.

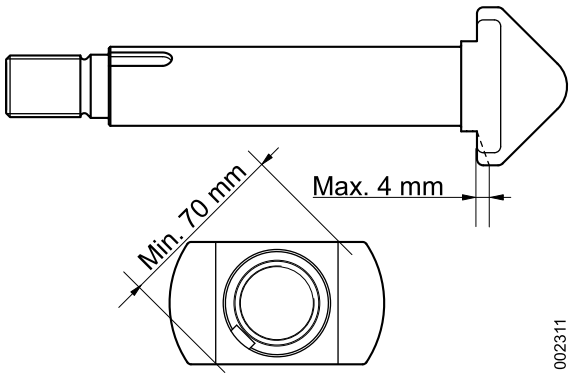
6 Press in the contact pin so that the head is flush with the spreader beam's underside. Check the distance to sensor contact, the distance should be **3-4 mm**. Adjust when needed.

NOTE

The contact pin should move easily and spring back completely.

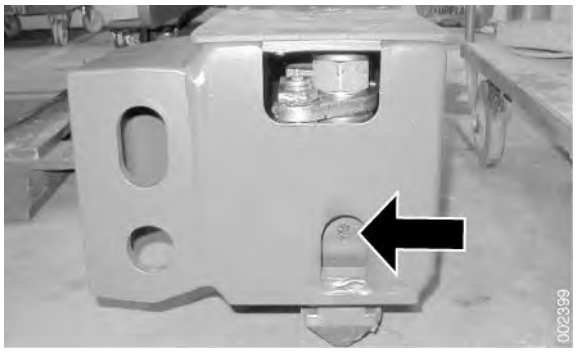
7 Check that the lock guide and lift pin can move freely.

8 Place a pry bar between the lift pin (position 4) and the lock guide (position 5) and check the clearance **max. clearance:** 1.5–2 mm.



Wear limits lift pin.

9 Turn twistlocks to locked position and check wear of the lift pin. Replace the lift pin if required.



10 Clean the area around the lubrication body.

11 Lubricate the lift pin's bearing with "EP2" universal grease.

12 Repeat steps 1-11 on all twistlocks.

Twistlocks, checking for cracks

DANGER

Material fatigue, reduced strength.

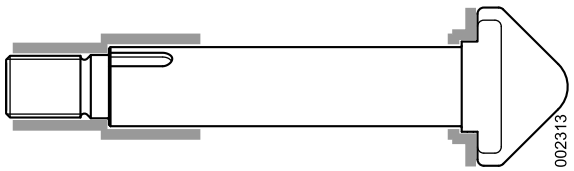
Fatal danger!

Change twistlocks that shows signs of cracks or other external damage, or twistlocks with more than 10 000 operating hours.

1 Remove the lift pins from the attachment.

NOTE

Twistlocks are heavy, be careful when removing.



Area for checking for cracks on lift pin.

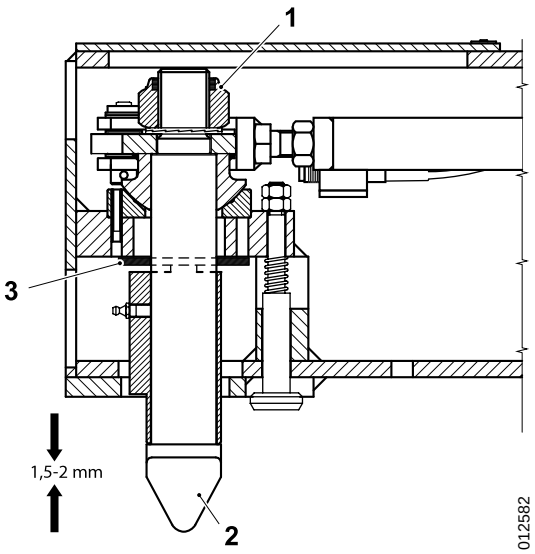
2 Check for cracks within the marked area on the lift pins without causing damage.

3 If the lift pins show signs of cracking, they must be replaced with new ones.

4 Install approved twistlocks.

NOTE

Use the new attaching nut and spherical bearing.



1. Nut
2. Twistlocks
3. Adjusting shims

Twistlocks, checking vertical movement

1 Check the vertical movement for twistlocks.

Press up the lift pin and check that the clearance is 1.5-2 mm.

2 Adjust the twistlocks as required. Step 3-6.

3 Remove the nut (position 1) from the lift pin and dismantle twistlocks (position 2).

NOTE

Twistlocks are heavy, be careful when removing.

4 Replace the adjusting shim (position 3) with the most suitable from the adjusting shim kit to obtain correct clearance for the vertical movement. See spare parts catalogue for part number of the kit.

5 Assemble the twistlocks. Tighten the nut to a torque of **700 Nm**.

6 Check again the vertical movement for twistlocks.

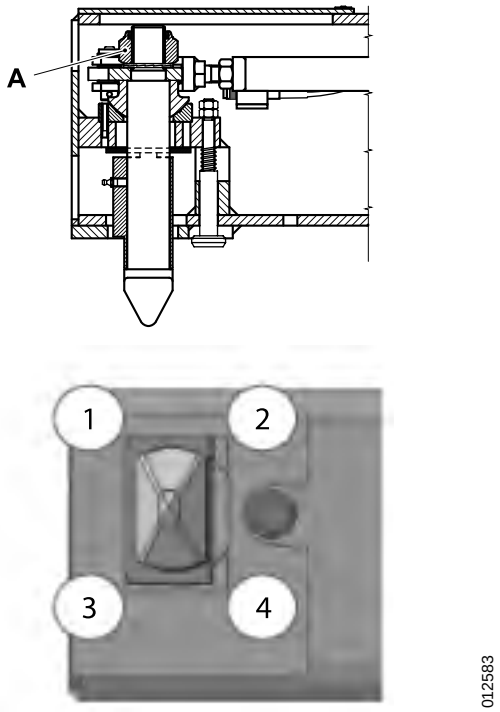
Twistlocks, checking float position

WARNING

In case of incorrect horizontal movement the twistlocks are subjected to material fatigue.

Shortened life of twistlocks.

Check the float position every 500 hours of operation.



1 Check that the tightening torque on the nut (position A) is **700 Nm**.

2 Move the lift pin around in the opening and check that the lift pin reaches all four corners and that the edges of the lift pin and opening have contact with each other at the same time.

3 Adjust the vertical movement if float position is not correct.

Twistlocks, replacement

1 Machine in service position, see section *B Safety*.

2 Clean the twistlocks and the surrounding area.

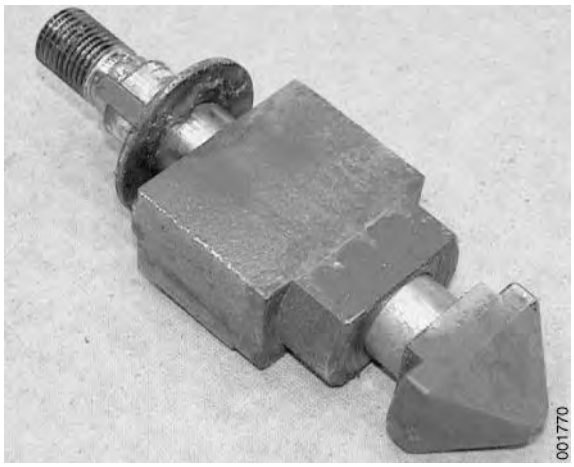
3 Detach the centre nut for the twistlocks.

4 Tap on the nut so that the lift pin releases from the wedge.

5 Hold the lift pin while removing the centre nut.

NOTE

Twistlocks are heavy, be careful when removing.



6 Remove the centre nut and lift away the twistlock.

7 Fit a new lift pin in the guide pin. Apply lubricating grease to the lift pin.

8 Fit the lift pin and guide pin in the extension beam. Fit the guide pin so that the grease cup is accessible through the holes in the extension beam.

NOTE

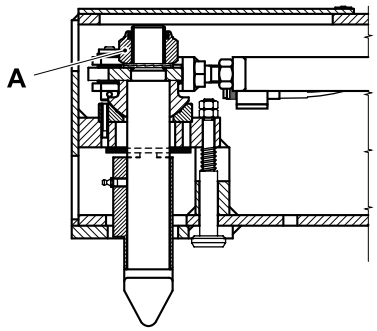
Do not forget the washer between the extension beam and guide pin.

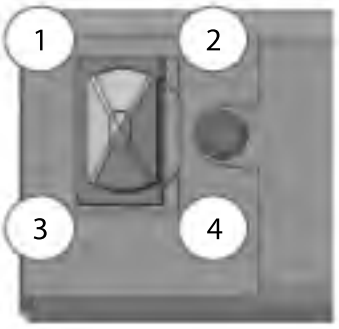
9 Position the wedge, bearing, lever, **new lock washers** and **new lock nuts** on the lock pin.

Apply lubricating grease to the parts before assembly.

10 Check the positions of the parts and that the twistlock can move.

11 Tighten the lock nut to a torque of **700 Nm**.

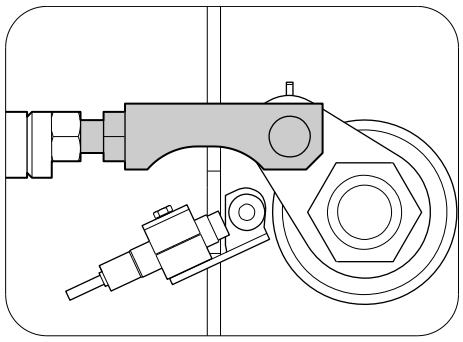




012583

12 Move the lift pin around in the opening and check that the lift pin reaches all four corners and that the edges of the lift pin and opening have contact with each other at the same time.

13 Check the vertical play, see *Twistlocks, checking vertical movement*, page 7:24.



018863

14 Check that all twistlocks are parallel; if necessary, adjust the position of the end attached in the lever on the twistlocks.

Loosen the lock nut and shaft in the lever on the twistlocks and turn the end to the correct position.

15 Lubricate the guide pin, lever and bearing with universal grease.

16 Check that the twistlock mechanism can move.

17 Test-run the machine, check that the twistlock is working.

Sensor contact, checking and adjusting

005180

Sensor mounting on the top lift attachment.

1 Check that the contact pins in the corner boxes can move freely up and down. The contact pins shall spring down when not loaded.

2 Check that the sensor is free of damage and dirt.

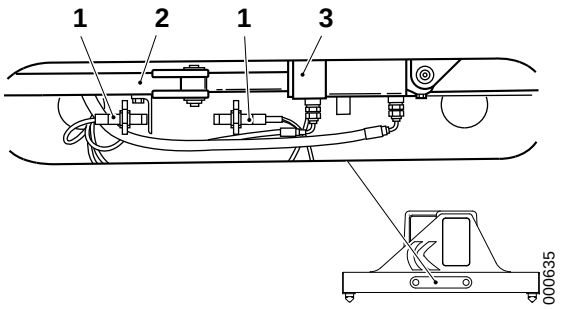
3 Turn the start key to position I and check that the LED on the sensor is switched off.

4 Lower the attachment onto a container and check that Indicator light contact is illuminated.

5 Lift the container a little bit so that the Indicator light contact is switched off.

6 With the container raised, check how much movement on the contact pins is needed to detect contact (LED on the sensor illuminates). The movement should be 3–4 mm.

7 If necessary, loosen the lock nut and screw the sensor in/out until the distance between the sensor and the contact pin is 5±1 mm.



1. Sensor twistlocks
2. Lock mechanism
3. Lock cylinder

Sensor twistlocks, checking and adjusting

1 Check that the sensors are free of damage and dirt.

2 Turn the start key to position I and check that the light indicator on the sensor is illuminated on the sensors that have indicator plates positioned in front of the sensor. On the other two, the light indicator should not be illuminated.

If necessary, loosen the lock nut and screw the sensor in/out until the distance between the sensor and the indicator plate is 5±1 mm.

3 Check that indicator light twistlocks open is illuminated.

4 Lower the attachment over a container and lock twistlocks.

5 Check that the LED on the sensor is illuminated for the sensors with the indicator plate in position in front of the sensor. On the other two, the light indicator should not be illuminated.

If necessary, loosen the lock nut and screw the sensor in/out until the distance between the sensor and the indicator plate is 5±1 mm.

6 Check that indicator light twistlocks locked is illuminated.

Contents 8 Control system

8 Control system

8.1 Instruments and controls

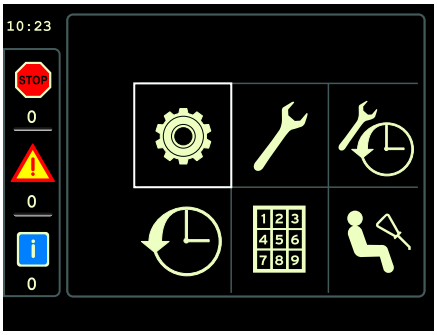
8.1.2 Information display

Date, time and units, setting

1 Machine in service position, see section *B Safety*.

2 Turn the start key to position I.

3 Scroll to the menu for Operating menu, system with ◀ or ▶ and confirm with ○.



016375

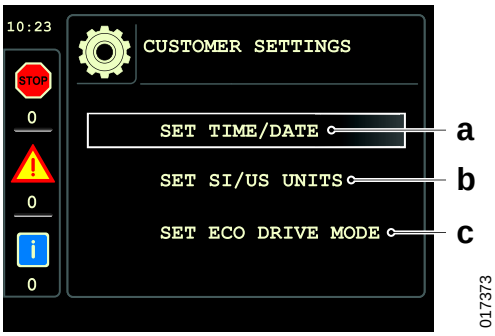
Clock

4 Select SET TIME/DATE with ▲ or ▼ and confirm with ○.

a. Setting the date and time

b. Setting the units

c. Setting the Eco Driving Mode ⊕



017373

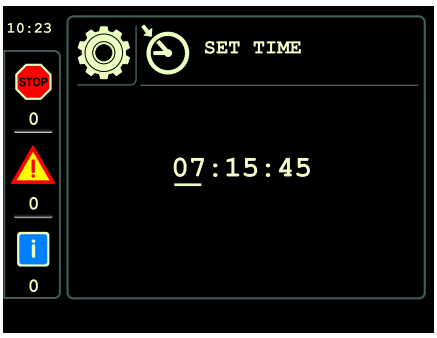
a. Setting the date and time.

b. Setting the units.

c. Setting drive mode.

5 Select SET TIME with ▲ or ▼ and confirm with ○.

014935



014941

6 Adjust the hours with ▲ and ▼, confirm with ○. Continue in the same way with the minutes and seconds.

7 Leave the menu with ⊘.

Date

015322

8 Select SET DATE with ▲ or ▼ and confirm with ○.

014942

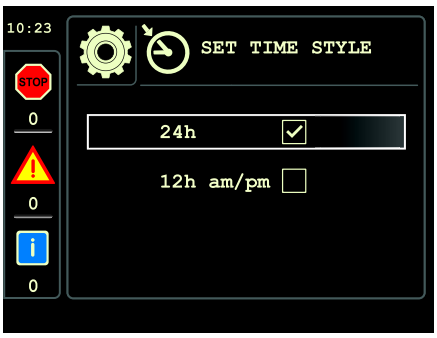
9 Adjust the year with ▲ and ▼, confirm with ○. Continue in the same way with the month and day.

10 Leave the menu with ⊘.

Time format

015323

11 Select SET TIME STYLE with ▲ or ▼ and confirm with ○.

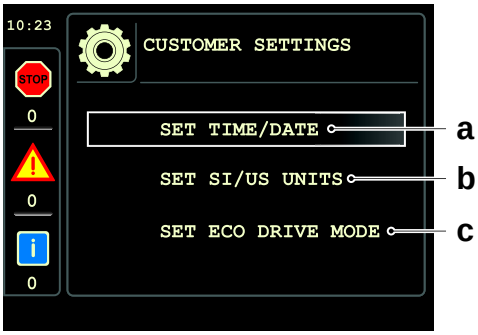


12 Select time format 24h or 12h am/pm with ▲ or ▼.

13 Leave the menu with ⊘.

14 Go back to the first menu for customer settings with ⊘.

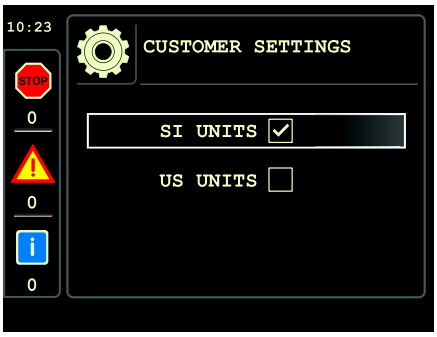
Unit display



15 Select SET SI/US UNITS with ▲ or ▼ and confirm with ○.

a. Setting the date and time
b. Setting the units
c. Setting the Eco Driving Mode ⊕

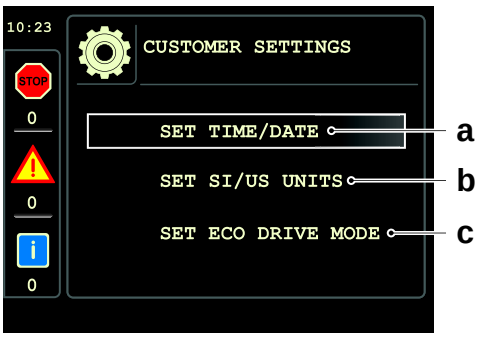
a. Setting the date and time.
b. Setting the units.
c. Setting drive mode.



16 Select SI UNITS or US UNITS with ▲ or ▼.

17 Go back to the first menu for customer settings with ⊘.

Eco Drive Mode

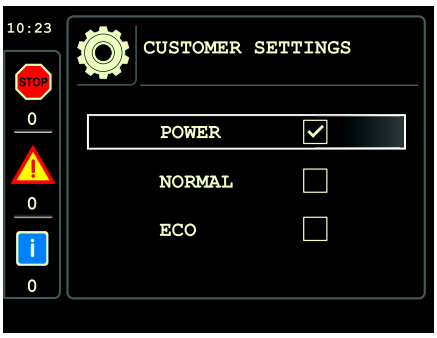


18 ⊕ The menu is only available if the machine is set so that Eco Drive Mode can be selected by the operator.

Select SET ECO DRIVE MODE with ▲ or ▼ and confirm with ○.

a. Setting the date and time
b. Setting the units
c. Setting the Eco Driving Mode ⊕

a. Setting the date and time.
b. Setting the units.
c. Setting drive mode.



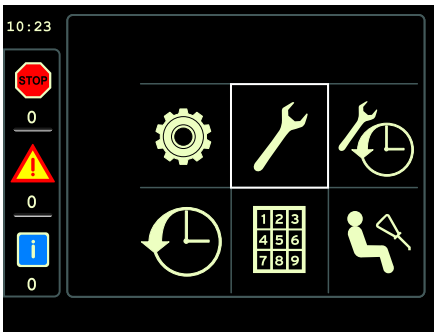
19 ⊕ The menu is only available if the machine is set so Eco Drive Mode can be selected by the operator.

Select ECO, NORMAL or PERFORMANCE with ▲ or ▼.

20 Go back to the first menu for customer settings with ⊘.

21 Leave the menu with several presses on ⊘ until the operating menus are shown again.

Active error codes, check



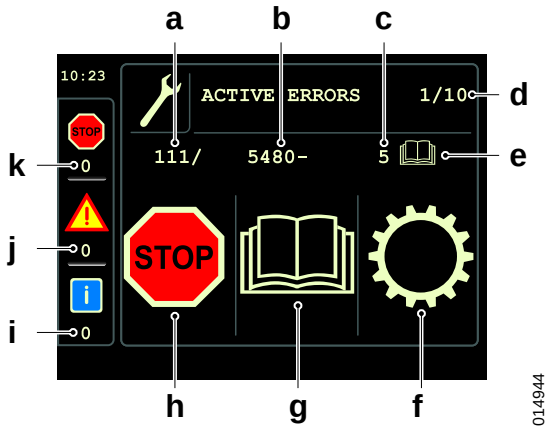
016376

1 Machine in service position, see section *B Safety*.

2 Turn the start key to position I.

3 Scroll to Operating menu, system, with ◀ or ▶ and confirm with ●.

4 Select the menu for ACTIVE ERRORS with ◀ or ▶ and confirm with ●.



014944

5 The menu shows the active error codes.

Scroll through the error codes with ▲ or ▼.

a. Unit that generated the error code.

b. Component error code concerns (SPN code).

c. Type of error (FMI code).

d. Number of active error codes. The first digit shows the error being displayed, the second digit the number of active error codes.

e. Information can be found in the operator's manual.

f. Symbol for the unit that generated the error code.

g. Symbol for operator action.

h. Symbol for error code level.

i. Number of error codes with the level INFORMATION.

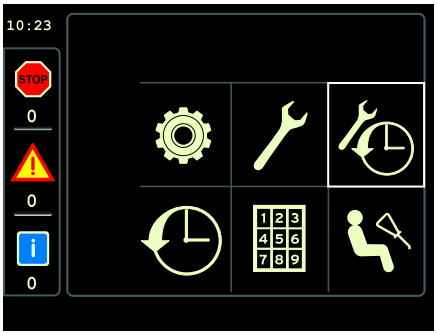
j. Number of error codes with the level WARNING.

k. Number of error codes with the level STOP.

For more information, see *Workshop manual*.

6 Leave the menu with several presses on ⊘ until the operating menus are shown again.

Inactive error codes, check



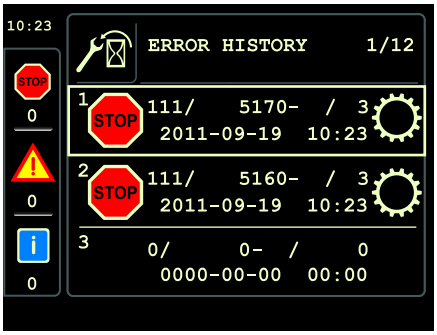
016377

1 Machine in service position, see section *B Safety*.

2 Turn the start key to position I.

3 Scroll to Operating menu, system with ◀ or ▶ and confirm with ●.

4 Select the menu for INACTIVE ERRORS with ◀ or ▶ and confirm with ●.



5 The menu shows the inactive error codes.

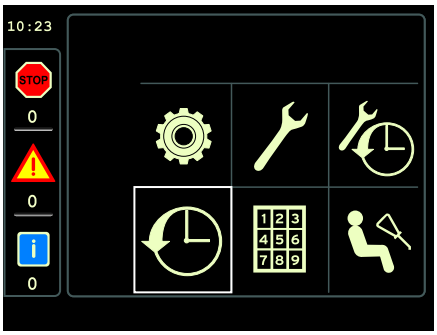
Scroll through the error codes with ▲ or ▼. Leave the menu with ⊘.

For more information, see *Workshop manual*.

Machine statistics, checking and resetting

⊕

1 Start the machine and let it idle.



2 Scroll to Operating menu, system with ◀ or ▶ and confirm with ○.

3 Select the menu for operating hours with ◀ or ▶ and confirm with ○.

4 The menu shows the cumulative operating time for the machine's components. This counter cannot be reset.

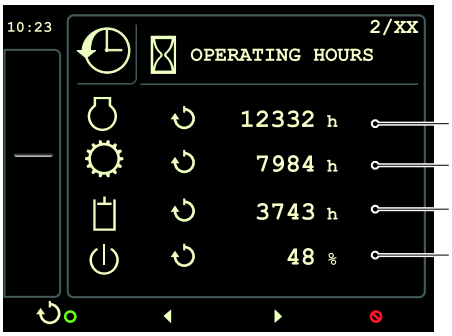
a. Operating time engine (hours).

b. Operating time transmission, with gear activated (hours).

c. Operating time hydraulic functions activated (hours).

d. Proportion of engine operating time that was idling (percent).

Select the next statistics and history menu with ▶ or go back with ◀. Leave the menu with ⊘.



5 The menu shows resettable operating time, since the last reset for the machine's components.

a. Operating time engine (hours).

b. Operating time transmission, with gear activated (hours).

c. Operating time hydraulic functions activated (hours).

d. Proportion of engine operating time that was idling (percent).

Select the row to be reset by pressing ○ briefly. Select the row with ▲ or ▼. Reset the row with ○.

Reset all rows by pressing ○ for more than 2 seconds.

Select the next statistics and history menu with ▶ or go back with ◀. Leave the menu with ⊘.

6 The menu shows driving distances.

a. Accumulated driving distance in km. This counter cannot be reset.

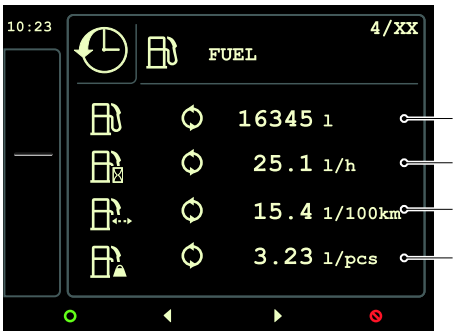
b. Driving distance trip meter 1 since last reset to zero in km.

c. Driving distance trip meter 2 since last reset to zero in km.

Select the row to be reset by pressing O briefly. Select the row with ▲ or ▼. Reset the row with O.

Reset all rows by pressing O for more than 2 seconds.

Select the next statistics and history menu with ▶ or go back with ◀. Leave the menu with ⊘.



7 The menu shows accumulated fuel statistics. This counter cannot be reset.

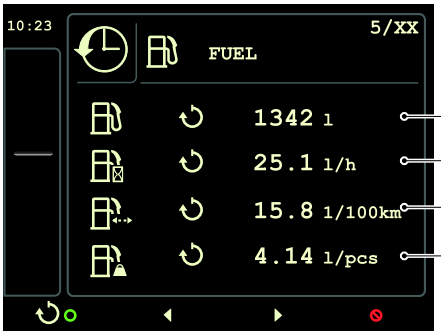
a. Total fuel consumption in litres.

b. Average fuel consumption in litres/hour.

c. Average fuel consumption in litres/100 km.

d. Average fuel consumption in litres/lift.

Select the next statistics and history menu with ▶ or go back with ◀. Leave the menu with ⊘.



8 The menu shows resettable fuel statistics since the last reset.

a. Fuel usage in litres.

b. Average fuel consumption in litres/hour.

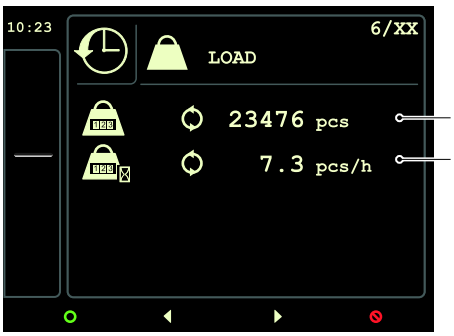
c. Average fuel consumption in litres/100 km.

d. Average fuel consumption in litres/lift.

Select the row to be reset by pressing O briefly. Select the row with ▲ or ▼. Reset the row with O.

Reset all rows by pressing O for more than 2 seconds.

Select the next statistics and history menu with ▶ or go back with ◀. Leave the menu with ⊘.

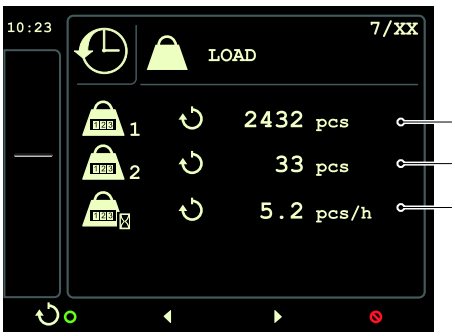


9 The menu shows accumulated load statistics. This counter cannot be reset.

a. Total number of lifts.

b. Average lift rate in number of lifts/hour.

Select the next statistics and history menu with ▶ or go back with ◀. Leave the menu with ⊘.



10 The menu shows resettable load statistics.

a. Number of lifts counter 1.

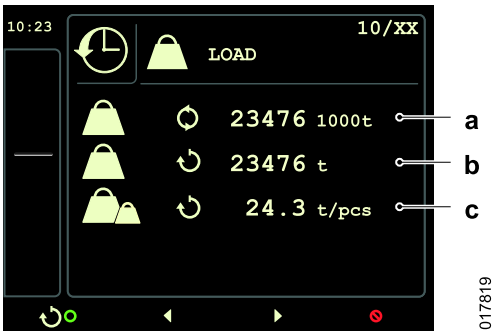
b. Number of lifts counter 2.

c. Average lift rate in number of lifts/hour.

Select the row to be reset by pressing O briefly. Select the row with ▲ or ▼. Reset the row with O.

Reset all rows by pressing O for more than 2 seconds.

Select the next statistics and history menu with ▶ or go back with ◀. Leave the menu with ⊘.



11 The menu shows resettable load statistics.

a. Accumulated lift load in 1000s of tonnes. This counter cannot be reset.

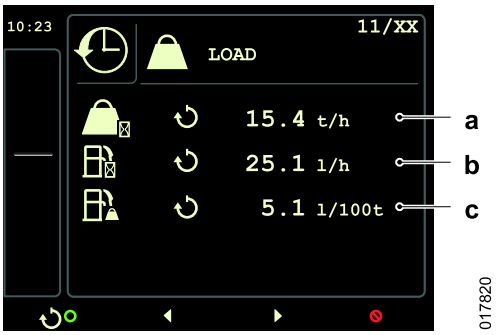
b. Total lift load since last reset in tonnes.

c. Average load per lift since last reset in tonnes/lift or pounds/lift.

Select the row to be reset by pressing briefly. Select the row with or . Reset the row with .

Reset all rows by pressing for more than 2 seconds.

Select the next statistics and history menu with or go back with . Leave the menu with .



12 The menu shows resettable load and fuel statistics.

a. Average lift load since last reset in tonnes/hour or pounds/hour.

b. Average fuel consumption since last reset in litres/hour or gallons/hour.

c. Average fuel consumption since last reset in litres/100 tonnes or gallons/100 tonnes.

Select the row to be reset by pressing briefly. Select the row with or . Reset the row with .

Reset all rows by pressing for more than 2 seconds.

Select the next statistics and history menu with or go back with . Leave the menu with .

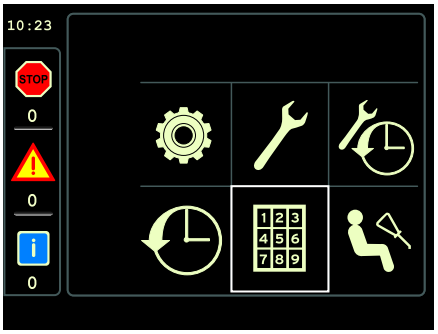
8.2 Monitoring functions

8.2.6 Service indicator

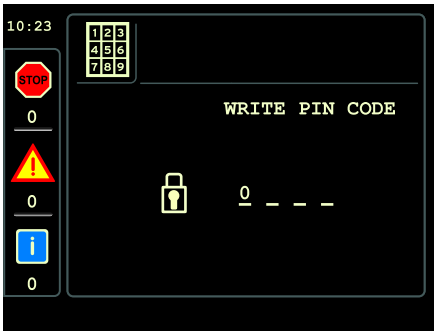
Service indicator, resetting

1 Machine in service position, see section *B Safety*.

2 In order to select the function to initiate, navigate first to the menu for service and settings with ◀ or ▶ and confirm with ●.



014981

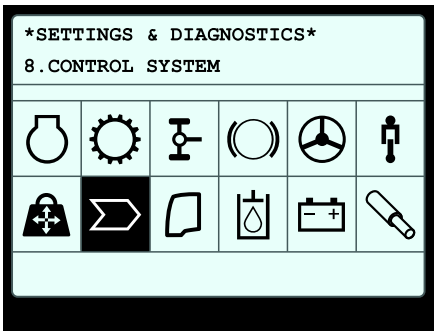


015625

3 Enter diagnostic code 1111 with ▲ or ▼. Confirm each digit with ●.

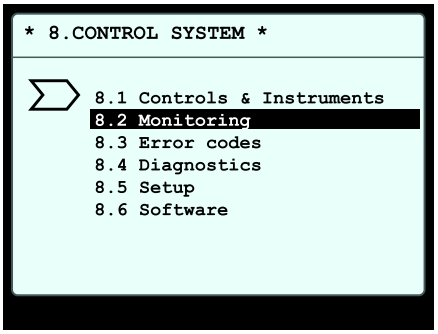
NOTE

The code determines which service menus are activated.



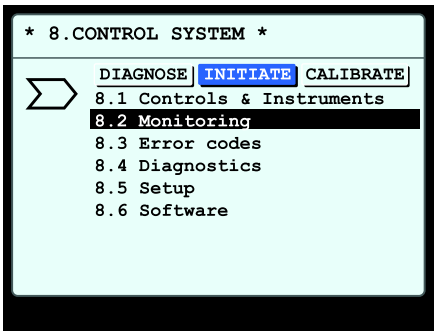
015624

4 Select 8. CONTROL SYSTEM by scrolling with ◀ or ▶ and confirm with ●.



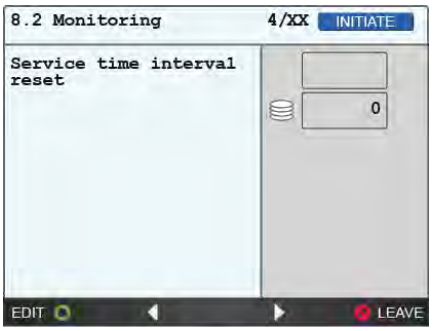
015629

5 Select 8.2 Monitoring by scrolling with ▲ or ▼ and confirm with ●.



015735

6 Select INITIATE by scrolling with ◀ or ▶ and confirm with ○.



7 Select Service time interval reset by scrolling with ◀ or ▶.

Press ○ twice, once for EDIT and once for SAVE in order to reset the service indicator.

8 Exit Initiation by scrolling out with ⊘.

8.2.7 Load sensor

Load sensor, calibration

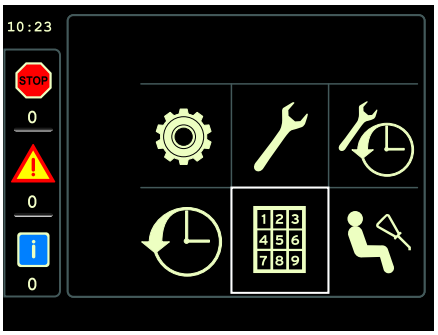
DANGER

Do not leave the machine during calibration. The machine may start to move.

1 Operate the trolley up and down a few times to remove any mechanical tension. Make sure that the mast is vertical.

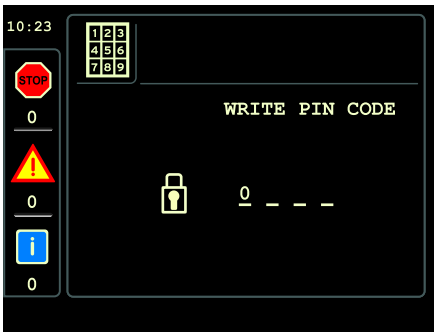
2 Run the machine a few minutes before calibration.

3 Stop the machine on level ground and apply the parking brake.



014981

4 In order to select the function to calibrate, navigate first to the menu for service and settings with ◀ or ▶ and confirm with ○.



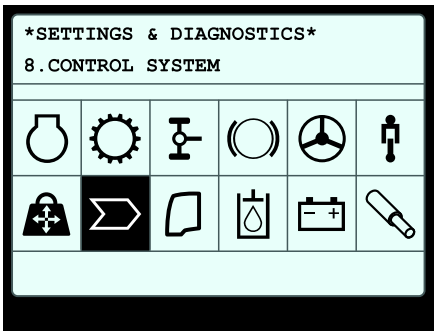
015625

5 Enter the code for calibration with ▲ or ▼. Confirm each digit with ○.

Code is obtained from Cargotec Support.

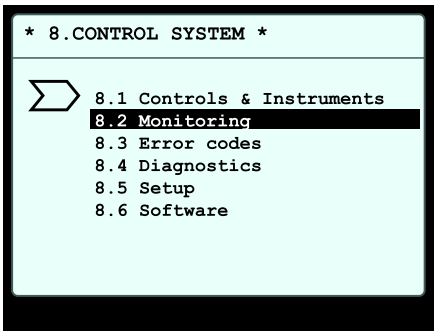
NOTE

The code determines which service menus are activated.



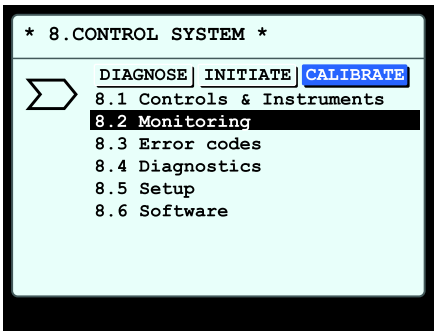
015624

6 Select 8. CONTROL SYSTEM by scrolling with ◀ or ▶ and confirm with ○.



015629

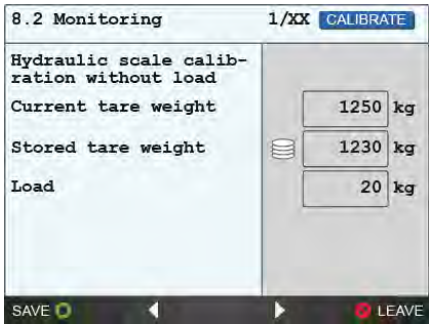
7 Select 8.2 Monitoring by scrolling with ▲ or ▼ and confirm with ○.



015628

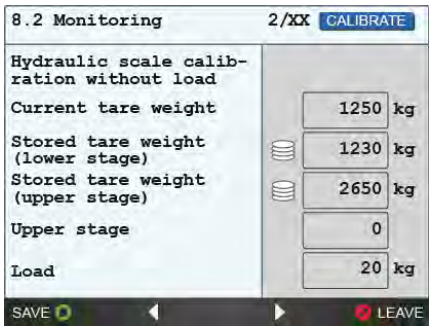
8 Select CALIBRATE by scrolling with ◀ or ▶ and confirm with ○.

Duplex standard mast



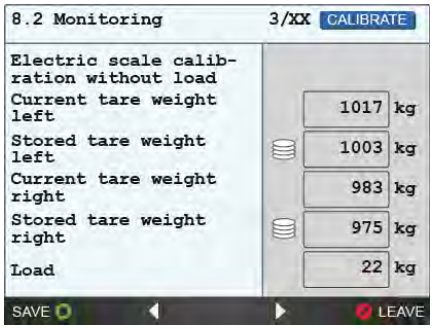
9 Operate the trolley up and lower it slowly to about 1 metre above the ground. Press ○.

Duplex/triplex free-lift mast



a. Operate the trolley up and lower it slowly to about 1 metre above the ground. Press ○.

b. Operate the trolley up to its maximum position without the inner mast having moved upwards. Then operate the mast up a further approx. 1 m and lower slightly. Press ○.



Mast with chain tightener

a. Operate the trolley up and lower it slowly to about 1 metre above the ground. Press .

10 Exit calibration by scrolling out with .

Contents 9 Frame, body, cab and accessories

9 Frame, body, cab and accessories

Safety for frame, body, cab and accessories

WARNING

Each case of mechanical impact on the cab may involve risks since the strength is changed. Consequently, making holes in load bearing parts is forbidden.

Risk of personal injury.

Contact Cargotec for recommendations.

WARNING

Never work underneath a cab that is not tilted over its balance point or secured in another way.

Risk of crushing injury.

Always tilt the cab as much as possible. At maximum tilting angle (on a horizontal surface) align the cab's centre of gravity so that it cannot tilt back.

WARNING

The hood may be slippery.

Danger of slipping.

It is forbidden to walk on the hood when it has no anti-slip protection or is not flat.

WARNING

The strength of the roof window can be substantially reduced by exposure to substances that contain aromatic hydrocarbons, ketones, esters, or chlorinated hydrocarbons.

Low strength! Danger!

Check the outside surface of the roof window at regular intervals. Clean only with windscreen washer fluid or a mild cleaning agent. Rinse thoroughly with plenty of lukewarm water. Replace a damaged roof window immediately if it is cracked or scratched!

CAUTION

All work on the roof pane is forbidden (e.g. making holes or cutting).

Risk of material damage.

Small cracks in the material around outer edges for example indicate that the strength of the roof window is affected and it must be replaced immediately.

9.4 Heating, ventilation and air conditioning

General recommendations for work on the air conditioning unit

CAUTION

Authorisation is required to perform repairs on the climate control unit.

WARNING

If there is a rupture of a cooling hose or leakage on the plant – turn off the unit immediately.

It is dangerous to allow refrigerants to come in contact with skin or eyes.

Never release refrigerant in a closed rum; the gas can cause asphyxiation in, for example, pits.

Never weld on or near a closed cooling system.

Empty refrigerant during repairs on the air conditioning.

Work may only be performed on the refrigerant circuit by an accredited company.

WARNING

Electric fans can injure hands.

Risk of personal injury.

Avoid placing hands near the cooling fans when the engine is running.

Air conditioning, checking/performance test

NOTE

The air conditioning does not work at temperatures below approx. 0 °C since the pressure in the refrigerant circuit is too low. If the pressure in the refrigerant circuit becomes too low the low pressure switch cuts off power supply to the compressor's magnet clutch, which means that the air conditioning stops working.

1 Read the safety instructions for coolant before starting work, see *Refrigerant*, page B:17.

2 Read the General instructions before working on the climate system, see *General recommendations for work on the air conditioning unit*, page 9:5.

3 Check that the condenser is not clogged, clean condenser fins with compressed air as required.

NOTE

Do not use high pressure wash.

4 Check that the compressor turns on and off without error.

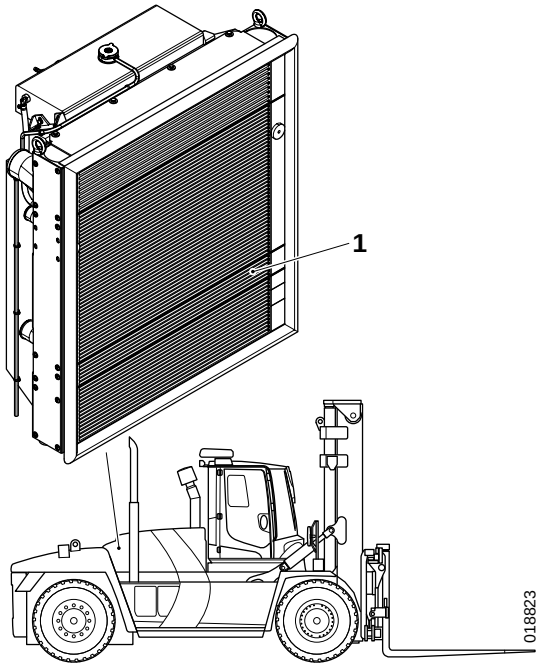
5 Check that the drain for the cooling element's condensation water from the cab is not clogged.

6 Check that there is no refrigerant leakage. In case of leakage, oil and gas often form a dusty, dirty spot.

7 Start the engine and engage the cooling function with setting on maximum cooling.

Let the engine run at min. 1,500 rpm. (At temperatures below approx. 0 °C, the cooling function will not start due to low pressure in the system.)

8 Set the fan to intermediate speed.



1. Condenser

Cover

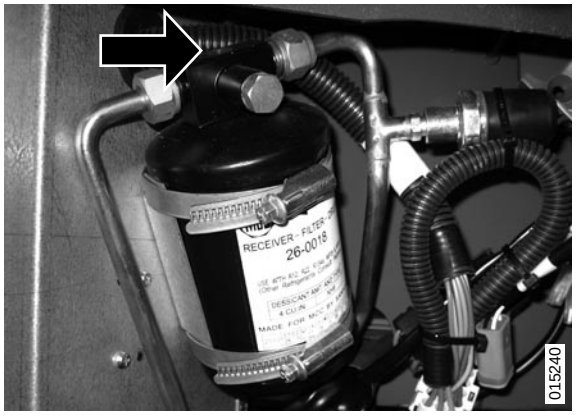
9 Remove the front cover on the left-hand side of the cab.

If the sight glass is difficult to see, the right-hand front cover can be removed for better access.

10 Inspect the receiver drier's sight glass by aiming light onto the sight glass.

Grey indication means that the receiver drier is worn out and must be replaced, see *Workshop manual* section *9 Frame, body, cab and accessories*, group *9.4.9 Receiver drier*.

Since the cooling circuit is closed, a worn out receiver drier indicates leakage in the cooling circuit. Before the receiver drier is replaced, the cooling circuit must be diagnosed for faults, see *Workshop manual* section *9 Frame, body, cab and accessories*, group *9.4 Heating, ventilation and air conditioning*.



Sight glass on receiver drier (cover removed)

11 Check after 10 minutes of driving that there are no visible bubbles in the dryer filter's sight glass. If there are bubbles, post-filling must be done by a professional. (Bubbles will occur only when the compressor starts and stops).

NOTE

Reliable checking of refrigerant quantity through the sight glass can only be performed when the ambient temperature is above approx. 15 °C.

Normally it should not be possible to see bubbles when the air conditioning system is operating. Bubbles may appear if the plant contains the wrong amount of refrigerant, in connection with the compressor stopping and starting, and if the condenser is defective or at very high ambient temperature.

It is easiest to confirm bubbles if you observe the sight glass at the same time as the compressor starts. Then bubbles are usually seen from a few seconds after the compressor has started, until the system starts to work normally.

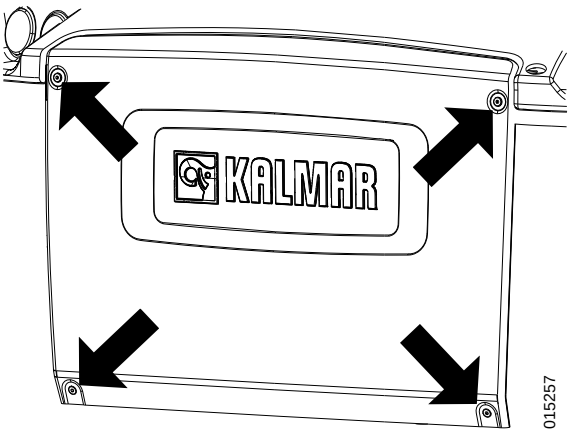
If leakage is suspected then the cooling circuit must be diagnosed for faults, see *Workshop manual* section *9 Frame, body, cab and accessories*, group *9.4 Heating, ventilation and air conditioning*.

12 Place a thermometer by the air vent closest to the evaporator. After 5-10 minutes, the temperature should be under 10 °C. (Deviations in the measurement result can occur if the performance test is conducted when the ambient temperature is below approx. 18 °C.)

In the event of poor cooling performance, perform troubleshooting on the cooling circuit, see *Workshop manual* section *9 Frame, body, cab and accessories*, group *9.4 Heating, ventilation and air conditioning*.

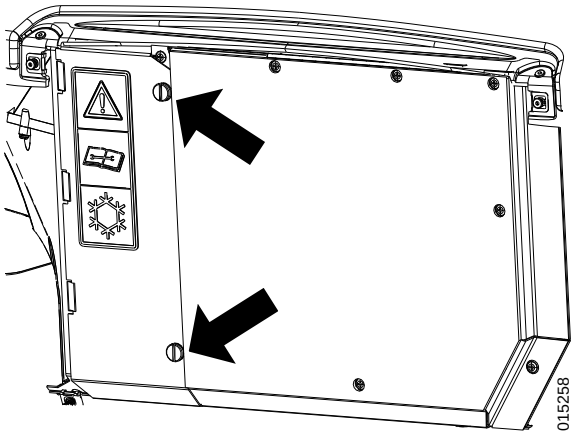
9.4.4 Fresh air filter

Fresh air filter air conditioning, checking and replacement

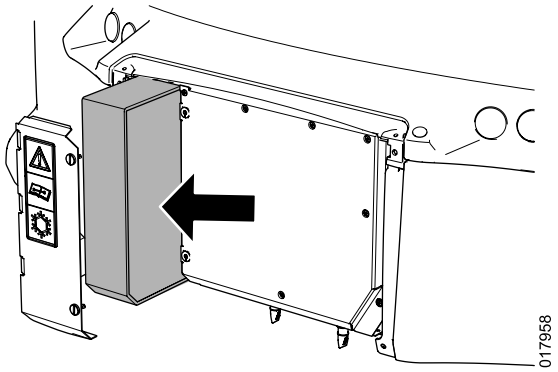


1 Machine in service position, see section *B Safety*.

2 Remove the four screws that secure the cab's front cover, remove the front cover.



3 Undo the two lock bolts and remove the cover plate in front of the fresh air filter.



4 Replace the filter when necessary.

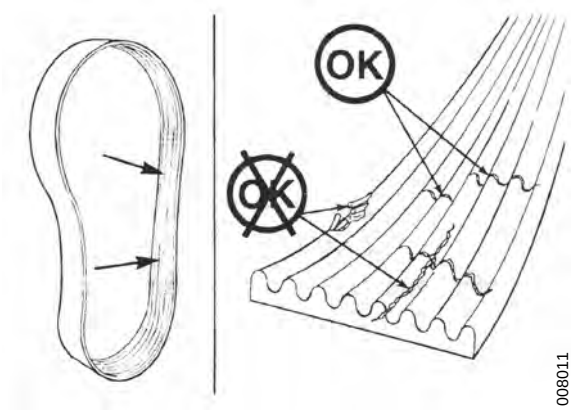
NOTE

Make sure that the filter is fitted in accordance with the arrow's marking. The bevelled corner must be turned downward and forward

5 Fit the cover plate and front cover.

9.4.7 Compressor

Drive belt AC compressor, check (engine alternative Cummins QSB6.7)



Check after operating when the belt is warm.

1 Machine in service position, see section *B Safety*.

2 Raise the hood.

3 It should be possible to press down the drive belt approx. 3-4 mm between the belt pulleys.

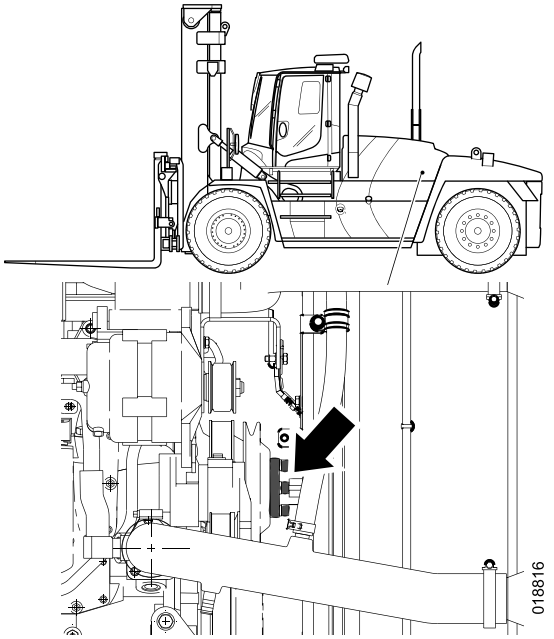
Check that the belt does not have any intersecting cracks. Transverse cracks are acceptable, longitudinal cracks that are intersected by transverse cracks are **not** acceptable.

IMPORTANT

Always change a drive belt that looks to be worn or has cracks.

4 Close the hood.

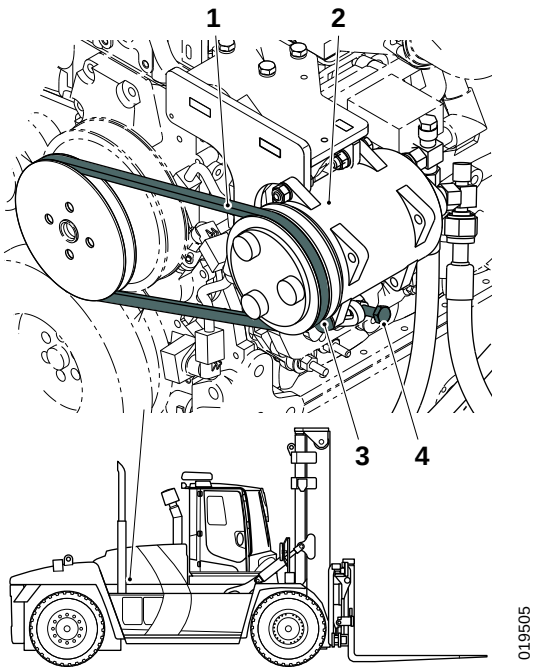
Drive belt AC compressor, replacement (engine alternative Cummins QSB6.7)



1 Machine in service position, see section *B Safety*.

2 Raise the hood.

3 Loosen the four screws (M10) holding the hub between engine and cooling fan. Fold down the cooling fan so that you have access to replace the belt.

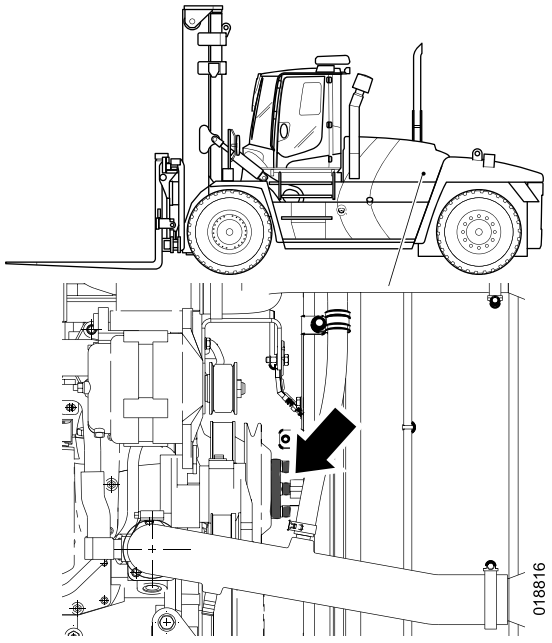


1. Compressor belt
2. Compressor
3. Lock nut
4. Rigging screw (belt tensioner)

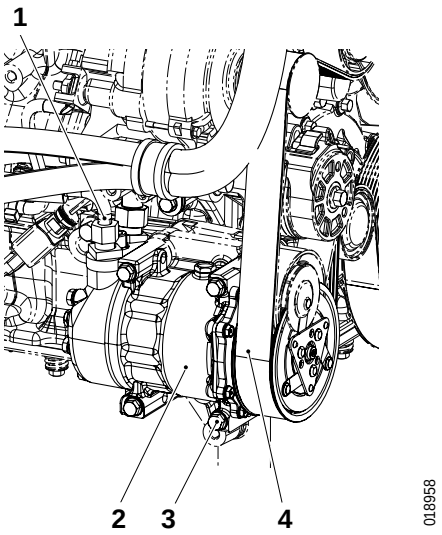
4 Loosen the nut (position 3) and loosen the belt tensioner with the rigging screw (position 4).

5 Thread off the belt (position 1) and fit a new one.

6 Tension the belt again.



7 Fit the four screws that hold the hub between engine and cooling fan.



Compressor, engine alternative Volvo TAD871VE

1. Connections
2. Compressor
3. Screw and nut
4. Compressor belt

Drive belt AC compressor, check (engine alternative Volvo TAD871VE)

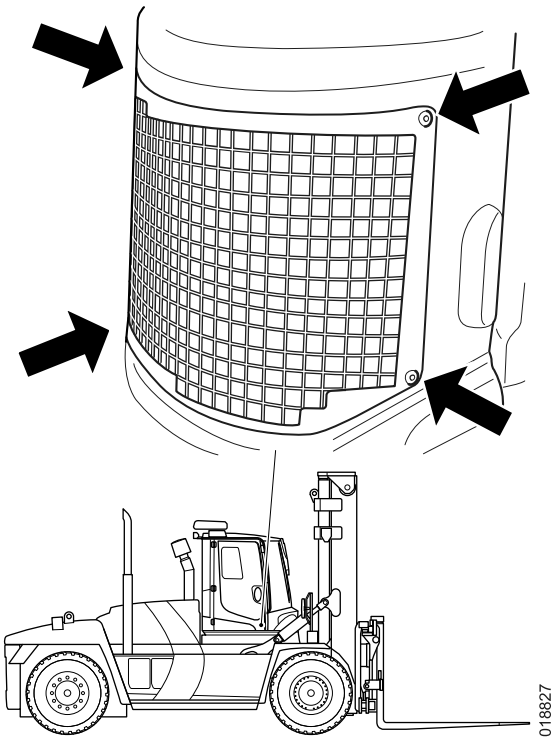
See *Drive belt, check (engine alternative Volvo)*, page 1:47.

Drive belt AC compressor, replacement (engine alternative Volvo TAD871VE)

See *Drive belt, changing (engine alternative Volvo TAD871VE)*, page 1:47.

9.4.23 Recirculation filter

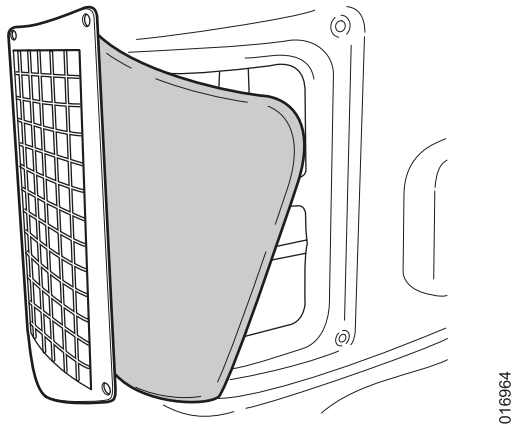
Recirculation filter, checking



1 Machine in service position, see section *B Safety*.

2 Remove the screws to facilitate access to the recirculation filter.

The recirculation filter is located by the floor inside the cab, on the right.



3 Remove the grille and remove the recirculation filter.

4 Clean or replace the recirculation filter.

A lightly soiled filter is shaken out, an excessively dirty filter is washed with mild soapy water and rinsed off. Replace the filter every two years or if the filter is damaged.

9.5 Wiping and cleaning of windows

Wipers, checking

CAUTION

When you try to move the wiper arms manually the wiper motor's gear or shaft will be damaged.

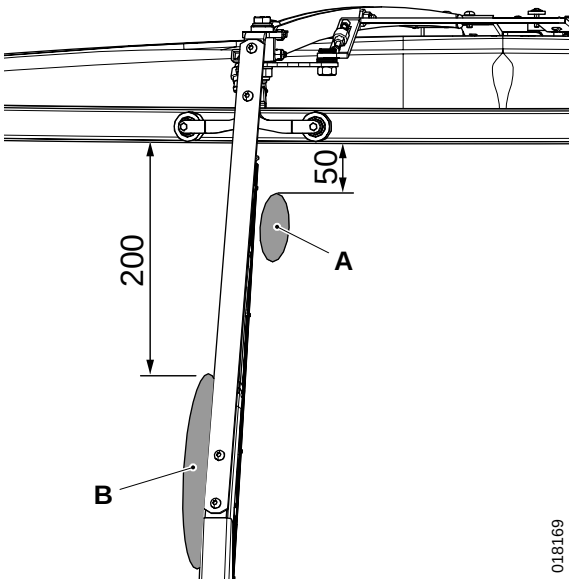
Damage to the wiper motor gear or shafts.

Never move the wiper arms manually.

Check that:

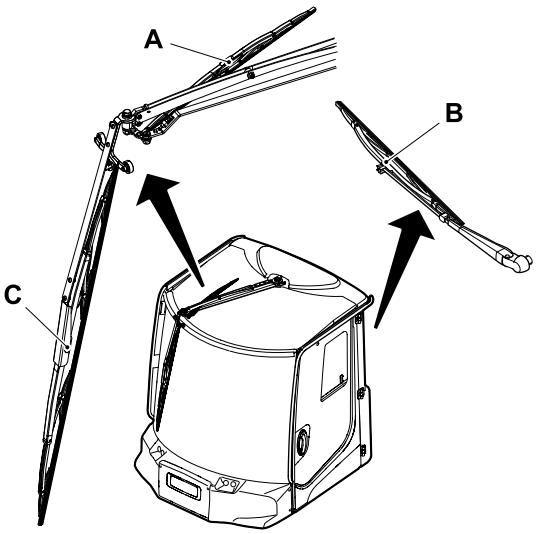
1. The motors are operating normally and without noise.
2. The wiper arms are pressing the wiper blades against the windows. Replace them if they show signs of damage or significant wear.

   Adjust the contact pressure of the wiper blades against the panes if necessary. The arms are made of spring steel, which allows the contact pressure to be adjusted. Carefully bend each wiper arm so that the pretension is increased or decreased to an equivalent degree.
3. The wiper blades are intact. Replace them if they are damaged or worn.
4. The washer function distributes washer fluid over the windows satisfactorily. If necessary, top up the washer fluid and adjust the washer nozzles. For optimal functionality, washing should occur within the grey areas.



A Area 30x70 mm

B Area 40x200 mm



A. Bracket, wiper blade, roof window

B. Bracket, wiper blade, rear window

C. Bracket screw, wiper blade, windscreen

Windscreen wipers, replacement (combined windscreen wiper windscreen/roof window)

1 Machine in service position, see section *B Safety*.

2 Replace the wiper blade.

The front wiper is attached with screws and nuts, the other has a standard mount.

CAUTION

When you try to move the wiper arms manually the wiper motor's gear or shaft will be damaged.

Damage to the wiper motor gear or shafts.

Never move the wiper arms manually.

NOTE

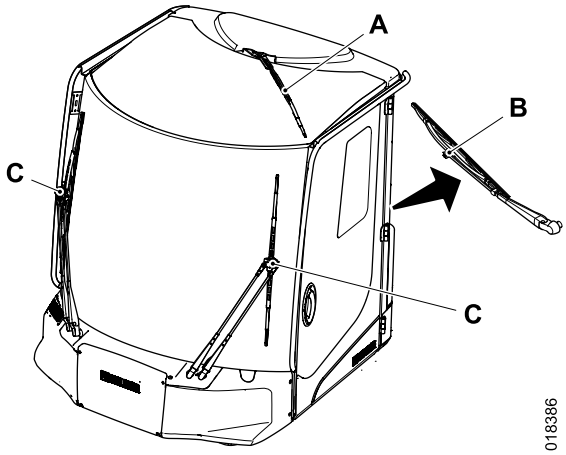
If the wiper blades for the roof and front are lifted off of each pane too much the arm can be damaged/bent so that contact against the panes is affected.

3 If a wiper arm for the rear pane or the balance wheel for the roof wiper needs to be loosened it is important to make sure that the grooves are free of metal shavings or similar. Also, the nuts shall be tightened so tight that the grooves are pressed into the bracket and work like drive flanges. Counterhold the wiper arm when installing so that the torque is not transmitted to the motor as it may be damaged (16–20 Nm tightening torque).

NOTE

The parking position of the roof wiper may be affected if the roof wiper's balance wheel has become loose or the motor replaced.

4 The wiper arm must be moved to the normal parking position before refitting the balance wheel. Run the wiper motor using the Switch for combined windscreen wipers front windscreen/roof pane and let the roof wiper stop in the "normal" parking position. Hold the wiper arm in the required position and fit the balance wheel.



A. Bracket, wiper blade, roof window

B. Bracket, wiper blade, rear window

C. Bracket screw, wiper blade, windscreen

Windscreen wipers, replacement (individual windscreen wiper windscreen/roof window)

1 Machine in service position, see section *B Safety*.

2 Replace the wiper blade.

The front wiper is attached with screws and nuts, the other has a standard mount.

CAUTION

When you try to move the wiper arms manually the wiper motor's gear or shaft will be damaged.

Damage to the wiper motor gear or shafts.

Never move the wiper arms manually.

NOTE

If the wiper blades for the roof and front are lifted off of each pane too much the arm can be damaged/bent so that contact against the panes is affected.

3 If a wiper arm for the rear pane or the balance wheel for the roof wiper needs to be loosened it is important to make sure that the grooves are free of metal shavings or similar. Also, the nuts shall be tightened so tight that the grooves are pressed into the bracket and work like drive flanges. Counterhold the wiper arm when installing so that the torque is not transmitted to the motor as it may be damaged (16–20 Nm tightening torque).

NOTE

The parking position of the roof wiper may be affected if the roof wiper's balance wheel has become loose or the motor replaced.

4 The wiper arm must be moved to the normal parking position before refitting the balance wheel. Run the wiper motor using the Switch for combined windscreen wipers front windscreen/roof pane and let the roof wiper stop in the "normal" parking position. Hold the wiper arm in the required position and fit the balance wheel.

9.6 Lighting system

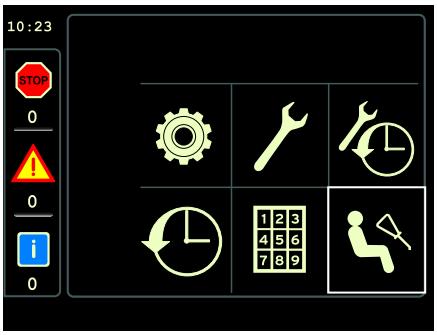
Lighting, check

1 Machine in service position, see section *B Safety*.

2 Start the engine and let it idle.

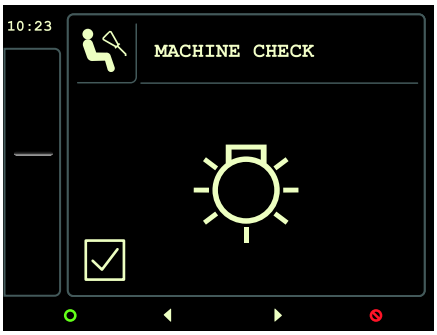
NOTE

Let the engine idle to prevent discharging the batteries.



016361

3 Select the menu for MACHINE CHECK with ◀ or ▶ and confirm with ○.



016362

4 Select the menu for lamp control with ◀ or ▶. This function turns on all the machine lights simultaneously. The silicone panels in the cab will change between background lighting and function lighting.

Turn on all the machine lights with ○. A tick in the box indicates that the lights are switched on.

5 Walk around the machine and check that all the lights are working, if necessary, replace broken bulbs.

6 Turn off all the machine lights with ○.

7 Exit the menu and step back to the main menu by pressing ⊘ repeatedly.

8 Turn off the engine.

9.9 Glass/windows/mirrors

Glass, safety

WARNING

The strength of the roof window can be substantially reduced by exposure to substances that contain aromatic hydrocarbons, ketones, esters, or chlorinated hydrocarbons.

Low strength! Danger!

Check the outside surface of the roof window at regular intervals. Clean only with windscreen washer fluid or a mild cleaning agent. Rinse thoroughly with plenty of lukewarm water. Replace a damaged roof window immediately if it is cracked or scratched!

CAUTION

All work on the roof pane is forbidden (e.g. making holes or cutting).

Risk of material damage.

Small cracks in the material around outer edges for example indicate that the strength of the roof window is affected and it must be replaced immediately.

Roof window, checking

1 Read the safety instructions for the glass, see *Glass, safety*, page 9:17.

2 Check that the roof window is not damaged or cracked. Replace a defective roof window immediately, see *Workshop manual*.

9.10 Construction and suspension of cab

Cab, safety

WARNING

Each case of mechanical impact on the cab may involve risks since the strength is changed. Consequently, making holes in load bearing parts is forbidden.

Risk of personal injury.

Contact Cargotec for recommendations.

9.10.1 Cab frame

Cab frame, checking

1 Read the safety instructions for the cab, see *Cab, safety*, page 9:18.

2 Machine in service position, see section *B Safety*.

3 Check the cab frame with regard to deformation or cracks. Rectify as needed.

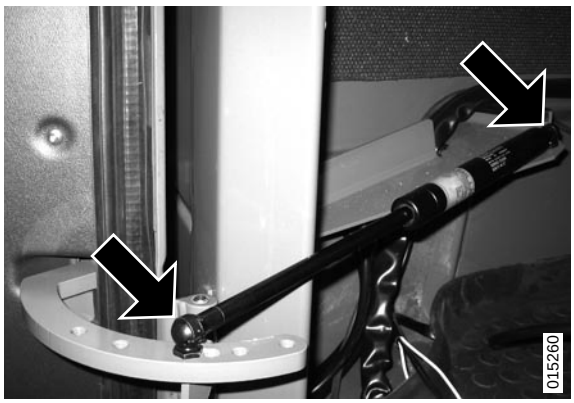
9.10.2 Doors

Doors, checking

1 Machine in service position, see section *B Safety*.

2 Visually inspect the door's mounting points.

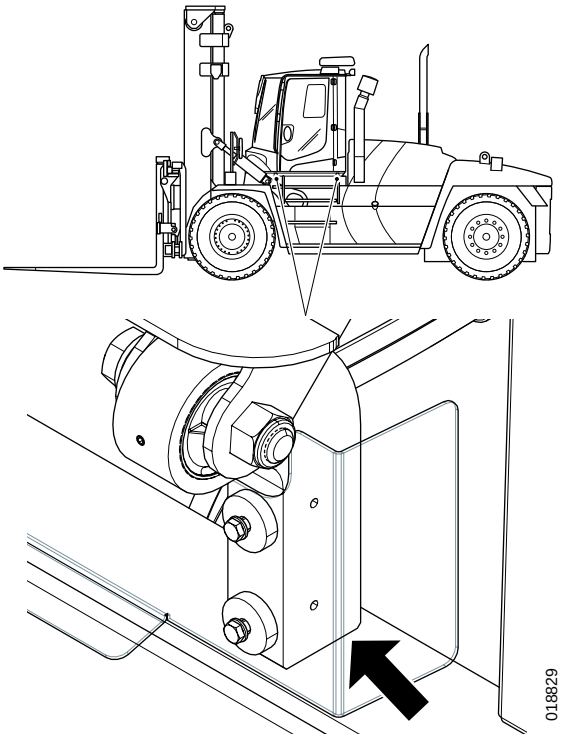
3 Check the door's locking mechanism with regard to function and wear.



4 Check the door stop's attachment points and joints with regard to wear and the door stop's (gas spring) function. Lubricate the gas spring's ball joints as required.

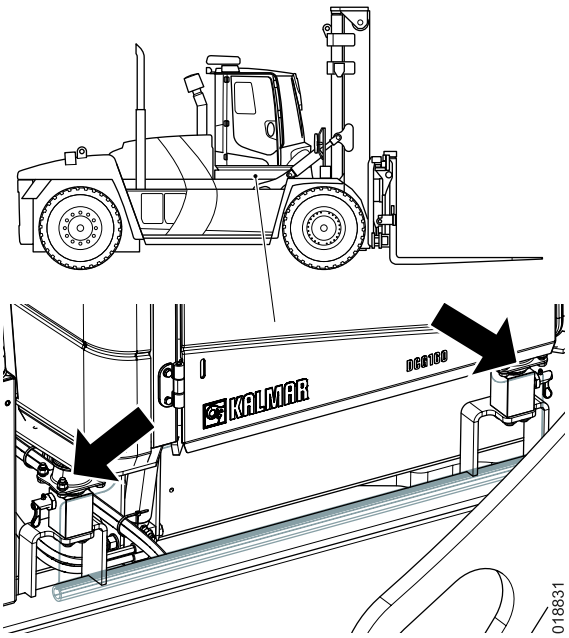
9.10.3 Cab undercarriage

Cab undercarriage, checking



1 Machine in service position, see section *B Safety*.

2 Check that the welding seams at the cab's mounting points are intact and free of visible cracks.

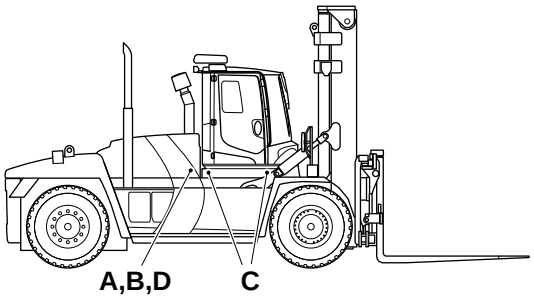


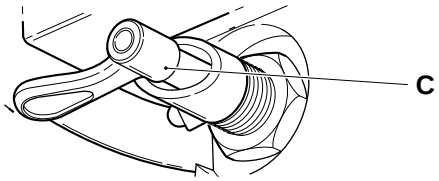
3 Check that the dampers are intact. Replace damaged dampers.

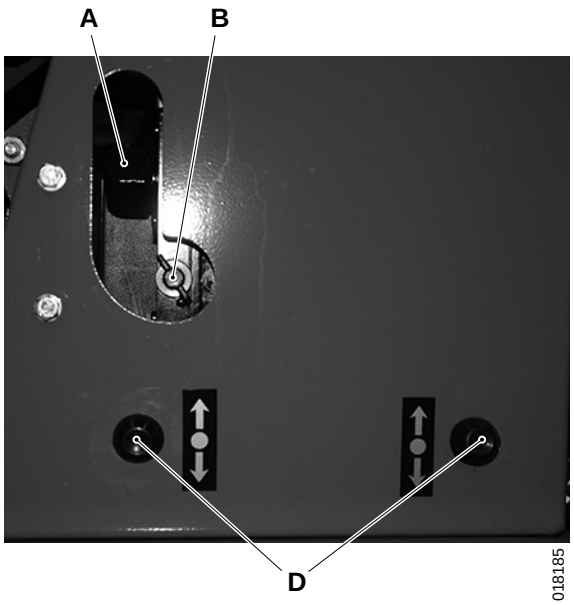
4 Check that the bolted joints are tightened, that the locking devices function (are not damaged) and that the brackets are undamaged. Rectify as needed.

9.10.4 Cab tilting

Tilting the cab







A. Pump rod bracket

B. Pump valve

C. Lock handle (figure shows open position)

D. Control buttons ⊕

WARNING

Never work underneath a cab that is not tilted over its balance point or secured in another way.

Risk of crushing injury.

Always tilt the cab as much as possible. At maximum tilting angle (on a horizontal surface) align the cab's centre of gravity so that it cannot tilt back.

The cab must always be tilted over the equilibrium position. If the space is insufficient laterally then the cab must always be secured against accidental lowering by means of a brace.

Preparation:

- Park the machine on level ground.
- Set the gear and travel direction selector in neutral.
- Tilt the mast forward and lower the forks.
- Apply the parking brake.
- Check that there is nothing loose in the cab.
- Close the doors.

Tilting

1. Turn both lock handles (position C) so that they reach their outer position to loosen the cab from the frame.
2. Turn the pump valve (position B) clockwise.
3. Fit the pump rod in its bracket (position A).
4. Pump until the cab has reached the end-position.

NOTE

Stop pumping/raise when the cab is in the end position, otherwise the pump valve will be hard to turn.

Lowering

1. Turn the pump valve (position B) anticlockwise.
2. Fit the pump rod in its bracket (position A).
3. Pump all the way until the cab rests on the frame.
4. Turn both lock handles (position C) so that they reach their inner position to lock the cab to the frame.

Electric tilting

⊞

1. Turn both lock handles (position C) so that they reach their outer position to loosen the cab from the frame.
2. Turn the pump valve (position B) clockwise.
3. Use the control buttons (position D) to raise the cab to the end position. Press both buttons simultaneously.

NOTE

Stop pumping/raise when the cab is in the end position, otherwise the pump valve will be hard to turn.

Electric lowering

⊞

1. Turn the pump valve (position B) anticlockwise.
2. Use the control buttons (position D) to lower the cab until it makes contact with the frame. Press both buttons simultaneously.
3. Turn both lock handles (position C) so that they reach their inner position to lock the cab to the frame.

9.12 Frame

Frame, checking

1 Machine in service position, see section *B Safety*.

2 Inspect for deformation and rust damage, as well as cracks in the welded joints. Rectify as needed. See section *C Preventive maintenance*.

9.13 Body structure

Body, safety

WARNING

The hood may be slippery.

Danger of slipping.

It is forbidden to walk on the hood when it has no anti-slip protection or is not flat.

9.13.4 Counterweights

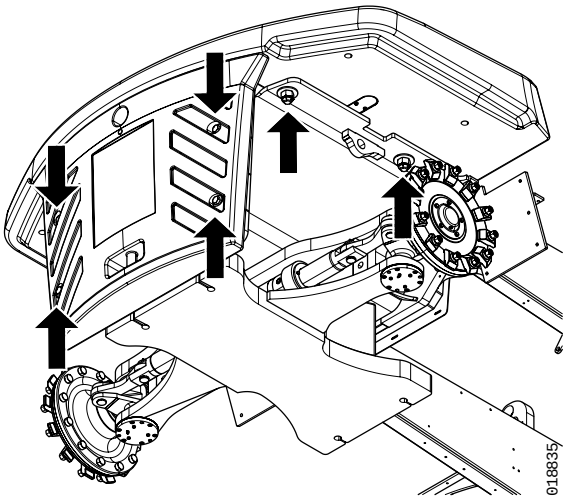
Counterweights, checking

DANGER

The counterweights are factory fitted and are adapted according to the machine's characteristics.

The machine's handling characteristics change if the counterweights are removed or added!

Never change the number of counterweights.



1 Machine in service position, see section *B Safety*, with transverse wheels.

2 Visually inspect that the counterweights are positioned properly and that the mounts and welding seams are intact and free of visible cracks.

3 Check the bolted joints.

9.14 Central lubrication

Central lubrication, checking

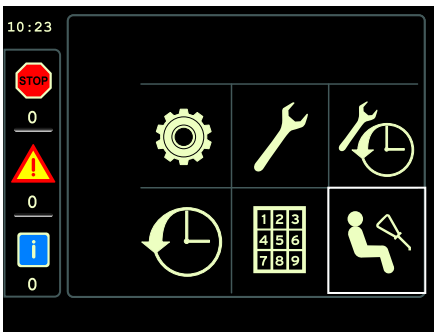
1 Check that no grease has been forced out through the safety valve (position 2).

If grease is pushed out through the safety valve, this means that there is a system blockage. Locate the blocked line by feeling the connections at the distribution block. A blocked hose remains pressurised and the connection becomes firm.

NOTE

If several distribution blocks are connected in series, a clogged line will be pressurised all the way to the first distribution block.

2 If necessary, fill lubricating grease in the pump unit through the filler nipple (position 1), for lubricating grease grade see section *F Technical data*.



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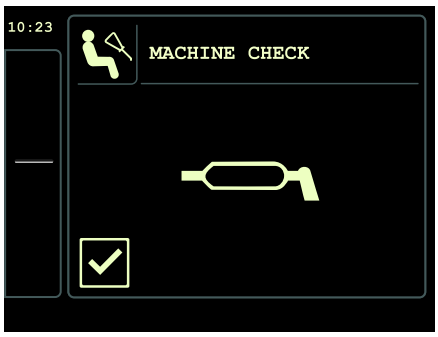
3 After filling, the pump may need to be run manually.

Select MACHINE CHECK by navigating to the menu for service and settings with ◀ or ▶ and confirm with ○.



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4 Select the menu for central lubrication with ◀ or ▶. Start the pump manually by pressing ○.

5 Allow the pump to operate until grease emerges from one of the lubrication points. Stop the pump by pressing ⊘.

If grease emerges through the safety valve then there is probably a blockage somewhere in the system. In such cases, stop the pump immediately by pressing ⊘. Troubleshoot the system.

6 Exit MACHINE CHECK by scrolling out with ⊘.

9.15 Paint/coatings

Paint/coatings, check

1 Check the machine's painted surfaces for stone chips and scratches.

2 Repair any damage immediately in order to avoid corrosion of the metal underneath.

Only use touch-up paint for minor damage and scratches. Major damage to paintwork should be repaired by a paint shop.

For information on other surface and material colours, contact Cargotec.

NOTE

Before performing touch-ups, the surface area must be carefully cleaned.

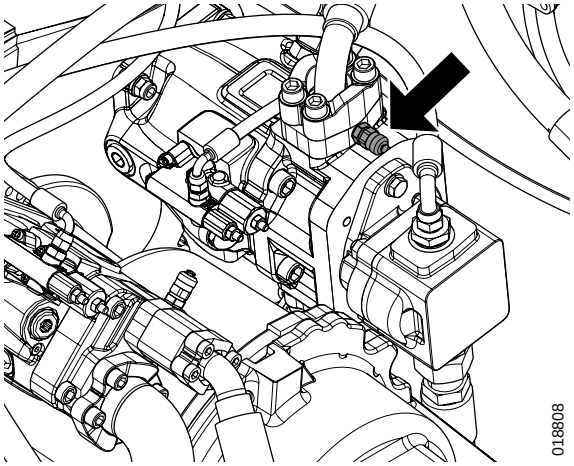
Contents 10 Common hydraulics

10 Common hydraulics

Hydraulic pressure, checking

NOTE

Read safety instructions for oil before starting work, see section B Safety.



Measuring outlet on hydraulic oil pump, steering and load handling

Pump pressure for steering and load handling

1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, approx. 50 °C.

2 Turn off the engine.

3 Connect a pressure gauge (0-25 MPa) to the measuring outlet on the hydraulic oil pump for steering and load handling.

4 Start the engine and let it idle.

5 Check the standby pressure for one pump at a time in the following order:

Hydraulic oil pump for steering and load handling: **2.8±0.2 MPa** (DCG 180-250), **4.0±0.2 MPa** (DCG 280-330)

Hydraulic oil pump for lift and tilt: **2.5±0.2 MPa**

The settings apply to a standard machine, certain machines may have higher standby pressure. However, the pressure difference between the pumps must always be maintained.

6 Increase the engine speed to approx. 1800 rpm and side shift right or left.

Continue to request max. side shift with the control lever. This causes the pump to provide maximum pressure.

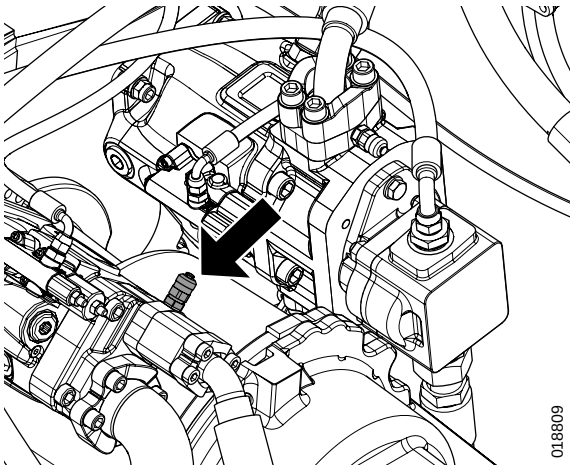
Check the max. pressure on the hydraulic oil pump for steering and load handling. The pressure should match the value on the pressure plate.

7 Increase engine speed to approx. 1800 rpm and turn to max. steering right or left and continue to activate the function.

Check the max. pressure on the hydraulic oil pump for steering and load handling. The pressure should match the value on the pressure plate.

8 Switch off the engine and remove the pressure gauge and fit the protective cap on the measuring outlet.

9 To adjust the hydraulic pressure, see *Workshop Manual*.



Adjusting screw max. pressure for hydraulic oil pump, load handling

Pump pressure load handling

1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, approx. 50 °C.

2 Turn off the engine.

3 Connect a pressure gauge (0-25 MPa) to the measuring outlet on the hydraulic oil pump for load handling.

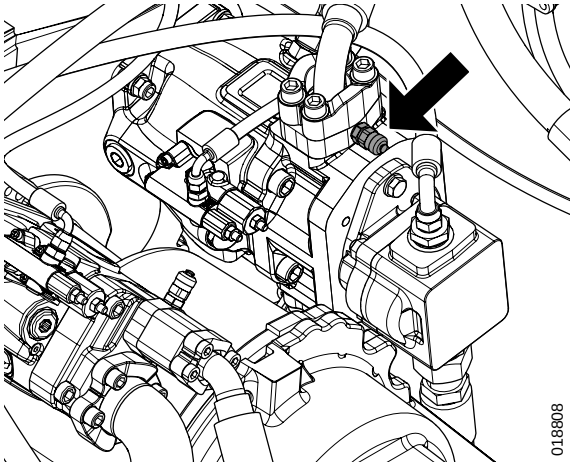
4 Start the engine and increase engine speed to approx. 1800 rpm.

Tilt in the mast to the max. position and continue requesting max. tilt in with the control lever. This will move the tilt function to relief (overflow).

Check the max. pressure on the hydraulic oil pump for load handling. The pressure should match the value on the pressure plate.

5 Switch off the engine and remove the pressure gauge and fit the protective cap on the measuring outlet.

6 To adjust the hydraulic pressure, see *Workshop Manual*.



Measuring outlet steering pressure

Steering pressure

1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, approx. 50 °C.

2 Turn off the engine.

3 Connect a pressure gauge (0-25 MPa) to the measuring outlet on the hydraulic oil pump for steering and load handling.

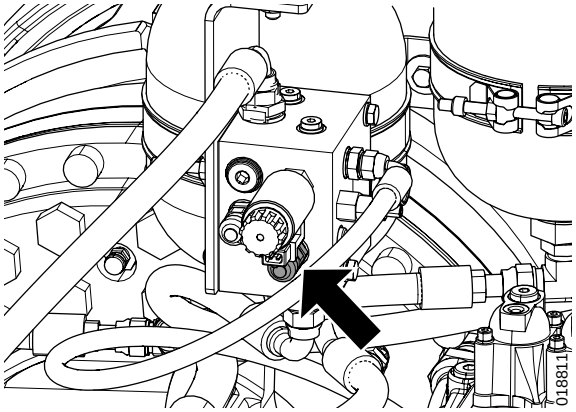
4 Start the engine and increase engine speed to approx. 1200 rpm.

5 Turn the steering wheel to full deflection and read the pump pressure when steering is against its end position, compare with the steering pressure on the hydraulics plate.

If the pump's maximum pressure is lower than the set steering pressure, the pump's maximum pressure is shown.

6 Switch off the engine and remove the pressure gauge and fit the protective cap on the measuring outlet.

7 To adjust the hydraulic pressure, see *Workshop Manual*.



Measuring outlet pump pressure

Pump pressure, brake system

1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, approx. 50 °C.

2 Machine in service position, see section *B Safety*.

3 Depressurise the hydraulic system, see section *B Safety*.

4 Connect a pressure gauge (0-25 MPa) to the measuring outlet for pump pressure on the accumulator charging valve.

5 Start the engine and let it idle.

6 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

7 Check the pump pressure during charging.

During charging the pressure should increase to **22.5±0.5 MPa** before the accumulator charging valve switches to cooling. The pressure drops when the accumulator charging valve switches to cooling.

8 Check the pressure during cooling.

During cooling, the pressure should be **max. 1.0–1.5 MPa**.

9 Turn off the engine.

10 Depressurise the hydraulic system, see section *B Safety*.

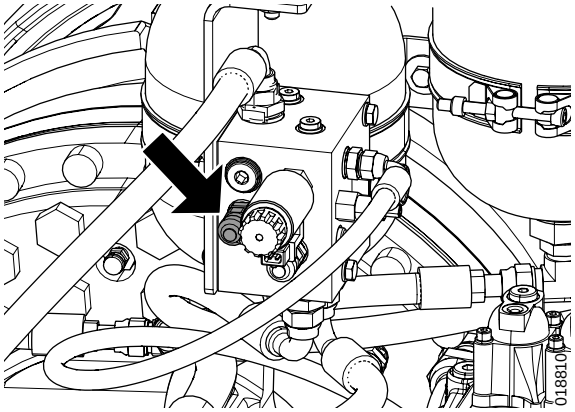
11 Remove the pressure gauge and fit the protective cap on the pressure check connection.

12 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

13 To adjust the hydraulic pressure, see *Workshop Manual*.



Measuring outlet accumulator pressure

Checking accumulator charging

1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, approx. 50 °C.

2 Machine in service position, see section *B Safety*.

3 Depressurise the hydraulic system, see section *B Safety*.

4 Connect a pressure gauge (0-25 MPa) to the measuring outlet for accumulator pressure on the accumulator charging valve.

5 Start the engine and let it idle.

6 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

7 Check that the pressure rises slowly to **19.0±1.0 MPa**.

8 Brake repeatedly and check at which pressure the accumulator charging valve switches to charging.

The valve must switch to charging before the pressure reaches **15.5±0.5 MPa**.

9 Depressurise the hydraulic system, see section *B Safety*.

10 Remove the pressure gauge and fit the protective cap on the pressure check connection.

11 Close the accumulator drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

12 To adjust the hydraulic pressure, see *Workshop Manual*.

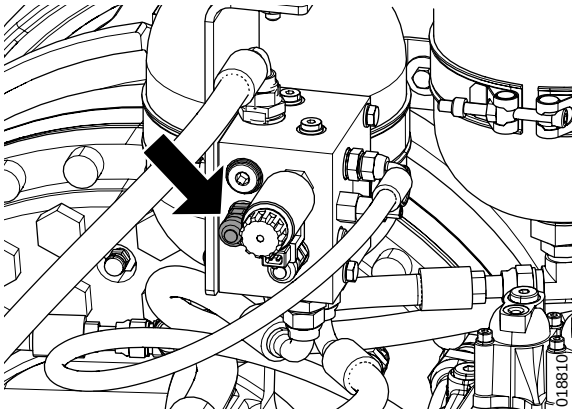
10.3 Tanks and accumulators

10.3.2 Accumulator

Accumulator, checking

NOTE

Read safety instructions for oil before starting work, see section B Safety.



Measuring outlet accumulator pressure

1 Machine in service position, see section *B Safety*.

2 Connect a pressure gauge (0-25 MPa) to the measuring outlet for accumulator pressure on the accumulator charging valve.

3 Turn on the system voltage and start the engine.

4 Charge the accumulator until the accumulator charging valve switches to cooling.

5 Turn off the engine.

6 Reduce the pressure slowly by braking gently several times while checking the pressure on the pressure gauge.

When the pressure reaches approx. **10.0 MPa** the pressure should decrease directly to **0 MPa**.

If the pressure drops immediately when the engine is switched off then the accumulator does not have any precharge pressure. Check that the accumulator charging valve is closed. Otherwise, this indicates internal leakage and the accumulator must be replaced.

If the pressure can be slowly reduced to a pressure below **10.0 MPa** then the precharge pressure is too low and the accumulator must be replaced or handed over to qualified personnel for maintenance or charging.

7 Check that the accumulator's connection is sealed.

8 Start the engine.

9 Deactivate the parking brake.

10 Check that at least **8** brake applications (pedal depressions) can be performed before the pressure drops to **10.0 MPa**.

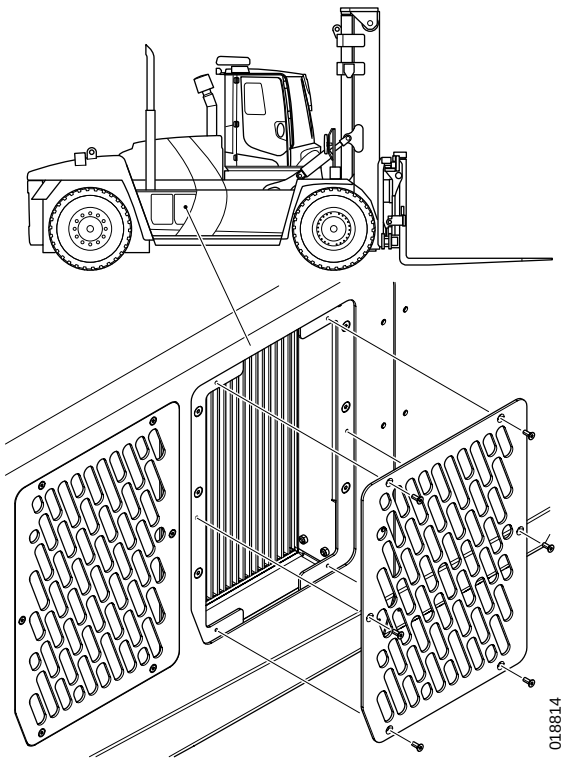
At **11.5 MPa** the event menu for low brake pressure should be shown.

10.6 Temperature control, cleaning and hydraulic oil

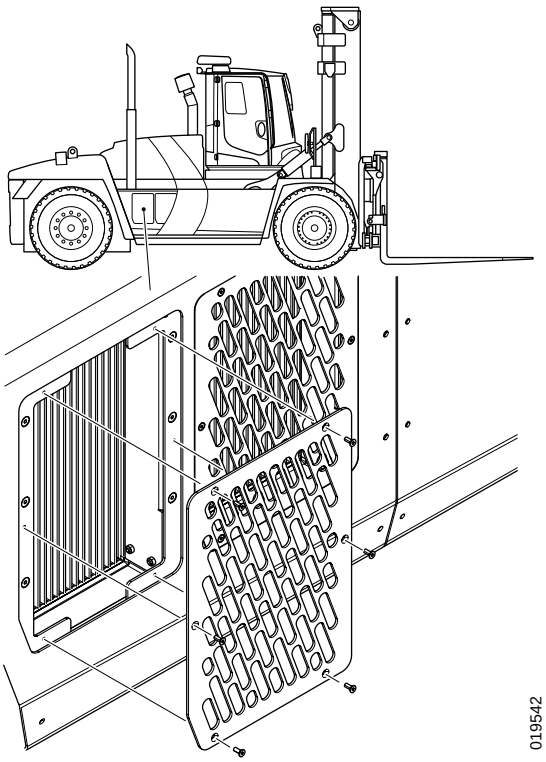
10.6.2 Hydraulic oil cooler

Hydraulic oil cooler, cleaning

1 Machine in service position, see section *B Safety*.



Machine with common hydraulic oil tank



Machine with separate oil tank for brake system

2 Clean the hydraulic oil cooler with compressed air. Blow away dust and other loose dirt.

10.6.7 Breather filter hydraulic oil tank

Breather filter hydraulic oil tank, changing

1 Machine in service position, see section *B Safety*.

2 Clean the area around the filter housing.

3 Remove the filter housing.

Press down and turn approx. 1/8 turn clockwise.

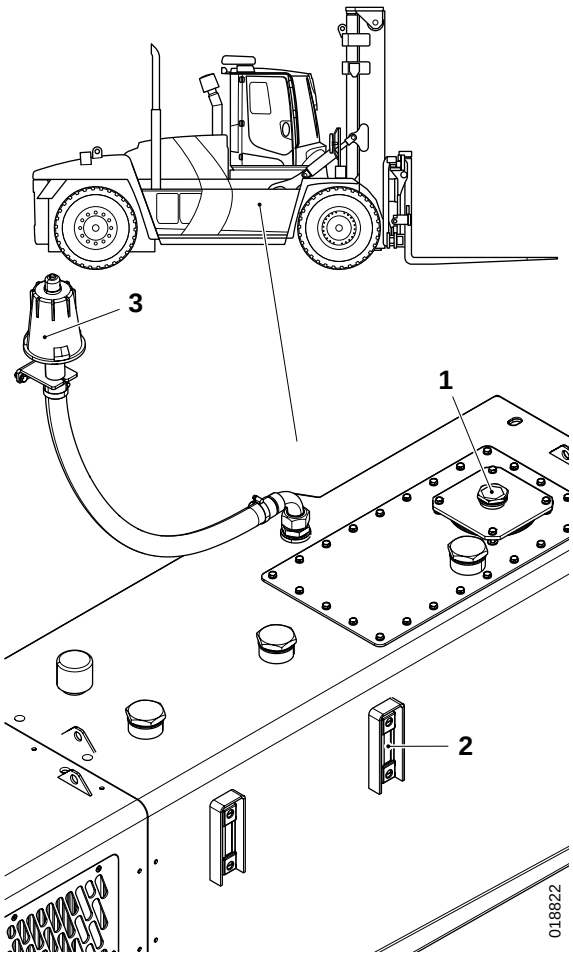
4 Replace the filter insert.

Handle the filter cartridge as environmentally hazardous waste.

5 Fit the filter housing.

Press down and turn approx. 1/8 turn anticlockwise.

6 Reset the filter indicator by pressing down the button in the middle on the glass centred on the filter cartridge.



1. Filler hole in the oil filter cover
2. Sight glass hydraulic oil
3. Breather filter hydraulic oil tank

10.6.8 Hydraulic oil filter

Hydraulic oil filter (high-pressure filter), changing

A high-pressure filter is fitted in the engine compartment as standard. There is an additional high-pressure filter for a machine equipped with a separate oil tank for the brake system.

NOTE

Read safety instructions for oil before starting work, see section B Safety.

IMPORTANT

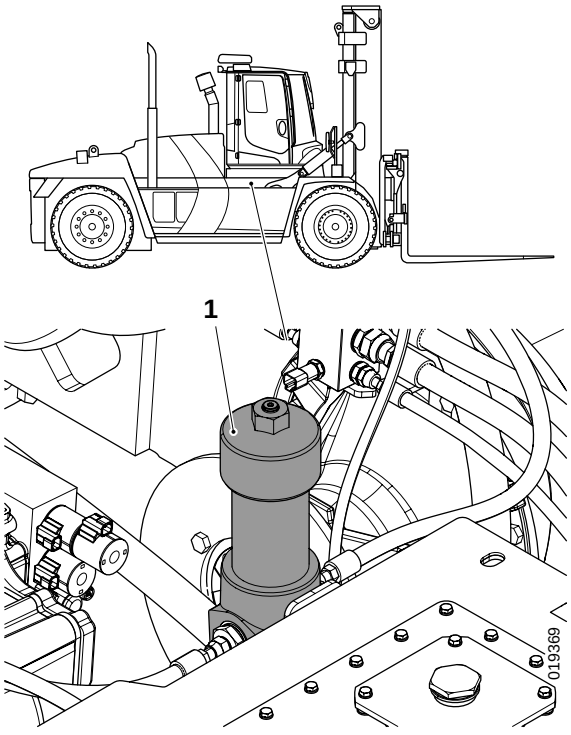
Ensure cleanliness around the filter and filling point when working on the hydraulic tank.

Dirt particles may cause machine damage.

Receptacle for hydraulic oil (5 l).

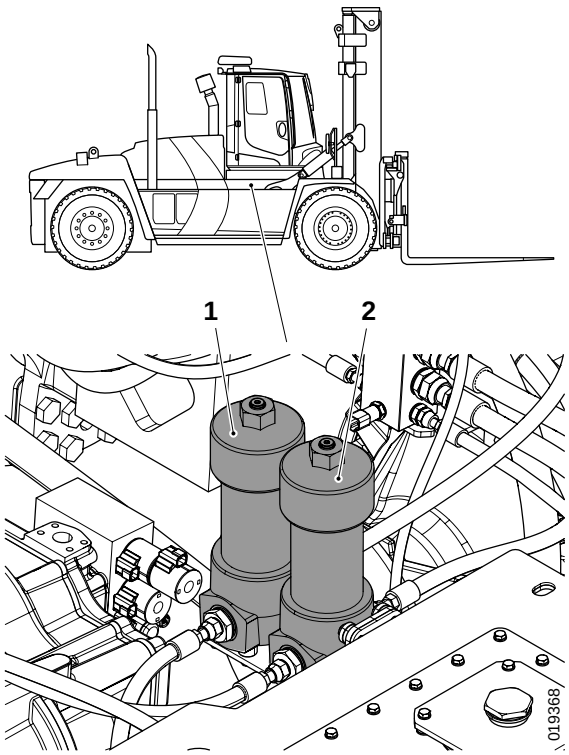
1 Machine in service position, see section *B Safety*.

2 Tilt the cab.



Machine with common hydraulic oil tank

1. Filter for cleaning hydraulic oil

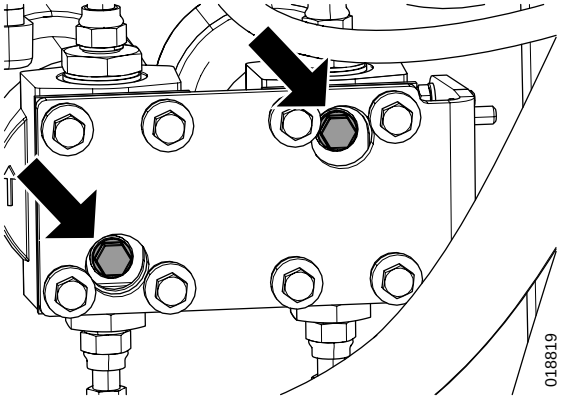


Machine with separate oil tank for brake system ⊞

1. Filter for cleaning hydraulic oil
2. Filter for cleaning oil for brake system ⊞

3 Clean the filter cover externally.

4 Place a receptacle under the hydraulic oil filter.



5 Drain the oil in the filter by loosening the drain plug on the underside of the filter.

6 Speed up filter draining by loosening the hex screw on the top of the filter cover.

7 Remove the top of the filter cover.

8 Remove the filter cartridge. Handle the filter cartridge as environmentally hazardous waste.

9 Fit the small O-ring, which is located in the packaging, onto the new filter.

In case of doubt, compare with the old filter insert.

10 Fit the new filter insert in the filter holder.

NOTE

Use only original filters.

11 Fit a new support ring (white) and O-ring (black), which are located in the packaging with the new filter, in the groove on the filter cover.

NOTE

It is important to fit the support ring under the O-ring as illustrated.

12 Lubricate the filter cover (on the side) with universal grease EP2.

13 Fit the top of the filter cover.

14 Start the engine and check that there are no leaks.

15 Turn off the engine.

16 Remove the receptacle. Handle the oil as environmentally hazardous waste.

17 Check the hydraulic oil level, see *Hydraulic oil, level check*, page 10:13.

Hydraulic oil filter (return filter), changing

NOTE

Read safety instructions for oil before starting work, see section B Safety.

IMPORTANT

Ensure cleanliness around the filter and filling point when working on the hydraulic tank.

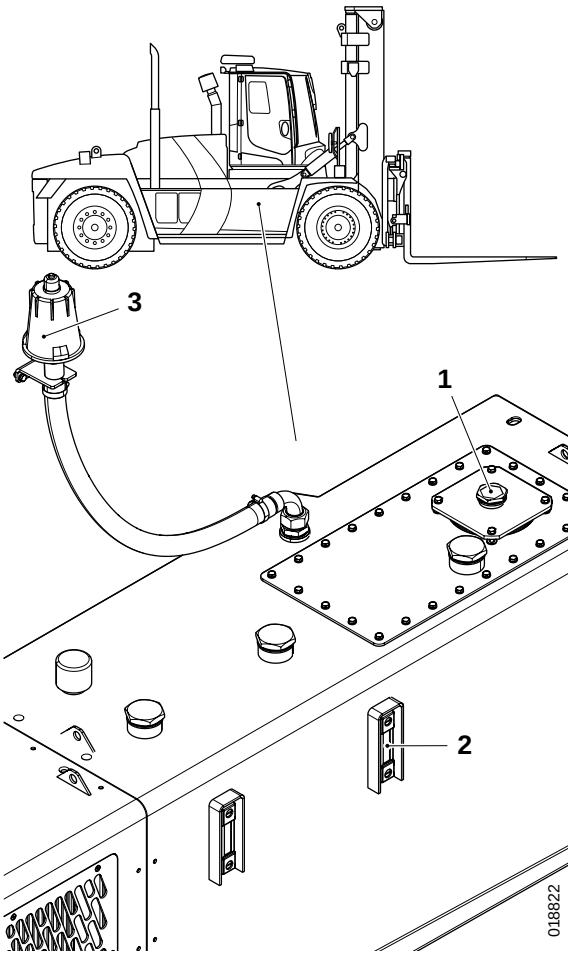
Dirt particles may cause machine damage.

1 Turn off the engine and turn off the main electric power.

2 Remove the cover (position 1) over the hydraulic oil filter.

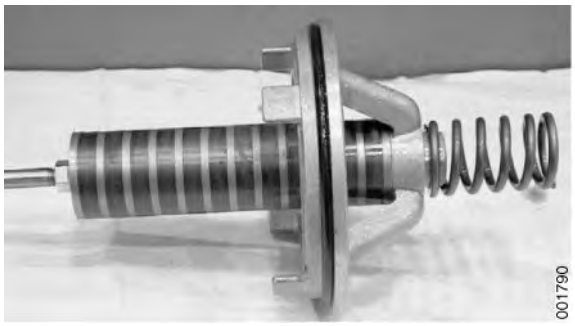
3 Lift up the filter unit and place it in the receptacle. Let the hydraulic oil drain.

4 Separate the filter unit and remove the filter insert. Handle the filter cartridge as environmentally hazardous waste. Note the position of the parts.



The figure shows the DCG 180-250 which has one filter. The DCG 280-330 has two filters.

1. Filler hole on the oil filter cover
2. Sight glass hydraulic oil
3. Breather filter hydraulic oil tank



Magnetic rod

5 Clean the filter holder's parts. Be especially thorough with the magnetic rod.

6 Fit the new filters and assemble the filter units.

7 Install the filter units and the covers. Tighten the bolts crosswise.

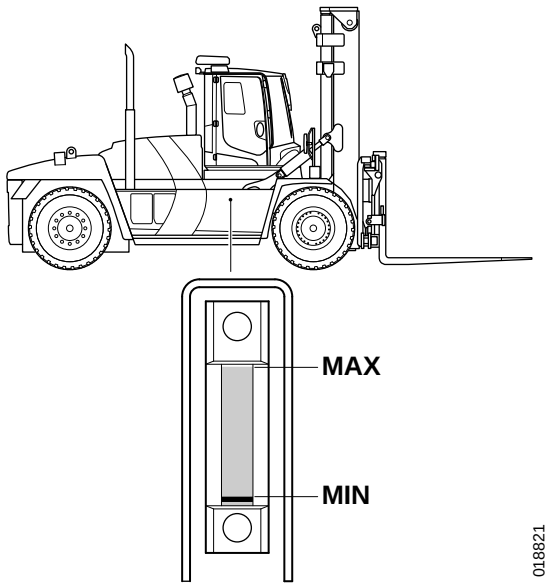
8 Check the oil level, see *Hydraulic oil, level check*, page 10:13.

10.6.9 Hydraulic oil

Hydraulic oil, level check

NOTE

Check the hydraulic oil level with the trolley completely lowered and the mast tilted completely inward.



1 Machine in service position, section *B Safety*.

2 Check the oil level in the hydraulic tank. The oil level should be visible in the sight glass. Fill oil as required. For oil grade, see section *F Technical data*.

Hydraulic oil, checking

The condition of the hydraulic oil should be checked via oil samples in order to minimise the number of oil changes.

NOTE

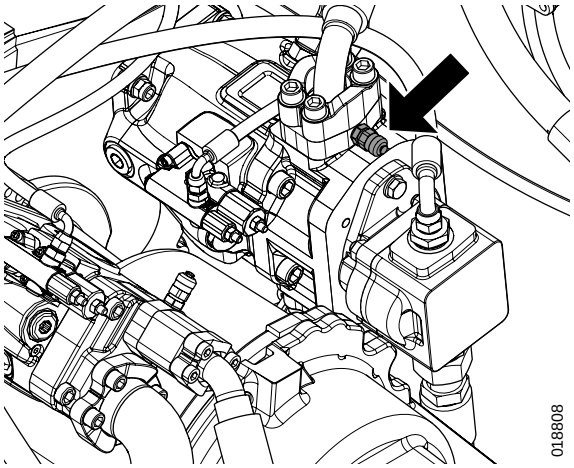
Read safety instructions for oil before starting work, see section B Safety.

IMPORTANT

Ensure cleanliness around the filter and filling point when working on the hydraulic tank.

Dirt particles may cause machine damage.

1 Tilt the cab.



Measuring outlet for steering and load handling

2 Take oil samples in accordance with the instructions from the relevant institution or oil supplier.

Connect a hose to the measuring outlet for steering and load handling. Use the hose for the pressure gauge to take the oil sample.

3 Tip back the cab.

4 Sit in the seat.

5 Start the engine. Do not activate any hydraulic function. Collect the oil that drains out when the hydraulic oil pump starts to charge the system.

6 Send the oil for analysis.

7 The oil must fulfil all of the following quality requirements in order to be considered approved for a new interval.

If any quality requirement is not approved then the hydraulic oil must be changed, see *Hydraulic oil, changing*, page 10:15.

Quality requirements for hydraulic oil

- **Viscosity**

  Viscosity is a measure of the internal friction of the oil, i.e. how thick and fatty it is.

  When samples are taken the value should be between 39 - 53 cSt at 40 °C, measured in accordance with ASTM D445.

  Standard oil at delivery has a viscosity of 46 cSt.

- **TAN/Acid value**

  The acid value is a measure of oil oxidation, i.e. degradation.

  When samples are taken the value must be a maximum of 0.9 mg KOH/g, measured in accordance with ASTM D664.

  If this limit value is exceeded before 4000 operating hours then it may be due to overheating of the hydraulic oil. Check the cooling of the hydraulic oil, and ensure that the cooling fan is working.

- **Water content**

  Max 1000 ppm, measured in accordance with ASTM D6304.

  If this limit value is exceeded, check that the tank's seals at connections and covers are intact and that the breather filter is dry and intact. Also check the fine filter.

- **Particle counting**

  20/18/14, measured in accordance with ISO 4406 or 9 measured in accordance with NAS 1638.

  If this limit value is exceeded, check that there are no visible leaks in the hydraulic system. Check the breather filter on the hydraulic oil tank. Check that fine filters, servo filters and hydraulic oil filters are changed regularly and are working.

- **Other comments**

  Oil samples may also give other readings that can be used to assess the status of the hydraulic system. There may be changes in appearance and colour as well as content of additive metals or wear particles. Follow the recommendations from the local oil supplier regarding oil change.

Hydraulic oil, changing

NOTE

Read safety instructions for oil before starting work, see section B Safety.

IMPORTANT

Ensure cleanliness around the filter and filling point when working on the hydraulic tank.

Dirt particles may cause machine damage.

1 Machine in service position, see section *B Safety*.

2 Remove the filler cap and pump out the hydraulic oil in a collection container.

3 When the most oil possible has been pumped out. Place a receptacle under the hydraulic oil tank's drain plug and drain the last hydraulic oil.

4 Fit the drain plug when the oil has drained.

NOTE

Make sure that the drain plug's washer seal is also removed.

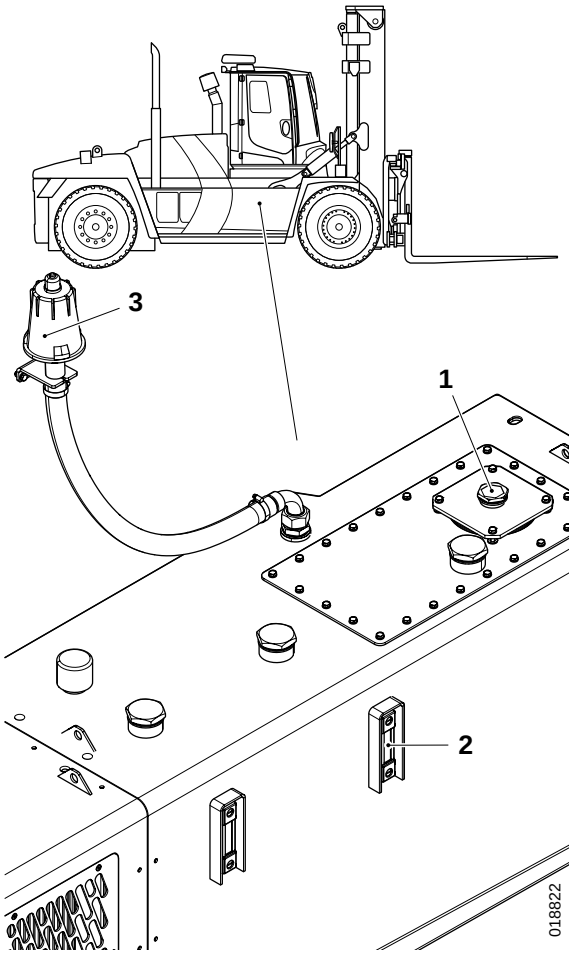
5 If the hydraulic oil filters are to be changed, change them before filling the tank with oil, see *Hydraulic oil filter (return filter), changing*, page 10:12.

6 Fill new hydraulic oil through the filler hole on the filter's cover (position 1). This filters the oil that is filled and protects the hydraulic system from contaminants, see *Hydraulic oil, level check*, page 10:13.

For volume and quality, see section *F Technical data*.

7 On machines without separate brake oil tank:

Bleed the brake cylinders and cooling circuit, see section *4 Brakes*, group *4.3.9 Wheel brake*.



1. Filler hole on the oil filter cover
2. Sight glass hydraulic oil
3. Breather filter hydraulic oil tank

Contents 11 Common electrics

11 Common electrics

11.2 Electrical protection

11.2.2 Fuses

Fuse, replacement

Main fuse

1 Machine in service position, see section *B Safety*.

2 Disconnect the system voltage with the battery disconnector.

3 Remove the electronic box cover on the frame.

4 Disconnect the negative cables from the negative terminals of the batteries.

5 Remove the plastic cover.

6 Check and replace fuses if necessary.

CAUTION

Never use fuses with a too high amperage.

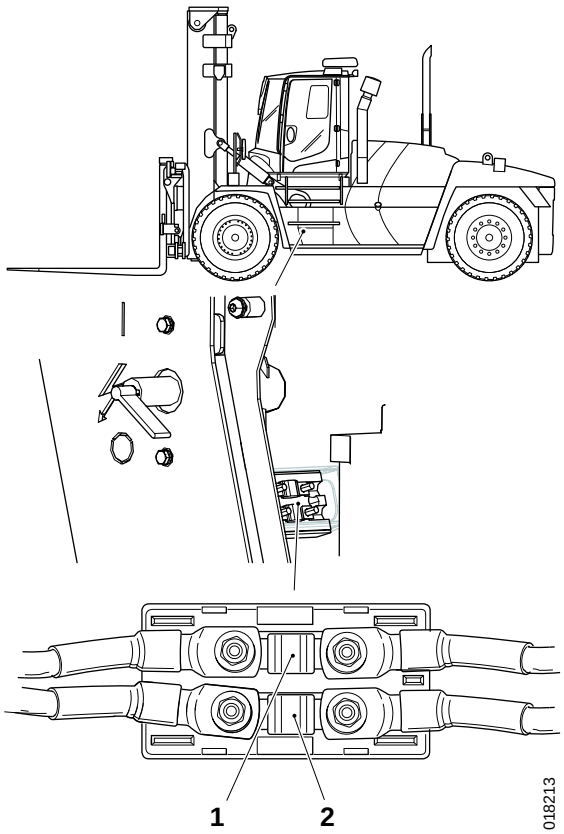
There is a risk of damage or fire on lines!

Follow the instructions on the fuse plate for the fuse type and amperage.

7 Fit the protective cover.

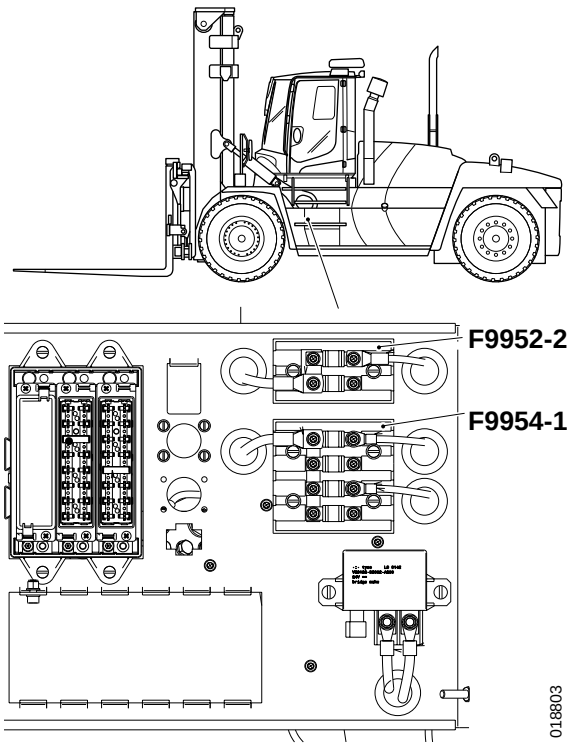
8 Connect the negative cables to the negative terminals of the batteries.

9 Switch on the system voltage with the battery disconnector



Fuses battery box (F9952-1)

1. Main fuse (100 A) (disconnected with the battery disconnector)
2. Main fuse (50 A) (direct feed)



F9952-2 Distribution fuses battery voltage

F9954-1 Distribution fuses ignition voltage

Distribution fuses

1 Machine in service position, see section *B Safety*.

2 Disconnect the system voltage with the battery disconnector.

3 Remove the electronic box cover on the frame.

4 Remove the plastic cover.

5 Check and replace fuses if necessary.

CAUTION

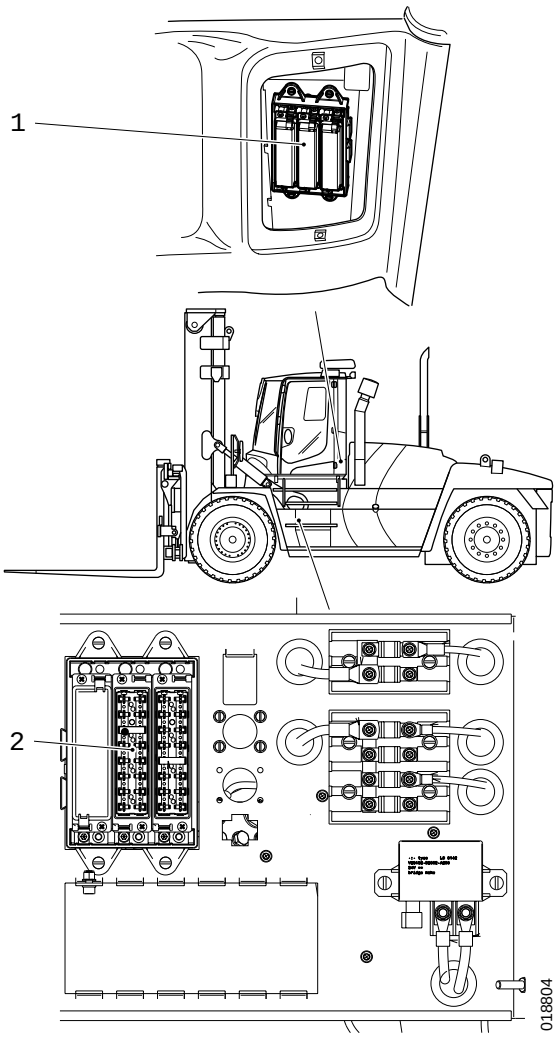
Never use fuses with a too high amperage.

There is a risk of damage or fire on lines!

Follow the instructions on the fuse plate for the fuse type and amperage.

6 Fit the protective cover.

7 Switch on the system voltage with the battery disconnector



1. Circuit fuses cab (F9568)
2. Circuit fuses frame (F9558)

Circuit fuses

1 Machine in service position, see section *B Safety*.

2 Disconnect the system voltage with the battery disconnector.

3 For fuses in the electronic box on the frame: Remove the electronic box cover on the frame.

4 Remove the plastic cover.

5 Check and replace fuses if necessary.

CAUTION

Never use fuses with a too high amperage.

There is a risk of damage or fire on lines!

Follow the instructions on the fuse plate for the fuse type and amperage.

6 Fit the protective cover.

7 Switch on the system voltage with the battery disconnector

11.3 Batteries

11.3.1 Start battery

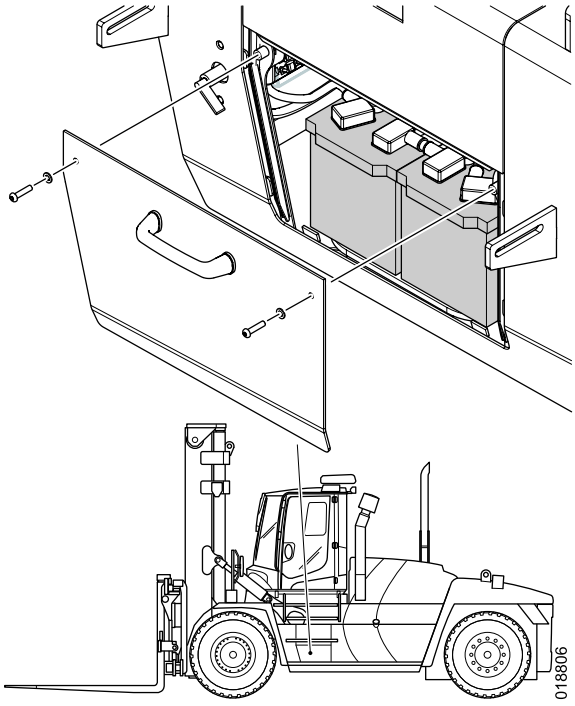
Start battery, checking

WARNING

Battery electrolyte contains corrosive sulphuric acid.

Risk of corrosive injuries! Hazardous to health!

Use protective safety goggles and protective work gloves when working with batteries. Remove immediately any electrolyte on the skin. Wash with soap and plenty of water. If electrolyte has splashed in the eyes, rinse immediately with plenty of water and contact a doctor immediately.



1 Check the battery's acid gravity with a hydrometer. In a fully charged battery the acid gravity should be 1.28 g/cm^3.

If the acid gravity is lower than 1.24 at +20 °C then the battery must be charged.

NOTE

A discharged battery freezes at -5 °C.

NOTE

If the acid gravity differs between the batteries they must be charged separately.

2 The fluid level should be flush with the level indication in the filler hole when the cover is unscrewed.

NOTE

Use only distilled water if topping up is necessary.

3 Check that the batteries are clean on the top to prevent leakage currents between cells, which can cause reduced battery capacity.

Wipe clean with a cloth and clean warm water without detergent.

4 Check that the battery's terminals are free from dirt. If needed, lube the battery terminals with terminal grease.

Battery cables, checking

DANGER

Check that the battery cables are correctly clamped and free from damage.

Fire hazard! Risk of personal injury!

Repair or replace damaged clamps and check that no machine parts wear or chafe against the battery cables. Change damaged battery cables.

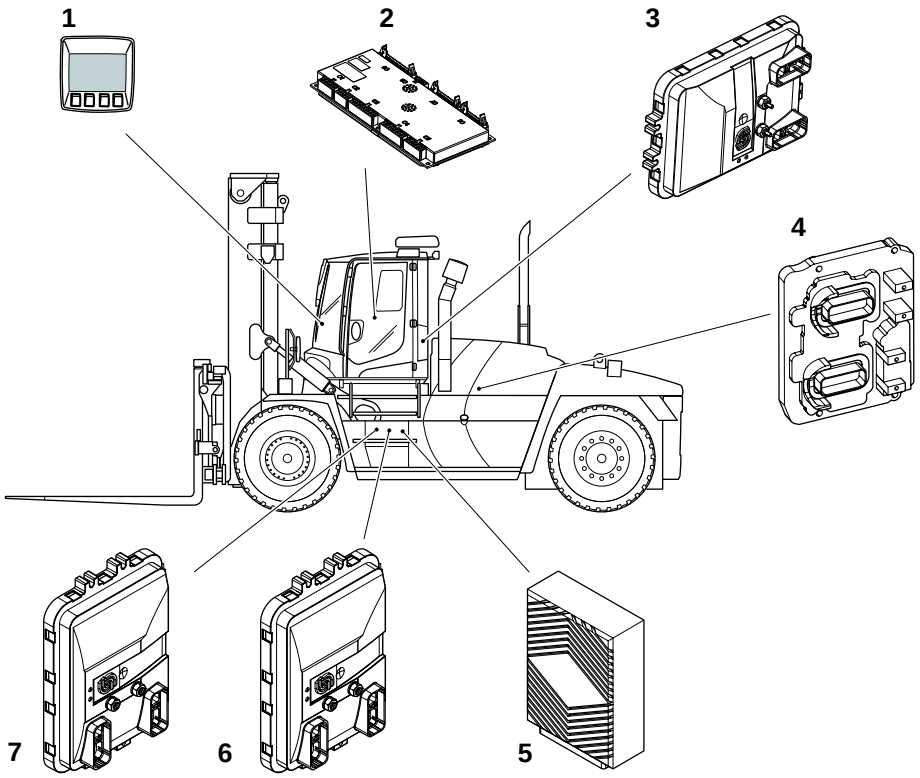
The following battery cables must be checked with regard to bolted joints, clamps, chafing risk and damage to the battery cables. Repair or replace defective clamps and eliminate chafing risks. Change battery cables that show signs of damage.

- Plus-cable between battery and battery disconnector.
- Plus-cable between battery disconnector and starter motor.
- Plus-cable between starter motor and alternator.
- Plus-cable between primary side battery disconnector and main fuses.
- Plus-cable between secondary side battery disconnector and main fuses.
- Plus-cable between starter motor and fuse, preheating F9952-3:1.
- Ground cable between battery and frame.
- Ground cable between engine and frame.

11.5 Distribution of electricity

11.5.3 Control units

Control units, location



1. Control unit, KID (D7950)
2. Control unit KPU (D7902)
3. Control unit KCU (D7901)
4. Control unit engine (D7940)
5. Control unit, transmission (D7930)
6. Control unit KFU2 (D7972) ⊞
7. Control unit KFU (D7971)

D Error codes

Error codes

See *Workshop manual DCG 180–330*, section *D Error codes*.

E Diagrams

Diagrams

See *Workshop manual DCG 180–330*, section *E Diagrams*.

Contents F Technical data

F Technical data

Data

Machine weights and dimensions vary with equipment installed on the machine and are described in detail in the product specification and spec. sheet for the relevant machine.

	DCG 180-250			DCG 280-330		
0 complete machine	Volvo TAD871VE Stage 4/Tier 4f	Cummings QSB6.7 Stage 3A/Tier 3	Cummings QSB6.7 Stage 4/Tier 4f	Volvo TAD871VE Stage 4/Tier 4f	Cummings QSB6.7 Stage 3A/Tier 3	Cummings QSB6.7 Stage 4/Tier 4f
Guaranteed sound power level in accordance with 2000/14/EC and 2005/88/EC including measurement uncertainty 1.5 dB.	L_{WA} 110 dB(A)	L_{WA} 109 dB(A)	L_{WA} 109 dB(A)	L_{WA} 110 dB(A)	L_{WA} 110 dB(A)	L_{WA} 110 dB(A)

	DCG 180-250			DCG 280-330		
1 Engine	Volvo TAD871VE Stage 4/Tier 4f	Cummings QSB6.7 Stage 3A/Tier 3	Cummings QSB6.7 Stage 4/Tier 4f	Volvo TAD871VE Stage 4/Tier 4f	Cummings QSB6.7 Stage 3A/Tier 3	Cummings QSB6.7 Stage 4/Tier 4f
Output in accordance with ISO 3046 (marked output)	185 kW between 1500 – 22 00 rpm	164 kW at 2200 rpm	168 kW at 2200 rpm	185 kW between 1500 – 22 00 rpm	194 kW at 2200 rpm	194 kW at 2200 rpm
Torque ISO 3046	1160 Nm at 1100 – 15 00 rpm	949 Nm at 1500 rpm	949 Nm at 1500 rpm	1160 Nm at 1100 – 15 00 rpm	987 Nm at 1500 rpm	990 Nm at 1500 rpm
Max. rpm	2200 rpm					
Number of cylinders	6					
Alternator, power	3080 W	1680 W	1680 W	3080 W	1680 W	1680 W
System voltage, voltage capacity	24 V (2x12 V / 145 Ah)					

2 Transmission	DANA TE17
No. of gears, forward - reverse	3 – 3

3.3 Driveline/Axle, drive axle	DCG 180-250	DCG 280-330
Drive axle, type	Kessler D91	AxleTech PRC3806W4H

4 Brakes	
Footbrake system - wheels affected	Wet Disc Brake - drive wheel
Parking brake system - wheels affected	Spring brake - drive wheel

5 Steering	
Steering system	Hydraulic servo

6 Wheels	DCG 180-250	DCG 280-330
Dimension, front and rear	14.00x24	16.00x25
Tyre pressure, also see pressure plate	1.0 MPa	1.0 MPa
Tyre type, front and rear	Air filled. Spare and replacement tyres must be of a brand approved by Cargotec.	

9 Cab	Cab	Protection bar
Equivalent sound pressure level in cab according to EN12053 with measurement uncertainty σ_R= 2.5 dB. Measuring value with standard engine.	L_{pAZ} 72 dB(A)	L_{pAZ} 73 dB(A)
Whole-body vibration in accordance with EN13059 with measurement uncertainty k = 0.3 x measured value.	0.4 - 0.7 m/s^2	

Light	**Rating (W)**	**Socket**
Direction indicator, front	-	LED replaced complete
Rear lights, brake lights & direction indicators rear	-	LED replaced complete
Running lights ⊕	-	LED replaced complete
Headlights (during high, low beam)	75/70	P43t-38 (H4)
Back-up lights	70	PK22s (H3)
Back-up light LED ⊕	-	LED replaced complete
Work light bulb	70	PK22s (H3)
Work light LED ⊕	-	LED replaced complete
Revolving beacon LED ⊕	-	LED replaced complete
Flashing hazard lights	15	Xenon tube. Cartridge replaced complete.
Adjustable searchlight	70	PK22s (H1)
Interior lighting	-	Replace complete

Volumes

For oil types see *Oils and lubricants, recommendation*, page F:10.

1.2 Engine, fuel system	DCG 180 -12LB	DCG 200 -12LB	DCG 220 -12LB	DCG 250 -12LB	DCG 280 -12LB	DCG 300 -12LB	DCG 330 -12LB
Fuel tank, volume	300 l	300 l	300 l	375 l	450 l	450 l	450 l
Fuel quality	**Recommendation for Stage 3A/Tier 3 engines** Diesel according to: EN590, ASTM D 975 No 1–D, ASTM D 975 No 2–D. **CAUTION** **Use only fuel of approved quality.** **Risk of engine damage, warranty invalidated.** **Only fuel of a quality that is approved by the engine supplier may be used.** **WARNING** **If fuel is used with a sulphur content higher than 0.3% then the engine oil and oil filter must be changed at more frequent intervals.** **Risk of engine damage!** **Change the engine oil and oil filter in accordance with the prescribed intervals.**						
	Requirements for Stage 4/Tier 4f engines Diesel according to: EN590, ASTM D 975 No 1–D, ASTM D 975 No 2–D. **CAUTION** **Use only fuel of approved quality.** **Risk of engine damage, warranty invalidated.** **Only fuel of a quality that is approved by the engine supplier may be used.**						
AdBlue tank, volume	35 l						
AdBlue quality	AdBlue, according to ISO standard 22241.						

1.7 Engine, cooling system	Volvo TAD871VE Stage 4/Tier 4f	Cummings QSB6.7 Stage 3A/Tier 3	Cummings QSB6.7 Stage 4/Tier 4f
Coolant volume	35 l	33 l	33 l
Coolant filling	Volvo Penta Coolant VCS, ready-mixed	ES Compleat, Premix	ES Compleat, Premix
	CAUTION **Use approved coolant.** **Risk of engine damage and invalidated warranty if unapproved coolant is used.** **When changing and filling coolant, only coolant approved by the engine manufacturer may be used.**		

1.8 Engine, lubrication system	Volvo TAD871VE Stage 4/Tier 4f	Cummings QSB6.7 Stage 3A/Tier 3	Cummings QSB6.7 Stage 4/Tier 4f
Oil type, quality	See *Oils and lubricants, recommendation*, page F:10.		
Oil volume incl. filter	27 l	23 l	23 l

2.6 Transmission, lubrication system	DANA TE17
Oil type	See *Oils and lubricants, recommendation*, page F:10
Oil volume	39 l

	DCG 180-250	DCG 280-330
3.3 Driveline/Axle, drive axle	Kessler D91	AxleTech PRC3806W4H
Oil grade	See *Oils and lubricants, recommendation*, page F:10.	
Oil volume, differential	29.9 l	34 l
Oil volume, hub reduction	2x3.8 l	2x12.5 l

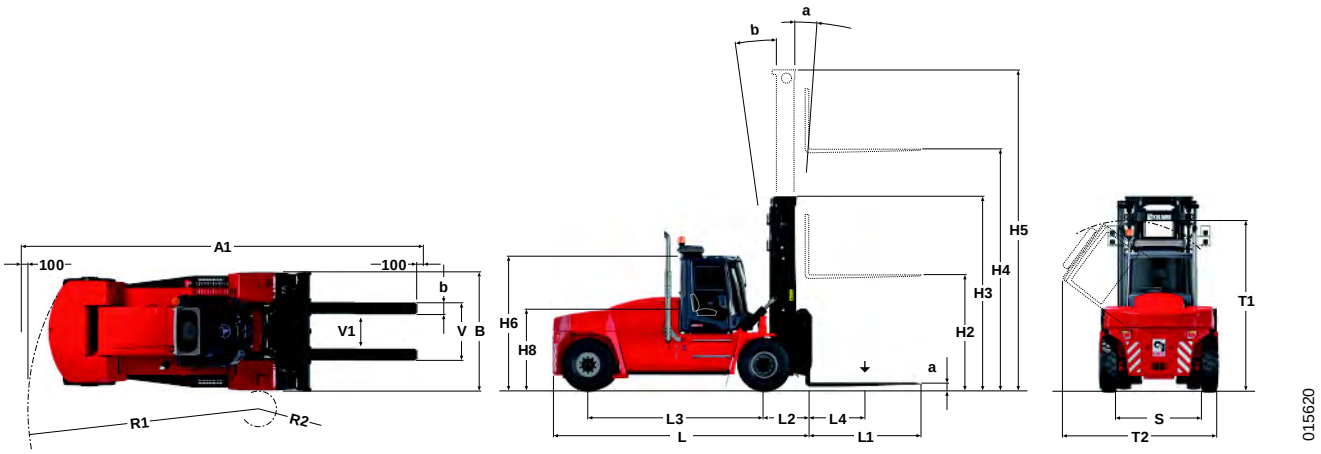
4.8 Brake system, separate oil tank ⊕	
Oil grade	See *Oils and lubricants, recommendation*, page F:10
Oil tank brake system, volume	90 l

7 Load handling ⊕	
Oil grade	See *Oils and lubricants, recommendation*, page F:10
Oil volume, planetary gear hydraulic motor	1.6 l

9 Frame, body, cab and accessories	
Refrigerant air conditioning ⊕	R134a
Volume refrigerant ⊕	2000 g (unless otherwise indicated on the air conditioning sign)
Lubricant air conditioning ⊕	ZXL100PG
Lubricant volume air conditioning unit ⊕	0.3 l (depending on compressor)
Volume, washer fluid	Max 6 l

10 Common hydraulics	
Oil grade	See *Oils and lubricants, recommendation*, page F:10.
Oil additive	Lubrizol 3%
Volume hydraulic oil tank	360 l
Volume hydraulic oil tank, machine with separate oil tank for brake system ⊞	270 l

Specifications for lifting capacity and dimensions



	DCG 180 -12LB	DCG 200 -12LB	DCG 220 -12LB	DCG 250 -12LB	DCG 280 -12LB	DCG 300 -12LB	DCG 330 -12LB
Lifting capacity							
Classified [kg]	18000	20000	22000	25000	28000	30000	33000
Centre of gravity distance (L4 [mm])	1200						
Dimensions							
Truck length incl. forkback (fork thickness) (L [mm])	6090	6090	6090	6340	6925	6925	6925
Truck width (B [mm])	3050	3050	3050	3050	3430	3430	3430
Height, basic machine (H6 [mm])	3270	3270	3300	3270	3415	3415	3415
Seat height (H8 [mm])	2150	2150	2350	2150	2300	2300	2300
Distance drive axle - fork front shank surface (L2 [mm])	1070	1070	1070	1070	1125	1125	1125
Axle distance (L3 [mm])	4000	4000	4000	4250	4750	4750	4750
Track (front - rear) (T [mm])	2200 - 2140	2200 - 2140	2200 - 2140	2200 - 2140	2540 - 2440	2540 - 2440	2540 - 2440
Minimum turning radius, outer (R1 [mm])	5600	5600	5600	5875	6600	6600	6600
Slewing radius, inner (R2 [mm])	425	425	425	550	950	950	950
Ground clearance, min [mm]	300	300	300	300	300	300	300
Height for cab tilting, basic machine max. (T1 [mm])	3800	3800	3800	3800	3800	3800	3800
Width for cab tilting, basic machine, max. (T2 [mm])	3700	3700	3700	3700	3800	3800	3800
Minimum track width for 90° stacking with forks (A1 [mm])	9270	9270	9270	9550	10325	10325	10325
Lift height (H4 [mm])	5000	5000	5000	5000	5000	5000	5000
Mast height min (H3 [mm])	4320	4320	4320	4320	4520	4520	4520
Mast height max (H5 [mm])	6820	6820	6820	6820	7020	7020	7020
Mast tilting, forward - backward (α – ß [°])	5 - 10	5 - 10	5 - 10	5 - 10	5 - 10	5 - 10	5 - 10

	DCG 180 -12LB	DCG 200 -12LB	DCG 220 -12LB	DCG 250 -12LB	DCG 280 -12LB	DCG 300 -12LB	DCG 330 -12LB
Forks, thickness (a [mm])	110	110	110	110	110	110	110
Forks, width (b [mm])	250	250	250	250	300	300	300
Fork arm, length (l [mm])	2400	2400	2400	2400	2400	2400	2400
Width across fork blade max - min (V [mm])	2600 - 1000	2600 - 1000	2600 - 1000	2600 - 1000	2750 - 1550	2750 - 1550	2750 - 1550
Side shift ± width across fork blade (V1-V [mm])	400 - 1800	400 - 1800	400 - 1800	400 - 1800	300 - 2150	300 - 2150	300 - 2150
Kerb weight [kg]	28500	29800	31200	32900	38300	39500	41500
Axle weight front, (without load) [kg]	15000	15000	15000	15500	20500	20500	20500
Axle weight front, (with classed load) [kg]	43200	46300	49500	53800	61700	64900	68800
Axle weight rear, (without load) [kg]	13500	14800	16200	17400	17800	19000	21000
Axle weight rear, (with classed load) [kg]	3300	3500	3700	4100	4100	4300	4800

Oils and lubricants, recommendation

Cargotec's stated service intervals in the maintenance manual are conditional on oil selection according to the following table. The table states recommended viscosity for different oil types and grades depending on outdoor temperature.

Any deviation from this table must be approved in writing by Cargotec, and may mean changed service intervals.

Oil type, quality	°C / °F	-30 / -22	-20 / -4	-10 / +14	0 / +32	+10 / +50	+20 / +68	+30 / +86	+40 / +104	+50 / +122
1.8 Engine, lubrication system **Cummins QSB6.7 Stage 3A/Tier 3:** API: CH-4/SJ, CI-4/SK ACEA: E5, E7 Cummins: CES-20071, CES-20072, CES-20076, CES-20077, CES-20078			SAE 15W40 (engine oil)							
			SAE 10W30 (engine oil)							
		SAE 5W30 (engine oil)								
1.8 Engine, lubrication system **Cummins QSB6.7 Stage 4/Tier 4f:** API: CJ-4 ACEA: E9-08 Cummins: CES 20081			SAE 5W/40 or 15W/40 (engine oil)							
			SAE 10W/30 (engine oil)							
		SAE 5W/30 (engine oil)								
Volvo: VDS-4			SAE 15W40 (engine oil)							
			SAE 10W30 (engine oil)							
		SAE 5W30[1] (engine oil)								
2.6 Transmission, lubrication system ATF Dexron III		DEXRON® III								
3.3 Driveline/Axle, drive axle **Kessler** Hypoid oil, API GL-5 and MIL-L-2105B			SAE 80W140							
			SAE 80W90							
			SAE 90							
					SAE 85W140					
AxleTech Hypoid oil, API GL-5			SAE 80W140							
		SAE 75W90								

[1] Only applies to synthetic or semi-synthetic engine oil.

Oil type, quality	°C °F	-30 -22	-20 -4	-10 +14	0 +32	+10 +50	+20 +68	+30 +86	+40 +104	+50 +122
4 Brakes (UTTO oil [2])										
GM Allison C-4		SAE 5W30 (transmission oil)								
John Deere J20 C, D Caterpillar TO-4										
10 Common hydraulics										
Hydraulic oil SS 155434			AV 32							
				AV 46						
Hydraulic oil DIN 51524				HVLP 46						
					HLP 68					
Hydraulic oil ISO 6743/4				ISO - LHV 46						
					ISO - LHM 68					

NOTE

Oil filters should be changed in connection with oil change.

[2] The oil in the brake system must fulfil one of the quality requirements.

ACEA = Association des Constructeurs Européenne d'Automobiles

API = American Petroleum Institute

CES = Cummins Engine Standard

VDS = Volvo Drain Specification

Engine oil

NOTE

Oil filters should be changed in connection with oil change.

Stage 3A/Tier 3 engines

⚠ WARNING

Change intervals for engine oil and oil filter depend on the sulphur content in the fuel.

Risk of engine damage!

Change the engine oil and oil filter in accordance with the prescribed intervals.

Grease

Use a universal grease type EP in accordance with NLGI Grade 2 (EP2) for all lubrication points except for slide plates.

NLGI Grade 1 (EP1) is useful in areas with low ambient temperatures.

NLGI Grade 3 (EP3) is useful in areas with high ambient temperatures.

For slide plates, use lubricants approved by Cargotec. Order from Cargotec Parts department. 0.65 kg cartridge for grease gun, part no. 923110.0360, and 5 kg can, part no. 923595.0003.

NOTE

Select grease grade according to relevant climate.

Electrical connector grease

Use electrical connector grease, part no. 923836.0552. Applies to sealed connectors.

Sealant silicone

Use silicone part no. 923107.0308.

Adhesive system for windows

Use only PU polymer recommended by Cargotec.

Coolant

Only use ready-mixed recommended coolant. Select mixture of the coolant that is adapted for correct temperature.

CAUTION

Use approved coolant.

Risk of engine damage and invalidated warranty if unapproved coolant is used.

When changing and filling coolant, only coolant approved by the engine manufacturer may be used.

Tightening torques, recommendations

The tightening torques in the following table are recommendations when tightening bolts and nuts.

General tolerance of specified tightening torques is ± 10%.

For soft materials (lower hardness than 200 HB), use washer under both bolt head and nut. As an alternative, use flange bolt or flange nut.

For bolted joints with Nord-Lock locking washers, the tightening torques should be increased by:

- Screw 8.8: + 20%
- Screw 10.9: + 10%
- Screw 12.9: + 0%

Recommended tightening torque varies depending on surface treatment. Certain combinations of bolts and nuts require lubrication according to the following table.

State	Screw	Nut	Lubrication
1	Zinc nickel coating (ZnNi) Zinc flake coating (flZn)	untreated or zinc nickel coating (ZnNi)	dry
2	hot dip galvanised (fzv)	hot dip galvanised (fzv) or untreated	dry
3	hot dip galvanised (fzv)	hot dip galvanised (fzv) or untreated	oil

Quality	8.8			10.9	12.9
State	1	2	3	1	1
M-thread					
M4	2.8 Nm	3.4 Nm	3.1 Nm	3.8 Nm	4.7 Nm
M5	5.5 Nm	6.7 Nm	6.1 Nm	7.8 Nm	9.3 Nm
M6	9.4 Nm	11.5 Nm	10.5 Nm	13 Nm	16.3 Nm
M8	23 Nm	28 Nm	26 Nm	32 Nm	38 Nm
M10	45 Nm	55 Nm	50 Nm	62 Nm	76 Nm
M12	78 Nm	95 Nm	87 Nm	109 Nm	131 Nm
M16	189 Nm	231 Nm	211 Nm	266 Nm	320 Nm
M20	370 Nm	450 Nm	412 Nm	519 Nm	623 Nm
M24	638 Nm	778 Nm	712 Nm	898 Nm	1075 Nm
M30	1258 Nm	1533 Nm	1402 Nm	1766 Nm	2122 Nm
M36	2189	2668 Nm	2440 Nm	3082 Nm	3696
Fine M-thread					
M4×0.5	3.0 Nm	3.5 Nm	3.2 Nm	4.1 Nm	5.0 Nm
M5×0.5	6.0 Nm	7.0 Nm	6.4 Nm	8.4 Nm	9.6 Nm
M6×0.75	9.6 Nm	11.2 Nm	10.3 Nm	14.4 Nm	16.3 Nm
M8×1	24 Nm	28 Nm	26 Nm	34 Nm	40.3 Nm
M10×1.25	46 Nm	54 Nm	49 Nm	65 Nm	78 Nm
M12×1.25	82 Nm	96 Nm	88 Nm	115 Nm	138 Nm
M16×1.5	196 Nm	229 Nm	210 Nm	276 Nm	330 Nm
M18×1.5	282 Nm	330 Nm	302 Nm	396 Nm	476 Nm
M20×1.5	392 Nm	459 Nm	419 Nm	551 Nm	660 Nm
M24×2	668 Nm	782 Nm	715 Nm	940 Nm	1123 Nm

Quality	8.8			10.9	12.9
M30×2	1334 Nm	1561 Nm	1427 Nm	1872 Nm	2246 Nm
M36×3	2256 Nm	2640 Nm	2414 Nm	3178 Nm	3811 Nm

Tightening torque, ORFS connections

Pipe and hose coupling

Pipe diameter		Tightening torque
mm	inch	Nm
6	1/4	23-25
8	5/16	33-38
10	3/8	
12	1/2	51-57
14	-	80-90
15	-	
16	5/8	
18	3/4	120-130
20	-	
22	7/8	150-170
25	1"	
28	-	180-200
30	-	
32	1"1/4	
35	-	200-240
38	1"1/2	

Wrench size		Tightening torque
mm	inch	Nm
17	11/16	23-25
22	13/16	33-38
24	15/16	51-57
36	1 3/8	120-130
41	1 5/8	150-170

Goods coupling

UNF-UN		Metric-ISO		BSSP	
Thread (inch)	Tightening torque (Nm)	Thread (mm)	Tightening torque (Nm)	Thread (inch)	Tightening torque (Nm)
7/16-20	21	10x1	20	1/8-28	20
1/2-20	27	12x1.5	35	1/4-19	35
9/16-18	40	14x1.5	45	3/8-19	70
3/4-16	78	16x1.5	55	1/2-14	100
7/8-14	110	18x1.5	68	3/4-14	190
1"1/16-12	180	20x1.5	80	1"-11	300
1"3/16-12	230	22x1.5	98	1"1/4-11	330
1"5/16-12	285	26x1.5	170	1"1/2-11	400
1"5/8-12	320	27x2	180		
1"7/8-12	400	33x2	310		
		42x2	330		
		48x2	400		

Tightening torque, connections for air conditioning unit

O-ring coupling cooling coils

Hose diameter		Thread	Tightening torque
mm	inch	**inch**	**Nm**
6	1/4"	7/16"	7-13 Nm
10	3/8"	5/8"	14-20 Nm
10	3/8"	11/16"	14-20 Nm
12	1/2"	3/4"	14-26 Nm
16	5/8"	7/8"	27-41 Nm
19	3/4"	1 1/16"	34-46 Nm
Pressure switch		3/8" 7/16"	7-13 Nm

The above values should be considered guidelines and may vary depending on installation.

Unit explanations

Unit	Abbreviation
Newton metre	Nm
Kilopond metre	kpm
Kilopascal	kPa
Megapascal	MPa
Kilowatt	kW
Kilojoule	kJ
British thermal unit	Btu
Calorie	ca
Inch	in
Feet	ft
Yard	yd
Mile	mile
Centimetre	cm
Meter	m
Kilometre	km

Conversion SI-units

SI-unit	Conversion factor	Non-SI	Conversion factor	SI
Torque				
Nm	x 10.2	= kg cm	x 0.8664	= lb in
Nm	x 0.74	= lbf ft	x 1.36	= Nm
Nm	x 0.102	= kg m	x 7.22	= lb ft
Pressure (Pa = N/m^2)				
kPa	x 4.0	= in.H_2O	x 0.249	= kPa
kPa	x 0.30	= in.Hg	x 3.38	= kPa
kPa	x 0.145	= psi	x 6.89	= kPa
bar	x 14.5	= psi	x 0.069	= bar
kp/cm ^{2}	x 14.22	= psi	x 0.070	= kp/cm^2
N/mm ^{2}	x 145.04	= psi	x 0.069	= bar
MPa	x 145	= psi	x 0.00689	= MPa
Power (W = J/s)				
kW	x 1.36	= hp (cv)	x 0.736	= kW
kW	x 1.34	= bhp	x 0.746	= kW
kW	x 0.948	= Btu/s	x 1.055	= kW
W	x 0.74	= ft lb/s	x 1.36	= W
Energy (J = Nm)				
kJ	x 0.948	= Btu	x 1.055	= kJ
J	x 0.239	= calorie	x 4.19	= J
Speed and acceleration				
m/s^2	x 3.28	= ft/s^2	x 0.305	= m/s^2
m/s	x 3.28	= ft/s	x 0.305	= m/s
km/h	x 0.62	= mph	x 1.61	= km/h
Horsepower/torque				
Bhp x 5252 rpm= TQ (lb ft)			TQ x rpm 5252 = bhp	
Temperature				
°C = (°F – 32)/1.8	°F = (°C x 1.8) + 32			
Flow factor				
l/min (dm^3 /min)	x 0.264	= US gal/min x 3.785		= litre/min

Conversion table, length

Unit	cm	m	km	in	ft	yd	mile
cm	1	0.01	0.00001	0.3937	0.03281	0.01094	0.000006
m	100	1	0.001	39.37	3.2808	1.0936	0.00062
km	100000	1000	1	39370.7	3280.8	1093.6	0.62137
in	2.54	0.0254	0.000025	1	0.08333	0.02777	0.000015
ft	30.48	0.3048	0.000304	12	1	0.3333	0.000189
yd	91.44	0.9144	0.000914	36	3	1	0.000568
mile	160930	1609.3	1.6093	63360	5280	1760	1
1 mm = 0.1 cm - 1 mm = 0.001 m							

Conversion table, area

Unit	cm^2	m^2	km^2	a	ft^2	yd^2	in^2
cm^2	1	0.0001	-	0.000001	0.001076	0.000012	0.155000
m^2	10000	1	0.000001	0.01	10.764	1.1958	1550.000
km^2	-	1000000	1	10000	1076400	1195800	-
a	0.01	100	0.0001	1	1076.4	119.58	-
ft^2	-	0.092903	-	0.000929	1	0.1111	144.000
yd^2	-	0.83613	-	0.008361	9	1	1296.00
in^2	6.4516	0.000645	-	-	0.006943	0.000771	1
1 ha = 100 a – 1 $mile^2$ = 259 ha = 2.59 km^2							

Conversion table, volume

Unit	cm^3 = cc	m^3	l	in^3	ft^3	yd^3
cm^3 = ml	1	0.000001	0.001	0.061024	0.000035	0.000001
m^3	1000000	1	1000	61024	35.315	1.30796
dm^3 (l)	1000	0.001	1	61.024	0.035315	0.001308
in^3	16.387	0.000016	0.01638	1	0.000578	0.000021
ft^3	28316.8	0.028317	28.317	1728	1	0.03704
yd^3	764529.8	0.76453	764.53	46656	27	1
1 gal (US) = 3785.41 cm^3 = 231 in^3 = 0.83267 gal (UK)						

Conversion table, weight

Unit	g	kg	t	oz	lb
g	1	0.001	0.000001	0.03527	0.0022
kg	1000	1	0.001	35.273	2.20459
t	1000000	1000	1	35273	2204.59
oz	28.3495	0.02835	0.000028	1	0.0625
lb	453.592	0.45359	0.000454	16	1
1 ton (metric) = 1.1023 ton (US) = 0.9842 ton (UK)					

Conversion table, pressure

Unit	kp/cm^2	bar	$Pa=N/m^2$	kPa	lbf/in^2	lbf/ft^2
kp/cm^2	1	0.98067	98066.5	98.0665	14.2233	2048.16
bar	1.01972	1	100000	100	14.5037	2088.6
$Pa=N/m^2$	0.00001	0.001	1	0.001	0.00015	0.02086
kPa	0.01020	0.01	1000	1	0.14504	20.886
lbf/in^2	0.07032	0.0689	6894.76	6.89476	1	144
lbf/ft^2	0.00047	0.00047	47.88028	0.04788	0.00694	1
kg/cm^2 = 735.56 Torr (mmHg) = 0.96784 atm						

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Terminology

Explanations

Term	Description
Accumulator	Reservoir that stores (accumulates) pressure for i.e. hydraulic functions.
AdBlue	AdBlue (DEF) contains deionised water mixed with 32.5% urea.
Attachment	Part of the machine that grabs the load when lifting.
Anti-corrosion agent	Prevents oxidation, in simple terms, rustproofing.
Working hydraulics	All load handling functions, e.g. lifting/lowering, tilt, side shift, spreading and levelling.
Axle distance	Distance between drive axle and steering axle.
Bar	Unit for measuring pressure.
Battery disconnector	Cuts off current from battery.
CAN	Controller Area Network – Network for communication between the control units.
CAN bus	The network between the control units in the machine.
CECS	Common Electrical and Control System. An electronic control system that monitors and regulates certain systems in the machine that require CECS, e.g. certain engine and transmission alternatives.
Central lubrication	An automatic system for the lubrication of a preset number of lubrication points.
Daily inspection	The actions that should be performed daily to ensure the machine's functionality.
Decitonne	Tenth of a tonne, measure of the machine's lift capacity.
DEF	Diesel Exhaust Fluid, see AdBlue.
Displacement	The oil volume that the pump can supply per pump revolution.
Display	"Window" showing digital information on steering wheel panel in cab.
DOC	Diesel Oxidation Catalyst. DOC is a catalyst which removes carbon monoxide (CO) and hydrocarbons (HC) from the exhaust gases and also a certain amount of particles, soot, etc.
Operating time	Number of hours machine has been in operation, shown on hour meter in cab.
Drive axle	Driving axle that receives the torque from the drivetrain.
Drivetrain	Parts in machine involved in power transmission; engine, torque converter, transmission, propeller shaft and drive axle with differential and hub reduction.
ECC	Electric Climate Control. Climate control unit with thermostat-controlled cooling, dehumidification, and heating.
EHC	Electric Heat Control. Heating system with thermostat-controlled heating.
Electrolyte level	Fluid level in battery cells.
Electric servo	Load handling hydraulic components receive control signals from electro-mechanical controls.
Expansion tank	Tank for coolant.
Fixed displacement	Non-adjustable volume (capacity) of a pump.
FMI	Fault Message Identifier. The part of the error code indicating the type of fault.
Forks	Lifting gear that lifts the load.
Fork bracket	Brackets for forks, mounted on the trolley.
Main fuse	Located by battery. Cuts the power to all systems in the whole machine.
Hydraulic oil	Oil for hydraulic system. See specifications in operator's manual.

Term	Description
Hydraulic oil pump	Pump in hydraulic system.
Hydraulic servo	Load handling hydraulic components receive control signals from mechanical controls.
Hydraulic system	System that uses oil pressure to transmit power to different functions.
Cab	Enclosed type of cab.
Hanging load	Lifted load.
Indicator	Manual "sensor", e.g., shows that a filter is clogged and needs to be replaced.
Inverted forks	Upside-down forks, for lifting and mounting of top lift.
KCU	Kalmar Cab Unit - Control Unit KCU (D7901) is fitted in the cab and is the control unit that controls the start-up and shutdown of the machine's electrical system.
KFU	Kalmar Frame Unit – Control unit KFU (D7971) is fitted in the electronic box on the left-hand side. The control unit operates components in the frame and on the mast.
KID	Kalmar Information Display - Control unit KID (D7950), the display in the cab.
KPU	Kalmar Panel Unit - Control unit KPU (D7902) is fitted in the right-hand switch panel in the cab and operates switches and controls in the cab.
KST	Kalmar Service Tool - Computer program for service, calibration, setting and programming of the machine's control units.
Piston rod	Rod that is inserted into the piston's cylinder barrel and is acted on by hydraulic pressure.
Refrigerant	Fluid/gas in air conditioning. May only be handled by authorised trained person.
LC	Load centre.
Lift capacity	Indicates machine's maximum lift capacity.
Lifting point	Attaching point for lift device when lifting an object.
Trolley	Lifts the load, located on the mast.
Low-emission engine	Engine with low emissions of hazardous substances. Manufactured according to regulations.
Solenoid valve	An electro-magnetically controlled valve. See also proportional valve.
Control valve	Valves that can be used to control something, e.g. release pressure and thus lower a mast or a fork.
Machine model	Machine type. Indicated, for example: DCG 90–180. See also type designation.
Environmental waste	Used oils, filters, etc., must be handled according to governing national laws and regulations.
Torque converter	Hydraulic, variable clutch.
Counterweight	Weights adapted to the machine's lifting capacity to provide a balancing load during lifting.
Hub reduction	Type of final drive (often next to drive wheel) that reduces rpm and increases torque from the drivetrain.
Pilot oil pressure	A low control pressure to, for example, a valve.
Planetary gear	Type of transmission with gears in constant mesh.
Product alternatives	One of several alternatives is selected for a machine, e.g., engine alternative.
Progressive steering	Rapid steering wheel movements give larger steering deflection.
Proportional valve	An electro-magnetically controlled valve. If a current is applied, the valve is activated in proportion to the current's amplitude. In everyday language, a stepless valve, as opposed to an Off/On valve. On, e.g., the transmission's valve housing.
Frame beam	Supporting beams in the frame.
Recirculation	Circulation in a closed system.

Term	Description
SCR	Selective Catalytic Reduction. Exhaust technology which means that AdBlue is added to the exhaust gases in order to reduce the amount of nitrogen oxides (NOx). The urea in AdBlue is broken down into ammonia, which reacts with nitrogen oxide (NOx) in the SCR catalyst so that harmless nitrogen and water vapour are formed. Available on Volvo Stage 4/Tier 4f engines.
Serial number	Unique machine designation. Available on machine plate.
Service position	How machine should be safely positioned before service may be started.
Servo	A small user movement results in a big machine movement, e.g. power steering.
Servo pressure	A low control pressure to control a higher pressure, for example, to a valve.
Side shift	Forks moved sidewards in parallel.
Levelling	Forks tilted, e.g. if a load is standing on an uneven surface.
SPN	Suspect Parameter Number. Is a unique number for machine components. Used in circuit diagrams and error codes.
Spreading	Spreading the forks, e.g. changing the relative distance between the forks.
Mast	Carrier of the attachment and the load.
Dust reservoir	The air filter collects the coarsest particles in a dust reservoir, emptied automatically during operation.
Steering axle	Wheel axle with steering.
Protection bar	Safety cage with a strong frame structure. Open.
Buzzer	Audible alarm to catch the operator's attention.
Option	Optional equipment for machine.
Tilt	The mast is leaned forward or backward.
Top lift	Attachment. See attachment.
Transmission oil	Oil for transmission and torque converter. See specifications in operator's manual.
Securing machine for transport	Actions before transporting machine.
Twistlocks	Two or four lock pins, one in each corner of the attachment, pushed down into corresponding holes in the container and twisted to lock the container when lifting.
Type designation	Indicates type of machine and capacity. See also machine model.
Maintenance	Periodic maintenance actions so that machine functions safely and for long life.
Variable pump	Pump with adjustable flow rate.
Variable displacement	Adjustable volume (capacity) of a pump.
Valve slide	Moving part in the valve. Decides the oil's path.
Wet brakes	Brake discs in oil-bath.
Recyclable	Used equipment must be handled according to national laws and regulations.

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